



MAZDA®

**Technical Training
Job Aid
Engine Timing: LF 2.0L, L3/L3T 2.3L**

Models

2001-present B2300 B-Series Truck (L3 2.3L)
2003-present MAZDA6 (L3 2.3L)
2004-present MAZDA3 (LF 2.0L / L3 2.3L)
2005-present Tribute (L3 2.3L)
2006-present MAZDASPEED6 (L3T 2.3L DISI Turbo)
2006-present MX-5 Miata (LF 2.0L)
2007-present CX-7 (L3T 2.3L DISI Turbo)
2007-present MAZDASPEED3 (L3T 2.3L DISI Turbo)

Description

Vehicles with any of the following symptoms may have slipped timing:

- DTC P0340
- Lack of power
- No start/engine seized.

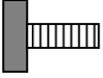
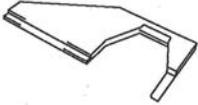
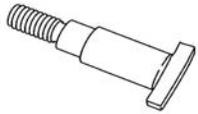
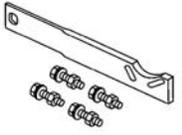
The LF and L3 engines are interference engines. If the timing slips the valves may contact the pistons. Verify base camshaft/crankshaft timing and correct if necessary. If the engine runs rough after correcting cam timing, perform a compression test. If compression is low, perform a cylinder leakdown test and determine leakage. Replace the cylinder head if necessary.

Follow specific procedures to time LF 2.0L and L3/L3T 2.3L engines. Timing the LF / 2.0L engine, the L3 and L3T / 2.3L engines must be done following specific procedures. This Job Aid explains how to verify base engine timing (relation of intake camshaft, exhaust camshaft, crankshaft sprocket and crankshaft pulley) and how to correct timing if it is incorrect. Do not skip any steps and always begin by Inspecting Engine Timing on page 3.

NOTE

The camshaft, crankshaft, crankshaft sprockets and crankshaft pulley are friction-fit components. Loosening any of these components requires re-timing the camshafts or crankshaft. Failure to properly re-time the engine will result in severe engine damage.

Special Service Tools

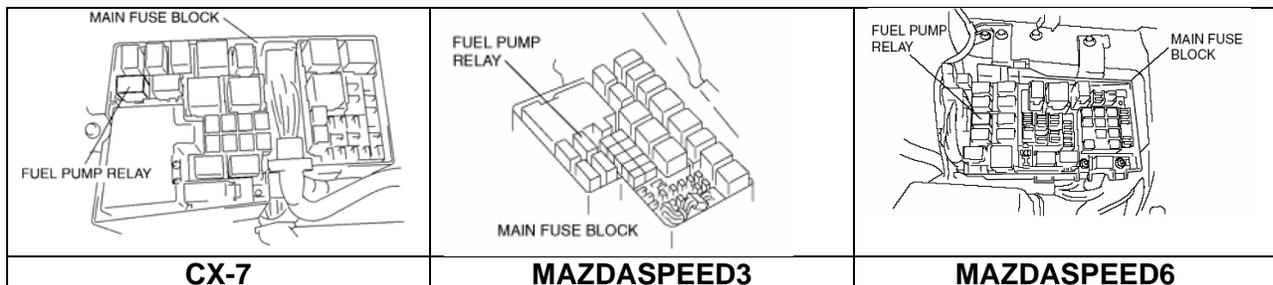
	M6 Bolt 6mm X 18mm (0.23 in X 0.7 in)
 <p>ST2645-A</p>	303-465 Camshaft Alignment Plate LF and L3
	303-1061 Camshaft Alignment Plate L3T
 <p>ST2639-A</p>	Adaptor for 205-072-02
	303-507 Crankshaft Timing Peg LF & L3
 <p>ST2647-A</p>	205-126 Holding Fixture

Hand Tools

Combination Wrenches	8mm, 10mm, 12mm, 14mm, 23mm
Sockets	8mm, 10mm, 12mm, 13mm, 15mm, 21mm
Screwdrivers	#2 Philips
Torque wrenches	1/4", 1/2" and 3/8"
Pliers	Needle Nose

Inspecting Engine Timing

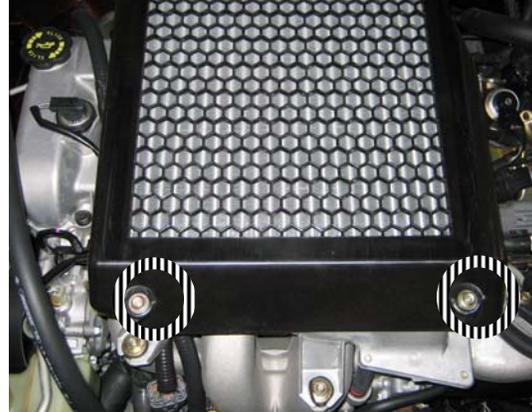
1. Remove the lower engine splash shield.
2. MAZDA3, MAZDA6, MAZDASPEED6 and Tribute: remove the passenger side splash shields, plastic fender skirts, and the passenger axle shaft to access the crankshaft pulley bolt and the engines blind plug bolt.
3. CX-7 MAZDASPEED3, MAZDSPEED6: relieve fuel pressure from the high pressure fuel system (the high pressure fuel pump must be removed to use the camshaft alignment plate).
 - A. Ignition OFF
 - B. Disconnect the Fuel Pump Speed Control Relay (labeled CIRCUIT in the underhood fuse box).



- C. Remove the fuel filler cap.
 - D. Crank the engine until the vehicle stalls.
 - E. Crank the engine several more times.
4. CX-7 MAZDASPEED3, MAZDSPEED6: remove the intercooler shroud and the intercooler to access the spark plugs.
 - A. MAZDASPEED3 and MAZDASPEED6: remove the 10 mm bolts securing the plastic intercooler cover.



A. CX-7: remove the two plastic clips securing the intercooler shroud to the vehicle and remove the three 10mm bolts securing the plastic intercooler cover.



B. Remove the three 12 mm bolts securing the intercooler to the intake.



C. Remove the air bypass control hose clamp and disconnect the hose from the valve.



D. Loosen the bypass outlet hose clamp.



E. Loosen the hose clamp from the turbo outlet to the intercooler inlet (10mm or #2 Phillips).



NOTE

Mark the position of the hose clamp by placing a mark on the hose and on the intercooler to make assembly easier.

- F. Loosen the hose clamp at the intercooler outlet where it connects to the intake manifold (10mm or #2 Phillips).



NOTE

Mark the position of the hose clamp by placing a mark on the hose and on the intercooler to make assembly easier.

- G. Separate the intercooler from the boot at the turbo outlet, separate the intercooler from the boot at the intake manifold, and separate the air bypass hose outlet. Remove the intercooler from the vehicle.

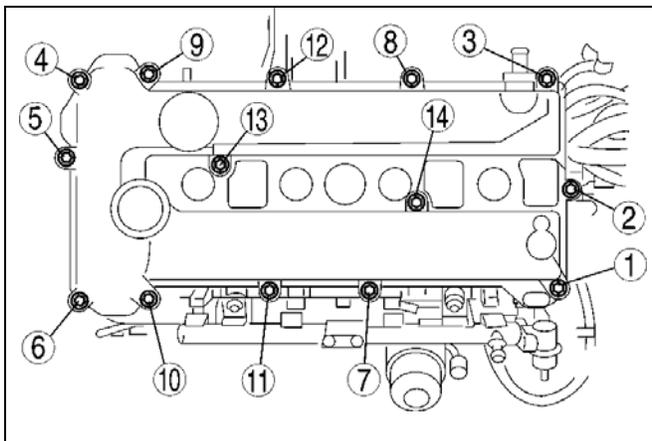


5. MX-5 Miata: remove the fresh air box and the battery to access the front of the engine.
6. Disconnect the negative battery cable.

