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Subject: VARIABLE VALVE TIMING (VVT) NOISE AND/OR TIMING CHAIN NOISE	Bulletin No: 01-012/12
	Last Issued: 04/03/2012

BULLETIN NOTE

- This bulletin supersedes the previous bulletin 01-012/12 issued on 2/23/12, 01-018/11 issued on 04/27/11 and 12/21/11 and 01-053/10 issued on 12/02/10. The REPAIR PROCEDURE FLOWCHART, REPAIR PROCEDURE and WARRANTY INFORMATION have been revised.
- Changes are noted below in Red beside the change bar.

APPLICABLE MODEL(S)/VINS

2006-2007 Mazdaspeed6

2007-2009 Mazdaspeed3

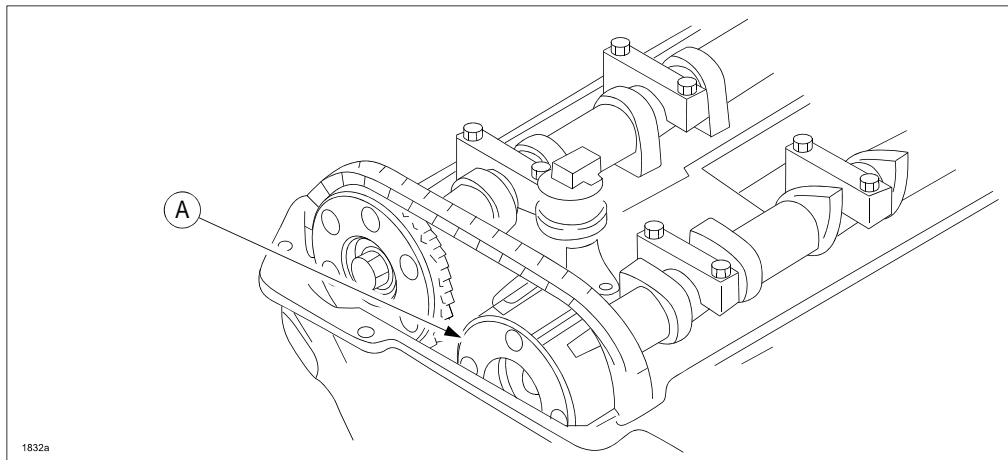
2007-2010 CX-7 2.3L Turbo vehicles with VINs lower than JM3ER*****327444 (prod. before Feb. 26, 2010)

2010 Mazdaspeed3 vehicles with VINs lower than JM1BL*****295247 (prod. before Feb. 27, 2010)

DESCRIPTION

VVT Noise:

When the engine is first started, some vehicles may exhibit a loud ticking noise from the variable valve timing (VVT) actuator (A). This is caused by the lock pin of the variable valve timing actuator not fully engaging or from a worn lock pin hole.



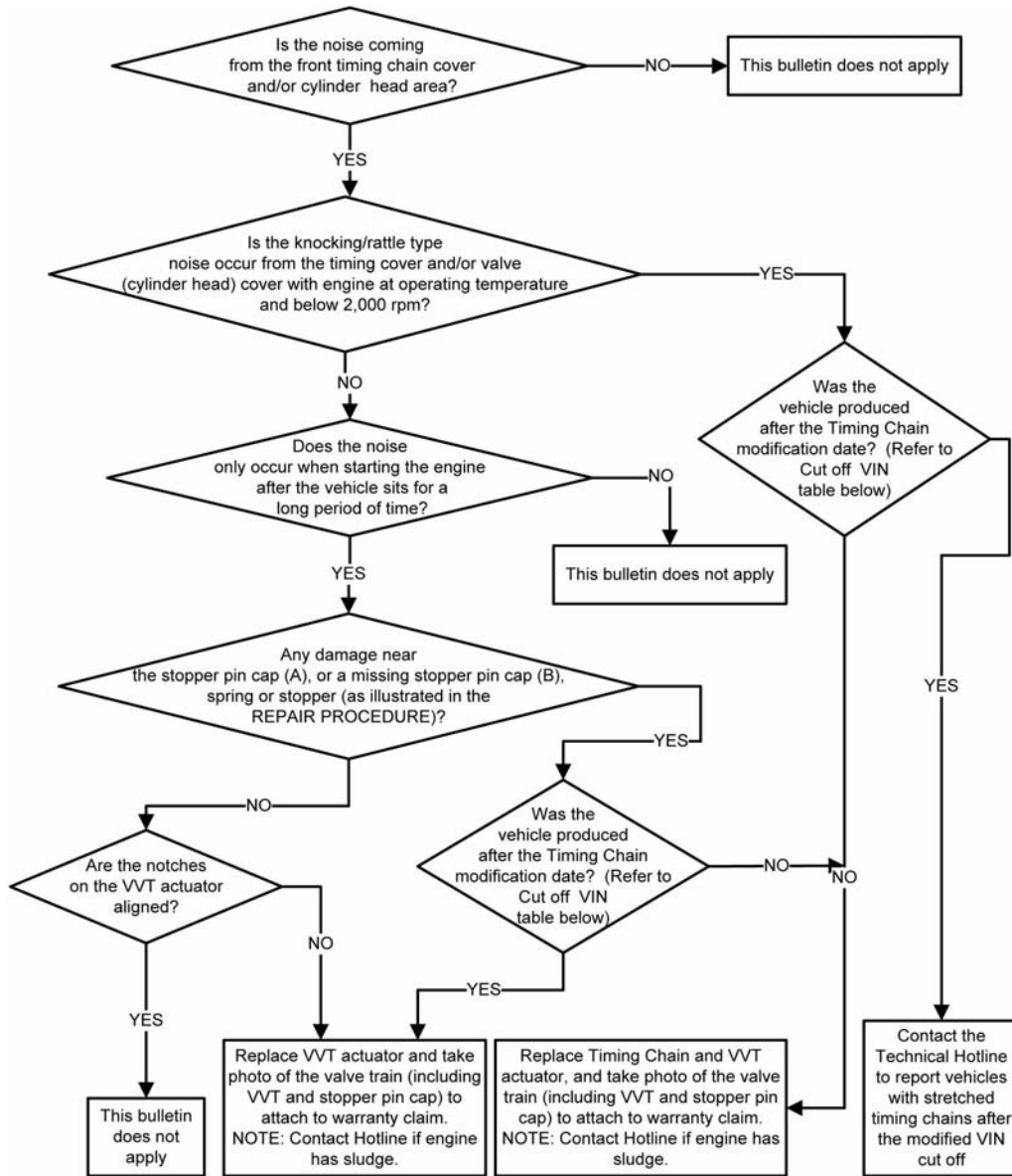
Timing Chain Noise:

With the engine warmed up, some vehicles may exhibit a knocking/rattle type noise from the front timing cover and/or valve (cylinder head) cover below 2,000 rpm. The noise is caused by excessive stretching of the timing chain.

Customers having this concern should have their vehicle repaired using the following repair procedure.

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REPAIR PROCEDURE FLOW CHART



VIN Cutoff for Modified Timing Chain

Model	Year	VIN/Date of Timing Chain Modification
MAZDASPEED3	2007-2009	No Modification
MAZDASPEED3	2010	JM1BL ***** 152985 (May 1, 2009)
MAZDASPEED6	2006-2007	No Modification
CX-7	2007-2009	JM3ER ***** 300119 (May 1, 2009)

COMPARISON PICTURES

OK	NEED TO CALL
	
	
	
	
	

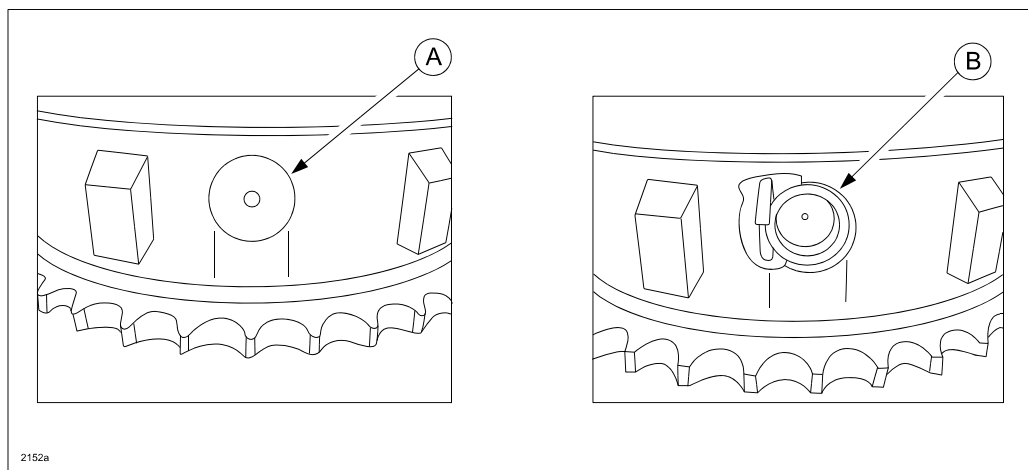
REPAIR PROCEDURE

1. Verify proper oil change intervals have been performed. If not, this information is not applicable.
2. Verify that the noise is coming from the front timing chain cover and/or cylinder head area.

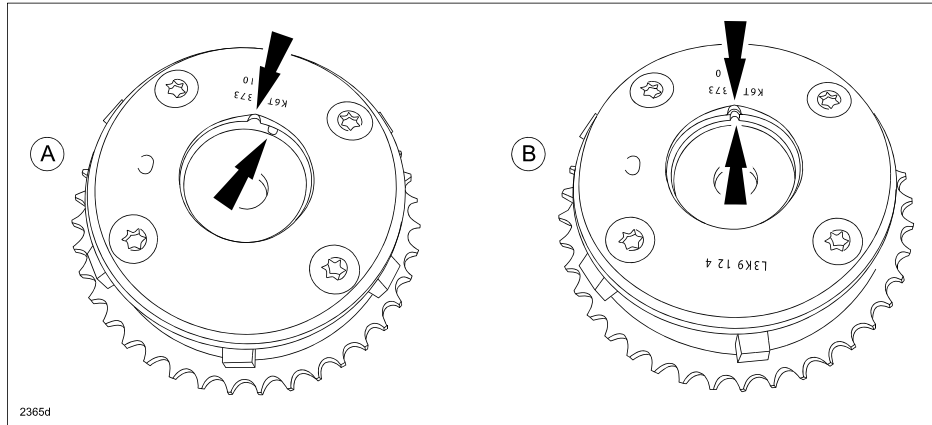
TIPS:

- The noise is heard inside the vehicle with all of the windows rolled up, all accessories turned off, and engine running at normal operating temperature.
 - Knock pulse is at camshaft speed (1/2 the engine RPMs).
 - Knock can usually be felt on the No. 3 engine mount.
- Does a knocking/rattle type noise come from the timing chain cover and/or cylinder head cover when the engine is at normal operating temperature and below 2,000 rpm.
 - **Yes:** Was the vehicle produced after the timing chain modification date (see page 2)?
 - *Yes: Report condition to Technical Hotline [(888) 832-8477].*
 - *No: Replace Timing Chain and VVT actuator. See REPLACEMENT OF TIMING CHAIN AND VVT ACTUATOR in this TSB (page 25).*
 - **No:** Does the noise only occur when starting the engine after the vehicle sits for long periods of time?
 - *Yes: Go to next step.*
 - *No: This information is no applicable.*
3. Remove the cylinder head cover. See TIMING CHAIN REMOVAL/INSTALLATION [L3 WITH TC] on MS3.
 4. Inspect the VVT actuator for damage around the stopper pin cap (A) or a missing stopper pin cap spring and stopper (B).
 - If no parts are missing or damaged, go to next step.
 - If parts are missing or damaged:
 - **Without modified Timing Chain (see page 2):** Replace the Timing Chain and VVT actuator. See REPLACEMENT OF TIMING CHAIN AND VVT ACTUATOR in this TSB (page 25).
 - **With modified Timing Chain (see page 2):** Replace the VVT actuator. See REPLACEMENT OF VVT ACTUATOR ONLY in this TSB using new SST (page 6).

