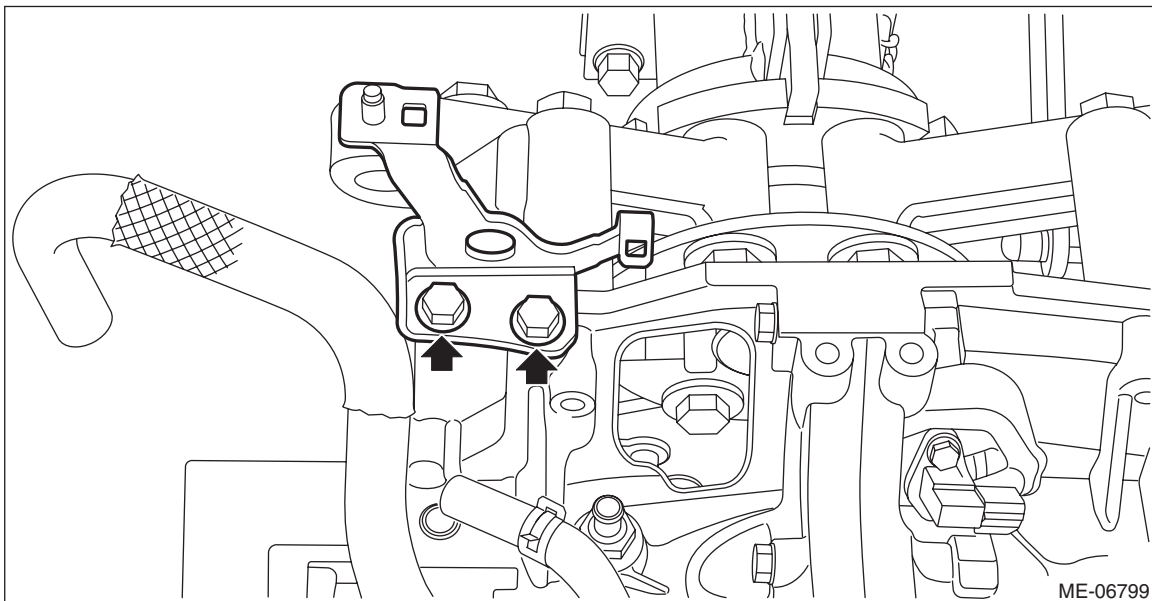


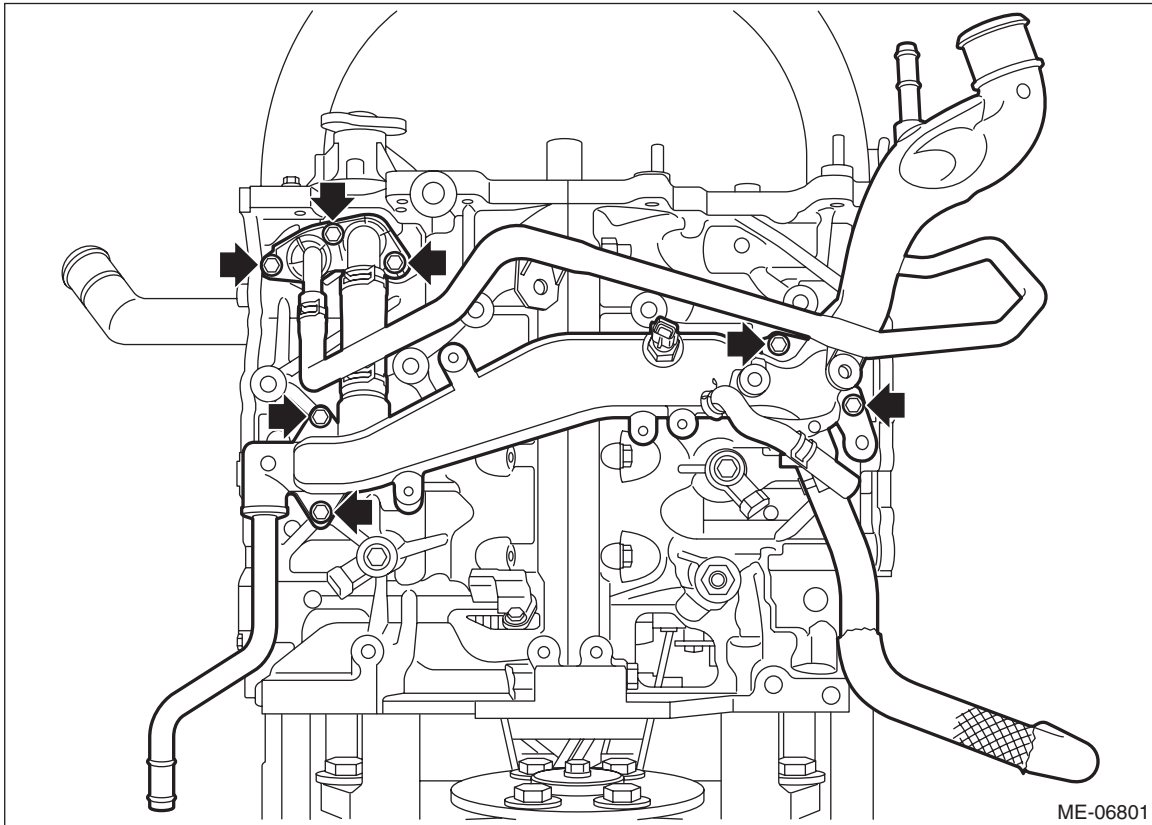
## 22.Cylinder Block

### A: REMOVAL

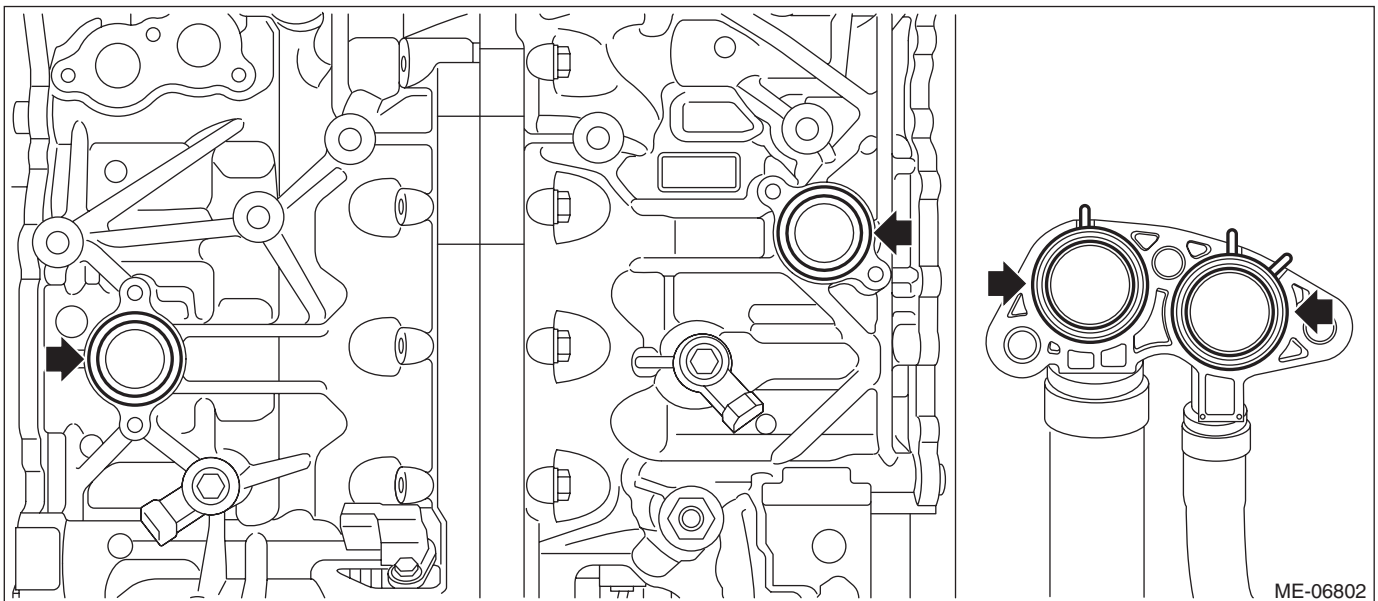
- 1) Remove the engine from the vehicle. <Ref. to ME(H4DOTC)-46, REMOVAL, Engine Assembly.>
- 2) Remove the crankshaft position sensor plate with drive plate. <Ref. to CVT(TR690)-135, REMOVAL, Drive Plate.>
- 3) Remove the intake manifold. <Ref. to FU(H4DOTC)-19, REMOVAL, Intake Manifold.>
- 4) Remove the tumble generator valve assembly. <Ref. to FU(H4DOTC)-44, REMOVAL, Tumble Generator Valve Assembly.>
- 5) Remove the engine wiring harness. <Ref. to FU(H4DOTC)-88, REMOVAL, Engine Wiring Harness.>
- 6) Remove the chain cover. <Ref. to ME(H4DOTC)-92, REMOVAL, Chain Cover.>
- 7) Remove the rocker cover. <Ref. to ME(H4DOTC)-149, REMOVAL, Rocker Cover.>
- 8) Remove the cam carrier. <Ref. to ME(H4DOTC)-174, REMOVAL, Cam Carrier.>
- 9) Remove the cylinder head. <Ref. to ME(H4DOTC)-217, REMOVAL, Cylinder Head.>
- 10) Remove the crank sprocket. <Ref. to ME(H4DOTC)-147, REMOVAL, Crank Sprocket.>
- 11) Remove the engine rear hanger from cylinder block RH.



12) Remove the bolts securing the water pipe assembly and PCV connector to the cylinder block, and remove the water pipe assembly and PCV connector as a set from cylinder block.



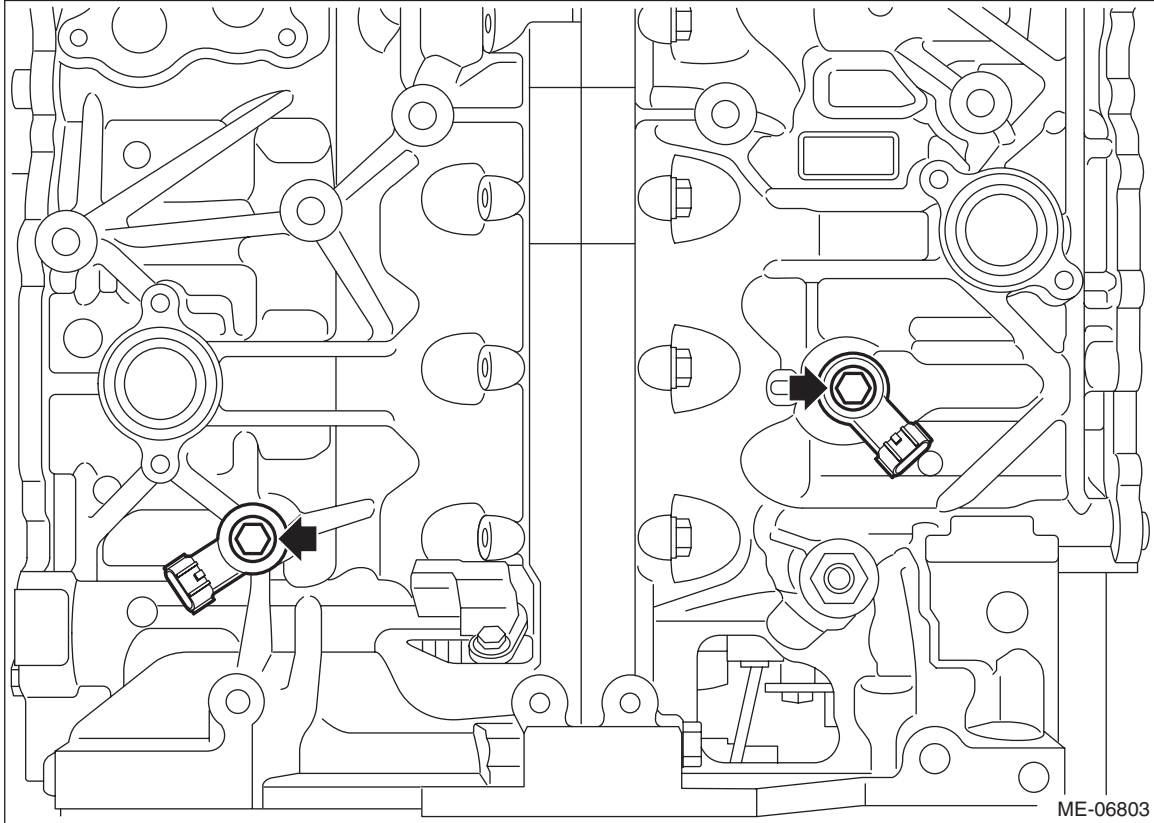
13) Remove the O-ring from the cylinder block and PCV connector.



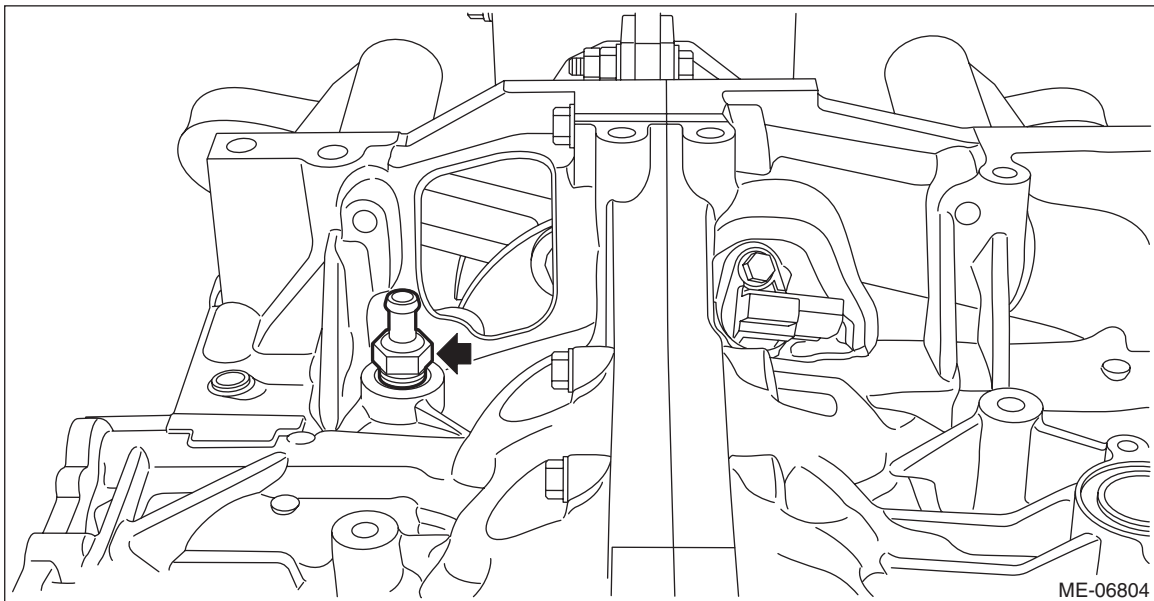
## Cylinder Block

### MECHANICAL

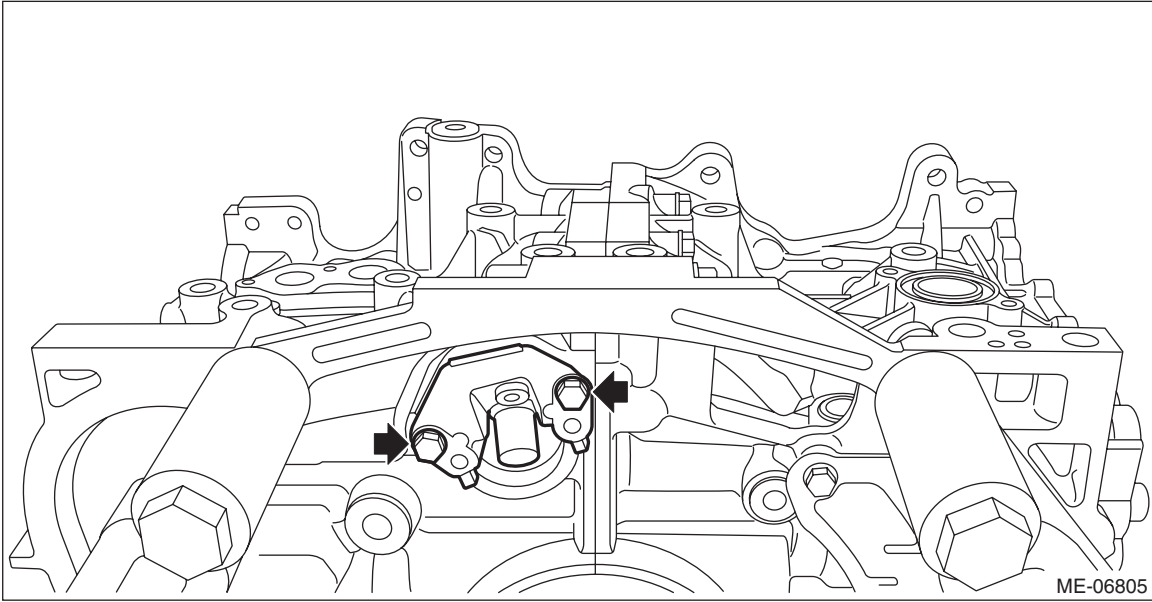
14) Remove the knock sensor from cylinder block LH.



15) Remove the PCV valve from the cylinder block RH.



16) Remove the bolts securing the crankshaft position sensor holder from the cylinder block LH, and remove the crankshaft position sensor with crankshaft position sensor holder.



17) Set the part so that the oil pan is on the upper side.

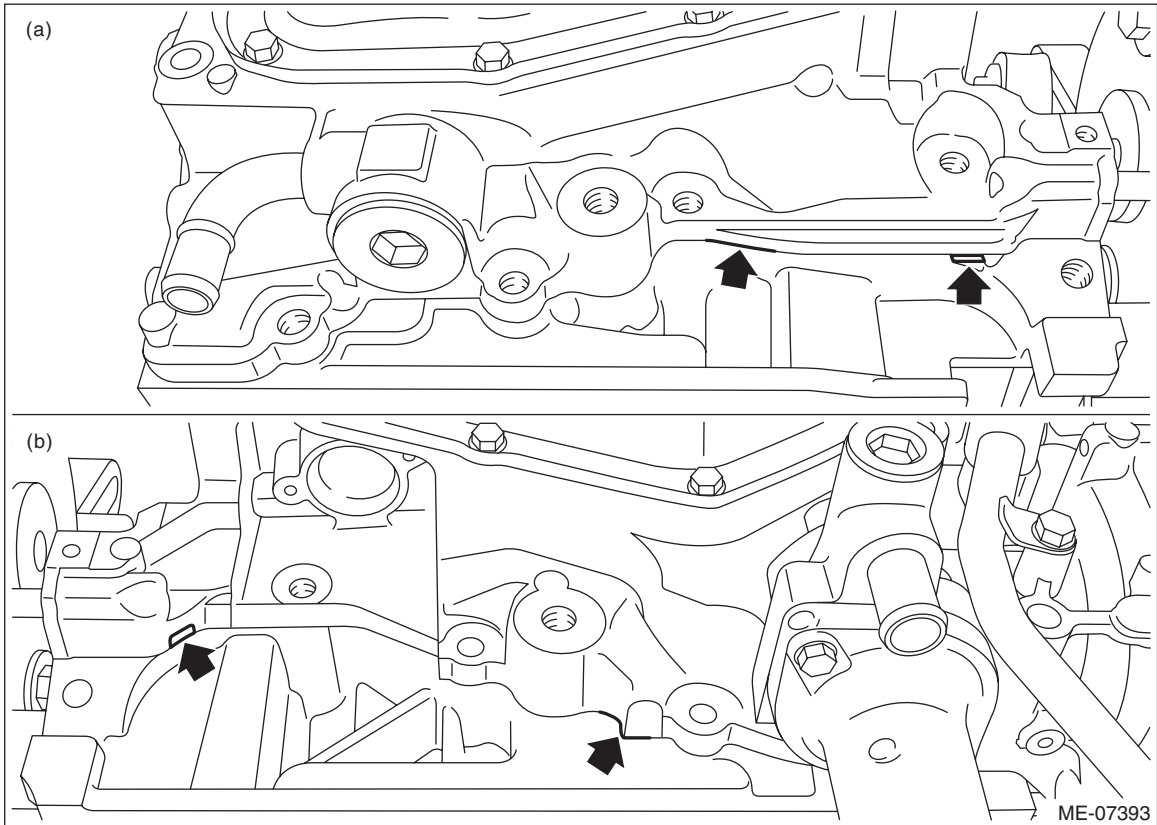
# Cylinder Block

## MECHANICAL

18) Remove the oil pan upper with oil pan from cylinder block.

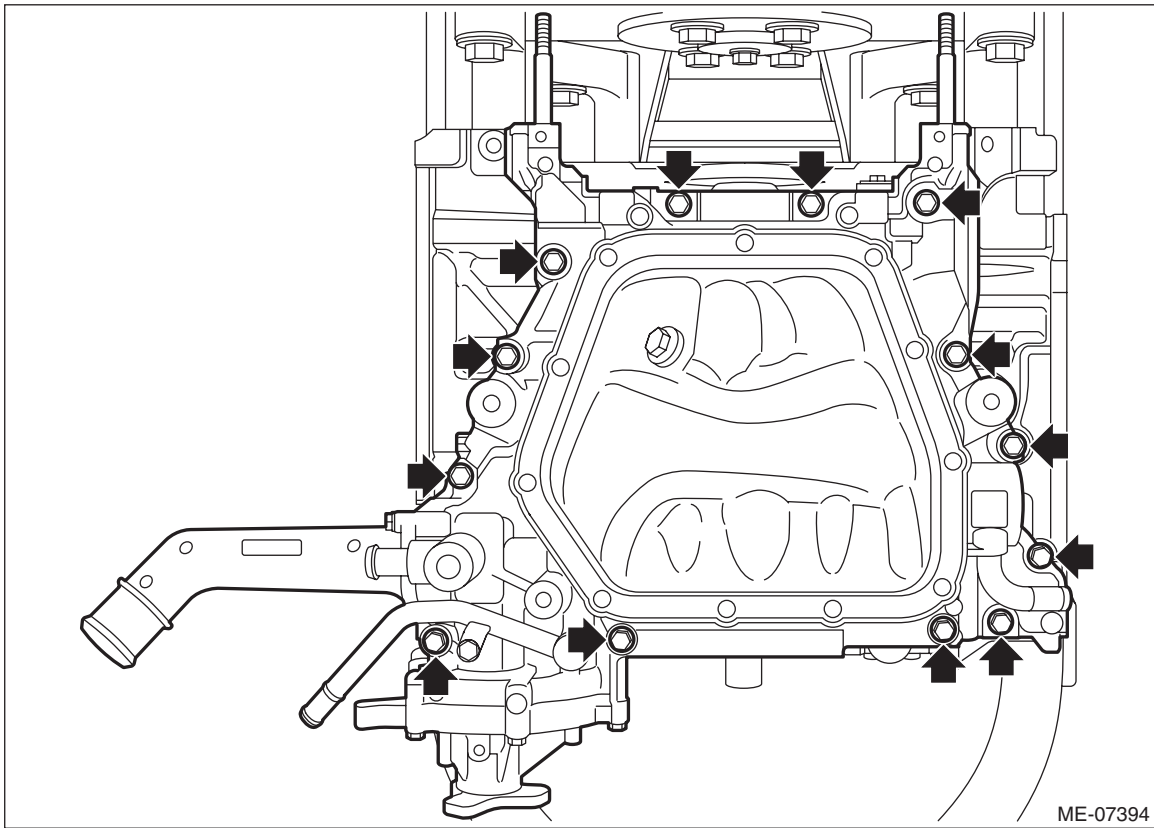
### NOTE:

Pry the points shown in the figure with a crowbar wrapped by protective tape, and then remove the oil pan upper.

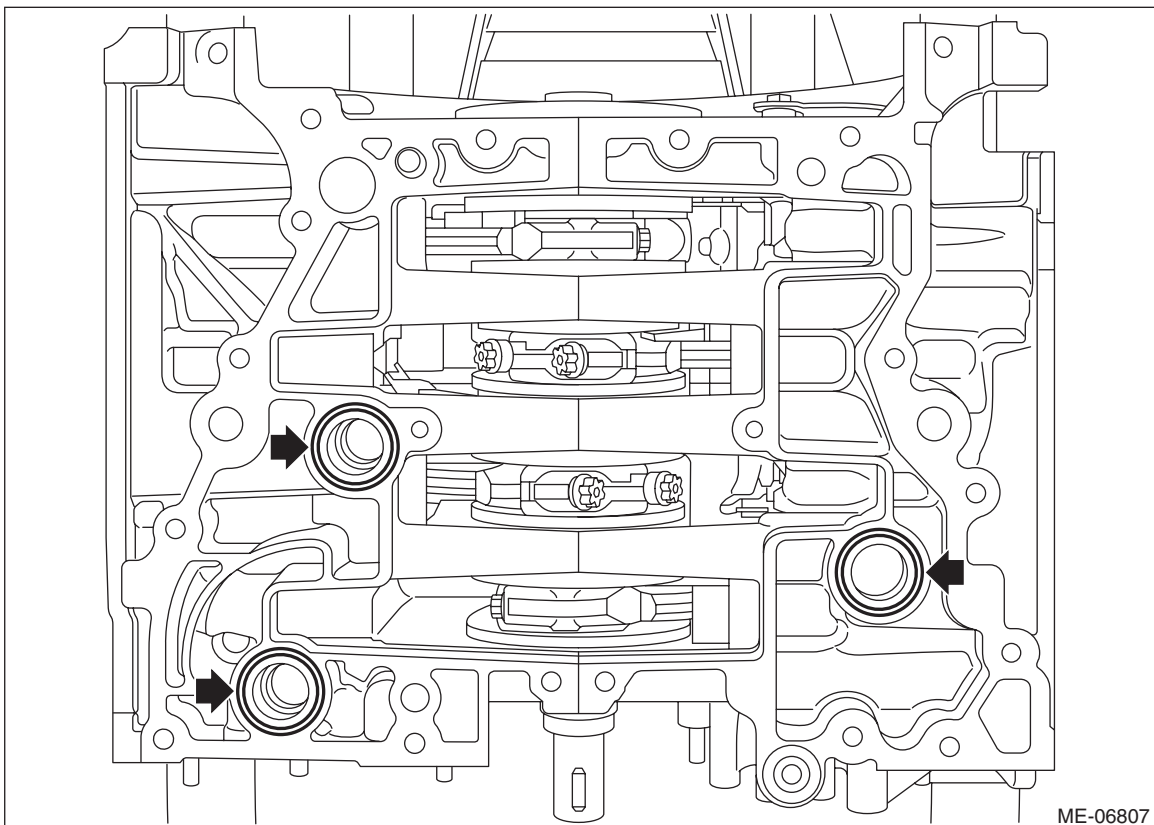


(a) RH side

(b) LH side



19) Remove the O-ring from the cylinder block.



20) Set the part so that the cylinder block RH is on the upper side.

# Cylinder Block

## MECHANICAL

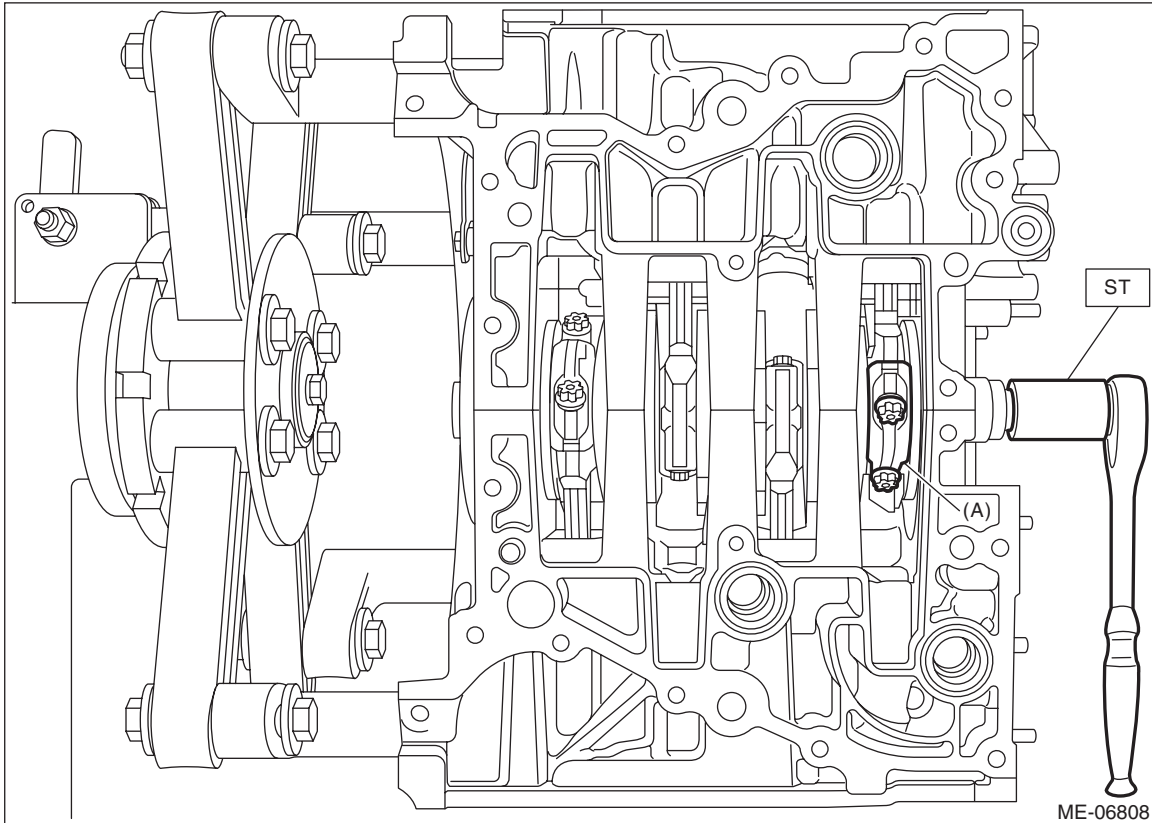
21) Remove the #1 and #3 connecting rod caps and pistons from the cylinder block.

### NOTE:

Mark each connecting rod cap and piston with a cylinder number.

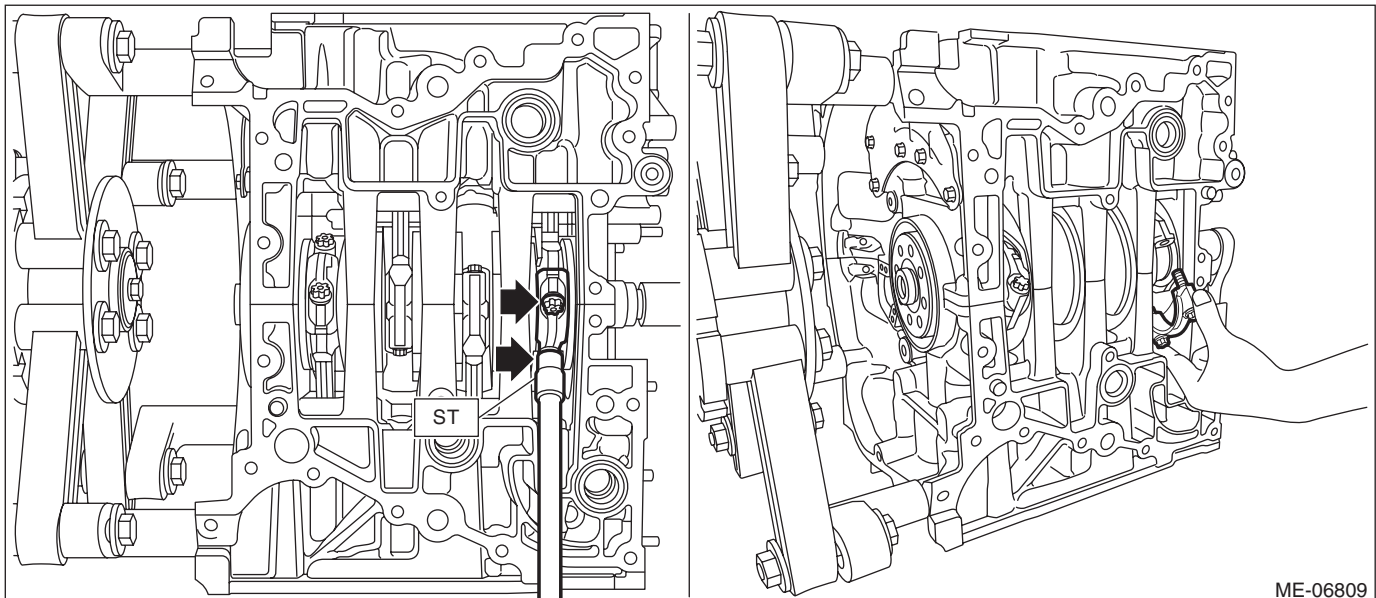
(1) Turn the crankshaft so that the #1 connecting rod cap (A) is located at the position shown in the figure using ST.

ST 18252AA000 CRANKSHAFT SOCKET



(2) Using ST, loosen the #1 connecting rod cap bolt, and remove the #1 connecting rod cap bolt and #1 connecting rod cap.

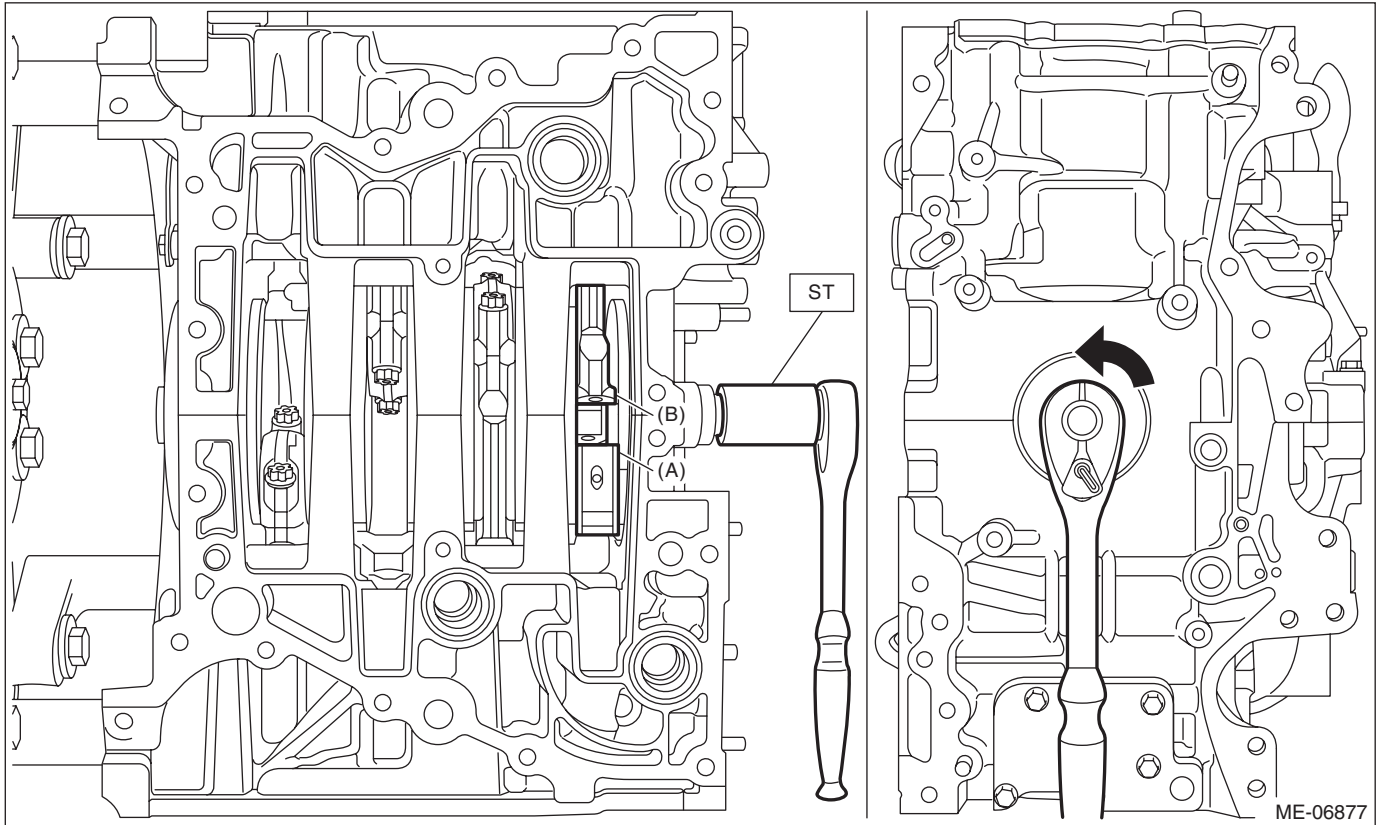
ST 18270AA020 SOCKET



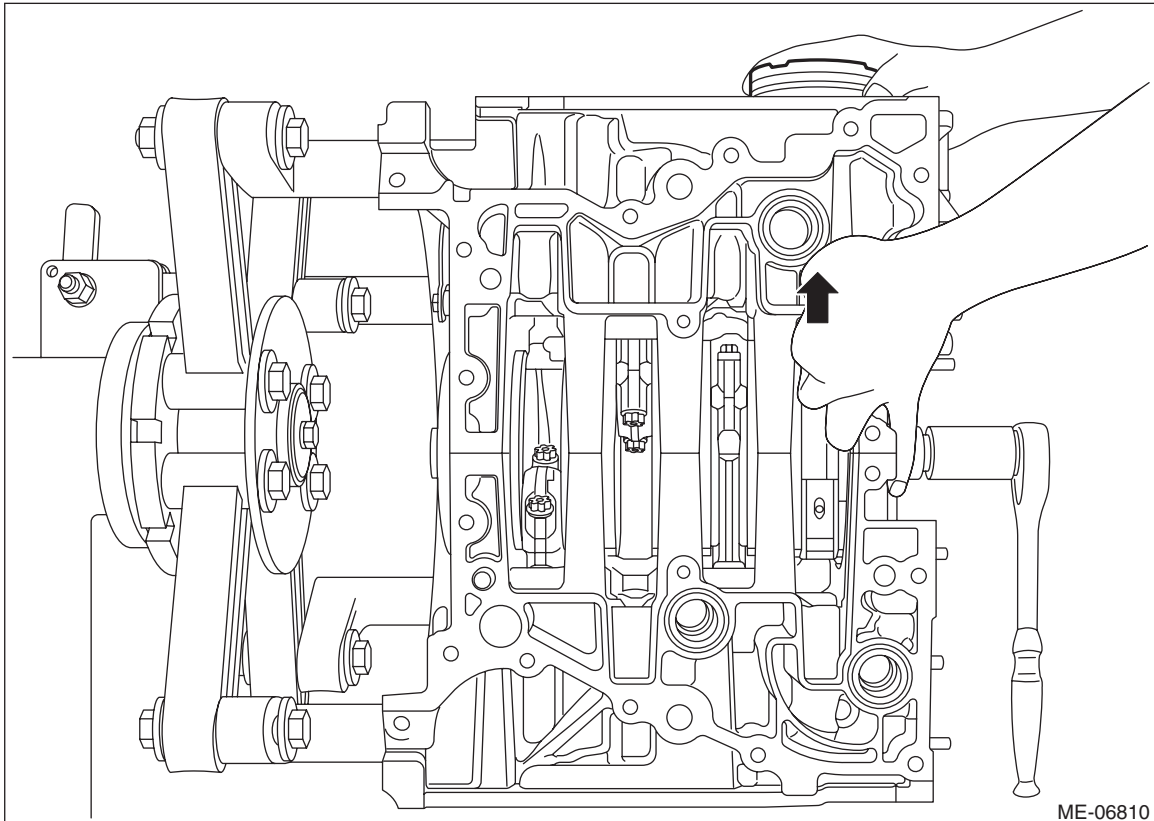


(3) Using the ST, turn the crankshaft counterclockwise and separate the positions of the #1 pin (A) of crankshaft and the large end (B) of #1 connecting rod.

ST 18252AA000 CRANKSHAFT SOCKET



(4) Push the #1 connecting rod in the direction of the arrow, and remove the #1 piston with #1 connecting rod from the cylinder block.



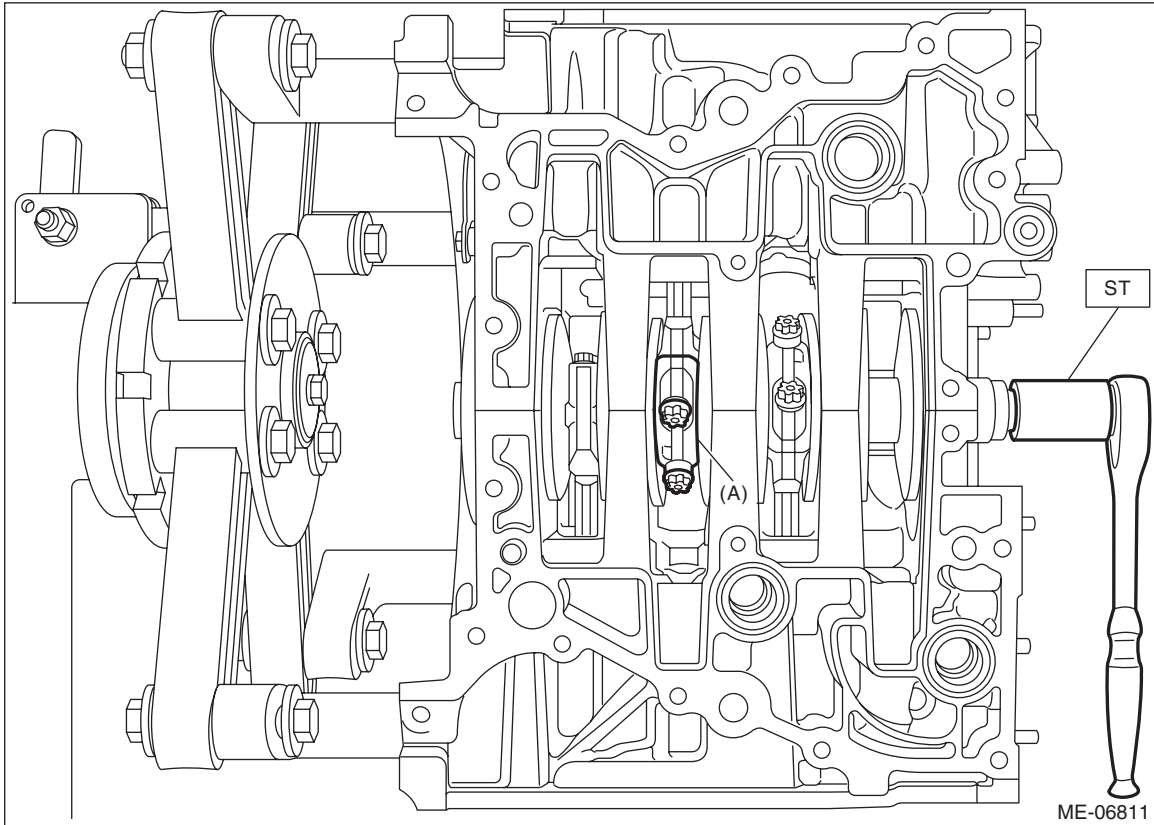


# Cylinder Block

## MECHANICAL

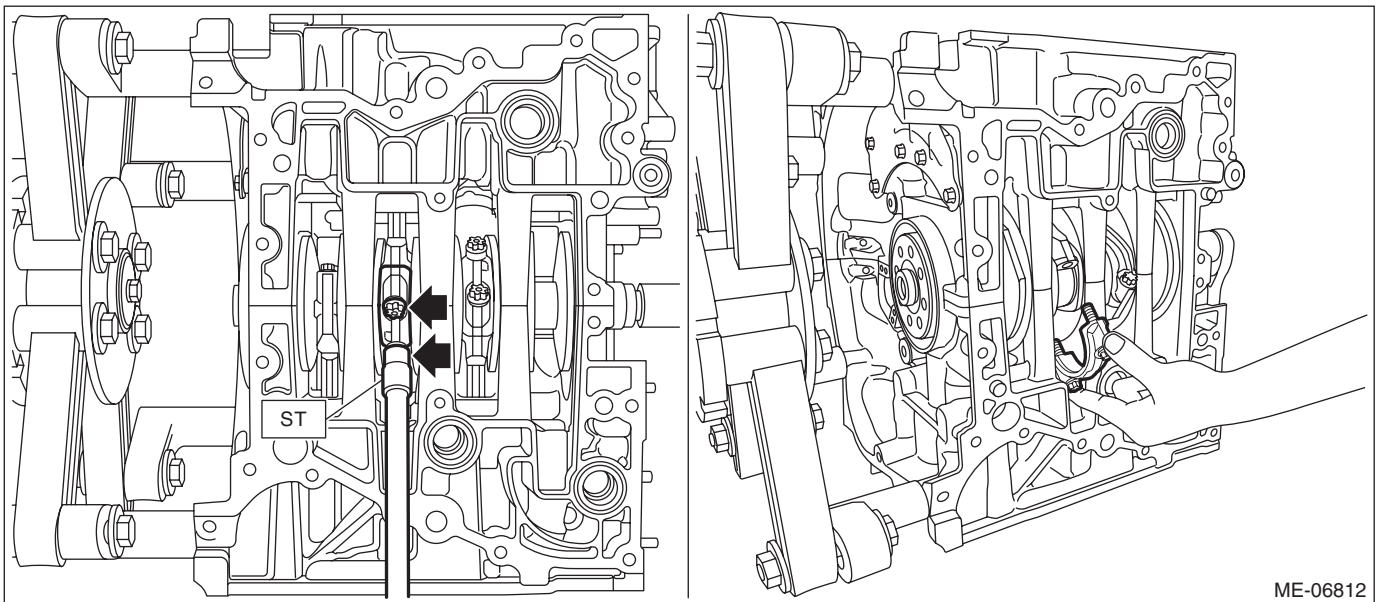
(5) Turn the crankshaft so that the #3 connecting rod cap (A) is located at the position shown in the figure using ST.

