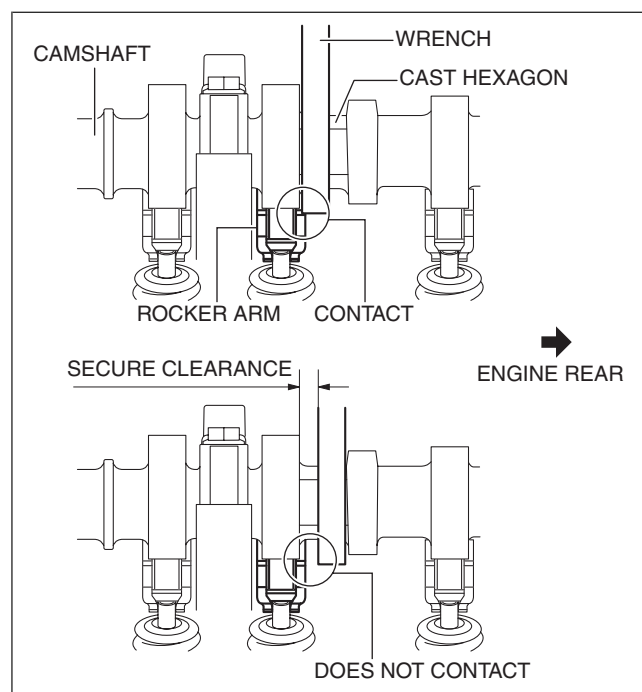


TIMING CHAIN ASSEMBLY

id011000505600

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.

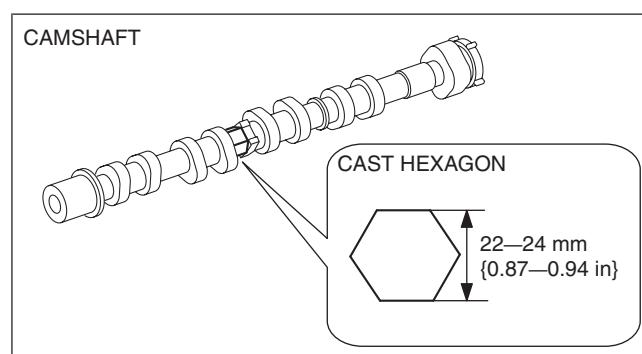


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Note

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

1. Assemble in the order indicated in the table.



am3uuw00009029

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

21

A

R

SEALANT

12

14

R

20—26
{2.1—2.6,
15—19}

R

17

16

15

R

SST

90—110
{9.2—11,
67—81}
+55—65°

8

10

7

*1

9—12 N·m
{92—122 kgf·m,
80—106 ft·lbf}

20

8.0—9.0 N·m
{82—91 kgf·m,
71—79 ft·lbf}

*1

9

SEALANT

SEALANT

SEALANT

SEALANT

18

*1

11

2

1

15—20
{1.6—2.0,
12—14}

19

SEALANT

SEALANT

SEALANT

SEALANT

13

*1

20—30
{2.1—3.0,
15—22}

4

SST

5

*1

22

A

*1: 8—11 N·m {82—112 kgf·m, 71—97 ft·lbf}

N·m {kgf·m, ft·lbf}

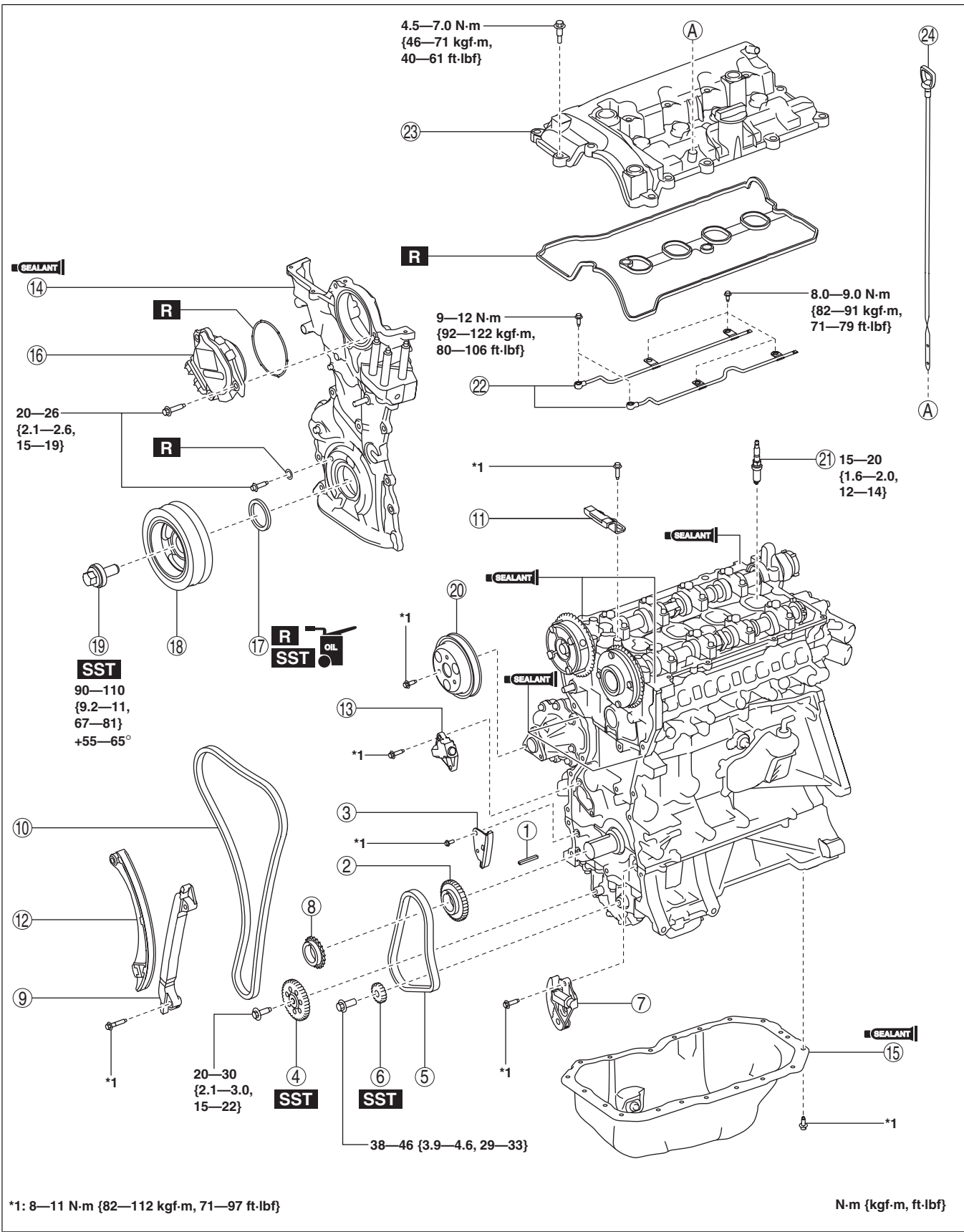
1	Key
2	Oil pump drive sprocket
3	Oil pump chain

4	Oil pump driven sprocket (See Oil Pump Driven Sprocket Assembly Note (SKYACTIV-G 2.0).)
---	-----------------------------------------------------------------------------------------------

5	Oil pump chain tensioner
6	Crankshaft sprocket
7	Chain guide (No.2)
8	Timing chain (See Timing Chain Assembly Note.)
9	Chain guide (No.1) (See Timing Chain Assembly Note.)
10	Tensioner arm (See Timing Chain Assembly Note.)
11	Chain tensioner (See Timing Chain Assembly Note.)
12	Engine front cover (See Engine Front Cover Assembly Note.)
13	Oil pan (See Oil Pan Assembly Note.)
14	Electric variable valve timing motor/driver (See Electric Variable Valve Timing Motor/Driver Assembly Note.)

15	Front oil seal (See Front Oil Seal Assembly Note.)
16	Crankshaft pulley
17	Crankshaft pulley lock bolt (See Crankshaft Pulley Lock Bolt Assembly Note.)
18	Water pump pulley (See Water Pump Pulley Assembly Note.)
19	Spark plug
20	Oil shower pipe (See Oil Shower Pipe Assembly Note.)
21	Cylinder head cover (See Cylinder Head Cover Assembly Note.)
22	Dipstick

SKYACTIV-G 2.5



1	Key
2	Oil pump drive sprocket
3	Oil pump chain guide

4	Oil pump driven sprocket (See Oil Pump Chain Assembly Note (SKYACTIV-G 2.5).)
---	----------------------------------------------------------------------------------

5	Oil pump chain (See Oil Pump Chain Assembly Note (SKYACTIV-G 2.5).)
6	Balancer shaft sprocket (See Oil Pump Chain Assembly Note (SKYACTIV-G 2.5).)
7	Oil pump chain tensioner (See Oil Pump Chain Assembly Note (SKYACTIV-G 2.5).)
8	Crankshaft sprocket
9	Chain guide (No.2)
10	Timing chain (See Timing Chain Assembly Note.)
11	Chain guide (No.1) (See Timing Chain Assembly Note.)
12	Tensioner arm (See Timing Chain Assembly Note.)
13	Chain tensioner (See Timing Chain Assembly Note.)
14	Engine front cover (See Engine Front Cover Assembly Note.)

