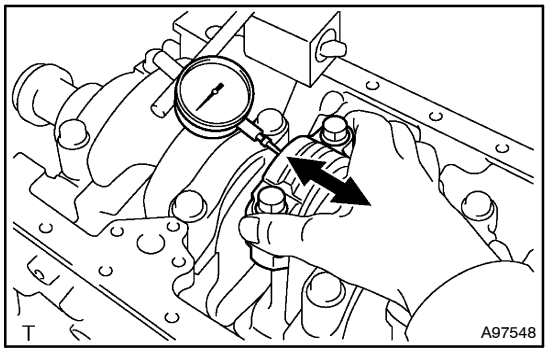
141UO–01

OVERHAUL



1. INSPECT CONNECTING ROD THRUST CLEARANCE

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

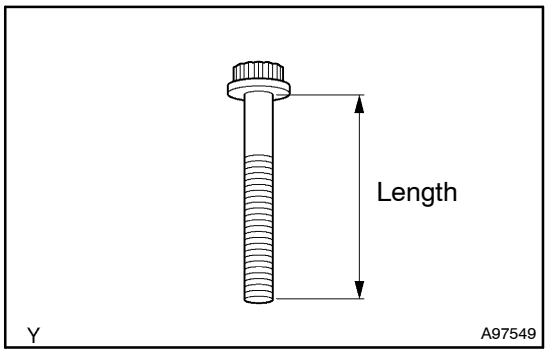
Standard thrust clearance:
0.200 to 0.520 mm (0.0079 to 0.0204 in.)
Maximum thrust clearance: 0.60 mm (0.0236 in.)

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

2. REMOVE PISTON W/CONNECTING ROD

(a) Remove the piston from the cylinder block.

3. REMOVE CONNECTING ROD BEARING

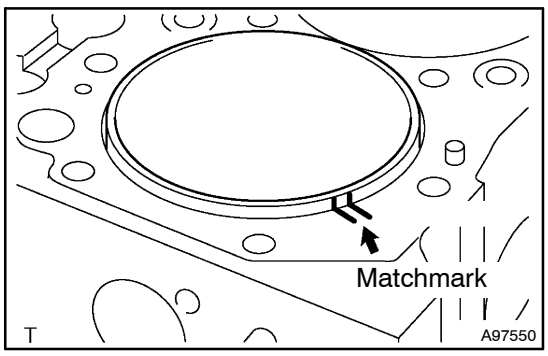


4. INSPECT CONNECTING ROD BOLT

(a) Using a vernier caliper, measure the length of the connecting rod bolt.

Standard bolt length: 59.00 mm (2.3228 in.)
Maximum bolt length: 61.5 mm (2.421 in.)

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



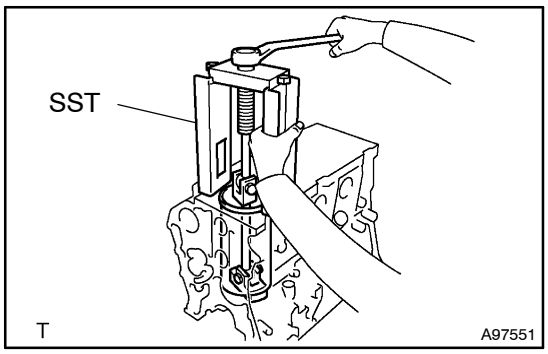
5. REMOVE CYLINDER LINER

HINT:

Before removing the cylinder liner, put matchmarks on the cylinder liner and cylinder is bent by ”run–in”.

NOTICE:

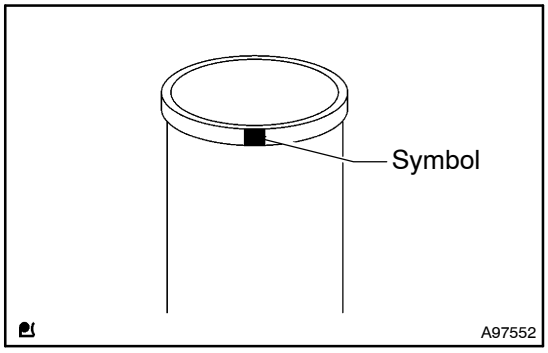
When reusing the cylinder liner, misalignment with the cylinder block may concentrate stress on the thin part of the cylinder liner and it may be broken.



(a) Using SST, remove the cylinder liner.
SST S0942–01460

NOTICE:

Organize the parts so that each parts location can be remembered for reassembly.



6. INSPECT CYLINDER LINER

(a) Using a micrometer, measure the outside diameter of the cylinder liner.

Standard:

Symbols	Outside Diameter
A	106.982 to 106.989 mm (4.2118 to 4.2121 in.)
B	106.990 to 106.995 mm (4.2121 to 4.2123 in.)
C	106.996 to 107.004 mm (4.2124 to 4.2127 in.)

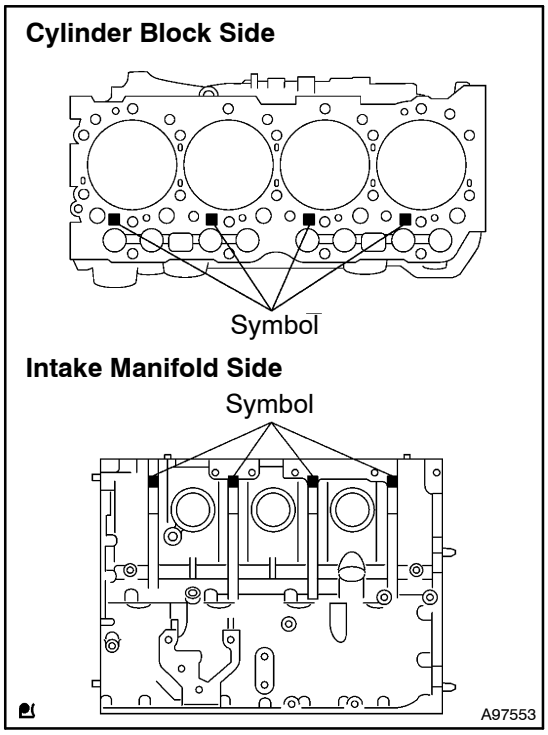
If the diameter is greater than the minimum, replace the cylinder liner.

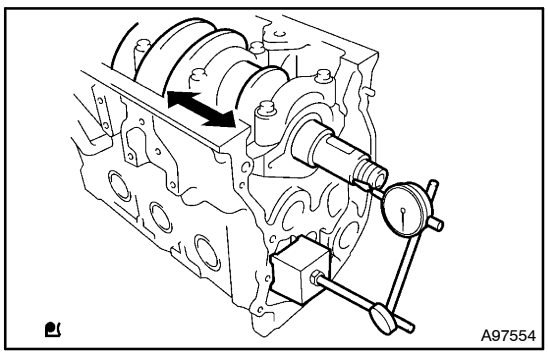
(b) Using a cylinder gauge, measure the inside diameter of the cylinder block.

Standard:

Symbols	Outside Diameter
A	107.000 to 107.008 mm (4.2125 to 4.2129 in.)
B	107.008 to 107.014 mm (4.2129 to 4.2131 in.)
C	107.014 to 107.022 mm (4.2131 to 4.2134 in.)

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



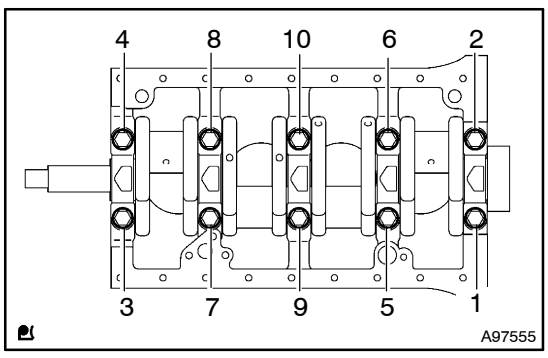


7. INSPECT CRANKSHAFT THRUST CLEARANCE

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

Standard thrust clearance:
0.050 to 0.220 mm (0.0019 to 0.0086 in.)
Maximum thrust clearance: 0.40 mm (0.0157 in.)

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



8. REMOVE CRANKSHAFT

(a) Remove the 10 bearing cap bolts in the order as shown in the illustration.

(b) Using a plastic–faced hammer, tap the bearing caps to remove them.

NOTICE:

Be careful not to damage the thrust washer and bearing.

(c) Remove the crankshaft.

9. REMOVE CRANKSHAFT THRUST WASHER SET

NOTICE:

Organize the parts so that each parts location can be remembered for reassembly.

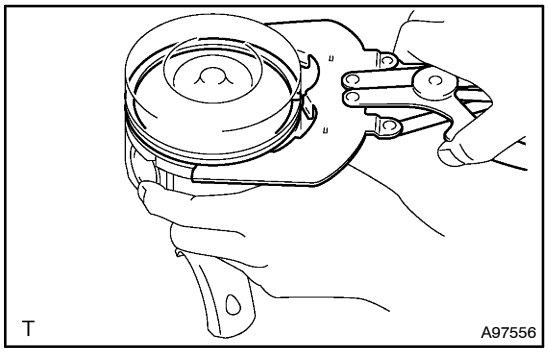
10. REMOVE CRANKSHAFT BEARING

NOTICE:

Organize the parts so that each parts location can be remembered for reassembly.

11. REMOVE SUB–ASSY OIL NOZZLE NO.1

(a) Remove the bolt and nozzle.

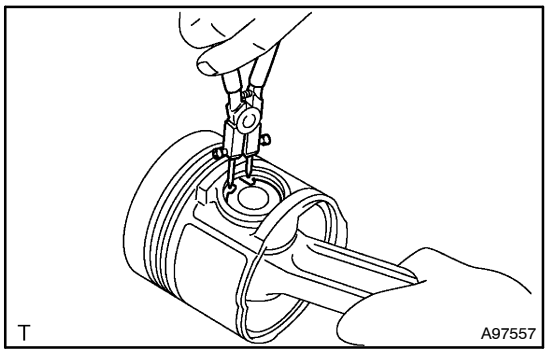


12. REMOVE PISTON RING SET

(a) Using a piston ring expander, remove the piston rings.

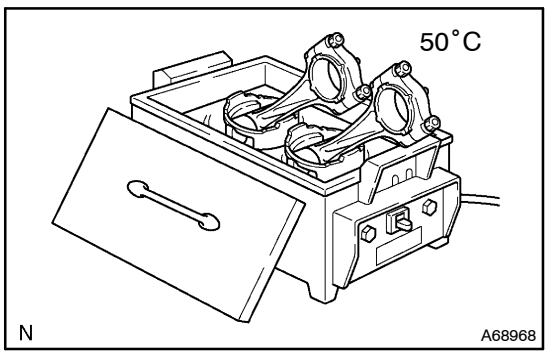
HINT:

Arrange the piston rings in the correct order.

