

## 20. Cylinder Block

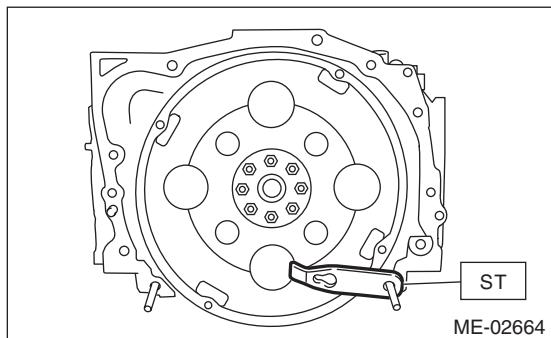
### A: REMOVAL

**NOTE:**

Before conducting this procedure, drain the engine oil completely.

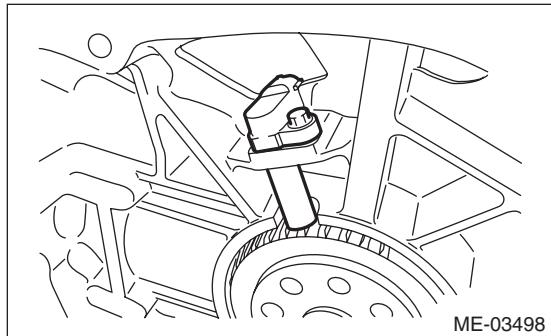
- 1) Remove the engine from vehicle. <Ref. to ME(H6DO)-33, REMOVAL, Engine Assembly.>
- 2) Remove the crank pulley. <Ref. to ME(H6DO)-44, REMOVAL, Crank Pulley.>
- 3) Remove the chain cover. <Ref. to ME(H6DO)-45, REMOVAL, Chain Cover.>
- 4) Remove the timing chain assembly. <Ref. to ME(H6DO)-51, REMOVAL, Timing Chain Assembly.>
- 5) Remove the cam sprocket. <Ref. to ME(H6DO)-69, REMOVAL, Cam Sprocket.>
- 6) Remove the crank sprocket. <Ref. to ME(H6DO)-70, REMOVAL, Crank Sprocket.>
- 7) Remove the camshaft. <Ref. to ME(H6DO)-71, REMOVAL, Camshaft.>
- 8) Remove the cylinder head. <Ref. to ME(H6DO)-77, REMOVAL, Cylinder Head.>
- 9) Use the ST to lock the crankshaft, and remove the drive plate.

ST 498497100 CRANKSHAFT STOPPER



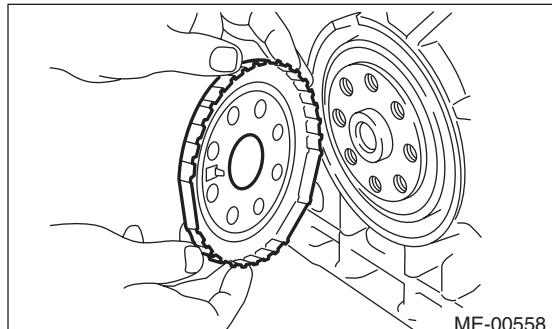
ME-02664

- 10) Remove the crankshaft position sensor.



ME-03498

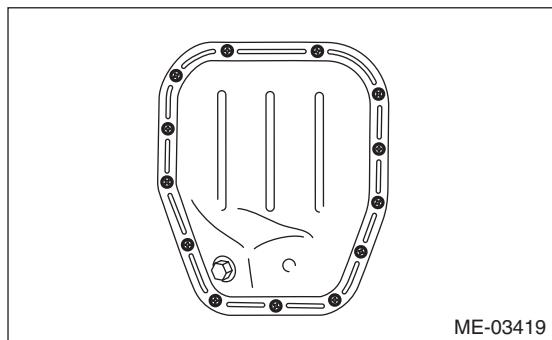
- 11) Remove the crankshaft position sensor plate.



ME-00558

- 12) Rotate the engine to set oil pan upper.

- 13) Remove the bolts which secure oil pan lower to oil pan upper.



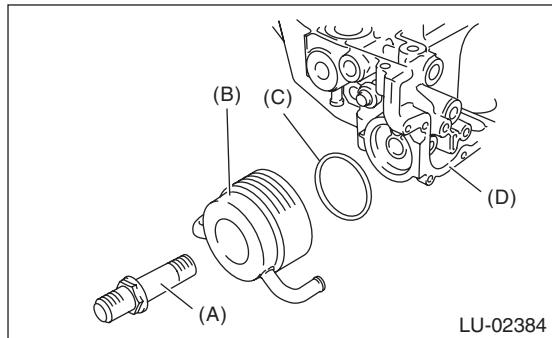
ME-03419

- 14) Insert an oil pan cutter blade into the gap between oil pan upper and oil pan lower, and remove the oil pan lower.

**CAUTION:**

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

- 15) Remove the oil cooler connector and remove the oil cooler.

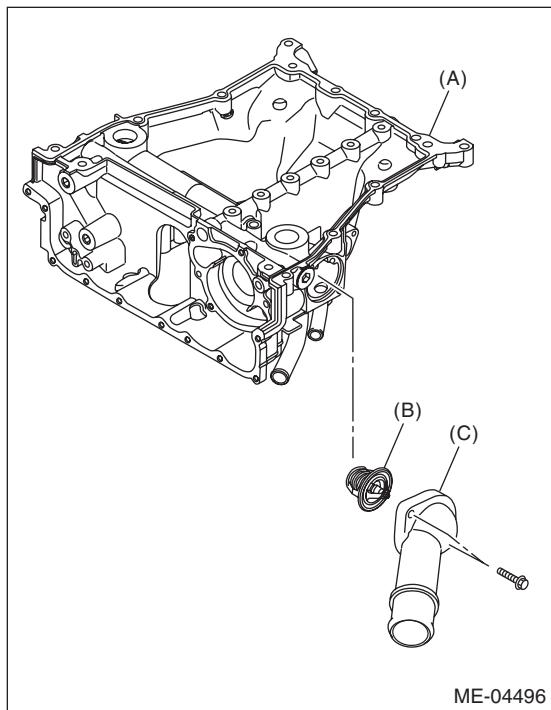


LU-02384

- (A) Oil cooler connector
- (B) Oil cooler
- (C) O-ring
- (D) Oil pan upper

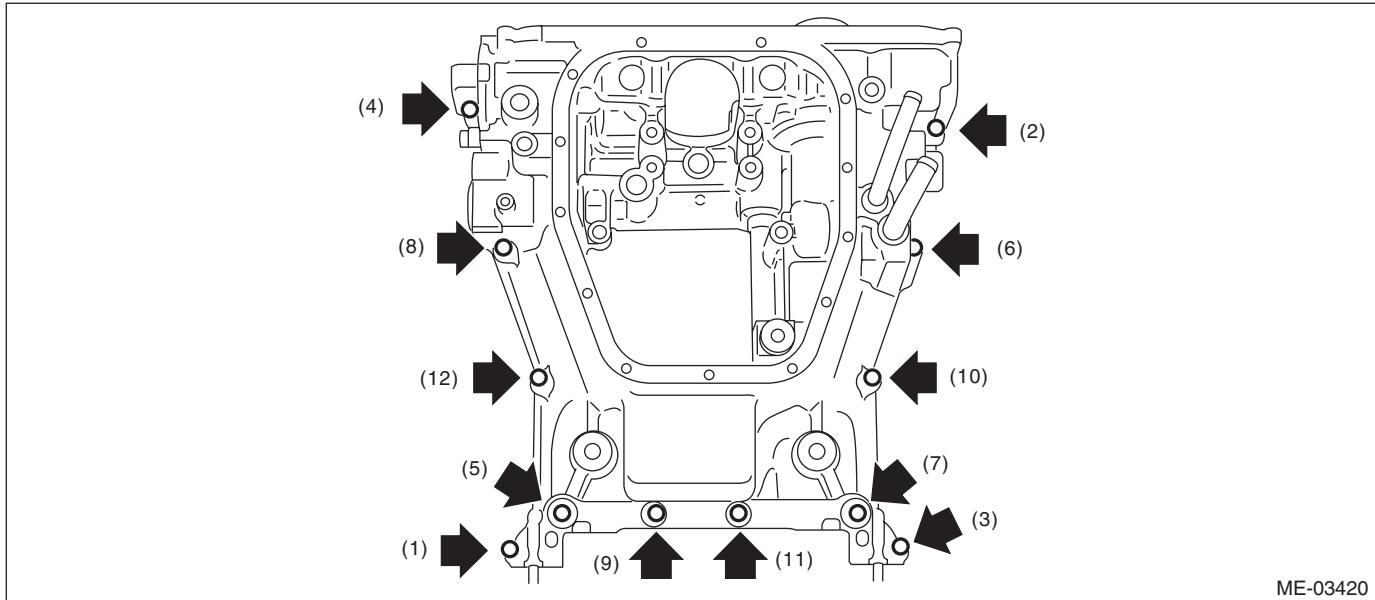
- 16) Remove the oil pump. <Ref. to LU(H6DO)-11, REMOVAL, Oil Pump.>

17) Remove the thermostat cover, and then remove the thermostat.



- (A) Oil pan upper
- (B) Thermostat
- (C) Thermostat cover

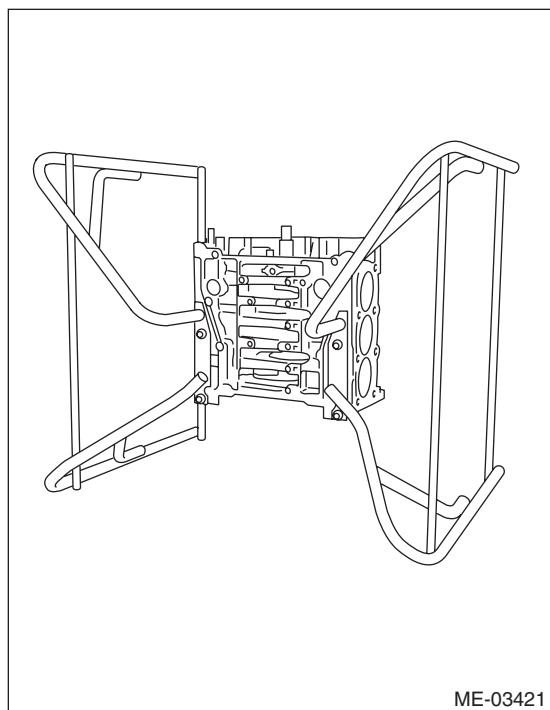
18) Remove the oil pump cover.



