

ENGINE SECTION 2

This service manual has been prepared to provide SUBARU service personnel with the necessary information and data for the correct maintenance and repair of SUBARU vehicles.

This manual includes the procedures for maintenance, disassembling, reassembling, inspection and adjustment of components and diagnostics for guidance of experienced mechanics.

Please peruse and utilize this manual fully to ensure complete repair work for satisfying our customers by keeping their vehicle in optimum condition. When replacement of parts during repair work is needed, be sure to use SUBARU genuine parts.

All information, illustration and specifications contained in this manual are based on the latest product information available at the time of publication approval.

FUEL INJECTION (FUEL SYSTEM) FU(H4DOTC)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICE) EC(H4DOTC)

INTAKE (INDUCTION) IN(H4DOTC)

MECHANICAL ME(H4DOTC)

EXHAUST EX(H4DOTC)

COOLING CO(H4DOTC)

LUBRICATION LU(H4DOTC)

SPEED CONTROL SYSTEM SP(H4DOTC)

IGNITION IG(H4DOTC)

STARTING/CHARGING SYSTEM SC(H4DOTC)

ENGINE (DIAGNOSTIC) EN(H4DOTC)

MECHANICAL

ME(H4DOTC)

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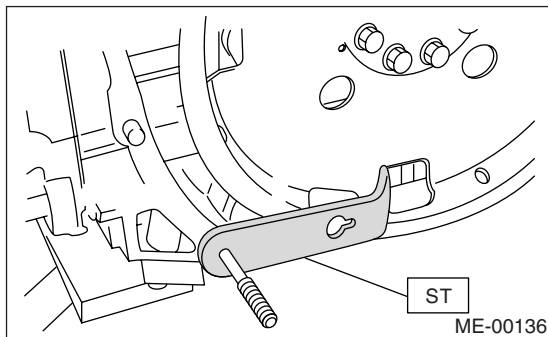
20. Cylinder Block

A: REMOVAL

NOTE:

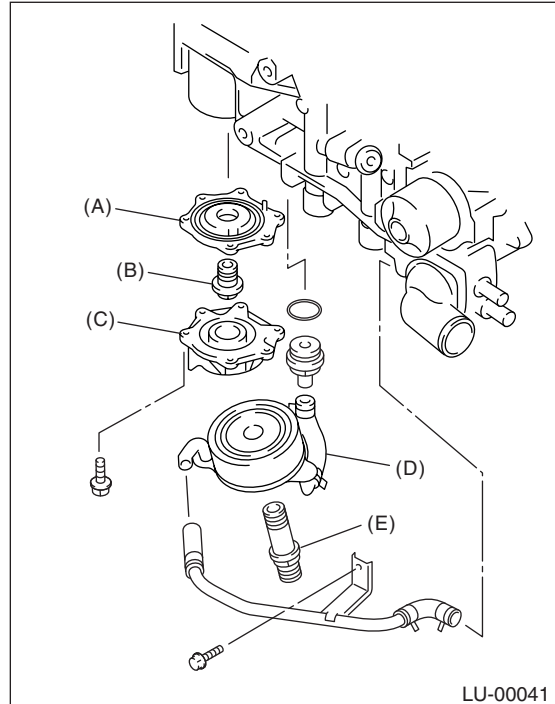
Before conducting this procedure, drain the engine oil completely if applicable.

- 1) Remove the intake manifold. <Ref. to FU(H4DOTC)-14, REMOVAL, Intake Manifold.> or <Ref. to FU(H4DOTC 2.5)-14, REMOVAL, Intake Manifold.>
- 2) Remove the V-belt. <Ref. to ME(H4DOTC)-52, REMOVAL, V-belt.>
- 3) Remove the crank pulley. <Ref. to ME(H4DOTC)-55, REMOVAL, Crank Pulley.>
- 4) Remove the timing belt cover. <Ref. to ME(H4DOTC)-57, REMOVAL, Timing Belt Cover.>
- 5) Remove the timing belt assembly. <Ref. to ME(H4DOTC)-58, REMOVAL, Timing Belt Assembly.>
- 6) Remove the cam sprocket. <Ref. to ME(H4DOTC)-67, REMOVAL, Cam Sprocket.>
- 7) Remove the crank sprocket. <Ref. to ME(H4DOTC)-68, REMOVAL, Crank Sprocket.>
- 8) Remove the generator and A/C compressor with their brackets.
- 9) Remove the cylinder head assembly. <Ref. to ME(H4DOTC)-76, REMOVAL, Cylinder Head Assembly.>
- 10) Remove the clutch disc and cover. (MT model) <Ref. to CL-16, REMOVAL, Clutch Disc and Cover.>
- 11) Remove the flywheel. (MT model) <Ref. to CL-19, REMOVAL, Flywheel.>
- 12) Remove the drive plate. (AT model)
Using the ST, lock crankshaft.
ST 498497100 CRANKSHAFT STOPPER



- 13) Remove the oil separator cover.
- 14) Remove the water by-pass pipe for heater.
- 15) Remove the oil filter using ST.
<Ref. to LU(H4SO)-23, REMOVAL, Engine Oil Filter.>

- 16) Remove the oil cooler.



- (A) Adapter (1)
- (B) Adapter connector
- (C) Adapter (2)
- (D) Oil cooler
- (E) Oil cooler connector

- 17) Removal of oil pan:

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

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

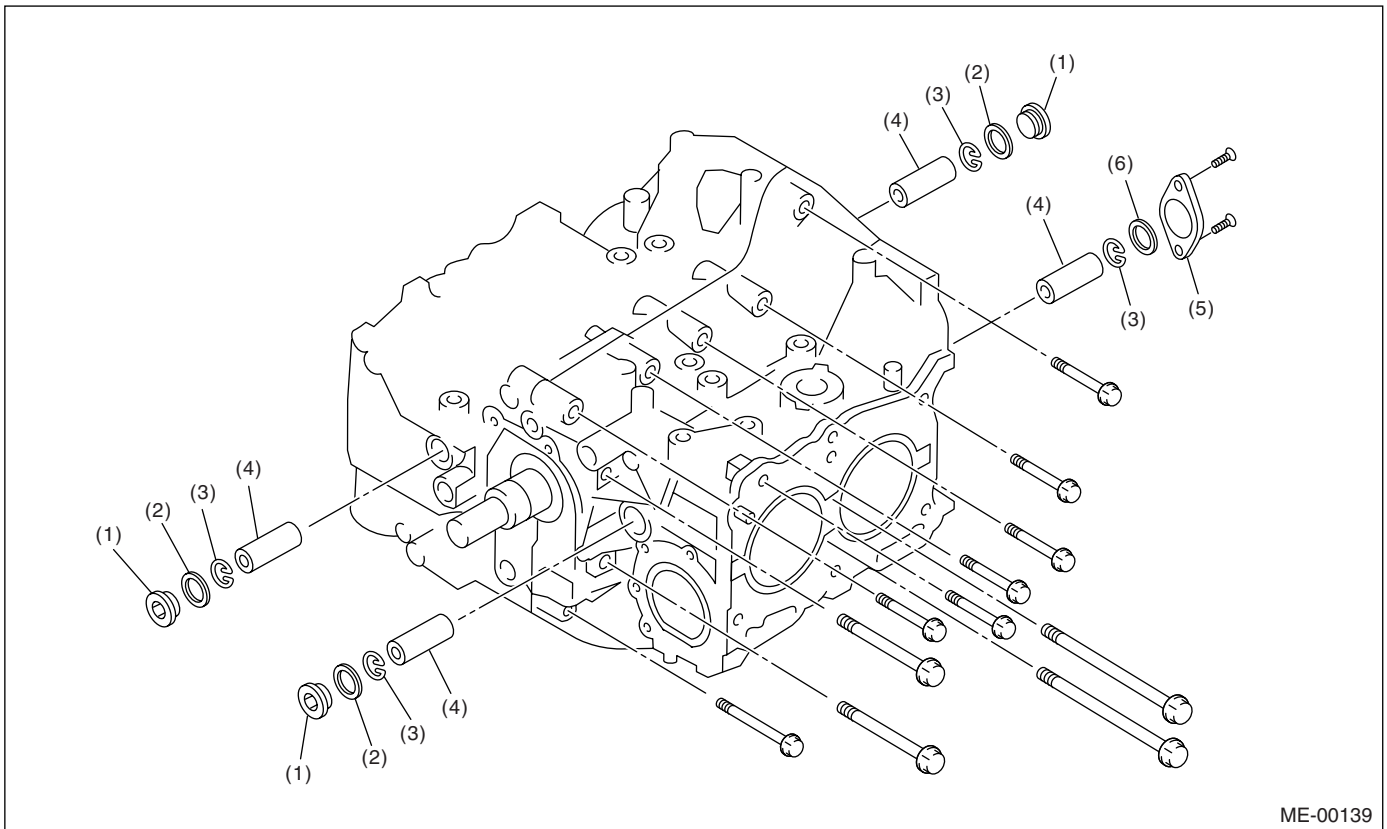
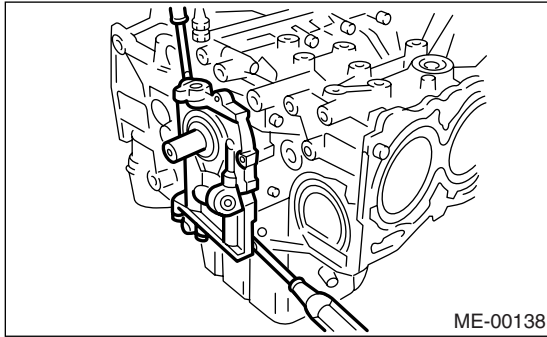
- 18) Remove the oil strainer stay.
- 19) Remove the oil strainer.
- 20) Remove the baffle plate.
- 21) Remove the water pipes.
- 22) Remove the water pump.
- 23) Remove the oil pump from cylinder block.
Use a flat-bladed screwdriver as shown in the figure when removing the oil pump.

Cylinder Block

MECHANICAL

NOTE:

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



- (1) Service hole plug
- (2) Gasket

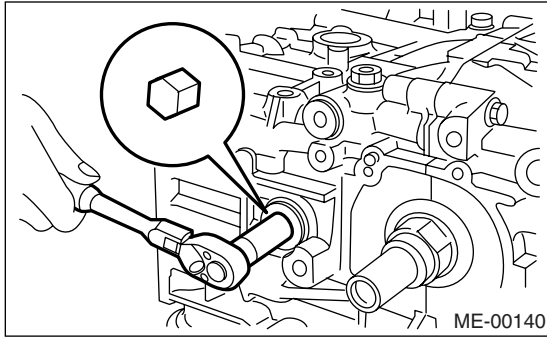
- (3) Circlip
- (4) Piston pin

- (5) Service hole cover
- (6) O-ring

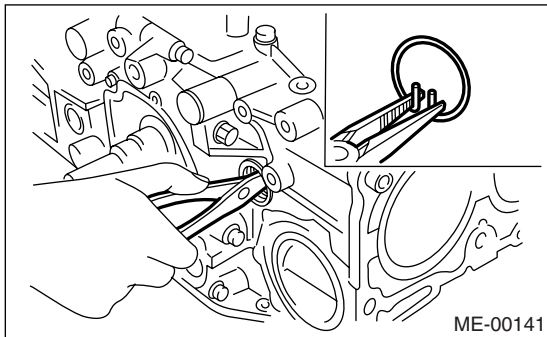
Cylinder Block

MECHANICAL

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



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



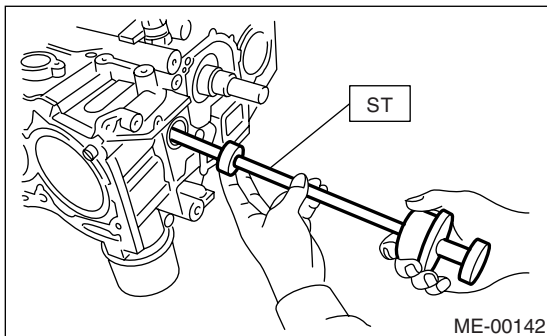
26) Draw out the piston pin from #1 and #2 pistons using ST.

ST 499097600 PISTON PIN REMOVER (2.0 L model)

ST 499097700 PISTON PIN REMOVER (2.5 L model)

NOTE:

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



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

28) Remove the bolts which connect the cylinder block on the side of #2 and #4 cylinders.

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

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

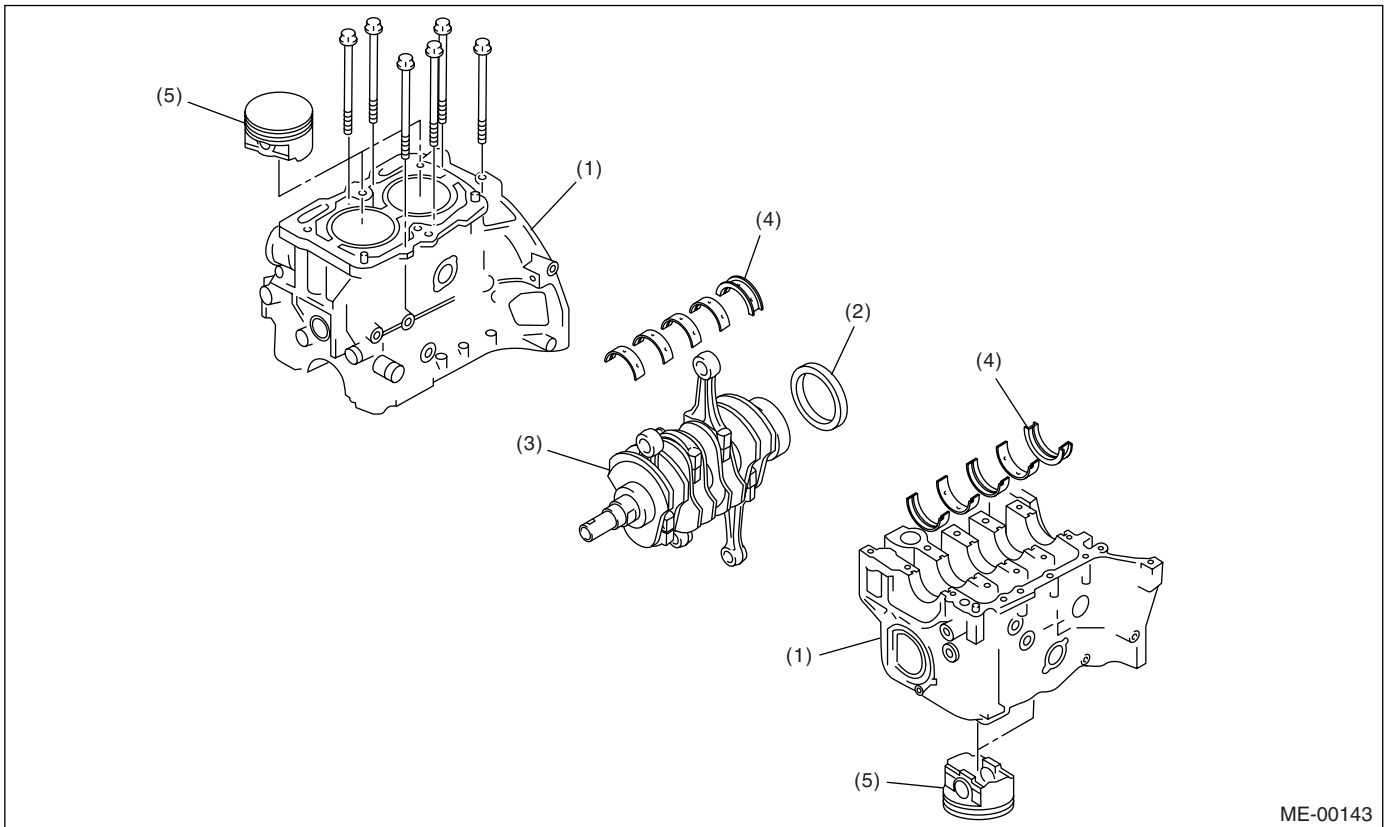
31) Separate the cylinder blocks (LH) and (RH).

