

Fig. 106: Intake Rocker Arm

Courtesy of GENERAL MOTORS COMPANY

NOTE:

- Used rocker arms must be returned to the original position on the camshaft. If the camshaft is being replaced, the rocker arms actuated by the camshaft must also be replaced.
 - Pre-oil roller bearings before installation.
2. Lubricate the roller bearings with valve rocker arm lubricant. Refer to [Adhesives, Fluids, Lubricants, and Sealers \(LTG\)](#) [Adhesives, Fluids, Lubricants, and Sealers \(LCV\)](#) .
 3. Position the valve rocker arm (1) on the tip of the valve stem and on the lash adjuster and lubricate. Refer to [Adhesives, Fluids, Lubricants, and Sealers \(LTG\)](#) [Adhesives, Fluids, Lubricants, and Sealers \(LCV\)](#) .
 4. Install the camshaft position actuator and camshaft - intake. Refer to [Camshaft Position Actuator and Camshaft Replacement - Intake](#).

CAMSHAFT TIMING CHAIN AND TENSIONER REPLACEMENT

Removal Procedure

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

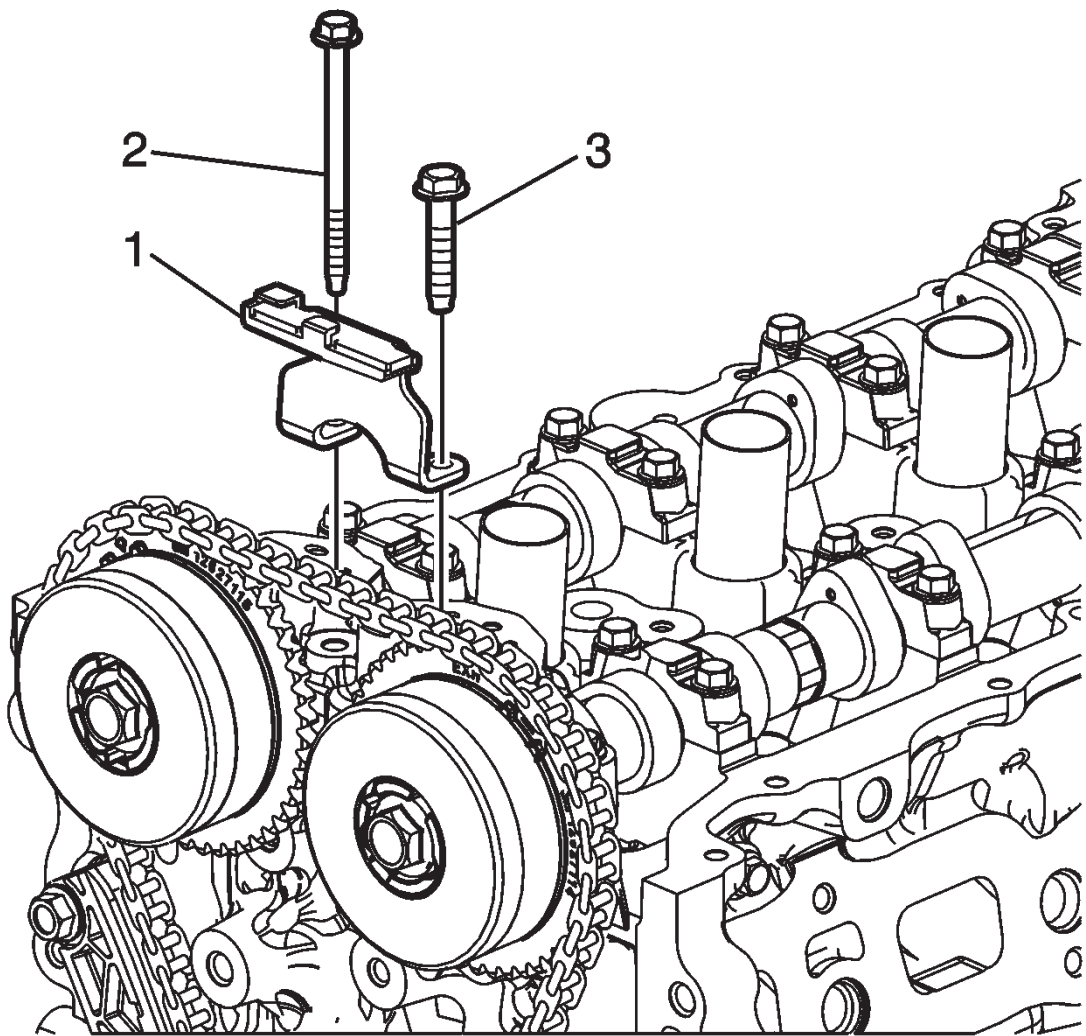


Fig. 107: Upper Timing Chain Guide Bolts
Courtesy of GENERAL MOTORS COMPANY

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

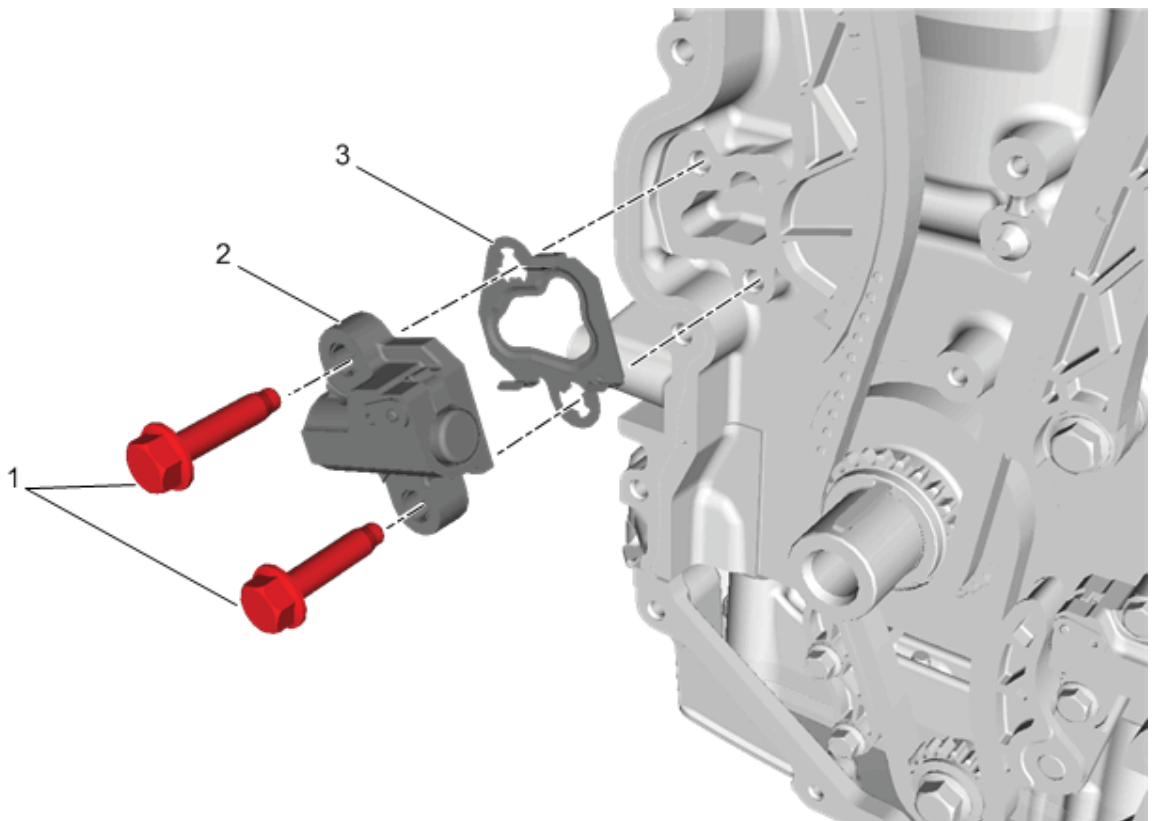


Fig. 108: Timing Chain Tensioner Bolts And Timing Chain Tensioner
Courtesy of GENERAL MOTORS COMPANY

4. Timing Chain Tensioner Bolt Remove
5. Timing Chain Tensioner Remove
6. Timing Chain Tensioner Gasket - Remove and DISCARD

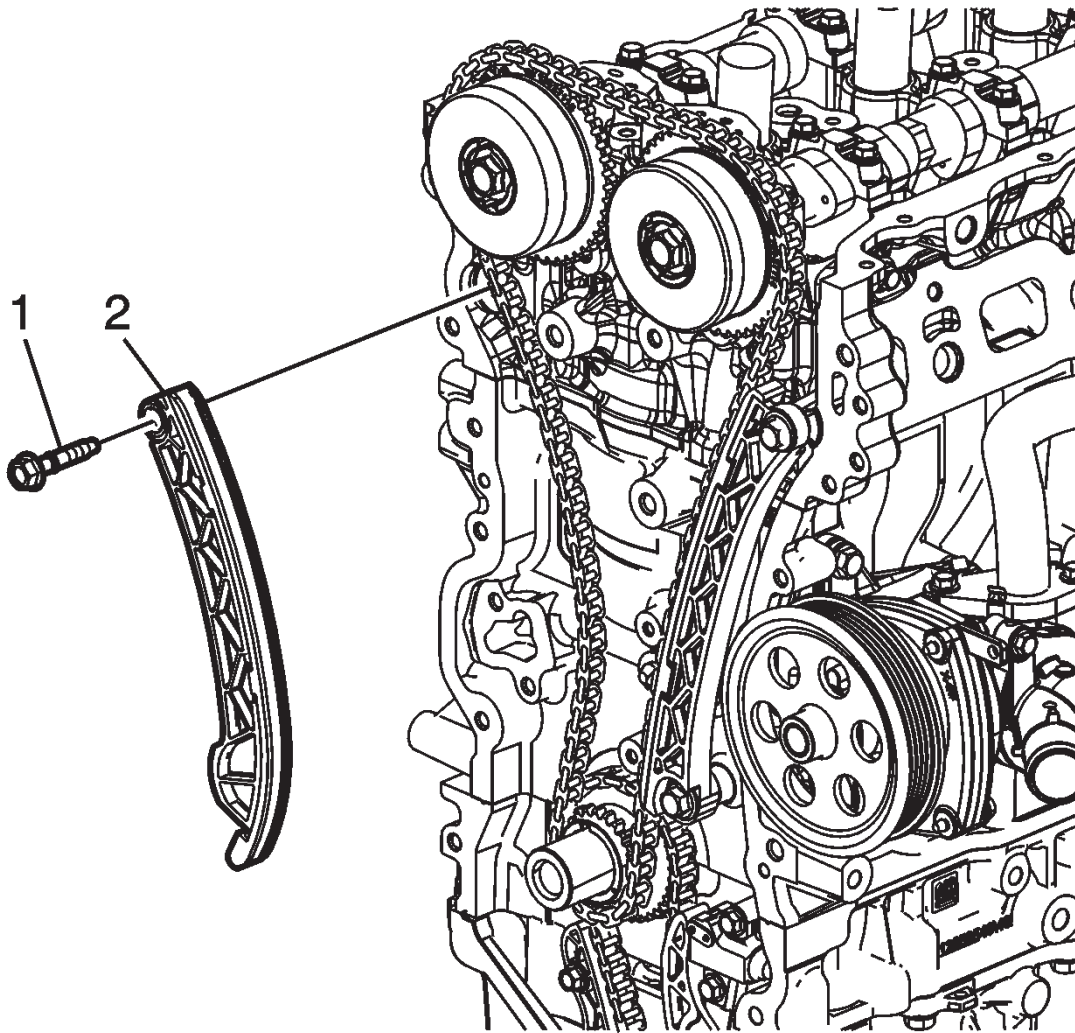


Fig. 109: Timing Chain Tensioner Pivot Arm Bolt
Courtesy of GENERAL MOTORS COMPANY

