

## 21. Cylinder Block

### A: REMOVAL

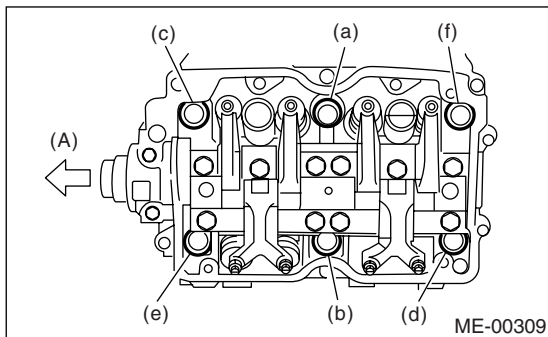
**NOTE:**

Before conducting this procedure, drain the engine oil completely if applicable.

- 1) Remove the intake manifold. <Ref. to FU(H4SO)-14, REMOVAL, Intake Manifold.>
- 2) Remove the V-belt. <Ref. to ME(H4SO)-42, REMOVAL, V-belt.>
- 3) Remove the crank pulley. <Ref. to ME(H4SO)-44, REMOVAL, Crank Pulley.>
- 4) Remove the timing belt cover. <Ref. to ME(H4SO)-45, REMOVAL, Timing Belt Cover.>
- 5) Remove the timing belt assembly. <Ref. to ME(H4SO)-46, REMOVAL, Timing Belt Assembly.>
- 6) Remove the cam sprocket. <Ref. to ME(H4SO)-51, REMOVAL, Cam Sprocket.>
- 7) Remove the crank sprocket. <Ref. to ME(H4SO)-44, REMOVAL, Crank Pulley.>
- 8) Remove the generator and A/C compressor with their brackets.
- 9) Disconnect the PCV hose and remove the rocker cover. <Ref. to ME(H4SO)-54, REMOVAL, Valve Rocker Assembly.>
- 10) Remove the cylinder head bolts in alphabetical sequence shown in the figure.

**NOTE:**

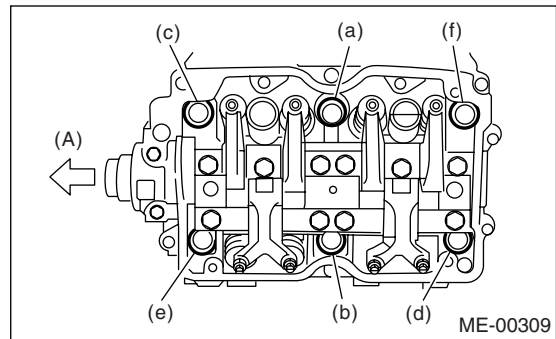
Leave bolts (c) and (f) engaged by three or four threads to prevent cylinder head from falling.



(A) Front

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

- 12) Remove the bolts (c) and (f) to remove cylinder head.



(A) Front

- 13) Remove the cylinder head gasket.

**NOTE:**

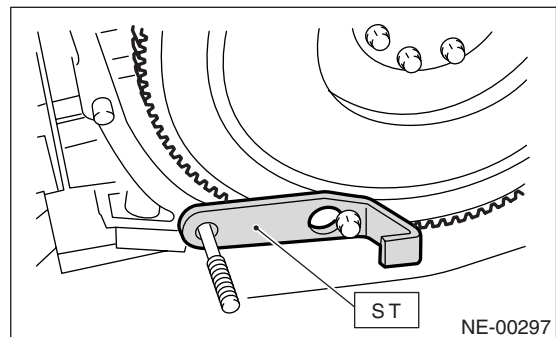
Do not scratch the mating surface of cylinder head and cylinder block.

- 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).

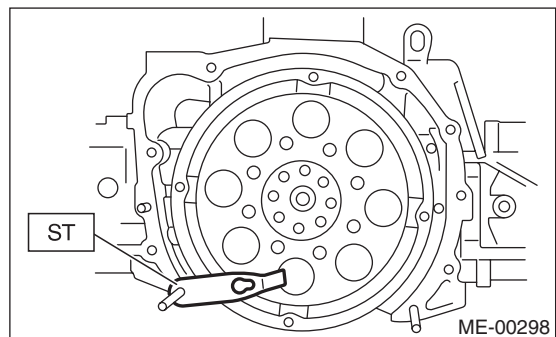
Using the ST, lock the crankshaft.

ST 498497100 CRANKSHAFT STOPPER

- MT model



- AT model

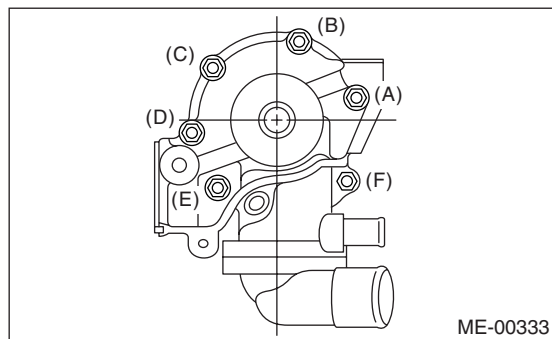


- 17) Remove the oil separator cover.
- 18) Remove the water by-pass pipe for heater.

# CYLINDER BLOCK

## MECHANICAL

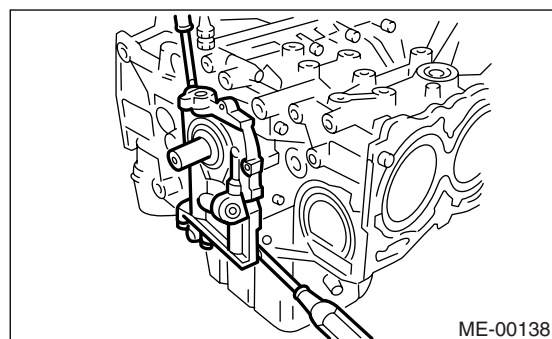
19) Loosen the bolts in alphabetical sequence as shown in the figure, and then remove water pump.



20) Remove the oil pump from cylinder block. Use a flat-bladed screwdriver as shown in the figure when removing oil pump.

### CAUTION:

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

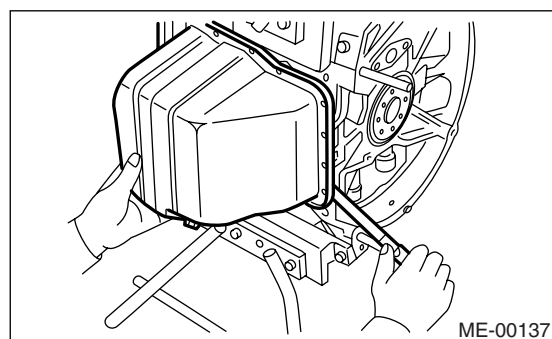


21) Removal of oil pan

- (1) Turn the cylinder block to face the #2 and #4 piston sides upward.
- (2) Remove the bolts which secure oil pan to cylinder block.
- (3) Insert a oil pan cutter blade between cylinder block-to-oil pan clearance, and then remove the oil pan.

### CAUTION:

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



22) Remove the oil strainer stay.

23) Remove the oil strainer.

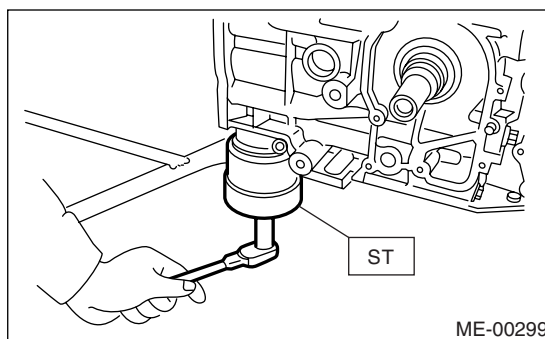
24) Remove the baffle plate.

25) Remove the oil filter using ST.

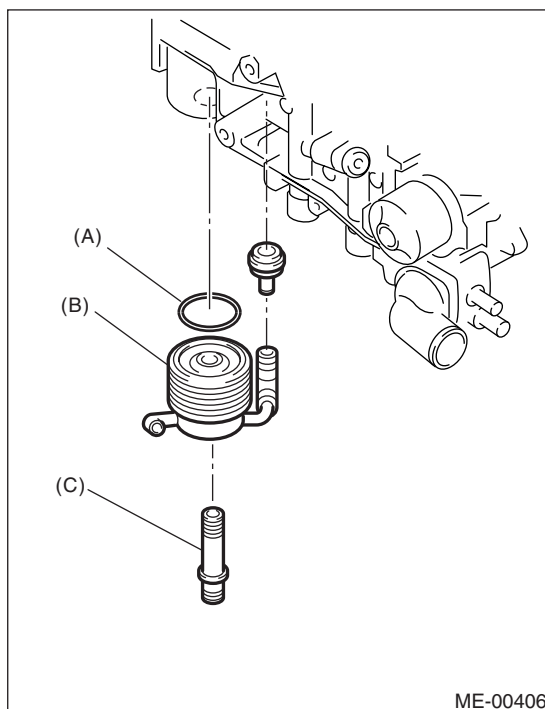
ST 498547000 OIL FILTER WRENCH  
(Outer diameter : 80 mm (3.15 in))

ST 18332AA000 OIL FILTER WRENCH  
(Outer diameter : 68 mm (2.68 in))

ST 18332AA010 OIL FILTER WRENCH  
(Outer diameter : 65 mm (2.56 in))



26) Remove the oil cooler. (AT model)



