

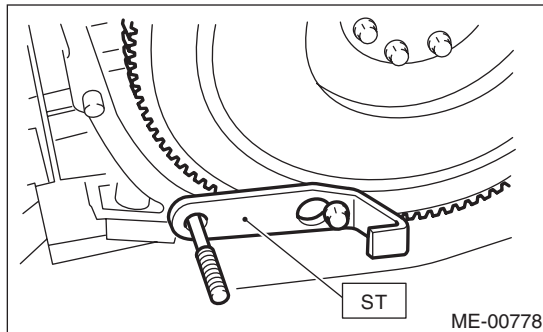
## 20. Cylinder Block

### A: REMOVAL

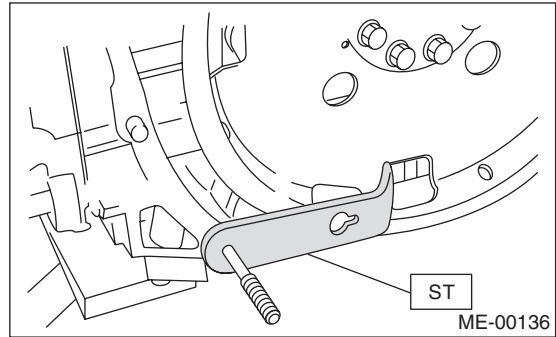
**NOTE:**

Before conducting this procedure, drain the engine oil completely.

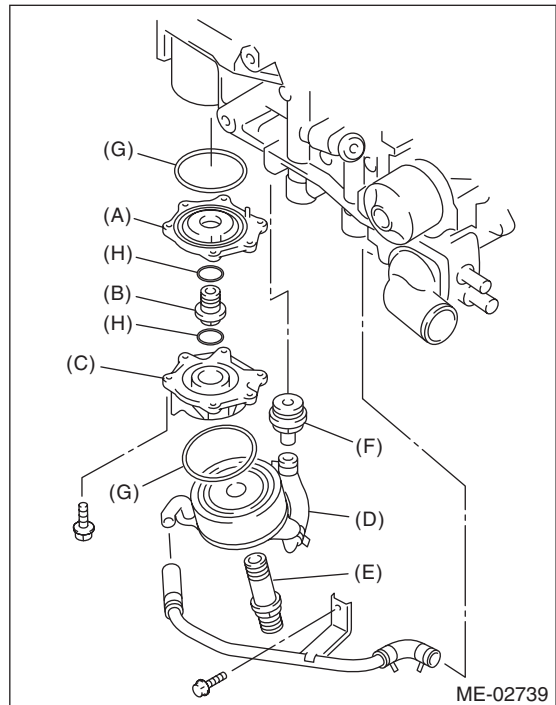
- 1) Remove the intake manifold.  
<Ref. to FU(H4DOTC)-14, REMOVAL, Intake Manifold.>
  - 2) Remove the V-belts. <Ref. to ME(H4DOTC)-40, REMOVAL, V-belt.>
  - 3) Remove the crank pulley.  
<Ref. to ME(H4DOTC)-42, REMOVAL, Crank Pulley.>
  - 4) Remove the timing belt cover.  
<Ref. to ME(H4DOTC)-43, REMOVAL, Timing Belt Cover.>
  - 5) Remove the timing belt.  
<Ref. to ME(H4DOTC)-44, REMOVAL, Timing Belt.>
  - 6) Remove the cam sprocket.  
<Ref. to ME(H4DOTC)-52, REMOVAL, Cam Sprocket.>
  - 7) Remove the crank sprocket.  
<Ref. to ME(H4DOTC)-53, REMOVAL, Crank Sprocket.>
  - 8) Remove the generator and A/C compressor with their brackets.
  - 9) Remove the cylinder head.  
<Ref. to ME(H4DOTC)-60, REMOVAL, Cylinder Head.>
  - 10) Remove the clutch disc and cover. <Ref. to CL-12, REMOVAL, Clutch Disc and Cover.>
  - 11) Remove the flywheel. (MT model)  
<Ref. to CL-14, REMOVAL, Flywheel.>
- ST 498497100 CRANKSHAFT STOPPER



- 12) Remove the drive plate. (AT model)  
Lock the crankshaft using ST.



- 13) Remove the oil separator cover.
- 14) Remove the water by-pass pipe for heater.
- 15) Remove the oil filter. <Ref. to LU (H4SO)-24, REMOVAL, Engine Oil Filter.>
- 16) Remove the oil cooler.



- (A) Adapter (1)
- (B) Adapter connector
- (C) Adapter (2)
- (D) Oil cooler
- (E) Oil cooler connector
- (F) Plug
- (G) Gasket
- (H) O-ring

- 17) Remove the water pump.

# Cylinder Block

## MECHANICAL

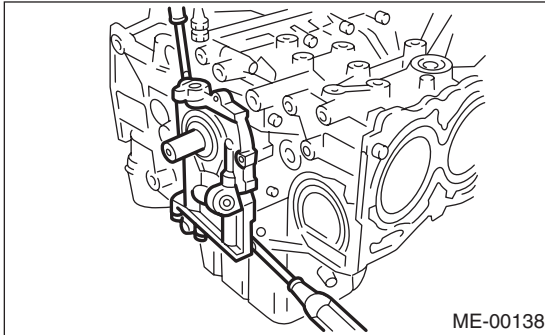
18) Remove the oil pump from cylinder block.

### NOTE:

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



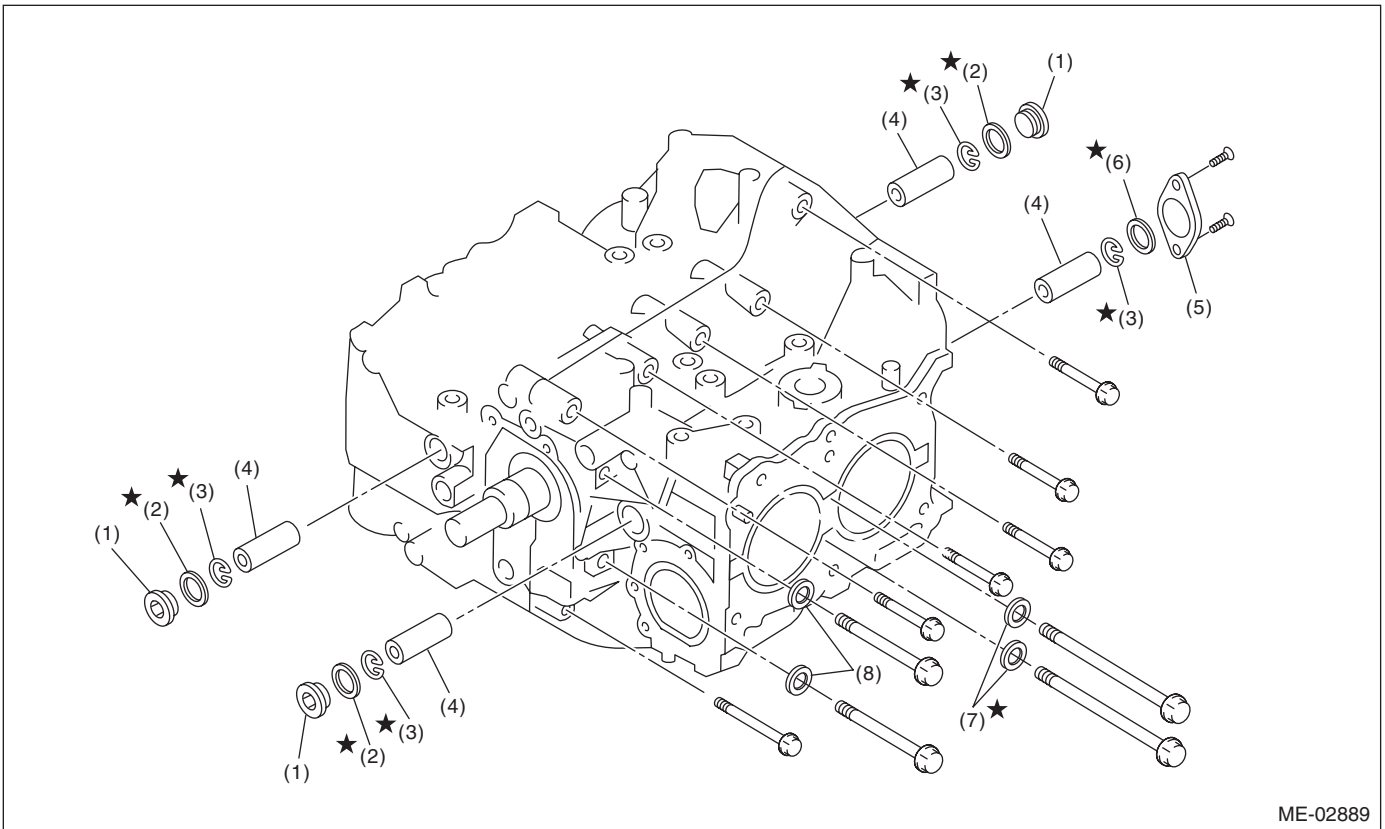
19) Removal of oil pan:

- (1) Turn the cylinder block with #2 and #4 piston sides facing 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.

- 20) Remove the oil strainer stay.
- 21) Remove the oil strainer.
- 22) Remove the baffle plate.
- 23) Remove the water pipe.

