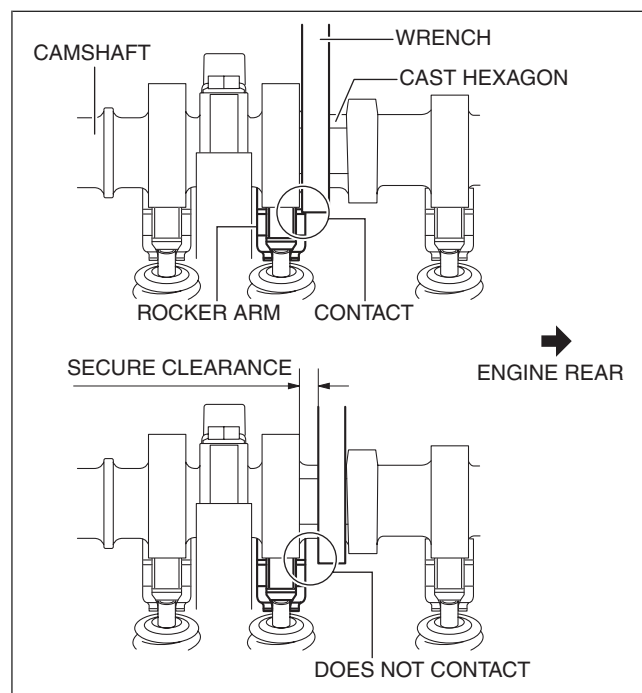


Warning

- A hot engine can cause severe burns. Turn off the engine and wait until it is cool before servicing.

Caution

- If the camshaft is rotated with the timing chain removed and the piston at the top dead center position, the valve may contact the piston and the engine could be damaged. When rotating the camshaft with the timing chain removed, rotate it after lowering the piston from the top dead center position.
- When rotating the camshaft using a wrench on the cast hexagon, the wrench may contact the rocker arm and damage the rocker arm. To prevent damage to the rocker arm when holding the camshaft on the cast hexagon, use the wrench at engine rear side as shown in the figure to secure a clearance between the cam.

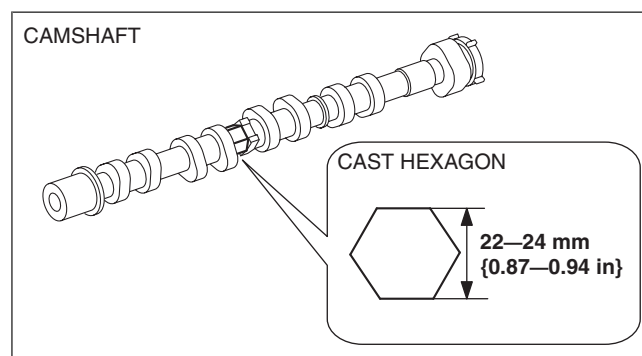


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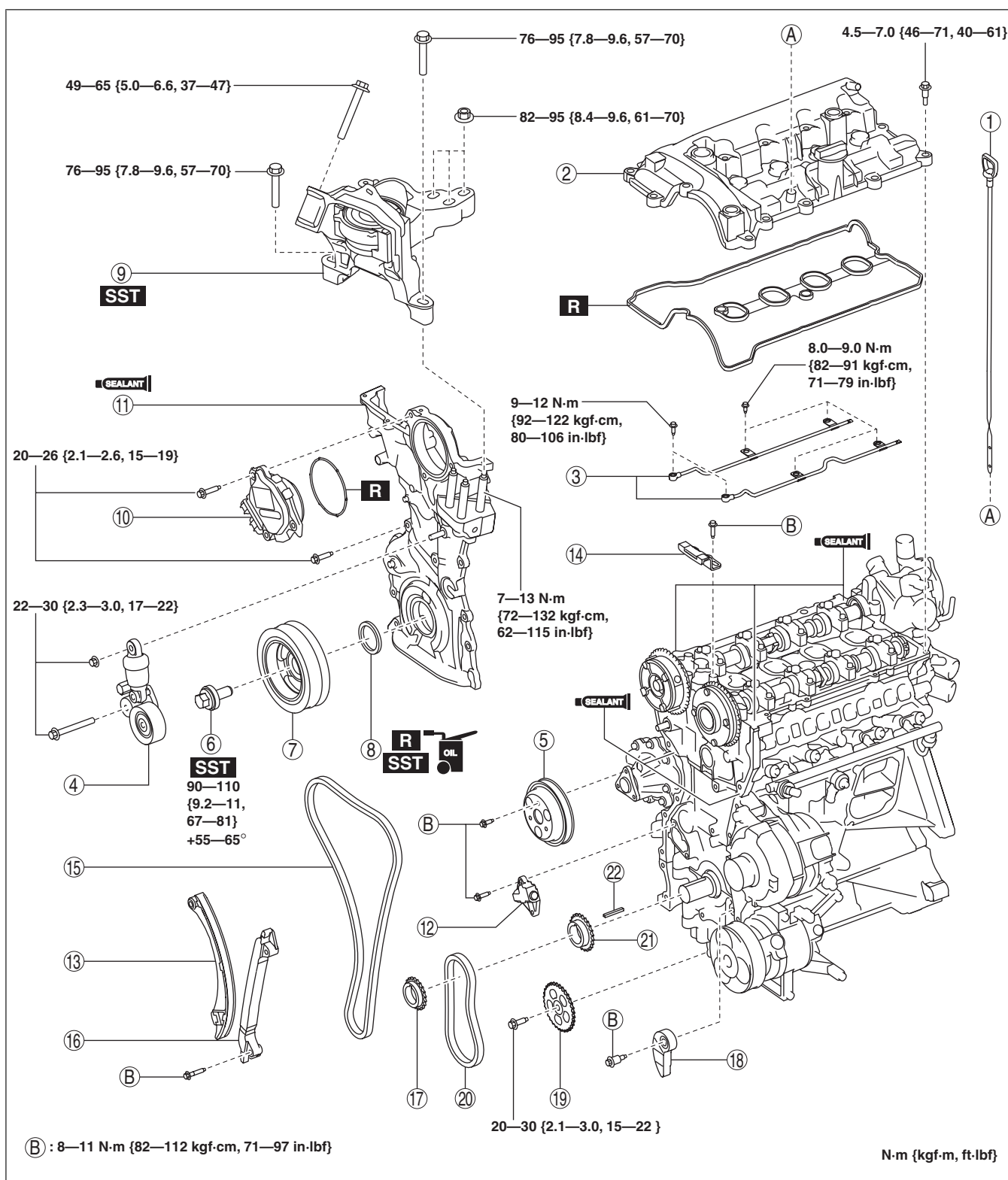
Note

- Width at the cast hexagon of the camshaft is 22—24 mm {0.87—0.94 in}.

1. Disconnect the negative battery cable. (See NEGATIVE BATTERY CABLE DISCONNECTION/ CONNECTION [SKYACTIV-G 2.0].) (See NEGATIVE BATTERY CABLE DISCONNECTION/ CONNECTION [SKYACTIV-G 2.0 (WITHOUT i-stop)].)
2. Remove the plug hole plate. (See PLUG HOLE PLATE REMOVAL/INSTALLATION [SKYACTIV-G 2.0].)
3. Remove the ignition coil/ion sensors. (See IGNITION COIL/ION SENSOR REMOVAL/INSTALLATION [SKYACTIV-G 2.0].)
4. Remove the front under cover No.2. (See FRONT UNDER COVER No.2 REMOVAL/INSTALLATION.)
5. Remove the splash shield. (See SPLASH SHIELD REMOVAL/INSTALLATION.)
6. Remove the drive belt. (See DRIVE BELT REMOVAL/INSTALLATION [SKYACTIV-G 2.0].)
7. Drain the engine oil. (See ENGINE OIL REPLACEMENT [SKYACTIV-G 2.0].)
8. Remove the oil pan. (See OIL PAN REMOVAL/INSTALLATION [SKYACTIV-G 2.0].)
9. Remove in the order indicated in the table.
10. Install in the reverse order of removal.
11. Refill with the specified type and amount of the engine oil. (See ENGINE OIL REPLACEMENT [SKYACTIV-G 2.0].)
12. Start the engine and inspect the following:
 - Leakage of engine oil.
 - Runout and contact of pulley and belt.
 - Ignition timing, idle speed and idle mixture. (See ENGINE TUNE-UP [SKYACTIV-G 2.0].)



ac5wzw00003213



1	Dipstick
2	Cylinder head cover (See Cylinder Head Cover Removal Note.) (See Cylinder Head Cover Installation Note.)
3	Oil shower pipe (See Oil Shower Pipe Installation Note.)
4	Drive belt auto tensioner (See Drive Belt Auto Tensioner Installation Note.)
5	Water pump pulley (See Water Pump Pulley Removal Note.) (See Water Pump Pulley Installation Note.)

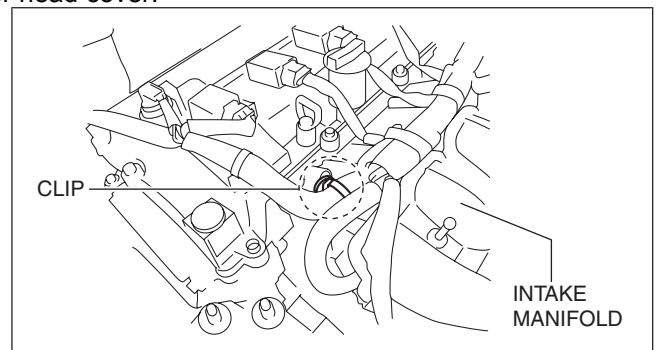
6	Crankshaft pulley lock bolt (See Crankshaft Pulley Lock Bolt Removal Note.) (See Crankshaft Pulley Lock Bolt Installation Note.)
7	Crankshaft pulley
8	Front oil seal (See FRONT OIL SEAL REPLACEMENT [SKYACTIV-G 2.0].)
9	No.3 engine mount (See No.3 Engine Mount Removal Note.) (See No.3 Engine Mount Installation Note.)

10	Electric variable valve timing motor/driver (See Electric Variable Valve Timing Motor/Driver Installation Note.)
11	Engine front cover (See Engine Front Cover Removal Note.) (See Engine Front Cover Installation Note.)
12	Chain tensioner (See Timing Chain Removal Note.) (See Timing Chain Installation Note.)
13	Tensioner arm (See Timing Chain Removal Note.) (See Timing Chain Installation Note.)
14	Chain guide (No.1) (See Timing Chain Removal Note.) (See Timing Chain Installation Note.)

15	Timing chain (See Timing Chain Removal Note.) (See Timing Chain Installation Note.)
16	Chain guide (No.2)
17	Crankshaft sprocket
18	Oil pump chain tensioner
19	Oil pump driven sprocket (See Oil Pump Driven Sprocket Removal Note.) (See Oil Pump Driven Sprocket Installation Note.)
20	Oil pump chain
21	Oil pump drive sprocket
22	Key

Cylinder Head Cover Removal Note

1. Disconnect the OCV connector.
2. Remove the wiring harness clips secured to the cylinder head cover.
3. Remove the wiring harness clip secured to the intake manifold as shown in the figure, and set the wiring harness aside.
4. Disconnect the ventilation hose.
5. Disconnect the brake vacuum hose from the intake manifold and set it aside.
6. Remove the cylinder head cover.



