

2010 ENGINE

Engine Mechanical - 1.6L (LDE, LLU, and LXV) or 1.8L (2H0) - Repair Instructions - On Vehicle

DRIVE BELT REPLACEMENT

REMOVAL PROCEDURE

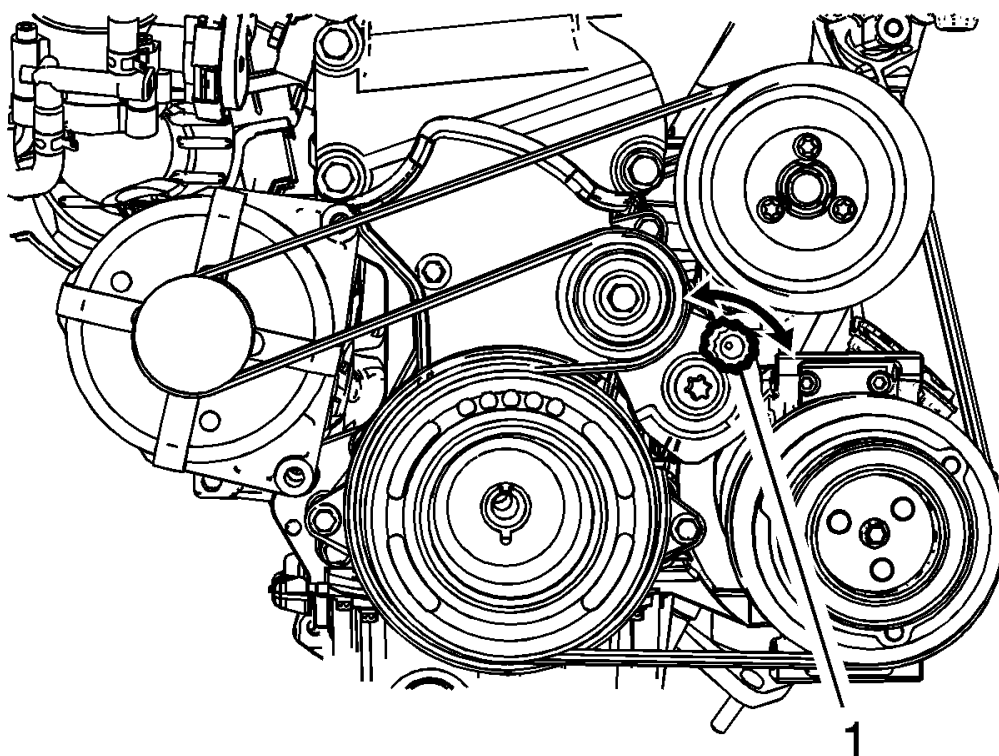


Fig. 1: Accessory Drive Belt Routing & Tensioner Star-Nut
Courtesy of GENERAL MOTORS CORP.

NOTE: To remove the power steering pump belt, do remove the accessory belt in advance.

1. Rotate the tensioner star-nut (1) and remove the accessory belt.
2. Remove the power steering belt. Refer to **Power Steering Pump Belt Replacement**.

INSTALLATION PROCEDURE

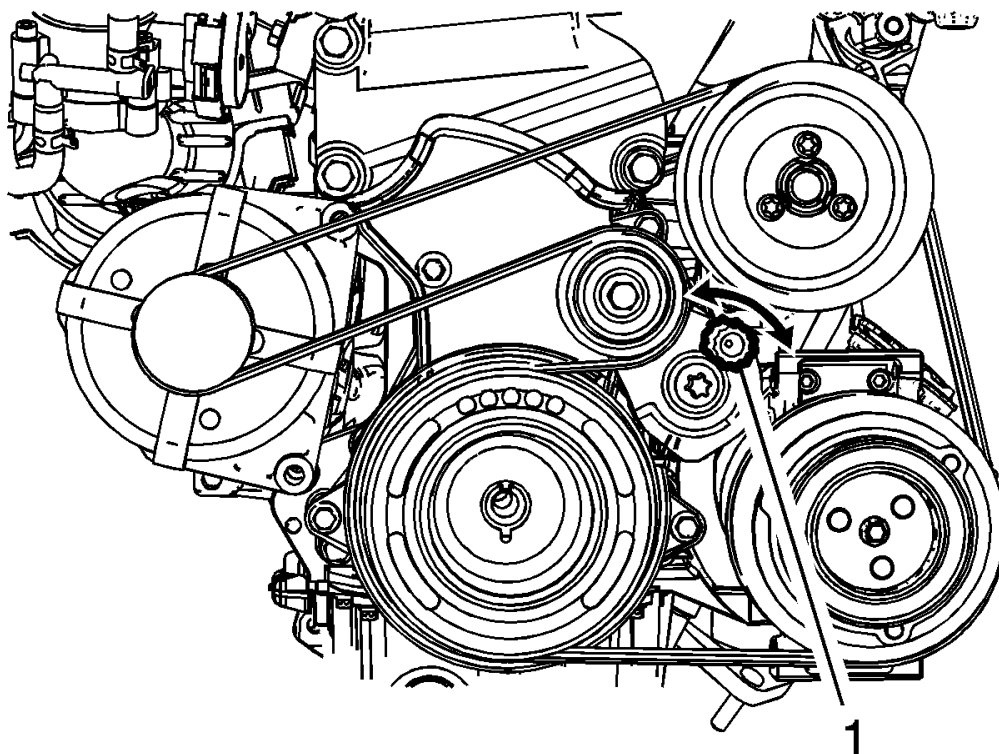


Fig. 2: Accessory Drive Belt Routing & Tensioner Star-Nut
Courtesy of GENERAL MOTORS CORP.

1. Install the power steering belt. Refer to **Power Steering Pump Belt Replacement**.
2. Rotate the tensioner star-nut (1) and install the accessory belt.
3. Install the engine front shield at the position of right front wheel.

DRIVE BELT TENSIONER REPLACEMENT

REMOVAL PROCEDURE

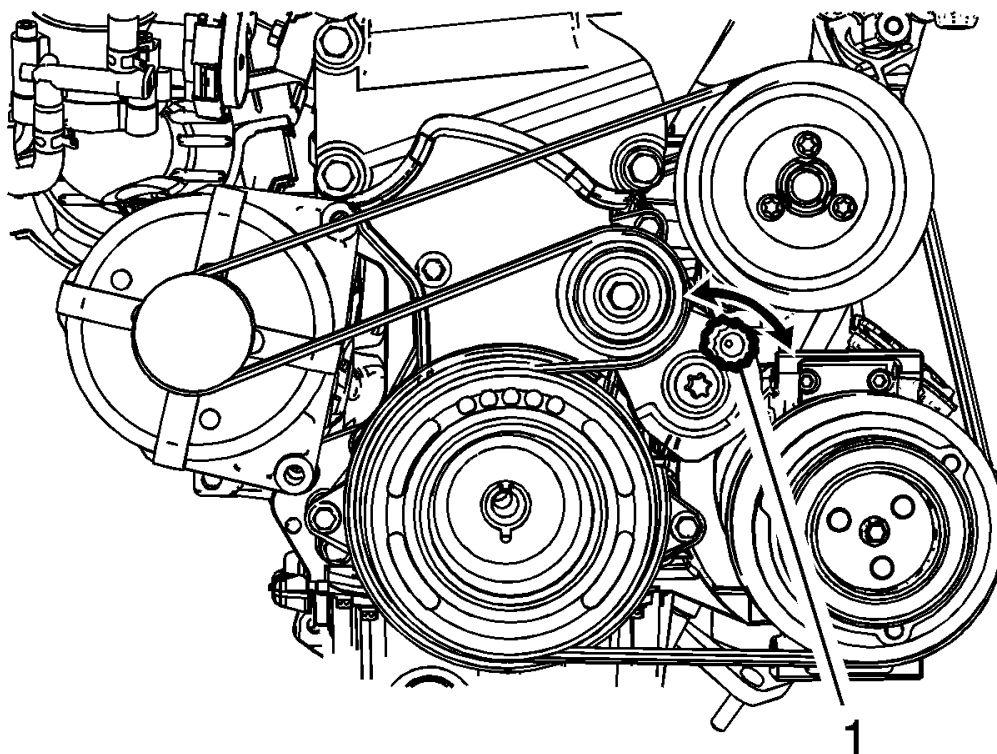


Fig. 3: Accessory Belt & Tensioner Star-Nut
Courtesy of GENERAL MOTORS CORP.

NOTE: To remove the power steering pump belt, do remove the accessory belt in advance.

1. Rotate the tensioner star-nut (1) and remove the accessory belt.
2. Remove the power steering belt. Refer to **Power Steering Pump Replacement (1.4L LDT and 1.6L LXV Engines)** .

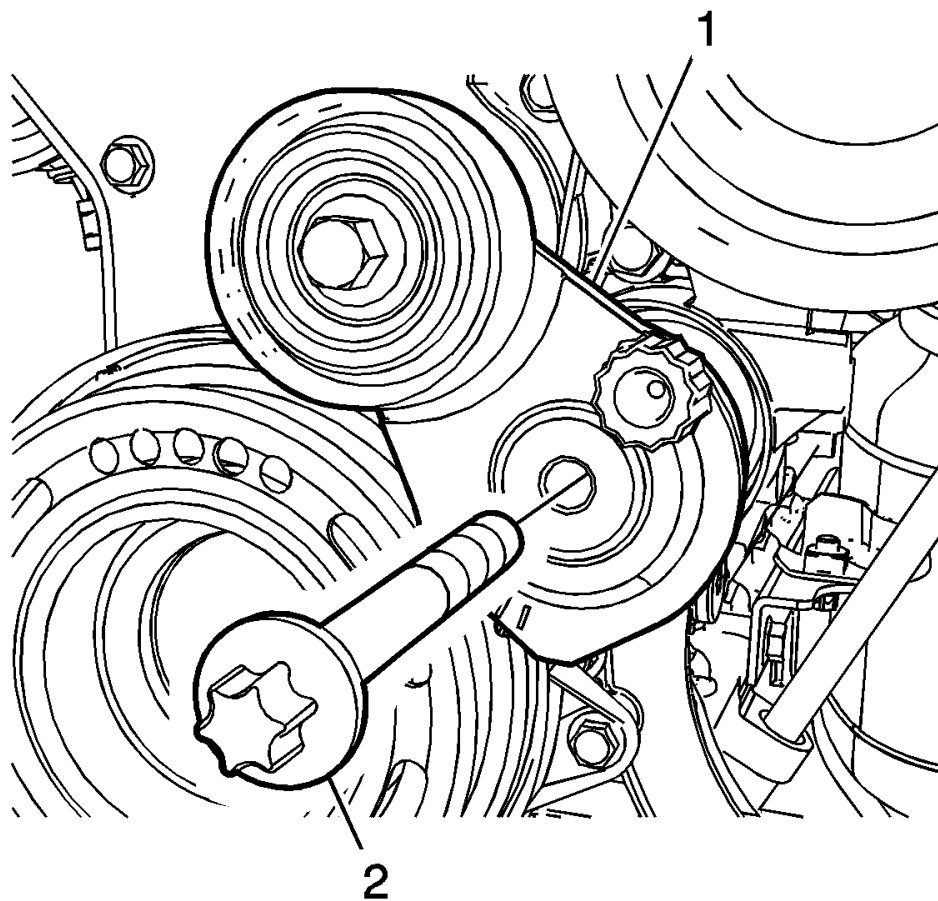


Fig. 4: Accessory Belt Tensioner
Courtesy of GENERAL MOTORS CORP.

3. Remove the accessory belt tensioner (1).

INSTALLATION PROCEDURE

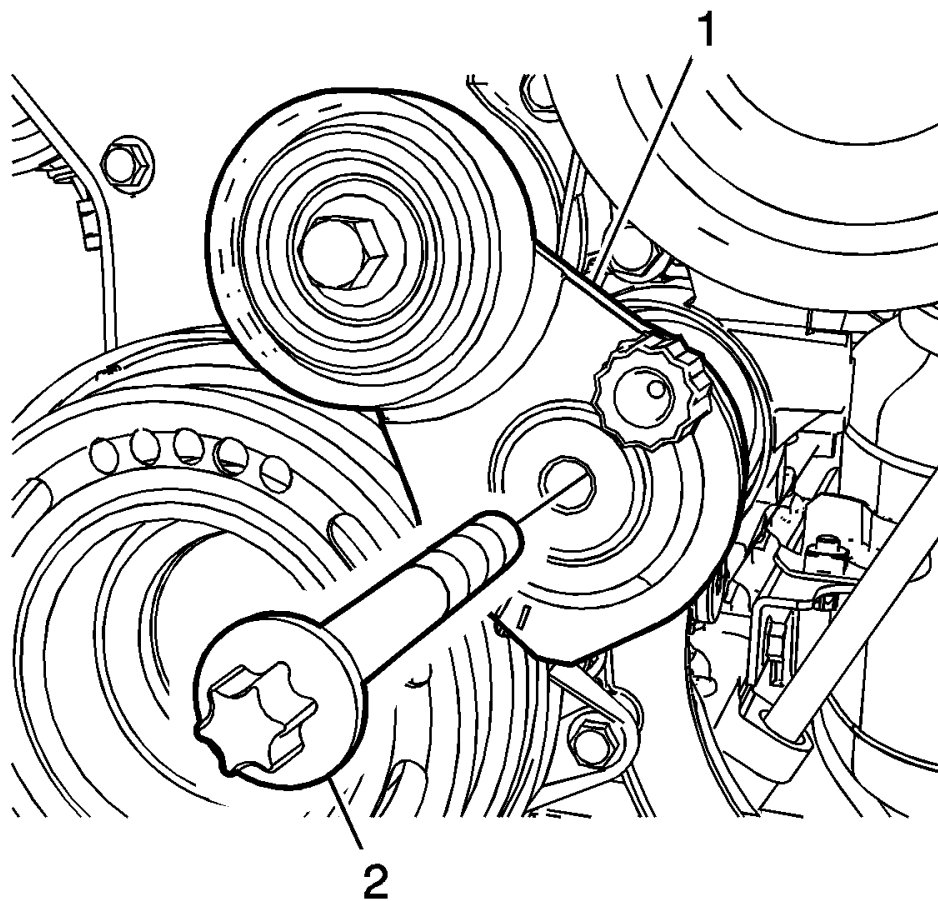


Fig. 5: Accessory Belt Tensioner
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

1. Install the accessory belt tensioner (1) and tighten to 50 N.m (36.8 lb ft).

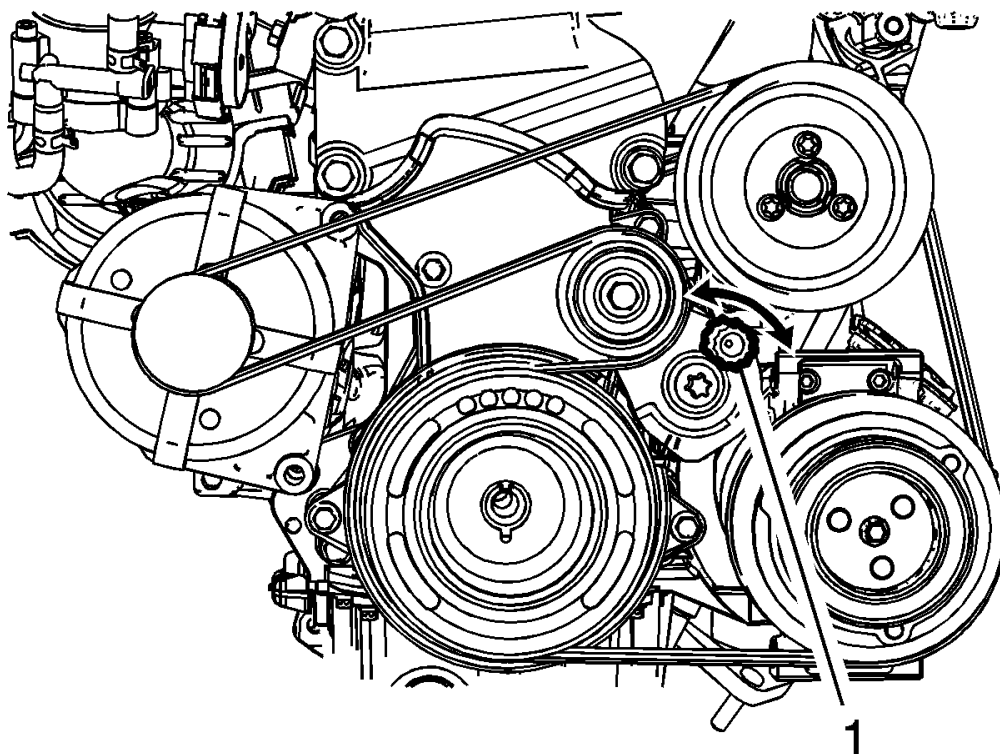


Fig. 6: Accessory Belt & Tensioner Star-Nut
Courtesy of GENERAL MOTORS CORP.

2. Install the power steering belt. Refer to **Power Steering Pump Replacement (1.4L LDT and 1.6L LXV Engines)** .
3. Rotate the tensioner star-nut (1) and install the accessory belt.
4. Install the engine front shield at the position of right front wheel.

POWER STEERING PUMP BELT REPLACEMENT

REMOVAL PROCEDURE

1. Remove the engine accessory drive belt. Refer to **Drive Belt Replacement**.

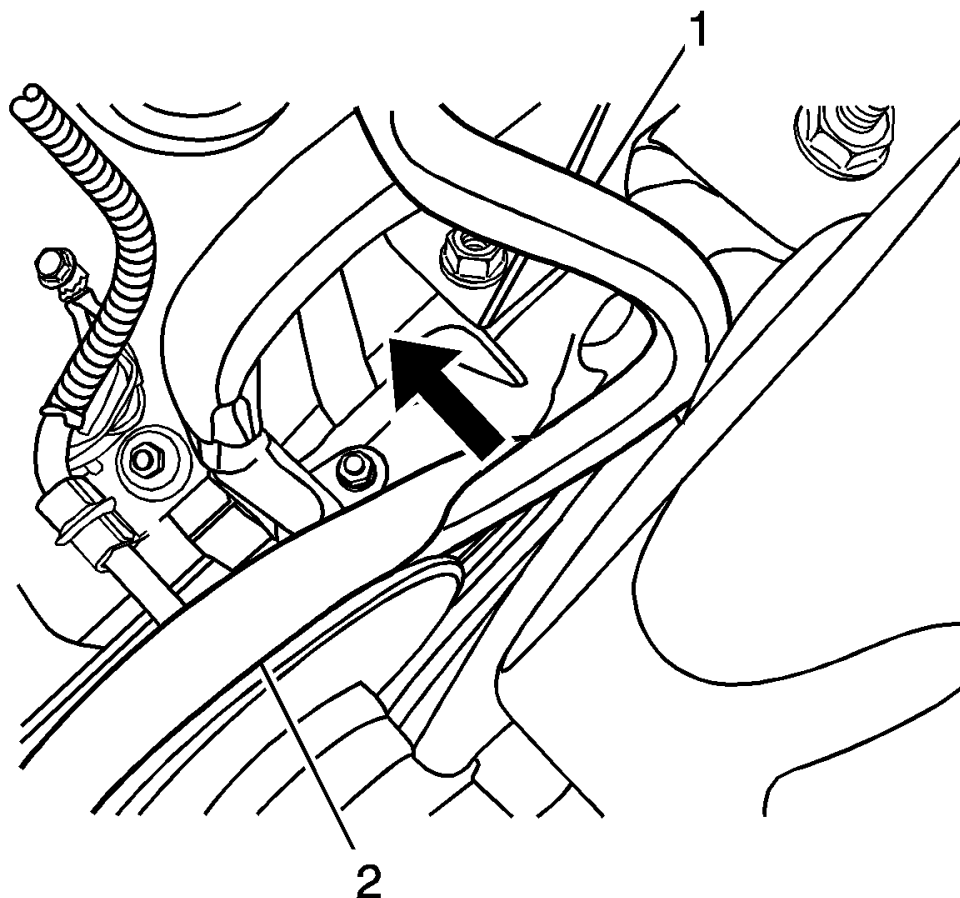


Fig. 7: Long Bar & Drive Belt

Courtesy of GENERAL MOTORS CORP.

2. Remove the RH headlamp assembly. Refer to Headlamp Replacement (Notchback) or Headlamp Replacement (Hatchback) .
3. Remove the air cleaner assembly. Refer to AIR CLEANER ASSEMBLY REPLACEMENT .
4. Place a long bar (1) in the opening between engine and pump drive belt.

NOTE: This will provide a guide function for the drive belt removal.

5. Using the bar (1) push the drive belt (2) into the opposite side of engine.

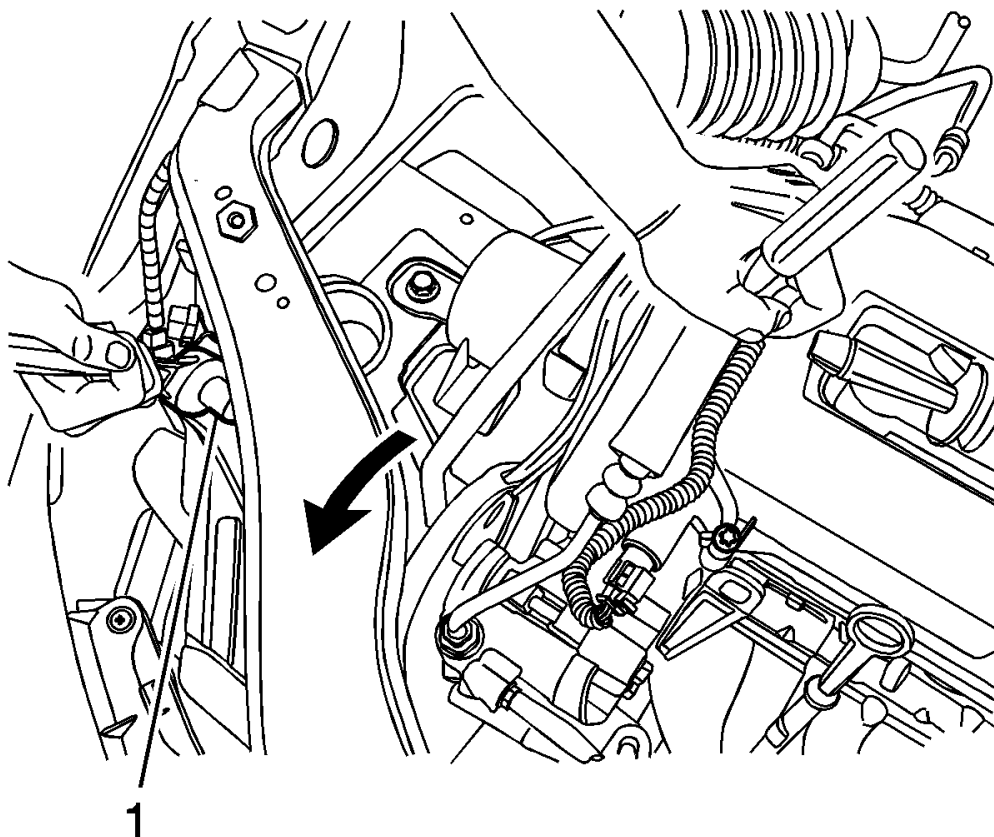


Fig. 8: Rotating Pulley
Courtesy of GENERAL MOTORS CORP.

NOTE: Outside surface of the belt should face toward the engine.

6. Rotate the pulley using 3/8 inch hex bit socket (1) in the power steering pump pulley shaft hole.
7. Rotate the power steering pump pulley clockwise while pushing the drive belt until the belt is fully removed from the pulley.

INSTALLATION PROCEDURE

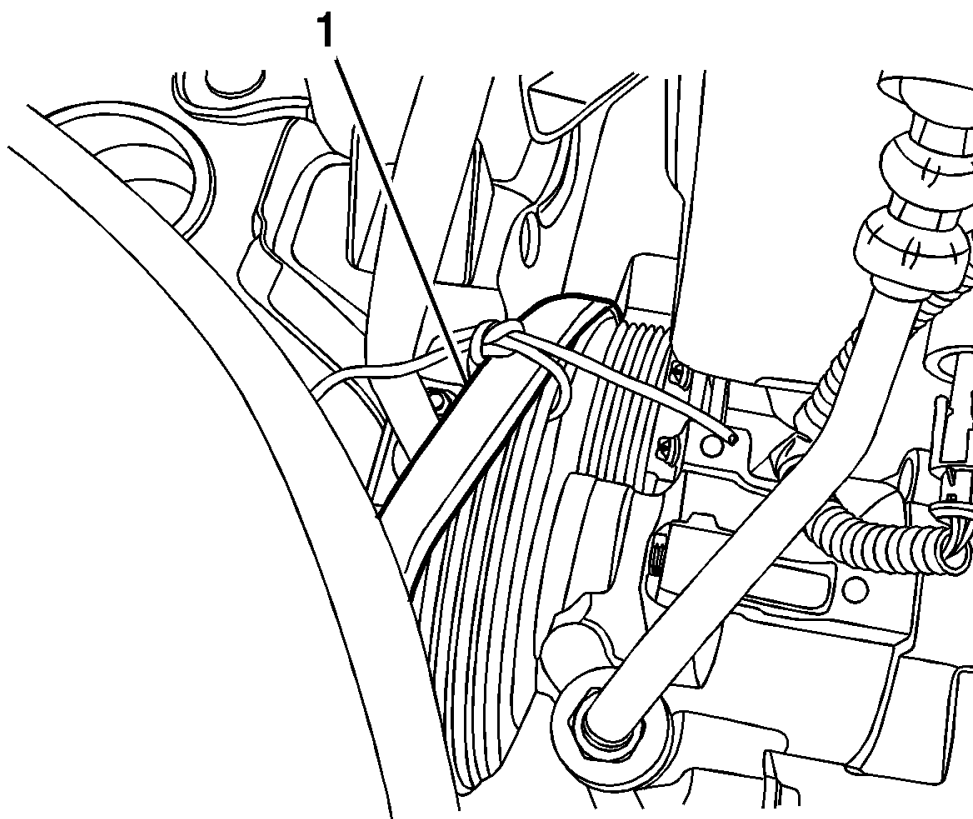


Fig. 9: Tying Drive Belt To Pump Pulley
Courtesy of GENERAL MOTORS CORP.

1. Route the power steering pump drive belt (1).
2. Align the drive belt on the water pump pulley first.
3. Position one of the three pulley holes on top point.

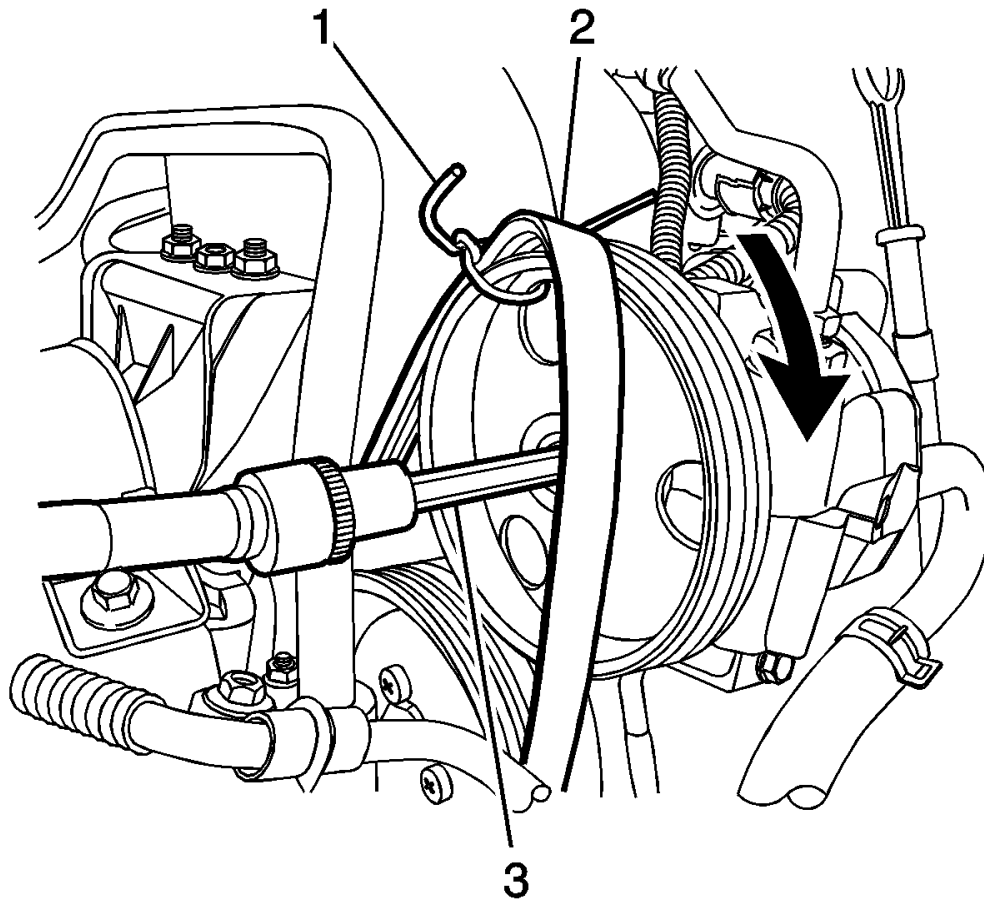


Fig. 10: Rotating Pulley
Courtesy of GENERAL MOTORS CORP.

4. Through the pulley hole tie the driver belt to the pump pulley using a cable tie (1).

NOTE: This will provide a guide function for the drive belt (2) installation.

5. Rotate the pulley using 3/8 inch hex bit socket (3) in the power steering pump pulley shaft hole.
6. Rotate the power steering pump pulley clockwise until the belt is fully installed on the pulley.
7. Remove the rope or cable tie.
8. Inspect for correct belt installation.
9. Install the air cleaner assembly. Refer to **AIR CLEANER ASSEMBLY REPLACEMENT** .
10. Install the RH headlamp assembly. Refer to **Headlamp Replacement (Notchback)** or **Headlamp Replacement (Hatchback)** .
11. Install the engine accessory belt. Refer to **Drive Belt Replacement**.

ENGINE MOUNT REPLACEMENT

SPECIAL TOOLS

J 28647-B: Engine Support Fixture

REMOVAL PROCEDURE

1. Remove the air cleaner assembly. Refer to **AIR CLEANER ASSEMBLY REPLACEMENT** .
2. Install **J 28647-B:** Engine Support Fixture.

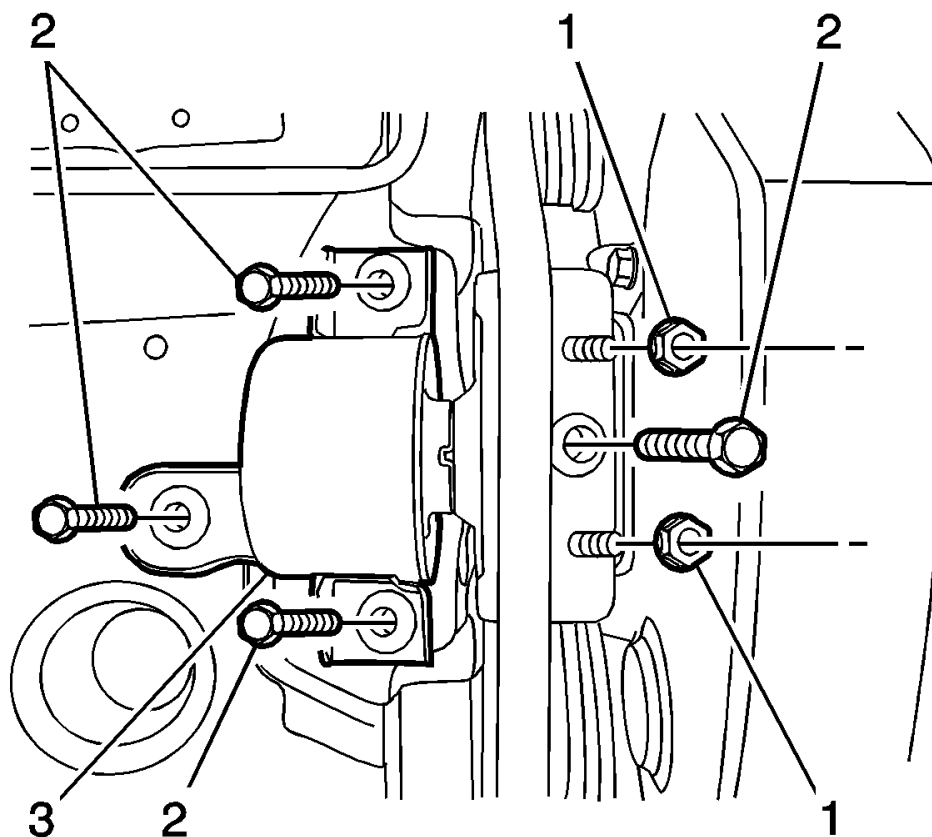


Fig. 11: Engine Mount, Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

3. Remove the engine mount bolts (2) and nuts (1).

INSTALLATION PROCEDURE

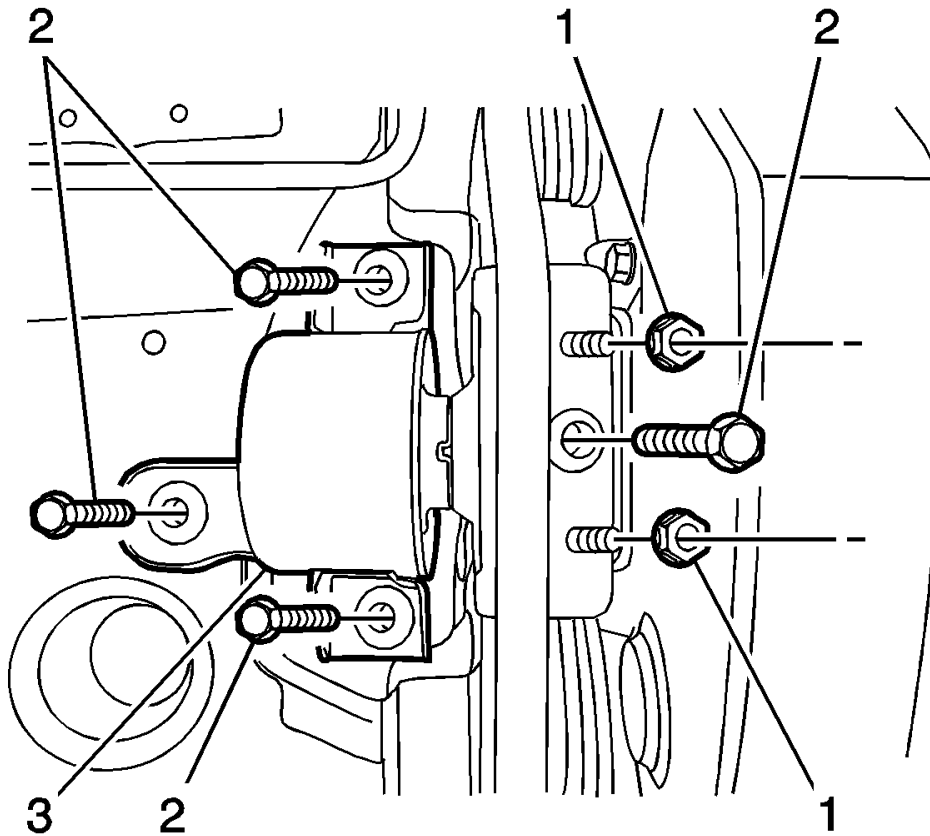


Fig. 12: Engine Mount, Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

1. Install the engine mount bolts (2) and nuts (1) and tighten to 55 N.m (40.5 lb ft).
2. Remove **J 28647-B**: Engine Support Fixture.
3. Install the air cleaner assembly. Refer to **AIR CLEANER ASSEMBLY REPLACEMENT** .

INTAKE MANIFOLD REPLACEMENT

REMOVAL PROCEDURE

WARNING: Refer to Battery Disconnect Warning .

1. Disconnect the battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection** .
2. Release the fuel pressure. Refer to **FUEL PRESSURE RELIEF** .
3. Remove the air cleaner assembly. Refer to **AIR CLEANER ASSEMBLY REPLACEMENT** .
4. Remove the power steering pressure pipe clamp from the intake manifold.
5. Disconnect the related sensor and actuator connectors and the pull engine wiring harness aside.
 - A/C pressure sensor (ACP) connector
 - CAM position solenoid valve connector
 - Electric throttle controller (ETC) connector
 - Manifold air pressure (MAP) sensor connector
 - EVAP solenoid valve connector
 - Injector connectors
6. Disconnect the fuel line from the fuel rail.
7. Disconnect the ETC coolant inlet/outlet hoses and then pull it aside.
8. Remove the PCV hose from the ETC.
9. Remove the cylinder head cover. Refer to **Valve Rocker Arm Cover Replacement**.

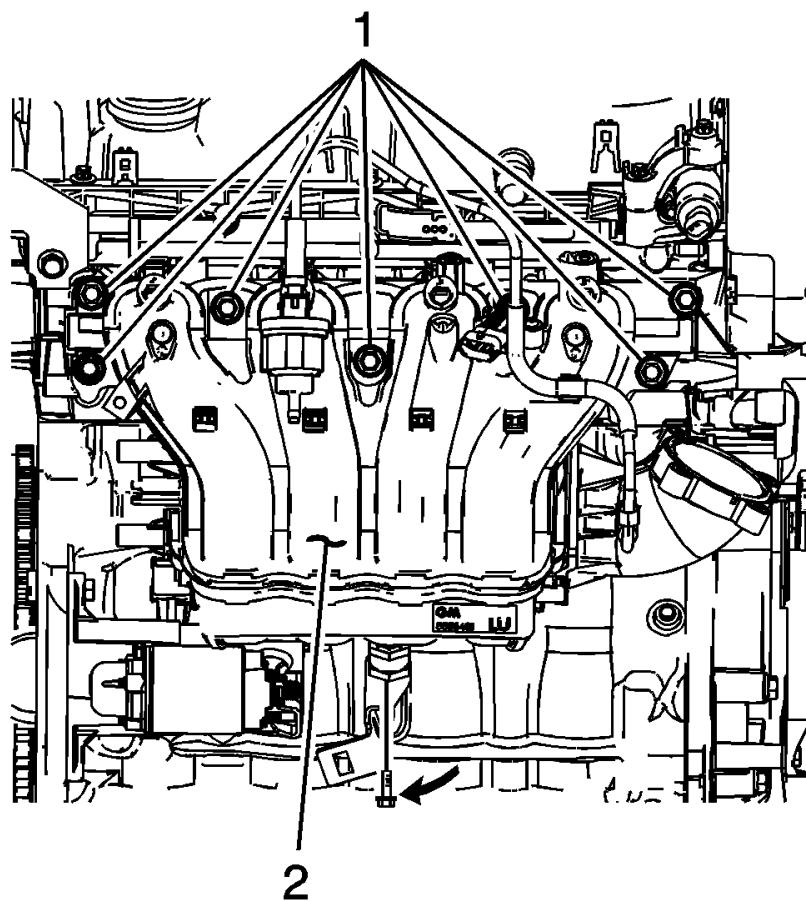


Fig. 13: Intake Manifold & Bolts
Courtesy of GENERAL MOTORS CORP.

10. Remove the electric throttle controller (ETC). Refer to **THROTTLE BODY ASSEMBLY REPLACEMENT**.
11. Remove the intake manifold (2) with the gasket.

INSTALLATION PROCEDURE

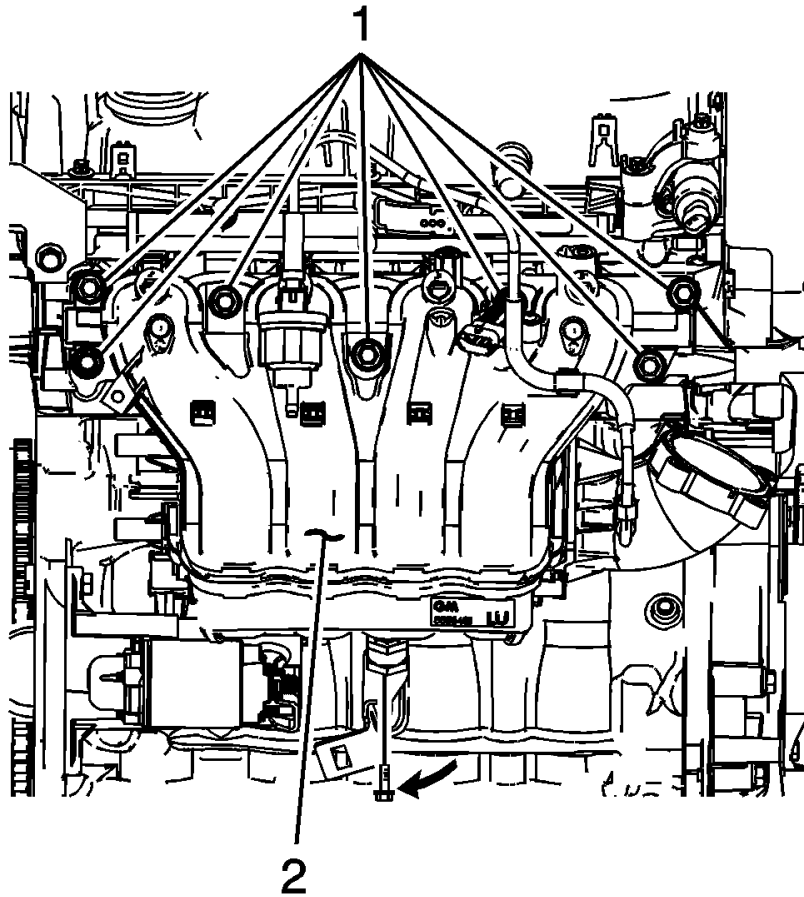


Fig. 14: Intake Manifold & Bolts
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

NOTE: Do not reuse the intake manifold gasket.

1. Install the intake manifold (2) with the new gasket and tighten.
 - The intake manifold bolts (1) to 20 N.m (14.7 lb ft).
 - The intake manifold lower bracket bolt to 8 N.m (70.8 lb in).
2. Install the electric throttle controller (ETC). Refer to THROTTLE BODY ASSEMBLY REPLACEMENT .
3. Install the cylinder head cover. Refer to Valve Rocker Arm Cover Replacement.
4. Install the PCV hose to the ETC.
5. Connect the ETC coolant inlet/outlet hoses.

6. Connect the fuel line to the fuel rail.
7. Connect the related sensor and actuator connectors.
 - A/C pressure sensor (ACP) connector
 - CAM position solenoid valve connector
 - Electric throttle controller (ETC) connector
 - Manifold air pressure (MAP) sensor connector
 - EVAP solenoid valve connector
 - Injector connectors
8. Install the power steering pressure pipe clamp to the intake manifold.
9. Install the air cleaner assembly. Refer to **AIR CLEANER ASSEMBLY REPLACEMENT** .
10. Connect the battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection** .

TIMING BELT REPLACEMENT

Special Tools

- **J 28647-B:** Engine Support Fixture
- **KM-6625:** Flywheel Locking Device
- **KM-6333:** Fixing Rod
- **MK-6628:** Locking Tool
- **MK-6340:** Locking Tool

REMOVAL PROCEDURE

WARNING: Refer to **Battery Disconnect Warning** .

1. Disconnect the battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection** .
2. Remove the air cleaner assembly. Refer to **AIR CLEANER ASSEMBLY REPLACEMENT** .
3. Install **J 28647-B:** Engine Support Fixture.
4. Remove the accessory belt. Refer to **Drive Belt Replacement**.
5. Remove the accessory belt tensioner. Refer to **Drive Belt Tensioner Replacement**.

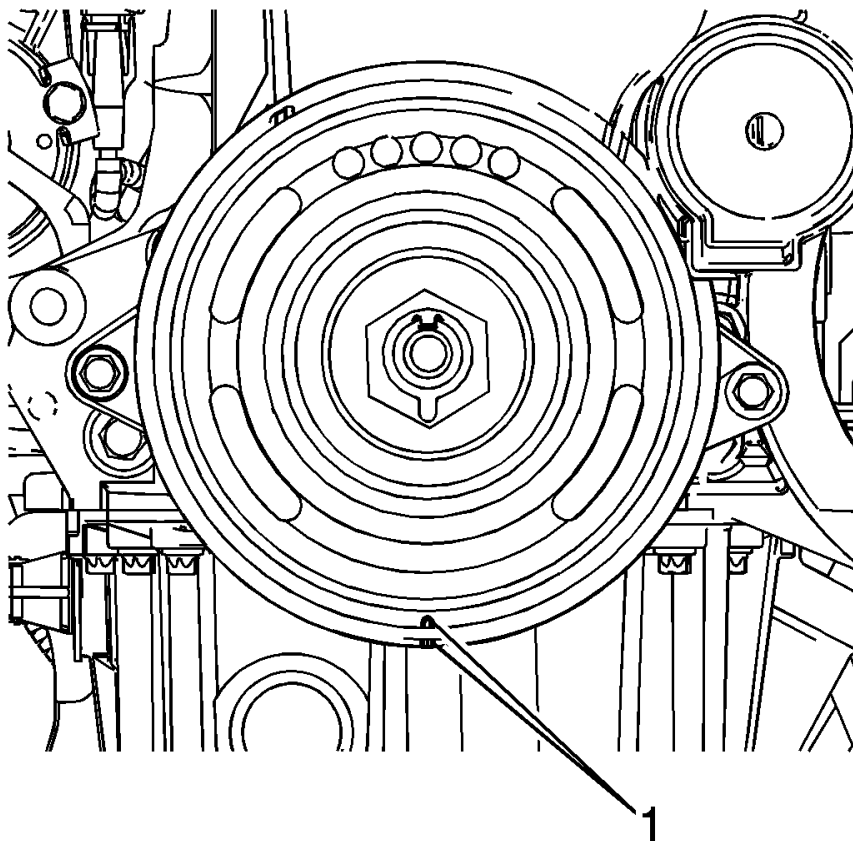


Fig. 15: Aligning Crankshaft Pulley & Cover
Courtesy of GENERAL MOTORS CORP.

6. Rotate the crankshaft pulley clockwise.
7. Align the notches (1) between the pulley and the cover.

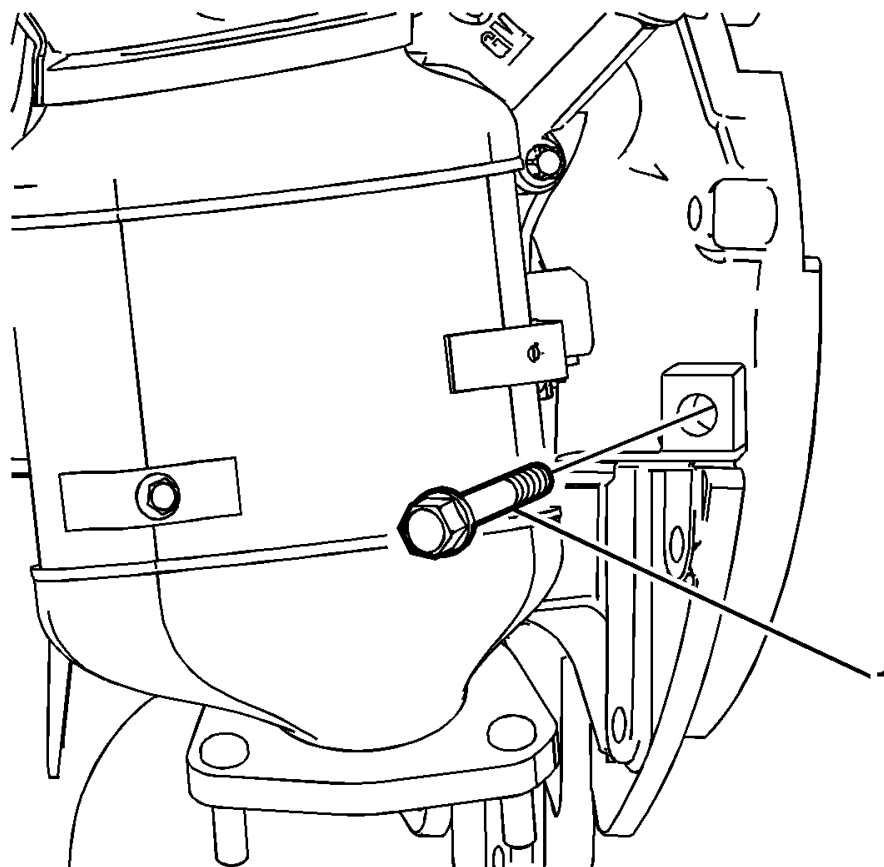


Fig. 16: Transmission Bolt
Courtesy of GENERAL MOTORS CORP.

