ENGINE SECTION 1

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.

ENGINE SECTION 1

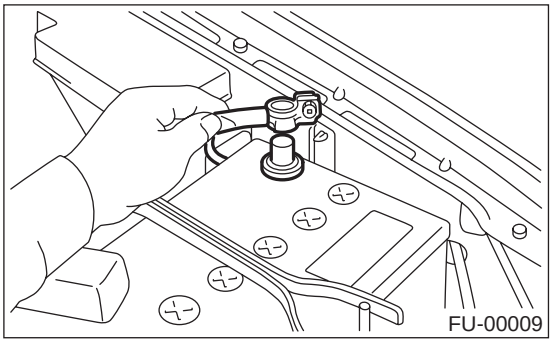
MECHANICAL

ME(H4SO)

9. Engine Assembly

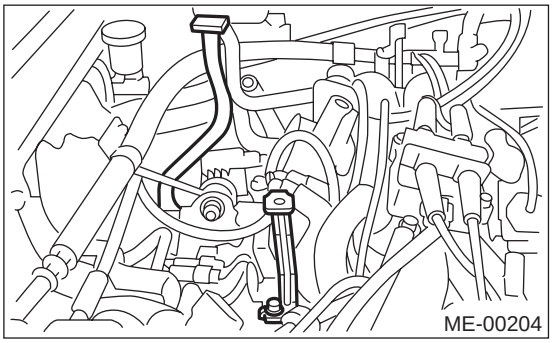
A: REMOVAL

1) Set the vehicle on lift arms.
2) Open the front hood fully, and then support with the hood stay.
3) Lower the fuel pressure. <Ref. to FU(H4SO)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
4) Disconnect the A/C pressure hoses from A/C compressor.
5) Remove the fuel filler cap.
6) Disconnect the ground cable from battery.

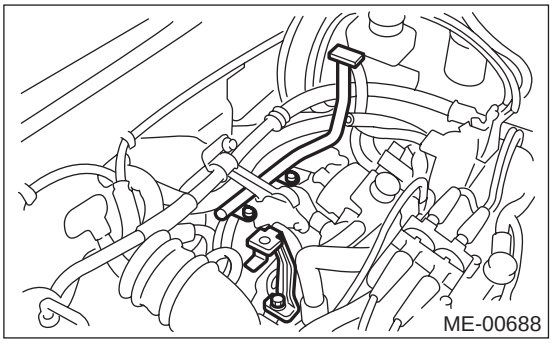


7) Remove the air intake duct and air cleaner case. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Duct.> and <Ref. to IN(H4SO)-6, Removal, Air Cleaner Case.>
8) Remove the under cover.
9) Remove the radiator from vehicle. <Ref. to CO(H4SO)-23, REMOVAL, Radiator.>
10) Remove the air cleaner case stay.

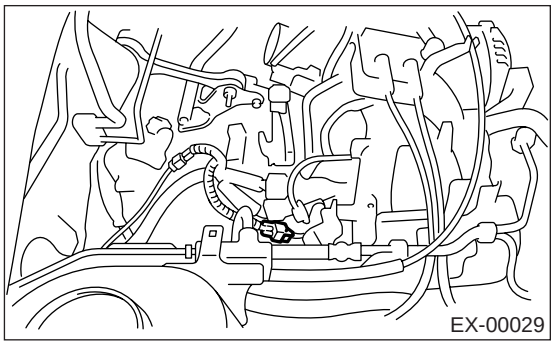
- MT VEHICLES



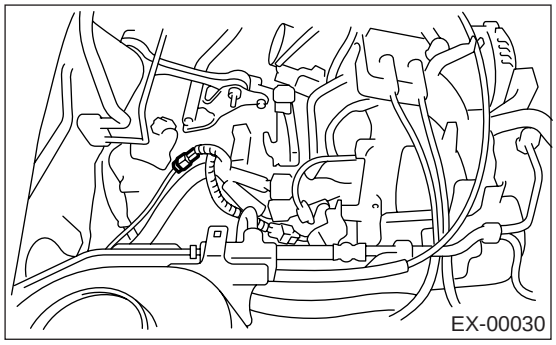
- AT VEHICLES



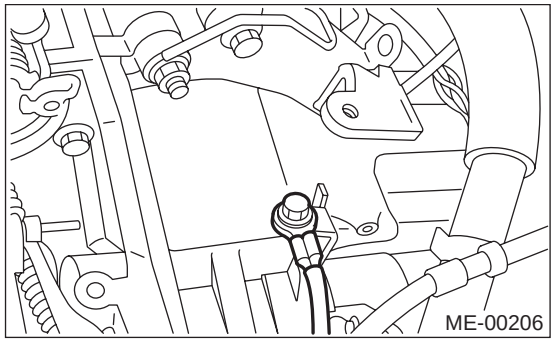
11) Disconnect the following connectors and cables.
(1) Front oxygen (A/F) sensor connector



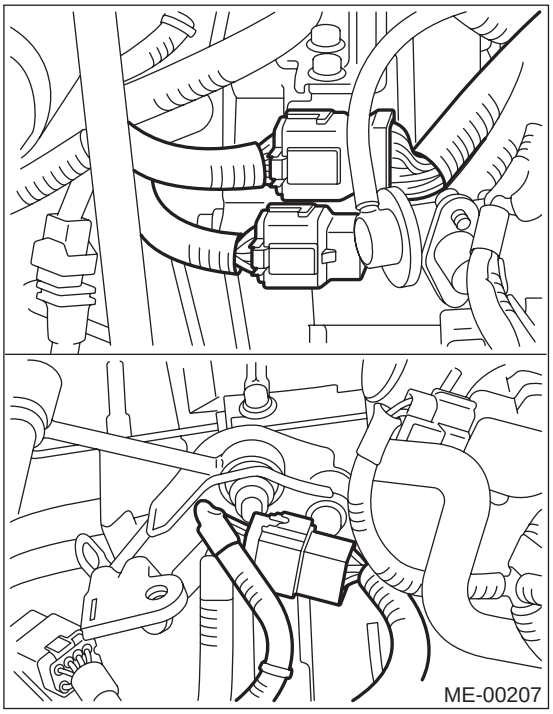
(2) Rear oxygen sensor connector



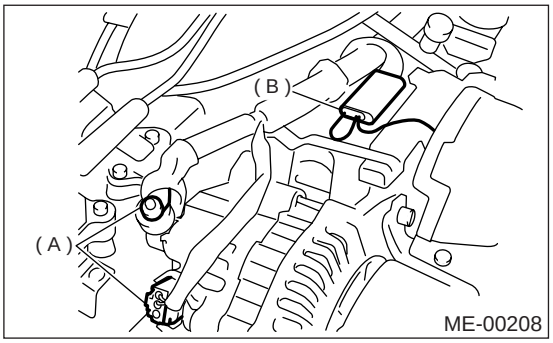
(3) Engine ground cable



(4) Engine harness connectors

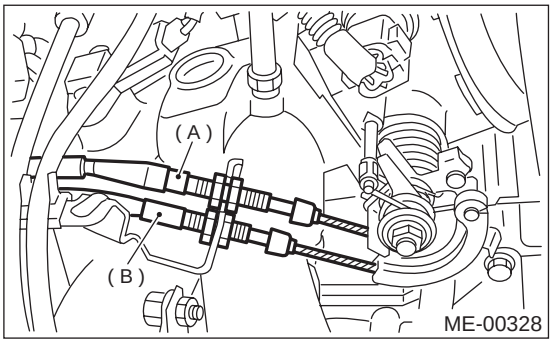


(5) Generator connector, terminal and A/C compressor connector

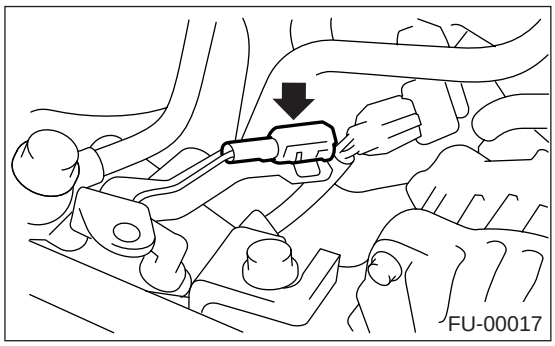


(A) Generator connector and terminal
(B) A/C compressor connector

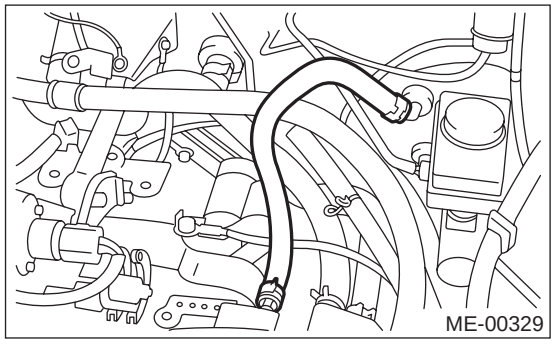
(6) Accelerator cable (A) and cruise control cable (B)



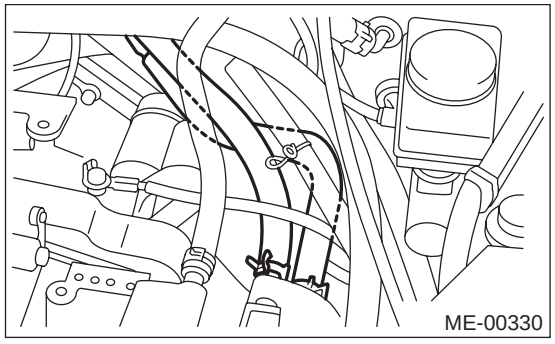
(7) Pressure switch



12) Disconnect the following hoses.
(1) Brake booster vacuum hose

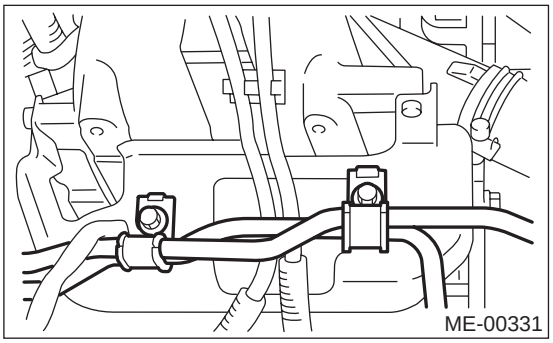


(2) Heater inlet outlet hose

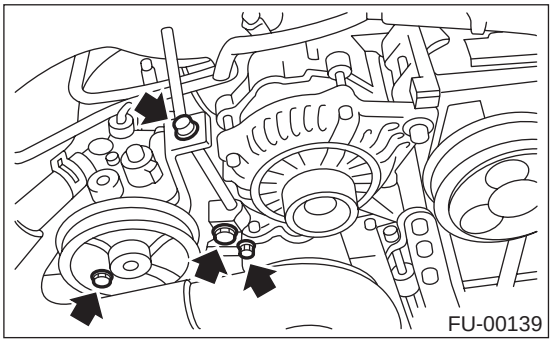


13) Remove the power steering pump from bracket.
(1) Remove the resonator chamber.
(2) Loosen the lock bolt and slider bolt, and then remove the front side V-belt. <Ref. to ME(H4SO)-41, FRONT SIDE BELT, REMOVAL, V-belt.>

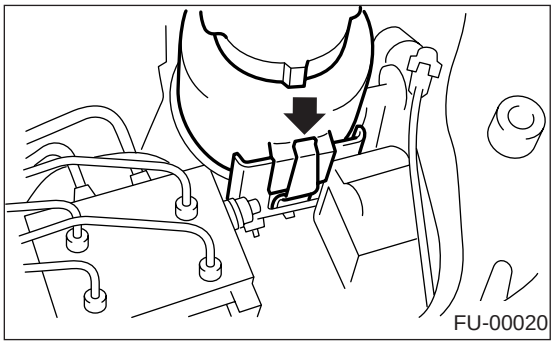
(3) Remove the pipe with bracket.



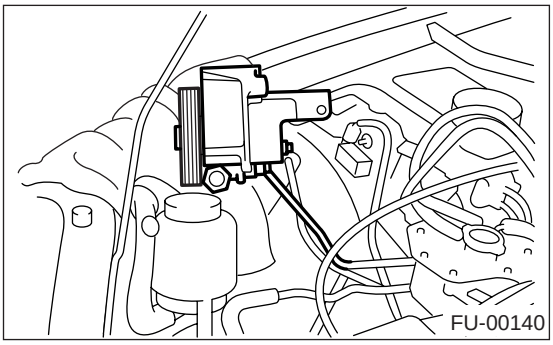
(4) Remove the bolts which install power steering pump bracket.



(5) Remove the power steering tank from the bracket by pulling it upward.

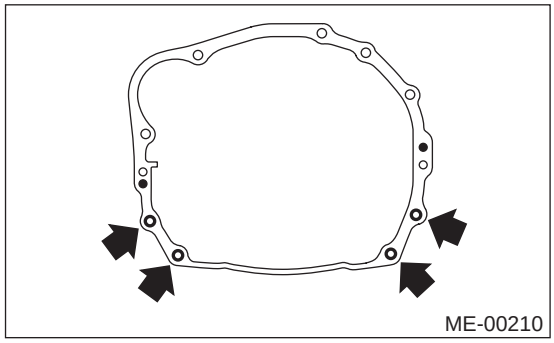


(6) Place the power steering pump on right side wheel apron.