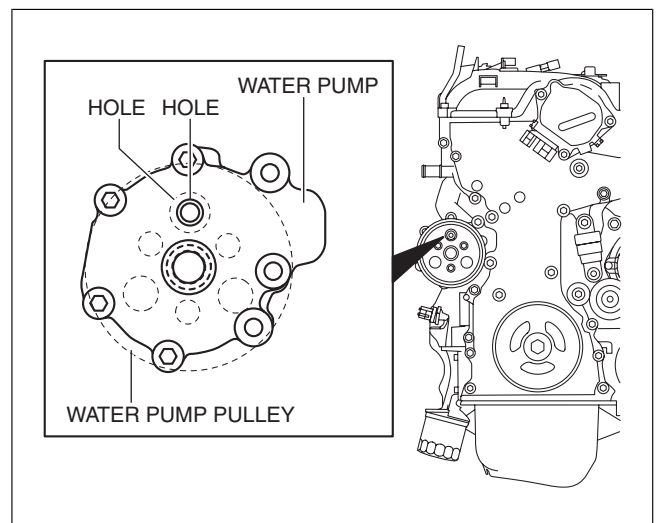
ac5wzw00003215

Water Pump Pulley Removal Note

Caution

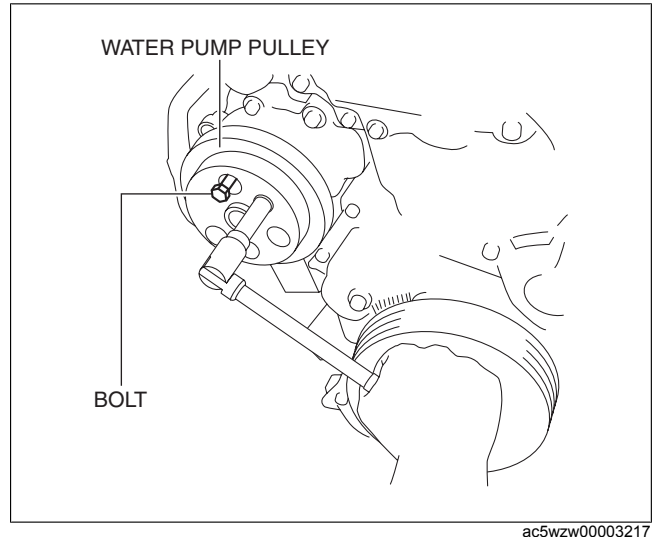
- Be careful not to damage the belt groove and surface of the water pump pulley when using tools, otherwise it will cause wear, breakage, abnormal noise of the drive belt (stretch belt), damage to the pulley, and rust.

1. Align the water pump pulley hole with the water pump hole as shown in the figure.



ac5wzw00003216

2. Insert an appropriate bolt (length **approx. 70 mm {2.8 in}**) into the water pump hole as shown in the figure, and lock the water pump pulley against rotation.
3. Remove the water pump pulley.
4. Remove the bolt used for locking the water pump pulley against rotation.



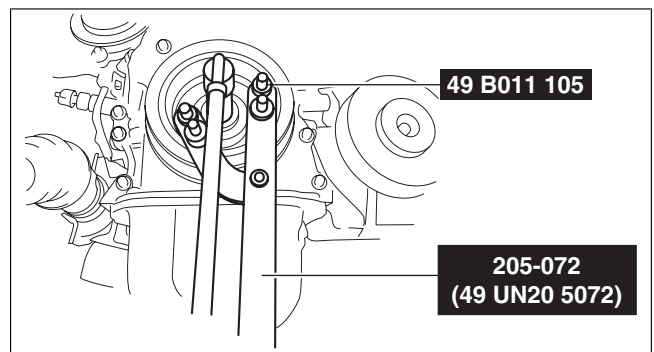
ac5wzw00003217

Crankshaft Pulley Lock Bolt Removal Note

Caution

- To prevent damage to the crankshaft pulley, protect the crankshaft pulley with a clean cloth so that the bar part (205-072) of the SST does not contact the crankshaft pulley.
- To prevent damage to the engine front cover, be careful not to allow the tab part (49 B011 105) of the SST to get caught between the crankshaft pulley and the engine front cover.

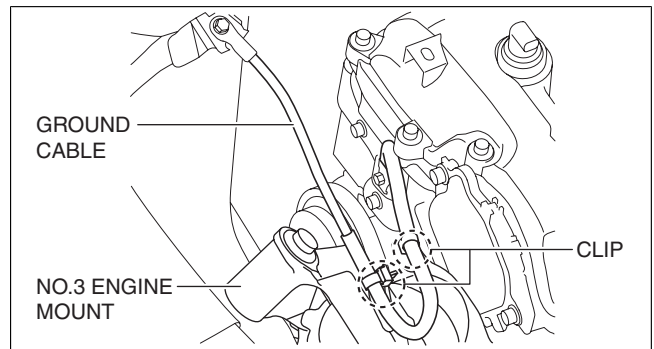
1. Install the **SST** to the crankshaft pulley, and lock the crankshaft against rotation.
2. Remove the crankshaft pulley lock bolt.



ac5wzw00003218

No.3 Engine Mount Removal Note

1. Remove the clips shown in the figure and set the ground cable aside.



ac5wzw00003219

2. Install the **SST** using **part number 99794 1025** or an **M10 x 1.25**, length **25 mm {0.98 in}** bolt as shown in the figure.

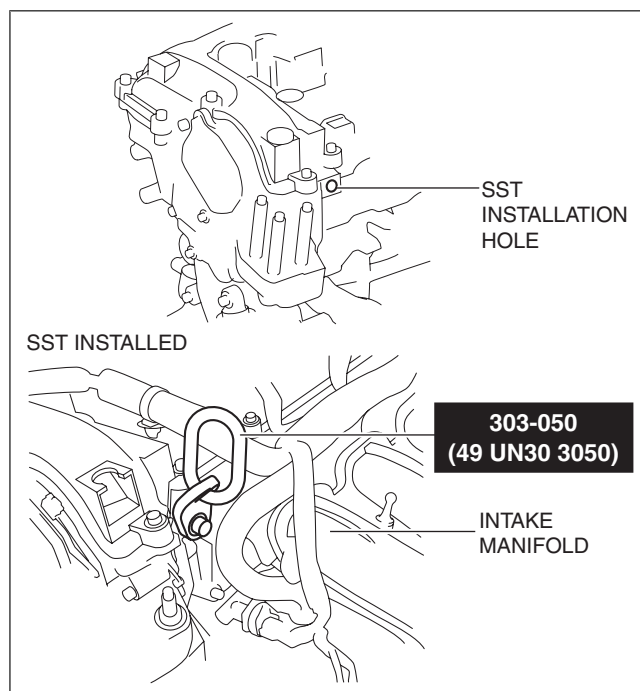
Caution

- Slots have been adopted for the No.3 engine mount installation holes. If the No.3 engine mount is deviated from the original position when installing the No.3 engine mount, engine noise or vibration could increase. Before removing the No.3 engine mount, place alignment marks on the No.3 engine mount and body so that they can be assembled to the same positions as before removal.

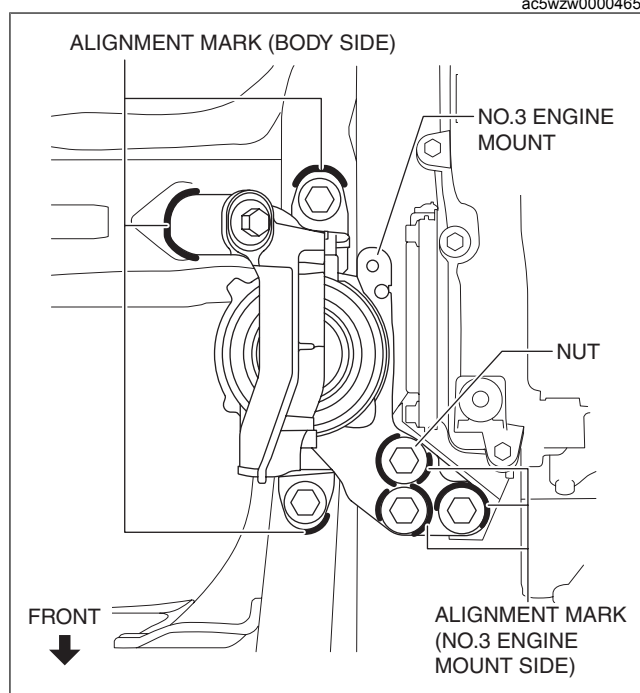
3. Place alignment marks on the locations shown in the figure so that they can be assembled to the same positions as before removal.

Note

- Paint so that the No.3 engine mount is framed on the body side and the outline of the nut is framed on the No.3 engine mount side.



ac5wzw00004655



ac5wzw00003221

4. Install the **SST** using the following procedures.

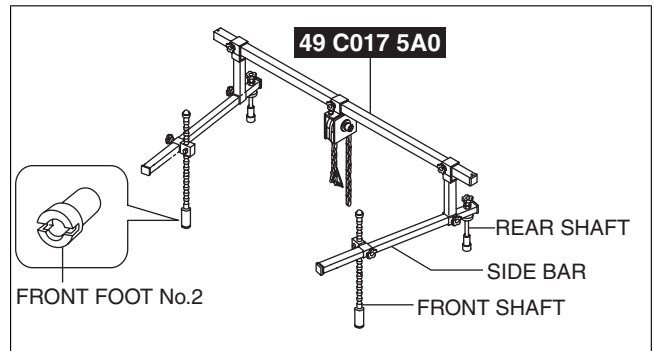
Caution

- Refer to the **SST instruction manual** for the basic handling procedure.

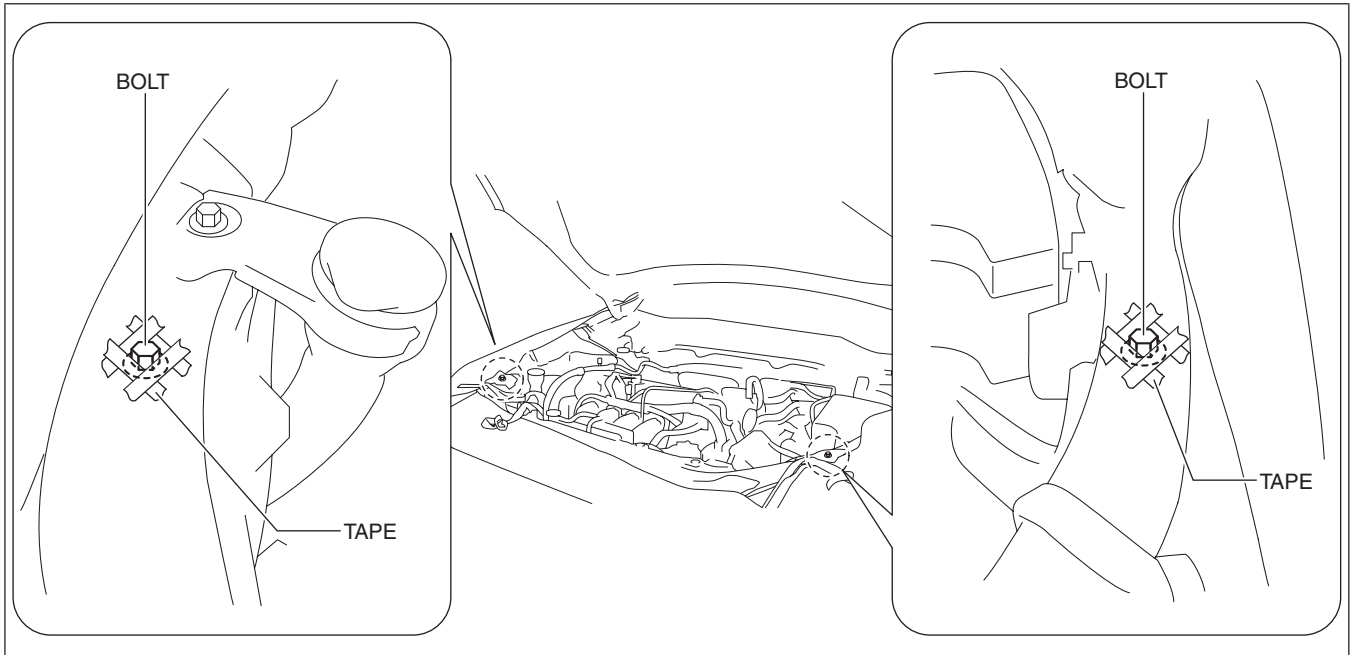
Note

- Install front feet No. 2 to the left and right front shafts of the **SST**.

- (1) Protect the positions shown in the figure using tape.