8. Remove the transmission bolt (1).
9. Install **KM-6625**: locking device to block the crankshaft.
10. Install the transmission bolt (1).
11. Remove the cylinder head cover. Refer to **Valve Rocker Arm Cover Replacement**.
12. Remove the engine mount. Refer to **Engine Mount Replacement**.

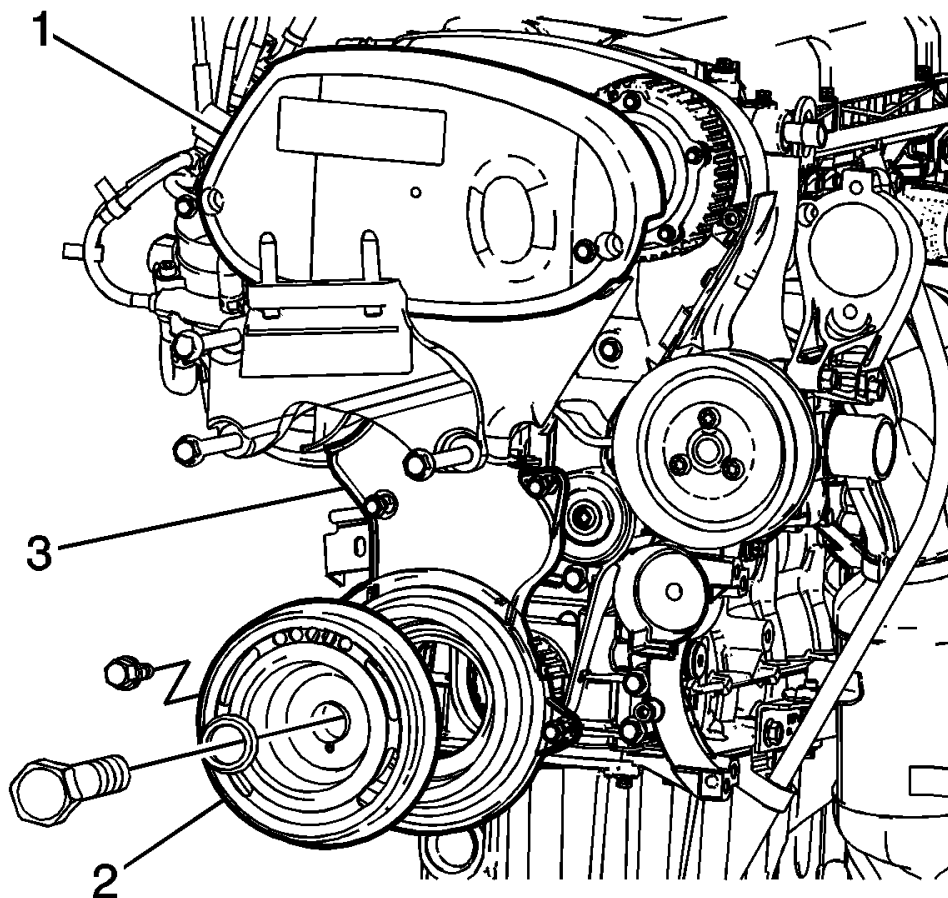


Fig. 17: Crankshaft Pulley & Timing Belt Covers
Courtesy of GENERAL MOTORS CORP.

13. Remove the crankshaft pulley (2).
14. Remove the timing belt upper cover (1).
15. Remove the engine mount bracket.
16. Remove the timing belt lower cover (3).
17. Remove the timing belt center cover.

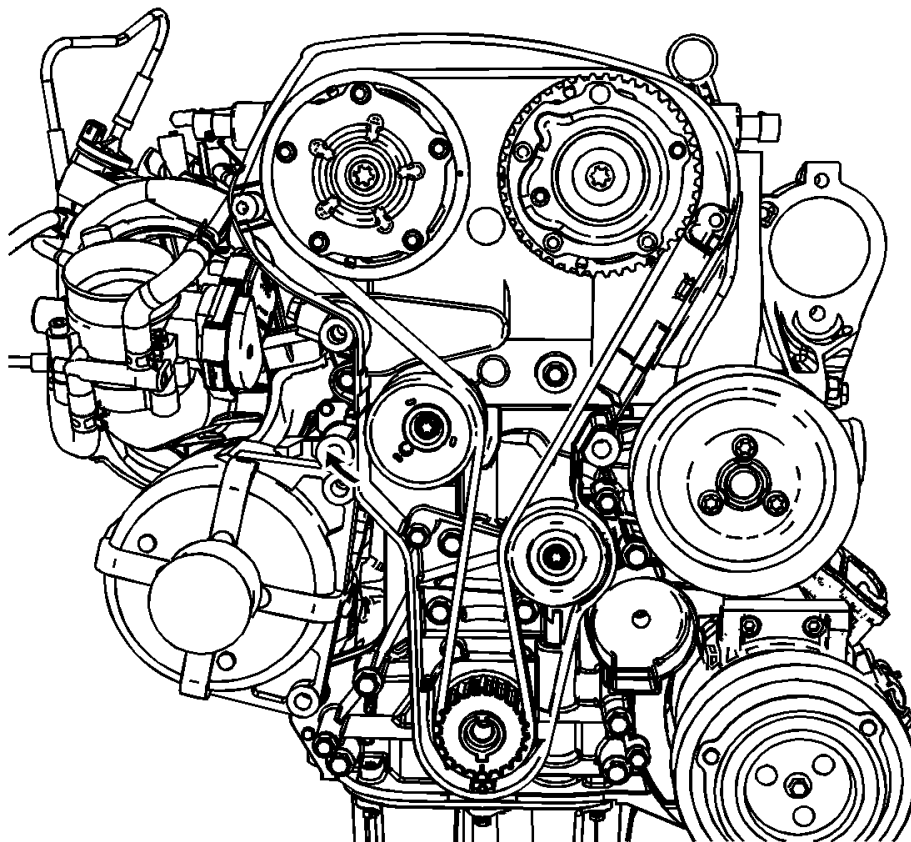


Fig. 18: Timing Belt

Courtesy of GENERAL MOTORS CORP.

18. Install **KM-6333**: rod during rotating the timing belt tensioner.
19. Remove the timing belt.

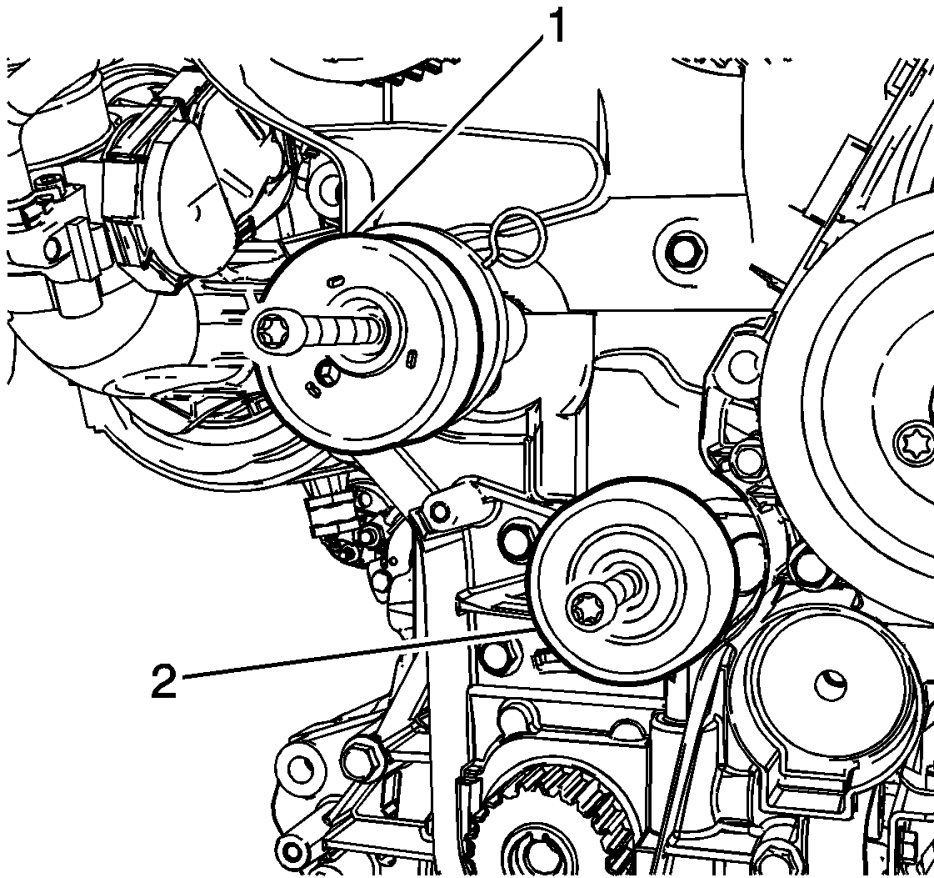


Fig. 19: Timing Belt Tensioner & Idler
Courtesy of GENERAL MOTORS CORP.

20. Remove the timing belt tensioner (1).
21. Remove the timing belt idler (2).

ADJUSTMENT PROCEDURE

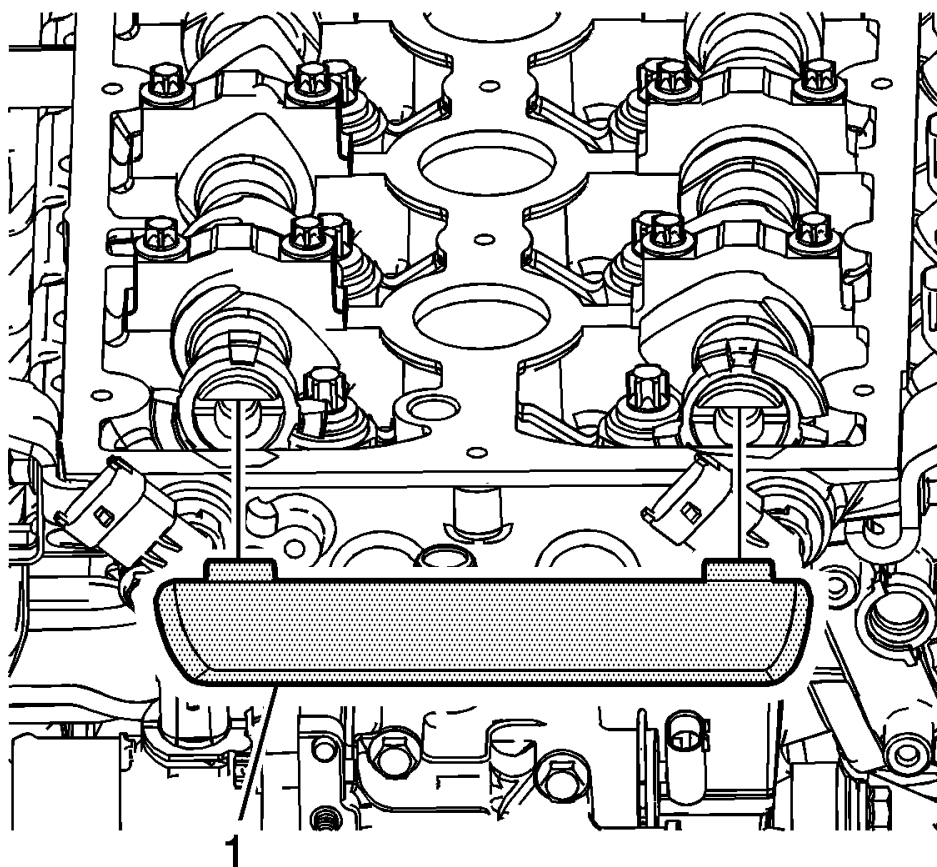


Fig. 20: Camshaft Locking Tool
Courtesy of GENERAL MOTORS CORP.

1. Align the both camshaft horizontally to install the **MK-6628**: locking tool.
2. Confirm the both camshaft sprocket spot aligned.

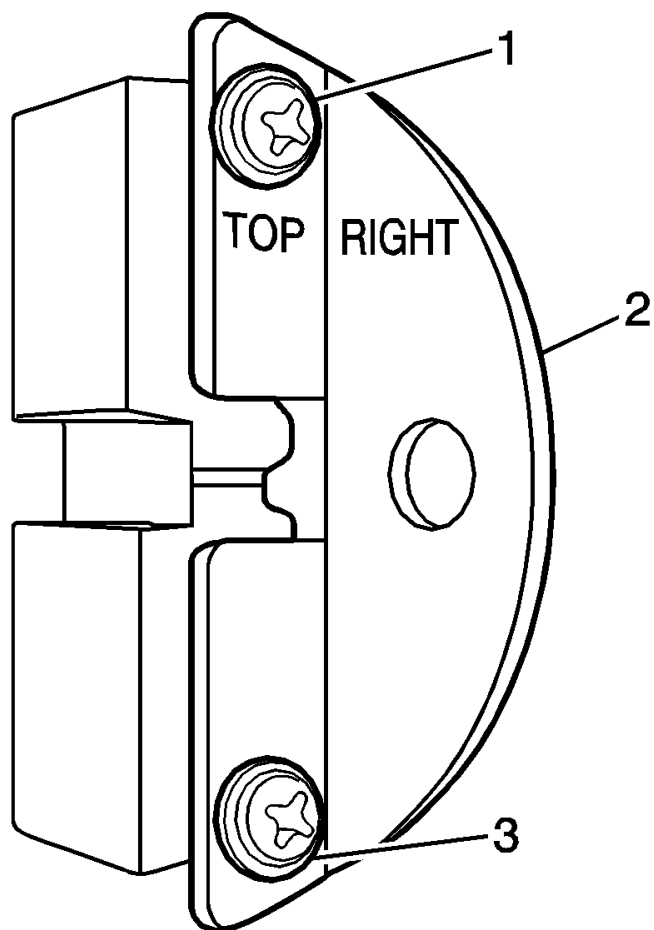


Fig. 21: Right Half Of Locking Tool
Courtesy of GENERAL MOTORS CORP.

3. Prepare the right half of **MK-6340**: locking tool.

NOTE: Recognizable from the lettering "Right"

4. Unscrew the bolts (1) and detach the front panel (2) from **MK-6628**: locking tool.

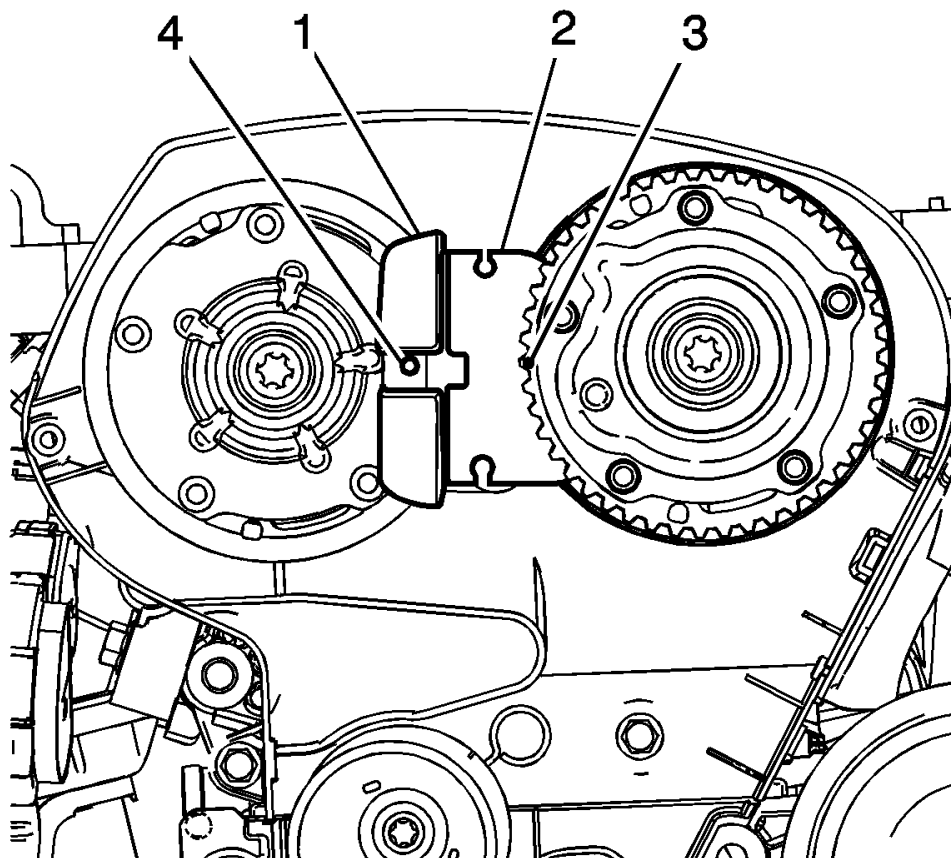


Fig. 22: Aligning Intake & Exhaust Camshaft Sprocket Side Spots
 Courtesy of GENERAL MOTORS CORP.

NOTE: The spot-type marking (4) on the intake camshaft sprocket does not correspond to the groove of MK-6628: locking tool during this process.

5. Confirm aligning between the intake side spot (3) and the exhaust side spot (4) on the camshaft sprockets.
6. If not aligned as shown, remove and install the camshaft sprocket to align.
7. Insert the left of **KM-6340** (1) into the intake camshaft sprocket side.
8. Insert the right of **KM-6340** (2) into the exhaust camshaft sprocket side.

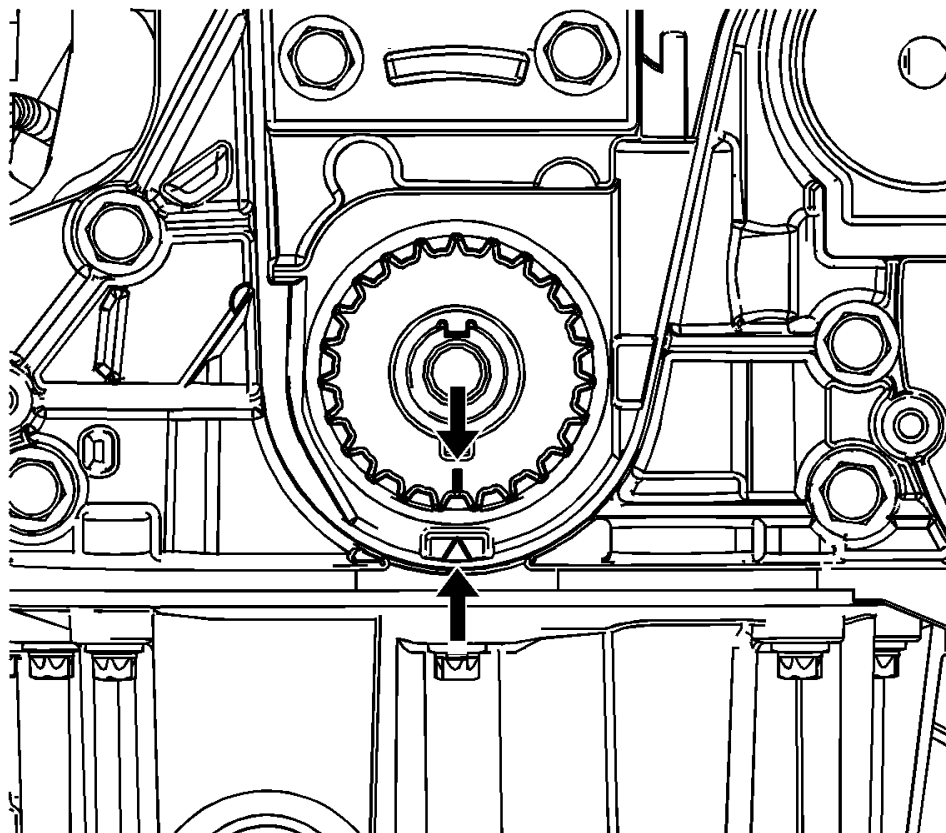


Fig. 23: Alignment Of Notches Between Crankshaft Sprocket & Cover
Courtesy of GENERAL MOTORS CORP.

NOTE: If not aligned the notches, rotate the crankshaft until aligning after remove KM-6625 .

9. Confirm alignment of the notches between the crankshaft sprocket and the cover.

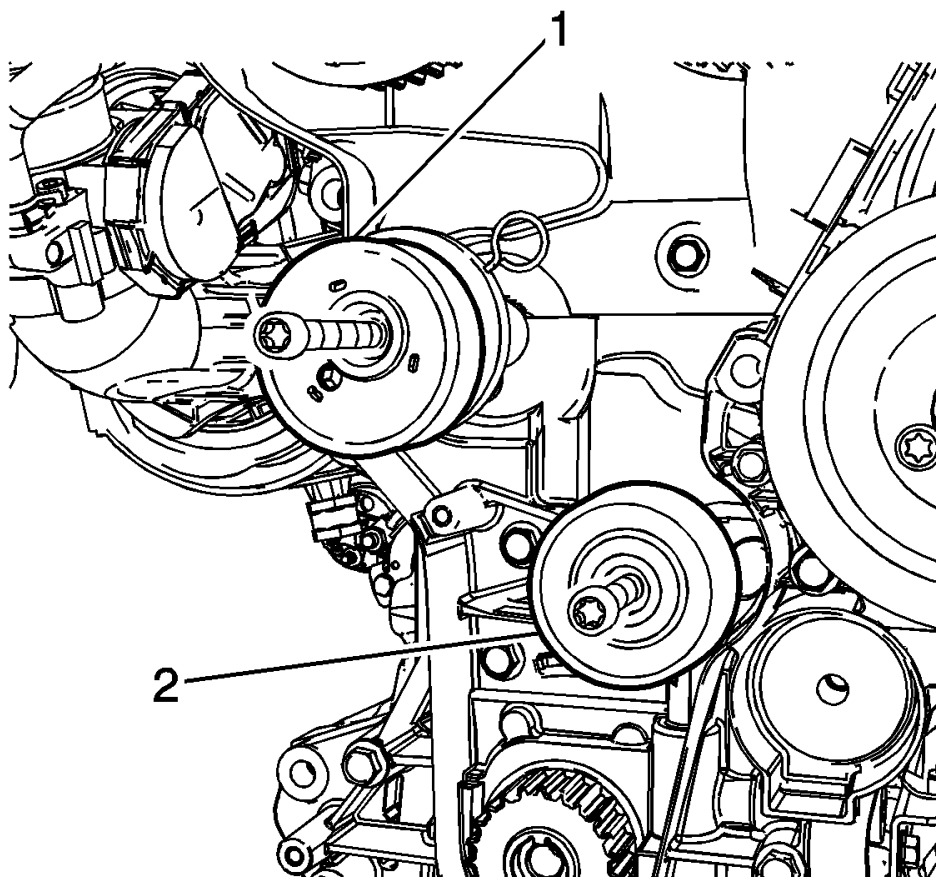


Fig. 24: Timing Belt Tensioner & Idler
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

10. Install the timing belt idler (2) and tighten to 50 N.m (36.8 lb ft).
11. Install the timing belt tensioner (1) and tighten to 55 N.m (40.6 lb ft).

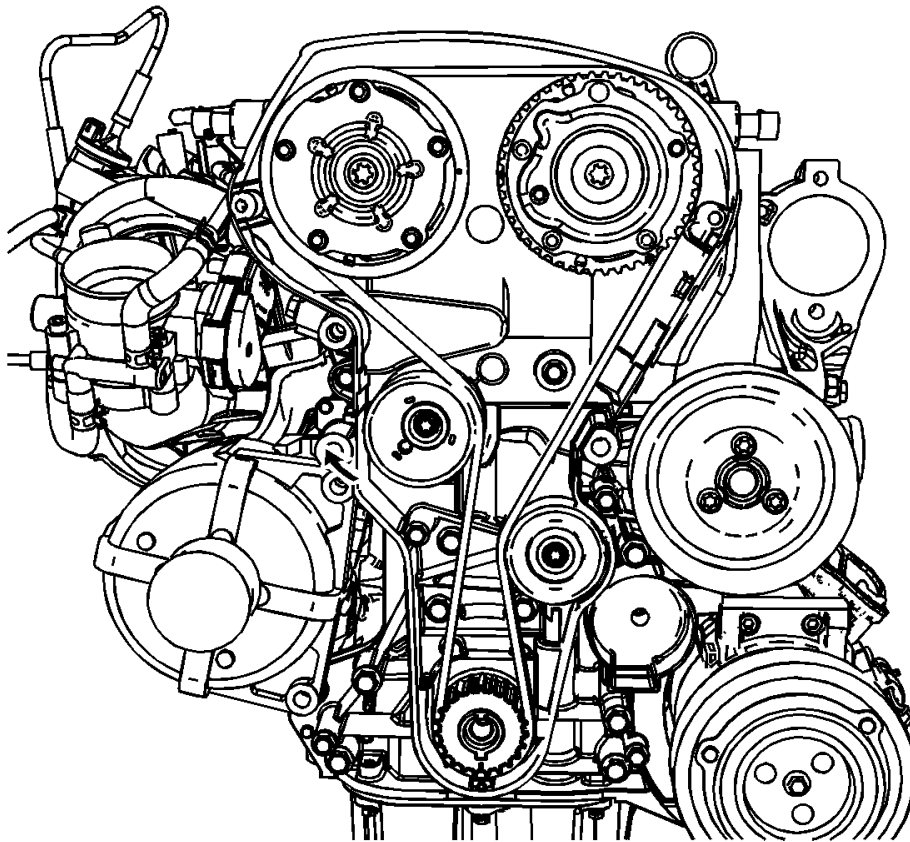


Fig. 25: Timing Belt

Courtesy of GENERAL MOTORS CORP.

12. Install the timing belt and adjust.
13. Pull out **KM-6333**: fixing rod.

INSTALLATION PROCEDURE

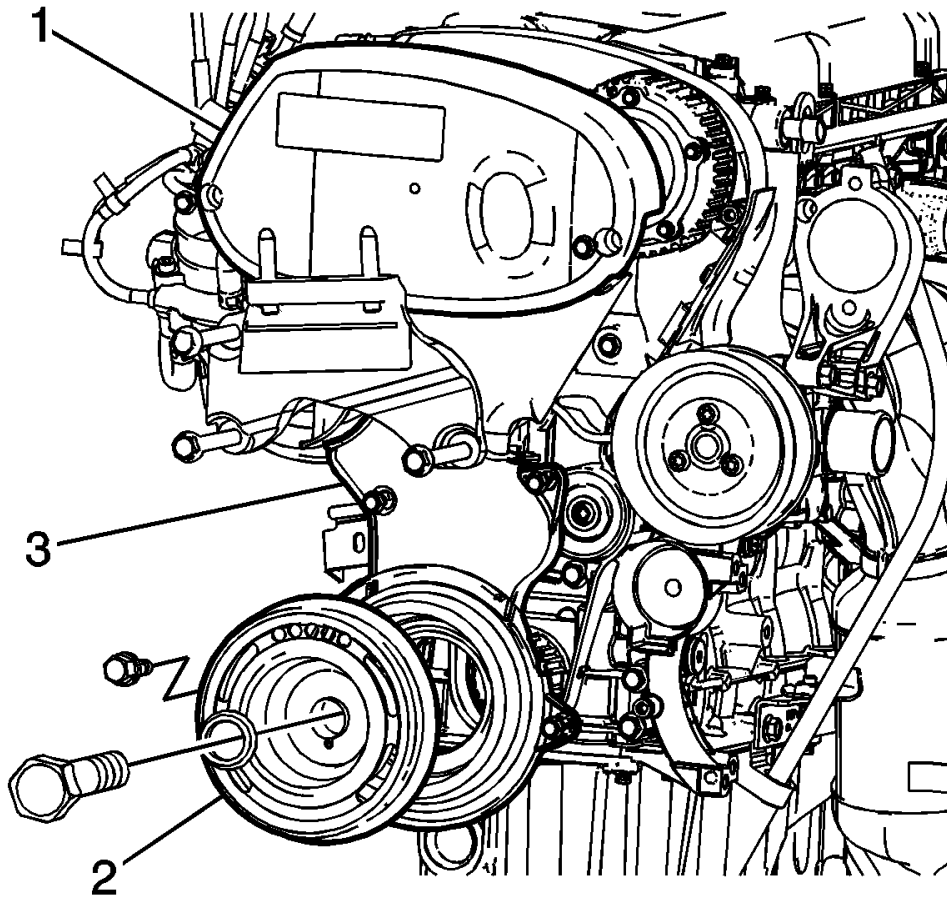


Fig. 26: Crankshaft Pulley & Timing Belt Covers
Courtesy of GENERAL MOTORS CORP.

1. Install the timing belt center cover.

CAUTION: Refer to Fastener Caution .

2. Install the timing belt lower cover (3) and tighten the bolts to 6 N.m (53.1 lb in).
3. Install the engine mount bracket and tighten the bolt to 65 N.m (47.9 lb ft).
4. Install the timing belt upper cover (1) and tighten the bolts to 4 N.m (35.4 lb ft).
5. Install the crankshaft pulley (2) with aligning crankshaft pulley notches and tighten to 95 N.m + 45° + 15° (70 lb ft + 45° + 15°).
6. Install the engine mount. Refer to Engine Mount Replacement
7. Install the cylinder head cover. Refer to Engine Mount Replacement.
8. Install the accessory belt. Refer to Drive Belt Tensioner Replacement.

9. Install the accessory belt tensioner. Refer to **Drive Belt Replacement**.

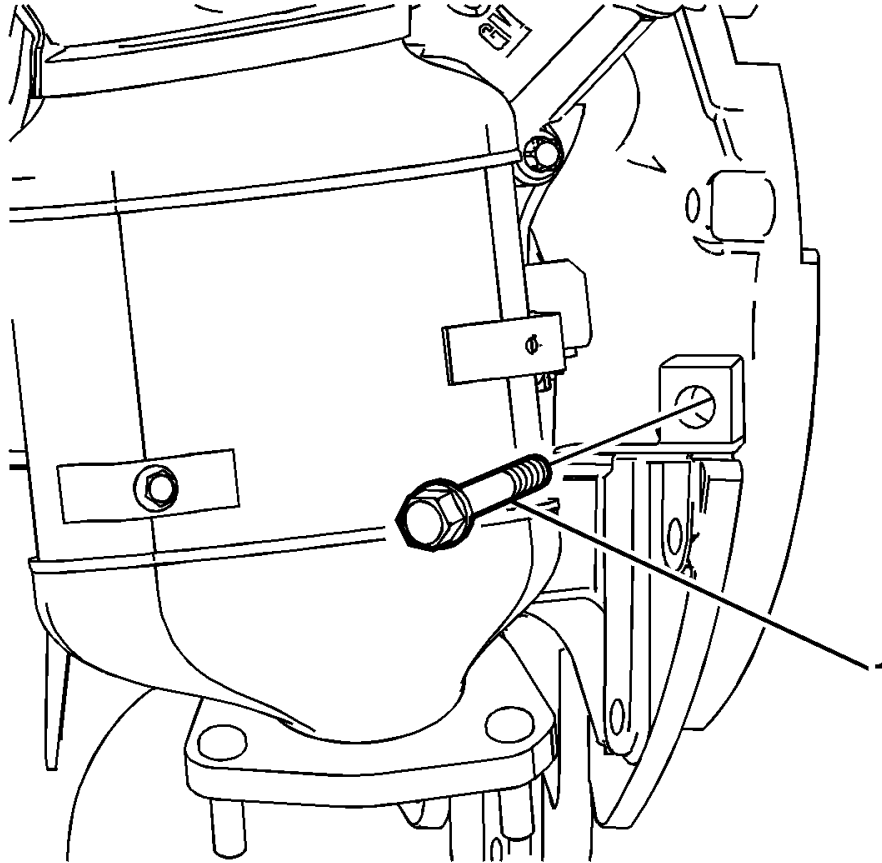


Fig. 27: Transmission Bolt
Courtesy of GENERAL MOTORS CORP.

10. Remove the transmission bolt (1).
11. Remove **KM-6625**: locking device to block the crankshaft.
12. Install the transmission bolt (1) and tighten to 60 N.m (44.2 lb ft).
13. Remove **J 28647-B**: Engine Support Fixture.
14. Install the air cleaner assembly. Refer to **AIR CLEANER ASSEMBLY REPLACEMENT** .
15. Connect the battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection** .

VALVE ROCKER ARM COVER REPLACEMENT

REMOVAL PROCEDURE

WARNING: Refer to **Battery Disconnect Warning** .

1. Disconnect the battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection** .
2. Disconnect the related sensor and actuator connector and pull engine wiring harness aside.
3. Disconnect the oil switch wiring connector.
4. Disconnect the A/C compressor connector.
5. Disconnect the manifold air temperature (MAT) sensor connector.
6. Disconnect the A/C pressure (ACP) sensor connector.
7. Disconnect the CAM position solenoid valve connectors (right/left).
8. Disconnect the manifold air pressure (MAP) sensor connector.
9. Disconnect the EVAP canister purge solenoid valve connector.
10. Disconnect the injectors connectors.
11. Disconnect the ignition coil connector.
12. Disconnect the camshaft position sensor (CPS) connectors (right/left).

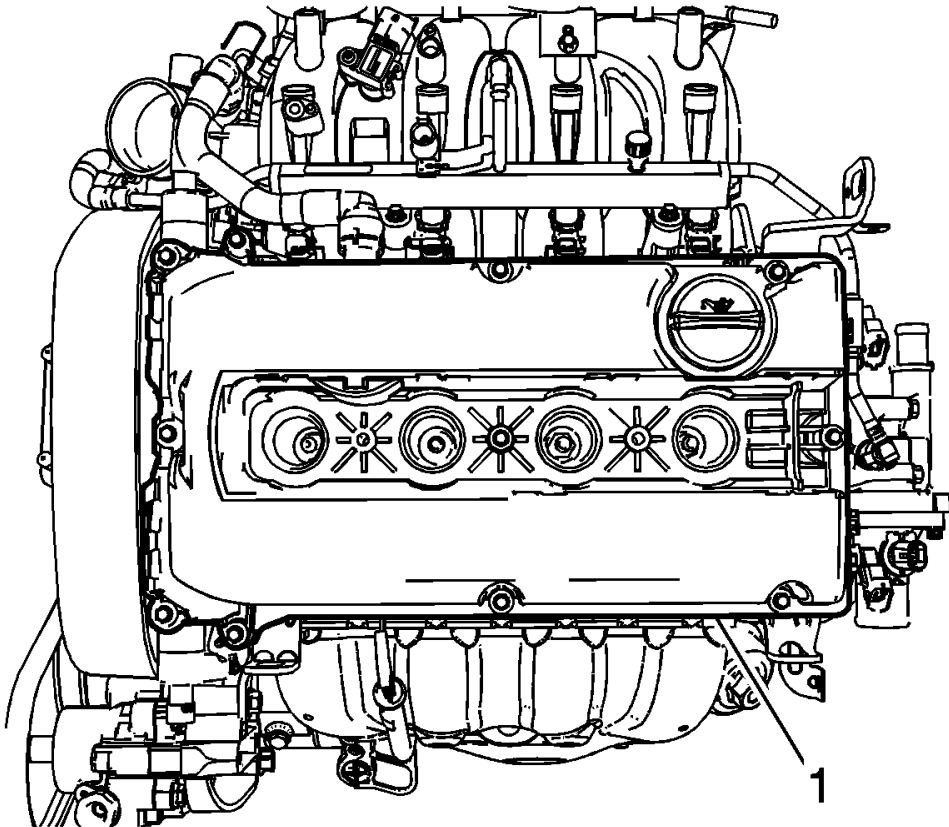
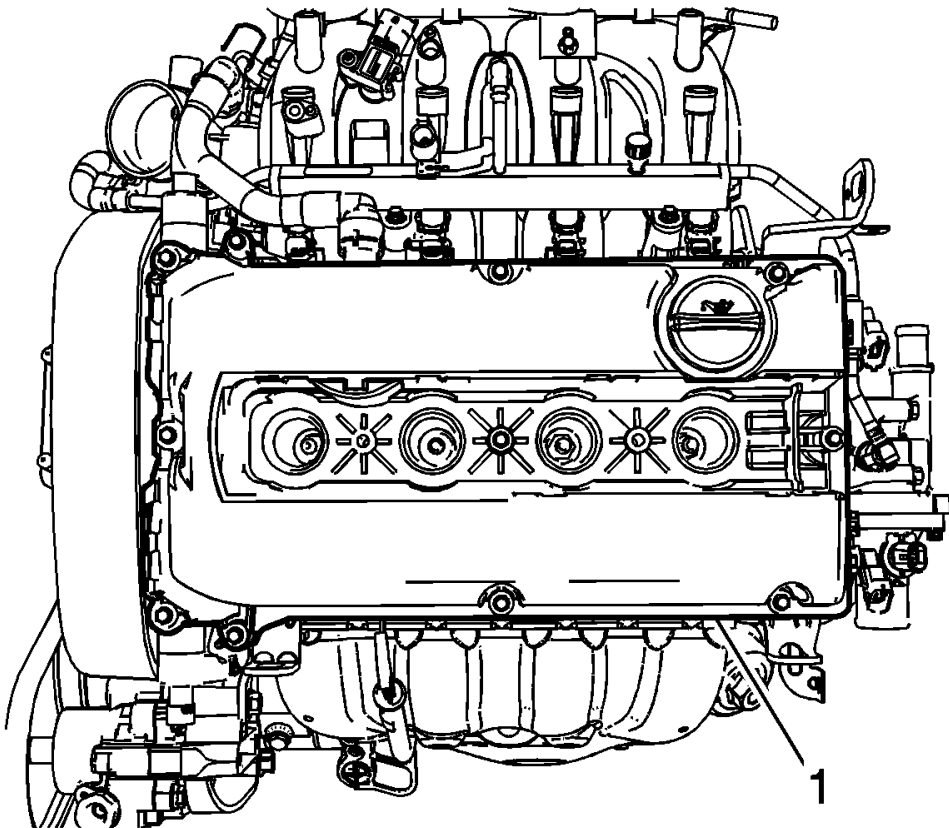


Fig. 28: Cylinder Head Cover**Courtesy of GENERAL MOTORS CORP.**

13. Remove the ignition coil. Refer to **IGNITION COIL REPLACEMENT** .
14. Detach the PCV clips from the PCV hose.
15. Remove the PCV hose from the cylinder head cover.
16. Remove the cylinder head cover bolts.
17. Remove the cylinder head cover (1).

INSTALLATION PROCEDURE**Fig. 29: Cylinder Head Cover****Courtesy of GENERAL MOTORS CORP.**

NOTE: Check and Confirm the damage or crack of the cylinder head gasket. If damaged or cracked, replace the new one.

1. Install the cylinder head cover (1) with the gasket.

CAUTION: Refer to Fastener Caution .

2. Install the cylinder head cover bolts and tighten to 8 N.m (70.8 lb in).
3. Install the PCV hose to the cylinder head cover.
4. Attach the PCV clips to the PCV hose.
5. Install the ignition coil. Refer to **IGNITION COIL REPLACEMENT** .
6. Position the engine wiring harness and connect the related sensor and actuator connector.
7. Connect the oil switch wiring connector.
8. Connect the A/C compressor connector.
9. Connect the manifold air temperature (MAT) sensor connector.
10. Connect the A/C pressure (ACP) sensor connector.
11. Connect the CAM position solenoid valve connectors (right/left).
12. Connect the manifold air pressure (MAP) sensor connector.
13. Connect the EVAP canister purge solenoid valve connector.
14. Connect the injector connectors.
15. Connect the ignition coil connector.
16. Connect the camshaft position sensor (CPS) connectors (right/left).
17. Connect the battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection** .

CAMSHAFT POSITION INTAKE ACTUATOR REPLACEMENT**REMOVAL PROCEDURE**

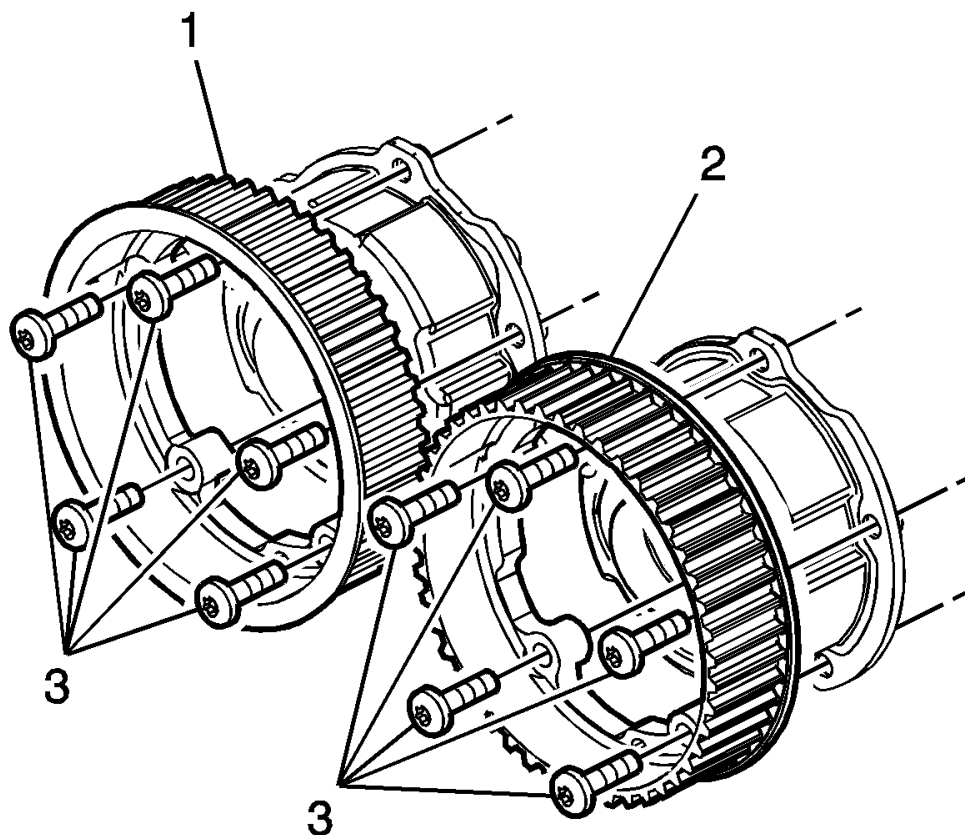


Fig. 30: Camshaft Adjusters & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the camshaft adjuster bolts (3).

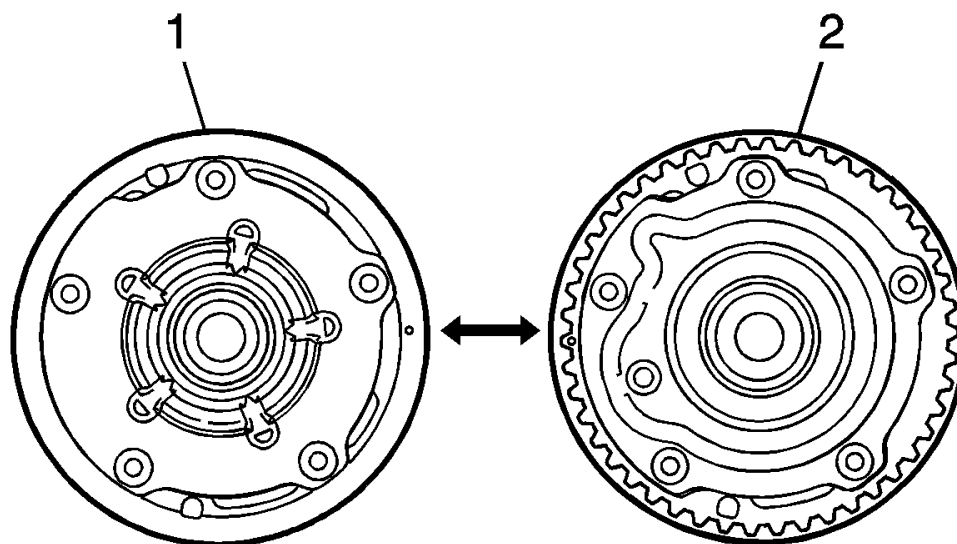


Fig. 31: Intake/Exhaust Adjusters
Courtesy of GENERAL MOTORS CORP.

NOTE: Ensure the location and direction of the intake/exhaust adjusters when removed.

2. Remove the camshaft adjusters (1, 2).

INSTALLATION PROCEDURE

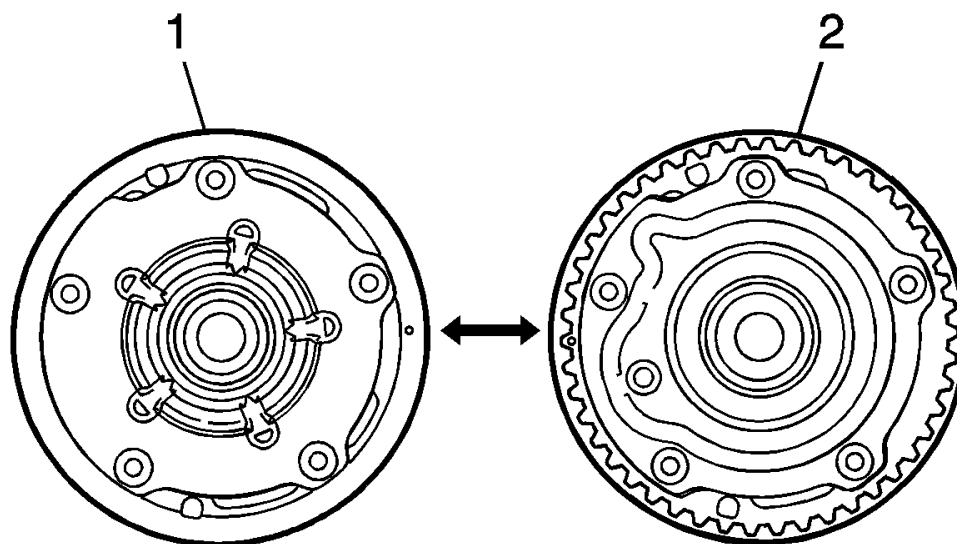


Fig. 32: Intake/Exhaust Adjusters
Courtesy of GENERAL MOTORS CORP.

NOTE: Ensure the location and direction of the intake/exhaust adjusters when removed.

1. Install the camshaft adjusters (1, 2).

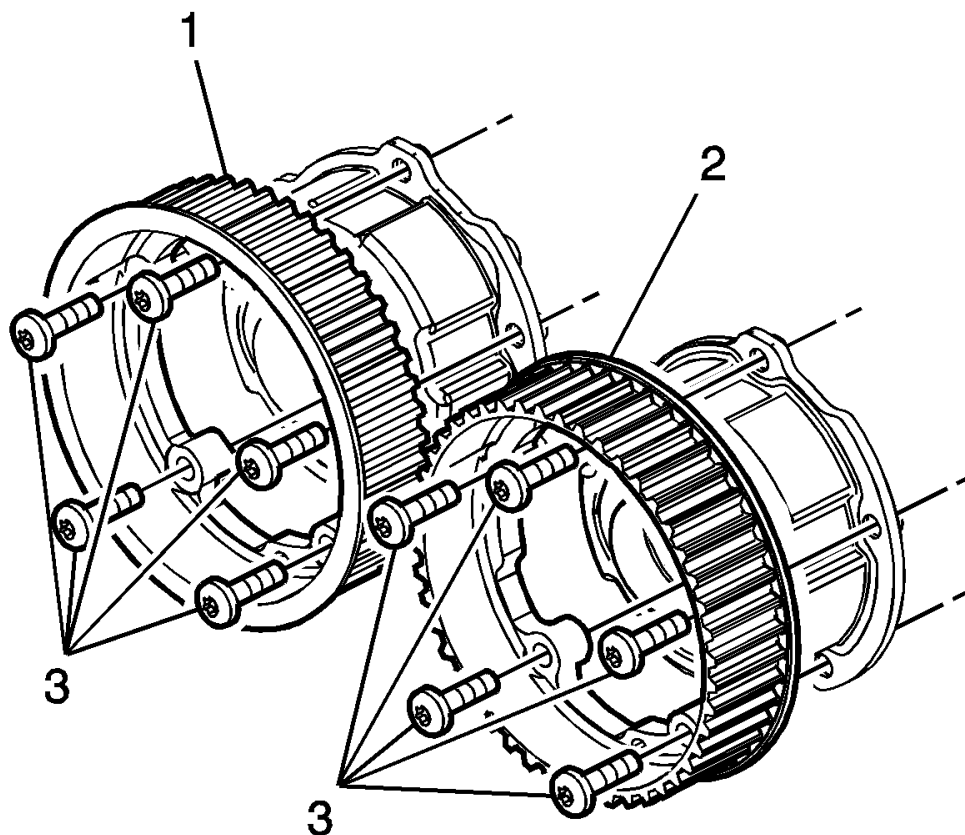


Fig. 33: Camshaft Adjusters & Bolts
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

2. Install the camshaft adjuster bolts (3) and tighten to 65 N.m +120° +15° (47.9 lb ft +120° +15°).

CAMSHAFT POSITION EXHAUST ACTUATOR REPLACEMENT

REMOVAL PROCEDURE

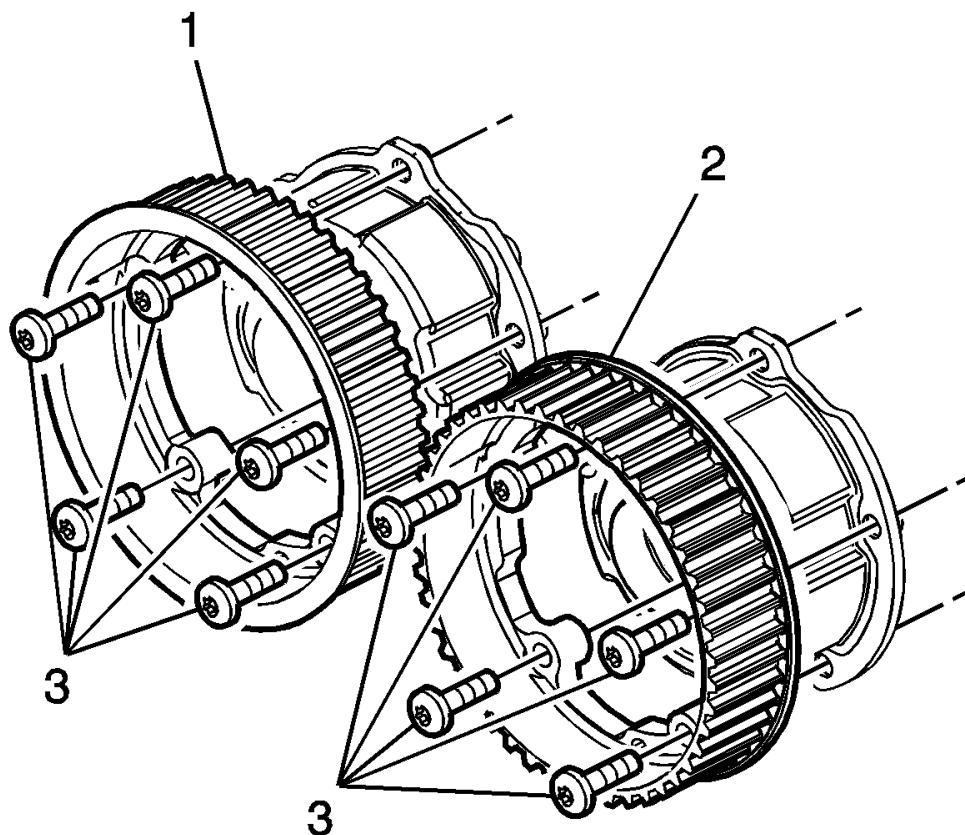


Fig. 34: Camshaft Adjusters & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the camshaft adjuster bolts (3).