Cylinder Block

MECHANICAL

NOTE:

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



ME-00143

(1) Cylinder block

(3) Crankshaft

(5) Piston

(2) Rear oil seal

(4) Crankshaft bearing

32) Remove the rear oil seal.

33) Remove the crankshaft together with connecting rod.

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

NOTE:

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

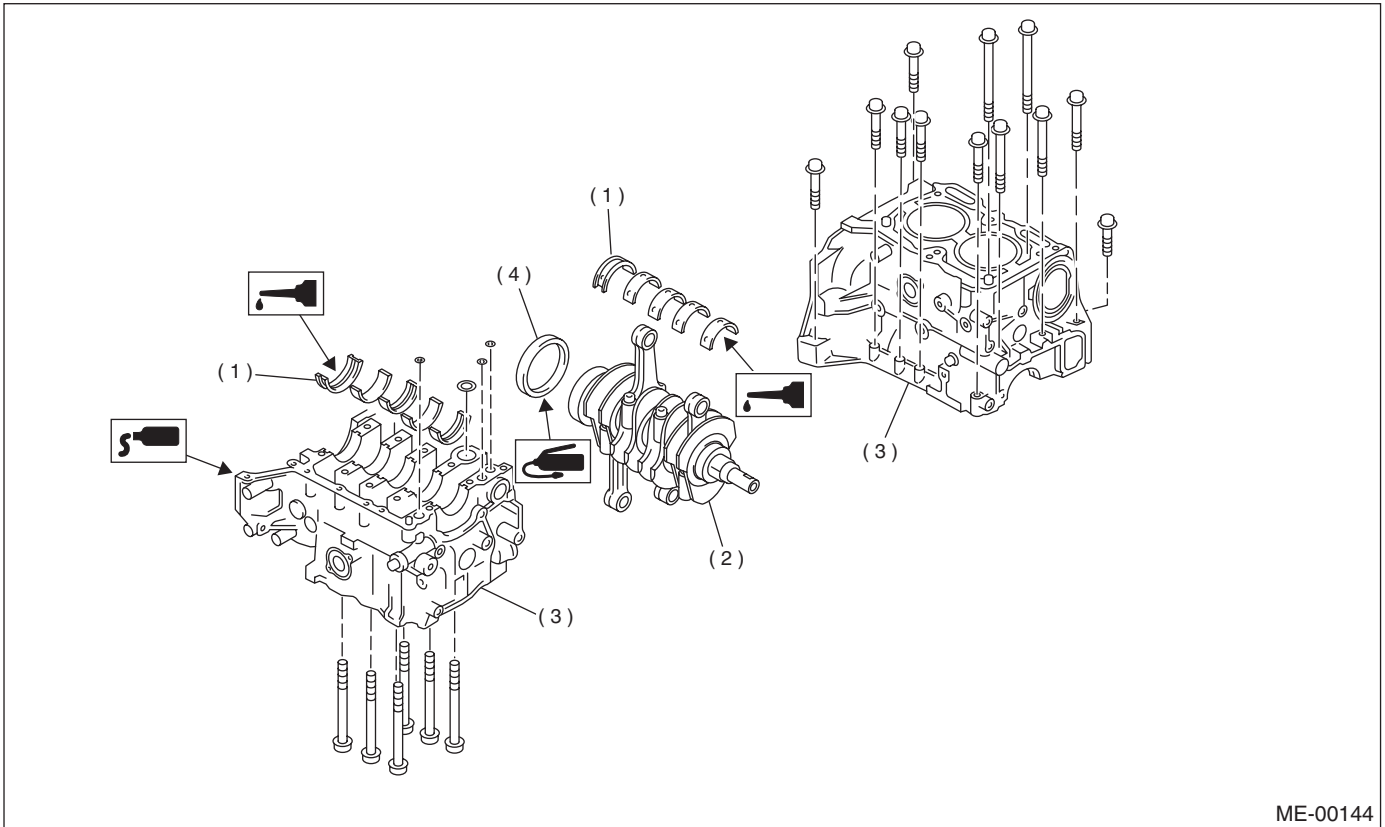
35) Draw out each piston from cylinder block using a wooden bar or hammer handle.

NOTE:

Do not confuse the combination of piston and cylinder.

B: INSTALLATION

1. 2.0 L MODEL



ME-00144

(1) Crankshaft bearing

(3) Cylinder block

(4) Rear oil seal

(2) Crankshaft

1) Remove oil in the mating surface of bearing and cylinder block before installation. Also apply a coat of engine oil to crankshaft pins.

2) Position the crankshaft on #2 and #4 cylinder block.

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

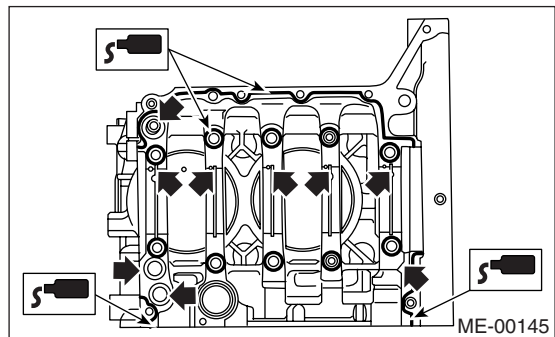
Liquid gasket:

Part No. 004403007

THREE BOND 1215 or equivalent

NOTE:

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



ME-00145

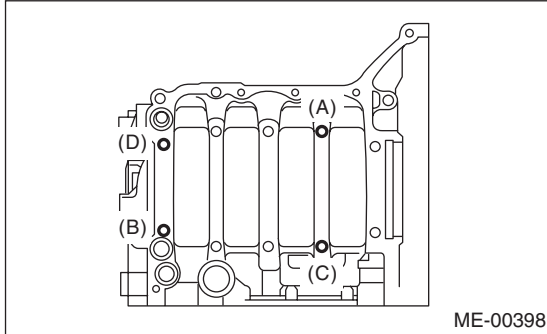
4) Apply a coat of engine oil to washers and bolt threads.

Cylinder Block

MECHANICAL

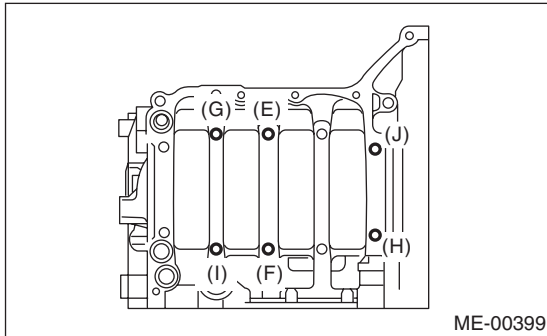
5) Tighten the 10 mm cylinder block connecting bolts in alphabetical sequence shown in the figure. (LH side)

Tightening torque:
15 N·m (1.5 kgf-m, 10.8 ft-lb)

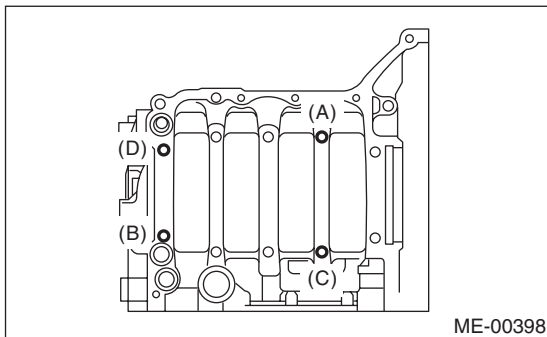


6) Tighten the 10 mm cylinder block connecting bolts in alphabetical sequence shown in the figure. (RH side)

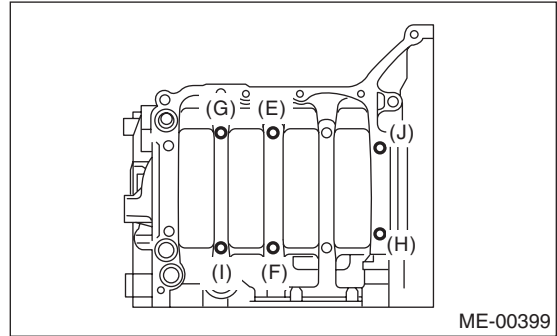
Tightening torque:
15 N·m (1.5 kgf-m, 10.8 ft-lb)



7) Further tighten the LH side bolts (A — D) to 90° in alphabetical sequence.

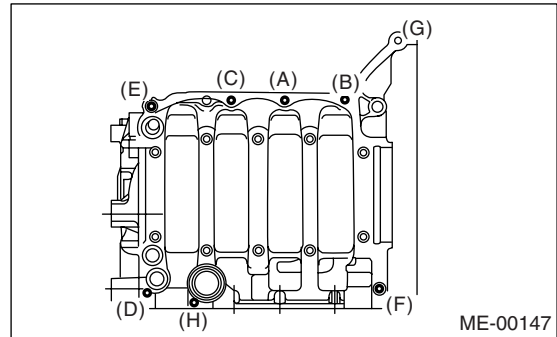


8) Further tighten the RH side bolts (E — J) to 90° in alphabetical sequence.

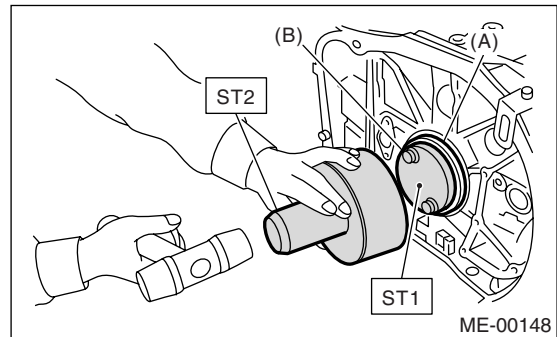


9) Tighten the 8 mm and 6 mm cylinder block connecting bolts in alphabetical sequence shown in the figure.

Tightening torque:
(A) — (G): 25 N·m (2.5 kgf-m, 18.1 ft-lb)
(H): 6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



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



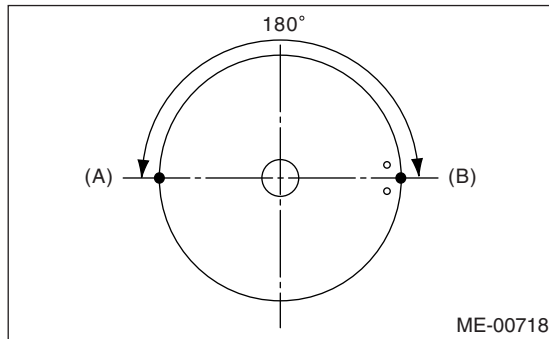
(A) Rear oil seal
 (B) Flywheel attaching bolt

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

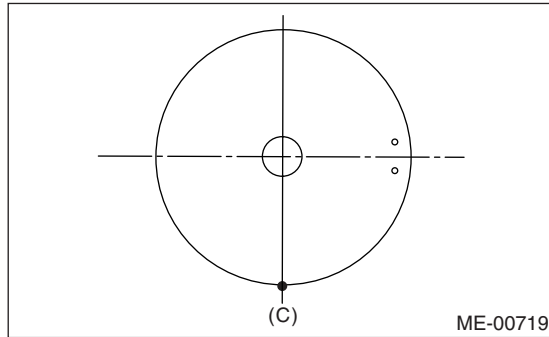
12) Position the second ring gap at 180° on the reverse side for the top ring gap.

Cylinder Block

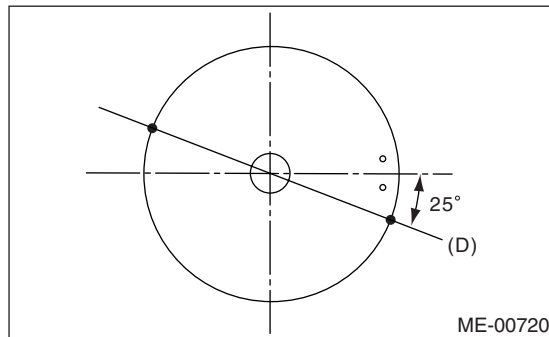
MECHANICAL



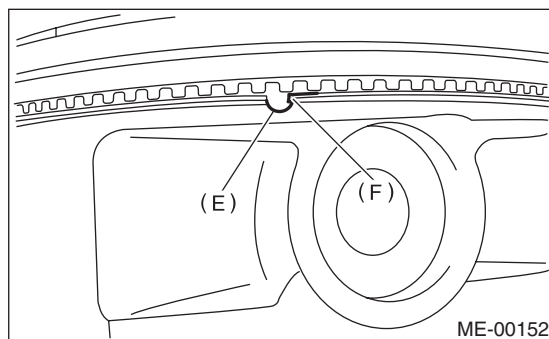
13) Position the expander gap at (C) in the figure.



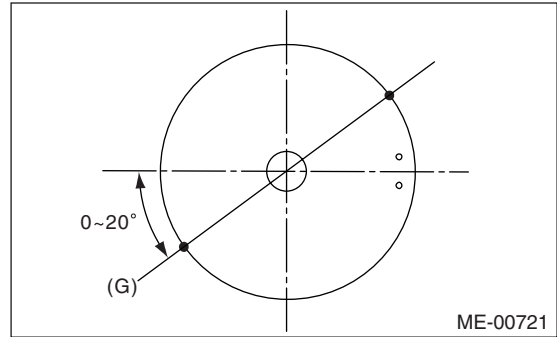
14) Position the lower rail gap at (D) in the figure.



15) Align lower rail spin stopper (F) with piston side surface hole (E).



16) Position the upper rail gap at (G) in the figure.



NOTE:

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

17) Install the circlip.

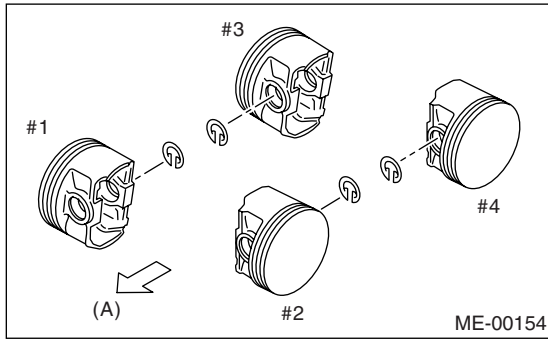
Install the circlips in piston holes located opposite of service holes in cylinder block, when positioning all pistons in the corresponding cylinders.

Cylinder Block

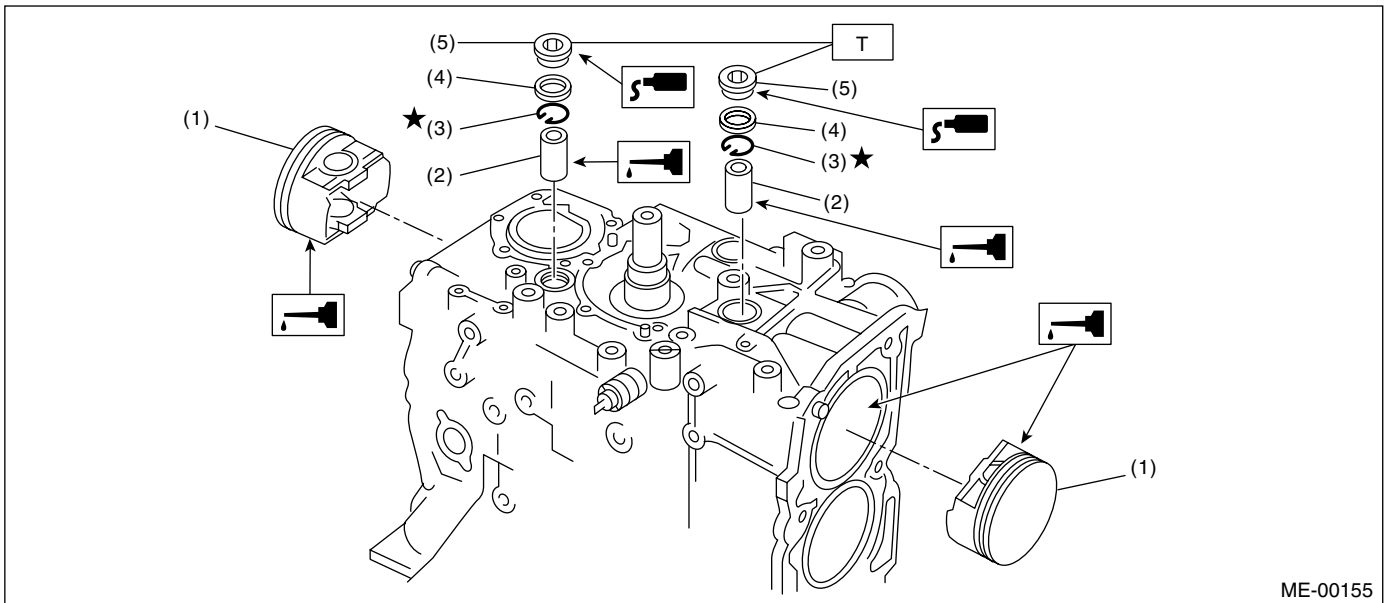
MECHANICAL

NOTE:

Use new circlips.



