

## 21. Cylinder Block

### A: REMOVAL

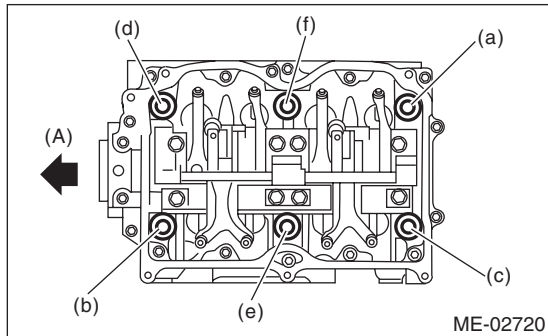
**NOTE:**

Before conducting this procedure, drain the engine oil completely.

- 1) Remove the intake manifold. <Ref. to FU(H4SO)-13, REMOVAL, Intake Manifold.>
- 2) Remove the V-belts. <Ref. to ME(H4SO)-40, REMOVAL, V-belt.>
- 3) Remove the crank pulley. <Ref. to ME(H4SO)-42, REMOVAL, Crank Pulley.>
- 4) Remove the timing belt cover. <Ref. to ME(H4SO)-43, REMOVAL, Timing Belt Cover.>
- 5) Remove the timing belt. <Ref. to ME(H4SO)-44, REMOVAL, Timing Belt.>
- 6) Remove the cam sprocket. <Ref. to ME(H4SO)-49, REMOVAL, Cam Sprocket.>
- 7) Remove the crank sprocket. <Ref. to ME(H4SO)-50, REMOVAL, Crank Sprocket.>
- 8) Remove the generator and A/C compressor with their brackets.
- 9) Remove the rocker cover.
- 10) Remove the cylinder head bolts in alphabetical sequence shown in the figure.

**NOTE:**

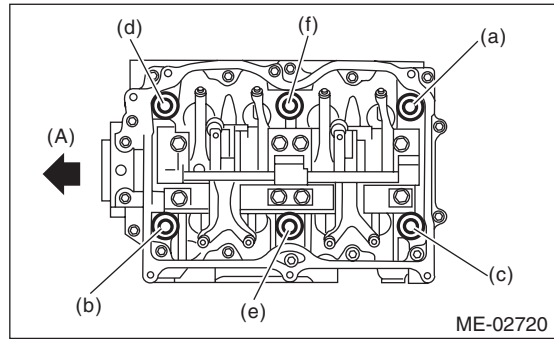
Leave bolts (a) and (d) engaged by three or four threads to prevent the cylinder head from falling.



(A) Front side

- 11) While tapping the cylinder head with a plastic hammer, separate it from cylinder block.

- 12) Remove the bolts (a) and (d) to remove cylinder head.



(A) Front side

- 13) Remove the cylinder head gasket.

**CAUTION:**

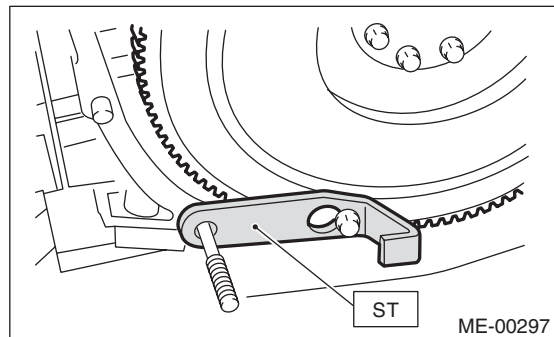
**Be careful not to scratch the mating surface of cylinder block and cylinder head.**

- 14) Similarly, remove the right side cylinder head.
- 15) Remove the clutch housing cover. (MT model)
- 16) Remove the flywheel (MT model) or drive plate (AT model).

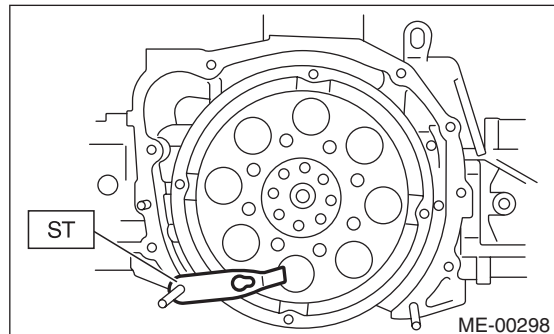
Using the ST, lock the crankshaft.

ST 498497100 CRANKSHAFT STOPPER

- MT model



- AT model

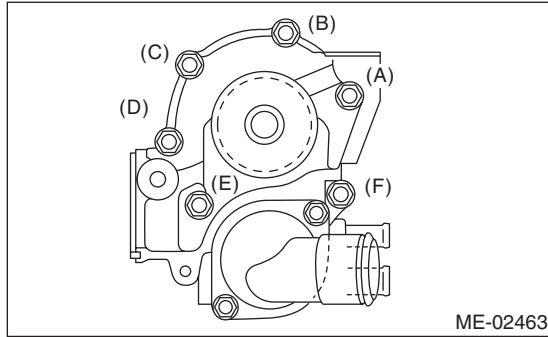


- 17) Remove the oil separator cover.
- 18) Remove the water by-pass pipe for heater.

# Cylinder Block

## MECHANICAL

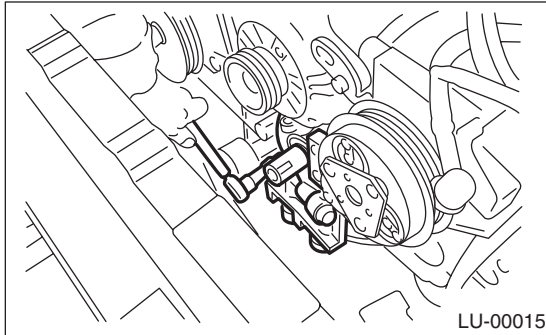
19) Remove the water pump after loosening the bolts in alphabetical sequence as shown in the figure.



20) Remove the bolts which install oil pump onto cylinder block.

### NOTE:

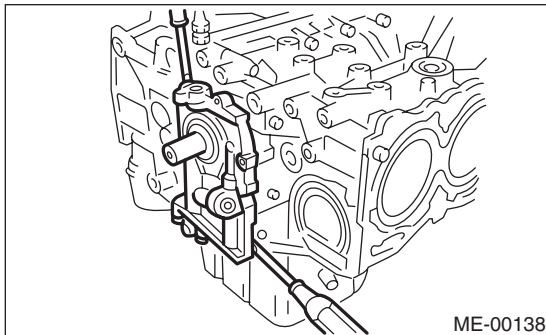
When disassembling and checking the oil pump, loosen the relief valve plug before removing the oil pump.



21) Remove the oil pump from cylinder block using a flat tip screwdriver.

### CAUTION:

Be careful not to scratch the mating surface of cylinder block and oil pump.



22) Remove the oil pan.

(1) Place the cylinder block to face the #2 and #4 piston side upward.

(2) Remove the bolts which secure oil pan to cylinder block.

(3) Insert an oil pan cutter blade between cylinder block-to-oil pan clearance and remove the oil pan.

### CAUTION:

Do not use a screwdriver or similar tool in place of oil pan cutter.

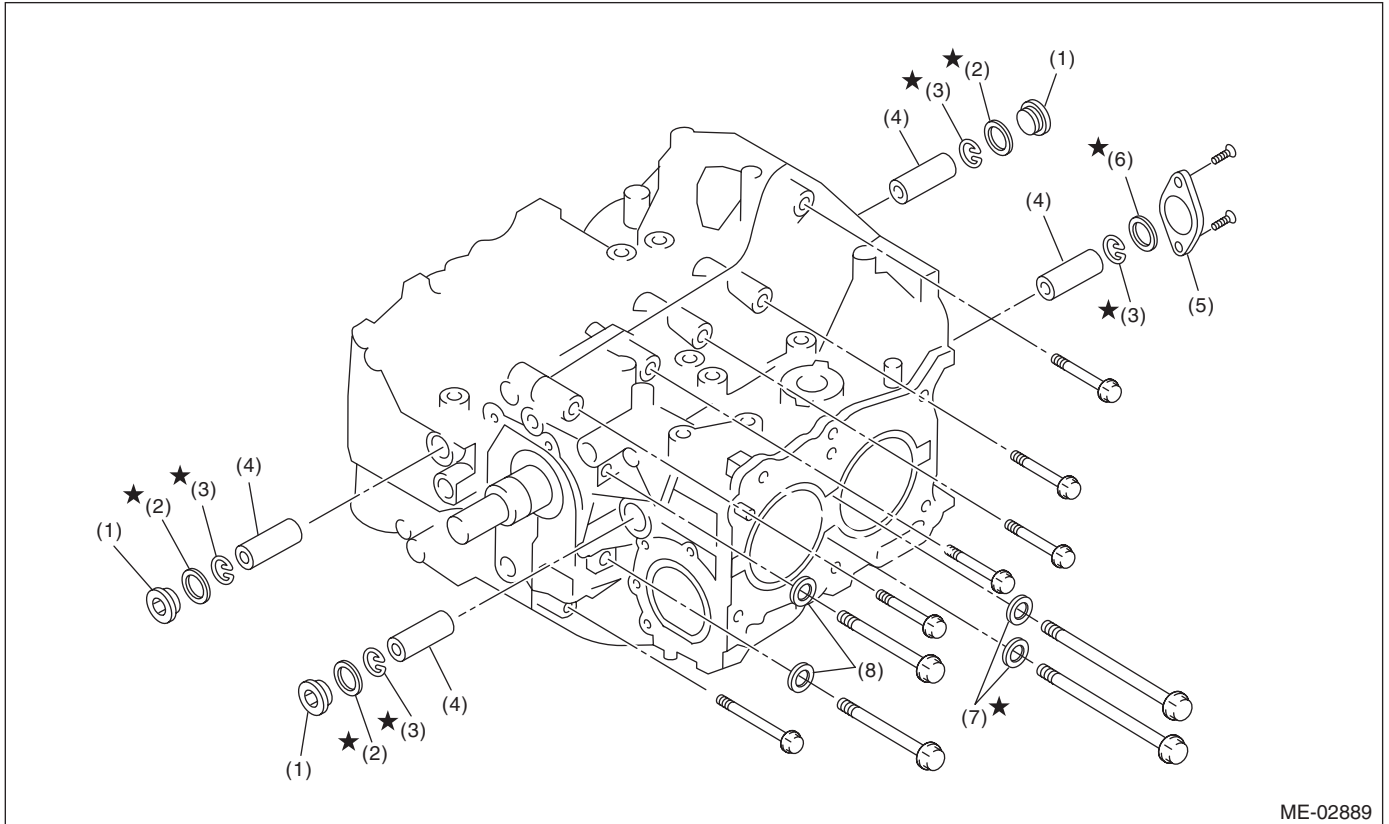
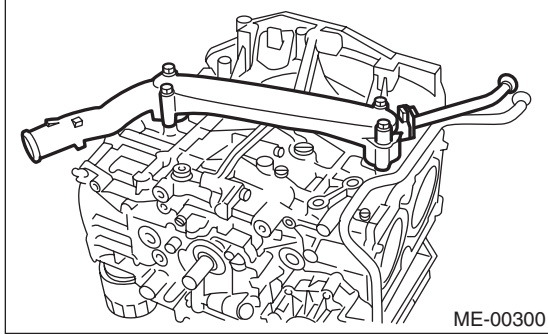
23) Remove the oil strainer stay.

24) Remove the oil strainer.

25) Remove the baffle plate.