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

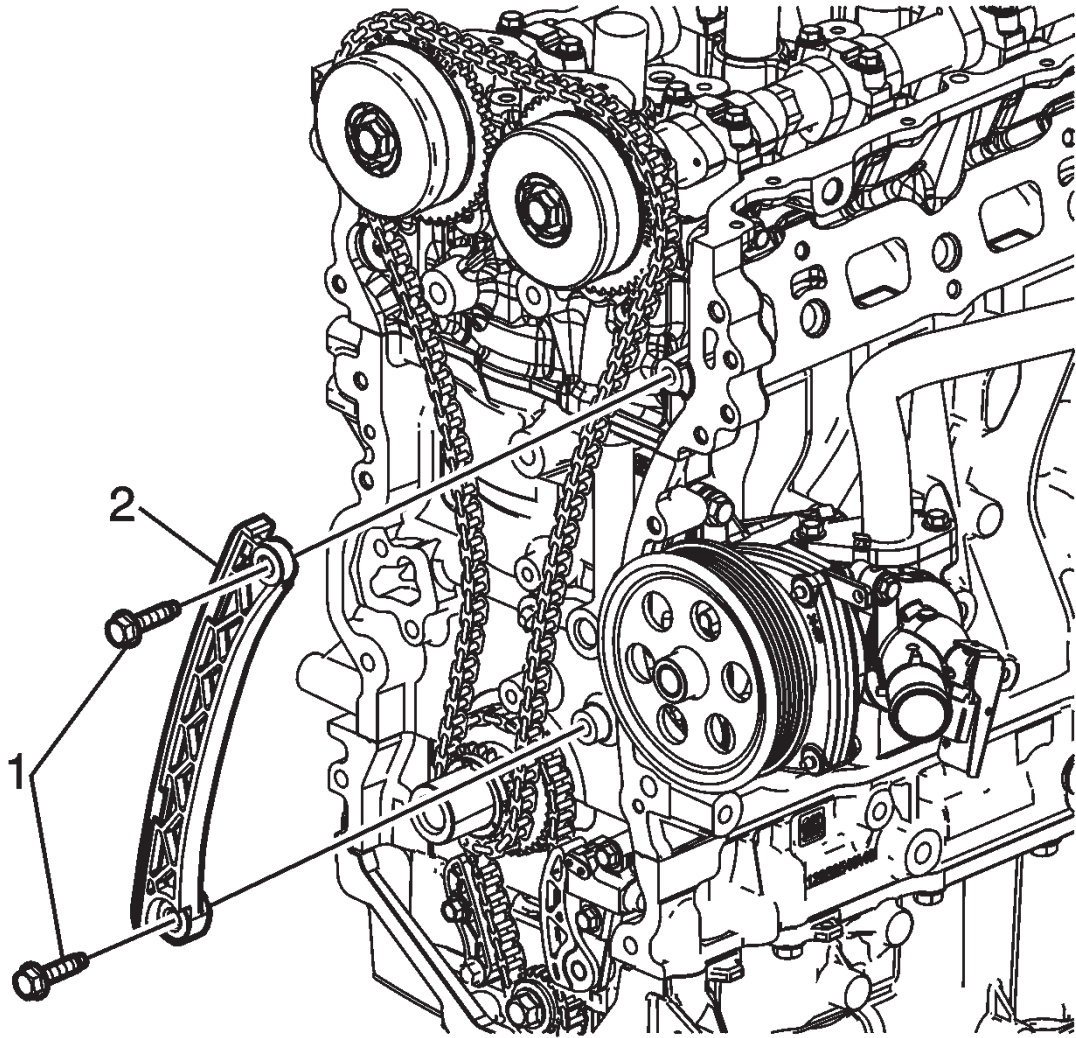


Fig. 110: Timing Chain Guide Bolts
Courtesy of GENERAL MOTORS COMPANY

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

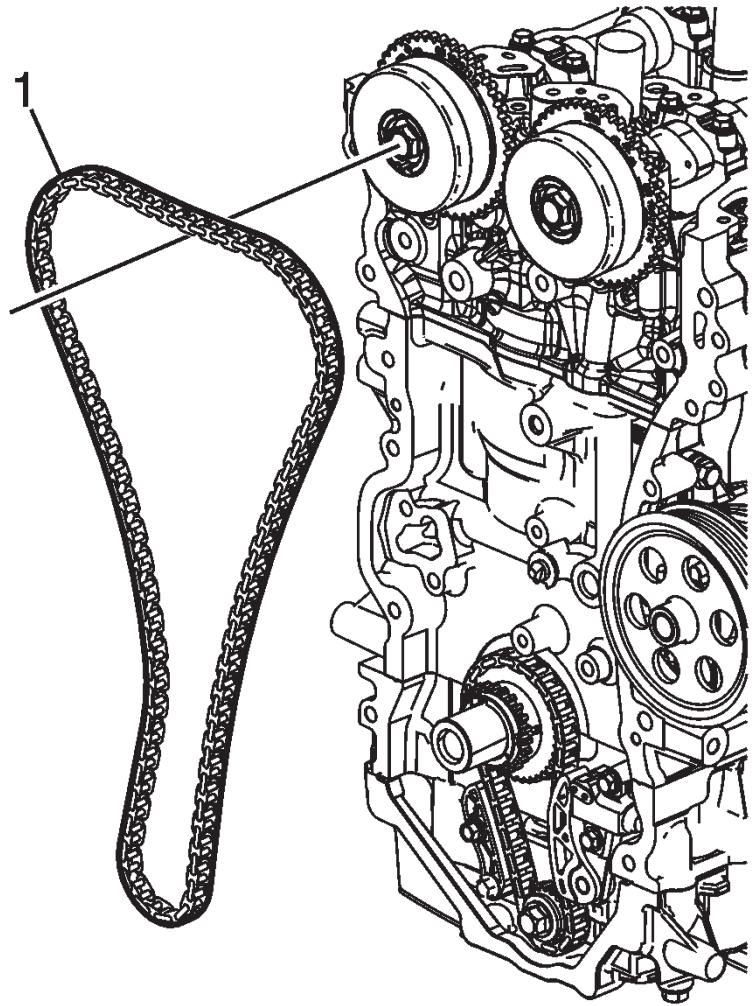


Fig. 111: Timing Chain
Courtesy of GENERAL MOTORS COMPANY

11. Remove the timing chain (1).

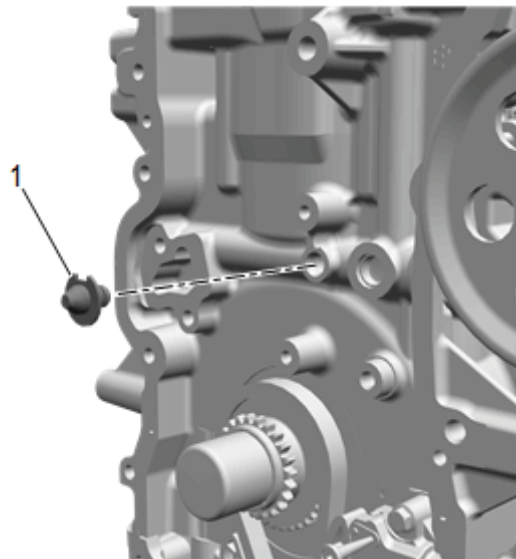


Fig. 112: Timing Chain Oil Nozzle
Courtesy of GENERAL MOTORS COMPANY

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

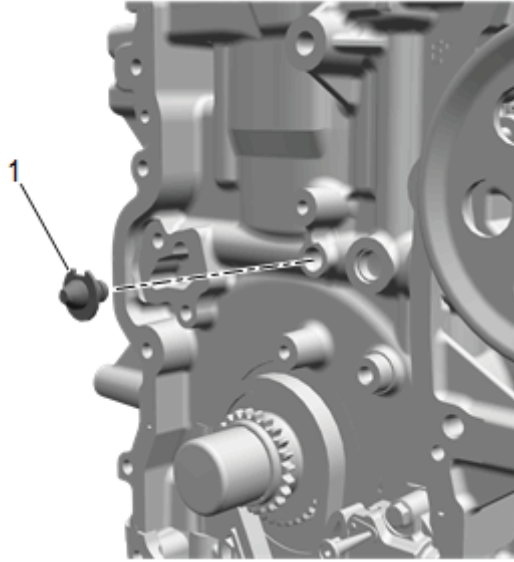


Fig. 113: Timing Chain Oil Nozzle
 Courtesy of GENERAL MOTORS COMPANY

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).

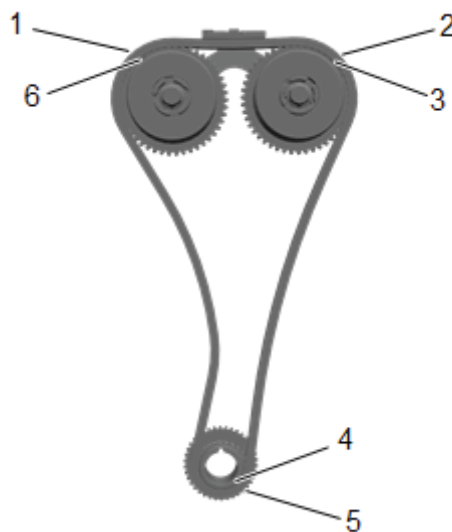


Fig. 114: Timing Chain Oil Nozzle
 Courtesy of GENERAL MOTORS COMPANY

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.