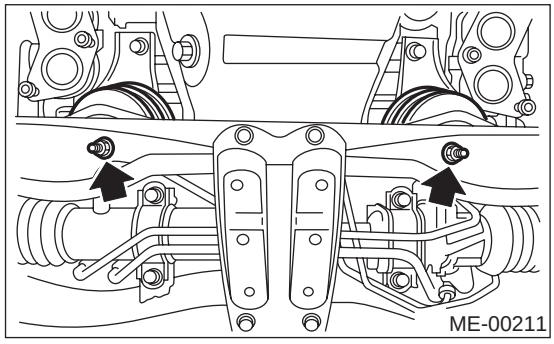


14) Remove the front and center exhaust pipe. <Ref. to EX(H4SO)-5, REMOVAL, Front Exhaust Pipe.>

15) Remove the nuts which hold lower side of transmission to engine.

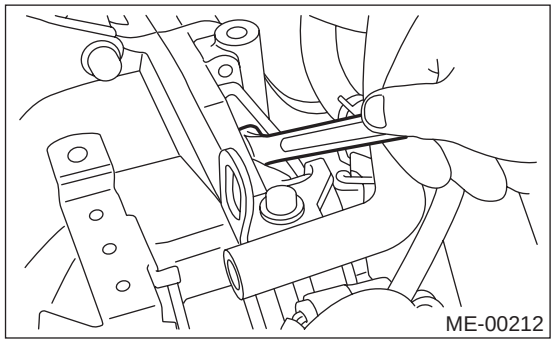


16) Remove the nuts which install front cushion rubber onto front crossmember.

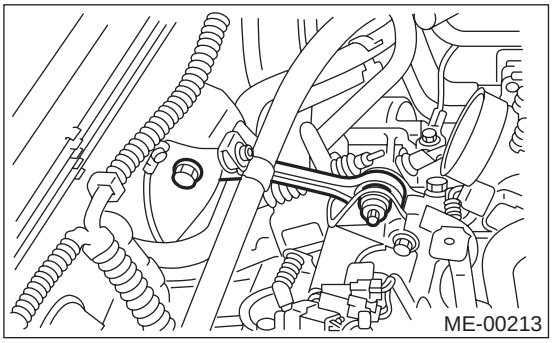


17) Separate the torque converter clutch from drive plate. (AT vehicles)

(1) Lower the vehicle.
(2) Remove the service hole plug.
(3) Remove the bolts which hold torque converter clutch to drive plate.
(4) Remove other bolts while rotating the engine using socket wrench.

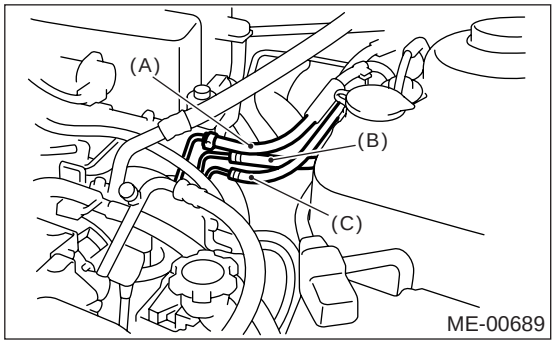


18) Remove the pitching stopper.

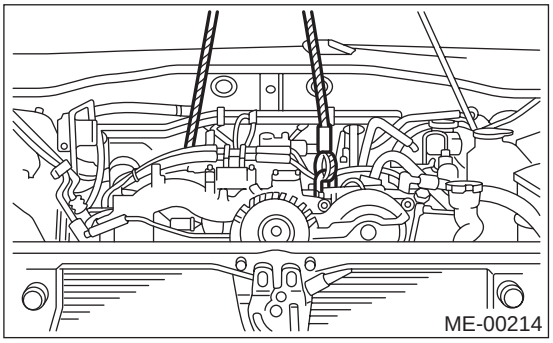


19) Disconnect the fuel deliverly hose (A), return hose (B) and evaporation hose (C).

CAUTION:
• Disconnect the hose with its end wrapped with cloth to prevent fuel from splashing.
• Catch fuel from the hose into container.

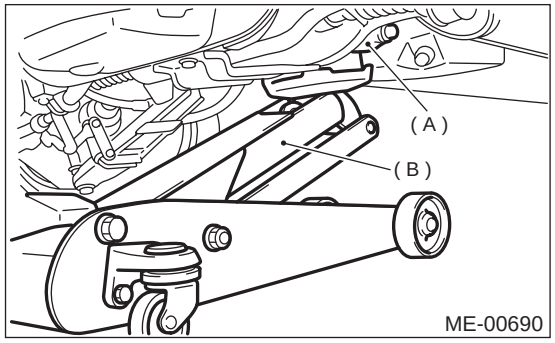


20) Support the engine with a lifting device and wire ropes.



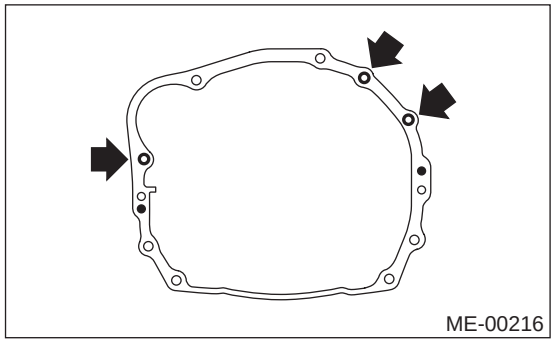
21) Support the transmission with a garage jack.

CAUTION:
Before moving the engine away from transmission, check to be sure no work has been overlooked. Doing this is very important in order to facilitate re-installation and because the transmission lowers under its own weight.

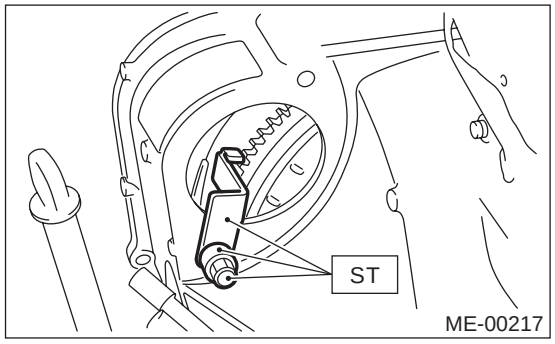


(A) Transmission
(B) Garage jack

22) Separation of the engine and transmission.
(1) Remove the starter. <Ref. to SC(H4SO)-6, REMOVAL, Starter.>
(2) Remove the bolts which hold upper side of transmission to engine.

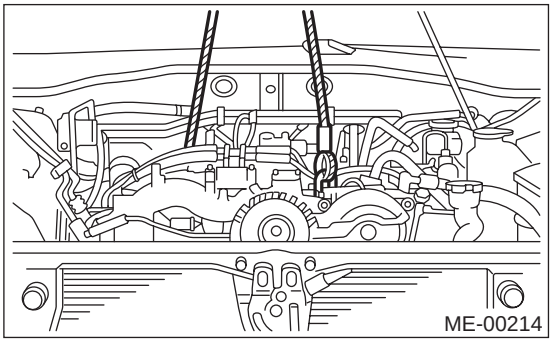


23) Install the ST to torque converter clutch case. (AT vehicles)
ST 498277200 STOPPER SET



24) Remove the engine from vehicle.
(1) Slightly raise the engine.
(2) Raise the transmission with garage jack.
(3) Move the engine horizontally until main shaft is withdrawn from clutch cover.
(4) Slowly move the engine away from engine compartment.

NOTE:
Be careful not to damage the adjacent parts or body panels with crankshaft pulley, oil level gauge, etc.



25) Remove the front cushion rubbers.

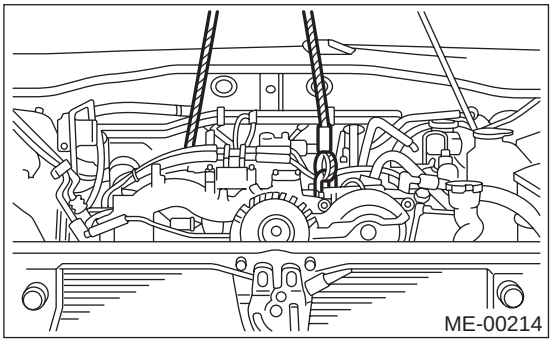
B: INSTALLATION

1) Install the front cushion rubbers.

Tightening torque:
34 N·m (3.5 kgf-m, 25.3 ft-lb)

2) Install the engine onto transmission.
(1) Position the engine in engine compartment and align it with transmission.

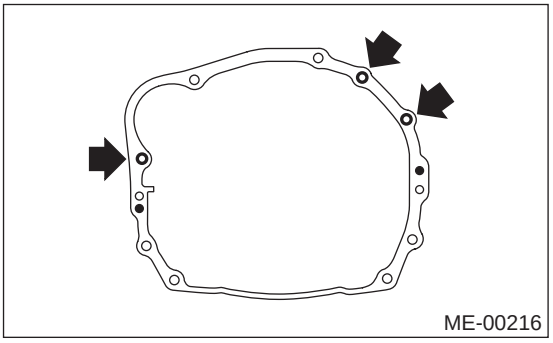
NOTE:
Be careful not to damage the adjacent parts or body panels with crankshaft pulley, oil level gauge, etc.



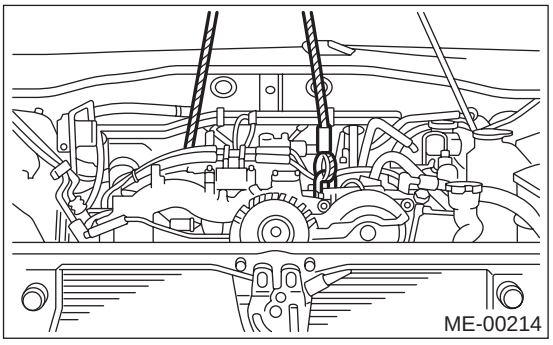
(2) Apply a small amount of grease to the spline of main shaft. (MT vehicles)

3) Tighten the bolts which hold upper side of transmission to engine.

Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)

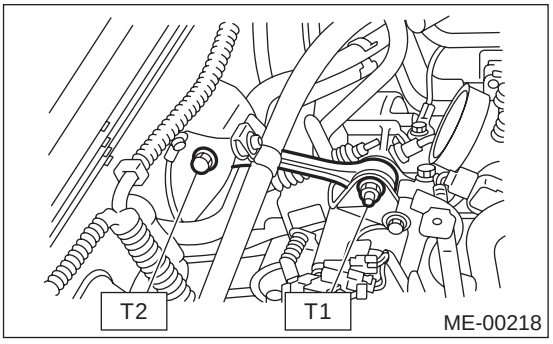


4) Remove the lifting device and wire ropes.



5) Remove the garage jack.
6) Install the pitching stopper.

Tightening torque:
T1: 50 N·m (5.1 kgf-m, 37 ft-lb)
T2: 58 N·m (5.9 kgf-m, 43 ft-lb)



7) Remove the ST from torque converter clutch case. (AT vehicles)

NOTE:
Be careful not to drop the ST into torque converter clutch case when removing ST.

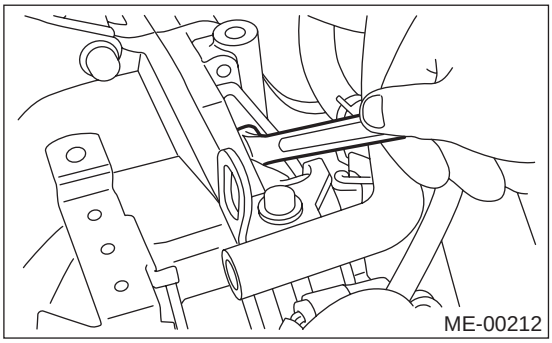
ST 498277200 STOPPER SET

8) Install the starter. <Ref. to SC(H4SO)-6, Installation, Starter.>

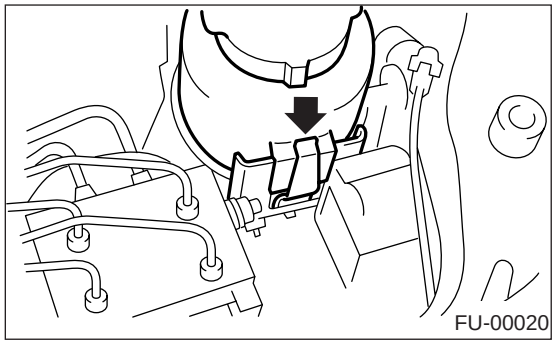
9) Install the torque converter clutch onto drive plate. (AT vehicles)
(1) Tighten the bolts which hold torque converter clutch to drive plate.
(2) Tighten other bolts while rotating the engine by using a socket wrench.

NOTE:
Be careful not to drop the bolts into torque converter clutch housing.

