

2006 ENGINE

Engine Mechanical - 3.6L - STS (2 Of 5)

CYLINDER HEAD REPLACEMENT - RIGHT SIDE

REMOVAL PROCEDURE

1. Remove the right bank secondary timing chain. Refer to **Secondary Camshaft Drive Chain Replacement - Right Side** .
2. Remove the coolant inlet pipe bolts and reposition the coolant inlet pipe to provide access. Refer to **Engine Coolant Inlet Pipe Replacement (LY7)** .
3. Remove the catalytic converter. Refer to **Catalytic Converter Replacement - Right Side (LY7)** .

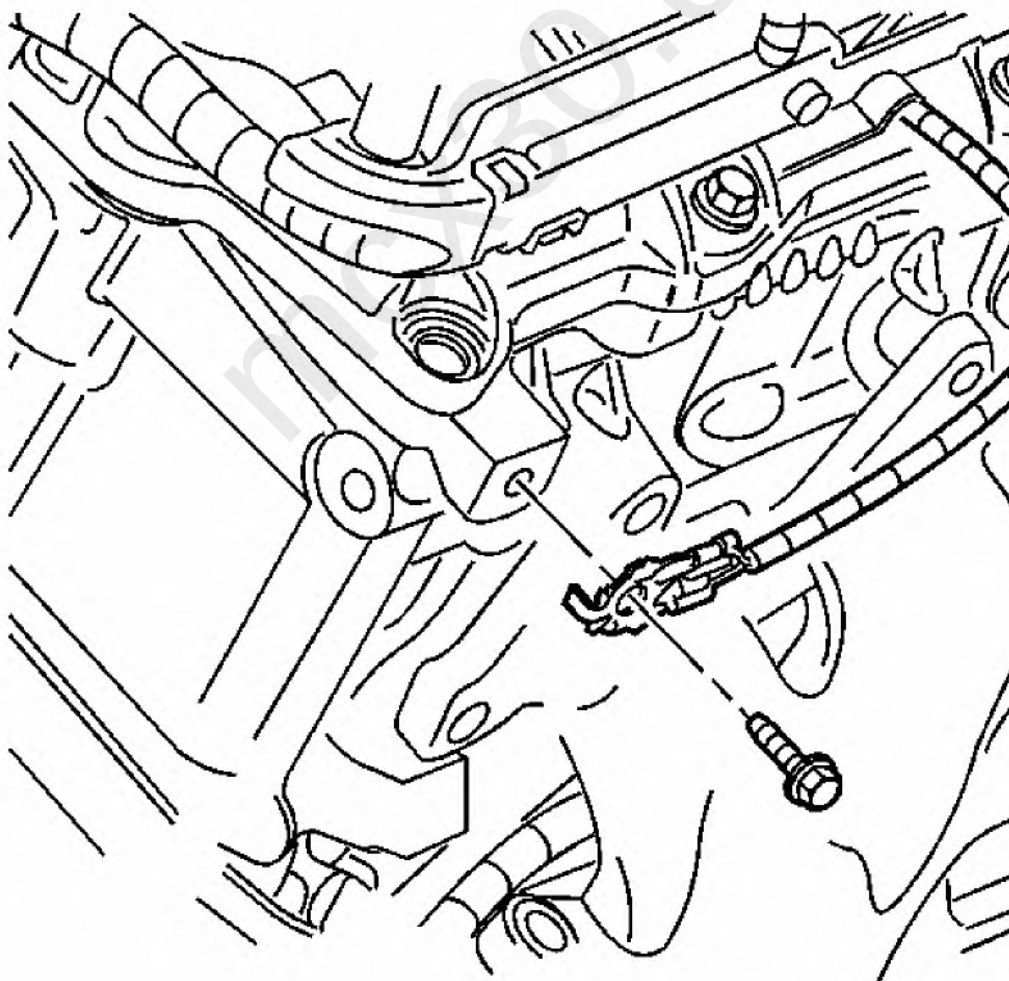


Fig. 1: View Of Wiring Harness Ground Bolt At Side Of Right Cylinder Head
Courtesy of GENERAL MOTORS CORP.

4. Remove the wiring harness ground from the side of the cylinder head.

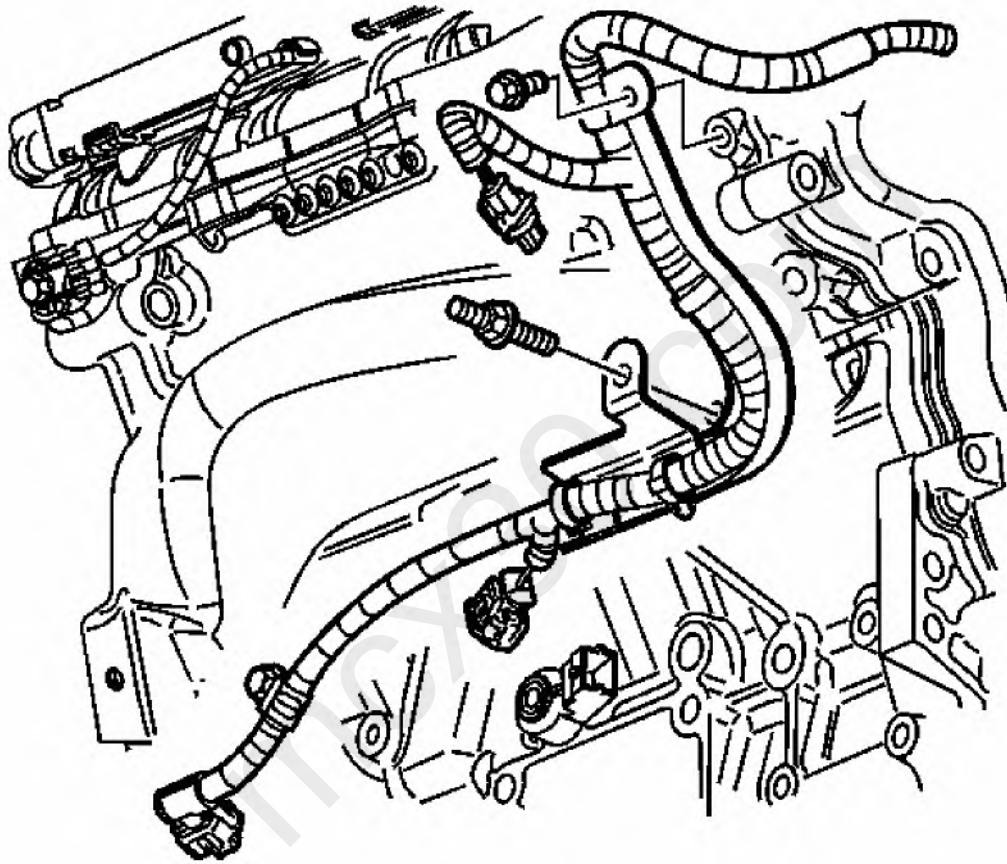


Fig. 2: Locating Engine Wiring Harness Bracket Bolt & Engine Wiring Harness Bracket Stud
Courtesy of GENERAL MOTORS CORP.

5. Remove the wiring harness conduit upper bolt from the cylinder head and reposition the conduit to provide access.
6. Remove the battery cable from the cylinder head. Refer to **Battery Negative Cable Replacement (LY7)** or **Battery Negative Cable Replacement (LH2)** or **Battery Negative Cable Replacement (LC3)** .

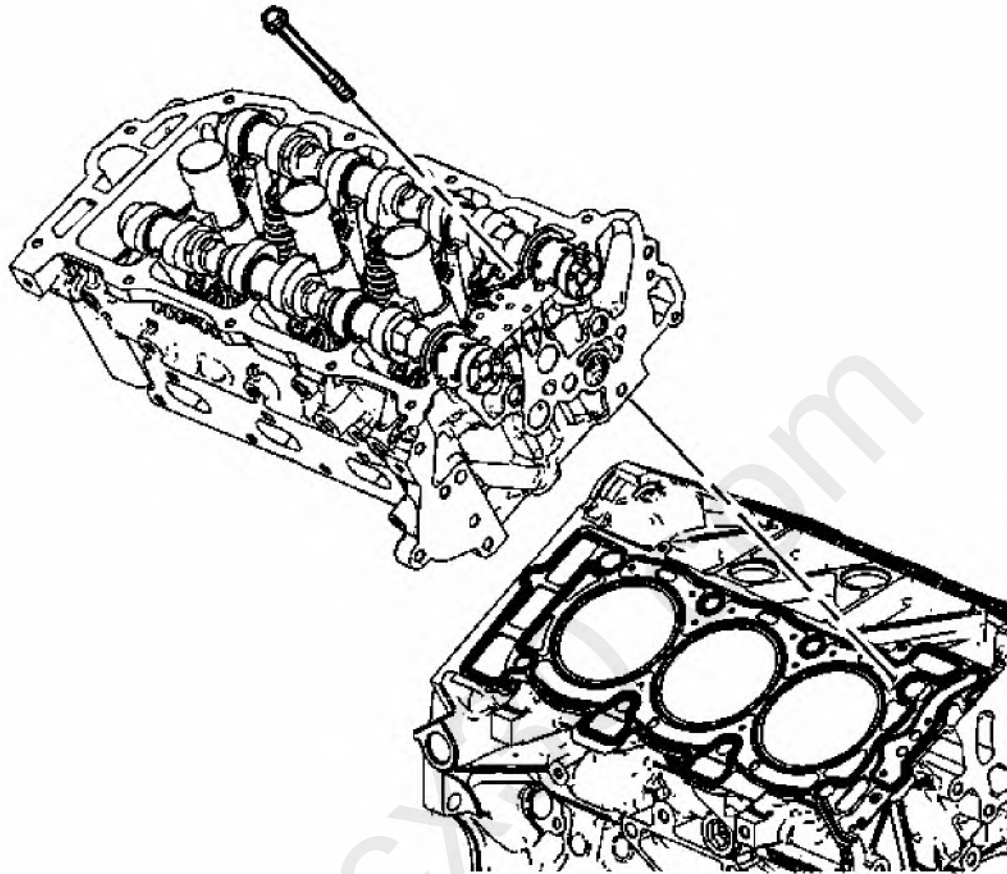


Fig. 3: View Of Right Cylinder Head
Courtesy of GENERAL MOTORS CORP.

7. Remove the cylinder head with the exhaust manifold. Refer to **Cylinder Head Removal - Right Side** .

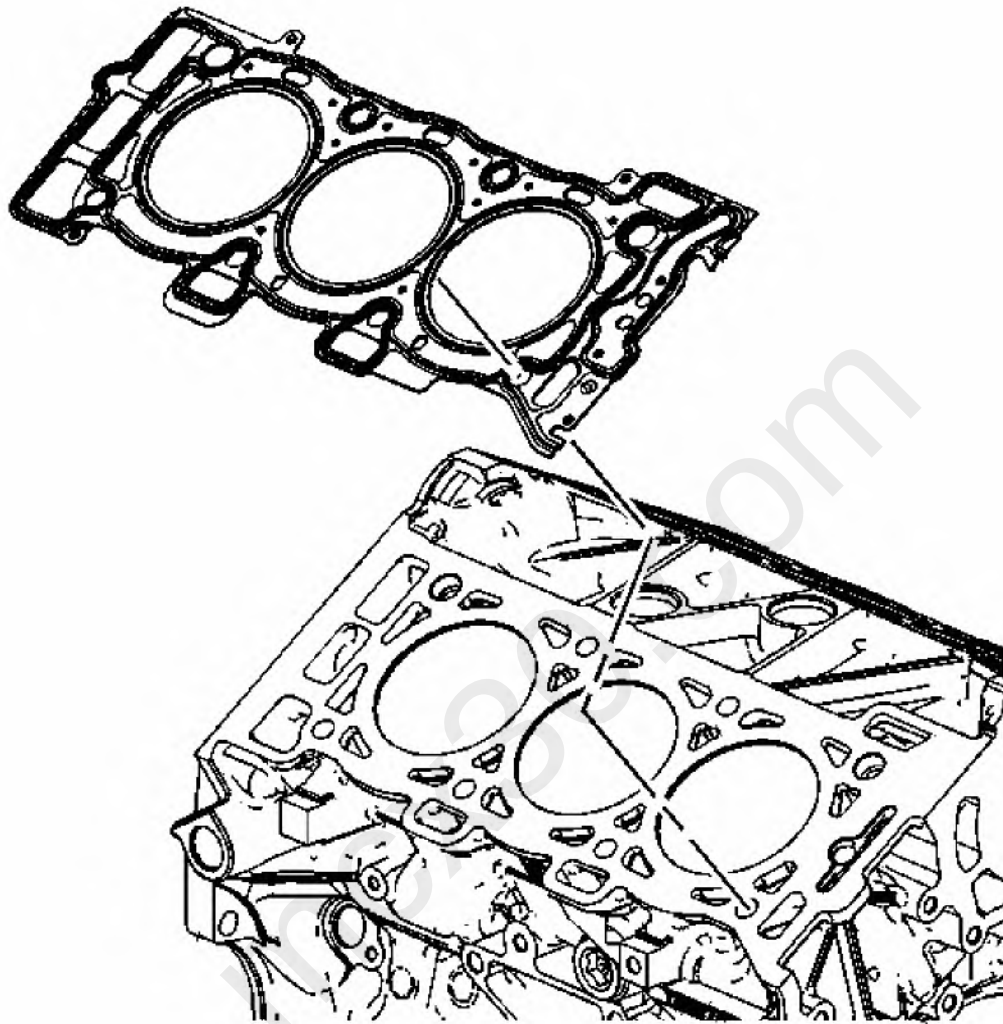


Fig. 4: View Of Right Cylinder Head Gasket
Courtesy of GENERAL MOTORS CORP.