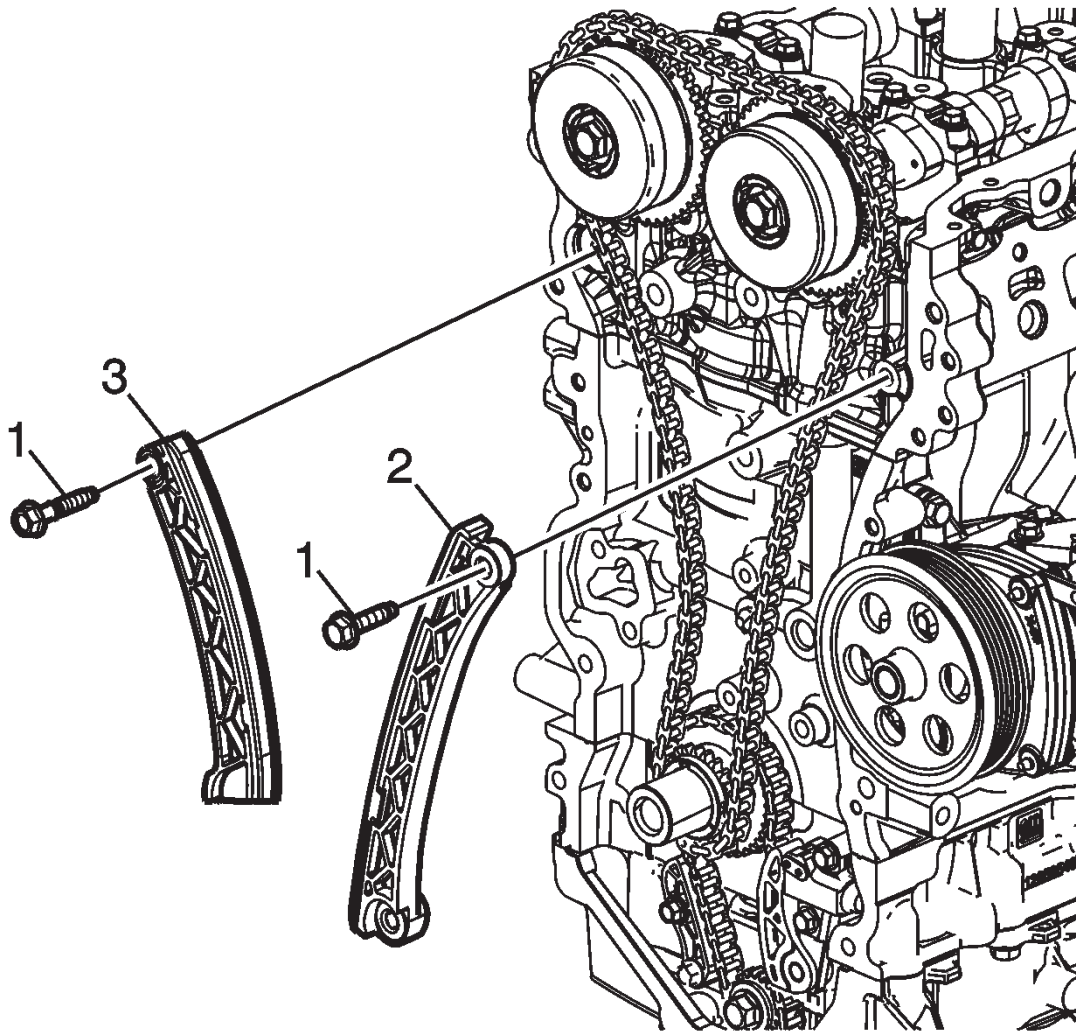


Fig. 115: Timing Chain Guides And Bolts
Courtesy of GENERAL MOTORS COMPANY

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.

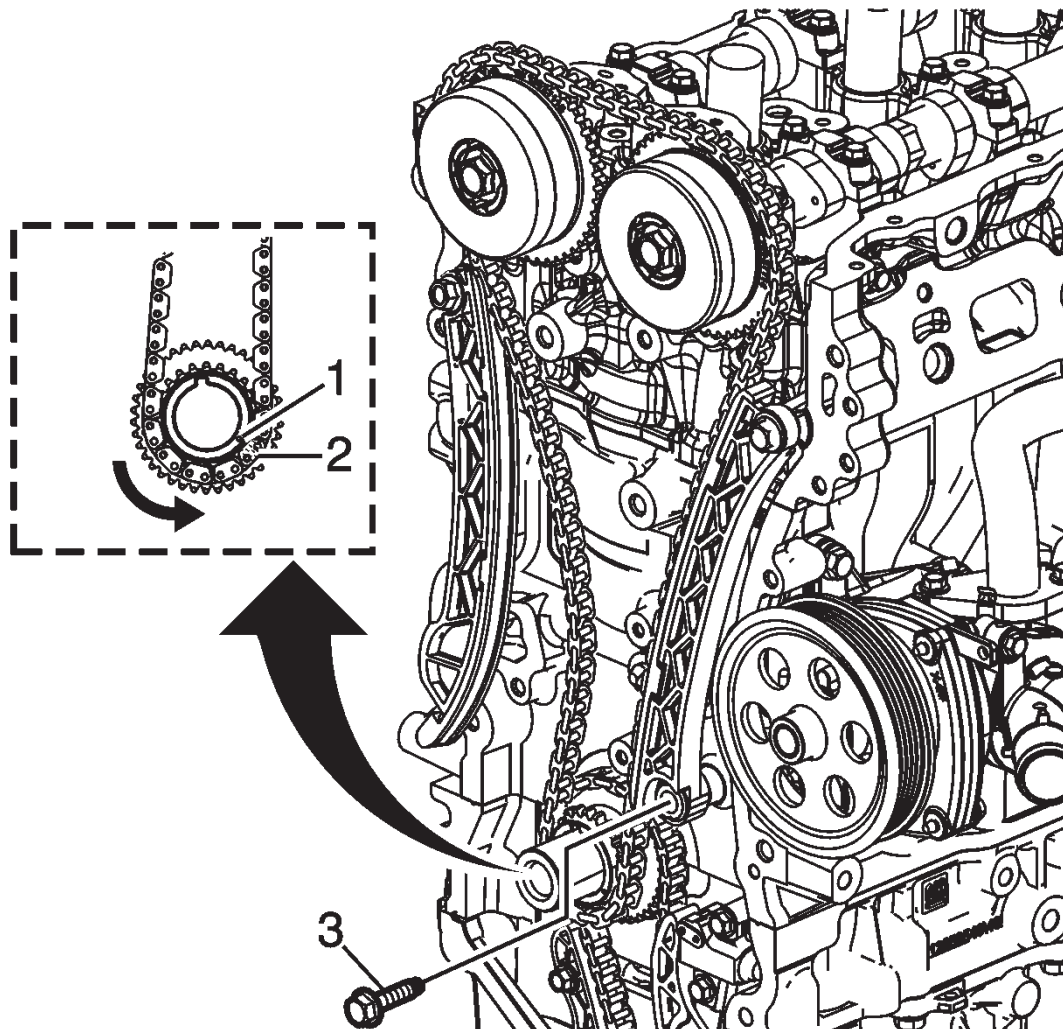


Fig. 116: Crankshaft Sprocket

Courtesy of GENERAL MOTORS COMPANY

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)