Tightening torque:
25 N·m (2.5 kgf-m, 18.1 ft-lb)

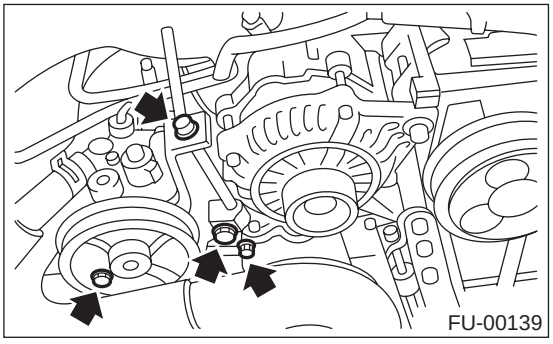


(3) Clog the plug onto service hole.
10) Install the power steering pump on bracket.
(1) Install the power steering tank on bracket.

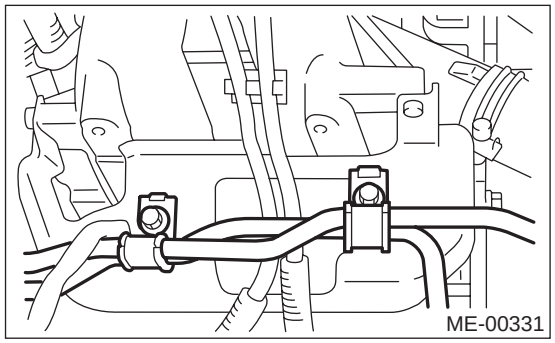


(2) Install the power steering pump on bracket, and then tighten the bolts.

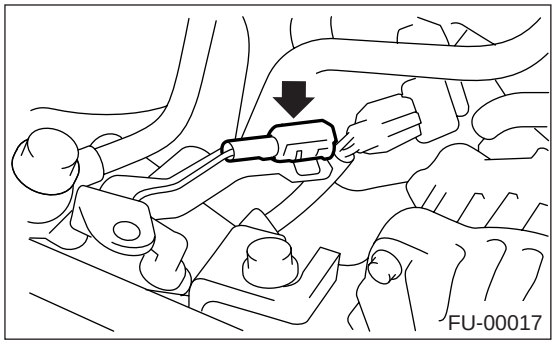
Tightening torque:
20.1 N·m (2.05 kgf-m, 14.8 ft-lb)



(3) Tighten the bolts which install power steering pump bracket, and then install the spark plug cords.

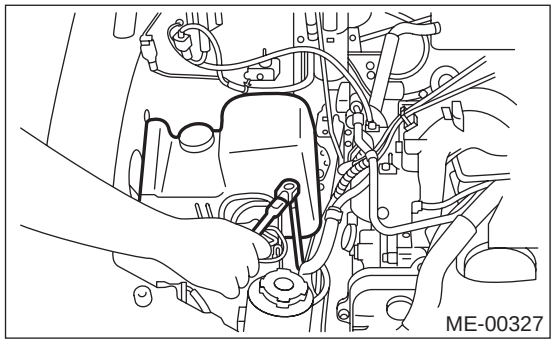


(4) Connect the power steering switch connector.



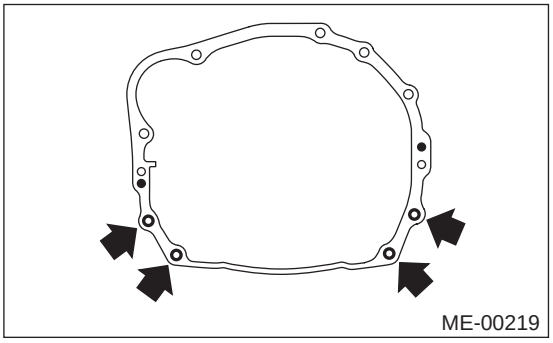
(5) Install the front side V-belt, and adjust it. <Ref. to ME(H4SO)-42, FRONT SIDE BELT, INSTALLATION, V-belt.>
(6) Install the resonator chamber.

Tightening torque:
33 N·m (3.4 kgf-m, 24.6 ft-lb)



11) Tighten the nuts which hold lower side of transmission to engine.

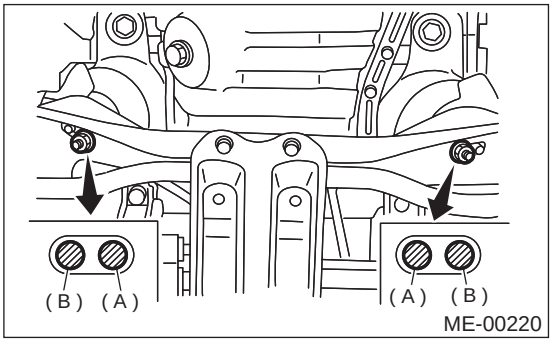
Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)



12) Tighten the nuts which install front cushion rubber onto crossmember.

Tightening torque:
85 N·m (8.7 kgf-m, 63 ft-lb)

NOTE:
Make sure the front cushion rubber mounting bolts (A) and locator (B) are securely installed.



13) Install the front and center exhaust pipe. <Ref. to EX(H4SO)-6, INSTALLATION, Front Exhaust Pipe.>
14) Connect the following hoses.
(1) Fuel delivery hose, return hose and evaporation hose
(2) Heater inlet and outlet hoses
(3) Brake booster vacuum hose
15) Connect the following connectors.
(1) Engine ground cables

Tightening torque:
14 N·m (1.4 kgf-m, 10.1 ft-lb)

(2) Engine harness connectors
(3) Generator connector and terminal
(4) A/C compressor connectors
(5) Power steering pressure switch
16) Connect the following cables.
(1) Accelerator cable
(2) Cruise control cables (With cruise control)
17) Adjust each connected cable.
18) Install the air cleaner case stay.

Tightening torque:
16 N·m (1.6 kgf-m, 11.6 ft-lb)

19) Install the A/C pressure hoses. <Ref. to AC-42, INSTALLATION, Flexible Hose.>
20) Install the radiator to vehicle. <Ref. to CO(H4SO)-24, INSTALLATION, Radiator.>
21) Install the air intake duct and air cleaner case. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Duct.> and <Ref. to IN(H4SO)-6, INSTALLATION, Air Cleaner Case.>
22) Install the under cover.
23) Install battery in the vehicle, and then connect the cables.
24) Fill engine coolant. <Ref. to CO(H4SO)-14, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
25) Check the ATF level and correct if necessary. (AT vehicles) <Ref. to AT-30, INSPECTION, Automatic Transmission Fluid.>
26) Charge the A/C system with refrigerant. <Ref. to AC-24, OPERATION, Refrigerant Charging Procedure.>
27) Remove the front hood stay, and then close the front hood.
28) Take off the vehicle from lift arms.

C: INSPECTION

1) Make sure the pipes and hoses are installed correctly.
2) Make sure the engine coolant and ATF are at specified levels.

10.Engine Mounting

A: REMOVAL

1) Remove the engine assembly. <Ref. to ME(H4SO)-32, REMOVAL, Engine Assembly.>
2) Remove the engine mounting from engine assembly.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
Engine mounting;
34 N·m (3.5 kgf-m, 25.3 ft-lb)

C: INSPECTION

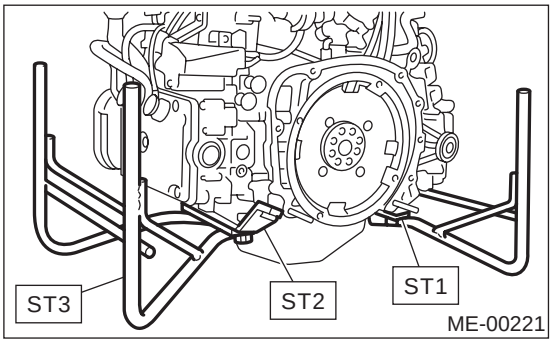
Make sure there are no cracks or other damage.

11.Preparation for Overhaul

A: PROCEDURE

1) After removing the engine from body, secure it in the ST shown below.

ST1	498457000	ENGINE STAND ADAPTER RH
ST2	498457100	ENGINE STAND ADAPTER LH
ST3	499817100	ENGINE STAND



2) In this section the procedures described under each index are all connected and stated in order. It will be the complete procedure for overhauling of the engine itself when you go through all steps in the process.
Therefore, in this section, to conduct the particular procedure within the flow of a section, you need to go back and conduct the procedure described previously in order to do that particular procedure.

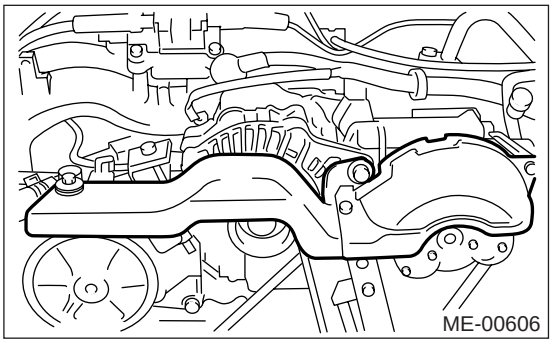
12.V-belt

A: REMOVAL

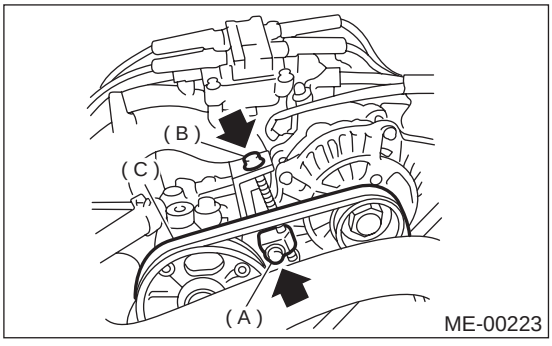
1. FRONT SIDE BELT

NOTE:
Perform the following procedures 1) to 4) with the engine installed to body.

1) Remove the V-belt cover.

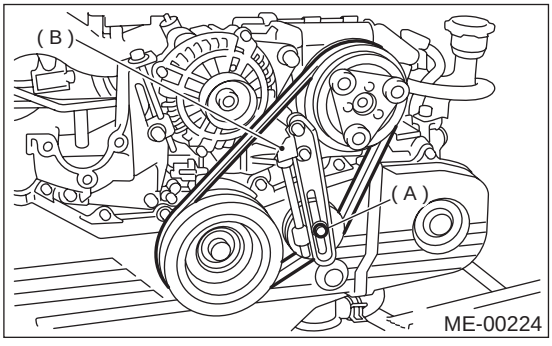


2) Loosen the lock bolt (A).
3) Loosen the slider bolt (B).
4) Remove the front side belt (C).



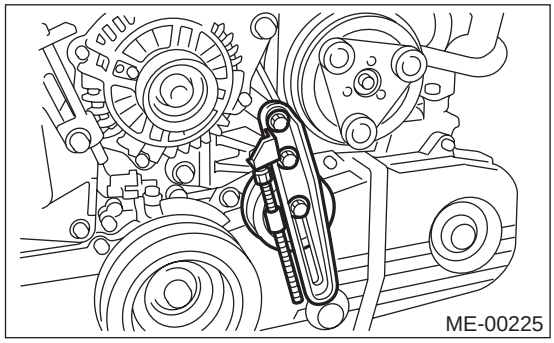
2. REAR SIDE BELT

1) Loosen the lock nut (A).
2) Loosen the slider bolt (B).



3) Remove the A/C belt.

4) Remove the A/C belt tensioner.

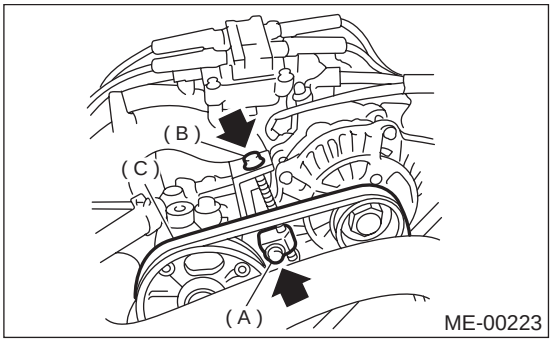


B: INSTALLATION

1. FRONT SIDE BELT

1) Wipe off any oil or water on the belt and pulley.
2) Install the belt (C), and tighten the slider bolt so as to obtain the specified belt tension. <Ref. to ME(H4SO)-42, INSPECTION, V-belt.>
3) Tighten the lock bolt (A).
4) Tighten the slider bolt (B).

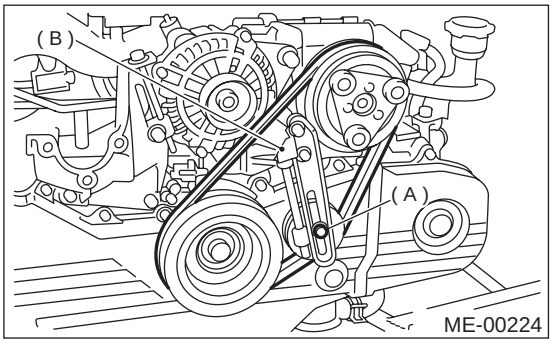
Tightening torque:
Lock bolt through-bolt:
25 N·m (2.5 kgf-m, 18.1 ft-lb)
Slider bolt:
8 N·m (0.8 kgf-m, 5.5 ft-lb)



2. REAR SIDE BELT

1) Install the belt, and tighten the slider bolt (B) so as to obtain the specified belt tension. <Ref. to ME(H4SO)-42, INSPECTION, V-belt.>
2) Tighten the lock nut (A).

