2011 ENGINE

Engine Mechanical - 1.6L (LDE, LLU, Or LXV) Or 1.8L (2H0 Or LUW) - Repair Instructions - On Vehicle - Cruze

DRIVE BELT REPLACEMENT

SPECIAL TOOLS

EN 6349: Locking Pin

For equivalent regional tools, refer to **Special Tools** .

REMOVAL PROCEDURE

1. Open the hood.
2. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Remove the front compartment splash shield. Refer to **Front Compartment Splash Shield Replacement** .

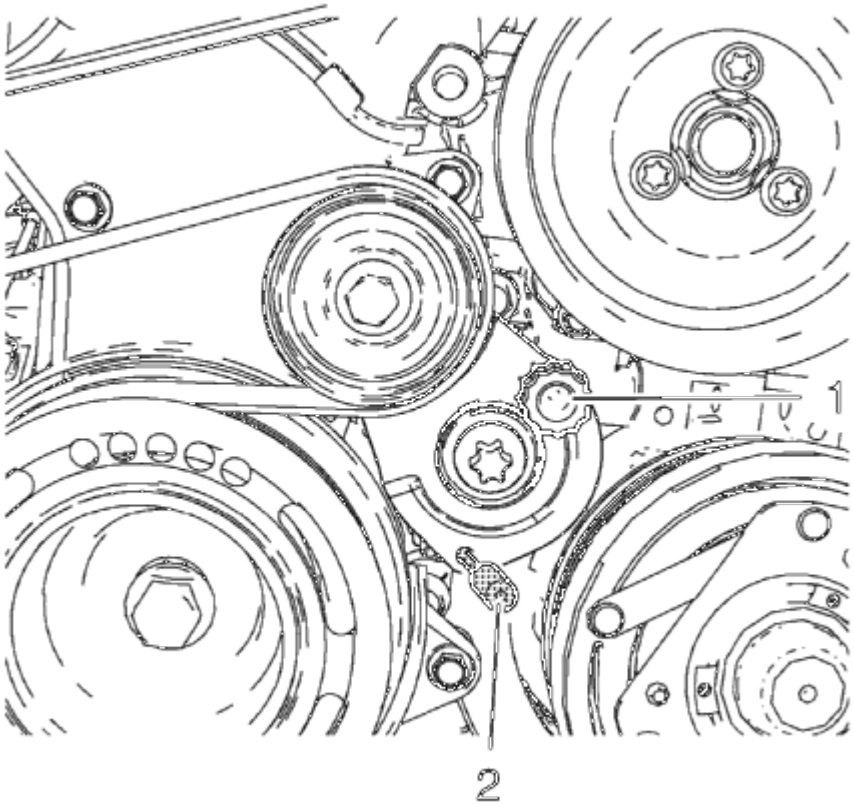

Fig. 1: Drive Belt Tensioner And Special Tool
Courtesy of GENERAL MOTORS CORP.

4. Release tension to the drive belt tensioner by rotating counterclockwise (1) and lock with **EN 6349:** pin (2).

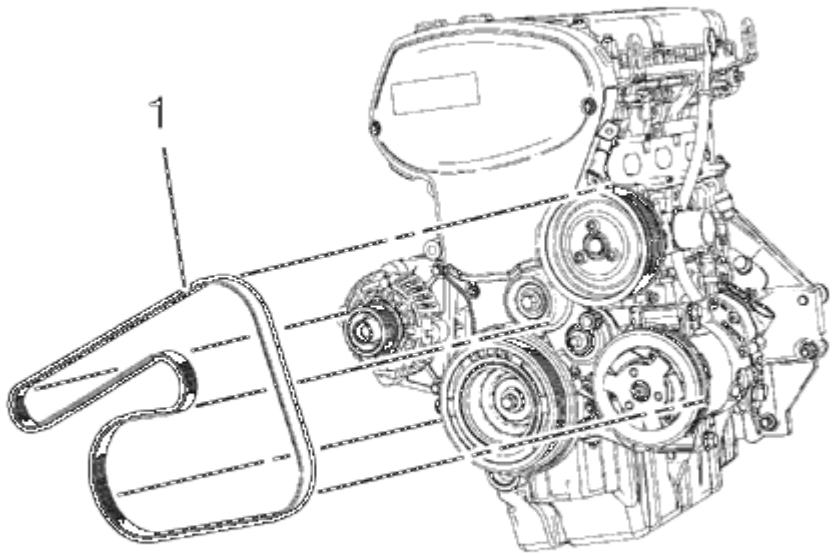

Fig. 2: Drive Belt Routing
Courtesy of GENERAL MOTORS CORP.

5. Remove the drive belt (1).

INSTALLATION PROCEDURE

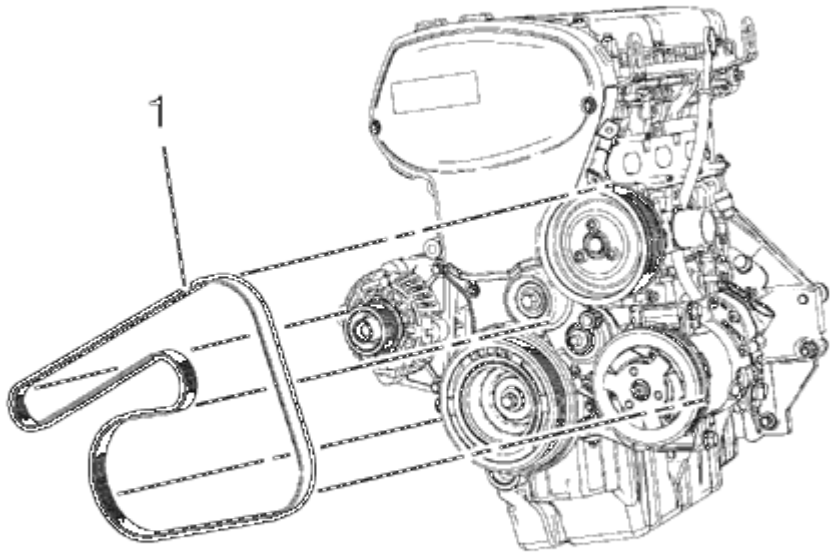

Fig. 3: Drive Belt Routing
Courtesy of GENERAL MOTORS CORP.

1. Install the drive belt (1).

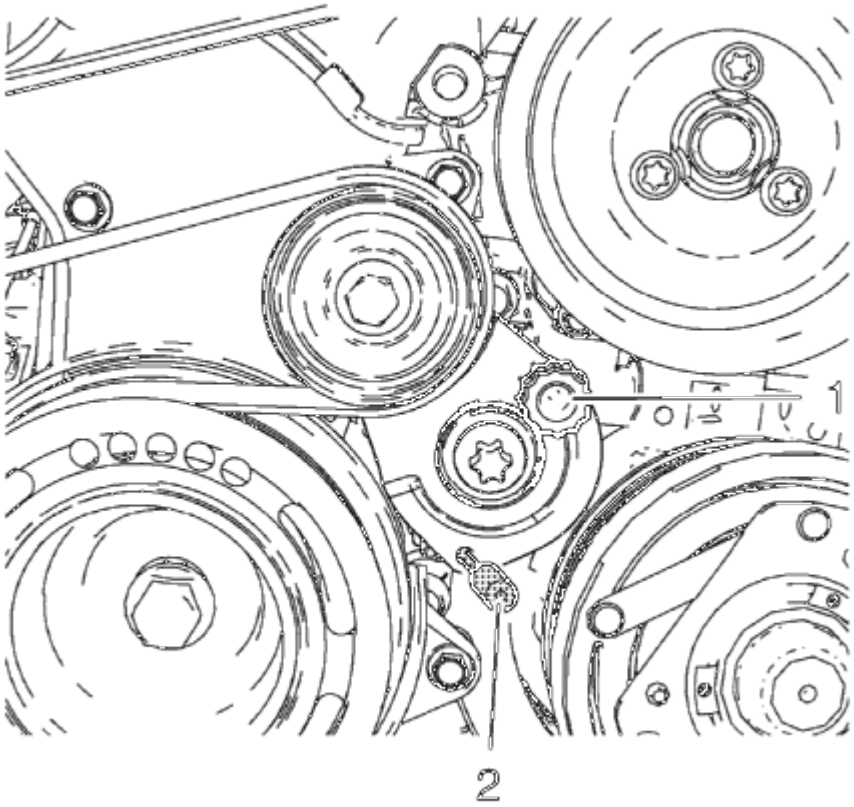

Fig. 4: Drive Belt Tensioner And Special Tool
Courtesy of GENERAL MOTORS CORP.

2. Release tension to the tensioner by rotating counterclockwise (1).

NOTE: Allow tensioner to slide back slowly.

3. Remove **EN 6349:** pin (2).
4. Apply tension to the tensioner clockwise (1).
5. Install the front compartment splash shield. Refer to **Front Compartment Splash Shield Replacement** .
6. Lower the vehicle.
7. Close the hood.

DRIVE BELT TENSIONER REPLACEMENT

REMOVAL PROCEDURE

1. Open the hood.
2. Remove the generator and air conditioning compressor belt. Refer to **Drive Belt Replacement**.

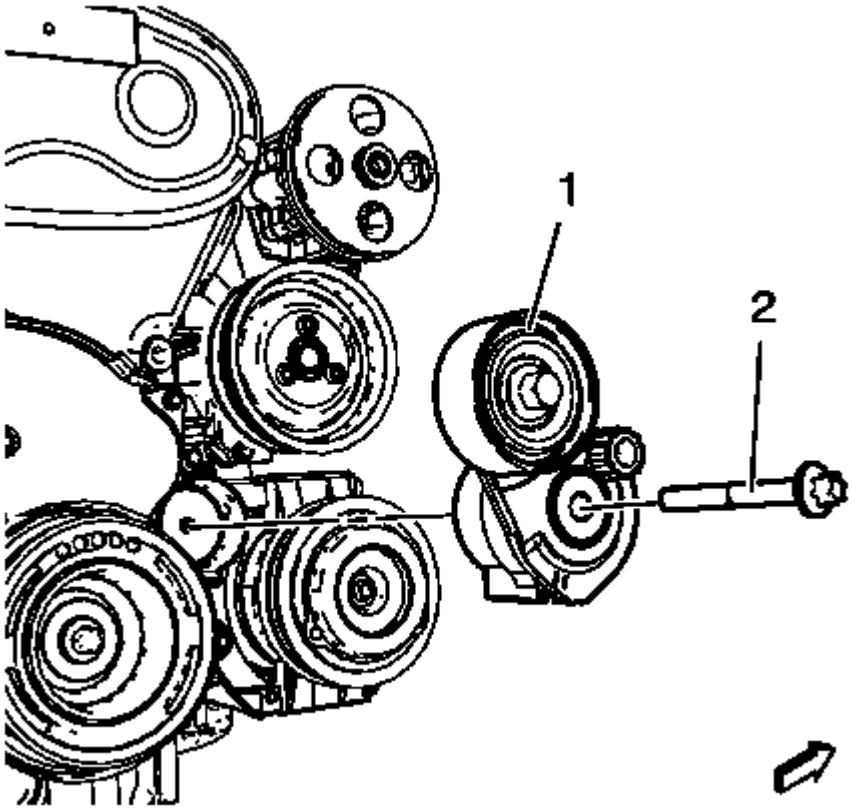

Fig. 5: Drive Belt Tensioner
Courtesy of GENERAL MOTORS CORP.

3. Remove the drive belt tensioner bolt (2).
4. Remove the drive belt tensioner (1).

INSTALLATION PROCEDURE

1. Clean the drive belt tensioner thread.

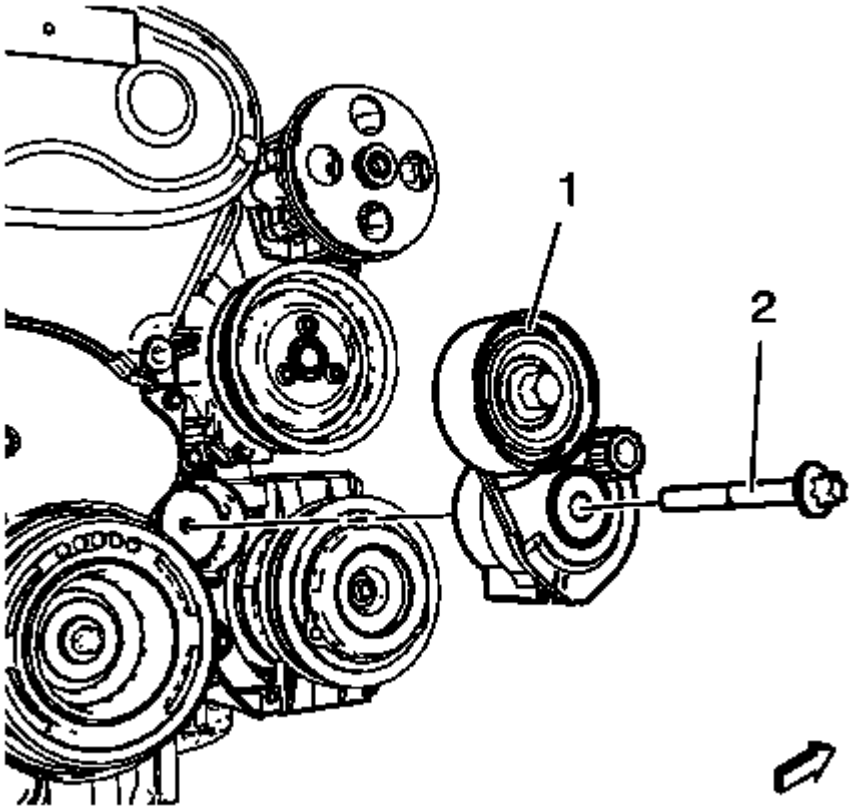

Fig. 6: Drive Belt Tensioner
Courtesy of GENERAL MOTORS CORP.

2. Install drive belt tensioner (1).

CAUTION: Refer to Fastener Caution .

3. Install drive belt tensioner bolt (2) and tighten to 55 N.m (41 lb ft).
4. Install the generator and air conditioning compressor belt. Refer to **Drive Belt Replacement**.
5. Close the hood.

ENGINE MOUNT REPLACEMENT

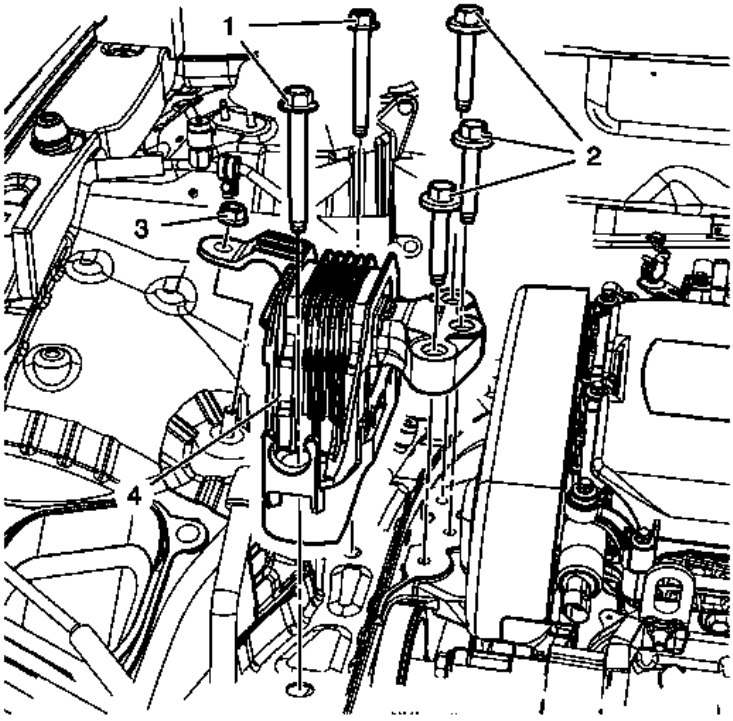

Fig. 7: Engine Mount
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures 1. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement (1.6L LDE, LXV, and 1.8L 2H0)** . 2. Support the engine. Install a suitable engine lifting device. Install a suitable cable at the 3 engine lift brackets and at the engine lifting device.	
1	Engine Mount Bolt (Qty: 2) **CAUTION:** **Refer to Fastener Caution .** **Tighten:** 62 N.m (46 lb ft)
2	Engine Mount Bracket Bolt (Qty: 3) **Tip:** Use only NEW bolts. **Tighten:** 50 N.m + 60°-75° (37 lb ft + 60°-75°)
3	Engine Mount Nut **Tighten:** 62 N.m (46 lb ft)
4	Engine Mount

POWERTRAIN MOUNT BALANCING

NOTE: Follow the balance procedure steps listed below when no starting point has been established such as in a collision repair.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

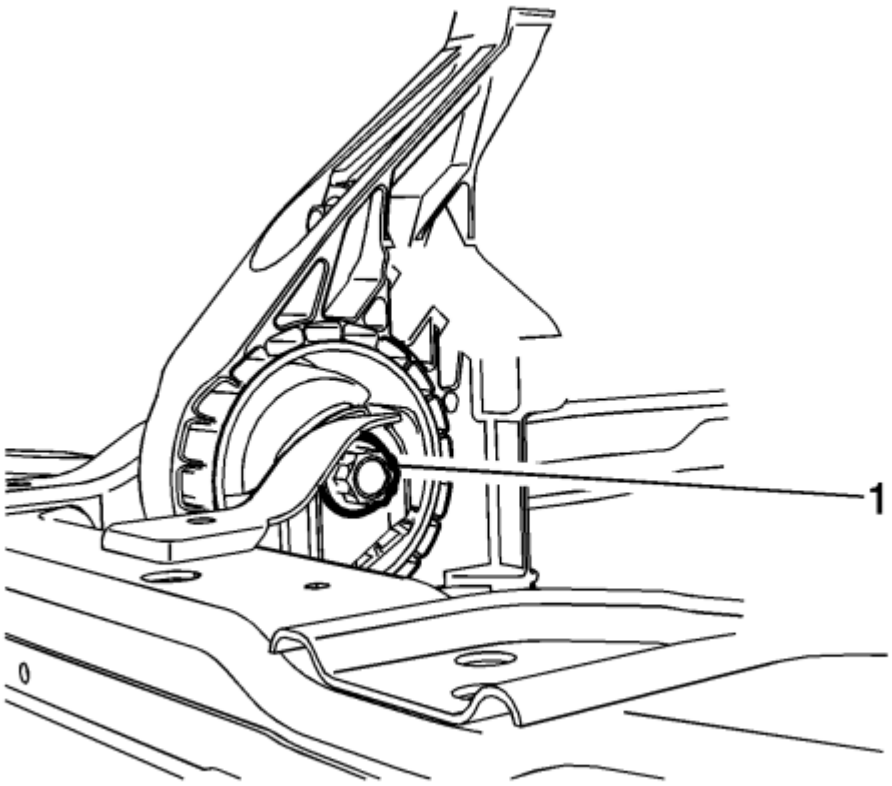

Fig. 8: Front Transaxle Mount Through Bolt
Courtesy of GENERAL MOTORS CORP.

2. Loosen the front transaxle mount through bolt (1) until it is finger tight.

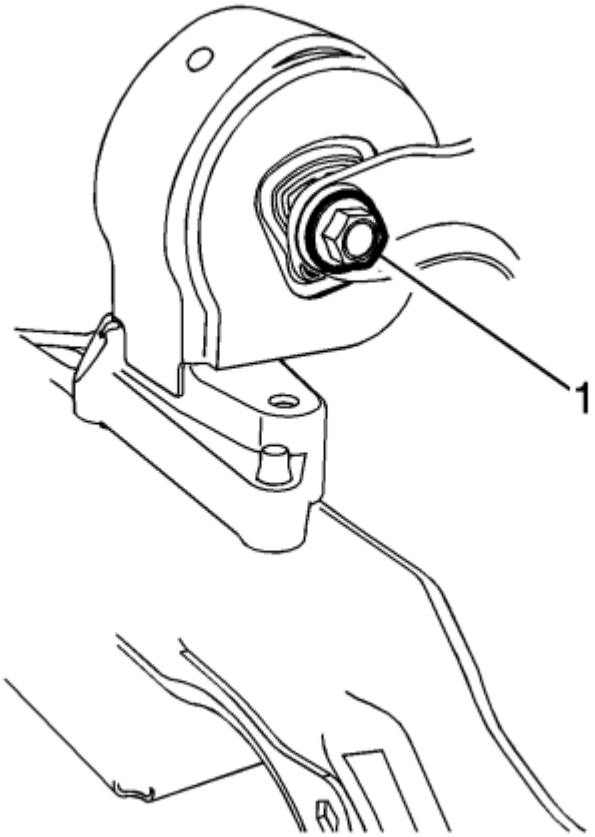

Fig. 9: Rear Transaxle Mount
Courtesy of GENERAL MOTORS CORP.

3. Loosen the rear transaxle mount (1) through bolt until it is finger tight.
4. Lower the vehicle.

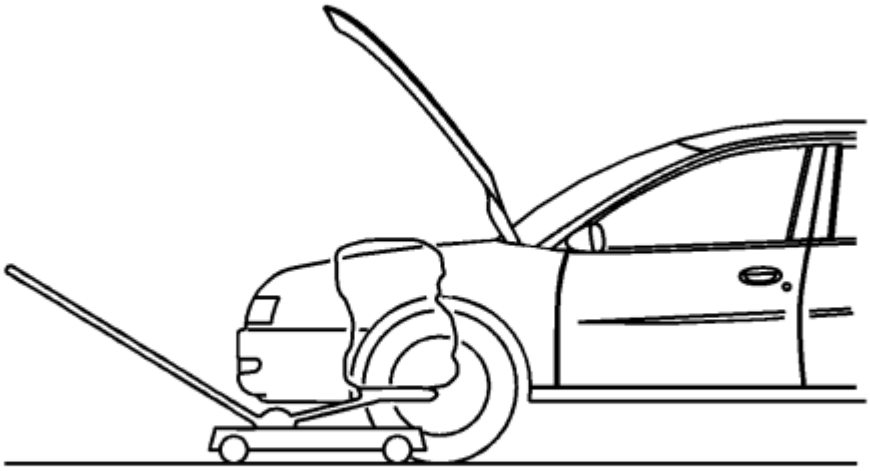

Fig. 10: Supporting Engine/Transmission With Hydraulic Floor Jack
Courtesy of GENERAL MOTORS CORP.

5. Position two floor jacks with wood blocks under the engine and transaxle in order to support the powertrain assembly.

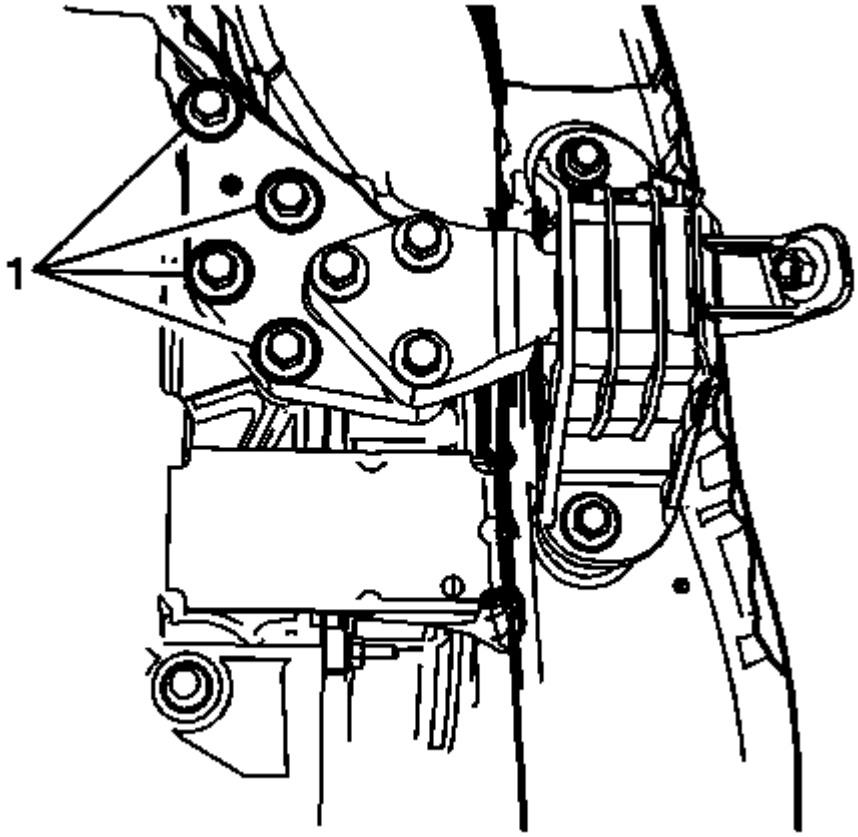

Fig. 11: Transaxle Bolts
Courtesy of GENERAL MOTORS CORP.

6. Loosen the transaxle adapter to transaxle bolts (1).

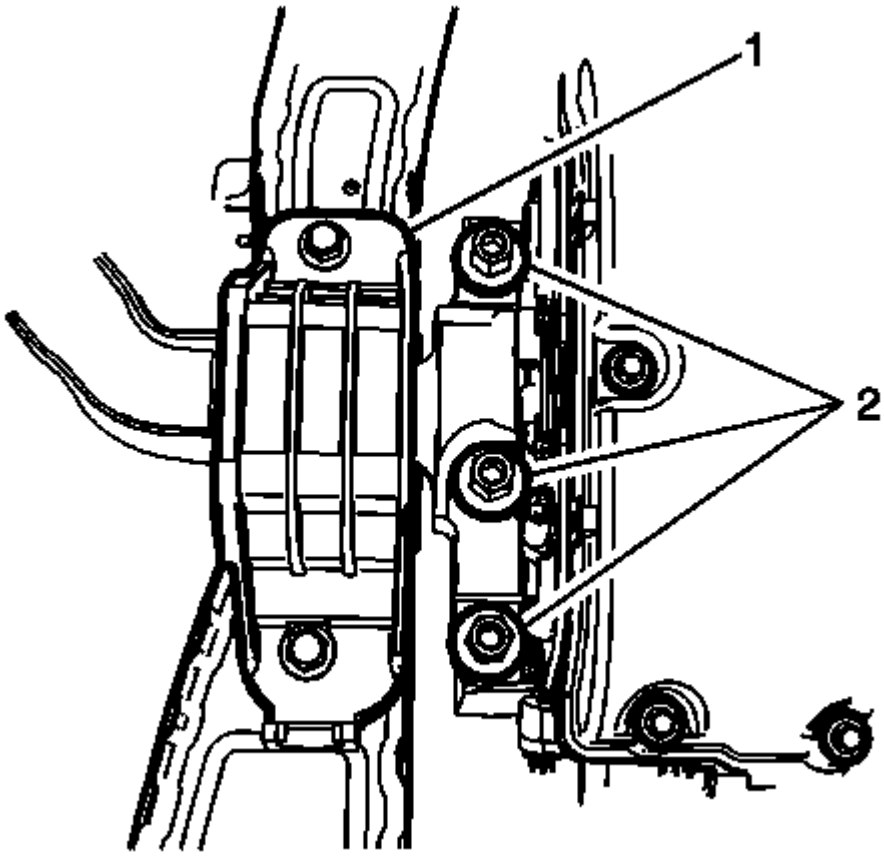

Fig. 12: Engine Mount And Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

7. Loosen the engine mount (1) to bracket bolts (2).
8. Lower the floor jacks in order to allow a 1/4 inch (6 mm) gap between the upper engine mount and engine mount bracket, and also between the transmission and left transmission mount.

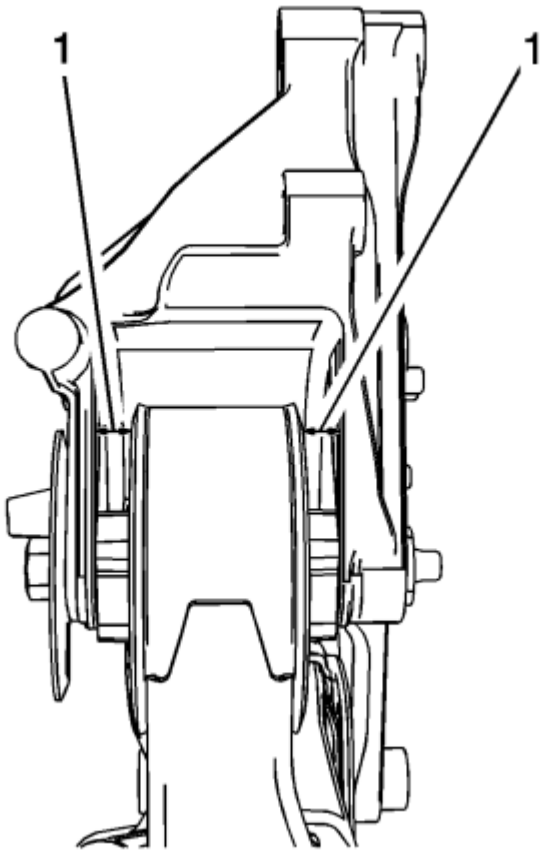

Fig. 13: Centered Front And Rear Mounts
Courtesy of GENERAL MOTORS CORP.

9. Check that the front and rear mounts are centered (1) in the mount brackets, adjust if necessary.
10. Tighten the left hand (transaxle side) mount bolts, starting with the bolt nearest to the center of the mount. See the appropriate transmission mount replacement procedure for the fastener tightening specifications.

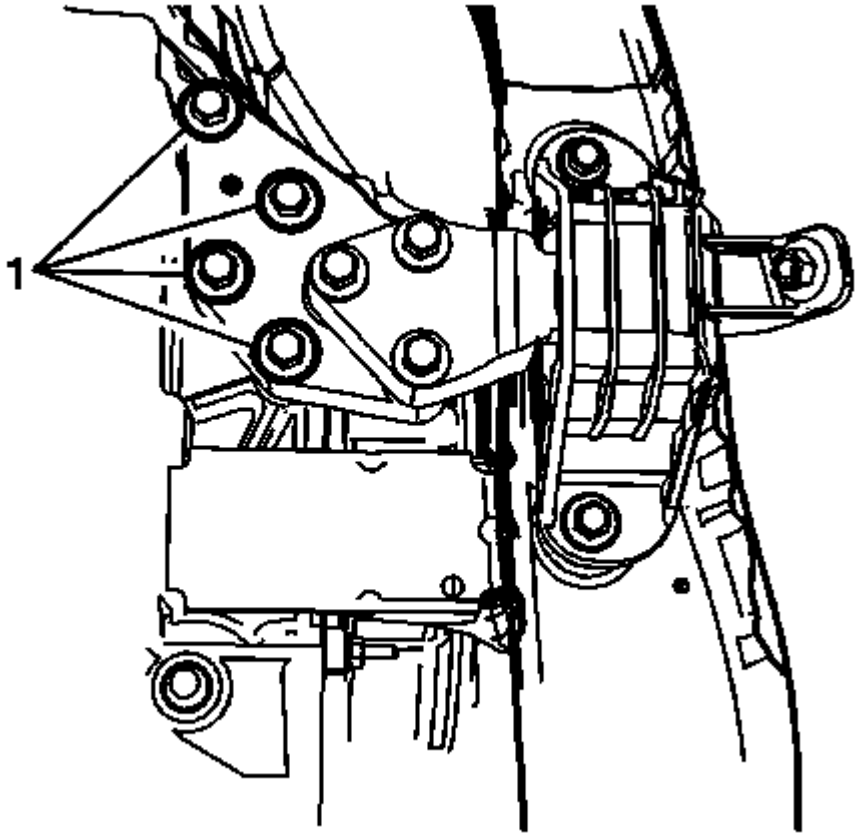

Fig. 14: Transaxle Bolts
Courtesy of GENERAL MOTORS CORP.

11. Tighten the right hand (engine side) mount bolts (1), starting with the bolt nearest to the center of the mount. See the appropriate engine mount replacement procedure for the fastener tightening specifications.
12. Remove the floor jacks from under the oil pan and transmission.
13. Raise the vehicle.
14. Shake the powertrain from front to rear and allow the powertrain to settle.

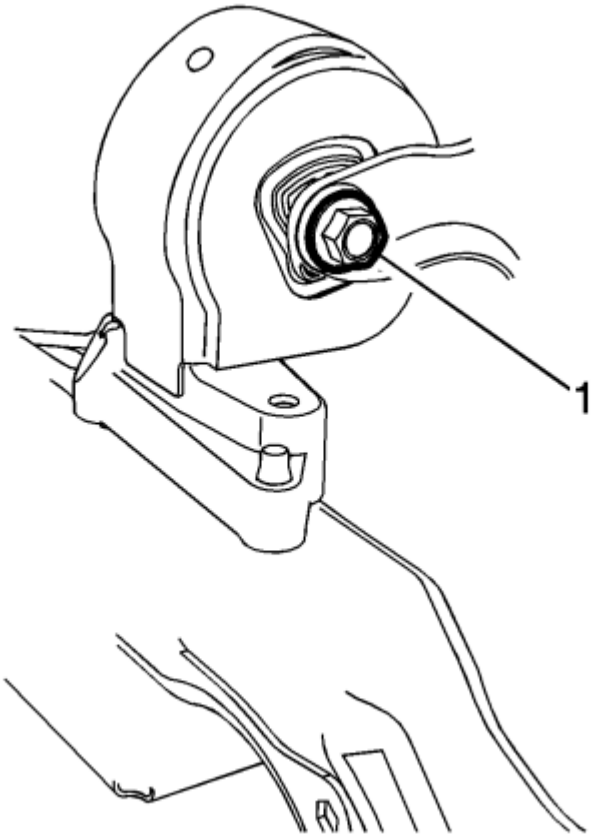

Fig. 15: Rear Transaxle Mount
Courtesy of GENERAL MOTORS CORP.

NOTE: It is essential that the lower mount through bolts should be as close to centered as possible in the oversized mount insert holes before tightening to specification.

15. Tighten the rear transaxle mount through bolt (1). See the appropriate transmission mount replacement procedure for the fastener tightening specifications.

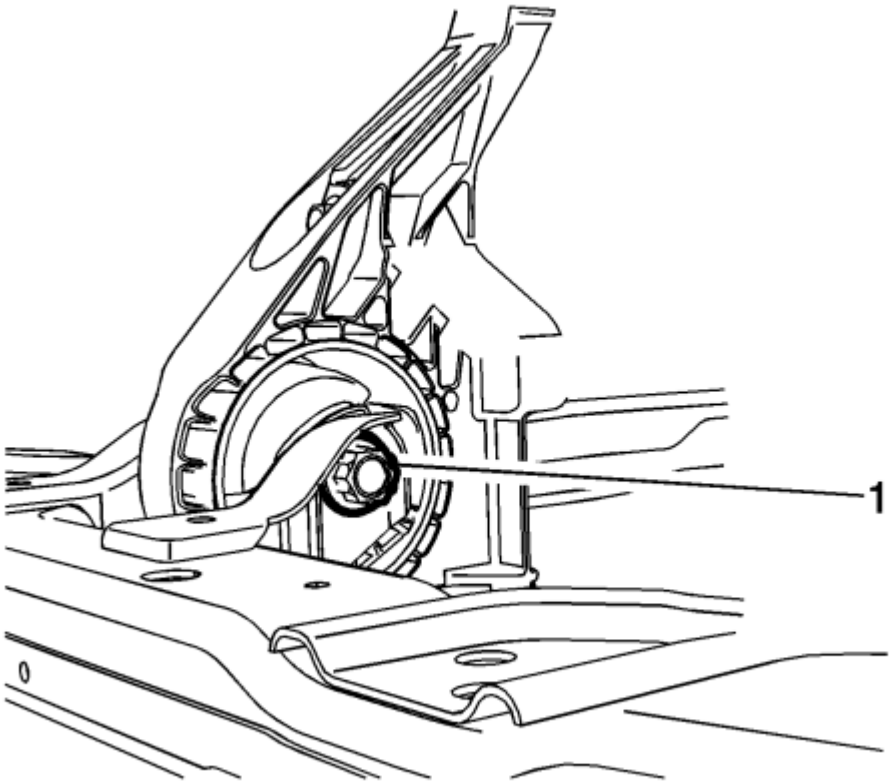

Fig. 16: Front Transaxle Mount Through Bolt
Courtesy of GENERAL MOTORS CORP.

16. Tighten the front transaxle mount through bolt (1). See the appropriate transmission mount replacement procedure for the fastener tightening specifications.
17. Lower the vehicle.

POWERTRAIN MOUNT BALANCING - LOWER

NOTE: Follow the balance procedure steps listed below when front or rear mounts through bolts are loosened or removed during a repair procedure.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

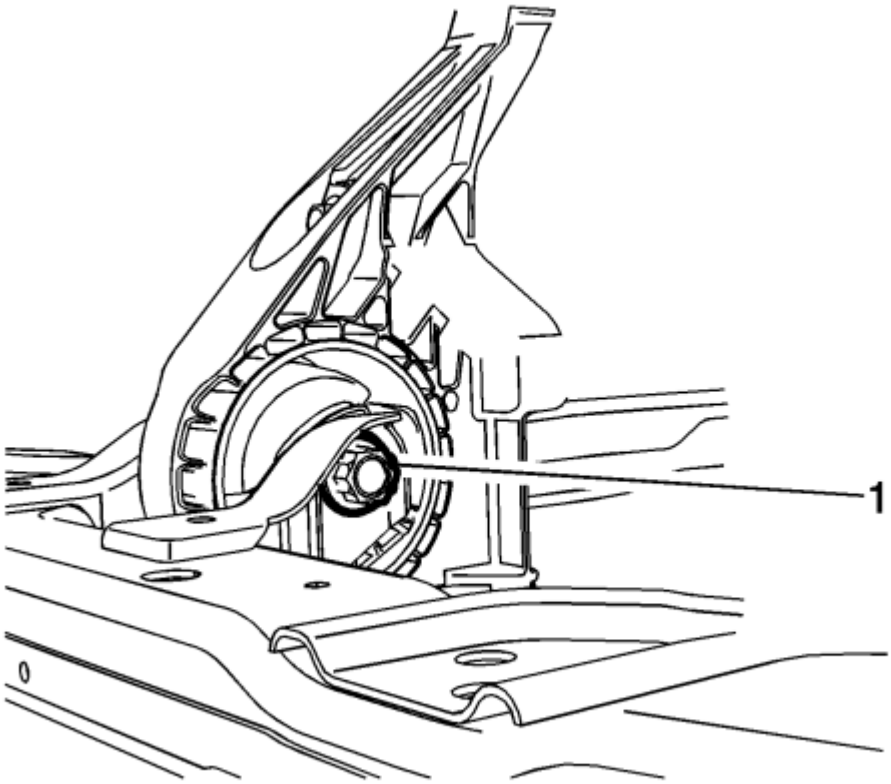

Fig. 17: Front Transaxle Mount Through Bolt
Courtesy of GENERAL MOTORS CORP.

2. Loosen the front transaxle mount through bolt (1).

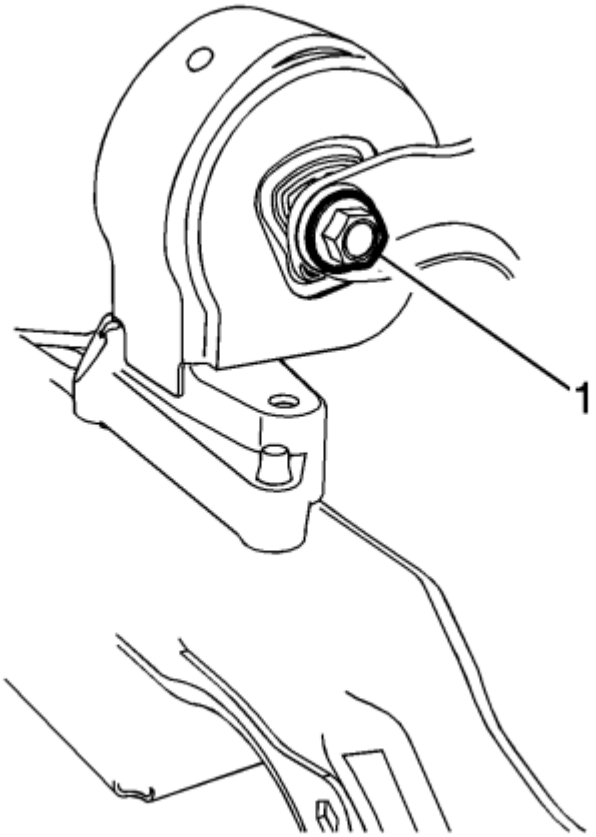

Fig. 18: Rear Transaxle Mount
Courtesy of GENERAL MOTORS CORP.

3. Loosen the rear transaxle mount through bolt (1).
4. Shake the powertrain from front to rear and allow the powertrain to settle.

NOTE: It is essential that the through bolts are as close to centered as possible in the oversized mount insert holes before tightening to specification.

5. Tighten the rear transaxle mount through bolt (1). See the appropriate transmission mount replacement procedure for the fastener tightening specifications.

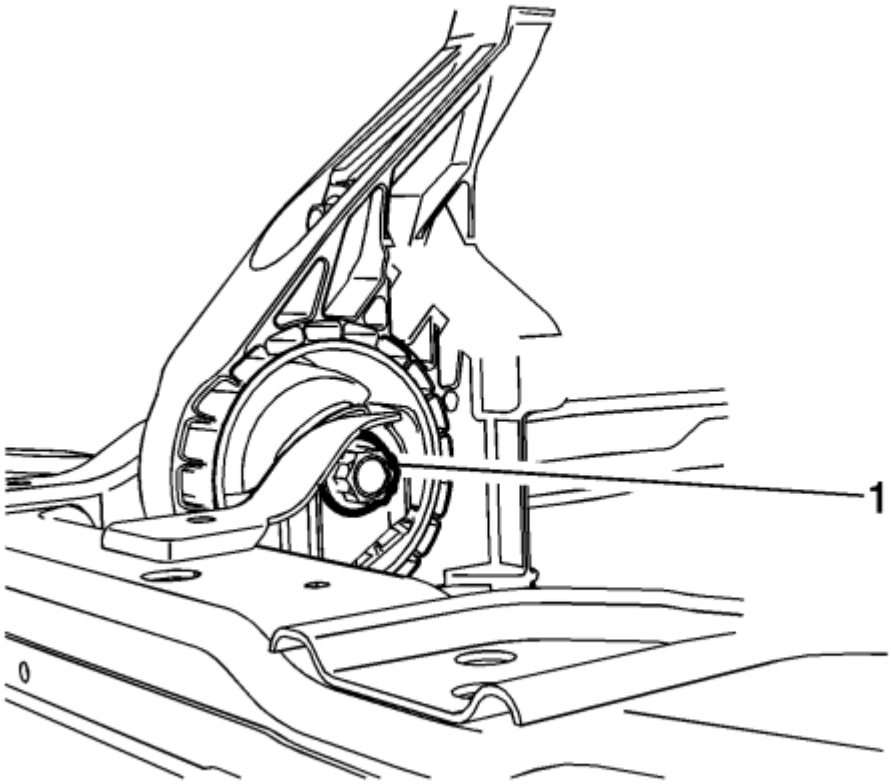

Fig. 19: Front Transaxle Mount Through Bolt
Courtesy of GENERAL MOTORS CORP.

6. Tighten the front transaxle mount through bolt (1). See the appropriate transmission mount replacement procedure for the fastener tightening specifications.
7. Lower the vehicle.

ENGINE MOUNT REPLACEMENT - RIGHT SIDE

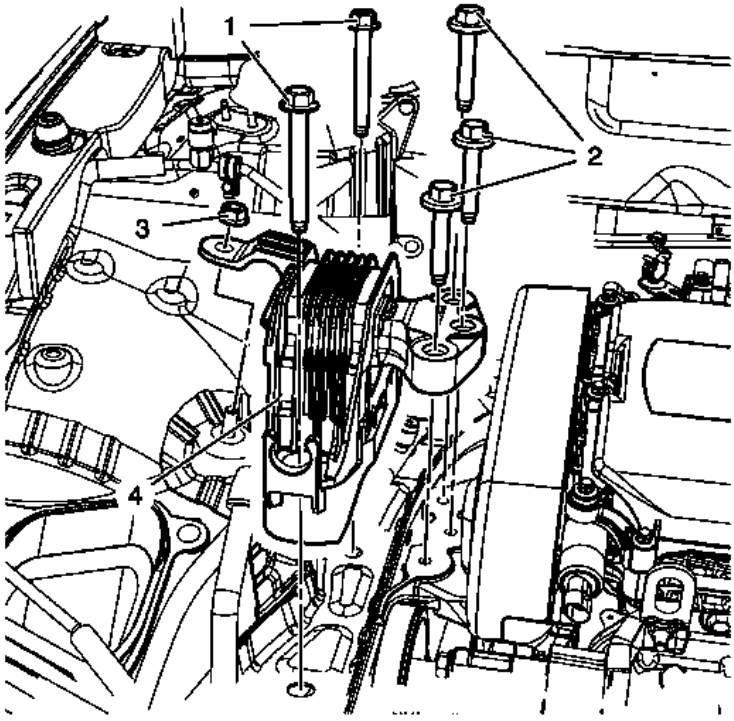

Fig. 20: Engine Mount
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures 1. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement (1.6L LDE, LXV, and 1.8L 2H0)** . 2. Support the engine. Install a suitable engine lifting device. Install a suitable cable at the 3 engine lift brackets and at the engine lifting device.	
1	Engine Mount Bolt (Qty: 2) **CAUTION:** **Refer to Fastener Caution .** **Tighten:** 62 N.m (46 lb ft)
2	Engine Mount Bracket Bolt (Qty: 3) **Tip:** Use only NEW bolts. **Tighten:** 50 N.m + 60°-75° (37 lb ft + 60°-75°)
3	Engine Mount Nut **Tighten:** 62 N.m (46 lb ft)
4	Engine Mount

ENGINE MOUNT INSPECTION

1. Install the engine support fixture. Refer to **Engine Support Fixture** .
2. Observe the engine mount while raising the engine. Raising the engine removes the weight from the engine mount and creates slight tension on the rubber.
3. Replace the engine mount if the engine mount exhibits any of the following conditions:
   - The hard rubber is covered with heat check cracks.
   - The rubber is separated from the metal plate of the engine mount.
   - The rubber is split through the center of the engine mount.
4. For engine mount replacement, refer to **Engine Mount Replacement - Right Side**.
5. For rear transmission mount replacement, refer to:
   - Automatic transmission, refer to **Transmission Rear Mount Replacement** .
   - Manual transmission, refer to **Transmission Rear Mount Replacement** .
6. For left transmission mount replacement, refer to:
   - Automatic transmission, refer to **Transmission Mount Replacement - Left Side** .
   - Manual transmission, refer to **Transmission Mount Bracket Replacement - Left Side** .

ENGINE MOUNT BRACKET REPLACEMENT

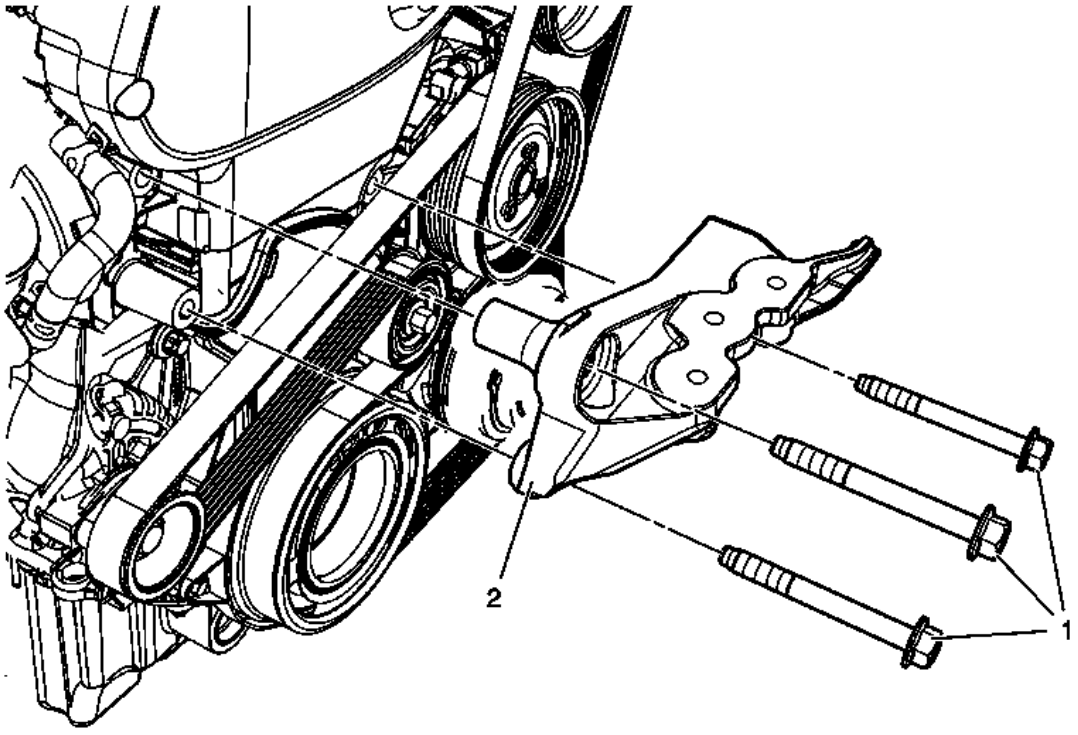

Fig. 21: Engine Mount Bracket
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the engine mount. Refer to **Engine Mount Replacement**.	
1	Engine Mount Bracket Bolt (Qty: 3) **CAUTION:** **Refer to Fastener Caution .** **Tighten:** 62 N.m (46 lb ft)
2	Engine Mount Bracket

INTAKE MANIFOLD REPLACEMENT

REMOVAL PROCEDURE

WARNING: Refer to Gasoline/Gasoline Vapors Warning .

WARNING: Refer to Safety Goggles and Fuel Warning .

WARNING: In order to reduce the risk of fire and personal injury observe the following items:

- **Replace all nylon fuel pipes that are nicked, scratched or damaged during installation, do not attempt to repair the sections of the nylon fuel pipes**
- **Do not hammer directly on the fuel harness body clips when installing new fuel pipes. Damage to the nylon pipes may result in a fuel leak.**
- **Always cover nylon vapor pipes with a wet towel before using a torch near them. Also, never expose the vehicle to temperatures higher than 115°C (239°F) for more than one hour, or more than 90°C (194°F) for any extended period.**
- **Apply a few drops of clean engine oil to the male pipe ends before connecting fuel pipe fittings. This will ensure proper reconnection and prevent a possible fuel leak. (During normal operation, the O-rings located in the female connector will swell and may prevent proper reconnection if not lubricated.)**

1. Open the hood.
2. Remove the air cleaner outlet duct. Refer to **Air Cleaner Outlet Duct Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)** .

3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Place a drain pan underneath the vehicle.

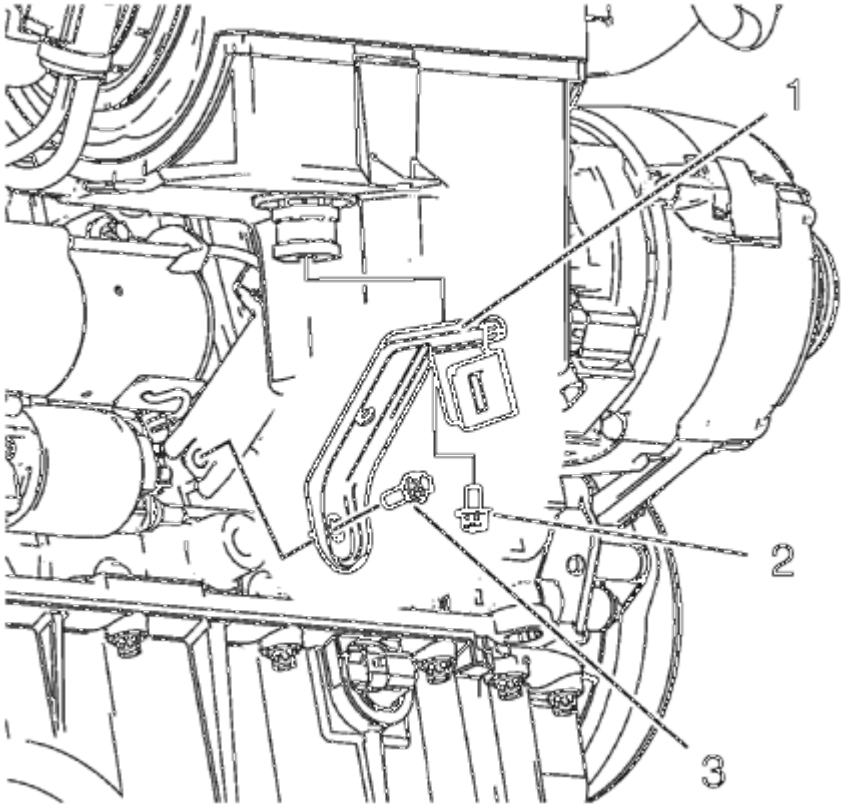

Fig. 22: Intake Manifold Brace
Courtesy of GENERAL MOTORS CORP.

5. Remove the 2 intake manifold brace bolts (2, 3).
6. Remove and disconnect the wiring harness plug from the heated oxygen sensor 1.
7. Remove the intake manifold brace (1).
8. Remove the evaporative emission canister purge solenoid valve. Refer to **Evaporative Emission Canister Purge Solenoid Valve Replacement**

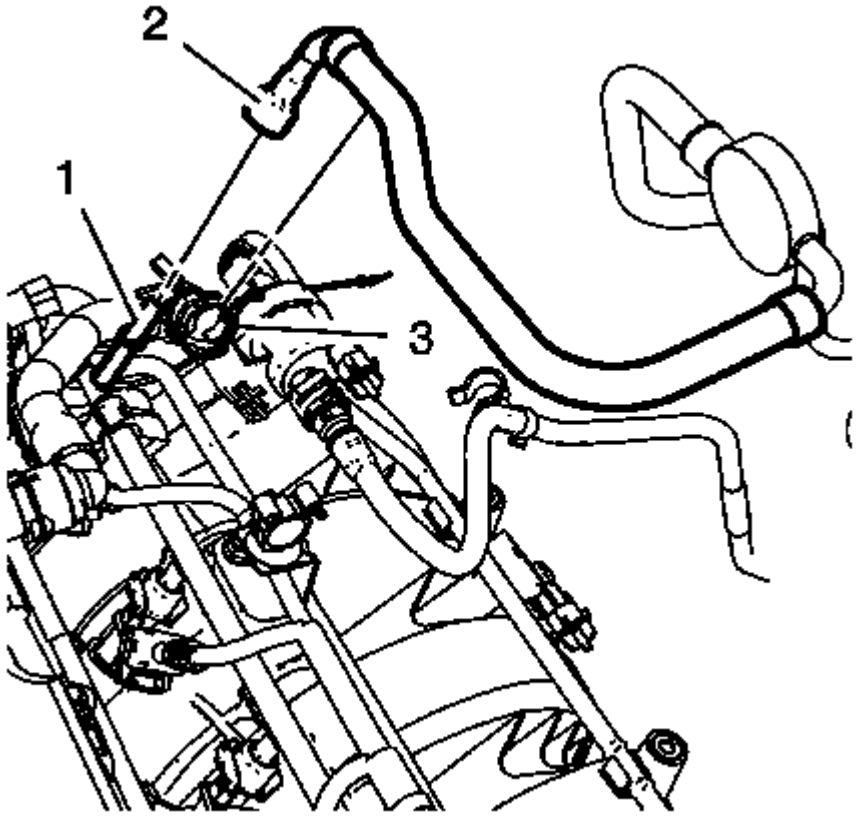

Fig. 23: Fuel Feed Pipe
Courtesy of GENERAL MOTORS CORP.

9. Unclip the fuel feed pipe (2) from the fuel feed pipe clip (3).
10. Release the fuel feed pipe (2) from the multiport fuel injection fuel rail (1) and remove the fuel feed pipe.
11. Close the fuel feed pipe with a suitable cap.

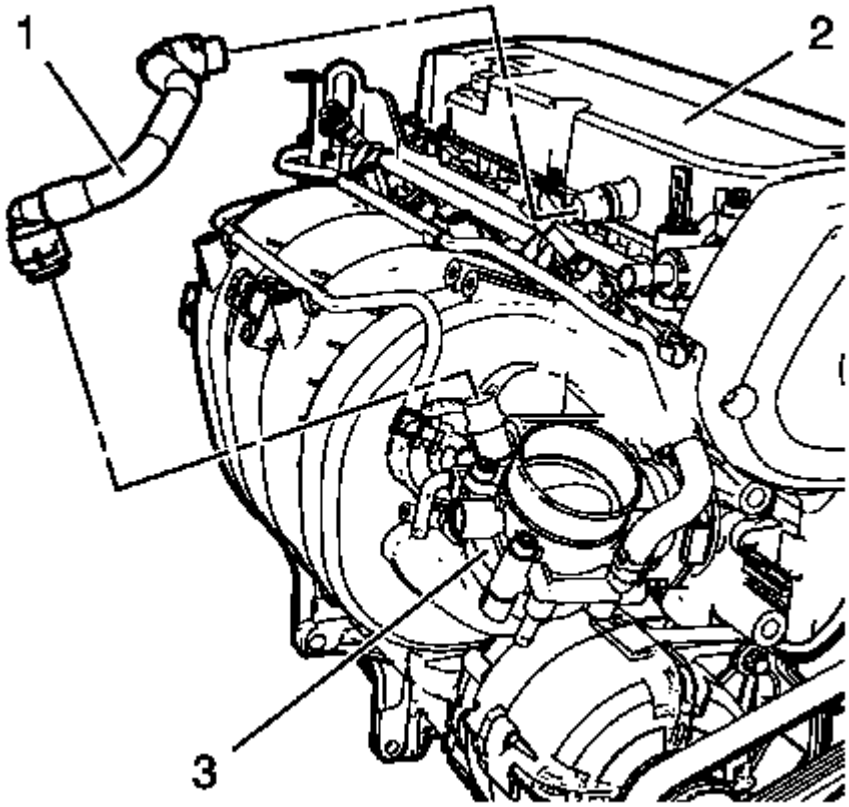

Fig. 24: Throttle Body And Positive Crankcase Ventilation Tube
Courtesy of GENERAL MOTORS CORP.

12. Remove the positive crankcase ventilation tube (1) from throttle body (3) and the camshaft cover (2).
13. Remove the throttle body assembly. Refer to **Throttle Body Assembly Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)** .

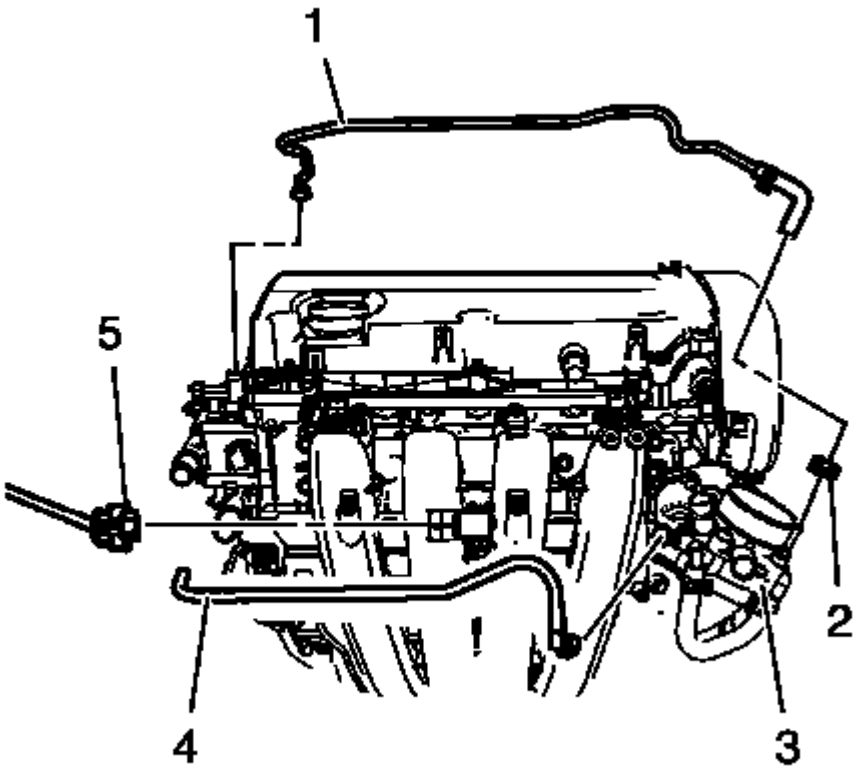

Fig. 25: Throttle Body, Throttle Body Heater Inlet Hose And Throttle Body Heater Outlet Hose
Courtesy of GENERAL MOTORS CORP.

14. Disconnect the manifold absolute pressure sensor wiring harness plug (5).
15. Remove the clamp (2) and remove the throttle body heater inlet hose (1) from throttle body (3).
16. Disconnect the throttle body heater outlet hose (4) from the throttle body (3).
17. Remove the engine management wiring harness and the fuel injectors wiring harness.

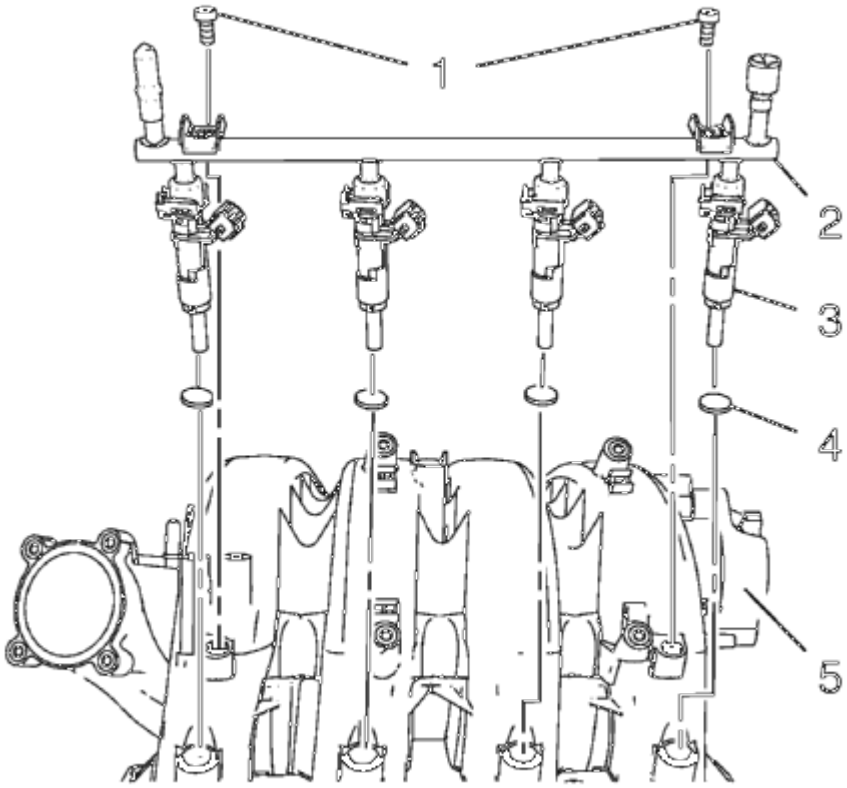

Fig. 26: Intake Manifold, Multiport Fuel Injection Fuel Rail, Fuel Injectors, Seals And Bolts
Courtesy of GENERAL MOTORS CORP.

18. Remove the 2 multiport fuel injection fuel rail bolts (1).
19. Remove the multiport fuel injection fuel rail (2) and the fuel injectors (3) from the intake manifold (5).
20. Remove the 4 multiport fuel injector seals (4).

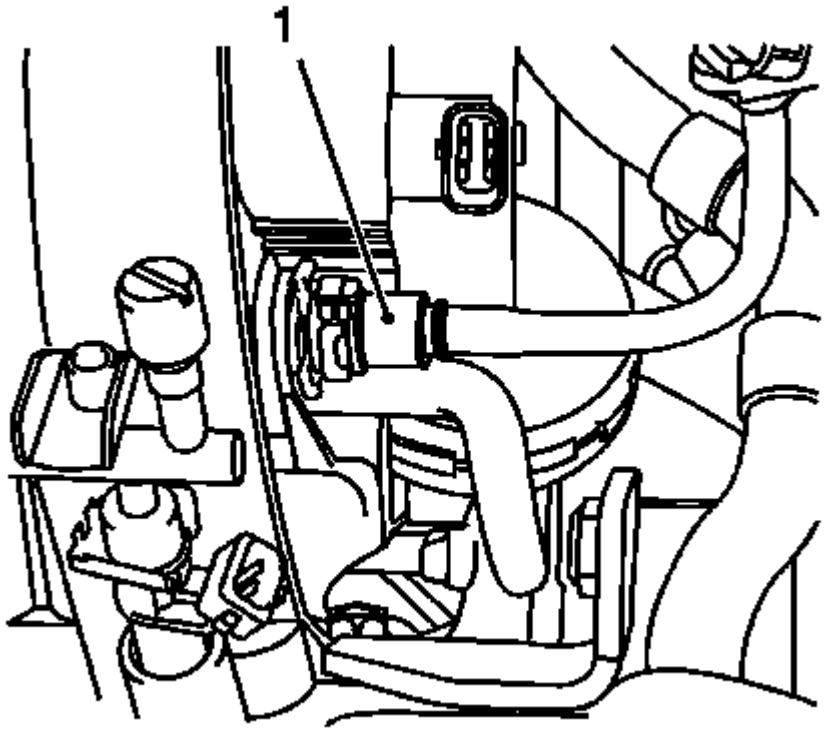

Fig. 27: View Of Brake Servo Vacuum Line
Courtesy of GENERAL MOTORS CORP.