ST 18252AA000 CRANKSHAFT SOCKET



(6) Using ST, loosen the #3 connecting rod cap bolt, and remove the #3 connecting rod cap bolt and #3 connecting rod cap.

ST 18270AA020 SOCKET

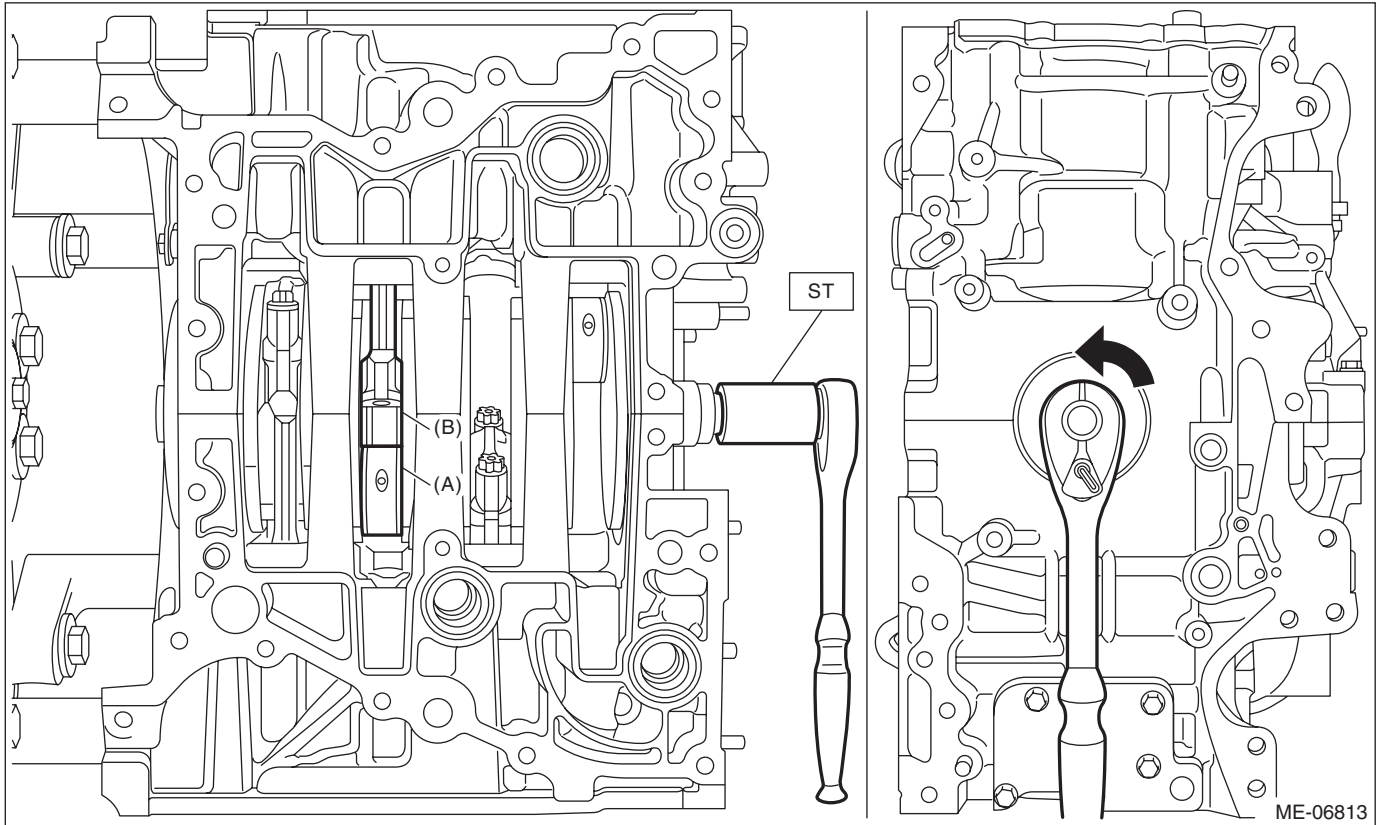


# Cylinder Block

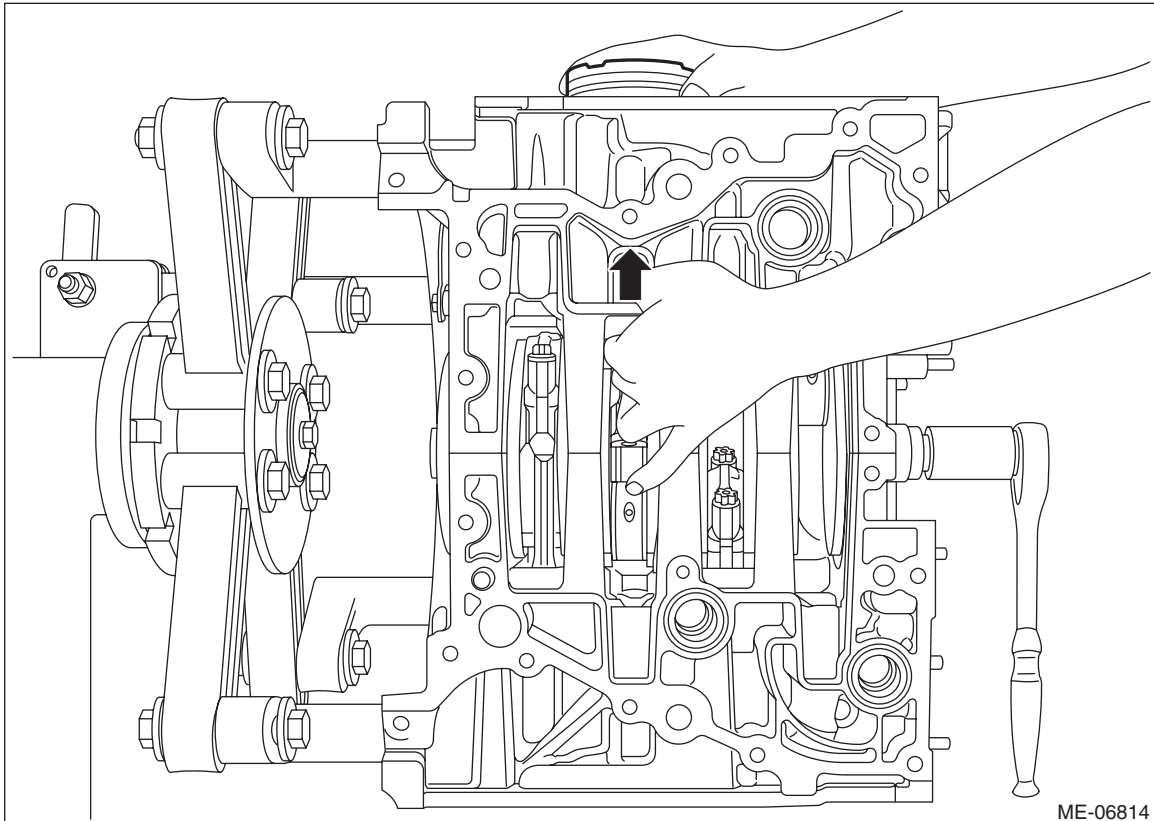
MECHANICAL

(7) Using the ST, turn the crankshaft counterclockwise and separate the positions of the #3 pin (A) of crankshaft and the large end (B) of #3 connecting rod.

ST 18252AA000 CRANKSHAFT SOCKET



(8) Push the #3 connecting rod in the direction of the arrow, and remove the #3 piston with #3 connecting rod from the cylinder block.

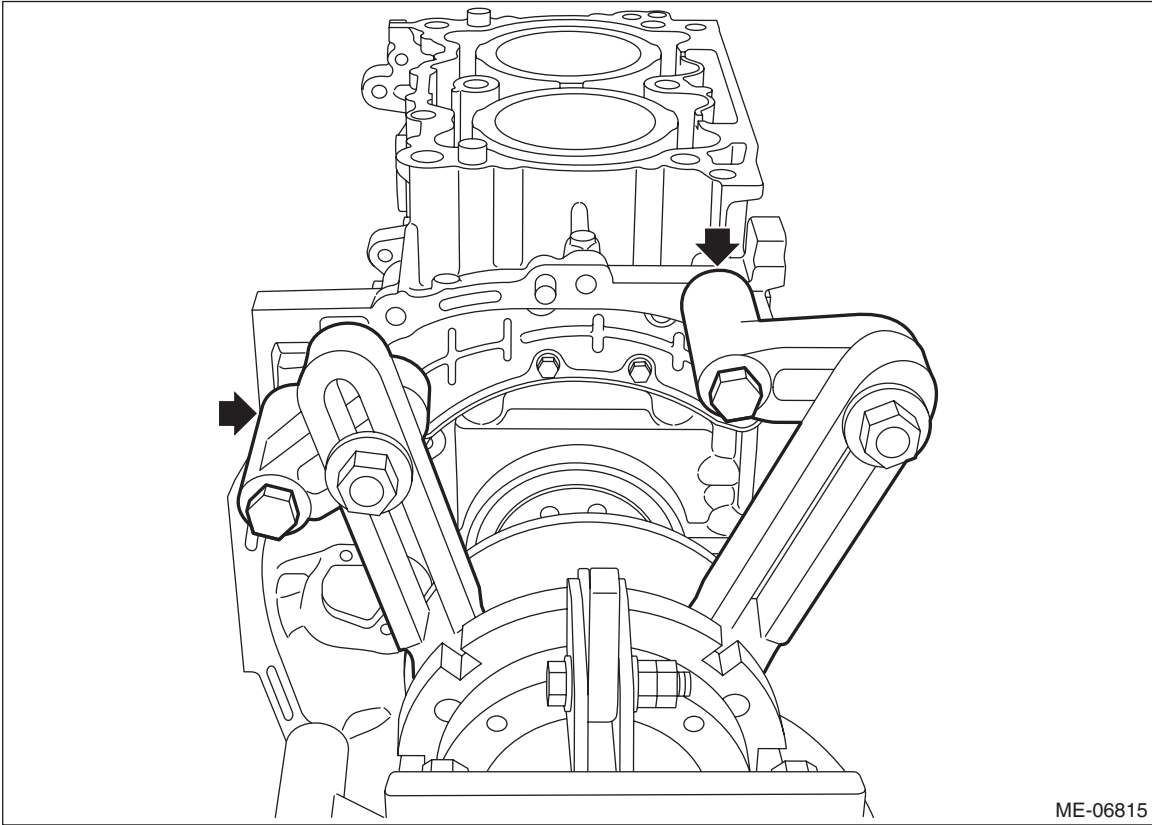


## Cylinder Block

### MECHANICAL

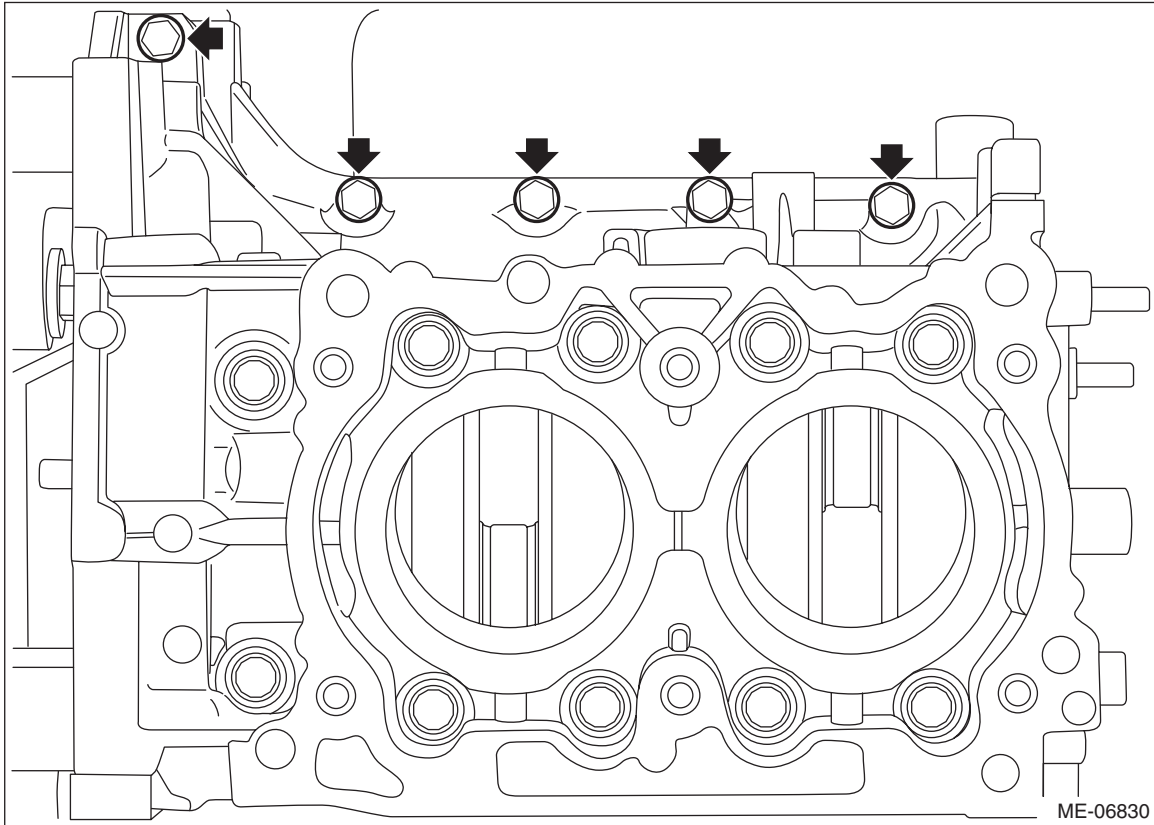
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- 22) Set the part so that the cylinder block LH is on the upper side.
- 23) Remove #2 and #4 connecting rod caps and pistons in the same removal procedure as #1 and 3# connecting rod caps and pistons.
- 24) Set the part so that the cylinder block RH is on the upper side, and separate the cylinder block.
  - (1) Remove the engine stand from the cylinder block RH.

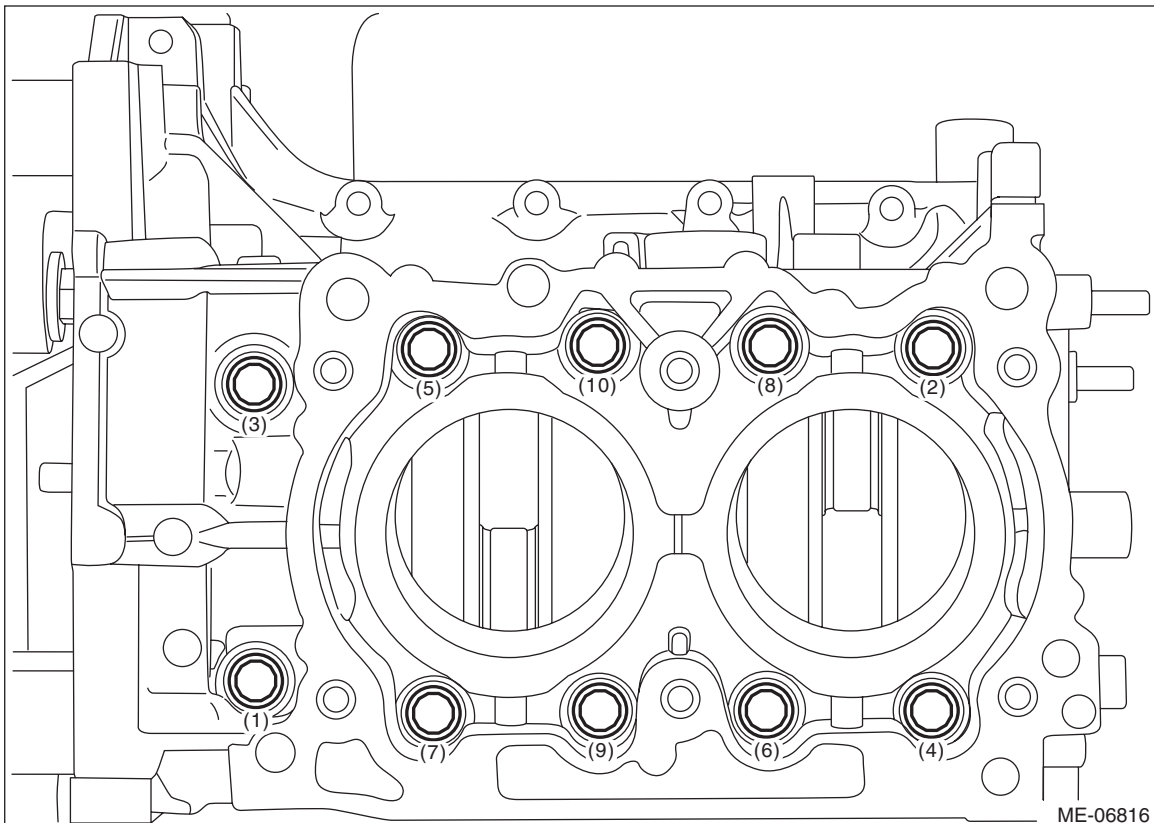


ME-06815

(2) Remove the bolt shown in the figure.



(3) Loosen the cylinder block mounting bolts in numerical order as shown in the figure.



# Cylinder Block

## MECHANICAL

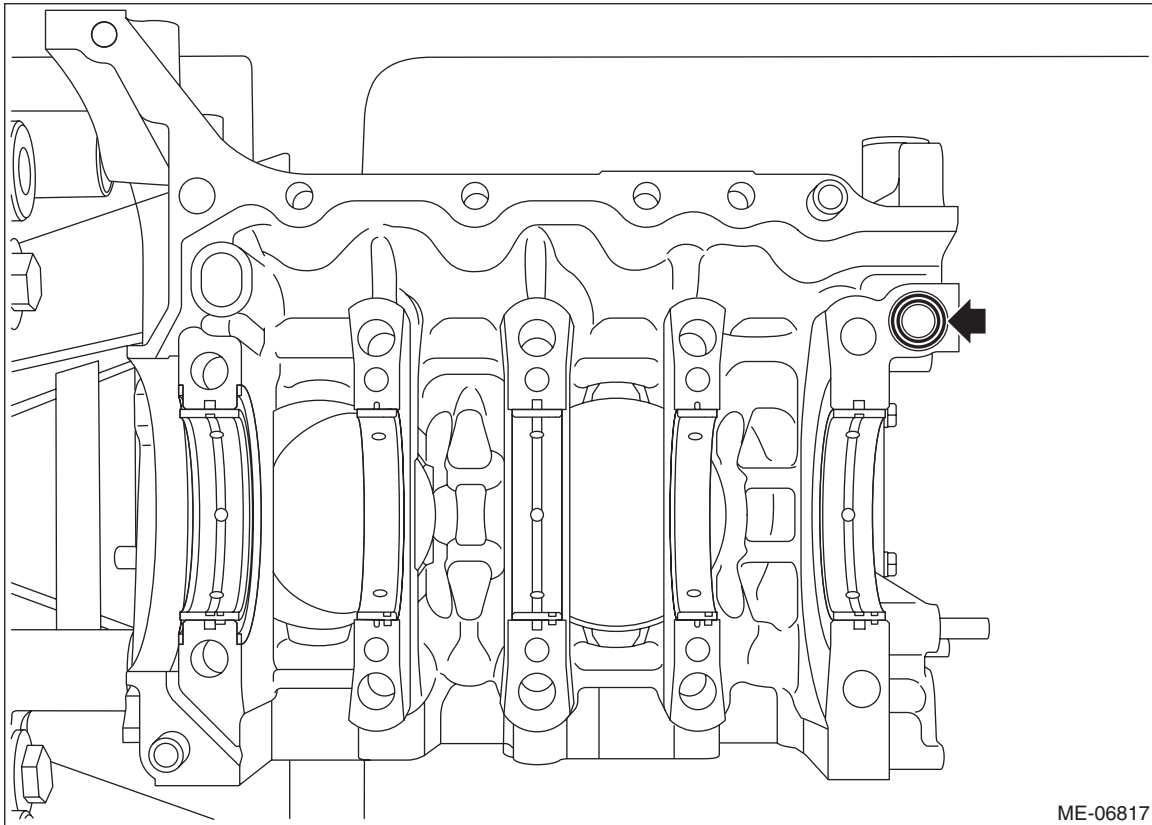
- (4) While tapping the cylinder block RH with a plastic hammer, separate the cylinder block RH from the cylinder block LH.

### NOTE:

Lift the cylinder block RH gradually, and confirm that the crankshaft is remaining in the cylinder block LH. If the cylinder block RH is lifted carelessly when separating, the crankshaft may stick to cylinder block RH, then fall off.

- 25) Remove the crankshaft from cylinder block LH, and remove the rear oil seal.

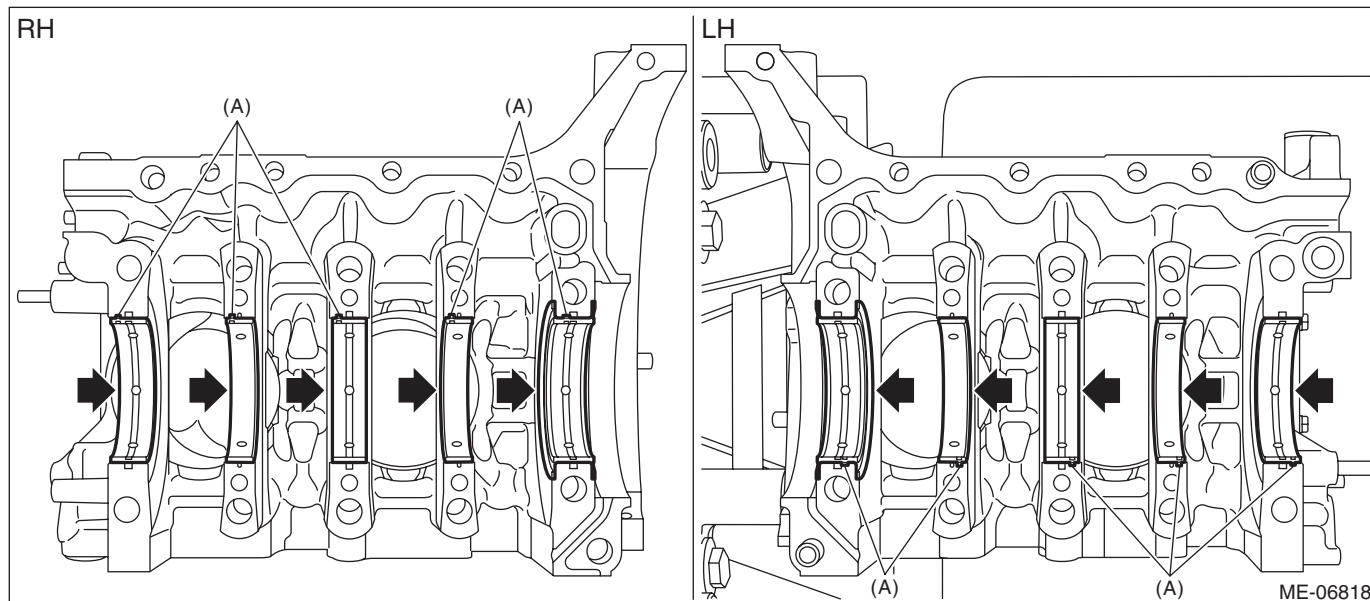
- 26) Remove the O-ring from the cylinder block LH.



27) Remove the crankshaft bearings from the cylinder block.

**NOTE:**

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



28) Remove the liquid gasket from cylinder block.

29) Remove the cylinder block LH from the engine stand.

## B: INSTALLATION

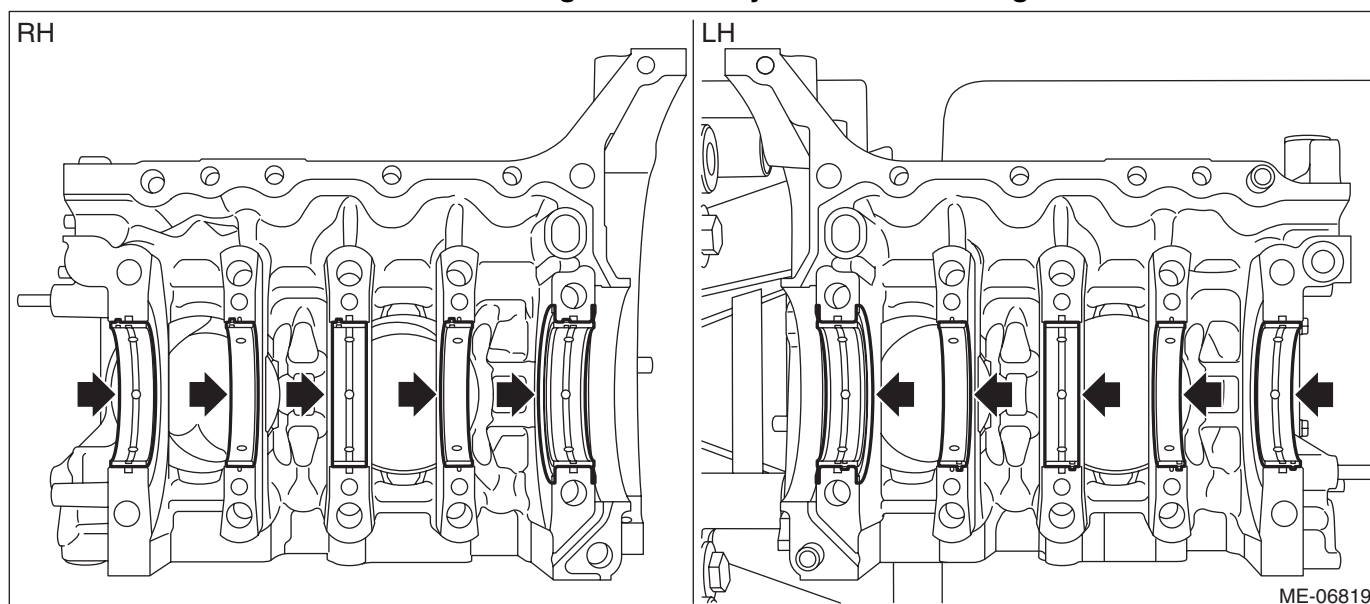
1) Install the cylinder block LH to the engine stand.

2) Apply engine oil to the crankshaft bearing, and install the crankshaft bearing to the cylinder block.

**CAUTION:**

When performing the operation of the cylinder block RH, be careful of the following.

1. Place a wood board wrapped with a waste cloth to prevent the knock pin damage and to stabilize the cylinder block before work.
2. Be careful not to scratch the mating surface of cylinder block during work.





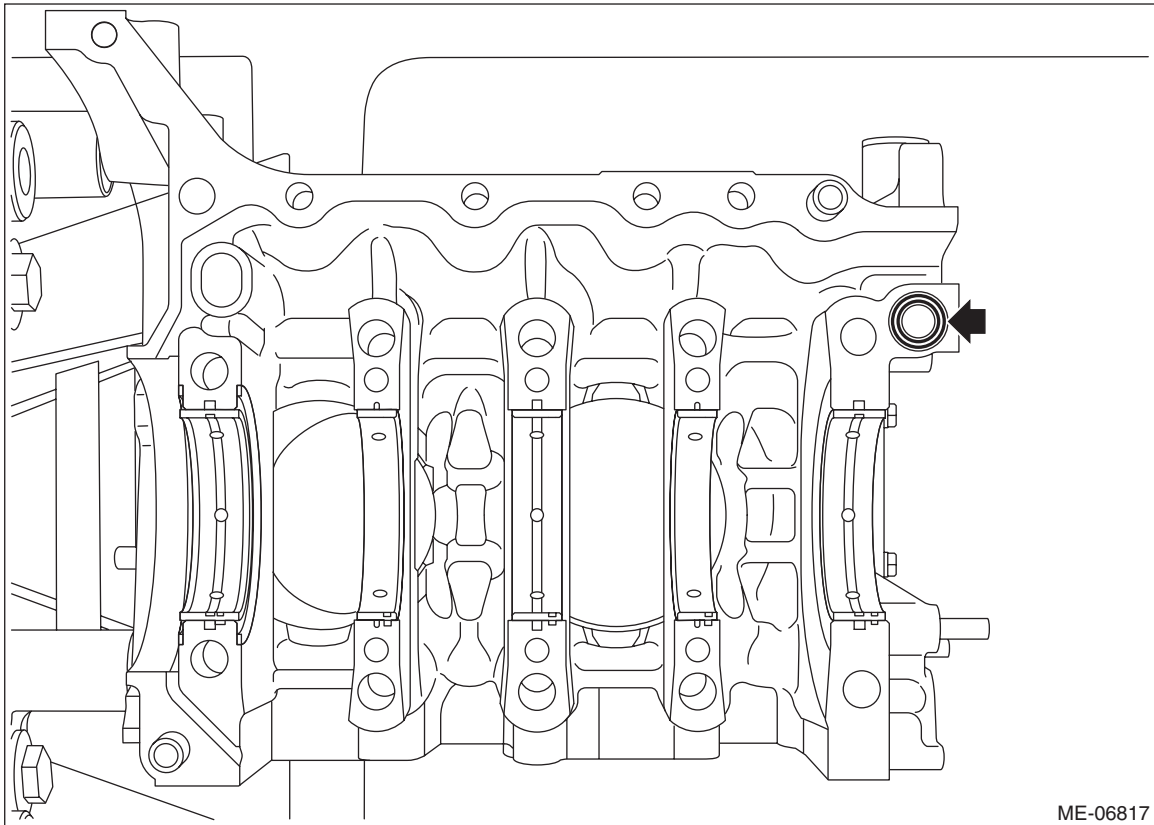
# Cylinder Block

## MECHANICAL

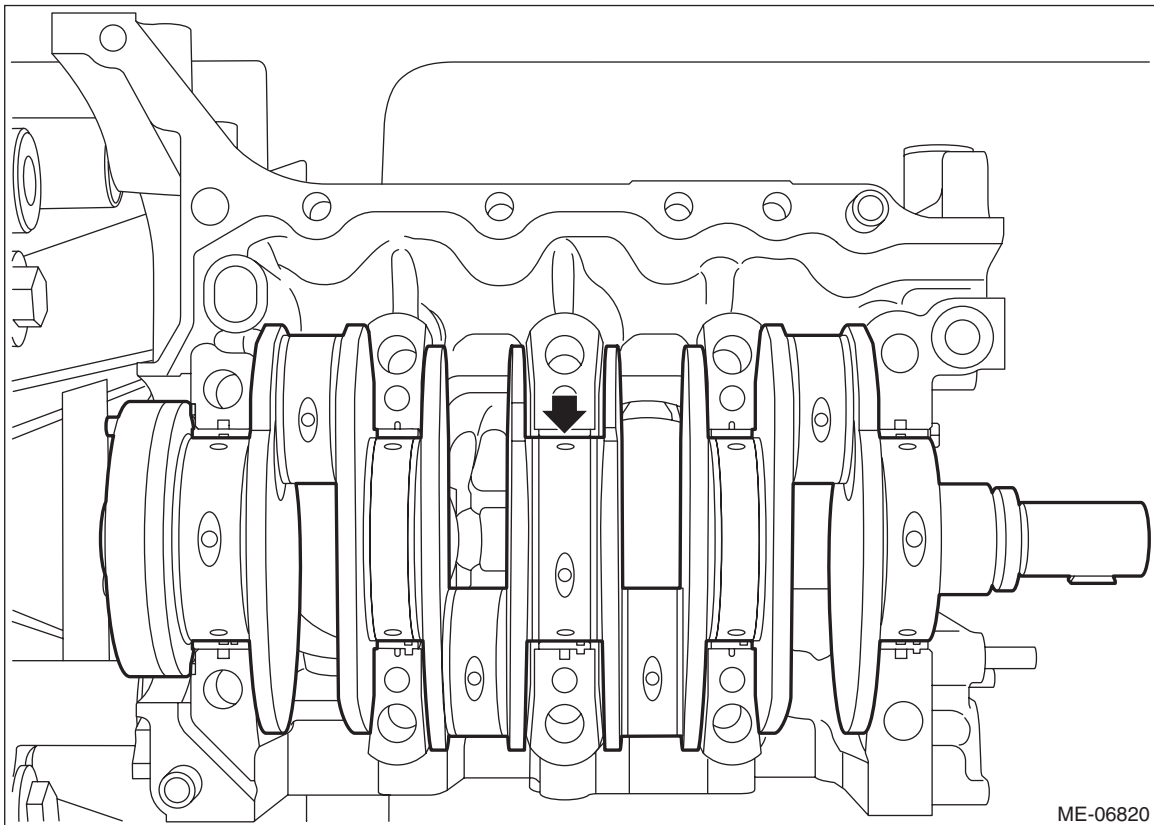
3) Install O-rings to the cylinder block LH.

NOTE:

Use new O-rings.



4) Apply engine oil to the crankshaft journal, and set the crankshaft to cylinder block LH.



5) Apply liquid gasket to the mating surface of cylinder block RH as shown in the figure.

**CAUTION:**

- Place a wood board wrapped with a waste cloth to prevent the knock pin damage and to stabilize the cylinder block before work.
- Be careful not to scratch the mating surface of cylinder block during work.
- Do not let the liquid gasket overflow to the oil passage and crankshaft bearing portions, because the engine seizure may result.

**NOTE:**

- Before applying liquid gasket, degrease the old liquid gasket seal surface of the cylinder block RH and cylinder block LH.
- Install within 5 min. after applying liquid gasket.

***Liquid gasket:***

***THREE BOND 1217G (Part No. K0877Y0100) or equivalent***

# Cylinder Block

## MECHANICAL

### Liquid gasket applying diameter:

**Mating surfaces other than ranges A, B and C**

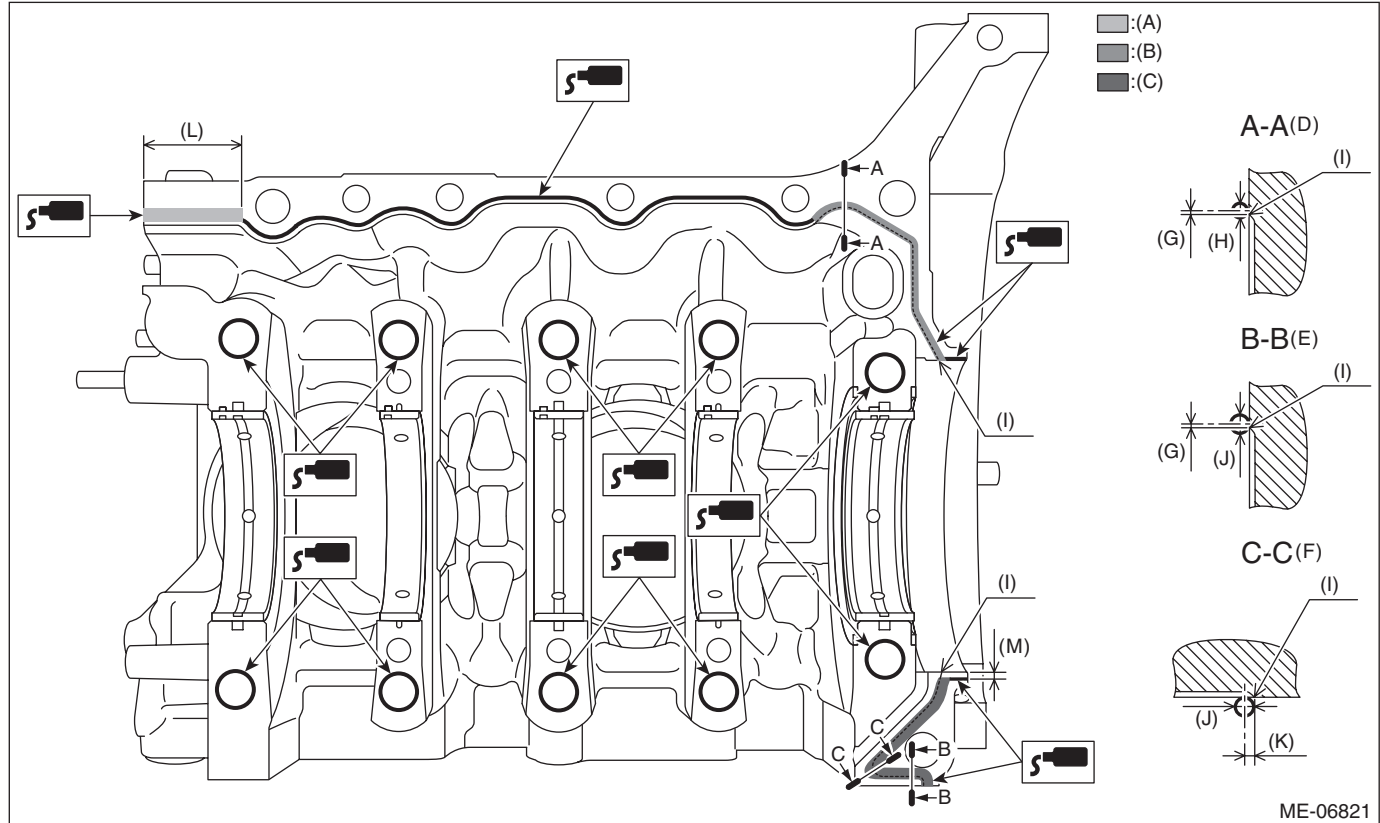
**$1 \pm 0.5 \text{ mm}$  ( $0.0394 \pm 0.0197 \text{ in}$ )**

**Mating surfaces of ranges A and C**

**$4 \pm 0.5 \text{ mm}$  ( $0.1575 \pm 0.0197 \text{ in}$ )**

**Mating surfaces of range B**

**$3.2 \pm 0.5 \text{ mm}$  ( $0.1260 \pm 0.0197 \text{ in}$ )**



- |   |  |                        |
|---|--|------------------------|
| (A) Range A   | (F) Liquid gasket applying position of mating surfaces (the edge) of range C | (K) 2 mm (0.0787 in)   |
| (B) Range B   | (G) 1 mm (0.0394 in) or less   | (L) 36 mm (1.4173 in)  |
| (C) Range C   | (H) $\phi 3.2 \pm 0.5 \text{ mm}$ ( $0.1260 \pm 0.0197 \text{ in}$ )         | (M) 2.5 mm (0.0984 in) |
| (D) Liquid gasket applying position of mating surfaces of range B                       | (I) Chamfer edge   |                        |
| (E) Liquid gasket applying position of mating surfaces (other than the edge) of range C | (J) $\phi 4 \pm 0.5 \text{ mm}$ ( $0.1575 \pm 0.0197 \text{ in}$ )           |                        |

6) Install the cylinder block RH to the cylinder block LH.

7) Join the cylinder blocks.

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

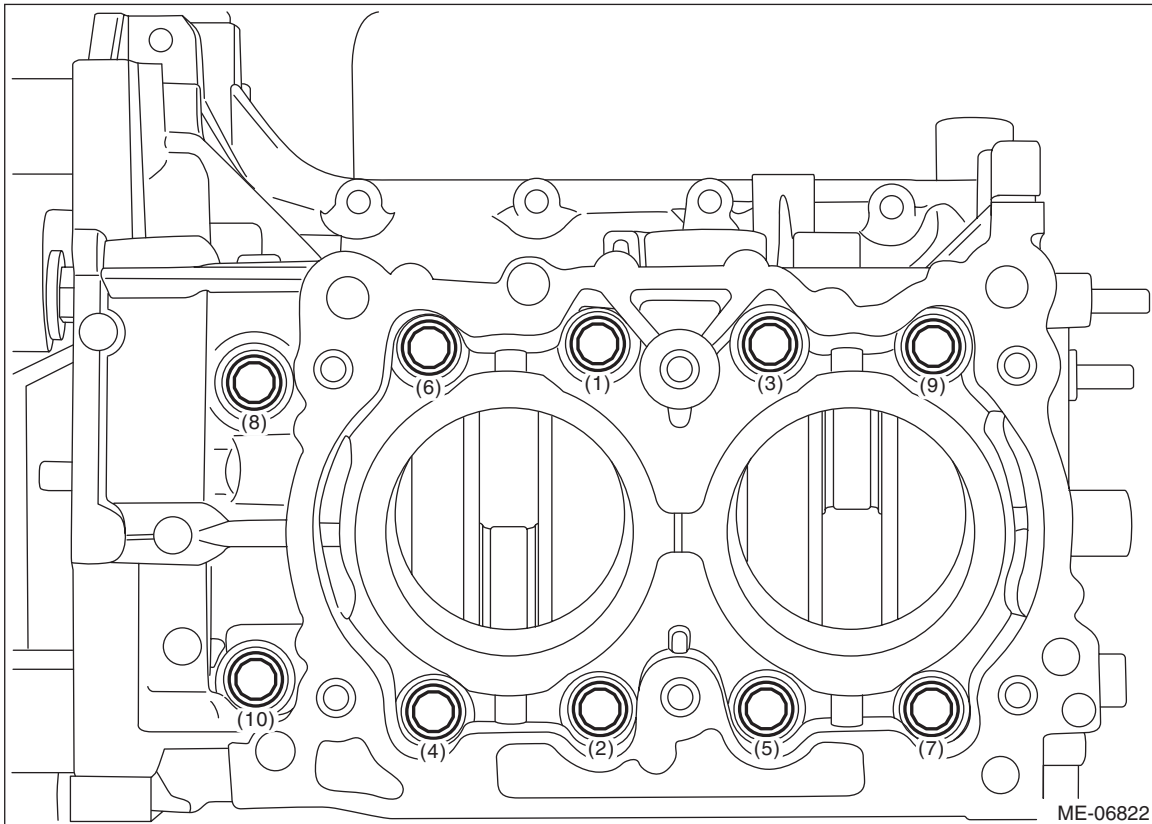
**NOTE:**

To prevent mixture of engine oil into the water jacket, do not apply a large amount.

(2) Tighten all mounting bolts with a torque of 35 N·m (3.6 kgf-m, 25.8 ft-lb) in numerical order as shown in the figure.

**CAUTION:**

**When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.**



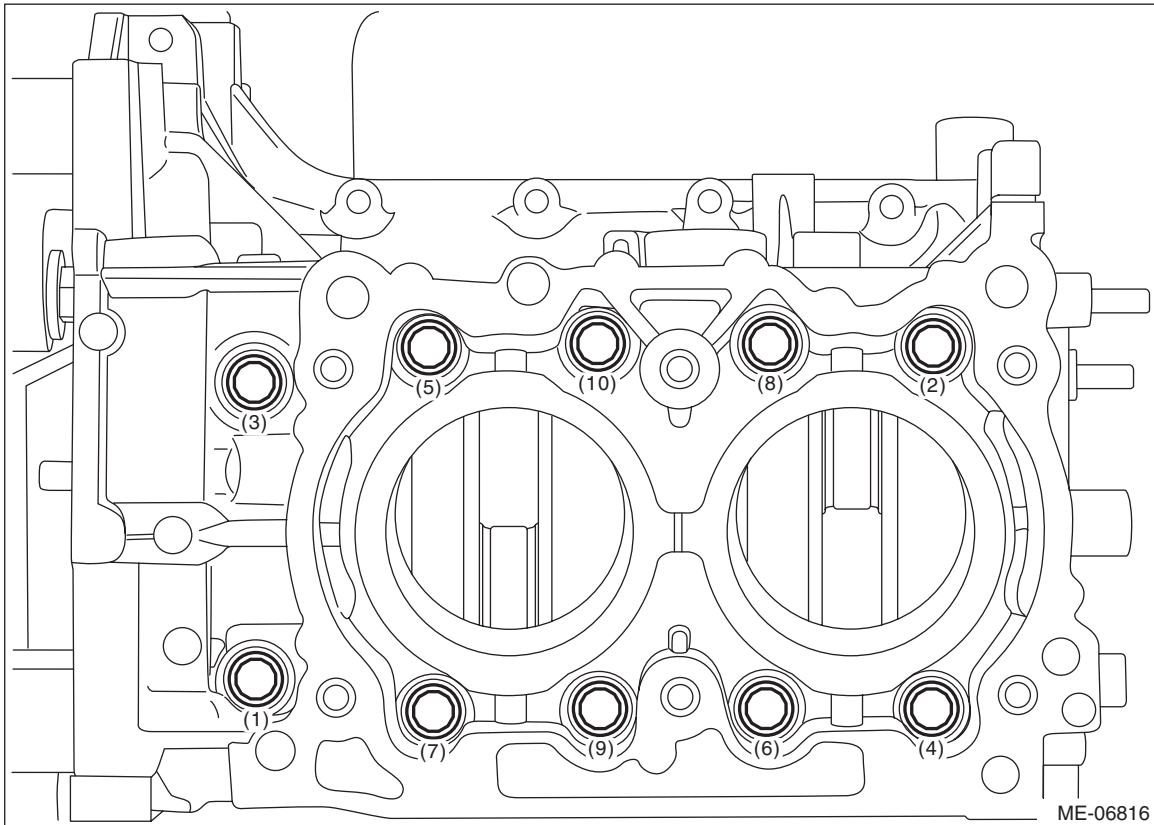
# Cylinder Block

## MECHANICAL

(3) Loosen all mounting bolts by 180° in numerical order as shown in the figure.