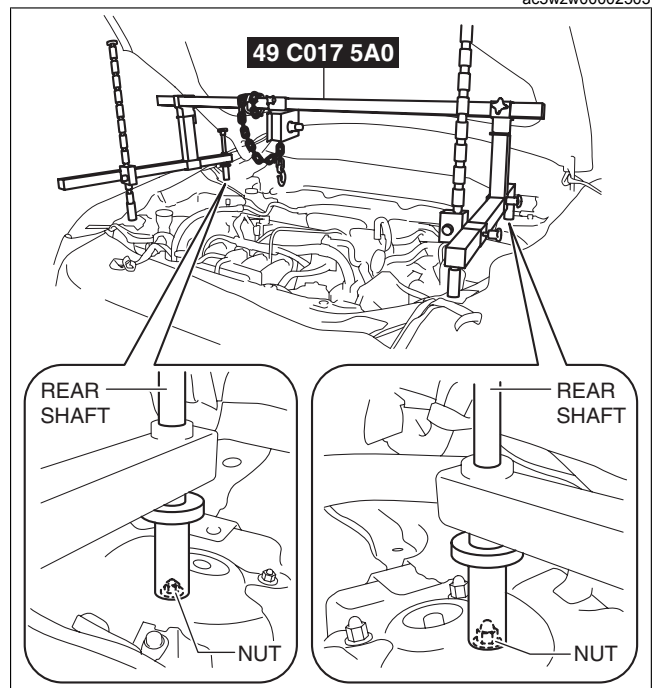


ac5wzw00003222



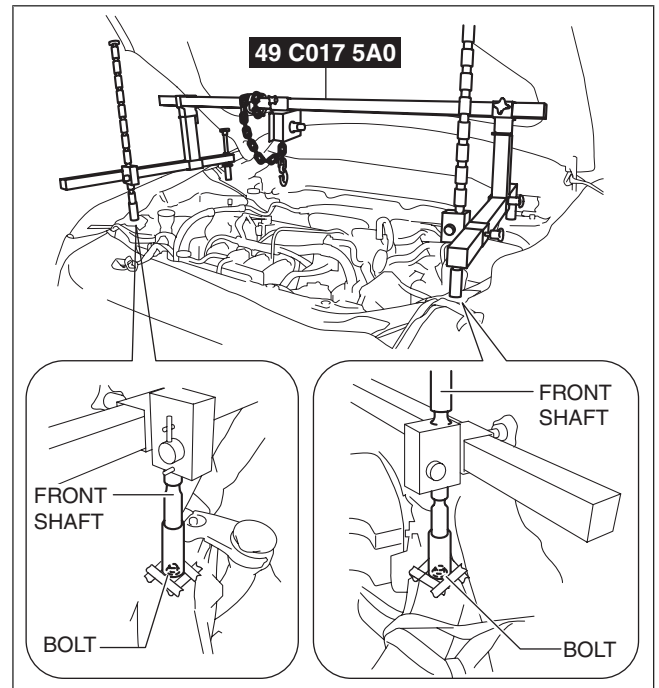
ac5wzw00002503

- (2) As shown in the figure, set the rear shafts of the **SST** to the left and right shock absorber nuts.



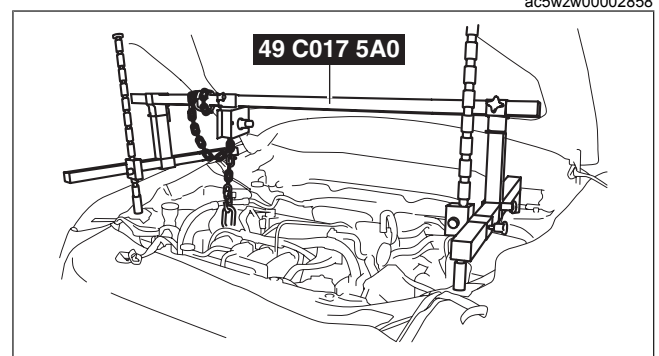
ac5wzw00003223

- (3) As shown in the figure, set the front shafts of the SST to the left and right bolts.



ac5wzw00002858

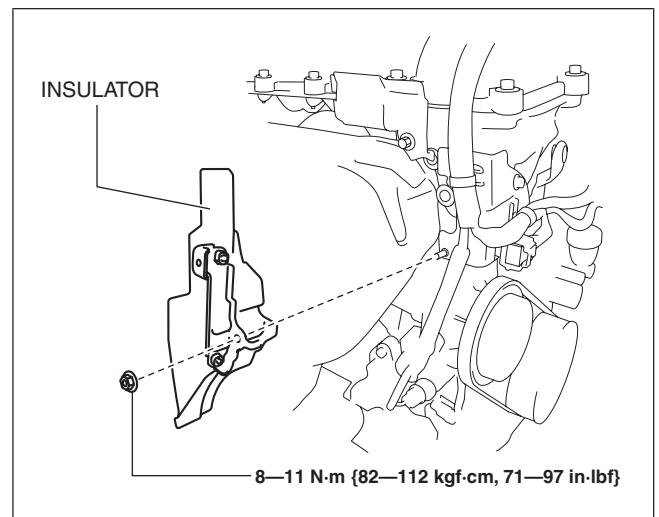
- (4) Adjust the height of the left and right side bars of the **SST** so that they are leveled, then tighten each part.
- (5) Apply tension to the chain to hold the engine.
5. Remove the No.3 engine mount.



ac5uuw00000631

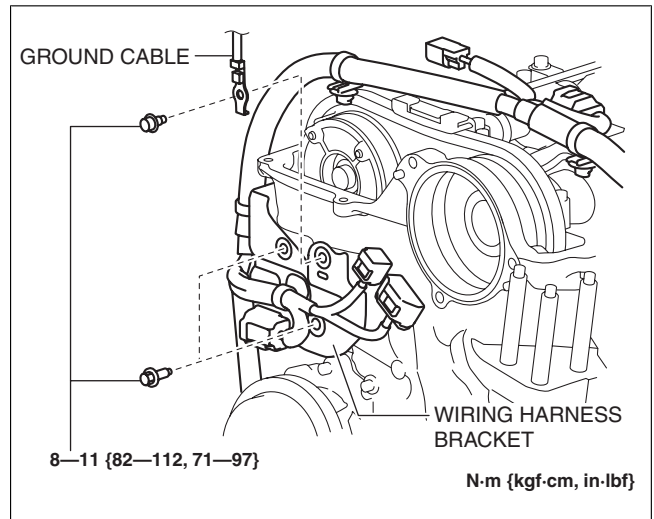
Engine Front Cover Removal Note

1. Remove the insulator shown in the figure.



ac5wzw00003224

2. Set the ground cable and wiring harness bracket shown in the figure aside.
3. Remove the engine front cover installation bolts.

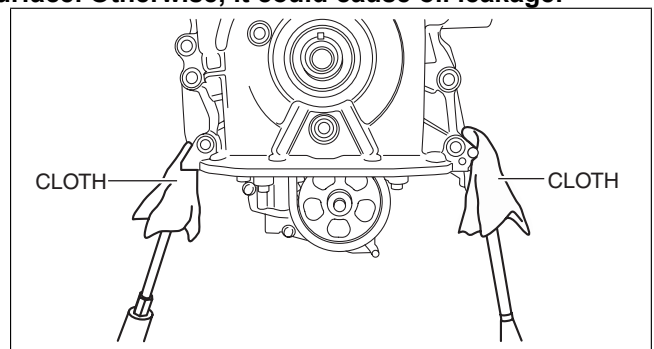


ac5wzw00003225

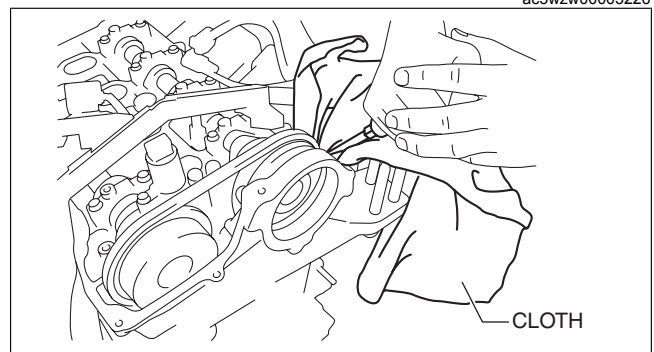
4. Using a screwdriver wrapped in a cloth, peel the sealant away a little at a time, and remove the engine front cover.

Caution

- Do not apply excessive force to the screwdriver. Otherwise, the engine front cover could be damaged.
- Be careful not to scratch or damage the seal surface. Otherwise, it could cause oil leakage.



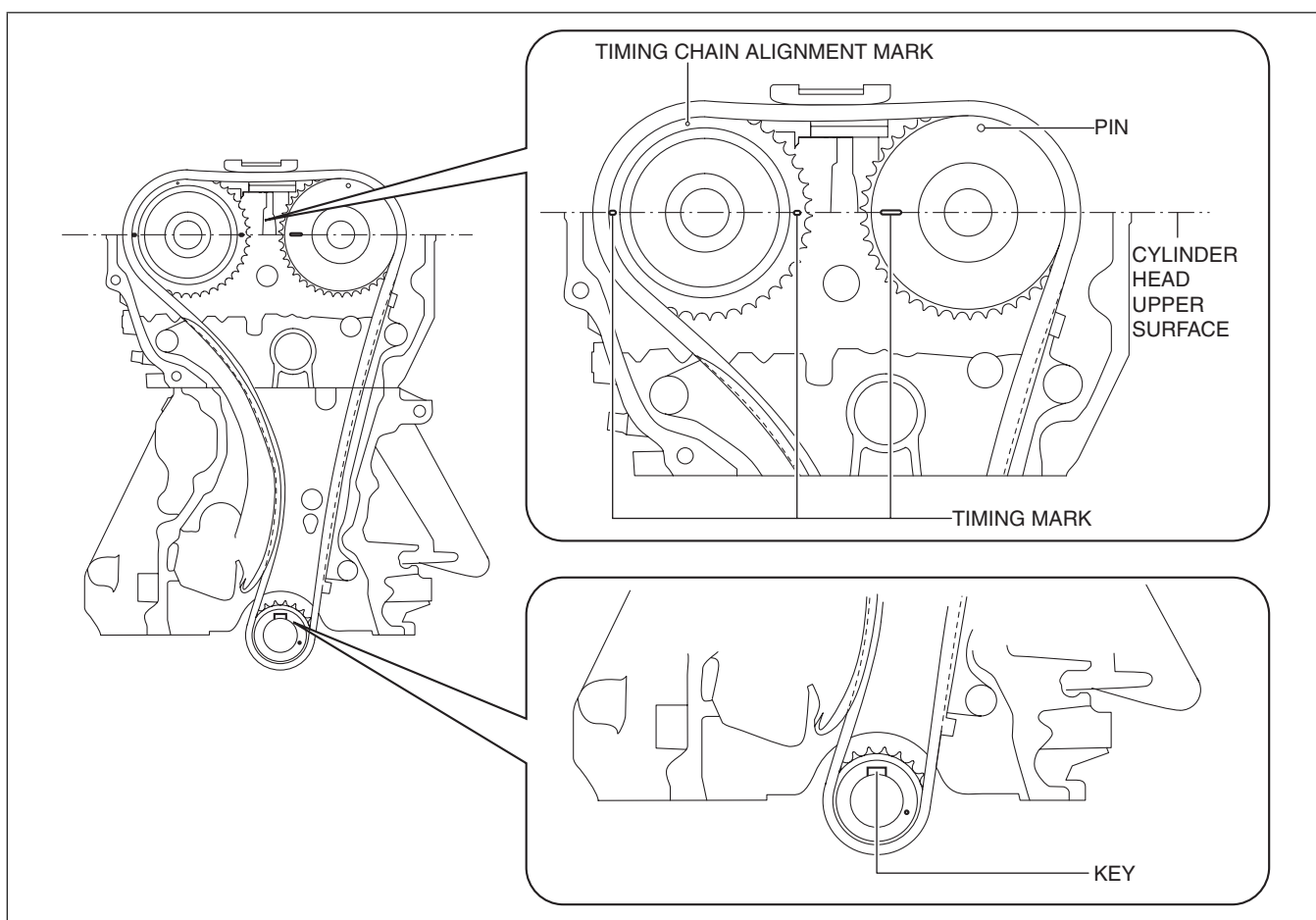
ac5wzw00003226



ac5wzw00003227

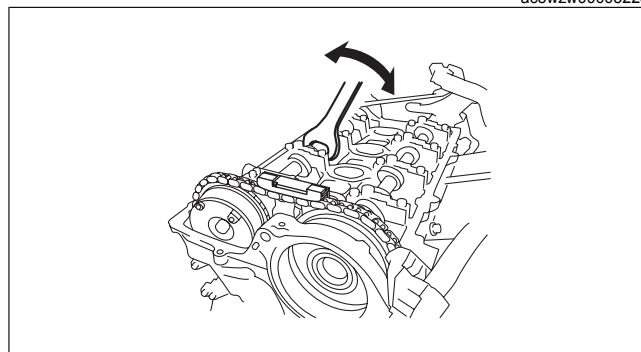
Timing Chain Removal Note

1. Rotate the crankshaft clockwise to align the timing marks and the key position as shown in the figure, and set cylinder No.1 at top dead center (TDC).



