

2012 - Mazda6 - Engine

VARIABLE VALVE TIMING ACTUATOR REMOVAL/ INSTALLATION [MZR 2.5]

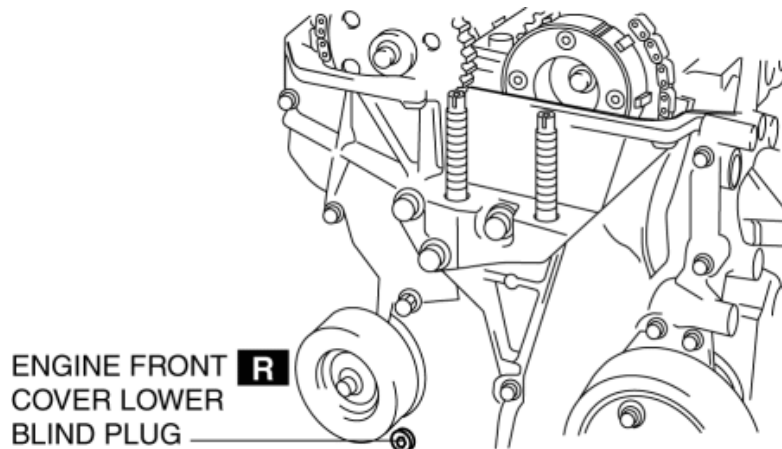
CAUTION:

- Variable valve timing actuator can not be disassembled because it is a precision unit.

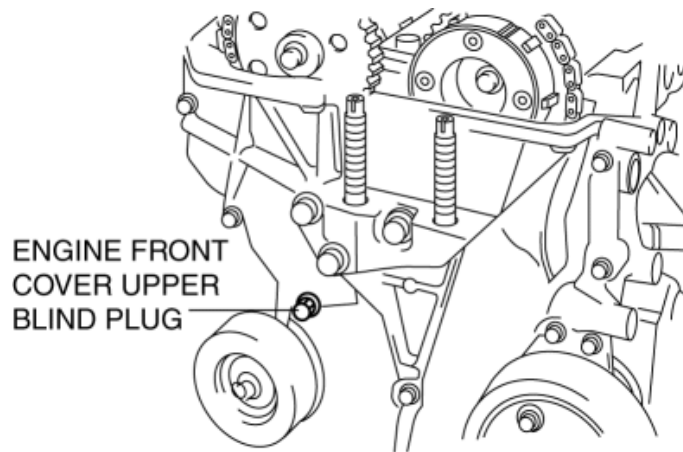
NOTE:

- Intake camshaft sprocket is integrated with the variable valve timing actuator and cannot be disassembled.

1. Disconnect the negative battery cable.
2. Remove the plug hole plate. (See [PLUG HOLE PLATE REMOVAL/ INSTALLATION \[MZR 2.5\]](#).)
3. Remove the ignition coils. (See [IGNITION COIL REMOVAL/ INSTALLATION \[MZR 2.5\]](#).)
4. Remove the spark plugs. (See [SPARK PLUG REMOVAL/ INSTALLATION \[MZR 2.5\]](#).)
5. Remove the ventilation hose. (See [INTAKE-AIR SYSTEM REMOVAL/ INSTALLATION \[MZR 2.5\]](#).)
6. Disconnect the camshaft position (CMP) sensor connector.
7. Disconnect the oil control valve (OCV) connector.
8. Remove the cylinder head cover. (See [TIMING CHAIN REMOVAL/ INSTALLATION \[MZR 2.5\]](#).)
9. Set the front mudguard (RH) out of the way. (See [FRONT MUDGUARD REMOVAL/ INSTALLATION](#).)
10. Remove the splash shield (RH).
11. Remove the aerodynamic under cover No.2. (See [AERODYNAMIC UNDER COVER NO.2 REMOVAL/ INSTALLATION](#).)
12. Remove the drive belt. (See [DRIVE BELT REMOVAL/ INSTALLATION \[MZR 2.5\]](#).)
13. Remove the engine front cover lower blind plug.

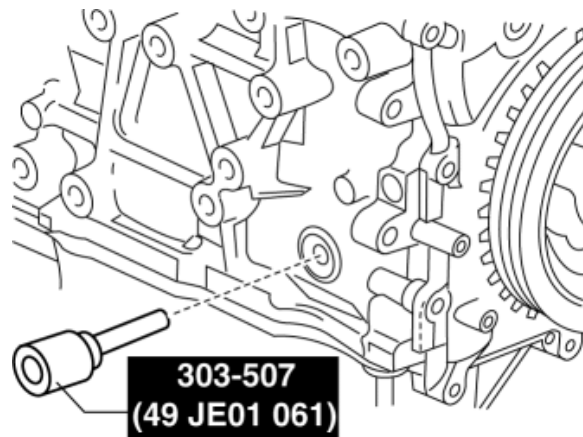


14. Remove the engine front cover upper blind plug.



15. Disconnect the drive shaft (RH) from joint shaft, set the drive shaft (RH) out of the way. (ATX) (See [DRIVE SHAFT REMOVAL/ INSTALLATION.](#))

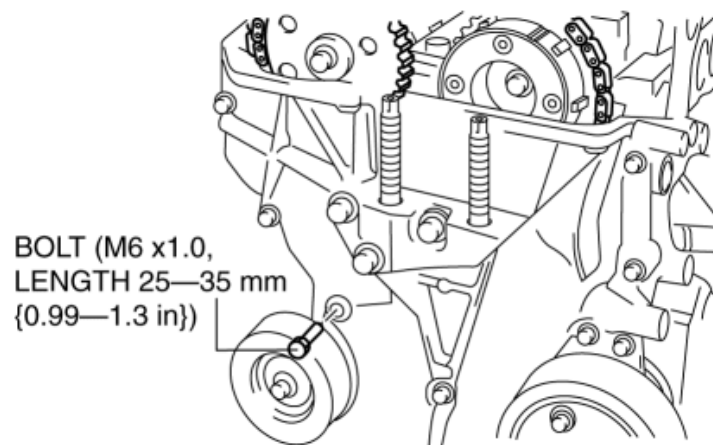
16. Remove the cylinder block lower blind plug, and install the **SST**.



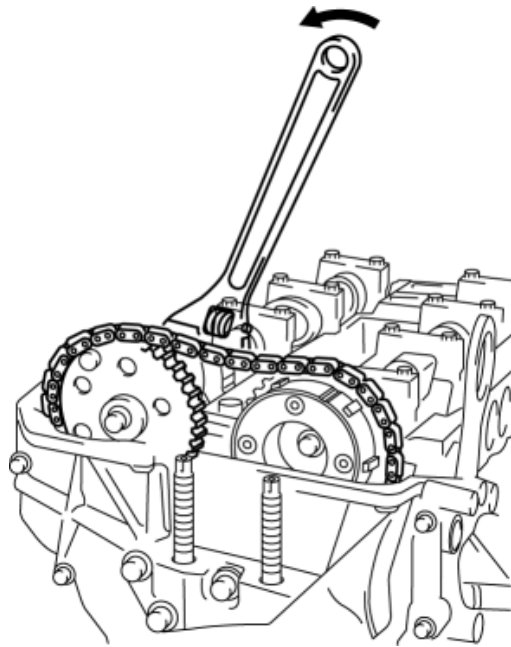
17. Rotate the crankshaft in the direction of the engine rotation so that the No.1 piston is at TDC of the compression stroke. (Until the counterweight contacts **SST** and stops.)

18. Loosen the timing chain using the following procedure.

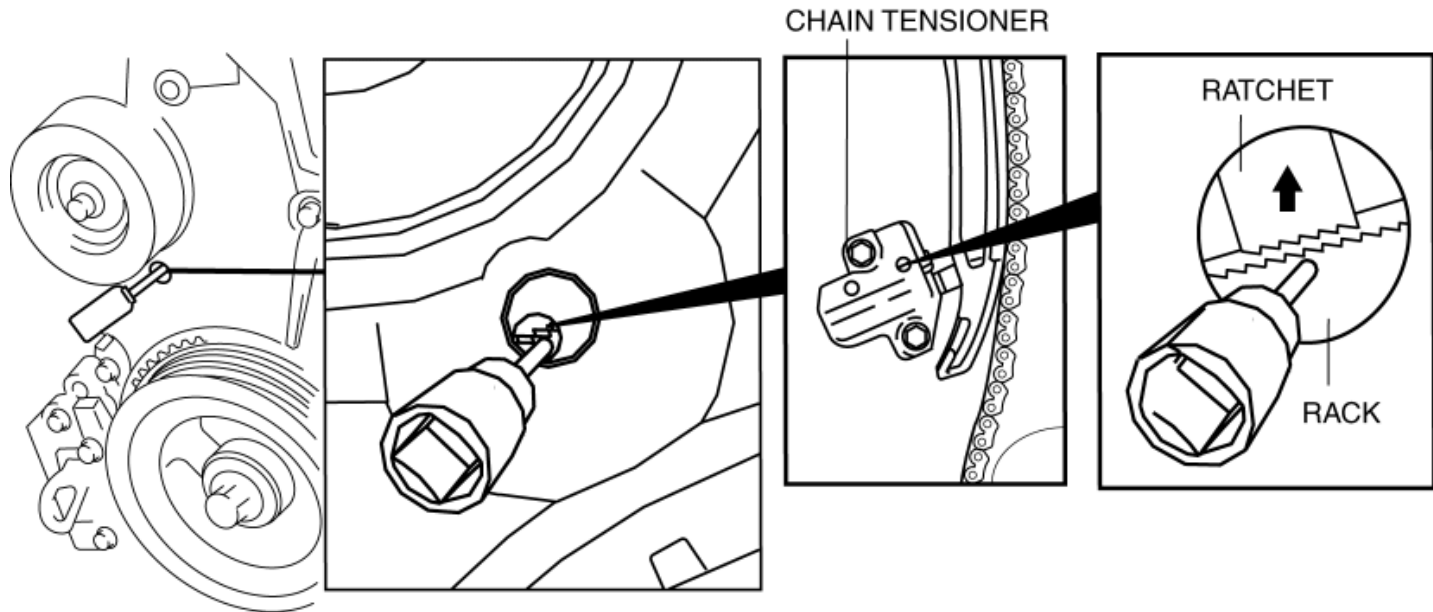
- a. Insert a suitable bolt (**M6 X 1.0, length 25—35 mm {0.99—1.3 in}**) into the engine front cover upper blind plug and tighten it until it contacts the chain tensioner arm, and then rotate it back one turn. (Set the bolt slightly away from the chain tensioner arm so that it does not contact it.)