### CAUTION:

When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



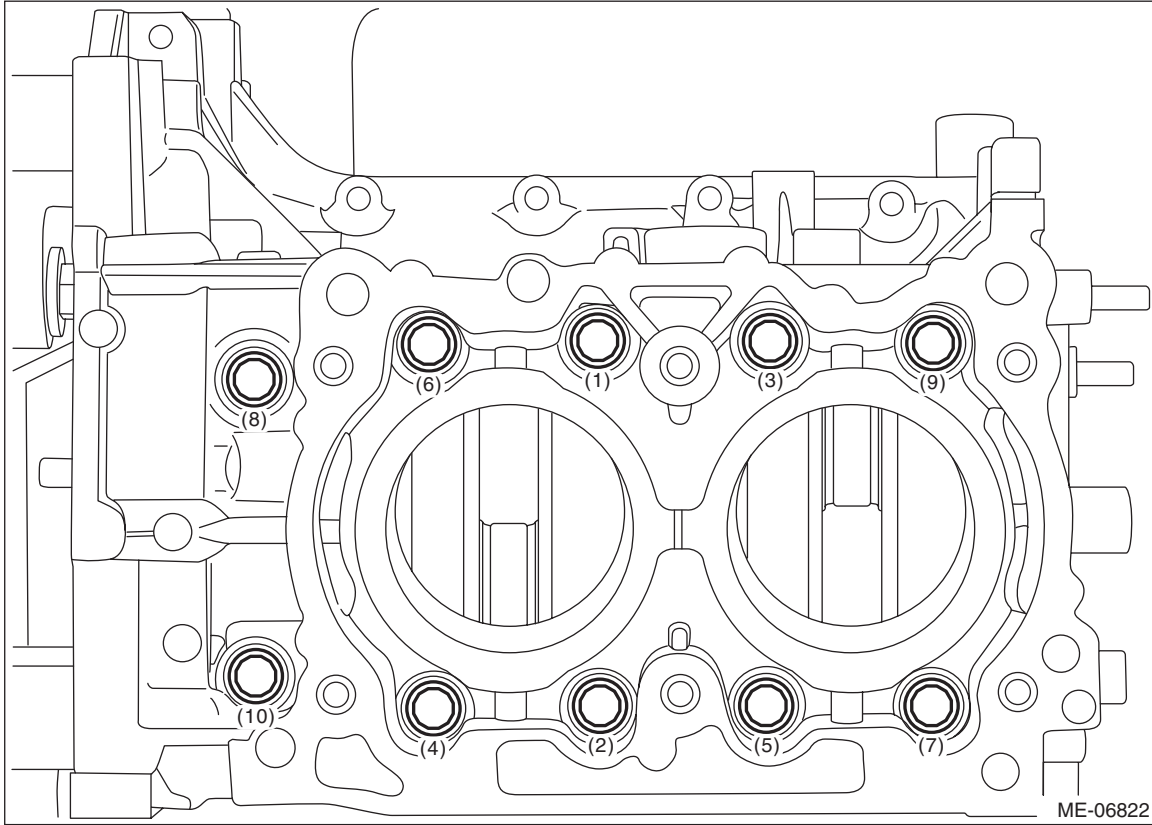
# Cylinder Block

MECHANICAL

(4) Tighten all mounting bolts with a torque of 35 N·m (3.6 kgf-m, 25.8 ft-lb) in numerical order as shown in the figure.

**CAUTION:**

When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.





## Cylinder Block

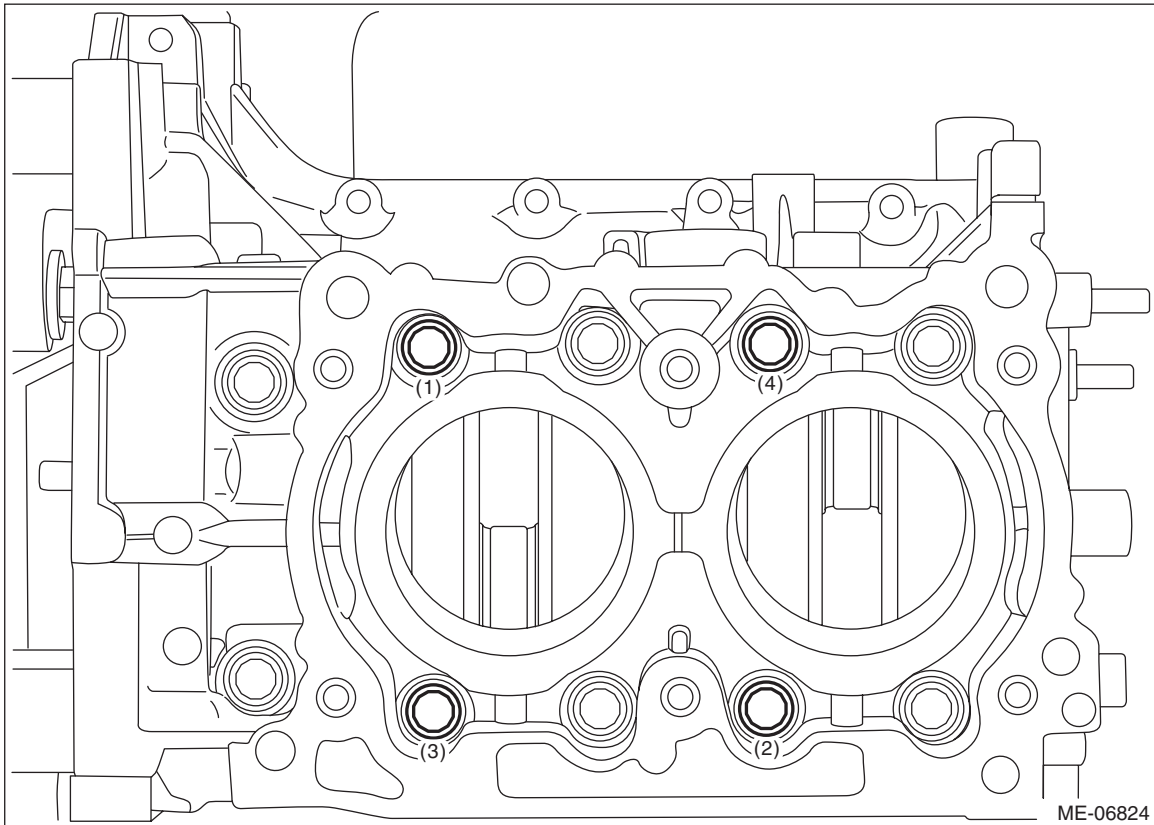
### MECHANICAL

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(5) Loosen the mounting bolts (4 places) by 180° in numerical order as shown in the figure.

**CAUTION:**

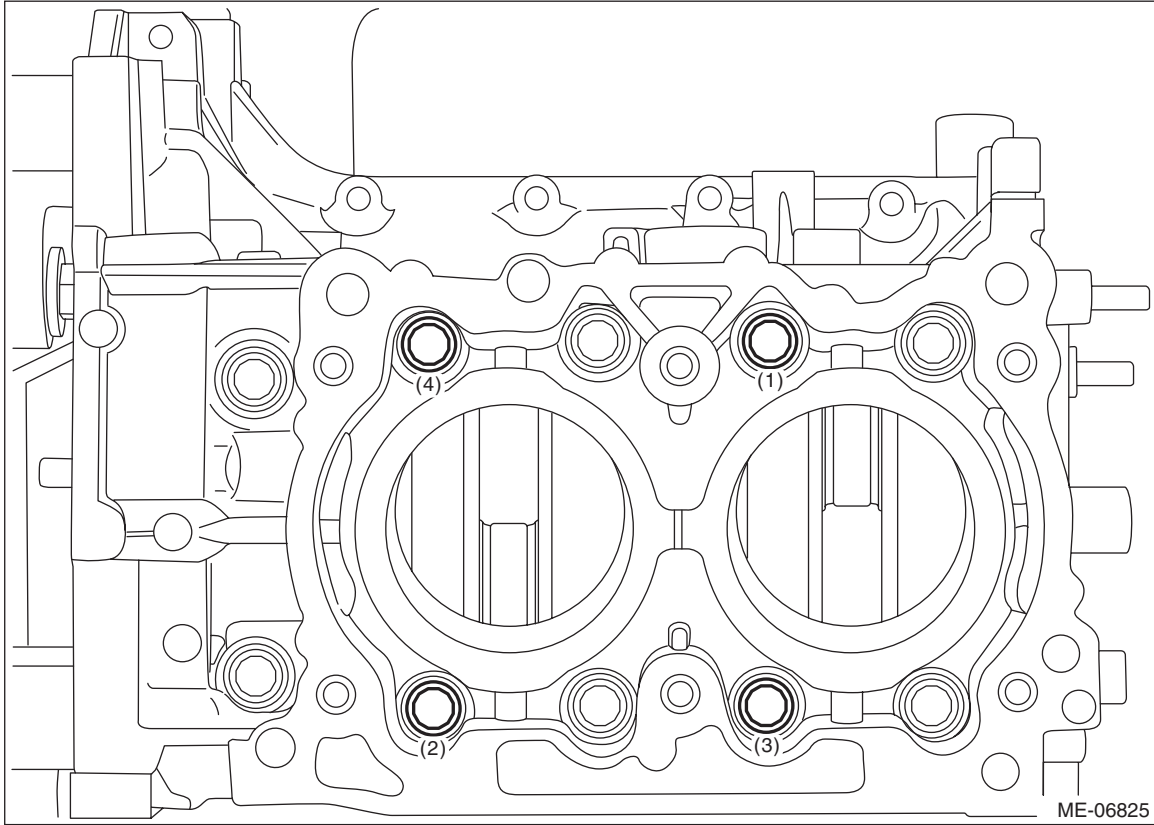
**When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.**



(6) Tighten the mounting bolts (4 places) with a torque of 17 N·m (1.7 kgf-m, 12.5 ft-lb) in numerical order as shown in the figure.

**CAUTION:**

When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



# Cylinder Block

## MECHANICAL

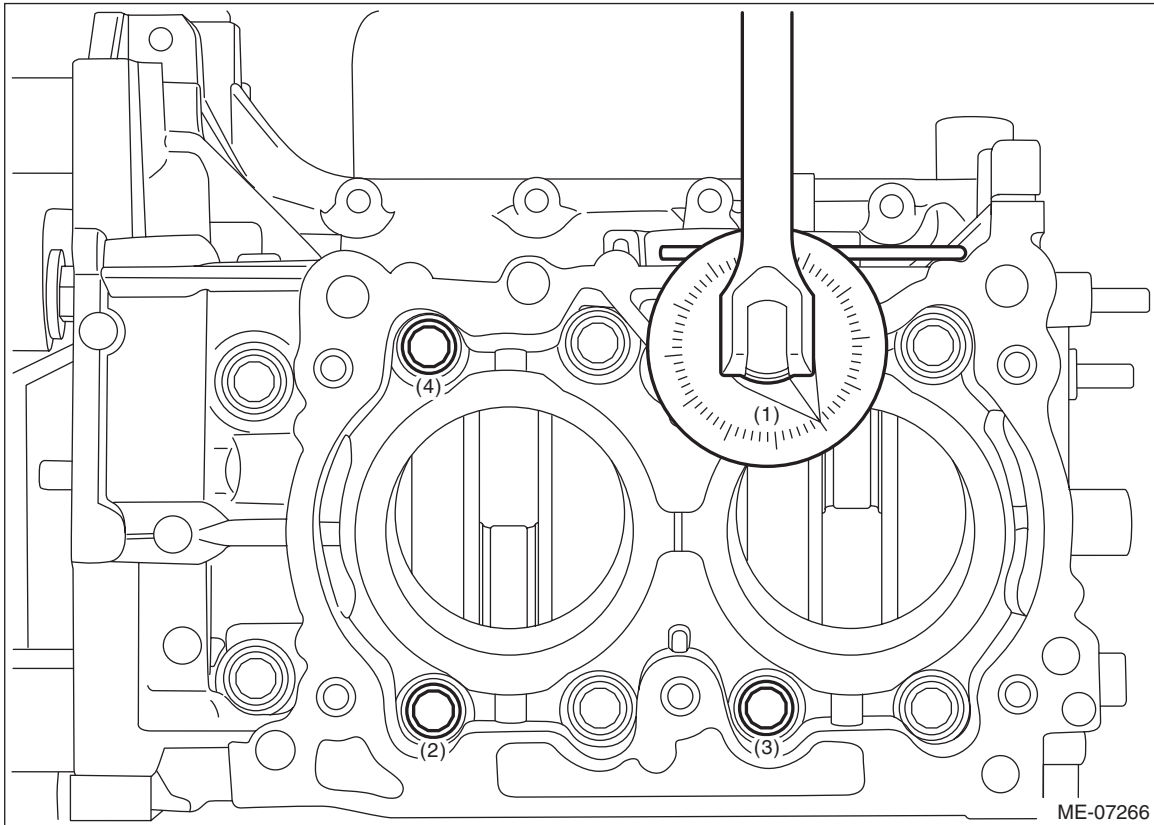
(7) Using angle gauge, tighten the mounting bolts (4 places) with specified angle in numerical order as shown in the figure.

### CAUTION:

When tightening the mounting bolts with specified angle, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.

**Tightening angle:**

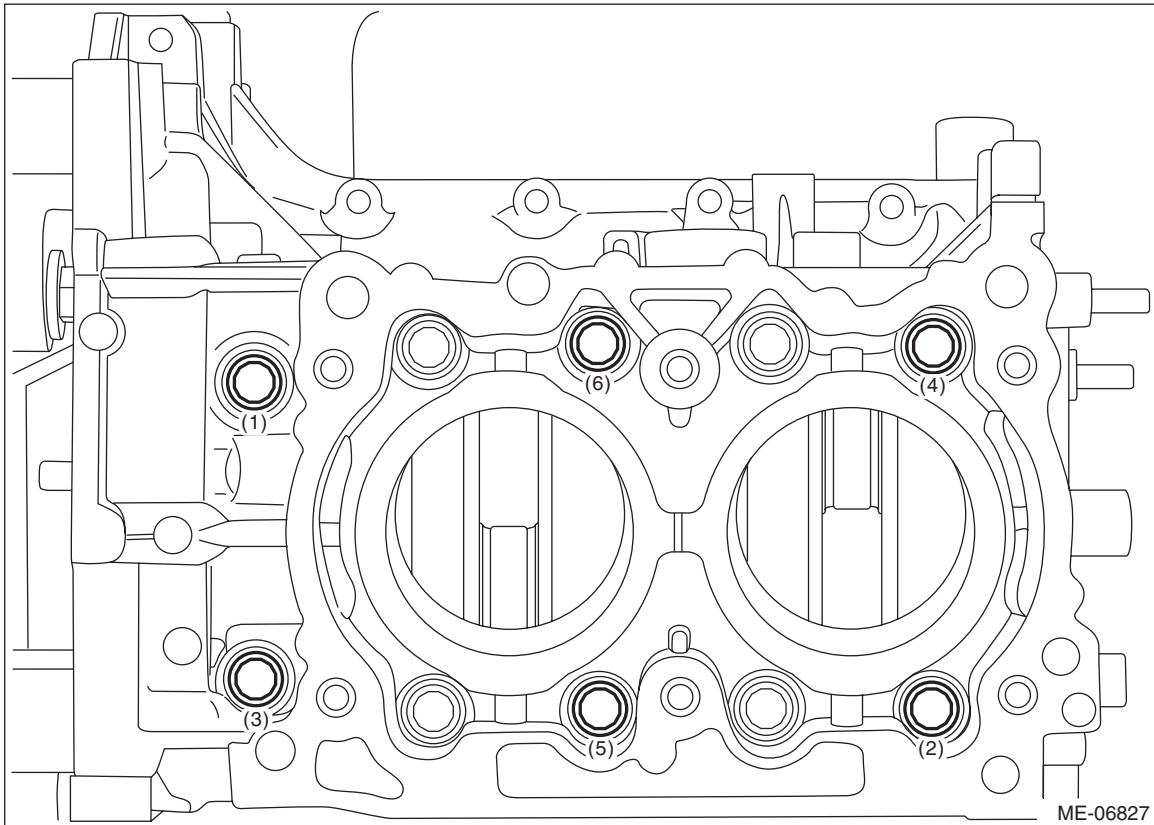
**$60^{\circ} \pm 2^{\circ}$**



(8) Loosen the mounting bolts (6 places) by 180° in numerical order as shown in the figure.

**CAUTION:**

**When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.**



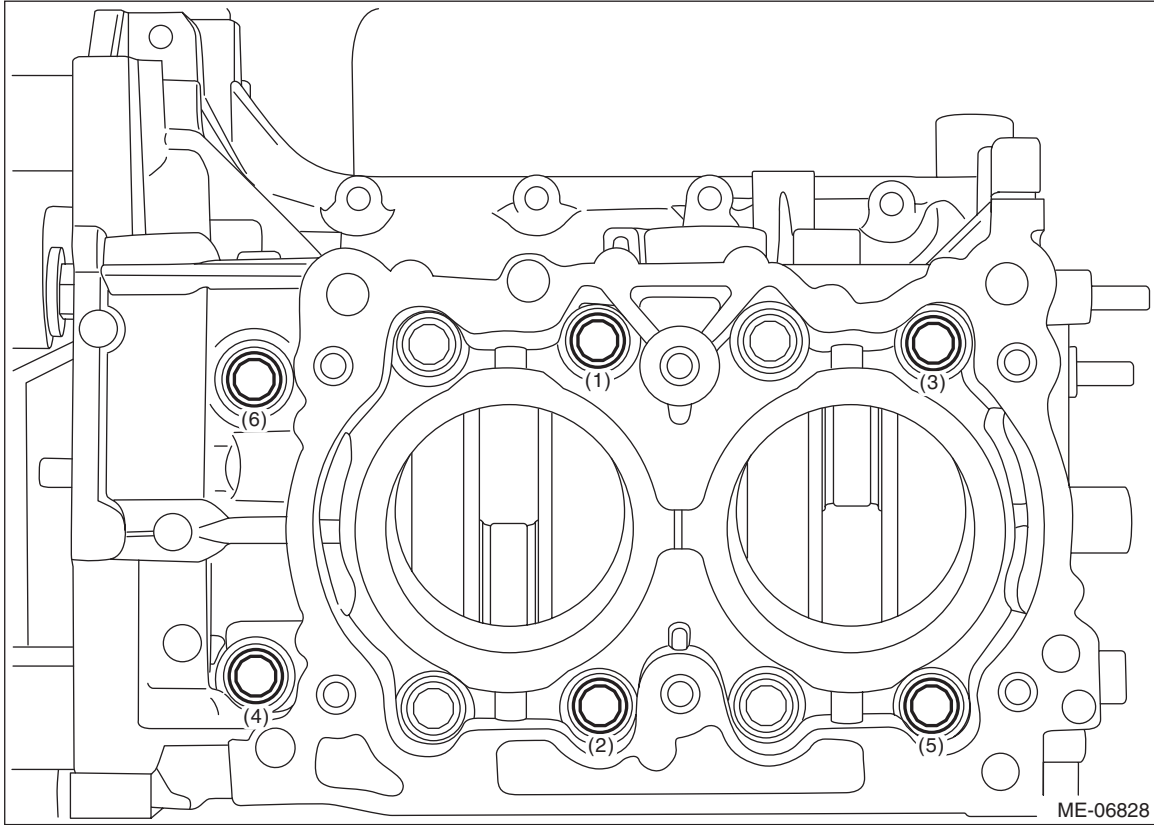
## Cylinder Block

### MECHANICAL

(9) Tighten the mounting bolts (6 places) with a torque of 17 N·m (1.7 kgf-m, 12.5 ft-lb) in numerical order as shown in the figure.

#### CAUTION:

When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



# Cylinder Block

MECHANICAL

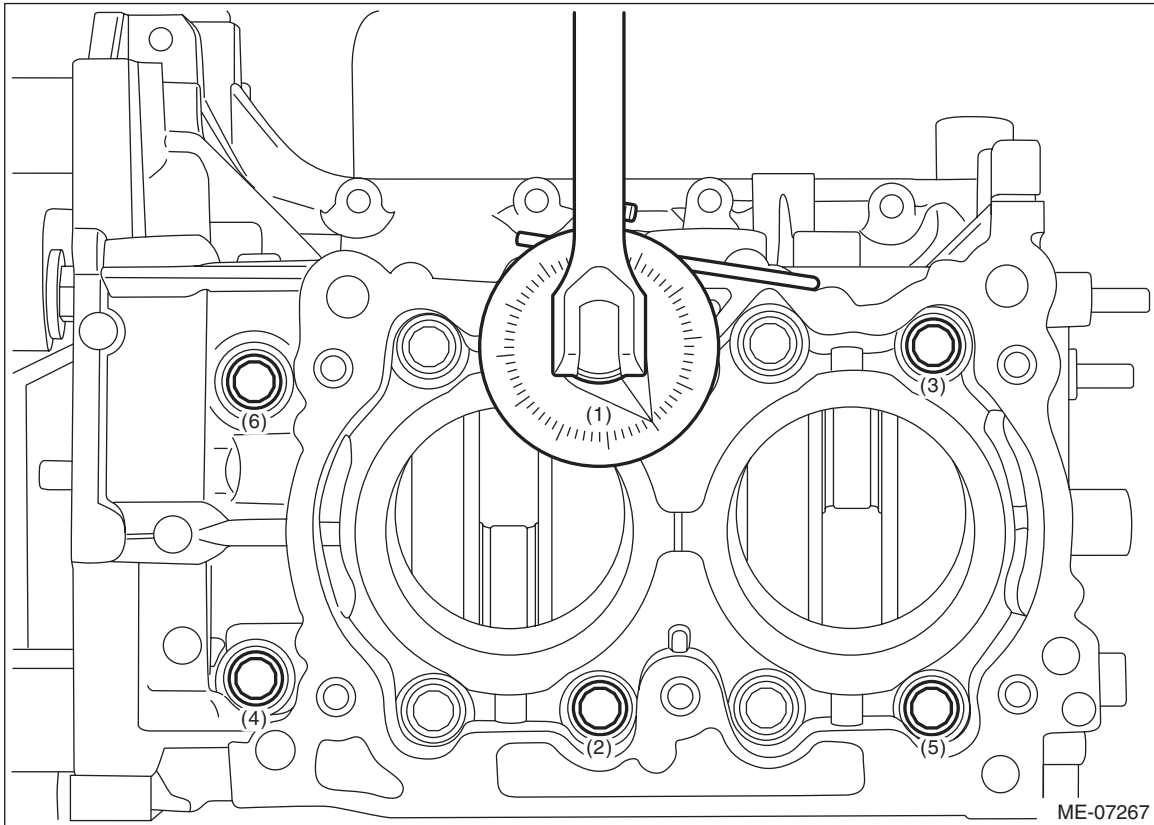
(10) Using angle gauge, tighten the mounting bolts (6 places) with specified angle in numerical order as shown in the figure.

**CAUTION:**

When tightening the mounting bolts with specified angle, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.

**Tightening angle:**

$60^{\circ} \pm 2^{\circ}$





# Cylinder Block

## MECHANICAL

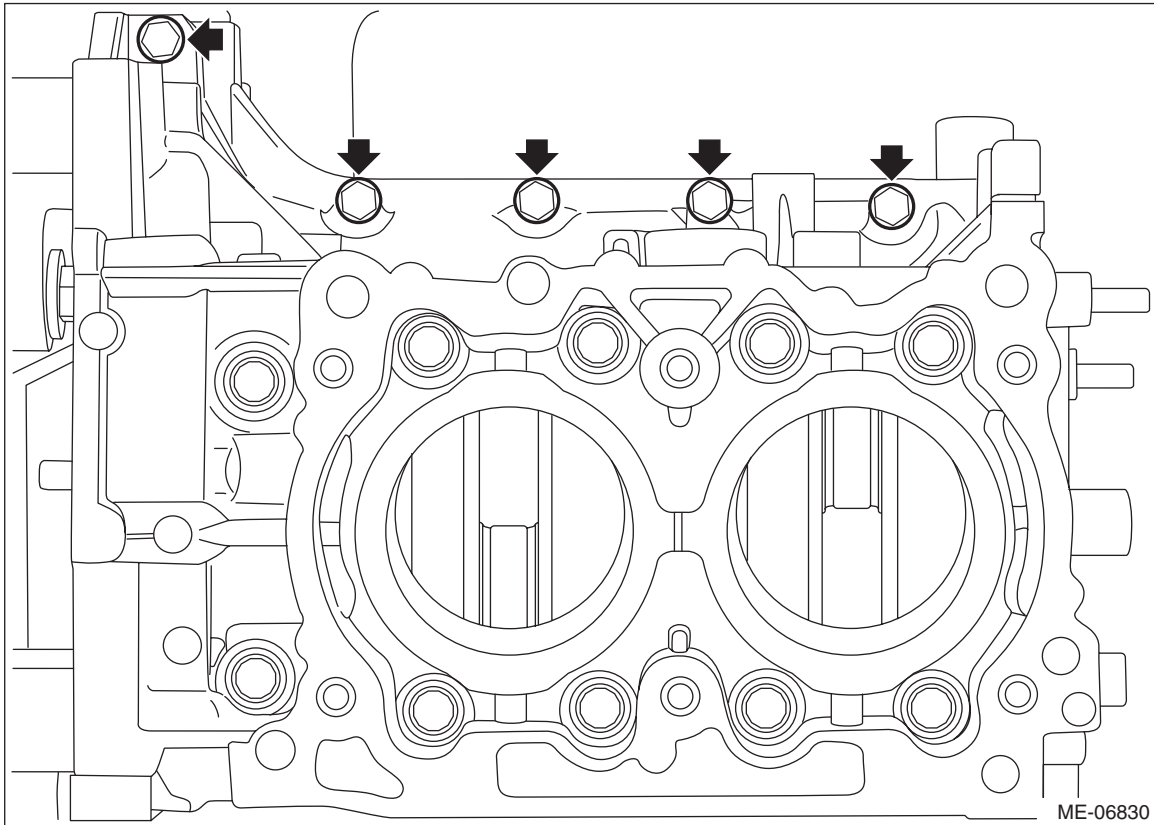
(11) Install the bolt shown in the figure.

### NOTE:

After tightening, if the liquid gasket is squeezed out in the seal surface area of the chain cover and oil pan upper, completely remove any liquid gasket that is squeezed out. Any liquid gasket on the chamfer area, however, should not be removed.

### **Tightening torque:**

**25 N·m (2.5 kgf-m, 18.4 ft-lb)**



8) Set the part so that the installation surface of the oil pan upper is on the upper side.

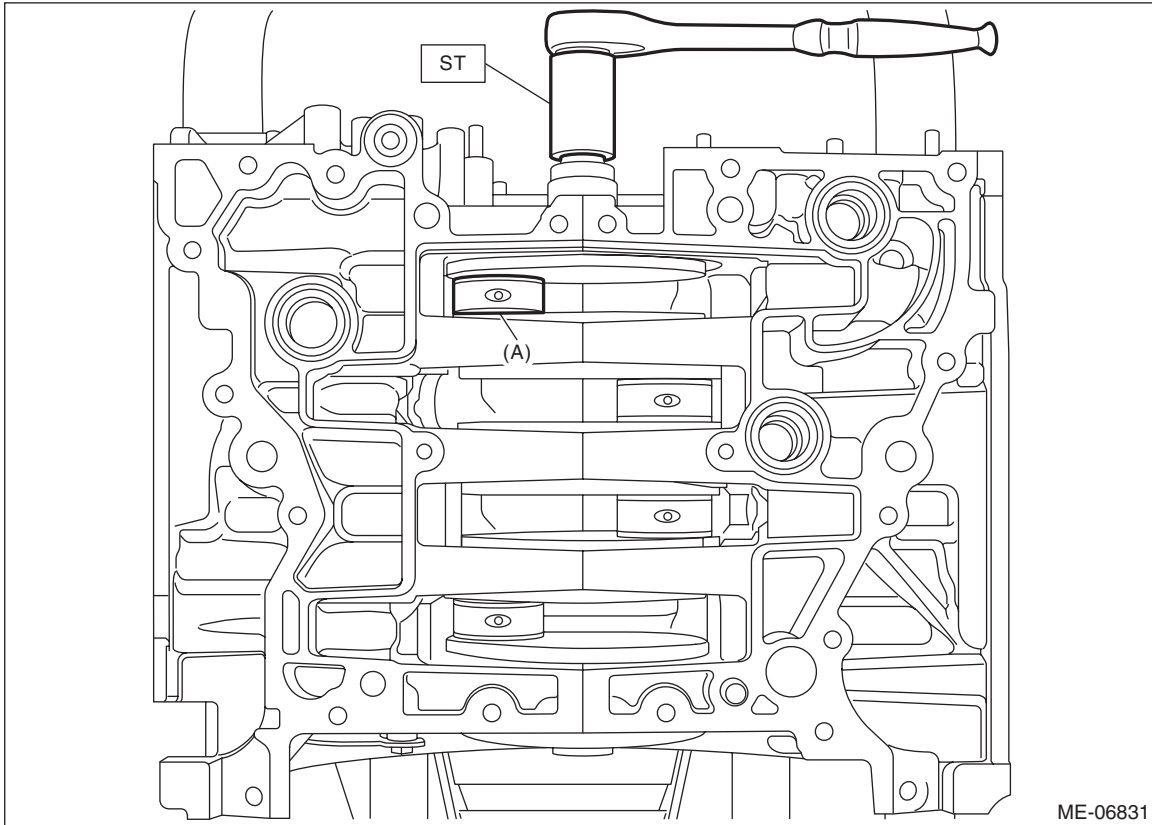
9) Check that the piston ring gap for each piston is positioned correctly.<Ref. to ME(H4DOTC)-315, PISTON AND CONNECTING ROD, ASSEMBLY, Cylinder Block.>

10) Install the piston and connecting rod to the cylinder block.

(1) Apply engine oil to the outer circumference of each piston, crankshaft pin, and in the cylinder block.

(2) Turn the crankshaft so that the #1 pin (A) of crankshaft is positioned at TDC using ST.

ST 18252AA000 CRANKSHAFT SOCKET



ME-06831

# Cylinder Block

## MECHANICAL

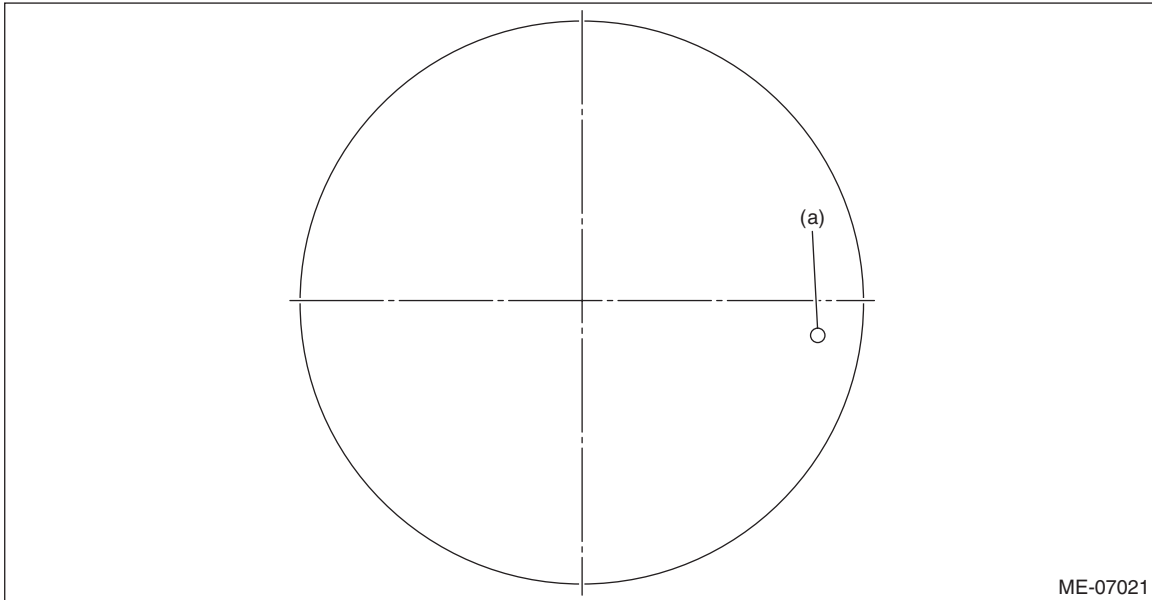
(3) Compress the piston ring using piston ring compressor, and insert the #1 connecting rod with #1 piston into cylinder block.

### CAUTION:

- Be careful not to damage the cylinder liner and #1 pin of crankshaft by the #1 connecting rod large end.
- Be careful not to apply strong impact when inserting to prevent connecting rod bearing from falling off.

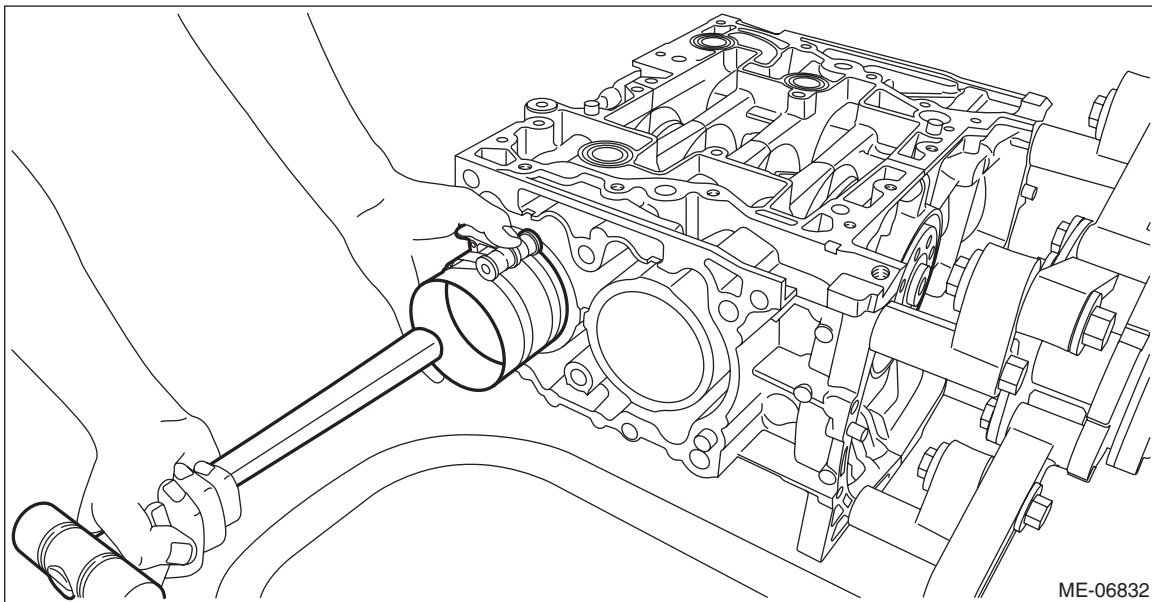
### NOTE:

- Face the piston front mark (round mark) towards the front of the engine.



(a) Front mark

- Insert while lightly tapping the crown of the piston with the handle of a plastic hammer.

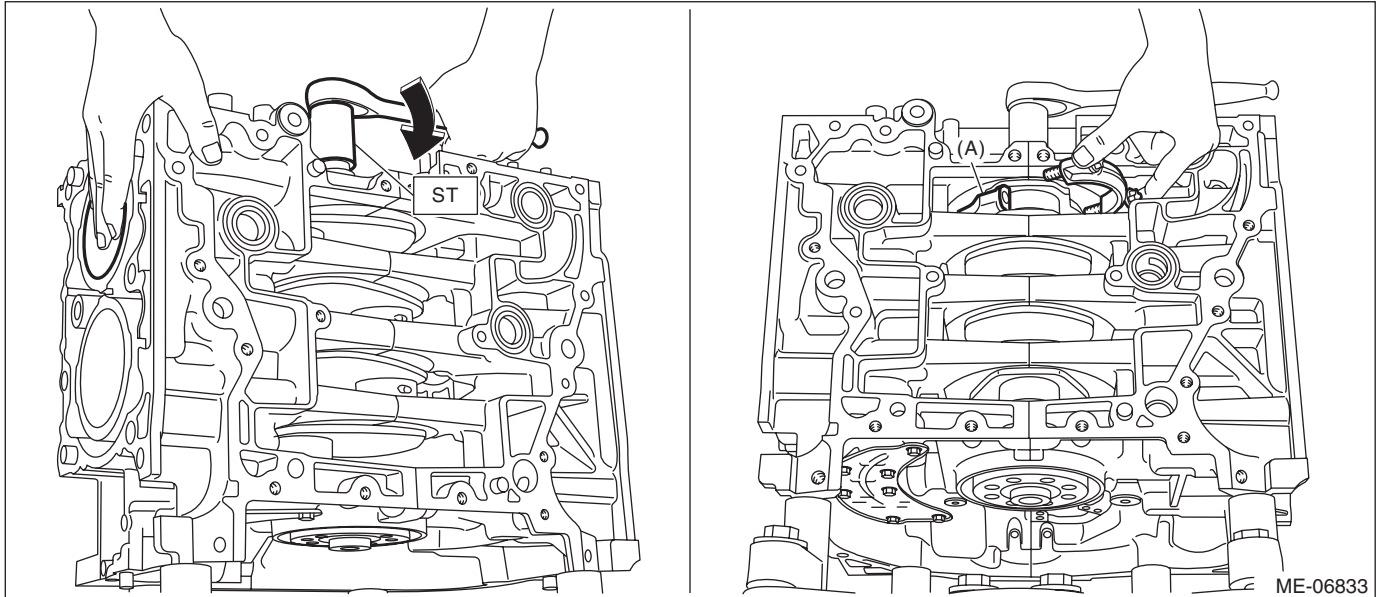


(4) Turn the crankshaft counterclockwise so that the #1 pin of crankshaft and the large end (A) of #1 connecting rod are positioned as shown in the figure using ST, while pressing the #1 piston crown, and then set the #1 connecting rod cap and #1 connecting rod cap bolt.

**NOTE:**

- Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.
- Use a new connecting rod cap bolt.
- Apply a coat of engine oil to the #1 connecting rod cap seat and the connecting rod cap bolt threads.

ST 18252AA000 CRANKSHAFT SOCKET

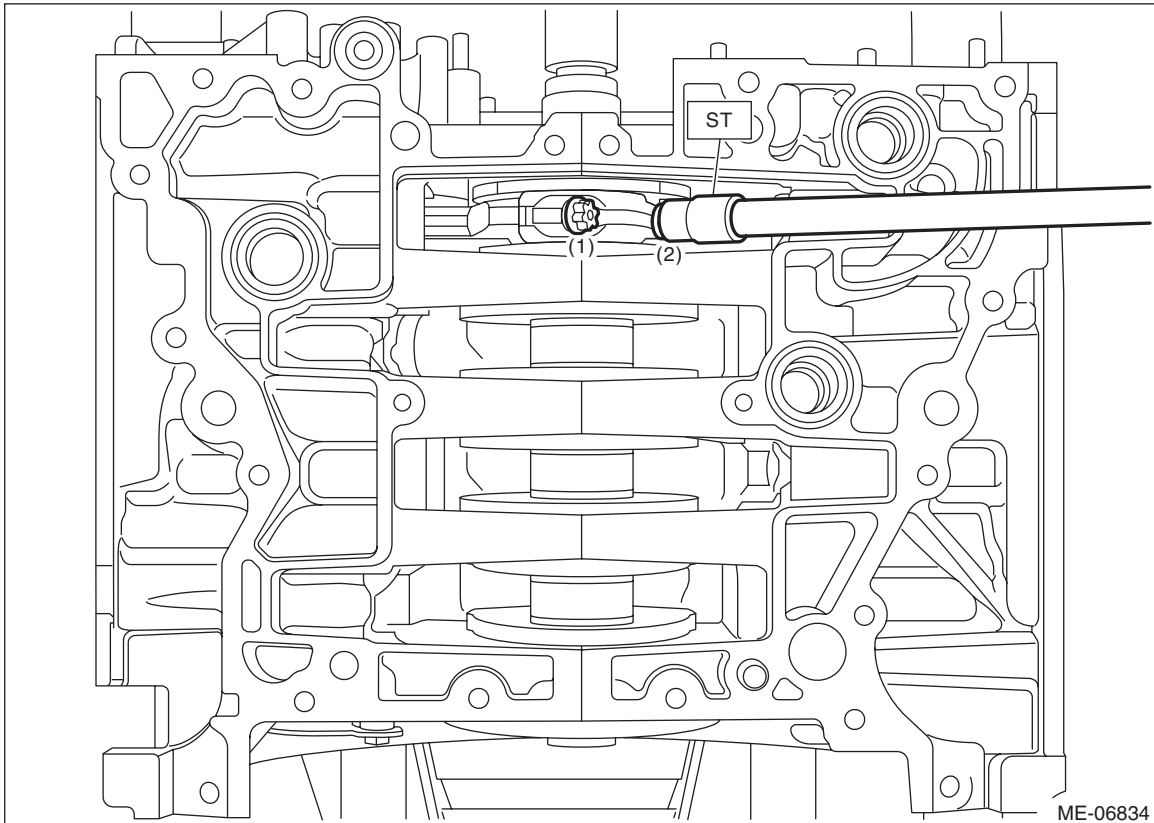


## Cylinder Block

### MECHANICAL

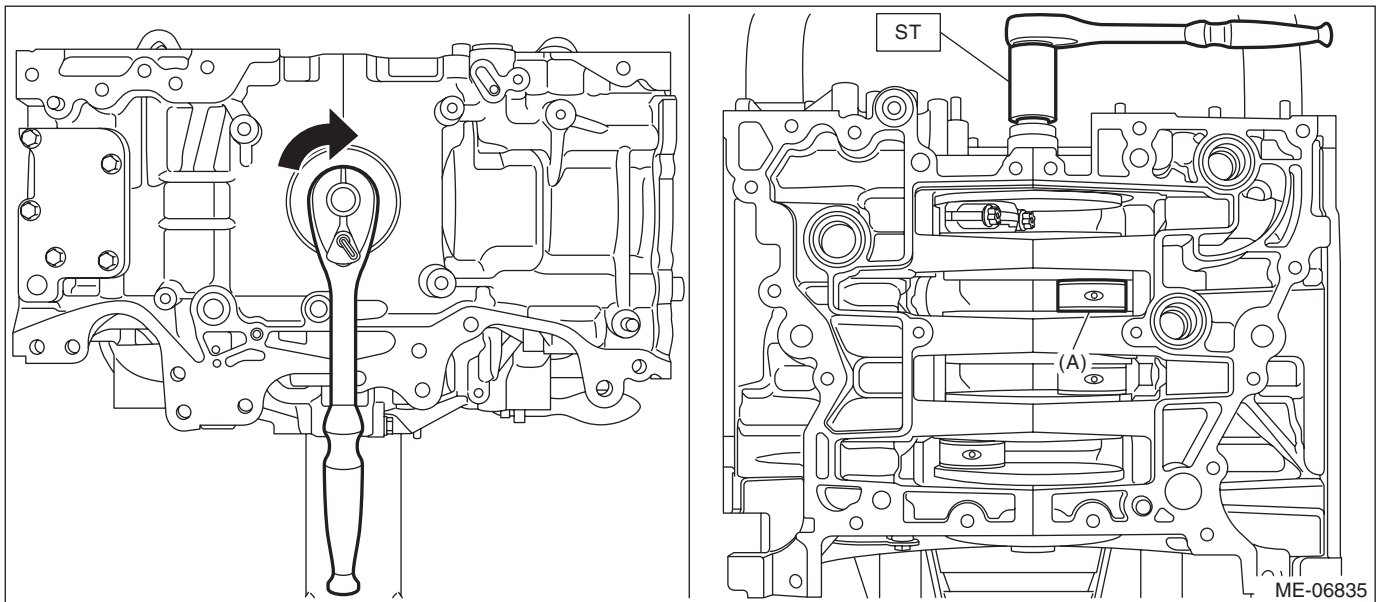
(5) Using ST, tighten the #1 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 25 N·m (2.5 kgf-m, 18.4 ft-lb) in numerical order as shown in the figure.