ac5wzw00003228

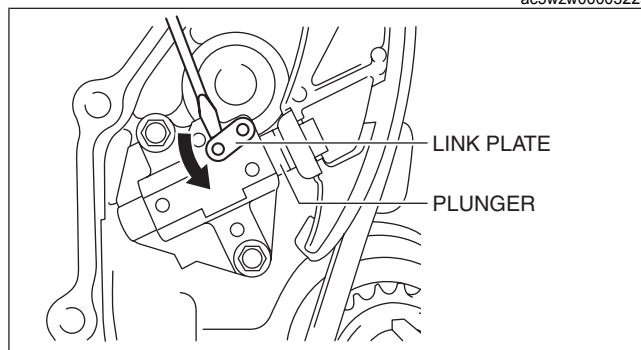
2. While moving the exhaust camshaft back and forth in the direction of the arrow using a wrench on the cast hexagon, press down the link plate of the timing chain tensioner using a precision screwdriver and release the plunger lock.



ac5wzw00003229

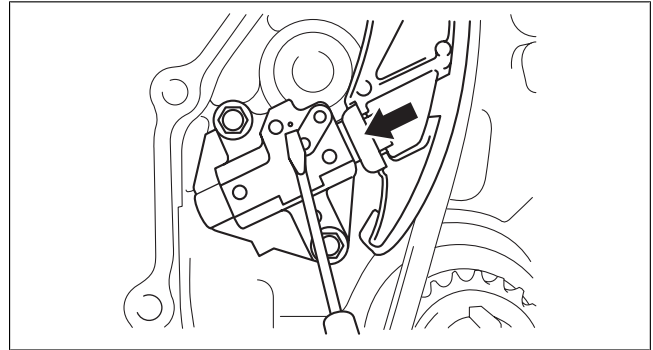
Note

- When moving the exhaust camshaft back and forth, the timing chain pushes the plunger in the chain tensioner making it easier to operate the link plate.



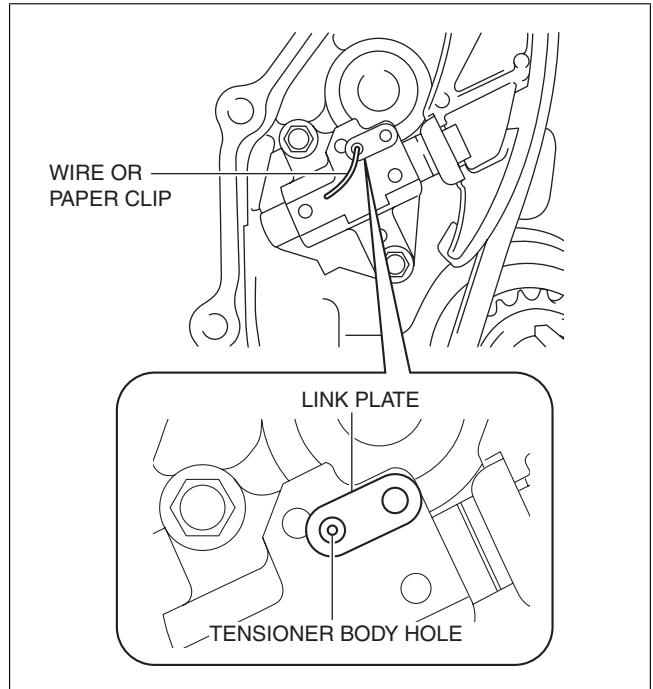
ac5wzw00003230

3. Push back the plunger slowly in the direction shown in the figure with the link plate still pushed down.
4. Remove the screwdriver from the link plate with the plunger still pushed down.
5. Release the force slightly from the plunger, and move it back and forth **2—3 mm {0.08—0.11 in}**.



ac5wzw00003231

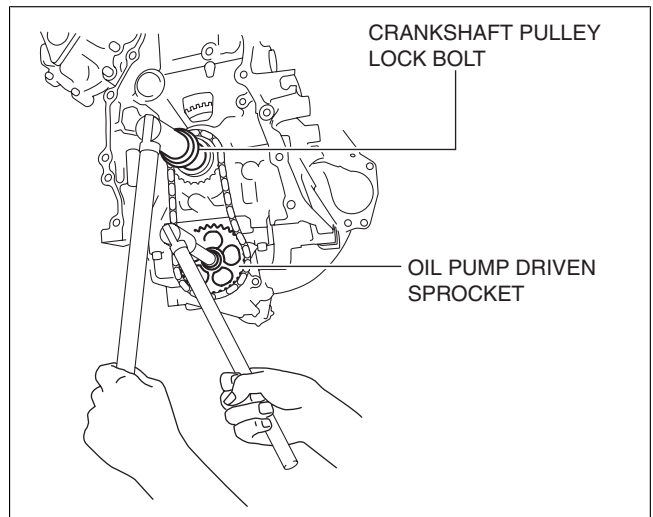
6. Insert a wire with an **approx. diameter of 1.5 mm {0.059 in}** or a paper clip where the link plate hole and the tensioner body hole overlap to secure the link plate and lock the plunger.
7. Remove the chain tensioner, tensioner arm, and the chain guide (No.1).
8. Remove the timing chain.



ac5wzw00003232

Oil Pump Driven Sprocket Removal Note

1. Temporarily assemble the crankshaft pulley lock bolt, and lock the oil pump against rotation as shown in the figure.
2. Remove the oil pump driven sprocket.
3. Remove the temporarily assembled crankshaft pulley lock bolt.



ac5wzw00003233

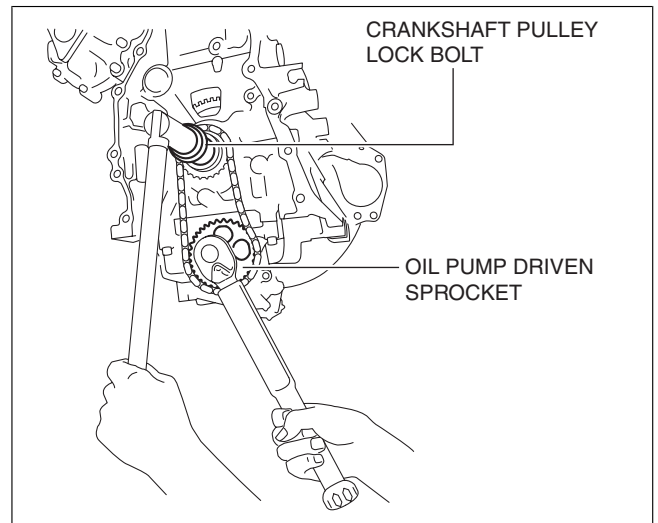
Oil Pump Driven Sprocket Installation Note

1. Temporarily assemble the crankshaft pulley lock bolt, and lock the oil pump against rotation as shown in the figure.
2. Install the oil pump driven sprocket.

Tightening torque

20—30 N·m {2.1—3.0 kgf·m, 15—22 ft·lbf}

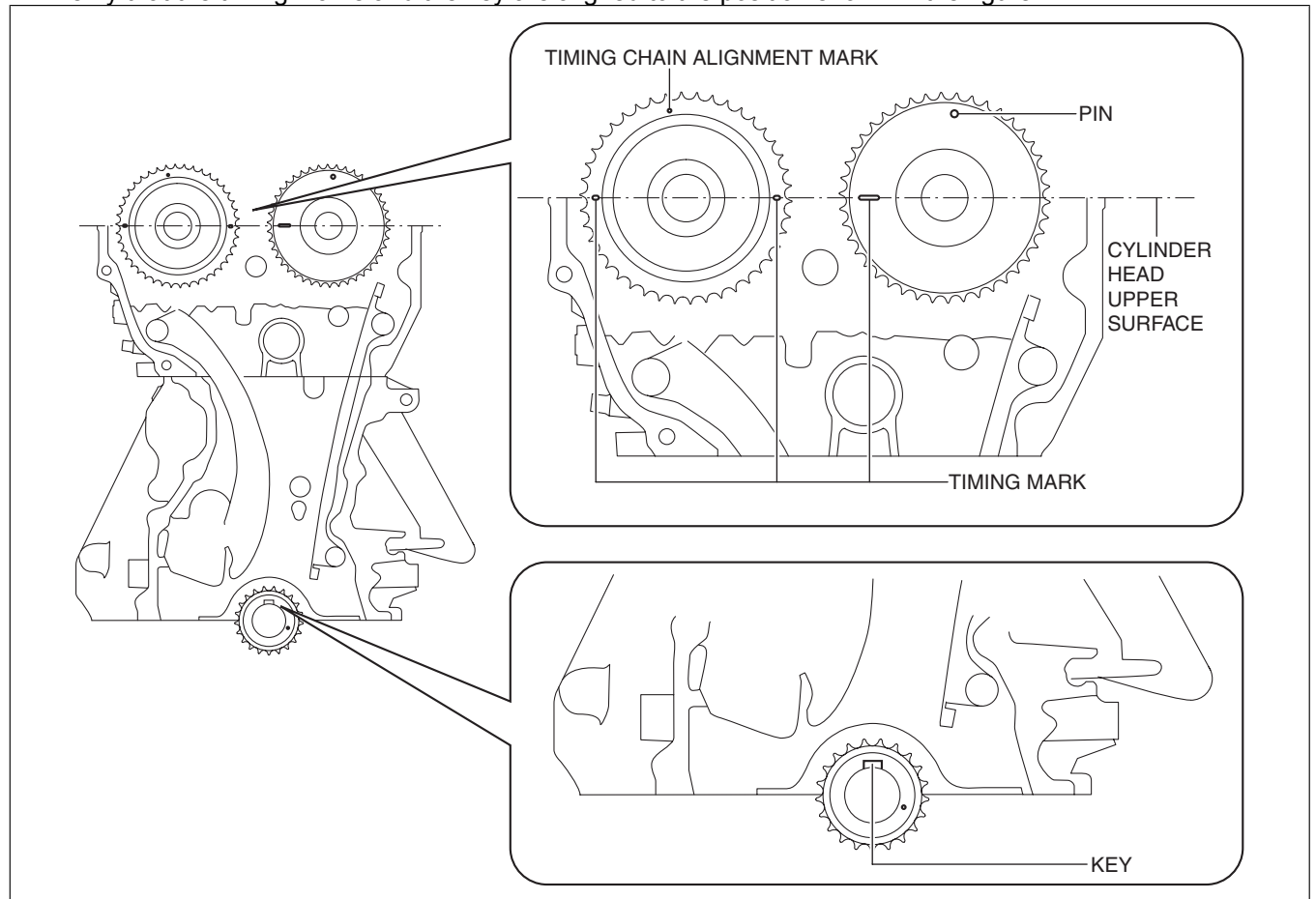
3. Remove the temporarily assembled crankshaft pulley lock bolt.