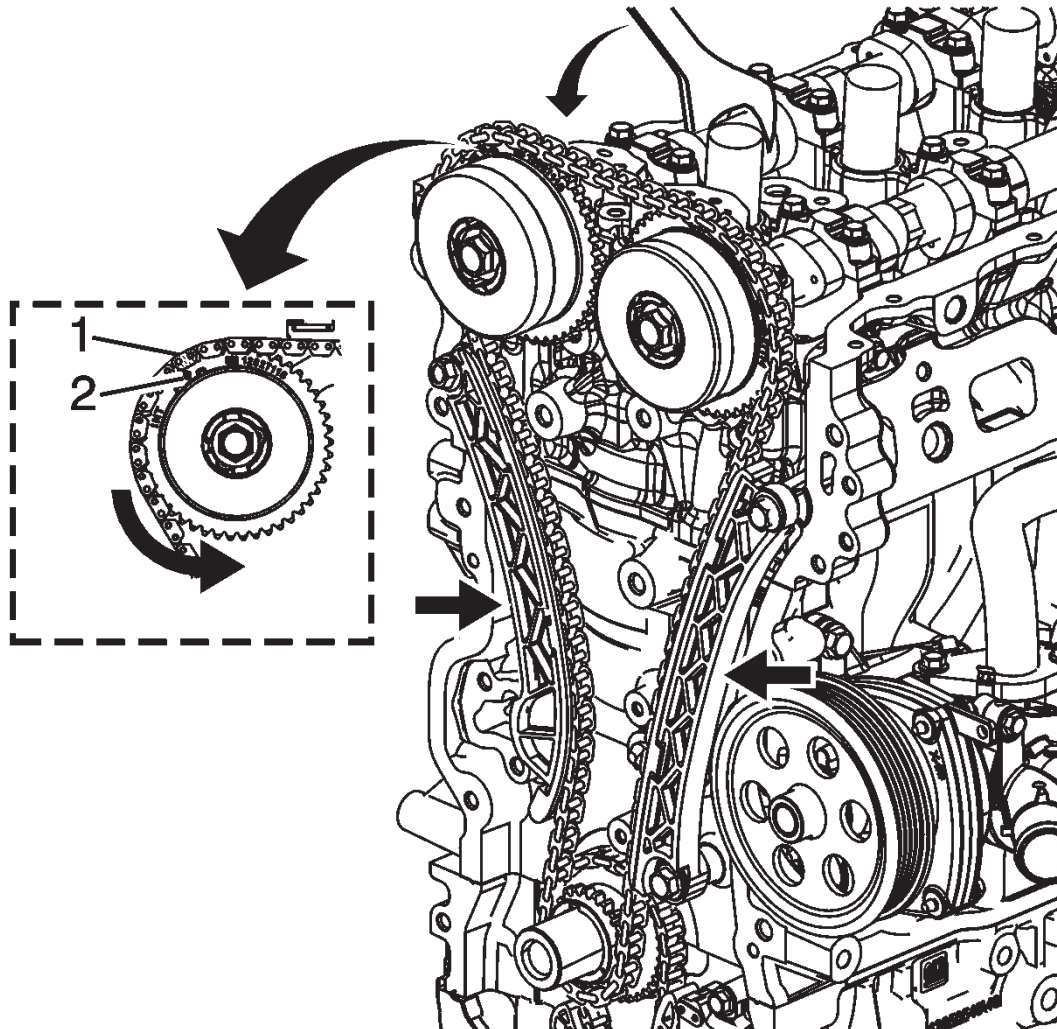


Fig. 117: Timing Mark On Intake Actuator
Courtesy of GENERAL MOTORS COMPANY

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.

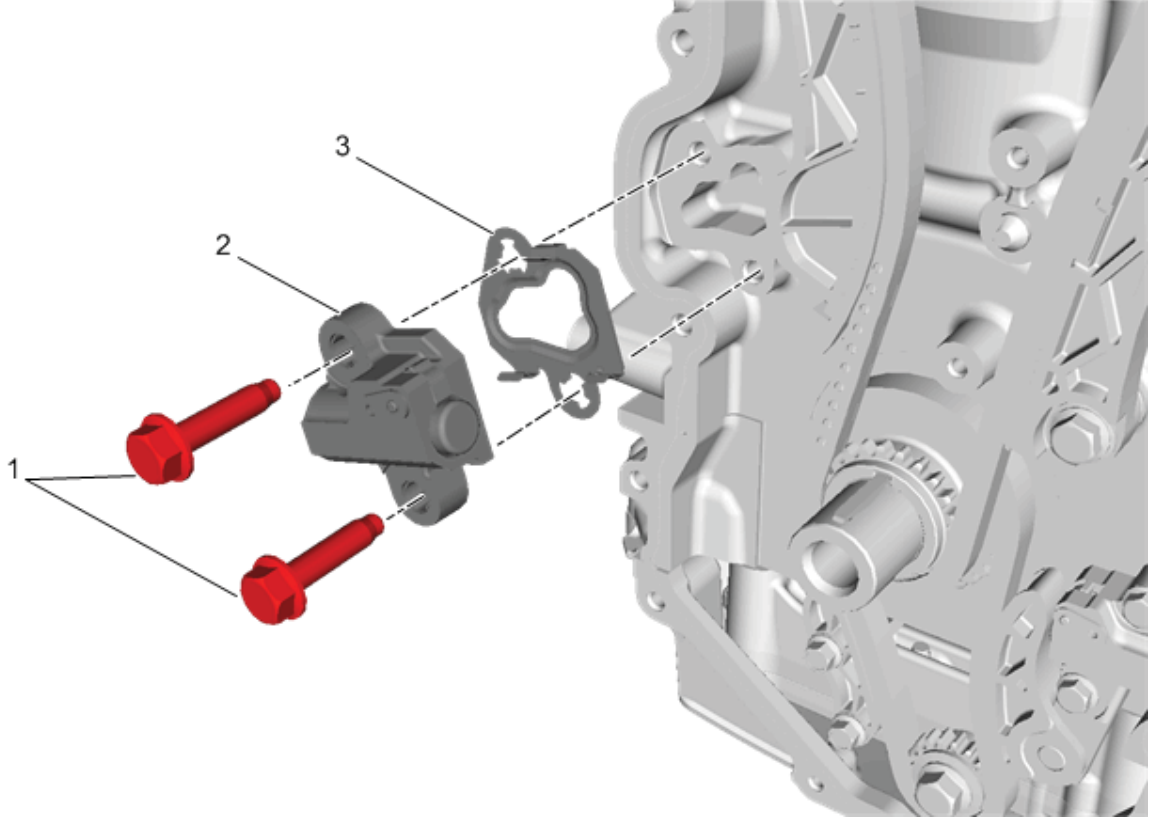


Fig. 118: Timing Chain Tensioner Bolts And Timing Chain Tensioner
 Courtesy of GENERAL MOTORS COMPANY

NOTE: Use a NEW gasket.