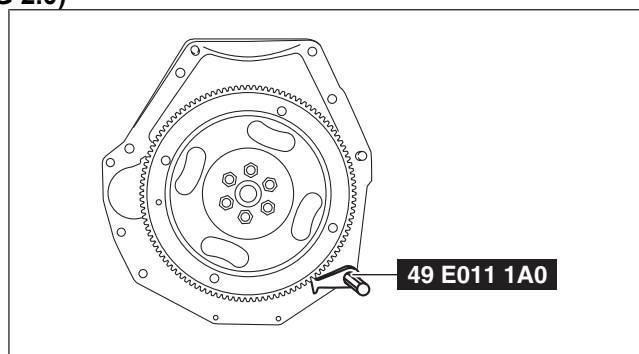
15	Oil pan (See Oil Pan Assembly Note.)
16	Electric variable valve timing motor/driver (See Electric Variable Valve Timing Motor/Driver Assembly Note.)
17	Front oil seal (See Front Oil Seal Assembly Note.)
18	Crankshaft pulley
19	Crankshaft pulley lock bolt (See Crankshaft Pulley Lock Bolt Assembly Note.)
20	Water pump pulley (See Water Pump Pulley Assembly Note.)
21	Spark plug
22	Oil shower pipe (See Oil Shower Pipe Assembly Note.)
23	Cylinder head cover (See Cylinder Head Cover Assembly Note.)
24	Dipstick

Oil Pump Driven Sprocket Assembly Note (SKYACTIV-G 2.0)

1. Hold the crankshaft using the SST.
2. Install the oil pump driven sprocket.

Tightening torque

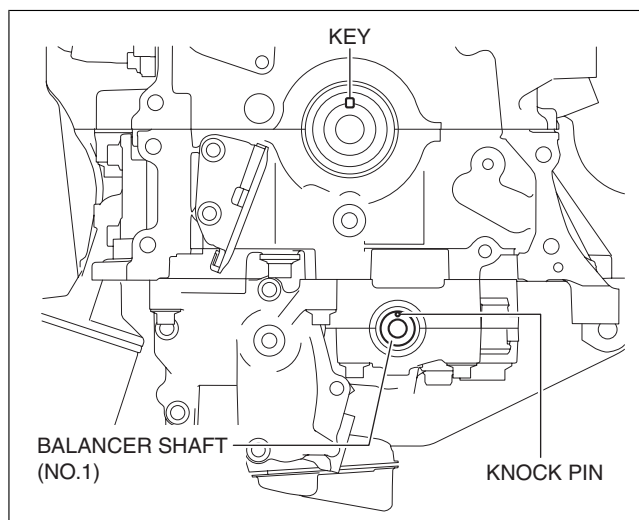
20—30 N·m {2.1—3.0 kgf·m, 15—22 ft·lbf}



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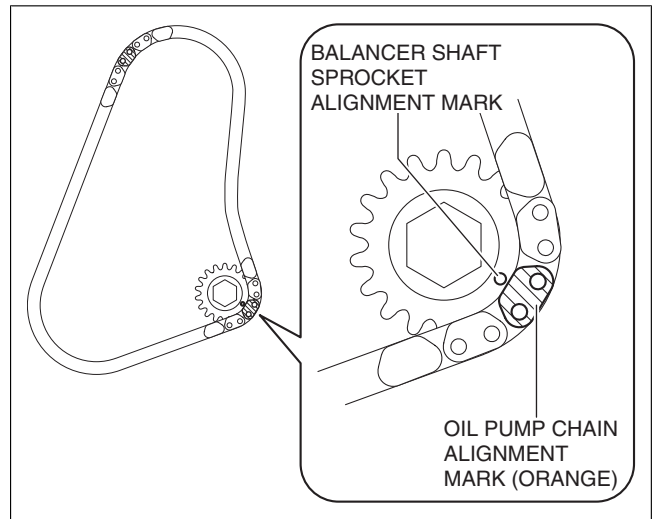
Oil Pump Chain Assembly Note (SKYACTIV-G 2.5)

1. Verify that the key and knock pin are aligned to the positions shown in the figure.
 - If they are not in the positions shown in the figure, rotate the crankshaft and balancer shaft (No.1) to set cylinder No.1 to top dead center (TDC).
2. Temporarily assemble the oil pump driven sprocket.
3. Temporarily tighten the oil pump driven sprocket installation bolt.



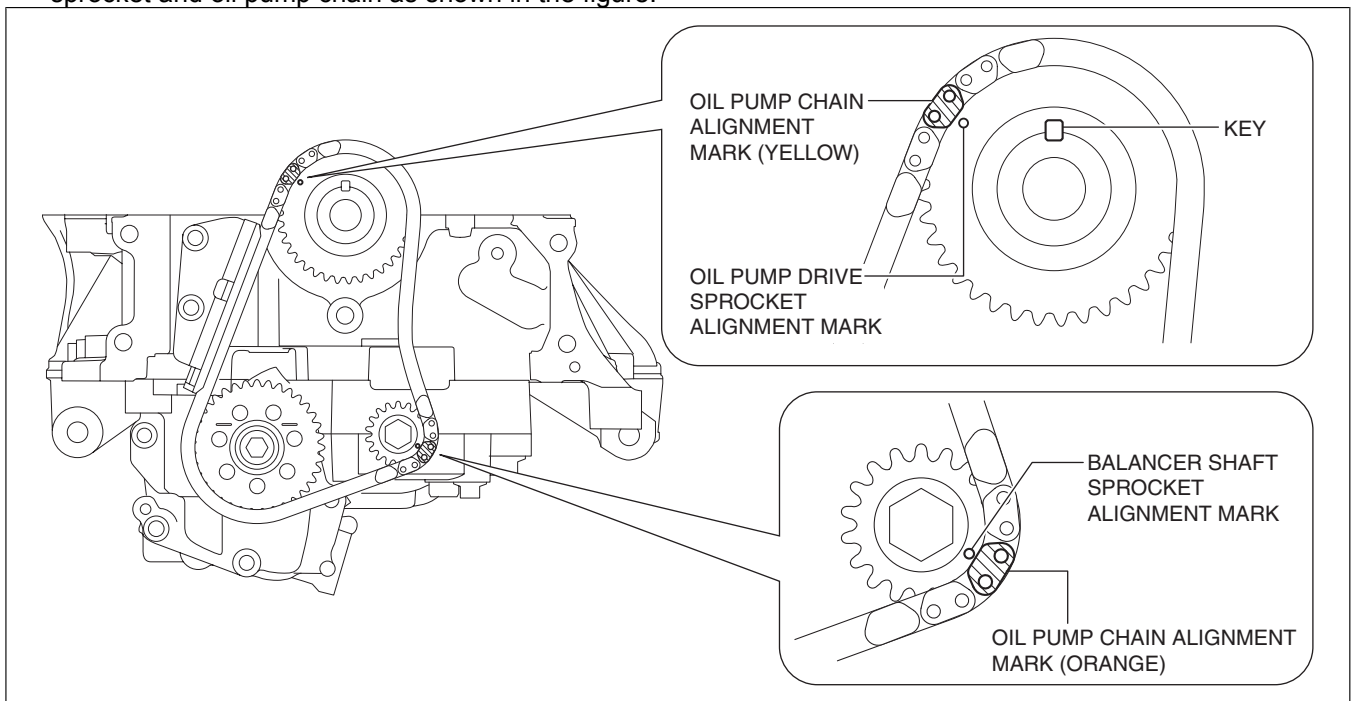
bpe1ze00000070

4. Align the oil pump chain alignment mark with the balancer shaft sprocket alignment mark.



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5. Install the oil pump chain and balancer shaft sprocket as a single unit while aligning the alignment marks on each sprocket and oil pump chain as shown in the figure.



bpe1ze00000072

6. Temporarily tighten the balancer shaft sprocket installation bolt.
7. Install the oil pump chain tensioner.

Caution

- At this stage, do not remove the wire or paper clip installed to the oil pump chain tensioner.