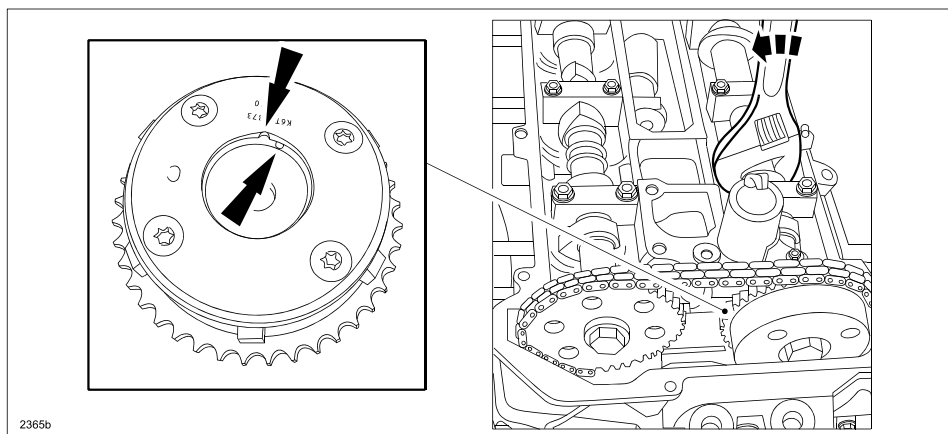
NOTE: If the VVT pin has fallen out and the oil pan needs to be removed to retrieve the pin, align the VVT damage so that it is visible in a photo with the valve train.



5. Turn the crankshaft clockwise so that the notches on the VVT actuator can be checked.
 - A. If the notches are NOT aligned, go to the next step.
 - B. If the notches are aligned, there is no problem with the VVT actuator and this information is not applicable. Refer to MS3 for troubleshooting.

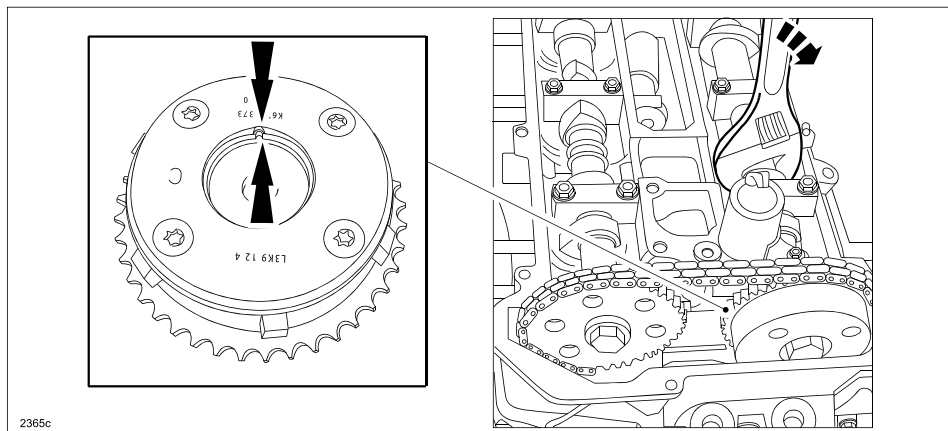


6. Turn the camshaft counterclockwise to align the notches on the variable valve timing actuator.



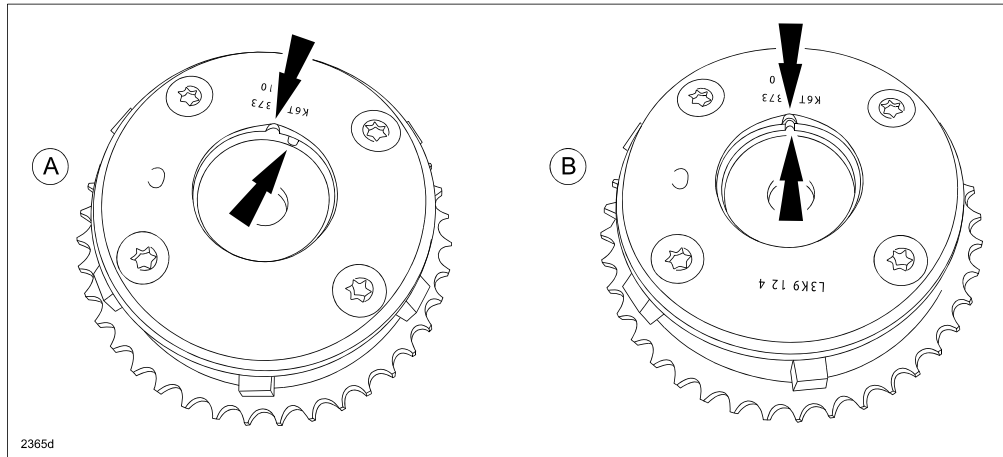
7. With the notches aligned, turn the camshaft clockwise 90 degrees using an adjustable wrench (or 24 mm box end wrench) on the intake camshaft cast hexagon as shown.

CAUTION: Do not use the bolt on the VVT actuator to rotate the camshaft.



8. Check the notches again.

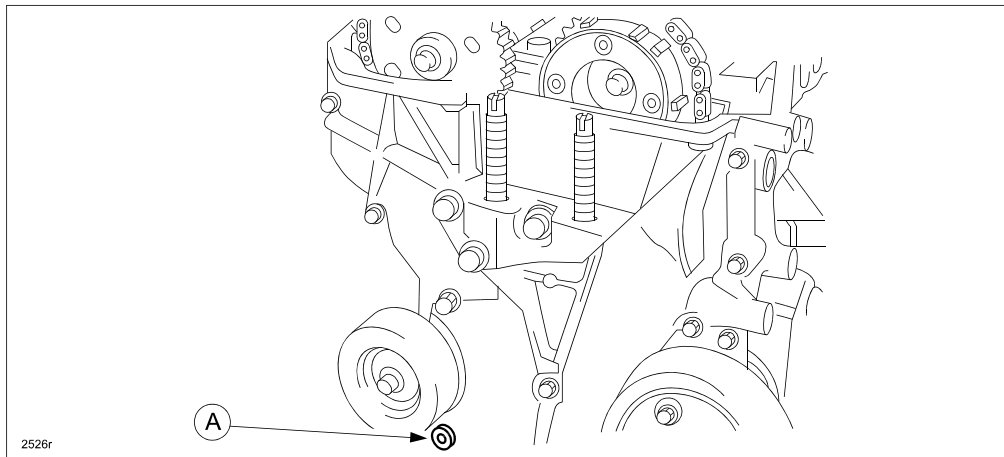
- A. If the notches are NOT aligned, replace the VVT actuator. See **REPLACEMENT OF VVT ACTUATOR ONLY** in this TSB using new SST (page 6).
- B. If the notches are aligned, there is no problem with the VVT actuator and this information is not applicable. Refer to MS3 for troubleshooting.

**CAUTION:**

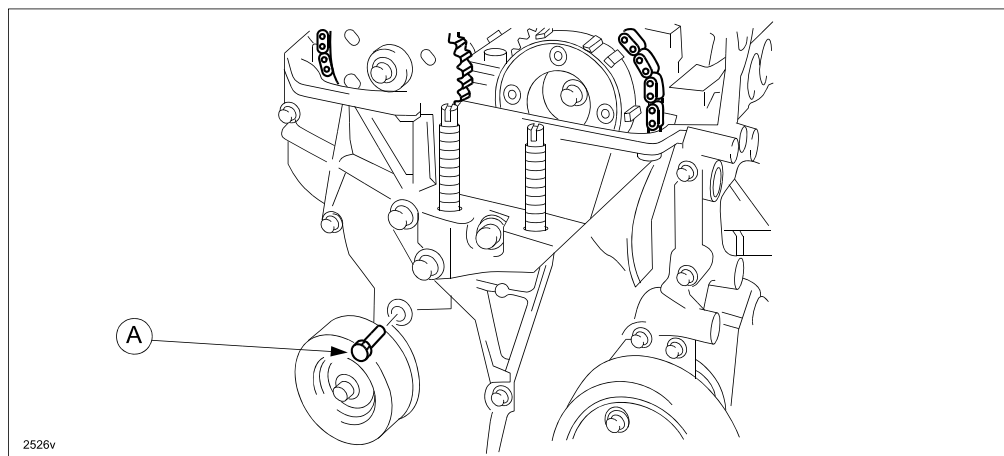
- If any parts are damaged or missing, remove the front cover to inspect the timing and oil pump chains and all related components for damage as a result of the loose parts. Replace components as necessary.
- If the loose parts cannot be located in the timing chain area, it will be necessary to remove the oil pan to remove them.

REPLACEMENT OF VVT ACTUATOR ONLY

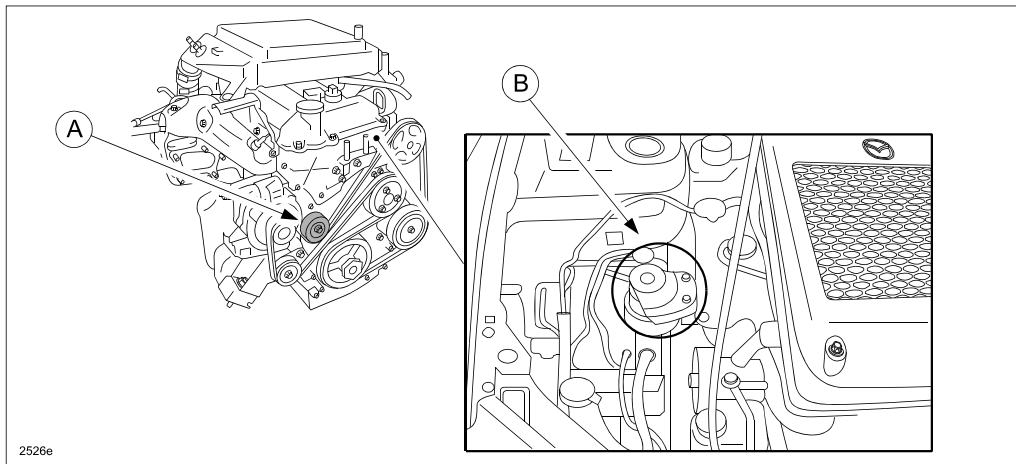
1. Record the customer's radio station presets.
2. Disconnect the negative battery cable.
3. Remove the splash shield (RH).
4. Remove the charge air cooler. See INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [L3 WITH TC] on MS3.
5. Remove the high pressure fuel pump. See HIGH PRESSURE FUEL PUMP REMOVAL/INSTALLATION [L3 WITH TC] on MS3.
6. Remove the ignition coils. See IGNITION COIL REMOVAL/INSTALLATION[L3 WITH TC] on MS3.
7. Disconnect the wiring harness.
8. Remove the ventilation hose.
9. Remove the cylinder head cover. See TIMING CHAIN REMOVAL/INSTALLATION [L3 WITH TC] on MS3.
10. Remove the drive belt. See DRIVE BELT REMOVAL/INSTALLATION[L3 WITH TC] on MS3.
11. Remove the engine front cover lower blind plug (A).