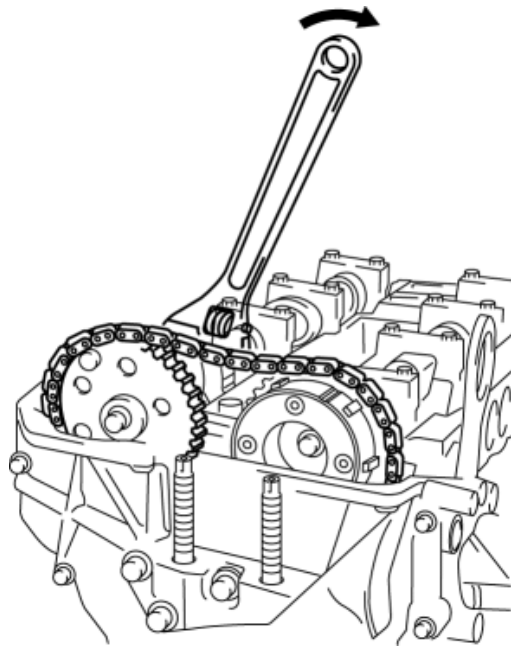
- b. Using the cast hexagon on the exhaust camshaft, apply force counterclockwise to facilitate unlocking the chain tensioner ratchet.



c. Using a Hex bit socket (**2.5 mm { 0.098 in }**) or T15 Torx bit socket, unlock the chain tensioner ratchet so that it can be lifted up.

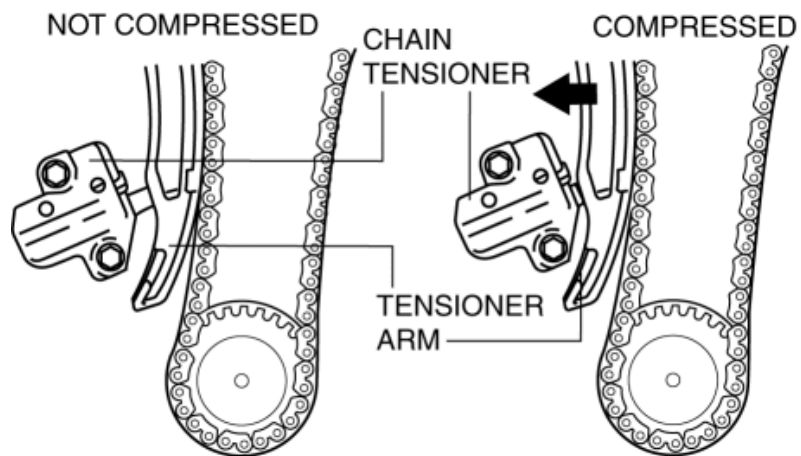


d. Using the cast hexagon on the exhaust camshaft, apply force in the direction of the engine rotation to increase tension on the chain.



NOTE:

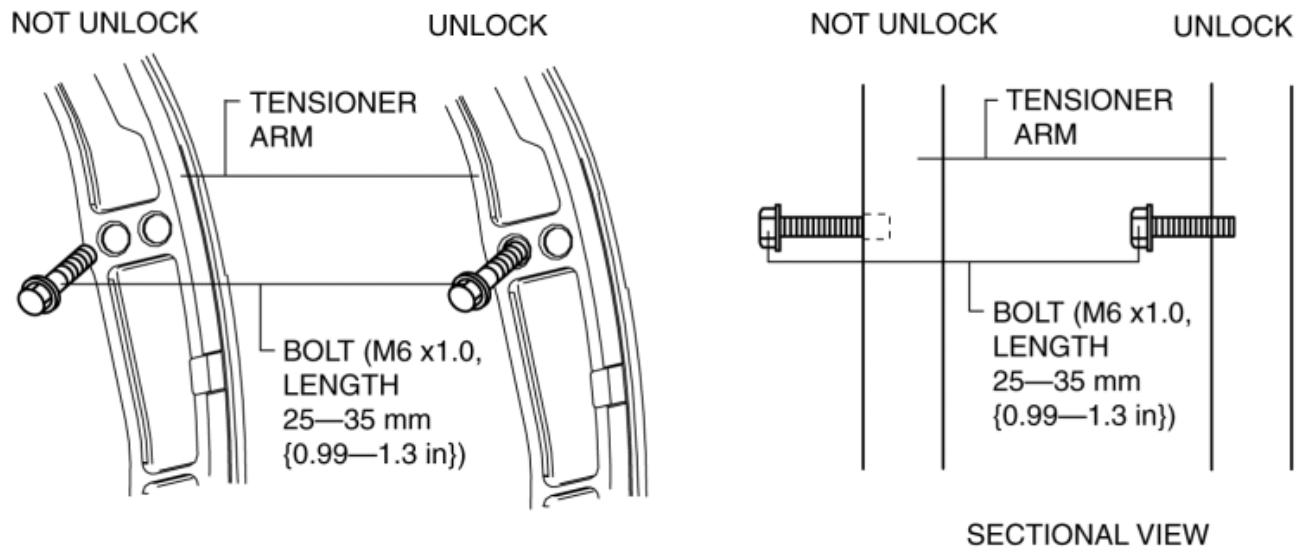
- The chain tensioner rack is compressed using the chain tension generated by applying force to the exhaust camshaft in the direction of the engine rotation.



NOTE:

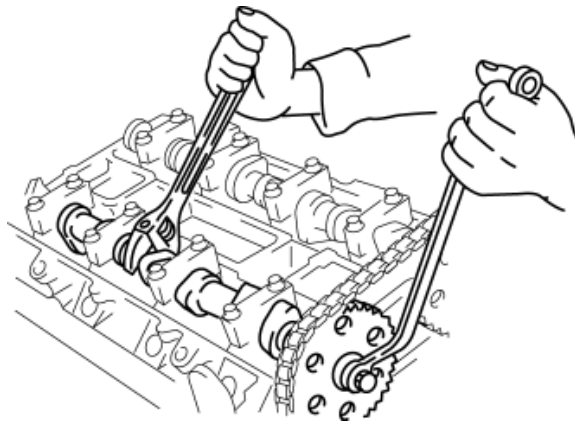
- The racket has not been unlocked if the bolt cannot be pressed in approx. 5 mm {0.2 in}.

e. Screw in the bolt set in Step 1 approx. 5 mm {0.2 in} and secure the tensioner arm with the rack compressed.



- If the tensioner arm cannot be secured, return the bolt to its original position and repeat the procedure from Step (3).

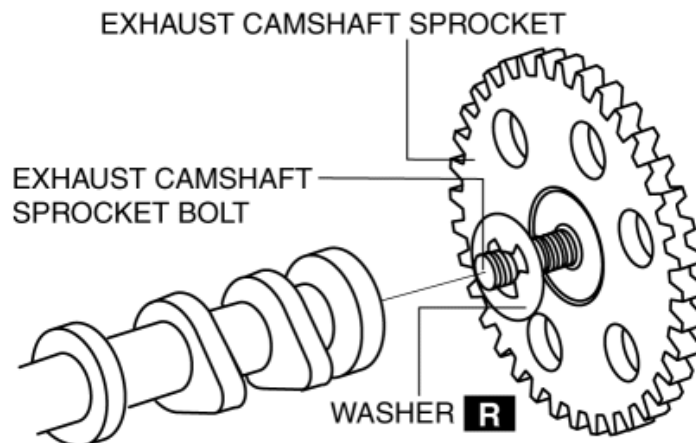
19. Fix the exhaust camshaft using a wrench on the cast hexagon, and loosen the camshaft sprocket bolt.



CAUTION:

- Perform the work carefully so that the washer does not drop out.

20. Remove the exhaust camshaft sprocket bolt, exhaust camshaft sprocket, and washer as a single unit.

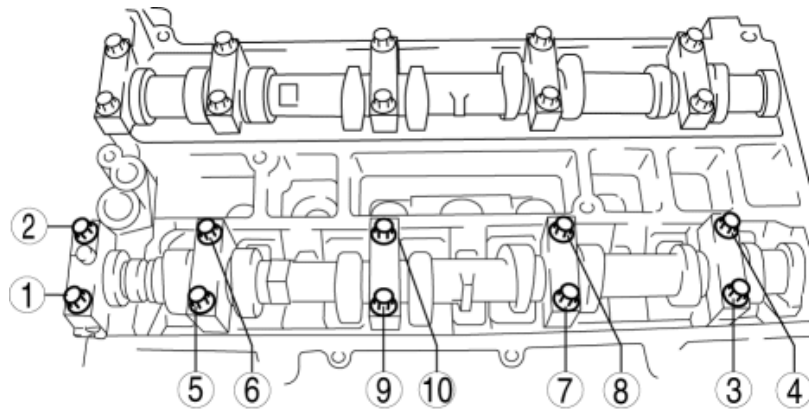


21. Remove the OCV. (See [OIL CONTROL VALVE \(OCV\) REMOVAL/ INSTALLATION \[MZR 2.5\]](#).)

NOTE:

- The camshaft caps are to be kept ordered for correct reassembly in their original positions. Do not mix the caps.

