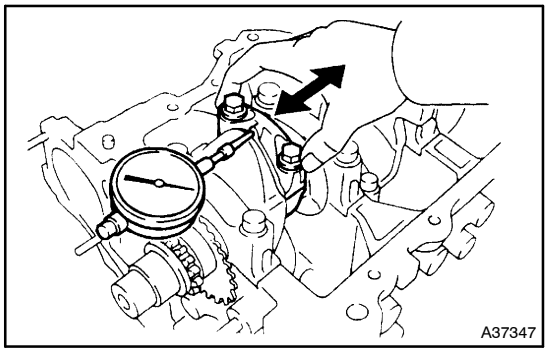
CYLINDER BLOCK ASSY (1NZ–FE/2NZ–FE)

14011–01

OVERHAUL

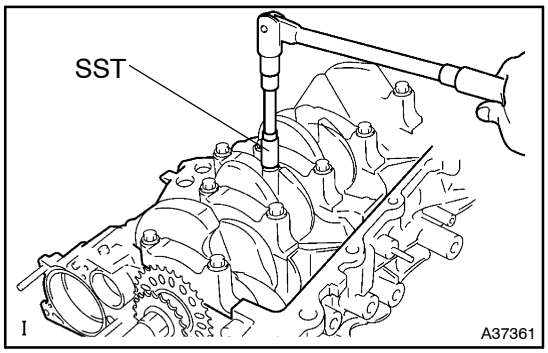


1. INSPECT CONNECTING ROD THRUST CLEARANCE

(a) Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.
Standard thrust clearance:
0.16 – 0.36 mm (0.0063 – 0.0142 in.)
Maximum thrust clearance: 0.36 mm (0.0142 in.)

2. INSPECT CONNECTING ROD OIL CLEARANCE

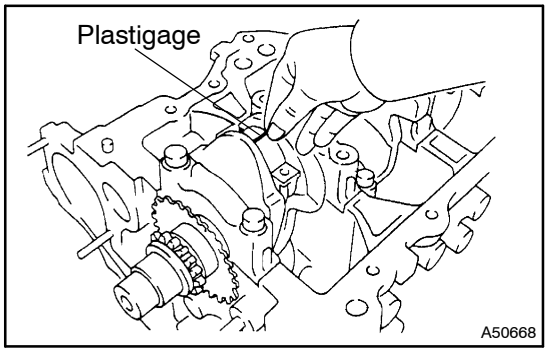
(a) Check the match marks on the connecting rod and cap are aligned to ensure correct reassembly.



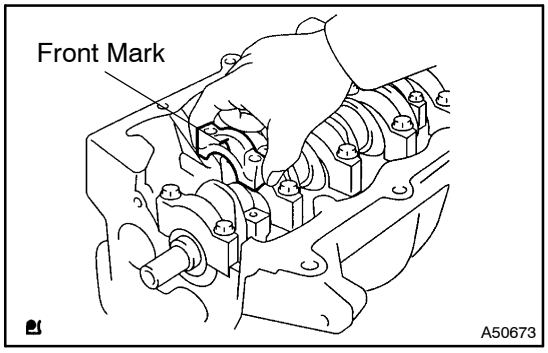
(b) Using SST, remove the 2 connecting rod cap bolts.
SST 09205–16010

(c) Clean the crank pin and bearing.

(d) Check the crank pin and bearing for pitting and scratches.

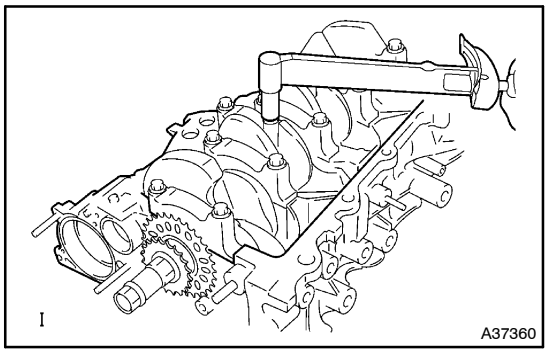


(e) Lay a strip of plastigage the crank pin.

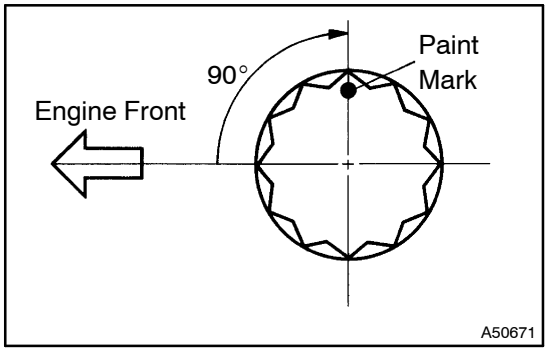


(f) Check that the protrusion of the connecting rod cap is facing in the correct direction.

(g) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.



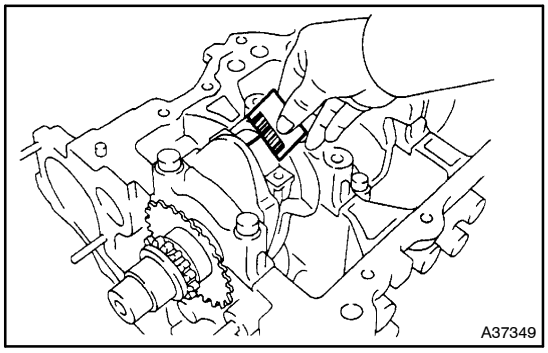
(h) Using SST, tighten the bolts in several passes by the specified torque.
SST 09205–16010
Torque: 15 N·m (150 kgf·cm, 11 ft·lbf)



(i) Mark the front of the connecting cap bolts with paint.
(j) Retighten the cap bolts by 90° as shown in the illustration.

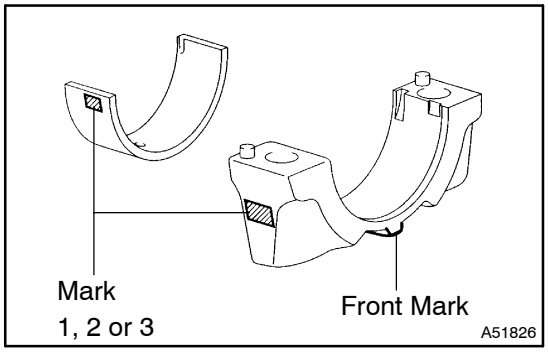
NOTICE:
Do not turn the crankshaft.

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



(l) Measure the plastigage at its widest point.
Standard oil clearance:
0.016 – 0.040 mm (0.0006 – 0.0016 in.)
Maximum oil clearance: 0.06 mm (0.0024 in.)

NOTICE:
Completely remove the plastigage.

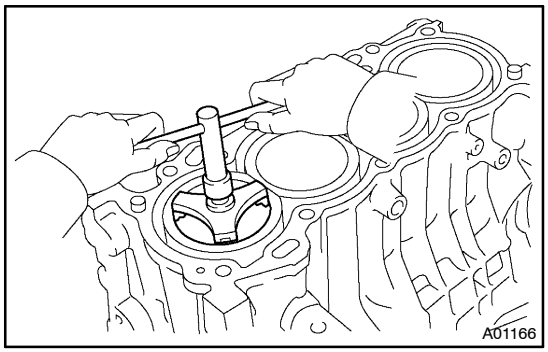


(m) If replacing a bearing, replace it with one having the same number as marked on the connecting rod. There are 3 sizes of standard bearings, marked ”1”, ”2” and ”3” accordingly.

HINT:

Standard bearing center wall thickness.

