

ENGINE

Engine Mechanical - 6.2L (LT1) - Repair Instructions - On Vehicle - Corvette

REPAIR INSTRUCTIONS - ON VEHICLE

DRIVE BELT REPLACEMENT - ACCESSORY

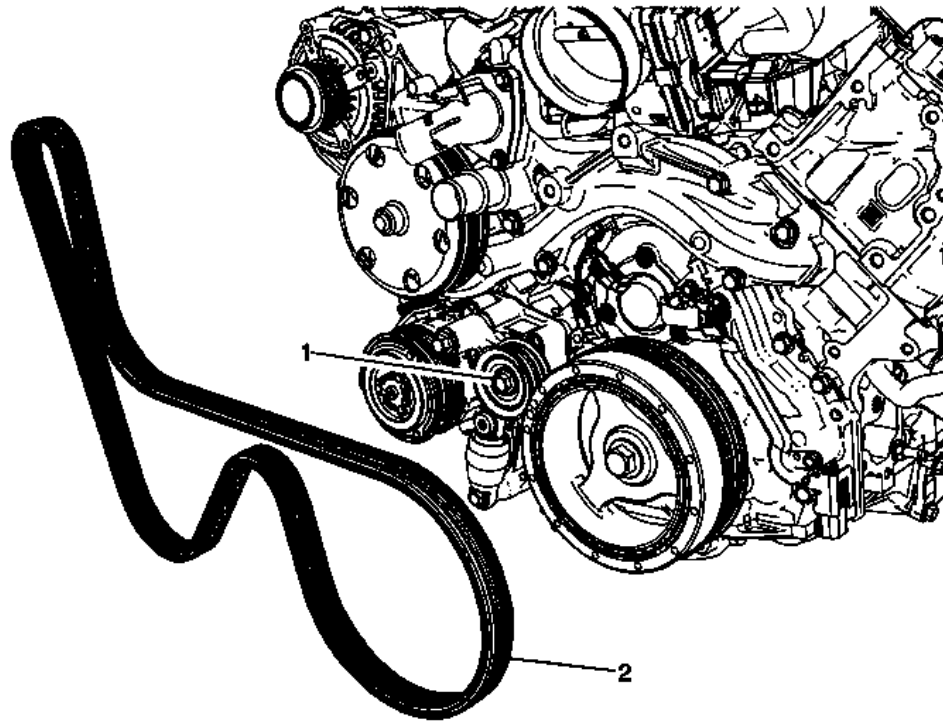


Fig. 1: Accessory Drive Belt Routing
Courtesy of GENERAL MOTORS COMPANY

Drive Belt Replacement - Accessory

Callout	Component Name
Preliminary Procedures	
Remove the air cleaner outlet duct. Refer to <u>Air Cleaner Outlet Duct Replacement</u> .	
1	Drive Belt Tensioner Procedure Rotate the drive belt tensioner clockwise to release the drive belt tension.
2	Drive Belt Procedure 1. Slide the drive belt off of the belt generator pulley. 2. Slowly release the drive belt tensioner.

DRIVE BELT TENSIONER REPLACEMENT - ACCESSORY

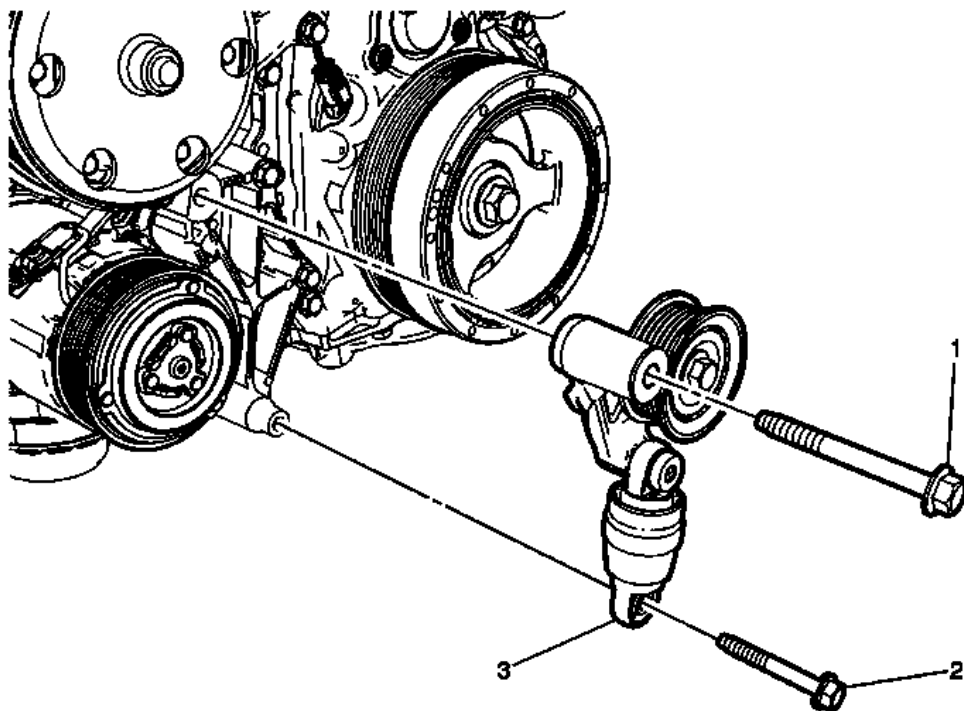


Fig. 2: Drive Belt Tensioner - Accessory
Courtesy of GENERAL MOTORS COMPANY

Drive Belt Tensioner Replacement - Accessory

Callout	Component Name
Preliminary Procedures Remove the drive belt. Refer to <u>Drive Belt Replacement - Accessory</u> .	
1	CAUTION: Refer to <u>Fastener Caution</u> . Air Conditioning Compressor Belt Tensioner Bolt Tighten 58 N.m (43 lb ft)
2	Tensioner Bolt Tighten 22 N.m (16 lb ft)
3	Drive Belt Tensioner - Accessory

ENGINE SUPPORT FIXTURE

Special Tools

- **J-28467-B** Universal Engine Support Fixture.
- **J-41803-9** Engine Lift Hook.

- **J-42451-1** Engine Support Adapter.
- **J-41803** Engine Support Fixture Feet.

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

1. Remove the generator from the accessory mounting bracket. Refer to **Generator Replacement (LT1)** .
2. Remove the engine covers.
3. Install **J-42451-1** Engine Support Adapter or **J-41803-9** Engine Lift Hook to the left cylinder head heavy duty bolt.
4. Install **J-42451-1** Engine Support Adapter or **J-41803-9** Engine Lift Hook to the right cylinder head heavy duty bolt.

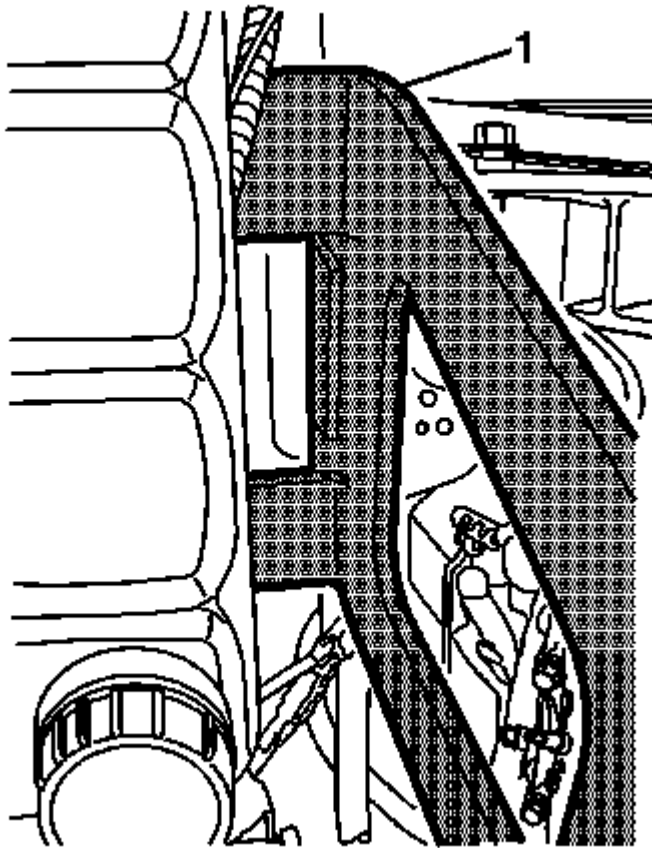


Fig. 3: Engine Support Fixture Feet
Courtesy of GENERAL MOTORS COMPANY

5. Install **J-41803** Engine Support Fixture Feet (1) to the frame rails, parts are marked left and right.

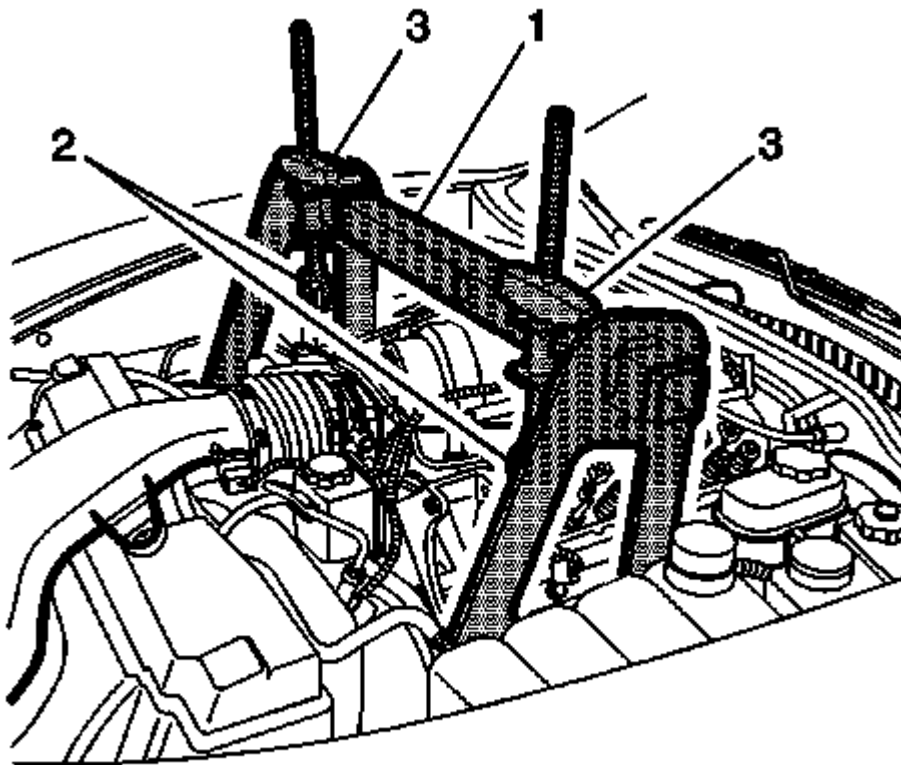


Fig. 4: Universal Engine Support Fixture Main Bar
Courtesy of GENERAL MOTORS COMPANY

6. Install **J-28467-B** Universal Engine Support Fixture main bar (1).
7. Install each J 28467-7A lift hook through each engine bracket (2). Ensure that the hooks do not damage the surrounding components.
8. Hand-tighten the lift hook wing nuts (3) securely to remove all slack from the engine support fixture assembly
9. The engine is now supported in the vehicle to perform repairs that require front frame removal.

ENGINE MOUNT INSPECTION

CAUTION: Phenolic spacer must be present to prevent galvanic/corrosive reaction and/or excessive temperature conduction between engine mount bracket and engine mount. Replace mount if phenolic spacer is missing or damaged. Failure to ensure phenolic spacer is intact and not damaged can lead to premature failure of engine mount and/or engine mount bracket.

NOTE: Before replacing any engine mount due to suspected fluid loss, verify that

the source of the fluid is the engine mount, not the engine or accessories.

1. Install the engine support fixture. Refer to **Engine Support Fixture**. Raising the engine removes the weight from the engine mount and creates slight tension in the rubber.
2. Observe the engine mount while raising the engine. Replace the engine mount if the engine mount exhibits any of the following conditions:
 - The hard rubber surface 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.
 - The GLYCOL™ fluid is leaking from the engine mount.
 - The phenolic spacer under the top mounting stud of the engine mount is missing or damaged (vehicles equipped with magnesium engine mount brackets).
3. If there is movement between the metal plate of the engine mount and its attaching points, lower the engine on the engine mount. Tighten the bolts or nuts attaching the engine mount to the frame or engine mount bracket. Refer to **Engine Mount Replacement - Left Side** or **Engine Mount Replacement - Right Side**.

ENGINE MOUNT REPLACEMENT - LEFT SIDE

Removal Procedure

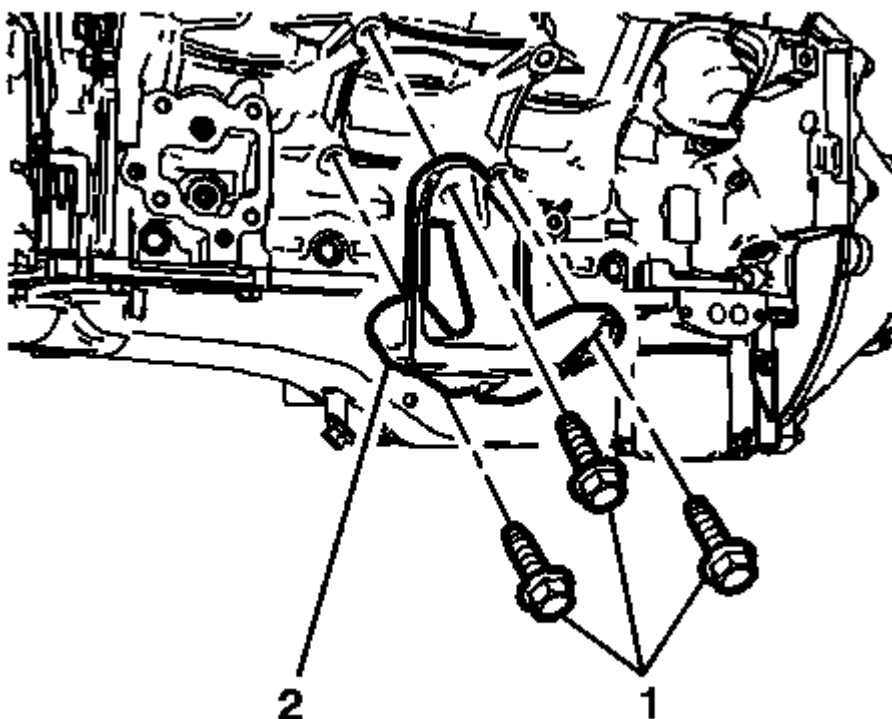


Fig. 5: Left Engine Mount Bracket

Courtesy of GENERAL MOTORS COMPANY

1. Remove the left engine mount bracket (2). Refer to **Engine Mount Bracket Replacement - Left Side**.

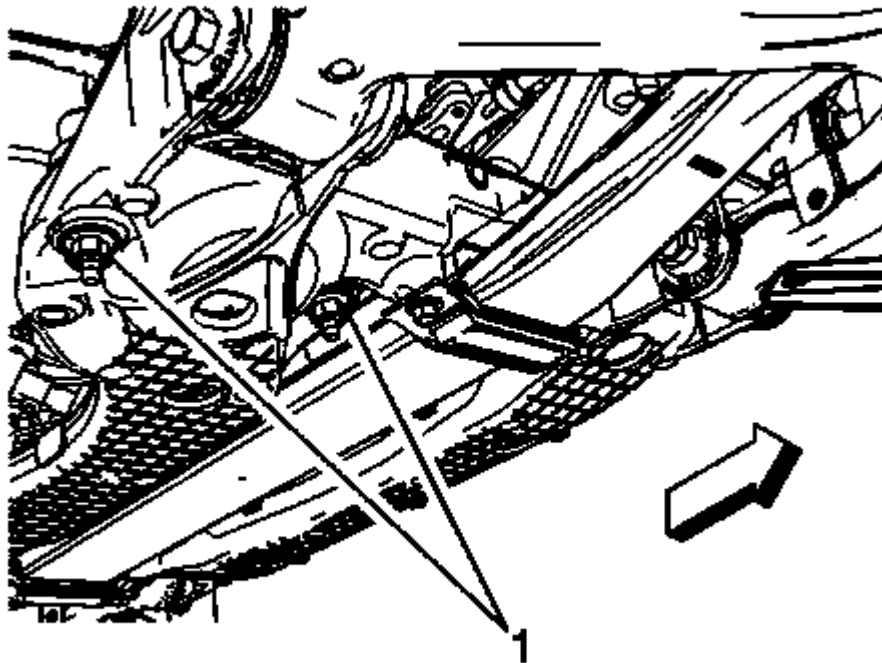


Fig. 6: Left Lower Engine Mounting Nuts
Courtesy of GENERAL MOTORS COMPANY

2. Remove the lower left engine mount-to-front suspension crossmember nuts (1).
3. Remove the left engine mount.

Installation Procedure

1. Install the left engine mount.

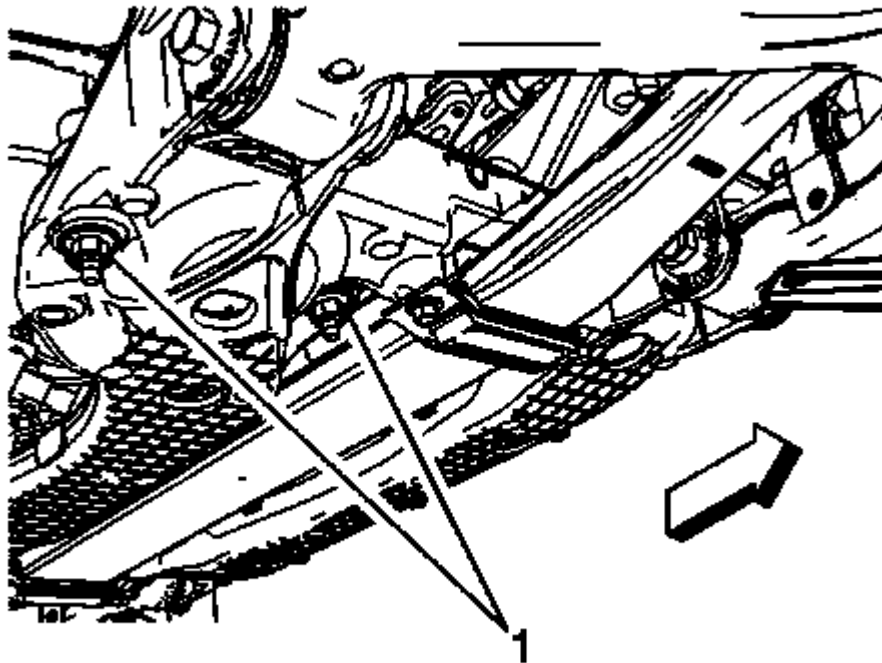


Fig. 7: Left Lower Engine Mounting Nuts
Courtesy of GENERAL MOTORS COMPANY

2. Install the lower left engine mount-to-front suspension crossmember nuts (1) and tighten to 43 (32 lb ft).

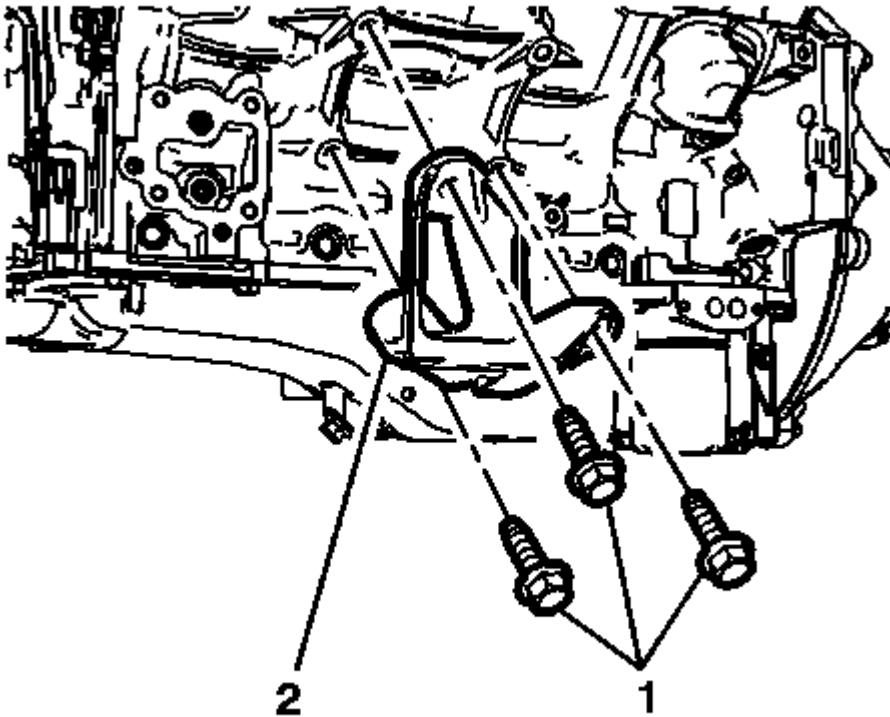


Fig. 8: Left Engine Mount Bracket
Courtesy of GENERAL MOTORS COMPANY

3. Install the left engine mount bracket (2). Refer to **Engine Mount Bracket Replacement - Left Side**.

ENGINE MOUNT BRACKET REPLACEMENT - LEFT SIDE

Special Tools

J-33432-B Leaf Spring Compressor

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

Removal Procedure

1. Remove the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** .
2. Place a transmission jack and a piece of wood under the engine where it mates with the engine flywheel housing.
3. Remove both lower stabilizer shaft bolts. Refer to **Stabilizer Shaft Replacement** .
4. Remove the front underbody side rail cross braces. Refer to **Underbody Side Rail Cross**

Brace Replacement (Rear) , Underbody Side Rail Cross Brace Replacement (Front) .

5. Remove the electronic suspension front position sensor. Refer to **Electronic Suspension Front Position Sensor Replacement** .

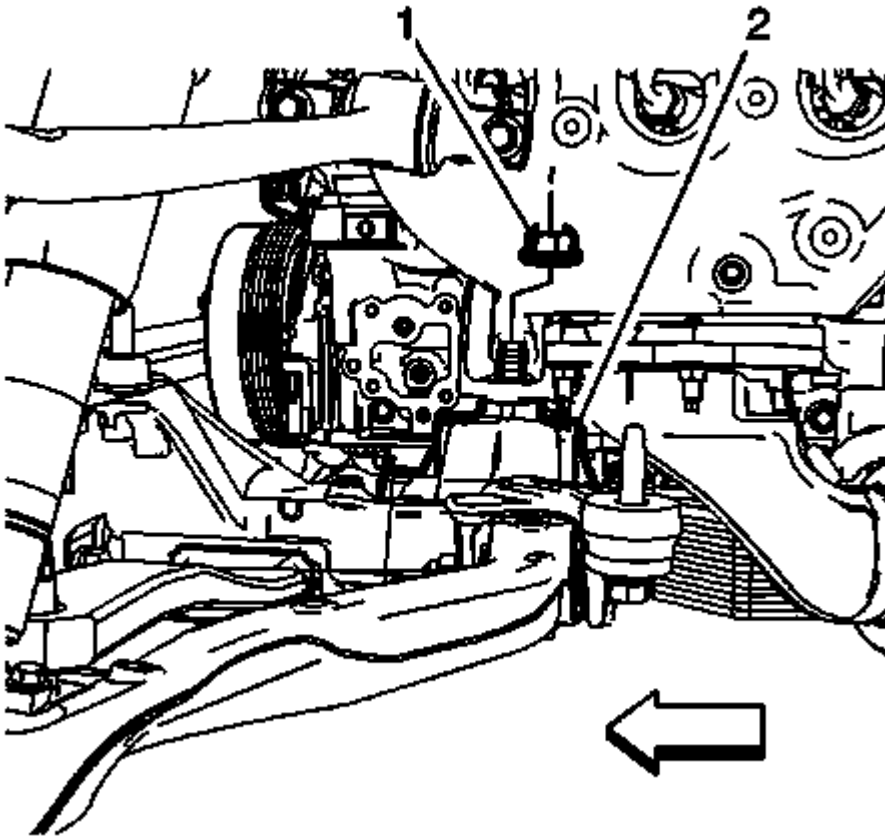


Fig. 9: Left Engine Mount

Courtesy of GENERAL MOTORS COMPANY

6. Remove the left engine mount (2) upper mounting nut (1).

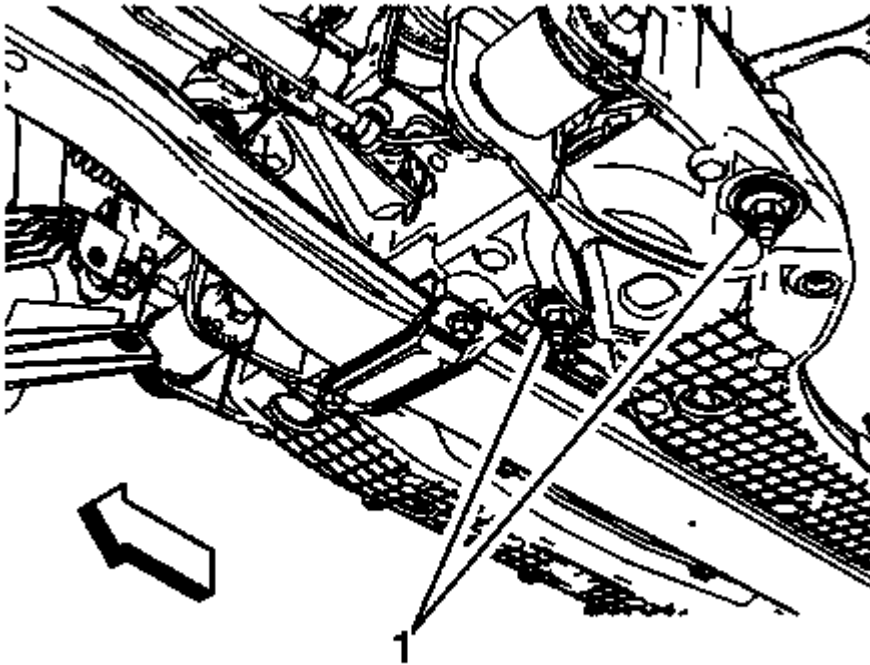


Fig. 10: Lower Engine Mounting Nuts
Courtesy of GENERAL MOTORS COMPANY

7. Remove the lower right engine mount-to-front suspension crossmember nuts (1).

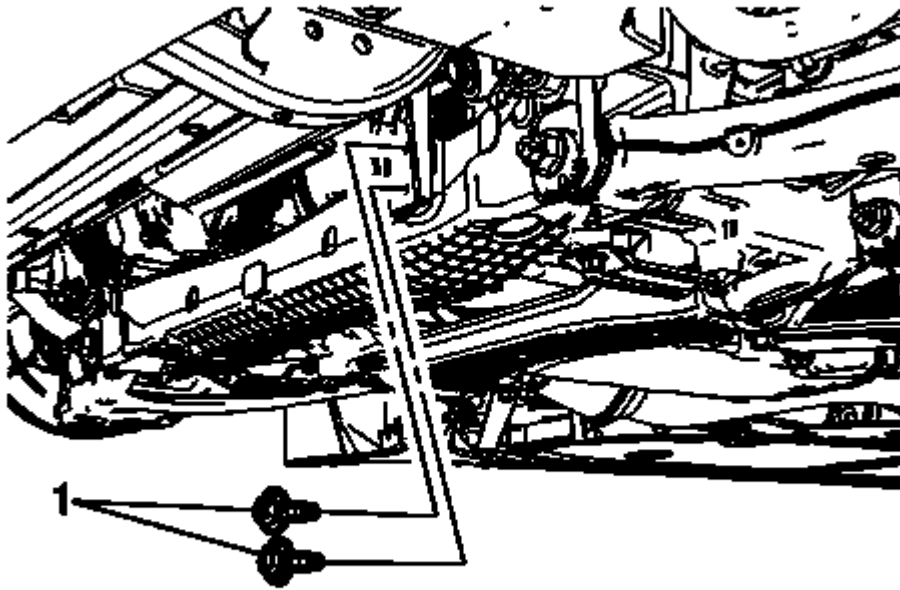


Fig. 11: BPMV Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

8. Remove the brake pressure modulator valve bracket bolts.

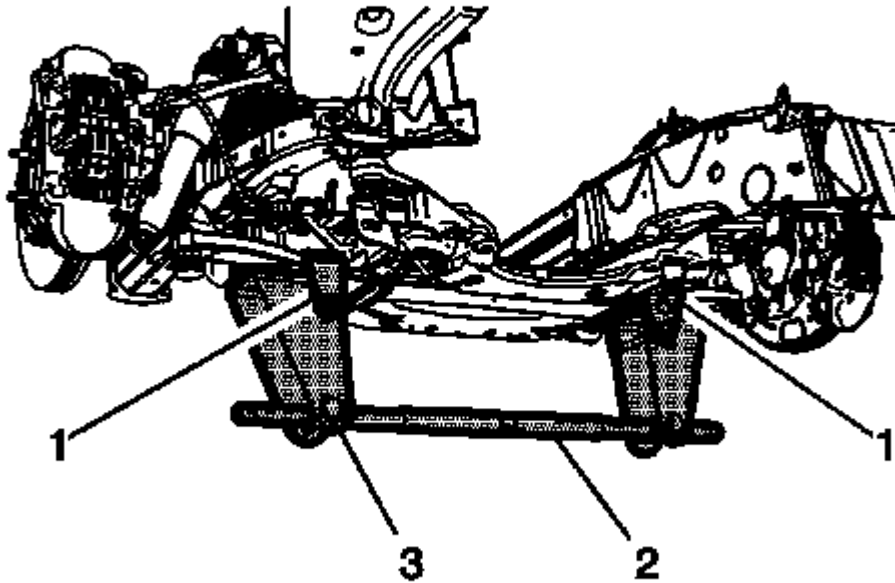


Fig. 12: Using J-33432-B compressor and adapters J-33432--97
Courtesy of GENERAL MOTORS COMPANY

NOTE: Do not scratch the front transverse spring surface.

9. Using the **J-33432-B** compressor (3) and adapters J-33432-97 (1) and (2), compress to the transverse spring.
10. Remove the crossmember mounting fasteners, then lower the crossmember to gain mount removal clearance.

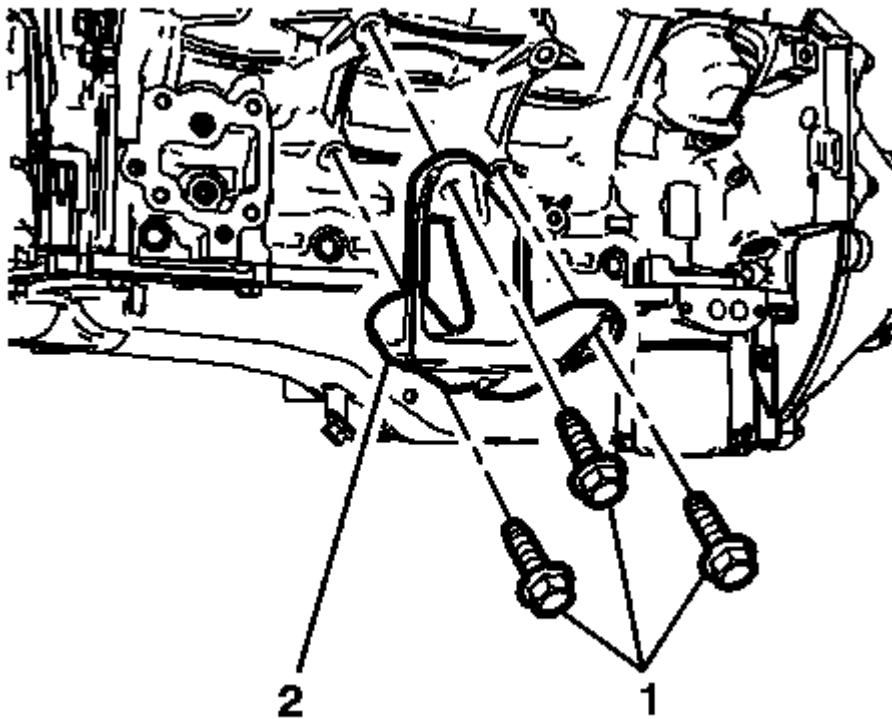


Fig. 13: Left Engine Mount Bracket
Courtesy of GENERAL MOTORS COMPANY

11. Remove the engine mount bracket bolts (1).
12. Remove the engine mount bracket (2).

Installation Procedure

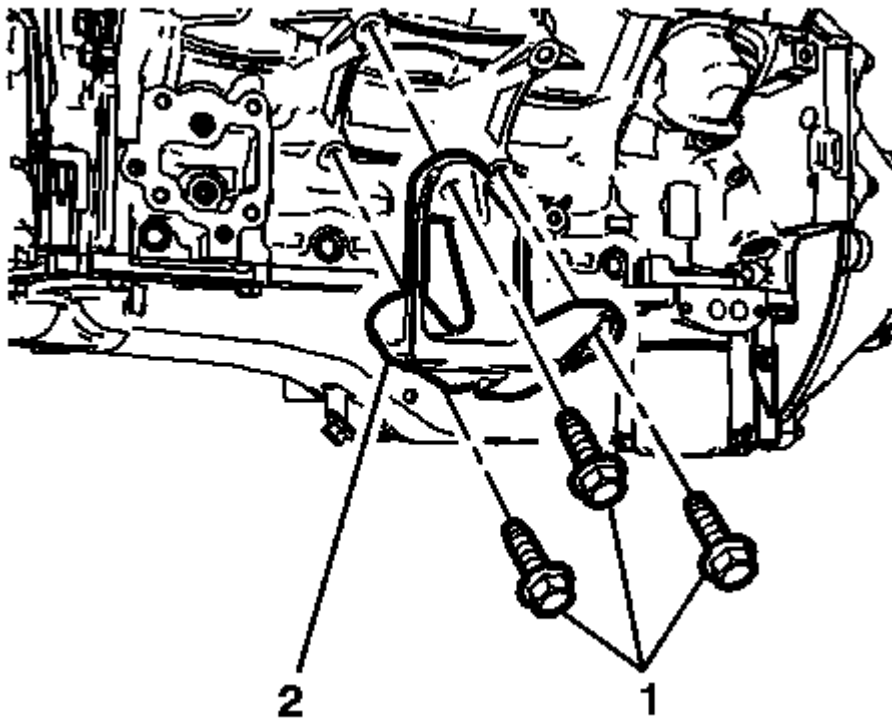


Fig. 14: Left Engine Mount Bracket
Courtesy of GENERAL MOTORS COMPANY

1. Install the engine mount bracket (2).
2. +

CAUTION: Refer to Fastener Caution .

Install the engine mount bracket bolts (1) and tighten to 100 N.m (74 lb ft).

3. Using ONLY hand tools, install the crossmember mounting fasteners and tighten to 160 (118 lb ft).
4. Remove the **J-33432-B** compressor from the transverse spring.
5. Remove the transmission jack.

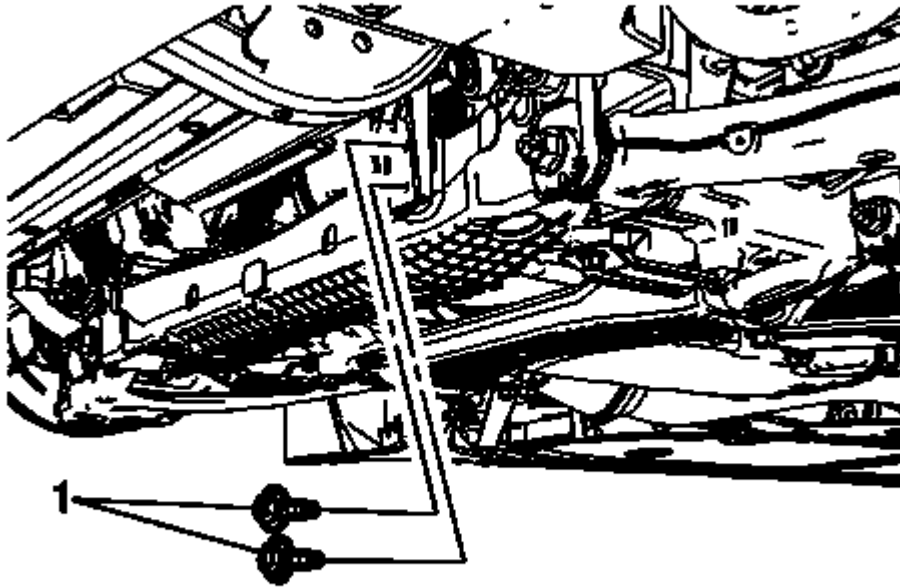


Fig. 15: BPMV Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

6. Install the brake pressure modulator valve bracket bolts (1) and tighten to 27 (20 lb ft).

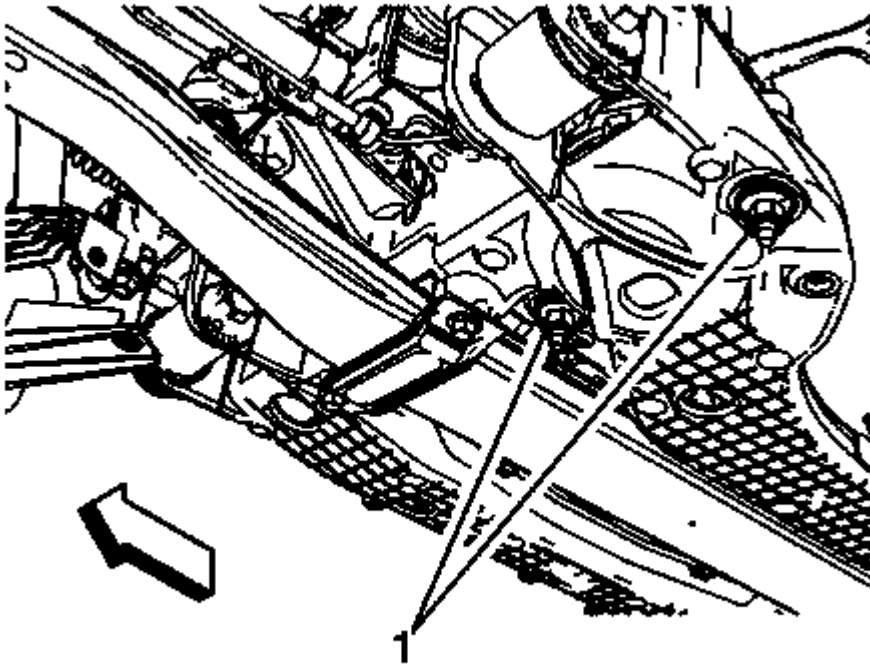


Fig. 16: Lower Engine Mounting Nuts
Courtesy of GENERAL MOTORS COMPANY

7. Install the lower right engine mount-to-front suspension crossmember nuts (1) and tighten to 43 (32 lb ft).

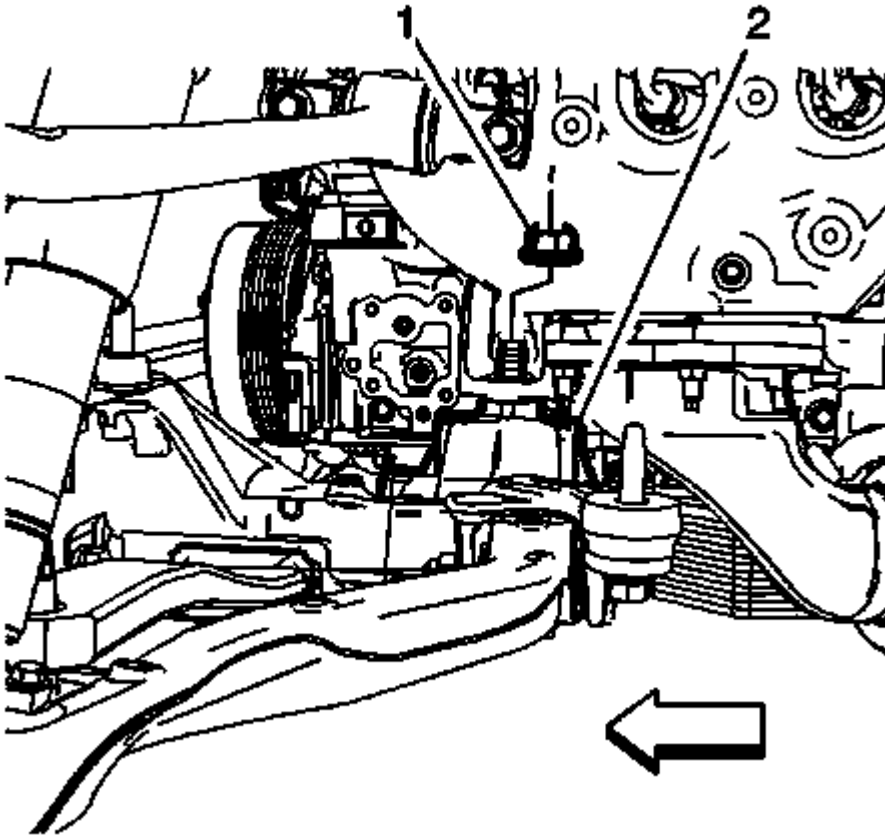


Fig. 17: Left Engine Mount

Courtesy of GENERAL MOTORS COMPANY

8. Install the left engine mount (2) upper mounting nut (1) and tighten to 75 (55 lb ft).
9. Install the electronic suspension front position sensor. Refer to **Electronic Suspension Front Position Sensor Replacement** .
10. Install the front underbody side rail cross braces. Refer to **Underbody Side Rail Cross Brace Replacement (Rear)** , **Underbody Side Rail Cross Brace Replacement (Front)** .
11. Install both lower stabilizer shaft bolts. Refer to **Stabilizer Shaft Replacement** .
12. Install the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** .

ENGINE MOUNT REPLACEMENT - RIGHT SIDE

Removal Procedure

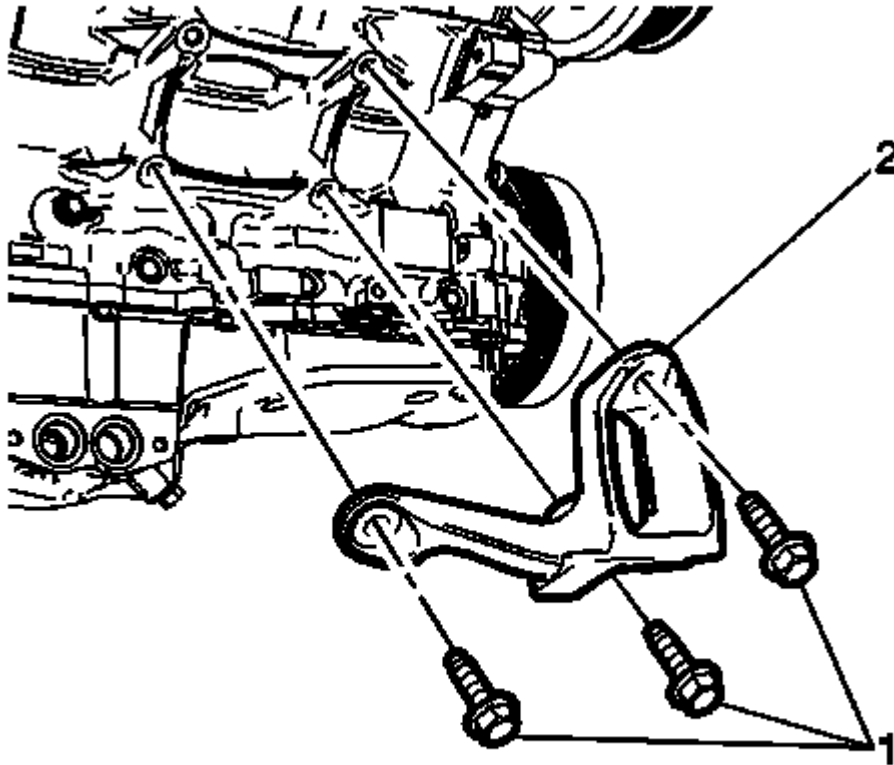


Fig. 18: Right Engine Mount Bracket
Courtesy of GENERAL MOTORS COMPANY

1. Remove the right engine mount bracket (2). Refer to **Engine Mount Bracket Replacement - Right Side.**

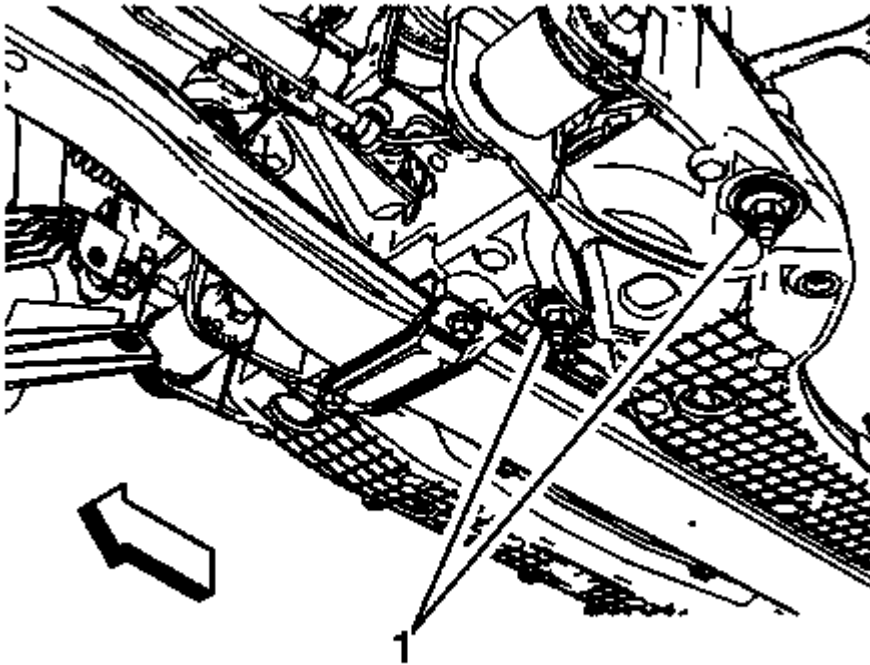


Fig. 19: Lower Engine Mounting Nuts
Courtesy of GENERAL MOTORS COMPANY

2. Remove the lower right engine mount-to-front suspension crossmember nuts (1).
3. Remove the right engine mount.

Installation Procedure

1. Install the right engine mount.

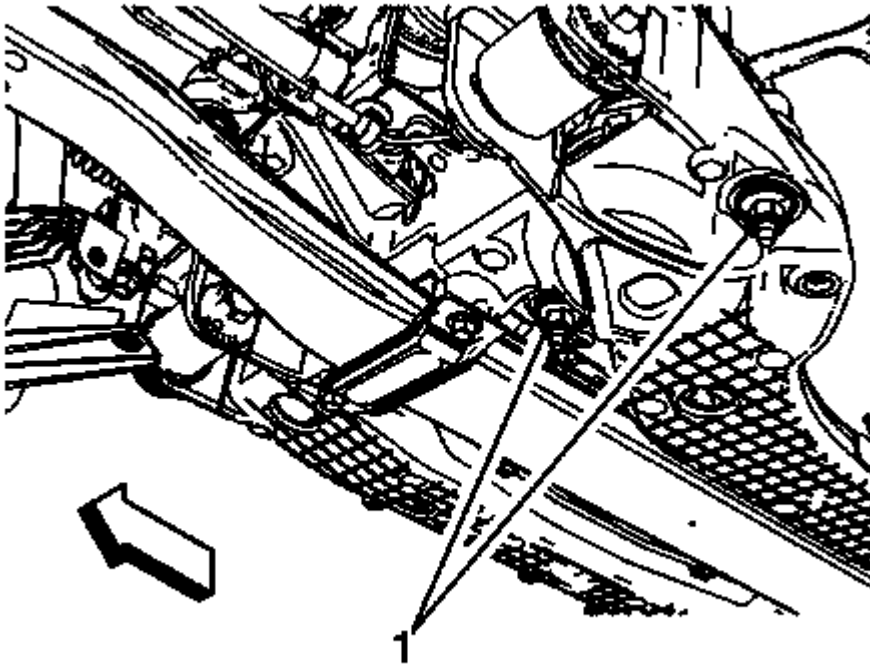


Fig. 20: Lower Engine Mounting Nuts
Courtesy of GENERAL MOTORS COMPANY

2. Install the lower right engine mount-to-front suspension crossmember nuts (1) and tighten to 43 (32 lb ft).

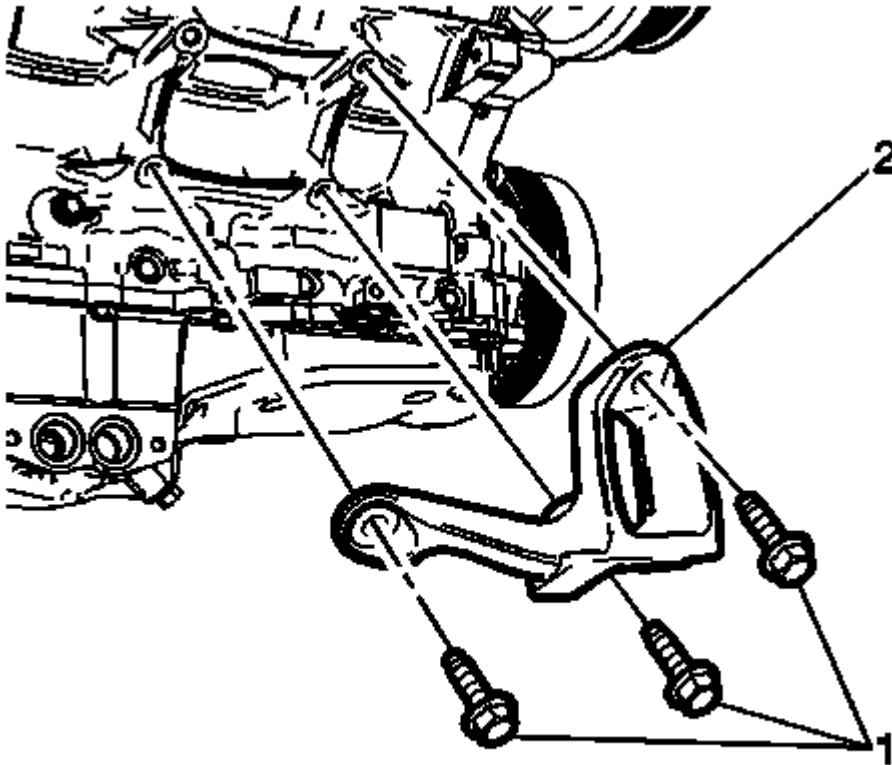


Fig. 21: Right Engine Mount Bracket
Courtesy of GENERAL MOTORS COMPANY

3. Install the right engine mount bracket (2). Refer to **Engine Mount Bracket Replacement - Right Side**.

ENGINE MOUNT BRACKET REPLACEMENT - RIGHT SIDE

Special Tools

J-33432-B Leaf Spring Compressor

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

Removal Procedure

1. Remove the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** .
2. Place a transmission jack and a piece of wood under the engine where it mates with the engine flywheel housing.
3. Remove both lower stabilizer shaft bolts. Refer to **Stabilizer Shaft Replacement** .
4. Remove the front underbody side rail cross braces. Refer to **Underbody Side Rail Cross**

Brace Replacement (Rear) , Underbody Side Rail Cross Brace Replacement (Front) .

5. Remove the electronic suspension front position sensor. Refer to **Electronic Suspension Front Position Sensor Replacement** .

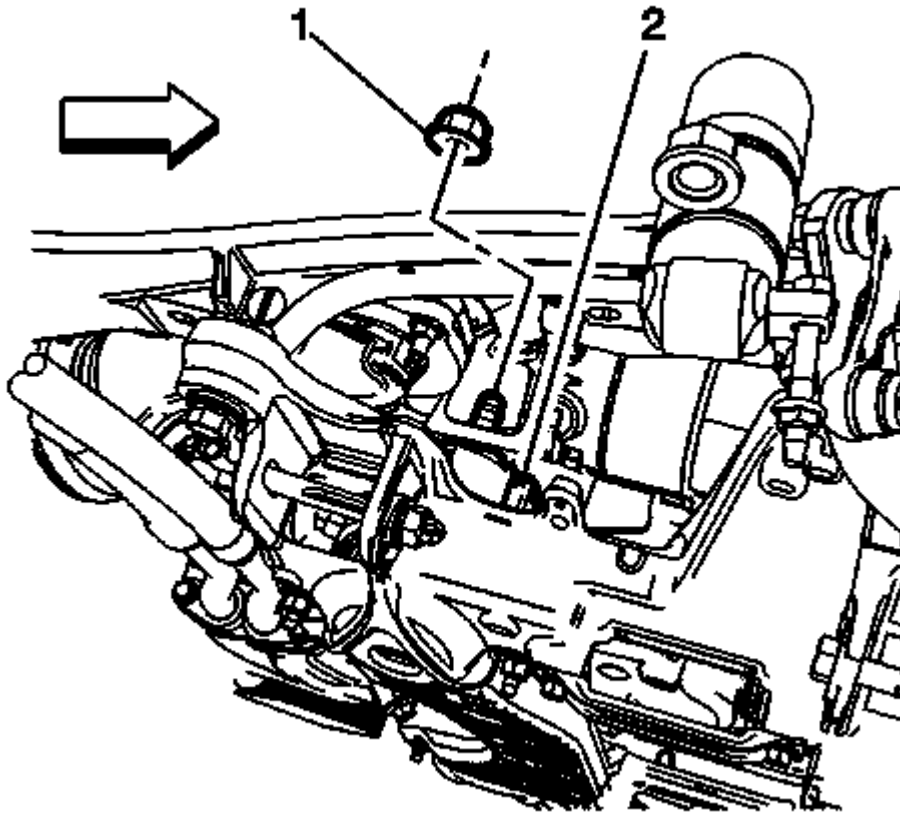


Fig. 22: Right Engine Mount

Courtesy of GENERAL MOTORS COMPANY

6. Remove the right engine mount (2) upper mounting nut (1).

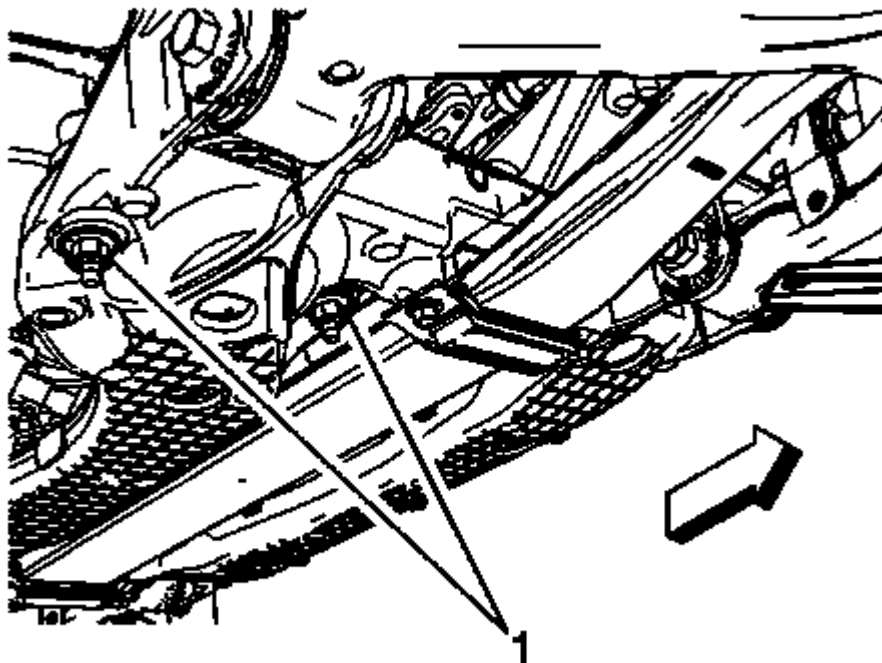


Fig. 23: Left Lower Engine Mounting Nuts
Courtesy of GENERAL MOTORS COMPANY

7. Remove the lower left engine mount-to-front suspension crossmember nuts (1).

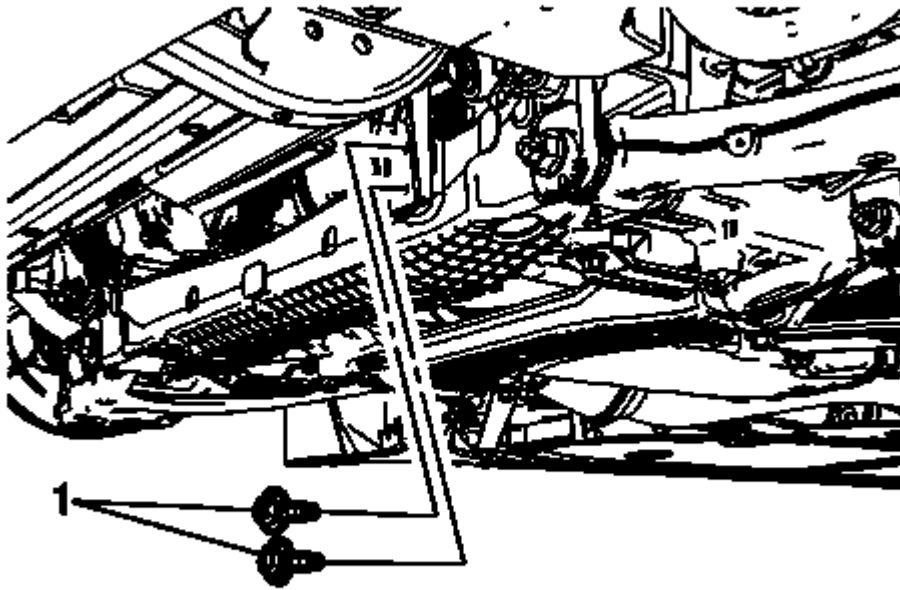


Fig. 24: BPMV Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

8. Remove the brake pressure modulator valve bracket bolts.

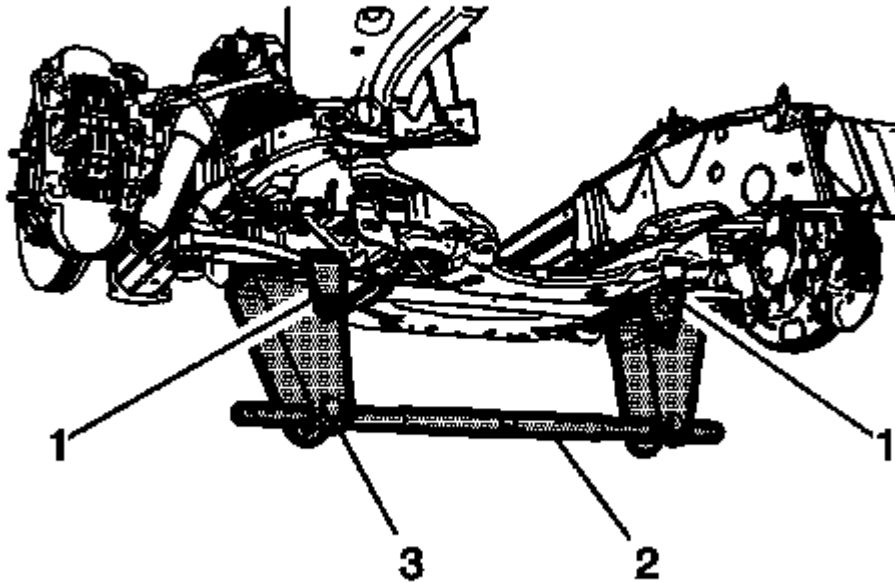


Fig. 25: Using J-33432-B compressor and adapters J-33432--97
Courtesy of GENERAL MOTORS COMPANY

NOTE: Do not scratch the front transverse spring surface.

9. Using the **J-33432-B** compressor (3) and adapters J-33432-97 (1) and (2), compress to the transverse spring.
10. Remove the crossmember mounting fasteners, then lower the crossmember to gain mount removal clearance.

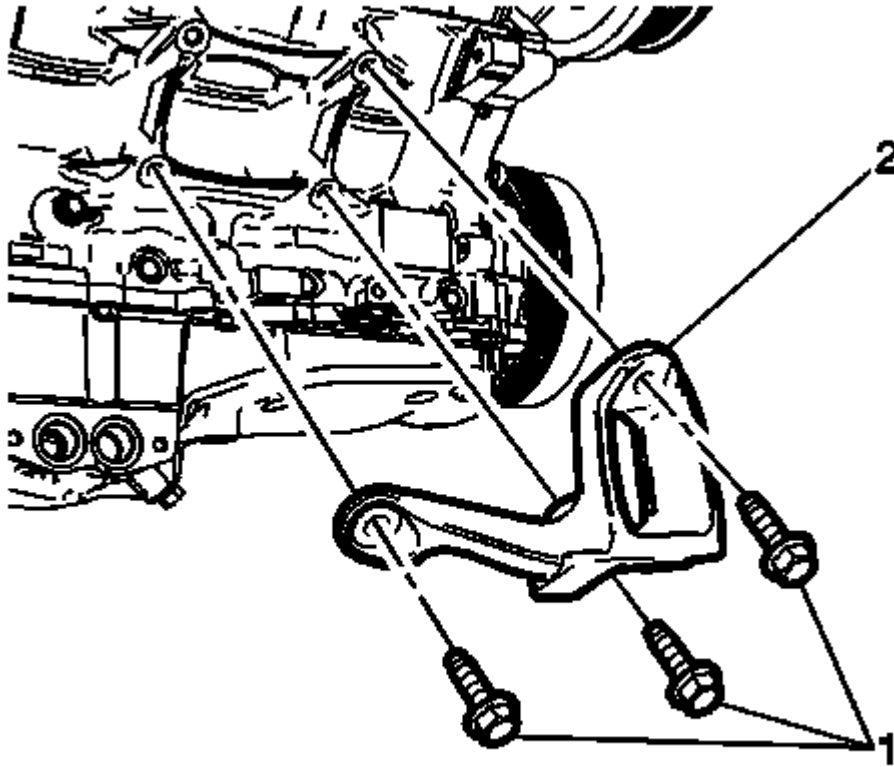


Fig. 26: Right Engine Mount Bracket
Courtesy of GENERAL MOTORS COMPANY

11. Remove the engine mount bracket bolts (1).
12. Remove the engine mount bracket (2).

Installation Procedure

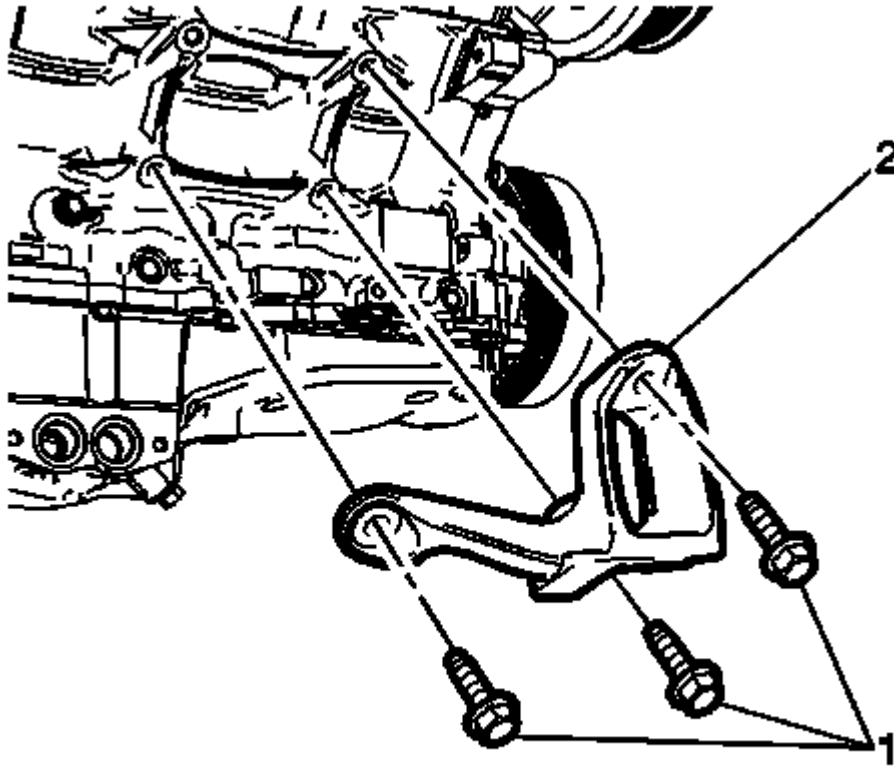


Fig. 27: Right Engine Mount Bracket
Courtesy of GENERAL MOTORS COMPANY

1. Install the engine mount bracket (2).
2. +

CAUTION: Refer to Fastener Caution .

Install the engine mount bracket bolts (1) and tighten to 100 N.m (74 lb ft).

3. Using ONLY hand tools, install the crossmember mounting fasteners and tighten to 160 (118 lb ft).
4. Remove the **J-33432-B** compressor from the transverse spring.
5. Remove the transmission jack.

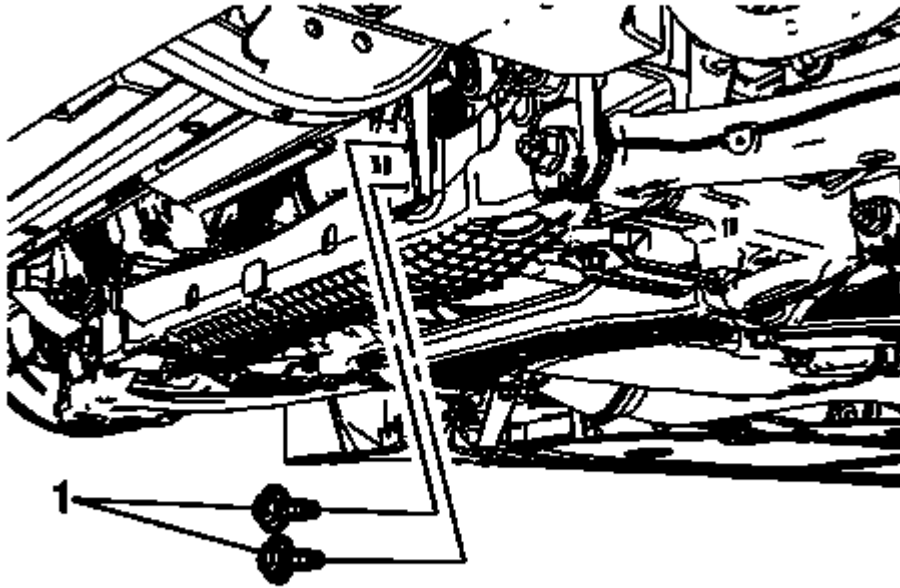


Fig. 28: BPMV Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

6. Install the brake pressure modulator valve bracket bolts (1) and tighten to 27 (20 lb ft).

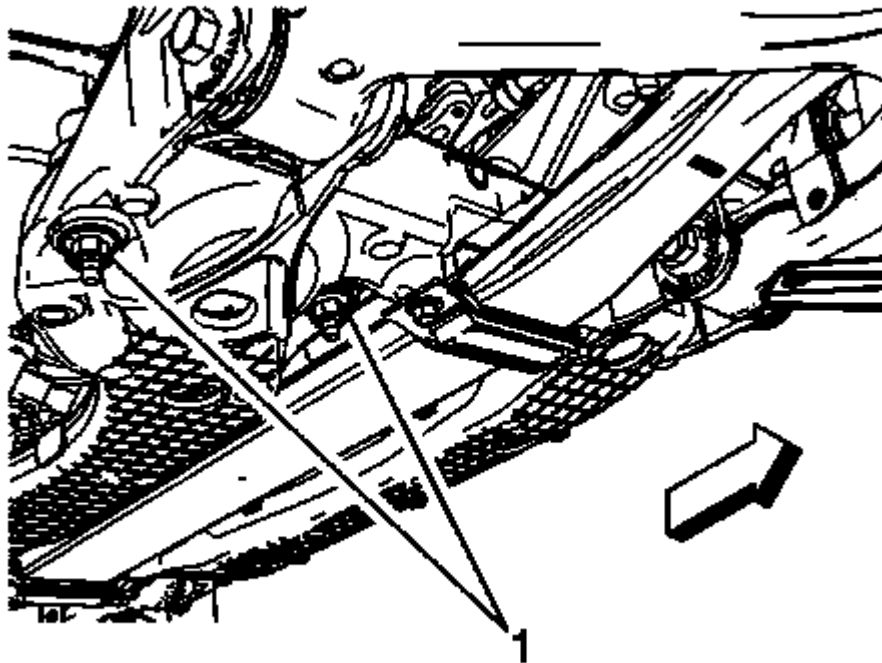


Fig. 29: Left Lower Engine Mounting Nuts
Courtesy of GENERAL MOTORS COMPANY

7. Install the lower left engine mount-to-front suspension crossmember nuts (1) and tighten to 43 (32 lb ft).

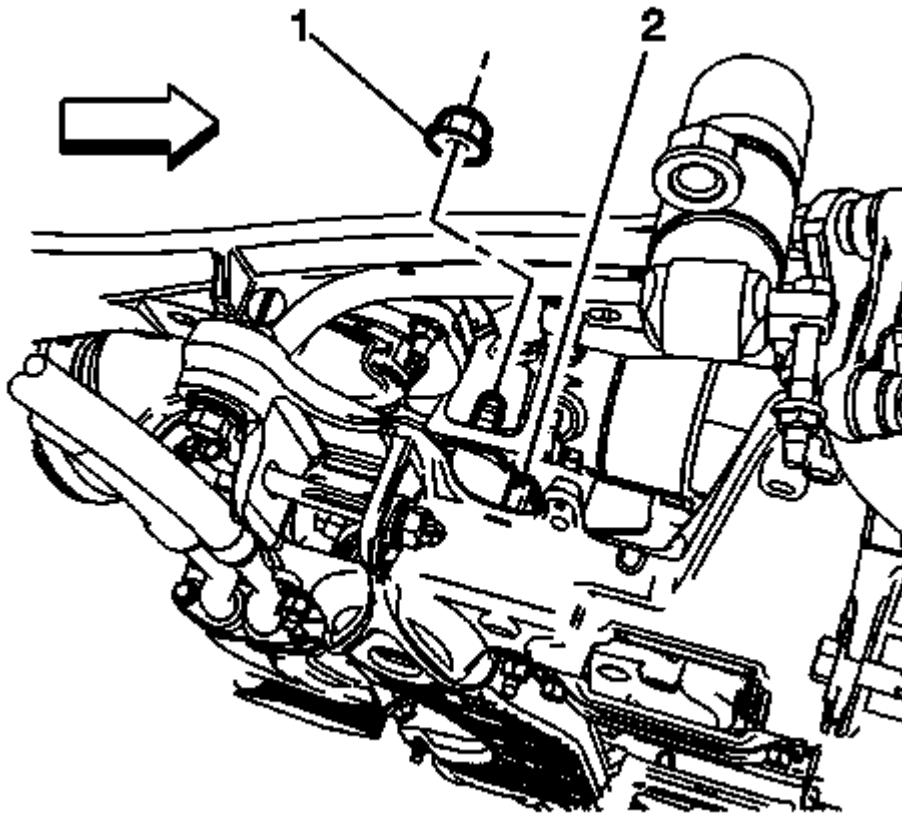


Fig. 30: Right Engine Mount

Courtesy of GENERAL MOTORS COMPANY

8. Install the right engine mount (2) upper mounting nut (1) and tighten to 75 (55 lb ft).
9. Install the electronic suspension front position sensor. Refer to **Electronic Suspension Front Position Sensor Replacement** .
10. Install the front underbody side rail cross braces. Refer to **Underbody Side Rail Cross Brace Replacement (Rear)** , **Underbody Side Rail Cross Brace Replacement (Front)** .
11. Install both lower stabilizer shaft bolts. Refer to **Stabilizer Shaft Replacement** .
12. Install the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** .

OIL TANK REPLACEMENT

Removal Procedure

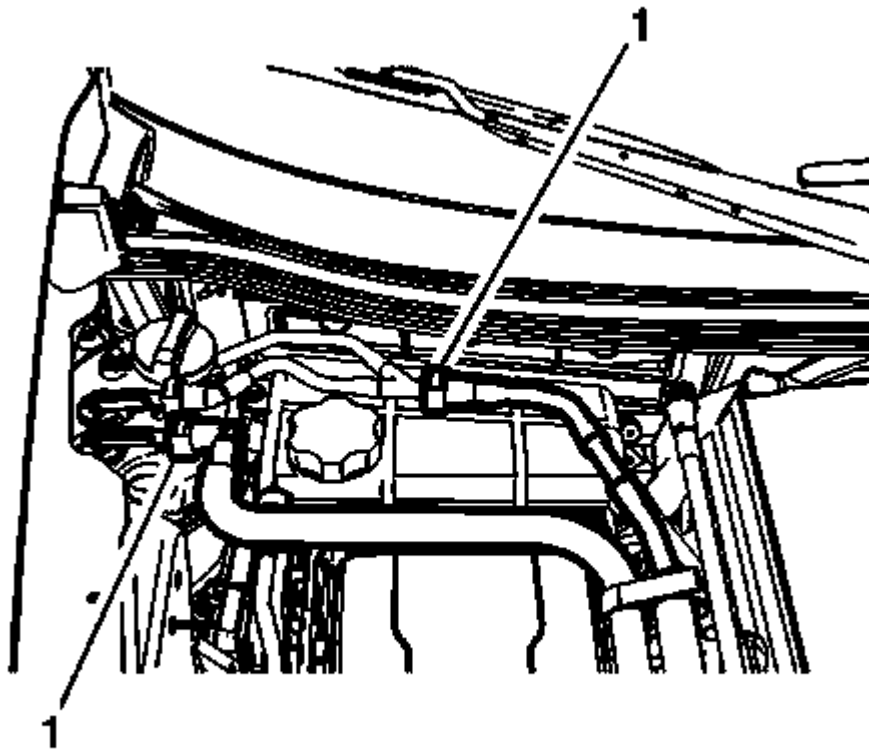


Fig. 31: Positive Crankcase Ventilation (PCV) Tubes
Courtesy of GENERAL MOTORS COMPANY

NOTE: Prior to the disconnecting the PCV tubes from the oil tank, mark the port locations to the proper tubes or they can be installed incorrectly.

1. Disconnect the positive crankcase ventilation (PCV) tubes (1) from the oil tank.
2. Drain the engine oil. Refer to **Engine Oil and Oil Filter Replacement (With Z52 Option)**, **Engine Oil and Oil Filter Replacement (Without Z52 Option)**.
3. Remove the right front tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
4. Remove the right front wheelhouse rear liner. Refer to **Front Wheelhouse Liner Replacement** .