(A) Front side



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

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

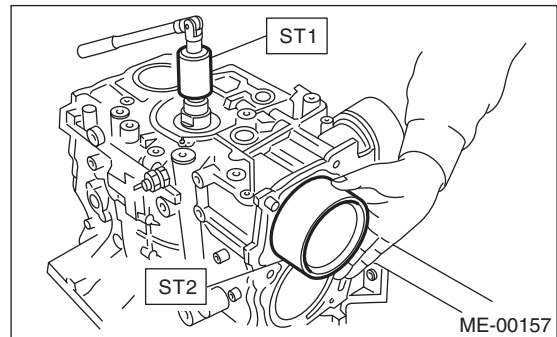
18) Installing the piston:

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

ST1 499987500 CRANKSHAFT SOCKET

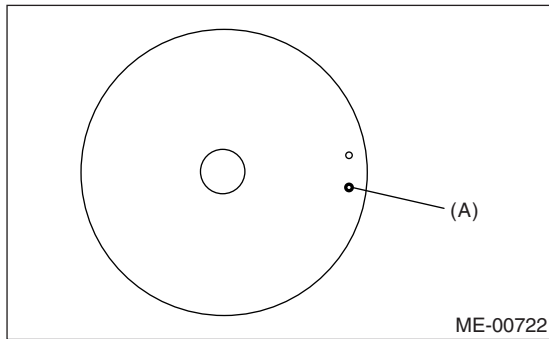
- (3) Apply a coat of engine oil to the pistons and cylinders and insert pistons in their cylinders using ST2.

ST2 398744300 PISTON GUIDE



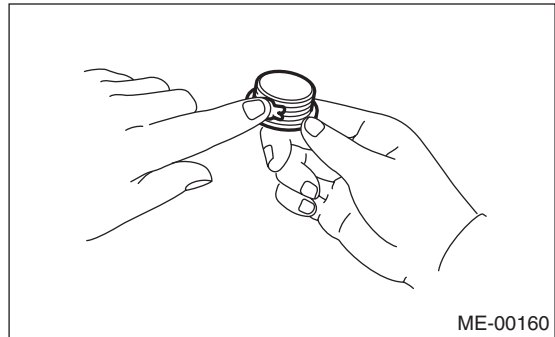
NOTE:

Piston front mark faces towards the front of the engine.



(A) Front mark

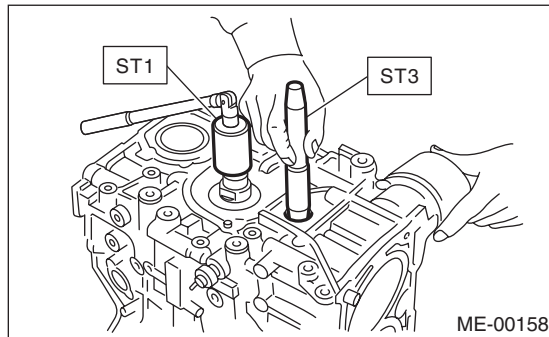
Liquid gasket:
Part No. 004403007
THREE BOND 1215 or equivalent



19) Installing piston pin:

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

ST3 499017100 PISTON PIN GUIDE

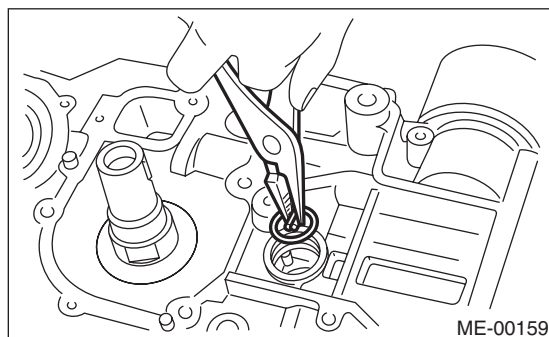


- (3) Apply a coat of engine oil to the piston pin and insert piston pin into piston and connecting rod through service hole.

- (4) Using the needle nose plier, install the circlip.

NOTE:

Use new circlips.



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

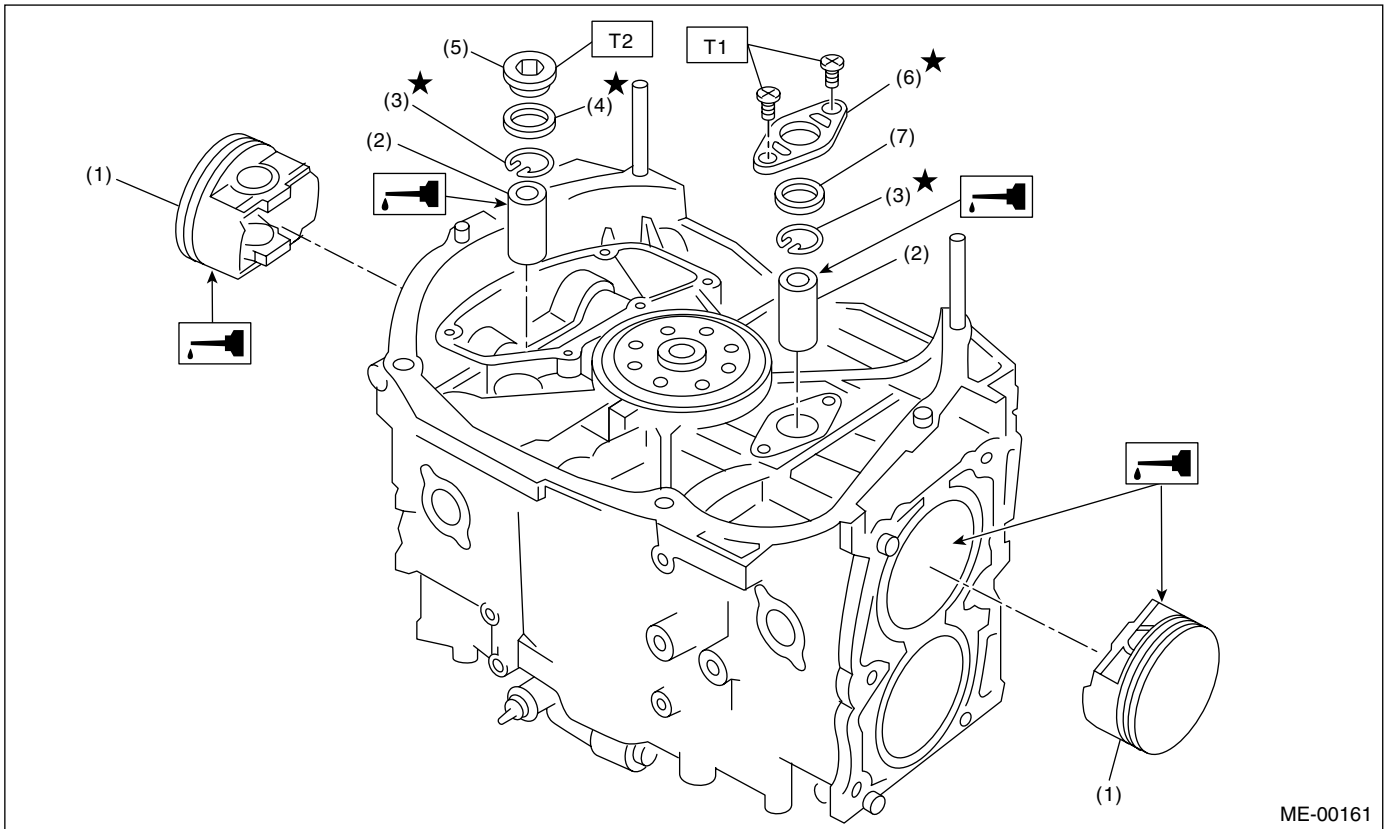
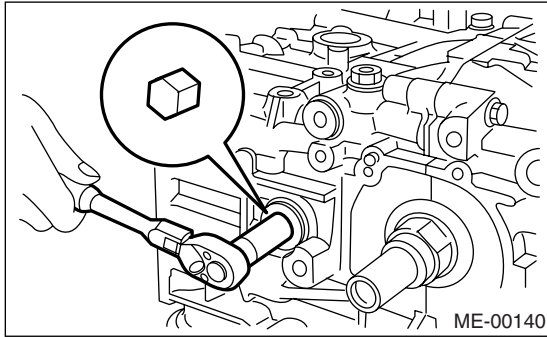
- (6) Install the service hole plug and gasket.

Cylinder Block

MECHANICAL

NOTE:

Use a new gasket.



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

Tightening torque: N·m (kgf·m, ft·lb)

T1: 6.4 (0.65, 4.7)

T2: 70 (7.1, 51.4)

(7) Turn the cylinder block so that #3 and #4 cylinders face upward. Using the same procedures as used for #1 and #2 cylinders, install the pistons and piston pins.

- 20) Install the water pipe.
21) Install the baffle plate.

Tightening torque:

6.4 N·m (0.65 kgf·m, 4.7 ft·lb)

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

Tightening torque:

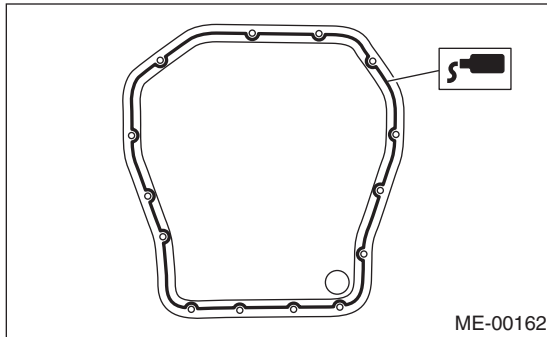
10 N·m (1.0 kgf·m, 7 ft·lb)

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

Liquid gasket:

Part No. 004403007

THREE BOND 1215 or equivalent



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

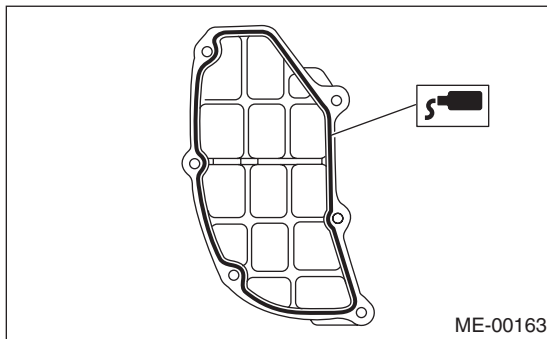
Liquid gasket:

Part No. 004403007

THREE BOND 1215 or equivalent

Tightening torque:

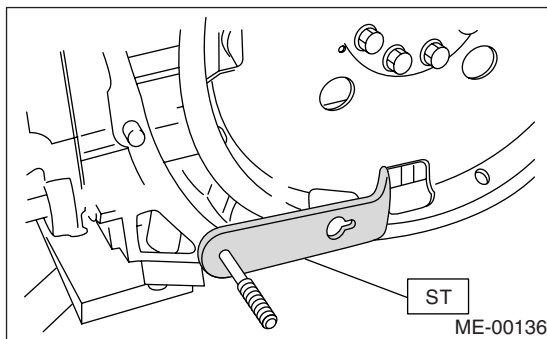
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



26) Install the drive plate. (AT model)
To lock the crankshaft, use ST.
ST 498497100 CRANKSHAFT STOPPER

Tightening torque:

72 N·m (7.3 kgf-m, 52.8 ft-lb)



27) Install the flywheel. (MT model) <Ref. to CL-19, INSTALLATION, Flywheel.>

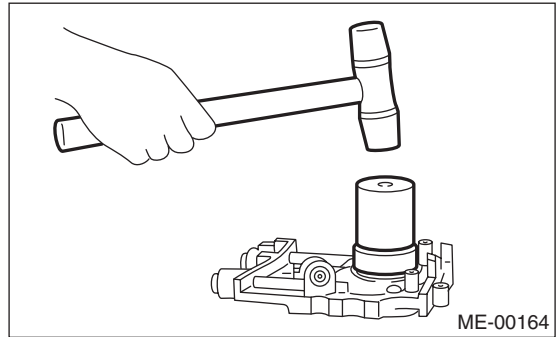
28) Install the clutch disc and cover. (MT model) <Ref. to CL-16, INSTALLATION, Clutch Disc and Cover.>

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

29) Installation of oil pump:

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

ST 499587100 OIL SEAL INSTALLER



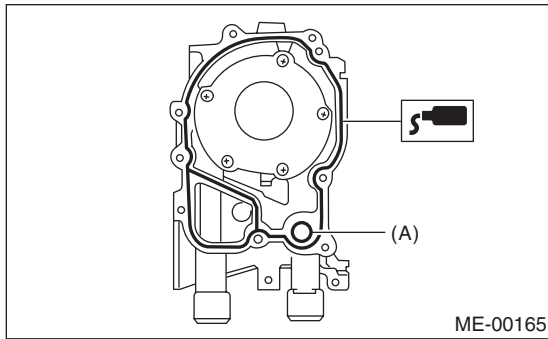
Cylinder Block

MECHANICAL

Liquid gasket:

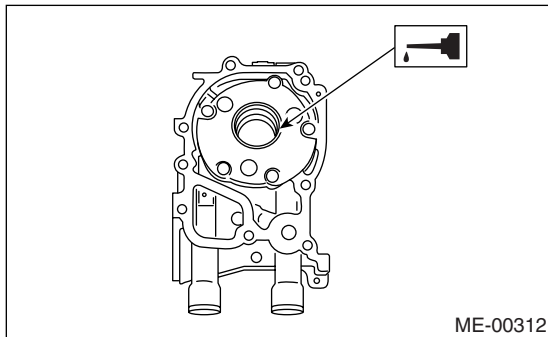
Part No. 004403007

THREE BOND 1215 or equivalent



(A) O-ring

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



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

Tightening torque:

6.4 N·m (0.65 kgf·m, 4.7 ft·lb)

NOTE:

- Do not forget to install the O-ring and seal when installing the oil pump.
- Align the flat surface of oil pump's inner rotor with crankshaft before installation.

30) Install the water pump and gasket.

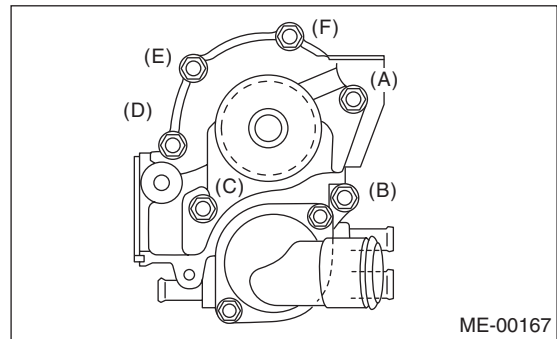
Tightening torque:

First; 12 N·m (1.2 kgf·m, 8.7 ft·lb)

Second; 12 N·m (1.2 kgf·m, 8.7 ft·lb)

NOTE:

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



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

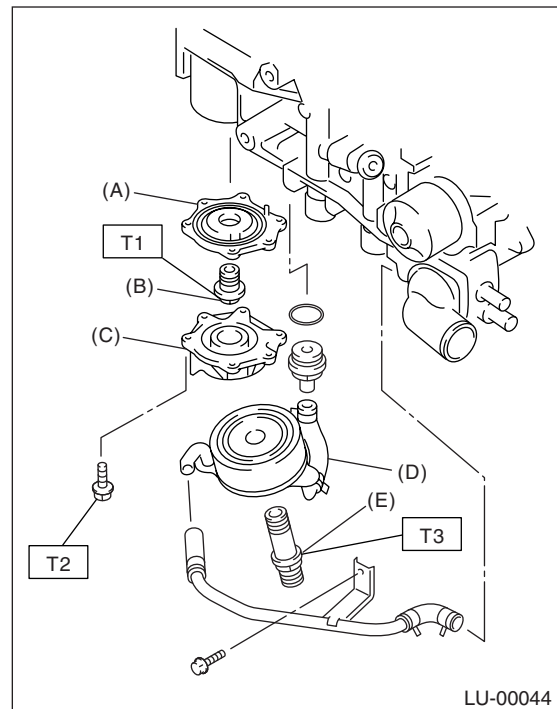
32) Install the oil cooler.