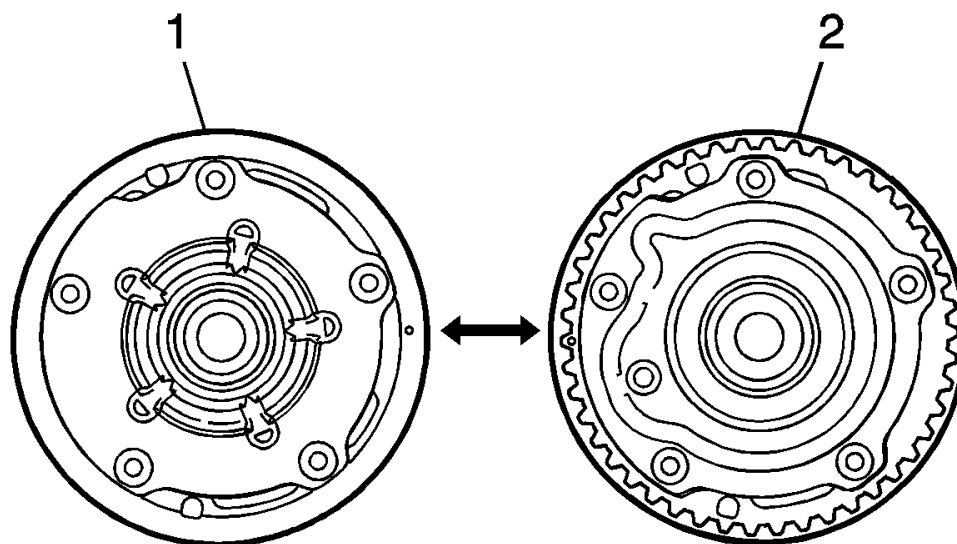


Fig. 35: Intake/Exhaust Adjusters
Courtesy of GENERAL MOTORS CORP.

NOTE: Ensure the location and direction of the intake/exhaust adjusters when removed.

2. Remove the camshaft adjusters (1, 2).

INSTALLATION PROCEDURE

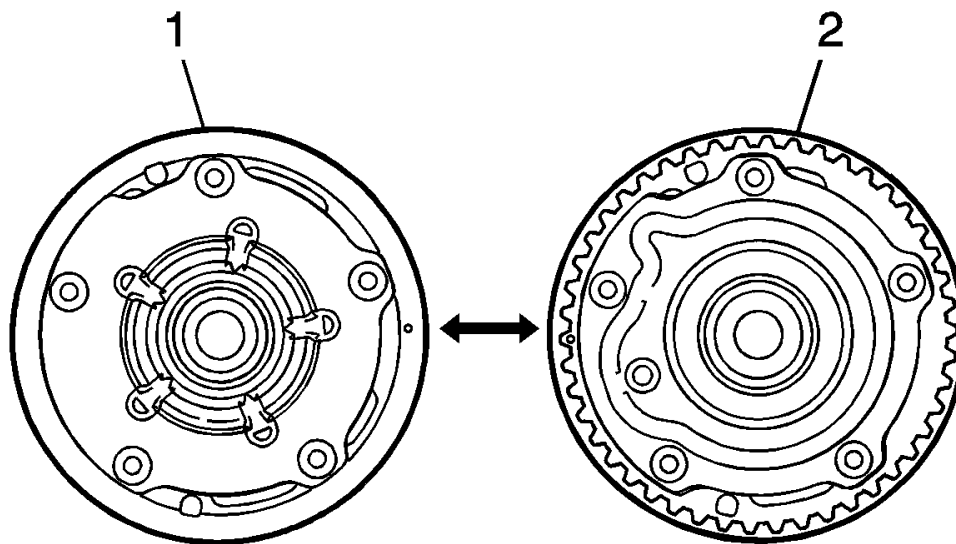


Fig. 36: Intake/Exhaust Adjusters
Courtesy of GENERAL MOTORS CORP.

NOTE: Ensure the location and direction of the intake/exhaust adjusters when removed.

1. Install the camshaft adjusters (1, 2).

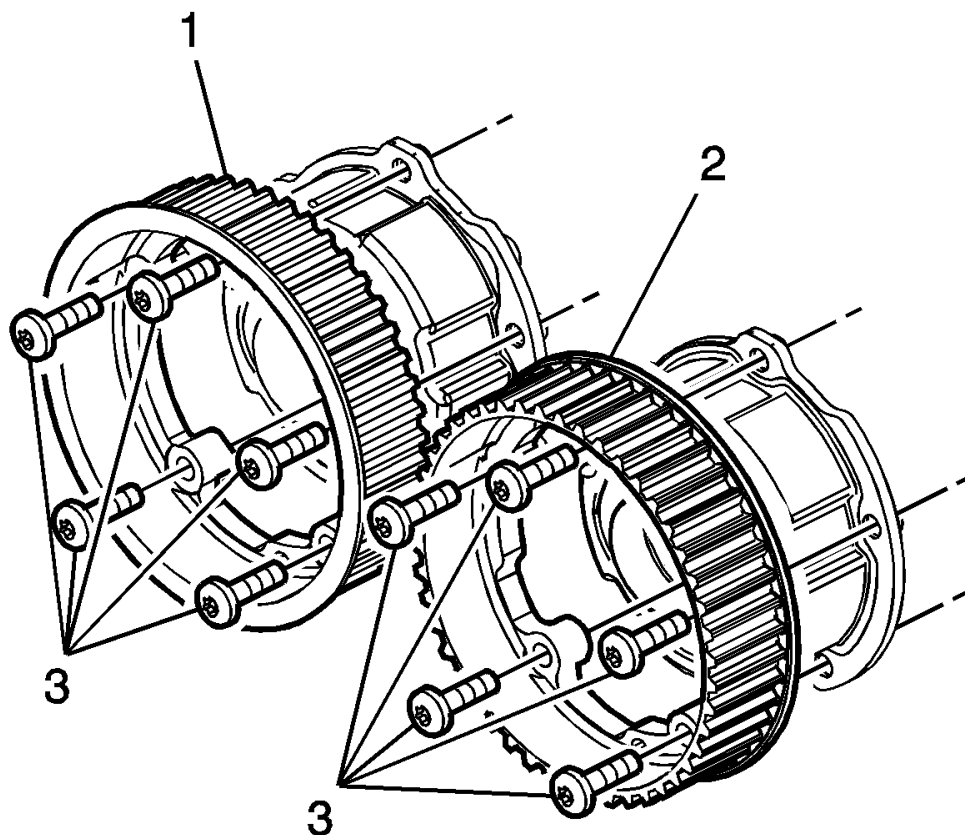


Fig. 37: Camshaft Adjusters & Bolts
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

2. Install the camshaft adjuster bolts (3) and tighten to 65 N.m +120° +15° (47.9 lb ft +120° +15°).

CAMSHAFT INTAKE SPROCKET WITH ACTUATOR REPLACEMENT

REMOVAL PROCEDURE

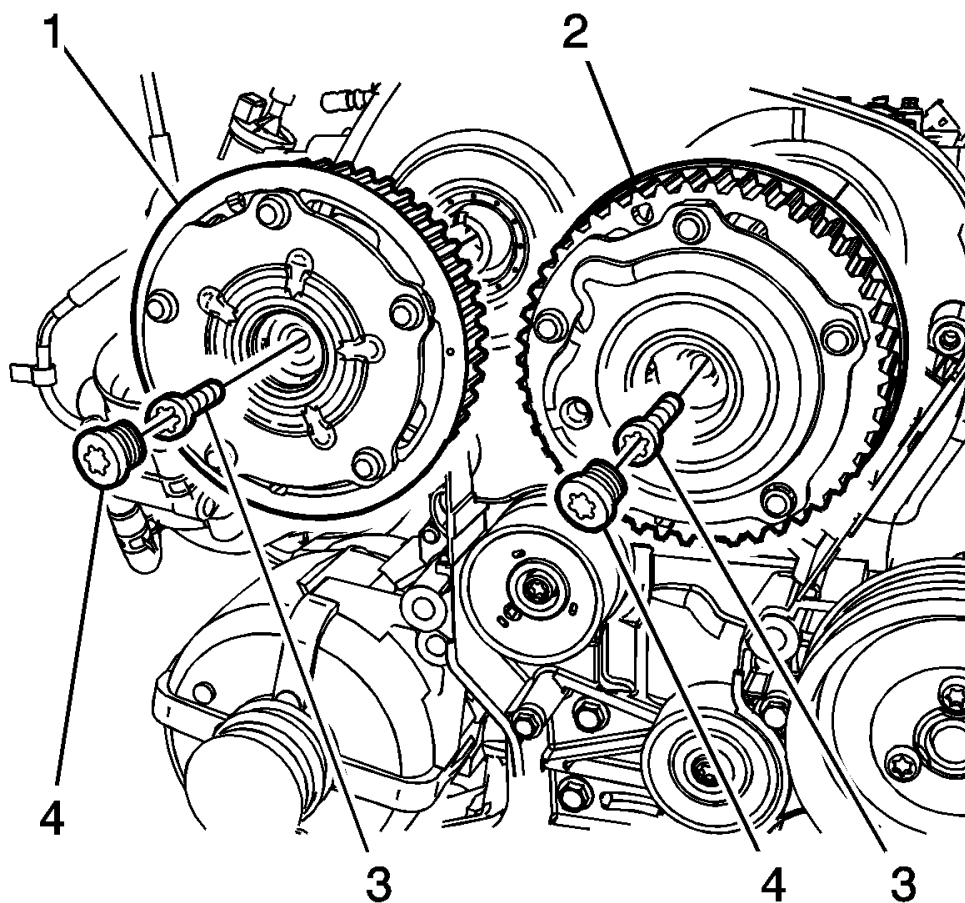


Fig. 38: Camshaft Sprockets, Caps & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: When removing the camshaft sprockets, the timing belt replacement procedure must be followed to ensure the camshafts and crankshaft are locked into position.

1. Remove the timing belt. Refer to **Timing Belt Replacement**.
2. Remove the camshaft intake sprocket bolt cap (4).
3. Remove the camshaft intake sprocket bolt (3).
4. Remove the camshaft intake sprocket with actuator (1).

INSTALLATION PROCEDURE

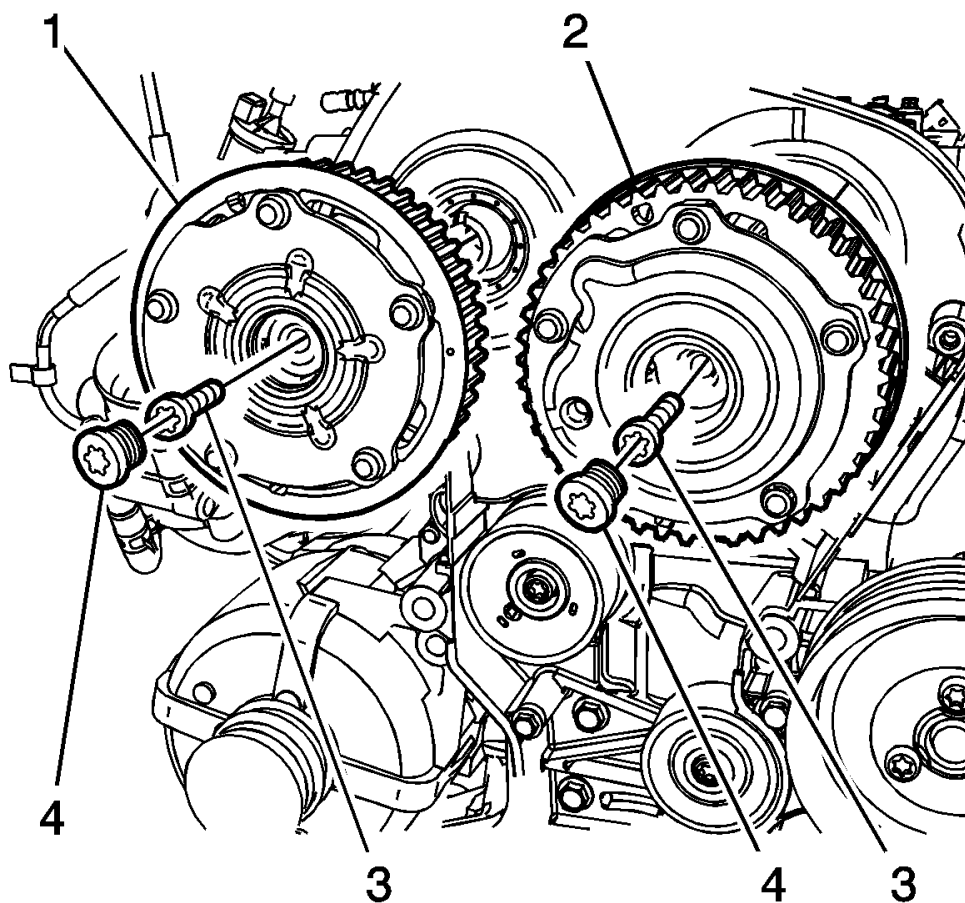


Fig. 39: Camshaft Sprockets, Caps & Bolts
 Courtesy of GENERAL MOTORS CORP.

1. Install the camshaft intake sprocket (1).

CAUTION: Refer to Fastener Caution .

2. Install the camshaft intake sprocket bolt (3).

Tighten: Tighten the camshaft sprocket bolt to 65 N.m (47.9 lb ft).

3. Install the camshaft intake sprocket bolt cap (4).

Tighten: Tighten the camshaft sprocket bolt cap to 50 N.m (36.8 lb ft).

4. Install the timing belt. Refer to Timing Belt Replacement.

CAMSHAFT EXHAUST SPROCKET WITH ACTUATOR REPLACEMENT

REMOVAL PROCEDURE

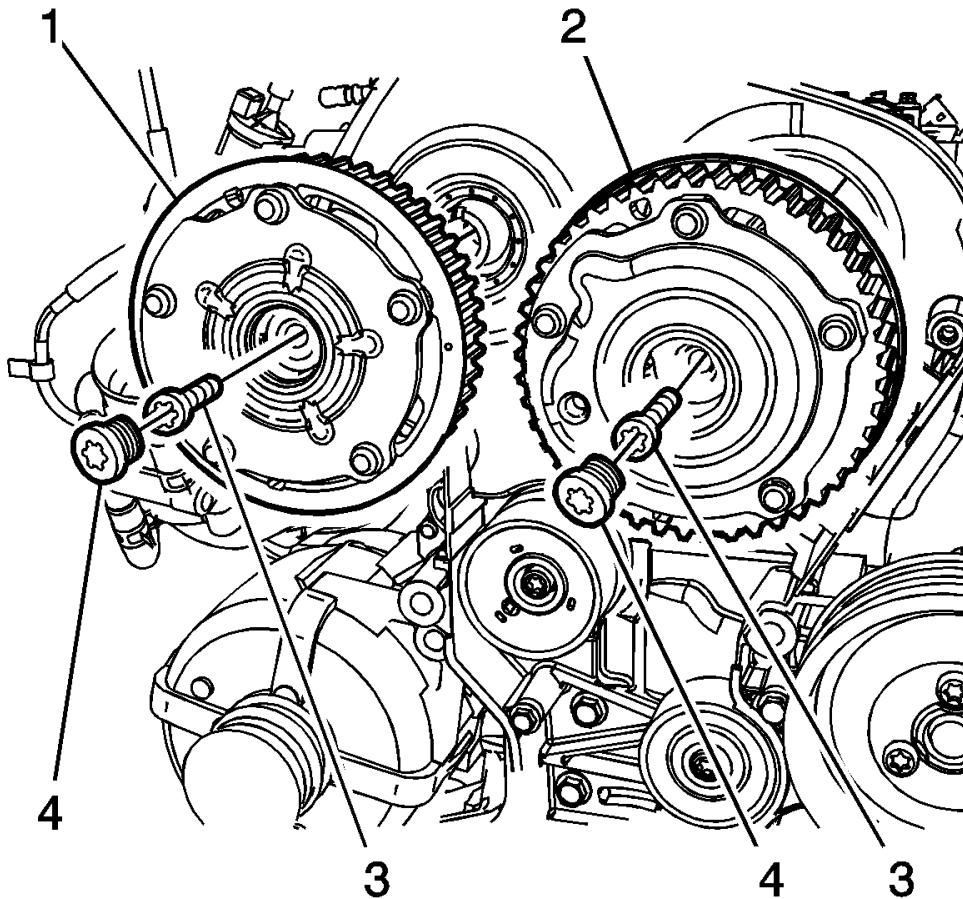


Fig. 40: Camshaft Sprockets, Caps & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: When removing the camshaft sprockets, the timing belt replacement procedure must be followed to ensure the camshafts and crankshaft are locked into position.

1. Remove the timing belt. Refer to **Timing Belt Replacement**.
2. Remove the camshaft exhaust sprocket bolt cap (4).
3. Remove the camshaft exhaust sprocket bolt (3).
4. Remove the camshaft exhaust sprocket with actuator (2).

INSTALLATION PROCEDURE

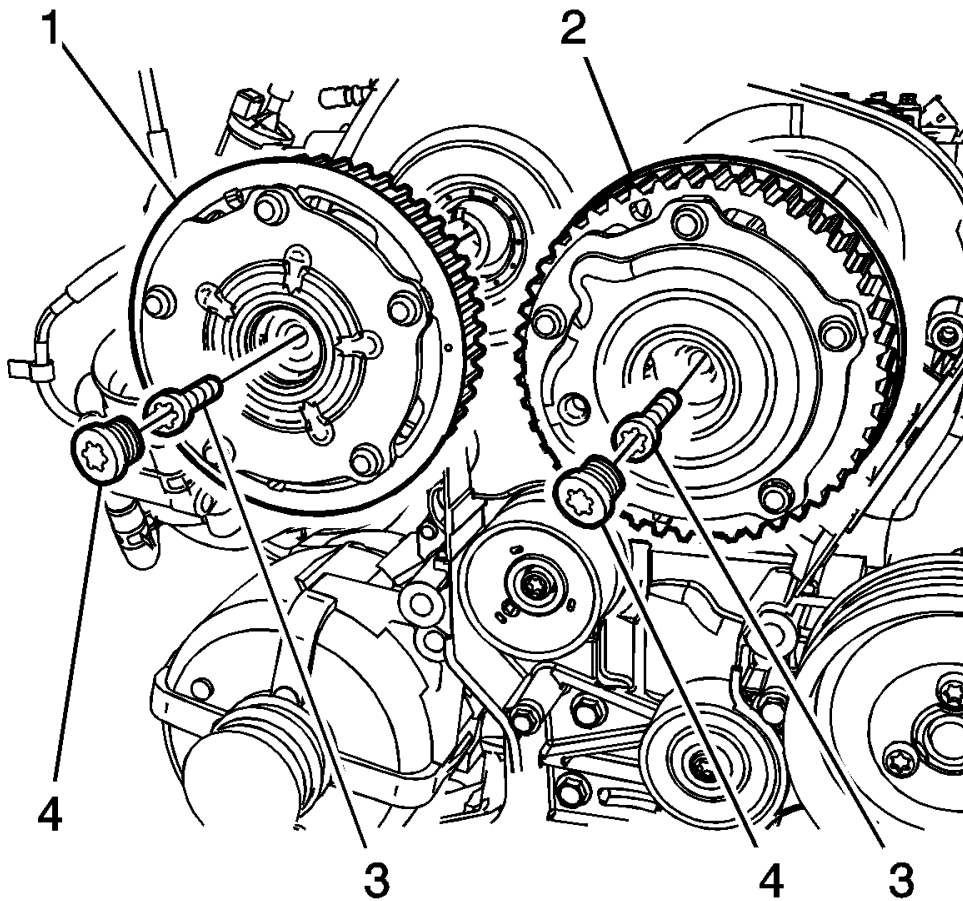


Fig. 41: Camshaft Sprockets, Caps & Bolts
 Courtesy of GENERAL MOTORS CORP.

1. Install the camshaft exhaust sprocket (2).

CAUTION: Refer to Fastener Caution .

2. Install the camshaft exhaust sprocket bolt (3).

Tighten: Tighten the camshaft sprocket bolt to 65 N.m (47.9 lb ft).

3. Install the camshaft exhaust sprocket bolt cap (4).

Tighten: Tighten the camshaft sprocket bolt cap to 50 N.m (36.8 lb ft).

4. Install the timing belt. Refer to Timing Belt Replacement.

CYLINDER HEAD REPLACEMENT

REMOVAL PROCEDURE

1. Drain the engine coolant. Refer to Cooling System Draining and Filling .
2. Release the fuel pressure. Refer to FUEL PRESSURE RELIEF .
3. Remove the timing belt. Refer to Timing Belt Replacement.
4. Remove the timing belt tensioner. Refer to Timing Belt Replacement.

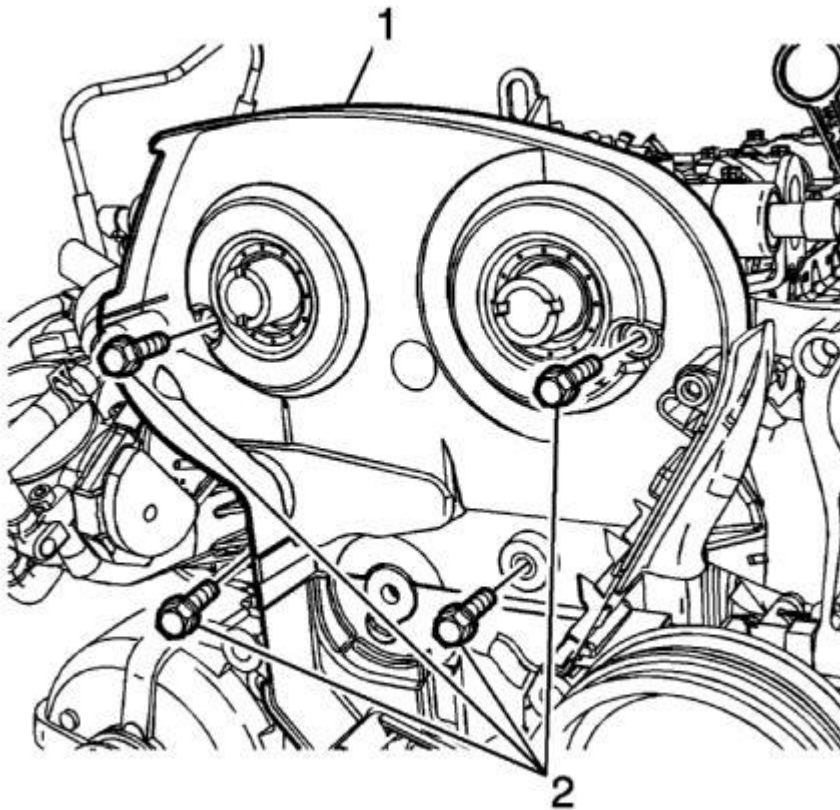


Fig. 42: Timing Belt Rear Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

5. Remove the camshaft. Refer to Camshaft Replacement.
6. Remove the timing belt rear cover (1).
7. Remove the intake manifold. Refer to Intake Manifold Replacement.
8. Remove the exhaust manifold. Refer to Catalytic Converter Replacement (1.4L LDT/1.6L LXV) .

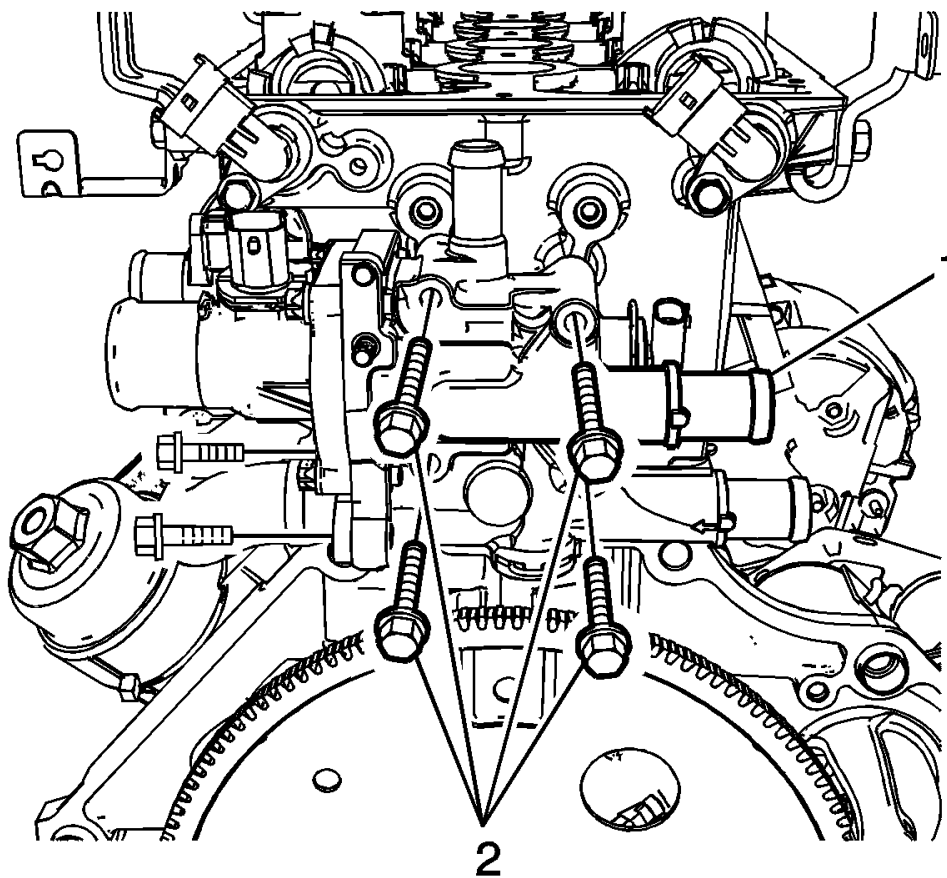


Fig. 43: Coolant Distributor
Courtesy of GENERAL MOTORS CORP.

9. Remove the coolant distributor (1).

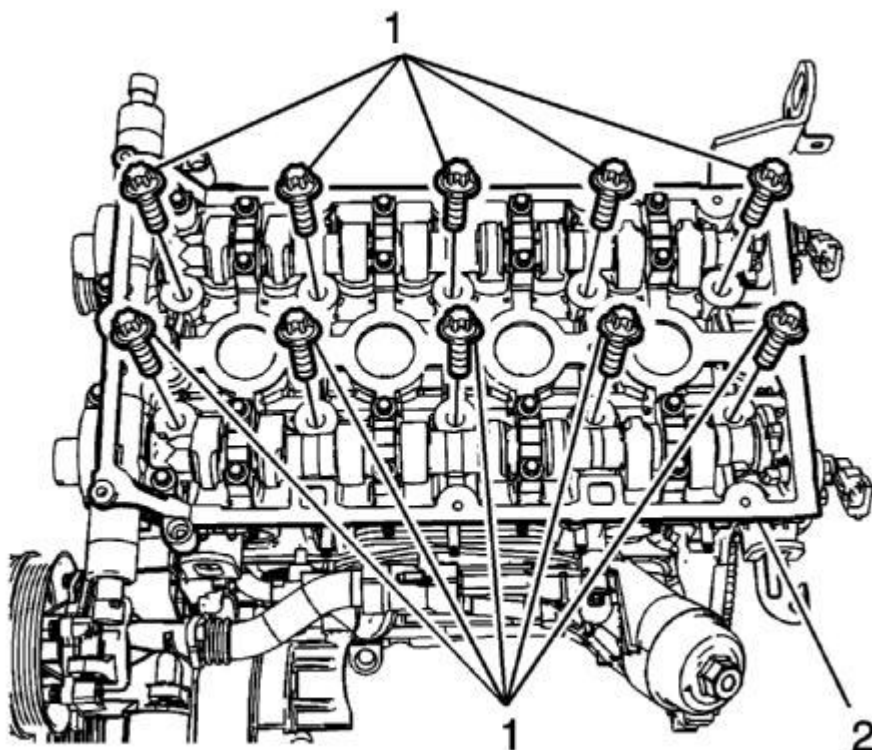


Fig. 44: Cylinder Head & Bolts
Courtesy of GENERAL MOTORS CORP.

10. Remove the cylinder head bolts (1).
11. Remove the cylinder head (2) with the gasket.

INSTALLATION PROCEDURE

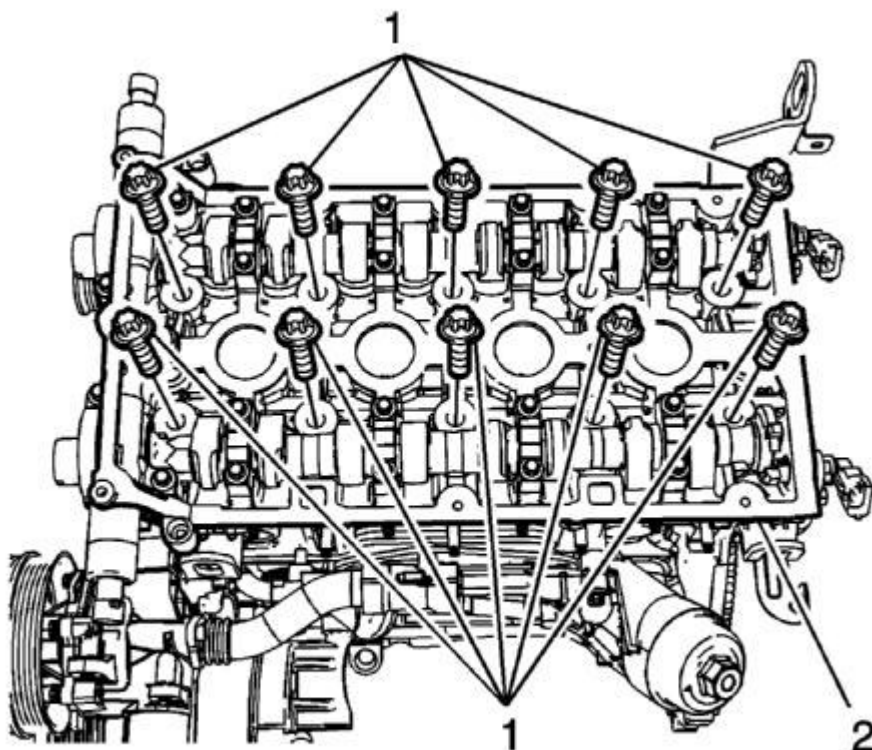


Fig. 45: Cylinder Head & Bolts

Courtesy of GENERAL MOTORS CORP.

1. Install the cylinder head (2) with the new gasket.

CAUTION: Refer to Fastener Caution .

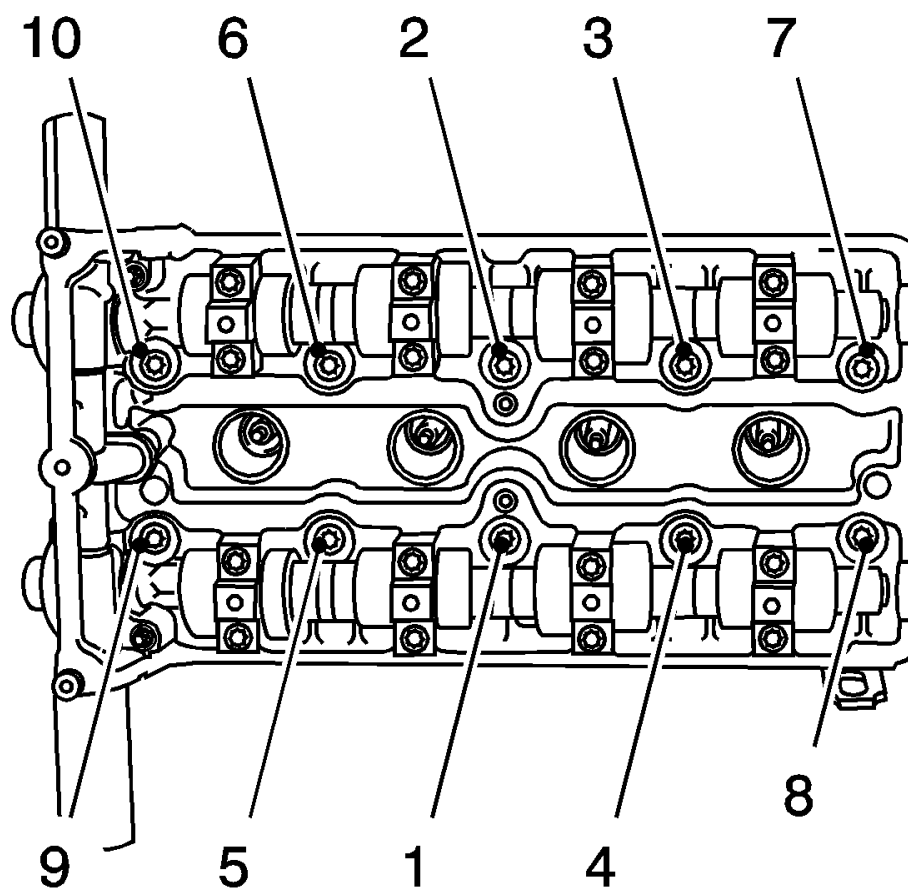


Fig. 46: Cylinder Head Bolt Tightening Sequence
 Courtesy of GENERAL MOTORS CORP.

2. Install the cylinder head bolts (1) and tighten to 25 N.m +90° +90° +90° +45° (18.4 lb ft +90° +90° +90° +45°).

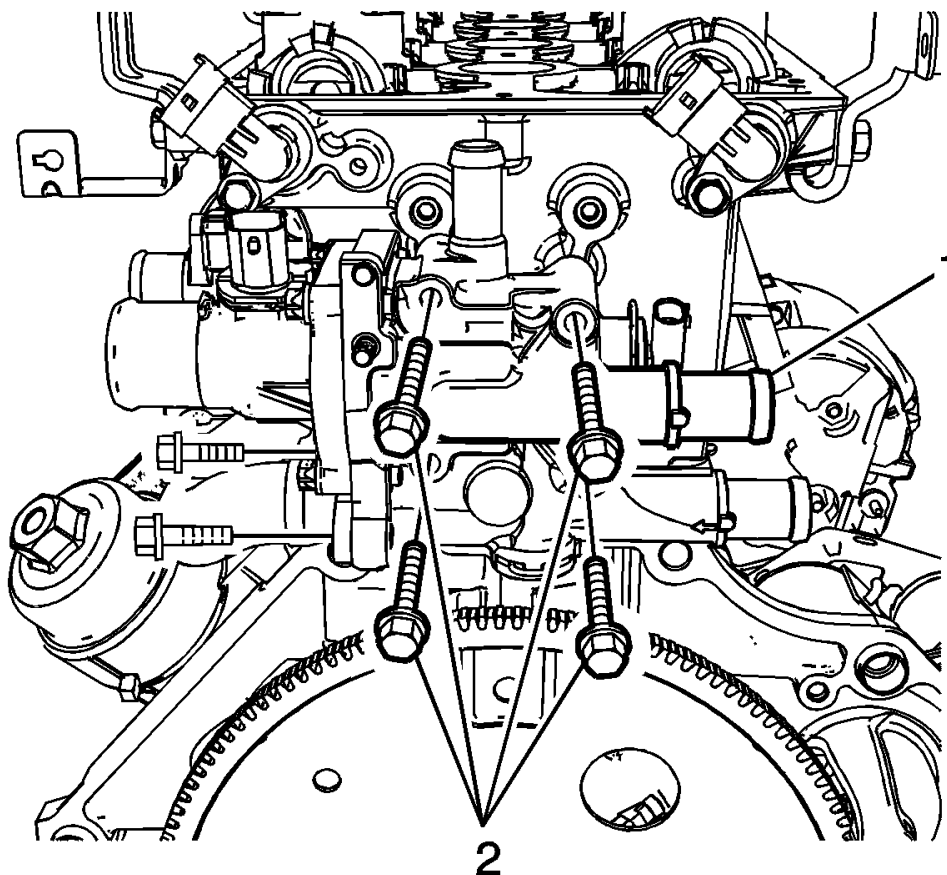


Fig. 47: Coolant Distributor

Courtesy of GENERAL MOTORS CORP.

3. Install the coolant distributor (1).
4. Install the exhaust manifold. Refer to **Catalytic Converter Replacement (1.4L LDT/1.6L LXV)** .
5. Install the intake manifold. Refer to **Intake Manifold Replacement**.

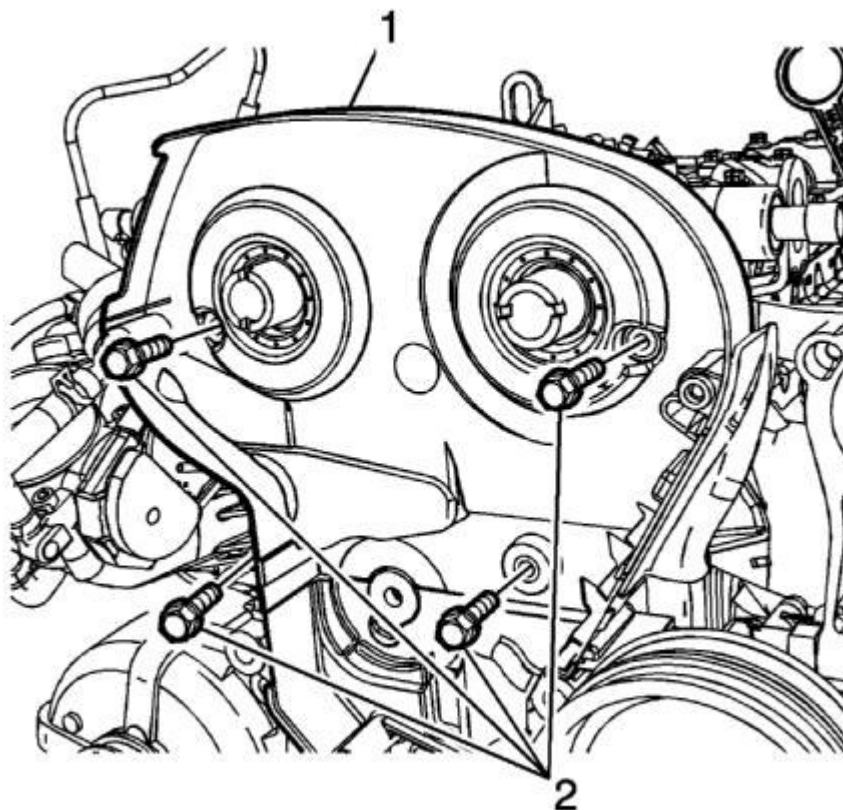


Fig. 48: Timing Belt Rear Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Install the timing belt rear cover (1) and tighten to 6 N.m (53.1 lb in).
7. Install the camshaft. Refer to **Camshaft Replacement**.
8. Adjust the belt timing. Refer to **Timing Belt Replacement**.

OIL PAN REPLACEMENT

REMOVAL PROCEDURE

1. Drain the engine oil. Refer to **Engine Oil and Oil Filter Replacement**.
2. Remove the front exhaust pipe. Refer to **Front Pipe Replacement**.

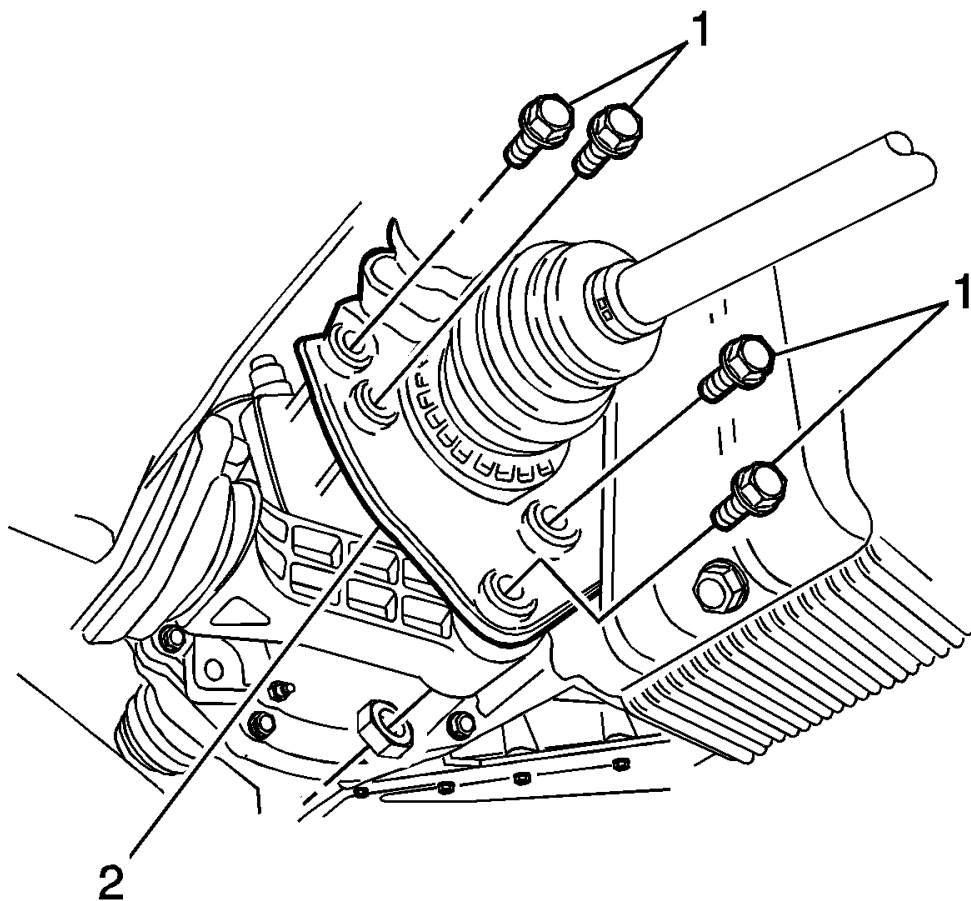


Fig. 49: Transmission Rear Mounting Bracket & Bolts (A/T)
Courtesy of GENERAL MOTORS CORP.

3. Remove the transmission rear mounting bracket (2), for automatic transmission only.

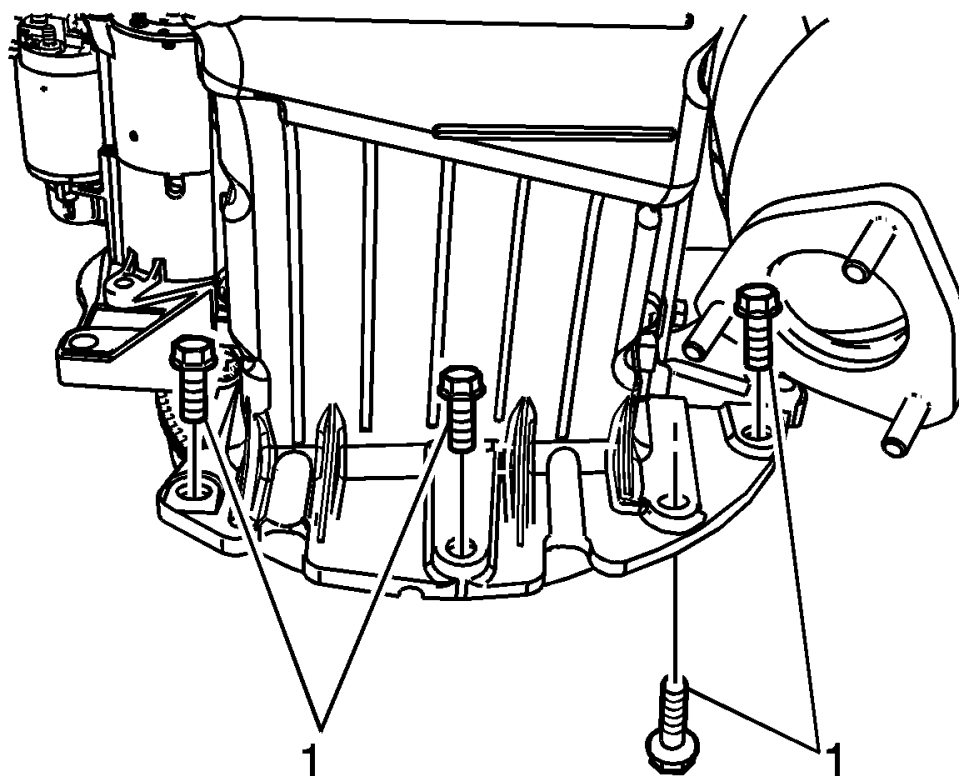


Fig. 50: Oil Pan-To-Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

4. Remove the oil pan-to-transmission bolts (1).

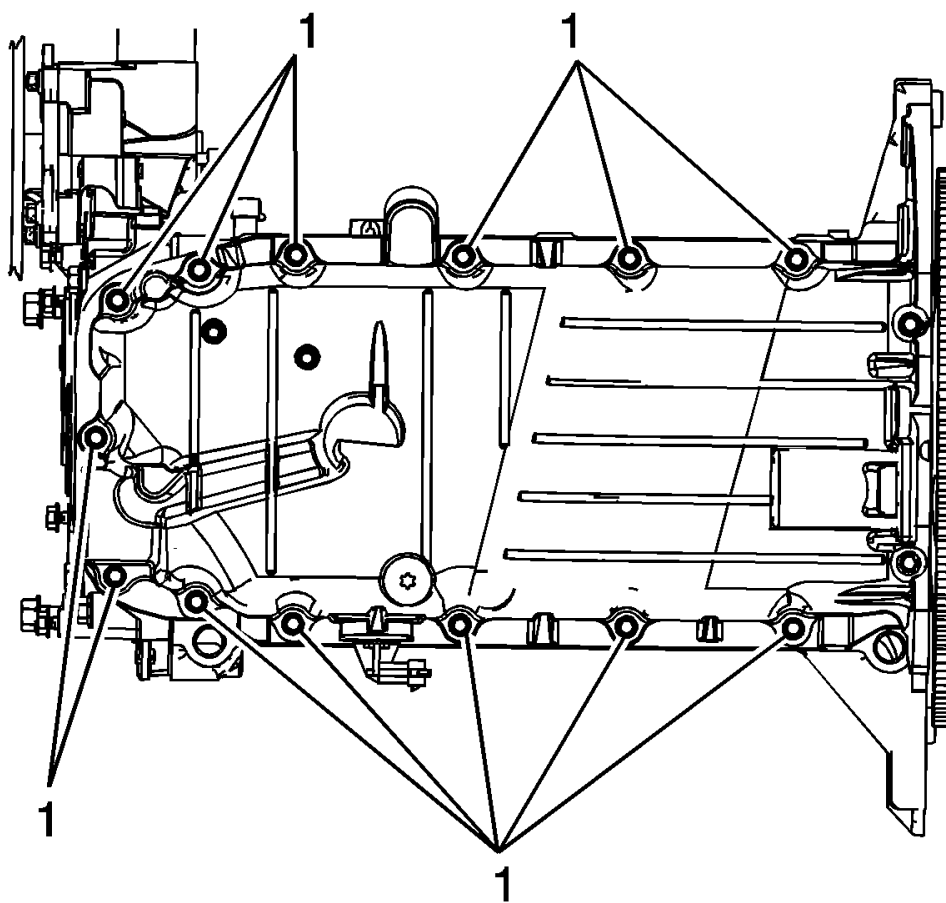


Fig. 51: Oil Pan Bolts

Courtesy of GENERAL MOTORS CORP.