22. Loosen the camshaft cap bolts in two or three steps in the order shown in the figure and remove the camshaft cap.

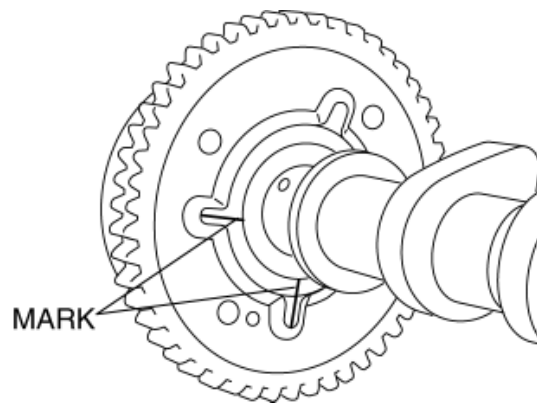


23. Remove the variable valve timing actuator and the camshaft on the intake air side as a single unit.

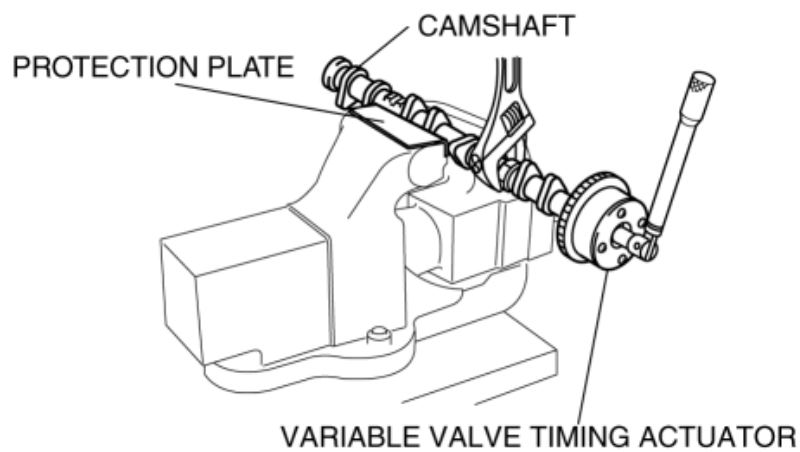
24. Remove the variable valve timing actuator.

NOTE:

- Do not add scratch marks to the camshaft thrust area.
- a. Mark the camshaft and variable valve timing actuator as shown in the figure to make sure they are installed in their original position.

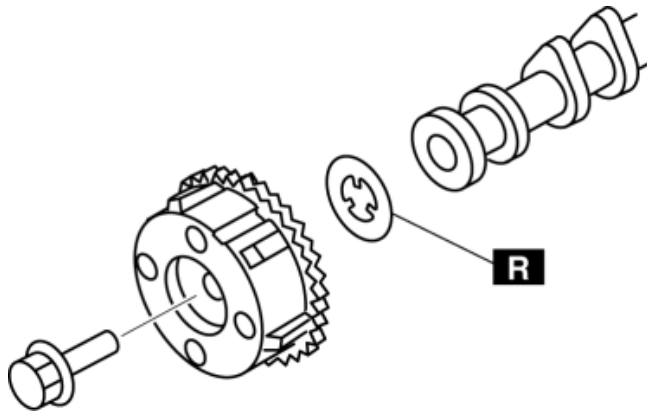


- b. Secure the camshaft in a vise.



- c. Loosen the variable valve timing actuator tightening bolt.

25. Install a new washer.



26. Install the variable valve timing actuator.

CAUTION:

- When the variable valve timing actuator is replaced with a new one, mark it in the same location as the old one.
- a. Secure the camshaft in a vise.
 - b. Align the marks of the camshaft and variable valve timing actuator.
 - c. Tighten variable valve timing actuator tightening bolt.

Tightening torque

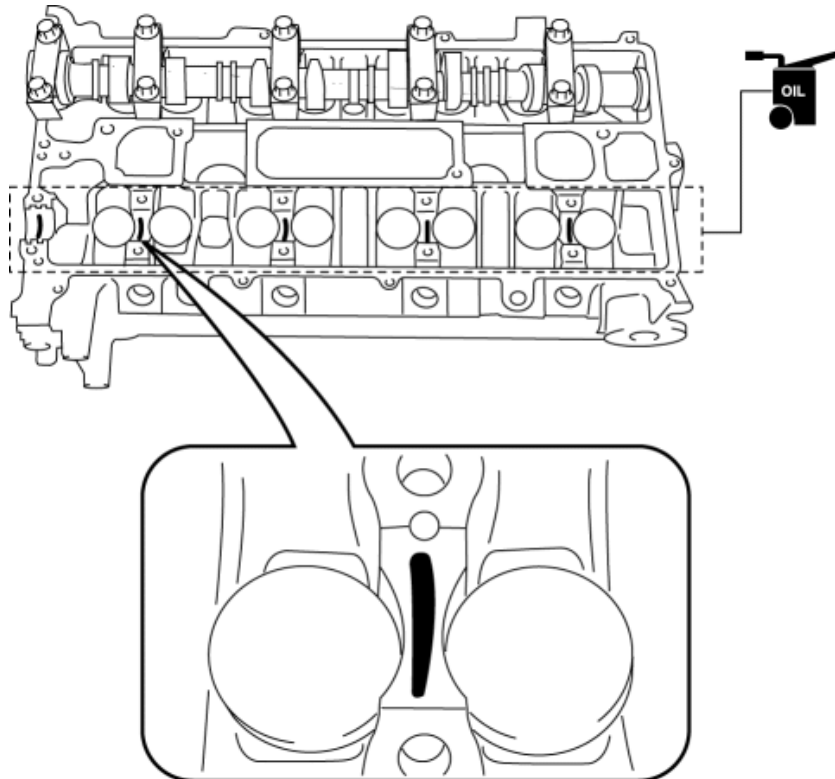
- 69—75 N·m {7.1—7.6 kgf·m, 51—55 ft·lbf}

NOTE:

- If the alignment marks on the variable valve timing actuator are not available, refer to the "TIMING CHAIN ASSEMBLY" in the engine workshop manual and perform the sprocket position alignment again.

27. Verify that No.1 cylinder is at TDC of the compression stroke. (Position counterweight contacts **SST**.)

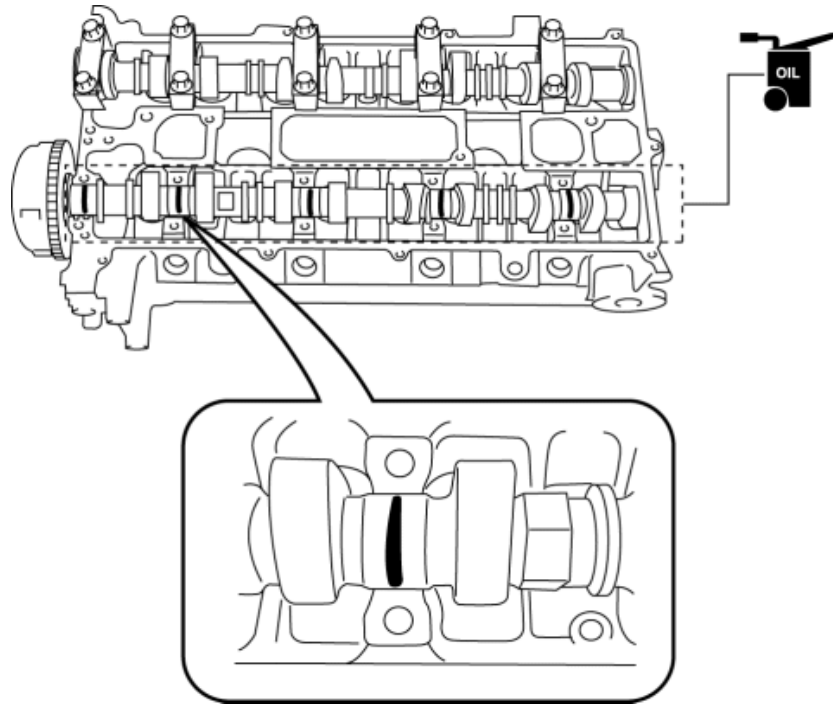
28. Apply the gear oil (SAE No.90 or equivalent) to each journal of the cylinder head as shown in the figure.



29. With No.1 cylinder cam aligned at TDC of the compression stroke, install the variable valve timing actuator

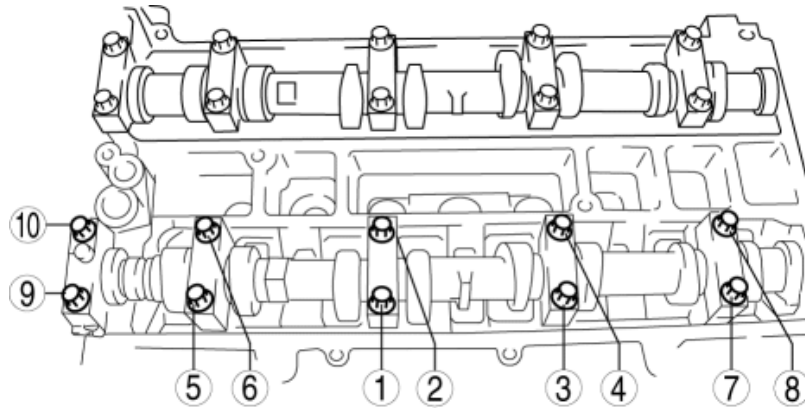
and the camshaft on the intake air side as a single unit.