Tightening torque:

T1: 45 N·m (4.6 kgf·m, 33 ft·lb)

T2: 6.4 N·m (0.65 kgf·m, 4.7 ft·lb)

T3: 54 N·m (5.3 kgf·m, 39 ft·lb)



- (A) Adapter (1)
- (B) Adapter connector
- (C) Adapter (2)
- (D) Oil cooler
- (E) Oil cooler connector

Cylinder Block

MECHANICAL

- 33) Install the oil filter using ST. <Ref. to LU(H4SO)-23, INSTALLATION, Engine Oil Filter.>
- 34) Install the water by-pass pipe between oil cooler and water pump.
- 35) Install the water pipe.

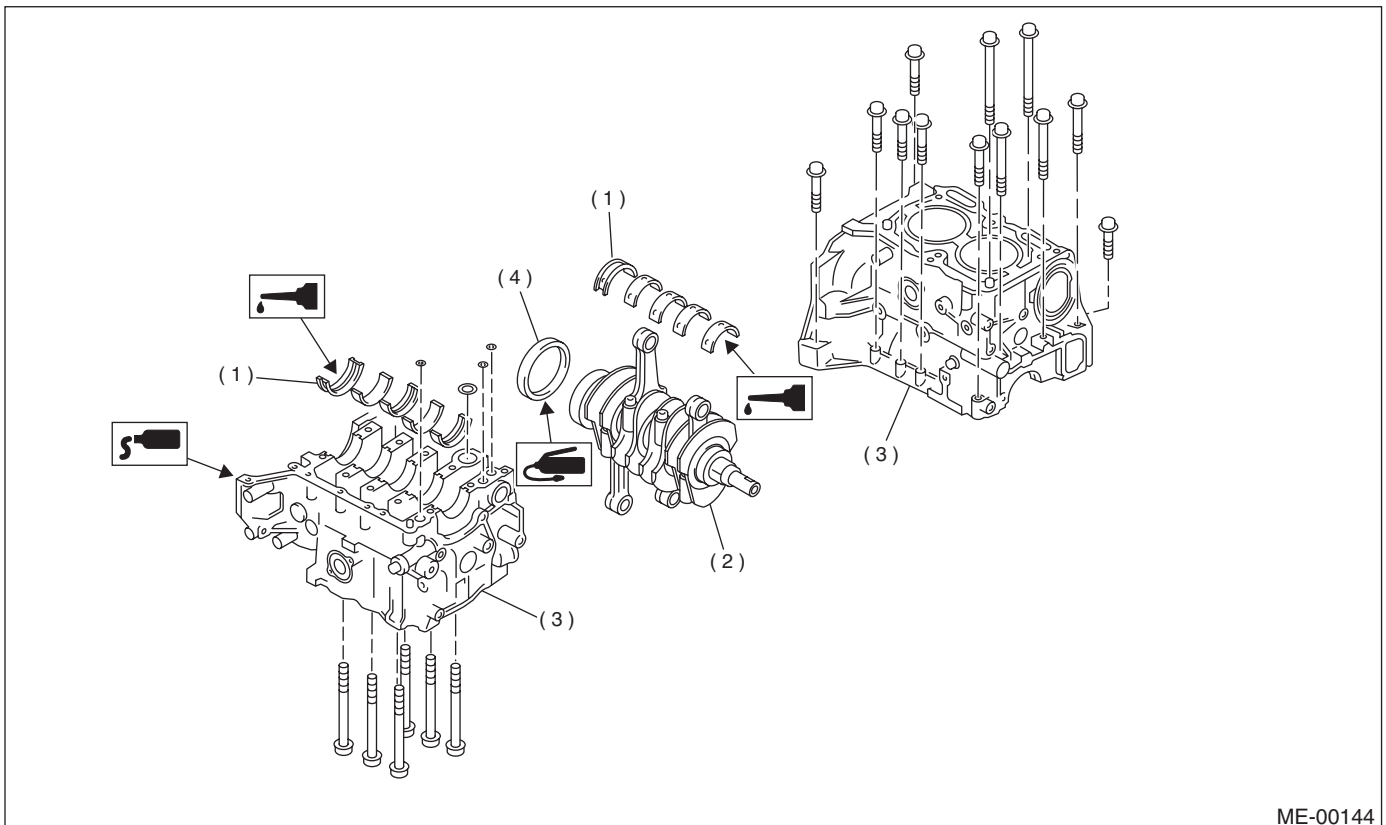
NOTE:

Always use a new O-ring.

- 36) Install the cylinder head assembly. <Ref. to ME(H4DOTC)-76, INSTALLATION, Cylinder Head Assembly.>
- 37) Install the oil level gauge guide and tighten the attaching bolt (LH side).
- 38) Install the rocker cover.
- 39) Install the crank sprocket. <Ref. to ME(H4DOTC)-68, INSTALLATION, Crank Sprocket.>

- 40) Install the cam sprocket. <Ref. to ME(H4DOTC)-67, INSTALLATION, Cam Sprocket.>
- 41) Install the timing belt assembly. <Ref. to ME(H4DOTC)-60, INSTALLATION, Timing Belt Assembly.>
- 42) Install the timing belt cover. <Ref. to ME(H4DOTC)-57, INSTALLATION, Timing Belt Cover.>
- 43) Install the crank pulley. <Ref. to ME(H4DOTC)-55, INSTALLATION, Crank Pulley.>
- 44) Install the generator and A/C compressor brackets on cylinder head.
- 45) Install the V-belt. <Ref. to ME(H4DOTC)-52, INSTALLATION, V-belt.>
- 46) Install the intake manifold. <Ref. to FU(H4DOTC)-17, INSTALLATION, Intake Manifold.>

2. 2.5 L MODEL



ME-00144

- (1) Crankshaft bearing
- (2) Crankshaft

- (3) Cylinder block

- (4) Rear oil seal

Cylinder Block

MECHANICAL

- 1) Remove oil in the mating surface of bearing and cylinder block before installation. Apply a coat of engine oil to crankshaft pins.
- 2) Install crankshaft bearings on the cylinder block, apply a coat of engine oil to crankshaft bearings, and position the crankshaft on #2 and #4 cylinder block.
- 3) Apply liquid gasket to the mating surface of #1 and #3 cylinder block, and position it on #2 and #4 cylinder block.

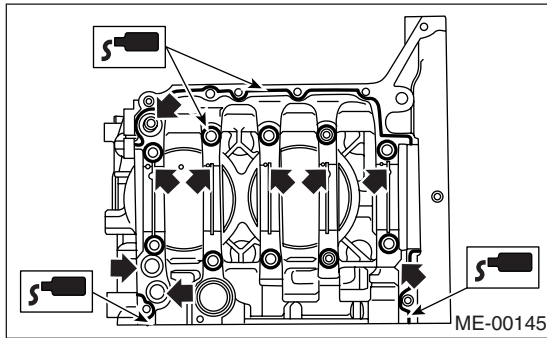
Liquid gasket:

Part No. 004403007

THREE BOND 1215 or equivalent

NOTE:

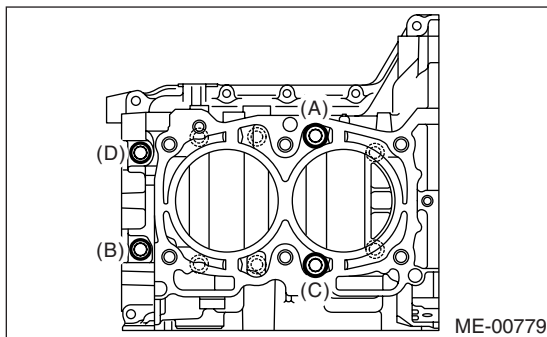
Do not allow liquid gasket to jut into O-ring grooves, oil passages, bearing grooves, etc.



- 4) Apply engine oil to washers and thread of bolts.
- 5) Tighten the 10 mm cylinder block connecting bolts in alphabetical sequence shown in the figure. (LH side)

Tightening torque:

10 N-m (1.0 kgf-m, 7.2 ft-lb)

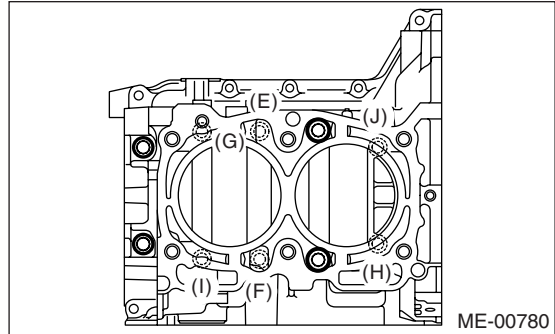


- 8) Further tighten the RH side bolts (E — J) in alphabetical sequence.

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

Tightening torque:

10 N-m (1.0 kgf-m, 7.2 ft-lb)

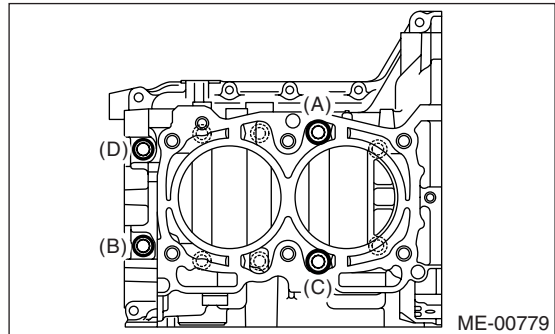


- 7) Further tighten the LH side bolts (A — D) in alphabetical sequence.

Tightening torque:

(A), (C): 20 N-m (2.0 kgf-m, 14.8 ft-lb)

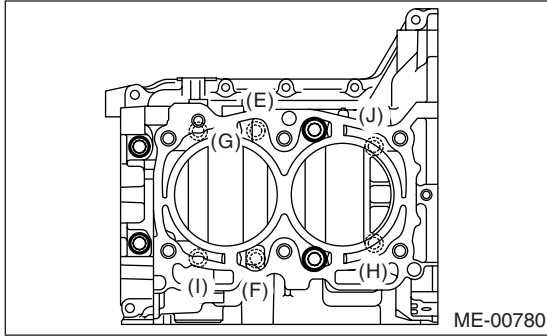
(B), (D): 15 N-m (1.5 kgf-m, 10.8 ft-lb)



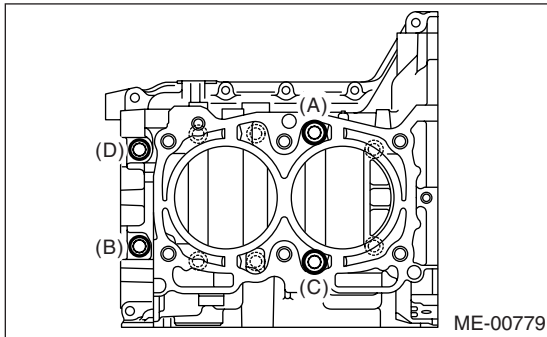
Tightening torque:

(E), (F), (G), (I): 20 N·m (2.0 kgf·m, 14.8 ft·lb)

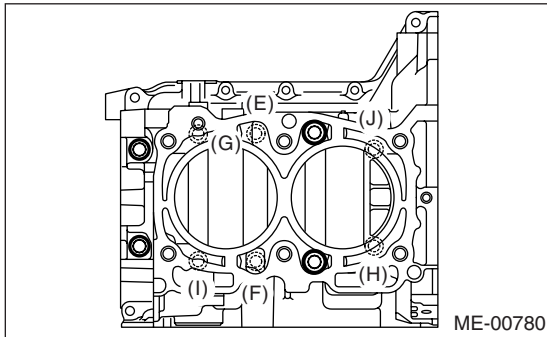
(H), (J): 18 N·m (1.8 kgf·m, 13.3 ft·lb)



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



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

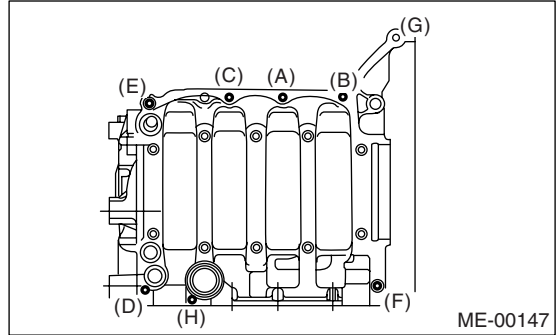


11) Tighten the 8 mm and 6 mm cylinder block connecting bolts in alphabetical sequence shown in the figure.

Tightening torque:

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

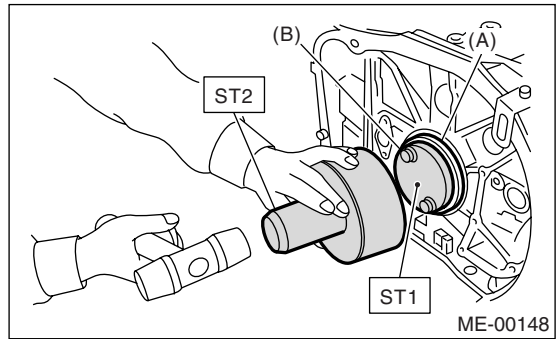
(H): 6.4 N·m (0.65 kgf·m, 4.7 ft·lb)



12) Install the rear oil seal using ST1 and ST2.

ST1 499597100 CRANKSHAFT OIL SEAL GUIDE

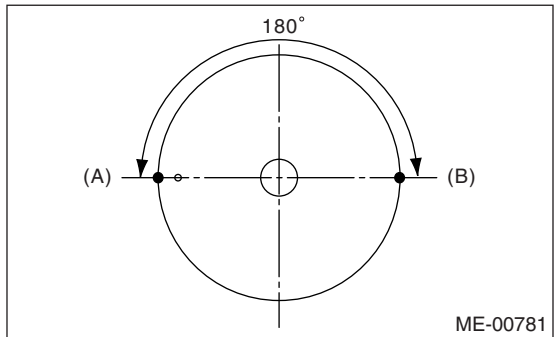
ST2 499587200 CRANKSHAFT OIL SEAL INSTALLER



- (A) Rear oil seal
- (B) Flywheel attaching bolt

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

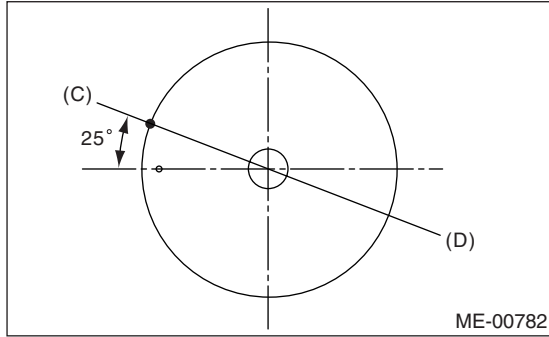
14) Position the second ring gap at 180° on the reverse side for the top ring gap.