8. Hold the crankshaft using the **SST**.
9. Tighten the oil pump driven sprocket installation bolt.

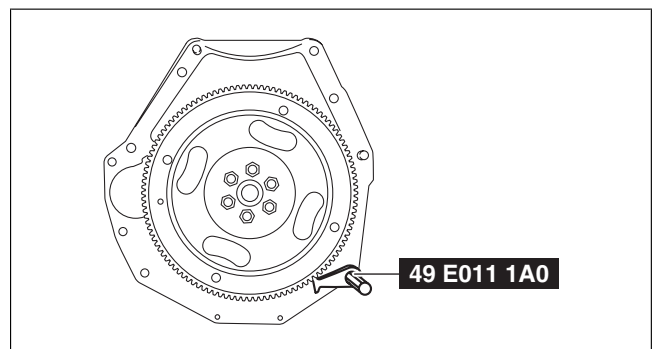
20—30 N·m {2.1—3.0 kgf·m, 15—22 ft·lbf}

10. Tighten the balancer shaft sprocket installation bolt.

38—46 N·m {3.9—4.6 kgf·m, 29—33 ft·lbf}

11. Remove the wire or paper clip installed to the oil pump chain tensioner and apply tension to the oil pump chain.

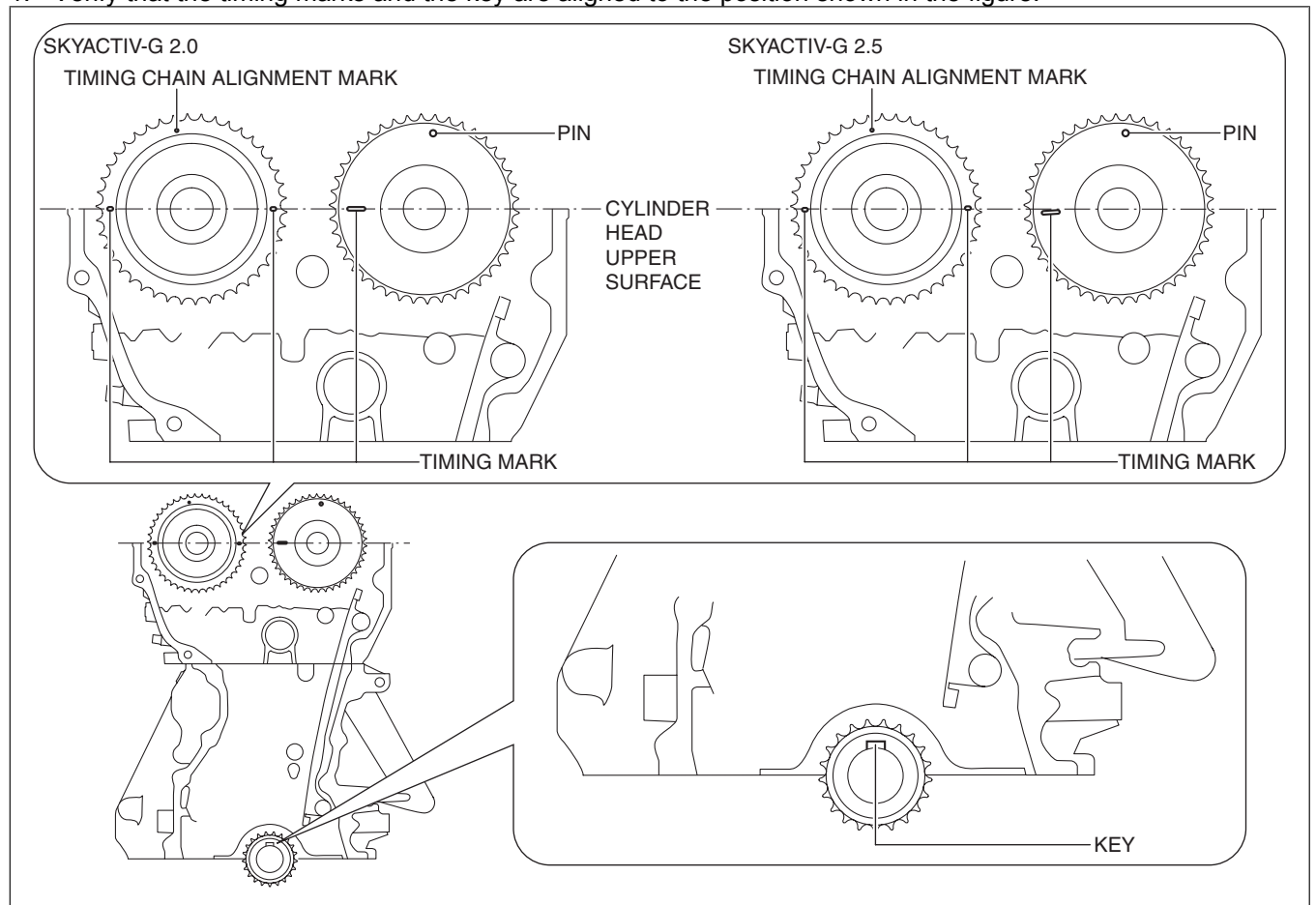
- If a new oil pump chain tensioner is used, remove the installed stopper.



bpe1ze00000096

Timing Chain Assembly Note

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

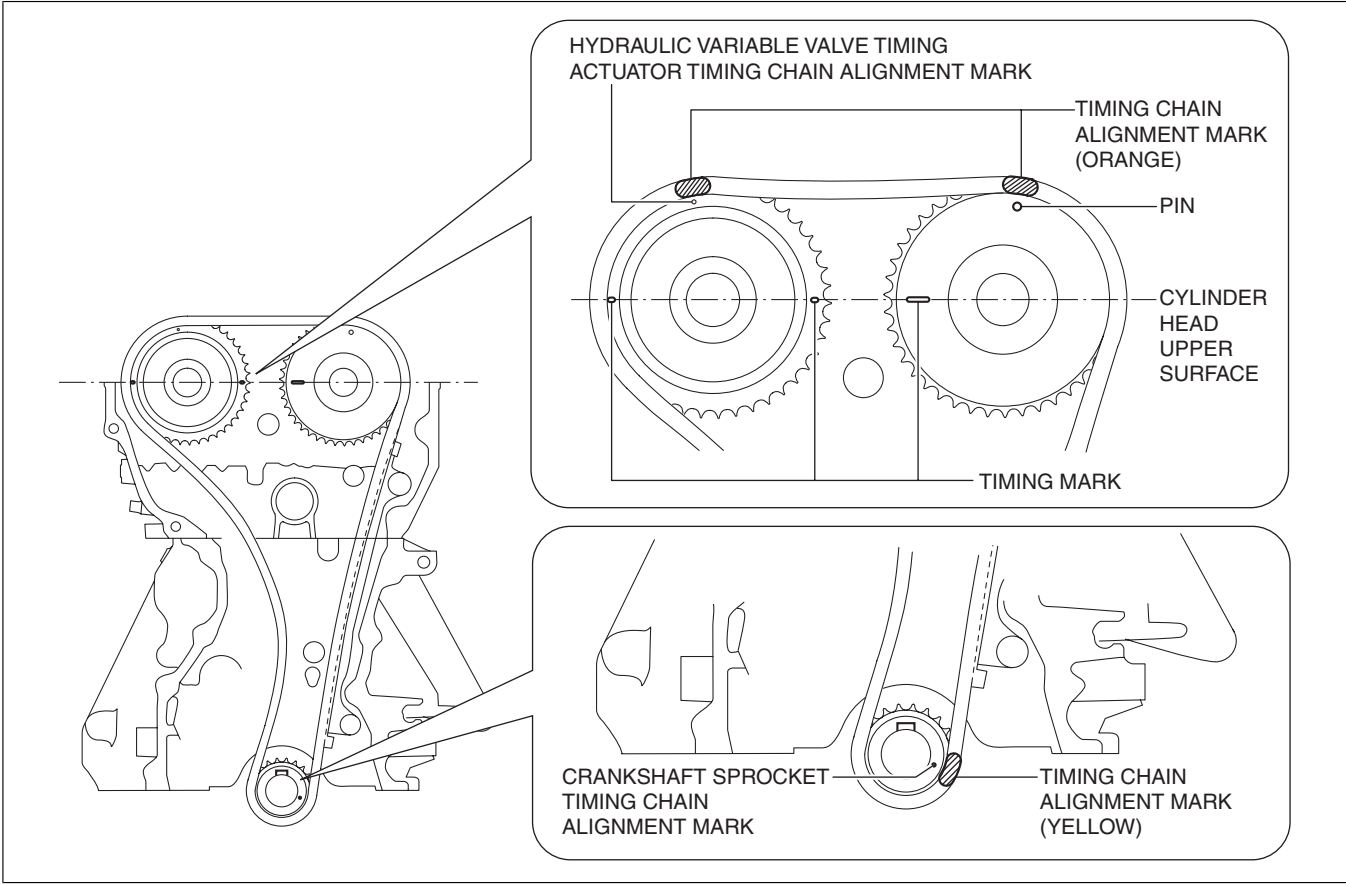


bpe1ze00000073

Note

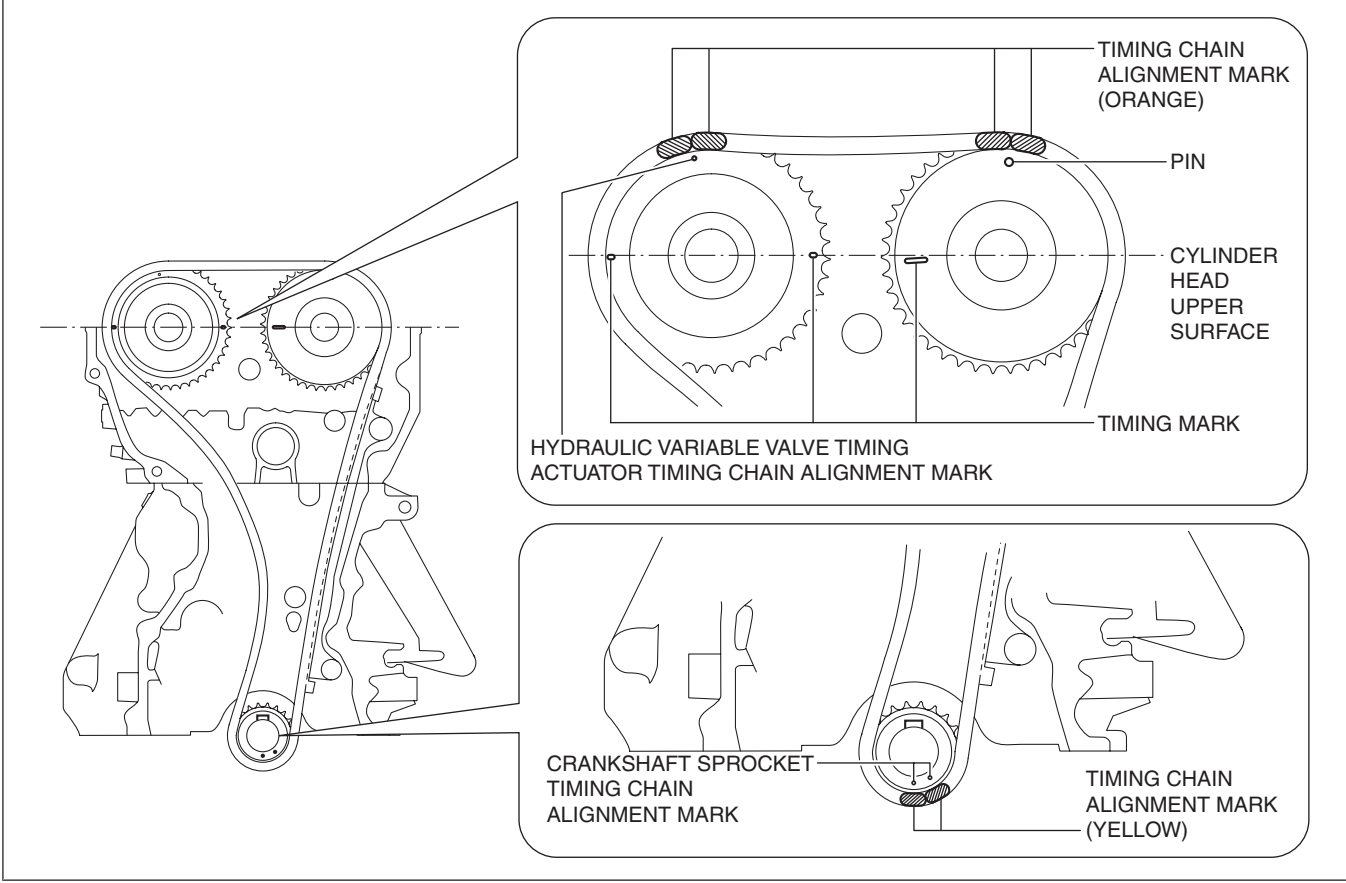
- The timing mark of SKYACTIV-G 2.5 is not completely parallel with the upper surface of the cylinder head.
 - If they are not in the position shown in the figure, rotate the camshaft and crankshaft to set the cylinder No. 1 top dead center (TDC).
2. Install the timing chain while aligning the marks on each sprocket and the timing chain as shown in the figure.