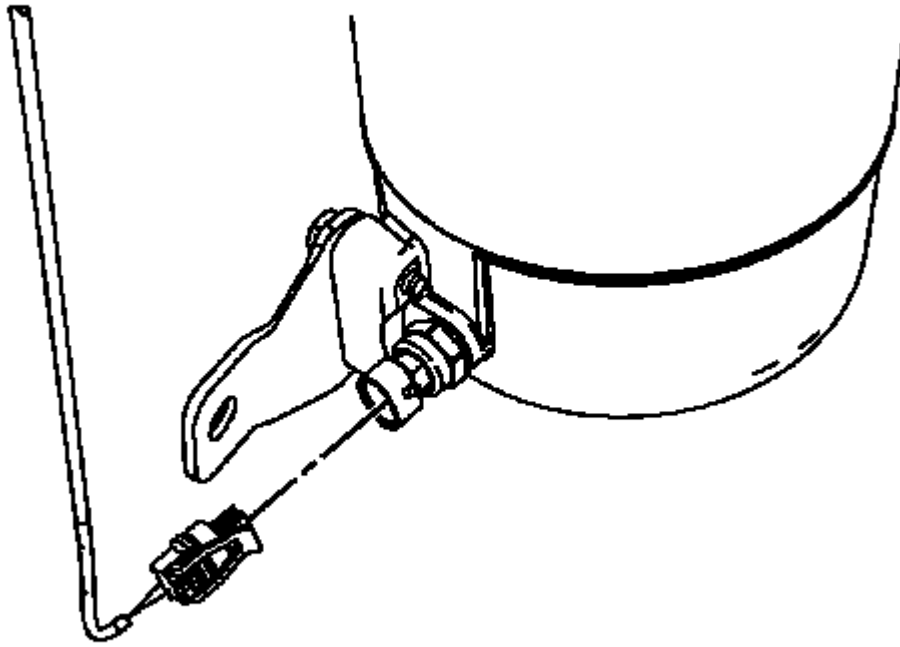


Fig. 32: View Of Oil Temperature Sensor Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

5. Disconnect the oil temperature sensor electrical connector.

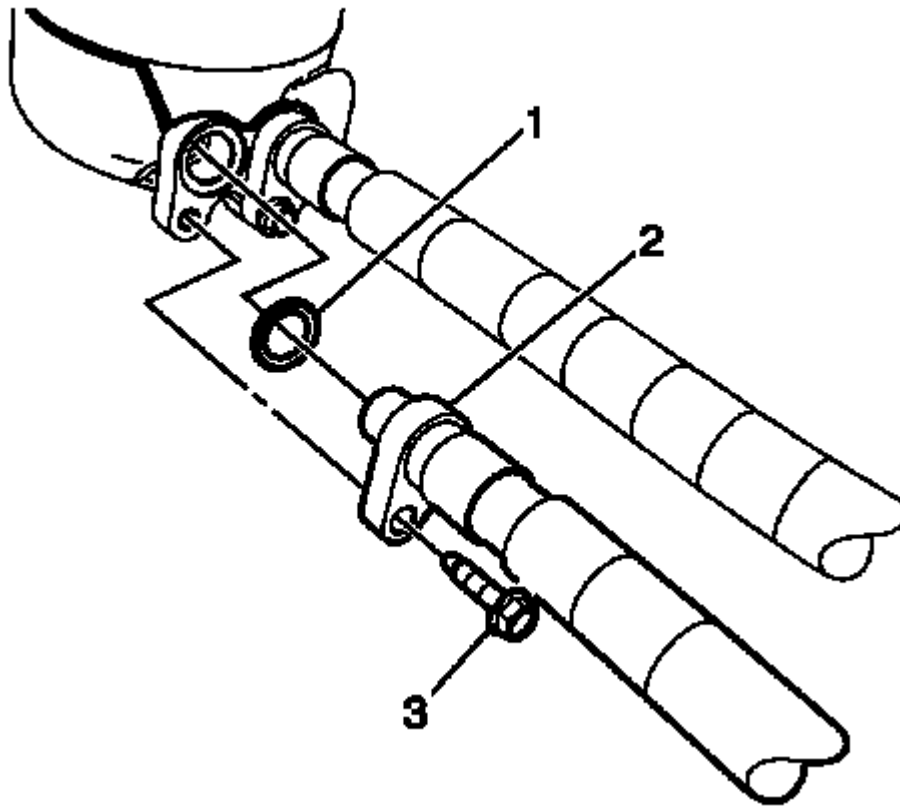


Fig. 33: View Of Oil Tank Inlet Hose, Inlet Hose To Oil Tank Bolt & Oil Seal
Courtesy of GENERAL MOTORS COMPANY

NOTE: Anytime the oil tank inlet and outlet hoses are serviced, the oil seals must be replaced.

6. Remove the inlet hose to oil tank bolt (3) and disconnect the hose (2) from the oil tank. Discard the oil seal (1).

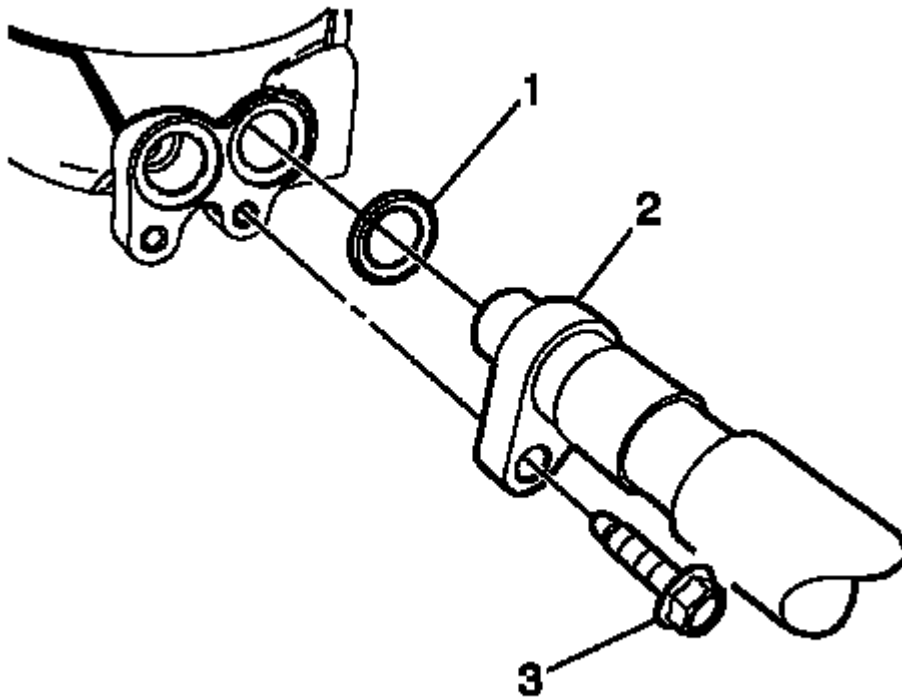


Fig. 34: View Of Oil Tank Outlet Hose, Outlet Hose To Oil Tank Bolt & Oil Seal
Courtesy of GENERAL MOTORS COMPANY

7. Remove the outlet hose to oil tank bolt (3) and disconnect the hose (2) from the oil tank. Discard the oil seal (1).

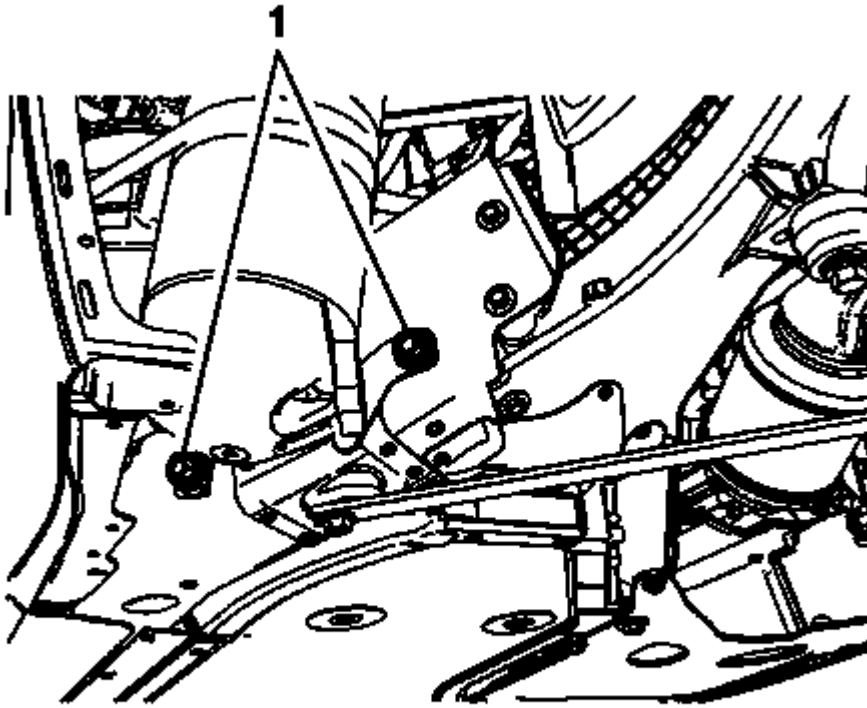


Fig. 35: Oil Tank To Frame Bolts
Courtesy of GENERAL MOTORS COMPANY

8. Remove the oil tank to frame bolts (1).
9. Remove the oil tank from the bottom of the vehicle.

Installation Procedure

CAUTION: Refer to Engine Oil Cooler Debris Caution .

1. Position the oil tank in place from the bottom of the vehicle.

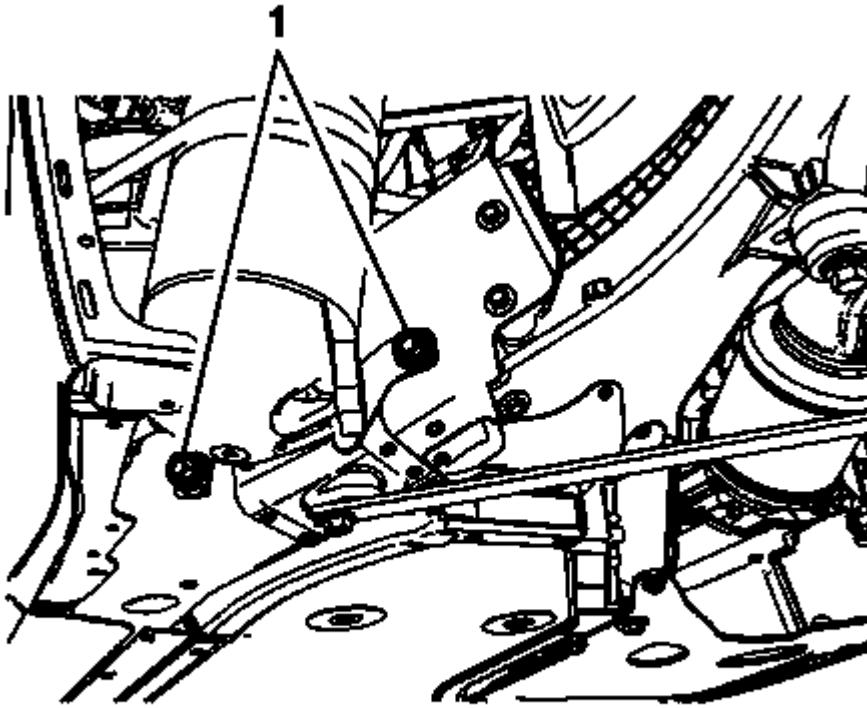


Fig. 36: Oil Tank To Frame Bolts
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

2. Install the oil tank lower bracket to frame bolts and tighten to 36 N.m (27 lb ft).

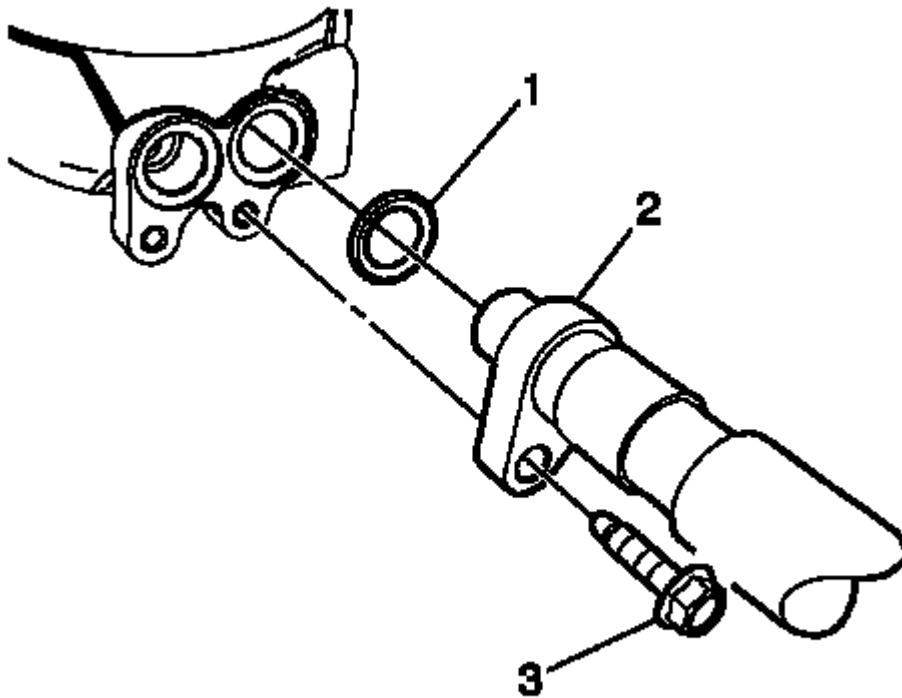


Fig. 37: View Of Oil Tank Outlet Hose, Outlet Hose To Oil Tank Bolt & Oil Seal
Courtesy of GENERAL MOTORS COMPANY

3. Using a new oil seal (1), install the oil tank outlet hose (2) and bolt (3) to the oil tank. Tighten the outlet hose to oil tank bolt to 22 N.m (16 lb ft).

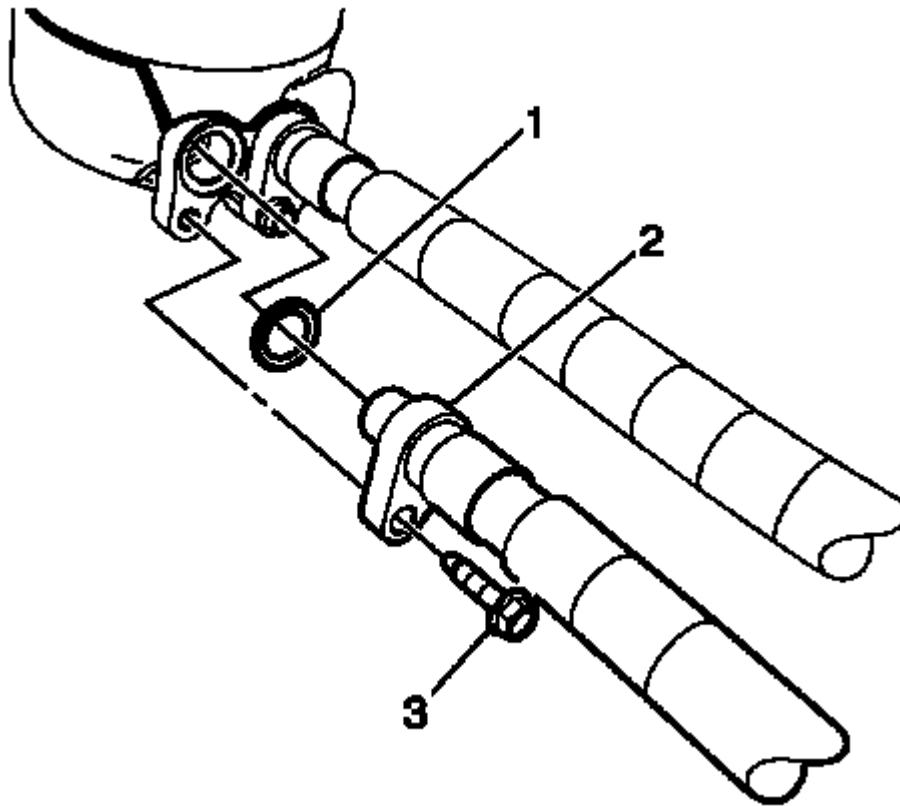


Fig. 38: View Of Oil Tank Inlet Hose, Inlet Hose To Oil Tank Bolt & Oil Seal
Courtesy of GENERAL MOTORS COMPANY

4. Using a new oil seal (1), install the oil tank inlet hose (2) and bolt (3) to the oil tank. Tighten the inlet hose to oil tank bolt to 22 N.m (16 lb ft).

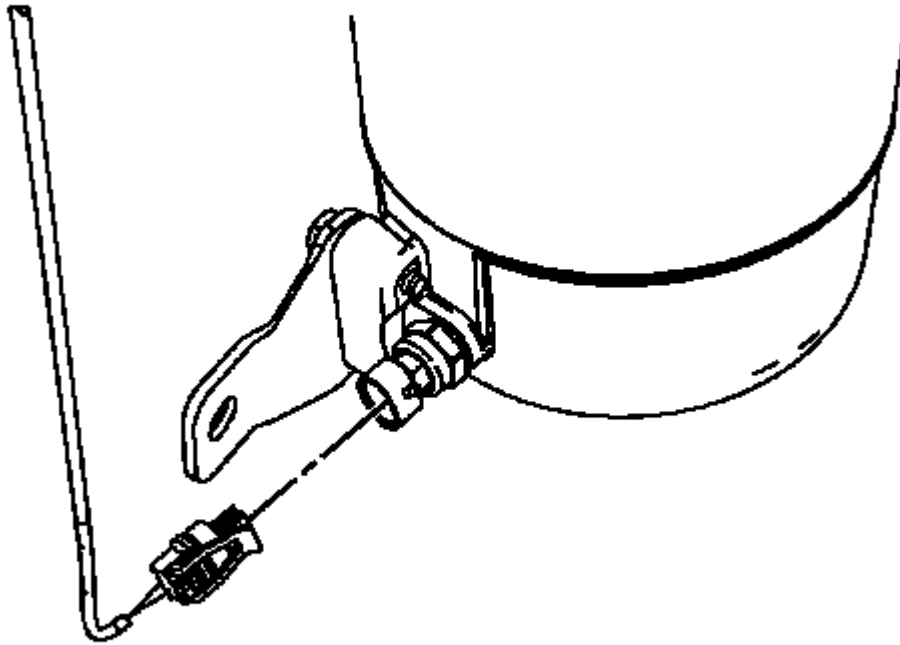


Fig. 39: View Of Oil Temperature Sensor Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

5. Connect the oil temperature sensor electrical connector.
6. Install the right front wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement** .
7. Install the right front tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
8. Lower the vehicle.

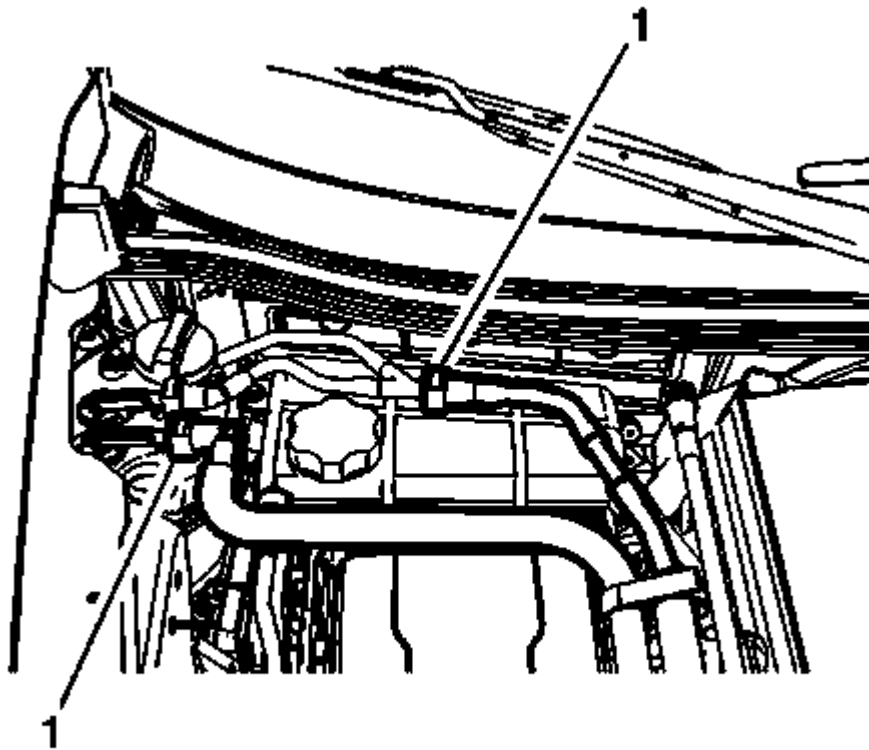


Fig. 40: Positive Crankcase Ventilation (PCV) Tubes
Courtesy of GENERAL MOTORS COMPANY

9. Connect the PCV tubes (1) to the oil tank.
10. Change the engine oil. Refer to **Engine Oil and Oil Filter Replacement (With Z52 Option)**, **Engine Oil and Oil Filter Replacement (Without Z52 Option)**.

OIL TANK INLET HOSE REPLACEMENT

Removal Procedure

1. Drain the engine oil. Refer to **Engine Oil and Oil Filter Replacement (With Z52 Option)**, **Engine Oil and Oil Filter Replacement (Without Z52 Option)**.
2. Remove the right front wheelhouse rear liner. Refer to **Front Wheelhouse Liner Replacement** .

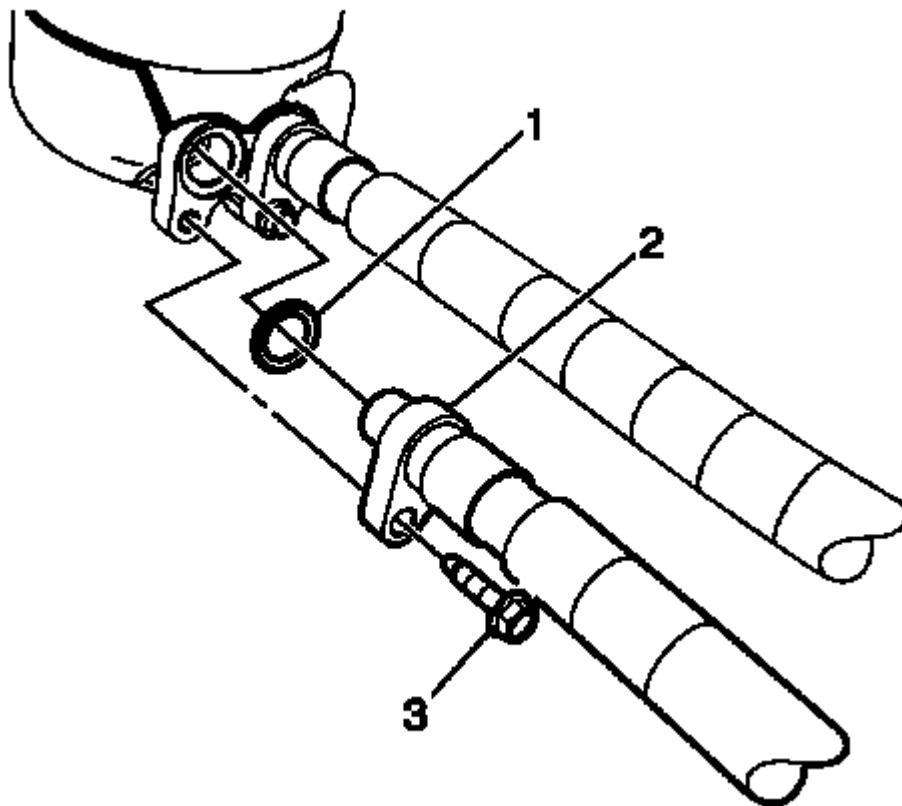


Fig. 41: View Of Oil Tank Inlet Hose, Inlet Hose To Oil Tank Bolt & Oil Seal
Courtesy of GENERAL MOTORS COMPANY

NOTE: Anytime the oil tank inlet and outlet hoses are serviced, the oil seals must be replaced.

3. Remove the inlet hose to oil tank bolt (3) and disconnect the hose (2) from the oil tank. Discard the oil seal (1).

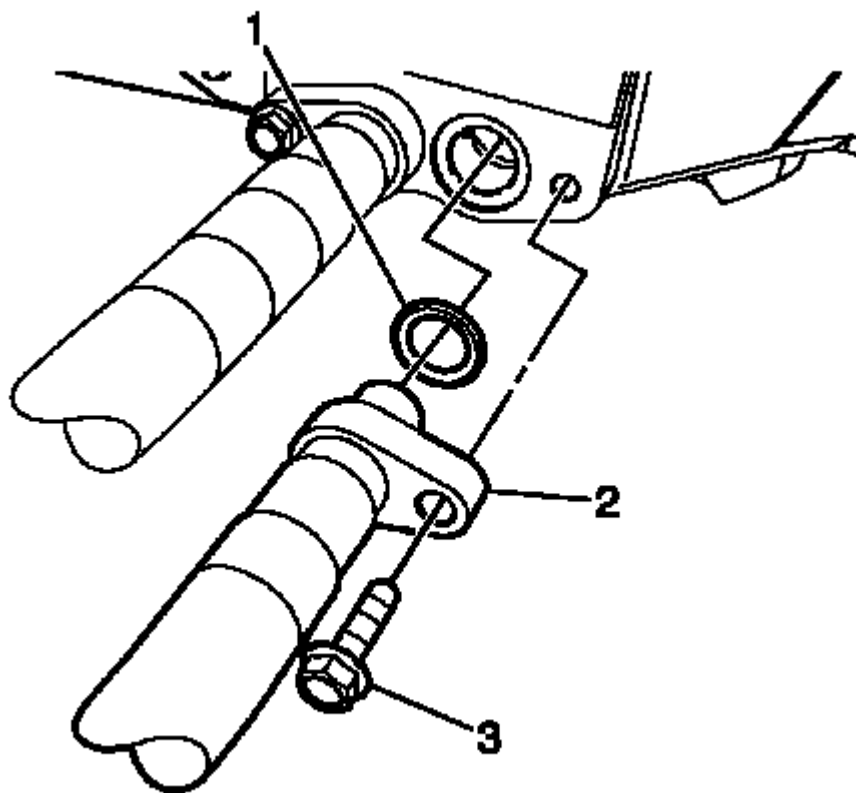


Fig. 42: Identifying Oil Tank Inlet Hose, Inlet Hose To Oil Tank Bolt & Oil Seal
Courtesy of GENERAL MOTORS COMPANY

4. Remove the inlet hose to oil pan bolt (3) and disconnect the hose (2) from the oil pan. Discard the oil seal (1).
5. Remove the oil inlet hose.

Installation Procedure

CAUTION: Refer to Engine Oil Cooler Debris Caution .

1. Position the oil inlet hose.

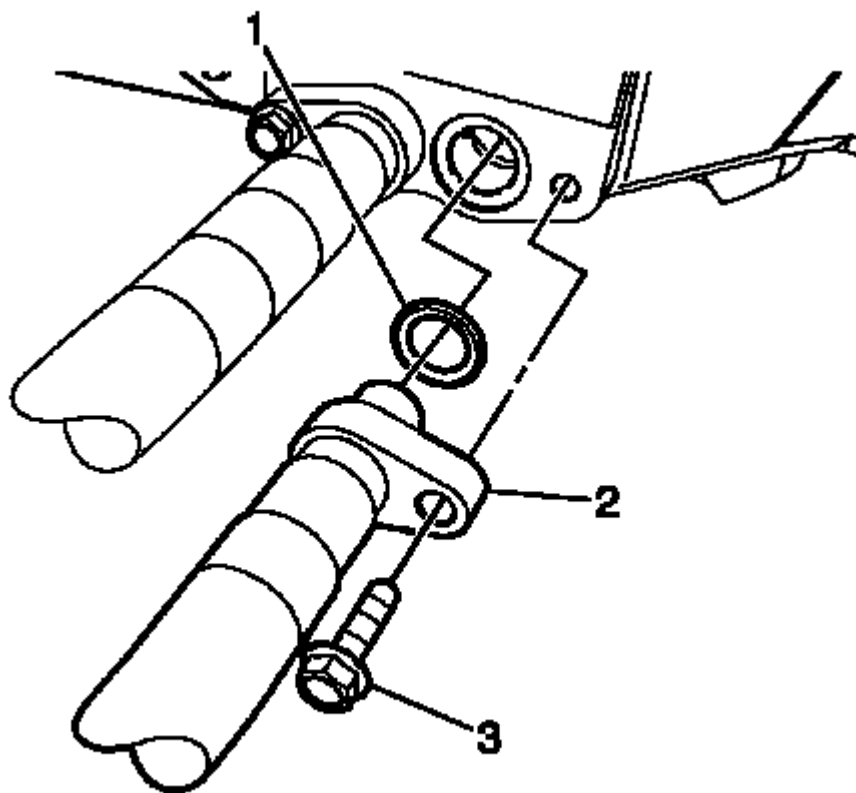


Fig. 43: Identifying Oil Tank Inlet Hose, Inlet Hose To Oil Tank Bolt & Oil Seal
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

2. Using a new oil seal (1), install the oil inlet hose (2) and bolt (3) to the oil pan. Tighten the inlet hose to oil pan bolt to 22 N.m (16 lb ft).

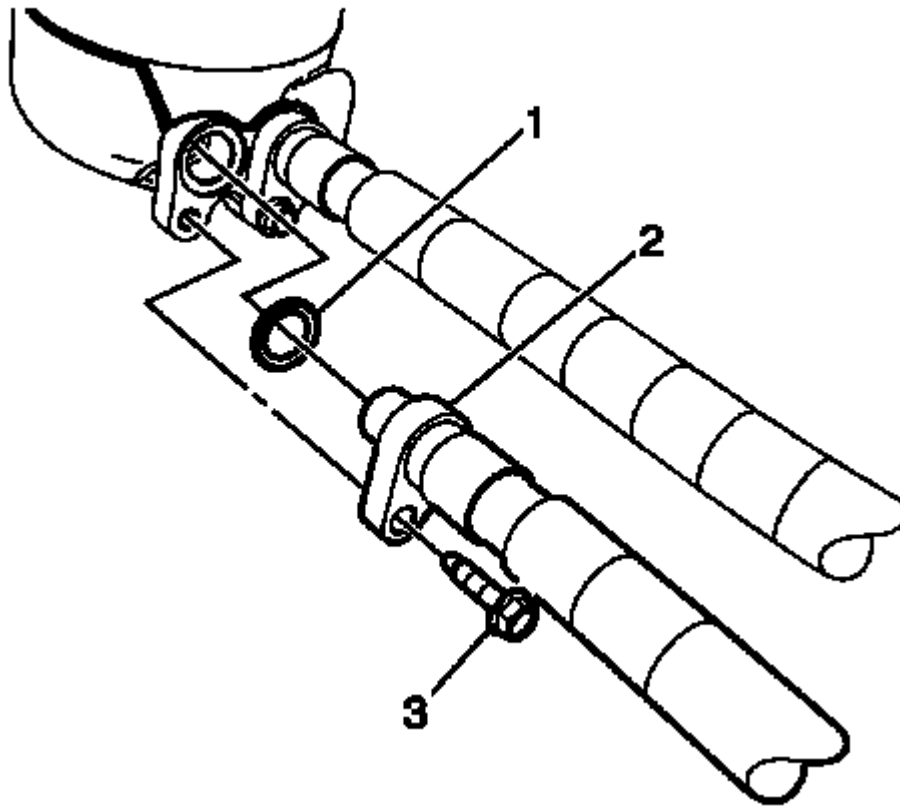


Fig. 44: View Of Oil Tank Inlet Hose, Inlet Hose To Oil Tank Bolt & Oil Seal
Courtesy of GENERAL MOTORS COMPANY

3. Using a new oil seal (1), install the oil inlet hose (2) and bolt (3) to the oil tank. Tighten the inlet hose to oil tank bolt to 22 N.m (16 lb ft).
4. Install the right front wheelhouse rear liner. Refer to **Front Wheelhouse Liner Replacement** .
5. Change the engine oil. Refer to **Engine Oil and Oil Filter Replacement (With Z52 Option)**, **Engine Oil and Oil Filter Replacement (Without Z52 Option)**.

OIL TANK OUTLET HOSE REPLACEMENT

Removal Procedure

1. Drain the engine oil. Refer to **Engine Oil and Oil Filter Replacement (With Z52 Option)**, **Engine Oil and Oil Filter Replacement (Without Z52 Option)**.
2. Remove the right front wheelhouse rear liner. Refer to **Front Wheelhouse Liner Replacement** .

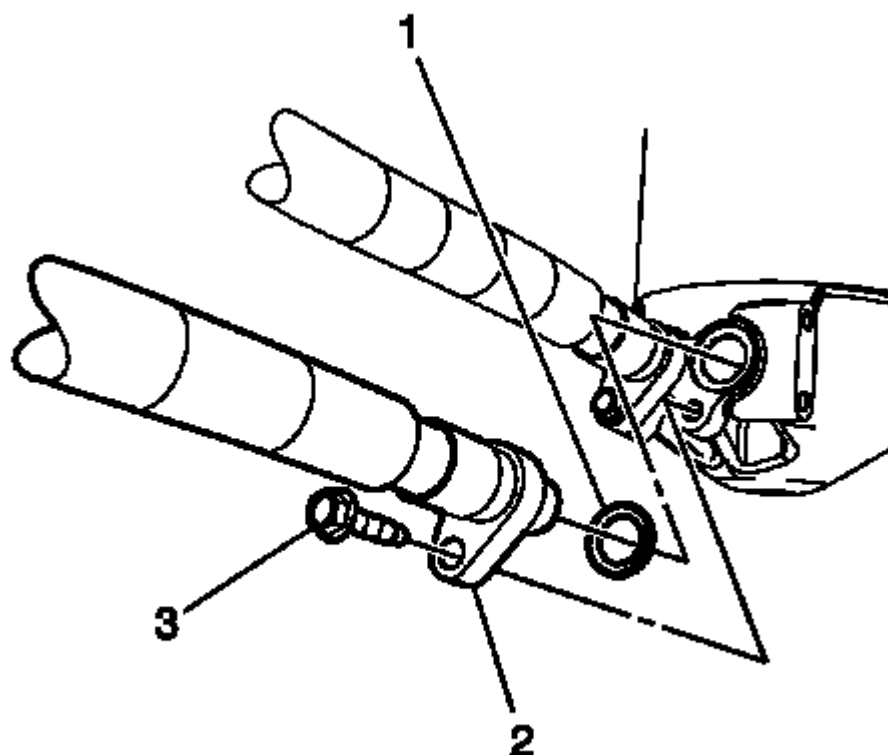


Fig. 45: View Of Oil Tank Outlet Hose, Outlet Hose To Oil Tank Bolt & Oil Seal
Courtesy of GENERAL MOTORS COMPANY

NOTE: Anytime the oil tank inlet and outlet hoses are serviced, the oil seals must be replaced.

3. Remove the outlet hose to oil tank bolt (3) and disconnect the hose (2) from the oil tank. Discard the oil seal (1).

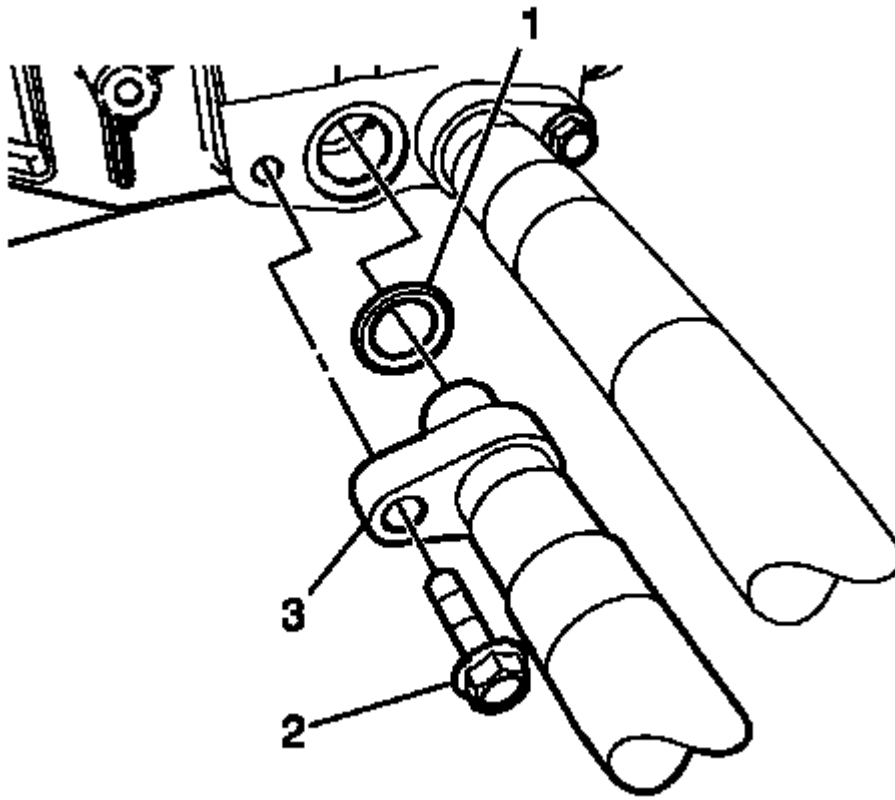


Fig. 46: Identifying Oil Tank Outlet Hose, Outlet Hose To Oil Tank Bolt & Oil Seal
Courtesy of GENERAL MOTORS COMPANY

4. Remove the outlet hose to oil pan bolt (2) and disconnect the hose (3) from the oil pan. Discard the oil seal (1).
5. Remove the oil outlet hose.

Installation Procedure

CAUTION: Refer to Engine Oil Cooler Debris Caution .

1. Position the oil outlet hose.

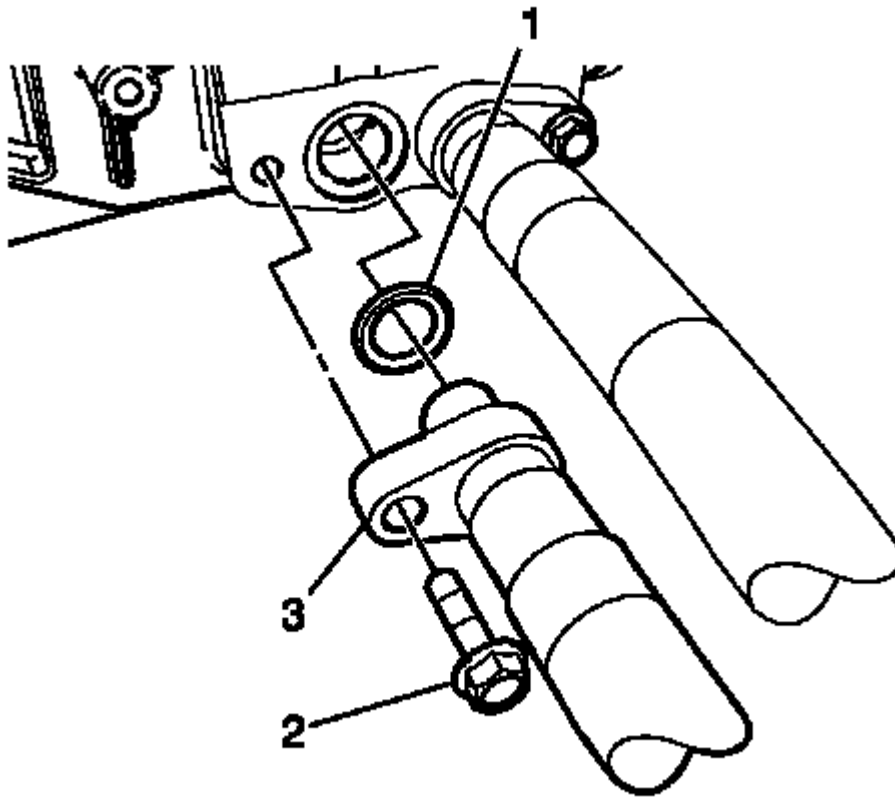


Fig. 47: Identifying Oil Tank Outlet Hose, Outlet Hose To Oil Tank Bolt & Oil Seal
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

2. Using a new oil seal (1), install the oil outlet hose (3) and bolt (2) to the oil pan. Tighten the outlet hose to oil pan bolt to 22 N.m (16 lb ft).

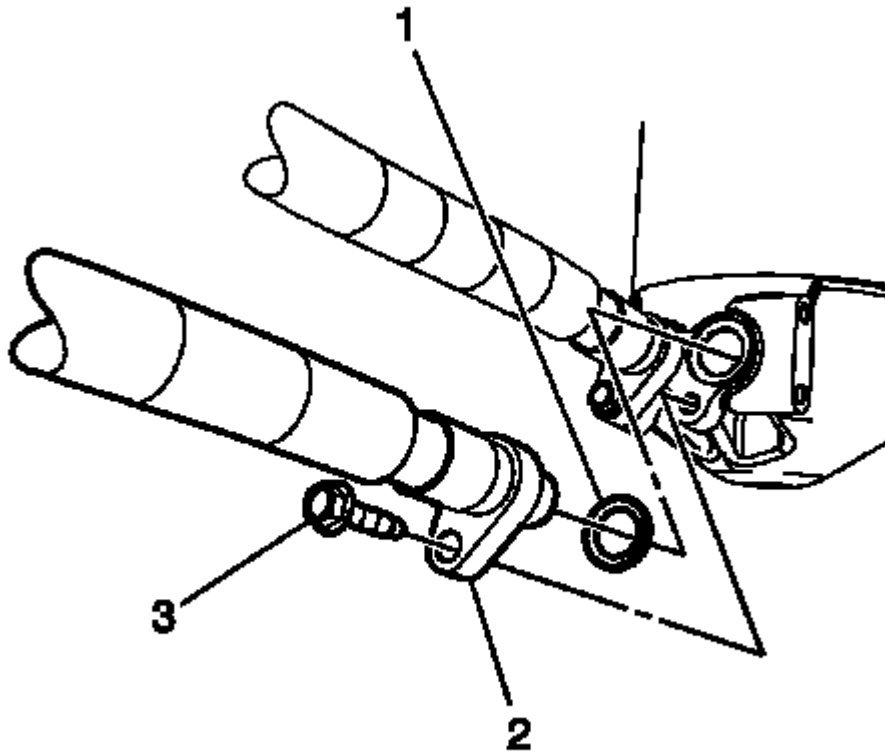


Fig. 48: View Of Oil Tank Outlet Hose, Outlet Hose To Oil Tank Bolt & Oil Seal
Courtesy of GENERAL MOTORS COMPANY

3. Using a new oil seal (1), install the oil outlet hose (2) and bolt (3) to the oil pan. Tighten the outlet hose to oil tank bolt to 22 N.m (16 lb ft).
4. Install the right front wheelhouse rear liner. Refer to **Front Wheelhouse Liner Replacement** .
5. Change the engine oil. Refer to **Engine Oil and Oil Filter Replacement (With Z52 Option)**, **Engine Oil and Oil Filter Replacement (Without Z52 Option)**.

POSITIVE CRANKCASE VENTILATION HOSE/PIPE/TUBE REPLACEMENT (POSITIVE CRANKCASE VENTILATION TUBE)

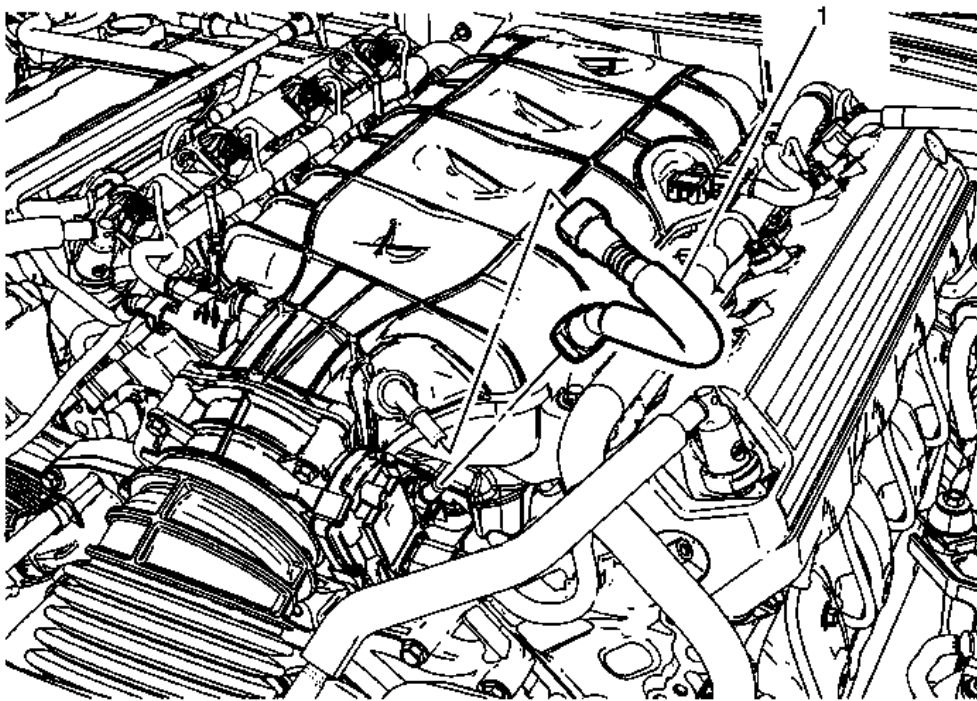


Fig. 49: Positive Crankcase Ventilation (PCV) Hose
Courtesy of GENERAL MOTORS COMPANY

Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Positive Crankcase Ventilation Tube)

Callout	Component Name
Preliminary Procedure Remove the intake manifold cover. Refer to <u>Intake Manifold Cover Replacement (Right), Intake Manifold Cover Replacement (Left)</u> .	
1	Positive Crankcase Ventilation Hose Procedure Remove tube from the intake manifold and the PCV valve. Refer to <u>Plastic Collar Quick Connect Fitting Service</u> .

POSITIVE CRANKCASE VENTILATION HOSE/PIPE/TUBE REPLACEMENT (OIL TANK TO RH ROCKER ARM COVER)

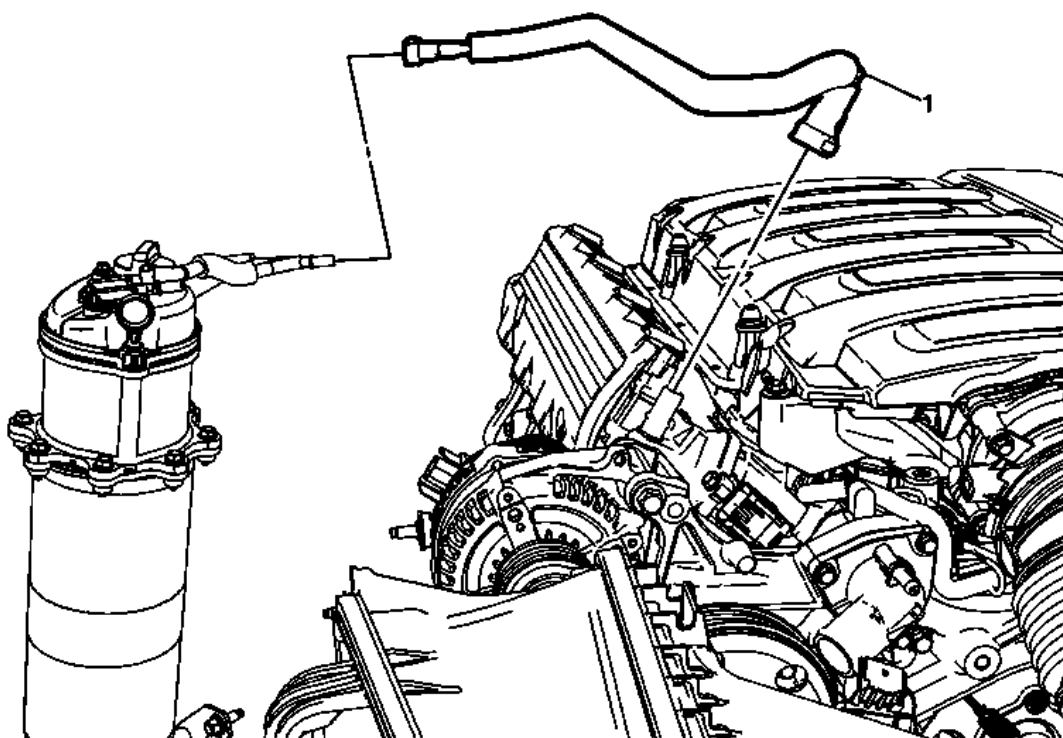


Fig. 50: Positive Crankcase Ventilation Hose/Pipe/Tube (Oil Tank to RH Rocker Arm Cover)
Courtesy of GENERAL MOTORS COMPANY

Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Oil Tank to RH Rocker Arm Cover)

Callout	Component Name
Preliminary Procedure Remove the intake manifold cover. Refer to <u>Intake Manifold Cover Replacement (Right)</u> , <u>Intake Manifold Cover Replacement (Left)</u> .	
1	Positive Crankcase Ventilation Hose Procedure Remove tube from the oil tank and the rocker arm cover. Refer to <u>Plastic Collar Quick Connect Fitting Service</u> .

POSITIVE CRANKCASE VENTILATION HOSE/PIPE/TUBE REPLACEMENT (AIR DUCT TO OIL TANK)

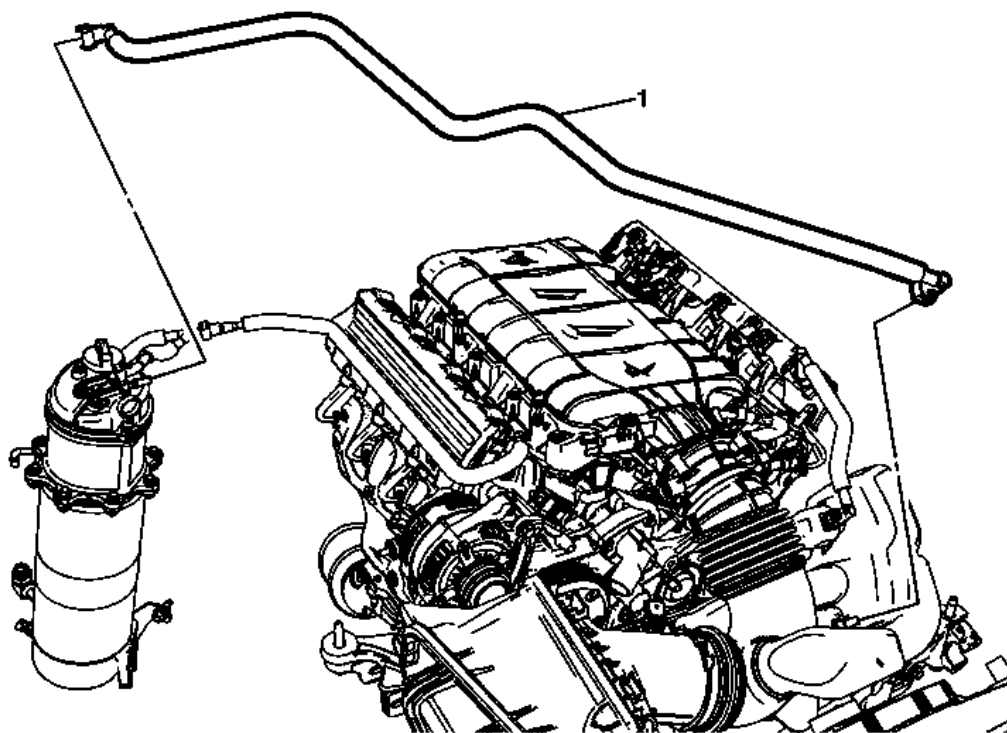


Fig. 51: Positive Crankcase Ventilation Hose/Pipe/Tube (Air Duct To Oil Tank)
 Courtesy of GENERAL MOTORS COMPANY

Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Air Duct To Oil Tank)

Callout	Component Name
Preliminary Procedure Remove the intake manifold cover. Refer to <u>Intake Manifold Cover Replacement (Right)</u> , <u>Intake Manifold Cover Replacement (Left)</u> .	
1	Positive Crankcase Ventilation Hose Procedure Remove tube from the oil tank and the air cleaner outlet duct. Refer to <u>Plastic Collar Quick Connect Fitting Service</u> .

POSITIVE CRANKCASE VENTILATION HOSE/PIPE/TUBE REPLACEMENT (FRESH AIR)

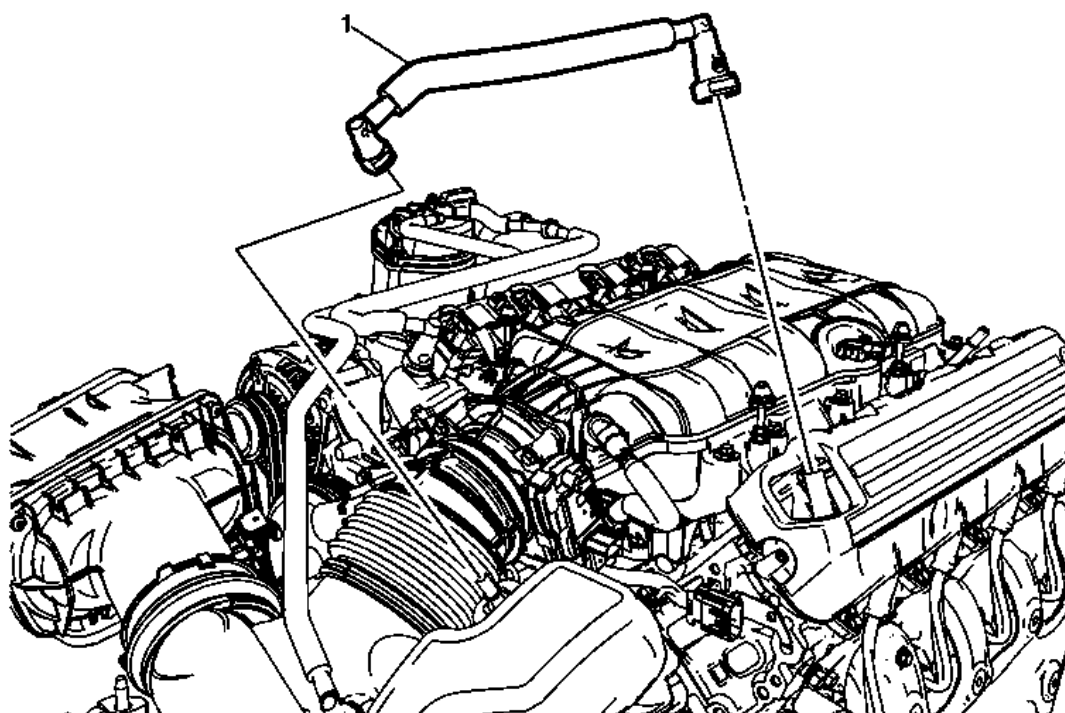


Fig. 52: Positive Crankcase Ventilation Hose/Pipe/Tube (Fresh Air)
 Courtesy of GENERAL MOTORS COMPANY

Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Fresh Air)

Callout	Component Name
Preliminary Procedure Remove the intake manifold cover. Refer to <u>Intake Manifold Cover Replacement (Right)</u> , <u>Intake Manifold Cover Replacement (Left)</u> .	
1	Positive Crankcase Ventilation Hose Procedure Remove tube from the rocker arm cover and the air cleaner outlet duct. Refer to <u>Plastic Collar Quick Connect Fitting Service</u> .

POSITIVE CRANKCASE VENTILATION VALVE REPLACEMENT

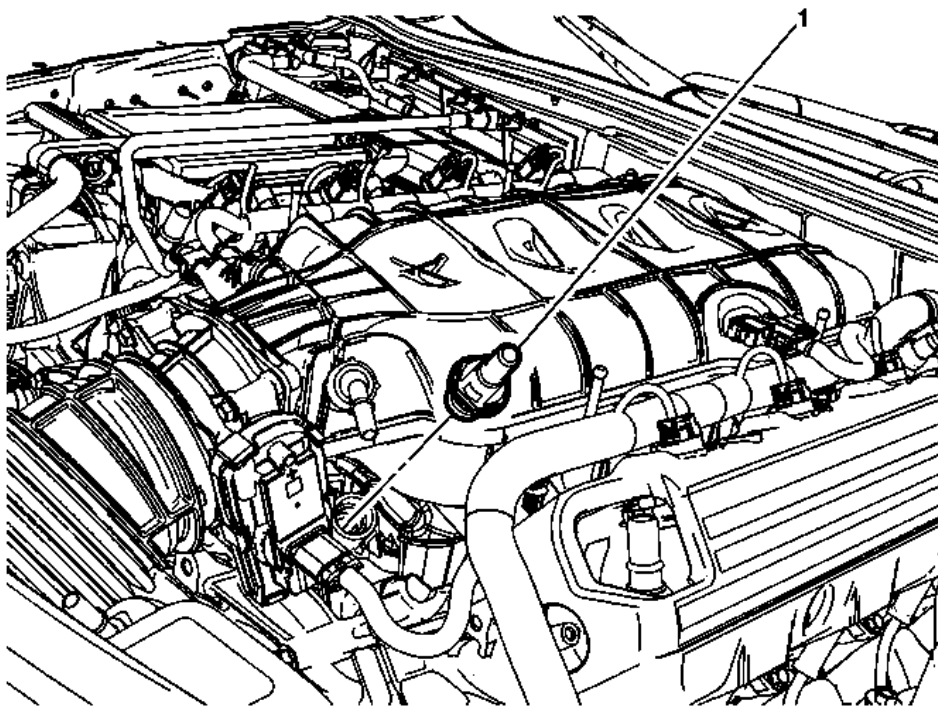


Fig. 53: Positive Crankcase Ventilation Valve
Courtesy of GENERAL MOTORS COMPANY

Positive Crankcase Ventilation Valve Replacement

Callout	Component Name
Preliminary Procedure Remove the PCV Hose. Refer to <u>Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Positive Crankcase Ventilation Tube)</u> , <u>Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Oil Tank to RH Rocker Arm Cover)</u> , <u>Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Air Duct To Oil Tank)</u> , <u>Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Fresh Air)</u> .	
1	Positive Crankcase Ventilation Valve CAUTION: Refer to <u>Component Fastener Tightening Caution</u> . Tighten 6 (53 lb in)

INTAKE MANIFOLD REPLACEMENT

Removal Procedure

1. Disconnect the battery ground cable. Refer to **Battery Negative Cable Disconnection and**

Connection .

2. Remove the air cleaner outlet duct. Refer to **Air Cleaner Outlet Duct Replacement** .

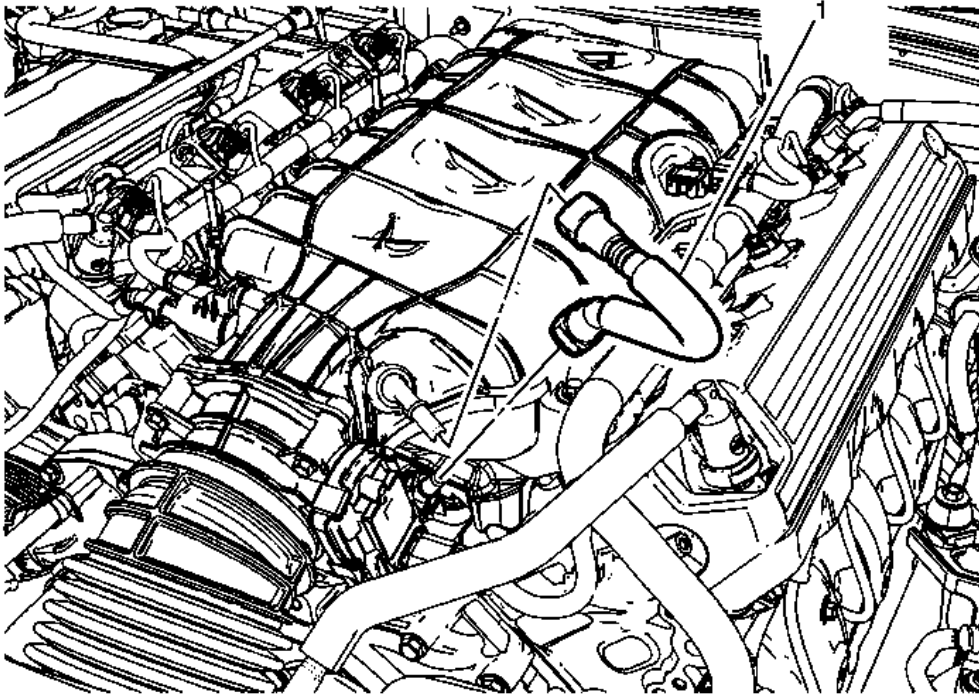


Fig. 54: Positive Crankcase Ventilation (PCV) Hose
Courtesy of GENERAL MOTORS COMPANY

3. Remove the positive crankcase ventilation (PCV) hose (1). Refer to **Plastic Collar Quick Connect Fitting Service** .

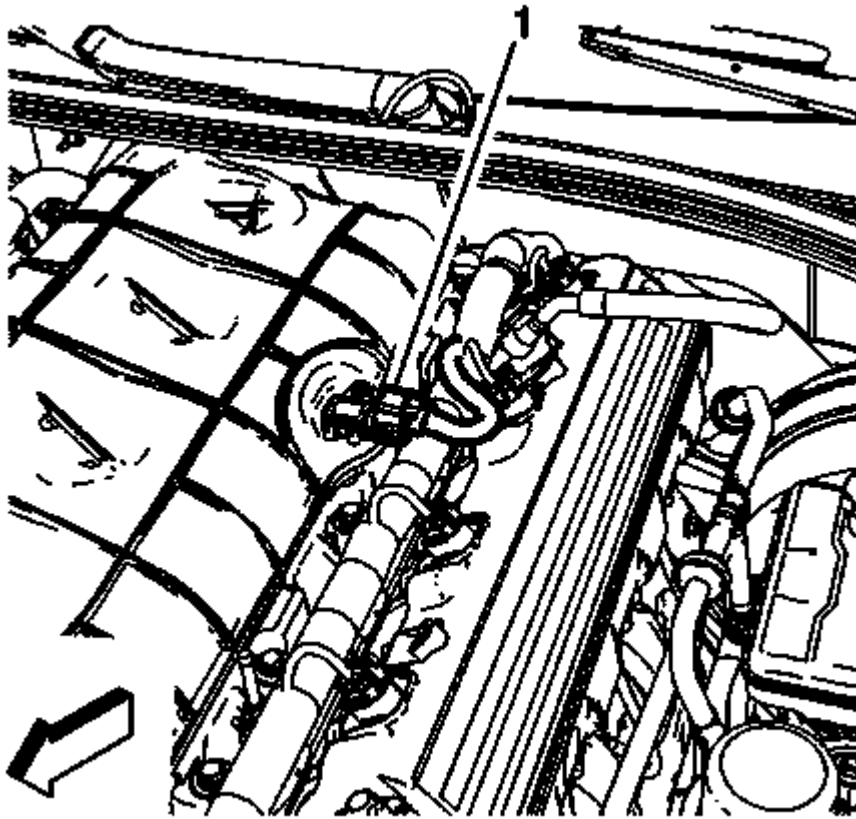


Fig. 55: Engine Wiring Harness Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

4. Disconnect the engine wiring harness electrical connector (1) from the manifold absolute pressure (MAP) sensor.

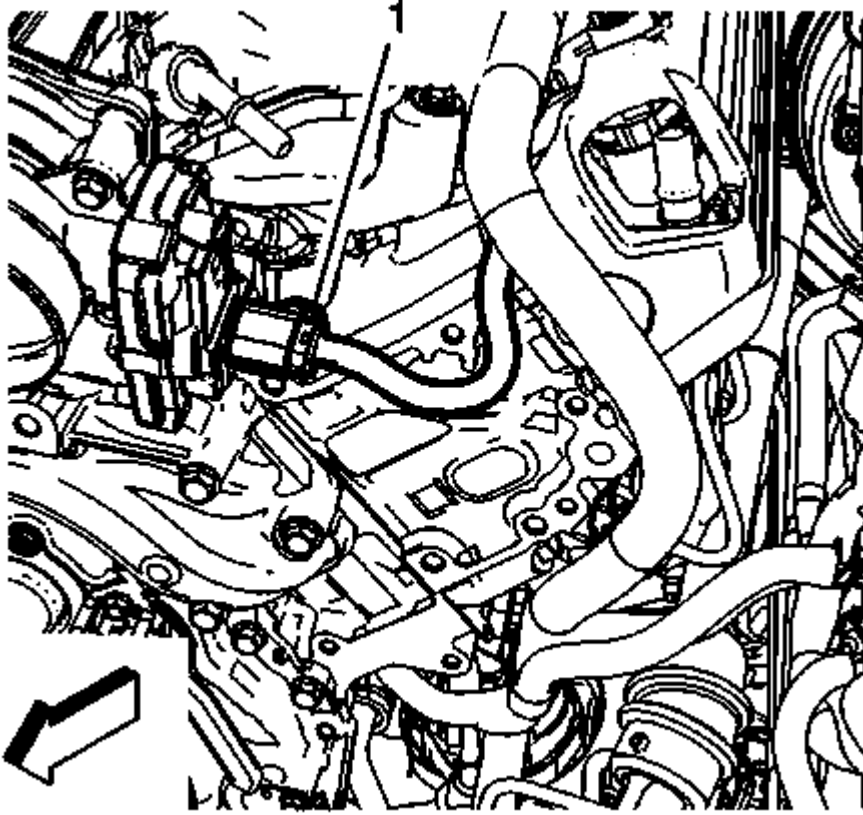


Fig. 56: Engine Harness Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

5. Disconnect the engine harness electrical connector (1) from the throttle actuator.

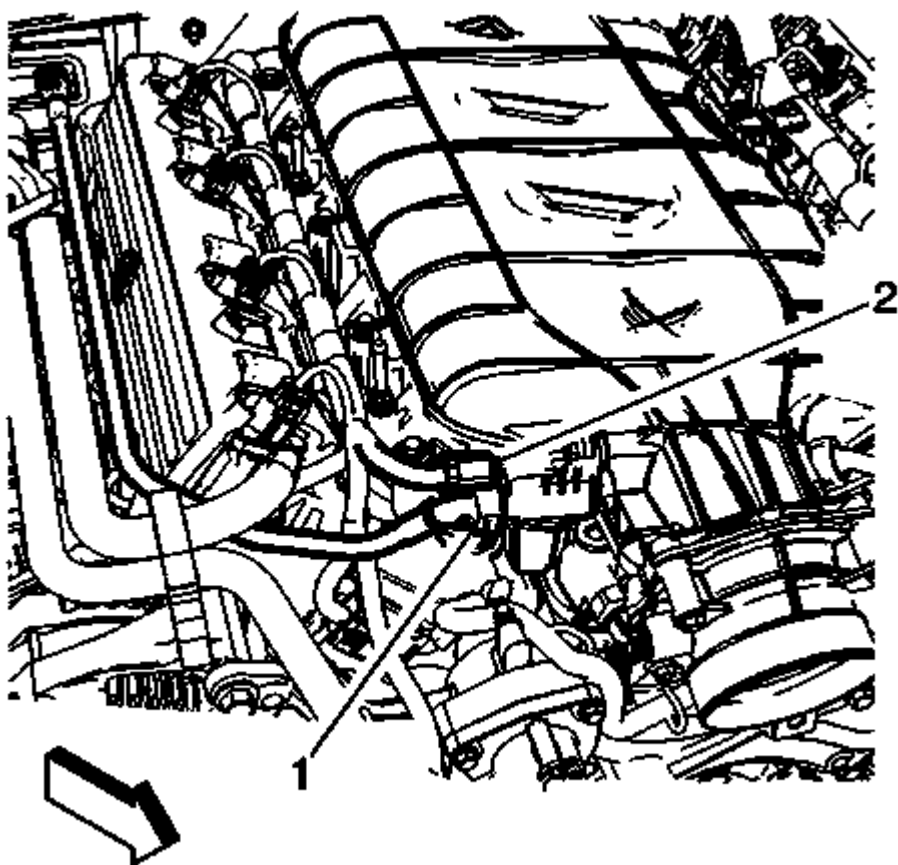


Fig. 57: EVAP Canister Purge Tube
Courtesy of GENERAL MOTORS COMPANY

6. Disconnect the EVAP canister purge tube (1) quick connect fitting from the EVAP canister purge solenoid valve. Refer to **Plastic Collar Quick Connect Fitting Service** .
7. Disconnect the engine harness electrical connector (2) from the evaporative emission (EVAP) canister purge solenoid valve.

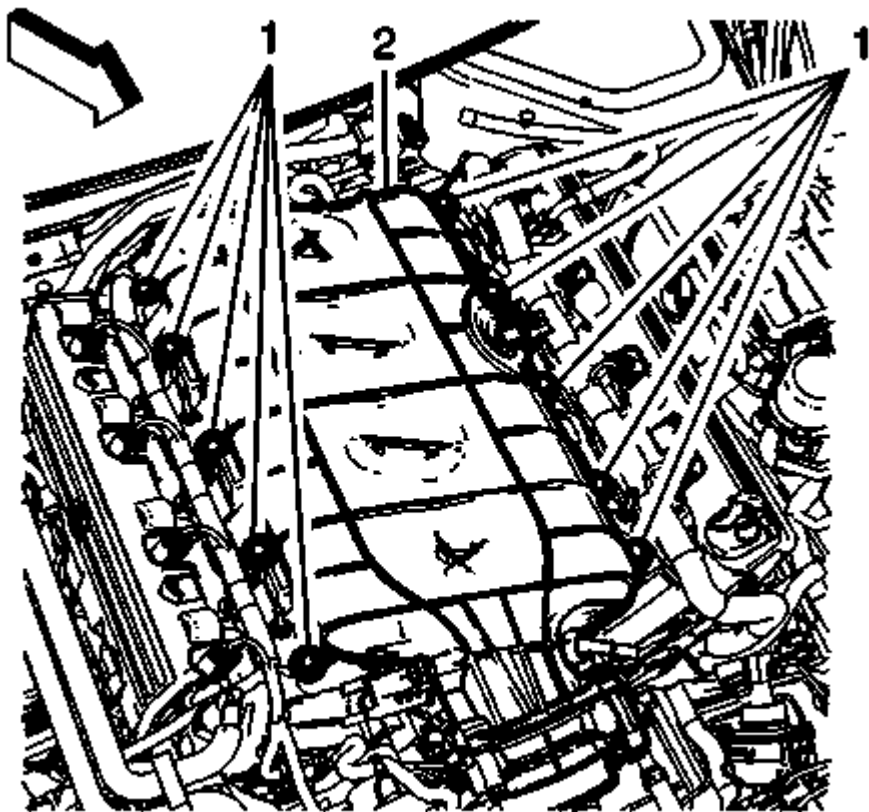


Fig. 58: Intake Manifold Bolts

Courtesy of GENERAL MOTORS COMPANY

8. Loosen the 10 intake manifold bolts (1).

NOTE: The aid of an assistant may be helpful in holding the engine harness up out of the way so the upper intake manifold cover does not get caught against the engine harness.

9. Remove the intake manifold (2).
10. Cover the cylinder head passages in order to prevent dirt or debris from entering the passages.

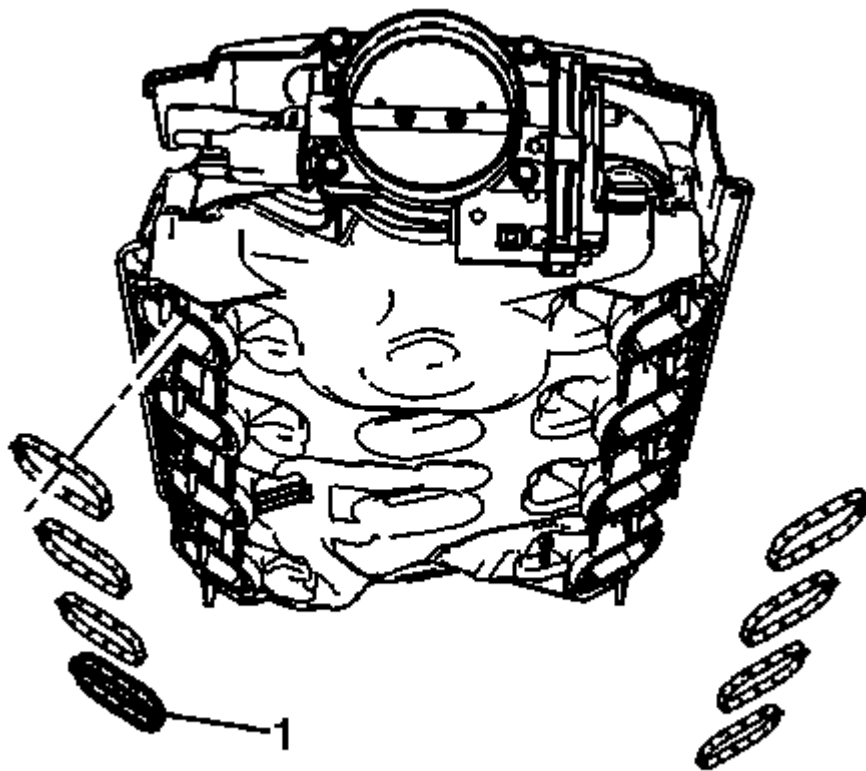


Fig. 59: Intake Manifold Gaskets
Courtesy of GENERAL MOTORS COMPANY

11. Remove and discard the intake manifold gaskets (1).
12. Clean and inspect the intake manifold. Refer to **Intake Manifold Cleaning and Inspection** .
13. Transfer components as necessary.

Installation Procedure

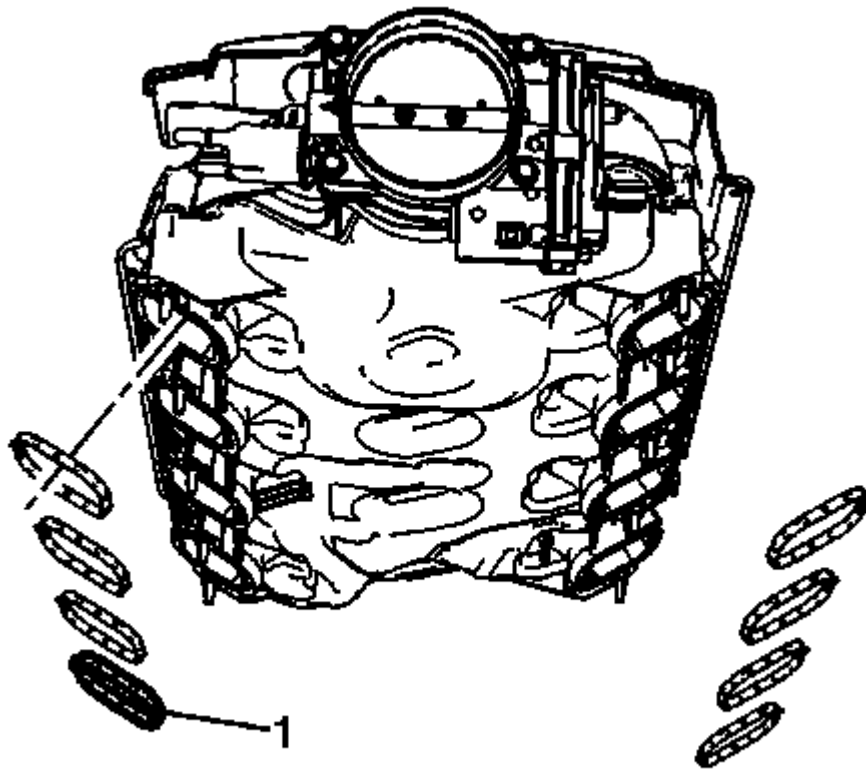


Fig. 60: Intake Manifold Gaskets

Courtesy of GENERAL MOTORS COMPANY

1. Install NEW intake manifold gaskets (1) to the intake manifold.
2. Apply a 5 mm (0.20 in) band of threadlock to the threads of the intake manifold bolts. Refer to **Adhesives, Fluids, Lubricants and Sealers** .
3. Remove the covers from the cylinder head passages.

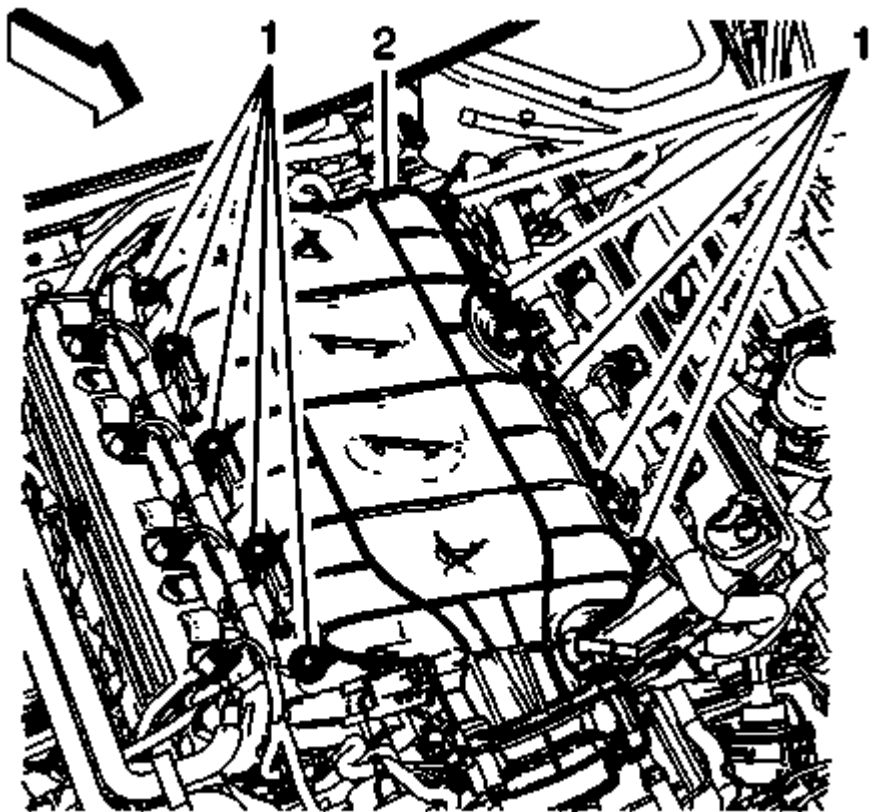


Fig. 61: Intake Manifold Bolts

Courtesy of GENERAL MOTORS COMPANY

4. Install the intake manifold (2).

NOTE: The aid of an assistant may be helpful in holding the engine harness up out of the way so the upper intake manifold cover does not get caught against the engine harness.