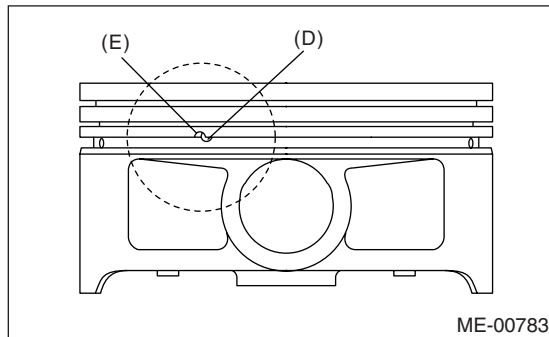
Cylinder Block

MECHANICAL

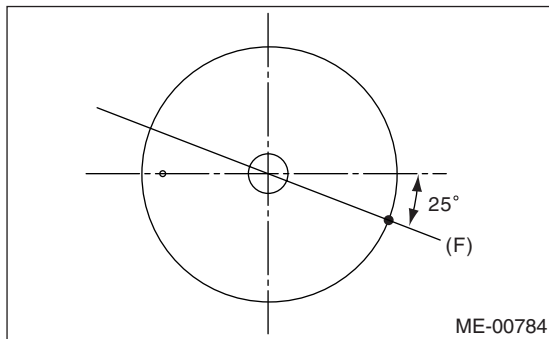
15) Position the upper rail gap at (C) in the figure.



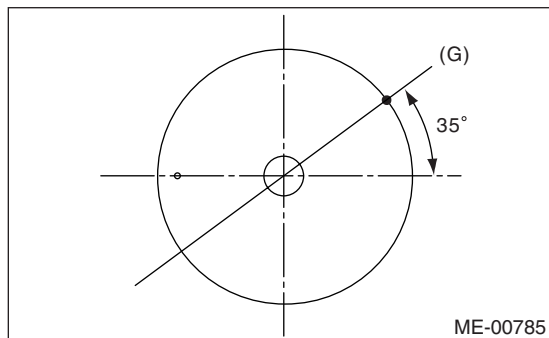
16) Align upper rail spin stopper (D) with piston side surface hole (E).



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



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



NOTE:

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

Cylinder Block

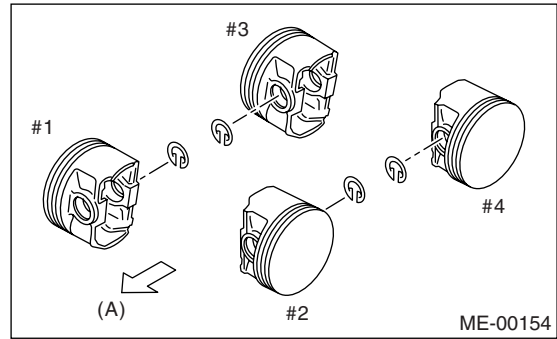
MECHANICAL

19) Install the circlip.

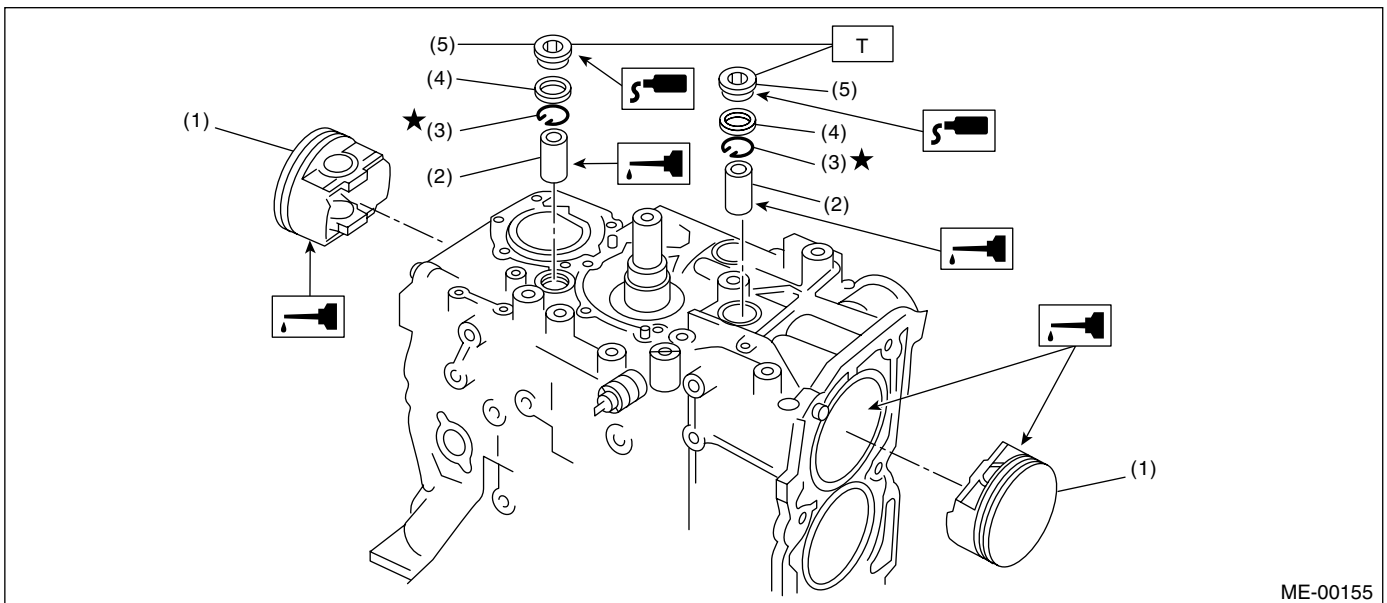
Install the circlips in piston holes located opposite of service holes in cylinder block, when positioning all pistons in the corresponding cylinders.

NOTE:

Use new circlips.



(A) Front side



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

Tightening torque: N·m (kgf·m, ft·lb)

T: 70 (7.1, 51.4)

20) Installing the piston:

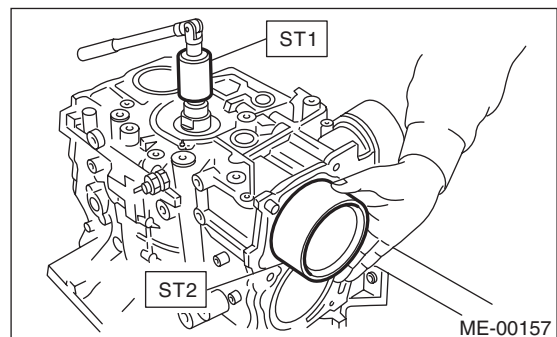
(1) Turn the cylinder block so that #1 and #2 cylinders face upward.

(2) Using the ST1, turn the crankshaft so that #1 and #2 connecting rods are set at bottom dead center.

ST1 499987500 CRANKSHAFT SOCKET

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

ST2 498747300 PISTON GUIDE

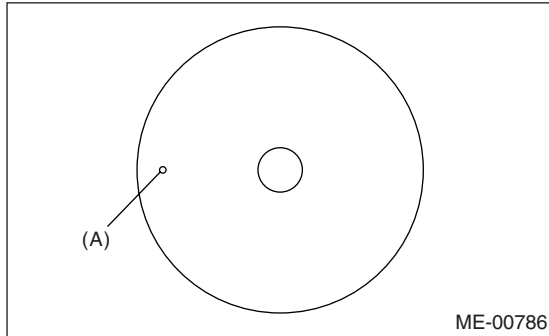


Cylinder Block

MECHANICAL

NOTE:

Piston front mark faces towards the front of the engine.

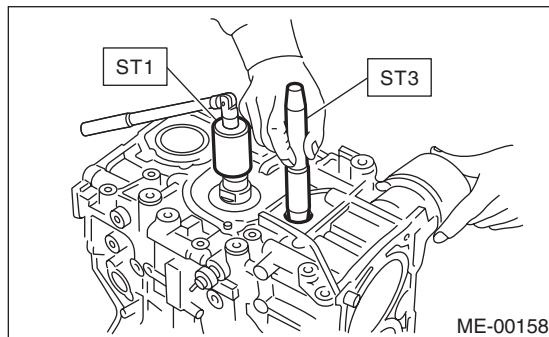


(A) Front mark

21) Installing piston pin:

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

ST3 499017100 PISTON PIN GUIDE

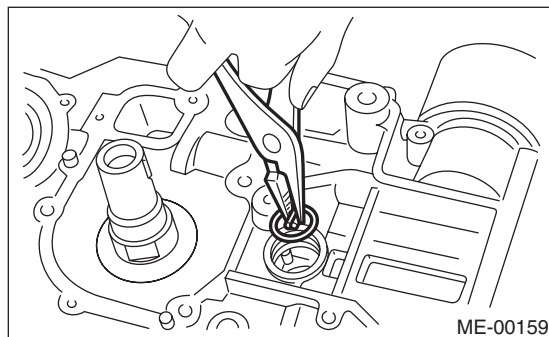


- (3) Apply a coat of engine oil to the piston pin and insert piston pin into piston and connecting rod through service hole.

- (4) Using the needle nose plier, install the circlip.

NOTE:

Use new circlips.

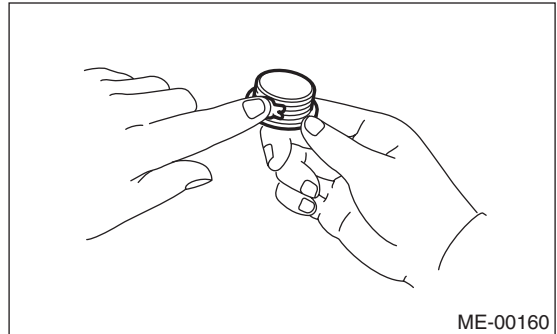


- (5) Apply liquid gasket around the service hole plug.

Liquid gasket:

Part No. 004403007

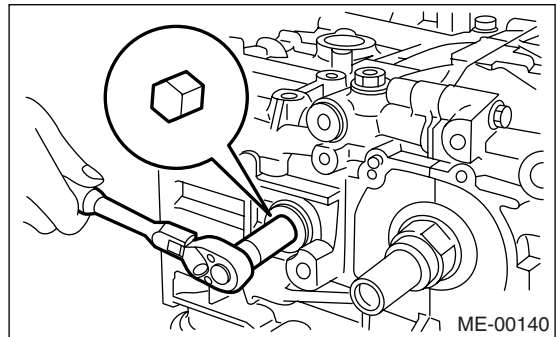
THREE BOND 1215 or equivalent

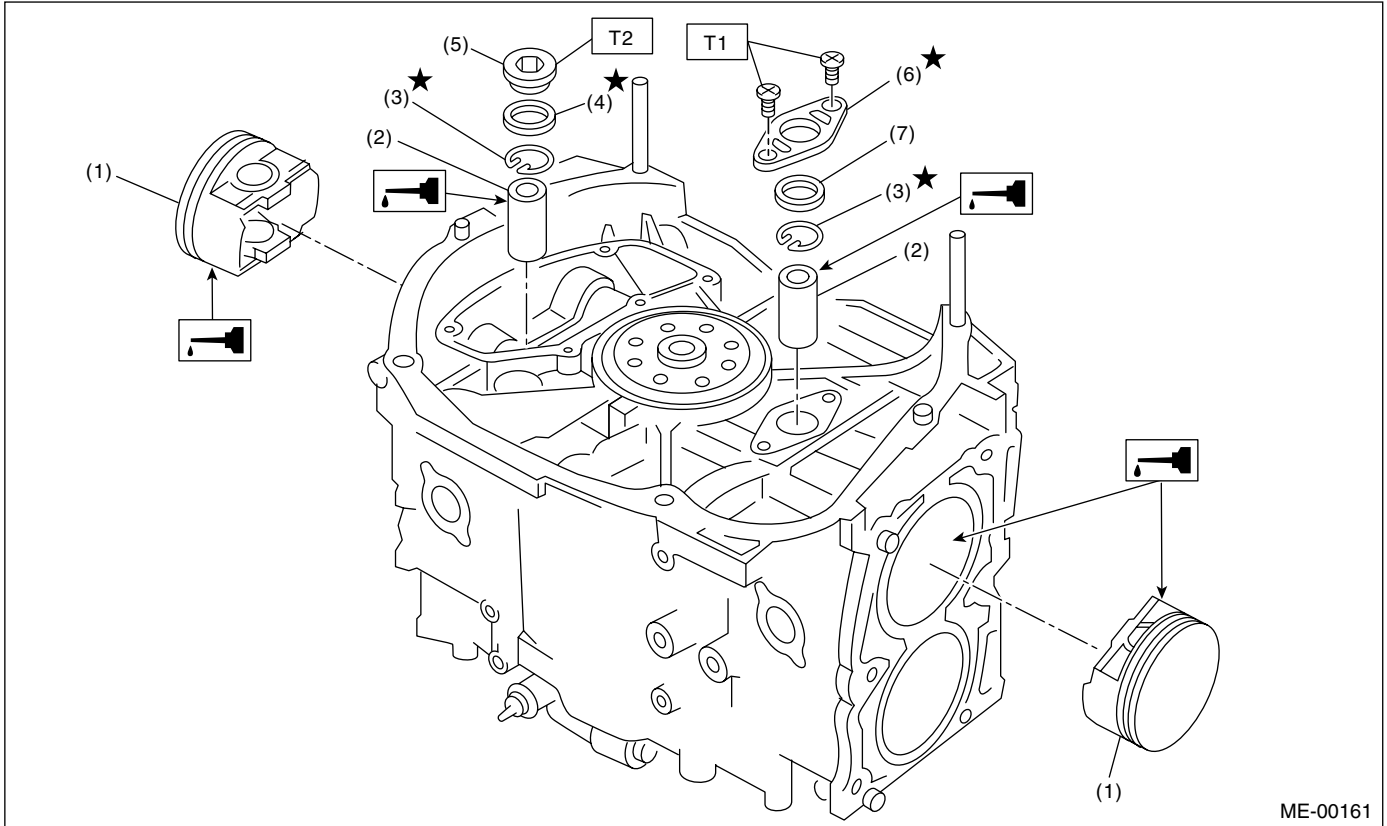


- (6) Install the service hole plug and gasket.

NOTE:

Use a new gasket.





ME-00161

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

Tightening torque: N·m (kgf-m, ft-lb)

T1: 6.4 (0.65, 4.7)

T2: 70 (7.1, 51.4)

- (7) Turn the cylinder block so that #3 and #4 cylinders face upward. Using the same procedures as used for #1 and #2 cylinders, install the pistons and piston pins.
- 22) Install the water pipe.
23) Install the baffle plate.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

- 24) Install the oil strainer and O-ring

Tightening torque:

10 N·m (1.0 kgf-m, 7 ft-lb)

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

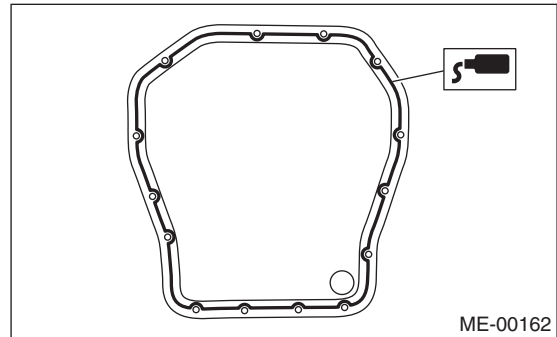
Liquid gasket:

Part No. 004403007

THREE BOND 1215 or equivalent

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)



ME-00162

Cylinder Block

MECHANICAL

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

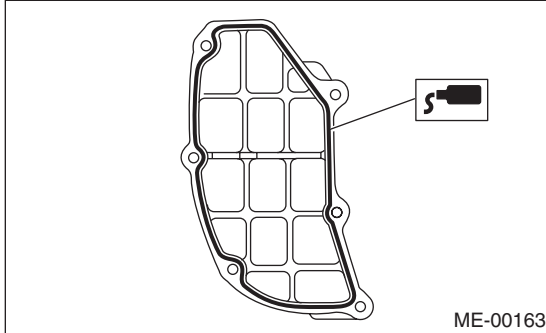
Liquid gasket:

Part No. 004403007

THREE BOND 1215 or equivalent

Tightening torque:

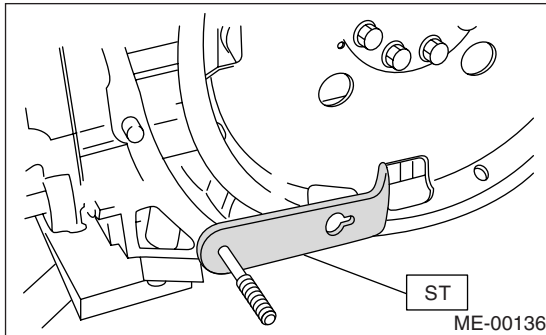
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



28) Install the drive plate. (AT model)
To lock the crankshaft, use ST.
ST 498497100 CRANKSHAFT STOPPER

Tightening torque:

72 N·m (7.3 kgf-m, 52.8 ft-lb)



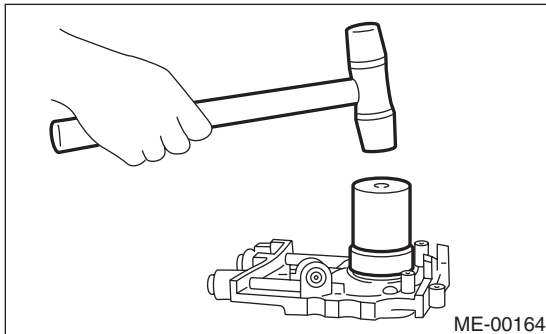
29) Install the flywheel. <Ref. to CL-19, INSTALLATION, Flywheel.>

30) Install the clutch disc and cover. <Ref. to CL-16, INSTALLATION, Clutch Disc and Cover.>

31) Installation of oil pump:

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

ST 499587100 OIL SEAL INSTALLER

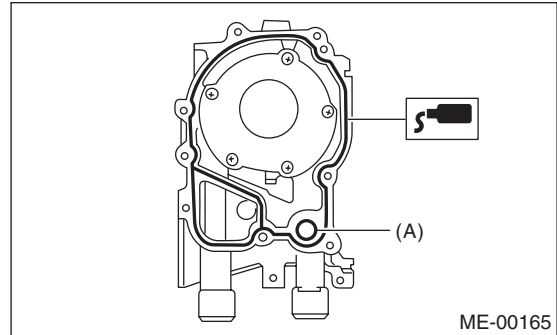


(2) Apply liquid gasket to the matching surface of oil pump.