8. Remove and discard the cylinder head gasket.
9. Clean and inspect the cylinder head and the engine block sealing surfaces. Refer to **Cylinder Head Cleaning and Inspection** and **Engine Block Cleaning and Inspection** .
10. If necessary, perform the following steps:
 - Remove the exhaust manifold from the cylinder head. Refer to **Exhaust Manifold Removal - Right Side (RWD)** or **Exhaust Manifold Removal - Right Side (AWD)**.
 - Disassemble the cylinder head. Refer to **Cylinder Head Disassemble** .

INSTALLATION PROCEDURE

1. If necessary, perform the following steps:
 - Assemble the cylinder head. Refer to **Cylinder Head Assemble** .
 - Install the exhaust manifold to the cylinder head. Refer to **Exhaust Manifold Installation - Right Side (RWD)** or **Exhaust Manifold Installation - Right Side (AWD)** .

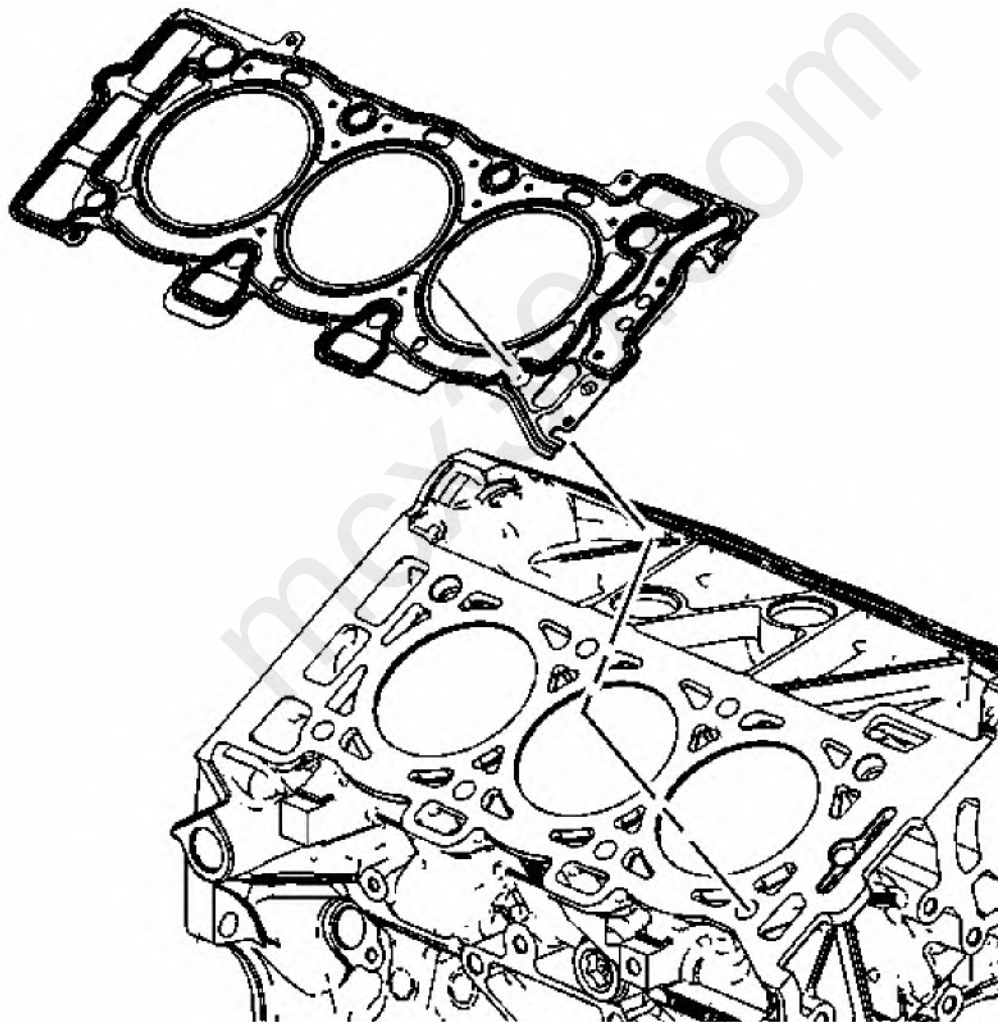


Fig. 5: View Of Right Cylinder Head Gasket
Courtesy of GENERAL MOTORS CORP.

2. Install a NEW cylinder head gasket.

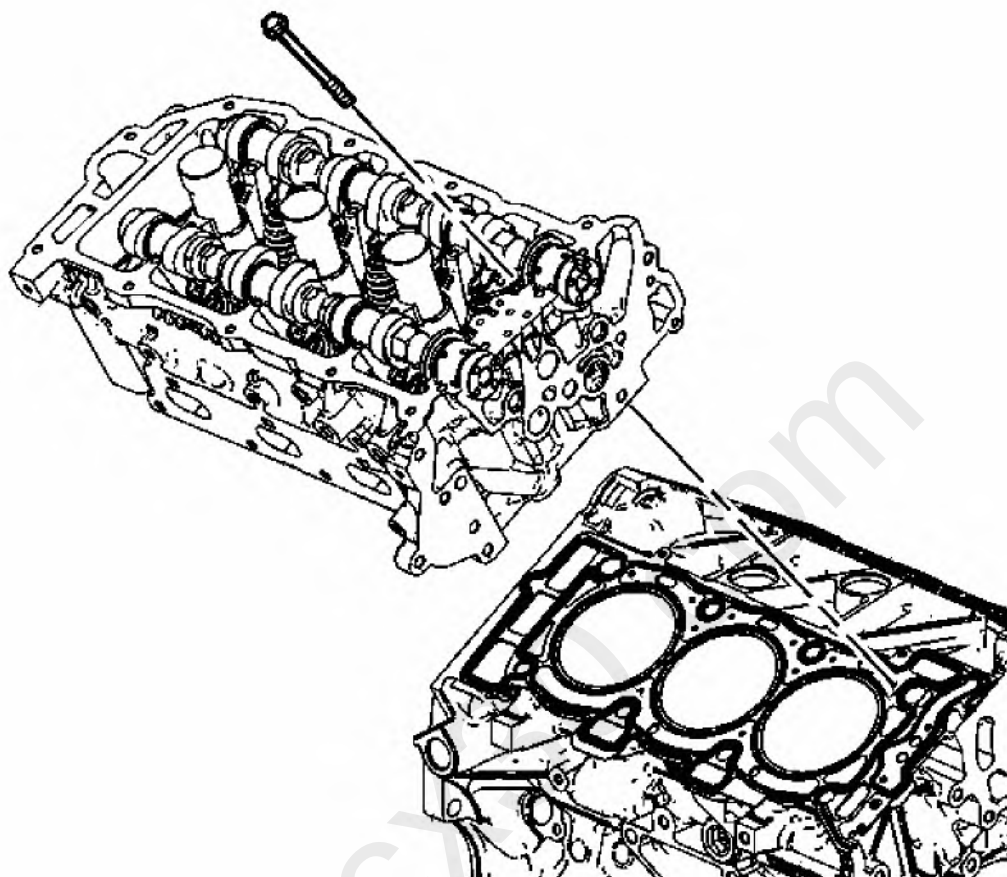


Fig. 6: View Of Right Cylinder Head
Courtesy of GENERAL MOTORS CORP.

3. Carefully install the cylinder head with the exhaust manifold to the engine. Refer to **Cylinder Head Installation - Right Side** .
4. Connect the catalytic converter to the exhaust manifold.
5. Install the battery negative cable to the cylinder head. Refer to **Battery Negative Cable Replacement (LY7)** or **Battery Negative Cable Replacement (LH2)** or **Battery Negative Cable Replacement (LC3)** .

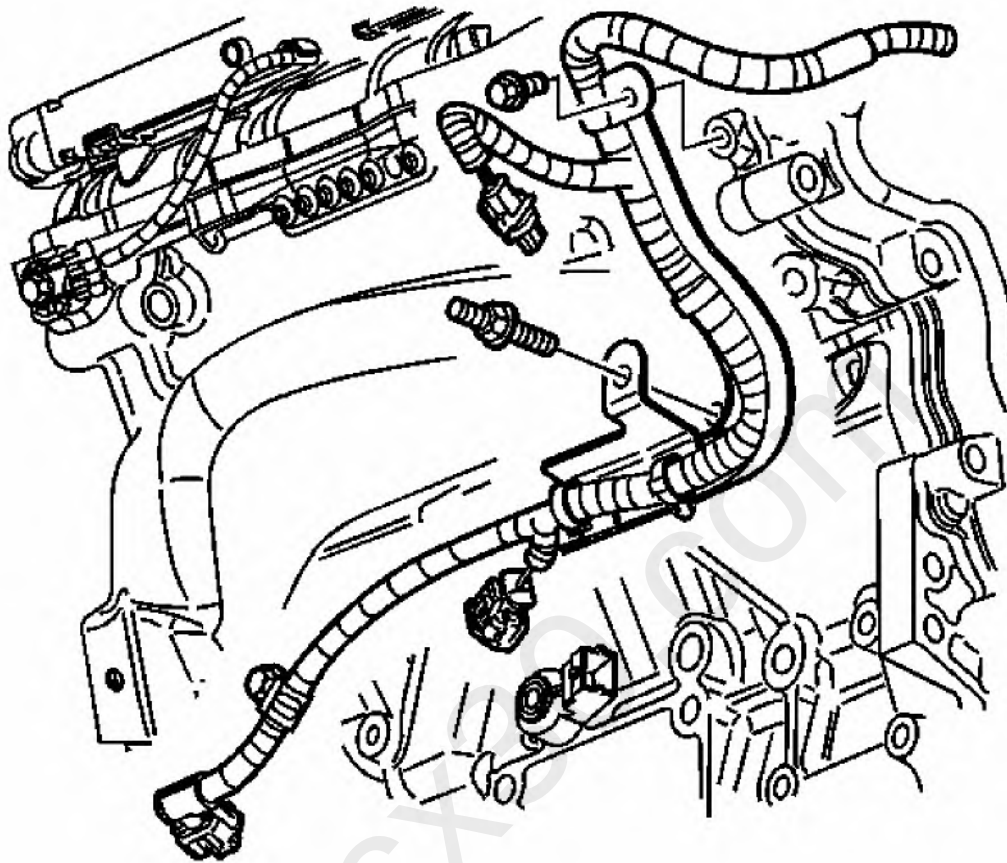


Fig. 7: Locating Engine Wiring Harness Bracket Bolt & Engine Wiring Harness Bracket Stud

Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

6. Install the wiring harness conduit to the cylinder head.

Tighten: Tighten the wiring harness upper bolt to 10 N.m (89 lb in).

