

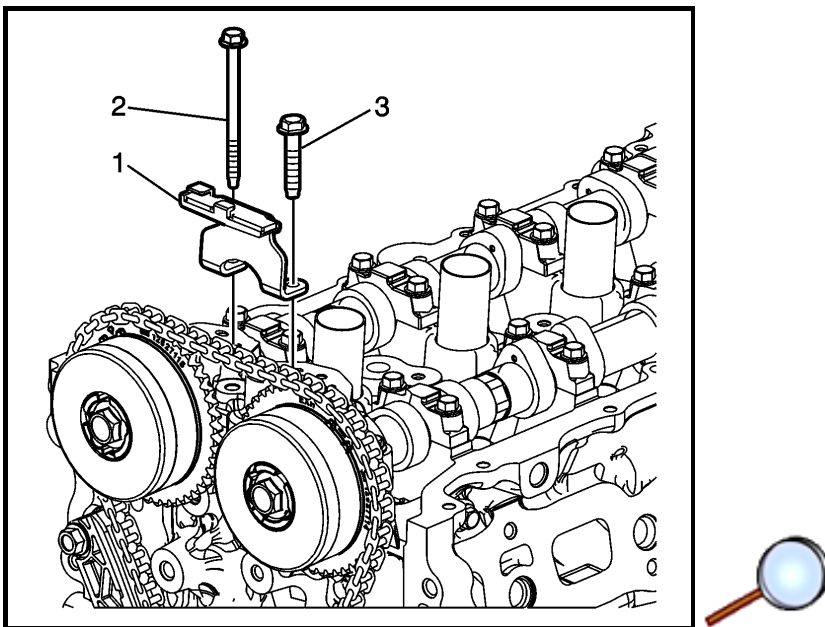
Camshaft Timing Chain and Tensioner Replacement

Single Use Fasteners and Components

- Camshaft Cover Gasket
- Crankshaft Balancer Bolt
- Engine Coolant Air Bleed Pipe Seal
- Engine Front Cover Bolt [3x]
- Fuel Feed Pipe
- Timing Chain Tensioner Seal