5. Remove the oil pan bolts (1).

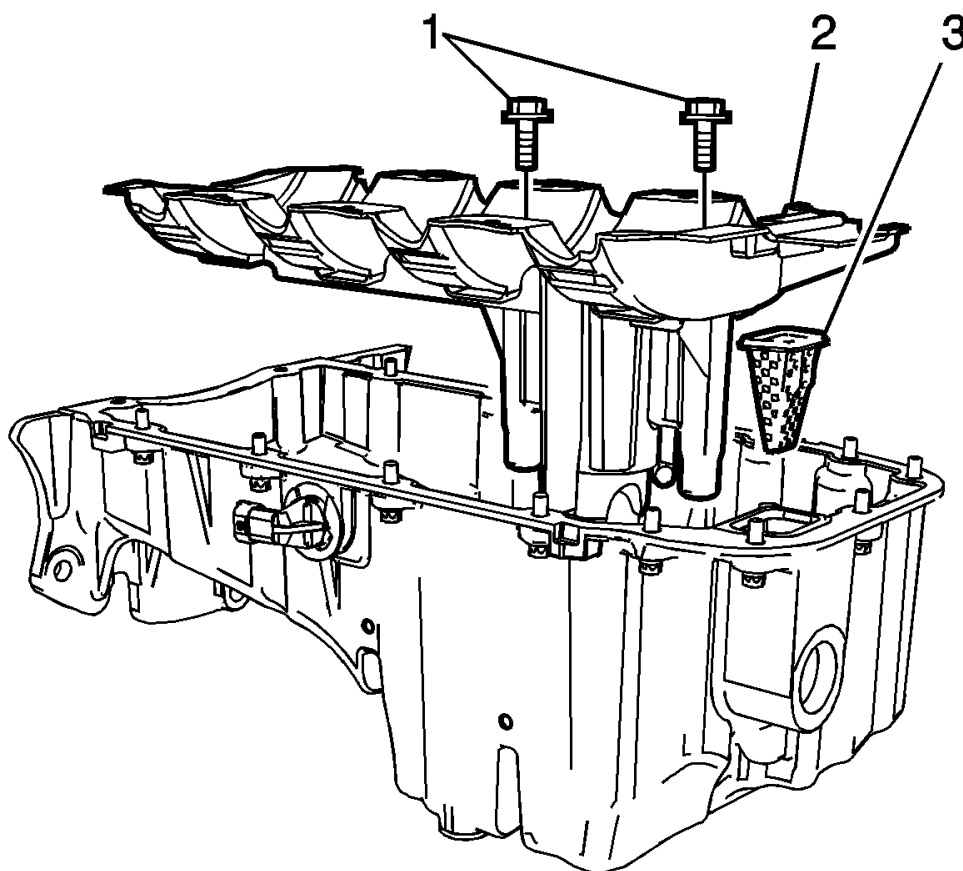


Fig. 52: Oil Pan Baffle & Oil Suction Filter
Courtesy of GENERAL MOTORS CORP.

6. Remove the oil pan baffle (2).
7. Remove the oil suction filter (3).

INSTALLATION PROCEDURE

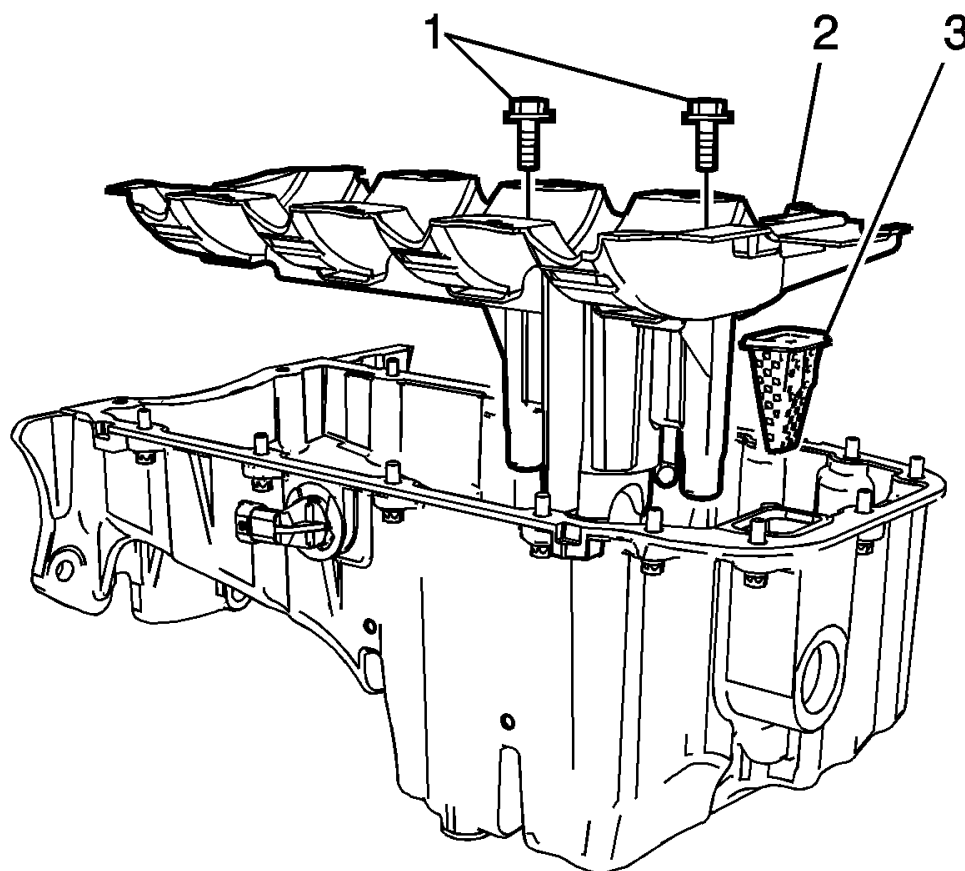


Fig. 53: Oil Pan Baffle & Oil Suction Filter
 Courtesy of GENERAL MOTORS CORP.

1. Install the oil suction filter (3) to the oil pan.

CAUTION: Refer to Fastener Caution .

2. Install the oil pan baffle (2).

Tighten: Tighten the oil pan baffle bolts (1) to 10 N.m (7.3 lb ft).

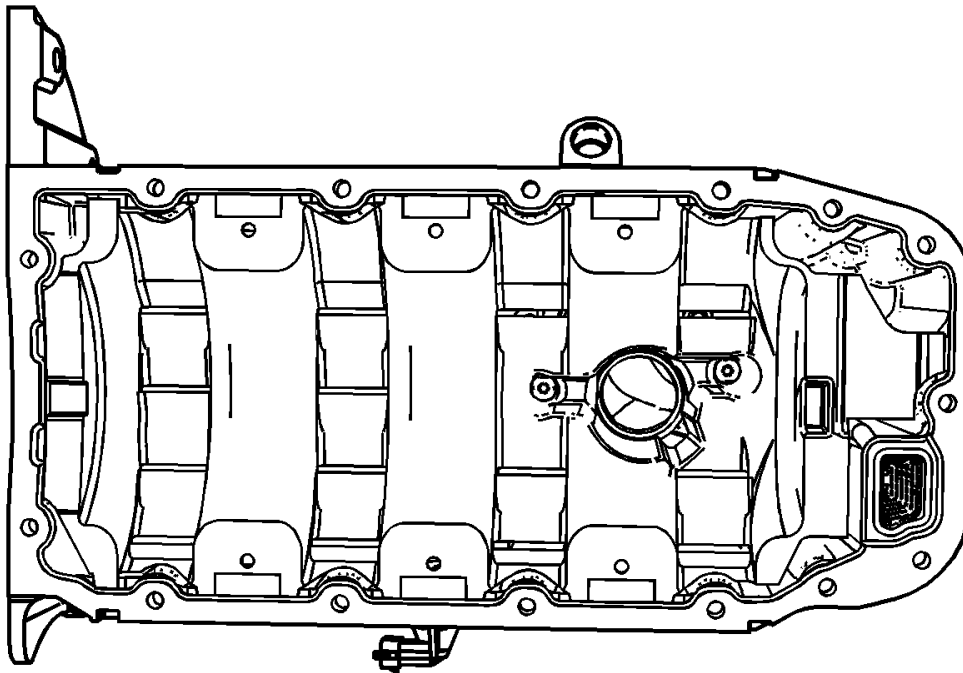


Fig. 54: Oil Pan Sealing Surface
Courtesy of GENERAL MOTORS CORP.

3. Clean the oil pan sealing surface.
4. Apply the oil pan sealant LOCTITE 5900 on the sealing surface.

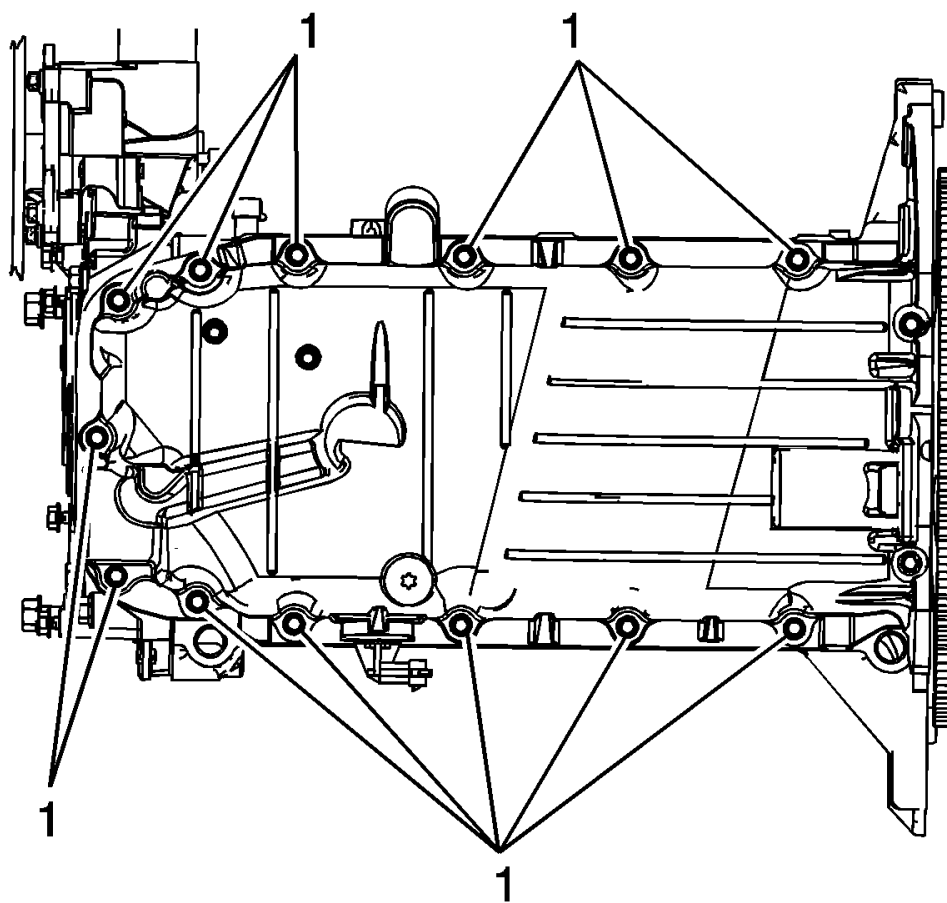


Fig. 55: Oil Pan Bolts

Courtesy of GENERAL MOTORS CORP.

5. Install the oil pan bolts (1).

Tighten: Tighten the oil pan bolts (1) to 14 N.m (10.3 lb ft).

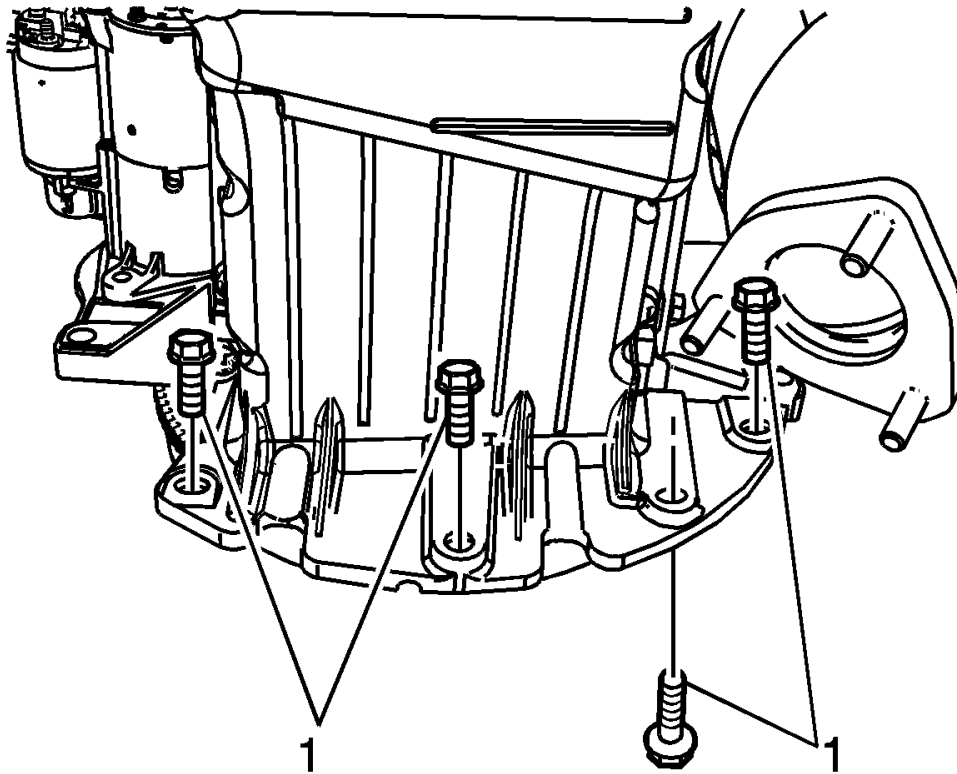


Fig. 56: Oil Pan-To-Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

6. Install the oil pan-to-transmission bolts (1).

Tighten: Tighten the oil pan-to-transmission bolts (1) to 40 N.m (29.5 lb ft).

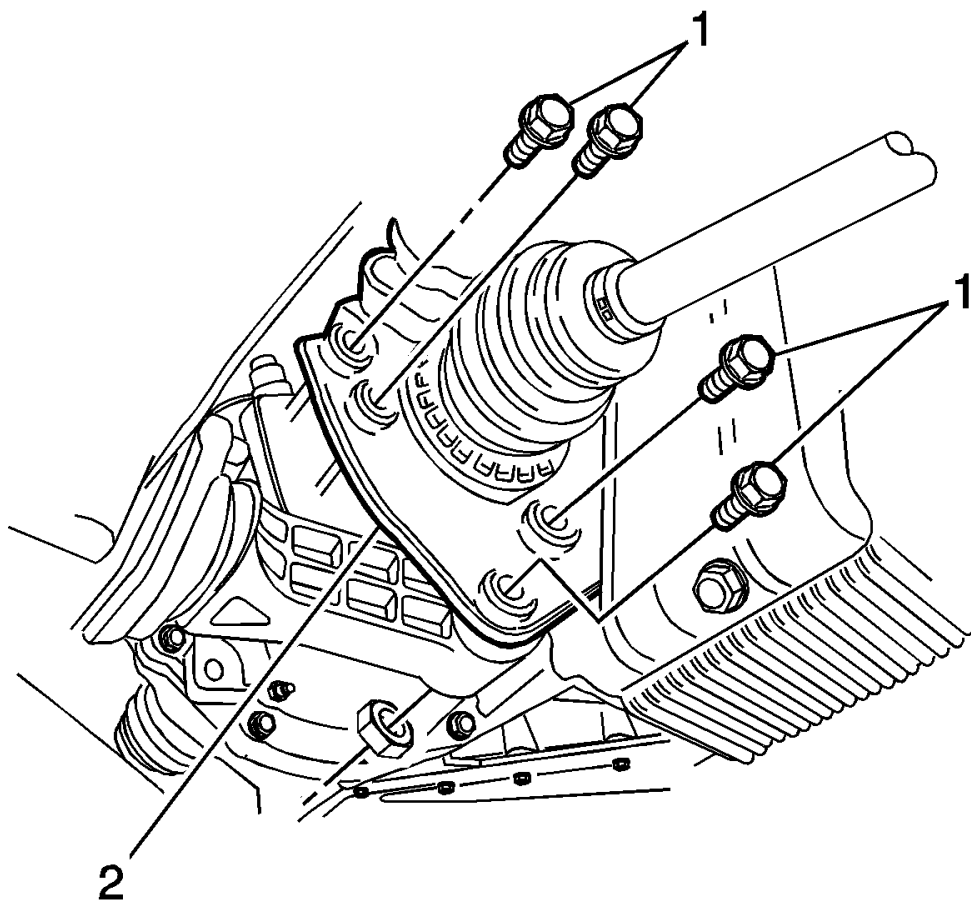


Fig. 57: Transmission Rear Mounting Bracket & Bolts (A/T)
Courtesy of GENERAL MOTORS CORP.

7. Install the transmission rear mounting bracket (2), for automatic transmission only.

Tighten: Tighten the transmission rear mounting bracket bolts and nut to 80 N.m (59 lb ft).

AUTOMATIC TRANSMISSION FLEX PLATE REPLACEMENT

Special Tools

- **J 28647-B:** Engine Support Fixture
- **KM-6625:** Flywheel Locking Device

REMOVAL PROCEDURE

1. Install **J 28647-B:** Engine Support Fixture.
2. Remove the automatic transmission. Refer to **Transmission Replacement**.

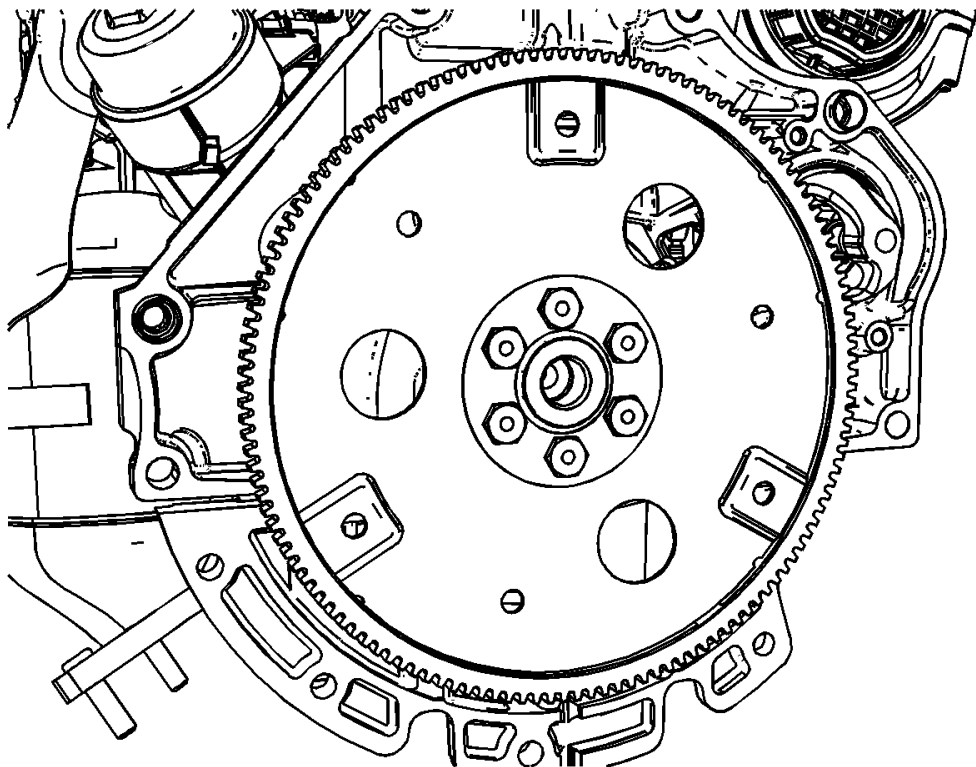


Fig. 58: Flexible Plate
Courtesy of GENERAL MOTORS CORP.

3. Install **KM-6625**: locking device to block the crankshaft.
4. Install the transmission bolt with **KM-6625**: locking device.

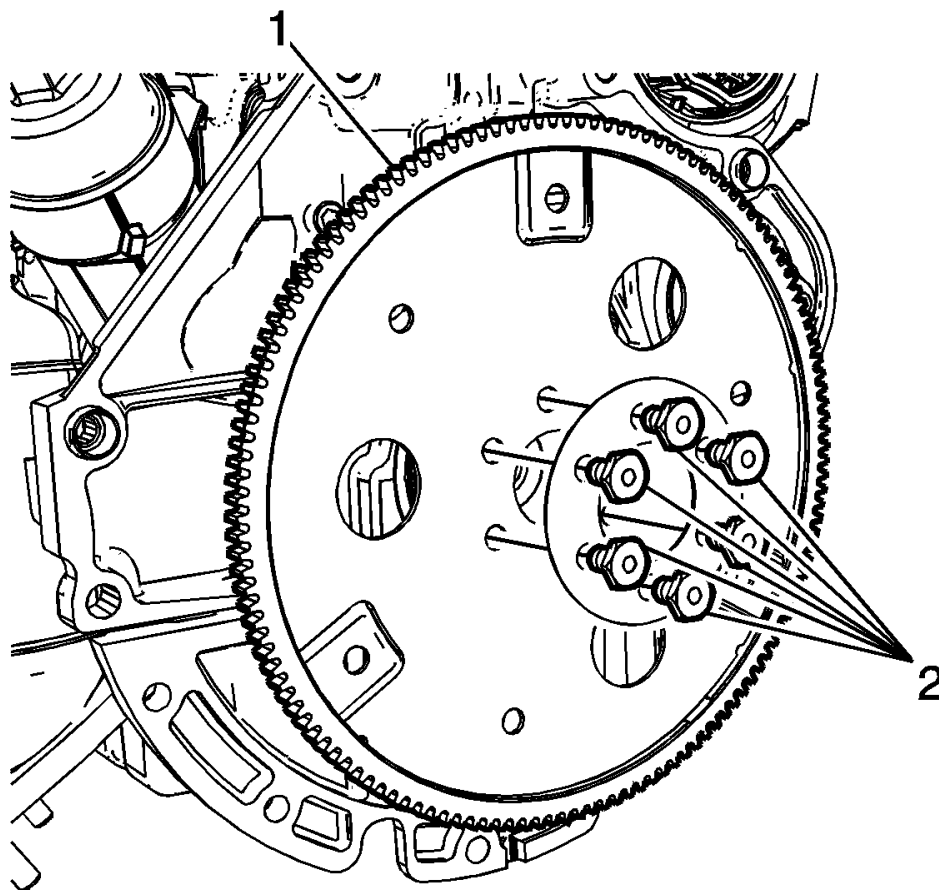


Fig. 59: Flexible Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

5. Remove the flexible plate bolts (2).
6. Remove the flexible plate (1).

INSTALLATION PROCEDURE

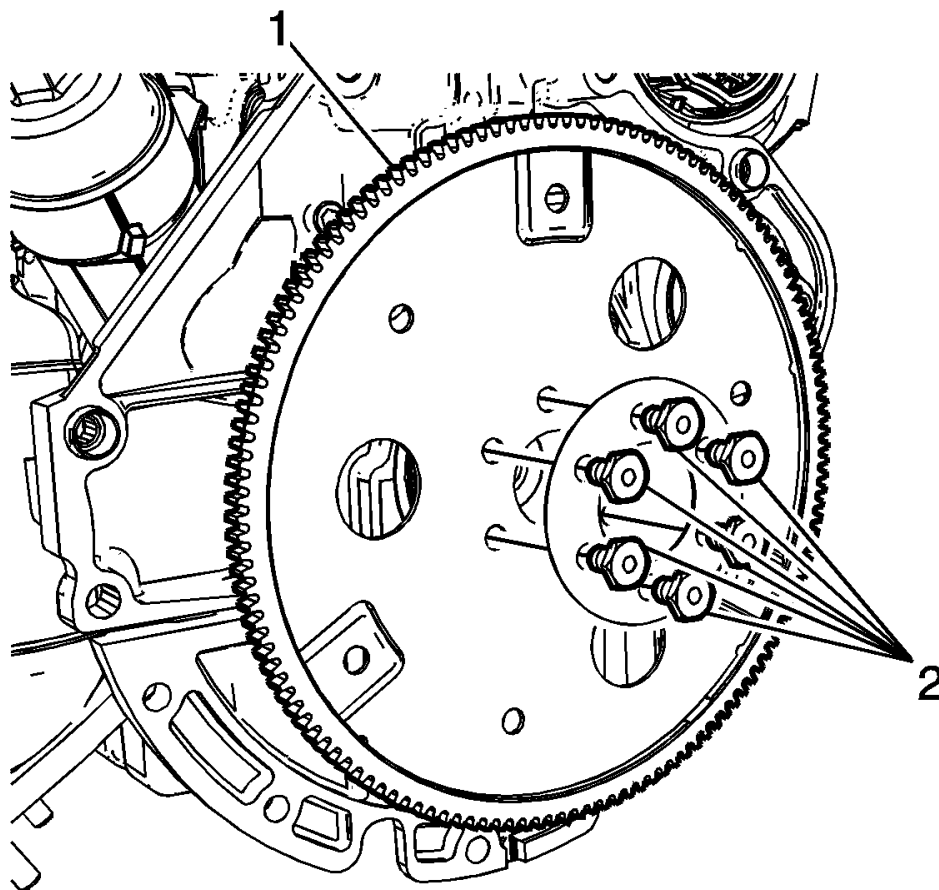


Fig. 60: Flexible Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the flexible plate (1).

CAUTION: Refer to Fastener Caution .

2. Install the flexible plate bolts (2).

Tighten: Tighten the flexible plate bolts (2) to 35 N.m +30° +15° (25.8 lb ft +30° +15°).

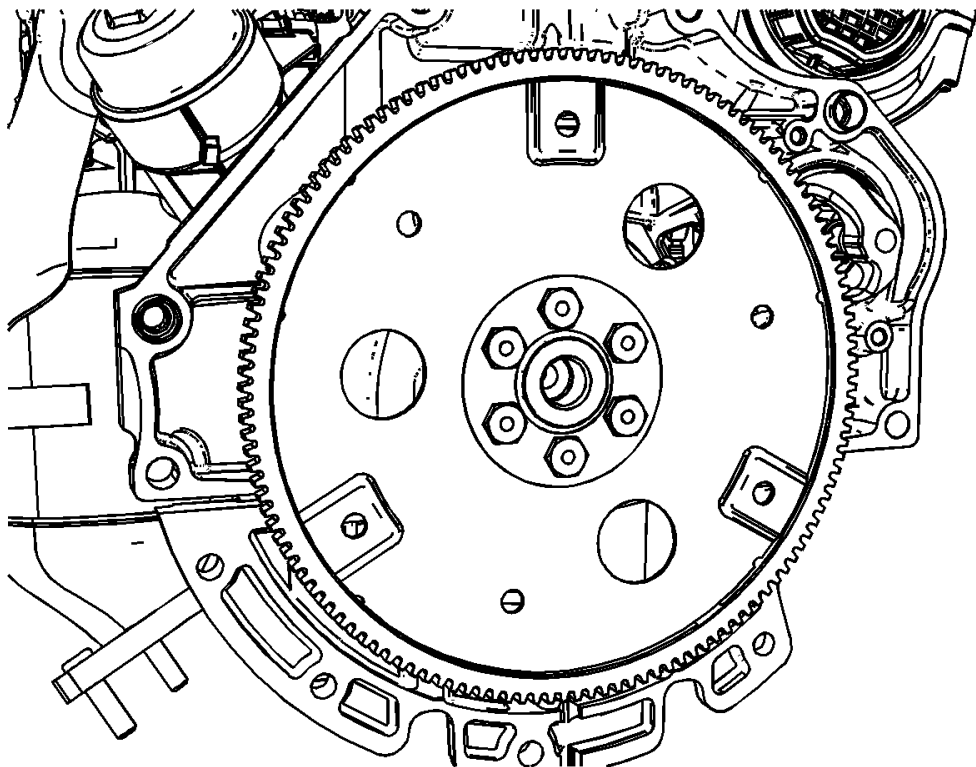


Fig. 61: Flexible Plate
Courtesy of GENERAL MOTORS CORP.

3. Remove **KM-6625**: locking device to block the crankshaft.
4. Install the automatic transmission. Refer to **Transmission Replacement** .
5. Remove **J 28647-B**: Engine Support Fixture.

ENGINE FLYWHEEL REPLACEMENT

Special Tools

- **J 28647-B**: Engine Support Fixture
- **KM-6625**: Flywheel Locking Device

REMOVAL PROCEDURE

1. Install **J 28647-B**: Engine Support Fixture.
2. Remove the manual transmission. Refer to **Transmission Replacement** D16.

3. Install **KM-6625**: locking device to block the crankshaft.
4. Install the transmission bolt with **KM-6625**: locking device.

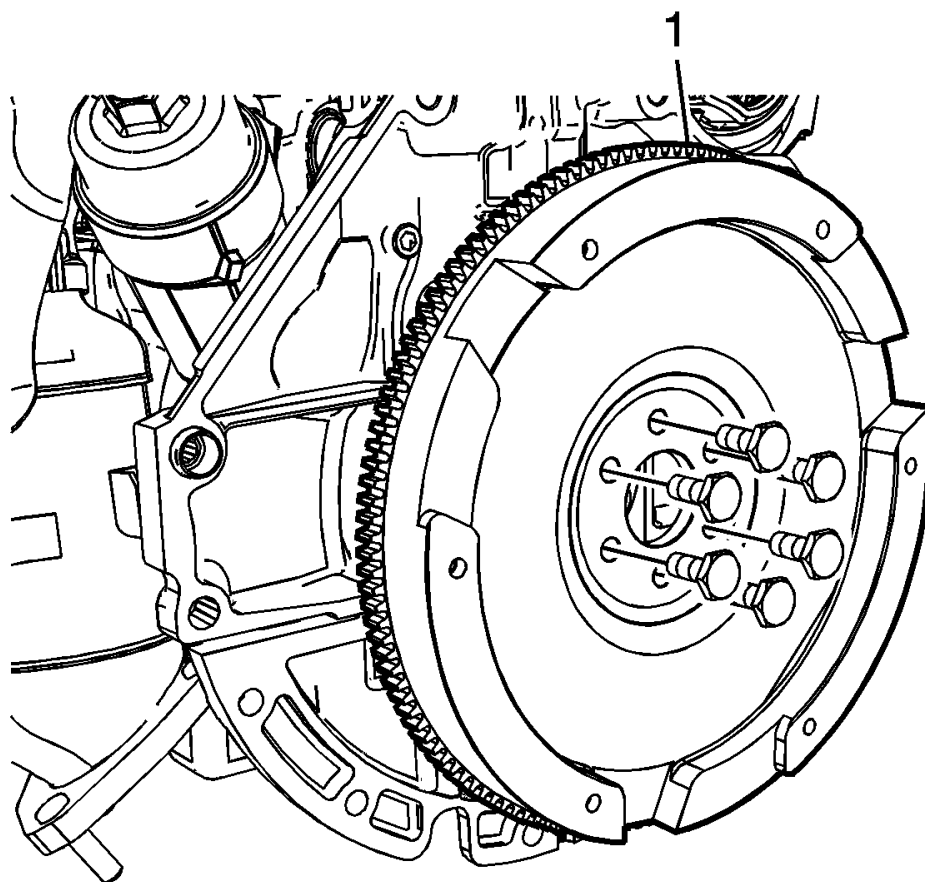


Fig. 62: Flywheel & Bolts
Courtesy of GENERAL MOTORS CORP.

5. Remove the flywheel bolts.
6. Remove the flywheel (1).

INSTALLATION PROCEDURE

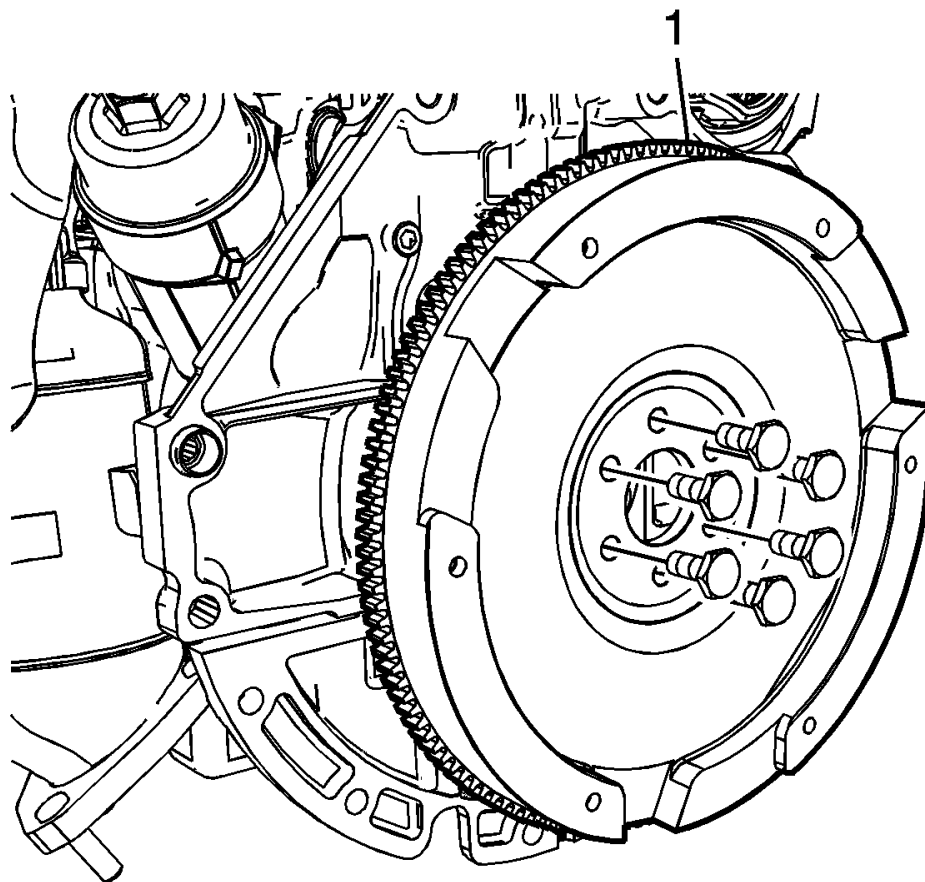


Fig. 63: Flywheel & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the flywheel (1).

CAUTION: Refer to Fastener Caution .

2. Install the flywheel bolts.

Tighten: Tighten the flywheel bolts to 35 N.m +30° +15° (25.8 lb ft +30° +15°).

3. Remove **KM-6625**: locking device.
4. Install manual transaxle. Refer to Transmission Replacement D16

CRANKSHAFT FRONT OIL SEAL REPLACEMENT

SPECIAL TOOLS

KM-6351: Assembly Sleeves**REMOVAL PROCEDURE**

1. Remove the timing belt. Refer to **Timing Belt Replacement**.
2. Remove the crankshaft sprocket.

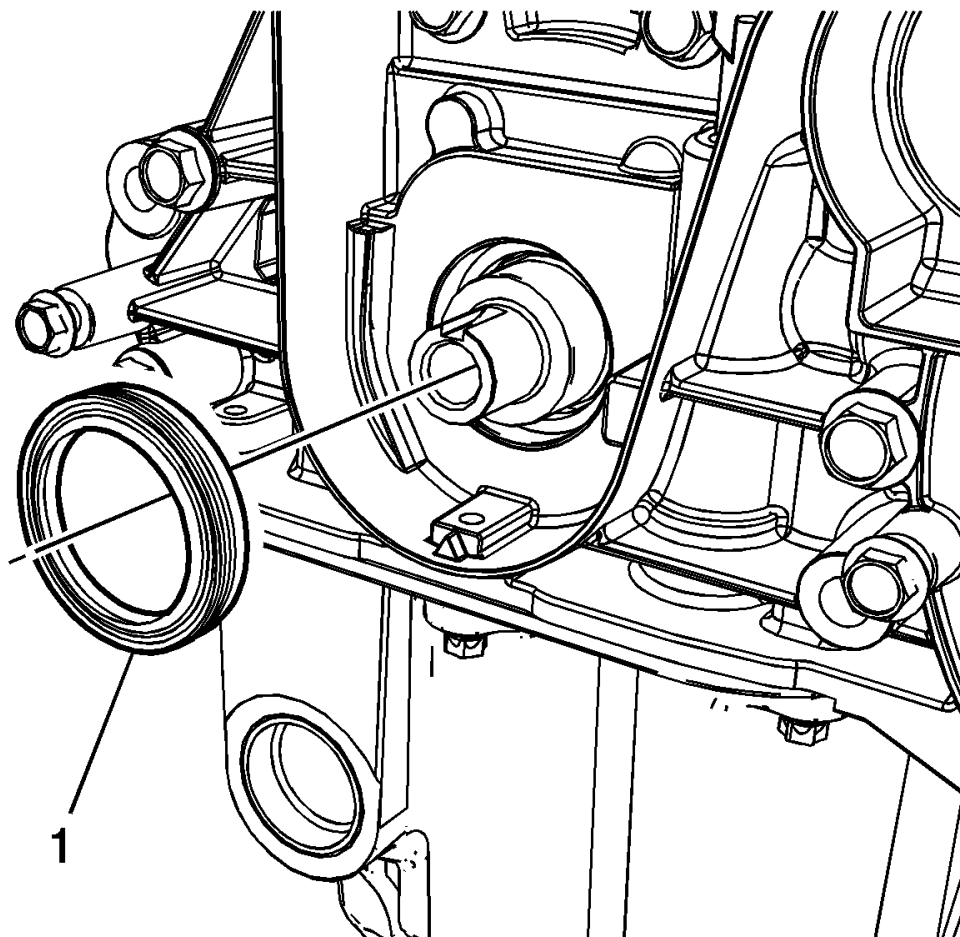


Fig. 64: Crankshaft Front Oil Seal Ring
Courtesy of GENERAL MOTORS CORP.

3. Remove the crankshaft front oil seal ring (1).

INSTALLATION PROCEDURE

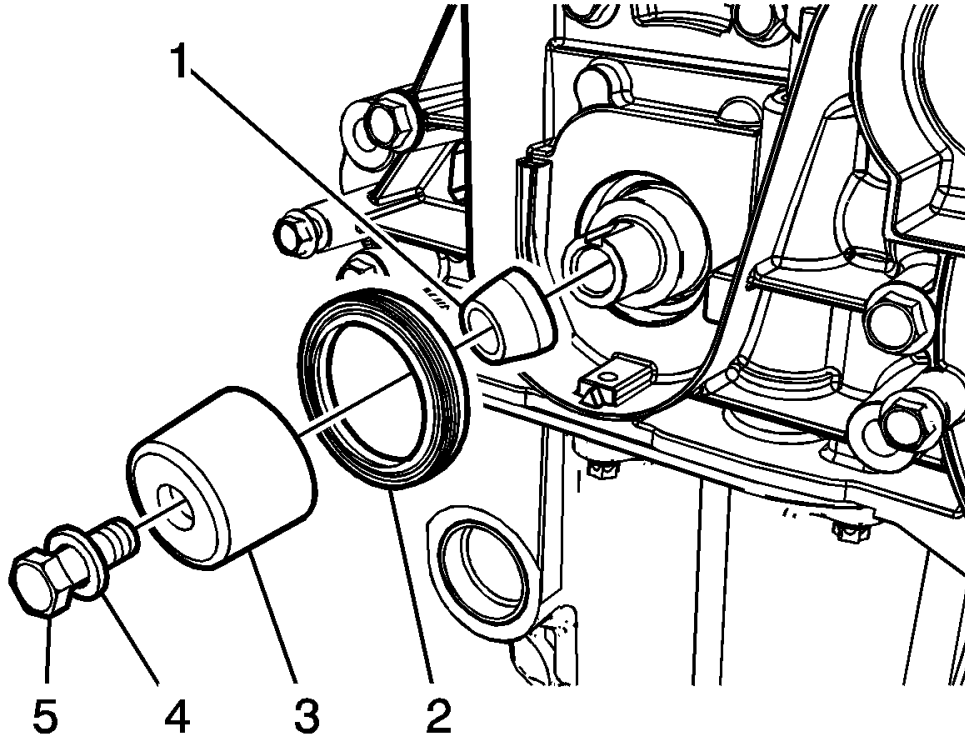


Fig. 65: Installing Crankshaft Front Oil Seal Ring
Courtesy of GENERAL MOTORS CORP.

1. Attach the installer inside sleeve (1).
2. Attach the crankshaft front oil seal ring to the inside sleeve (1).
3. Attach the installer outside sleeve (2).
4. Install the crankshaft bolt (4) and washer (3).
5. Install the crankshaft sprocket.
6. Install the timing belt. Refer to **Timing Belt Replacement**.

CRANKSHAFT REAR OIL SEAL REPLACEMENT

Special Tools

- **J 45296-1:** Frame Insulator Remover/Installer
- **J 7079-2:** Universal Driver Handle

REMOVAL PROCEDURE

1. Remove the flywheel or flexible plate. Refer to **Automatic Transmission Flex Plate Replacement** and **Engine Flywheel Replacement**.
2. Remove the crankshaft position (CKP) sensor. Refer to **CRANKSHAFT POSITION SENSOR REPLACEMENT**.

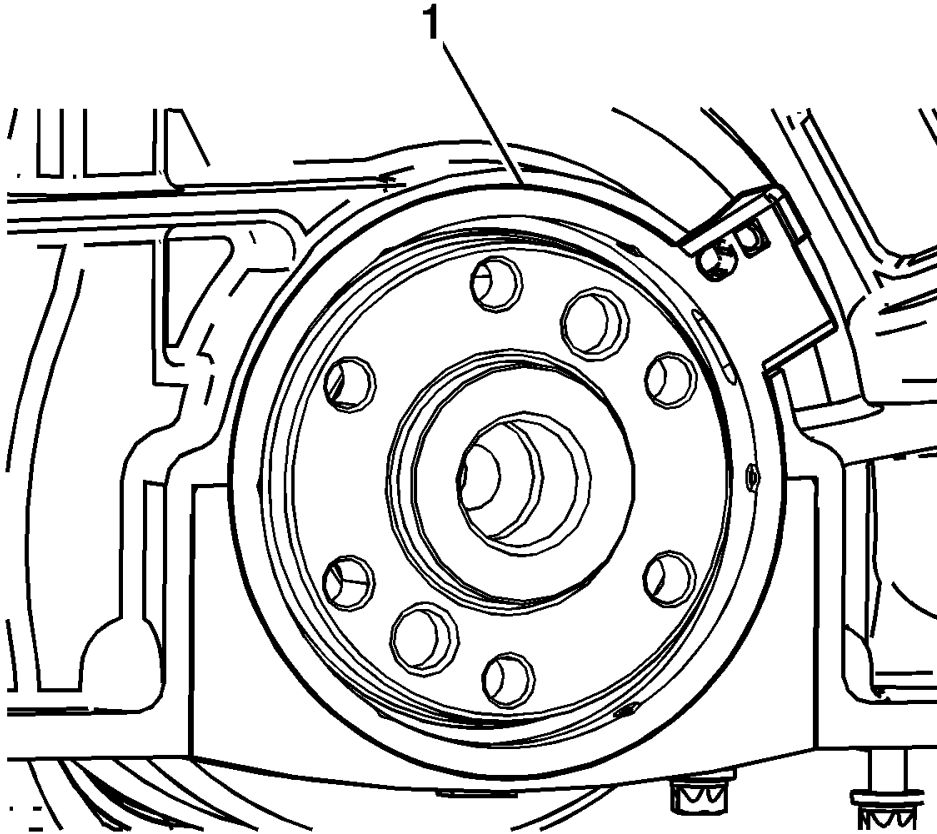


Fig. 66: Crankshaft Rear Oil Seal
Courtesy of GENERAL MOTORS CORP.

3. Remove the crankshaft rear oil seal with housing (1).

INSTALLATION PROCEDURE

1. Install the new crankshaft rear oil seal using **J 45296-1: Frame Insulator Remover/Installer** and **J 7079-2: Universal Driver Handle**.
2. Install crankshaft position sensor. Refer to **CRANKSHAFT POSITION SENSOR REPLACEMENT**.
3. Install the flywheel or flexible plate. Refer to **Automatic Transmission Flex Plate Replacement** and

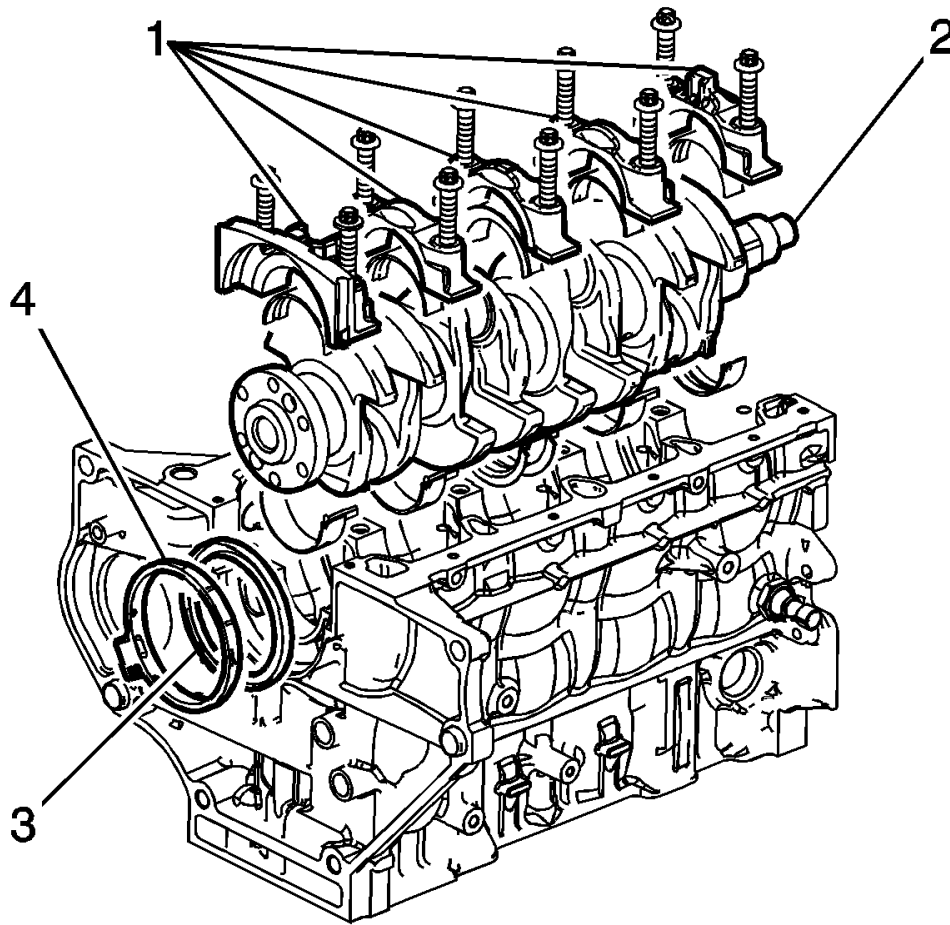
Engine Flywheel Replacement.**CRANKSHAFT REPLACEMENT****REMOVAL PROCEDURE**

Fig. 67: Crankshaft, Seal, Caps & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Check and confirm the sequence of the crankshaft caps and bearings.

1. Remove the pistons and connecting rods. Refer to Piston, Connecting Rod, and Bearing Replacement.
2. Remove the crankshaft cap bolts.
3. Remove the crankshaft caps with journal bearings (1).
4. Remove the crankshaft (2).
5. Remove the crankshaft rear oil seal (3) with housing (4).
6. Detach the crankshaft rear oil seal from the housing.