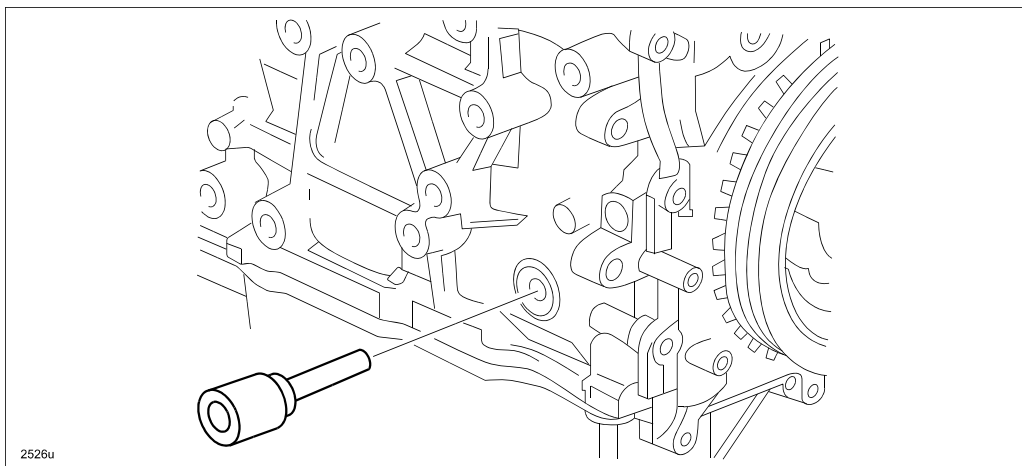
12. Remove the engine front cover upper blind plug (A).



13. Remove the drive belt idler pulley (A). For the Mazdaspeed6, remove the No.3 engine joint bracket and the No. 3 mount (B).

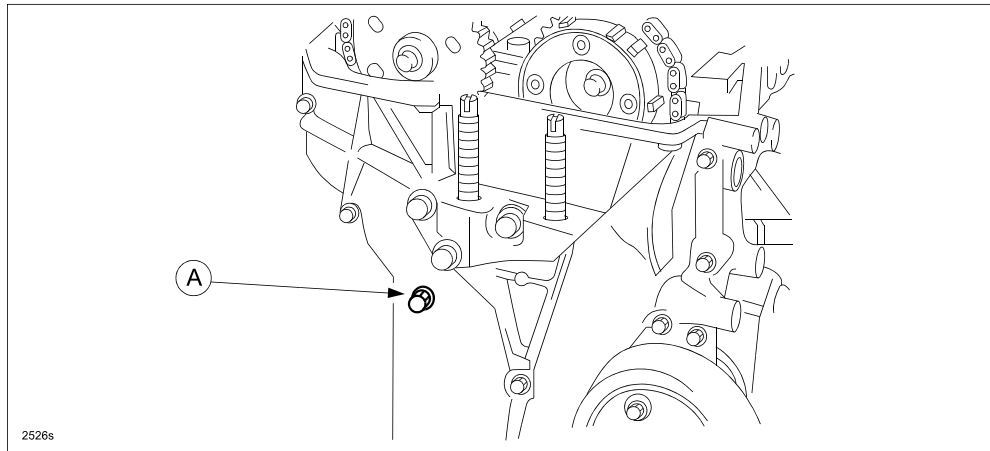


14. Remove the cylinder block lower blind plug, and install the SST.



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

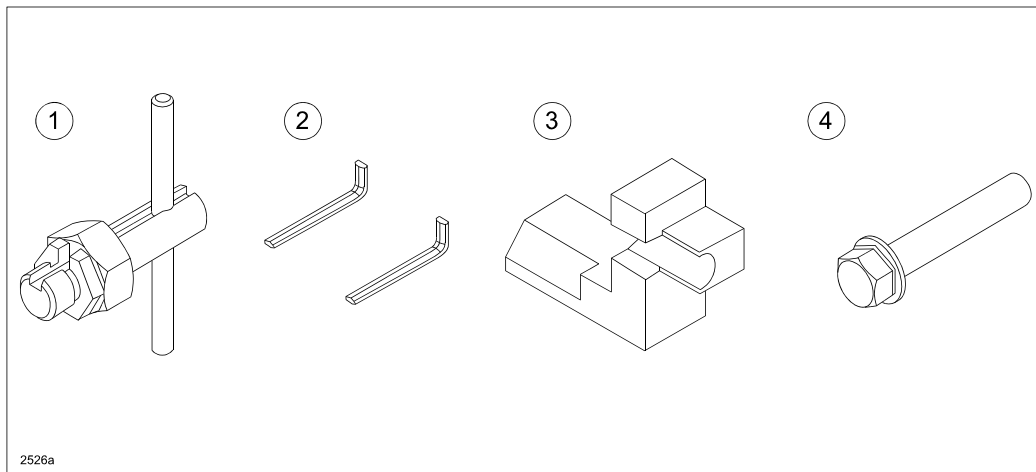
16. Insert a suitable bolt (A) - M6 X 1.0, length 25—35 mm (0.99—1.3 in) - into the engine front cover upper blind plug and tighten it until it contacts the chain tensioner arm, and then rotate it back one turn. (Set the bolt slightly away from the chain tensioner arm so that it does not contact it.)



17. Unlock the timing chain tensioner ratchet with the Tensioner Release Tool Set (Part Number 49-G010-4A0)

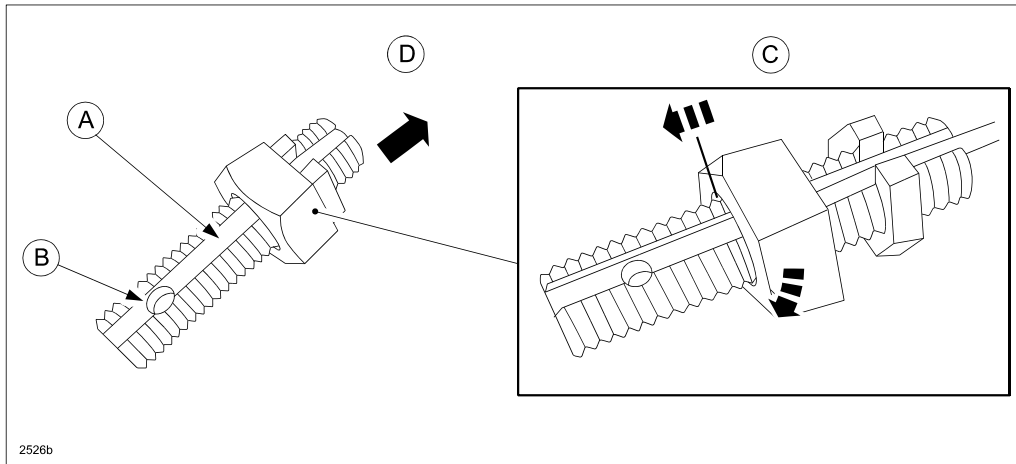
Tensioner Release Tool Set includes:

- (1) Tensioner Release Tool: 49-G010-401, quantity 1
- (2) Tensioner Release Arm: 49-G010-402, quantity 2
- (3) Tensioner Release Guide (plastic): 49-G010-403, quantity 1
- (4) Flange Bolt: quantity 1



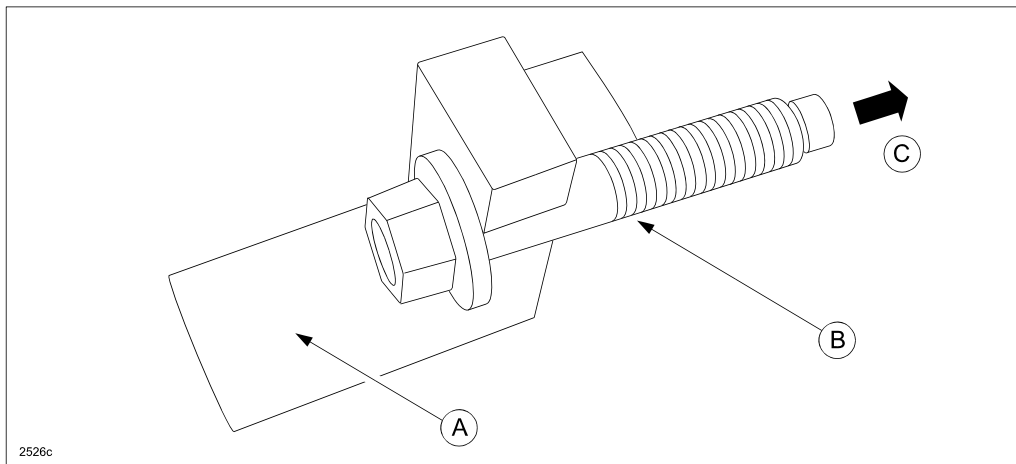
Tensioner Release Tool

- (A) Tensioner Release Arm Groove
- (B) Handle Lever Hole
- (C) Nut - to remove tensioner release arm (reverse threaded); use in case the tip of the arm is deformed and unable to remove by hand
- (D) End to engine front cover blind plug hole

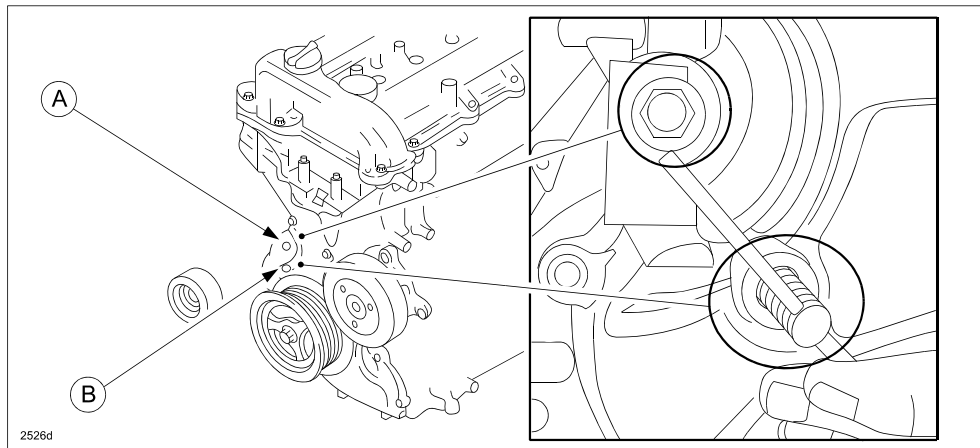


Tensioner Release Guide and Flange Bolt

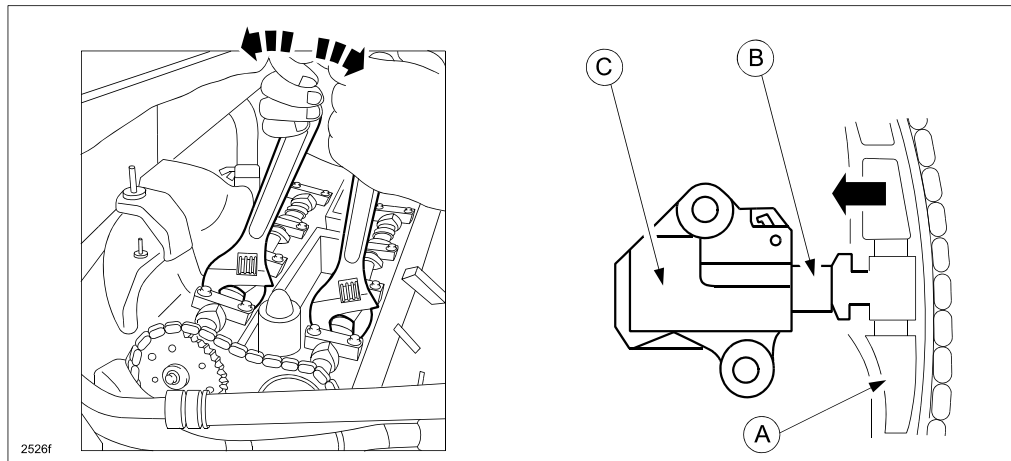
- (A) Tensioner Release Guide
- (B) Flange Bolt
- (C) End to idler pulley threaded hole