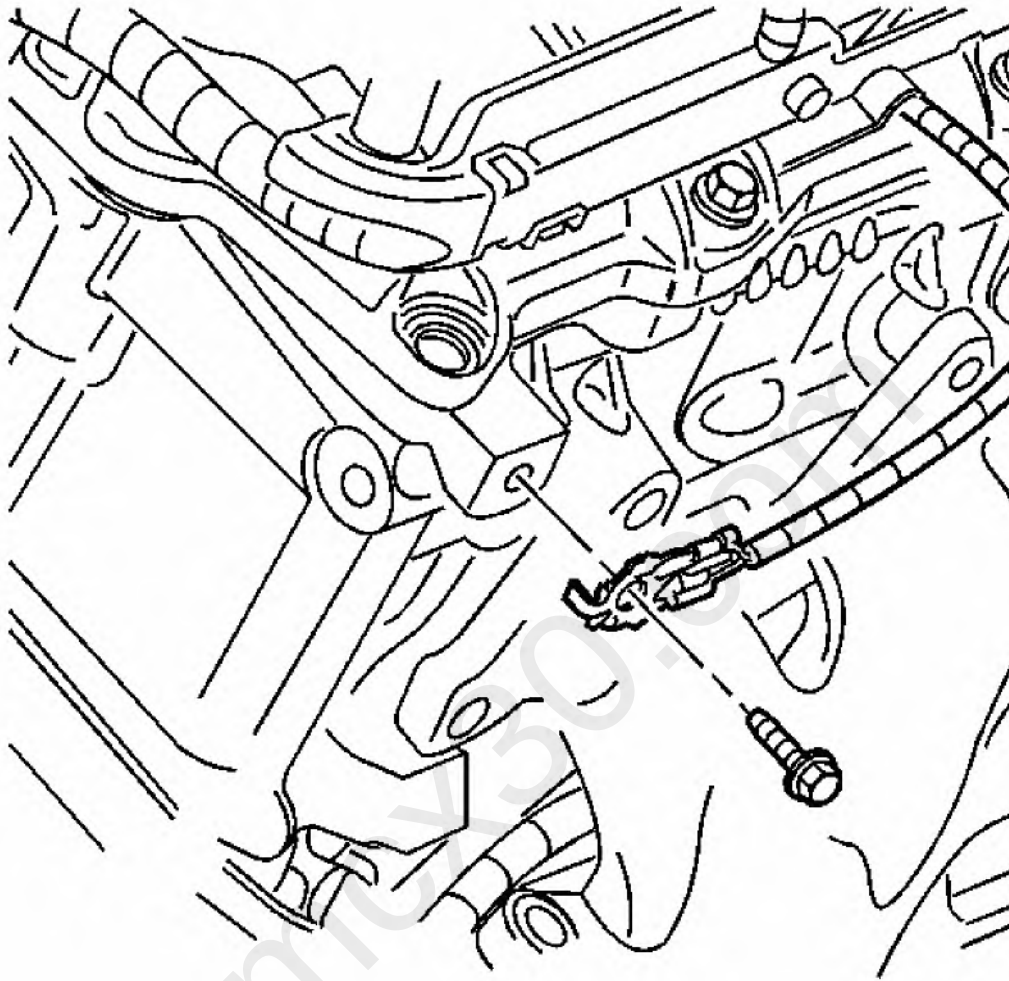


Fig. 8: View Of Wiring Harness Ground Bolt At Side Of Right Cylinder Head
Courtesy of GENERAL MOTORS CORP.

7. Install the wiring harness ground to the side of the cylinder head.

Tighten: Tighten the wiring harness ground bolt to 10 N.m (89 lb in).

8. Install the catalytic converter. Refer to **Catalytic Converter Replacement - Right Side (LY7)** .
9. Install the coolant inlet pipe. Refer to **Engine Coolant Inlet Pipe Replacement (LY7)** .
10. Install the right bank secondary timing chain. Refer to **Secondary Camshaft Drive Chain Replacement - Right Side** .

ENGINE FLYWHEEL REPLACEMENT

REMOVAL PROCEDURE

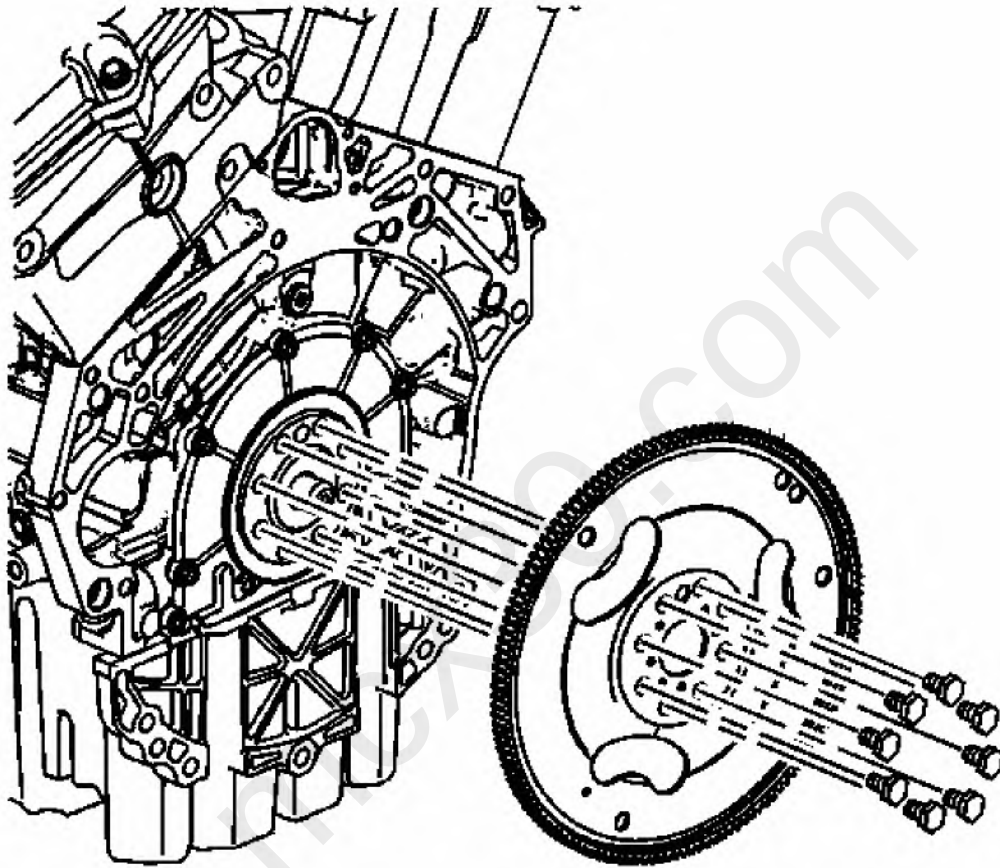


Fig. 9: View Of Engine Flywheel
Courtesy of GENERAL MOTORS CORP.

1. Remove the transmission. Refer to **Transmission Replacement (w/RPO LH2)** .
2. Remove the engine flywheel bolts and the flywheel. Refer to **Engine Flywheel Removal**.
3. Clean and inspect the flywheel. Refer to **Engine Flywheel Cleaning and Inspection** . If the flywheel teeth are damaged, inspect the starter for proper operation. Replace the starter if you find excessive wear or damage to the starter drive. Refer to **Starter Motor Replacement (LY7)** or **Starter Motor Replacement (LH2)** or **Starter Motor Replacement (LC3)** .

INSTALLATION PROCEDURE

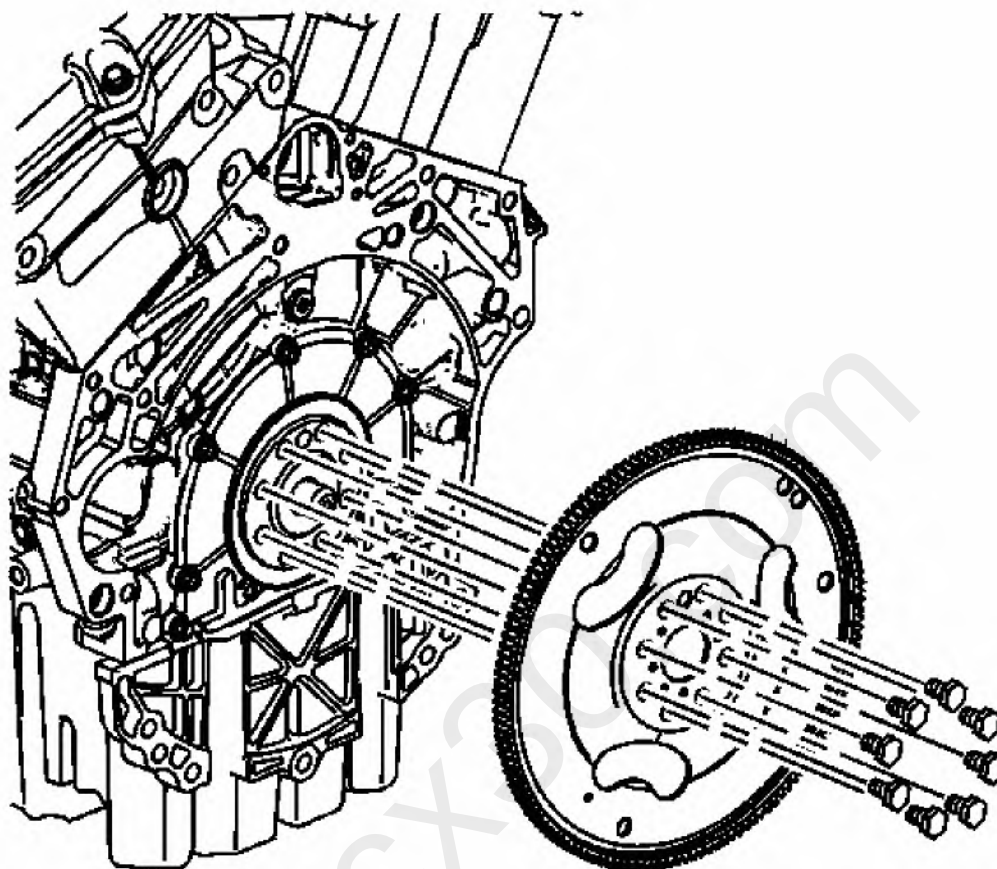


Fig. 10: View Of Engine Flywheel
Courtesy of GENERAL MOTORS CORP.

1. Install the engine flywheel. Refer to Engine Flywheel Installation .
2. Install the transmission. Refer to Transmission Replacement (w/RPO LH2) .

CRANKSHAFT REAR OIL SEAL AND HOUSING REPLACEMENT

REMOVAL PROCEDURE

1. Remove the engine flywheel. Refer to Engine Flywheel Replacement.
2. Remove the oil pan. Refer to Oil Pan Replacement.

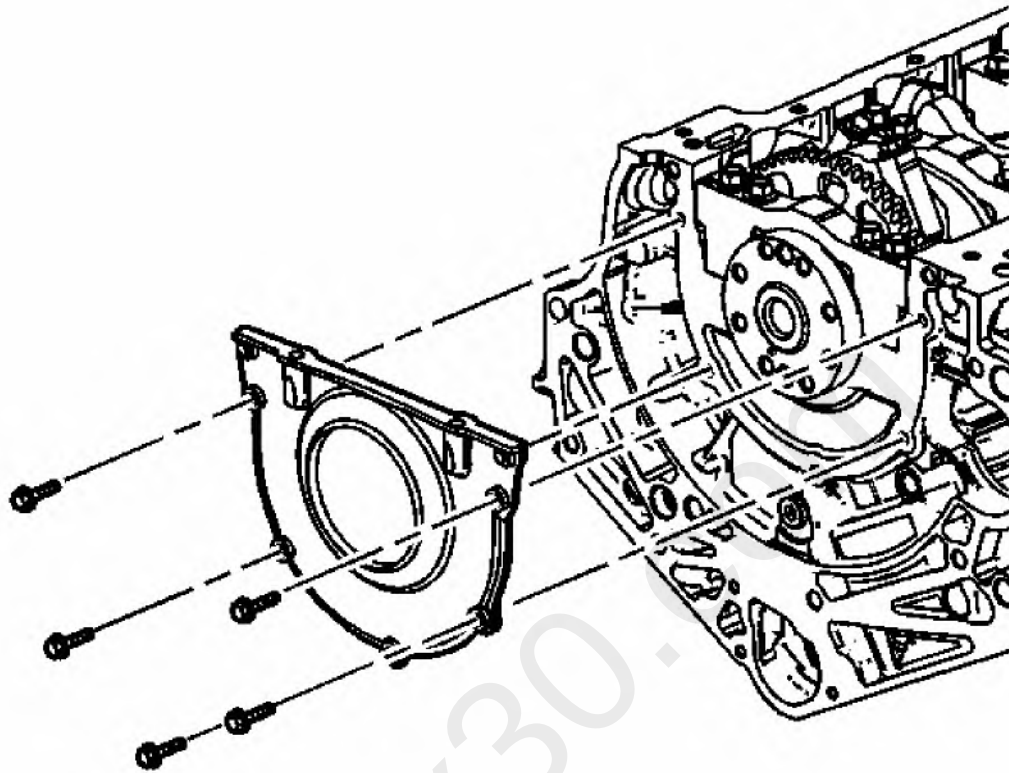


Fig. 11: View Of Crankshaft Rear Oil Seal And Housing
Courtesy of GENERAL MOTORS CORP.