(A) O-ring

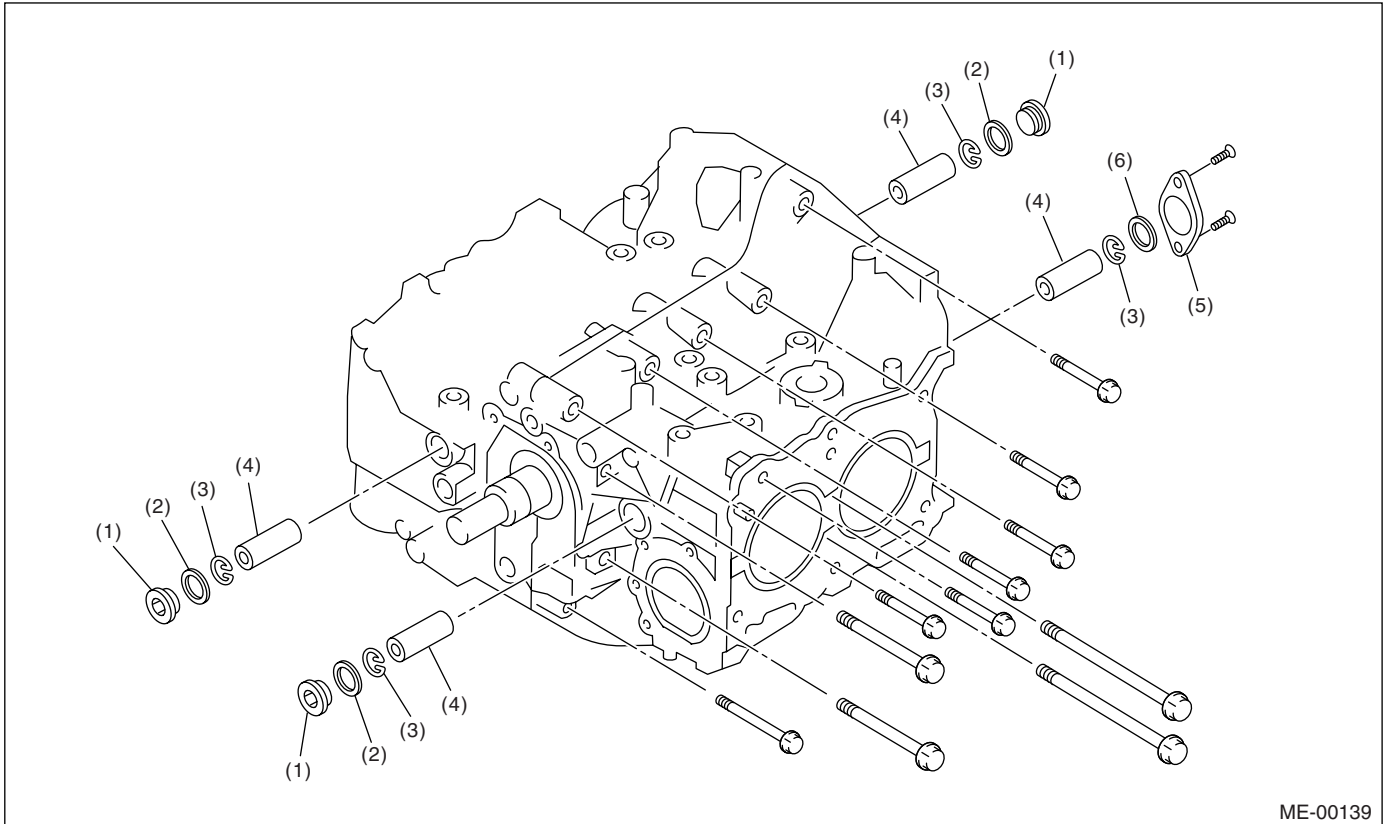
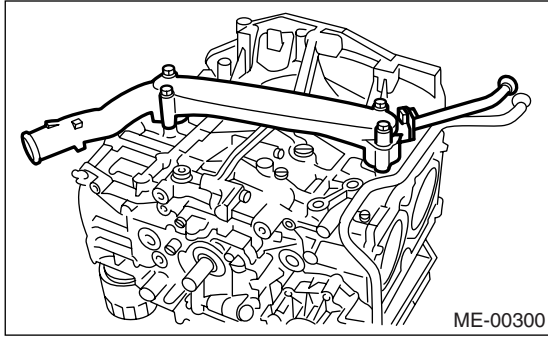
(B) Oil cooler

(C) Connector

# CYLINDER BLOCK

MECHANICAL

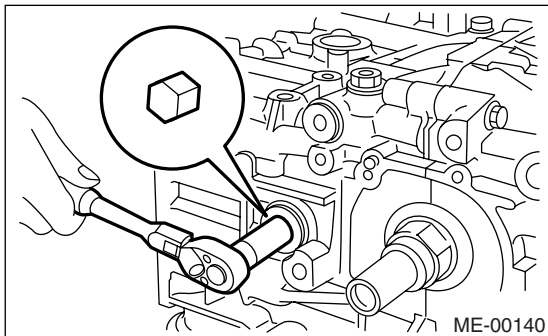
27) Remove the water pipe.



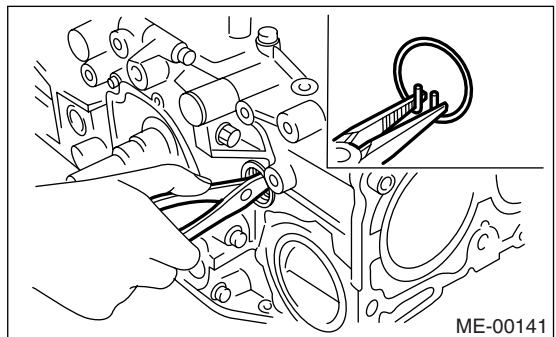
ME-00139

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

28) Remove the service hole cover and service hole plugs using hexagon wrench [14 mm (0.55 in)].



29) Rotate the crankshaft to bring #1 and #2 pistons to bottom dead center position, and then remove the piston circlip through service hole of #1 and #2 cylinders using needle nose plier.



# CYLINDER BLOCK

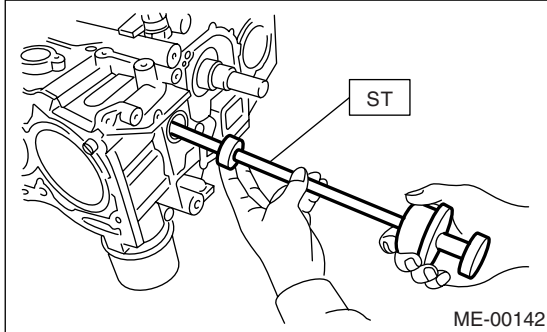
## MECHANICAL

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

ST 499097700 PISTON PIN REMOVER

### CAUTION:

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 #2 and #4 cylinders.

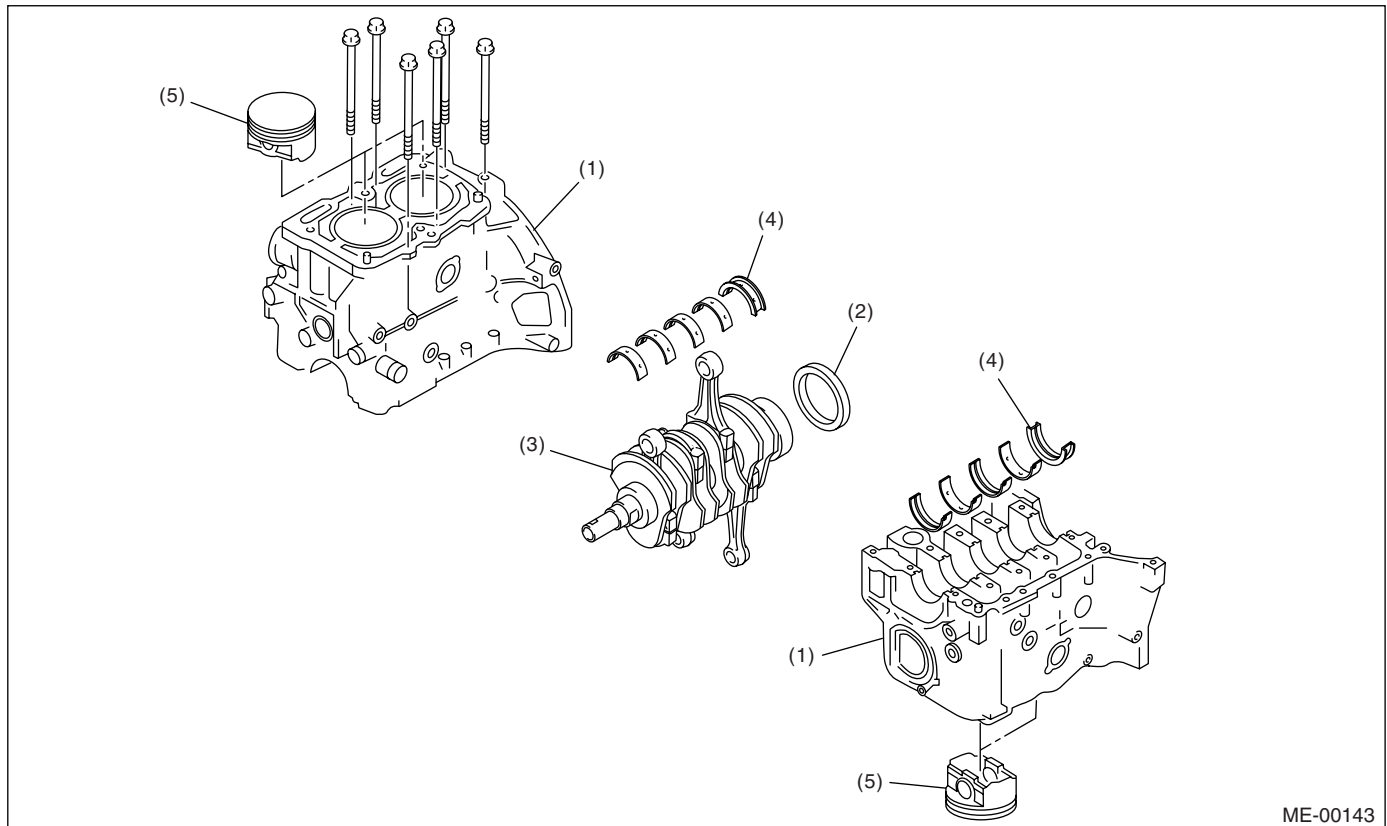
33) Back off the bolts which connect cylinder block on the side of #1 and #3 cylinders two or three turns.

34) Set up the cylinder block so that #1 and #3 cylinders are on the upper side, and then remove the cylinder block connecting bolts.

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

### NOTE:

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



(1) Cylinder block

(3) Crankshaft

(5) Piston

(2) Rear oil seal

(4) Crankshaft bearing

36) Remove the rear oil seal.

37) Remove the crankshaft together with connecting rod.