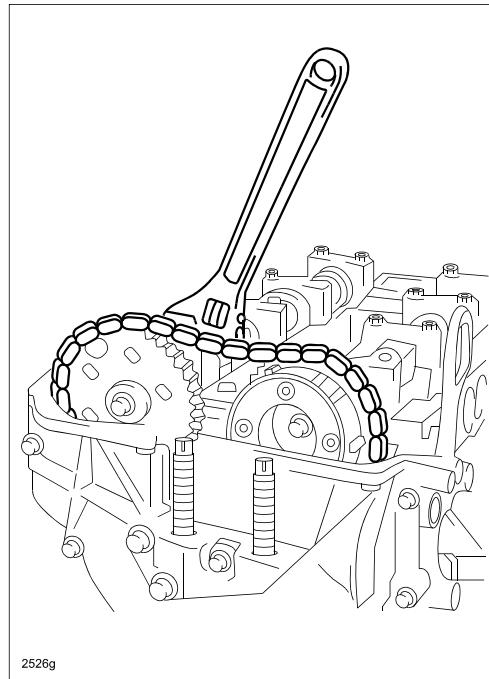
The tensioner release guide and flange bolt (A) will attach to the front drive belt idler pulley hole and the tensioner release tool (B) will attach to the engine front cover lower blind plug hole.



- a. Using the cast hexagon on the exhaust and intake camshafts, hold the intake cam with an adjustable wrench (or 24 mm box end wrench) then using another wrench rock the exhaust camshaft back and forth (approximately 10 times) to move the tensioner arm (A) and tensioner plunger (B) to drop the oil pressure inside the chain tensioner (C). Apply force counterclockwise to facilitate unlocking the chain tensioner ratchet.



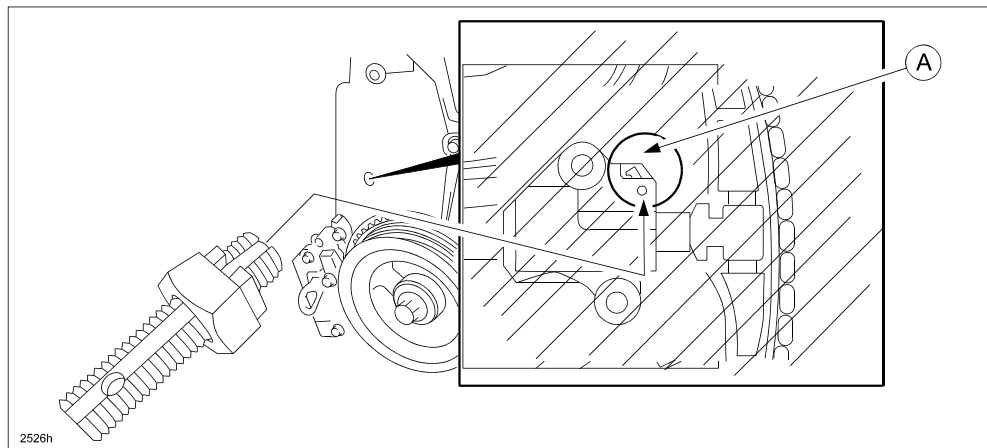
- b. Remove the wrench from the intake camshaft, leaving the adjustable wrench on the exhaust camshaft.



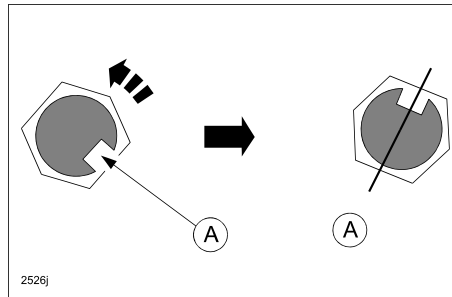
- c. Screw the SST into the front cover lower blind plug hole by hand until the hexagon portion contacts the front cover.

NOTE:

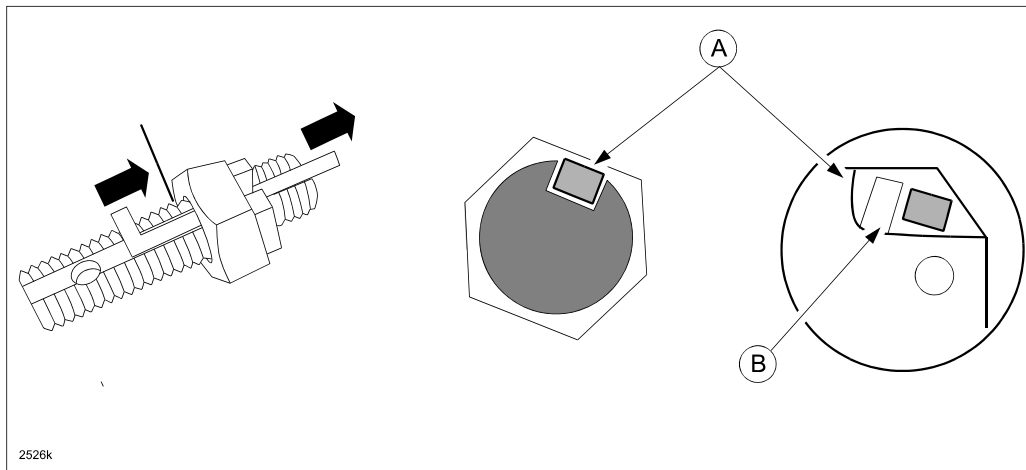
- Screw the SST into the front cover lower blind plug hole by hand until the hexagon portion contacts the front cover.
- Do NOT attach tensioner release arm or handle lever at this step.



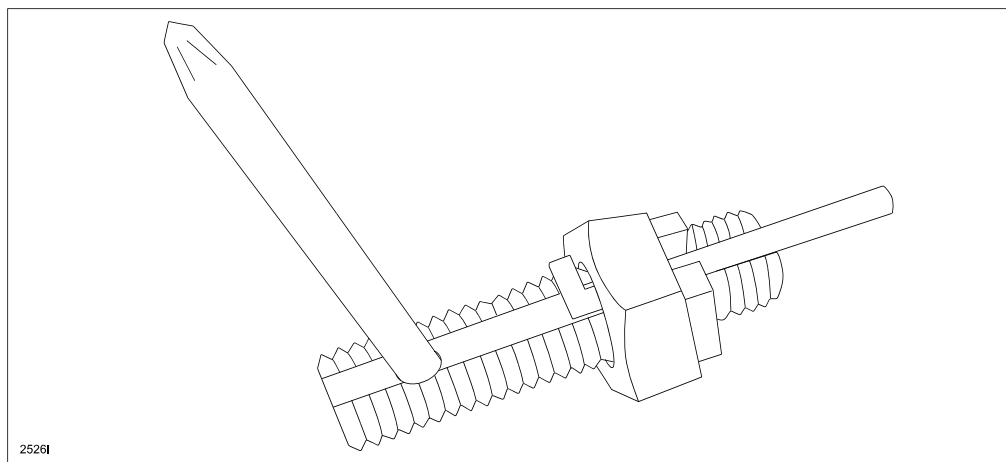
- d. Rotate the SST counterclockwise to align the tensioner release arm slot (A) point to the 1 to 2 o'clock position.



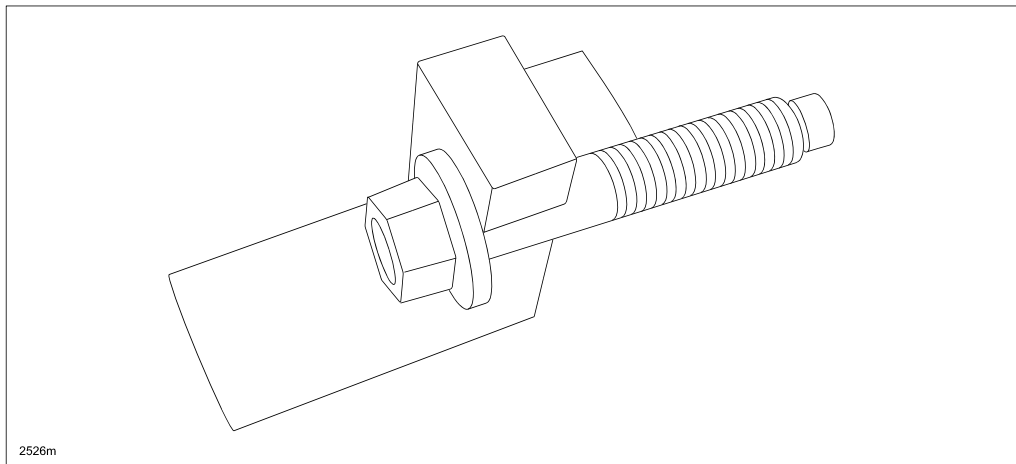
- e. Insert the tensioner release arm into the slot until it rests against the nut on the SST. The tensioner release arm (A) releases the timing chain tensioner ratchet lever (B).



- f. Insert the handle into the hole in the SST.

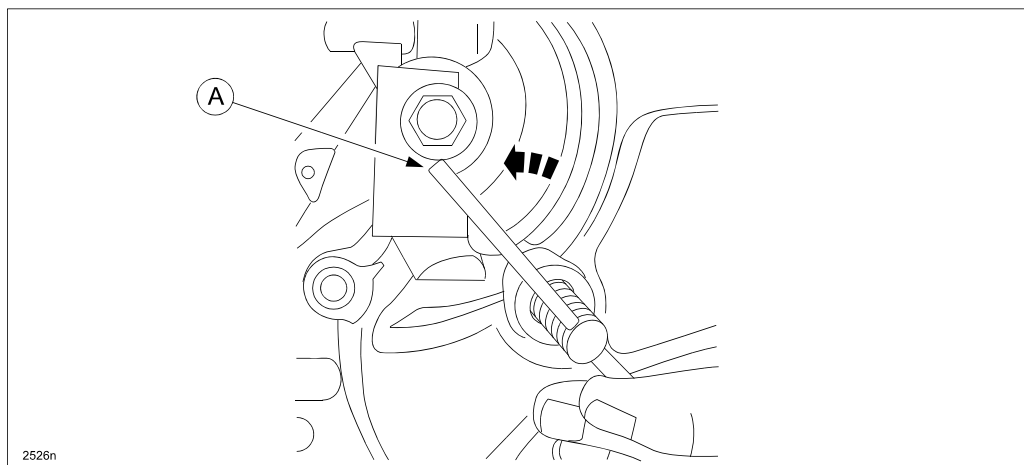


- g. Attach the tensioner release guide at the idler pulley hole using the bolt in the SST kit, and tighten by hand. Do not use a wrench to tighten the bolt.