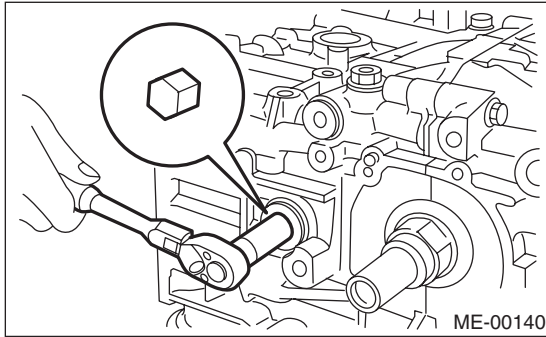


- (1) Service hole plug
- (2) Gasket
- (3) Snap ring

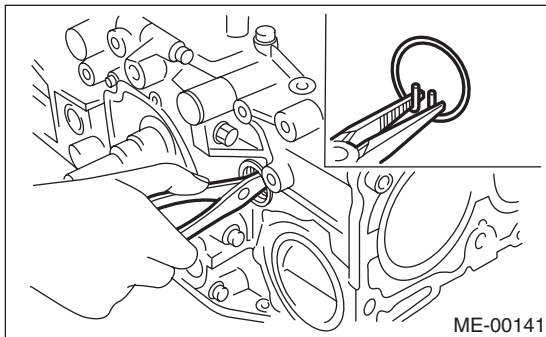
- (4) Piston pin
- (5) Service hole cover
- (6) O-ring

- (7) Seal washer
- (8) Washer

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



25) Rotate the crankshaft to bring #1 and #2 pistons to bottom dead center position, then remove the piston snap ring by inserted the radio pincers into the service hole of #1 and #2 cylinders.

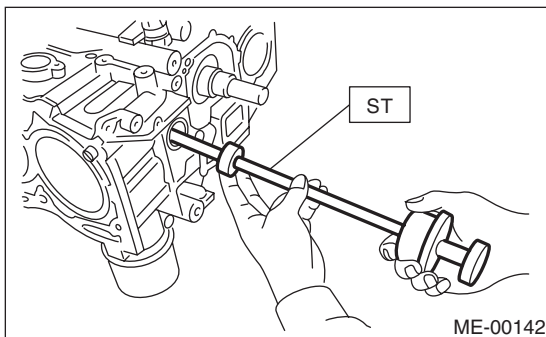


26) Draw out the piston pin from #1 and #2 pistons using ST.

ST 499097700 PISTON PIN REMOVER

**NOTE:**

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



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

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

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

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

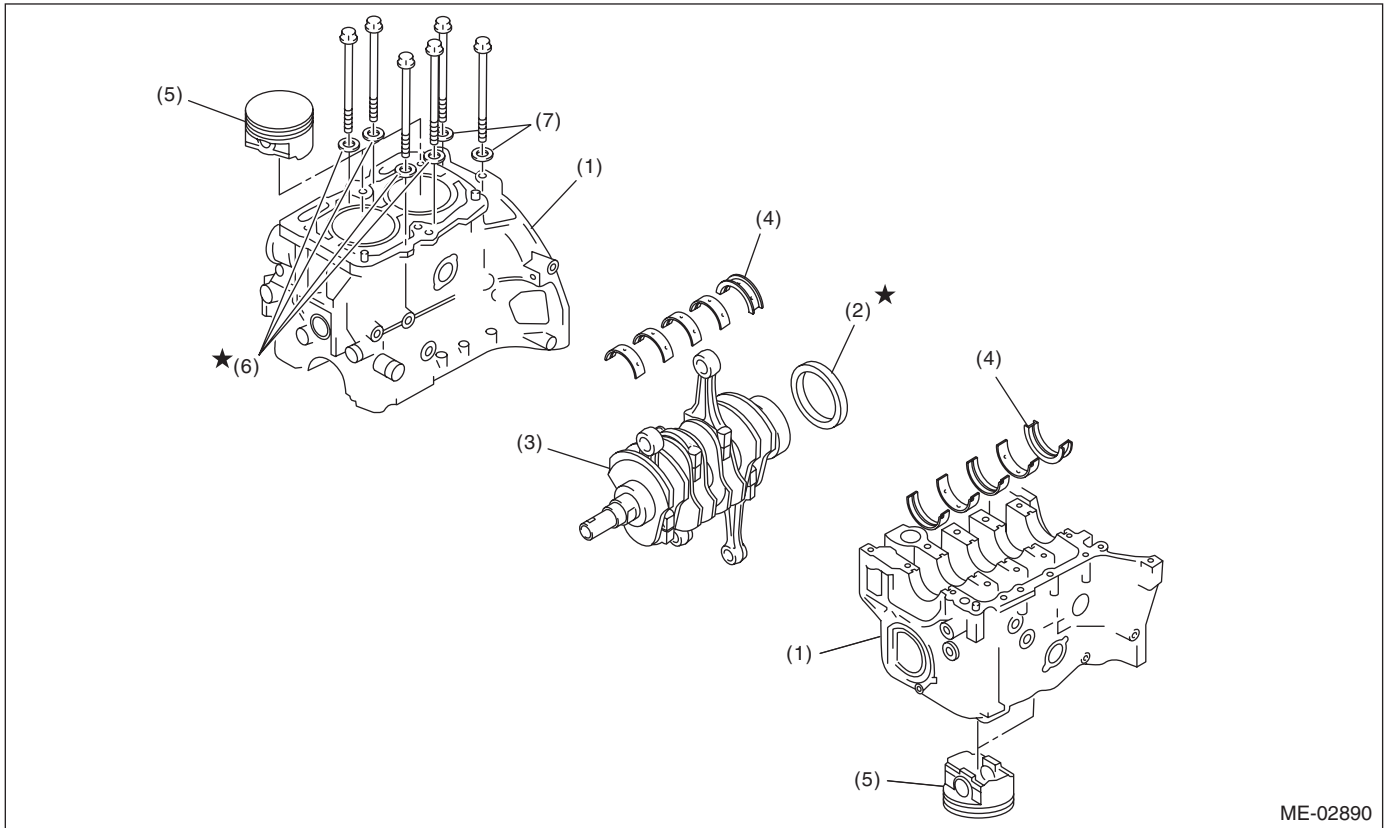
# Cylinder Block

## MECHANICAL

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

### NOTE:

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



ME-02890

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

32) Remove the rear oil seal.

33) Remove the crankshaft together with connecting rod.

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

### NOTE:

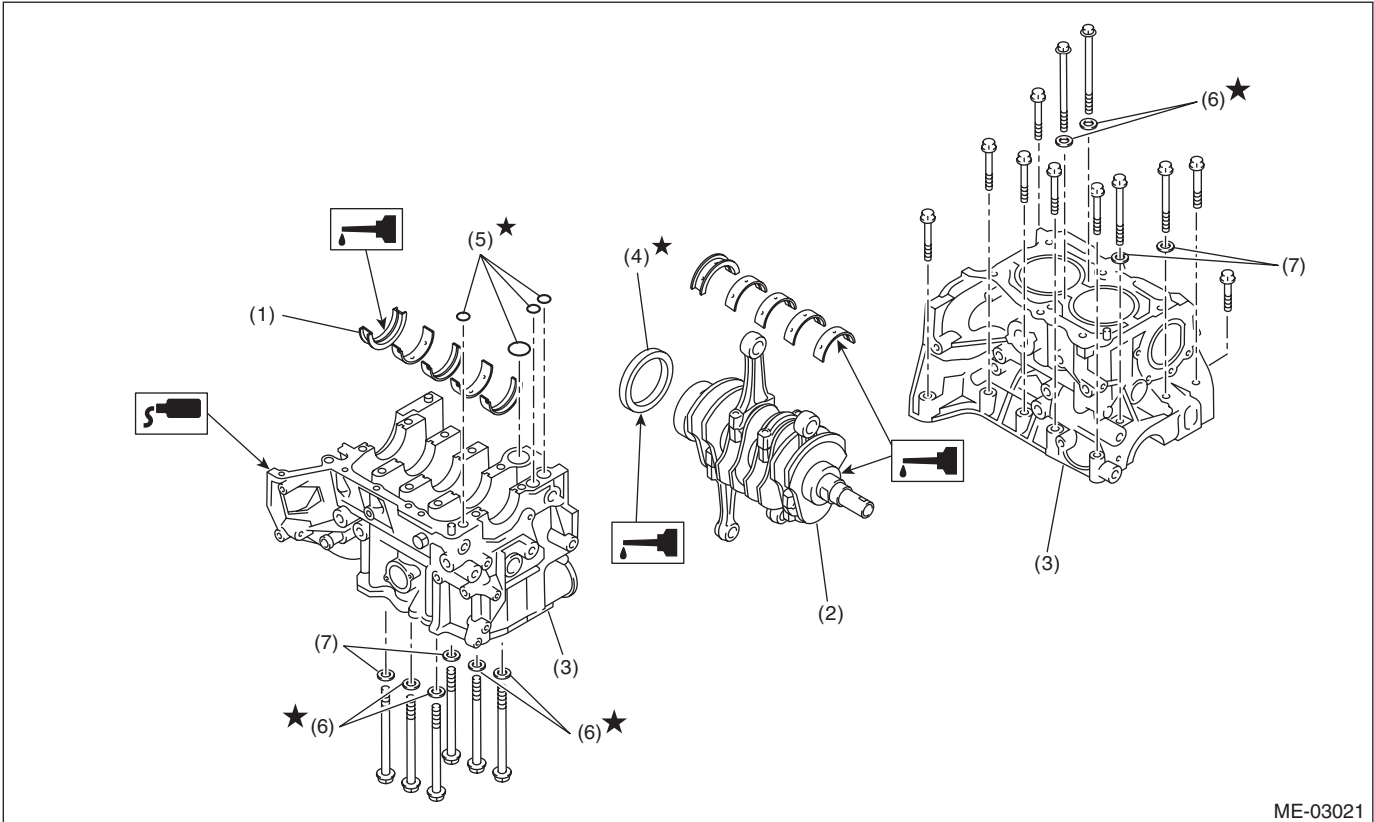
Do not confuse the combination of crankshaft bearings. Press the bearing at the end opposite to locking lip.