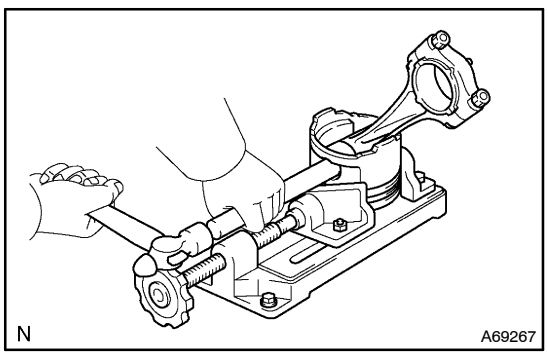


13. REMOVE PISTON PIN

(a) Using snap ring pliers, remove the snap rings.



(b) Gradually heat the piston to approximately 50°C (122°F).

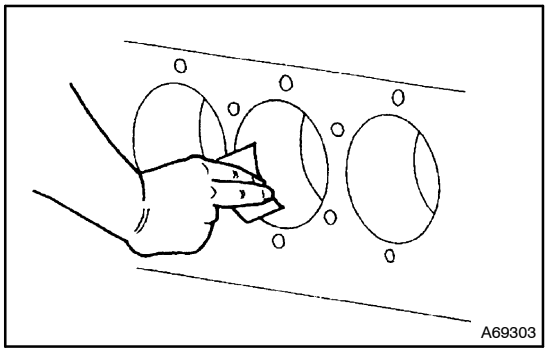


(c) Using a plastic–faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.

HINT:

- The piston and pin are a set.
- Arrange the pistons, pins, rings, connecting rods and bearings in the correct order.

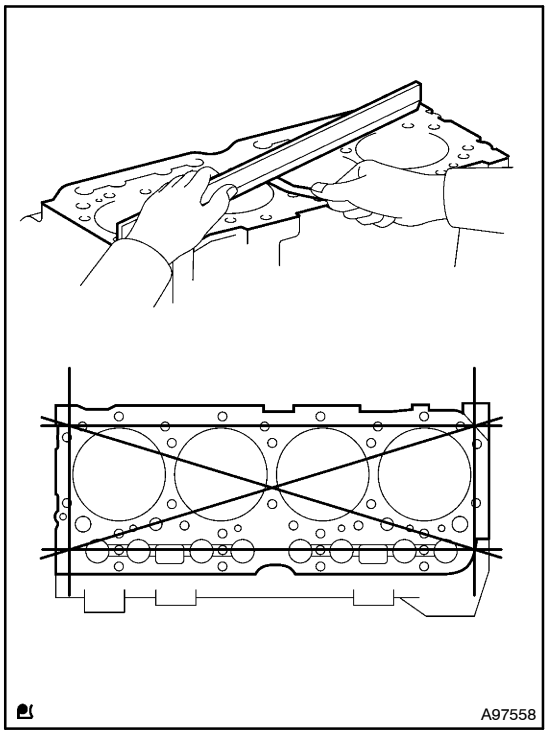
14. REMOVE STUD BOLT



15. INSPECT CYLINDER BLOCK FOR FLATNESS

HINT:

Before the measurement, remove carbon deposits from the upper end inside the cylinder liner with a scraper or an emery paper (recommended: No.150), working in a circular direction. Make sure that there is no scratches inside the cylinder liner.



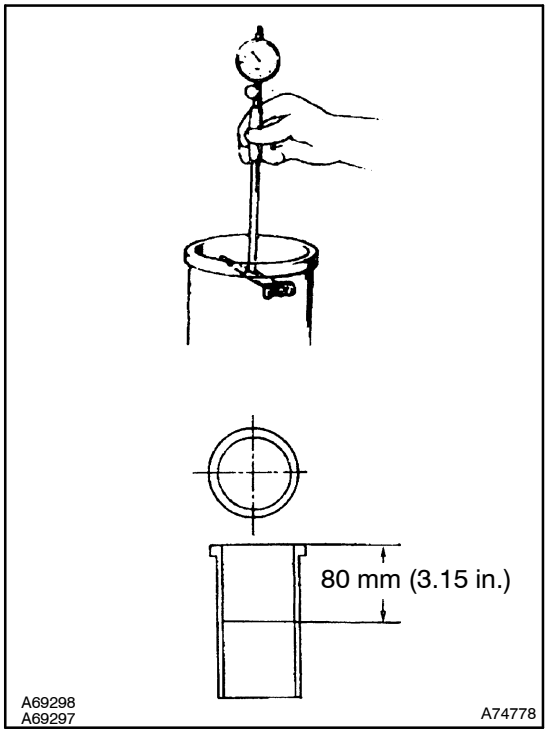
(a) Using a precision straight edge and feeler gauge, measure the warpage of the surface contacting the cylinder head cap.

Maximum warpage: 0.10 mm (0.0039 in.)

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

(b) Visually check the cylinders for vertical scratches.

If deep scratches are found, rebore all the 4 cylinders. If necessary, replace the cylinder block.



16. INSPECT CYLINDER BORE

(a) Using a cylinder gauge, measure the cylinder liner inside diameter at the 4 points in the piston boss and thrust direction, as shown in the illustration.

Standard inside diameter:
104.012 to 104.036 mm (4.0950 to 4.0959 in.)
Maximum inside diameter: 104.15 mm (4.1004 in.)

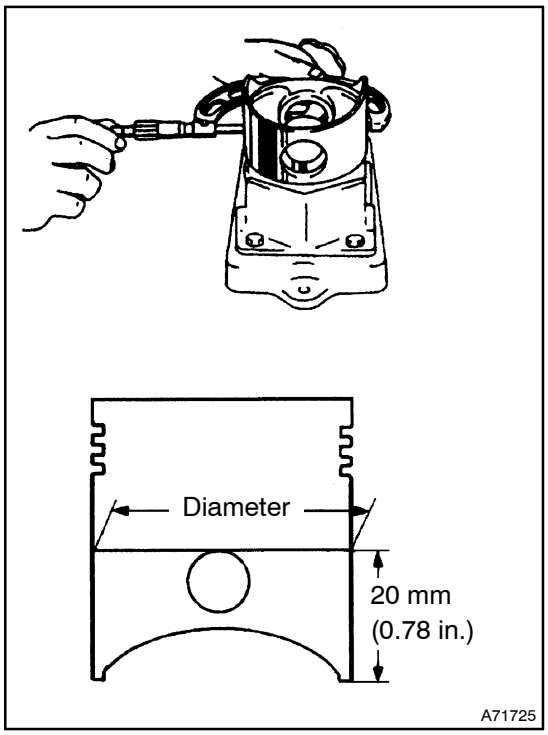
If the inside diameter is greater than the maximum, replace the cylinder liner with a new one.

HINT:

- Apply the value measured at the most worn point to the cylinder liner inside diameter.
- If the cylinder liner is heavily worn or if only the piston ring must be replaced, correct the corrugation in the top of the cylinder liner.

Standard oil clearance:
0.084 to 0.124 mm (0.0033 to 0.0048 in.)

If the clearance is greater than the standard, replace the cylinder liner and/or piston with a new one.



17. INSPECT PISTON

(a) Using a micrometer, measure the piston diameter at the points in the illustration.

Standard piston diameter:
103.912 to 103.928 mm (4.0910 to 4.0916 in.)

If the piston diameter is less than the minimum, replace the piston with a new one.

18. INSPECT PISTON OIL CLEARANCE

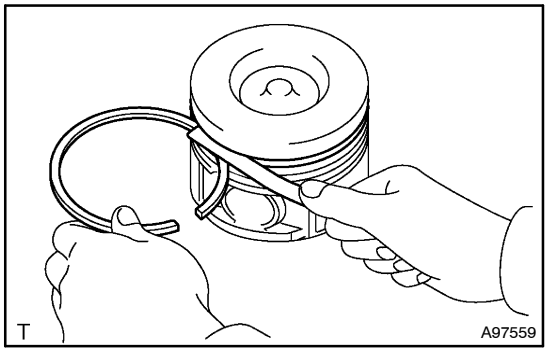
(a) Subtract the piston diameter measurement from the cylinder liner inside diameter measurement.

Standard oil clearance: 0.084 to 0.124 mm (0.0033 to 0.0048 in.)

If the clearance is greater than the standard, replace the cylinder liner and/or piston with a new one.

HINT:

Apply the value measured at the most worn point to the cylinder liner inside diameter.



19. INSPECT RING GROOVE CLEARANCE

(a) Insert the piston ring into the piston ring groove.

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

Standard groove clearance:

1st	0.11 to 0.15 mm (0.0043 to 0.0059 in.)
2nd	0.07 to 0.11 mm (0.0028 to 0.0043 in.)
Oil	0.02 to 0.06 mm (0.0008 to 0.0024 in.)

Maximum groove clearance: 0.30 mm (0.0118 in.)

If the clearance is greater than the maximum, measure the width of the piston ring and piston ring groove individually and replace any parts that do not meet the limit with new ones.

(c) Using a feeler gauge, measure the dimension each groove.

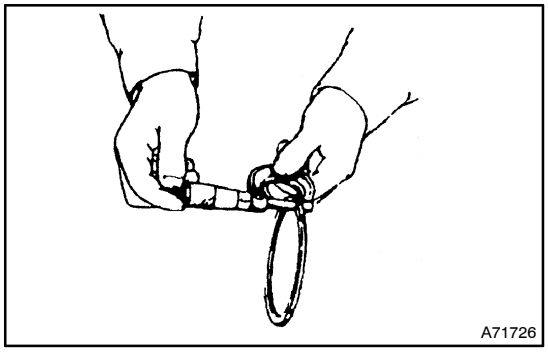
Standard groove width:

1st	2.58 to 2.60 mm (0.1016 to 0.1024 in.)
2nd	2.06 to 2.08 mm (0.0811 to 0.0819 in.)
Oil	4.01 to 4.03 mm (0.1579 to 0.1587 in.)

Maximum groove width:

1st	3.10 mm (0.1220 in.)
2nd	2.20 mm (0.0866 in.)
Oil	4.08 mm (0.1606 in.)

If the dimension is greater than the maximum, replace the piston and piston ring as a set.



(d) Using a micrometer , measure the piston ring thickness.

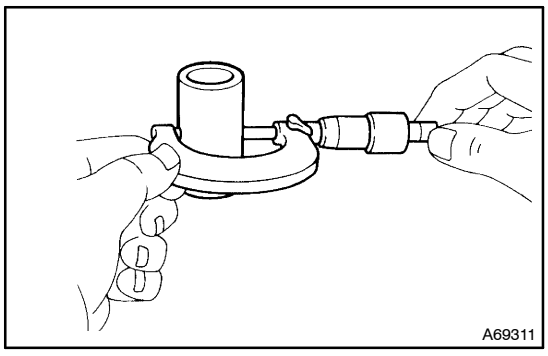
Standard ring thickness:

1st	2.47 to 2.49 mm (0.0972 to 0.0980 in.)
2nd	1.97 to 1.99 mm (0.0776 to 0.0783 in.)
Oil	4.97 to 4.99 mm (0.1957 to 0.1965 in.)

Minimum ring thickness:

1st	2.32 mm (0.0913 in.)
2nd	1.82 mm (0.0717 in.)
Oil	4.95 mm (0.1949 in.)

If the thickness is less than the minimum, replace the piston ring.