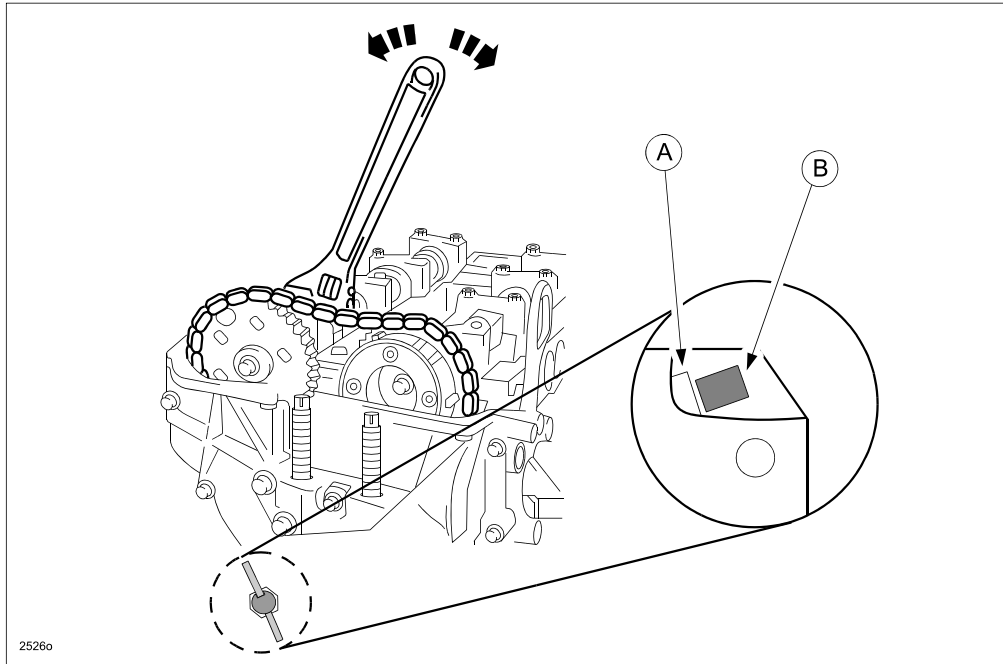


- h. Slowly turn the handle lever of SST (A) counterclockwise until it hits to the tensioner release guide.

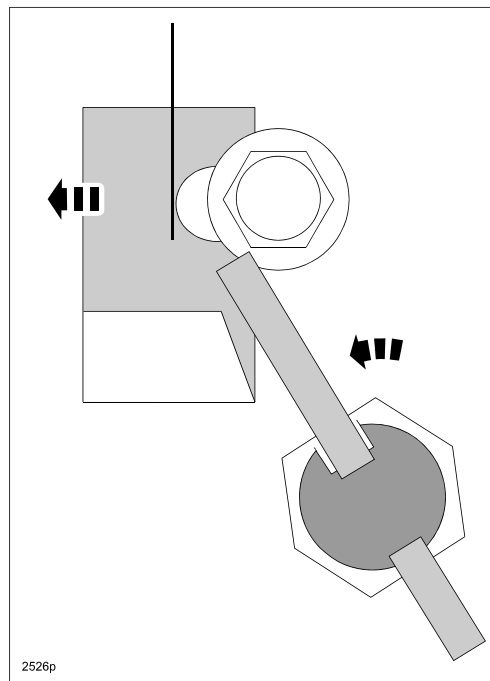
NOTE: The tensioner release guide is to prevent breakage and/or damage of the tensioner release arm from over rotation.



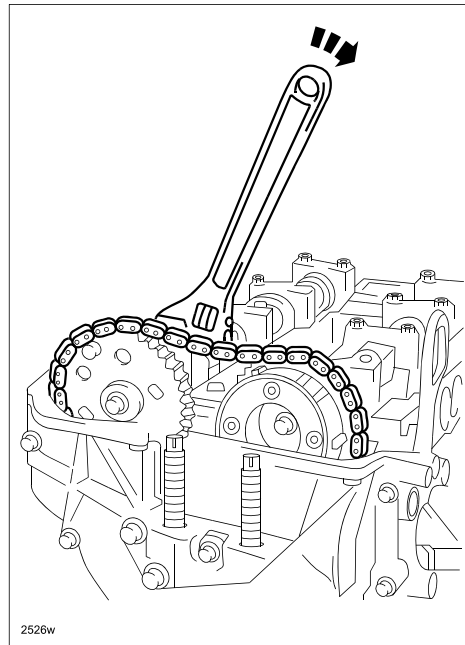
- i. While holding pressure on the SST handle, rock the exhaust camshaft back and forth with the wrench until there is no movement felt in the SST handle. The timing chain tensioner ratchet lever (A) will be released by the SST tensioner release arm (B).



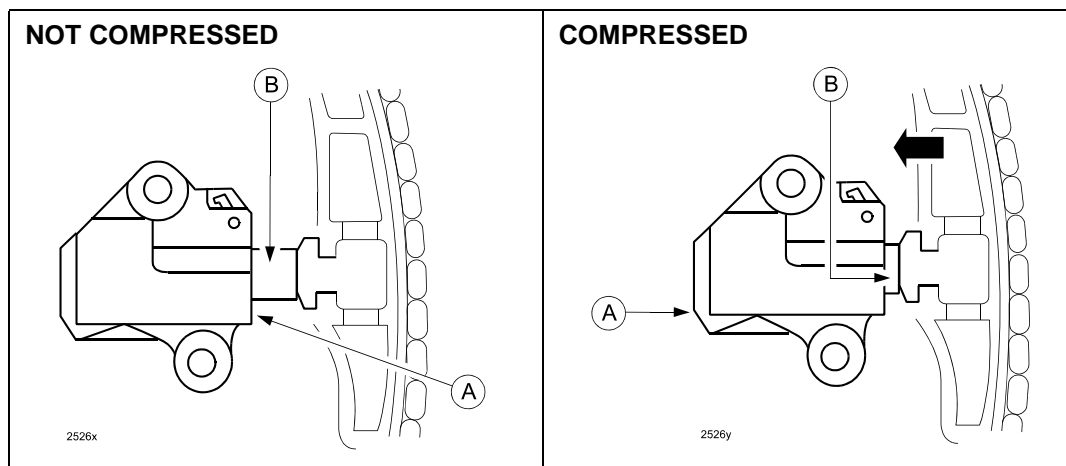
NOTE: If the movement in the SST handle did not go away, move the tensioner release guide as indicated in the illustration, then repeat step (i) until no movement is felt and the ratchet is unlocked.



- j. Once the chain tensioner ratchet is released, compress the chain guide and tensioner plunger by applying force to the exhaust camshaft with the wrench in the direction of the engine rotation, then tighten the bolt in the upper blind plug to secure the chain tensioner arm.



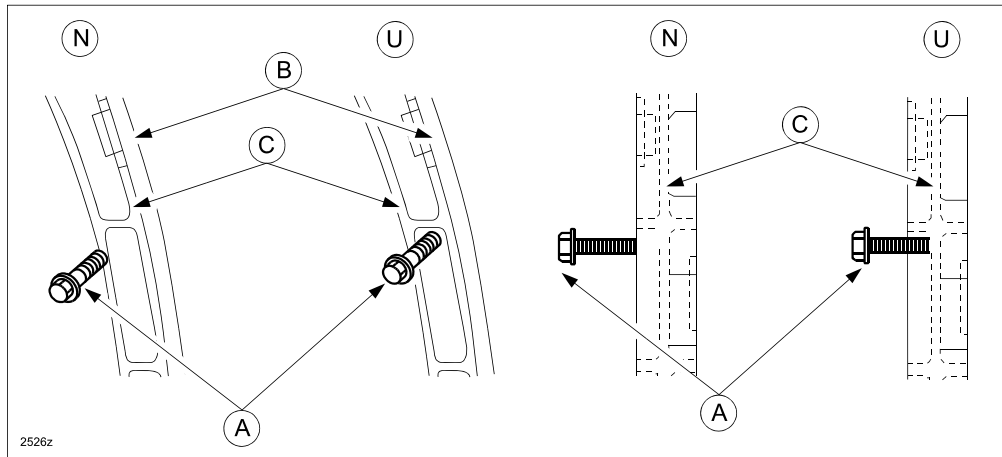
NOTE: The chain tensioner rack is compressed using the chain tension generated by applying force to the exhaust camshaft in the direction of the engine rotation.



A: Chain Tensioner
B: Plunger

NOTE:

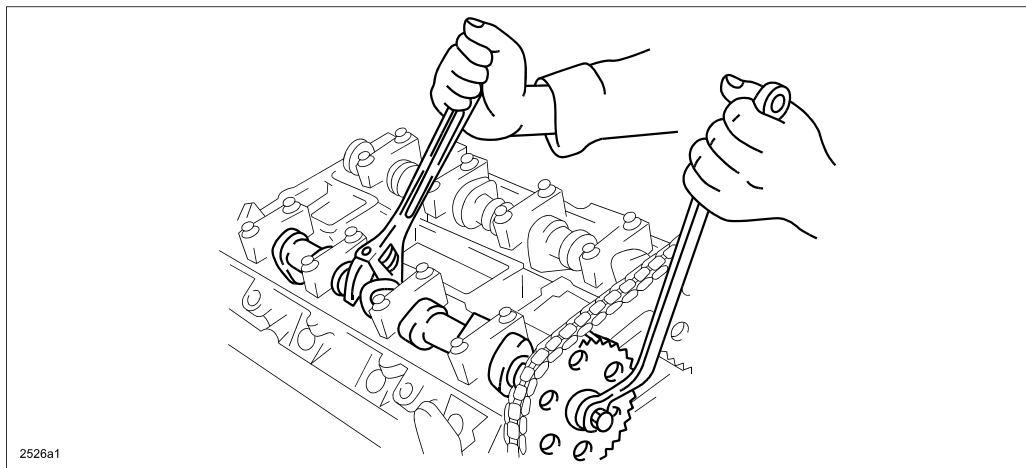
- The ratchet has not been unlocked if the bolt cannot be screwed in approx. 5 mm {0.2 in}.
- Screw in the bolt set in step 16 approximately 5 mm {0.2 in} and secure the tensioner arm with the rack compressed.



- A: Bolt (M6x1.0, Length 25-35 mm {0.99-1.3 in})
- B: Tensioner Arm
- C: Rib
- N: Not Unlocked
- U: Unlocked

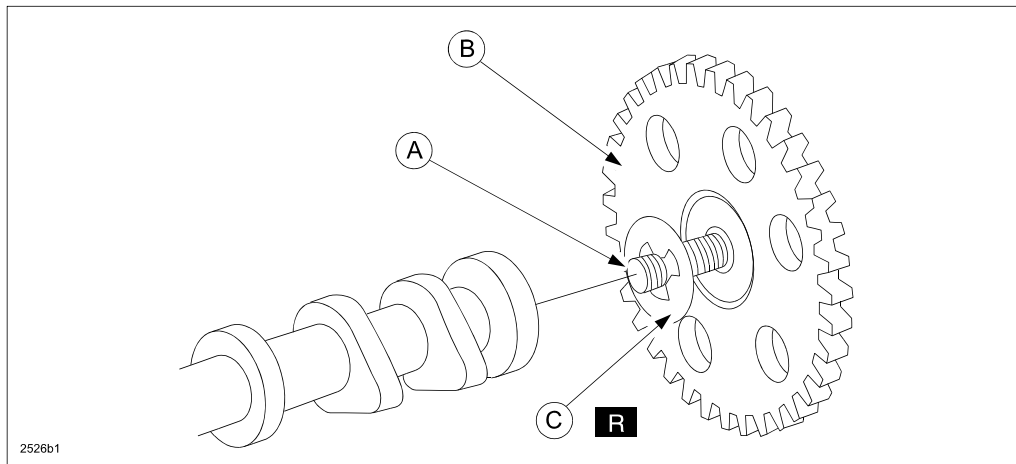
- If the tensioner arm cannot be secured, return the bolt to its original position and repeat the procedure from Steps (i- j).