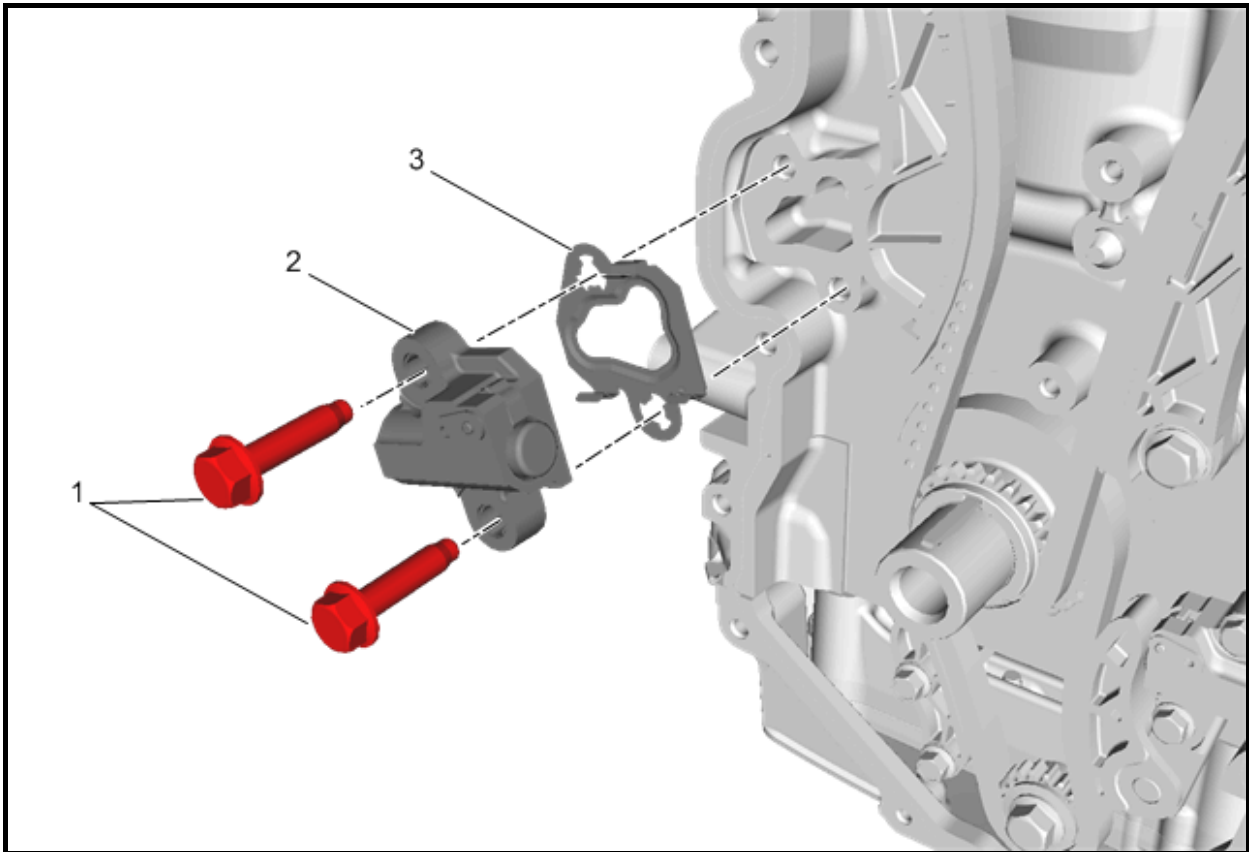
Removal Procedure

1. Remove the engine front cover. Refer to [Engine Front Cover Replacement](#).

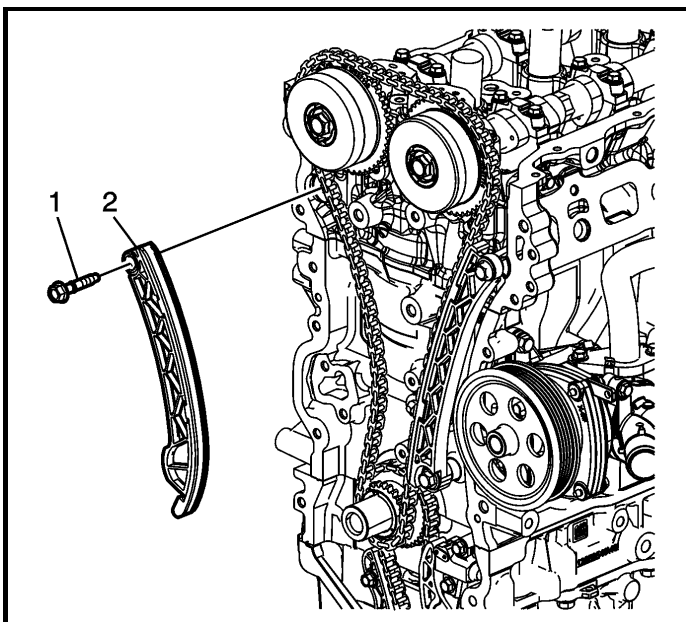


2. Remove the upper timing chain guide bolts (2, 3).
3. Remove the upper timing chain guide (1).

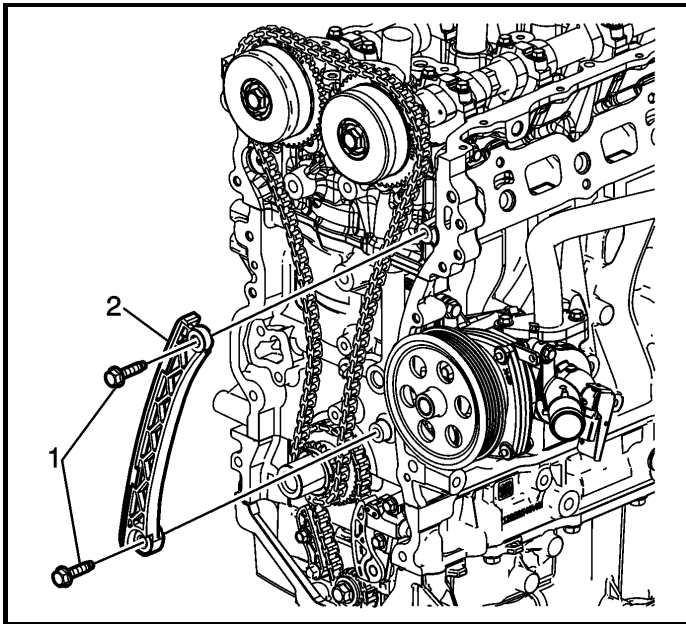
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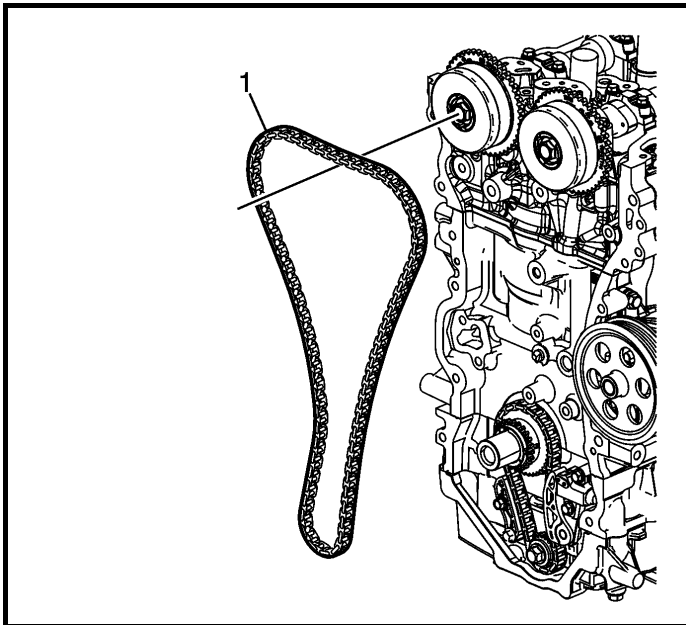
4. Timing Chain Tensioner Bolt (1) » Remove [2x]
5. Timing Chain Tensioner (2) » Remove
6. Timing Chain Tensioner Seal (3) » Remove and DISCARD