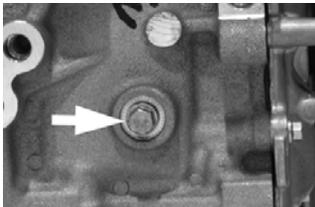
7. Remove the accessory drive belt by turning the tension bolt (14mm) clockwise.



8. Remove the ignition coil(s) (four 8mm).
9. Blow compressed air in the park plug holes to remove dirt and debris.
10. Remove the valve cover (8mm).



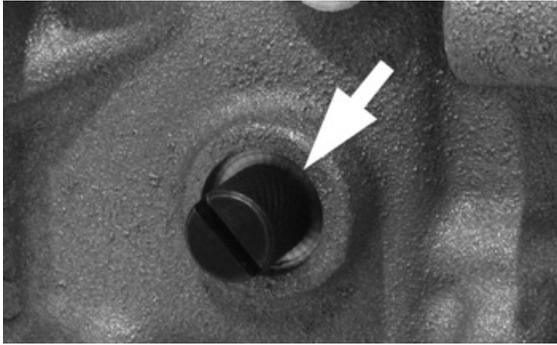
11. Remove all spark plugs to make the engine easier to turn over.
12. Remove the blind plug bolt behind the CKP sensor (13mm).



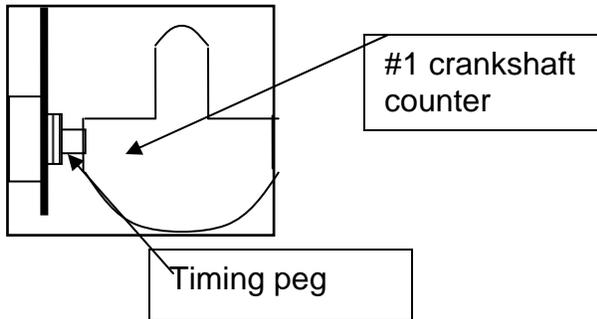
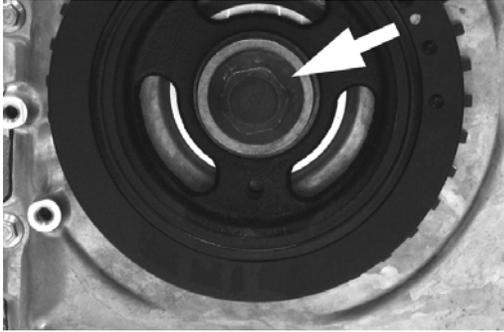
13. Install the crankshaft timing peg SST 303-507.

NOTE

Installing the SST timing peg in this step will prevent the engine from being rotated in the clockwise direction.

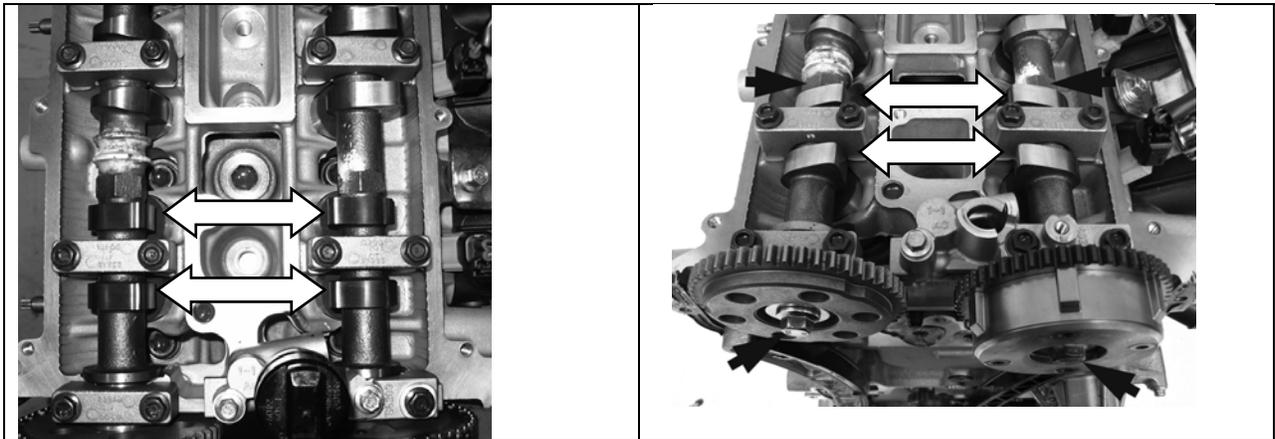


14. Using the crankshaft pulley bolt (21mm), turn the crankshaft clockwise until it stops turning. The crankshaft stops when the #1 cylinder counterweight contacts the timing peg.

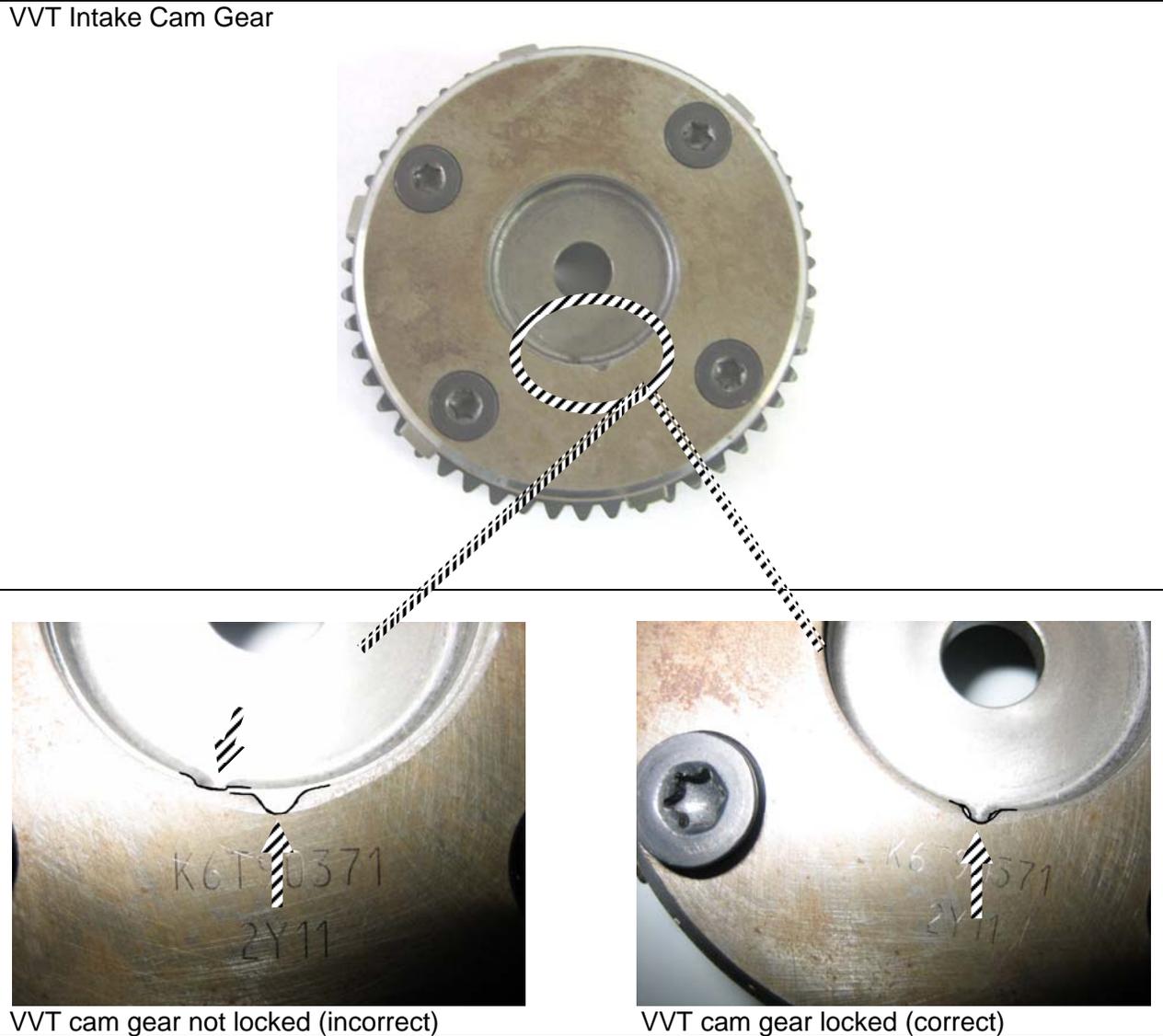


NOTE

All camshaft lobes for #1 cylinder should point up and toward the inside. See both pictures below:



- 15. For vehicles with Variable Valve Timing (VVT) including MAZDA3 L3, MX-5 Miata, MAZDA6 L3, MAZDASPEED3, MAZDASPEED6, and Tribute L3: the VVT mechanism normally locks when the engine shuts off. Make sure the VVT camshaft gear is locked before attempting to adjust timing. The notches in the gear must be aligned so the timing is fixed. If it is not, turn the camshaft to lock the gear.

