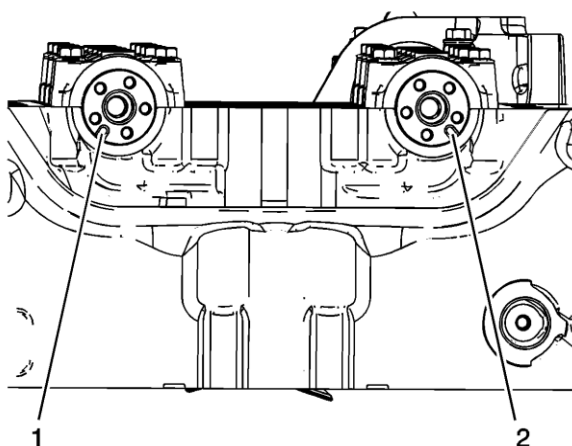


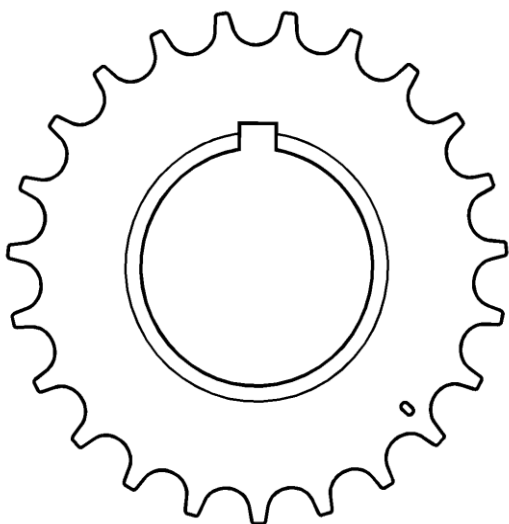
Camshaft Timing Chain, Sprocket, and Tensioner Installation

Tools Required

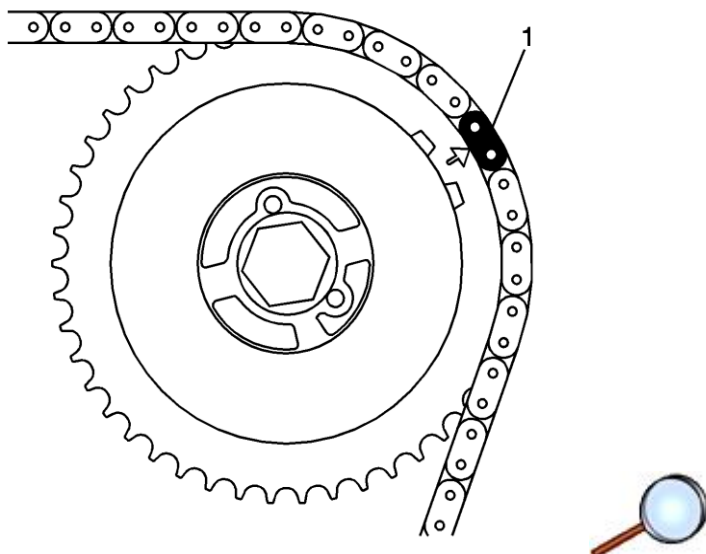
- [EN-48953](#) Camshaft Actuator Locking Tool
- [J 45027](#) Tensioner Tool
- [J 45059](#) Angle Meter



1. Ensure the intake camshaft notch is in the 5 o'clock position (2) and the exhaust camshaft notch is in the 7 o'clock position (1). The number 1 piston should be at top dead center (TDC), crankshaft key at 12 o'clock.



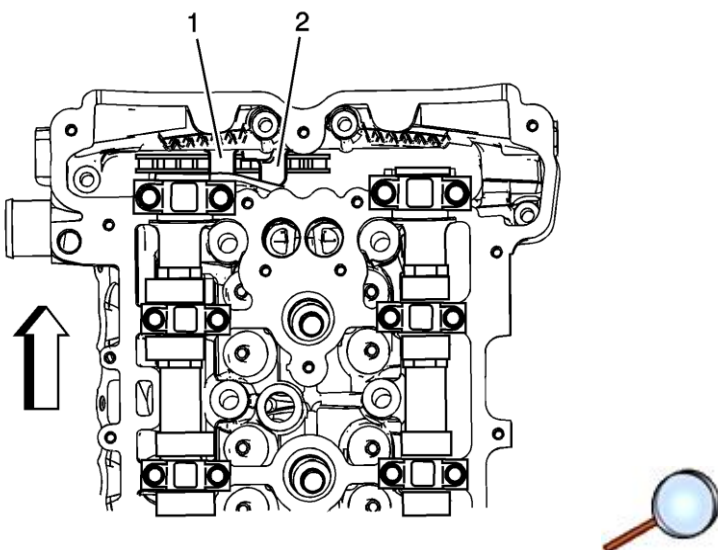
2. Install the timing chain drive sprocket to the crankshaft with the timing mark in the 5 o'clock position and the front of the sprocket facing out.