35) Remove 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

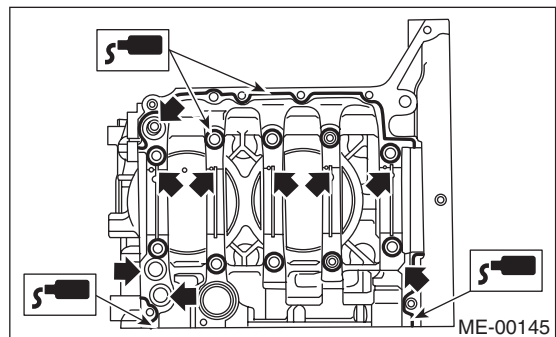
- |                        |                   |            |
|------------------------|-------------------|------------|
| (1) Crankshaft bearing | (4) Rear oil seal | (7) Washer |
| (2) Crankshaft         | (5) O-ring        |            |
| (3) Cylinder block     | (6) Seal washer   |            |

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, and position #2 and #4 cylinder blocks.

**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.



ME-00145

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

**NOTE:**  
 Use new seal washer.

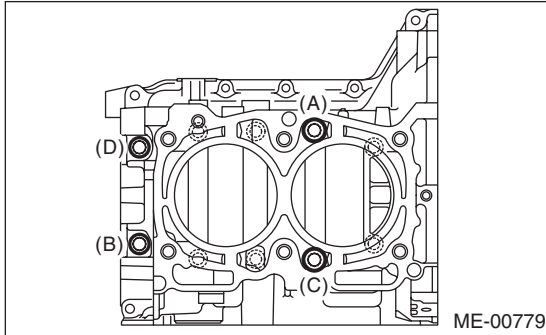
# Cylinder Block

## MECHANICAL

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

**Tightening torque:**

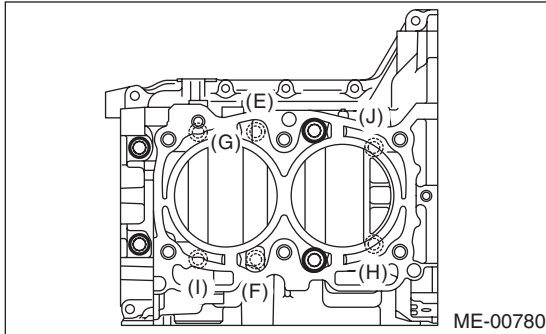
**10 N·m (1.0 kgf·m, 7.2 ft·lb)**



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

**Tightening torque:**

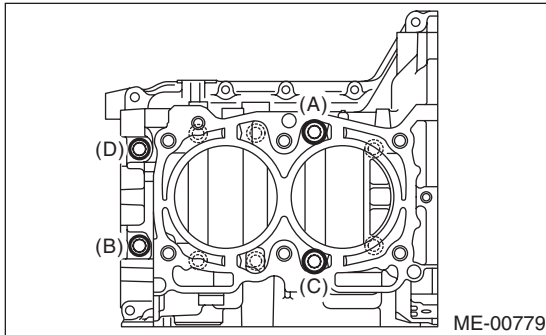
**10 N·m (1.0 kgf·m, 7.2 ft·lb)**



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

**Tightening torque:**

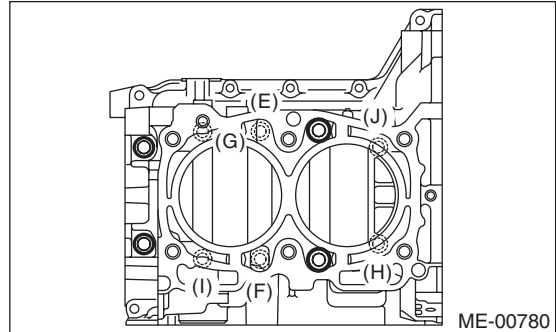
**18 N·m (1.8 kgf·m, 13.3 ft·lb)**



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, 13.3 ft·lb)**



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

- (A), (C): Angle tightening

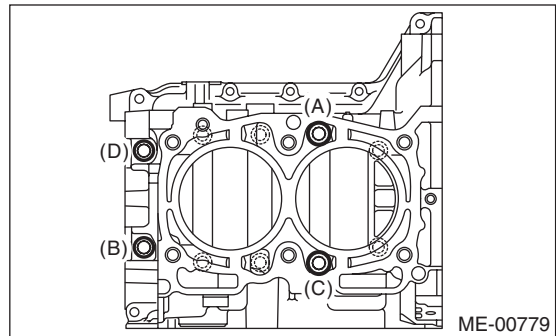
**Tightening angle:**

**90°**

- (B), (D): Torque tightening

**Tightening torque:**

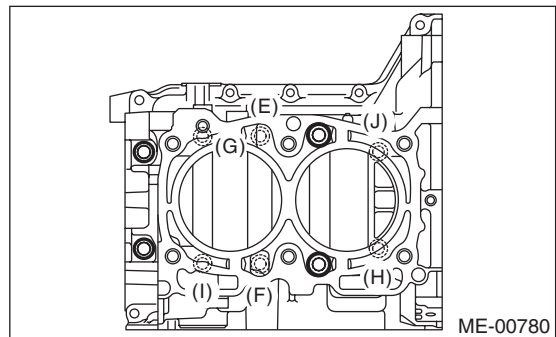
**40 N·m (4.1 kgf·m, 29.6 ft·lb)**



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

**Tightening angle:**

**90°**

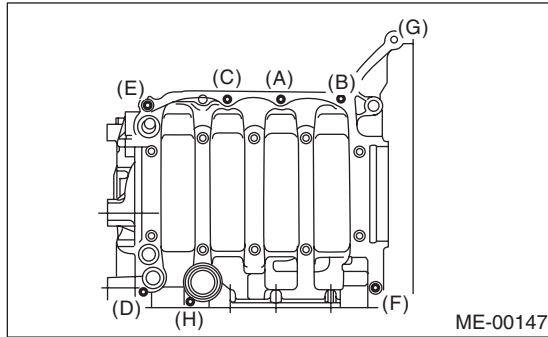


11) Tighten the 8 mm and 6 mm cylinder block connecting bolts on LH side (A — H) in alphabetical sequence.

**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)



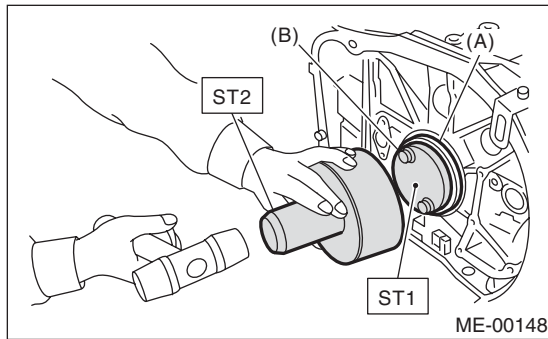
12) Apply a coat of engine oil to the oil seal periphery, then install the rear oil seal using ST1 and ST2.

**NOTE:**

Use a new rear oil seal.

ST1 499597100 CRANKSHAFT OIL SEAL GUIDE

ST2 499587200 CRANKSHAFT OIL SEAL INSTALLER

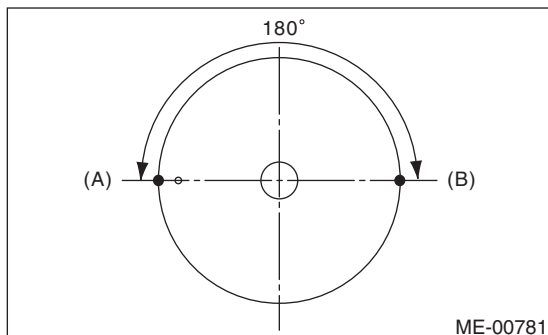


(A) Rear oil seal

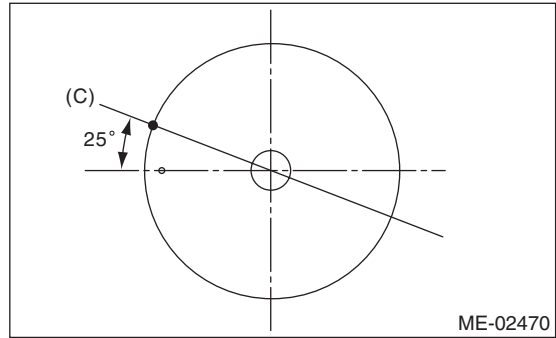
(B) Flywheel attaching bolt

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

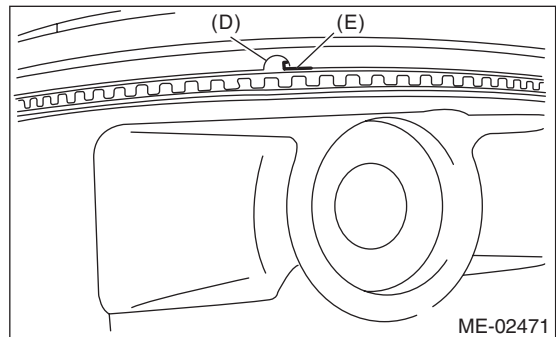
14) Position the second ring gap at 180° on the reverse side the top ring gap.



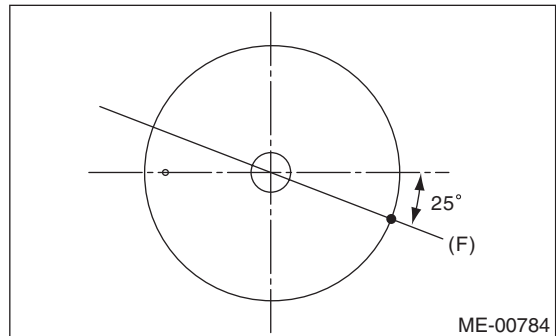
15) Position the upper rail gap at (C) in the figure.