21. Disconnect the booster vacuum pipe (1) from the intake manifold.

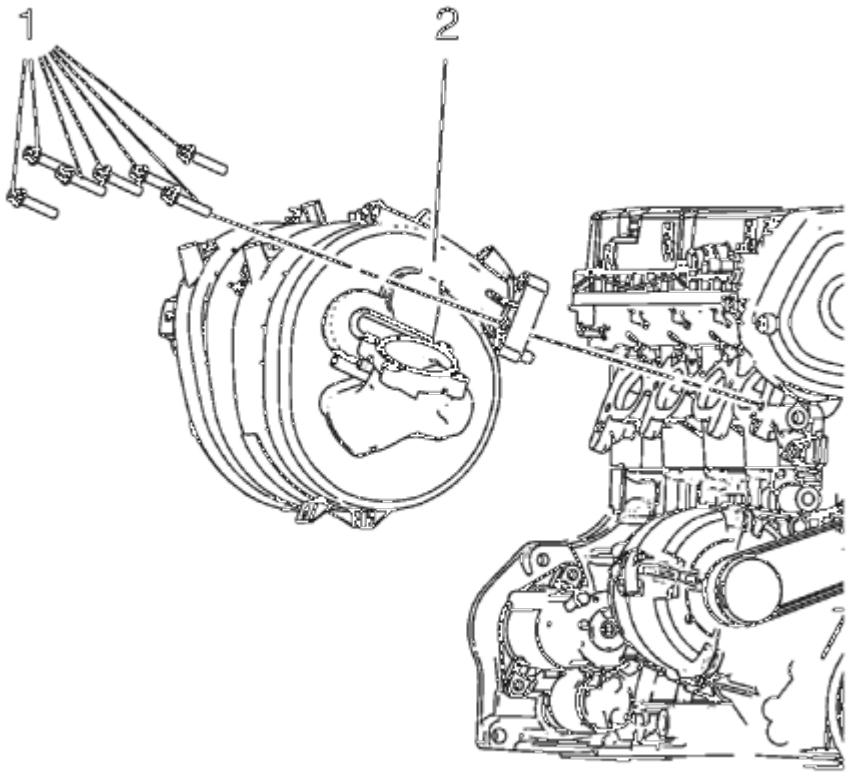

Fig. 28: Intake Manifold
Courtesy of GENERAL MOTORS CORP.

22. Remove the 7 intake manifold bolts (1).
23. Remove the intake manifold (2).

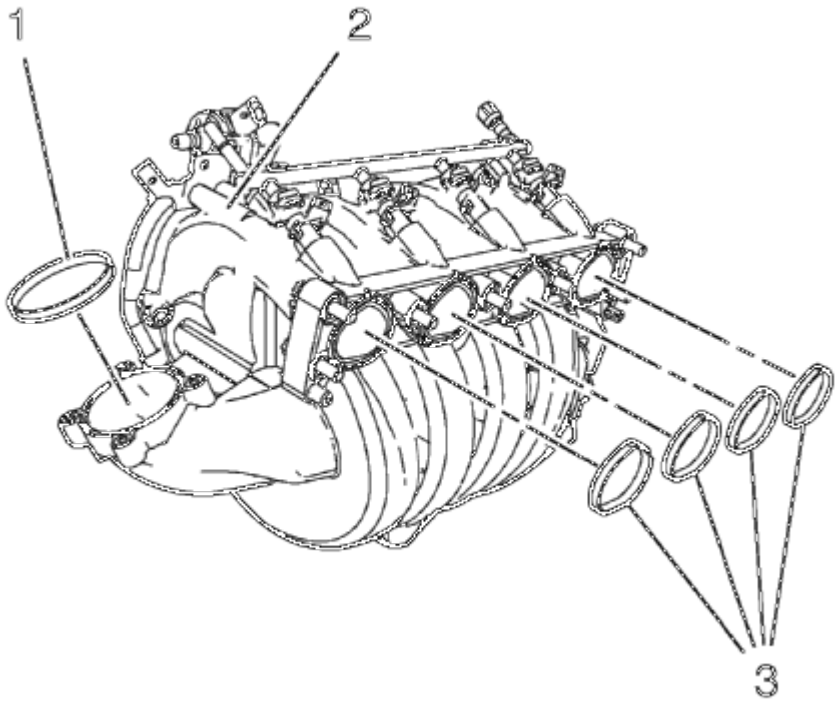

Fig. 29: Intake Manifold, Intake Manifold Seal And Throttle Body Seal
Courtesy of GENERAL MOTORS CORP.

24. Remove the intake manifold gaskets (1, 3) from the intake manifold (2).

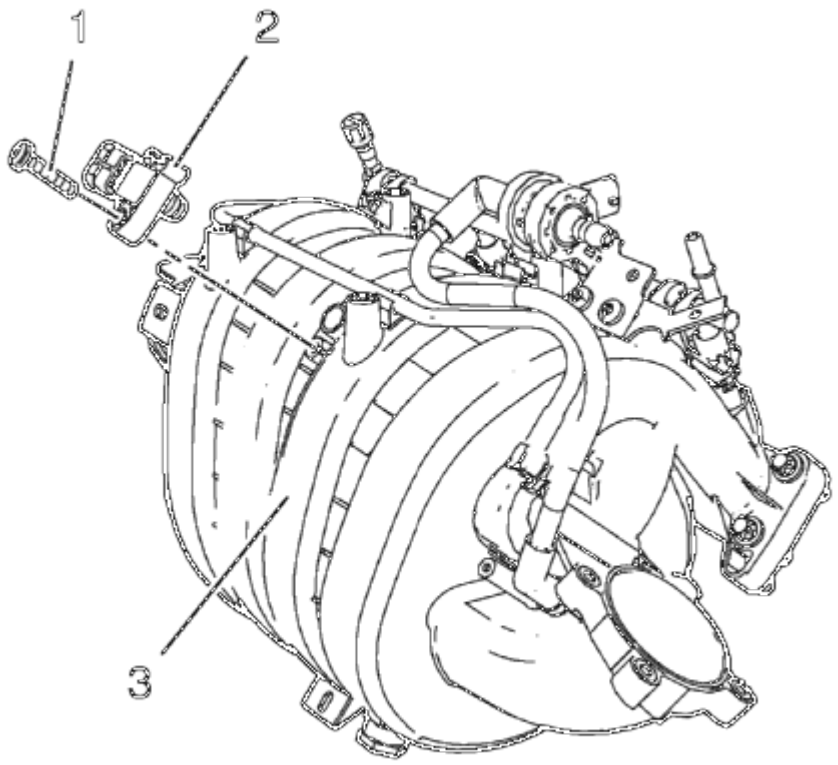

Fig. 30: Intake Manifold, Manifold Absolute Pressure Sensor And Bolt
Courtesy of GENERAL MOTORS CORP.

25. Remove the manifold absolute pressure sensor bolt (1).
26. Remove the manifold absolute pressure sensor (2) from the intake manifold (3).

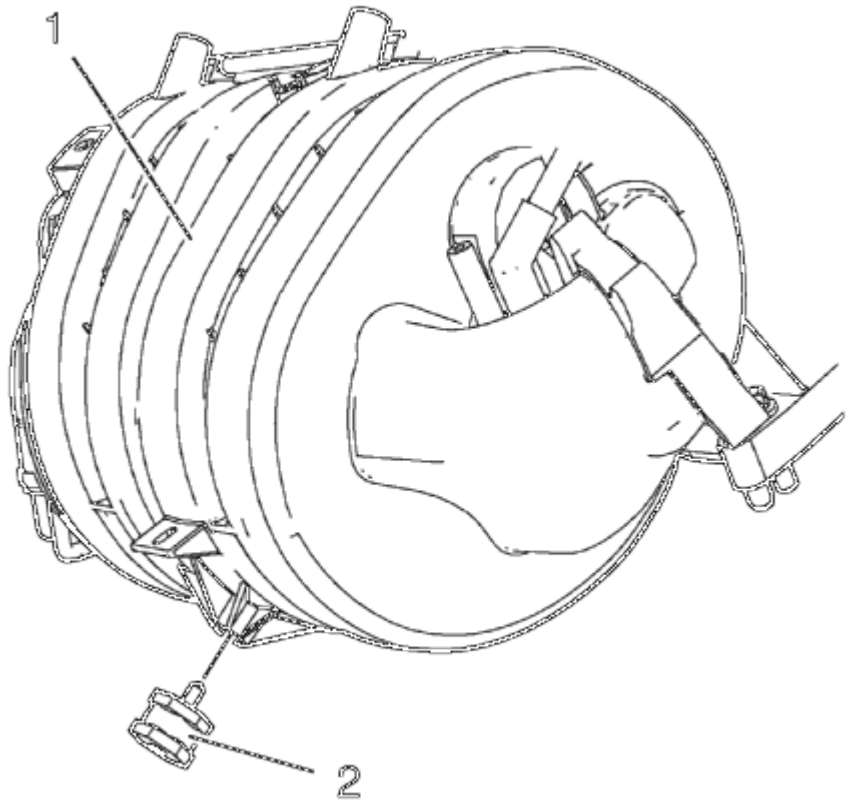

Fig. 31: Intake Manifold And Mount
Courtesy of GENERAL MOTORS CORP.

27. Remove the rubber bracket (2) from intake manifold (1).

CLEANING AND INSPECTION PROCEDURE

Clean and inspect the intake manifold. Refer to **Intake Manifold Cleaning and Inspection (1.6L LDE, LXV, 1.8L 2H0, and LUW)** .

INSTALLATION PROCEDURE

1. Clean the sealing surfaces.

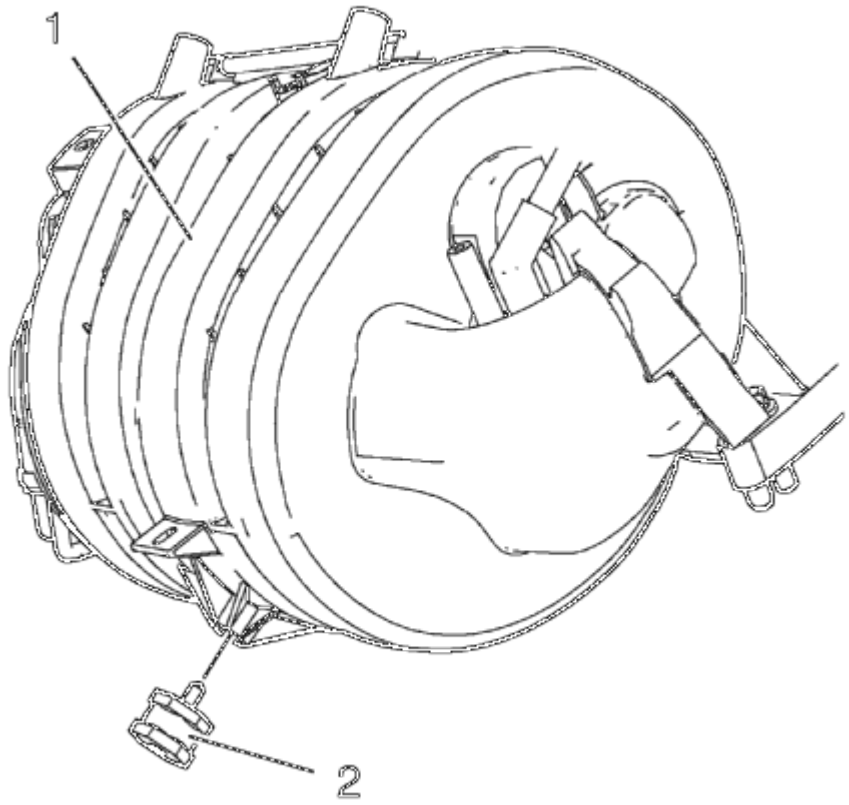

Fig. 32: Intake Manifold And Mount
Courtesy of GENERAL MOTORS CORP.

2. Install the rubber bracket (2) to intake manifold (1).

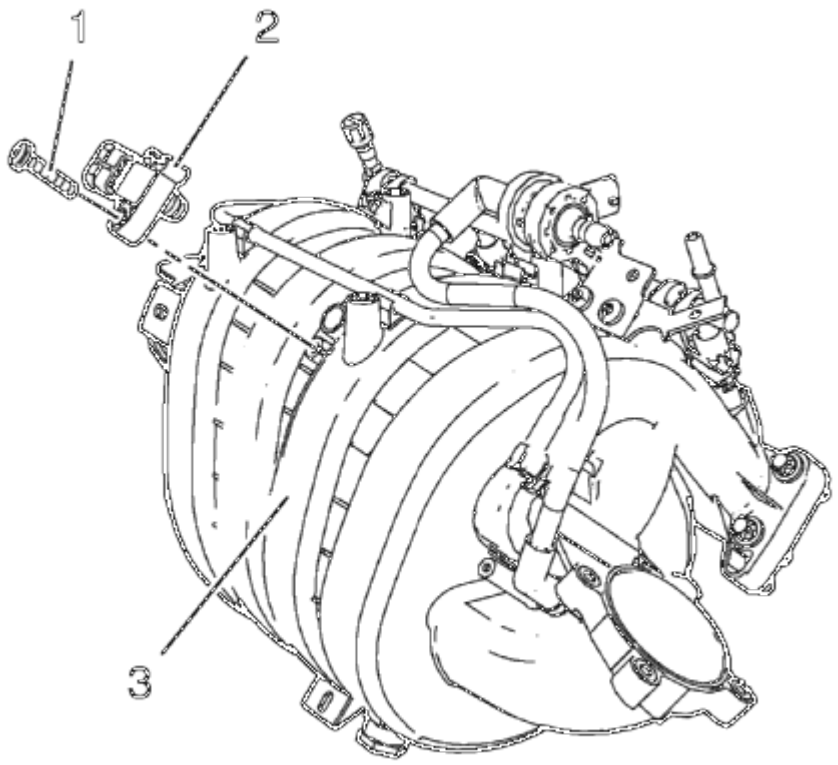

Fig. 33: Intake Manifold, Manifold Absolute Pressure Sensor And Bolt
Courtesy of GENERAL MOTORS CORP.

3. Install the manifold absolute pressure sensor (2) to the intake manifold (3).
4. Install the manifold absolute pressure sensor bolt (1) and tighten to 6 N.m (53 lb in).

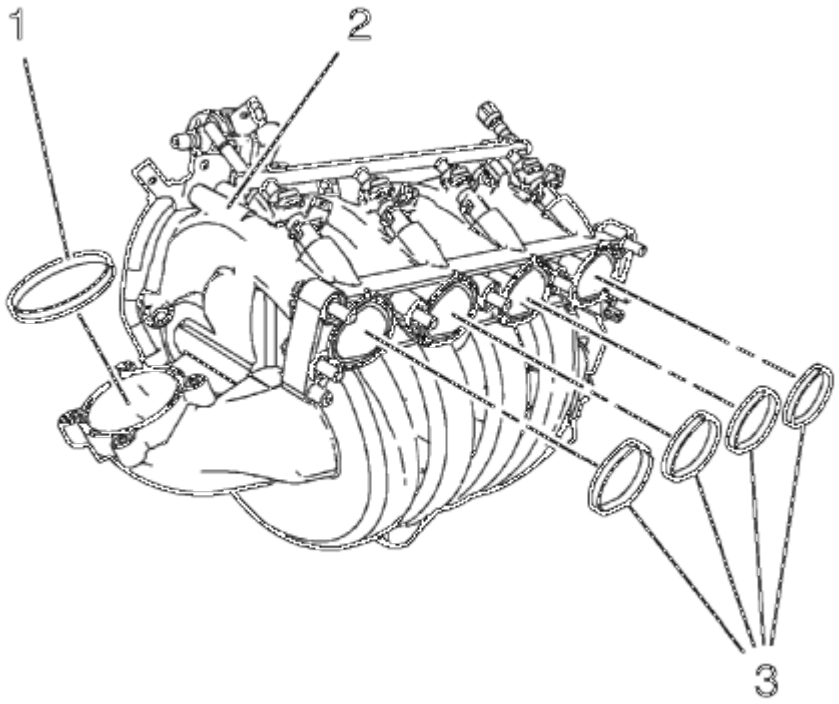

Fig. 34: Intake Manifold, Intake Manifold Seal And Throttle Body Seal
Courtesy of GENERAL MOTORS CORP.

5. Install the NEW gaskets (1, 3) to the intake manifold (2).

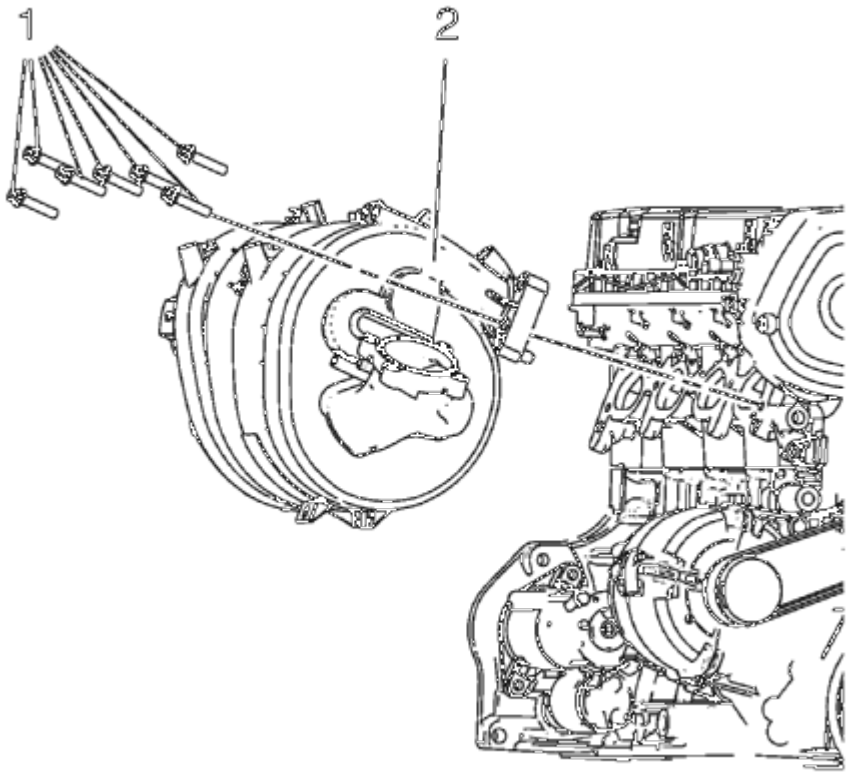

Fig. 35: Intake Manifold
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

6. Install the intake manifold (2) and the 7 intake manifold bolts (1) and tighten to 20 N.m (15 lb ft).

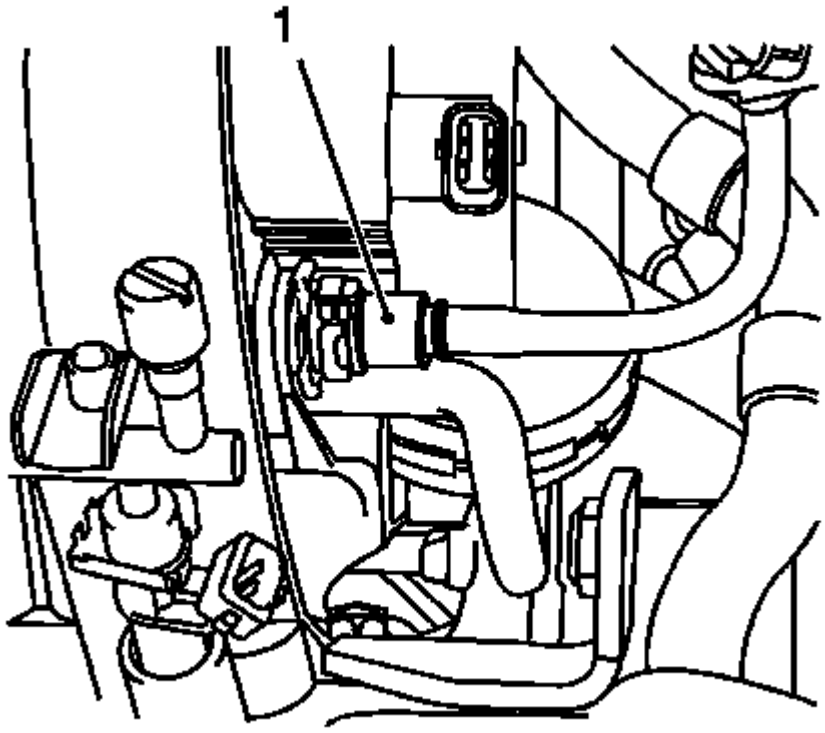

Fig. 36: View Of Brake Servo Vacuum Line
Courtesy of GENERAL MOTORS CORP.

7. Connect the booster vacuum pipe (1) to the intake manifold.

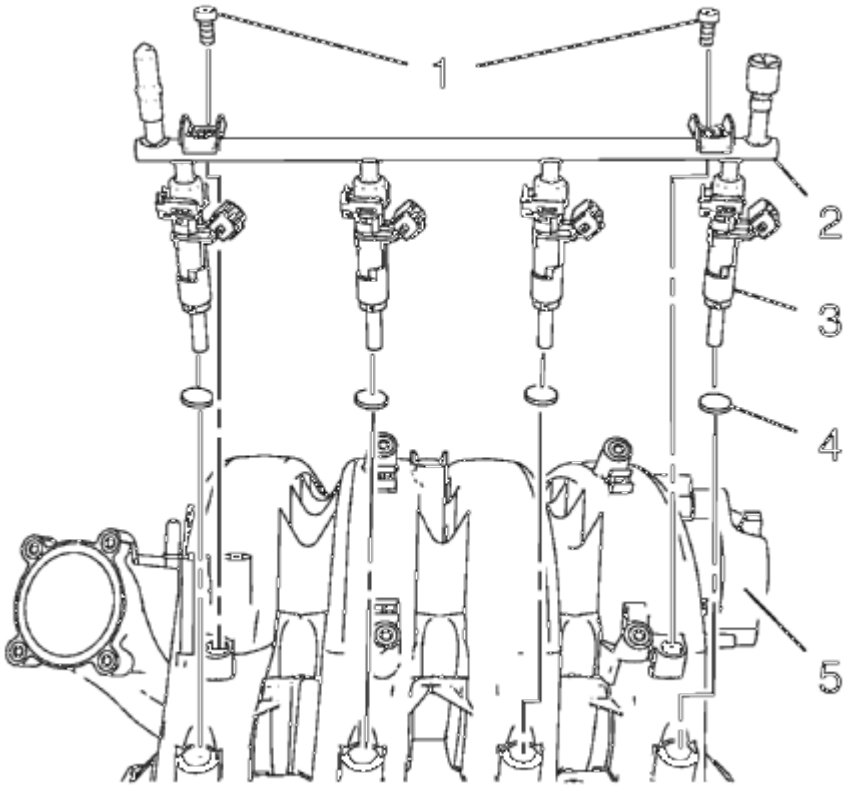

Fig. 37: Intake Manifold, Multiport Fuel Injection Fuel Rail, Fuel Injectors, Seals And Bolts
Courtesy of GENERAL MOTORS CORP.

8. Install the 4 multiport fuel injector seals (4).
9. Install the multiport fuel injection fuel rail (2) and the fuel injectors (3) to the intake manifold (5).
10. Install the 2 multiport fuel injection fuel rail bolts (1) and tighten to 8 N.m (71 lb in).

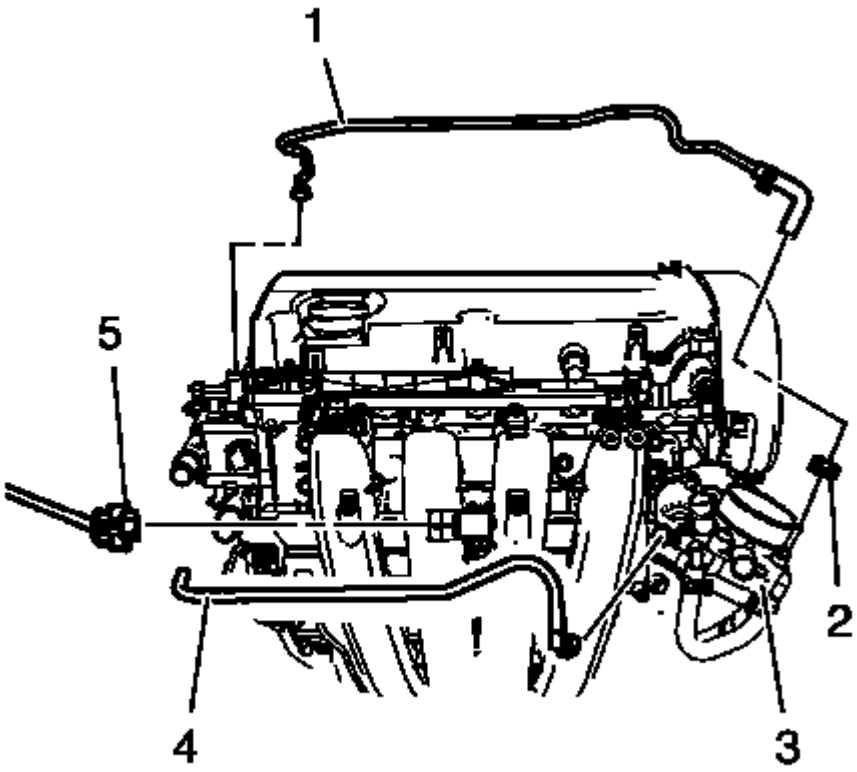

Fig. 38: Throttle Body, Throttle Body Heater Inlet Hose And Throttle Body Heater Outlet Hose
Courtesy of GENERAL MOTORS CORP.

11. Connect the throttle body heater outlet hose (4) to the throttle body (3).
12. Install the throttle body heater inlet hose (1) to the throttle body (3) and install the clamp (2).
13. Connect the manifold absolute pressure sensor wiring harness plug (5).
14. Install the engine management wiring harness and the fuel injectors wiring harness.

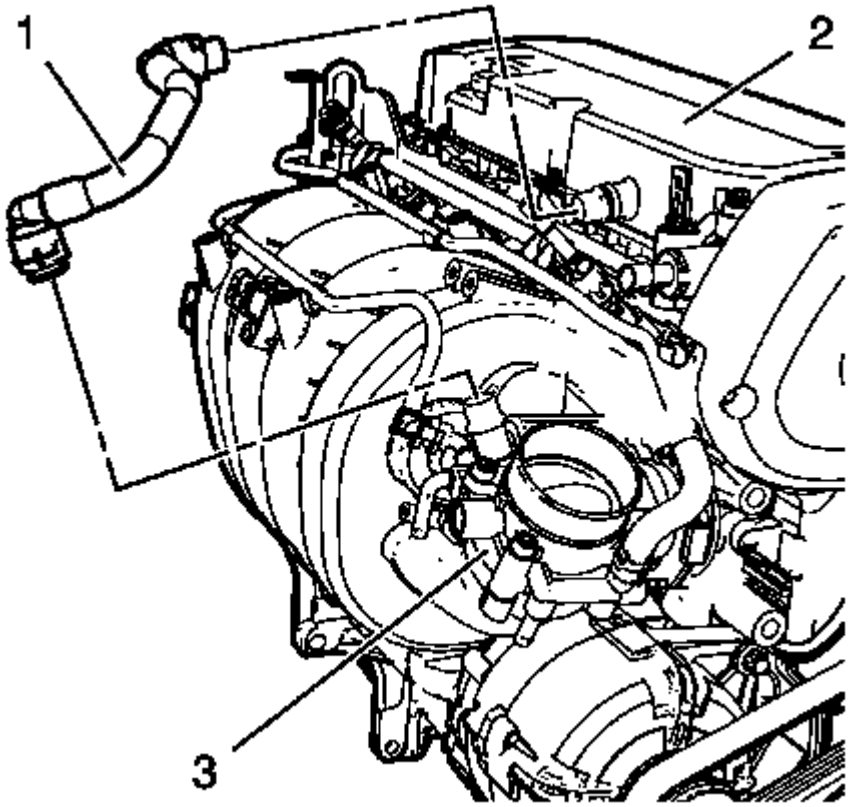

Fig. 39: Throttle Body And Positive Crankcase Ventilation Tube
Courtesy of GENERAL MOTORS CORP.

15. Install the positive crankcase ventilation tube (1) the to throttle body (3) and to the camshaft cover (2).
16. Install the throttle body assembly. Refer to **Throttle Body Assembly Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)** .
17. Install the evaporative emission canister purge solenoid valve. Refer to **Evaporative Emission Canister Purge Solenoid Valve Replacement**

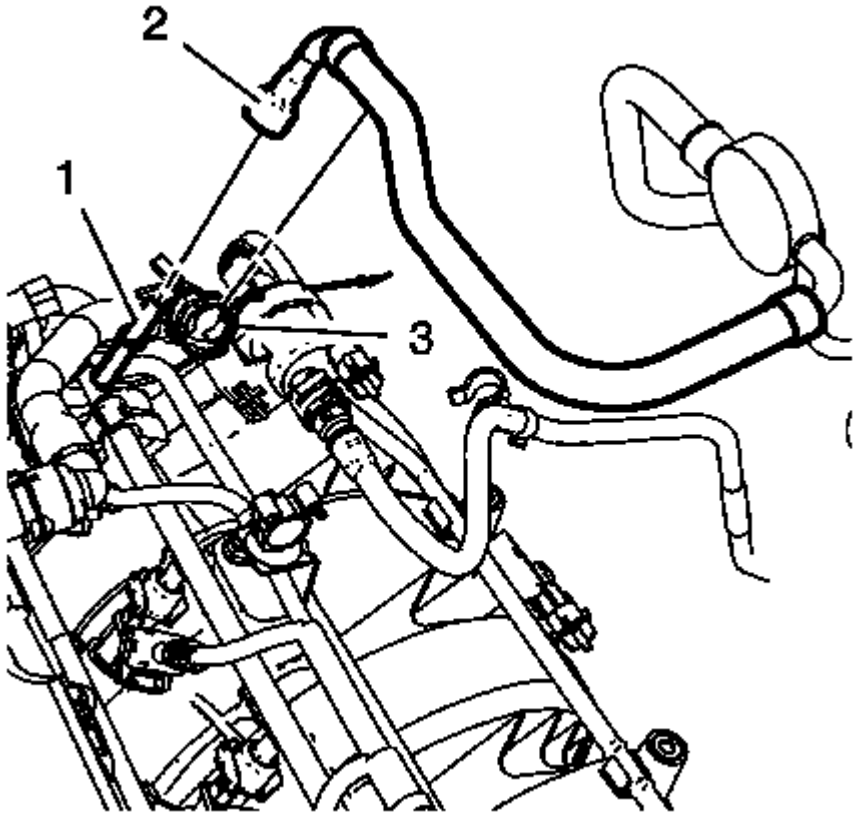

Fig. 40: Fuel Feed Pipe
Courtesy of GENERAL MOTORS CORP.

18. Remove the cap from fuel feed pipe (2).
19. Install the fuel feed pipe (2) to the multiport fuel injection fuel rail (1).
20. Clip the fuel feed pipe (2) to the fuel feed pipe clip (3).

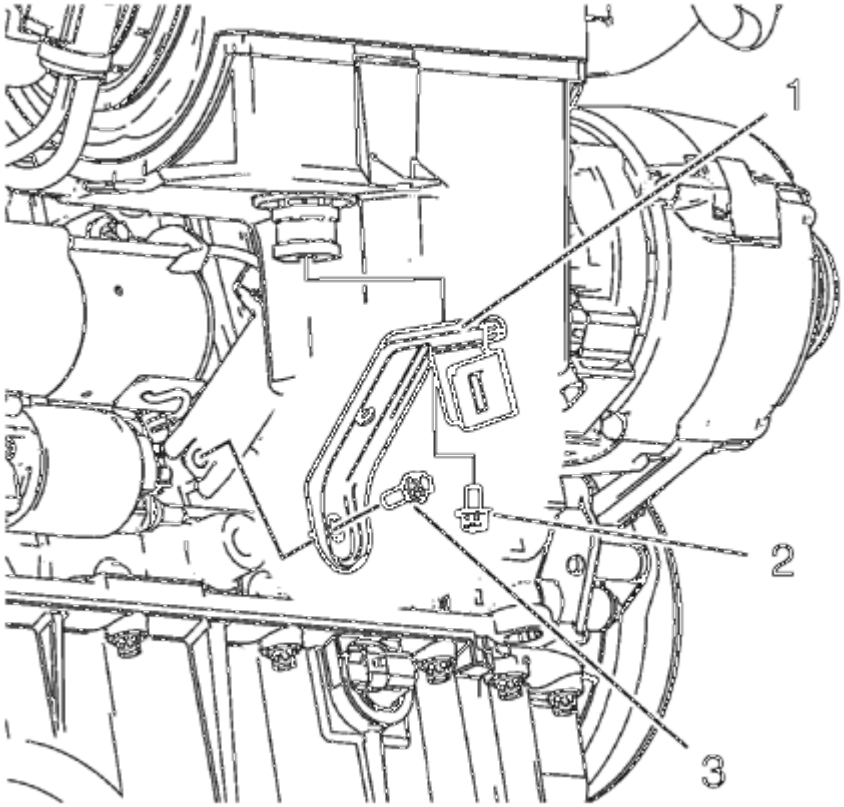

Fig. 41: Intake Manifold Brace
Courtesy of GENERAL MOTORS CORP.

21. Install the intake manifold brace (1).
22. Install and connect the wiring harness plug to the heated oxygen sensor 1.
23. Install the 2 intake manifold brace bolts (2, 3) and tighten to 8 N.m (71 lb in).
24. Lower the vehicle.
25. Install the air cleaner outlet duct. Refer to **Air Cleaner Outlet Duct Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)** .
26. Close the hood.

TIMING BELT REPLACEMENT (1.6L LDE, LXV, 1.8L 2H0, AND LUW)

Special Tools

- **EN-6333:** Timing Belt Tensioner Locking Pin
- **EN-6340:** Camshaft Locking Tool
- **EN-6625:** Crankshaft Locking Device
- **EN-45059:** Torque Angle Sensor Kit

For equivalent regional tools, refer to **Special Tools** .

REMOVAL PROCEDURE

1. Open the hood.
2. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement (1.6L LDE, LXV, and 1.8L 2H0)** .
3. Remove the timing belt upper front cover. Refer to **Timing Belt Upper Front Cover Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.
4. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
5. Remove the front compartment splash shield. Refer to **Front Compartment Splash Shield Replacement** .
6. Remove the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement**.

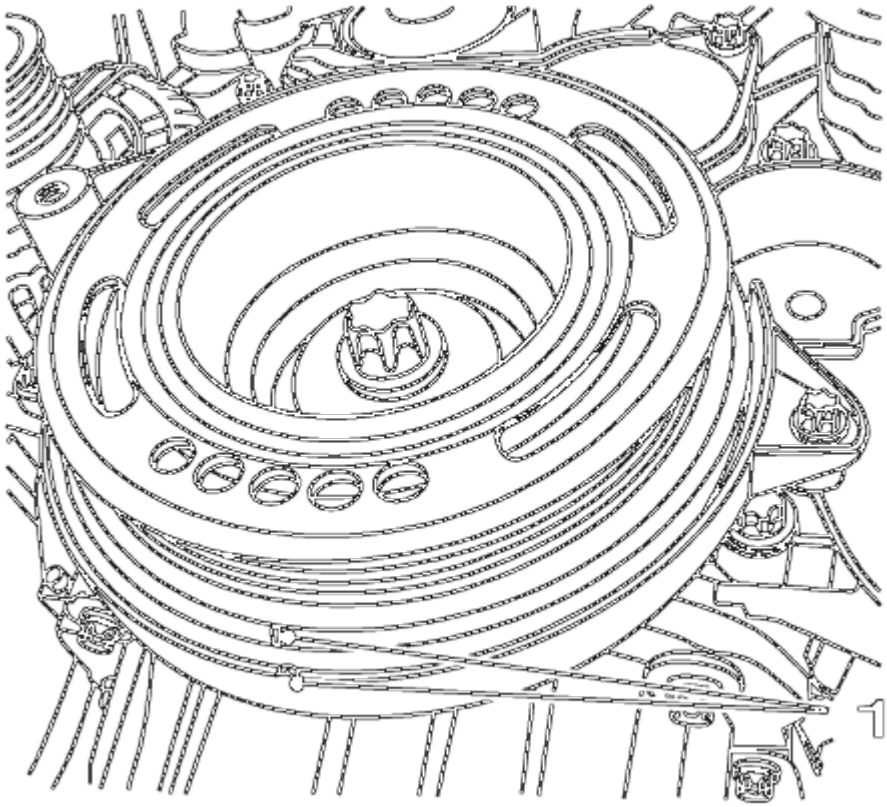

Fig. 42: View Of Crankshaft TDC Position
Courtesy of GENERAL MOTORS CORP.

7. Set crankshaft balancer in direction of engine rotation to cylinder 1 TDC of combustion stroke (1).

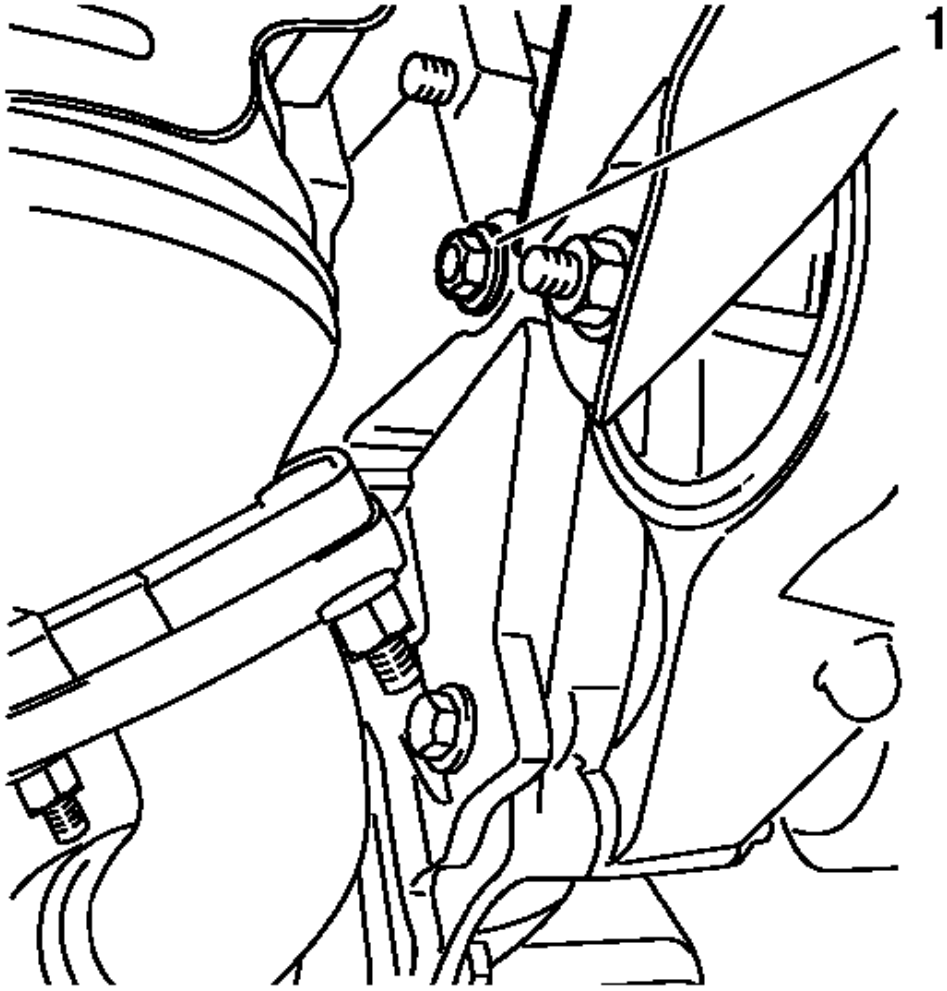

Fig. 43: View Of Bolt
Courtesy of GENERAL MOTORS CORP.

8. Remove the bolt (1).

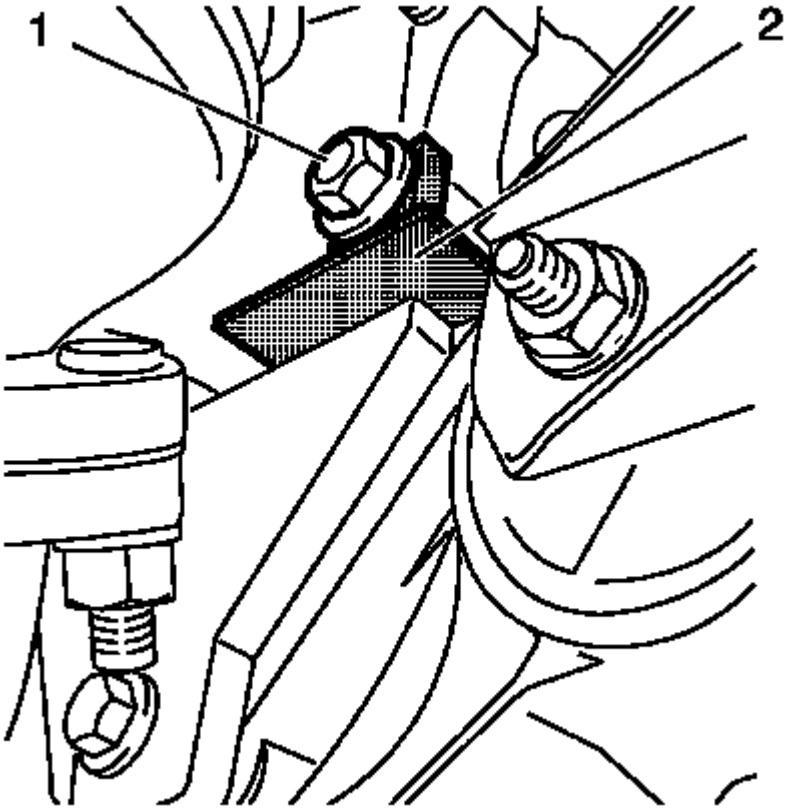

Fig. 44: Locking Device And Bolt
Courtesy of GENERAL MOTORS CORP.

9. Install **EN-6625:** locking device (2) and the bolt (1) to block the crankshaft.

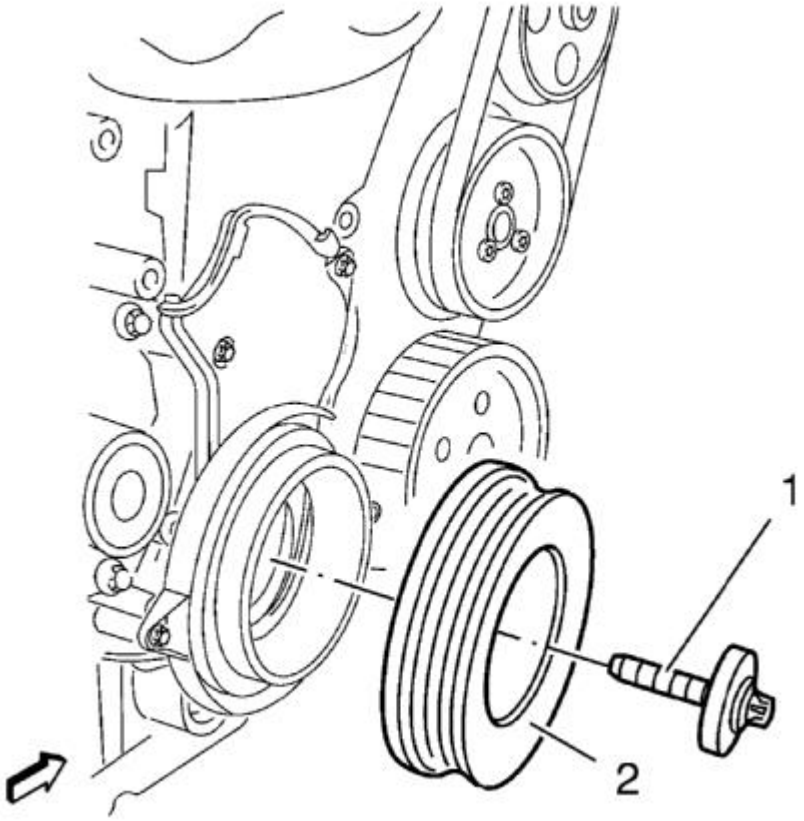

Fig. 45: Crankshaft Balancer And Bolt
Courtesy of GENERAL MOTORS CORP.

10. Remove the crankshaft balancer bolt (1).
11. Remove the crankshaft balancer (2).

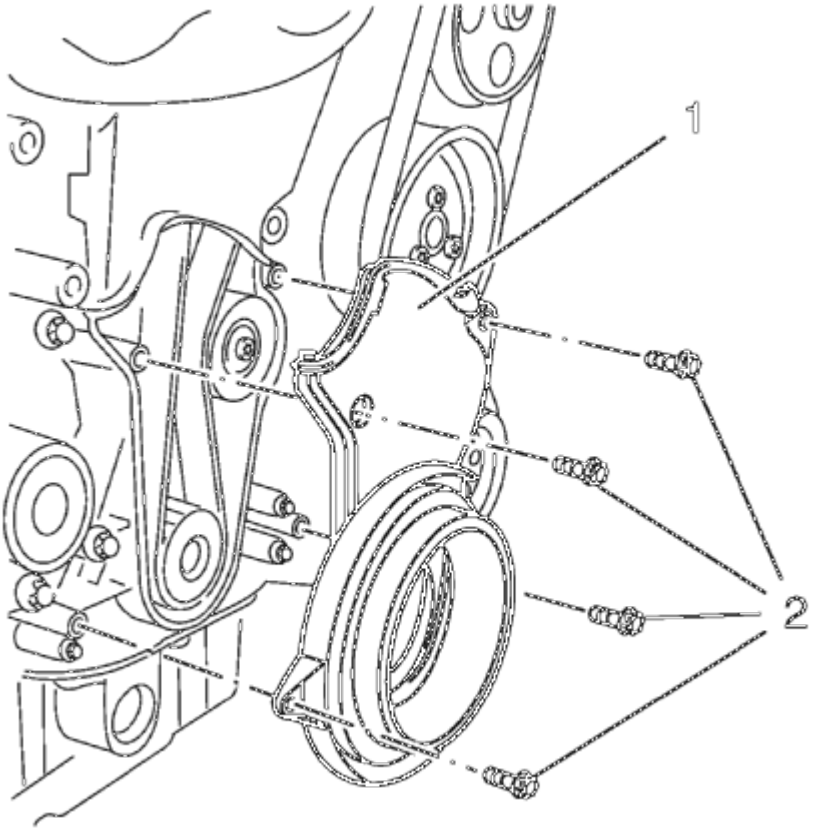

Fig. 46: Timing Belt Lower Front Cover
Courtesy of GENERAL MOTORS CORP.

12. Remove the 4 lower timing belt cover bolts (2).
13. Remove the lower timing belt cover (1).
14. Lower the vehicle.

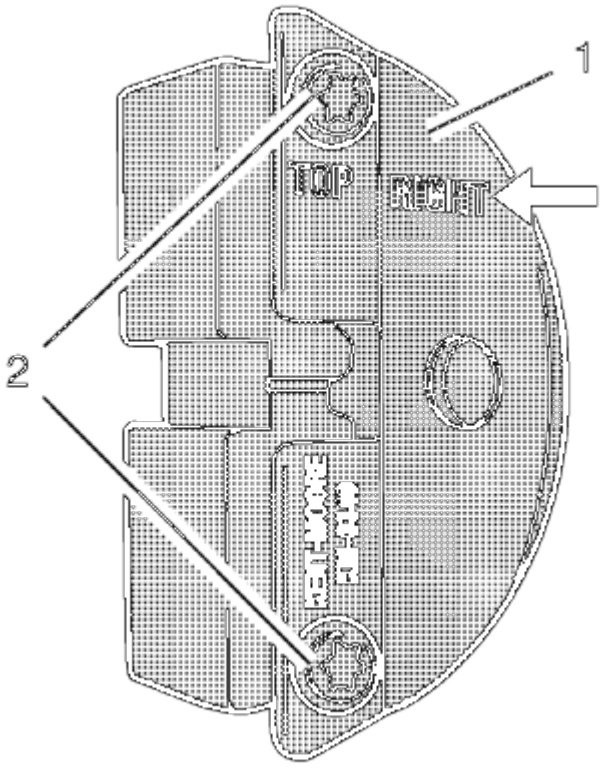

Fig. 47: Front Panel And Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: The right half of the EN-6340: locking tool can be recognized by the lettering right, arrow, on the tool.

15. Prepare the right half of the **EN-6340:** locking tool.
    1. Remove the 2 bolts (2).
    2. Remove the front panel (1) from the **EN-6340:** locking tool -right.

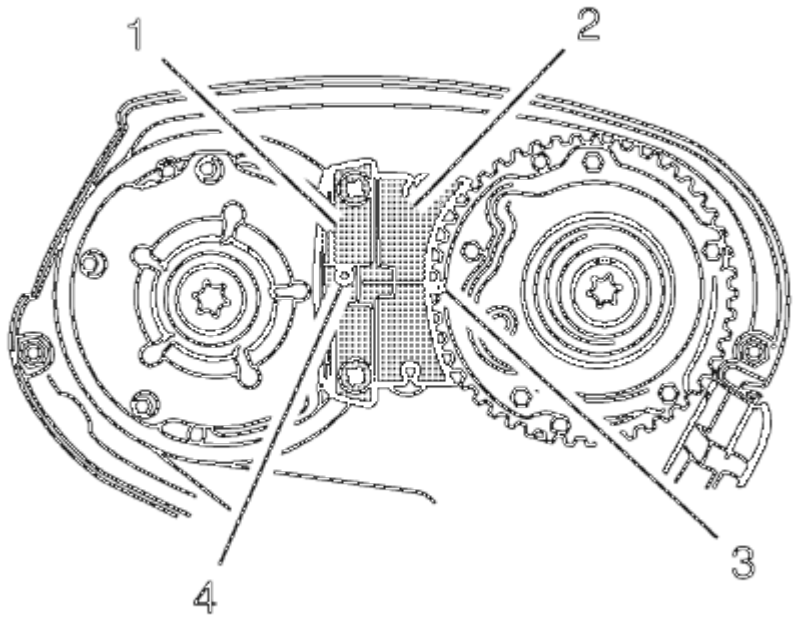

Fig. 48: Spot Type Markings And Special Tool
Courtesy of GENERAL MOTORS CORP.

16. Install **EN-6340:** locking tool into the camshaft position actuator adjusters.

NOTE: The spot type marking (4) on the intake camshaft adjuster does not correspond to the groove of EN-6340-left during this process but must be somewhat above as shown.

- Install **EN-6340-left:** locking tool (1) in the camshaft position actuator adjusters as shown.

NOTE: The spot type marking (3) on the exhaust camshaft adjuster must correspond to the groove on EN-6340-right.

- Install **EN-6340:** locking tool - right (2) in the camshaft position actuator adjusters as shown.

17. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

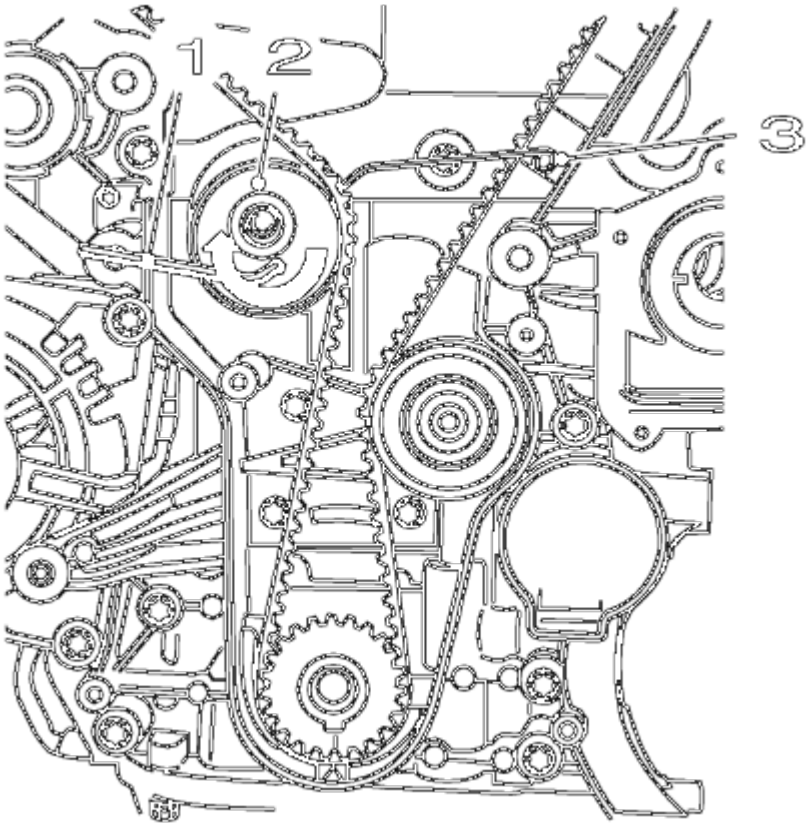

Fig. 49: Timing Belt Tension Roller, Allen Key And Special Tool
Courtesy of GENERAL MOTORS CORP.

18. Loosen the timing belt tensioner bolt.
19. Apply tension to the timing belt tensioner (2) in the direction of the arrow, using an Allen key (1).
20. Install the **EN-6333:** locking pin (3).
21. Lower the vehicle.

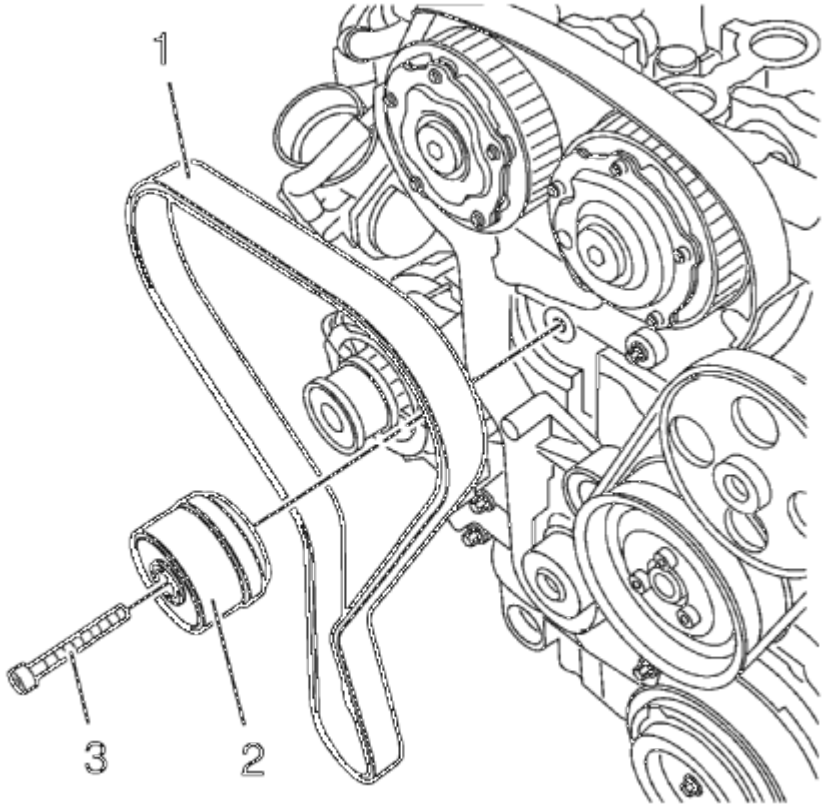

Fig. 50: Timing Belt, Timing Belt Tensioner
Courtesy of GENERAL MOTORS CORP.

NOTE: Note the direction of the belt.

22. Remove the timing belt (1).

INSTALLATION PROCEDURE

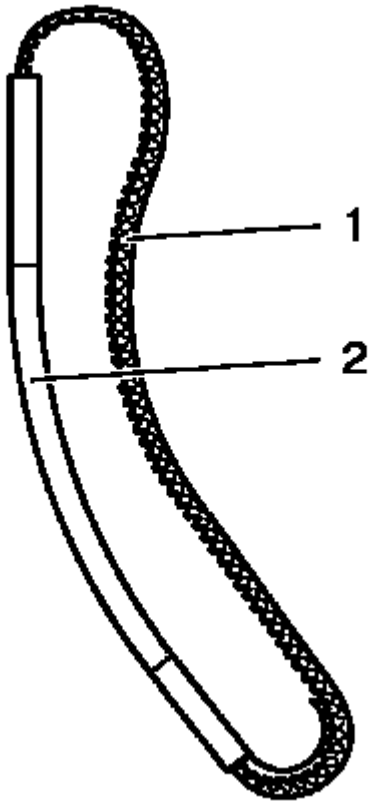

Fig. 51: Timing Belt And Assembly Tool
Courtesy of GENERAL MOTORS CORP.

NOTE: If the toothed belt has been used, observe the direction of rotation.

1. Install the timing belt (1) in the enclosed assembly tool (2).
2. Guide the timing belt through the engine mount bracket with the assembly tool.
3. Remove the assembly tool.

NOTE: Threading the timing belt through the engine mount bracket is only permissible in conjunction with the assembly tool supplied with NEW timing belts or otherwise it is possible to damage the toothed belt at this stage by kinking it.

4. Install the timing belt.
5. Guide the timing belt past the tensioner and place it on the crankshaft sprocket wheel.
6. Place the timing belt on the exhaust and intake camshaft position actuator adjusters.
7. Raise and support the vehicle.

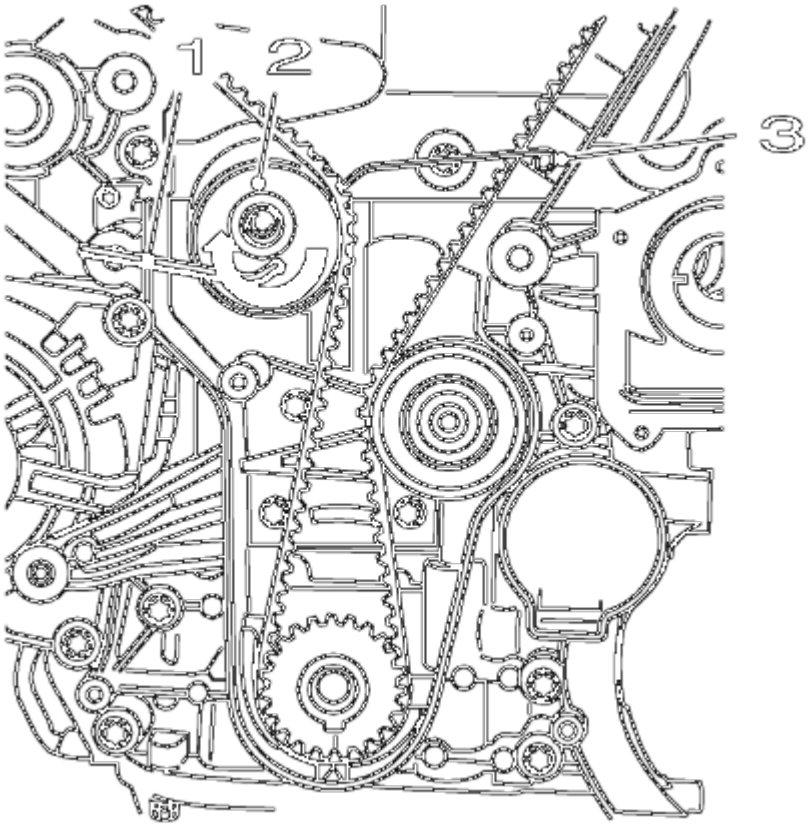

Fig. 52: Timing Belt Tension Roller, Allen Key And Special Tool
Courtesy of GENERAL MOTORS CORP.

8. Apply tension to the timing belt tensioner (2) in the direction of the arrow, using an Allen key (1).
9. Remove the **EN-6333:** locking pin (3).

NOTE: The timing belt tensioner moves automatically to the correct position.

10. Release tension on timing belt tensioner.

CAUTION: Refer to Fastener Caution .

11. Tighten the timing belt tensioner bolt to 20 N.m (15 lb ft).

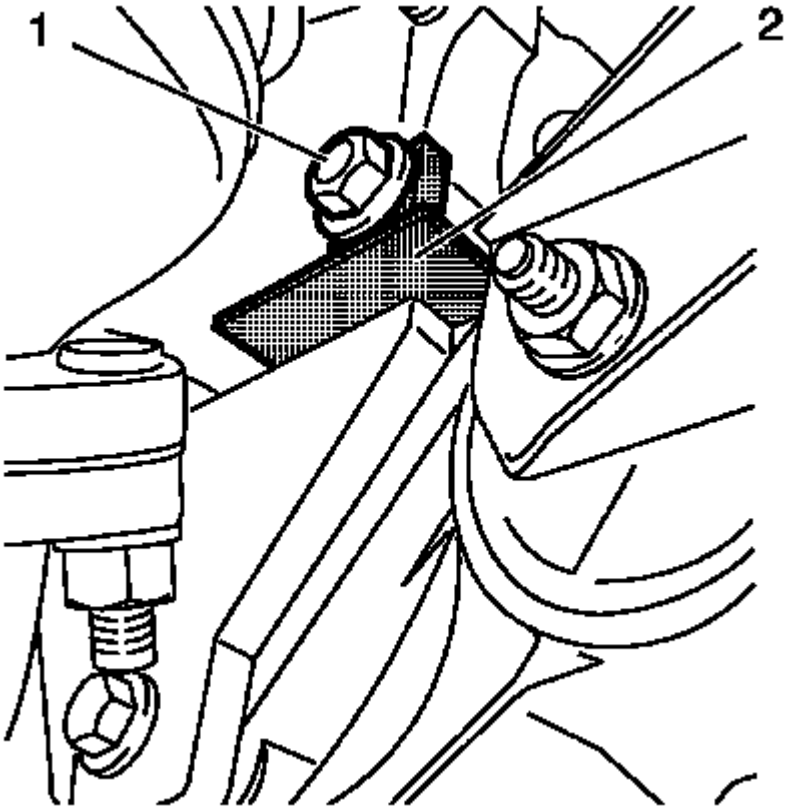

Fig. 53: Locking Device And Bolt
Courtesy of GENERAL MOTORS CORP.

12. Remove the bolt (1).
13. Remove **EN-6625:** locking device (2).
14. Lower the vehicle. Refer to **Lifting and Jacking the Vehicle** .
15. Remove **EN-6340:** locking tool.

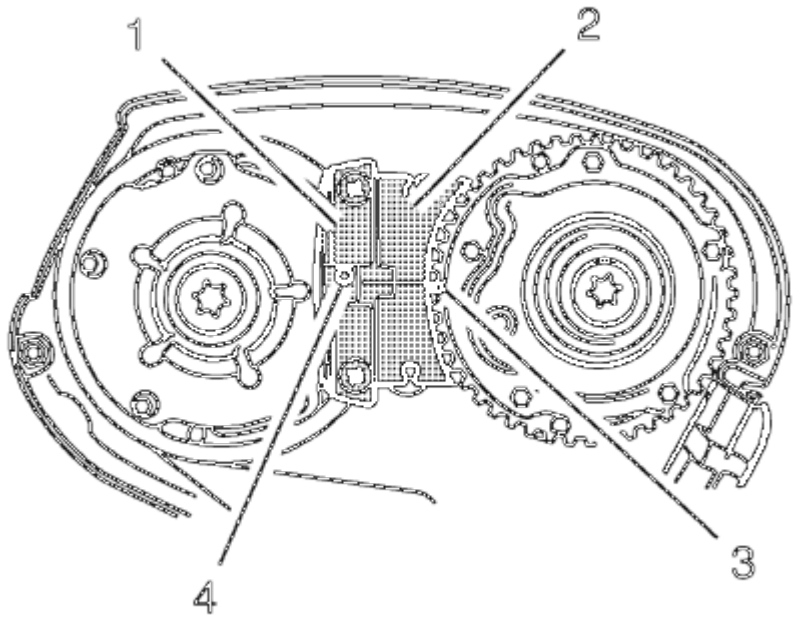

Fig. 54: Spot Type Markings And Special Tool
Courtesy of GENERAL MOTORS CORP.

16. Check the timing.

NOTE: Note the marking at the camshaft sprockets.

- Turn the crankshaft 720° in the direction of engine rotation by the bolt on the crankshaft balancer.

NOTE: The spot type marking (4) on the intake camshaft position actuator adjuster does not correspond to the groove of EN-6340-left during this process but must be slightly above as shown.

- Install **EN-6340:** locking tool -left (1) into the camshaft position actuator adjusters as shown.

NOTE: The spot type marking (3) on the exhaust camshaft position actuator adjuster must correspond to the groove on EN-6340-right.

- Install **EN-6340:** locking tool -right (2) into the camshaft position actuator adjusters as shown.

17. Remove the **EN-6340:** locking tool.
18. Raise and support the vehicle.

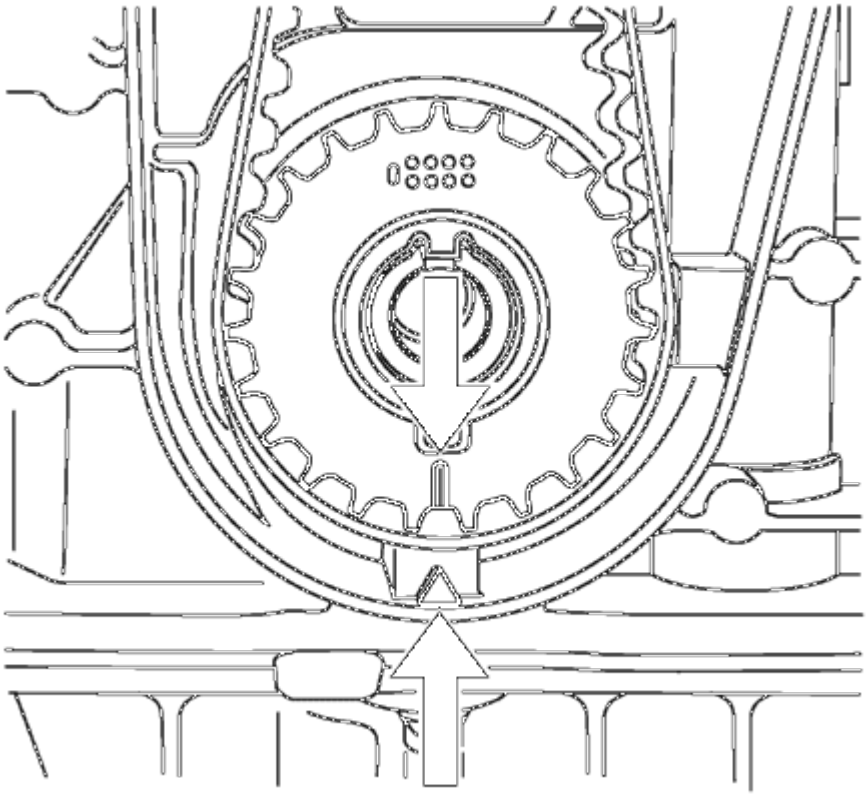

Fig. 55: Aligning Timing Belt Drive Gear And Oil Pump Housing
Courtesy of GENERAL MOTORS CORP.