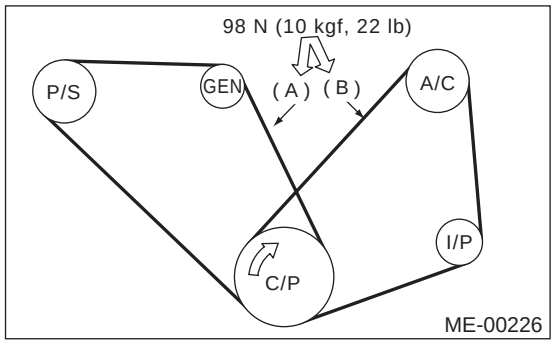
Tightening torque:
Lock nut (A);
22.6 N·m (2.3 kgf-m, 16.6 ft-lb)



C: INSPECTION

1) Replace the belts, if cracks, fraying or wear is found.
2) Check the drive belt tension and adjust it if necessary by changing the generator installing position and/or idler pulley installing position.

Belt tension
(A)
replaced: 7 — 9 mm (0.276 — 0.354 in)
reused: 9 — 11 mm (0.354 — 0.433 in)
(B)
replaced: 7.5 — 8.5 mm (0.295 — 0.335 in)
reused: 9.0 — 10.0 mm (0.354 — 0.394 in)



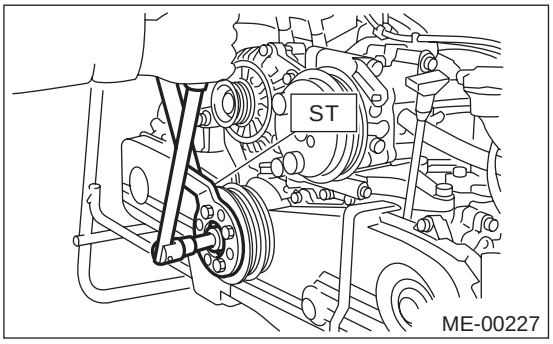
C/P	Crankshaft pulley
GEN	Generator
P/S	Power steering oil pump pulley
A/C	Air conditioning compressor pulley
I/P	Idler pulley

13.Crankshaft Pulley

A: REMOVAL

1) Remove the V-belt. <Ref. to ME(H4SO)-41, REMOVAL, V-belt.>
2) Remove the crankshaft pulley bolt. To lock the crankshaft, use ST.

ST 499977400 CRANKSHAFT PULLEY WRENCH (2000 cc model)
ST 499977100 CRANKSHAFT PULLEY WRENCH (2500 cc model)



3) Remove the crankshaft pulley.

B: INSTALLATION

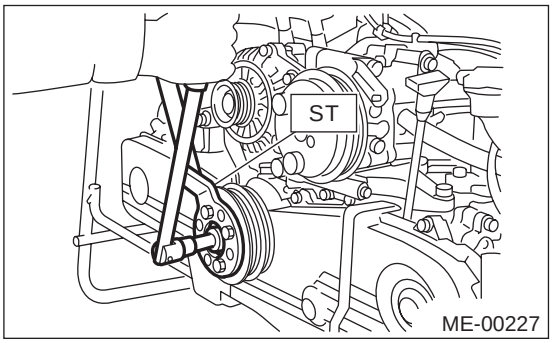
1. 2000 CC MODEL

1) Install the crankshaft pulley.
2) Install the pulley bolt.
To lock the crankshaft, use ST.

ST 499977400 CRANKSHAFT PULLEY WRENCH

(1) Clean the crankshaft pulley thread using an air gun.
(2) Apply engine oil to the crankshaft pulley bolt seat and thread.
(3) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 33 ft-lb).
(4) Tighten the crankshaft pulley bolts.

Tightening torque:
127 N·m (13.0 kgf-m, 94.0 ft-lb)



3) Confirm that the tightening angle of crankshaft pulley bolt is 45 degrees or more. If the tightening angle of crankshaft pulley bolt is less than 45 degrees, conduct the following procedures.

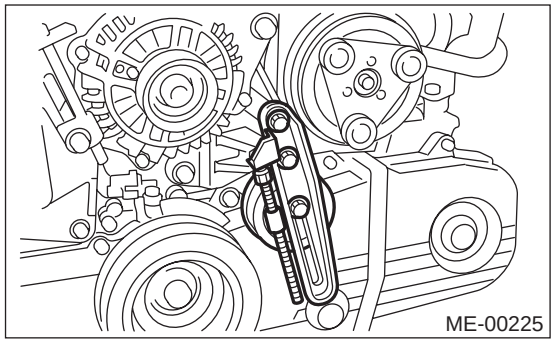
(1) Replace the crankshaft pulley bolts and clean them.

Crankshaft pulley bolt:
12369AA011

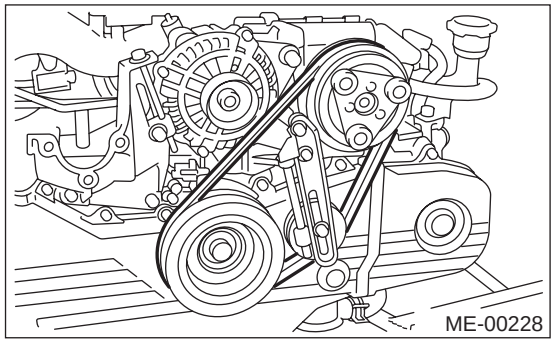
(2) Clean the crankshaft thread using an air gun.
(3) Apply engine oil to the crankshaft pulley bolt seal and thread.
(4) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 33 ft-lb).
(5) Tighten the crankshaft pulley bolts keeping them in an angle between 45 degrees and 60 degrees.

NOTE:
Conduct the tightening procedures by confirming the turning angle of crankshaft pulley bolt referring to the gauge indicated on belt cover.

4) Install the A/C belt tensioner.



5) Install the A/C belt.



2. 2500 CC MODEL

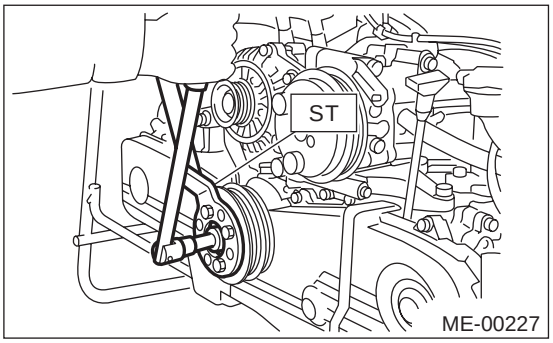
1) Install the crankshaft pulley.
2) Install the pulley bolt.
To lock the crankshaft, use ST.

ST 499977100 CRANKSHAFT PULLEY WRENCH

(1) Clean the crankshaft pulley thread using an air gun.

(2) Apply engine oil to the crankshaft pulley bolt seat and thread.
(3) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 33 ft-lb).
(4) Tighten the crankshaft pulley bolts.

Tightening torque:
177 N·m (18.0 kgf-m, 130.2 ft-lb)



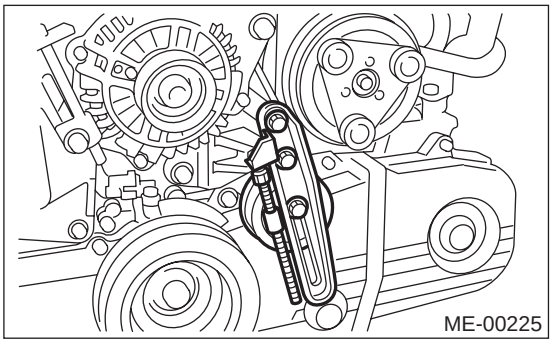
3) Confirm that the tightening angle of crankshaft pulley bolt is 65 degrees or more. If the tightening angle of crankshaft pulley bolt is less than 65 degrees, conduct the following procedures.
(1) Replace the crankshaft pulley bolts and clean them.

Crankshaft pulley bolt:
12369AA011

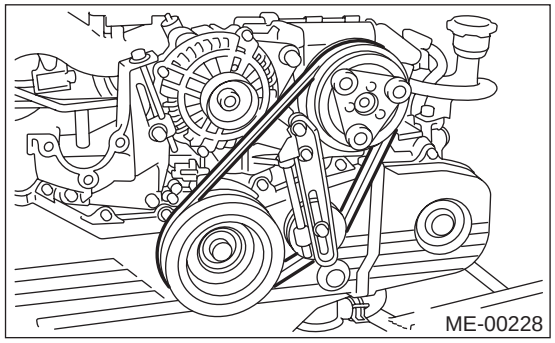
(2) Clean the crankshaft thread using an air gun.
(3) Apply engine oil to the crankshaft pulley bolt seat and thread.
(4) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 33 ft-lb).
(5) Tighten the crankshaft pulley bolts keeping them in an angle between 65 degrees and 75 degrees.

NOTE:
Conduct the tightening procedures by confirming the turning angle of crankshaft pulley bolt referring to the gauge indicated on belt cover.

4) Install the A/C belt tensioner.



5) Install the A/C belt.



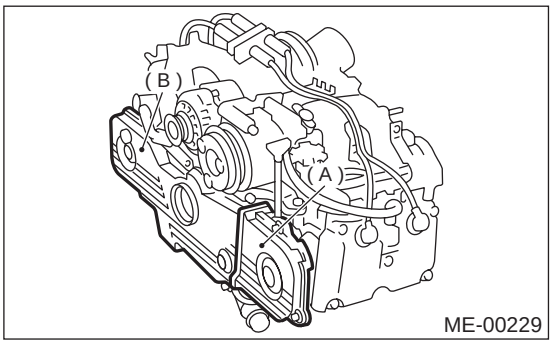
C: INSPECTION

1) Make sure the V-belt is not worn or otherwise damaged.
2) Check the tension of the belt. <Ref. to ME(H4SO)-42, INSPECTION, V-belt.>

14.Belt Cover

A: REMOVAL

1) Remove the V-belt. <Ref. to ME(H4SO)-41, REMOVAL, V-belt.>
2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-43, REMOVAL, Crankshaft Pulley.>
3) Remove the belt cover (LH).
4) Remove the front belt cover.



(A) Belt cover (LH)
(B) Front belt cover

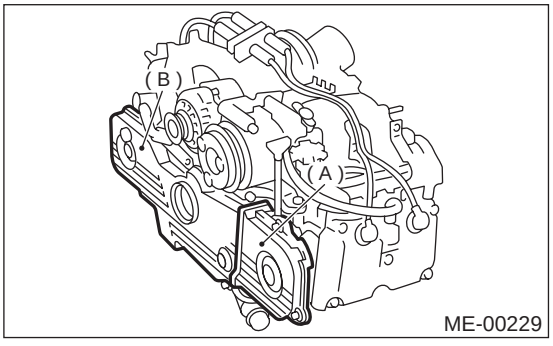
B: INSTALLATION

1) Install the front belt cover.

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)

2) Install the belt cover (LH).

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)



(A) Belt cover (LH)
(B) Front belt cover

3) Install the crankshaft pulley. ***<Ref. to ME(H4SO)-43, INSTALLATION, CRANKSHAFT PULLEY.>***
4) Install the V-belt. <Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>

C: INSPECTION

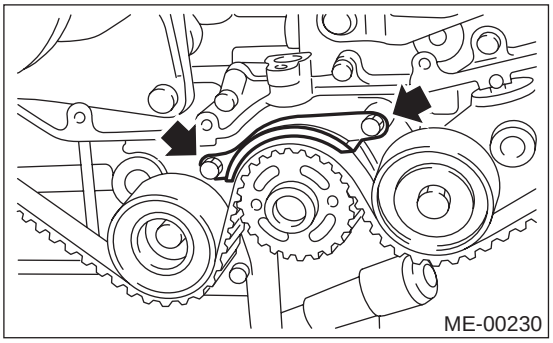
Make sure the cover is not damaged.

