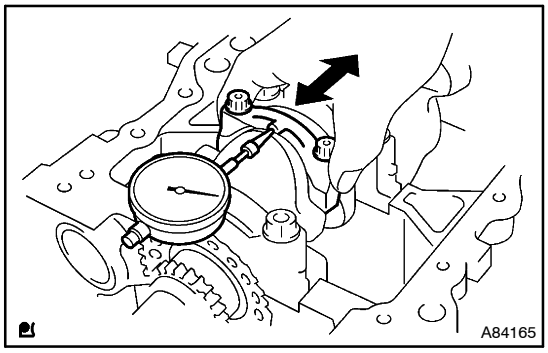
141O1–01

OVERHAUL



1. INSPECT CONNECTING ROD THRUST CLEARANCE

(a) Using a dial indicator, measure the thrust clearance of the connecting rod while moving the connecting rod back and forth.

Standard thrust clearance:
0.16 to 0.36 mm (0.0063 to 0.0142 in.)
Maximum thrust clearance: 0.36 mm (0.0142 in.)

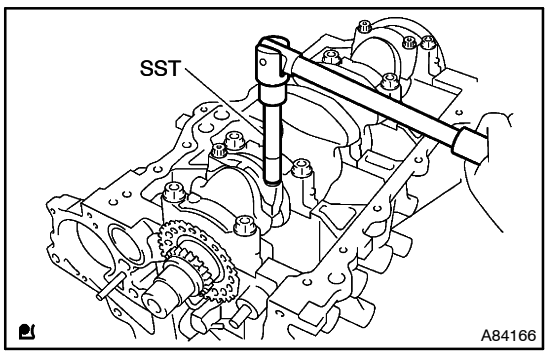
If the thrust clearance is greater than maximum, replace the connecting rod.

2. INSPECT CONNECTING ROD OIL CLEARANCE

(a) Put the cylinder number on the connecting rod and connecting rod cap with paint.

HINT:

Take step (a) so that the connecting rod and connecting rod cap can be returned to the original locations when reassembling.

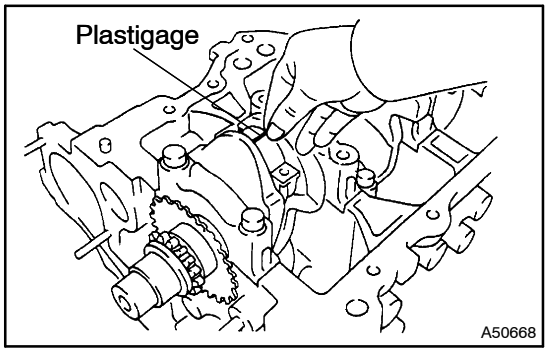


(b) Using SST, remove the 2 bolts.
SST 09205–16010

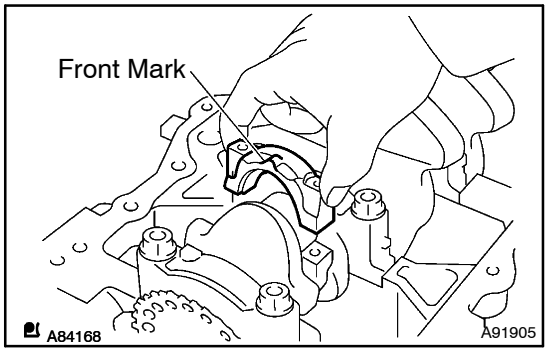
(c) Remove the connecting rod cap from the connecting rod.

(d) Clean the bearing, connecting rod end and crank pin.

(e) Check that the bearing and crank pin are not excessively worn or scratched.

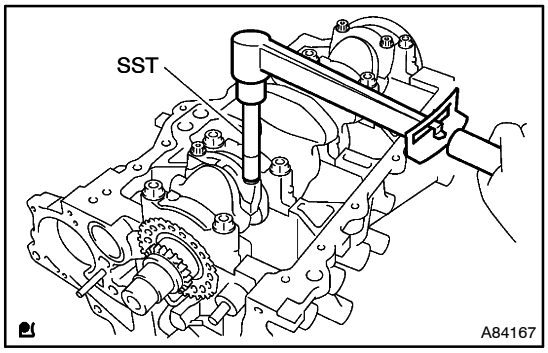


(f) Lay a strip of Plastigage across the crank pin.

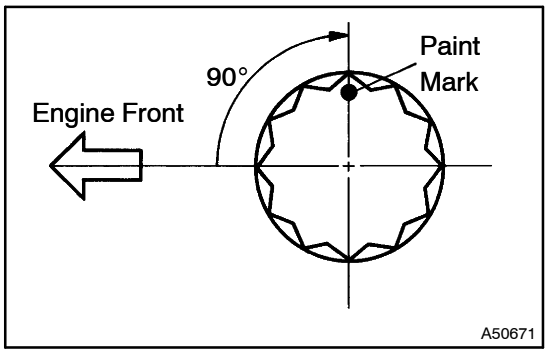


(g) Check the front marks of the connecting rod and connecting rod cap, then install the connecting rod cap to the connecting rod

(h) Apply a light coat of engine oil to the threads and contact surface of the bolts.



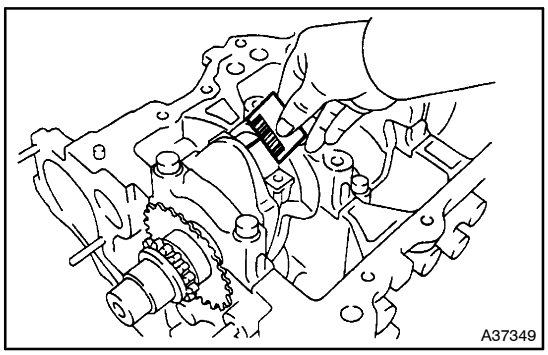
(i) Using SST,temporarily tighten the bolts in several steps, then retighten them with the specified torque.
SST 09205–16010
Torque: 15 N·m (153 kgf·cm, 11 ft·lbf)



(j) Mark the front of the connecting cap bolts with paint.

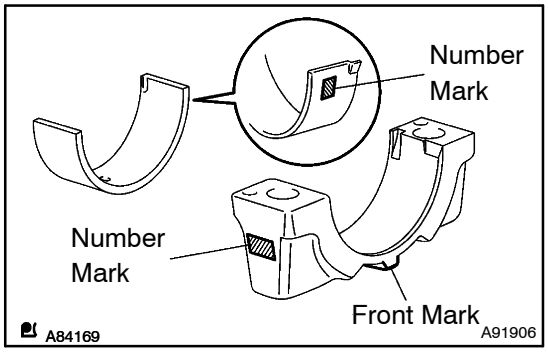
(k) Retighten the cap bolts by 90° as shown in the illustration.

NOTICE:
Do not turn the crankshaft when measuring.



(l) Remove the connecting rod cap, then measure the Plastigage at its widest point.
Standard oil clearance:
0.016 to 0.040 mm (0.0006 to 0.0016 in.)
Maximum oil clearance: 0.06 mm (0.0024 in.)

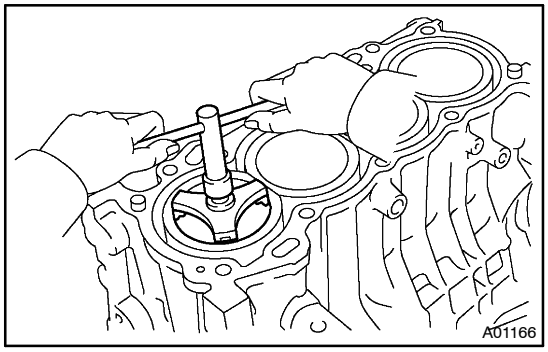
NOTICE:
Completely remove the Plastigage.



(m) If the width is greater than maximum, select and replace the bearing. If necessary, use the undersize bearing.

HINT:

Number Mark	Connecting Rod External Diameter mm (in.)	Center Bearing Thickness mm (in.)	Oil Clearance mm (in.)
1	43.000 to 43.008 (1.69291 to 1.69323)	1.488 to 1.492 (0.05858 to 0.05874)	0.016 to 0.040 (0.00063 to 0.00157)
2	43.009 to 43.016 (1.69327 to 1.69354)	1.493 to 1.496 (0.05878 to 0.05890)	↑
3	43.017 to 43.024 (1.69358 to 1.69386)	1.497 to 1.500 (0.05894 to 0.05906)	↑
U/S 0.25	43.000 to 43.024 (1.69291 to 1.69386)	1.608 to 1.614 (0.06331 to 0.06354)	↑



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.

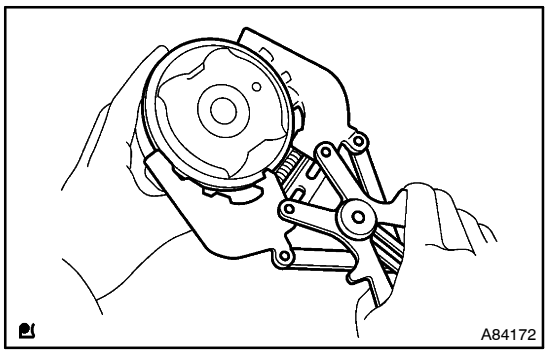
HINT:

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

4. REMOVE CONNECTING ROD BEARING

(a) Remove the connecting rod bearing from the connecting rod cap.

(b) Remove the connecting rod bearing from the connecting rod.