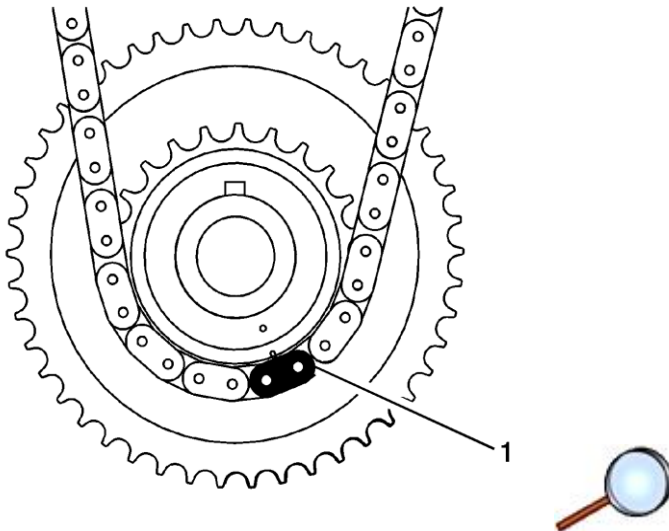
Important:

- There are 3 colored links on the timing chain. 2 links are of matching color, and 1 link is of 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.
- Always use new actuator bolts.

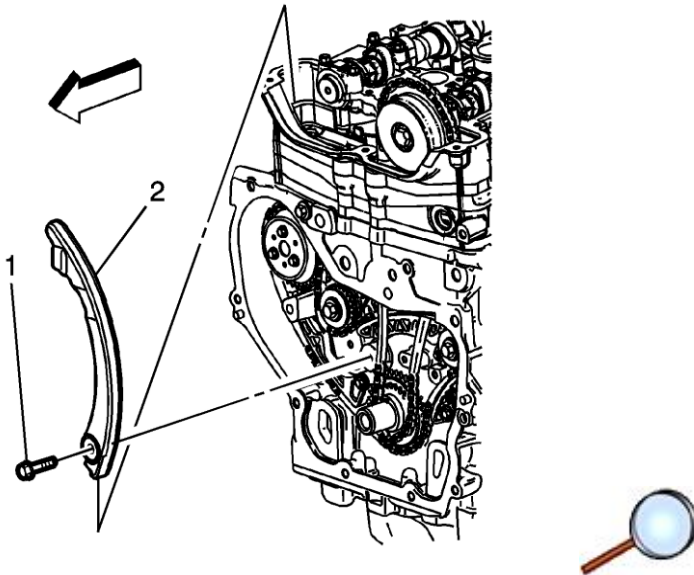
3. Assemble the intake camshaft actuator into the timing chain with the timing mark lined up with the uniquely colored link (1).



4. Lower the timing chain through the opening in the cylinder head. Use care to ensure that the chain goes around both sides of the cylinder block bosses (1, 2).
5. Install the intake camshaft actuator onto the intake camshaft while aligning the dowel pin into the camshaft slot.
6. Hand tighten the new intake camshaft actuator bolt.



7. Route the timing chain around the crankshaft sprocket and line up the first matching colored link (2) with the timing mark on the crankshaft sprocket, in approximately the 5 o'clock position.



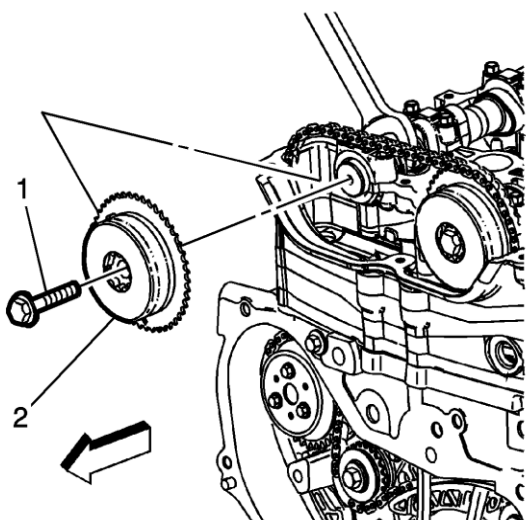
8. Rotate the crankshaft clockwise to remove all chain slack. Do not rotate the intake camshaft.