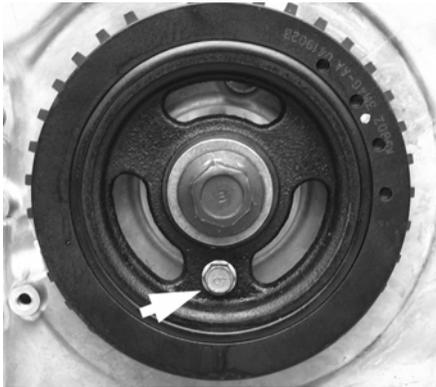


16. Place an M6 bolt (6mm X18mm) through the crankshaft pulley into the timing cover. Can you install the bolt and does it fit flush through the timing bolt cover?

- Yes, the crankshaft pulley is properly timed. Note this on the Repair Order and **Go to step 17.**
- No, the crankshaft pulley is out of time. Note this on the Repair Order and **Go to step #17.**

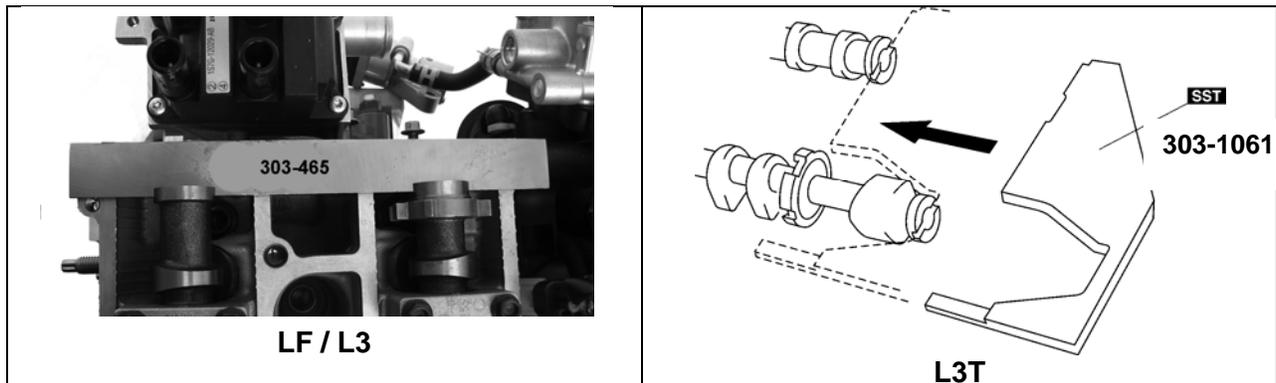
CAUTION

Only hand-tighten the bolt or you may damage the front cover.



17. Attempt to place the camshaft alignment plate SST into the slots on the rear of the camshafts. Does the SST fit?

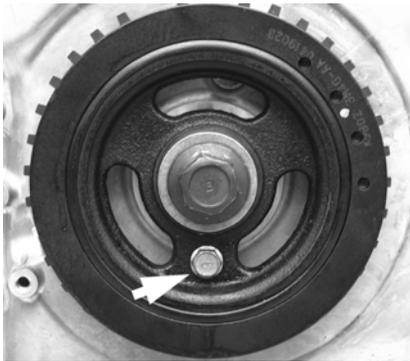
- Yes, the camshaft alignment plate fits. The camshafts are properly timed. Note this on the Repair Order. **Go to step 18.**
- No, the camshaft alignment plate does not fit. One or both camshafts are out of time. Note this on the Repair Order. **Go to step 18.**



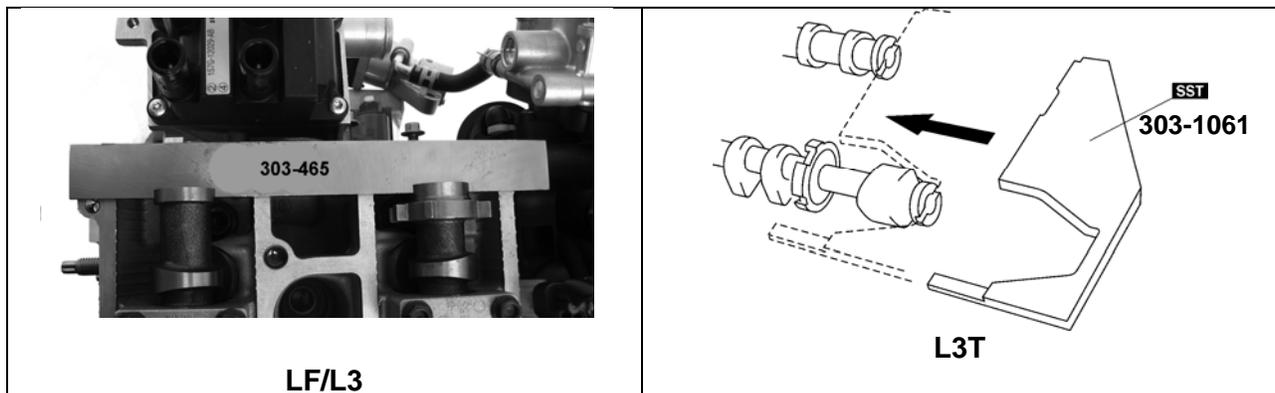
18. Review the notes you made on the repair order and determine which repair procedure to perform:

Only the crankshaft pulley is out of time, correct crankshaft pulley timing	Go to page 15
One or both camshafts and crankshaft timing is off, correct base engine timing	Go to page 19
Both camshaft and crankshaft pulley timing is correct. Note this on the repair order	Go to step #19

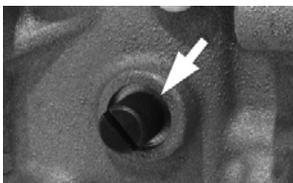
19. Remove the M6 bolt from the crankshaft pulley.



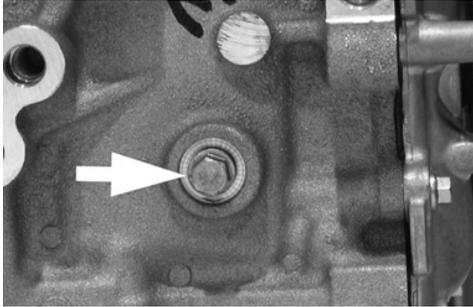
20. Remove the camshaft alignment plate.