SKYACTIV-G 2.0



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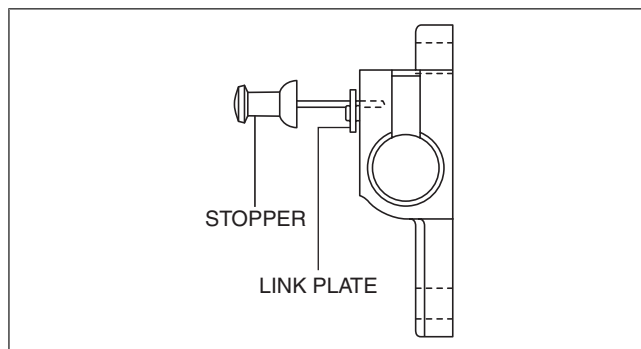
SKYACTIV-G 2.5



bpe1ze00000075

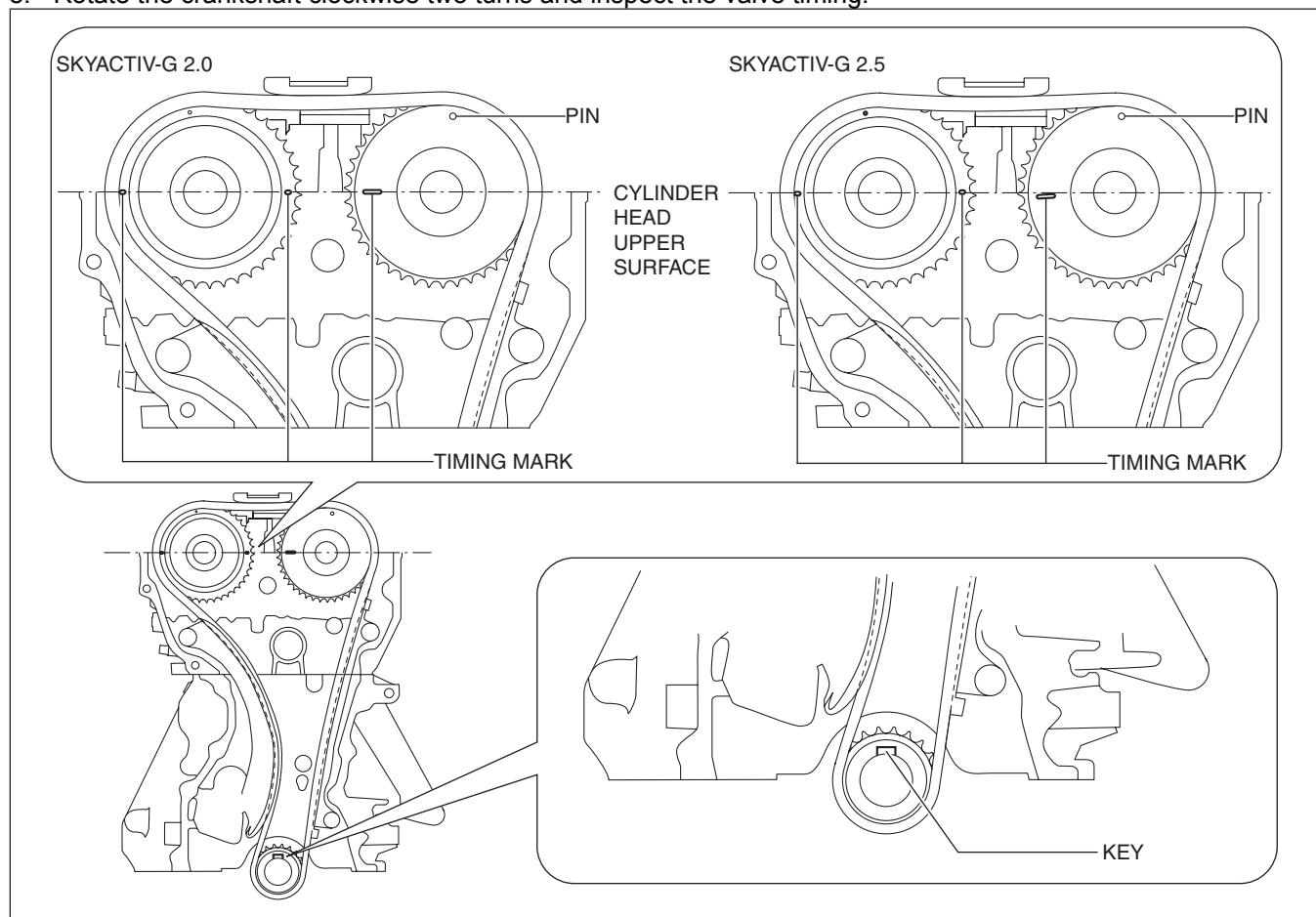
3. Install the tensioner arm.

4. Install the chain tensioner.
5. 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.
6. Install the chain guide (No.1).
7. Verify that there is no looseness in the timing chain, and re-verify that each sprocket is in the specified location.



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



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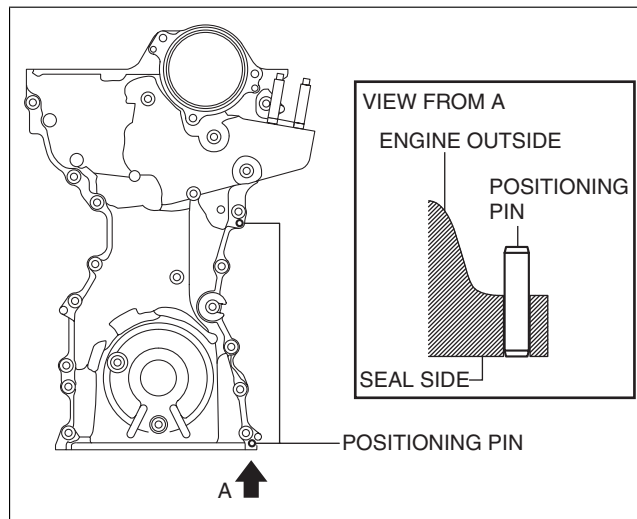
Note

- The timing mark of SKYACTIV-G 2.5 is not completely parallel with the upper surface of the cylinder head.

Engine Front Cover Assembly 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.

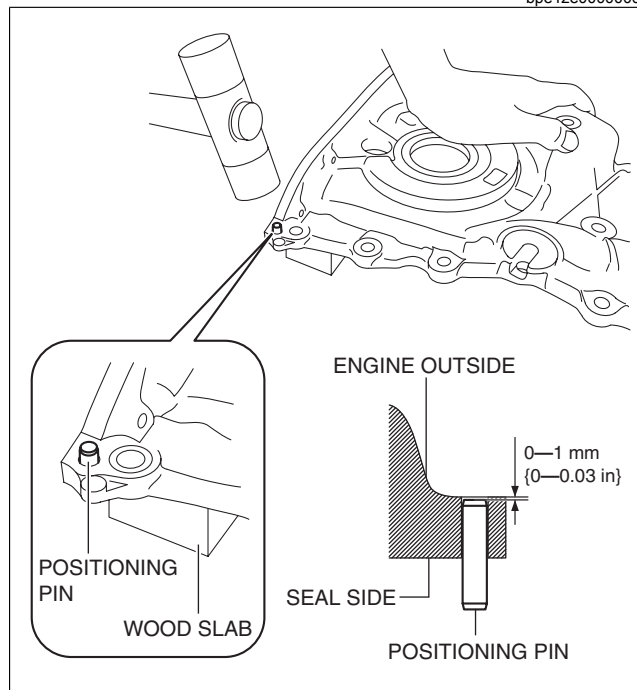


bpe1ze00000006

- If the engine front cover is newly replaced, tap the positioning pins in the two locations to the seal surface side.
- Completely clean and remove any oil, dirt, sealant or other foreign material that may be adhering to the engine front cover, cylinder head, and cylinder block.
- When reusing the engine front cover installation bolts, clean any old sealant from the bolts.