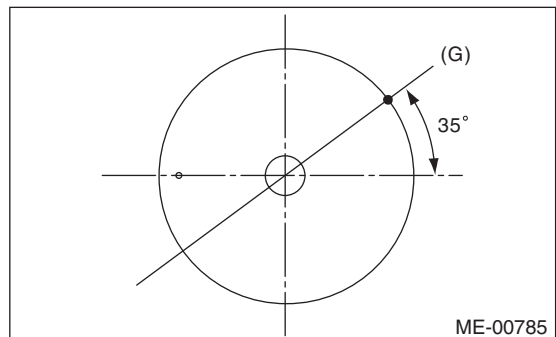
16) Align the upper rail spin stopper (E) to the side hole (D) on the piston.



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



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



**NOTE:**

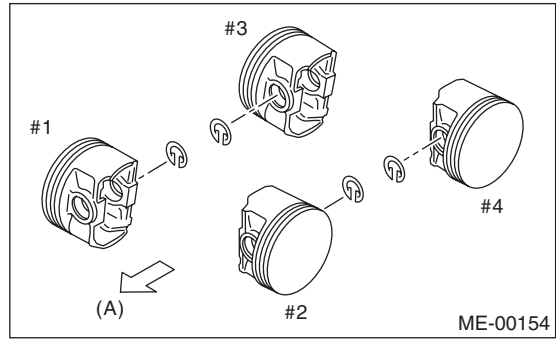
- Make sure the ring gaps do not face the same direction.
- Make sure ring gaps are not within the piston skirt area.

# Cylinder Block

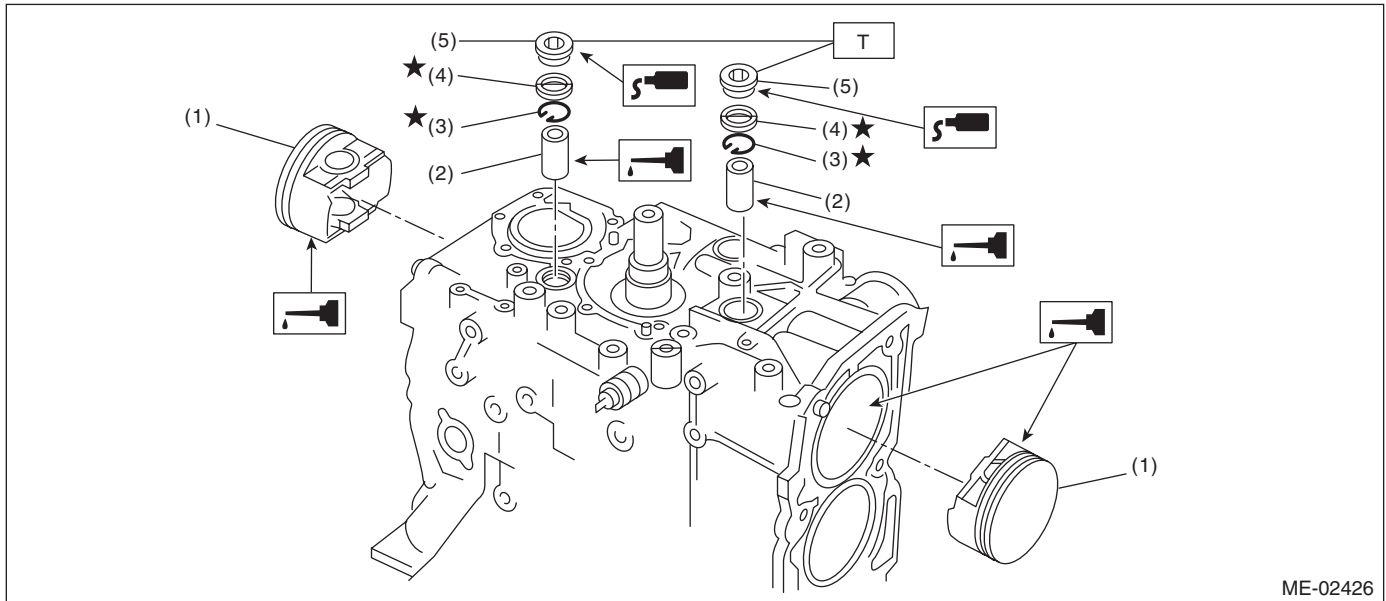
## MECHANICAL

19) Install the snap ring.  
Install the snap rings in the piston holes located opposite to the service holes in cylinder block before positioning pistons to the cylinder.

NOTE:  
Use new snap rings.



(A) Front side



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

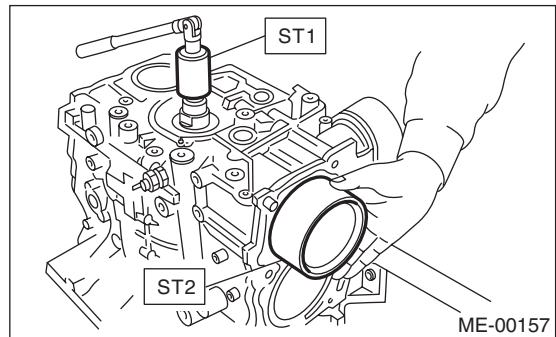
**Tightening torque: N·m (kgf·m, ft·lb)**  
**T: 70 (7.1, 51.4)**

20) Installing 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



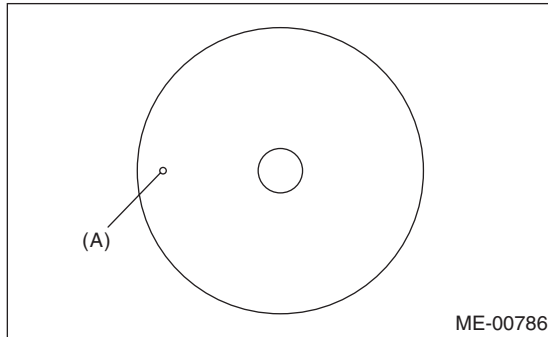


# Cylinder Block

MECHANICAL

**NOTE:**

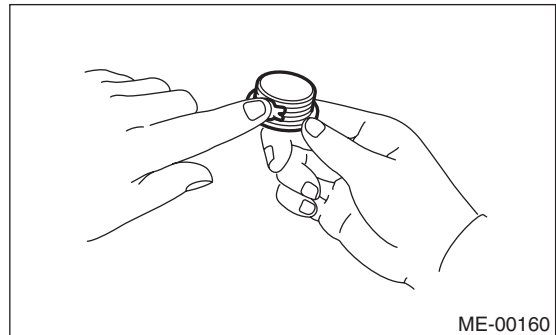
Face the piston front mark towards the front of the engine.



(A) Front mark

(5) Apply liquid gasket around the service hole plug.

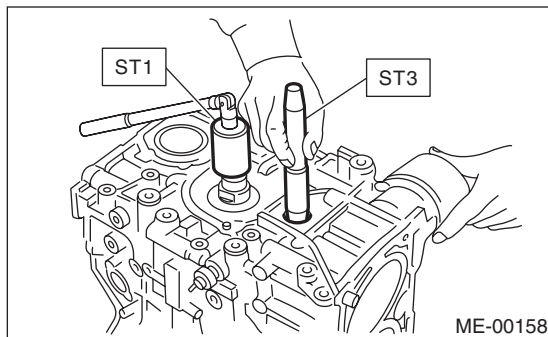
**Liquid gasket:**  
**THREE BOND 1105 (Part No. 004403010) or equivalent**



**21) Installing piston pin:**

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

ST3 499017100 PISTON PIN GUIDE

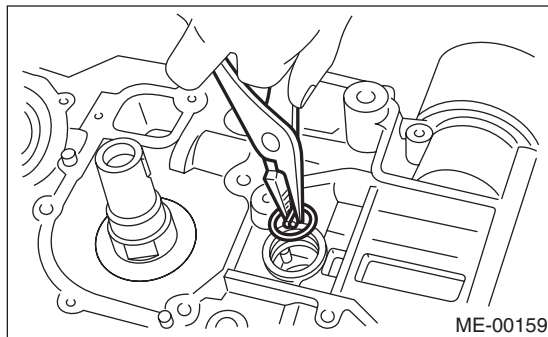


(3) Apply a coat of engine oil to piston pin, and insert the piston pin into piston and connecting rod through service hole.

(4) Using radio pincers, install the snap ring.

**NOTE:**

Use new snap rings.