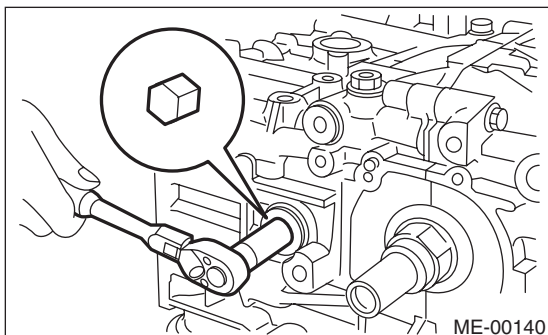
26) Remove the oil filter. <Ref. to LU (H4SO)-24, REMOVAL, Engine Oil Filter.>

27) Remove the water pipe.

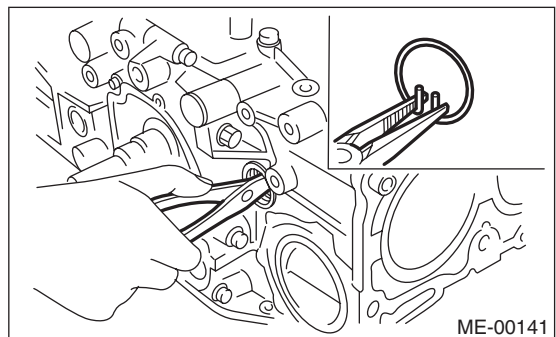


- |                       |                        |                 |
|-----------------------|------------------------|-----------------|
| (1) Service hole plug | (4) Piston pin         | (7) Seal washer |
| (2) Gasket            | (5) Service hole cover | (8) Washer      |
| (3) Snap ring         | (6) O-ring             |                 |

28) Remove the service hole cover and service hole plugs using a hexagon wrench [14 mm].



29) Rotate the crankshaft to bring #1 and #2 pistons to bottom dead center position, then remove the piston snap ring through service hole of #1 and #2 cylinders.



# Cylinder Block

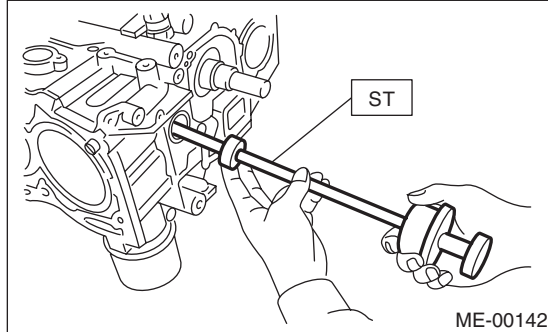
## MECHANICAL

30) Draw out the piston pin from #1 and #2 pistons using ST.

ST 499097700 PISTON PIN REMOVER

### NOTE:

Be careful not to confuse the original combination of piston, piston pin and cylinder.



31) Similarly remove the piston pins from #3 and #4 pistons.

32) Remove the bolts which connect cylinder block on the side of #1 and #3 cylinders (RH).

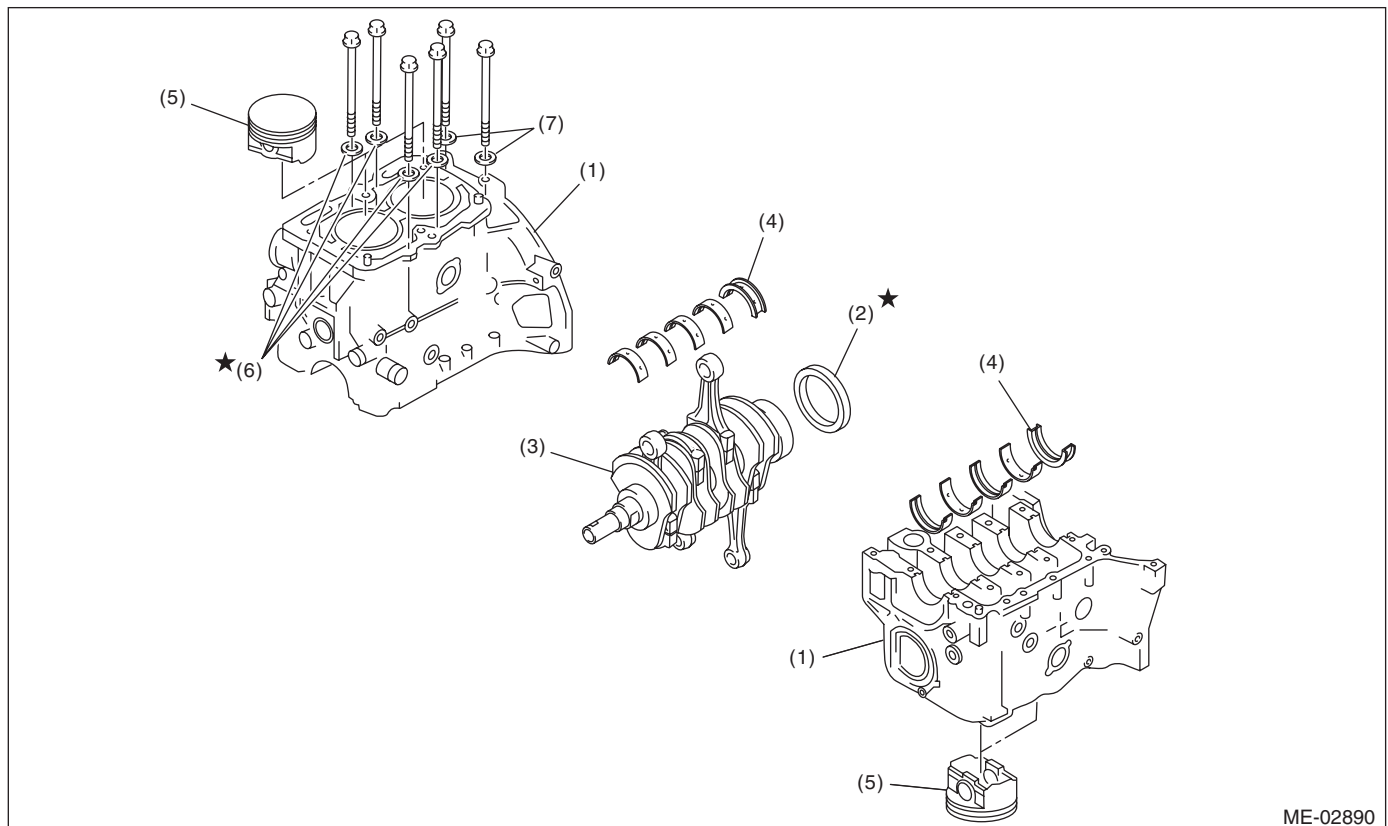
33) Loosen the bolts which connect cylinder block on the side of #2 and #4 cylinders (LH) two or three turns.

34) Set up the cylinder block so that #2 and #4 cylinders (LH) are on the upper side, then remove bolts connecting the cylinder block.

35) Separate the cylinder block (RH) and (LH).

### NOTE:

When separating the cylinder block, do not allow the connecting rod to fall or damage the cylinder block.



(1) Cylinder block

(4) Crankshaft bearing

(6) Seal washer

(2) Rear oil seal

(5) Piston

(7) Washer

(3) Crankshaft

36) Remove the rear oil seal.

37) Remove the crankshaft together with connecting rod.

38) Remove the crankshaft bearings from cylinder block using a hammer handle.

### NOTE:

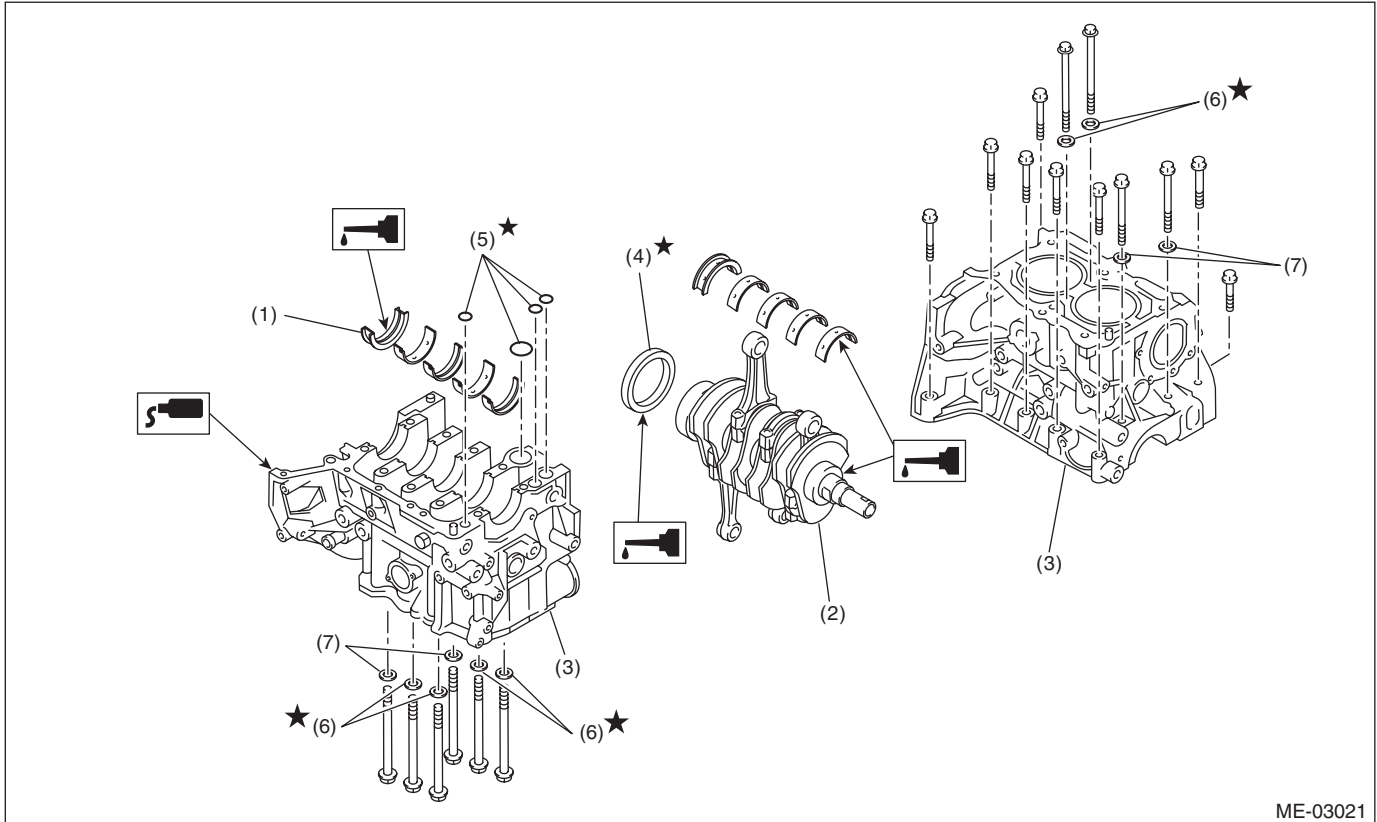
Be careful not to confuse the crankshaft bearing combination. Press the bearing at the end opposite to locking lip.

39) Draw out each piston from cylinder block using wooden bar or hammer handle.

### NOTE:

Be careful not to confuse the piston and cylinder combination.

## B: INSTALLATION



ME-03021

- |                        |                   |                 |
|------------------------|-------------------|-----------------|
| (1) Crankshaft bearing | (4) Rear oil seal | (6) Seal washer |
| (2) Crankshaft         | (5) O-ring        | (7) Washer      |
| (3) Cylinder block     |                   |                 |

1) Remove oil on the mating surface of cylinder block before installation. Apply a coat of engine oil to the bearing and crankshaft journal.