INSTALLATION PROCEDURE

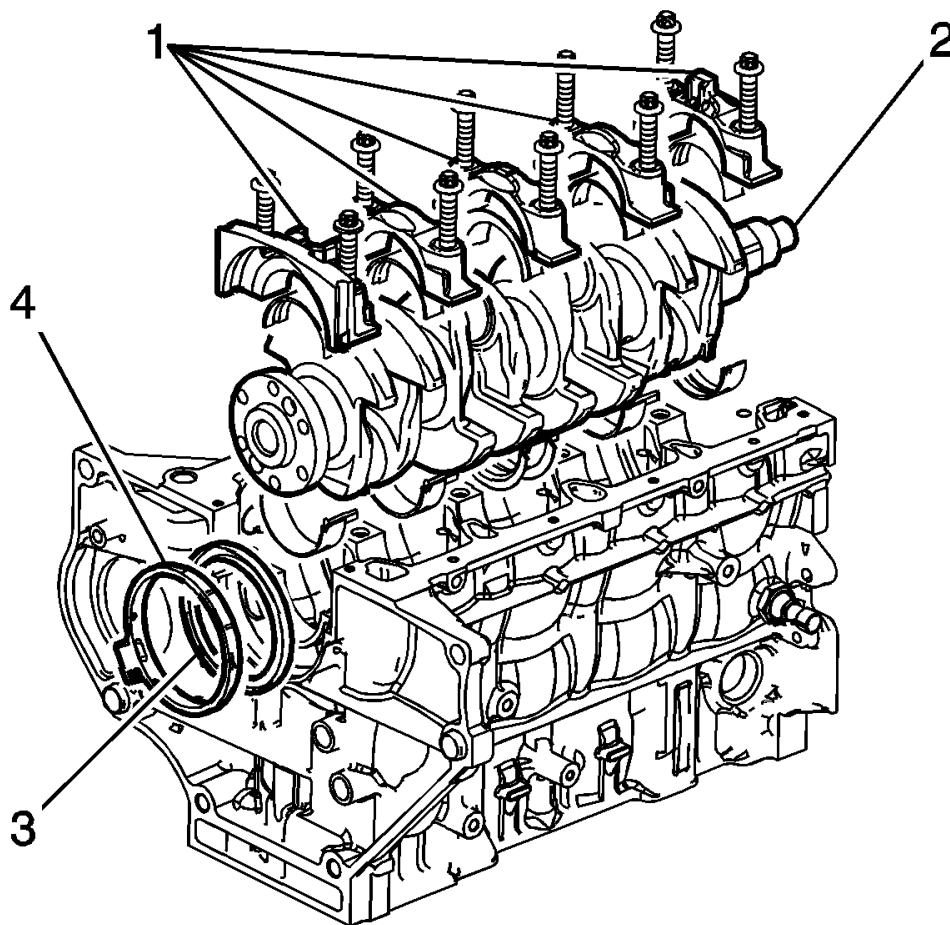


Fig. 68: Crankshaft, Seal, Caps & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Check and confirm the sequence of the crankshaft caps and bearings.

1. Coat and lubricate the crankshaft caps and bearings (1).
2. Install the crankshaft (2) with bearings in sequences.
3. Install the crankshaft caps with journal bearings (1).

Tighten: Tighten the crankshaft cap bolts to 50+50° N.m (36.8+50° lb ft).

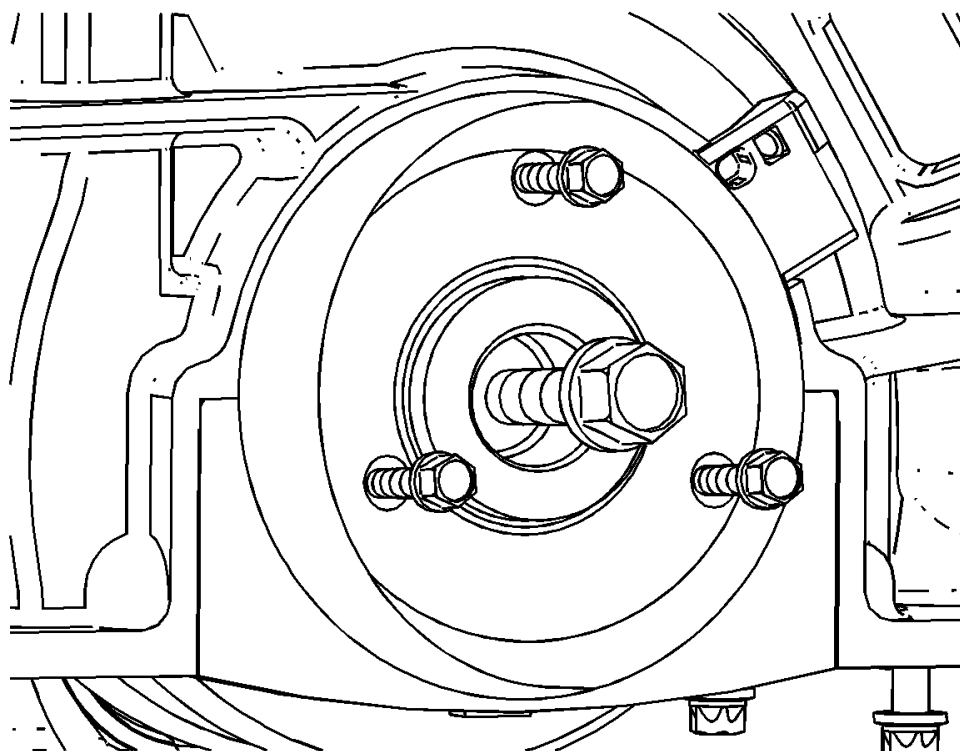


Fig. 69: Crankshaft Rear Oil Seal, Housing & Bolts
Courtesy of GENERAL MOTORS CORP.

4. Attach the crankshaft rear oil seal to the housing.
5. Install the crankshaft rear oil seal. Refer to **Crankshaft Rear Oil Seal Replacement**.
6. Install the pistons and connecting rods. Refer to **Piston, Connecting Rod, and Bearing Replacement**.

ENGINE OIL HEATER REPLACEMENT

REMOVAL PROCEDURE

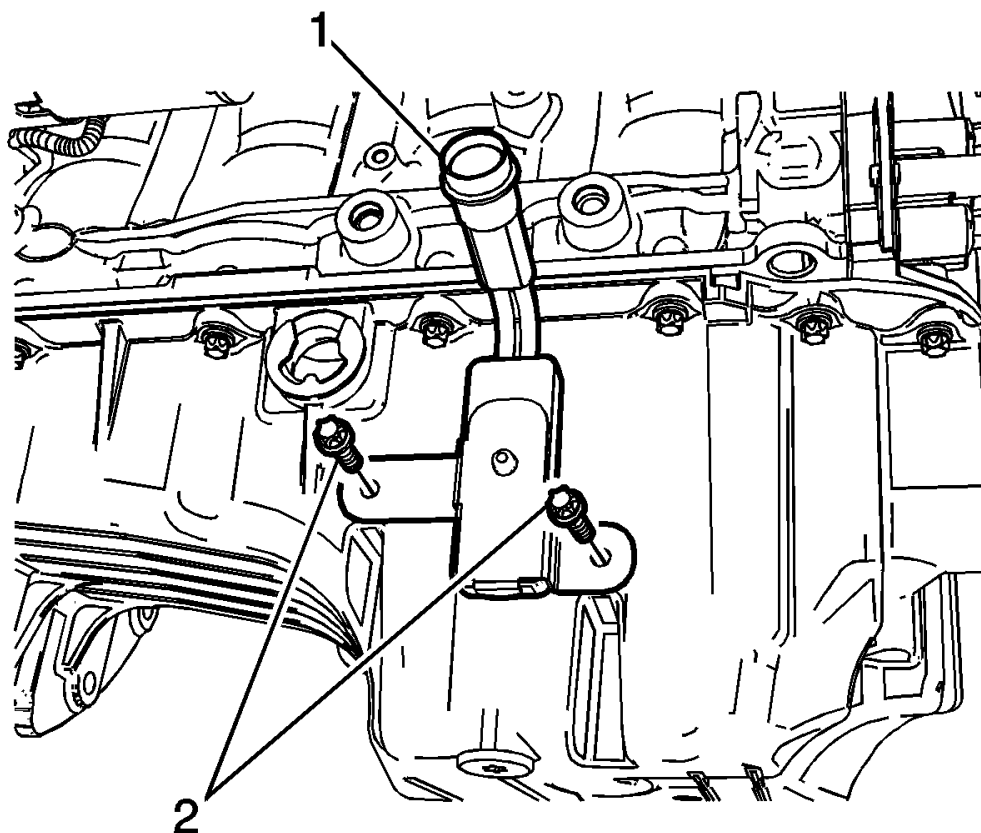


Fig. 70: Oil Pan Heater, Mounting Bolts & Injector Cable Connector
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the injector cable connector (1).
2. Remove the oil pan heater mounting bolts (2).
3. Remove the oil pan heater.

INSTALLATION PROCEDURE

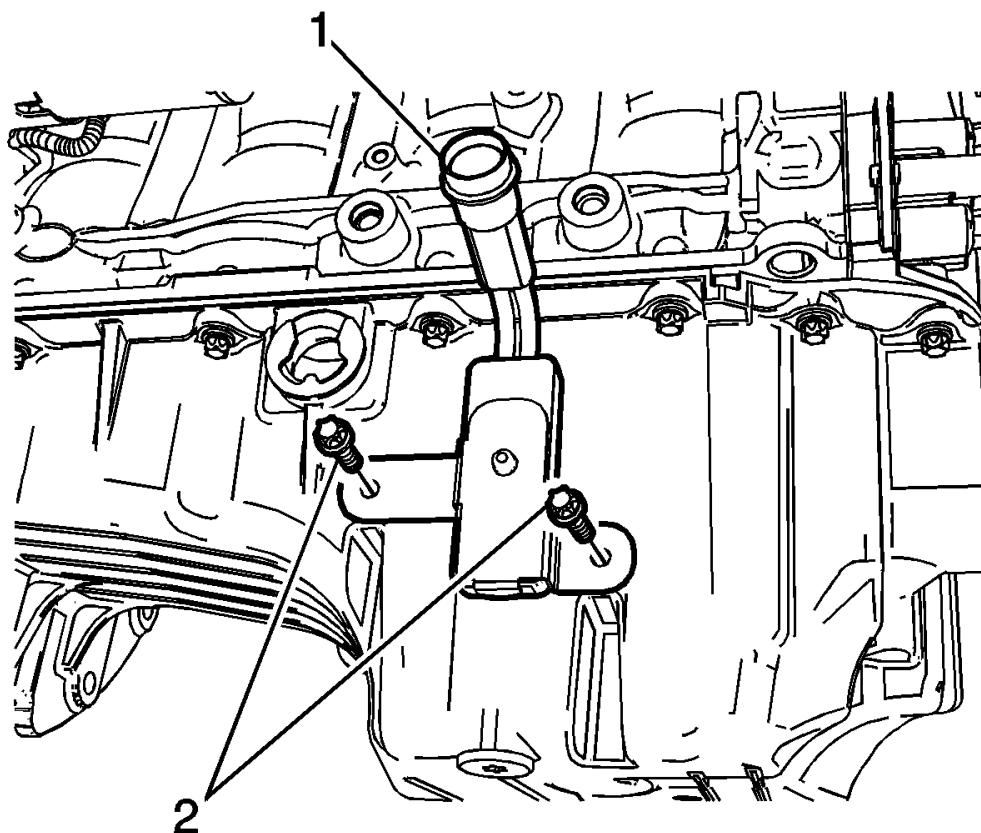


Fig. 71: Oil Pan Heater, Mounting Bolts & Injector Cable Connector
Courtesy of GENERAL MOTORS CORP.

1. Apply suitable silicon on oil pan heater mounting surface.
2. Install the oil pan heater.

CAUTION: Refer to Fastener Caution .

3. Install the oil pan heater bolts (2).

Tighten: Tighten the coil pan heater bolts to 8 N.m (71 lb in).

4. Connect the injector cable connector (1).

OIL PUMP REPLACEMENT

REMOVAL PROCEDURE

1. Drain the engine coolant. Refer to Cooling System Draining and Filling .
2. Drain the engine oil. Refer to Engine Oil and Oil Filter Replacement.
3. Remove the exhaust manifold. Refer to Catalytic Converter Replacement (1.4L LDT/1.6L LXV) or Catalytic Converter Replacement (1.2L) .
4. Remove the timing belt. Refer to Timing Belt Replacement.
5. Remove the oil pan. Refer to Oil Pan Replacement.
6. Remove the power steering pump and bracket. Refer to Power Steering Pump Replacement (1.4L LDT and 1.6L LXV Engines) .
7. Remove the alternator. Refer to Generator Replacement (1.4L LDT, 1.6L LXV) .
8. Remove the A/C compressor. Refer to Air Conditioning Compressor Replacement .

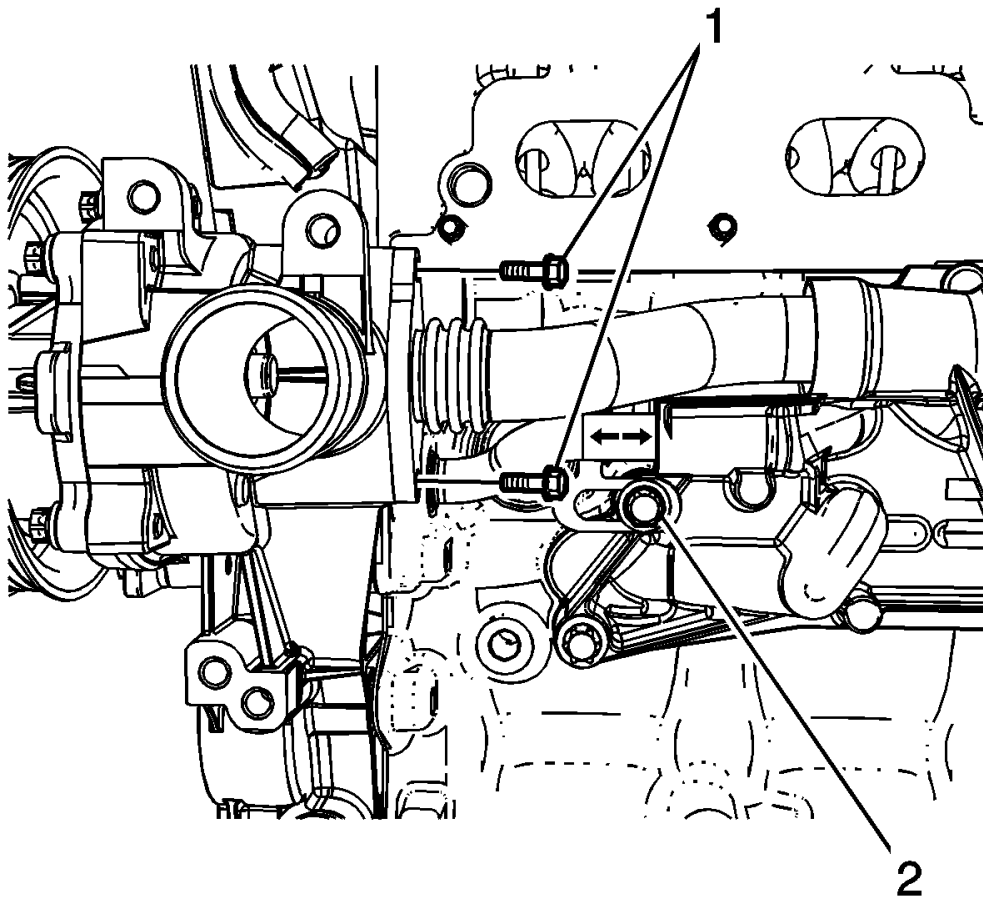


Fig. 72: Engine Coolant Pipe & Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

9. Remove the engine coolant pipe (1) bolts.
10. Remove the engine coolant pipe (2) bracket bolt and then push the pipe into the oil cooler housing.

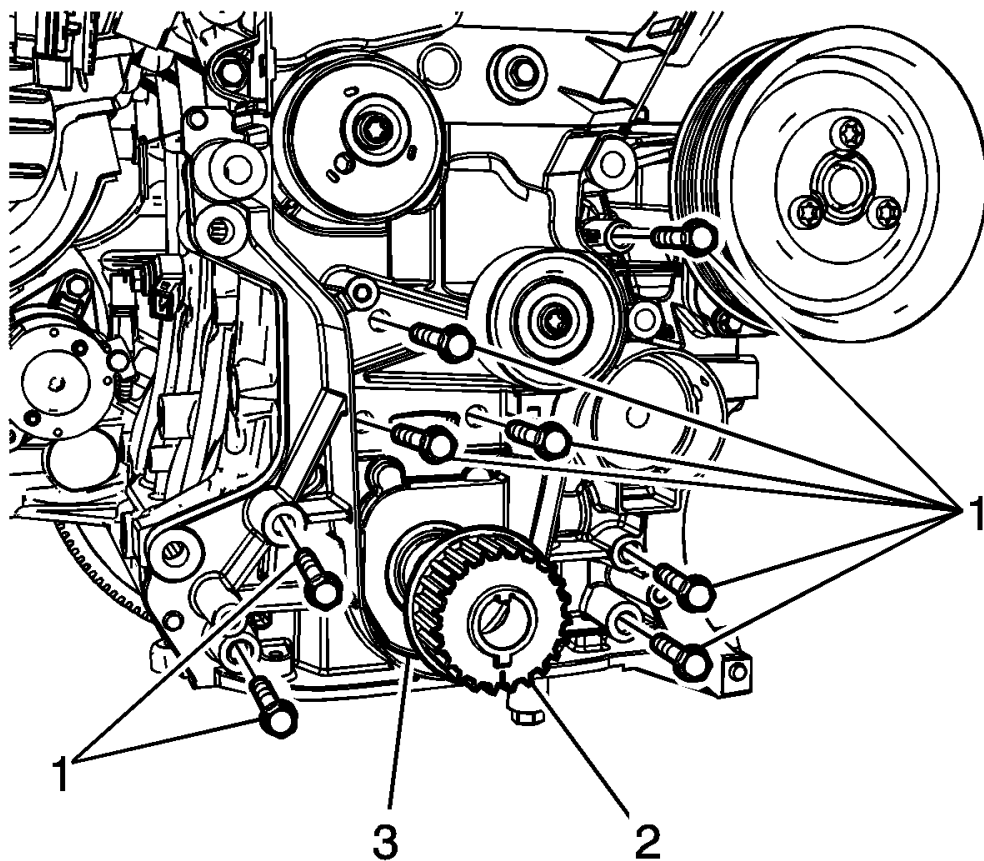


Fig. 73: Crankshaft Sprocket & Engine Front Cover Assembly
Courtesy of GENERAL MOTORS CORP.

11. Remove the crankshaft sprocket (2).
12. Remove the engine front cover assembly (3) with the gasket.

INSPECTION PROCEDURE

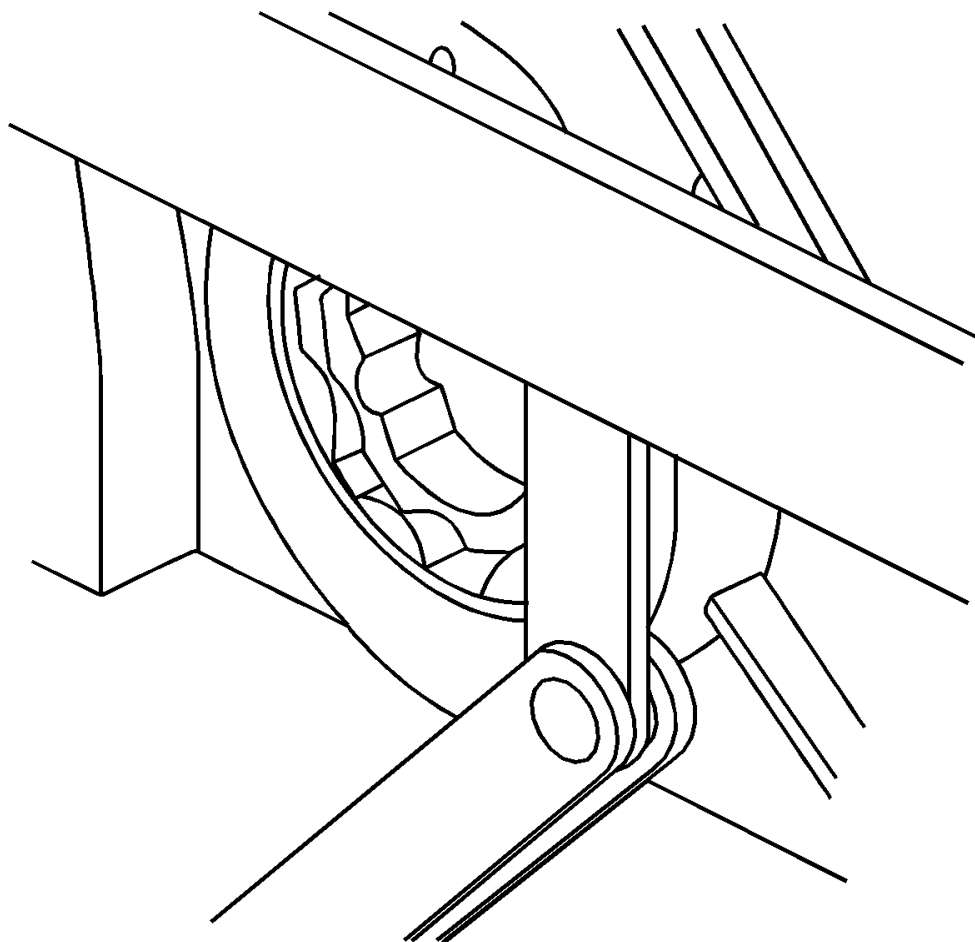


Fig. 74: Measuring Axial Clearance Of Rotors
Courtesy of GENERAL MOTORS CORP.

1. Clean the measuring surface.
2. Measure the axial clearance of rotors.

If out-of-specifications, replace with a new one. Refer to **Engine Mechanical Specifications** .

INSTALLATION PROCEDURE

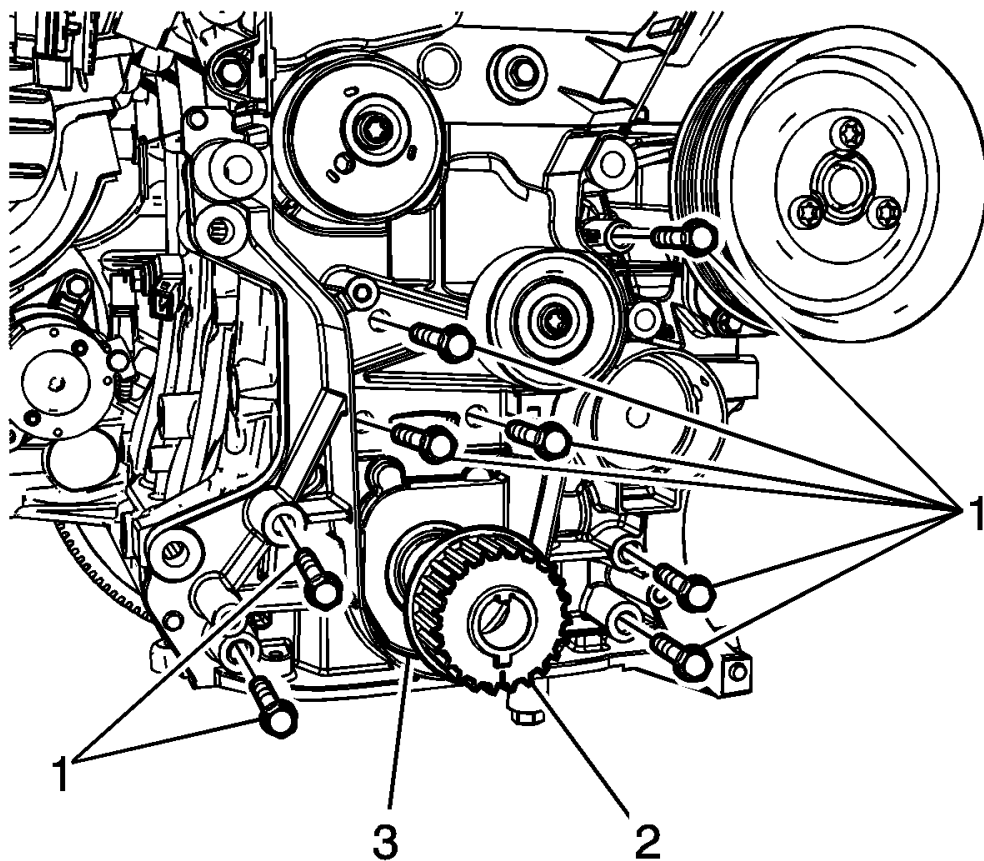


Fig. 75: Crankshaft Sprocket & Engine Front Cover Assembly
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

NOTE: Do not reuse the engine front cover gasket.

1. Install the engine front cover assembly (3) with the new gasket.

Tighten: Tighten the engine front cover assembly bolts to 20 N.m (14.7 lb ft).

2. Install the crankshaft sprocket (2).

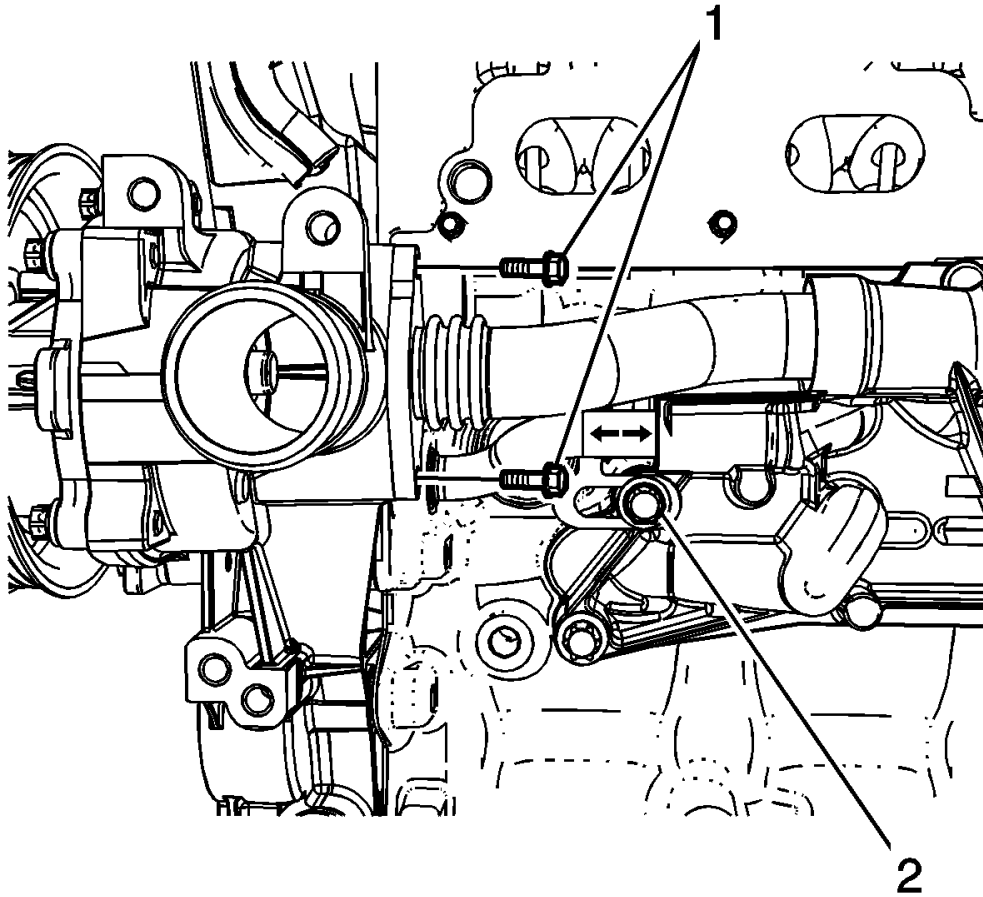


Fig. 76: Engine Coolant Pipe & Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

3. Install the engine coolant pipe (1) bolts.
4. Install the engine coolant pipe (2) bracket bolt and then push the pipe into the oil cooler housing.
5. Install the A/C compressor. Refer to **Air Conditioning Compressor Replacement** .
6. Install the alternator. Refer to **Generator Replacement (1.4L LDT, 1.6L LXV)** .
7. Install the power steering pump and bracket. Refer to **Power Steering Pump Replacement (1.4L LDT and 1.6L LXV Engines)** .
8. Install the oil pan. Refer to **Oil Pan Replacement**.
9. Install the timing belt. Refer to **Timing Belt Replacement**.

OIL PRESSURE RELIEF VALVE REPLACEMENT (PRIMARY)

REMOVAL PROCEDURE

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

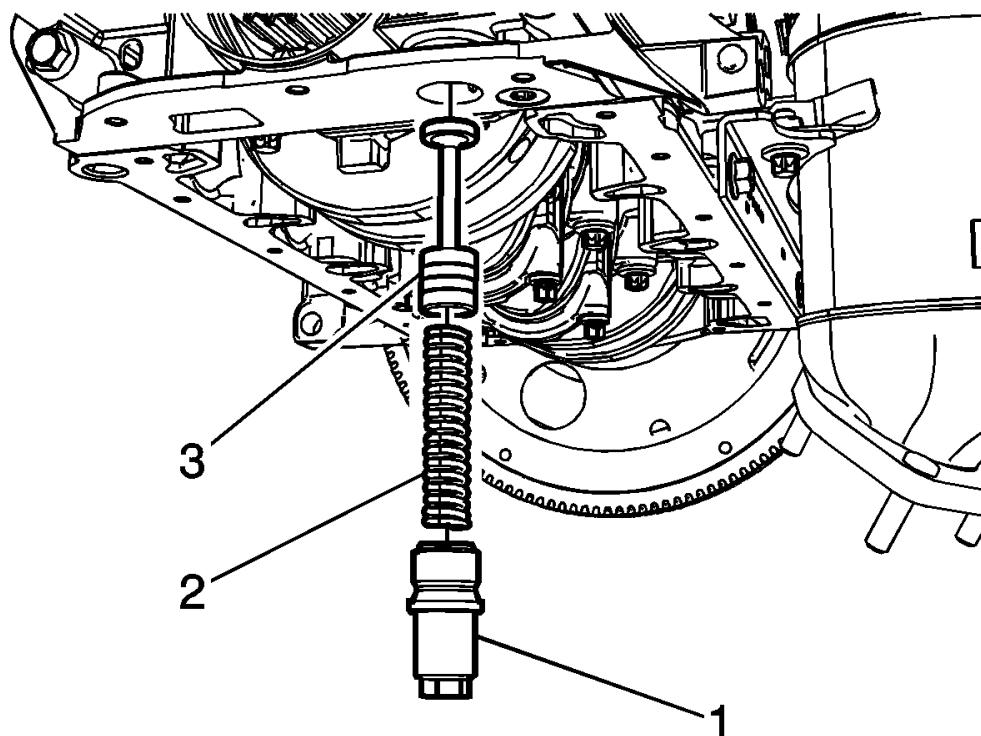


Fig. 77: Oil Pressure Relief Valve Plug, Spring & Piston (Primary)
Courtesy of GENERAL MOTORS CORP.

2. Remove the oil pressure relief valve plug (1).
3. Remove the valve spring (2).
4. Remove the valve piston (3).

INSTALLATION PROCEDURE

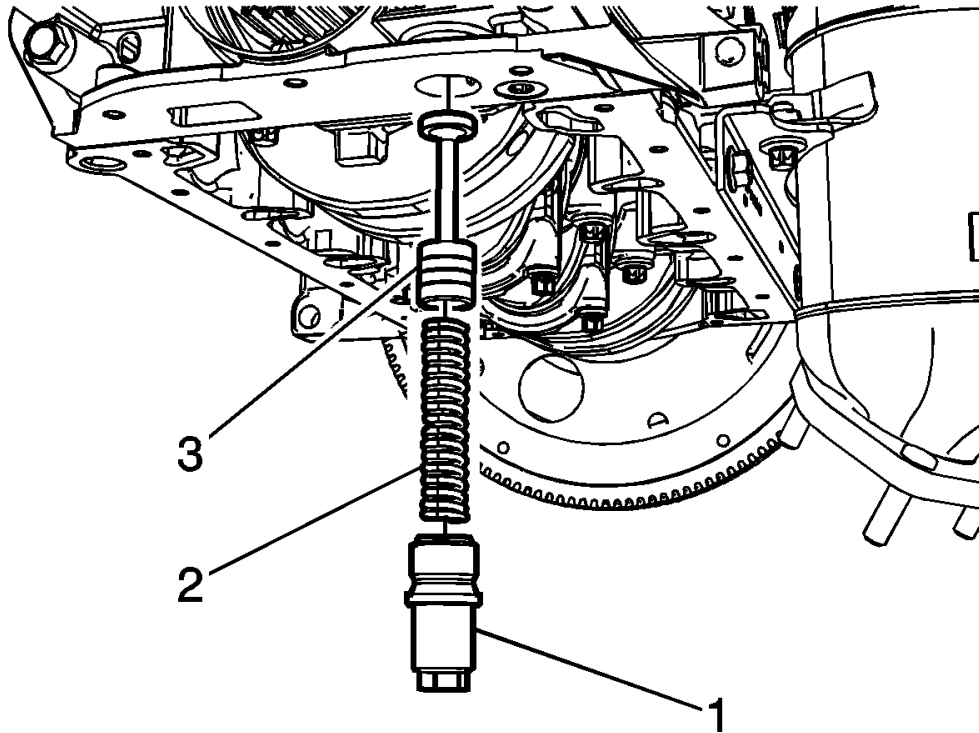


Fig. 78: Oil Pressure Relief Valve Plug, Spring & Piston (Primary)
 Courtesy of GENERAL MOTORS CORP.

1. Clean the plug thread, spring and piston.
2. Install the valve piston (3).
3. Install the valve spring (2).

CAUTION: Refer to Fastener Caution .

4. Install the oil pressure relief valve plug (1).

Tighten: Tighten the oil pressure relief valve plug to 21 N.m (15.5 lb ft).

5. Install the oil pan. Refer to Oil Pan Replacement.

OIL PRESSURE RELIEF VALVE REPLACEMENT (SECONDARY)

REMOVAL PROCEDURE

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

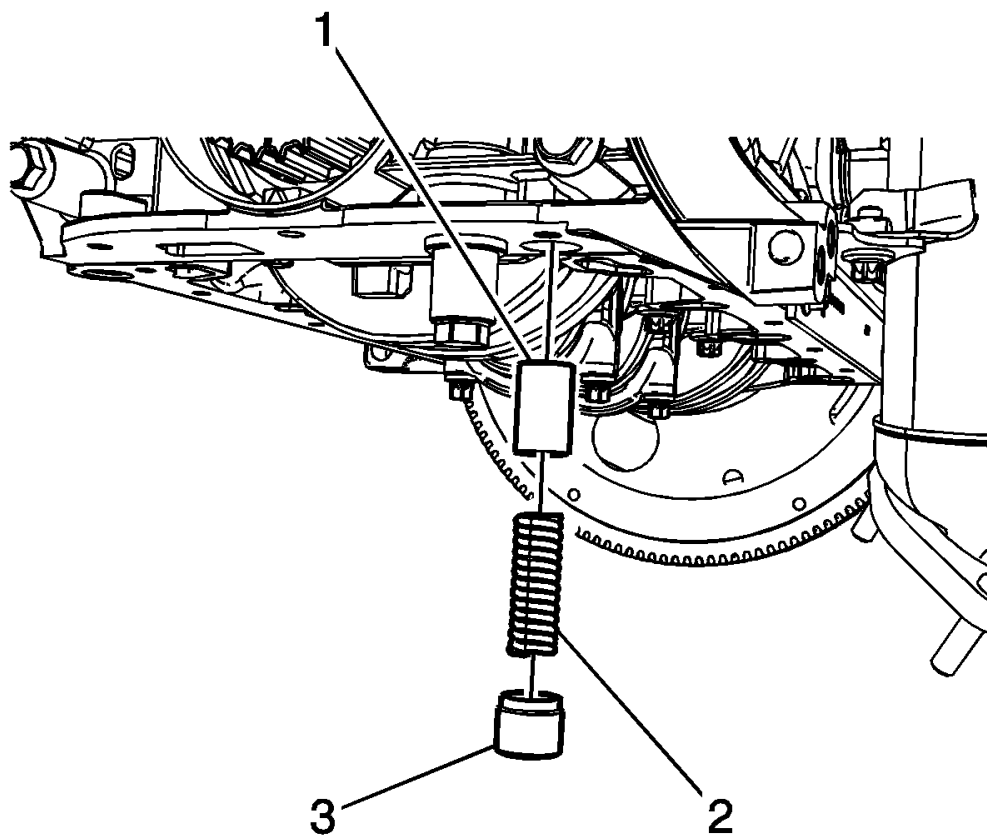


Fig. 79: Oil Pressure Relief Valve Plug, Spring & Piston (Secondary)
Courtesy of GENERAL MOTORS CORP.

2. Remove the oil overpressure relief valve plug (3).
3. Remove the valve spring (2).
4. Remove the valve piston (1).

INSTALLATION PROCEDURE

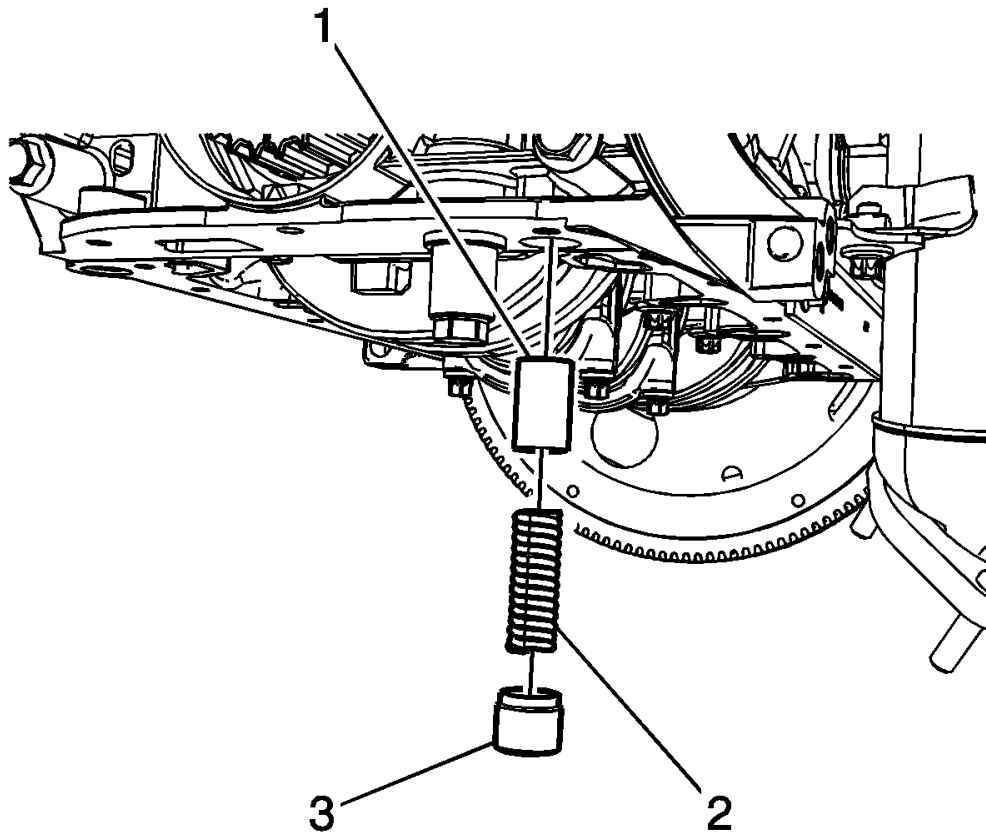


Fig. 80: Oil Pressure Relief Valve Plug, Spring & Piston (Secondary)
Courtesy of GENERAL MOTORS CORP.

1. Clean the plug thread, spring and piston.
2. Install the valve piston (1).
3. Install the valve spring (2).

CAUTION: Refer to Fastener Caution .

4. Install the oil overpressure relief valve plug (3).

Tighten: Tighten the oil pressure relief valve plug to 10 N.m (88.5 lb in).

5. Install the oil pan. Refer to Oil Pan Replacement.

OIL LEVEL INDICATOR TUBE REPLACEMENT

REMOVAL PROCEDURE

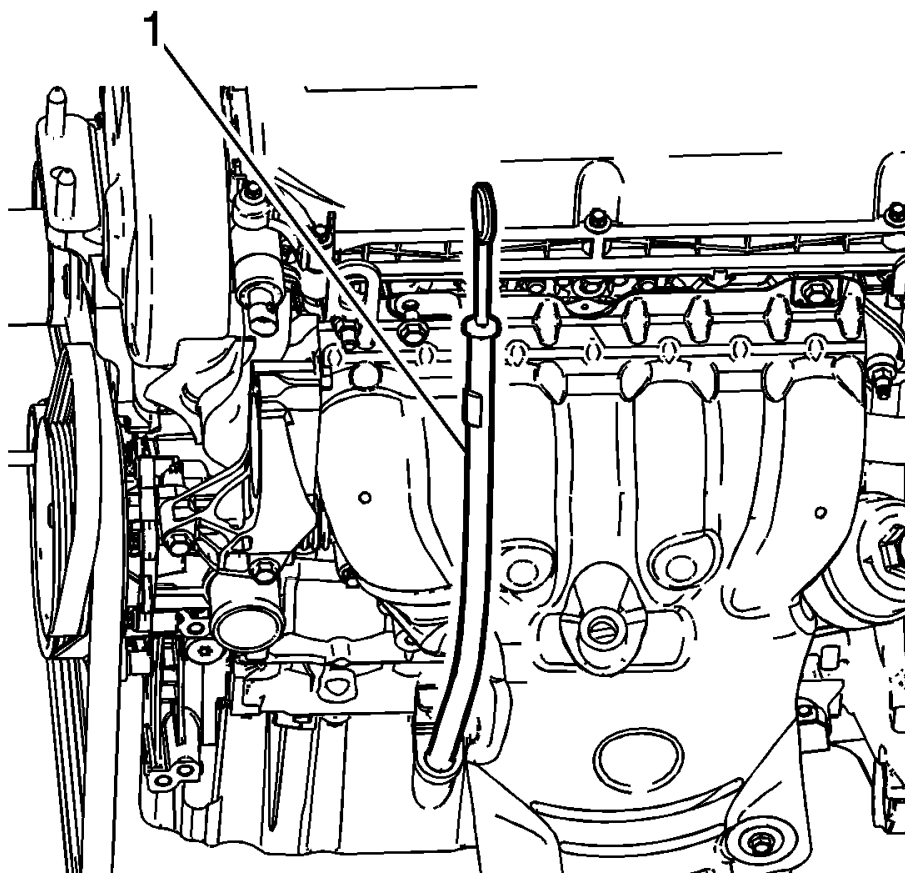


Fig. 81: Oil Indicator & Tube
Courtesy of GENERAL MOTORS CORP.

1. Remove the oil indicator tube tightening bolt.
2. Remove the oil indicator and tube (1).

INSTALLATION PROCEDURE

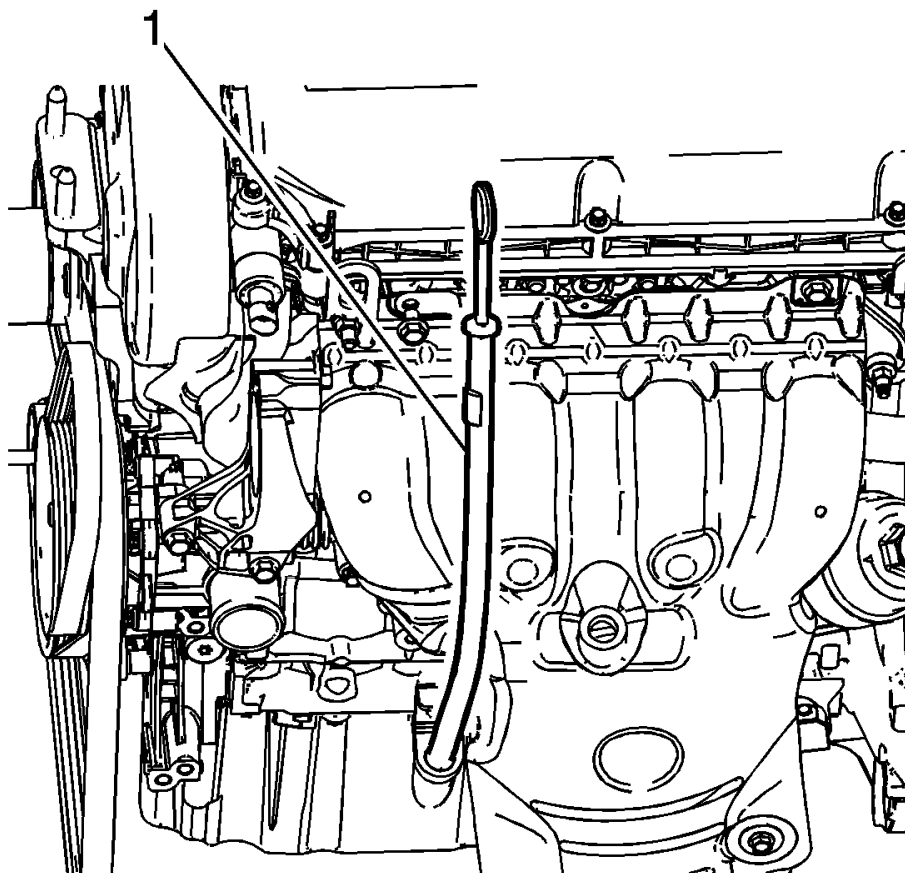


Fig. 82: Oil Indicator & Tube
Courtesy of GENERAL MOTORS CORP.

1. Install the oil indicator and tube (1).

CAUTION: Refer to Fastener Caution .

2. Install the oil indicator tube tightening bolt.

Tighten: Tighten the oil indicator tube tightening bolt to 10 N.m (7.3 lb ft).

ENGINE REPLACEMENT

REMOVAL PROCEDURE

1. Release the fuel pressure. Refer to FUEL PRESSURE RELIEF .
2. Disconnect the fuel pipe from the fuel rail.

3. Disconnect the EVAP hose from the EVAP canister solenoid valve.
4. Drain the engine coolant. Refer to **Cooling System Draining and Filling** .
5. Remove the air cleaner assembly. Refer to **AIR CLEANER ASSEMBLY REPLACEMENT** .
6. Remove the battery and tray. Refer to **Battery Tray Replacement** .
7. Remove the fuse box bolts.

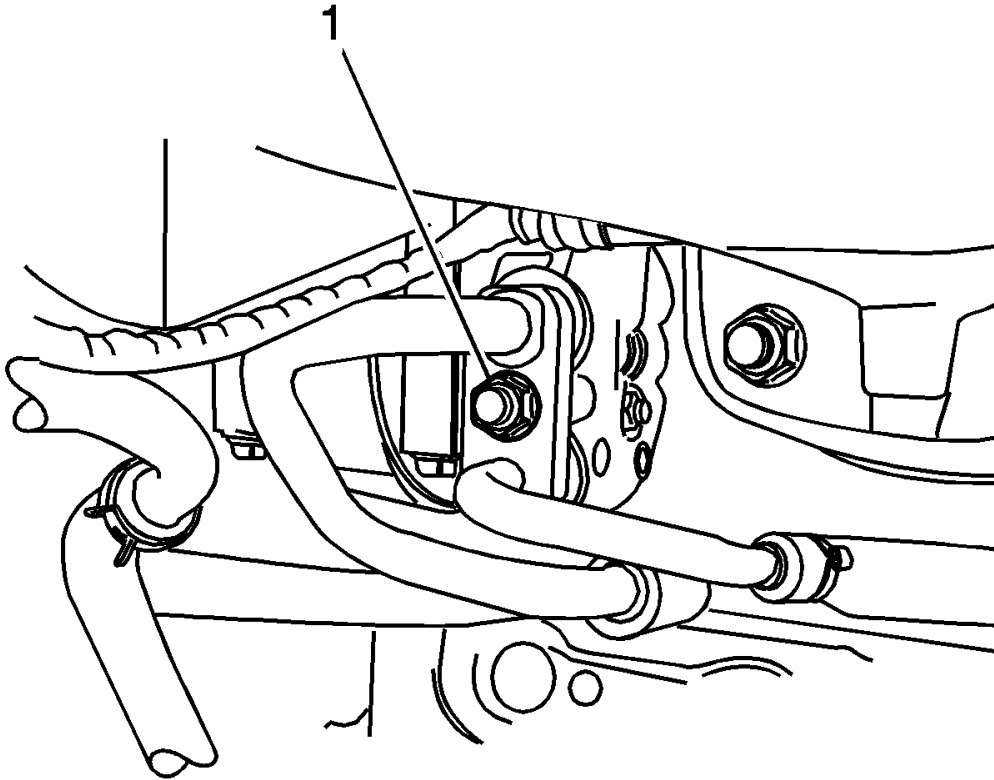


Fig. 83: A/C Inlet/Outlet Pipe Tightening Bolt
Courtesy of GENERAL MOTORS CORP.