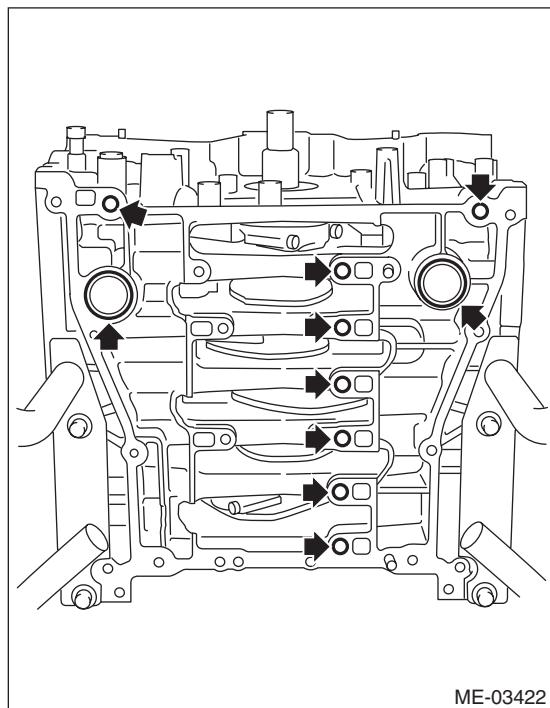
# Cylinder Block

## MECHANICAL

19) Face the front of the engine up, standing the engine on one end.



20) Remove ten O-rings from the underside of the cylinder block.



21) Mark the direction of front and the number of connecting rod caps.

22) Remove the #1 and #4 connecting rod caps and pistons from the cylinder block.

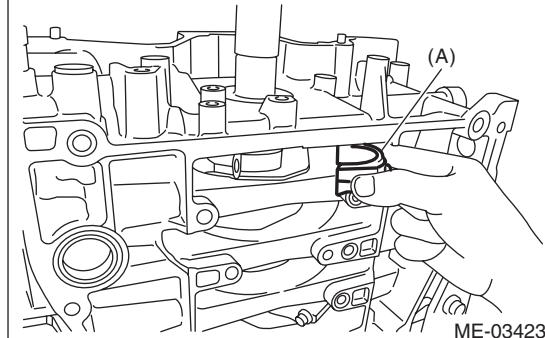
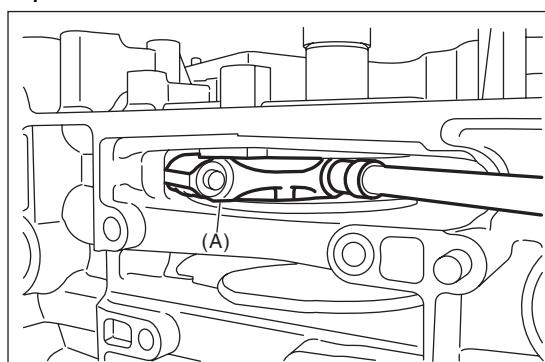
### NOTE:

- Use 3/8 inch (9.5sq.) for the extension and TORX® socket (E12).
- After removing the two connecting rod connection bolts, turning the crankshaft (ST) counterclockwise will remove the connecting rod cap.
- Mark each connecting rod cap and piston with connecting rod cap number and piston number.
- The removal of all connecting rod caps and pistons are performed in three separate steps. First, remove the #1 and #4 connecting rod caps and pistons simultaneously, then the #2 and #5 connecting rod caps and pistons simultaneously, and then the #3 and #6 connecting rod caps and pistons simultaneously.

(1) Using the ST, turn the crankshaft and set the #1 piston at the mid point between TDC and BDC.

ST 18252AA000 CRANKSHAFT SOCKET

(2) Remove the two #1 connecting rod cap connection bolts, and remove the connecting rod cap.

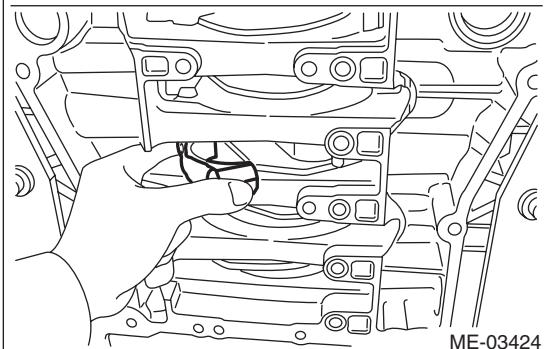
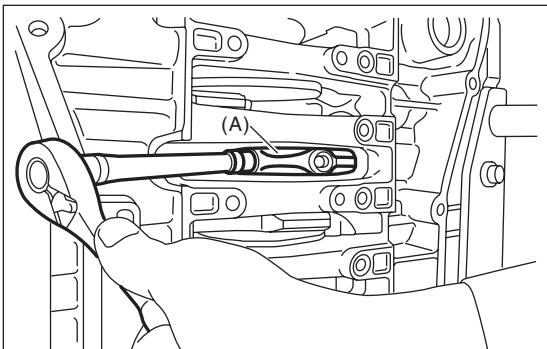


(A) #1 connecting rod cap

# Cylinder Block

## MECHANICAL

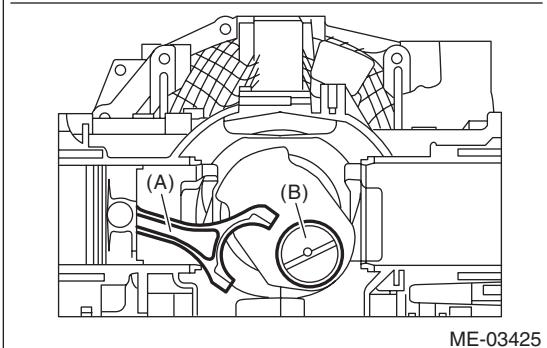
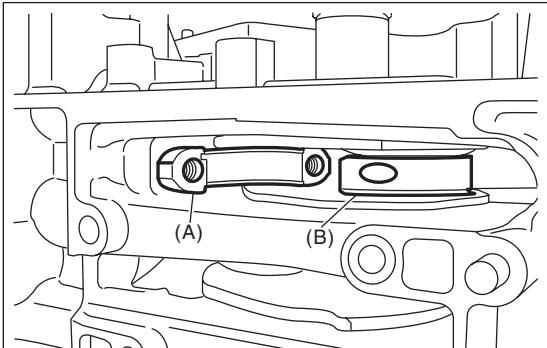
(3) Remove the two #4 connecting rod cap connection bolts, and remove the connecting rod cap.



(A) #4 connecting rod cap

(4) Using the ST, turn the crankshaft and separate the positions of the crank pin and the large end of the #1 connecting rod.

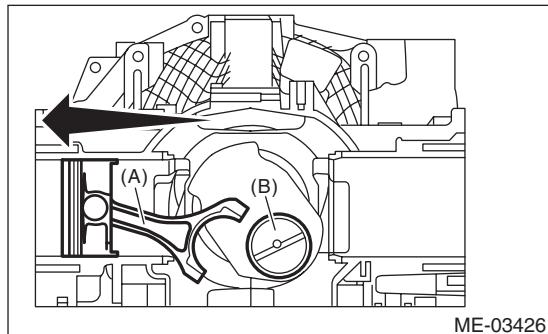
ST 18252AA000 CRANKSHAFT SOCKET



(A) #1 connecting rod

(B) Crank pin

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



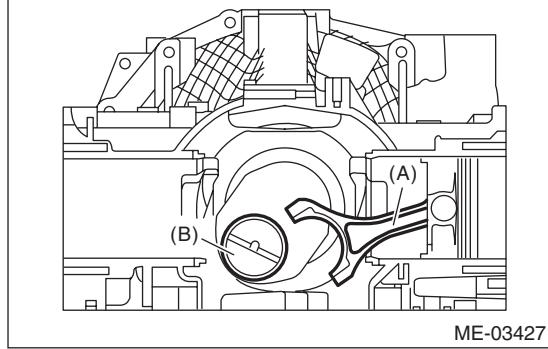
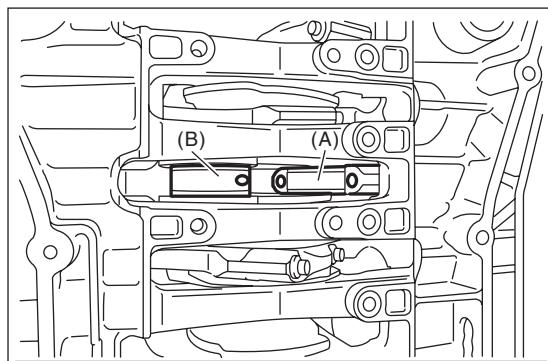
ME-03426

(A) #1 connecting rod

(B) Crank pin

(6) Using the ST, turn the crankshaft and separate the positions of the crank pin and the large end of the #4 connecting rod.

ST 18252AA000 CRANKSHAFT SOCKET



ME-03427

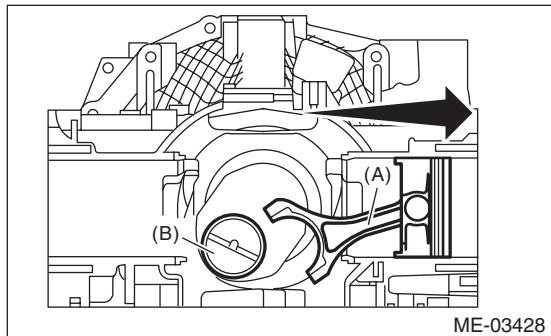
(A) #4 connecting rod

(B) Crank pin

# Cylinder Block

## MECHANICAL

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



(A) #4 connecting rod

(B) Crank pin

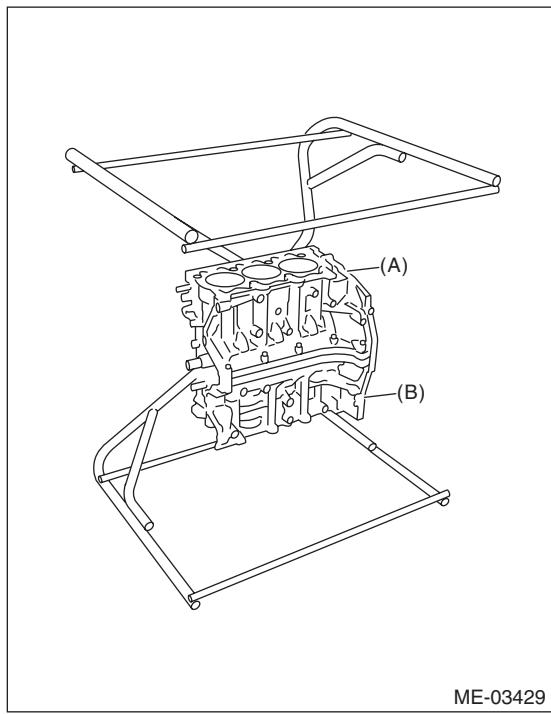
23) Remove the #2 and #5 connecting rods and pistons from the cylinder block in the same manner.

ST 18252AA000 CRANKSHAFT SOCKET

24) Remove the #3 and #6 connecting rods and pistons from the cylinder block in the same manner.