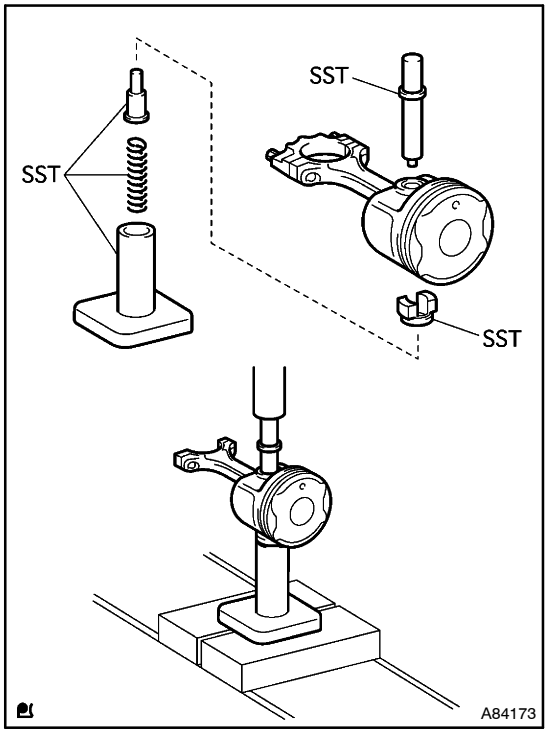


5. REMOVE PISTON RING SET

HINT:

Keep the piston rings in the correct combination and order so that they can be returned to the original locations when reassembling

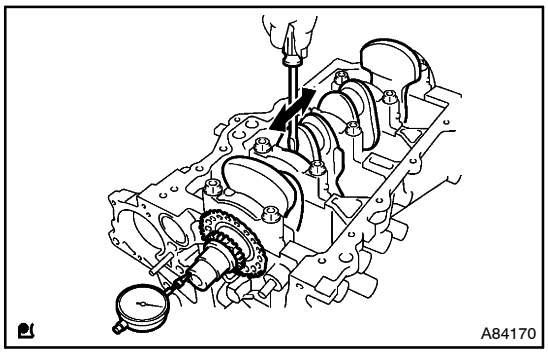
(a) Using a piston ring expander, remove the compression ring No. 1, No. 2 and oil ring.



6. REMOVE W/PIN PISTON SUB–ASSY

(a) Using SST and a press, remove the piston pin.
SST 09221–25026 (09221–00021, 09221–00030, 09221–00061, 09221–00090, 09221–00100)

NOTICE:
Do not change the combination of the piston and piston pin so that they can be returned to the original locations when reassembling.

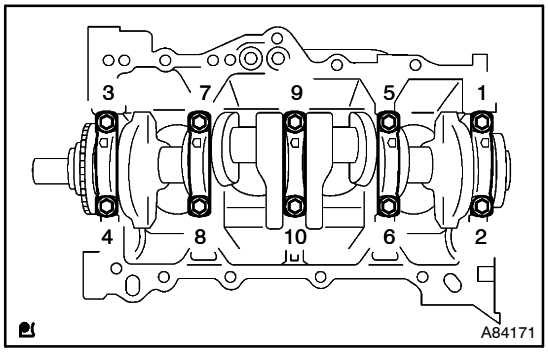


7. INSPECT CRANKSHAFT THRUST CLEARANCE

(a) Using a dial indicator, measure the thrust clearance of the crankshaft while moving a screwdriver back and forth.
Standard thrust clearance:
0.09 to 0.19 mm (0.0035 to 0.0075 in.)
Maximum thrust clearance: 0.30 mm (0.0118 in.)

If the thrust clearance is greater than maximum, replace the thrust washer or crankshaft.

HINT:
Thrust washer thickness is 2.43 to 2.48 mm (0.0957 to 0.0976 in.).



8. REMOVE CRANKSHAFT

(a) Using SST, uniformly loosen the bearing caps in several steps in the sequence shown in the illustration.
SST 09011–38121

(b) Remove the bearing caps and crankshaft.

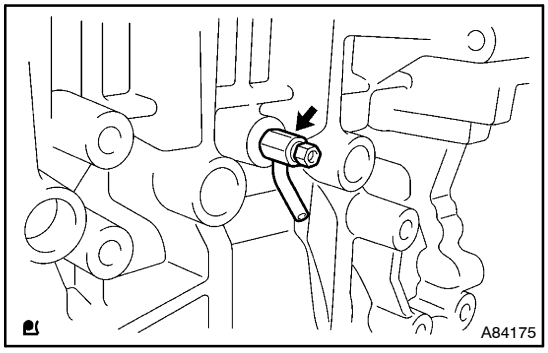
9. REMOVE CRANKSHAFT THRUST WASHER UPPER

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

10. REMOVE CRANKSHAFT BEARING

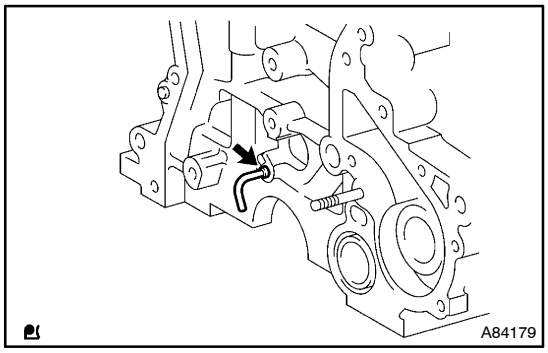
(a) Remove the crankshaft bearing from the cylinder block.

(b) Remove the crankshaft bearing from the bearing cap.



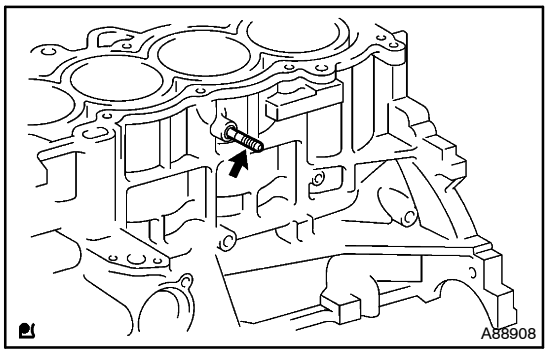
11. REMOVE CYLINDER BLOCK WATER DRAIN COCK PLUG

(a) Remove the cylinder block water drain cock plug from the cylinder block.



12. REMOVE OIL JET

(a) Remove the oil jet from the cylinder block.



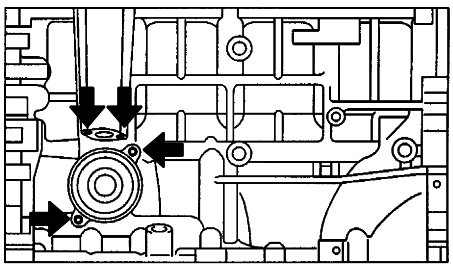
13. REMOVE STUD BOLT (FOR KNOCK SENSOR)

(a) Remove the stud bolt (for knock control sensor) from the cylinder block.

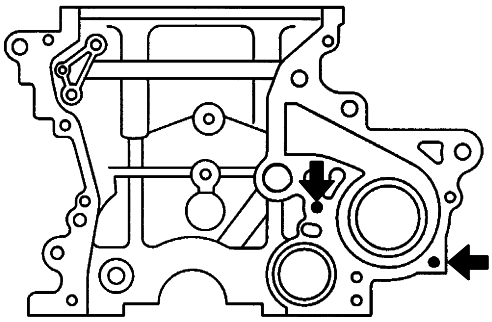
14. REMOVE STUD BOLT

(a) Remove the 6 stud bolts indicated in the illustration from the cylinder block.

Intake Side:

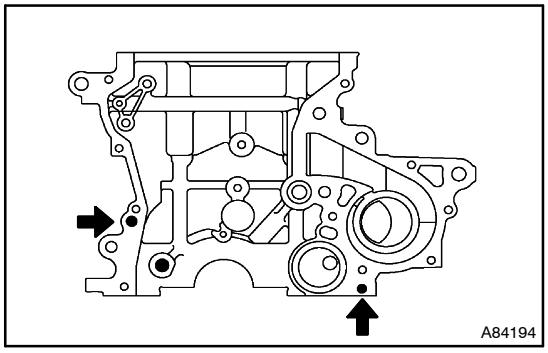


Front Side:



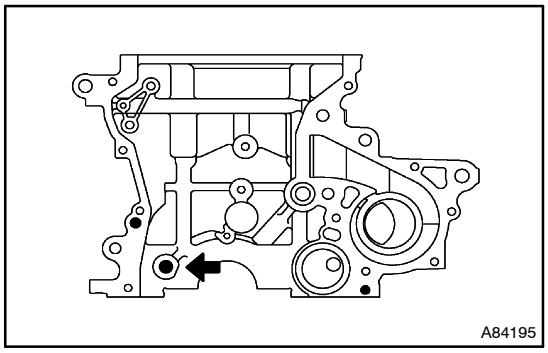
A84192

A92959



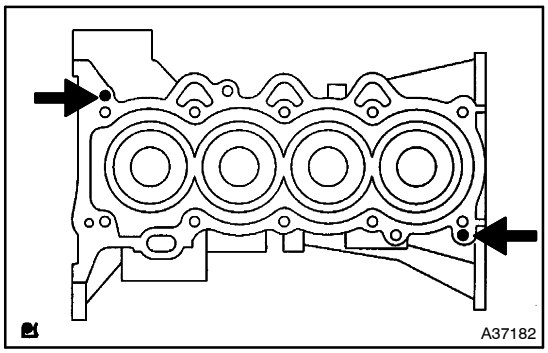
15. REMOVE OIL PUMP SET RING PIN

(a) Remove the 2 oil ring pins indicated in the illustration from the cylinder block



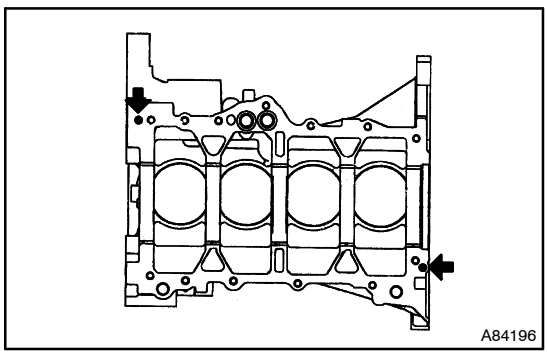
16. REMOVE CHAIN TENSIONER STRAIGHT PIN

(a) Remove the chain tensioner straight pin indicated in the illustration from the cylinder block.