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

9. Install the adjustable timing chain guide down through the opening in the cylinder head and install the adjustable timing chain bolt.

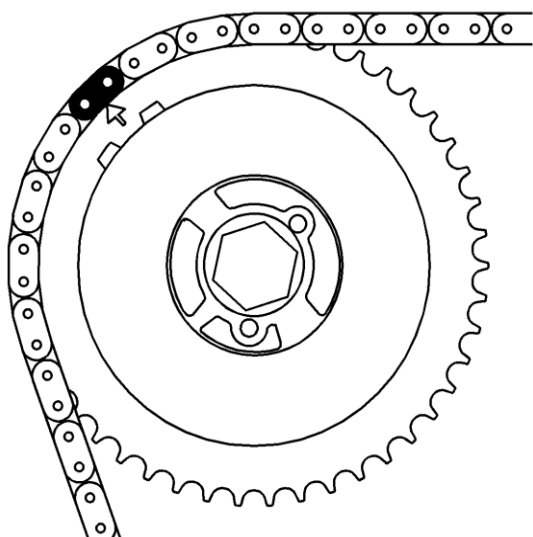
Tighten

Tighten the adjustable timing chain guide bolt to 10N•m (89lbin).

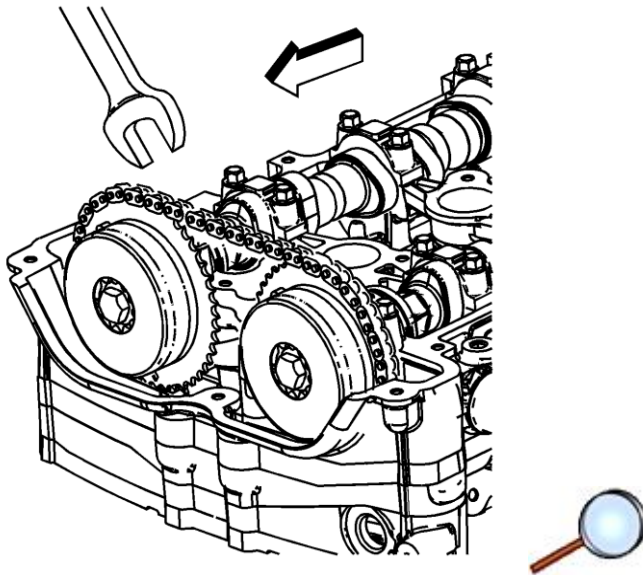


Important: Always install NEW actuator bolts.

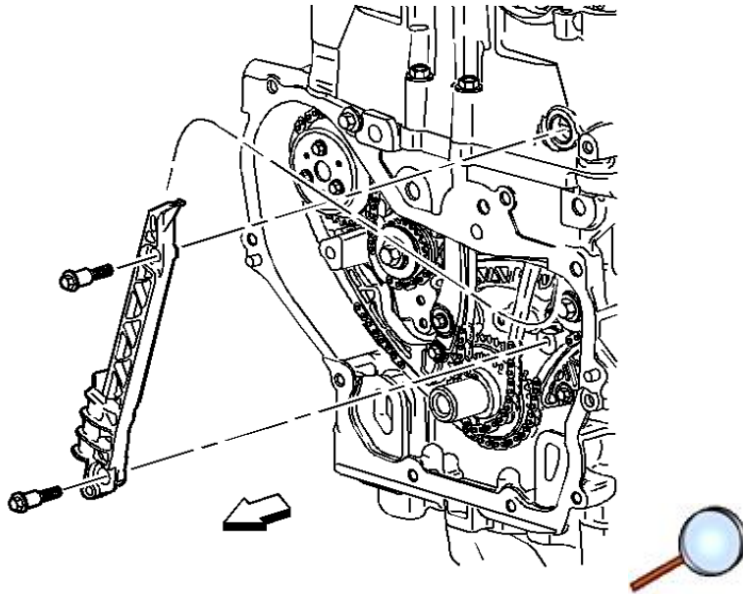
10. Install the exhaust camshaft actuator into the timing chain with the timing mark lined up with the second matching colored link.