Mark	mm (in.)
1	1.488 – 1.492 (0.0586 – 0.0587)
2	1.492 – 1.496 (0.0587 – 0.0589)
3	1.496 – 1.500 (0.0589 – 0.0591)



3. REMOVE PISTON SUB–ASSY W/CONNECTING LOD

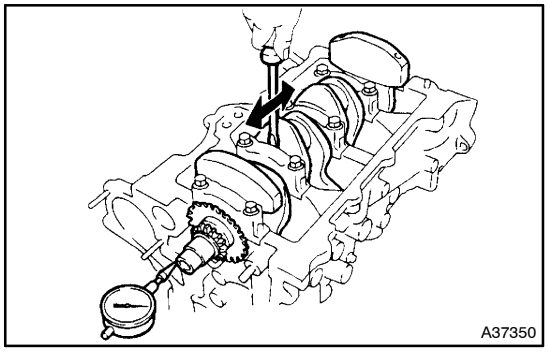
(a) Using a ride reamer, remove all the carbon from the top of the cylinder.

(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



5. INSPECT CRANKSHAFT THRUST CLEARANCE

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

Standard thrust clearance:

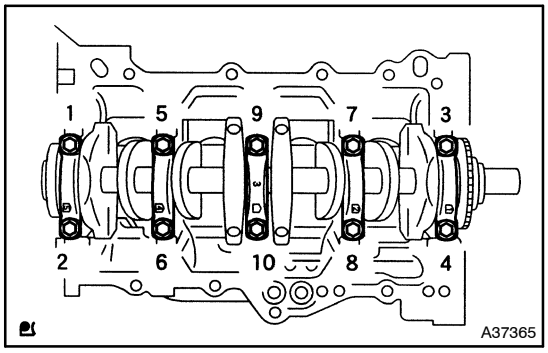
0.09 – 0.19 mm (0.0035 – 0.0075 in.)

Maximum thrust clearance: 0.03 mm (0.0012 in.)

If the thrust clearance is greater than maximum, replace the thrust washers as a set or crankshaft.

HINT:

Thrust washer thickness.2.43 – 2.48 mm (0.0957 – 0.0976 in.)



6. REMOVE CRANKSHAFT

(a) Using SST, uniformly loosen and remove the 10 bearing cap sub–assembly bolts, in several passes, in the sequence shown.

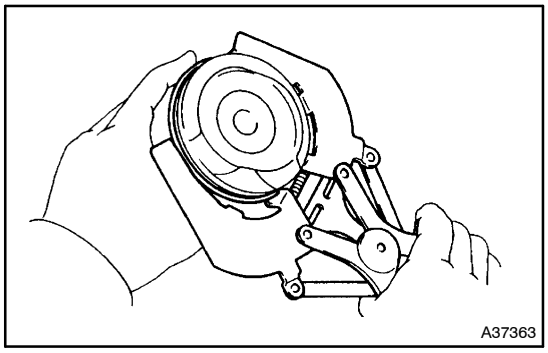
SST 09011–38121

(b) Remove the bearing cap and crankshaft.

7. REMOVE CRANKSHAFT BEARING

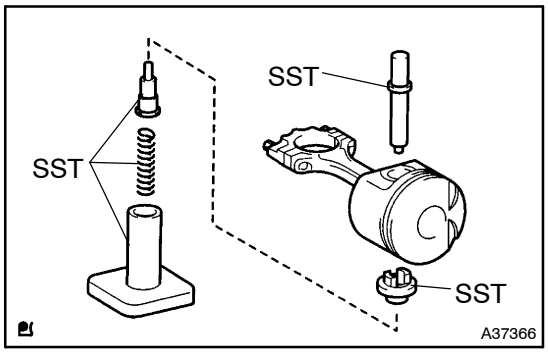
8. REMOVE PISTON RING SET

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.
SST 99999–60013
(b) Remove the 2 side rails and oil ring by hand.

9. REMOVE W/PIN PISTON SUB–ASSY



(a) Using SST, press out the piston pin from the piston.
SST 09221–25026 (09221–00021, 09221–00030, 09221–00190, 09221–00141, 09221–00150)

NOTICE:
Arrange the pistons, pins, ring, connecting rods and bearings in correct order.

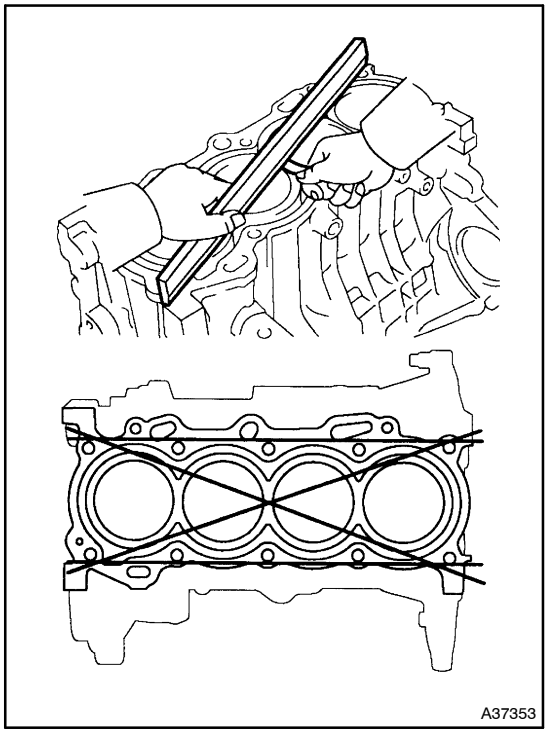
10. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB–ASSY

11. REMOVE STUD BOLT

12. REMOVE STRAIGHT PIN

13. REMOVE CYLINDER HEAD SET STRAIGHT PIN

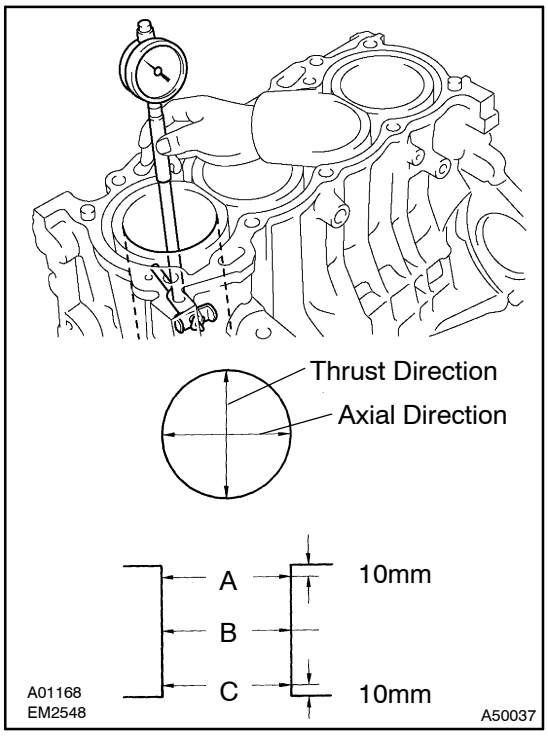
14. REMOVE TIGHT PLUG



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.

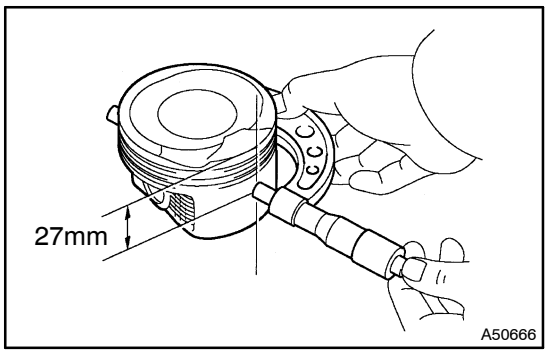
Maximum warpage: 0.05 mm (0.0020 in.)



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:
75.000 – 75.013 mm (2.9528 – 2.9533 in.)
Maximum diameter: 75.013 mm (2.9533 in.)