20. INSPECT PISTON PIN OIL CLEARANCE

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

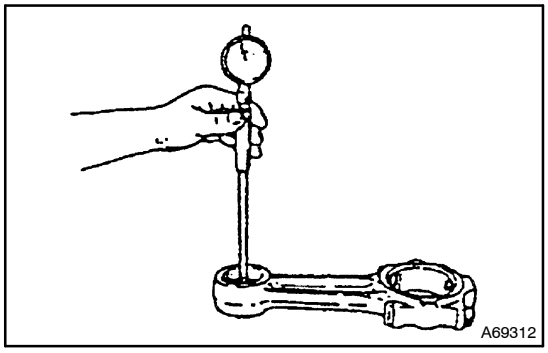
Standard piston pin diameter:
36.989 to 37.000 mm (1.4563 to 1.4567 in.)

Minimum piston pin diameter: 36.96 mm (1.4551 in.)

If the diameter is less than the minimum, replace the piston pin with a new one.

HINT:

Never grind the piston pin, because the surface is coated with a special material.



(b) Using a cylinder gauge, measure the connecting rod bush inside diameter.

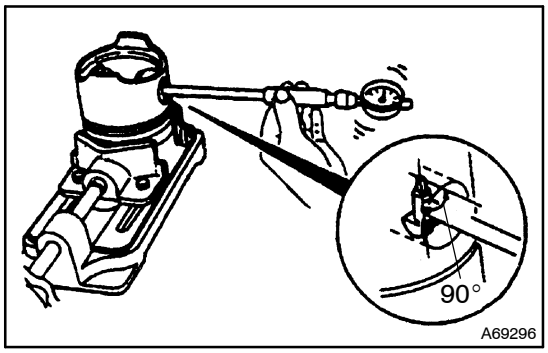
Standard bush inside diameter:
37.035 to 37.045 mm (1.4581 to 1.4585 in.)
Maximum bush inside diameter: 37.10 mm (1.4606 in.)

If the inside diameter is greater than the maximum, replace the connecting rod bush with a new one.

(c) Subtract the diameter measurement of the piston pin from the inside diameter measurement of the connecting rod bush.

Standard oil clearance:
0.035 to 0.056 mm (0.0014 to 0.0022 in.)
Maximum oil clearance: 0.08 mm (0.0031 in.)

If the oil clearance is greater than the maximum, replace the piston with a new one.



(d) Using a cylinder gauge, measure the piston pin boss inside diameter while turning the gauge by 90°.

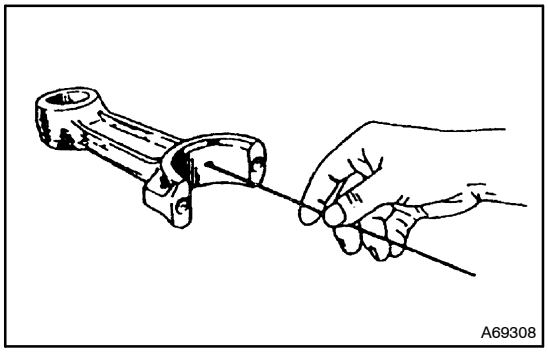
Standard piston pin boss inside diameter:
36.987 to 37.003 mm (1.4562 to 1.4568 in.)
Maximum piston pin boss inside diameter:
37.05 mm (1.4587 in.)

If the piston pin boss inside diameter is greater than the maximum, replace the piston with a new one.

(e) Subtract the diameter measurement of the piston pin from the inside diameter measurement of the piston pin boss.

Standard oil clearance:
0.013 to 0.014 mm (0.0051 to 0.0055 in.)
Maximum oil clearance: 0.05 mm (0.0020 in.)

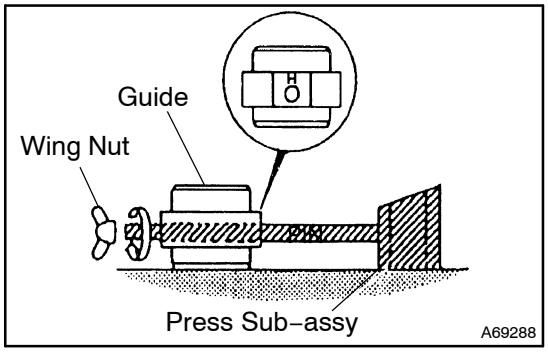
HINT:
T = tightening allowance, L = clearance
If the clearance is greater than the maximum, replace the piston or piston pin.



21. INSPECT CONNECTING ROD SUB–ASSY

(a) Check that there is no clogging in the lubrication passage to the connecting rod small end.

If there is any clogging, blow air through the lubrication passage using an air gun, or clean by inserting a wire.

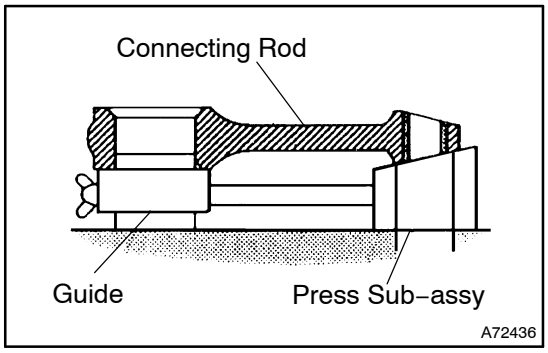


22. REMOVE CONNECTING ROD SMALL END BUSH

(a) Prepare SST.

SST S0940–21450, S0948–11130, S9233–10360

(1) Assemble the guide and press sub–assy by inserting its pin into the guide, then secure them with the wing nut.

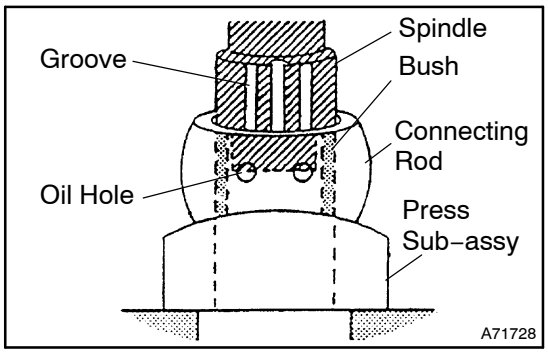


HINT:

- Bring the lever W punched on the guide above the pin.
- Make sure to align both supporting surfaces of the guide and press sub–assy flatly on a plane.

(b) Using the SST, remove the bush.

(1) Set the connecting rod assembled without crankshaft pin bore bearing on the guide and press sub–assembly.

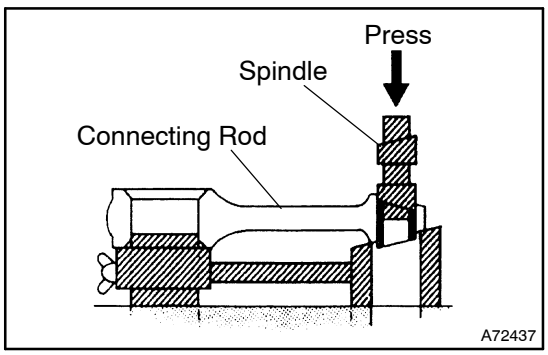


(2) Using SST, install the spindle into the bush.

SST S0940–21470

HINT:

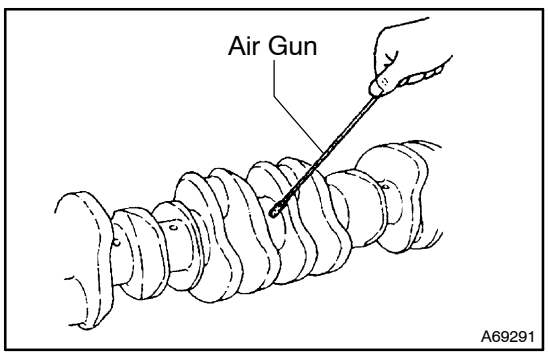
Align the groove of the spindle with the oil hole of the bush.



(3) Using a press, remove the bush.

HINT:

Always operate the press slowly and smoothly.



23. INSPECT CRANKSHAFT

HINT:

Before the inspection, clean the crankshaft with a commercial cleaning agent and clean the lubrication passage using an air gun.

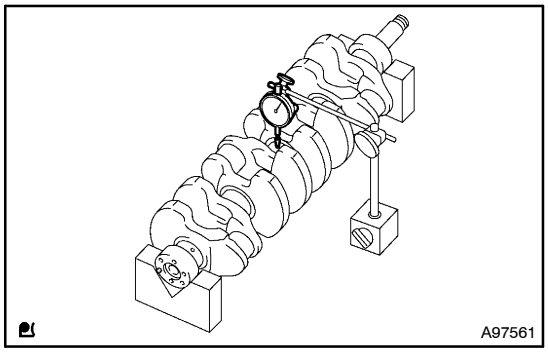
(a) Performing the dye penetrant test, check the crankshaft for cracks.

HINT:

Pay special attention to the finished R section and oil hole of the crankshaft journal and crankshaft pin.

(b) Visually check the condition of the crankshaft journal and pin for damage or wear.

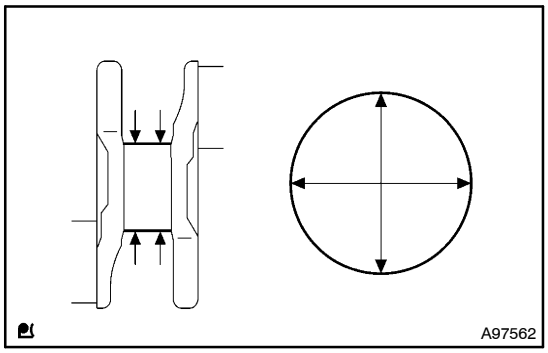
If any damages are found, replace the crankshaft with a new one.



(c) Inspect for bend.
(1) Place the crankshaft on V–blocks.
(2) Using a dial gauge, measure the bend of the crankshaft at the center journal.

Maximum bend: 0.04 mm (0.0016 in.)

If the bend is greater than the maximum, replace the crankshaft with a new one.



(d) Using a micrometer, measure the main journal outside diameter.

Standard journal diameter:
72.94 to 72.96 mm (2.8716 to 2.8724 in.)
Minimum journal diameter:

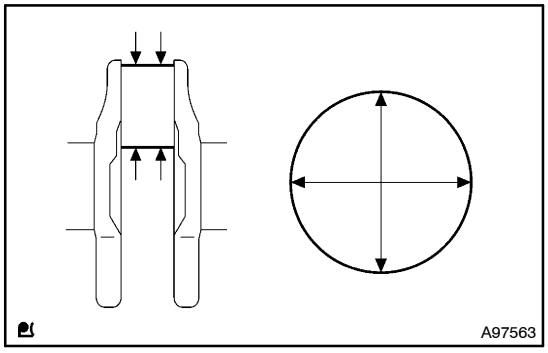
New	72.74 mm (2.8638 in.)
Old	71.76 mm (2.8252 in.)

If the diameter is less than the minimum for use, replace the crankshaft with a new one.

(e) Check each main journal for taper and out–of–round.

Maximum taper and out–of–round:
0.01 mm (0.0003 in.)

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



(f) Using a micrometer, measure the main journal outside diameter.