8. Discharge the A/C system, if equipped. Refer to **Refrigerant Recovery and Recharging** .
9. Remove the A/C inlet/outlet pipe bolt (1) from the A/C compressor.

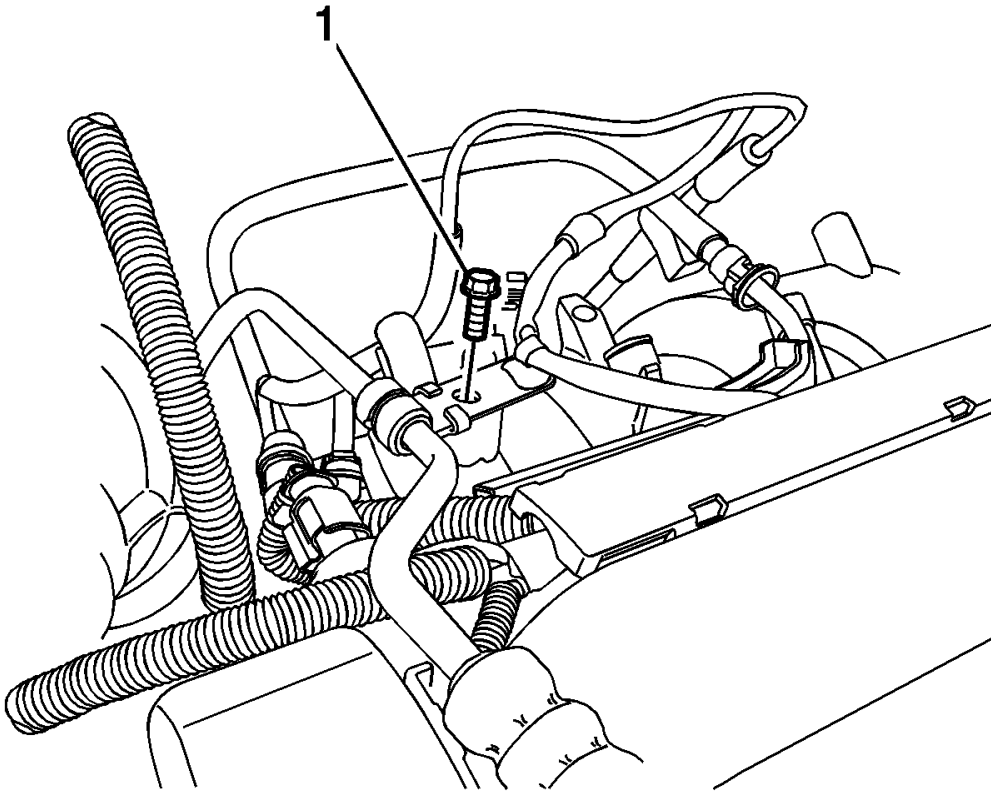


Fig. 84: Power Steering Pump Pressure Pipe Clamp Bolt
Courtesy of GENERAL MOTORS CORP.

10. Drain the power steering oil if equipped. Refer to **Power Steering Pump Replacement (1.4L LDT and 1.6L LXV Engines)** .
11. Remove the power steering pump pressure line union nut. Refer to **Power Steering Pump Replacement (1.4L LDT and 1.6L LXV Engines)** .
12. Remove the power steering pressure pipe retaining clamp bolt (1) from the intake manifold.
13. Disconnect the power steering hose from the power steering pump.
14. Disconnect the following:
 - Oil switch wiring connector
 - A/C compressor connector
15. Disconnect the following:
 - Intake air temperature sensor connector
 - A/C pressure sensor (ACP) connector
 - Cam position solenoid valve connector

- Electric throttle controller (ETC) connector
- Manifold air pressure (MAP) sensor connector
- EVAP solenoid valve connector
- Injector connectors

16. Disconnect the following

- Ignition coil connector
- Camshaft position sensor (CPS) connectors (right/left)
- Coolant temperature sensor connector
- Oxygen sensor connector
- Ground bolt
- Thermostat heater connector

17. Disconnect the following and pull the engine harness aside.

- Crankshaft position (CKP) sensor connector
- Knock sensor connector
- Alternator connector
- Alternator B+ nut
- Oil level switch connector, if equipped
- Starter solenoid B+ nut
- Ground tightening nut
- Starter solenoid ground nut

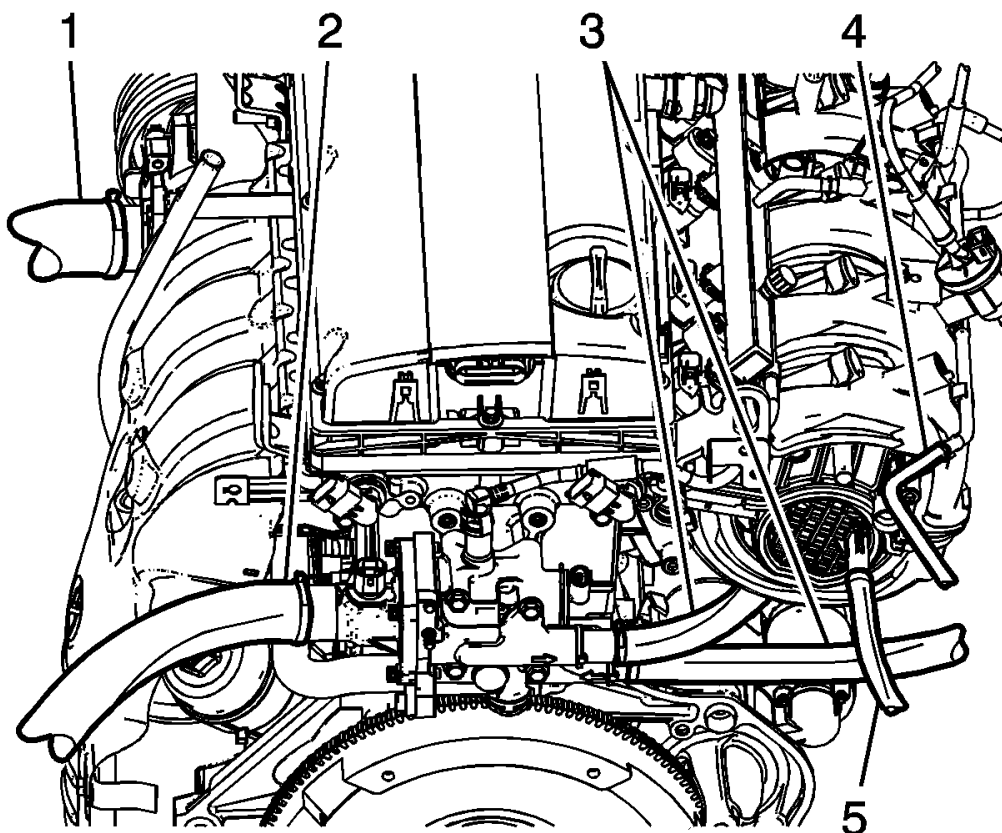


Fig. 85: Coolant & Brake Boost Hoses
Courtesy of GENERAL MOTORS CORP.

18. Disconnect the coolant hose (1) from water pump.
19. Disconnect the coolant hose (2) from the thermostat housing.
20. Disconnect the heater core coolant inlet/outlet hoses (3) from the coolant distributor.
21. Disconnect the ETC-to-coolant tank hose (4).
22. Disconnect the brake boost hose (5) from the intake manifold.
23. Remove and disconnect the cables and wiring harness related to the automatic transaxle.
24. Disconnect the auto transaxle fluid cooler inlet/outlet hoses.

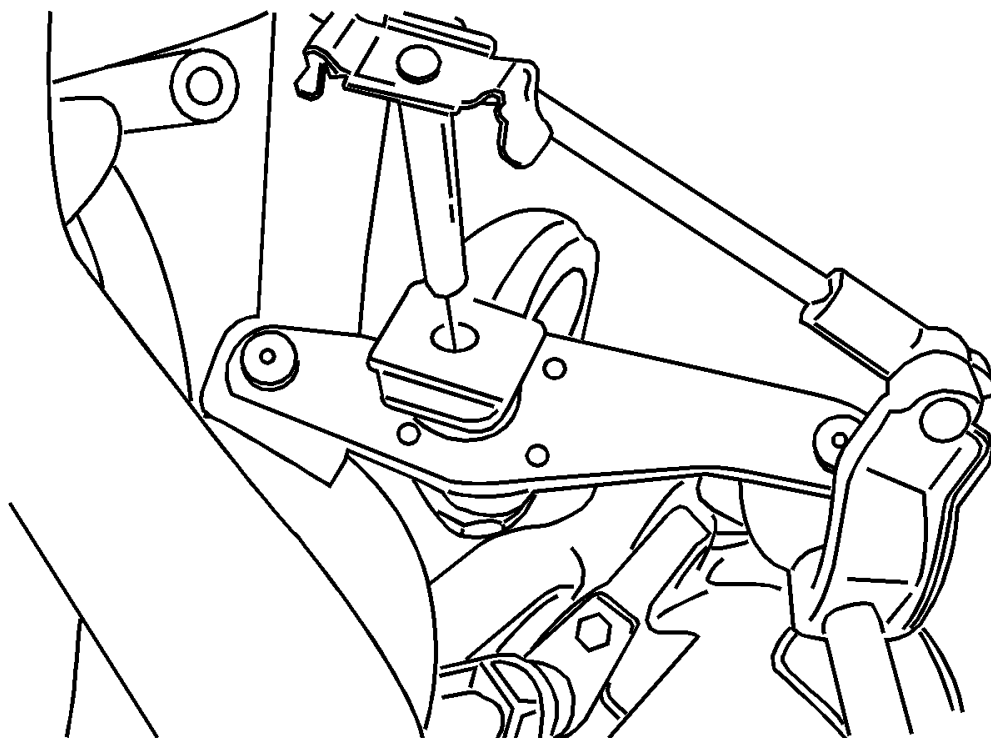


Fig. 86: Manual Transaxle Cable Connector
Courtesy of GENERAL MOTORS CORP.

25. Remove and disconnect the cables and wiring harness related to the manual transaxle.

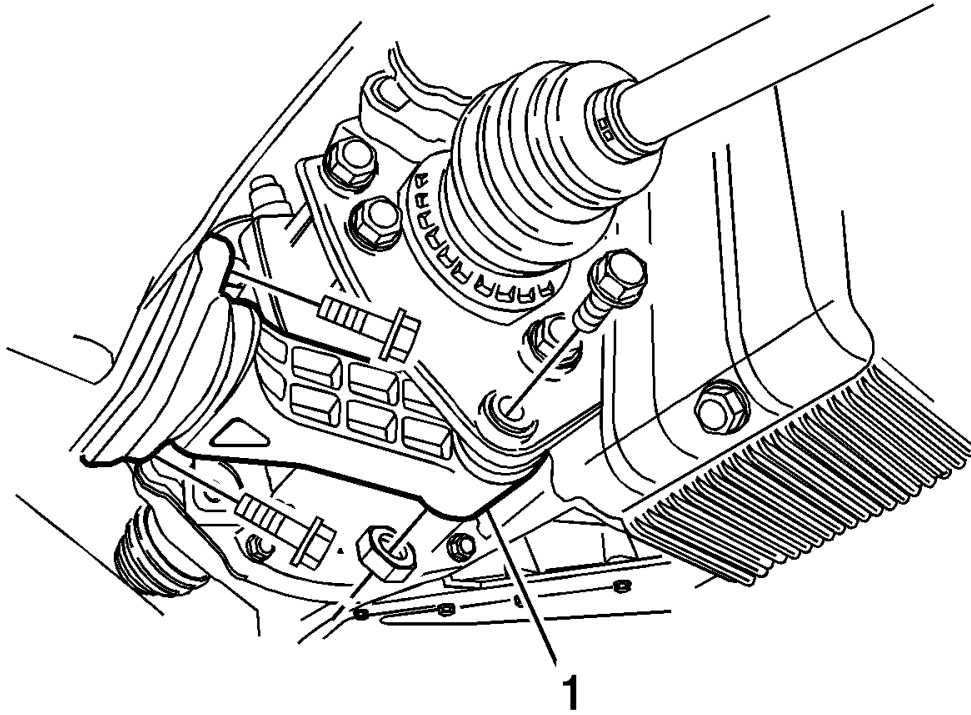


Fig. 87: Reaction Rod

Courtesy of GENERAL MOTORS CORP.

26. Remove the reaction rod (1).
27. Remove the exhaust front pipe. Refer to **Front Pipe Replacement** .
28. Remove the drive axle shafts. Refer to **Front Drive Axle Inner Shaft Replacement**
29. Raise the vehicle.
30. Locate a suitable supporter under the vehicle engine and transaxle.
31. Lower the vehicle until engine assembly is on the supporter.
32. Remove the engine mount. Refer to **Engine Mount Replacement**.
33. Remove the transaxle mount.

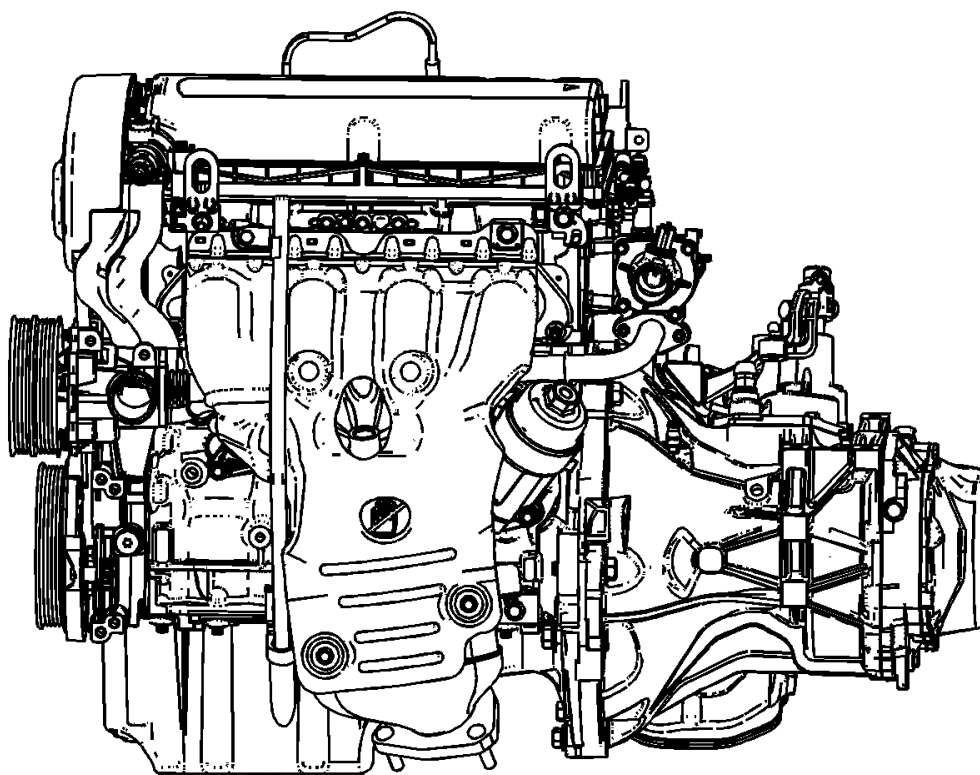


Fig. 88: Engine & Transaxle
Courtesy of GENERAL MOTORS CORP.

34. Separate the engine and the transaxle.

INSTALLATION PROCEDURE

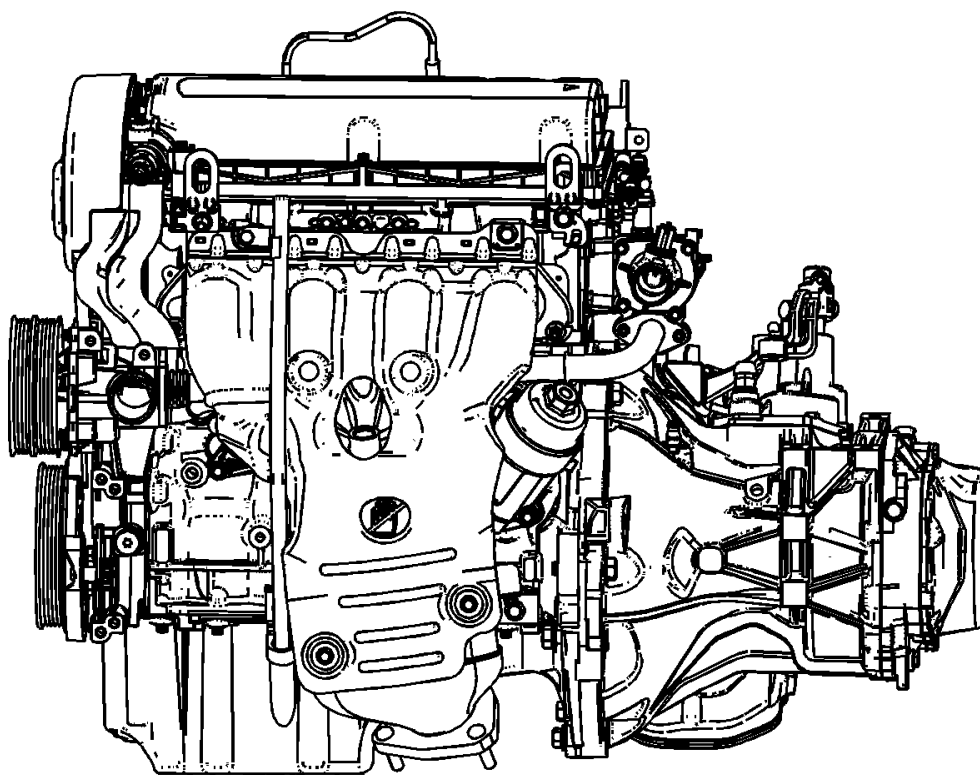


Fig. 89: Engine & Transaxle
Courtesy of GENERAL MOTORS CORP.

1. Assemble the engine to the transaxle.
2. Place the engine assembly on the supporter.
3. Raise the vehicle.
4. Locate the engine assembly with the supporter.
5. Lower the vehicle.
6. Install the engine mount. Refer to **Engine Mount Replacement**.
7. Install the transaxle mount.

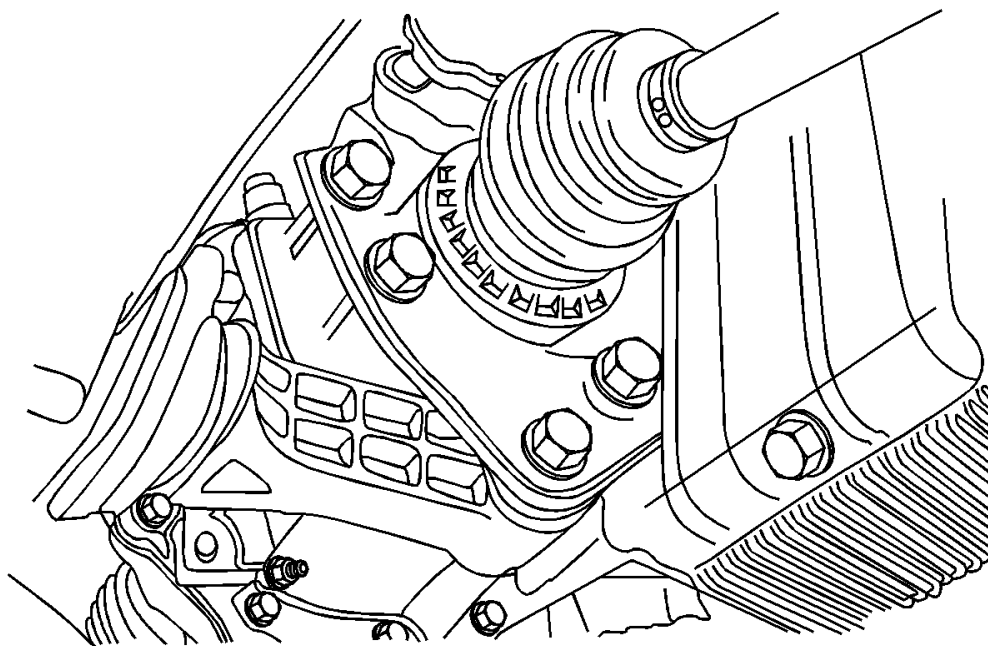


Fig. 90: Drive Axle Shafts

Courtesy of GENERAL MOTORS CORP.

8. Install the drive axle shafts. Refer to **Front Drive Axle Inner Shaft Replacement** .
9. Install the exhaust front pipe. Refer to **Front Pipe Replacement** .

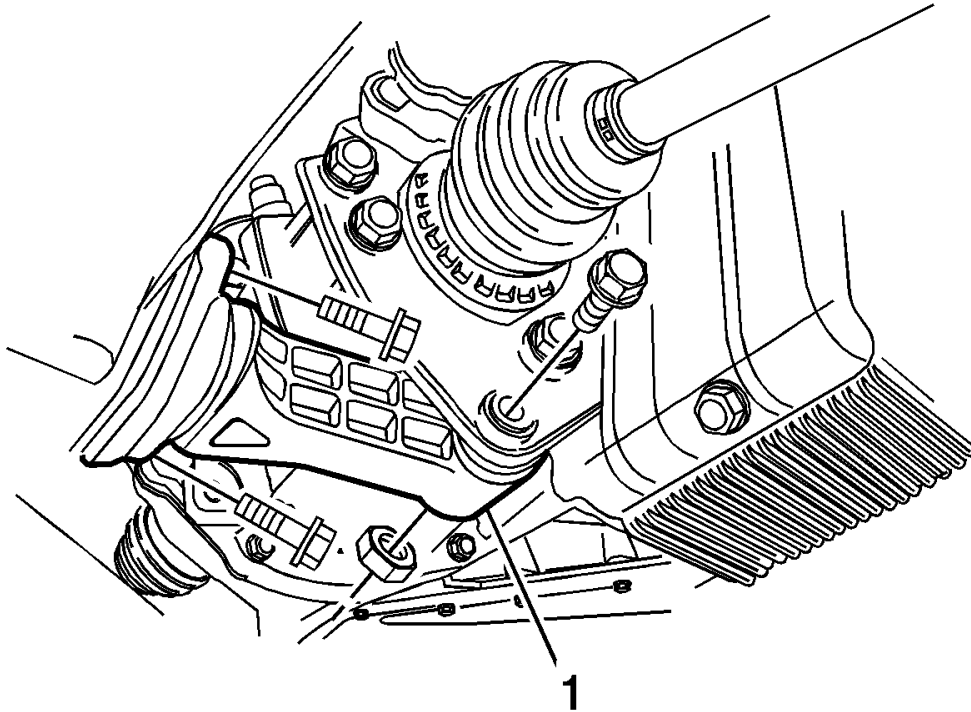


Fig. 91: Reaction Rod
Courtesy of GENERAL MOTORS CORP.

10. Install the reaction rod (1).
11. Install and connect the cables and wiring harness related to the automatic transaxle.
12. Connect the auto transaxle fluid cooler inlet/outlet hoses.

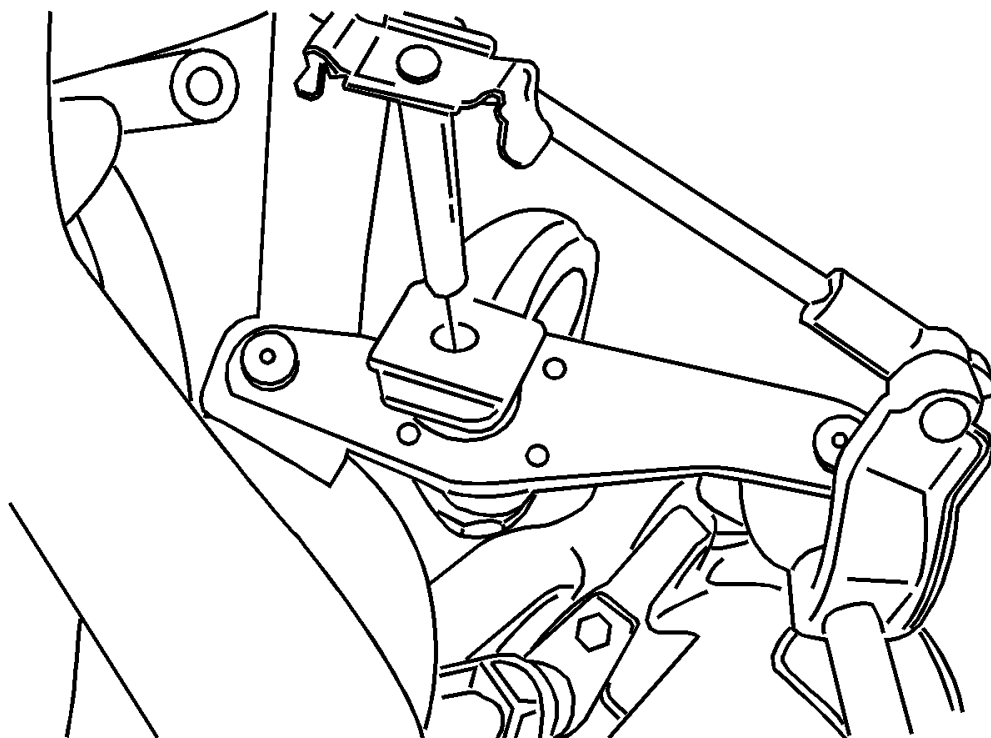


Fig. 92: Manual Transaxle Cable Connector
Courtesy of GENERAL MOTORS CORP.

13. Install and connect the cables and wiring harness related to the manual transaxle.

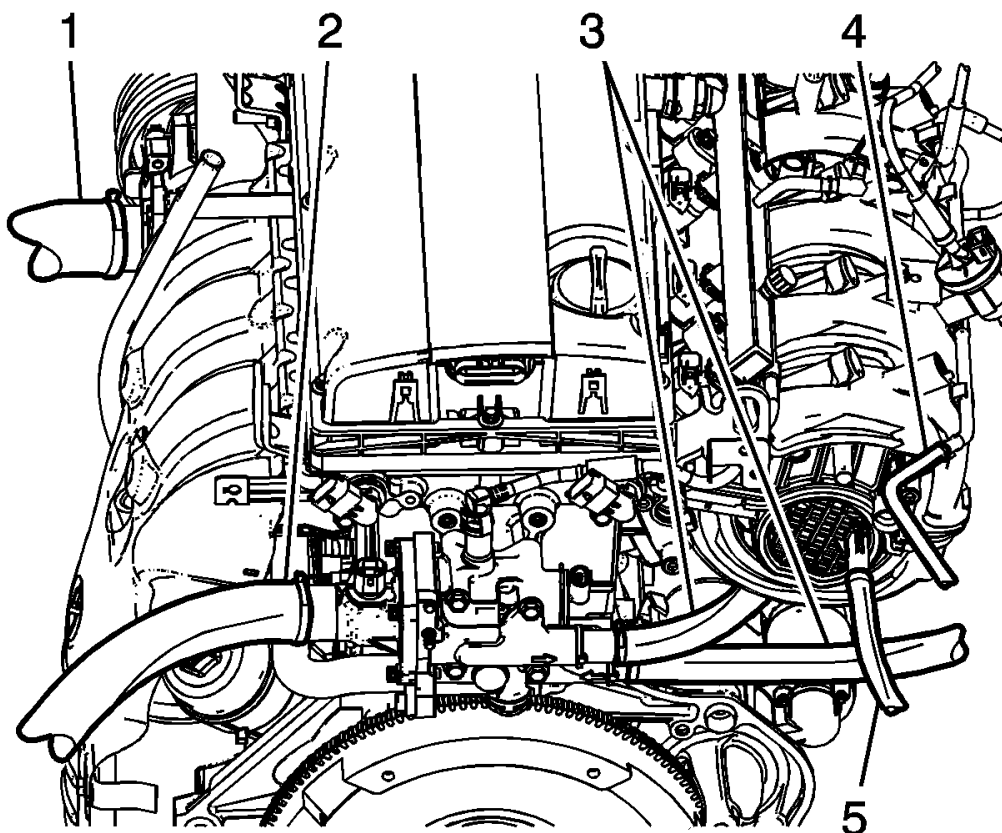


Fig. 93: Coolant & Brake Boost Hoses
Courtesy of GENERAL MOTORS CORP.

14. Connect the coolant hose (1) to the water pump.
15. Connect the coolant hose (2) to the thermostat housing.
16. Connect the heater core coolant inlet/outlet hoses (3) to the coolant distributor.
17. Connect the ETC-to-coolant tank hose (4).
18. Connect the brake boost hose (5) to the intake manifold.

CAUTION: Refer to Fastener Caution .

19. Position the engine harness and connect the following connectors.
 - Crankshaft position (CKP) sensor connector
 - Knock sensor connector
 - Alternator connector

- Alternator B+ nut
- Oil level switch connector, if equipped
- Starter solenoid B+ nut
- Ground nut
- Starter solenoid ground nut

Tighten:

- Tighten the alternator B+ nut to 15 N.m (11 lb ft).
- Tighten the starter solenoid B+ nut to 10.5 N.m (7.7 lb ft).
- Tighten the ground nut to 12 N.m (8.8 lb ft).
- Tighten the starter solenoid ground nut to 38 N.m (28 lb ft).

20. Connect the following:

- Ignition coil connector
- Camshaft position sensor (CPS) connectors (right/left)
- Coolant temperature sensor connector
- Oxygen sensor connector
- Ground bolt

Tighten: Tighten the ground bolt to 12 N.m (8.8 lb ft).

- Thermostat heater connector

21. Connect the following:

- Oil switch wiring connector
- A/C compressor connector

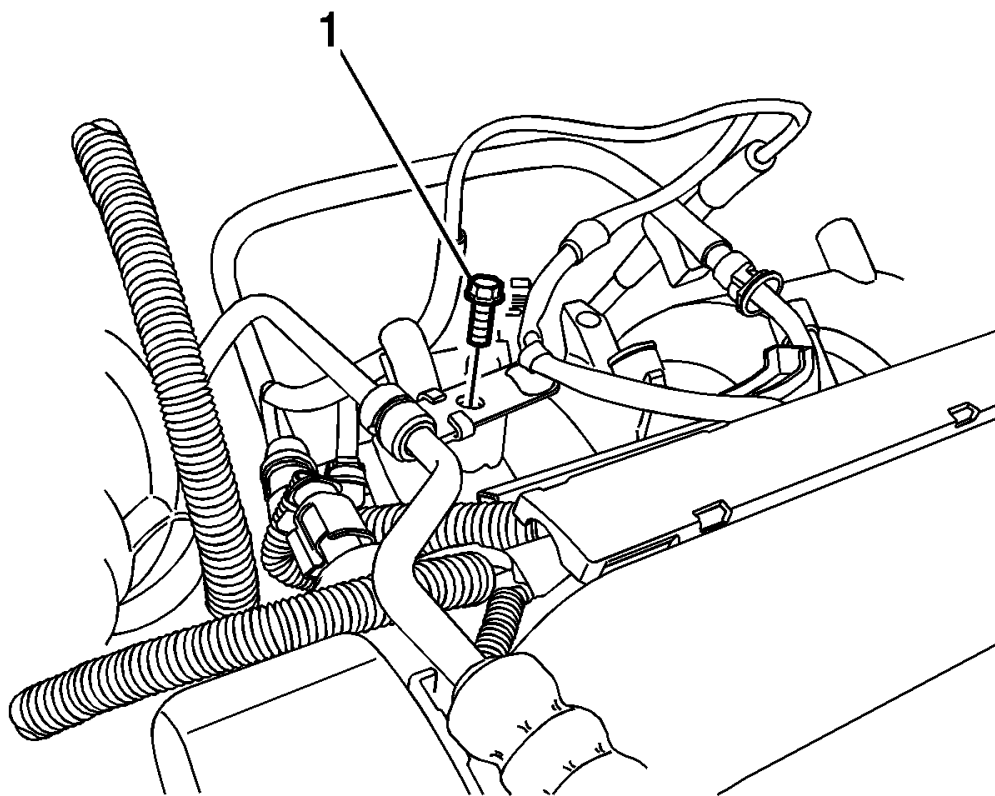


Fig. 94: Power Steering Pump Pressure Pipe Clamp Bolt
Courtesy of GENERAL MOTORS CORP.

22. Install the power steering pump pressure line union nut.
23. Install the power steering pressure pipe retaining clamp bolt (1) to the intake manifold.
24. Connect the power steering hose to the power steering pump.

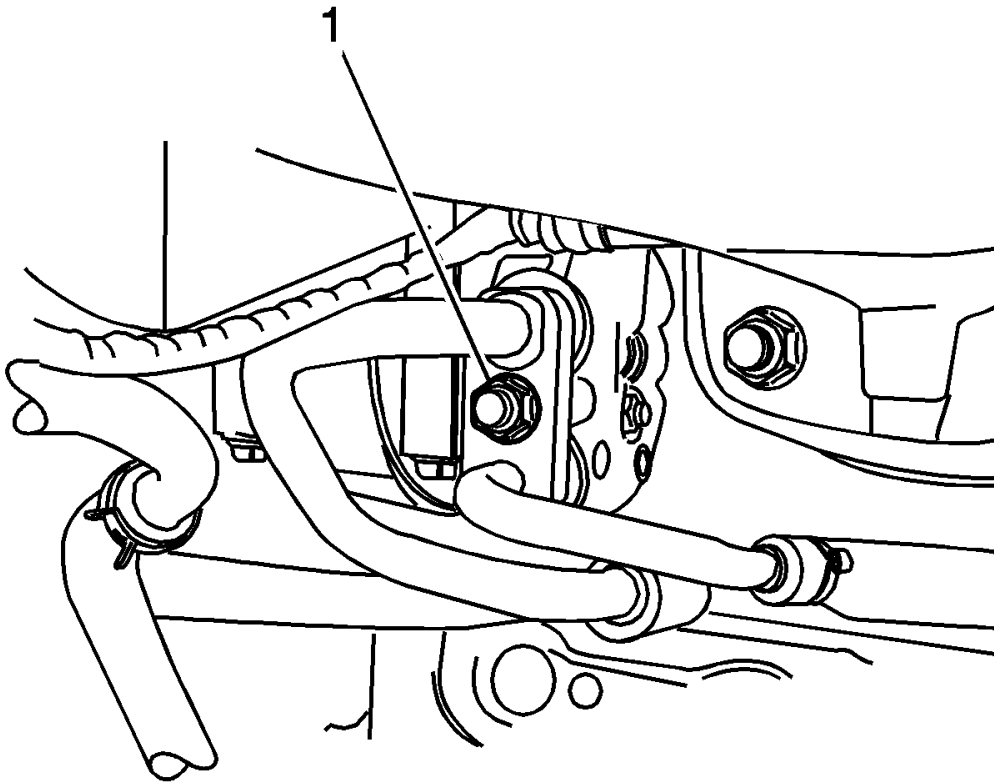


Fig. 95: A/C Inlet/Outlet Pipe Tightening Bolt
Courtesy of GENERAL MOTORS CORP.

25. Install the A/C inlet/outlet pipe bolt (1) from the A/C compressor if equipped.
26. Charge the A/C system. Refer to **Refrigerant Recovery and Recharging** .
27. Install the fuse box bolts.
28. Install the battery and tray. Refer to **Battery Tray Replacement** .
29. Install the air cleaner assembly. Refer to **AIR CLEANER ASSEMBLY REPLACEMENT** .
30. Connect the fuel pipe to the fuel rail.
31. Connect the EVAP hose to the EVAP canister solenoid valve.

ENGINE OIL AND OIL FILTER REPLACEMENT

REMOVAL PROCEDURE

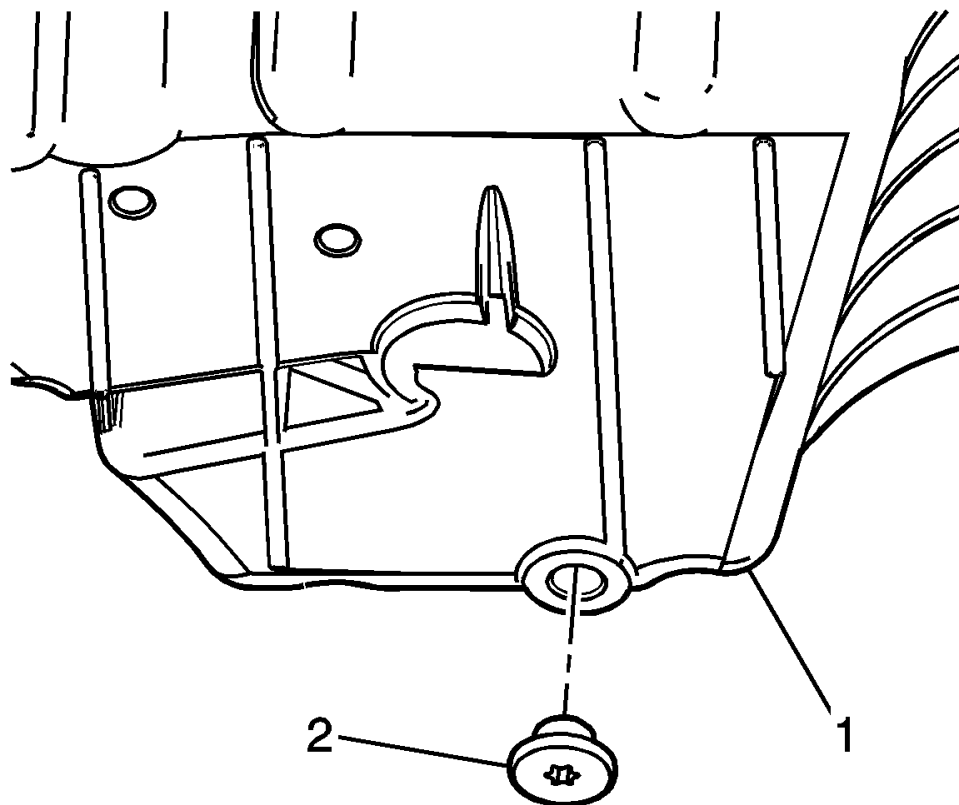


Fig. 96: Oil Pan Drain Plug

Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Locate the vessel for containing engine oil beneath drain plug of the vehicle.
3. Remove the oil drain (2) carefully.
4. Drain the engine oil.

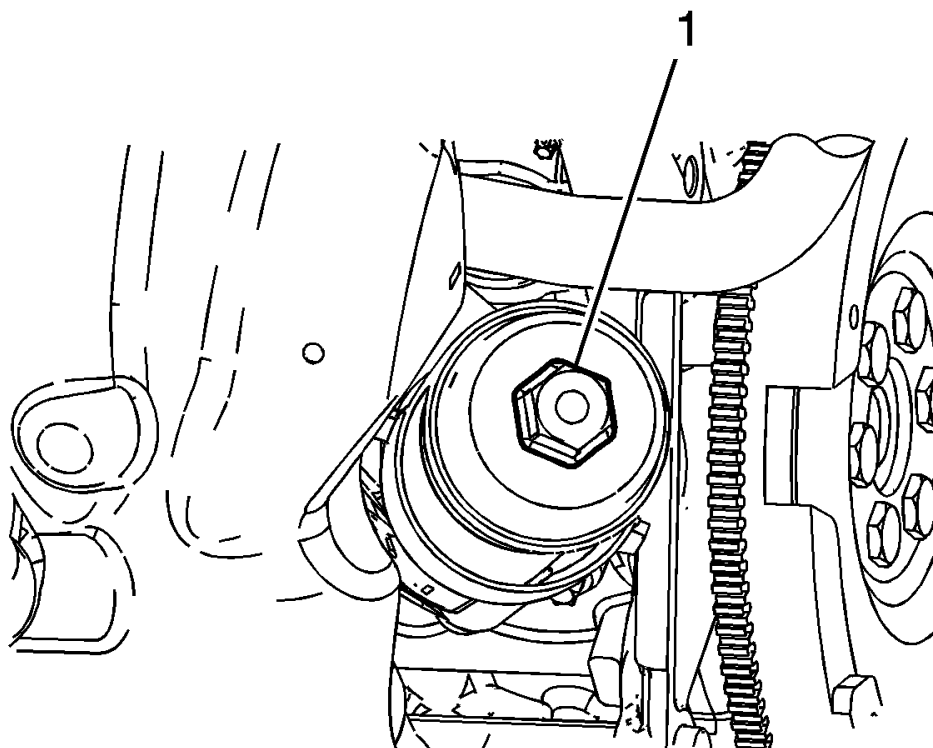


Fig. 97: Oil Filter Cap
Courtesy of GENERAL MOTORS CORP.

5. Remove the oil filter cap (1).
6. Remove the oil filter.

INSTALLATION PROCEDURE

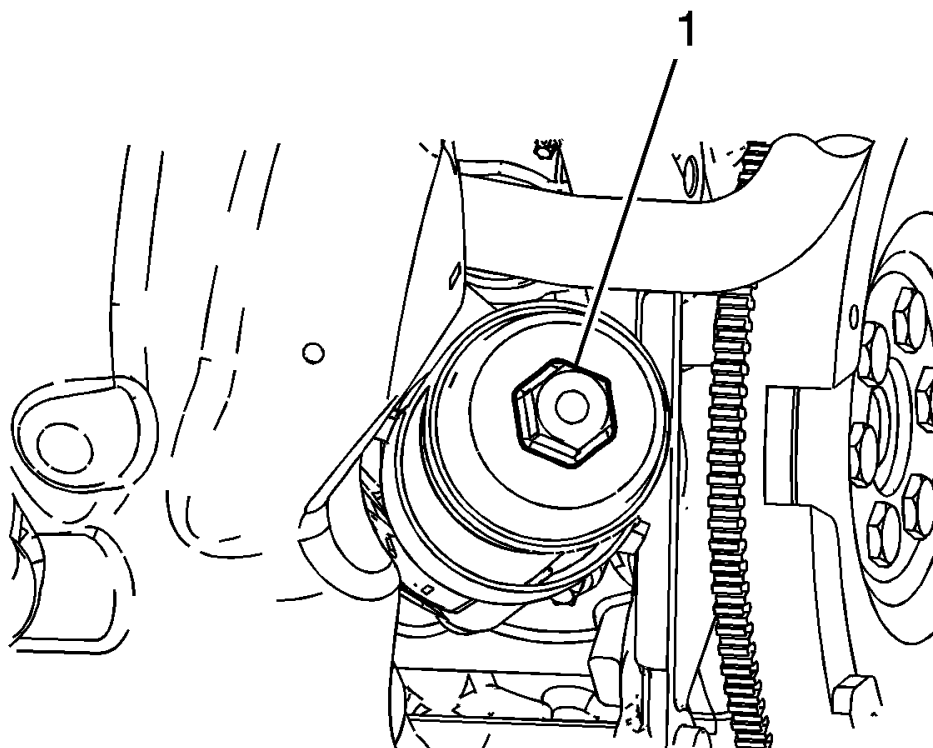


Fig. 98: Oil Filter Cap

Courtesy of GENERAL MOTORS CORP.

NOTE: Do not re-use the engine oil filter.

1. Install the new oil filter.

CAUTION: Refer to Fastener Caution .

2. Install the oil filter cap (1).

Tighten: Tighten the oil filter cap to 25 N.m (18.4 lb ft).

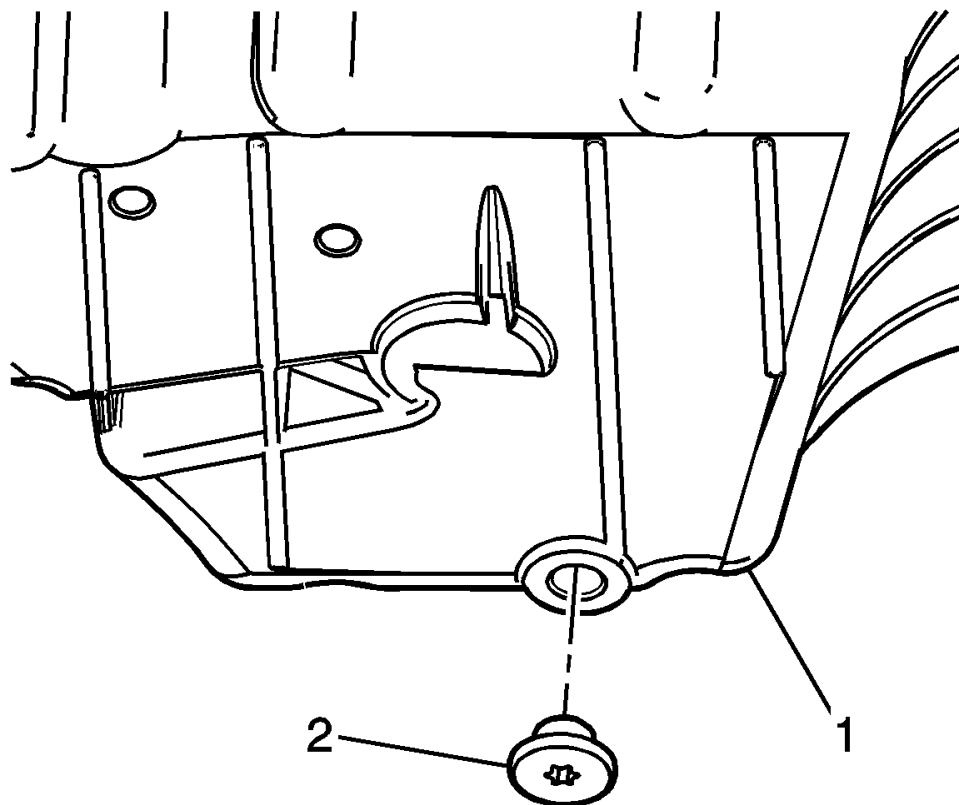


Fig. 99: Oil Pan Drain Plug
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to engine oil specifications in the owners manual and refill with the recommended engine oil and quantity.

3. Install the drain plug (2).

Tighten: Tighten the drain plug to 9 N.m (79.7 lb in).

4. Open the oil filling cap.
5. Refill the new engine oil.

PISTON, CONNECTING ROD, AND BEARING REPLACEMENT

REMOVAL PROCEDURE

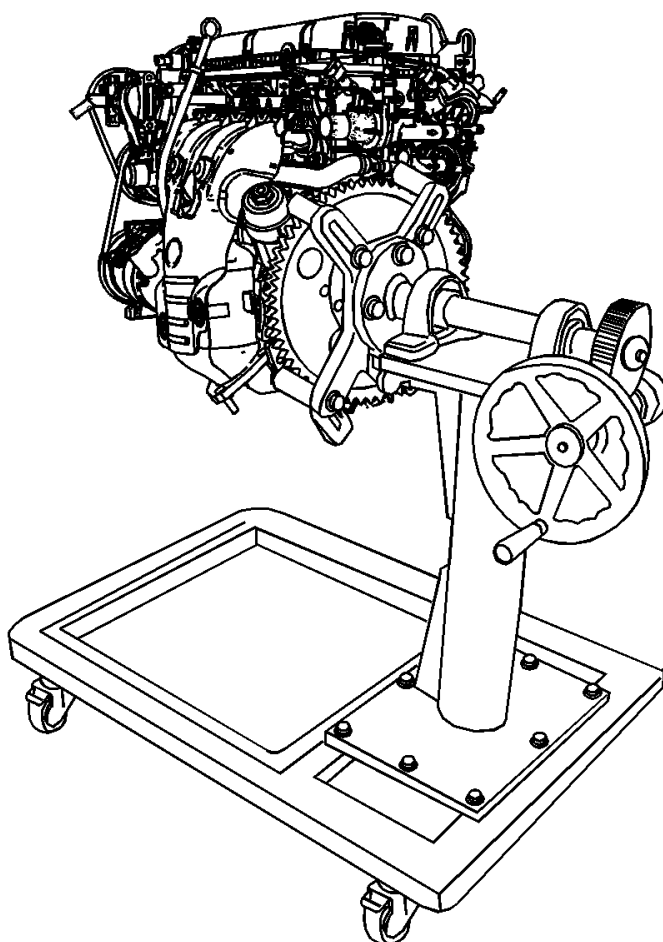


Fig. 100: Engine Assembly On Stand
Courtesy of GENERAL MOTORS CORP.