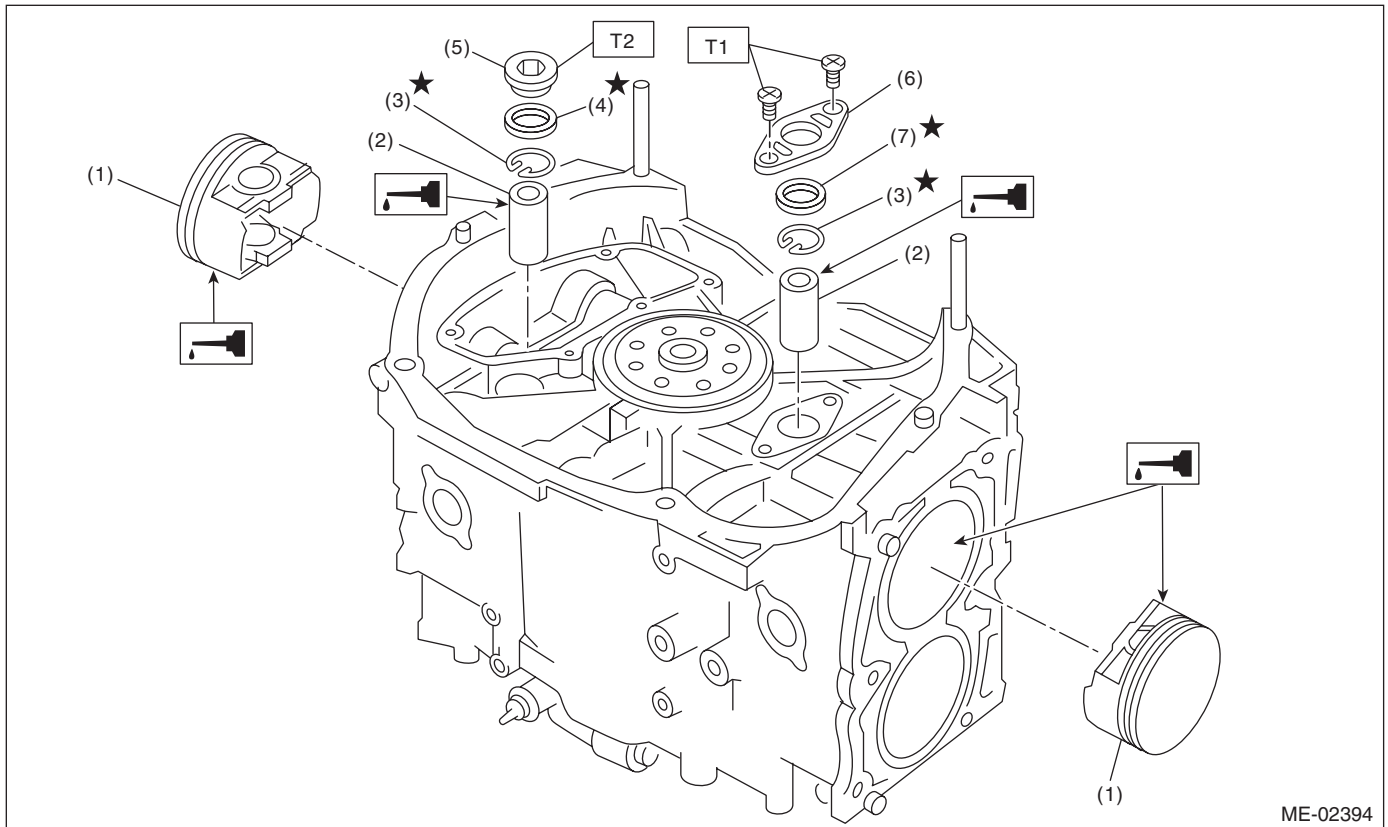
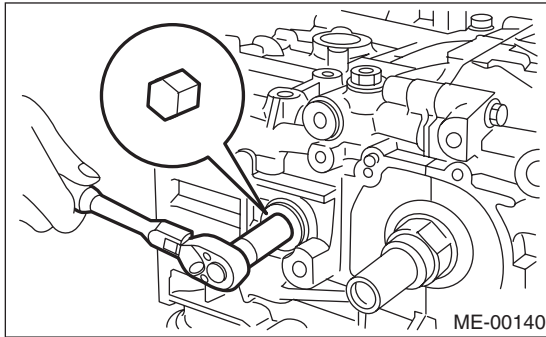
# Cylinder Block

## 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, 51.4)**

(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.

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 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)**

# Cylinder Block

MECHANICAL

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

NOTE:

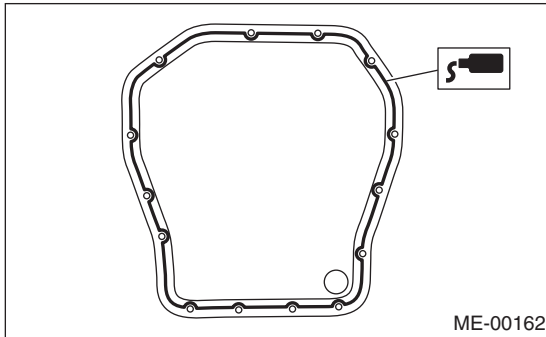
Install within 5 min. after applying liquid gasket.

**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**

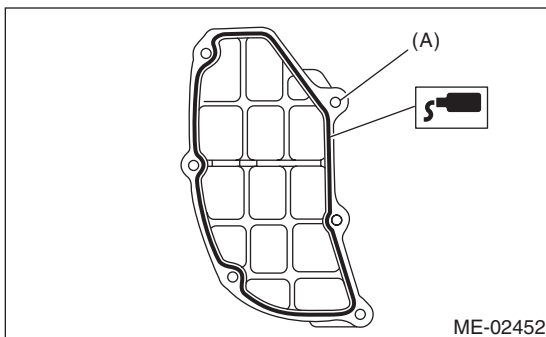
**THREE BOND 1217G or equivalent**

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

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

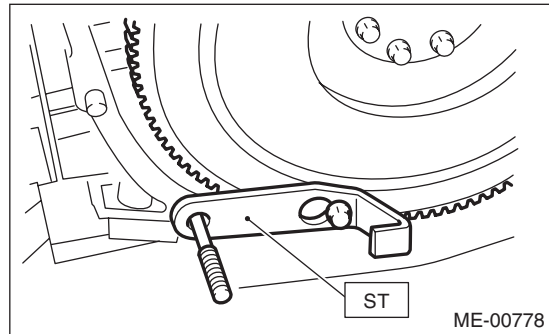
**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft-lb)**



28) Install the flywheel. (MT model) <Ref. to CL-14, INSTALLATION, Flywheel.>

ST 498497100 CRANKSHAFT STOPPER



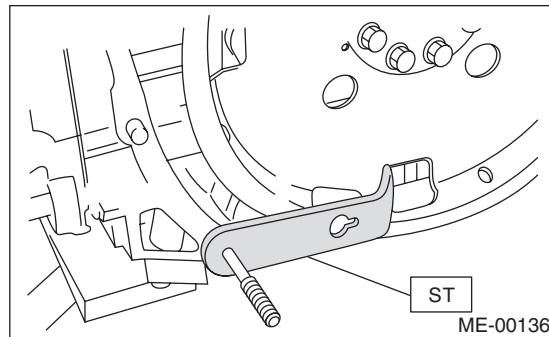
29) Install the drive plate. (AT model)

To lock the crankshaft, use ST.

ST 498497100 CRANKSHAFT STOPPER

**Tightening torque:**

**72 N·m (7.3 kgf·m, 53.1 ft-lb)**



30) Install the clutch disc and cover. <Ref. to CL-12, INSTALLATION, Clutch Disc and Cover.>

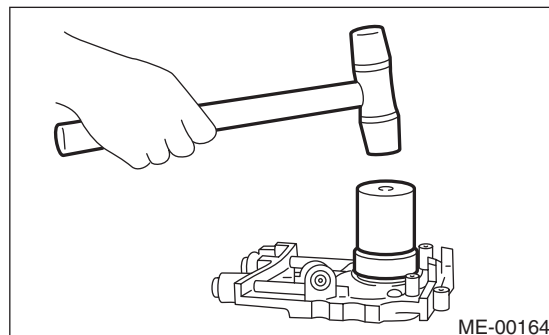
31) Installation of oil pump:

(1) Install a new oil seal using ST.

ST 499587100 OIL SEAL INSTALLER

NOTE:

Use a new front oil seal.

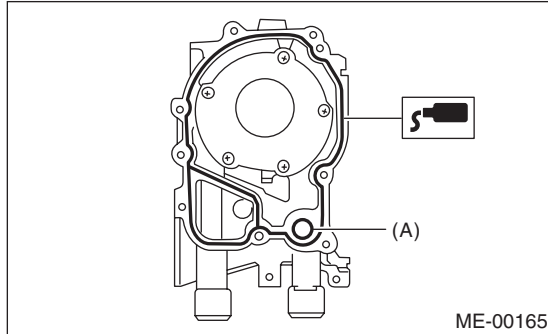


# Cylinder Block

## MECHANICAL

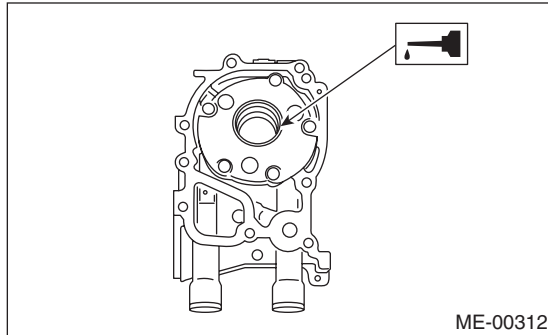
(2) Apply liquid gasket to the matching surface of oil pump.

**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.

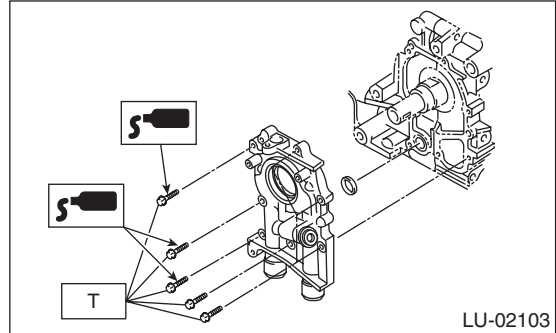
**NOTE:**

- 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) When reusing three bolts shown in the figure, apply liquid gasket to the bolt threads.

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

**Tightening torque:**  
**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**

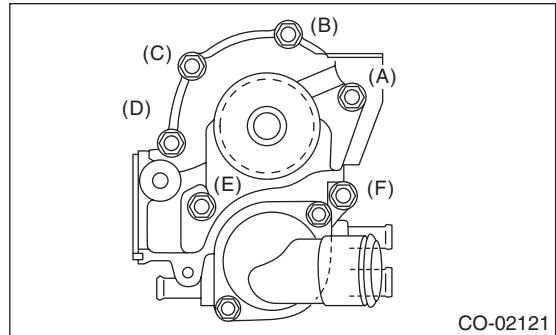


32) Install the service hole plug and gasket.