5. Install the intake manifold bolts (1) finger tight.

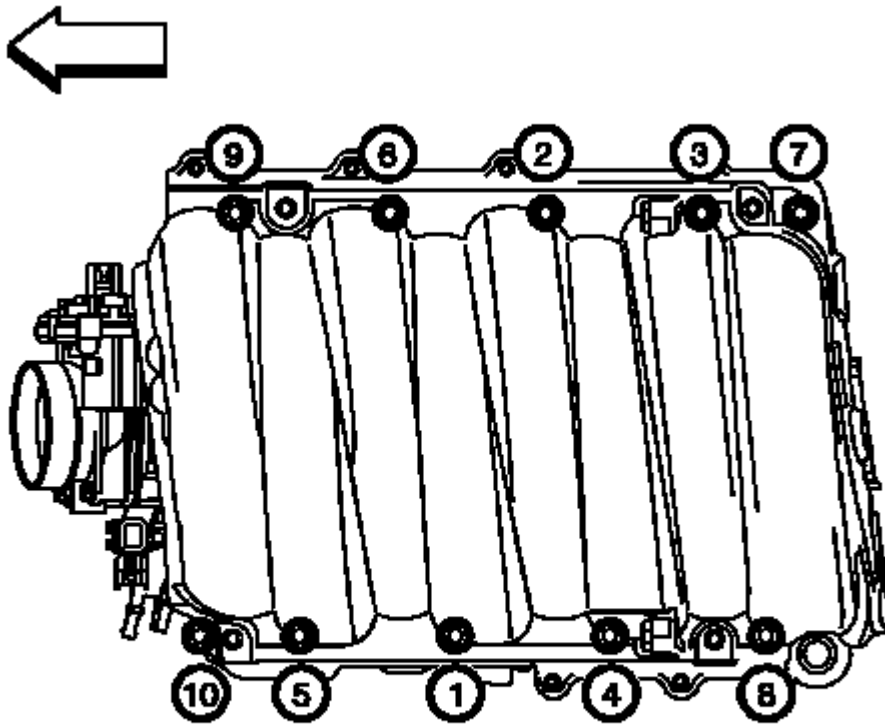


Fig. 62: Intake Manifold Bolts Tightening Sequence
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

6. Tighten the intake manifold bolts to specifications.

Tighten

- Tighten the bolts a first pass in the sequence shown to 5 N.m (44 lb in).
- Tighten the bolts a final pass in the sequence shown to 10 N.m (89 lb in).

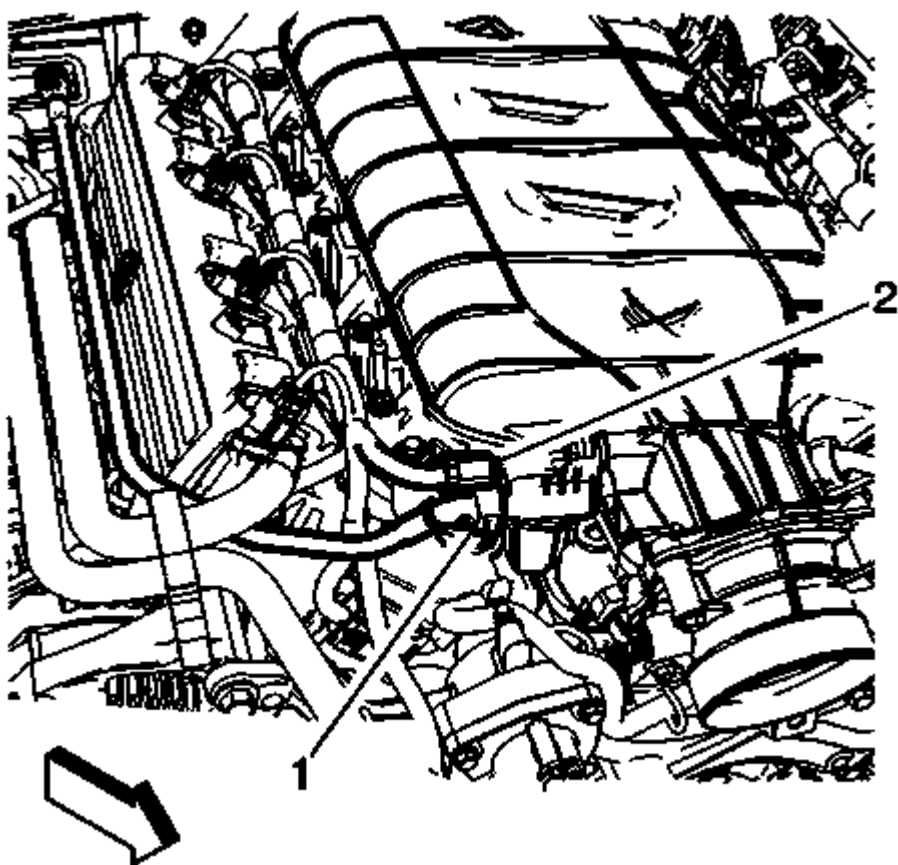


Fig. 63: EVAP Canister Purge Tube

Courtesy of GENERAL MOTORS COMPANY

7. Connect the engine harness electrical connector (2) to the evaporative emission (EVAP) canister purge solenoid valve.
8. Connect the EVAP canister purge tube (1) quick connect fitting to the EVAP canister purge solenoid valve.

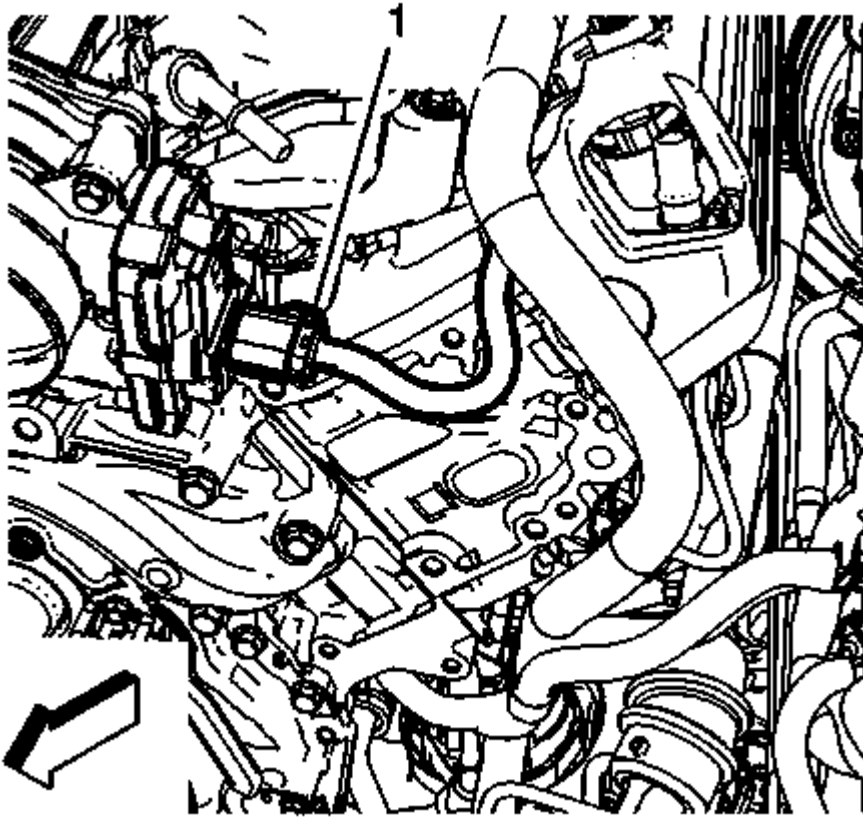


Fig. 64: Engine Harness Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

9. Connect the engine harness electrical connector (1) to the throttle actuator.

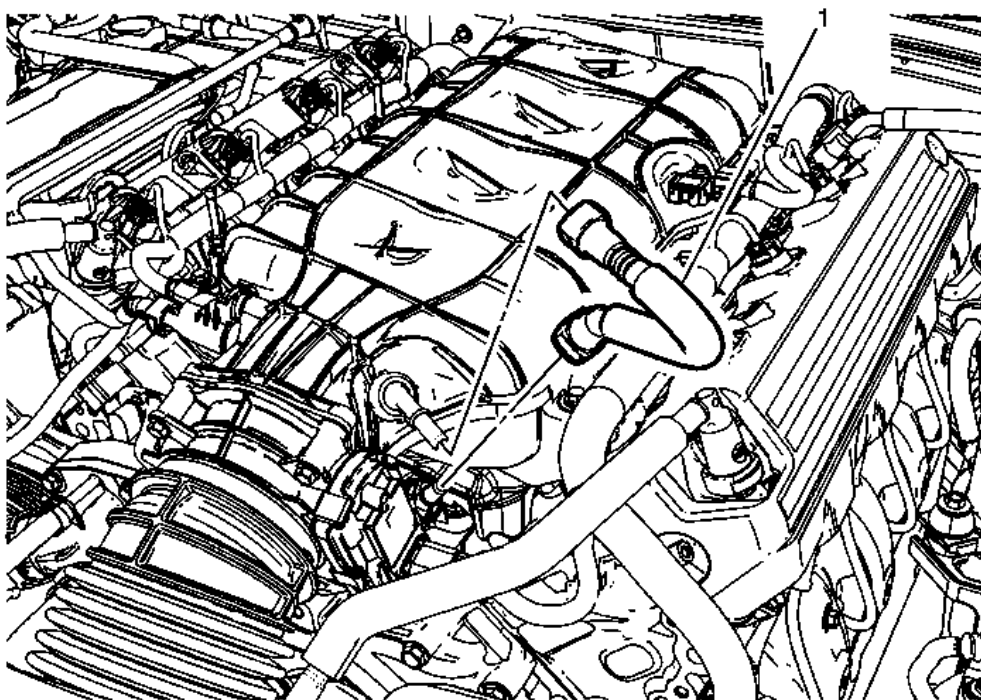


Fig. 65: Positive Crankcase Ventilation (PCV) Hose
Courtesy of GENERAL MOTORS COMPANY

10. Install the positive crankcase ventilation (PCV) hose (1). Refer to **Plastic Collar Quick Connect Fitting Service** .

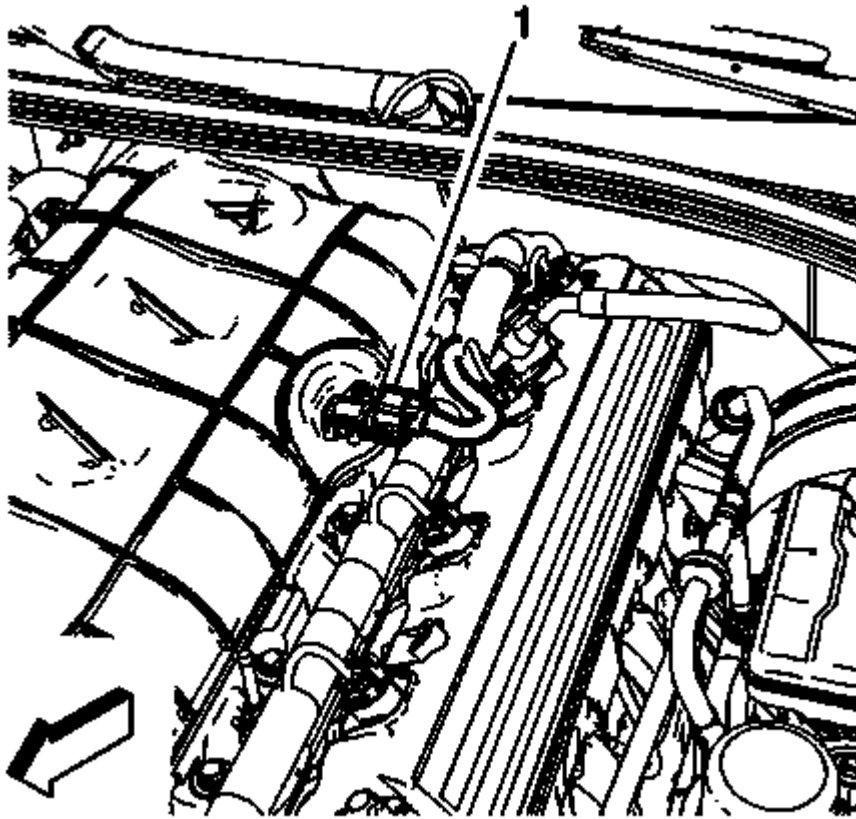


Fig. 66: Engine Wiring Harness Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

11. Connect the engine wiring harness electrical connector (1) to the manifold absolute pressure (MAP) sensor.
12. Install the air cleaner outlet duct. Refer to **Air Cleaner Outlet Duct Replacement** .
13. Connect the battery ground cable. Refer to **Battery Negative Cable Disconnection and Connection** .

INTAKE MANIFOLD COVER REPLACEMENT (RIGHT)

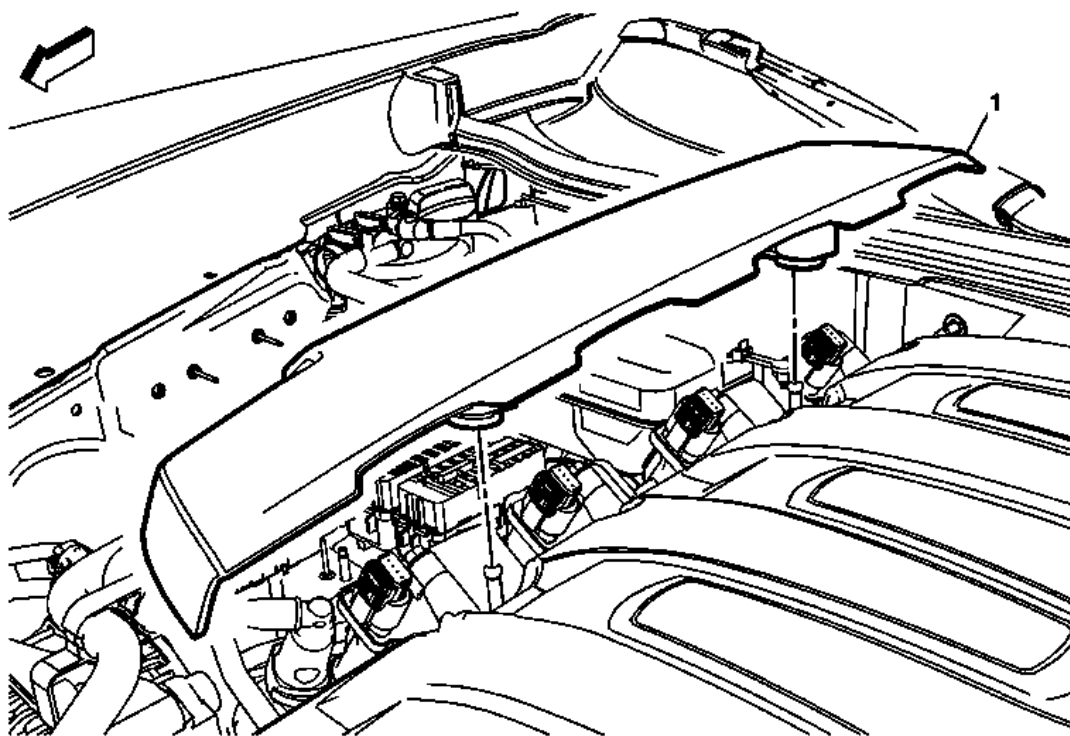


Fig. 67: Intake Manifold Cover (Right)
 Courtesy of GENERAL MOTORS COMPANY

Intake Manifold Cover Replacement (Right)

Callout	Component Name
1	Intake Manifold Cover Procedure Grasp the intake manifold cover and lift up disengaging the grommets from the studs.

INTAKE MANIFOLD COVER REPLACEMENT (LEFT)

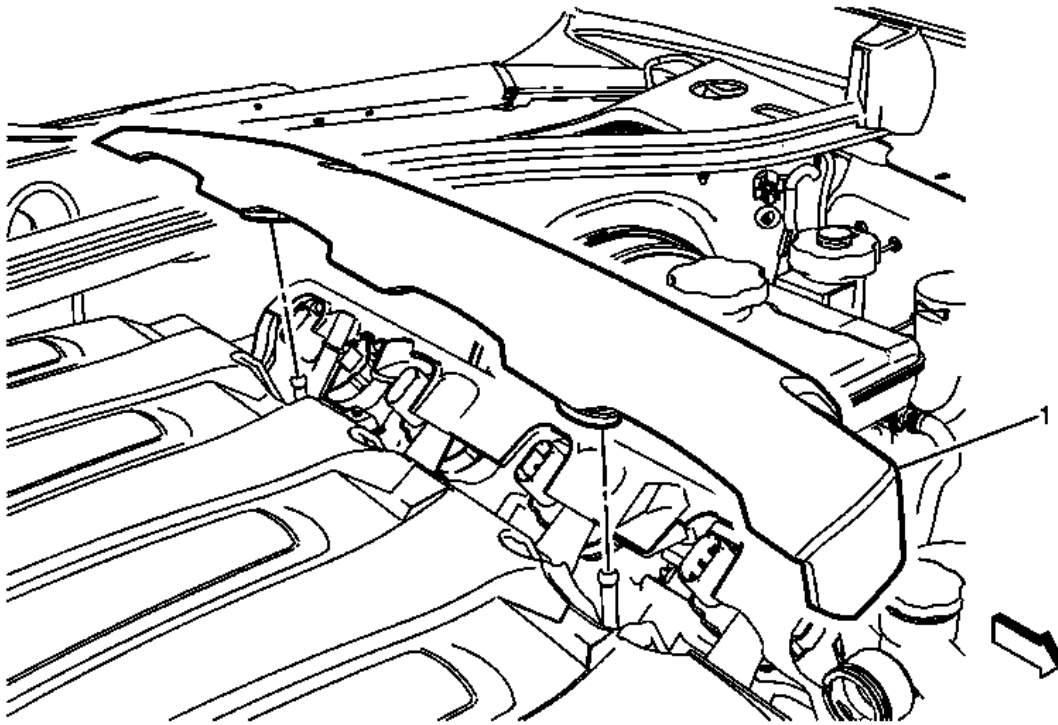


Fig. 68: Intake Manifold Cover (Left)
 Courtesy of GENERAL MOTORS COMPANY

Intake Manifold Cover Replacement (Left)

Callout	Component Name
1	Intake Manifold Cover Procedure Grasp the intake manifold cover and lift up disengaging the grommets from the studs.

UPPER INTAKE MANIFOLD COVER REPLACEMENT

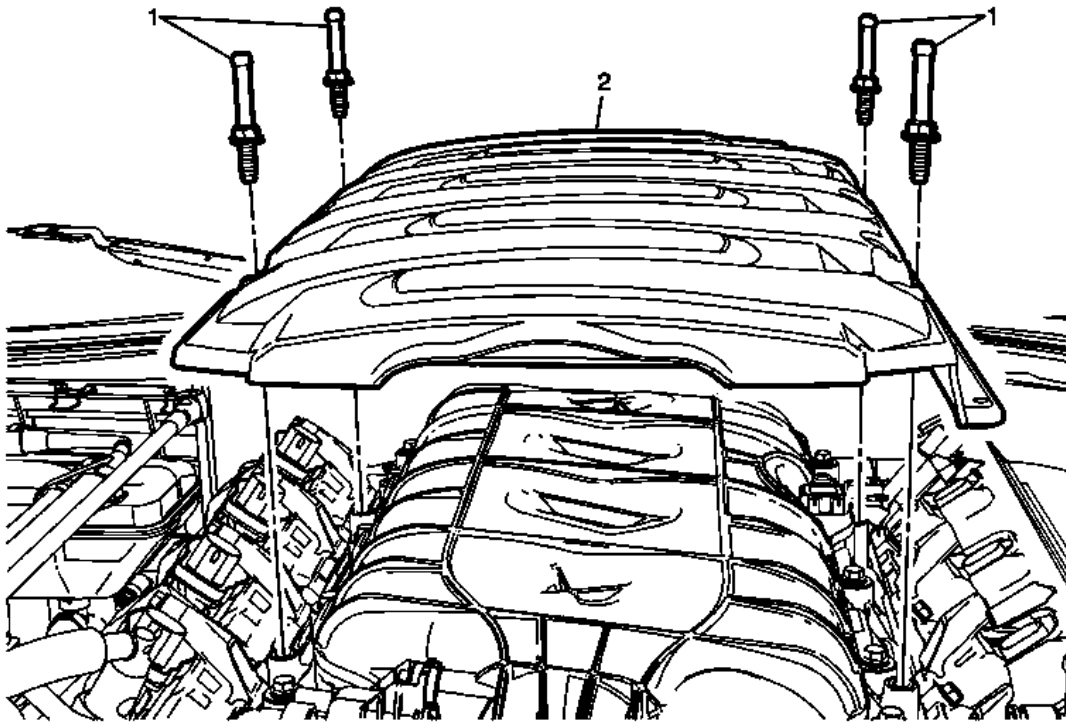


Fig. 69: Upper Intake Manifold Cover
 Courtesy of GENERAL MOTORS COMPANY

Upper Intake Manifold Cover Replacement

Callout	Component Name
Preliminary Procedures Remove the left and right side intake manifold covers. Refer to Intake Manifold Cover Replacement (Right) , Intake Manifold Cover Replacement (Left) .	
1	Upper Intake Manifold Cover Fasteners CAUTION: Refer to Fastener Caution . Tighten 10 (89 lb in)
2	Upper Intake Manifold Cover Procedure 1. Disconnect the manifold absolute pressure sensor electrical connector. 2. Detach the engine wiring harness from the upper intake manifold cover.

VALVE LIFTER OIL MANIFOLD REPLACEMENT

1. Remove the fuel pump. Refer to **Fuel Pump Replacement** .
2. Remove the fuel injection fuel rail assemblies. Refer to **Fuel Injection Fuel Rail Assembly Replacement - Bank 1** and **Fuel Injection Fuel Rail Assembly Replacement - Bank 2** .
3. Disconnect electrical connectors as needed.

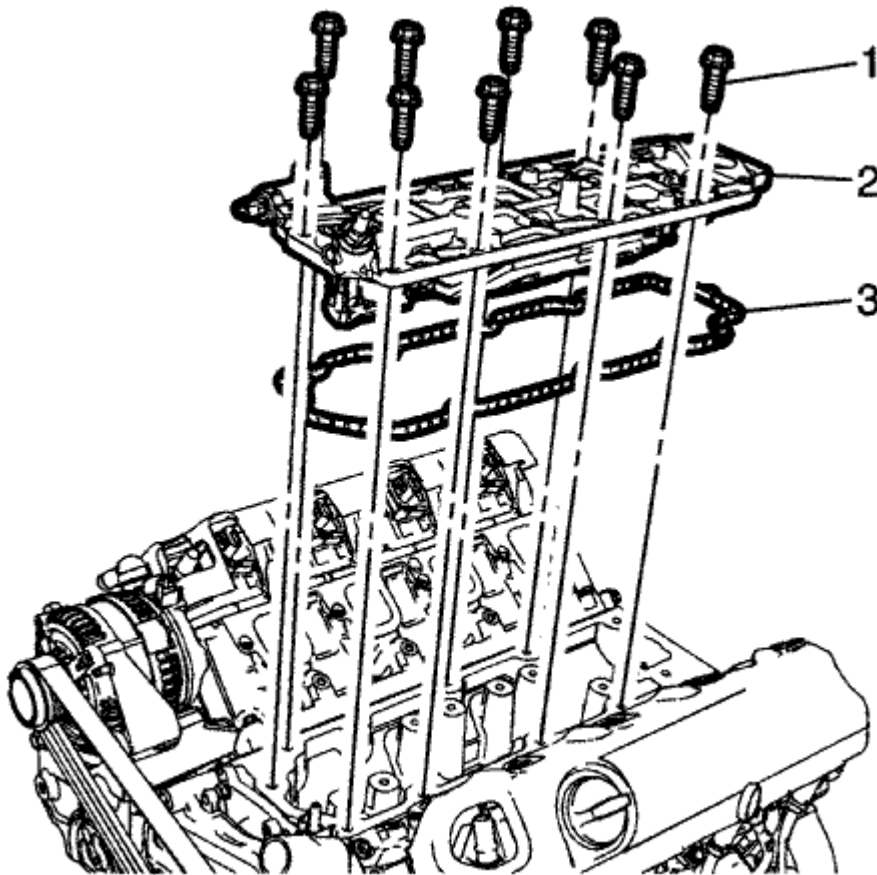


Fig. 70: Valve Lifter Oil Manifold Bolts
Courtesy of GENERAL MOTORS COMPANY

4. Remove the valve lifter oil manifold bolts (1).
5. Remove the valve lifter oil manifold (2).
6. Remove the gasket (3) from the valve lifter oil manifold and discard.
7. Transfer parts as necessary.

Installation Procedure

NOTE: All gasket surfaces should be free of oil or other foreign material during assembly.

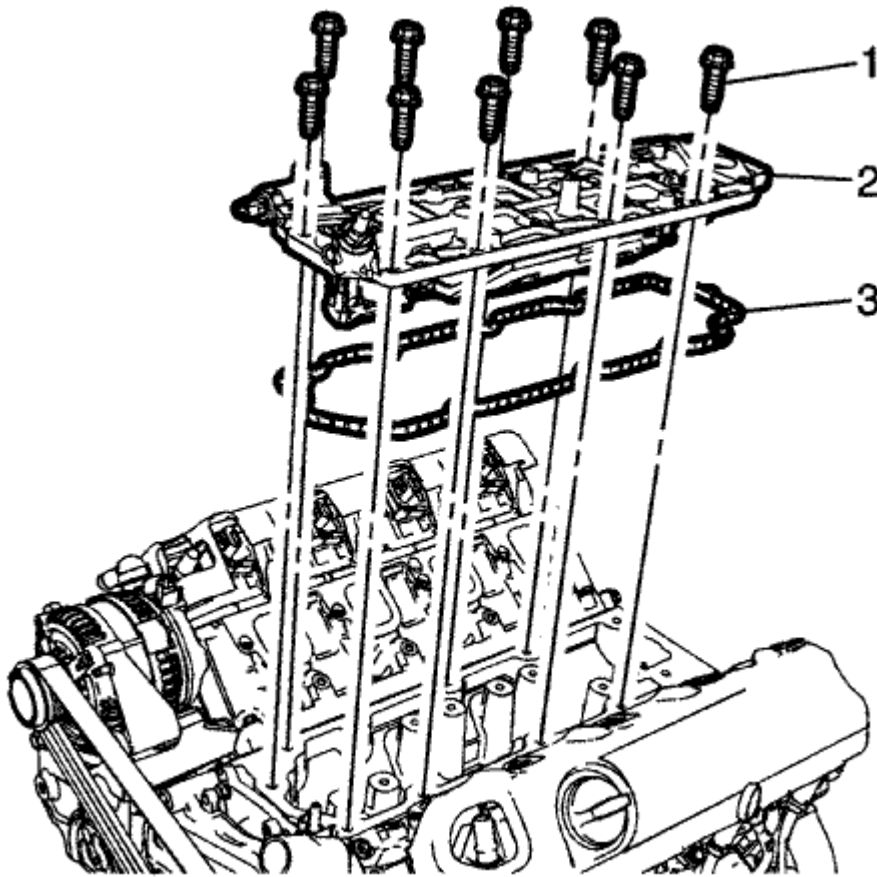


Fig. 71: Valve Lifter Oil Manifold Bolts
Courtesy of GENERAL MOTORS COMPANY

1. Install a NEW gasket (3) on the valve lifter oil manifold.
2. Set the valve lifter oil manifold (2) onto the engine.
3. Install the engine valley cover bolts (1).

Tighten

Tighten the bolts to 25 N.m (18 lb ft).

4. Connect electrical connectors.
5. Install the fuel injection fuel rail assemblies. Refer to **Fuel Injection Fuel Rail Assembly Replacement - Bank 1** and **Fuel Injection Fuel Rail Assembly Replacement - Bank 2**.
6. Install the fuel pump. Refer to **Fuel Pump Replacement**.

VALVE LIFTER OIL FILTER REPLACEMENT

Removal Procedure

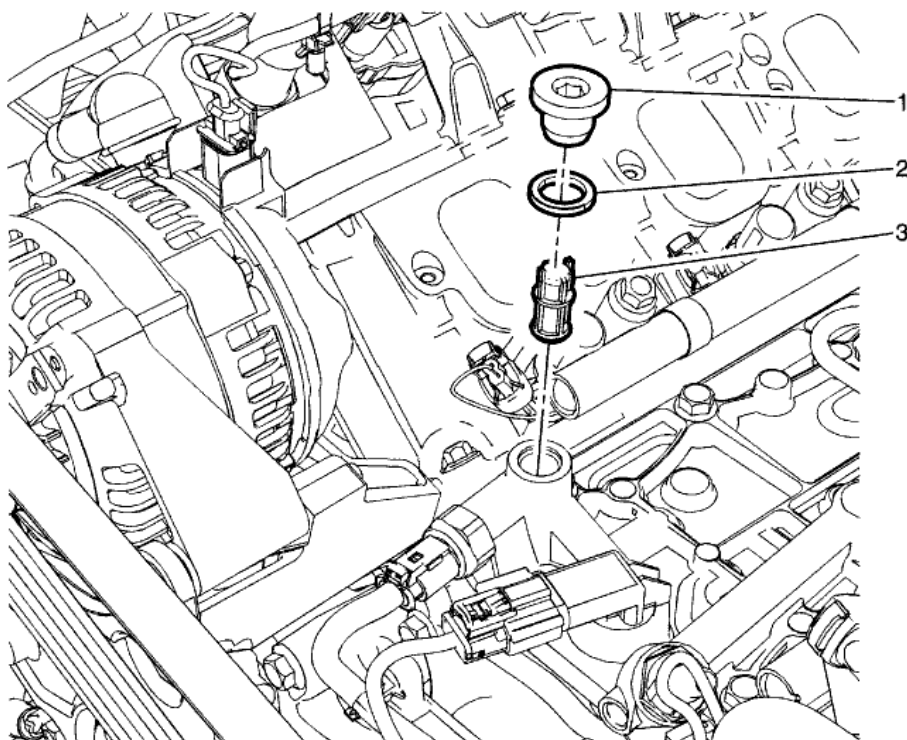


Fig. 72: Drive Motor Oil Filler Hole Plug And Washer
Courtesy of GENERAL MOTORS COMPANY

2. Remove the drive motor oil filler hole plug (1) and washer (2).
3. Remove and discard the valve lifter oil filter (3).

Installation Procedure

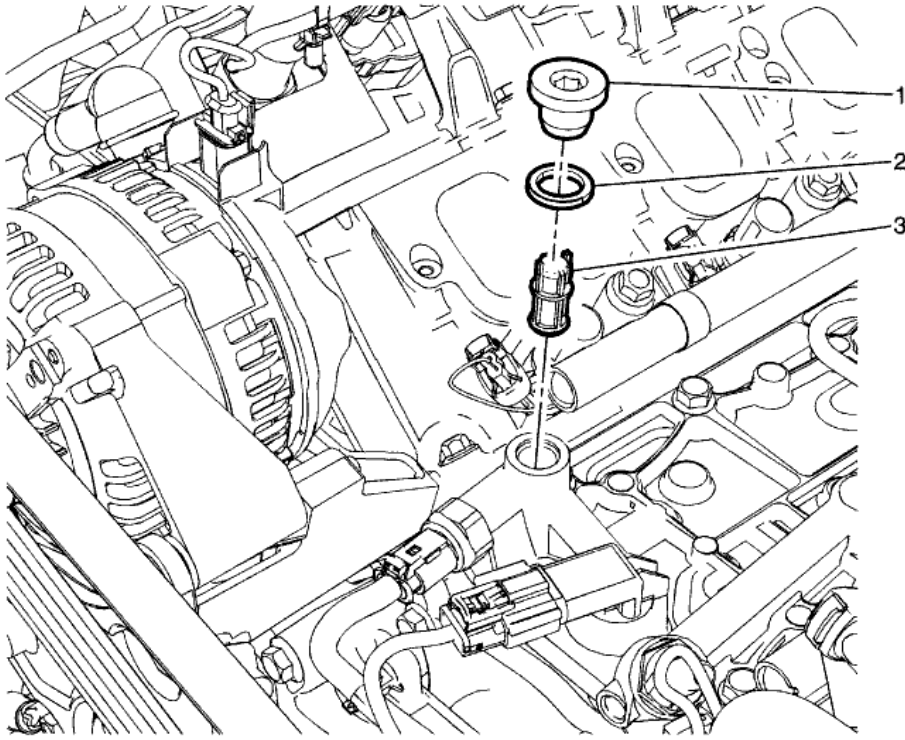


Fig. 73: Drive Motor Oil Filler Hole Plug And Washer
Courtesy of GENERAL MOTORS COMPANY

1. Install the NEW valve lifter oil filter (3).
2. Apply approved GM sealant or equivalent to the threads of the drive motor oil filler hole plug. Refer to **Adhesives, Fluids, Lubricants and Sealers** .

CAUTION: Refer to Fastener Caution .

3. Install the drive motor oil filler hole plug washer (2) and plug (1).

Tighten

Tighten the plug to 65 (48 lb ft).

4. Install the intake manifold. Refer to **Intake Manifold Replacement**.

VALVE ROCKER ARM COVER INSULATOR REPLACEMENT - LEFT SIDE

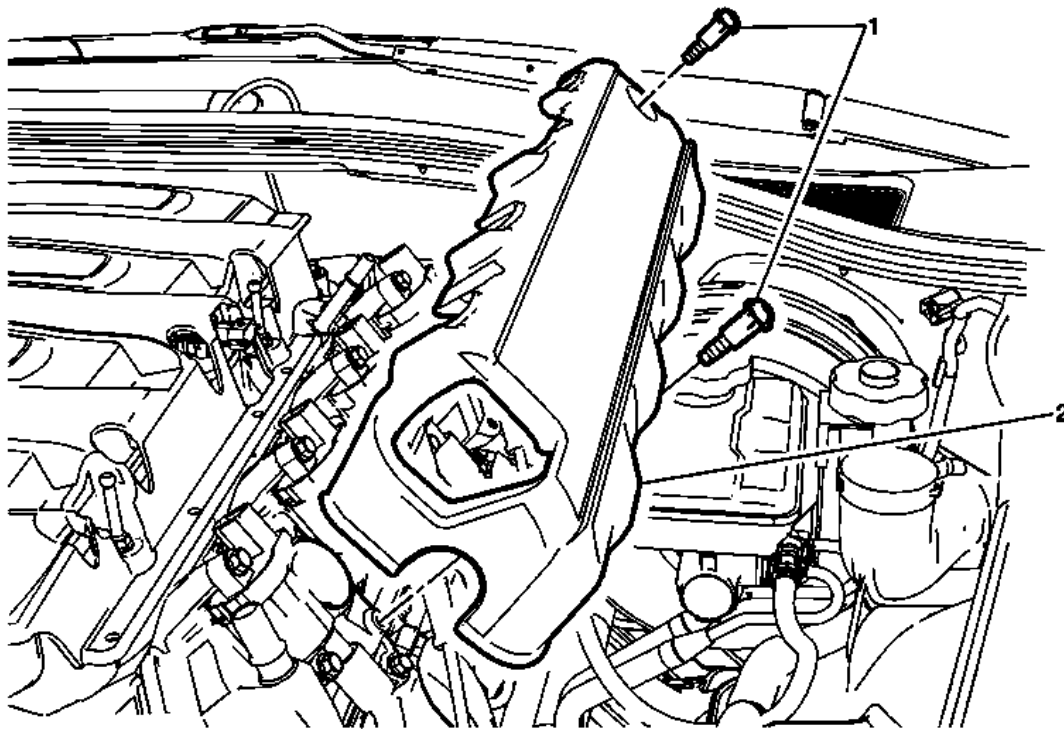


Fig. 74: Valve Rocker Arm Cover Insulator - Left Side
Courtesy of GENERAL MOTORS COMPANY

Valve Rocker Arm Cover Insulator Replacement - Left Side

Callout	Component Name
Preliminary Procedures 1. Remove the left side intake manifold cover. Refer to <u>Intake Manifold Cover Replacement (Right)</u>, <u>Intake Manifold Cover Replacement (Left)</u>. 2. Remove the Positive Crankcase Ventilation Hose/Pipe/Tube. Refer to <u>Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Positive Crankcase Ventilation Tube)</u>, <u>Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Oil Tank to RH Rocker Arm Cover)</u>, <u>Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Air Duct To Oil Tank)</u>, <u>Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Fresh Air)</u>.	
1	Valve Rocker Arm Cover Insulator Fasteners CAUTION: Refer to <u>Fastener Caution</u> . Tighten 9 (80 lb in)
2	Valve Rocker Arm Cover Insulator

If equipped with Z52, remove the engine oil cap.

VALVE ROCKER ARM COVER INSULATOR REPLACEMENT - RIGHT SIDE

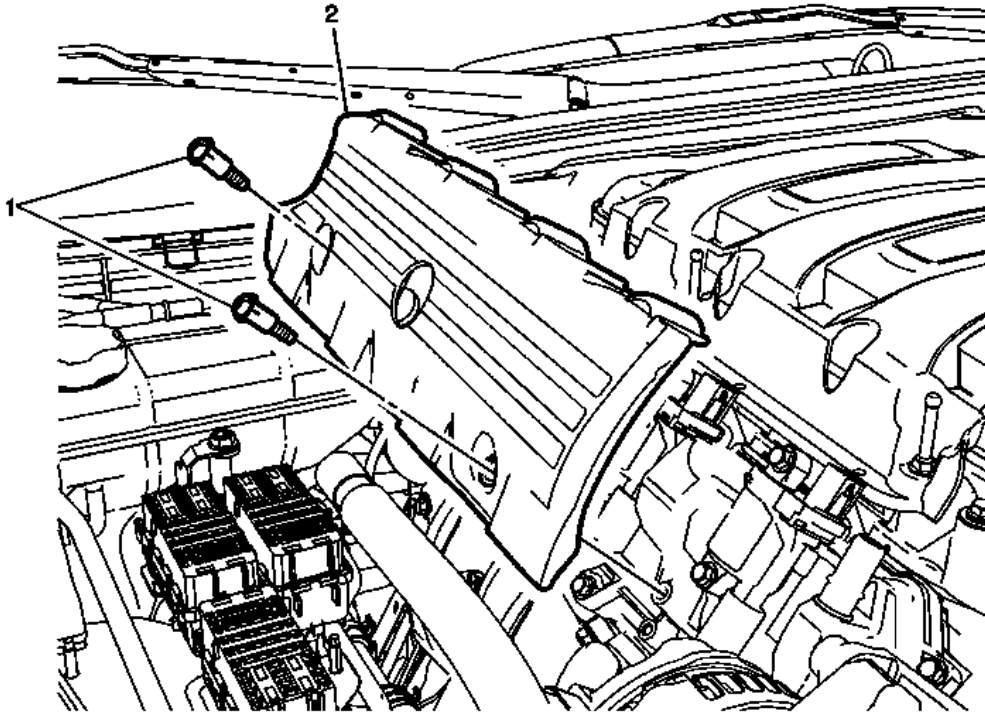


Fig. 75: Valve Rocker Arm Cover Insulator - Right Side
Courtesy of GENERAL MOTORS COMPANY

Valve Rocker Arm Cover Insulator Replacement - Right Side

Callout	Component Name
Preliminary Procedures	
1. Remove the right side intake manifold cover. Refer to <u>Intake Manifold Cover Replacement (Right)</u> , <u>Intake Manifold Cover Replacement (Left)</u> .	
2. Remove the evaporative emission canister purge pipe. Refer to <u>Evaporative Emission Canister Purge Pipe Replacement</u> .	
3. Remove the oil tank to right hand rocker arm cover and air duct to oil tank positive crankcase ventilation hose/pipe/tubes. Refer to <u>Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Positive Crankcase Ventilation Tube)</u> , <u>Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Oil Tank to RH Rocker Arm Cover)</u> , <u>Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Air Duct To Oil Tank)</u> , <u>Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Fresh Air)</u> .	
	Valve Rocker Arm Cover Insulator Fasteners
	CAUTION:

1	Refer to <u>Fastener Caution</u> . Tighten 9 (80 lb in)
2	Valve Rocker Arm Cover Insulator

VALVE ROCKER ARM COVER REPLACEMENT - LEFT SIDE

Removal Procedure

1. Remove the air cleaner outlet duct. Refer to **Air Cleaner Outlet Duct Replacement** .
2. If equipped, remove the oil indicator tube. Refer to **Oil Level Indicator Tube Replacement**.
3. Remove the ignition coils. Refer to **Ignition Coil Replacement** .

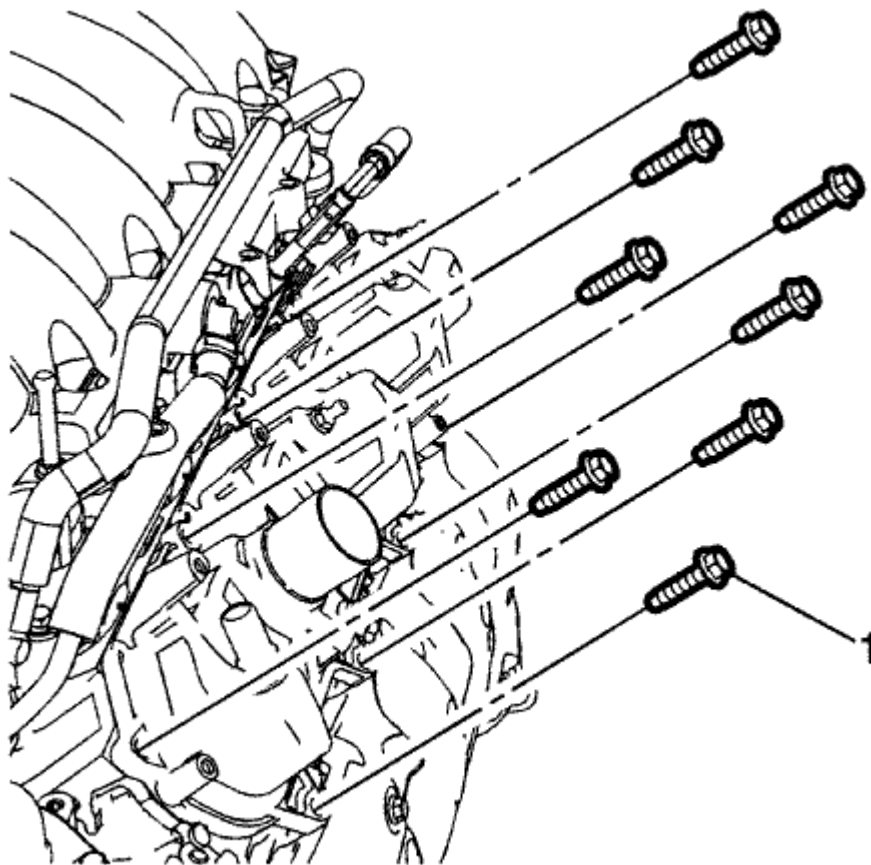


Fig. 76: Valve Rocker Arm Cover Bolts
Courtesy of GENERAL MOTORS COMPANY

4. Remove the valve rocker arm cover bolts (1).

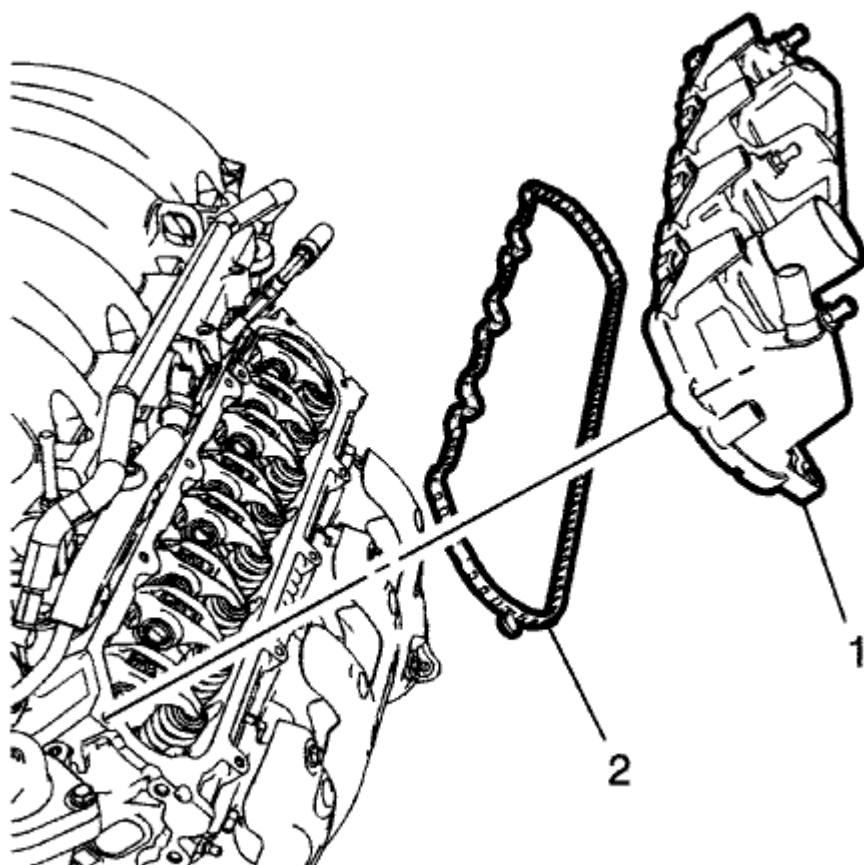


Fig. 77: Valve Rocker Arm Cover And Valve Rocker Arm Gasket
Courtesy of GENERAL MOTORS COMPANY

5. Remove the valve rocker arm cover (1).
6. Remove and DISCARD valve rocker arm gasket (2).
7. Clean and inspect the rocker arm cover. Refer to **Valve Rocker Arm Cover Cleaning and Inspection** .

Installation Procedure

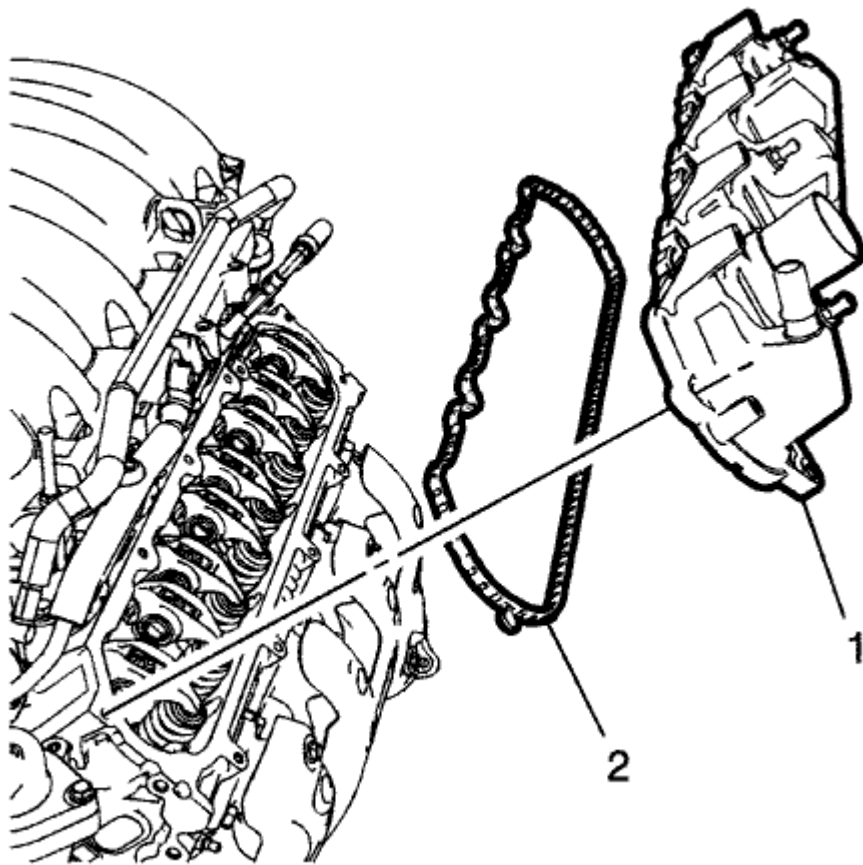


Fig. 78: Valve Rocker Arm Cover And Valve Rocker Arm Gasket
Courtesy of GENERAL MOTORS COMPANY

NOTE: If the valve rocker arm cover grommets are cracked or damaged, replace the valve rocker arm cover bolts. The grommet is serviced with the rocker arm cover bolt.

1. Install a NEW valve rocker arm gasket (2).
2. Install the valve rocker arm cover (1).

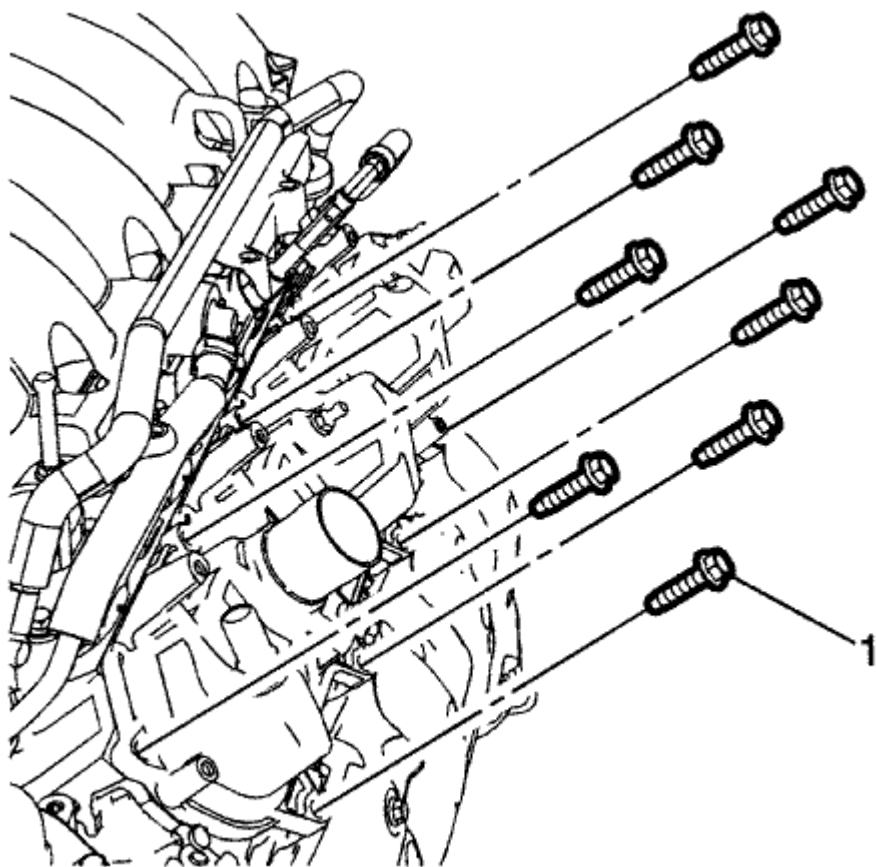


Fig. 79: Valve Rocker Arm Cover Bolts
Courtesy of GENERAL MOTORS COMPANY

3. Install valve rocker arm cover bolts (1) and hand tighten.

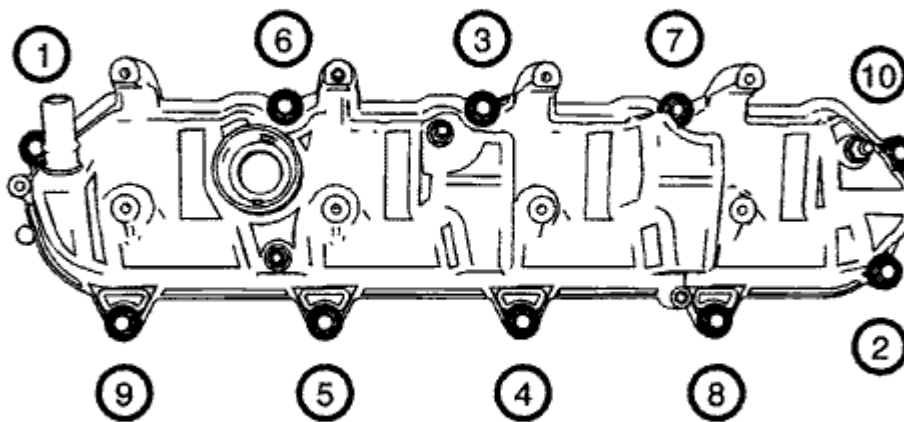


Fig. 80: Tightening Bolts In Sequence
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

4. Tighten the bolts in sequence to 10 (89 lb in) as shown.
5. If equipped, install the oil indicator tube. Refer to Oil Level Indicator Tube Replacement.
6. Install the ignition coil. Refer to Ignition Coil Replacement .
7. Install the air cleaner outlet duct. Refer to Air Cleaner Outlet Duct Replacement .

VALVE ROCKER ARM COVER REPLACEMENT - RIGHT SIDE

Removal Procedure

1. Remove the air cleaner outlet duct. Refer to Air Cleaner Outlet Duct Replacement .
2. Remove the ignition coils. Refer to Ignition Coil Replacement .

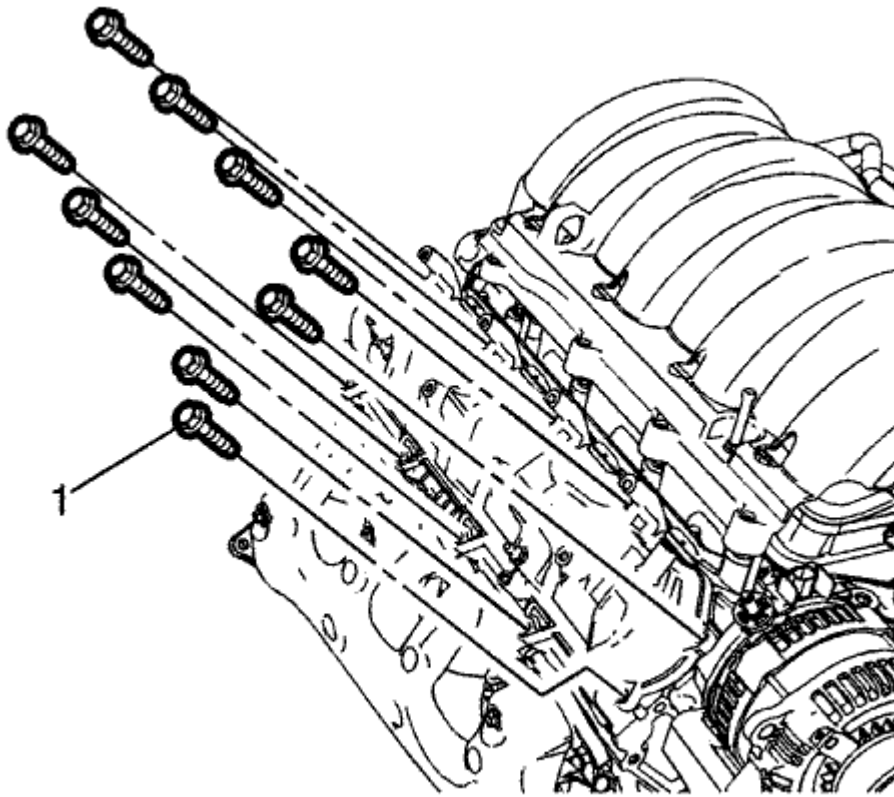


Fig. 81: Valve Rocker Arm Cover Bolts
Courtesy of GENERAL MOTORS COMPANY

3. Remove the valve rocker arm cover bolts (1).

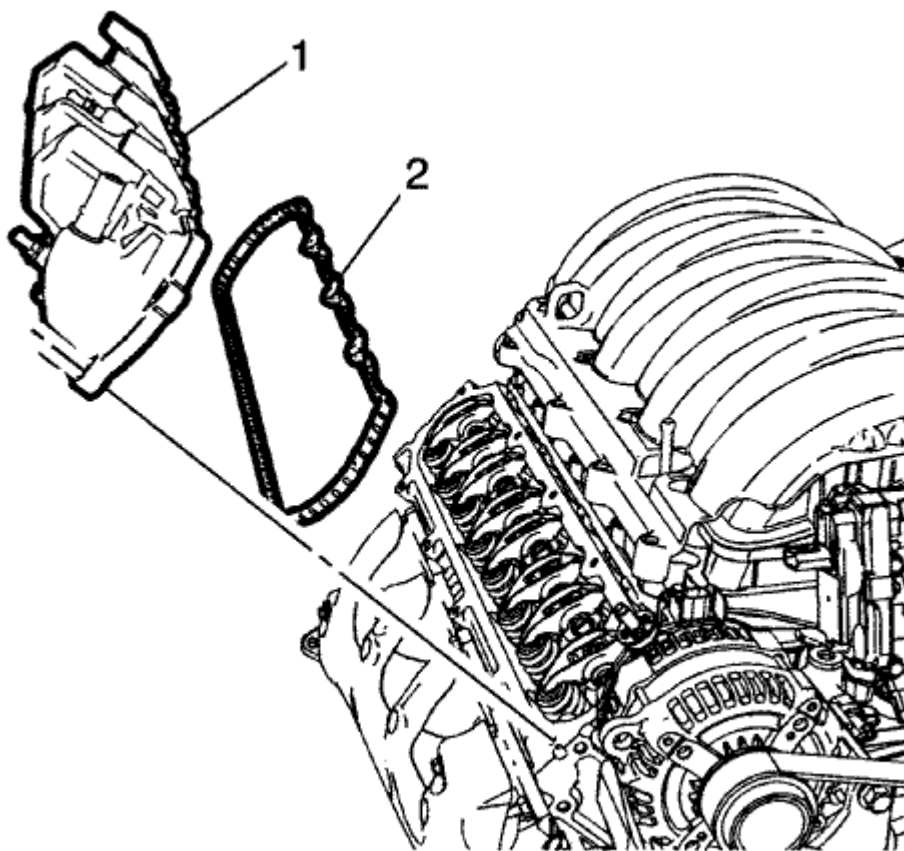


Fig. 82: Valve Rocker Arm Cover
Courtesy of GENERAL MOTORS COMPANY

4. Remove the valve rocker arm cover (1).
5. Remove and DISCARD valve rocker arm gasket (2).
6. Clean and inspect the rocker arm cover. Refer to **Valve Rocker Arm Cover Cleaning and Inspection** .

Installation Procedure

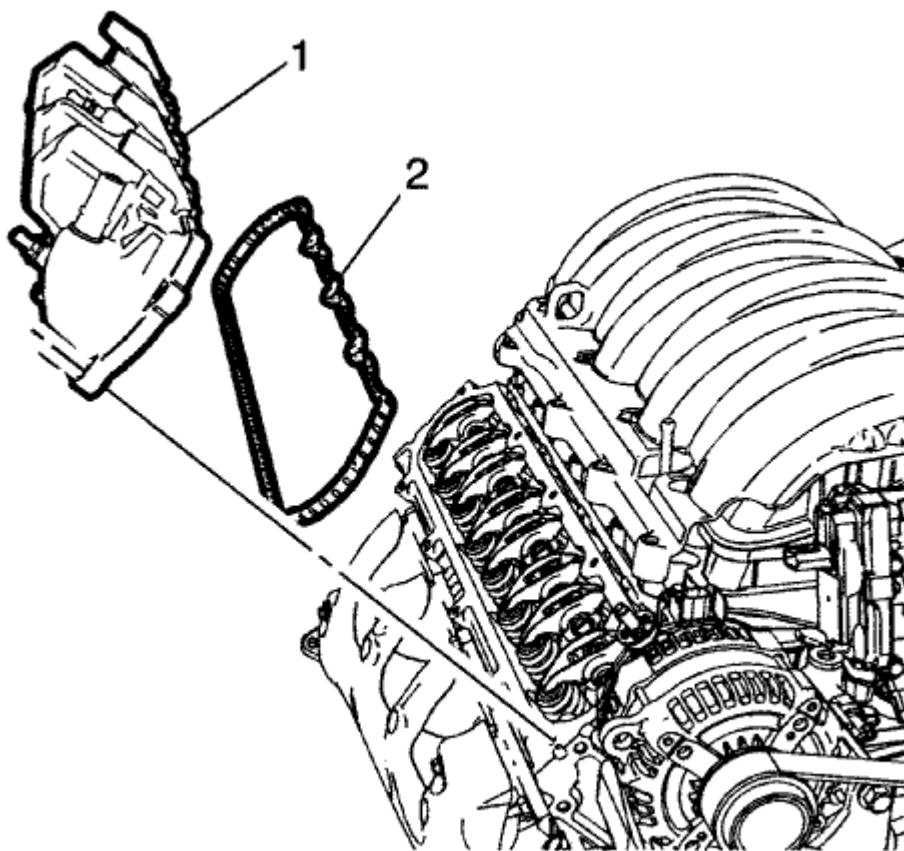


Fig. 83: Valve Rocker Arm Cover
Courtesy of GENERAL MOTORS COMPANY

NOTE: If the valve rocker arm cover grommets are cracked or damaged, replace the valve rocker arm cover bolts. The grommet is serviced with the rocker arm cover bolt.

1. Install a NEW valve rocker arm gasket (2).
2. Install the valve rocker arm cover (1).

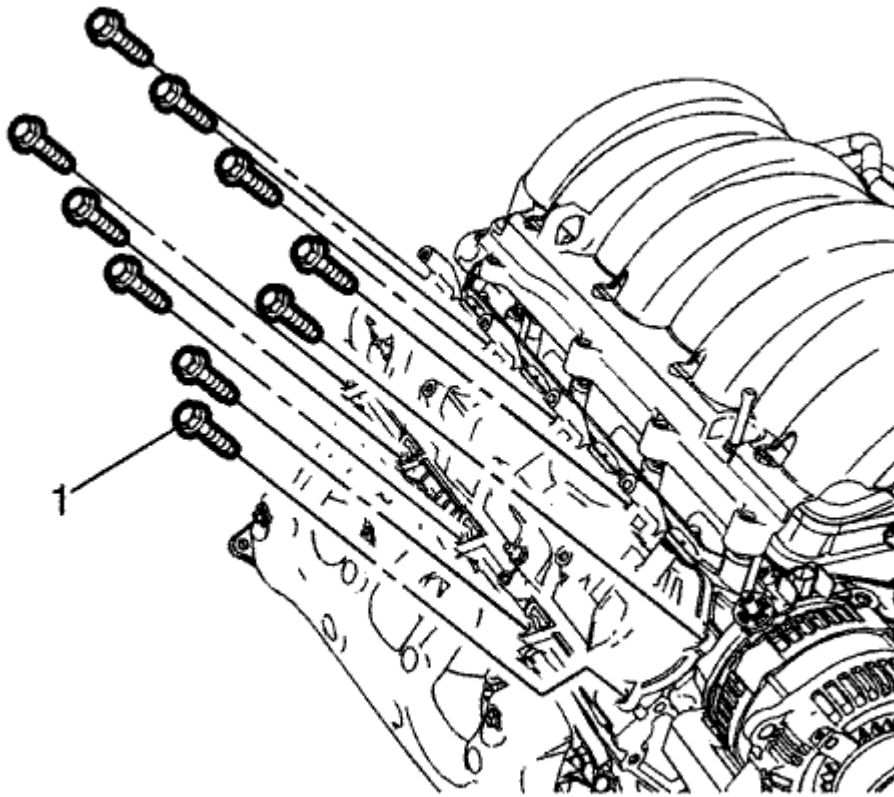


Fig. 84: Valve Rocker Arm Cover Bolts
Courtesy of GENERAL MOTORS COMPANY

3. Install valve rocker arm cover bolts (1) and hand tighten.

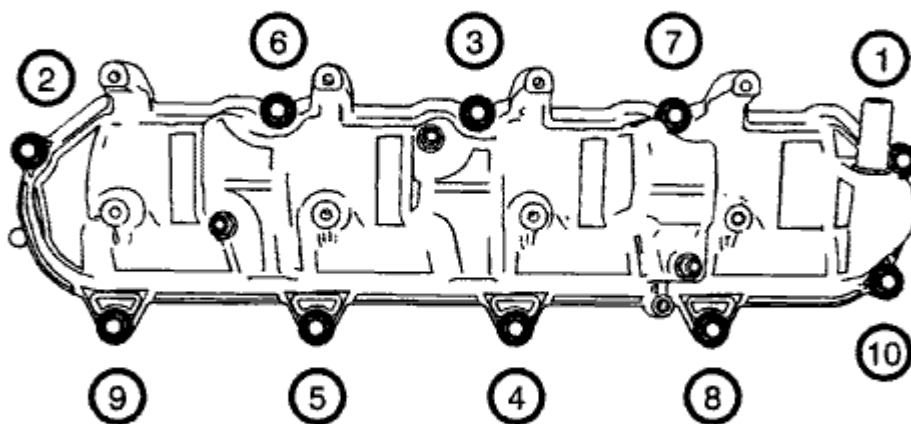


Fig. 85: Tightening Bolts In Sequence
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

4. Tighten the bolts in sequence to 10 (89 lb in) as shown.
5. Install the ignition coil. Refer to Ignition Coil Replacement .
6. Install the air cleaner outlet duct. Refer to Air Cleaner Outlet Duct Replacement .

VALVE ROCKER ARM AND PUSH ROD REPLACEMENT

Removal Procedure

1. Remove the valve rocker arm cover. Refer to Valve Rocker Arm Cover Replacement - Left Side or Valve Rocker Arm Cover Replacement - Right Side.

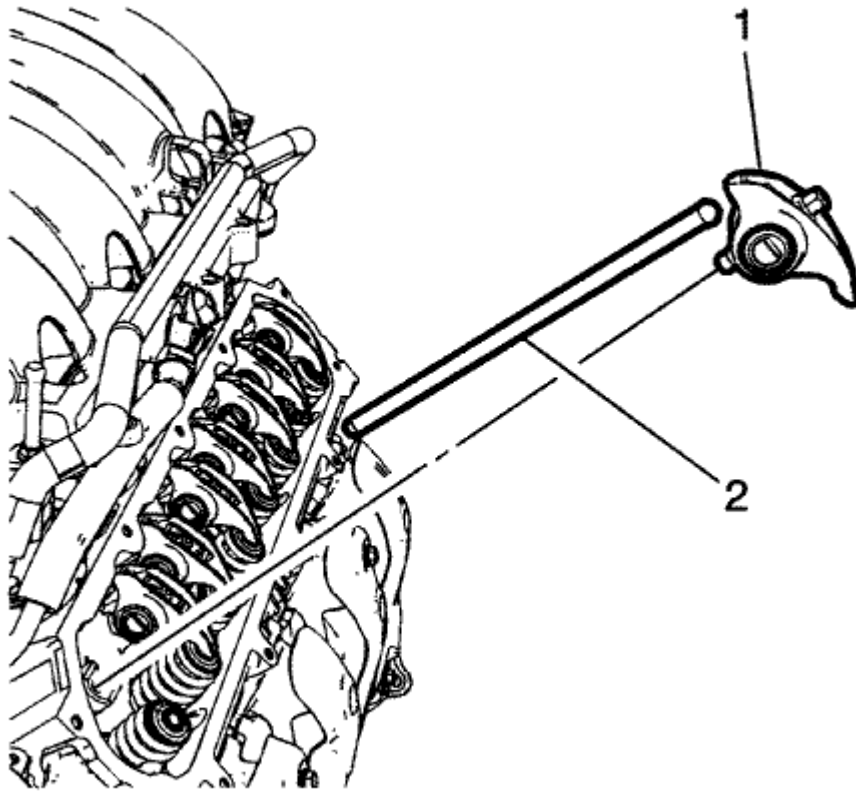


Fig. 86: Valve Rocker Arm And Bolt Assembly And Pushrod
Courtesy of GENERAL MOTORS COMPANY

NOTE: Place the valve rocker arms, valve pushrods and pivot support, in a rack so that they can be installed in the same location from which they were removed.

2. Remove the valve rocker arm and bolt assembly (1).
3. Remove the pushrod (2).
4. Clean and inspect the rocker arms and/or pushrods, if necessary. Refer to **Valve Rocker Arm and Push Rod Cleaning and Inspection** .

Installation Procedure

NOTE: Be sure to keep parts in order. Parts must be reinstalled into the original location and position.

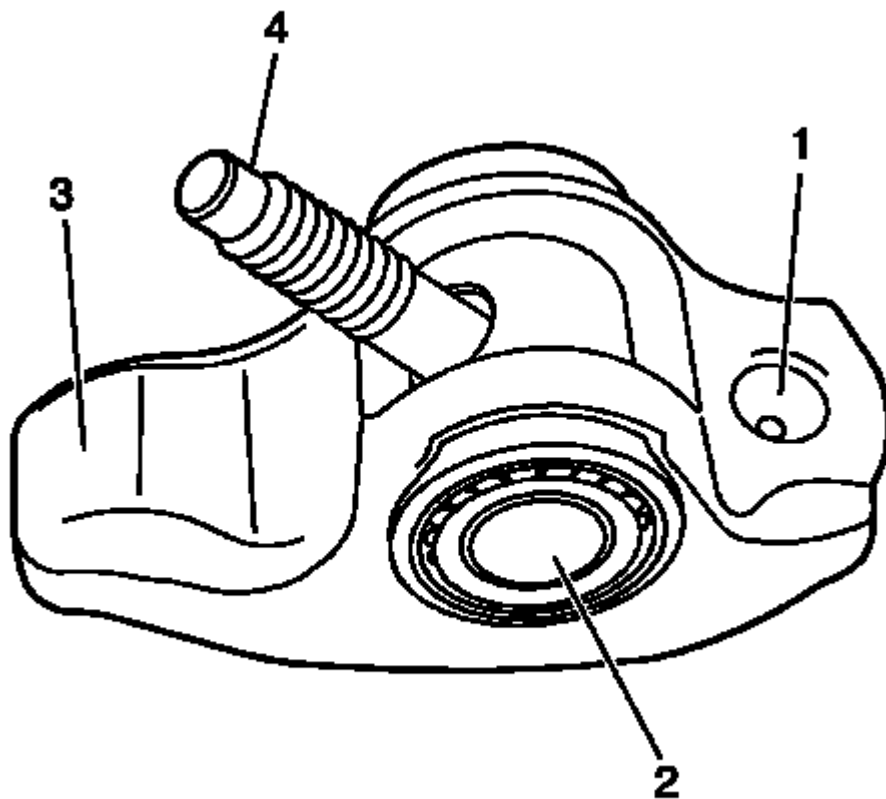


Fig. 87: Pushrod Socket, Roller Pivot & Valve Stem Tip
Courtesy of GENERAL MOTORS COMPANY

1. Apply lubricant to the following rocker arm contact surfaces:
 - Pushrod socket (1)
 - Roller pivot (2)
 - Valve stem tip (3)

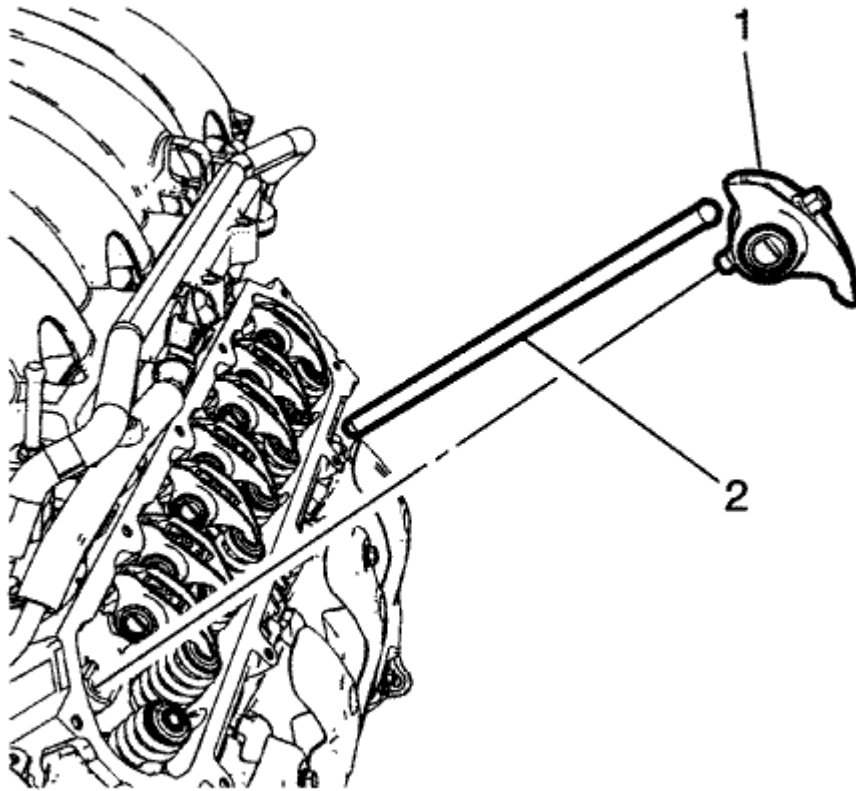


Fig. 88: Valve Rocker Arm And Bolt Assembly And Pushrod
Courtesy of GENERAL MOTORS COMPANY

2. Install the pushrod (2).

CAUTION: Refer to Fastener Caution .

3. Install the rocker arm and bolt assembly (1). Tighten the bolt to 30 (22 lb ft).
4. Install the valve rocker arm cover. Refer to Valve Rocker Arm Cover Replacement - Left Side or Valve Rocker Arm Cover Replacement - Right Side.

VALVE STEM OIL SEAL AND VALVE SPRING REPLACEMENT

Special Tools

- **J-22794** Spark Plug Port Adapter
- **J-38606** Valve Spring Compressor

For equivalent regional tools, refer to Special Tools .

Removal Procedure

1. Remove the valve rocker arms as needed. Refer to Valve Rocker Arm and Push Rod Replacement.
2. Remove the spark plugs as needed. Refer to Spark Plug Replacement.

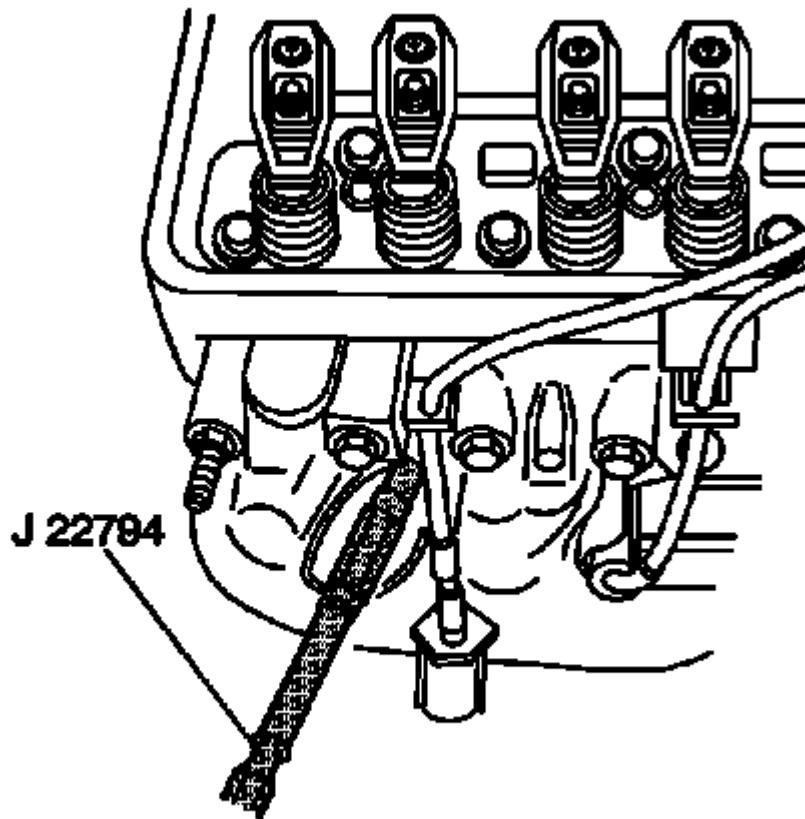


Fig. 89: View Of J 22794 In Spark Plug Hole
Courtesy of GENERAL MOTORS COMPANY

3. Install the **J- 22794** adapter into the spark plug hole.
4. Connect a shop air supply hose and apply compressed air in order to hold the valves in place.

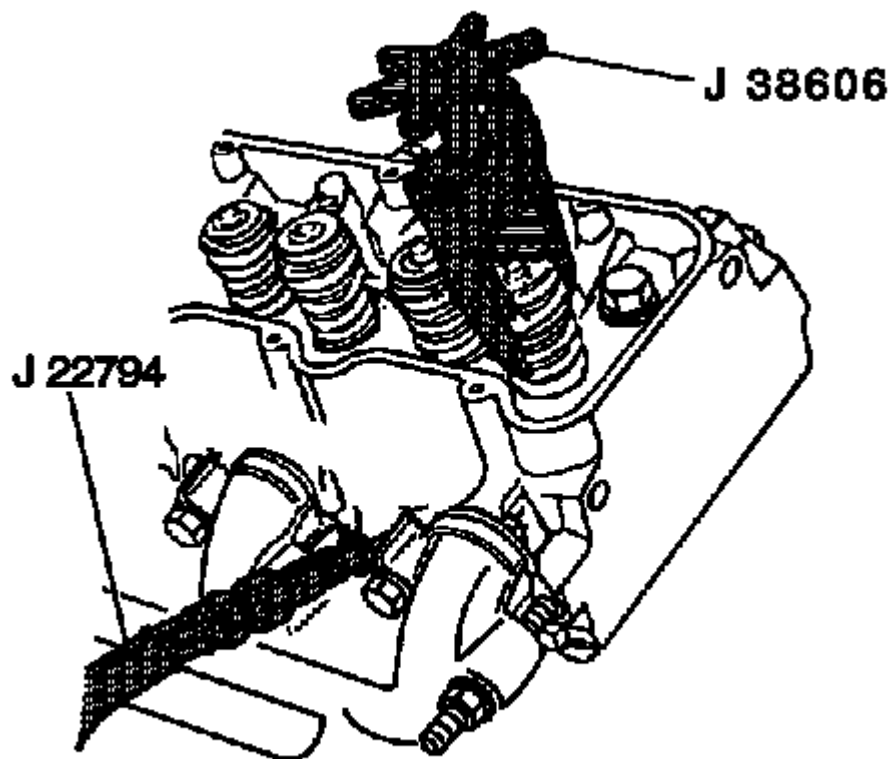


Fig. 90: Compress Valve Spring (Cylinder Head Installed) Using Special Tools
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Completely engage the J 38606 jaws on the valve spring. The J 38606 may slip off and scratch the valve spring. Replace the valve spring if the valve spring becomes scratch.