Liquid gasket:

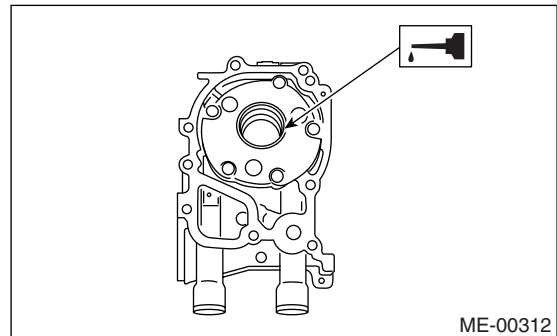
Part No. 004403007

THREE BOND 1215 or equivalent



(A) O-ring

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



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

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

NOTE:

- Do not forget to install the O-ring and seal when installing the oil pump.
- Align the flat surface of oil pump's inner rotor with crankshaft before installation.

32) Install the water pump and gasket.

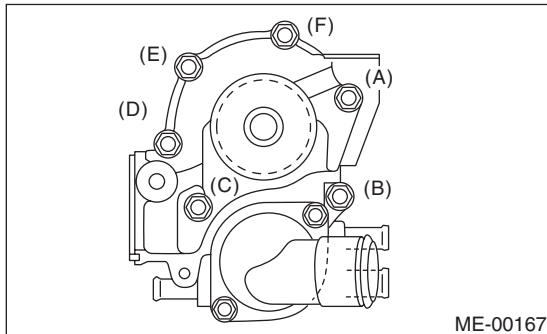
Tightening torque:

First; 12 N·m (1.2 kgf-m, 8.7 ft-lb)

Second; 12 N·m (1.2 kgf-m, 8.7 ft-lb)

NOTE:

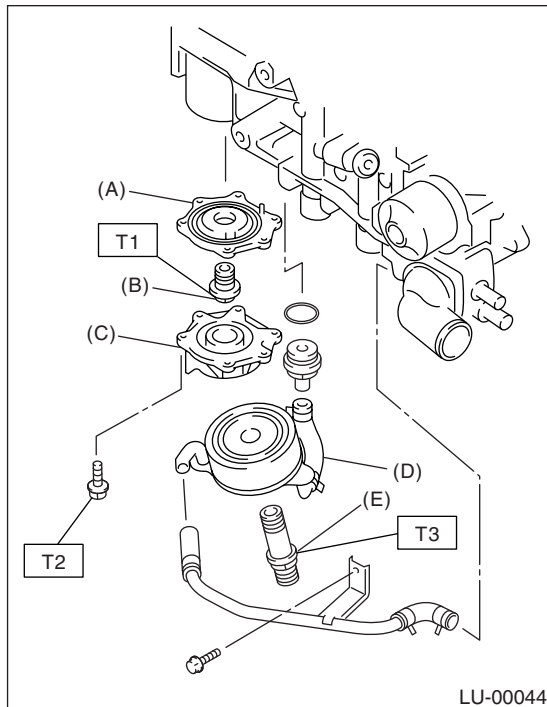
- Be sure to use a new gasket.
- When installing the water pump, tighten the bolts in two stages in alphabetical sequence as shown in the figure.



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

Tightening torque:

- T1: 45 N·m (4.6 kgf-m, 33 ft-lb)**
T2: 6.4 N·m (0.65 kgf-m, 4.7 ft-lb)
T3: 54 N·m (5.3 kgf-m, 39 ft-lb)



- (A) Adapter (1)
- (B) Adapter connector
- (C) Adapter (2)
- (D) Oil cooler
- (E) Oil cooler connector

- 35) Install the oil filter using ST. <Ref. to LU(H4SO)-23, INSTALLATION, Engine Oil Filter.>
 ST 498547000 OIL FILTER WRENCH

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

- 37) Install the water pipe.

CAUTION:

Always use a new O-ring.

- 38) Install the cylinder head assembly. <Ref. to ME(H4DOTC)-76, INSTALLATION, Cylinder Head Assembly.>

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

- 40) Install the rocker cover.

- 41) Install the crank sprocket. <Ref. to ME(H4DOTC)-68, INSTALLATION, Crank Sprocket.>

- 42) Install the cam sprocket. <Ref. to ME(H4DOTC)-67, INSTALLATION, Cam Sprocket.>

- 43) Install the timing belt assembly. <Ref. to ME(H4DOTC)-60, INSTALLATION, Timing Belt Assembly.>

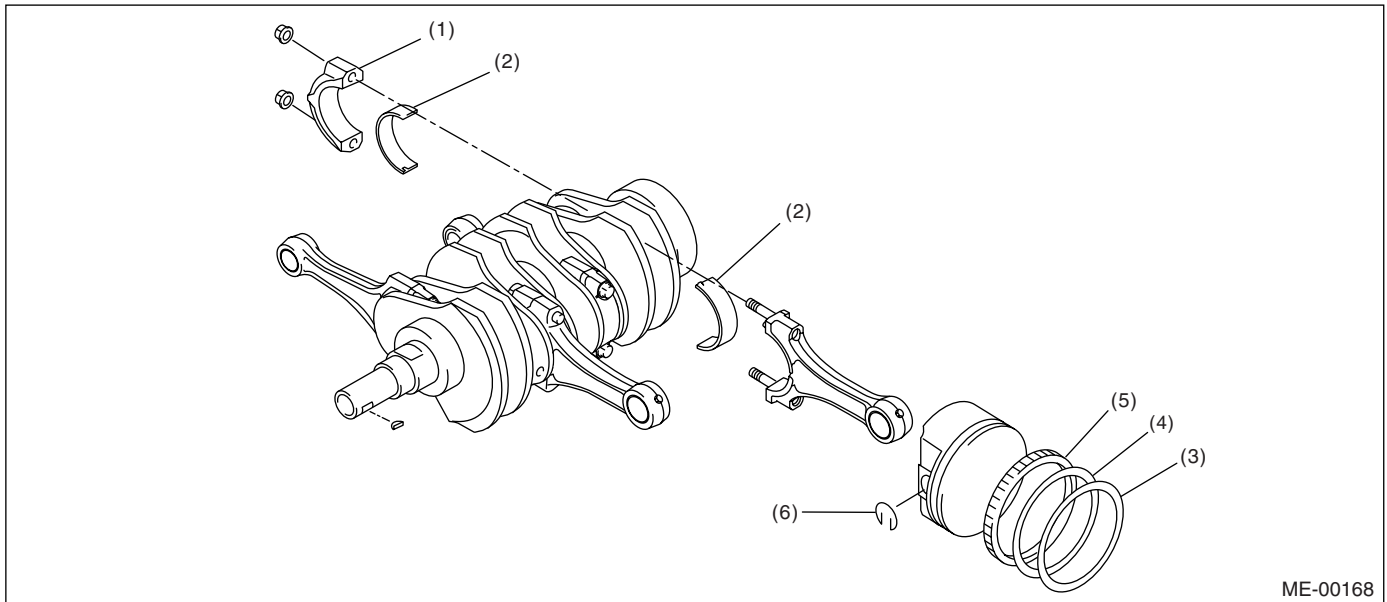
- 44) Install the timing belt cover. <Ref. to ME(H4DOTC)-57, INSTALLATION, Timing Belt Cover.>

- 45) Install the crank pulley. <Ref. to ME(H4DOTC)-55, INSTALLATION, Crank Pulley.>

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

- 47) Install the V-belt. <Ref. to ME(H4DOTC)-52, INSTALLATION, V-belt.>

- 48) Install the intake manifold. <Ref. to FU(H4DOTC 2.5)-17, INSTALLATION, Intake Manifold.>

C: DISASSEMBLY

(1) Connecting rod cap

(3) Top ring

(5) Oil ring

(2) Connecting rod bearing

(4) Second ring

(6) Circlip

1) Remove the connecting rod cap.

2) Remove the connecting rod bearing.

NOTE:

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

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

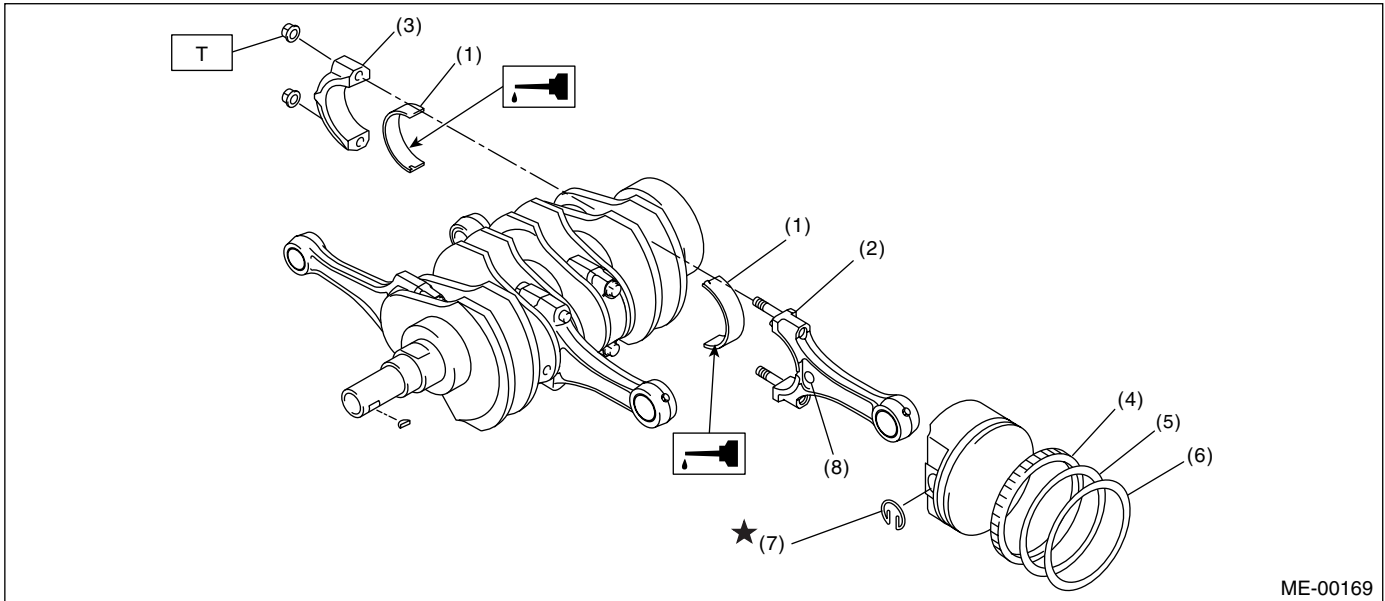
4) Remove the oil ring by hand.

NOTE:

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

5) Remove the circlip.

D: ASSEMBLY



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

Tightening torque: N·m (kgf-m, ft-lb)
T: 45 (4.6, 33)

- 1) Apply oil to the surfaces of the connecting rod bearings. Install the connecting rod bearings on connecting rods and connecting rod caps.
- 2) Install the connecting rod on crankshaft.

NOTE:

Position each connecting rod with the side marked facing forward.

- 3) Install the connecting rod cap with connecting rod nut.

Ensure the arrow on connecting rod cap faces the front during installation.

NOTE:

- Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching number.
- When tightening the connecting rod nuts, apply oil on the threads.

- 4) Install the oil ring spacer, upper rail and lower rail in this order by hand. Then install the second ring and top ring with a piston ring expander.

E: INSPECTION

1. CYLINDER BLOCK

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

Warping limit:
0.05 mm (0.0020 in)

Grinding limit:
0.1 mm (0.004 in)

Standard height of cylinder block:
201.0 mm (7.91 in)

2. CYLINDER AND PISTON

- 1) The cylinder bore size is stamped on cylinder block's front upper surface.

NOTE:

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

Cylinder Block

MECHANICAL

2.0 L MODEL

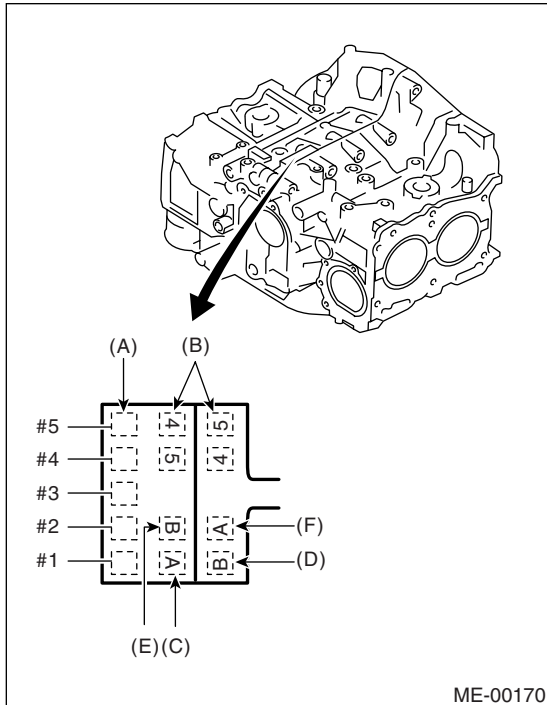
Standard diameter:

- A: 92.005 — 92.015 mm (3.6222 — 3.6226 in)
 B: 91.995 — 92.005 mm (3.6218 — 3.6222 in)

2.5 L MODEL

Standard diameter:

- A: 99.505 — 99.515 mm (3.9175 — 3.9179 in)
 B: 99.495 — 99.505 mm (3.9171 — 3.9175 in)



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

2) How to measure the inner diameter of each cylinder:

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

NOTE:

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

Taper:

Standard

0.015 mm (0.0006 in)

Limit

0.050 mm (0.0020 in)

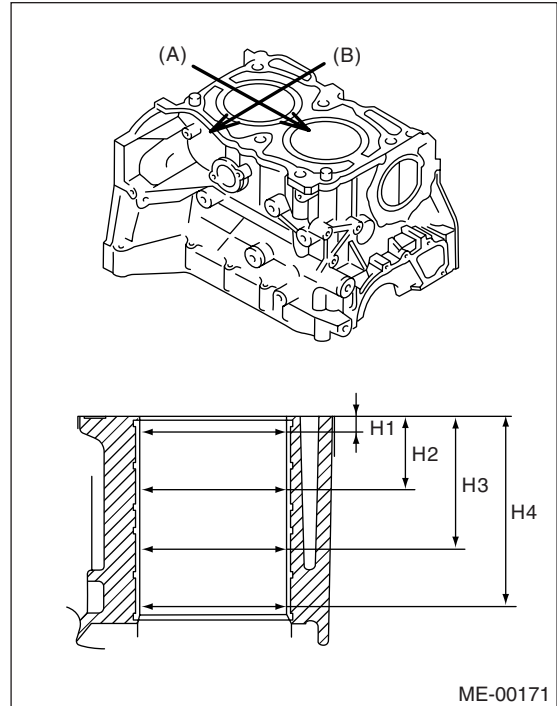
Out-of-roundness:

Standard

0.010 mm (0.0004 in)

Limit

0.050 mm (0.0020 in)



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

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

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

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

NOTE:

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

2.0 L MODEL

Piston grade point H:
40.0 mm (1.57 in)

Piston outer diameter:

Standard

A: 91.985 — 91.995 mm
(3.6214 — 3.6218 in)

B: 91.975 — 91.985 mm
(3.6211 — 3.6214 in)

0.25 mm (0.0098 in) oversize
92.225 — 92.235 mm
(3.6309 — 3.6313 in)

0.50 mm (0.0197 in) oversize
92.475 — 92.485 mm
(3.6407 — 3.6411 in)

2.5 L MODEL

Piston grade point H:
38.2 mm (1.50 in)

Piston outer diameter:

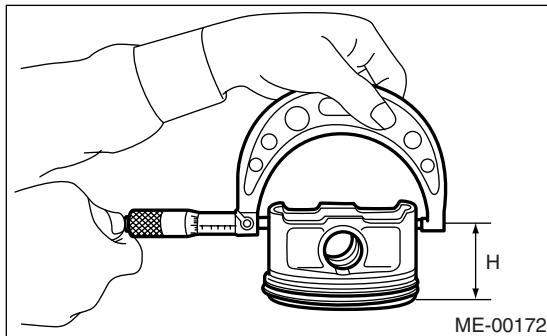
Standard

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

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

0.25 mm (0.0098 in) oversize
99.745 — 99.765 mm
(3.9270 — 3.9278 in)

0.50 mm (0.0197 in) oversize
99.995 — 100.015 mm
(3.9368 — 3.9376 in)



5) Calculate the clearance between cylinder and piston.