**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.

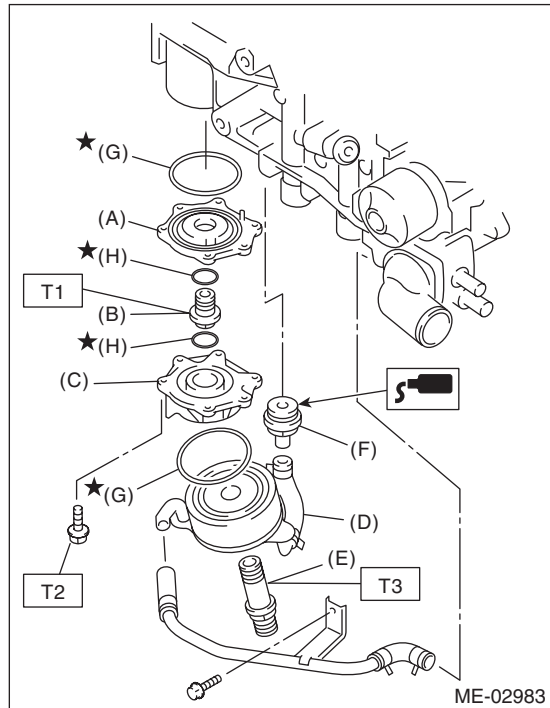
34) Install the oil cooler.

**Tightening torque:**

**T1: 45 N·m (4.6 kgf·m, 33 ft·lb)**

**T2: 6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

**T3: 54 N·m (5.3 kgf·m, 39 ft·lb)**



- (A) Adapter (1)
- (B) Adapter connector
- (C) Adapter (2)
- (D) Oil cooler
- (E) Oil cooler connector
- (F) Plug
- (G) Gasket
- (H) O-ring

35) Install the oil filter. <Ref. to LU (H4SO)-24, INSTALLATION, Engine Oil Filter.>

36) Install the water by-pass pipe between oil cooler and water pump.

37) Install the water pipe.

**NOTE:**

Use new O-rings.

38) Install the cylinder head.

<Ref. to ME(H4DOTC)-60, INSTALLATION, Cylinder Head.>

39) Install the oil level gauge guide and tighten the attaching bolt (left side).

40) Install the rocker cover and rocker cover gasket.

**NOTE:**

Use a new gasket.

41) Install the crank sprocket.

<Ref. to ME(H4DOTC)-53, INSTALLATION, Crank Sprocket.>

42) Install the cam sprocket.

<Ref. to ME(H4DOTC)-52, INSTALLATION, Cam Sprocket.>

43) Install the timing belt.

<Ref. to ME(H4DOTC)-46, INSTALLATION, Timing Belt.>

44) Install the timing belt cover.

<Ref. to ME(H4DOTC)-43, INSTALLATION, Timing Belt Cover.>

45) Install the crank pulley.

<Ref. to ME(H4DOTC)-42, INSTALLATION, Crank Pulley.>

46) Install the intake manifold.

<Ref. to FU(H4DOTC)-17, INSTALLATION, Intake Manifold.>

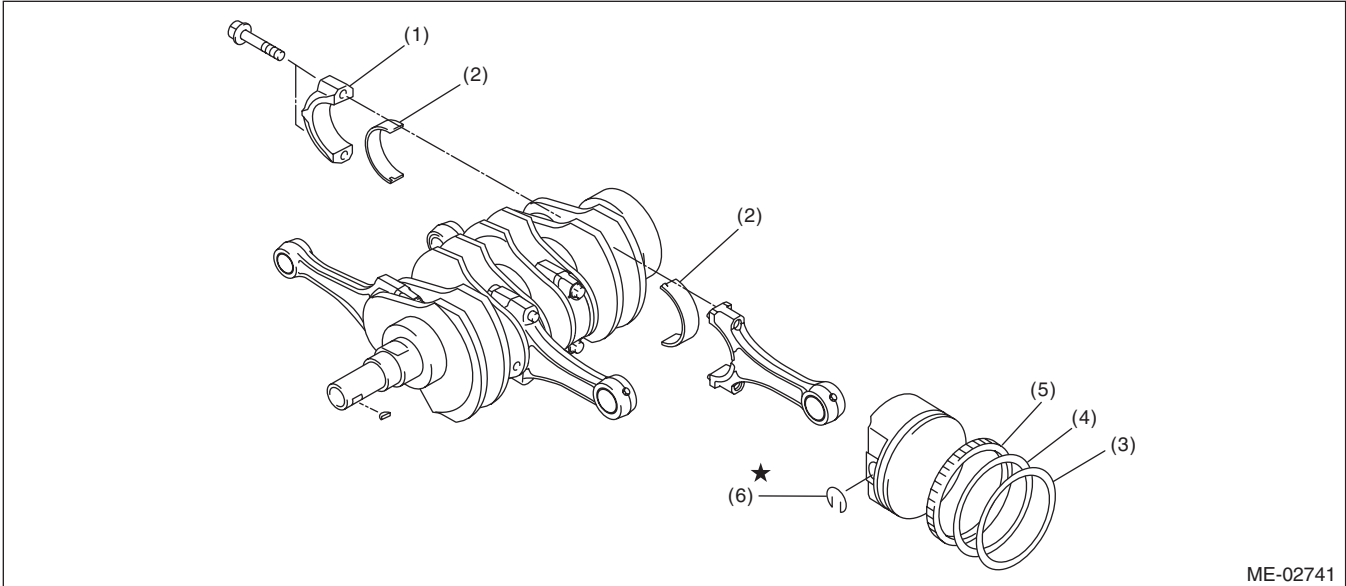
47) Install the generator and A/C compressor brackets on cylinder head.

48) Install the V-belts. <Ref. to ME(H4DOTC)-40, INSTALLATION, V-belt.>

# Cylinder Block

MECHANICAL

## C: DISASSEMBLY



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

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

**NOTE:**

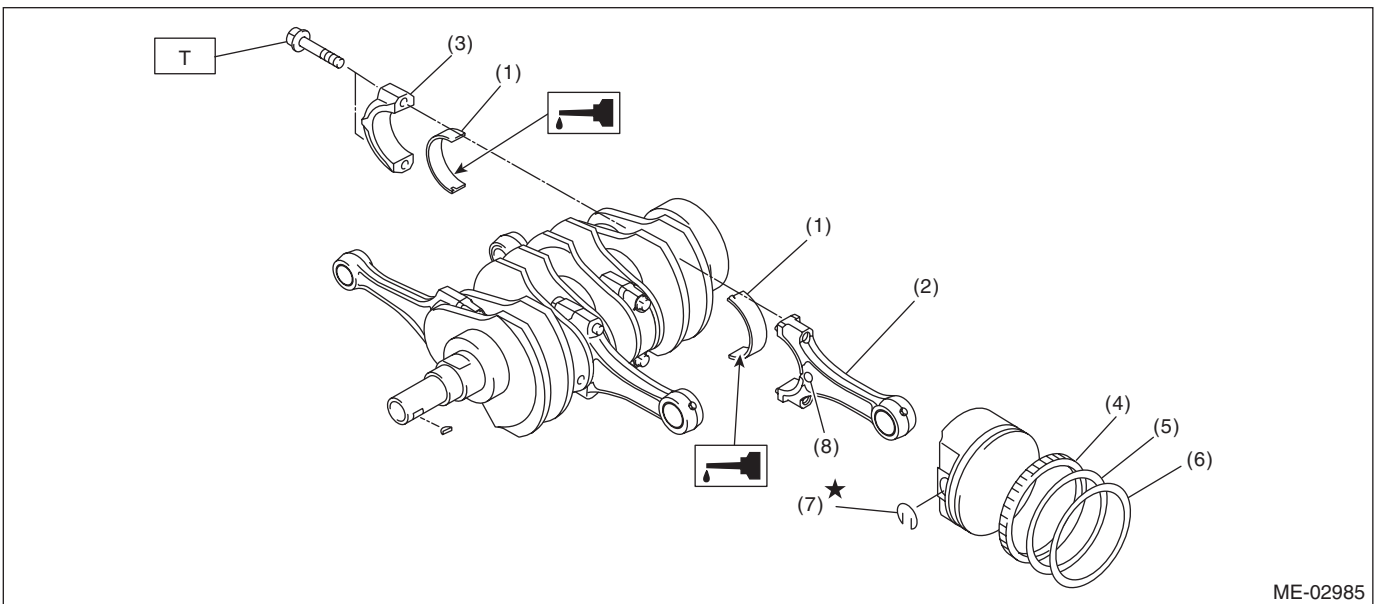
Arrange the removed connecting rod, connecting rod cap and bearing in order to prevent confusion.  
 3) Remove the piston rings using piston ring expander.

- 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: 52 (5.3, 38.4)**

- 1) Apply oil to the surface of the connecting rod bearings, and install the connecting rod bearings on connecting rods and connecting rod caps.
- 2) Install the connecting rod on crankshaft.
- 3) Position each connecting rod with the marking side facing forward.
- 4) Tighten the connecting rod cap with the connecting rod bolt. Make sure the arrow on connecting rod cap faces the front during installation.

***Tightening torque:***

***52 N·m (5.3 kgf·m, 38.4 ft·lb)***

**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 oil ring upper rail, expander and lower rail by hand.
  - 6) Install the second ring and top ring using piston ring expander.