5. Use J 38606 compressor.

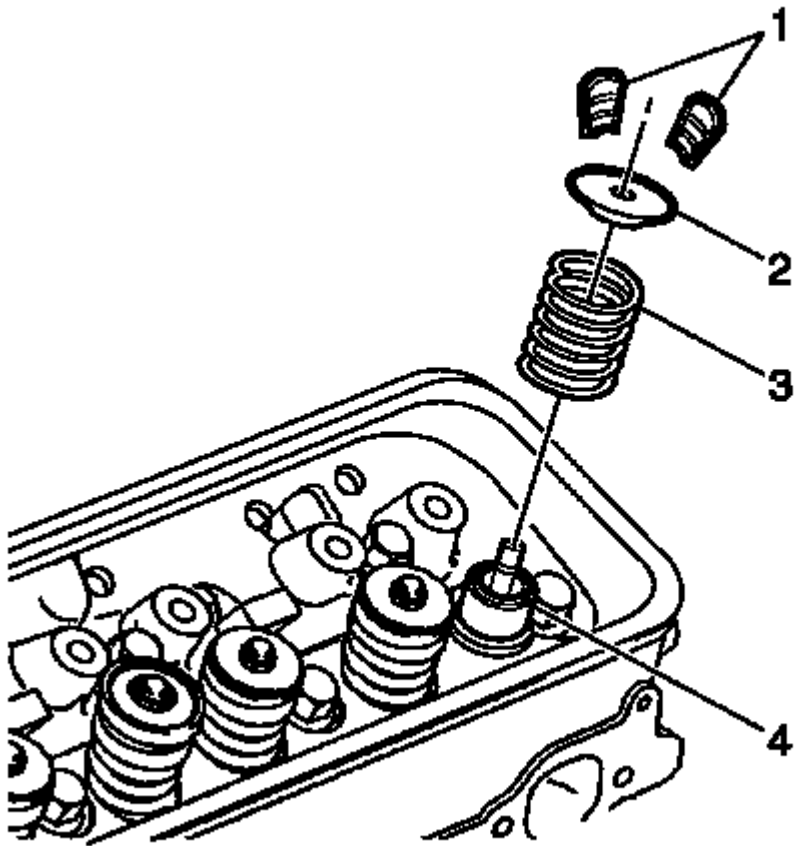


Fig. 91: Identifying Valve Components
Courtesy of GENERAL MOTORS COMPANY

6. Remove the valve keys (1).
7. Carefully release the valve spring tension.
8. Remove the **J-38606** compressor.
9. Remove the valve spring cap (2) and valve spring (3).
10. Remove the valve stem oil seal (4).

Installation Procedure

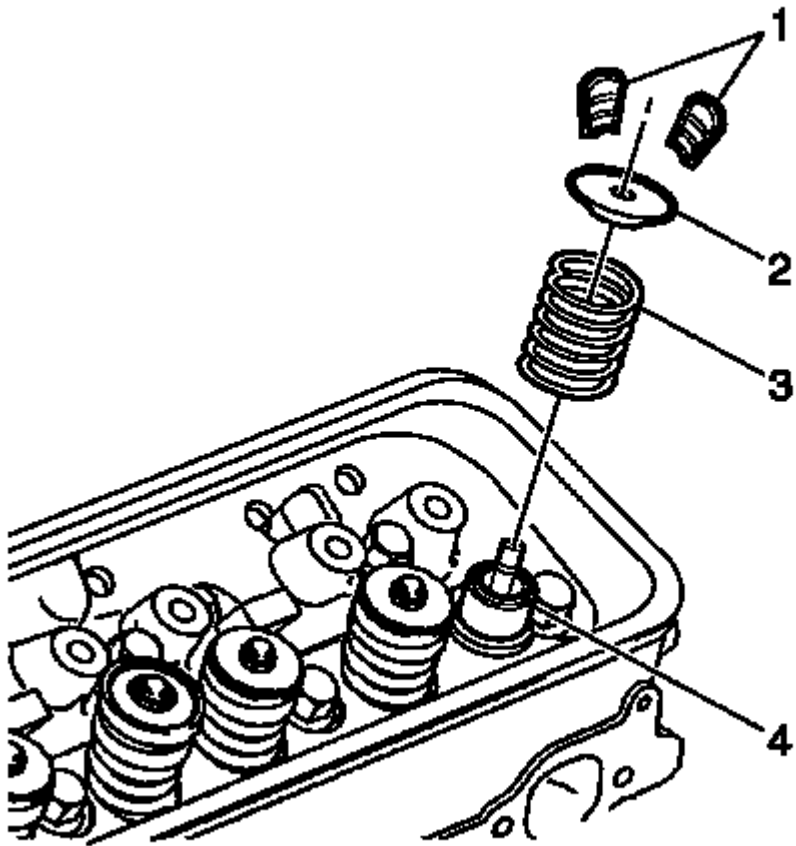


Fig. 92: Identifying Valve Components
Courtesy of GENERAL MOTORS COMPANY

1. Install the valve spring (3).
2. Install the valve spring cap (2) onto the valve spring (3), over the valve stem.
3. Apply steady pressure on the valve spring cap until the valve keys are accessible.

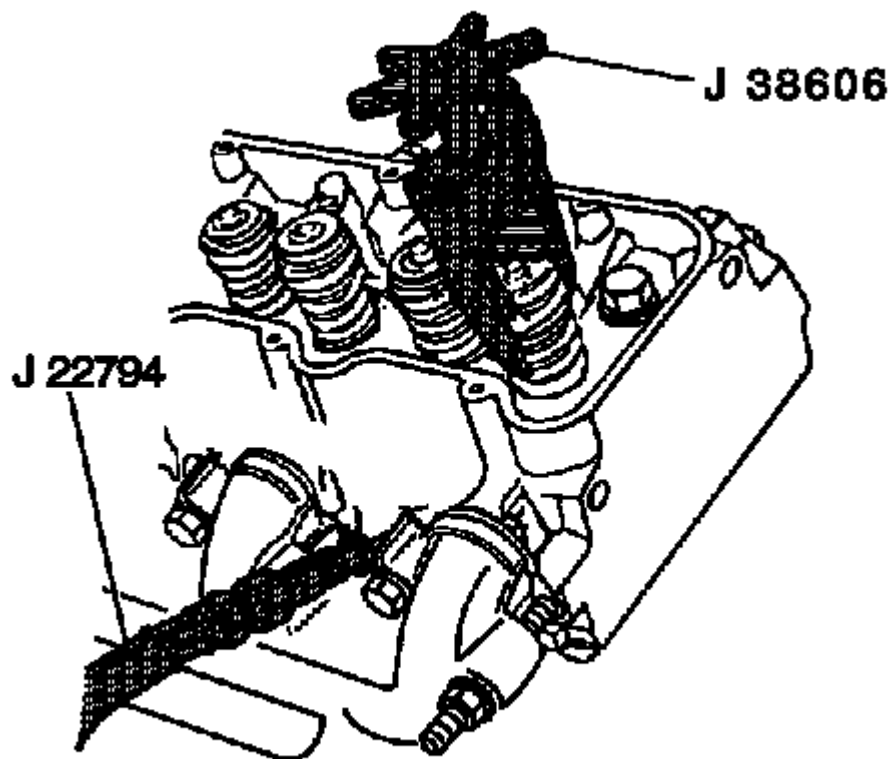


Fig. 93: Compress Valve Spring (Cylinder Head Installed) Using Special Tools
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Completely engage the J 38606 jaws on the valve spring. The J 38606 may slip off and scratch the valve spring. Replace the valve spring if the valve spring becomes scratch.

4. Use the **J-38606** compressor.
5. Install the valve stem O-ring seal.

NOTE: Use grease in order to hold the valve stem keys in place.

6. Install the valve stem keys.
7. Carefully release the valve spring pressure, making sure the valve stem keys stay in place.

CAUTION: The valve stem keys must correctly seat in the valve spring cap. Engine damage may occur by not installing properly.

1. Look to ensure that the valve stem keys seat properly in the upper groove of the valve stem.
2. Tap the end of the valve stem with a plastic faced hammer in order to seat the valve stem keys, if necessary.

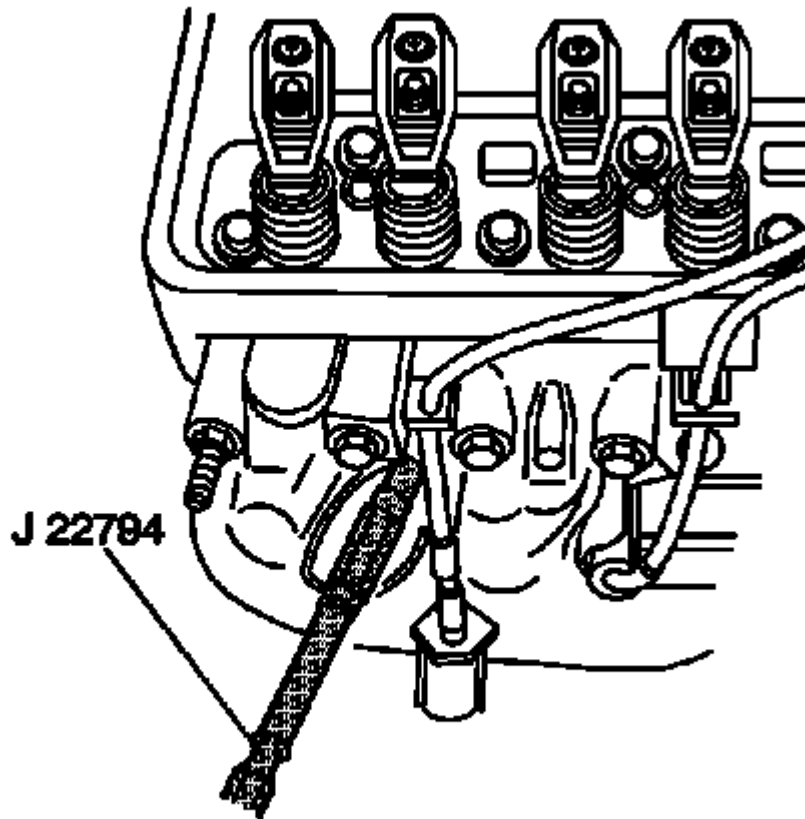


Fig. 94: View Of J 22794 In Spark Plug Hole
Courtesy of GENERAL MOTORS COMPANY

9. Remove the **J-22794** adapter.
10. Install the spark plugs. Refer to **Spark Plug Replacement**.
11. Install the valve rocker arms. Refer to **Valve Rocker Arm and Push Rod Replacement**.

OIL LEVEL INDICATOR TUBE REPLACEMENT

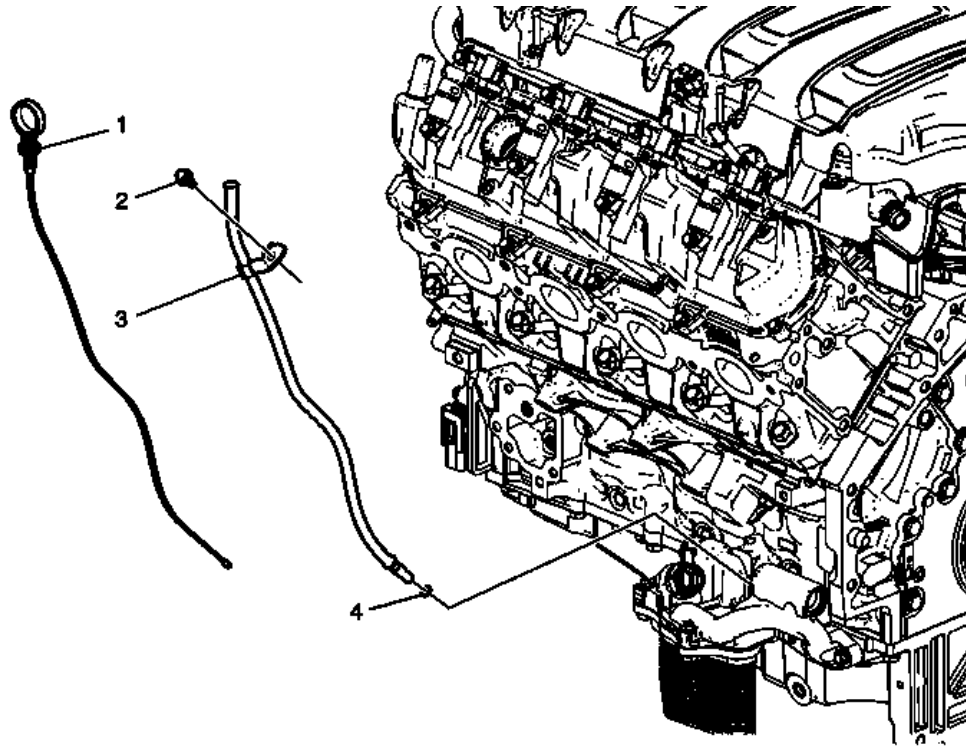


Fig. 95: Oil Level Indicator Tube
 Courtesy of GENERAL MOTORS COMPANY

Oil Level Indicator Tube Replacement

Callout	Component Name
Preliminary Procedure Remove the valve rocker arm insulator. Refer to <u>Valve Rocker Arm Cover Insulator Replacement - Left Side</u> .	
1	Oil Level Indicator
2	Oil Level Indicator Tube Bracket Bolt CAUTION: Refer to <u>Fastener Caution</u> . Tighten 10 N.m (88 lb in)
3	Oil Level Indicator Tube
4	Oil Level Indicator Tube O-Ring Procedure Use a NEW oil level indicator tube seal when installing the tube.

CYLINDER HEAD REPLACEMENT - LEFT SIDE

Removal Procedure

1. Drain the coolant system. Refer to **Cooling System Draining and Filling (Static Fill)** , **Cooling System Draining and Filling (GE 47716)** .
2. Remove the fuel injector rail. Refer to **Fuel Injection Fuel Rail Assembly Replacement - Bank 2** .
3. Remove the exhaust manifold. Refer to **Exhaust Manifold Replacement - Left Side** .
4. Remove the valve rocker arms and push rods. Refer to **Valve Rocker Arm and Push Rod Replacement**.

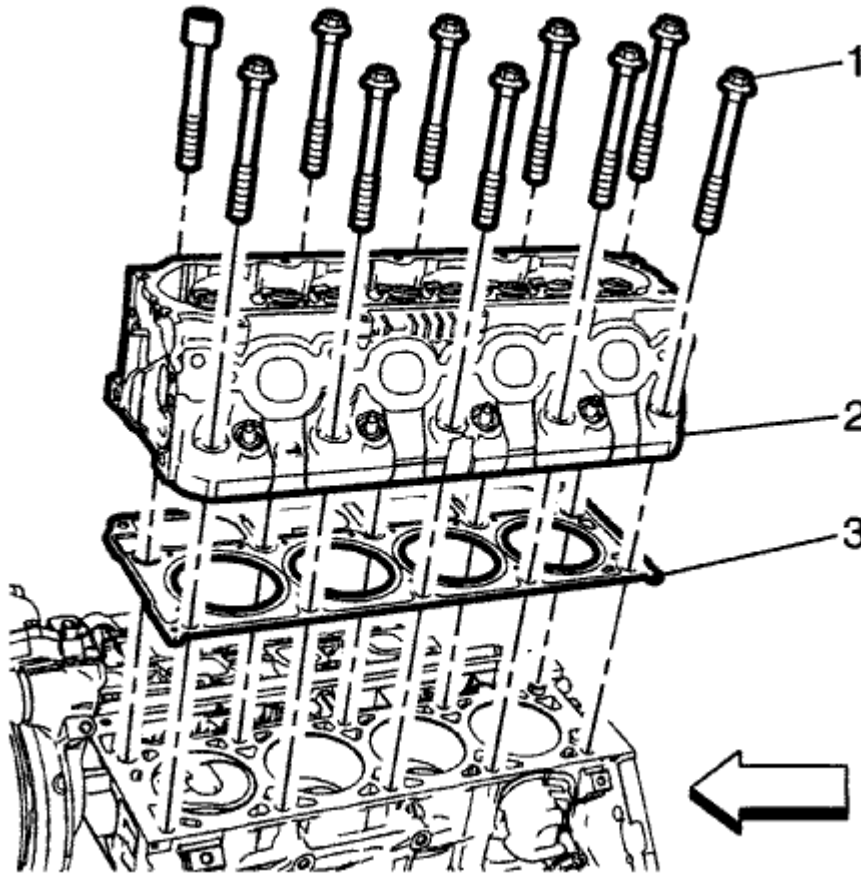


Fig. 96: Cylinder Head Bolts
Courtesy of GENERAL MOTORS COMPANY

NOTE: Ensure to DISCARD all cylinder head bolts.

5. Remove the cylinder head bolts (1).
6. Disconnect electrical connectors as necessary.
7. Remove cylinder head (2).
8. Remove and DISCARD cylinder head gasket (3). Refer to **Replacing Engine Gaskets** .
9. For cleaning and inspection. Refer to **Cylinder Head Cleaning and Inspection** .
10. For cylinder head disassemble. Refer to **Cylinder Head Disassemble** .

Installation Procedure

1. For cylinder head assemble. Refer to Cylinder Head Assemble .

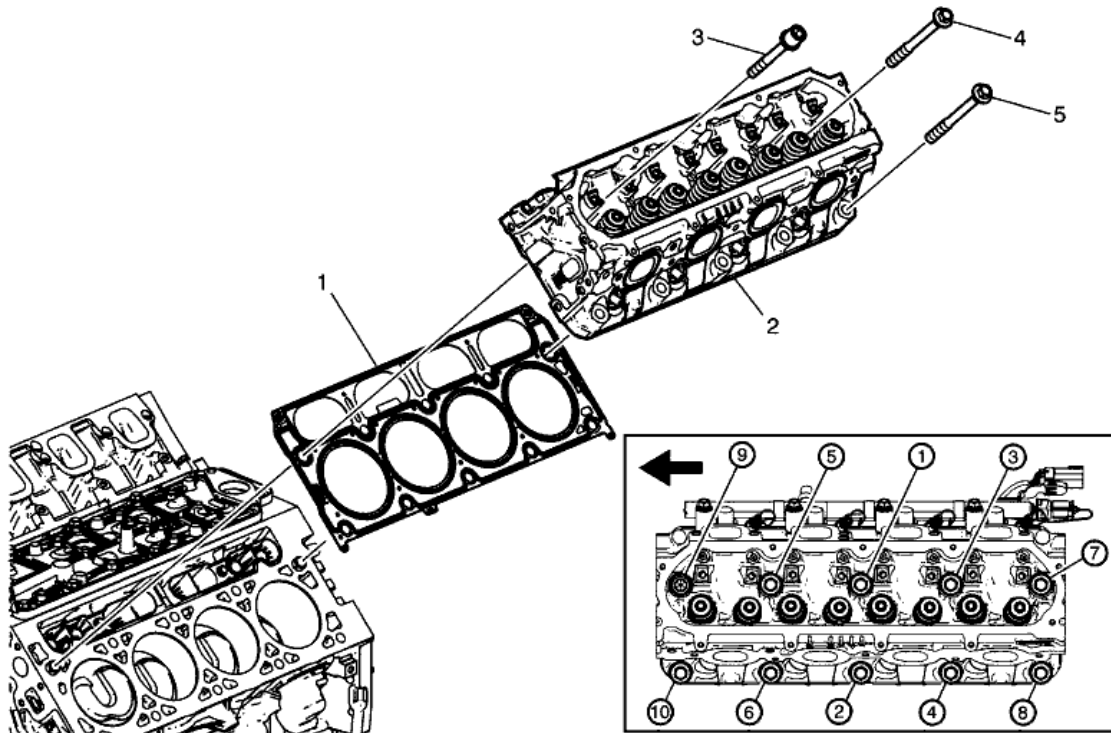


Fig. 97: NEW Cylinder Head Gasket
Courtesy of GENERAL MOTORS COMPANY

2. Install a NEW cylinder head gasket (1).
3. Install cylinder head (2).

CAUTION: This vehicle is equipped with torque-to-yield or single use fasteners. Install a NEW torque-to-yield or single use fastener when installing this component. Failure to replace the torque-to-yield or single use fastener could cause damage to the vehicle or component.

4. Hand start cylinder head bolts (3, 4 and 5).

CAUTION: Refer to Fastener Caution .

5. Tighten cylinder head bolts in sequence as shown above.
 1. Tighten cylinder bolts (3) to 80 (59 lb ft) plus 130°.
 2. Tighten cylinder bolts (4 and 5) to 80 (59 lb ft) plus 150°.
6. Install the valve rocker arms and push rods. Refer to Valve Rocker Arm and Push Rod

7. Install the exhaust manifold. Refer to **Exhaust Manifold Replacement - Left Side** .
8. Install the fuel injector rail. Refer to **Fuel Injection Fuel Rail Assembly Replacement - Bank 2** .
9. Refill the coolant system. Refer to **Cooling System Draining and Filling (Static Fill)** , **Cooling System Draining and Filling (GE 47716)** .

CYLINDER HEAD REPLACEMENT - RIGHT SIDE

Removal Procedure

1. Drain the coolant system. Refer to **Cooling System Draining and Filling (Static Fill)** , **Cooling System Draining and Filling (GE 47716)** .
2. Remove the fuel injector rail. Refer to **Fuel Injection Fuel Rail Assembly Replacement - Bank 1** .
3. Remove the exhaust manifold. Refer to **Exhaust Manifold Replacement - Right Side** .
4. Remove the valve rocker arms and push rods. Refer to **Valve Rocker Arm and Push Rod Replacement**.

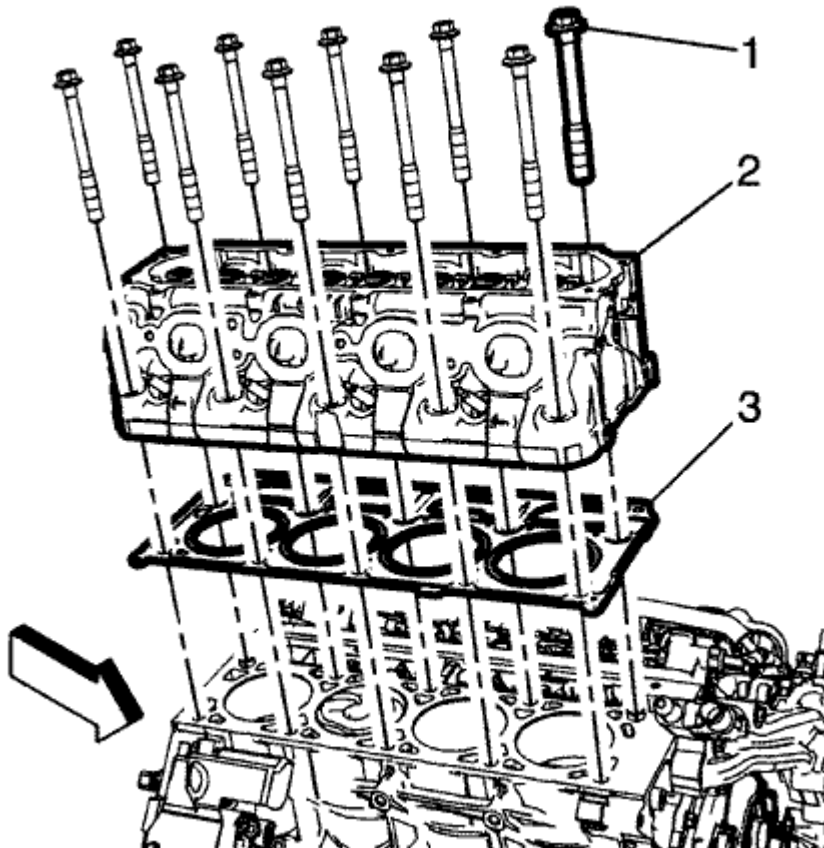


Fig. 98: Cylinder Head Bolts And Cylinder Head Gasket
Courtesy of GENERAL MOTORS COMPANY

NOTE: Ensure to **DISCARD** all cylinder head bolts.

5. Remove the cylinder head bolts (1). Discard bolts.
6. Disconnect electrical connectors as necessary.
7. Remove cylinder head (2).
8. Remove and **DISCARD** cylinder head gasket (3). Refer to **Replacing Engine Gaskets** .
9. For cleaning and inspection. Refer to **Cylinder Head Cleaning and Inspection** .
10. For cylinder head disassemble. Refer to **Cylinder Head Disassemble** .

Installation Procedure

1. For cylinder head assemble. Refer to **Cylinder Head Assemble** .

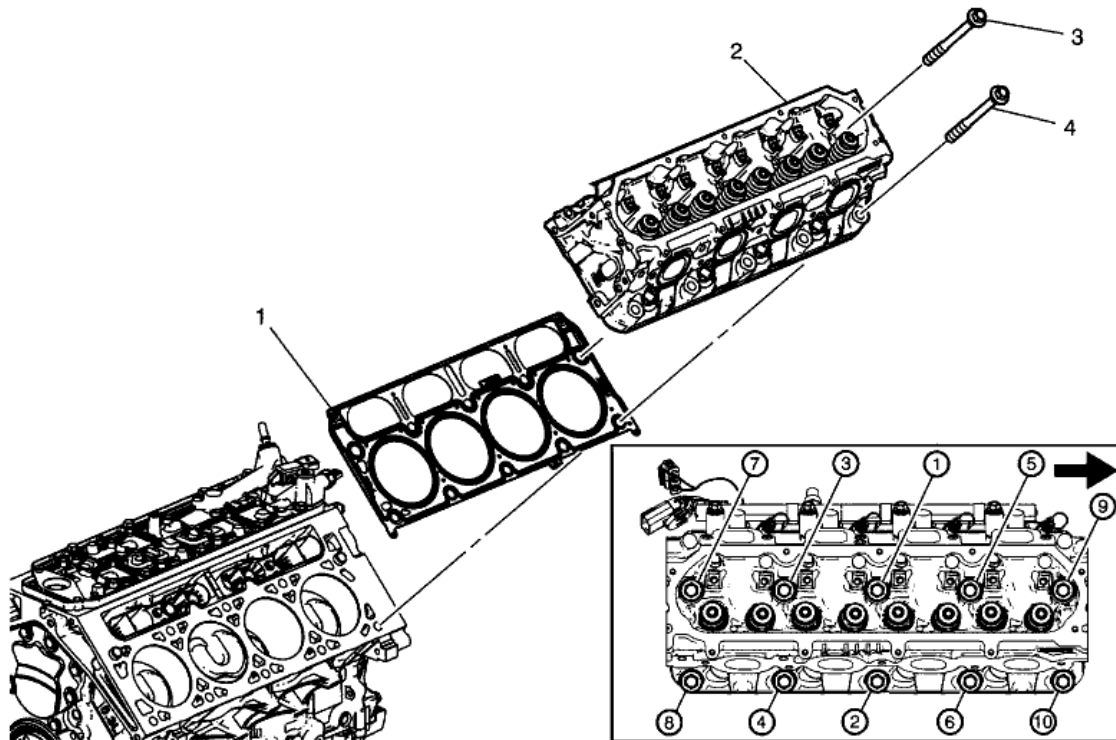


Fig. 99: NEW Cylinder Head Gasket And Cylinder Head
Courtesy of GENERAL MOTORS COMPANY

2. Install a NEW cylinder head gasket (3).
3. Install cylinder head (2).

CAUTION: This vehicle is equipped with torque-to-yield or single use fasteners. Install a NEW torque-to-yield or single use fastener when installing this component. Failure to replace the torque-to-yield or single use fastener could cause damage to the vehicle or component.

4. Hand start NEW cylinder head bolts (3 and 4).

CAUTION: Refer to Fastener Caution .

- 5. Tighten cylinder head bolts in sequence as shown above.
 - 1. Tighten cylinder bolts (3 and 4) to 80 (59 lb ft) plus150°..
- 6. Install the valve rocker arms and push rods. Refer to Valve Rocker Arm and Push Rod Replacement.
- 7. Install the exhaust manifold. Refer to Exhaust Manifold Replacement - Right Side .
- 8. Install the fuel injector rail. Refer to Fuel Injection Fuel Rail Assembly Replacement - Bank 1 .
- 9. Refill the coolant system. Refer to Cooling System Draining and Filling (Static Fill) , Cooling System Draining and Filling (GE 47716) .

VALVE LIFTER FOLLOWER GUIDE ASSEMBLY REPLACEMENT

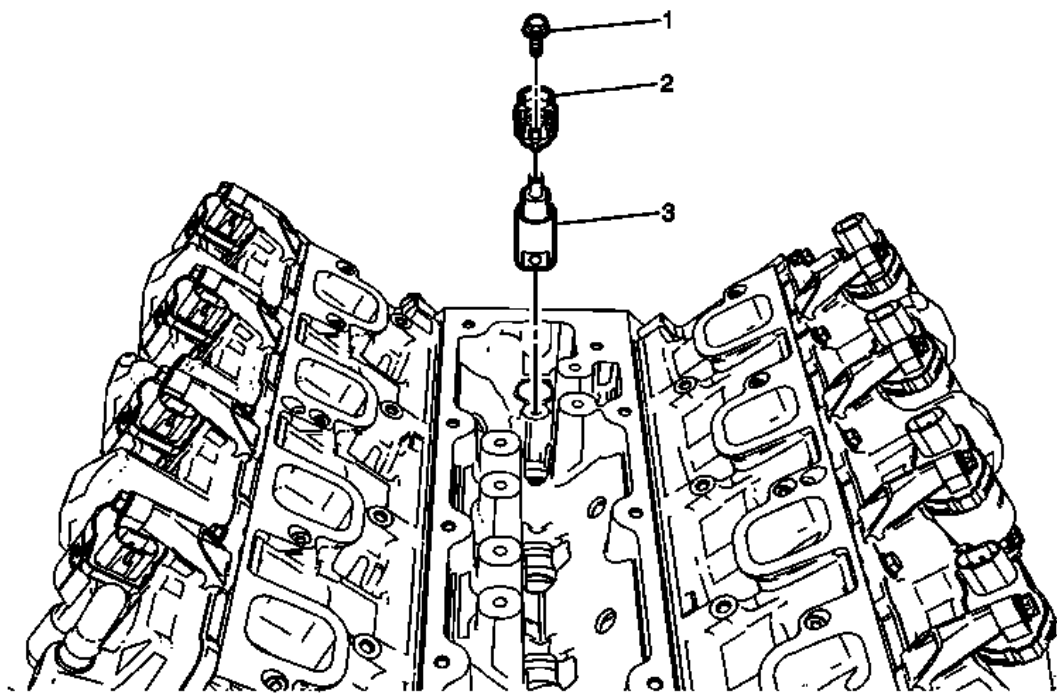


Fig. 100: Valve Lifter Follower Guide Assembly
Courtesy of GENERAL MOTORS COMPANY

Valve Lifter Follower Guide Assembly Replacement

Callout	Component Name

Remove the valve lifter oil manifold. Refer to **Valve Lifter Oil Manifold Replacement**.

1	Valve Lifter Follower Guide Fastener
	CAUTION: Refer to Fastener Caution .
	Tighten 12 (106 lb in)
2	Valve Lifter Follower Guide
3	Valve Lifter Follower

VALVE LIFTER FOLLOWER GUIDE REPLACEMENT

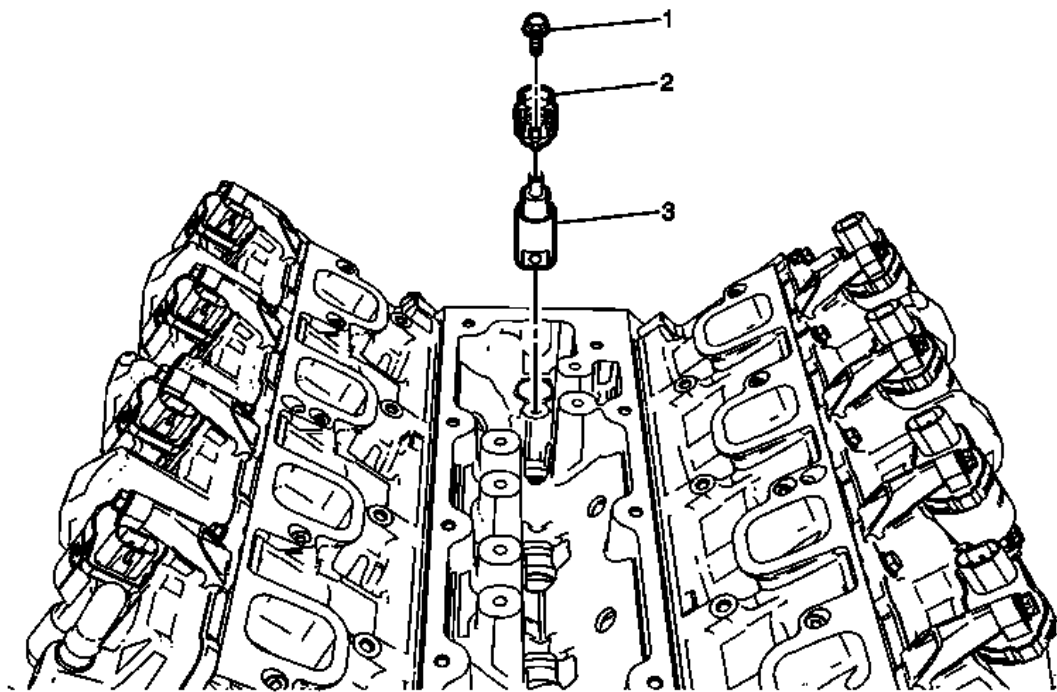


Fig. 101: Valve Lifter Follower Guide
Courtesy of GENERAL MOTORS COMPANY

Valve Lifter Follower Guide Replacement

Callout	Component Name
Preliminary Procedure Remove the valve lifter oil manifold. Refer to Valve Lifter Oil Manifold Replacement .	
	Valve Lifter Follower Guide Fastener
	CAUTION:

1	Refer to Fastener Caution . Tighten 12 (106 lb in)
2	Valve Lifter Follower Guide
3	Valve Lifter Follower

VALVE LIFTER REPLACEMENT

Removal Procedure

1. Remove the cylinder head and gasket. Refer to **Cylinder Head Replacement - Left Side** or **Cylinder Head Replacement - Right Side**.

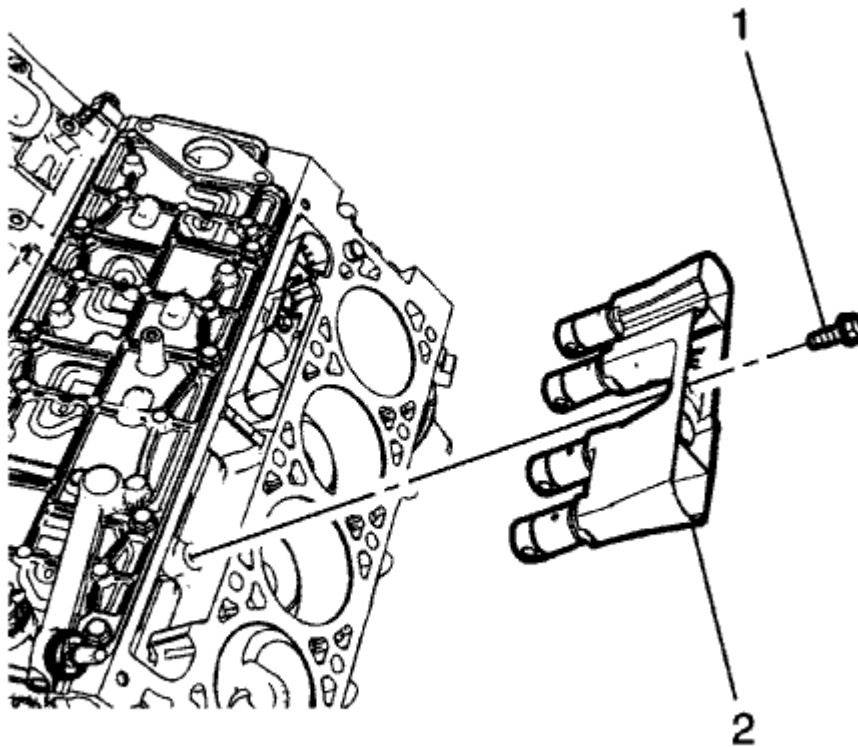


Fig. 102: Valve Lifter Guide Bolt
Courtesy of GENERAL MOTORS COMPANY

2. Remove the valve lifter guide bolt (1).
3. Remove the valve lifter guides (2) with the lifters. Note the installed position of the guides. The

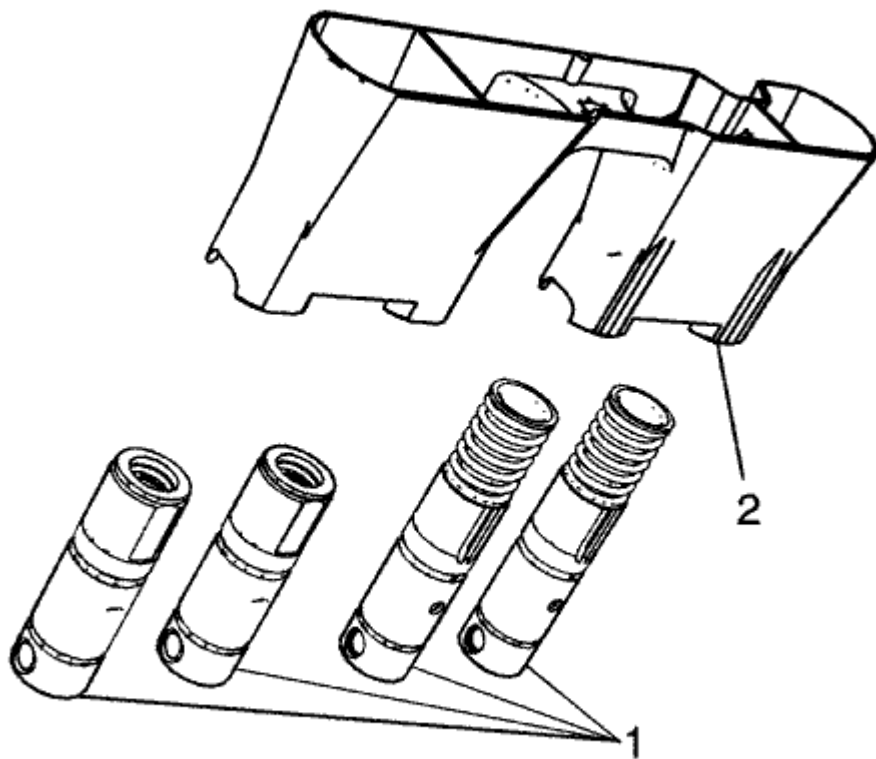


Fig. 103: Valve Lifters And Guide
Courtesy of GENERAL MOTORS COMPANY

4. Remove the valve lifters (1) from the guide (2).

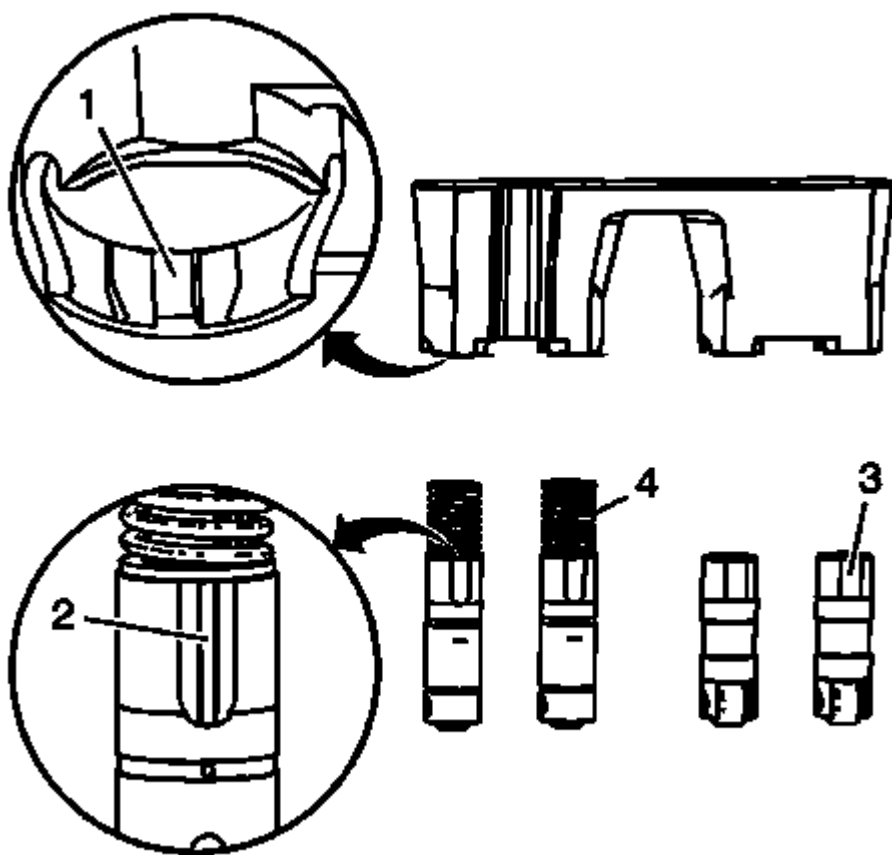


Fig. 104: Inserting Valve Lifters Into Lifter Guides
 Courtesy of GENERAL MOTORS COMPANY

NOTE: The active fuel management lifters are installed into the guide by aligning the notched area of the guide (1) with the raised surface on the side of the lifter (2).

5. Organize or mark the components so that they can be installed in the same location from which they were removed, if required.
6. Clean and inspect the valve lifters, if required. Refer to Valve Lifter and Guide Cleaning and Inspection .

Installation Procedure

- IMPORTANT:**
- When reusing valve lifters, install the lifters to their original locations.
 - Each of the 4 valve guide assemblies will contain 2 active fuel management valve lifters and 2 non active fuel management valve lifters.
 - With the lifters and guides properly installed, cylinders 1, 4, 6 and 7 lifter bores will each contain 2 active fuel management valve lifters.

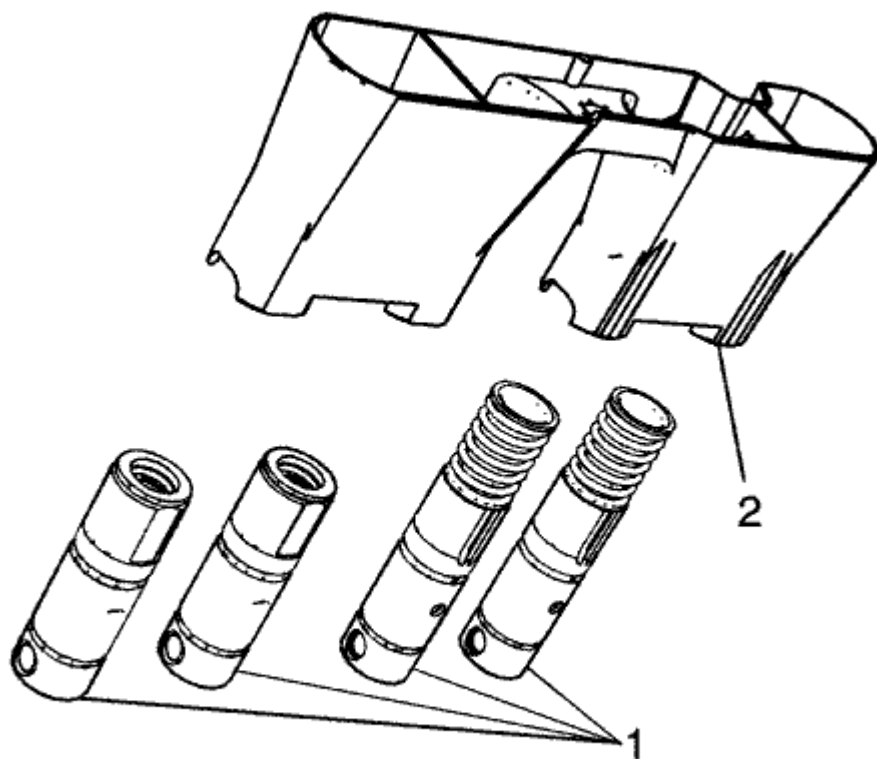


Fig. 105: Valve Lifters And Guide
Courtesy of GENERAL MOTORS COMPANY

1. Lubricate the valve lifters (1) and engine block valve lifter bores with clean engine oil.

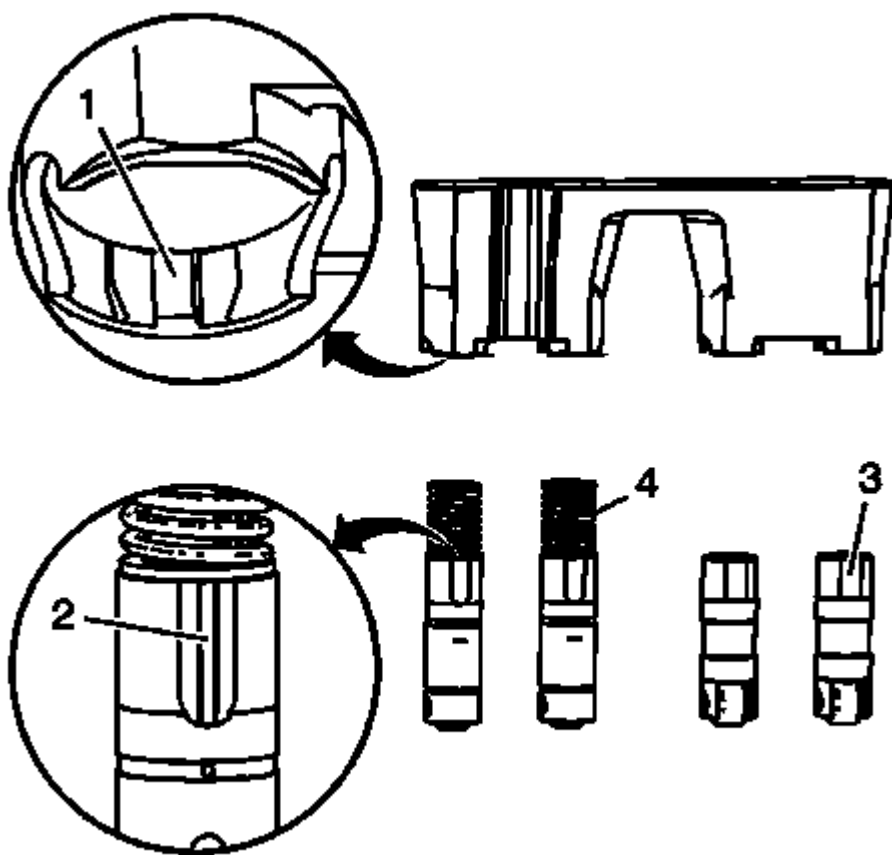


Fig. 106: Inserting Valve Lifters Into Lifter Guides
Courtesy of GENERAL MOTORS COMPANY

2. Insert the valve lifters into the lifter guides.
 - Align the flat area (3) on the top of the non active fuel management lifter with the flat area in the lifter guide bore. Push the lifter completely into the guide bore.
 - The active fuel management lifters are to be installed into the guide, with the notch in the guide (1) aligned with the raised area (2) of the lifter.

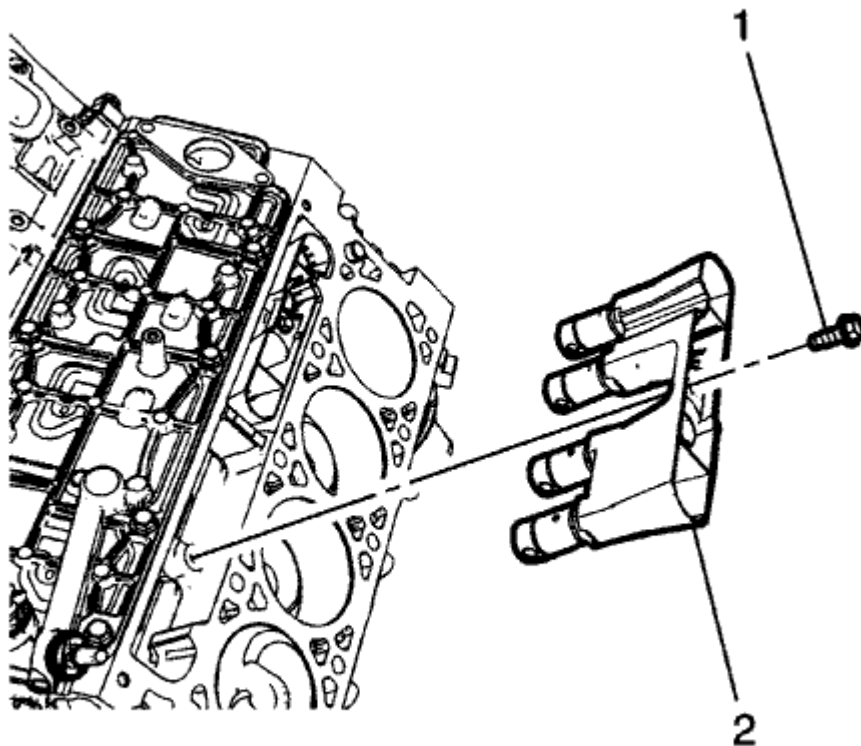


Fig. 107: Valve Lifter Guide Bolt
Courtesy of GENERAL MOTORS COMPANY

3. Install the valve lifters and guide (2) to the engine block.

CAUTION: Refer to Fastener Caution .

4. Install the valve lifter guide bolts (1).

Tighten

Tighten the bolt to 12 N.m (106 lb in).

5. Install the cylinder head and gasket. Refer to Cylinder Head Replacement - Left Side or Cylinder Head Replacement - Right Side.

CRANKSHAFT BALANCER REPLACEMENT

Special Tools

- **EN 47812** Installer Bolt
- **J 41478** Crankshaft Front Oil Seal Installer
- **J 41665** Crankshaft Balancer and Sprocket Installer
- **J 41816** Crankshaft Balancer Remover
- **J 41816-2** Crankshaft End Protector
- **J 42386-A** Flywheel Holding Tool
- **J 45059** Angle Meter

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

Removal Procedure

1. Remove the accessory drive belt. Refer to **Drive Belt Replacement - Accessory**.
2. Remove the electric belt drive rack and pinion steering gear. Refer to **Electric Belt Drive Rack and Pinion Steering Gear Replacement** .
3. Remove the starter motor. Refer to **Starter Replacement (LT1)** .

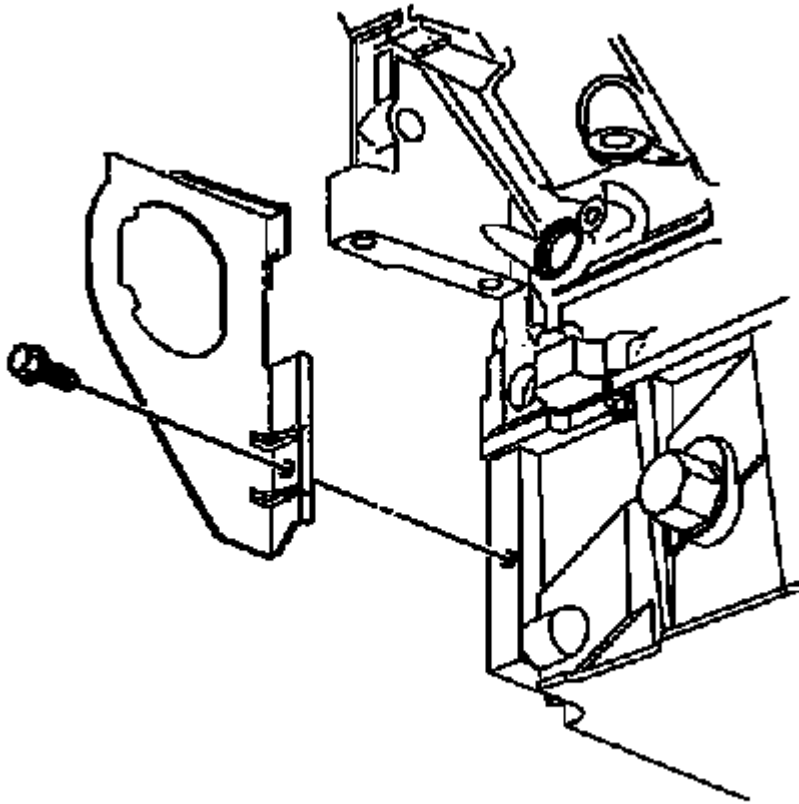


Fig. 108: View Of Right Transmission Cover & Bolt

Courtesy of GENERAL MOTORS COMPANY

4. Remove the right transmission cover and bolt.

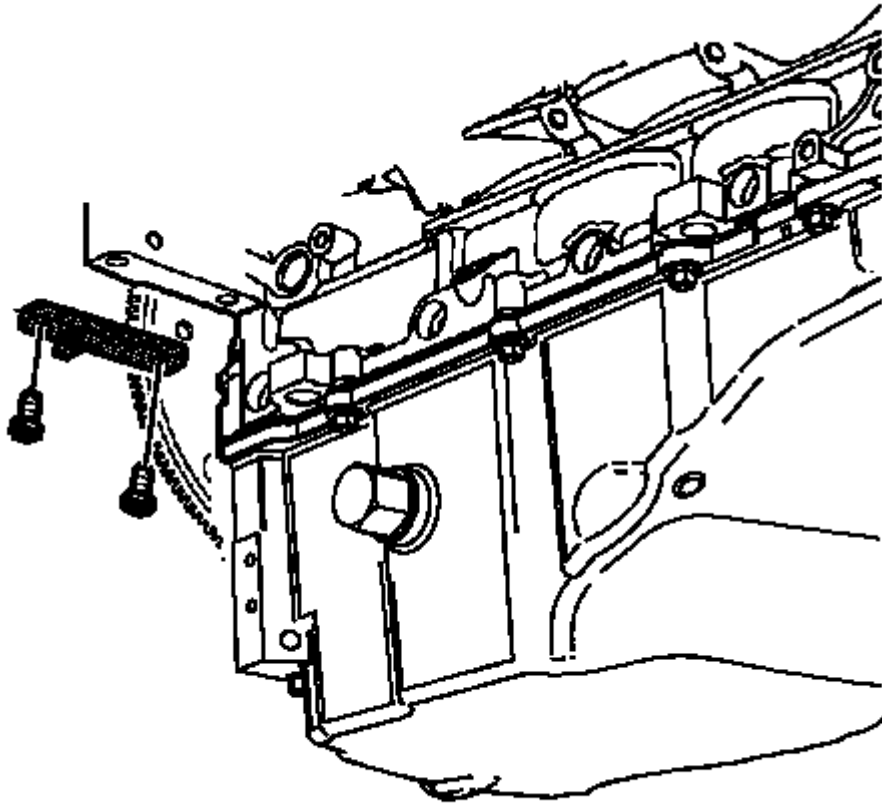


Fig. 109: Identifying J 42386-A
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

NOTE:

- Note the position of the crankshaft balancer before removal. The balancer does not use a key or keyway for positioning. Mark or scribe the end of the crankshaft and the balancer before component removal. The crankshaft balancer must be installed to the original position. If replacing the crankshaft balancer, note the location of any existing balance weights, if applicable. Crankshaft balance weights must be installed into the new balancer in the same location as the old balancer. A properly installed balance weight will be either flush or below flush with the face of the balancer.

crankshaft balancer bolt during final assembly.

5. Install the **J 42386-A** flywheel holding tool and bolts.

Use one M10 - 1.5 x 120 mm and one M10 - 1.5 x 45 mm bolt for proper tool operation. Tighten the **J 42386-A** flywheel holding tool bolts to 50 N.m (37 lb ft).

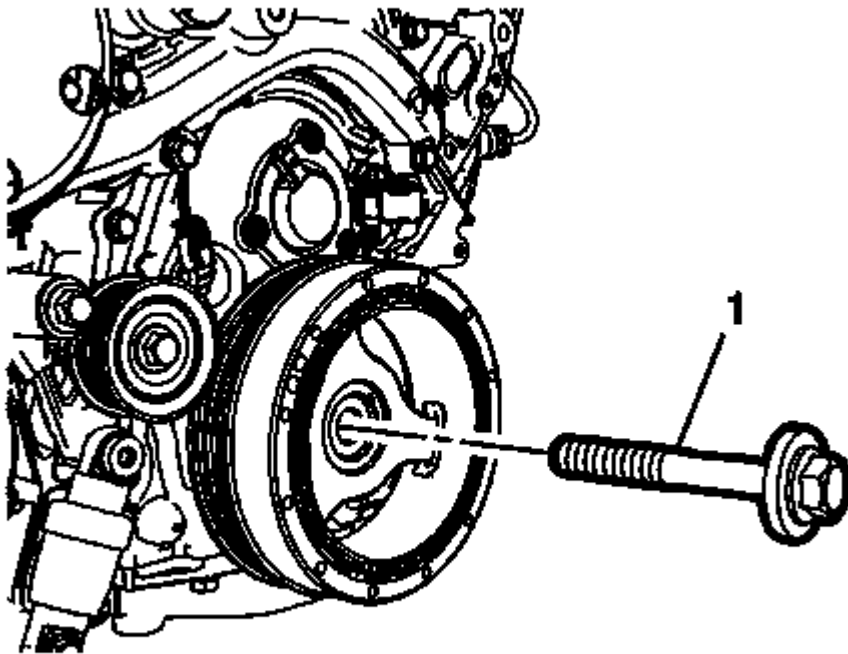


Fig. 110: Crankshaft Balancer Bolt
Courtesy of GENERAL MOTORS COMPANY

6. Remove the crankshaft balancer bolt (1).

Do not discard the crankshaft balancer bolt. The balancer bolt will be used during the balancer installation procedure.

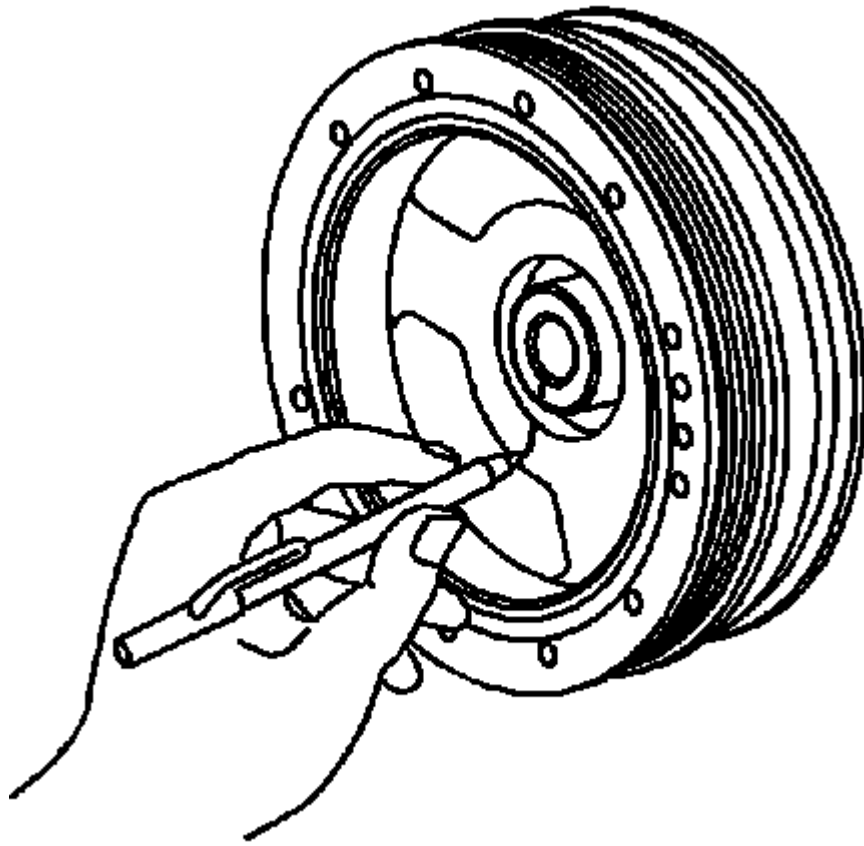


Fig. 111: Marking Crankshaft Balancer & End Of Crankshaft
Courtesy of GENERAL MOTORS COMPANY

7. Mark or scribe the crankshaft balancer and the end of the crankshaft.

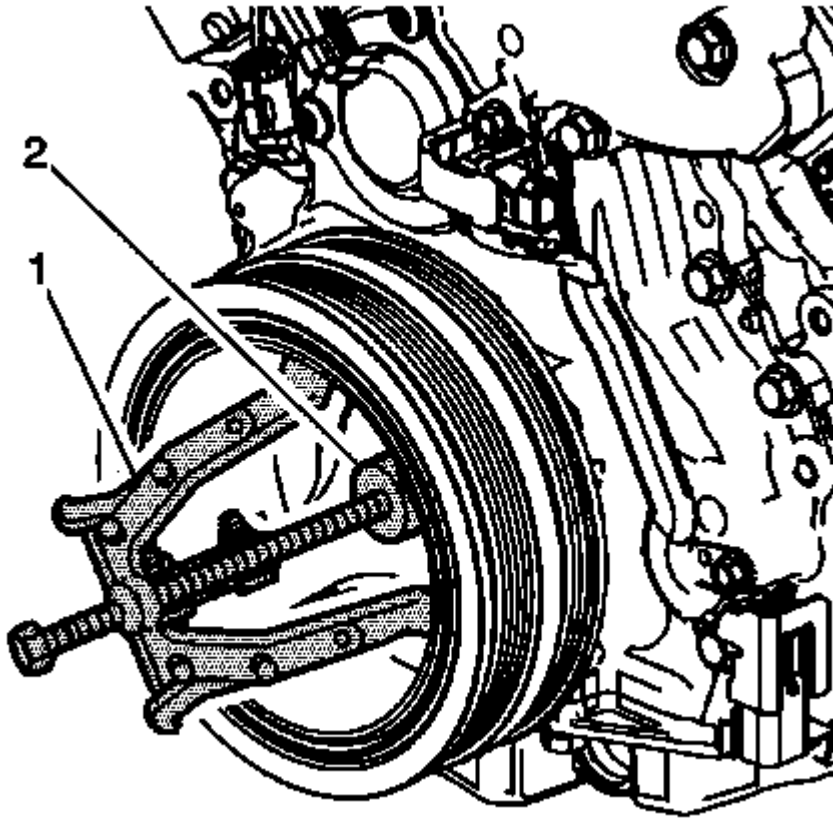


Fig. 112: J 41816 Crankshaft Balancer Remover And J 41816-2 Crankshaft End Protector
Courtesy of GENERAL MOTORS COMPANY

8. Use the **J 41816** crankshaft balancer remover (1) and the **J 41816-2** crankshaft end protector (2) in order to remove the crankshaft balancer.
9. Clean and inspect the crankshaft balancer. Refer to **Crankshaft Balancer Cleaning and Inspection** .

Installation Procedure

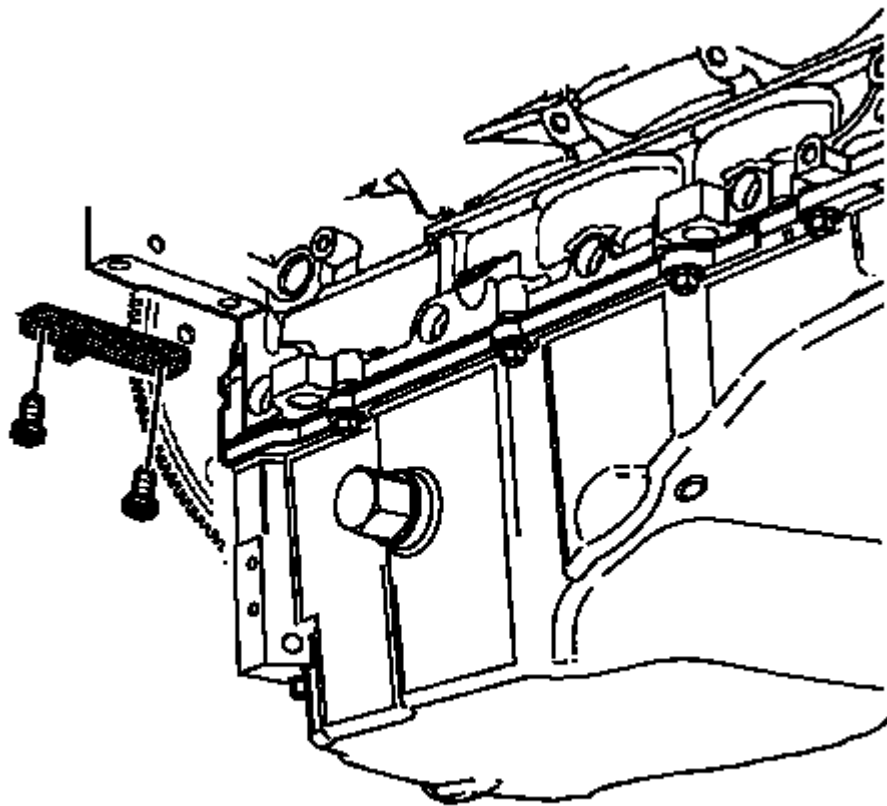


Fig. 113: Identifying J 42386-A
Courtesy of GENERAL MOTORS COMPANY

NOTE:

- The crankshaft balancer installation and bolt tightening involves a four stage tightening process. The first pass ensures that the balancer is installed completely onto the crankshaft. The second, third and fourth passes tighten the NEW bolt to the proper torque.
- The used crankshaft balancer bolt is used only during the first pass of the balancer installation procedure. Install a NEW crankshaft balancer bolt and tighten as described in the second, third and fourth passes of the balancer bolt tightening procedure.

1. Install the **J 42386-A** flywheel holding tool and bolts.

Use one M10 - 1.5 x 120 mm and one M10 - 1.5 x 45 mm bolt for proper tool operation. Tighten the **J 42386-A** flywheel holding tool bolts to 50 N.m (37 lb ft).

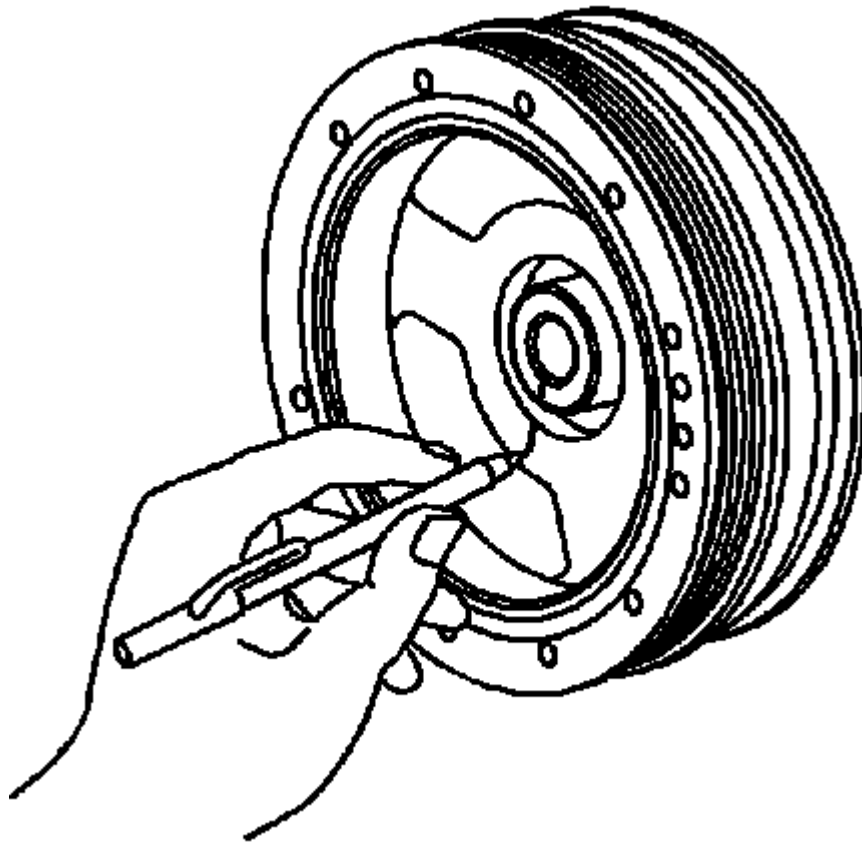


Fig. 114: Marking Crankshaft Balancer & End Of Crankshaft
Courtesy of GENERAL MOTORS COMPANY

2. Using the old balancer as a reference, mark or scribe the new balancer in the same location, if applicable.

NOTE: The balancer should be positioned onto the end of the crankshaft as straight as possible prior to tool installation.

3. Position the balancer onto the end of the crankshaft.

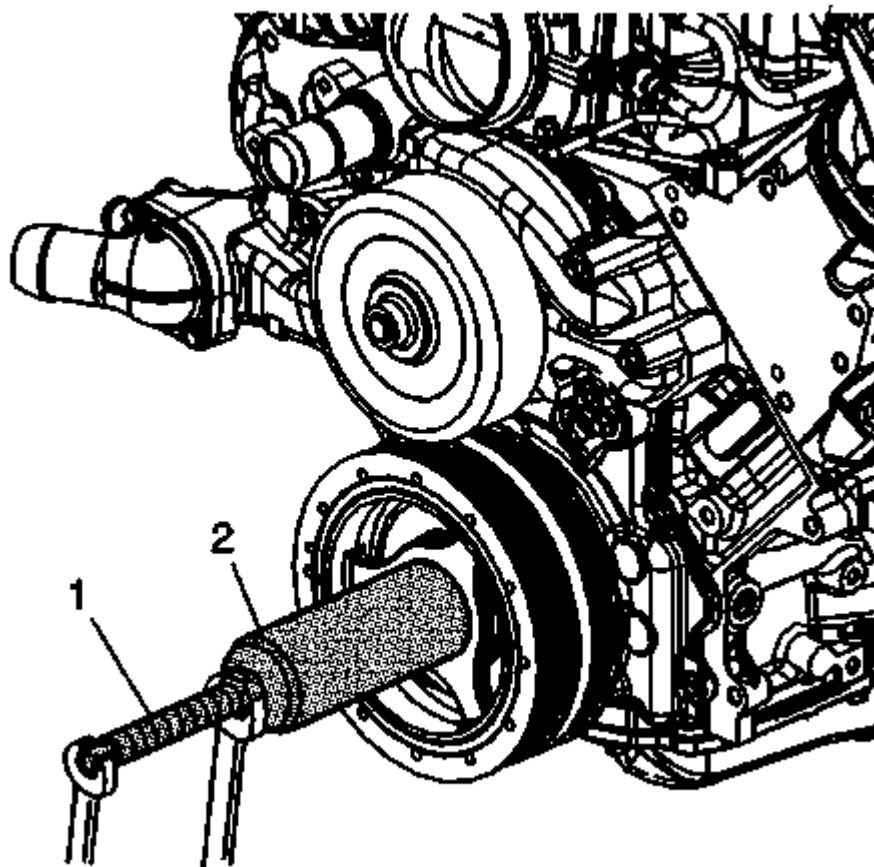


Fig. 115: Using Special Tools J 41665 & EN-47812 To Install Balancer
Courtesy of GENERAL MOTORS COMPANY

4. Use the **J 41665** crankshaft balancer and sprocket installer (2) and the **J 41478** crankshaft front oil seal installer (1) in order to install the balancer.
 1. Assemble the **J 41478** crankshaft front oil seal installer (1), nut, washer and the **J 41665** crankshaft balancer and sprocket installer (2).

Insert the smaller end of the **J 41665** crankshaft balancer and sprocket installer into the front of the balancer.

2. Use a wrench and hold the hex end of the **J 41478** crankshaft front oil seal installer.
3. Use a second wrench and rotate the installation tool nut clockwise until the balancer is started onto the crankshaft.
4. Remove the **J 41665** crankshaft balancer and sprocket installer and reverse the installation tool.

Position the larger end of the **J 41665** crankshaft balancer and sprocket installer against the front of the balancer.

5. Use a wrench and hold the end of the **J 41478** crankshaft front oil seal installer.

6. Use a second wrench and rotate the installation tool nut clockwise until the balancer is installed onto the crankshaft.
7. Remove the balancer installation tool.

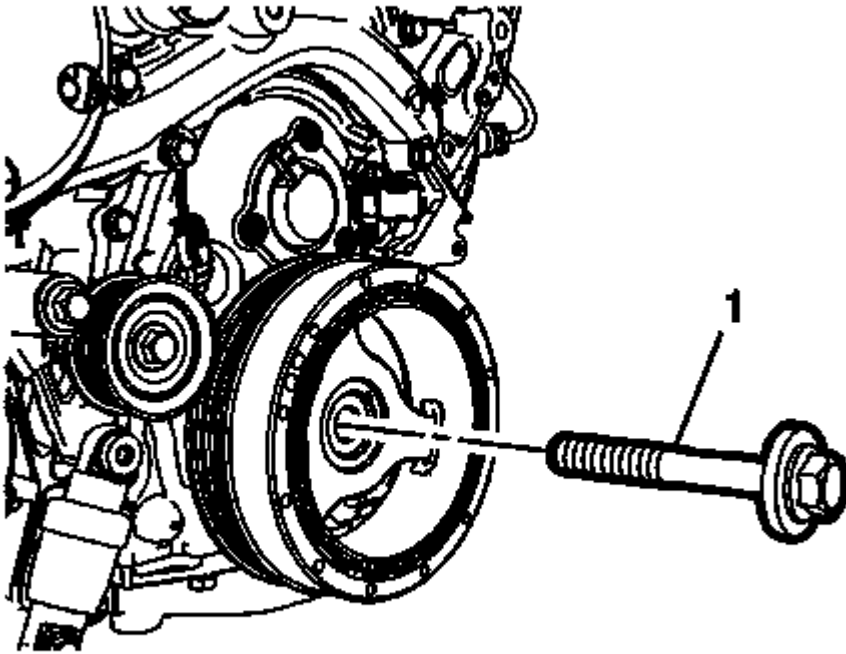


Fig. 116: Crankshaft Balancer Bolt
Courtesy of GENERAL MOTORS COMPANY

5. Install the used crankshaft balancer bolt (1) and tighten to 330 N.m (240 lb ft).
6. Remove the used crankshaft balancer bolt.

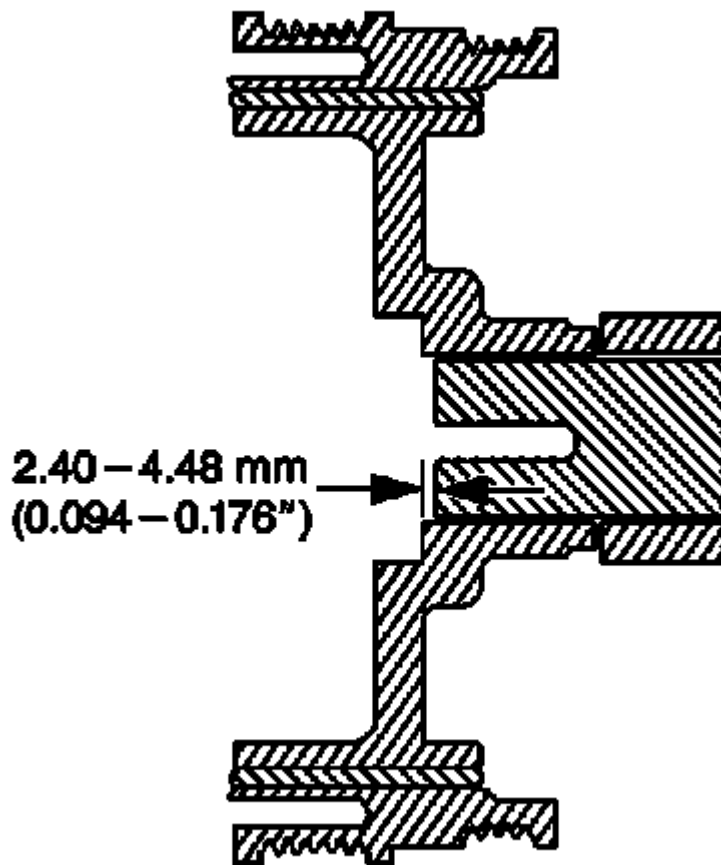


Fig. 117: Identifying Hub To Crankshaft Distance
Courtesy of GENERAL MOTORS COMPANY

NOTE: The nose of the crankshaft should be recessed 2.4-4.48 mm (0.094-0.176 in) into the balancer bore.