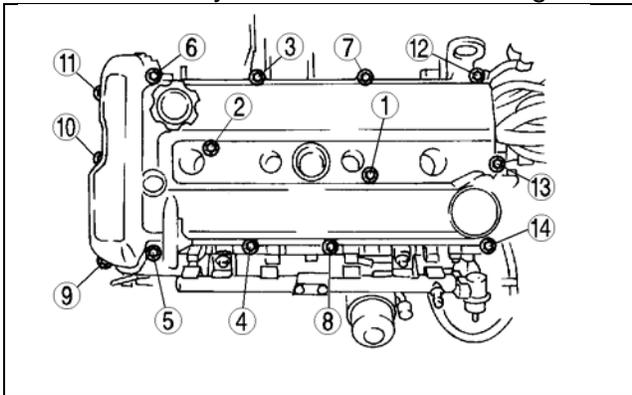
21. Remove the crankshaft timing peg 303-507.



22. Install the plug bolt. Tighten to 18-22 Nm (13.3-16.2 ftlbf).



23. Install the cylinder head cover and tighten in sequence to 8.0-11.5 Nm (70.9-101.7 inlbf).



24. Install the spark plugs and tighten to 10-14 Nm (8.0-10.3 ftlbf).

25. Install the ignition coils and tighten to 5-7 Nm (44-61 inlbf).

26. CX-7, MAZDASPEED3, MAZDASPEED6: Install the intercooler and intercooler shroud.

27. Install the accessory drive belt.

28. Install the fan and shroud.

29. MX-5 Miata: install the battery box and fresh air box.

30. Install the axle shaft if removed.

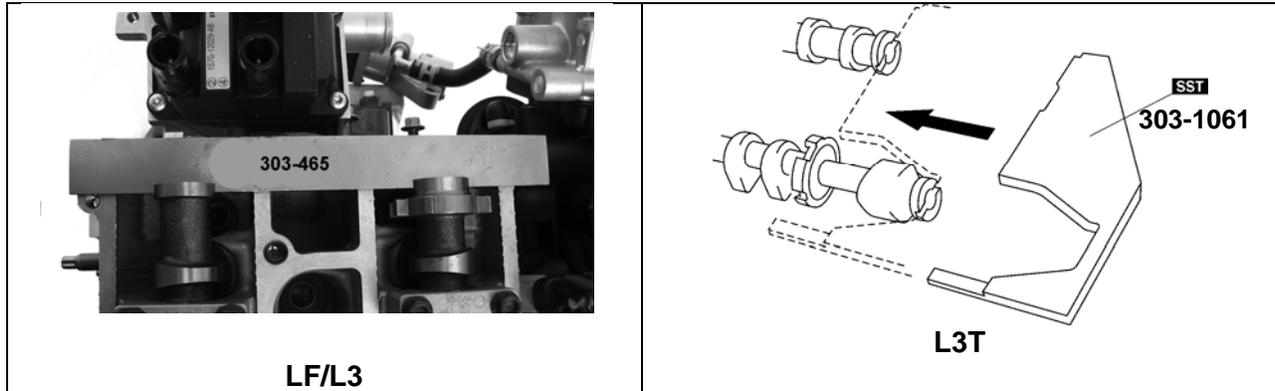
31. Install any splash shields.

Procedure complete, stop here.

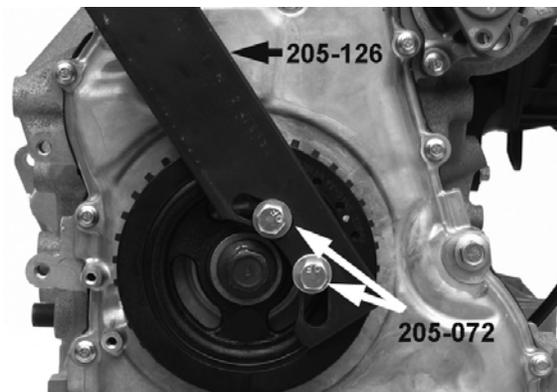
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Correcting Crankshaft Pulley Timing Only

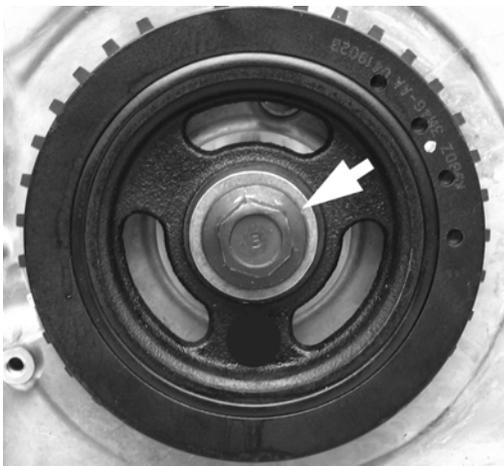
1. Remove camshaft alignment plate SST from the camshafts.



2. Hold the crankshaft pulley bolt (21mm) with SST 205-126, and loosen the crankshaft pulley bolt. (This may take two people)



3. Rotate the crankshaft clockwise using the crankshaft pulley bolt until it stops turning (held by the timing peg).



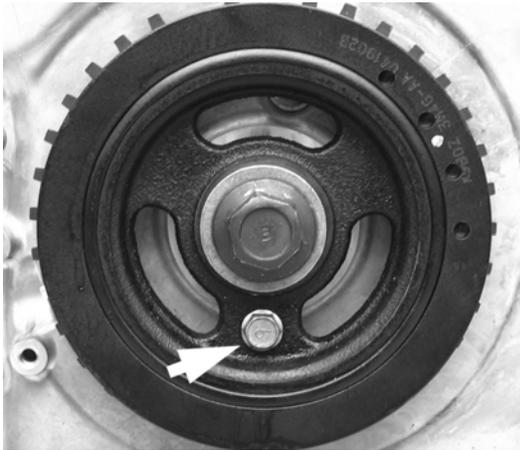
- Remove the crankshaft pulley bolt. Replace the crankshaft pulley bolt with a new bolt.

NOTES

Make sure the crankshaft does not rotate.
 Rotate the crankshaft pulley until you can insert the M6 bolt through the pulley into the timing cover.

CAUTION

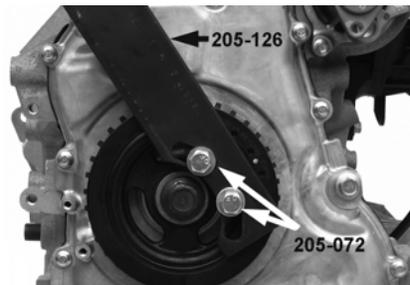
Only hand-tighten the bolt or you may damage the front cover may occur.



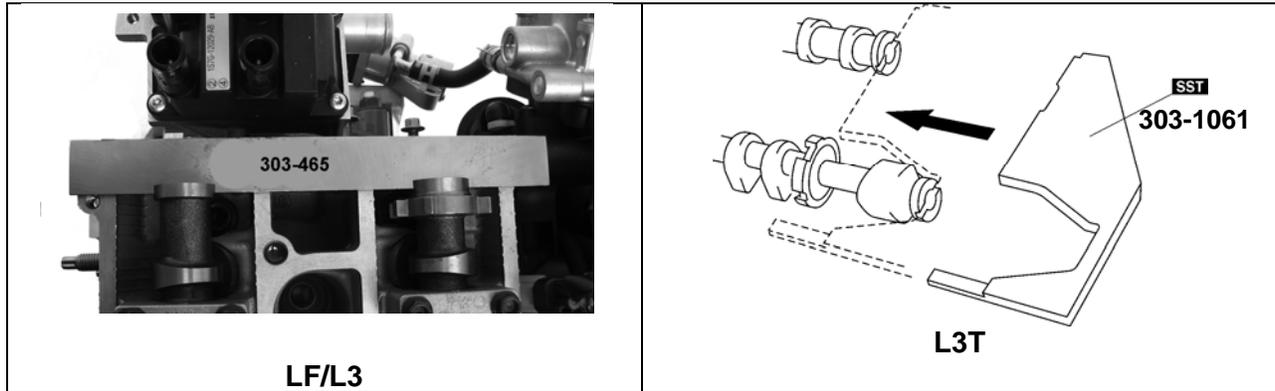
- Use SST 205-126 to hold the crankshaft pulley while tightening the crankshaft pulley. Torque the bolt to:
 - Stage 1:** Torque bolt to 96-104 Nm (70.9-76.7 lb-fft)
 - Stage 2:** Tighten bolt an additional 87-93 degrees (1/4 turn).