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

### CAUTION:

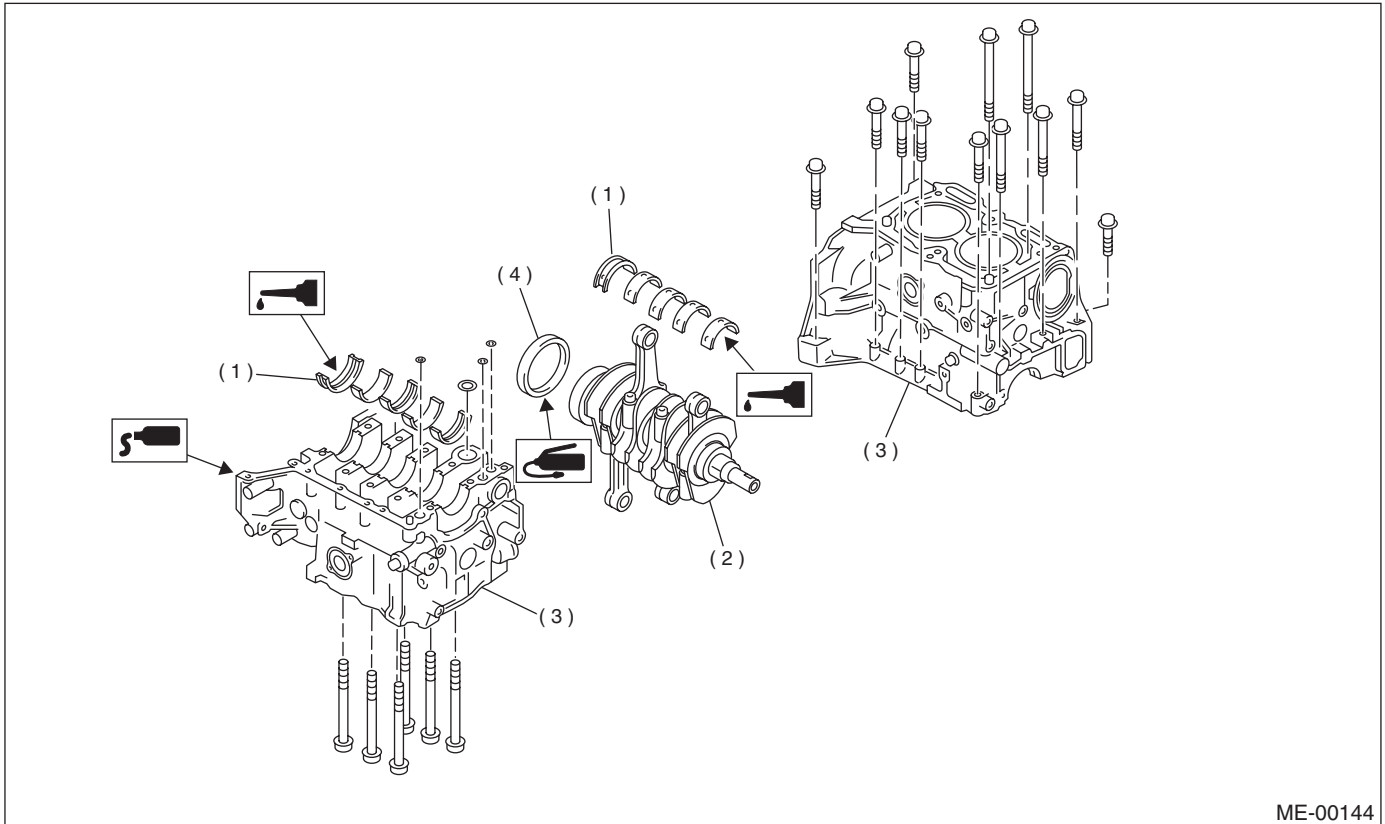
Do not confuse the combination of crankshaft bearings. Press bearing at the end opposite to locking lip.

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

### CAUTION:

Do not confuse the combination of piston and cylinder.

## B: INSTALLATION



ME-00144

(1) Crankshaft bearing  
(2) Crankshaft

(3) Cylinder block

(4) Rear oil seal

### CAUTION:

- Remove oil in the mating surface of bearing and cylinder block before installation.
- Apply a coat of engine oil to crankshaft pins.

1) Install the crankshaft bearings to cylinder block, and then apply engine oil to crankshaft bearings thinly. Position the crankshaft on #2 and #4 cylinder block.

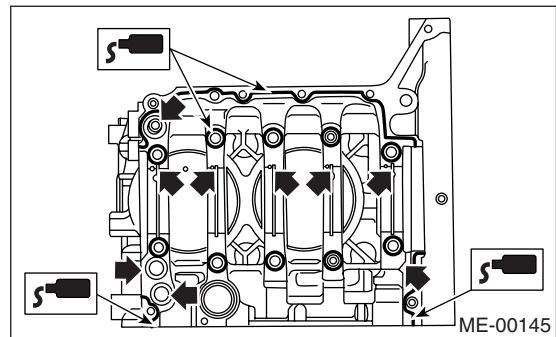
2) Apply liquid gasket to the mating surface of #1 and #3 cylinder block, and position it on #2 and #4 cylinder block.

### Liquid gasket:

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

### CAUTION:

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



ME-00145

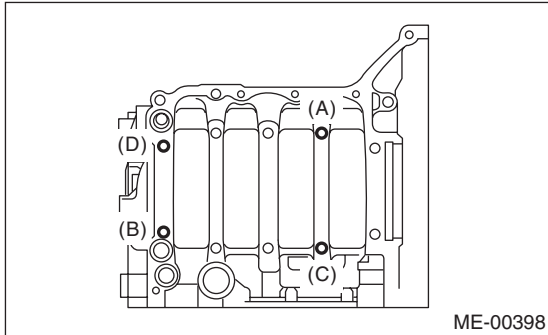
# CYLINDER BLOCK

## MECHANICAL

3) Tighten the 10 mm cylinder block connecting bolts in alphabetical sequence shown in the figure. (LH side)

**Tightening torque:**

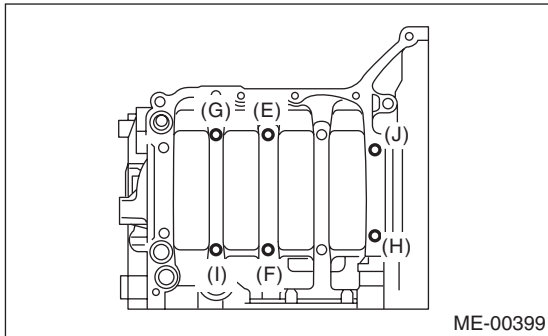
**15 N·m (1.5 kgf·m, 10.8 ft·lb)**



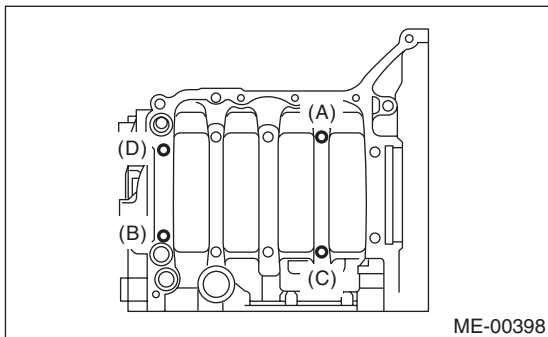
4) Tighten the 10 mm cylinder block connecting bolts in alphabetical sequence shown in the figure. (RH side)

**Tightening torque:**

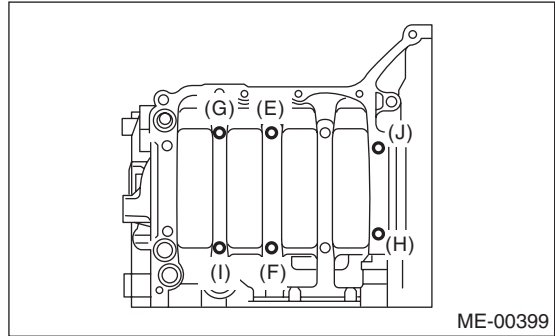
**15 N·m (1.5 kgf·m, 10.8 ft·lb)**



5) Further tighten LH side bolts (A) — (D) by 90° in alphabetical sequence.



6) Further tighten RH side bolts (E) — (J) by 90° in alphabetical sequence.

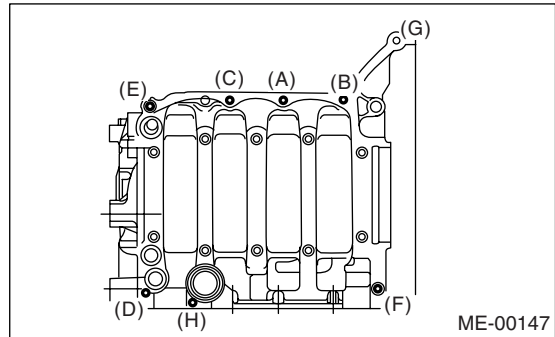


7) Tighten the 8 mm and 6 mm cylinder block connecting bolts in alphabetical sequence shown in the figure.

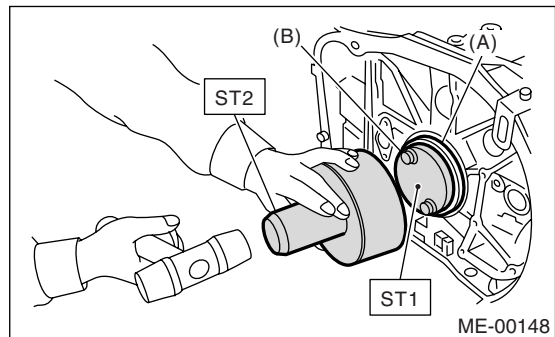
**Tightening torque:**

**(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)**



8) Install the rear oil seal using ST1 and ST2.  
 ST1 499597100 OIL SEAL GUIDE  
 ST2 499587200 OIL SEAL INSTALLER



(A) Rear oil seal

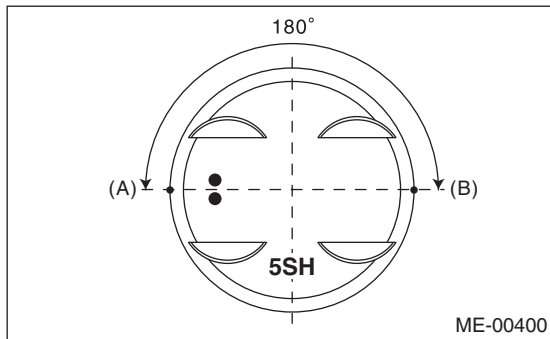
(B) Fly wheel attaching bolt

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

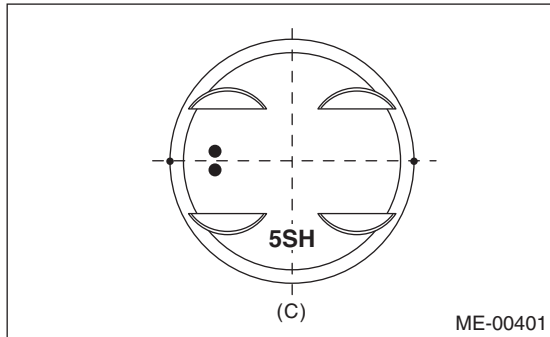
# CYLINDER BLOCK

MECHANICAL

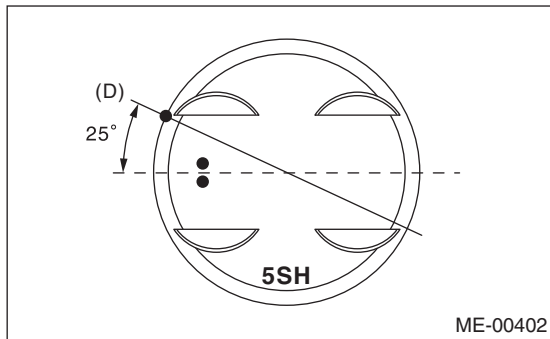
10) Position the second ring gap at 180° on the reverse side for top ring gap.