2) Position the crankshaft and the O-ring on the #1 and #3 cylinder block.

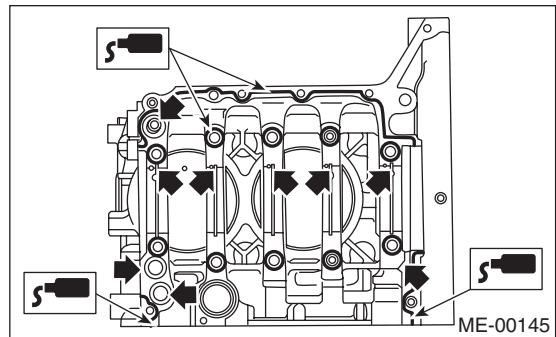
3) Apply liquid gasket to the mating surface of #1 and #3 cylinder blocks (RH), and install #2 and #4 cylinder blocks (LH) to above and position them.

**Liquid gasket:**

**THREE BOND 1215 (Part No. 004403007) or equivalent**

**NOTE:**

Do not allow liquid gasket to jut into O-ring grooves, oil passages, bearing grooves, etc.



4) Apply a coat of engine oil to the washer and bolt thread.

**NOTE:**

Use new seal washer.

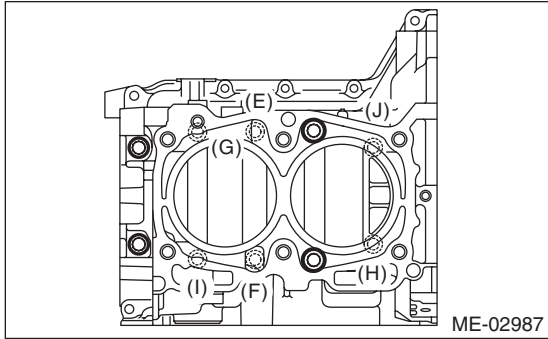
# Cylinder Block

## MECHANICAL

5) Tighten the 10 mm cylinder block connecting bolts on the LH side (A — D) in alphabetical order.

**Tightening torque:**

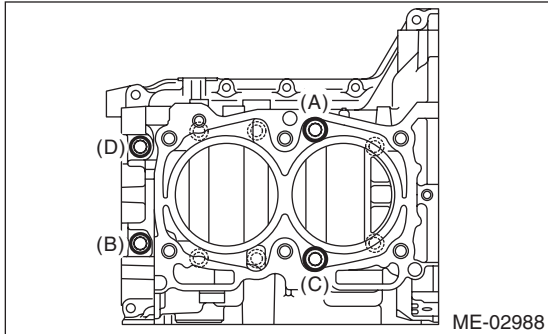
**10 N·m (1.0 kgf·m, 7.2 ft·lb)**



6) Tighten the 10 mm cylinder block connecting bolts on the RH side (E — J) in alphabetical order.

**Tightening torque:**

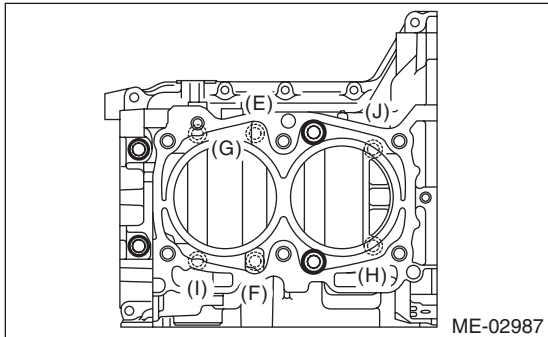
**10 N·m (1.0 kgf·m, 7.2 ft·lb)**



7) Further tighten the cylinder block connecting bolts on the LH side (A — D) in alphabetical sequence.

**Tightening torque:**

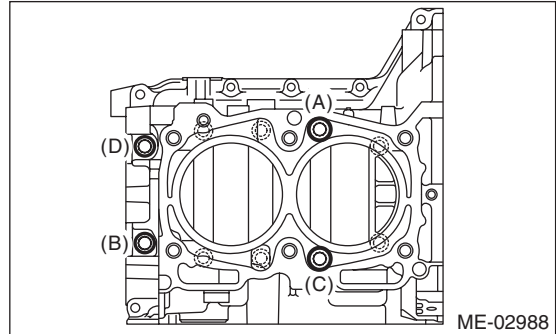
**18 N·m (1.8 kgf·m, 13 ft·lb)**



8) Further tighten the cylinder block connecting bolts on the RH side (E — J) in alphabetical sequence.

**Tightening torque:**

**18 N·m (1.8 kgf·m, 13 ft·lb)**



9) Further tighten the cylinder block connecting bolts on the LH side (A — D) in alphabetical sequence.

- (A), (C): Angle tightening

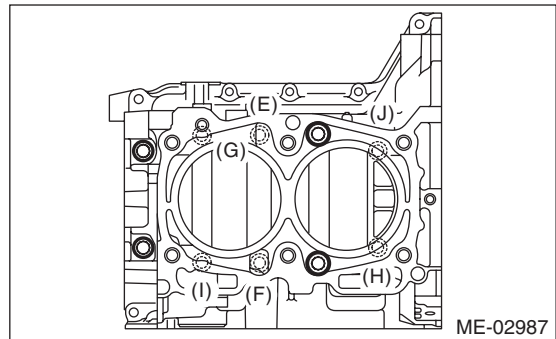
**Tightening angle:**

**90°**

- (B), (D): Torque tightening

**Tightening torque:**

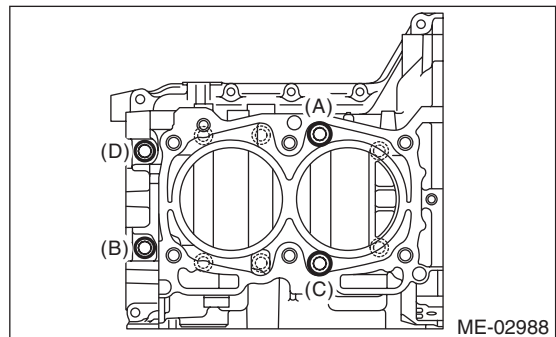
**40 N·m (4.1 kgf·m, 29.6 ft·lb)**



10) Tighten the cylinder block connecting bolts on the RH side (E — J) in alphabetical sequence.

**Tightening angle:**

**90°**



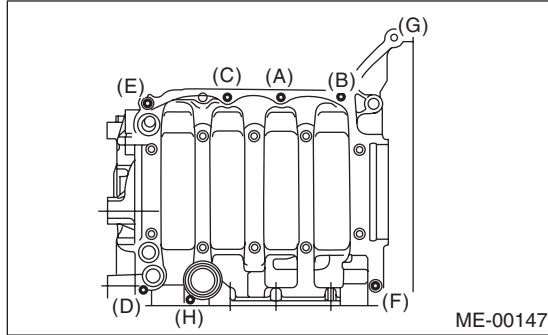


11) Tighten the 8 mm and 6 mm cylinder block connecting bolts on LH side (A — H) in alphabetical sequence.

**Tightening torque:**

(A) — (G): 25 N·m (2.5 kgf·m, 18.1 ft·lb)

(H): 6.4 N·m (0.65 kgf·m, 4.7 ft·lb)



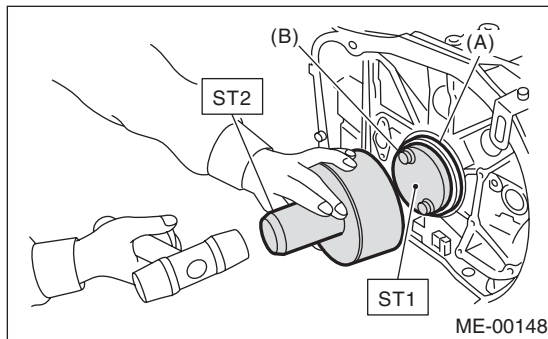
12) Apply a coat of engine oil to the oil seal periphery, then install the rear oil seal using ST1 and ST2.

**NOTE:**

Use a new rear oil seal.

ST1 499597100 OIL SEAL GUIDE

ST2 499587200 OIL SEAL INSTALLER



(A) Rear oil seal

(B) Flywheel attaching bolt

13) Position the top ring gap at (A) or (B) in the figure.

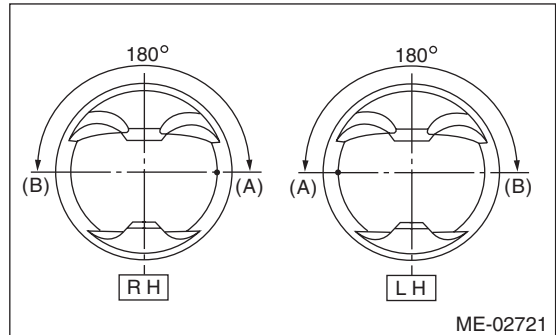
**NOTE:**

Assemble so that the piston ring mark “R” faces the upper side of the piston.

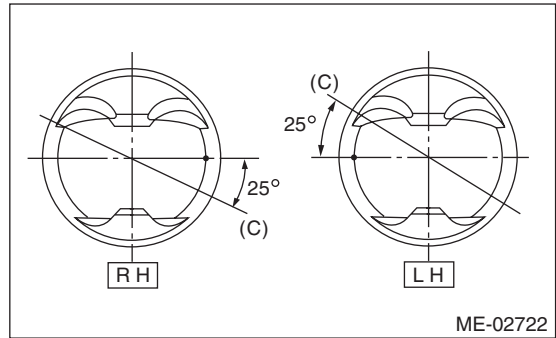
14) Position the second ring gap at 180° on the reverse side the top ring gap.

**NOTE:**

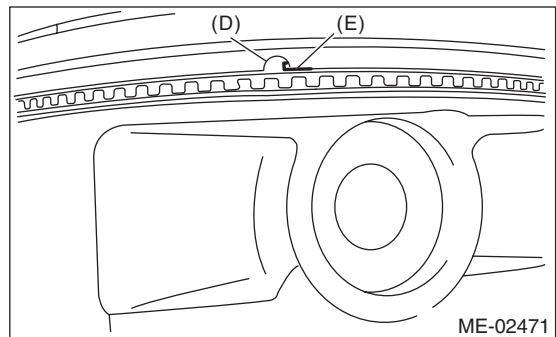
Assemble so that the piston ring mark “R” faces the upper side of the piston.



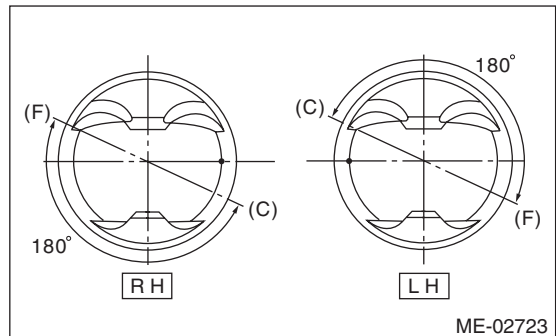
15) Position the upper rail gap at (C) in the figure.



16) Align the upper rail spin stopper (E) to the side hole (D) on the piston.