CAUTION

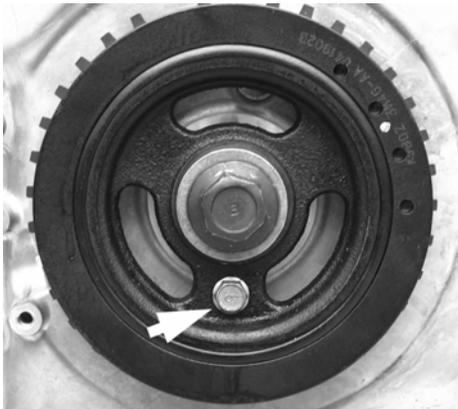
Do not rely on the M6 bolt in the timing cover to hold the crankshaft from turning; you will crack the timing cover.



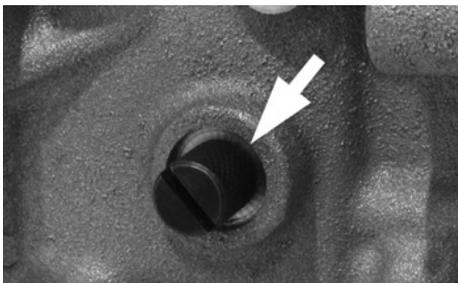
6. Verify camshaft timing. Make sure the camshaft alignment plate SST fits in the camshafts. Remove the SST.



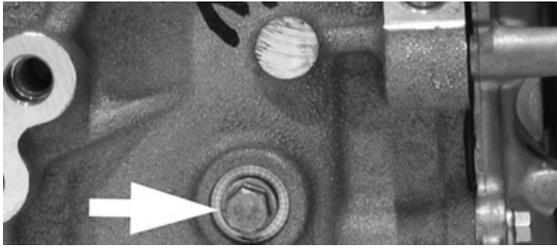
7. Remove the M6 bolt from the crankshaft pulley.



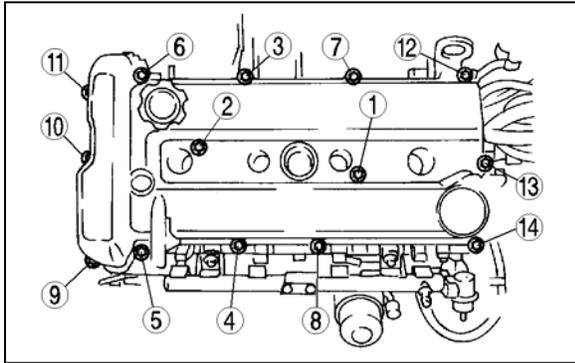
8. Remove the crankshaft timing peg 303-507.



9. Install the plug bolt. Tighten to 18-22 Nm (13.3-16.2 ftlbf).



10. Install the cylinder head cover and tighten in sequence to 8.0-11.5 Nm (70.9-101.7 inlbf).



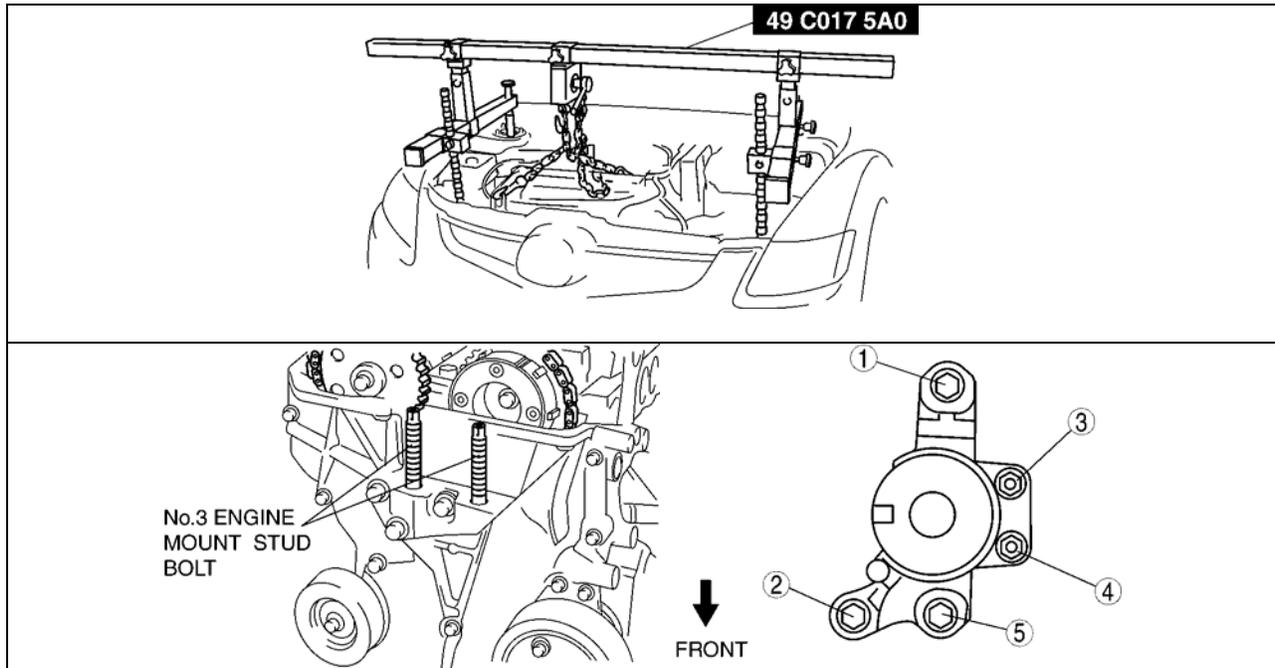
11. CX-7, MAZDASPEED3, MAZDASPEED6: Install the intercooler and intercooler shroud.
12. Install the spark plugs and tighten to 10-14 Nm (8.0-10.3 ftlbf).
13. Install the ignition coils and tighten to 5-7 Nm (44-61 inlbf).
14. Install the accessory drive belt.
15. Install the fan and shroud.
16. MX-5 Miata: install the battery box and fresh air box.
17. Install the axle shaft if removed.
18. Install any splash shields and additional components removed to access the front of the engine.

Procedure complete, stop here.

Correcting Camshaft or Both Camshaft and Crankshaft Timing

1. CX-7, MAZDA3, MAZDA6, MAZDASPEED3, MAZDASPEED6, and Tribute:

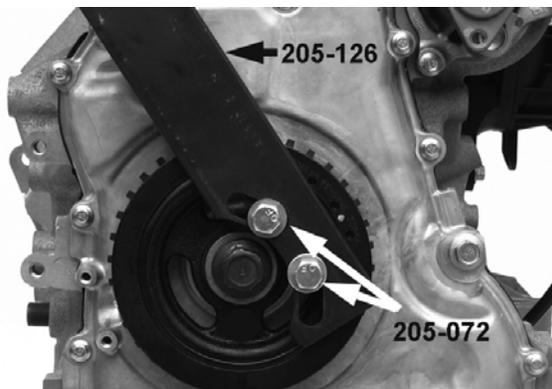
- You must remove the front upper engine mount; support the engine following Workshop Manual procedures.



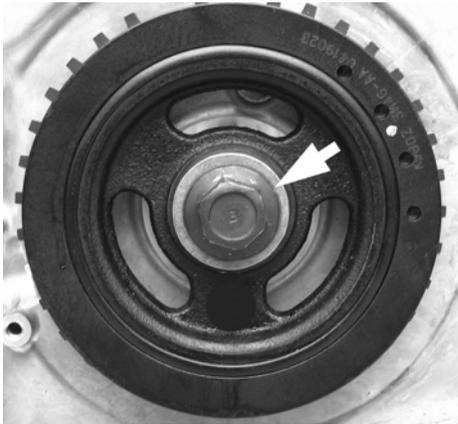
2. Hold the crankshaft pulley bolt (21mm) with SST 205-126, and loosen the crankshaft pulley bolt. (This may take two people)

CAUTION

Failure to hold the crankshaft pulley stationary during bolt tightening may damage the front cover.