15.Timing Belt Assembly

A: REMOVAL

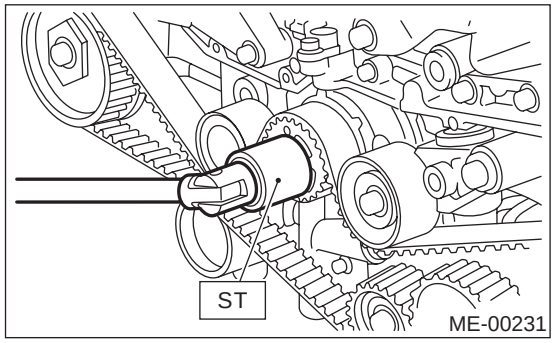
1. TIMING BELT

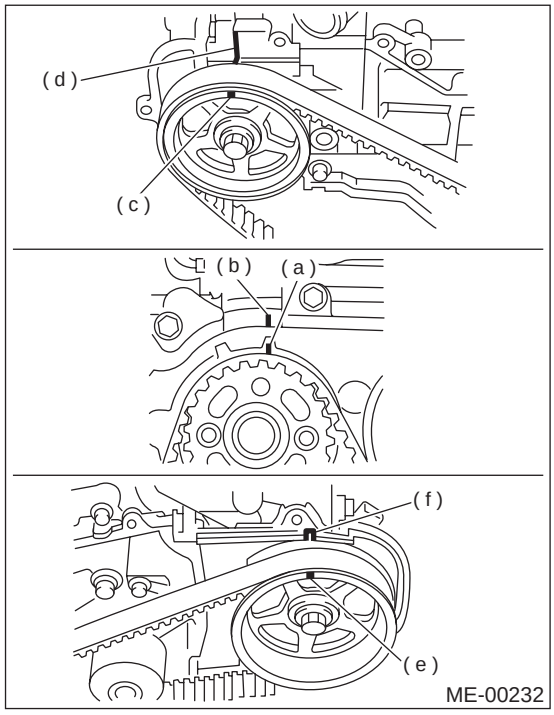
1) Remove the V-belt. <Ref. to ME(H4SO)-41, REMOVAL, V-belt.>
2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-43, REMOVAL, Crankshaft Pulley.>
3) Remove the belt cover. <Ref. to ME(H4SO)-45, REMOVAL, Belt Cover.>
4) Remove the timing belt guide. (MT vehicles)



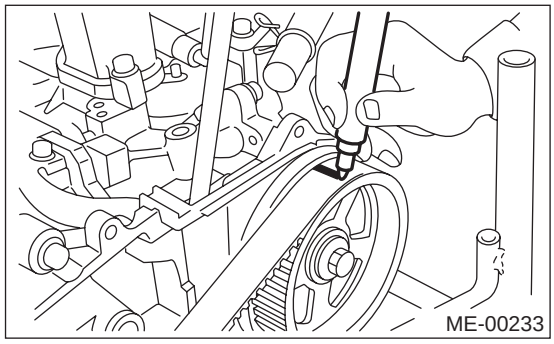
5) If the alignment mark (a) and/or arrow mark (which indicates rotation direction) on timing belt fade away, put new marks before removing the timing belt as shown in procedures below.
   (1) Turn the crankshaft using ST. Align the mark (a) of sprocket to cylinder block notch (b) and ensure the right side cam sprocket mark (c), cam cap and cylinder head matching surface (d) and/or left side cam sprocket mark (e) and belt cover notch (f) are properly adjusted.

ST 499987500 CRANKSHAFT SOCKET

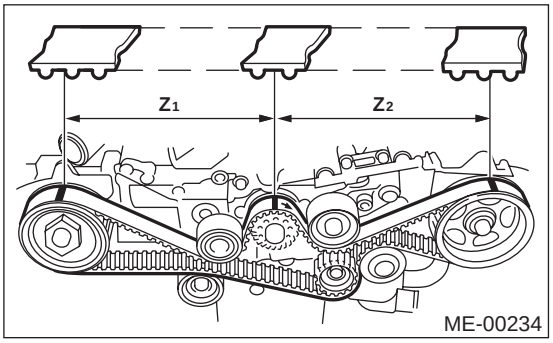




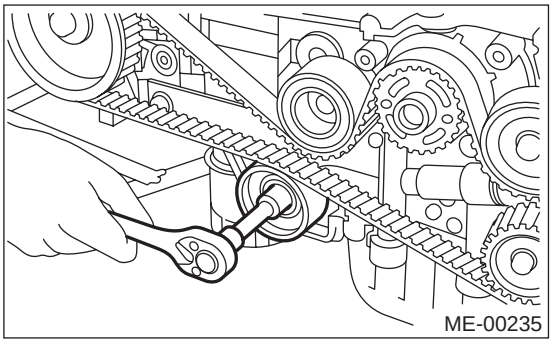
   (2) Using white paint, put alignment and/or arrow marks on the timing belts in relation to crankshaft sprocket and cam sprockets.



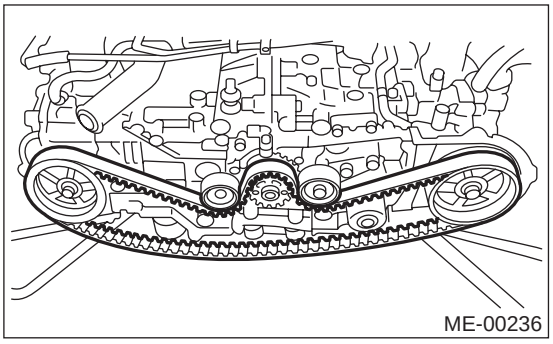
Specified data:
Z_1: 46.8 tooth length
Z_2: 43.7 tooth length



6) Remove the belt idler (No. 2).
7) Remove the belt idler No. 2.

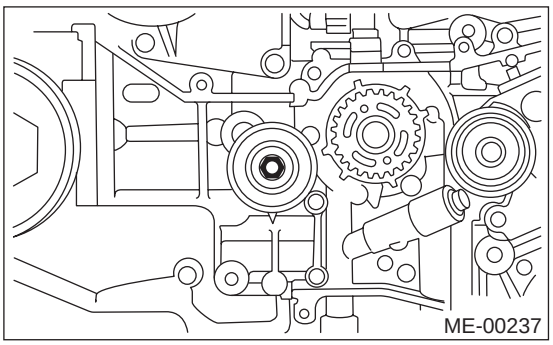


8) Remove the timing belt.

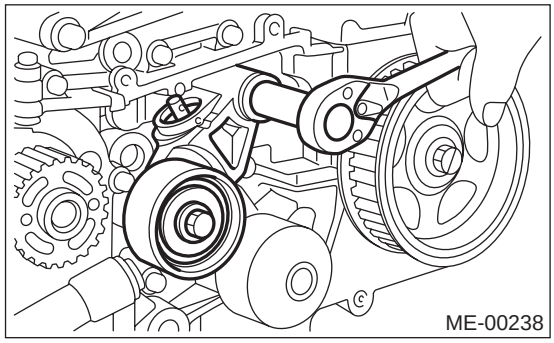


2. BELT IDLER AND AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY

1) Remove the belt idler (No. 1).



2) Remove the automatic belt tension adjuster assembly.



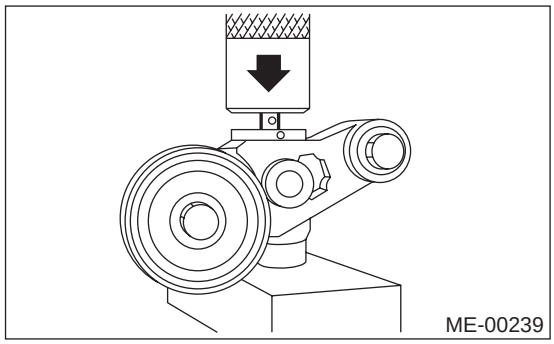
B: INSTALLATION

1. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

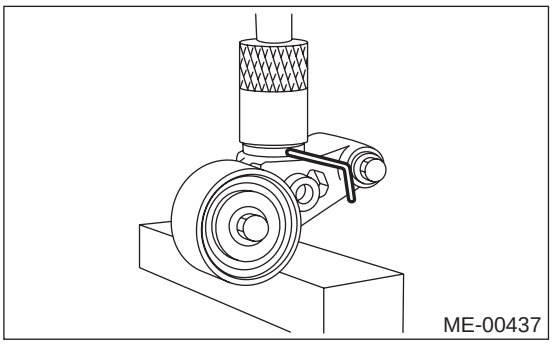
1) Preparation for installation of automatic belt tension adjuster assembly;

NOTE:
• Always use a vertical type pressing tool to move the adjuster rod down.
• Do not use a lateral type vise.
• Push the adjuster rod vertically.
• Press-in the push adjuster rod gradually taking more than 3 minutes.
• Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lb).
• Press the adjuster rod as far as the end surface of the cylinder. Do not press the adjuster rod into the cylinder. Doing so may damage the cylinder.
• Do not release the press pressure until stopper pin is completely inserted.

(1) Attach the automatic belt tension adjuster assembly to the vertical pressing tool.
(2) Slowly move the adjuster rod down with a pressure of 294 N (30 kgf, 66 lb) until the adjuster rod is aligned with the stopper pin hole in the cylinder.

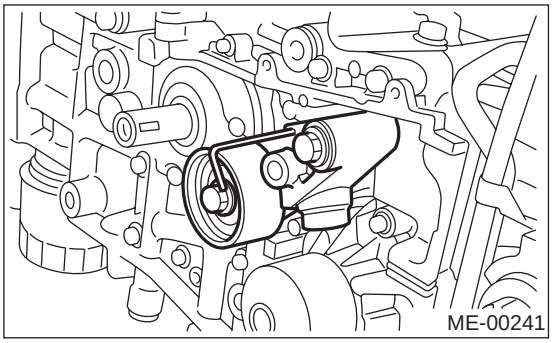


(3) With a 2 mm (0.08 in) dia. stopper pin or a 2 mm (0.08 in) (nominal) dia. hex bar wrench inserted into the stopper pin hole in the cylinder, secure the adjuster rod.



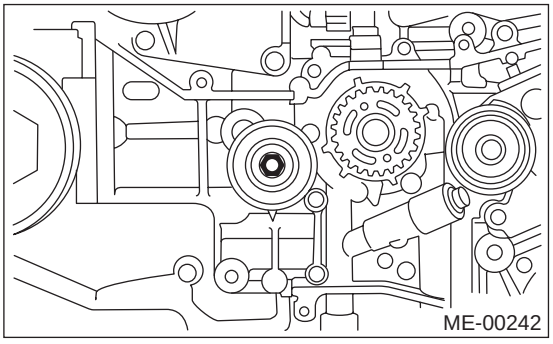
2) Install the automatic belt tension adjuster assembly.

Tightening torque:
39 N·m (4.0 kgf-m, 28.9 ft-lb)



3) Install the belt idler (No. 1).

Tightening torque:
39 N·m (4.0 kgf-m, 28.9 ft-lb)



2. TIMING BELT

1) Preparation for the installation of automatic belt tension adjuster assembly. <Ref. to ME(H4SO)-47, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt Assembly.>

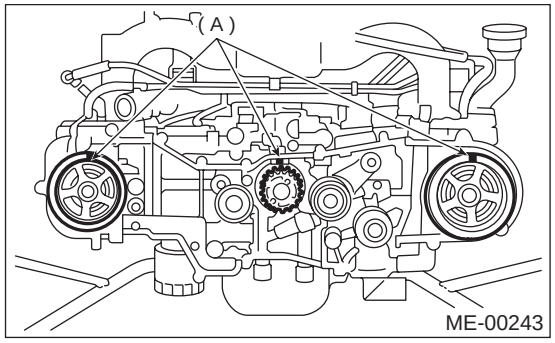
2) Installation of timing belt

(1) Turn the camshaft sprocket No. 2 using ST1, and then turn the camshaft sprocket No. 1 using ST2 so that their alignment marks (A) come to top positions.

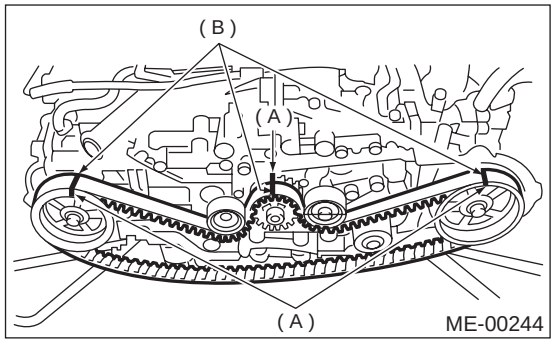
ST1 18231AA010 CAMSHAFT SPROCKET WRENCH

NOTE:
Also the CAMSHAFT SPROCKET WRENCH (499207100) can be used.

ST2 499207400 CAMSHAFT SPROCKET WRENCH



(2) While aligning alignment marks (B) on the timing belt with marks (A) on sprockets, position the timing belt properly.

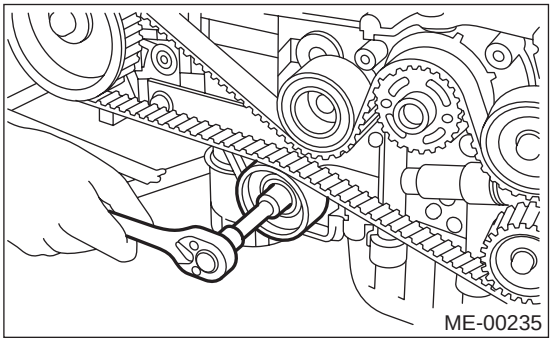


3) Install the belt idler No. 2.

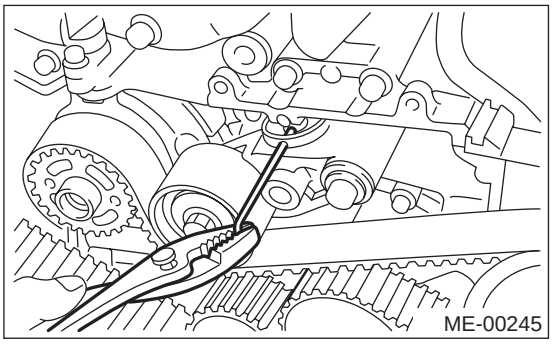
Tightening torque:
39 N·m (4.0 kgf-m, 28.9 ft-lb)

4) Install the belt idler (No. 2).