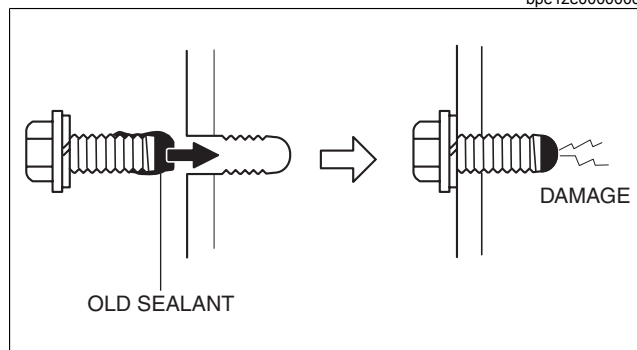
Caution

- Apply the silicon sealant in a single, unbroken line.**
- To prevent silicone sealant from hardening, adhere the engine front cover to the cylinder block within 10 min. after silicone sealant is applied. Tighten the installation bolts completely soon after adhering.**



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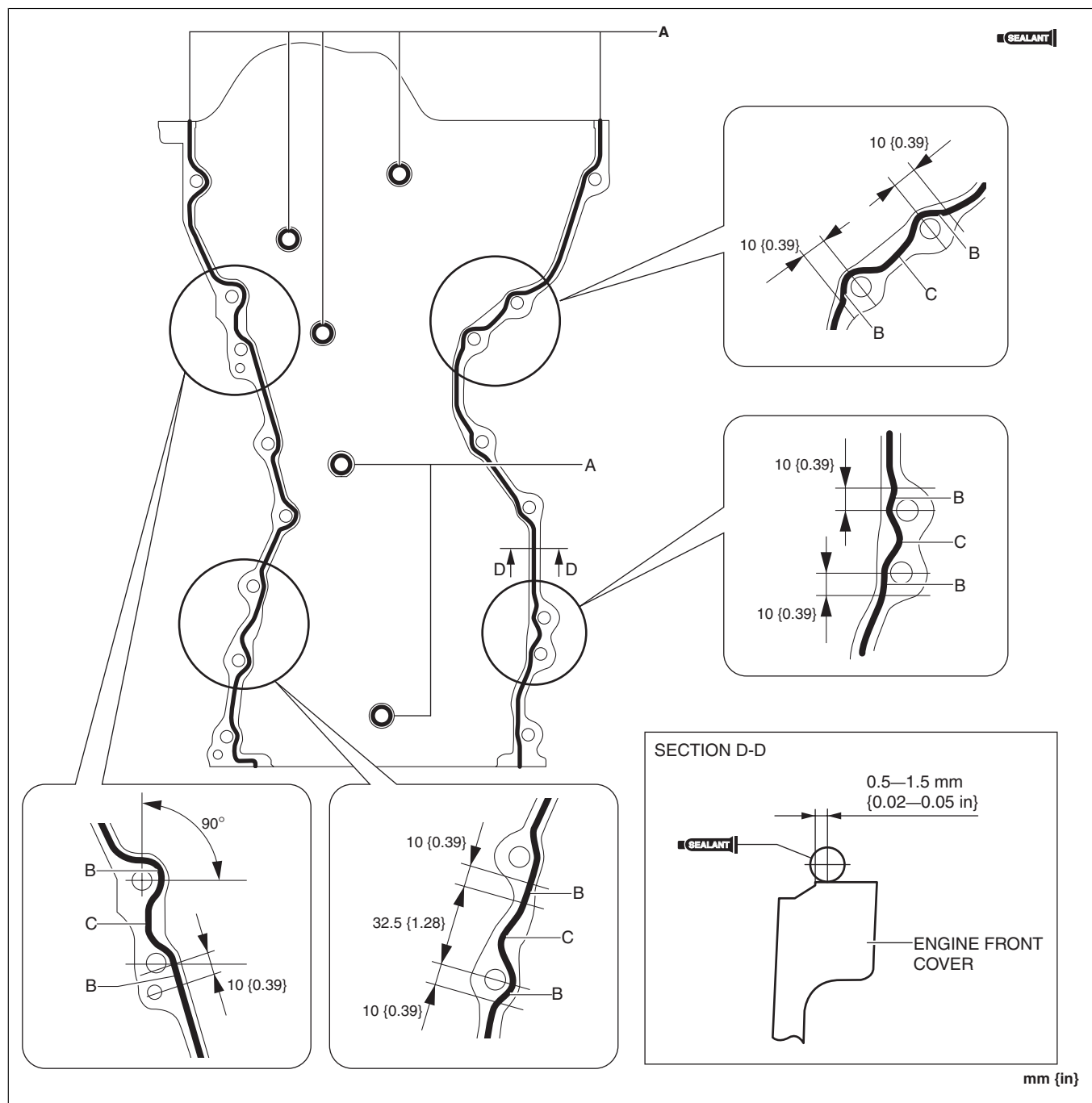
- Using bolts with the old seal adhering could cause cracks in the cylinder head and cylinder block.**



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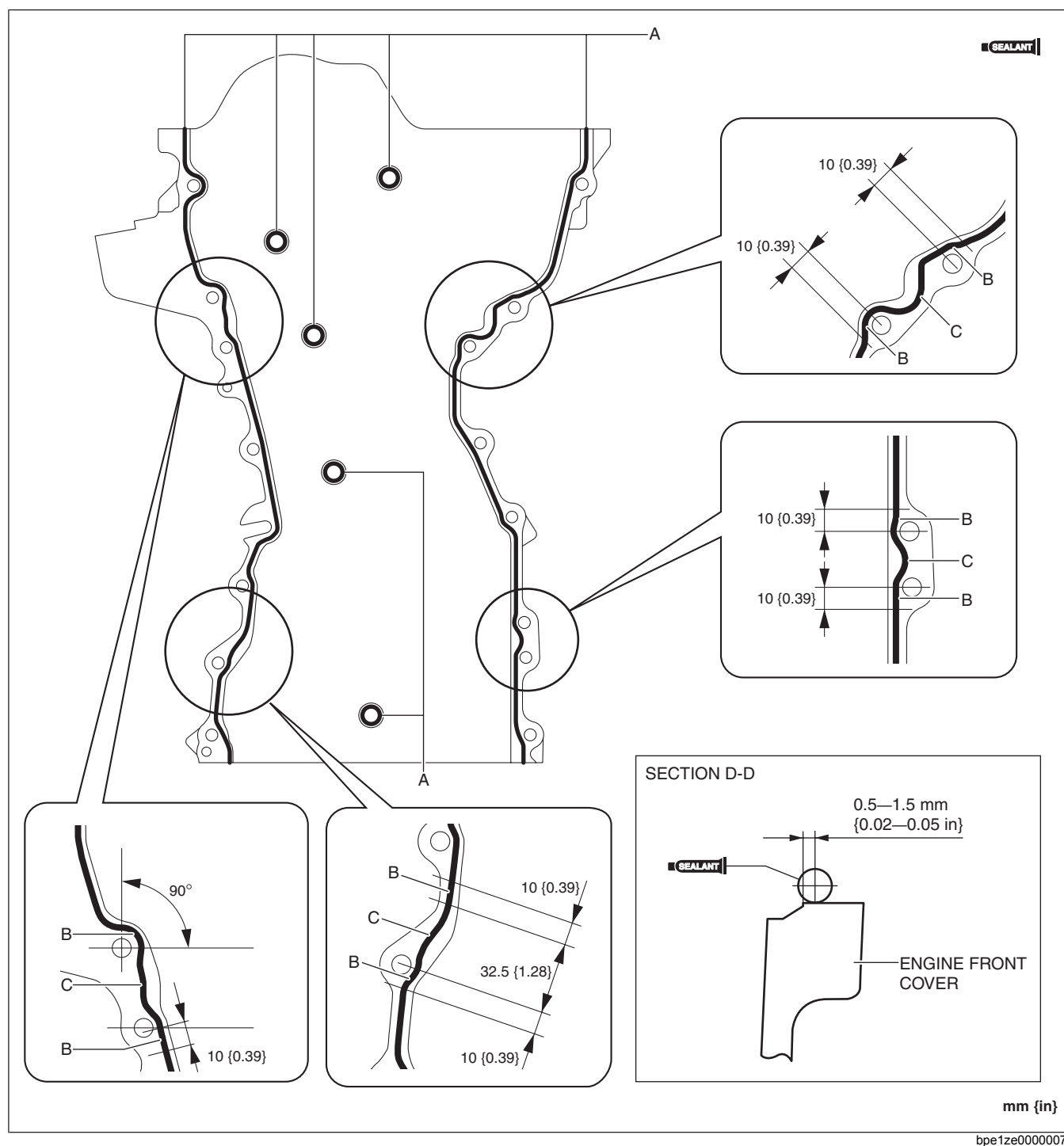
- Apply silicone sealant to the engine front cover as shown in the figure.

SKYACTIV-G 2.0



bpe1ze00000077

SKYACTIV-G 2.5



Bead thickness

A: 2—6 mm {0.1—0.2 in}

B: 4—6 mm {0.16—0.23 in}

C: 4—8 mm {0.2—0.3 in}

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

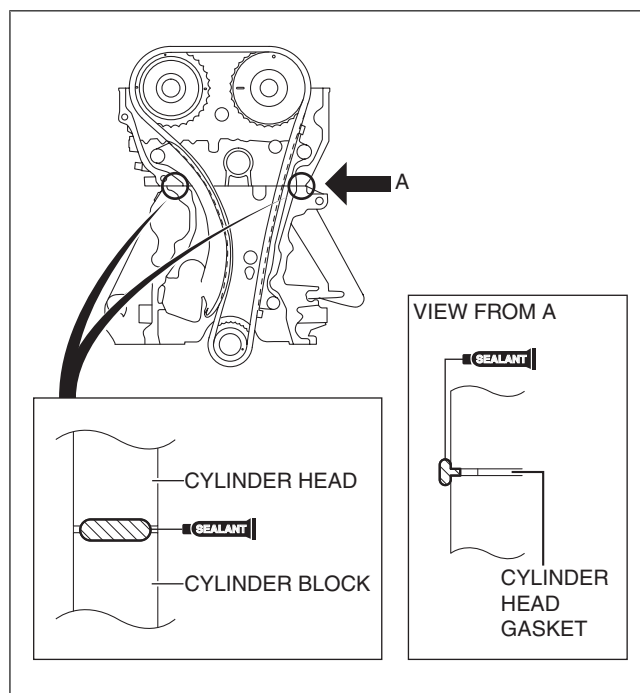
Caution

- **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.