30. Apply the gear oil (SAE No.90 or equivalent) to each journal of the camshaft as shown in the figure.



31. Temporarily tighten the camshaft cap bolts evenly in 2—3 steps.

32. Tighten the camshaft cap bolts in the order shown in the following two steps.



Tightening procedure

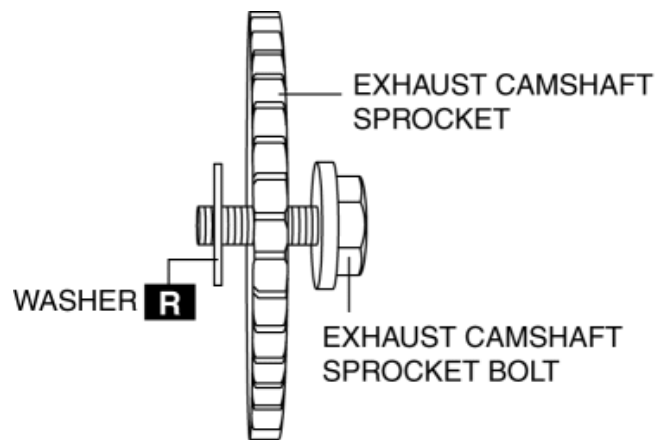
- 5.0—9.0 N·m {51—91 kgf·cm, 45—79 in·lbf}
- 14—17 N·m {1.5—1.7 kgf·m, 11—12 ft·lbf}

33. Install the OCV. (See [OIL CONTROL VALVE \(OCV\) REMOVAL/ INSTALLATION \[MZR 2.5\]](#).)

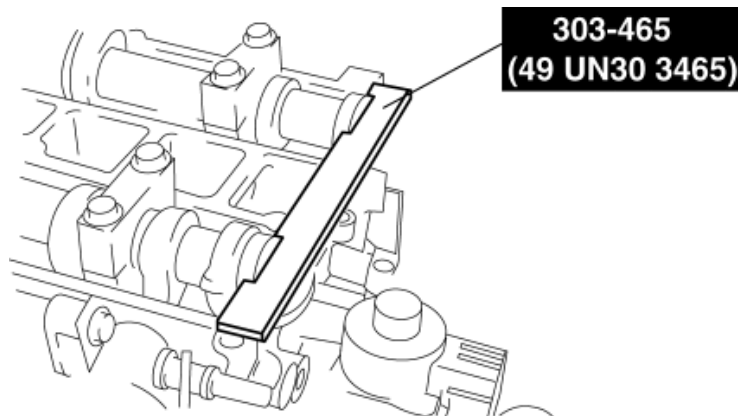
CAUTION:

- Install a washer to the fourth or fifth thread of the exhaust camshaft sprocket bolt being careful not to drop the washer.
- Do not tighten the camshaft sprocket bolt at this stage. Verify the valve timing before performing the bolt tightening.

34. Install the timing chain, exhaust camshaft sprocket bolt, exhaust camshaft sprocket, and a new washer as a single unit.

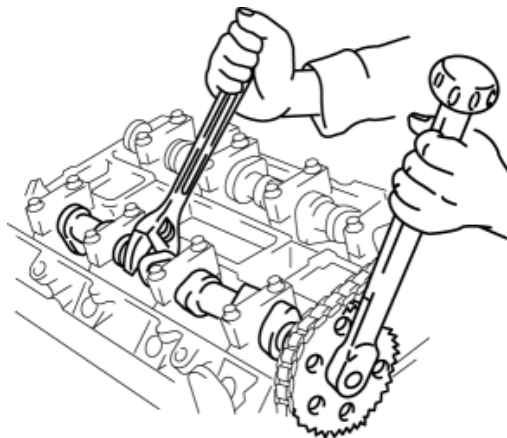


35. Install the **SST** on the camshaft as shown in the figure.



36. Remove the installation bolt for the engine front cover upper blind plug (**M6 X 1.0 length 25—35mm { 1.0—1.3 in }**), and apply tension to the timing chain.

37. Fix the exhaust camshaft using a wrench on the cast hexagon, and tighten the sprocket bolt.



Tightening torque

- 69—75 N·m {7.1—7.6 kgf·m, 51—55 ft·lbf}

38. Remove the **SST** from the camshaft.

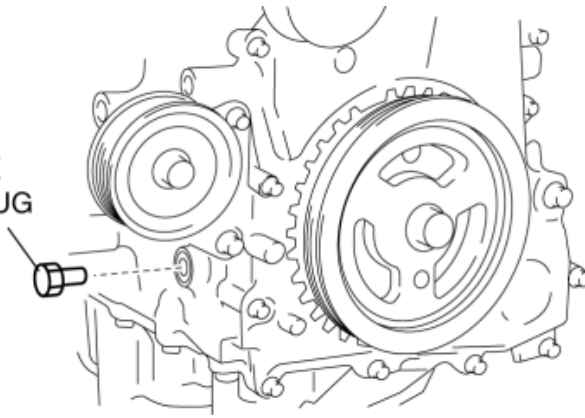
39. Remove the **SST** installed in the cylinder block lower blind plug hole.

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

- If not aligned, loosen the camshaft sprocket bolt and repeat the procedure from Step 35.

41. Install the cylinder block lower blind plug.

CYLINDER BLOCK
LOWER BLIND PLUG

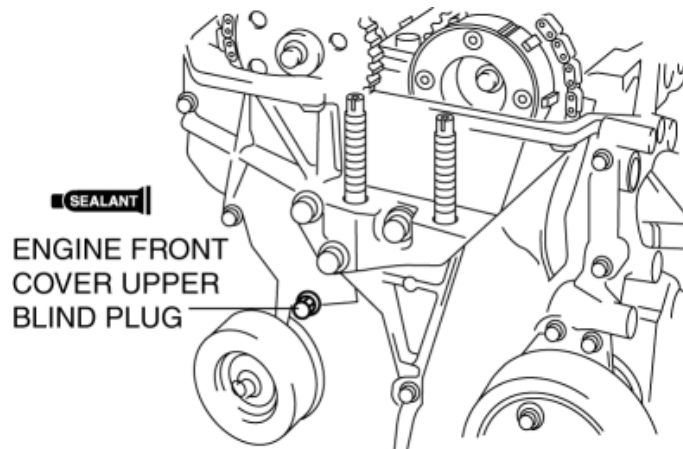


Tightening torque

- 18—22 N·m {1.9—2.2 kgf·m, 14—16 ft·lbf}

42. Connect the drive shaft (RH) to joint shaft. (ATX) (See [DRIVE SHAFT REMOVAL/ INSTALLATION.](#))

43. Apply the silicone sealant and install the engine front cover upper blind plug.



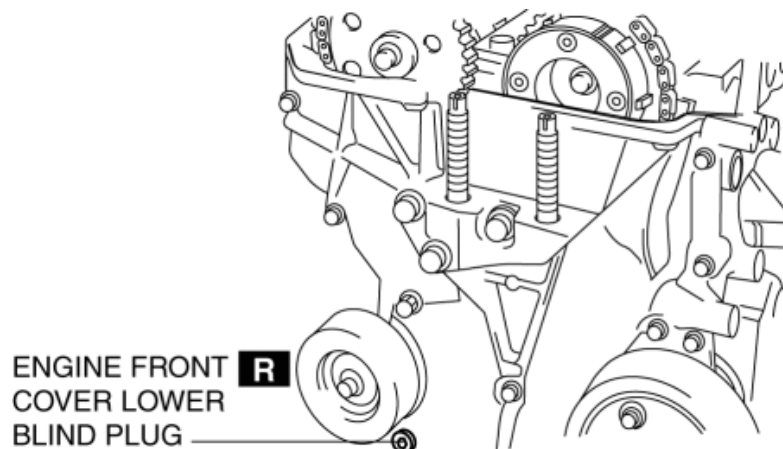
CAUTION:

- Install the engine front cover upper blind plug before the applied silicone sealant starts to harden.

Tightening torque

- 8—11 N·m {82—117 kgf·cm, 71—101 in·lbf}

44. Install a new engine front cover lower blind plug.



Tightening torque

10—14 N·m {102—142 kgf·cm, 89—123 in·lbf}

45. Install the drive belt. (See [DRIVE BELT REMOVAL/ INSTALLATION \[MZR 2.5\].](#))
46. Install the aerodynamic under cover No.2. (See [AERODYNAMIC UNDER COVER NO.2 REMOVAL/ INSTALLATION.](#))
47. Install the splash shield (RH).
48. Install the front mudguard (RH). (See [FRONT MUDGUARD REMOVAL/ INSTALLATION.](#))
49. Install the cylinder head cover. (See [TIMING CHAIN REMOVAL/ INSTALLATION \[MZR 2.5\].](#))
50. Connect the OCV connector.
51. Connect the CMP sensor connector.
52. Install the ventilation hose. (See [INTAKE-AIR SYSTEM REMOVAL/ INSTALLATION \[MZR 2.5\].](#))
53. Install the spark plugs. (See [SPARK PLUG REMOVAL/ INSTALLATION \[MZR 2.5\].](#))
54. Install the ignition coils. (See [IGNITION COIL REMOVAL/ INSTALLATION \[MZR 2.5\].](#))
55. Install the plug hole plate. (See [PLUG HOLE PLATE REMOVAL/ INSTALLATION \[MZR 2.5\].](#))
56. Connect the negative battery cable.