ST 18270AA020 SOCKET



(6) Turn the crankshaft clockwise so that the #2 pin (A) of crankshaft is positioned at TDC using ST.

ST 18252AA000 CRANKSHAFT SOCKET



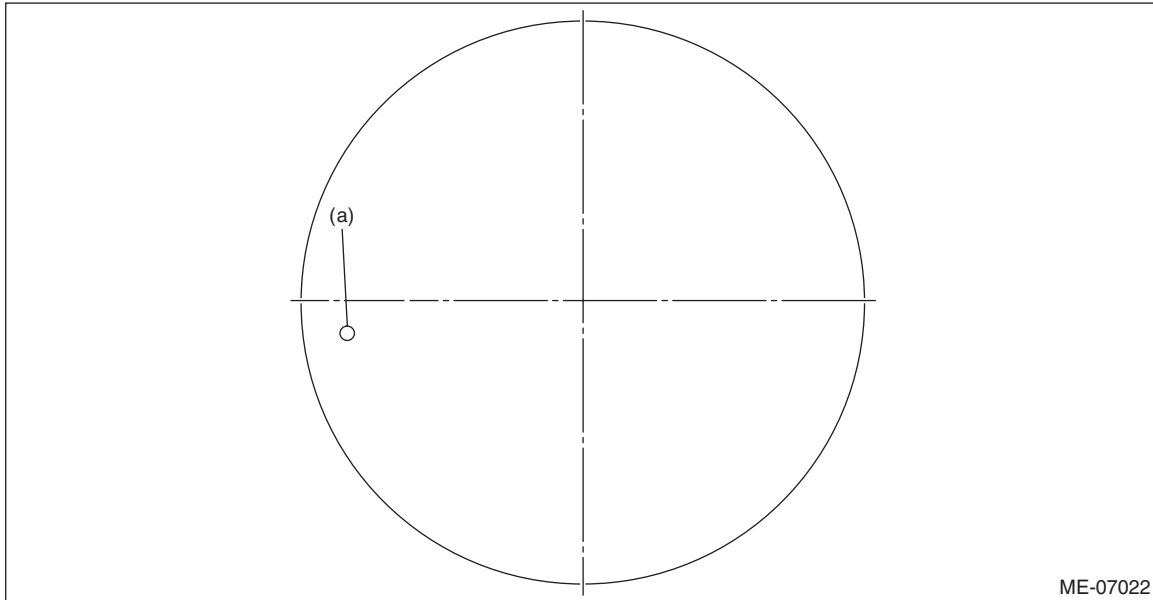
(7) Compress the piston ring using piston ring compressor, and insert the #2 connecting rod with #2 piston into cylinder block.

**CAUTION:**

- Be careful not to damage the cylinder liner and #2 pin of crankshaft by the #2 connecting rod large end.
- Be careful not to apply strong impact when inserting to prevent connecting rod bearing from falling off.

**NOTE:**

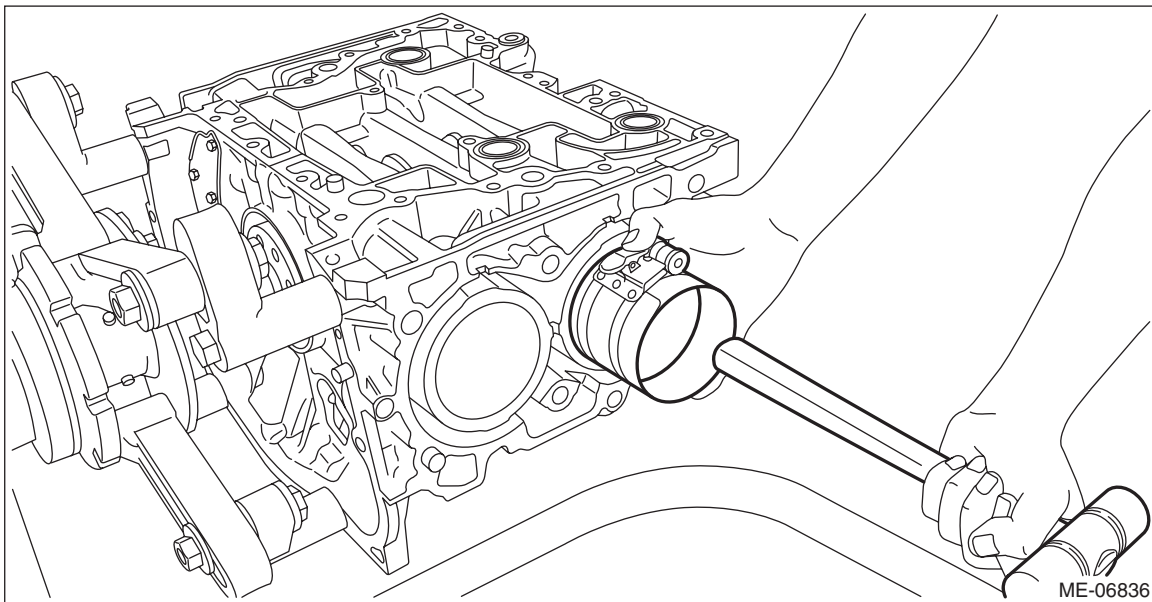
- Face the piston front mark (round mark) towards the front of the engine.



ME-07022

(a) Front mark

- Insert while lightly tapping the crown of the piston with the handle of a plastic hammer.



ME-06836



# Cylinder Block

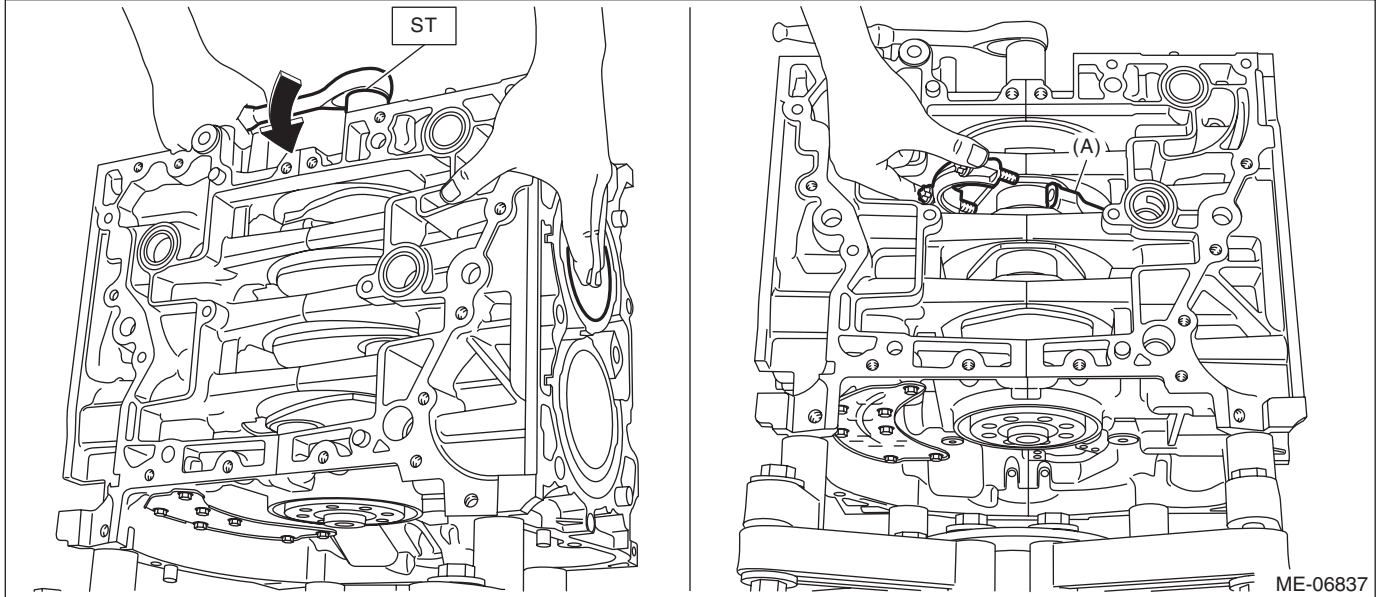
## MECHANICAL

(8) Turn the crankshaft clockwise so that the #2 pin of crankshaft and the large end (A) of #2 connecting rod are positioned as shown in the figure using ST, while pressing the #2 piston crown, and then set the #2 connecting rod cap and #2 connecting rod cap bolt.

### NOTE:

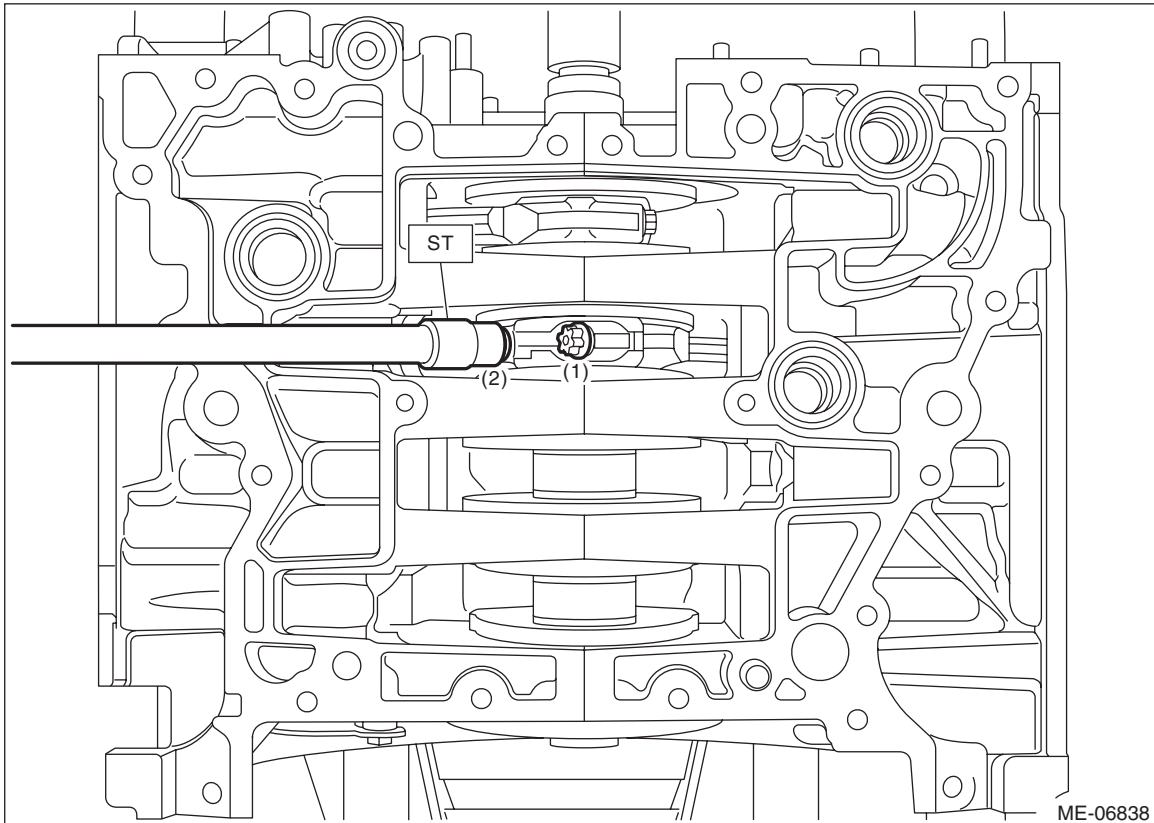
- Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.
- Use a new connecting rod cap bolt.
- Apply a coat of engine oil to the #2 connecting rod cap seat and the connecting rod cap bolt threads.

ST 18252AA000 CRANKSHAFT SOCKET



(9) Using ST, tighten the #2 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 25 N·m (2.5 kgf-m, 18.4 ft-lb) in numerical order as shown in the figure.

ST 18270AA020 SOCKET



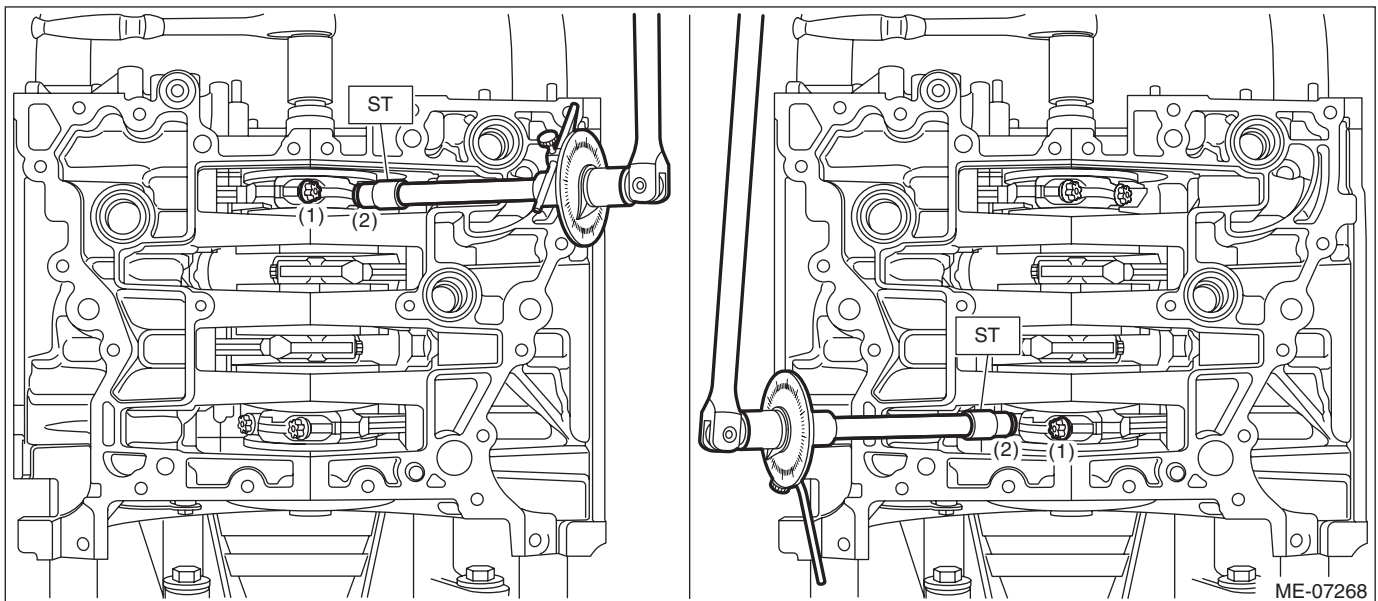
(10) Install #3 and #4 pistons and connecting rod caps in the same installation procedure as #1 and #2 pistons and connecting rod caps.

(11) Using ST and angle gauge, tighten the #1 connecting rod cap bolts and #4 connecting rod cap bolts with specified angle in numerical order as shown in the figure.

ST 18270AA020 SOCKET

**Tightening angle:**

$90^{+5^{\circ}}_{-0^{\circ}}$

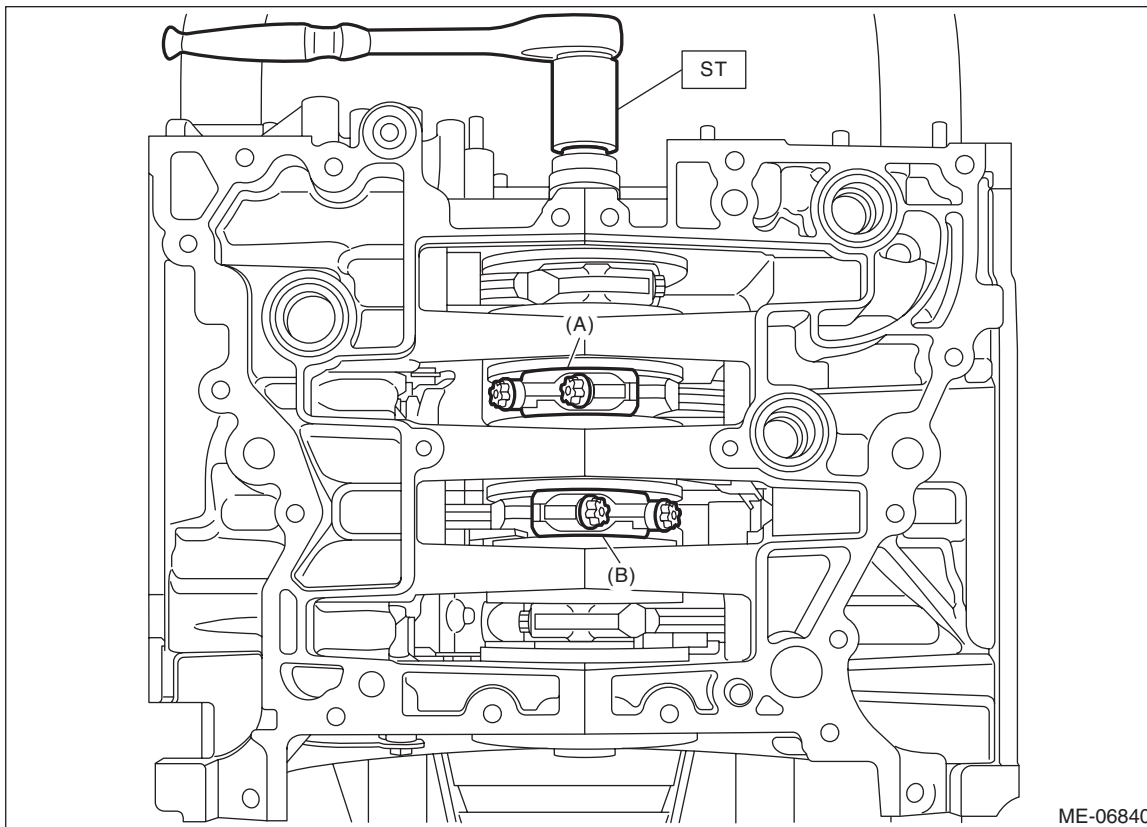


## Cylinder Block

### MECHANICAL

(12) Turn the crankshaft so that the #2 connecting rod cap (A) and #3 connecting rod cap (B) is located at the position shown in the figure using ST.

ST 18252AA000 CRANKSHAFT SOCKET

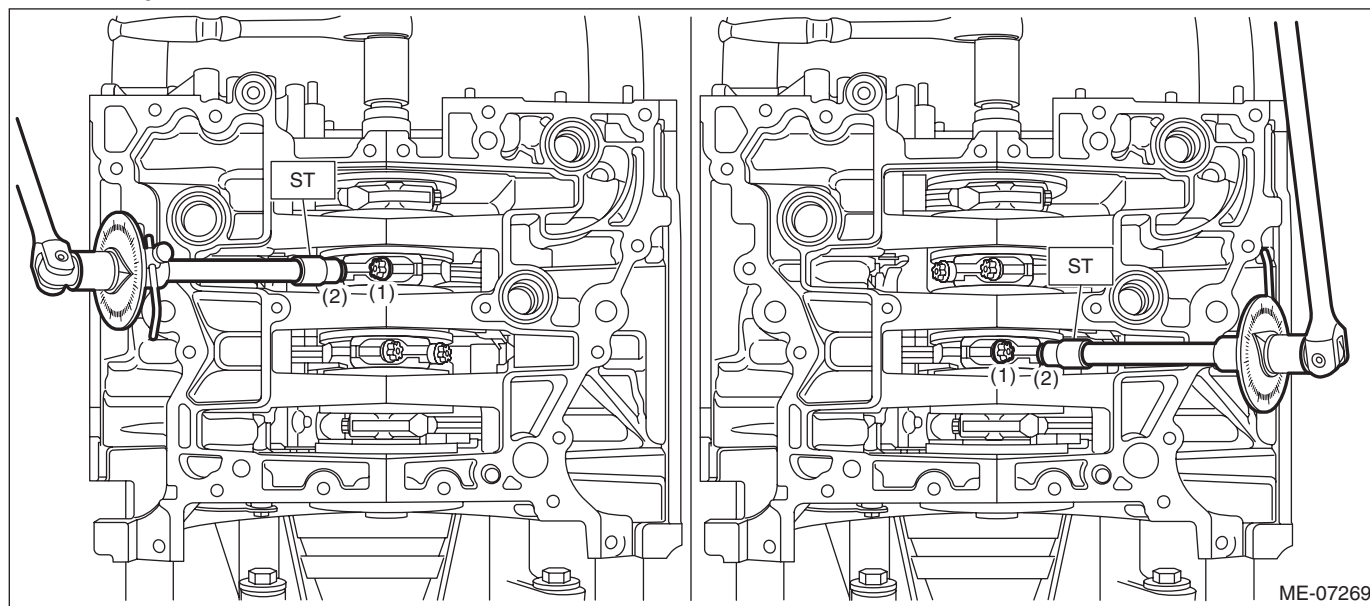


(13) Using ST and angle gauge, tighten the #2 connecting rod cap bolts and #3 connecting rod cap bolts with specified angle in numerical order as shown in the figure.

ST 18270AA020 SOCKET

**Tightening angle:**

$90^{+5}_{-0}^{\circ}$



11) Install the oil pan upper with oil pan to the cylinder block.

(1) Apply liquid gasket to the mating surface of oil pan upper as shown in the figure.

**NOTE:**

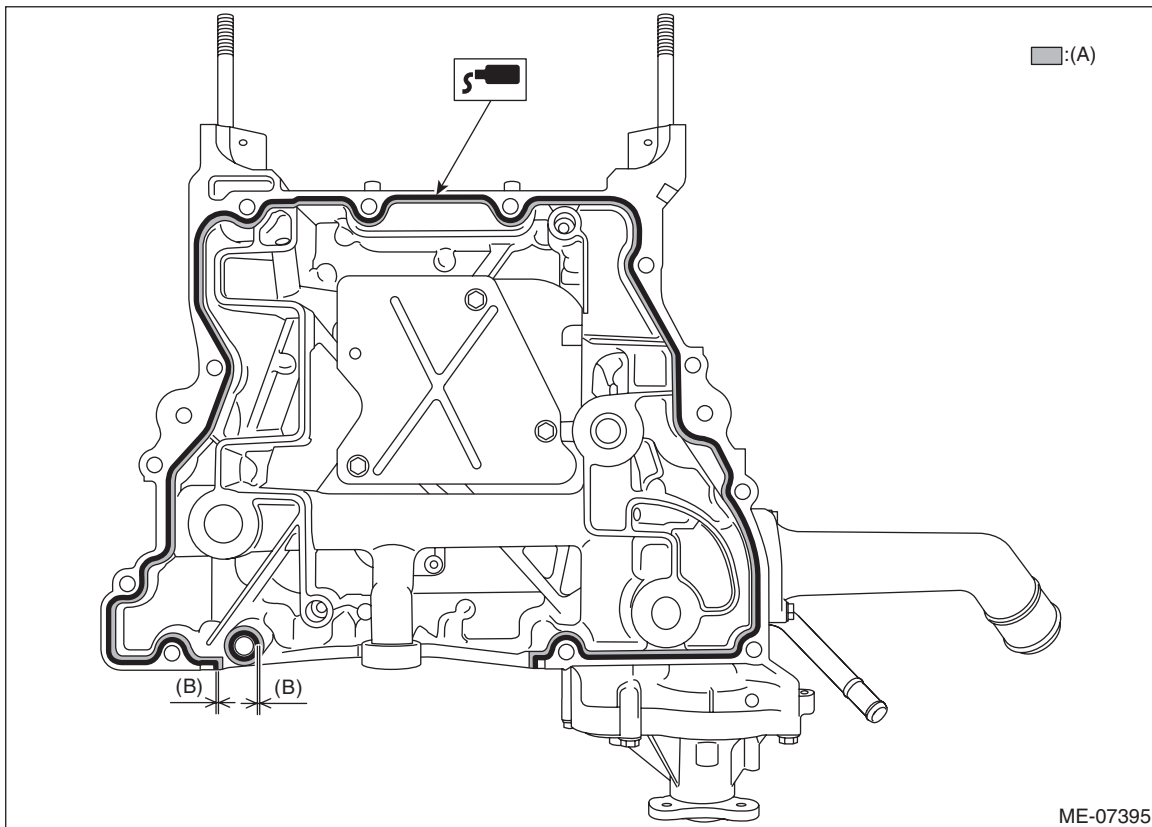
- Before applying liquid gasket, degrease the old liquid gasket seal surface of the cylinder block and the oil pan upper.
- Install within 5 min. after applying liquid gasket.
- Apply liquid gasket 1.5 mm (0.0591 in) outside from the chamfer surface. However, application of liquid gasket on the chamfer surface around the bolt hole is allowed.

**Liquid gasket:**

**THREE BOND 1217G (Part No. 0877Y0100) or equivalent**

**Liquid gasket applying diameter:**

**$5 \pm 1$  mm (0.1969  $\pm$  0.0394 in)**



(A) Chamfer surface

(B) 1.5 mm (0.0591 in)

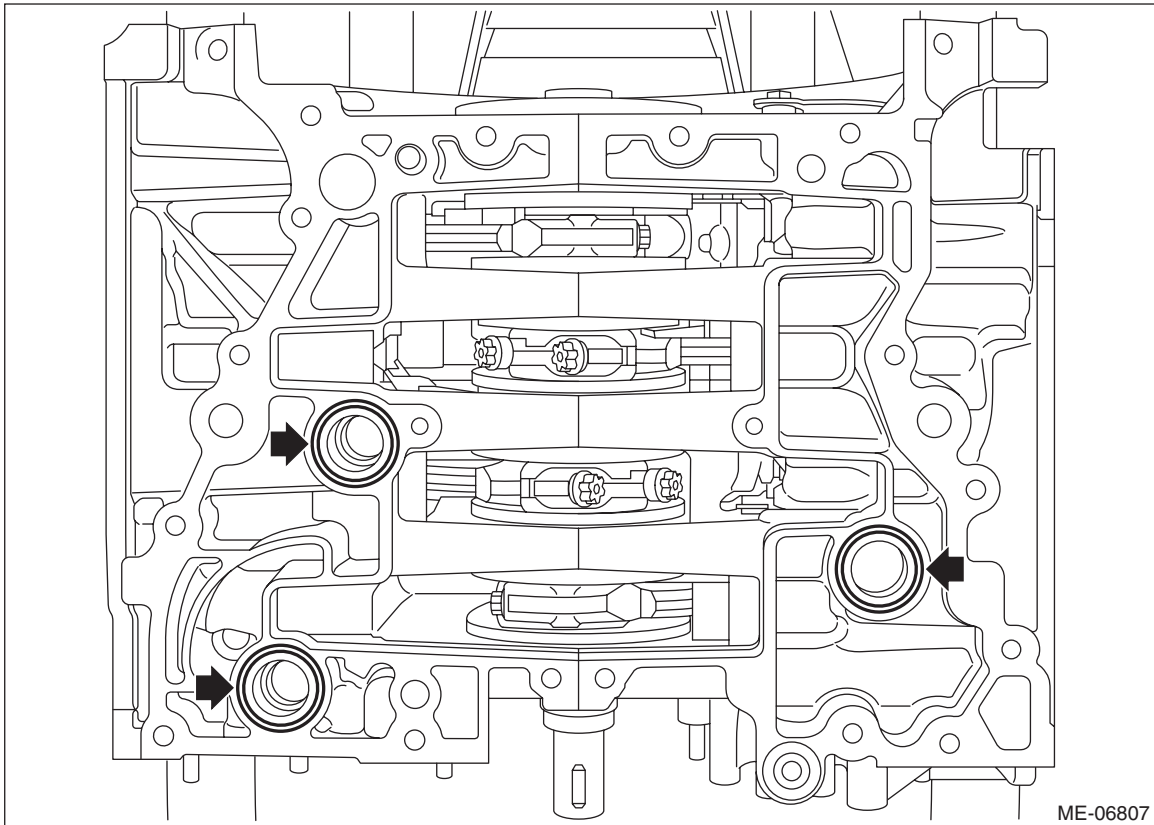
# Cylinder Block

## MECHANICAL

(2) Install the O-ring to the cylinder block.

### NOTE:

Use new O-rings.



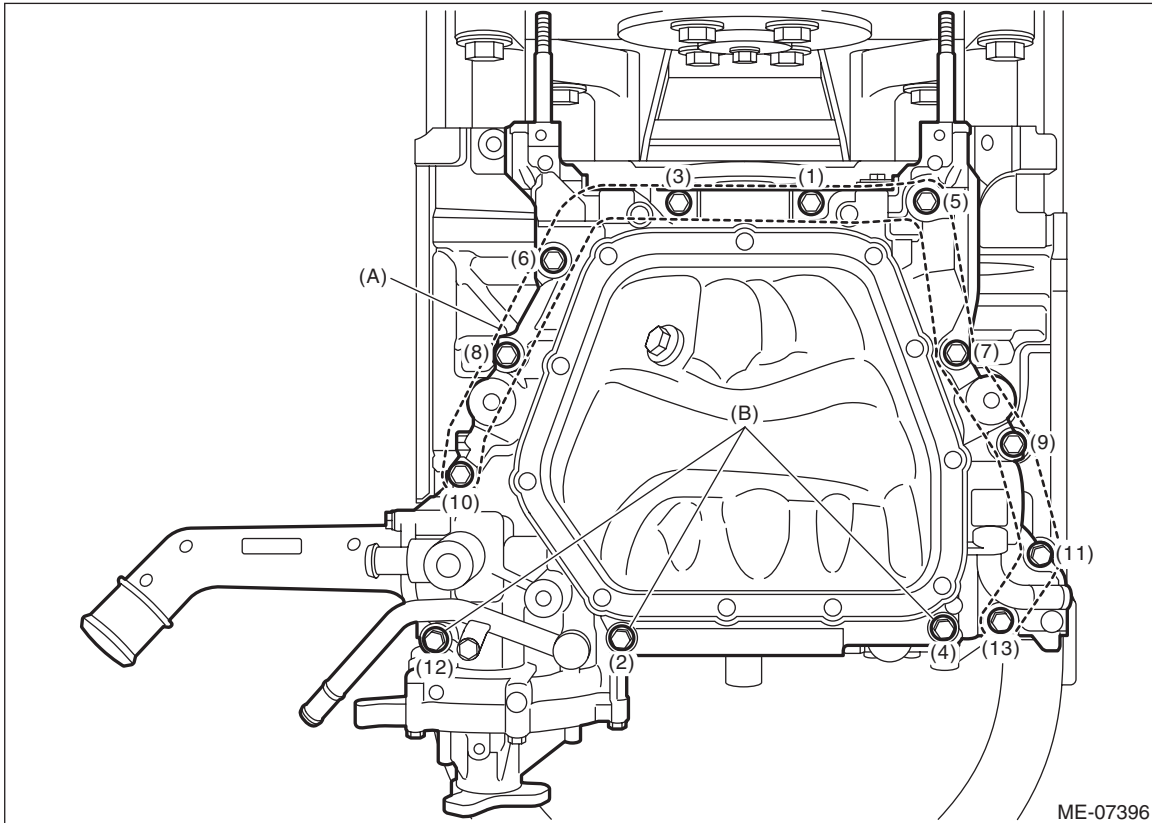
(3) Set the oil pan with oil pan upper to the cylinder block, and tighten the bolts in numerical order as shown in the figure.

**NOTE:**

After tightening, if the liquid gasket is squeezed out onto the seal surface of the chain cover, completely remove any squeezed-out liquid gasket.

**Tightening torque:**

**18 N·m (1.8 kgf-m, 13.3 ft-lb)**



(A) M8 × 25

(B) M8 × 75

12) Set the part so that the installation surface of the intake manifold is on the upper side.

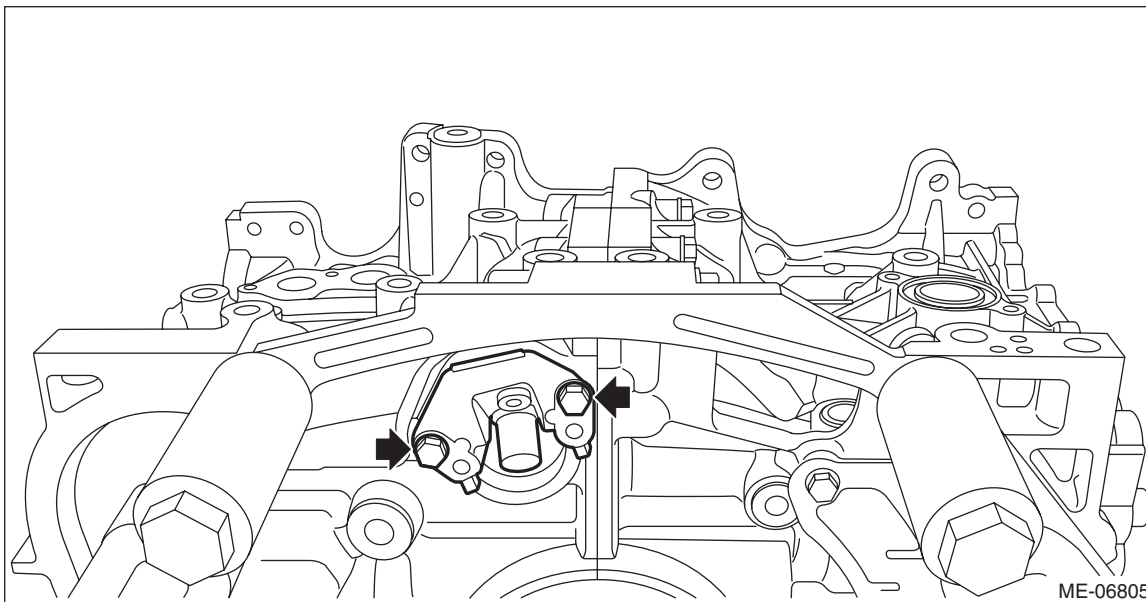
## Cylinder Block

### MECHANICAL

13) Install the crankshaft position sensor with crankshaft position sensor holder to the cylinder block LH.

**Tightening torque:**

**6.4 N·m (0.7 kgf-m, 4.7 ft-lb)**



14) Install the PCV valve onto the cylinder block RH.

**NOTE:**

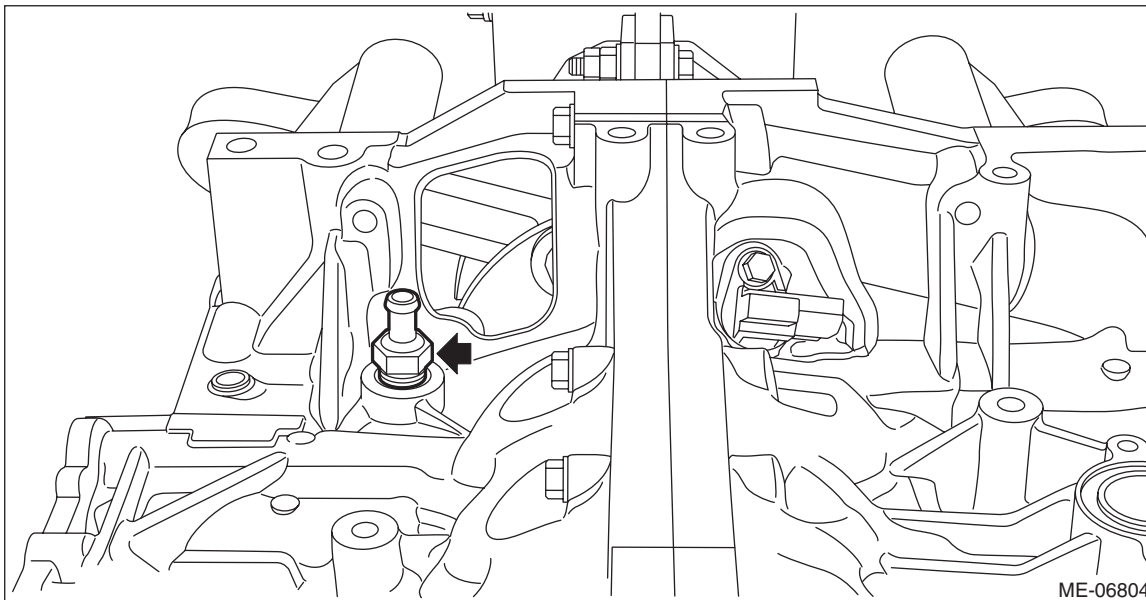
Apply liquid gasket to the bolt threads of PCV valve.

**Liquid gasket:**

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

**Tightening torque:**

**23 N·m (2.3 kgf-m, 17.0 ft-lb)**





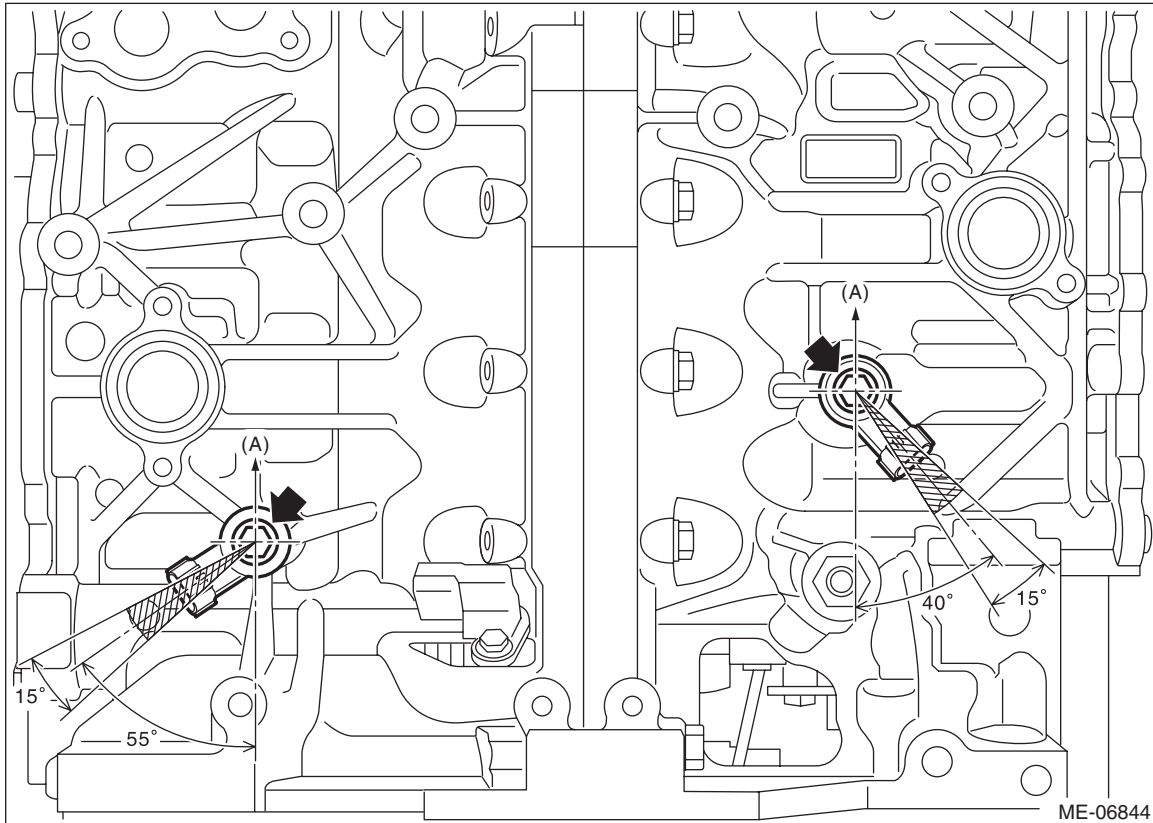
15) Install the knock sensor to the cylinder block LH.

**NOTE:**

Knock sensor must be positioned toward engine front so that the connector center position is within the range of shaded area shown in the figure.

**Tightening torque:**

**24 N·m (2.4 kgf-m, 17.7 ft-lb)**

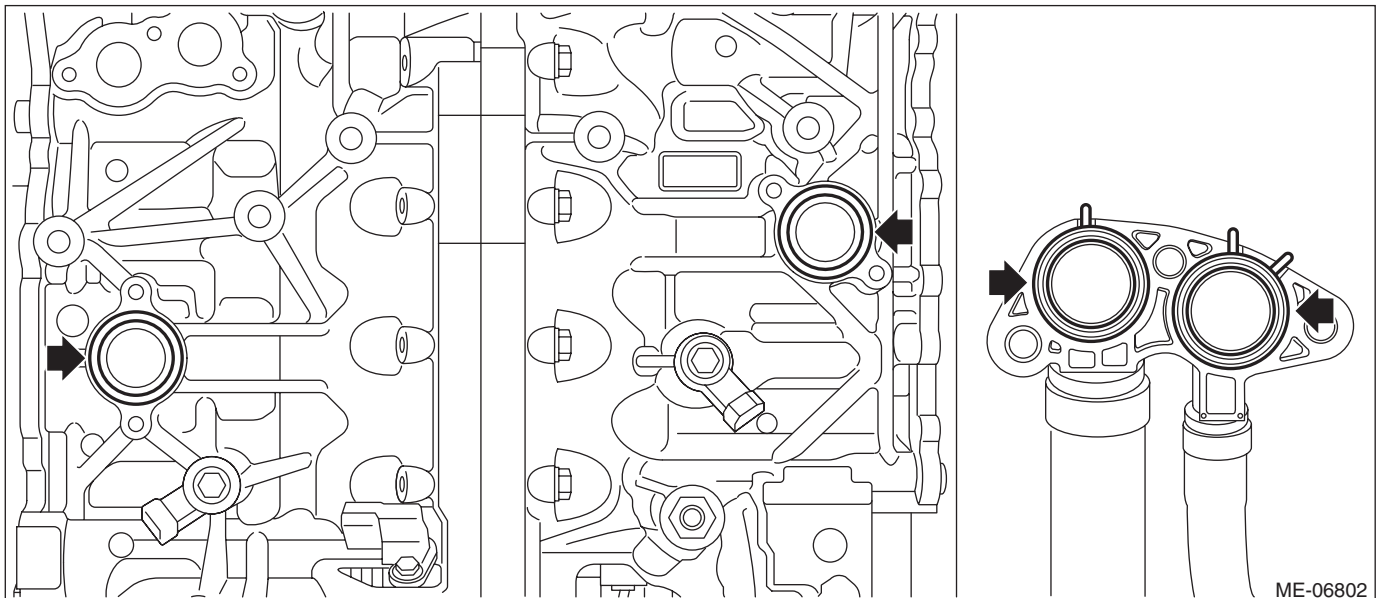


(A) Front of engine

16) Install the O-ring to the cylinder block and PCV connector.

**NOTE:**

Use new O-rings.



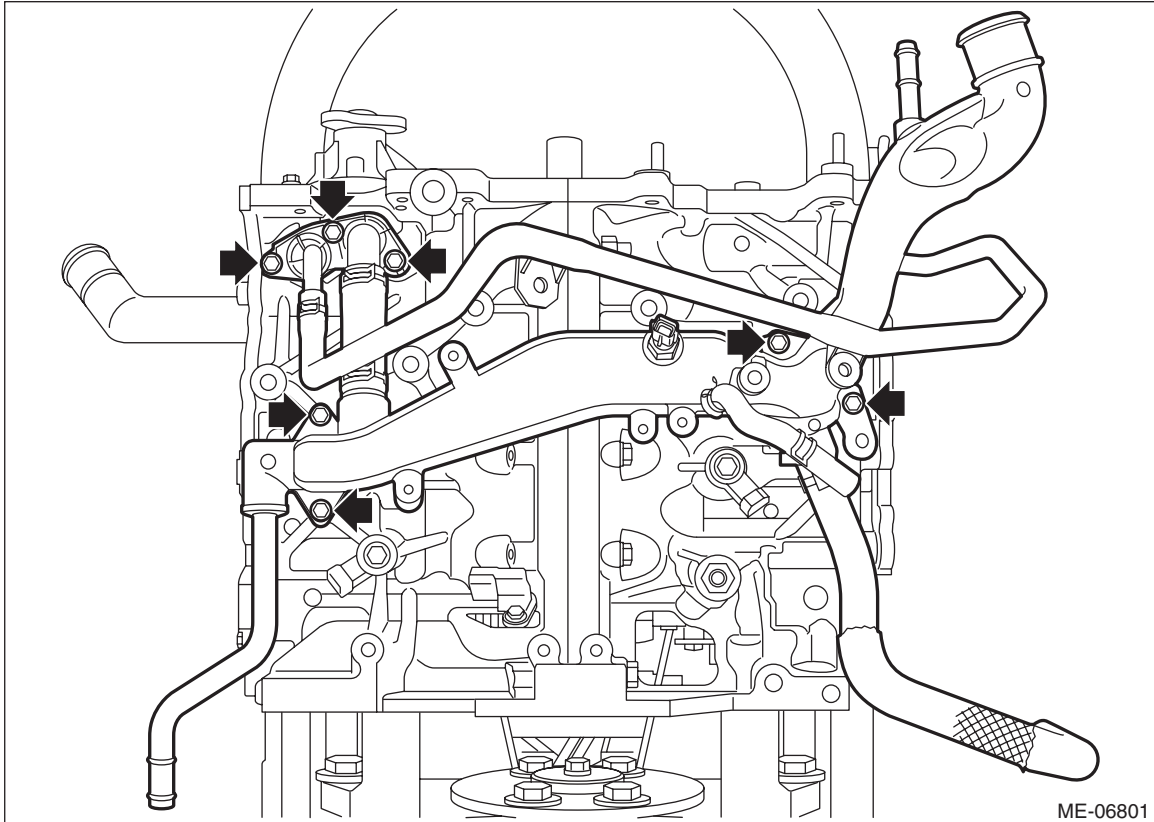
## Cylinder Block

### MECHANICAL

17) Install the water pipe assembly and PCV connector to the cylinder block.