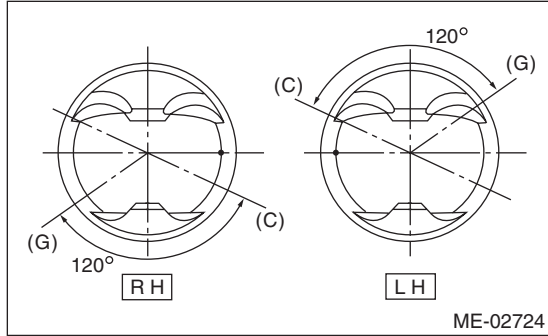
17) Position the expander gap at (F) in the figure.



# Cylinder Block

## MECHANICAL

18) Position the lower rail gap at (G) in the figure.



**NOTE:**

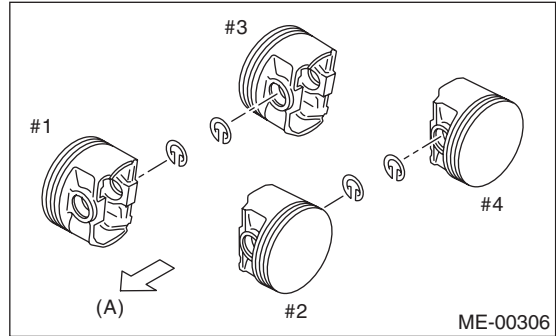
- Make sure the ring gaps do not face the same direction.
- Make sure ring gaps are not within the piston skirt area.

19) Install the snap ring.

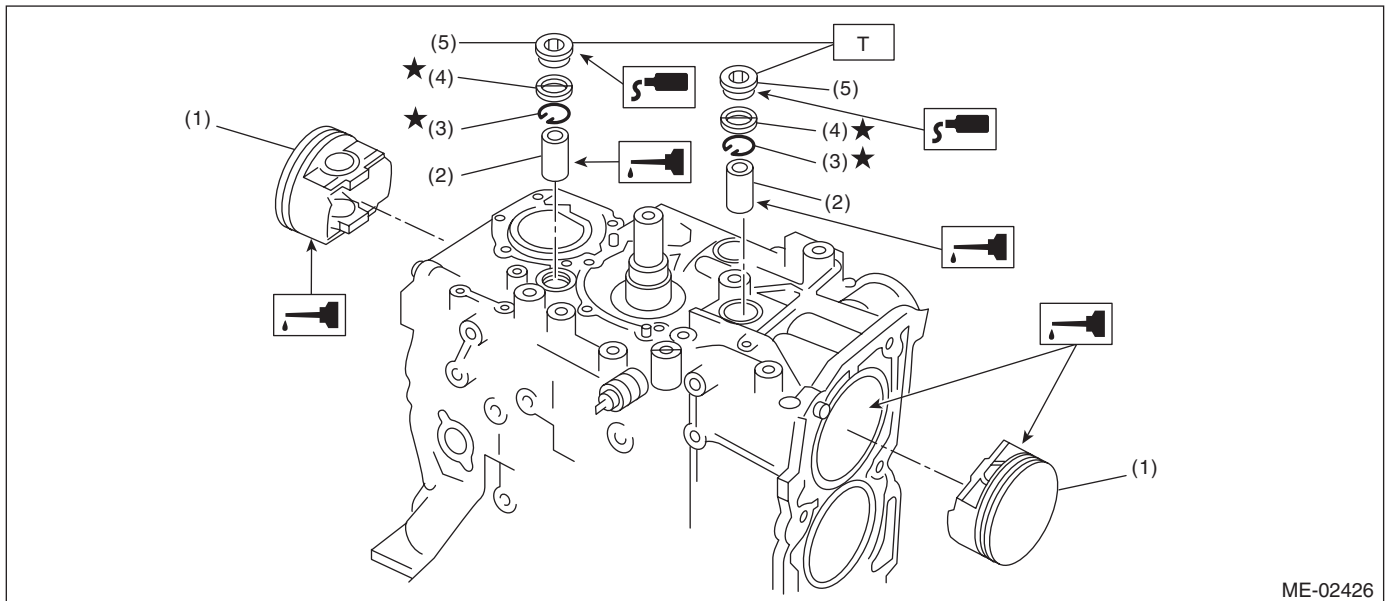
Install the snap rings in the piston holes located opposite to the service holes in cylinder block before assembling pistons to the cylinder.

**NOTE:**

Use new snap rings.



(A) Front side



ME-02426

- |                |                       |
|----------------|-----------------------|
| (1) Piston     | (4) Gasket            |
| (2) Piston pin | (5) Service hole plug |
| (3) Snap ring  |                       |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T: 70 (7.1, 50.6)**



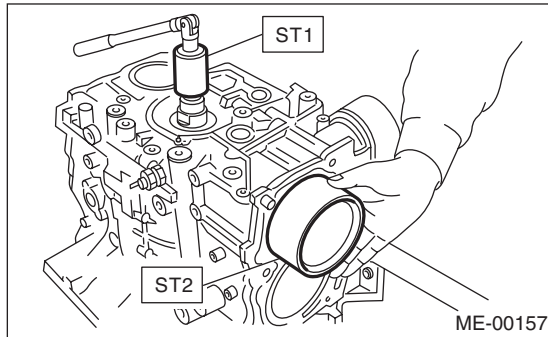
20) Install the piston.

- (1) Place the cylinder block to face the #1 and #2 cylinder side upward.
- (2) Using the ST1, turn the crankshaft so that #1 and #2 connecting rods are set at bottom dead center.

ST1 499987500 CRANKSHAFT SOCKET

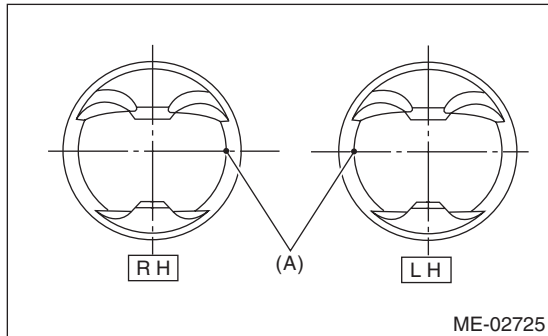
- (3) Apply a coat of engine oil to the pistons and cylinders and insert pistons in their cylinders using ST2.

ST2 498747300 PISTON GUIDE



NOTE:

Face the piston front mark towards the front of the engine.

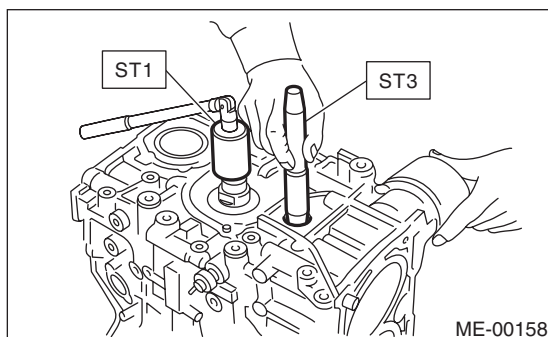


(A) Front mark

21) Install the piston pin.

- (1) Apply a coat of engine oil to ST3.
- (2) Insert ST3 into the service hole to align piston pin hole with connecting rod small end.

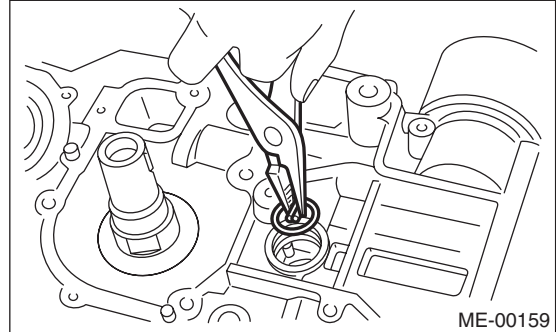
ST3 499017100 PISTON PIN GUIDE



- (3) Apply a coat of engine oil to piston pin, and insert the piston pin into piston and connecting rod through service hole.
- (4) Install the snap ring.

NOTE:

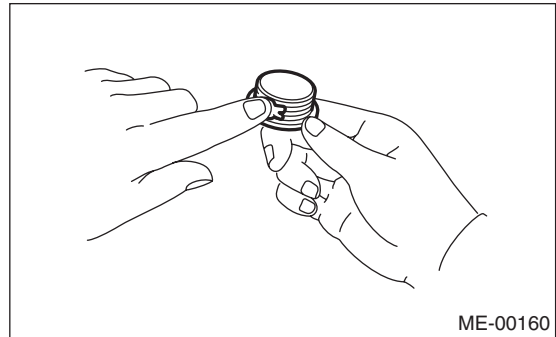
Use new snap rings.



- (5) Apply liquid gasket to the bolt threads of service plug.

**Liquid gasket:**

**THREE BOND 1105 (Part No. 004403010) or equivalent**



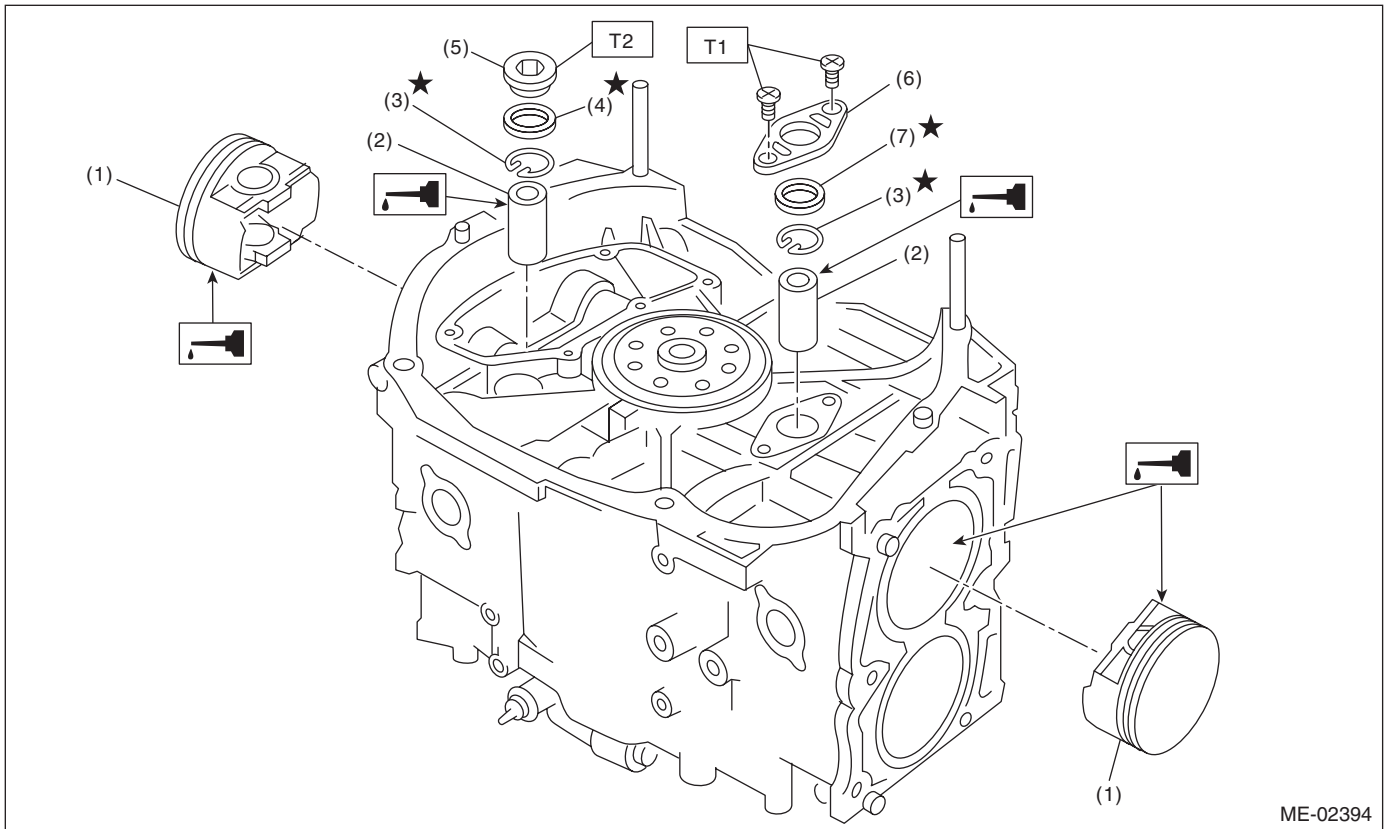
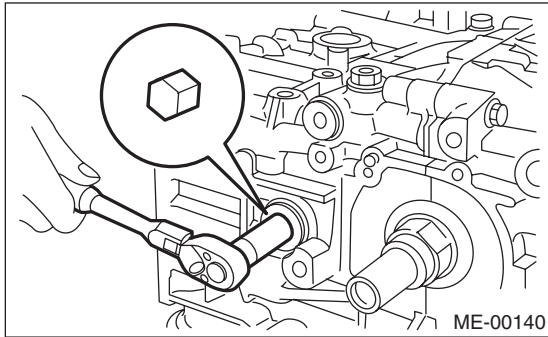
# Cylinder Block

## MECHANICAL

(6) Install the service hole plug and gasket.