Standard journal diameter:
61.94 to 61.96 mm (2.4385 to 2.4393 in.)
Minimum journal diameter:

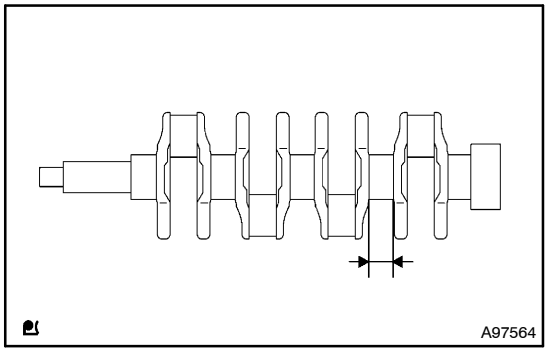
New	61.74 mm (2.4307 in.)
Old	60.76 mm (2.3921 in.)

If the diameter is less than the minimum for use, replace the crankshaft with a new one.

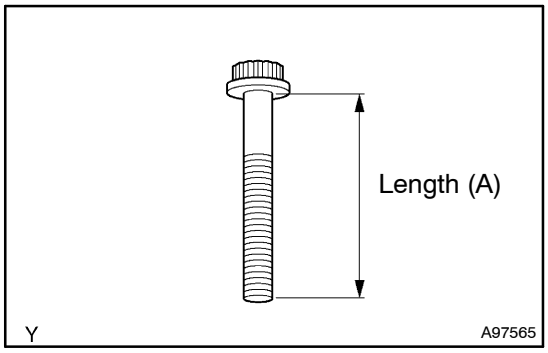
(g) Check each crankshaft pin for taper and out–of–round.

Maximum taper and out–of–round:
0.01 mm (0.0003 in.)

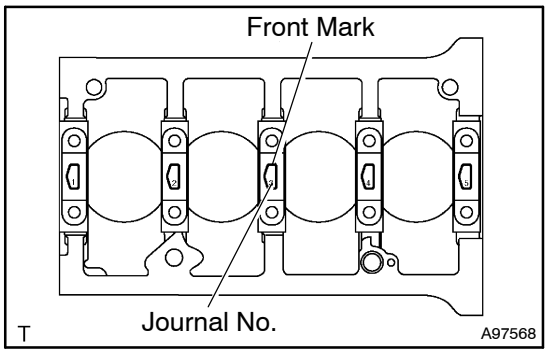
If the taper and out–of–round is greater than maximum, replace the crankshaft.



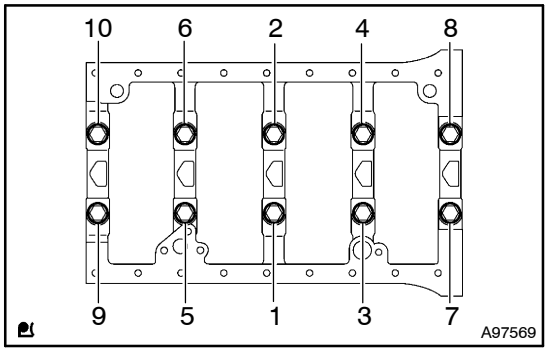
(h) Using a vernier caliper, measure the dimension of the crankshaft No. 4 journal.
Standard journal dimension:
34.00 to 34.08 mm (1.3386 to 1.3417 in.)
Maximum journal dimension: 34.48 mm (1.3574 in.)
If the dimension is greater than the maximum, replace the crankshaft.
(i) Visually check if there are any cracks on the crankshaft.
(j) Check if the oil hole of the crankshaft is choked.
If any defect is found, replace the crankshaft.



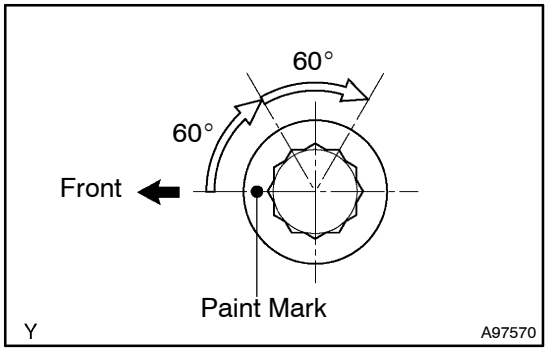
24. INSPECT CRANKSHAFT BEARING CAP BOLT
(a) Using a vernier caliper, measure the bearing cap bolt length (A).
Standard bolt length (A):
92.80 to 93.80 mm (3.6535 to 3.6929 in.)
Maximum bolt length (A): 95.00 mm (3.7401 in.)
If the length is longer than the maximum, replace the bolt.



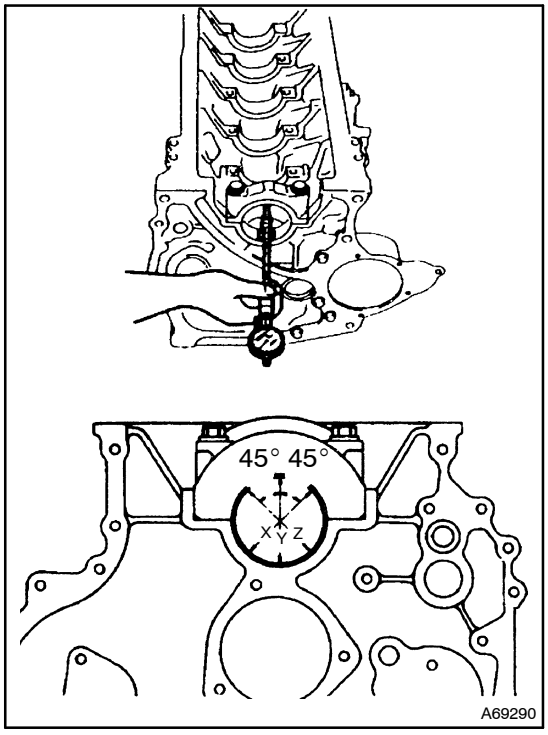
25. INSPECT CRANKSHAFT BEARING CAP
(a) Install the bearing cap to the cylinder block.
(b) Apply a light coat of engine oil on the threads of the bearing cap bolt.



(c) Uniformly tighten the 10 bolts in the order shown in the illustration.
Torque: 58.8 N·m (600 kgf·cm, 43 ft·lbf)



(d) Mark the front side of the bolts with paint.
(e) Retighten the bolts by 60° in the same order as step (c).
(f) Perform step (e) again.
(g) Check that each painted mark is now at a 120° angle to the front.

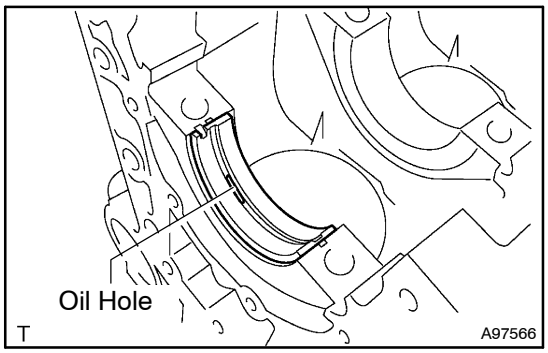


(h) Using a cylinder gauge, measure the crankshaft bearing cap inside diameter at 3 point (X, Y, Z in the illustration).
Standard crankshaft bearing cap inside diameter:
77.985 to 78.00 mm (3.0703 to 3.0709 in.)
Maximum crankshaft bearing cap inside diameter:
78.20 mm (3.0787 in.)

If the inside diameter is greater than the maximum, carry out boring after overlay welding or replace the cylinder block with a new one.

HINT:

When installing the main bearing caps, make sure to return them to their original locations according to the number stamped on the caps. The main bearing caps together with the cylinder block are round.



26. INSPECT CRANKSHAFT OIL CLEARANCE

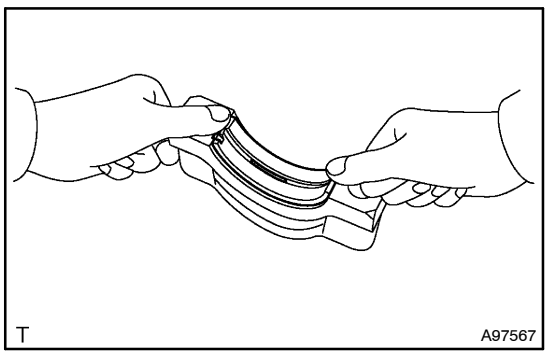
HINT:

The upper bearings have an oil groove and oil hole, however, the lower bearings do not.

(a) Align the key of the bearing with the keyway of the cylinder block, and push in the upper bearing.

NOTICE:

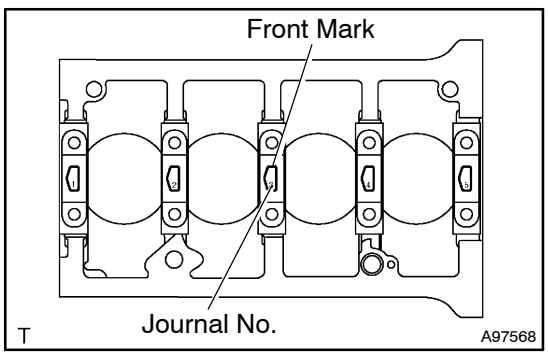
Do not apply engine oil to the bearing and its contact surface.



(b) Align the key of the bearing with the keyway of the main bearing cap, and push in the lower bearing.

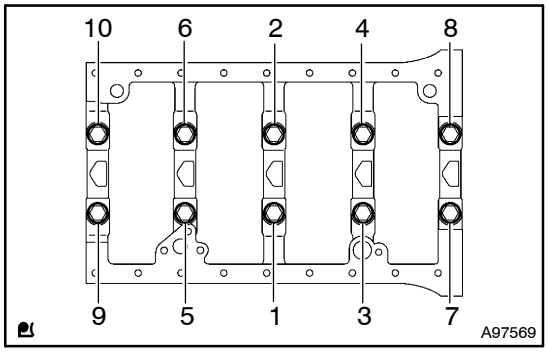
NOTICE:

Do not apply engine oil to the bearing and its contact surface.



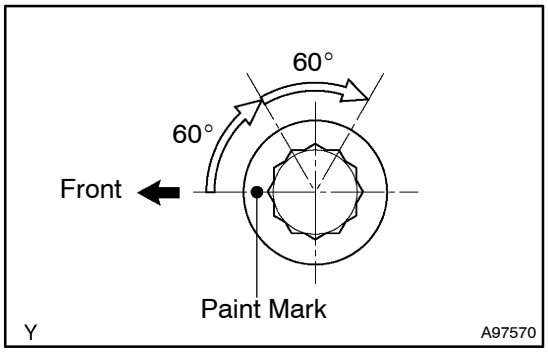
(c) Install the bearing cap to the cylinder block.

(d) Apply a light coat of engine oil on the threads of the bearing cap bolt.