**Tightening torque:**

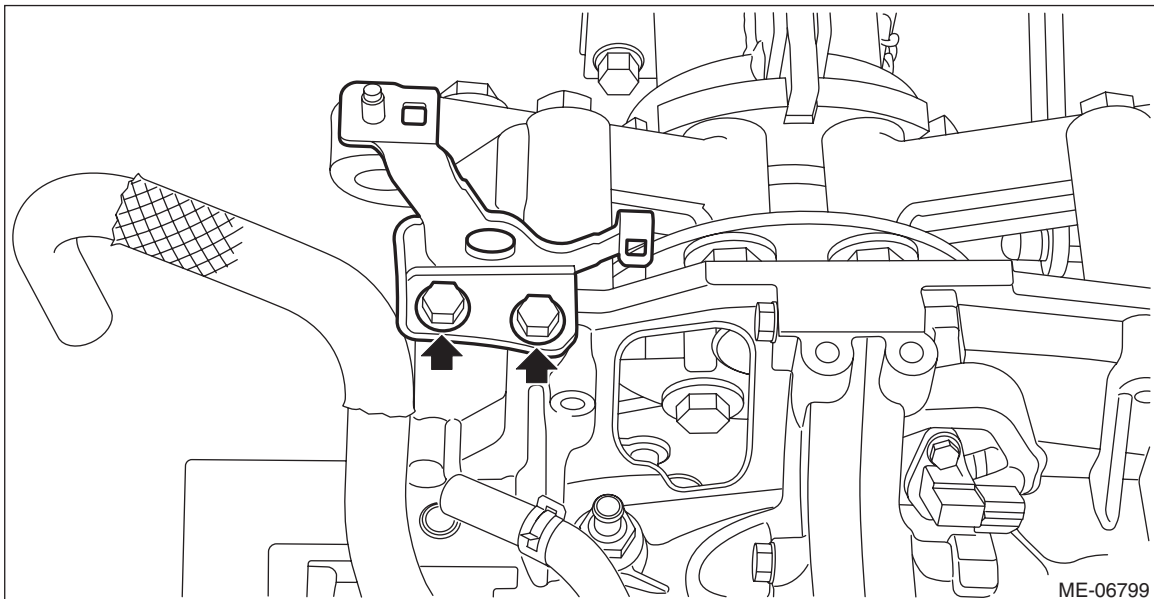
**6.4 N·m (0.7 kgf-m, 4.7 ft-lb)**



18) Install the engine rear hanger to the cylinder block RH.

**Tightening torque:**

**21 N·m (2.1 kgf-m, 15.5 ft-lb)**



19) Install the crank sprocket.<Ref. to ME(H4DOTC)-148, INSTALLATION, Crank Sprocket.>

20) Install the cylinder head.<Ref. to ME(H4DOTC)-221, INSTALLATION, Cylinder Head.>

21) Install the cam carrier.<Ref. to ME(H4DOTC)-182, INSTALLATION, Cam Carrier.>

22) Install the rocker cover.<Ref. to ME(H4DOTC)-161, INSTALLATION, Rocker Cover.>

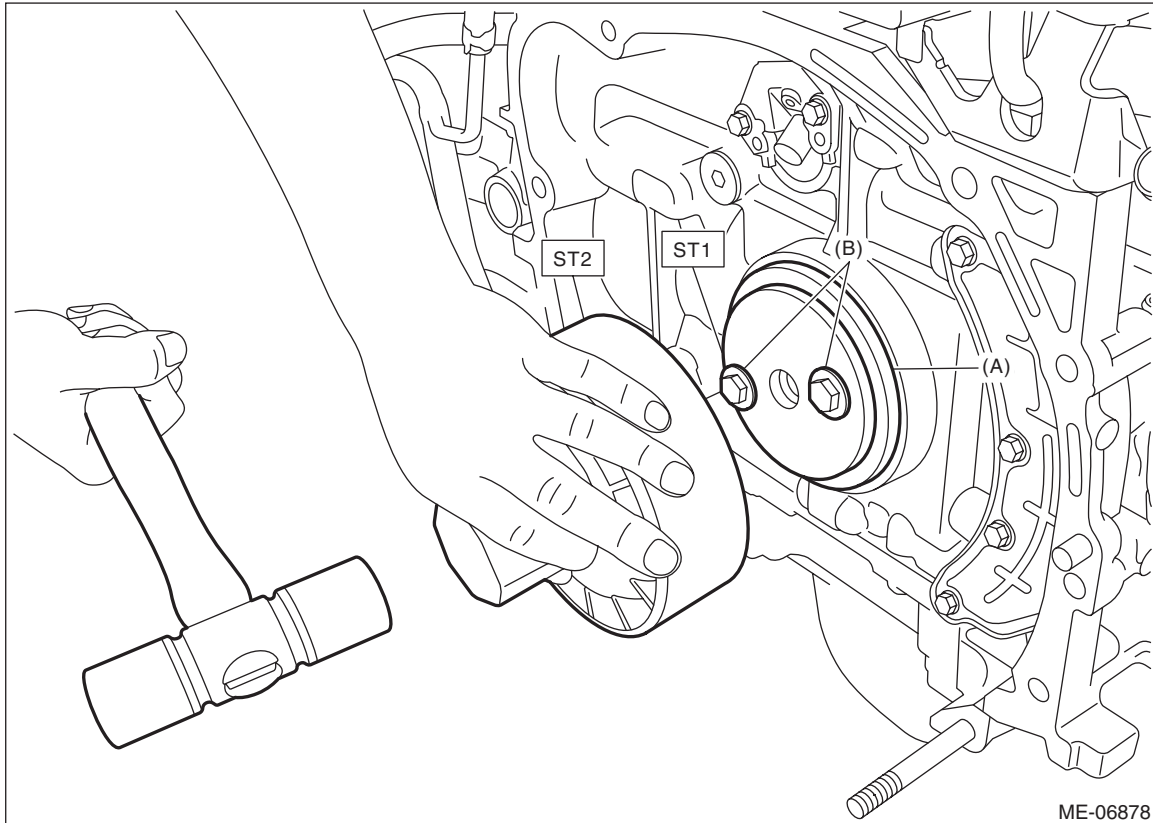
- 23) Install the chain cover.<Ref. to ME(H4DOTC)-99, INSTALLATION, Chain Cover.>
- 24) Install the engine wiring harness.<Ref. to FU(H4DOTC)-92, INSTALLATION, Engine Wiring Harness.>
- 25) Install the tumble generator valve assembly.<Ref. to FU(H4DO)-78, INSTALLATION, Tumble Generator Valve Assembly.>
- 26) Install the intake manifold.<Ref. to FU(H4DO)-27, INSTALLATION, Intake Manifold.>
- 27) Apply a coat of engine oil to the oil seal inner periphery and outer periphery, and install the rear oil seal using ST1 and ST2.

**NOTE:**

Use a new rear oil seal.

ST1 18671AA020 OIL SEAL GUIDE

ST2 18657AA030 OIL SEAL INSTALLER



(A) Rear oil seal

(B) Drive plate mounting bolt

- 28) Install the crankshaft position sensor plate with drive plate.<Ref. to CVT(TR690)-136, INSTALLATION, Drive Plate.>
- 29) Install the engine to the vehicle.<Ref. to ME(H4DOTC)-61, INSTALLATION, Engine Assembly.>

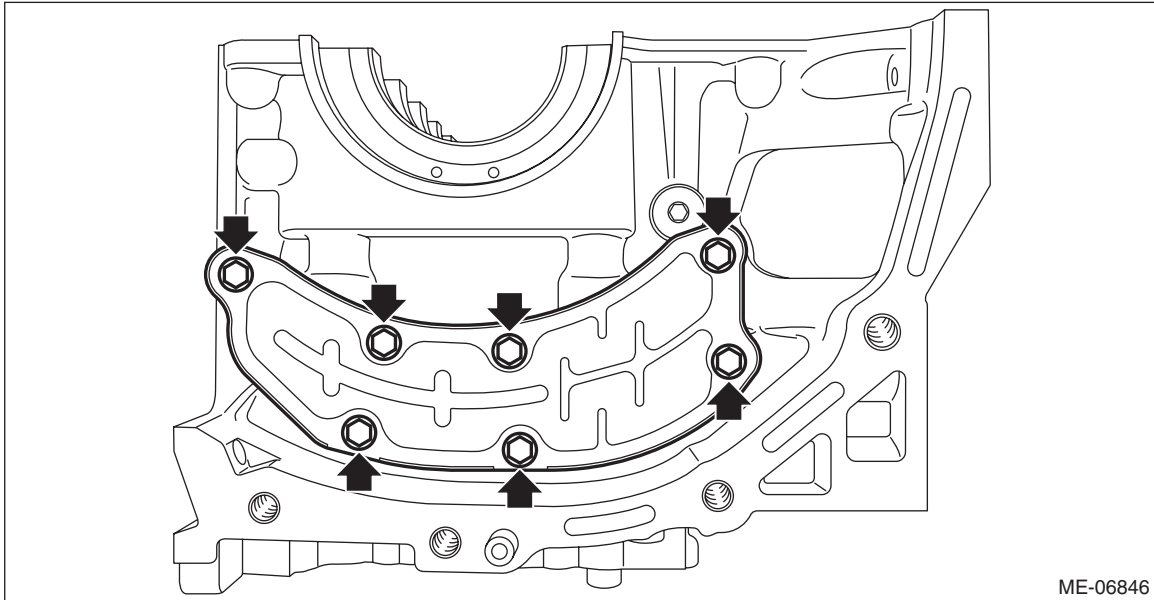
# Cylinder Block

MECHANICAL

## C: DISASSEMBLY

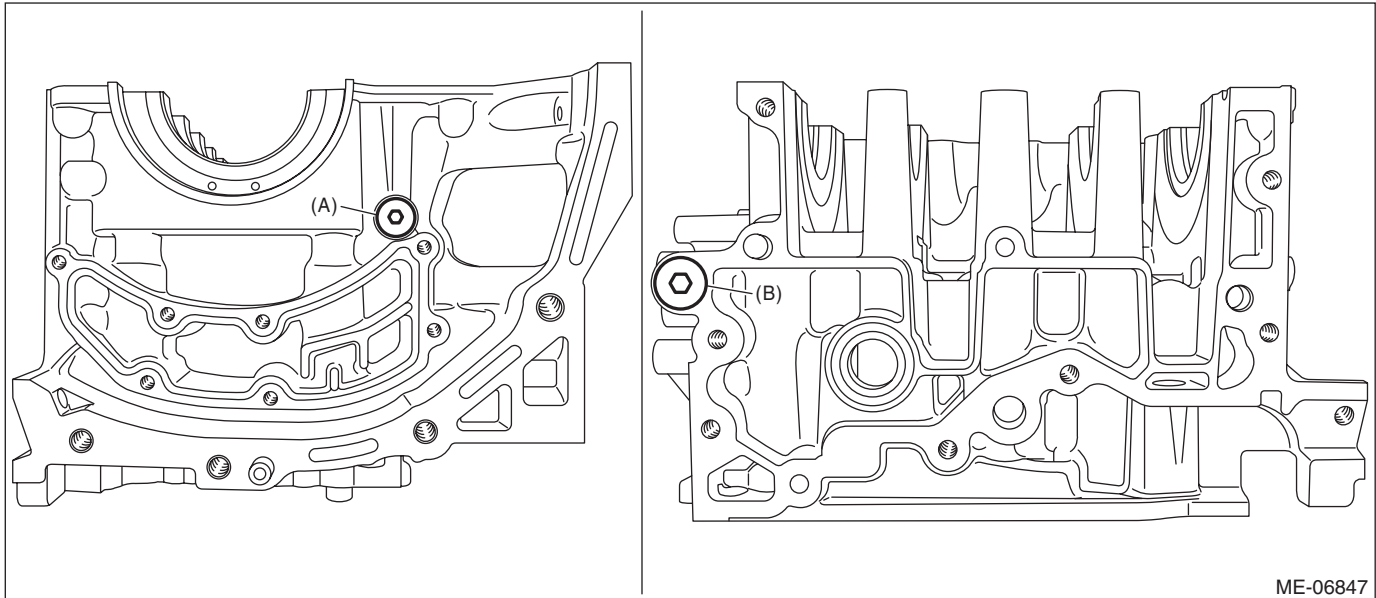
### 1. CYLINDER BLOCK

1) Remove the oil separator cover from cylinder block RH.



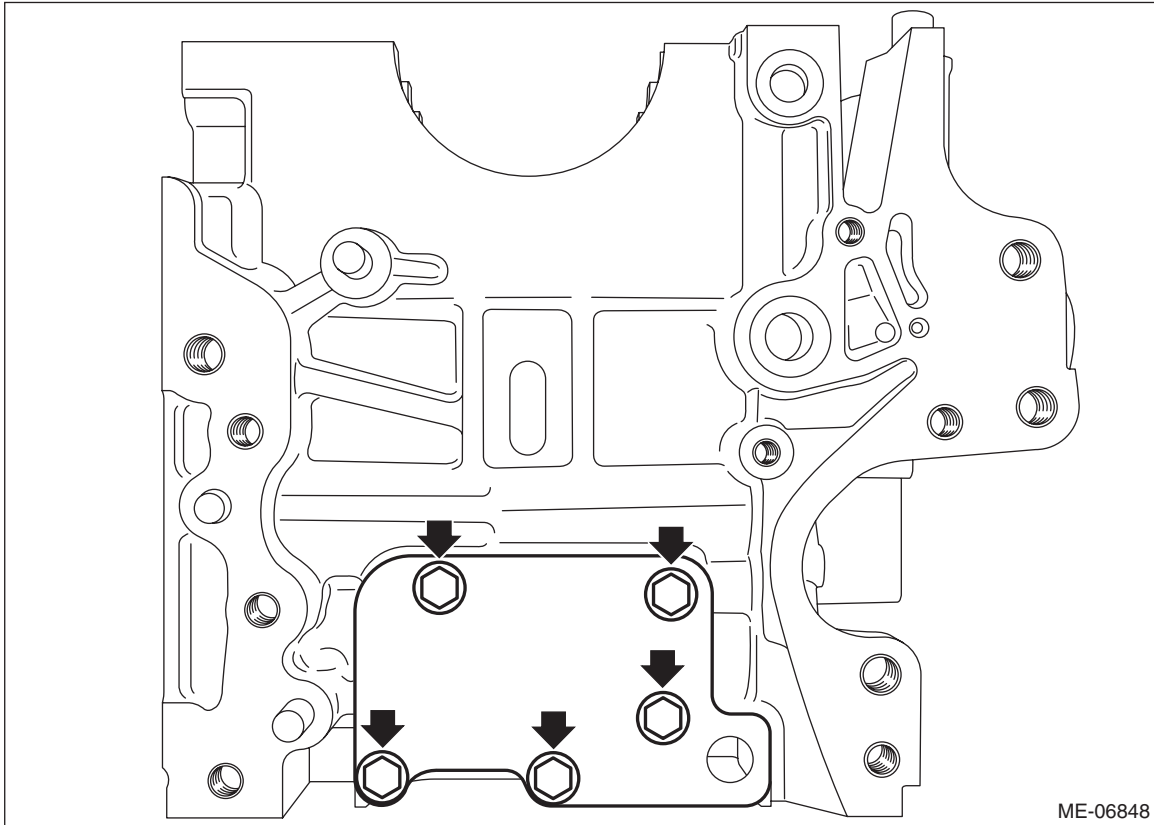
2) Remove the liquid gasket from cylinder block RH.

3) Remove the cylinder block plug (A) and the main gallery plug (B) from cylinder block RH.

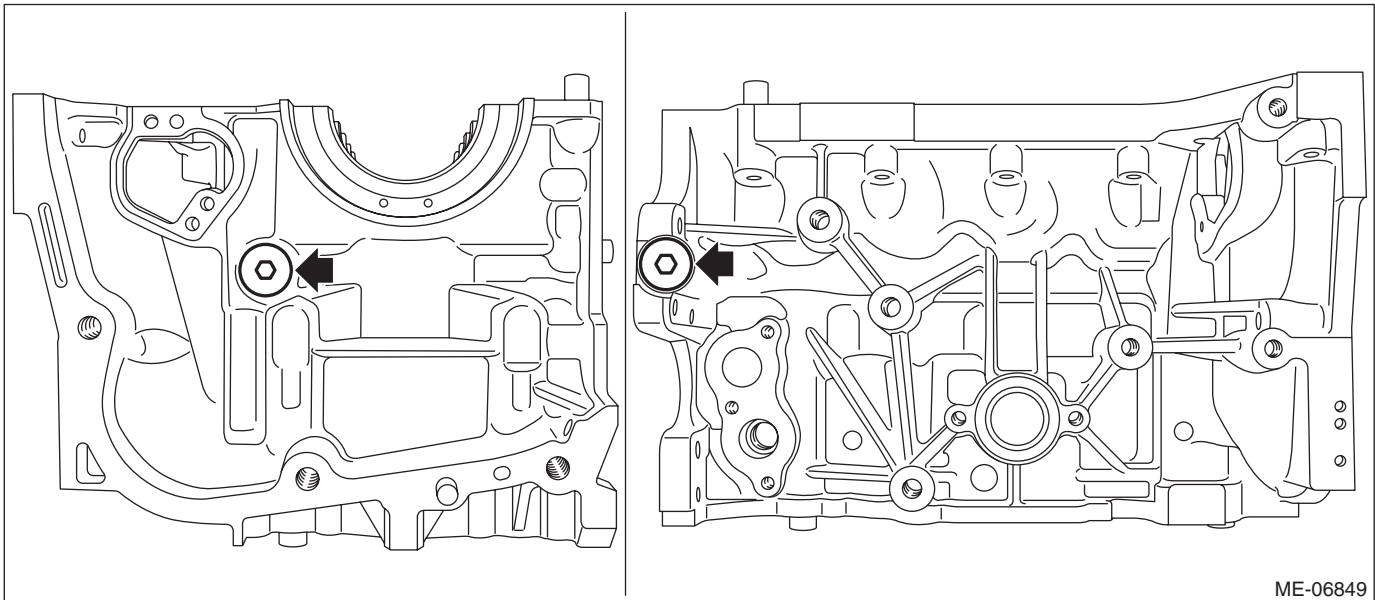


4) Remove the liquid gasket from the thread holes of the cylinder block RH, and from the threaded portions of cylinder block plug and main gallery plug.

5) Remove the cylinder block plate from cylinder block LH.



6) Remove the main gallery plug from cylinder block LH.

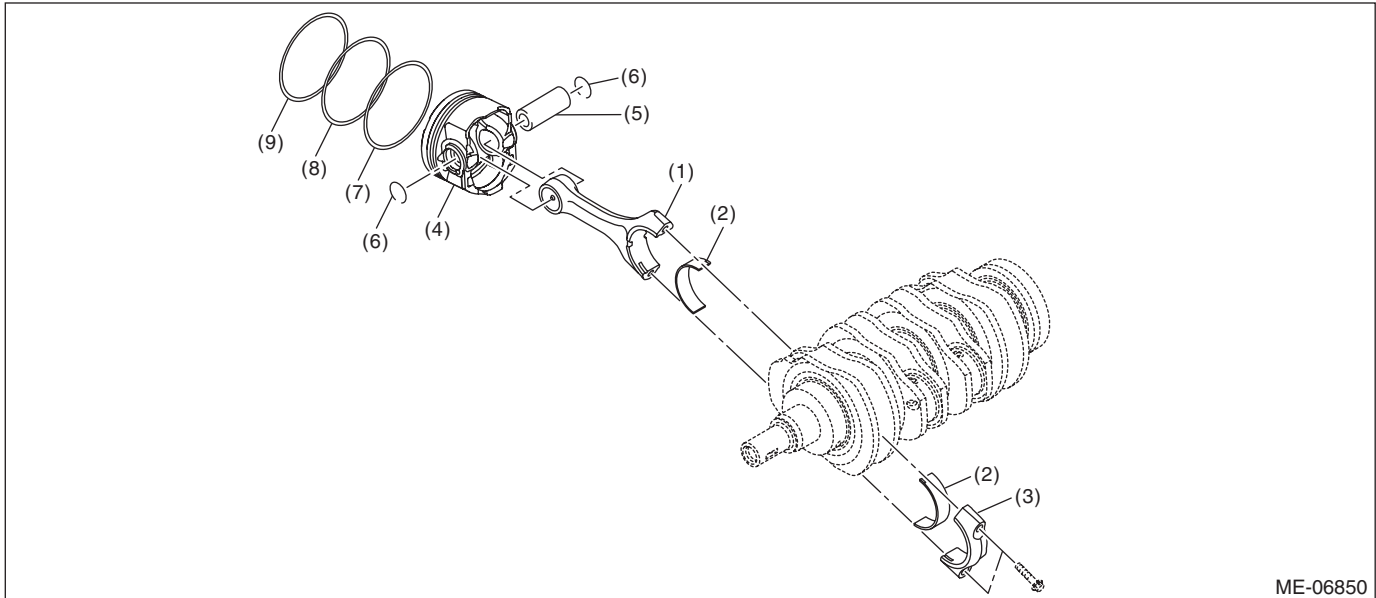


7) Remove the liquid gasket from the thread holes of the cylinder block LH and main gallery plug.

# Cylinder Block

## MECHANICAL

### 2. PISTON AND CONNECTING ROD



- |                            |                |                 |
|----------------------------|----------------|-----------------|
| (1) Connecting rod         | (4) Piston     | (7) Oil ring    |
| (2) Connecting rod bearing | (5) Piston pin | (8) Second ring |
| (3) Connecting rod cap     | (6) Circlip    | (9) Top ring    |

#### NOTE:

To prevent confusion of various parts, mark each part.

- 1) Remove the connecting rod bearing from connecting rod and connecting rod cap.
- 2) Remove the piston rings from the piston.

#### NOTE:

Arrange the piston rings in order so that they can be installed in their original positions without confusion.

- (1) Remove the compression rings in the order of top ring and second ring, using piston ring expander.
- (2) Remove the oil rings in the order of upper rail, lower rail and expander by hand.
- 3) Remove the circlip on one end from the piston using a flat tip screwdriver.

#### NOTE:

Be careful not damage the piston and piston pin, by wrapping the tip of flat tip screwdriver with tape.

- 4) Remove the piston pin from piston, and remove the connecting rod from piston.

- 5) Remove the circlip on other end from the piston using a flat tip screwdriver.

#### NOTE:

Be careful not damage the piston and piston pin, by wrapping the tip of flat tip screwdriver with tape.

## D: ASSEMBLY

### 1. CYLINDER BLOCK

1) Apply liquid gasket to the threaded portion of the main gallery plug, and install the main gallery plug to the cylinder block LH.

**NOTE:**

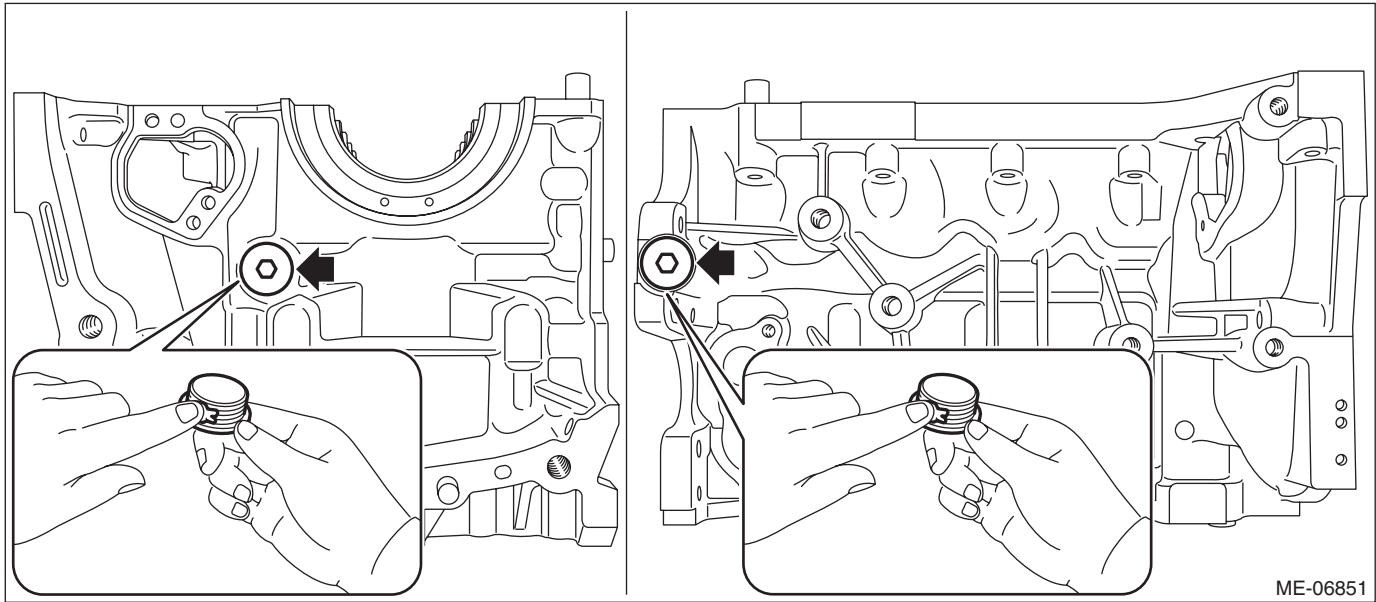
Before applying liquid gasket, degrease the thread holes of the cylinder block LH and main gallery plug.

**Liquid gasket:**

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

**Tightening torque:**

**37 N·m (3.8 kgf-m, 27.3 ft-lb)**





## Cylinder Block

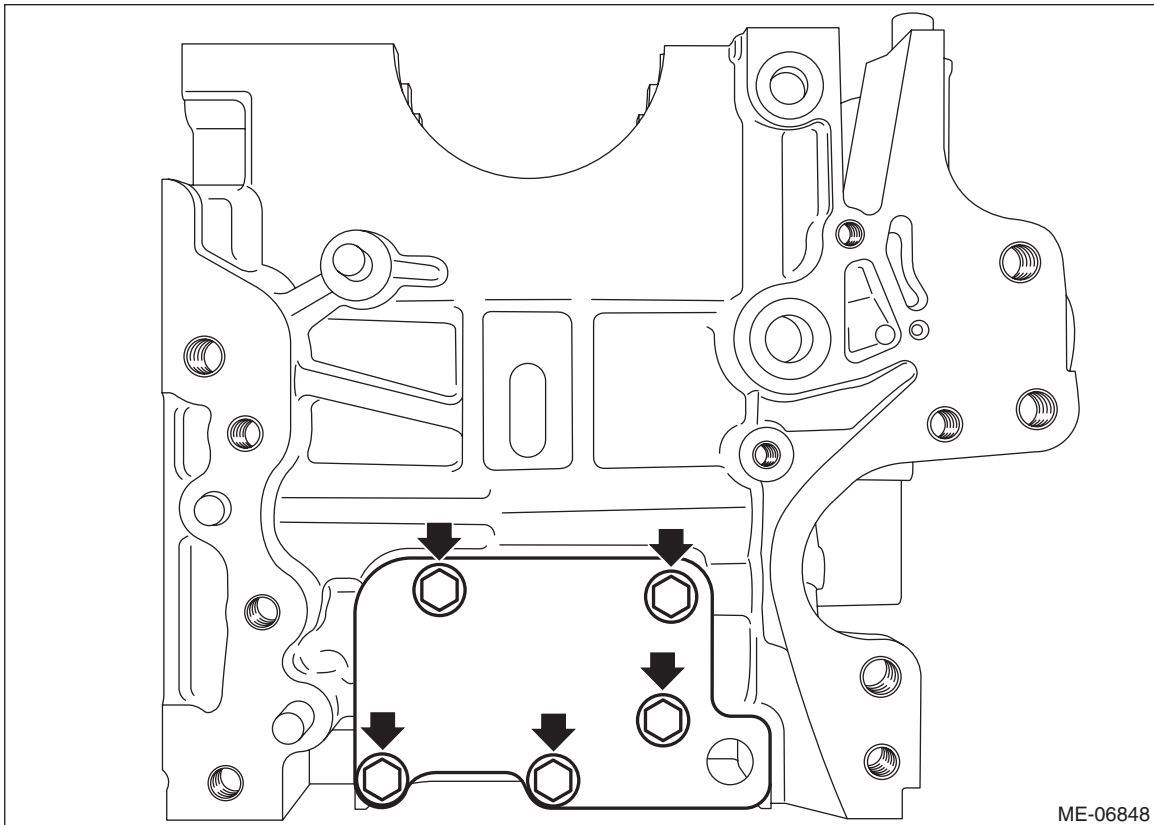
### MECHANICAL

---

2) Install the cylinder block plate onto cylinder block LH.

**Tightening torque:**

**6.4 N·m (0.7 kgf-m, 4.7 ft-lb)**



ME-06848

3) Apply liquid gasket to the threaded portions of cylinder block plug and main gallery plug, and install the cylinder block plug (A) and main gallery plug (B) to cylinder block RH.

**NOTE:**

Before applying liquid gasket, degrease the thread holes of the cylinder block RH, and the threaded portions of cylinder block plug and main gallery plug.

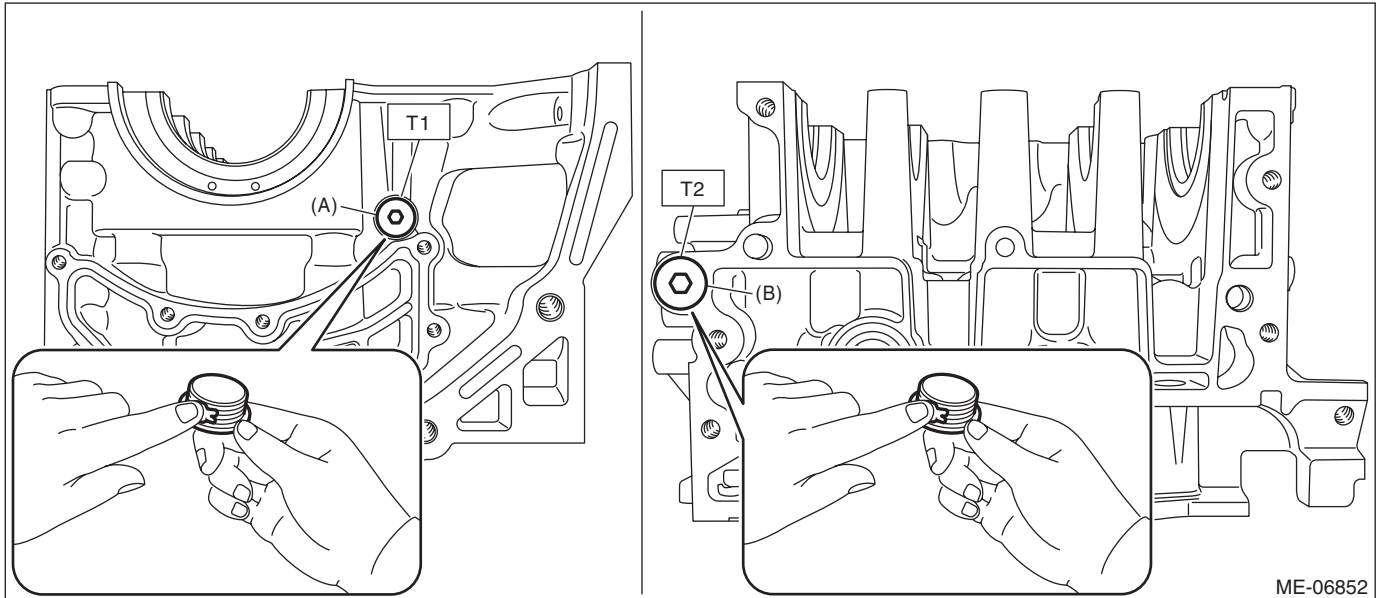
**Liquid gasket:**

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

**Tightening torque:**

**T1: 16 N·m (1.6 kgf-m, 11.8 ft-lb)**

**T2: 37 N·m (3.8 kgf-m, 27.3 ft-lb)**



# Cylinder Block

## MECHANICAL

- 4) Install the oil separator cover to the cylinder block RH.  
(1) Apply liquid gasket to the mating surfaces of oil separator cover.

### NOTE:

- Use new oil separator cover.
- Before applying liquid gasket, degrease the old liquid gasket seal surface of cylinder block RH.
- Install within 5 min. after applying liquid gasket.

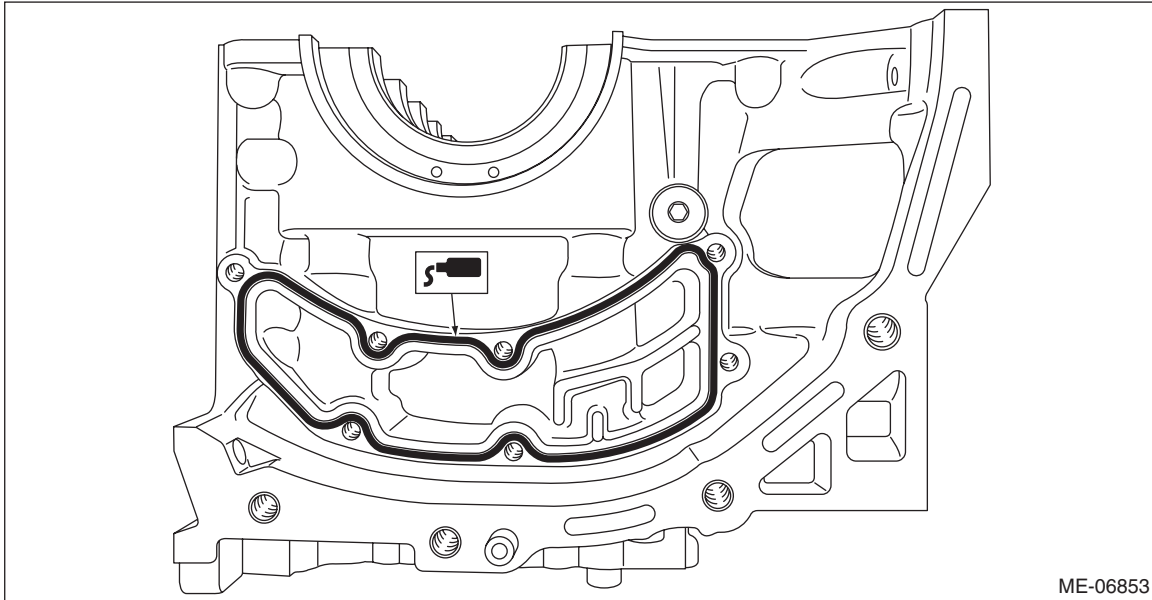
### Liquid gasket:

#### Mating surface

**THREE BOND 1217G (Part No. K0877Y0100) or equivalent**

### Liquid gasket applying diameter:

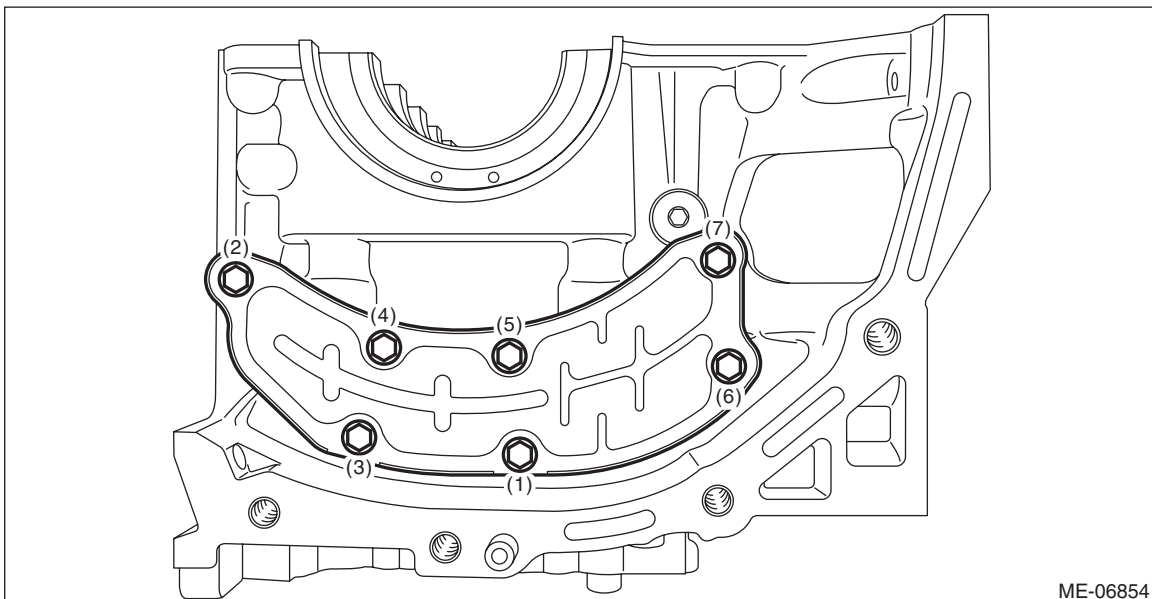
**$4 \pm 1$  mm ( $0.1772 \pm 0.0394$  in)**



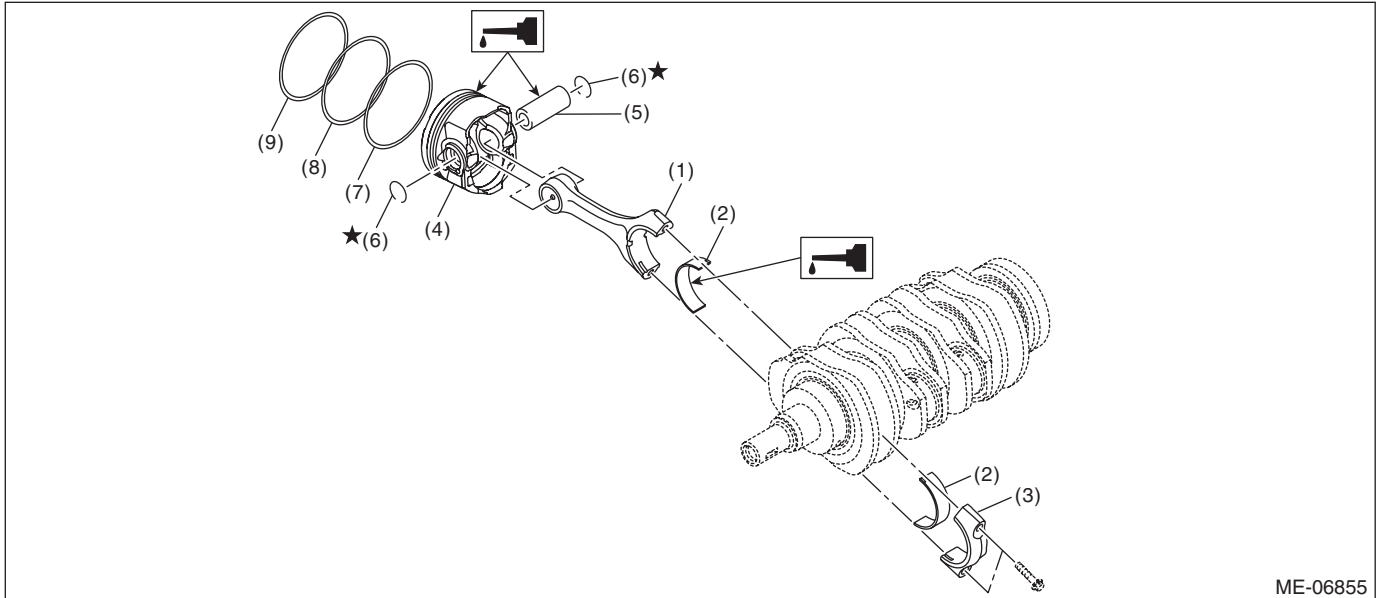
- (2) Install the oil separator cover to the cylinder block RH, and tighten the oil separator cover bolts in numerical order as shown in the figure.

### Tightening torque:

**6.4 N·m (0.7 kgf-m, 4.7 ft-lb)**



## 2. PISTON AND CONNECTING ROD

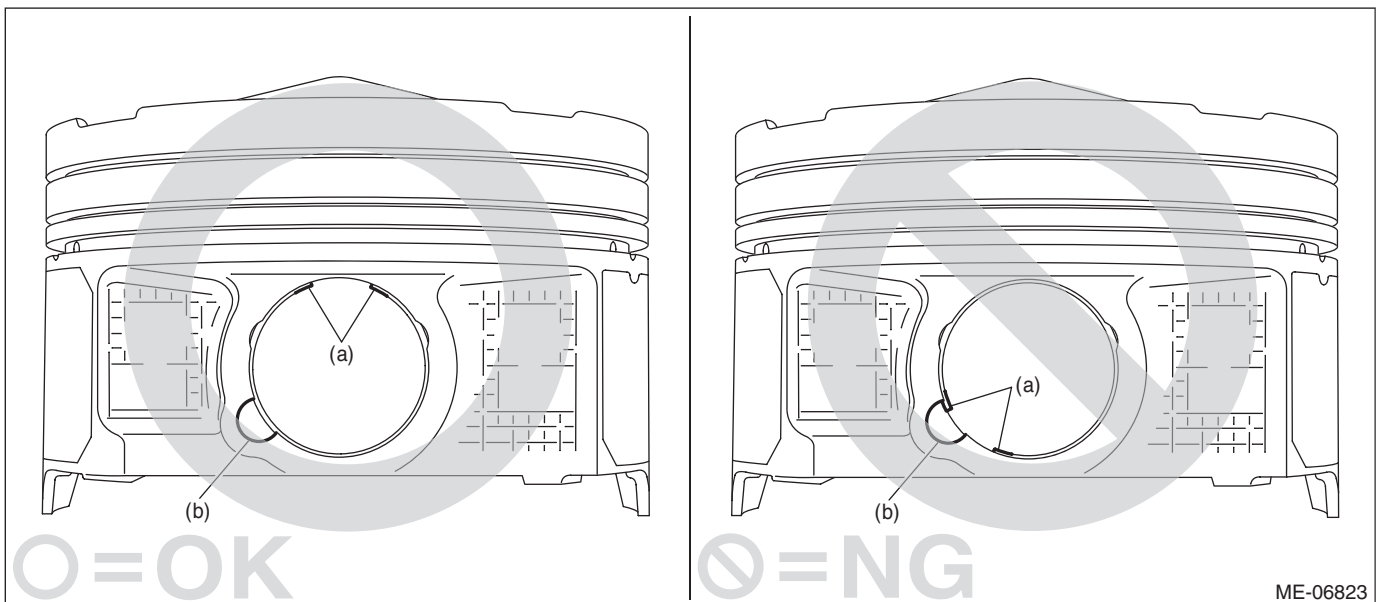


- |                            |                |                 |
|----------------------------|----------------|-----------------|
| (1) Connecting rod         | (4) Piston     | (7) Oil ring    |
| (2) Connecting rod bearing | (5) Piston pin | (8) Second ring |
| (3) Connecting rod cap     | (6) Circlip    | (9) Top ring    |

- 1) Install the connecting rod bearing to the connecting rod and connecting rod cap.
- 2) Install the circlip on one end of the piston using a flat tip screwdriver.

### NOTE:

- Be careful not damage the piston, by wrapping the tip of flat tip screwdriver with tape.
- Make sure the circlip is firmly inserted into the circlip groove.
- After installing the circlip, rotate the circlip so that its end part (a) and the cutout portion of circlip groove (b) do not match.