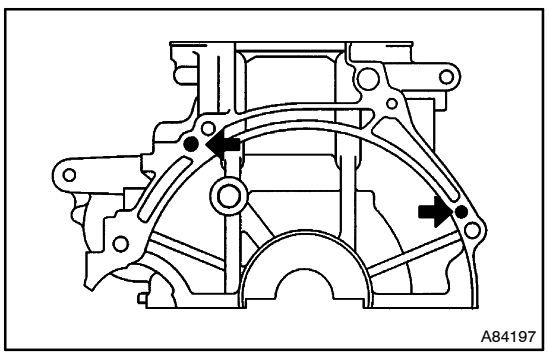
17. REMOVE CYLINDER HEAD SET STRAIGHT PIN

(a) Remove the 2 cylinder straight pins indicated in the illustration from the cylinder block.



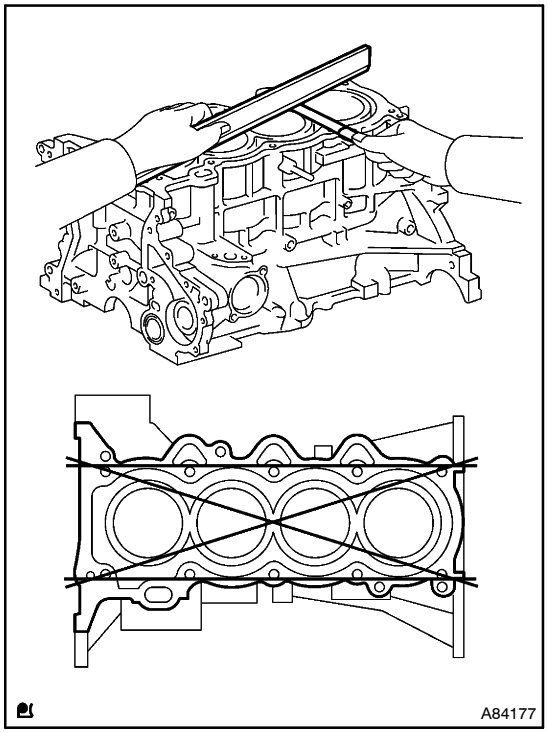
18. REMOVE OIL PAN STRAIGHT PIN

(a) Remove the 2 oil pan straight pins indicated in the illustration from the cylinder block.



19. REMOVE END PLATE STRAIGHT PIN

(a) Remove the 2 end plate straight pins indicated in the illustration from the cylinder block.

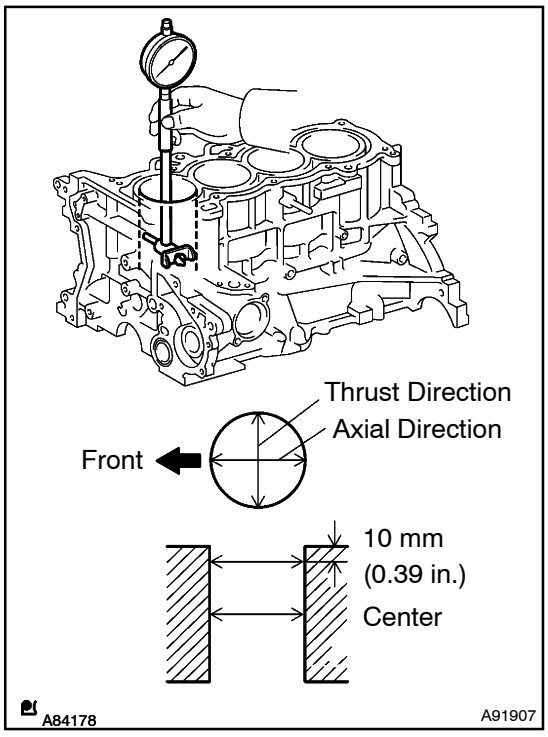


20. INSPECT CYLINDER BLOCK FOR FLATNESS

(a) Using a precision straight edge and feeler gauge, measure the warpage on the top surface of the cylinder block.

Maximum warpage: 0.05 mm (0.0020 in.)

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



21. INSPECT CYLINDER BORE

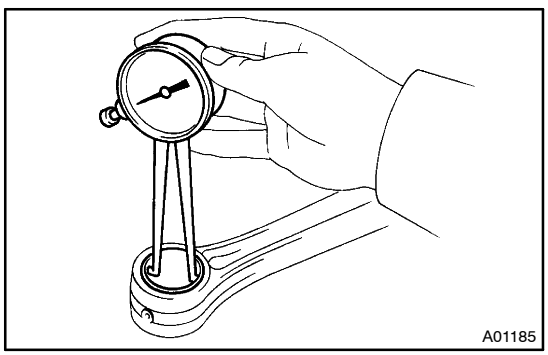
(a) Using a cylinder gauge, measure the bore diameter at the 4 positions as illustrated.

Calculate the average of the thrust direction measurement and axial direction measurement at each level.

Standard diameter:

75.000 to 75.133 mm (2.9528 to 2.9580 in.)

If either of the 2 average values is greater than maximum, replace the cylinder block.



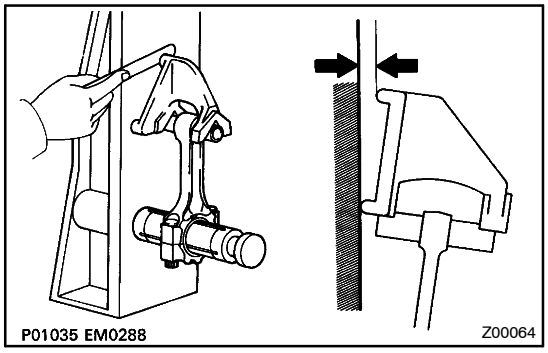
22. INSPECT CONNECTING ROD SUB–ASSY

(a) Using a caliper gauge, measure the internal diameter of the connecting rod.

Connecting rod inside diameter:

17.965 to 17.985 mm (0.7073 to 0.7081 in.)

If the diameter is greater than maximum, replace the connecting rod.



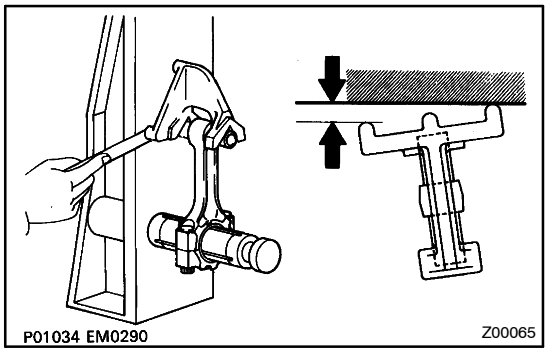
(b) Using a rod aligner and feeler gauge, check the connecting rod alignment.

(1) Check the misalignment.

Maximum misalignment:

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

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

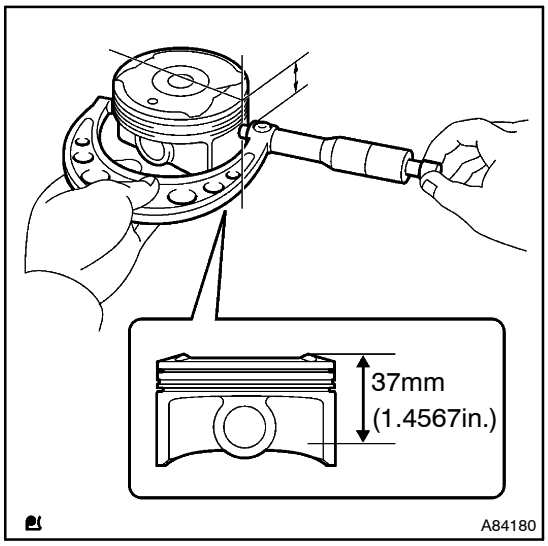


(2) Check the twist.

Maximum twist:

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

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

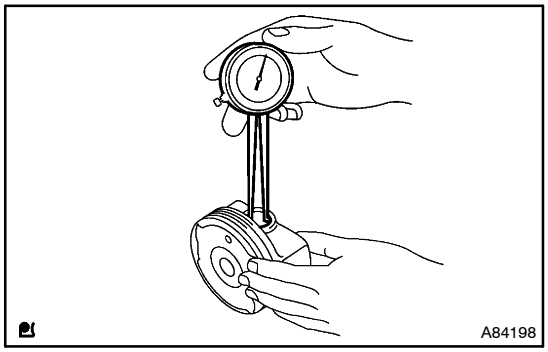


23. INSPECT W/PIN PISTON SUB–ASSY

(a) Using a micrometer, measure the diameter of the piston. Align the micrometer so it is 37 mm (1.4567 in.) from the top of the piston and at a right angle (90°) to the piston pin holes.

Piston diameter:

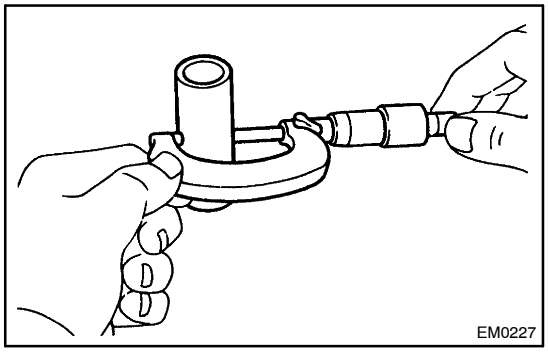
74.941 to 74.979 mm (2.9504 to 2.9519 in.)