NOTE:

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

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

2.0 L MODEL

Standard

0.010 — 0.030 mm (0.0004 — 0.0012 in)

Limit

0.050 mm (0.0020 in)

2.5 L MODEL

Standard

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

Limit

0.030 mm (0.0012 in)

6) Boring and honing:

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

CAUTION:

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

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

NOTE:

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

Limit of cylinder enlarging (boring):

0.5 mm (0.020 in)

3. PISTON AND PISTON PIN

- 1) Check the pistons and piston pins for damage, cracks and wear, Replace if defective.
- 2) Check the piston ring grooves for wear and damage, Replace if defective.
- 3) Measure the piston-to-cylinder clearance at each cylinder. <Ref. to ME(H4DOTC)-106, CYLINDER AND PISTON, INSPECTION, Cylinder Block.> If any of the clearances is not within specification, replace the piston or bore the cylinder to use an oversize piston.

Cylinder Block

MECHANICAL

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

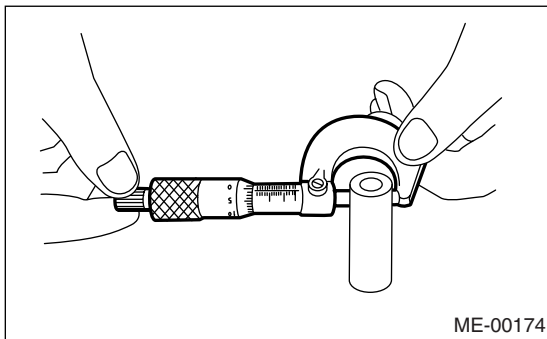
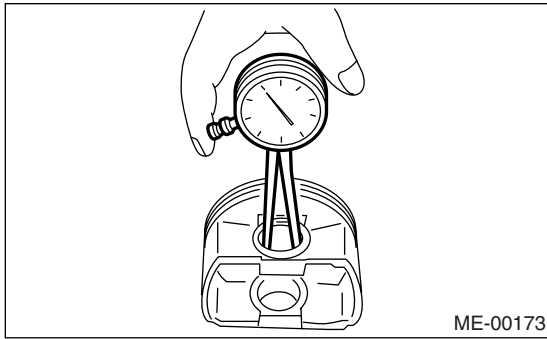
Standard clearance between piston pin and hole in piston:

Standard

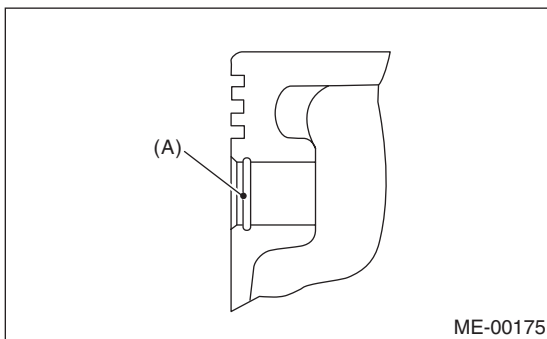
0.004 — 0.008 mm (0.0002 — 0.0003 in)

Limit

0.020 mm (0.0008 in)



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



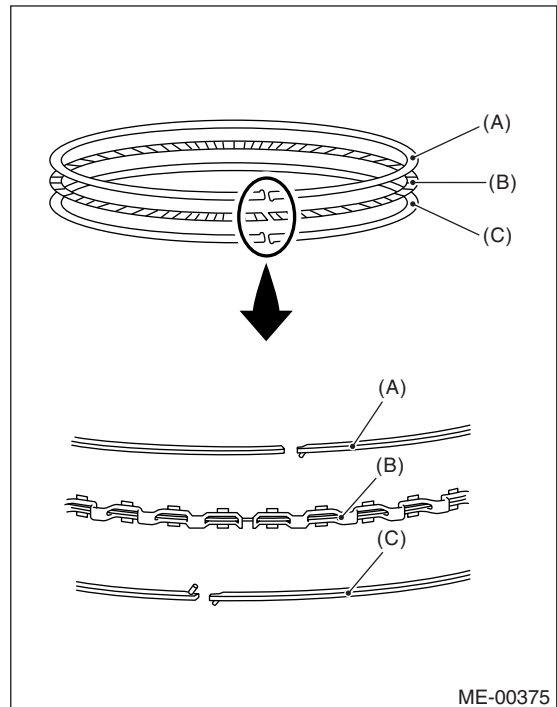
6) Check the piston pin circlip for distortion, cracks and wear.

4. PISTON RING

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

NOTE:

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



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

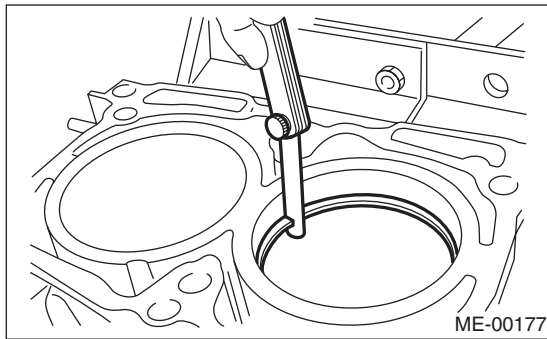
2) Squarely place the piston ring and oil ring in cylinder, and then measure the piston ring gap with a thickness gauge.

• 2.0 L MODEL

		Unit: mm (in)	
		Standard	Limit
Piston ring gap	Top ring	0.20 — 0.25 (0.0079 — 0.0098)	1.0 (0.039)
	Second ring	0.35 — 0.50 (0.0138 — 0.0197)	1.0 (0.039)
	Oil ring rail	0.20 — 0.50 (0.0079 — 0.0197)	1.5 (0.059)

• 2.5 L MODEL

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

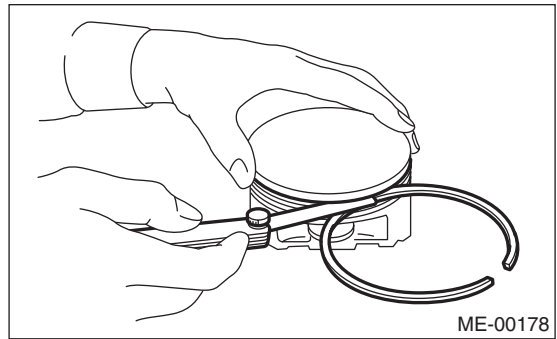


3) Measure the clearance between piston ring and piston ring groove with a thickness gauge.

NOTE:

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

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

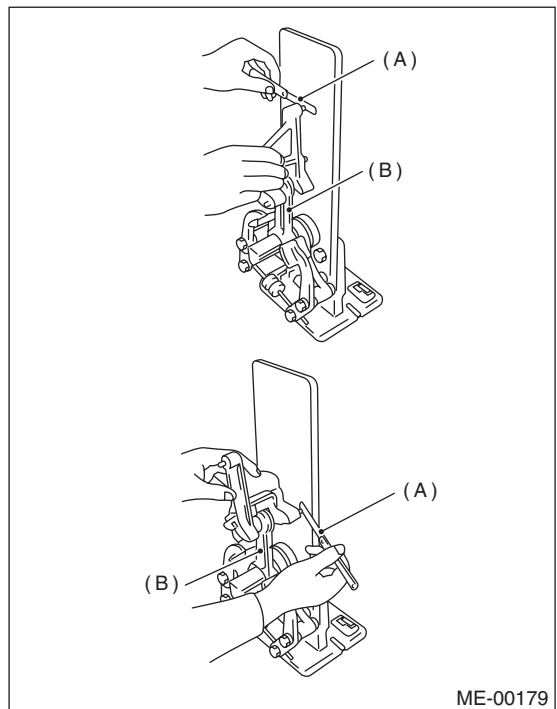


5. CONNECTING ROD

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

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

0.10 mm (0.0039 in)



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

Cylinder Block

MECHANICAL

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

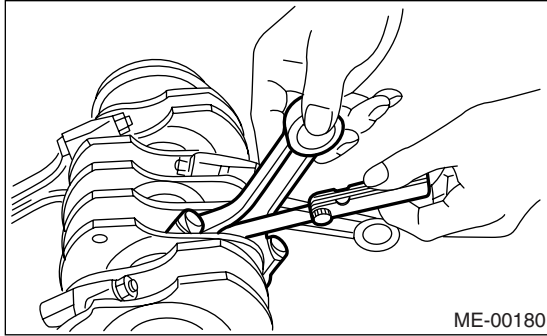
Connecting rod side clearance:

Standard

0.070 — 0.330 mm (0.0028 — 0.0130 in)

Limit

0.40 mm (0.016 in)



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

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

2.0 L MODEL

Connecting rod oil clearance:

Standard

0.020 — 0.046 mm (0.0008 — 0.0018 in)

Limit

0.050 mm (0.0020 in)

Unit: mm (in)		
Bearing	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.486 — 1.498 (0.0585 — 0.0590)	51.984 — 52.000 (2.0466 — 2.0472)
0.03 (0.0012) undersize	1.504 — 1.512 (0.0592 — 0.0595)	51.954 — 51.970 (2.0454 — 2.0461)
0.05 (0.0020) undersize	1.514 — 1.522 (0.0596 — 0.0599)	51.934 — 51.950 (2.0447 — 2.0453)
0.25 (0.0098) undersize	1.614 — 1.622 (0.0635 — 0.0639)	51.734 — 51.750 (2.0368 — 2.0374)

2.5 L MODEL

Connecting rod oil clearance:

Standard

0.017 — 0.045 mm (0.0007 — 0.0018 in)

Limit

0.05 mm (0.0020 in)

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

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

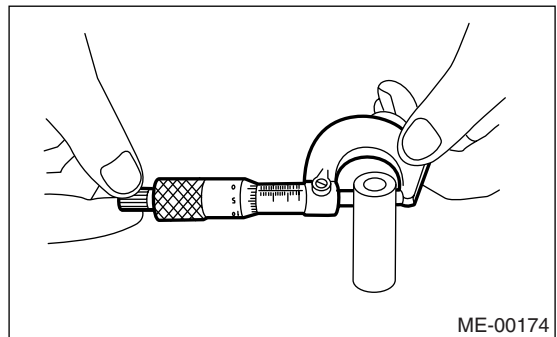
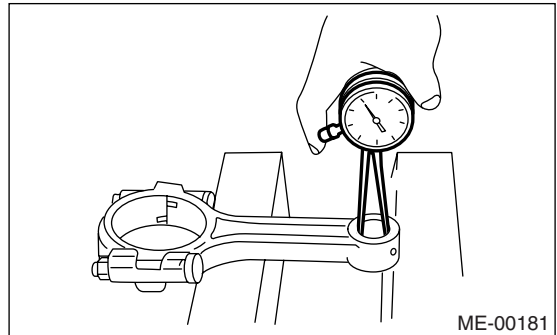
Clearance between piston pin and bushing:

Standard

0 — 0.022 mm (0 — 0.0009 in)

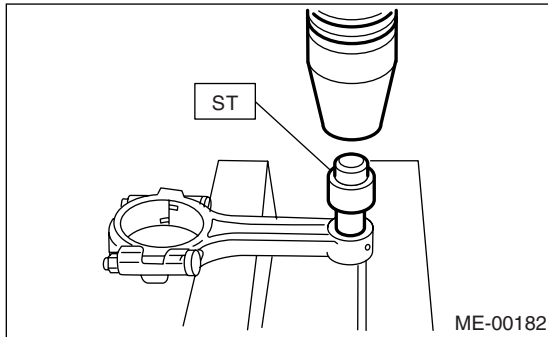
Limit

0.030 mm (0.0012 in)



- 7) Replacement procedure is as follows:
- (1) Remove the bushing from connecting rod with ST and press.
 - (2) Press the bushing with ST after applying oil on the periphery of bushing.

ST 499037100 CONNECTING ROD BUSHING REMOVER AND INSTALLER



- (3) Make two 3 mm (0.12 in) holes in bushing. Ream the inside of bushing.
- (4) After the completion of reaming, clean the bushing to remove chips.

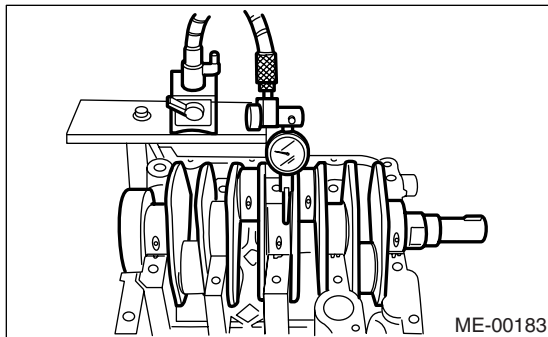
6. CRANKSHAFT AND CRANKSHAFT BEARING

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

NOTE:

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

Crankshaft bend limit:
0.035 mm (0.0014 in)



- 3) Inspect the crank journal and crank pin for wear. If they are not within the specifications, replace the bearing with a suitable (undersize) one, and then replace or recondition the crankshaft as necessary. When grinding the crank journal or crank pin, finish

them to specified dimensions according to the undersize bearing to be used.