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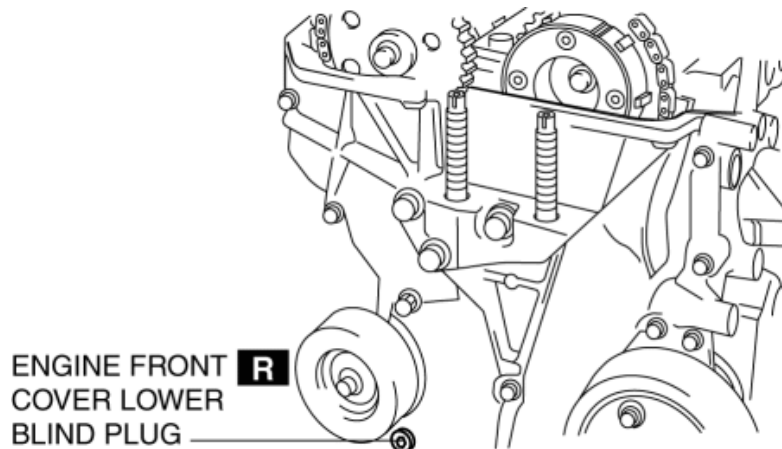
CAUTION:

- Variable valve timing actuator can not be disassembled because it is a precision unit.

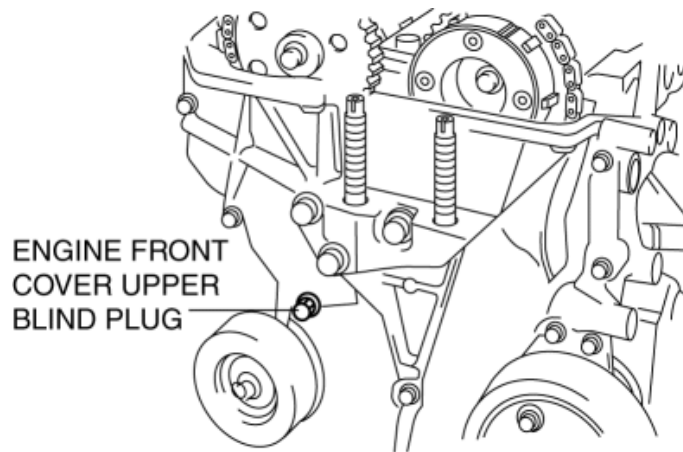
NOTE:

- Intake camshaft sprocket is integrated with the variable valve timing actuator and cannot be disassembled.

1. Disconnect the negative battery cable.
2. Remove the plug hole plate. (See [PLUG HOLE PLATE REMOVAL/ INSTALLATION \[MZR 2.5\]](#).)
3. Remove the ignition coils. (See [IGNITION COIL REMOVAL/ INSTALLATION \[MZR 2.5\]](#).)
4. Remove the spark plugs. (See [SPARK PLUG REMOVAL/ INSTALLATION \[MZR 2.5\]](#).)
5. Remove the ventilation hose. (See [INTAKE-AIR SYSTEM REMOVAL/ INSTALLATION \[MZR 2.5\]](#).)
6. Disconnect the camshaft position (CMP) sensor connector.
7. Disconnect the oil control valve (OCV) connector.
8. Remove the cylinder head cover. (See [TIMING CHAIN REMOVAL/ INSTALLATION \[MZR 2.5\]](#).)
9. Set the front mudguard (RH) out of the way. (See [FRONT MUDGUARD REMOVAL/ INSTALLATION](#).)
10. Remove the splash shield (RH).
11. Remove the aerodynamic under cover No.2. (See [AERODYNAMIC UNDER COVER NO.2 REMOVAL/ INSTALLATION](#).)
12. Remove the drive belt. (See [DRIVE BELT REMOVAL/ INSTALLATION \[MZR 2.5\]](#).)
13. Remove the engine front cover lower blind plug.

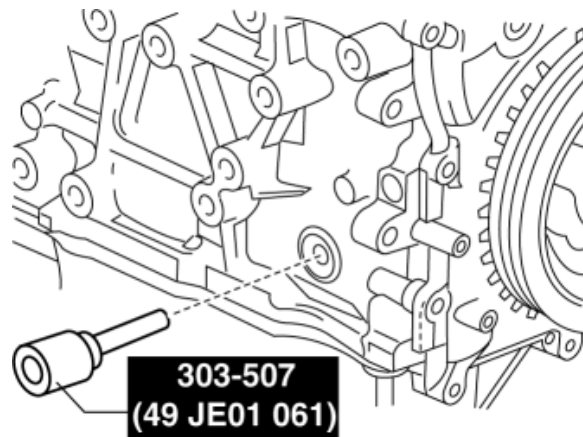


14. Remove the engine front cover upper blind plug.



15. Disconnect the drive shaft (RH) from joint shaft, set the drive shaft (RH) out of the way. (ATX) (See **DRIVE SHAFT REMOVAL/ INSTALLATION.**)

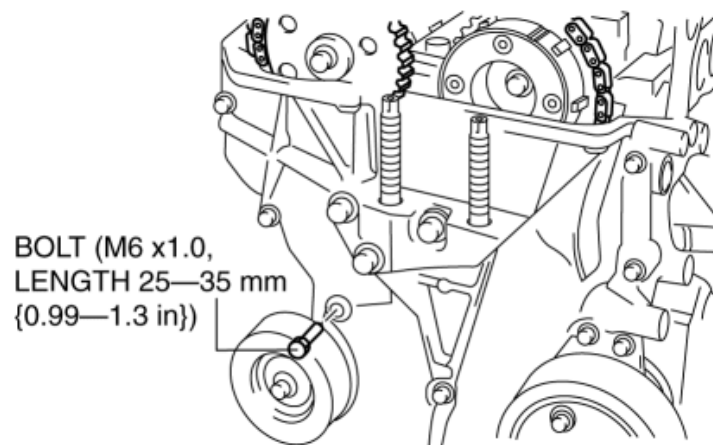
16. Remove the cylinder block lower blind plug, and install the **SST**.



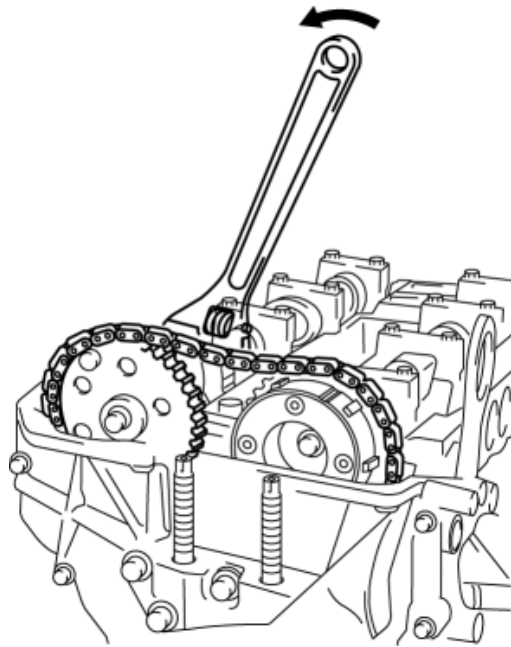
17. Rotate the crankshaft in the direction of the engine rotation so that the No.1 piston is at TDC of the compression stroke. (Until the counterweight contacts **SST** and stops.)

18. Loosen the timing chain using the following procedure.

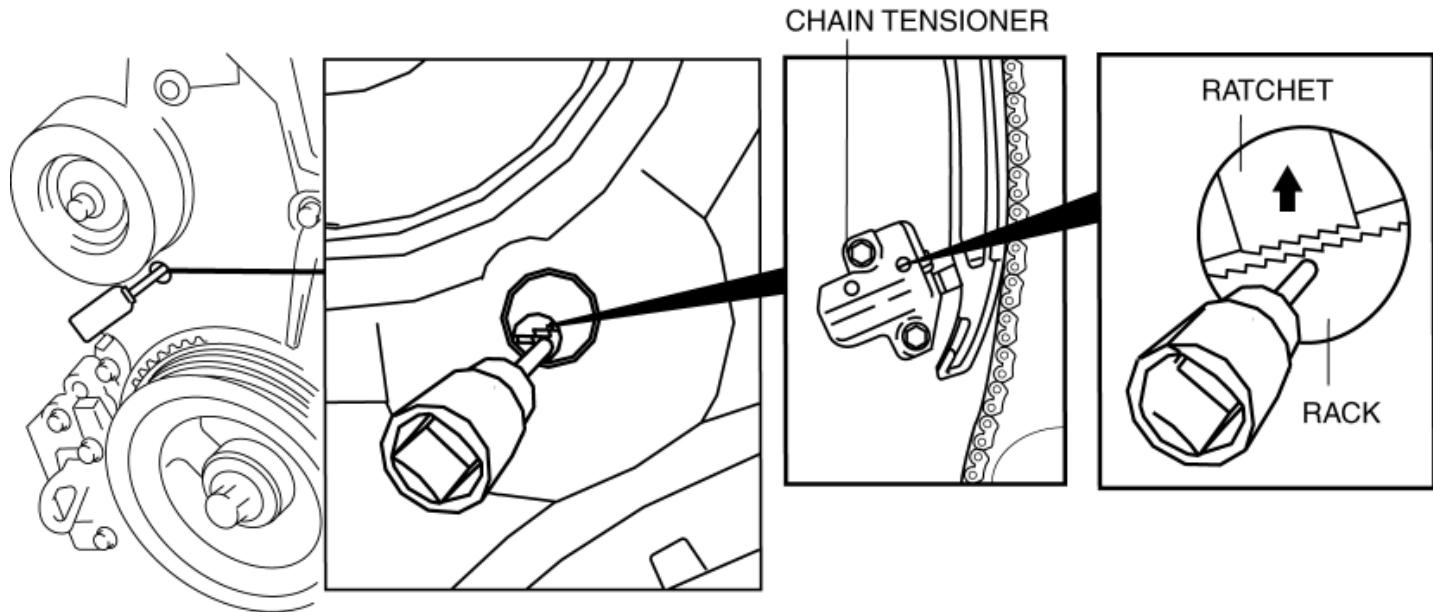
- a. Insert a suitable bolt (**M6 X 1.0, length 25—35 mm {0.99—1.3 in}**) into the engine front cover upper blind plug and tighten it until it contacts the chain tensioner arm, and then rotate it back one turn. (Set the bolt slightly away from the chain tensioner arm so that it does not contact it.)