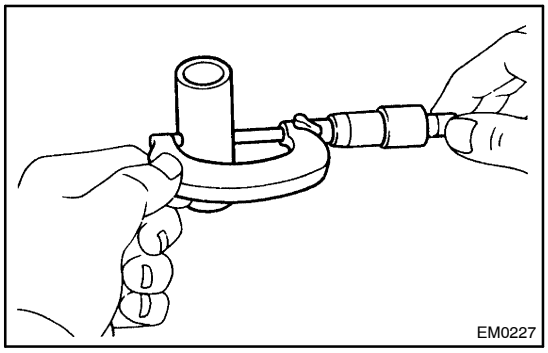


17. INSPECT W/PIN PISTON SUB–ASSY

(a) Using a micrometer, measure the piston diameter at right angle to the piston pin center line, and at the position of 27 mm (1.06 in.) from the piston head.

Piston diameter:
74.945 – 74.955 mm (2.95058 – 2.95098 in.)

(b) Using caliper gauge, measure the piston pin hole diameter of the piston.
Piston pin hole diameter at 20°C (68°F):
18.013 – 18.016 mm (0.70917 – 0.70929 in.)



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

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

If the clearance is greater than maximum, replace the bushing. If necessary, replace the piston and piston pin as s set.

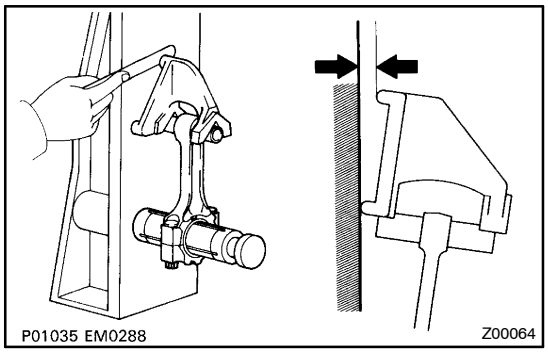
18. INSPECT PISTON CLEARANCE

(a) Subtract the piston diameter measurement from the cylinder bore diameter measurement.
Standard oil clearance: 0.045 – 0.068 mm (0.0018 – 0.0027 in.)
Maximum oil clearance: 0.08 mm (0.0031 in.)

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

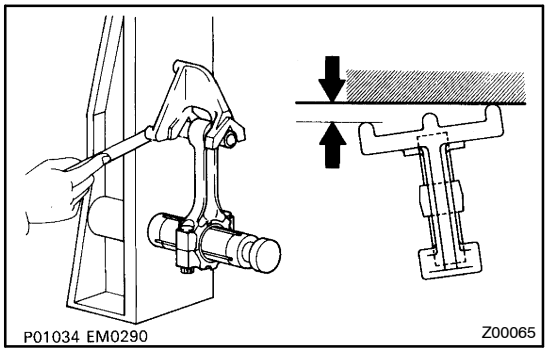
19. INSPECT CONNECTING ROD SUB–ASSY

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



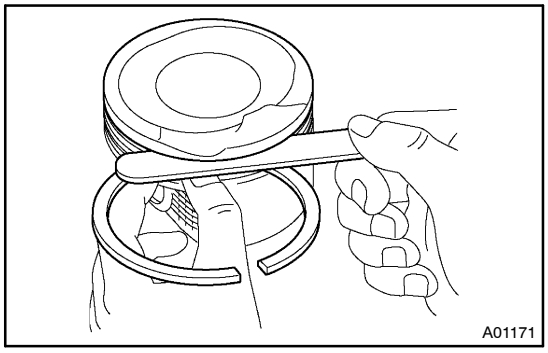
(1) Check for out–of–alignment.
Maximum out–of alignment:
0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

If out–of alignment is greater than maximum, replace the connecting rod assembly.



(2) Check for twist.
Maximum twist:
0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

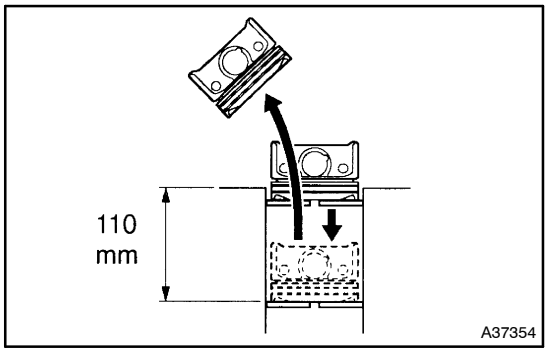
If twist is greater than maximum, replace the connecting rod assembly.



20. INSPECT RING GROOVE CLEARANCE

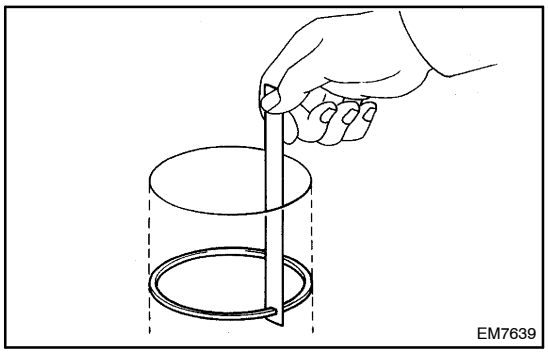
(a) Using a feeler gauge, measure the clearance between new piston ring and the wall of the ring groove.

Ring groove clearance:
No.1 0.03 – 0.07 mm (0.0012 – 0.0028 in.)
No.2 0.02 – 0.06 mm (0.0008 – 0.0024 in.)



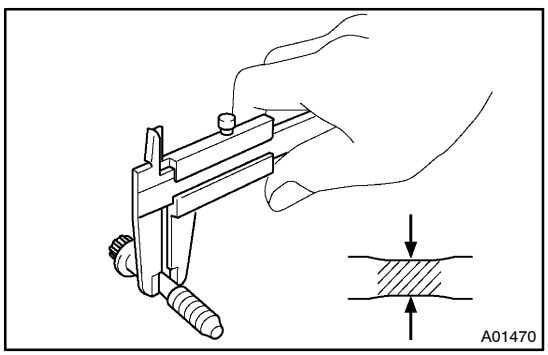
21. INSPECT PISTON RING END GAP

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



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

Standard end gap (1NZ–FE):
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) 0.10 – 0.35 mm (0.0039 – 0.0138 in.)
Standard end gap (2NZ–FE):
No. 1 0.22 – 0.32 mm (0.0087 – 0.0126 in.)
No. 2 0.32 – 0.47 mm (0.0126 – 0.0185 in.)
Oil (Side rail) 0.10 – 0.35 mm (0.0039 – 0.0138 in.)
Maximum end gap (1NZ–FE):
No. 1 0.91 mm (0.0358 in.)
No. 2 1.06 mm (0.0417 in.)
Oil (Side rail) 0.82 mm (0.0323 in.)
Maximum end gap (2NZ–FE):
No. 1 0.88 mm (0.0346 in.)
No. 2 1.03 mm (0.0406 in.)
Oil (Side rail) 0.82 mm (0.0323 in.)