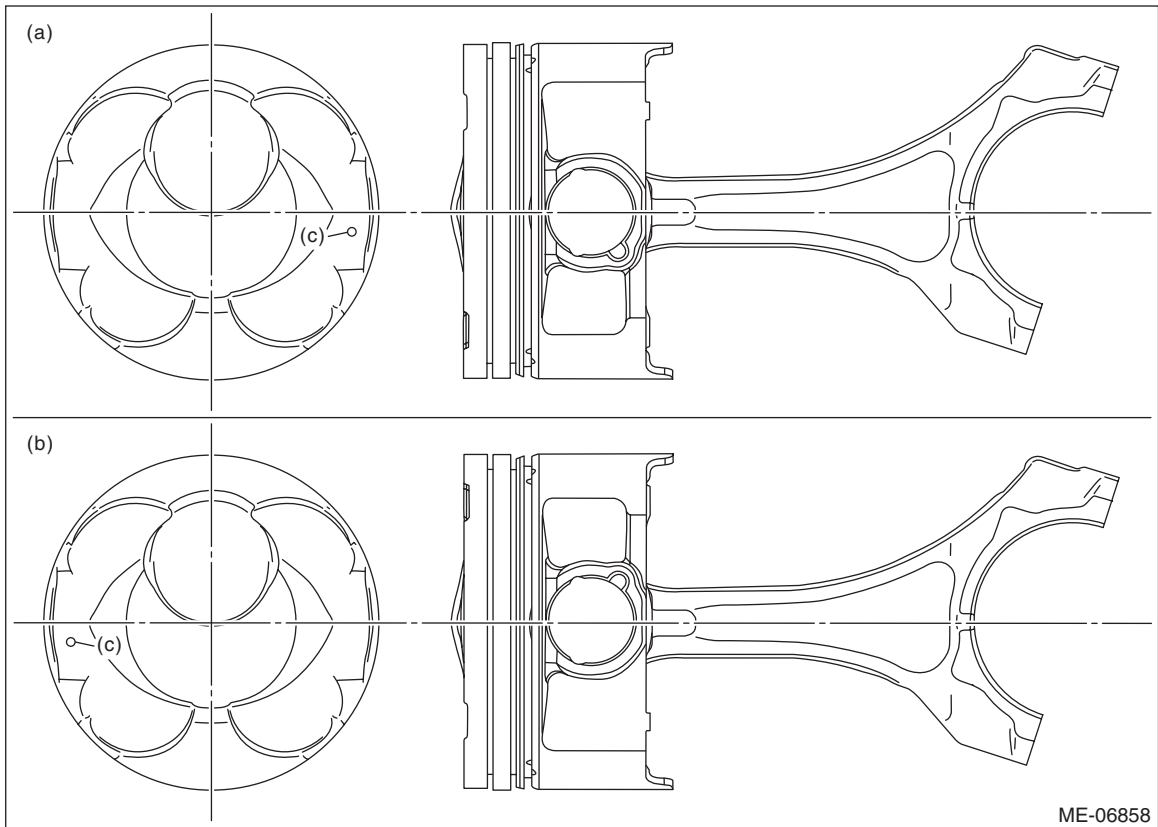
# Cylinder Block

## MECHANICAL

3) Set the piston to the connecting rod.

### NOTE:

Align the front mark of piston and the connecting rod direction correctly as shown in the figure.



(a) RH side (#1 and #3)

(b) LH side (#2 and #4)

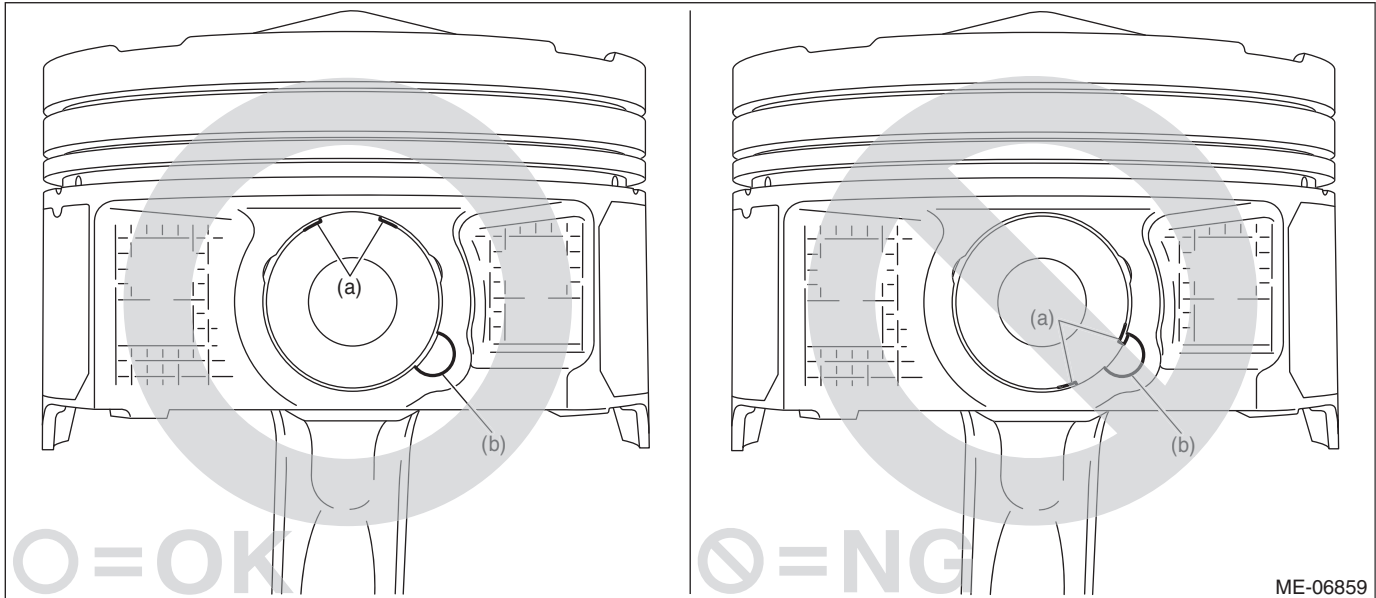
(c) Front mark

4) Apply engine oil to the piston pin, and attach the piston pin.

5) Install the circlip on the piston using a flat tip screwdriver.

**NOTE:**

- Be careful not damage the piston and piston pin, by wrapping the tip of flat tip screwdriver with tape.
- Make sure the circlip is firmly inserted into the circlip groove.
- After installing the circlip, rotate the circlip so that its end part (a) and the cutout portion of circlip groove (b) do not match.

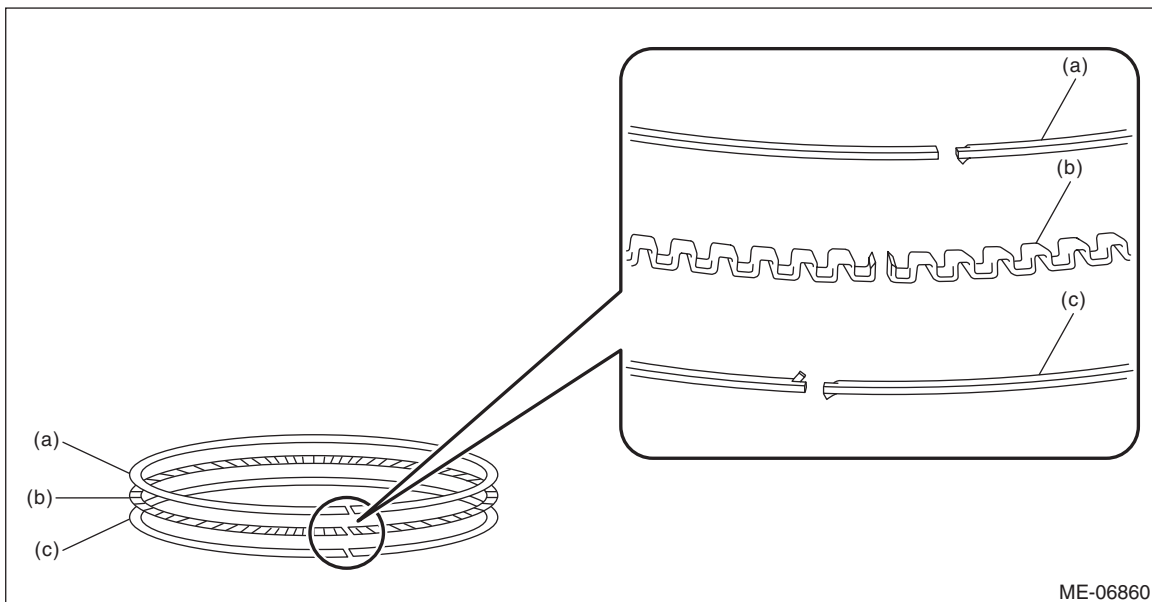


ME-06859

6) Install the oil rings to the piston in the order of expander, lower rail and upper rail by hand.

**NOTE:**

Oil ring consists of the upper rail, expander and lower rail.



ME-06860

(a) Upper rail

(b) Expander

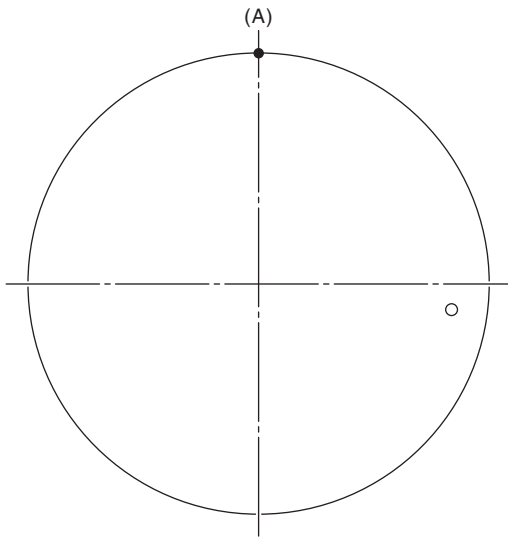
(c) Lower rail

# Cylinder Block

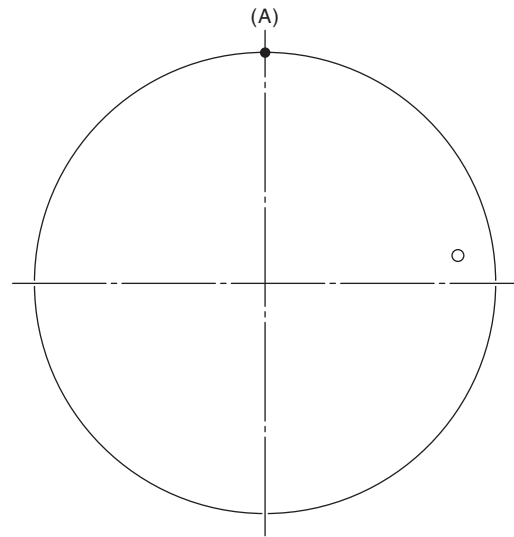
MECHANICAL

(1) Set the ring gap of the expander to the position (A).

RH



LH



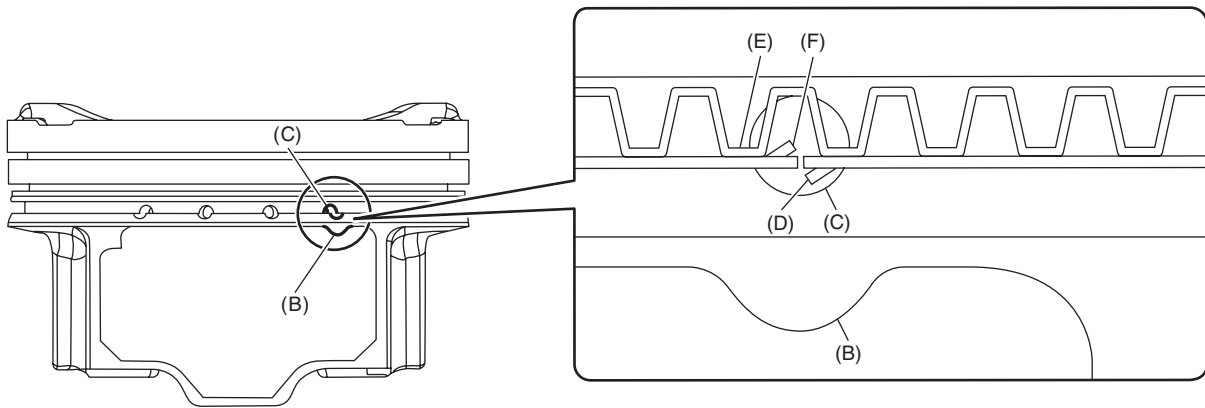
ME-06861



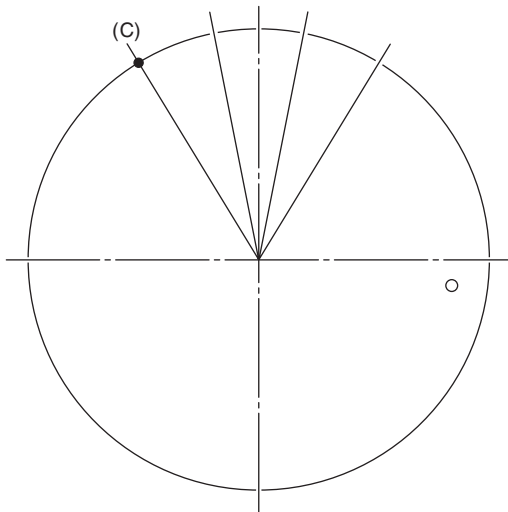
# Cylinder Block

MECHANICAL

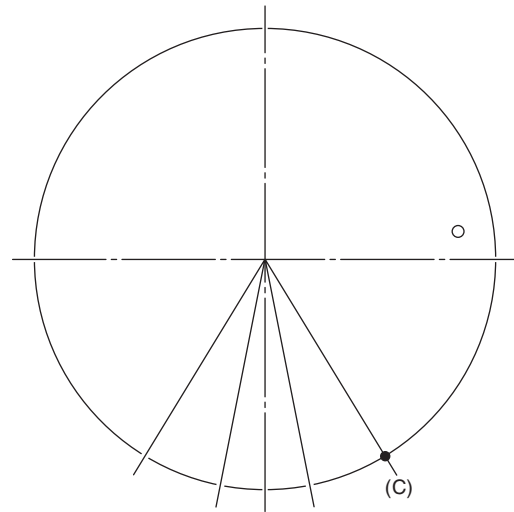
(2) Set the lower rail spin stopper (D) to the oil groove (C) located above the cutout portion (B) of the piston skirt coating, and hook the lower rail spin stopper (F) to the expander (E).



RH



LH

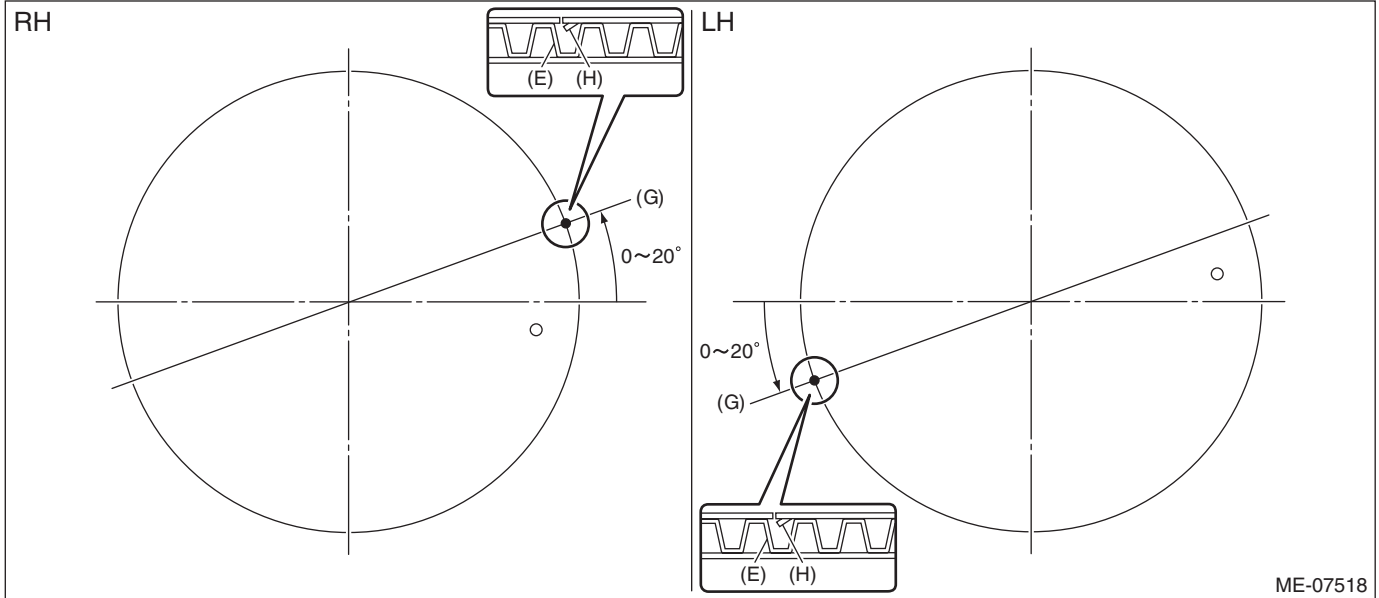


ME-07477

# Cylinder Block

## MECHANICAL

(3) Set the upper rail gap to the position (G), and hook the upper rail spin stopper (H) to the expander (E).

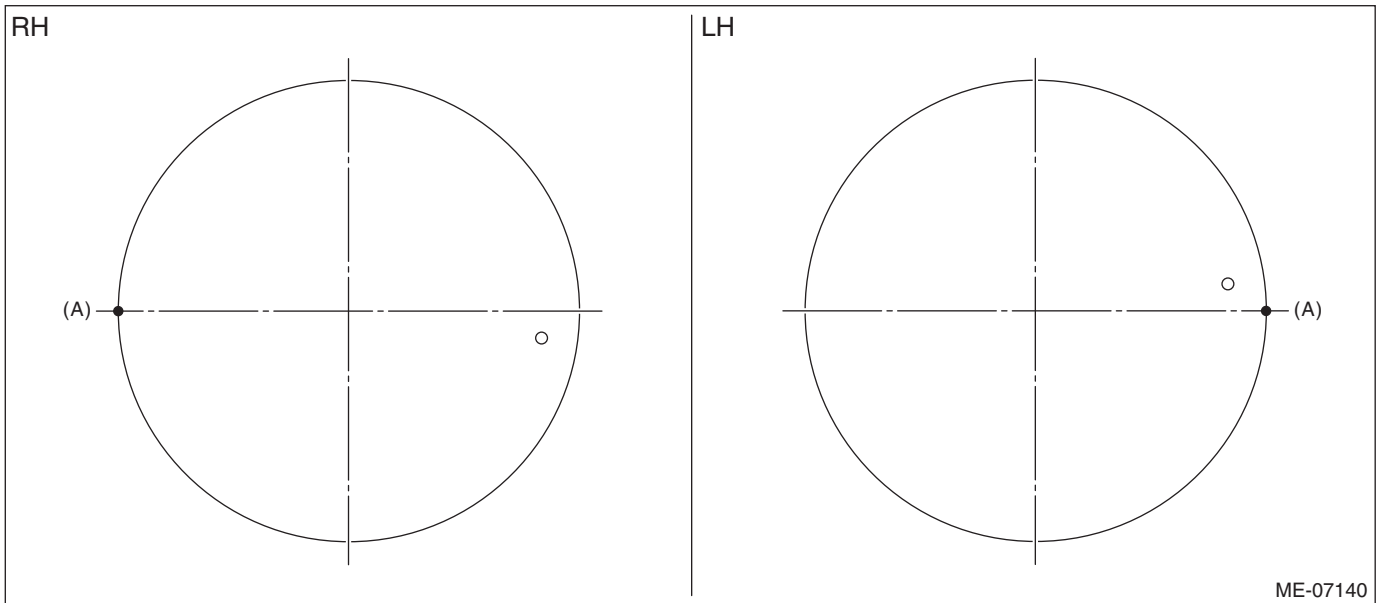


7) Install the compression rings to the piston in the order of second ring and top ring, using piston ring expander.

(1) Set the ring gap of the second ring to the position (A) in the figure.

### NOTE:

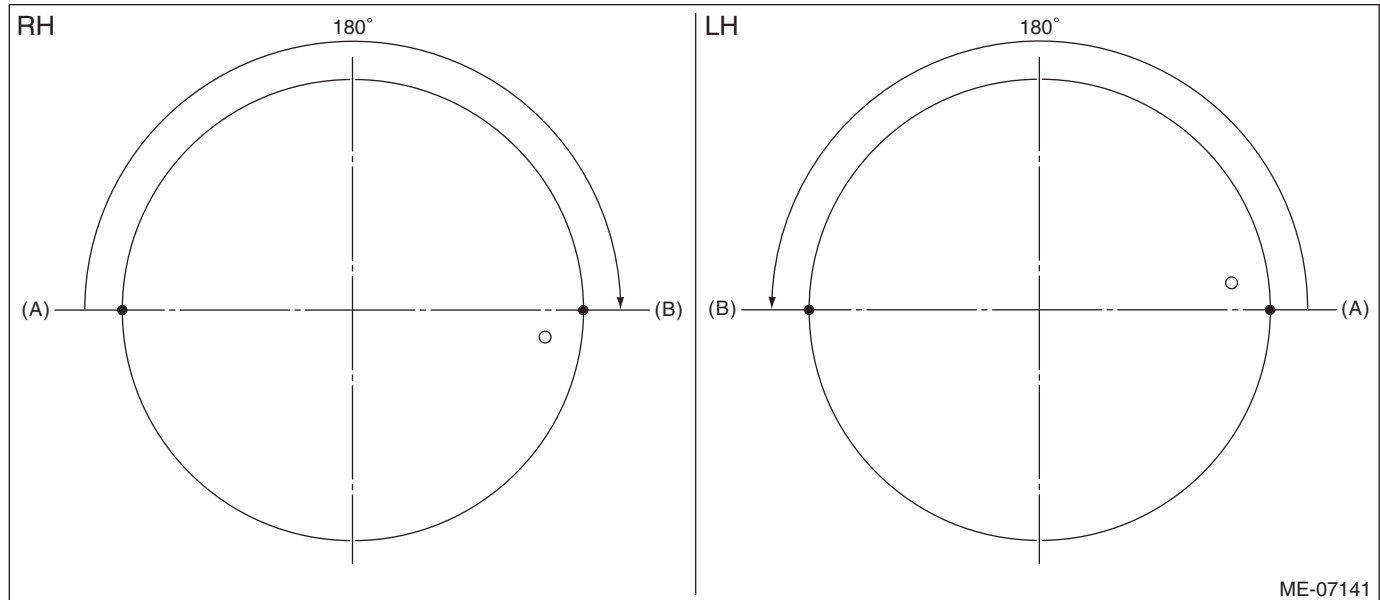
Install the second ring so that the ring mark (2N) faces the piston crown.



(2) Set the ring gap of top ring at (B) in the figure on the 180° opposite direction of (A).

**NOTE:**

Install the top ring so that the ring mark (TN) faces the piston crown.



8) Check that the piston ring is installed correctly.

## E: INSPECTION

### 1. CYLINDER BLOCK & PISTON

- 1) Visually inspect to make sure that there are no cracks, scratches or other damage.
- 2) Use liquid penetrant tester on the important sections to check for fissures.
- 3) Check that there are no traces of gas leaking or water leaking on the gasket attachment surface.
- 4) Check the oil passages for clogging.
- 5) Check for warpage of mating surfaces of the cylinder block that contacts cylinder head using a straight edge and thickness gauge. If it exceeds the limit, correct the surface by grinding it with a surface grinder or replace the cylinder block.

**NOTE:**

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

**Cylinder block warpage:**

**Limit**

**0.025 mm (0.00098 in)**

**Grinding limit of cylinder block :**

**To 204.9 mm (8.067 in)**

**Height of cylinder block:**

**Standard**

**205.0 mm (8.071 in)**

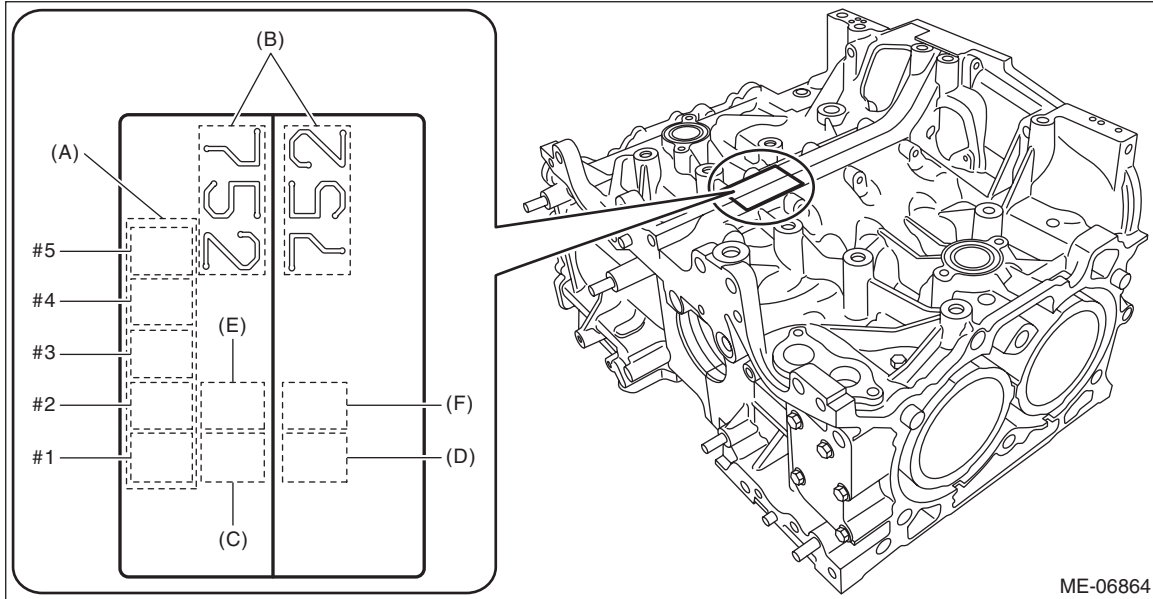
# Cylinder Block

## MECHANICAL

6) Using a cylinder bore gauge, check the inner diameter of cylinder liner, cylindricity, out-of-roundness. If it is not within the standard, perform boring and honing, or replace the cylinder block and piston as a set. For boring and honing procedure, refer to step 8).

### NOTE:

- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the inner diameter of each cylinder liner in both the thrust and piston pin directions at the heights as shown in the figure.
- The cylinder bore size mark is stamped on the upper face of the cylinder block.



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

**Inner diameter of cylinder liner:**

**Cylinder bore size mark A**

**Standard**

86.005 — 86.015 mm (3.3860 — 3.3864 in)

**Cylinder bore size mark B**

**Standard**

85.995 — 86.005 mm (3.3856 — 3.3860 in)

**Cylindricity of cylinder liner:**

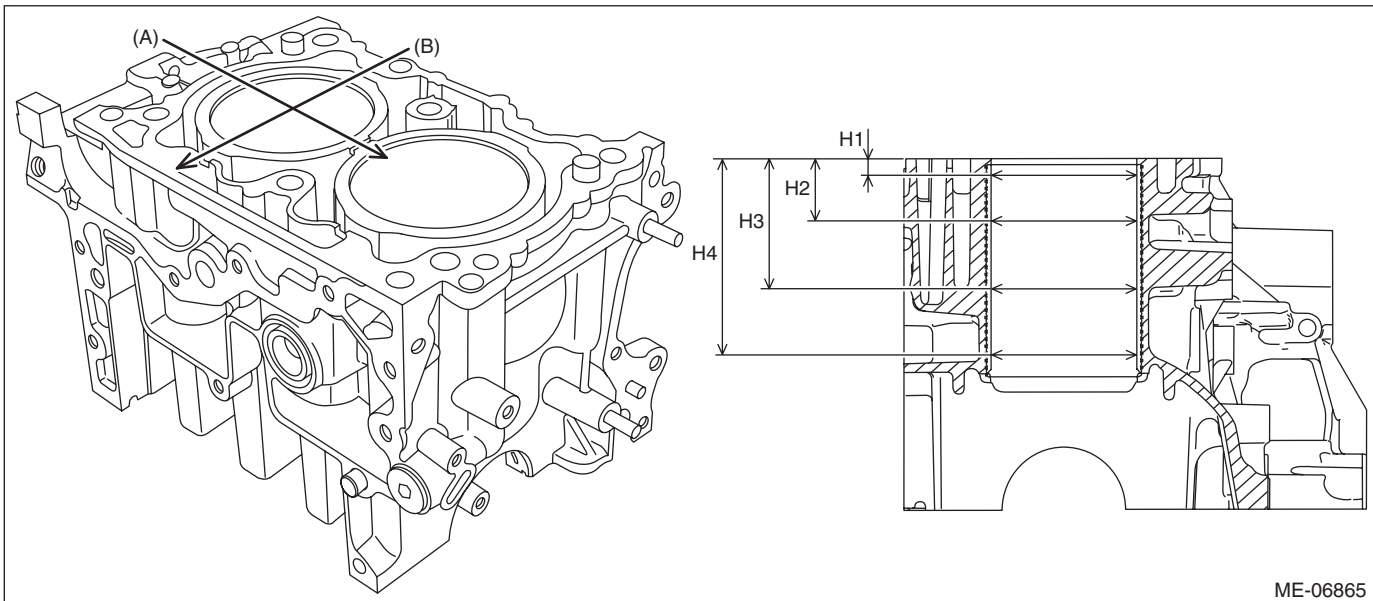
**Limit**

0.03 mm (0.0012 in)

**Out-of-roundness of cylinder liner:**

**Limit**

0.010 mm (0.0004 in)



ME-06865

(A) Thrust direction

(B) Piston pin direction

H1: 10 mm (0.3937 in)

H2: 45 mm (1.7717 in)

H3: 80 mm (3.1496 in)

H4: 115 mm (4.5276 in)

# Cylinder Block

## MECHANICAL

7) Check the clearance between cylinder liner and piston. Check the clearance between cylinder liner and piston by measuring the inner diameter of cylinder liner and the outer diameter of piston respectively.

### NOTE:

For the measurement of the inner diameter of cylinder liner, refer to step 6).

(1) Check the outer diameter of piston with a micrometer. If it is not within the standard, replace the piston.

### NOTE:

- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the outer diameter of each piston in thrust direction at the height as shown in the figure.
- Standard sized pistons are classified into two grades, "A" and "B". These grades should be used as guide lines in selecting a standard piston.
- If the piston is replaced, check the clearance between cylinder liner and piston in the step (2), and select a suitable sized piston.

### **Piston grade point H:**

**40.0 mm (1.57 in)**

### **Piston outer diameter:**

#### **Standard size (grade A)**

##### **Standard**

**85.985 — 85.995 mm (3.3852 — 3.3856 in)**

#### **Standard size (grade B)**

##### **Standard**

**85.975 — 85.985 mm (3.3848 — 3.3852 in)**

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

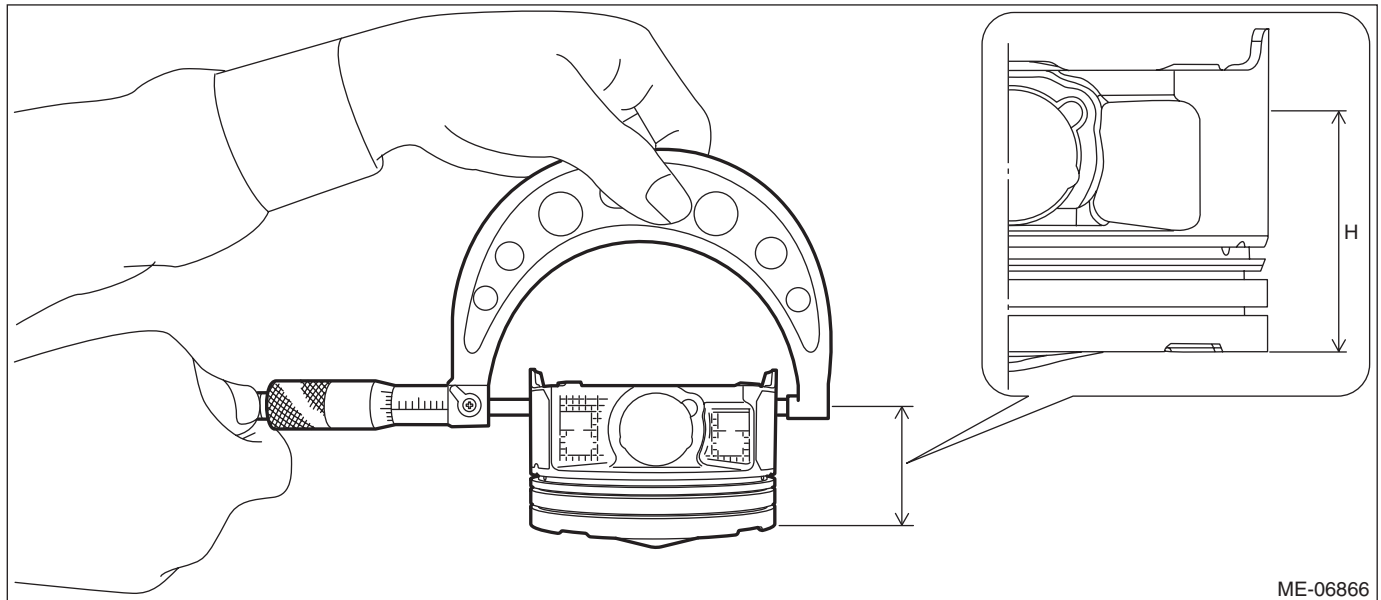
##### **Standard**

**86.225 — 86.245 mm (3.3947 — 3.3955 in)**

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

##### **Standard**

**86.475 — 86.495 mm (3.4045 — 3.4053 in)**



ME-06866

(2) Calculate the clearance between cylinder liner and piston. If it is not within the standard, perform boring and honing, or replace the cylinder block and piston as a set. For boring and honing procedure, refer to step 8).

### **Clearance between cylinder liner and piston:**

#### **Standard**

**0.010 — 0.030 mm (0.00039 — 0.00118 in)**

## 8) Boring and honing

- (1) If any of the inner diameter, cylindricity, out-of-roundness or clearance between cylinder liner and piston is out of standard or if there is any damage on the cylinder liner, rebore it to replace with an over-size piston.

### CAUTION:

**When any of the cylinder liner needs reboring, all other cylinder liners must be bored at the same time, and replaced with oversize pistons.**

- (2) If the inner diameter of cylinder liner exceeds the limit after boring and honing, replace the cylinder block and piston as a set.

### NOTE:

- Immediately after reboring, the inner diameter of cylinder liner may differ from its real diameter due to temperature rise. Thus, when measuring the inner diameter of cylinder liner, wait until the temperature has cooled to 20°C (68°F).
- For the measurement of the inner diameter of cylinder liner, refer to step 6).

**Inner diameter of cylinder liner boring limit (diameter):**

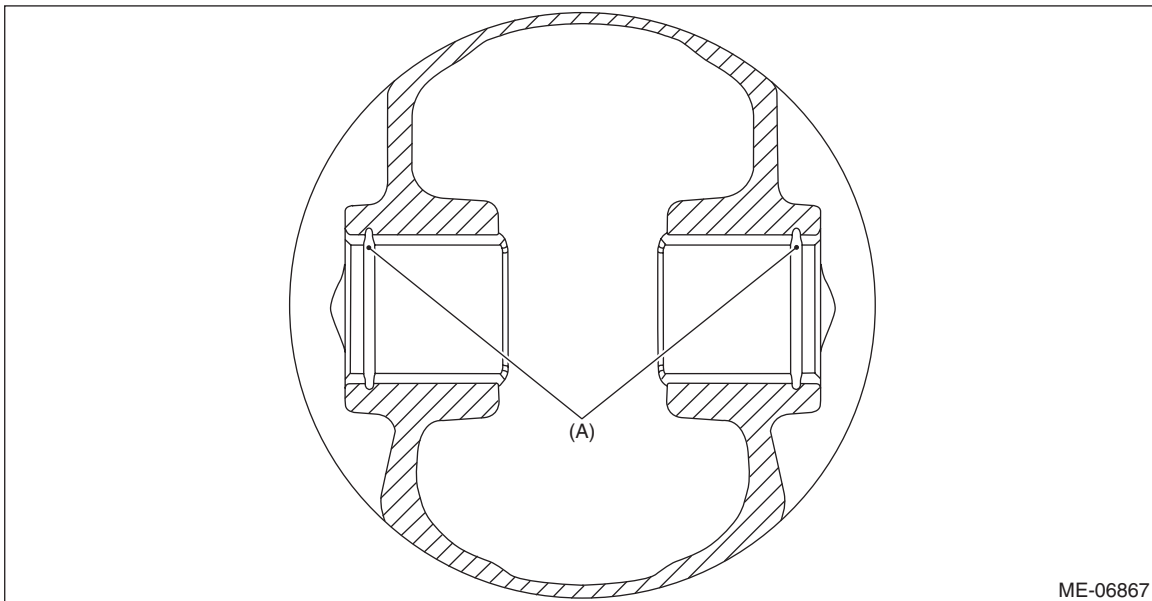
**To 86.505 mm (3.4057 in)**

## 2. PISTON AND PISTON PIN

- 1) Check the piston and piston pin for wear or crack.
- 2) Check the snap ring for distortion or wear.
- 3) Check the piston ring groove for damage.
- 4) Check the circlip groove (A) for burr.

### NOTE:

If the burr is found, remove the burr from groove.



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- 5) Check that the piston pin can be inserted into the piston with a thumb at 20°C (68°F).
- 6) Check the clearance between piston and piston pin. Check the clearance between piston and piston pin by measuring the inner diameter of piston pin hole and the outer diameter of piston pin respectively.

- (1) Using a caliper gauge, measure the inner diameter of piston pin hole.

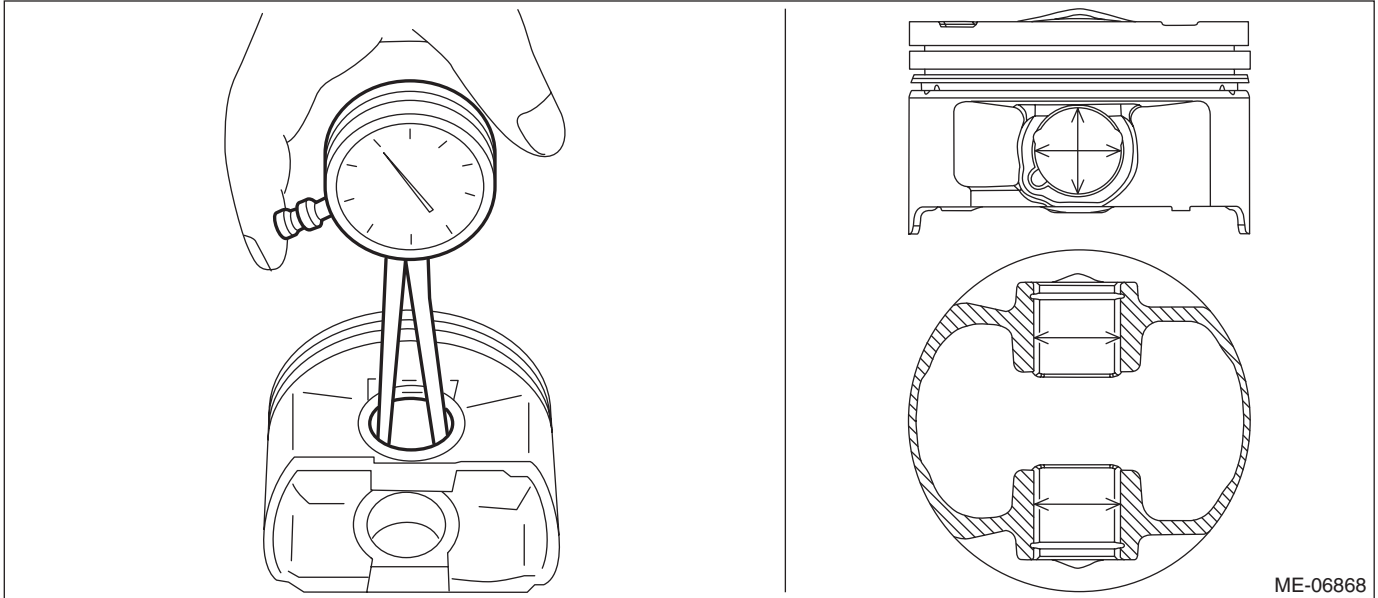
### NOTE:

- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the inner diameter of the piston pin hole at the four locations as shown in the figure, and read the value of most worn location.

# Cylinder Block

## MECHANICAL

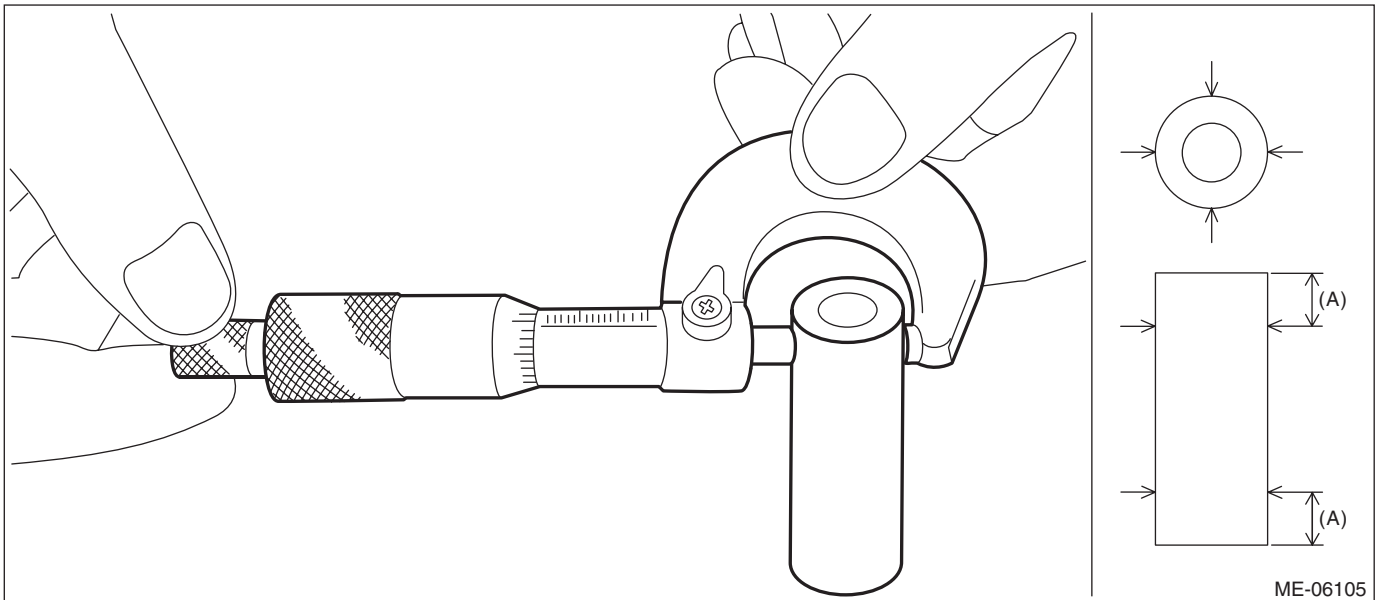
- Record the measured value.



(2) Measure the outer diameter of piston pin with a micrometer.

### NOTE:

- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the outer diameter of the piston pin at the four locations as shown in the figure, and read the value of most worn location.
- Record the measured value.



(A) 10 mm (0.394 in)

(3) Calculate the clearance between piston and piston pin. If it is not within the standard, replace the piston and piston pin as a set.

### Clearance between piston and piston pin:

#### Standard

0.004 — 0.008 mm (0.0002 — 0.0003 in)



## 3. PISTON RING

- 1) Make sure the piston ring is not broken or damaged.
- 2) Using a cylindrical guide, insert the piston ring into the cylinder liner so that they are perpendicular to the cylinder wall, and check the piston ring gap using a thickness gauge. If it is not within the standard, replace the piston ring.

### NOTE:

- Measurement should be performed at a temperature of 20°C (68°F).
- Use piston ring with same size as piston when replacing piston ring.