3. Remove the crankshaft rear oil seal and housing. Refer to **Crankshaft Rear Oil Seal and Housing Removal** .

INSTALLATION PROCEDURE

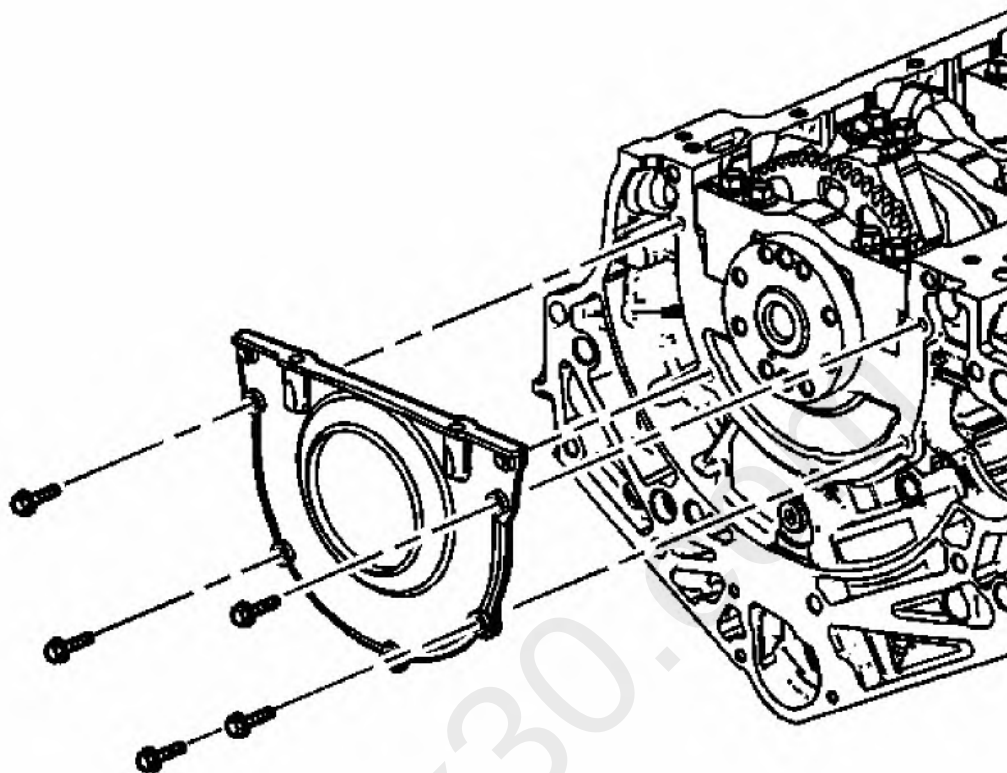


Fig. 12: View Of Crankshaft Rear Oil Seal And Housing
Courtesy of GENERAL MOTORS CORP.

1. Install the crankshaft rear oil seal and housing. Refer to **Crankshaft Rear Oil Seal and Housing Installation** .
2. Install the oil pan. Refer to **Oil Pan Replacement**.
3. Install the engine flywheel. Refer to **Engine Flywheel Replacement**.

OIL PUMP REPLACEMENT

REMOVAL PROCEDURE

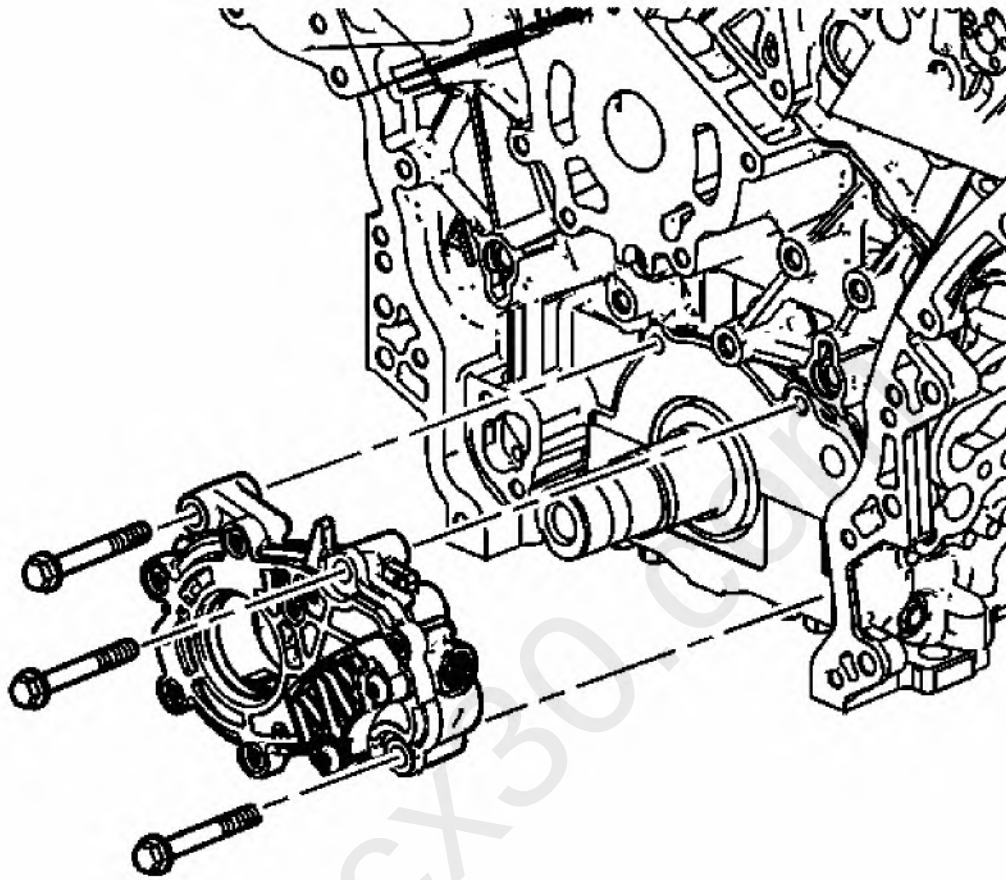


Fig. 13: View Of Oil Pump & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not remove the left bank idler sprocket.

1. Remove the primary timing chain. Refer to **Primary Camshaft Drive Chain and Sprockets Replacement**.
2. Remove the crankshaft sprocket. Refer to **Crankshaft Sprocket Removal (Second Design)**.
3. Remove the oil pump bolts and the oil pump. Refer to **Oil Pump Removal**.
4. Perform the following steps as necessary:
 - Disassemble the oil pump. Refer to **Oil Pump Disassemble**.
 - Clean and inspect the oil pump. Refer to **Oil Pump Cleaning and Inspection**.

1. Assemble the oil pump as necessary. Refer to Oil Pump Assemble .

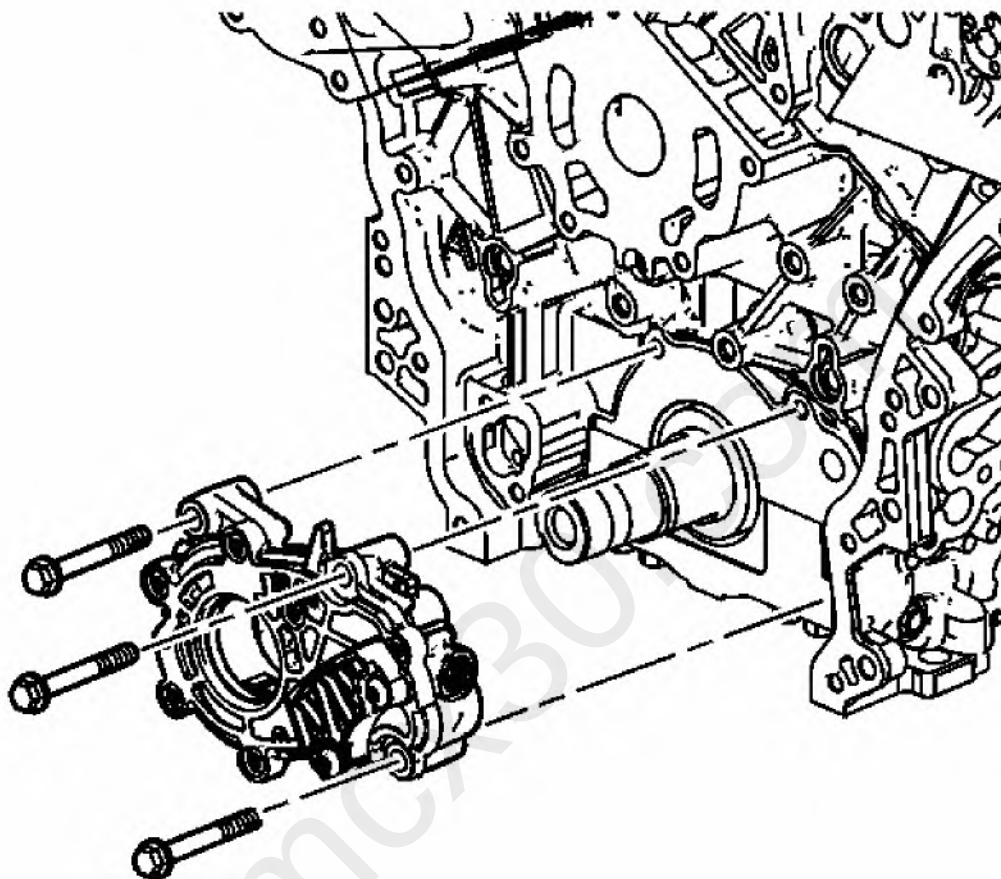


Fig. 14: View Of Oil Pump & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

2. Install the oil pump. Refer to Oil Pump Installation .
3. Install the crankshaft sprocket. Refer to Crankshaft Sprocket Installation (Second Design) .
4. Install the primary timing chain. Refer to Primary Camshaft Drive Chain and Sprockets Replacement .

OIL PAN REPLACEMENT

REMOVAL PROCEDURE

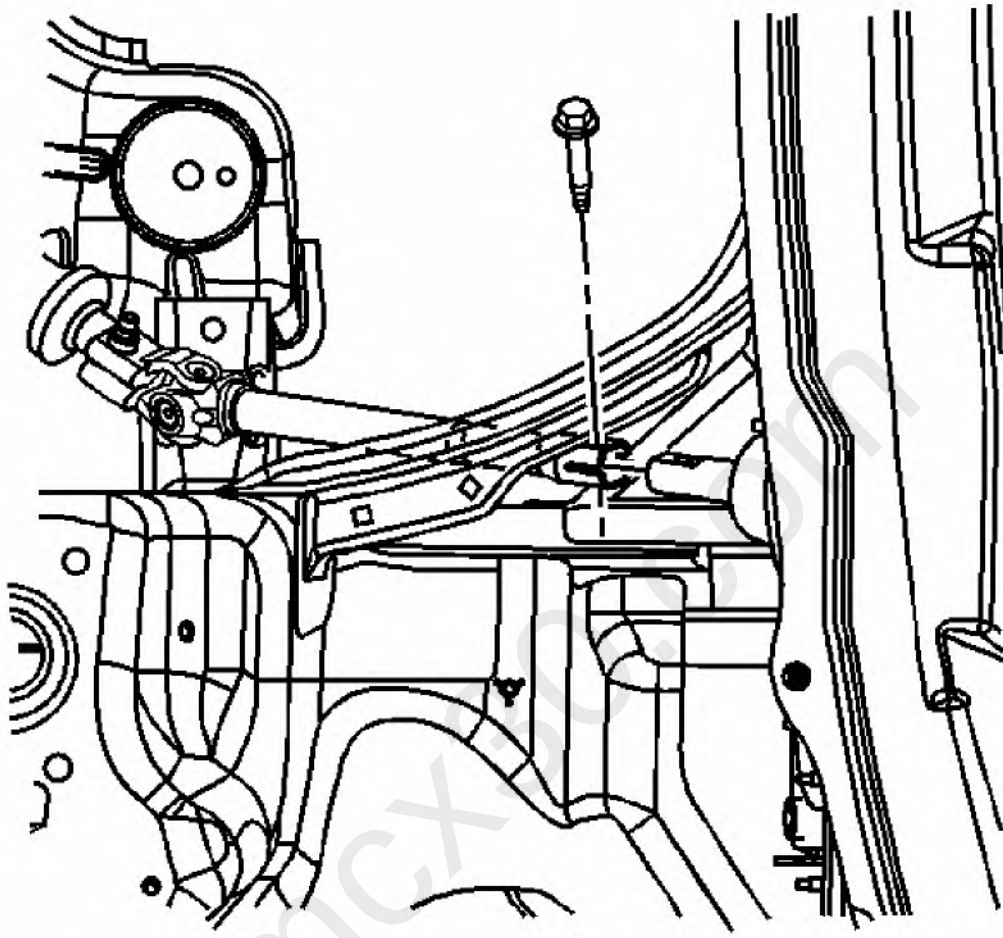


Fig. 15: View Of Intermediate Steering Shaft
Courtesy of GENERAL MOTORS CORP.

1. Remove the engine front cover. Refer to **Engine Front Cover Replacement** .
2. Remove the power steering hose retainer from the air conditioning (A/C) compressor bracket.
3. Disconnect the intermediate steering shaft.