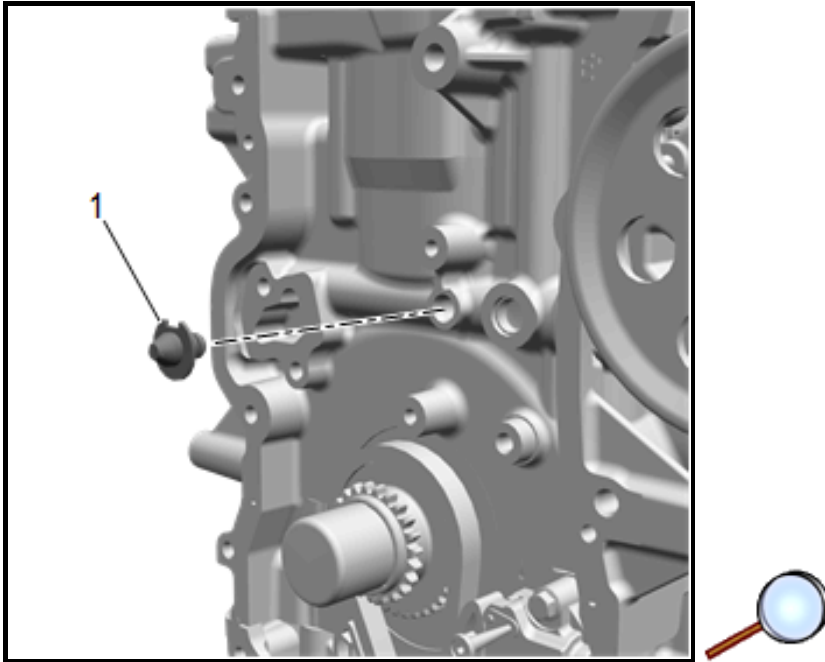
7. Remove the timing chain tensioner pivot arm bolt (1).
8. Remove the timing chain tensioner pivot arm (2).