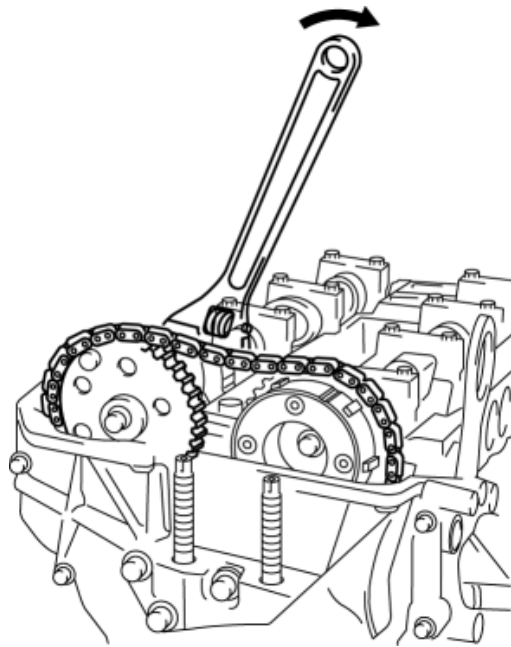
- b. Using the cast hexagon on the exhaust camshaft, apply force counterclockwise to facilitate unlocking the chain tensioner ratchet.



c. Using a Hex bit socket (**2.5 mm { 0.098 in }**) or T15 Torx bit socket, unlock the chain tensioner ratchet so that it can be lifted up.

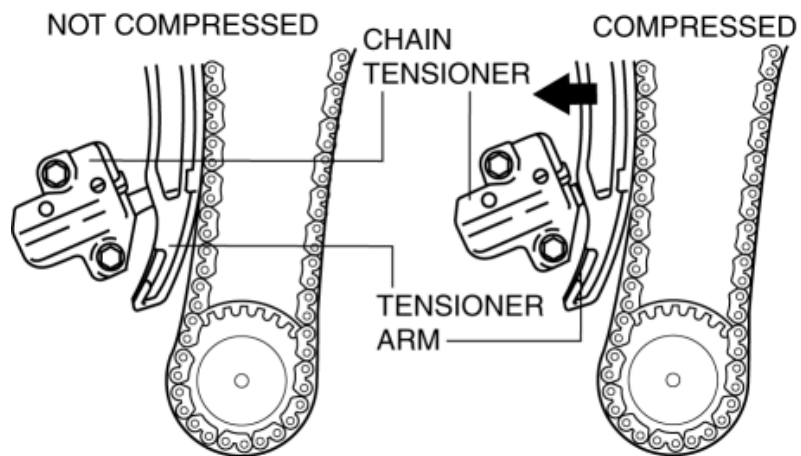


d. Using the cast hexagon on the exhaust camshaft, apply force in the direction of the engine rotation to increase tension on the chain.



NOTE:

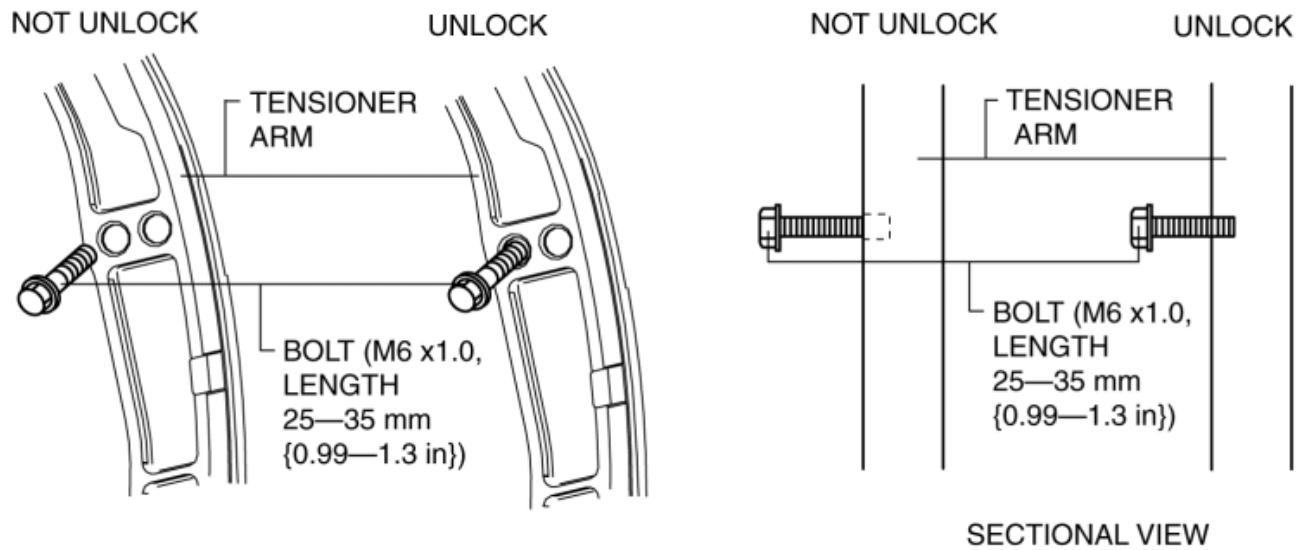
- The chain tensioner rack is compressed using the chain tension generated by applying force to the exhaust camshaft in the direction of the engine rotation.



NOTE:

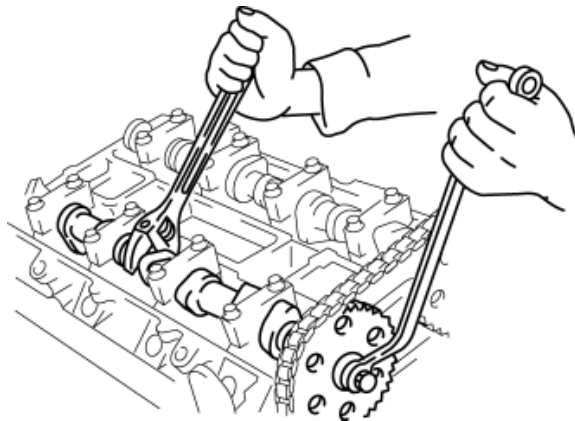
- The racket has not been unlocked if the bolt cannot be pressed in approx. 5 mm {0.2 in}.

e. Screw in the bolt set in Step 1 approx. 5 mm {0.2 in} and secure the tensioner arm with the rack compressed.



- If the tensioner arm cannot be secured, return the bolt to its original position and repeat the procedure from Step (3).

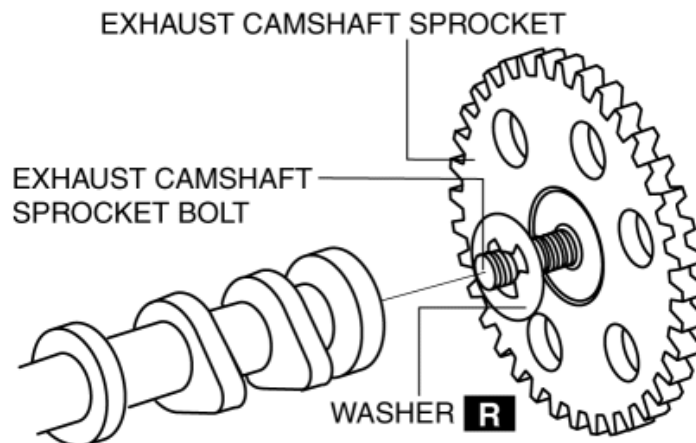
19. Fix the exhaust camshaft using a wrench on the cast hexagon, and loosen the camshaft sprocket bolt.



CAUTION:

- Perform the work carefully so that the washer does not drop out.

20. Remove the exhaust camshaft sprocket bolt, exhaust camshaft sprocket, and washer as a single unit.

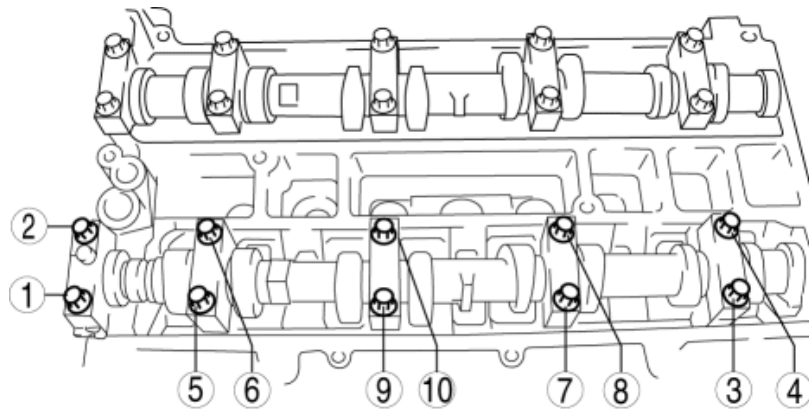


21. Remove the OCV. (See [OIL CONTROL VALVE \(OCV\) REMOVAL/ INSTALLATION \[MZR 2.5\]](#).)

NOTE:

- The camshaft caps are to be kept ordered for correct reassembly in their original positions. Do not mix the caps.