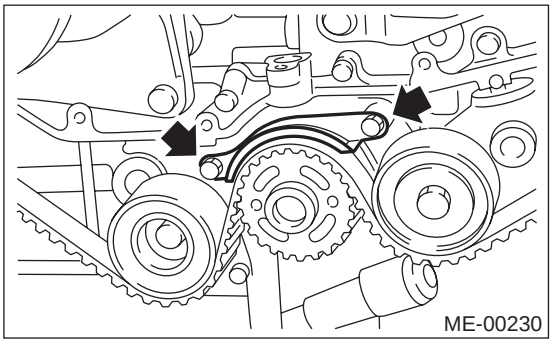
Tightening torque:
39 N·m (4.0 kgf-m, 28.9 ft-lb)



5) After ensuring that the marks on timing belt and camshaft sprockets are aligned, remove the stopper pin from belt tensioner adjuster.

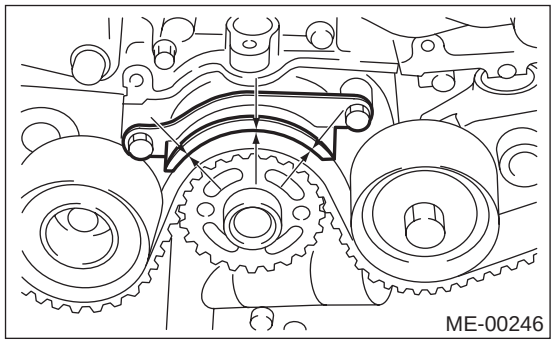


6) Install the timing belt guide. (MT vehicles)
(1) Temporarily tighten the remaining bolts.



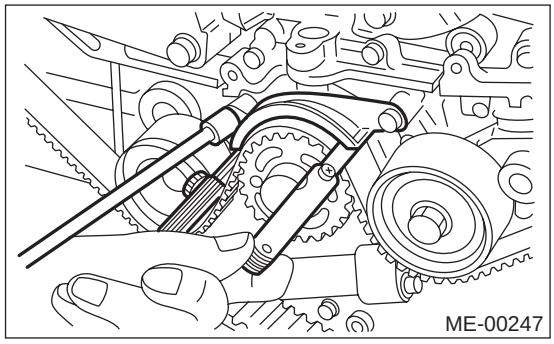
(2) Check and adjust the clearance between timing belt and timing belt guide by using thickness gauge.

Clearance:
1.0±0.5 mm (0.039±0.020 in)



(3) Tighten the remaining bolts.

Tightening torque:
10 N·m (1.0 kgf-m, 7.2 ft-lb)



7) Install the belt cover. <Ref. to ME(H4SO)-45, INSTALLATION, Belt Cover.>
8) Install the crankshaft pulley. ***<Ref. to ME(H4SO)-43, INSTALLATION, CRANKSHAFT PULLEY.>***
9) Install the V-belt. <Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>

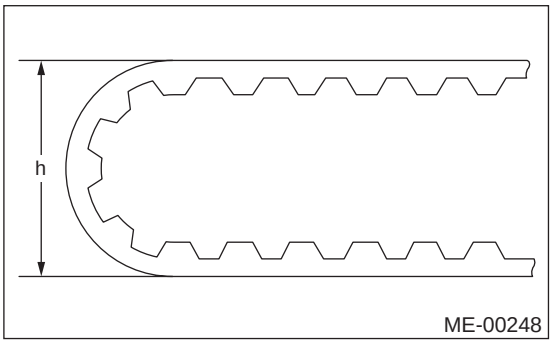
C: INSPECTION

1. TIMING BELT

1) Check the timing belt teeth for breaks, cracks, and wear. If any fault is found, replace the belt.
2) Check the condition of back side of belt; if any crack is found, replace the belt.

NOTE:
• Be careful not to let oil, grease or coolant contact the belt. Remove quickly and thoroughly if this happens.
• Do not bend the belt sharply.

Bending radius: h
60 mm (2.36 in) or more



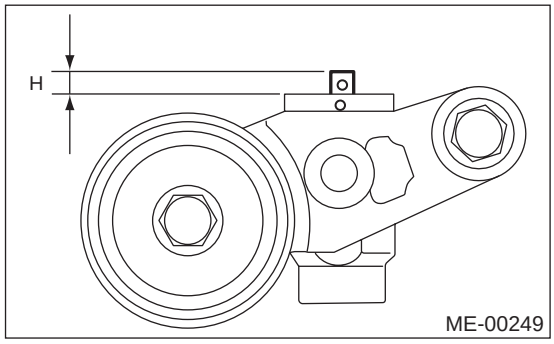
2. AUTOMATIC BELT TENSION ADJUSTER

1) Visually check oil seals for leaks, and rod ends for abnormal wear or scratches. If necessary, replace faulty parts.
2) Check that the adjuster rod does not move when a pressure of 294 N (30 kgf, 66 lb) is applied to it. This is to check adjuster rod stiffness.
3) If the adjuster rod is not stiff and moves freely when applying 294 N (30 kgf, 66 lb), check it using the following procedures:
(1) Slowly press the adjuster rod down to the end surface of the cylinder. Repeat this motion 2 or 3 times.
(2) With the adjuster rod moved all the way up, apply a pressure of 294 N (30 kgf, 66 lb) to it. Check adjuster rod stiffness.
(3) If the adjuster rod is not stiff and moves down, replace the automatic belt tension adjuster assembly with a new one.

NOTE:
• Always use a vertical type pressing tool to move the adjuster rod down.
• Do not use a lateral type vise.
• Push the adjuster rod vertically.
• Press-in the adjuster rod gradually taking more than 3 minutes.
• Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lb).
• Press the adjuster rod as far as the end surface of the cylinder. Do not press the adjuster rod into the cylinder. Doing so may damage the cylinder.

4) Measure the extension of rod beyond the body. If it is not within specifications, replace with a new one.

Rod extension: H
5.7±0.5 mm (0.224±0.020 in)



3. BELT TENSION PULLEY

1) Check the mating surfaces of timing belt and contact point of adjuster rod for abnormal wear or scratches. Replace the automatic belt tension adjuster assembly if faulty.
2) Check the tension pulley for smooth rotation. Replace if noise or excessive play is noted.
3) Check the tension pulley for grease leakage.

4. BELT IDLER

1) Check the belt idler for smooth rotation. Replace if noise or excessive play is noted.
2) Check the belt outer contacting surfaces of idler pulley for abnormal wear and scratches.
3) Check the belt idler for grease leakage.

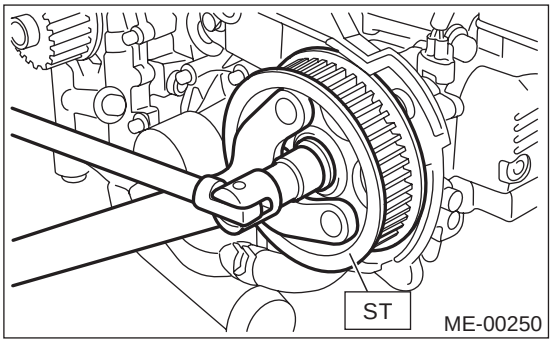
16.Camshaft Sprocket

A: REMOVAL

1) Remove the V-belt. <Ref. to ME(H4SO)-41, REMOVAL, V-belt.>
2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-43, REMOVAL, Crankshaft Pulley.>
3) Remove the belt cover. <Ref. to ME(H4SO)-45, REMOVAL, Belt Cover.>
4) Remove the timing belt assembly. <Ref. to ME(H4SO)-46, REMOVAL, Timing Belt Assembly.>
5) Remove the camshaft position sensor. <Ref. to FU(H4SO)-28, REMOVAL, Camshaft Position Sensor.>
6) Remove the camshaft sprocket No. 2. To lock the camshaft, use ST.

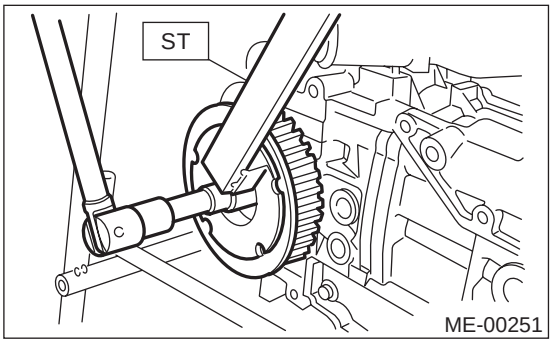
ST 18231AA010 CAMSHAFT SPROCKET WRENCH

NOTE:
Also the CAMSHAFT SPROCKET WRENCH (499207100) can be used.



7) Remove the camshaft sprocket No. 1. To lock the camshaft, use ST.

ST 499207400 CAMSHAFT SPROCKET WRENCH



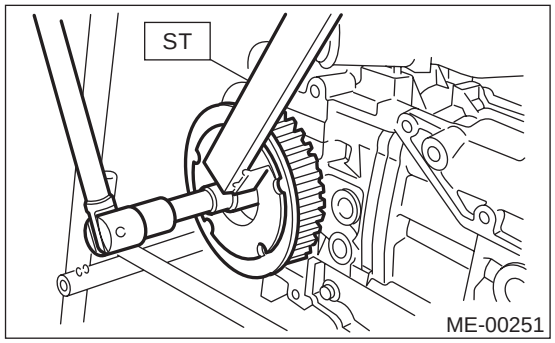
B: INSTALLATION

1) Install the camshaft sprocket No. 1. To lock the camshaft, use ST.

ST 499207400 CAMSHAFT SPROCKET WRENCH

Tightening torque:
78 N·m (8.0 kgf-m, 57.9 ft-lb)

NOTE:
Do not confuse the right and left side camshaft sprockets during installation. The camshaft sprocket No. 2 is identified by a projection used to monitor camshaft position sensor.

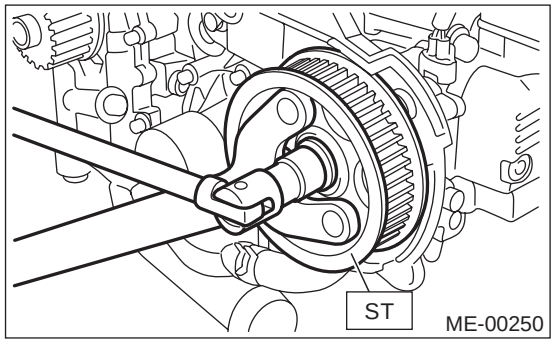


2) Install the camshaft sprocket No. 2. To lock camshaft, use ST.

ST 18231AA010 CAMSHAFT SPROCKET WRENCH

NOTE:
Also the CAMSHAFT SPROCKET WRENCH (499207100) can be used.

Tightening torque:
78 N·m (8.0 kgf-m, 57.9 ft-lb)



3) Install the camshaft position sensor. <Ref. to FU(H4SO)-28, INSTALLATION, Camshaft Position Sensor.>
4) Install the timing belt assembly. <Ref. to ME(H4SO)-47, INSTALLATION, Timing Belt Assembly.>
5) Install the belt cover. <Ref. to ME(H4SO)-45, INSTALLATION, Belt Cover.>

6) Install the crankshaft pulley. ***<Ref. to ME(H4SO)-43, INSTALLATION, CRANKSHAFT PULLEY.>***
7) Install the V-belt. <Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>

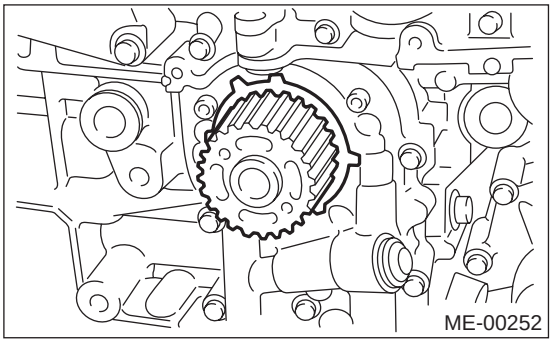
C: INSPECTION

1) Check the sprocket teeth for abnormal wear and scratches.
2) Make sure there is no free play between sprocket and key.
3) Check the crankshaft sprocket notch for sensor for damage and contamination of foreign matter.

17.Crankshaft Sprocket

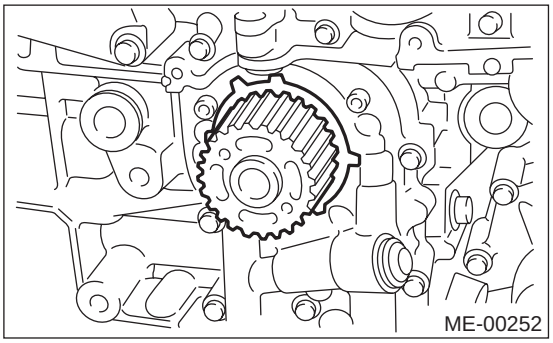
A: REMOVAL

1) Remove the V-belt. <Ref. to ME(H4SO)-41, REMOVAL, V-belt.>
2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-43, REMOVAL, Crankshaft Pulley.>
3) Remove the belt cover. <Ref. to ME(H4SO)-45, REMOVAL, Belt Cover.>
4) Remove the timing belt assembly. <Ref. to ME(H4SO)-46, REMOVAL, Timing Belt Assembly.>
5) Remove the camshaft sprocket. <Ref. to ME(H4SO)-51, REMOVAL, Camshaft Sprocket.>
6) Remove the crankshaft sprocket.