## **E: INSPECTION**

### **1. CYLINDER BLOCK**

- 1) Visually check for cracks and damage. Use liquid penetrant tester on the important sections to check for fissures.
- 2) Check the oil passages for clogging.
- 3) Inspect the crankcase 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)***

# Cylinder Block

## MECHANICAL

### 2. CYLINDER AND PISTON

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

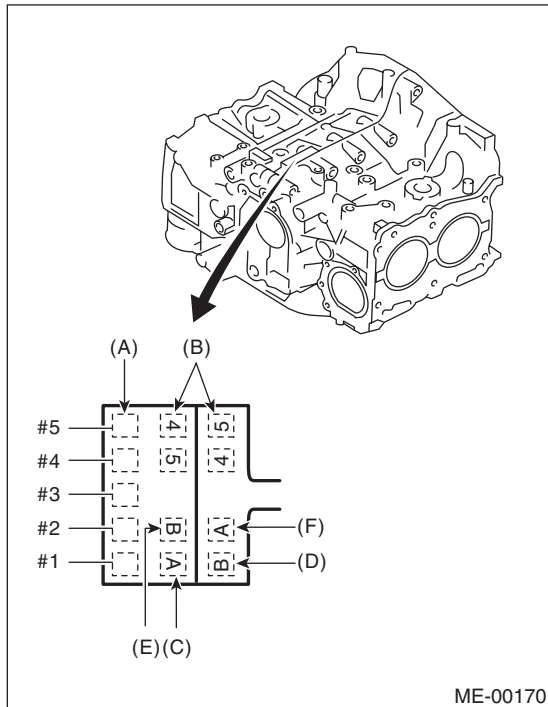
**NOTE:**

- 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)**

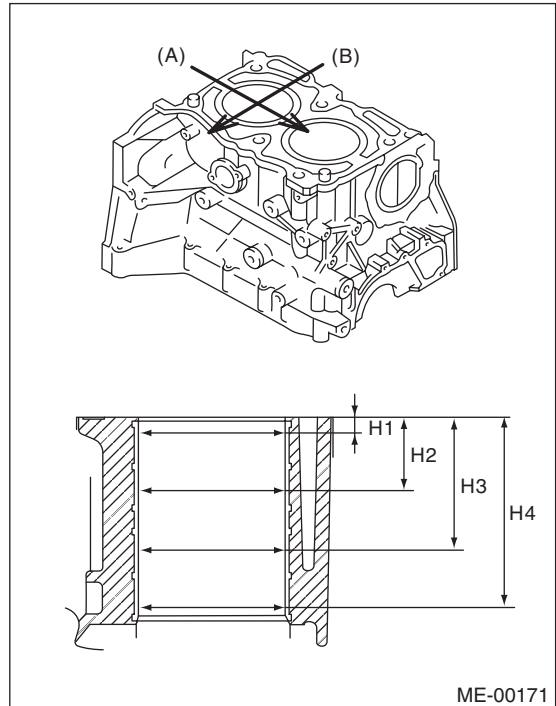
**Out-of-roundness:**

**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 or cylinder wear, determine a suitable sized piston by measuring the piston clearance.

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

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 (1.50 in)**

**Piston outer diameter:**

**Standard:**

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

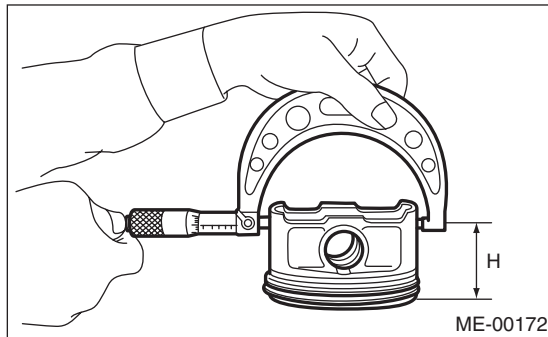
**B: 99.495 — 99.505 mm (3.9171 — 3.9175 in)**

**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 (-0.0004 — 0.0004 in)**

**Service limit:**

**0.030 mm (0.0012 in)**

6) Boring and honing:

(1) If the value of taper, out-of-roundness, or cylinder-to-piston clearance measured exceeds the specified limit or if there is any damage on the cylinder wall, rebore 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.

**NOTE:**

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

**Cylinder inner boring limit (diameter):**

**100.005 mm (3.9372 in)**

**3. PISTON AND PISTON PIN**

- 1) Check the piston and piston pin for breaks, cracks or wear. Replace if faulty.
- 2) Check the piston ring groove for wear and damage. Replace if faulty.
- 3) Measure the piston-to-cylinder clearance at each cylinder. <Ref. to ME(H4DOTC)-82, CYLINDER AND PISTON, INSPECTION, Cylinder Block.> If any of the clearances exceeds the limit, replace the piston or bore the cylinder to use an oversize piston.
- 4) Make sure that the piston pin can be inserted into the piston pin hole with a thumb at 20°C (68°F). Replace if faulty.

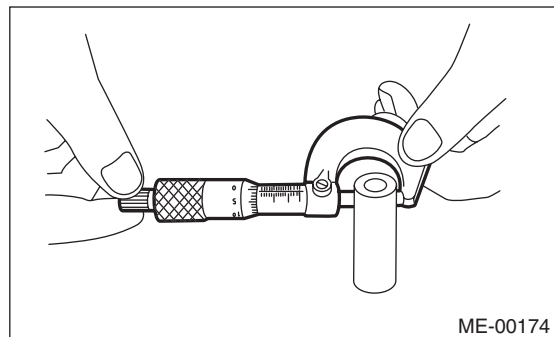
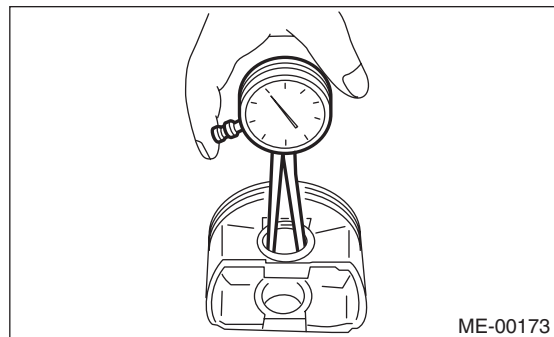
**Standard clearance between piston pin and hole in piston:**

**Standard:**

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

**Service limit:**

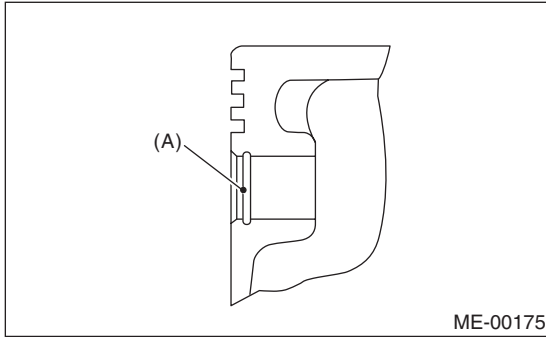
**0.020 mm (0.0008 in)**



# Cylinder Block

## MECHANICAL

5) 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.



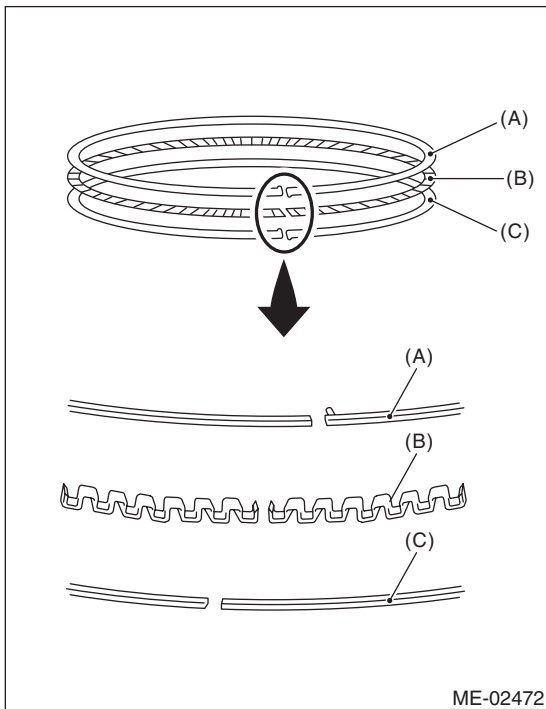
6) Check the piston pin snap ring for distortion, cracks and wear.

### 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:

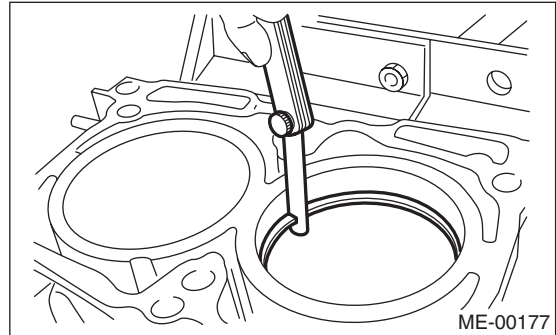
- Marks that shows the installing direction are shown on the end of top and second rings. Face these marks upward when installing the rings to piston.
- Oil ring consists of the upper rail, expander and lower rail. When installing the oil ring on piston, be careful of each rails direction.



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

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

		Unit: mm (in)	
		Standard	Limit
Piston ring gap	Top ring	0.20 — 0.25 (0.0079 — 0.0098)	1.0 (0.039)
	Second ring	0.37 — 0.52 (0.015 — 0.020)	1.0 (0.039)
	Oil ring rail	0.20 — 0.50 (0.0079 — 0.0197)	1.5 (0.059)

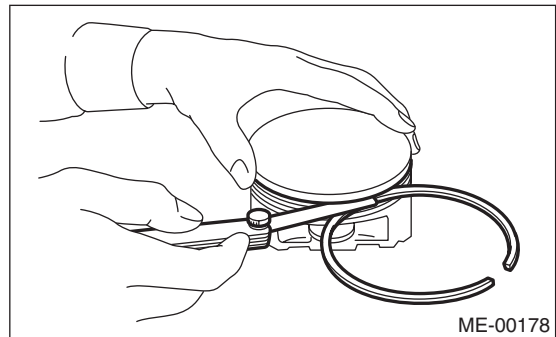


3) Fit the piston ring straight into the piston ring groove, then measure the clearance between piston ring and piston ring groove with a thickness gauge.