9. Remove the timing chain guide bolts (1).
10. Remove the timing chain guide (2).

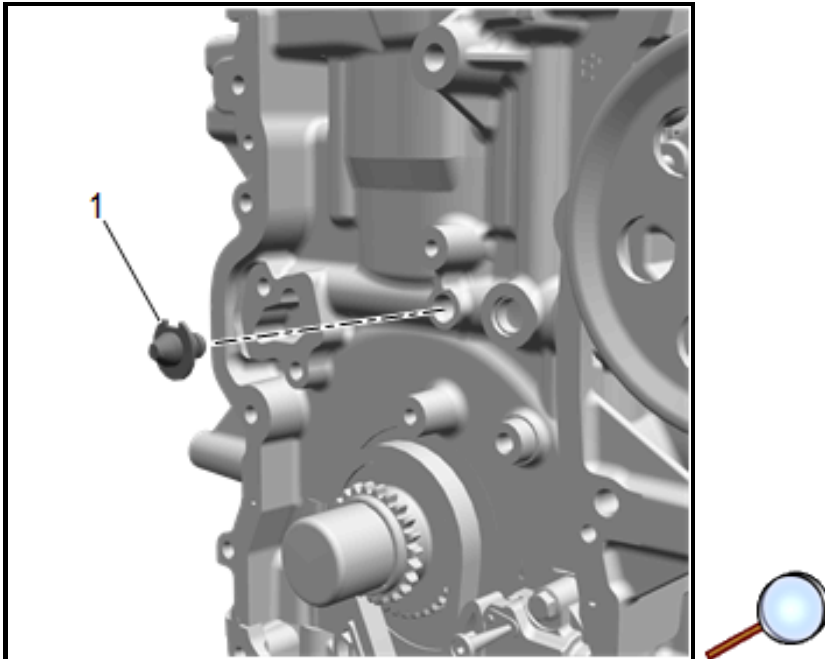


11. Remove the timing chain (1).



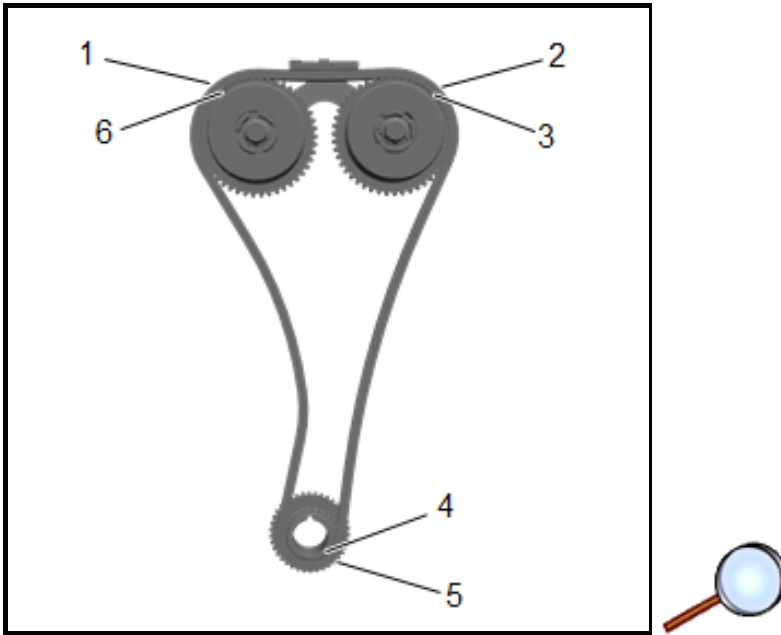
12. Remove the timing chain oil nozzle (1).
13. For camshaft timing chain, sprocket, and tensioner cleaning and inspection. Refer to [Camshaft Timing Chain, Sprocket, and Tensioner Cleaning and Inspection](#).

Installation Procedure



Note: Ensure the timing chain oil nozzle is rotated with the notch facing upward, and aligned with the tab on the engine block.

1. Install the timing chain oil nozzle (1).

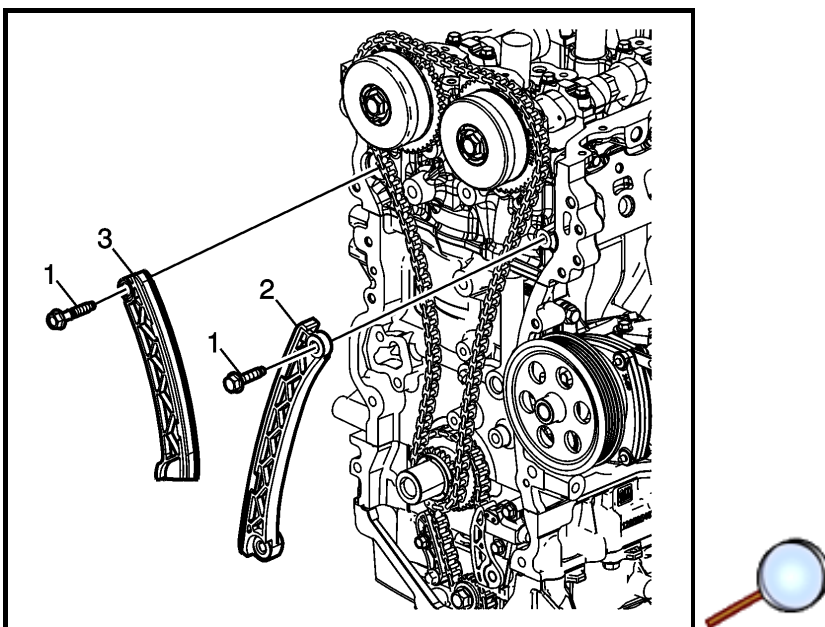


Note: There are three colored links on the timing chain. The two links that align to the timing marks on the actuators are the same color. The timing link that aligns with the timing mark on the crankshaft sprocket is a unique color. Use the following procedure to line up the links with the actuators. Orient the chain so that the colored links are visible.