12. Timing Chain Tensioner Gasket - Install
13. Timing Chain Tensioner - Install
14. Timing Chain Tensioner Bolt - Install and tighten 25 N.m (18 lb ft)

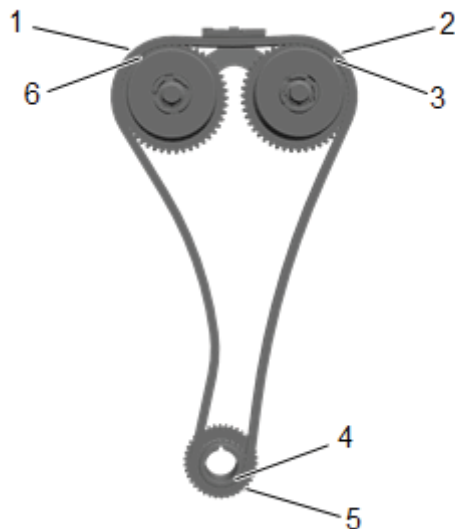


Fig. 119: Timing Chain Oil Nozzle
 Courtesy of GENERAL MOTORS COMPANY

15. Verify the timing links on the timing chain are properly aligned to the timing marks:
 1. The timing links (1, 2) are aligned to the appropriate timing marks on the camshaft actuators (6, 3).
 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.