### *Piston ring gap:*

#### *Compression ring (top ring)*

##### *Standard*

*0.20 — 0.25 mm (0.0079 — 0.0098 in)*

#### *Compression ring (second ring)*

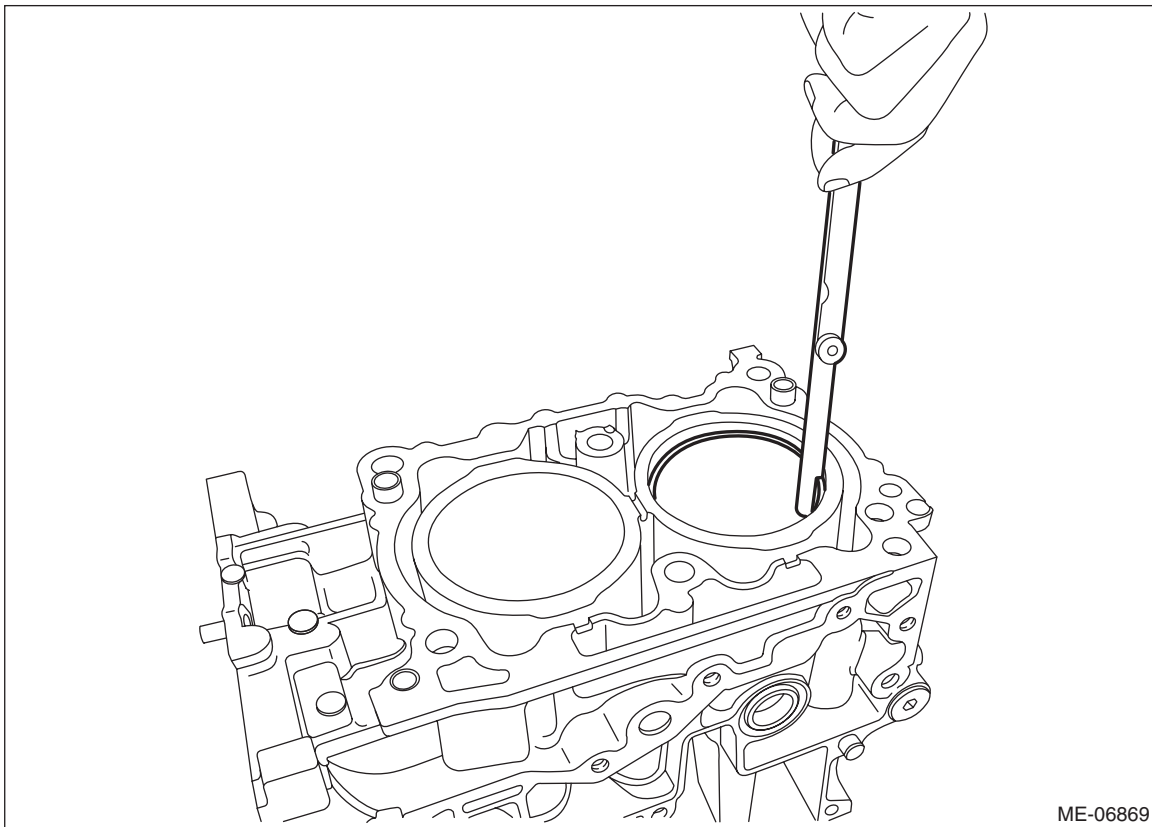
##### *Standard*

*0.40 — 0.50 mm (0.0157 — 0.0197 in)*

#### *Oil ring (upper rail and lower rail)*

##### *Standard*

*0.10 — 0.35 mm (0.0039 — 0.0138 in)*



ME-06869

# Cylinder Block

## MECHANICAL

3) Fit the compression ring straight into the piston ring groove, then check the clearance between compression ring and piston with a thickness gauge. If it is not within the standard, replace the compression ring.

### NOTE:

- Measurement should be performed at a temperature of 20°C (68°F).
- Before inspecting the clearance, clean the piston ring groove and compression ring.
- Use compression ring with same size as piston when replacing compression ring.

### **Clearance between compression ring and piston:**

#### **Top ring**

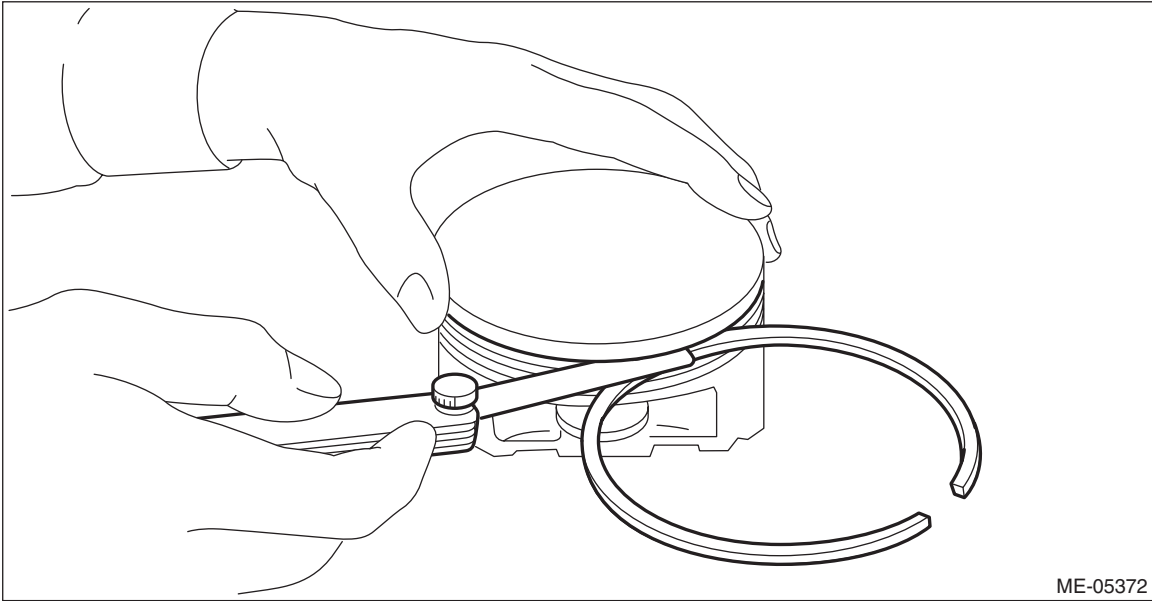
##### **Standard**

**0.040 — 0.080 mm (0.0016 — 0.0031 in)**

#### **Second ring**

##### **Standard**

**0.045 — 0.085 mm (0.0018 — 0.0033 in)**



ME-05372

## 4. CONNECTING ROD AND CONNECTING ROD BEARING

1) Check for bend or twist using a connecting rod aligner. If it exceeds the limit, replace the connecting rod.

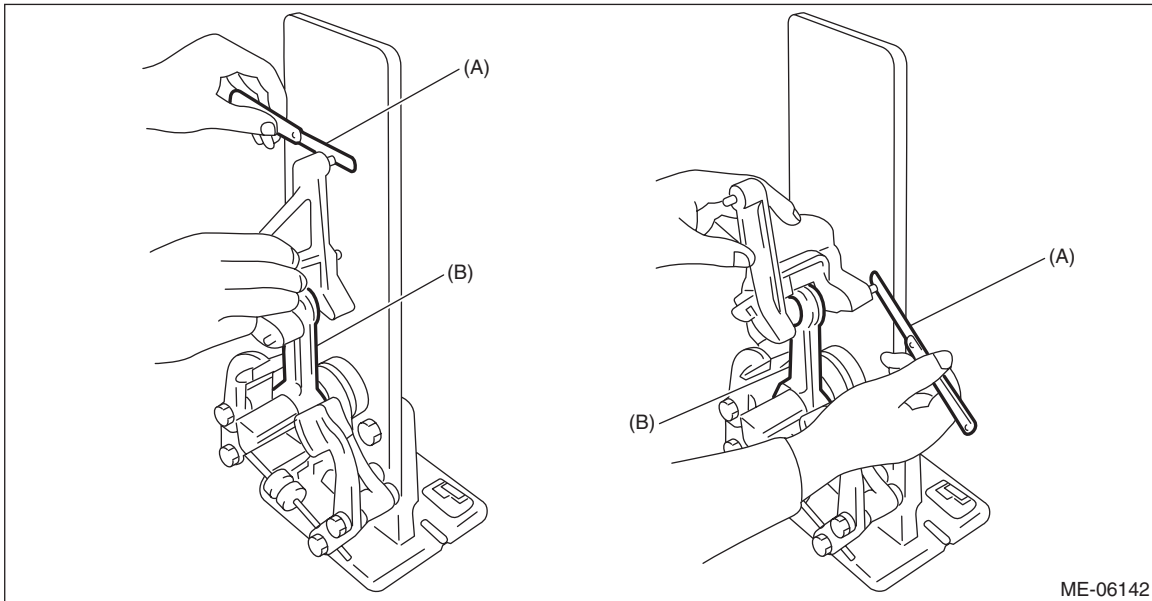
NOTE:

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

**Bend or twist per 100 mm (3.94 in) in length:**

**Limit**

**0.10 mm (0.0039 in)**



(A) Thickness gauge

(B) Connecting rod

2) Check that the large or small end thrust surface of each connecting rod is not damaged.

3) Check each connecting rod bearing for scar, peeling, seizure, melting or wear, etc.

4) Check the thrust clearance of each connecting rod using a thickness gauge.

NOTE:

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

(1) Clean the #1 connecting rod bearing and the #1 pin of crankshaft, and apply engine oil to the #1 pin of crankshaft.

(2) Set the #1 connecting rod bearing to the #1 connecting rod and #1 connecting rod cap.

(3) Set the #1 connecting rod, #1 connecting rod cap and #1 connecting rod cap bolt to the #1 pin of crankshaft.

NOTE:

- Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.
- Use a new connecting rod cap bolt.
- Apply a coat of engine oil to the #1 connecting rod cap bolt thread.

# Cylinder Block

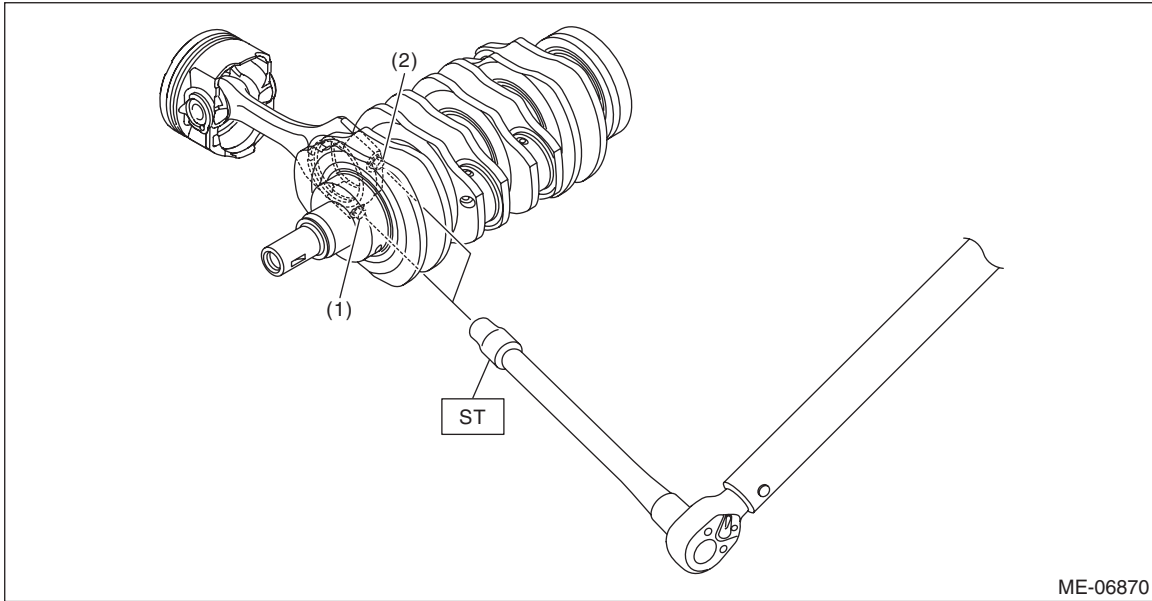
## MECHANICAL

(4) Using ST, tighten the #1 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 25 N·m (2.5 kgf-m, 18.4 ft-lb) in numerical order as shown in the figure.

### CAUTION:

- Make sure to hold the crankshaft securely during work.
- When holding the crankshaft, be careful not to damage the crankshaft.

ST 18270AA020 SOCKET



(5) Using ST and angle gauge, tighten the #1 connecting rod cap bolts with specified angle in numerical order as shown in the figure.

### CAUTION:

- Make sure to hold the crankshaft securely during work.
- When holding the crankshaft, be careful not to damage the crankshaft.

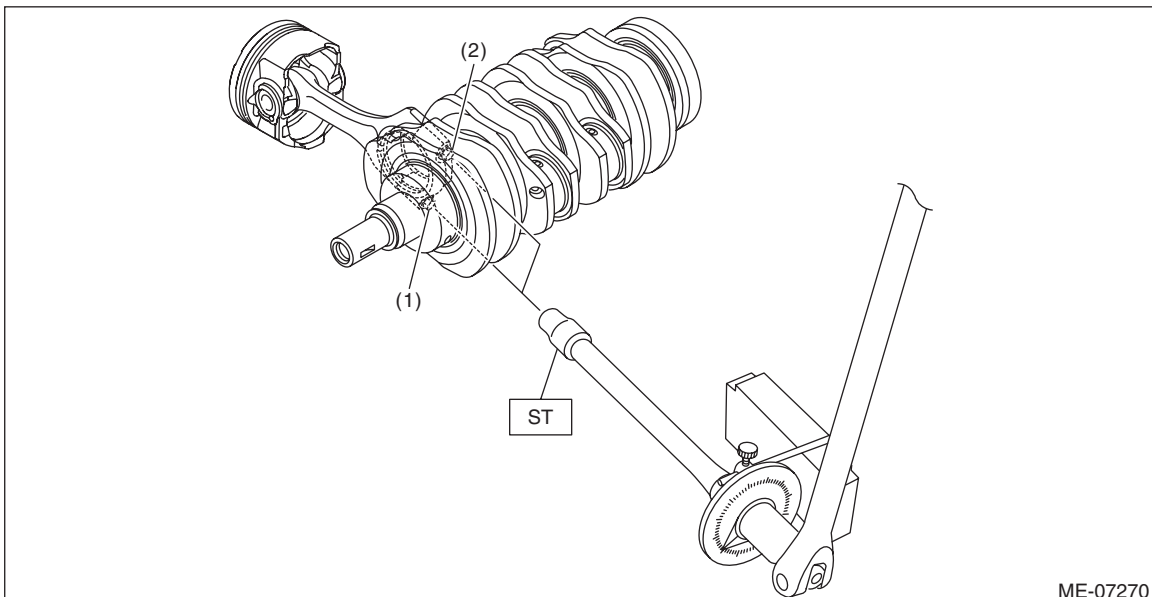
### NOTE:

Prevent angle gauge from rotating using a V-block, etc.

ST 18270AA020 SOCKET

### Tightening angle:

$90^{\circ} \pm 5^{\circ}$   
 $-0^{\circ}$



- (6) In the same manner, install the #2, #3 and #4 connecting rods.
- (7) Check the thrust clearance of each connecting rod using a thickness gauge. If it is not within the standard, replace the connecting rod.

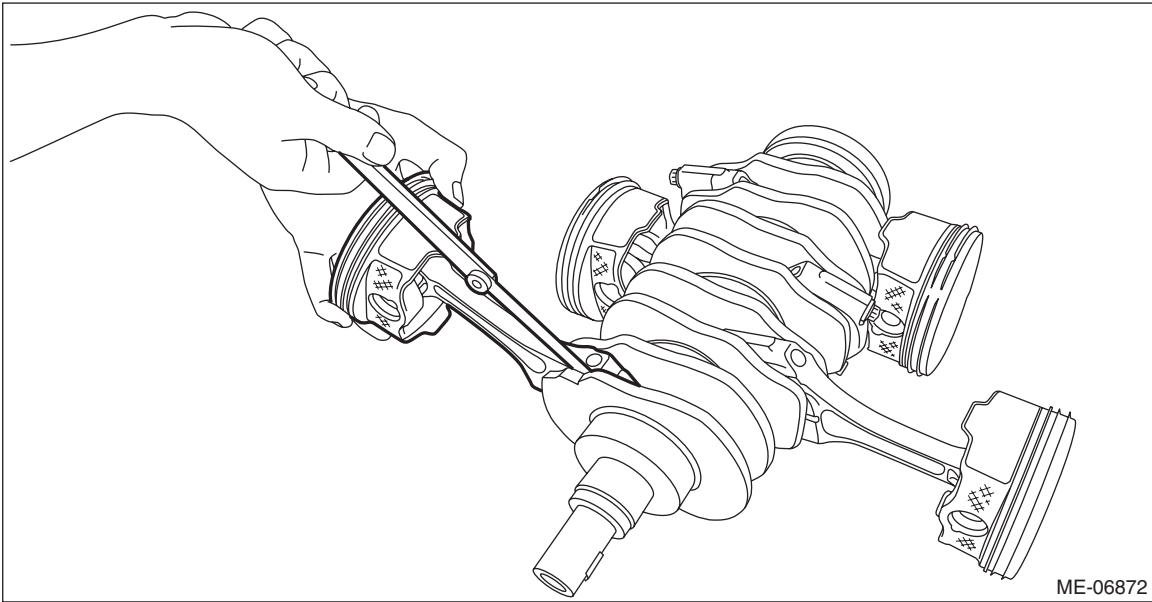
**NOTE:**

Measure the thrust clearance of each connecting rod at several points, and replace the connecting rod if there is uneven wear.

**Connecting rod thrust clearance:**

**Standard**

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



- 5) Check the oil clearance on each connecting rod bearing using plastigauge.

**NOTE:**

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

- (1) Clean the #1 connecting rod bearing and the #1 pin of crankshaft.
- (2) Set the #1 connecting rod bearing to the #1 connecting rod and #1 connecting rod cap.
- (3) Place a plastigauge across the #1 pin of crankshaft, and set the #1 connecting rod, #1 connecting rod cap and #1 connecting rod cap bolt to the #1 pin of crankshaft.

**NOTE:**

- Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.
- Use a new connecting rod cap bolt.
- Apply a coat of engine oil to the #1 connecting rod cap bolt thread.

# Cylinder Block

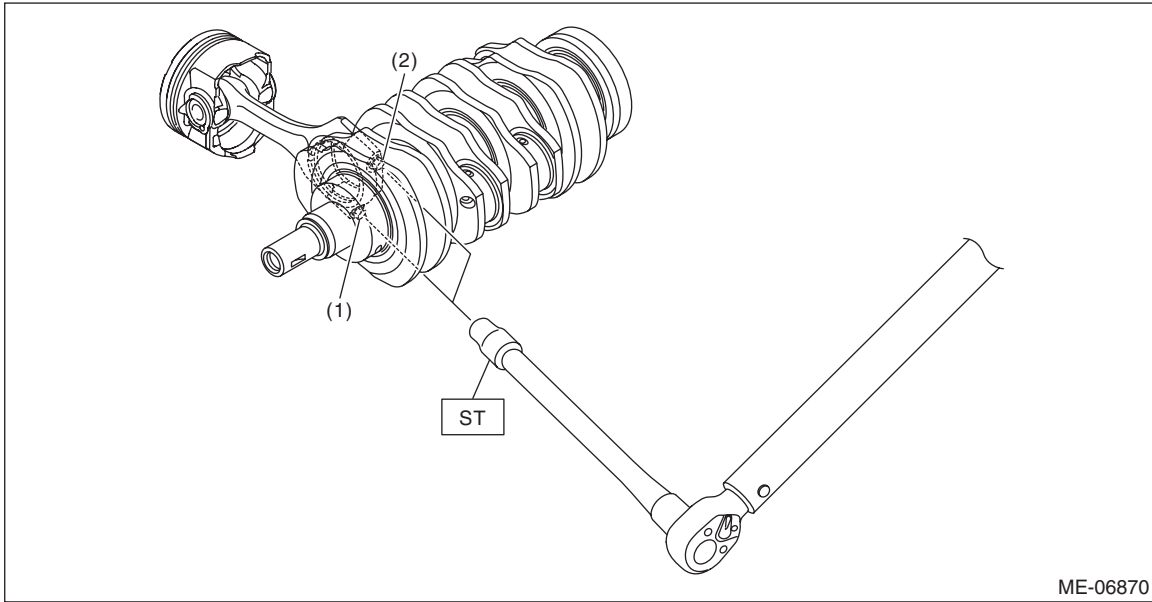
## MECHANICAL

(4) Using ST, tighten the #1 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 25 N·m (2.5 kgf-m, 18.4 ft-lb) in numerical order as shown in the figure.

### CAUTION:

- Make sure to hold the crankshaft securely during work.
- When holding the crankshaft, be careful not to damage the crankshaft.
- During tightening, be careful not to move the #1 connecting rod and the #1 connecting rod cap.

ST 18270AA020 SOCKET



(5) Using ST and angle gauge, tighten the #1 connecting rod cap bolts with specified angle in numerical order as shown in the figure.

**CAUTION:**

- Make sure to hold the crankshaft securely during work.
- When holding the crankshaft, be careful not to damage the crankshaft.
- During tightening, be careful not to move the #1 connecting rod and the #1 connecting rod cap.

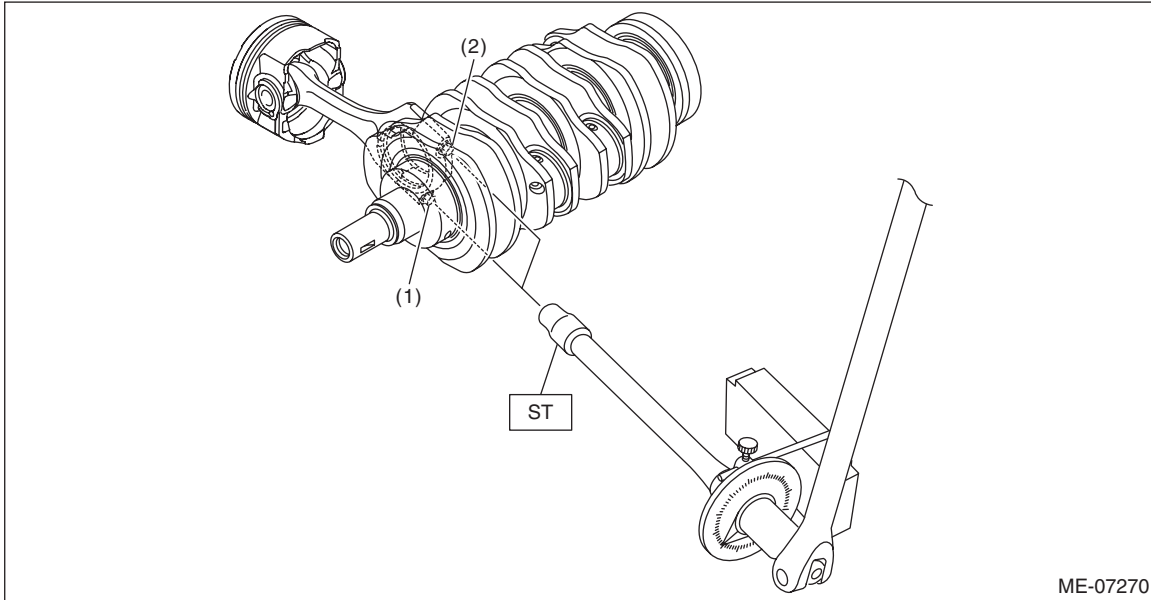
**NOTE:**

Prevent angle gauge from rotating using a V-block, etc.

ST 18270AA020 SOCKET

**Tightening angle:**

$90^{+5^{\circ}}_{-0^{\circ}}$



# Cylinder Block

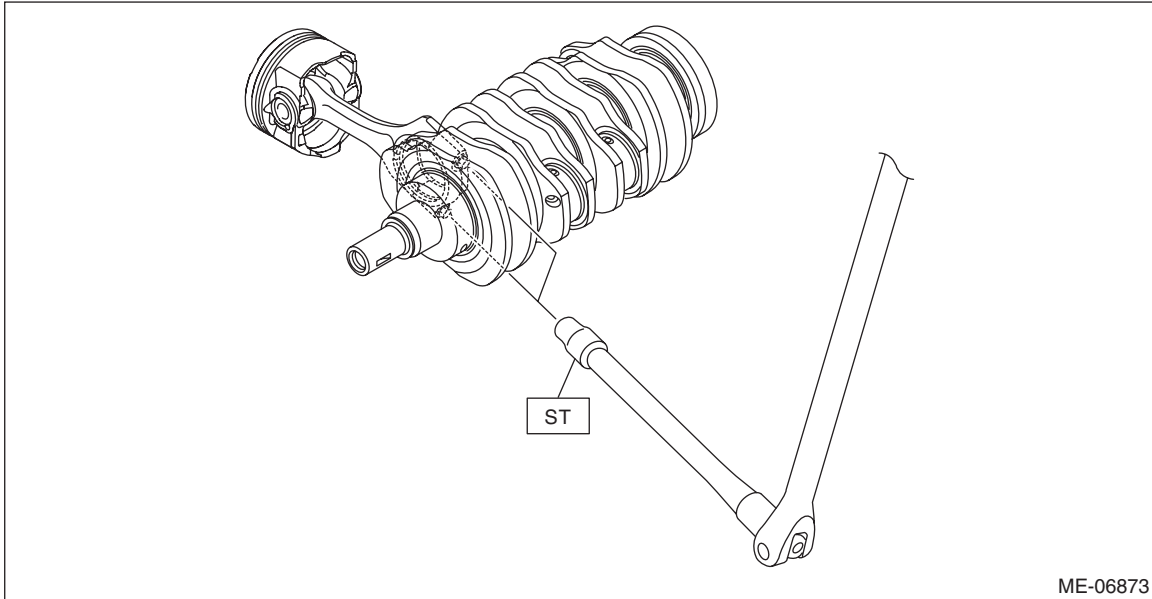
## MECHANICAL

(6) Using ST, loosen the #1 connecting rod cap bolt, and remove the #1 connecting rod cap bolt and #1 connecting rod cap.

### CAUTION:

- Make sure to hold the crankshaft securely during work.
- When holding the crankshaft, be careful not to damage the crankshaft.
- During removal, be careful not to move the #1 connecting rod and the #1 connecting rod cap.

ST 18270AA020 SOCKET



(7) Determine oil clearance of the #1 connecting rod bearing by matching the widest point of the plastigauge on #1 pin of crankshaft against scale printed on a package of the plastigauge. If it is not within the standard, replace the #1 connecting rod bearing.

### NOTE:

Measure the outer diameter of crankshaft pin using micrometer, and select the suitable size connecting rod bearing when replacing the connecting rod bearing.

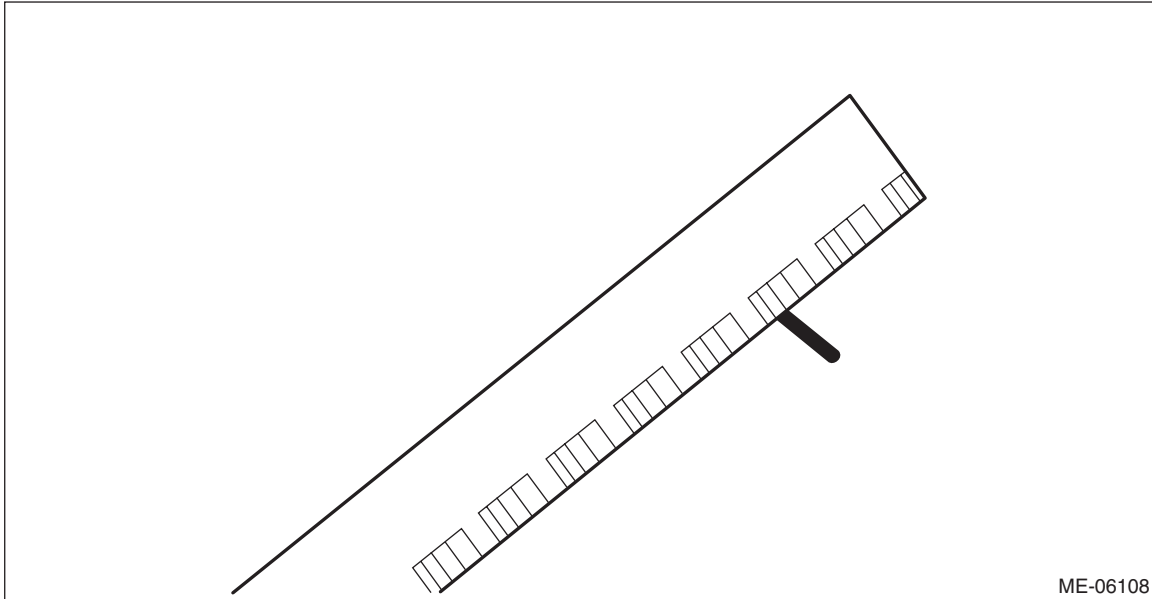
Unit: mm (in)		
Bearing	Connecting rod bearing thickness (at center)	Crankshaft pin outer diameter
	Standard	Standard
Standard size	1.492 — 1.508 (0.0587 — 0.0594)	49.976 — 50.000 (1.9676 — 1.9685)
0.03 (0.0012) Undersize	1.511 — 1.515 (0.0595 — 0.0596)	49.946 — 49.970 (1.9664 — 1.9673)
0.05 (0.0020) Undersize	1.521 — 1.525 (0.0599 — 0.0600)	49.926 — 49.950 (1.9656 — 1.9665)
0.25 (0.0098) Undersize	1.621 — 1.625 (0.0638 — 0.0640)	49.726 — 49.750 (1.9577 — 1.9587)



## Connecting rod bearing oil clearance:

### Standard

0.025 — 0.055 mm (0.0010 — 0.0022 in)



ME-06108

(8) Completely remove the plastigauge.

(9) In the same manner, check oil clearance of the #2, #3 and #4 connecting rod bearings.

## 5. PISTON PIN & CONNECTING ROD BUSHING

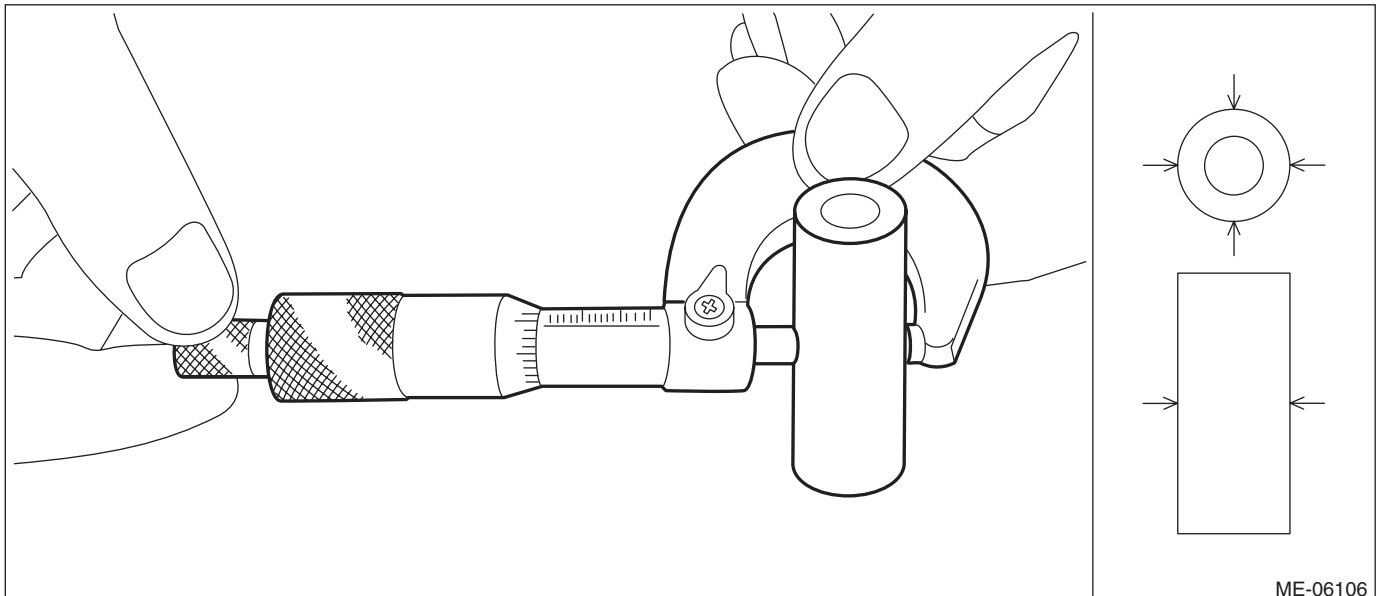
1) Check that the connecting rod bushing is not damaged.

2) Check the clearance between piston pin and connecting rod bushing. Check the clearance between piston pin and connecting rod bushing by measuring the outer diameter of piston pin and the inner diameter of connecting rod bushing respectively.

(1) Measure the outer diameter of piston pin with a micrometer.

### NOTE:

- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the outer diameter of the piston pin at the two locations as shown in the figure, and read the value of most worn location.
- Record the measured value.



ME-06106

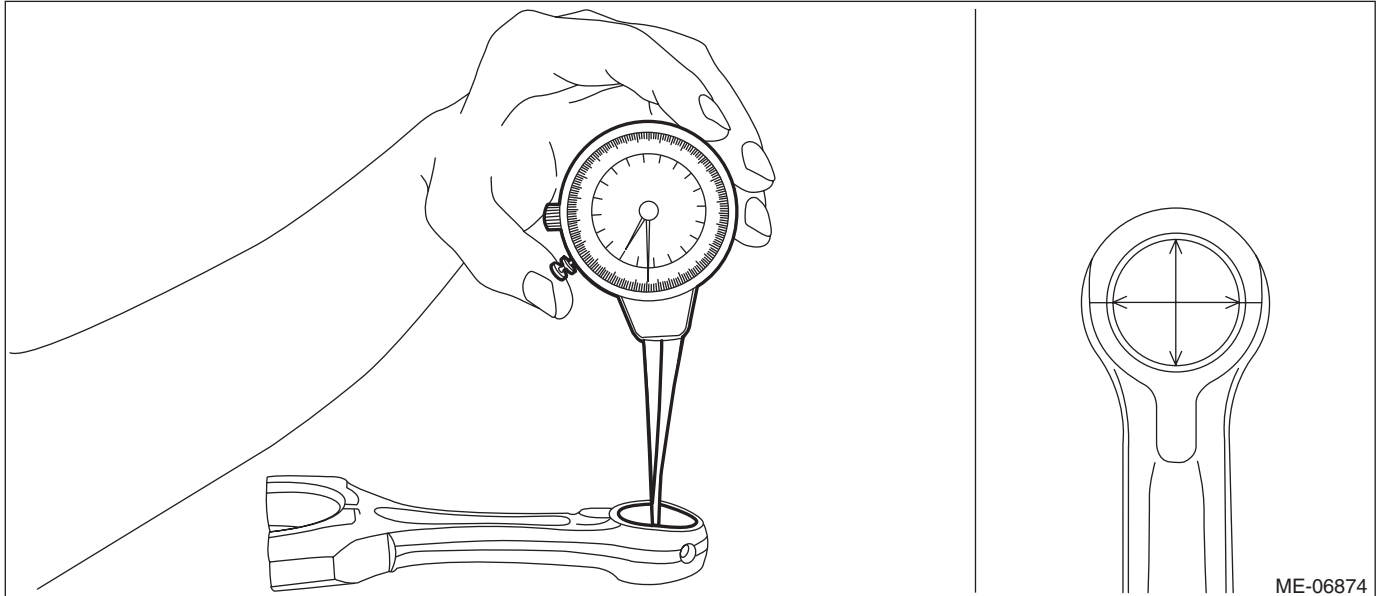
# Cylinder Block

## MECHANICAL

(2) Using a caliper gauge, measure the inner diameter of connecting rod bushing.

### NOTE:

- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the inner diameter of the connecting rod bushing at the two locations as shown in the figure, and read the value of most worn location.
- Record the measured value.



(3) Calculate the clearance between piston pin and connecting rod bushing.

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

#### **Standard**

**0.004 — 0.026 mm (0.0002 — 0.0010 in)**

3) If the clearance between piston pin and connecting rod bushing is not within the standard, replace the connecting rod and piston pin as a set.

## 6. CRANKSHAFT AND CRANKSHAFT BEARING

- 1) Clean the crankshaft completely, and check it for cracks using liquid penetrant tester.
- 2) Using a dial gauge, check the crankshaft bend. If it exceeds the limit, grind to correct the crankshaft journal or replace the crankshaft.

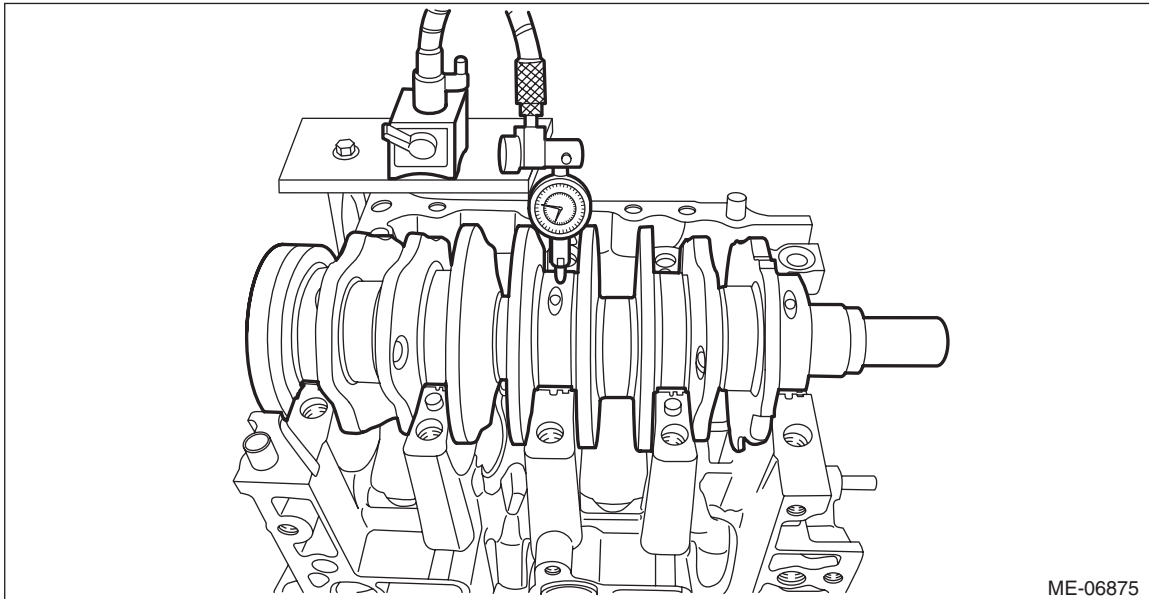
### NOTE:

- Measurement should be performed at a temperature of 20°C (68°F).
- If a suitable V-block is not available, using just the #1 and #5 crankshaft bearings on cylinder block, position the crankshaft on cylinder block. Then, measure the crankshaft bend using a dial gauge.
- When grinding to correct the crankshaft journal, refer to step 3).

### Crankshaft bend:

#### Limit

**0.035 mm (0.0014 in)**



- 3) Using a micrometer, check the outer diameter of crankshaft pin, outer diameter of journal, cylindricity, and out-of-roundness. If it is not within the standard, replace the connecting rod bearing or crankshaft bearing, and grind to correct the crankshaft pin or journal or replace the crankshaft as required.

### NOTE:

- Measurement should be performed at a temperature of 20°C (68°F).
- Select the suitable size connecting rod bearing or crankshaft bearing when replacing the connecting rod bearing or crankshaft bearing.
- When grinding to correct the crankshaft pin or journal, finish them to the suitable outer diameter as shown in the table below according to the undersize bearing to be used.

Unit: mm (in)					
Bearing	Connecting rod bearing thickness (at center)	Crankshaft pin outer diameter	Crankshaft bearing thickness (at center)		Crankshaft journal outer diameter
	Standard		#1, #2, #3, #4	#5	
Standard size	1.492 — 1.508 (0.0587 — 0.0594)	49.976 — 50.000 (1.9676 — 1.9685)	2.495 — 2.513 (0.0982 — 0.0989)	2.493 — 2.511 (0.0981 — 0.0989)	67.985 — 68.009 (2.6766 — 2.6775)
0.03 (0.0012) Undersize	1.511 — 1.515 (0.0595 — 0.0596)	49.946 — 49.970 (1.9664 — 1.9673)	2.519 — 2.522 (0.0992 — 0.0993)	2.517 — 2.520 (0.0991 — 0.0992)	67.955 — 67.979 (2.6754 — 2.6763)
0.05 (0.0020) Undersize	1.521 — 1.525 (0.0599 — 0.0600)	49.926 — 49.950 (1.9656 — 1.9665)	2.529 — 2.532 (0.0996 — 0.0997)	2.527 — 2.530 (0.0995 — 0.0996)	67.935 — 67.959 (2.6746 — 2.6755)
0.25 (0.0098) Undersize	1.621 — 1.625 (0.0638 — 0.0640)	49.726 — 49.750 (1.9577 — 1.9587)	2.629 — 2.632 (0.1035 — 0.1036)	2.627 — 2.630 (0.1034 — 0.1035)	67.735 — 67.759 (2.6667 — 2.6677)

# Cylinder Block

## MECHANICAL

### **Crankshaft pin:**

#### **Cylindricity**

#### **Limit**

**0.006 mm (0.0002 in)**

#### **Out-of-roundness**

#### **Limit**

**0.005 mm (0.0002 in)**

#### **Grinding limit (dia.)**

**To 49.726 mm (1.9577 in)**

### **Crankshaft journal:**

#### **Cylindricity**

#### **Limit**

**0.006 mm (0.0002 in)**

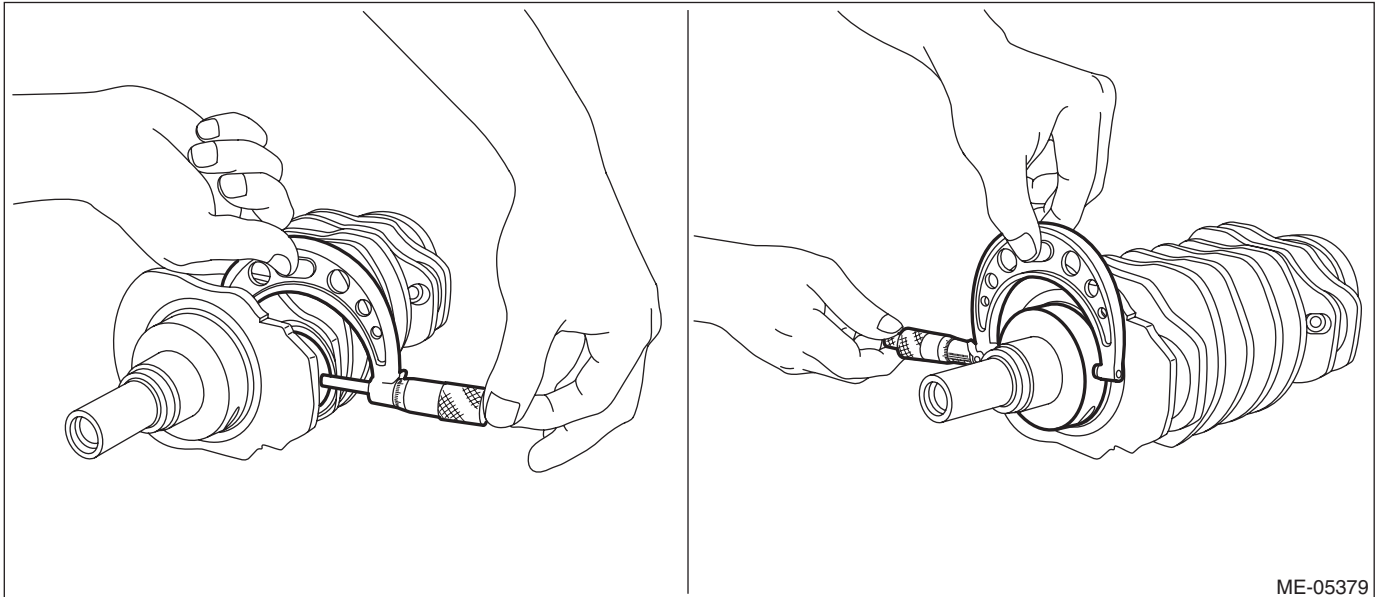
#### **Out-of-roundness**

#### **Limit**

**0.005 mm (0.0002 in)**

#### **Grinding limit (dia.)**

**To 67.735 mm (2.6667 in)**



ME-05379

- 4) Inspect the crankshaft bearing for scar, peeling, seizure, melting or wear, etc.
- 5) Use a thickness gauge to check the thrust clearance of crankshaft at thrust of #5 crankshaft bearing. If it is not within the standard, replace the #5 crankshaft bearing.