22. Loosen the camshaft cap bolts in two or three steps in the order shown in the figure and remove the camshaft cap.

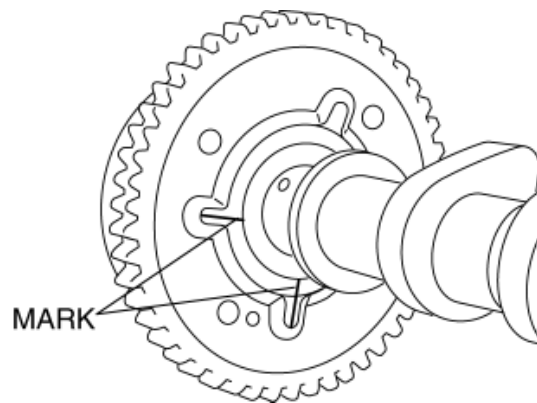


23. Remove the variable valve timing actuator and the camshaft on the intake air side as a single unit.

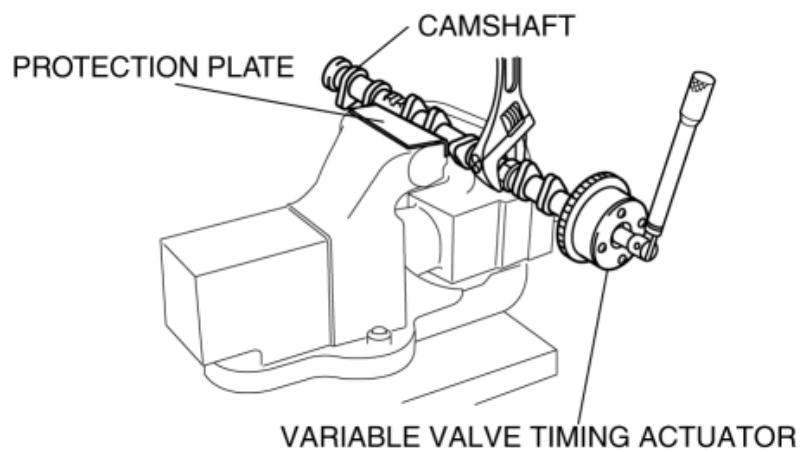
24. Remove the variable valve timing actuator.

NOTE:

- Do not add scratch marks to the camshaft thrust area.
- a. Mark the camshaft and variable valve timing actuator as shown in the figure to make sure they are installed in their original position.

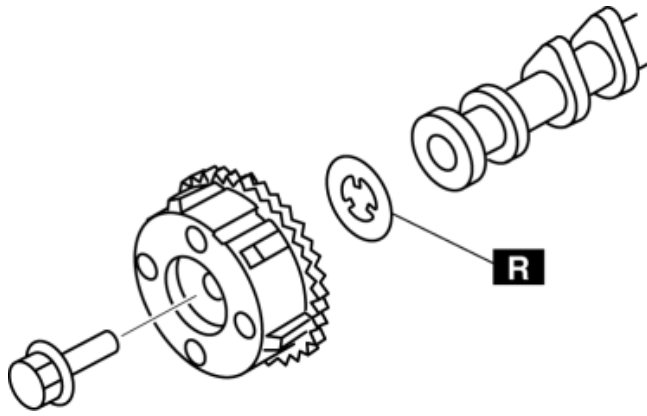


b. Secure the camshaft in a vise.



c. Loosen the variable valve timing actuator tightening bolt.

25. Install a new washer.



26. Install the variable valve timing actuator.

CAUTION:

- When the variable valve timing actuator is replaced with a new one, mark it in the same location as the old one.
- a. Secure the camshaft in a vise.
 - b. Align the marks of the camshaft and variable valve timing actuator.
 - c. Tighten variable valve timing actuator tightening bolt.

Tightening torque

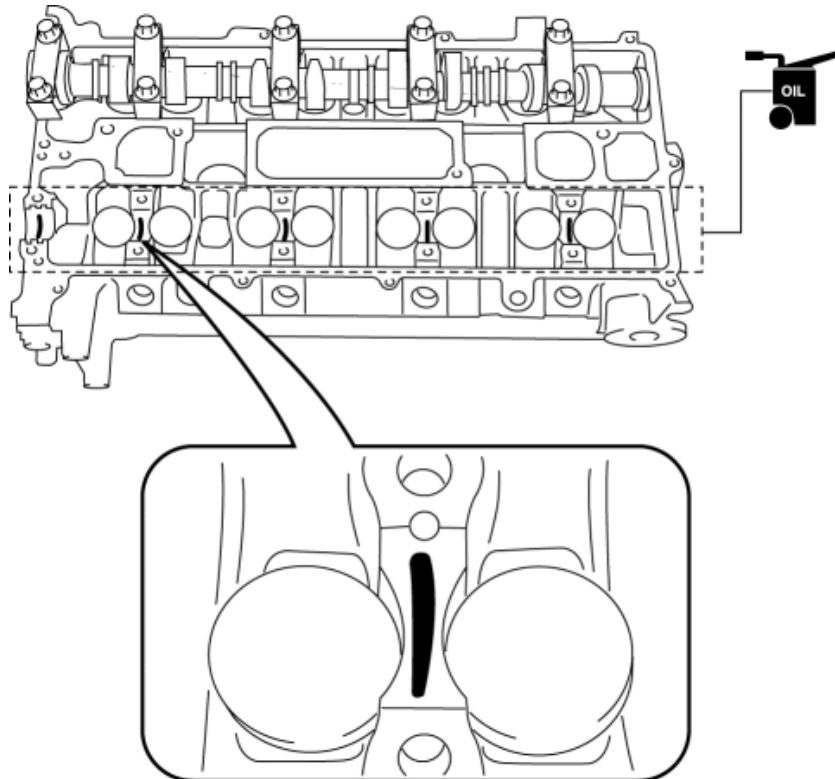
- 69—75 N·m {7.1—7.6 kgf·m, 51—55 ft·lbf}

NOTE:

- If the alignment marks on the variable valve timing actuator are not available, refer to the "TIMING CHAIN ASSEMBLY" in the engine workshop manual and perform the sprocket position alignment again.

27. Verify that No.1 cylinder is at TDC of the compression stroke. (Position counterweight contacts **SST**.)

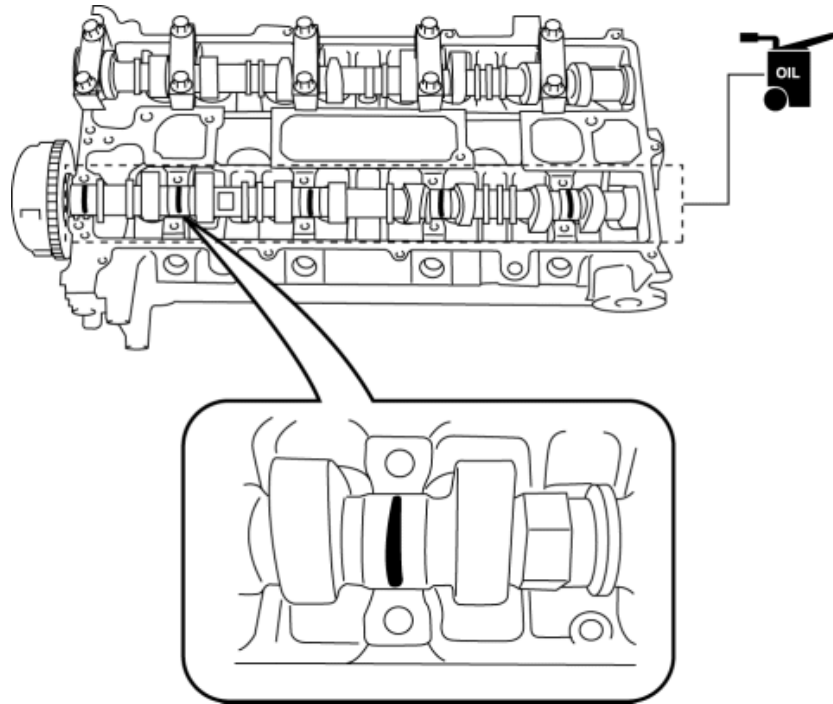
28. Apply the gear oil (SAE No.90 or equivalent) to each journal of the cylinder head as shown in the figure.



29. With No.1 cylinder cam aligned at TDC of the compression stroke, install the variable valve timing actuator

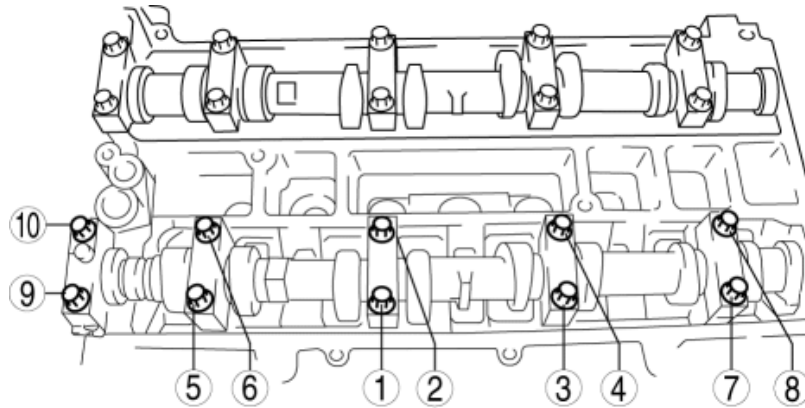
and the camshaft on the intake air side as a single unit.