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



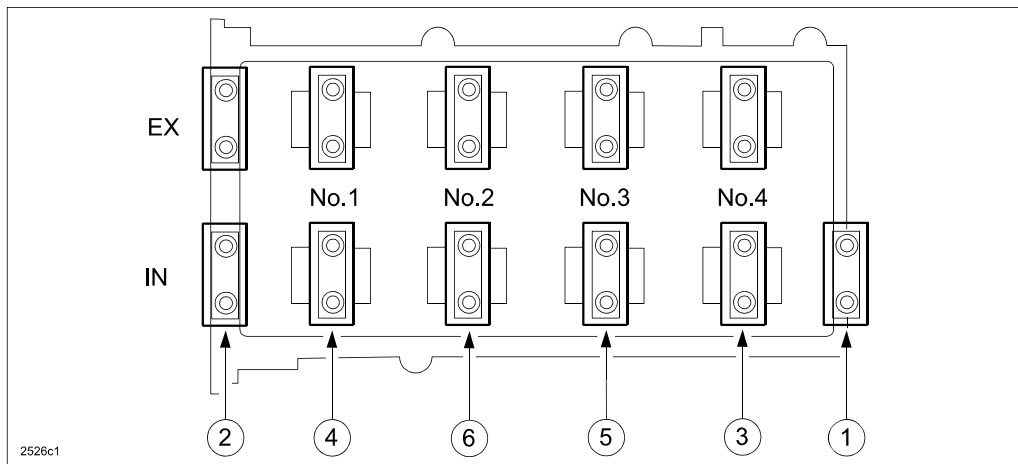
CAUTION: Perform the work carefully so that the washer does not drop out.

19. Remove the exhaust camshaft sprocket bolt (A) exhaust camshaft sprocket (B), and washer (C) as a single unit.



20. Remove the oil control valve (OCV). (See OIL CONTROL VALVE (OCV) REMOVAL/INSTALLATION[L3 WITH TC].)
21. Loosen the camshaft cap bolts in two or three passes in the order shown in the figure and remove the camshaft cap.

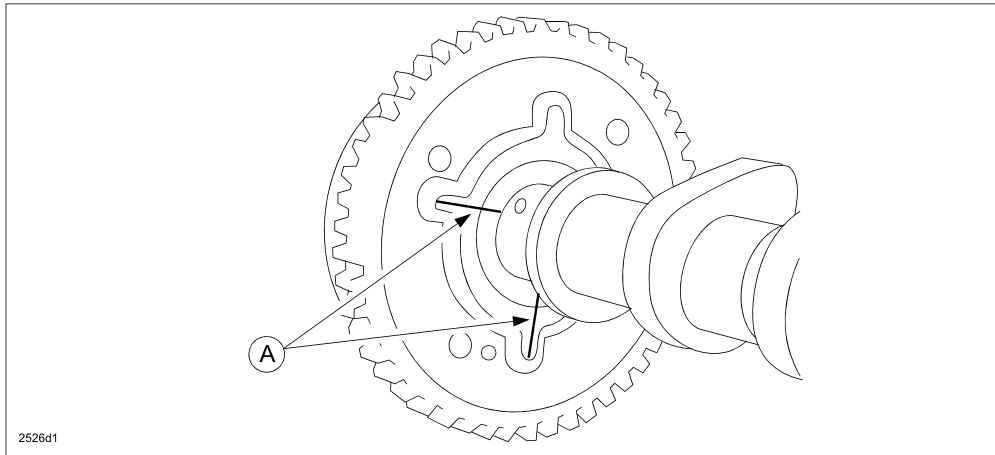
NOTE: The camshaft caps are to be kept in order for correct reassembly in their original positions. Do not mix the caps.



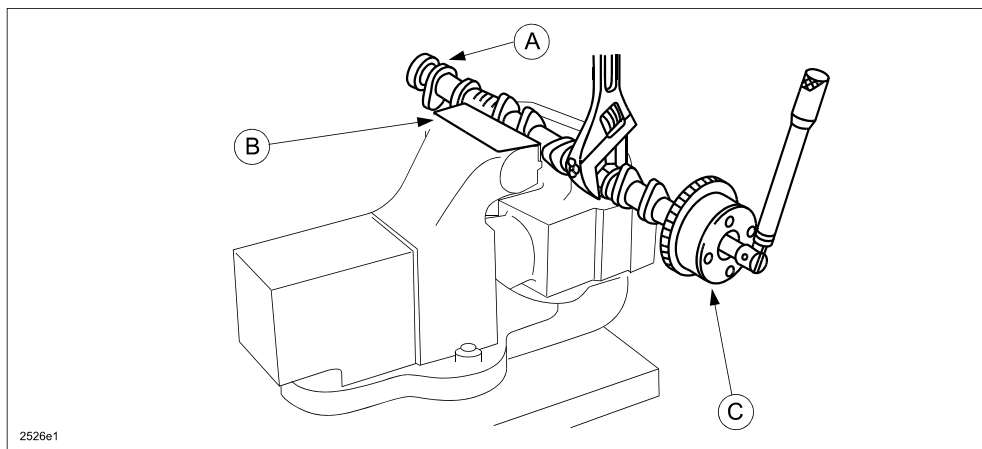
22. Remove the variable valve timing actuator and the camshaft on the intake air side as a single unit.

23. Remove the variable valve timing (VVT) actuator.

- a. Place alignment marks (A) on the camshaft and variable valve timing actuator as shown in the figure so that the variable valve timing actuator is re-assembled in its original position.

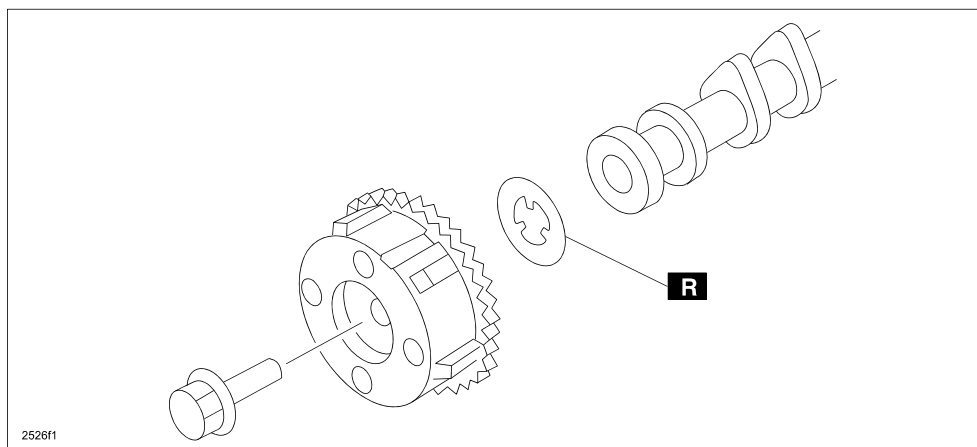


- b. Fix the camshaft in a vise (A) using a protection plate (B).



- c. Loosen the VVT actuator installation bolt and remove the VVT actuator (C).

24. Install a new washer.



25. Install the variable valve timing actuator.

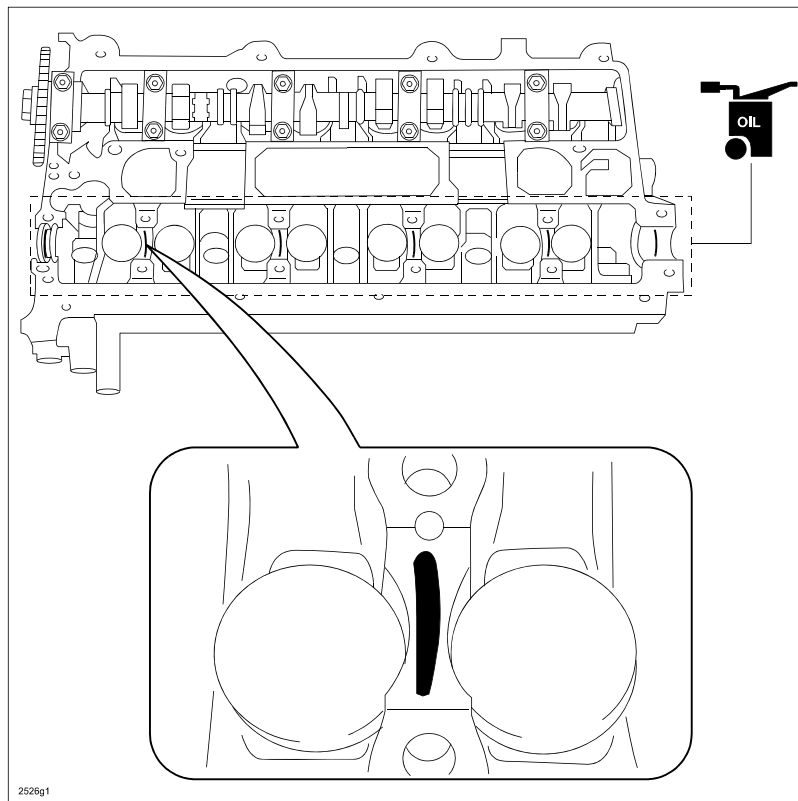
NOTE:

- When newly replacing the variable valve timing actuator, place alignment marks on the new part in the same position as the old actuator.
 - 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.
- a. Align the marks on the camshaft and the variable valve timing actuator.
 - b. Tighten the variable valve timing actuator installation bolt.

Tightening torque: 69-75 N·m (7.1-7.6 kgf·m, 51-55 ft·lbf)

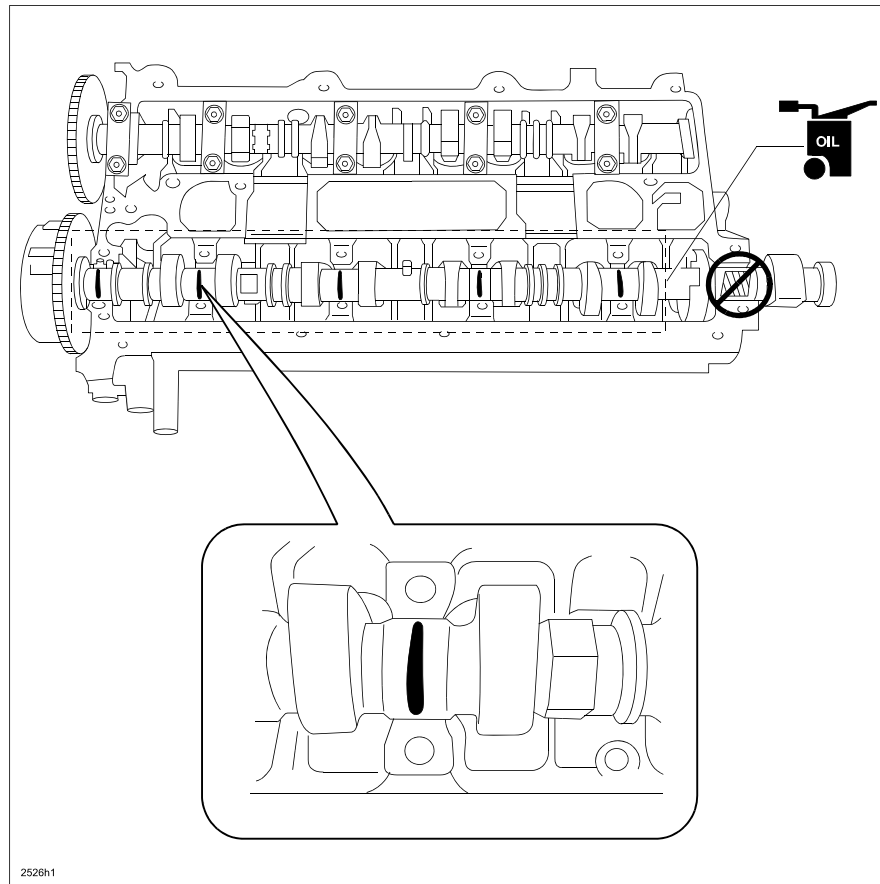
26. Verify that the No.1 cylinder is at TDC of the compression stroke (the position of the counterweight contacts the SST) .