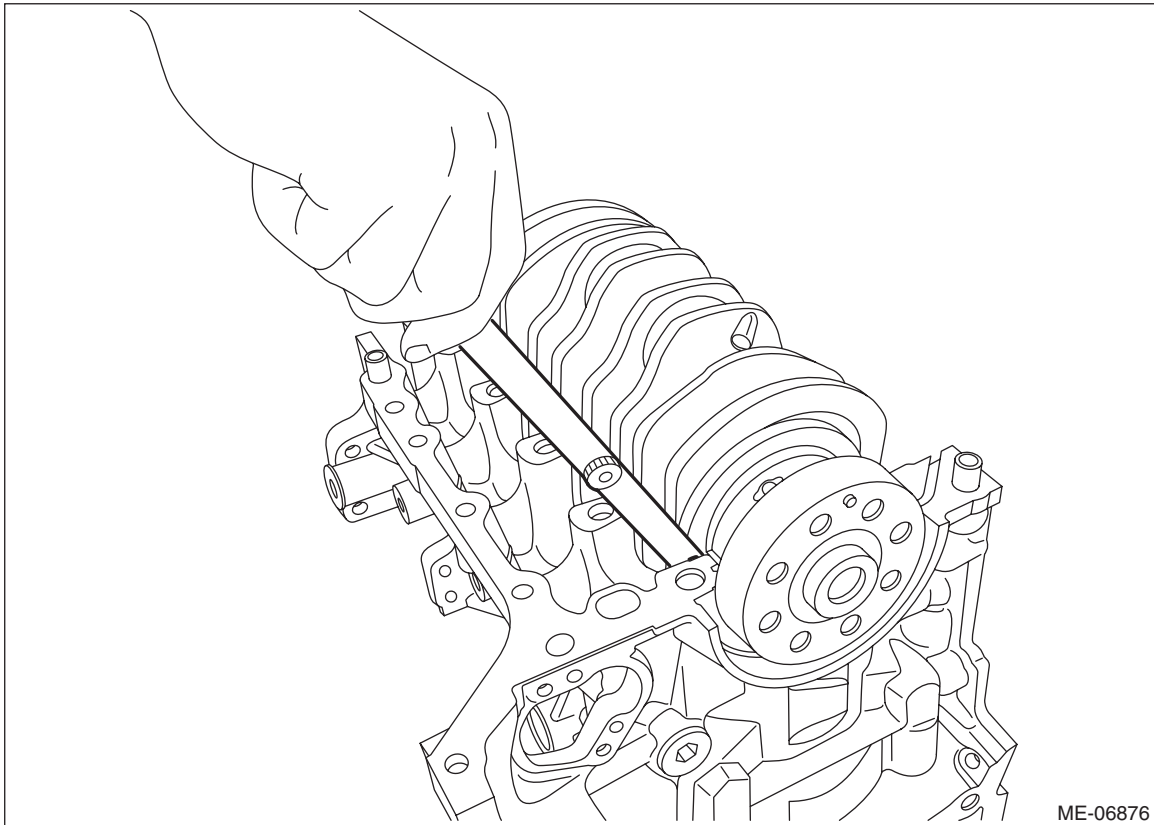
**NOTE:**

- Measurement should be performed at a temperature of 20°C (68°F).
- Set all the crankshaft bearings onto the cylinder block, then mount the crankshaft on the cylinder block, and use a thickness gauge to measure the thrust clearance of crankshaft.
- Select the #5 crankshaft bearing of suitable size by referring to step 3) when replacing #5 crankshaft bearing.

**Crankshaft thrust clearance:**

**Standard**

**0.130 — 0.308 mm (0.00512 — 0.01213 in)**



- 6) Check the oil clearance on each crankshaft bearing using plastigauge.

**NOTE:**

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

- (1) Install the cylinder block LH to the engine stand.

**CAUTION:**

- **When the engine stand is not used, place a wood board wrapped with a waste cloth to prevent the knock pin damage and to stabilize the cylinder block before work.**
- **Be careful not to scratch the mating surface of cylinder block during work.**
  - (2) Remove the liquid gasket from cylinder block.
  - (3) Clean each crankshaft bearing and crankshaft journal.
  - (4) Set each crankshaft bearing to the cylinder block.

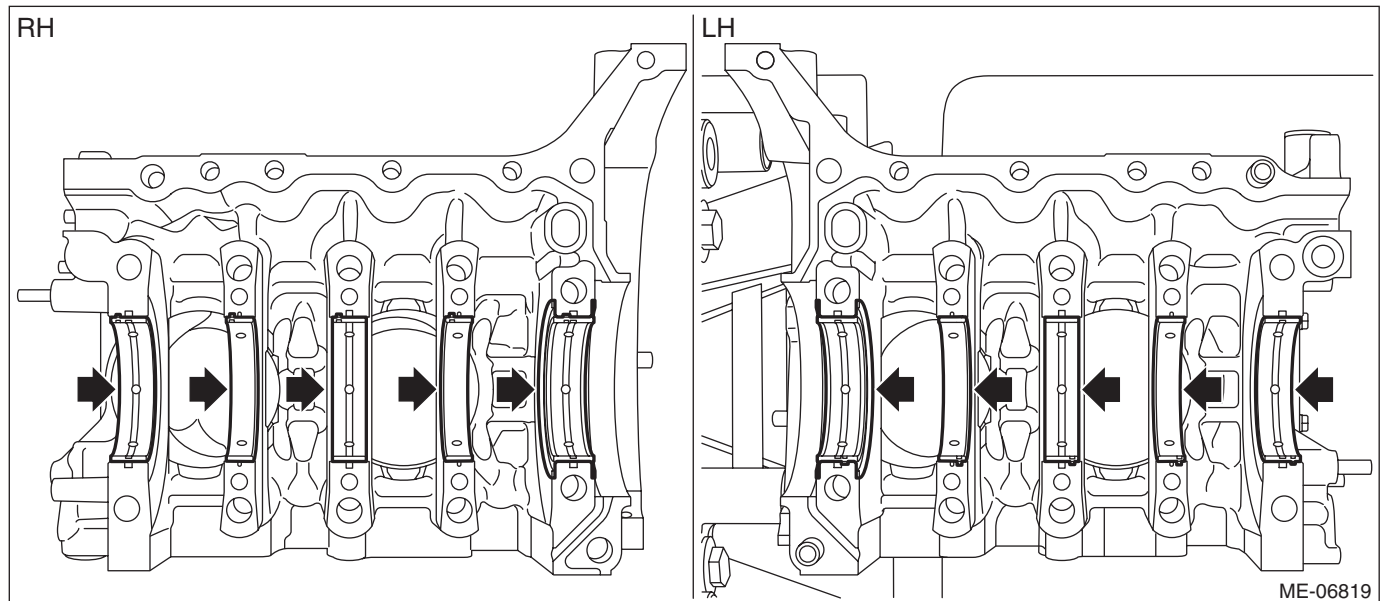
# Cylinder Block

## MECHANICAL

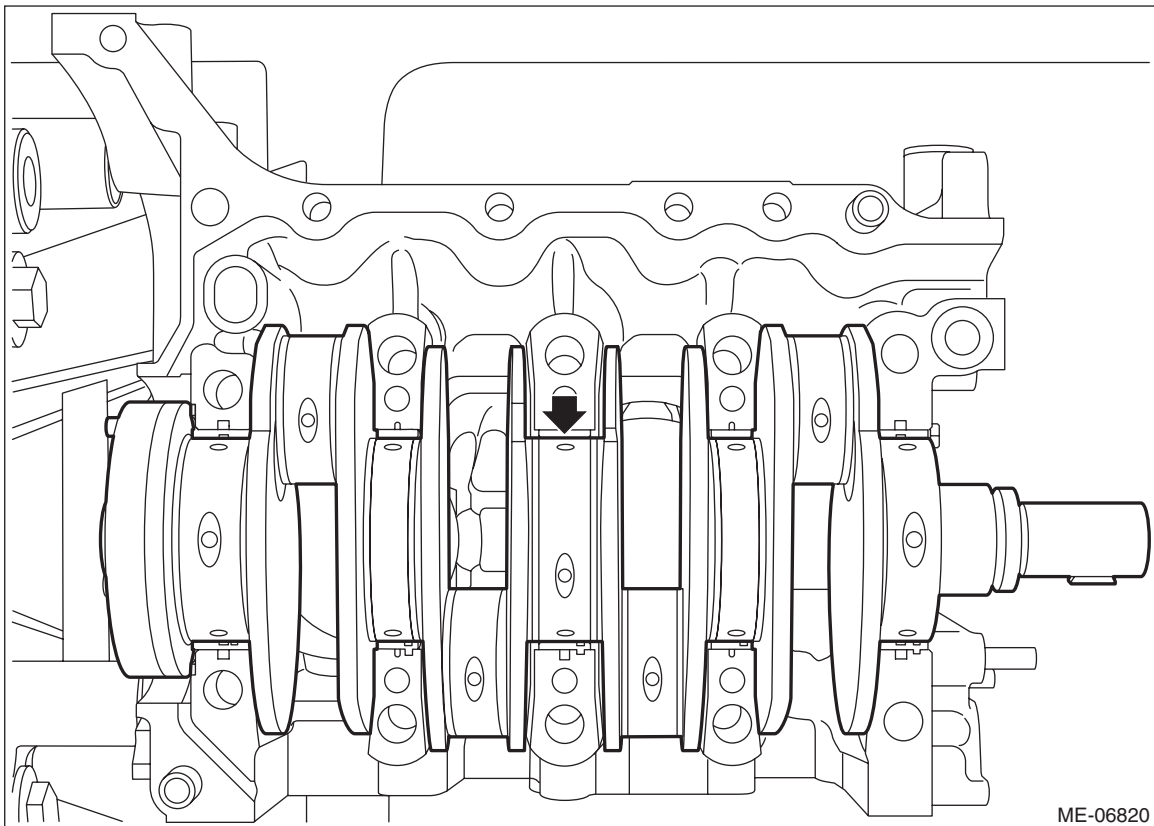
### CAUTION:

When performing the operation of the cylinder block RH, be careful of the following.

1. Place a wood board wrapped with a waste cloth to prevent the knock pin damage and to stabilize the cylinder block before work.
2. Be careful not to scratch the mating surface of cylinder block during work.



(5) Set the crankshaft to the cylinder block LH.



(6) Place a plastigauge across the crankshaft journals and set the cylinder block RH to the cylinder block LH.

(7) Apply a coat of engine oil to the washers and cylinder block mounting bolt threads.

### NOTE:

To prevent mixture of engine oil into the water jacket, do not apply a large amount.

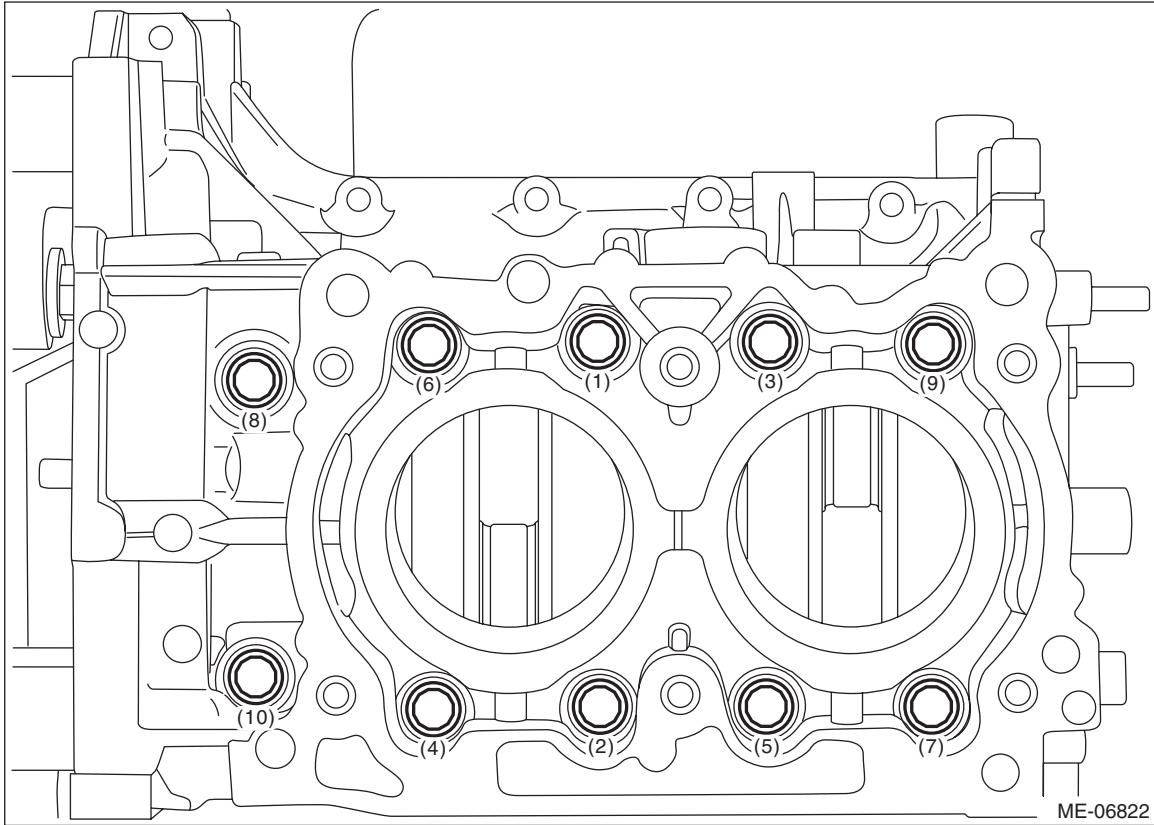
# Cylinder Block

MECHANICAL

(8) Tighten all mounting bolts with a torque of 35 N·m (3.6 kgf-m, 25.8 ft-lb) in numerical order as shown in the figure.

**CAUTION:**

When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



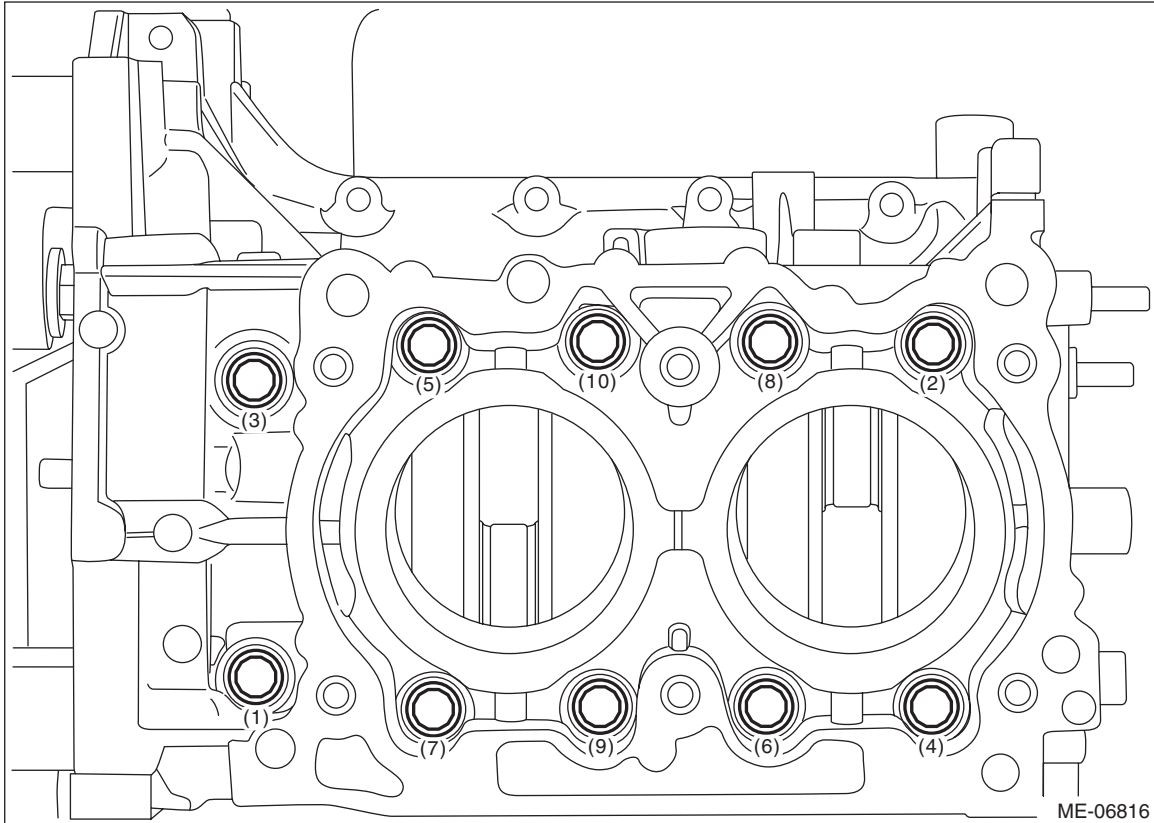
# Cylinder Block

## MECHANICAL

(9) Loosen all mounting bolts by 180° in numerical order as shown in the figure.

### CAUTION:

When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.





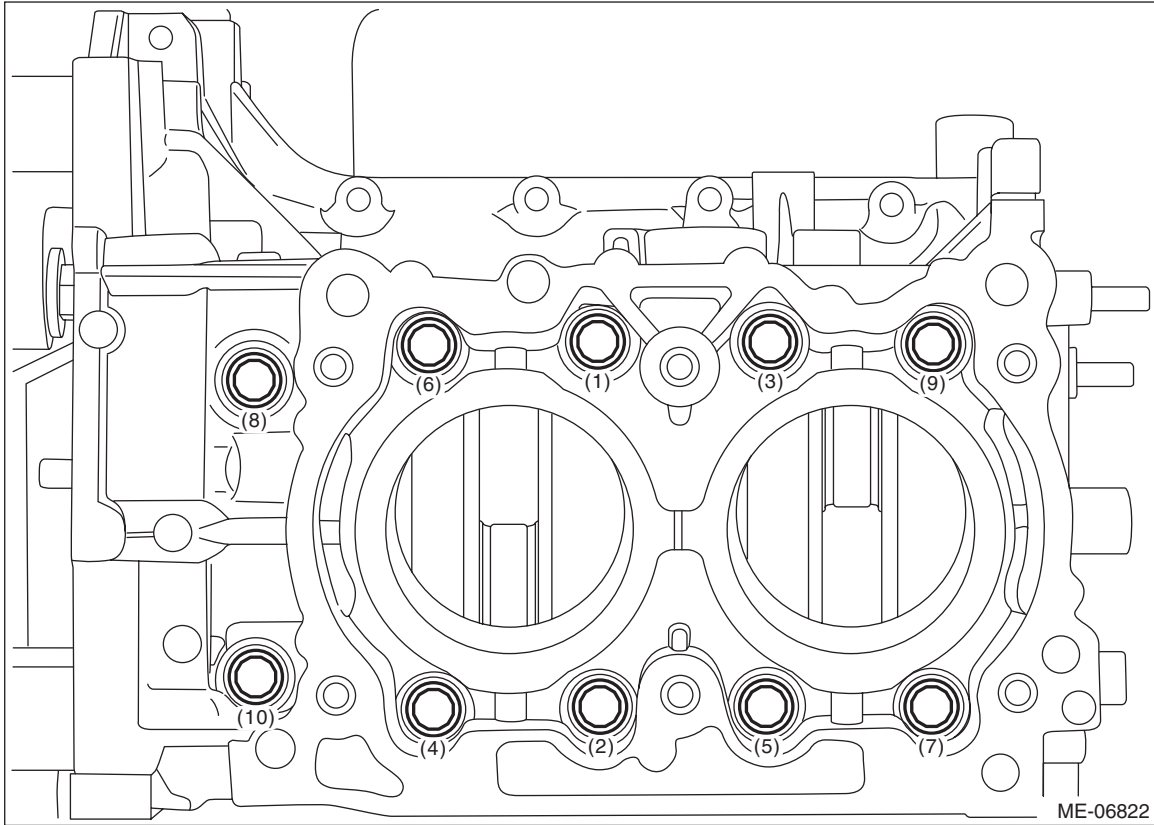
# Cylinder Block

MECHANICAL

(10) Tighten all mounting bolts with a torque of 35 N·m (3.6 kgf-m, 25.8 ft-lb) in numerical order as shown in the figure.

**CAUTION:**

**When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.**



## Cylinder Block

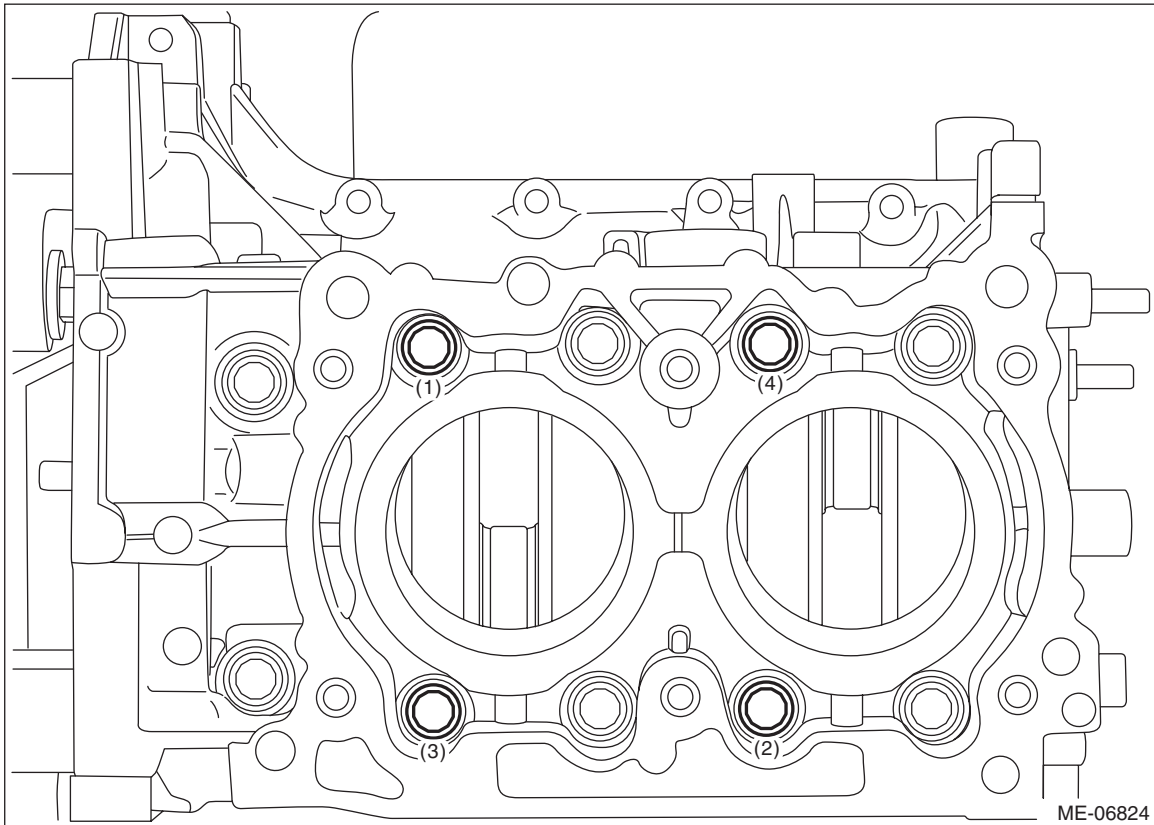
### MECHANICAL

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(11) Loosen the mounting bolts (4 places) by 180° in numerical order as shown in the figure.

**CAUTION:**

**When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.**



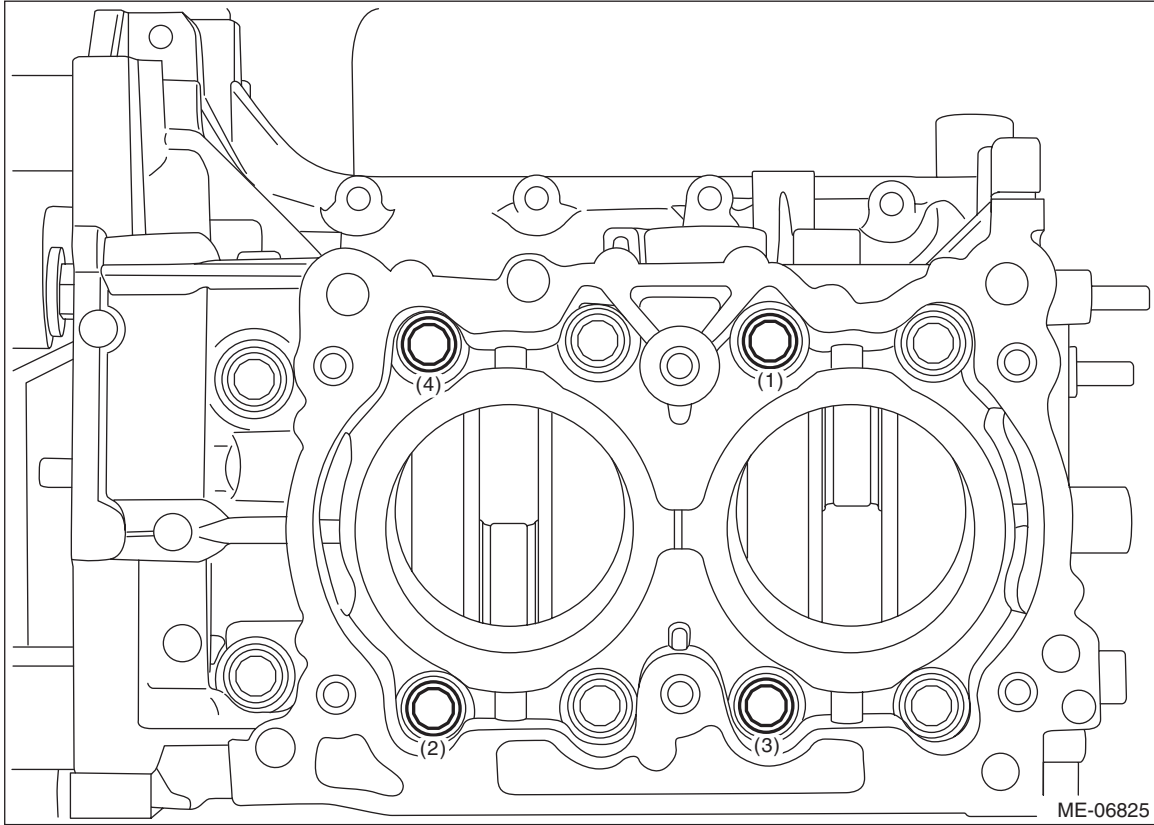
# Cylinder Block

MECHANICAL

(12) Tighten the mounting bolts (4 places) with a torque of 17 N·m (1.7 kgf-m, 12.5 ft-lb) in numerical order as shown in the figure.

**CAUTION:**

When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



# Cylinder Block

## MECHANICAL

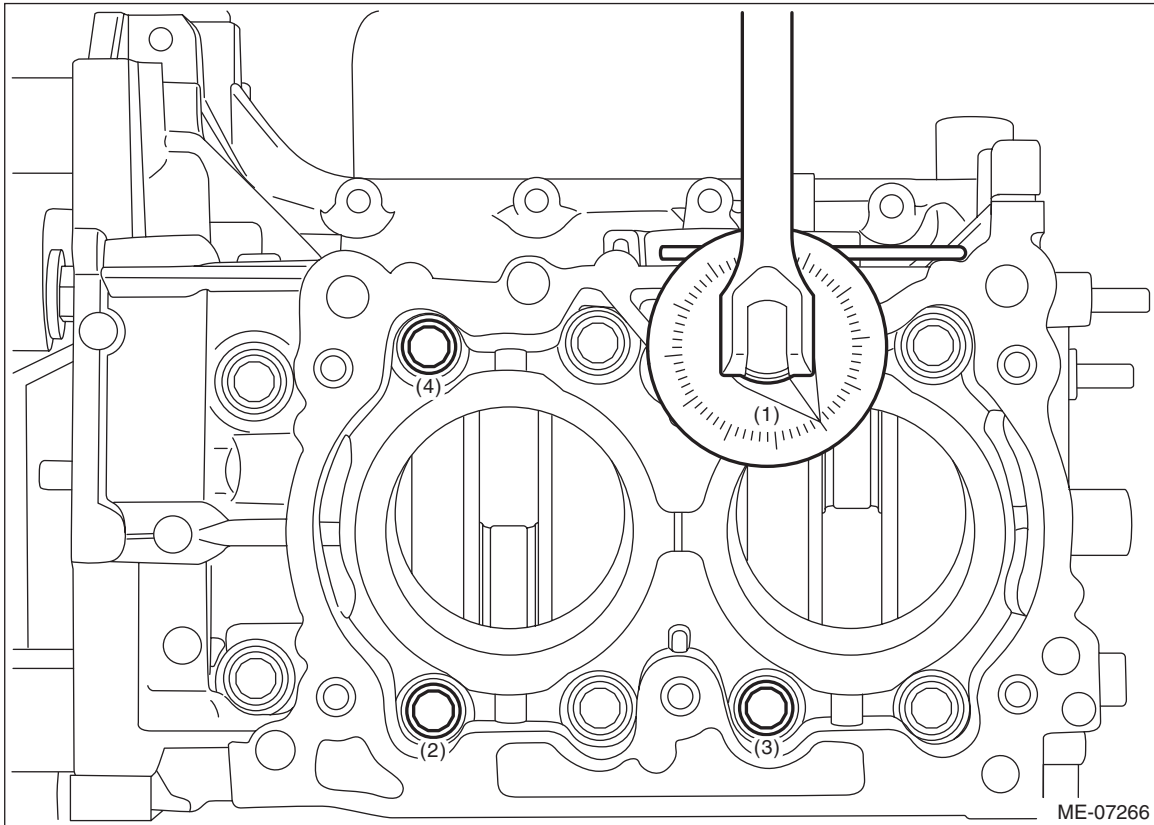
(13) Using angle gauge, tighten the mounting bolts (4 places) with specified angle in numerical order as shown in the figure.

### CAUTION:

When tightening the mounting bolts with specified angle, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.

**Tightening angle:**

$60^{\circ} \pm 2^{\circ}$



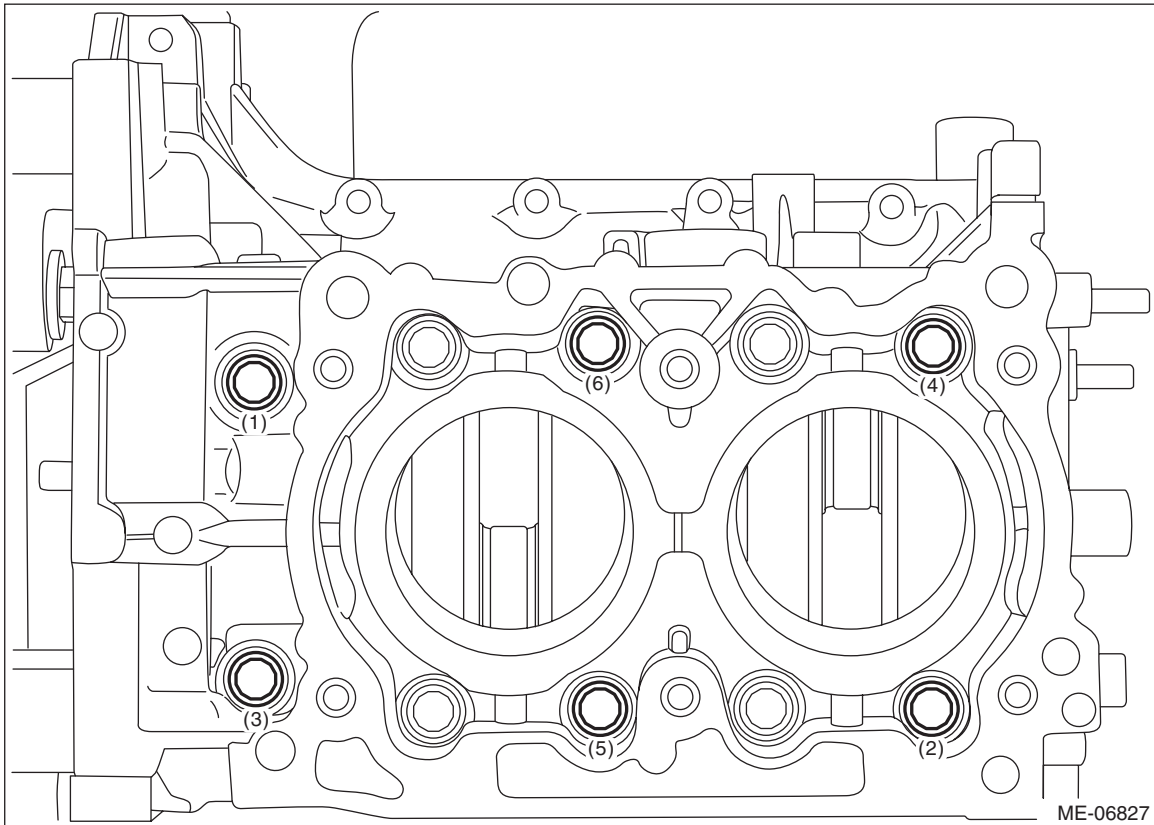
## Cylinder Block

MECHANICAL

(14) Loosen the mounting bolts (6 places) by 180° in numerical order as shown in the figure.

**CAUTION:**

When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



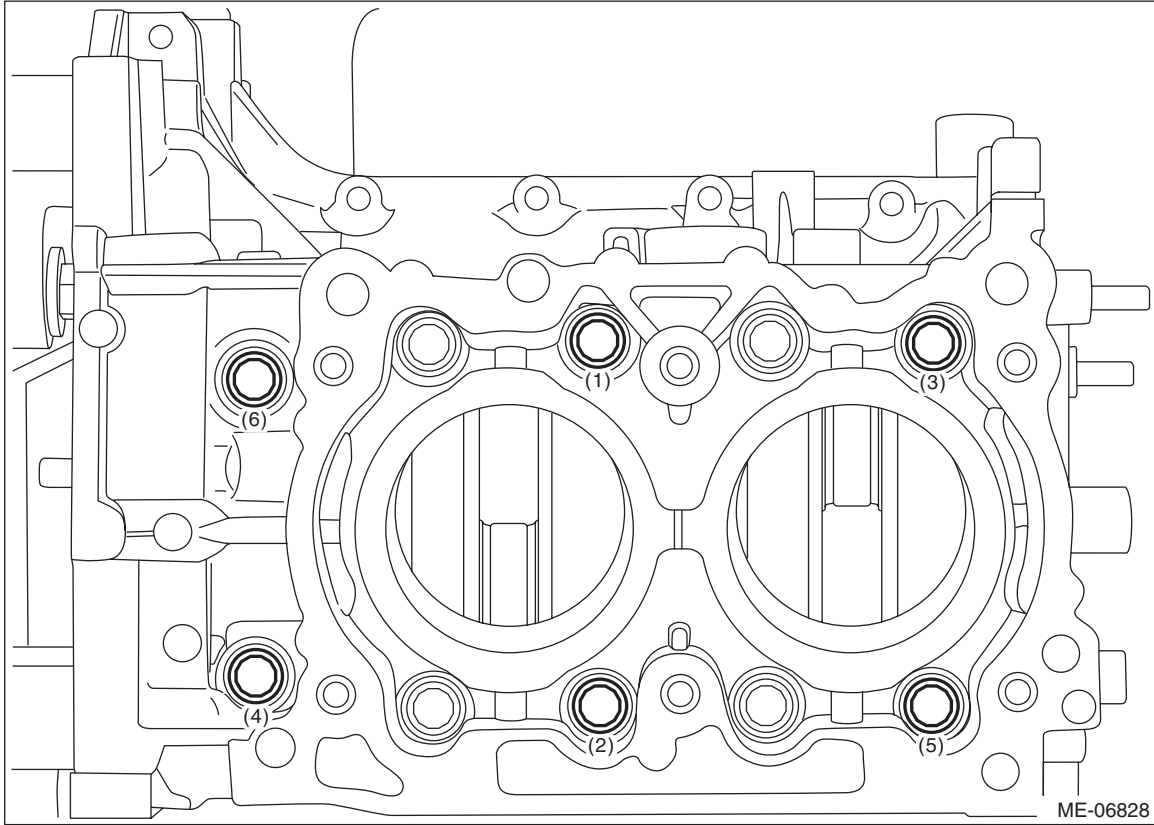
## Cylinder Block

### MECHANICAL

(15) Tighten the mounting bolts (6 places) with a torque of 17 N·m (1.7 kgf-m, 12.5 ft-lb) in numerical order as shown in the figure.

#### CAUTION:

When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



# Cylinder Block

MECHANICAL

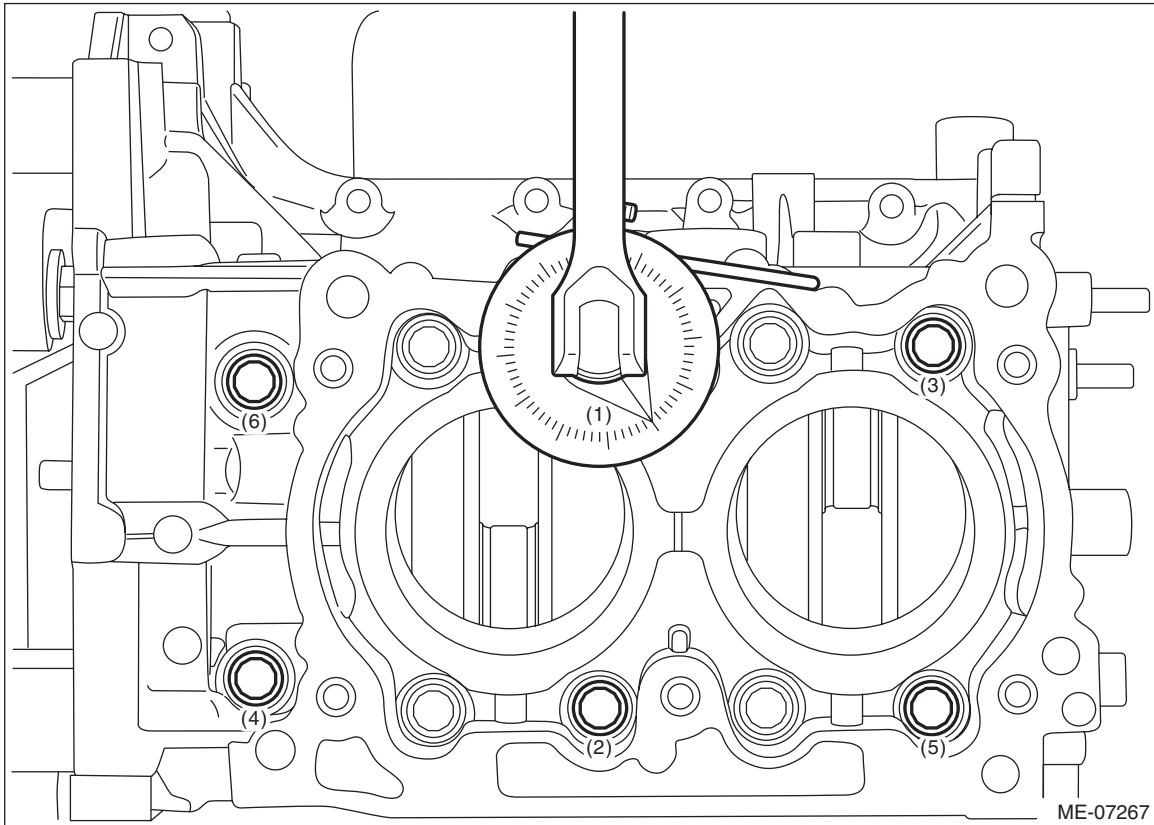
(16) Using angle gauge, tighten the mounting bolts (6 places) with specified angle in numerical order as shown in the figure.

**CAUTION:**

When tightening the mounting bolts with specified angle, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.

**Tightening angle:**

$60^{\circ} \pm 2^{\circ}$



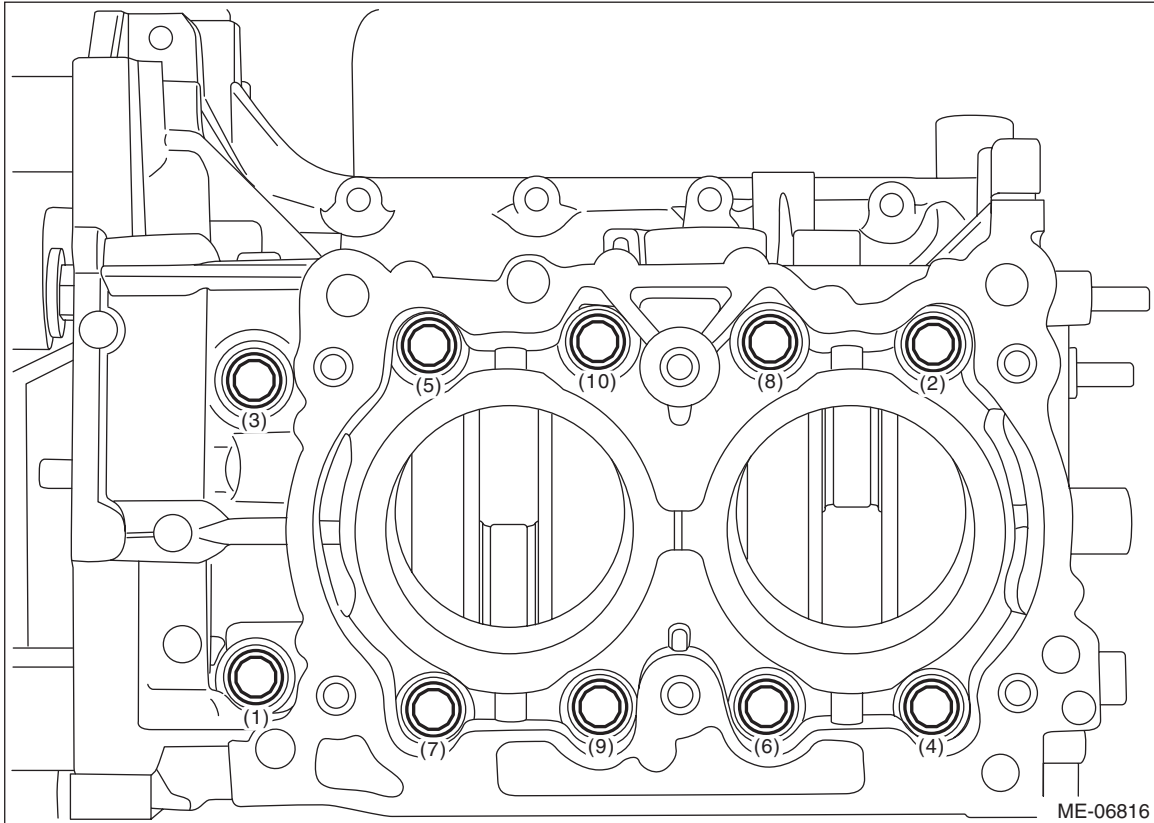
## Cylinder Block

### MECHANICAL

(17) Loosen the cylinder block mounting bolts in numerical order as shown in the figure, and separate the cylinder block RH and LH.

#### NOTE:

Lift the cylinder block RH slightly, and confirm that the crankshaft is remaining in the cylinder block LH. If the cylinder block RH is lifted carelessly when separating, the crankshaft may stick to cylinder block RH, then fall off.





(18) Determine the crankshaft oil clearance by matching the widest point of the plastigauge on each journal against scale printed on a package of the plastigauge. If it is not within the standard, replace the crankshaft bearing, and grind to correct the crankshaft journal or replace the crankshaft as required.

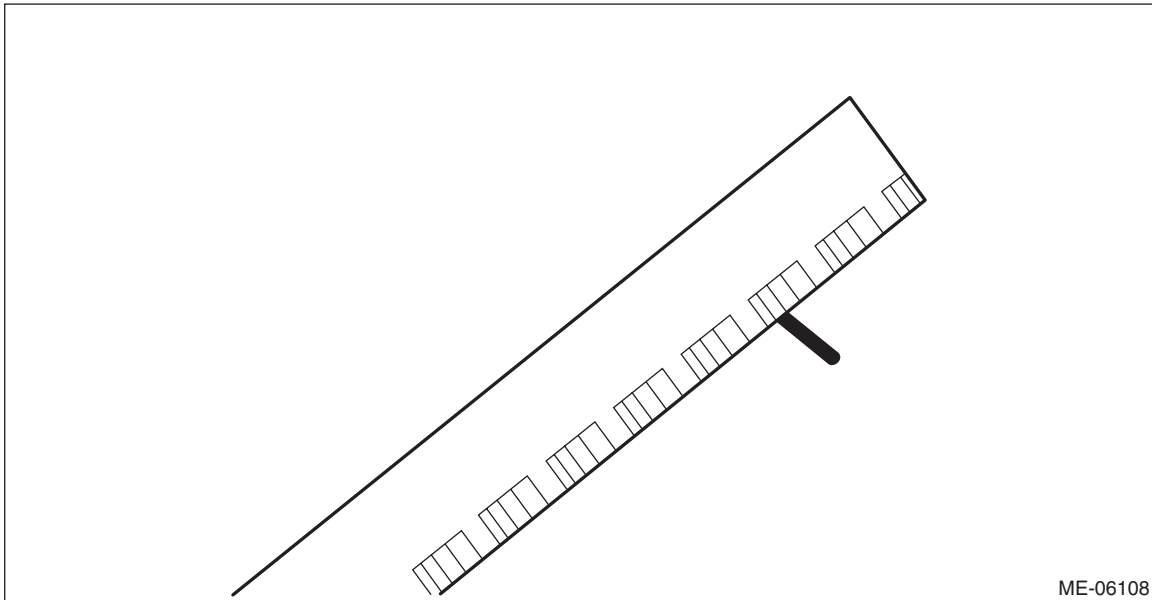
**NOTE:**

- Select the crankshaft bearing of suitable size by referring to step 3) when replacing crankshaft bearing.
- When grinding to correct the crankshaft journal, finish it to the suitable outer diameter by referring to step 3) according to the undersize bearing to be used.

**Crankshaft oil clearance:**

**Standard**

**0.013 — 0.031 mm (0.00051 — 0.00122 in)**



(19) Completely remove the plastigauge.