(b) Using a caliper gauge, measure the internal diameter of the piston pin hole.

Piston pin hole diameter at 20°C (68°F):

18.013 to 18.016 mm (0.7092 to 0.7093 in.)



(c) Using a micrometer, measure the external diameter of the piston pin.
Piston pin diameter:
18.001 to 18.004 mm (0.7087 to 0.7088 in.)

NOTICE:
Do not change the combination of the piston and piston pin so that they can be returned to the original locations when reassembling.

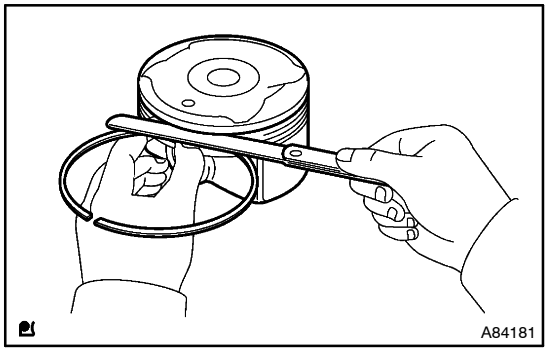
(d) Subtract the piston pin diameter measurement from the piston pin hole diameter measurement to calculate the oil clearance.
Standard oil clearance:
0.009 to 0.015 mm (0.0004 to 0.0006 in.)
Maximum oil clearance:
0.050 mm (0.0020 in.)

If the oil clearance is greater than maximum, replace the piston with pin.

24. INSPECT PISTON CLEARANCE

(a) Subtract the piston pin hole diameter measurement from the cylinder bore minimum diameter measurement to calculate the piston clearance.
Standard oil clearance: 0.045 to 0.068 mm (0.0018 to 0.0027 in.)
Maximum oil clearance: 0.08 mm (0.0032 in.)

If the piston clearance is greater than maximum, replace the piston or cylinder block.

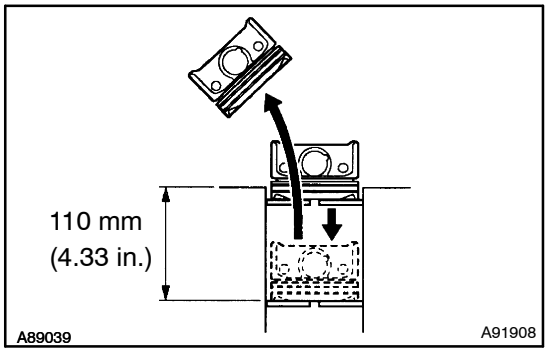


25. INSPECT RING GROOVE CLEARANCE

(a) Using a feeler gauge, measure the clearance between the piston ring and ring groove all around the piston.
Standard ring groove clearance:

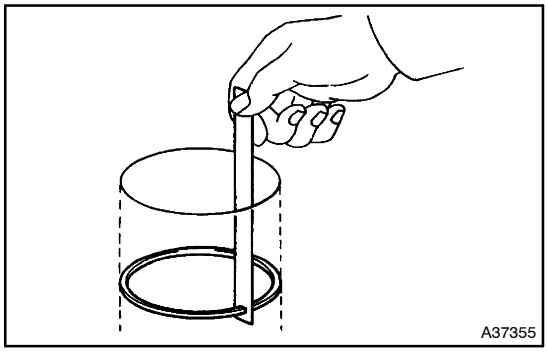
Ring	Standard mm (in.)
No.1	0.02 to 0.07 (0.0008 to 0.0028)
No.2	0.02 to 0.06 (0.0008 to 0.0024)
Oil	0.02 to 0.06 (0.0008 to 0.0024)

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



26. INSPECT PISTON RING END GAP

(a) Using the piston, push the piston ring until it is 110 mm (4.33 in.)from the top of the cylinder block.

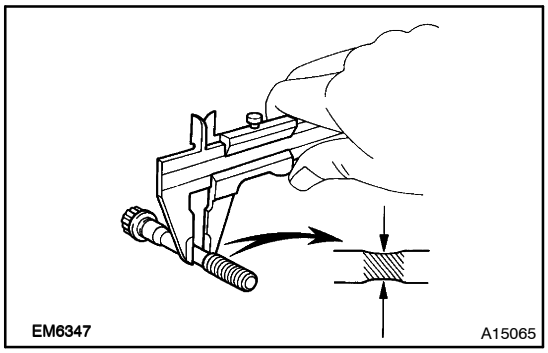


(b) Using a feeler gauge, measure the end gap.

Standard end gap:

Ring	Standard mm (in.)	Maximum mm (in.)
No.1	0.20 to 0.30 (0.0079 to 0.0118)	0.61 (0.0240)
No.2	0.30 to 0.45 (0.0118 to 0.0177)	1.20 (0.0472)
Oil	0.10 to 0.40 (0.0039 to 0.0158)	1.15 (0.0453)

If the end gap is greater than maximum, replace the piston ring and oil ring.



27. INSPECT CONNECTING ROD BOLT

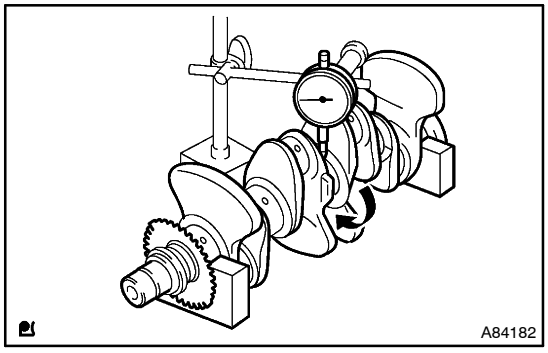
(a) Using vernier calipers, measure the diameter at the position as illustrated.

Standard diameter:

6.6 to 6.7 mm (0.260 to 0.264 in.)

Maximum diameter: 6.4 mm (0.252 in.)

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



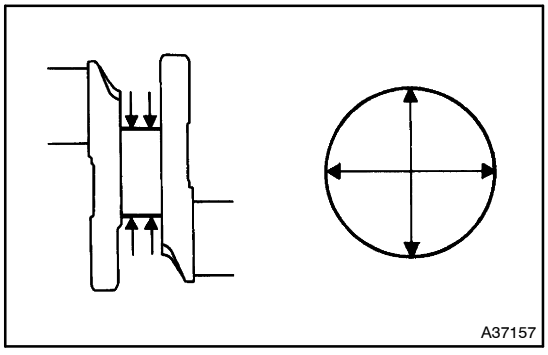
28. INSPECT CRANKSHAFT

(a) Inspect the circle runout.

(1) Using a dial indicator and V–blocks, measure the circle runout of the crankshaft.

Maximum circle runout: 0.03 mm (0.0012 in.)

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



(b) Inspect the diameter.

(1) Using a micrometer, measure the diameter of each main journal as illustrated.

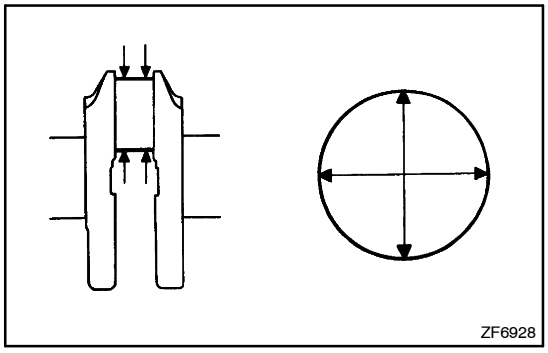
Diameter: 45.988 to 46.000 mm (1.8106 to 1.8110 in.)

(2) Calculate the taper and out–of–roundness of the main journal.

Maximum taper and out–of–round:

0.02 mm (0.0008 in.)

If the taper and out–of–roundness are greater than maximum, replace the crankshaft.



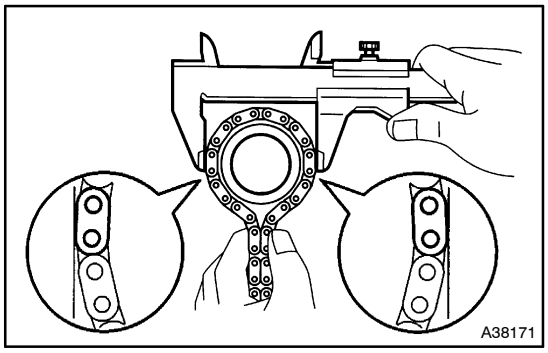
(3) Using a micrometer, measure the diameter of each crank pin as illustrated.

Diameter: 39.992 to 40.000 mm (1.5745 to 1.5748 in.)

(4) Calculate the taper and out–of–roundness of the crank pin.

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

If the taper and out–of–roundness are greater than maximum, replace the crankshaft.

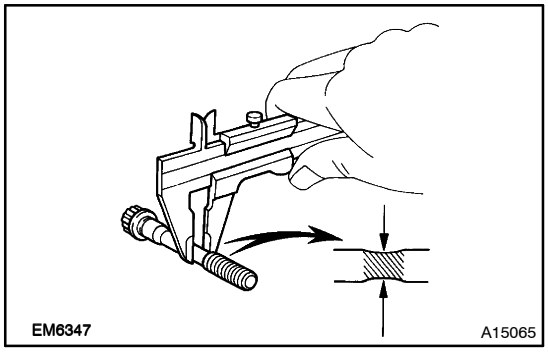


(5) Wrap the chain around the timing sprocket.
Using vernier calipers, measure the diameter of the timing sprocket with the chain wrapped.

Standard sprocket diameter (w/ chain):
51.72 mm (2.0362 in.)
Maximum sprocket diameter (w/ chain):
50.5 mm (1.988 in.)

NOTICE:
When measuring the diameter, vernier calipers must contact the chain roller.

If the diameter is less than minimum, replace the chain and crankshaft.