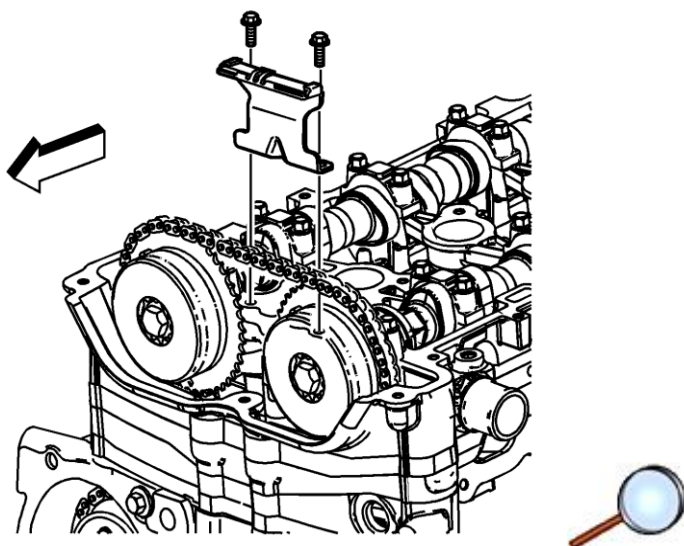
11. Install the exhaust camshaft actuator onto the exhaust camshaft, aligning the dowel pin into the camshaft slot.
12. Using a 23 mm open end wrench, rotate the exhaust camshaft approximately 45 degrees until the dowel pin in the camshaft actuator goes into the camshaft slot.



13. When the actuator seats on the cam, tighten the new exhaust camshaft actuator bolt hand tight.
14. Verify that all of the colored links and the appropriate timing marks are still aligned. If they are not, repeat the portion of the procedure necessary to align the timing marks.



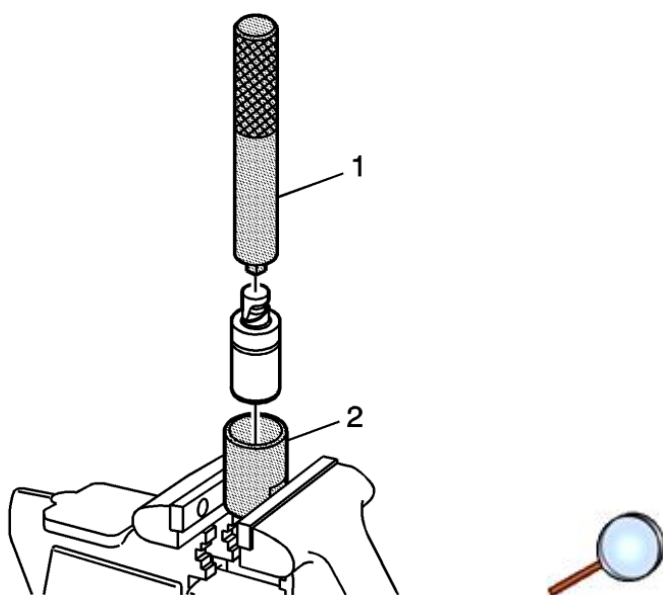
15. Install the fixed timing chain guide and bolts.
Tighten
Tighten the fixed timing chain guide bolts to 12N•m (106lb in).



16. Install the upper timing chain guide and bolts.

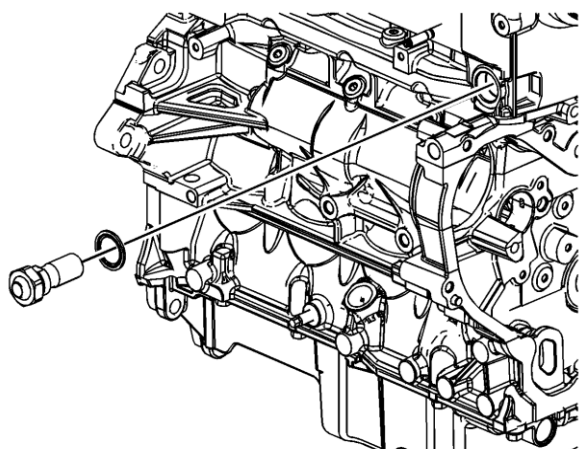
Tighten

Tighten the upper timing chain guide bolts to 10N•m (89lbin).



17. Reset the timing chain tensioner by performing the following steps:

- 17.1. Remove the snap ring.
- 17.2. Remove the piston assembly from the body of the timing chain tensioner.
- 17.3. Install the J45027-2(2) into a vise.
- 17.4. Install the notch end of the piston assembly into the J45027-2(2).
- 17.5. Using the J45027-1(1), turn the ratchet cylinder into the piston.
- 17.6. Reinstall the piston assembly into the body of the tensioner.
- 17.7. Install the snap ring.