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

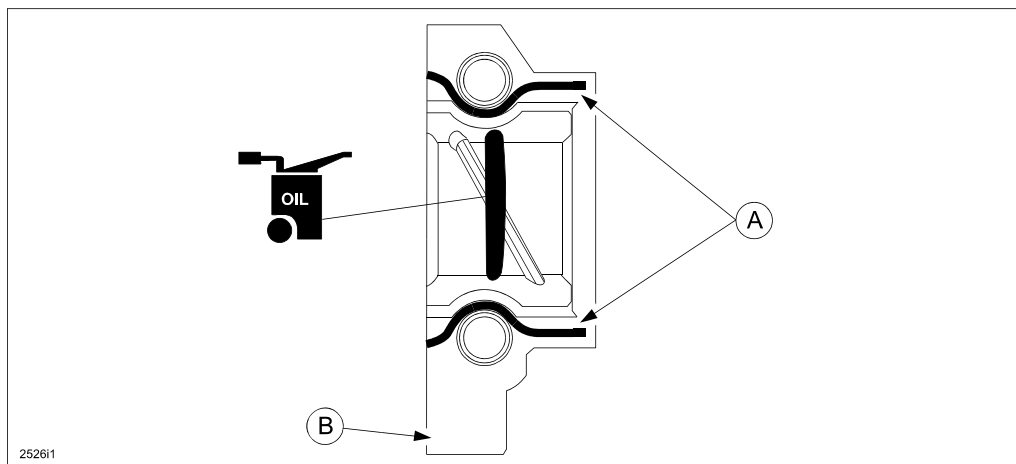


28. With No.1 cylinder cam aligned at TDC of the compression stroke, install the variable valve timing actuator and the camshaft on the intake air side as a single unit.

29. Apply the gear oil (SAE No. 90 or equivalent) to each journal of the camshaft as shown in the figure. However, do not apply it to the end journal of the intake camshaft.



30. Carefully apply adhesive agent (Loctite 518 or 962) to the area indicated in the figure (A) so that it does not leak into the sliding part then, apply the gear oil (SAE No. 90 or equivalent) to the journal.
Adhesive agent thickness: 1.0mm (0.039 in)

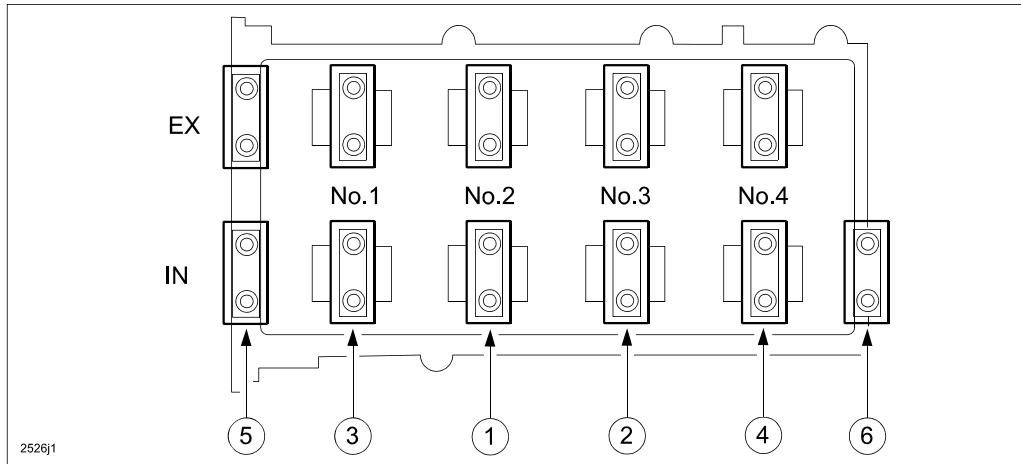


31. Install the camshaft caps and temporarily tighten the camshaft cap bolts evenly in two or three passes, and then tighten the camshaft cap bolts in two passes, using the following two steps and in the order shown in the figure.

Tightening procedure:

Step 1: 5.0-9.0 Nm {51-91 kgfcm, 45-79 in-lbf}

Step 2: 14.0-17.0 Nm {1.5-1.7 kgfm, 10.4-12.5 ft-lbf}

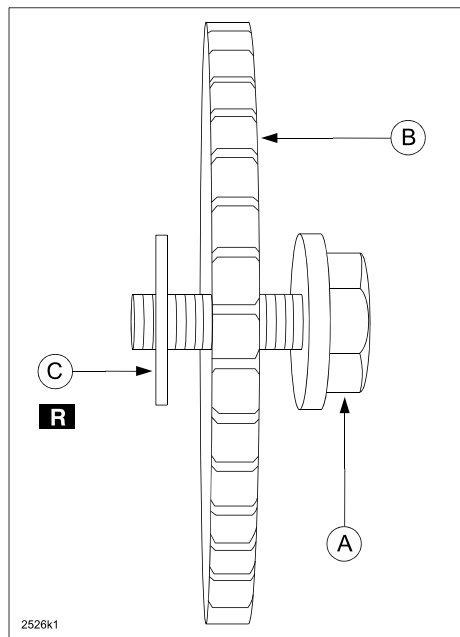


32. Install the OCV. (See OIL CONTROL VALVE (OCV) REMOVAL/INSTALLATION[L3 WITH TC].)

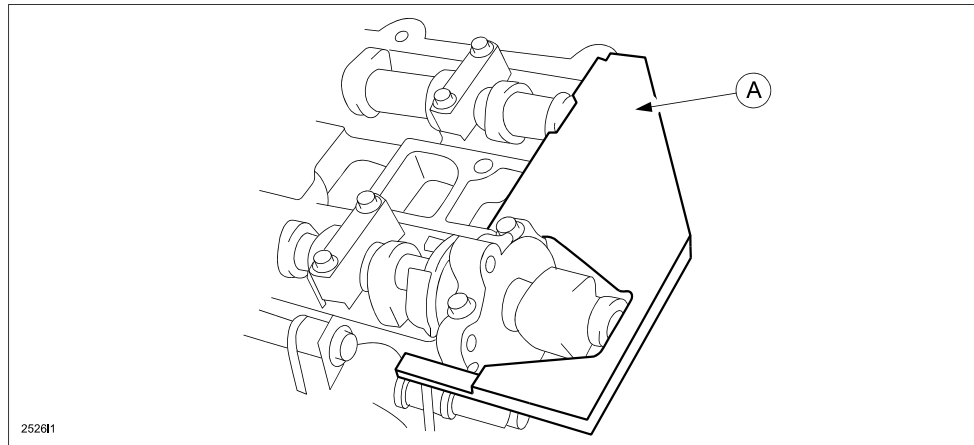
33. Install the timing chain, exhaust camshaft sprocket bolt (A), exhaust camshaft sprocket (B), and a new washer (C) as a single unit.

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.



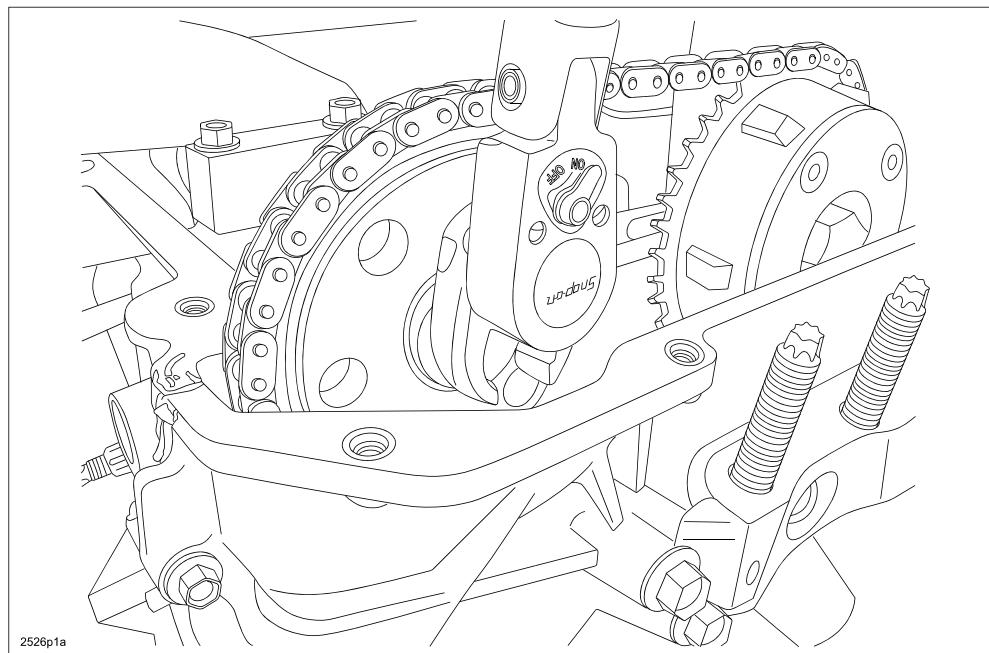
34. Install the SST on the camshaft as shown in the figure.



35. Remove the installation bolt for the engine front cover upper blind plug (M6 X 1.0 length 25-35mm {0.99-1.3 in}), and apply tension to the timing chain.

36. Secure exhaust camshaft using adjustable wrench on cast hexagon and tighten the exhaust camshaft sprocket bolt.

Tightening torque: 69-75 N·m (7.1-7.6 kgf·m, 50.9-55.3 ft·lbf)

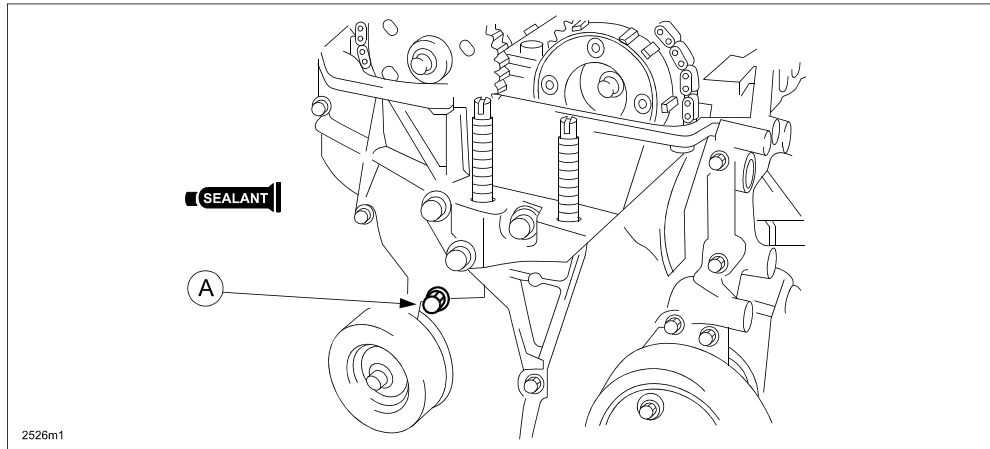


37. Rotate the crankshaft clockwise and verify that the No.1 cylinder is at TDC of the compression stroke (the position of the counterweight contacts the SST).