11) Position the expander gap at (C) in the figure.

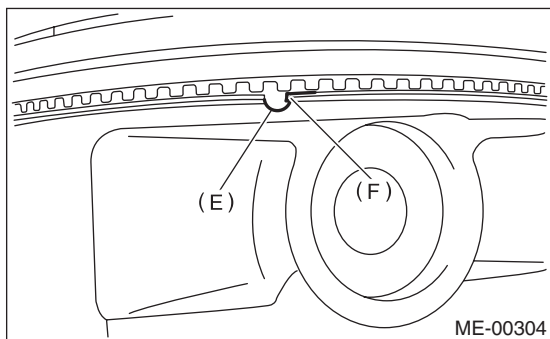


12) Position the lower rail gap at (D) in the figure.

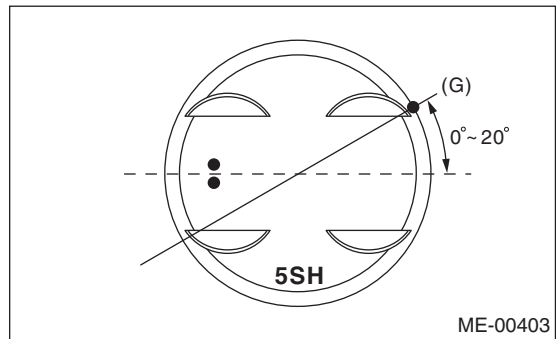


NOTE:

Align the lower rail stopper (F) to the lateral hole (E) on the piston.



13) Position the upper rail gap within (G) in the figure.



**CAUTION:**

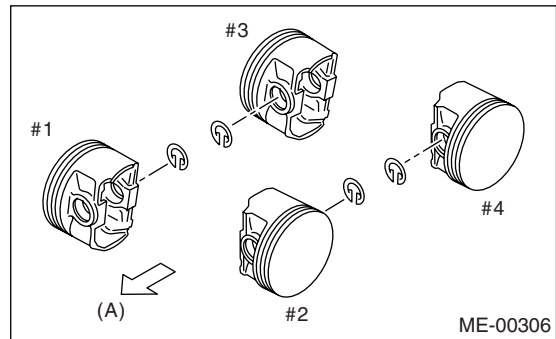
- Ensure ring gaps do not face the same direction.
- Ensure ring gaps are not within the piston skirt area.

14) Install circlip.

Install circlips in the piston holes located opposite service holes in cylinder block, when positioning all pistons in the corresponding cylinders.

NOTE:

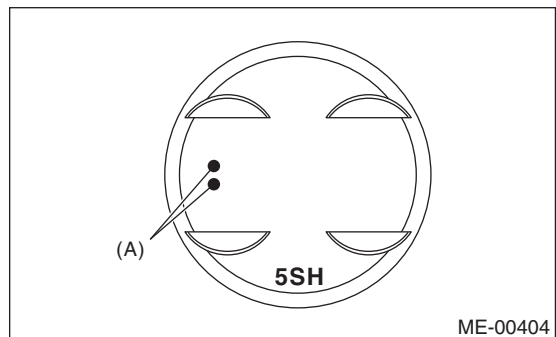
Use new circlips.



(A) Front side

**CAUTION:**

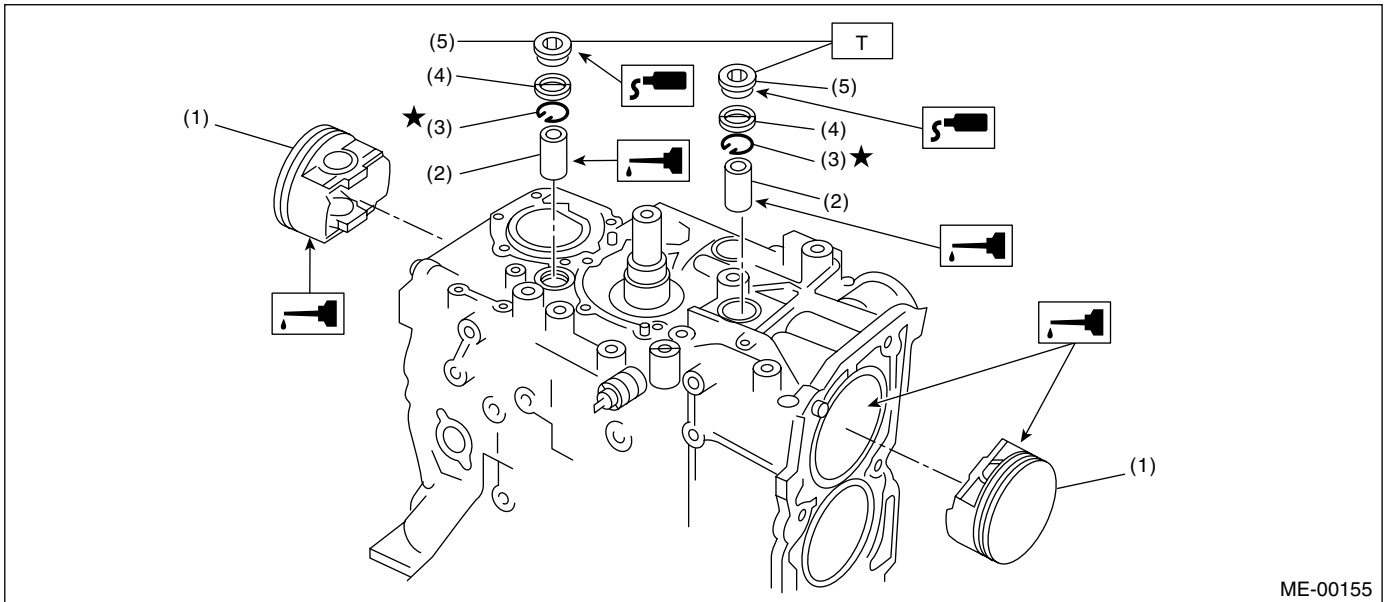
Piston front mark faces towards the front of the engine.



(A) Front mark

# CYLINDER BLOCK

MECHANICAL



ME-00155

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

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

**T: 70 (7.1, 51.6)**

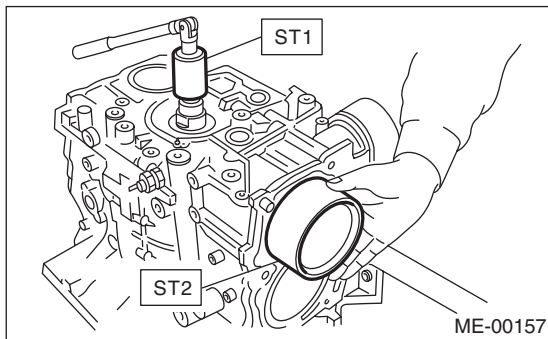
## 15) Installing piston

- (1) Turn the cylinder block to face the #1 and #2 piston 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 pistons and cylinders, and then insert the pistons in their cylinders using ST2.

ST2 498747300 PISTON GUIDE

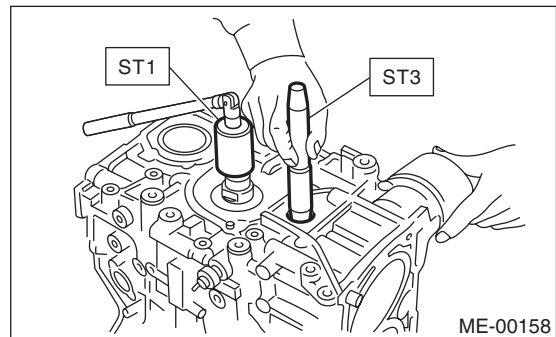


ME-00157

## 16) Installing piston pin

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

ST3 499017100 PISTON PIN GUIDE

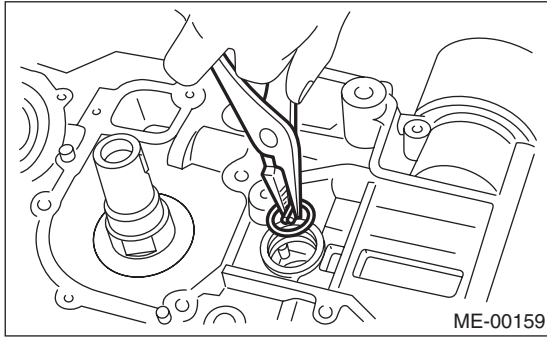


ME-00158

- (3) Apply a coat of engine oil to the piston pin, and then insert the piston pin into piston and connecting rod through service hole.
- (4) Install the circlip using needle nose plier.

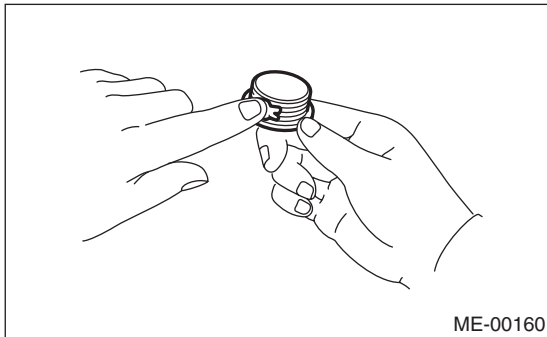


NOTE:  
Use new circlips.



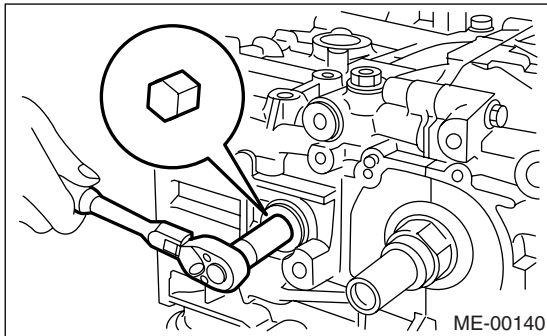
(5) Apply liquid gasket around the service hole plug.