B: INSTALLATION

1) Install the crankshaft sprocket.



2) Install the camshaft sprocket. <Ref. to ME(H4SO)-51, INSTALLATION, Camshaft Sprocket.>
3) Install the timing belt assembly. <Ref. to ME(H4SO)-47, INSTALLATION, Timing Belt Assembly.>
4) Install the belt cover. <Ref. to ME(H4SO)-45, INSTALLATION, Belt Cover.>
5) Install the crankshaft pulley. ***<Ref. to ME(H4SO)-43, INSTALLATION, CRANKSHAFT PULLEY.>***
6) Install the V-belt. <Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>

C: INSPECTION

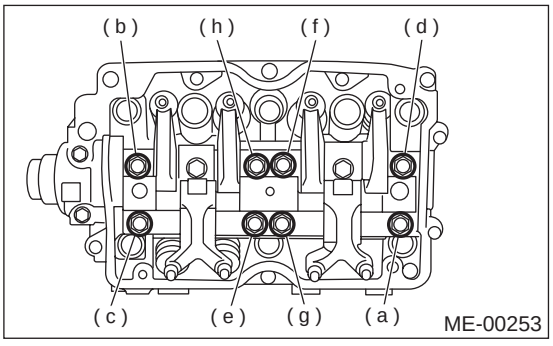
1) Check the sprocket teeth for abnormal wear and scratches.
2) Make sure there is no free play between sprocket and key.
3) Check the crankshaft sprocket notch for sensor for damage and contamination of foreign matter.

18.Valve Rocker Assembly

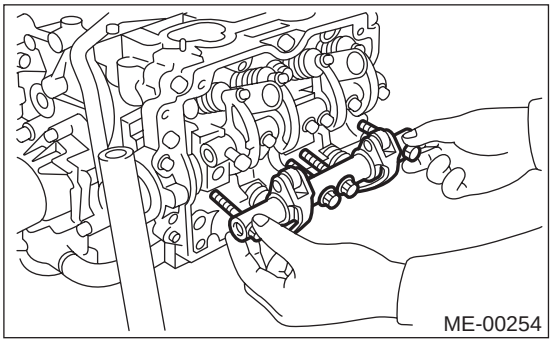
A: REMOVAL

1) Remove the V-belt. <Ref. to ME(H4SO)-41, REMOVAL, V-belt.>
2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-43, REMOVAL, Crankshaft Pulley.>
3) Remove the belt cover. <Ref. to ME(H4SO)-45, REMOVAL, Belt Cover.>
4) Remove the timing belt assembly. <Ref. to ME(H4SO)-46, REMOVAL, Timing Belt Assembly.>
5) Remove the camshaft sprocket. <Ref. to ME(H4SO)-51, REMOVAL, Camshaft Sprocket.>
6) Disconnect the PCV hose and remove rocker cover.
7) Removal of valve rocker assembly
   (1) Remove the bolts (a) through (h) in alphabetical sequence.

NOTE:
Leave two or three threads of bolts (g and h) engaged to retain the valve rocker assembly.



(2) Remove the valve rocker assembly.



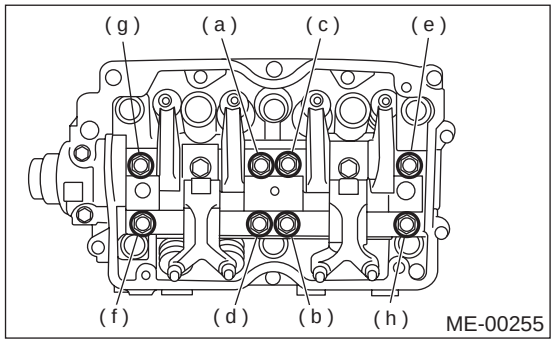
B: INSTALLATION

1) Installation of valve rocker assembly
   (1) Temporarily tighten the bolts (a) through (d) equally as shown in the figure.

NOTE:
Do not allow the valve rocker assembly to gouge knock pins.

   (2) Tighten the bolts (e) through (h) to specified torque.
   (3) Tighten the bolts (a) through (d) to specified torque.

Tightening torque:
25 N·m (2.5 kgf-m, 18.1 ft-lb)



2) Adjust the valve clearances. <Ref. to ME(H4SO)-30, ADJUSTMENT, Valve Clearance.>
3) Install the rocker cover and connect PCV hose.
4) Install the camshaft sprocket. <Ref. to ME(H4SO)-51, INSTALLATION, Camshaft Sprocket.>
5) Install the timing belt assembly. <Ref. to ME(H4SO)-47, INSTALLATION, Timing Belt Assembly.>
6) Install the belt cover. <Ref. to ME(H4SO)-45, INSTALLATION, Belt Cover.>
7) Install the crankshaft pulley. ***<Ref. to ME(H4SO)-43, INSTALLATION, CRANKSHAFT PULLEY.>***
8) Install the V-belt. <Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>

C: DISASSEMBLY

1) Remove the bolts which secure rocker shaft.
2) Extract the rocker shaft. Remove the valve rocker arms, springs, plates and shaft supports from rocker shaft.

NOTE:
Arrange all removed parts in order so that they can be installed in their original positions.

3) Remove the nut and adjuster screw from valve rocker.

D: ASSEMBLY

1) Install the adjuster screw and nut to valve rocker.
2) Arrange the valve rocker arms, springs and shaft supports in assembly order and insert valve rocker shaft.

Tightening torque (Shaft supports installing bolts):
5 N·m (0.5 kgf-m, 3.6 ft-lb)

NOTE:
Valve rocker arms, rocker shaft and shaft supports have identification marks. Ensure the parts with same markings are properly assembled.

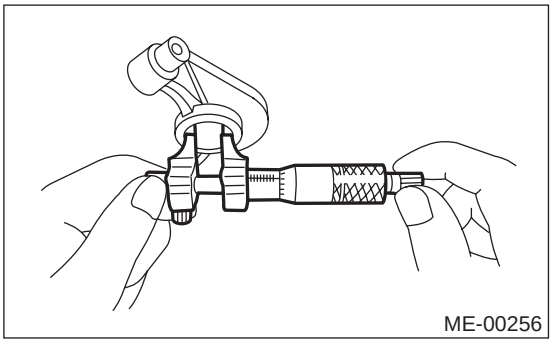
3) Install the valve rocker shaft securing bolts.

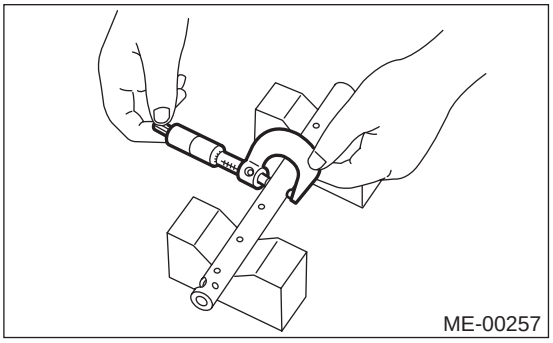
E: INSPECTION

1. VALVE ROCKER ARM AND ROCKER SHAFT

1) Measure the inside diameter of valve rocker arm and outside diameter of valve rocker shaft, and determine the difference between the two (= oil clearance).

Clearance between arm and shaft:
Standard
0.020 — 0.054 mm (0.0008 — 0.0021 in)
Limit
0.10 mm (0.0039 in)


ME-00256


ME-00257

2) If oil clearance exceeds the limit, replace the valve rocker arm or shaft, whichever shows greater amount of wear.

Rocker arm inside diameter:
22.020 — 22.041 mm (0.8669 — 0.8678 in)

Rocker shaft diameter:
21.987 — 22.000 mm (0.8656 — 0.8661 in)

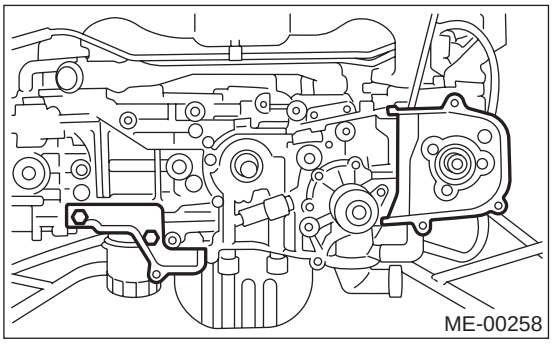
3) If cam or valve contact surface of valve rocker arm is worn or dented excessively, replace the valve rocker arm.
4) Check that the valve rocker arm roller rotates smoothly. If not, replace the valve rocker arm.

19.Camshaft

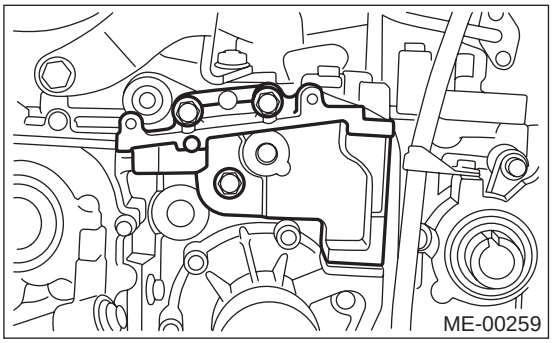
A: REMOVAL

1) Remove the V-belt. <Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>
2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-43, REMOVAL, Crankshaft Pulley.>
3) Remove the belt cover. <Ref. to ME(H4SO)-45, REMOVAL, Belt Cover.>
4) Remove the timing belt assembly. <Ref. to ME(H4SO)-46, REMOVAL, Timing Belt Assembly.>
5) Remove the camshaft sprocket. <Ref. to ME(H4SO)-51, REMOVAL, Camshaft Sprocket.>
6) Remove the crankshaft sprocket. <Ref. to ME(H4SO)-53, REMOVAL, Crankshaft Sprocket.>
7) Remove the belt cover No. 2 (LH).
8) Remove the belt cover No. 2 (RH).

NOTE:
Do not damage or lose the seal rubber when removing belt covers.

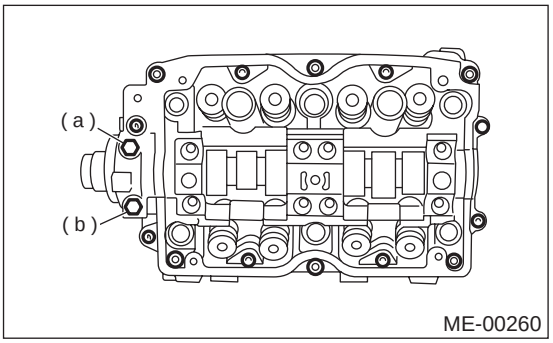

ME-00258

9) Remove the tensioner bracket.


ME-00259

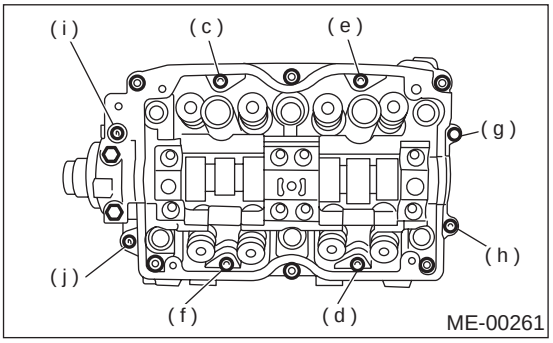
10) Remove the camshaft position sensor support. (LH side only)
11) Remove the oil level gauge guide. (LH side only)
12) Remove the valve rocker assembly. <Ref. to ME(H4SO)-54, REMOVAL, Valve Rocker Assembly.>
13) Remove the camshaft cap.

(1) Remove the bolts (a) through (b) in alphabetical sequence.



ME-00260

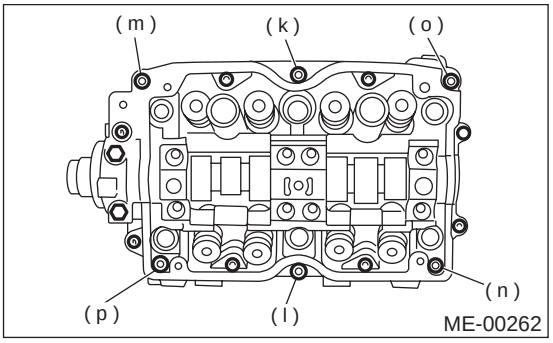
(2) Equally loosen the bolts (c) through (j) all the way in alphabetical sequence.



ME-00261

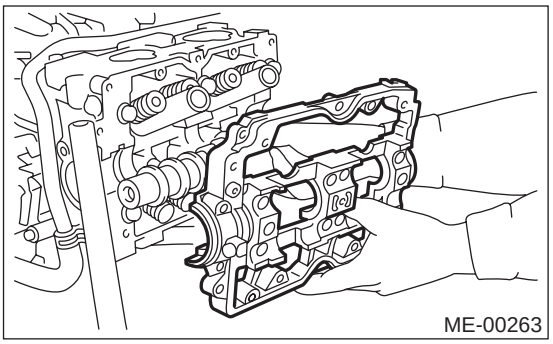
(3) Remove the bolts (k) through (p) in alphabetical sequence using ST.