7. Measure for a correctly installed balancer.

If the balancer is not installed to the proper dimensions, install the **EN 47812** installer bolt and the **J 41665** crankshaft balancer and sprocket installer and repeat the installation procedure.

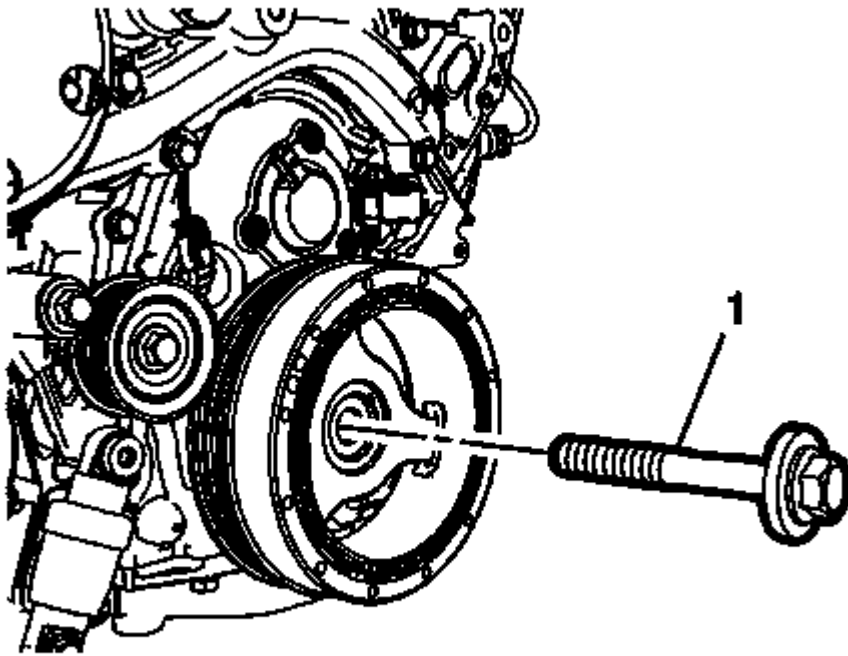


Fig. 118: Crankshaft Balancer Bolt
Courtesy of GENERAL MOTORS COMPANY

8. Install the NEW crankshaft balancer bolt (1).
 1. Tighten the crankshaft balancer bolt to 150 N.m (110 lb ft).
 2. Loosen the crankshaft balancer bolt 360 degrees.
 3. Tighten the crankshaft balancer bolt to 80 N.m (59 lb ft).
 4. Tighten the crankshaft balancer bolt a final pass to 200 degrees using the **J 45059** angle meter.
9. Remove the **J 42386-A** flywheel holding tool.
10. Install the starter motor. Refer to **Starter Replacement (LT1)** .
11. Install the electric belt drive rack and pinion steering gear. Refer to **Electric Belt Drive Rack and Pinion Steering Gear Replacement** .
12. Install the accessory drive belt. Refer to **Drive Belt Replacement - Accessory**.

CRANKSHAFT FRONT OIL SEAL REPLACEMENT

Special Tools

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

Removal Procedure

1. Remove the crankshaft balancer. Refer to **Crankshaft Balancer Replacement**.

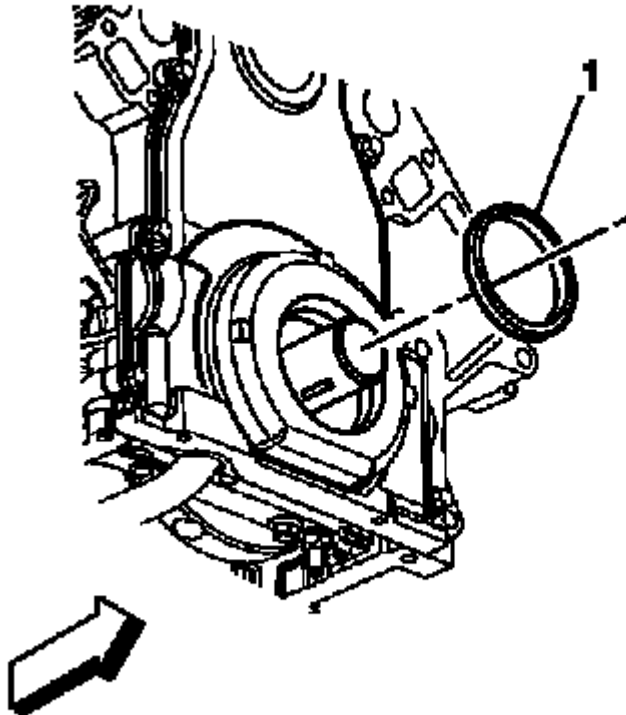


Fig. 119: Identifying Crankshaft Oil Seal
Courtesy of GENERAL MOTORS COMPANY

2. Gently pry the crankshaft oil seal (1) from the front cover.

Installation Procedure

IMPORTANT:

- Do not lubricate the oil seal sealing surface.
- Do not reuse the crankshaft oil seal.

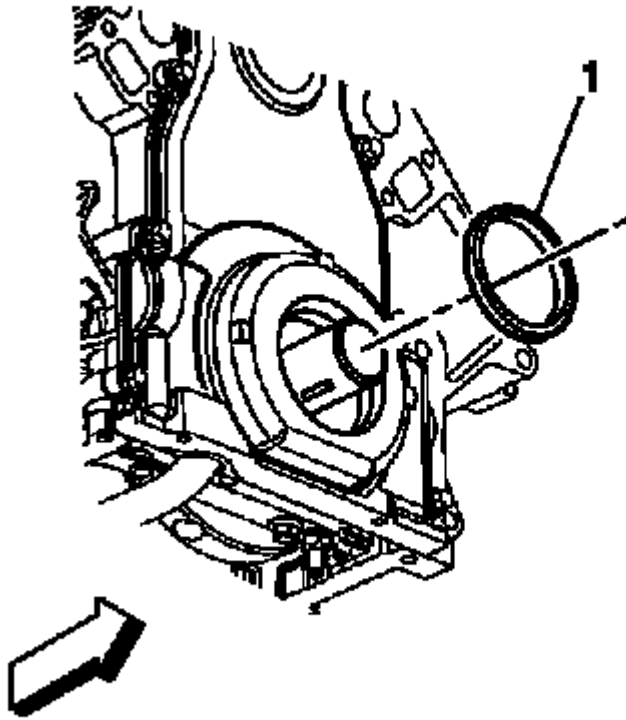


Fig. 120: Identifying Crankshaft Oil Seal
Courtesy of GENERAL MOTORS COMPANY

1. Lubricate the outer edge of the oil seal (1) with clean engine oil.
2. Lubricate the front cover oil seal bore with clean engine oil.

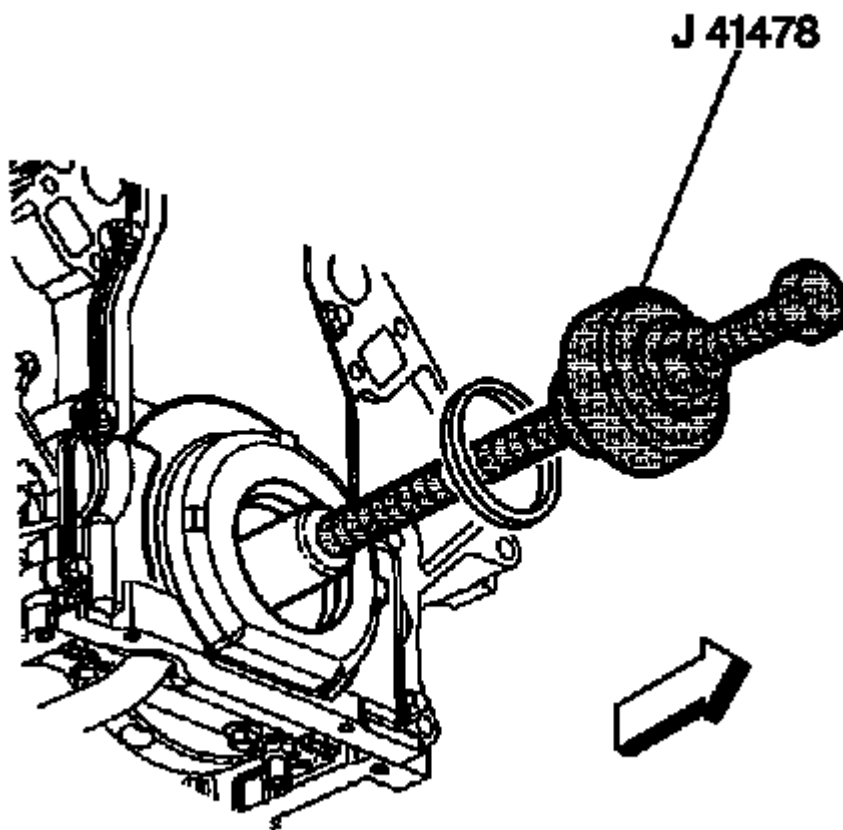


Fig. 121: Crankshaft Front Oil Seal And Installer Guide
Courtesy of GENERAL MOTORS COMPANY

3. Install the crankshaft front oil seal onto the **J 41478** crankshaft front oil seal installer guide.
4. Use the **J 41478** crankshaft front oil seal installer in order to install the oil seal into the cover bore.
 1. Use a wrench and hold the hex on the installer tool.
 2. Use a second wrench and rotate the installer nut clockwise until the seal bottoms in the cover bore.
 3. Remove the tool.
 4. Inspect the oil seal for proper installation. The oil seal should be installed evenly and completely into the front cover bore.
5. Install the crankshaft balancer. Refer to **Crankshaft Balancer Replacement**.

ENGINE FRONT COVER REPLACEMENT

Removal Procedure

1. Remove the oil pan. Refer to **Oil Pan Replacement (Without Z52 Option)**, **Oil Pan**

Replacement (With Z52 Option).

2. Remove the crankshaft balancer. Refer to **Crankshaft Balancer Replacement**.
3. Remove the engine coolant manifold. Refer to **Engine Coolant Manifold Replacement**.
4. Remove the A/C compressor. Refer to **Air Conditioning Compressor Replacement**.

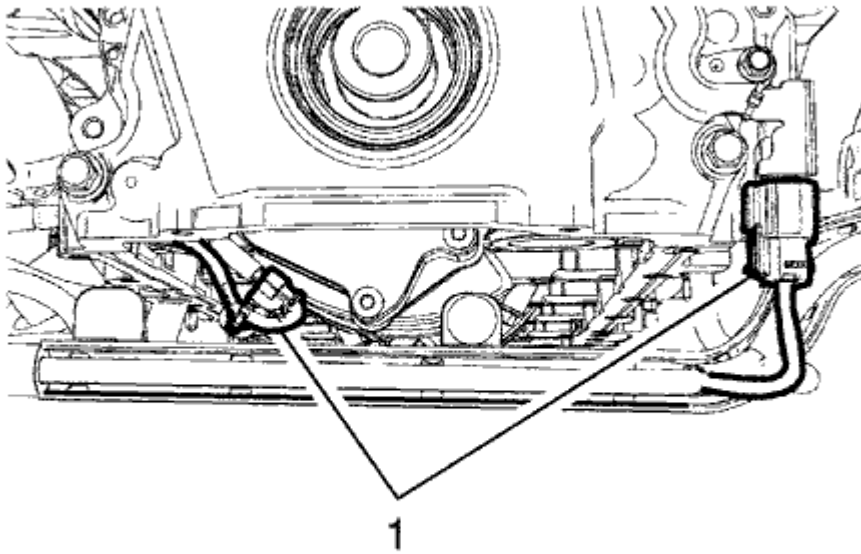


Fig. 122: Electrical Connectors
Courtesy of GENERAL MOTORS COMPANY

5. Disconnect the electrical connectors (1).

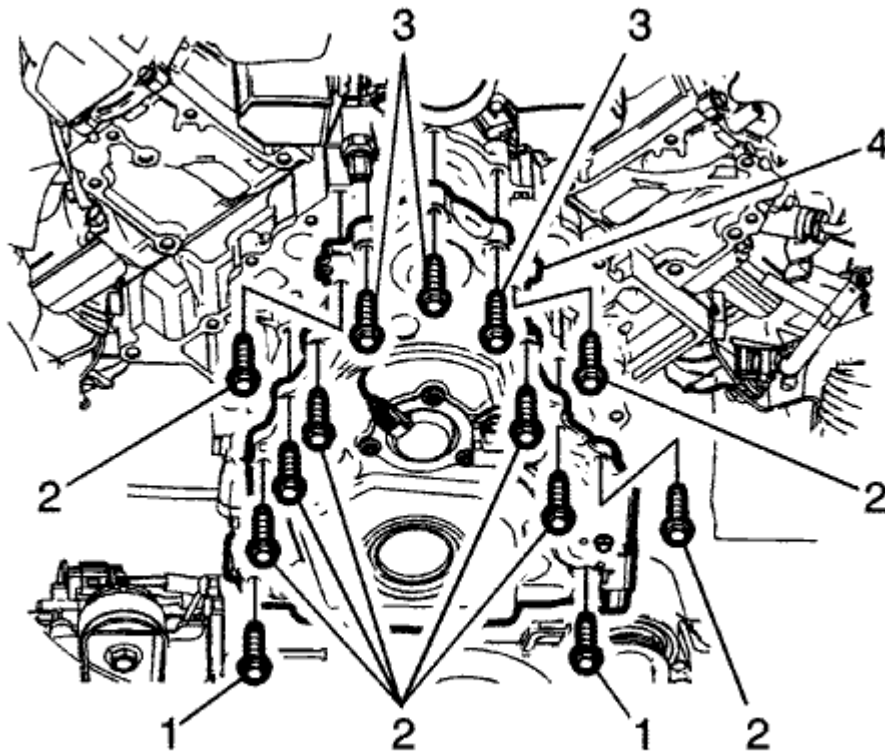


Fig. 123: Front Cover Bolts

Courtesy of GENERAL MOTORS COMPANY

6. Remove the front cover bolts (1-3).
7. Remove front cover (4).
8. Ensure to clean and inspect the engine front cover. Refer to **Engine Front Cover Cleaning and Inspection** .

Installation Procedure

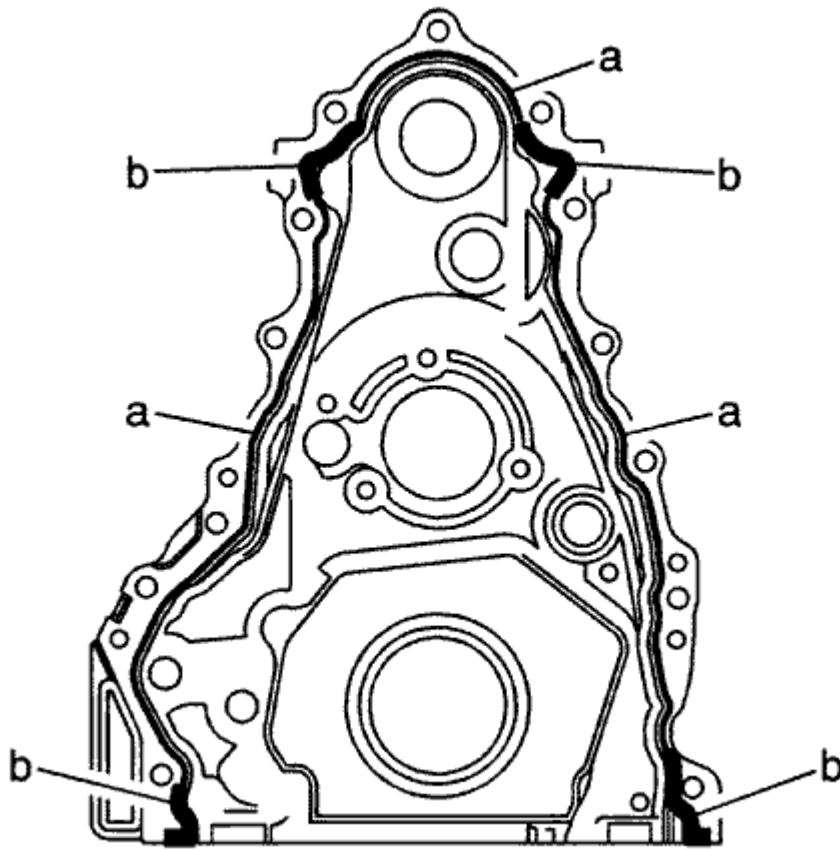


Fig. 124: Applying 3 mm (0.118 in) Bead Of RTV Sealant On Engine Front Cover
Courtesy of GENERAL MOTORS COMPANY

1. Apply a 3 mm (0.118 in) bead of RTV sealant on the engine front cover as shown (a). Apply a 5 mm (0.197 in) bead of RTV sealant on the engine front cover as shown (b). Refer to **Adhesives, Fluids, Lubricants and Sealers** .

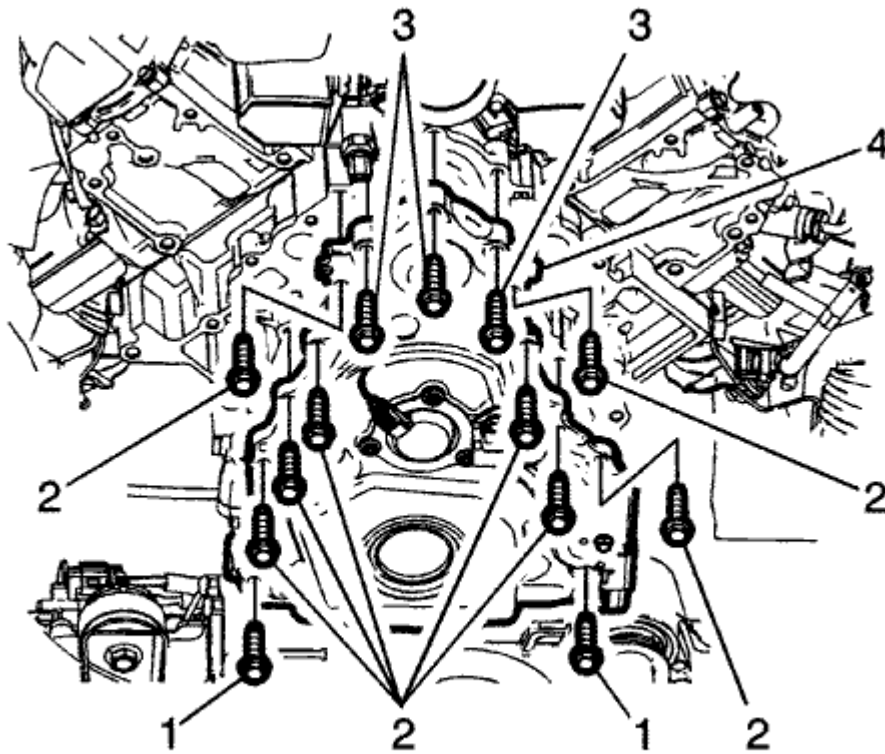


Fig. 125: Front Cover Bolts
Courtesy of GENERAL MOTORS COMPANY

2. Install the front cover (4).

CAUTION: Refer to Fastener Caution .

3. Install the front cover bolts (1-3) and tighten to 25 (18 lb ft).

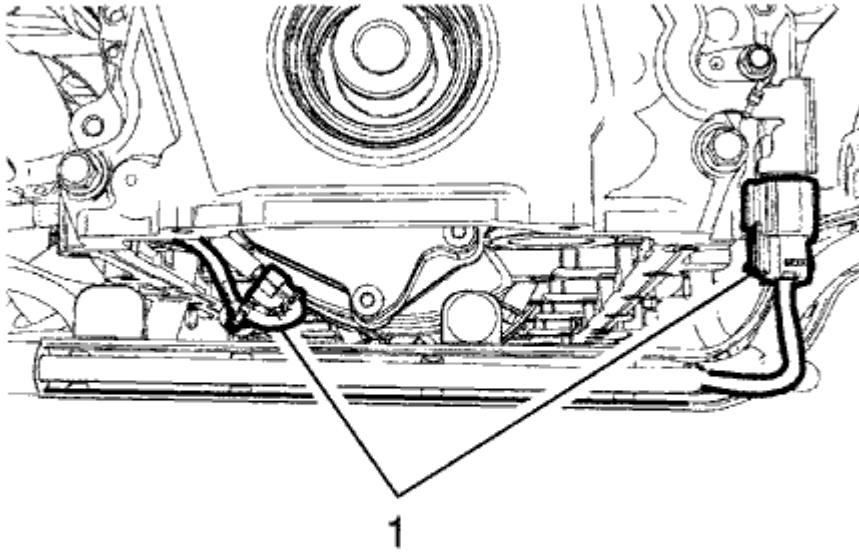


Fig. 126: Electrical Connectors
Courtesy of GENERAL MOTORS COMPANY

4. Connect the electrical connectors (1).
5. Install the engine coolant manifold. Refer to **Engine Coolant Manifold Replacement** .
6. Install the crankshaft balancer. Refer to **Crankshaft Balancer Replacement**.
7. Install the A/C compressor. Refer to **Air Conditioning Compressor Replacement** .
8. Install the oil pan. Refer to **Oil Pan Replacement (Without Z52 Option)**, **Oil Pan Replacement (With Z52 Option)**.

OIL PUMP REPLACEMENT

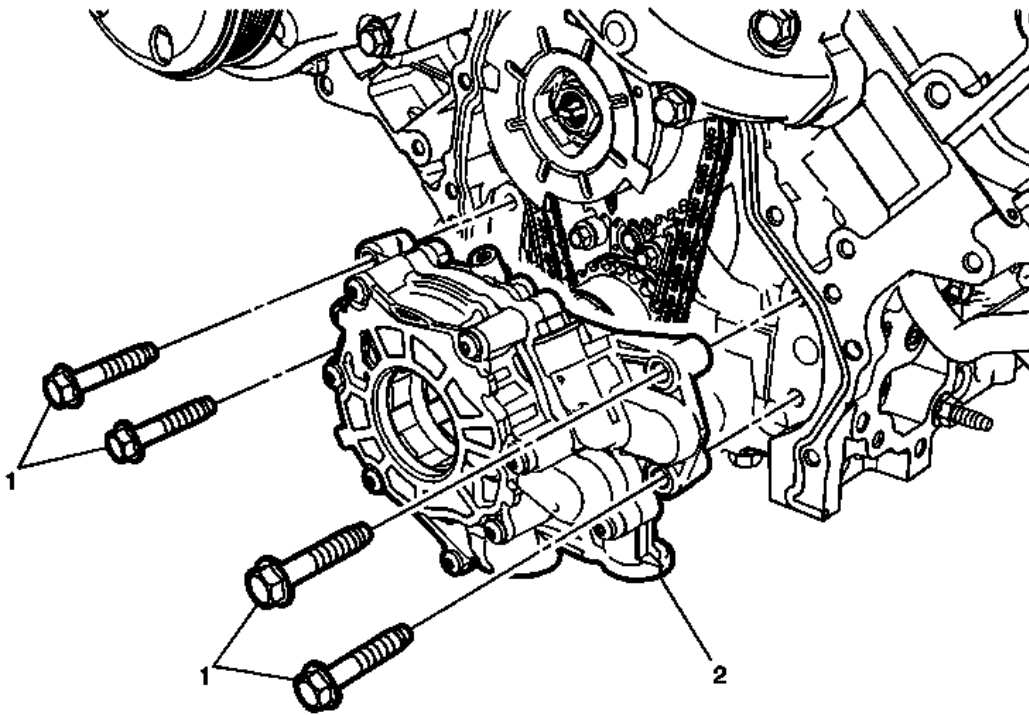


Fig. 127: Oil Pump
 Courtesy of GENERAL MOTORS COMPANY

Oil Pump Replacement

Callout	Component Name
Preliminary Procedure Remove the engine front cover. Refer to Engine Front Cover Replacement .	
1	Oil Pump Fastener (Qty: 4) CAUTION: Refer to Fastener Caution . Procedure For oil pump tighten sequence. Refer to Oil Pump Installation , Oil Pump Installation (with Z52 Option) . NOTE: Upward pressure must be applied to the oil pump while tightening the fasteners Tighten 25 (18 lb ft)
	Oil Pump

OIL PUMP SCREEN REPLACEMENT

Removal Procedure

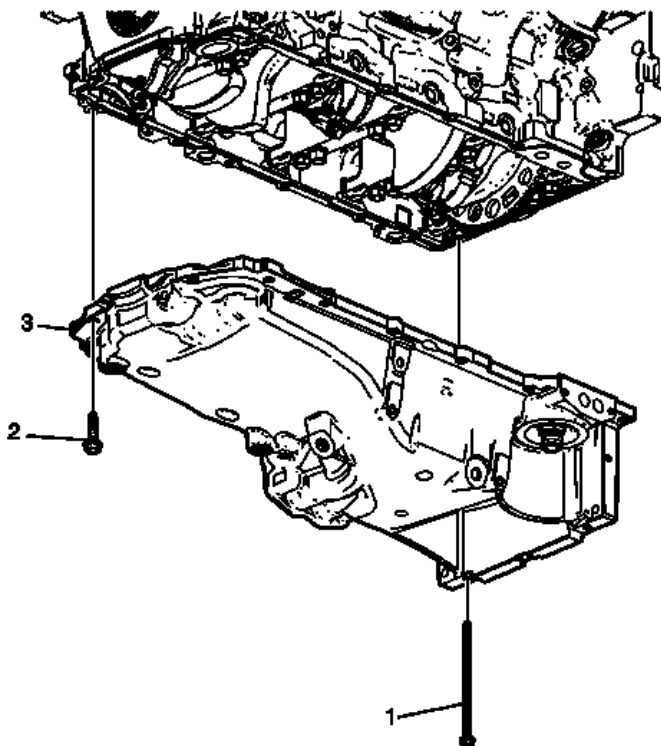


Fig. 128: Oil Pan

Courtesy of GENERAL MOTORS COMPANY

1. Remove the oil pan (3). Refer to **Oil Pan Replacement (Without Z52 Option)**, **Oil Pan Replacement (With Z52 Option)**.

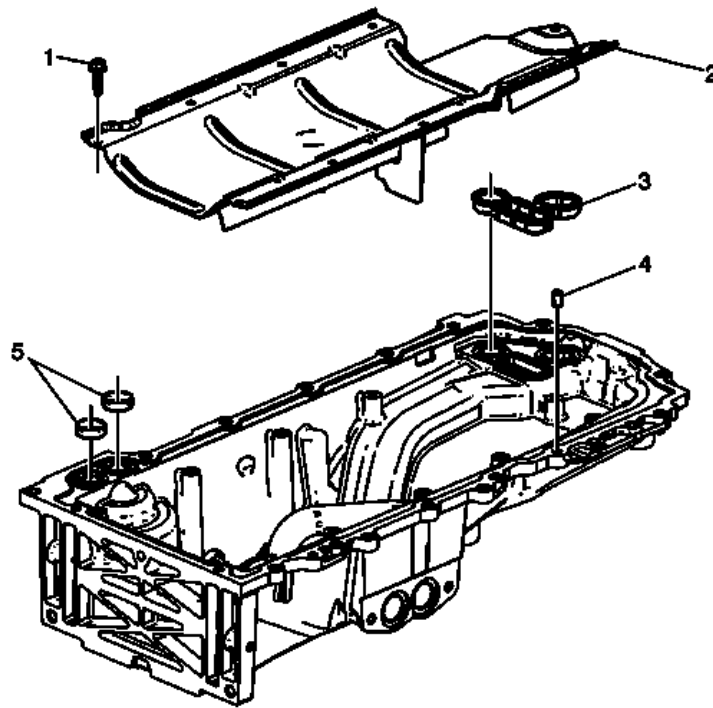


Fig. 129: Crankshaft Oil Deflector Bolts And Crankshaft Oil Deflector
Courtesy of GENERAL MOTORS COMPANY

2. Remove the crankshaft oil deflector bolts (1) and crankshaft oil deflector (2). Discard seals (3 and 5).

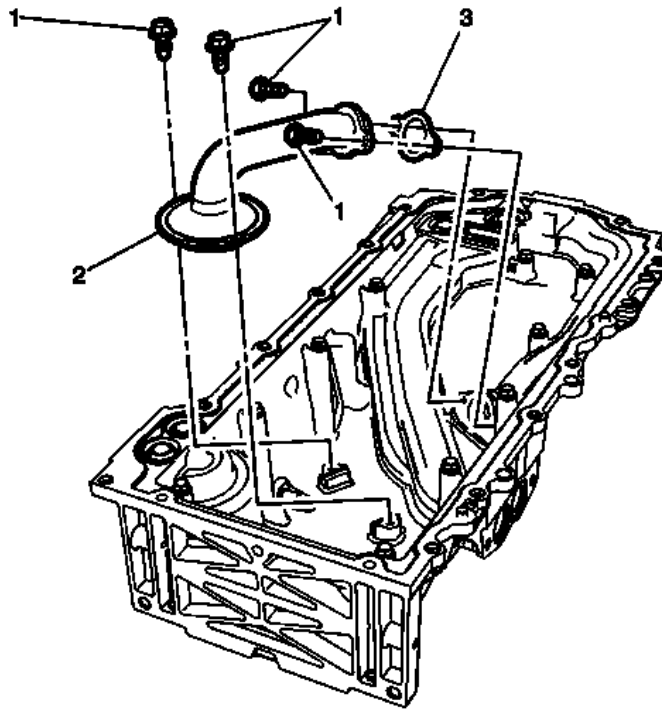


Fig. 130: Oil Pump Screen Bolts And Oil Pump Screen
Courtesy of GENERAL MOTORS COMPANY

3. Remove the oil pump screen bolts (1), the oil pump screen (2) and the oil pump screen gasket (3). Discard the gasket (3).
4. For cleaning and inspection. Refer to **Oil Pan Cleaning and Inspection** , **Oil Pan Cleaning and Inspection (with Z52 Option)** .

Installation Procedure

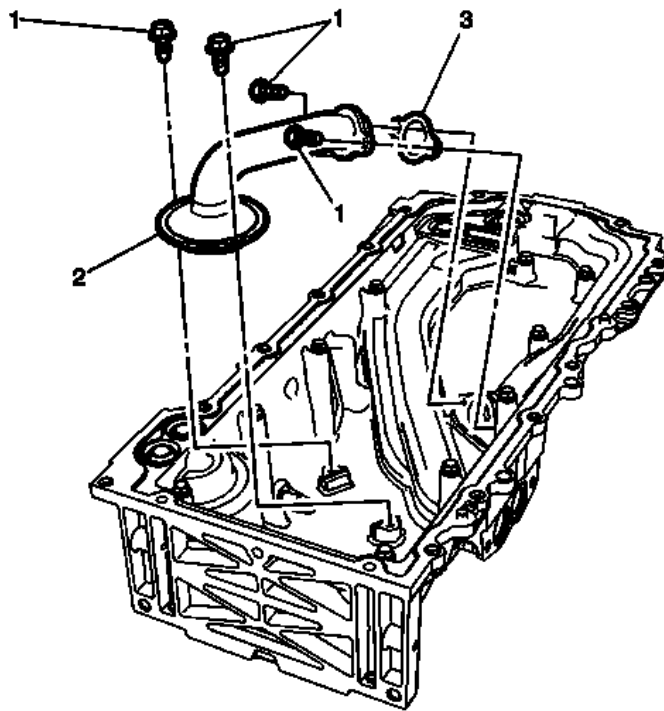


Fig. 131: Oil Pump Screen Bolts And Oil Pump Screen
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

1. Install NEW oil pump screen gasket (3), oil pump screen (2) and the oil pump screen bolts (1).

Tighten

Tighten the bolts to 10 N.m (89 lb in).

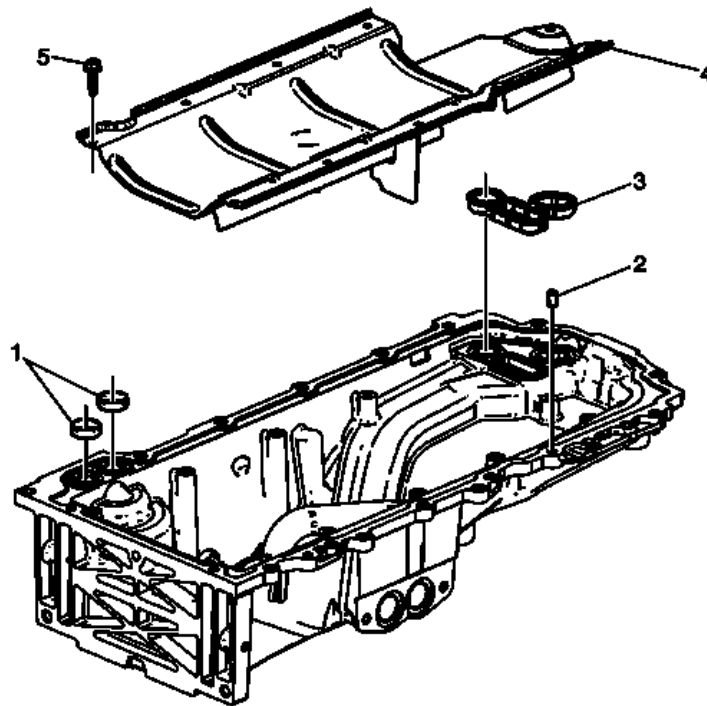


Fig. 132: Crankshaft Oil Deflector And Crankshaft Oil Deflector Bolts
Courtesy of GENERAL MOTORS COMPANY

2. Install NEW seals (1 and 3), the crankshaft oil deflector (4) and the crankshaft oil deflector bolts (5). Refer to Oil Pan Assemble , Oil Pan Assemble (with Z52 Option) .

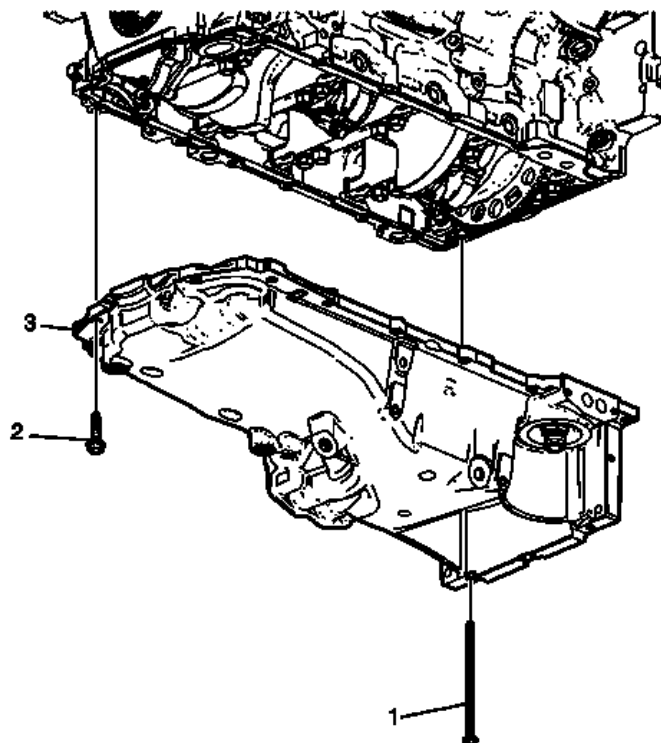


Fig. 133: Oil Pan
 Courtesy of GENERAL MOTORS COMPANY

3. Install the oil pan (3). Refer to Oil Pan Replacement (Without Z52 Option), Oil Pan Replacement (With Z52 Option).

OIL PUMP FLOW CONTROL SOLENOID VALVE REPLACEMENT

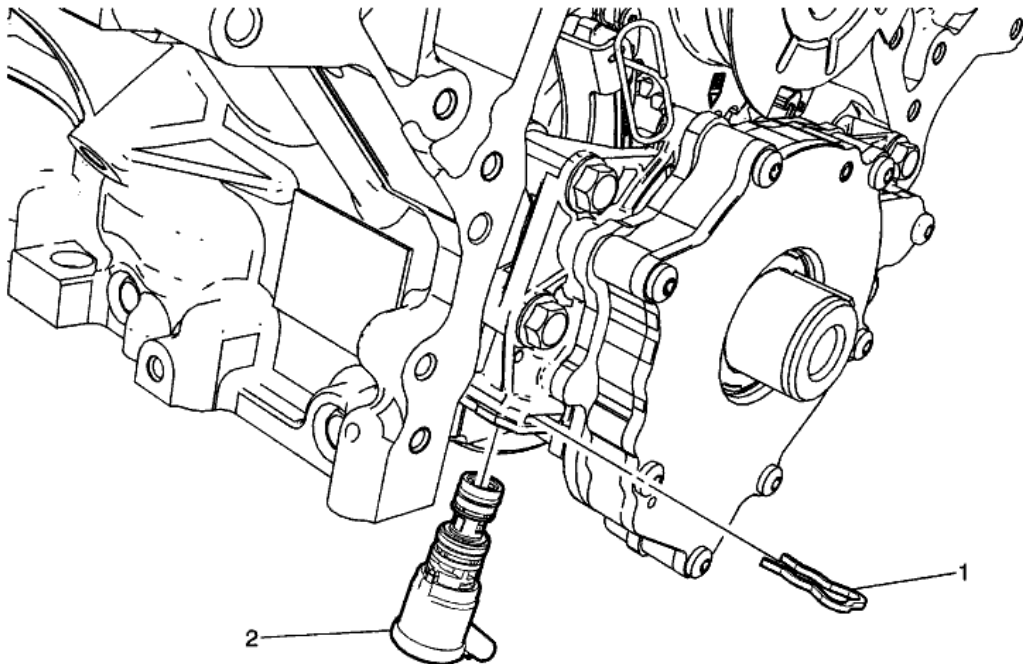


Fig. 134: Oil Pump Flow Control Solenoid Valve
 Courtesy of GENERAL MOTORS COMPANY

Oil Pump Flow Control Solenoid Valve Replacement

Callout	Component Name
Preliminary Procedure	
Remove the engine front cover. Refer to <u>Engine Front Cover Replacement</u> .	
1	Oil Pump Flow Control Solenoid Valve Clip
2	Oil Pump Flow Control Solenoid Valve

CAMSHAFT POSITION ACTUATOR SOLENOID VALVE REPLACEMENT

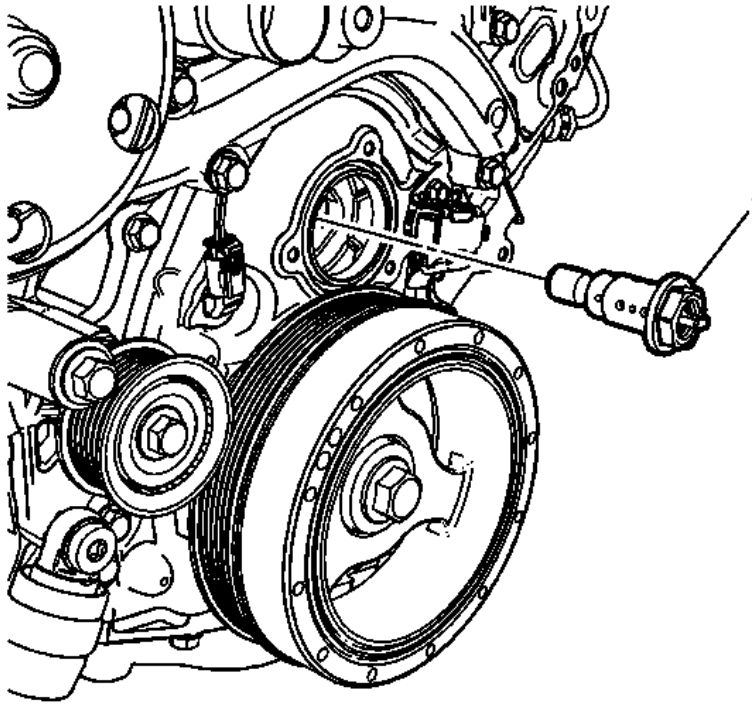


Fig. 135: Camshaft Position Actuator Solenoid Valve
 Courtesy of GENERAL MOTORS COMPANY

Camshaft Position Actuator Solenoid Valve Replacement

Callout	Component Name
Preliminary Procedure	
Remove the camshaft position actuator. Refer to Camshaft Position Actuator Replacement .	
1	Camshaft Position Actuator Solenoid Valve WARNING: Refer to Camshaft Position Actuator Removal and Installation Warning . CAUTION: Refer to Component Fastener Tightening Caution . CAUTION: The camshaft position actuator solenoid valves must be kept parallel to the engine front cover during removal and installation. The camshaft position actuator solenoid valves can be damaged if they become wedged or stuck during this process. Tighten

2. Final pass 90 degrees.

Special tools

J 45059 Angle Meter

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

CAMSHAFT POSITION ACTUATOR REPLACEMENT

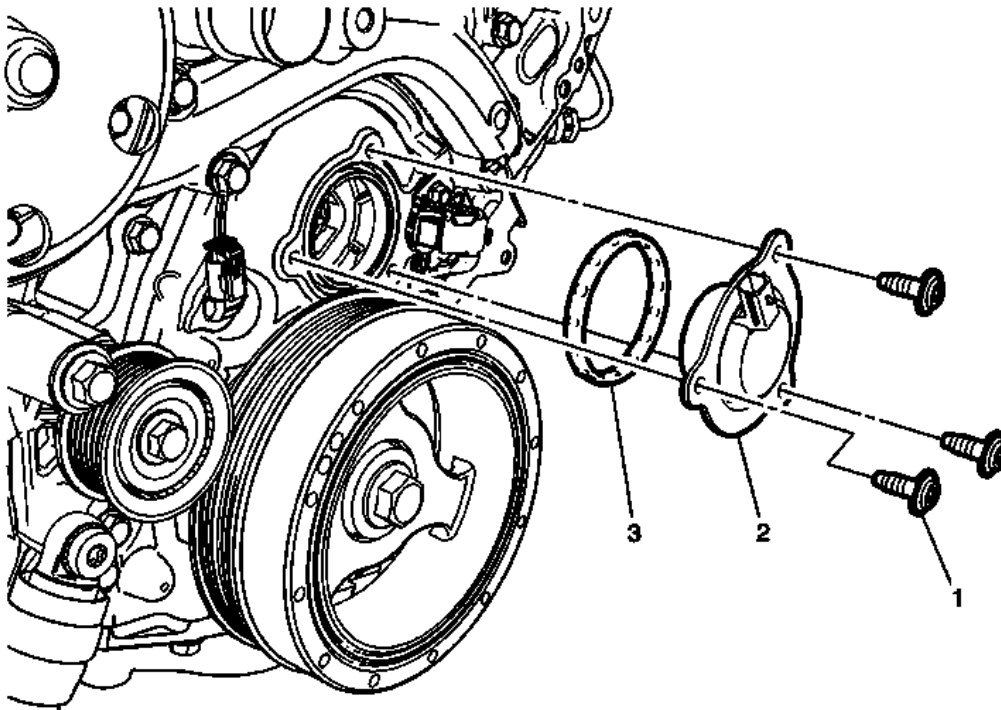


Fig. 136: Camshaft Position Actuator

Courtesy of GENERAL MOTORS COMPANY

Camshaft Position Actuator Replacement

Callout	Component Name
1	Camshaft Position Actuator Fasteners (Qty: 3) CAUTION: Refer to <u>Fastener Caution</u> . Tighten 10 (89 lb in)
2	Camshaft Position Actuator

	Unplug the camshaft position actuator electrical connector.
3	Camshaft Position Actuator Seal NOTE: Replace with NEW seal.

CRANKSHAFT REAR OIL SEAL REPLACEMENT

Special Tools

J-41479 Crankshaft Rear Oil Seal Installer

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

Removal Procedure

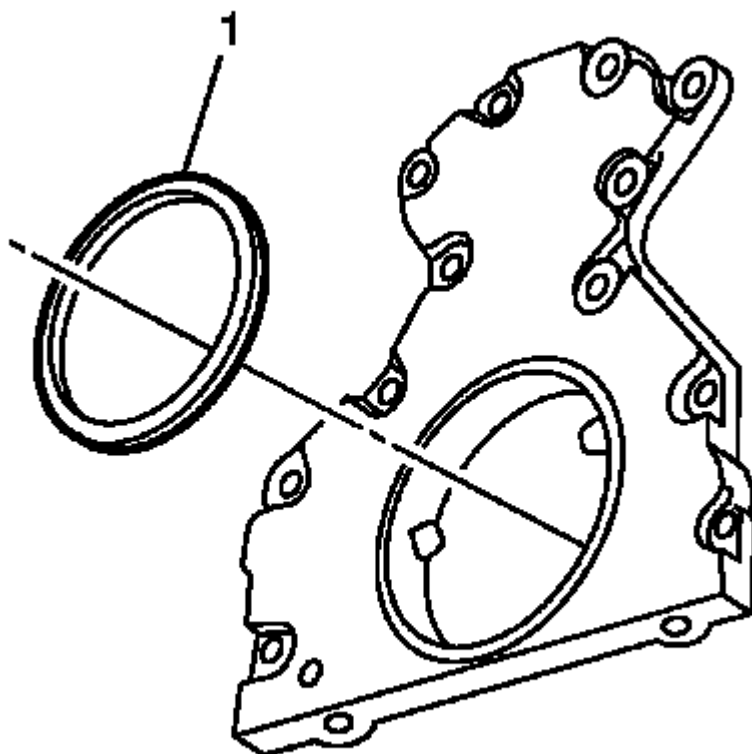


Fig. 137: View Of Crankshaft Rear Oil Seal
Courtesy of GENERAL MOTORS COMPANY

1. If equipped with a manual transmission, remove the engine flywheel. Refer to **Engine Flywheel Replacement**.

2. If equipped with a automatic transmission, remove the automatic transmission flex plate. Refer to **Automatic Transmission Flex Plate Replacement**.
3. Gently pry the crankshaft rear oil seal (1) from the rear cover.

Installation Procedure

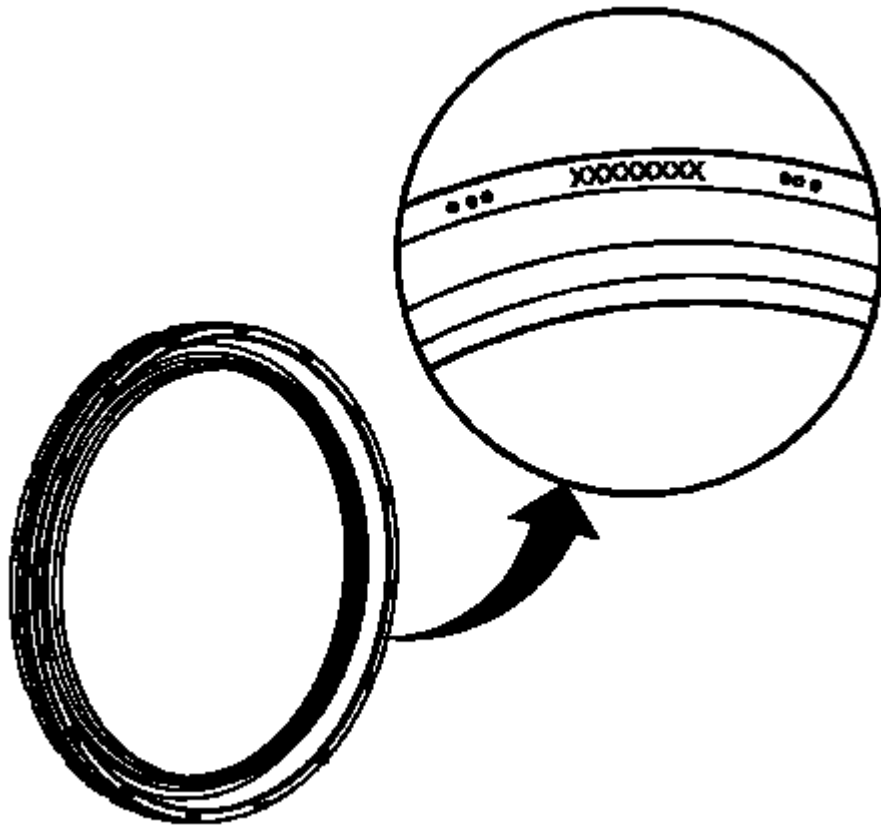


Fig. 138: Identifying Oil Seal

Courtesy of GENERAL MOTORS COMPANY

IMPORTANT: For proper orientation, note the installation direction of the oil seal. The oil seal is a reverse-lip design.

The part number is applied to the outside face of the seal, as shown.

1. Inspect the seal and identify the part number markings for proper orientation.

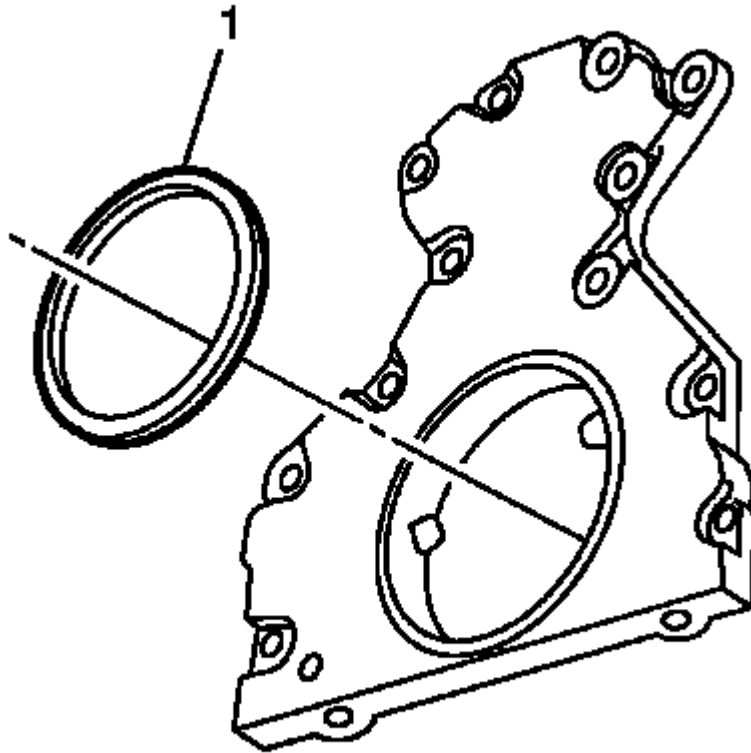


Fig. 139: View Of Crankshaft Rear Oil Seal
Courtesy of GENERAL MOTORS COMPANY

IMPORTANT:

- Do not lubricate the oil seal inside diameter (ID) of the crankshaft surface.
- Do not reuse the crankshaft rear oil seal.

2. Lubricate the outside diameter (OD) of the oil seal (1) with clean engine oil.

DO NOT allow oil or other lubricants to contact the seal surface.

3. Lubricate the rear cover oil seal bore with clean engine oil.

DO NOT allow oil or other lubricants to contact the crankshaft surface.

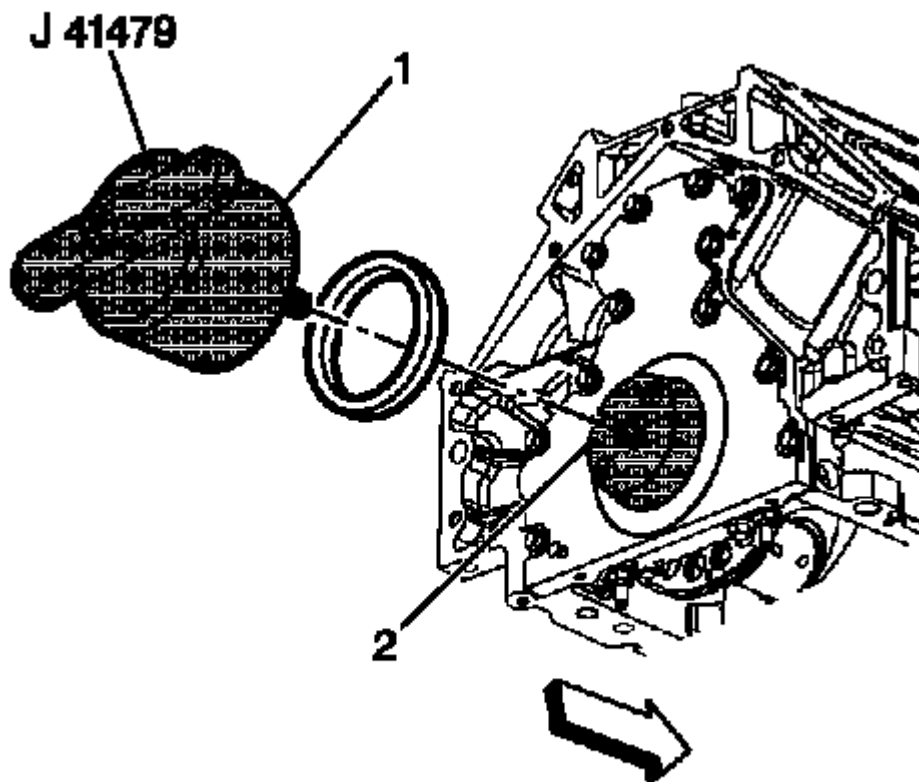


Fig. 140: Installing Crankshaft Rear Oil Seal Using J 41479
Courtesy of GENERAL MOTORS COMPANY

4. Install the **J-41479** crankshaft rear oil seal installer cone (2) and bolts onto the rear of the crankshaft.
5. Tighten the bolts until snug. Do not overtighten.
6. Install the rear oil seal onto the tapered cone (2) and push the seal to the rear cover bore.
7. Thread the **J-41479** crankshaft rear oil seal installer threaded rod into the tapered cone until the tool (1) contacts the oil seal.
8. Align the oil seal onto the tool (1).
9. Rotate the handle of the tool (1) clockwise until the seal enters the rear cover and bottoms into the cover bore.
10. Remove the **J-41479** crankshaft rear oil seal installer.
11. If equipped with a automatic transmission, Install the automatic transmission flex plate. Refer to **Automatic Transmission Flex Plate Replacement**.
12. If equipped with a manual transmission, install the engine flywheel. Refer to **Engine Flywheel Replacement**.

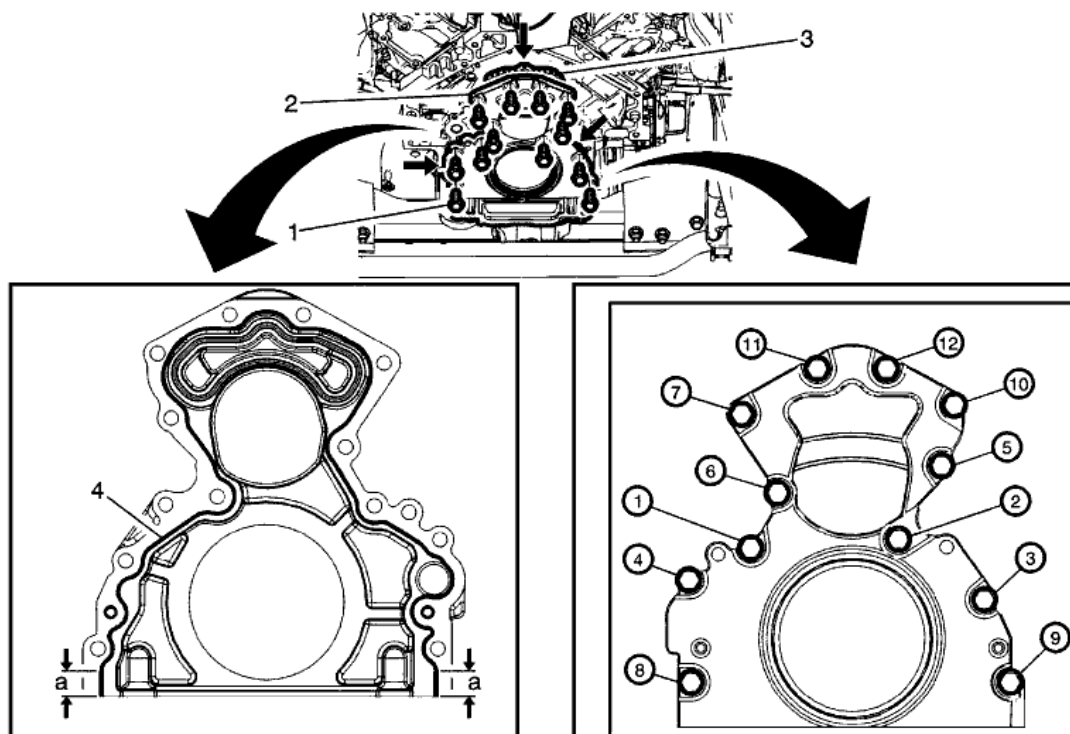


Fig. 141: Crankshaft Rear Oil Seal Housing
Courtesy of GENERAL MOTORS COMPANY

Crankshaft Rear Oil Seal Housing Replacement

Callout	Component Name
Preliminary Procedure 1. If equipped with a automatic transmission, remove the automatic transmission flex plate. Refer to <u>Automatic Transmission Flex Plate Replacement</u>. 2. If equipped with a manual transmission, remove the engine flywheel. Refer to <u>Engine Flywheel Replacement</u>.	
1	Crankshaft Rear Oil Seal Housing Fastener (Qty; 12) CAUTION: Refer to <u>Fastener Caution</u> . Tighten 25 (18 lb ft)
2	Crankshaft Rear Oil Seal Housing Procedure To separate the rear housing from the engine, pry at the points that are shown by the arrows.

3	Procedure 1. A NEW gasket must be used when installing the rear housing.
4	Procedure Apply a 3 mm (0.118 in) bead of RTV sealant on the engine rear cover as shown. Apply a 5 mm (0.197 in) bead of RTV sealant on the engine rear cover as shown. The 5 mm (0.197 in) bead must be applied only 10 mm (0.393 in) up from the bottom of the rear cover as shown (a). Refer to <u>Adhesives, Fluids, Lubricants and Sealers</u> .

OIL FILTER ADAPTER REPLACEMENT

Removal Procedure

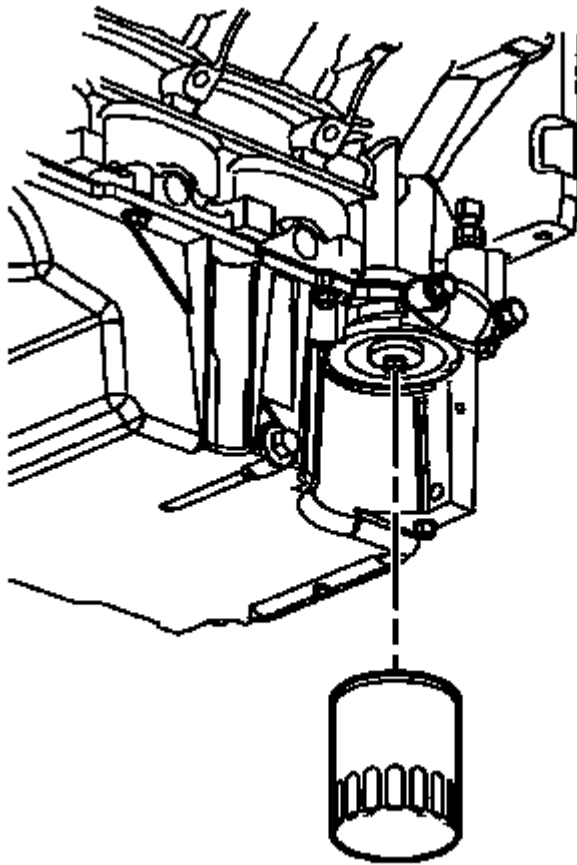


Fig. 142: Installing/Removing Oil Filter
Courtesy of GENERAL MOTORS COMPANY

1. Remove the oil filter.

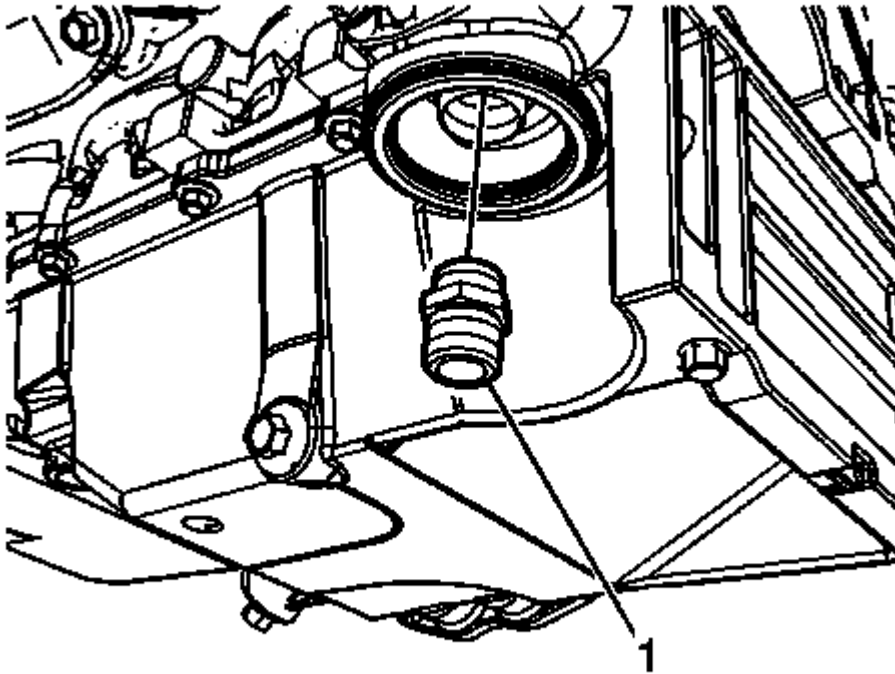


Fig. 143: Oil Filter Adapter
Courtesy of GENERAL MOTORS COMPANY

2. Remove the oil filter adapter (1).

Installation Procedure

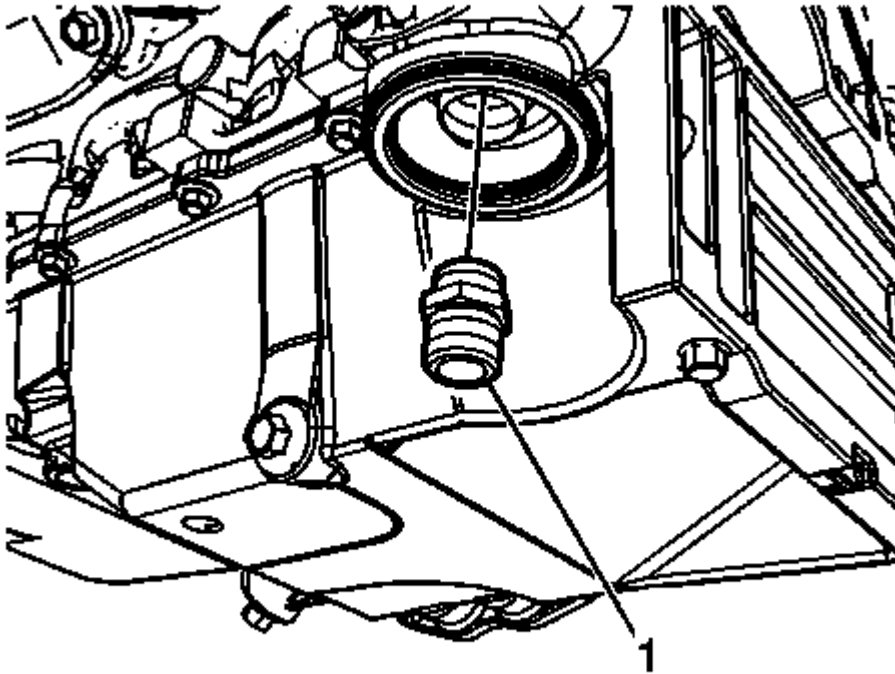


Fig. 144: Oil Filter Adapter

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

1. Install the oil filter adapter (1).

Tighten

Tighten the oil filter adapter to 55 N.m (40 lb ft).

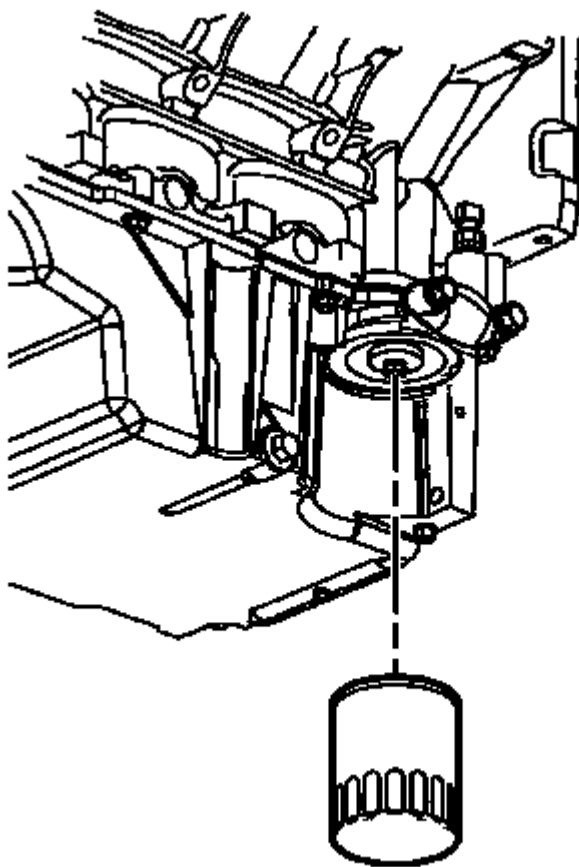


Fig. 145: Installing/Removing Oil Filter
Courtesy of GENERAL MOTORS COMPANY

2. Install the oil filter.

Tighten

Tighten the oil filter to 30 N.m (22 lb ft).

OIL PAN REPLACEMENT (WITHOUT Z52 OPTION)

Removal Procedure

1. Remove the oil level indicator tube. Refer to **Oil Level Indicator Tube Replacement.**

NOTE: It is not necessary to remove the transverse spring or steering gear intermediate shaft from the cradle.

NOTE: It is not necessary to remove the stabilizer shaft, only to disconnect the links.

2. Remove the front cradle. Refer to **Front Cradle Replacement** .

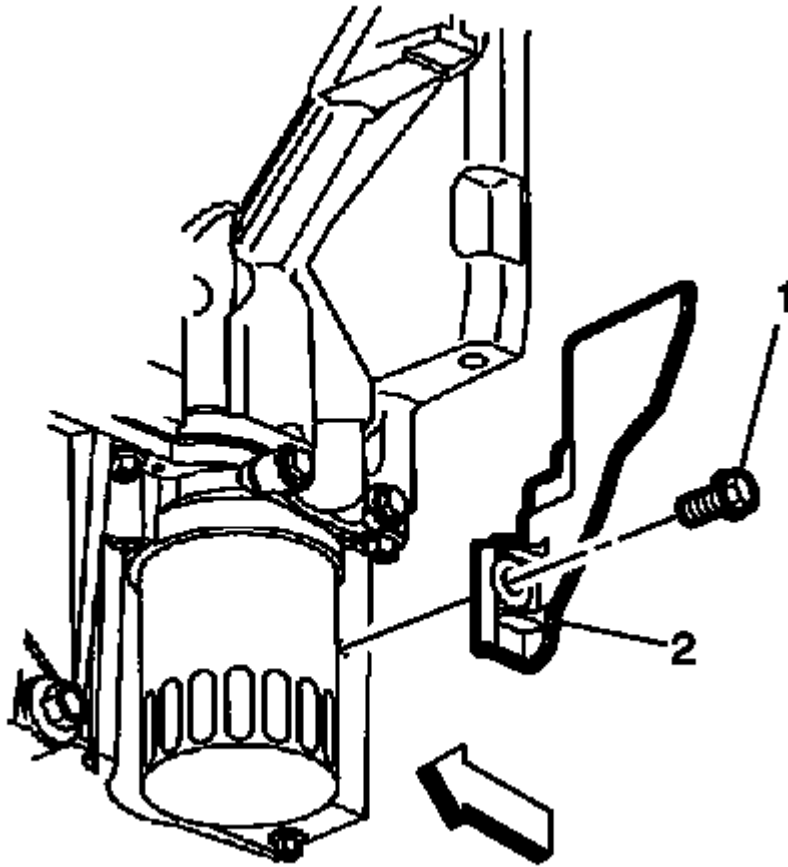


Fig. 146: View Of Left Closeout Cover & Bolt
Courtesy of GENERAL MOTORS COMPANY

3. Remove the bolt (1) and the left rear transmission cover (2).
4. Remove the oil filter. Refer to **Engine Oil and Oil Filter Replacement (With Z52 Option)**, **Engine Oil and Oil Filter Replacement (Without Z52 Option)**.
5. Remove the starter motor assembly. Refer to **Starter Replacement (LT1)** .
6. Remove the engine oil cooler adapter. Refer to **Engine Oil Cooler Adapter Replacement** .

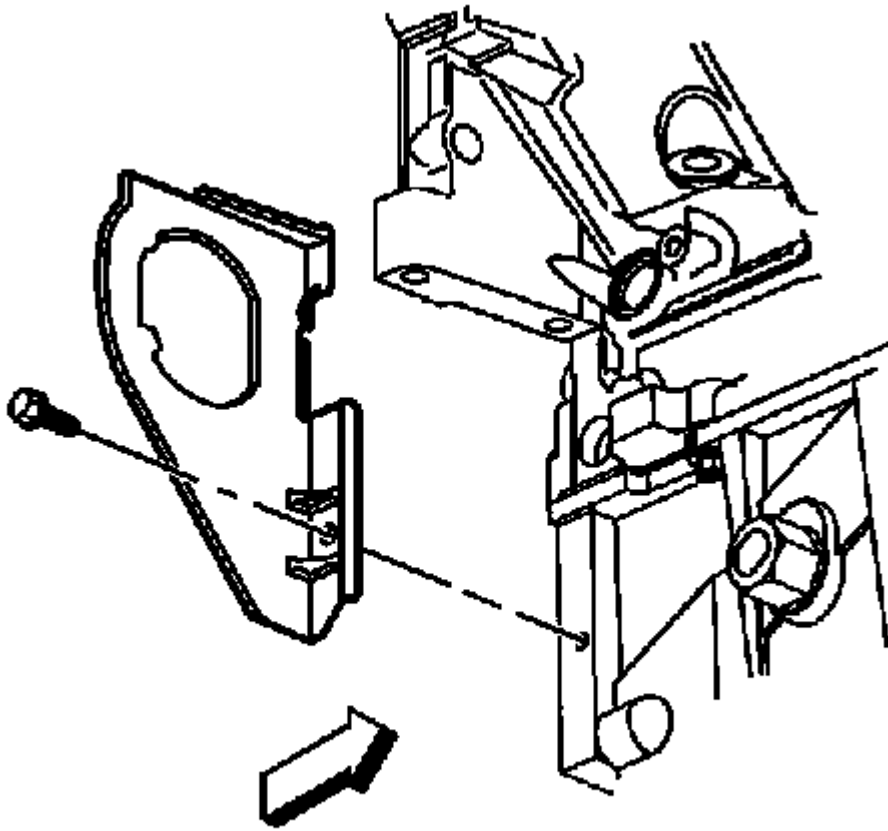


Fig. 147: View Of Right Closeout Cover & Bolt
Courtesy of GENERAL MOTORS COMPANY

7. Remove the bolt and right transmission cover.

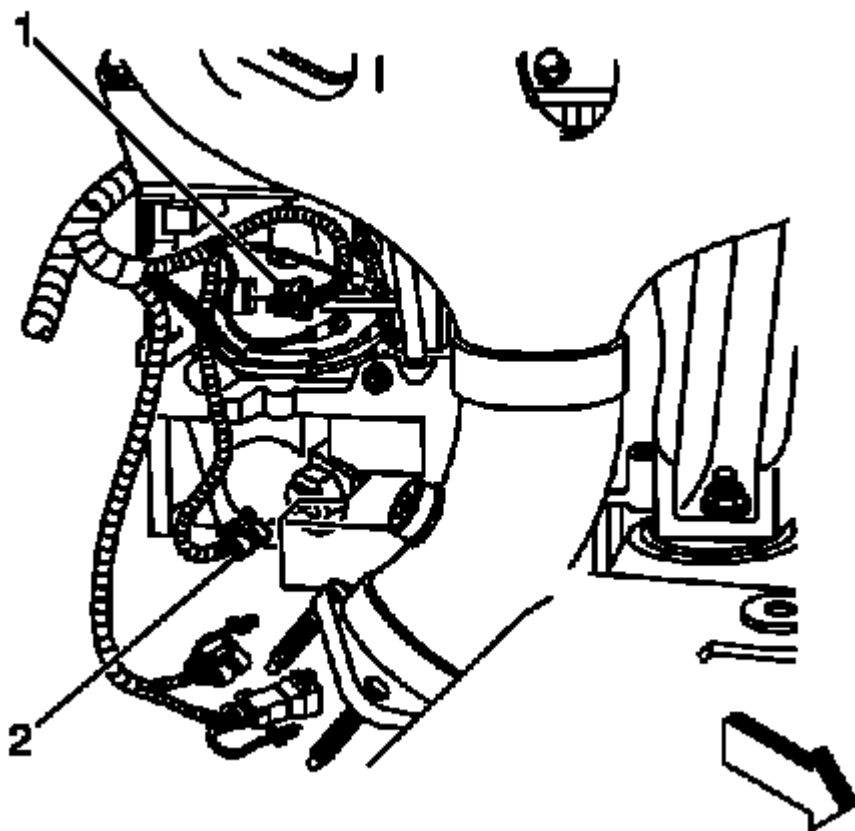


Fig. 148: Engine Oil Level Sensor Electrical Connector & CKP Sensor Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

8. Disconnect the engine oil level sensor electrical connector (2).

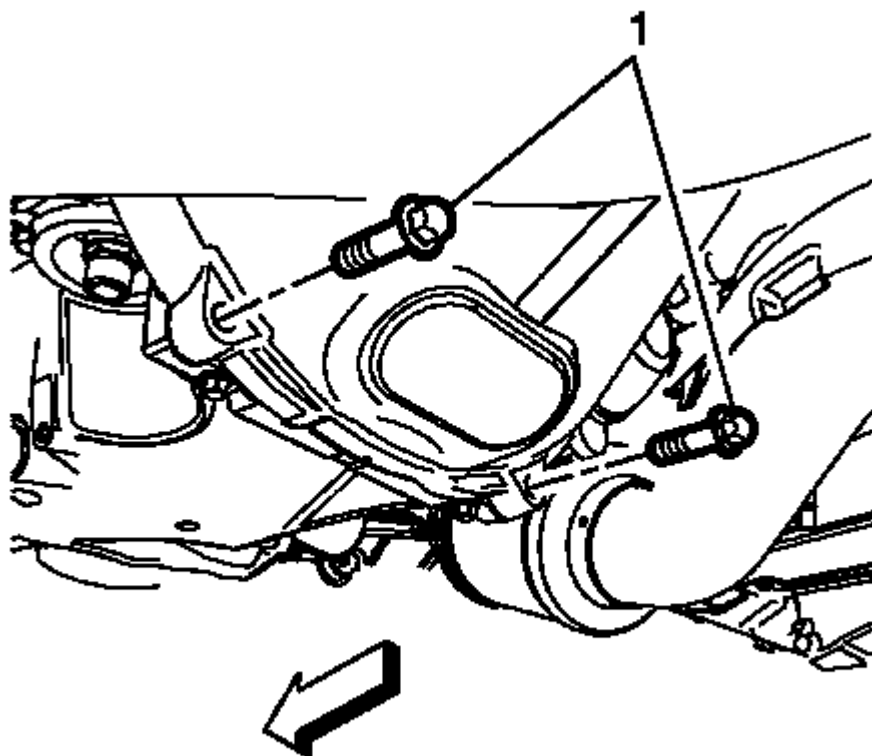


Fig. 149: Removing Bolts From Bell Housing To Oil Pan
Courtesy of GENERAL MOTORS COMPANY

9. Remove the bolts from the bell housing to the oil pan (1).

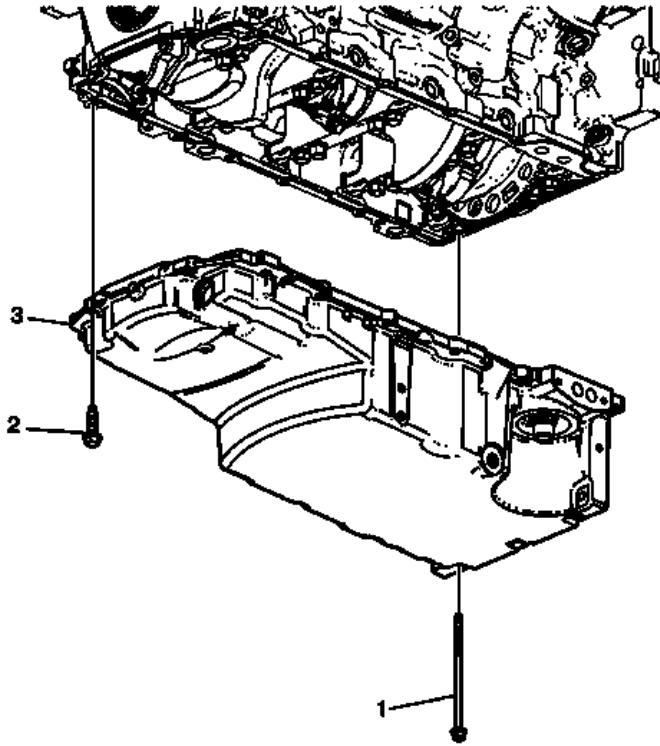


Fig. 150: Oil Pan Bolts

Courtesy of GENERAL MOTORS COMPANY

10. Remove the oil pan bolts (1 and 2).
11. Remove the oil pan (3) from the engine block.
12. For oil pan disassemble, refer to **Oil Pan Disassemble** , **Oil Pan Disassemble (with Z52 Option)** .
13. For cleaning and inspection, refer to **Oil Pan Cleaning and Inspection** , **Oil Pan Cleaning and Inspection (with Z52 Option)** .