ac5wzw00003234

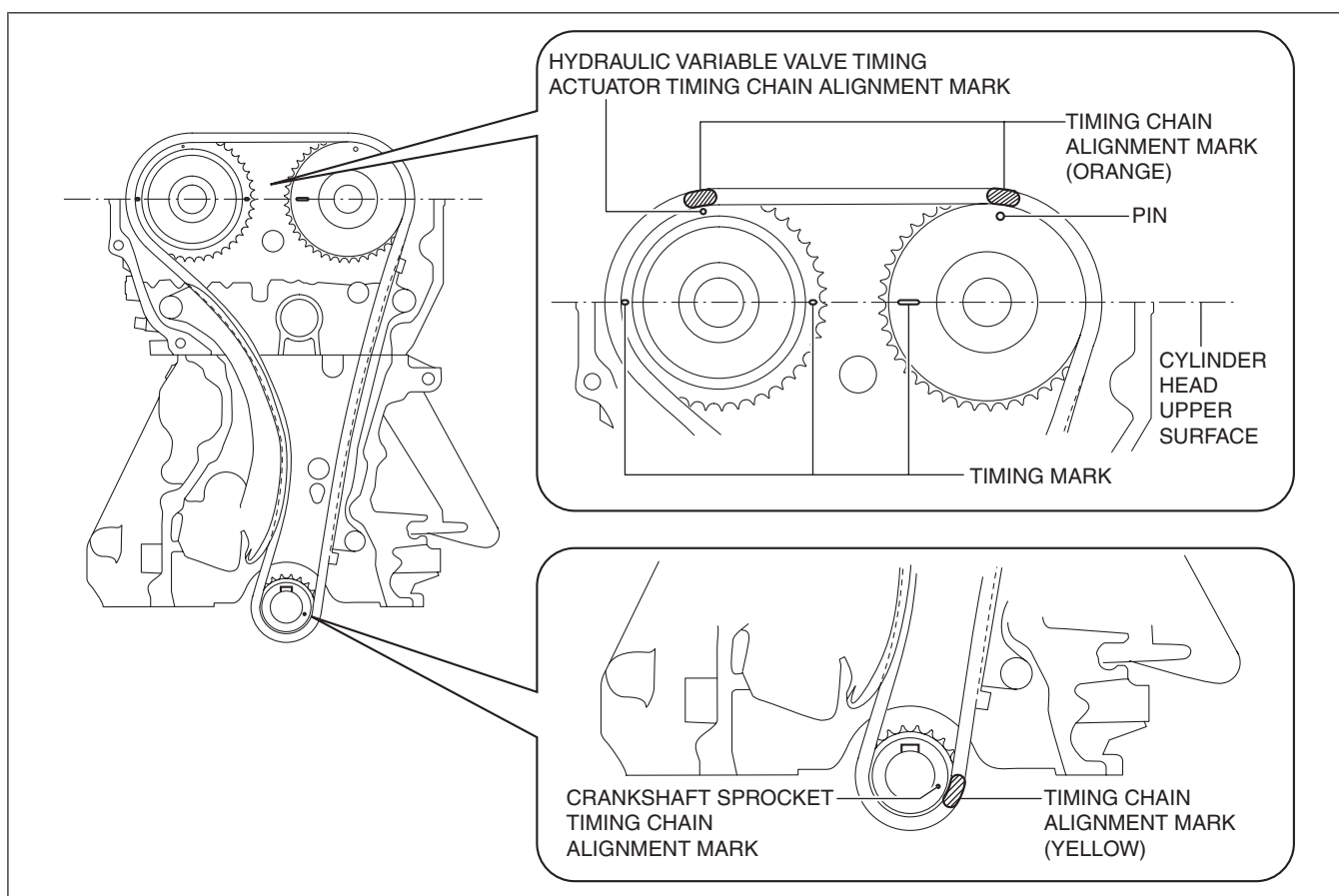
Timing Chain Installation Note

1. Verify that the timing marks and the key are aligned to the position shown in the figure.



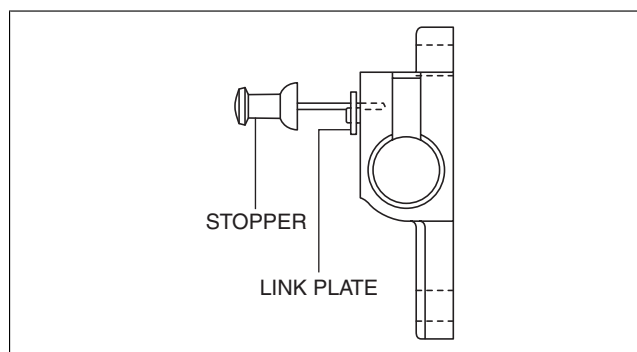
ac5wzw00003235

- If they are not in the position shown in the figure, rotate the camshaft and crankshaft to set the cylinder No. 1 top dead center (TDC).
2. Install the timing chain while aligning the marks on each sprocket and the timing chain as shown in the figure.



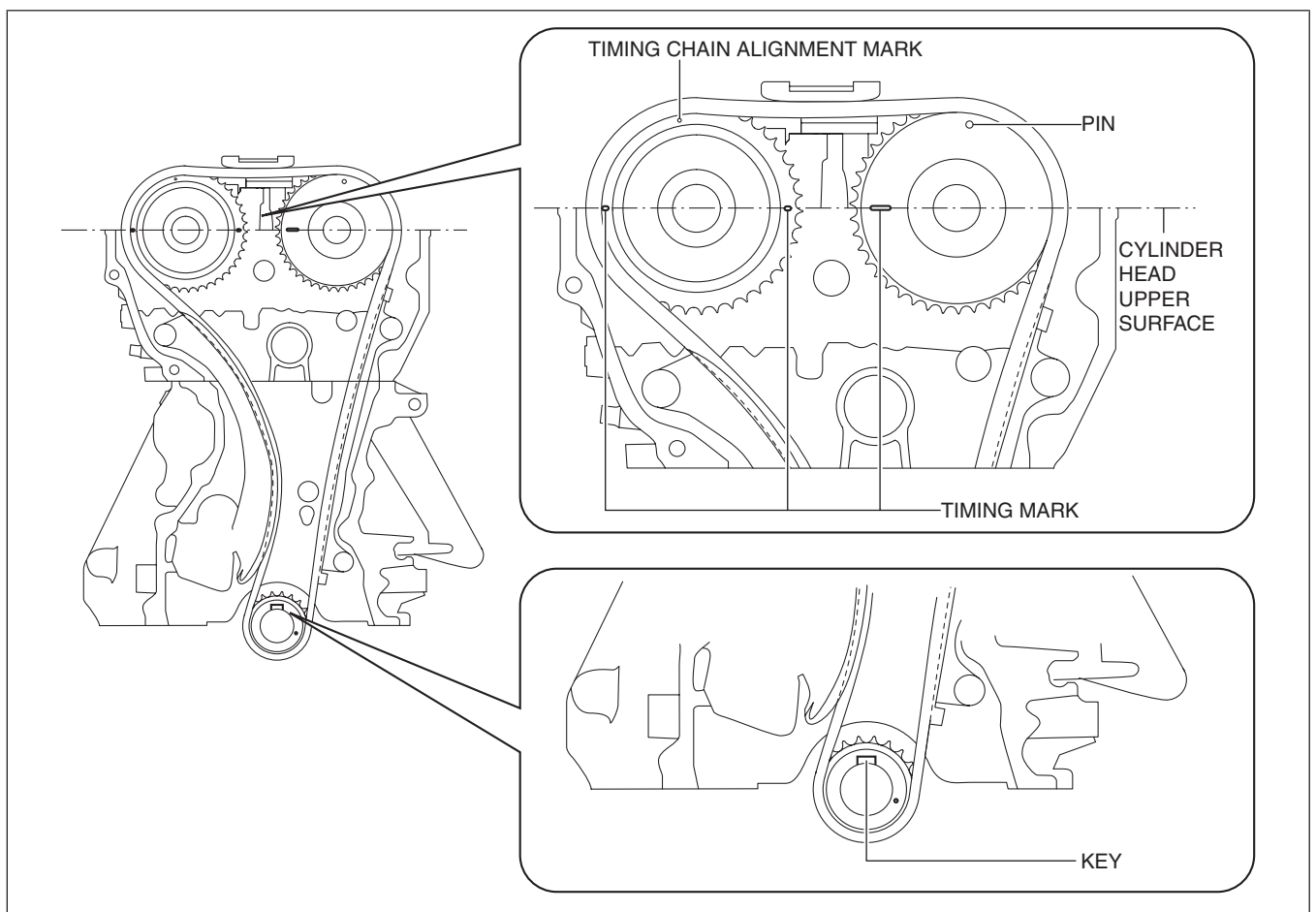
ac5wzw00003236

3. Install the chain guide (No.1).
4. Install the tensioner arm.
5. Install the chain tensioner.
6. After installing the chain tensioner, remove the installed wire or paper clip, and then apply tension to the timing chain.
 - If a new chain tensioner is used, remove the installed stopper.
7. Verify that there is no looseness in the timing chain, and re-verify that each sprocket is in the specified location.



ac5wzw00003237

8. Rotate the crankshaft clockwise two turns and inspect the valve timing.

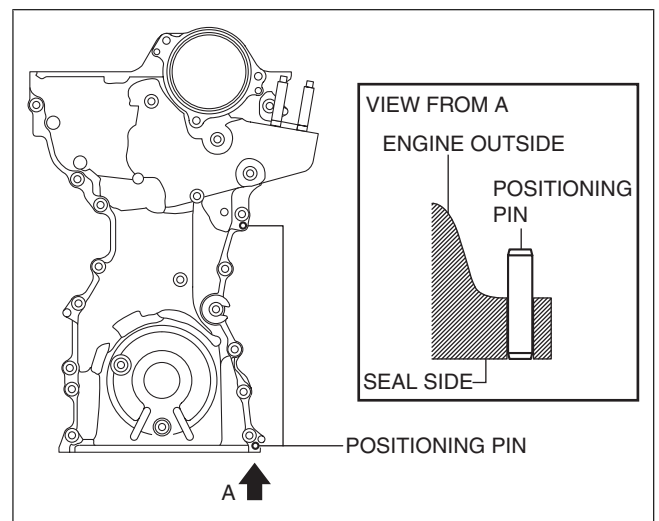


ac5wzw00003228

Engine Front Cover Installation Note

Note

- For a new engine front cover, the positioning pins in the two locations shown in the figure project to the outside of the engine.

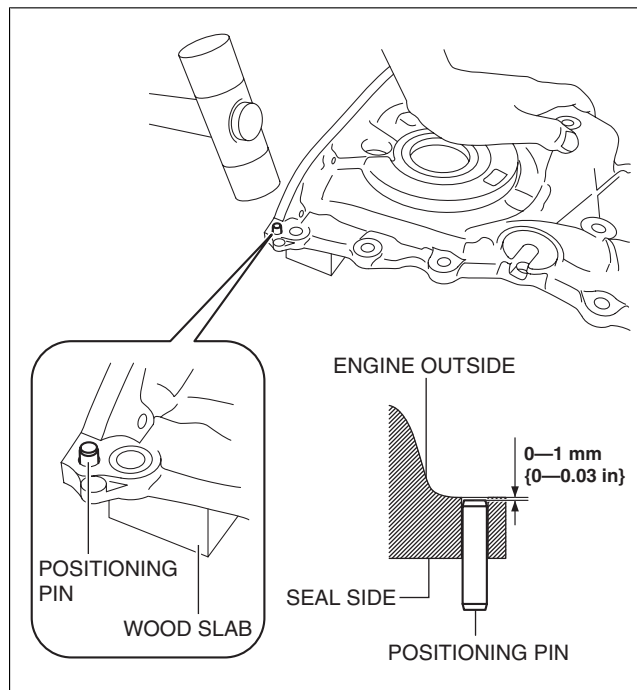


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1. If the engine front cover is newly replaced, tap the positioning pins in the two locations to the seal surface side.
2. Remove oil, dirt, and sealant adhering to the engine front cover, cylinder head, and cylinder block.
3. When reusing an engine front cover installation bolts, remove sealant adhering to the bolts.