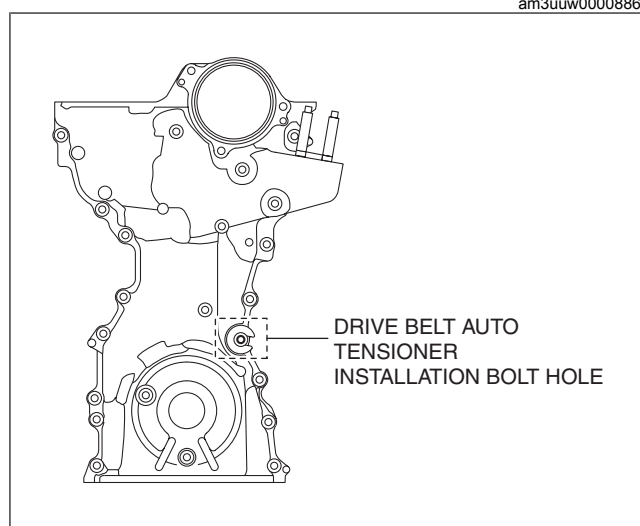


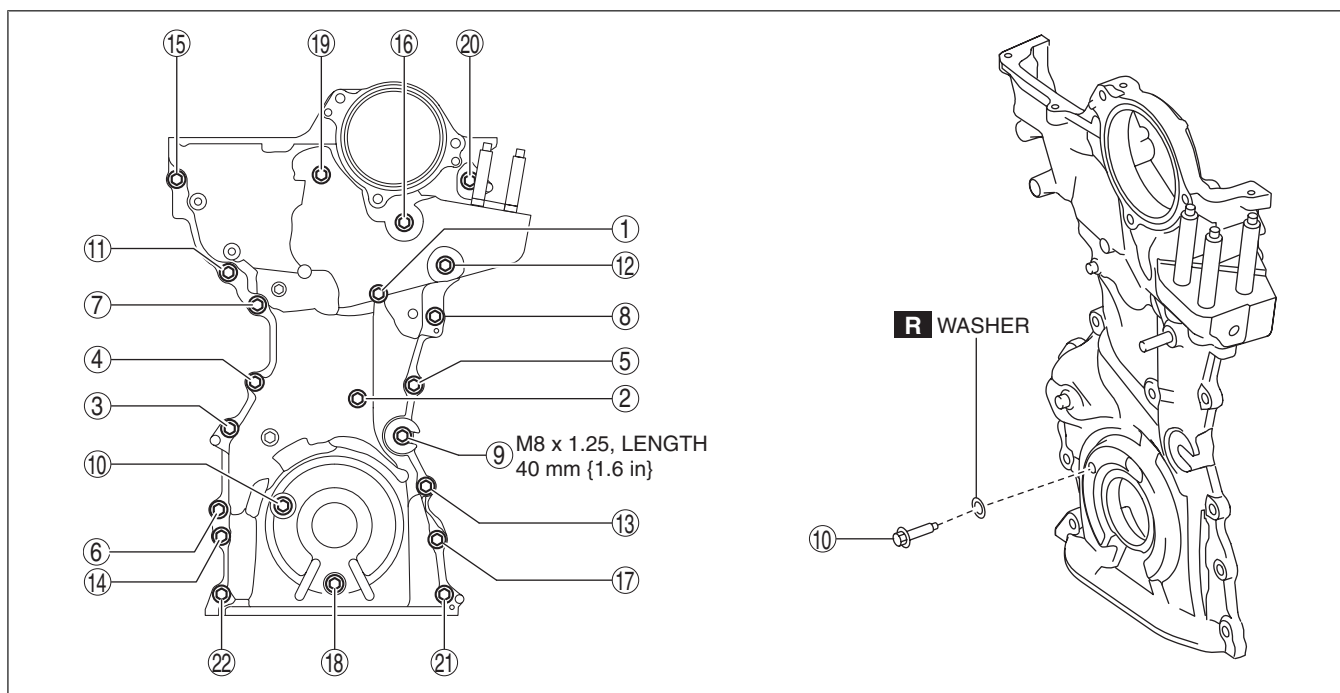
7. Prepare an appropriate **M8 X 1.25** bolt (length **40 mm {1.6 in}**).

Caution

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

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





Tightening torque

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

9. Remove the bolt installed to the drive belt auto tensioner installation bolt hole when installing the drive belt auto tensioner.

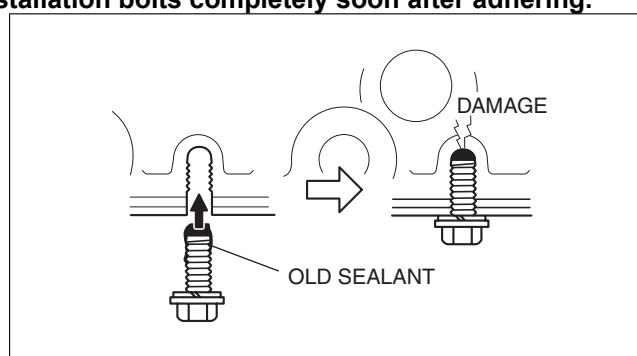
Oil Pan Assembly Note

1. Completely clean and remove any oil, dirt, sealant or other foreign material that may be adhering to the cylinder block and oil pan.
2. When reusing the oil pan installation bolts, clean any old sealant from the bolts.

Caution

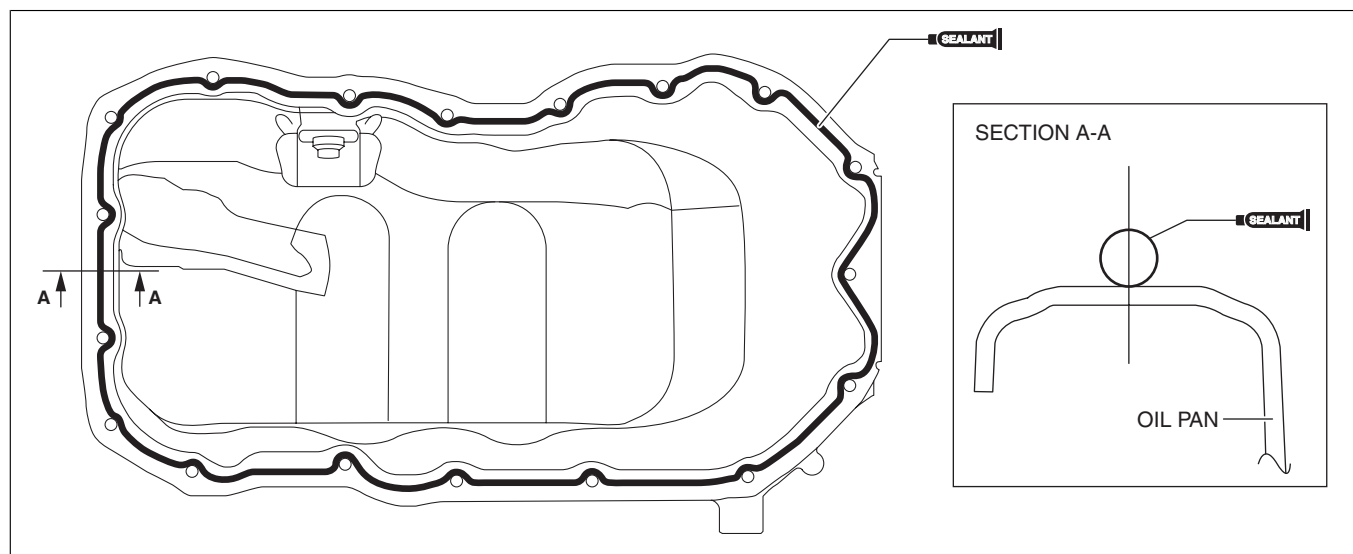
- Apply the silicon sealant in a single, unbroken line around the whole perimeter.
- To prevent silicone sealant from hardening, adhere the oil pan to the cylinder block within 10 min. after silicone sealant is applied. Tighten the installation bolts completely soon after adhering.
- Using bolts with the old seal adhering could cause cracks in the cylinder block, etc.

3. Apply silicone sealant to the oil pan along the inside of the bolt holes as shown in the figure.



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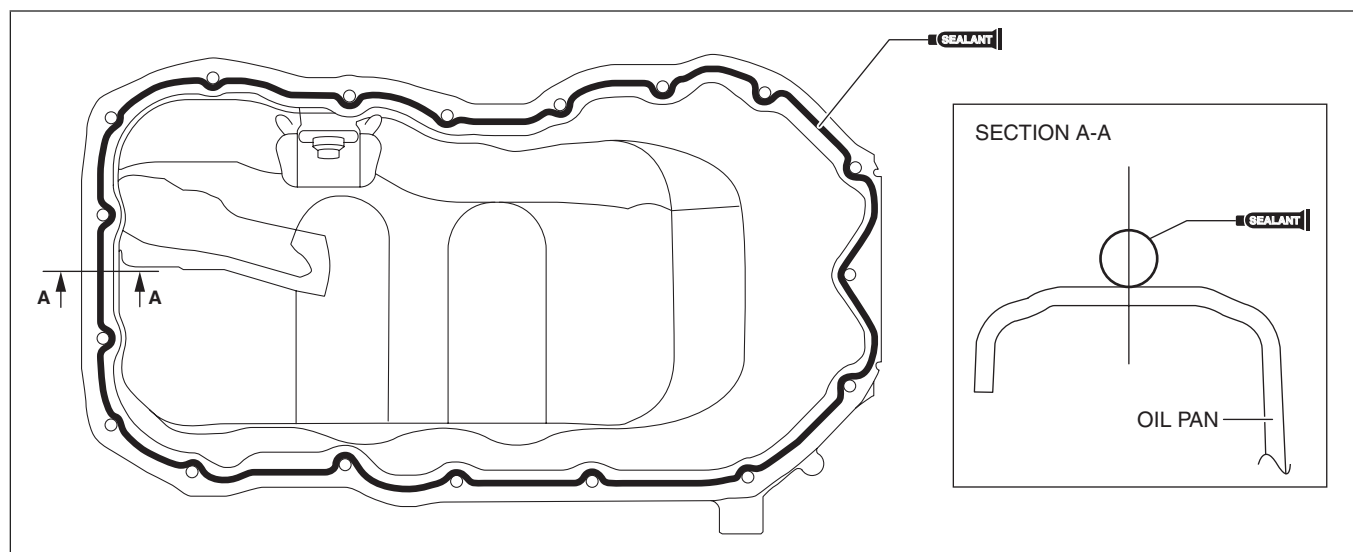
SKYACTIV-G 2.0



bpe2ue00000080

Thickness (SKYACTIV-G 2.0)
2.0—6.0 mm {0.08—0.23 in}

SKYACTIV-G 2.5



bpe2ue00000080

Thickness (SKYACTIV-G 2.5)
3.0—7.0 mm {0.12—0.27 in}

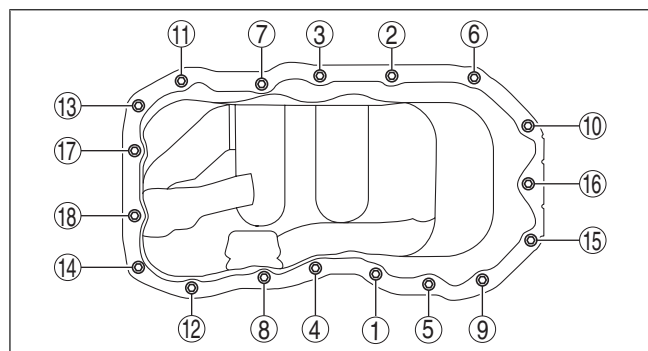
4. Install the oil pan using the following procedure:
SKYACTIV-G 2.0