(e) Uniformly tighten the 10 bolts in the order shown in the illustration.
Torque: 58.8 N·m (600 kgf·cm, 43 ft·lbf)

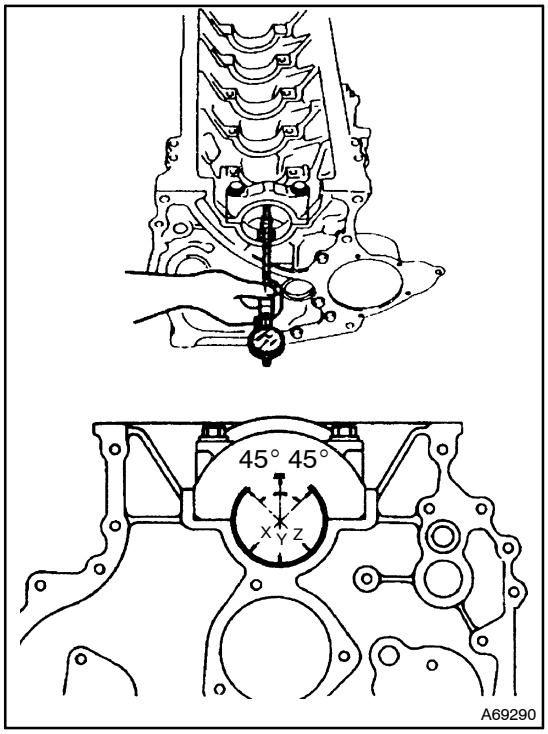
(f) Mark the front side of the bolts with paint.



(g) Retighten the bolts by 60° in the same order as step (e).

(h) Perform step (g) again.

(i) Check that each painted mark is now at a 120° angle to the front.



(j) Using a cylinder gauge, measure the crankshaft bearing inside diameter at 3 point (X, Y, Z in the illustration).
Standard crankshaft bearing inside diameter:
73.01 to 73.04 mm (2.8744 to 2.8756 in.)
Maximum crankshaft bearing inside diameter:
73.30 mm (2.8858 in.)

NOTICE:
Do not damage the crankshaft bearing.

If the inside diameter is greater than maximum, replace the bearing with a new one.

HINT:

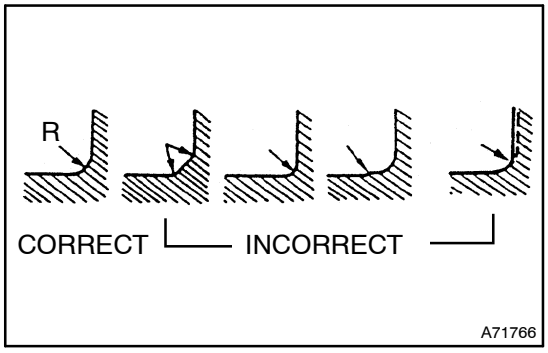
When installing the bearing caps, make sure to return them to their original locations according to the number stamped on the caps. The bearing caps together with the cylinder block are round.

(k) Subtract the crankshaft journal diameter measurement from the bearing inside diameter measurement.
Standard oil clearance:
0.051 to 0.102 mm (0.0020 to 0.0004 in.)
Maximum oil clearance: 0.20 mm (0.0078 in.)

If the result is greater than the maximum, use an undersize bearing and correct or regrind crankshaft so that the oil clearance becomes 0.20 mm (0.0078 in.) or less.

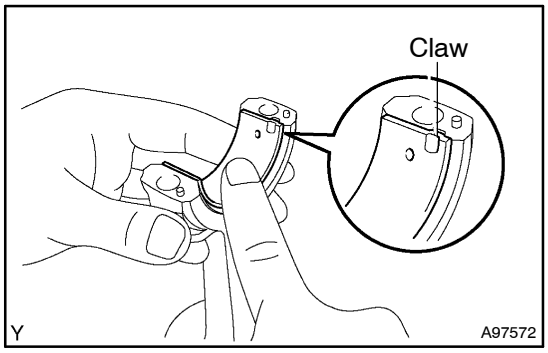
Under size bearing diameter:

STD	72.94 to 72.96 mm (2.8716 to 2.8724 in.)
U/S 0.25	72.69 to 72.71 mm (2.8618 to 2.8625 in.)
U/S 0.50	72.44 to 72.46 mm (2.8519 to 2.8527 in.)
U/S 0.75	72.19 to 72.21 mm (2.8421 to 2.8429 in.)
U/S 1.00	71.94 to 71.96 mm (2.8322 to 2.8330 in.)



HINT:

- Make sure to replace the upper and lower main bearings as one set. The upper and lower main bearings must be round.
- Machined dimension of file R
  Main crankshaft journal:
  3.00 to 3.50 mm (0.1181 to 0.1378 in.)



27. INSPECT CONNECTING ROD BEARING OIL CLEARANCE

(a) Align the claw of the bearing with the claw grooves of the connecting rod and connecting cap.

NOTICE:

Clean the backside of the bearing and the bearing surface of the connecting rod. The surface should be free of dust and oils.

(b) Tighten the connecting rod bolts.

(1) Install the bearing cap.

NOTICE:

Be careful of the installation direction of the bearing cap.

(2) Uniformly tighten the bolts several time.

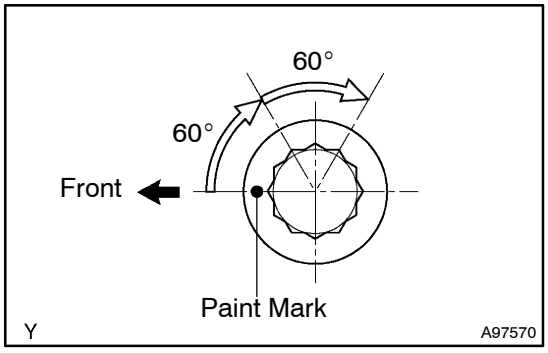
(3) Retighten the connecting rod bolts.

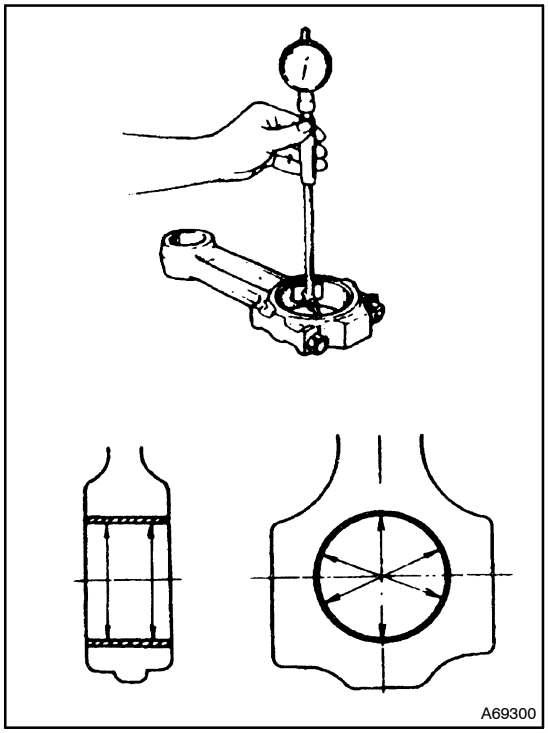
Torque: 29.5 N·m (301 kgf·cm, 22 ft·lbf)

(4) Mark the front side of the bolts with paint.

(c) Retighten the bolts by 60° in the same order as step (b–2).

(d) Perform step (c) again.




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(e) Using a cylinder gauge, measure the connecting rod big end inside diameter.

Standard big end inside diameter (w/ bearing):
61.991 to 62.022 mm (2.446 to 2.4418 in.)
Maximum big end inside diameter (w/ bearing):
62.06 mm (2.4433 in.)

If the result is greater than the maximum, replace the connecting rod bearing.

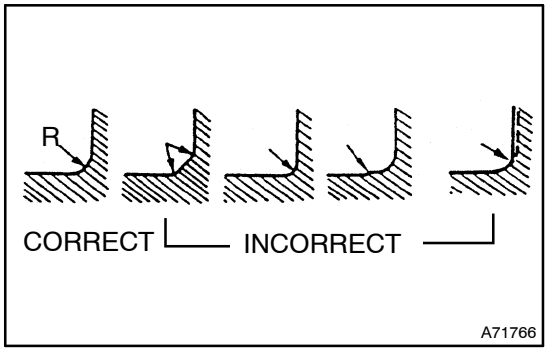
(f) Subtract the inside diameter measurement of the connecting rod from the diameter measurement of the crankshaft pin.

Standard clearance:
0.031 to 0.082 mm (0.0012 to 0.0032 in.)
Maximum oil clearance: 0.20 mm (0.0078 in.)

If the result is greater than the maximum, use an undersize bearing and correct or regrind crankshaft so that the oil clearance becomes 0.2 mm (0.0078 in.) or less.

Under size bearing diameter:

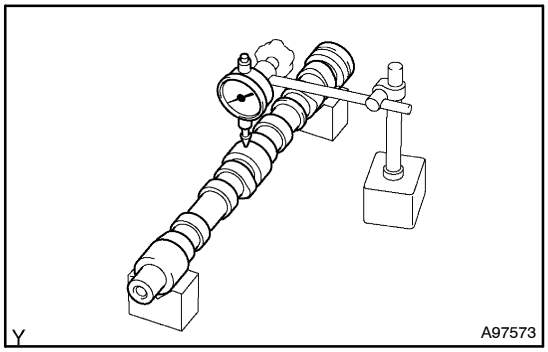
STD	61.94 to 61.96 mm (2.4385 to 2.4393 in.)
U/S 0.25	61.69 to 61.71 mm (2.4287 to 2.4295 in.)
U/S 0.50	61.44 to 61.46 mm (2.4188 to 2.4196 in.)
U/S 0.75	61.19 to 61.21 mm (2.4090 to 2.4098 in.)
U/S 1.00	60.94 to 60.96 mm (2.3992 to 2.3999 in.)



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HINT:
Machined dimension of file R

Crankshaft pin: 3.50 to 4.00 mm (0.1378 to 0.1575 in.)



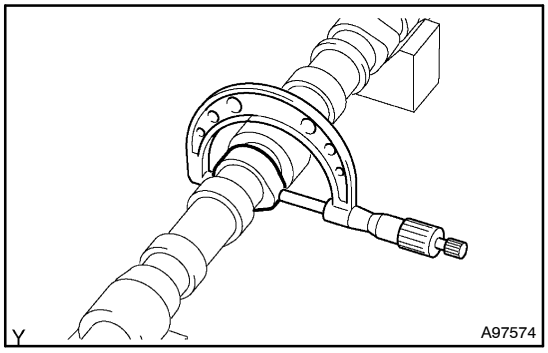
A97573

28. INSPECT CAMSHAFT

(a) Inspect the camshaft for circle runout.
  (1) Place the camshaft on V–blocks.
  (2) Using a dial gauge, measure the circle runout at the center journal.

Maximum circle runout: 0.06 mm (0.0023 in.)

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



(b) Using a micrometer, measure the cam lobe height.