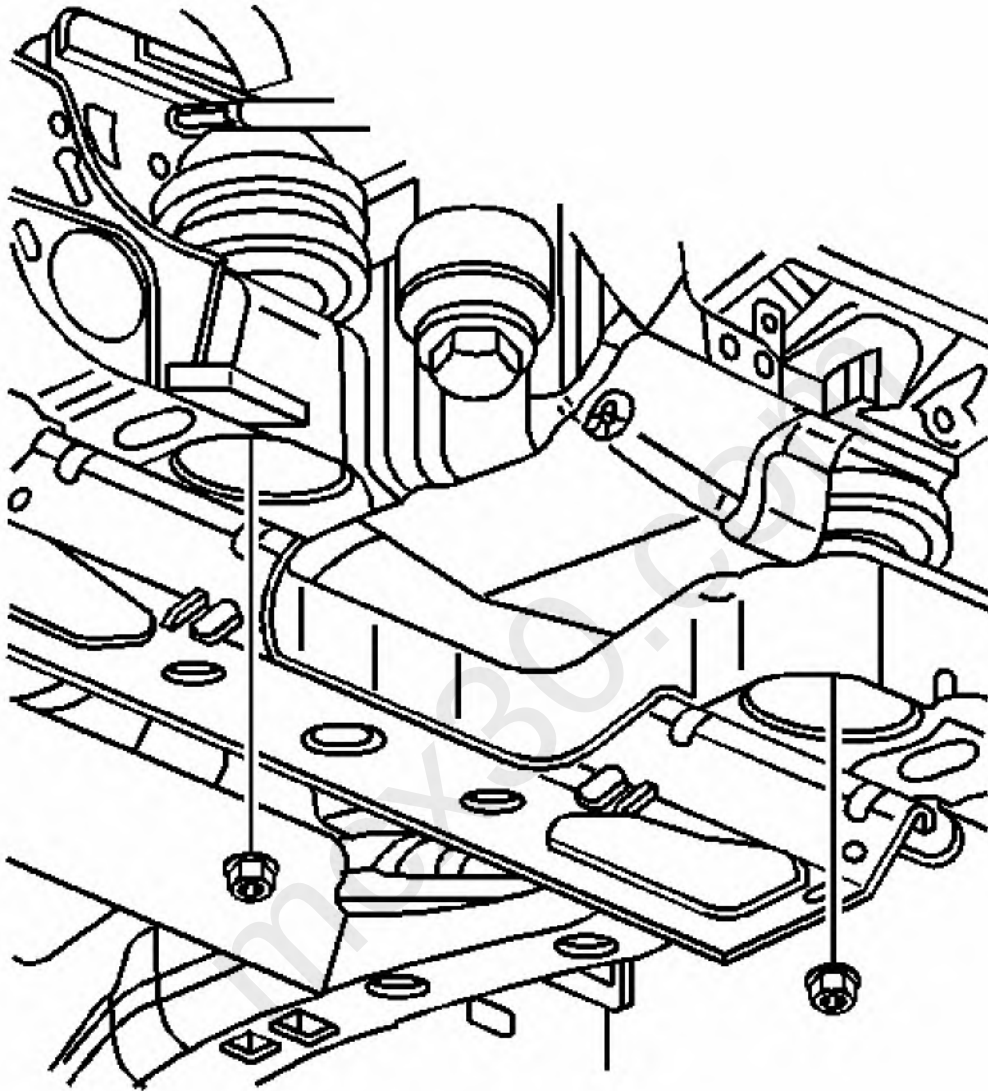


Fig. 16: Identifying Frame Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

4. Remove the engine mount lower nuts.

IMPORTANT: Do NOT disconnect the A/C pipes and/or hoses.

5. Remove the A/C compressor bracket bolts and reposition aside. Refer to [Air Conditioning \(A/C\) Compressor Removal](#).
6. Drain the engine oil. Refer to [Engine Oil and Oil Filter Replacement](#).

7. Remove the transmission oil cooler pipe retainer from the engine right side.
8. Install the engine support fixture. Refer to **Engine Support Fixture** .
9. Tighten the support fixture wing nuts in order to provide clearance for the oil pan.
10. Remove the front differential carrier, if equipped. Refer to **Differential Carrier Assembly Replacement** .

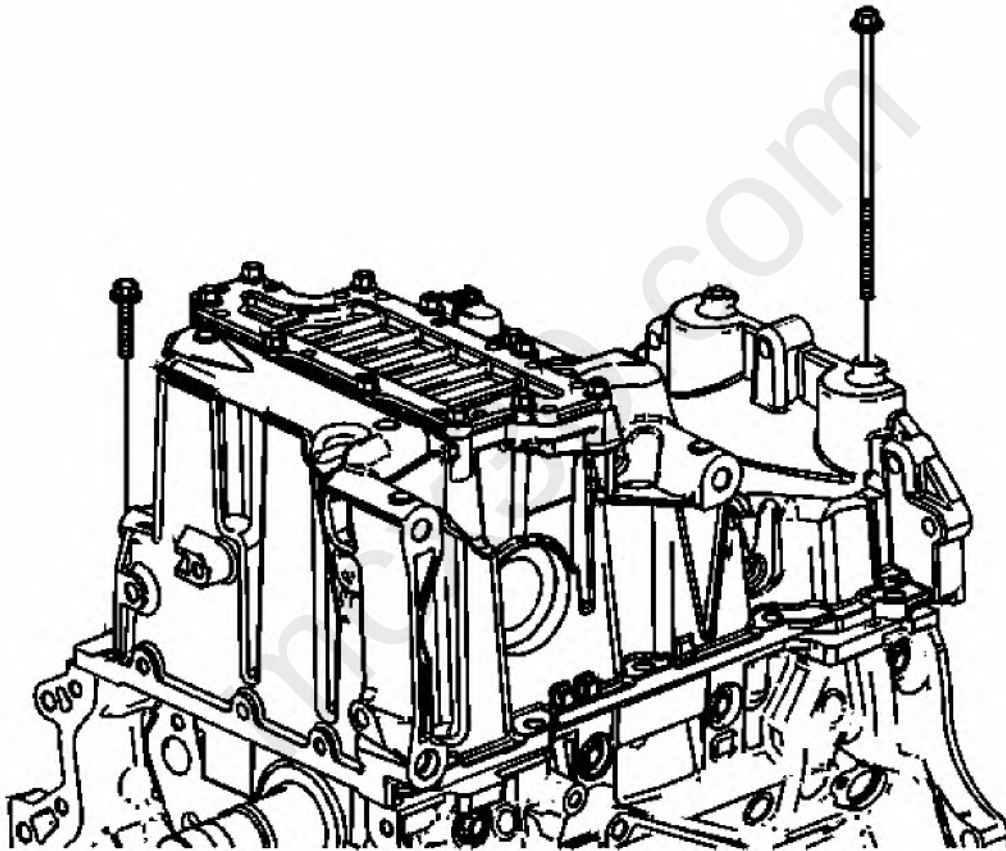


Fig. 17: View Of Oil Pan Bolts
Courtesy of GENERAL MOTORS CORP.

11. Remove the oil pan. Refer to **Oil Pan Removal** .
12. Perform the following steps as necessary.
 - Disassemble the oil pan. Refer to **Oil Pan Disassemble**
 - Clean and inspect the oil pan. Refer to **Oil Pan Cleaning and Inspection** .

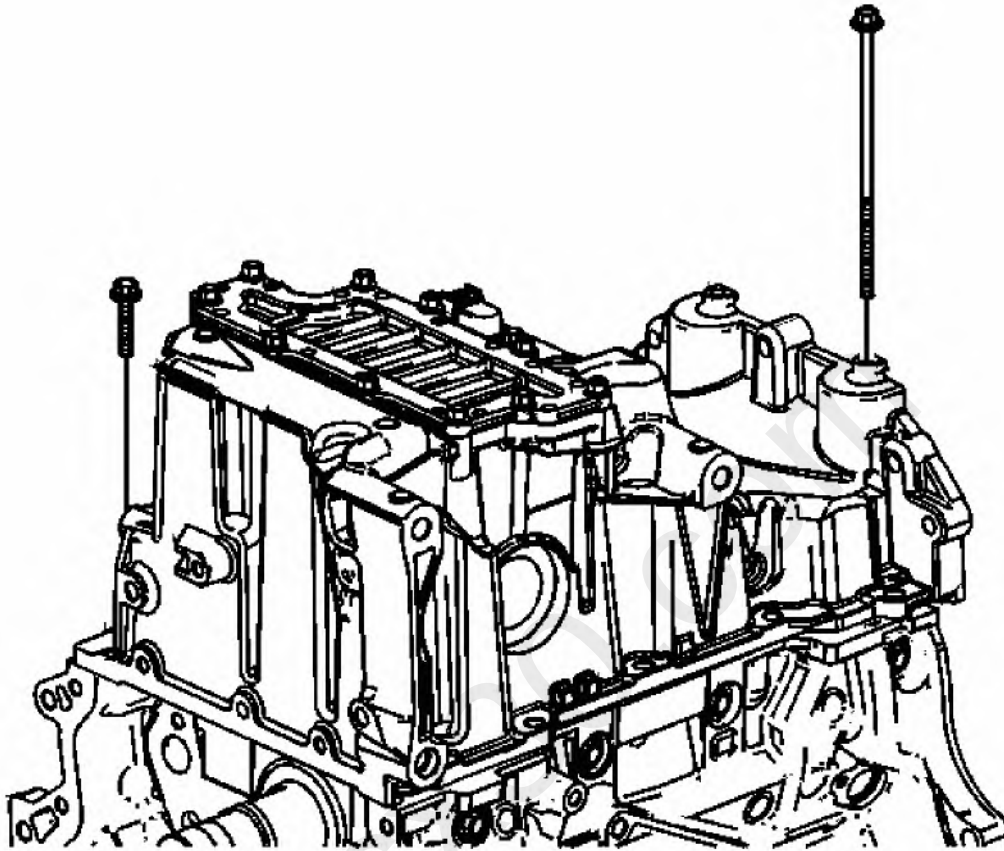


Fig. 18: View Of Oil Pan Bolts
Courtesy of GENERAL MOTORS CORP.

1. Assemble the oil pan as necessary. Refer to **Oil Pan Assemble** .
2. Install the oil pan. Refer to **Oil Pan Installation** .
3. Install the front differential carrier, if equipped. Refer to **Differential Carrier Assembly Replacement** .
4. Loosen the engine support fixture wing nuts in order to lower the engine and engage the engine mounts to the frame.
5. Remove the engine support fixture. Refer to **Engine Support Fixture** .
6. Remove the transmission oil cooler pipe retainer from the engine right side.
7. Fill the engine with new engine oil. Refer to **Engine Oil and Oil Filter Replacement**.
8. Install the A/C compressor bracket with the A/C compressor. Refer to **Air Conditioning (A/C) Compressor Installation** .

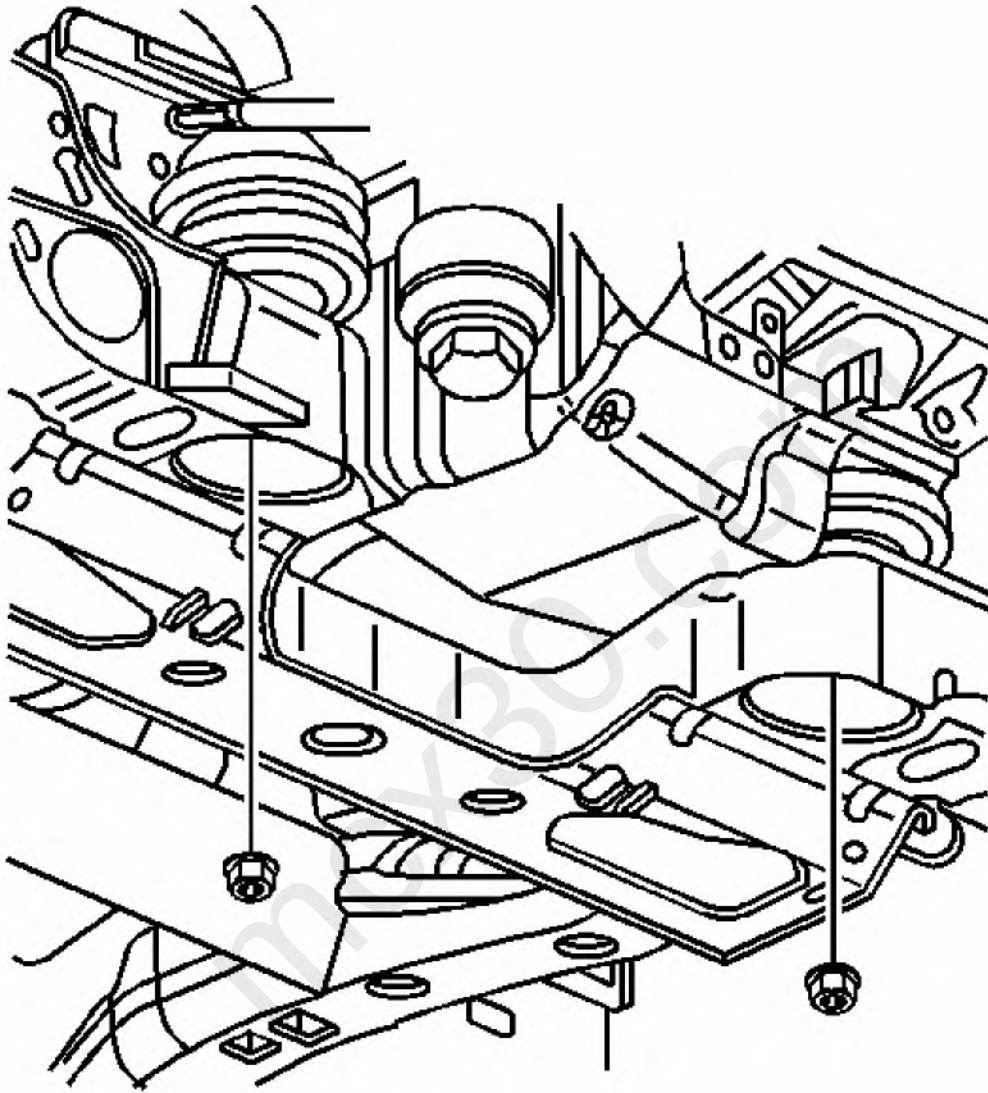


Fig. 19: Identifying Frame Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

9. Install the engine mount lower nuts. Refer to Engine Mount Replacement - Left Side , and Engine Mount Replacement - Right Side (w/RWD) or Engine Mount Replacement - Right Side (W/AWD) .