1. Remove the engine assembly. Refer to **Engine Replacement**.
2. Install the engine assembly to the stand.
3. Remove the ignition coil. Refer to **IGNITION COIL REPLACEMENT**.

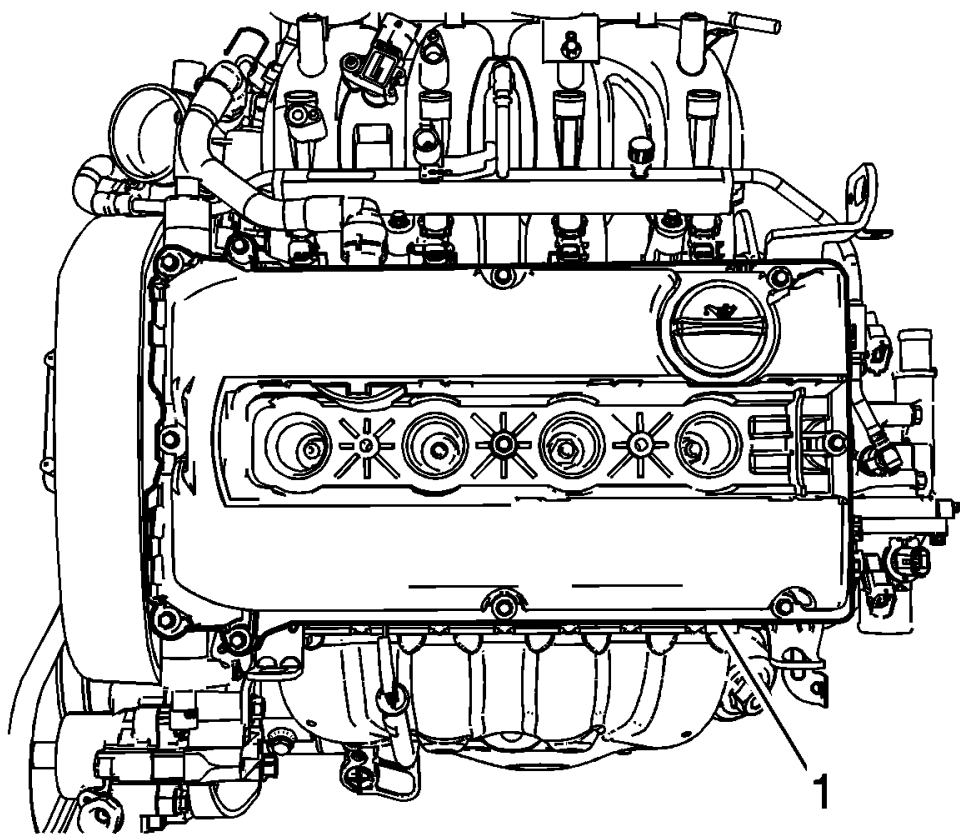


Fig. 101: Cylinder Head Cover
Courtesy of GENERAL MOTORS CORP.

4. Detach the PCV clips from the PCV hose.
5. Remove the PCV hose from the cylinder head cover.
6. Remove the cylinder head cover bolts.
7. Remove the cylinder head cover (1).
8. Remove the power steering pump and bracket. Refer to **Power Steering Pump Replacement (1.4L LDT and 1.6L LXV Engines)** .

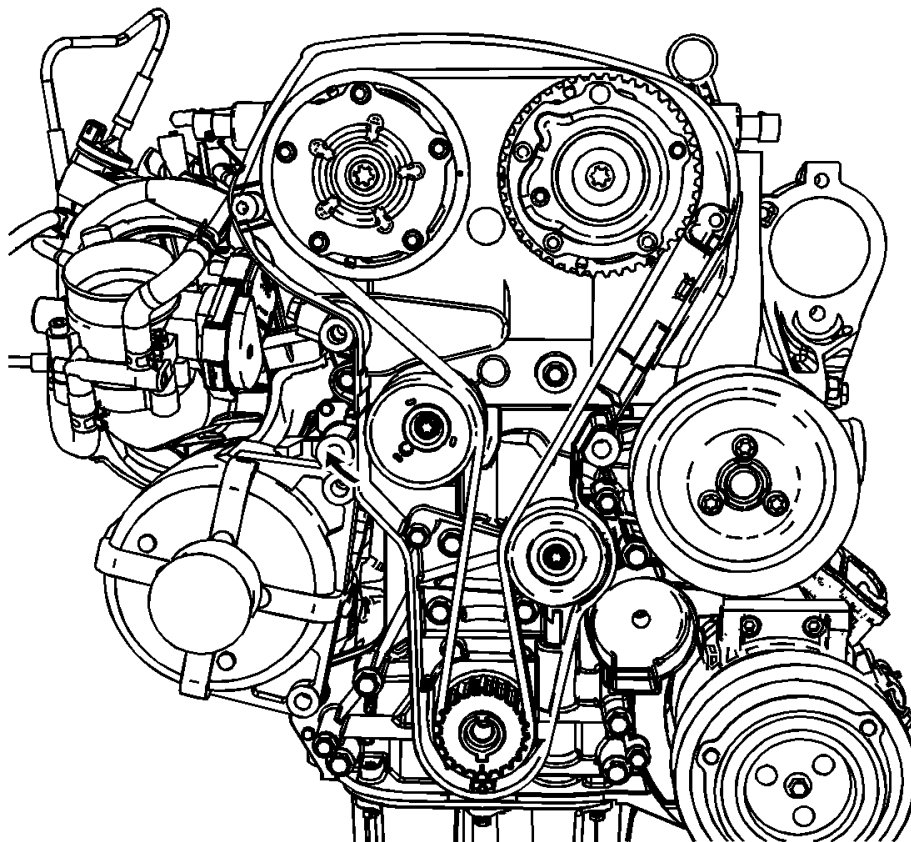


Fig. 102: Timing Belt

Courtesy of GENERAL MOTORS CORP.

9. Remove the timing belt. Refer to **Timing Belt Replacement**.
10. Remove the timing belt tensioner. Refer to **Timing Belt Replacement**.
11. Remove the camshaft intake and exhaust sprockets. Refer to **Camshaft Intake Sprocket with Actuator Replacement** and **Camshaft Exhaust Sprocket with Actuator Replacement**.

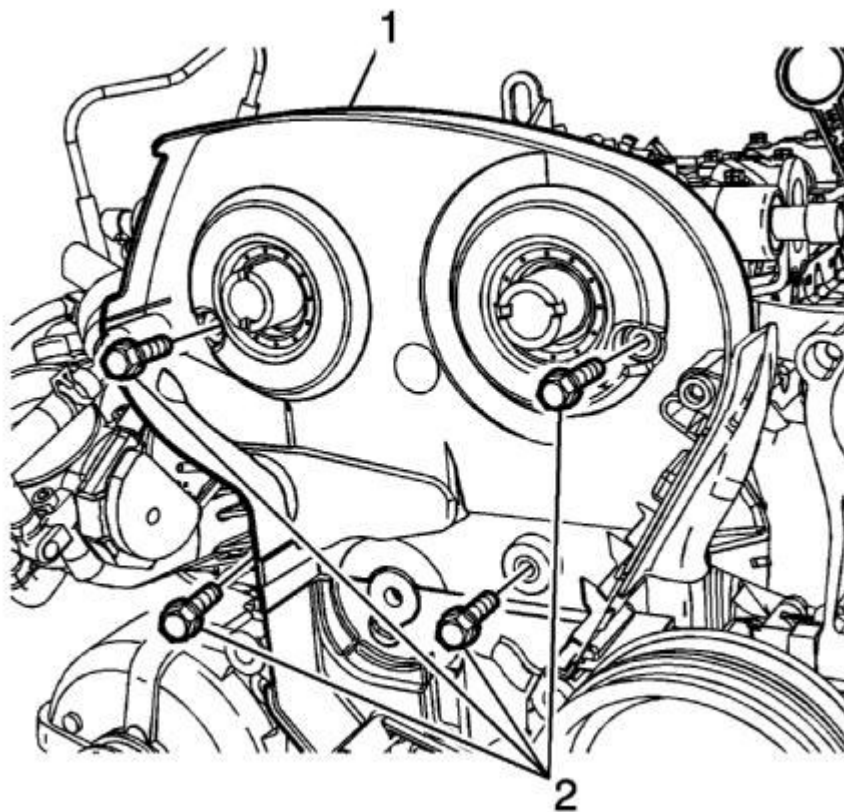


Fig. 103: Timing Belt Rear Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

12. Remove the camshaft rear cover (1).

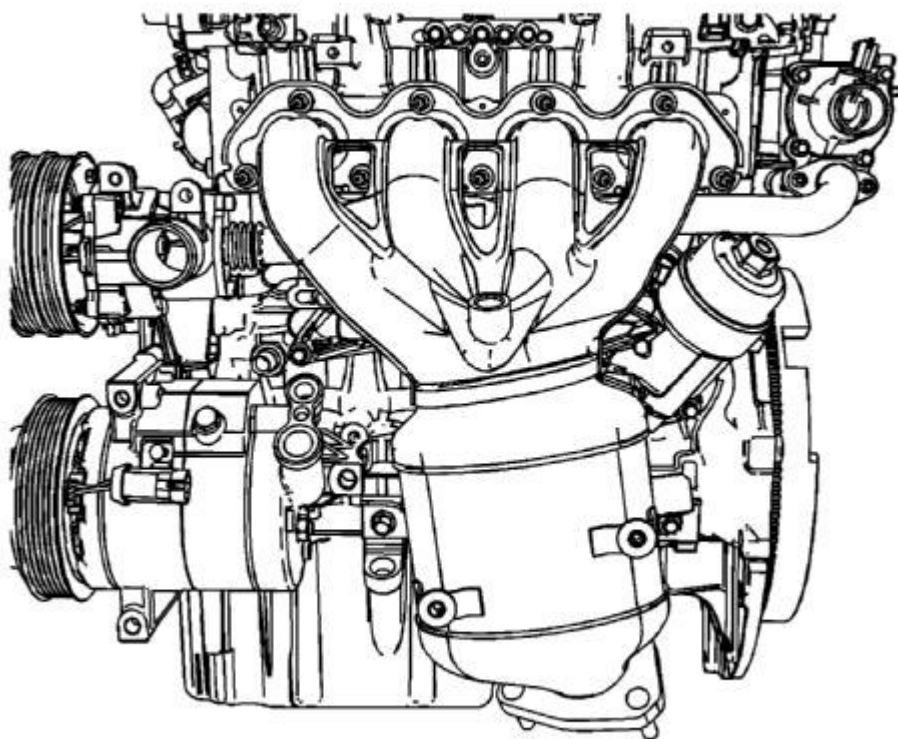


Fig. 104: Exhaust Manifold & Catalytic Converter
Courtesy of GENERAL MOTORS CORP.

13. Remove the exhaust manifold. Refer to **Catalytic Converter Replacement (1.4L LDT/1.6L LXV)** .
14. Remove the throttle body. Refer to **THROTTLE BODY ASSEMBLY REPLACEMENT** .
15. Remove the intake manifold. Refer to **Intake Manifold Replacement**.

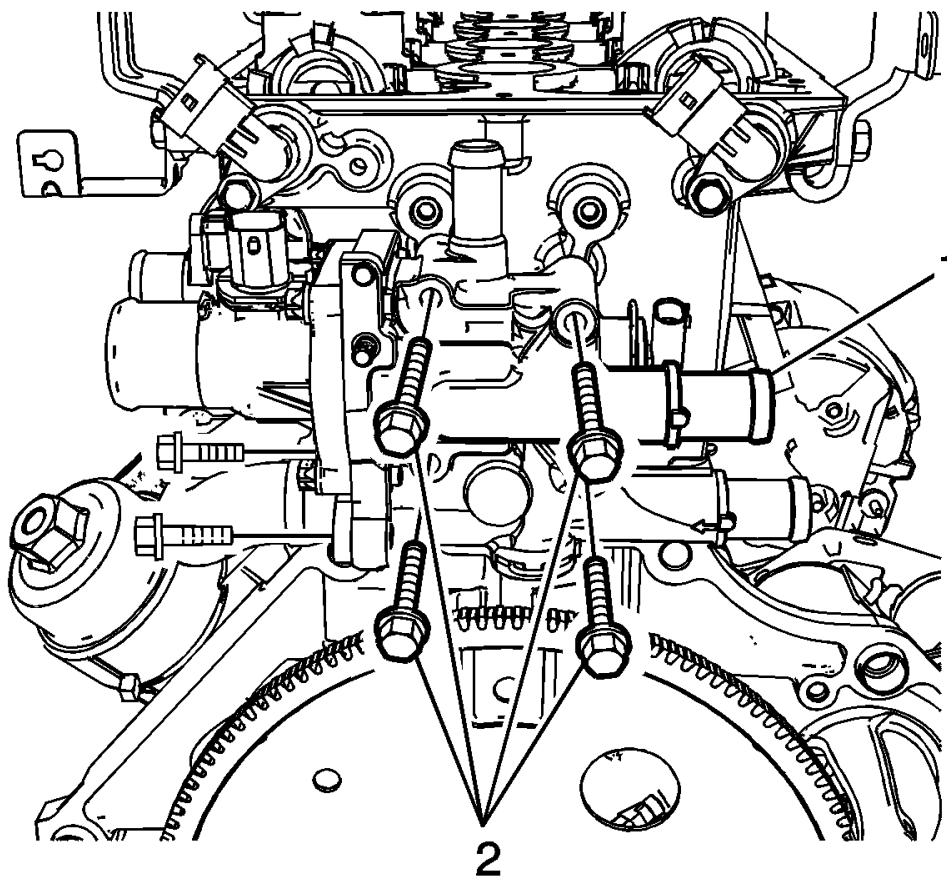


Fig. 105: Coolant Distributor
Courtesy of GENERAL MOTORS CORP.

16. Remove the engine coolant distributor (1).

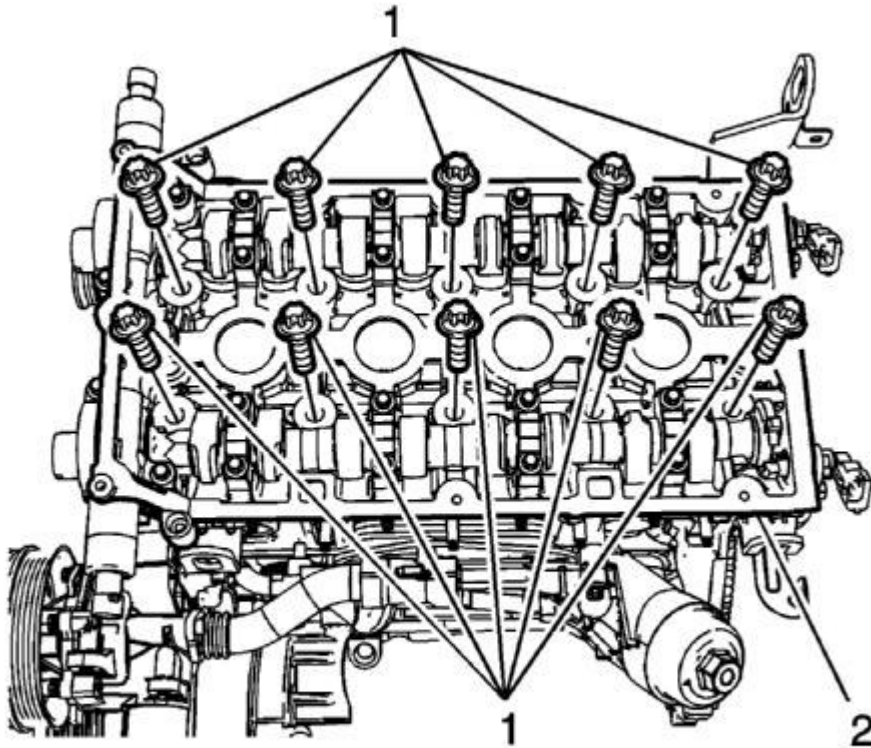


Fig. 106: Cylinder Head & Bolts
Courtesy of GENERAL MOTORS CORP.

17. Remove the cylinder head bolts (1).
18. Remove the cylinder head assembly (2) with the cylinder head gasket.
19. Remove the engine oil cooler. Refer to **Engine Oil Cooler Replacement** .
20. Remove the A/C compressor. Refer to **Air Conditioning Compressor Replacement** .
21. Remove the alternator. Refer to **Generator Replacement (1.4L LDT, 1.6L LXV)** .
22. Remove the starter. Refer to **Starter Replacement (1.4L LDT, 1.6 LXV)** .
23. Remove the oil pan. Refer to **Oil Pan Replacement**.
24. Remove the oil pump assembly. Refer to **Oil Pump Replacement**.
25. Remove the flexible plate or flywheel. Refer to **Automatic Transmission Flex Plate Replacement** and **Engine Flywheel Replacement**.

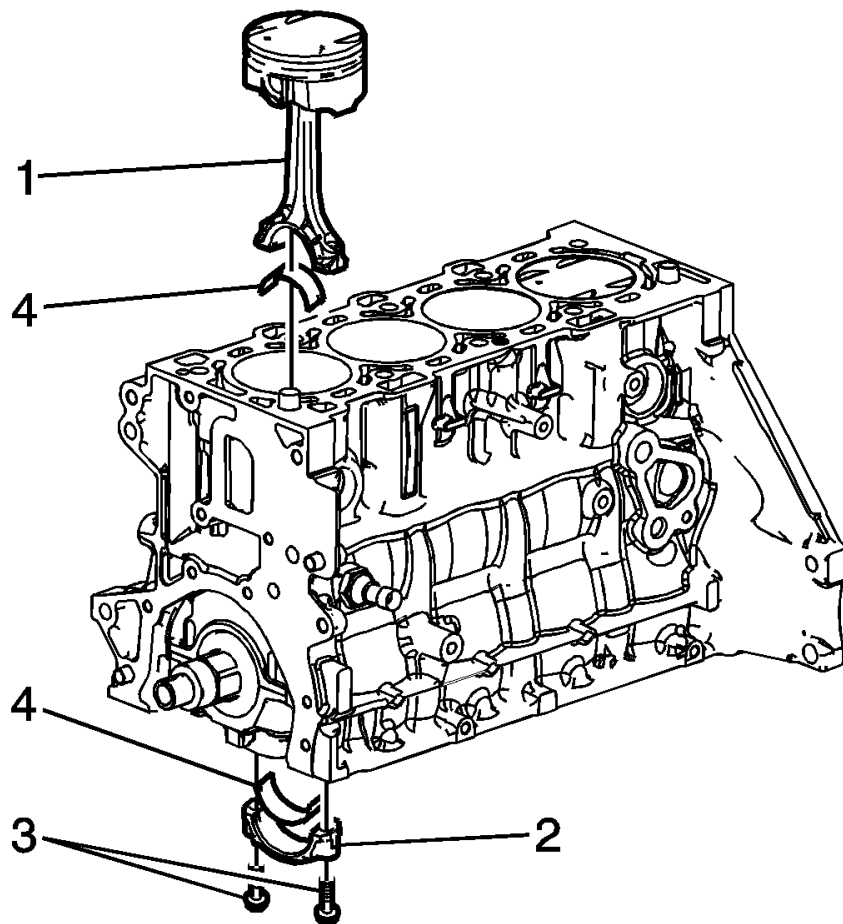


Fig. 107: Piston, Connecting Rod, Cap & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Check and confirm the piston assembly sequence and the connecting rod bearing sequence, to not confuse.

26. Remove the connecting rod cap (2) and bolts (3).
27. Remove the piston assembly (1).

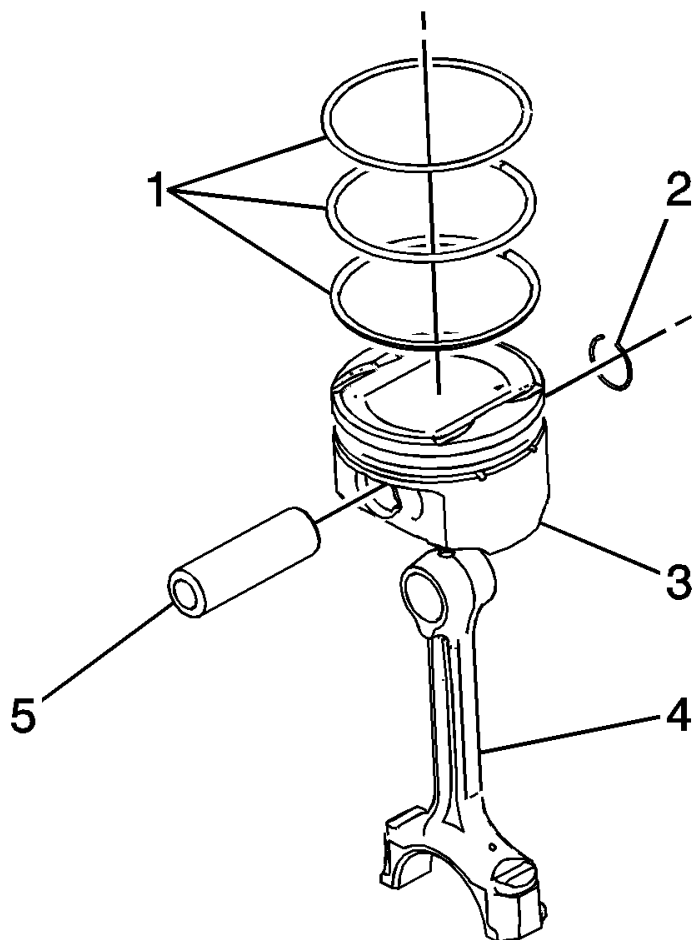


Fig. 108: Piston, Pin, Connecting Rod & Rings
Courtesy of GENERAL MOTORS CORP.

28. Separate the piston pin (5) from the piston.
29. Separate the piston ring (1) from the piston (3) using the expansion tool.

INSTALLATION PROCEDURE

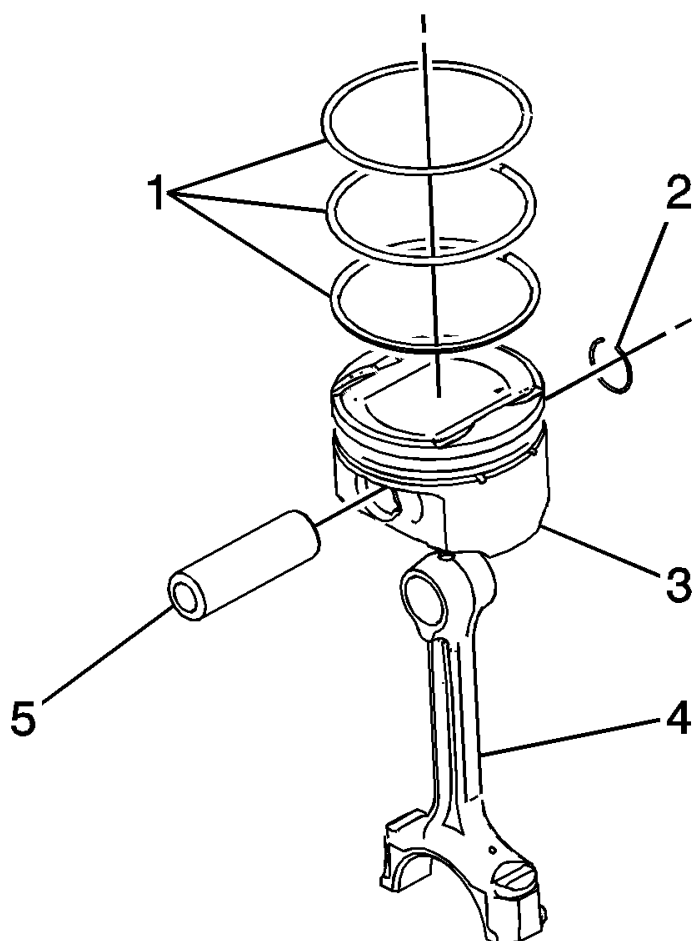


Fig. 109: Piston, Pin, Connecting Rod & Rings
Courtesy of GENERAL MOTORS CORP.

NOTE: Take extreme care to prevent any scratches or damage to the inner side of the cylinder, piston, and connecting rod cap bearings.

1. Install the piston pin (5) to the piston.
2. Install the piston ring (1) from the piston (3) using the expansion tool.

NOTE: Check and confirm the piston assembly sequence and the connecting rod bearing sequence, to not confuse.

3. Install the piston assembly using the piston installer (1.6L only - EN-49153).

CAUTION: Refer to Fastener Caution .

4. Install the connecting rod cap and bolts with bearings.

Tighten: Tighten the connecting rod caps bolts to $35+45^{\circ}+15^{\circ}$ N.m ($25.8+45^{\circ}+15^{\circ}$ lb ft).

5. Install the flexible plate or flywheel. Refer to **Automatic Transmission Flex Plate Replacement** and **Engine Flywheel Replacement**.
6. Install the oil pump assembly. Refer to **Oil Pump Replacement**.
7. Install the engine oil cooler. Refer to **Engine Oil Cooler Replacement**.
8. Install the A/C compressor. Refer to **Air Conditioning Compressor Replacement**.
9. Install the alternator. Refer to **Generator Replacement (1.4L LDT, 1.6L LXV)**.
10. Install the starter. Refer to **Starter Replacement (1.4L LDT, 1.6 LXV)**.
11. Install the oil pan. Refer to **Oil Pan Replacement**.

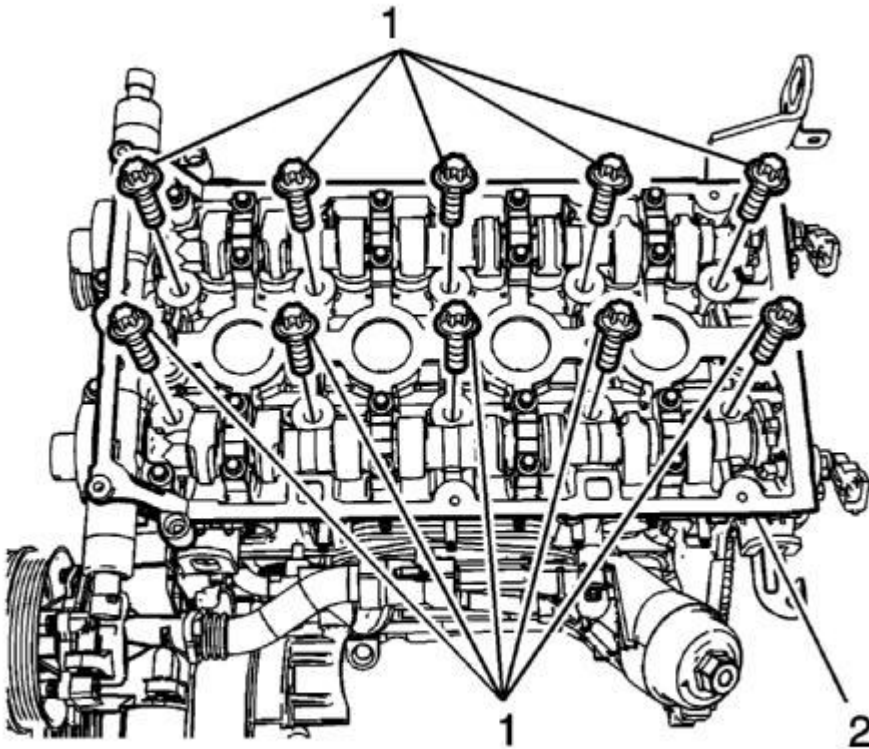


Fig. 110: Cylinder Head & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Do not reuse the cylinder head gasket.

12. Install the cylinder head assembly (2) with the new cylinder head gasket.

13. Install the cylinder head bolts (1).

Tighten: Tighten the cylinder head bolts to 25+90° +90° +90° +45° N.m (18.4+90° +90° +90° +45° lb ft).

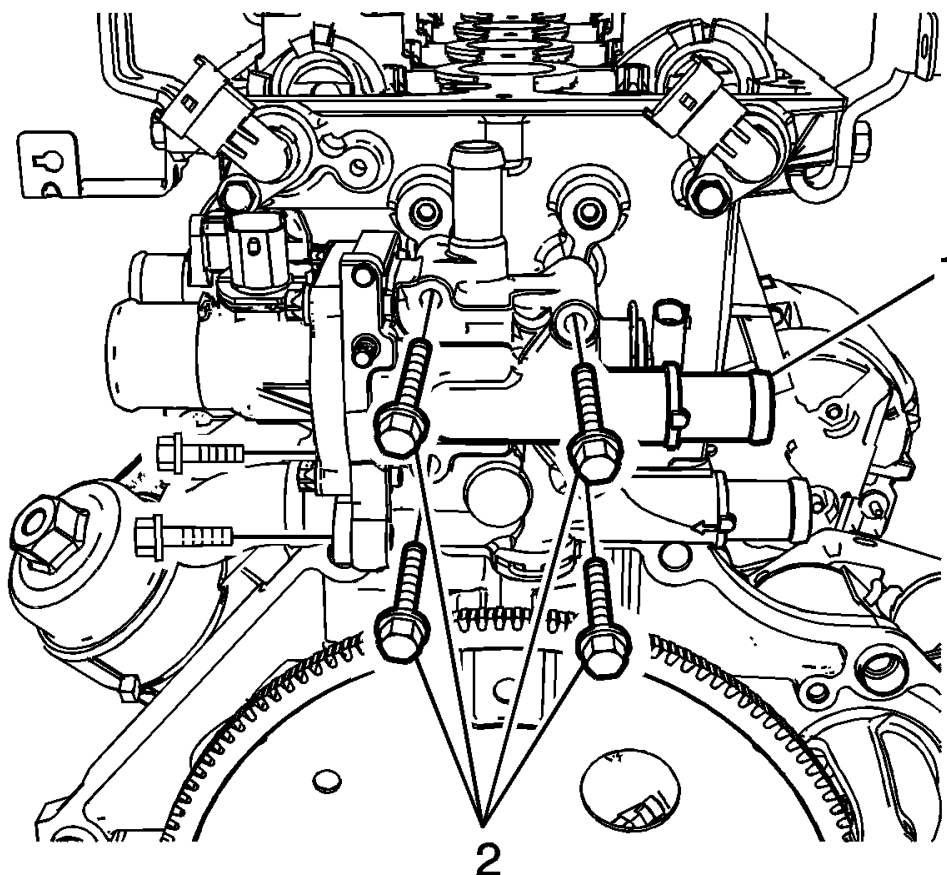


Fig. 111: Coolant Distributor
Courtesy of GENERAL MOTORS CORP.

14. Install the engine coolant distributor (1).
15. Install the intake manifold. Refer to **Intake Manifold Replacement**.
16. Install the throttle body. Refer to **THROTTLE BODY ASSEMBLY REPLACEMENT** ..
17. Install the exhaust manifold. Refer to **Catalytic Converter Replacement (1.4L LDT/1.6L LXV)** .

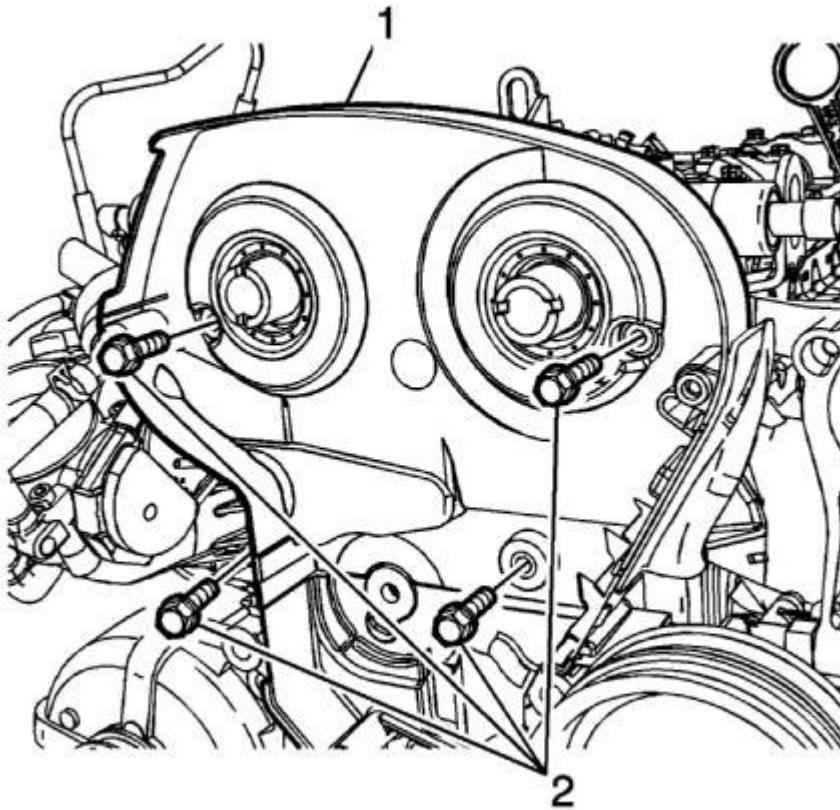


Fig. 112: Timing Belt Rear Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

18. Install the camshaft rear cover (1).
19. Install the camshaft intake and exhaust sprockets. Refer to **Camshaft Intake Sprocket with Actuator Replacement** and **Camshaft Exhaust Sprocket with Actuator Replacement**.
20. Install timing belt system and adjust the timing. Refer to **Timing Belt Replacement**.
21. Install the accessory belt. Refer to **Drive Belt Replacement**.
22. Install the power steering pump and bracket. Refer to **Power Steering Pump Replacement (1.4L LDT and 1.6L LXV Engines)** .

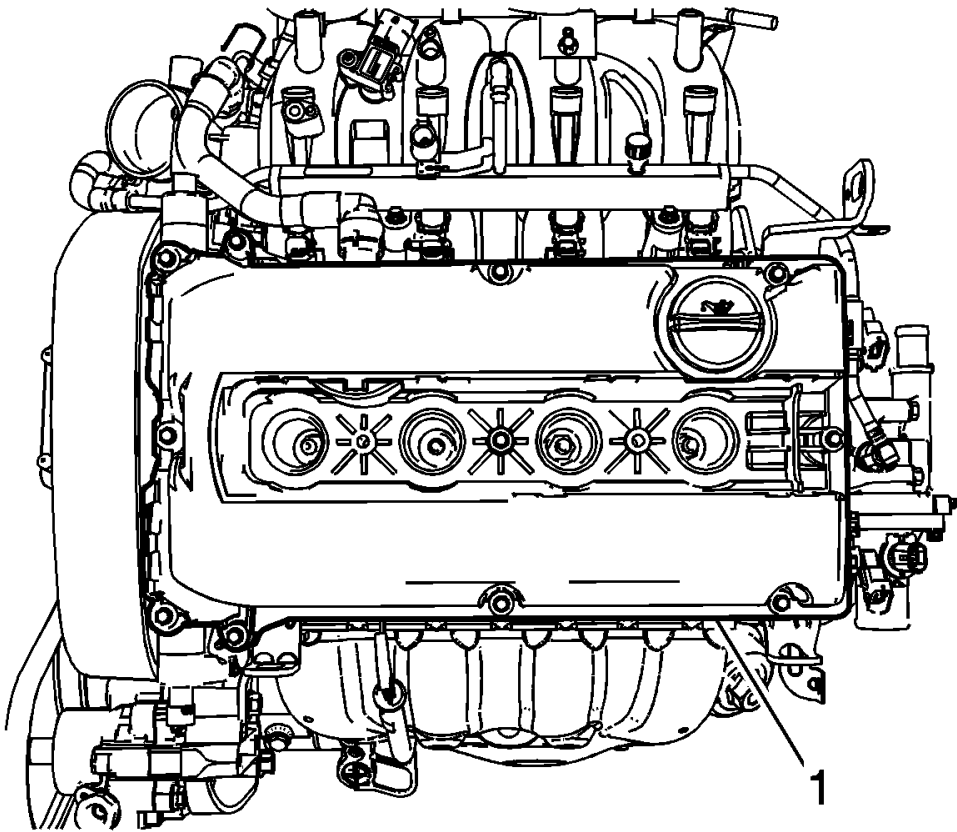


Fig. 113: Cylinder Head Cover
Courtesy of GENERAL MOTORS CORP.

23. Install the cylinder head cover (1).
24. Install the cylinder head cover bolts.
25. Install the PCV hose from the cylinder head cover.
26. Attach the PCV clips from the PCV hose.
27. Install the ignition coil. Refer to **IGNITION COIL REPLACEMENT**.

CAMSHAFT FRONT OIL SEAL REPLACEMENT

SPECIAL TOOLS

KM-422: Installer

REMOVAL PROCEDURE

1. Remove the camshaft intake and exhaust sprockets. Refer to **Camshaft Intake Sprocket with Actuator**

Replacement and Camshaft Exhaust Sprocket with Actuator Replacement.

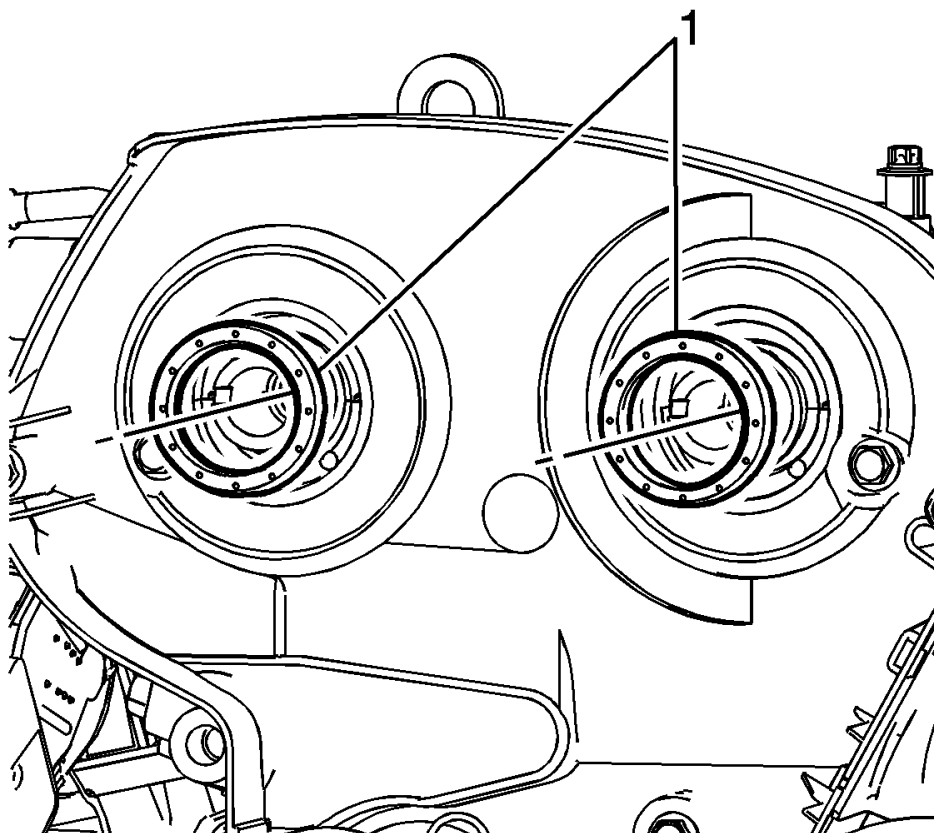


Fig. 114: Camshaft Seal Rings
Courtesy of GENERAL MOTORS CORP.

NOTE: **Extremely take care of contacting of camshaft surface. If damaged on the camshaft surface, engine oil could be leaked.**

2. Remove the camshaft seal ring (1).

INSTALLATION PROCEDURE

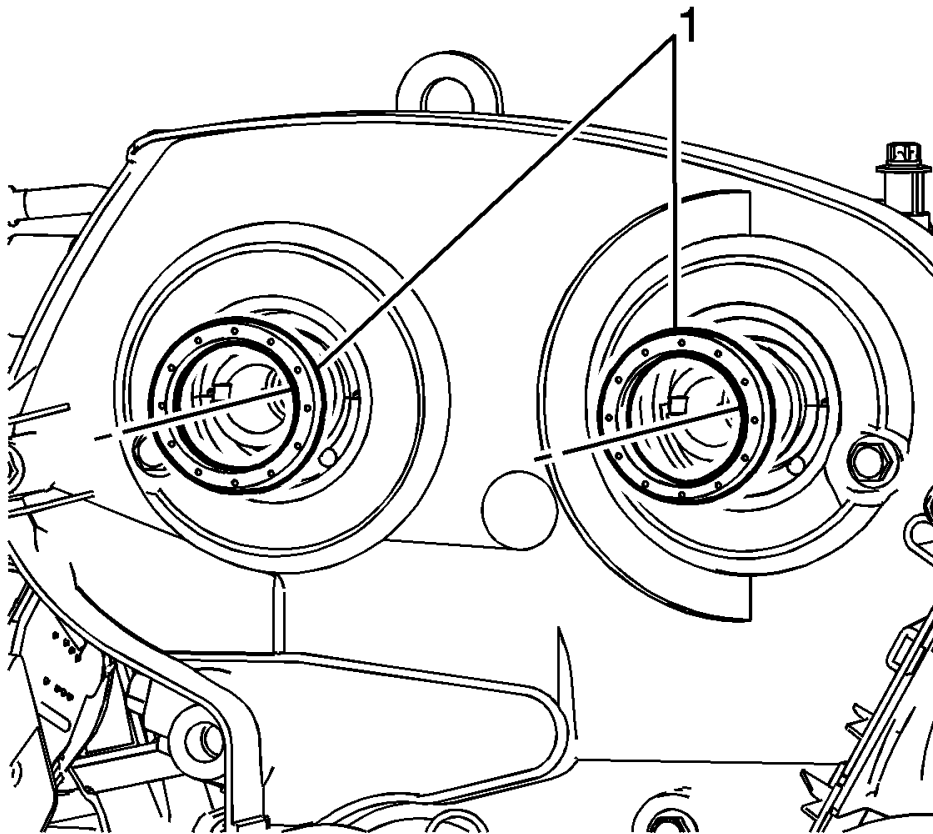


Fig. 115: Camshaft Seal Rings
Courtesy of GENERAL MOTORS CORP.

NOTE: Do not reuse the camshaft seal ring.

1. Install the camshaft seal ring (1) with new one.

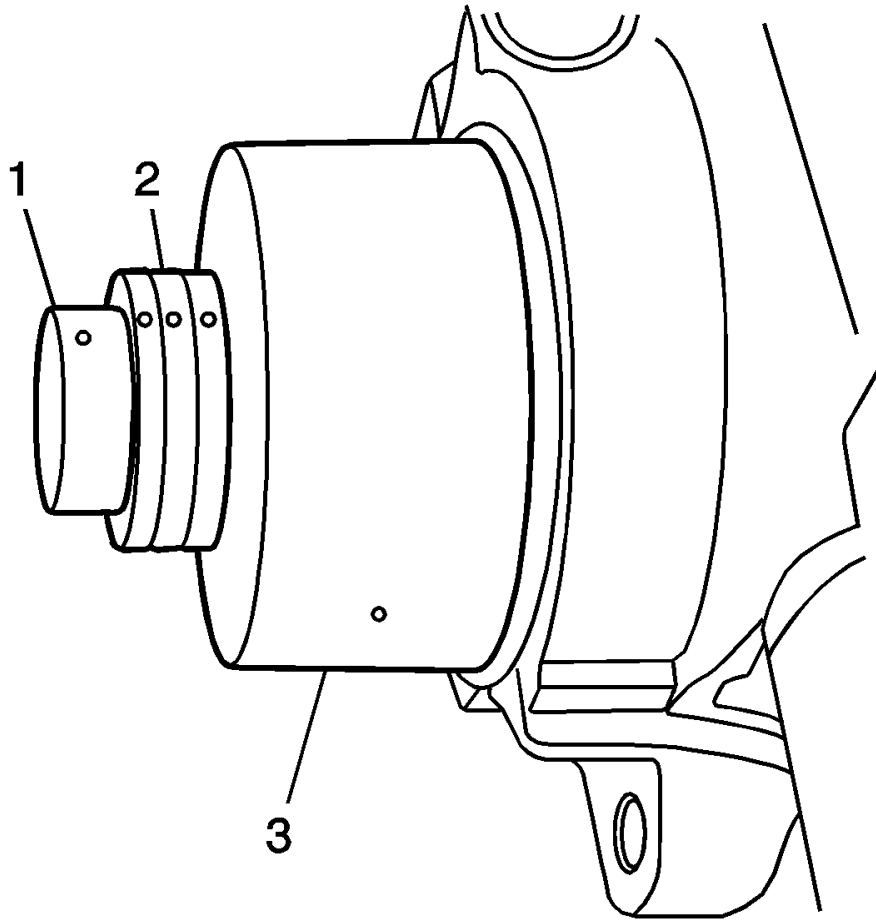


Fig. 116: Camshaft Installer, Shims & Camshaft Bolt
Courtesy of GENERAL MOTORS CORP.

2. Install the **KM-422:** installer (3) with shims (2), with a total thickness of approximately 10 mm and tighten the camshaft bolt (1) manually.
3. Remove the **KM-422:** installer.
4. Install the camshaft intake and exhaust sprockets. Refer to **Camshaft Intake Sprocket with Actuator Replacement** and **Camshaft Exhaust Sprocket with Actuator Replacement**.

CAMSHAFT REPLACEMENT

SPECIAL TOOLS

KM-422: Installer

REMOVAL PROCEDURE

NOTE: Take extreme care to prevent any scratches, nicks or damage to the

camshafts and caps bearing surfaces.

1. Remove the camshaft intake and exhaust sprockets. Refer to **Camshaft Intake Sprocket with Actuator Replacement** and **Camshaft Exhaust Sprocket with Actuator Replacement**.
2. Remove the timing belt tensioner. Refer to **Timing Belt Replacement**.

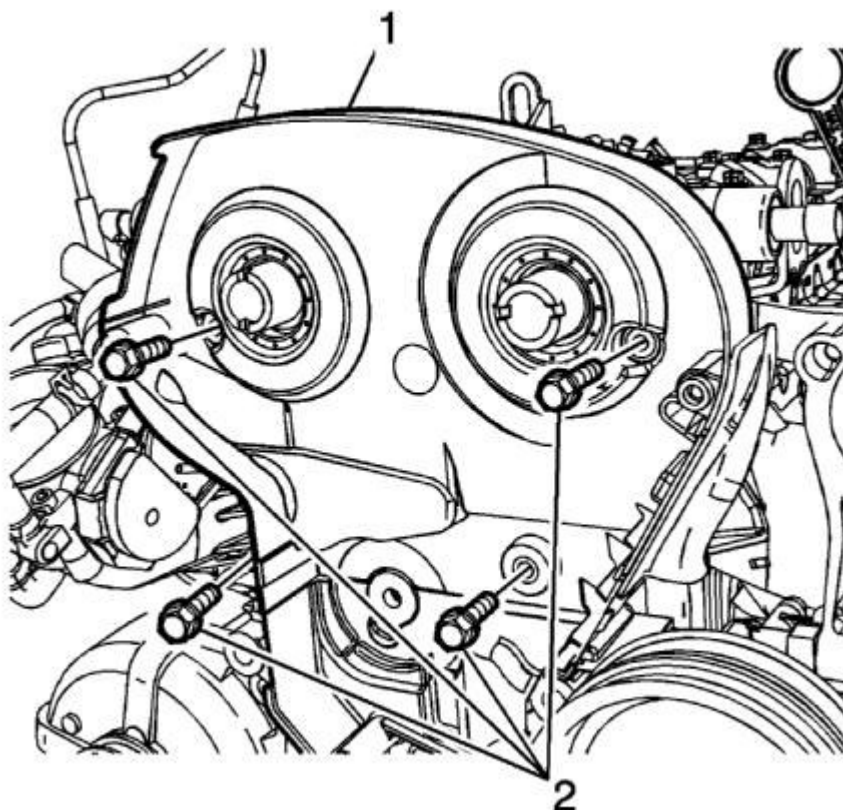


Fig. 117: Timing Belt Rear Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

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

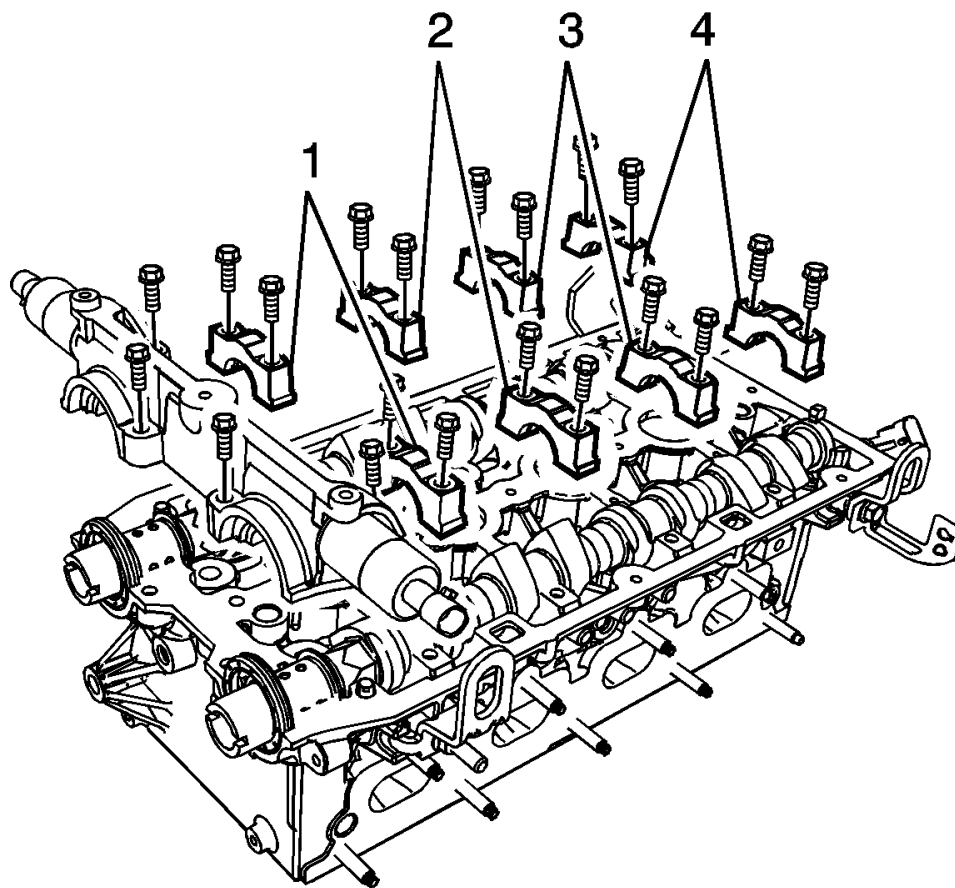


Fig. 118: Camshaft Position Solenoid Valve Housing, Camshaft Caps & Bolts
Courtesy of GENERAL MOTORS CORP.