2. Loop the timing chain over the intake and exhaust camshaft actuators, aligning one of the same colored links (2) with the timing mark on the exhaust camshaft actuator (3).

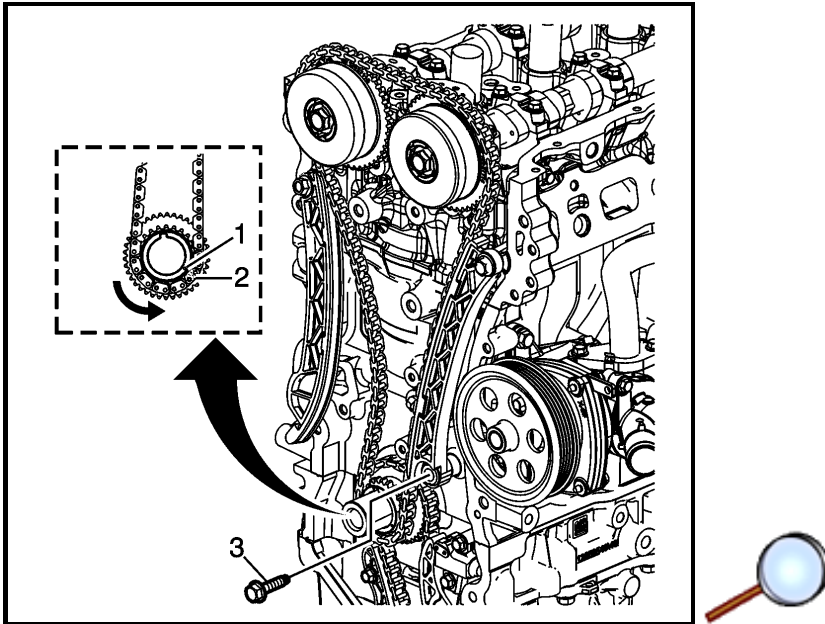
Note: The same colored link corresponding to the intake actuator will not initially align with the intake actuator timing mark, nor the unique colored timing chain link align with the crankshaft sprocket timing mark.

3. Ensure the crankshaft key in the 12 O'clock position. Loop the timing chain onto the crankshaft sprocket.



Note: Timing will be established before the final install and torque of the guide bolts.

4. Install the timing chain guide (2) and upper bolt (1) only, finger tight.
5. Install the timing chain tensioner pivot arm (3).
6. Install the pivot arm bolt (1) finger tight.



7. With a suitable tool, rotate the crankshaft counterclockwise to align the timing mark on the crankshaft sprocket (1) with the timing link (2).

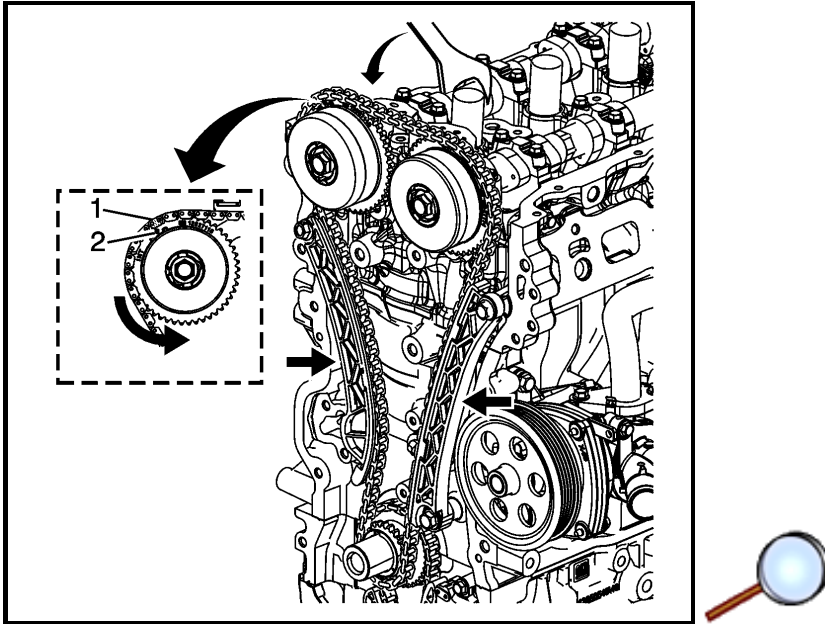
Note:

- Continue to rotate the crankshaft counterclockwise as necessary to maintain timing alignment.
- Ensure that the alignment mark on the exhaust camshaft actuator remains aligned with the timing link.