Installation Procedure

1. For oil pan assemble, refer to **Oil Pan Assemble** , **Oil Pan Assemble (with Z52 Option)** .

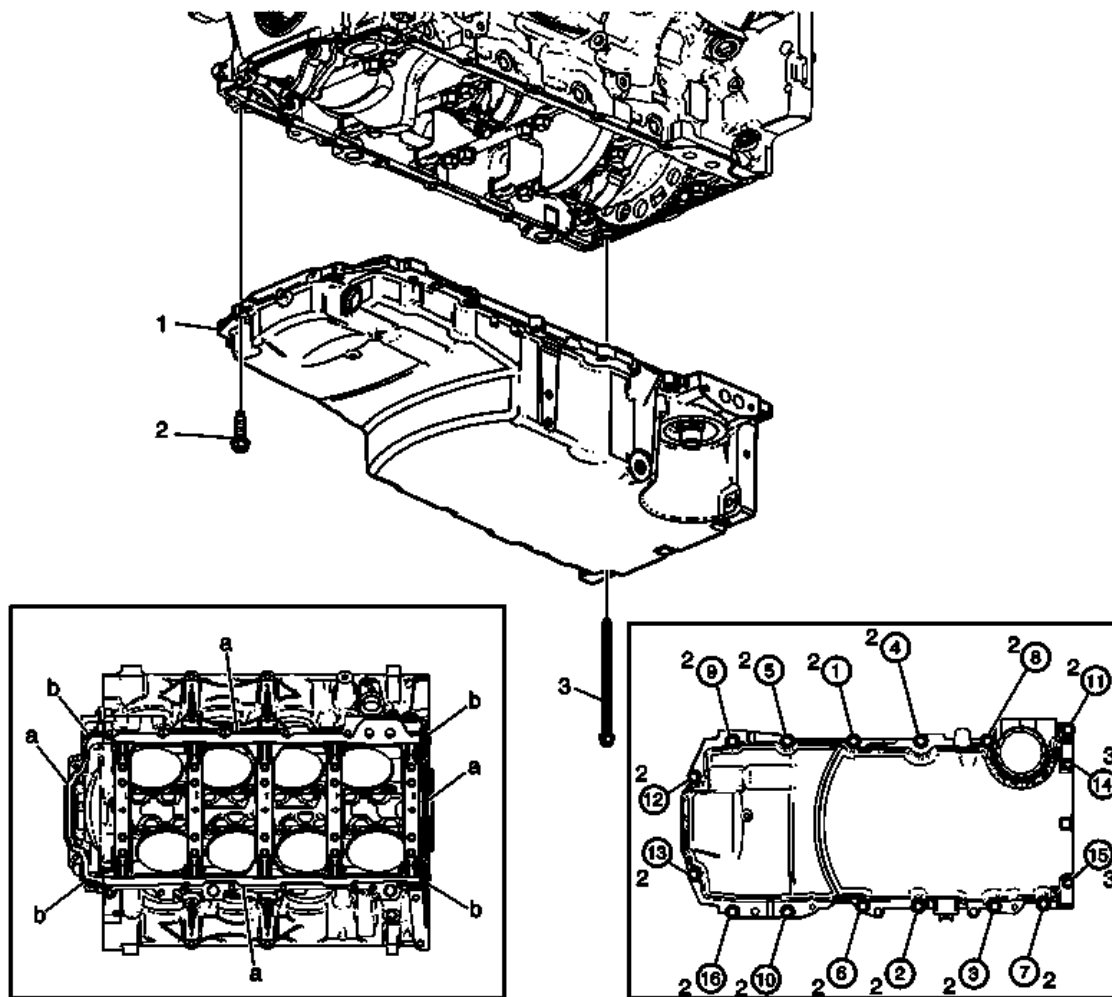


Fig. 151: Applying 3 mm (0.118 in) Bead Of RTV Sealant On Engine Front Cover
Courtesy of GENERAL MOTORS COMPANY

2. Apply a **3 mm (0.118 in)** bead of RTV sealant on the engine front cover as shown (a). Refer to **Adhesives, Fluids, Lubricants and Sealers** .
3. Apply a **5 mm (0.197 in)** bead of RTV sealant on the engine front cover as shown (b).
4. Position the oil pan in place on the engine block.

CAUTION: Refer to Fastener Caution .

5. Install the mounting bolts (2 and 3) for the oil pan assembly.

Tighten

1. Tighten the oil pan mounting bolts (2) M6 to 12 N.m (106 lb in).
2. Tighten the oil pan mounting bolts (3) M8 to 25 N.m (18 lb ft).

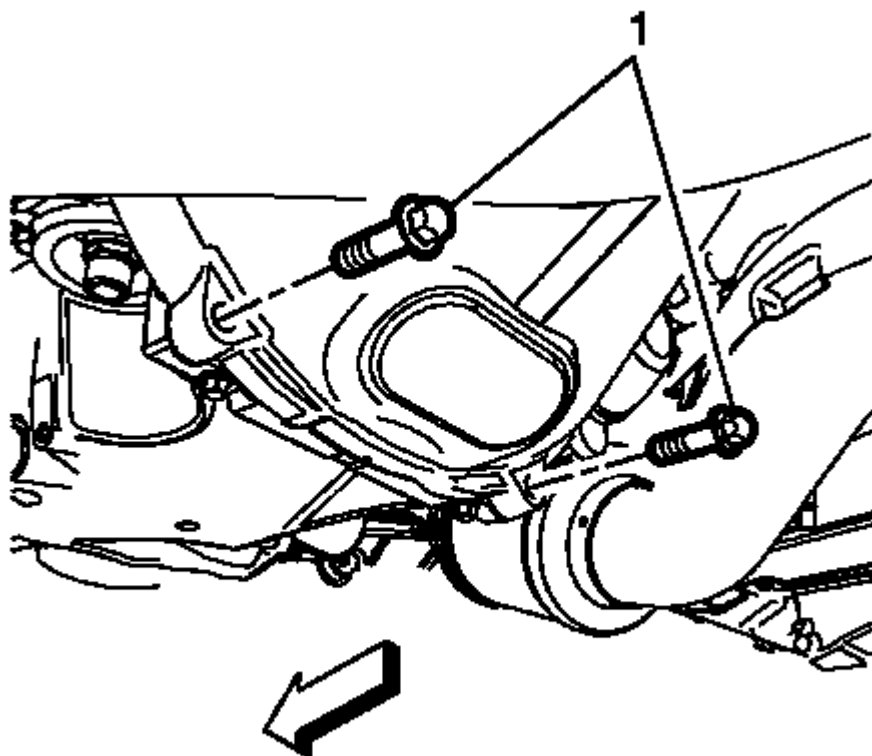


Fig. 152: Removing Bolts From Bell Housing To Oil Pan
Courtesy of GENERAL MOTORS COMPANY

6. Install the bell housing to oil pan bolts (1). Tighten the bolts to 50 N.m (37 lb ft).

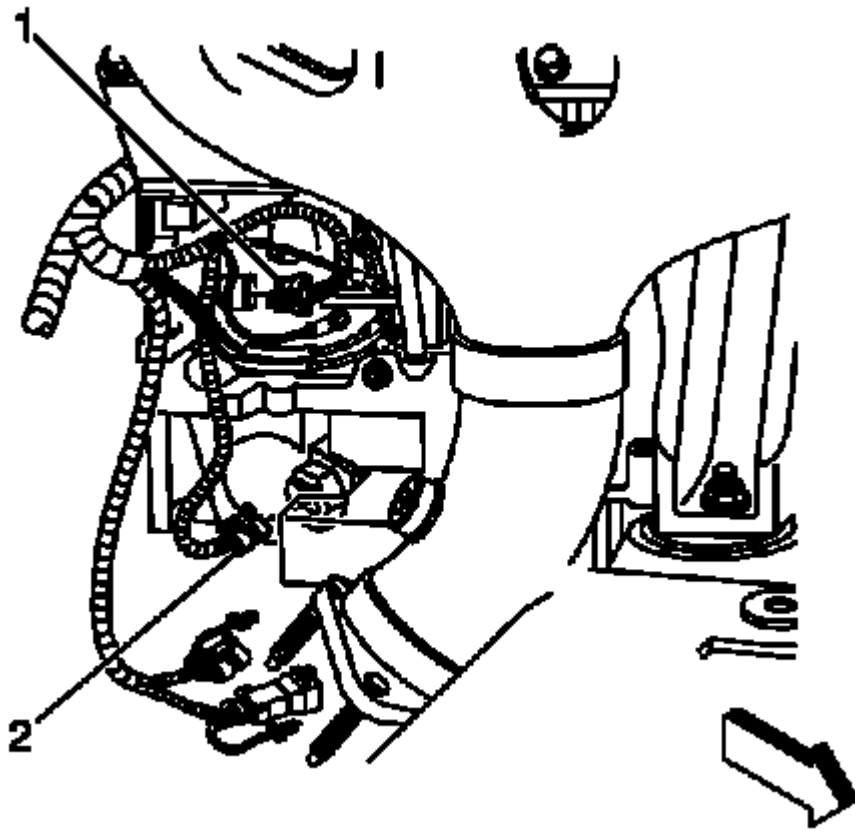


Fig. 153: Engine Oil Level Sensor Electrical Connector & CKP Sensor Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

7. Connect the engine oil level sensor electrical connector (2).

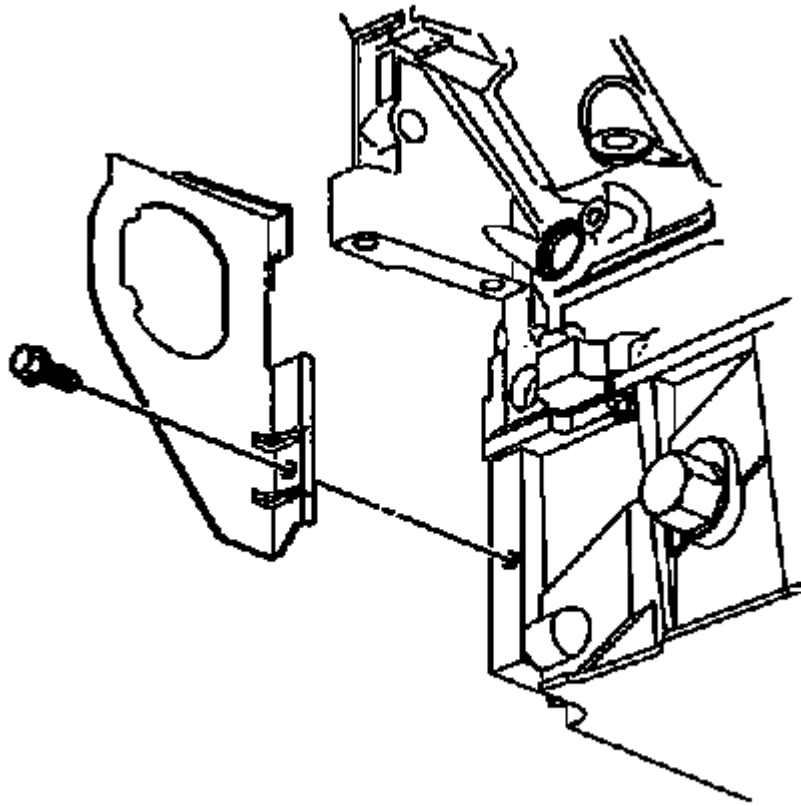


Fig. 154: View Of Right Transmission Cover & Bolt
Courtesy of GENERAL MOTORS COMPANY

8. Install the right transmission cover and bolt.

Tighten

Tighten the transmission cover bolt to 12 N.m (106 lb in).

9. Install the engine oil cooler adapter. Refer to **Engine Oil Cooler Adapter Replacement** .
10. Install the starter assembly. Refer to **Starter Replacement (LT1)** .
11. Install the oil filter. Refer to **Engine Oil and Oil Filter Replacement (With Z52 Option)**, **Engine Oil and Oil Filter Replacement (Without Z52 Option)**.

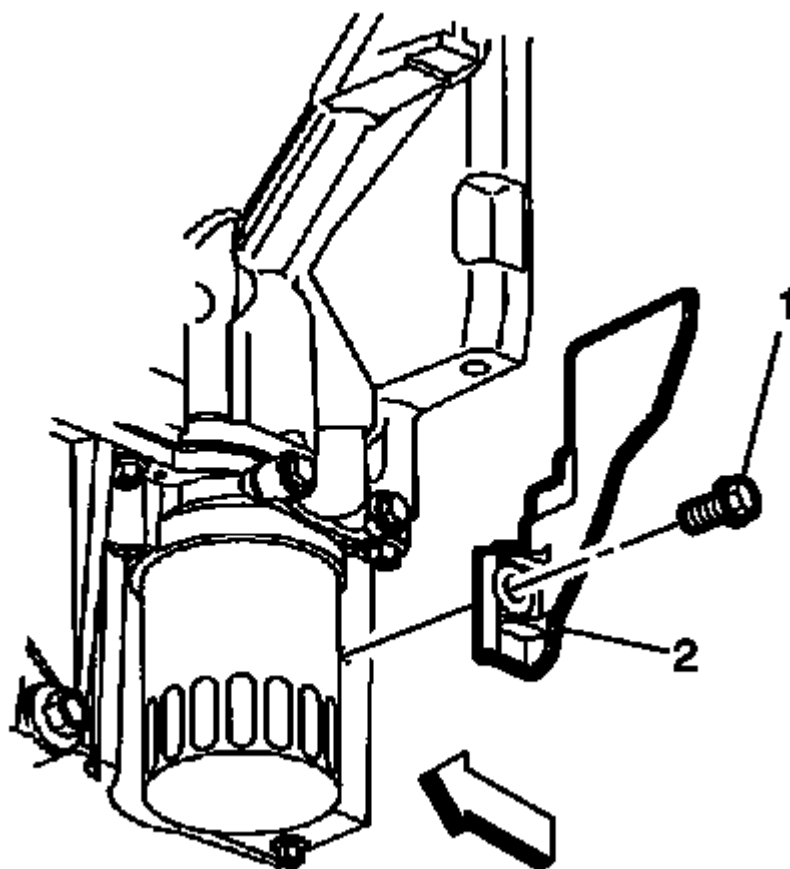


Fig. 155: View Of Left Closeout Cover & Bolt
Courtesy of GENERAL MOTORS COMPANY

12. Install left rear transmission cover (2) and bolt (1).

Tighten

Tighten the transmission cover bolt to 12 (106 lb in).

13. Install the front cradle. Refer to **Front Cradle Replacement** .
14. Install the oil level indicator tube. Refer to **Oil Level Indicator Tube Replacement**.

OIL PAN REPLACEMENT (WITH Z52 OPTION)

Removal Procedure

NOTE: It is not necessary to remove the transverse spring or steering gear intermediate shaft from the cradle.

NOTE: It is not necessary to remove the stabilizer shaft, only to disconnect the links.

1. Remove the front cradle. Refer to **Front Cradle Replacement** .

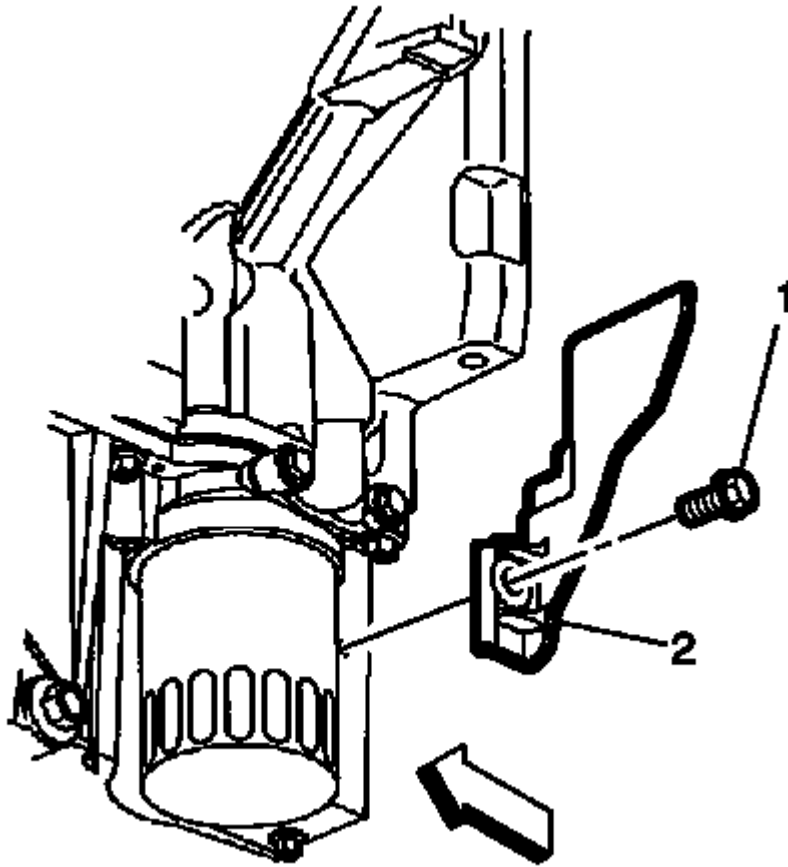


Fig. 156: View Of Left Closeout Cover & Bolt
Courtesy of GENERAL MOTORS COMPANY

2. Remove the bolt (1) and the left rear transmission cover (2).
3. Remove the oil filter. Refer to **Engine Oil and Oil Filter Replacement (With Z52 Option)**, **Engine Oil and Oil Filter Replacement (Without Z52 Option)**.
4. Remove the starter motor assembly. Refer to **Starter Replacement (LT1)** .
5. Remove the engine oil cooler adapter. Refer to **Engine Oil Cooler Adapter Replacement** .

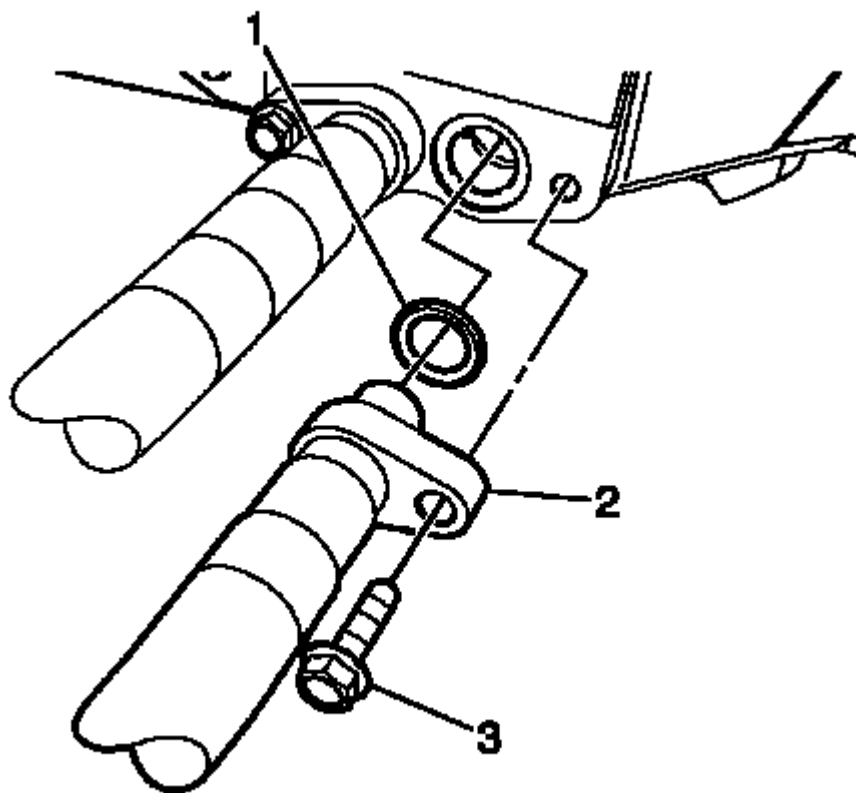


Fig. 157: Identifying Oil Tank Inlet Hose, Inlet Hose To Oil Tank Bolt & Oil Seal
Courtesy of GENERAL MOTORS COMPANY

6. Remove the oil inlet hose to oil pan bolt (3) and disconnect the hose (2) from the oil pan.
Discard the oil seal (1).
7. Remove the oil tank outlet hose to oil pan bolt and disconnect the hose from the oil pan.
Discard the oil seal.

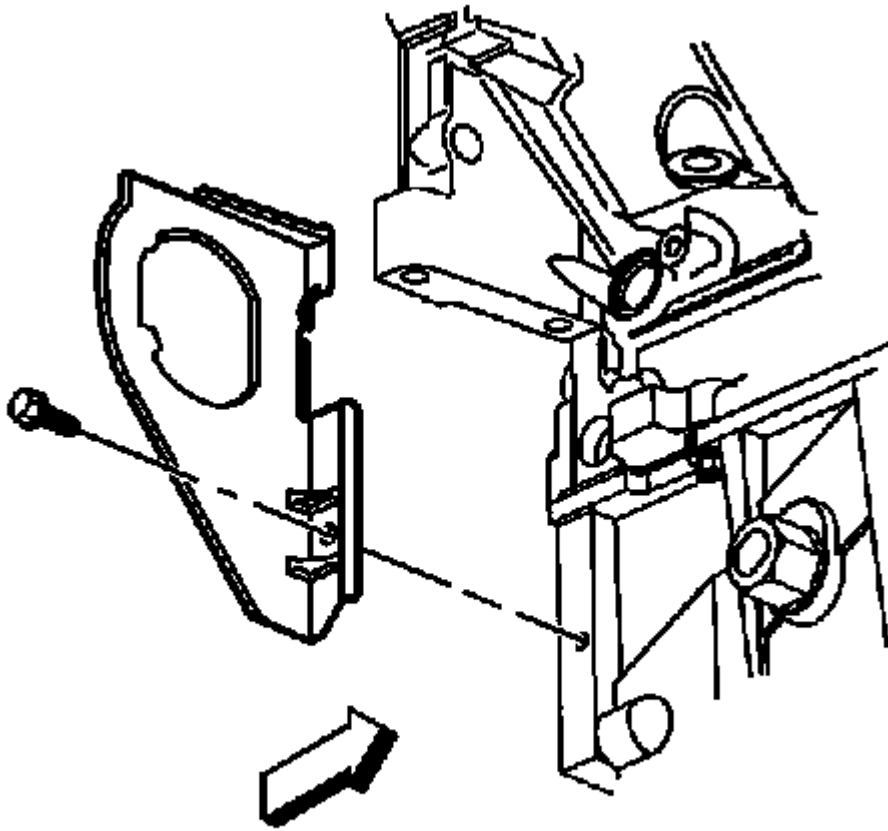


Fig. 158: View Of Right Closeout Cover & Bolt
Courtesy of GENERAL MOTORS COMPANY

8. Remove the bolt and right transmission cover.

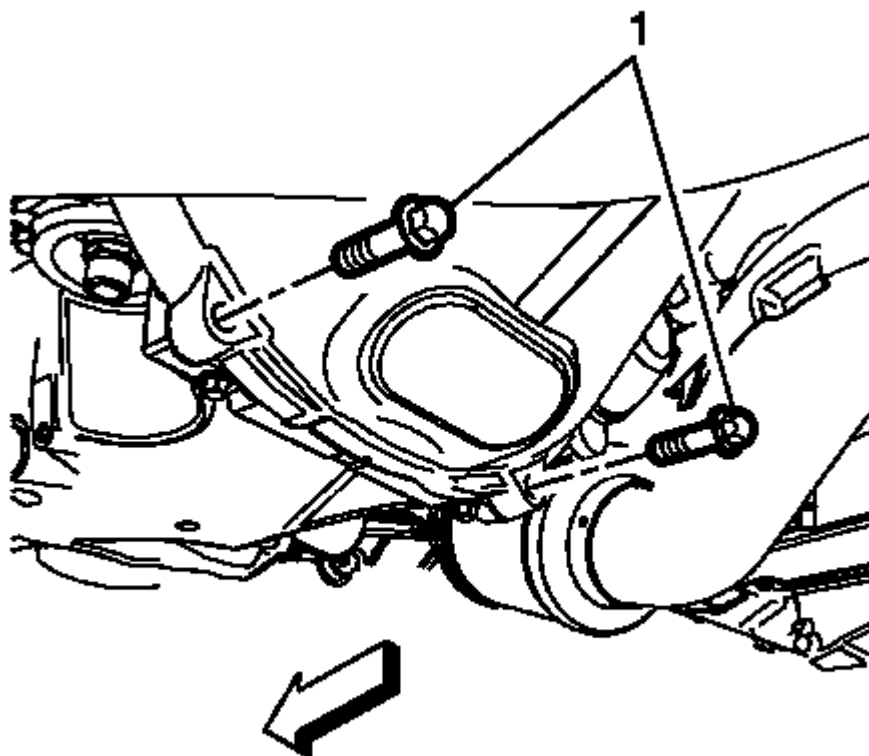


Fig. 159: Removing Bolts From Bell Housing To Oil Pan
Courtesy of GENERAL MOTORS COMPANY

9. Remove the bolts from the bell housing to the oil pan (1).

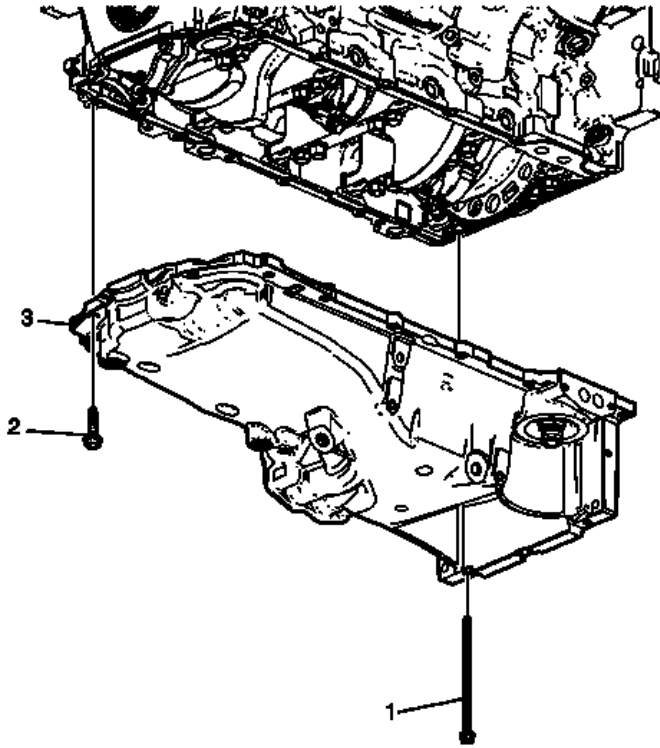


Fig. 160: Oil Pan

Courtesy of GENERAL MOTORS COMPANY

10. Remove the oil pan bolts (1 and 2).
11. Remove the oil pan (3) from the engine block.
12. For oil pan disassemble, refer to **Oil Pan Disassemble** , **Oil Pan Disassemble (with Z52 Option)** .
13. For cleaning and inspection, refer to **Oil Pan Cleaning and Inspection** , **Oil Pan Cleaning and Inspection (with Z52 Option)** .

Installation Procedure

1. For oil pan assemble, refer to **Oil Pan Assemble** , **Oil Pan Assemble (with Z52 Option)** .

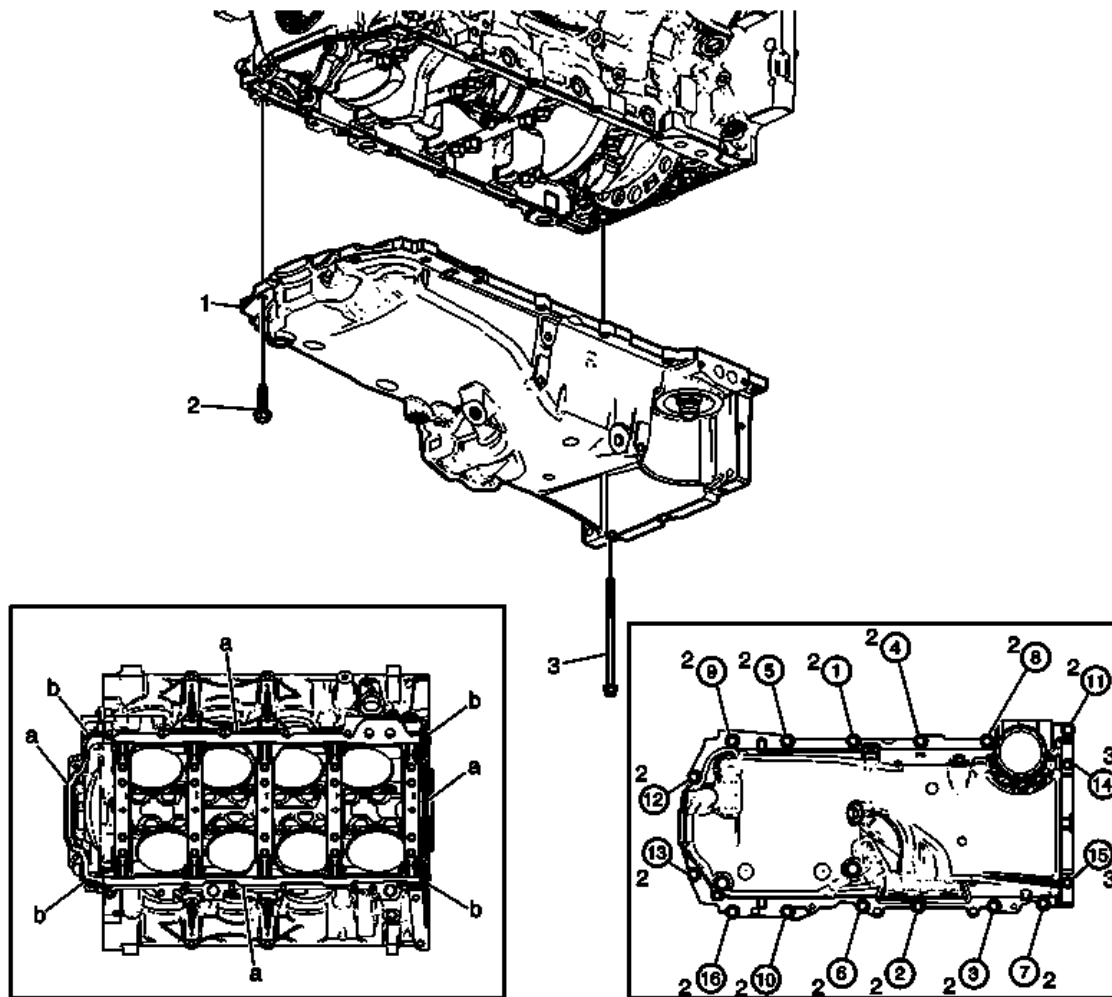


Fig. 161: Apply 3 mm (0.118 in) Bead Of RTV Sealant On Engine Front Cover And Block
Courtesy of GENERAL MOTORS COMPANY

2. Apply a **3 mm (0.118 in)** bead of RTV sealant on the engine front cover and block as shown (a). Refer to **Adhesives, Fluids, Lubricants and Sealers** .
3. Apply a **5 mm (0.197 in)** bead of RTV sealant on the engine front cover and block as shown (b).
4. Position the oil pan in place on the engine block.

CAUTION: Refer to Fastener Caution .

5. Install the mounting bolts (2 and 3) for the oil pan assembly.

Tighten

1. Tighten the oil pan mounting bolts (2) M6 to 12 N.m (106 lb in).
2. Tighten the oil pan mounting bolts (3) M8 to 25 N.m (18 lb ft).

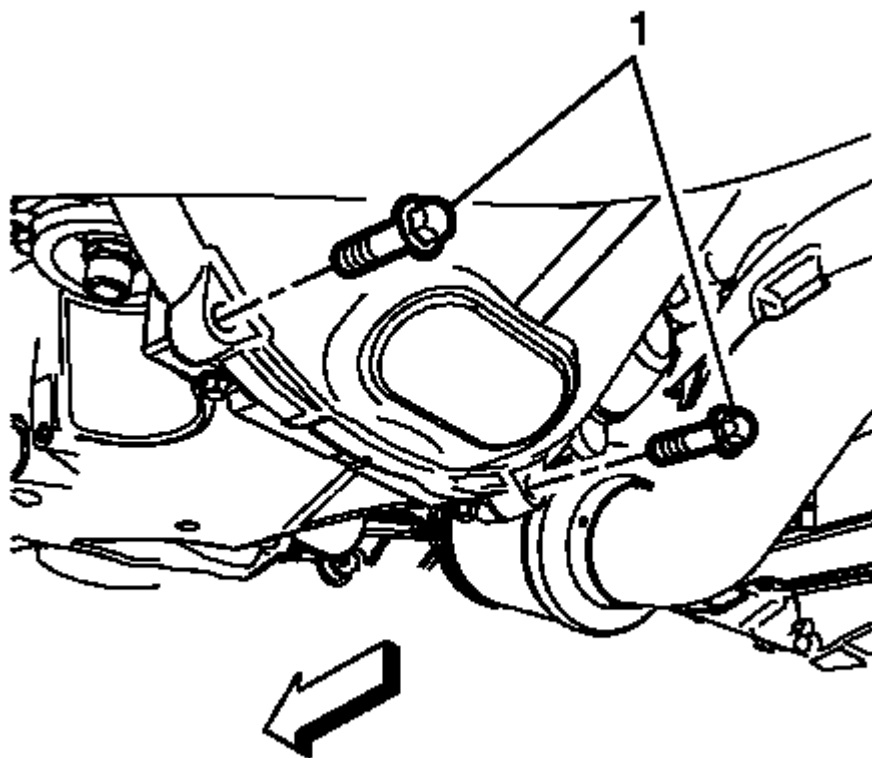


Fig. 162: Removing Bolts From Bell Housing To Oil Pan
Courtesy of GENERAL MOTORS COMPANY

6. Install the bell housing to oil pan bolts (1). Tighten the bolts to 50 N.m (37 lb ft).

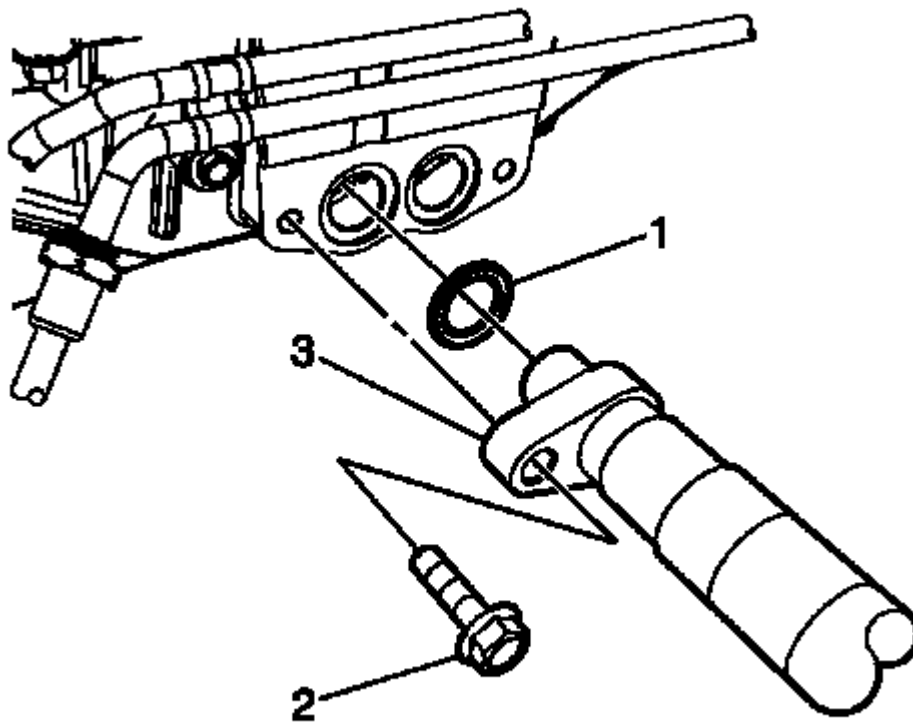


Fig. 163: Identifying Oil Tank Outlet Hose, Outlet Hose To Oil Tank Bolt & Oil Seal
Courtesy of GENERAL MOTORS COMPANY

7. Using a NEW oil seal (1) install the oil tank outlet hose (3) and bolt (2) to the oil pan. Tighten the outlet hose to oil pan bolt to 22 N.m (16 lb ft).

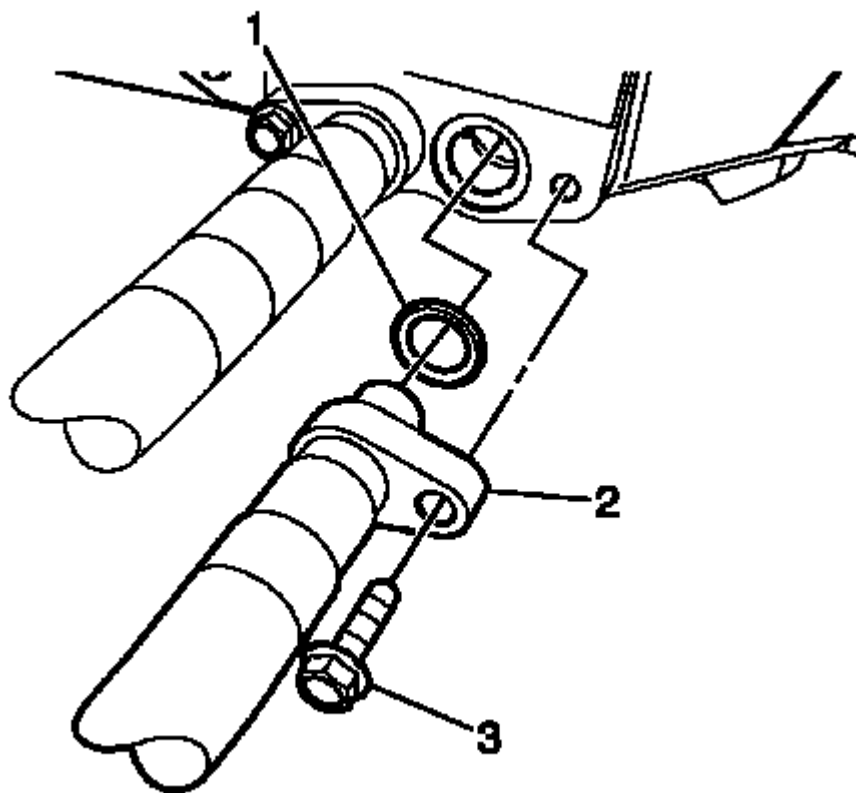


Fig. 164: Identifying Oil Tank Inlet Hose, Inlet Hose To Oil Tank Bolt & Oil Seal
Courtesy of GENERAL MOTORS COMPANY

8. Using a NEW oil seal (1) install the oil tank inlet hose (2) and bolt (3) to the oil pan. Tighten the inlet hose to oil pan bolt to 22 N.m (16 lb ft).

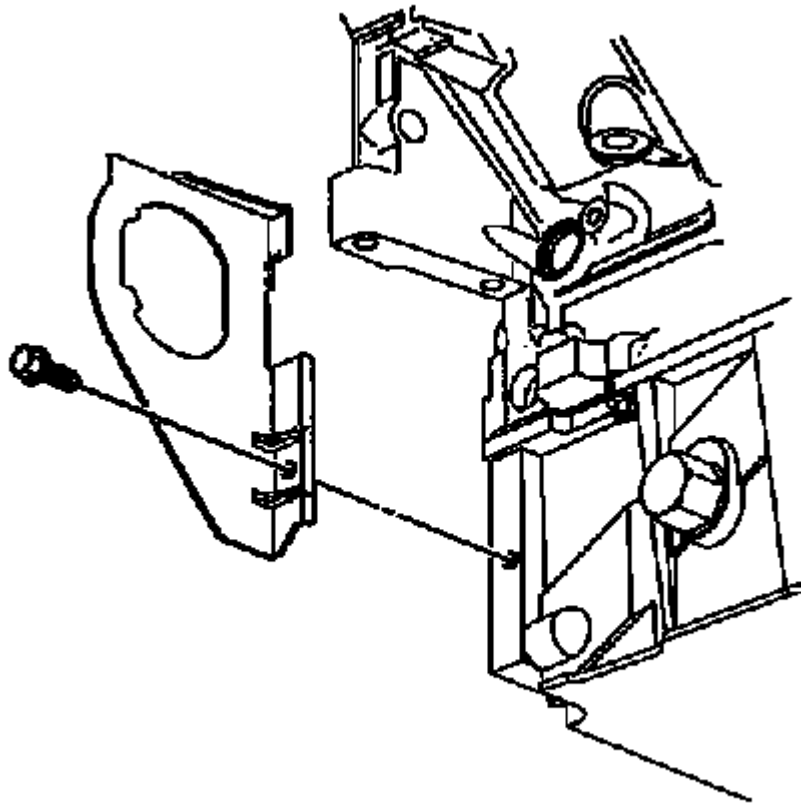


Fig. 165: View Of Right Transmission Cover & Bolt
Courtesy of GENERAL MOTORS COMPANY

9. Install the right transmission cover and bolt.

Tighten

Tighten the transmission cover bolt to 12 N.m (106 lb in).

10. Install the engine oil cooler adapter. Refer to **Engine Oil Cooler Adapter Replacement** .
11. Install the starter assembly. Refer to **Starter Replacement (LT1)** .

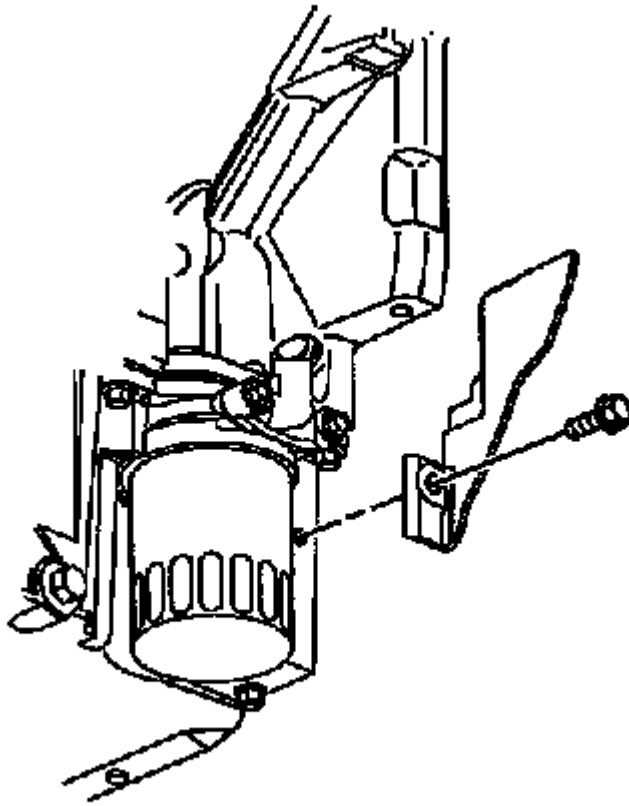


Fig. 166: View Of Converter Cover
Courtesy of GENERAL MOTORS COMPANY

12. Install the left rear transmission cover and bolt.

Tighten

Tighten the transmission cover bolt to 12 N.m (106 lb in).

13. Install the oil filter. Refer to **Engine Oil and Oil Filter Replacement (With Z52 Option)**, **Engine Oil and Oil Filter Replacement (Without Z52 Option)**.
14. Install the front cradle. Refer to **Front Cradle Replacement** .

ENGINE OIL LEVEL INDICATOR SWITCH REPLACEMENT (WITHOUT Z52)

Removal Procedure

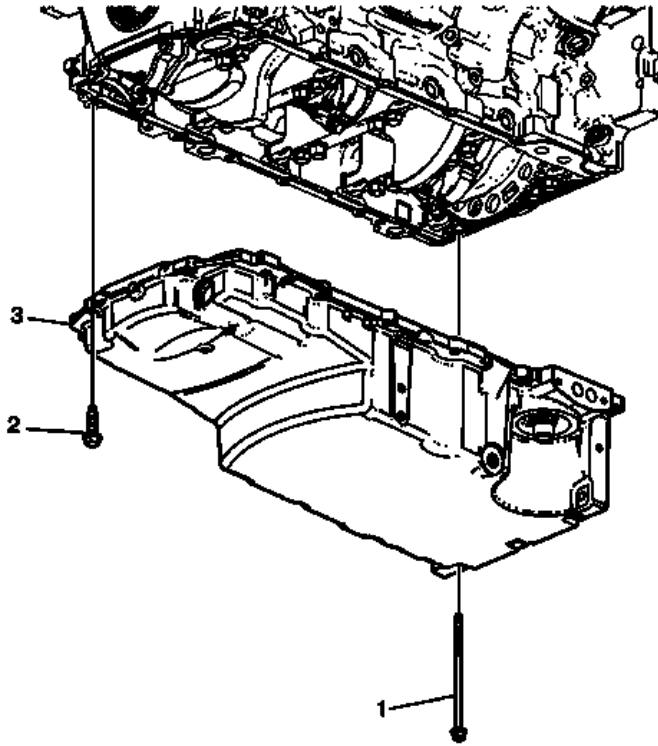


Fig. 167: Oil Pan Bolts

Courtesy of GENERAL MOTORS COMPANY

1. Remove the oil pan (3). Refer to Oil Pan Replacement (Without Z52 Option), Oil Pan Replacement (With Z52 Option).

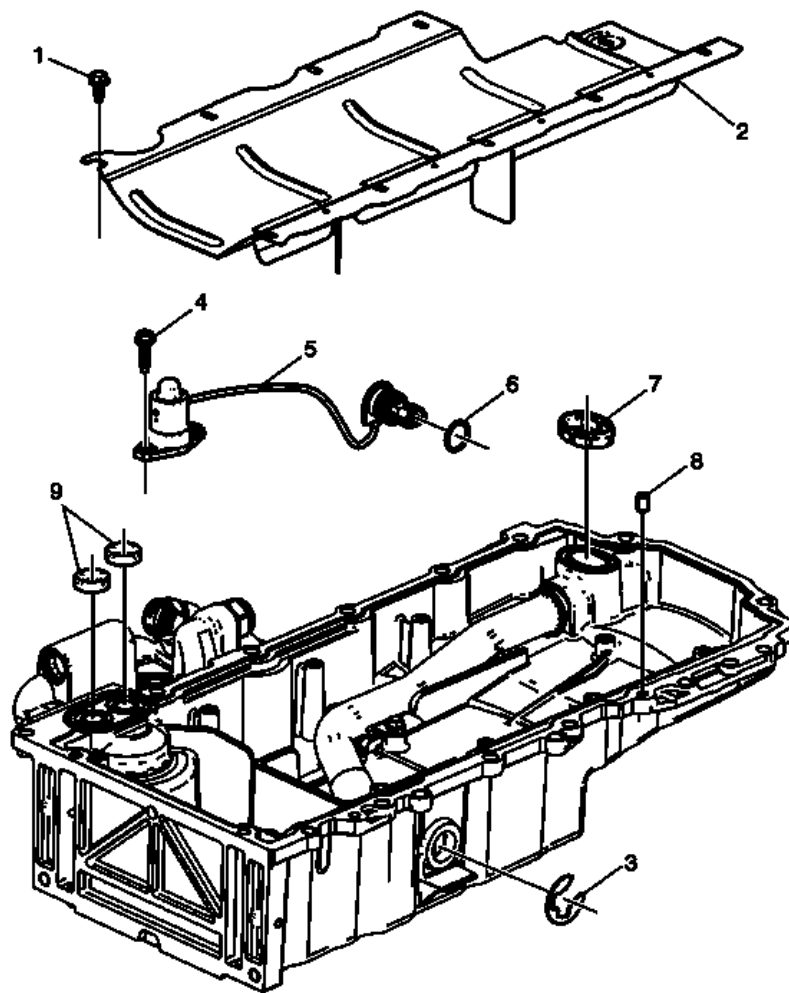


Fig. 168: Engine Oil Level Indicator Switch Bolt And Switch
Courtesy of GENERAL MOTORS COMPANY

2. Remove the engine oil level indicator switch bolt (4) and switch (5). Discard seals (6, 7, 9). Refer to **Oil Pan Disassemble** , **Oil Pan Disassemble (with Z52 Option)** .
3. For cleaning and inspection. Refer to **Oil Pan Cleaning and Inspection** , **Oil Pan Cleaning and Inspection (with Z52 Option)** .

Installation Procedure

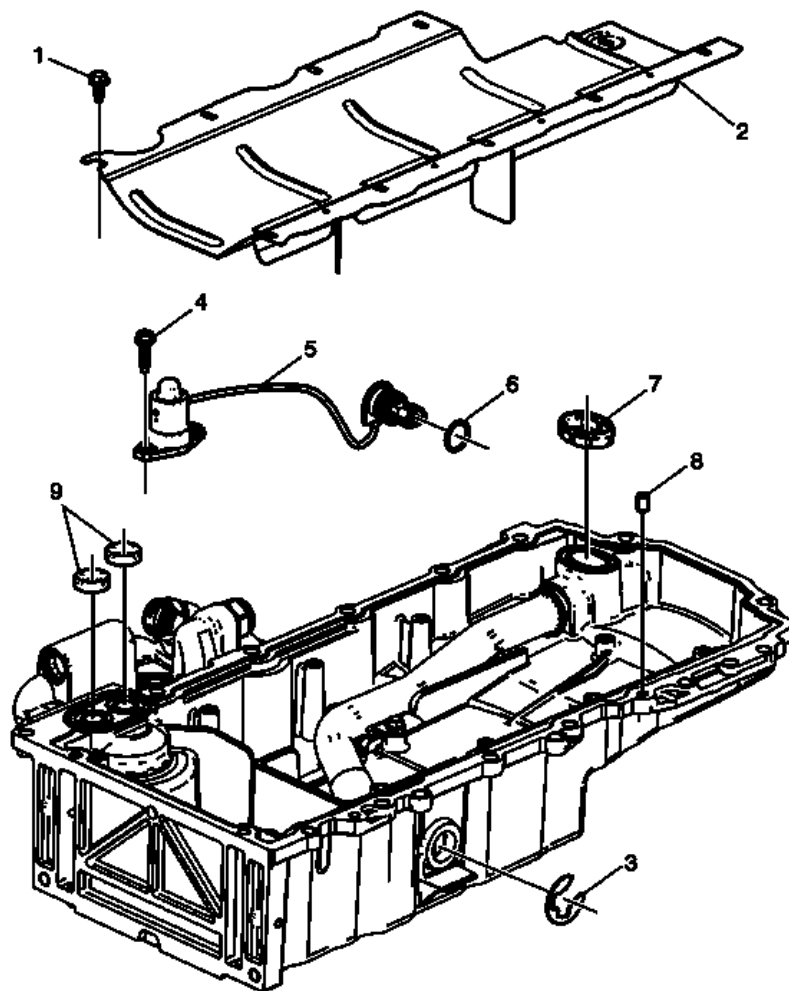


Fig. 169: Engine Oil Level Indicator Switch Bolt And Switch
Courtesy of GENERAL MOTORS COMPANY

1. Install the engine oil level indicator switch (5) and bolt (4). Install NEW seals (6, 7, 9). Refer to Oil Pan Assemble , Oil Pan Assemble (with Z52 Option) .

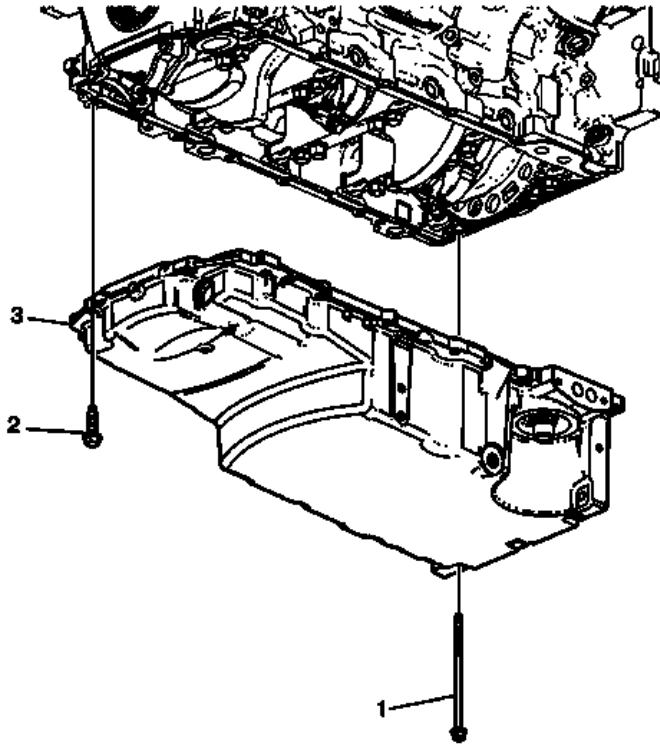


Fig. 170: Oil Pan Bolts

Courtesy of GENERAL MOTORS COMPANY

2. Install the oil pan (3). Refer to Oil Pan Replacement (Without Z52 Option), Oil Pan Replacement (With Z52 Option).

TIMING CHAIN, CRANKSHAFT SPROCKET, CAMSHAFT POSITION ACTUATOR AND SOLENOID VALVE REPLACEMENT

Special Tools

- **EN 46330** Timing Belt Tensioner Retaining Pin
- **EN-42386-A** Flywheel Holding Tool
- **EN-45059** Angle Meter

For equivalent regional tools, refer to Special Tools .

Removal Procedure

1. Remove oil pump. Refer to Oil Pump Replacement.

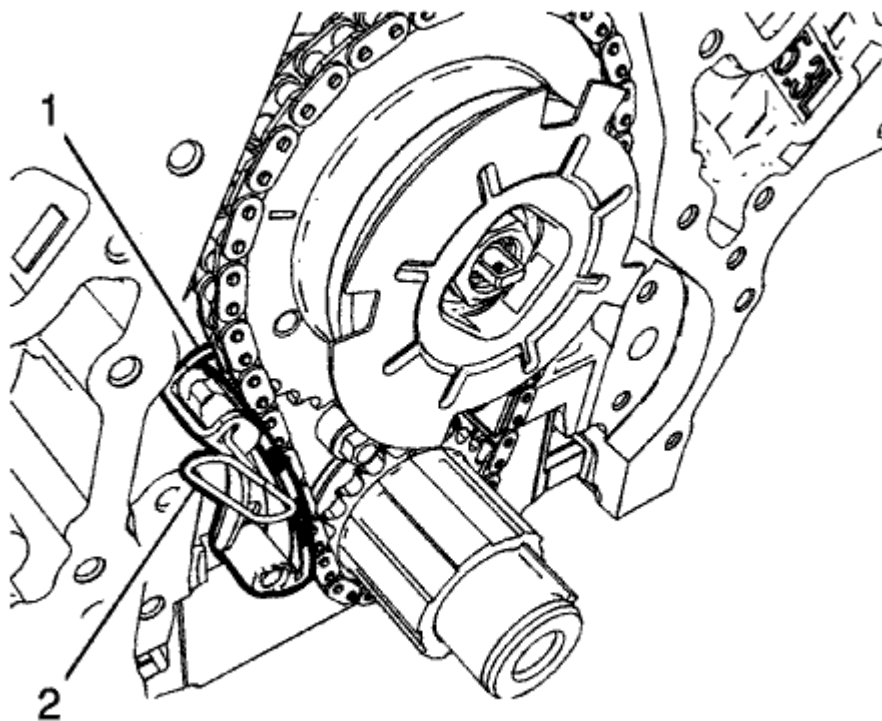


Fig. 171: Back Timing Chain Tensioner
Courtesy of GENERAL MOTORS COMPANY

2. Push back the timing chain tensioner (1) and install **EN-46330** tension pin (2).

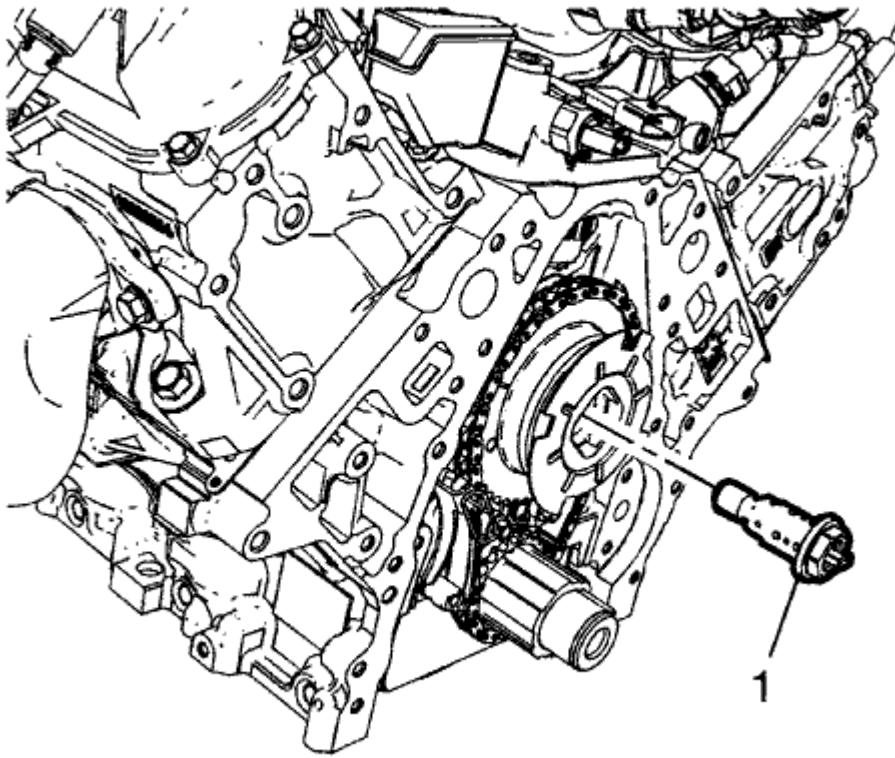


Fig. 172: CMP Actuator Solenoid Valve
Courtesy of GENERAL MOTORS COMPANY

3. Remove the CMP actuator solenoid valve (1).
4. Discard the solenoid valve.

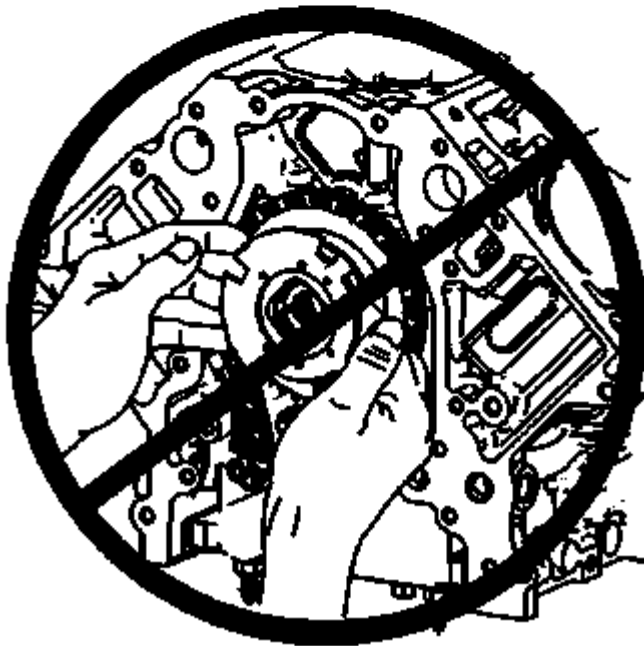
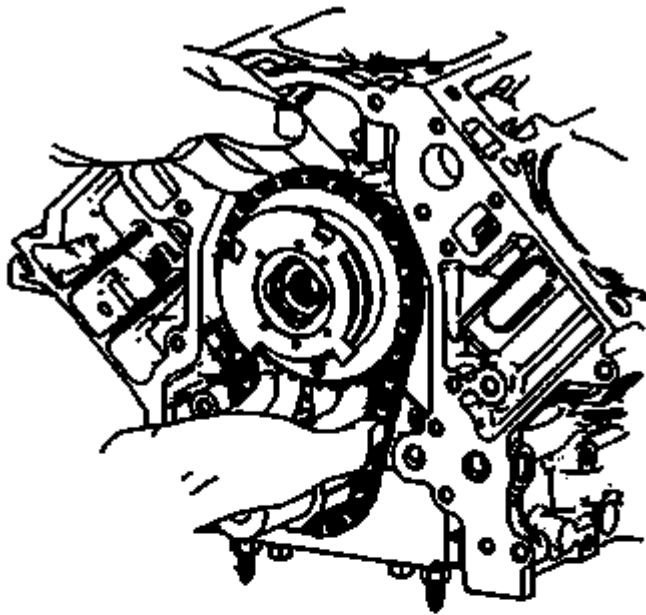


Fig. 173: View Of Proper CMP Actuator Removal
Courtesy of GENERAL MOTORS COMPANY

WARNING: Refer to Camshaft Position Actuator Removal and Installation Warning .

5. Loosen and separate the CMP actuator and timing chain from the camshaft. Position fingers behind the actuator sprocket and pull the actuator away from the front of the camshaft. Never

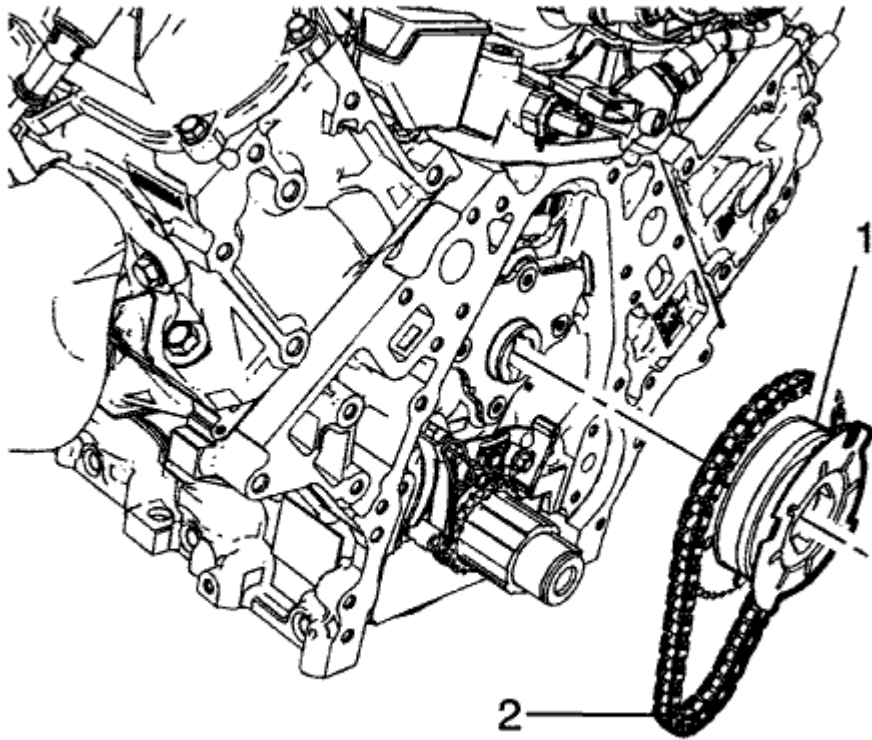


Fig. 174: CMP Actuator And Timing Chain
Courtesy of GENERAL MOTORS COMPANY

6. Remove the CMP actuator (1) and timing chain (2).

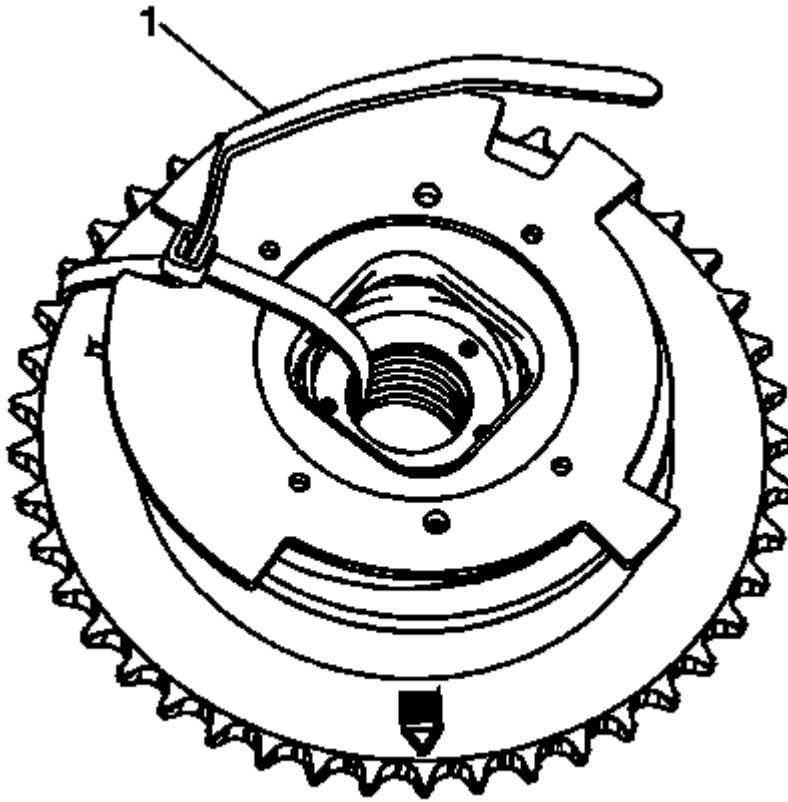


Fig. 175: View Of Tie Strap Through Center Of Actuator
Courtesy of GENERAL MOTORS COMPANY

7. Insert a tie strap (1) through the center of the actuator and over the reluctor wheel.

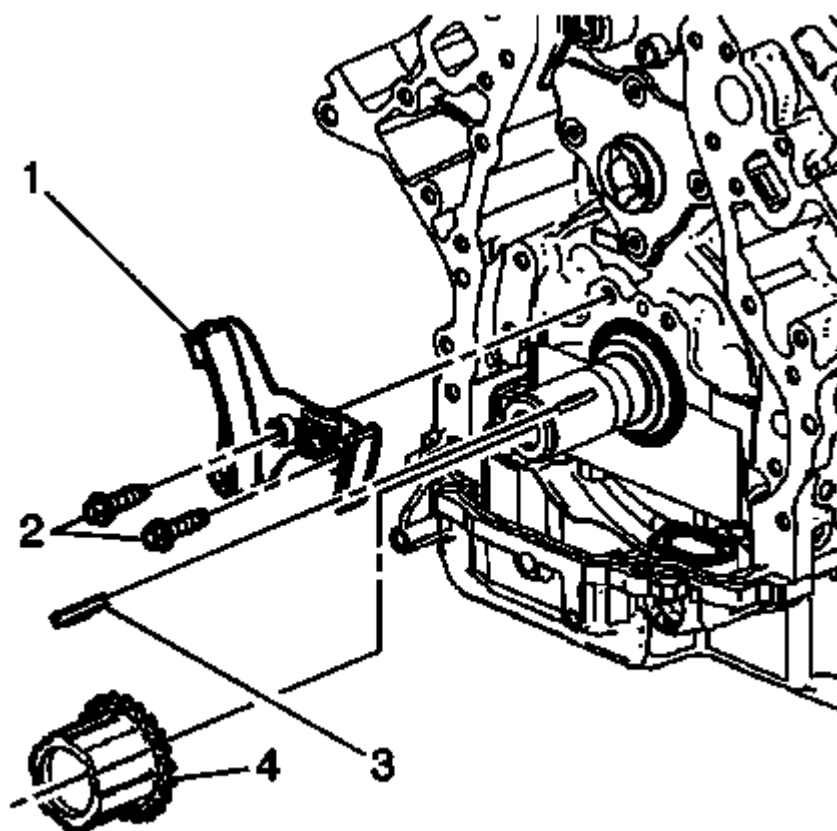


Fig. 176: Crankshaft Sprocket And Key
Courtesy of GENERAL MOTORS COMPANY

8. Remove the crankshaft sprocket (4) and key (3).
9. Remove the timing chain tensioner bolts (2) and the timing chain tensioner (1).

Installation Procedure

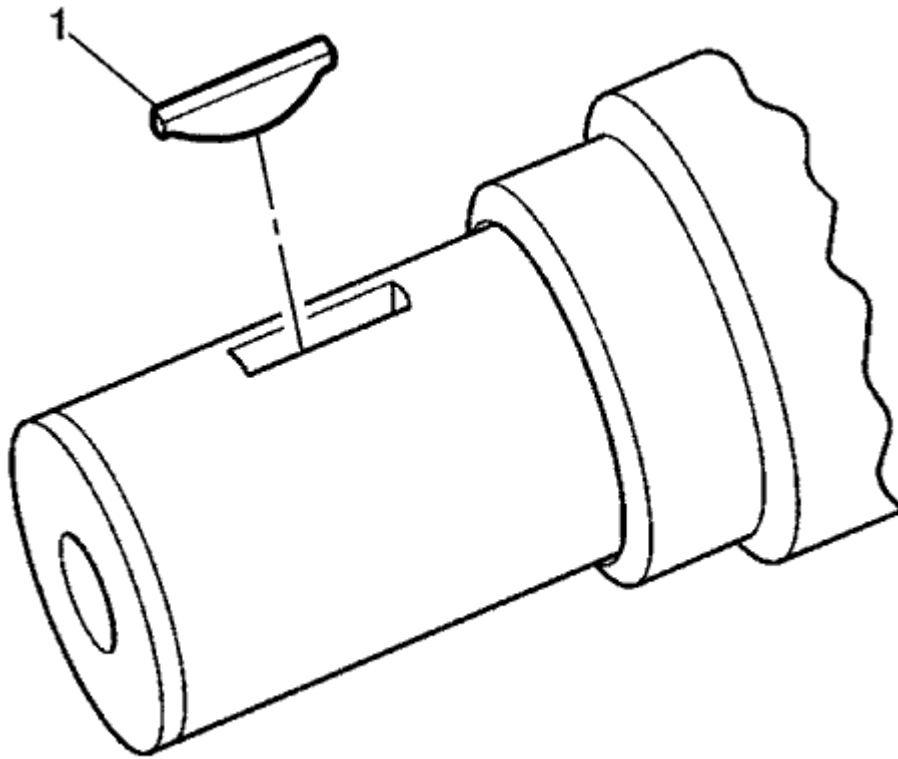


Fig. 177: Key Into Crankshaft Keyway
Courtesy of GENERAL MOTORS COMPANY

1. Install the key into the crankshaft keyway (1).

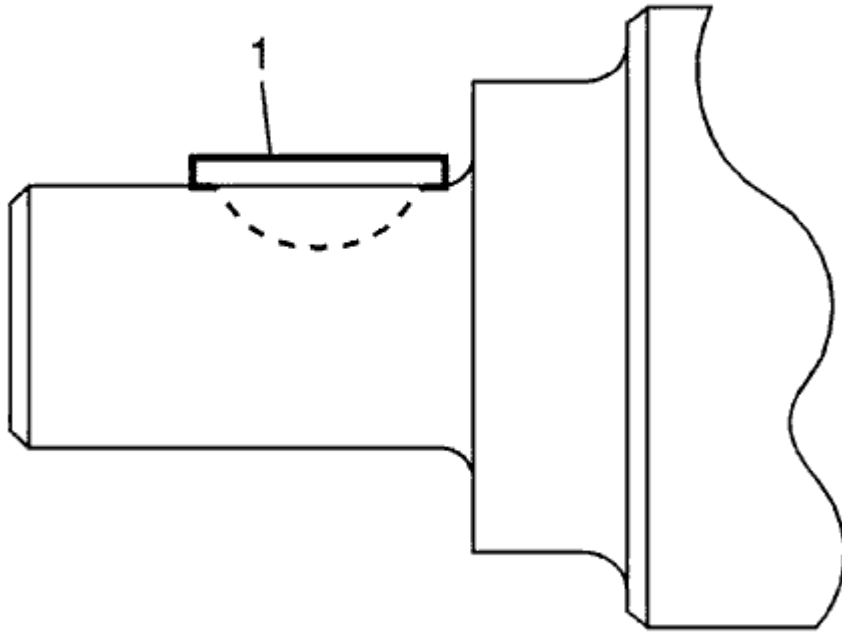


Fig. 178: Key Into Keyway

Courtesy of **GENERAL MOTORS COMPANY**

2. Tap the key (1) into the keyway until both ends of the key bottom onto the crankshaft.

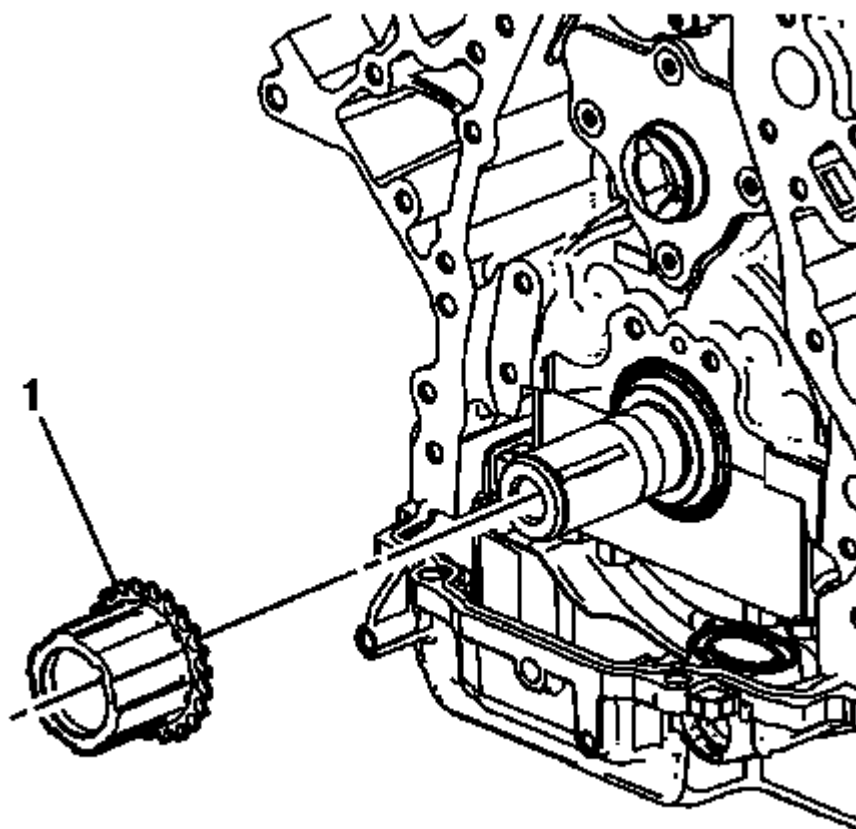


Fig. 179: Crankshaft Sprocket
Courtesy of GENERAL MOTORS COMPANY

3. Install the crankshaft sprocket (1). Align the crankshaft key with the crankshaft sprocket keyway.

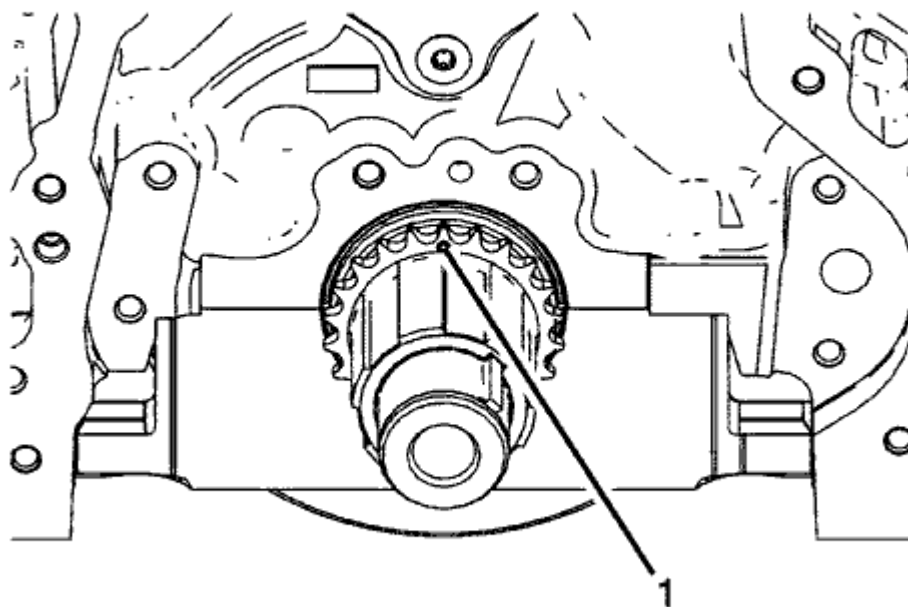


Fig. 180: Rotating Crankshaft Until Sprocket Alignment Mark
Courtesy of GENERAL MOTORS COMPANY

4. Rotate the crankshaft until the sprocket alignment mark (1) is in the 12 o'clock position.

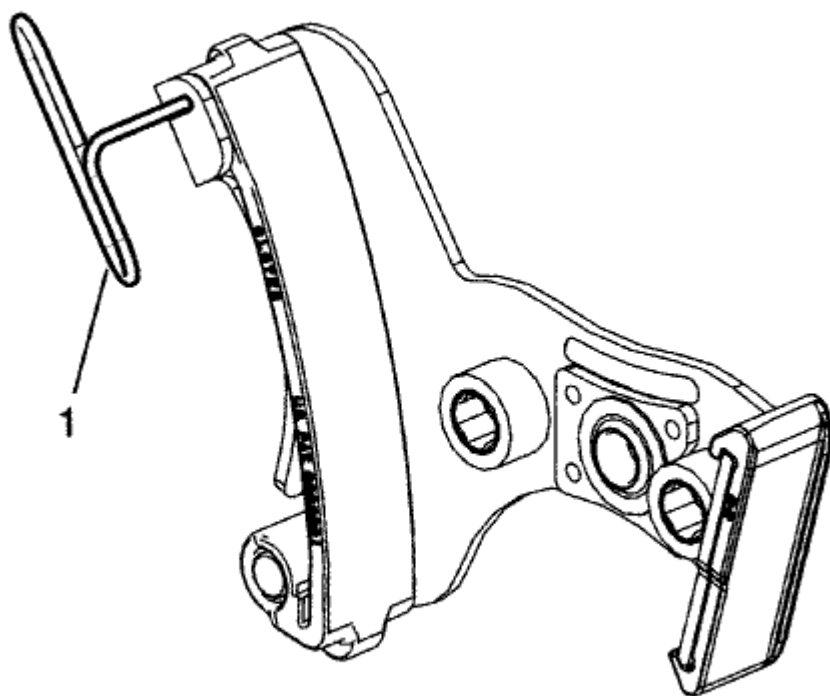


Fig. 181: Tension Pin

Courtesy of **GENERAL MOTORS COMPANY**

5. Compress the timing chain tensioner guide and install the **EN-46330** tension pin (1).

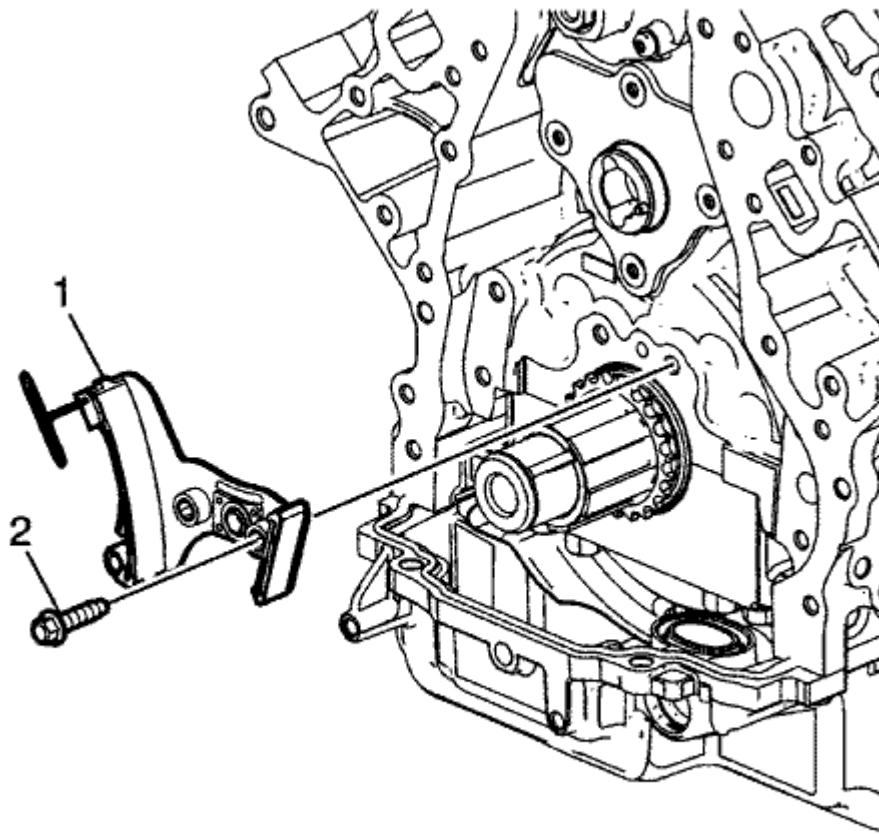


Fig. 182: Timing Chain Tensioner And Left Side Bolt
Courtesy of GENERAL MOTORS COMPANY

6. Install the timing chain tensioner and left side bolt (2) hand tight. Do not install the right side bolt at this time. The right side bolt will be installed after the camshaft position (CMP) actuator and chain have been installed onto the engine.