29. INSPECT CRANKSHAFT BEARING CAP SET BOLT

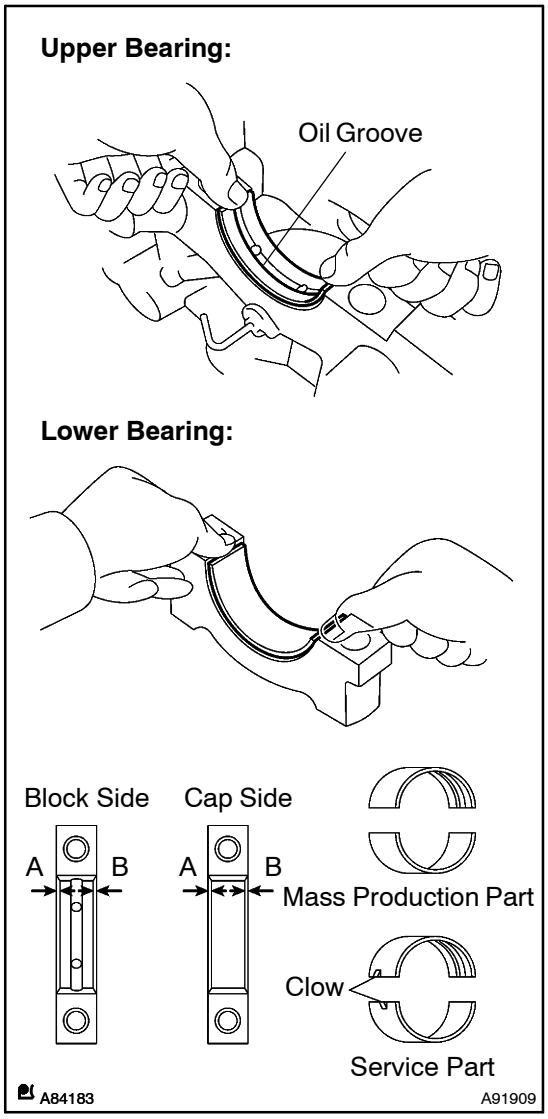
(a) Using vernier calipers, measure the diameter at the position as illustrated.

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

If the diameter is less than minimum, replace the crank bearing cap bolt.

30. INSPECT CRANKSHAFT OIL CLEARANCE

(a) Clean the main journal and bearing



(b) Install the upper bearing with the oil groove to the cylinder block, the lower bearing to the bearing cap.

NOTICE:

Do not apply engine oil to the contact surface of the cylinder block and the backside of the bearing.

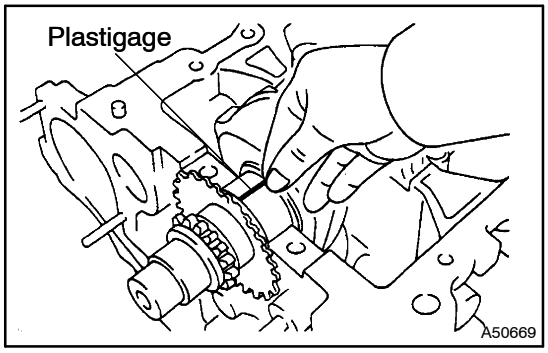
HINT:

The mass production parts do not have claws as marks. If reusing the mass production part, measure the clearance of the both sides so that the bearing comes in the center of the bearing cap.

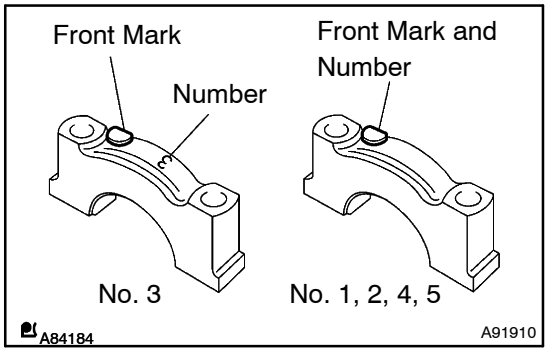
Specified clearance:

A – B = within 0.8 mm (0.032 in.)

(c) Install the crankshaft to the cylinder block.

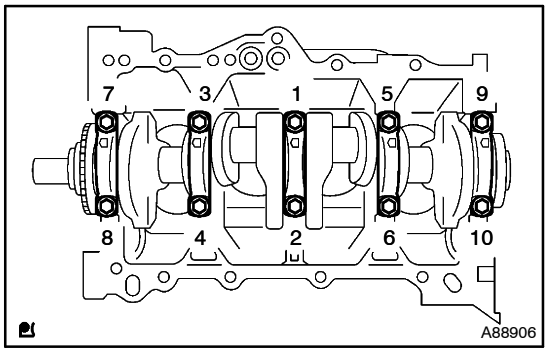


(d) Lay a strip of Plastigage across the crankshaft journal.

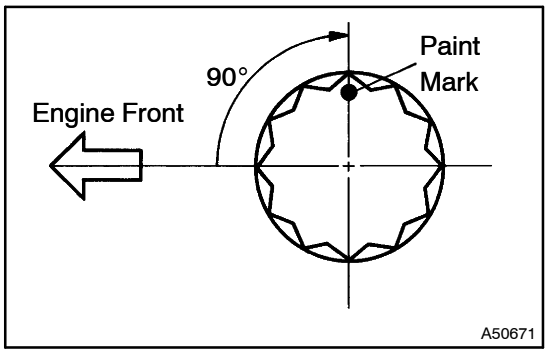


(e) Check the front marks and imprinted numbers on the bearing cap, then install the bearing cap to the cylinder block.

(f) Apply a light coat of engine oil to the threads and contact surface of the bolt.



(g) Using SST, temporarily tighten the bolts in several steps in the sequence shown in the illustration, then tighten the bolts with the specified torque.
SST 09011–38121
Torque: 22 N·m (224 kgf·cm, 16 ft·lbf)

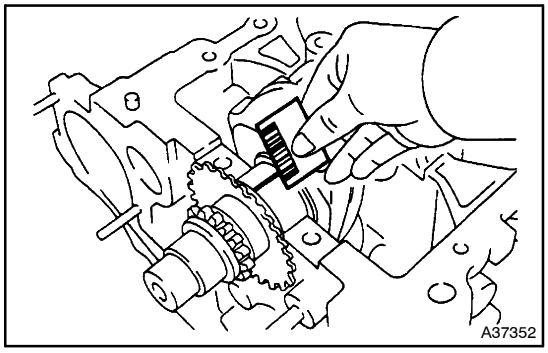


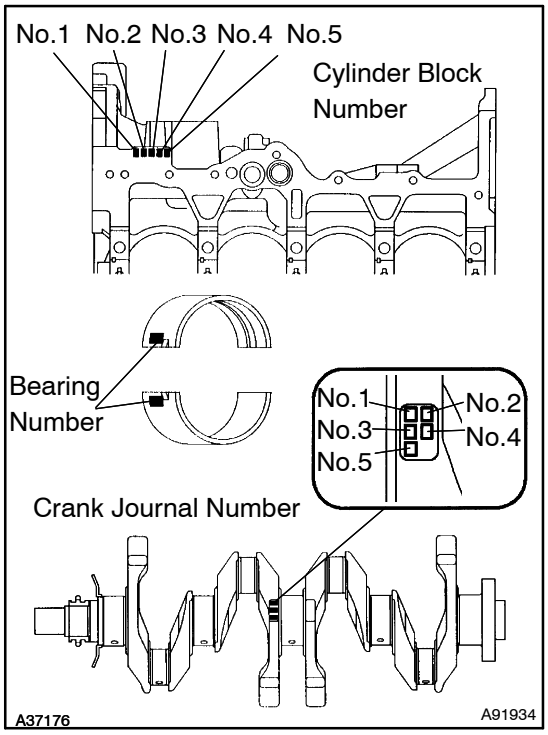
(h) Mark the front of the bearing cap bolts with paint.

(i) Retighten the bearing cap bolts by 90° in the same sequence as step (g).

(j) Check that each paint mark is now at the 90° angle to the front.

NOTICE:
Do not turn the crankshaft when measuring.





(k) Remove the bearing cap, then measure the Plastigage at its widest point.

Standard oil clearance:
0.010 to 0.023 mm (0.0004 to 0.0009 in.)
Maximum oil clearance: 0.07 mm (0.0028 in.)

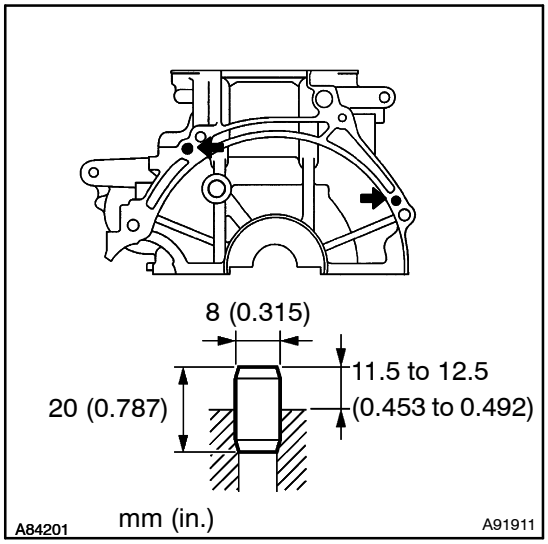
NOTICE:
Completely remove the Plastigage.

HINT:

- If the width is greater than maximum, select and replace the bearing. If necessary, use the undersize bearing.
- To select the correct bearing size, calculate the bearing number by adding together the numbers imprinted on the cylinder block and crank journal.
- Example:
  Imprinted number on the cylinder block is 3.
  Imprinted number on the crank journal is 5.
  3+5=8
  Select the bearing with the bearing number 3.