3. Rotate the crankshaft clockwise using the crankshaft pulley bolt until it stops turning (held by the timing peg).

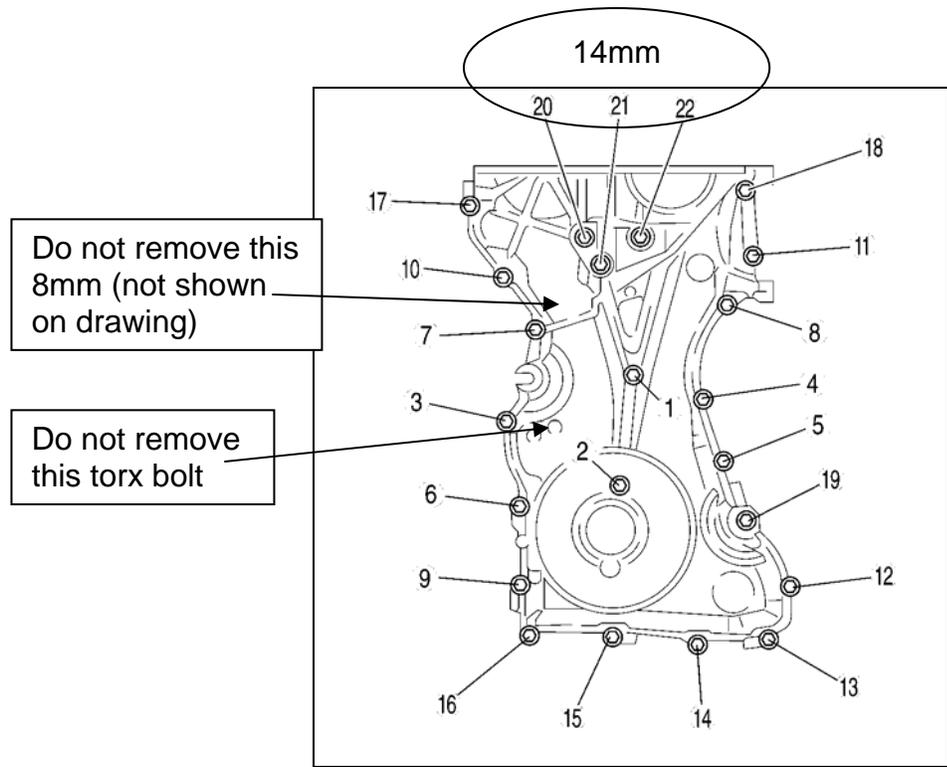


4. Remove the crankshaft pulley bolt.

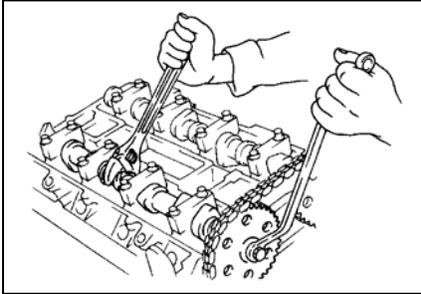
NOTE

Make sure the crankshaft does not rotate.

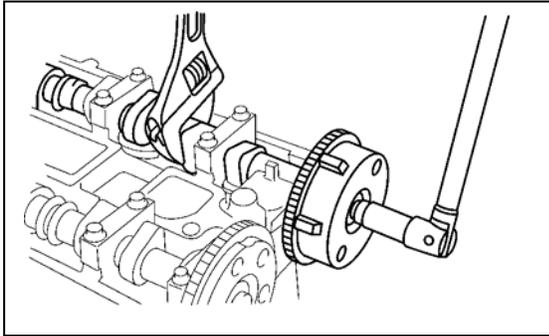
5. Remove the timing cover (18 8mm and three 14mm bolts).



6. Use a 23mm open end wrench to hold the exhaust camshaft hexagon. Loosen the exhaust camshaft bolt (13mm).

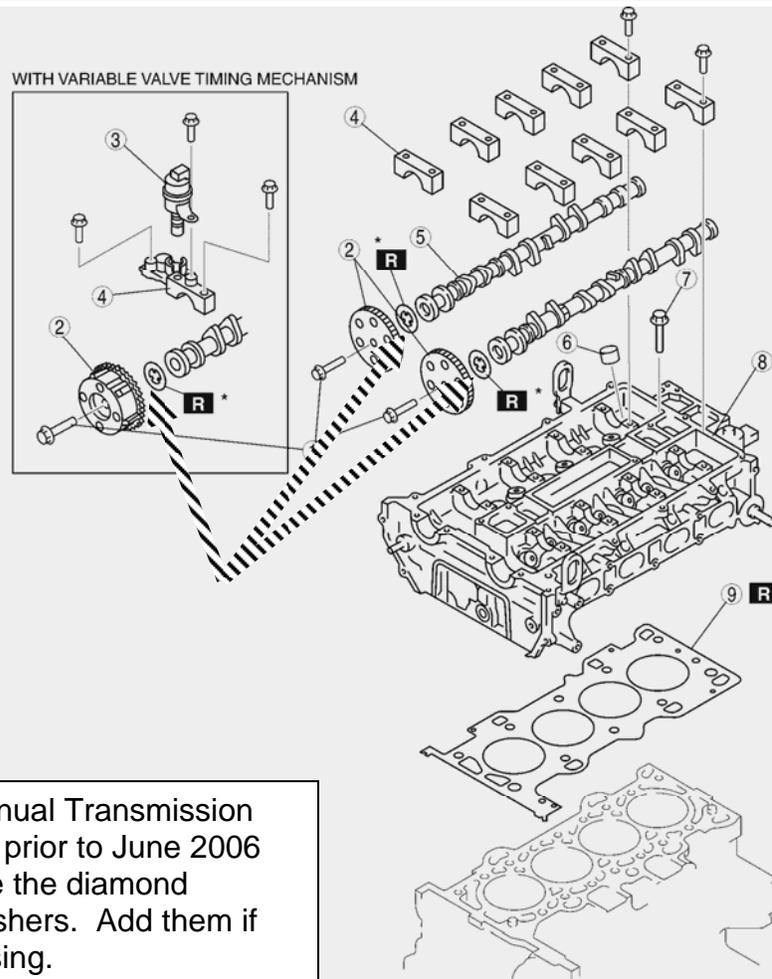


- Use a 23mm open end wrench to hold the intake camshaft hexagon. Loosen the intake camshaft bolt (15mm).



CAUTION

CX-7, MAZDA3, MAZDA6, MAZDASPEED3, MAZDASPEED6, and Tribute: you must replace the camshaft pulley washers or add them if missing.



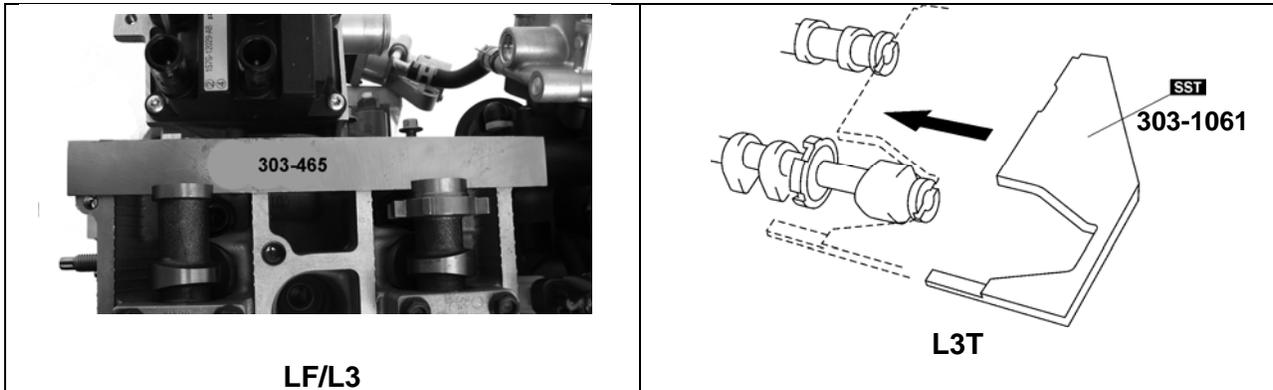
MAZDA6 Manual Transmission vehicles built prior to June 2006 may not have the diamond camshaft washers. Add them if they are missing.