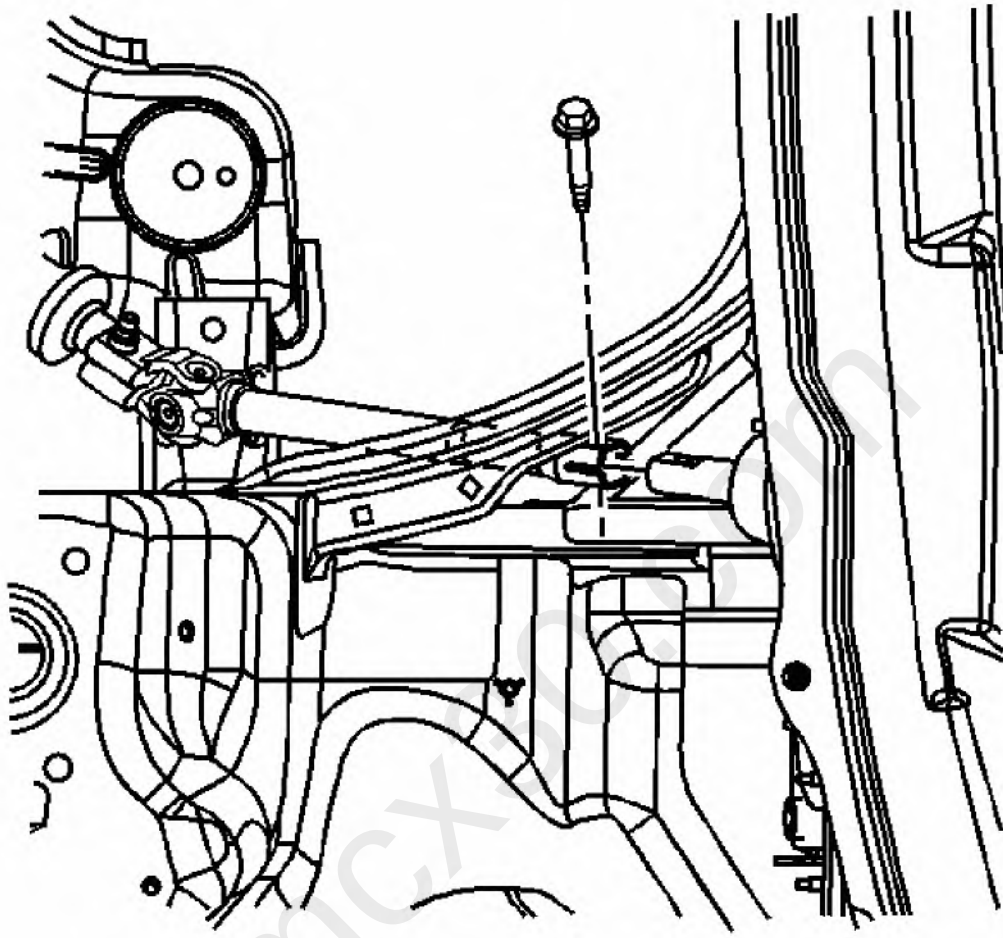


Fig. 20: View Of Intermediate Steering Shaft
Courtesy of GENERAL MOTORS CORP.

10. Connect the intermediate steering shaft. Refer to **Upper Intermediate Steering Shaft Replacement** .
11. Install the power steering hose retainer to the A/C compressor bracket.
12. Install the engine front cover. Refer to **Engine Front Cover Replacement** .

ENGINE OIL PRESSURE SENSOR AND/OR SWITCH REPLACEMENT

REMOVAL PROCEDURE

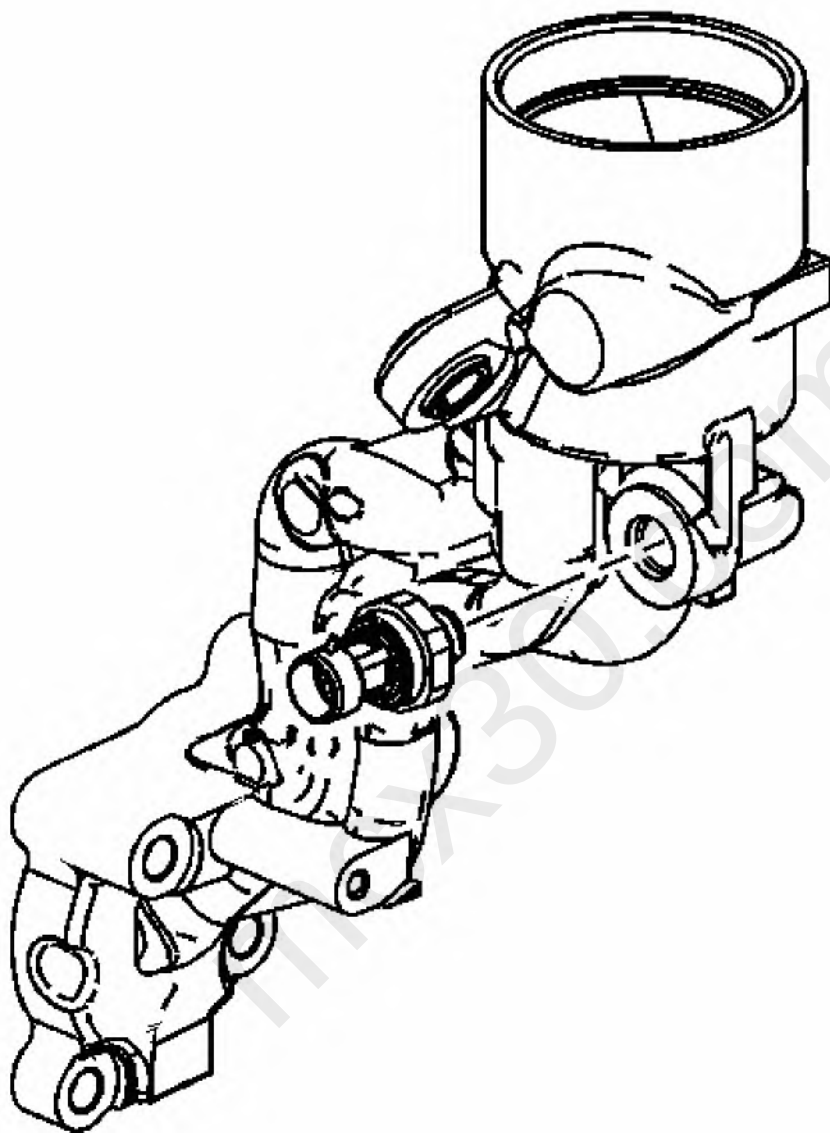


Fig. 21: View Of Oil Pressure Sender
Courtesy of GENERAL MOTORS CORP.

1. Turn the ignition OFF.
2. Remove the front compartment sight shield as necessary. Refer to **Front Compartment Sight Shields Replacement** .
3. Disconnect the oil pressure sensor electrical connector.
4. Remove the oil pressure sensor.

INSTALLATION PROCEDURE

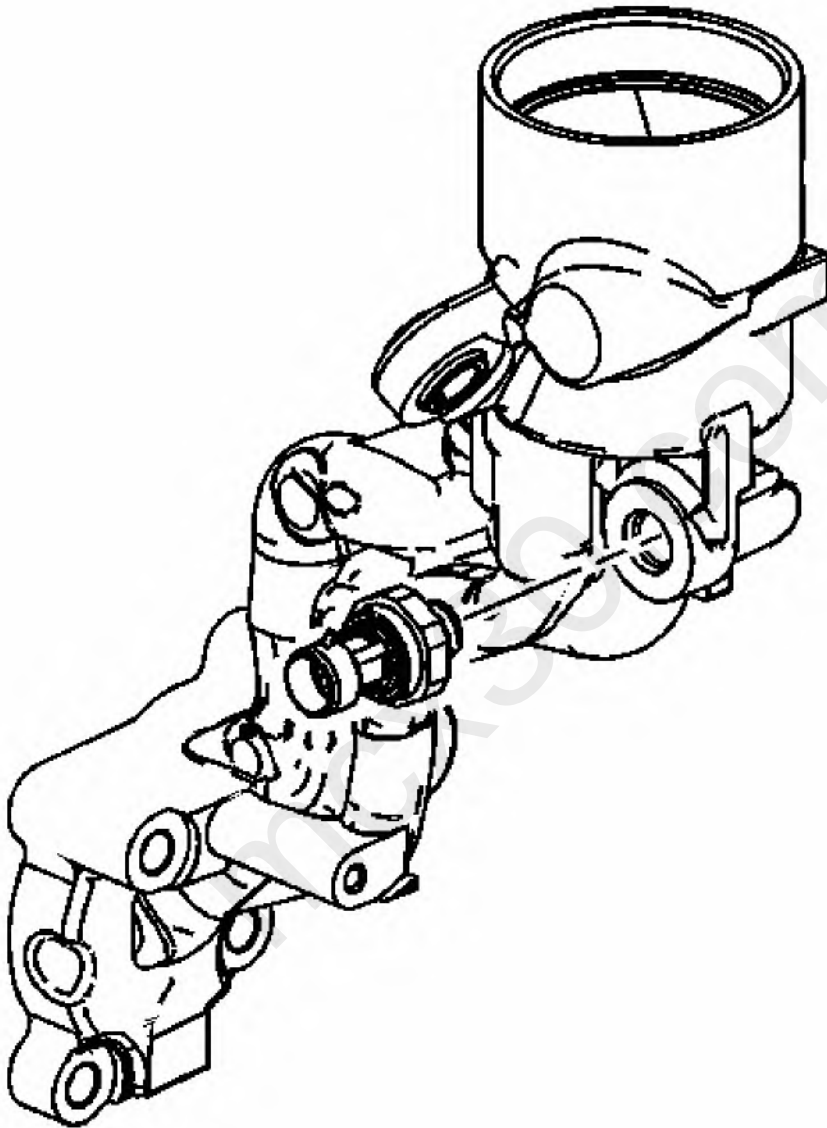


Fig. 22: View Of Oil Pressure Sender
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Install the oil pressure sensor.

Tighten: Tighten the oil pressure sensor to 20 N.m (15 lb ft).

2. Connect the oil pressure sensor electrical connector.
3. Install the front compartment sight shield as necessary. Refer to **Front Compartment Sight Shields Replacement**.