Number	Cylinder Block Number mm (in.)	Crank Journal Number mm (in.)
0	50.000 to 50.003 (1.96850 to 1.96862)	46.000 to 46.001 (1.81102 to 1.81106)
1	50.003 to 50.005 (1.96862 to 1.96870)	46.002 to 46.003 (1.81110 to 1.81114)
2	50.005 to 50.007 (1.96870 to 1.96878)	46.004 to 46.005 (1.81118 to 1.81122)
3	50.007 to 50.010 (1.96878 to 1.96890)	46.006 to 46.007 (1.81126 to 1.81130)
4	50.010 to 50.012 (1.96890 to 1.96898)	46.008 to 46.009 (1.81134 to 1.81138)
5	50.012 to 50.014 (1.96898 to 1.96906)	46.010 to 46.011 (1.81142 to 1.81146)
6	50.014 to 50.016 (1.96906 to 1.96913)	–

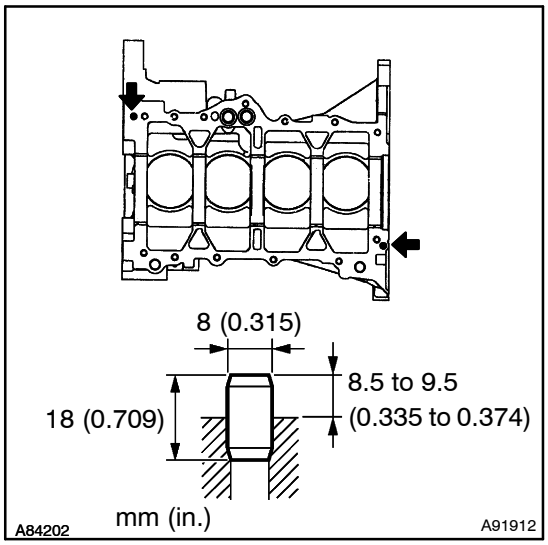
Cylinder Block Number + Crank Journal Number	Bearing Number	Center Bearing Thickness mm (in.)	Oil Clearance mm (in.)
0–2	1	1.992 to 1.995 (0.07843 to 0.07854)	0.010 to 0.023 (0.00039 to 0.00091)
3–5	2	1.996 to 1.998 (0.07858 to 0.07866)	↑
6–8	3	1.999 to 2.001 (0.07870 to 0.07878)	↑
9–11	4	2.002 to 2.004 (0.07882 to 0.07890)	↑
–	U/S 0.25	2.111 to 2.117 (0.08311 to 0.08335)	↑



31. INSTALL END PLATE STRAIGHT PIN

(a) Using a plastic–faced hammer, tap in a new end plate straight pin.

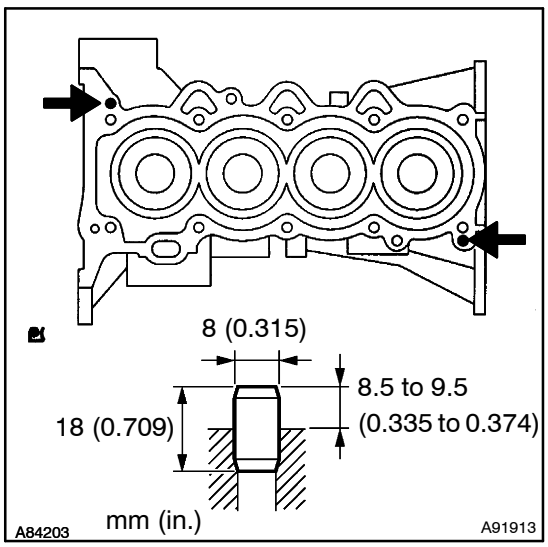
Standard protrusion:
11.5 to 12.5 mm (0.453 to 0.492 in.)



32. INSTALL OIL PAN STRAIGHT PIN

(a) Using a plastic–faced hammer, tap in a new oil pan straight pin.

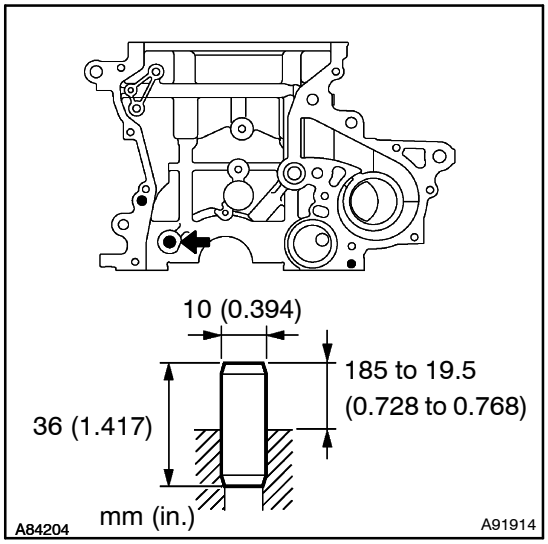
Standard protrusion:
8.5 to 9.5 mm (0.335 to 0.374 in.)



33. INSTALL CYLINDER HEAD SET STRAIGHT PIN

(a) Using a plastic–faced hemmer, tap in a new cylinder head straight pin.

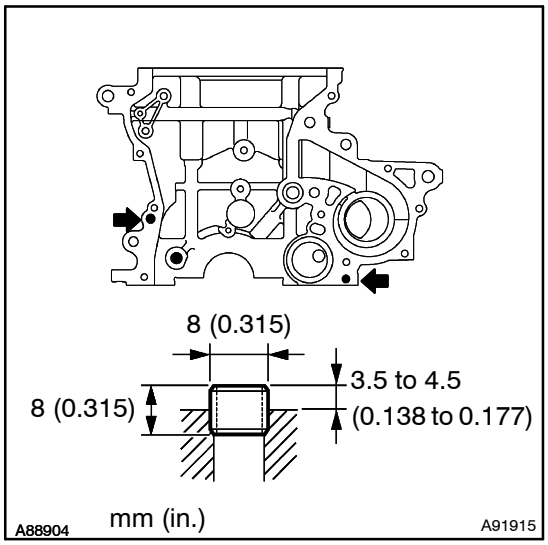
Standard protrusion:
8.5 to 9.5 mm (0.335 to 0.374 in.)



34. INSTALL CHAIN TENSIONER STRAIGHT PIN

(a) Using a plastic–faced hammer, tap in a new chain tensioner straight pin.

Standard protrusion:
18.5 to 19.5 mm (0.728 to 0.768 in.)



35. INSTALL OIL PUMP SET RING PIN

(a) Using a plastic–faced hammer, tap in a new oil pump ring pin.

Standard protrusion:
3.5 to 4.5 mm (0.138 to 0.177 in.)

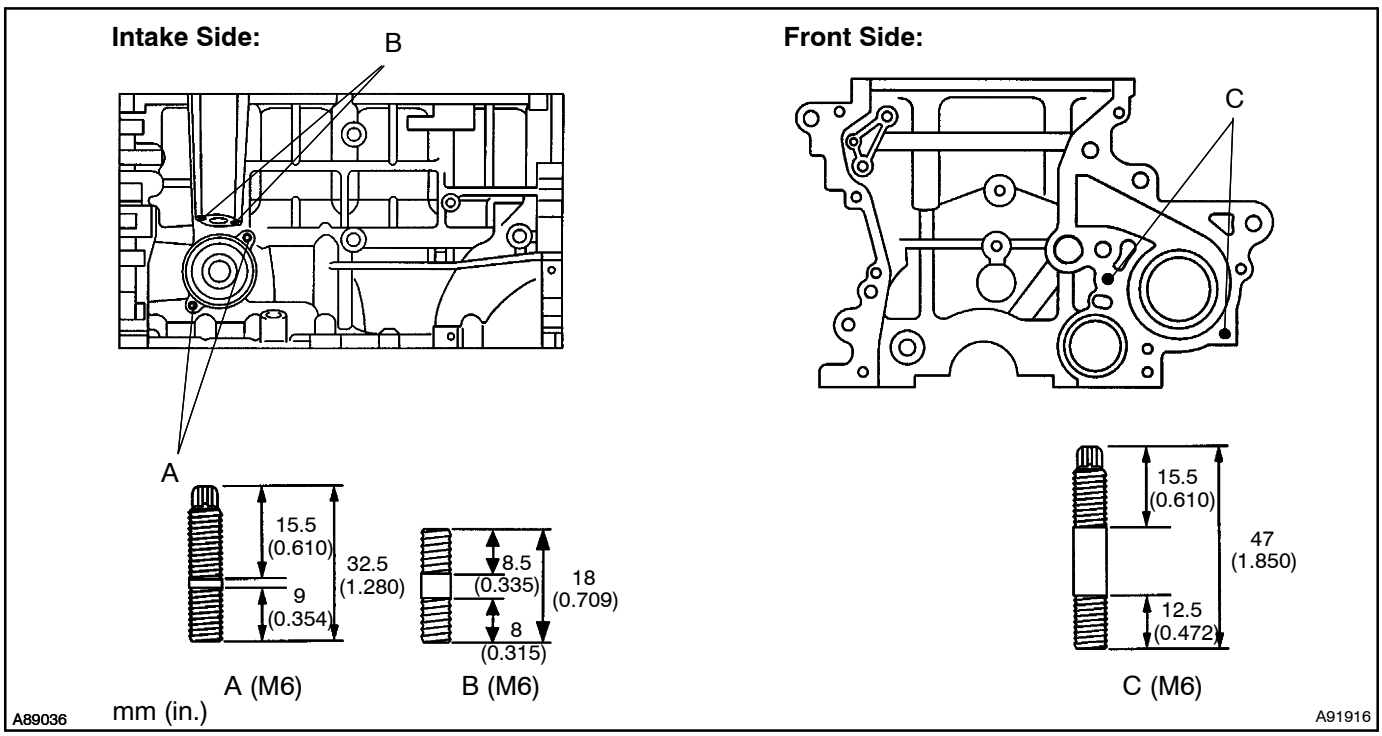
36. INSTALL STUD BOLT

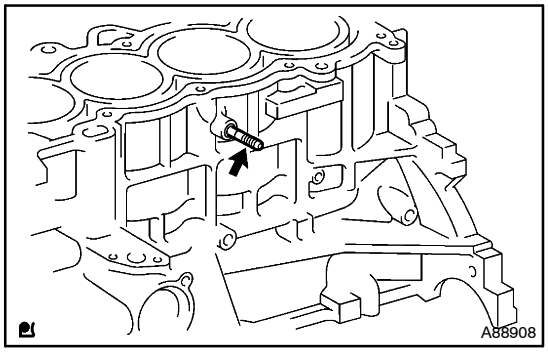
(a) Install the 6 stud bolts in the positions shown in the illustration.