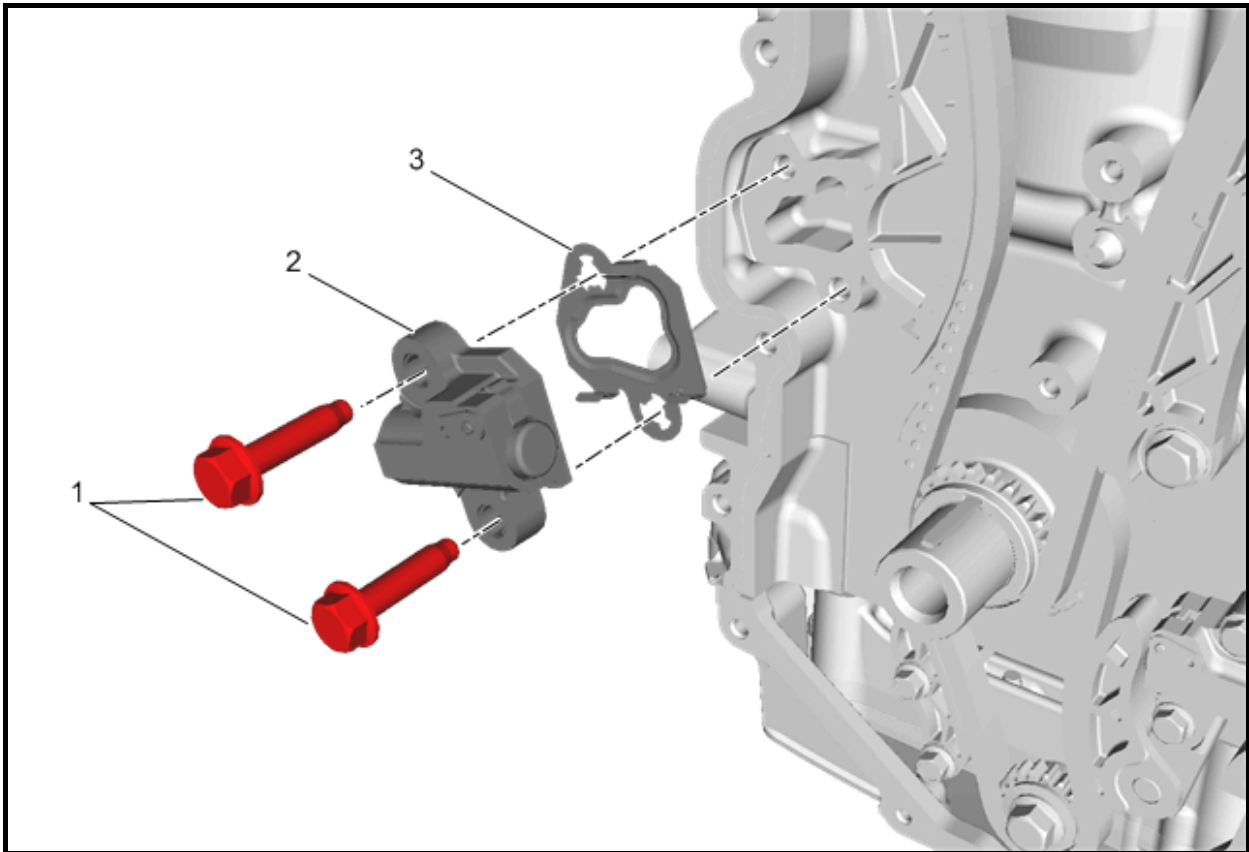
8. Rotate the lower end of the fixed timing chain guide into installation position and install the lower bolt (3).

Caution: Refer to [Fastener Caution](#).