ST 18252AA000 CRANKSHAFT SOCKET

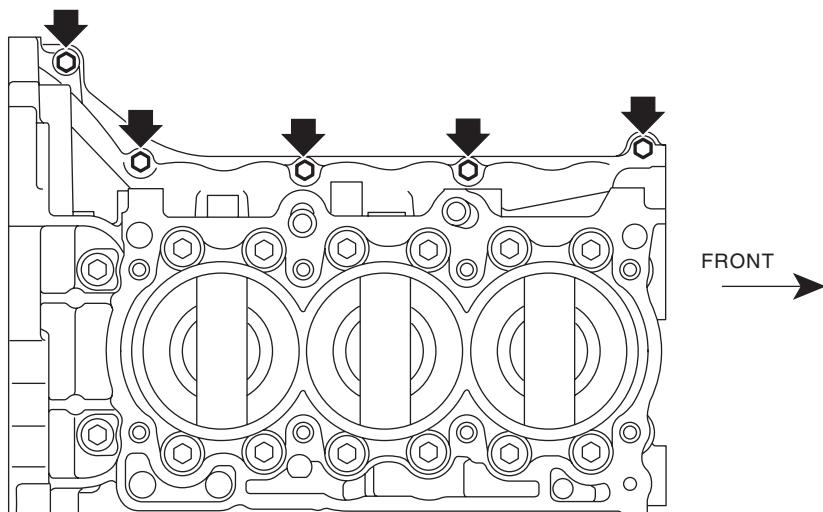
25) Face the cylinder block (RH) up.



(A) Cylinder block (RH)

(B) Cylinder block (LH)

26) Remove the upper bolt.



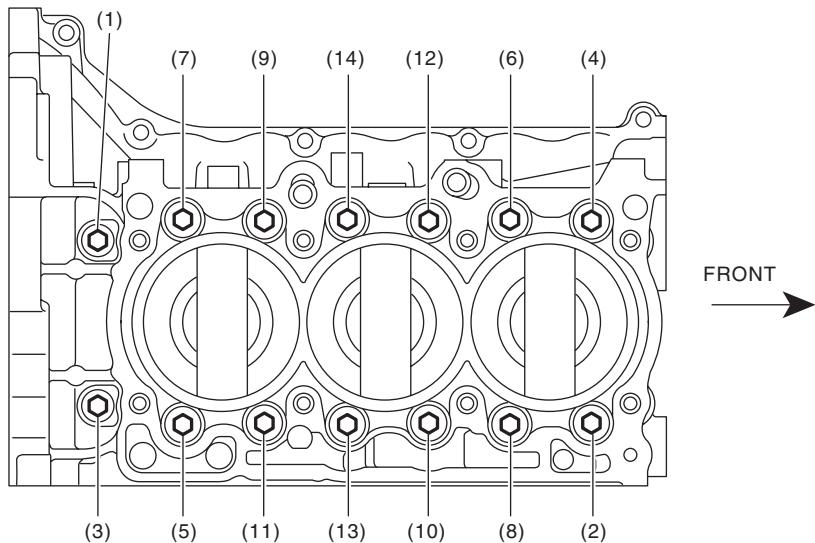
ME-03433

27) Loosen the cylinder block bolts in the order indicated in the figure, and separate cylinder block (RH) and (LH).

NOTE:

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.



ME-03430

28) Remove the rear oil seal.

29) Remove the crankshaft from cylinder block (LH).

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

NOTE:

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

# Cylinder Block

## MECHANICAL

### B: INSTALLATION

- 1) After setting the cylinder block to ST, install the crankshaft bearing.  
ST 18232AA000 ENGINE STAND

#### NOTE:

Apply a coat of engine oil to the bearing and crankshaft journal.

- 2) Mount the crankshaft in cylinder block (LH).

- 3) Apply liquid gasket to the mating surfaces of cylinder block (RH).

#### CAUTION:

**Do not allow liquid gasket to run over into oil passages, bearing grooves, etc.**

#### NOTE:

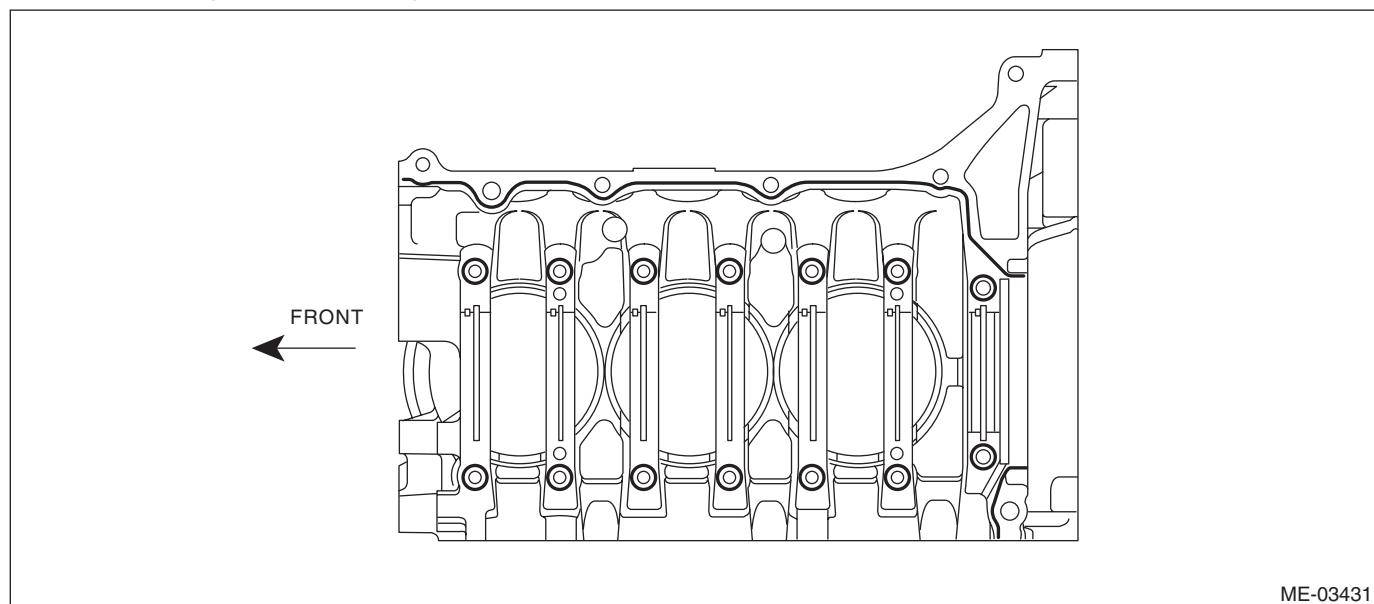
Install within 5 min. after applying liquid gasket.

#### *Liquid gasket:*

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

#### *Liquid gasket applying diameter:*

**$1.0 \pm 0.2$  mm (0.039  $\pm$  0.008 in)**

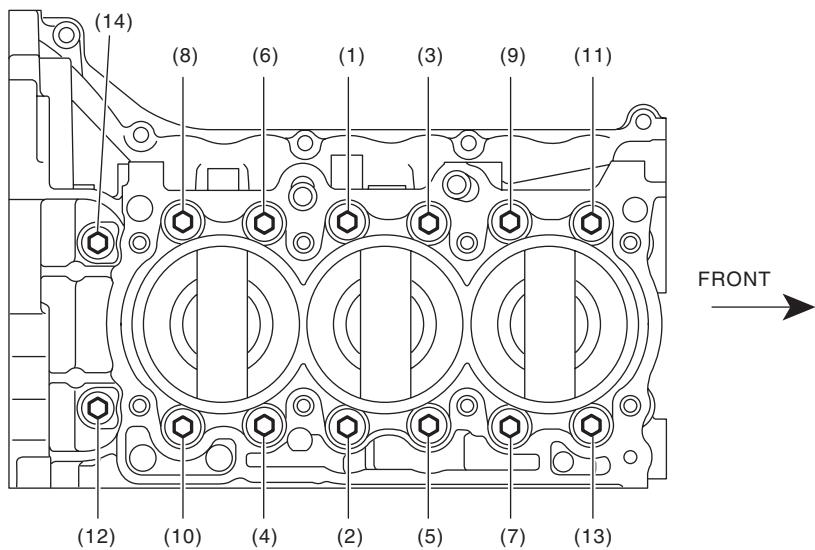


- 4) Attach cylinder block (RH) to cylinder block (LH).
- 5) Apply a coat of engine oil to the washer and bolt thread.

6) Tighten all bolts in the numerical order as shown in the figure.

**Tightening torque:**

**12 N·m (1.2 kgf·m, 8.9 ft-lb)**

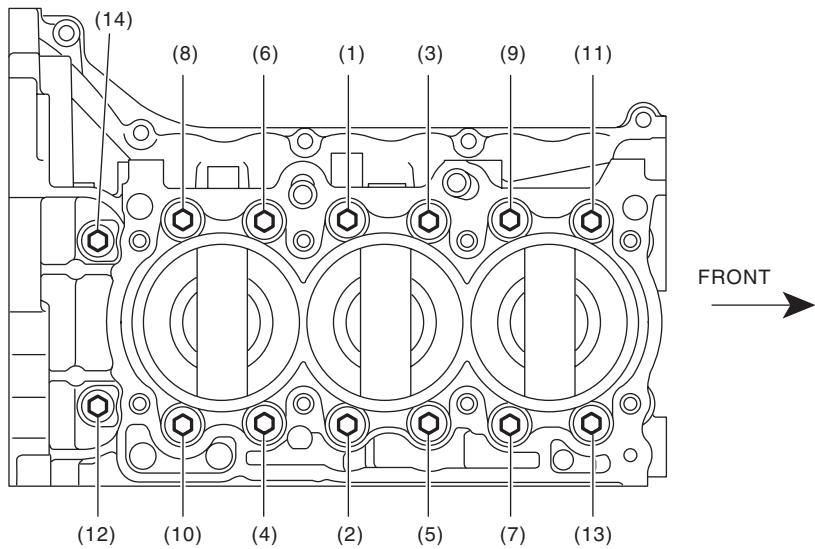


ME-03432

7) Retighten all bolts in the numerical order as shown in the figure.