#### NOTE:

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

		Unit: mm (in)	
		Standard	Limit
Clearance between piston ring and piston ring groove	Top ring	0.040 — 0.080 (0.0016 — 0.0031)	0.15 (0.0059)
	Second ring	0.030 — 0.070 (0.0012 — 0.0028)	0.15 (0.0059)

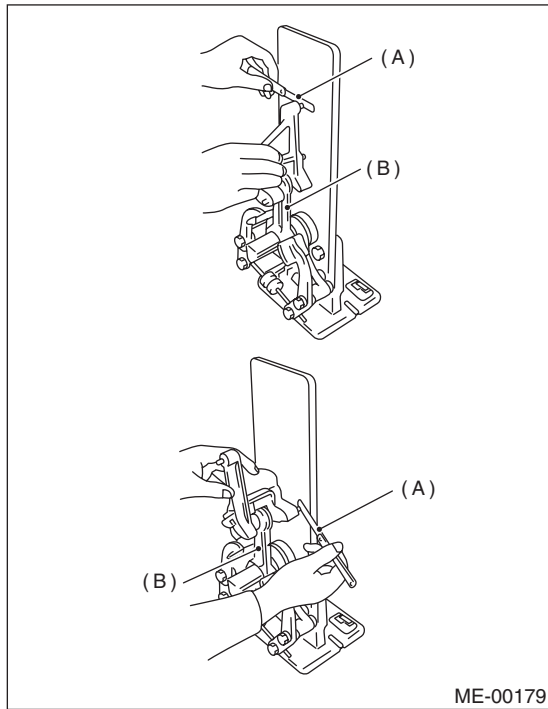


## 5. CONNECTING ROD

- 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 the crankshaft and measure the side clearance (thrust clearance) using a thickness gauge. Replace the connecting rod if the side clearance exceeds the specified limit.

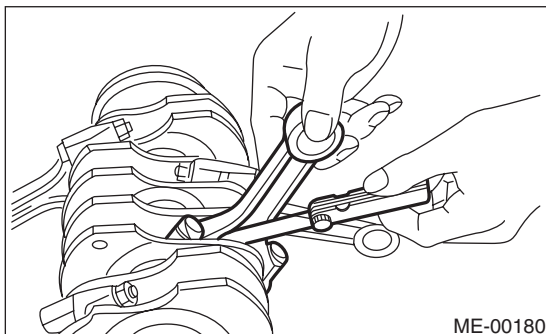
**Connecting rod side clearance:**

**Standard:**

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

**Service limit:**

**0.4 mm (0.016 in)**



- 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 any oil clearance is not within specification, replace the defective bearing with a new part of standard size or under-size as necessary. (See the table below.)

**Connecting rod oil clearance:**

**Standard:**

**0.017 — 0.045 mm (0.0007 — 0.0018 in)**

**Service limit:**

**0.05 mm (0.0020 in)**

Unit: mm (in)		
Bearing	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.490 — 1.502 (0.0587 — 0.0591)	51.984 — 52.000 (2.0466 — 2.0472)
0.03 (0.0012) undersize	1.504 — 1.512 (0.0592 — 0.0595)	51.954 — 51.970 (2.0454 — 2.0461)
0.05 (0.0020) undersize	1.514 — 1.522 (0.0596 — 0.0599)	51.934 — 51.950 (2.0447 — 2.0453)
0.25 (0.0098) undersize	1.614 — 1.622 (0.0635 — 0.0639)	51.734 — 51.750 (2.0368 — 2.0374)

# Cylinder Block

## MECHANICAL

- 6) Inspect the bushing at connecting rod small end, and replace with a new part if worn or damaged.
- 7) Measure the piston pin clearance at connecting rod small end. Replace it with a new part if the limit has been exceeded.

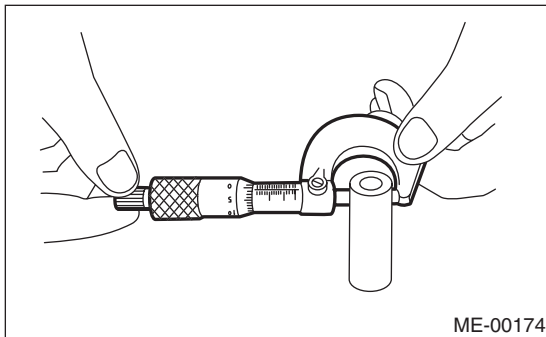
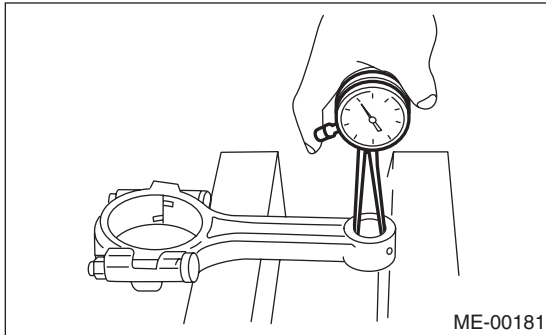
### **Clearance between piston pin and bushing:**

#### **Standard:**

**0 — 0.022 mm (0 — 0.0009 in)**

#### **Service limit:**

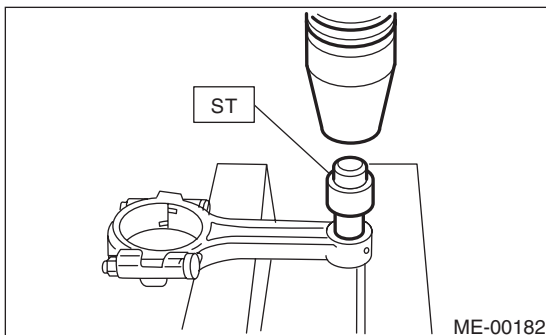
**0.030 mm (0.0012 in)**



- 8) The replacement procedure for the connecting rod small end bushing 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 according to the pre-manufactured holes on the connecting rod to ream the inside of bushing.

- (4) After completion of reaming, clean the bushing to remove chips.

## **6. CRANKSHAFT AND CRANKSHAFT BEARING**

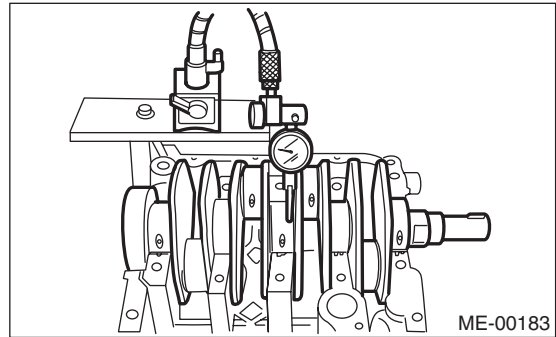
- 1) Clean the crankshaft completely, and check for cracks by means of red lead check etc. If faulty, replace with new a new crankshaft.
- 2) Measure the bend of crankshaft. If it exceeds the limit, correct or replace it.

### **NOTE:**

If a suitable V-block is not available, use only a #1 and #5 crankshaft bearings on cylinder block, and position the crankshaft on cylinder block. Then, measure the crankshaft bend using a dial gauge.

### **Crankshaft bend limit:**

**0.035 mm (0.0014 in)**



# Cylinder Block

MECHANICAL

3) Inspect the crank journal and crank pin for wear. If they are not within the specification, replace the bearing with a suitable (undersize) one, and replace or grind to correct the crankshaft as 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:**

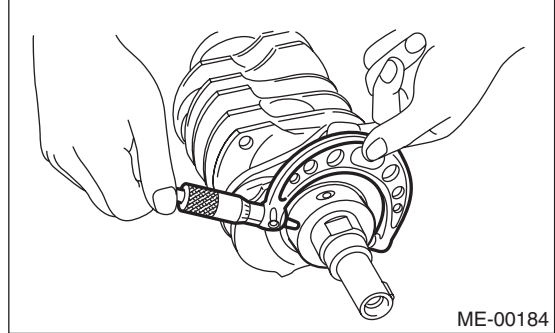
**0.005 mm (0.0002 in)**

**Cylindricity:**

**0.006 mm (0.0002 in)**

**Grinding limit:**

**To 59.758 mm (2.3527 in) dia.**



		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)	1.490 — 1.502 (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)	1.504 — 1.512 (0.0592 — 0.0595)
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 (2.0447 — 2.0453)
	Bearing size (Thickness at center)	2.027 — 2.030 (0.0798 — 0.0799)	2.029 — 2.032 (0.0799 — 0.0800)	1.514 — 1.522 (0.0596 — 0.0599)
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)	1.614 — 1.622 (0.0635 — 0.0639)

# Cylinder Block

## MECHANICAL

---

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

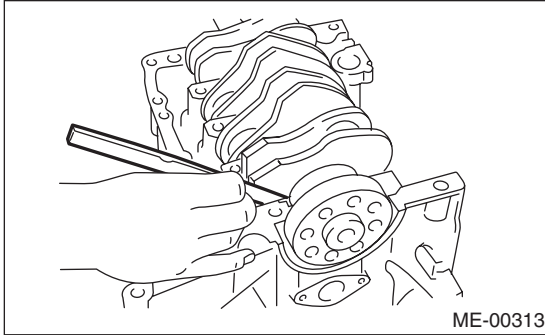
### **Crankshaft thrust clearance:**

#### **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)**