4. Remove the camshaft position solenoid valve housing.
5. Remove the camshaft cap bolts in sequence (1, 4, 2, 3).
6. Remove the camshaft caps.

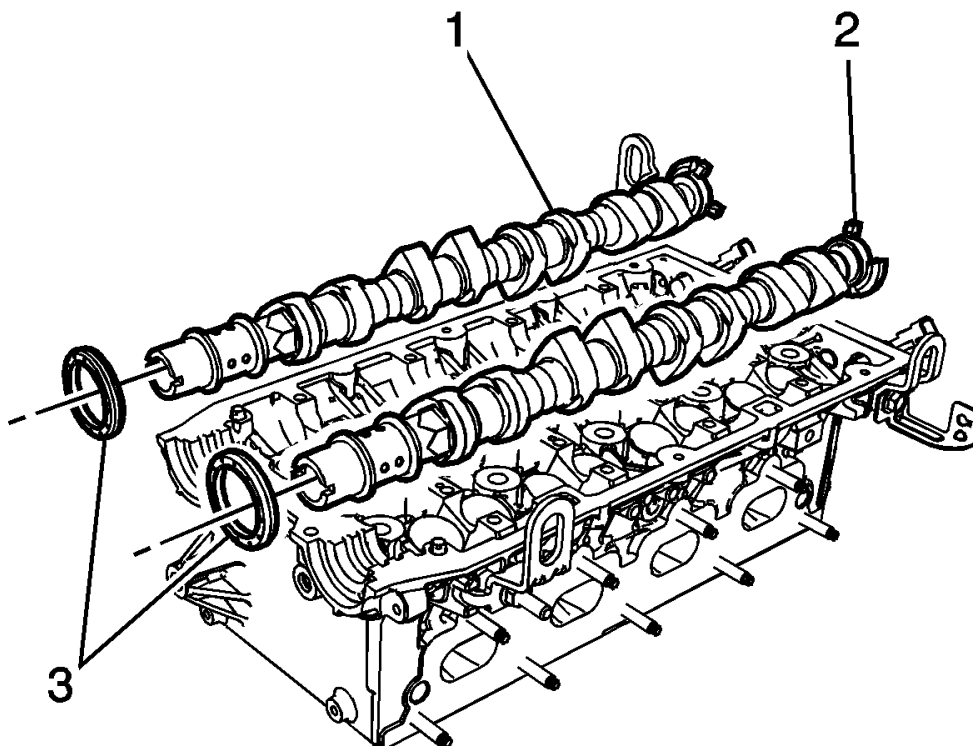


Fig. 119: Intake/Exhaust Camshafts With Seal Rings
Courtesy of GENERAL MOTORS CORP.

7. Remove the intake (2)/exhaust (1) camshafts with the seal rings (3).

INSTALLATION PROCEDURE

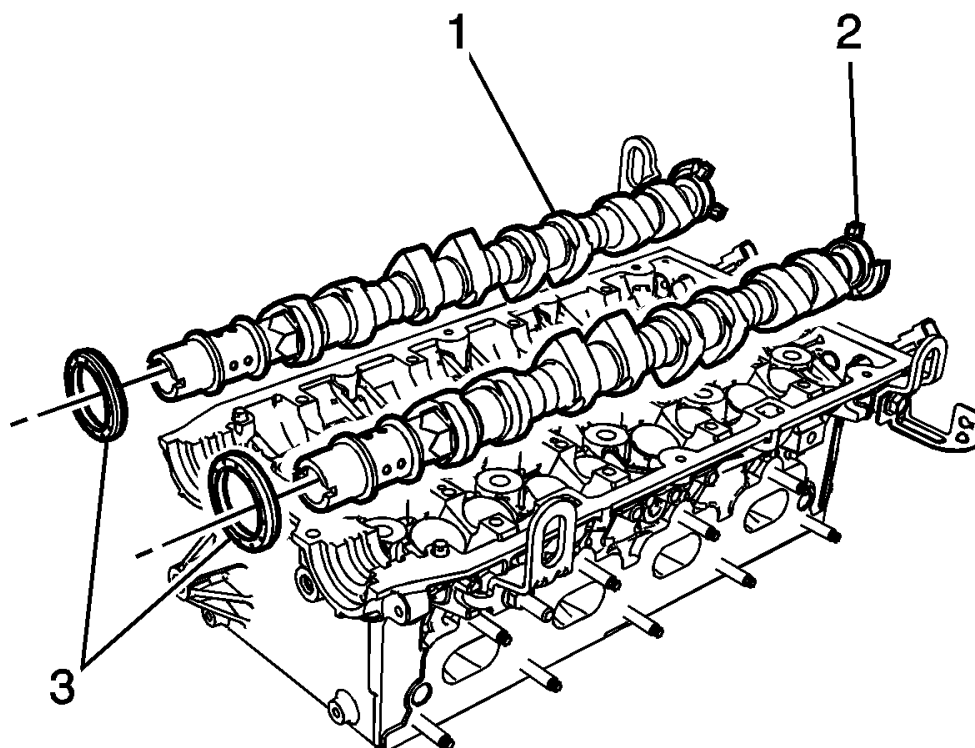


Fig. 120: Intake/Exhaust Camshafts With Seal Rings
 Courtesy of GENERAL MOTORS CORP.

1. Coat/Lubricate the camshaft bearing and cam surfaces with clean engine oil.

NOTE: It is essential to ensure that no sealant is applied outside the marked sealing areas.

2. Install the camshafts (1, 2) on the cylinder head.

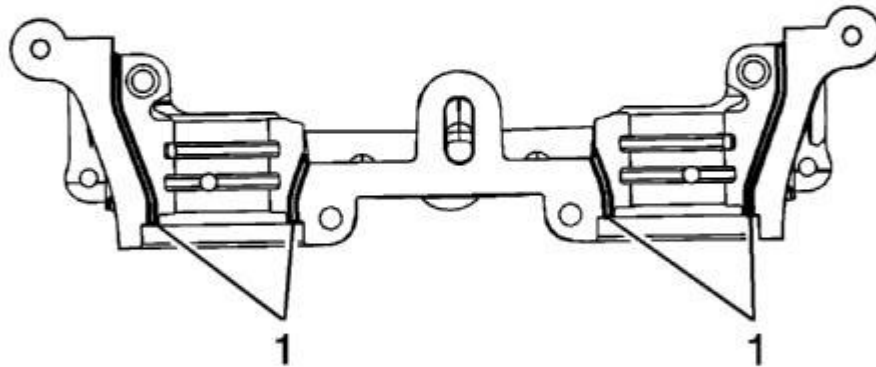


Fig. 121: Grooves Adjacent To Sealing Surfaces
Courtesy of GENERAL MOTORS CORP.

NOTE: The grooves (1) adjacent to the sealing surfaces must remain free from sealant

3. Apply surface sealant LOCTITE 574 to sealing surfaces of the 1st camshaft bearing cap thinly and evenly.

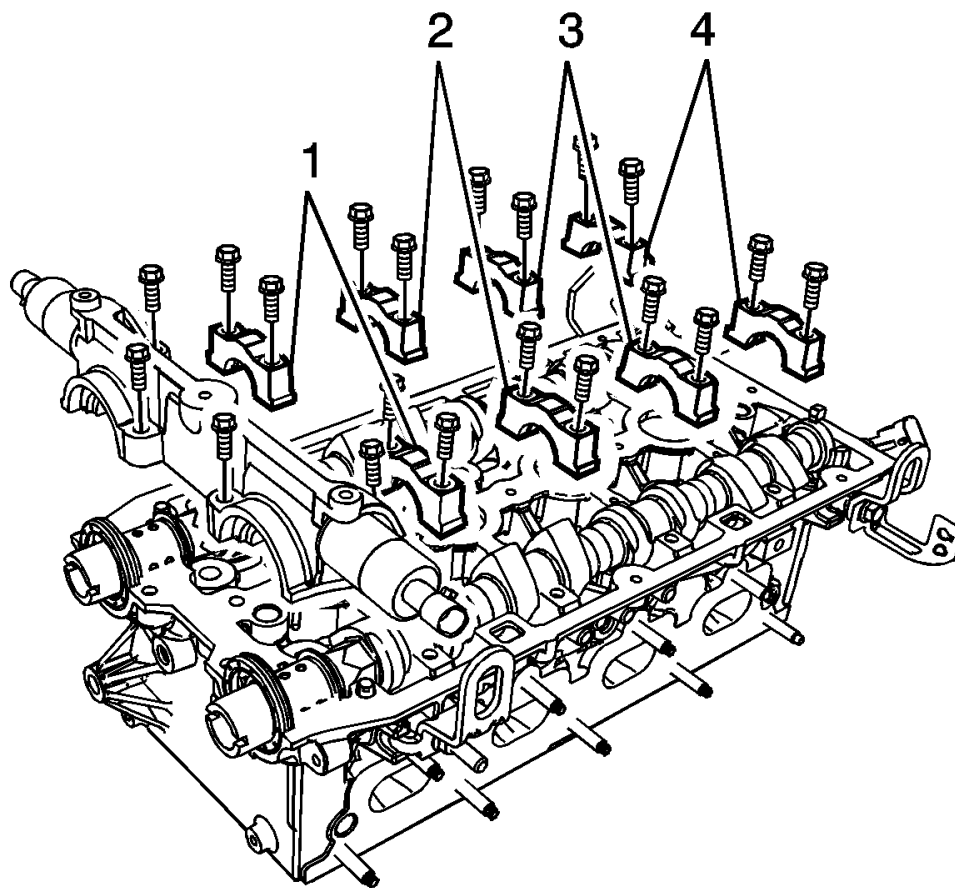


Fig. 122: Camshaft Position Solenoid Valve Housing, Camshaft Caps & Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the camshaft bearing caps in sequence (2, 3, 1, 4).

CAUTION: Refer to Fastener Caution .

5. Install the camshaft position solenoid valve housing.

Tighten: Tighten the camshaft bearing cap bolts to 8 N.m (70.8 lb in).

6. Install the new camshaft oil seal rings using **KM-422** . Refer to Camshaft Front Oil Seal Replacement.

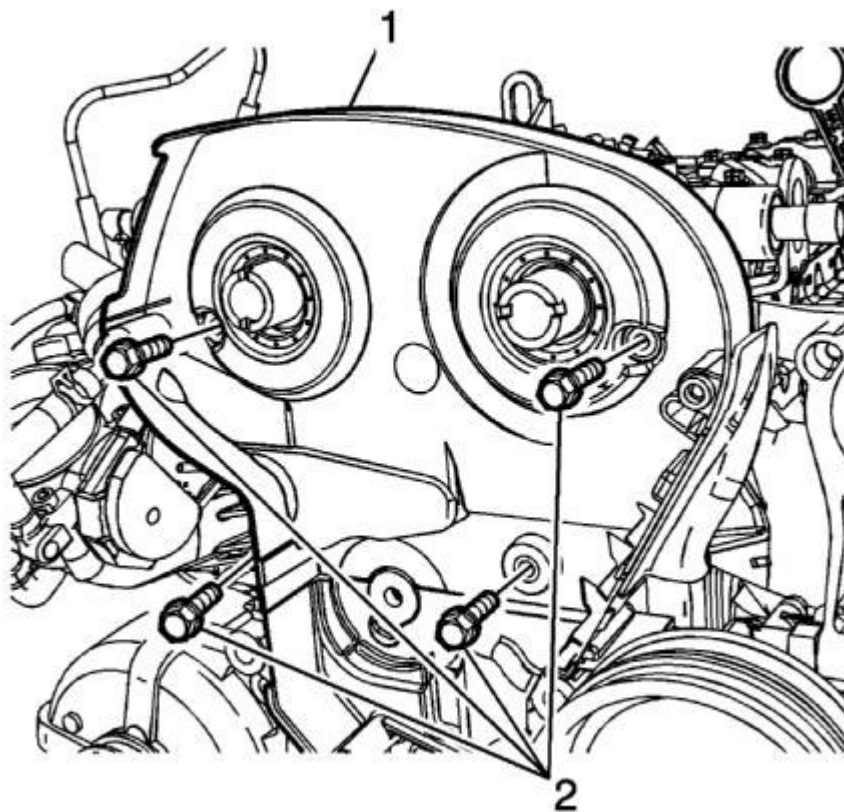


Fig. 123: Timing Belt Rear Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

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

Tighten: Tighten the timing belt rear cover bolts (2) to 6 N.m (53.1 lb in).

8. Install the timing belt tensioner. Refer to **Timing Belt Replacement**.
9. Install the camshaft intake and exhaust sprockets. Refer to **Camshaft Intake Sprocket with Actuator Replacement** and **Camshaft Exhaust Sprocket with Actuator Replacement**.

CAMSHAFT GEAR REPLACEMENT

REMOVAL PROCEDURE

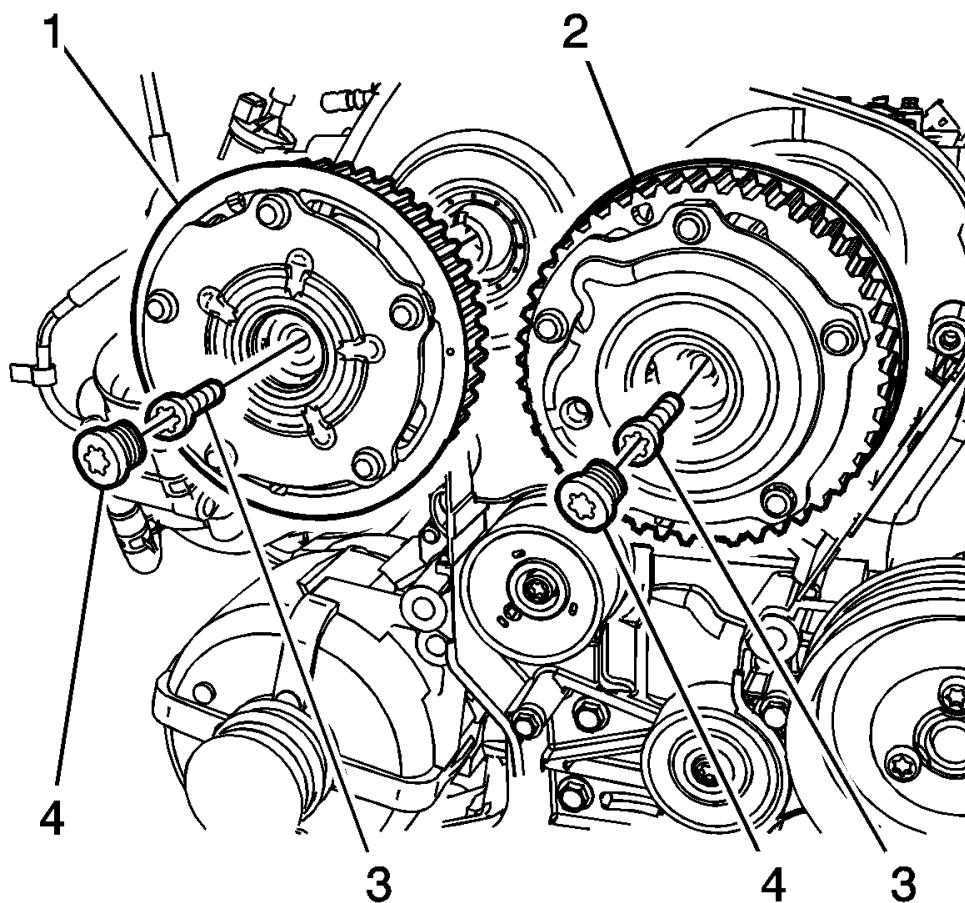


Fig. 124: Camshaft Sprockets, Caps & Bolts
 Courtesy of GENERAL MOTORS CORP.

1. Remove the timing belt. Refer to **Timing Belt Replacement**.
2. Remove the camshaft sprocket bolt cap (4).
3. Remove the camshaft sprocket bolts (3).
4. Remove the camshaft sprockets (1, 2).

INSTALLATION PROCEDURE

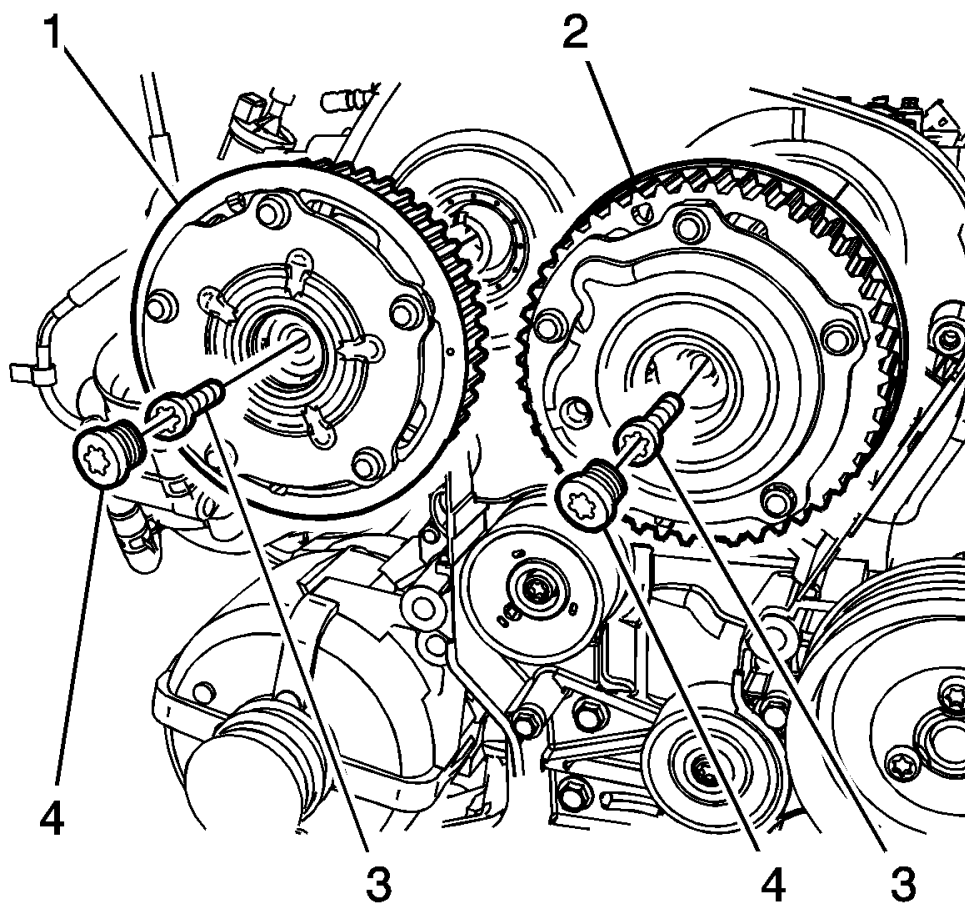


Fig. 125: Camshaft Sprockets, Caps & Bolts
 Courtesy of GENERAL MOTORS CORP.

NOTE: When installing the camshaft sprockets, the timing adjustment procedure must be accomplished. Refer to Timing Belt Replacement.

1. Install the camshaft sprockets (1, 2).

CAUTION: Refer to Fastener Caution .

2. Install the camshaft sprocket bolts (3).

Tighten: Tighten the camshaft sprocket bolts to 65 N.m (47.9 lb ft).

3. Install the camshaft sprocket bolt caps (4).

Tighten: Tighten the camshaft sprocket bolt cap to 50 N.m (36.8 lb ft).

4. Install the timing belt. Refer to **Timing Belt Replacement**.

CAMSHAFT CLEANING AND INSPECTION

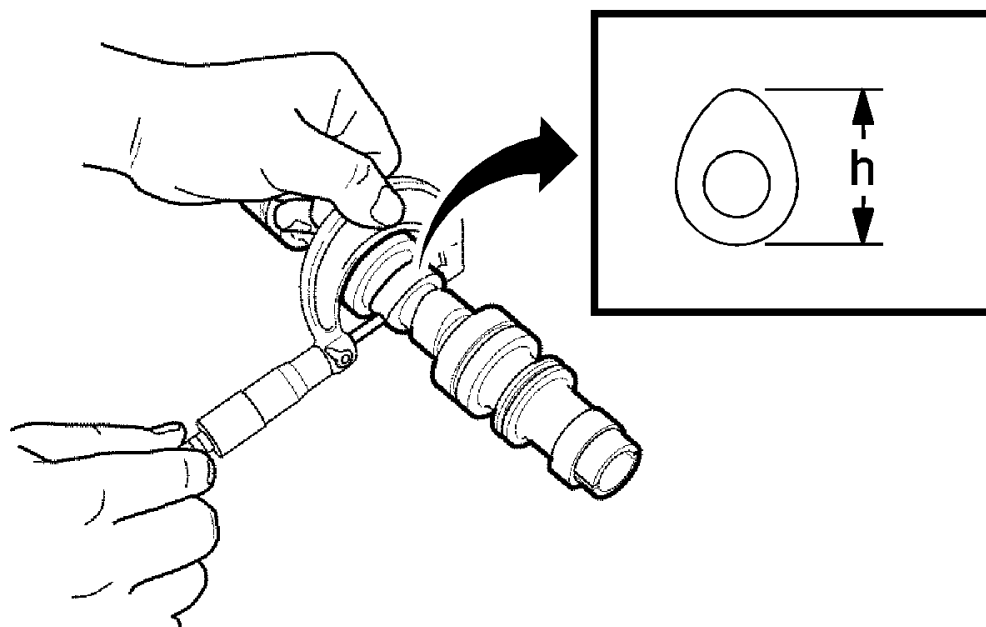


Fig. 126: Measuring Camshaft Lift
Courtesy of GENERAL MOTORS CORP.

1. Measure the camshaft lift.
2. Replace the camshaft if the measured value is not as specified.

Specification: The specification is 46.3 mm (1.8228 in).

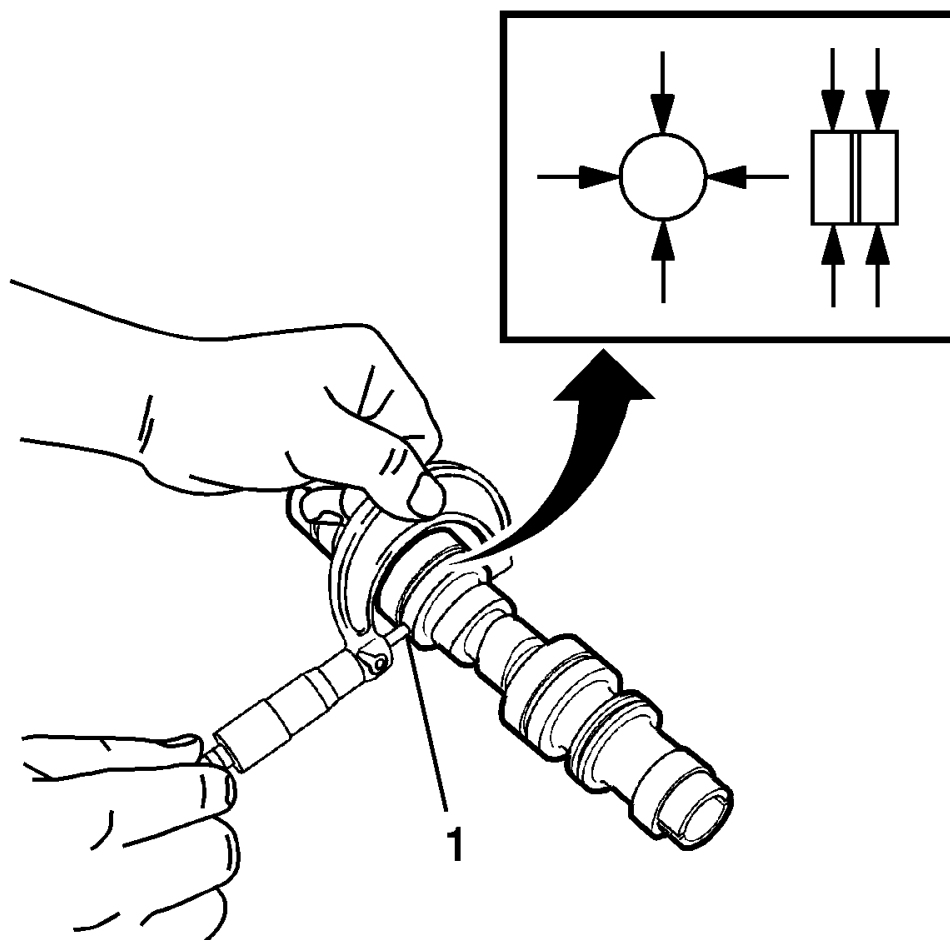


Fig. 127: Measuring Outer Diameter Of Camshaft Journal
 Courtesy of GENERAL MOTORS CORP.

3. Measure the outer diameter of each journal (1) at the 4 different places.
4. Replace the camshaft if the measured value is not as specified.

Specification: The specification is 27.939-27.960 mm (1.1000-1.1008 in).

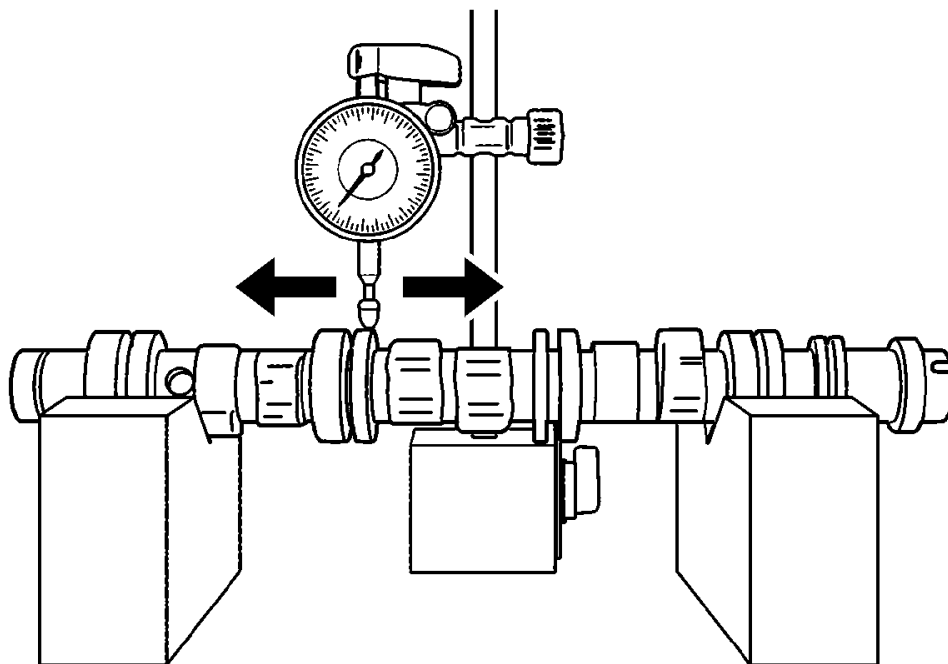


Fig. 128: Measuring Straightness Of Camshaft
 Courtesy of GENERAL MOTORS CORP.

5. Measure the straightness of the camshaft using a dial gauge.
6. Replace the camshaft if the measured value is over the specified limit.

Specification: The specification limit is 0.04 mm (0.0016 in).

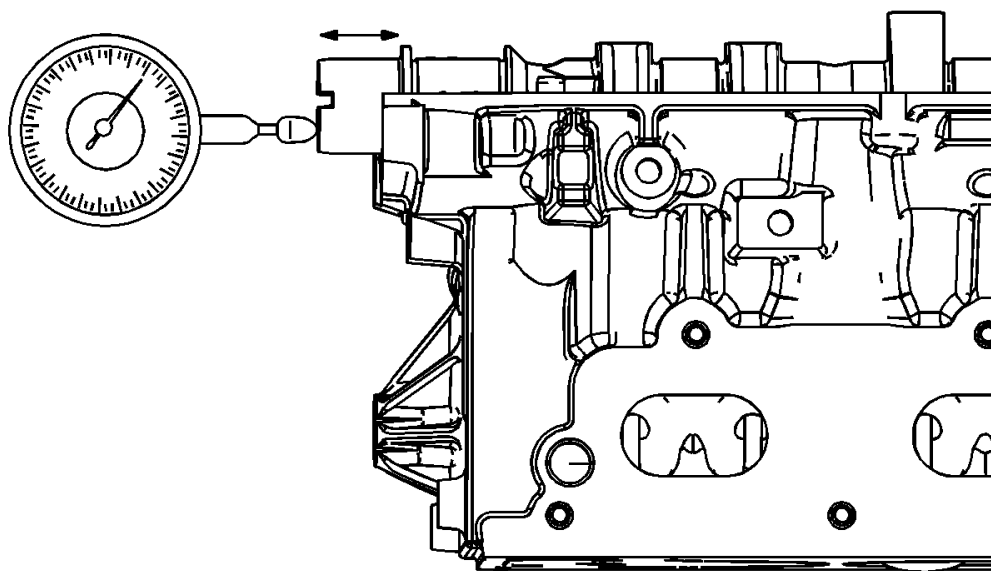


Fig. 129: Measuring Camshaft Endplay
Courtesy of GENERAL MOTORS CORP.

7. Measure the camshaft endplay using a dial gauge.
8. Replace the camshaft if the measured value is over the specified limit.

Specification: The specification limit is 0.130-.215 mm (0.0051-.0085 in).

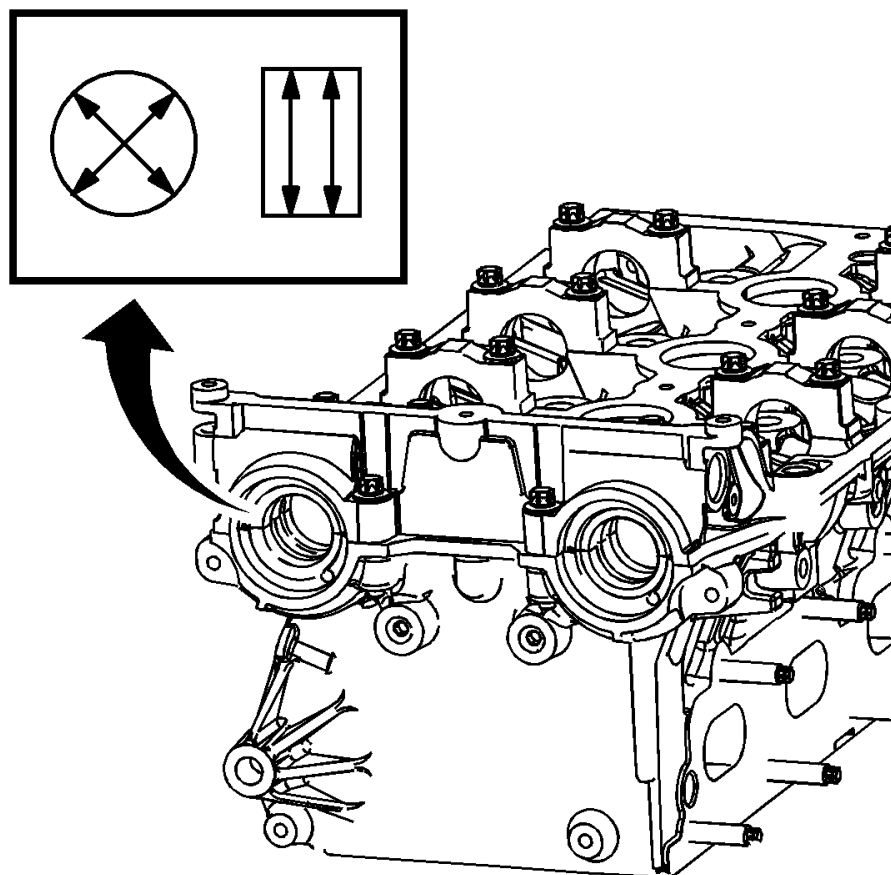


Fig. 130: Measuring Inner Diameter Of Cylinder Head Journal
Courtesy of GENERAL MOTORS CORP.

9. Measure the inner diameter of the cylinder head journal at the 2 places.

Specification: The specification limit is 28.000-28.021 mm (1.1024-1.1032 in).

10. If necessary, replace cylinder head.

VALVE CLEARANCE ADJUSTMENT

MEASUREMENT

1. Remove the valve rocker arm cover. Refer to Valve Rocker Arm Cover Replacement.

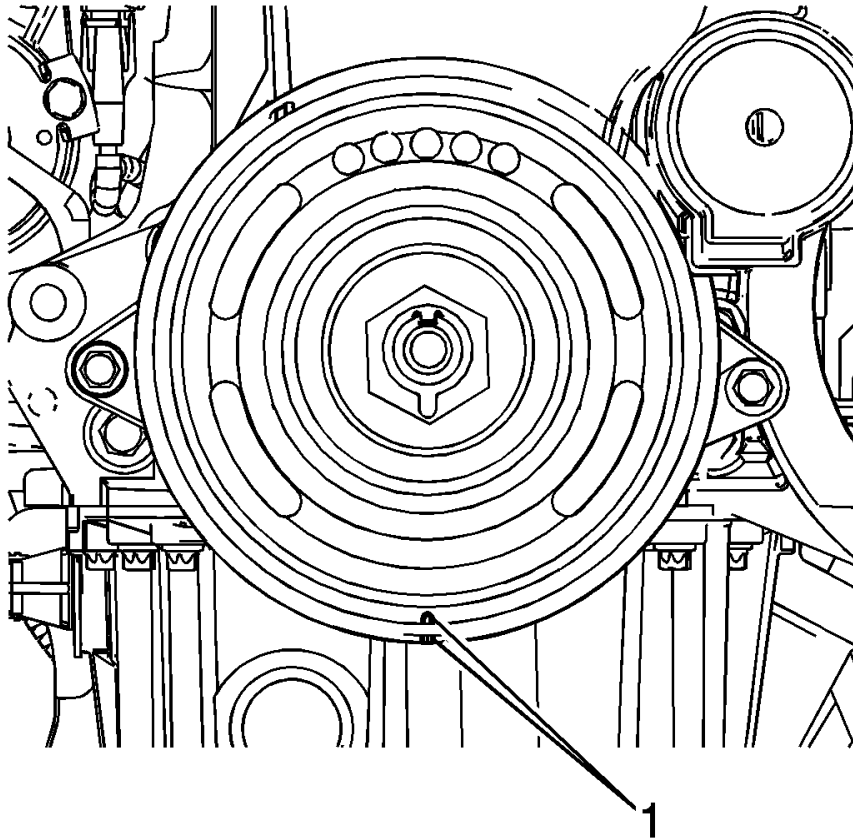


Fig. 131: Aligning Crankshaft Pulley & Cover
Courtesy of GENERAL MOTORS CORP.

2. Rotate the crankshaft pulley clockwise, aligning the notches (1) between the pulley and the cover.

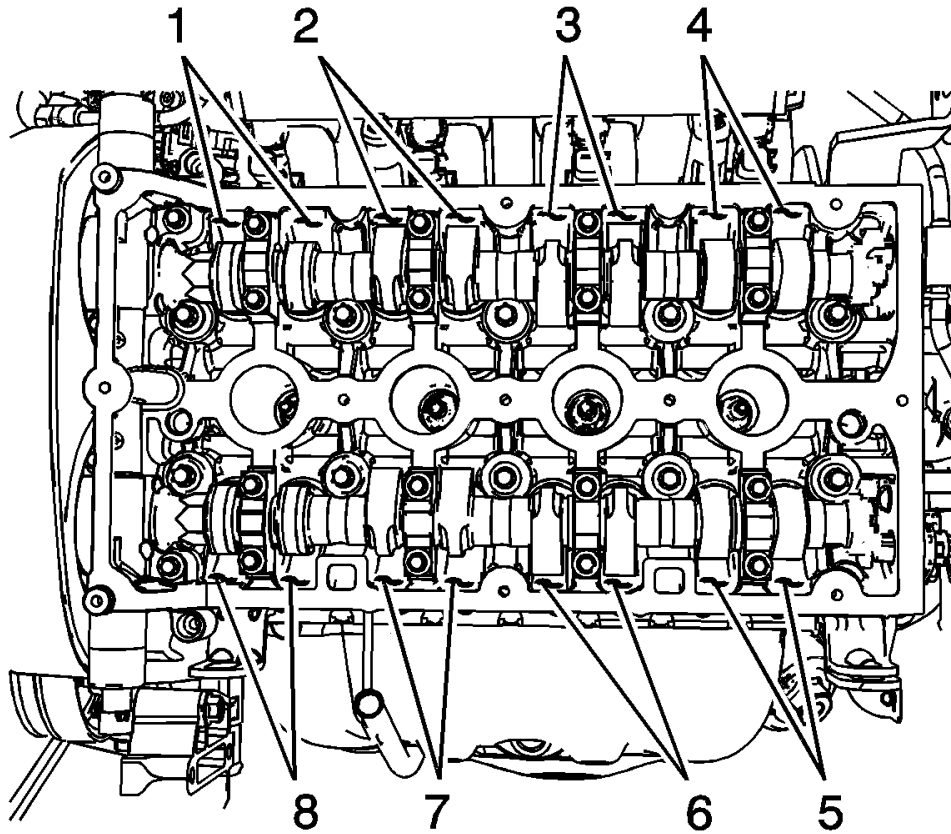


Fig. 132: Identifying Valve Clearance Positions
Courtesy of GENERAL MOTORS CORP.

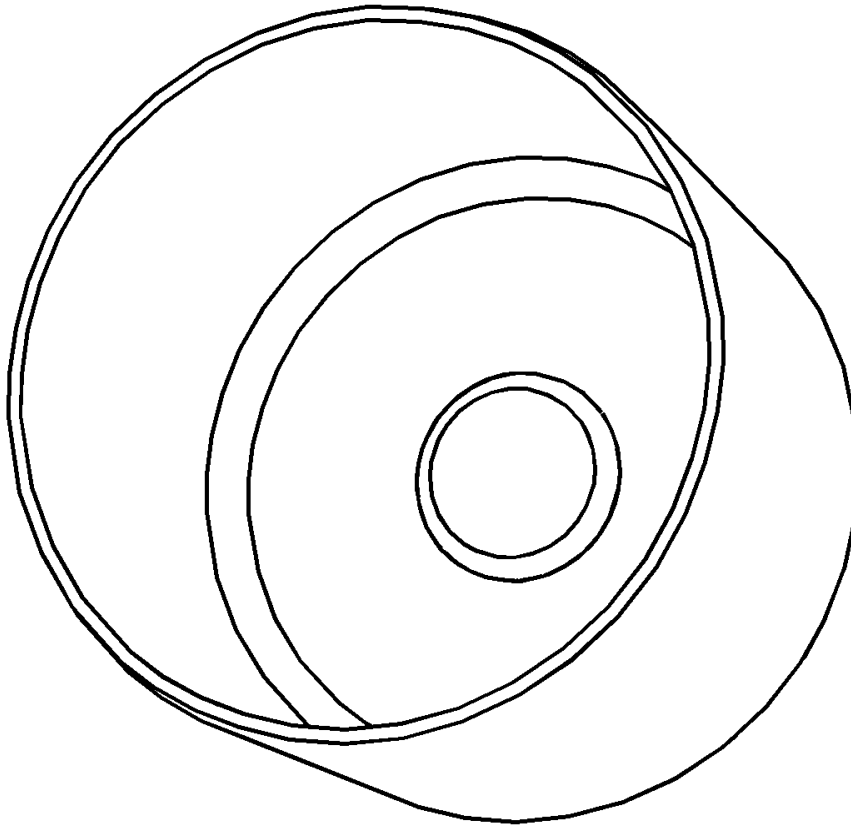
3. Measure the valve clearance at positions (2) and (6). Rotate the crankshaft pulley clockwise 180 degrees.
4. Measure the valve clearance at positions (3) and (7). Rotate the crankshaft pulley clockwise 180 degrees.
5. Measure the valve clearance at positions (4) and (8). Rotate the crankshaft pulley clockwise 180 degrees.
6. Measure the valve clearance at positions (1) and (5). Rotate the crankshaft pulley clockwise 180 degrees.
7. If the measured values are not within specifications, replace the valve tappets.

Specifications:

- Intake Side: 0.21-0.29 mm (Nominal Value: 0.25 mm)
- Exhaust Side: 0.27-0.35 mm (Nominal Value: 0.30 mm)

8. Determine the tappet size. Refer to Determining Replacement Tappet Size.
9. Replace the valve tappets if necessary. Refer to Cylinder Head Disassemble.

DETERMINE REPLACEMENT TAPPET SIZE

**Fig. 133: Tappet**

Courtesy of GENERAL MOTORS CORP.

1. Remove the old tappet.
2. Locate the ID number inside old tappet.
3. Locate the ID number in the following table and record the value.
4. Perform the following calculation to determine the replacement tappet size.

Value of removed tappet + measured clearance - nominal value = new tappet size

Example:

- ID of old tappet = 20 = 3.20 mm, clearance was 0.31 mm, nominal value is 0.25 mm
- $3.20 \text{ mm} + 0.31 \text{ mm} - 0.25 \text{ mm} = 3.265 \text{ mm}$
- $3.265 \text{ mm} = 27\text{X}$ (ID number) = 55353766 (part number)

Tappet Selection

2010 Chevrolet Aveo LS

2010 ENGINE Engine Mechanical - 1.6L (LDE, LLU, and LXV) or 1.8L (2H0) - Repair Instructions - On Vehicle

Part Number	ID Number	Value (mm)
24465260	04	3.060-3.050
24465261	06	3.050-3.070
24438041	08	3.070-3.090
24438145	10	3.090-3.110
24438146	12	3.110-3.130
24438147	14	3.130-3.150
24438148	16	3.150-3.170
24438149	18	3.170-3.190
24438150	20	3.190-3.210
24438151	22	3.210-3.230
55353764	24X	3.230-3.244
55353765	25X	3.244-3.258
55353766	27X	3.258-3.272
55353767	28X	3.272-3.286
55353768	30X	3.286-3.300
55353769	31X	3.300-3.314
55353770	32X	3.314-3.328
55353771	34X	3.328-3.342
55353772	35X	3.342-3.356
55353773	36X	3.356-3.370
55353774	38X	3.370-3.384
55353775	39X	3.384-3.398
55353776	41X	3.398-3.412
55353777	42X	3.412-3.426
55353778	43X	3.426-3.440
55353779	45	3.440-3.460
55353780	47	3.460-3.480
55353781	49	3.480-3.500
55353782	51	3.500-3.520
55353783	53	3.520-3.540
55353784	55	3.540-3.560
55353785	57	3.560-3.580
55353786	59	3.580-3.600

VALVE SPRING INSPECTION AND MEASUREMENT

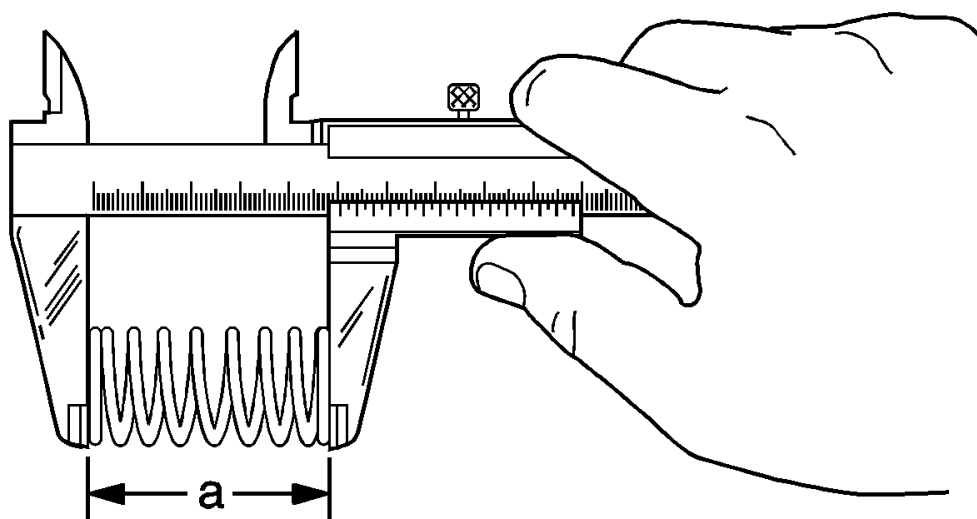


Fig. 134: Inspecting Valve Spring Height
 Courtesy of GENERAL MOTORS CORP.

1. Measure the valve spring height (a). Refer to **Engine Mechanical Specifications** . If the valve spring height does not match the specifications, replace the valve spring.

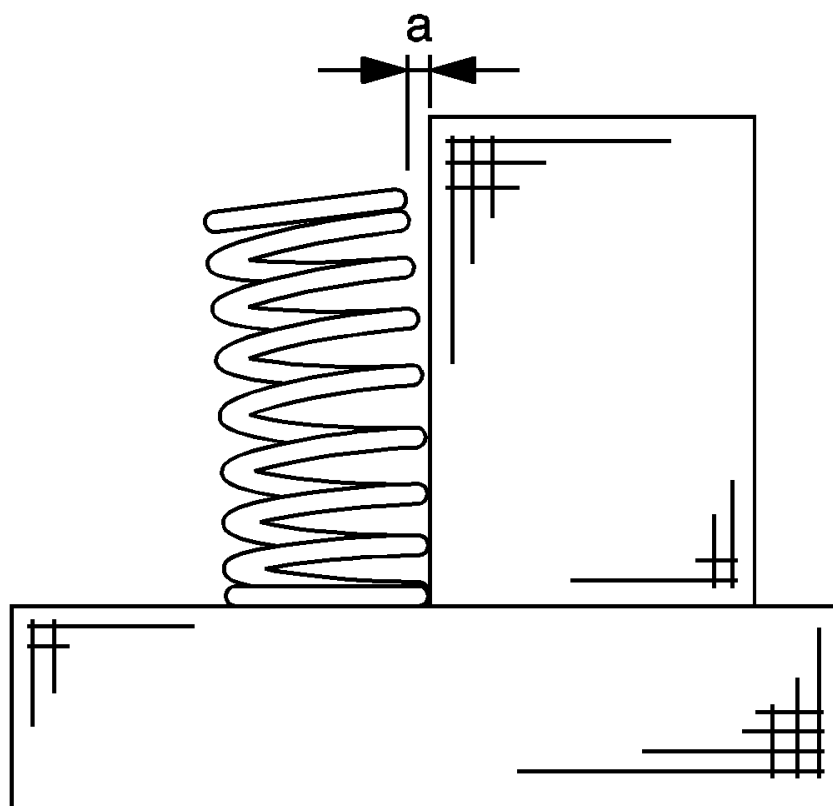


Fig. 135: Valve Spring Squareness
Courtesy of GENERAL MOTORS CORP.

2. Measure the valve spring squareness (a). Refer to **Engine Mechanical Specifications** . If the valve spring squareness does not match the specifications, replace the valve spring.
3. Inspect the valve spring seating surface of the valve rotators for wear or gouges. Replace as required.