NOTE: The timing belt drive gear and oil pump housing must align.

19. Control the crankshaft balancer position.

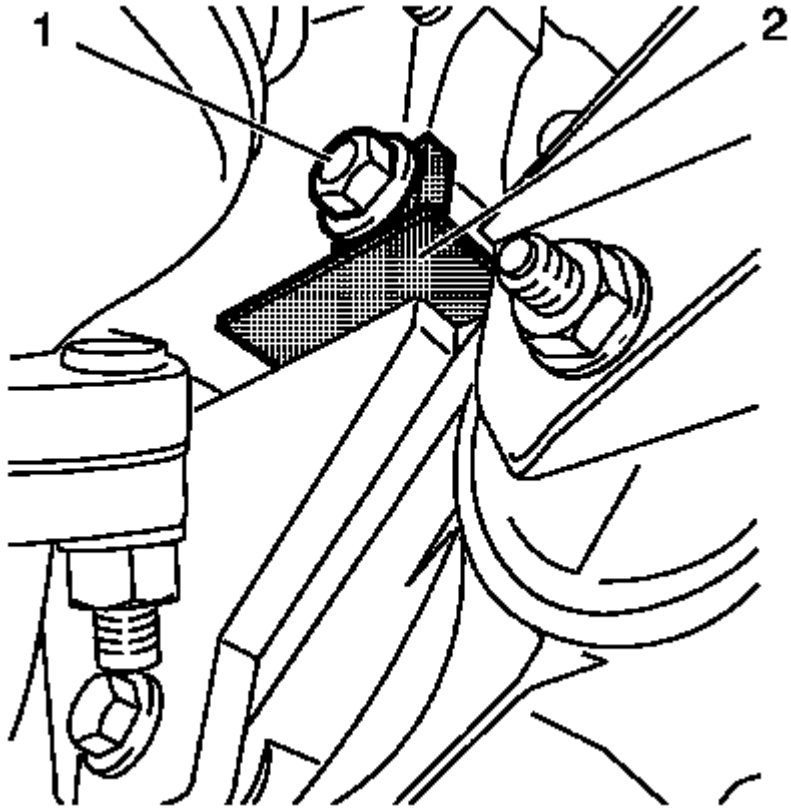

Fig. 56: Locking Device And Bolt
Courtesy of GENERAL MOTORS CORP.

20. Install **EN-6625:** locking device (2) and the bolt (1) to block the crankshaft.

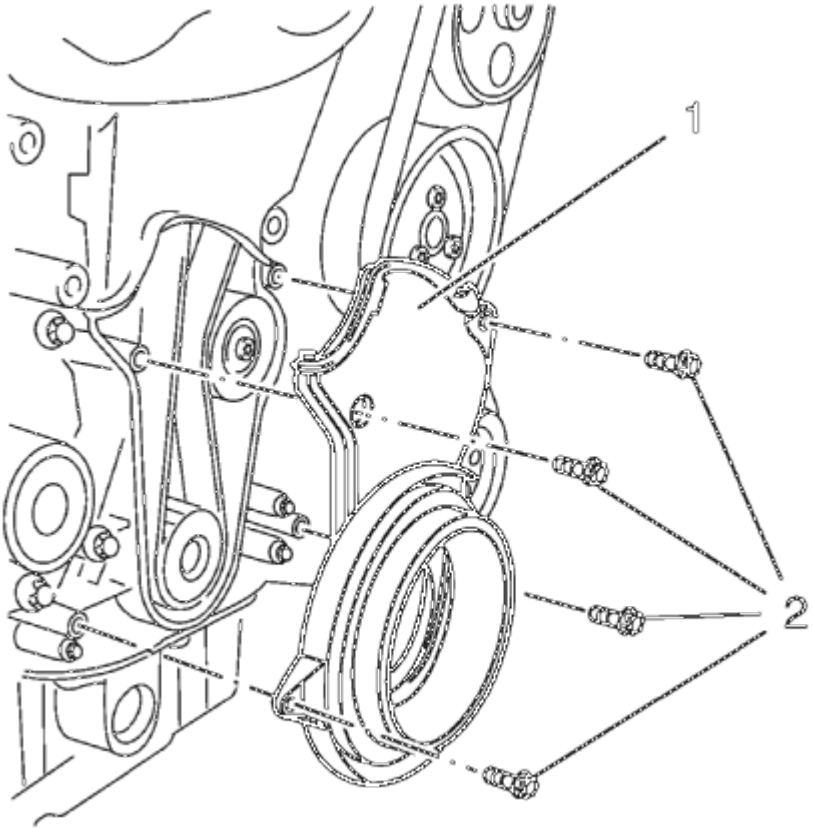

Fig. 57: Timing Belt Lower Front Cover
Courtesy of GENERAL MOTORS CORP.

21. Install the lower timing belt cover (1).
22. Install the 4 lower timing belt cover bolts (2) and tighten to 6 N.m (53 lb in).

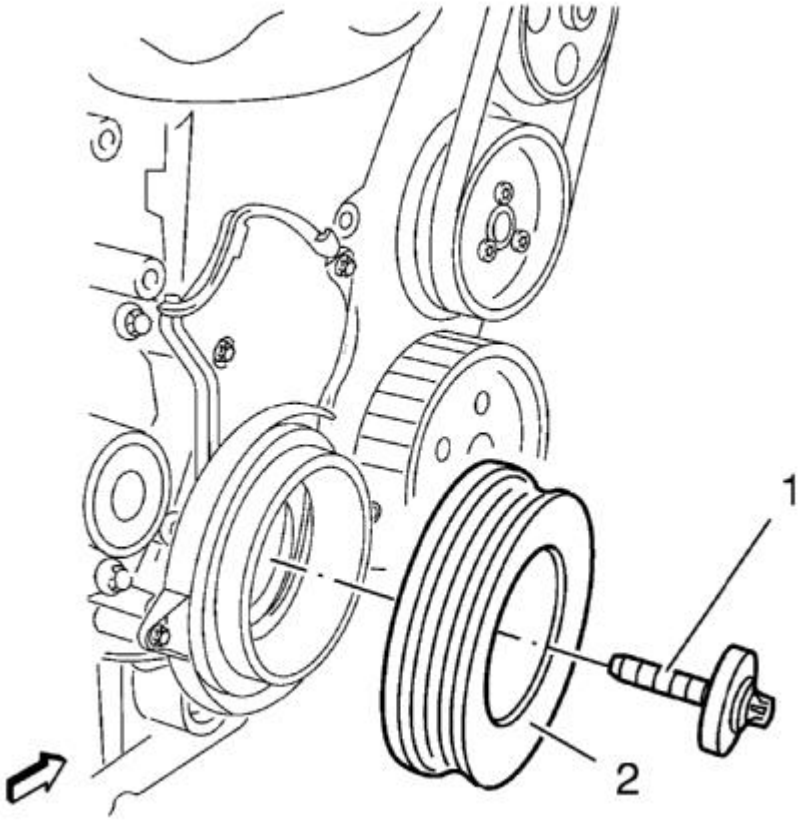

Fig. 58: Crankshaft Balancer And Bolt
Courtesy of GENERAL MOTORS CORP.

23. Install the crankshaft balancer (2).
24. Install a NEW crankshaft balancer bolt (1) and tighten in 3 passes using the **EN-45059:** sensor kit :
    1. First pass to 95 N.m (70 lb ft).
    2. Second pass to 45°.
    3. Third pass to 15°.

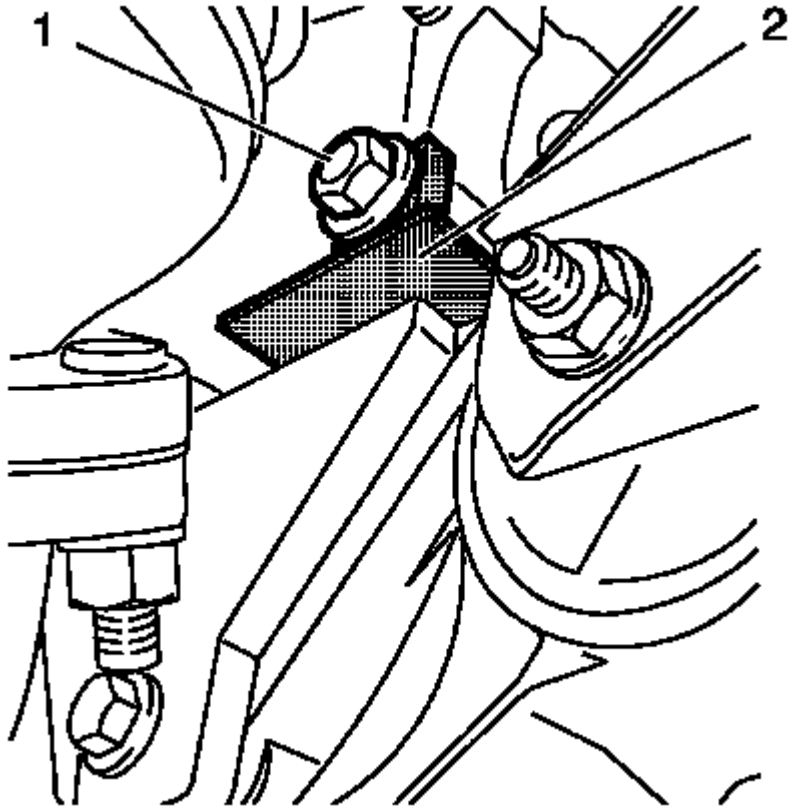

Fig. 59: Locking Device And Bolt
Courtesy of GENERAL MOTORS CORP.

25. Remove bolt (1).
26. Remove **EN-6625:** locking device (2).

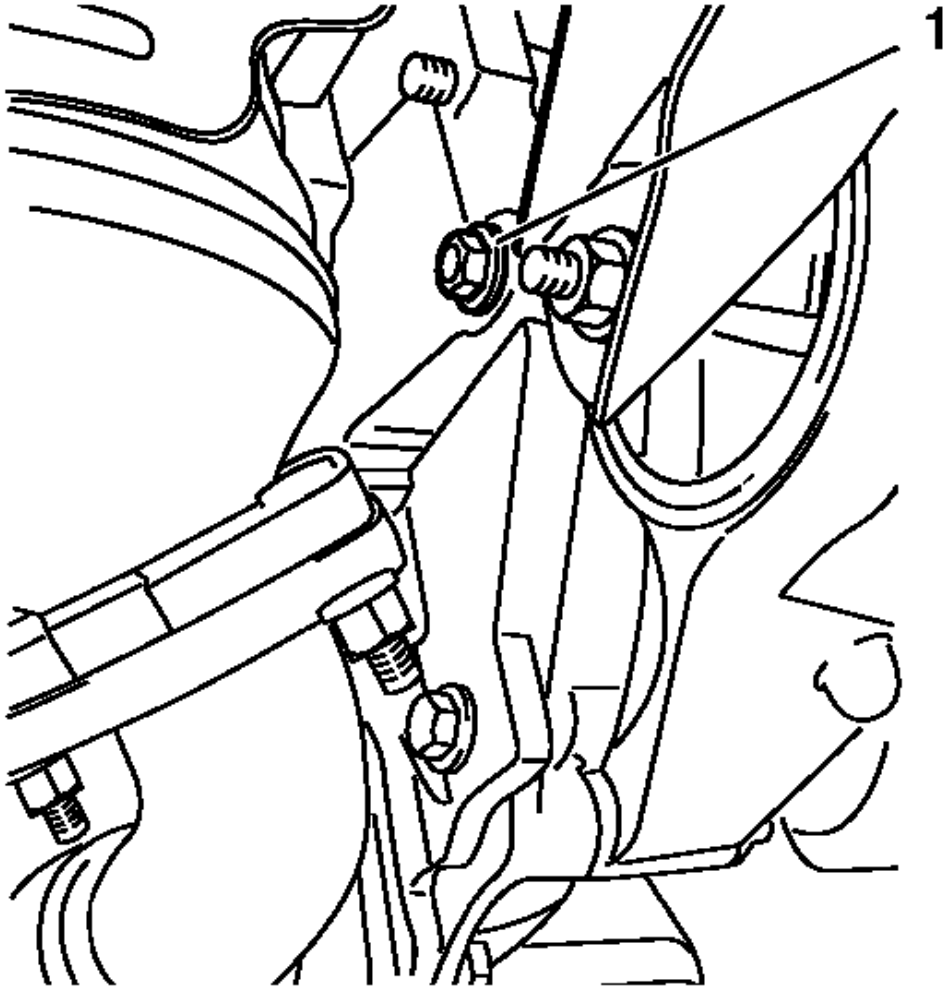

Fig. 60: View Of Bolt
Courtesy of GENERAL MOTORS CORP.

27. Install the bolt (1) and tighten to 75 N.m (55 lb ft).
28. Install the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement**.
29. Install the compartment splash shield. Refer to **Front Compartment Splash Shield Replacement** .
30. Lower the vehicle. Refer to **Lifting and Jacking the Vehicle** .
31. Install the timing belt upper front cover. Refer to **Timing Belt Upper Front Cover Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.
32. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement (1.6L LDE, LXV, and 1.8L 2H0)** .
33. Close the hood.

TIMING BELT IDLER PULLEY REPLACEMENT

REMOVAL PROCEDURE

1. Remove the timing belt. Refer to **Timing Belt Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.

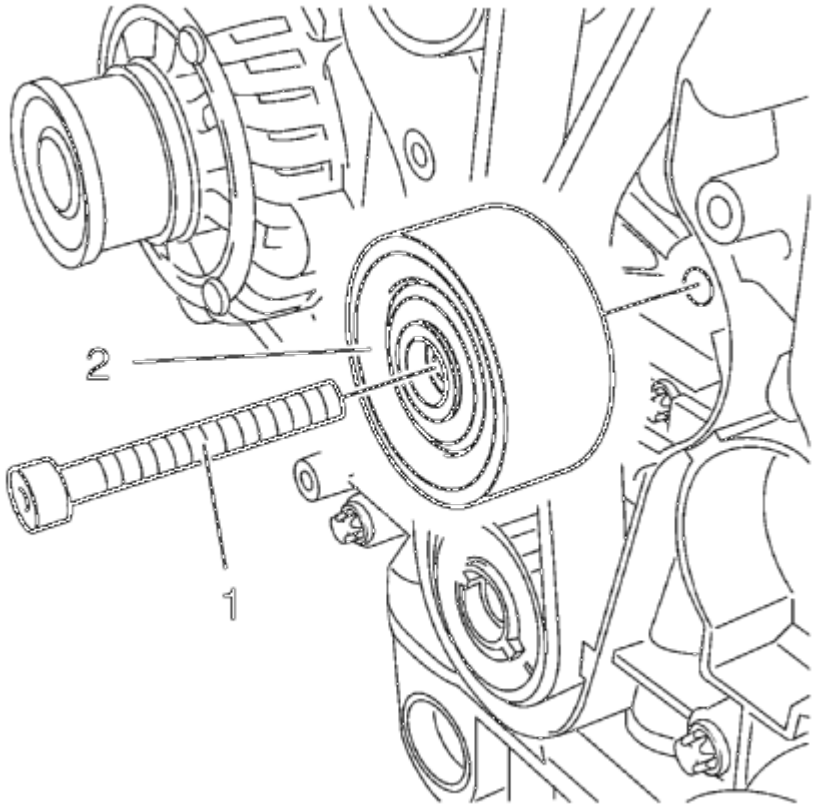

Fig. 61: Timing Belt Idler Pulley
Courtesy of GENERAL MOTORS CORP.

2. Remove the timing belt idler pulley bolt (1).
3. Remove the timing belt idler pulley (2).

INSTALLATION PROCEDURE

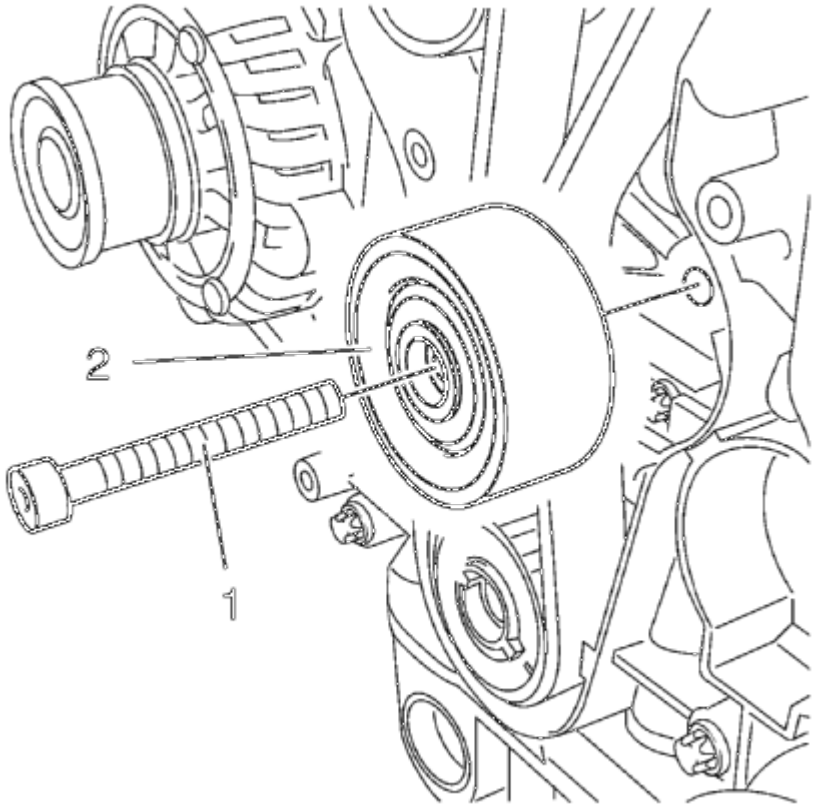

Fig. 62: Timing Belt Idler Pulley
Courtesy of GENERAL MOTORS CORP.

1. Clean the timing belt idler pulley thread.

CAUTION: Refer to Fastener Caution .

NOTE: Use an assembly tool.

2. Install the timing belt idler pulley (2) and the NEW bolt (1) with screw locking compound. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .
3. Tighten the NEW bolt (1) to 25 N.m (18 lb ft).
4. Install the timing belt. Refer to **Timing Belt Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.

TIMING BELT TENSIONER REPLACEMENT (1.6L LDE, LXV, 1.8L 2H0, AND LUW)

Special Tools

- **EN-6333:** Timing Belt Tensioner Locking Pin

- **EN-6340:** Camshaft Locking Tool
- **EN-6625:** Crankshaft Locking Device

For equivalent regional tools, refer to **Special Tools** .

REMOVAL PROCEDURE

1. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement (1.6L LDE, LXV, and 1.8L 2H0)** .
2. Remove the timing belt upper front cover. Refer to **Timing Belt Upper Front Cover Removal (1.6L LDE, LXV, 1.8L 2H0, and LUW)** .
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Remove the front compartment splash shield. Refer to **Front Compartment Splash Shield Replacement** .
5. Remove the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement**.
6. Lower the vehicle.

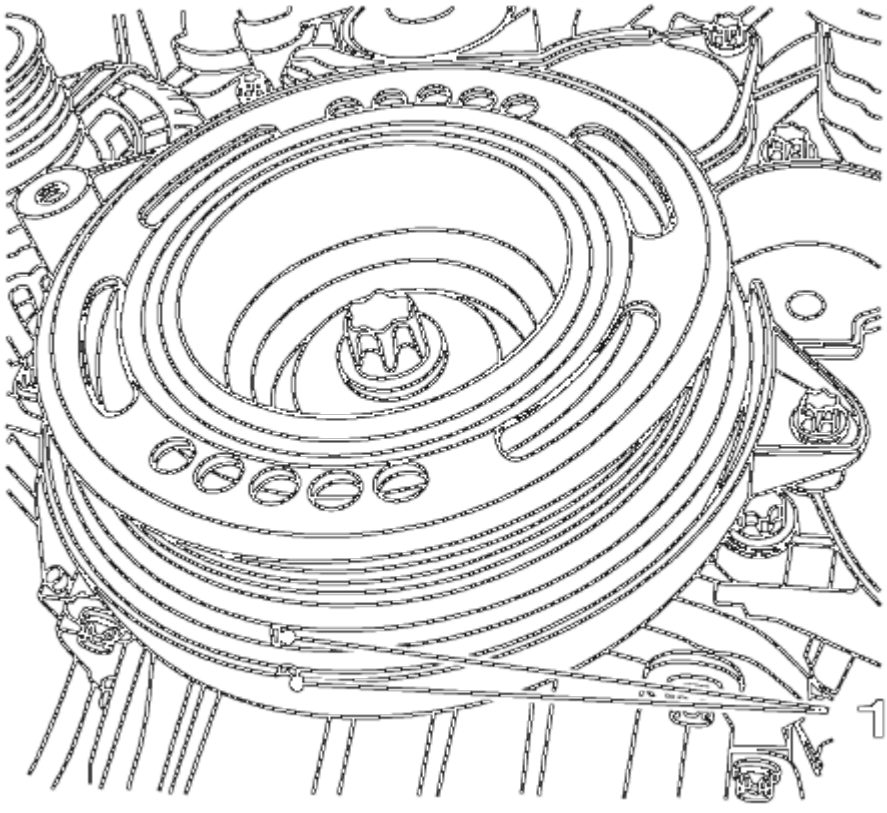

Fig. 63: View Of Crankshaft TDC Position
Courtesy of GENERAL MOTORS CORP.

7. Set crankshaft balancer in direction of engine rotation to cylinder 1 TDC of combustion stroke (1).

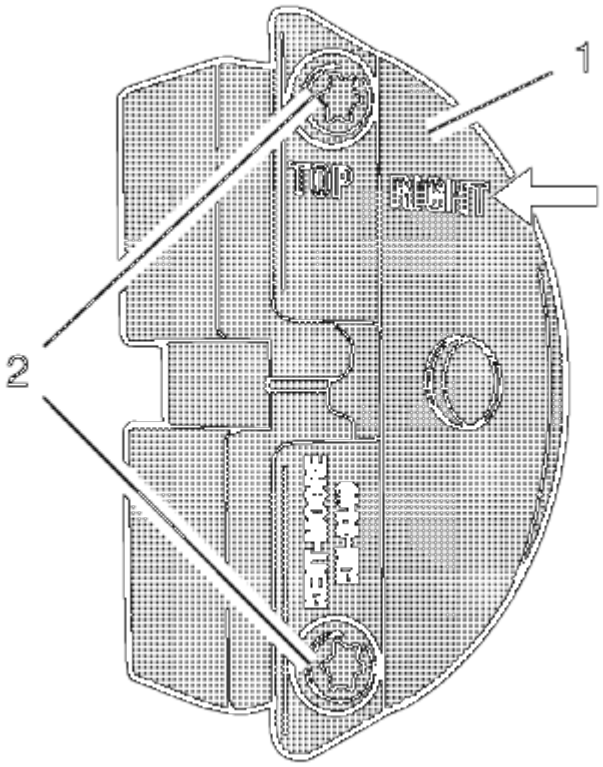

Fig. 64: Front Panel And Bolts
Courtesy of GENERAL MOTORS CORP.

8. Prepare the right half of the **EN-6340:** locking tool.
    1. Remove the 2 bolts (2)
    2. Remove the front panel (1)

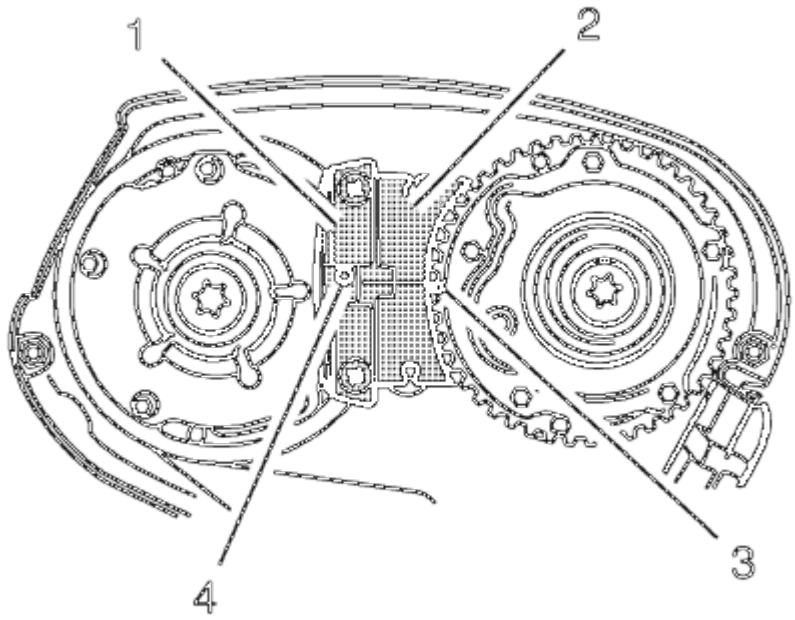

Fig. 65: Spot Type Markings And Special Tool
Courtesy of GENERAL MOTORS CORP.

9. Install the **EN-6340:** locking tool into the camshaft adjusters.

NOTE: The spot type marking (4) on the intake camshaft adjuster does not correspond to the groove of EN-6340-left during this process but must be somewhat above as shown.

- Install the **EN-6340:** locking tool -left (1) in the camshaft adjusters as shown.

NOTE: The spot type marking (3) on the exhaust camshaft adjuster must correspond to the groove on EN-6340-right.

- Install **EN-6340:** locking tool -right (2) in the camshaft adjusters as shown.

10. Remove **EN-6340:** locking tool.
11. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

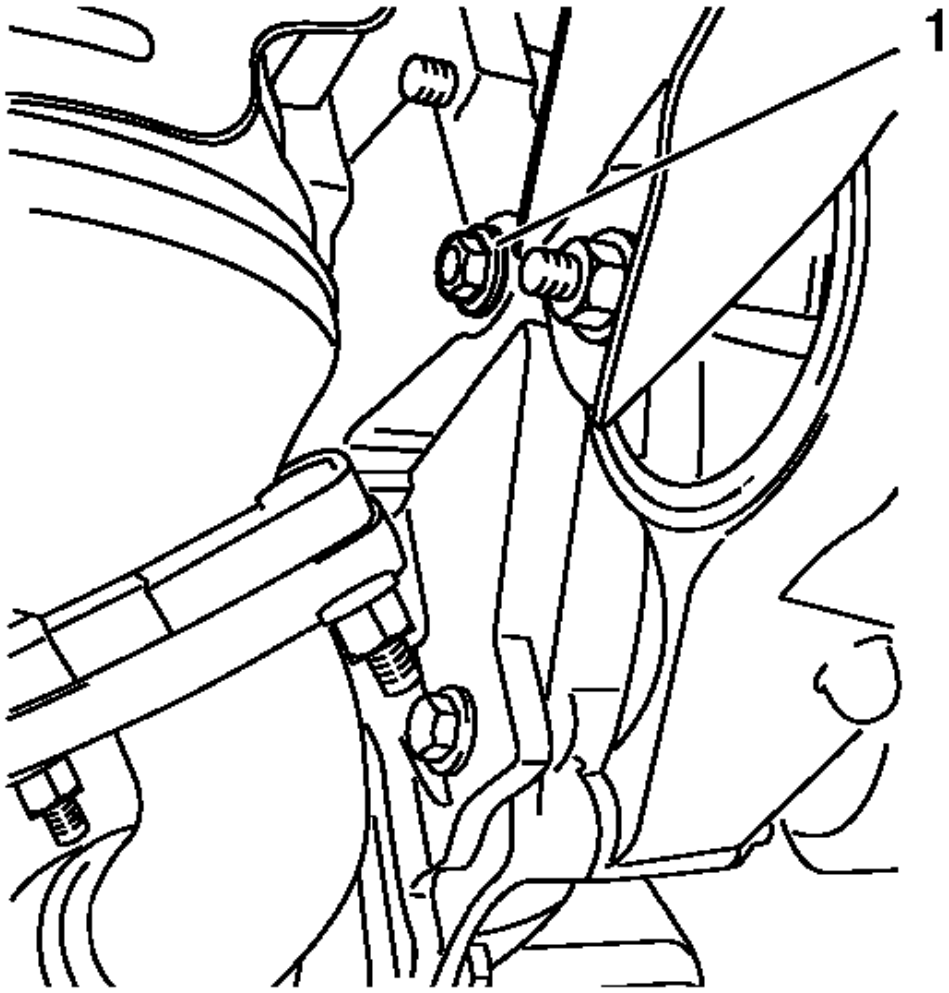

Fig. 66: View Of Bolt
Courtesy of GENERAL MOTORS CORP.

12. Remove the bolt (1).

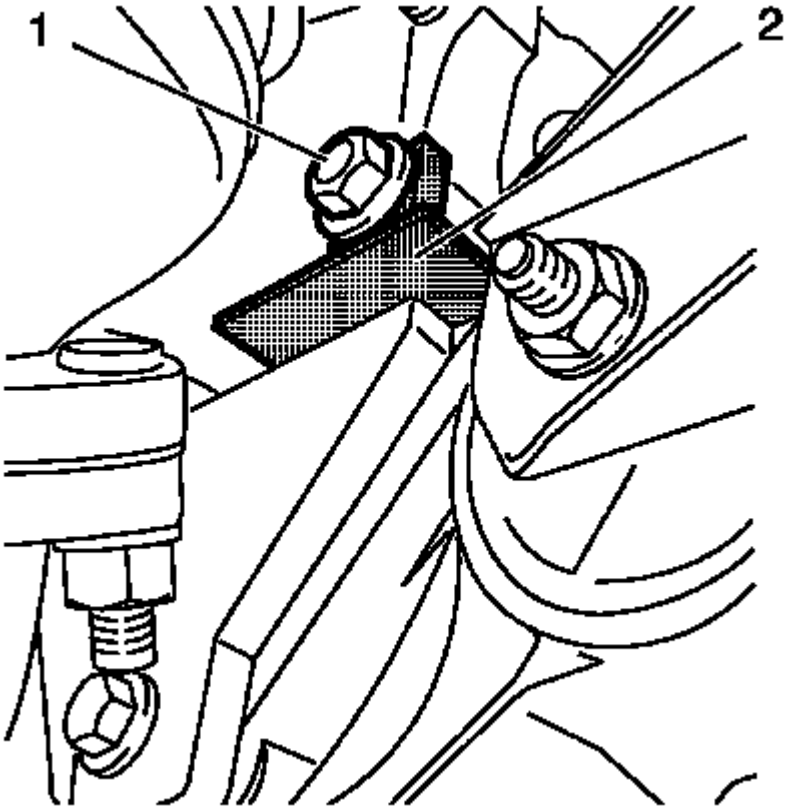

Fig. 67: Locking Device And Bolt
Courtesy of GENERAL MOTORS CORP.

13. Install **EN-6625:** locking device (2) to block the crankshaft.
14. Install the bolt (1).
15. Remove the crankshaft balancer. Refer to **Crankshaft Balancer Removal** .
16. Remove the engine mount bracket. Refer to **Engine Mount Bracket Replacement**.
17. Remove the timing belt center front cover. Refer to **Timing Belt Center Front Cover Removal** .
18. Remove the timing belt lower front cover. Refer to **Timing Belt Lower Front Cover Removal** .

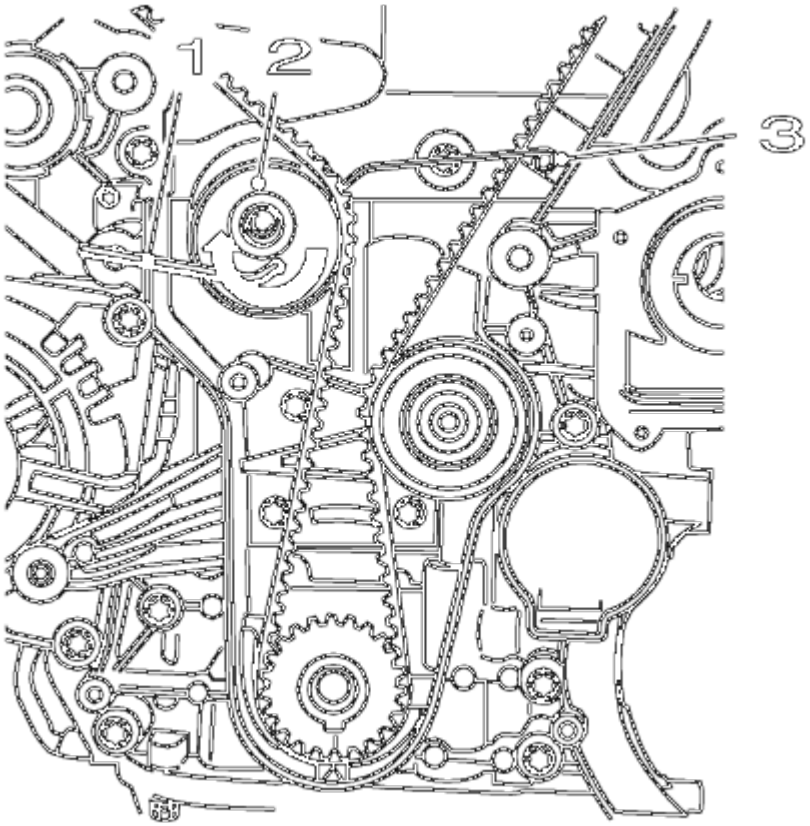

Fig. 68: Timing Belt Tension Roller, Allen Key And Special Tool
Courtesy of GENERAL MOTORS CORP.

19. Loosen the timing belt tensioner bolt.
20. Apply tension to the drive belt tensioner (2) in the direction of the arrow, using an allen key (1).
21. Install the **EN-6333:** locking pin (3).

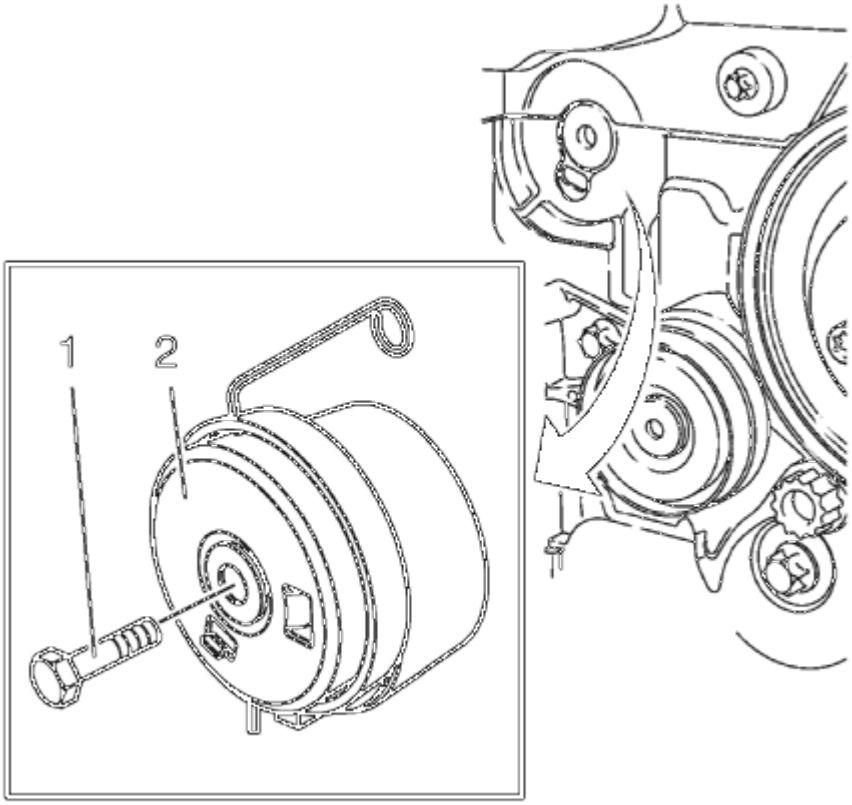

Fig. 69: Timing Belt Tensioner
Courtesy of GENERAL MOTORS CORP.

22. Remove the timing belt tensioner bolt (1) and the timing belt tensioner (2).

INSTALLATION PROCEDURE

1. Clean the timing belt tensioner thread.

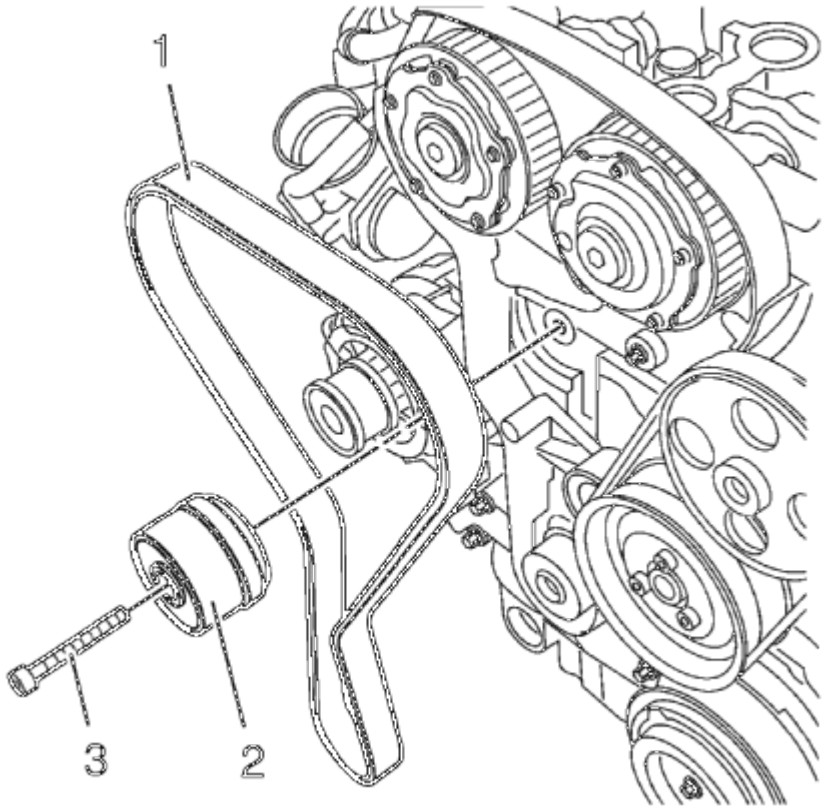

Fig. 70: Timing Belt, Timing Belt Tensioner
Courtesy of GENERAL MOTORS CORP.

2. Install the timing belt tensioner (2).
3. Install the timing belt tensioner bolt (3).

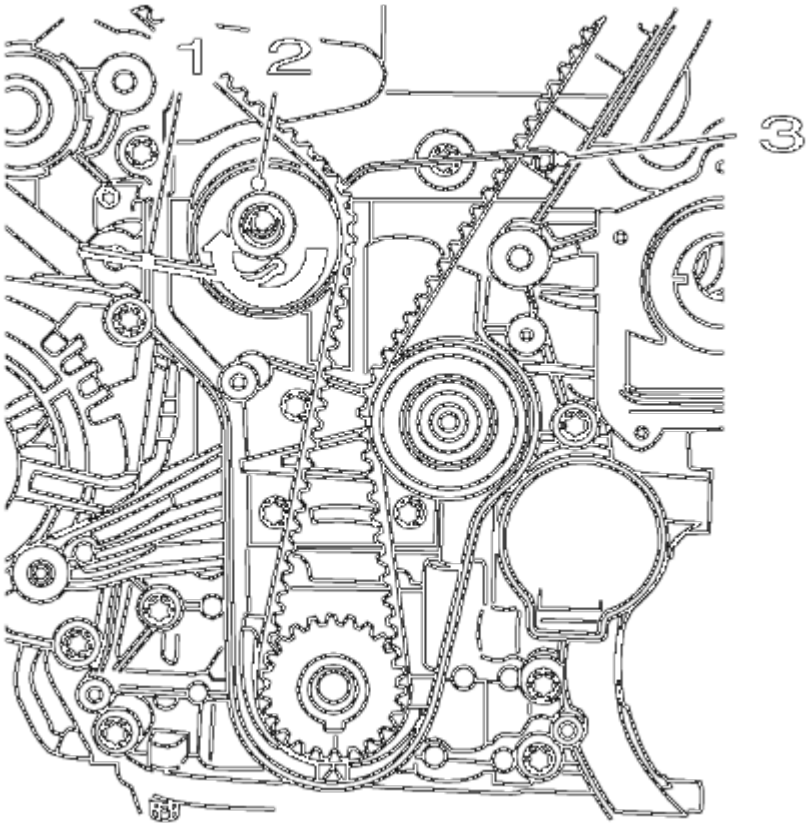

Fig. 71: Timing Belt Tension Roller, Allen Key And Special Tool
Courtesy of GENERAL MOTORS CORP.

4. Apply tension to the drive belt tensioner (2) in the direction of the arrow, using an allen key (1).
5. Remove the **EN-6333:** locking pin (3).

NOTE: The timing belt tensioner moves automatically to the correct position.

6. Release tension on timing belt tensioner.

CAUTION: Refer to Fastener Caution .

7. Tighten the timing belt tensioner bolt to 20 N.m (15 lb ft).
8. Install the timing belt lower front cover. Refer to **Timing Belt Lower Front Cover Installation** .
9. Install the timing belt center front cover. Refer to **Timing Belt Center Front Cover Installation** .
10. Install the engine mount bracket. Refer to **Engine Mount Bracket Replacement**.
11. Install the crankshaft balancer. Refer to **Crankshaft Balancer Installation** .

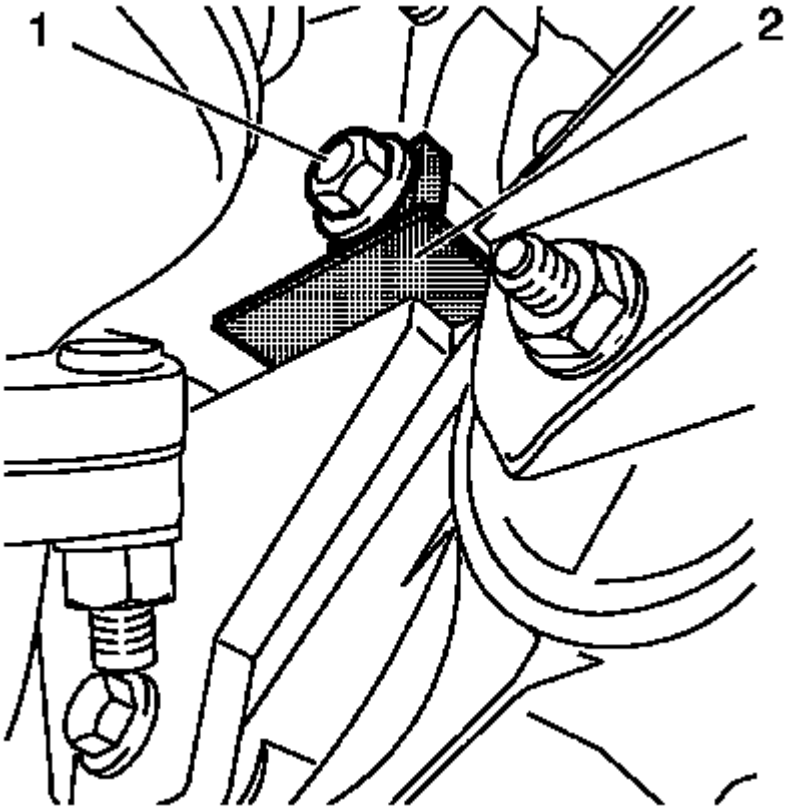

Fig. 72: Locking Device And Bolt
Courtesy of GENERAL MOTORS CORP.

12. Remove bolt (1).
13. Remove **EN-6625:** locking device (2) to block the crankshaft.

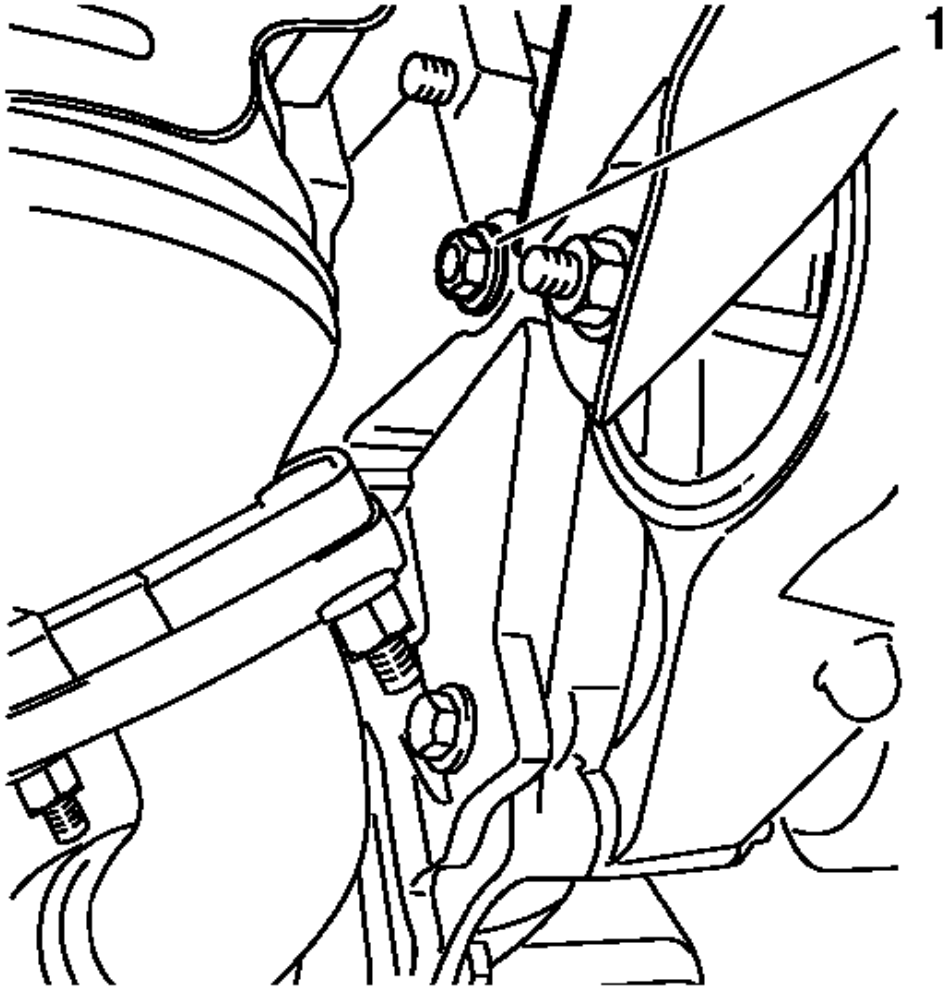

Fig. 73: View Of Bolt
Courtesy of GENERAL MOTORS CORP.

14. Install the bolt (1) and tighten to 75 N.m (55 lb ft).
15. Lower the vehicle.

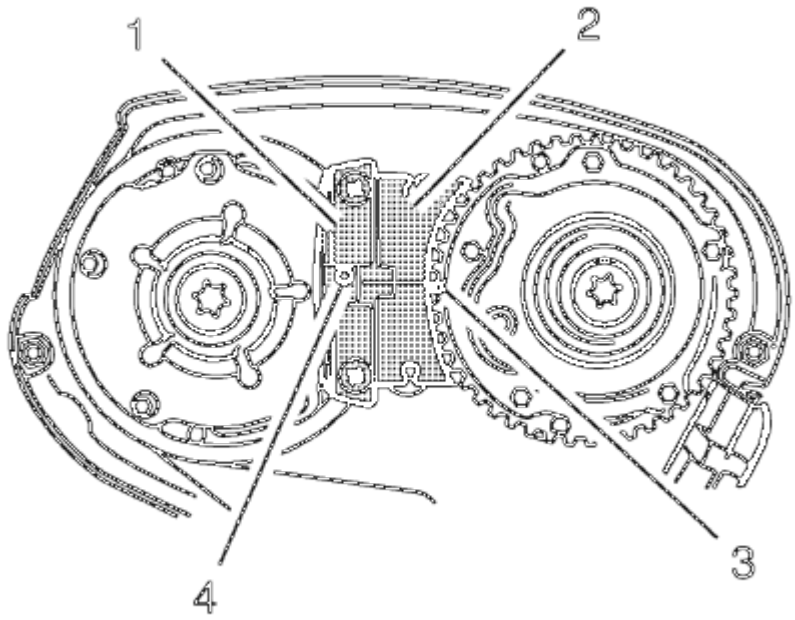

Fig. 74: Spot Type Markings And Special Tool
Courtesy of GENERAL MOTORS CORP.

16. Check the timing

NOTE: Note the marking at the camshaft sprockets.

- Turn the crankshaft 720° in the direction of engine rotation by the bolt on the crankshaft balancer.

NOTE: The spot type marking (4) on the intake camshaft adjuster does not correspond to the groove of EN-6340-left during this process but must be somewhat above as shown.

- Install **EN-6340-left:** locking tool (1) into the camshaft adjusters as shown.

NOTE: The spot type marking (3) on the exhaust camshaft adjuster must correspond to the groove on EN-6340-right.

- Install **EN-6340-right:** locking tool (2) into the camshaft adjusters as shown.
- Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

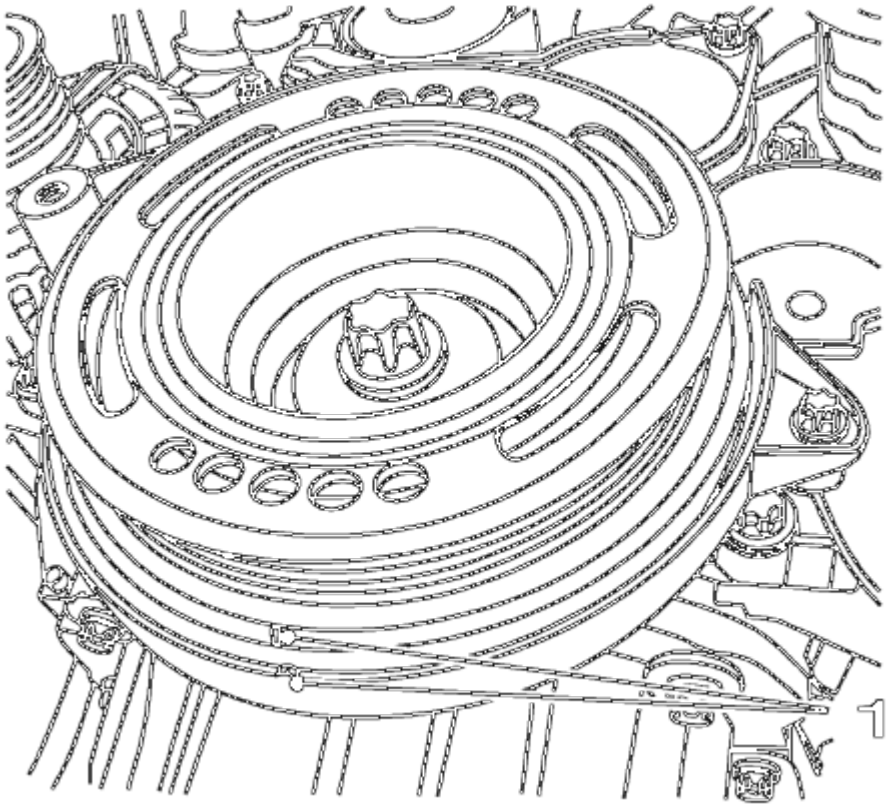

Fig. 75: View Of Crankshaft TDC Position
Courtesy of GENERAL MOTORS CORP.

NOTE: Note the marking at the crankshaft balancer and the cover.

17. Control the crankshaft balancer position.

    Markings on torsional crankshaft balancer (1) and lower cover (1) must align.

18. Install the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement**.
19. Install the front compartment splash shield. Refer to **Front Compartment Splash Shield Replacement** .
20. Lower the vehicle.
21. Remove the **EN-6340:** locking tool.
22. Install the timing belt upper front cover. Refer to **Timing Belt Upper Front Cover Installation (1.6L LDE, LXV, 1.8L 2H0, and LUW)** .
23. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement (1.6L LDE, LXV, and 1.8L 2H0)** .

TIMING BELT CENTER FRONT COVER REPLACEMENT

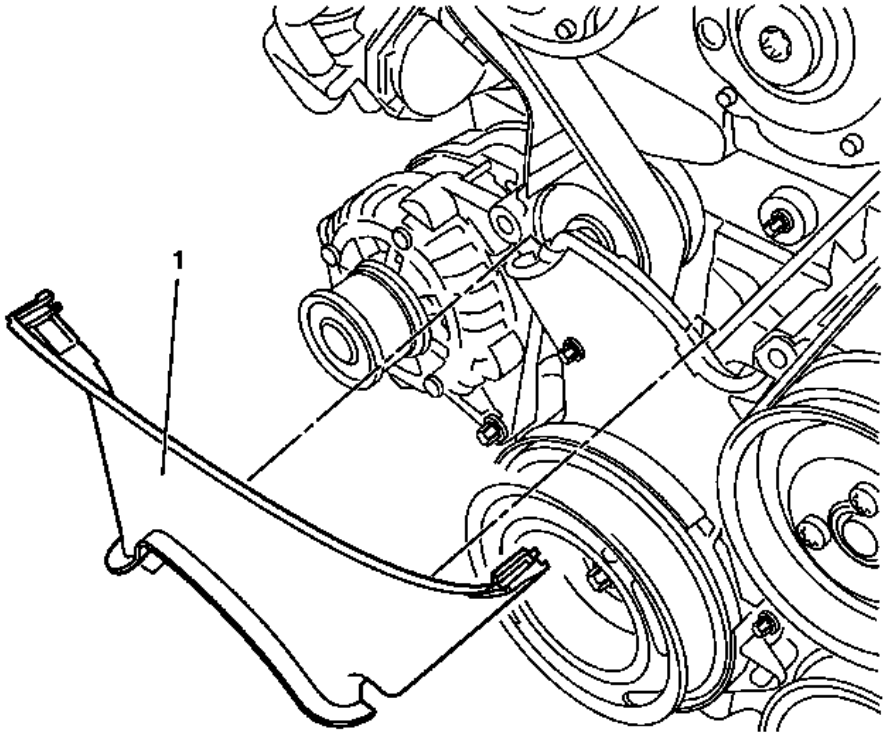

Fig. 76: Timing Belt Center Front Cover
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure 1. Remove the timing belt upper front cover. Refer to **Timing Belt Upper Front Cover Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**. 2. Remove the engine mount bracket. Refer to **Engine Mount Bracket Replacement**.	
1	Timing Belt Center Front Cover

TIMING BELT UPPER FRONT COVER REPLACEMENT (1.6L LDE, LXV, 1.8L 2H0, AND LUW)

REMOVAL PROCEDURE

1. Open the hood.

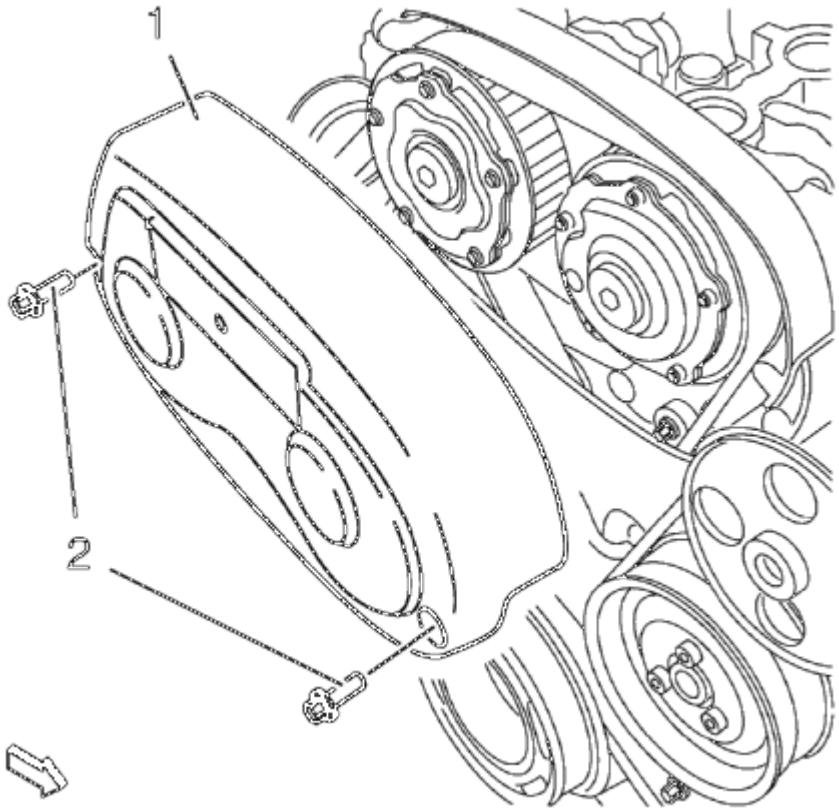

Fig. 77: Timing Belt Upper Front Cover
Courtesy of GENERAL MOTORS CORP.

2. Remove the 2 timing belt upper front cover bolts (2).
3. Remove the timing belt upper front cover (1).

INSTALLATION PROCEDURE

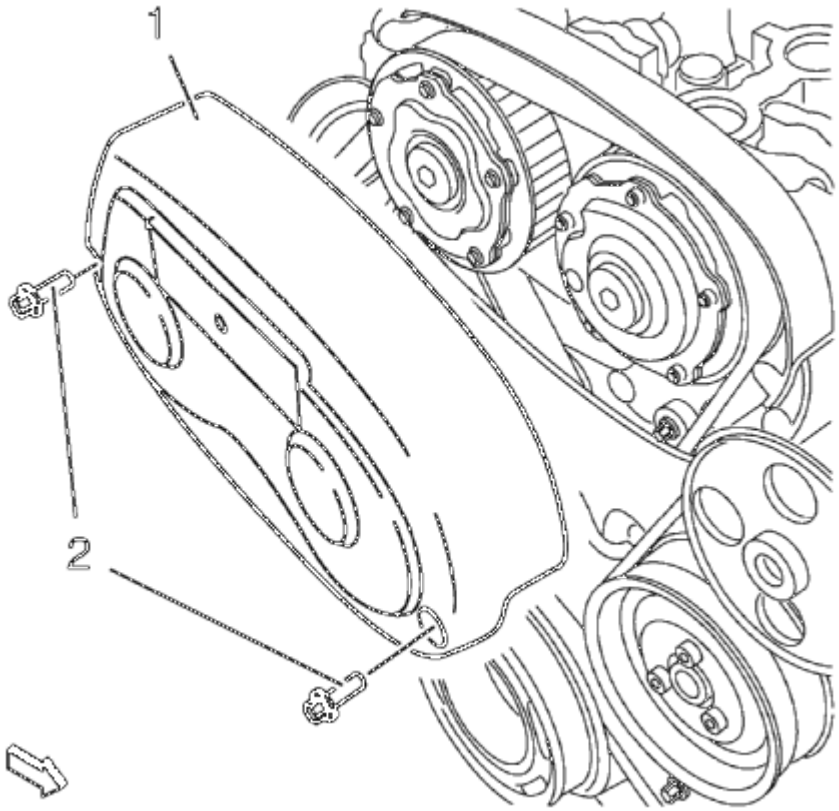

Fig. 78: Timing Belt Upper Front Cover
Courtesy of GENERAL MOTORS CORP.

1. Install the timing belt upper front cover (1).

CAUTION: Refer to Fastener Caution .

2. Install the 2 timing belt upper front cover bolts (2) and tighten to 6 N.m (53 lb in).
3. Close the hood.

TIMING BELT LOWER FRONT COVER REPLACEMENT

Special Tools

- **EN-6625:** Crankshaft Locking Device
- **EN-45059:** Torque Angle Sensor Kit

For equivalent regional tools, refer to **Special Tools** .

REMOVAL PROCEDURE

1. Open the hood.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Remove the front compartment splash shield. Refer to **Front Compartment Splash Shield Replacement** .
4. Remove the generator and air conditioning compressor belt tensioner. Refer to **Drive Belt Tensioner Replacement**.

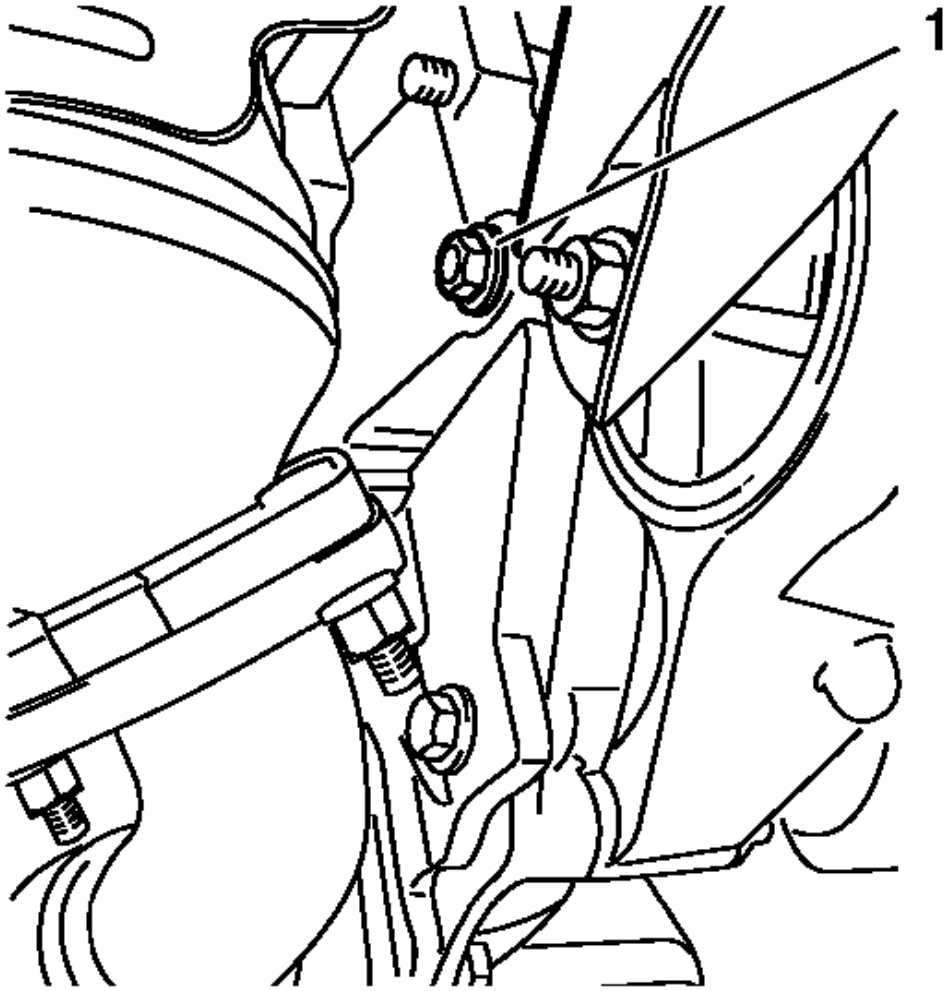

Fig. 79: View Of Bolt
Courtesy of GENERAL MOTORS CORP.

5. Remove the bolt (1).

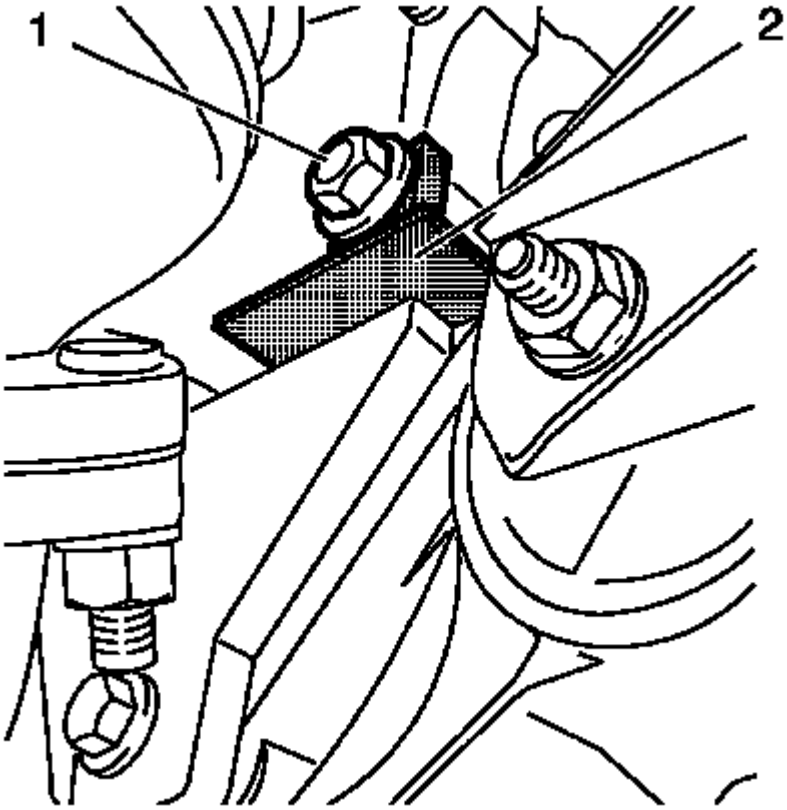

Fig. 80: Locking Device And Bolt
Courtesy of GENERAL MOTORS CORP.

6. Install **EN-6625:** locking device (2) to block the crankshaft.
7. Install the bolt (1).

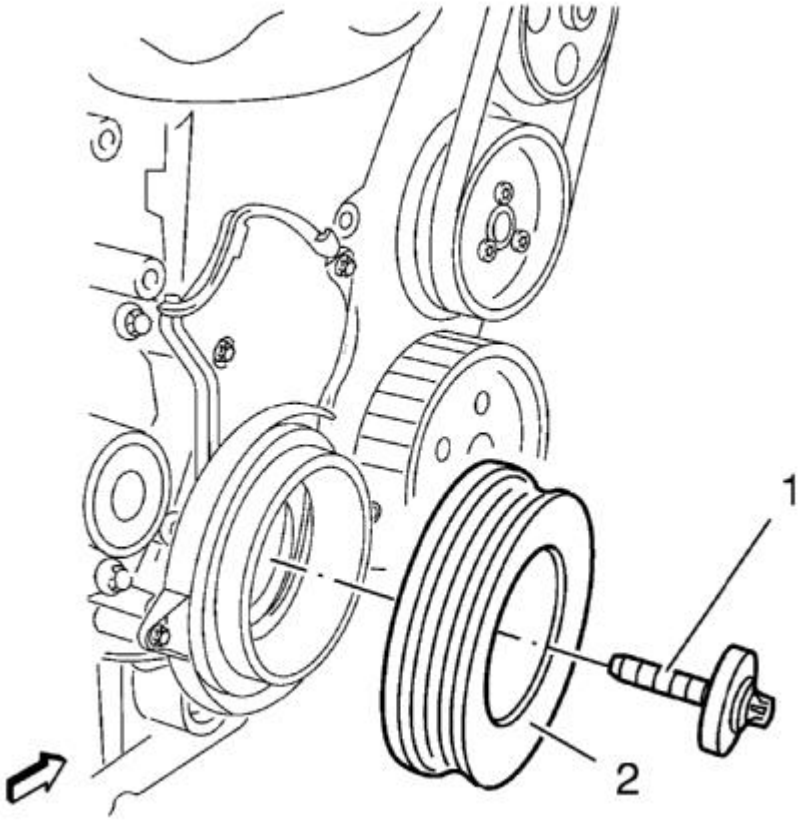

Fig. 81: Crankshaft Balancer And Bolt
Courtesy of GENERAL MOTORS CORP.