9. Tighten the timing chain guide upper and lower bolts to **25 N·m (18 lb ft)**.
10. Tighten the pivot arm bolt to **25 N·m (18 lb ft)**

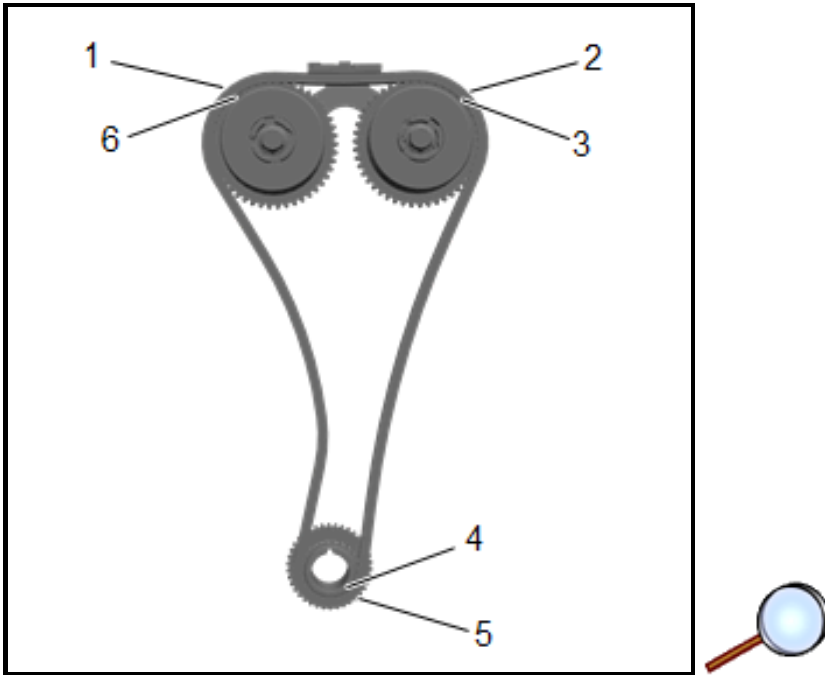
**Note:**

- The timing for the exhaust camshaft actuator and the crankshaft sprocket has been established.
 - Applying or loosening pressure by hand between the timing chain guides will allow the chain to slip or bind during counterclockwise rotation of the camshaft.
11. Using a suitable tool, rotate the intake camshaft counterclockwise until the timing mark on the intake actuator (2) is aligned with the timing link (1). Maintain tension on intake camshaft until the timing chain tensioner can be installed and activated.



Note: Use a NEW gasket.

12. Timing Chain Tensioner Seal (3) » Install
13. Timing Chain Tensioner (2) » Install
14. Timing Chain Tensioner Bolt (1) » Install and tighten [2x] **25 N·m (18 lb ft)**