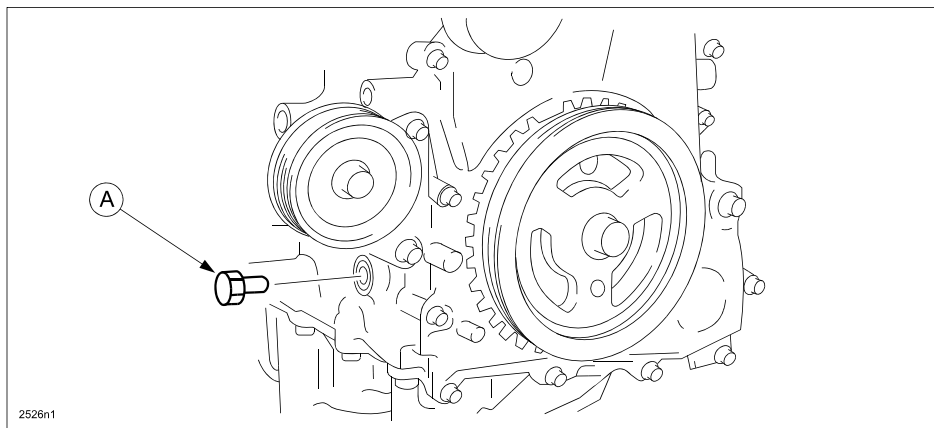
38. Remove the SST from the camshaft.

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 33.
41. Install the drive belt idler pulley. For the Mazdaspeed6, install the No.3 engine joint bracket and the No. 3 mount.
42. Apply the silicone sealant and install the engine front cover upper blind plug (A).
Tightening torque: 8.0-11.5 N·m {82-117 kgf·cm, 71-101 in·lbf}

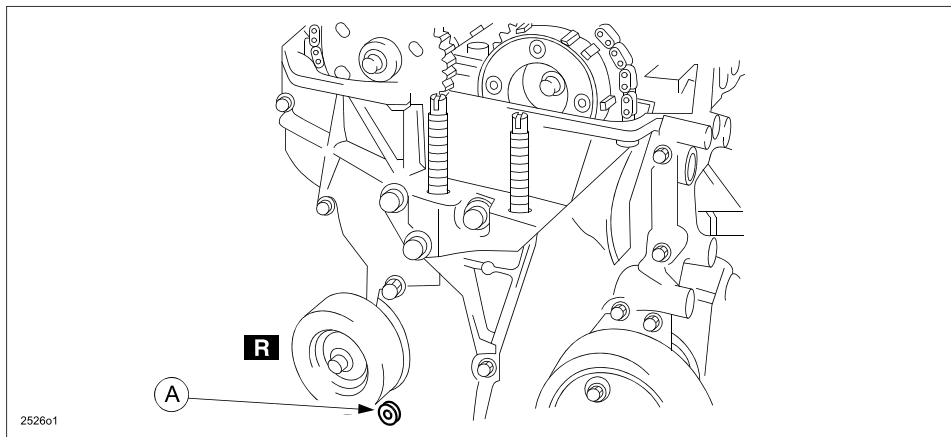


43. Install the cylinder block lower blind plug (A).
Tightening torque: 18-22 N·m {1.9-2.2 kgf·m, 14-16 ft·lbf}



44. Install a new engine front cover lower blind plug (A).

Tightening torque: 10.0-14.0 N·m {102-142 kgf·cm, 89-123 in·lbf}



45. Install the drive belt. See DRIVE BELT REMOVAL/INSTALLATION[L3 WITH TC] on MS3.

46. Install the cylinder head cover. See TIMING CHAIN REMOVAL/INSTALLATION [L3 WITH TC] on MS3.

47. Install the ventilation hose.

48. Connect the wiring harness.

49. Install the ignition coils. See IGNITION COIL REMOVAL/INSTALLATION[L3 WITH TC] on MS3.

50. Install the high pressure fuel pump. See HIGH PRESSURE FUEL PUMP REMOVAL/INSTALLATION [L3 WITH TC] on MS3.

51. Install the charge air cooler. See INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [L3 WITH TC] on MS3.

52. Install the splash shield (RH).

53. Connect the negative battery cable.

54. Set the customer's radio station presets.

55. Start the engine and make sure there is no fuel leakage around the high pressure fuel pump.

56. After the engine cools down, change the engine oil.

57. Verify repair.

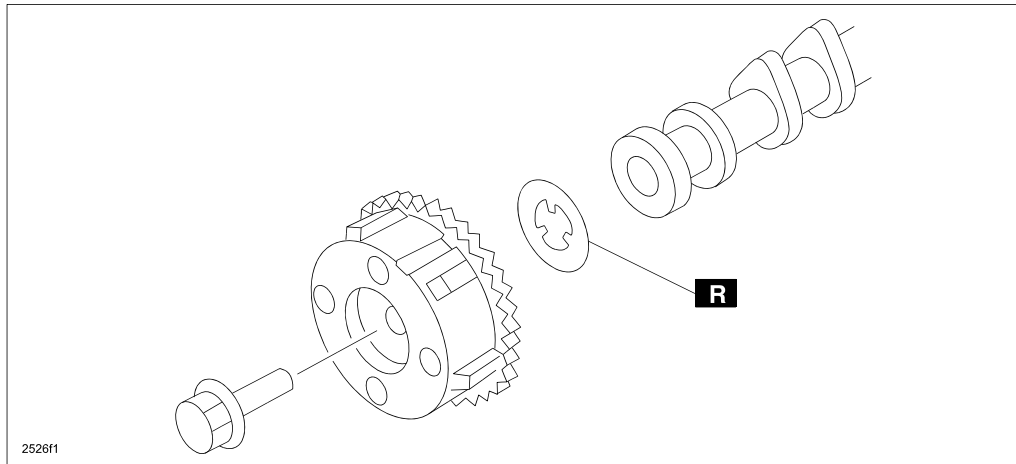
REPLACEMENT OF TIMING CHAIN AND VVT ACTUATOR

1. Record the customer's radio station presets.
2. Disconnect the negative battery cable.
3. Remove the engine front cover. See TIMING CHAIN REMOVAL/INSTALLATION on MS3.
4. Replace the timing chain with modified one. See TIMING CHAIN REMOVAL/INSTALLATION on MS3.

NOTE: DO NOT replace the chain adjuster.

5. Replace the VVT actuator with modified one. See VARIABLE VALVE TIMING ACTUATOR REMOVAL/INSTALLATION on MS3.

NOTE: DO NOT use the printed WSM. The procedure has been updated online.



6. Install the engine front cover.
NOTE: Be sure to properly seal the engine front cover using RTV Sealer according to TSB 01-019/11 (OIL SEEPAGE FROM ENGINE FRONT COVER) to eliminate the possibility of oil leaks.
7. Install the cylinder head cover. See TIMING CHAIN REMOVAL/INSTALLATION [L3 WITH TC] on MS3.
8. Connect the negative battery cable.
9. Set the customer's radio station presets.
10. Start the engine and make sure there is no fuel leakage around the high pressure fuel pump.
11. After the engine cools down, change the engine oil.
12. Verify repair.

PART(S) INFORMATION

Variable Valve Timing (VVT) Actuator Replacement Only:

Part Number	Description	Qty.	Notes
L3K9-12-4X0C	Variable Valve Timing Actuator	1	---
L3K9-10-230	Seal Cover	1	---
LFBL-10-237	Sealing Head Cover Washer	14	---
L3K9-12-429	Washer	2	---
0000-77-5W30-QT	Engine Oil (5W-30)	6 qts	---
9XG0-99-667L	Blind Plug	1	---
L3K9-10-193	High Pressure Fuel Pump Gasket	1	---
L3K9-13-ZE5	High Pressure Fuel Pump O-ring	1	---

VVT Actuator and Timing Chain Replacement:

Part Number	Description	Qty.	Notes
L3K9-12-201A	Timing Chain	1	---
L3K9-10-230	Seal Cover	1	---
LFBL-10-237	Sealing Head Cover Washer	14	---
LF01-11-406	Crankshaft Pulley Lock Bolt	1	---
L3G6-10-602	Oil Seal	1	---
L3K9-11-407	Lock Washer	3	---
0000-77-1217-ES	RTV Sealer	1	1 tube = 1 repair
L3K9-12-4X0C	Variable Valve Timing Actuator	1	---
L3K9-12-429	Washer	2	---
0000-77-5W30-QT	Engine Oil (5W-30)	6 qts	---
9XG0-99-667L	Blind Plug	1	---
L3K9-10-193	High Pressure Fuel Pump Gasket	1	---
L3K9-13-ZE5	High Pressure Fuel Pump O-ring	1	---

WARRANTY INFORMATION

NOTE:

- This warranty information applies only to verified customer complaints on vehicles eligible for warranty repairs.
- This repair will be covered under Mazda's New Vehicle Limited Warranty term for a Powertrain Component.
- Additional diagnostic time cannot be claimed for this repair.

	VVT Actuator and Timing Chain Replacement	VVT Actuator Replacement Only
Warranty Type	A	A
Symptom Code	82	82
Damage Code	9C	9C
Part Number Main Cause	L3K9-12-201A	L3K9-12-4X0C
Quantity	1	1
Operation Number / Labor Hours:	XXG5MXRX / 4.4 Hrs. (2007-2010 CX-7) XXG5NXXRX / 4.3 Hrs. (2007-2009 Mazdaspeed3) XXG5PXXRX / 4.5 Hrs. (2010 Mazdaspeed3) XXG5RXXRX / 4.1 Hrs. (2006-2007 Mazdaspeed6)	XXG5JXXRX / 2.9 Hrs. (2007-2010 CX-7) XXG5KXXRX / 3.0 Hrs. (2007-2010 Mazdaspeed3) XXG5LXXRX / 3.2 Hrs. (2006-2007 Mazdaspeed6)

NOTE: If oil pan removal and reinstallation is necessary to locate any missing parts, extra labor time can be claimed using the following labor operation and labor time.

	VVT Actuator and Timing Chain Replacement	VVT Actuator Replacement Only
Supplemental Labor Operation / Labor Hours for Oil Pan Removal and Reinstallation (if needed)	XXH23XXRX / 0.6 Hrs. (All vehicles)	XXH24XXRX / 2.1 Hrs. (2007-2010 CX-7 and 2010 Mazdaspeed3) XXH25XXRX / 1.9 Hrs. (2007-2009 Mazdaspeed3) XXH36XXRX / 1.5 Hrs. (2006-2007 Mazdaspeed6)