1. Install the oil pan to the cylinder block.
2. Tighten the bolts in the order shown in the figure.

Tightening torque
8—11 N·m {82—112 kgf·cm, 71—97 in·lbf}

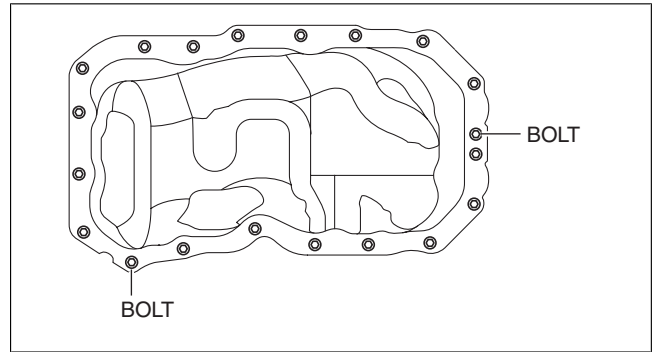
SKYACTIV-G 2.5

1. Install the oil pan to the cylinder block.



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- Temporarily tighten the two bolts shown in the figure.

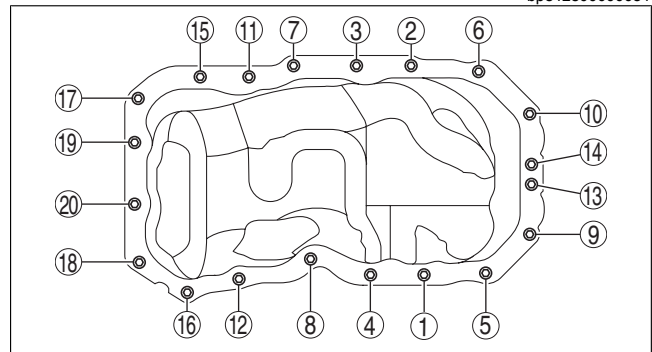


bpe1ze00000081

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

Tightening torque

8—11 N·m {82—112 kgf·cm, 71—97 in·lbf}



bpe1ze00000082

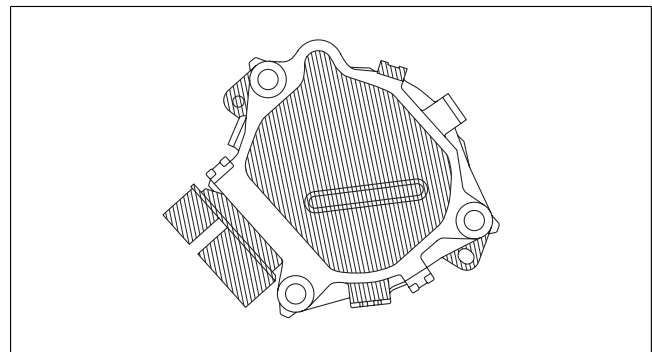
Electric Variable Valve Timing Motor/Driver Assembly Note

- 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.

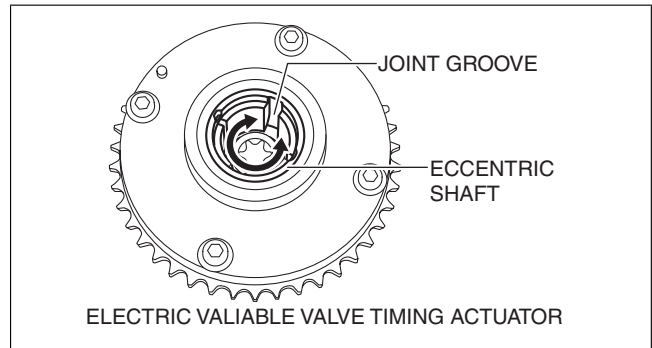
- Install the electric variable valve timing motor/driver using the following procedures.



bpe1ze00000009

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.

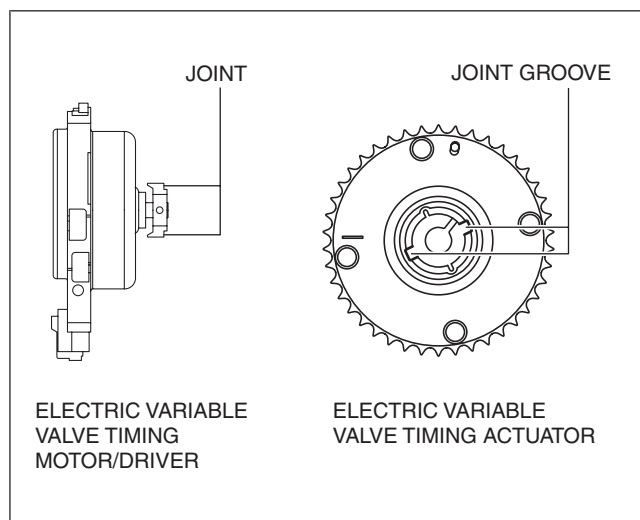


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- (1) Before installation, rotate the joint of the end of the electric variable valve timing motor so that it is aligned to the joint groove on the electric variable valve timing actuator side.
- (2) Engage the joint on the end of the electric variable 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

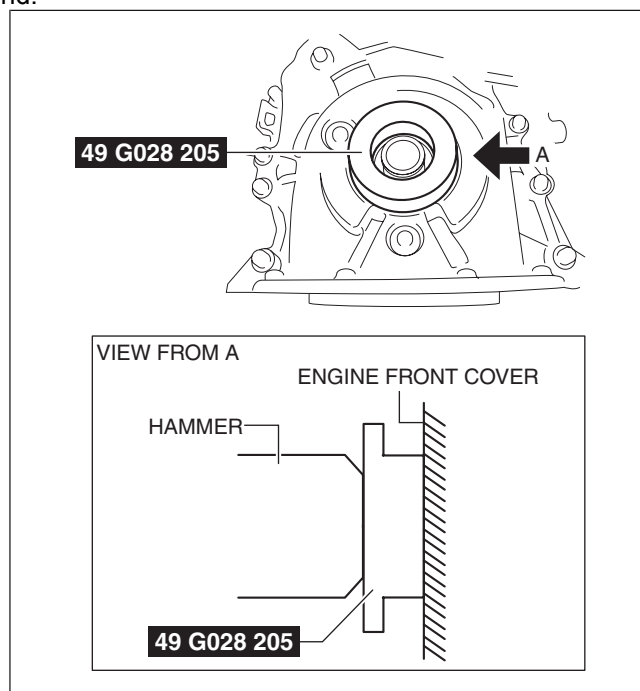
20—26 N·m {2.1—2.6 kgf·m, 15—19 ft·lbf}



am3uuw00009043

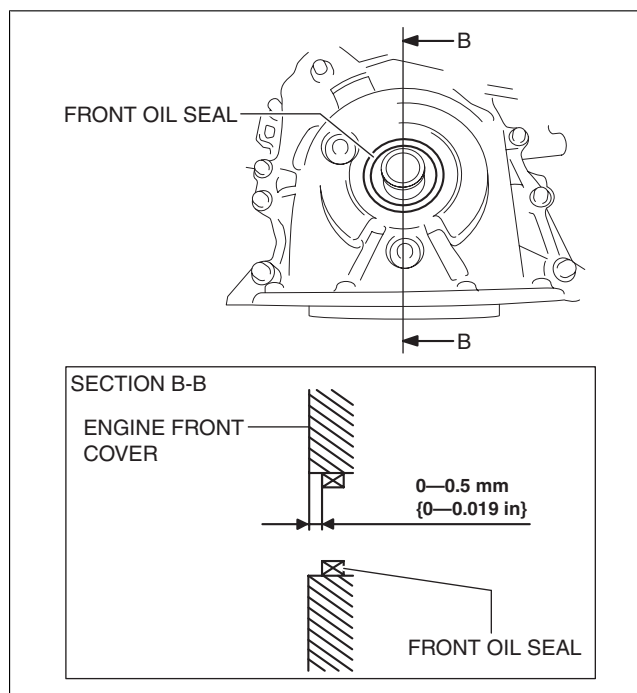
Front Oil Seal Assembly Note

1. Apply clean engine oil to the inner surface of a new front oil seal.
2. Insert the front oil seal into the engine front cover by hand.
3. Tap the oil seal in evenly using the **SST** and a hammer.