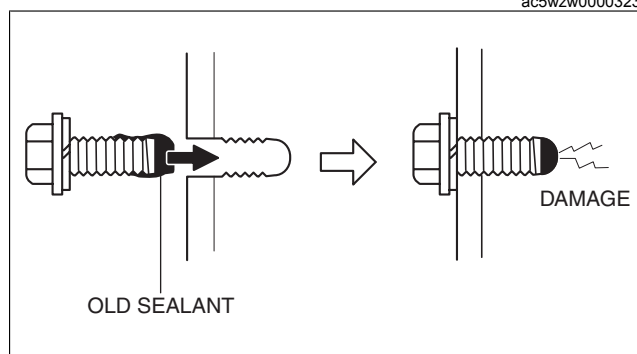
Caution

- Apply the silicon sealant in a single, unbroken line.
- To prevent silicone sealant from hardening, adhere the engine front cover and the cylinder block firmly within 10 min. after applying silicone sealant. After adhering them, tighten the installation bolts immediately.



ac5wzw00003239

- If a bolt with sealant adhering to it is used, it could result in cracks in the cylinder head and cylinder block.



ac5wzw00003240

4. Apply silicone sealant to the engine front cover as shown in the figure.

5. Apply silicone sealant to the areas shown in the figure.

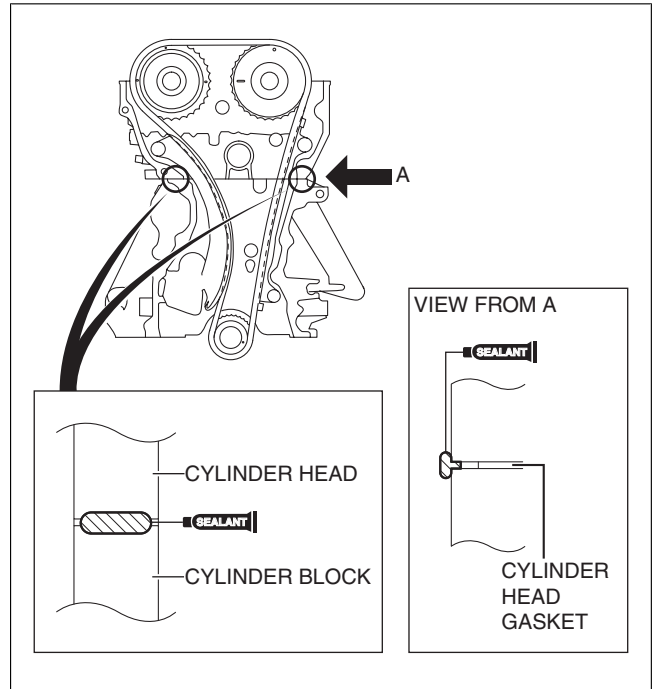
Caution

- **Apply the silicone sealant so that it goes into the cylinder head gasket.**

6. Install the engine front cover to the engine.

Note

- Temporarily install an appropriate bolt to the drive belt auto tensioner installation bolt hole to prevent:
 - A silicone sealant adhesion malfunction in the drive belt auto tensioner installation bolt hole.
 - A bolt mis-installation due to silicone sealant hardening.

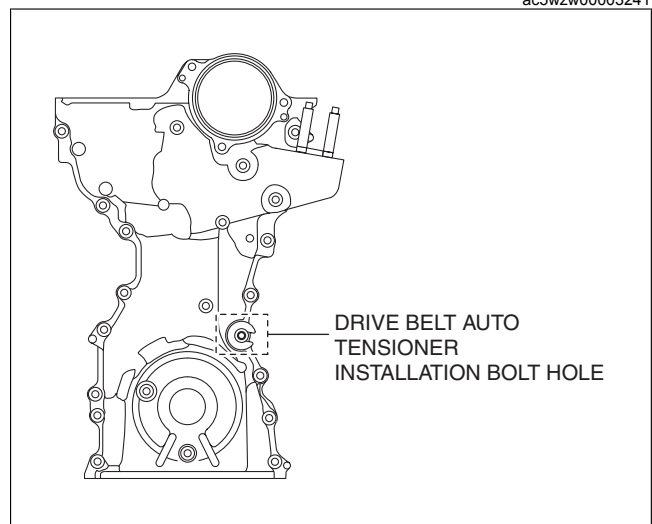


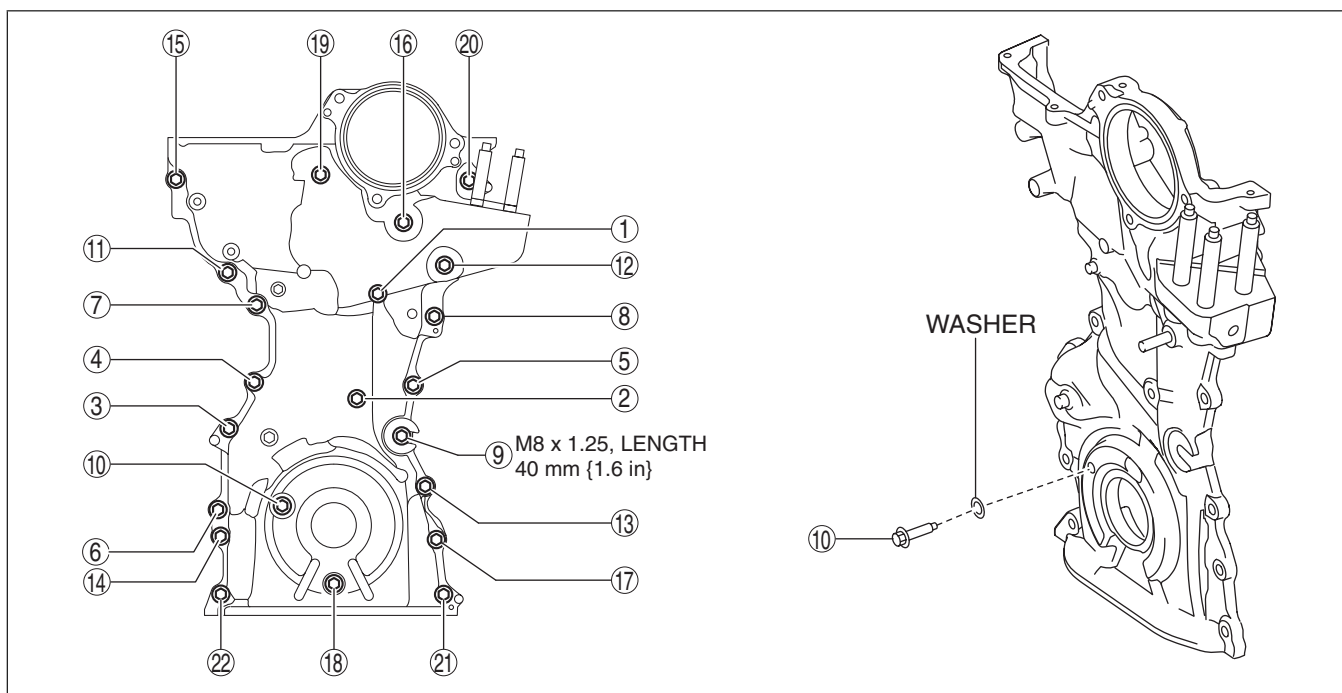
7. Prepare an appropriate **M8 x 1.25** bolt (length **40 mm {1.6 in}**).

Caution

- **For the number 10 bolt of the tightening order, install the bolts with washers.**

8. Tighten the engine front cover installation bolts in the order shown in the figure.



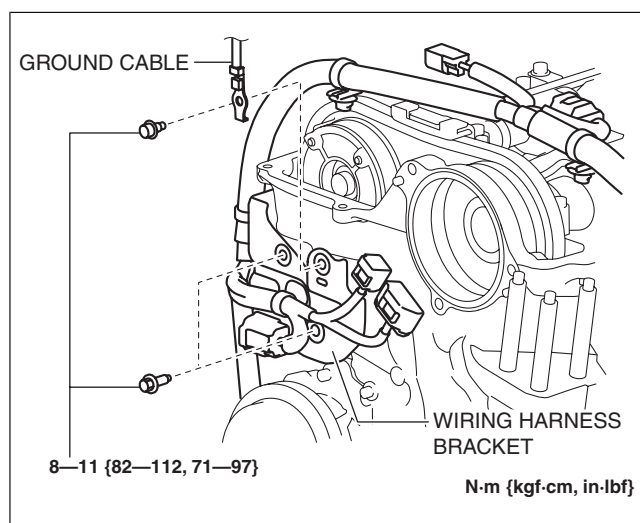


ac5wzw00003242

Tightening torque

20—26 N·m {2.1—2.6 kgf·cm, 15—19 in·lbf}

9. Remove the bolt installed to the drive belt auto tensioner installation bolt hole when installing the drive belt auto tensioner.
10. Install the ground cable and wiring harness bracket shown in the figure.



ac5wzw00003225

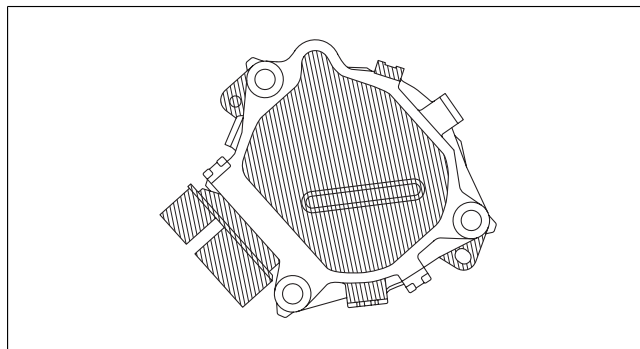
Electric Variable Valve Timing Motor/Driver Installation Note

1. Install a new O-ring to the O-ring installation groove of the engine front cover.

Caution

- To prevent damage to the electric variable valve timing motor/driver, do not apply excessive force (force of 100 N {10.2 kgf, 22.5 lbf} or more) to the shaded areas shown in the figure.

2. Install the electric variable valve timing motor/driver using the following procedures.



ac5wzw00003243

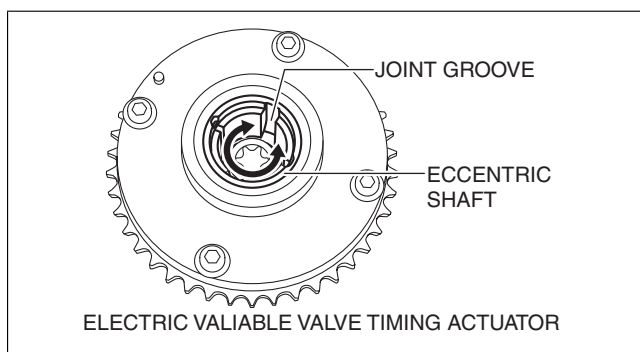
Note

- The eccentric shaft on the electric variable valve timing actuator side can be rotated to the left and right.
- The electric variable valve timing motor/driver can be assembled with the joint groove of the eccentric shaft in any position, and it will not lead to vehicle damage or performance reduction.

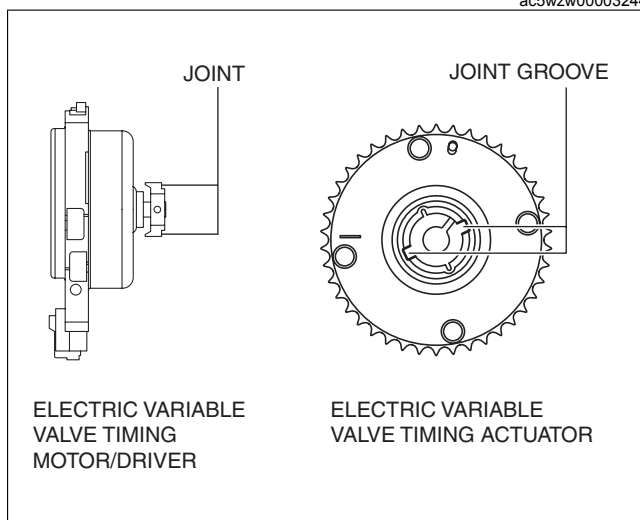
- (1) Before installation, rotate the joint of the end of the electric variable valve timing motor so that it is aligned to the joint groove on the electric variable valve timing actuator side.
- (2) Engage the joint on the end of the electric variable valve timing motor with the joint groove on the electric variable valve timing actuator side.
- (3) Attach the seal surface.
- (4) Tighten the electric variable valve timing motor/driver installation bolts.