Torque: 5.0 N·m (51 kgf·cm, 44 in.·lbf)

NOTICE:

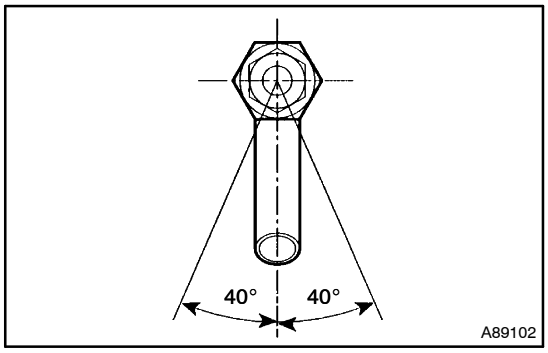
In the illustration below, the bottom of the stud bolt contacts the cylinder block.





37. INSTALL STUD BOLT (FOR KNOCK SENSOR)

(a) Install the stud bolt (for knock control sensor) to the cylinder block.
Torque: 11 N·m (112 kgf·cm, 8 ft.·lbf)



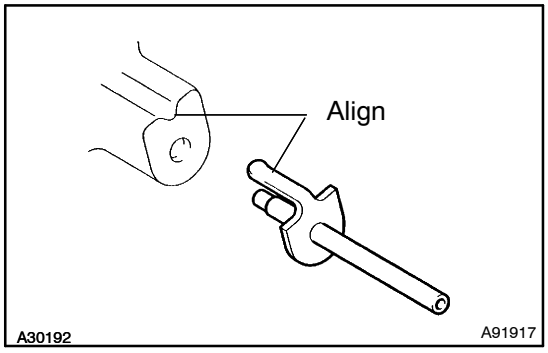
38. INSTALL CYLINDER BLOCK WATER DRAIN COCK PLUG

(a) Apply adhesive to the threads of the drain cock.
Adhesive:
Part No. 08833–00080, THREE BOND 1344, LOCTITE 242 or equivalent

(b) After applying the specified torque, retighten the drain cock by within 1 revolution so the pipe of the drain cock faces downward.
Torque: 35 N·m (357 kgf·cm, 26 ft·lbf)

NOTICE:

- **Install the drain cock within 3 minutes after applying the adhesive.**
- **Do no expose the drain cock to coolant within 1 hour of installation.**
- **Do not retighten the drain cock more than 1 revolution in step (b). Never loosen it once the drain cock is retightened.**
- **The pipe of the drain cock should be within 40° of either side.**

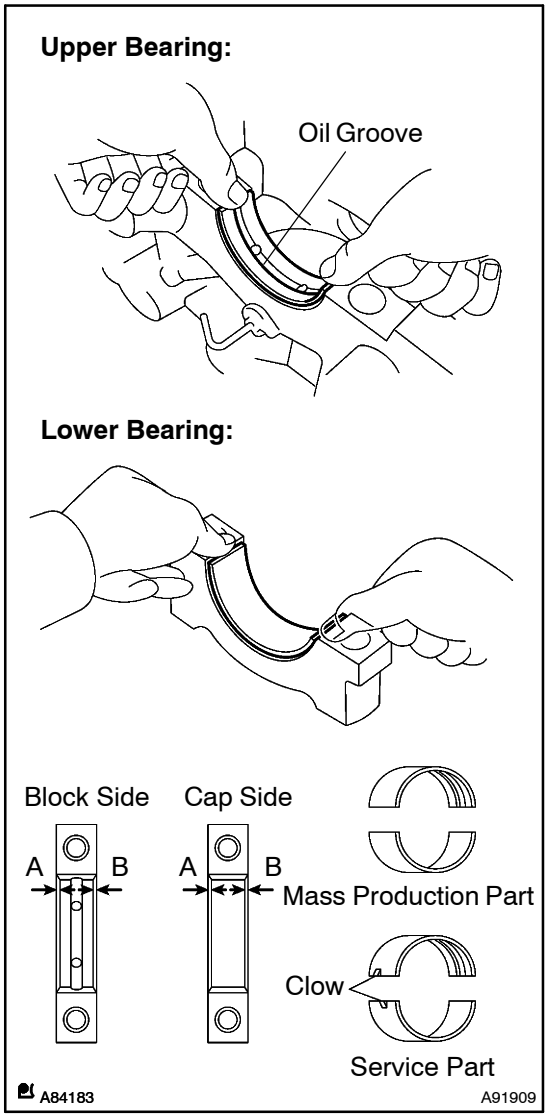


39. INSTALL OIL JET

(a) Align the concave of the cylinder block with the bracket of the oil jet, then tap in the oil jet (the service part).

NOTICE:

Do not tap the tip of the oil jet.



40. INSTALL CRANKSHAFT

(a) Install the upper bearing with the oil groove to the cylinder block, the lower bearing to the bearing cap.

NOTICE:

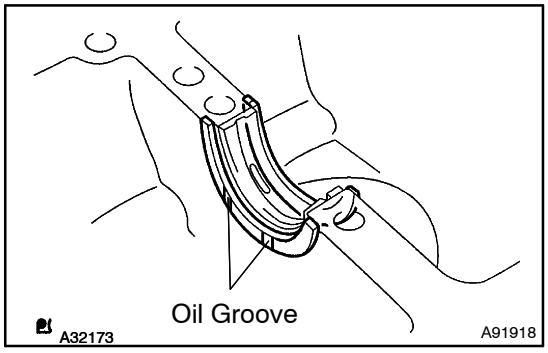
Do not apply engine oil to the contact surface of the cylinder block and the backside of the bearing.

HINT:

The mass production parts do not have claws as marks. If reusing the mass production part, measure the clearance of the both sides so that the bearing comes in the center of the bearing cap.

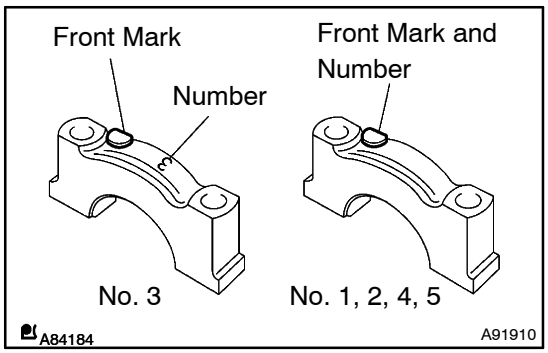
Specified clearance:

A – B = within 0.8 mm (0.032 in.)



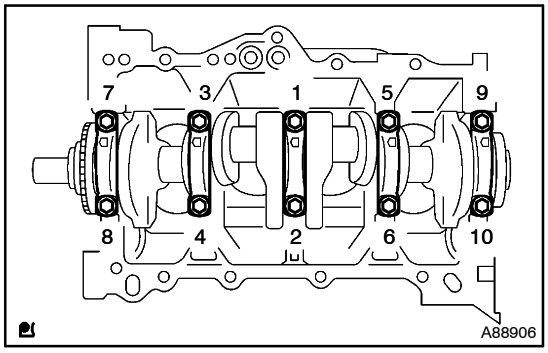
(b) Install the thrust washer to the cylinder block and the front and backside of the bearing cap No. 3 with the oil groove facing outward.

(c) Apply oil to the upper bearing, then install the crankshaft to the cylinder block.



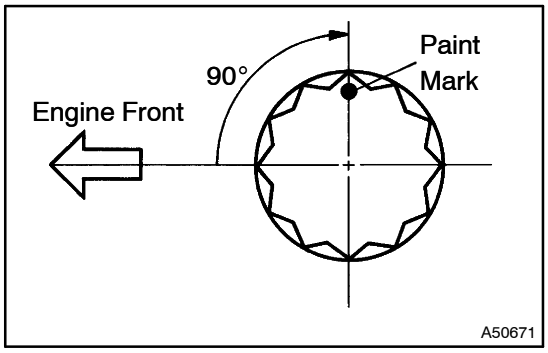
(d) Check the front marks and numbers on the bearing caps, then install the bearing caps to the cylinder block.

(e) Apply a light coat of engine oil to the bearing of the bearing cap sub–assembly, the thread and contact surface of the bolt.