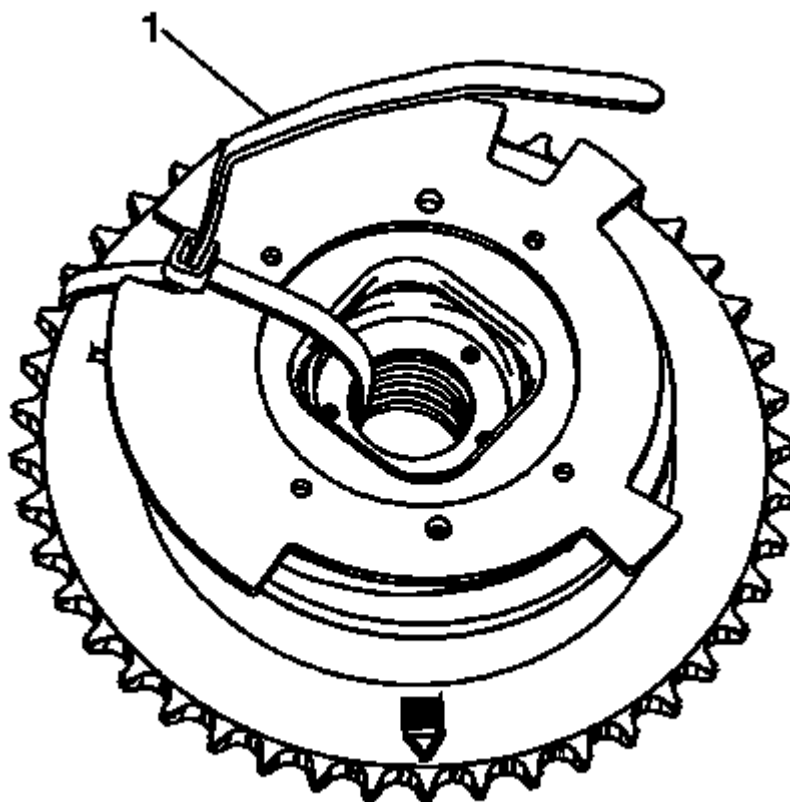


Fig. 183: View Of Tie Strap Through Center Of Actuator
Courtesy of GENERAL MOTORS COMPANY

WARNING: Refer to Camshaft Position Actuator Removal and Installation Warning .

7. Remove the tie strap (1) from the actuator.

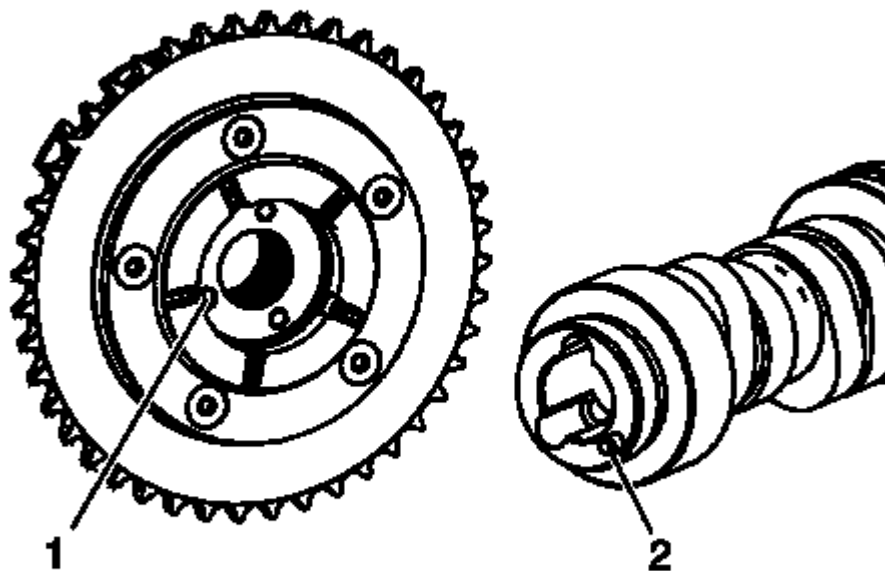


Fig. 184: Identifying Alignment Hole & Locating Pin
Courtesy of GENERAL MOTORS COMPANY

NOTE:

- Properly locate the CMP actuator onto the locating pin of the camshaft.
- The sprocket teeth and timing chain must mesh
- The camshaft and the sprocket alignment marks **MUST** be aligned properly.
- Do not use the CMP solenoid valve again. Install a **NEW** valve during assembly.

8. Identify the alignment hole (1) in the rear face of the CMP actuator and the locating pin (2) on the front face of the camshaft.

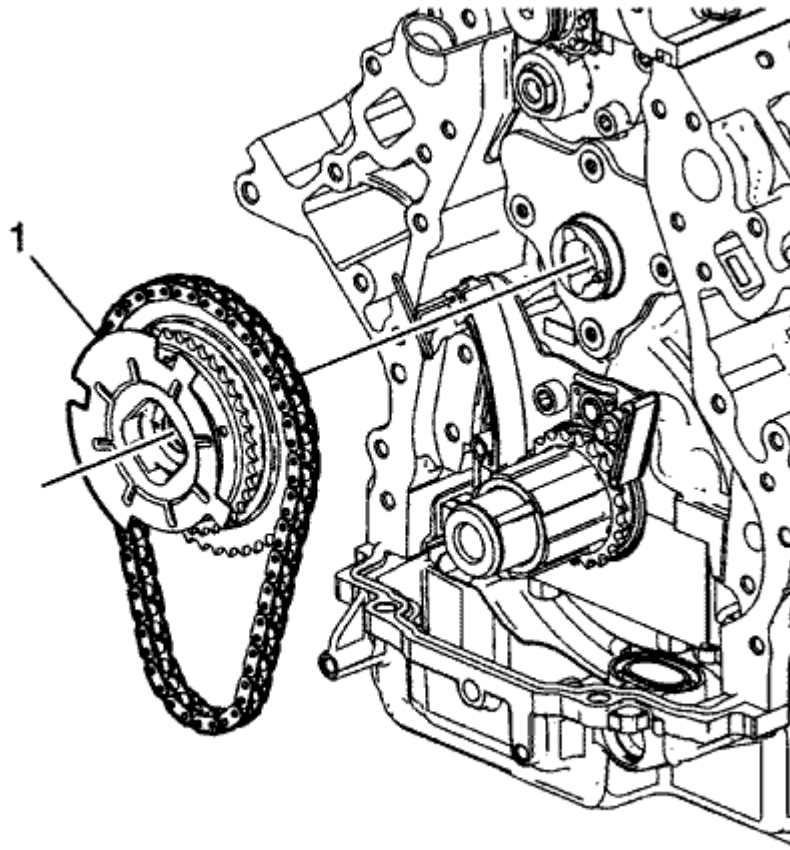


Fig. 185: CMP Actuator And Timing Chain
Courtesy of GENERAL MOTORS COMPANY

9. Install the CMP actuator and timing chain (1). Use care to install the actuator completely onto the front of the camshaft. Position fingers onto the face of the actuator sprocket and push the actuator onto the front of the camshaft. Never push on the reluctor wheel when attempting to install the actuator.

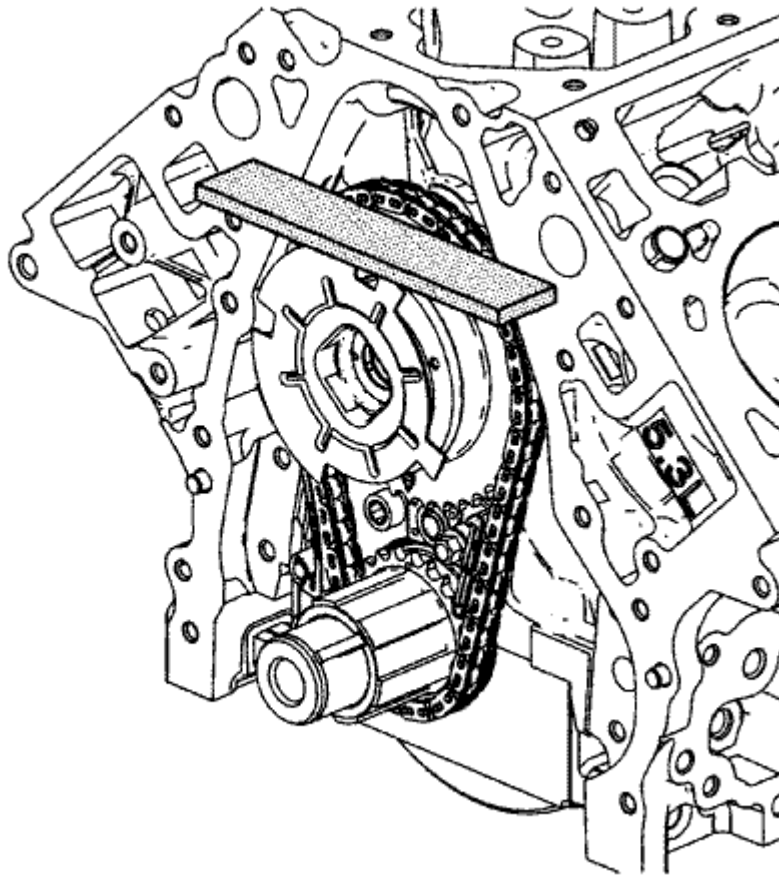


Fig. 186: CMP Actuator And Timing Chain
Courtesy of GENERAL MOTORS COMPANY

NOTE: It is possible to push the camshaft rearward when installing the CMP actuator. Verify that the camshaft lobes are centered in the valve lifter bores after the CMP actuator is installed.

10. Locate a straight edge across the front face of the engine block and inspect for proper installation of the CMP actuator and timing chain. With the CMP actuator properly and completely installed onto the front of camshaft, the timing chain will not protrude beyond the front face of engine block.

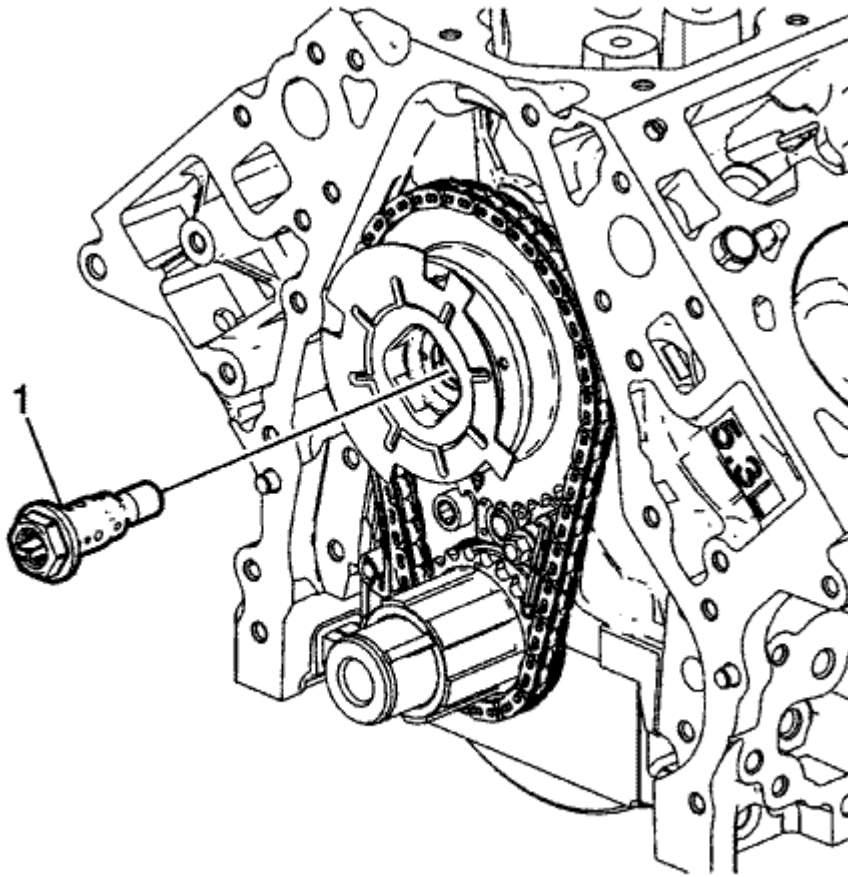


Fig. 187: NEW CMP Actuator Solenoid Valve
Courtesy of GENERAL MOTORS COMPANY

11. Install a NEW CMP actuator solenoid valve (1). With the CMP actuator properly positioned onto the camshaft, the CMP actuator solenoid valve can be threaded completely into the camshaft using light hand pressure. Tighten by hand until snug.

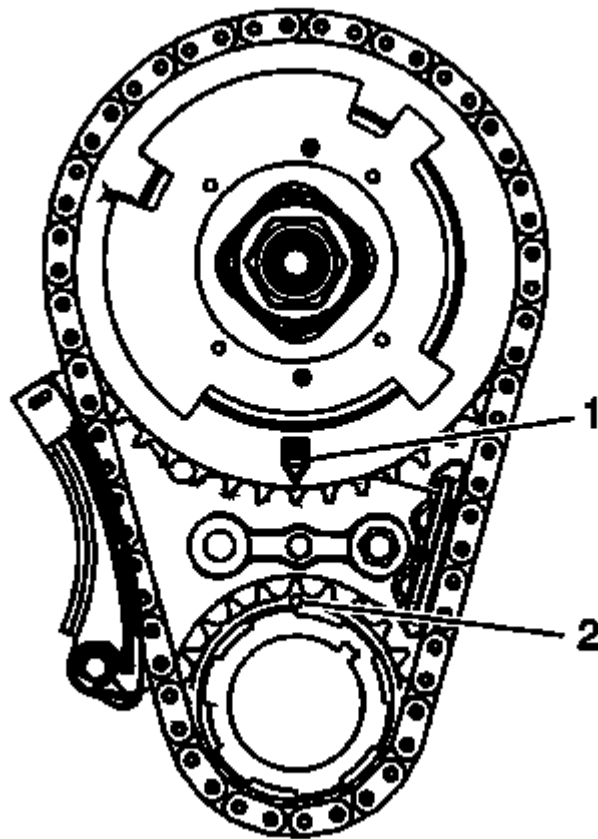


Fig. 188: View Of CMP Actuator Alignment Mark & Crankshaft Sprocket Alignment Mark
Courtesy of GENERAL MOTORS COMPANY

12. Inspect the sprockets for proper alignment. The mark on the CMP actuator sprocket (1) should be located in the 6 o'clock position and the mark on the crankshaft sprocket (2) should be located in the 12 o'clock position.

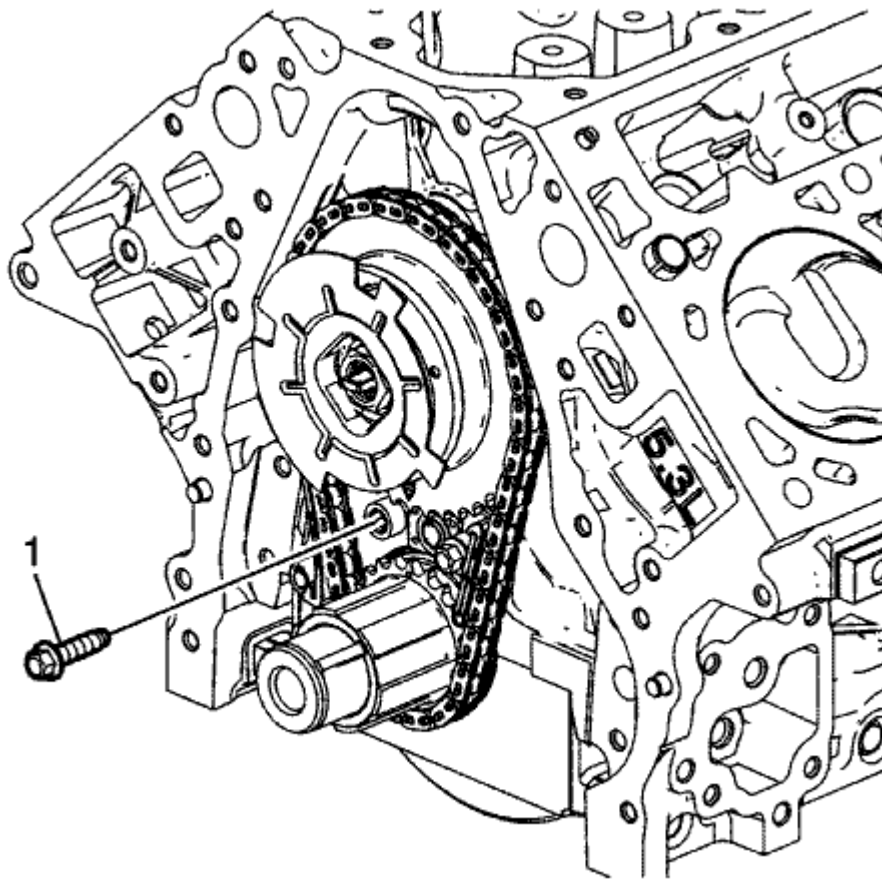


Fig. 189: Right Side Bolt

Courtesy of GENERAL MOTORS COMPANY

13. Install the right side bolt (1) into the timing chain tensioner and tighten both bolts to 30 N.m (22 lb ft).
14. Install oil pump. Refer to **Oil Pump Replacement**.

CAMSHAFT REPLACEMENT

Removal Procedure

1. Remove the engine. Refer to **Engine Replacement**.
2. Remove the valve rocker arm and pushrods. Refer to **Valve Rocker Arm and Push Rod Replacement**.
3. Remove the valve lifter follower guide. Refer to **Valve Lifter Follower Guide Replacement**.

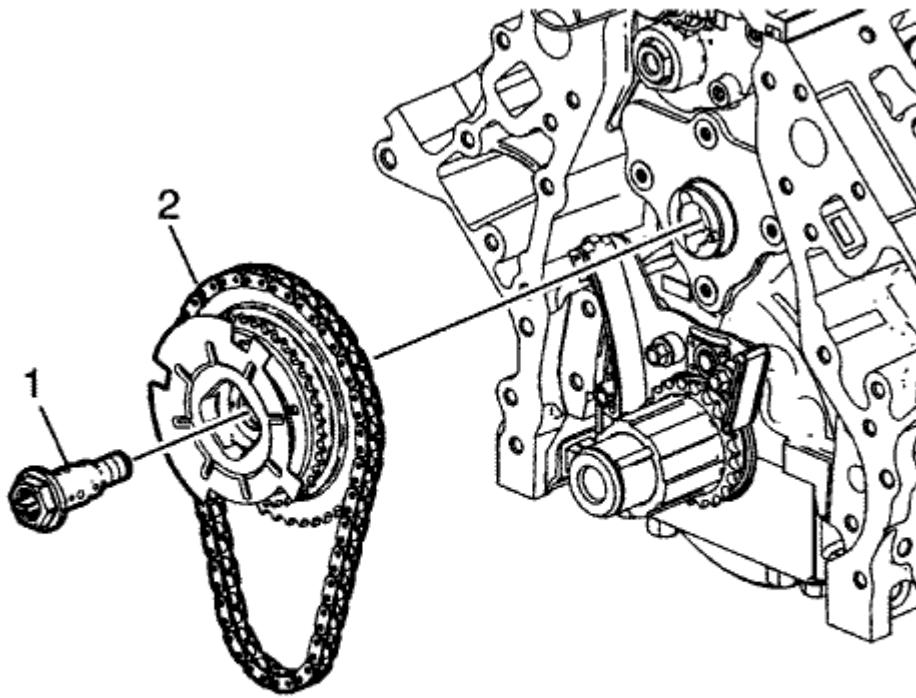


Fig. 190: Actuator And Timing Chain
Courtesy of GENERAL MOTORS COMPANY

4. Remove the CMP actuator and timing chain (2). Refer to **Timing Chain, Crankshaft Sprocket, Camshaft Position Actuator and Solenoid Valve Replacement**.

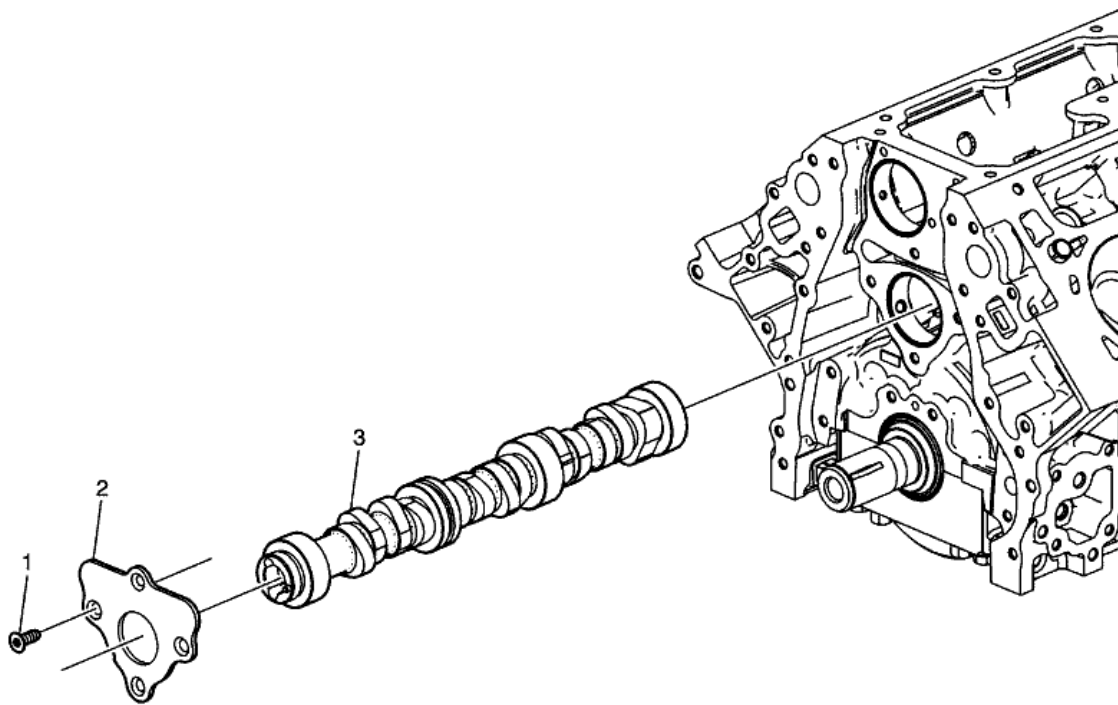


Fig. 191: Camshaft Retainer Bolts
Courtesy of GENERAL MOTORS COMPANY

5. Remove the 4 camshaft retainer bolts (1).
6. Remove the camshaft retainer (2).
7. Remove the camshaft (3).
8. For camshaft cleaning and inspection, refer to **Camshaft and Bearings Cleaning and Inspection** .

Installation Procedure

NOTE: **he threads of the camshaft retainer bolts and threaded holes of the engine block must be free of residue and debris prior to the application of threadlocker to ensure proper adhesion and fastener retention.**

1. Prepare the camshaft retainer bolts and engine block threaded holes for assembly:
 - Thoroughly clean the residue from the bolt threads with denatured alcohol and allow to dry.
 - Thoroughly clean the residue from the threaded holes of the engine block with denatured alcohol and allow to dry.
 - Apply threadlocker to 2/3 of the threaded length of the camshaft retainer bolts. Refer to **Adhesives, Fluids, Lubricants and Sealers** .
 - Ensure there are no gaps in the threadlocker along the filled area of the bolts.
 - Allow the threadlocker to cure approximately 10 minutes before installation.

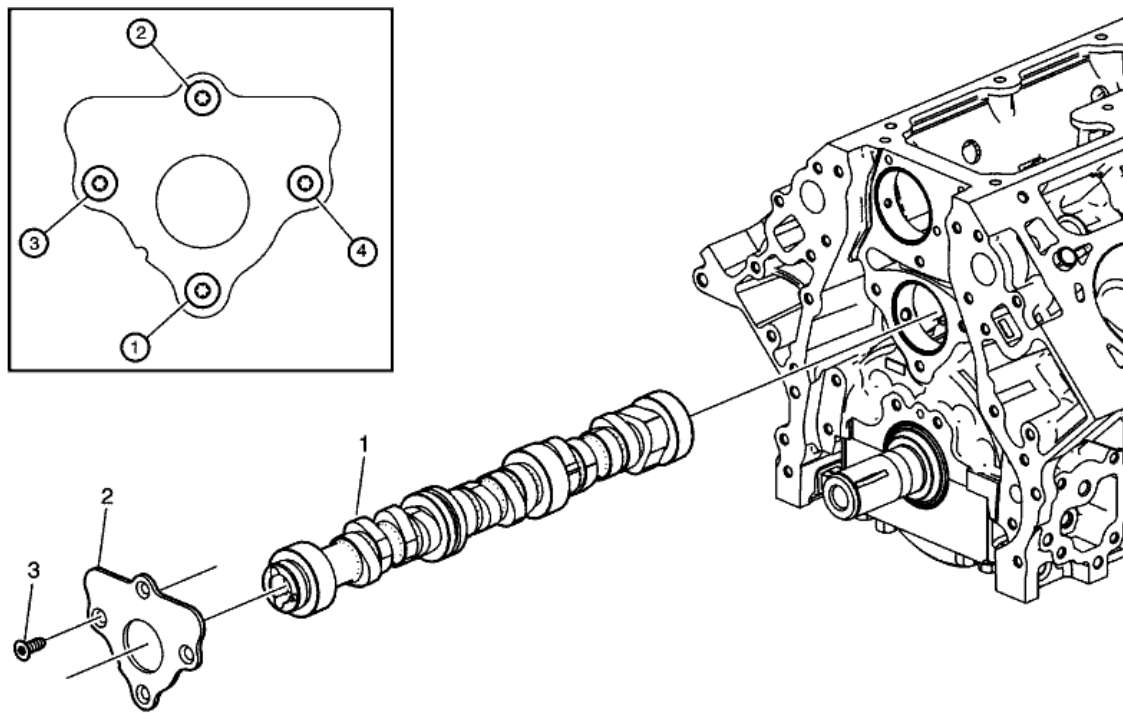


Fig. 192: Camshaft Retainer And Bolts
Courtesy of GENERAL MOTORS COMPANY

2. Install the camshaft (1), camshaft retainer (2) and camshaft retainer bolts (3). Refer to **Camshaft Installation** .

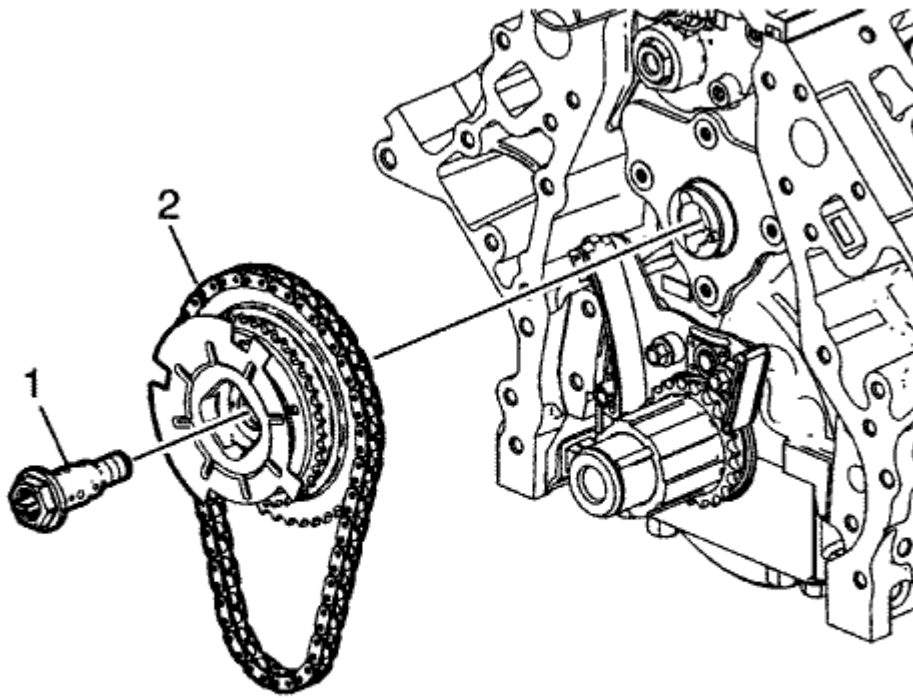


Fig. 193: Actuator And Timing Chain
Courtesy of GENERAL MOTORS COMPANY

3. Install the CMP actuator and timing chain (2). Refer to **Timing Chain, Crankshaft Sprocket, Camshaft Position Actuator and Solenoid Valve Replacement**.
4. Install the valve lifter follower guide. Refer to **Valve Lifter Follower Guide Replacement**.
5. Install the valve rocker arm and pushrods. Refer to **Valve Rocker Arm and Push Rod Replacement**.
6. Install the engine. Refer to **Engine Replacement**.

ENGINE FLYWHEEL REPLACEMENT

Special Tools

- **J-42386-A** Flywheel Holding Tool

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

Removal Procedure

1. Remove the clutch assembly. Refer to **Clutch Assembly Replacement** .

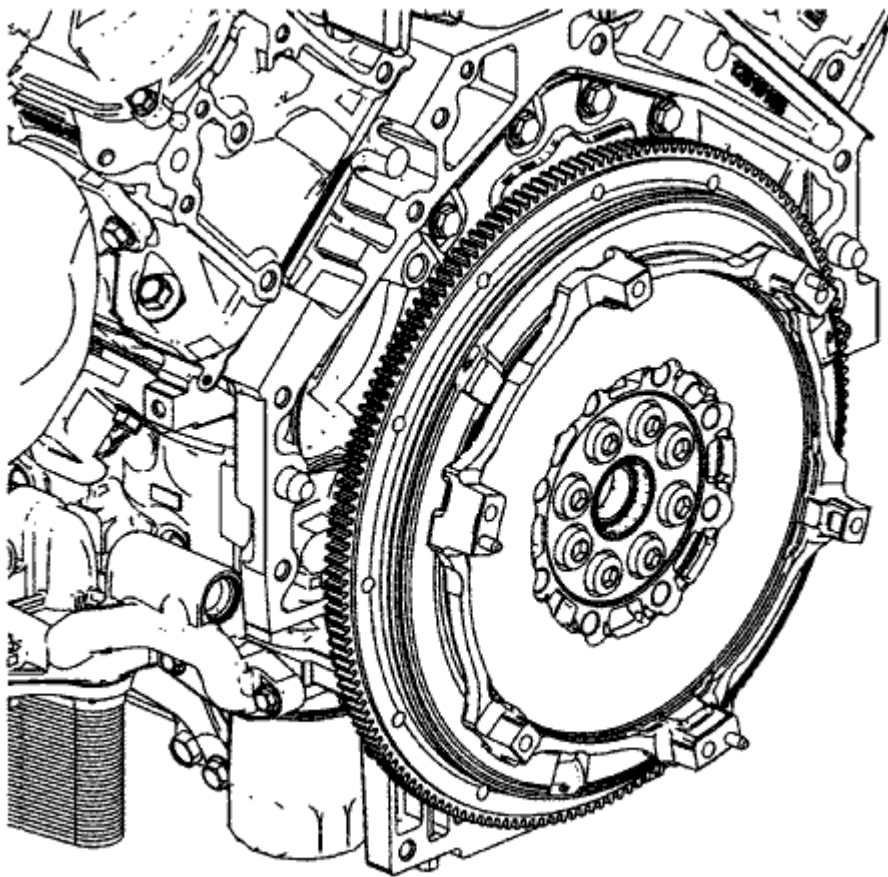


Fig. 194: Mark Or Scribe End Of Crankshaft And Manual Transmission Flywheel
Courtesy of GENERAL MOTORS COMPANY

NOTE: Note the position and direction of the engine flywheel before removal. The flywheel does not use a locating pin for alignment. Mark or scribe the end of the crankshaft and the flywheel before component removal. The existing manual transmission engine flywheel must be installed to the original position and direction.

2. Mark or scribe the end of the crankshaft and the manual transmission flywheel.

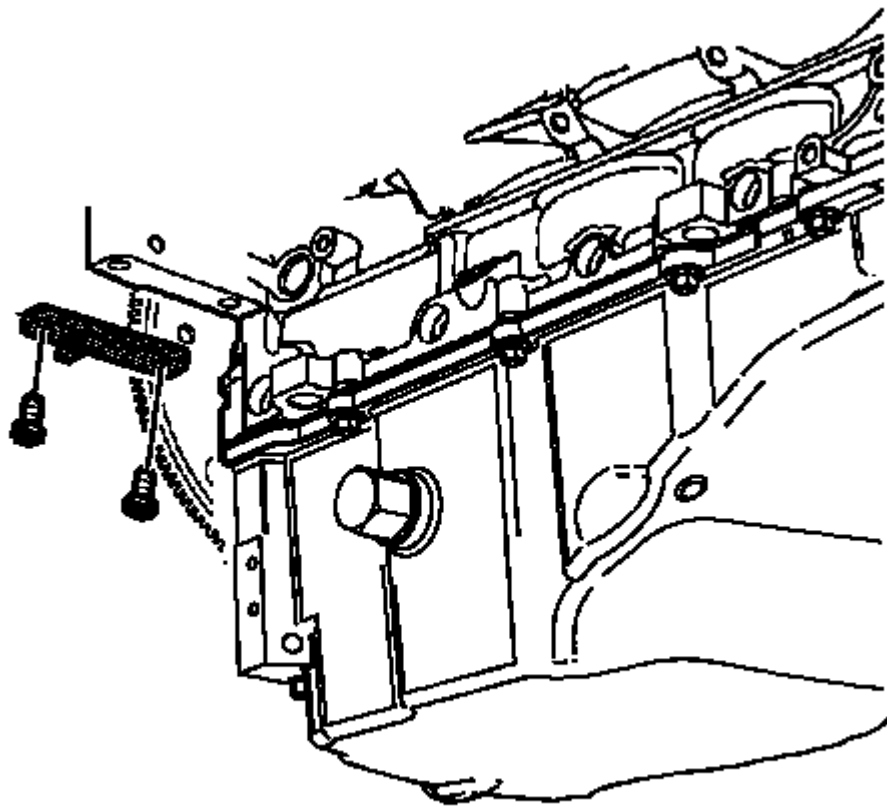


Fig. 195: Identifying J 42386-A
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

3. Install the **J-42386-A** flywheel holding tool and bolts.

Use 1 M10 -1.5 x 120 mm and 1 M10 -1.5 x 45 mm bolt for proper tool operation.

Tighten the **J-42386-A** flywheel holding tool and bolts to 50 N.m (37 lb ft).

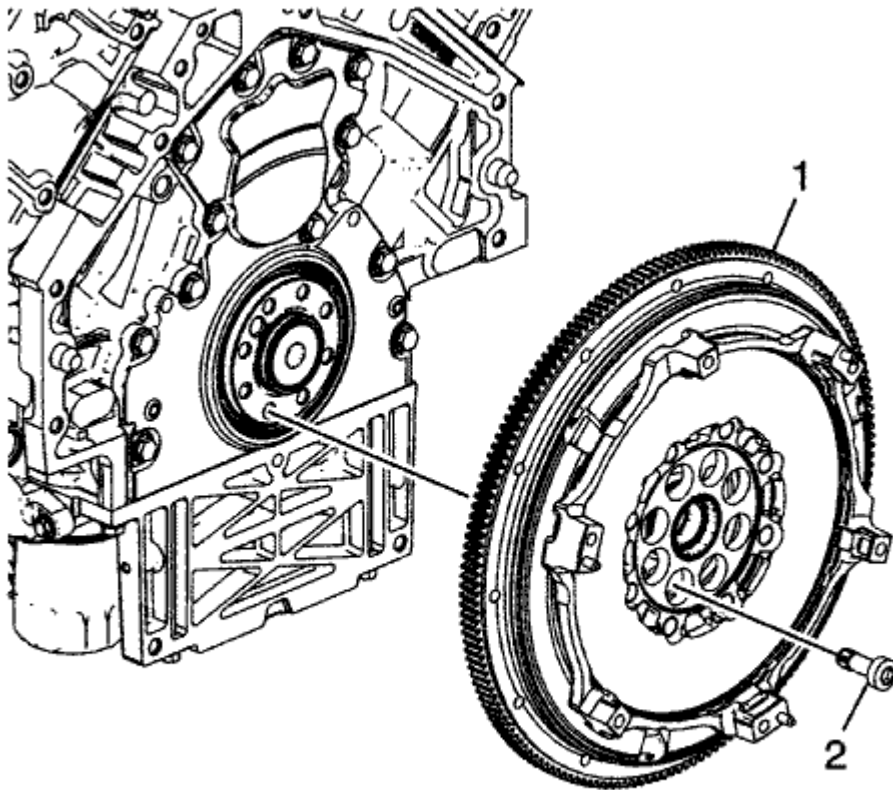


Fig. 196: Flywheel Bolts

Courtesy of GENERAL MOTORS COMPANY

NOTE: Do NOT reuse the flywheel bolts.

4. Remove and discard the flywheel bolts (2).
5. Remove the manual transmission flywheel (1).

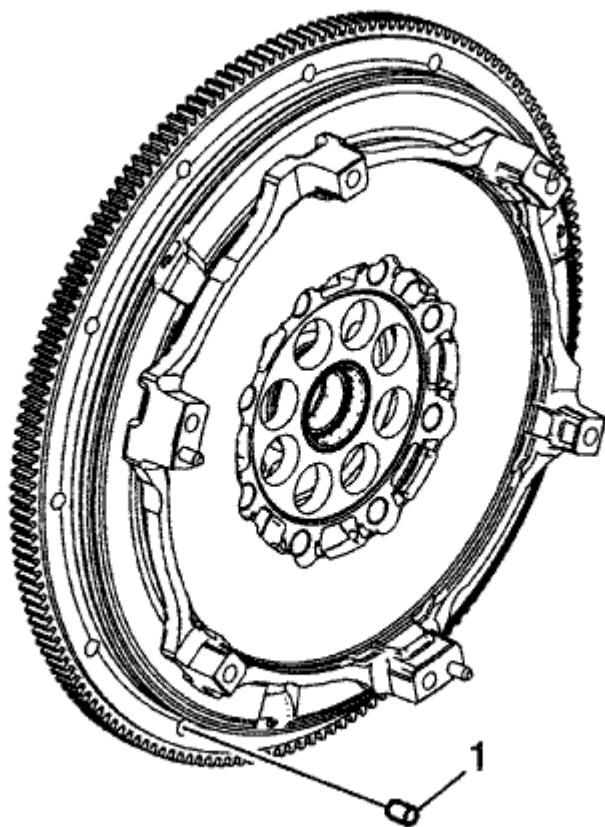


Fig. 197: Location Of Manual Transmission Flywheel Balance Weights
Courtesy of GENERAL MOTORS COMPANY

6. Note the location of the manual transmission flywheel balance weights (1), if applicable.
7. Remove the **J-42386-A** flywheel holding tool

Installation Procedure

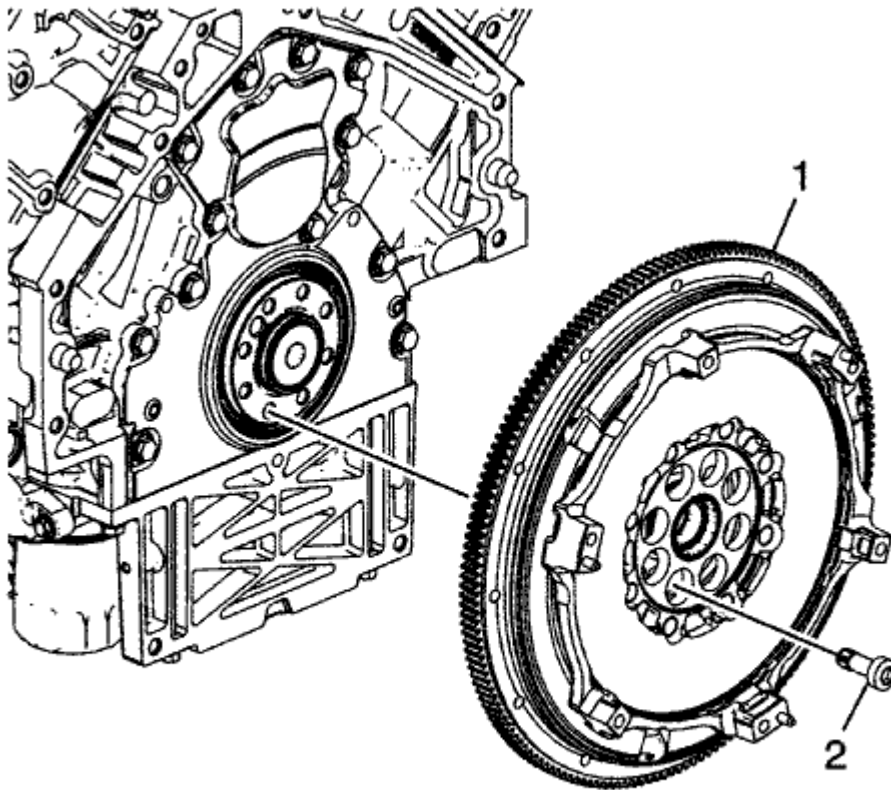


Fig. 198: Flywheel Bolts

Courtesy of GENERAL MOTORS COMPANY

CAUTION: This vehicle is equipped with torque-to-yield or single use fasteners. Install a **NEW** torque-to-yield or single use fastener when installing this component. Failure to replace the torque-to-yield or single use fastener could cause damage to the vehicle or component.

NOTE: The flywheel does not use a locating pin for alignment and will not initially seat against the crankshaft flange, but will be pulled onto the crankshaft by the engine flywheel bolts.

1. Install the flywheel (1) to the crankshaft.

CAUTION: This vehicle is equipped with torque-to-yield or single use fasteners. Install a **NEW** torque-to-yield or single use fastener when installing this component. Failure to replace the torque-to-yield or single use fastener could cause damage to the vehicle or component.

2. Apply threadlocker to the threads of the flywheel bolts (2). Refer to **Adhesives, Fluids,**

3. Install and hand tighten the NEW flywheel bolts (2).

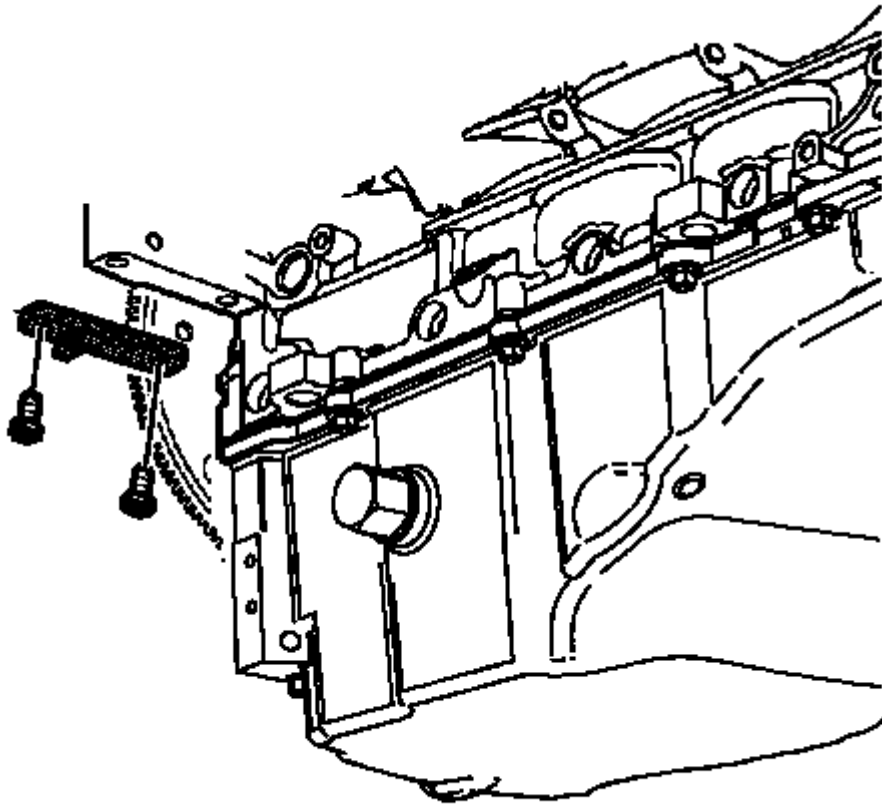


Fig. 199: Identifying J 42386-A
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

4. Install the **J-42386-A** flywheel holding tool and bolts.

Use 1 M10 -1.5 x 120 mm and 1 M10 -1.5 x 45 mm bolt for proper tool operation.

Tighten the **J-42386-A** flywheel holding tool and bolts to 50 N.m (37 lb ft).

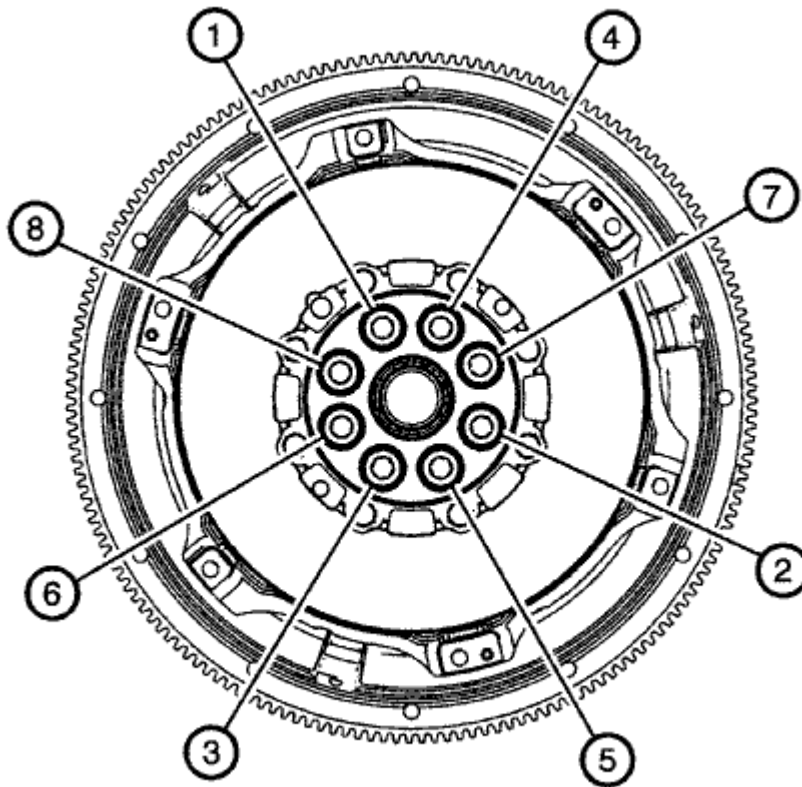


Fig. 200: Tightening Flywheel Bolts
 Courtesy of GENERAL MOTORS COMPANY

5. Tighten the flywheel bolts (1).
 1. Tighten the bolts (1-8) a first pass in sequence to 15 N.m (11 lb ft).
 2. Tighten the bolts (1-8) a second pass in sequence to 30 N.m (22 lb ft).
 3. Tighten the bolts (1-8) a final pass in sequence an additional 30 degrees using **EN-45059** angle meter.
6. Remove the **J-42386-A** flywheel holding tool
7. Install the clutch assembly. Refer to **Clutch Assembly Replacement** .

AUTOMATIC TRANSMISSION FLEX PLATE REPLACEMENT

Special Tools

- **EN-45059** Angle Meter

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

Removal Procedure

1. Remove the automatic transmission. Refer to Transmission Replacement .

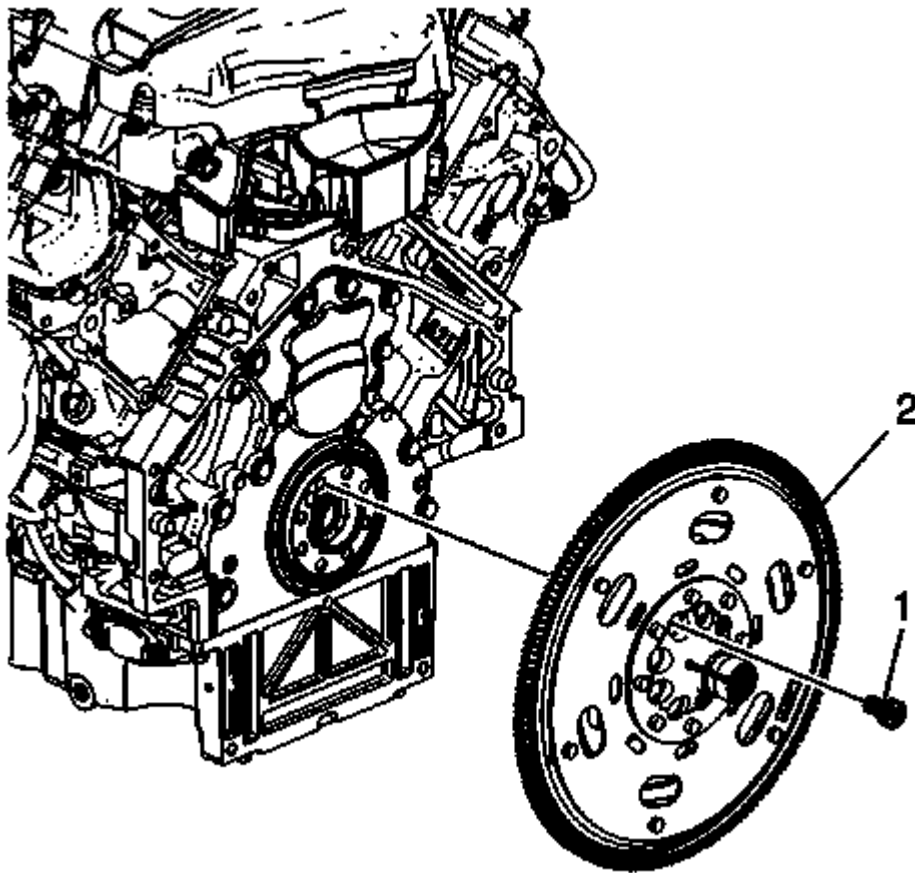


Fig. 201: Engine Flex Plate Bolts
Courtesy of GENERAL MOTORS COMPANY

NOTE: The flex plate does not use a locating pin for alignment and will not initially seat against the crankshaft flange, but will be pulled onto the crankshaft by the engine flex plate bolts. This procedure requires a 3 stage tightening process.

2. Remove the engine flex plate bolts (1).

NOTE: Mark the flex plate and crankshaft before removal.

3. Remove the flex plate (2).

Installation Procedure

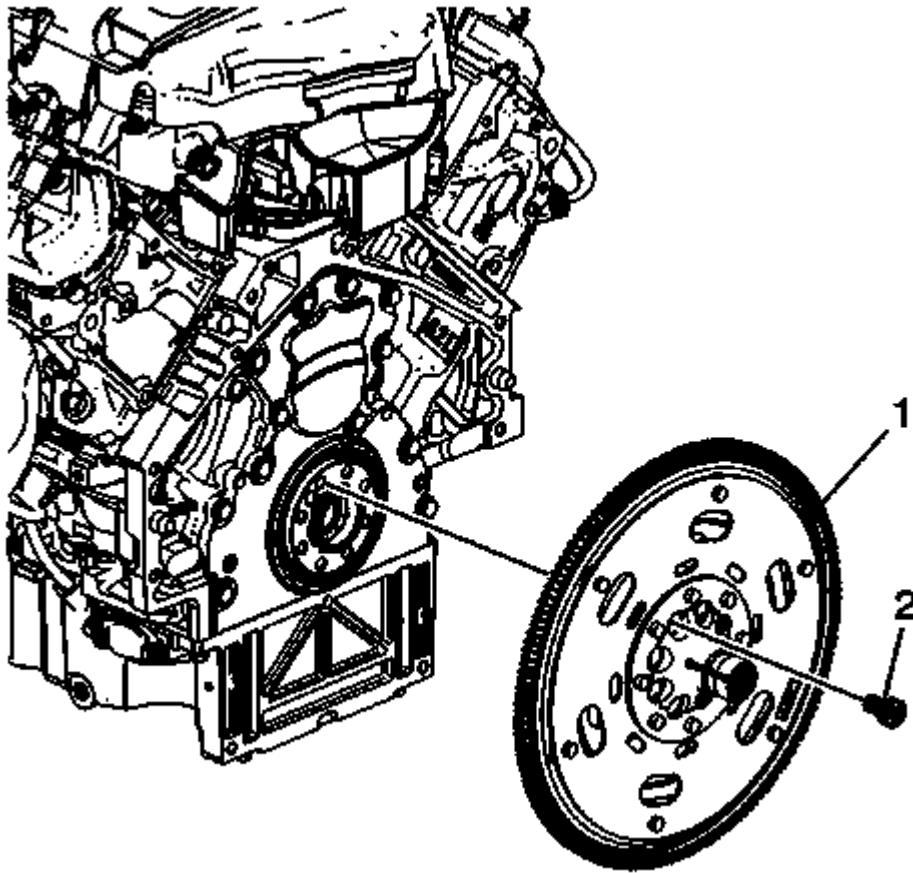


Fig. 202: Flex Plate And Crankshaft
Courtesy of GENERAL MOTORS COMPANY

NOTE: The flex plate does not use a locating pin for alignment and will not initially seat against the crankshaft flange, but will be pulled onto the crankshaft by the engine flex plate bolts. This procedure requires a 3 stage tightening process.

1. Install the flex plate (1) to the crankshaft.
2. Apply threadlock to the threads of the flex plate bolts (2). Refer to **Adhesives, Fluids, Lubricants and Sealers** .

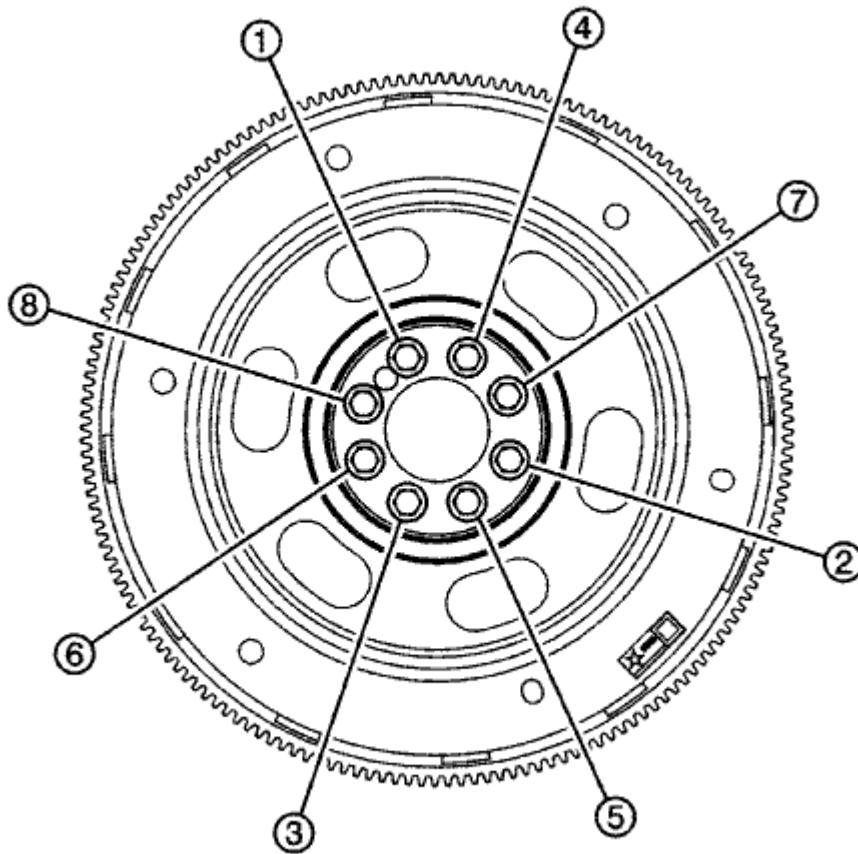


Fig. 203: Engine Flex Plate Bolts
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

3. Install the engine flex plate bolts (2).
 1. Tighten the engine flex plate bolts (1-8) a first pass in sequence to 15 N.m (11 lb ft).
 2. Tighten the engine flex plate bolts (1-8) a second pass in sequence to 30 N.m (22 lb ft).
 3. Tighten the engine flex plate bolts (1-8) a final pass in sequence an additional 30 degrees using **EN-45059** angle meter.
4. Install the automatic transmission. Refer to Transmission Replacement .

ENGINE REPLACEMENT

Special Tools

- **J 36660-A** Torque Angle Meter
- **J 39580** Engine Support Table

- **J 39580-500** Engine Support Table Top
- **J 41798** Engine Lifting Brackets
- **J 42203** Driveline Support

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

Removal Procedure

1. Recover the air conditioning (A/C) refrigerant. Refer to **Refrigerant Recovery and Recharging (LT1)** .
2. Remove the radiator. Refer to **Radiator Replacement** .
3. Remove the brake pressure modulator valve (BPMV) bracket. Refer to **Brake Pressure Modulator Valve Bracket Replacement** .
4. Reposition the brake pipes.
5. Disconnect the fuel feed hose from the engine. Refer to **Fuel Feed Hose Replacement (Engine To Tank)** , **Fuel Feed Hose Replacement (At Tank)** .
6. Remove the heater hoses from the engine coolant manifold.
7. Remove the generator. Refer to **Generator Replacement (LT1)** .
8. Remove the front tires and wheels. Refer to **Tire and Wheel Removal and Installation** .
9. Remove the electric belt drive rack and pinion steering gear. Refer to **Electric Belt Drive Rack and Pinion Steering Gear Replacement** .
10. Remove the starter motor. Refer to **Starter Replacement (LT1)** .

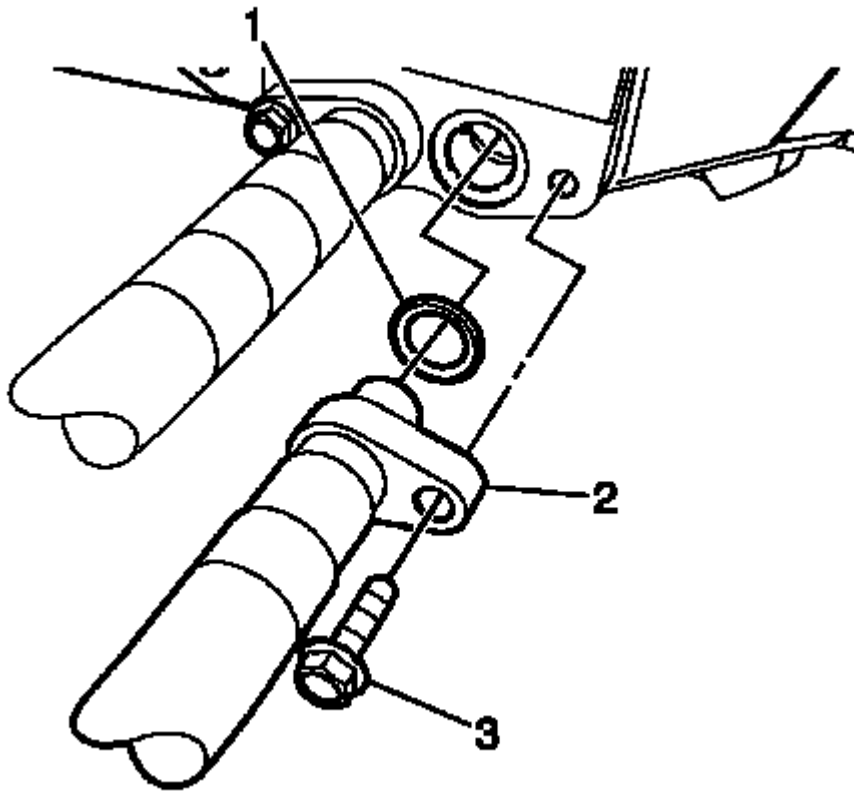


Fig. 204: Identifying Oil Tank Inlet Hose, Inlet Hose To Oil Tank Bolt & Oil Seal
Courtesy of GENERAL MOTORS COMPANY

11. Remove the oil inlet hose to oil pan bolt (3) and disconnect the hose (2) from the oil pan.
Discard the oil seal (1).
12. If the engine failed and debris was created, remove the oil tank inlet hose and discard. Refer to **Oil Tank Inlet Hose Replacement**

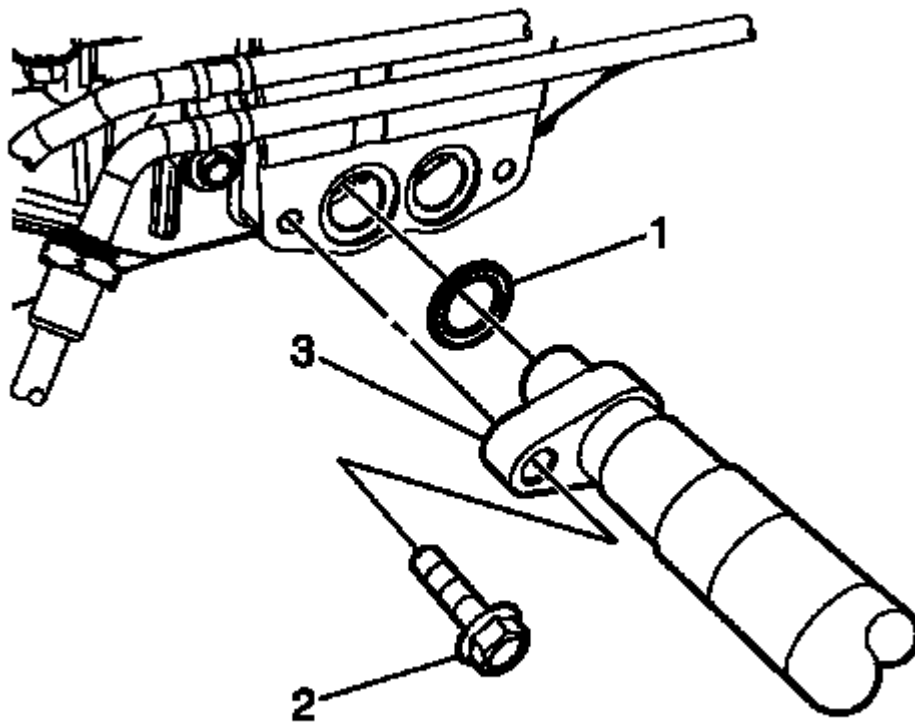


Fig. 205: Identifying Oil Tank Outlet Hose, Outlet Hose To Oil Tank Bolt & Oil Seal
Courtesy of GENERAL MOTORS COMPANY

13. Remove the oil tank outlet hose to oil pan bolt (2) and disconnect the hose (3) from the oil pan.
Discard the oil seal (1).
14. If the engine failed and debris was created, remove the oil tank outlet hose and discard. Refer to **Oil Tank Outlet Hose Replacement**.
15. Remove the engine oil cooler adapter. Refer to **Engine Oil Cooler Adapter Replacement**.

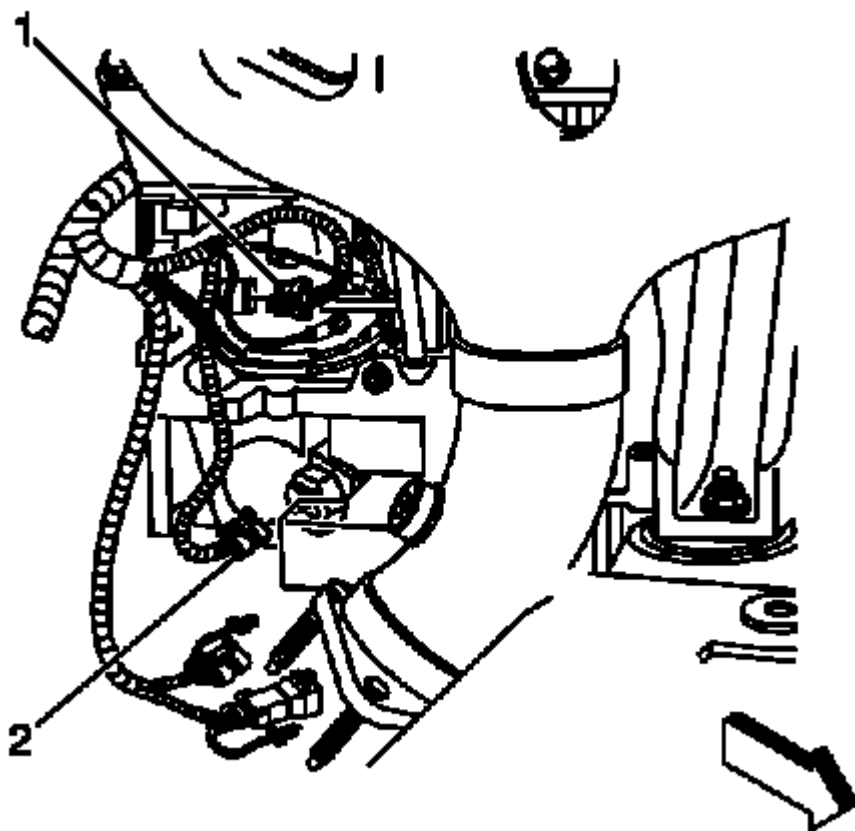


Fig. 206: Engine Oil Level Sensor Electrical Connector & CKP Sensor Electrical Connector

Courtesy of GENERAL MOTORS COMPANY

16. Disconnect the crankshaft position (CKP) sensor electrical connector (1).
17. If equipped, disconnect the oil level sensor electrical connector (2).
18. Disconnect the right heated oxygen sensor (HO2S) electrical connector.

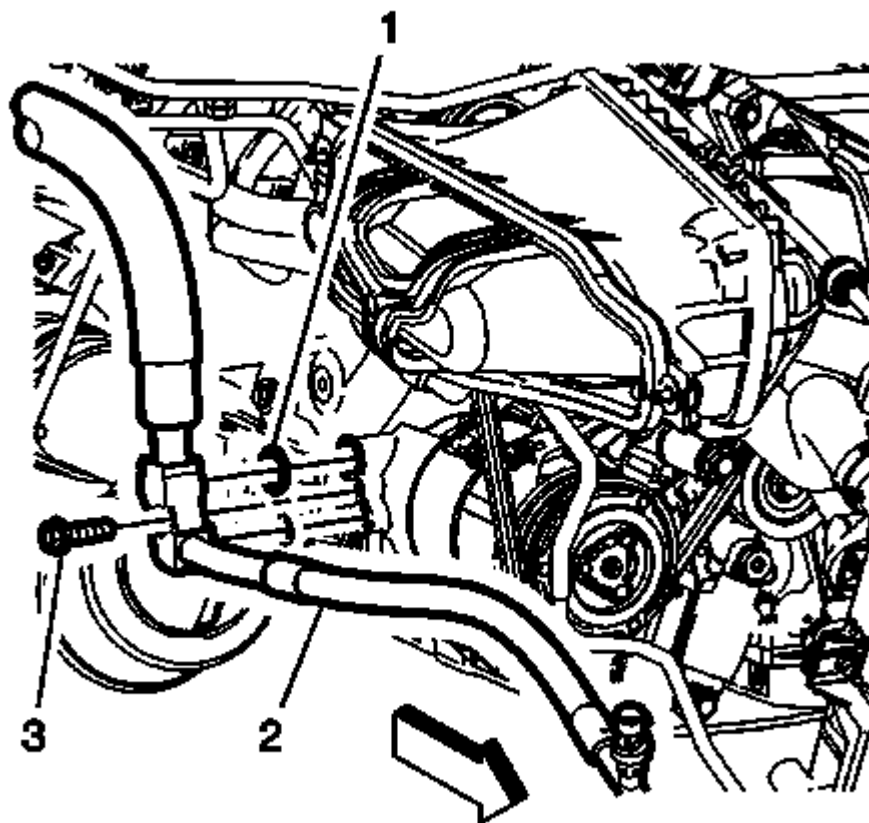


Fig. 207: Separating A/C Compressor And Condenser Hose From A/C Compressor
Courtesy of GENERAL MOTORS COMPANY

19. Separate the A/C compressor and condenser hose from the A/C compressor. Refer to **Air Conditioning Compressor and Condenser Hose Replacement** .

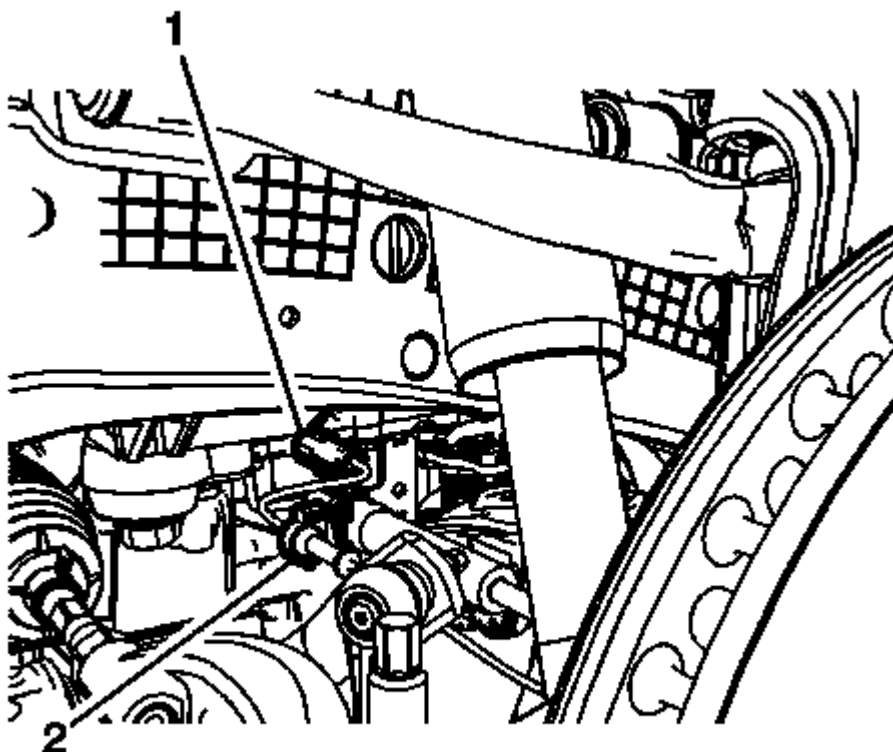


Fig. 208: Wheel Speed Sensor Electrical Connector And Release Connector
Courtesy of GENERAL MOTORS COMPANY

20. Disconnect the wheel speed sensor electrical connectors (1). Refer to **Front Wheel Speed Sensor Replacement** .
21. If equipped with real time damping (RTD) disconnect the following electrical connectors:
 - Shock absorber damper
 - Position sensor pigtail

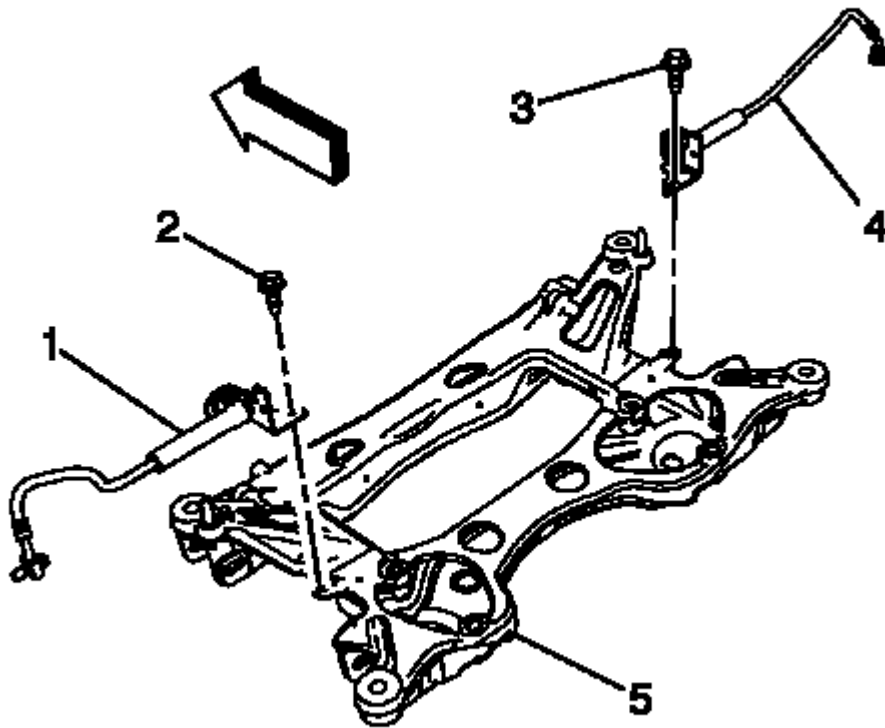


Fig. 209: Left Front Brake Hose Mounting Bracket Fastener
Courtesy of GENERAL MOTORS COMPANY

22. Remove the left front brake hose mounting bracket fastener (2) and set aside the left front brake hose (1).
23. Remove the right front brake hose mounting bracket fastener (3) and set aside the right front brake hose (4).