### NOTE:

Use a new gasket.



- |                |                        |
|----------------|------------------------|
| (1) Piston     | (5) Service hole plug  |
| (2) Piston pin | (6) Service hole cover |
| (3) Snap ring  | (7) O-ring             |
| (4) Gasket     |                        |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 6.4 (0.65, 4.7)**

**T2: 70 (7.1, 50.6)**

# Cylinder Block

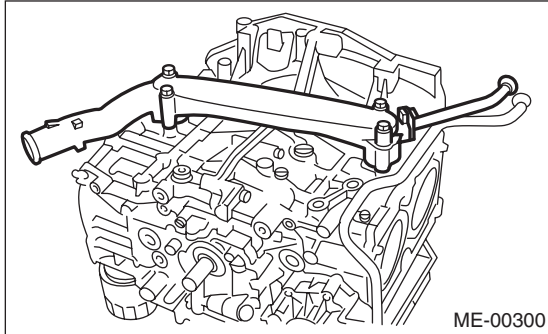
MECHANICAL

(7) Place the cylinder block to face the #3 and #4 cylinder side upward. Following the same procedures as used for #1 and #2 cylinders, install the pistons and piston pins.

22) Install the water pipe.

**Tightening torque:**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**



23) Install the baffle plate.

**Tightening torque:**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**

24) Install the oil strainer and O-ring.

**Tightening torque:**

**10 N·m (1.0 kgf-m, 7.2 ft-lb)**

25) Install the oil strainer stay.

NOTE:

Tighten the oil strainer stay together with the baffle plate.

**Tightening torque:**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**

26) Apply liquid gasket to the mating surfaces, and install the oil pan.

NOTE:

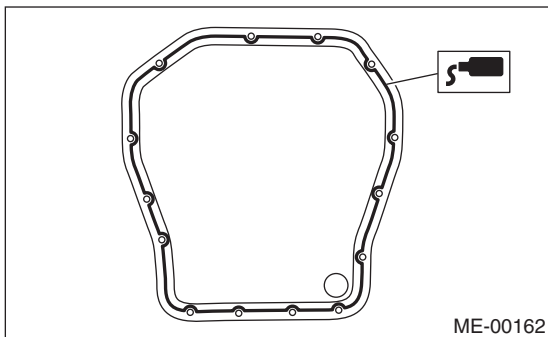
Install within 5 min. after applying liquid gasket.

**Liquid gasket:**

**THREE BOND 1207C (Part No. 004403012) or equivalent**

**Tightening torque:**

**5 N·m (0.5 kgf-m, 3.6 ft-lb)**



27) Apply liquid gasket to the mating surfaces and the threaded portion of bolt (A) shown in the figure (when reusing the bolt), and then install the oil separator cover.

NOTE:

Install within 5 min. after applying liquid gasket.

**Liquid gasket:**

• **Mating surface**

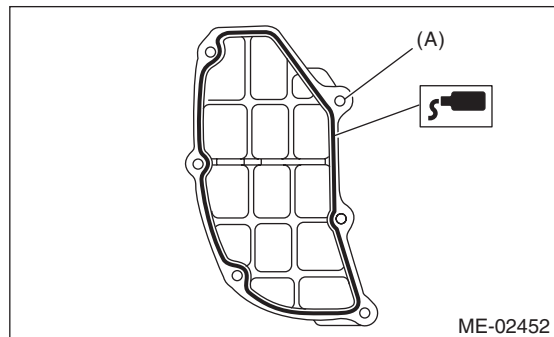
**THREE BOND 1217G or equivalent**

• **Bolt (A) thread (when reusing the bolt)**

**THREE BOND 1324 (Part No. 004403042) or equivalent**

**Tightening torque:**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**



28) Install the flywheel. (MT model)

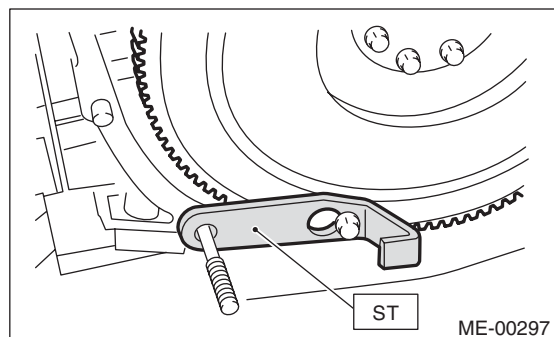
<Ref. to CL-14, INSTALLATION, Flywheel.>

To lock the crankshaft, use the ST.

ST 498497100 CRANKSHAFT STOPPER

**Tightening torque:**

**72 N·m (7.3 kgf-m, 52.8 ft-lb)**



# Cylinder Block

## MECHANICAL

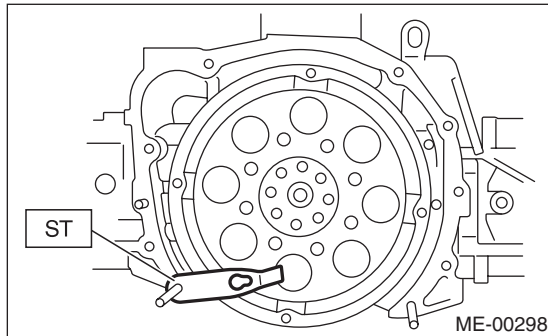
29) Install the drive plate.

To lock the crankshaft, use the ST.

ST 498497100 CRANKSHAFT STOPPER

**Tightening torque:**

**72 N·m (7.3 kgf·m, 52.8 ft·lb)**

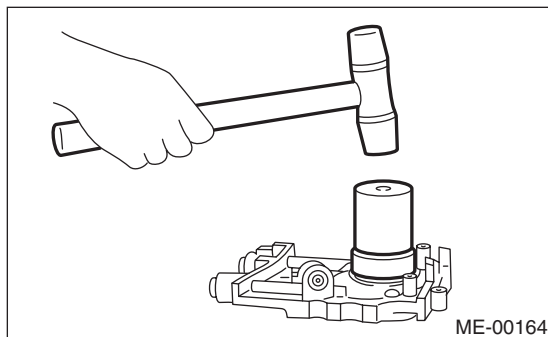


30) Install the housing cover.

31) Installation of oil pump:

(1) Replace the front oil seal with a new part using ST.

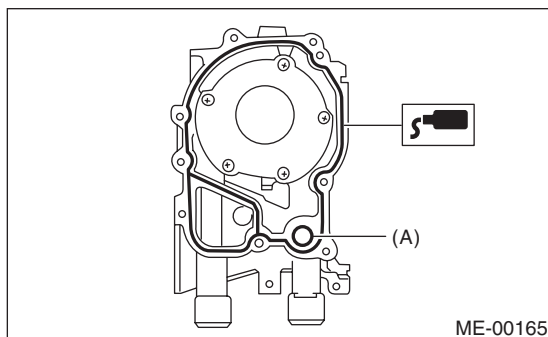
ST 499587100 OIL SEAL INSTALLER



(2) Apply liquid gasket to the matching surface of oil pump.

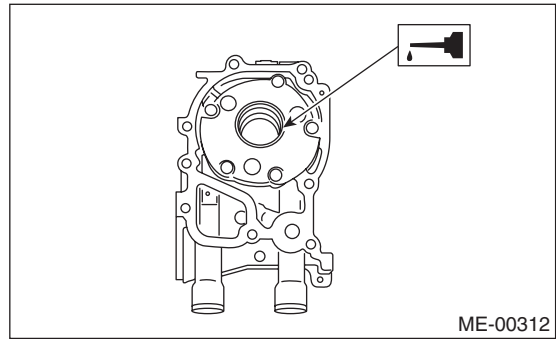
**Liquid gasket:**

**THREE BOND 1215 (Part No. 004403007) or equivalent**



(A) O-ring

(3) Apply a coat of engine oil to the inside of oil seal.



(4) Install the oil pump to cylinder block. Be careful not to damage the oil seal during installation.

**NOTE:**

- Make sure the oil seal lip is not folded.
- Align the flat surface of oil pump's inner rotor with crankshaft before installation.
- Use new O-rings and seals when installing the oil pump.

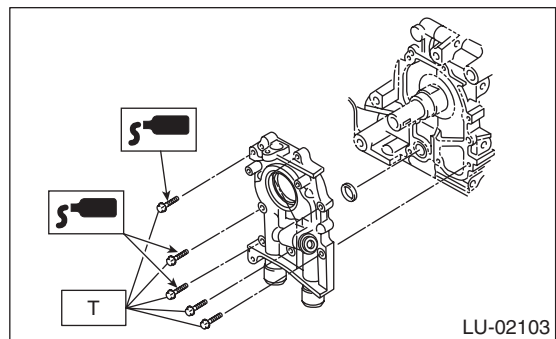
(5) Apply liquid gasket to the three bolts thread shown in figure. (when reusing the bolt)

**Liquid gasket:**

**THREE BOND 1324 (Part No. 004403042) or equivalent**

**Tightening torque:**

**T: 6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



32) Install the water pump and gasket.

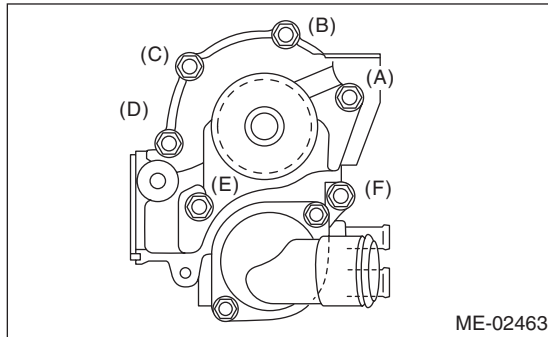
**Tightening torque:**

**First: 12 N·m (1.2 kgf-m, 8.7 ft-lb)**

**Second: 12 N·m (1.2 kgf-m, 8.7 ft-lb)**

**NOTE:**

- When installing the water pump, tighten bolts in two stages in alphabetical sequence as shown in the figure.
- Use a new gasket.



33) Install the water by-pass pipe for heater.

34) Install the oil filter.