8. Remove the crankshaft balancer bolt (1).
9. Remove the crankshaft balancer (2).

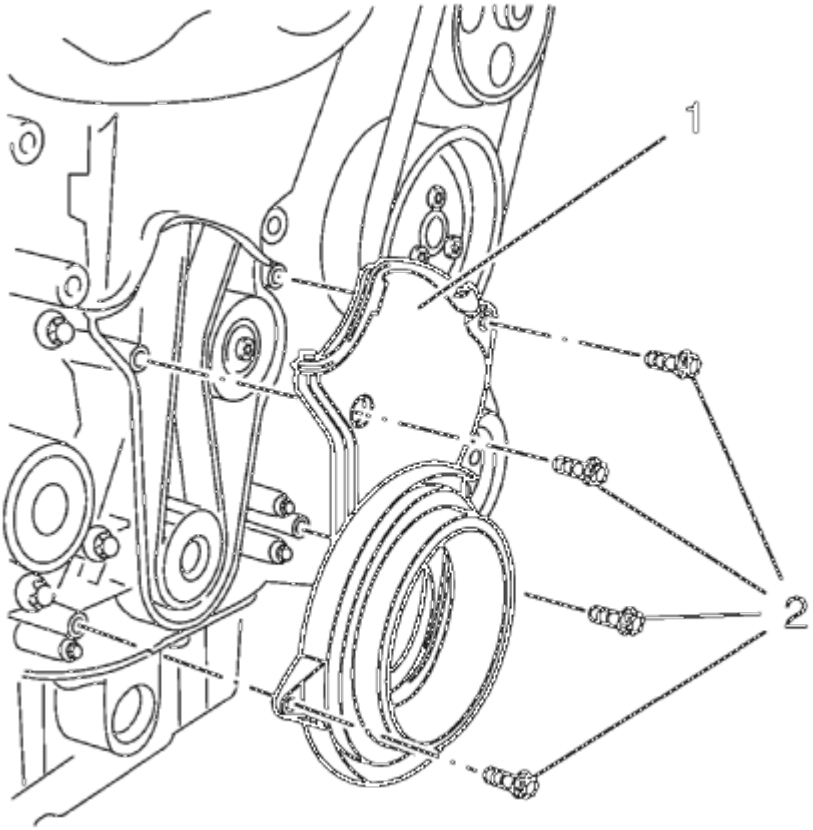

Fig. 82: Timing Belt Lower Front Cover
Courtesy of GENERAL MOTORS CORP.

10. Remove the 4 lower timing belt cover bolts (2).
11. Remove the lower timing belt cover (1).

INSTALLATION PROCEDURE

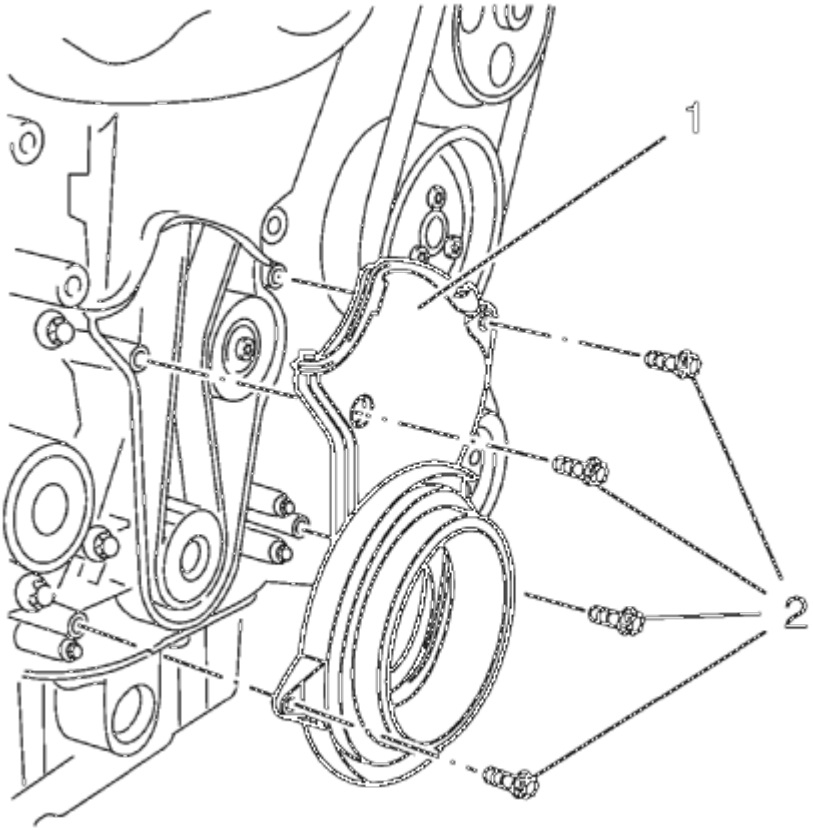

Fig. 83: Timing Belt Lower Front Cover
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

1. Install the lower timing belt cover (1).
2. Install the 4 lower timing belt cover bolts (2) and tighten to 6 N.m (53 lb in).

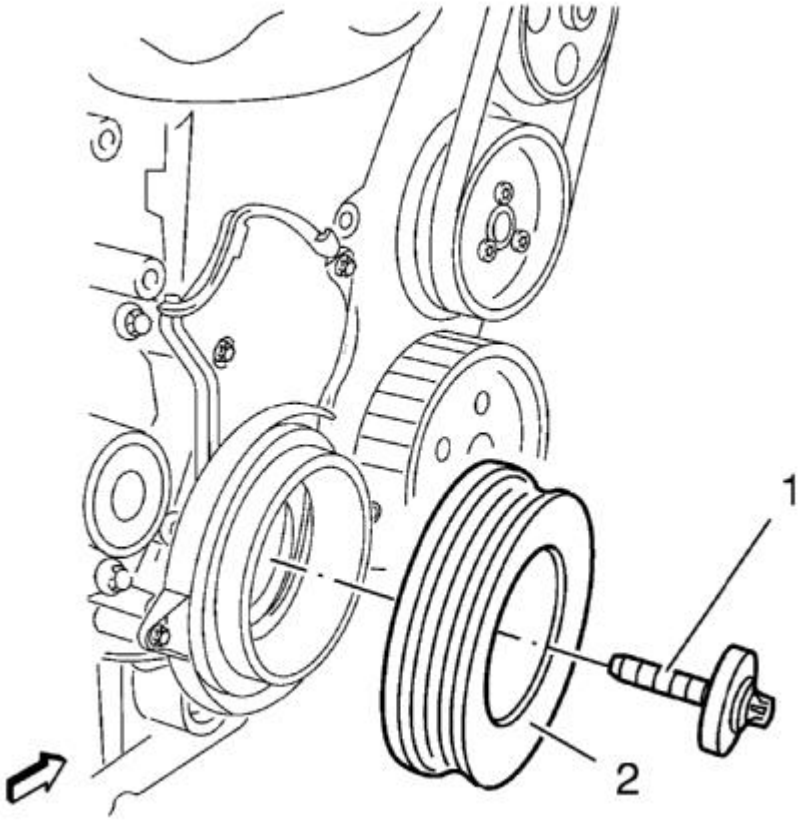

Fig. 84: Crankshaft Balancer And Bolt
Courtesy of GENERAL MOTORS CORP.

3. Install the crankshaft balancer (2).
4. Install a NEW crankshaft balancer bolt (1) and tighten in 3 passes using the **EN-45059:** sensor kit :
    1. First pass to 95 N.m (70 lb ft).
    2. Second pass to 45°.
    3. Third pass to 15°.

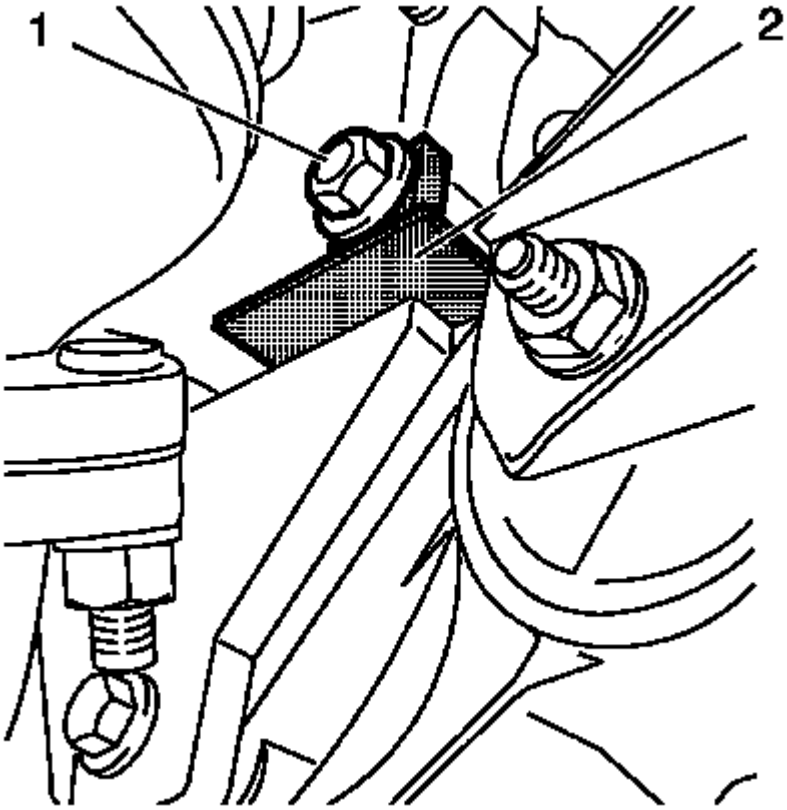

Fig. 85: Locking Device And Bolt
Courtesy of GENERAL MOTORS CORP.

5. Remove the bolt and the nut (1).
6. Remove **EN-6625:** locking device (2) to block the crankshaft.

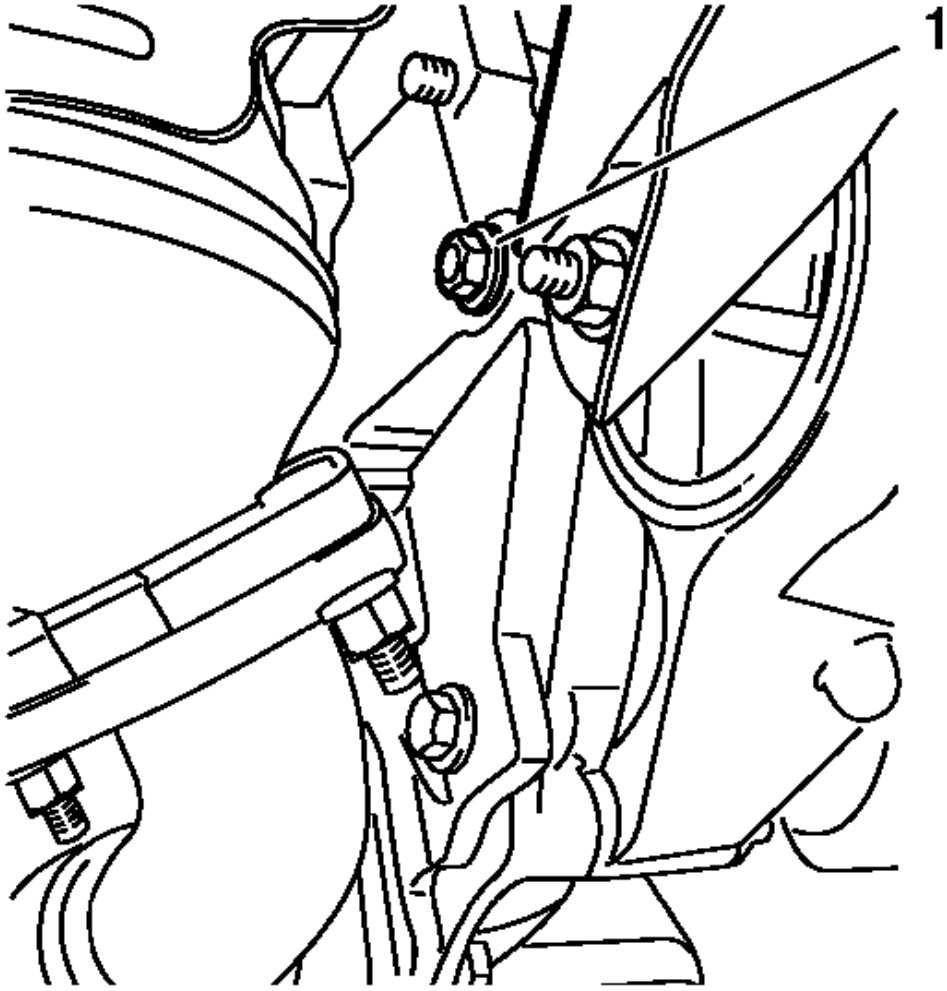

Fig. 86: View Of Bolt
Courtesy of GENERAL MOTORS CORP.

7. Install and tighten bolt (1) to 75 N.m (55 lb ft).
8. Install the generator and air conditioning compressor belt tensioner. Refer to **Drive Belt Tensioner Replacement**.
9. Install the front compartment splash shield. Refer to **Front Compartment Splash Shield Replacement** .
10. Lower the vehicle.
11. Close the hood.

TIMING BELT REAR COVER REPLACEMENT (1.6L LDE, LXV, 1.8L 2H0, AND LUW)

REMOVAL PROCEDURE

1. Remove the camshaft position actuator adjuster. Refer to **Camshaft Position Actuator Adjuster**

Replacement.

2. Remove the timing belt tensioner. Refer to **Timing Belt Tensioner Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.

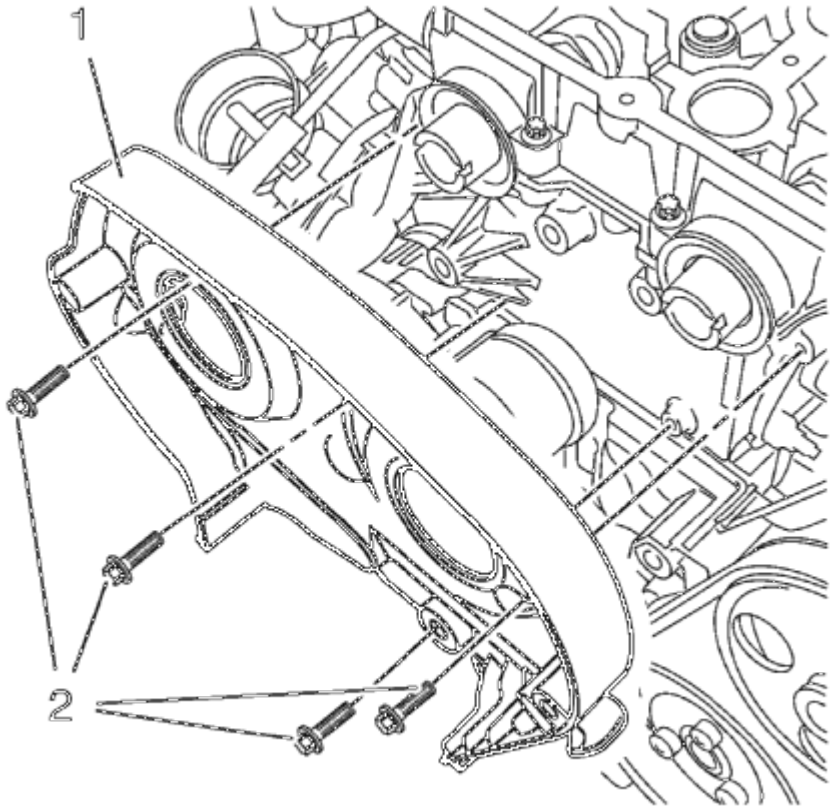

Fig. 87: Timing Belt Rear Cover
Courtesy of GENERAL MOTORS CORP.

3. Remove the 4 timing belt rear cover bolts (2).

NOTE: Oil can escape. Use a cloth, rag or paper to take the oil drain away from all timing components.

4. Remove the timing belt rear cover (1).

INSTALLATION PROCEDURE

1. Clean the 4 timing belt rear cover threads.
2. Apply locking compound to the 4 NEW timing belt rear cover bolts.

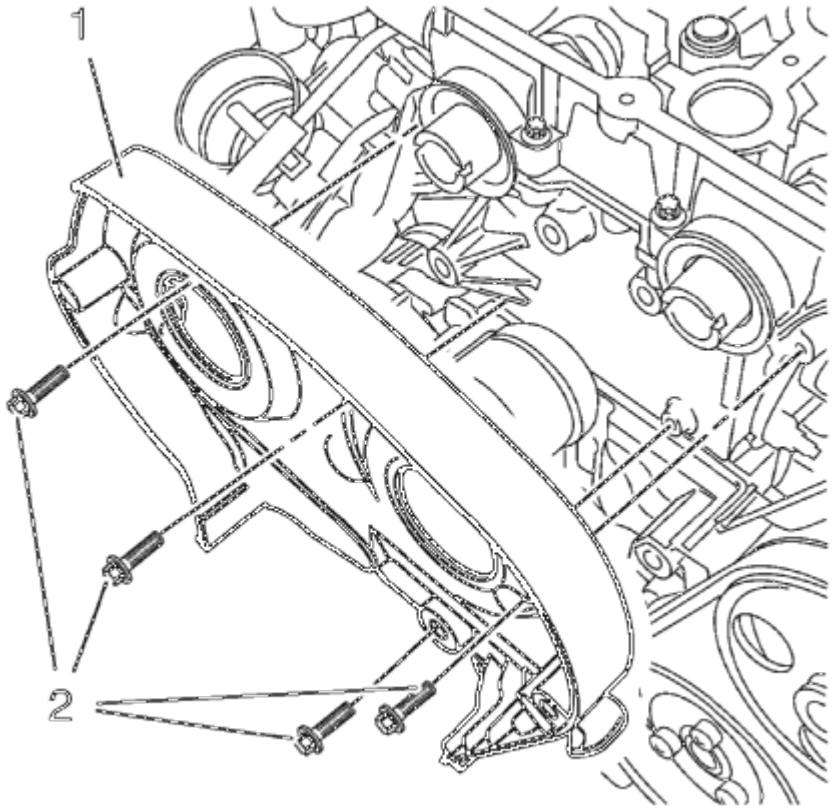

Fig. 88: Timing Belt Rear Cover
Courtesy of GENERAL MOTORS CORP.

NOTE: If the cover is contaminated with oil. You have to clean it close.

3. Install the timing belt rear cover (1).

CAUTION: Refer to Fastener Caution .

4. Install the 4 timing belt rear cover bolts (2) and tighten to 6 N.m (53 lb in).
5. Install the timing belt tensioner. Refer to **Timing Belt Tensioner Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.
6. Install the camshaft position actuator adjuster. Refer to **Camshaft Position Actuator Adjuster Replacement**.

VALVE LIFTER REPLACEMENT

SPECIAL TOOLS

EN-845: Suction Device

For equivalent regional tools, refer to **Special Tools** .

REMOVAL PROCEDURE

1. Remove the camshaft. Refer to **Camshaft Replacement**.

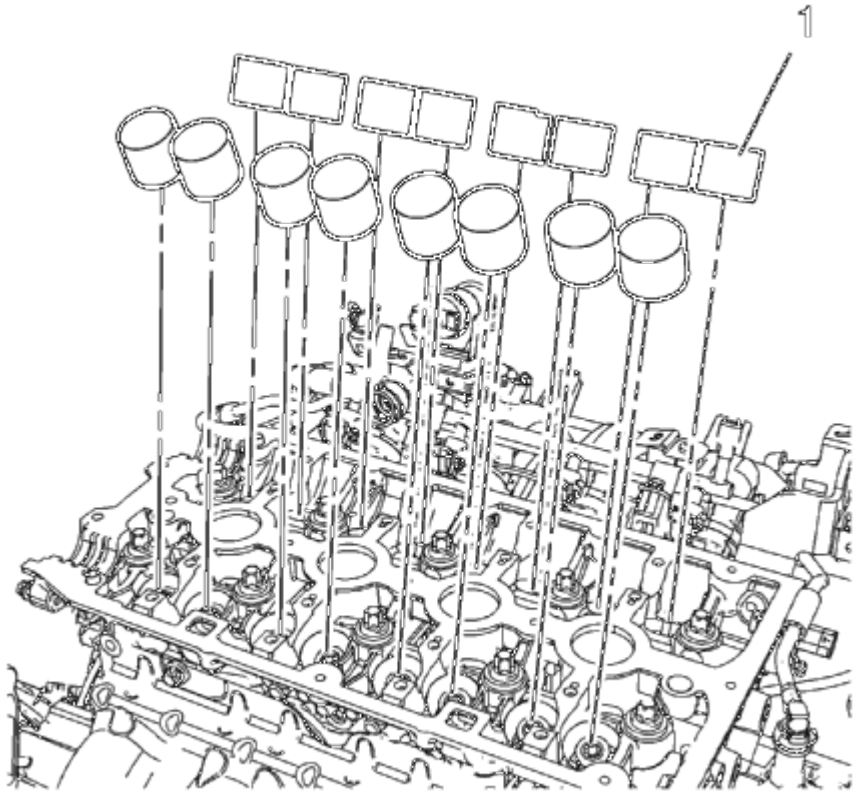

Fig. 89: Valve Lifters
Courtesy of GENERAL MOTORS CORP.

NOTE: Mark the assignments.

2. Remove the 16 valve lifter (1) use the **EN-845:** suction device.

INSTALLATION PROCEDURE

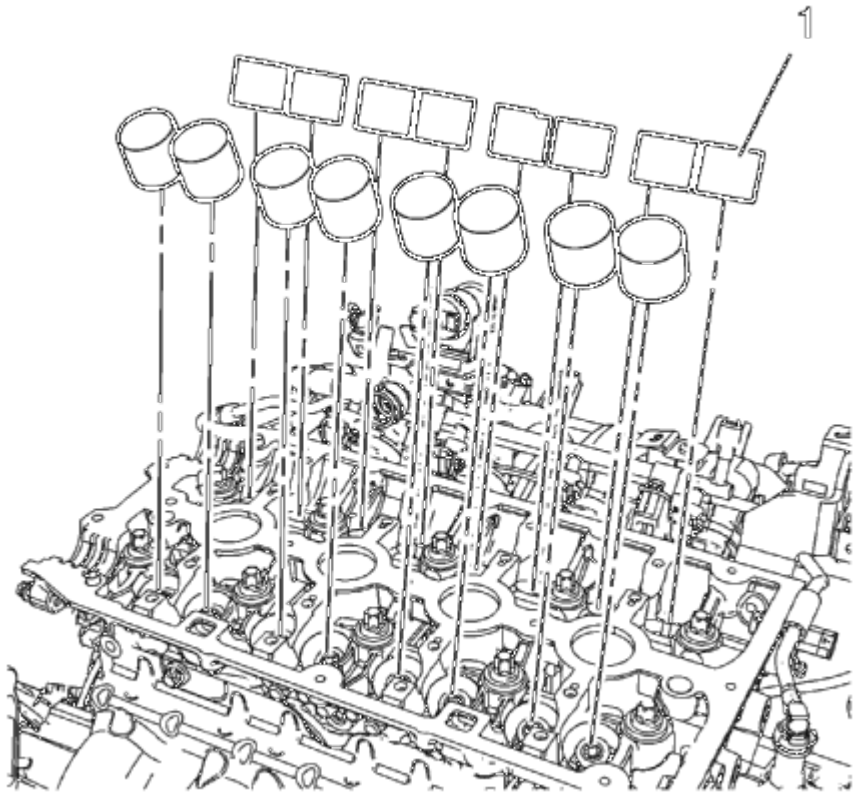

Fig. 90: Valve Lifters
Courtesy of GENERAL MOTORS CORP.

NOTE: Observe the correct assignment.

NOTE: Coat the sliding surfaces with NEW engine oil.

1. Install the 16 valve lifter (1) use the **EN-845:** suction device.
2. Install the camshaft. Refer to **Camshaft Replacement**.

CYLINDER HEAD REPLACEMENT (1.6L LDE, LXV, AND 1.8L 2H0,LUW)

REMOVAL PROCEDURE

1. Remove the intake manifold. Refer to **Intake Manifold Replacement**.
2. Remove the exhaust manifold. Refer to **Exhaust Manifold Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)** .
3. Remove the timing belt tensioner. Refer to **Timing Belt Tensioner Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.
4. Remove the camshaft cover. Refer to **Camshaft Cover Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.

5. Remove the 2 camshaft position sensor. Refer to **Camshaft Position Sensor Replacement (1.6L LDE, LXV, and 1.8L 2H0)** .
6. Remove the 2 camshaft position actuator solenoid valve. Refer to **Camshaft Position Actuator Solenoid Valve Replacement**.
7. Remove the 2 camshaft position actuator adjuster. Refer to **Camshaft Position Actuator Adjuster Removal** .
8. Remove the timing belt rear cover. Refer to **Timing Belt Rear Cover Removal** .
9. Remove engine coolant thermostat housing. Refer to **Engine Coolant Thermostat Replacement (1.6L LDE, LXV, LLU, 1.8L 2H0, and LUW)** .
10. Remove the cylinder head. Refer to **Cylinder Head Removal** .

INSTALLATION PROCEDURE

1. Install the cylinder head. Refer to **Cylinder Head Installation** .
2. Install engine coolant thermostat housing. Refer to **Engine Coolant Thermostat Replacement (1.6L LDE, LXV, LLU, 1.8L 2H0, and LUW)** .
3. Install the timing belt rear cover. Refer to **Timing Belt Rear Cover Installation** .
4. Install the camshaft position actuator adjuster. Refer to **Camshaft Position Actuator Adjuster Installation** .
5. Install the camshaft position actuator solenoid valve. Refer to **Camshaft Position Actuator Solenoid Valve Replacement**.
6. Install the 2 camshaft position sensor. Refer to **Camshaft Position Sensor Replacement (1.6L LDE, LXV, and 1.8L 2H0)** .
7. Install the camshaft cover. Refer to **Camshaft Cover Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.
8. Install the timing belt tensioner. Refer to **Timing Belt Tensioner Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.
9. Install the exhaust manifold. Refer to **Exhaust Manifold Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)** .
10. Install the intake manifold. Refer to **Intake Manifold Replacement**.
11. Fill the cooling system. Refer to **Cooling System Draining and Filling (Static Fill)** or **Cooling System Draining and Filling (GE-47716 Fill)** .
12. Check and correct the engine oil.

OIL PAN REPLACEMENT

REMOVAL PROCEDURE

1. Open the hood.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Place collecting basin underneath.
4. Remove the oil drain bolt.

5. Collect the engine oil.

CAUTION: Refer to Fastener Caution .

6. Install the NEW seal ring and the oil drain bolt, tighten to 14 N.m (124 lb in).
7. Lower the vehicle.
8. Remove the oil level indicator tube. Refer to **Oil Level Indicator Tube Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.
9. Raise the vehicle.
10. Remove the front compartment splash shield. Refer to **Front Compartment Splash Shield Replacement** .
11. Remove the engine oil heater. Refer to **Engine Oil Heater Replacement**.
12. Remove the exhaust front pipe. Refer to **Exhaust Front Pipe Replacement** .

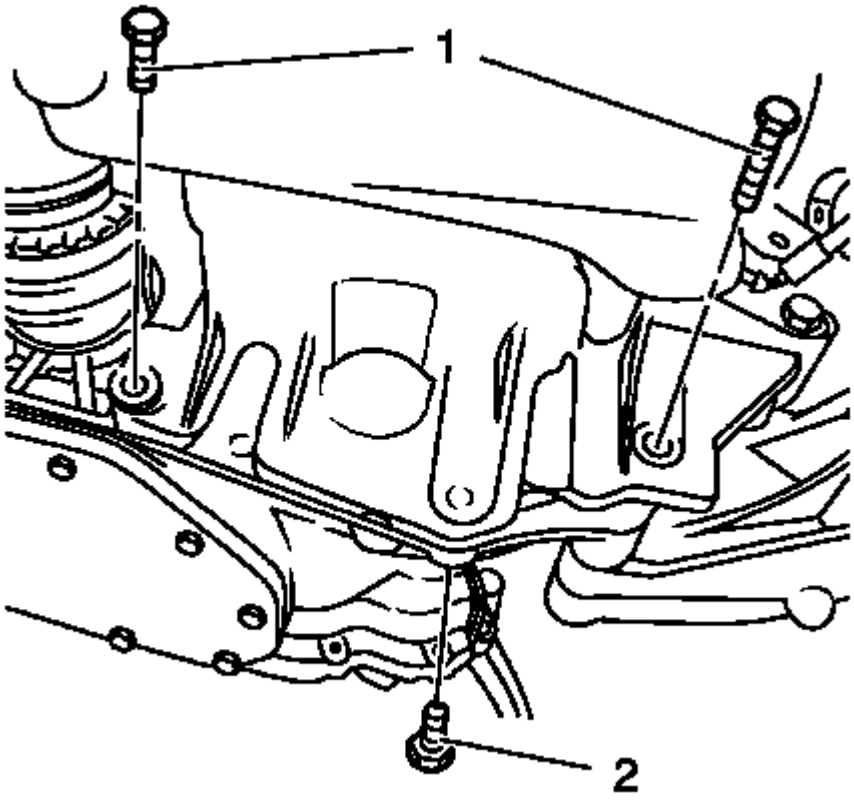

Fig. 91: Engine Oil Pan Bolts
Courtesy of GENERAL MOTORS CORP.

13. Remove the 3 oil pan bolts (1, 2) from the transmission.

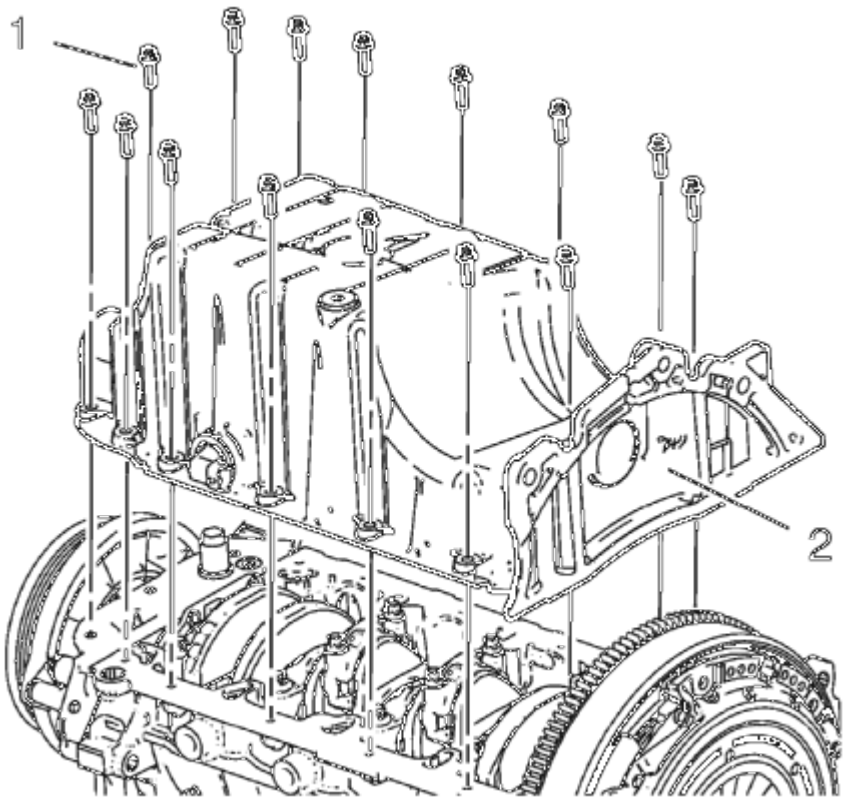

Fig. 92: Oil Pan And Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Remove the oil pan evenly all the way around with a suitable tool.

14. Remove the 15 oil pan bolts (1) and remove the oil pan (2).

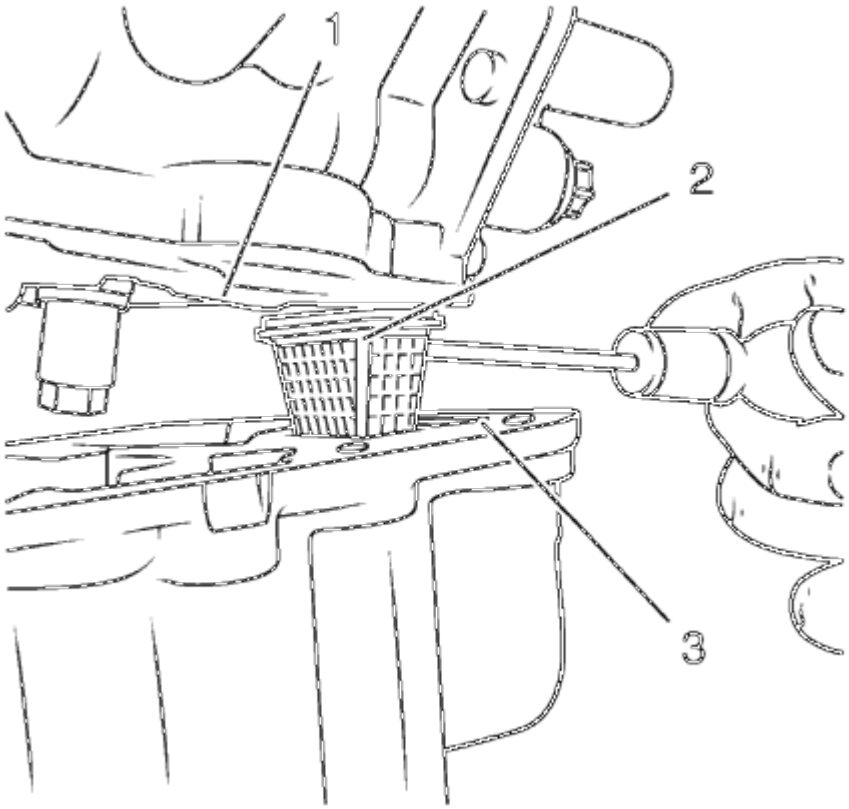

Fig. 93: Cylinder Block, Engine Oil Pan And Oil Screen
Courtesy of GENERAL MOTORS CORP.

NOTE: Use a screwdriver or another suitable tool.

15. To prevent damage to the oil screen, ensure that the oil screen (2) remains in the oil pan (3). If the oil screen gets caught on the cylinder block (1), push it into the oil pan.
16. Remove the oil pan.

INSTALLATION PROCEDURE

1. Clean the sealing surfaces.

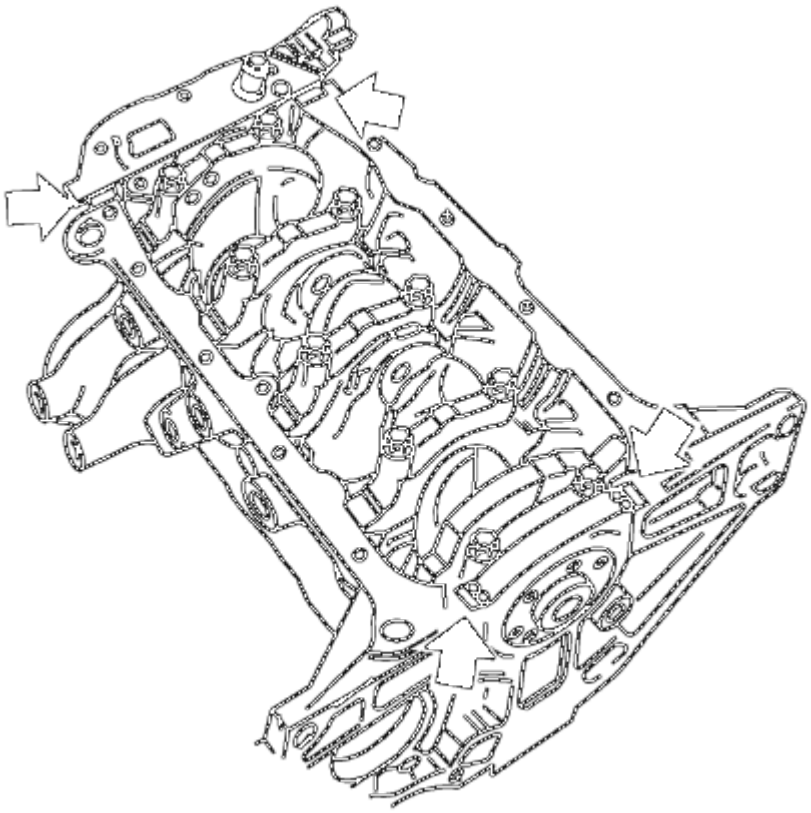

Fig. 94: View Of Joints For Sealant
Courtesy of GENERAL MOTORS CORP.

2. Apply an approximately 3.5 mm (0.14 in) thick bead of oil pan sealant to the joints (arrows).

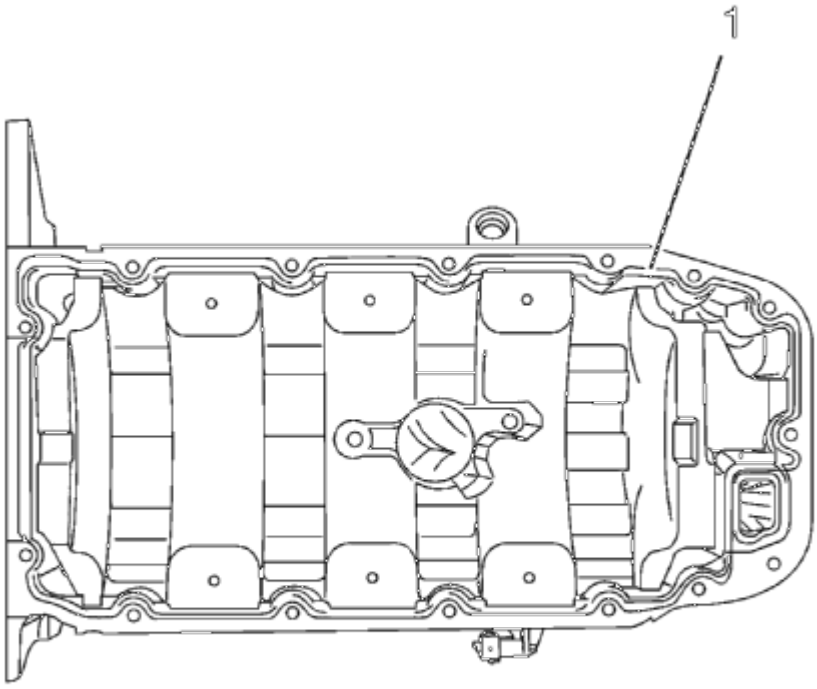

Fig. 95: Sealant Application Area
Courtesy of GENERAL MOTORS CORP.

NOTE: The assembly time including torque check must take no longer than 10 minutes.

3. Apply an approximately 3.5 mm (0.14 in) thick bead of oil pan sealant (1) as illustrated.

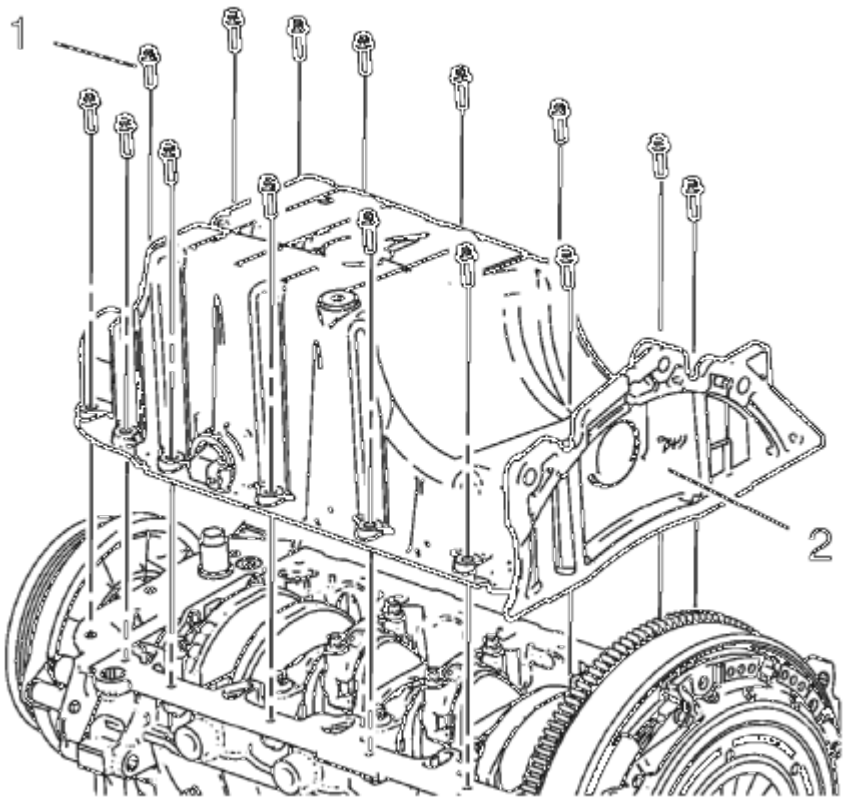

Fig. 96: Oil Pan And Bolts
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

4. Install the 15 oil pan bolts (1) to the oil pan (2) and tighten to 10 N.m (89 lb in).

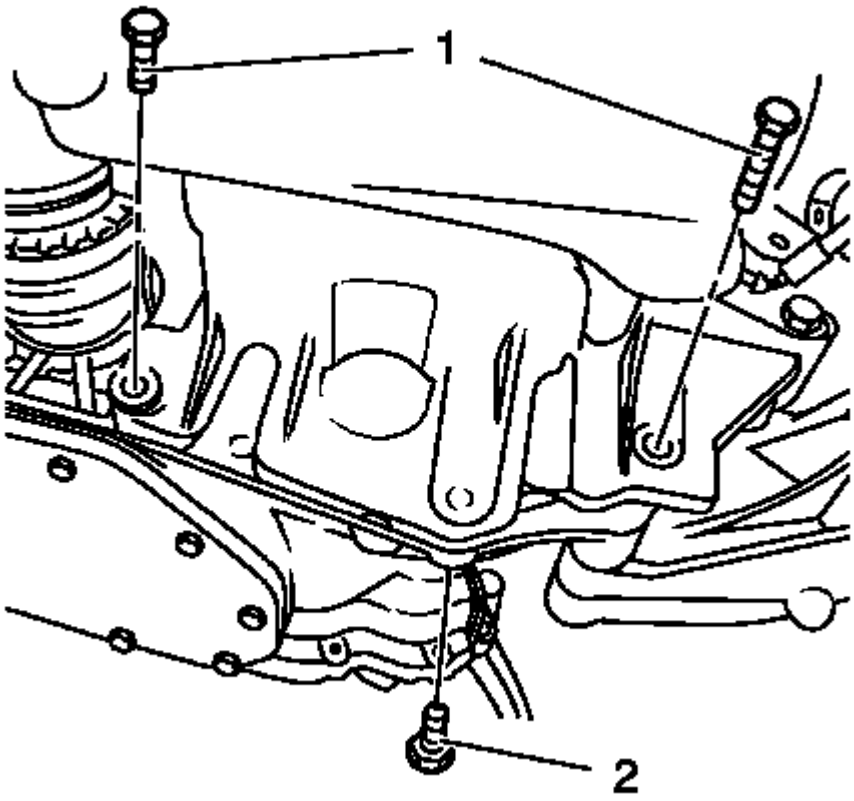

Fig. 97: Engine Oil Pan Bolts
Courtesy of GENERAL MOTORS CORP.

5. Install the 3 oil pan bolts (1, 2) to the transmission and tighten to 40 N.m (30 lb ft).
6. Install the exhaust front pipe. Refer to **Exhaust Front Pipe Replacement** .
7. Install the engine oil heater. Refer to **Engine Oil Heater Replacement**.
8. Install the front compartment splash shield. Refer to **Front Compartment Splash Shield Replacement** .
9. Lower the vehicle.
10. Install the oil level indicator tube. Refer to **Oil Level Indicator Tube Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.

NOTE: Inspect the engine oil level and correct if necessary.

11. Refill the collected engine oil.
12. Close the hood.

AUTOMATIC TRANSMISSION FLEX PLATE REPLACEMENT (1.6L LDE, LXV, 1.8L 2H0, AND LUW)

REMOVAL PROCEDURE

1. Remove the automatic transmission. Refer to **Transmission Replacement** .
2. Remove the automatic transmission flex plate. Refer to **Automatic Transmission Flex Plate Removal (1.6L LDE, LXV, 1.8L 2H0, and LUW)** .

INSTALLATION PROCEDURE

1. Install the automatic transmission flex plate. Refer to **Automatic Transmission Flex Plate Installation (1.6L LDE, LXV, 1.8L 2H0, and LUW)** .
2. Install the automatic transmission. Refer to **Transmission Replacement** .

ENGINE FLYWHEEL REPLACEMENT

REMOVAL PROCEDURE

1. Remove the manual transmission. Refer to **Transmission Replacement** .
2. Remove the clutch pressure and driven plate. Refer to **Clutch Pressure and Driven Plate Replacement (LUJ, LUW with MF3, MZ0, or MZ4)** .
3. Remove the engine flywheel. Refer to **Engine Flywheel Removal (1.6L LDE, LXV, 1.8L 2H0, and LUW)** .

INSTALLATION PROCEDURE

1. Install the engine flywheel. Refer to **Engine Flywheel Installation (1.6L LDE, LXV, 1.8L 2H0, and LUW)**
2. Install the clutch pressure and driven plate. Refer to **Clutch Pressure and Driven Plate Replacement (LUJ, LUW with MF3, MZ0, or MZ4)** .
3. Install the manual transmission. Refer to **Transmission Replacement** .

CRANKSHAFT BALANCER REPLACEMENT

Special Tools

- **EN-6625:** Crankshaft Locking Device
- **EN-45059:** Torque Angle Sensor Kit

For equivalent regional tools, refer to **Special Tools** .

REMOVAL PROCEDURE

1. Open the hood.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Remove the front compartment splash shield. Refer to **Front Compartment Splash Shield Replacement** .
4. Remove the drive belt. Refer to **Drive Belt Replacement**.

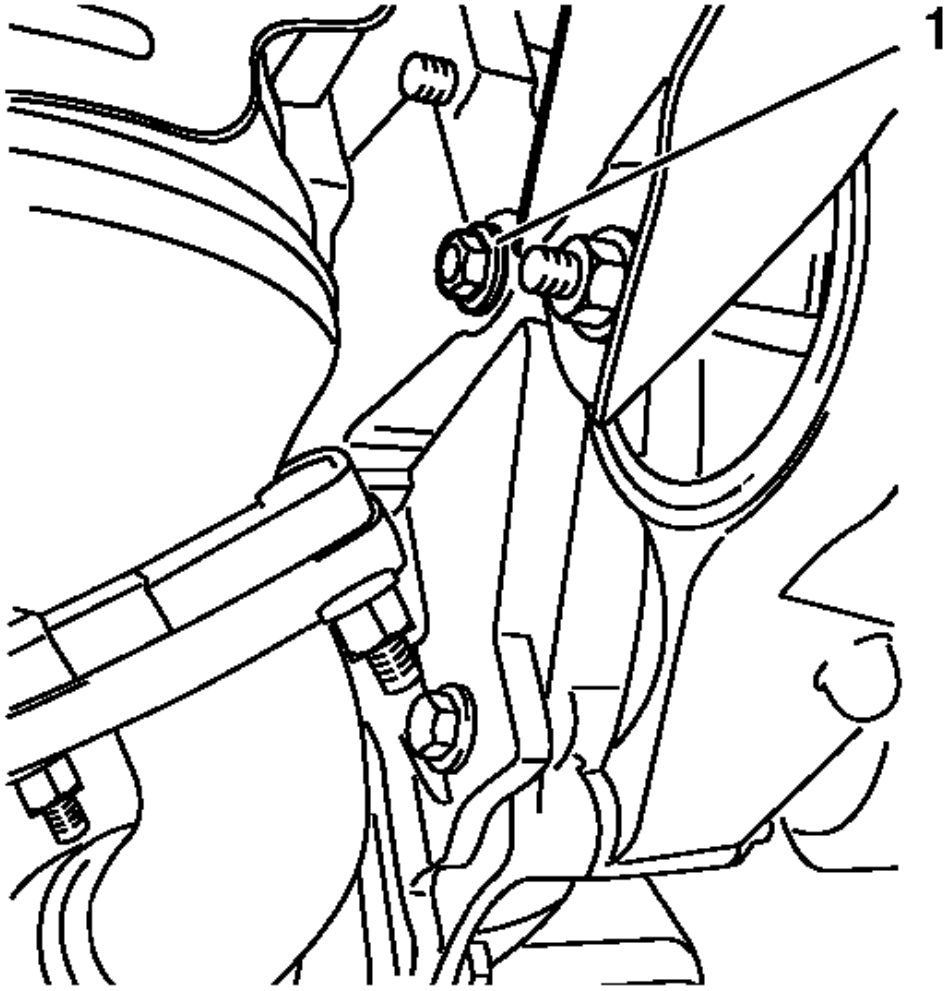

Fig. 98: View Of Bolt
Courtesy of GENERAL MOTORS CORP.

5. Remove the bolt (1).

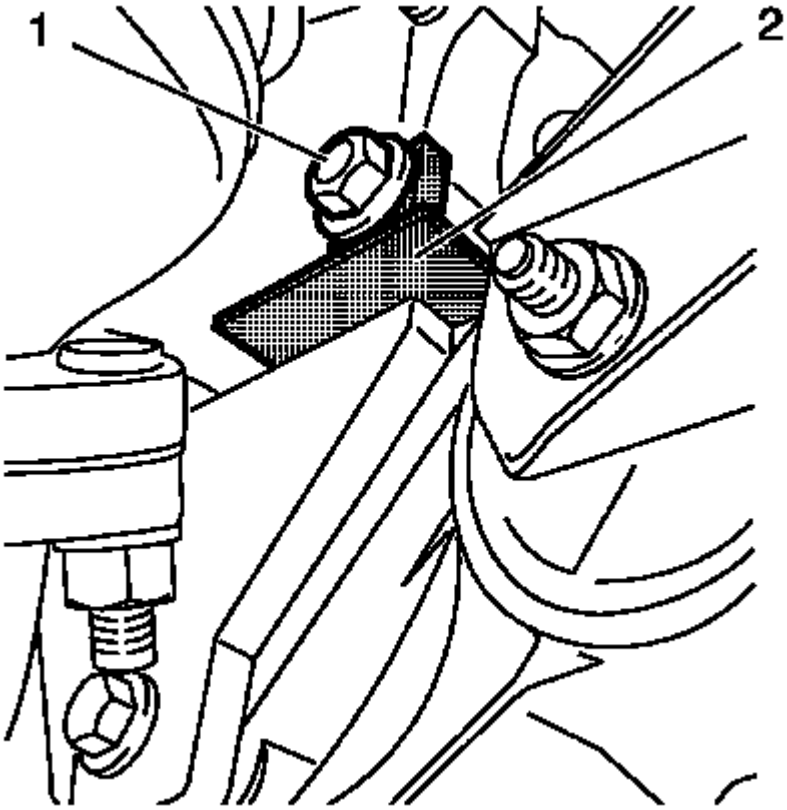

Fig. 99: Locking Device And Bolt
Courtesy of GENERAL MOTORS CORP.

6. Install the **EN-6625:** locking device (2) to lock the crankshaft.
7. Install the bolt (1).

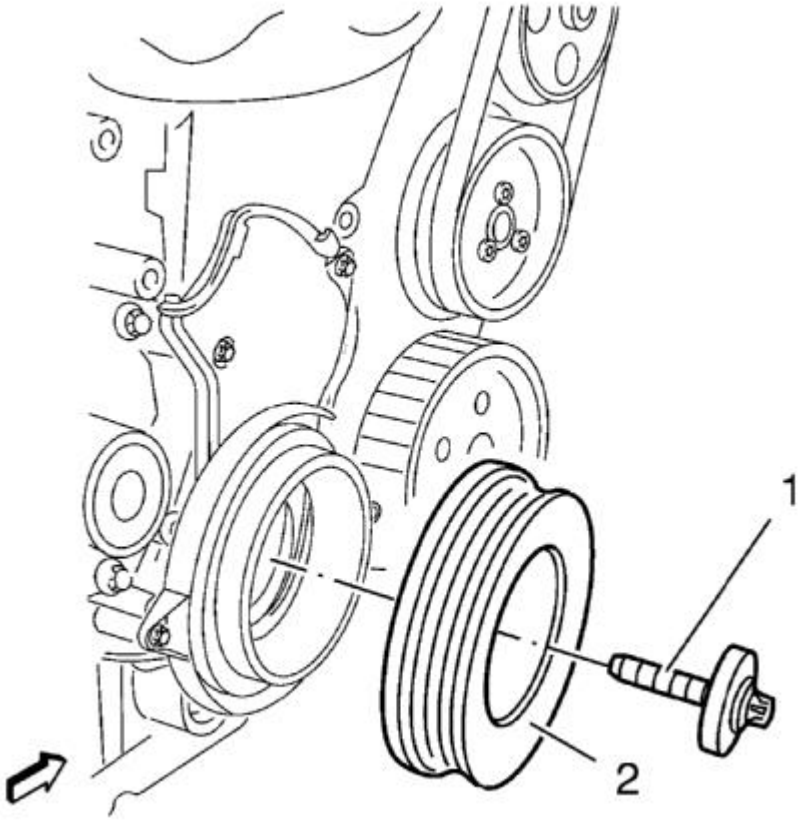

Fig. 100: Crankshaft Balancer And Bolt
Courtesy of GENERAL MOTORS CORP.

8. Remove the crankshaft balancer bolt (1).
9. Remove the crankshaft balancer (2).

INSTALLATION PROCEDURE

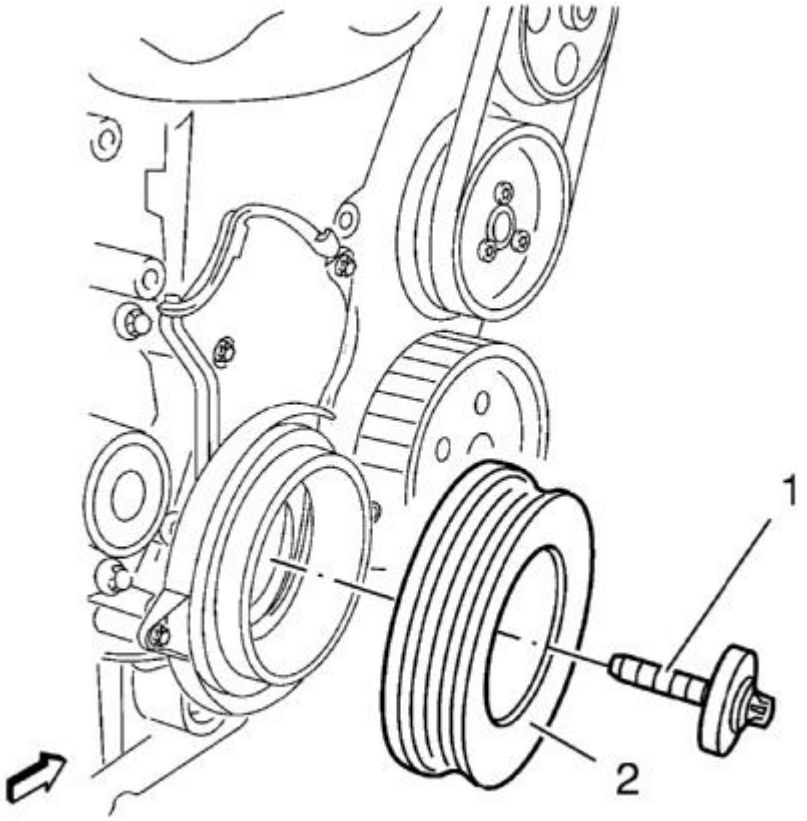

Fig. 101: Crankshaft Balancer And Bolt
Courtesy of GENERAL MOTORS CORP.

1. Install the crankshaft balancer (2).

CAUTION: Refer to Fastener Caution .

2. Install a NEW crankshaft balancer bolt (1) and tighten in 3 passes using the **EN-45059:** sensor kit :
    1. First pass to 95 N.m (70 lb ft).
    2. Second pass to 45°.
    3. Third pass to 15°.

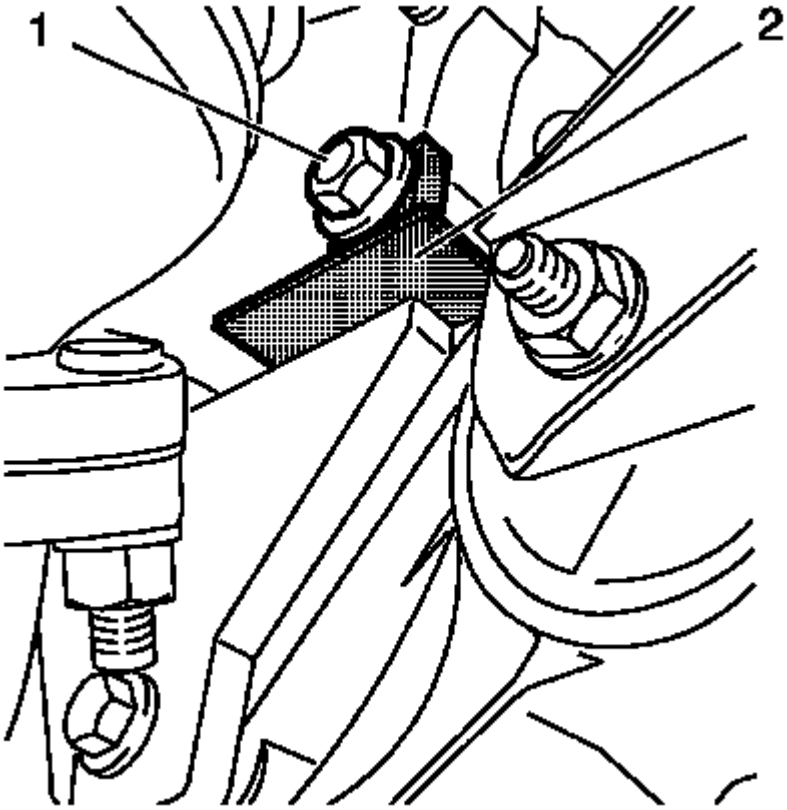

Fig. 102: Locking Device And Bolt
Courtesy of GENERAL MOTORS CORP.

3. Remove the bolt (1).
4. Remove **EN-6625:** locking device (2) to unlock the crankshaft.

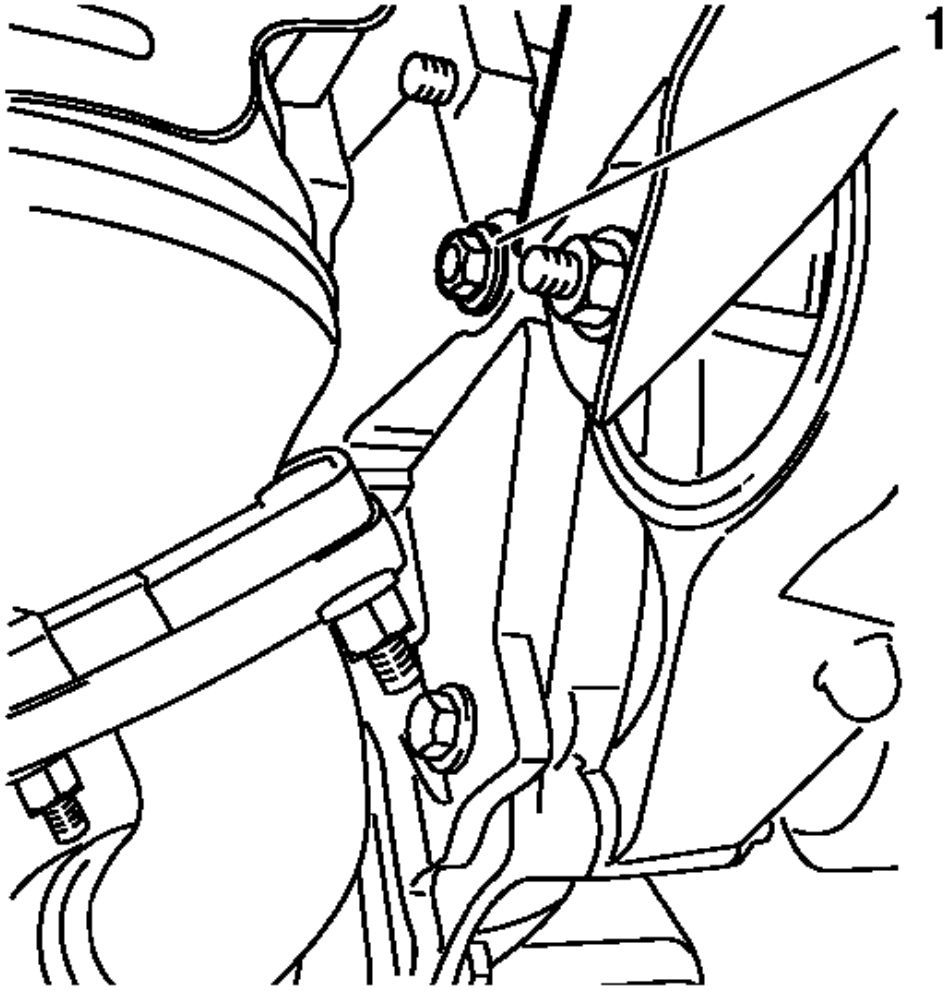

Fig. 103: View Of Bolt
Courtesy of GENERAL MOTORS CORP.

5. Install the bolt (1) and tighten to 75 N.m (55 lb ft).
6. Install the drive belt. Refer to **Drive Belt Replacement**.
7. Install the front compartment splash shield. Refer to **Front Compartment Splash Shield Replacement** .
8. Lower the vehicle.
9. Close the hood.

CRANKSHAFT FRONT OIL SEAL REPLACEMENT

REMOVAL PROCEDURE

1. Open the hood.
2. Remove the lower timing belt cover. Refer to **Timing Belt Lower Front Cover Replacement**.

3. Remove the timing belt. Refer to **Timing Belt Removal (1.6L LDE, LXV, 1.8L 2H0, and LUW)** .
4. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
5. Remove the crankshaft sprocket. Refer to **Crankshaft Sprocket Removal** .
6. Remove the crankshaft front oil seal. Refer to **Crankshaft Front Oil Seal Removal** .

INSTALLATION PROCEDURE

1. Install the crankshaft front oil seal. Refer to **Crankshaft Front Oil Seal Installation** .
2. Install the crankshaft sprocket. Refer to **Crankshaft Sprocket Installation** .
3. Lower the vehicle.
4. Install the timing belt. Refer to **Timing Belt Installation (1.6L LDE, LXV, 1.8L 2H0, and LUW)** .
5. Install the lower timing belt cover. Refer to **Timing Belt Lower Front Cover Replacement**.
6. Close the hood.

CRANKSHAFT REAR OIL SEAL REPLACEMENT

REMOVAL PROCEDURE

1. Remove the engine flywheel. Refer to **Engine Flywheel Replacement**.
2. Remove the crankshaft rear oil seal. Refer to **Crankshaft Rear Oil Seal Removal** .

INSTALLATION PROCEDURE

1. Install the crankshaft rear oil seal. Refer to **Crankshaft Rear Oil Seal Installation** .
2. Install the engine flywheel. Refer to **Engine Flywheel Replacement**.

POSITIVE CRANKCASE VENTILATION HOSE/PIPE/TUBE REPLACEMENT (1.6L LDE, LXV, AND 1.8L 2H0)

REMOVAL PROCEDURE

1. Open the hood.

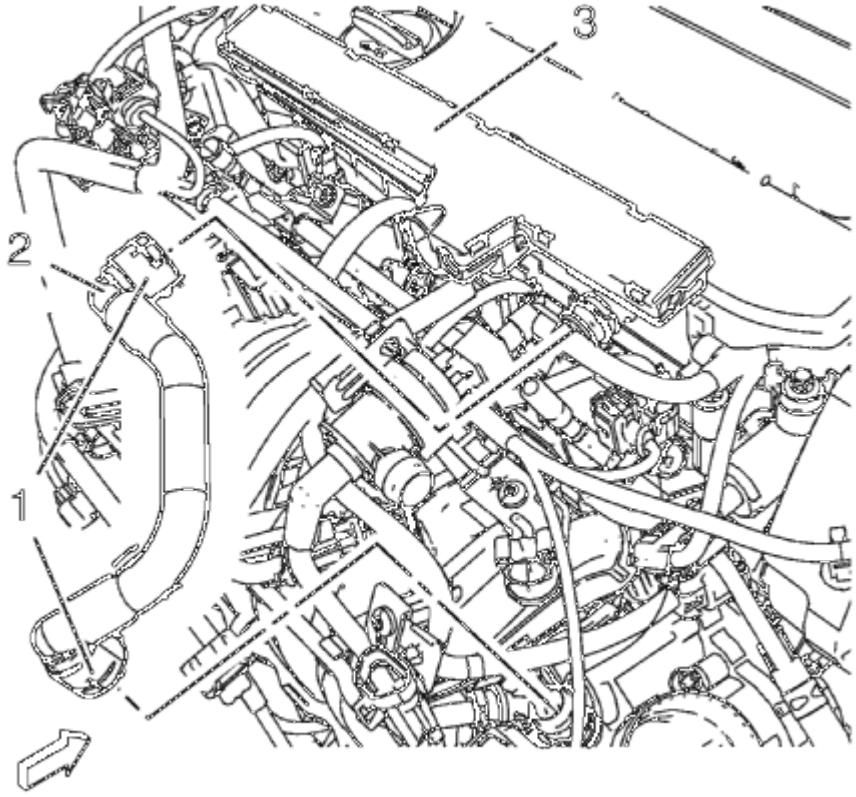

Fig. 104: Positive Crankcase Ventilation Tube, Connectors And ECM Wiring Harness Guide
Courtesy of GENERAL MOTORS CORP.