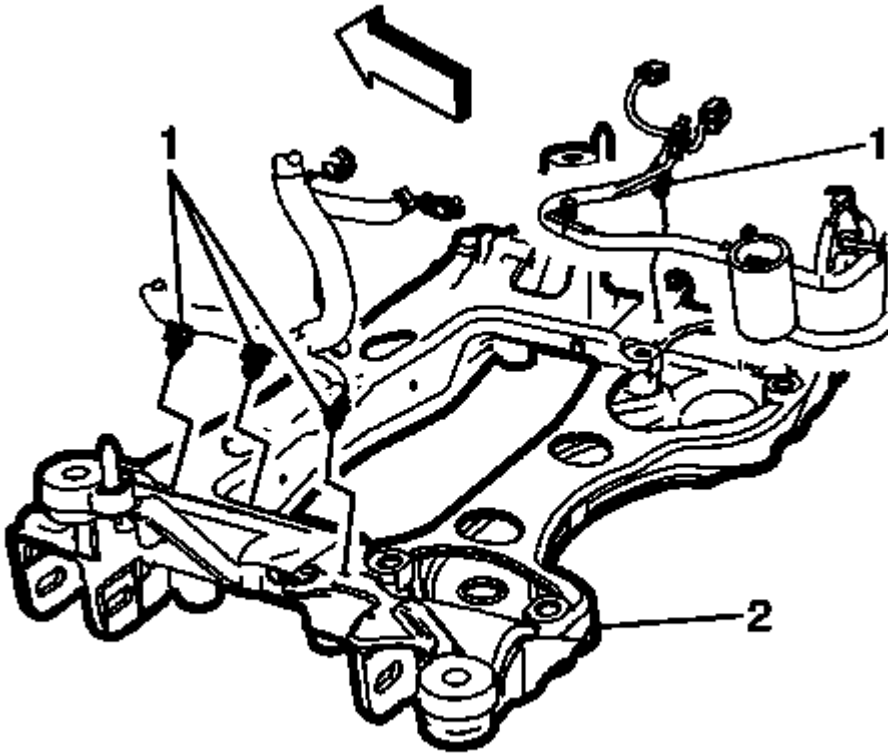


Fig. 210: Engine Harness Retainers
Courtesy of GENERAL MOTORS COMPANY

24. Remove the engine harness retainers (1) from the front cradle assembly (2).
25. Remove the stabilizer shaft. Refer to **Stabilizer Shaft Replacement** .
26. Remove the driveline support assembly. Refer to **Driveline Support Assembly Replacement (with Manual Transmission)** , **Driveline Support Assembly Replacement (with Automatic Transmission)** .
27. Support the engine and cradle on the **J 39580** engine support table and the **J 39580-500** engine support table top.

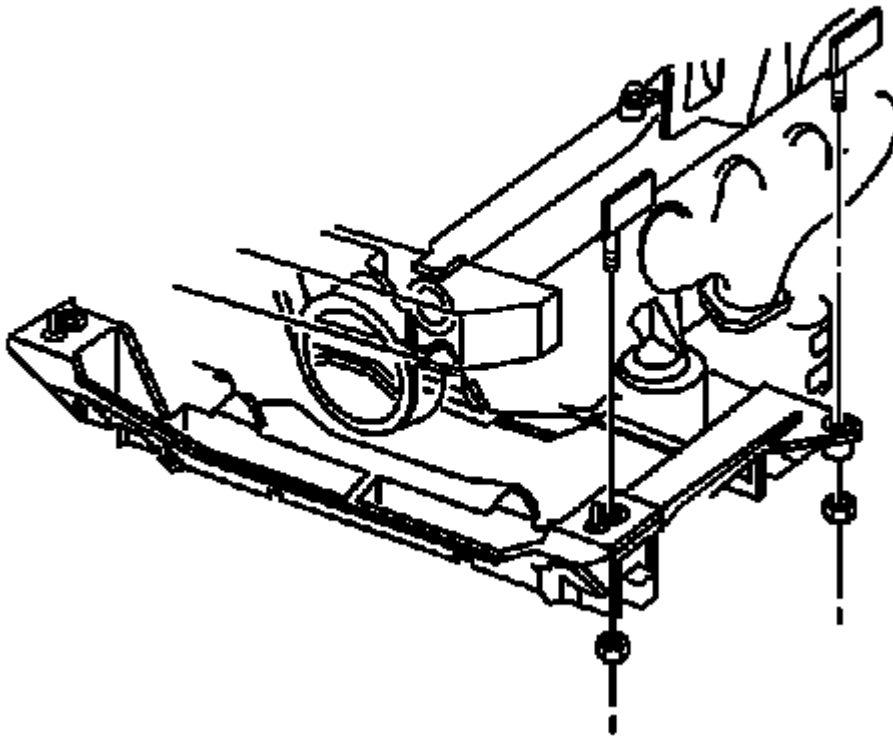


Fig. 211: View Of Front & Rear Crossmember Nuts
Courtesy of GENERAL MOTORS COMPANY

28. Using HAND TOOLS ONLY, remove the front and rear cradle nuts.
29. Partially raise the vehicle.
30. Disconnect the manifold absolute pressure (MAP) sensor electrical connector.
31. Disconnect the camshaft position (CMP) sensor electrical connector.
32. Remove the ground strap bolt.
33. Remove the ground strap from the left rear cylinder head.
34. Disconnect the engine oil pressure sensor electrical connector from the back of the engine.

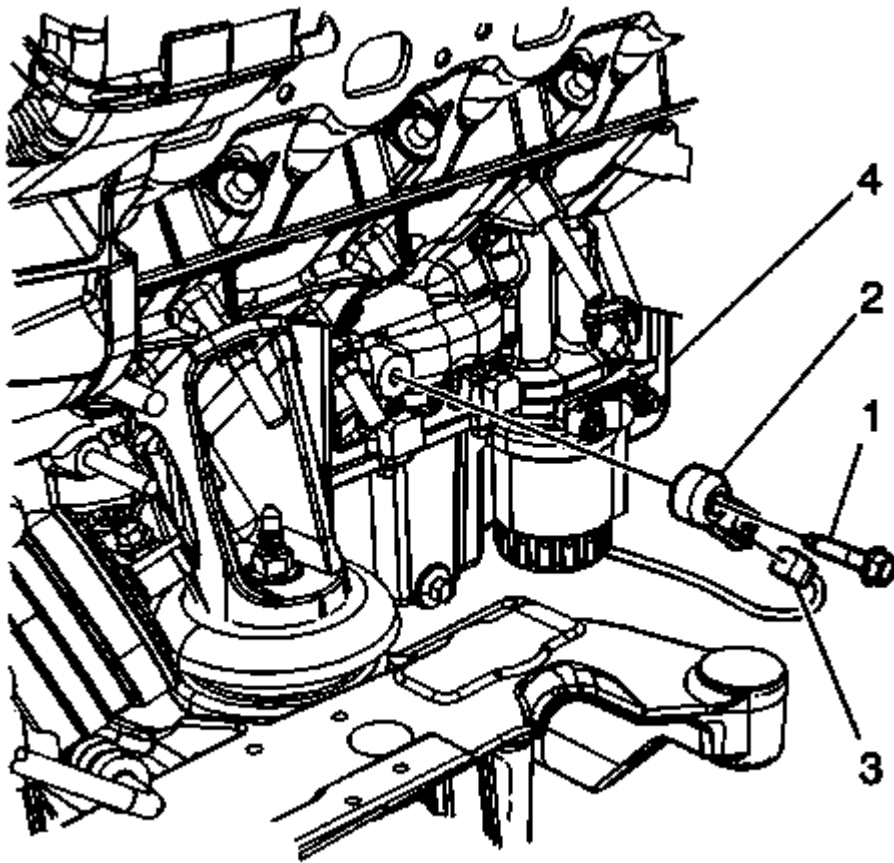


Fig. 212: Knock Sensor, Engine Harness & Engine Block - Left Side
Courtesy of GENERAL MOTORS COMPANY

35. Disconnect the electrical connector (2) for the knock sensor, left side.

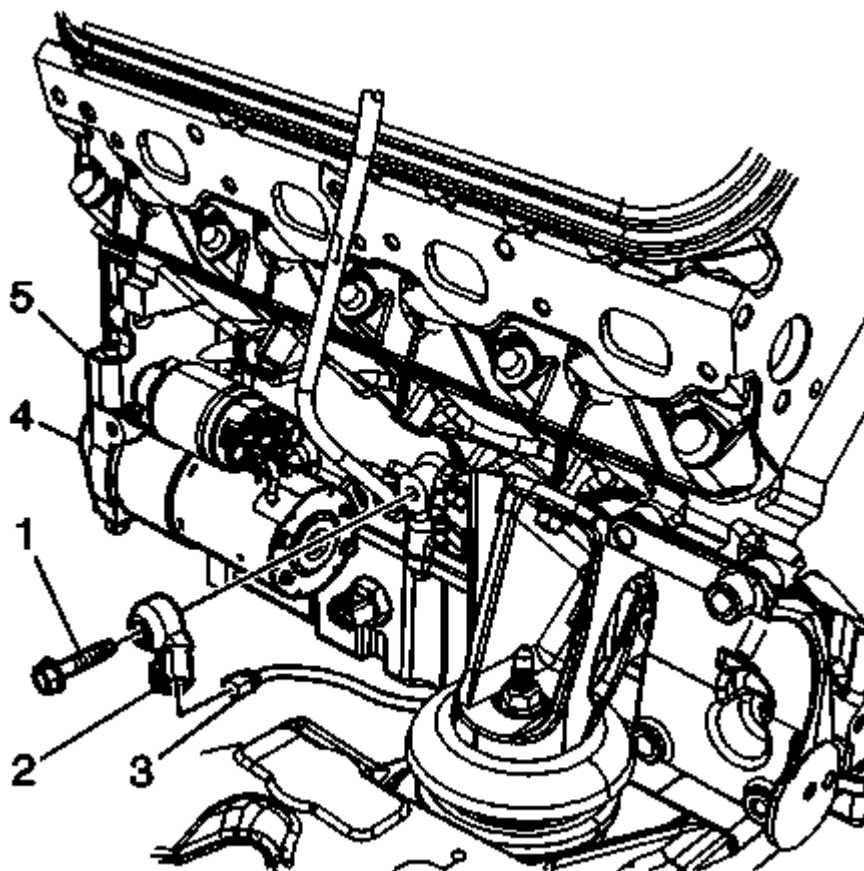


Fig. 213: Knock Sensor, Starter Assembly, Engine Electrical Connector & Engine Block - Right Side
Courtesy of GENERAL MOTORS COMPANY

36. Disconnect the electrical connector (2) for the knock sensor, right side.

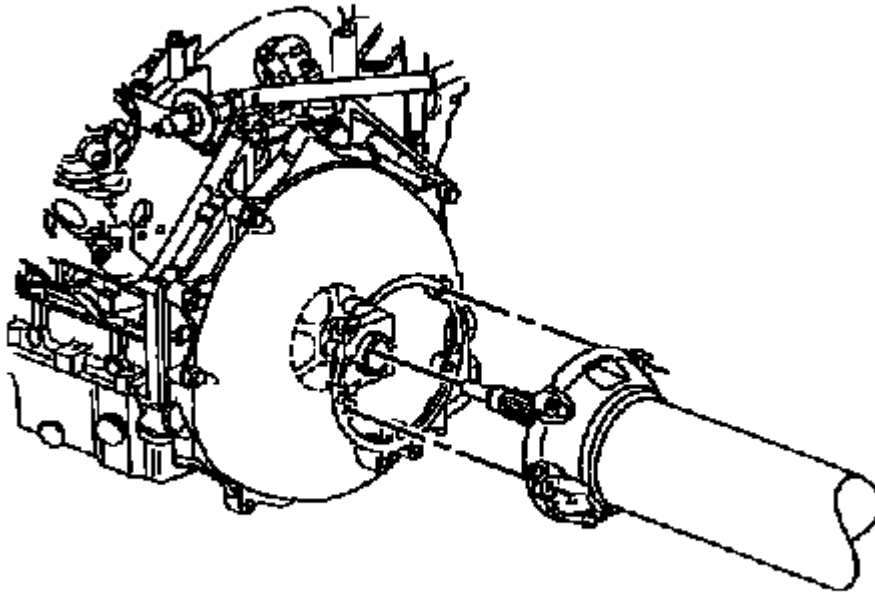


Fig. 214: Removing/Installing Driveline
Courtesy of GENERAL MOTORS COMPANY

37. Remove the driveline support bolts.
38. Slowly pull the engine away from the propeller shaft.
39. As soon as the propeller input shaft clears the flywheel housing, slowly raise the vehicle.
40. Slide the engine and cradle forward in order to clear the propeller shaft spline.
41. Remove the electronic brake control module (EBCM). Refer to **Electronic Brake Control Module Replacement** .

NOTE: **Visually inspect the wiring harness clearances while raising the vehicle.**

42. Raise the vehicle completely off of the engine and cradle.
43. Install the **J 41798** engine lifting brackets to the engine.

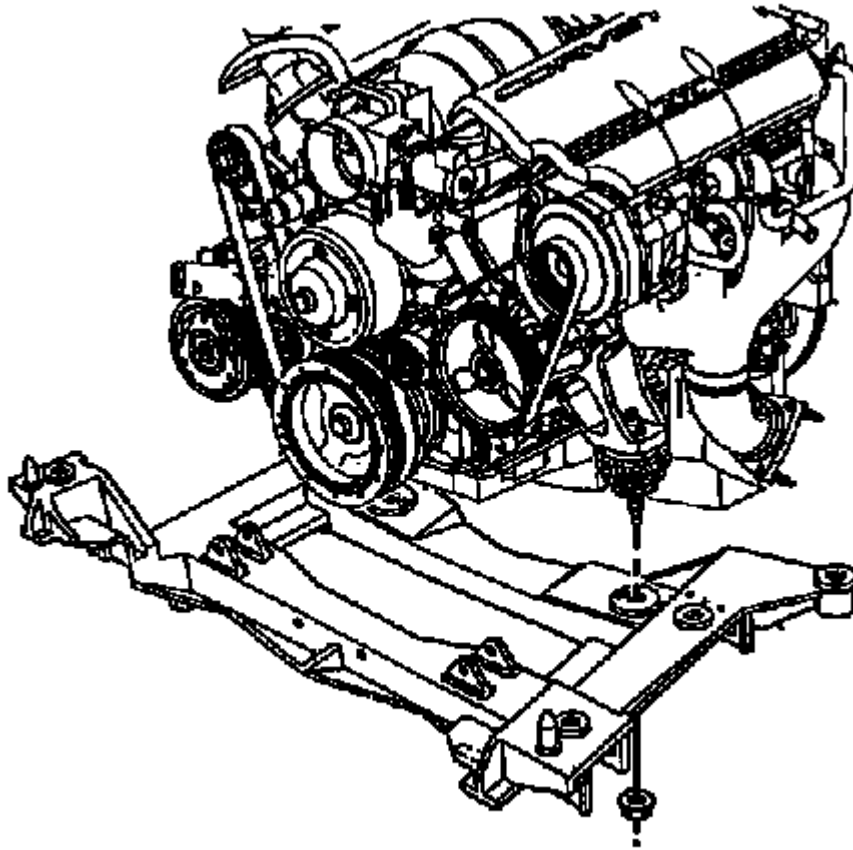


Fig. 215: Engine Mount & Nuts
Courtesy of GENERAL MOTORS COMPANY

44. Remove the engine mount nuts.
45. Using a engine hoist and the **J 41798** engine lifting brackets slowly raise the engine.
46. Remove the engine from the cradle.

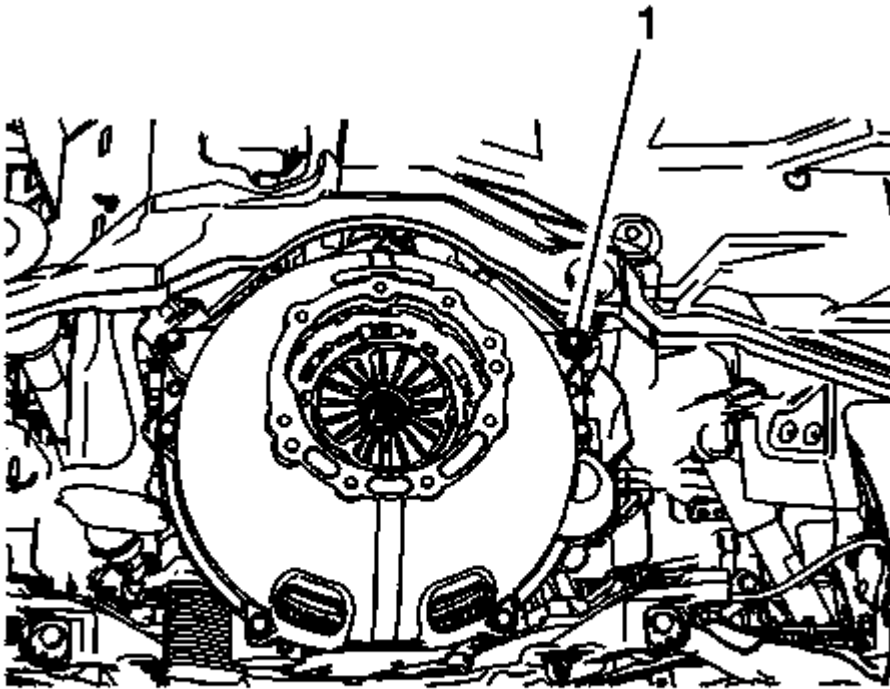


Fig. 216: Flywheel Housing Bolts
Courtesy of GENERAL MOTORS COMPANY

47. Remove the flywheel housing bolts (1).
48. Remove the flywheel housing from the engine block.
49. Install the engine onto an engine stand and prepare for disassembly.
50. Remove the engine hoist.

CAUTION: Avoid engine damage. Debris in the engine oil tank, oil tank hoses and engine oil cooler may be pulled back into the engine causing severe engine damage. You must clean the engine oil tank and replace the engine oil hoses and engine oil cooler.

51. Remove the **J 41798** engine lifting brackets from the engine.

Installation Procedure

1. Prepare the engine for installation.
2. Install the **J 41798** engine lifting brackets to the engine.
3. Using an engine hoist and the **J 41798** engine lifting brackets raise the engine slightly.

4. Remove the engine from the engine stand.
5. Install the flywheel housing to the engine block.

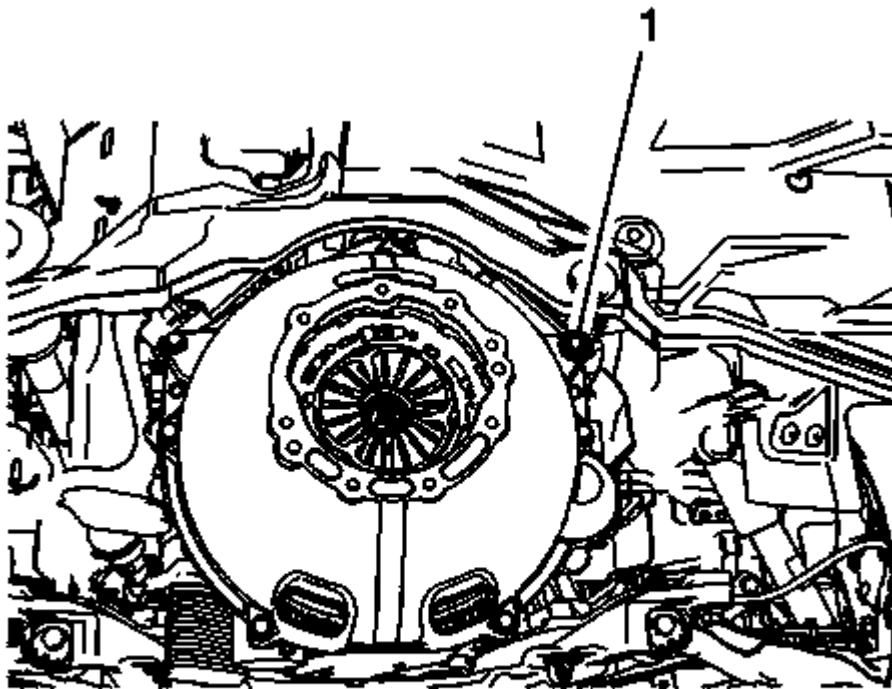


Fig. 217: Flywheel Housing Bolts
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

6. Install the flywheel housing bolts (1) and tighten to 50 N.m (37 lb ft).
7. Using an engine hoist and the **J 41798** engine lifting brackets lower the engine onto the cradle.

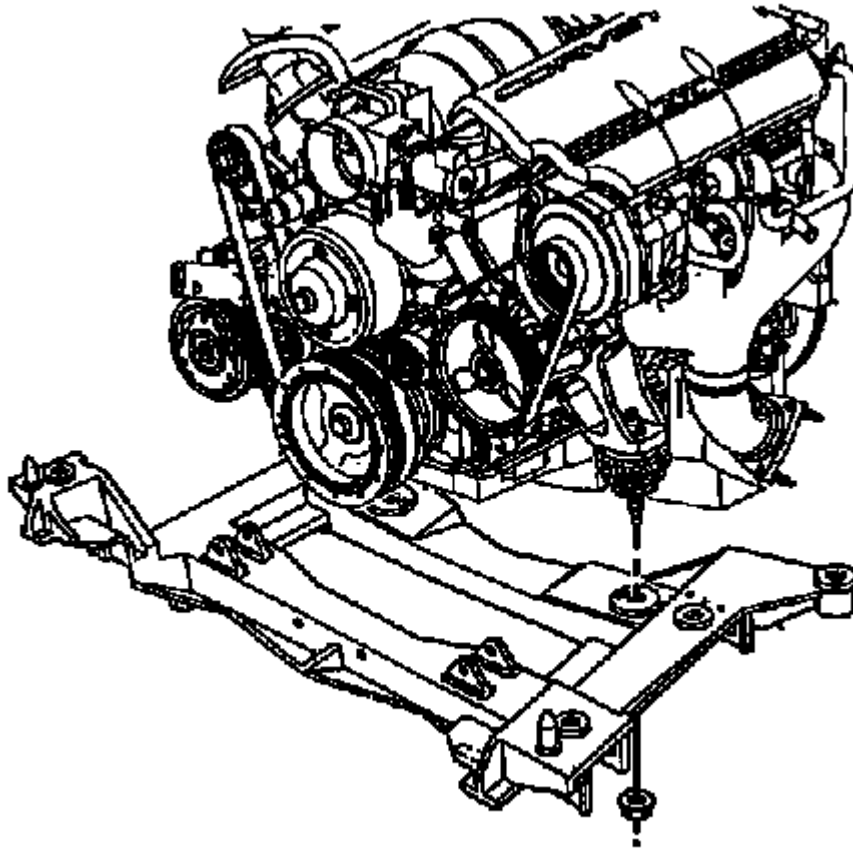


Fig. 218: Engine Mount & Nuts
Courtesy of GENERAL MOTORS COMPANY

8. Install the engine mount nuts and tighten to 65 N.m (48 lb ft).
9. Remove the **J 41798** engine lifting brackets from the engine.
10. Install the EBCM. Refer to **Electronic Brake Control Module Replacement** .
11. Roll the engine and cradle underneath the vehicle.
12. Partially lower the vehicle onto the engine and cradle.
13. Install the ground strap and ground strap bolt to the rear of the left cylinder head. Tighten the ground strap bolt to 32 N.m (24 lb ft).
14. Connect the engine oil pressure sensor electrical connector.
15. Connect the MAP sensor electrical connector.
16. Connect the CMP sensor electrical connector.

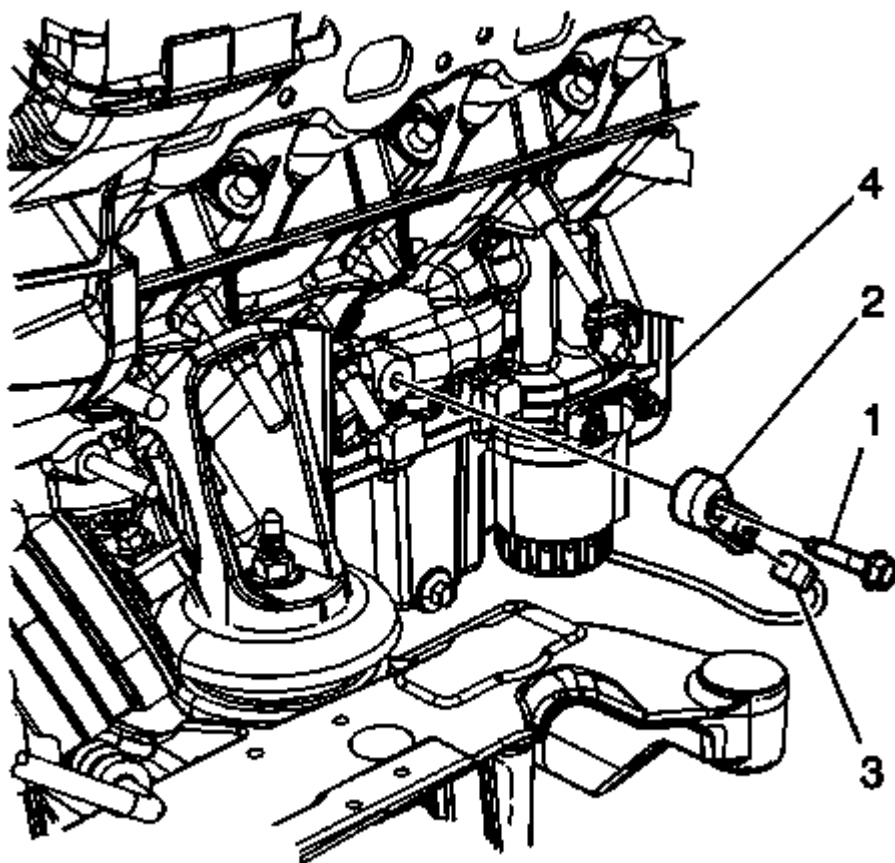


Fig. 219: Knock Sensor, Engine Harness & Engine Block - Left Side
Courtesy of GENERAL MOTORS COMPANY

17. Reconnect the electrical connector (2) for the knock sensor, left side.

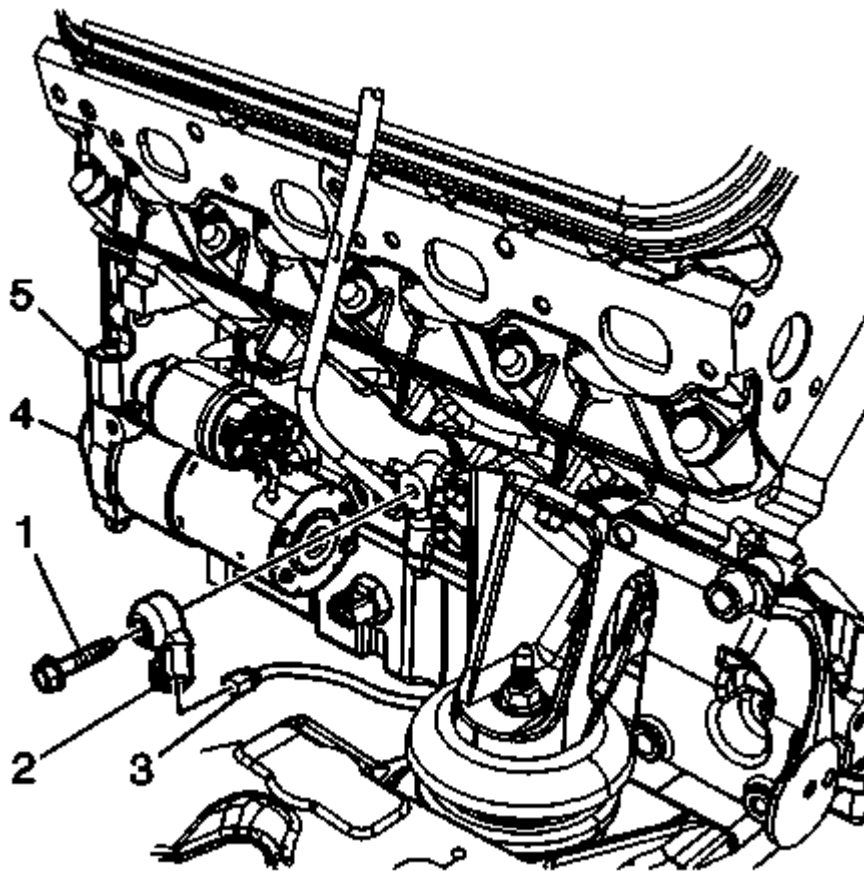


Fig. 220: Knock Sensor, Starter Assembly, Engine Electrical Connector & Engine Block - Right Side

Courtesy of GENERAL MOTORS COMPANY

18. Reconnect the electrical connector (2) for the knock sensor, right side.
19. Vehicles equipped with a manual transmission, slide the engine and cradle rearward. Do not force the engine onto the propeller spline.
20. Position the engine to the proper height and angle in order to install the propeller input shaft.
21. Insert the propeller input shaft into the clutch driven plate hub while maintaining the proper angle, DO NOT force. Rotate the shaft slightly to bring the 2 splines into alignment, if necessary.
22. Slowly seat the flywheel housing to the driveline.

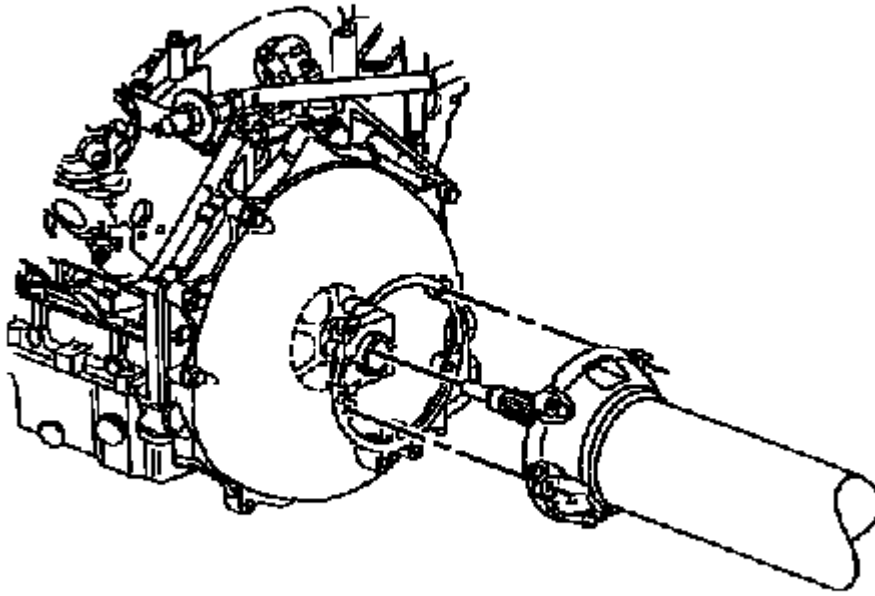


Fig. 221: Removing/Installing Driveline
Courtesy of GENERAL MOTORS COMPANY

23. Install the driveline support bolts and tighten to 50 N.m (37 lb ft).
24. Connect the master cylinder hose to the clutch actuator hose.
25. Hand tighten the flywheel hub collar bolt.
26. Lower the vehicle onto the cradle and align the dowels.

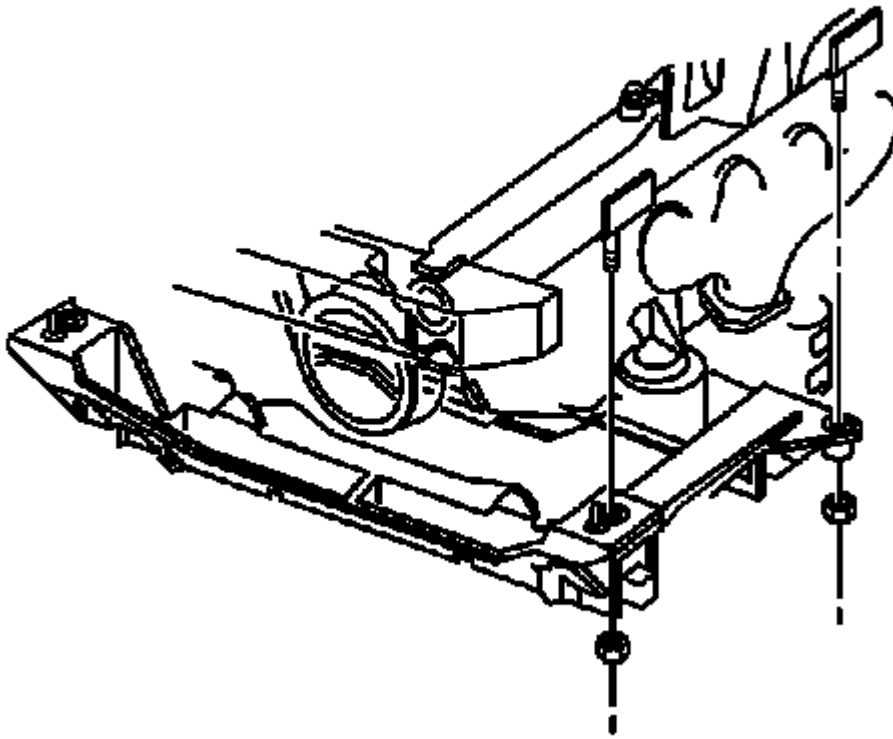


Fig. 222: View Of Front & Rear Crossmember Nuts
Courtesy of GENERAL MOTORS COMPANY

NOTE: Use only hand tools when tightening or torquing cradle nuts.

27. By HAND, install NEW cradle nuts until snug. Tighten the cradle nuts to 110 N.m (81 lb ft).
28. Raise and suitably support the vehicle.
29. Remove the **J 39580** engine support table and the **J 39580-500** engine support table top.
30. Remove the **J 42203** driveline support from the vehicle.
31. Install the driveline support assembly. Refer to **Driveline Support Assembly Replacement (with Manual Transmission)** , **Driveline Support Assembly Replacement (with Automatic Transmission)** .
32. Install the front stabilizer shaft. Refer to **Stabilizer Shaft Replacement** .

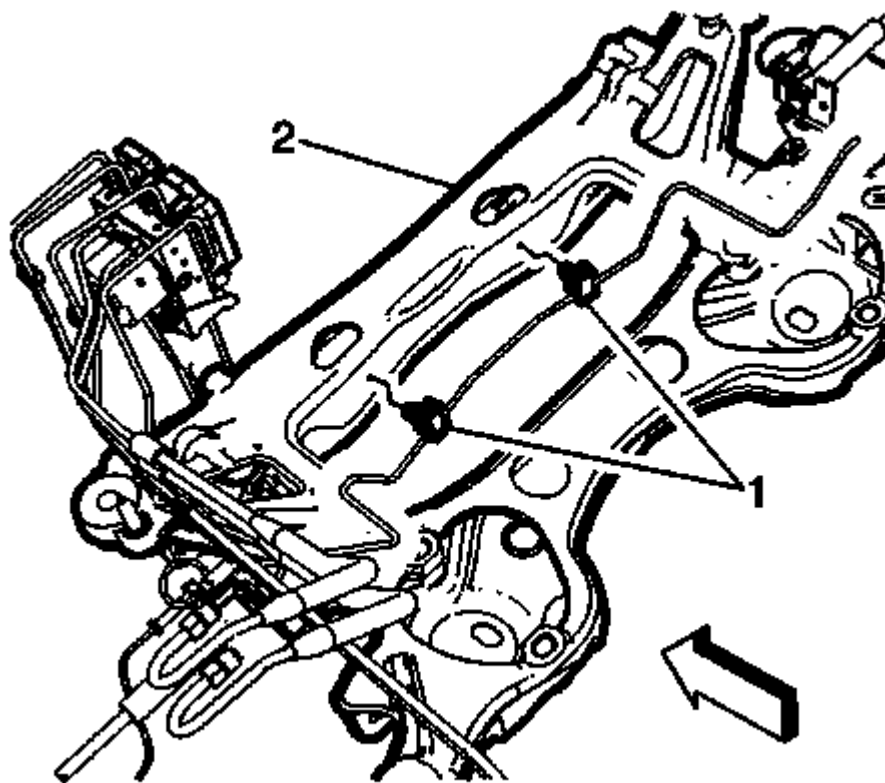


Fig. 223: Brake Pipe Retainers And Front Cradle
Courtesy of GENERAL MOTORS COMPANY

33. Install the brake pipe retainers (1) to the front cradle (2).

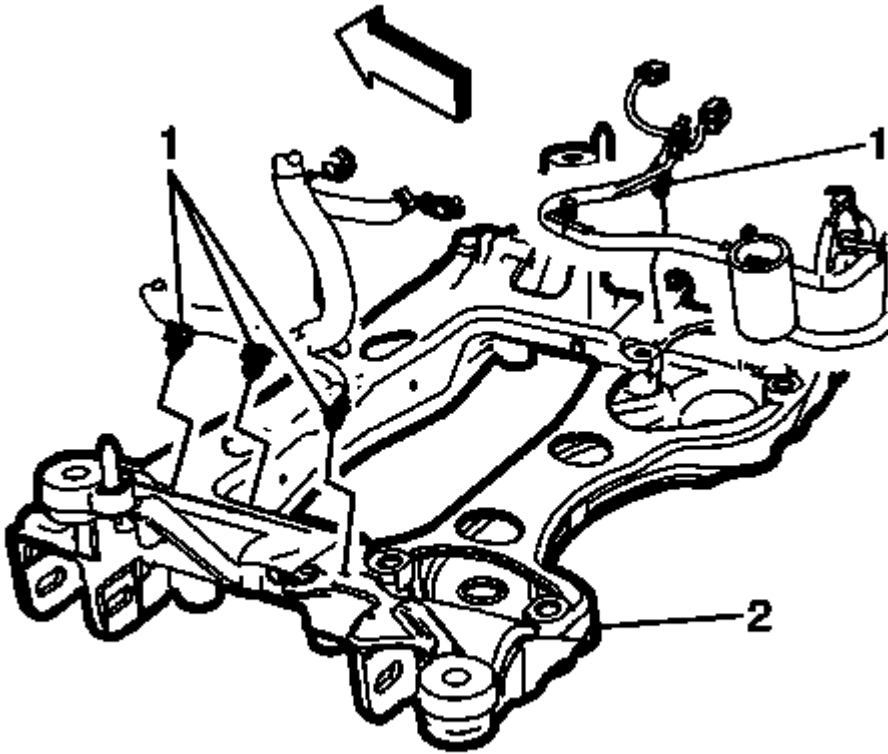


Fig. 224: Engine Harness Retainers
Courtesy of GENERAL MOTORS COMPANY

34. Install the engine harness retainers (1) to the front cradle (2).
 1. Tighten the transmission wire harness clip bolt, near the harness ground, to 32 N.m (23 lb ft).
 2. Tighten the transmission wire harness clip bolt, near the oil pan, to 25 N.m (18 lb ft).

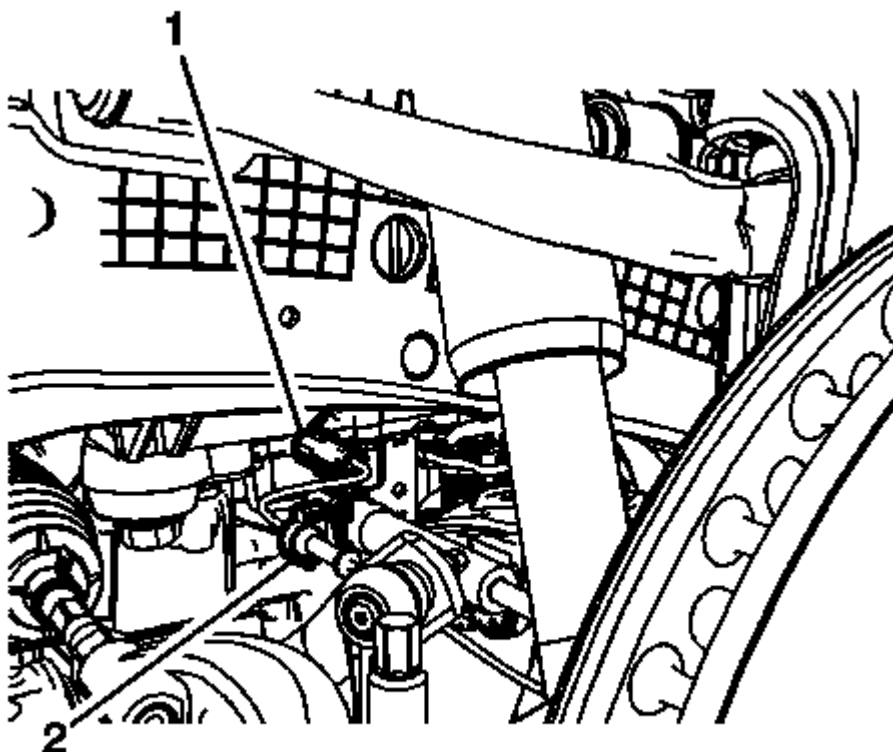


Fig. 225: Wheel Speed Sensor Electrical Connector And Release Connector
Courtesy of GENERAL MOTORS COMPANY

35. Connect the wheel speed sensor electrical connectors (1). Refer to **Front Wheel Speed Sensor Replacement** .
36. If equipped with RTD connect the following electrical connectors:
 - Position sensor pigtail
 - Shock absorber damper
37. Connect the left HO2S electrical connector.

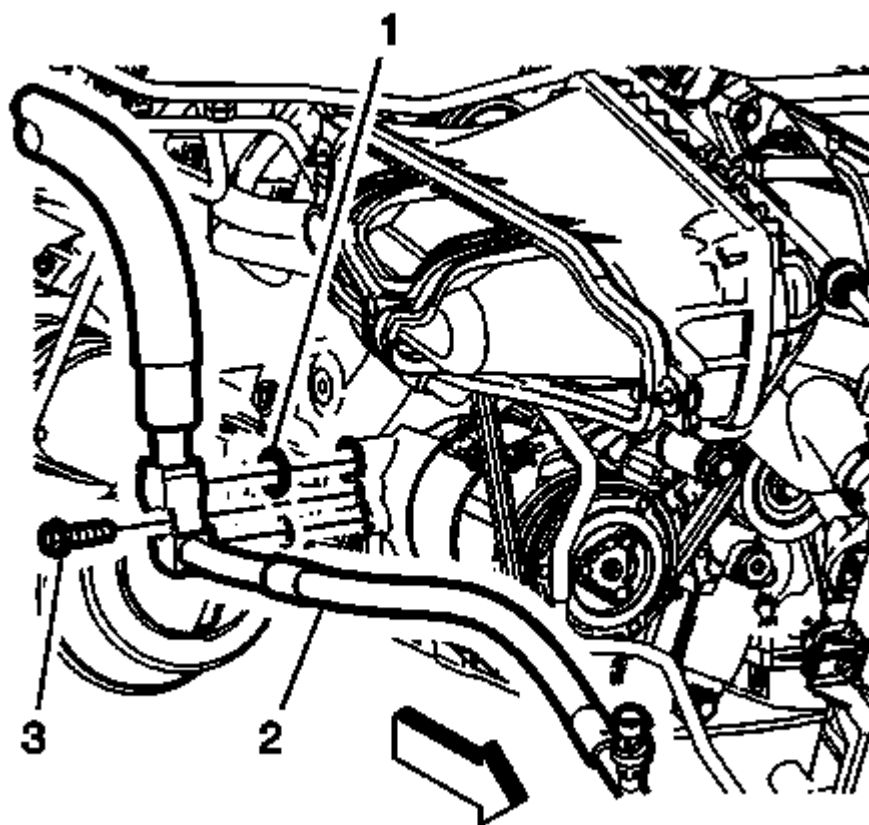


Fig. 226: Separating A/C Compressor And Condenser Hose From A/C Compressor
Courtesy of GENERAL MOTORS COMPANY

38. Install the A/C compressor and condenser hose to the A/C compressor. Refer to **Air Conditioning Compressor and Condenser Hose Replacement** .

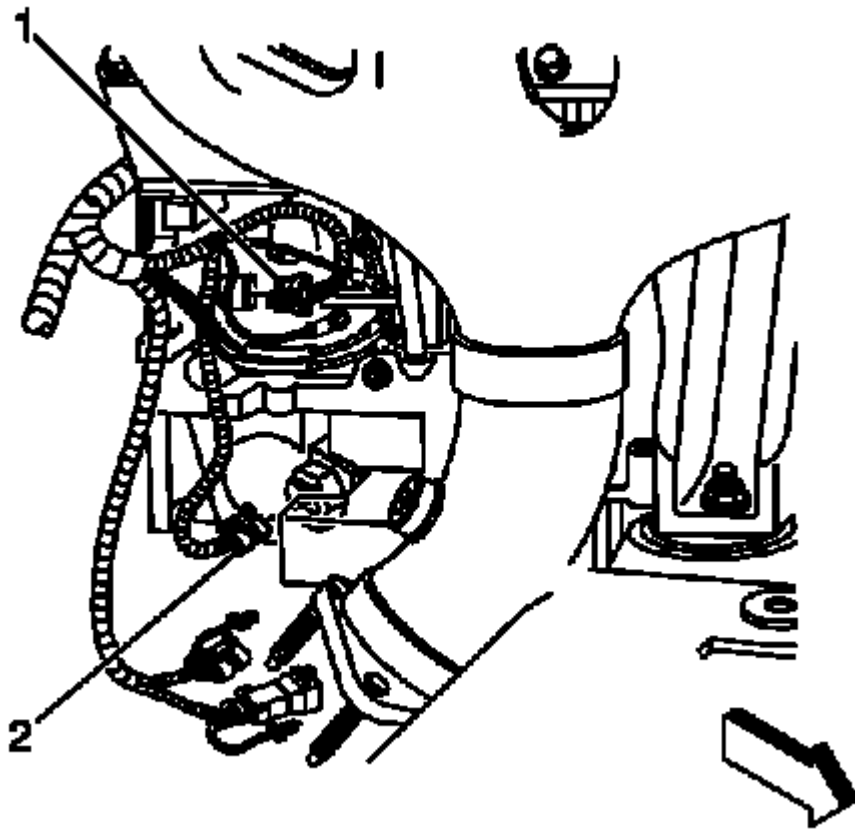


Fig. 227: Engine Oil Level Sensor Electrical Connector & CKP Sensor Electrical Connector

Courtesy of GENERAL MOTORS COMPANY

39. Connect the right front HO2S sensor electrical connector.
40. Connect the oil level sensor (2) electrical connector.
41. Connect the CKP sensor (1) electrical connector.

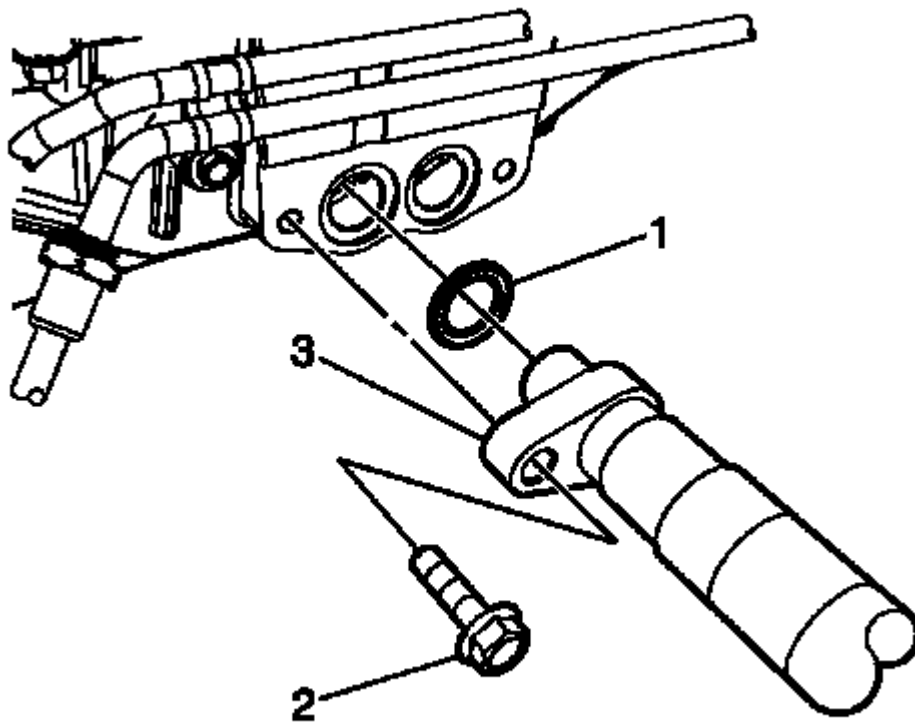


Fig. 228: Identifying Oil Tank Outlet Hose, Outlet Hose To Oil Tank Bolt & Oil Seal
Courtesy of GENERAL MOTORS COMPANY

42. Using a new oil seal (1) install the oil tank outlet hose (3) and bolt (2) to the oil pan. Tighten the outlet hose to oil pan bolt to 22 N.m (16 lb ft).
43. If the oil tank outlet hose was discarded, install a new hose. Refer to **Oil Tank Outlet Hose Replacement**.

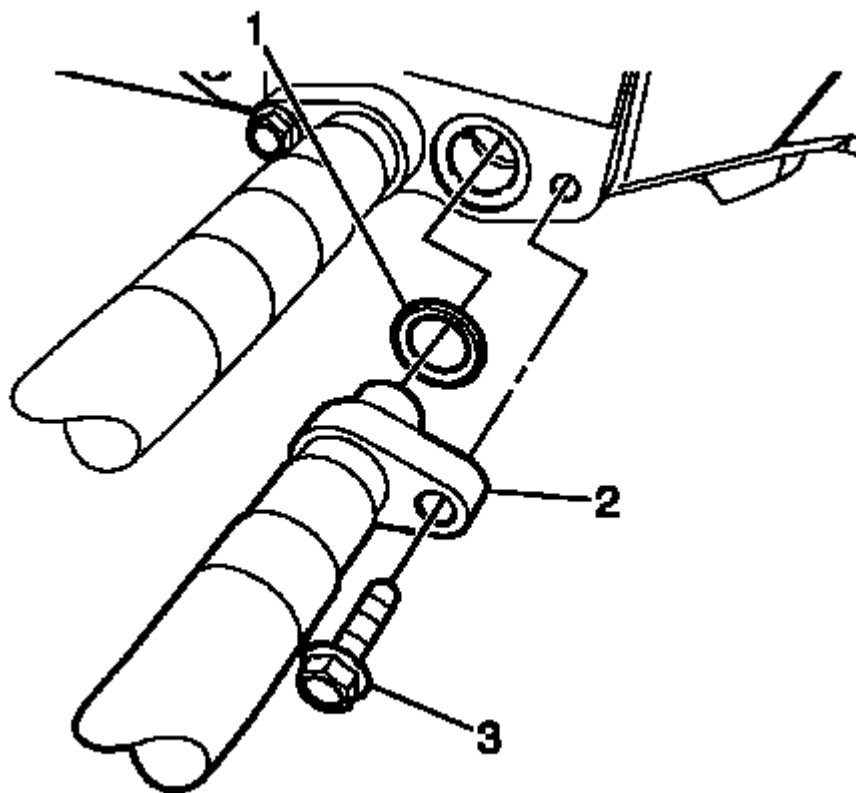


Fig. 229: Identifying Oil Tank Inlet Hose, Inlet Hose To Oil Tank Bolt & Oil Seal
Courtesy of GENERAL MOTORS COMPANY

44. Using a new oil seal (1) install the oil tank inlet hose (2) and bolt (3) to the oil pan. Tighten the inlet hose to oil pan bolt to 22 N.m (16 lb ft).
45. If the oil tank inlet hose was discarded, install a new hose. Refer to **Oil Tank Inlet Hose Replacement**.
46. Install the starter motor. Refer to **Starter Replacement (LT1)** .

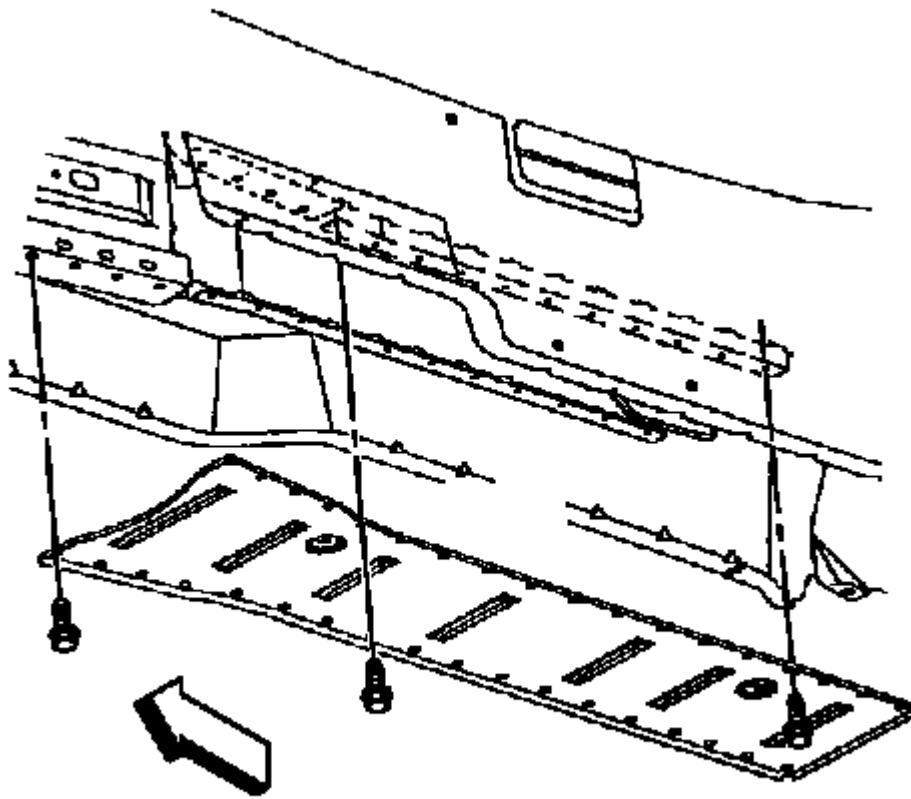


Fig. 230: View Of Driveline Tunnel Closeout Panel & Bolts
Courtesy of GENERAL MOTORS COMPANY

47. Install the driveline close-out panel.
48. Install the driveline close-out panel bolts and tighten to 12 N.m (106 lb in).
49. Install the electric belt drive rack and pinion steering gear. Refer to **Electric Belt Drive Rack and Pinion Steering Gear Replacement** .
50. Install the front tires and wheels. Refer to **Tire and Wheel Removal and Installation** .
51. Lower the vehicle.
52. Install the generator. Refer to **Generator Replacement (LT1)** .
53. Connect the following electrical connectors to the engine:
 - The fuel injectors
 - The ignition coil main harness connectors
 - The EVAP solenoid
 - The electric throttle motor
 - The ECT sensor
 - The A/C compressor

54. Install the heater hoses on the engine coolant manifold.

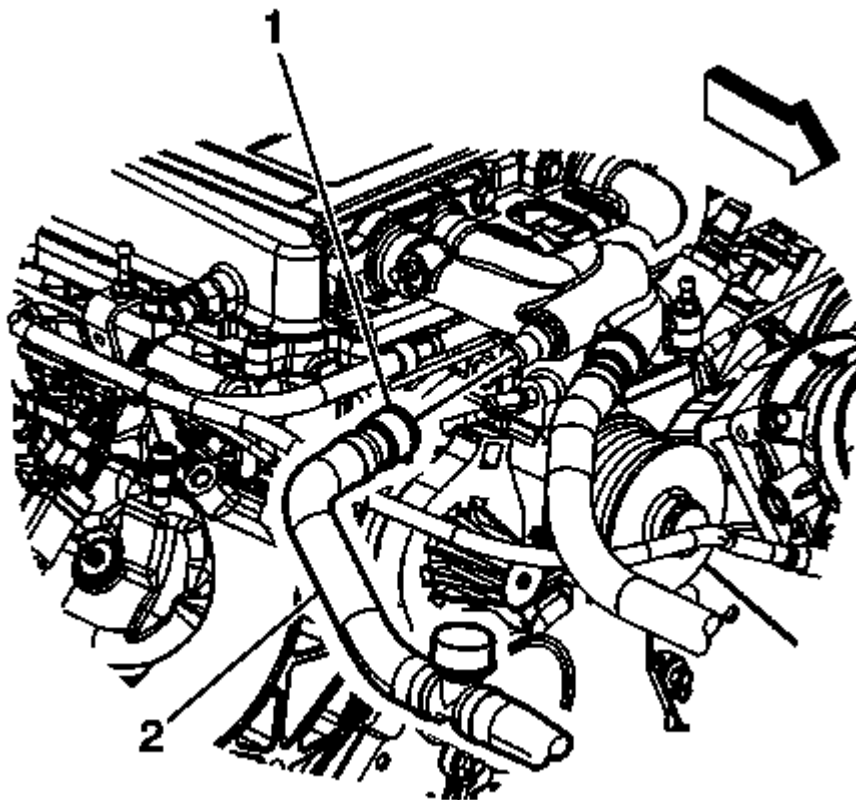


Fig. 231: Identifying Charge Air Cooler Coolant Hose & Fitting
Courtesy of GENERAL MOTORS COMPANY

55. Connect the intercooler cooling system hoses (1).
56. Connect the fuel feed hose. Refer to **Fuel Feed Hose Replacement (Engine To Tank)** , **Fuel Feed Hose Replacement (At Tank)** .
57. Connect the EVAP emission canister purge hose at the fuel line.
58. Install the BPMV bracket. Refer to **Brake Pressure Modulator Valve Bracket Replacement** .
59. Install the radiator. Refer to **Radiator Replacement** .
60. Recharge the A/C system. Refer to **Refrigerant Recovery and Recharging (LT1)** .
61. Bleed the clutch hydraulic system, if equipped. Refer to **Hydraulic Clutch System Bleeding** .
62. Fill the crankcase with the proper quantity and grade of engine oil. Refer to **Approximate Fluid Capacities** and **Fluid and Lubricant Recommendations** .
63. Disable the ignition system.
64. Crank the engine several times. Listen for any unusual noises or evidence that parts are binding.

66. Start the engine and listen for unusual noises.
67. Check the vehicle oil pressure gauge and confirm that the engine has acceptable oil pressure.

If necessary, install an oil pressure gauge and measure the engine oil pressure.

68. Stop the engine and add oil to the engine oil tank as needed to bring the oil level to the FULL mark, approximately 2.4 liters (2.5 quarts).
69. Start the engine and run the engine speed at about 1, 000 RPM until the engine has reached normal operating temperature.
70. Listen for sticking lifters and other unusual noises.
71. Inspect for fuel, oil, and/or other coolant leaks while the engine is running.

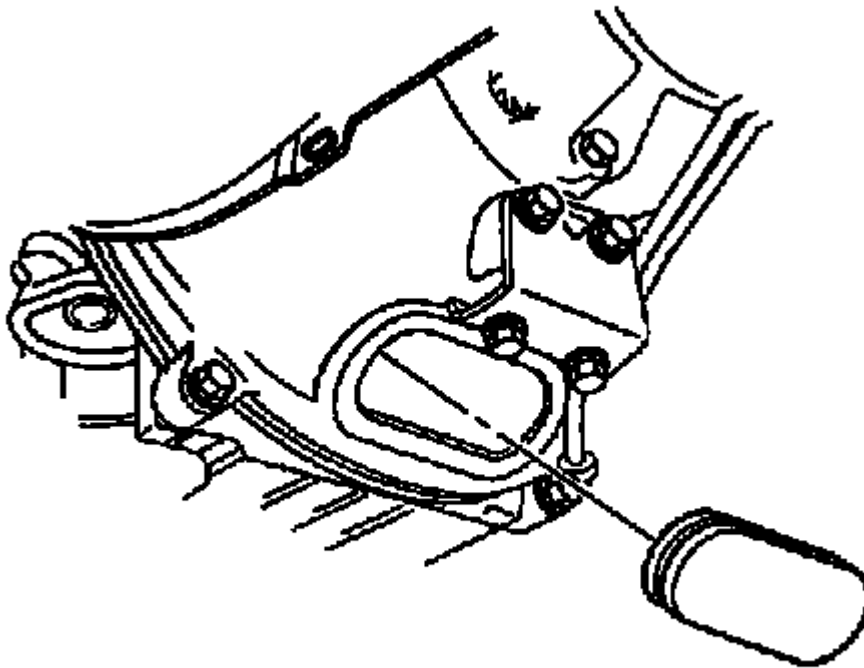


Fig. 232: View Of Engine Flywheel Housing Access Plug
Courtesy of GENERAL MOTORS COMPANY

72. Install the engine flywheel housing inspection plug.
73. Perform a final inspection for the proper engine oil and coolant levels.

ENGINE OIL AND OIL FILTER REPLACEMENT (WITH Z52 OPTION)

Removal Procedure

1. Open the hood.

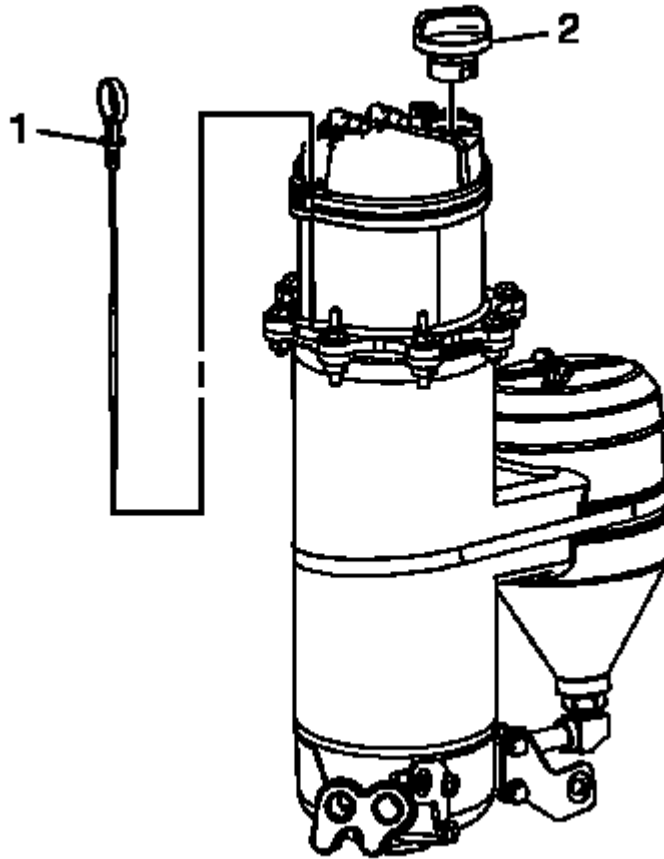


Fig. 233: View Of Oil Level Indicator & Oil Fill Cap
Courtesy of GENERAL MOTORS COMPANY

2. Remove the oil fill cap (2).
3. Raise the vehicle. Refer to Lifting and Jacking the Vehicle .

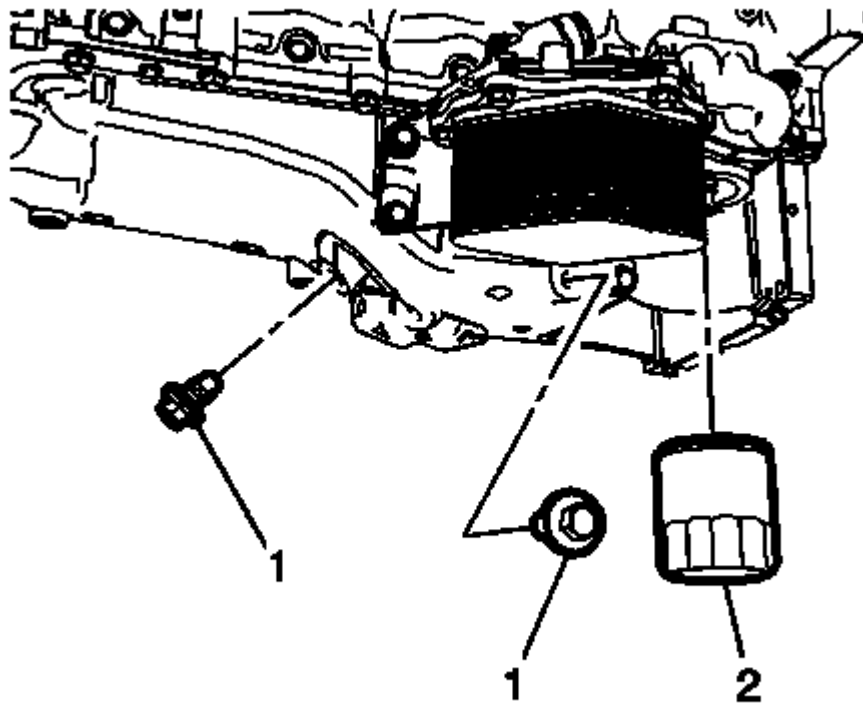


Fig. 234: Oil Pan Drain Plugs

Courtesy of GENERAL MOTORS COMPANY

4. Remove both oil pan drain plugs (1).
5. Drain the engine oil into an appropriate container.
6. Remove the engine oil filter (2).

Installation Procedure

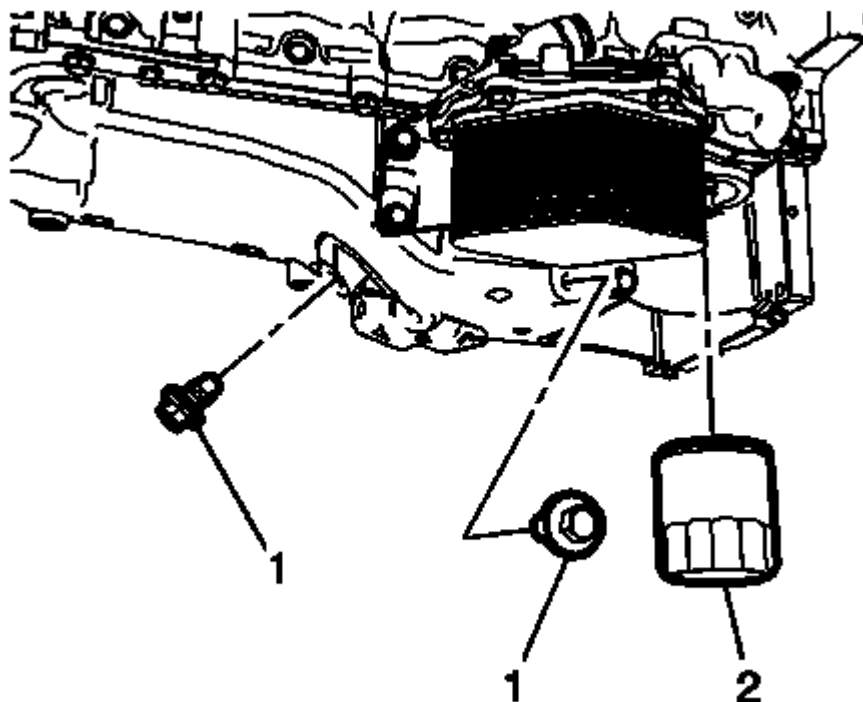


Fig. 235: Oil Pan Drain Plugs

Courtesy of GENERAL MOTORS COMPANY

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.

NOTE: Before installing the new oil filter, ensure that the old oil filter seal has been removed. If not, remove the old seal.

1. Lubricate the NEW oil filter seal with clean engine oil.

CAUTION: Refer to Fastener Caution .

NOTE: Use oil filter UPF48R or equivalent.

2. Install the oil filter (2) and tighten to 30 N.m (22 lb ft).
3. Install both oil pan drain plugs (1) and tighten to 25 N.m (18 lb ft).
4. Lower the vehicle.

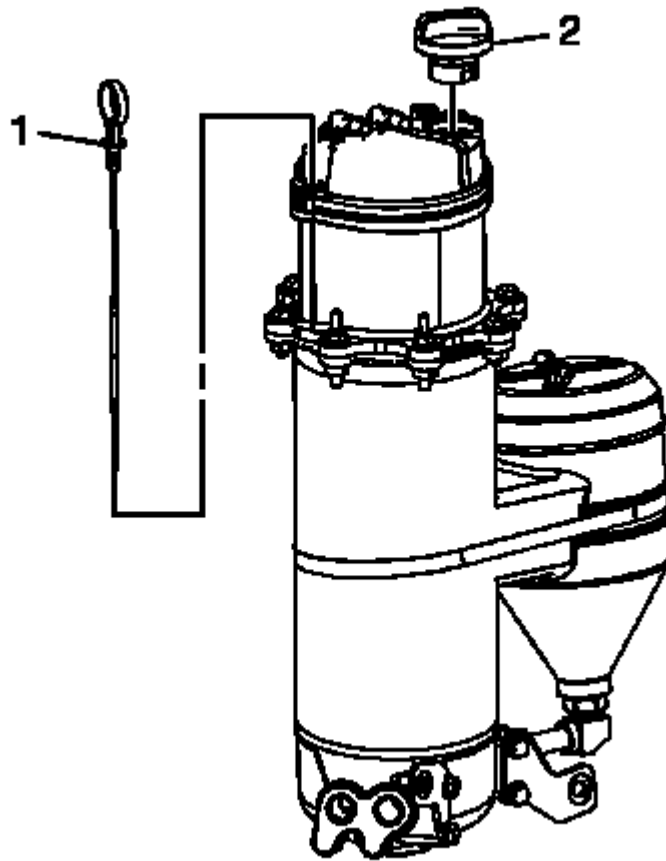


Fig. 236: View Of Oil Level Indicator & Oil Fill Cap
Courtesy of GENERAL MOTORS COMPANY

NOTE: DO NOT use any engine oil additives in Corvette engines.

5. Add 9.2 liters (9.8 quarts) of oil to the dry sump tank. Refer to **Fluid and Lubricant Recommendations** for engine oil requirements.
6. Check the oil level.
7. Install the oil fill cap (2).
8. Start the engine, check for leaks and correct.
9. Shut the engine off, wait 2-5 minutes and check the oil level using the oil level indicator (1).

Add oil if needed to bring the oil level to the full mark.

10. Close the hood.
11. Reset the engine oil life system. Refer to **GM Oil Life System Resetting** .

ENGINE OIL AND OIL FILTER REPLACEMENT (WITHOUT Z52 OPTION)

Removal Procedure

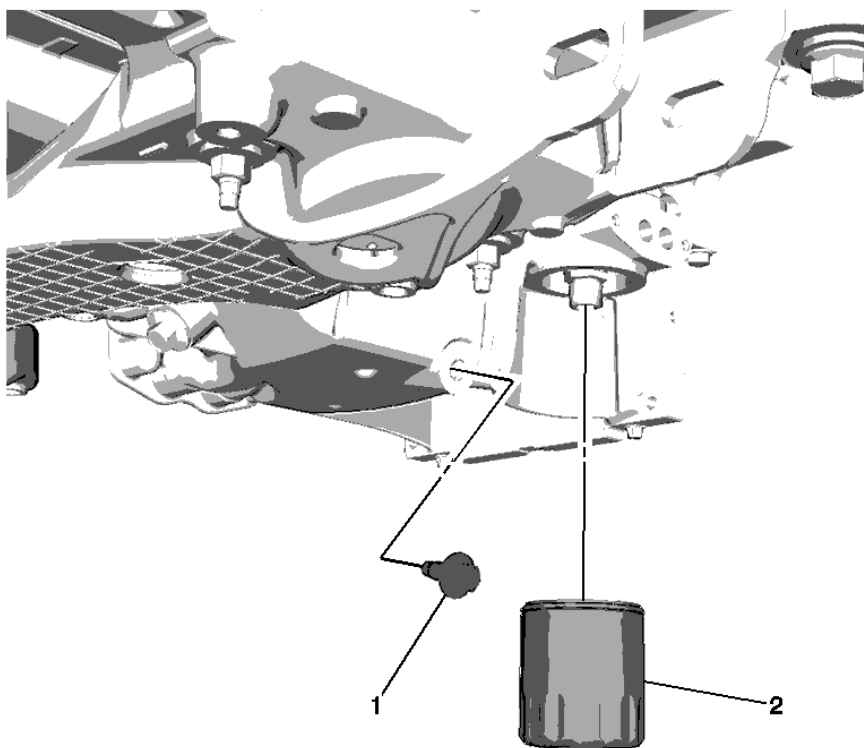


Fig. 237: Oil Pan Drain Plug And Engine Oil Filter
Courtesy of GENERAL MOTORS COMPANY

1. Open the hood.
2. Remove the oil fill cap.
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Remove the oil pan drain plug (1).
5. Drain the engine oil into an appropriate container.
6. Remove the engine oil filter (2) from the engine block.

Installation Procedure

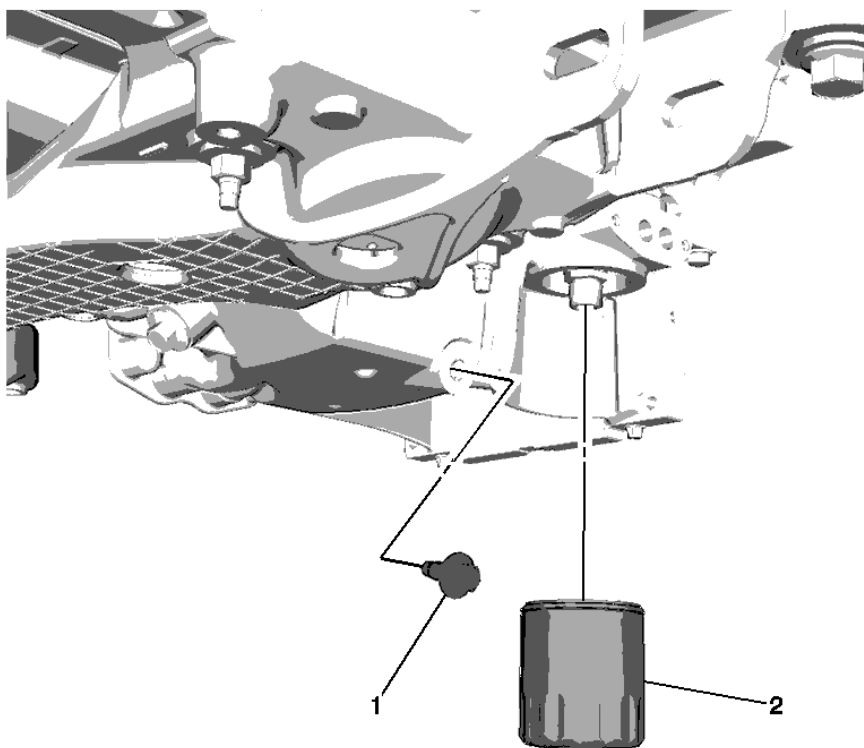


Fig. 238: Oil Pan Drain Plug And Engine Oil Filter
Courtesy of GENERAL MOTORS COMPANY

NOTE: Before installing the new oil filter, ensure that the old oil filter seal has been removed. If not, removed the old seal.

1. Lubricate the oil filter seal with clean engine oil.

CAUTION: Refer to Fastener Caution .

2. Install the oil filter (2) to the engine block and tighten the engine oil filter to 30 N.m (22 lb ft).
3. Install the oil pan drain plug (1) and tighten to 25 N.m (18 lb ft).
4. Lower the vehicle.

NOTE: DO NOT use any engine oil additives in Corvette engines.

5. Fill the engine with the appropriate amount and type of engine oil. Refer to Approximate Fluid Capacities and Fluid and Lubricant Recommendations .
6. Start the engine, check for leaks and correct.
7. Shut the engine off and check the oil level.
8. Install the oil fill cap.

10. Reset the engine oil life monitor. Refer to **GM Oil Life System Resetting** .