<Ref. to LU (H4SO)-24, INSTALLATION, Engine Oil Filter.>

35) Tighten the cylinder head bolts. <Ref. to ME(H4SO)-58, INSTALLATION, Cylinder Head.>

36) Install the oil level gauge guide and tighten the bolts. (LH side only)

37) Install the crank sprocket.

<Ref. to ME(H4SO)-50, INSTALLATION, Crank Sprocket.>

38) Install the cam sprocket. <Ref. to ME(H4SO)-49, INSTALLATION, Cam Sprocket.>

39) Install the timing belt. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt.>

40) Adjust the valve clearance. <Ref. to ME(H4SO)-31, ADJUSTMENT, Valve Clearance.>

41) After assembling the rocker cover gasket to the rocker cover, install it to the cylinder head, and then connect it to PCV hose.

**NOTE:**

Use a new rocker cover gasket.

42) Install the timing belt cover.

<Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt Cover.>

43) Install the crank pulley. <Ref. to ME(H4SO)-42, INSTALLATION, Crank Pulley.>

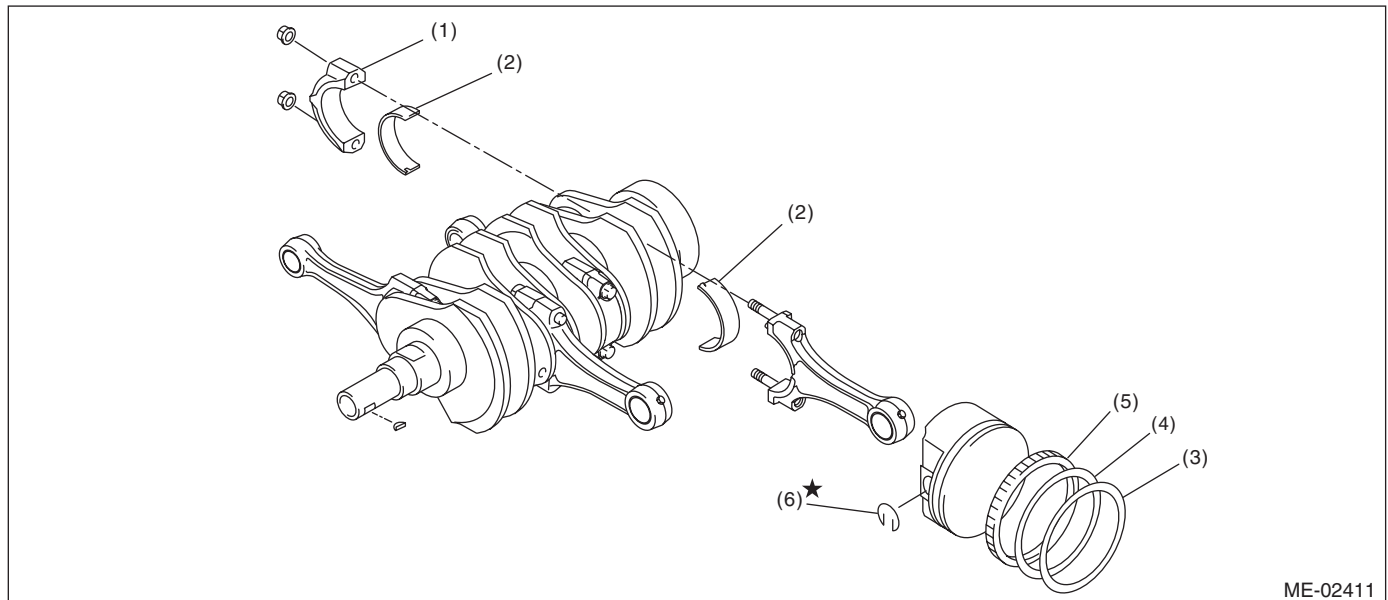
44) Install the intake manifold.

<Ref. to FU(H4SO)-15, INSTALLATION, Intake Manifold.>

45) Install the generator and A/C compressor brackets on cylinder head.

46) Install the V-belts. <Ref. to ME(H4SO)-40, INSTALLATION, V-belt.>

## C: DISASSEMBLY



- (1) Connecting rod cap
- (2) Connecting rod bearing

- (3) Top ring
- (4) Second ring

- (5) Oil ring
- (6) Snap ring

# Cylinder Block

## MECHANICAL

- 1) Remove the connecting rod cap.
- 2) Remove the connecting rod bearing.

### NOTE:

Arrange the removed connecting rod, connecting rod cap and bearing in order, to prevent confusion.

- 3) Remove the piston rings using piston ring expander.

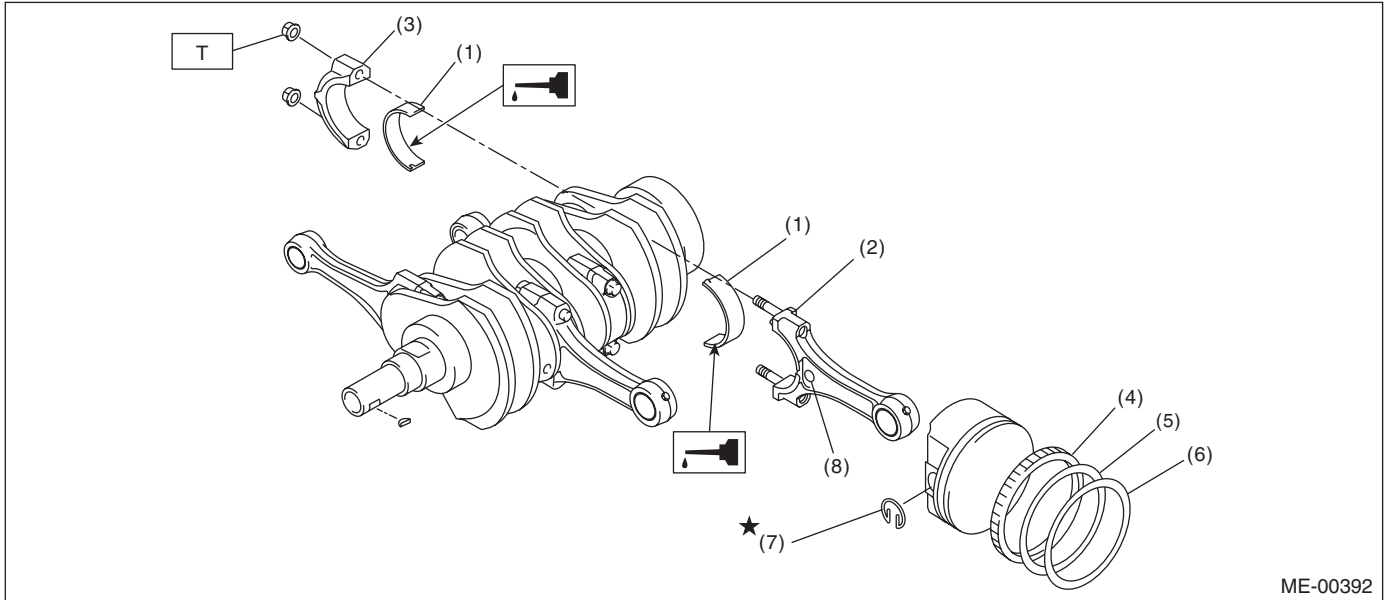
- 4) Remove the oil ring by hand.

### NOTE:

Arrange the removed piston rings in proper order, to prevent confusion.

- 5) Remove the snap ring.

## D: ASSEMBLY



- |                            |                 |
|----------------------------|-----------------|
| (1) Connecting rod bearing | (5) Second ring |
| (2) Connecting rod         | (6) Top ring    |
| (3) Connecting rod cap     | (7) Snap ring   |
| (4) Oil ring               | (8) Side mark   |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T: 45 (4.6, 33.3)**

- 1) Apply oil to the surfaces of the connecting rod bearings.
- 2) Install the connecting rod bearings on connecting rods and connecting rod caps.
- 3) Position each connecting rod with a side mark facing forward, and install it.
- 4) Install the connecting rod cap with connecting rod nut.

Make sure the arrow on connecting rod cap faces toward front during installation.

### NOTE:

- Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching number.
  - When tightening the connecting rod nuts, apply oil on the threads.
- 5) Install the expander, lower rail and upper rail by hand. Install the second ring and top ring using piston ring expander.

## E: INSPECTION

### 1. CYLINDER BLOCK

- 1) Visually check for cracks and damage. Especially, inspect the important parts using liquid penetrant tester.
- 2) Check the oil passages for clogging.
- 3) Inspect the cylinder block surface that mates with cylinder head for warping by using a straight edge, and correct by grinding if necessary.

#### Warping limit:

**0.025 mm (0.00098 in)**

#### Grinding limit:

**0.1 mm (0.004 in)**

#### Standard height of cylinder block:

**201.0 mm (7.91 in)**



## 2. CYLINDER AND PISTON

1) The cylinder bore size is stamped on the cylinder block front upper surface.

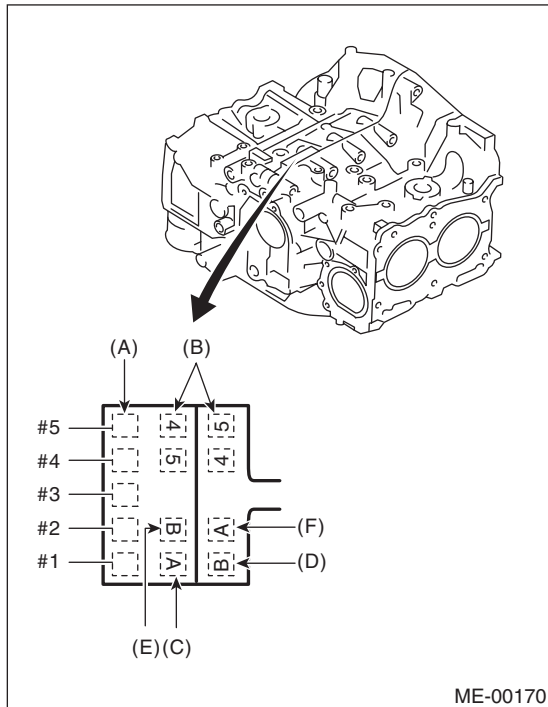
NOTE:

- Measurement should be performed at a temperature of 20°C (68°F).
- Standard sized pistons are classified into two grades, "A" and "B". These grades should be used as guide lines in selecting a standard piston.

**Standard diameter:**

**A: 99.505 — 99.515 mm (3.9175 — 3.9179 in)**

**B: 99.495 — 99.505 mm (3.9171 — 3.9175 in)**



- (A) Main journal size mark
- (B) Cylinder block (RH)-(LH) combination mark
- (C) #1 cylinder bore size mark
- (D) #2 cylinder bore size mark
- (E) #3 cylinder bore size mark
- (F) #4 cylinder bore size mark

2) How to measure the inner diameter of each cylinder

Measure the inner diameter of each cylinder in both the thrust and piston pin directions at the heights as shown in the figure, using a cylinder bore gauge.

NOTE:

Measurement should be performed at a temperature of 20°C (68°F).