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



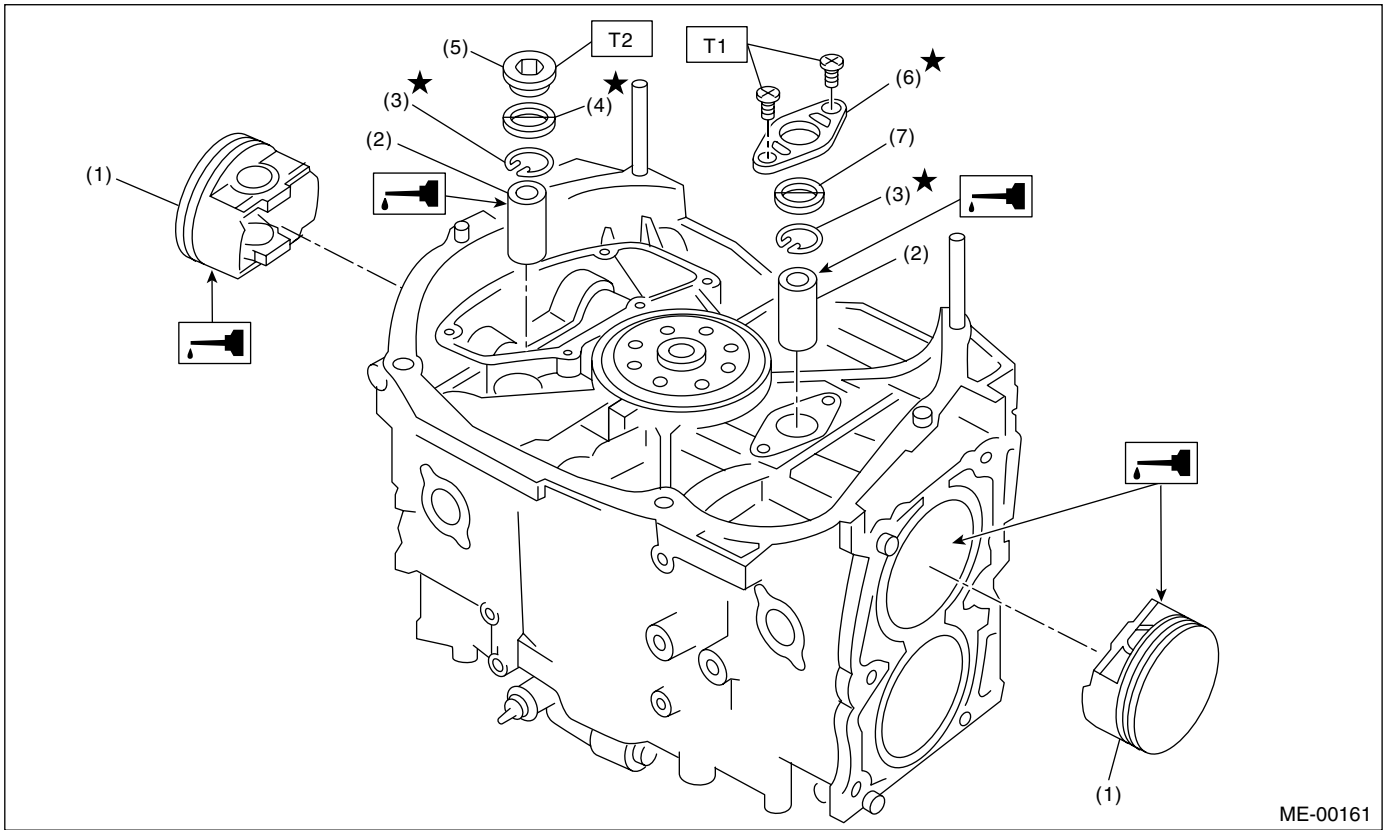
(6) Install the service hole plug and gasket.

NOTE:  
Use a new gasket.



# CYLINDER BLOCK

MECHANICAL



ME-00161

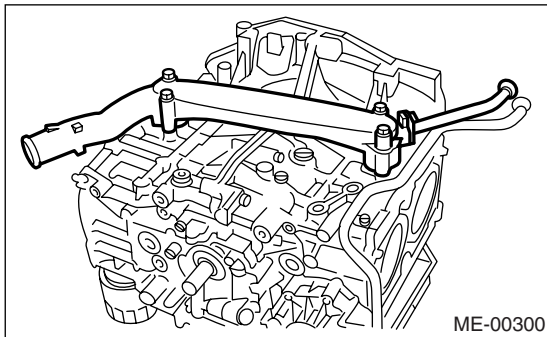
- |                |                        |
|----------------|------------------------|
| (1) Piston     | (5) Service hole plug  |
| (2) Piston pin | (6) Service hole cover |
| (3) Circlip    | (7) O-ring             |
| (4) Gasket     |                        |

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

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

**T2: 70 (7.1, 51.6)**

- (7) Turn the cylinder block to face the #3 and #4 piston side upward. Using the same procedures as used for #1 and #2 cylinders, install the pistons and piston pins.
- 17) Install the water pipe.



ME-00300

- 18) Install the baffle plate.

**Tightening torque:**

**6.4 N-m (0.65 kgf-m, 4.7 ft-lb)**

- 19) Install the oil strainer and O-ring.

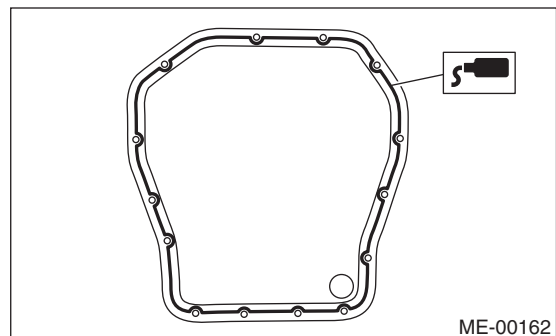
**Tightening torque:**

**10 N-m (1.0 kgf-m, 7 ft-lb)**

- 20) Install the oil strainer stay.
- 21) Apply liquid gasket to the matching surfaces, and then install the oil pan.

**Liquid gasket:**

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

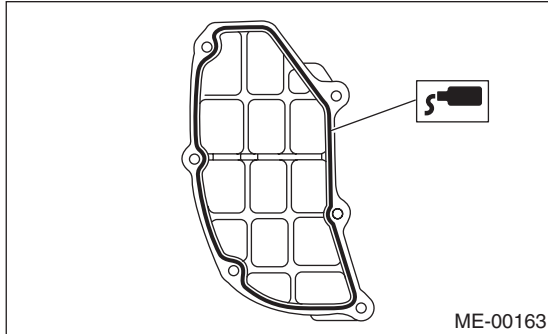


ME-00162

22) Apply liquid gasket to the matching surfaces, and then install the oil separator cover.

**Liquid gasket:**

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



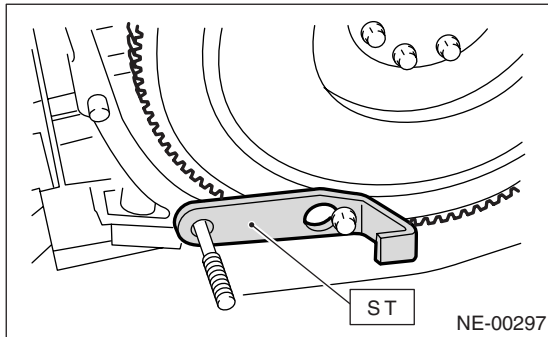
23) Install the flywheel or drive plate. To lock the crankshaft, use ST.

ST 498497100 CRANKSHAFT STOPPER

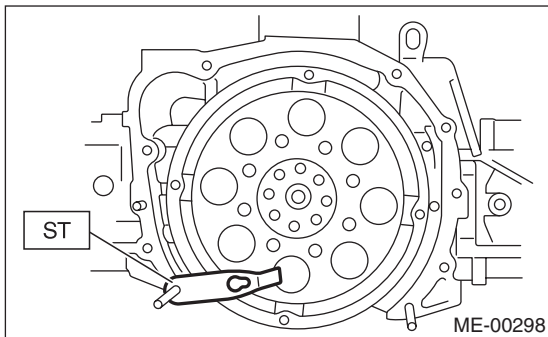
**Tightening torque:**

**72 N·m (7.3 kgf·m, 52.8 ft·lb)**

- MT model



- AT model

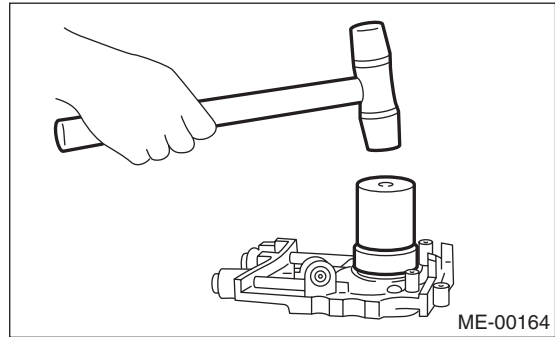


24) Install the housing cover.

25) Installation of oil pump

(1) Discard the front oil seal after removal. Replace it with a new one using the ST.

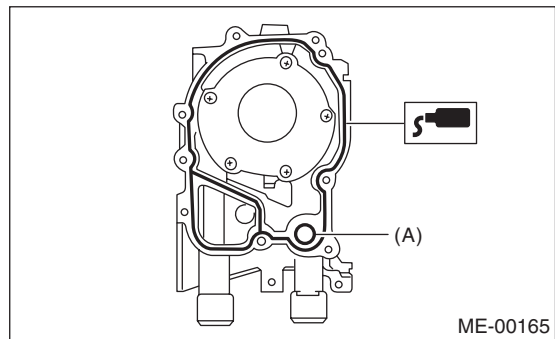
ST 499587100 OIL SEAL INSTALLER



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

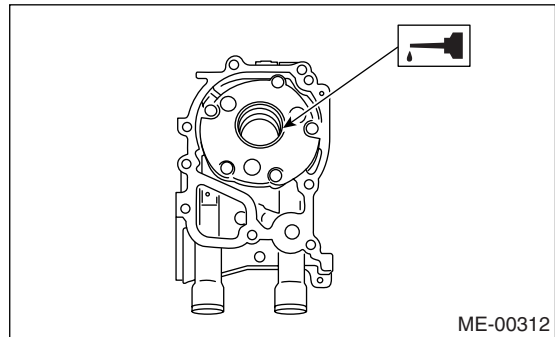
**Liquid gasket:**

**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 on cylinder block. Be careful not to damage the oil seal during installation.

**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

# CYLINDER BLOCK

## MECHANICAL

### CAUTION:

- Be sure to install the O-ring and seal when installing oil pump.
- Align flat surface of oil pump's inner rotor with crankshaft before installation.

26) Install the water pump and gasket.