Tightening torque

20—26 N·m {2.1—2.6 kgf·m, 15—19 ft·lbf}



ac5wzw00003244



ac5wzw00003245

No.3 Engine Mount Installation Note

Caution

- If the No.3 engine mount is deviated from the original position when installing the No.3 engine mount, engine noise or vibration could increase. When installing the No.3 engine mount, align the alignment mark placed during removal and install it to the original position.

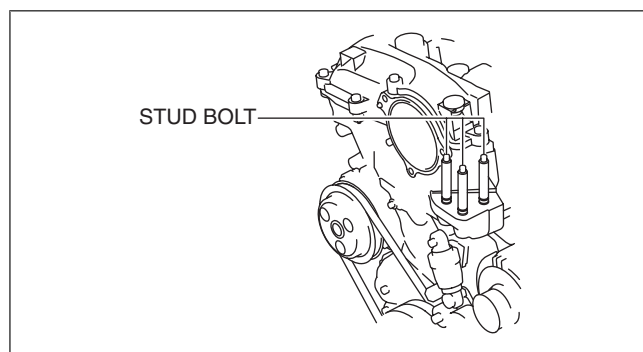
Note

- When replacing the No.3 engine mount, place a mark at the same position as the one placed before removal.
- If the No.3 engine mount nut is loosened, tighten the engine front cover stud bolts because they may be loosened.

1. Tighten the engine front cover stud bolts.

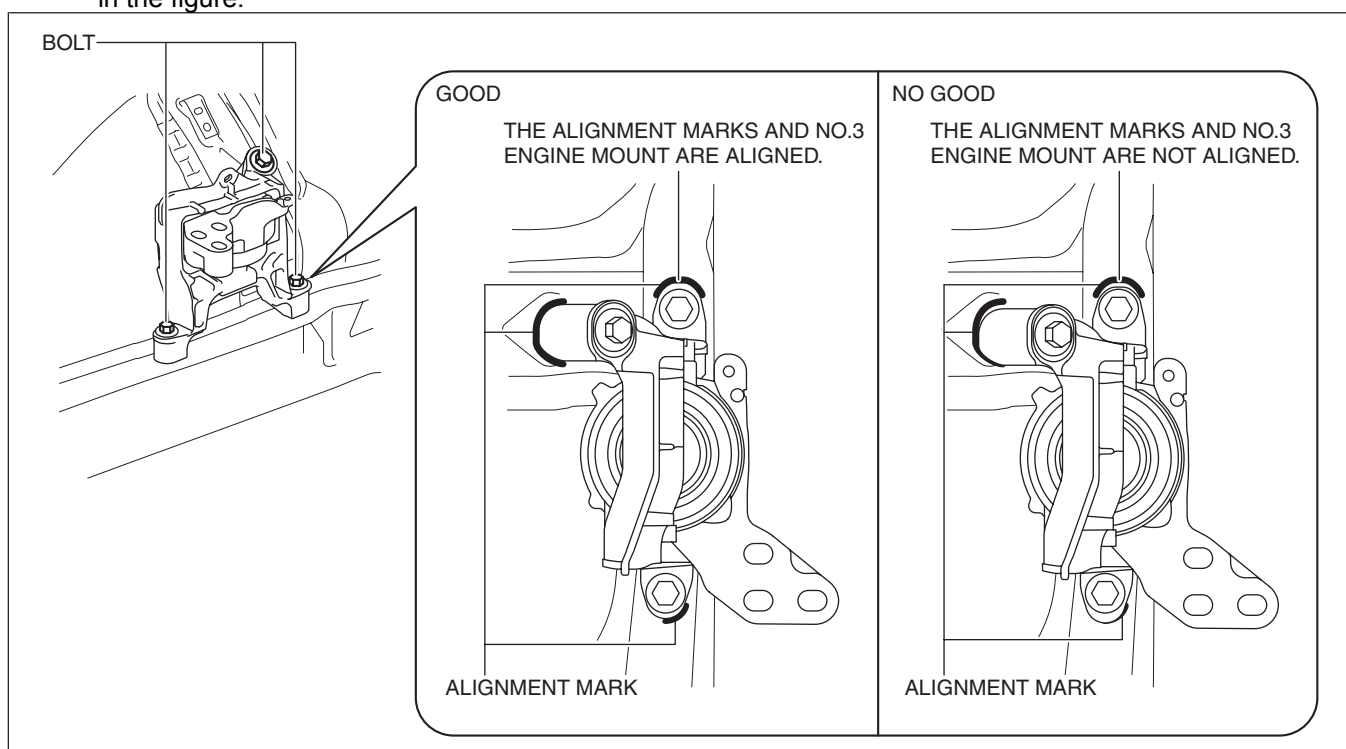
Tightening torque

7—13 N·m {72—132 kgf·cm, 62—115 in·lbf}



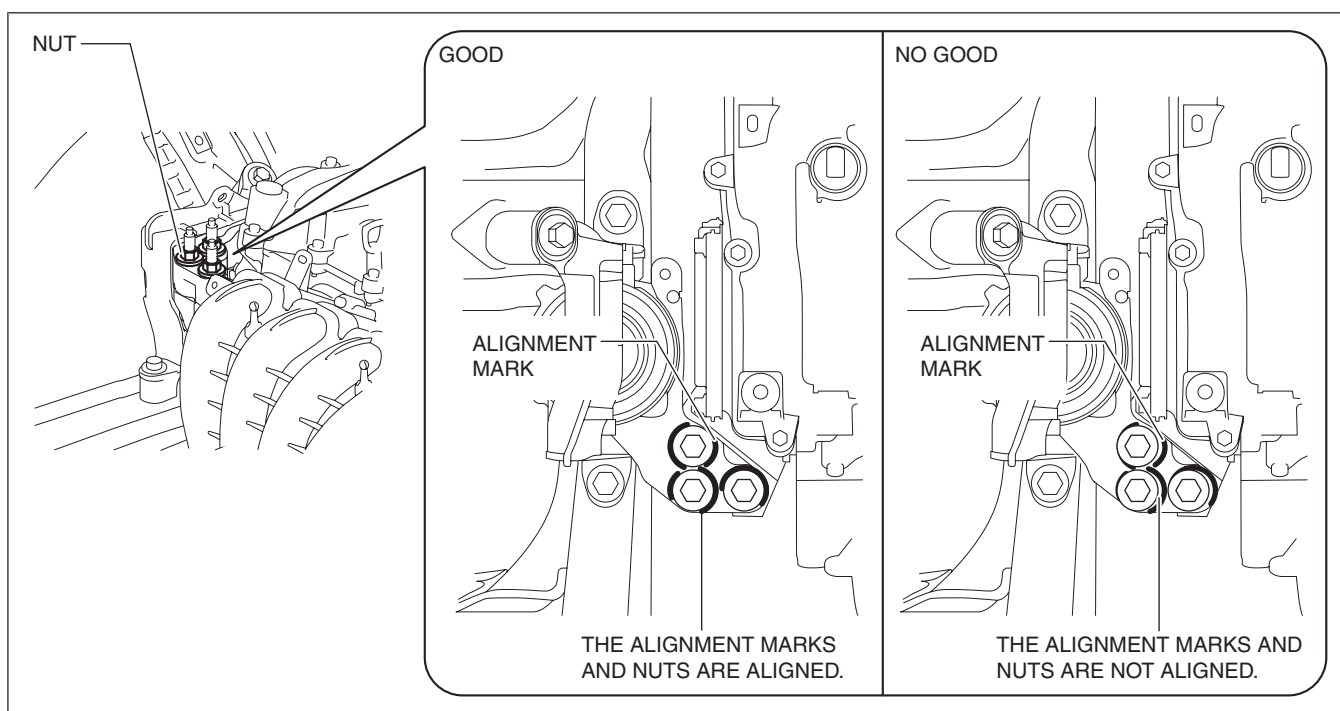
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2. Temporarily tighten the No.3 engine mount installation bolts and nuts using the following procedure:
(1) Align the alignment marks on the body side and No.3 engine mount, and temporarily tighten the bolts shown in the figure.



ac5wzw00005197

- (2) Temporarily tighten the nuts shown in the figure while aligning the alignment marks of the No.3 engine mount and nuts.



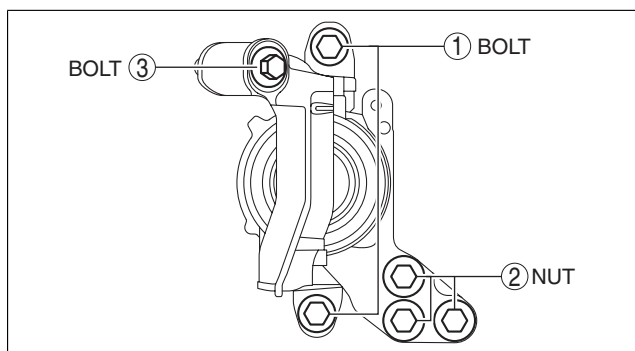
ac5wzw00005198

Note

- If the alignment marks are not aligned, align the alignment marks while slightly moving the engine and temporarily tighten the nuts.

- Tighten the No.3 engine mount installation bolts and nuts in the order as shown in the figure.

No.	Tightening torque
1	76—95 N·m {7.8—9.6 kgf·m, 57—70 ft·lbf}
2	82—95 N·m {8.4—9.6 kgf·m, 61—70 ft·lbf}
3	49—65 N·m {5.0—6.6 kgf·m, 37—47 ft·lbf}



ac5wzw00003249

- Remove the **SST**.
- Install the clip of ground cable to the No.3 engine mount.

Crankshaft Pulley Lock Bolt Installation Note

Caution

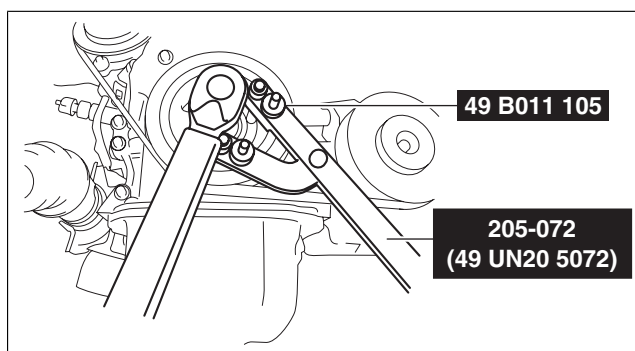
- To prevent damage to the crankshaft pulley, protect the crankshaft pulley with a clean cloth so that the bar part (205-072) of the SST does not contact the crankshaft pulley.
- To prevent damage to the engine front cover, be careful not to allow the tab part (49 B011 105) of the SST to get caught between the crankshaft pulley and the engine front cover.

- Install the **SST** on the crankshaft pulley to lock the crankshaft against rotation.
- Tighten the crankshaft pulley lock bolt in the order shown in the following two steps.

Tightening procedure

Step 1: 90—110 N·m {9.2—11 kgf·m, 67—81 ft·lbf}

Step 2: 55—65°



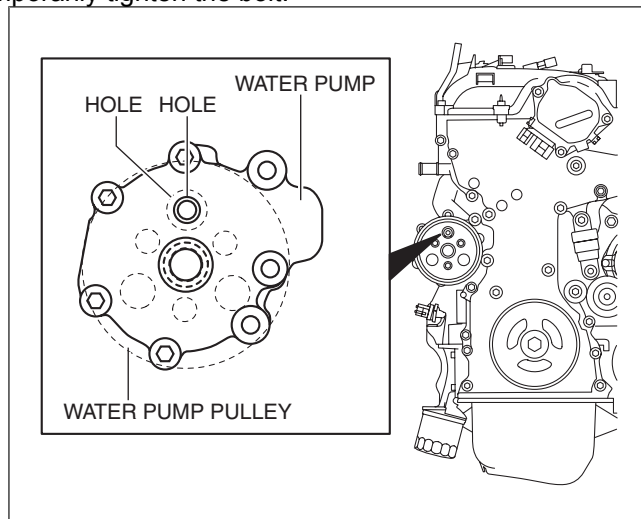
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Water Pump Pulley Installation Note

Caution

- Be careful not to damage the belt groove and surface of the water pump pulley when using tools, otherwise it will cause wear, breakage, abnormal noise of the drive belt (stretch belt), damage to the pulley, and rust.