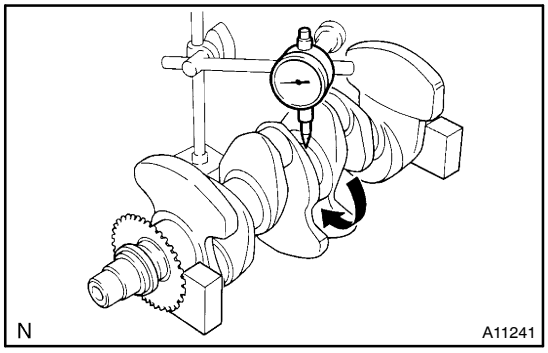


22. INSPECT CONNECTING ROD BOLT

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

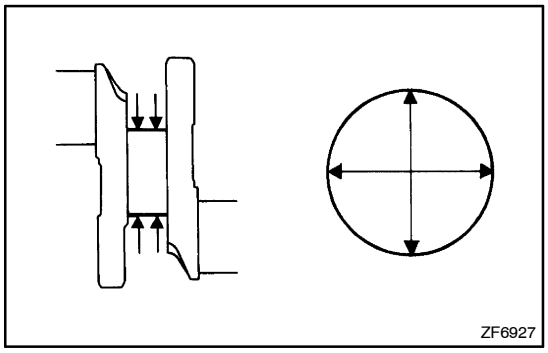
Standard diameter:
6.6 – 6.7 mm (0.260 – 0.264 in.)
Maximum diameter: 6.4 mm (0.252 in.)

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



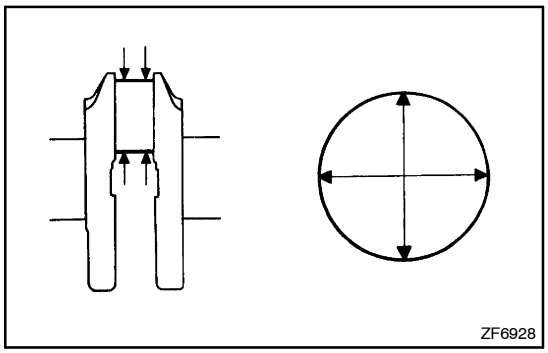
23. INSPECT CRANKSHAFT

(a) Using a dial indicator and V–blocks, measure the circle runout, as shown in the illustration.
SST 99999–60009
Maximum circle runout: 0.03 mm (0.0012 in.)



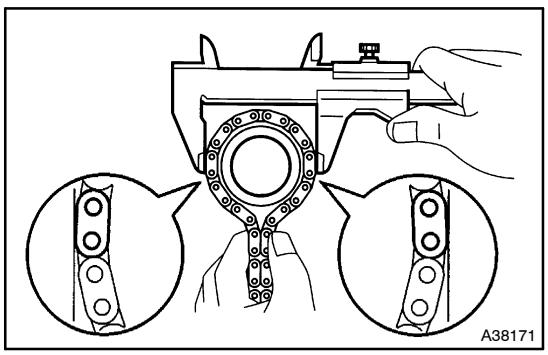
(b) Using a micrometer, measure the diameter of each main journal.
Diameter: 45.988 – 46.000 mm (1.8105 – 1.8110 in.)

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

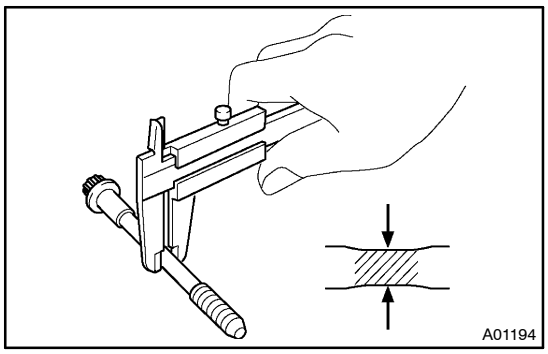
(e) Check each crank pin for taper and out–of–round as shown.
Maximum taper and out–of–round:
0.02 mm (0.0008 in.)



(f) Wrap the chain around the timing sprocket.

(g) Using a vernier calipers, measure the timing sprocket diameter with the chain.
Standard sprocket diameter (w/ chain):
51.72 mm (2.0362 in.)
Maximum sprocket diameter (w/ chain):
50.5 mm (1.988 in.)

NOTICE:
Vernier calipers must contact the chain rollers for measuring.



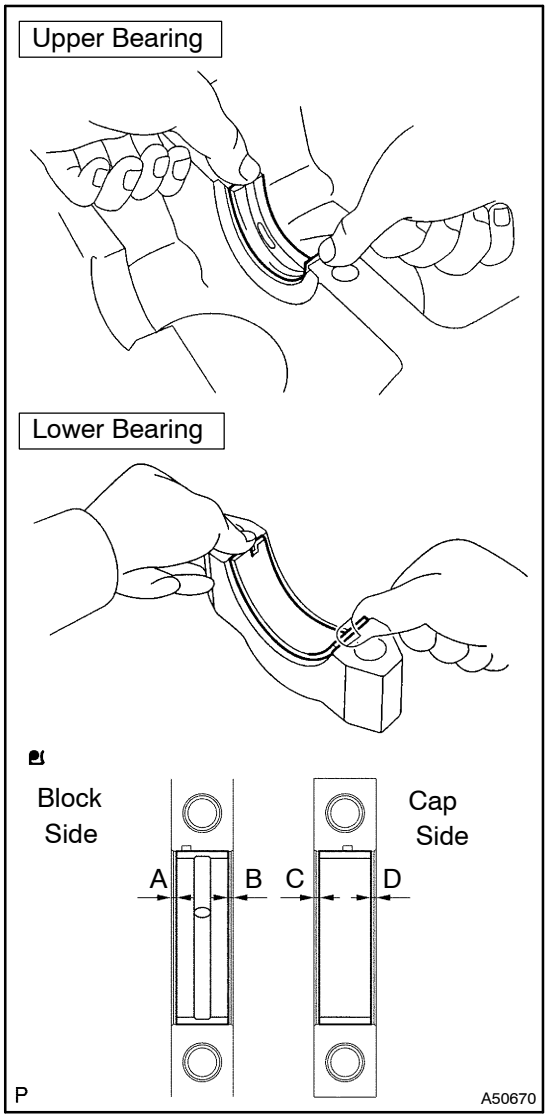
24. INSPECT CRANKSHAFT BEARING CAP SET BOLT

(a) Using vernier calipers, measure the tension portion diameter of the bolt.
Standard diameter: 7.3 – 7.5 mm (0.287 – 0.295 in.)
Minimum diameter: 7.2 mm (0.283 in.)

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

25. INSPECT CRANKSHAFT OIL CLEARANCE

(a) Clean each main journal and bearing.



(b) Install the bearing on the cylinder block and bearing cap.

NOTICE:

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

HINT:

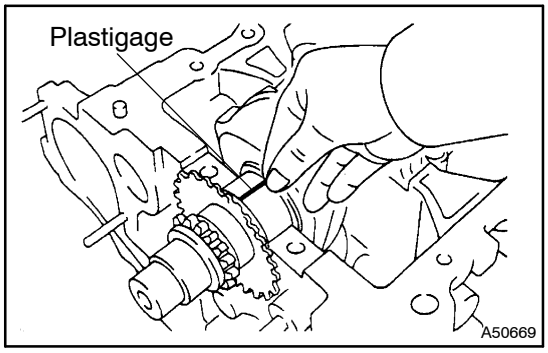
In case of reusing manufacture parts, measure the clearance on both sides of the bearing and install it so that the difference between measured values will be within the specified bellow.

Specified clearance:

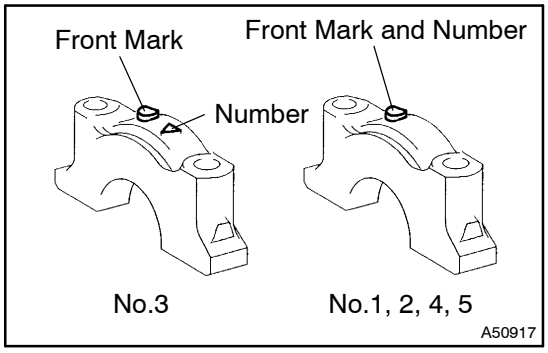
A – B = within 0.8 mm (0.032 in.)

C – D = within 0.4 mm (0.016 in.)

(c) Place the crankshaft on the cylinder block.