am3uuw00008830

Front oil seal press-in amount
0—0.5 mm {0—0.019 in}



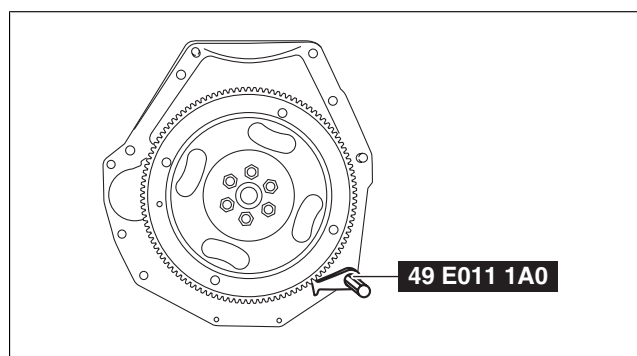
Crankshaft Pulley Lock Bolt Assembly Note

1. Hold the crankshaft using the **SST**.
2. 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°



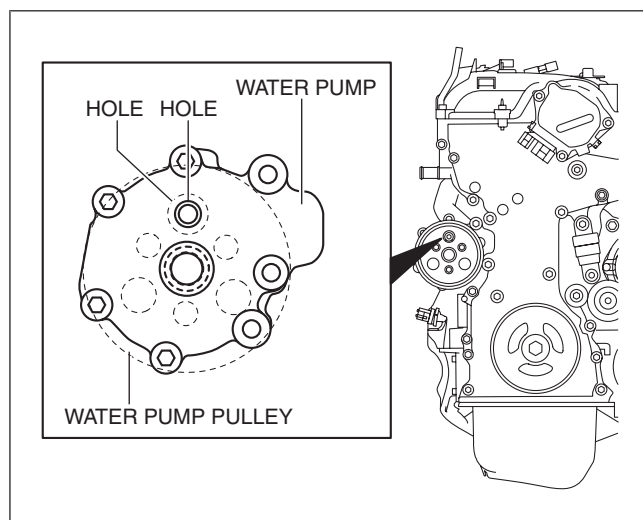
Water Pump Pulley Assembly Note

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.

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



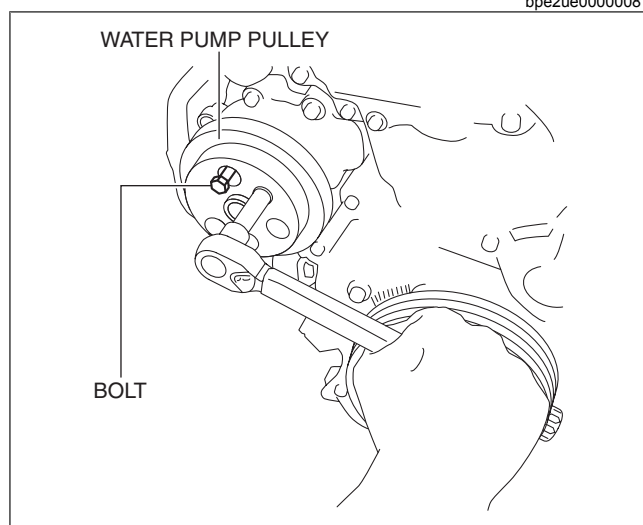
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- Insert an appropriate bolt (length **70 mm {2.8 in}**) into the water pump hole shown in the figure and lock the water pump pulley against rotation.
- Completely tighten the water pump pulley bolt to the specified torque.

Tightening torque

8—11 N·m {82—112 kgf·cm, 71—97 in·lbf}

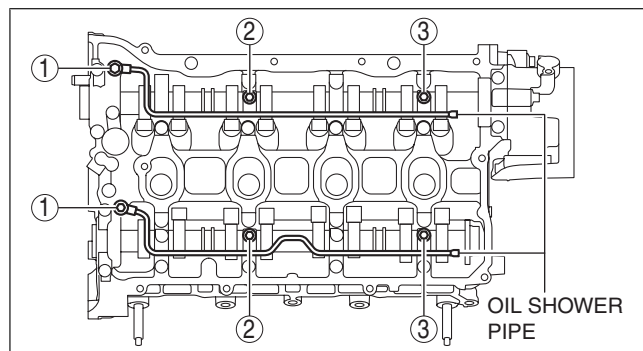
- Remove the bolt used for locking the water pump pulley against rotation.



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Oil Shower Pipe Assembly Note

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



am3zzw00012759

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}

Cylinder Head Cover Assembly Note

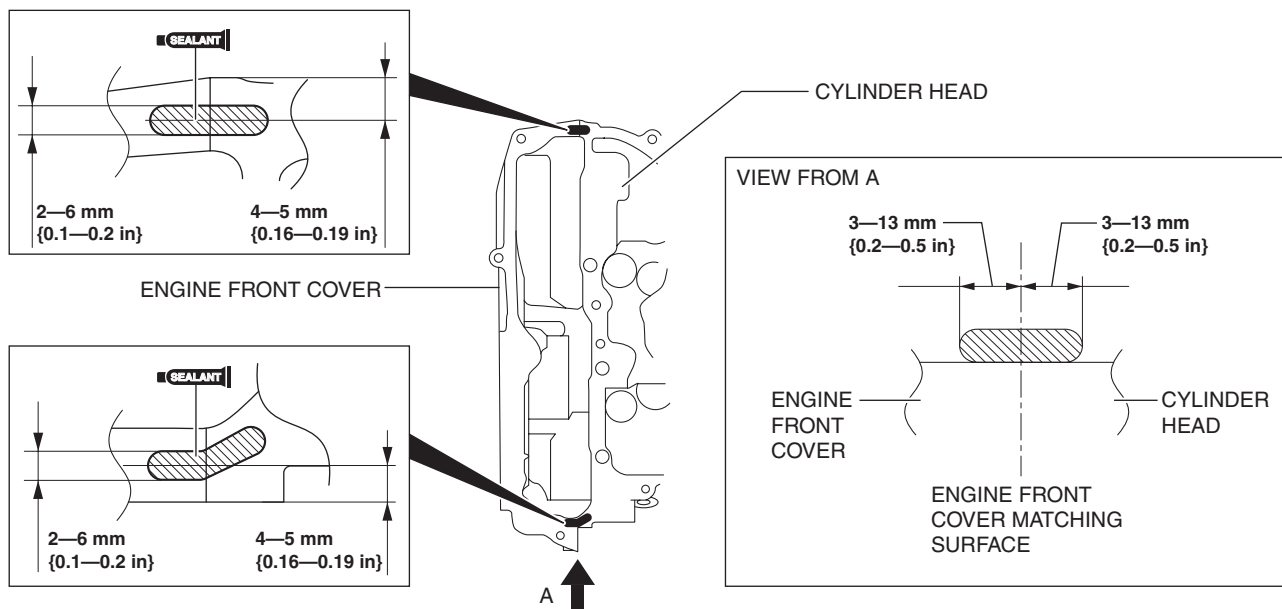
Caution

- 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.
 - Completely clean and remove any oil, dirt, sealant or other foreign material from the seal surface.

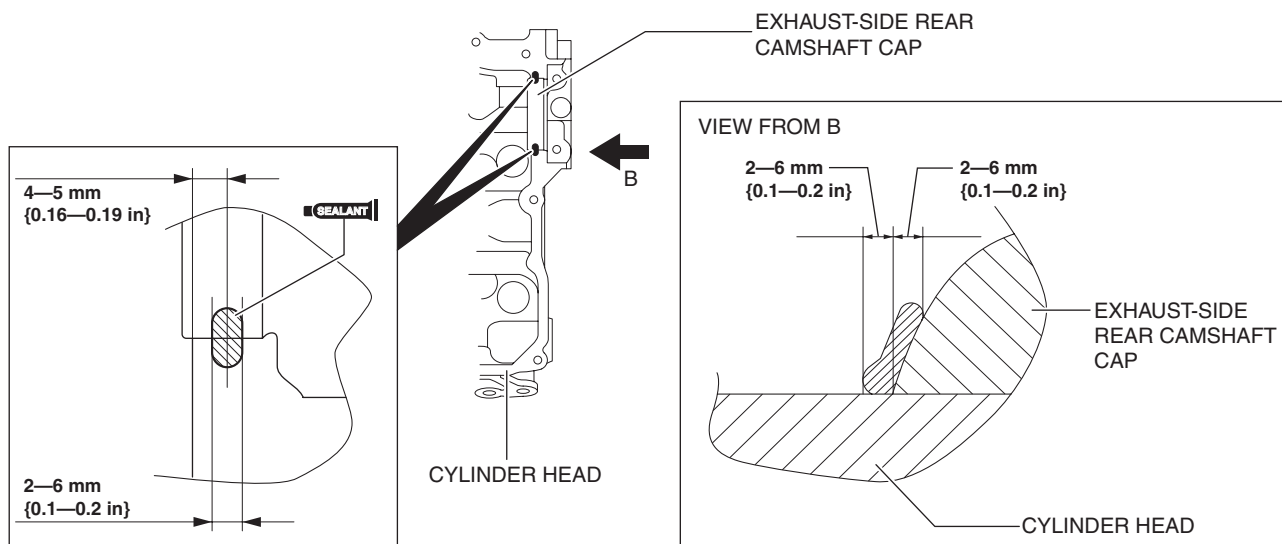
- To prevent silicone sealant from hardening, adhere the cylinder head cover and the cylinder head within 10 min. after silicone sealant is applied. Tighten the installation bolts completely soon after adhering.

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



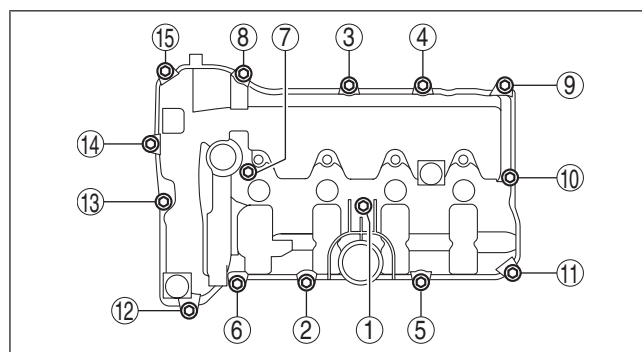
ENGINE REAR SIDE



3. Tighten the cylinder head 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}



am3uuw00008879