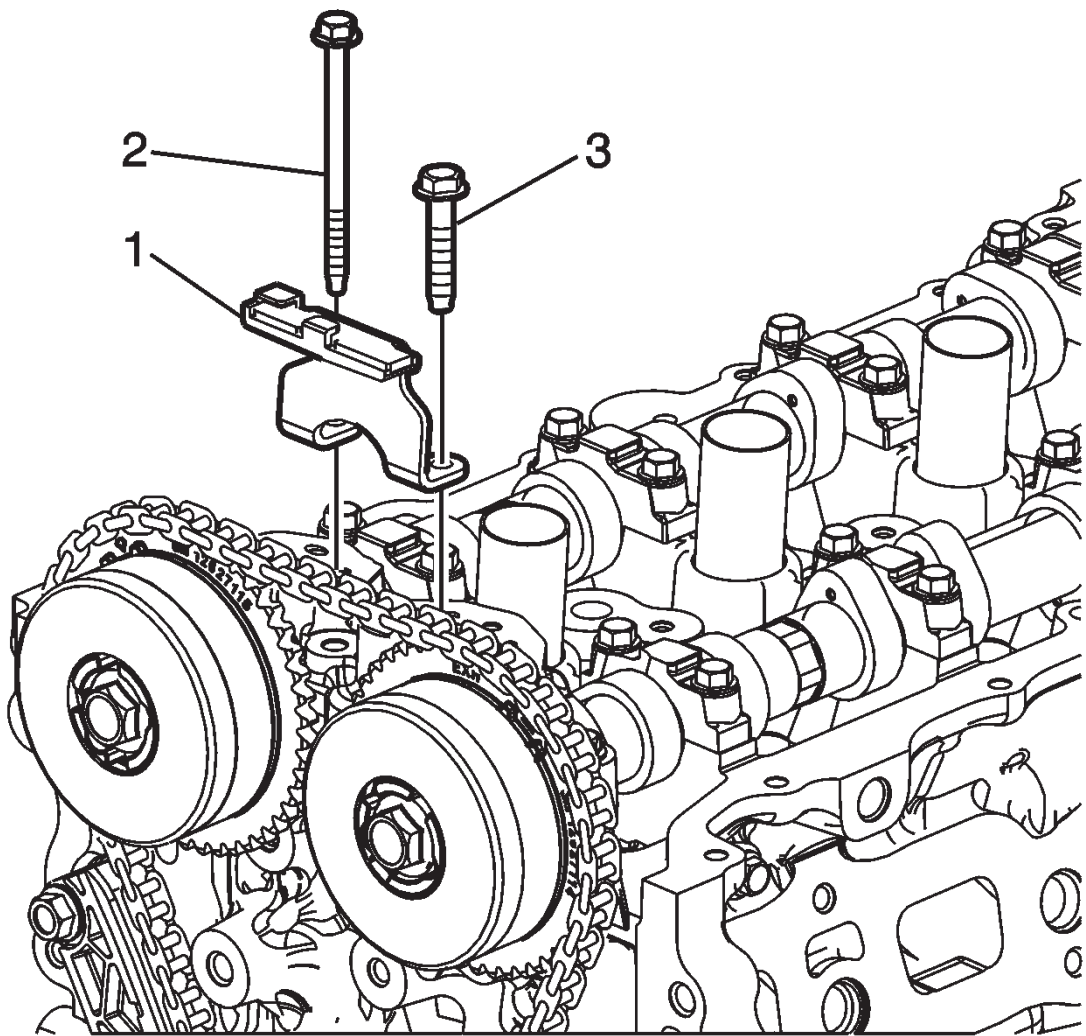


Fig. 120: Upper Timing Chain Guide Bolts
Courtesy of GENERAL MOTORS COMPANY

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

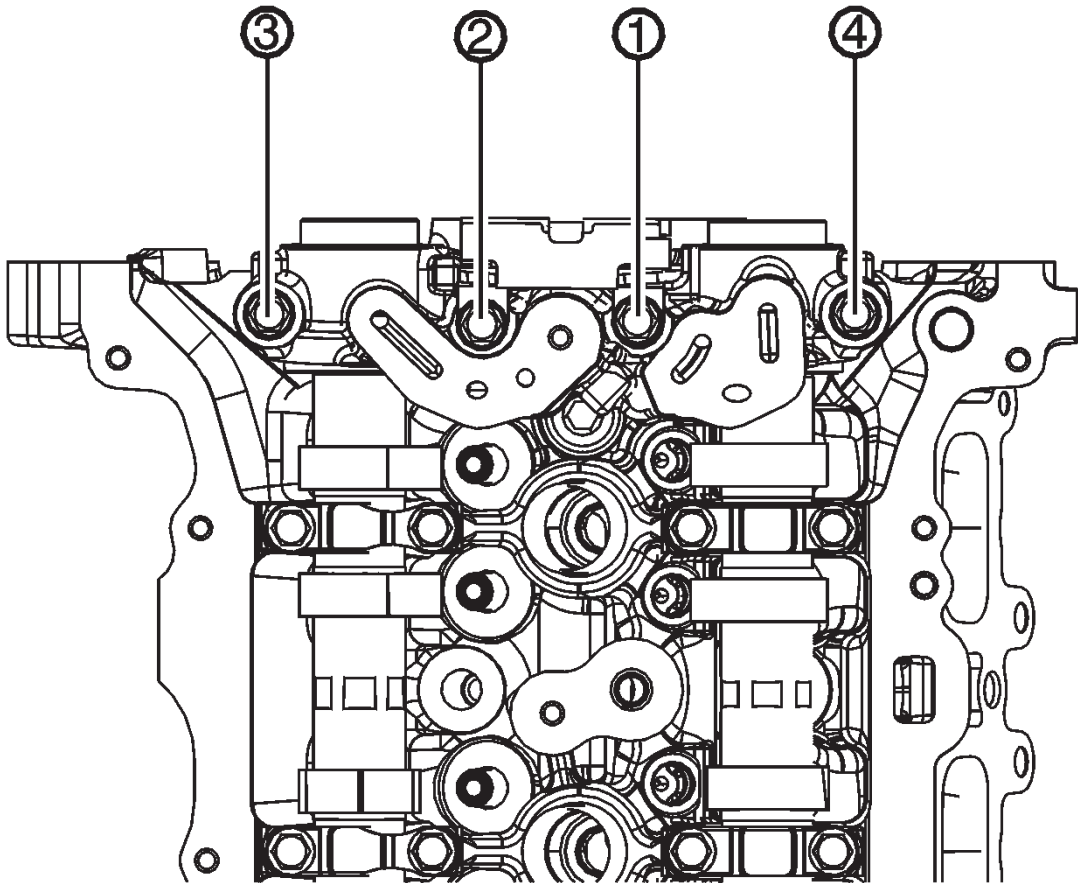


Fig. 121: Front Camshaft Cap Bolt Tightening Sequence
Courtesy of GENERAL MOTORS COMPANY

18. Tighten the front camshaft cap bolts in sequence to 10 N.m 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.

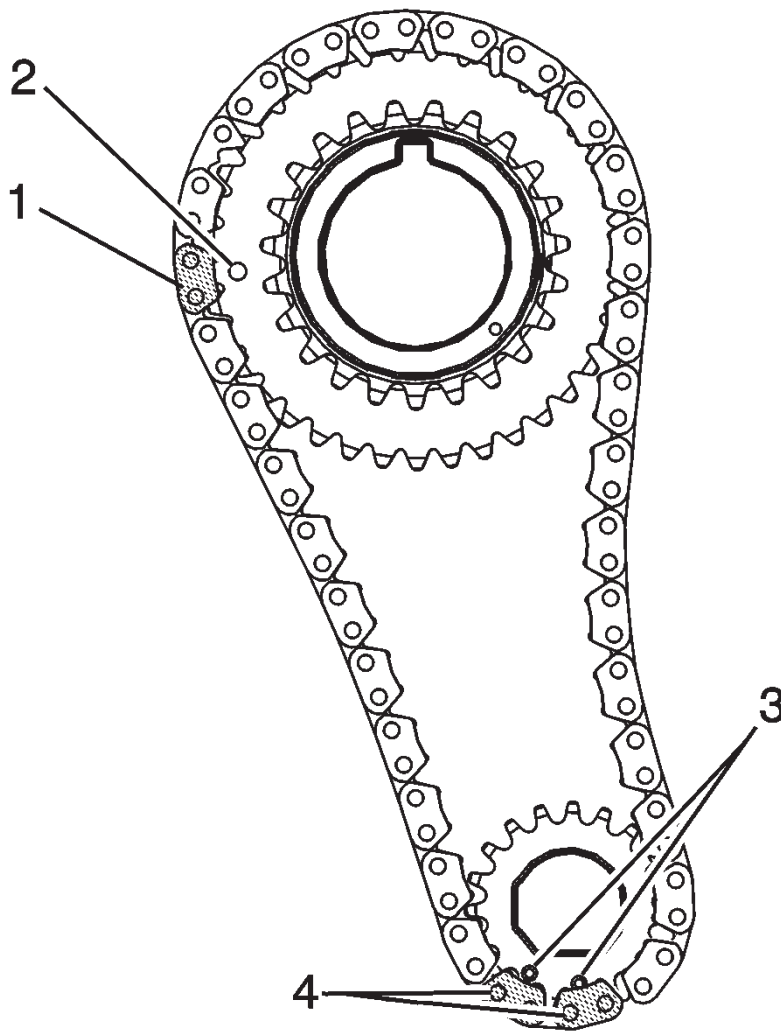


Fig. 122: Timing Link Lines & Timing Mark
Courtesy of GENERAL MOTORS COMPANY

20. Verify the timing links on the balance chain are properly aligned to the timing marks:
 1. The timing link (1) is aligned to the timing mark on the crankshaft sprocket (2).
 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](#).

BALANCER SHAFT WITH OIL PUMP REPLACEMENT

Removal Procedure

1. [Oil Pan Replacement \(Upper\)](#)- Remove
2. [Timing Chain Crankshaft Sprocket Replacement](#)- Remove