2. Unclip the ECM wiring harness guide (3) from the cylinder head cover.
3. Disconnect the 2 positive crankcase ventilation tube connectors (1).
4. Remove the positive crankcase ventilation tube (2).

INSTALLATION PROCEDURE

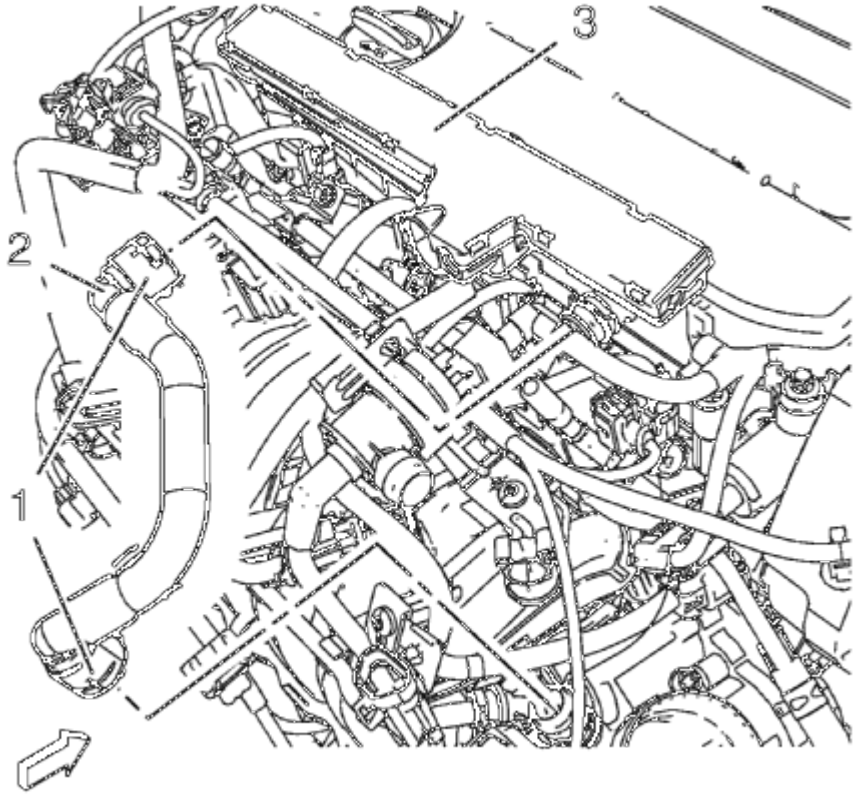

Fig. 105: Positive Crankcase Ventilation Tube, Connectors And ECM Wiring Harness Guide
Courtesy of GENERAL MOTORS CORP.

1. Install the positive crankcase ventilation tube (2).
2. Connect the 2 positive crankcase ventilation tube connectors (1).
3. Clip in the ECM wiring harness guide (3) to the cylinder head cover.
4. Close the hood.

ENGINE OIL HEATER REPLACEMENT

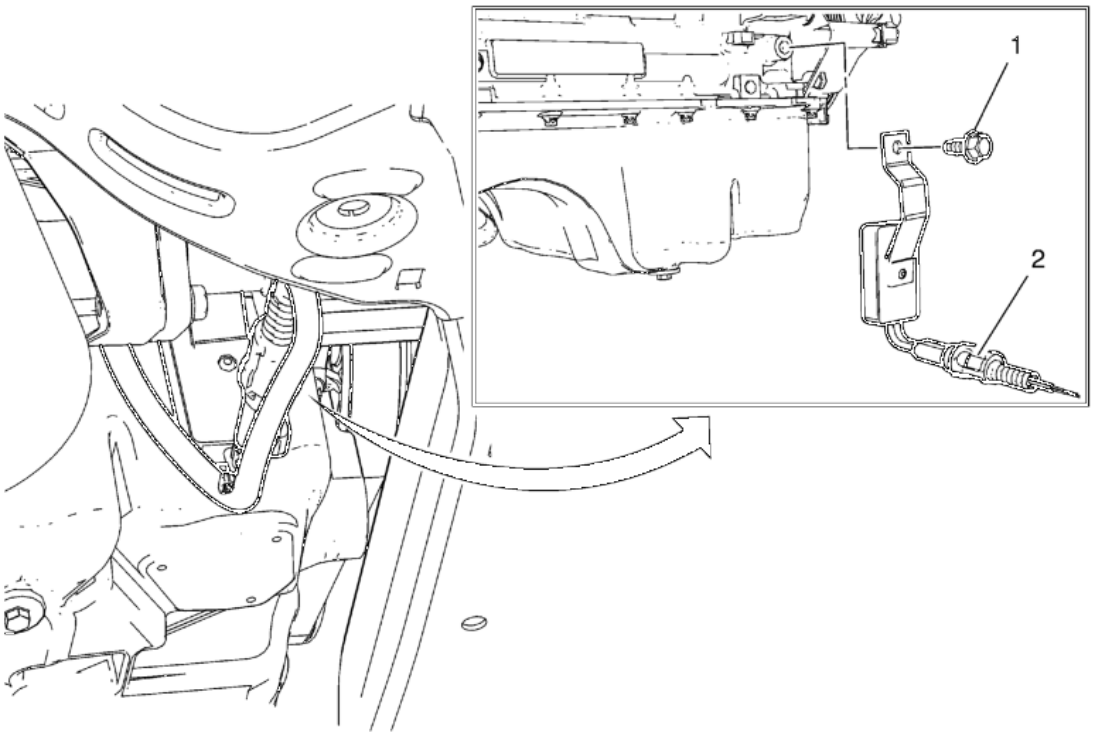

Fig. 106: Engine Oil Heater
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
WARNING: **While engine is operating, the exhaust system will become extremely hot. To prevent burns avoid contacting a hot exhaust system.** **Preliminary Procedures:** Disconnect the battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection** .	
1	Engine Oil Heater Bolt **CAUTION:** **Refer to Fastener Caution .** **Tighten:** 40 N.m (30 lb ft)
2	Engine Oil Heater **Procedure:** Disconnect the wiring harness plug.

ENGINE FRONT COVER WITH OIL PUMP REPLACEMENT

REMOVAL PROCEDURE

1. Open the hood.
2. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection** .
3. Remove the exhaust manifold. Refer to **Exhaust Manifold Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)** .
4. Drain the cooling system. Refer to **Cooling System Draining and Filling (Static Fill)** or **Cooling System Draining and Filling (GE-47716 Fill)** .
5. Remove the air conditioning compressor. Refer to **Air Conditioning Compressor Replacement (1.8L LUW)** .
6. Remove the generator. Refer to **Generator Replacement (1.6L LDE, LXV, LLU, 1.8L 2H0, and LUW)** .
7. Remove the timing belt rear cover. Refer to **Timing Belt Rear Cover Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.
8. Remove the oil pan. Refer to **Oil Pan Replacement**.
9. Remove the radiator outlet hose from the water pump. Refer to **Radiator Outlet Hose Replacement (LDE, LXV, 2H0, and LUW)** .

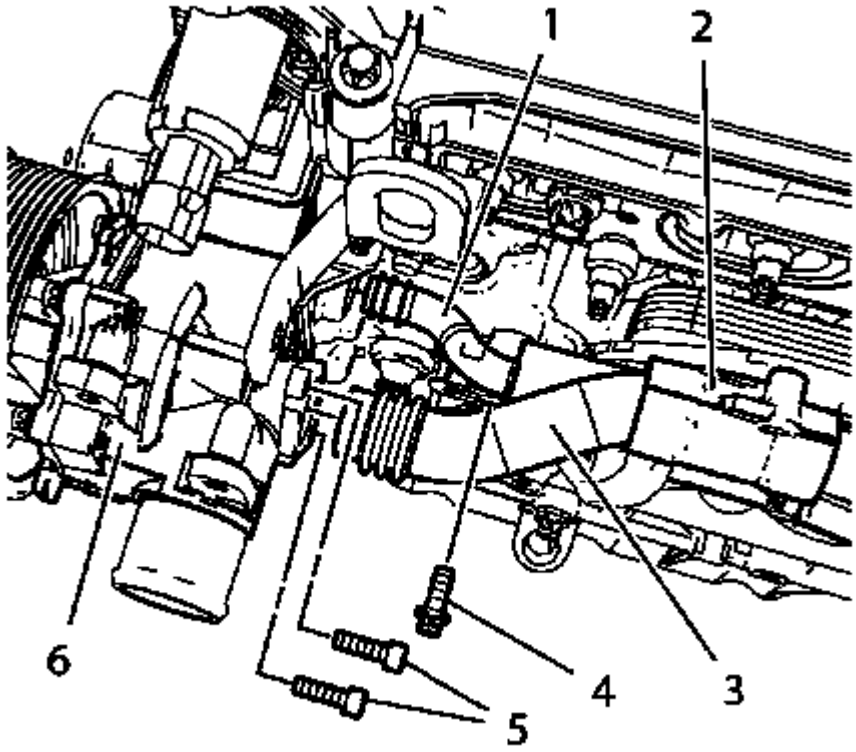

Fig. 107: Engine Oil Cooler Housing, Engine Oil Cooler Inlet Pipe And Engine Oil Cooler Outlet Pipe
Courtesy of GENERAL MOTORS CORP.

10. Remove the engine oil cooler inlet pipe bolt (4).
11. Push the engine oil cooler inlet pipe (1) into the engine oil cooler housing (2).
12. Remove the 2 engine oil cooler outlet pipe bolts (5) from the water pump.
13. Push the engine oil cooler outlet pipe (3) into the engine oil cooler housing (2).

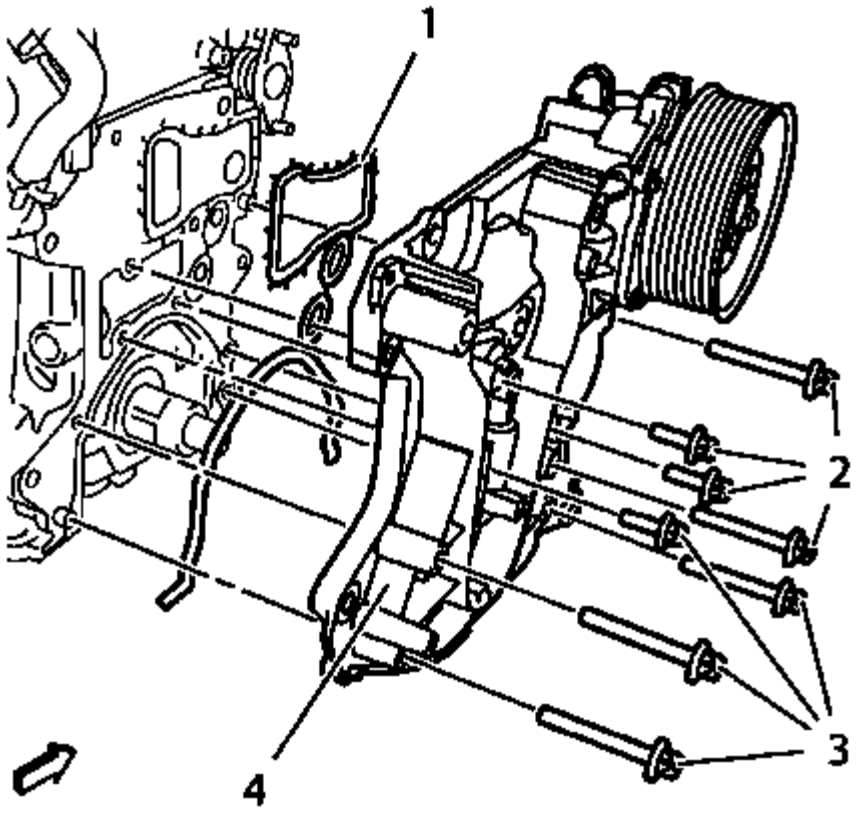

Fig. 108: Engine Front Cover
Courtesy of GENERAL MOTORS CORP.

14. Remove the 8 engine front cover bolts (2, 3).
15. Remove the engine front cover (4).
16. Remove the engine front cover seal (1).

INSTALLATION PROCEDURE

1. Clean sealing surface.

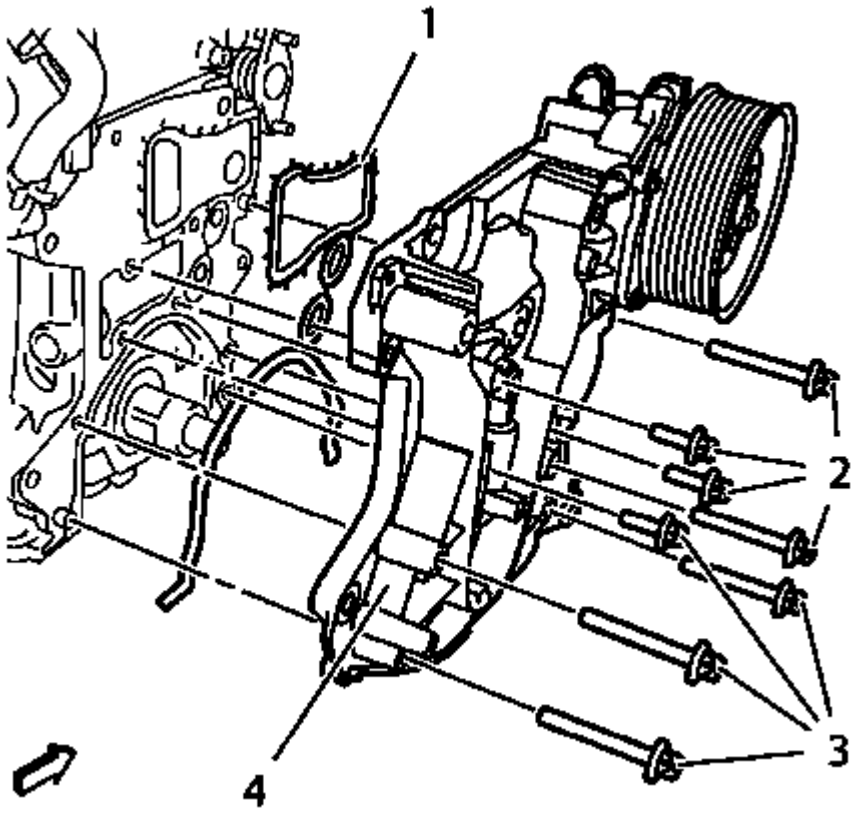

Fig. 109: Engine Front Cover
Courtesy of GENERAL MOTORS CORP.

2. Install a NEW engine front cover seal (1).
3. Install the engine front cover (4).

CAUTION: Refer to Fastener Caution .

4. Install the 8 engine front cover bolts (2, 3) and tighten to 20 N.m (15 lb ft).

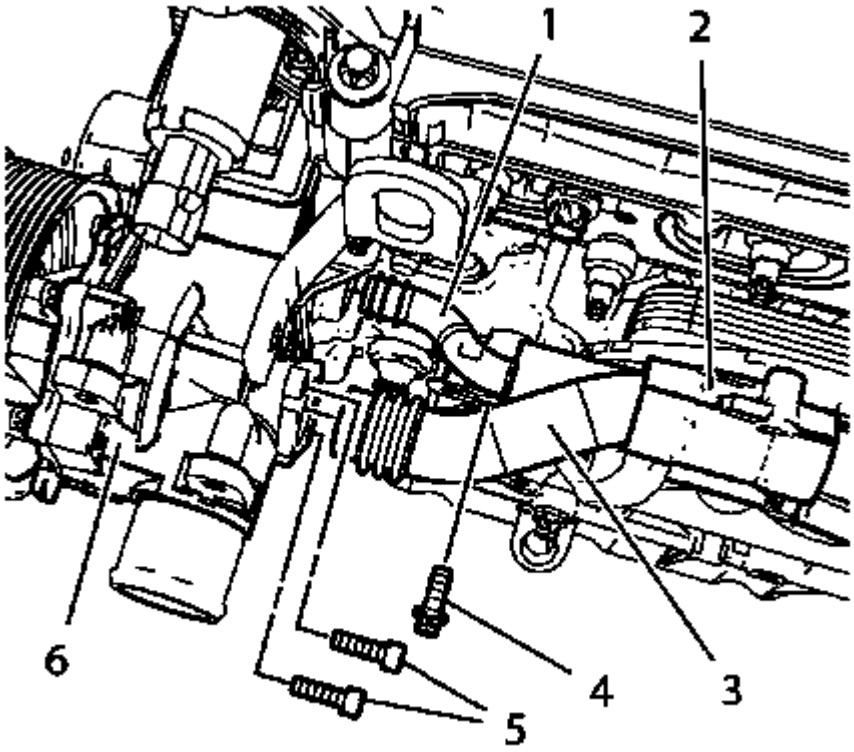

Fig. 110: Engine Oil Cooler Housing, Engine Oil Cooler Inlet Pipe And Engine Oil Cooler Outlet Pipe
Courtesy of GENERAL MOTORS CORP.

5. Push the engine oil cooler outlet pipe (3) to the water pump (6).
6. Install the engine oil cooler outlet pipe bolts (5) and tighten to 8 N.m (71 lb in).
7. Push the engine oil cooler inlet pipe (1) into the water pump (6).
8. Install the engine oil cooler inlet pipe bolt (4) and tighten to 8 N.m (71 lb in).
9. Install the radiator outlet hose to the water pump. Refer to **Radiator Outlet Hose Replacement (LDE, LXV, 2H0, and LUW)** .
10. Install the oil pan. Refer to **Oil Pan Replacement**.
11. Install the timing belt rear cover. Refer to **Timing Belt Rear Cover Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.
12. Install the generator. Refer to **Generator Replacement (1.6L LDE, LXV, LLU, 1.8L 2H0, and LUW)** .
13. Install the air conditioning compressor. Refer to **Air Conditioning Compressor Replacement (1.8L LUW)** .
14. Install the exhaust manifold. Refer to **Exhaust Manifold Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)** .
15. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection** .
16. Fill the cooling system. Refer to **Cooling System Draining and Filling (Static Fill)** or **Cooling System**

Draining and Filling (GE-47716 Fill) .

17. Close the hood.

OIL PRESSURE RELIEF VALVE REPLACEMENT

REMOVAL PROCEDURE

1. Remove the oil pan. Refer to **Oil Pan Replacement**.

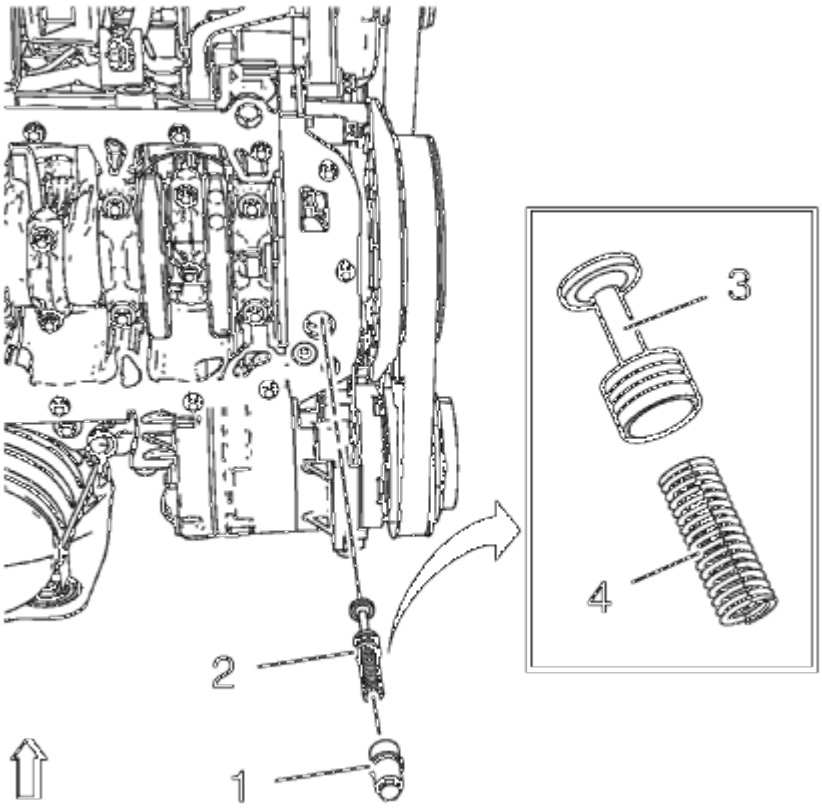

Fig. 111: Engine Oil Pressure Relief Valve Assembly
Courtesy of GENERAL MOTORS CORP.

2. Remove the oil pressure relief valve closure bolt (1).
3. Remove the oil pressure relief valve assembly (2).
4. Remove the piston (3) and the spring (4).

WARNING: Bodily injury may occur if the cleaning solvent is inhaled or exposed to the skin.

WARNING: To avoid eye injury, use approved safety lenses, goggles, or face shield when using buffing and cleaning equipment.

5. Clean the parts.
6. Inspect the parts.
7. Clean the thread.

INSTALLATION PROCEDURE

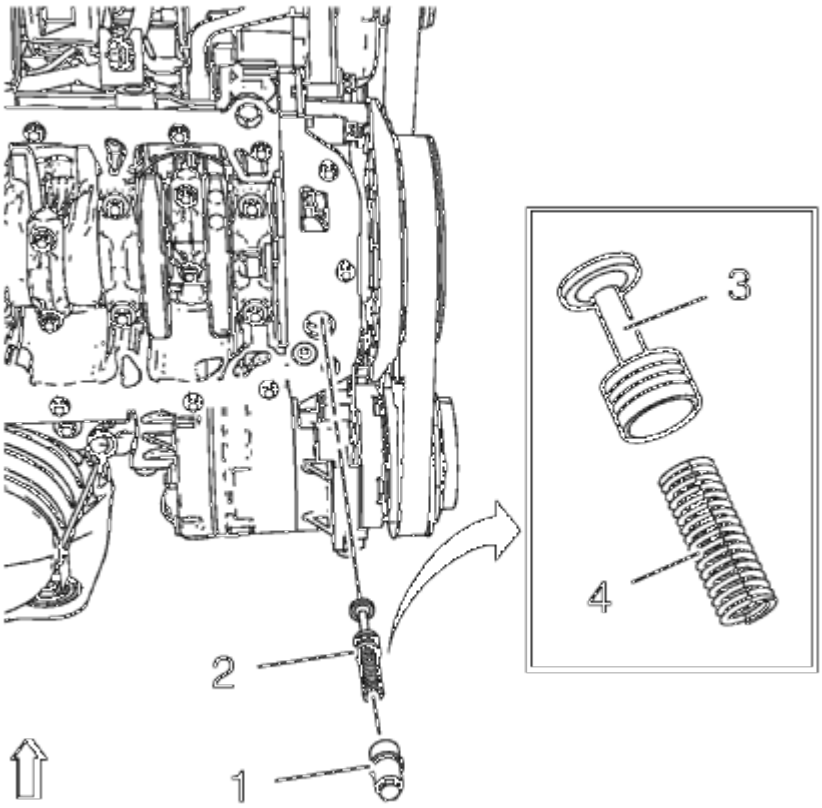

Fig. 112: Engine Oil Pressure Relief Valve Assembly
Courtesy of GENERAL MOTORS CORP.

1. Install the piston (3) and the spring (4).
2. Install the oil pressure relief valve assembly (2).

CAUTION: Refer to Fastener Caution .

3. Install the oil pressure relief valve closure bolt (1) and tighten to 21 N.m (16 lb ft).
4. Install the oil pan. Refer to **Oil Pan Replacement**.

ENGINE OIL COOLER HOUSING REPLACEMENT

Refer to **Engine Oil Cooler Replacement (1.6L LDE, LXV, 1.8L 2H0, LUW)** , it is the same procedure.

OIL FLOW CHECK VALVE REPLACEMENT

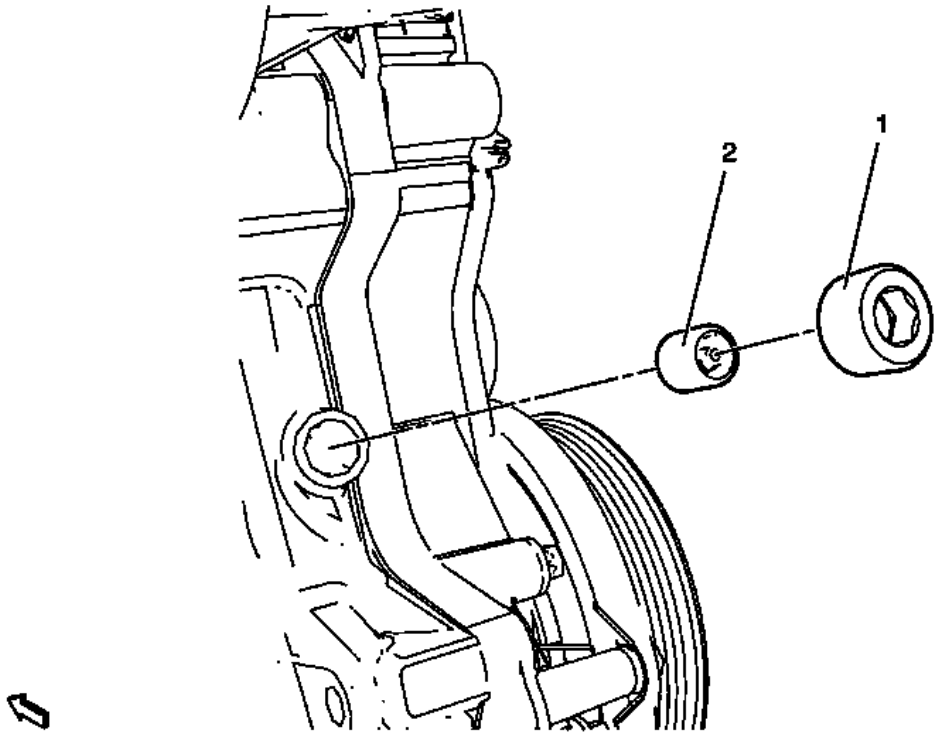

Fig. 113: Oil Flow Check Valve
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the generator. Refer to **Generator Replacement (1.6L LDE, LXV, LLU, 1.8L 2H0, and LUW)** .	
1	Oil Flow Check Valve Bore Plug **CAUTION:** **Refer to Fastener Caution .** **Tighten:** 21 N.m (16 lb ft)
2	Oil Flow Check Valve

OIL LEVEL INDICATOR TUBE REPLACEMENT (1.6L LDE, LXV, 1.8L 2H0, AND LUW)

REMOVAL PROCEDURE

1. Open the hood.
2. Remove the oil dipstick.

NOTE: If the engine oil level is at maximum, some oil may emerge when drawing out the oil dipstick guide tube.

3. Place collecting basin underneath.

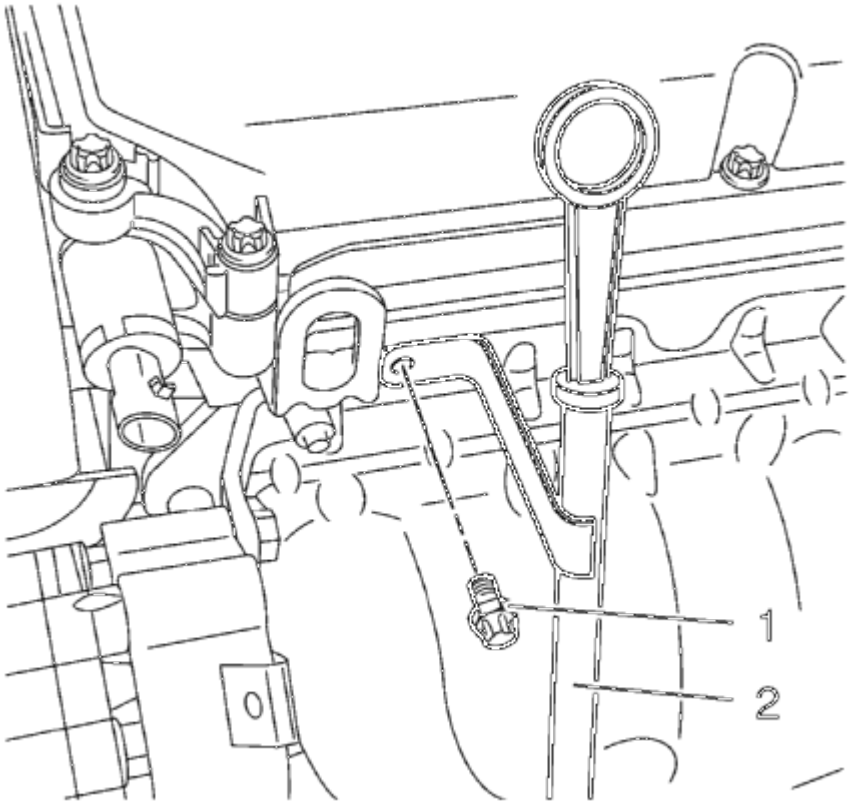

Fig. 114: Oil Level Indicator Tube
Courtesy of GENERAL MOTORS CORP.

4. Remove the oil level indicator tube bolt (1).
5. Remove the oil level indicator tube (2) and the oil level indicator seal.

INSTALLATION PROCEDURE

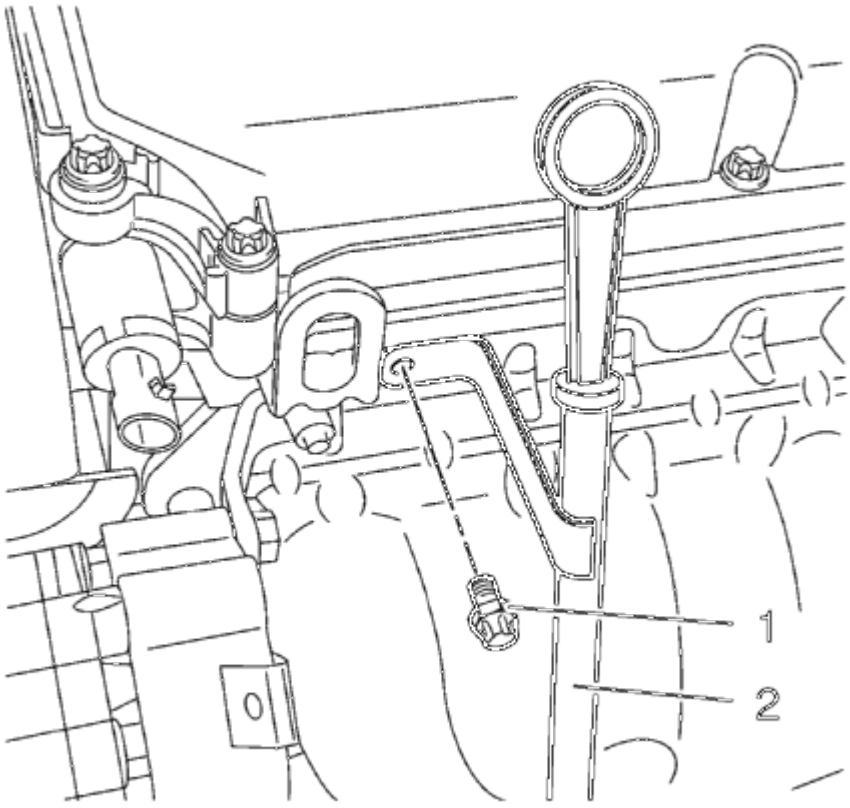

Fig. 115: Oil Level Indicator Tube
Courtesy of GENERAL MOTORS CORP.

1. Install the oil level indicator tube (2).
2. Install a NEW oil level indicator tube gasket.

CAUTION: Refer to Fastener Caution .

3. Install the oil level indicator tube bolt (1) and tighten to 8 N.m (71 lb in).
4. Install the oil dipstick.
5. Close the hood.

ENGINE REPLACEMENT

REMOVAL PROCEDURE

1. Disconnect the negative battery cable from the battery. Refer to **Battery Negative Cable Disconnection and Connection** .
2. Drain the engine cooling system. Refer to **Cooling System Draining and Filling (Static Fill)** or **Cooling System Draining and Filling (GE-47716 Fill)** .

3. Recover the air conditioning refrigerant. Refer to **Refrigerant Recovery and Recharging** .

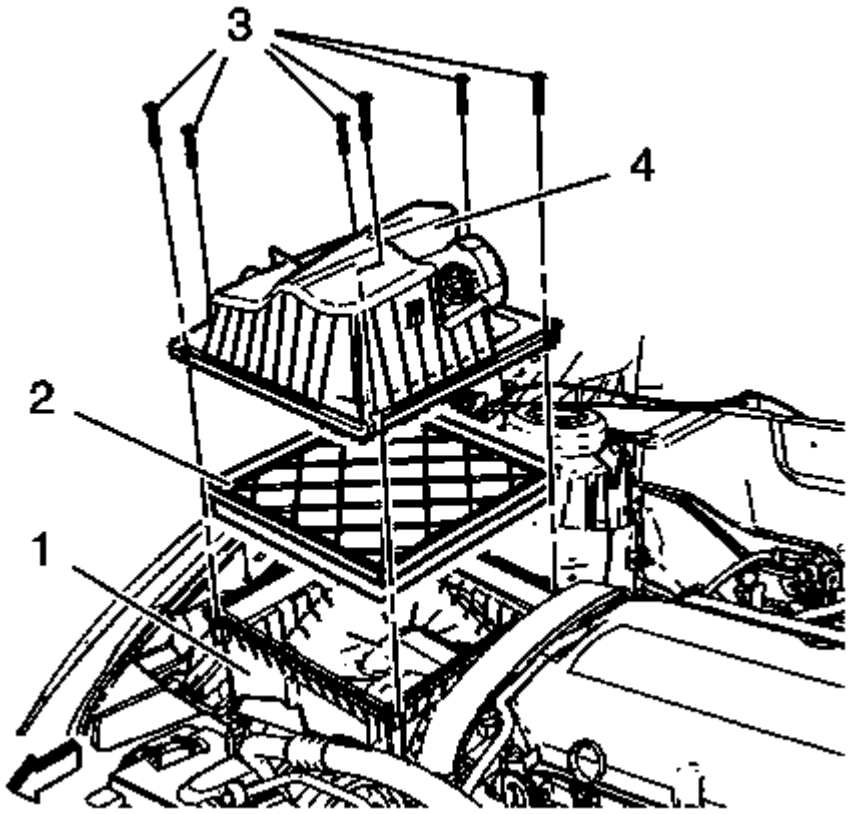

Fig. 116: Air Cleaner Element, Air Cleaner Housing, Air Cleaner Housing Cover And Bolts
Courtesy of GENERAL MOTORS CORP.

4. Remove the air cleaner housing cover bolts (3).
5. Remove the air cleaner housing cover (4).
6. Remove the air cleaner element (2) from the air cleaner housing (1). Refer to **Air Cleaner Element Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)** .

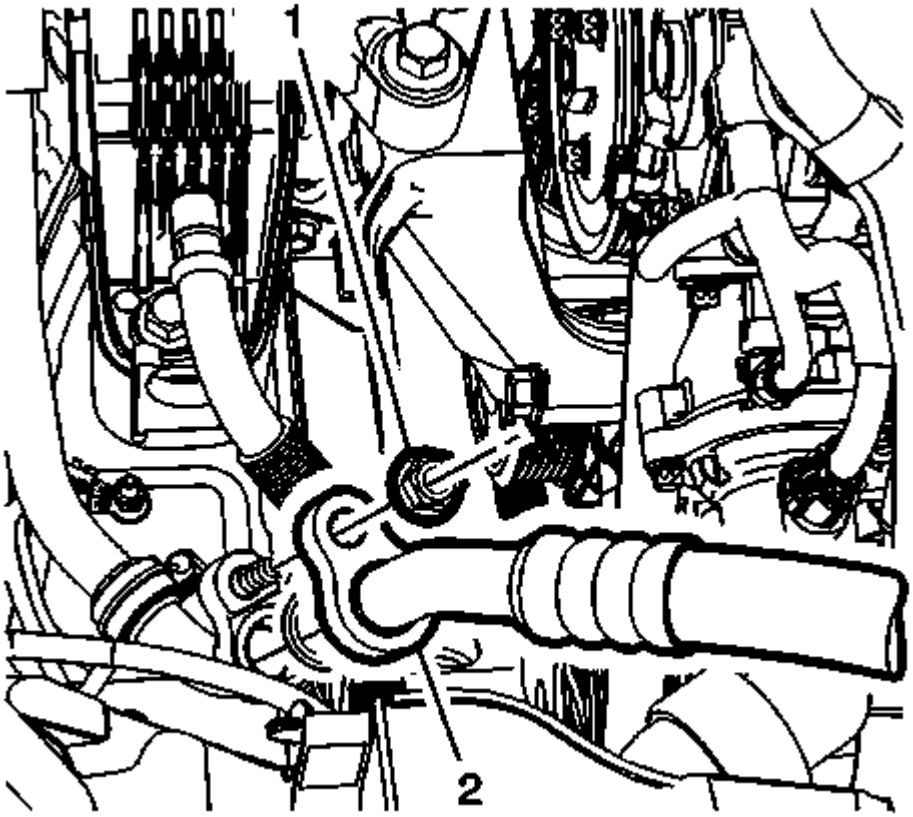

Fig. 117: Refrigerant Hose And Nut
Courtesy of GENERAL MOTORS CORP.

7. Remove refrigerant hose nut (1) from refrigerant hose (2).

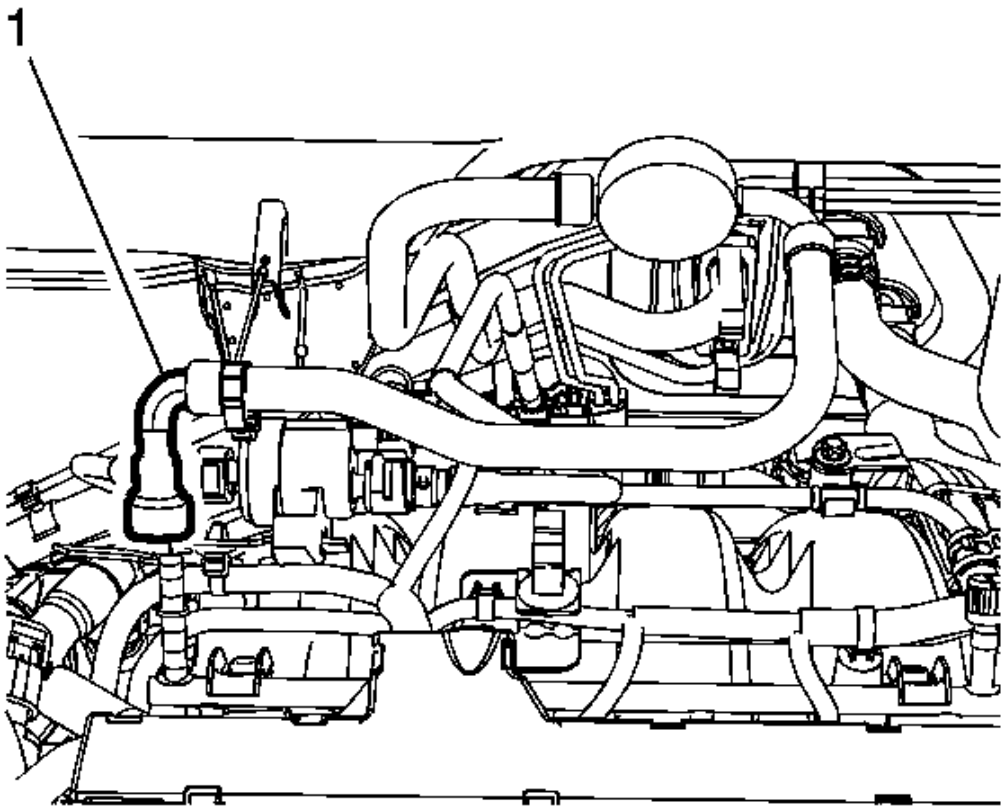

Fig. 118: Fuel Feed Line
Courtesy of GENERAL MOTORS CORP.

8. Disconnect the fuel feed line (1) and reposition away from the engine. Refer to **Plastic Collar Quick Connect Fitting Service** .

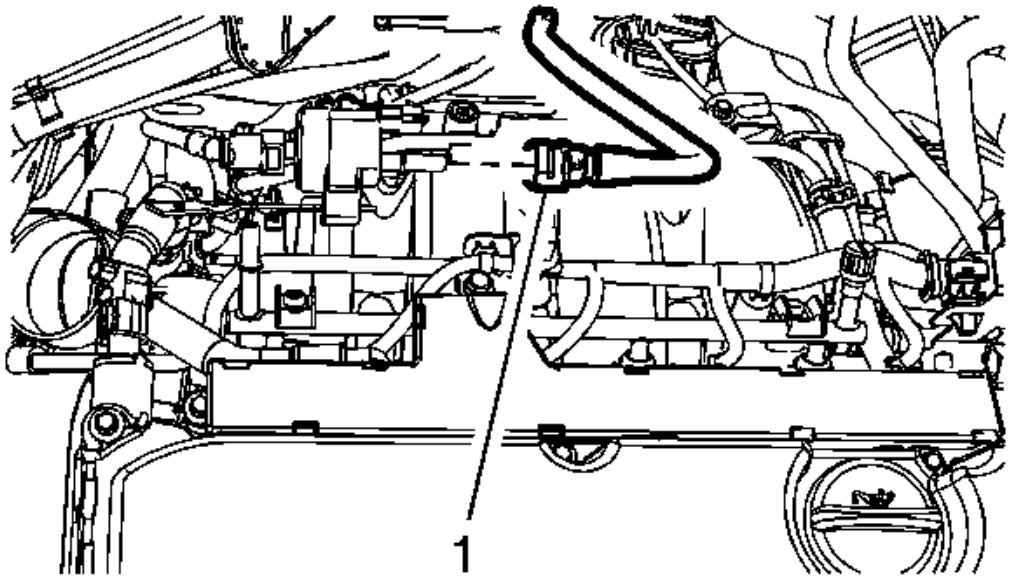

Fig. 119: EVAP Hose
Courtesy of GENERAL MOTORS CORP.

9. Disconnect the EVAP hose (1). Refer to **Plastic Collar Quick Connect Fitting Service** .
10. Disconnect the power brake booster vacuum pipe. Refer to **Power Brake Booster Vacuum Pipe Replacement (Left Hand Drive)** or **Power Brake Booster Vacuum Pipe Replacement (Left Hand Drive with Electric Pump)** .

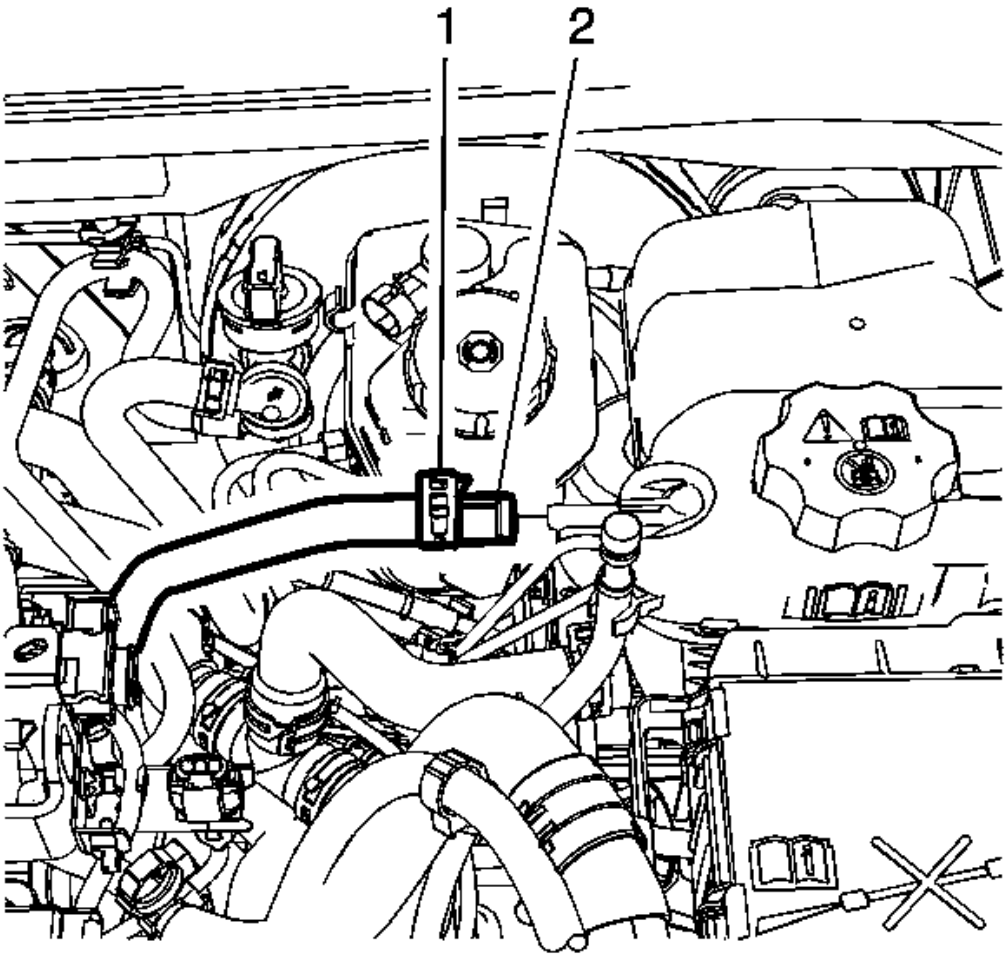

Fig. 120: Radiator Surge Tank Outlet Hose
Courtesy of GENERAL MOTORS CORP.

11. Reposition the hose clamp (1) and remove the radiator surge tank outlet hose (2).

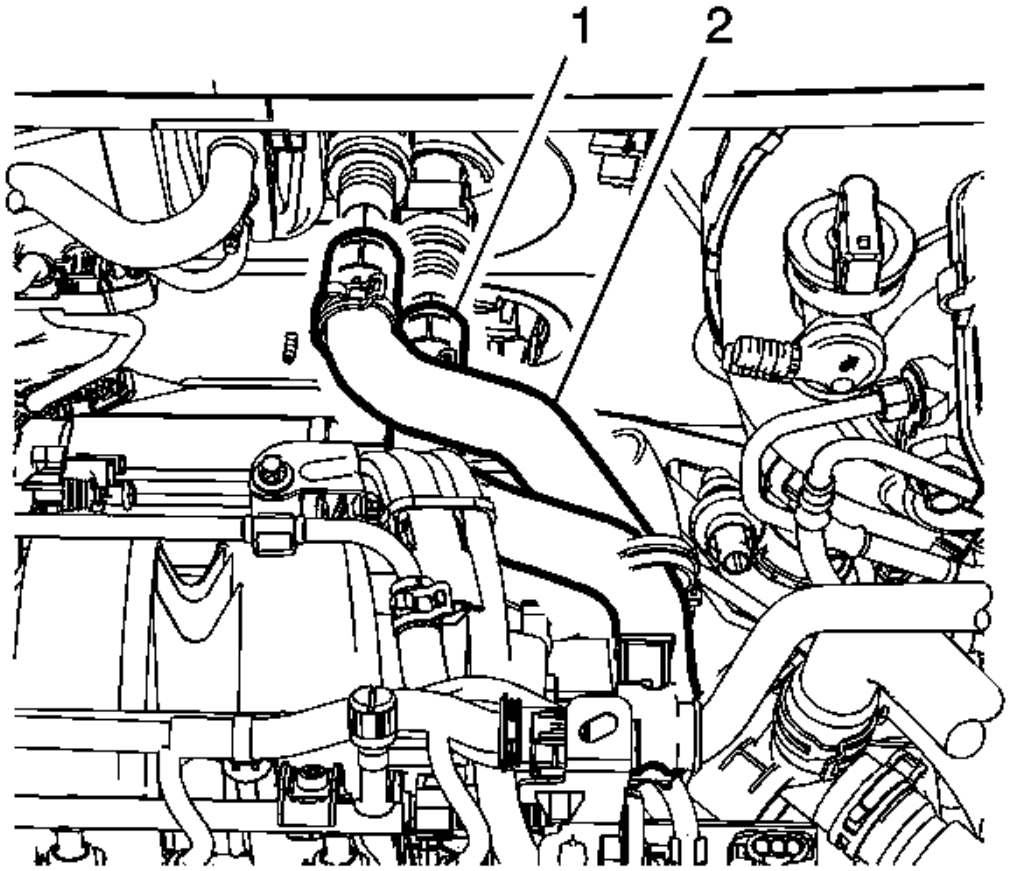

Fig. 121: Inlet And Outlet Heater Core Hoses
Courtesy of GENERAL MOTORS CORP.

12. Disconnect inlet (2) and outlet (1) heater core hoses.

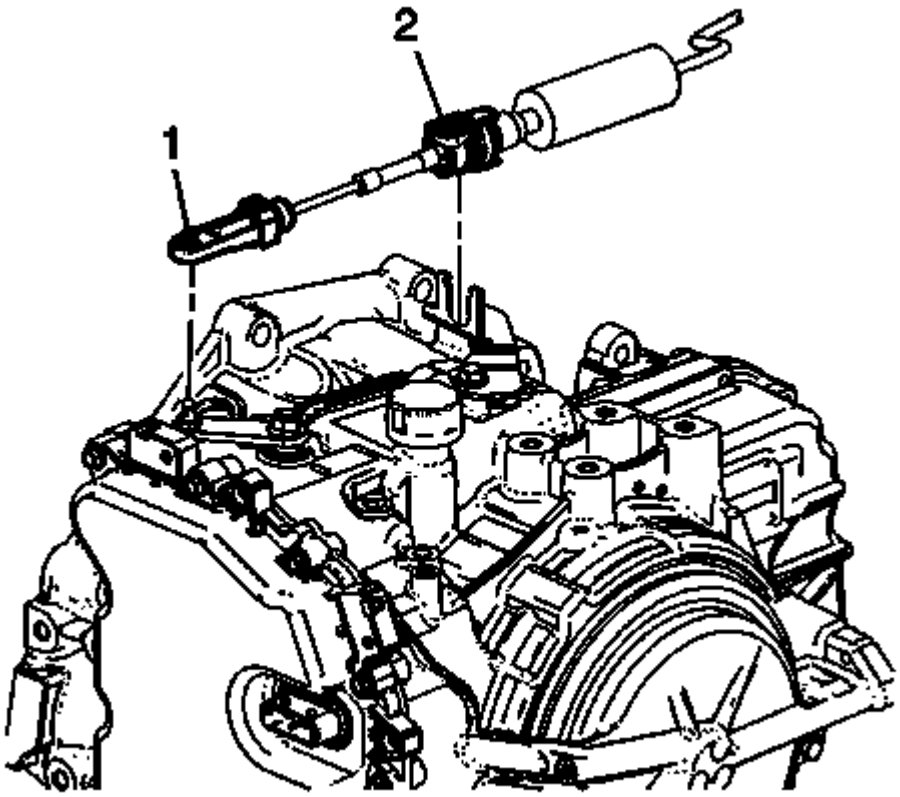

Fig. 122: View Of Transmission Range Selector Lever & Cable Connection
Courtesy of GENERAL MOTORS CORP.

13. On vehicles equipped with a automatic transmission, disconnect the transmission range selector lever cable terminal (1) from the transmission manual shift lever pin.
14. On vehicles equipped with a automatic transmission, press the locking tabs inward in order to release the transmission range selector lever cable (2) from the cable bracket.

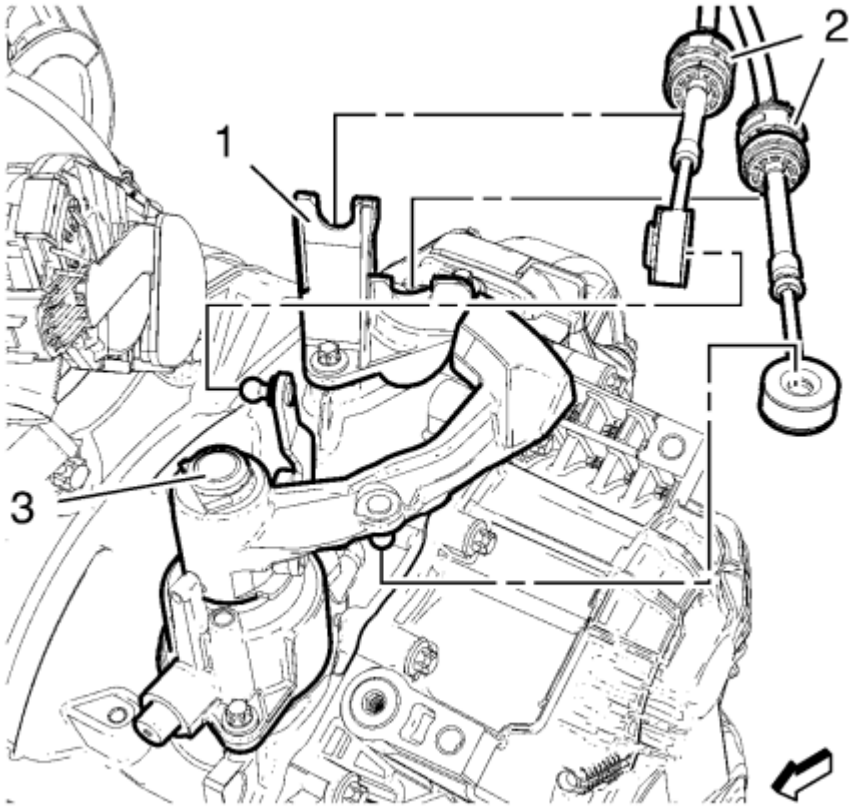

Fig. 123: Selector Lever Cable, Bracket And Transmission Control Housing
Courtesy of GENERAL MOTORS CORP.

15. On vehicles equipped with a manual transmission, using a suitable pry tool, disconnect the shift lever cables (2) from the shift levers (3)
16. On vehicles equipped with a manual transmission, remove the shift lever cables (2) from the cable bracket (1).

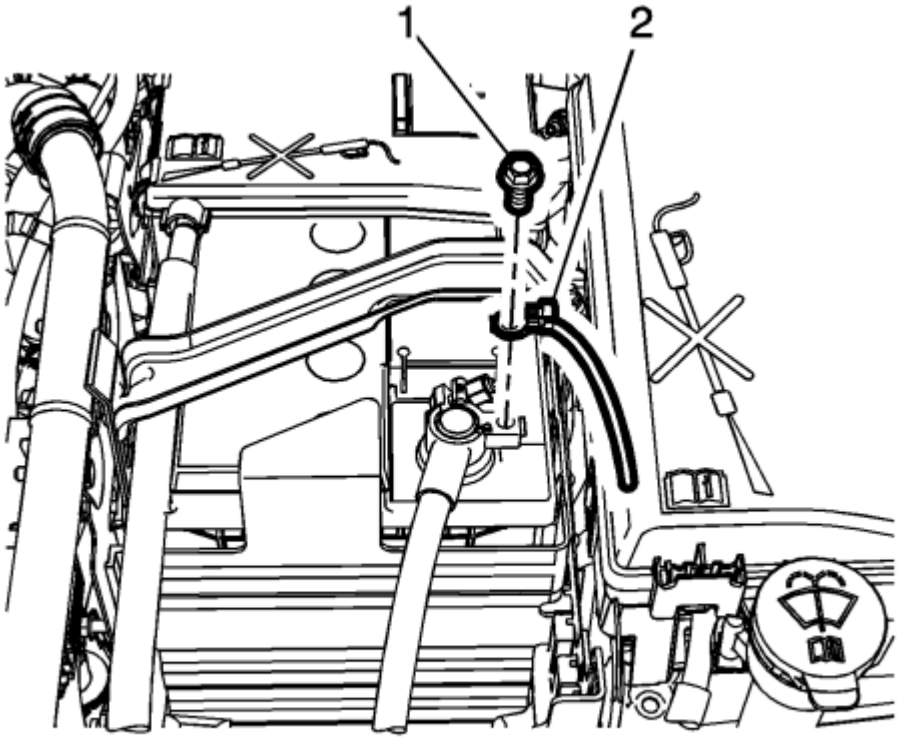

Fig. 124: Ground Strap And Bolt
Courtesy of GENERAL MOTORS CORP.

17. Remove the ground strap bolt (1) from the battery cable and reposition the strap (2) aside.
18. Remove the battery tray. Refer to **Battery Tray Replacement** .

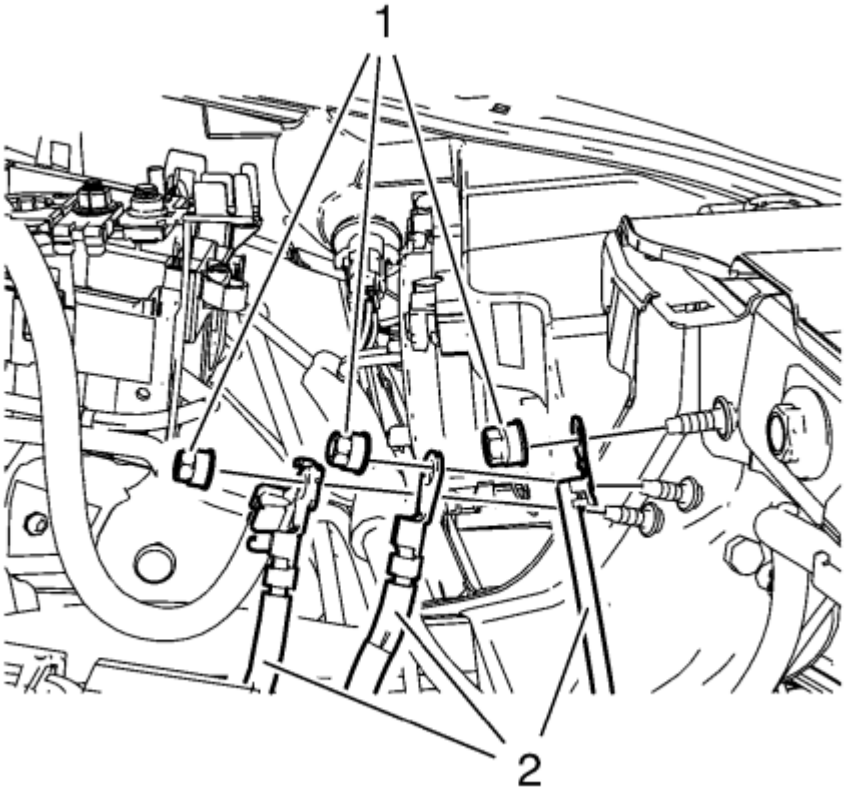

Fig. 125: Wiring Harness And Ground Nuts
Courtesy of GENERAL MOTORS CORP.

19. Remove the ground nuts (1) and put the wiring harness (2) aside.
20. Disconnect the electrical connectors from the engine control module (ECM). Refer to **Engine Control Module Replacement** .
21. Disconnect the wiring harness from the accessory wiring junction block.

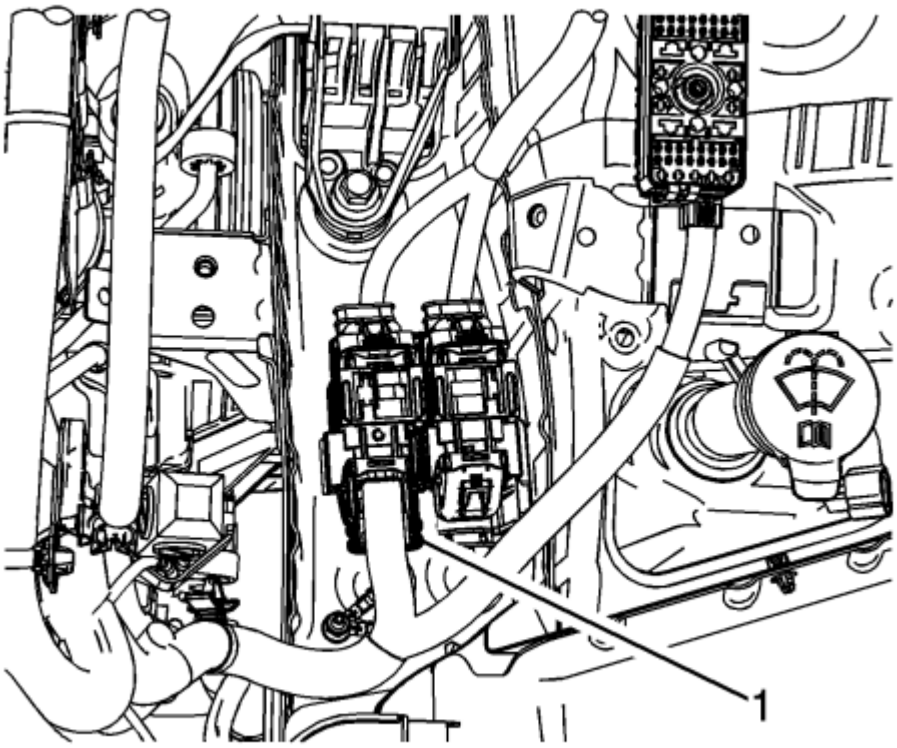

Fig. 126: Junction Connector
Courtesy of GENERAL MOTORS CORP.

22. Disconnect the wiring harness from the junction connector (1).
23. Place the ECM, transmission and the accessory wiring junction block wiring harnesses on the top of the engine assembly.
24. Install the engine support fixture. Refer to **Engine Support Fixture** .

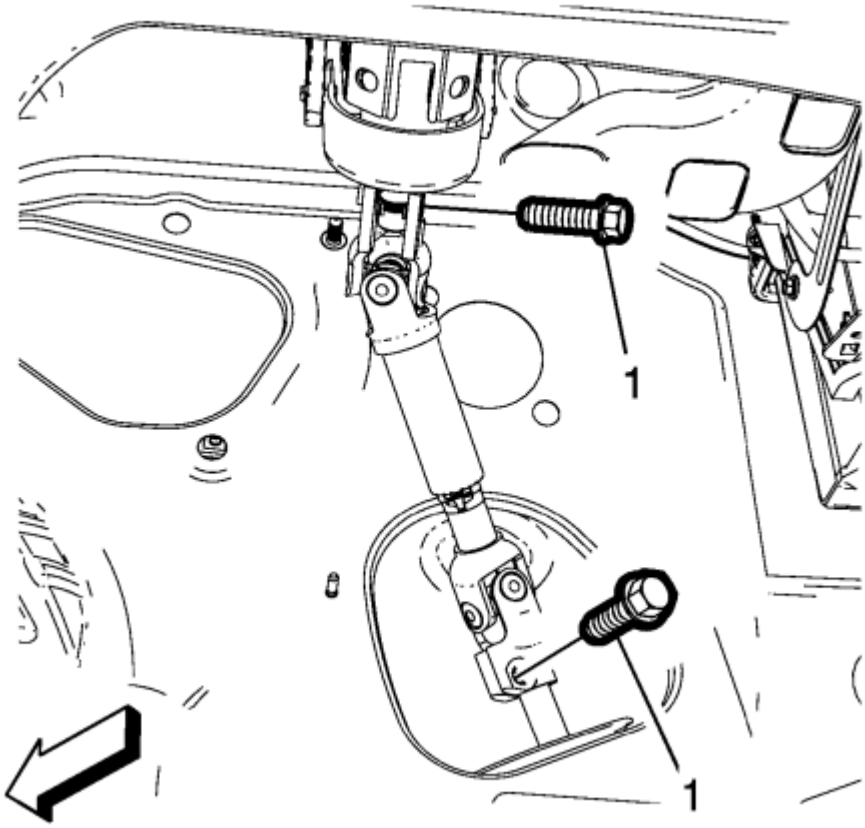

Fig. 127: Lower Steering Intermediate Shaft Bolt
Courtesy of GENERAL MOTORS CORP.

25. Remove the lower steering intermediate shaft bolt (1).

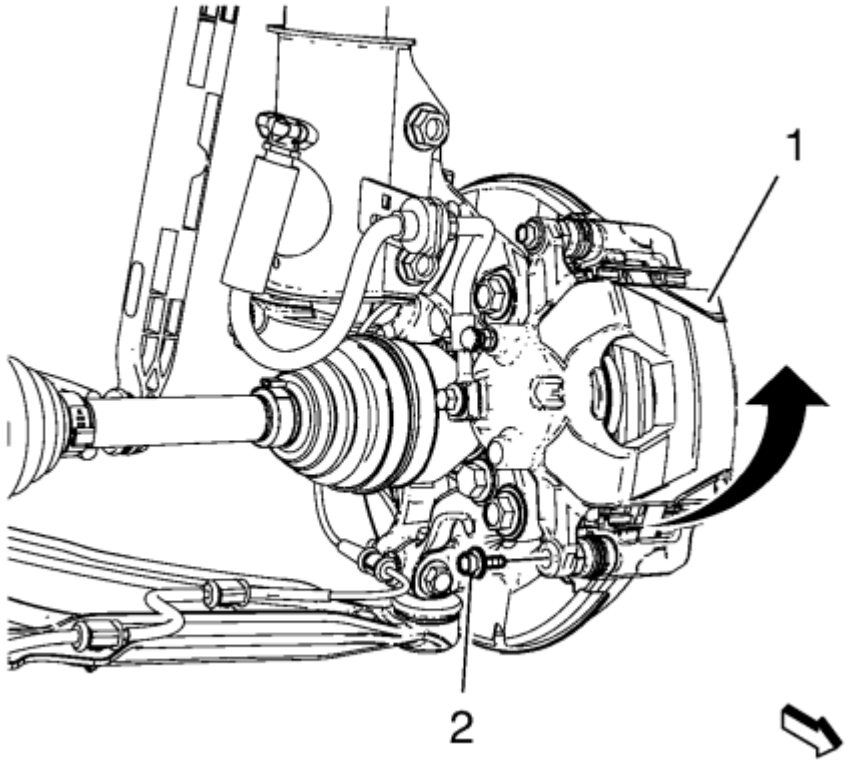

Fig. 128: View Of Brake Caliper And Brake Caliper Guide Pin Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: Do Not disconnect the brake hoses from the calipers.

26. Remove the front brake calipers (1) and caliper bolts (2) from the caliper brackets, and then suspend the calipers with mechanics wire to the body.
27. Remove the exhaust system. Refer to **Exhaust System Replacement (Gasoline)** .