*EXCEPT FOR MAZDA6 ARE EQUIPPED. IF WASHER IS NOT INSTALLED TO THE ENGINE, INSTALL A NEW WASHER.

8. Rotate the exhaust camshaft and intake camshaft until the camshaft alignment plate SST fits into the slots in both camshafts.

CAUTION

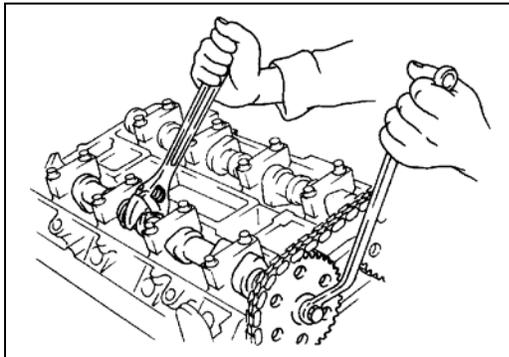
The SSTs are for camshaft and crankshaft pulley alignment only. Using either of these tools to prevent engine rotation may damage the engine or timing cover.



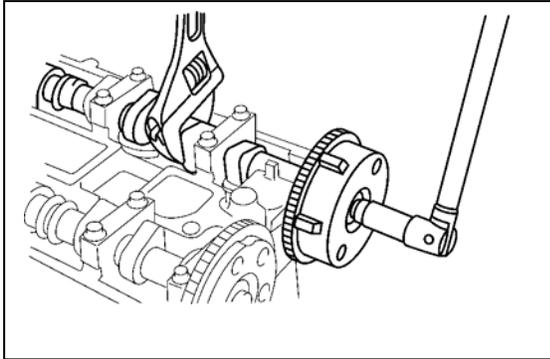
9. Use a 23mm open end wrench to hold the exhaust camshaft hexagon. Torque the exhaust camshaft bolt (13mm) to 69-75 Nm (50.9-55.3 ft-lbs).

CAUTION

The SSTs are for camshaft and crankshaft pulley alignment only. Using either of these tools to prevent engine rotation may damage the engine or timing cover.



10. Use a 23mm open end wrench to hold the intake camshaft hexagon. Torque the camshaft bolt (15mm) to 69-75 Nm (50.9 – 55.3 ft-lbs).

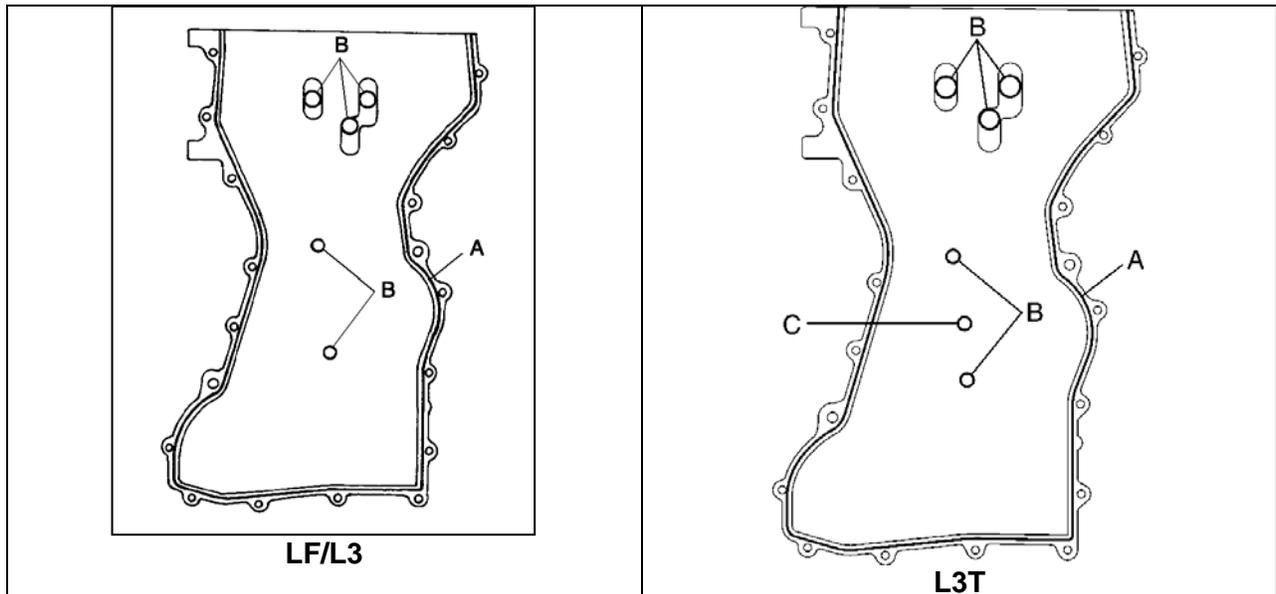


11. Apply RTV silicone sealant to the timing cover to areas **A** and **B** in the correct thickness.

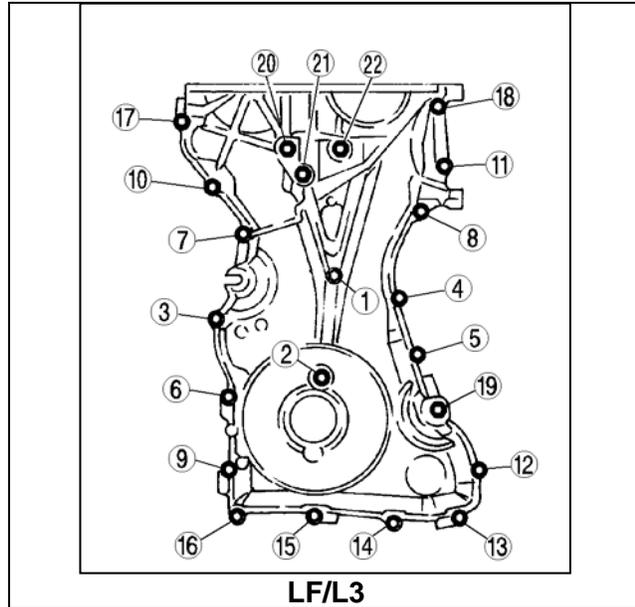
A = 2.0 to 3.0 mm (0.079 to 0.118 in)

B = 1.5 to 2.5 mm (0.059 to 0.098 in)

C = None



12. Torque bolts 1 through 18 (8mm) in the sequence indicated to 8.0-11.5 Nm (70.9-101.7 inlbf)
13. Torque bolts 19 through 22 to 40-55Nm (29.7-40.5 ftlbf).



14. Slide the crankshaft pulley onto the crankshaft.
15. Replace the crankshaft pulley bolt with a new bolt.

CAUTION

A new crankshaft pulley bolt must be used each time the bolt has been removed. Do not reuse the crankshaft pulley bolt.