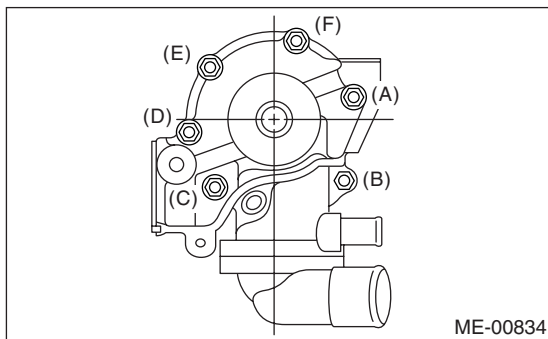
### Tightening torque:

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

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

### CAUTION:

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



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

28) Apply liquid gasket to the nipple (D), and then install the oil cooler.

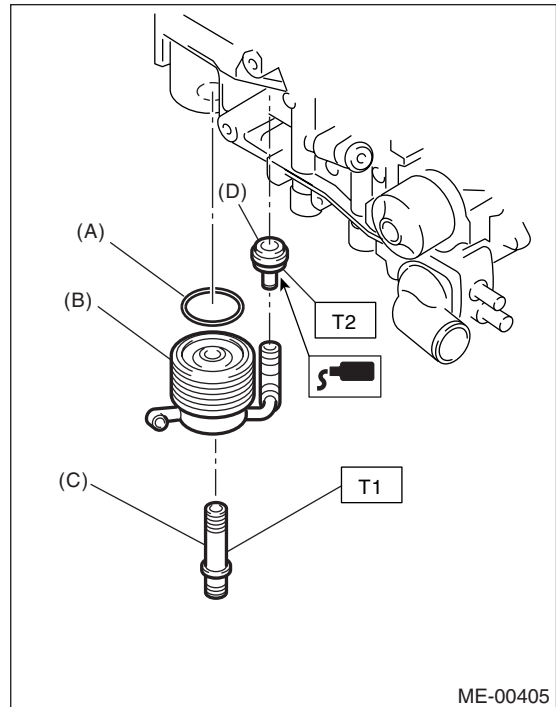
### Liquid gasket:

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

### Tightening torque:

**T1: 54 N·m (5.5 kgf-m, 40 ft-lb)**

**T2: 70 N·m (7.1 kgf-m, 51.6 ft-lb)**



(A) O-ring

(B) Oil cooler

(C) Connector

(D) Nipple

29) Get a engine oil filter and apply a thin coat of engine oil to the seal rubber.

30) Install the oil filter by turning it by hand, being careful not to damage the seal rubber.

- Tighten the oil filter 80 mm (3.15 in) in diameter by approx. 2/3 — 3/4 rotation more after the seal rubber of oil filter comes in contact with cylinder block or oil cooler.

- Tighten the oil filter 68 mm (2.68 in) or 65 mm (2.56 in) in diameter by approx. 1 rotation more after the seal rubber of oil filter comes in contact with cylinder block or oil cooler.

### CAUTION:

**Do not tighten excessively, or oil may leak.**

31) Tighten the cylinder head bolts.

(1) Apply a coat of engine oil to the washers and bolt threads.

(2) Tighten all bolts to 29 N·m (3.0 kgf-m, 22 ft-lb) in alphabetical sequence.

(3) Tighten all bolts to 69 N·m (7.0 kgf-m, 51 ft-lb) in alphabetical sequence.

(4) Back off all bolts by 180° in the reverse alphabetical sequence, and then back them off by 180° again.

(5) Tighten again all bolts 40° — 45° in alphabetical sequence.

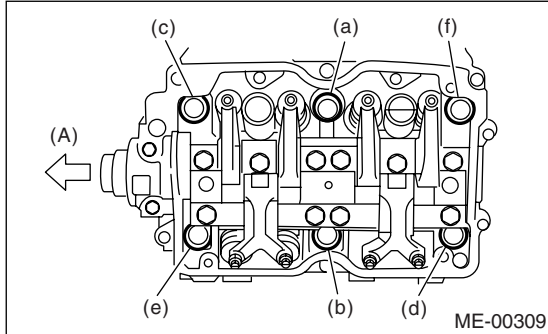
**CAUTION:**

**Do not tighten bolts more than 45°.**

(6) Tighten again the bolts (a) and (b) to 40° — 45°.

**CAUTION:**

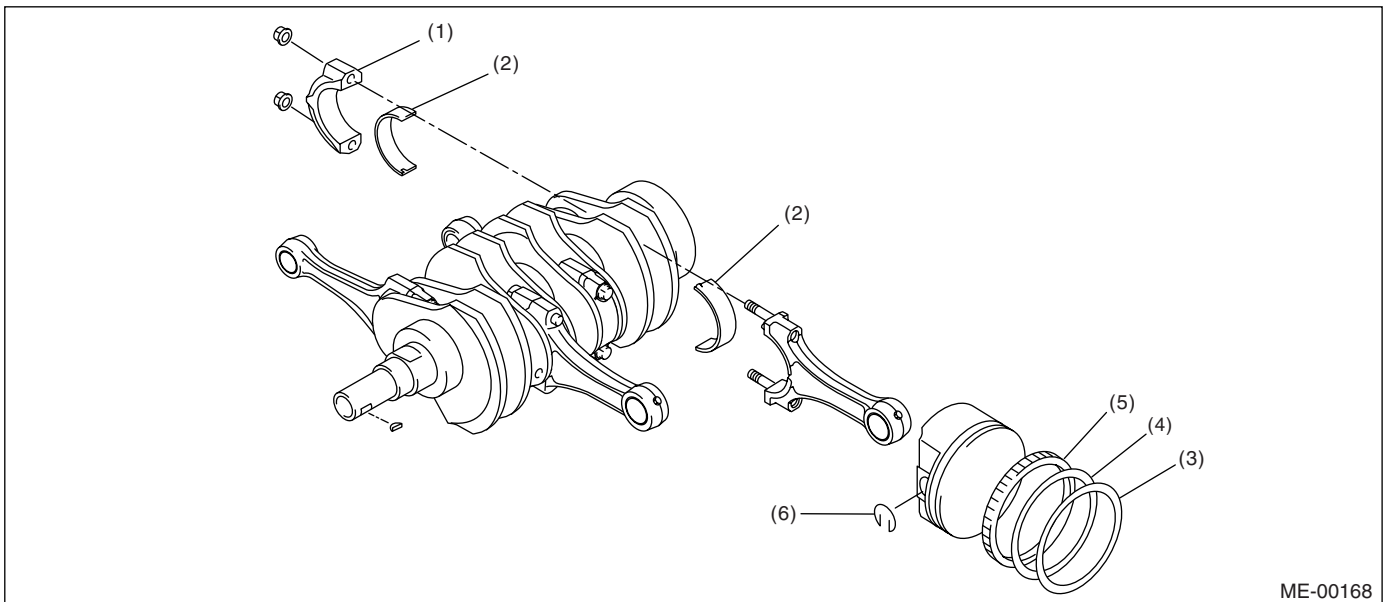
**Do not tighten bolts more than 90° in total angle.**



(A) Front side

- 32) Install the oil level gauge guide (left side only).
- 33) Install the rocker cover.
- 34) Install the crank sprocket. <Ref. to ME(H4SO)-53, INSTALLATION, Crankshaft Sprocket.>
- 35) Install the cam sprocket. <Ref. to ME(H4SO)-51, INSTALLATION, Cam Sprocket.>
- 36) Install the timing belt assembly. <Ref. to ME(H4SO)-47, INSTALLATION, Timing Belt Assembly.>
- 37) Install the timing belt cover. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt Cover.>
- 38) Install the crank pulley. <Ref. to ME(H4SO)-44, INSTALLATION, Crank Pulley.>
- 39) Install the generator and A/C compressor brackets on cylinder head.
- 40) Install the V-belt. <Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>
- 41) Install the intake manifold. <Ref. to FU(H4SO)-16, INSTALLATION, Intake Manifold.>

## C: DISASSEMBLY



- (1) Connecting rod cap
- (2) Connecting rod bearing
- (3) Top ring
- (4) Second ring

- (5) Oil ring
- (6) Circlip

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

**CAUTION:**

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

- 3) Remove the piston rings using the piston ring expander.
- 4) Remove the oil ring by hand.

**CAUTION:**

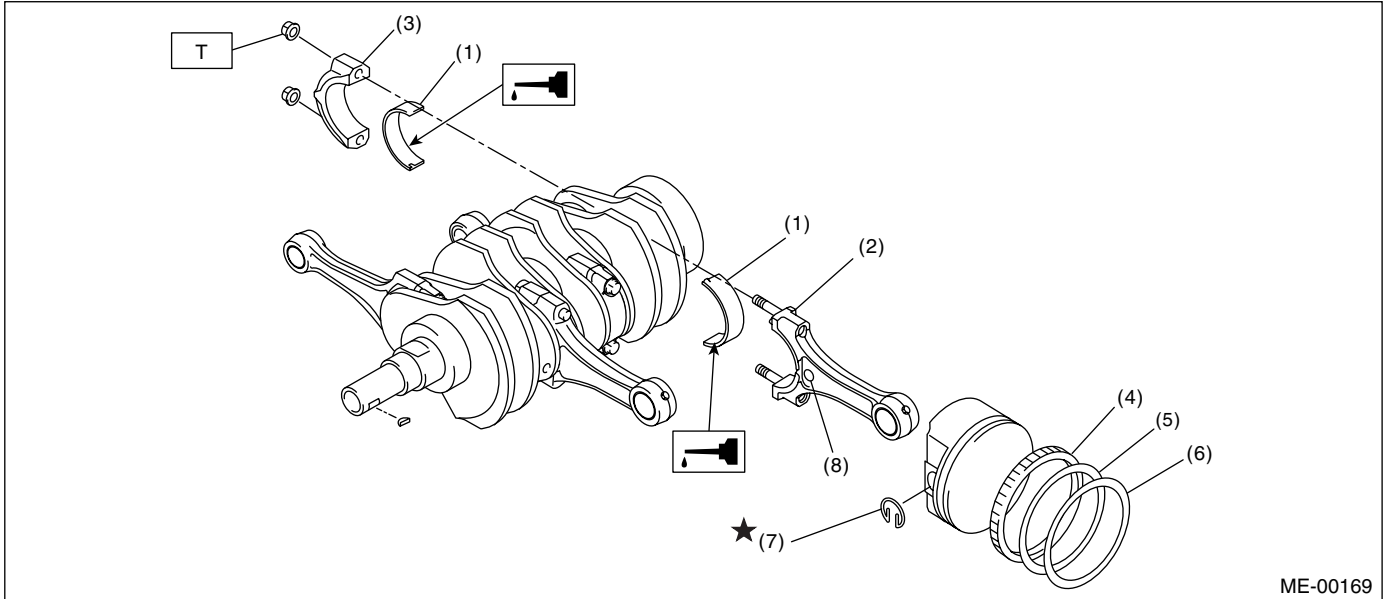
- Do not use piston ring expander. Oil ring may be bent if piston ring expander is used.
- Arrange the removed piston rings in good order to prevent confusion.