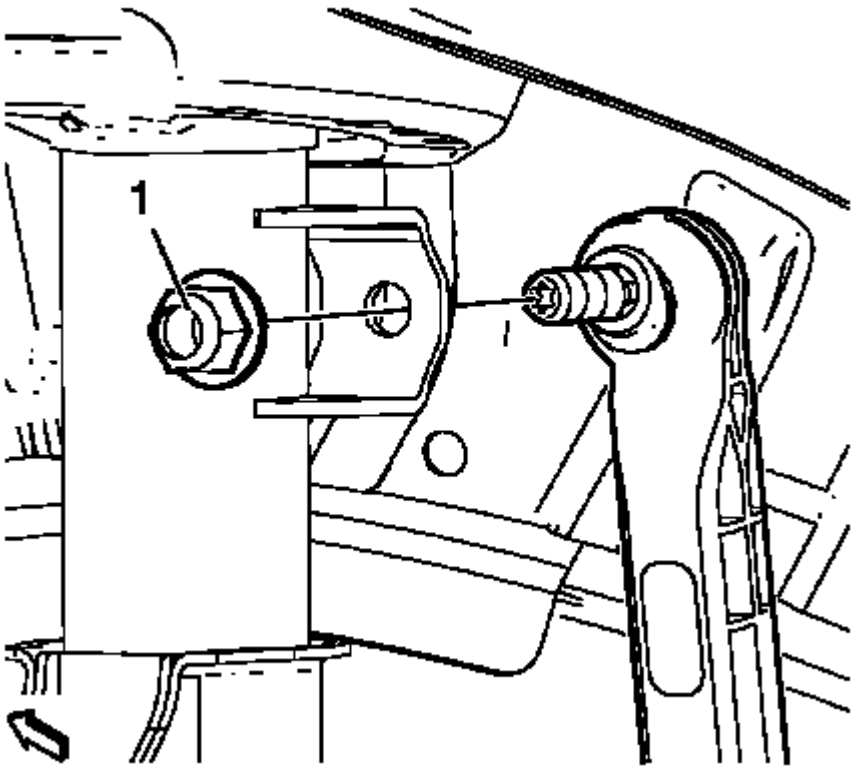

Fig. 129: Identifying Stabilizer Link Nut
Courtesy of GENERAL MOTORS CORP.

28. Disconnect the stabilizer link nut (1) from the strut assemblies. Refer to **Stabilizer Shaft Link Replacement** .
29. Disconnect the right wheel drive shaft from the intermediate shaft.
30. Disconnect the front steering knuckles from the strut assemblies. Refer to **Steering Knuckle Replacement** .
31. Disconnect the electronic power steering connectors from the electronic power steering assembly. Refer to **FEP Connectors (Steering Gear)** .

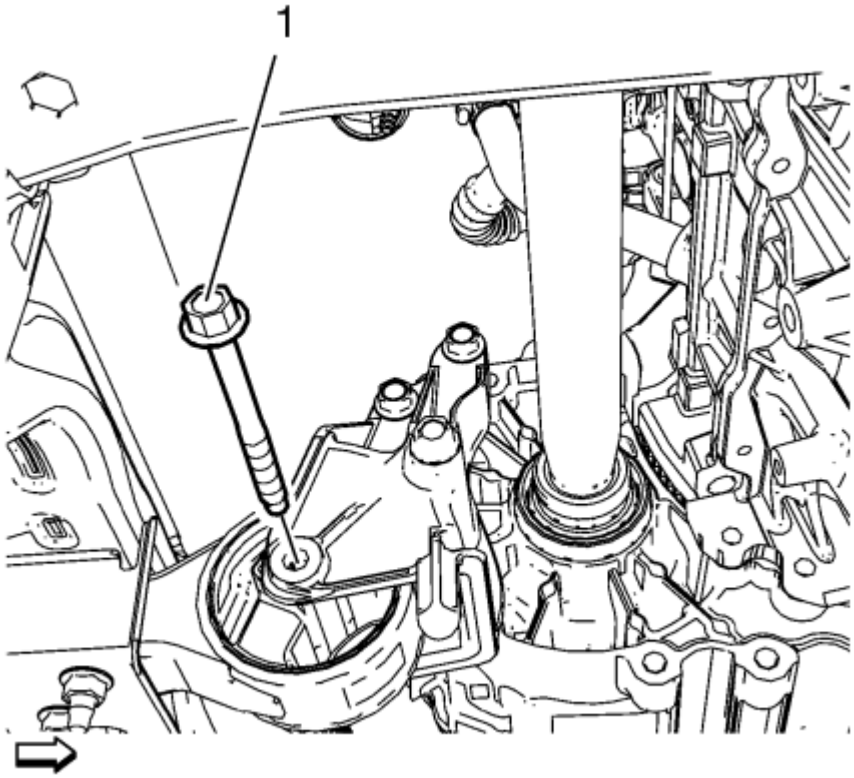

Fig. 130: Automatic Transmission Mount Bracket Through Bolt
Courtesy of GENERAL MOTORS CORP.

32. Remove the rear transmission mount bracket to rear mount through bolt (1).

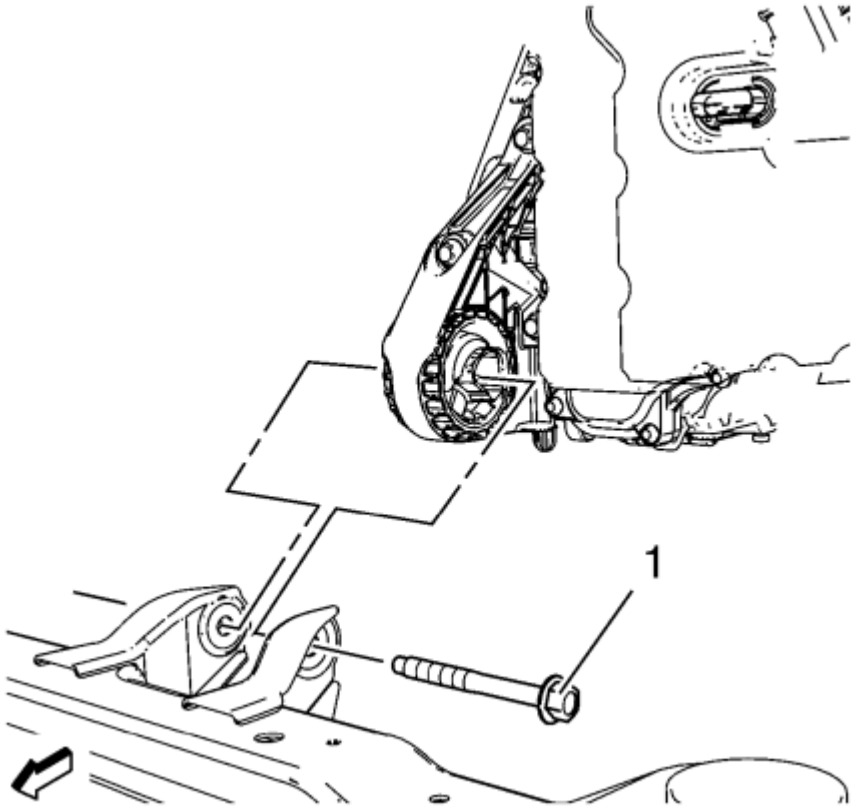

Fig. 131: Automatic Transmission Mount Bracket Through Bolt
Courtesy of GENERAL MOTORS CORP.

33. Remove the transmission front mount through bolt (1).
34. Using suitable straps or chains, secure the front of vehicle to the hoist arms.

NOTE: Use the engine support fixture to slightly raise the powertrain assembly to aid in the removal of the engine and transmission mount bolts.

35. Use the engine support fixture to slightly raise the powertrain assembly to aid in the removal of the engine and transmission mount bolts.

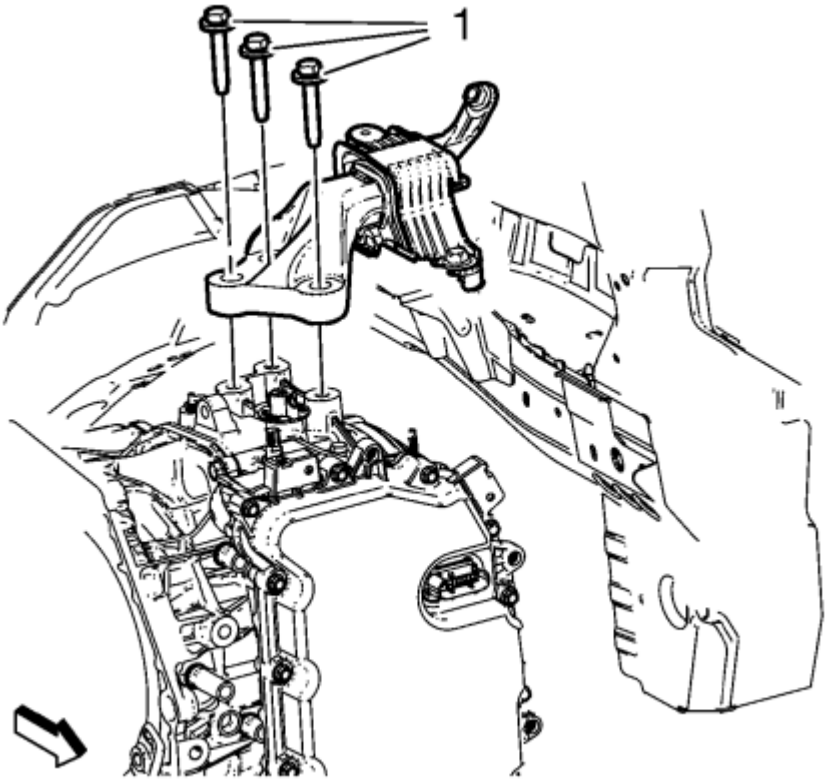

Fig. 132: Automatic Transmission Mount Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

36. Remove and DISCARD the left transmission mount to bracket bolts (1).

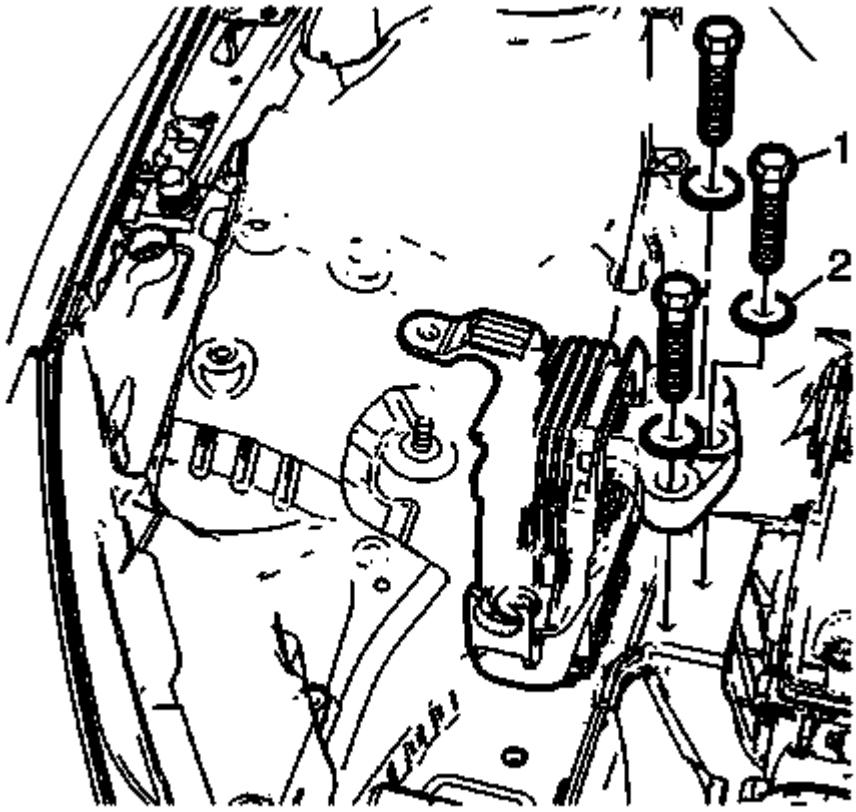

Fig. 133: Engine Mount Bracket Bolts And Washers
Courtesy of GENERAL MOTORS CORP.

37. Remove the engine mount to engine mount bracket bolts (1) and the washers (2).
38. Using a suitable engine support table, lower the vehicle until the drivetrain and front suspension frame contacts the engine support table.
39. Position blocks of wood below the oil pan and transmission to stabilize the powertrain on the support table.
40. Using the engine support fixture, lower the powertrain down until it is resting on the engine support table.
41. Remove the engine support fixture.
42. Remove the drivetrain and front suspension frame reinforcements from the rear of the frame.
43. Remove the front drivetrain and front suspension frame retaining bolts.
44. Slowly and carefully raise the vehicle, ensure the engine, transmission, radiator assembly and drivetrain suspension frame are free from wiring, hoses and other engine compartment components.
45. Separate the transmission from the engine assembly.
46. Disconnect engine coolant hoses as necessary.
47. Disconnect electrical connectors as necessary.
48. Transfer components as necessary.
49. Remove the engine from the table.

INSTALLATION PROCEDURE

1. Position the engine to the transmission assembly.
2. Position the engine, transmission, radiator assembly and drivetrain suspension frame under the vehicle.
3. Slowly and carefully lower the vehicle, ensure the engine, transmission, radiator assembly and drivetrain suspension frame are free from wiring, hoses and other engine compartment components.

CAUTION: Refer to Fastener Caution .

4. Install the four front drivetrain and front suspension frame retaining bolts, then tighten the fasteners to 160 N.m (118 lb ft).
5. Install the drivetrain and front suspension frame reinforcements (1) to the rear of the frame, then tighten the reinforcement fasteners (2) to 22 N.m (16 lb ft).

NOTE: Use the engine support fixture to slightly raise the powertrain assembly to aid in the installation of the engine and transmission mount bolts.

6. Install the engine support fixture. Refer to **Engine Support Fixture** .

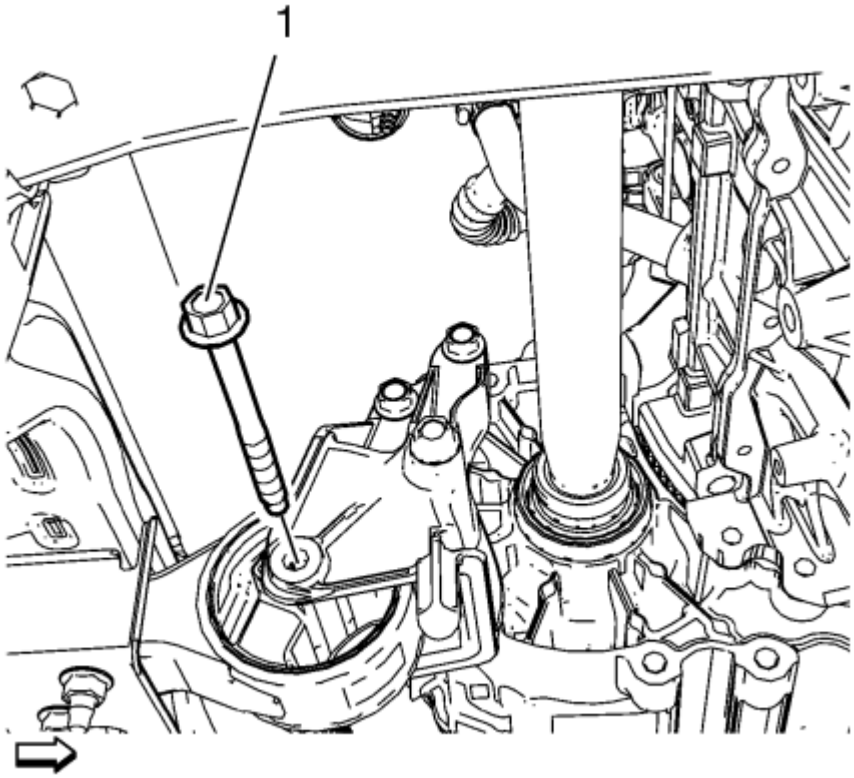

Fig. 134: Automatic Transmission Mount Bracket Through Bolt

Courtesy of GENERAL MOTORS CORP.

7. Install the transmission bracket mount to mount through bolt (1) and tighten to 100 N.m (74 lb ft).

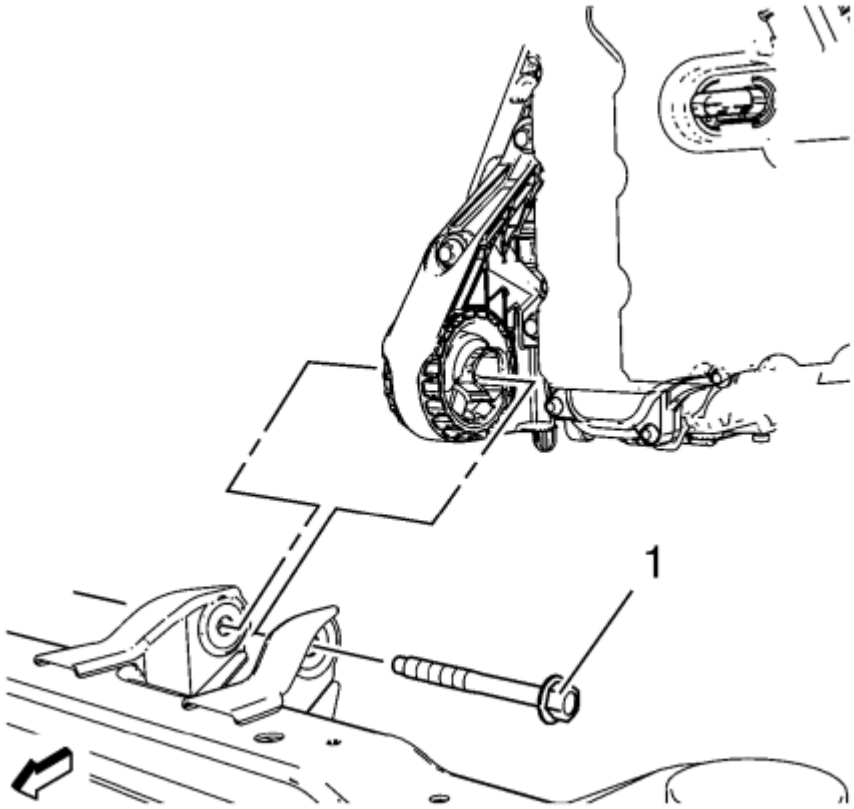

Fig. 135: Automatic Transmission Mount Bracket Through Bolt
Courtesy of GENERAL MOTORS CORP.

8. Install the transmission mount through bolt (1) and tighten to 58 N.m (43 lb ft).
9. Install the engine mount. Refer to **Engine Mount Replacement** and **Engine Mount Replacement - Right Side**.

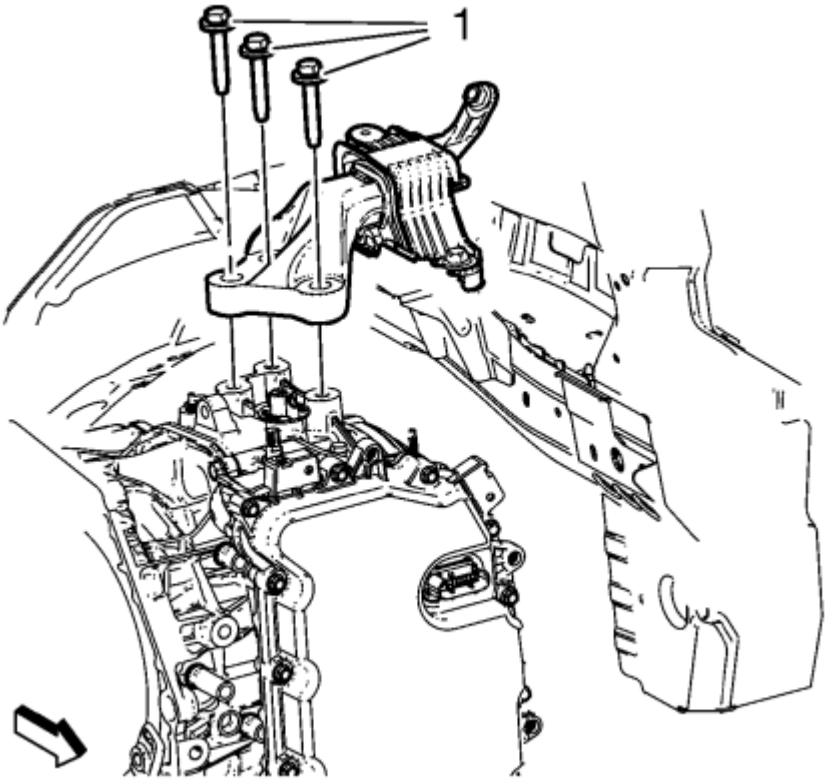

Fig. 136: Automatic Transmission Mount Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

10. Install the NEW left transmission mount to transmission bolts (1) and tighten to 50 N.m (37 lb ft) plus 60-75 degrees.

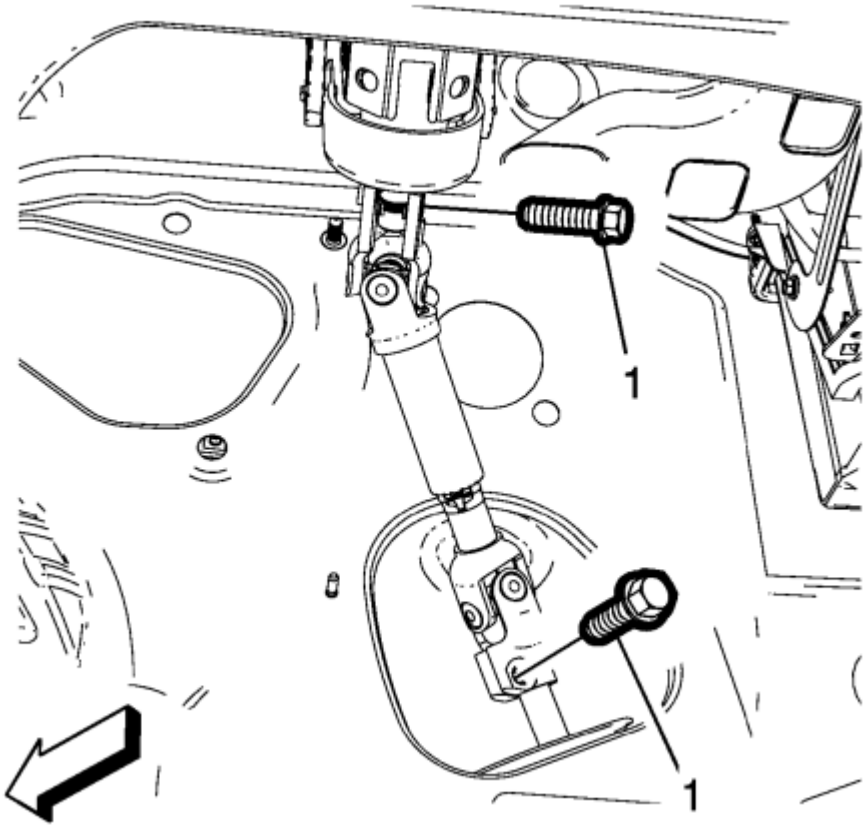

Fig. 137: Lower Steering Intermediate Shaft Bolt
Courtesy of GENERAL MOTORS CORP.

11. Install the lower steering intermediate shaft (1) bolt and tighten to 34 N.m (25 lb ft).
12. Connect the electronic power steering connectors to the electronic power steering assembly. Refer to **FEP Connectors (Steering Gear)** .
13. Connect the front steering knuckles to the strut assemblies. Refer to **Steering Knuckle Replacement** .

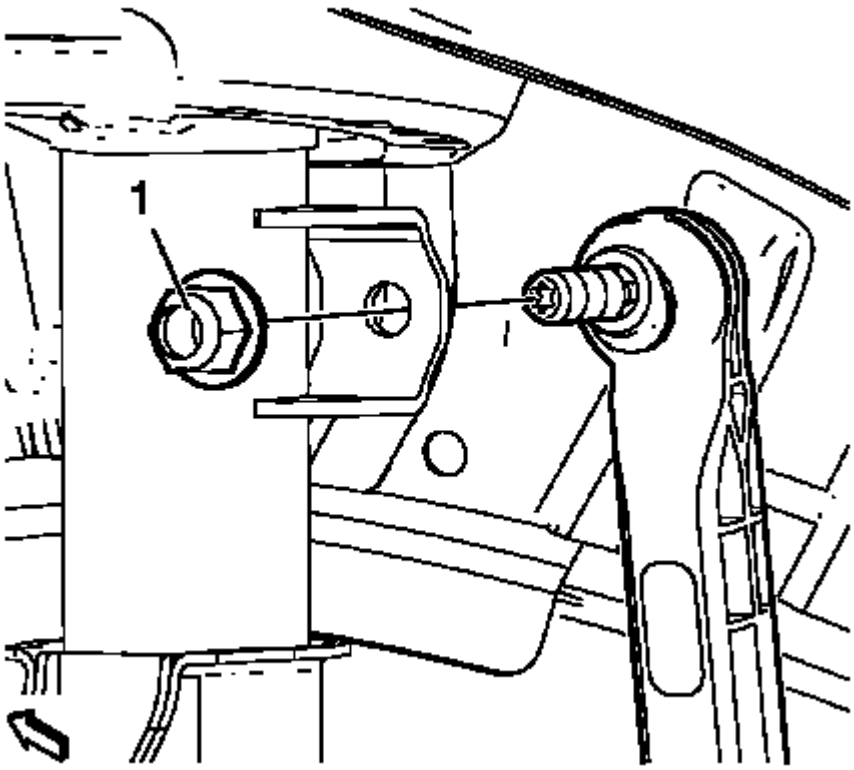

Fig. 138: Identifying Stabilizer Link Nut
Courtesy of GENERAL MOTORS CORP.

14. Connect the stabilizer link nut (1) to the strut assemblies. Refer to **Stabilizer Shaft Link Replacement** .
15. Connect the right wheel drive shaft from the intermediate shaft.

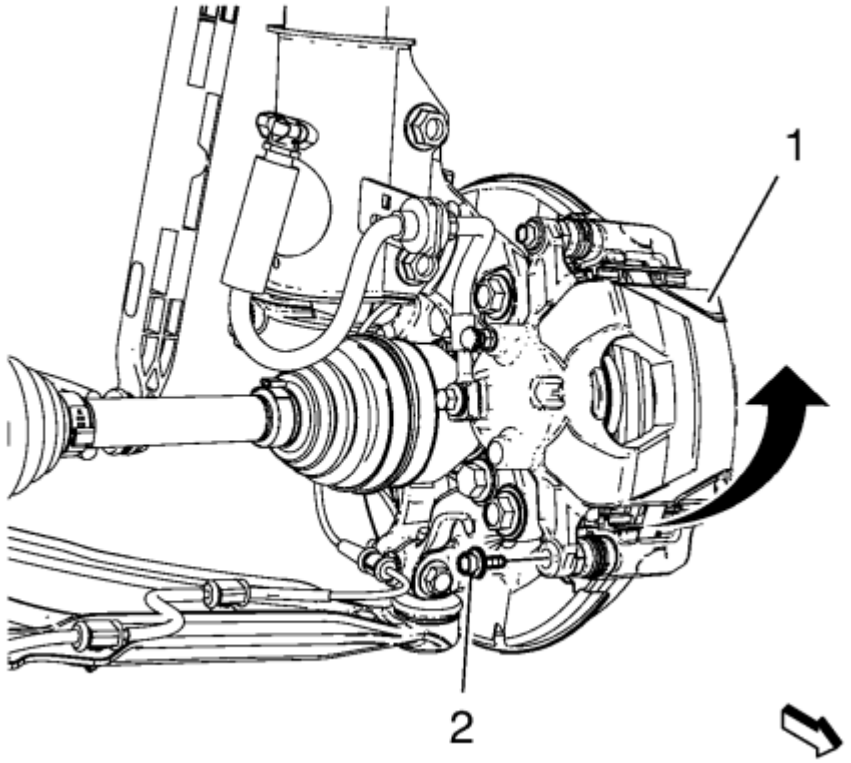

Fig. 139: View Of Brake Caliper And Brake Caliper Guide Pin Bolt
Courtesy of GENERAL MOTORS CORP.

16. Install the front brake caliper (1) and tighten the brake caliper guide pin bolt (2) to 28 N.m (21 lb ft).
17. Install the exhaust system. Refer to **Exhaust System Replacement (Gasoline)** .
18. Connect the wheel speed connectors to the steering knuckles.
19. Remove the engine support fixture.
20. Connect the wiring connectors and ground strap to the transmission.
21. Connect the wiring harness to the accessory wiring junction block.
22. Connect the electrical connectors to the ECM. Refer to **Engine Control Module Replacement** .
23. Install the battery tray. Refer to **Battery Tray Replacement** .

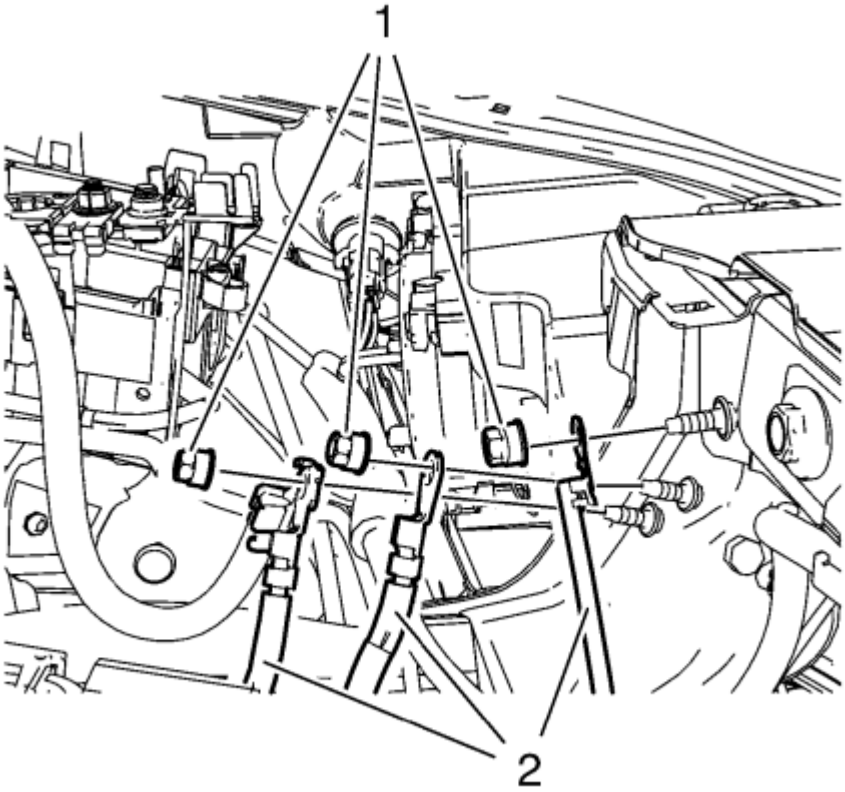

Fig. 140: Wiring Harness And Ground Nuts
Courtesy of GENERAL MOTORS CORP.

24. Install the wiring harnesses (2).
25. Install the ground nuts (1) and tighten to 9 N.m (80 lb in).

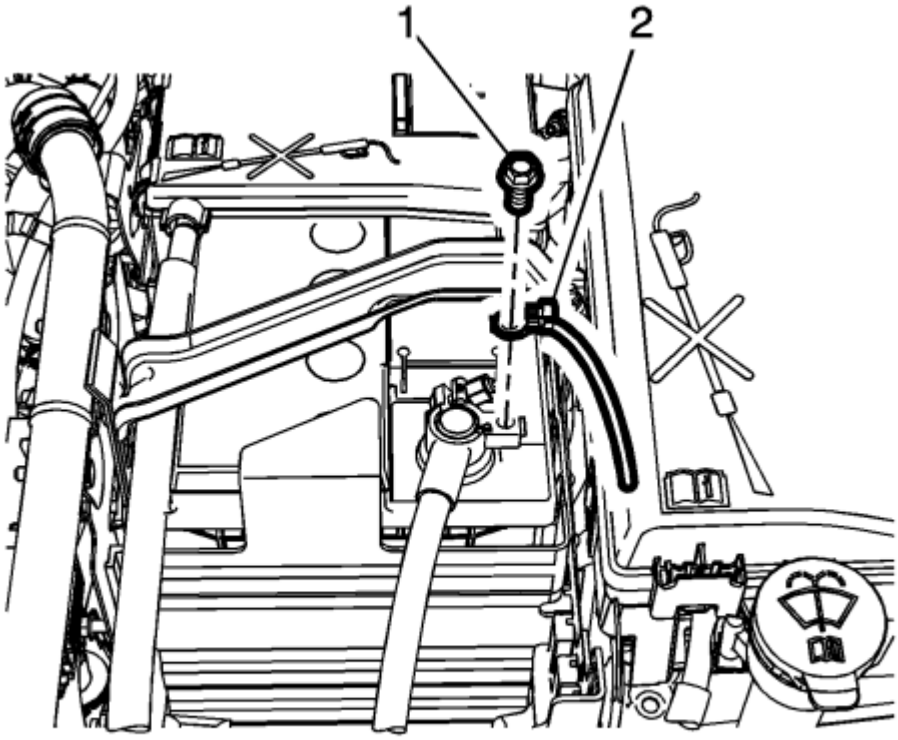

Fig. 141: Ground Strap And Bolt
Courtesy of GENERAL MOTORS CORP.

26. Connect the wiring harness plugs (1).

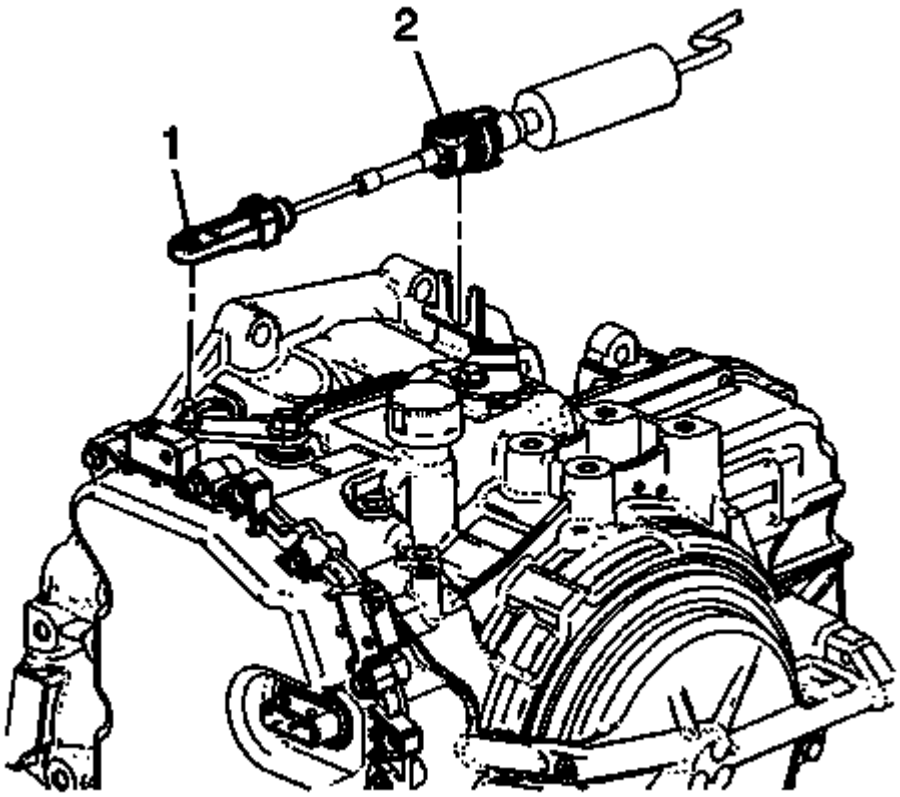

Fig. 142: View Of Transmission Range Selector Lever & Cable Connection
Courtesy of GENERAL MOTORS CORP.

27. On vehicles equipped with a automatic transmission, connect the transmission range selector lever cable terminal (1) to the transmission manual shift lever pin.
28. On vehicles equipped with a automatic transmission, press the locking tabs outward in order to lock the transmission range selector lever cable (2) to the cable bracket.

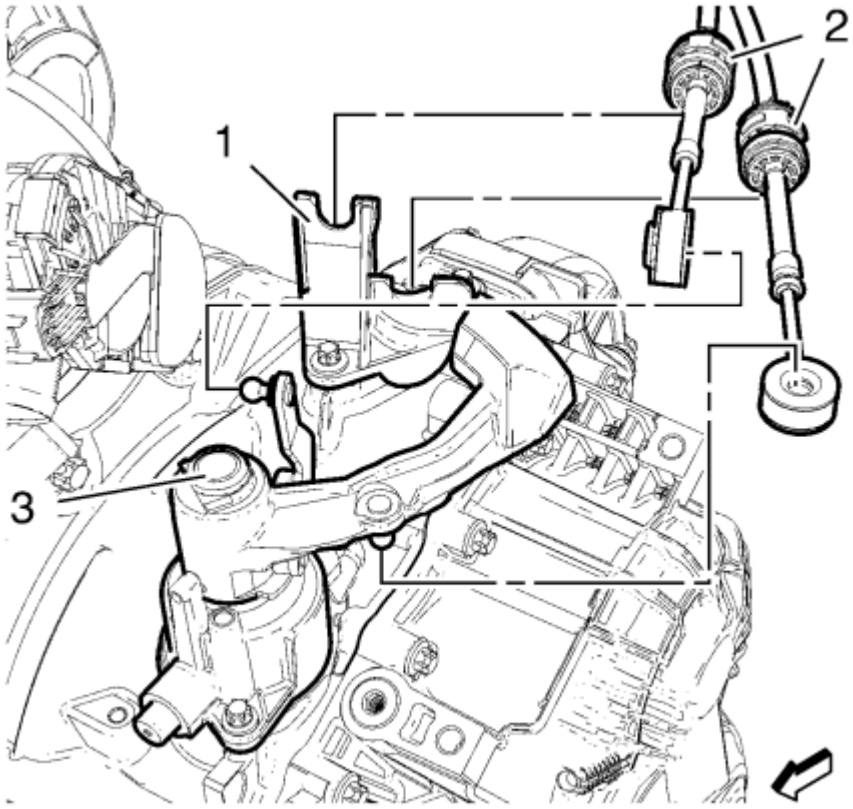

Fig. 143: Selector Lever Cable, Bracket And Transmission Control Housing
Courtesy of GENERAL MOTORS CORP.

29. On vehicles equipped with a manual transmission, connect the shift lever cables (2) to the shift levers (3)
30. On vehicles equipped with a manual transmission, install the shift lever cables (2) to the cable bracket (1).
31. Install the battery tray. Refer to **Battery Tray Replacement** .

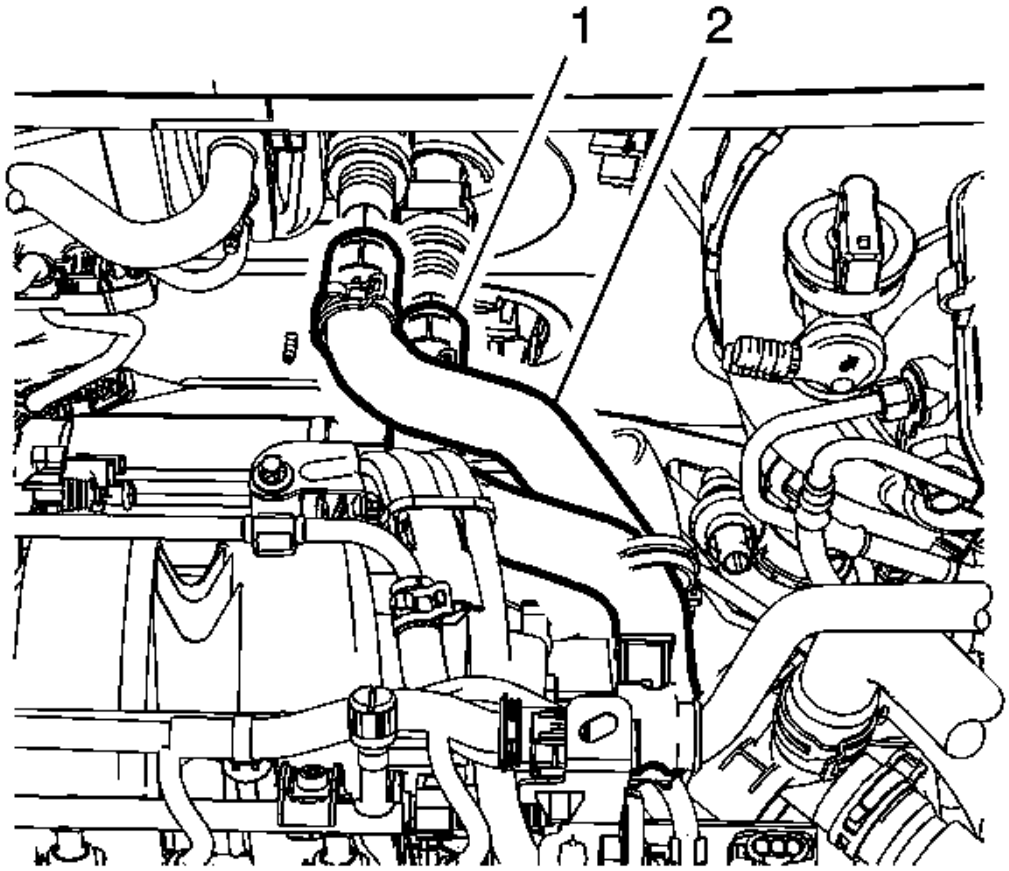

Fig. 144: Inlet And Outlet Heater Core Hoses
Courtesy of GENERAL MOTORS CORP.

32. Connect inlet (2) and outlet (1) heater core hoses.
33. Connect the power brake booster vacuum pipe. Refer to **Power Brake Booster Vacuum Pipe Replacement (Left Hand Drive)** or **Power Brake Booster Vacuum Pipe Replacement (Left Hand Drive with Electric Pump)** .

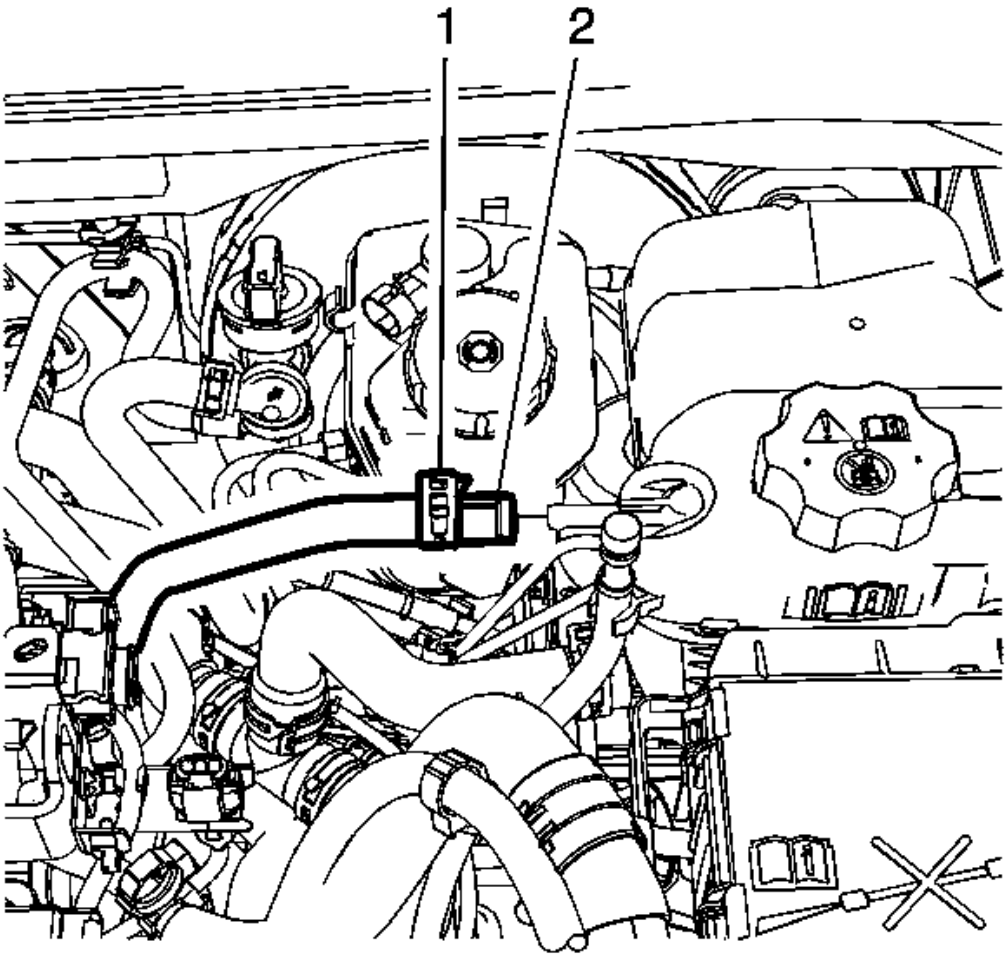

Fig. 145: Radiator Surge Tank Outlet Hose
Courtesy of GENERAL MOTORS CORP.

34. Connect the coolant hose (2) and reposition the clamp (1).

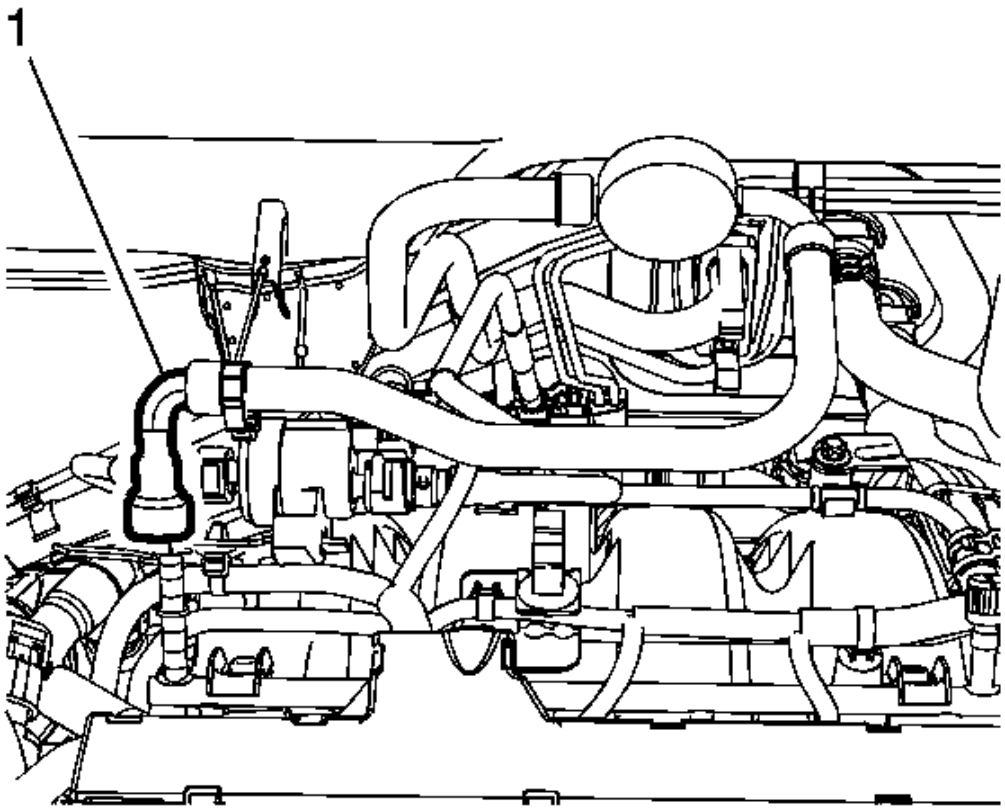

Fig. 146: Fuel Feed Line
Courtesy of GENERAL MOTORS CORP.

35. Connect the fuel feed line (1) and reposition away from the engine. Refer to **Plastic Collar Quick Connect Fitting Service** .

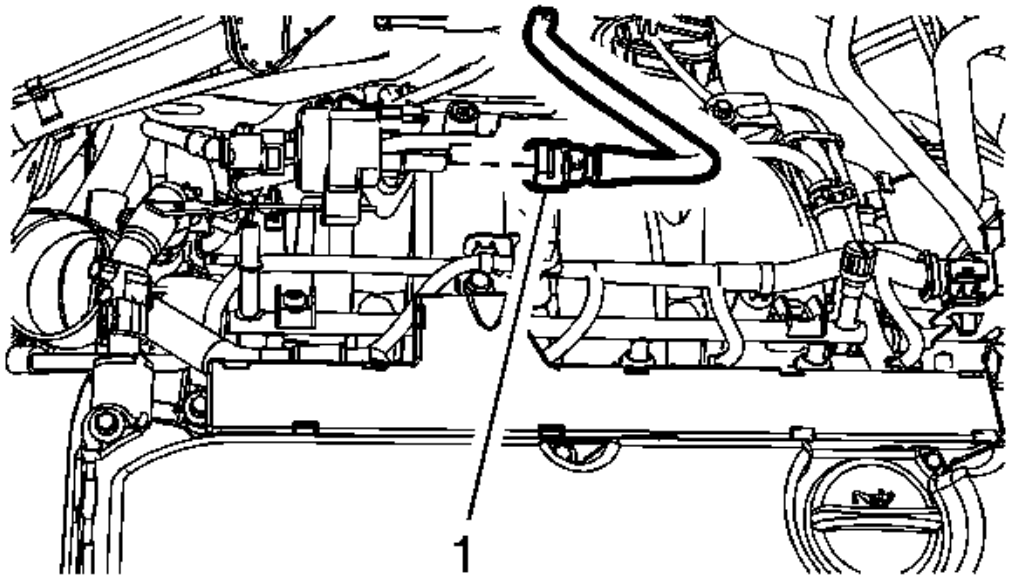

Fig. 147: EVAP Hose
Courtesy of GENERAL MOTORS CORP.

36. Connect the EVAP hose (1). Refer to **Plastic Collar Quick Connect Fitting Service** .

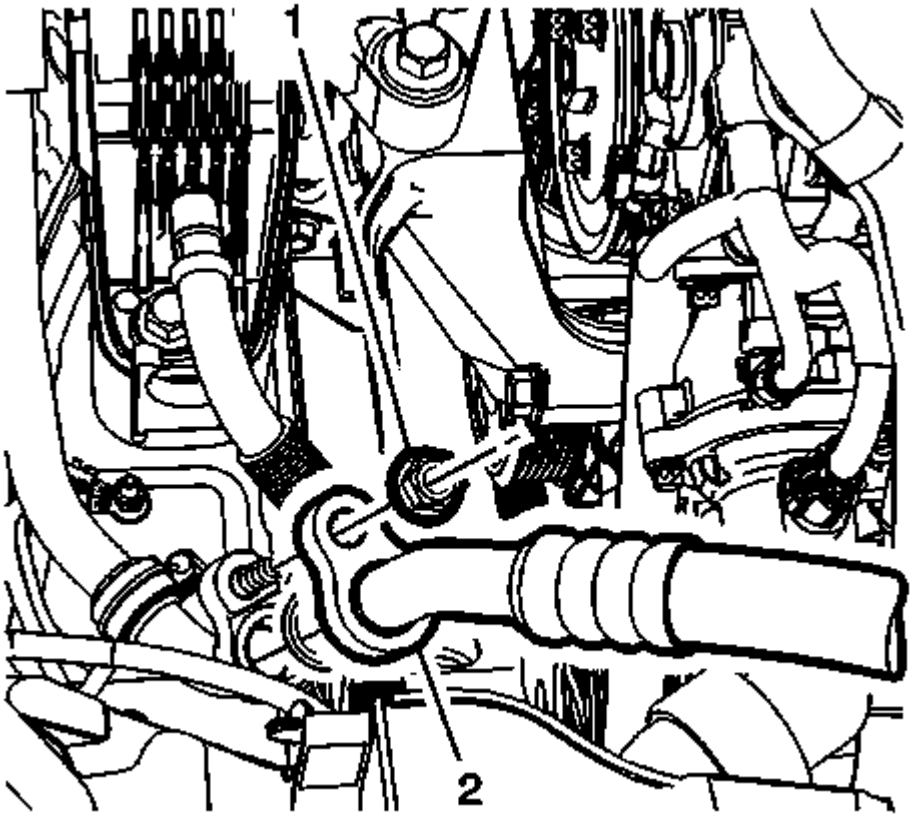

Fig. 148: Refrigerant Hose And Nut
Courtesy of GENERAL MOTORS CORP.

NOTE: Use NEW O-ring seals. Refer to Air Conditioning O-Ring Seal Replacement .

37. Install refrigerant hose (2) and tighten the nut (1) to 19 N.m (14 lb ft).
38. Connect engine coolant hoses as necessary.
39. Connect electrical connectors as necessary.
40. Install the front fascia.
41. Install the front wheelhouse front liners.
42. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement (1.6L LDE, LXV, and 1.8L 2H0)** .
43. Fill the engine cooling system. Refer to **Cooling System Draining and Filling (Static Fill)** or **Cooling System Draining and Filling (GE-47716 Fill)** .
44. Charge the air conditioning system. Refer to **Refrigerant Recovery and Recharging** .
45. Check engine oil level. Refer to **Engine Oil and Oil Filter Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.
46. Connect the negative battery cable to the battery. Refer to **Battery Negative Cable Disconnection and**

Connection .

ENGINE OIL AND OIL FILTER REPLACEMENT (1.6L LDE, LXV, 1.8L 2H0, AND LUW)

REMOVAL PROCEDURE

1. Open the hood.
2. Place a collecting basin underneath.

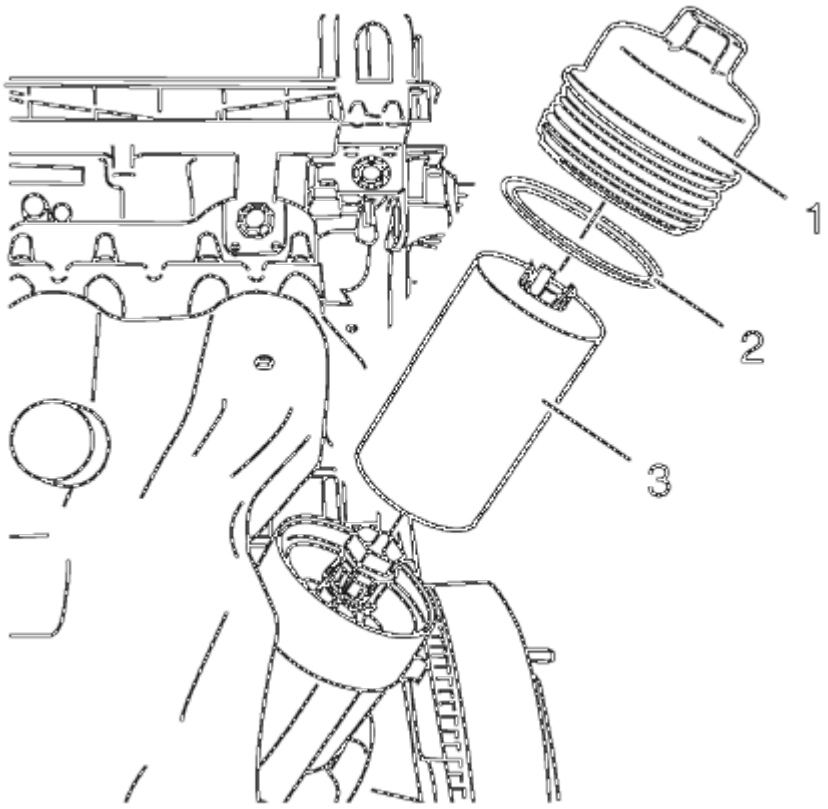

Fig. 149: Oil Filter Cap, Oil Filter Seal And Oil Filter Insert
Courtesy of GENERAL MOTORS CORP.

3. Remove the oil filter cap (1).
4. Remove the oil filter cap seal (2)

CAUTION: This engine uses a special high performance oil filter. Use of any other filter may lead to filter failure and/or severe engine damage.

5. Remove and properly dispose of the oil filter insert (3).
6. Raise the vehicle by its full height. Refer to **Lifting and Jacking the Vehicle** .

7. Remove the oil drain bolt.
8. Drain the engine oil into collecting basin.

INSTALLATION PROCEDURE

1. Clean the oil drain bolt thread and the thread in the oil pan.
2. Install a NEW seal to the oil drain bolt.

CAUTION: Refer to Fastener Caution .

3. Install the oil drain bolt to the oil pan and tighten to 14 N.m (124 lb in).
4. Lower the vehicle by its full height.

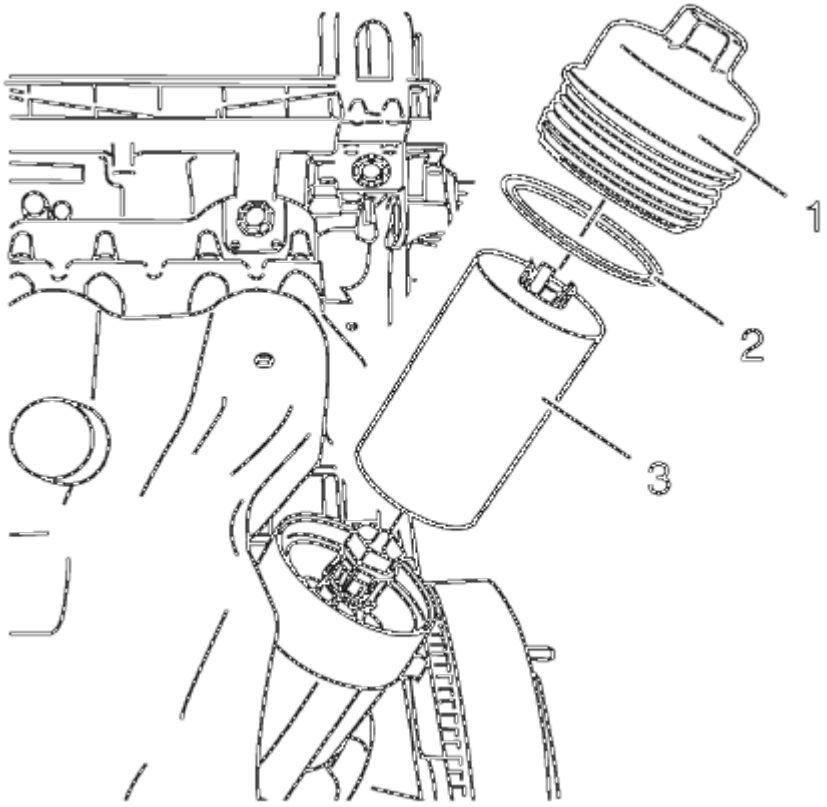

Fig. 150: Oil Filter Cap, Oil Filter Seal And Oil Filter Insert
Courtesy of GENERAL MOTORS CORP.

5. Install the NEW oil filter insert (3).

NOTE: Coat the seal ring with NEW engine oil.

6. Install the NEW oil filter cap seal (2)

CAUTION: Over torquing the oil filter cap may cause damage to the oil filter cap resulting in an oil leak.

7. Install the oil filter cap (1) and tighten to 25 N.m (18 lb ft).

CAUTION: Using engine oils of any viscosity other than those viscosities recommended could result in engine damage.

NOTE: Use specified volume of engine oil with the specified viscosity class.

NOTE: Start the engine and allow it to run until the oil pressure control indicator goes off.

NOTE: Inspect the engine oil level.

8. Fill in NEW engine oil. Refer to **Engine Mechanical Specifications** .
9. Close the hood
10. Reset the service interval indicator.

CAMSHAFT SEAL REPLACEMENT (1.6L LDE, LXV, 1.8L 2H0, AND LUW)

Special Tools

- **EN-422:** Installer
- **EN-45000:** Remover

For equivalent regional tools, refer to **Special Tools** .

REMOVAL PROCEDURE

1. Remove the camshaft position actuator adjuster. Refer to **Camshaft Position Actuator Adjuster Replacement**.

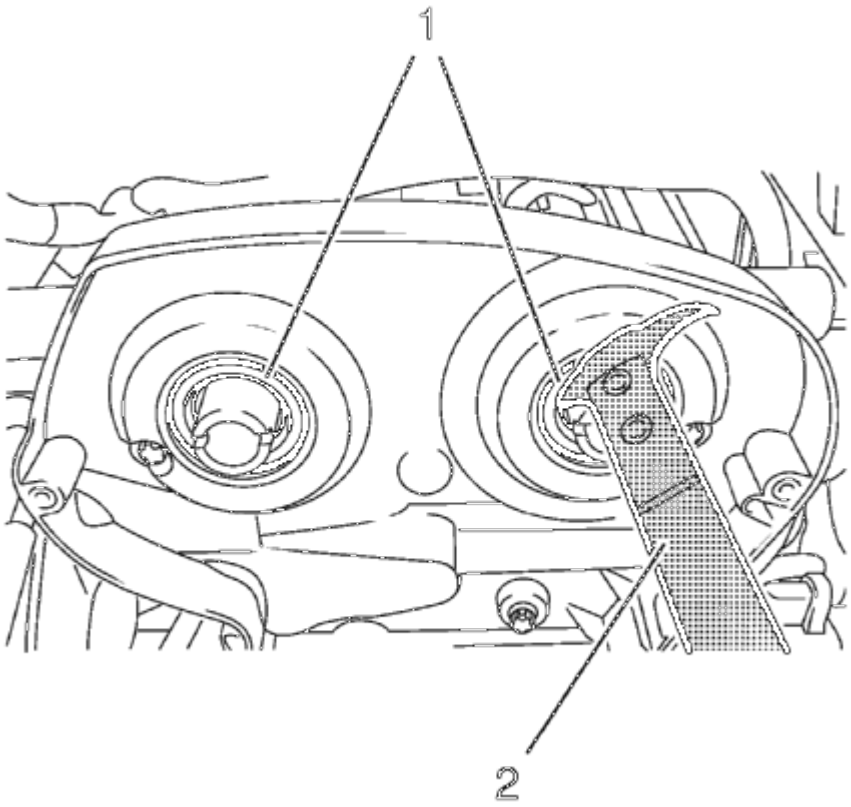

Fig. 151: Camshaft Front Oil Seals And Tool
Courtesy of GENERAL MOTORS CORP.

NOTE: Do not damage the sealing surfaces.

2. Use the **EN-45000:** remover to loosen the camshaft front oil seals (1).

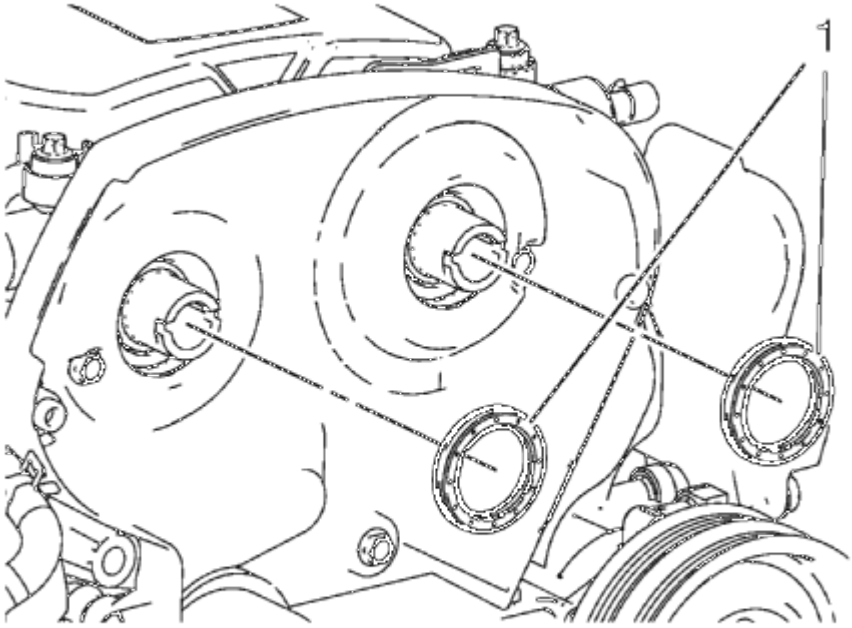

Fig. 152: Camshaft Front Oil Seals
Courtesy of GENERAL MOTORS CORP.

3. Remove the camshaft front oil seals (1).

INSTALLATION PROCEDURE

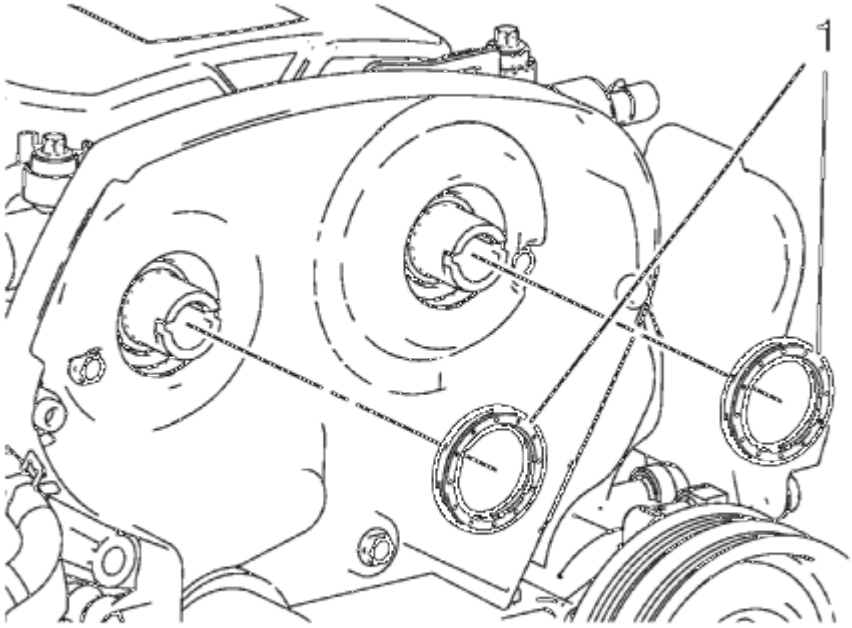

Fig. 153: Camshaft Front Oil Seals
Courtesy of GENERAL MOTORS CORP.