**Taper:**

**Standard:**

**0.015 mm (0.0006 in)**

**Service limit:**

**0.050 mm (0.0020 in)**

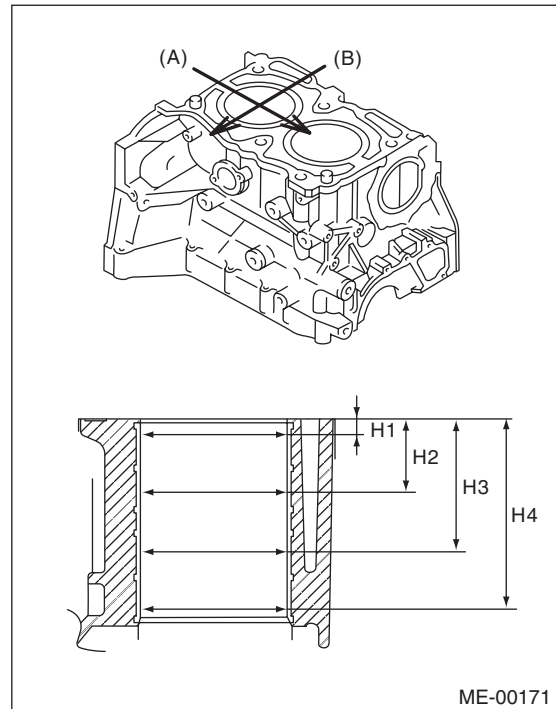
**Out-of-roundness:**

**Standard:**

**0.010 mm (0.0004 in)**

**Service limit:**

**0.050 mm (0.0020 in)**



- (A) Piston pin direction
- (B) Thrust direction
- H1 10 mm (0.39 in)
- H2 45 mm (1.77 in)
- H3 80 mm (3.15 in)
- H4 115 mm (4.53 in)

3) When the piston is to be replaced due to general wear or cylinder wear, select a suitable sized piston by measuring the piston clearance.

# Cylinder Block

## MECHANICAL

4) How to measure the outer diameter of each cylinder:

Measure the outer diameter of each piston at the height as shown in the figure. (Thrust direction)

NOTE:

Measurement should be performed at a temperature of 20°C (68°F).

**Piston grade point H:**  
**38.2 mm (1.504 in)**

**Standard:**

**A: 99.505 — 99.515 mm (3.9175 — 3.9179 in)**

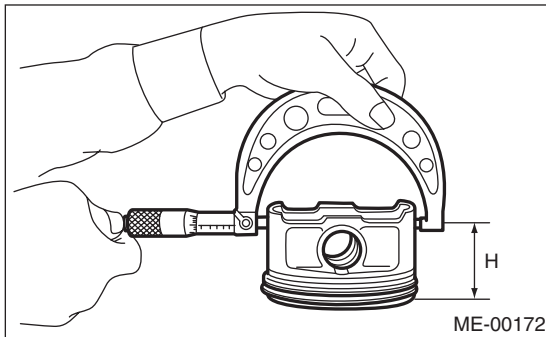
**B: 99.495 — 99.505 mm (3.9171 — 3.9175 in)**

**0.25 mm (0.0098 in) oversize:**

**99.745 — 99.765 mm (3.9270 — 3.9278 in)**

**0.50 mm (0.0197 in) oversize:**

**99.995 — 100.015 mm (3.9368 — 3.9376 in)**



5) Calculate the clearance between cylinder and piston.

NOTE:

Measurement should be performed at a temperature of 20°C (68°F).

**Cylinder to piston clearance at 20°C (68°F):**

**Standard:**

**-0.010 — 0.010 mm (-0.00039 — 0.00039 in)**

**Service limit:**

**0.030 mm (0.0012 in)**

6) Boring and honing

(1) If any of the measured value of taper, out-of-roundness or cylinder-to-piston clearance is not within the service limit or if there is any damage on the cylinder wall, rebores it to use an oversize piston.

**CAUTION:**

- When any of the cylinders needs reboring, all other cylinders must be bored at the same time, and replace to oversize pistons.
- Do not perform boring on one cylinder only. Nor replace an oversize piston for one cylinder only.

(2) If the cylinder inner diameter exceeds the limit after boring and honing, replace the cylinder block.

**Cylinder inner boring limit (diameter):**  
**To 100.005 mm (3.9372 in)**

NOTE:

Immediately after reboring, the cylinder diameter may differ from its real diameter due to temperature rise. Thus, pay attention when measuring the cylinder diameter.

### 3. PISTON AND PISTON PIN

1) Check the pistons and piston pins for damage, cracks and wear, and the piston ring grooves for wear and damage. Replace if faulty.

2) Measure the piston-to-cylinder clearance at each cylinder. <Ref. to ME(H4SO)-79, CYLINDER AND PISTON, INSPECTION, Cylinder Block.>If any of the clearances exceeds the limit value, replace the piston or bore the cylinder to enable use of the oversize piston.

3) Make sure that the piston pin can be inserted into the piston pin hole with fingers at 20°C (68°F). Replace if faulty.

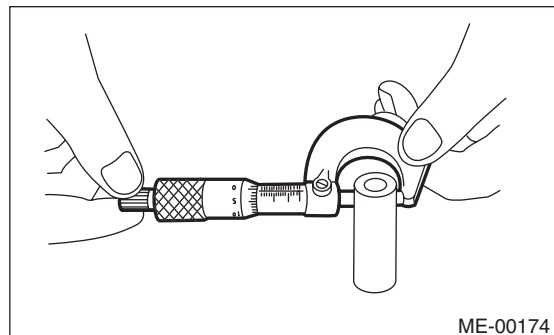
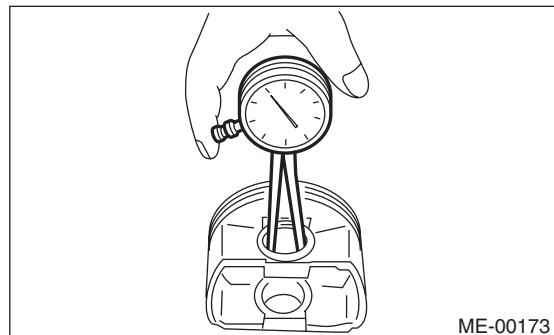
**Clearance between piston hole and piston pin:**

**Standard:**

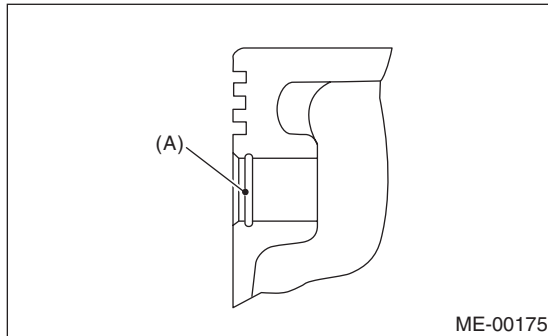
**0.004 — 0.008 mm (0.0002 — 0.0003 in)**

**Service limit:**

**0.020 mm (0.0008 in)**



4) Check the snap ring installation groove (A) on the piston for burr. If necessary, remove burr from the groove so that the piston pin can lightly move.



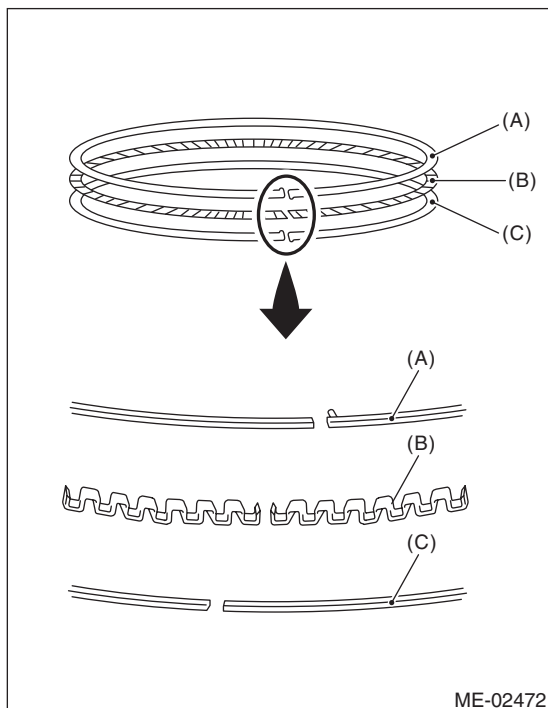
5) Check the piston pin snap ring for distortion, cracks and wear.

## 4. PISTON RING

1) If the piston ring is broken, damaged or worn, or if its tension is insufficient, or when the piston is replaced, replace the piston ring with a new part of the same size as piston.

### NOTE:

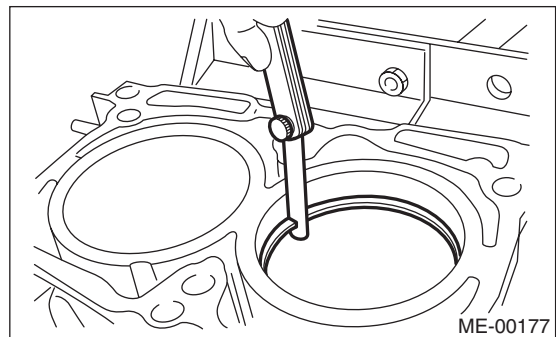
- Marks that shows the installing direction are shown on the end of top and second rings. Face these marks upward when installing the rings to piston.
- Oil ring consists of the upper rail, expander and lower rail. Be careful about the direction of rail when installing the oil ring to piston.



- (A) Upper rail
- (B) Expander
- (C) Lower rail

2) Clean the piston ring groove and piston ring.  
3) Squarely place the piston ring and oil ring in cylinder, and measure the piston ring gap with a thickness gauge.

		mm (in)	
		Standard	Limit
Piston ring gap	Top ring	0.20 — 0.35 (0.0079 — 0.0138)	1.0 (0.039)
	Second ring	0.37 — 0.52 (0.0144 — 0.0203)	
	Oil ring rail	0.20 — 0.50 (0.0079 — 0.0197)	1.5 (0.059)

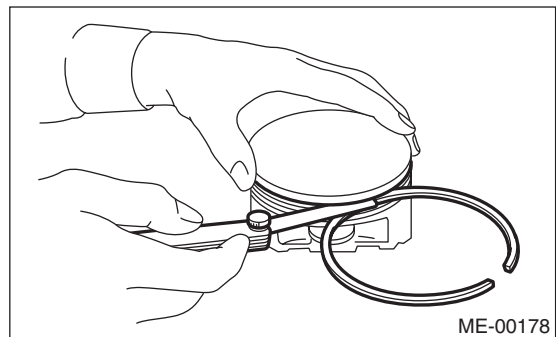


4) Measure the clearance between piston ring and piston ring groove with a thickness gauge.

### NOTE:

Before measuring the clearance, clean the piston ring groove and piston ring.

		mm (in)	
		Standard	Limit
Clearance between piston ring and piston ring groove	Top ring	0.040 — 0.080 (0.0016 — 0.0031)	0.15 (0.059)
	Second ring	0.030 — 0.070 (0.0012 — 0.0028)	



# Cylinder Block

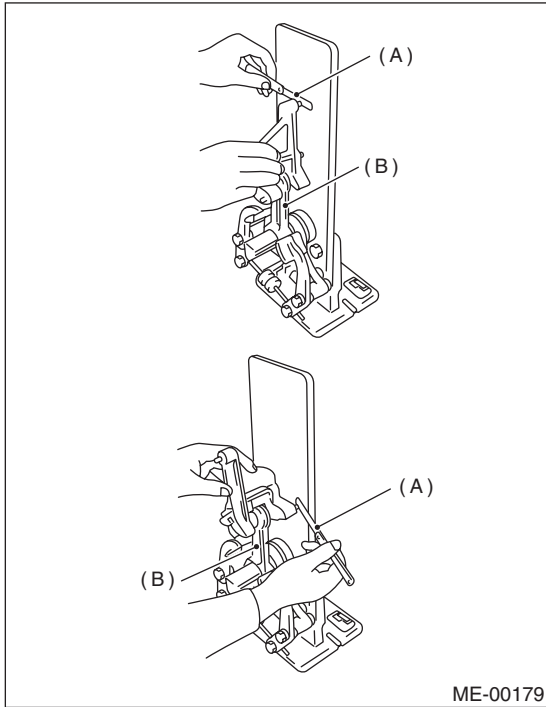
## MECHANICAL

### 5. CONNECTING ROD

- 1) Replace the connecting rod, if the large or small end thrust surface is damaged.
- 2) Check for bend or twist using a connecting rod aligner. Replace the connecting rod if the bend or twist exceeds the limit.