ST 499497000 TORX PLUS



ME-00262

(4) Remove the camshaft cap.


ME-00263

14) Remove the camshaft.
15) Remove the oil seal.

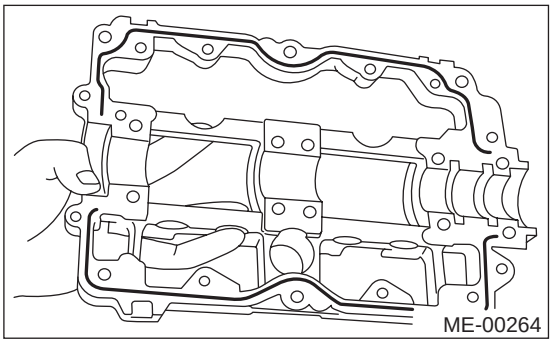
16) Remove the plug from rear side of camshaft.

NOTE:
• Do not remove the oil seal unless necessary.
• Do not scratch the journal surface when removing oil seal.

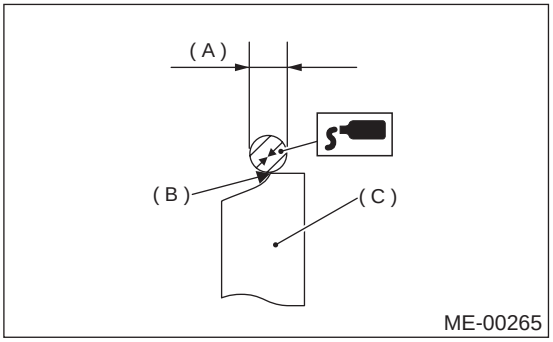
B: INSTALLATION

1) Apply a coat of engine oil to the camshaft journals, and then install the camshaft.
2) Install the camshaft cap.
(1) Apply liquid gasket on the around of camshaft cap.

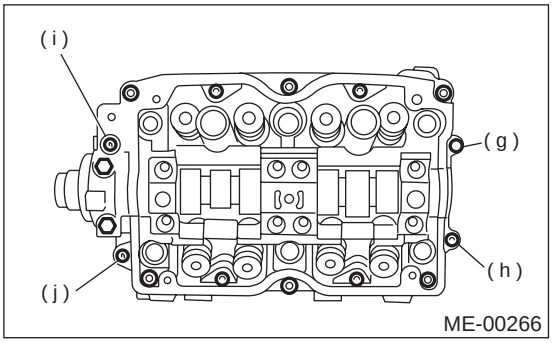
Liquid gasket:
THREE BOND 1280B
P/N K0877YA018



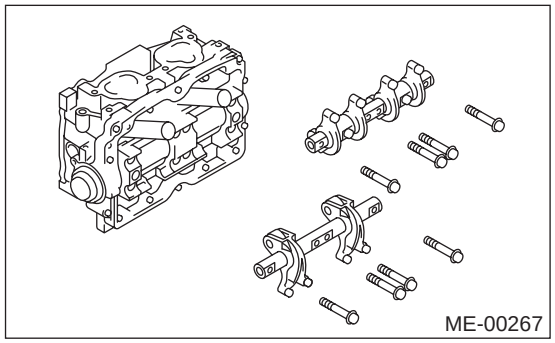
NOTE:
Apply a coat of 3 mm (0.12 in) dia (A). liquid gasket along edge (B) of the camshaft cap (C) mating surface.



(2) Temporarily tighten the bolts (g) through (j) in alphabetical sequence.

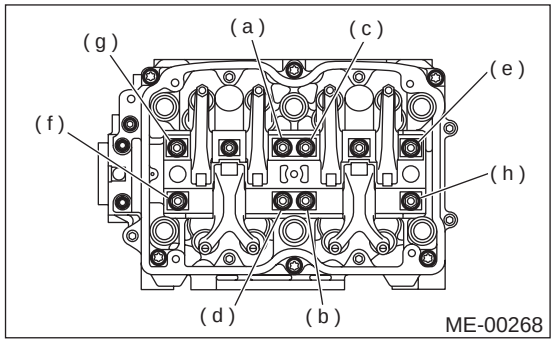


(3) Install the valve rocker assembly.



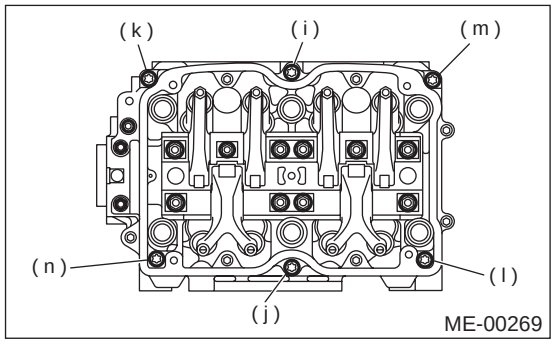
(4) Tighten the bolts (a) through (h) in alphabetical sequence.

Tightening torque:
25 N·m (2.5 kgf-m, 18.1 ft-lb)



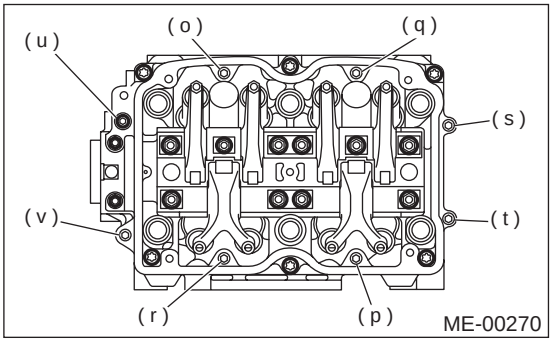
(5) Tighten the TORX bolts (i) through (n) in alphabetical sequence using ST.
ST 499497000 TORX PLUS

Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)



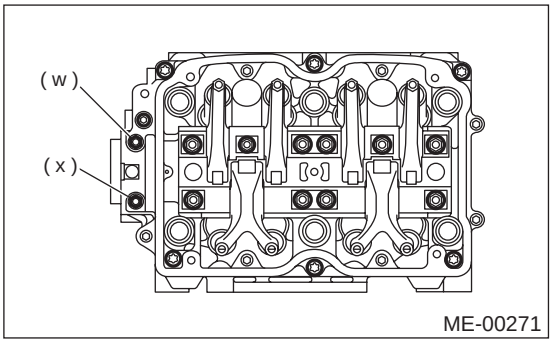
(6) Tighten the bolts (o) through (v) in alphabetical sequence.

Tightening torque:
10 N·m (1.0 kgf-m, 7.2 ft-lb)



(7) Tighten the bolts (w) through (x) in alphabetical sequence.

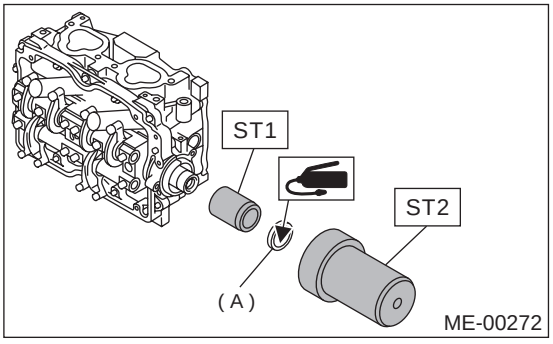
Tightening torque:
10 N·m (1.0 kgf-m, 7.2 ft-lb)



3) Apply a coat of grease to oil seal lips, and then install the oil seal (A) on camshaft using ST1 and ST2.

NOTE:
Use a new oil seal.

ST1 499597000 OIL SEAL GUIDE
ST2 499587500 OIL SEAL INSTALLER



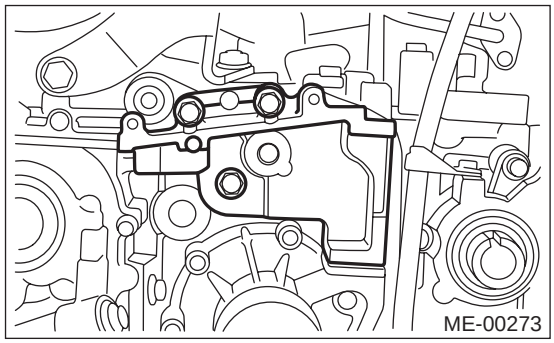
4) Install the plug using ST.

ST 499587700 CAMSHAFT OIL SEAL INSTALLER

5) Adjust the valve clearance. <Ref. to ME(H4SO)-30, ADJUSTMENT, Valve Clearance.>

6) Install the rocker cover and connect PCV hose.
7) Install the oil level gauge guide. (LH side only)
8) Install the camshaft position sensor support. (LH side only)
9) Install the tensioner bracket.

Tightening torque:
25 N·m (2.5 kgf-m, 18.1 ft-lb)

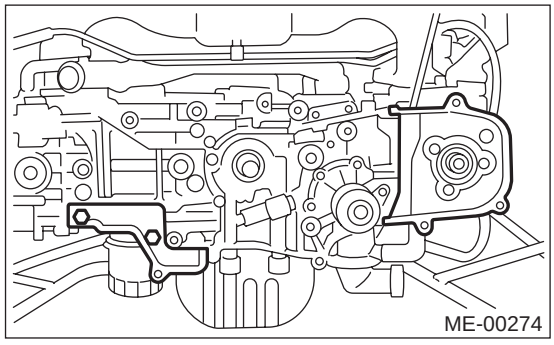


10) Install the belt cover No. 2 (RH).

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)

11) Install the belt cover No. 2 (LH).

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)



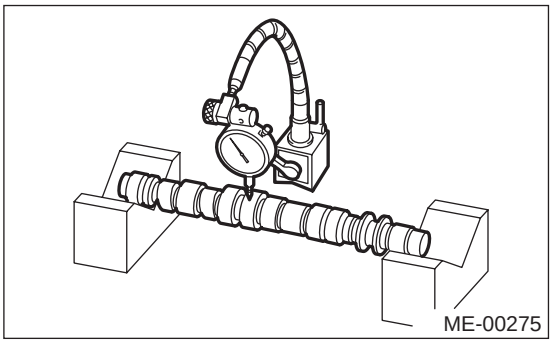
12) Install the crankshaft sprocket. <Ref. to ME(H4SO)-53, INSTALLATION, Crankshaft Sprocket.>
13) Install the camshaft sprocket. <Ref. to ME(H4SO)-51, INSTALLATION, Camshaft Sprocket.>
14) Install the timing belt assembly. <Ref. to ME(H4SO)-47, INSTALLATION, Timing Belt Assembly.>
15) Install the belt cover. <Ref. to ME(H4SO)-45, INSTALLATION, Belt Cover.>
16) Install the crankshaft pulley. ***<Ref. to ME(H4SO)-43, INSTALLATION, CRANKSHAFT PULLEY.>***
17) Install the V-belt. <Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>

C: INSPECTION

1. CAMSHAFT

1) Measure the bend, and repair or replace if necessary.

Limit:
0.025 mm (0.0010 in)



2) Check the journal for damage and wear. Replace if faulty.
3) Measure the outside diameter of camshaft journal and inside diameter of cylinder head journal, and determine the difference between two (= oil clearance). If the oil clearance exceeds specifications, replace the camshaft or cylinder head as necessary.

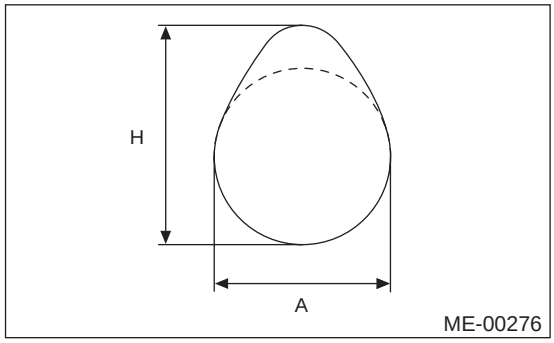
		Unit: mm (in)
Clearance at journal	Standard	0.055 — 0.090 (0.0022 — 0.0035)
	Limit	0.10 (0.0039)
Camshaft journal O.D.		31.928 — 31.945 (1.2570 — 1.2577)
Journal hole I.D.		32.000 — 32.018 (1.2598 — 1.2605)

4) Check the cam face condition; remove the minor faults by grinding with oil stone. Measure the cam height H; replace if the limit has been exceeded.

Cam height: H

Model	Item	Unit: mm (in)	
2000 cc	Intake	STD	38.732 — 38.832 (1.5249 — 1.528885)
		Limit	38.632 (1.5209)
	Exhaust	STD	39.257 — 39.357 (1.5455 — 1.5495)
		Limit	39.157 (1.5416)
2500 cc	Intake	STD	39.485 — 39.585 (1.5545 — 1.5585)
		Limit	39.385 (1.5506)
	Exhaust	STD	39.257 — 39.357 (1.5455 — 1.5495)
		Limit	39.157 (1.5416)

Cam base circle diameter A:
IN: 34.00 mm (1.3386 in)
EX: 34.00 mm (1.3386 in)



2. CAMSHAFT SUPPORT

Measure the thrust clearance of camshaft with dial gauge. If the clearance exceeds the limit, replace the camshaft support.

Standard:
0.030 — 0.090 mm (0.0012 — 0.0035 in)

Limit:
0.10 mm (0.0039 in)