Crank pin and crank journal:

Out-of-roundness

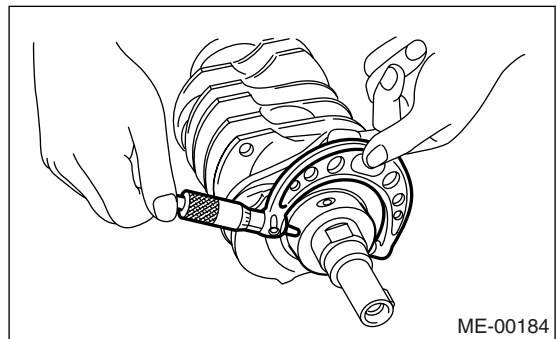
0.005 mm (0.0002 in) or less

Taper limit

0.07 mm (0.0028 in)

Grinding limit

0.250 mm (0.0098 in)



Cylinder Block

MECHANICAL

• 2.0 L MODEL

Unit: mm (in)				
		Crank journal diameter		Crank pin diameter
		#1, #3, #5	#2, #4	
Standard	Journal O.D.	59.992 — 60.008 (2.3619 — 2.3625)	59.992 — 60.008 (2.3619 — 2.3625)	51.984 — 52.000 (2.0466 — 2.0472)
	Bearing size (Thickness at center)	1.998 — 2.011 (0.0787 — 0.0792)	2.000 — 2.013 (0.0787 — 0.0793)	1.486 — 1.498 (0.0585 — 0.0590)
0.03 (0.0012) undersize	Journal O.D.	59.962 — 59.978 (2.3607 — 2.3613)	59.962 — 59.978 (2.3607 — 2.3613)	51.954 — 51.970 (2.0454 — 2.0461)
	Bearing size (Thickness at center)	2.017 — 2.020 (0.0794 — 0.0795)	2.019 — 2.022 (0.0795 — 0.0796)	1.504 — 1.512 (0.0592 — 0.0595)
0.05 (0.0020) undersize	Journal O.D.	59.942 — 59.958 (2.3599 — 2.3605)	59.942 — 59.958 (2.3599 — 2.3605)	51.934 — 51.950 (2.0447 — 2.0453)
	Bearing size (Thickness at center)	2.027 — 2.030 (0.0798 — 0.0799)	2.029 — 2.032 (0.0799 — 0.0800)	1.514 — 1.522 (0.0596 — 0.0599)
0.25 (0.0098) undersize	Journal O.D.	59.742 — 59.758 (2.3520 — 2.3527)	59.742 — 59.758 (2.3520 — 2.3527)	51.734 — 51.750 (2.0368 — 2.0374)
	Bearing size (Thickness at center)	2.127 — 2.130 (0.0837 — 0.0839)	2.129 — 2.132 (0.0838 — 0.0839)	1.614 — 1.622 (0.0635 — 0.0639)

O.D.: Outer Diameter

• 2.5 L MODEL

Unit: mm (in)				
		Crank journal diameter		Crank pin outer diameter
		#1, #3, #5	#2, #4	
Standard	Journal O.D.	59.992 — 60.008 (2.3619 — 2.3625)	59.992 — 60.008 (2.3619 — 2.3625)	51.984 — 52.000 (2.0466 — 2.0472)
	Bearing size (Thickness at center)	1.998 — 2.011 (0.0787 — 0.0792)	2.000 — 2.013 (0.0787 — 0.0793)	1.490 — 1.502 (0.0587 — 0.0591)
0.03 (0.0012) undersize	Journal O.D.	59.962 — 59.978 (2.3607 — 2.3613)	59.962 — 59.978 (2.3607 — 2.3613)	51.954 — 51.970 (2.0454 — 2.0461)
	Bearing size (Thickness at center)	2.017 — 2.020 (0.0794 — 0.0795)	2.019 — 2.022 (0.0795 — 0.0796)	1.504 — 1.512 (0.0592 — 0.0595)
0.05 (0.0020) undersize	Journal O.D.	59.942 — 59.958 (2.3599 — 2.3605)	59.942 — 59.958 (2.3599 — 2.3605)	51.934 — 51.950 (2.0447 — 2.0453)
	Bearing size (Thickness at center)	2.027 — 2.030 (0.0798 — 0.0799)	2.029 — 2.032 (0.0799 — 0.0800)	1.514 — 1.522 (0.0596 — 0.0599)
0.25 (0.0098) undersize	Journal O.D.	59.742 — 59.758 (2.3520 — 2.3527)	59.742 — 59.758 (2.3520 — 2.3527)	51.734 — 51.750 (2.0368 — 2.0374)
	Bearing size (Thickness at center)	2.127 — 2.130 (0.0837 — 0.0839)	2.129 — 2.132 (0.0838 — 0.0839)	1.614 — 1.622 (0.0635 — 0.0639)

O.D.: Outer Diameter

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

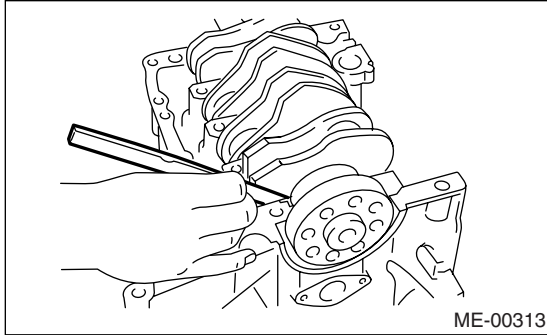
Crankshaft thrust clearance:

Standard

0.030 — 0.115 mm (0.0012 — 0.0045 in)

Limit

0.25 mm (0.0098 in)



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

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

Crankshaft oil clearance:

Standard

0.010 — 0.030 mm (0.0004 — 0.0012 in)

Limit

0.040 mm (0.0016 in)

21. Intake and Exhaust Valve

A: REMOVAL AND INSTALLATION

For operations related to intake and exhaust valve, refer to "19. Cylinder Head." <Ref. to ME(H4DOTC)-76, REMOVAL, Cylinder Head Assembly.> <Ref. to ME(H4DOTC)-76, INSTALLATION, Cylinder Head Assembly.>

22.Piston

A: REMOVAL AND INSTALLATION

For operations related to piston, refer to “20. Cylinder Block.” <Ref. to ME(H4DOTC)-84, REMOVAL, Cylinder Block.> <Ref. to ME(H4DOTC)-88, INSTALLATION, Cylinder Block.>

23.Connecting Rod

A: REMOVAL AND INSTALLATION

For operations related to connecting rod, refer to "20. Cylinder Block." <Ref. to ME(H4DOTC)-84, REMOVAL, Cylinder Block.> <Ref. to ME(H4DOTC)-88, INSTALLATION, Cylinder Block.>

24.Crankshaft

A: REMOVAL AND INSTALLATION

For operations related to crankshaft, refer to “20. Cylinder Block.” <Ref. to ME(H4DOTC)-84, REMOVAL, Cylinder Block.> <Ref. to ME(H4DOTC)-88, INSTALLATION, Cylinder Block.>

Engine Trouble in General

MECHANICAL

25.Engine Trouble in General

A: INSPECTION

NOTE:

“RANK” shown in the chart refers to the possibility of reason for the trouble in order (“Very often” to “Rarely”)

A — Very often

B — Sometimes

C — Rarely

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
1. Engine will not start.			
1) Starter does not turn.	Starter	Defective battery-to-starter harness	B
		Defective starter switch	C
		Defective inhibitor switch or neutral switch	C
		Defective starter	B
	Battery	Poor terminal connection	A
		Run-down battery	A
		Defective charging system	B
	Friction	Seizure of crankshaft and connecting rod bearing	C
		Seized camshaft	C
Seized or stuck piston and cylinder		C	
2) Initial combustion does not occur.	Starter	Defective starter	C
	Engine control system <Ref. to EN(H4DOTC)-2, Basic Diagnostics Procedure.>		A
	Fuel line	Defective fuel pump and relay	A
		Lack of or insufficient fuel	B
	Belt	Defective (deterioration, etc.)	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plugs or defective gasket	C
		Loosened cylinder head bolts or defective gasket	C
		Improper valve seating	C
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	B
Improper engine oil (low viscosity)	B		
3) Initial combustion occurs.	Engine control system <Ref. to EN(H4DOTC)-2, Basic Diagnostics Procedure.>		A
	Intake system	Defective intake manifold gasket	B
		Defective throttle body gasket	B
	Fuel line	Defective fuel pump and relay	C
		Clogged fuel line	C
		Lack of or insufficient fuel	B
	Belt	Defective (deterioration, etc.)	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plugs or defective gasket	C
		Loosened cylinder head bolts or defective gasket	C
		Improper valve seating	C
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	B
	Improper engine oil (low viscosity)	B	

Engine Trouble in General

MECHANICAL

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
4) Engine stalls after initial combustion.	Engine control system <Ref. to EN(H4DOTC)-2, Basic Diagnostics Procedure.>		A
	Intake system	Loosened or cracked intake duct	B
		Loosened or cracked PCV hose	C
		Loosened or cracked vacuum hose	C
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Dirty air cleaner element	C
	Fuel line	Clogged fuel line	C
		Lack of or insufficient fuel	B
	Belt	Defective (deterioration, etc.)	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plugs or defective gasket	C
		Loosened cylinder head bolts or defective gasket	C
		Improper valve seating	C
		Defective valve stem	C
		Worn or broken valve spring	B
Worn or stuck piston rings, cylinder and piston		C	
Incorrect valve timing		B	
Improper engine oil (low viscosity)	B		
2. Rough idle and engine stall	Engine control system <Ref. to EN(H4DOTC)-2, Basic Diagnostics Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	A
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	C
		Loosened oil filler cap	B
		Dirty air cleaner element	C
	Fuel line	Defective fuel pump and relay	C
		Clogged fuel line	C
		Lack of or insufficient fuel	B
	Belt	Defective timing	C
	Compression	Incorrect valve clearance	B
		Loosened spark plugs or defective gasket	B
		Loosened cylinder head bolts or defective gasket	B
		Improper valve seating	B
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	B
		Incorrect valve timing	A
	Improper engine oil (low viscosity)	B	
	Lubrication system	Incorrect oil pressure	B
		Defective rocker cover gasket	C
	Cooling system	Overheating	C
	Others	Malfunction of evaporative emission control system	A
		Stuck or damaged throttle valve	B
		Accelerator cable out of adjustment	C

Engine Trouble in General

MECHANICAL

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
3. Low output, hesitation and poor acceleration	Engine control system <Ref. to EN(H4DOTC)-2, Basic Diagnostics Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	B
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	B
		Loosened oil filler cap	B
		Dirty air cleaner element	A
	Fuel line	Defective fuel pump and relay	B
		Clogged fuel line	B
		Lack of or insufficient fuel	C
	Belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plugs or defective gasket	B
		Loosened cylinder head bolts or defective gasket	B
		Improper valve seating	B
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	A
	Improper engine oil (low viscosity)	B	
	Lubrication system	Incorrect oil pressure	B
Cooling system	Overheating	C	
	Over cooling	C	
Others	Malfunction of evaporative emission control system	A	
4. Surging	Engine control system <Ref. to EN(H4DOTC)-2, Basic Diagnostics Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	A
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	B
		Loosened oil filler cap	B
		Dirty air cleaner element	B
	Fuel line	Defective fuel pump and relay	B
		Clogged fuel line	B
		Lack of or insufficient fuel	C
	Belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plugs or defective gasket	C
		Loosened cylinder head bolts or defective gasket	C
		Improper valve seating	C
		Defective valve stem	C
		Worn or broken valve spring	C
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	A
	Improper engine oil (low viscosity)	B	
	Cooling system	Overheating	B
Others	Malfunction of evaporative emission control system	C	

Engine Trouble in General

MECHANICAL

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
5. Engine does not return to idle.	Engine control system <Ref. to EN(H4DOTC)-2, Basic Diagnostics Procedure.>		A
	Intake system	Loosened or cracked vacuum hose	A
	Others	Stuck or damaged throttle valve	A
		Accelerator cable out of adjustment (2.0 L model)	B
6. Dieseling (Run-on)	Engine control system <Ref. to EN(H4DOTC)-2, Basic Diagnostics Procedure.>		A
	Cooling system	Overheating	B
	Others	Malfunction of evaporative emission control system	B
7. Afterburning in exhaust system	Engine control system <Ref. to EN(H4DOTC)-2, Basic Diagnostics Procedure.>		A
	Intake system	Loosened or cracked intake duct	C
		Loosened or cracked PCV hose	C
		Loosened or cracked vacuum hose	B
		Defective PCV valve	B
		Loosened oil filler cap	C
	Belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plugs or defective gasket	C
		Loosened cylinder head bolts or defective gasket	C
		Improper valve seating	B
		Defective valve stem	C
		Worn or broken valve spring	C
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	A
Lubrication system	Incorrect oil pressure	C	
Cooling system	Over cooling	C	
Others	Malfunction of evaporative emission control system	C	
8. Knocking	Engine control system <Ref. to EN(H4DOTC)-2, Basic Diagnostics Procedure.>		A
	Intake system	Loosened oil filler cap	B
	Belt	Defective timing	B
	Compression	Incorrect valve clearance	C
		Incorrect valve timing	B
	Cooling system	Overheating	A
9. Excessive engine oil consumption	Intake system	Loosened or cracked PCV hose	A
		Defective PCV valve	B
		Loosened oil filler cap	C
	Compression	Defective valve stem	A
		Worn or stuck piston rings, cylinder and piston	A
	Lubrication system	Loosened oil pump attaching bolts and defective gasket	B
		Defective oil filter o-ring	B
		Defective crankshaft oil seal	B
		Defective rocker cover gasket	B
		Loosened oil drain plug or defective gasket	B
	Loosened oil pan fitting bolts or defective oil pan	B	

Engine Trouble in General

MECHANICAL

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK	
10. Excessive fuel consumption	Engine control system <Ref. to EN(H4DOTC)-2, Basic Diagnostics Procedure.>		A	
	Intake system	Dirty air cleaner element	A	
	Belt	Defective timing	B	
	Compression	Incorrect valve clearance		B
		Loosened spark plugs or defective gasket		C
		Loosened cylinder head bolts or defective gasket		C
		Improper valve seating		B
		Defective valve stem		C
		Worn or broken valve spring		C
		Worn or stuck piston rings, cylinder and piston		B
		Incorrect valve timing		B
	Lubrication system	Incorrect oil pressure	C	
	Cooling system	Over cooling	C	
	Others	Accelerator cable out of adjustment (2.0 L model)	B	

26.Engine Noise

A: INSPECTION

Type of sound	Condition	Possible cause
Regular clicking sound	Sound increases as engine speed increases.	<ul style="list-style-type: none"> Valve mechanism is defective. Incorrect valve clearance Worn valve rocker Worn camshaft Broken valve spring
Heavy and dull clank	Oil pressure is low.	<ul style="list-style-type: none"> Worn crankshaft main bearing Worn connecting rod bearing (big end)
	Oil pressure is normal.	<ul style="list-style-type: none"> Loose flywheel mounting bolts Damaged engine mounting
High-pitched clank (Spark knock)	Sound is noticeable when accelerating with an overload.	<ul style="list-style-type: none"> Ignition timing advanced Accumulation of carbon inside combustion chamber Wrong heat range of spark plug Improper octane number of gasoline
Clank when engine speed is medium (1,000 to 2,000 rpm).	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	<ul style="list-style-type: none"> Worn crankshaft main bearing Worn bearing at crankshaft end of connecting rod
Knocking sound when engine is operating under idling speed and engine is warm	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	<ul style="list-style-type: none"> Worn cylinder liner and piston ring Broken or stuck piston ring Worn piston pin and hole at piston end of connecting rod
	Sound is not reduced if each fuel injector connector is disconnected in turn. (NOTE*)	<ul style="list-style-type: none"> Unusually worn valve lifter Worn cam gear Worn camshaft journal bore in crankcase
Squeaky sound	—	<ul style="list-style-type: none"> Insufficient generator lubrication
Rubbing sound	—	<ul style="list-style-type: none"> Defective generator brush and rotor contact
Gear scream when starting engine	—	<ul style="list-style-type: none"> Defective ignition starter switch Worn gear and starter pinion
Sound like polishing glass with a dry cloth	—	<ul style="list-style-type: none"> Loose drive belt Defective water pump shaft
Hissing sound	—	<ul style="list-style-type: none"> Loss of compression Air leakage in air intake system, hoses, connections or manifolds
Timing belt noise	—	<ul style="list-style-type: none"> Loose timing belt Belt contacting case/adjacent part
Valve tappet noise	—	<ul style="list-style-type: none"> Incorrect valve clearance

NOTE*:

When disconnecting the fuel injector connector, Malfunction Indicator Light illuminates and DTC is stored in ECM memory.

Therefore, carry out the CLEAR MEMORY MODE <Ref. to EN(H4DOTC)-47, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4DOTC)-40, OPERATION, Inspection Mode.> after connecting the fuel injector connector.

Engine Noise

MECHANICAL