1. Insert 2 NEW camshaft front oil seals (1).

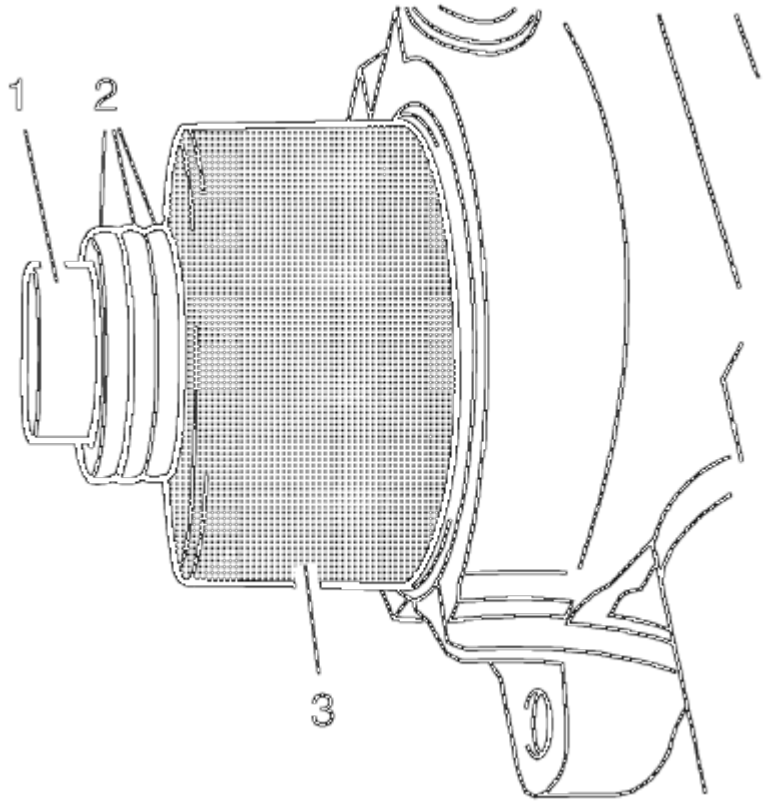

Fig. 154: Camshaft Sprocket Bolt, Shims And Tool
Courtesy of GENERAL MOTORS CORP.

2. Tighten the seal ring with **EN-422:** installer (3) on the camshaft until this is in contact with the cylinder head.
3. To install, use camshaft sprocket bolt (1) in conjunction with shims (2) with a total thickness of approximately 10 mm (0.393 in).
4. Install the camshaft position actuator adjuster. Refer to **Camshaft Position Actuator Adjuster Replacement**.

CAMSHAFT COVER REPLACEMENT (1.6L LDE, LXV, 1.8L 2H0, AND LUW)

REMOVAL PROCEDURE

1. Open the hood.
2. Remove the ignition coil. Refer to **Ignition Coil Replacement** .

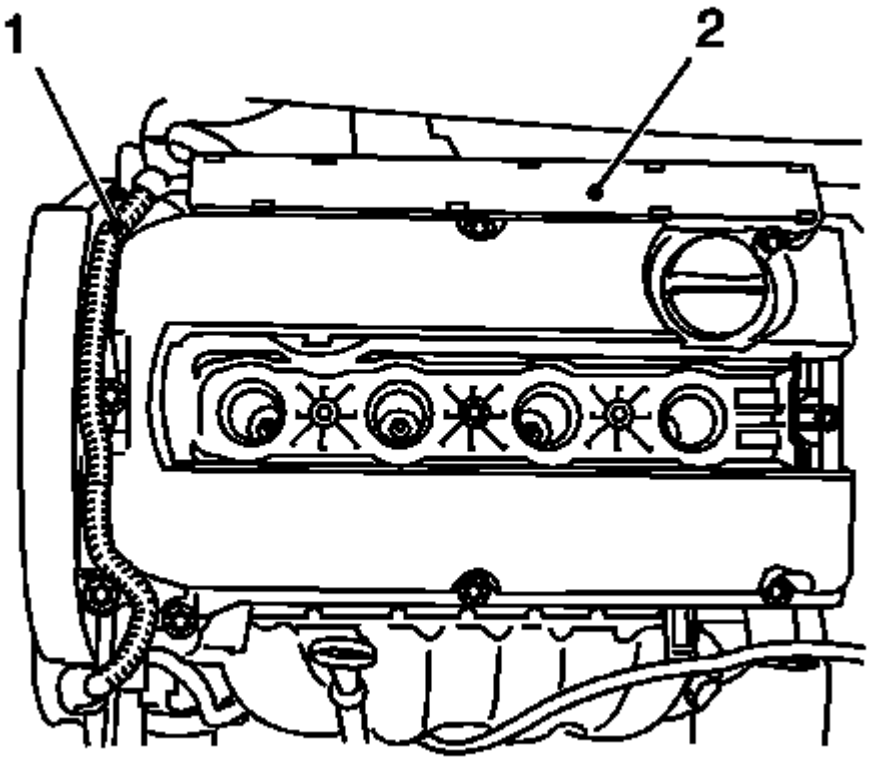

Fig. 155: View Of Wiring Harness And Wiring Trough
Courtesy of GENERAL MOTORS CORP.

3. Unclip the ECM wiring harness guide (1) from the cylinder head cover.
4. Disconnect the wiring guide (2).
5. Remove the positive crankcase ventilation tube. Refer to **Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (1.6L LDE, LXV, and 1.8L 2H0)**.

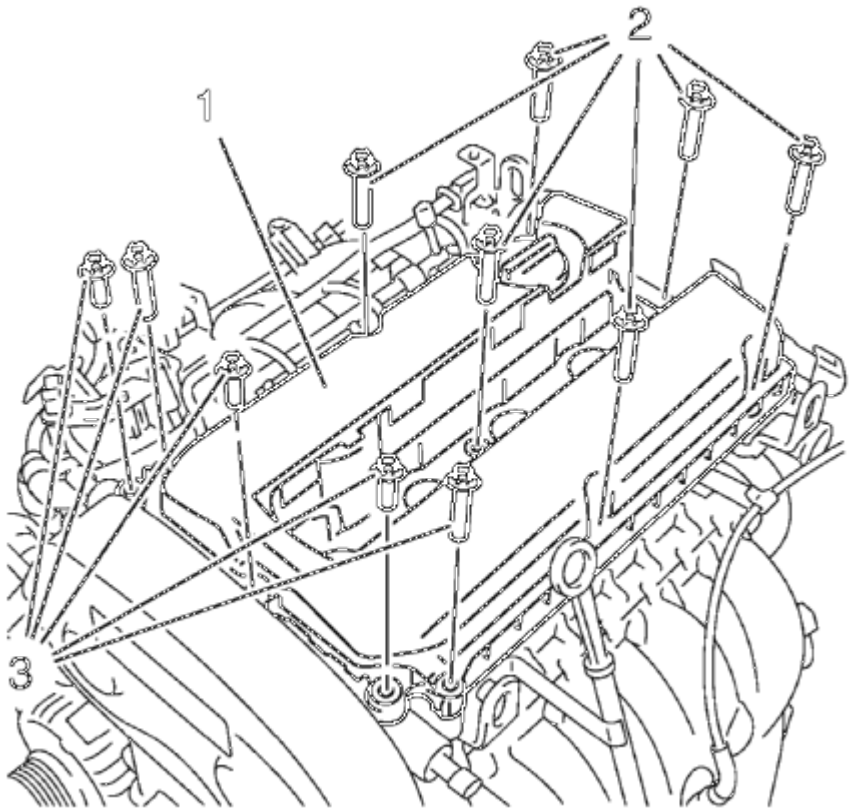

Fig. 156: Camshaft Cover And Bolts
Courtesy of GENERAL MOTORS CORP.

6. Remove the 11 bolts (2, 3).
7. Remove the camshaft cover (1).

INSTALLATION PROCEDURE

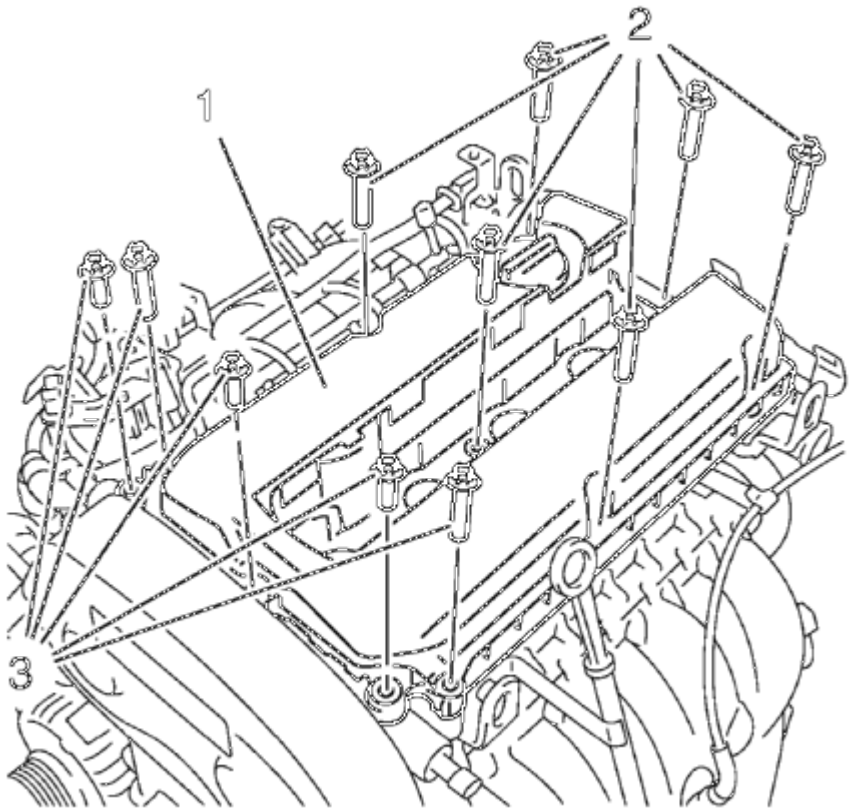

Fig. 157: Camshaft Cover And Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the camshaft cover (1).

   Insert a NEW gasket in the cylinder head cover.

   CAUTION: Refer to Fastener Caution .

2. Install the 11 bolts (2, 3) and tighten to 8 N.m (71 lb in).
3. Install the positive crankcase ventilation tube. Refer to **Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (1.6L LDE, LXV, and 1.8L 2H0)**.

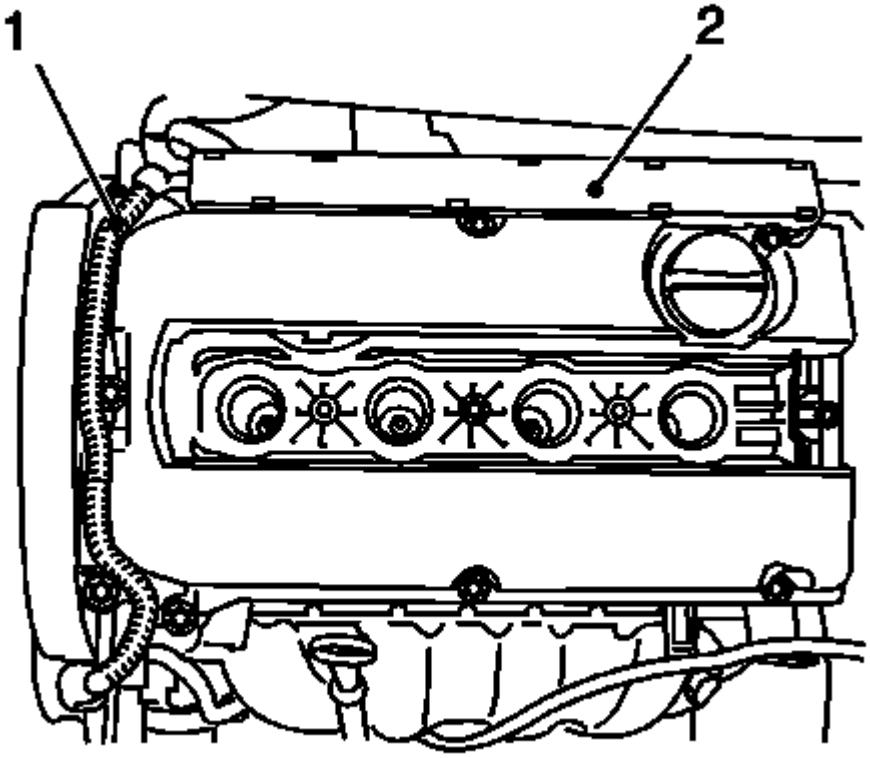

Fig. 158: View Of Wiring Harness And Wiring Trough
Courtesy of GENERAL MOTORS CORP.

4. Clip in the ECM wiring harness guide (1) to the cylinder head cover.
5. Connect the wiring guide (2).
6. Install the ignition coil. Refer to **Ignition Coil Replacement** .
7. Close the hood.

CAMSHAFT POSITION ACTUATOR ADJUSTER REPLACEMENT

Special Tools

- **EN-6340:** Camshaft Adjuster Locking Tool
- **EN-6628-A:** Camshaft Locking Tool
- **EN-45059:** Angle Meter

For equivalent regional tools, refer to **Special Tools**

REMOVAL PROCEDURE

1. Open the hood.
2. Remove the air cleaner housing. Refer to **Air Cleaner Assembly Replacement (1.6L LDE, LXV, and 1.8L 2H0)** .
3. Remove the camshaft cover. Refer to **Camshaft Cover Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.
4. Remove the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement**.
5. Remove the timing belt. Refer to **Timing Belt Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.
6. Remove the timing belt idler pulley. Refer to **Timing Belt Idler Pulley Removal** .

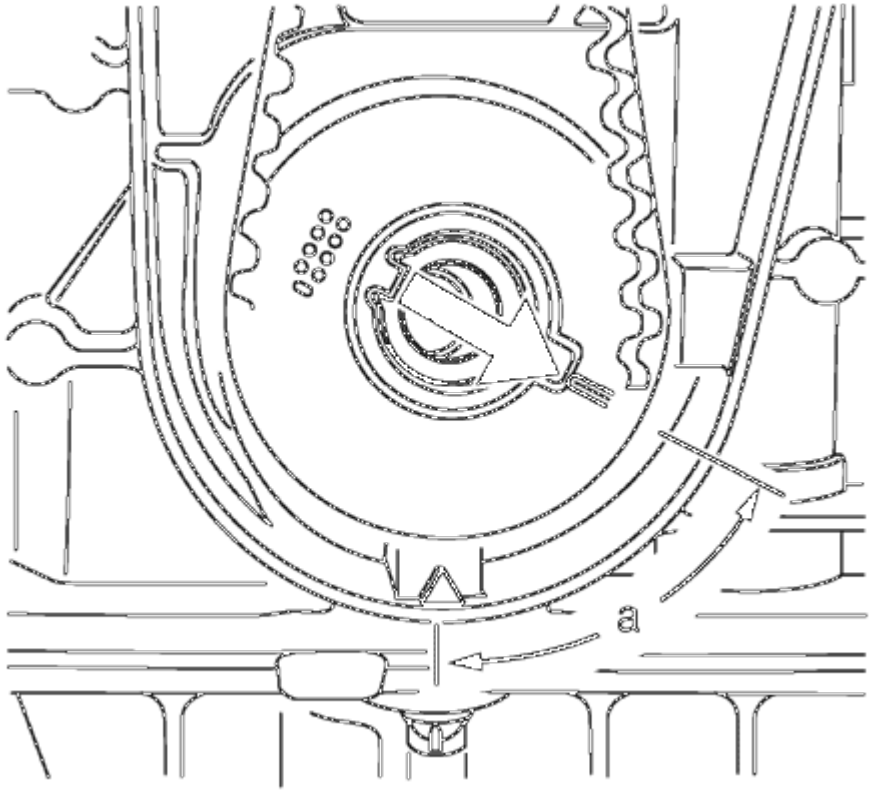

Fig. 159: Turning Crankshaft Against Direction Of Engine Rotation
Courtesy of GENERAL MOTORS CORP.

7. Set the crankshaft in direction of engine rotation to 60° before TDC. Use the **EN-45059:** meter and the crankshaft balancer bolt.
8. Remove the crankshaft sprocket. Refer to **Crankshaft Sprocket Removal** .
9. Lower the vehicle.
10. Remove the engine mount bracket. Refer to **Engine Mount Bracket Replacement**.

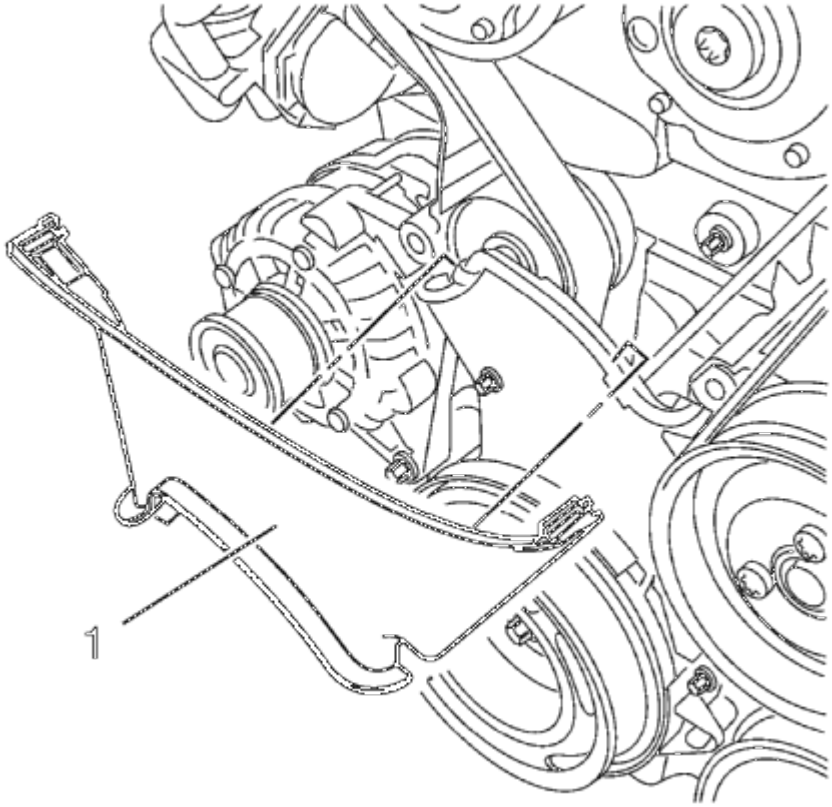

Fig. 160: Timing Belt Center Front Cover
Courtesy of GENERAL MOTORS CORP.

11. Remove the center front timing belt cover from the rear timing belt cover at 2 locations.
12. Remove the center front timing belt cover (1).

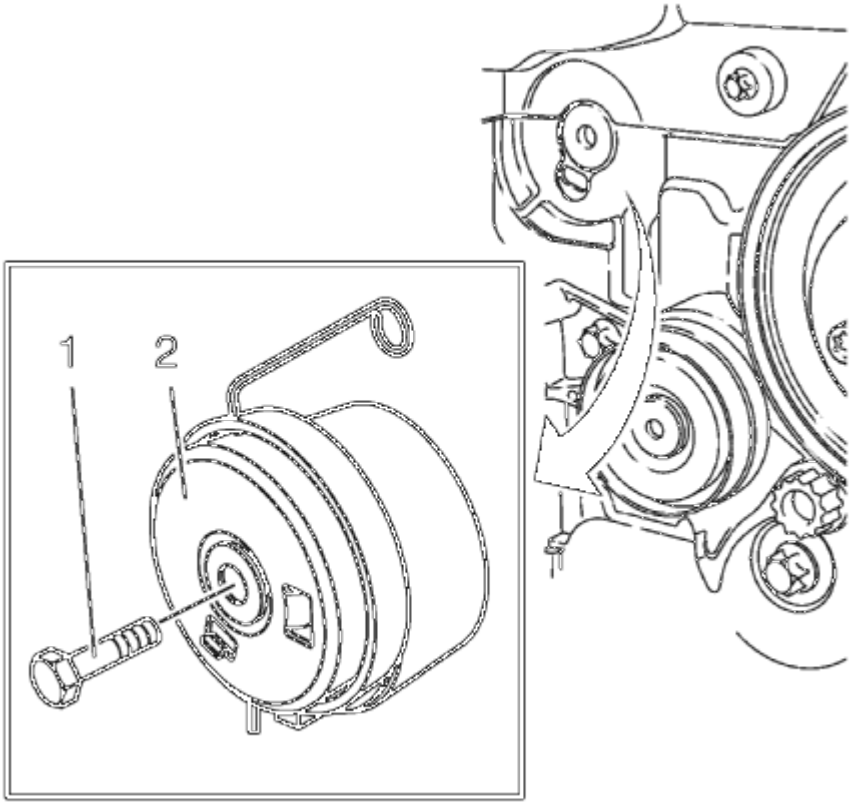

Fig. 161: Timing Belt Tensioner
Courtesy of GENERAL MOTORS CORP.

13. Remove the tensioner bolt (1).
14. Remove the timing belt tensioner (2).

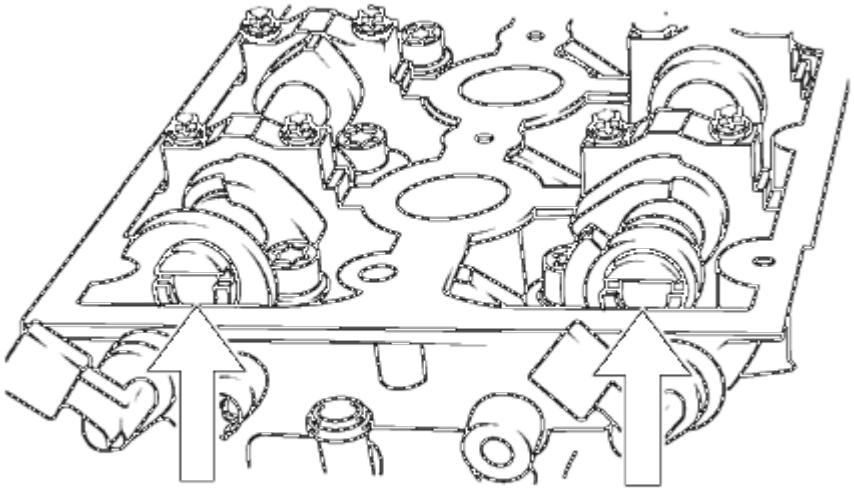

Fig. 162: Aligning Camshafts Horizontally
Courtesy of GENERAL MOTORS CORP.

NOTE: Note the arrows.

15. Turn the camshaft by the hexagon until the groove on the end of the camshafts is horizontal.

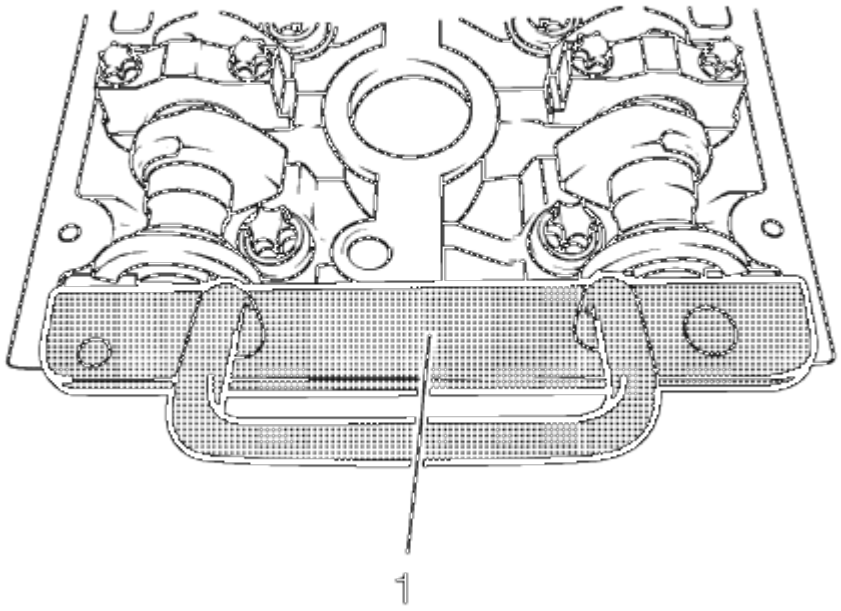

Fig. 163: Locking Tool
Courtesy of GENERAL MOTORS CORP.

16. Install the **EN-6628-A:** locking tool (1).
17. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

NOTE: Some engine oil will run out of the camshaft and the camshaft position actuator adjuster. That is the reason for the removal of the whole timing assembly.

18. Place a collecting basin underneath the vehicle.

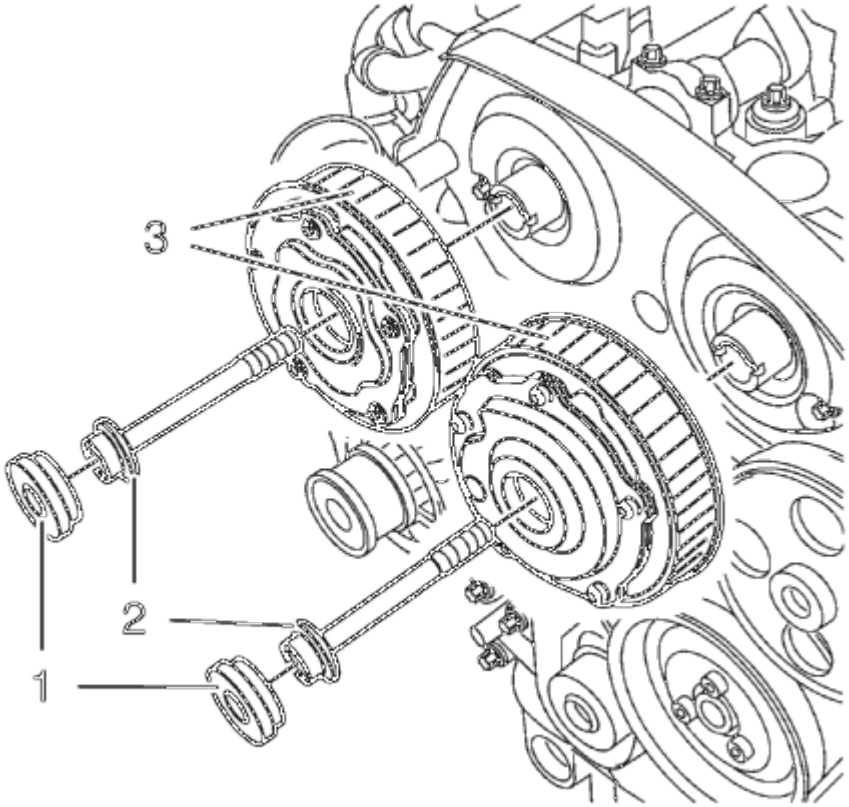

Fig. 164: Camshaft Position Actuator Adjuster
Courtesy of GENERAL MOTORS CORP.

19. Remove the camshaft position actuator adjuster closure bolt (1) of the intake camshaft position actuator adjuster and/or the exhaust camshaft position actuator adjuster (3).
20. Remove the intake camshaft position actuator adjuster bolt and/or the exhaust camshaft position actuator adjuster bolt (2).

NOTE: A second person is required. Counterhold against the hexagon of corresponding camshaft with a open-ended wrench.

21. Remove the intake camshaft position actuator adjuster and/or the exhaust camshaft position actuator adjuster (3).

INSTALLATION PROCEDURE

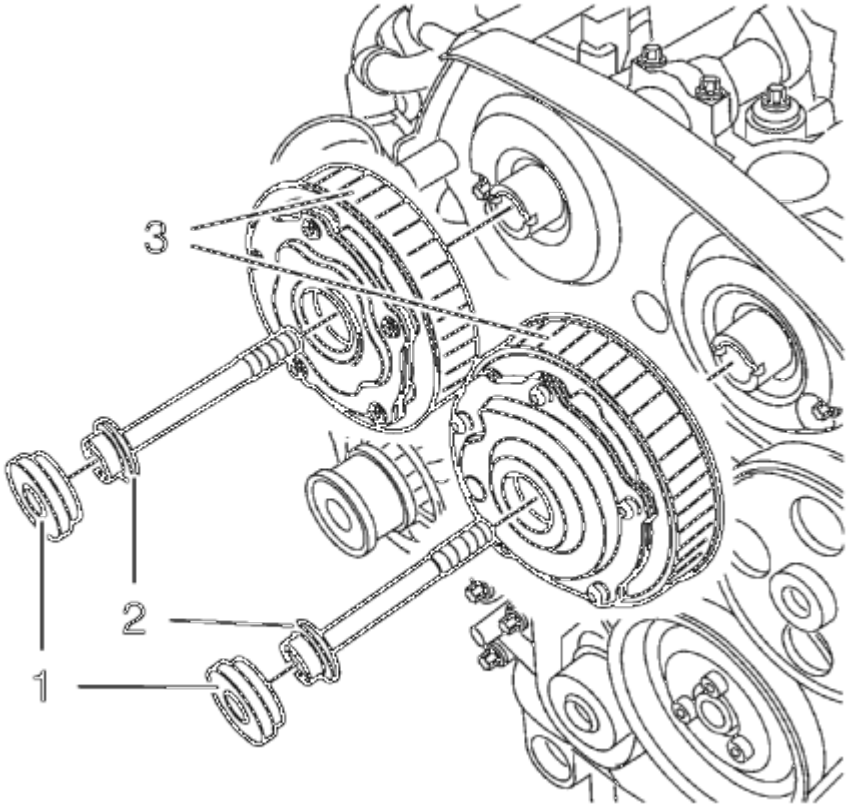

Fig. 165: Camshaft Position Actuator Adjuster
Courtesy of GENERAL MOTORS CORP.

NOTE: If the cover is contaminated with oil, you have to clean it close.

NOTE: A second person is required. Counterhold against the hexagon of corresponding camshaft with a open-ended wrench.

1. Install intake camshaft position actuator adjuster and/or the exhaust camshaft position actuator adjuster (3).
2. Install the intake camshaft position actuator adjuster bolt and/or the exhaust camshaft position actuator adjuster bolt (2).

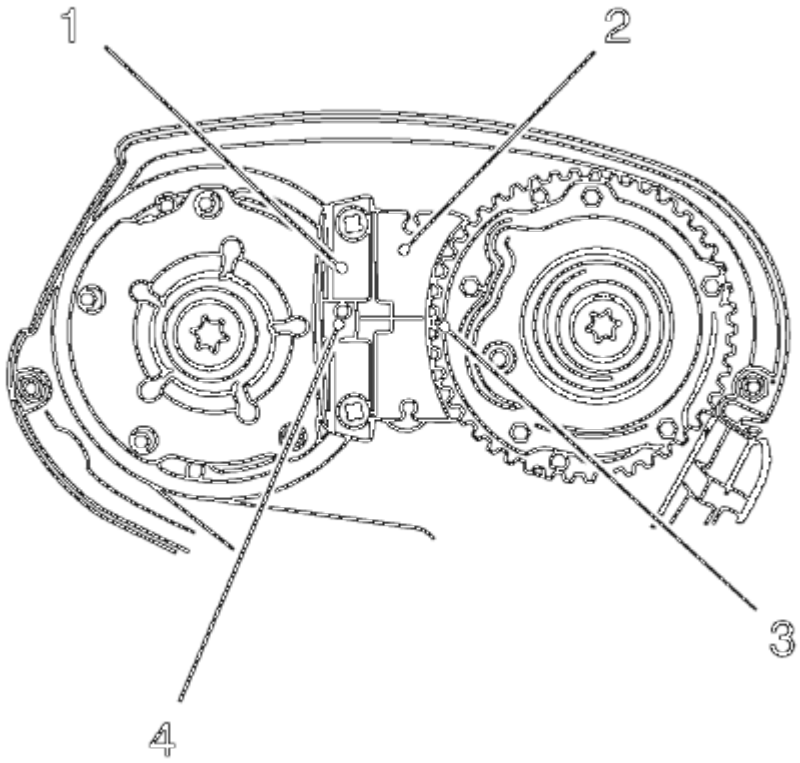

Fig. 166: Spot Type Markings And Special Tool
Courtesy of GENERAL MOTORS CORP.

3. Install the **EN-6340:** locking tool into the camshaft position actuator adjusters.

NOTE: The spot type marking (4) on the intake camshaft position actuator adjuster does not correspond to the groove of EN-6340-left during this process but must be somewhat above as shown.

1. Install the **EN-6340-left:** locking tool (1) in the camshaft position actuator adjusters as shown.

NOTE: The spot type marking (3) on the exhaust camshaft position actuator adjuster must correspond to the groove on EN-6340-right.

2. Install the **EN-6340-right:** locking tool (2) in the camshaft position actuator adjusters as shown.

CAUTION: Refer to Fastener Caution .

NOTE: A second person is required. Counterhold at the camshaft hexagon.

4. Tighten the intake camshaft position actuator adjuster or exhaust camshaft position actuator adjuster bolts to 65 N.m (48 lb ft) + 120° + 15° use the **EN-45059:** meter.

NOTE: Install a NEW seal ring.

5. Install camshaft closure bolt and tighten to 30 N.m (22 lb ft).
6. Remove the **EN-6628-A:** locking tool.

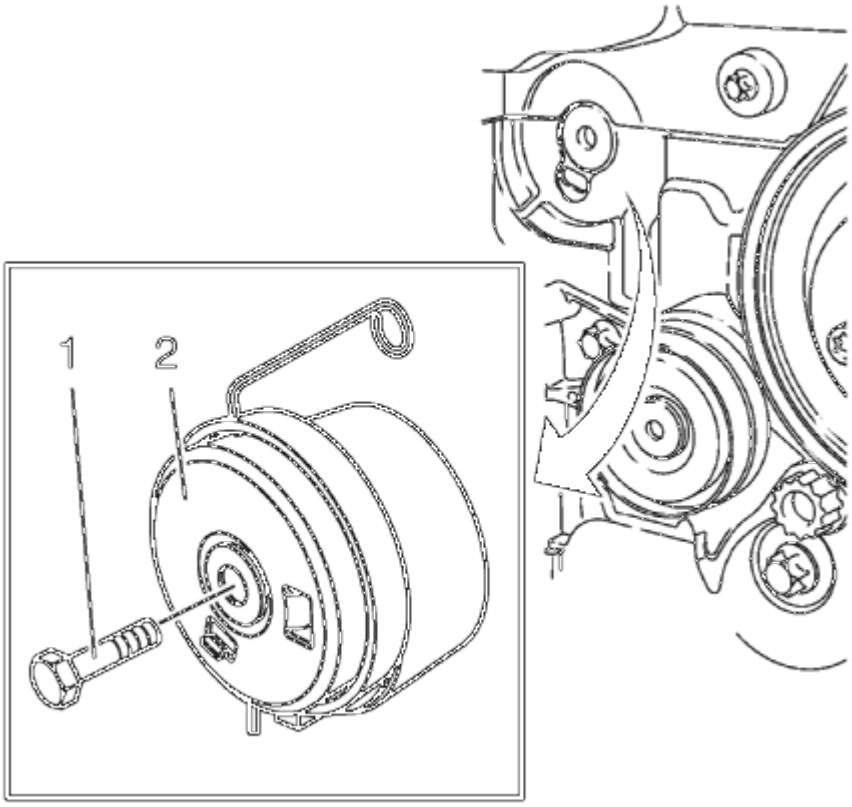

Fig. 167: Timing Belt Tensioner
Courtesy of GENERAL MOTORS CORP.

7. Clean the timing belt tensioner thread.
8. Install the timing belt tensioner (2) and tighten the NEW timing belt tensioner bolt (1) to 20 N.m (15 lb ft).

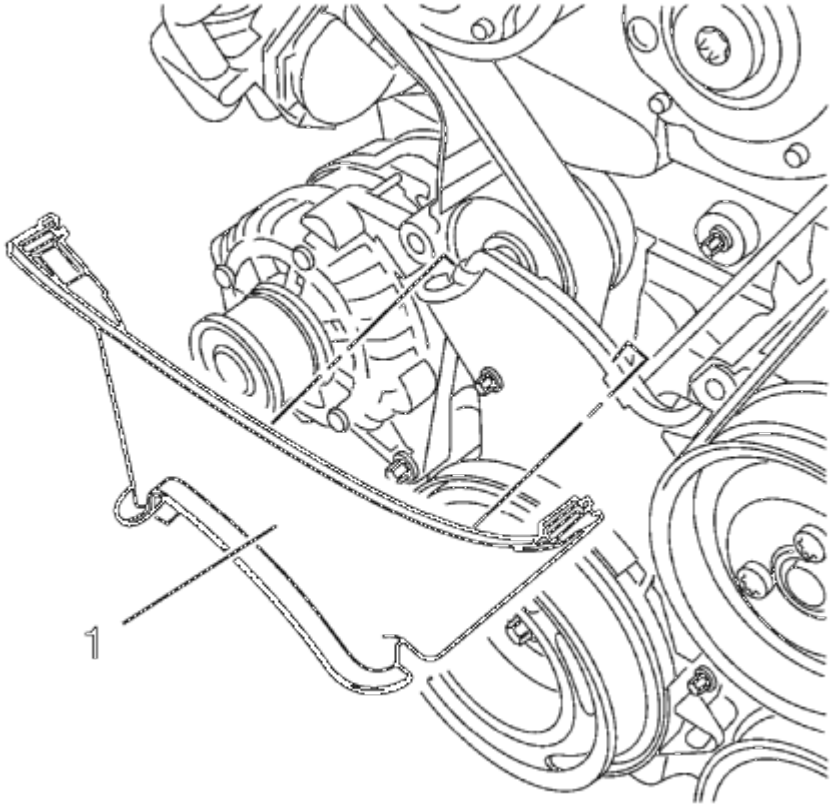

Fig. 168: Timing Belt Center Front Cover
Courtesy of GENERAL MOTORS CORP.

9. Install the timing belt center front cover (1) to the timing belt rear cover at 2 locations.
10. Install the engine mount bracket. Refer to **Engine Mount Bracket Replacement**.
11. Raise the vehicle.
12. Install the crankshaft sprocket. Refer to **Crankshaft Sprocket Installation** .

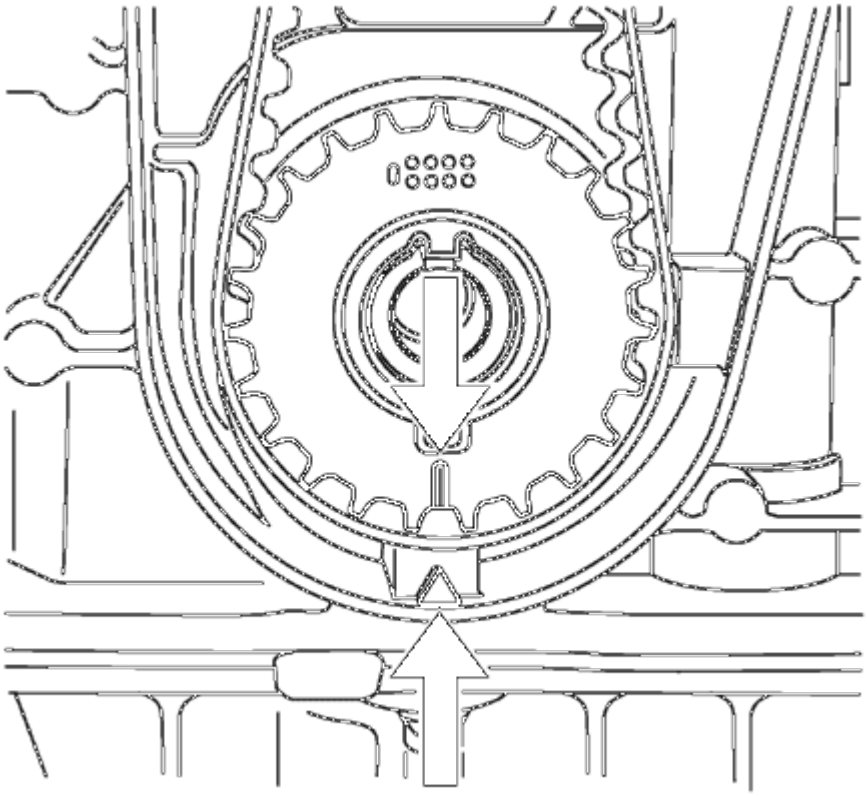

Fig. 169: Aligning Timing Belt Drive Gear And Oil Pump Housing
Courtesy of GENERAL MOTORS CORP.

13. Set the crankshaft in the direction of engine rotation to TDC. Use the crankshaft balancer bolt.
14. Install the timing belt idler pulley. Refer to **Timing Belt Idler Pulley Installation** .
15. Install the timing belt. Refer to **Timing Belt Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.
16. Install the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement**.
17. Install the camshaft cover. Refer to **Camshaft Cover Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.
18. Install the air cleaner housing. Refer to **Air Cleaner Assembly Replacement (1.6L LDE, LXV, and 1.8L 2H0)** .
19. Close the hood.

CAMSHAFT POSITION ACTUATOR SOLENOID VALVE REPLACEMENT

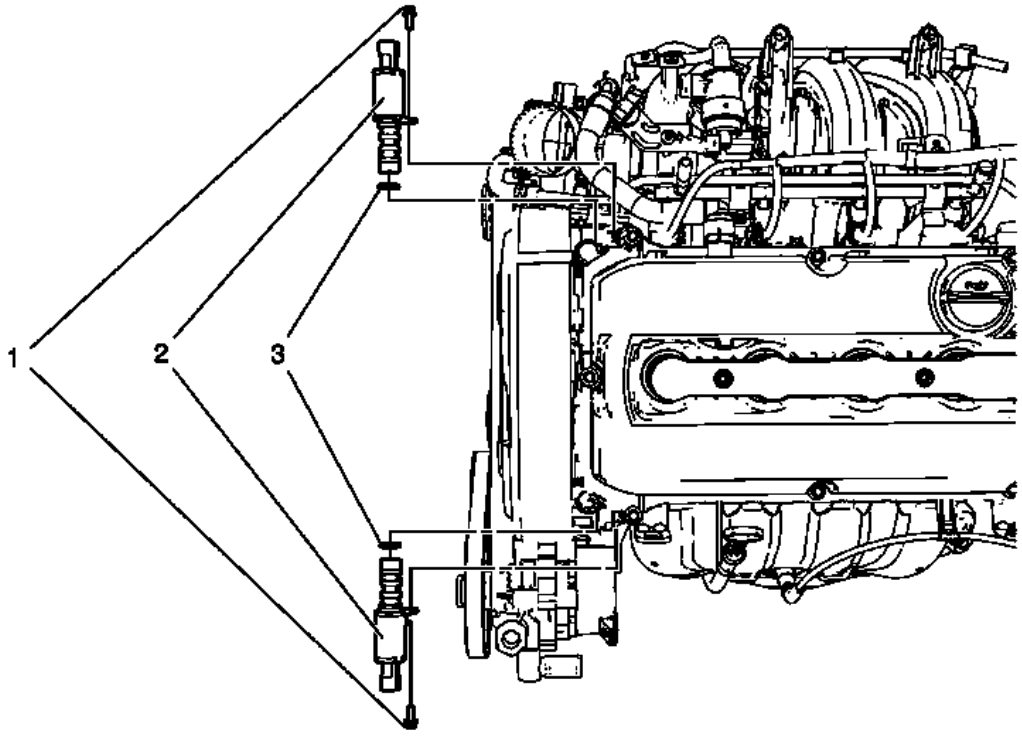

Fig. 170: Camshaft Position Actuator Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Camshaft Position Actuator Solenoid Valve Bolt (Qty: 2) **CAUTION:** **Refer to Fastener Caution .** **Tighten:** 6 N.m (53 lb in)
2	Camshaft Position Actuator Solenoid Valve (Qty: 2)
3	Camshaft Position Actuator Solenoid Valve Seal (Qty: 2) **Tip:** Coat the camshaft position actuator solenoid valve seals with NEW engine oil.

CAMSHAFT REPLACEMENT

Special Tools

- **EN-422:** Installer
- **EN-6628-A:** Locking Tool

For equivalent regional tools, refer to **Special Tools** .

REMOVAL PROCEDURE

1. Remove the camshaft adjuster. Refer to **Camshaft Position Actuator Adjuster Replacement**.
2. Remove the rear timing belt cover. Refer to **Timing Belt Rear Cover Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.
3. Remove intake camshaft position sensor. Refer to **Camshaft Position Sensor Replacement (1.6L LDE, LXV, and 1.8L 2H0)** .
4. Remove exhaust camshaft position sensor. Refer to **Camshaft Position Sensor Replacement (1.6L LDE, LXV, and 1.8L 2H0)** .
5. Remove **EN-6628-A:** locking tool.

   Counterhold at hexagon of camshaft.

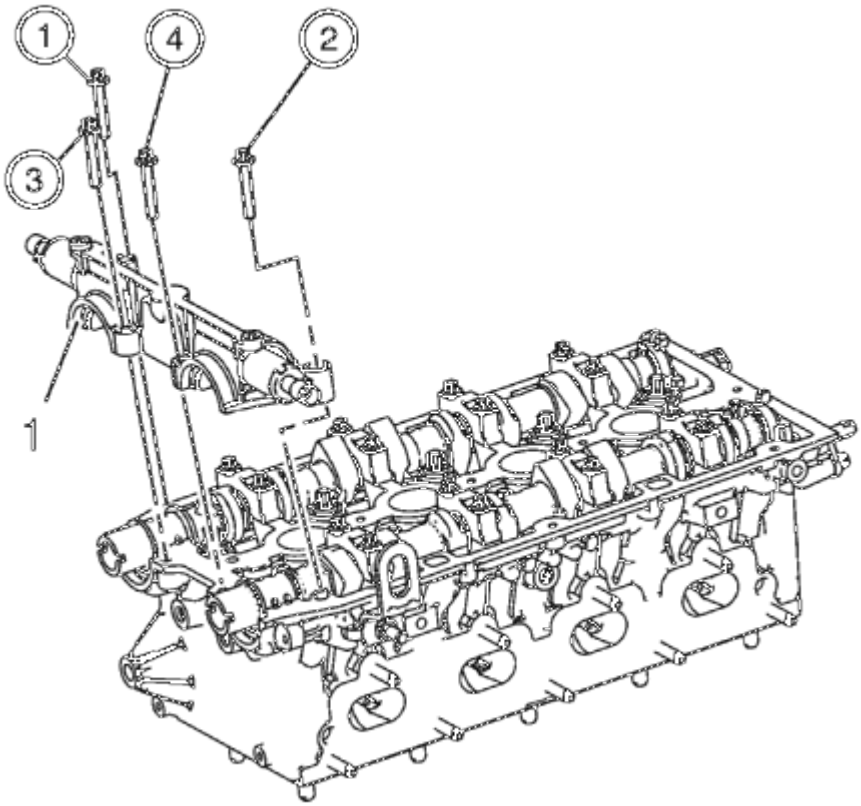

Fig. 171: Camshaft Bearing Cap And Camshaft Bearing Cap Bolts Removal Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: Note removal sequence 1-4.

6. Remove the 4 camshaft bearing cap bolts.

NOTE: Release the bearing support by striking it gently with a plastic hammer.

7. Remove the first camshaft bearing cap (1).

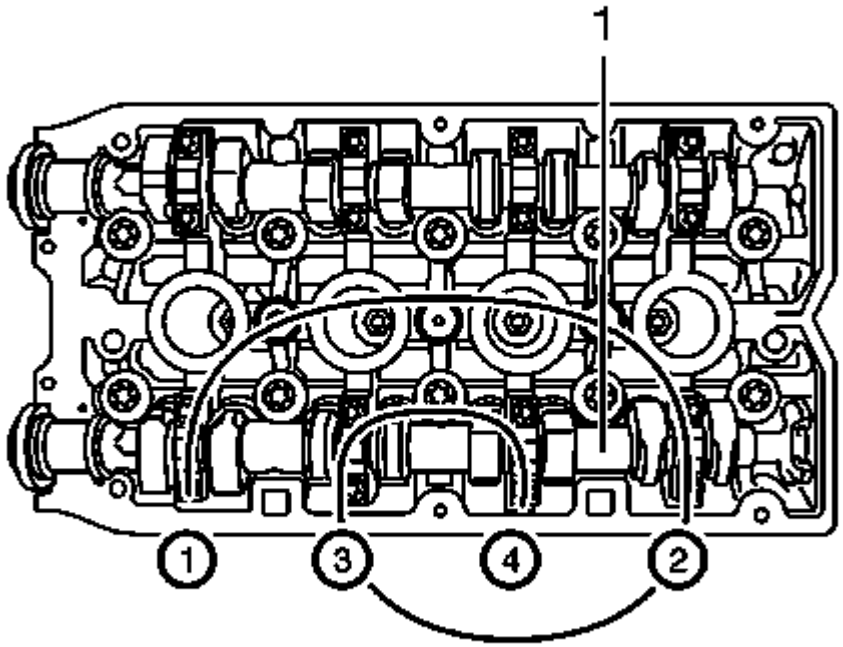

Fig. 172: Exhaust Camshaft Bearing Cap Bolts Loosening Sequence
Courtesy of GENERAL MOTORS CORP.

8. Loosen the 8 exhaust camshaft bearing cap bolts working from outside to inside in a spiral in steps of 1/2 up to 1 turn.
9. Remove the 8 exhaust camshaft bearing cap bolts.

NOTE: Mark camshaft bearing caps before removal.

10. Remove the 4 exhaust camshaft bearing caps Numbers 6-9 from the cylinder head.
11. Remove the exhaust camshaft (1).

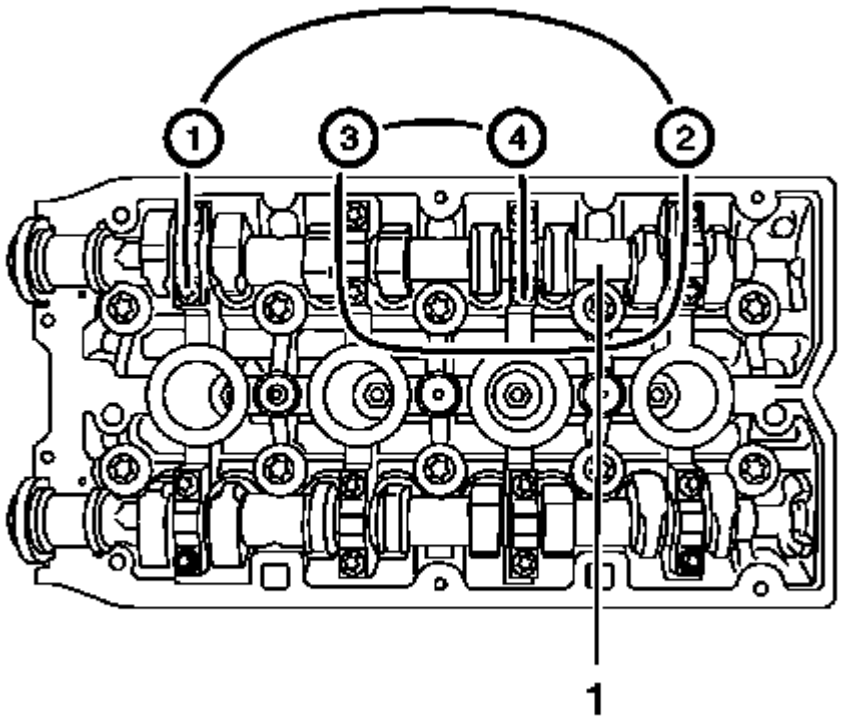

Fig. 173: Intake Camshaft Bearing Cap Bolts Loosening Sequence
Courtesy of GENERAL MOTORS CORP.

12. Loosen the 8 intake camshaft bearing cap bolts working from outside to inside in a spiral in steps of 1/2 up to 1 turn.
13. Remove the 8 intake camshaft bearing cap bolts.

NOTE: Mark camshaft bearing caps before removal.

14. Remove the 4 intake camshaft bearing caps Numbers 2-5 from the cylinder head.
15. Remove the intake camshaft (1).
16. Detach the seal rings from the camshafts.

INSTALLATION PROCEDURE

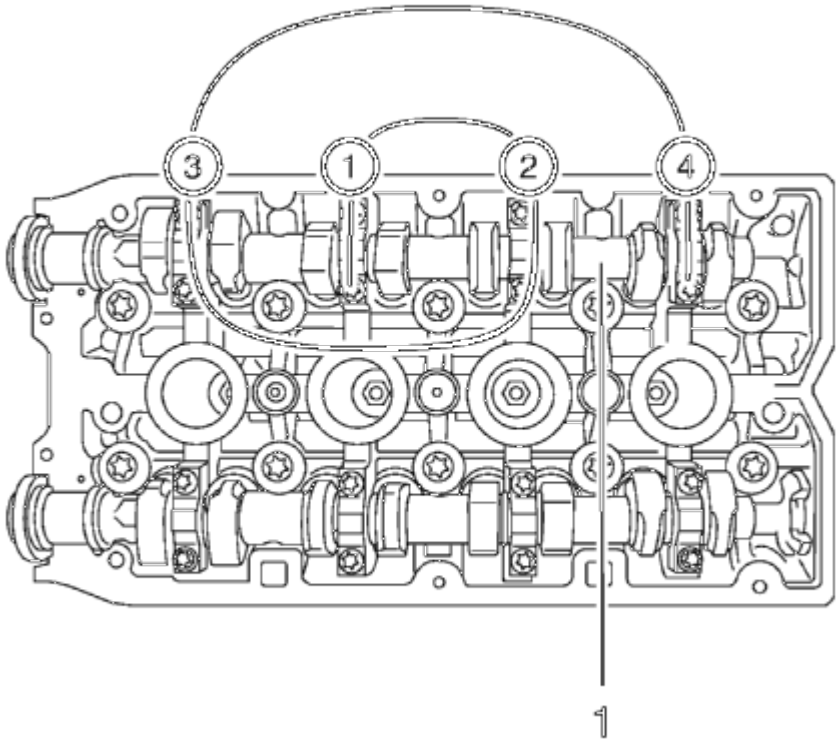

Fig. 174: Intake Camshaft Bearing Cover Bolts Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: Lubricate with clean engine oil.

1. Install the intake camshaft (1).

NOTE: Note the identification marking on the camshaft bearing cover.

2. Install the 4 intake camshaft bearing cover Numbers 2-5.

CAUTION: Refer to Fastener Caution .

3. Install the 8 intake camshaft bearing cover bolts and tighten in a spiral from the inside to the outside to 8 N.m (71 lb in).

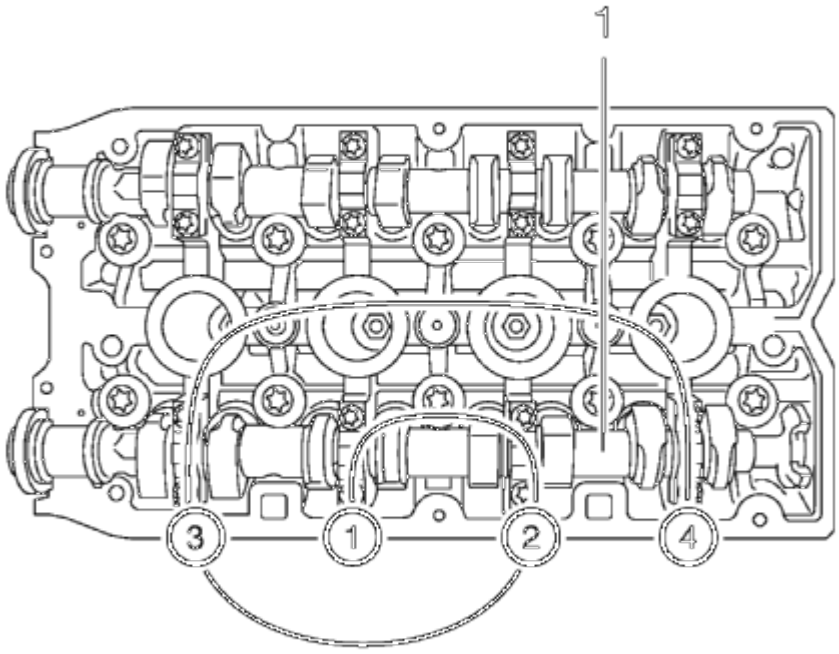

Fig. 175: Exhaust Camshaft Bearing Cover Bolts Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: Lubricate with clean engine oil.

4. Install the exhaust camshaft (1).

NOTE: Note the identification marking on the camshaft bearing cover.

5. Install the 4 exhaust camshaft bearing cover Numbers 6-9.
6. Install the 8 exhaust camshaft bearing cover bolts and tighten in a spiral from the inside to the outside to 8 N.m (71 lb in).

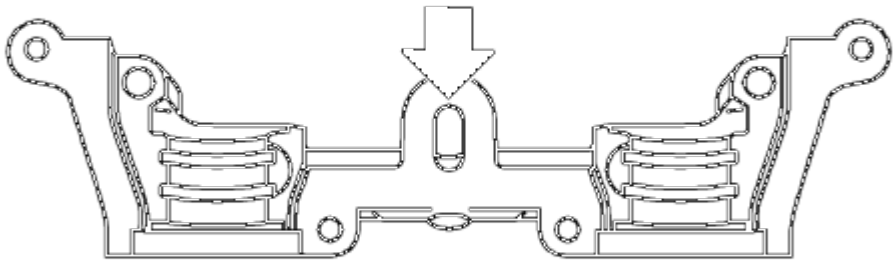

Fig. 176: View Of Oil Duct
Courtesy of GENERAL MOTORS CORP.

NOTE: Sealing surfaces must be free from oil and grease.

7. Clean sealing surfaces of the first camshaft bearing support and the cylinder head with a suitable tool.

   Clean oil duct from any sealant residue.

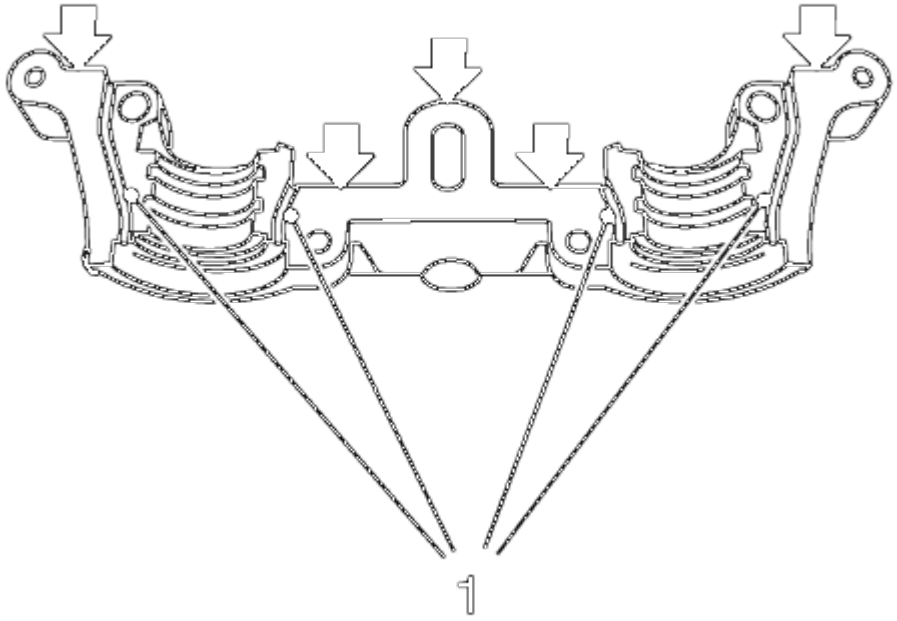

Fig. 177: View Of Sealing Surfaces And Grooves
Courtesy of GENERAL MOTORS CORP.

NOTE:

- **Sealing surfaces must be free from oil and grease.**
- **It is essential to ensure that no sealant is applied outside the marked sealing areas.**
- **The grooves adjacent to the sealing surfaces must remain free from sealant.**

8. Apply surface sealant to sealing surfaces of the first camshaft bearing cap thinly and evenly.
9. Position the first camshaft bearing cap on the cylinder block and tighten the bolts approximately to 2 N.m (18 lb in).

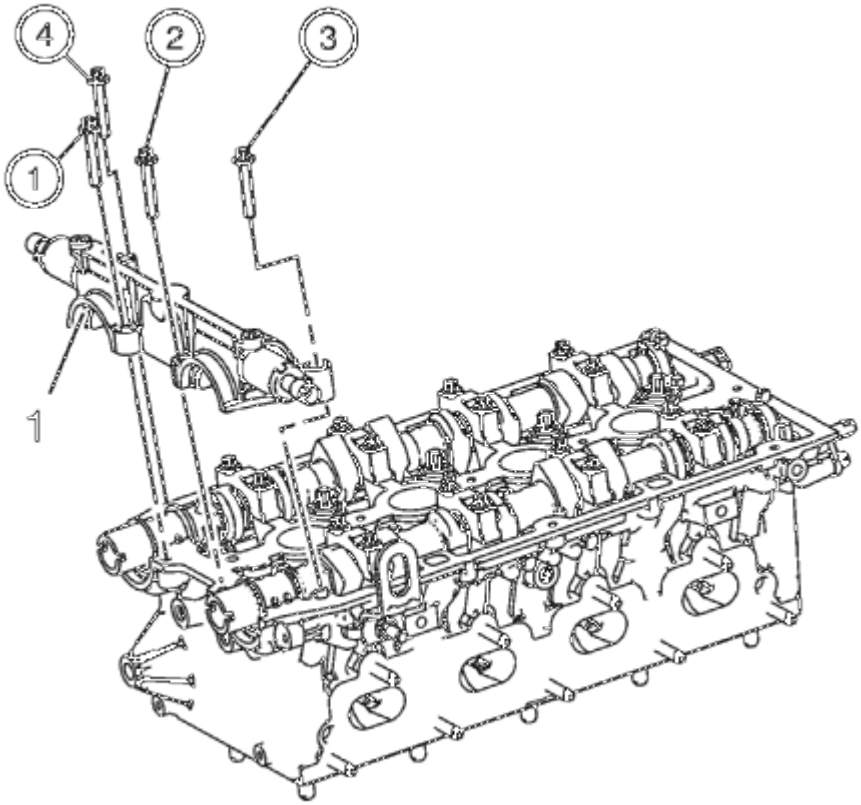

Fig. 178: Camshaft Bearing Cap
Courtesy of GENERAL MOTORS CORP.

NOTE: No sealant may reach the camshafts.

10. Install the first camshaft bearing cap (1).

NOTE: Note installation sequence 1-4.

11. Install the first camshaft bearing cap bolts and tighten to 8 N.m (71 lb in).

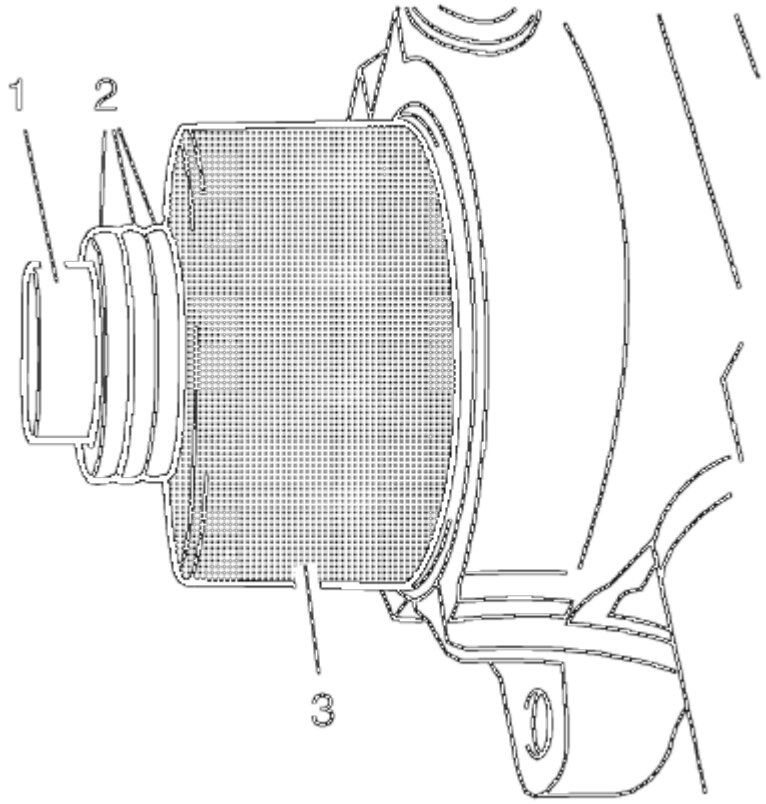

Fig. 179: Camshaft Sprocket Bolt, Shims And Tool
Courtesy of GENERAL MOTORS CORP.

12. Install 2 NEW sealing rings to the camshafts.
13. Tighten the seal ring with **EN-422:** installer (3) on the camshaft until this is in contact with the cylinder head.
14. To install, use camshaft sprocket bolt (1) in conjunction with shims (2) with a total thickness of approximately 10 mm (0.394 in).
15. Remove the **EN-422:** installer (3).
16. Turn the intake camshaft against the direction of engine rotation.
17. Install **EN-6628-A:** locking tool.
18. Turn the exhaust camshaft in the direction of rotation of the engine.
19. Install **EN-6628-A:** locking tool.
20. Install exhaust camshaft position sensor. Refer to **Camshaft Position Sensor Replacement (1.6L LDE, LXV, and 1.8L 2H0)** .
21. Install intake camshaft position sensor. Refer to **Camshaft Position Sensor Replacement (1.6L LDE, LXV, and 1.8L 2H0)** .
22. Install the rear timing belt cover. Refer to **Timing Belt Rear Cover Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.
23. Install the camshaft adjuster. Refer to **Camshaft Position Actuator Adjuster Replacement**.

VALVE CLEARANCE ADJUSTMENT (1.6L LDE, LXV, 1.8L 2H0, AND LUW)

Special Tools

- **EN-845:** Suction Device
- **EN-6361:** Feeler Gauge
- **EN-6628-A:** Locking Tool

For equivalent regional tools, refer to **Special Tools** .

REMOVAL PROCEDURE

1. Remove the camshaft adjuster. Refer to **Camshaft Position Actuator Adjuster Removal** .
2. Remove the timing belt rear cover. Refer to **Timing Belt Rear Cover Replacement (1.6L LDE, LXV, 1.8L 2H0, and LUW)**.
3. Remove exhaust camshaft position sensor. Refer to **Camshaft Position Sensor Replacement (1.6L LDE, LXV, and 1.8L 2H0)** .
4. Remove intake camshaft position sensor. Refer to **Camshaft Position Sensor Replacement (1.6L LDE, LXV, and 1.8L 2H0)** .
5. Remove the **EN-6628-A:** locking tool.