**Tightening torque:**

**18 N·m (1.8 kgf·m, 13.3 ft-lb)**

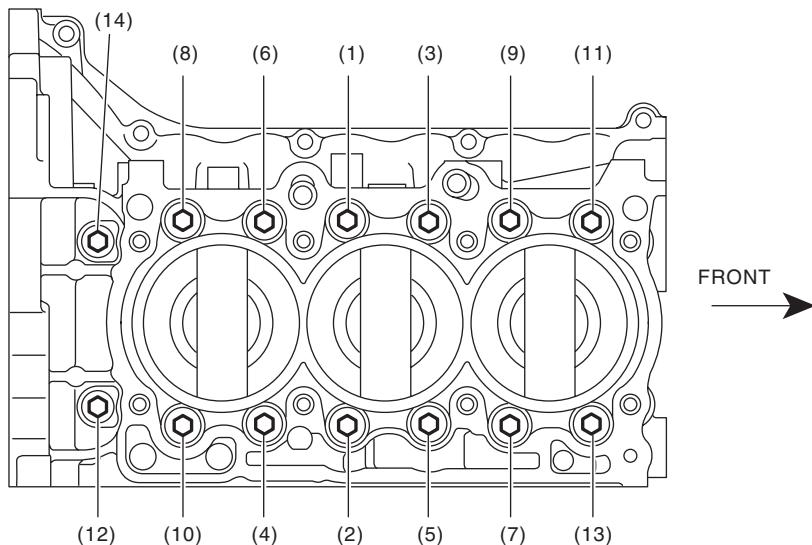


ME-03432

# Cylinder Block

## MECHANICAL

8) Tighten all bolts by 90° in numerical order as shown in the figure.



ME-03432

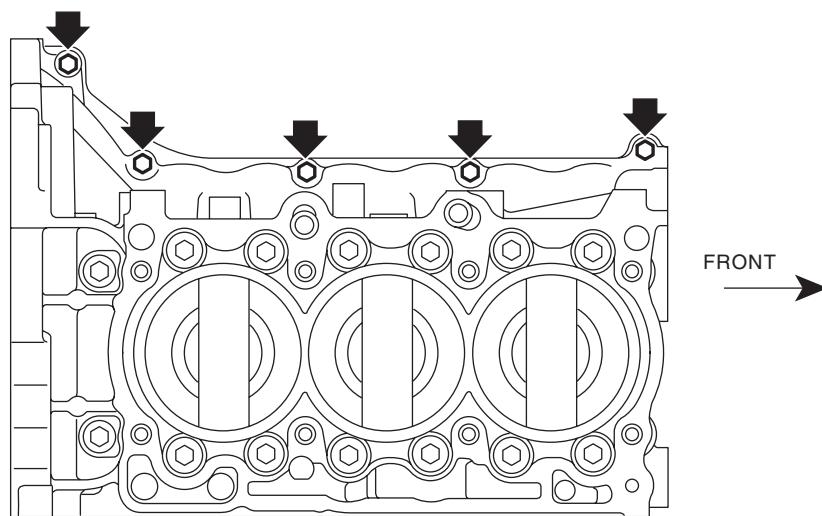
9) Install the upper bolt to cylinder block.

**Tightening torque:**

**25 N·m (2.5 kgf·m, 18.4 ft-lb)**

**NOTE:**

Remove any liquid gasket squeezed out onto the seal surface between the chain cover and oil pan upper, after tightening the cylinder block connecting bolts.



ME-03433

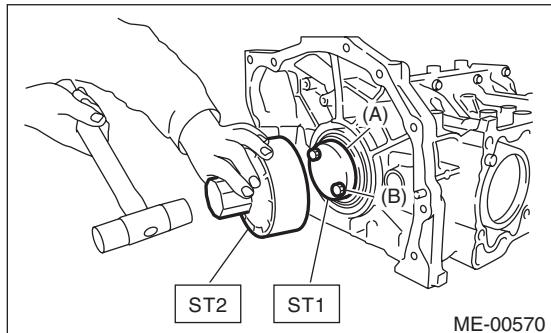
10) Apply a coat of engine oil to the oil seal periphery and install the rear oil seal using ST1 and ST2.

NOTE:

Use a new rear oil seal.

ST1 499597100 CRANKSHAFT OIL SEAL GUIDE

ST2 499587200 CRANKSHAFT OIL SEAL INSTALLER

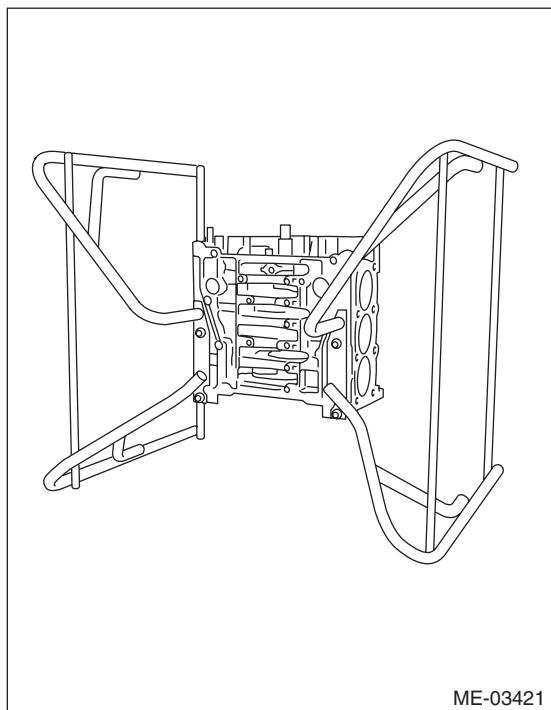


ME-00570

(A) Rear oil seal

(B) Drive plate installation bolt

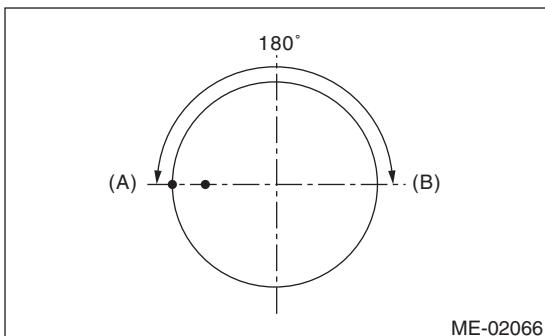
11) Face the front of the engine up, standing the engine on one end.



ME-03421

12) Attach the piston ring and oil ring to the piston.

- (1) Position the top ring gap at (A) in the figure.
- (2) Position the second ring gap at (B).

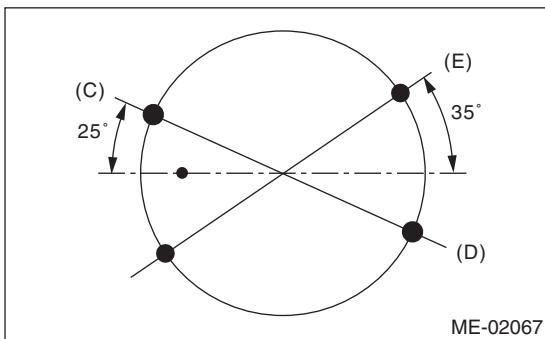


ME-02066

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

- (4) Position the expander gap at (D) in the figure.

- (5) Position the lower rail gap at (E) in the figure.



ME-02067

### CAUTION:

- Make sure ring gaps do not face the same direction.
- Make sure ring gaps are not within the piston skirt area.
- Assemble it so that R mark faces to top side of piston.

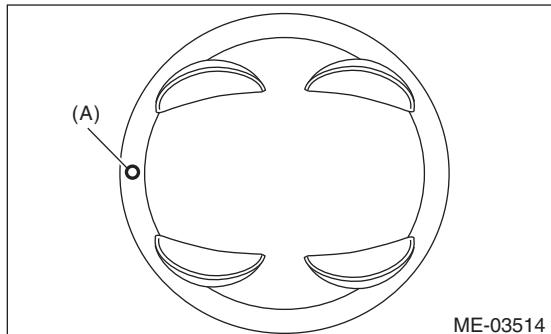
# Cylinder Block

## MECHANICAL

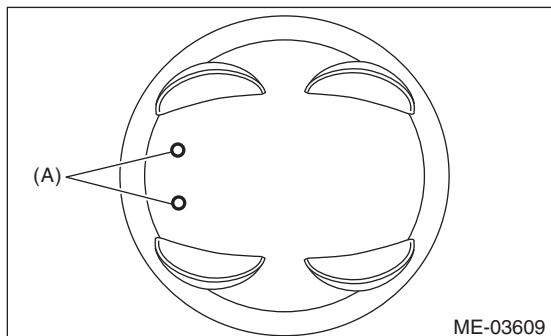
13) Install the #1 piston and connecting rod to the cylinder block.

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

(2) Face the front mark of piston (A) towards the front of the engine, and set the piston to the ST.



ME-03514



ME-03609

(3) Using ST, press-fit the piston into cylinder block.

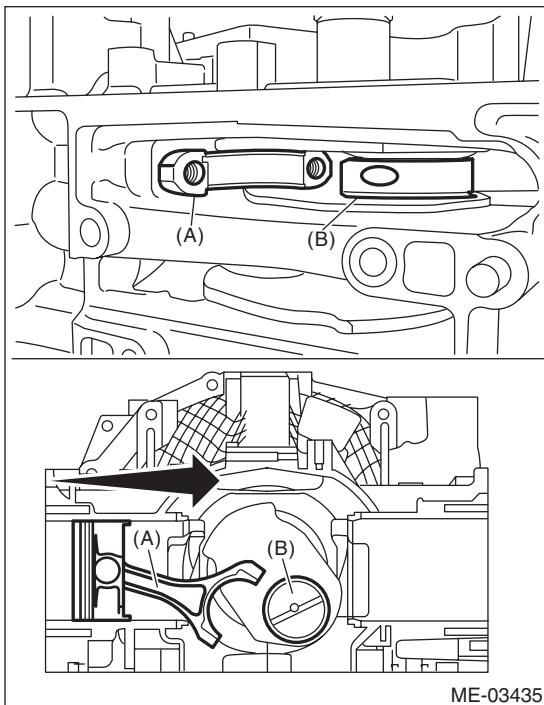
### NOTE:

When inserting the piston into the cylinder block, perform according to the items listed below.

- Insert while lightly tapping the top of the piston with the handle of a plastic hammer.
- Insert while making sure that the large end of the connecting rod does not scratch the cylinder liner.

- Insert while continually making sure that the large end of the connecting rod does not touch the crankshaft.

ST 398744300 PISTON GUIDE



ME-03435

(A) #1 connecting rod

(B) Crank pin

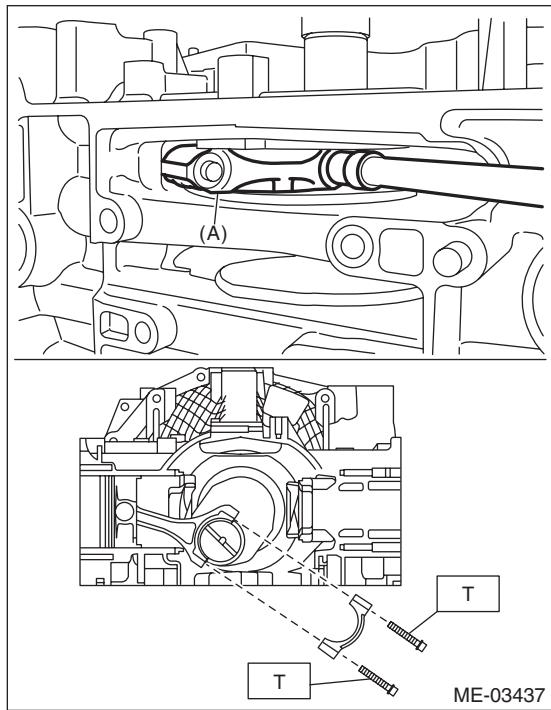
(4) Using the ST, turn the crankshaft and match the positions of the crank pin and the large end of the connecting rod.