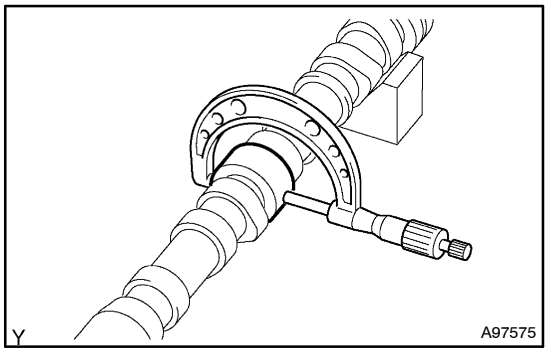
Standard cam lobe height:

Intake	50.6576 to 50.8596 mm (1.9943 to 2.0023 in.)
Exhaust	49.3561 to 49.5581 mm (1.9431 to 1.9511 in.)

Minimum cam lobe height:

Intake	50.20 mm (1.9763 in.)
Exhaust	48.95 mm (1.9271 in.)

If the lobe height is less than the minimum, replace the camshaft.



29. INSPECT CAMSHAFT OIL CLEARANCE

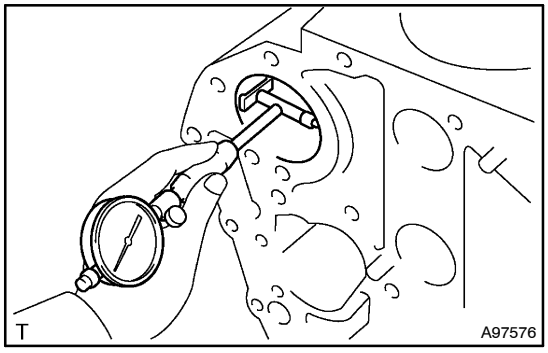
(a) Measure the oil clearance of the camshaft journal.

(1) Using a micrometer, measure the camshaft journal outside diameter.

Journal outside diameter:

No. 1	56.95 to 56.97 mm (2.2421 to 2.2429 in.)
No. 2	56.75 to 56.77 mm (2.2342 to 2.2350 in.)
No. 3	56.55 to 56.57 mm (2.2263 to 2.2271 in.)

If the outside diameter is greater than the maximum, replace the camshaft.



(2) Using a cylinder gauge, measure the camshaft bearing inside diameter.

Inside diameter:

No. 1	57.035 to 57.135 mm (2.2454 to 2.2494 in.)
No. 2	56.835 to 56.935 mm (2.2375 to 2.2415 in.)
No. 3	56.635 to 56.735 mm (2.2297 to 2.2336 in.)

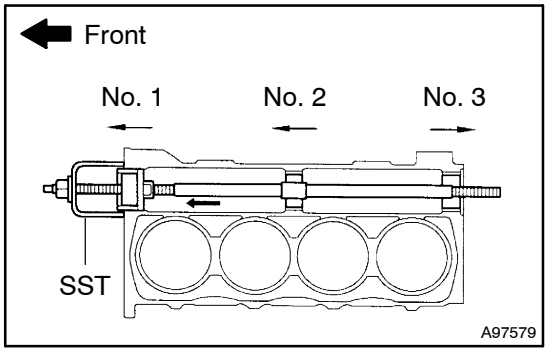
If the inside diameter is greater than the maximum, replace the camshaft.

(3) Subtract the outside diameter measurement of the camshaft journal from the inside diameter measurement of the camshaft bearing.

Oil clearance:

Standard	0.030 to 0.120 mm (0.0011 to 0.0047 in.)
Maximum	0.15 mm (0.0059 in.)

If the oil clearance is greater than the maximum, replace the camshaft or camshaft bearing.



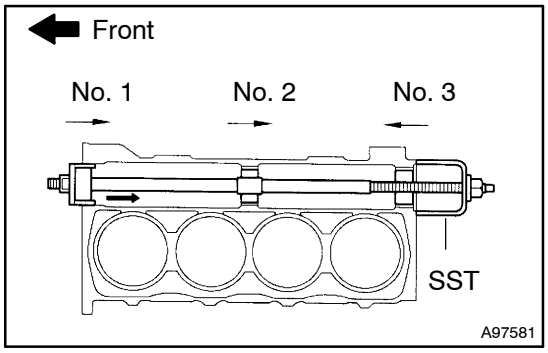
30. REMOVE CAMSHAFT BEARING SET

(a) Using SST, remove the camshaft bearings in the directions indicated by the arrow marks in the illustration.

SST 09215–00101 (09215–00130, 09215–00141, 09215–00150, 09215–00161), 09215–00013 (09215–00021, 09215–00461)

NOTICE:

Remove the bearings No. 1, No. 2 and No. 3 in order.



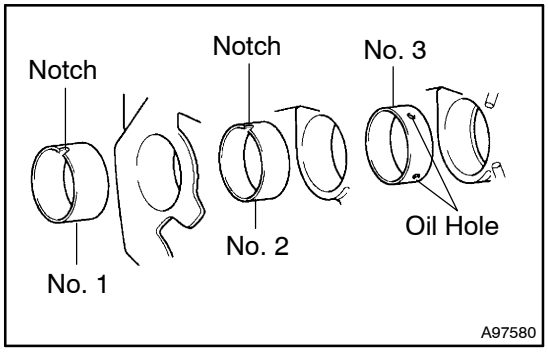
31. INSTALL CAMSHAFT BEARING SET

(a) Using SST, install new camshaft bearings in the direction indicated by the arrow marks in the illustration.

SST 09215–00101 (09215–00130, 09215–00141, 09215–00150, 09215–00161), 09215–00013 (09215–00021, 09215–00461)

Journal bearing diameter:

Journal No.	Inside diameter	Outside diameter
No. 1	57.0 mm (2.2440 in.)	60.0 mm (2.3622 in.)
No. 2	56.8 mm (2.2362 in.)	59.8 mm (2.3543 in.)
No. 3	56.6 mm (2.2283 in.)	59.6 mm (2.3464 in.)

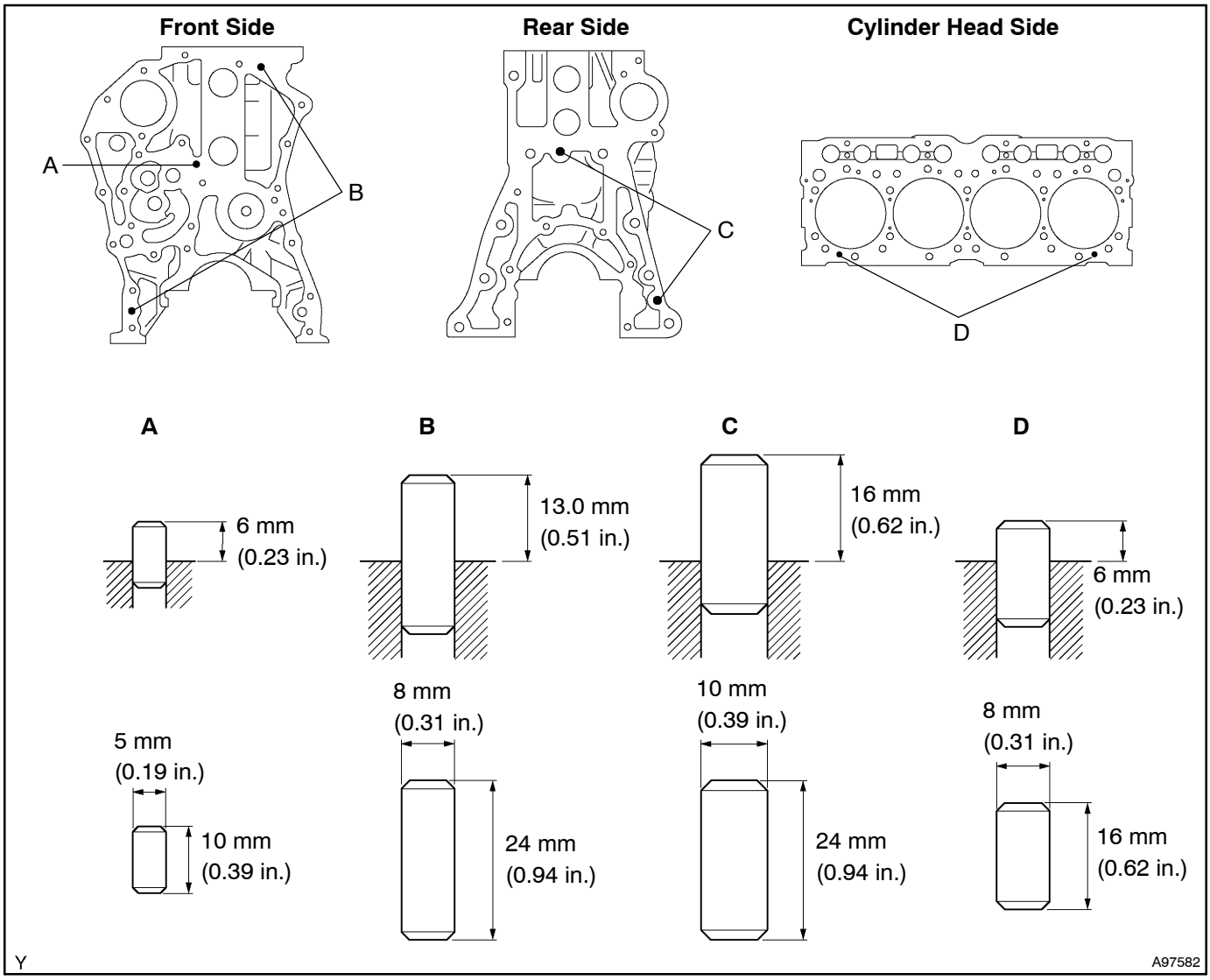


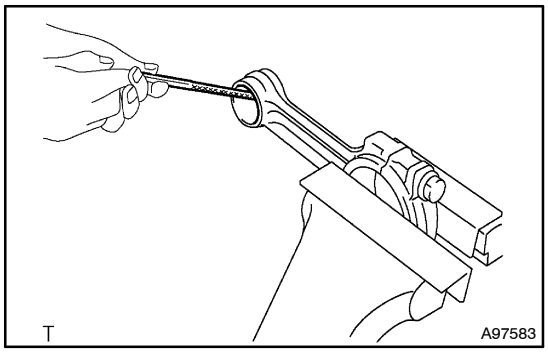
NOTICE:

- **Be sure to face the notches of the bearing No. 1 and No. 2 and oil holes of the No. 3 to the correct direction.**
- **Install the bearings No. 2, No. 1 and No. 3 in order.**

32. INSTALL STRAIGHT PIN

(a) Using a plastic hammer, tap in the straight pin.



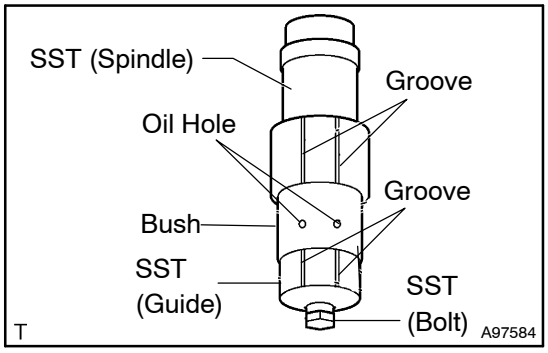


33. INSTALL CONNECTING ROD SMALL END BUSH

(a) Uniformly chamfer one edge of the bush hole at the small end of the connecting rod.