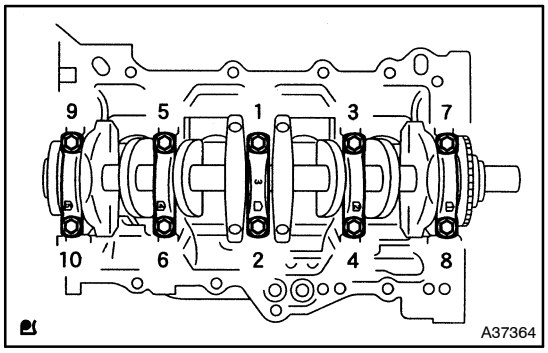


(d) Lay a strip of plastigage across each journal.

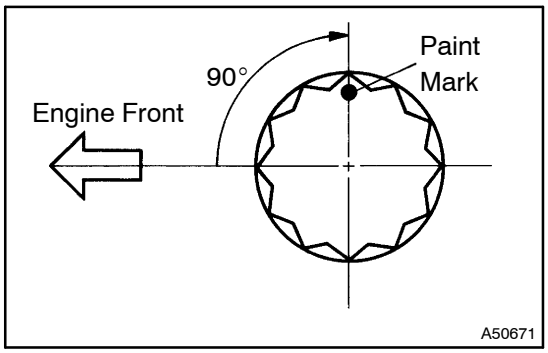


(e) Examine the front marks and numbers and install the bearing caps on the cylinder block.

(f) Apply a light coat of engine oil on the threads and under the bearing cap bolts.



(g) Using SST, tighten the bolts in several passes by the specified torque.
SST 09011–38121
Torque: 22 N·m (225 kgf·cm, 16 ft·lbf)



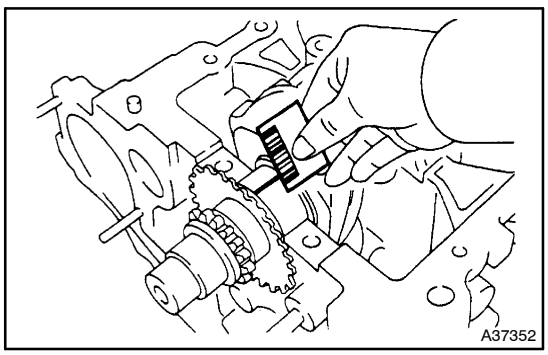
(h) Mark the front of the bearing cap bolts with paint.

(i) Retighten the bearing cap bolts by 90° in the numerical order shown.

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

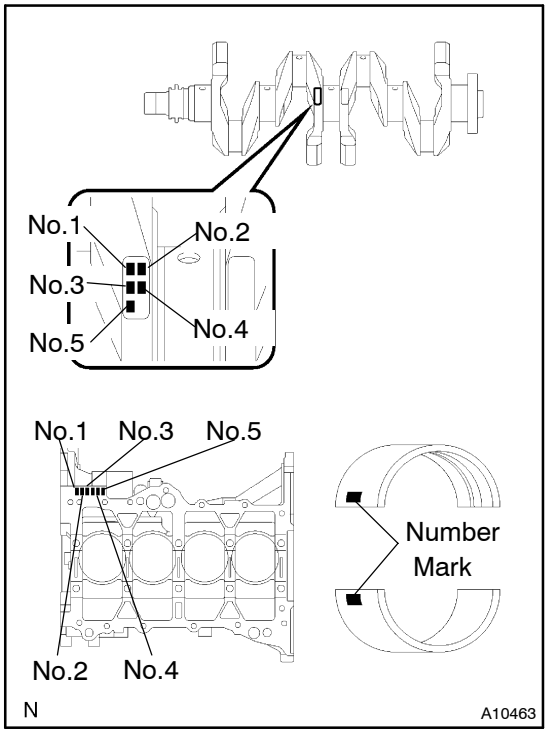
NOTICE:
Do not turn the crankshaft.

(k) Remove the bearing cap sub–assembly.



(l) Measure the plastigage at its widest point.
Standard oil clearance:
0.01 – 0.023 mm (0.0004 – 0.0009 in.)
Maximum oil clearance: 0.07 mm (0.0028 in.)

NOTICE:
Completely remove the plastigage.



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

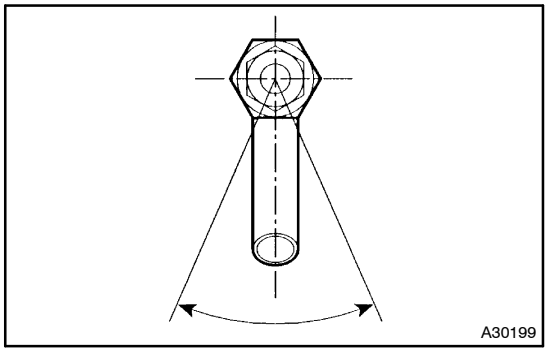
Cylinder block (A) + Crankshaft (B)	0–2	3–5	6–8	9–11
Use bearing	"1"	"2"	"3"	"4"

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"	50.000 – 50.003 (1.96850 – 1.96862)
	"1"	50.003 – 50.005 (1.96862 – 1.96870)
	"2"	50.005 – 50.007 (1.96870 – 1.96878)
	"3"	50.007 – 50.010 (1.96878 – 1.96889)
	"4"	50.010 – 50.012 (1.96889 – 1.96897)
	"5"	50.012 – 50.014 (1.96897 – 1.96905)
	"6"	50.014 – 50.016 (1.96905 – 1.96913)
Crankshaft main journal diameter (B)	"0"	45.998 – 46.000 (1.81094 – 1.81102)
	"1"	45.996 – 45.998 (1.81087 – 1.81094)
	"2"	45.994 – 45.996 (1.81079 – 1.81087)
	"3"	45.992 – 45.994 (1.81071 – 1.81079)
	"4"	45.990 – 45.992 (1.81063 – 1.81071)
	"5"	45.988 – 45.990 (1.81055 – 1.81063)
Standard bearing center wall thickness	"1"	1.992 – 1.995 (0.07843 – 0.07854)
	"2"	1.995 – 1.998 (0.07854 – 0.07866)
	"3"	1.998 – 2.001 (0.07866 – 0.07878)
	"4"	2.001 – 2.004 (0.07878 – 0.07890)

26. 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.



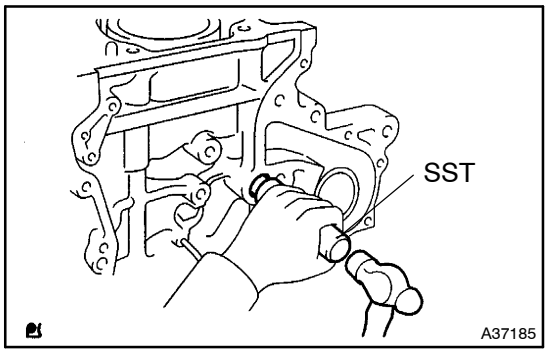
(b) After applying the specified torque, rotate the drain union clockwise until its drain port faces downward.
Torque: 35 N·m (350 kgf·cm, 25 ft·lbf)

NOTICE:

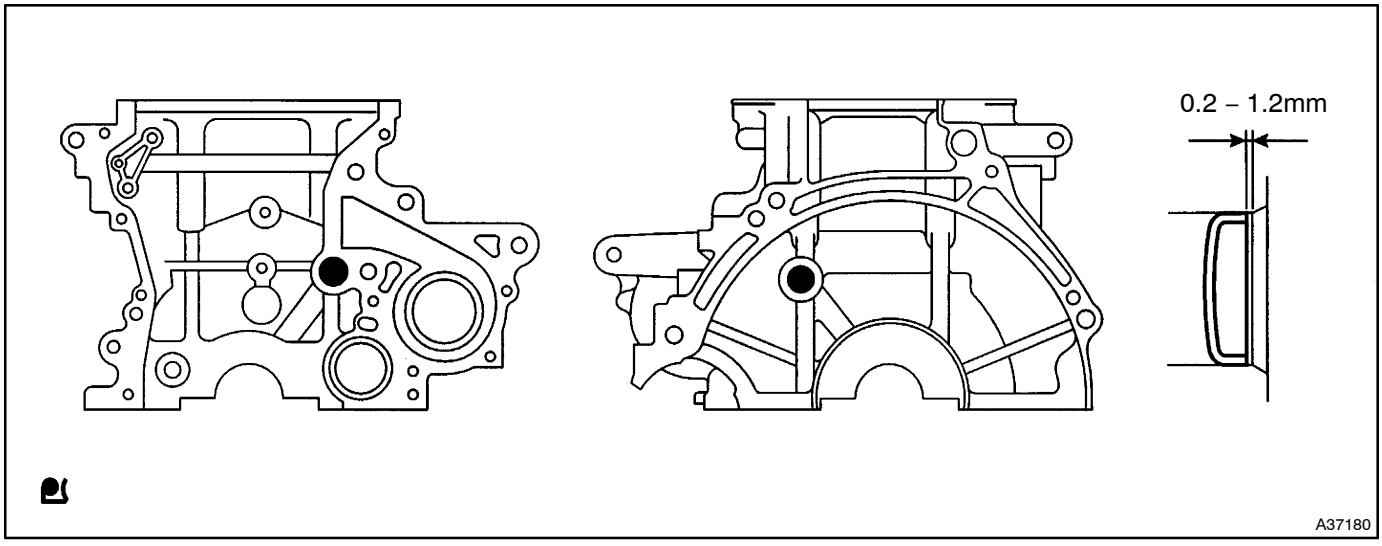
- **Install the water drain cock within 3 minutes after applying adhesive.**
- **Put into coolant in an hour after the installation.**
- **Do not rotate the drain union more than 360° in (b), and never loosen it after setting the union correctly.**

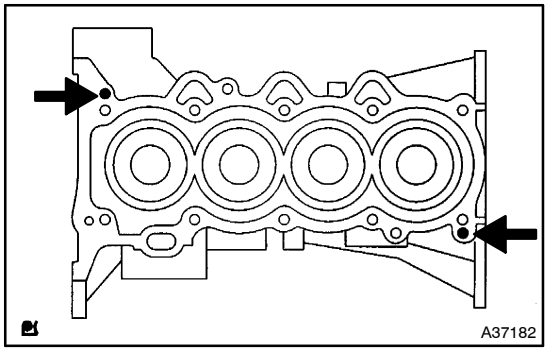
27. INSTALL TIGHT PLUG

(a) Apply adhesive around tight plugs.



(b) Using SST, into the tight plugs as shown in the illustration.
SST 09950–60010 (09951–00180), 09950–70010 (09951–07100)
Standard depth: 0.2 – 1.2 mm (0.008 – 0.047 in.)





28. INSTALL CYLINDER HEAD SET STRAIGHT PIN

(a) Using a plastic–faced hammer, tap into the straight pin.
Standard protrusion:
6.0 – 7.0 mm (0.236 – 0.276 in.)

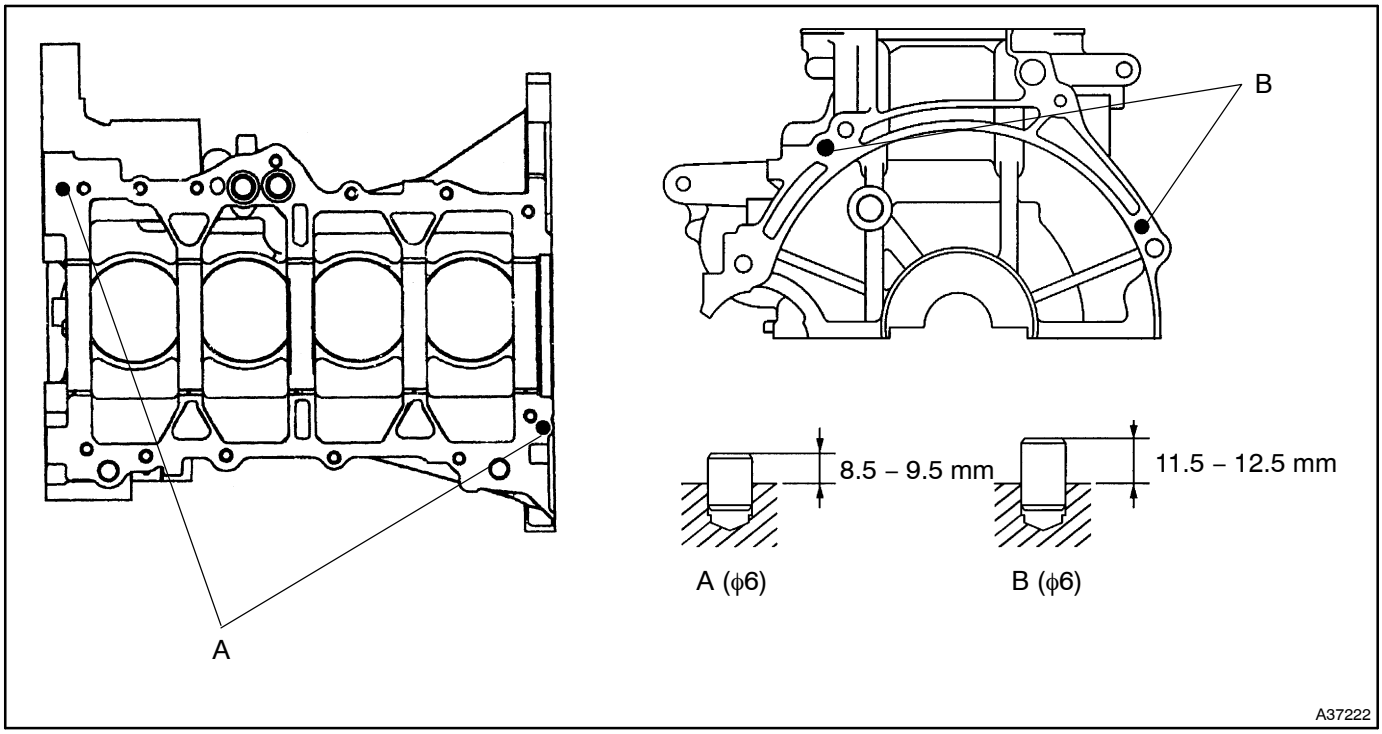
29. INSTALL STRAIGHT PIN

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

Standard protrusion:

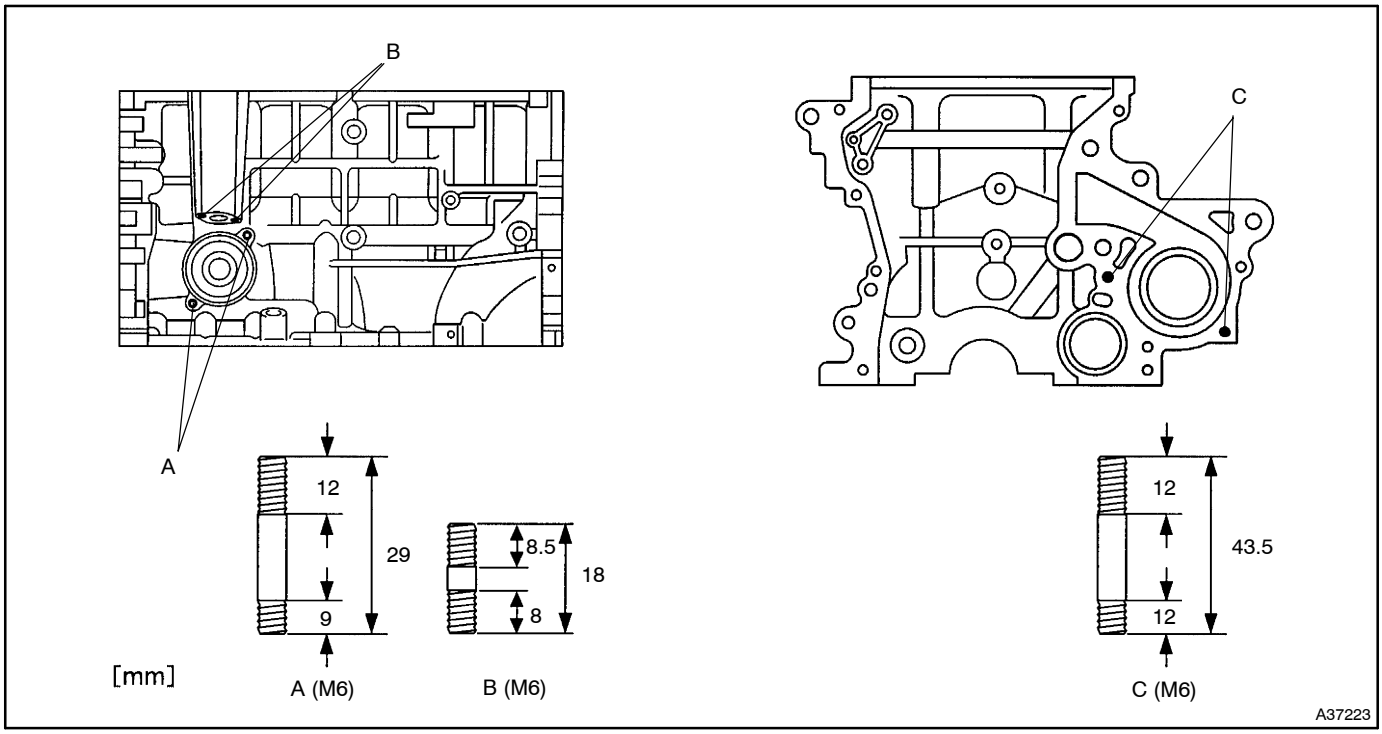
Pin A 8.5 – 9.5 mm (0.335 – 0.374 in.)

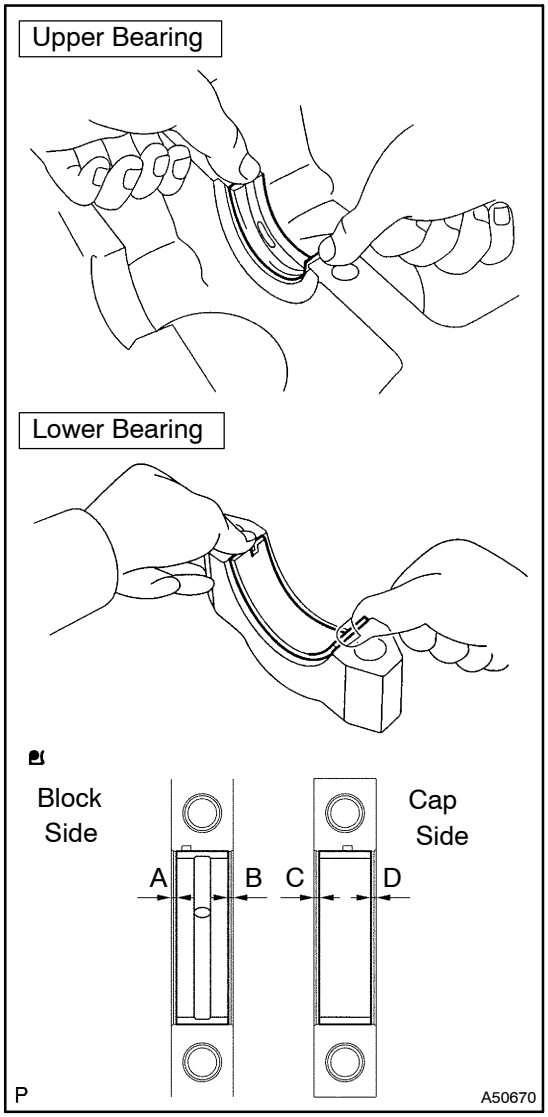
Pin B 11.5 – 12.5 mm (0.453 – 0.492 in.)



30. INSTALL STUD BOLT

(a) Install the stud bolts as shown in the illustration.
Torque: 5.0 N·m (50 kgf·cm, 43 in.·lbf)





31. INSTALL CRANKSHAFT

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

(b) Install the lower bearing on bearing cap.

NOTICE:

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

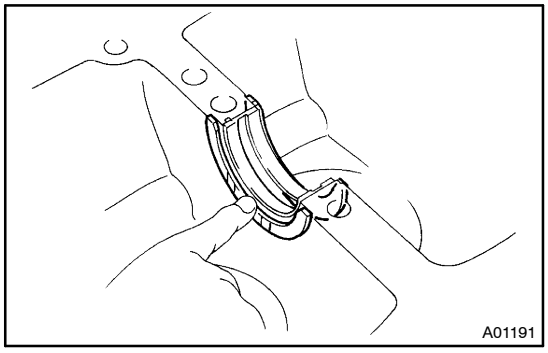
HINT:

In case of reusing manufacture parts,measure the clearance on both sides of the bearing and install it so that the difference between measured values will be within the specified bellow.

Specified clearance:

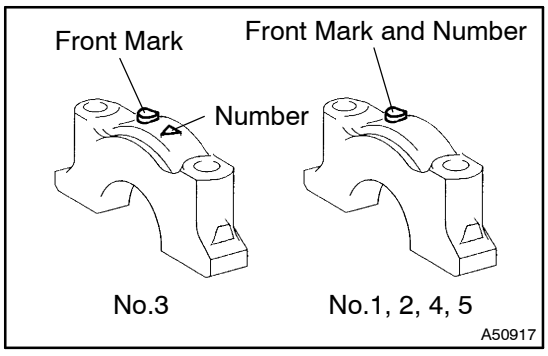
A – B = within 0.8 mm (0.032 in.)

C – D = within 0.4 mm (0.016 in.)



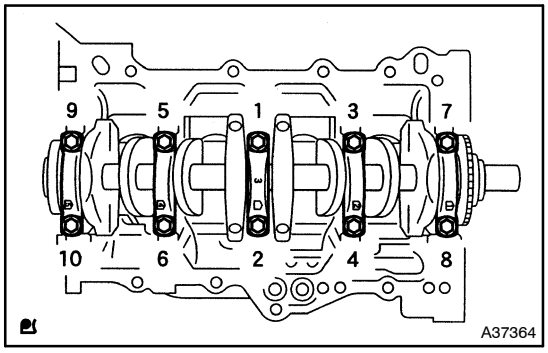
(c) Install the 2 thrust washers under the No. 3 journal position of the cylinder block with the oil grooves facing outward.

(d) Apply engine oil to upper bearing and install the crankshaft on the cylinder block.



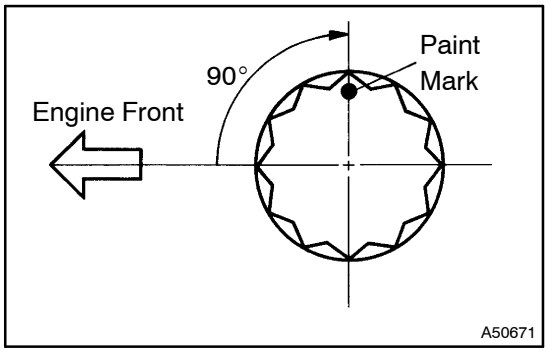
(e) Examine the front marks and numbers and install the bearing caps on the cylinder block.