ST 18252AA000 CRANKSHAFT SOCKET

(5) Install the connecting rod cap.

**Tightening torque:**

**60 N·m (6.1 kgf·m, 44.3 ft-lb)**



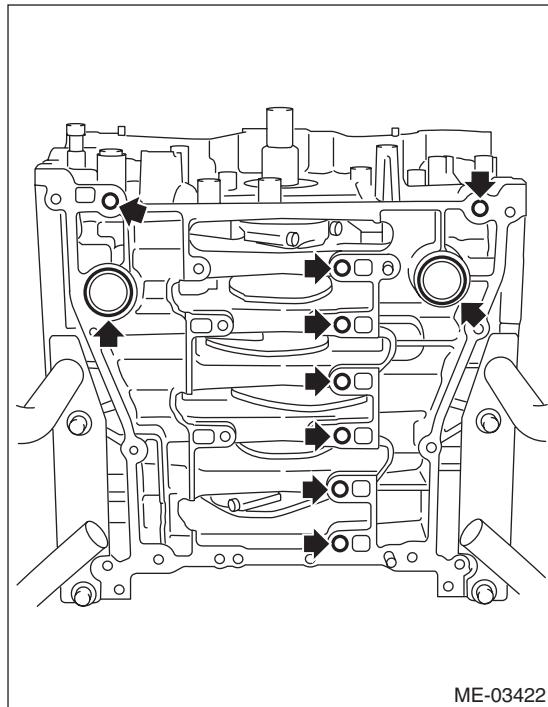
(A) #1 connecting rod

14) In the same procedures as for the #1 piston, install the piston and connecting rods to the cylinder block, in the order of #2, #3, #4, #5 and #6.

15) Install the O-ring to the underside of the cylinder block.

**NOTE:**

Use new O-rings.



# Cylinder Block

## MECHANICAL

16) Apply liquid gasket to the mating surface of oil pan upper.

NOTE:

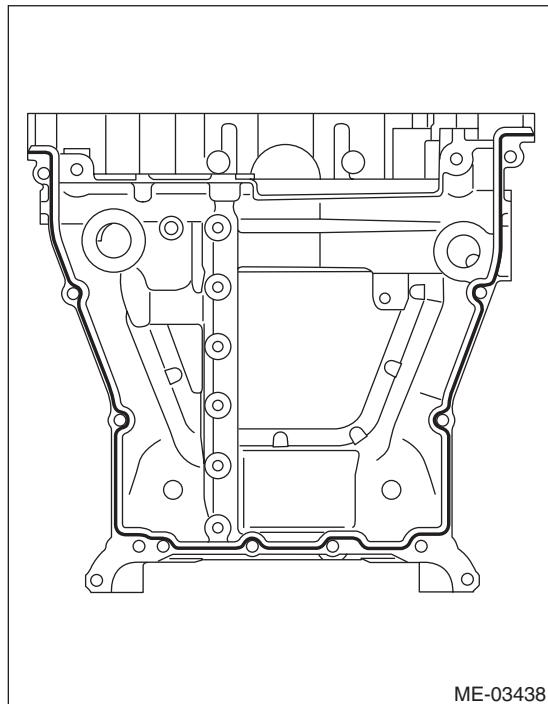
Install within 5 min. after applying liquid gasket.

**Liquid gasket:**

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

**Liquid gasket applying diameter:**

**$5.0 \pm 1.0 \text{ mm (0.20} \pm 0.04 \text{ in)}$**

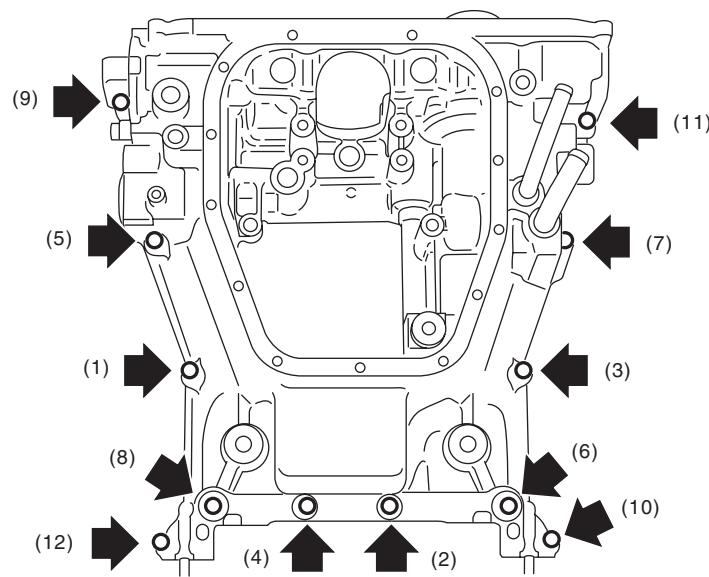


17) Temporarily tighten the oil pan upper.

18) Tighten the oil pan upper installing bolts in the numerical order as shown in the figure.

**Tightening torque:**

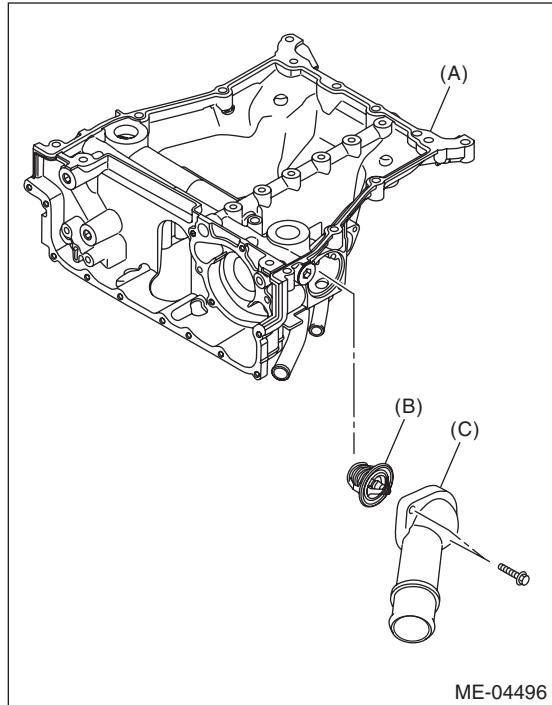
**18 N·m (1.8 kgf·m, 13.3 ft-lb)**



19) Install the oil pump. <Ref. to LU(H6DO)-11, INSTALLATION, Oil Pump.>  
 20) Install the thermostat and thermostat cover.

**Tightening torque:**

**6.4 N·m (0.7 kgf-m, 4.7 ft-lb)**



(A) Oil pan upper  
 (B) Thermostat  
 (C) Thermostat cover

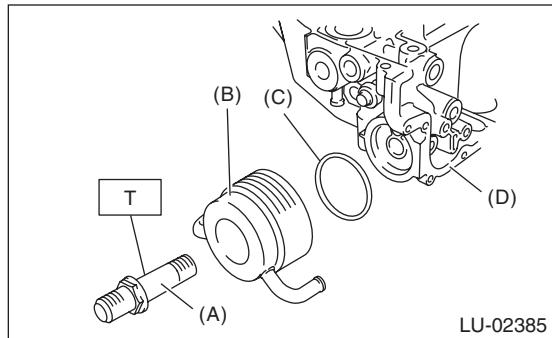
21) Tighten the oil cooler connector to install the oil cooler to the oil pan upper.

**Tightening torque:**

**54 N·m (5.5 kgf-m, 39.8 ft-lb)**

**NOTE:**

Use new O-rings.



(A) Oil cooler connector  
 (B) Oil cooler  
 (C) O-ring  
 (D) Oil pan upper

22) Apply liquid gasket to the matching surface of oil pan lower.

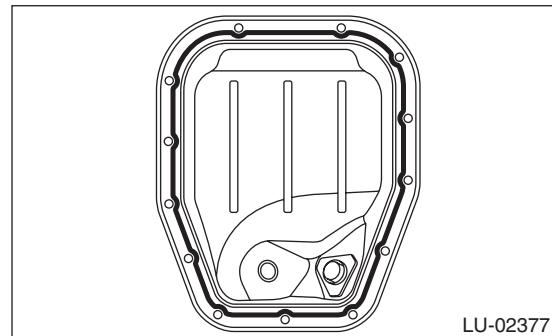
**NOTE:**

Install within 5 min. after applying liquid gasket.

**Liquid gasket:**

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

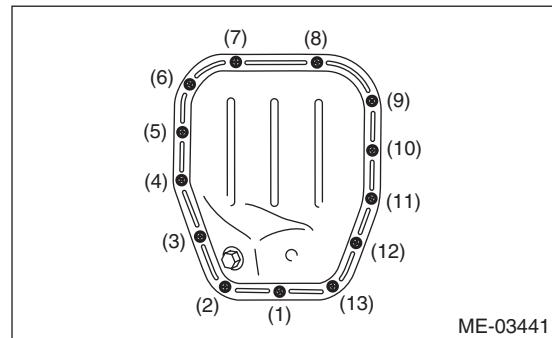
**Liquid gasket applying diameter:**  
 $5.0 \pm 1.0 \text{ mm (0.20} \pm 0.04 \text{ in)}$



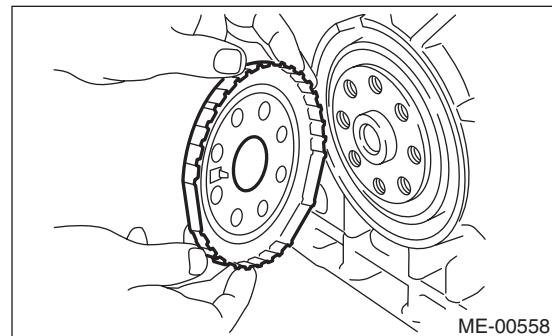
23) Tighten the oil pan lower installing bolts in the numerical order as shown in the figure.

**Tightening torque:**

**6.4 N·m (0.7 kgf-m, 4.7 ft-lb)**



24) Install the crankshaft position sensor plate.



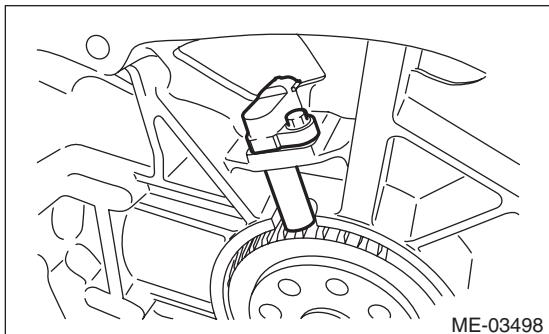
# Cylinder Block

## MECHANICAL

25) Install the crankshaft position sensor.