HINT:

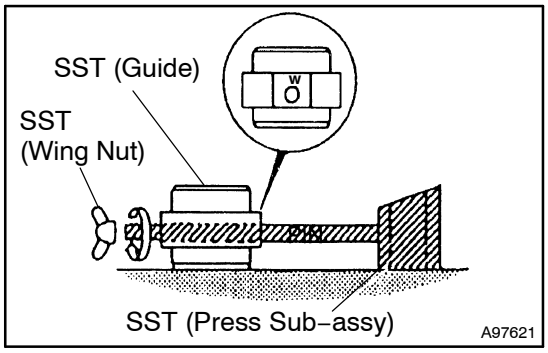
- Irregular chamfering can cause out–of–roundness of the pressed bush, which may result in jamming during the insertion.
- Remove dust from the inner surface of the smaller hole.



(b) Mount the bush on the spindle.
SST S0940–21470, S0948–11140, S9191–08252, S0940–21450, S0948–11130, S9233–10360
Torque: 6.0 N·m (61 kgf·cm, 53 in.·lbf)

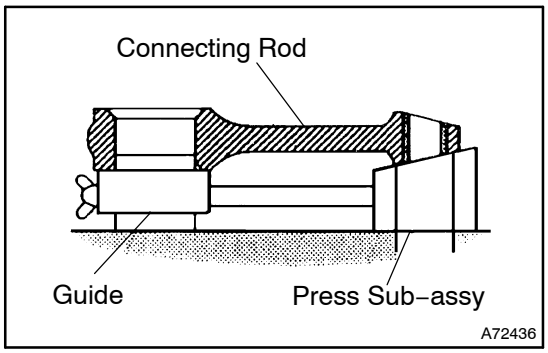
HINT:
Align oil hole in the bush with both groove or the spindle and guide, and make sure that oil hole will meet with oil path in the connecting rod led from the big end bore in the rod.

(1) Apply fresh engine oil around the bush and guide.

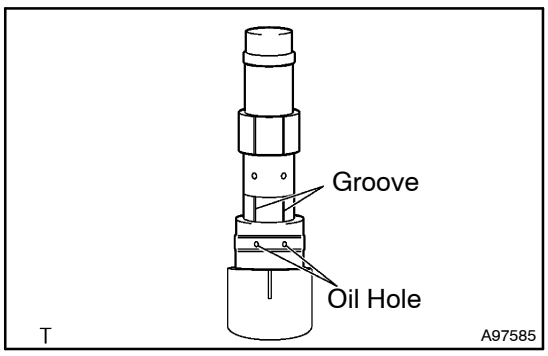


(c) Prepare SST.
SST S0940–21470, S0948–11140, S9191–08252, S0940–21450, S0948–11130, S9233–10360

(1) Assemble the guide and press sub–assy by inserting its pin into the guide, then secure them with the wing nut.

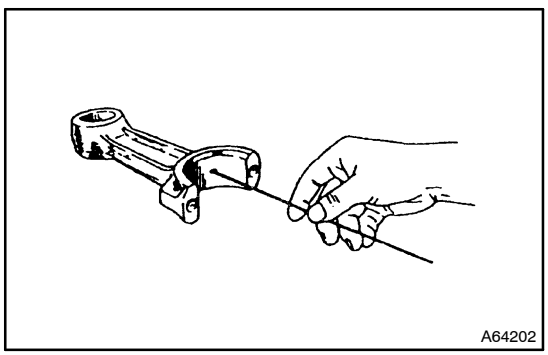


HINT:
- Bring the lever W punched on the guide above the pin.
- Make sure to align both supporting surfaces of the guide and press sub–assy flatly on a plane.



(d) Install the bush in the connecting rod. Position the bush tool assembly so that the oil hole aligns with the oil path through the connecting rod.

HINT:
Before installing, fully coat the bore in the connecting rod with fresh engine oil.

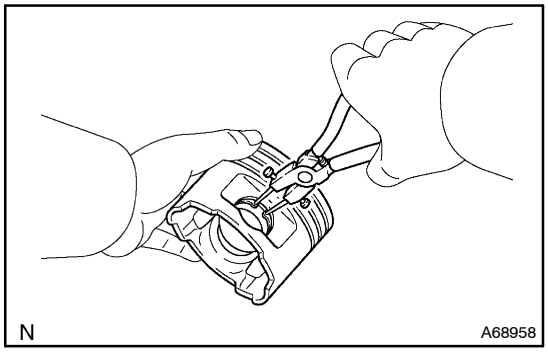


(e) Inspect the bush position after the installation.

(1) Make sure that the oil hole of the bush and the oil path of the connecting rod are suitably aligned allowing a 6 mm (0.23 in.) diameter rod to penetrate.

HINT:
Misalignment can lead to insufficient lubrication, which may result in seizure.

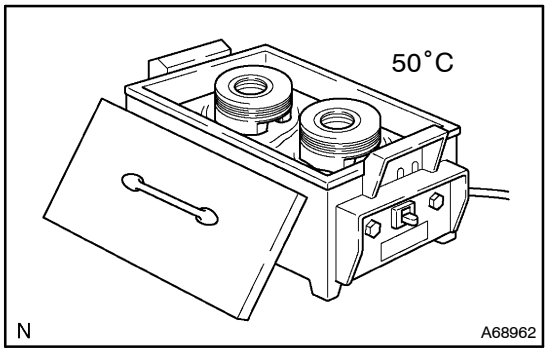
(2) With a new piston pin inserted in the piston, make sure that the bush can be rotated by hand without rattling.



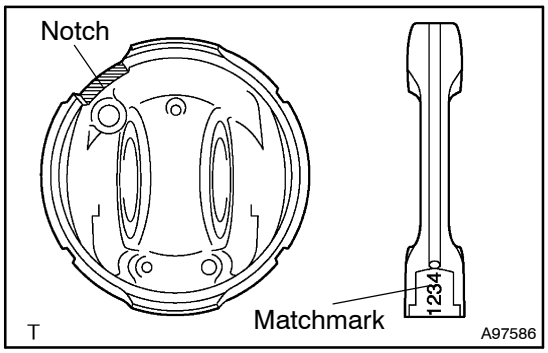
34. INSTALL PISTON PIN

(a) Assemble the piston and connecting rod.

(1) Using snap ring pliers, install a new snap ring on one side of the piston hole.

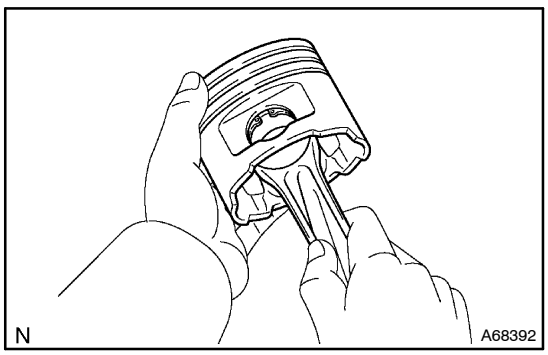


(2) Gradually heat the piston to approximately 50˚C (122˚F).



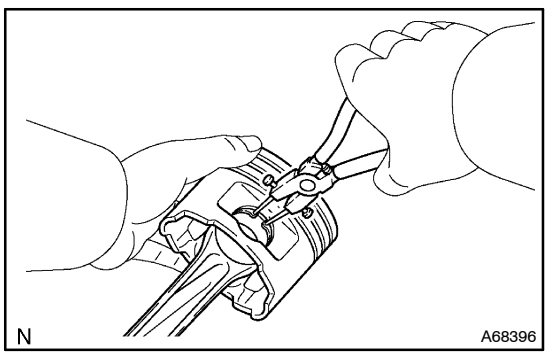
(3) Coat the piston pin with engine oil.

(4) Install the piston to the connecting rod with the notch of the piston faced in the opposite direction to the matchmark of the rod. Then, secure them with the piston pin.

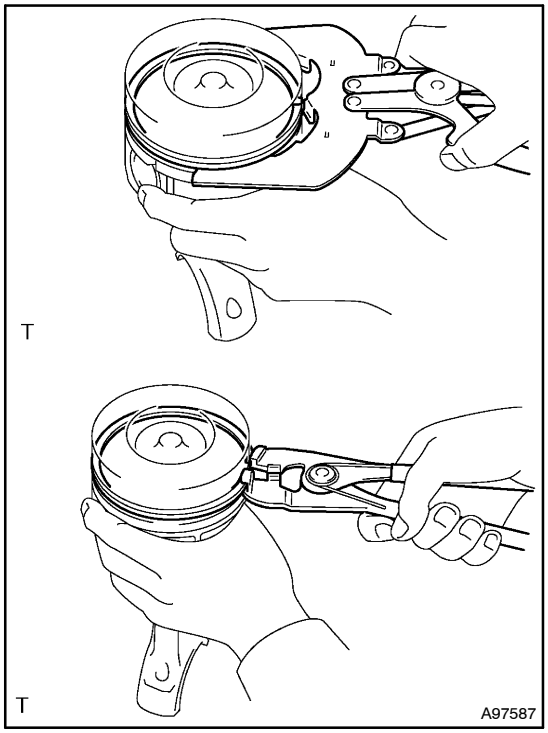


(5) Check that the piston and piston pin fit.

- Try to move the piston back and forth.



(6) Using snap ring pliers, install a new snap ring on the other side of the piston pin hole.



35. INSTALL PISTON RING SET

(a) Facing the identification marks on the piston ring upper surface, using a piston ring expander, install them in the order of the oil ring, 2nd ring and 1st ring.

HINT:

- Never change the combination of the coil and oil ring.
- Connect the joint of the coil expander for the oil ring and install it inside the piston ring. Assemble the ring with the joint 180˚opposite to the matching point of the ring.

CAUTION:

Never touch the piston with your bare hands while it is hot.

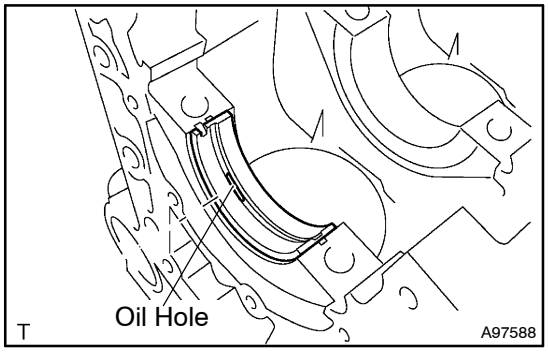
36. INSTALL SUB–ASSY OIL NOZZLE NO.1

(a) Install the nozzle with the bolt.

Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)

NOTICE:

- **If the oil nozzle has been dropped or impact is applied to a nozzle, replace the nozzle with a new one.**
- **Replace the deformed nozzle with a new one.**

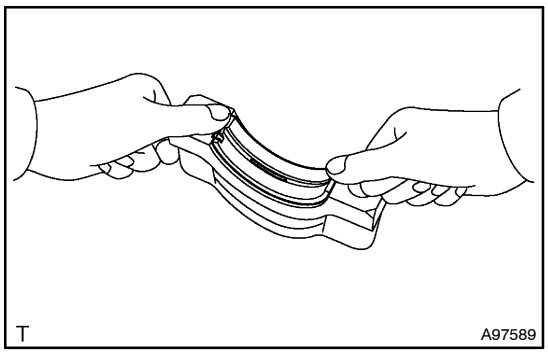


37. INSTALL CRANKSHAFT BEARING SET

(a) Align the oil groove of the bearing with the oil hole of the cylinder block, and push in the 5 upper bearings.

NOTICE:

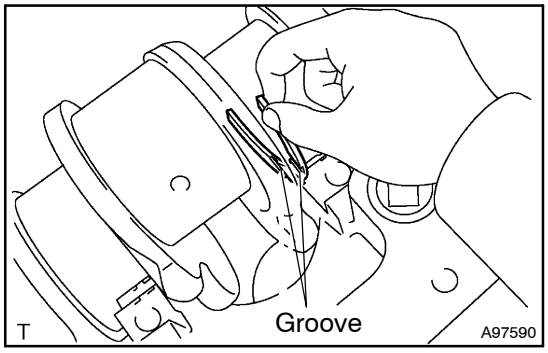
Clean the backside of the bearing and the bearing surface of the bearing cap and do not let the oil and fats stick.



(b) Align the bearing with the crankshaft bearing cap, and push in the 5 lower bearings.

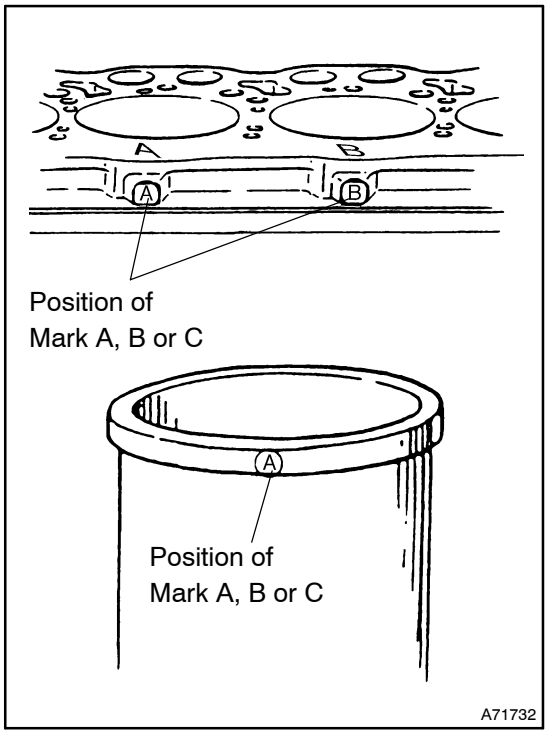
NOTICE:

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



(c) Insert the thrust washer into the clearance between the cylinder block and crankshaft with the oil groove facing outward.
(d) Install the main bearing cap to the cylinder block.
(e) Apply a light coat of engine oil to the threads and under the cap bolt.

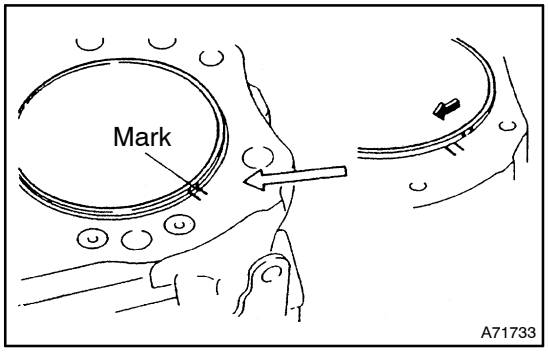
NOTICE:
Be sure to install the thrust washer to its orginal position.



38. INSTALL CYLINDER LINER

HINT:

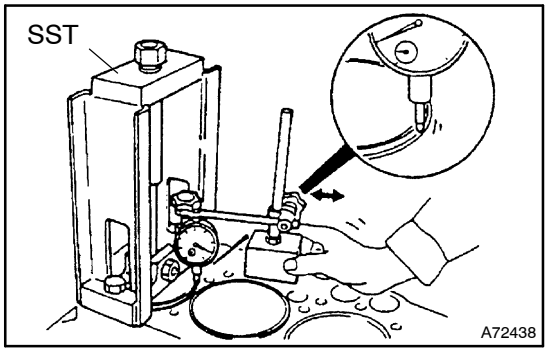
- When assembling the cylinder liner with the cylinder block, clearance can be set to 3 levels.
- The upper surface and side surface of the cylinder block are stamped A, B or C. When using a new cylinder liner, insert a matching cylinder liner having the same symbol.



- When reusing a cylinder liner, install it according to the marks made during the removal. When reusing the cylinder liner, misalignment with the cylinder block may concentrate stress on the thin part of the cylinder liner and it may be broken.

(a) Apply engine oil to the cylinder block inside bore.
(b) Align the marks of the cylinder liner and cylinder block.
(c) Install the cylinder liner.

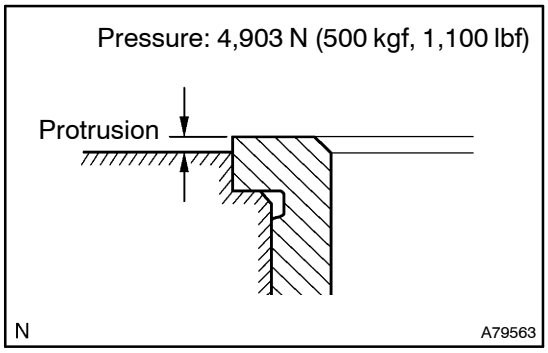
NOTICE:
Make sure to install the cylinder liner to its orginal location as the reused liner is bent by ”run–in”



39. INSPECT PROTRUSION OF CYLINDER LINER

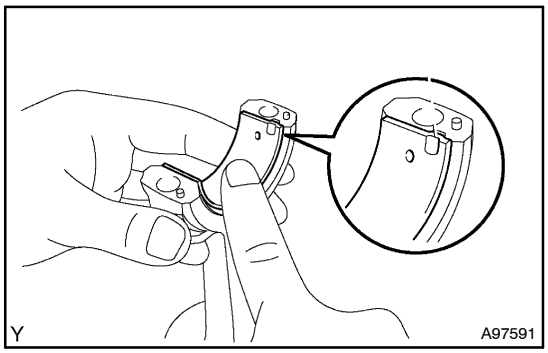
(a) Install SST onto the cylinder block.
SST S0942–01460

(b) Tighten the center bolt to the specified torque below to set the cylinder liner in the normal installation condition.
Torque: 9.8 N·m (100 kgf·cm, 87 in.·lbf)



(c) Using a dial gauge, measure the protrusion of the cylinder liner.
Standard protrusion:
0.01 to 0.08 mm (0.0004 to 0.0031 in.)
Maximum protrusion: 0.08 mm (0.0031 in.)

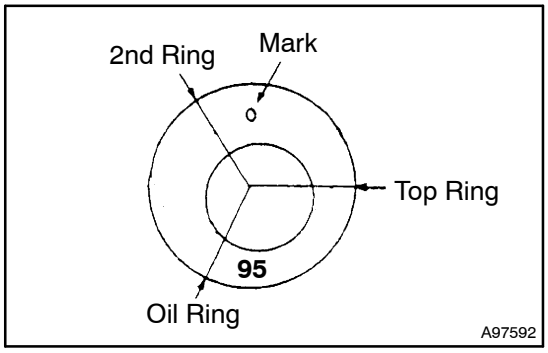
If the protrusion is greater than the maximum, replace the cylinder liner.



40. INSTALL CONNECTING ROD BEARING

NOTICE:

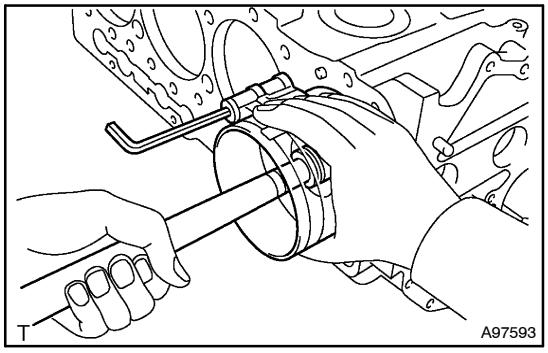
- **When reusing the bearing, make sure to reassemble the removed bearing as it was originally installed.**
- **Install the bearing with the oil hole on the connecting rod side and install the bearing without the oil hole on the cap side.**
- **Match the bearing protrusion with the notch of the connecting rod or cap.**
- **Clean the backside of the bearing and the bearing surface of the bearing cap and do not let the oil and fats stick.**



41. INSTALL PISTON W/CONNECTING ROD

HINT:

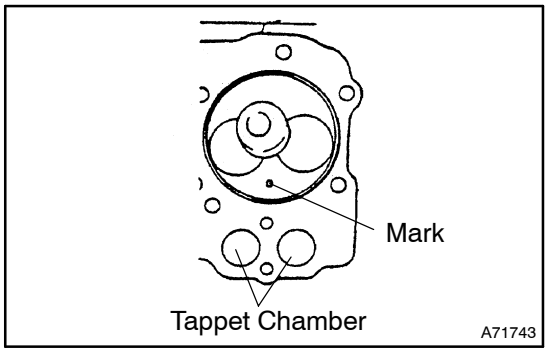
- Position the matching points of the piston ring at an even distance. Be careful not to position at the piston boss.
- Before assembling the piston with the connecting rod, check whether the piston is specified for this engine. Check should be performed using the engine compatible identification code on the top of the piston.
Engine compatible identification: 95



(a) Using a piston ring compressor and a hammer handle, insert the piston through the connecting rod assembly into the cylinder block.

HINT:

- Before the installation, apply engine oil to the piston pin, piston ring, cylinder liner and connecting rod bearing.
- Recheck the matching point of each piston ring.

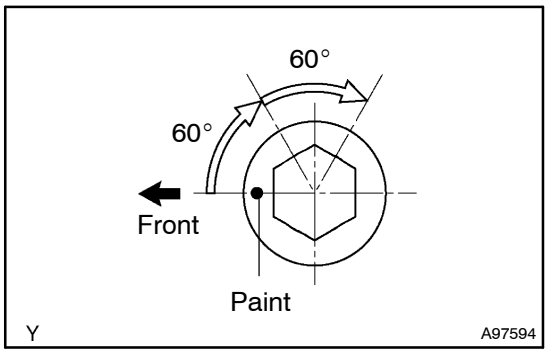


- Make sure that the mark on the piston is at the tappet chamber side.
- Do not damage the inside of the liner.

(b) Install the bearing cap to the connecting rod with the front mark facing to the correct direction.

(c) Uniformly install and tighten the bolts several times. Them, retighten the bolts.

Torque: 29.5 N·m (301 kgf·cm, 22 ft·lbf)



(d) Mark the front side of the bolt head with paint as shown in the illustration.

(e) Retighten the bolts by 60° in the same order as step (c).

(f) Perform step (e) again.

(g) Check that each painted mark is now at a 120° angle to the front.