(f) Apply a light coat of engine oil on the threads and under the bearing cap bolts.



(g) Using SST, tighten the bolts in several passes by the specified torque.
SST 09011–38121
Torque: 22 N·m (225 kgf·cm, 16 ft·lbf)

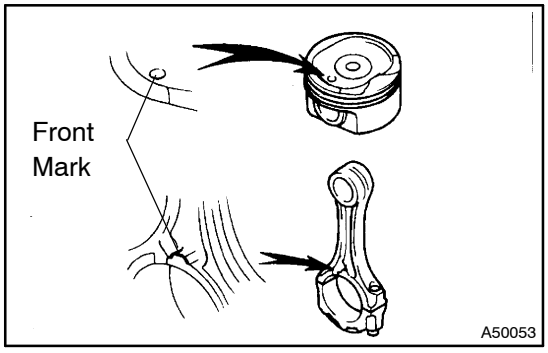
NOTICE:
Check that the crankshaft turns smoothly.



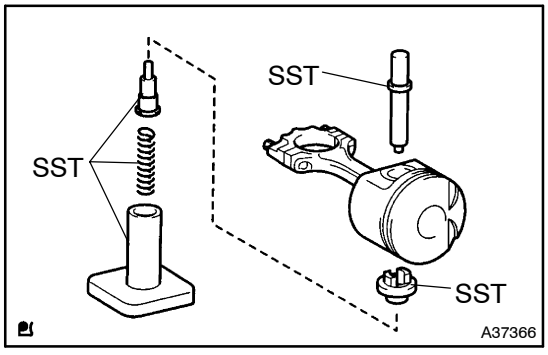
(h) Mark the front of the bearing cap bolts with paint.
(i) Retighten the bearing cap bolts by 90° in the numerical order shown.
(j) Check that the painted mark is now at a 90° angle to the front.

32. INSTALL W/PIN PISTON SUB–ASSY

(a) Coat the piston pin and pin holes of the piston with engine oil.

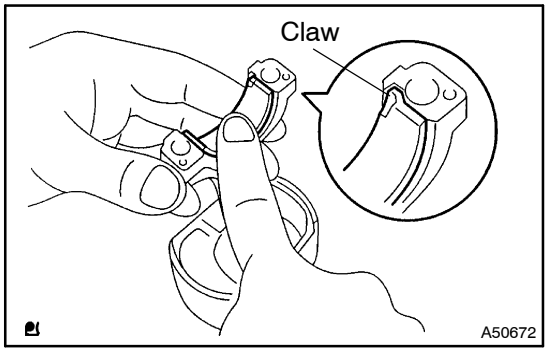


(b) Align the cavity on the piston with the protrusion on the connecting rod.



(c) Using SST, press in the piston pin.
SST 09221–25026 (09221–00021, 09221–00030, 09221–00190, 09221–00141, 09221–00150)

NOTICE:
Arrange the pistons, pins, rings, connecting rods and bearings in correct order.

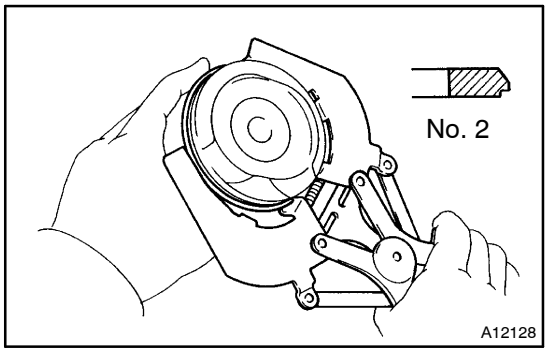


33. INSTALL CONNECTING ROD BEARING

(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.



34. INSTALL PISTON RING SET

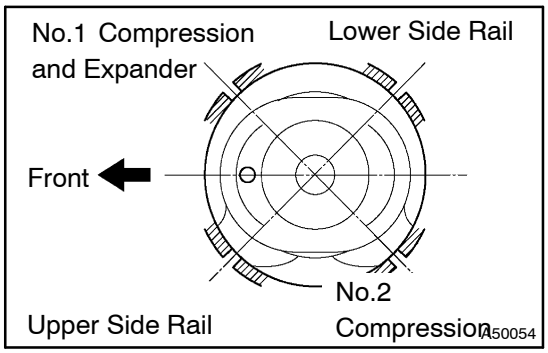
HINT:

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.

SST 99999–60013

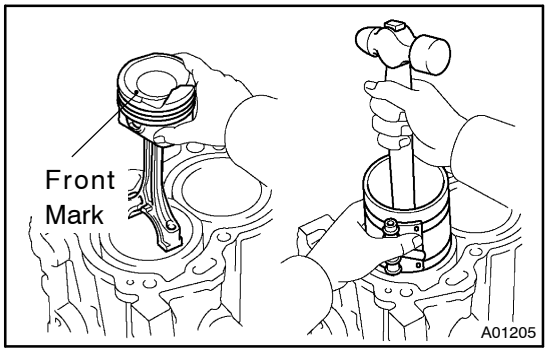


(c) Position the piston rings so that the ring ends are as shown.

35. INSTALL PISTON SUB–ASSY W/CONNECTING LOD

(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.

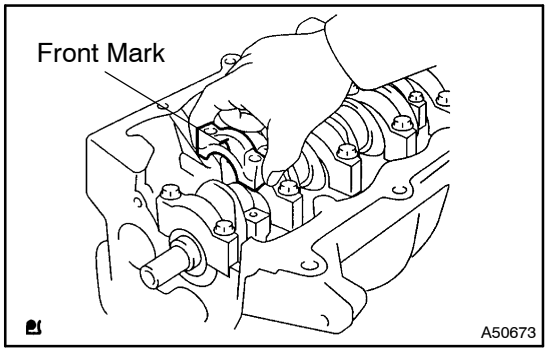


(c) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.

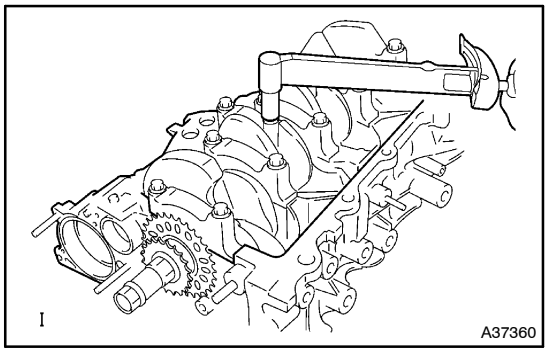
SST 99999–60012

NOTICE:

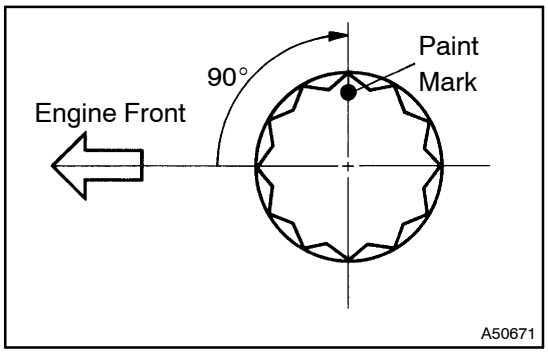
- **Clean the backside of the bearing and the bearing surface of the connecting rod cap and let not stick the oils and fats.**
- **Match the numbered connecting rod cap with the connecting rod.**



(d) Check that the protrusion of the connecting rod cap is facing in the correct direction.
(e) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.



(f) Using SST, tighten the bolts in several passes by the specified torque.
SST 09205–16010
Torque: 15 N·m (150 kgf·cm, 11 ft·lbf)



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