**Tightening torque:**

6.4 N·m (0.7 kgf·m, 4.7 ft·lb)

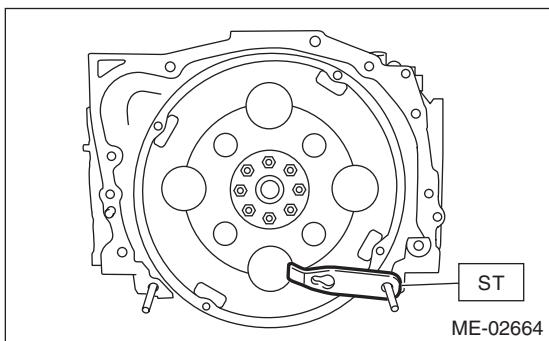


26) Using the ST, lock the crankshaft and install drive plate.

ST 498497100 CRANKSHAFT STOPPER

**Tightening torque:**

90 N·m (9.2 kgf·m, 66.4 ft·lb)



27) Install the cylinder head. <Ref. to ME(H6DO)-78, INSTALLATION, Cylinder Head.>

28) Install the camshaft. <Ref. to ME(H6DO)-72, INSTALLATION, Camshaft.>

29) Install the crank sprocket. <Ref. to ME(H6DO)-70, INSTALLATION, Crank Sprocket.>

30) Install the cam sprocket. <Ref. to ME(H6DO)-69, INSTALLATION, Cam Sprocket.>

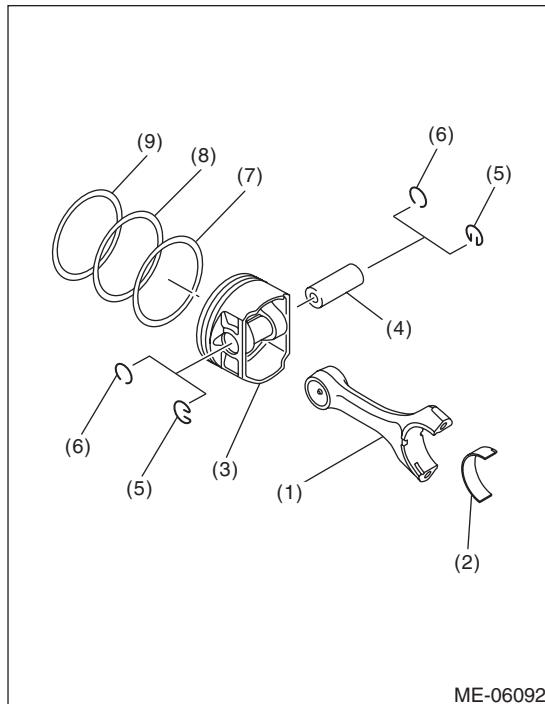
31) Install the timing chain assembly. <Ref. to ME(H6DO)-57, INSTALLATION, Timing Chain Assembly.>

32) Install the chain cover. <Ref. to ME(H6DO)-46, INSTALLATION, Chain Cover.>

33) Install the crank pulley. <Ref. to ME(H6DO)-44, INSTALLATION, Crank Pulley.>

34) Install the engine to the vehicle. <Ref. to ME(H6DO)-37, INSTALLATION, Engine Assembly.>

## C: DISASSEMBLY



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

**NOTE:**

To prevent confusion of various parts, mark each part.

1) Remove the connecting rod bearing.

2) Remove the piston rings using piston ring expander.

3) Remove the oil ring by hand.

**NOTE:**

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

4) Remove the snap ring on one end from the piston using a snap ring pliers. (Snap ring type)

5) Remove the circlip on one end from the piston using a flat tip screwdriver. (Circlip type)

**NOTE:**

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

6) Remove the piston pin from the piston.

7) Separate the piston and connecting rod.

NOTE:

Mark the direction of front side to each connecting rod.

8) Remove the snap ring on other end from the piston using a snap ring pliers. (Snap ring type)

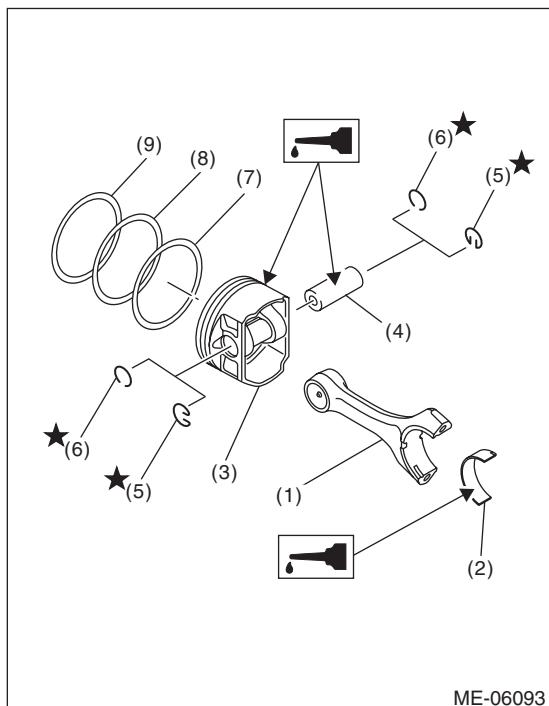
9) Remove the circlip on other end from the piston using a flat tip screwdriver. (Circlip type)

NOTE:

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

10) Remove the plug and orifice from the cylinder block as necessary. <Ref. to ME(H6DO)-12, CYLINDER BLOCK, COMPONENT, General Description. >

## D: ASSEMBLY



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

1) Apply engine oil to the surface of the connecting rod bearing. Attach the connecting rod bearing to the connecting rod.

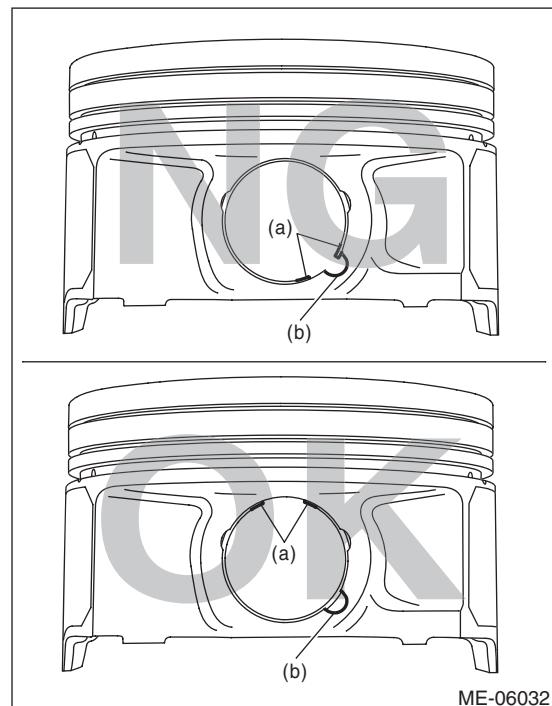
2) Install the circlip on one end of the piston using a flat tip screwdriver. (Circlip type)

NOTE:

- Be careful not to 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) Install the snap ring on one end of the piston using a snap ring pliers. (Snap ring type)

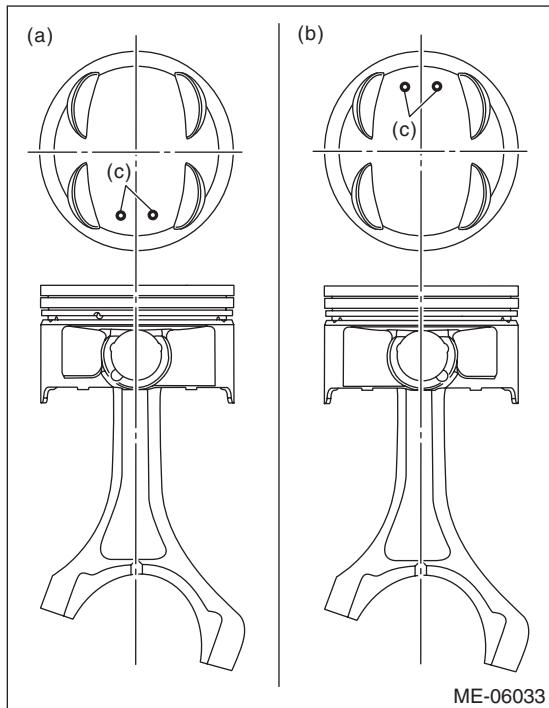
**NOTE:**

Make sure the snap ring is firmly inserted into the snap ring groove.

4) 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, #3 and #5)

(b) LH side (#2, #4 and #6)

(c) Front mark

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

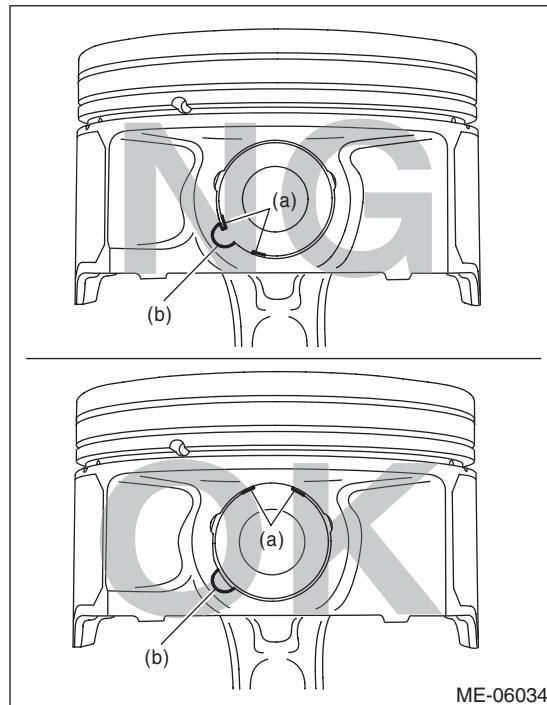
6) Install the circlip on the piston using a flat tip screwdriver. (Circlip type)

**NOTE:**

- Be careful not to 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.



7) Install the snap ring on the piston using a snap ring pliers. (Snap ring type)

**NOTE:**

Make sure the snap ring is firmly inserted into the snap ring groove.

8) Install the oil ring upper rail, expander and lower rail by hand.

9) Install the second ring and top ring using piston ring expander.

10) Install the plug and orifice to the cylinder block as necessary. <Ref. to ME(H6DO)-12, CYLINDER BLOCK, COMPONENT, General Description.>

### E: INSPECTION

#### 1. CYLINDER BLOCK

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

##### Surface warpage limit:

0.02 mm (0.0008 in)

##### Standard height of cylinder block:

202 mm (7.95 in)

#### 2. CYLINDER AND PISTON

- 1) The cylinder bore size is stamped on the front upper face of the cylinder block.