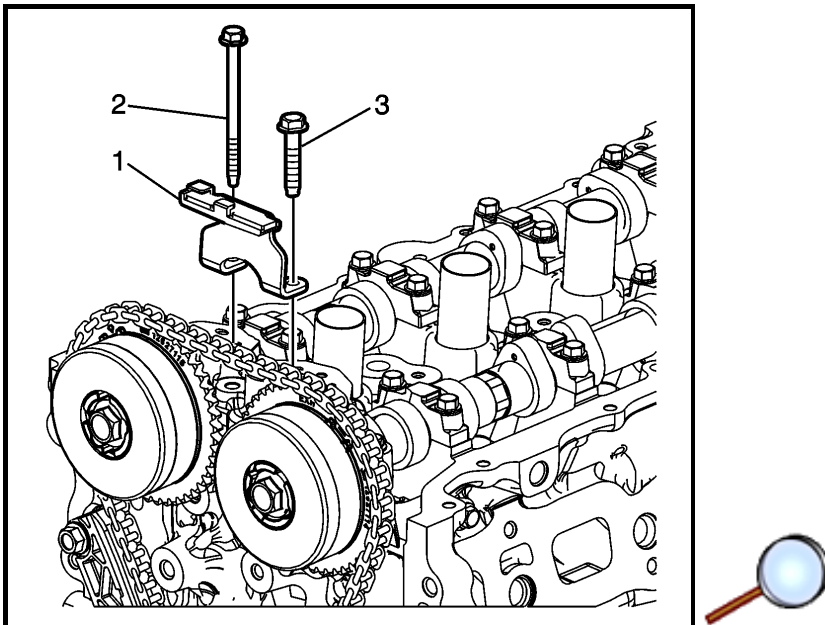


15. Verify the timing links on the timing chain are properly aligned to the timing marks:

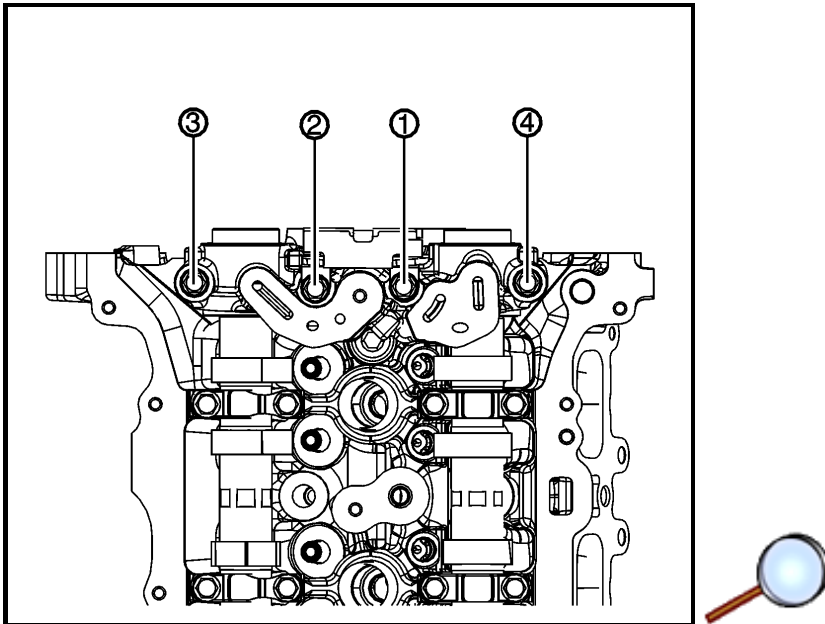
15.1. The timing links (1, 2) are aligned to the appropriate timing marks on the camshaft actuators (6, 3).

15.2. The unique colored link (5) is aligned to the timing mark on the crankshaft sprocket (4).

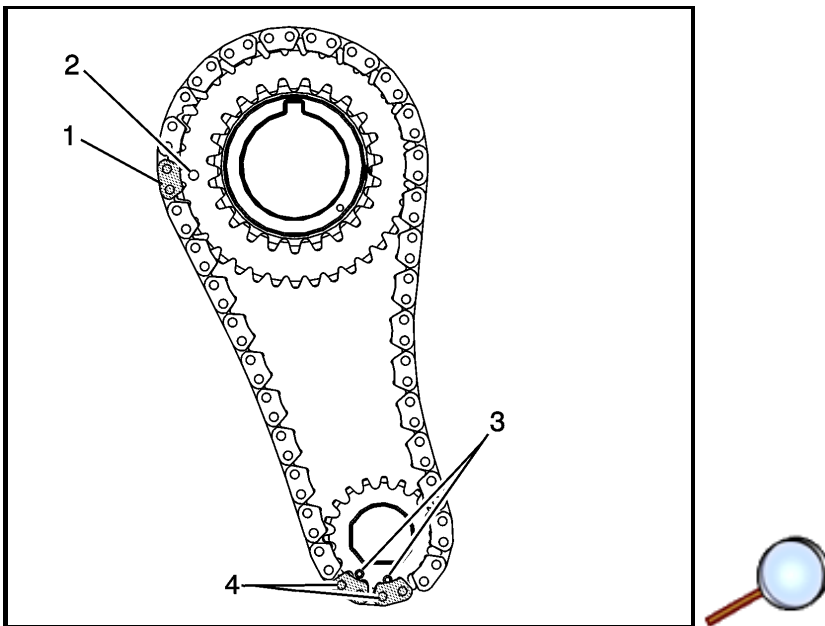
16. If they are not, repeat the portion of the procedure necessary to align the timing marks.



17. Install the timing chain guide (1) and bolts (2, 3) finger tight.



18. Tighten the front camshaft cap bolts in sequence to **10 N·m (89 lb in)** twice.
19. Rotate the crankshaft clockwise to see if either of the actuators or the crankshaft sprocket jump timing chain teeth. If this occurs, repeat procedure to align the timing marks.



Note: Due to the difference of crankshaft sprocket and balance shaft sprocket, timing marks on the chain will not match during every crankshaft revolution. Ensure that the marks on the sprockets are aligned appropriately before installing the timing chain.

20. Verify the timing links on the balance chain are properly aligned to the timing marks:
 - 20.1. The timing link (1) is aligned to the timing mark on the crankshaft sprocket (2).
 - 20.2. The adjacent timing links (4) are aligned with both timing marks (3) on the balancer shaft driven sprocket.
21. Install the engine front cover. Refer to [Engine Front Cover Replacement](#).