- 5) Remove the circlip.

# CYLINDER BLOCK

MECHANICAL

## D: ASSEMBLY



ME-00169

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

**Tightening torque: N·m (kgf·m, ft·lb)**  
**T: 45 (4.6, 33.2)**

- 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 the marked side facing forward, and then install them to crankshaft.
- 4) Install the connecting rod cap to crankshaft with connecting rod nut.  
Ensure the arrow on connecting rod cap faces the front during installation.

**Tightening torque:**  
**45 N·m (4.6 kgf·m, 33.2 ft·lb)**

### CAUTION:

- 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 in this order by hand.
  - 6) Install the second ring and top ring using a piston ring expander.

## E: INSPECTION

### 1. CYLINDER BLOCK

- 1) Visually check for cracks and damage. Especially, inspect the important parts by means of red lead check.
- 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:**  
**0.05 mm (0.0020 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 cylinder block's front upper surface.

#### NOTE:

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

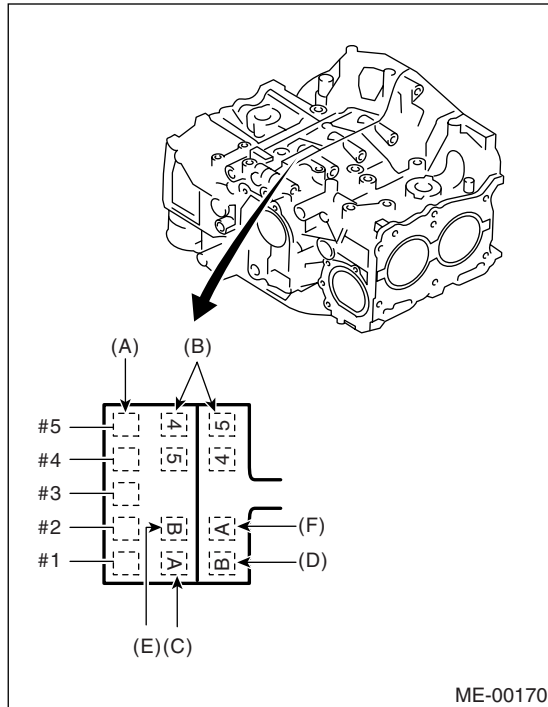
# CYLINDER BLOCK

MECHANICAL

## 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 shown in the figure, using a cylinder bore gauge.

### NOTE:

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

## Taper:

### Standard

**0.015 mm (0.0006 in)**

### Limit

**0.050 mm (0.0020 in)**

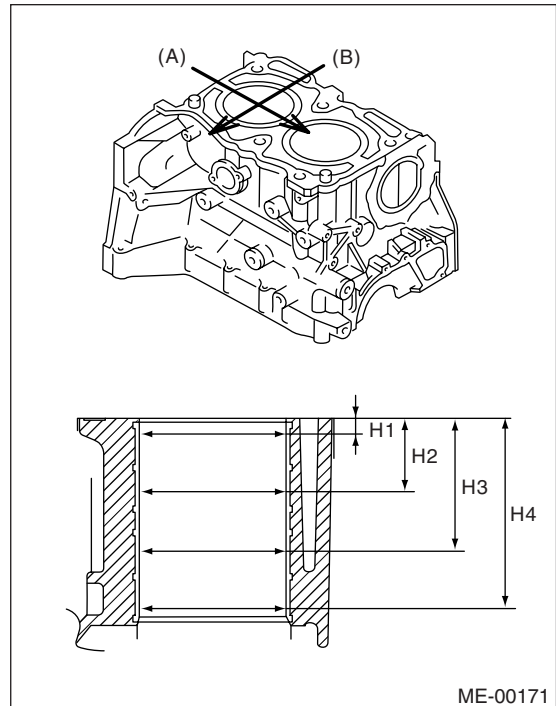
## Out-of-roundness:

### Standard

**0.010 mm (0.0004 in)**

### 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 (4.35 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 shown in the figure. (Thrust direction)

### NOTE:

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

### Piston grade point H:

**37.0 mm (1.457 in)**

# CYLINDER BLOCK

MECHANICAL

## **Piston outer diameter:**

### **Standard A:**

**99.485 — 99.495 mm (3.9167 — 3.9171 in)**

### **Standard B:**

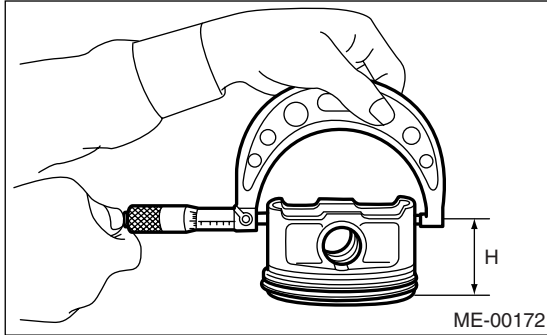
**99.475 — 99.485 mm (3.9163 — 3.9167 in)**

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

**99.725 — 99.735 mm (3.9262 — 3.9266 in)**

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

**99.975 — 99.985 mm (3.9360 — 3.9364 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 — 0.030 mm (0.0004 — 0.0012 in)**

### **Limit**

**0.050 mm (0.0020 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 use oversize pistons.
- Do not perform boring on one cylinder only, nor use an oversize piston for one cylinder only.

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

### **NOTE:**

Immediately after reboring, the cylinder diameter may differ from its real diameter due to temperature rise. Thus, measure the cylinder diameter after the temperature of cylinder is at room temperature.

## **Limit of cylinder enlarging (boring):**

**0.5 mm (0.020 in)**

## **3. PISTON AND PISTON PIN**

- 1) Check the pistons and piston pins for damage, cracks and wear. Replace if defective.
- 2) Check the piston ring grooves for wear and damage. Replace if defective.
- 3) Measure the piston-to-cylinder clearance at each cylinder. <Ref. to ME(H4SO)-80, CYLINDER AND PISTON, INSPECTION, Cylinder Block.> If any of the clearances is not to specification, replace the piston with oversize piston and bore the cylinder.
- 4) Make the sure that piston pin can be inserted into piston pin hole with a thumb at 20°C (68°F). Replace if defective.

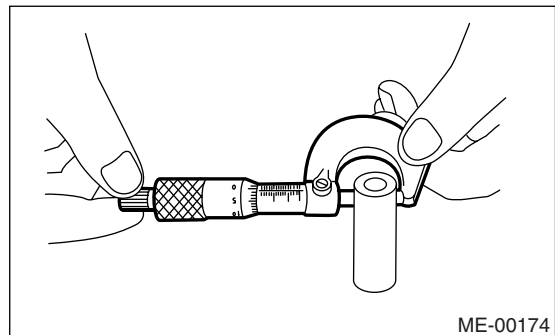
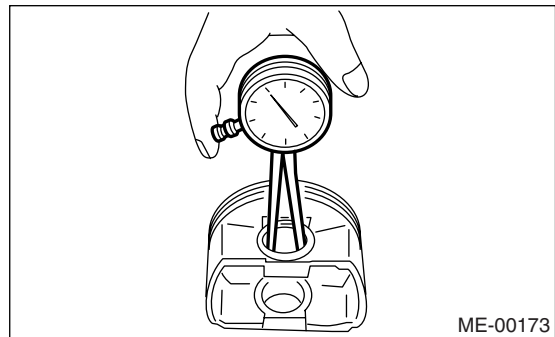
## **Standard clearance between piston pin and hole in piston:**

### **Standard**

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

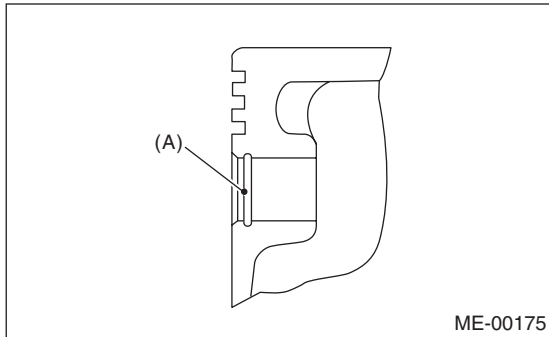
### **Limit**

**0.020 mm (0.0008 in)**





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



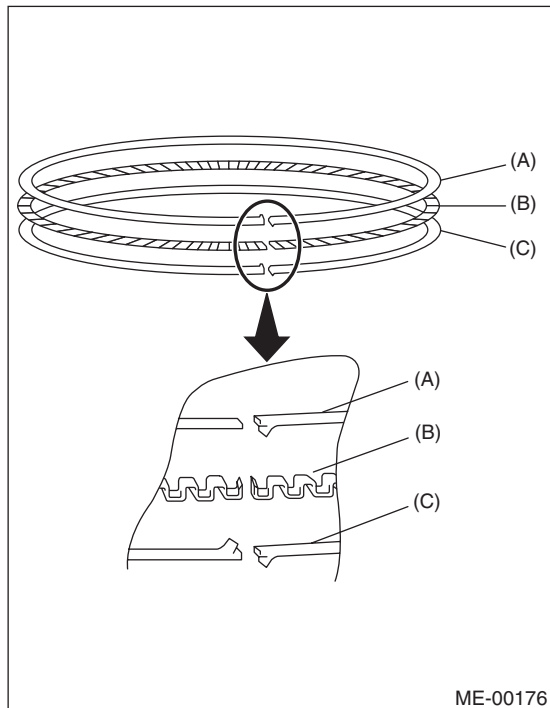
6) Check the piston pin circlip for distortion, cracks and wear.

## 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 one of the same size as the piston.

### CAUTION:

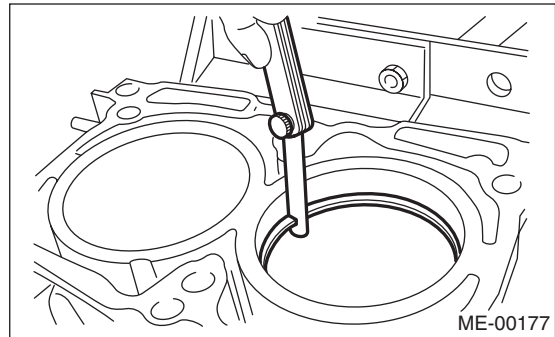
- Marks are shown on the end of top and second rings. When installing the rings to piston, face these marks upward.
- Oil ring is composed of upper rail, expander and lower rail. Be careful of the rail direction when installing oil ring to the piston.