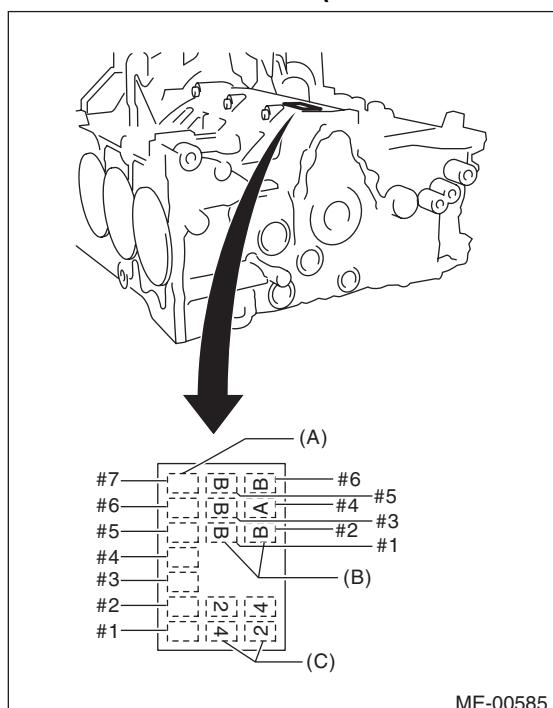
##### NOTE:

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

##### Standard diameter:

A: 92.005 — 92.015 mm (3.6222 — 3.6226 in)

B: 91.995 — 92.005 mm (3.6218 — 3.6222 in)



(A) Main journal size mark  
 (B) Cylinder bore size mark  
 (C) Cylinder block (RH) – (LH) combination mark

- 2) Measurement method for cylinder inner diameters:

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

##### NOTE:

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

##### Taper:

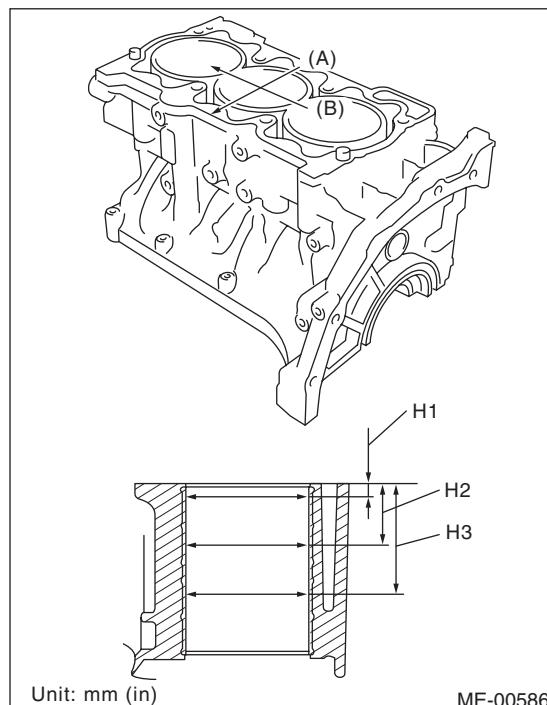
##### Standard

0.030 mm (0.0012 in)

##### Out-of-roundness:

##### Standard

0.010 mm (0.0004 in)



(A) Thrust direction

(B) Piston pin direction

H1: 10 mm (0.39 in)

H2: 45 mm (1.77 in)

H3: 80 mm (3.15 in)

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

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

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

##### NOTE:

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

# Cylinder Block

## MECHANICAL

**Piston grade point H:**  
37.3 mm (1.4685 in)

**Piston outer diameter:**  
**Standard**

**A: 92.005 — 92.015 mm (3.6222 — 3.6226 in)**

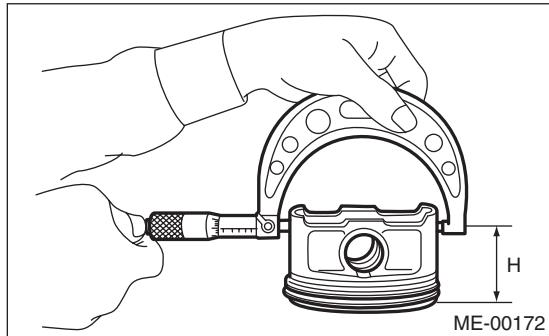
**B: 91.995 — 92.005 mm (3.6218 — 3.6222 in)**

**0.25 mm (0.0098 in) oversize**

**92.245 — 92.265 mm (3.6317 — 3.6325 in)**

**0.50 mm (0.0197 in) oversize**

**92.495 — 92.515 mm (3.6415 — 3.6423 in)**



5) Calculate the clearance between cylinder and piston.

**NOTE:**

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

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

**Standard**

**-0.010 — 0.010 mm (-0.0004 — 0.0004 in)**

6) Boring and honing:

(1) If the value of cylindricality, out-of-roundness, or cylinder-to-piston clearance measured is out of standard or if there is any damage on the cylinder wall, re bore 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 92.515 mm (3.6317 in) after boring and honing, replace the cylinder block.

**NOTE:**

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

## 3. PISTON AND PISTON PIN

1) Check the piston and piston pin for damage, cracks or wear. And check the piston ring groove for wear or damage. Replace if faulty.

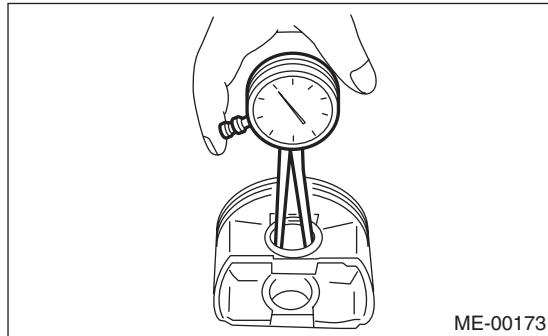
2) Measure the clearance between piston and cylinder in each cylinder. **<Ref. to ME(H6DO)-105, CYLINDER AND PISTON, INSPECTION, Cylinder Block.>** If the clearance exceeds the standard, replace the piston, or re bore the cylinder so that an oversize piston can be used.

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

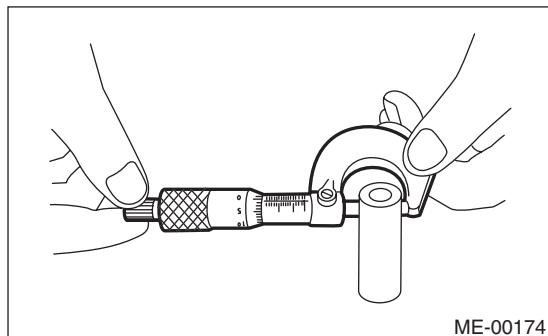
**Clearance between piston pin hole and piston pin:**

**Standard**

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

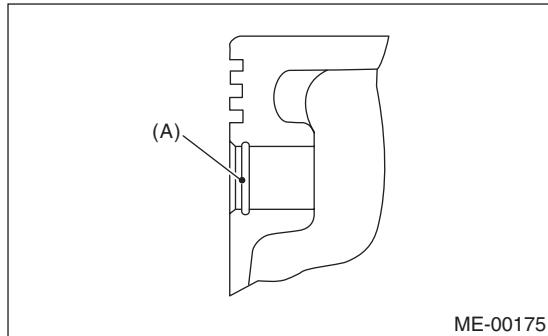


ME-00173



ME-00174

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



ME-00175

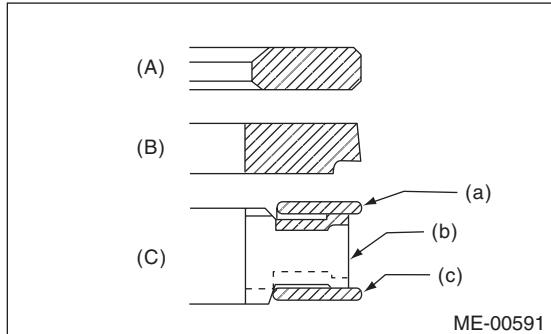
5) Check the piston pin snap ring for distortion, cracks and wear.

### 4. PISTON RING

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

#### CAUTION:

- Marks are displayed on the end of top and second rings. When installing the ring to piston, face this mark upward.
- Oil ring consists of the upper rail, expander and lower rail. When installing on the piston, be careful of the direction of each rail

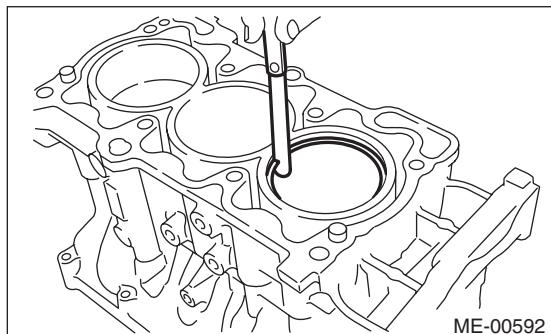


ME-00591

- (A) Top ring
- (B) Second ring
- (C) Oil ring
- (a) Upper rail
- (b) Expander
- (c) Lower rail

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

|                 |             | Standard<br>mm (in)              |
|-----------------|-------------|----------------------------------|
| Piston ring gap | Top ring    | 0.20 — 0.25<br>(0.0079 — 0.0098) |
|                 | Second ring | 0.40 — 0.50<br>(0.0157 — 0.0197) |
|                 | Oil ring    | 0.20 — 0.50<br>(0.0079 — 0.0197) |



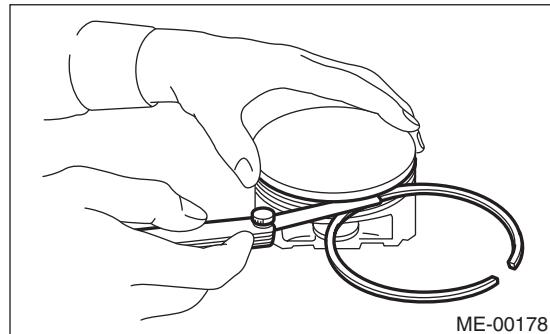
ME-00592

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

#### NOTE:

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

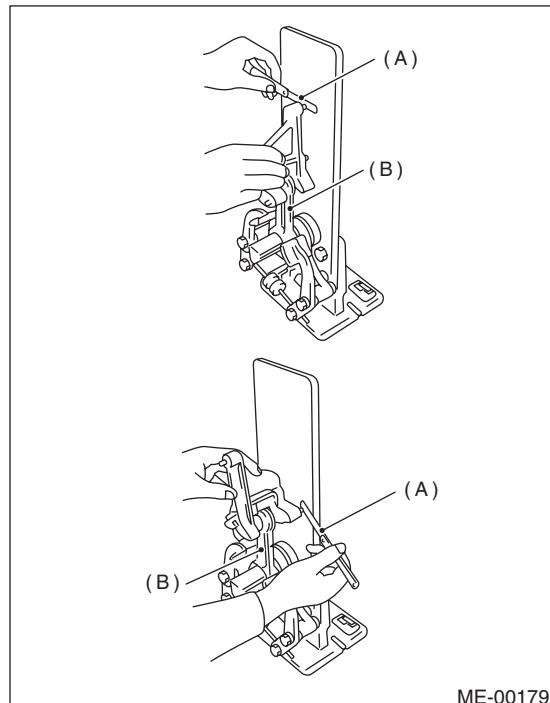
|   |             | Standard<br>mm (in)                |
|---|-------------|------------------------------------|
| Clearance<br>between piston<br>ring and piston<br>ring groove | Top ring    | 0.040 — 0.080<br>(0.0016 — 0.0031) |
|   | Second ring | 0.030 — 0.070<br>(0.0012 — 0.0028) |
| Clearance between oil ring and oil<br>ring groove             |             | 0.065 — 0.165<br>(0.0026 — 0.0065) |