**Limit of bend or twist per 100 mm (3.94 in) in length:**

**0.10 mm (0.0039 in)**



(A) Thickness gauge  
(B) Connecting rod

- 3) Install the connecting rod fitted with bearing to crankshaft and measure the side clearance (thrust clearance). Replace the connecting rod if the side clearance exceeds the specified limit.

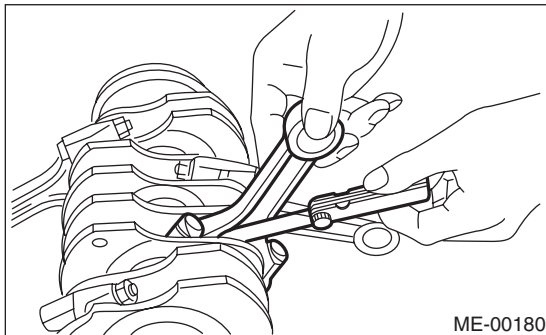
**Connecting rod side clearance:**

**Standard:**

**0.070 — 0.330 mm (0.0028 — 0.0130 in)**

**Service limit:**

**0.4 mm (0.016 in)**



ME-00180

- 4) Inspect the connecting rod bearing for scar, peeling, seizure, melting, wear, etc.

- 5) Measure the oil clearance on each connecting rod bearing using plastigauge. If there is an oil clearance that exceeds the service limit, replace the defective bearing with a new standard or undersized bearing as necessary. (See the table below.)

**Connecting rod oil clearance:**

**Standard:**

**0.016 — 0.044 mm (0.00063 — 0.0017 in)**

**Service limit:**

**0.05 mm (0.0020 in)**

Unit: mm (in)		
Bearing	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.492 — 1.501 (0.0587 — 0.0591)	51.984 — 52.000 (2.0466 — 2.0472)
0.03 (0.0012) Undersize	1.510 — 1.513 (0.0594 — 0.0596)	51.954 — 51.970 (2.0454 — 2.0461)
0.05 (0.0020) Undersize	1.520 — 1.523 (0.0598 — 0.0600)	51.934 — 51.950 (2.0446 — 2.0453)
0.25 (0.0098) Undersize	1.620 — 1.623 (0.0638 — 0.0639)	51.734 — 51.750 (2.0368 — 2.0374)

- 6) Inspect the bushing at connecting rod small end, and replace if worn or damaged. Also measure the piston pin clearance at connecting rod small end.

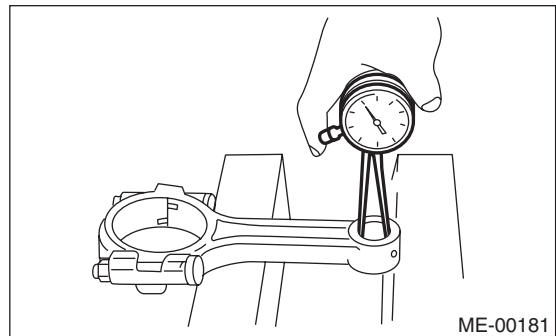
**Clearance between piston pin and bushing:**

**Standard:**

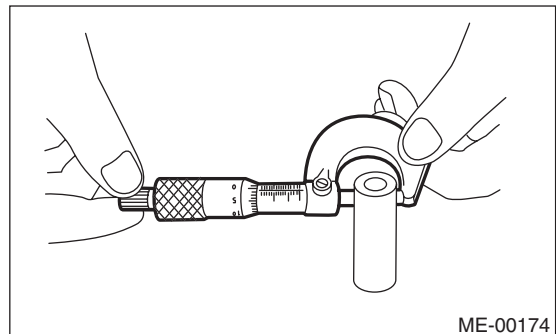
**0 — 0.022 mm (0 — 0.0009 in)**

**Service limit:**

**0.030 mm (0.0012 in)**

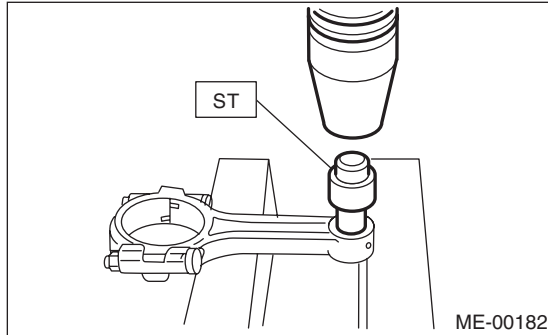


ME-00181



ME-00174

- 7) Replacement procedure is as follows.
- (1) Remove the bushing from connecting rod with ST and press.
  - (2) Press the bushing with the ST after applying oil on the periphery of new bushing.
- ST 499037100 CONNECTING ROD BUSHING REMOVER AND INSTALLER



- (3) Make two 3 mm (0.12 in) holes in the pressed bushing by aligning with the pre-manufactured holes on the connecting rod. Then, ream the inside of bushing.
- (4) After completion of reaming, clean the bushing to remove chips.

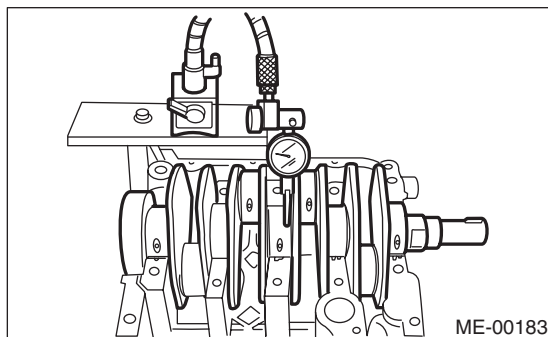
## 6. CRANKSHAFT AND CRANKSHAFT BEARING

- 1) Clean the crankshaft completely, and check it for cracks using liquid penetrant tester. Replace if faulty.
- 2) Measure the bend of crankshaft. If it exceeds the limit, repair or replace it.

### NOTE:

If a suitable V-block is not available, install #1 and #5 crankshaft bearing on cylinder block, position the crankshaft on these bearings, and then measure the crankshaft bend using a dial gauge.

**Crankshaft bend limit:**  
**0.035 mm (0.0014 in)**



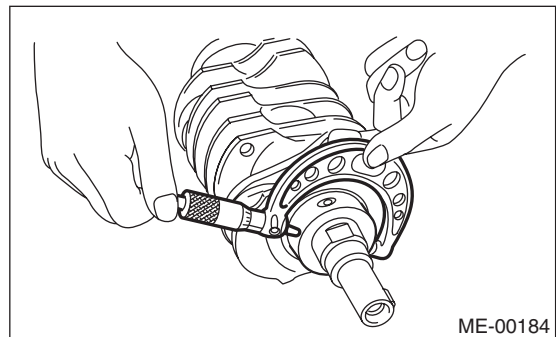
- 3) Inspect the crank journal and crank pin for wear. If they are not within the standard, replace the bearing with a suitable (undersize) one, and replace or readjust the crankshaft if necessary. When grinding the crank journal or crank pin, finish them to the specified dimensions according to the undersize bearing to be used.

### Crank pin

**Out-of-roundness:**  
**0.003 mm (0.0001 in)**  
**Cylindricity:**  
**0.004 mm (0.0002 in)**  
**Grinding limit:**  
**To 51.750 mm (2.0374 in) dia.**

### Crank journal

**Out-of-roundness:**  
**0.005 mm (0.0002 in)**  
**Cylindricity:**  
**0.006 mm (0.0002 in)**  
**Grinding limit:**  
**To 59.758 mm (2.3527 in) dia.**



# Cylinder Block

MECHANICAL

		Unit: mm (in)		
		Crank journal outer diameter		Crank pin outer diameter
		#1, #3	#2, #4, #5	
Standard	Journal O.D.	59.992 — 60.008 (2.3619 — 2.3625)	59.992 — 60.008 (2.3619 — 2.3625)	51.984 — 52.000 (2.0466 — 2.0472)
	Bearing size (Thickness at center)	1.998 — 2.011 (0.0787 — 0.0792)	2.000 — 2.013 (0.0787 — 0.0793)	1.492 — 1.501 (0.0587 — 0.0591)
0.03 (0.0012) Undersize	Journal O.D.	59.962 — 59.978 (2.3607 — 2.3613)	59.962 — 59.978 (2.3607 — 2.3613)	51.954 — 51.970 (2.0454 — 2.0461)
	Bearing size (Thickness at center)	2.017 — 2.020 (0.0794 — 0.0795)	2.019 — 2.022 (0.0795 — 0.0796)	1.510 — 1.513 (0.0594 — 0.0596)
0.05 (0.0020) Undersize	Journal O.D.	59.942 — 59.958 (2.3599 — 2.3605)	59.942 — 59.958 (2.3599 — 2.3605)	51.934 — 51.950 (2.0446 — 2.0453)
	Bearing size (Thickness at center)	2.027 — 2.030 (0.0798 — 0.0799)	2.029 — 2.032 (0.0799 — 0.0800)	1.520 — 1.523 (0.0598 — 0.0600)
0.25 (0.0098) Undersize	Journal O.D.	59.742 — 59.758 (2.3520 — 2.3527)	59.742 — 59.758 (2.3520 — 2.3527)	51.734 — 51.750 (2.0368 — 2.0374)
	Bearing size (Thickness at center)	2.127 — 2.130 (0.0837 — 0.0839)	2.129 — 2.132 (0.0838 — 0.0839)	1.620 — 1.623 (0.0638 — 0.0639)

4) Use a thickness gauge to measure the thrust clearance of crankshaft at center bearing. If the clearance exceeds the limit, replace the bearing.

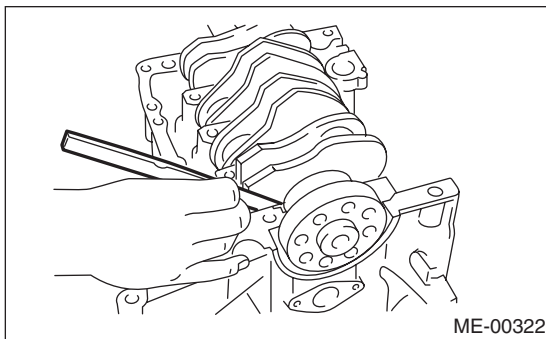
**Crankshaft thrust clearance:**

**Standard:**

**0.030 — 0.115 mm (0.0012 — 0.0045 in)**

**Service limit:**

**0.25 mm (0.0098 in)**



5) Inspect individual crankshaft bearings for signs of flaking, seizure, melting and wear.

6) Measure the oil clearance on each crankshaft bearing using plastigauge. If the measured value exceeds the limit, replace the defective bearing with an undersize one, and replace or readjust the crankshaft if necessary.

**Crankshaft oil clearance:**

**Standard:**

**0.010 — 0.030 mm (0.0004 — 0.0012 in)**

**Service limit:**

**0.040 mm (0.0016 in)**