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

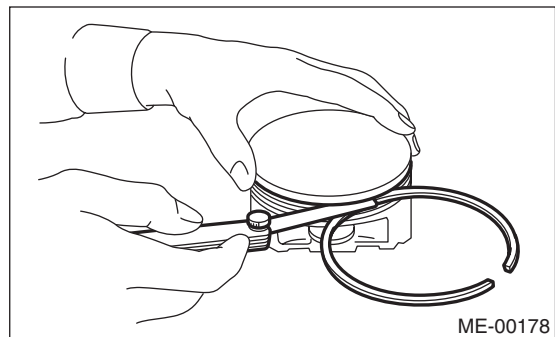
2) Clean the piston ring groove and piston ring.  
3) Squarely place the piston ring and oil ring in cylinder, and then measure the piston ring gap with a thickness gauge.

		Unit: 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 (0.0146 — 0.0205)	1.0 (0.039)
	Oil ring rail	0.20 — 0.50 (0.0079 — 0.0197)	1.5 (0.059)



4) Set the piston ring into piston ring groove at rights, and then measure the clearance between piston ring and piston ring groove with a thickness gauge.

		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)



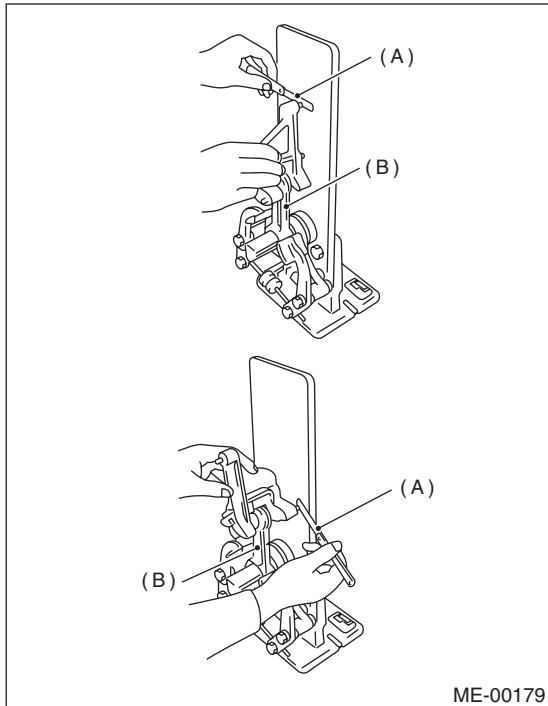
# CYLINDER BLOCK

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 then measure the side clearance (thrust clearance) using thickness gauge. Replace the connecting rod if the side clearance exceeds the specified limit.

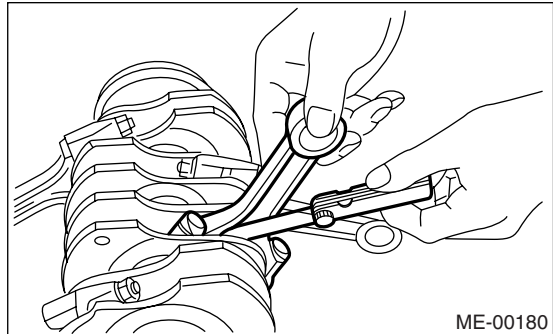
**Connecting rod side clearance:**

**Standard**

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

**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 individual connecting rod bearings by means of plastigage. If any oil clearance is not within specification, replace the defective bearing with a new one of standard size or undersize as necessary. (See the table below.)

**Connecting rod oil clearance:**

**Standard**

**0.016 — 0.044 mm (0.0006 — 0.0017 in)**

**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 — 1.513 (0.0592 — 0.0596)	51.954 — 51.970 (2.0454 — 2.0461)
0.05 (0.0020) undersize	1.514 — 1.523 (0.0596 — 0.0600)	51.934 — 51.950 (2.0446 — 2.0453)
0.25 (0.0098) undersize	1.614 — 1.623 (0.0635 — 0.0639)	51.734 — 51.750 (2.0368 — 2.0374)

- 6) Inspect the bushing at connecting rod small end, and replace it with a new one if worn or damaged. Also measure the piston pin clearance at connecting rod small end and replace it with a new one if the measured value exceeds the limit.

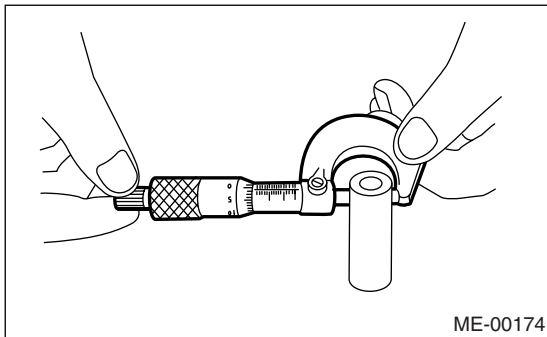
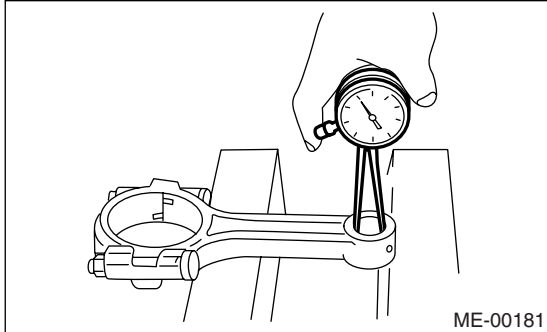
## Clearance between piston pin and bushing:

### Standard

0 — 0.022 mm (0 — 0.0009 in)

### Limit

0.030 mm (0.0012 in)

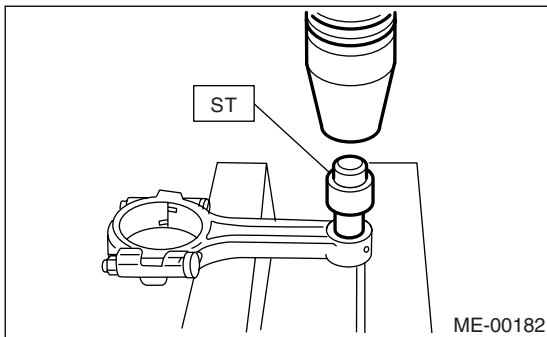


7) Replacement procedure of bushing of connecting rod small end is as follows.

(1) Remove the bushing from connecting rod with ST and press.

(2) Press the bushing with 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 bushing. Ream the inside of bushing.

(4) After the 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., and replace them with new ones if defective.

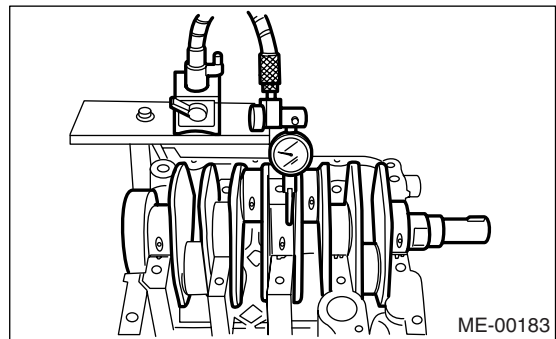
2) Measure the crankshaft bend, and correct or replace if it exceeds the limit.

### NOTE:

If a suitable V-block is not available, install the #1 and #5 crankshaft bearing on cylinder block, position the crankshaft on cylinder block and 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 specifications, replace the bearing with a suitable (undersize) one, and then replace or recondition the crankshaft as necessary. When grinding the crank journal or crank pin, finish them to specified dimensions according to the undersize bearing to be used.

### Crank pin and crank journal:

#### Out-of-roundness:

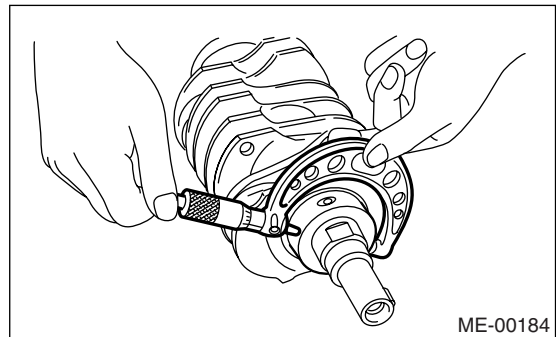
0.020 mm (0.0008 in) or less

#### Taper limit:

0.07 mm (0.0028 in)

#### Grinding limit:

0.250 mm (0.0098 in)



# CYLINDER BLOCK

MECHANICAL

		Unit: mm (in)		
		Crank journal diameter		Crank pin 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 — 1.513 (0.0592 — 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)	1.514 — 1.523 (0.0596 — 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)	1.614 — 1.623 (0.0635 — 0.0639)

O.D.: Outer Diameter

4) Measure the thrust clearance of crankshaft at center bearing using thickness gauge. If the clearance exceeds the limit, replace bearing.

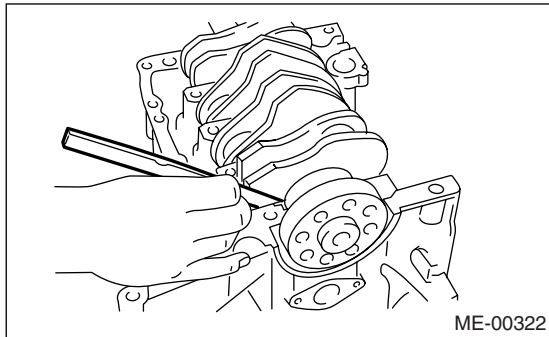
**Crankshaft thrust clearance:**

**Standard**

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

**Limit**

**0.25 mm (0.0098 in)**



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

6) Measure the oil clearance on each crankshaft bearing by means of plastigage. If the measurement is not within the specification, replace the defective bearing with an undersize one, and then replace or recondition the crankshaft as necessary.

Unit: mm (in)		
Crankshaft oil clearance		
#1	Standard	0.010 — 0.030 (0.0004 — 0.0012)
	Limit	0.040 (0.0016)
#2	Standard	0.010 — 0.030 (0.0004 — 0.0012)
	Limit	0.045 (0.0018)
#3	Standard	0.010 — 0.030 (0.0004 — 0.0012)
	Limit	0.040 (0.0016)
#4	Standard	0.010 — 0.030 (0.0004 — 0.0012)
	Limit	0.045 (0.0018)
#5	Standard	0.010 — 0.031 (0.0004 — 0.0012)
	Limit	0.040 (0.0016)