OIL PUMP SUCTION PIPE AND SCREEN ASSEMBLY REPLACEMENT

REMOVAL PROCEDURE

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

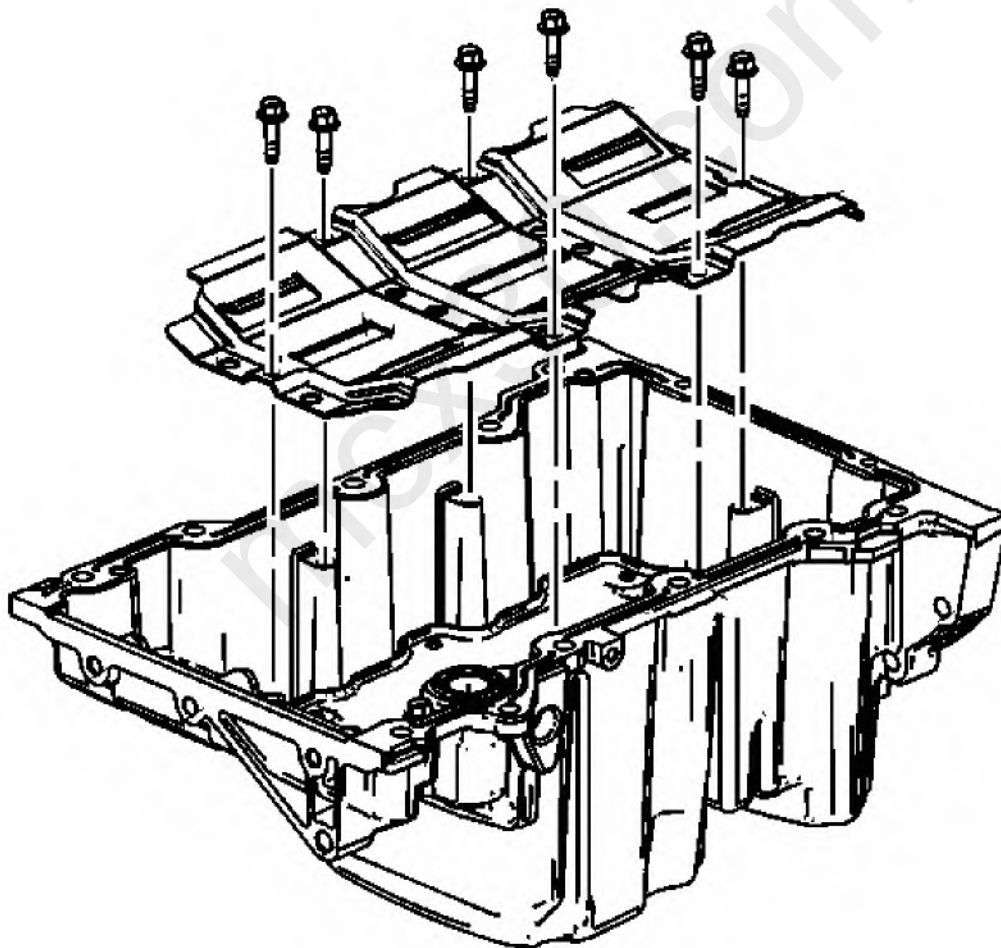


Fig. 23: View Of Oil Pan Scraper And Bolts
Courtesy of GENERAL MOTORS CORP.

2. Remove the oil pan scraper bolts.
3. Remove the oil pan scraper.

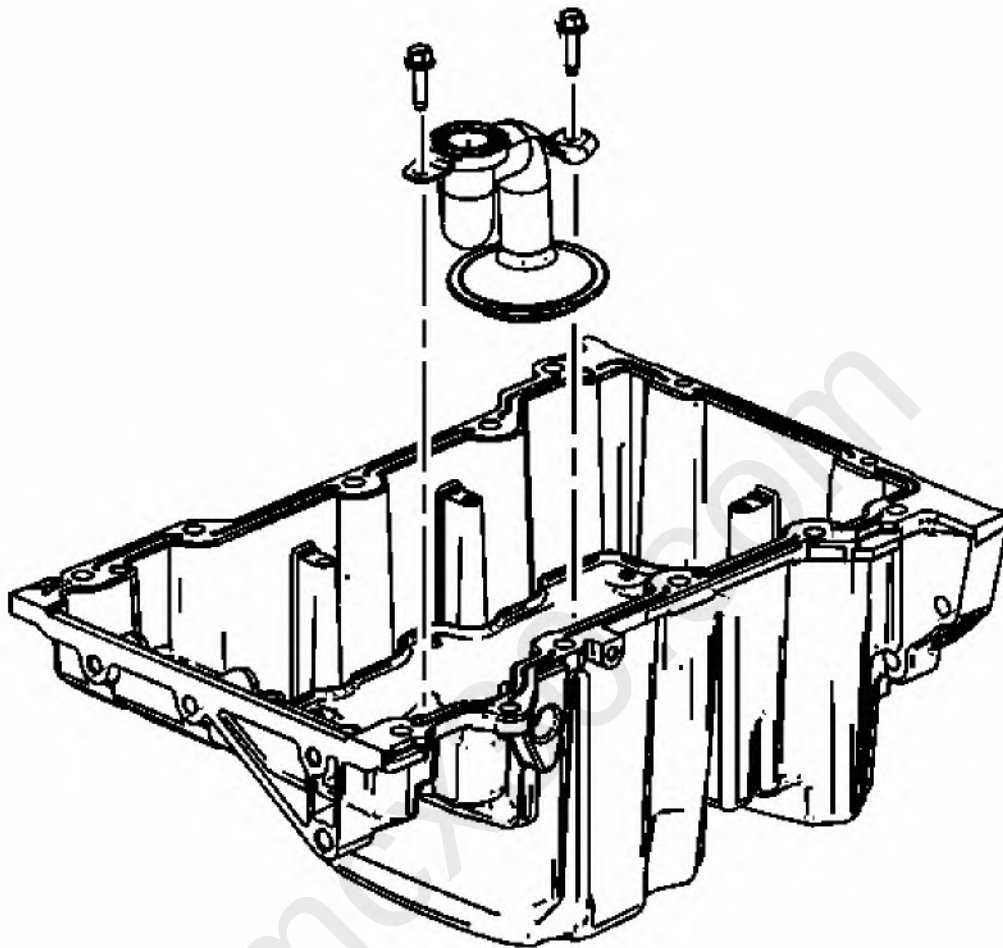


Fig. 24: View Of Oil Suction Pipe
Courtesy of GENERAL MOTORS CORP.

4. Remove the oil suction pipe bolts.
5. Remove the oil suction pipe.

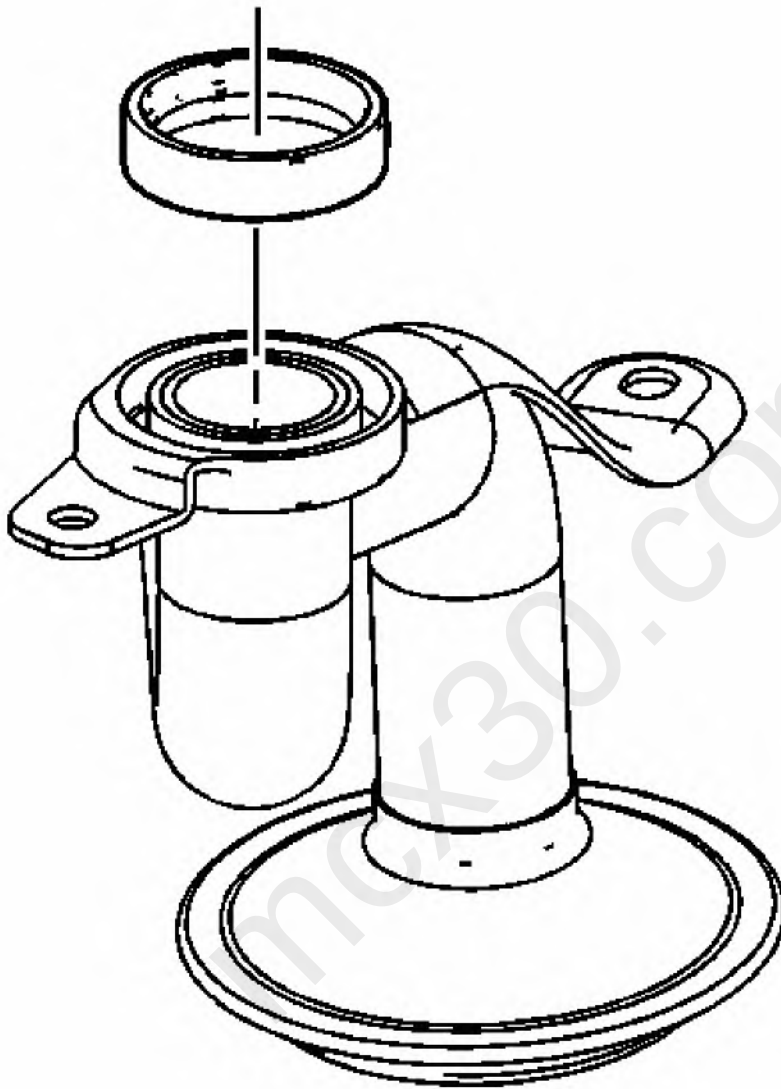


Fig. 25: View Of Oil Suction Tube Seal & Oil Suction Tube
Courtesy of GENERAL MOTORS CORP.

6. Remove the oil suction tube seal from the oil suction tube. Discard the oil suction tube seal.

INSTALLATION PROCEDURE

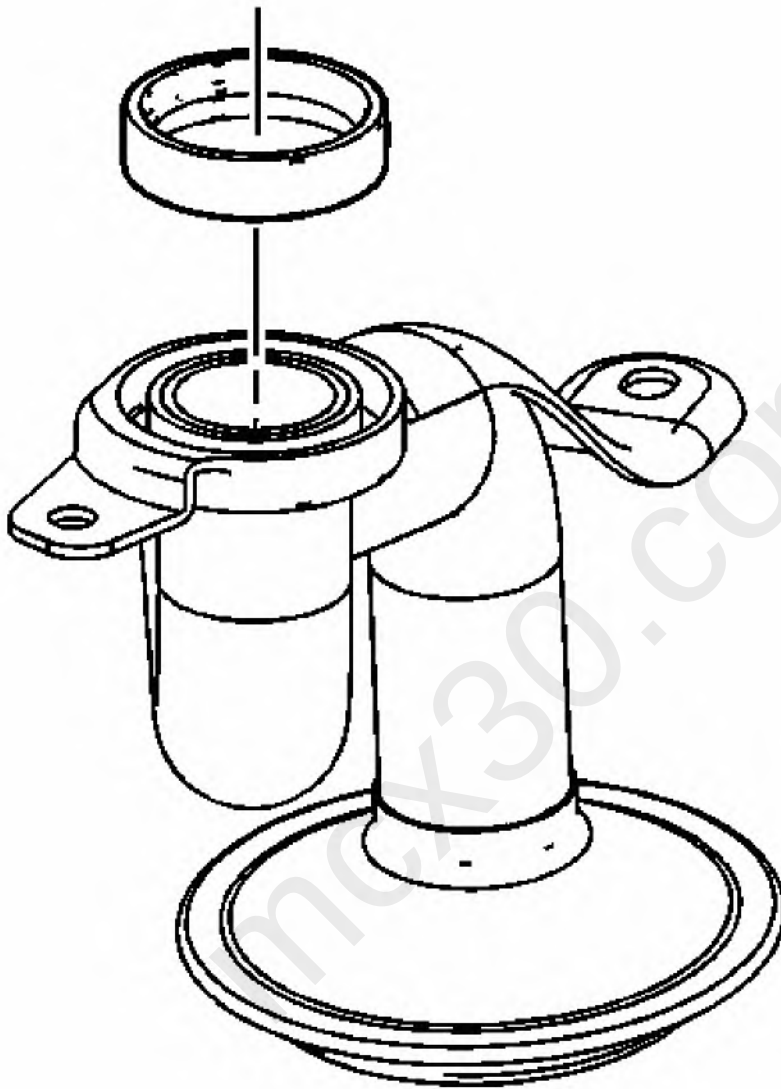


Fig. 26: View Of Oil Suction Tube Seal & Oil Suction Tube
Courtesy of GENERAL MOTORS CORP.