18. Inspect the timing chain tensioner seal for damage. If damaged, replace the seal.
19. Inspect to ensure all dirt and debris is removed from the timing chain tensioner threaded hole in the cylinder head.

Important: Ensure the timing chain tensioner seal is centered throughout the torque procedure to eliminate the possibility of an oil leak.

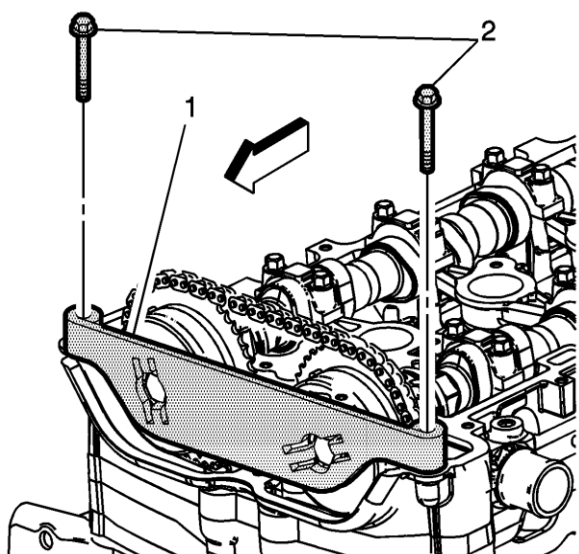
20. Install the timing chain tensioner assembly.

Tighten

Tighten the timing chain tensioner to 75N•m (55lb ft).

Important: The timing chain tensioner is released by compressing it 2 mm (0.079 in), which will release the locking mechanism in the ratchet.

21. The crankshaft balancer must be installed in order to release the tensioner. Refer to [Crankshaft Balancer Installation](#) for tensioner release instructions.



22. Install the [EN-48953](#) (1) and tighten the bolts into the cylinder head.

Tighten

Tighten the [EN-48953](#) retaining bolts to 10N•m (89 lb in).

23. Using a torque wrench, tighten the camshaft actuator bolt.

Tighten

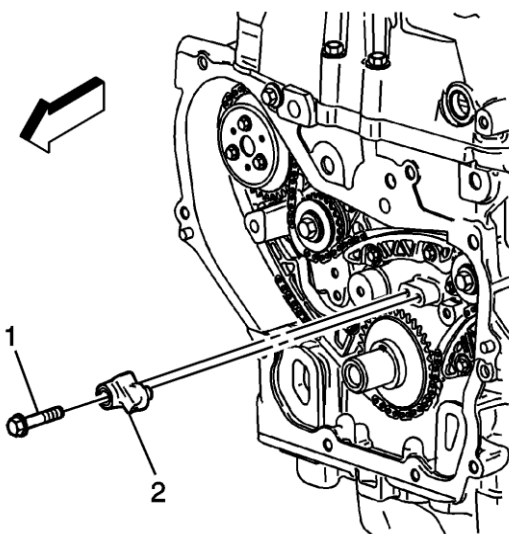
Tighten the intake camshaft position actuator bolt to 30N•m (22 lb ft), plus 100 degrees using the [45059](#).

24. Using a torque wrench, tighten the camshaft actuator bolt.

Tighten

Tighten the exhaust camshaft position actuator bolt to 30N•m (22lbft), plus 100degrees using the [J 45059](#).

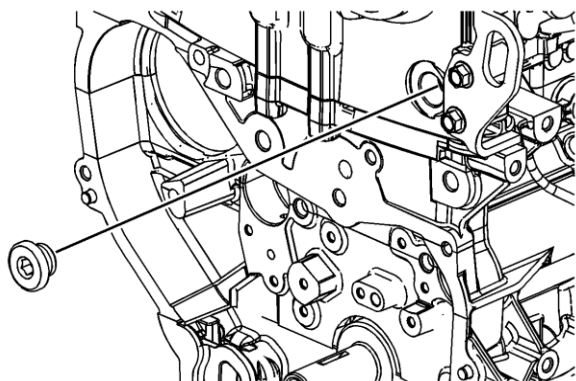
25. Remove the [EN-48953](#).



26. Install the timing chain oiling nozzle.

Tighten

Tighten the timing chain oiling nozzle bolt to 10N•m (89lbin).



27. Apply sealant compound GMP/N12345382 (Canadian P/N 10953489) to the thread of the timing chain guide bolt access hole plug.

28. Install the timing chain guide bolt access hole plug.

Tighten

Tighten the access hole plug to 90N•m (66lb ft).