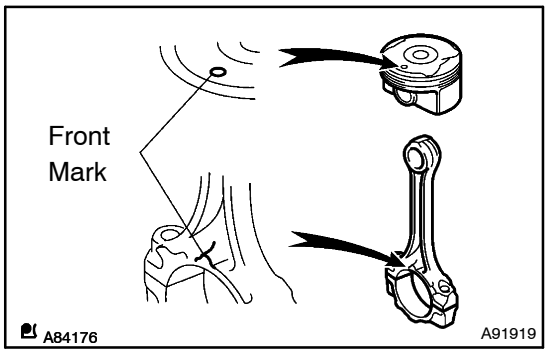


(f) Using SST, temporarily tighten the bolts in several steps in the sequence shown in the illustration, then tighten the bolts with the specified torque.
SST 09011–38121
Torque: 22 N·m (224 kgf·cm, 16 ft·lbf)

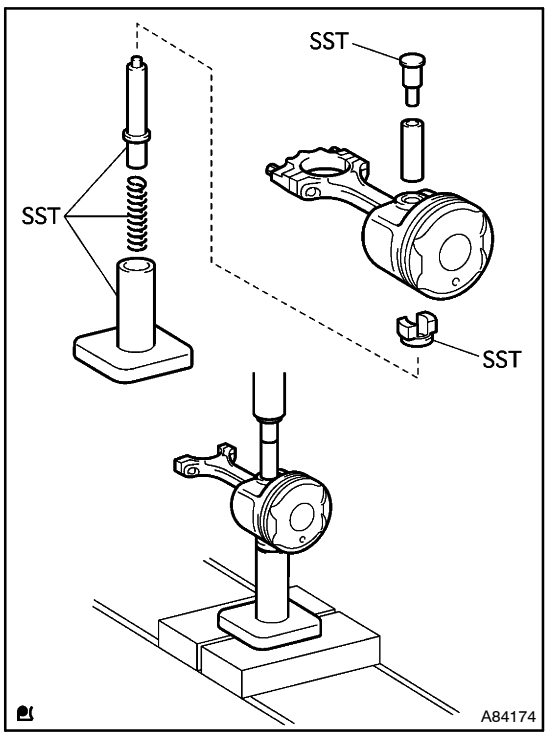
NOTICE:
Check that the crankshaft turns smoothly while tightening the bolts.



(g) Mark the front of the bearing cap bolts with paint.
(h) Retighten the bearing cap bolts by 90° in the same sequence as step (f).
(i) Check that each paint mark is now at the 90° angle to the front.

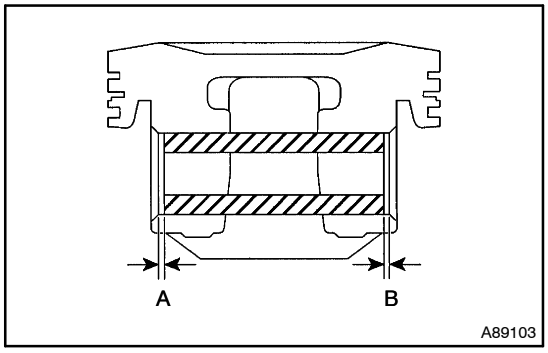


41. INSTALL W/PIN PISTON SUB–ASSY
(a) Apply engine oil to the piston pin and the inside surface of the connecting rod.
(b) Align the front marks of the piston and connecting rod cap.

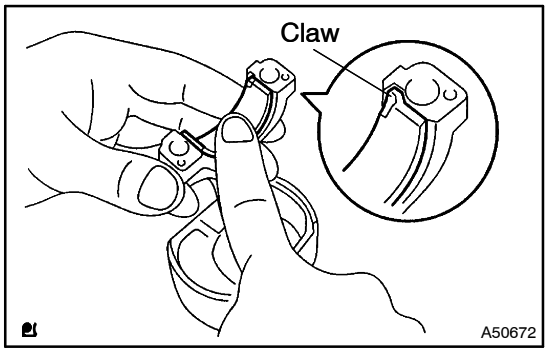


(c) Using SST and a press, press into the piston pin.
SST 09221–25026 (09221–00021, 09221–00030, 09221–00061, 09221–00090, 09221–00100)

NOTICE:
Do not change the combination of the piston and piston pin so that they can be returned to the original locations when reassembling.



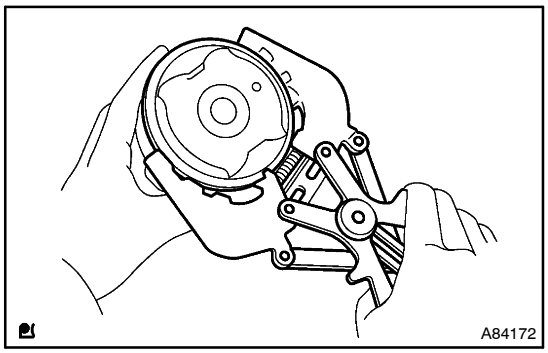
(d) Check the piston pin position.
Specified clearance:
A – B = ± 0.5 mm (0.0197 in.)



42. INSTALL CONNECTING ROD BEARING

(a) Align the bearing claws and oil grooves, then install the bearing to the connecting rod.

NOTICE:
Do not apply engine oil to the contact surface of the connecting rod and connecting rod cap and the backside of the bearing.

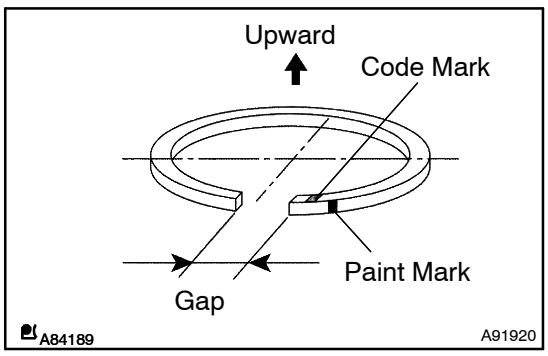


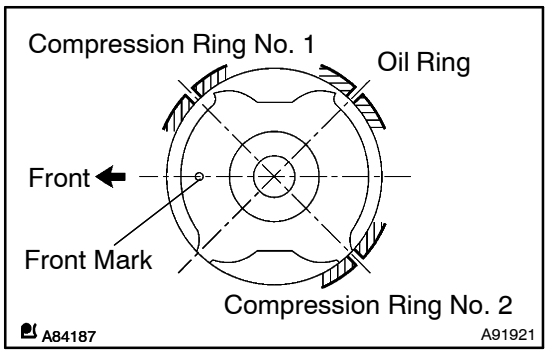
43. INSTALL PISTON RING SET

If reusing the piston rings, install them in the same combination with the surfaces facing correctly.

(a) Using a piston pin expander, install the compression ring and oil ring.

Part	Paint Color	Code Mark
Compression Ring No. 1	Red	1R
Compression Ring No. 2	Blue	2R
Oil Ring	—	—



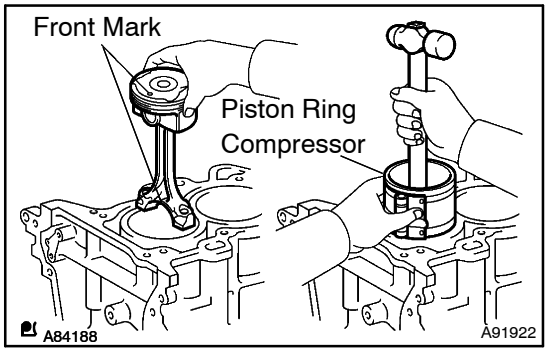


(b) Adjust the piston ring so that its gap is located as illustrated.

44. INSTALL PISTON SUB–ASSY W/CONNECTING ROD

(a) Apply engine oil to the cylinder walls, pistons and surfaces of the connecting rod bearings.

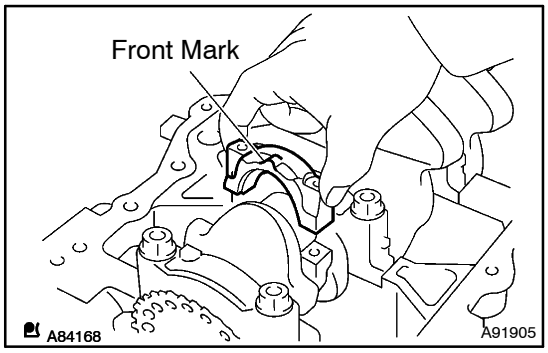
(b) Check that the gap of the piston ring is located correctly.



(c) Check the front marks. Using a piston ring compressor, install the piston with connecting rod.

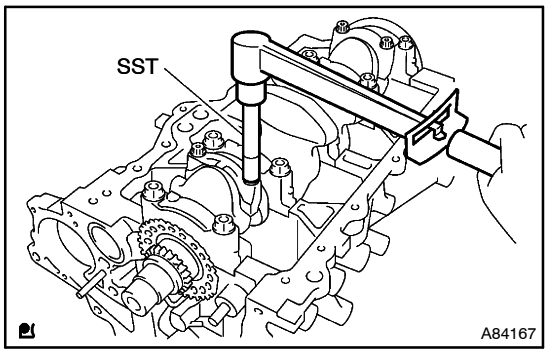
NOTICE:

- **Do not apply engine oil to the contact surface of the connecting rod cap and the backside of the bearing.**
- **The connecting rod and its cap should be in the same combination as they were assembled.**

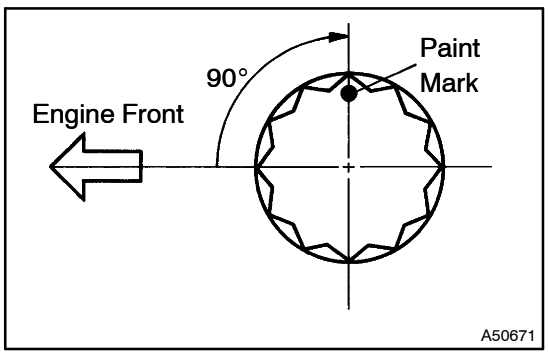


(d) Check that the connecting rod and its cap are in the correct combination and that the front marks are facing correctly, then install the connecting rod cap to the connecting rod.

(e) Apply a light coat of engine oil to the threads and contact surface of the bolts.



(f) Using SST, temporarily tighten the bolts in several steps, then tighten the bolts with the specified torque.
SST 09205–16010
Torque: 15 N·m (153 kgf·cm, 11 ft·lbf)



(g) Mark the front of the bolts with paint.

(h) Retighten the bolts by additional 90°.

(i) Check that the crankshaft turns smoothly.