30. Apply the gear oil (SAE No.90 or equivalent) to each journal of the camshaft as shown in the figure.



31. Temporarily tighten the camshaft cap bolts evenly in 2—3 steps.

32. Tighten the camshaft cap bolts in the order shown in the following two steps.



Tightening procedure

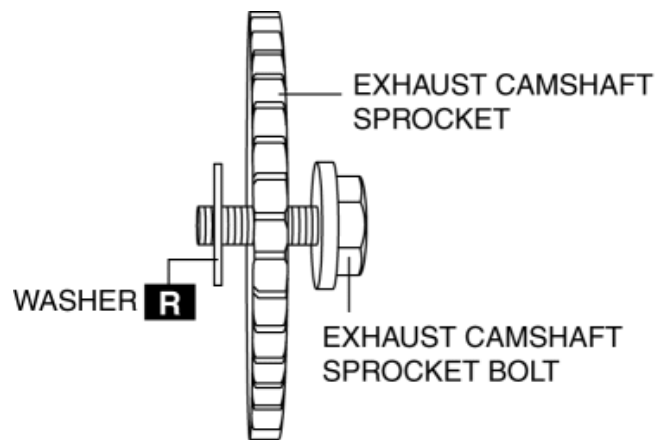
- 5.0—9.0 N·m {51—91 kgf·cm, 45—79 in·lbf}
- 14—17 N·m {1.5—1.7 kgf·m, 11—12 ft·lbf}

33. Install the OCV. (See [OIL CONTROL VALVE \(OCV\) REMOVAL/ INSTALLATION \[MZR 2.5\]](#).)

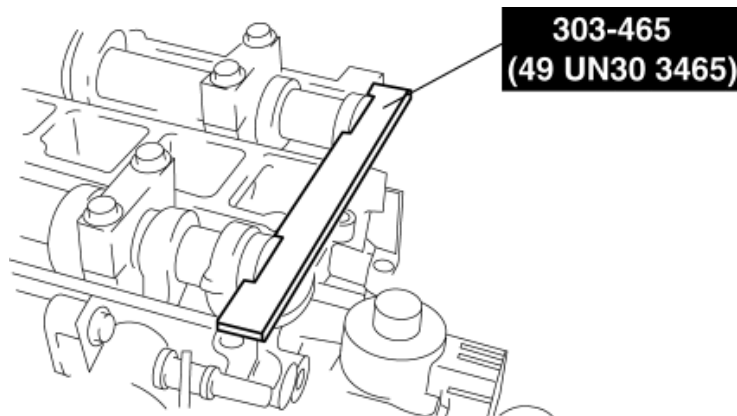
CAUTION:

- Install a washer to the fourth or fifth thread of the exhaust camshaft sprocket bolt being careful not to drop the washer.
- Do not tighten the camshaft sprocket bolt at this stage. Verify the valve timing before performing the bolt tightening.

34. Install the timing chain, exhaust camshaft sprocket bolt, exhaust camshaft sprocket, and a new washer as a single unit.

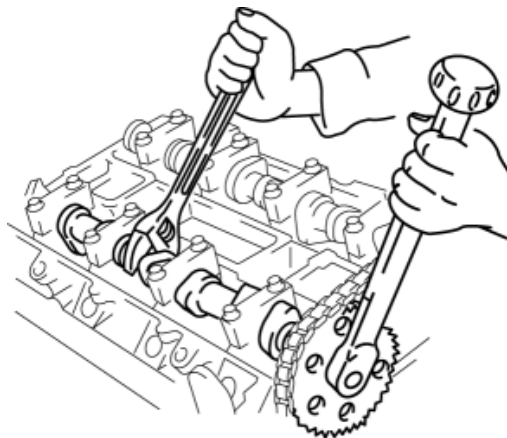


35. Install the **SST** on the camshaft as shown in the figure.



36. Remove the installation bolt for the engine front cover upper blind plug (**M6 X 1.0 length 25—35mm { 1.0—1.3 in }**), and apply tension to the timing chain.

37. Fix the exhaust camshaft using a wrench on the cast hexagon, and tighten the sprocket bolt.



Tightening torque

- 69—75 N·m {7.1—7.6 kgf·m, 51—55 ft·lbf}

38. Remove the **SST** from the camshaft.

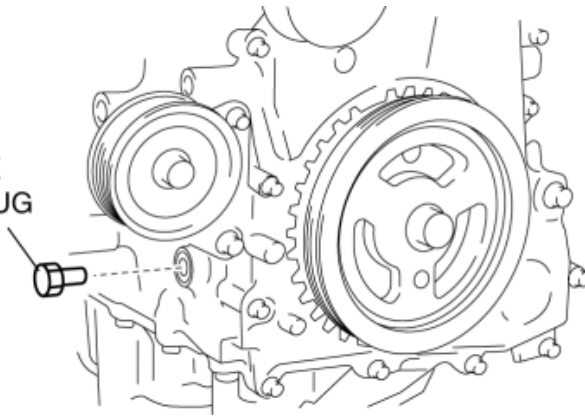
39. Remove the **SST** installed in the cylinder block lower blind plug hole.

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

- If not aligned, loosen the camshaft sprocket bolt and repeat the procedure from Step 35.

41. Install the cylinder block lower blind plug.

CYLINDER BLOCK
LOWER BLIND PLUG

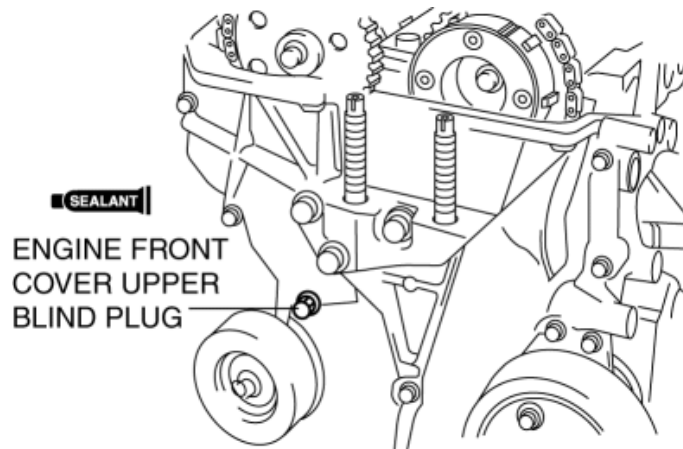


Tightening torque

- 18—22 N·m {1.9—2.2 kgf·m, 14—16 ft·lbf}

42. Connect the drive shaft (RH) to joint shaft. (ATX) (See [DRIVE SHAFT REMOVAL/ INSTALLATION.](#))

43. Apply the silicone sealant and install the engine front cover upper blind plug.



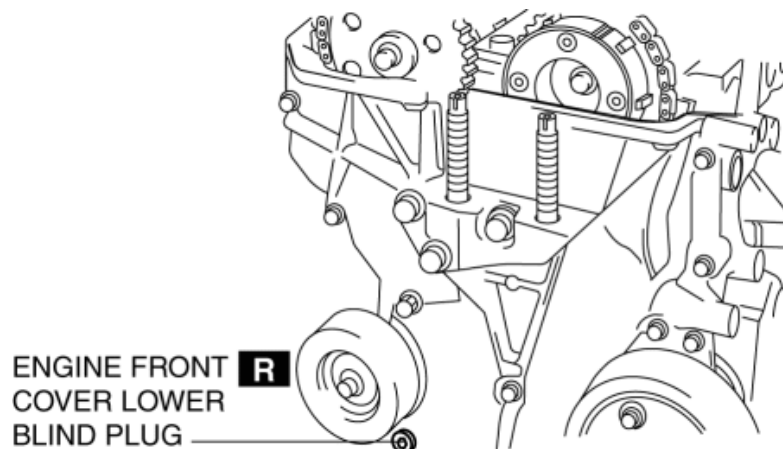
CAUTION:

- Install the engine front cover upper blind plug before the applied silicone sealant starts to harden.

Tightening torque

- 8—11 N·m {82—117 kgf·cm, 71—101 in·lbf}

44. Install a new engine front cover lower blind plug.



Tightening torque

10—14 N·m {102—142 kgf·cm, 89—123 in·lbf}

45. Install the drive belt. (See [DRIVE BELT REMOVAL/ INSTALLATION \[MZR 2.5\].](#))
46. Install the aerodynamic under cover No.2. (See [AERODYNAMIC UNDER COVER NO.2 REMOVAL/ INSTALLATION.](#))
47. Install the splash shield (RH).
48. Install the front mudguard (RH). (See [FRONT MUDGUARD REMOVAL/ INSTALLATION.](#))
49. Install the cylinder head cover. (See [TIMING CHAIN REMOVAL/ INSTALLATION \[MZR 2.5\].](#))
50. Connect the OCV connector.
51. Connect the CMP sensor connector.
52. Install the ventilation hose. (See [INTAKE-AIR SYSTEM REMOVAL/ INSTALLATION \[MZR 2.5\].](#))
53. Install the spark plugs. (See [SPARK PLUG REMOVAL/ INSTALLATION \[MZR 2.5\].](#))
54. Install the ignition coils. (See [IGNITION COIL REMOVAL/ INSTALLATION \[MZR 2.5\].](#))
55. Install the plug hole plate. (See [PLUG HOLE PLATE REMOVAL/ INSTALLATION \[MZR 2.5\].](#))
56. Connect the negative battery cable.

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