1. Install the water pump pulley to the water pump and temporarily tighten the bolt.
2. Align the water pump pulley hole with the water pump hole as shown in the figure.



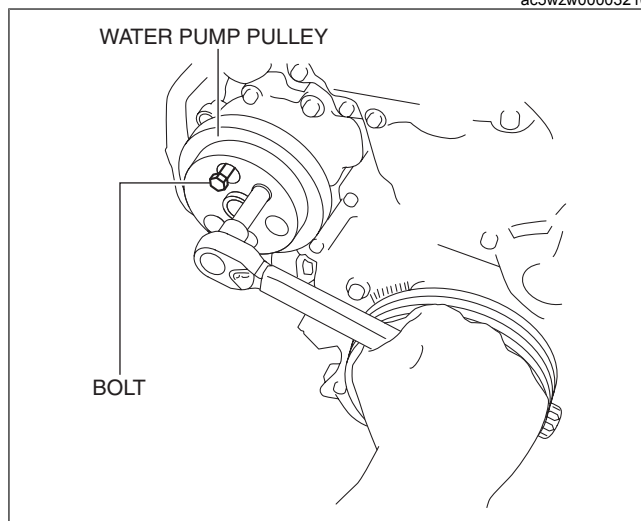
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3. Insert an appropriate bolt (length **70 mm {2.8 in}**) into the water pump hole shown in the figure and lock the water pump pulley against rotation.
4. Completely tighten the water pump pulley bolt to the specified torque.

Tightening torque

8—11 N·m {82—112 kgf·cm, 71—97 in·lb}

5. Remove the bolt used for locking the water pump pulley against rotation.



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Drive Belt Auto Tensioner Installation Note

Caution

- To allow the drive belt auto tensioner to function correctly, always bleed the air from the drive belt auto tensioner using the following procedure after assembling the drive belt auto tensioner.

1. Install the drive belt auto tensioner to the engine.

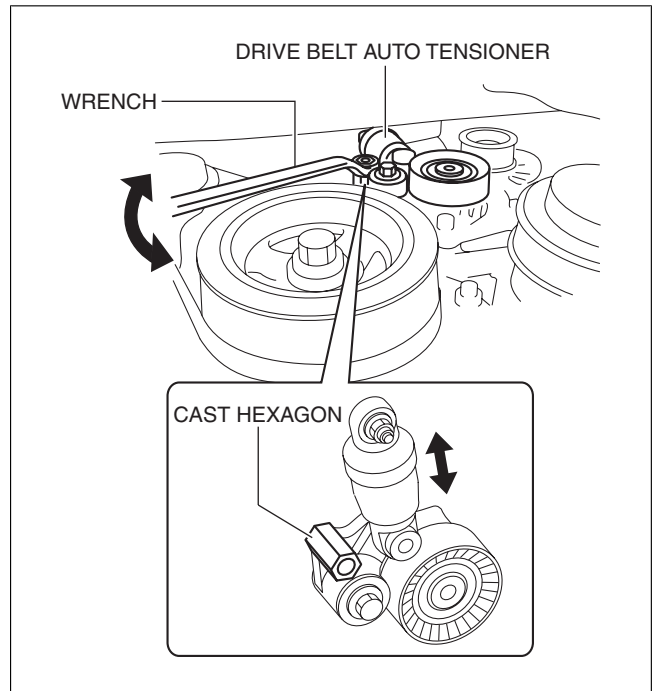
Caution

- To prevent damage to the drive belt auto tensioner, do not apply excessive torque after the tensioner moves full-stroke.

2. Insert the wrench onto the cast hexagon on the drive belt auto tensioner, move the drive belt auto tensioner up and down at full-stroke three times to bleed the air.

Note

- By moving the drive belt auto tensioner up and down full-stroke three times, the piston inside the tensioner moves to bleed the air.



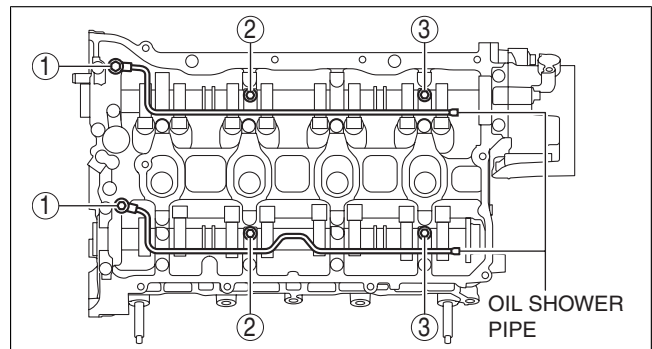
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Oil Shower Pipe Installation Note

1. Install the oil shower pipe in the order shown in the figure.

Tightening torque

Installation position	Tightening torque
1	9—12 N·m {92—122 kgf·cm, 80—106 in·lbf}
2, 3	8.0—9.0 N·m {82—91 kgf·cm, 71—79 in·lbf}



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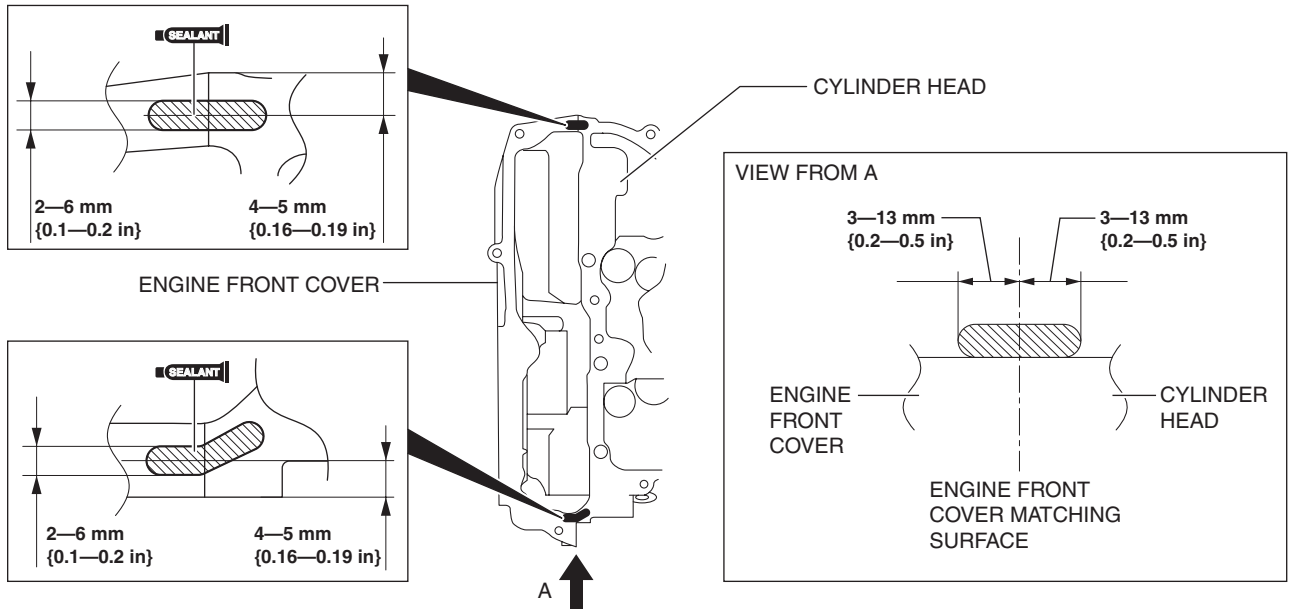
Cylinder Head Cover Installation Note

Caution

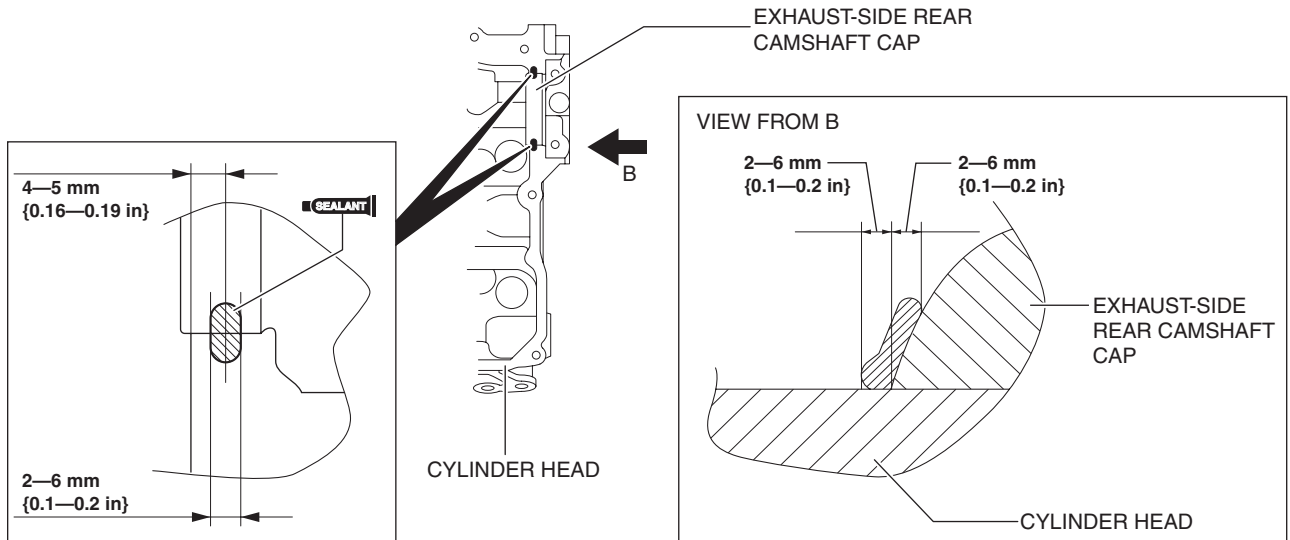
- To assure the sealing performance of the cylinder head cover, be careful of the following:
 - Verify that the cylinder head cover gasket is inserted into the cylinder head cover groove and install the cylinder head cover.
 - Remove oil, dirt, and sealant from the seal surface.
- To prevent silicone sealant from hardening, adhere the cylinder head cover and the cylinder head firmly within 10 min. after applying silicone sealant. After adhering them, tighten the installation bolts immediately.

1. Insert a new cylinder head cover gasket into the cylinder head cover groove.
2. Apply silicone sealant to the areas shown in the figure.

ENGINE FRONT SIDE



ENGINE REAR SIDE

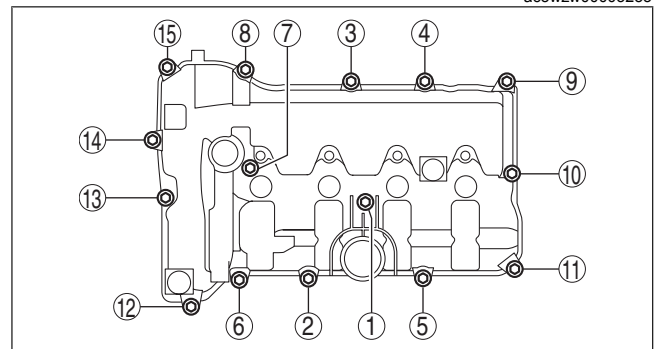


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- Tighten the cylinder cover bolts in the order shown in the figure.

Tightening torque

4.5—7.0 N·m {46—71 kgf·cm, 40—61 in·lbf}



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