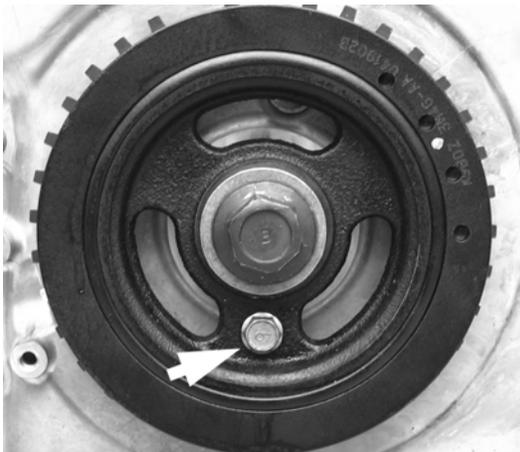
16. Rotate the crankshaft pulley until you can insert the M6 bolt through the pulley into the timing cover.

NOTE

This step will correctly align the crankshaft pulley to the crankshaft.

CAUTION

Only hand-tighten the bolt or you may damage to the front cover.

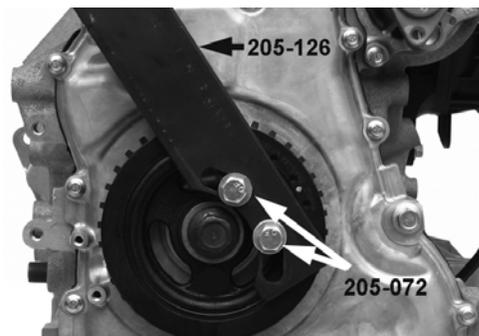


17. Use SST 205-126 to hold the crankshaft pulley while tightening the crankshaft pulley. Torque the bolt to:

- **Stage 1:** Torque bolt to 96-104 Nm (70.9-76.6 ftlbf)
- **Stage 2:** Tighten bolt an additional 87-93 degrees (1/4 turn).

CAUTION

Do not rely on the M6 bolt in the timing cover to hold the crankshaft from turning; you will crack the timing cover.



18. If necessary, adjust the alignment of the CKP sensor centerline:

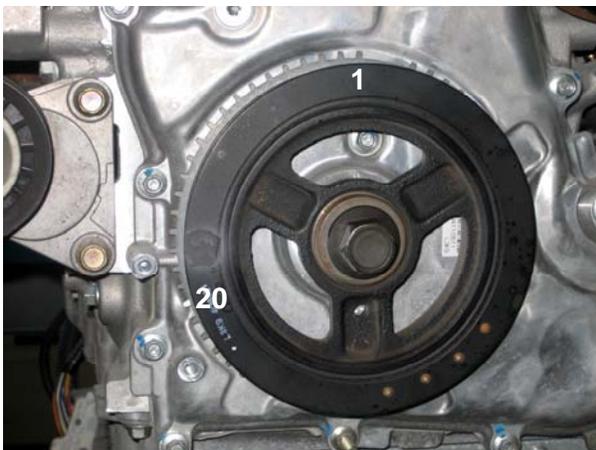
- Federal specification LF and California/Federal specification L3 engines with the centerline of the 9th tooth on the sensor wheel.



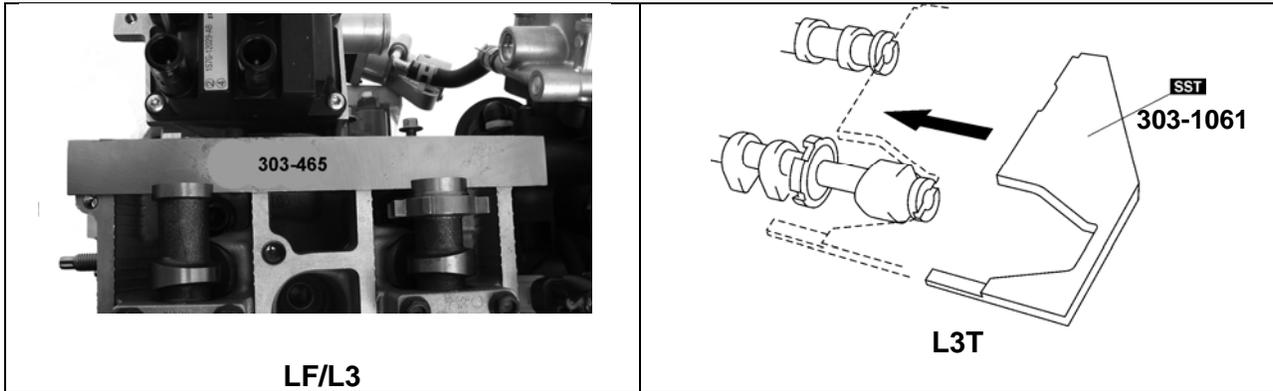
- California specification LF engines: align the CKP sensor with the centerline of the 4th tooth down from missing teeth as pictured.



- L3T Engines the correct timing mark is 20 teeth back from the missing tooth.



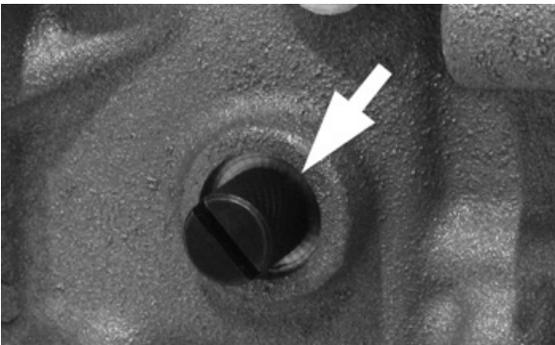
19. Verify camshaft timing; make sure camshaft alignment plate SST fits in the camshafts.
Remove the SST.



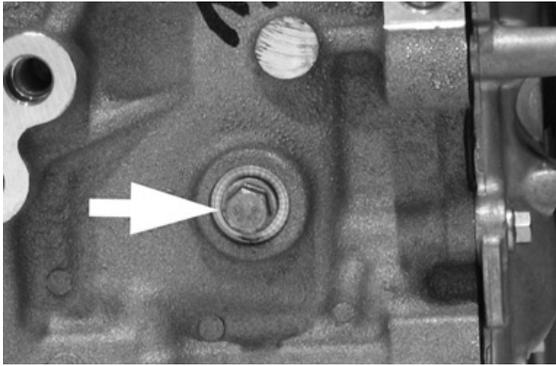
20. Remove the M6 bolt from the crankshaft pulley.



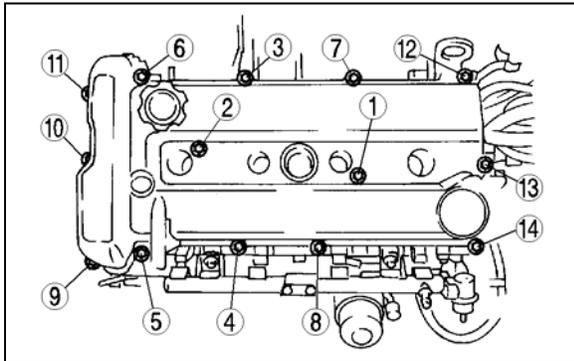
21. Remove the crankshaft timing peg 303-507.



22. Install the plug bolt. Tighten to 18-22 Nm (13.3-16.2 ftlbf).



23. Install the cylinder head cover and tighten in sequence to 8.0-11.5 Nm (70.9-101.7 inlbf).



LF/L3

24. Install the spark plugs and tighten to 10-14 Nm (8.0-10.3 ftlbf).

25. Install the ignition coils and tighten to 5-7 Nm (44-61 inlbf).

26. CX-7, MAZDASPEED3, MAZDASPEED6: Install the intercooler and intercooler shroud.

27. Install the accessory drive belt.

28. Install the fan and shroud.

29. MX-5 Miata: install the battery box and fresh air box.

30. Install the axle shaft if removed.

31. Install any splash shields.

32. Start the engine and verify engine runs and idles smoothly:

- If the engine does not idle well, perform a compression test and cylinder leak down test and replace the cylinder head if necessary.

Procedure complete, stop here.

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