ME-00178

### 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 it has the bend or twist.



ME-00179

- (A) Thickness gauge
- (B) Connecting rod

# Cylinder Block

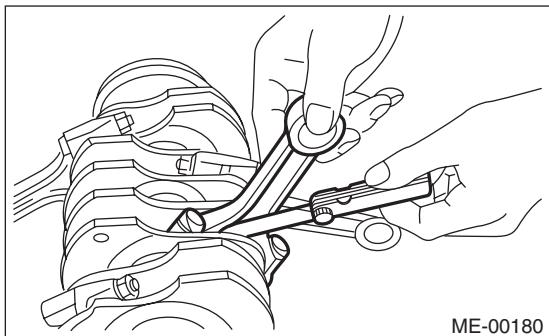
## MECHANICAL

3) Install the connecting rod fitted with bearing to crankshaft and measure the thrust clearance. If the clearance exceeds the standard or offset wear occurs, replace the connecting rod.

### Connecting rod thrust clearance:

**Standard**

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



ME-00180

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

5) Measure the oil clearance on each connecting rod bearing using plastigauge. If any oil clearance is not within the standard, replace the defective bearing with a new part of standard size or undersize as necessary. (See the table below.)

### Connecting rod oil clearance:

**Standard**

**0.016 — 0.043 mm (0.0006 — 0.0017 in)**

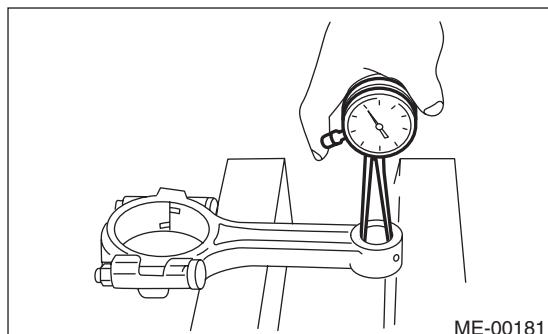
| Bearing                       | Unit: mm (in)                         |                                      |
|-------------------------------|---------------------------------------|--------------------------------------|
|                               | Bearing size<br>(Thickness at center) | Outer diameter of<br>crank pin       |
| Standard                      | 1.489 — 1.505<br>(0.0586 — 0.0593)    | 51.976 — 52.000<br>(2.0463 — 2.0472) |
| 0.03<br>(0.0012)<br>Undersize | 1.507 — 1.515<br>(0.0593 — 0.0596)    | 51.954 — 51.970<br>(2.0454 — 2.0461) |
| 0.05<br>(0.0020)<br>Undersize | 1.517 — 1.525<br>(0.0597 — 0.0600)    | 51.934 — 51.950<br>(2.0446 — 2.0453) |
| 0.25<br>(0.0098)<br>Undersize | 1.617 — 1.625<br>(0.0637 — 0.0640)    | 51.734 — 51.750<br>(2.0368 — 2.0374) |

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

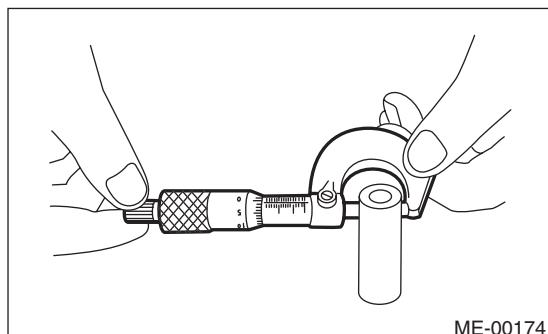
### Clearance between piston pin and bushing:

**Standard**

**0 — 0.022 mm (0 — 0.0009 in)**



ME-00181

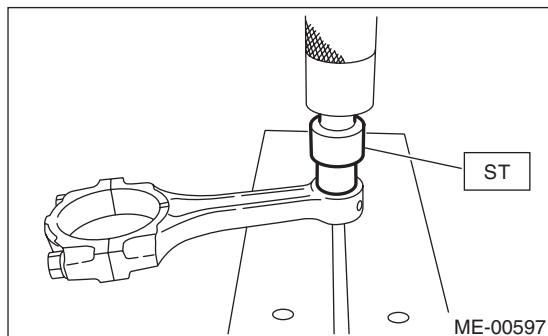


ME-00174

7) Replacement procedure is as follows.

- (1) Remove the bushing from connecting rod with ST and press.
- (2) Press the bushing with the ST after applying oil on the periphery of new bushing.

ST 18350AA000 CONNECTING ROD BUSHING REMOVER AND INSTALLER



ME-00597

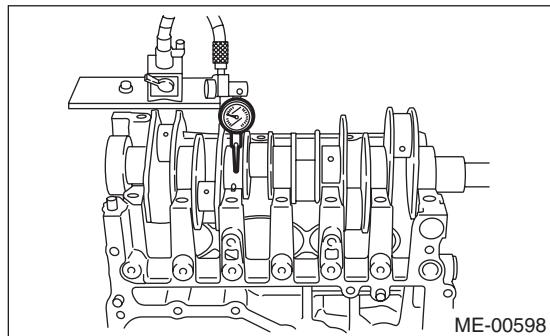
- (3) Make two 3 mm (0.12 in) holes in the pressed bushing by aligning with the pre-manufactured holes on the connecting rod. Ream the inside of bushing.
- (4) After completion of reaming, clean the bushing to remove chips.

## 6. CRANKSHAFT AND CRANKSHAFT BEARING

- 1) Clean the crankshaft completely, and check it for cracks using liquid penetrant tester. Replace if defective.
- 2) Check the crankshaft for bend, and repair or replace if needed. Repair or replace if bent.

**NOTE:**

If a suitable V-block is not available, install #1 and #7 crankshaft bearing on cylinder block, position the crankshaft on these bearings, and then check the crankshaft bend using a dial gauge.



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

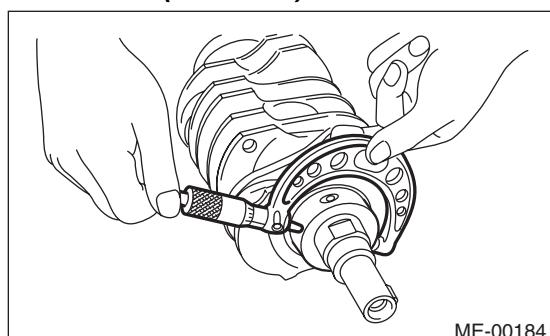
***Crank pin and crank journal:***

***Out-of-roundness***

***0.005 mm (0.0002 in)***

***Cylindricality***

***0.006 mm (0.0002 in)***



# Cylinder Block

## MECHANICAL

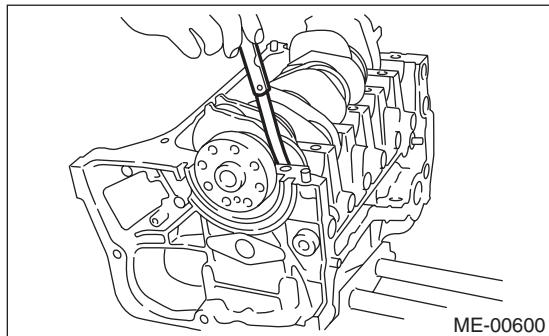
|                            |                                       |                                      |                                    |                                    | Unit: mm (in)                        |
|----------------------------|---------------------------------------|--------------------------------------|------------------------------------|------------------------------------|--------------------------------------|
|                            |                                       | Crank journal diameter               |                                    |                                    | Crank pin outer diameter             |
|                            |                                       | #1, #3, #5                           | #7                                 | #2, #4, #6                         |                                      |
| Standard                   | Journal O.D.                          | 63.992 — 64.016<br>(2.5194 — 2.5203) |                                    |                                    | 51.976 — 52.000<br>(2.0463 — 2.0472) |
|                            | Bearing size<br>(Thickness at center) | 1.996 — 2.013<br>(0.0786 — 0.0793)   | 1.992 — 2.009<br>(0.0784 — 0.0791) | 1.996 — 2.013<br>(0.0786 — 0.0793) | 1.489 — 1.501<br>(0.0586 — 0.0591)   |
| 0.03 (0.0012)<br>Undersize | Journal O.D.                          | 63.962 — 63.978<br>(2.5182 — 2.5188) |                                    |                                    | 51.954 — 51.970<br>(2.0454 — 2.0461) |
|                            | Bearing size<br>(Thickness at center) | 2.011 — 2.014<br>(0.0792 — 0.0793)   |                                    | 2.015 — 2.018<br>(0.0793 — 0.0794) | 1.507 — 1.515<br>(0.0593 — 0.0596)   |
| 0.05 (0.0020)<br>Undersize | Journal O.D.                          | 63.942 — 63.958<br>(2.5174 — 2.5180) |                                    |                                    | 51.934 — 51.950<br>(2.0446 — 2.0453) |
|                            | Bearing size<br>(Thickness at center) | 2.021 — 2.024<br>(0.0796 — 0.0797)   |                                    | 2.025 — 2.028<br>(0.0797 — 0.0798) | 1.517 — 1.525<br>(0.0597 — 0.0600)   |
| 0.25 (0.0098)<br>Undersize | Journal O.D.                          | 63.742 — 63.758<br>(2.5095 — 2.5102) |                                    |                                    | 51.734 — 51.750<br>(2.0368 — 2.0374) |
|                            | Bearing size<br>(Thickness at center) | 2.121 — 2.124<br>(0.0835 — 0.0836)   |                                    | 2.125 — 2.128<br>(0.0837 — 0.0838) | 1.617 — 1.625<br>(0.0637 — 0.0640)   |

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

### Crankshaft thrust clearance:

#### Standard

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



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

6) Measure the oil clearance on each crankshaft bearing using plastigauge. If the measurement value is not within the standard, replace the defective bearing with an undersize one, and as necessary, replace or recondition the crankshaft.

### Crankshaft oil clearance:

#### Standard

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