ADJUSTMENT PROCEDURE

1. Inspect the 2 valve lash, intake valve cylinder 1.
    1. Turn the intake camshaft in the direction of engine rotation by the camshaft hexagon until the cams of cylinder 1 are in the test position.
    2. Insert the **EN-6361:** gauge, inspect the valve lash.

       Write down the result.
2. Inspect the 2 valve lash, intake valve cylinder 3.
    1. Turn the intake camshaft in the direction of engine rotation by the camshaft hexagon until the cams of cylinder 3 are in the test position.
    2. Insert the **EN-6361:** gauge, inspect the valve lash.

       Write down the result.
3. Inspect the 2 valve lash, intake valve cylinder 4.
    1. Turn the intake camshaft in the direction of engine rotation by the camshaft hexagon until the cams of cylinder 4 are in the test position.
    2. Insert the **EN-6361:** gauge, inspect the valve lash.

       Write down the result.

4. Inspect the 2 valve lash, intake valve cylinder 2.
    1. Turn the intake camshaft in the direction of engine rotation by the camshaft hexagon until the cams of cylinder 2 are in the test position.
    2. Insert the **EN-6361:** gauge, inspect the valve lash.

       Write down the result.

5. Inspect the 2 valve lash, exhaust valve cylinder 4.
    1. Turn the exhaust camshaft in the direction of engine rotation by the camshaft hexagon until the cams of cylinder 4 are in the test position.
    2. Insert the **EN-6361:** gauge, inspect the valve lash.

       Write down the result.

6. Inspect the 2 valve lash, exhaust valve cylinder 2.
    1. Turn the exhaust camshaft in the direction of engine rotation by the camshaft hexagon until the cams of cylinder 2 are in the test position.
    2. Insert the **EN-6361:** gauge, inspect the valve lash.

       Write down the result.

7. Inspect the 2 valve lash, exhaust valve cylinder 1.
    1. Turn the exhaust camshaft in the direction of engine rotation by the camshaft hexagon until the cams of cylinder 1 are in the test position.
    2. Insert the **EN-6361:** gauge, inspect the valve lash.

       Write down the result.

8. Inspect the 2 valve lash, exhaust valve cylinder 3.
    1. Turn the exhaust camshaft in the direction of engine rotation by the camshaft hexagon gear until the cams of cylinder 3 are in the test position.
    2. Insert the **EN-6361:** gauge, inspect the valve lash.

       Write down the result.

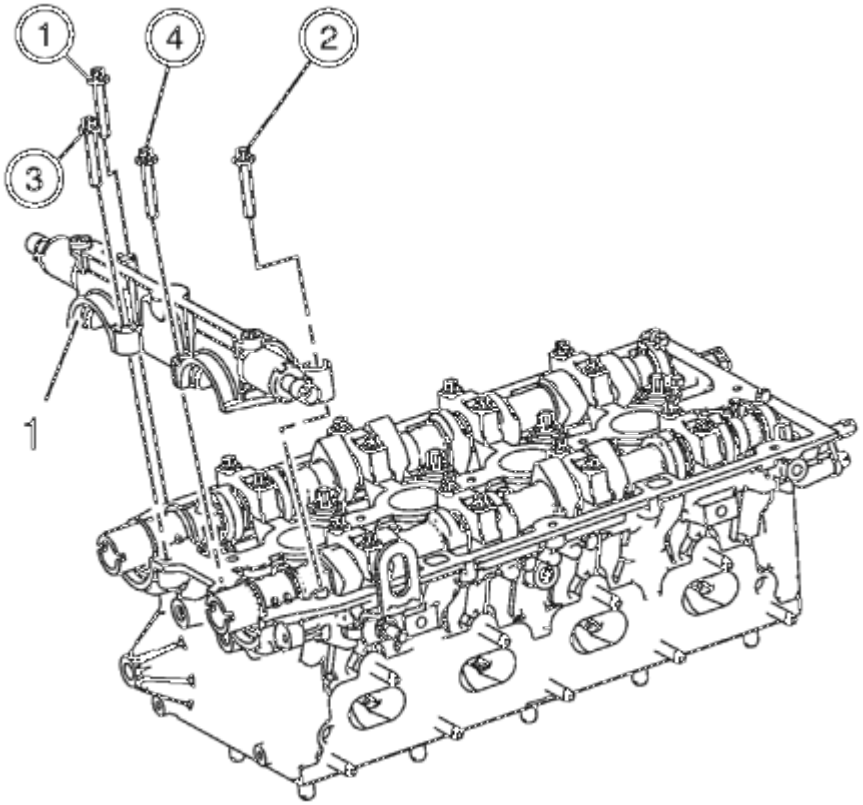

Fig. 180: Camshaft Bearing Cap And Camshaft Bearing Cap Bolts Removal Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: Note the removal sequence 1-4.

9. Remove the 4 camshaft bearing support bolts.
10. Release the bearing support by striking it gently with a plastic hammer.
11. Remove the 1st camshaft bearing support (1).

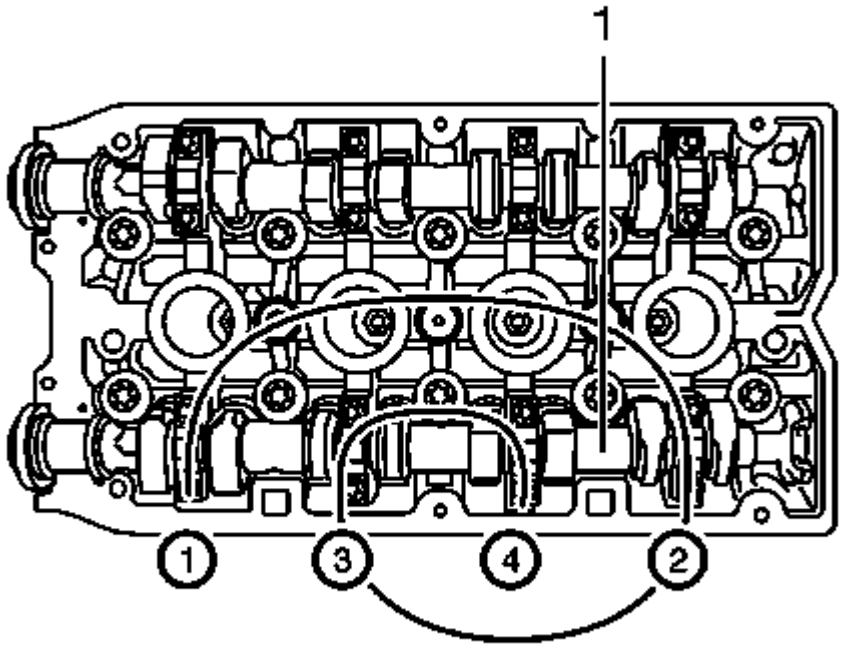

Fig. 181: Exhaust Camshaft Bearing Cap Bolts Loosening Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: Mark the exhaust camshaft bearing caps before removal.

12. Loosen the 8 exhaust camshaft bearing cap bolts working from outside to inside in a spiral in steps of 1/2 up to 1 turn.
13. Remove the 8 exhaust camshaft bearing cap bolts.
14. Remove the 4 exhaust camshaft bearing caps Numbers 6-9 from the cylinder head.
15. Remove the exhaust camshaft (1).

NOTE: Mark the intake camshaft bearing caps before removal.

16. Loosen the 8 intake camshaft bearing cap bolts working from outside to inside in a spiral in steps of 1/2 up to 1 turn.
17. Remove the 8 intake camshaft bearing cap bolts.
18. Remove the 4 intake camshaft bearing caps Numbers 2-5 from the cylinder head.
19. Remove the intake camshaft (1).

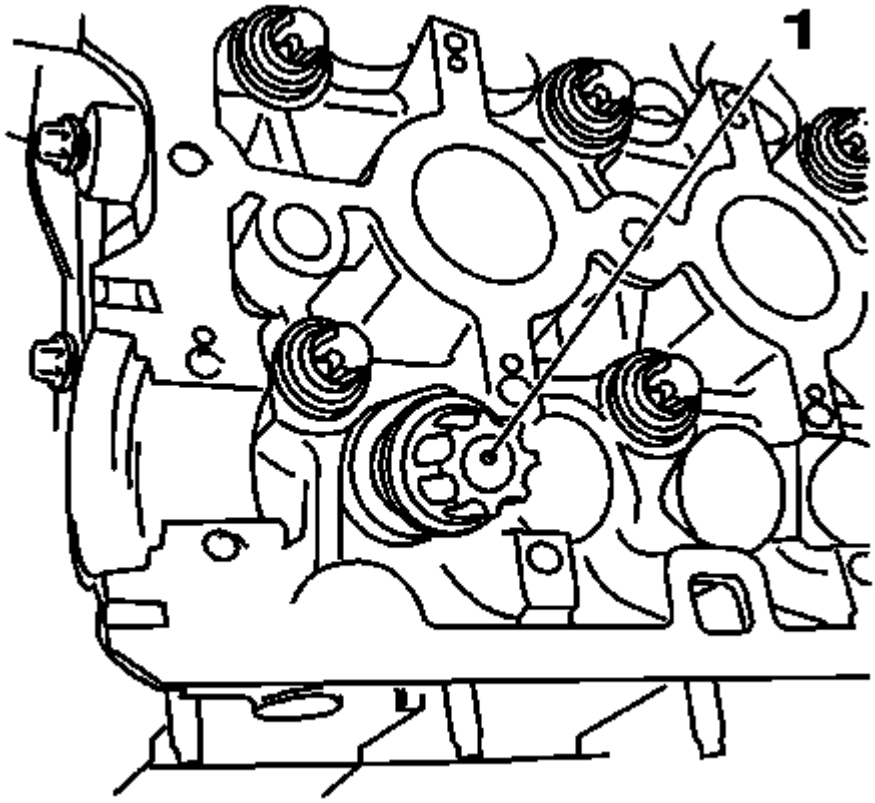

Fig. 182: View Of Camshaft Bearing Cap
Courtesy of GENERAL MOTORS CORP.

20. Using the **EN-845:** device (1), remove the 16 valve tappets.

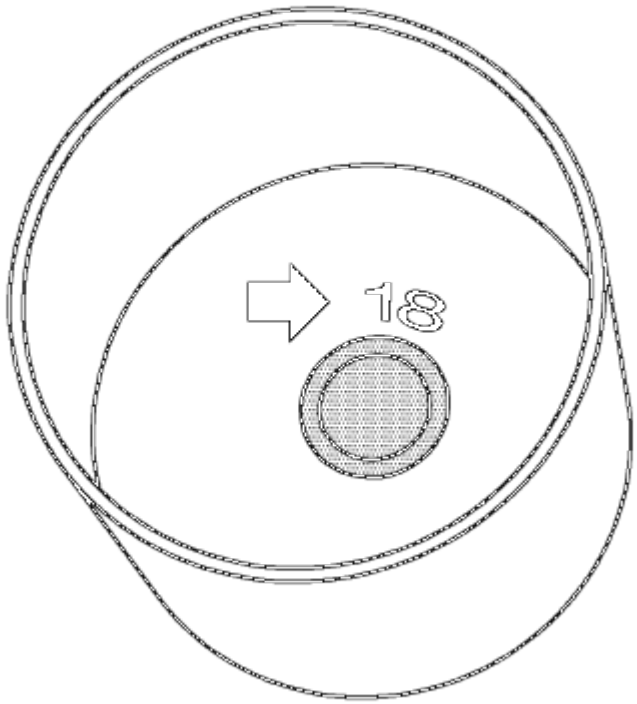

Fig. 183: Identifying Cup Tappet Size
Courtesy of GENERAL MOTORS CORP.

21. Example for determine valve tappet size.
    1. Measurement of the cup tappet installed 3.12 mm (0.123 in), identification number 12.
    2. Measured value between cams and cup tappets +0.31 mm (0.012 in) = 3.43 mm (0.135 in).
    3. Required value, intake valve lash - 0.25 mm (0.010 in).

    NOTE: The identification number, arrow, is on the inside of the valve tappet.

    4. Measurement of the new cup tappet = 3.18 mm (0.125 in), identification number 18.
    5. Use a valve tappet with this dimension or one that is nearest to it.
22. Refer to **Engine Mechanical Specifications** for the valve clearance values.
23. Refer to Electronic Parts Catalogue for the valve tappers sizes.

INSTALLATION PROCEDURE

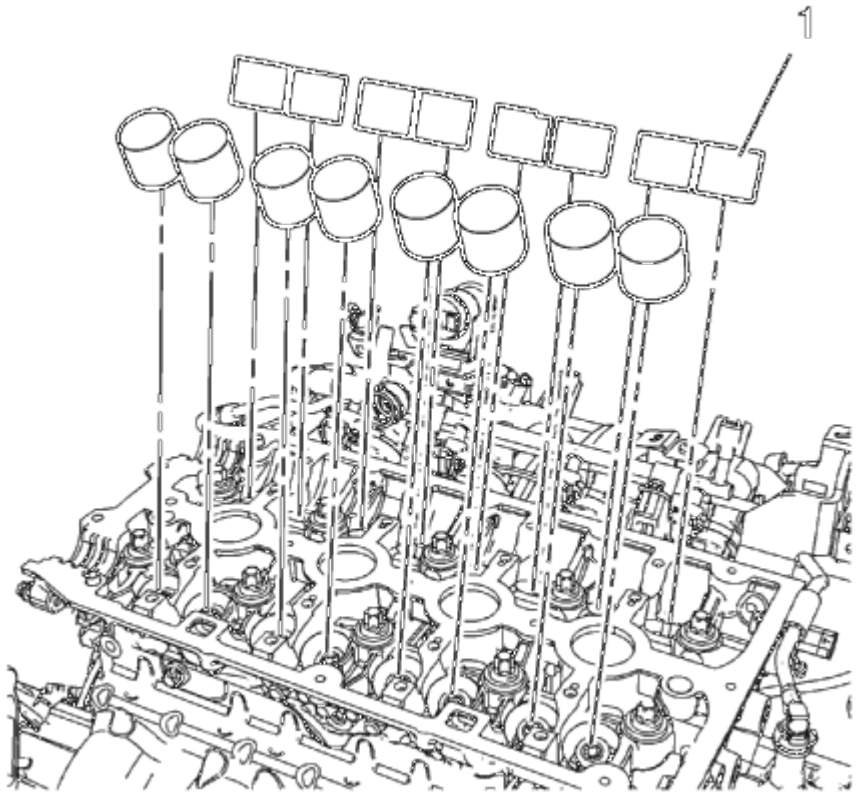

Fig. 184: Valve Lifters
Courtesy of GENERAL MOTORS CORP.

NOTE: Observe the correct assignment.

NOTE: Coat the sliding surfaces with NEW engine oil.

1. Install the 16 valve lifter (1) use the **EN 845:** suction device.
2. Install the camshafts. Refer to **Camshaft Replacement**.

VALVE STEM OIL SEAL AND VALVE SPRING REPLACEMENT

Special Tools

- **EN-840:** Pliers/Remover
- **EN-958:** Installer
- **EN-6086:** Basic Kit, Spring and Wedge Replacer
- **EN-6625:** Flywheel Holder

For equivalent regional tools, refer to **Special Tools** .

REMOVAL PROCEDURE

1. Remove both camshafts. Refer to **Camshaft Replacement**.
2. Remove the spark plugs. Refer to **Spark Plug Replacement** .

NOTE: 180° offset to marking ignition TDC cylinder number 1.

3. Make alignment mark on the toothed belt drive belt.
4. Turn the crankshaft to ignition TDC marking, cylinder number 1.
5. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

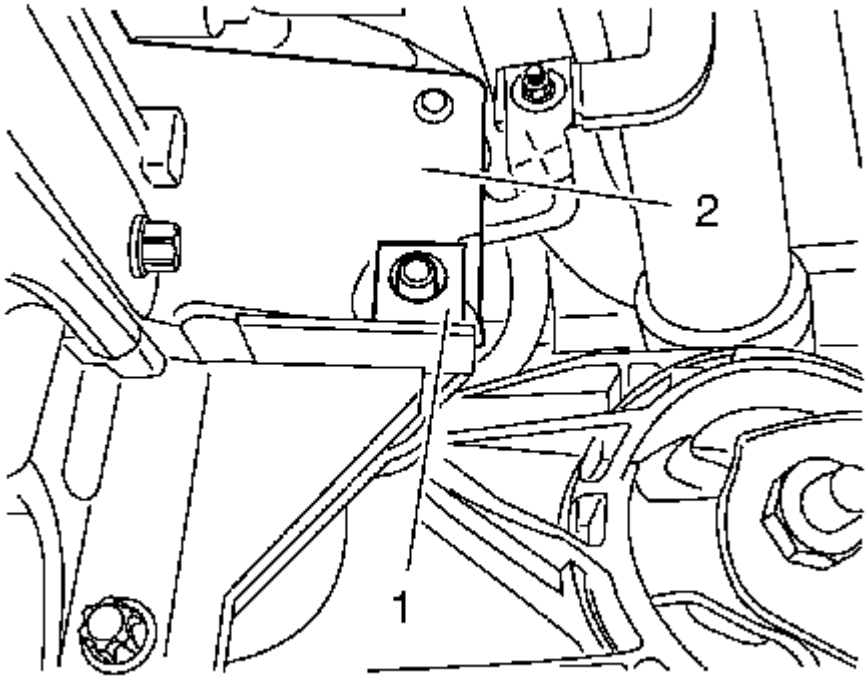

Fig. 185: Engine Block And Flywheel Holder
Courtesy of GENERAL MOTORS CORP.

6. Block the crankshaft.
7. Install **EN-6625:** flywheel holder (1) to the engine block (2).
8. Lower the vehicle.
9. Install the supports.

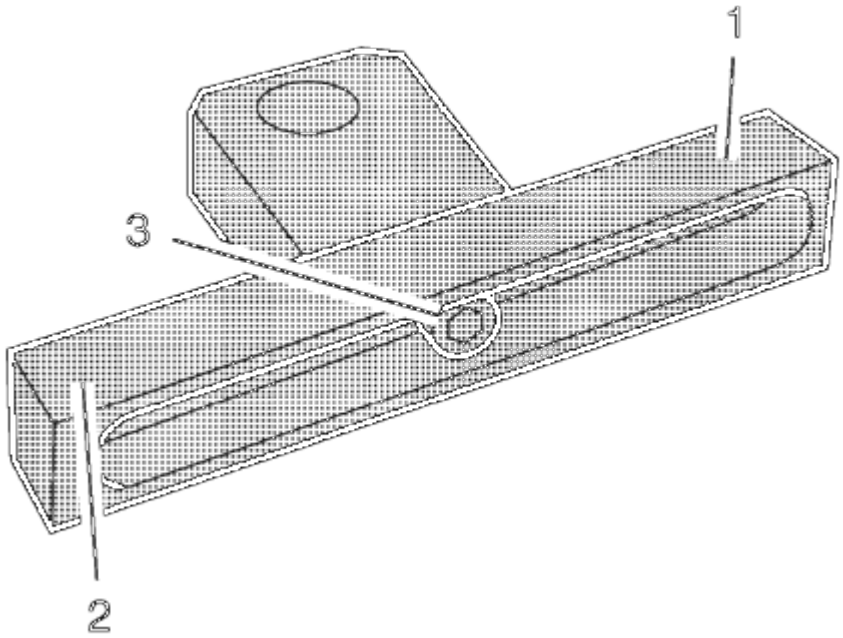

Fig. 186: Support Head, Rail And Fastener
Courtesy of GENERAL MOTORS CORP.

10. Tighten one of the support head (1) in the center of the rail (2) with the fastener (3).

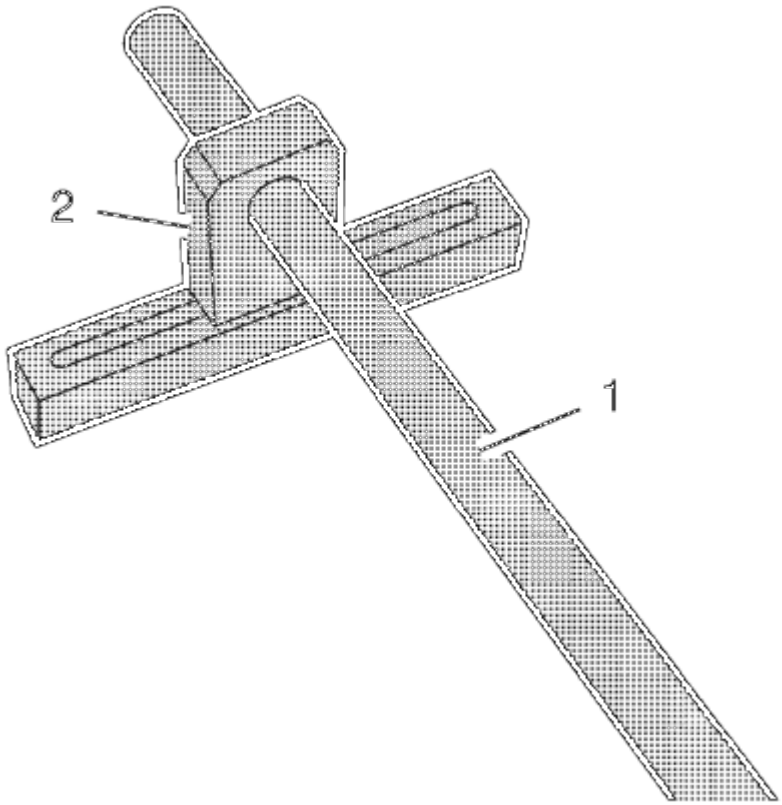

Fig. 187: Mounting Shaft And Support
Courtesy of GENERAL MOTORS CORP.

11. Install the **EN-6086-5:** mounting shaft (1) to one of the **EN-6086-6:** support (2).
12. Install the second support to the mounting shaft.
13. Install the lever arm bracket to the cylinder head.

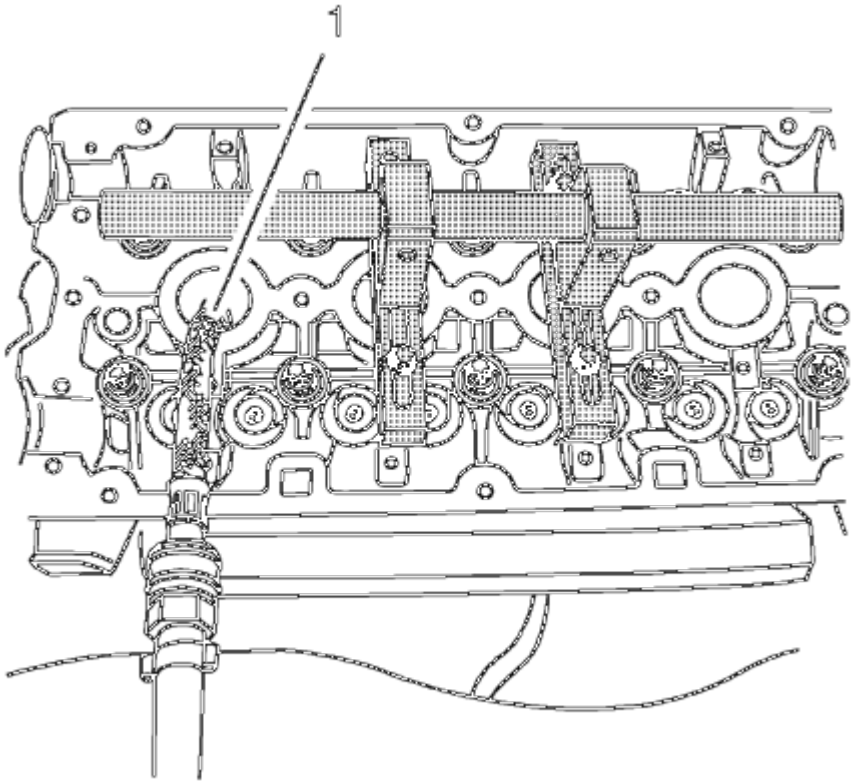

Fig. 188: Pneumatic Adapter
Courtesy of GENERAL MOTORS CORP.

14. Attach the **EN-6086-15:** pneumatic adapter (1).
    1. Attach the adapter to cylinder number 1.
    2. Apply compressed air to cylinder number 1.

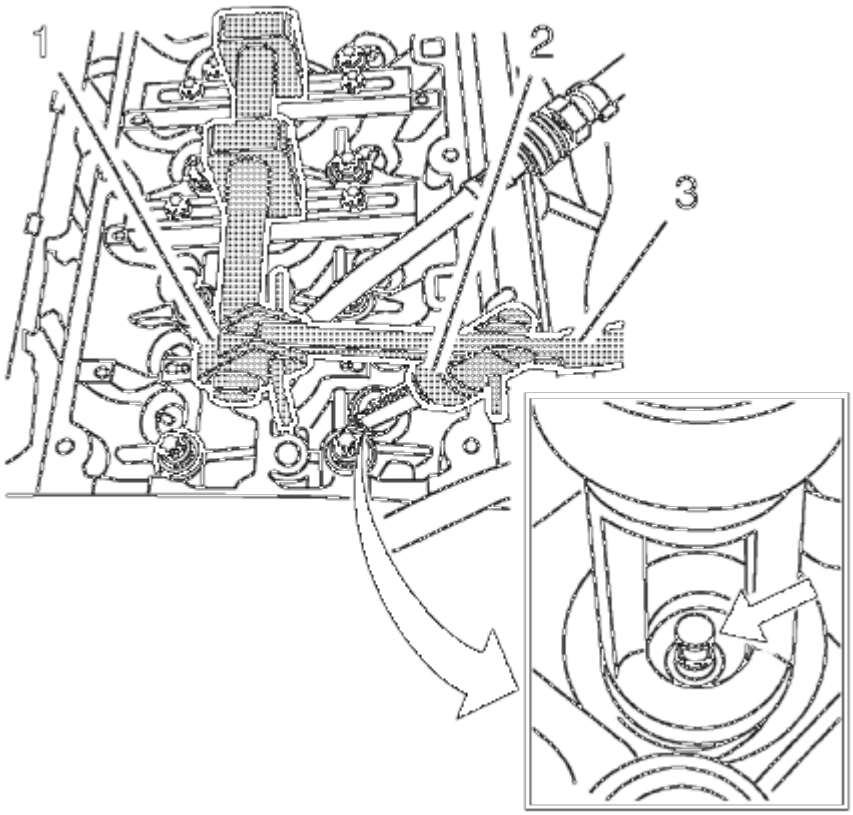

Fig. 189: Lever Arm, Joint And Removal Head
Courtesy of GENERAL MOTORS CORP.

15. Attach the **EN-6086-7:** lever arm (3).
    1. Complete the lever arm with the **EN-6086-8:** joint (1) and the **EN-6086-11:** removal head (2).

       NOTE: Removal head must point toward the intake side.

    2. Slide assembly on installation shaft over the 1st cylinder.
16. Remove the intake valve springs, 1st cylinder.

    NOTE: Removal head must be positioned vertically over the valve stem.

    1.
    2. Carefully push the valve springs down using the **EN-6086-7:** lever arm.

       NOTE: Observe correct assignment.

    3. Remove the valve keepers.
    4. Remove the valve head and the valve springs.

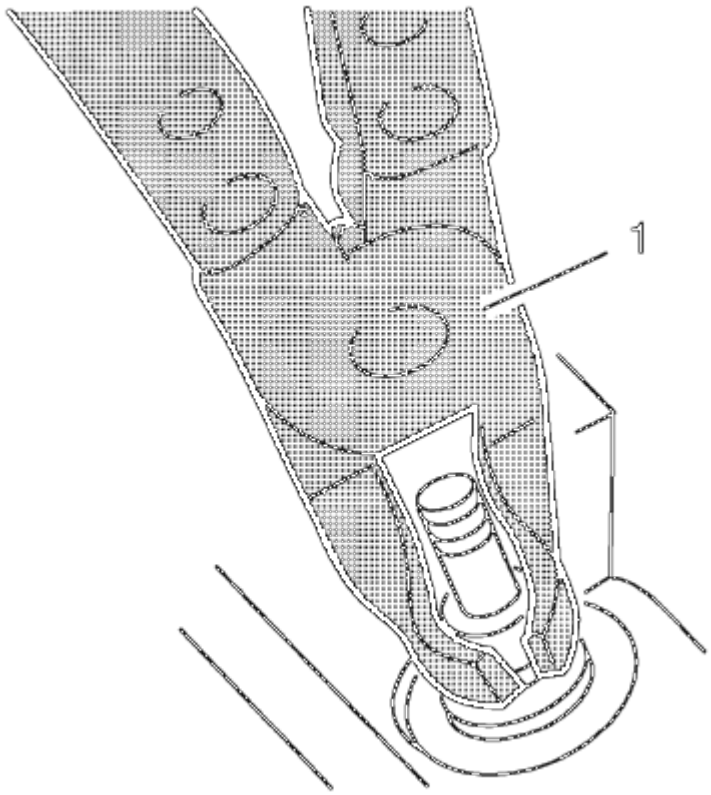

Fig. 190: Identifying Tool
Courtesy of GENERAL MOTORS CORP.

17. Remove the valve stem seals.

    Remove the valve stem seals with the **EN-840:** remover (1).

18. Install the valve stem seals.
    1. Coat the valve stem with engine oil.
    2. Connect the new valve stem seals onto valve stem.
    3. Using the **EN-958:** installer, drive home to limit stop.

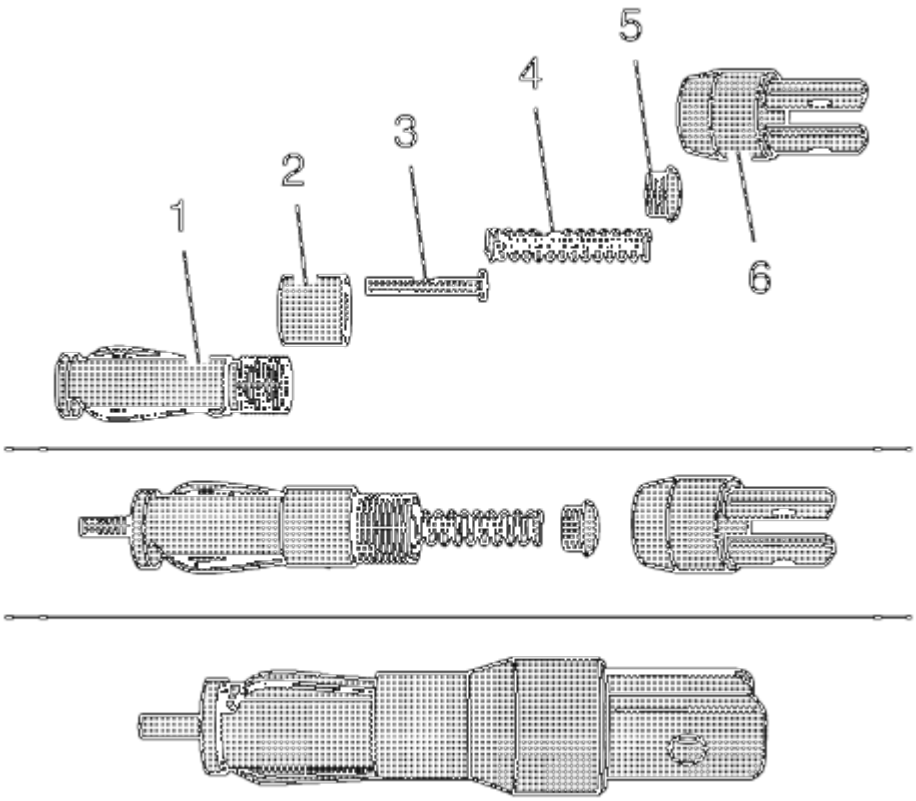

Fig. 191: Mount, Fixing Sleeve, Thrust Piece, Spring, Screw Fixing And Lever Mount
Courtesy of GENERAL MOTORS CORP.

NOTE: Note manufacturer provisions.

19. Complete the **EN-6086-200-1:** assembly head.
    1. Use the **EN-6086-200-10:** thrust piece.
    2. Put together the assembly head consisting of mount (1), fixing sleeve (2), thrust piece (3), spring (4), screw fixing (5) and lever mount (6).

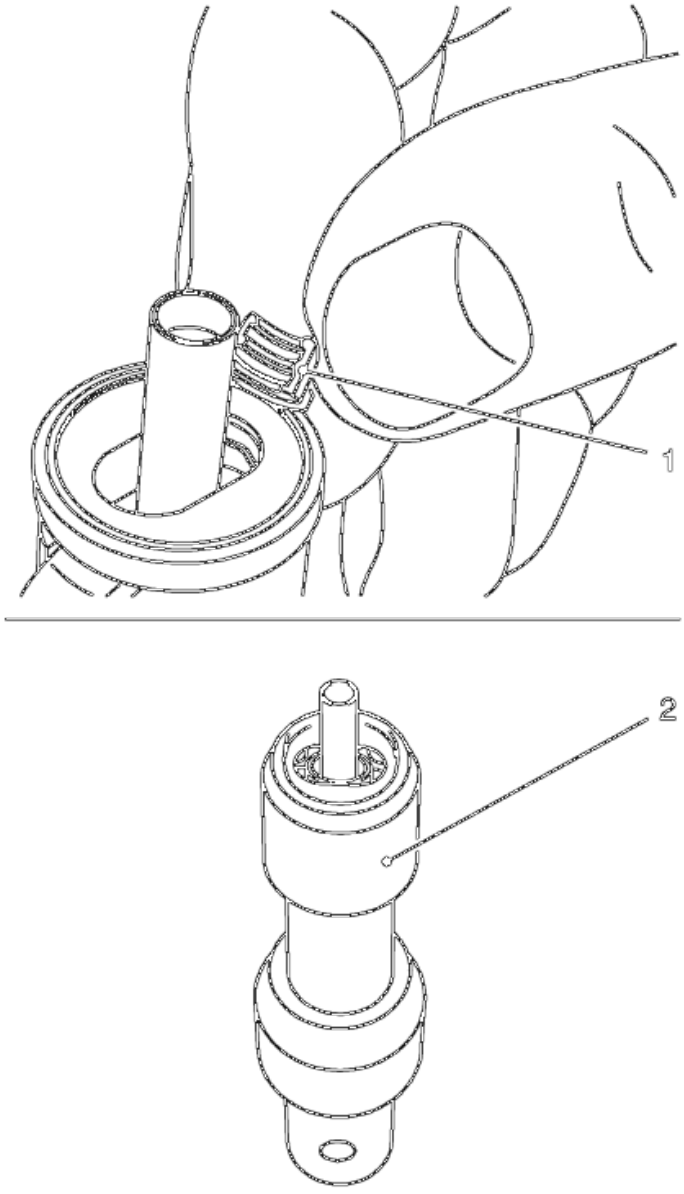

Fig. 192: View Of Valve Cotters And Clamping Sleeve
Courtesy of GENERAL MOTORS CORP.

20. Install the intake valve springs, 1st cylinder.
    1. Insert the valve springs and valve head.

NOTE: Insert the valve cotters with the tapered end toward the valve.

2. Insert the valve cotters (1) in the **EN-6086-200-1:** assembly head.
   - Slide the plastic clamping sleeve (2) in the direction of the lever arm mount.
   - Push the plastic clamping sleeve toward the valve.

NOTE: Assembly head must stand vertically above the valve stem. Valve cotters must engage audibly.

3. Attach the assembly head to the lever arm.
4. Carefully push the valve spring down using the **EN-6086-7:** lever arm.

NOTE: Do not make 2nd attempt without inspecting that both valve cotters are seated in the assembly head.

21. Inspect installation position.

    Inspect seating of the valve keepers (visual inspection).

22. Transfer the **EN-6086-7:** lever arm.
    1. Remove the lever arm.
    2. Detach the assembly head.

NOTE: Removal head must point toward the exhaust side.

    3. Attach the removal head.
    4. Install the lever arm.
23. Remove the exhaust valve springs, 1st cylinder.
    1. Carefully push the valve springs down using the **EN-889-12:** lever arm.

NOTE: Removal head must be positioned vertically over the valve stem.

    2. Remove the valve keepers

NOTE: Observe correct assignment.

    3. Remove the valve head and valve springs.
24. Replace the valve stem seals.
    1. Pull off with the **EN-840:** remover.
    2. Coat the valve stem with engine oil.
    3. Connect the new valve stem seals onto the valve stem.
    4. Using the **EN-958:** installer, drive home to limit stop.

25. Attach the **EN-6086-7:** lever arm.
    1. Insert the valve springs and valve head.
    2. Insert the valve wedges in the **EN-889-2:** assembly head.

       NOTE: Insert the valve cotters with the tapered end toward the valve.

       -
       - Push the plastic clamping sleeve toward the lever arm mounting.
       - Push the plastic clamping sleeve toward the valve.

       NOTE: Assembly head must stand vertically above the valve stem. Valve cotters must engage audibly.

    3. Attach the assembly head to the lever arm.

       NOTE: Do not make 2nd attempt without inspecting that both valve cotters are seated in the assembly head.

    4. Carefully push the valve spring down using the **EN-889-12:** lever arm.
26. Inspect installation position.

    Inspect seating of the valve keepers (visual inspection).

27. Transfer the **EN-6086-15:** pneumatic adapter.
    1. Interrupt the compressed air feed.
    2. Remove the adapter from cylinder number 1.
    3. Install the adapter to cylinder number 4.
    4. Apply compressed air to cylinder number 4.
28. Replace the valve stem seal of cylinder 4 by analogy with step 14 - 21.
29. Remove the **EN-6086-15:** pneumatic adapter.
    1. Interrupt the compressed air feed.
    2. Remove the adapter from cylinder number 4.
30. Raise and support the vehicle.
31. Remove **EN-6625:** holder.
32. Set the crankshaft to ignition TDC of cylinder 3.

    NOTE: Alignment marking on toothed belt drive wheel must align with marking on rear toothed belt cover.

33. Turn crankshaft evenly by 180°.
34. Block the crankshaft.

35. Install **EN-6625:** holder to the engine block.
36. Lower the vehicle
37. Replace the valve stem seal of cylinders 2 and 3 by analogy with step 7 to step 21.
38. Remove the **EN-6086-15:** pneumatic adapter.
    1. Interrupt the compressed air feed.
    2. Remove the adapter from cylinder number 3.
39. Remove the **EN-6086:** automatic valve spring lever.
    1. Release the installation shaft.
    2. Remove both supports with the installation shaft.
    3. Remove the installation head from the lever arm.

INSTALLATION PROCEDURE

1. Raise the vehicle.
2. Remove **EN-6625:** holder from the engine block.
    1. Detach the screwed connection.
    2. Tighten the bolted connection.
    3. Use new nuts.

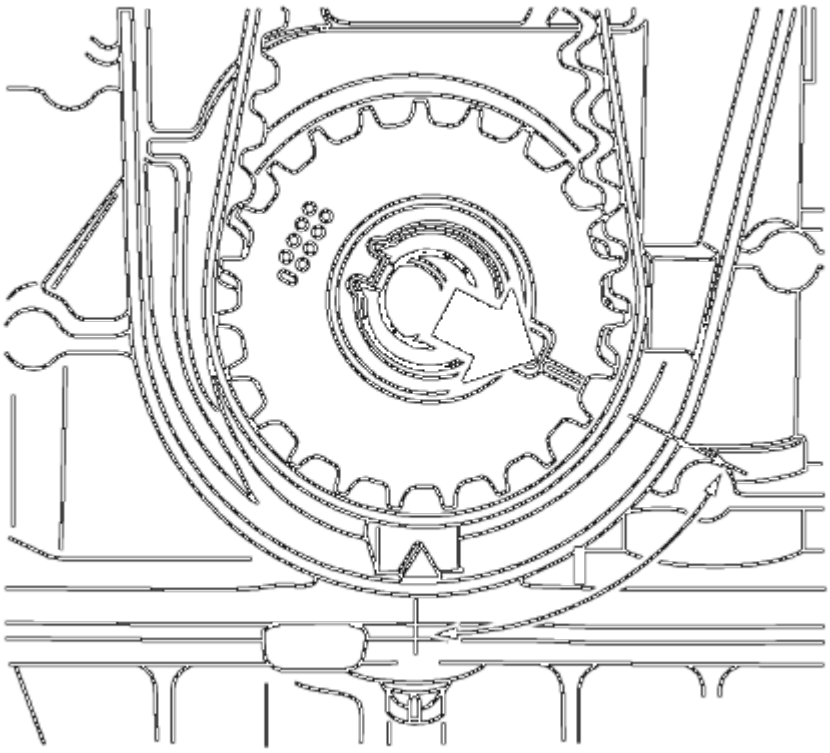

Fig. 193: View Of Marking
Courtesy of GENERAL MOTORS CORP.

3. Set the engine to 60° (measurement l) before TDC.

   Set the crankshaft in direction of engine rotation to 60° (measurement l) before TDC.

4. Install the spark plugs. Refer to **Spark Plug Replacement** .
5. Install both camshafts. Refer to **Camshaft Replacement**.

VALVE GUIDE REAMING, AND VALVE AND SEAT GRINDING

VALVE CLEANING PROCEDURE

1. Use soft bristle wire brush to clean any carbon build-up from the valve head. DO NOT use a wire brush on any part of the valve stem. The valve stem is chrome plated to provide enhanced wear characteristics. Wire brushing the stem could remove the chrome plating.
2. Thoroughly clean the valve with solvent and wipe dry.

VALVE VISUAL INSPECTION PROCEDURE

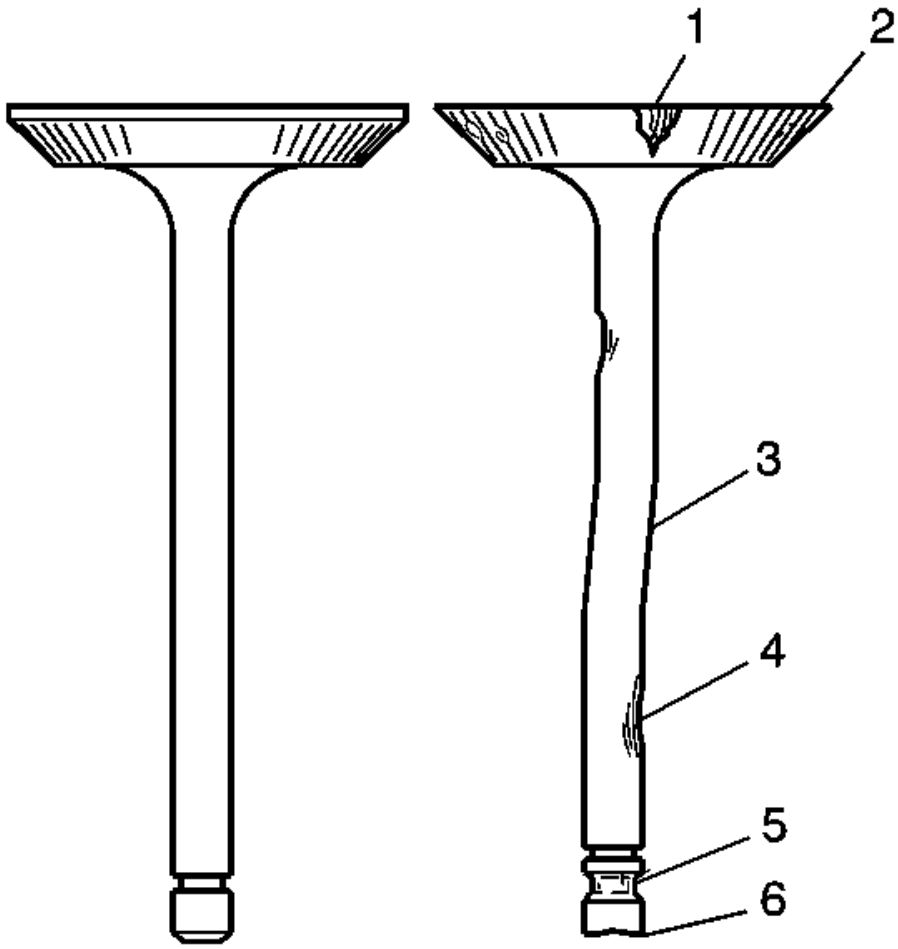

Fig. 194: Identifying Inspection Points For Valves Damage
Courtesy of GENERAL MOTORS CORP.

1. Inspect the valve for damage from the head to tip for the following conditions:
   - Pitting in the valve seat area (1)
   - Lack of valve margin (2)
   - Bending in the valve stem (3)
   - Pitting or excessive wear in the stem (4)
   - Worn valve key grooves (5)
   - Worn valve tip (6)
2. Replace the valve if any of these conditions exist.

VALVE MEASUREMENT AND RECONDITIONING OVERVIEW

NOTE:

- **Proper valve service is critical to engine performance. Therefore, all**

detailed measurement procedures must be followed to identify components that are out of specification.

- **If the measurement procedures reveal that the valve or valve seat must be reconditioned, it is critical to perform the measurement procedures after reconditioning.**

VALVE SEAT WIDTH MEASUREMENT PROCEDURE

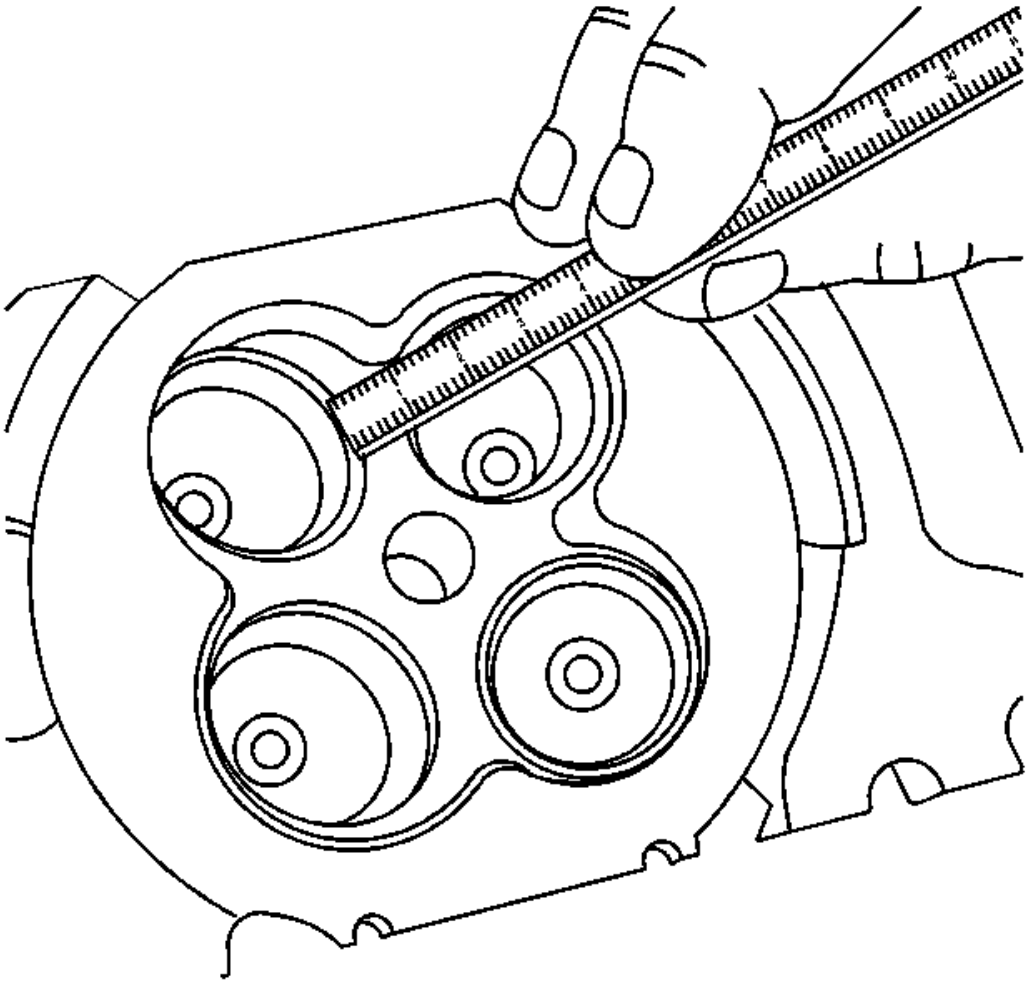

Fig. 195: Checking Valve Seat Width
Courtesy of GENERAL MOTORS CORP.

1. Measure the valve seat width in the cylinder head using a proper scale.

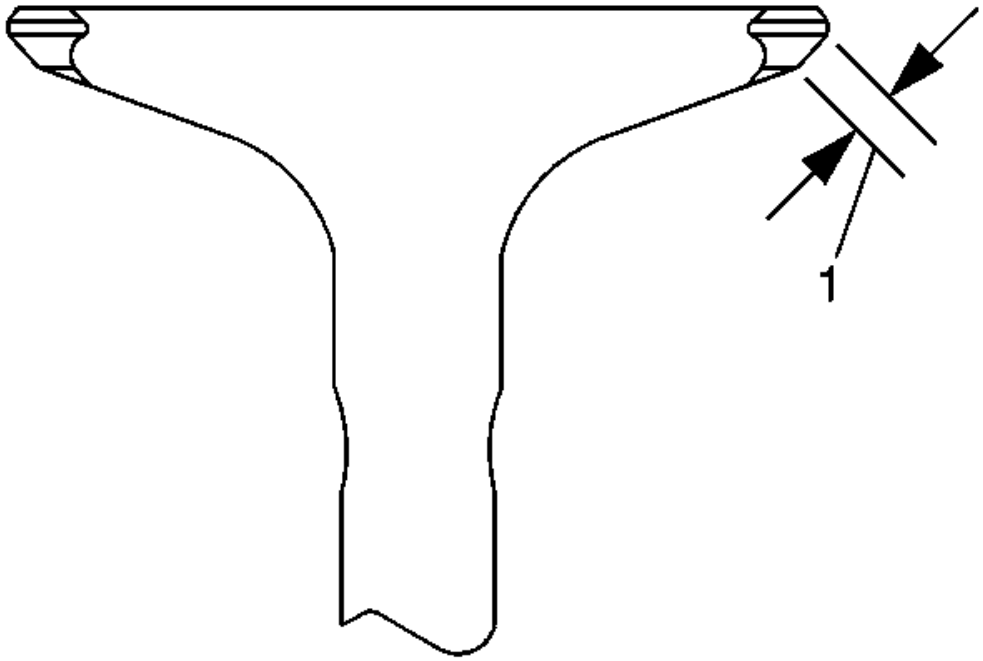

Fig. 196: Measuring Seat Width On Valve Face
Courtesy of GENERAL MOTORS CORP.

2. Measure the seat width on the valve face (1) using a proper scale.

NOTE: The seat contact area must be at least 0.5 mm (0.020 in) from the outer diameter (margin) of the valve. If the contact area is too close to the margins, the seat must be reconditioned to move the contact area away from the margin.

3. Compare your measurements with the specifications, refer to **Engine Mechanical Specifications** .
4. If the seat widths are acceptable, check the valve seat roundness using the Valve Seat Roundness Measurement Procedure.
5. If the seat width is not acceptable, you must grind the valve seat using the Valve and Seat Reconditioning Procedure to bring the width back into specification. Proper valve seat width is critical to providing the correct amount of valve heat dissipation.

VALVE SEAT ROUNDNESS MEASUREMENT PROCEDURE

1. Measure the valve seat roundness using a dial indicator attached to a tapered pilot installed in the guide. The pilot should have a slight bind when installed in the guide.

CAUTION: The correct size pilot must be used. Do not use adjustable diameter pilots. Adjustable pilots may damage the valve guides.

2. Compare your measurements with the specifications, refer to **Engine Mechanical Specifications** .
3. If the valve seat exceeds the roundness specification, you must grind the valve and valve seat using the Valve and Seat Reconditioning Procedure.
4. If new valves are being used, the valve seat roundness must be within 0.05 mm (0.002 in).

VALVE MARGIN MEASUREMENT PROCEDURE

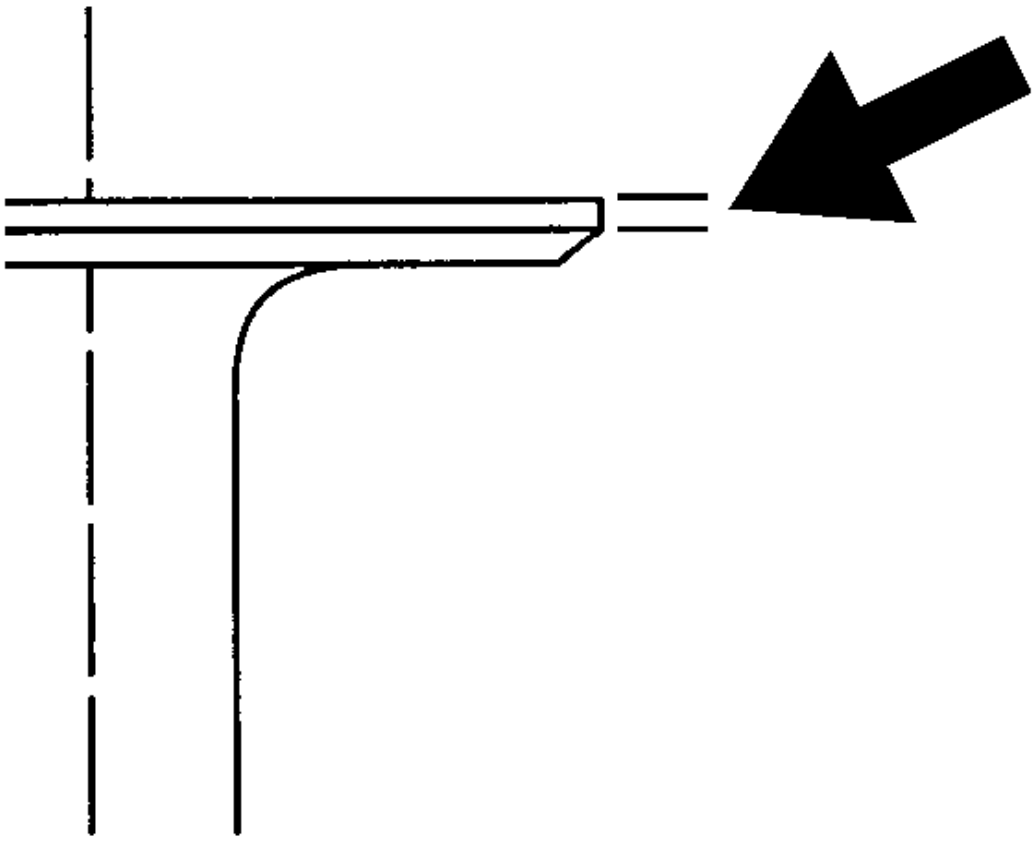

Fig. 197: View Of Valve Margin Measurement
Courtesy of GENERAL MOTORS CORP.

1. Measure the valve margin using an appropriate scale.
2. Reference the specifications in this section for minimum valve margin and compare them to your measurements.
3. If the valve margins are beyond specification, replace the valves.
4. If the valve margins are within specification and do not require refacing, test the valve for seat concentricity using the Valve-to-Seat Concentricity Measurement Procedure.

VALVE-TO-SEAT CONCENTRICITY MEASUREMENT PROCEDURE

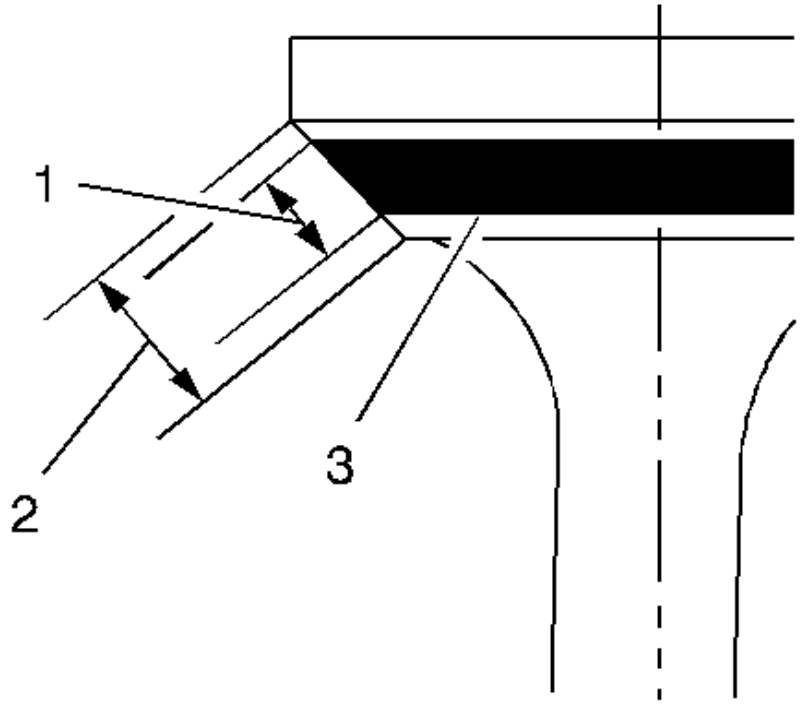

Fig. 198: View Of Valve Contact Face Measurements
Courtesy of GENERAL MOTORS CORP.

NOTE:

- **Checking the valve-to-seat concentricity determines whether the valve and seat are sealing properly.**
- **You must measure the valve face and the valve seat to ensure proper valve sealing.**

1. Coat the valve face lightly with blue dye (3).
2. Install the valve in the cylinder head.
3. Turn the valve against the seat with enough pressure to wear off the dye.
4. Remove the valve from the cylinder head.
5. Inspect the valve face.
   - If the valve face is concentric, providing a proper seal, with the valve stem, a continuous mark will be made around the entire face (1).

     NOTE: The wear mark MUST be at least 0.5 mm (0.020 in) from the outer diameter, the margin, of the valve. If the wear mark is too close to the margin, the seat must be reconditioned to move the contact area away from the margin.

   - If the face is not concentric with the stem, the mark will NOT be continuous around the valve face. The valve should be refaced or replaced and the seat must be reconditioned using the Valve and Seat Reconditioning Procedure.

VALVE AND SEAT RECONDITIONING PROCEDURE

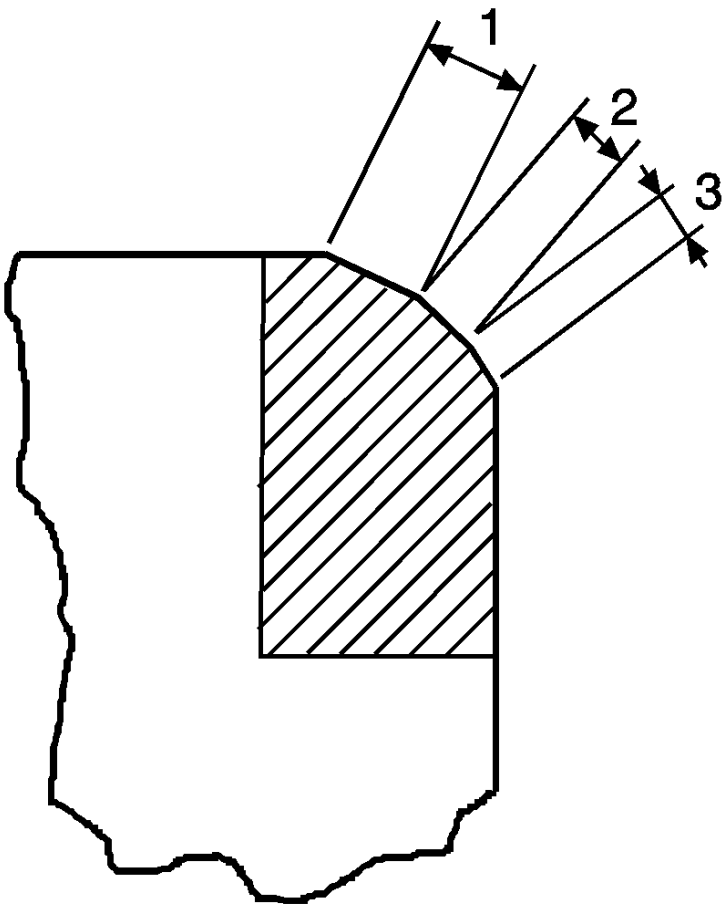

Fig. 199: View Of Valve Seat Proper Angles
Courtesy of GENERAL MOTORS CORP.

NOTE:

- **If the valve seat width, roundness or concentricity is beyond specifications, you must grind the seats in order to ensure proper heat dissipation and prevent the build up of carbon on the seats.**
- **It is necessary to reface the valve if seat reconditioning is required unless a new valve is used.**

1. Grind the valve seats (2) to the proper angle specification, refer to **Engine Mechanical Specifications** .
2. Using the proper angle specification, refer to **Engine Mechanical Specifications** , grind, relieve, the valve seats (1) to correctly position the valve seating surface (2) to the valve.
3. Using the proper angle specification listed in engine mechanical specifications, refer to **Engine Mechanical Specifications** , grind, undercut, the valve seats (3) to narrow the valve seat widths to the specifications, refer to **Engine Mechanical Specifications** .
4. If the original valve is being used, grind the valve to the specifications, refer to **Engine Mechanical**

Specifications . Measure the valve margin again after grinding using the Valve Margin Measurement Procedure. Replace the valve if the margin is out of specification. New valves do not require grinding.

5. When grinding the valves and seats, grind off as little material as possible. Cutting valve seat results in lowering the valve spring pressure.
6. Install the valve in the cylinder head.
    - If you are using refaced valves, lap the valves into the seats with a fine grinding compound. The refacing and reseating operations should leave the refinished surfaces smooth and true so that minimal lapping is required. Excessive lapping will groove the valve face and prevent a good seat when hot.

      NOTE: Be sure to clean any remaining lapping compound from the valve and seat with solvent and compressed air prior to final assembly.

    - If you are using new valves, do not lap the valves under any condition.
7. After obtaining the proper valve seat width in the cylinder head, you must re-measure the valve stem height using the Valve Stem Height Measurement Procedure.
8. If the valve stem height is acceptable, test the seats for concentricity using the Valve-to-Seat Concentricity Measurement Procedure.

VALVE STEM HEIGHT MEASUREMENT PROCEDURE

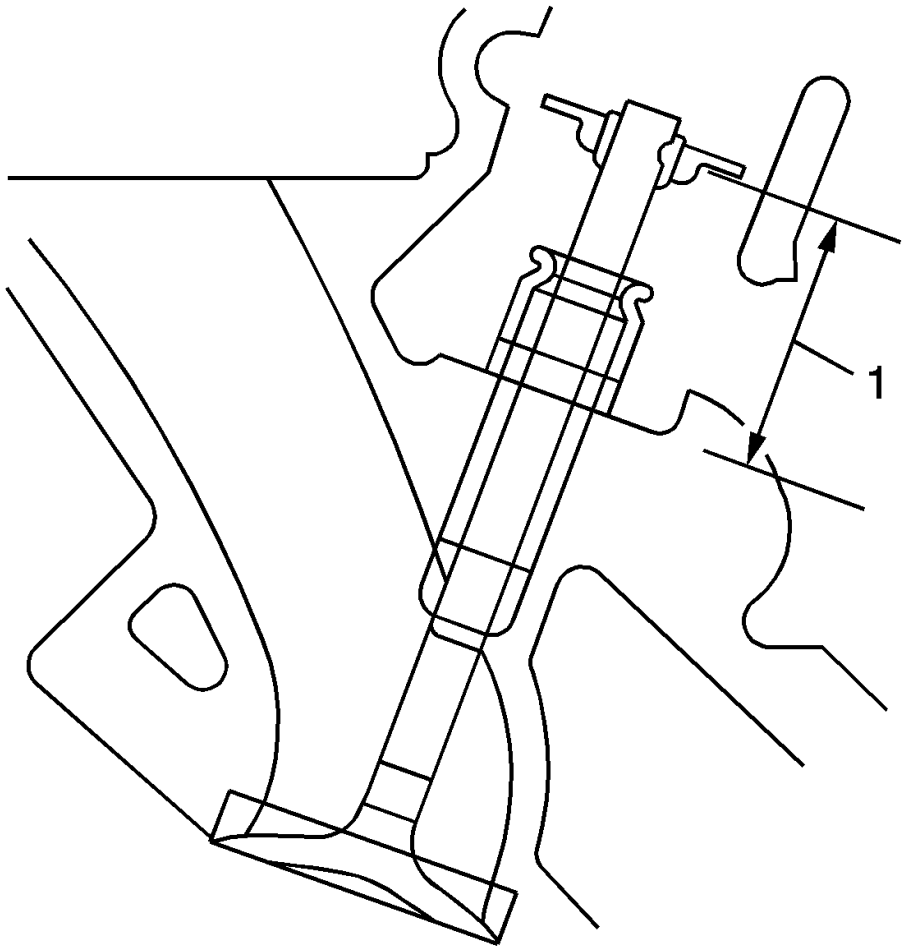

Fig. 200: Measuring Valve Stem Height
Courtesy of GENERAL MOTORS CORP.

NOTE: To determine the valve stem height measurement, measure from the valve spring seat to the valve spring retainer.

1. Install the valve into the valve guide.
2. Ensure the valve is seated to the cylinder head valve seat.
3. Install the valve stem oil seal.
4. Install the valve spring retainer and valve stem locks.
5. Measure the distance (1) between the cylinder head to the bottom of the valve spring retainer. Refer to **Engine Mechanical Specifications** .
6. If the maximum height specification is exceeded, a new valve should be installed and the valve stem height re-measured.

CAUTION: DO NOT grind the valve stem tip. The tip of the valve is hardened and grinding the tip will eliminate the hardened surface causing

premature wear and possible engine damage.

CAUTION: DO NOT use shims in order to adjust valve stem height. The use of shims will cause the valve spring to bottom out before the camshaft lobe is at peak lift and engine damage could result.

7. If the valve stem height still exceeds the maximum height specification, the cylinder head must be replaced.

VALVE SPRING INSPECTION AND MEASUREMENT

SPECIAL TOOL

GE-22738-B: Valve Spring Tester

For equivalent regional tools, refer to **Special Tools** .

INSPECTION PROCEDURE

1. Clean the valve springs in solvent.

WARNING: Wear safety glasses in order to avoid eye damage.

2. Dry the valve springs with compressed air.
3. Inspect the valve springs for broken coils or coil ends.

MEASUREMENT PROCEDURE

1. Measure the tension of the valve spring using the **GE-22738-B:** tester. Refer to **Engine Mechanical Specifications** .
2. If low valve spring load is found, replace the valve springs. DO NOT use shims to increase spring load. The use of shims can cause the valve spring to bottom out before the camshaft lobe is at peak lift.