1. Install a NEW oil suction tube seal onto the oil suction tube. DO NOT reuse the old oil suction tube seal.

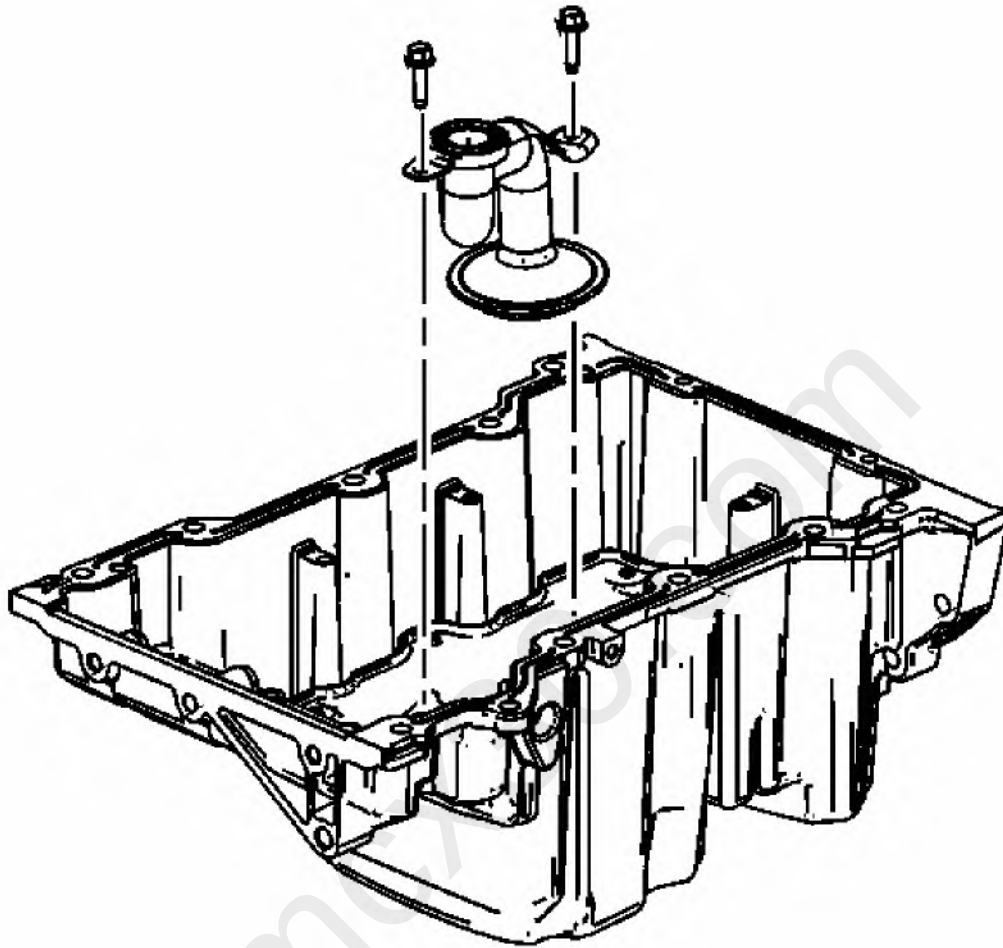


Fig. 27: View Of Oil Suction Pipe
Courtesy of GENERAL MOTORS CORP.

2. Install the oil suction pipe.

NOTE: Refer to Fastener Notice .

3. Install the oil suction pipe bolts.

Tighten: Tighten the oil suction pipe bolts to 10 N.m (89 lb in).

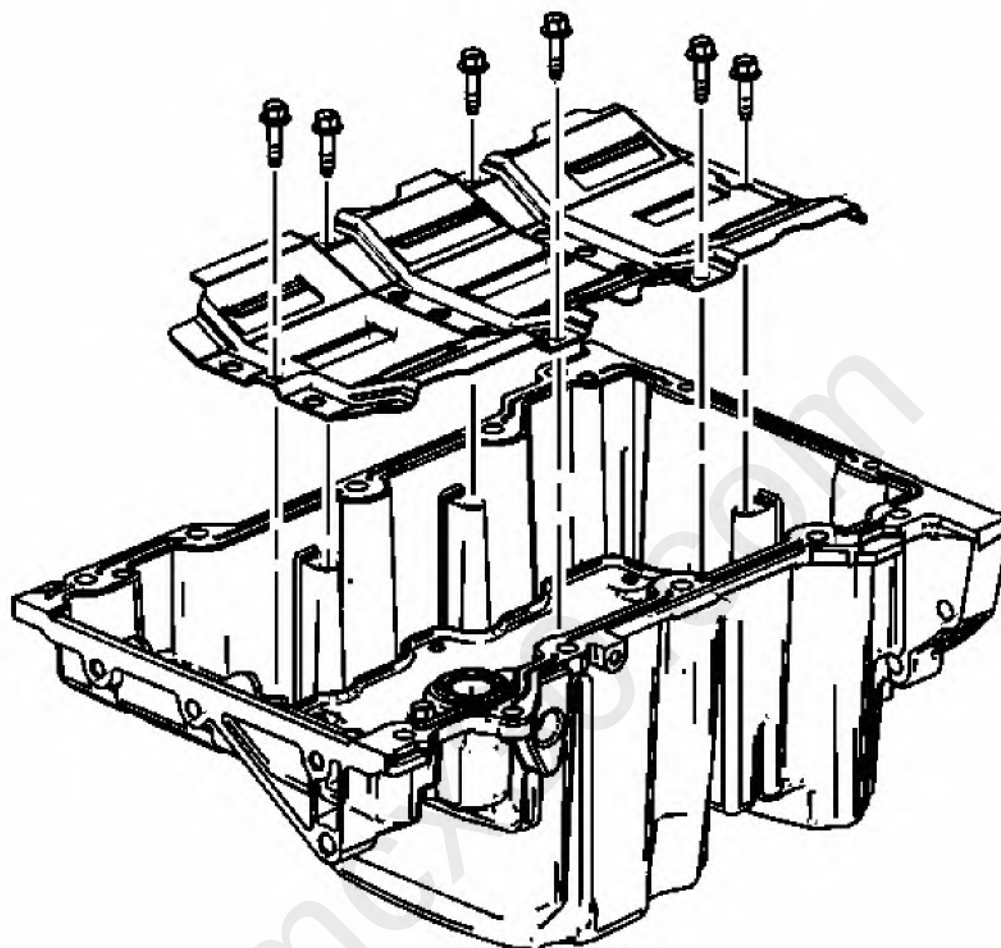


Fig. 28: View Of Oil Pan Scraper And Bolts
 Courtesy of GENERAL MOTORS CORP.

4. Install the oil pan scraper.
5. Install the oil pan scraper bolts.

Tighten: Tighten the oil pan scraper bolts to 10 N.m (89 lb in).

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

ENGINE REPLACEMENT

Tools Required

- EN 46114 Engine Lift Brackets. See Special Tools .

- **J 42640** Steering Column Anti-Rotation Pin. See Special Tools .

REMOVAL PROCEDURE

1. Center the steering wheel.
2. Turn the ignition OFF.

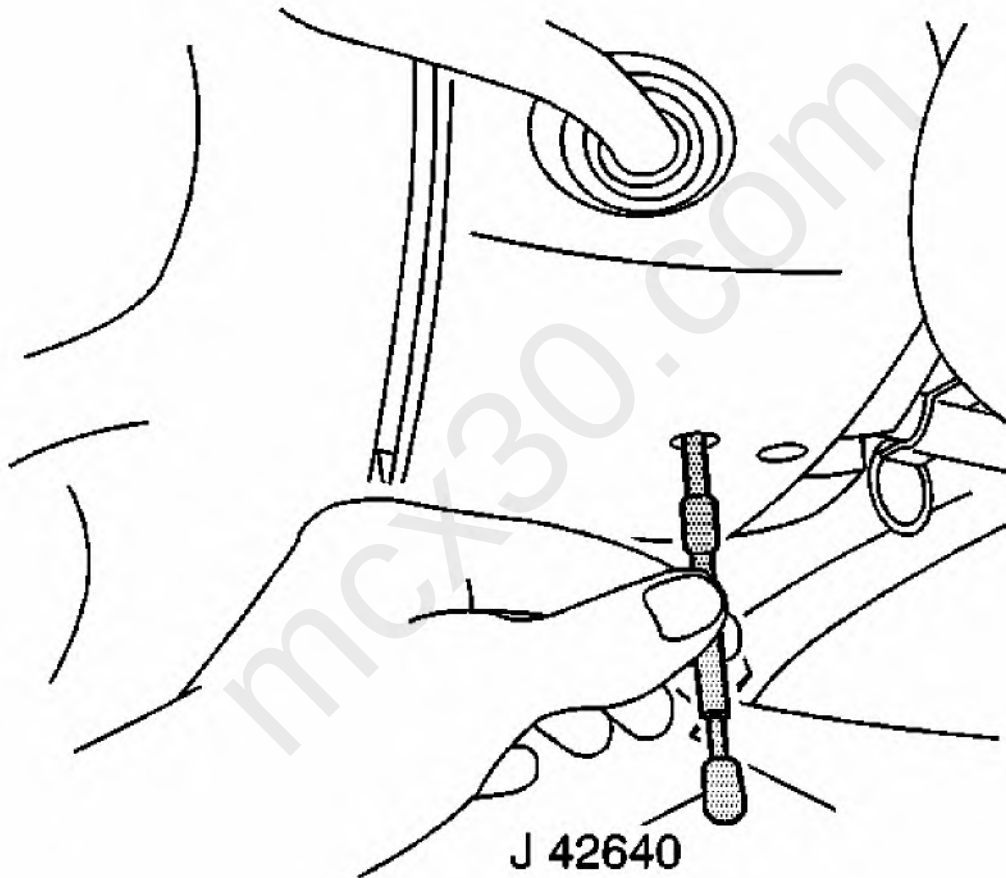


Fig. 29: Identifying J 42640
Courtesy of GENERAL MOTORS CORP.

3. Install **J 42640** to the steering column. See Special Tools .

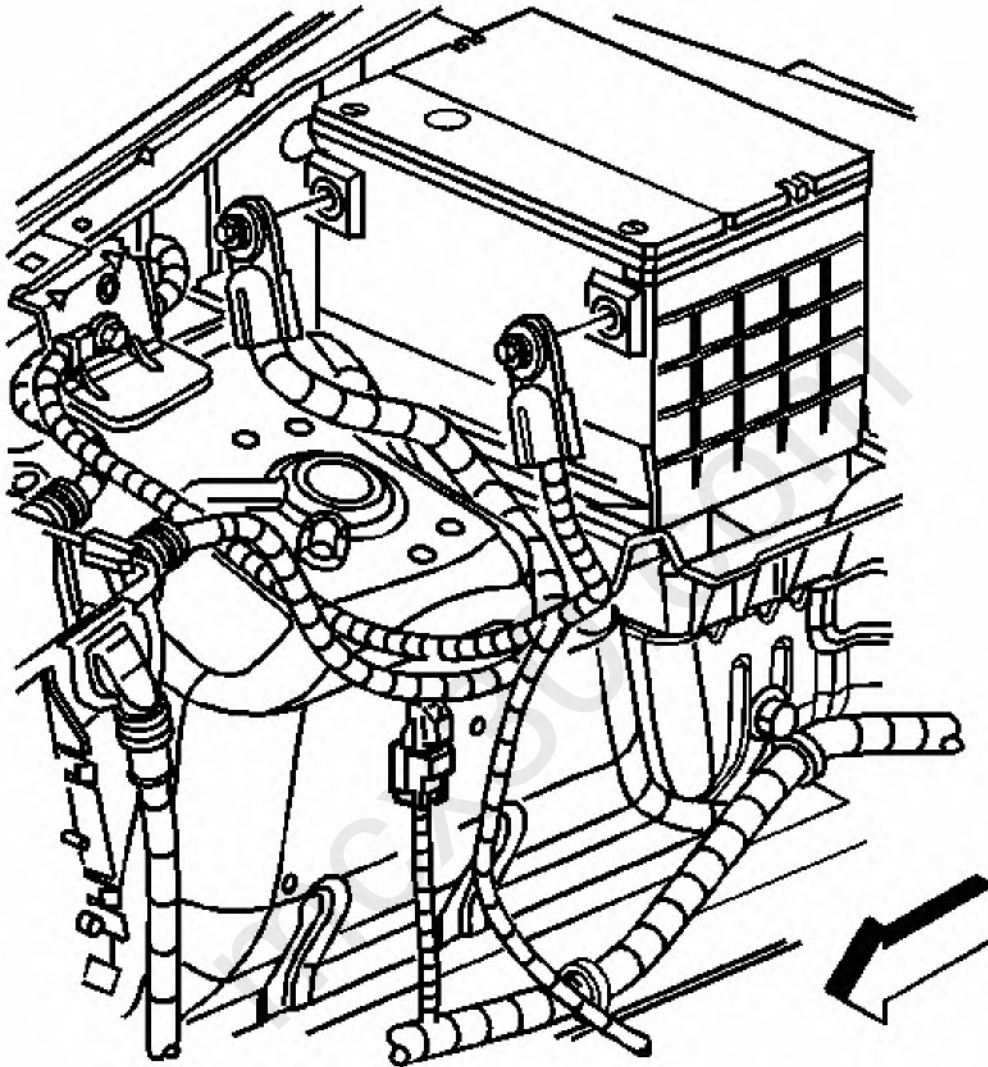


Fig. 30: View Of Battery Positive & Negative Cables
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do NOT disconnect the battery cables from the engine.

4. Disconnect the negative cable from the battery and the body. Refer to **Battery Negative Cable Replacement (LY7)** or **Battery Negative Cable Replacement (LH2)** or **Battery Negative Cable Replacement (LC3)** in Engine Electrical.
5. Disconnect the positive cable from the battery and the underhood electrical center. Refer to **Battery Positive Cable Replacement (LY7)** or **Battery Positive Cable Replacement (LH2)** or **Battery Positive Cable Replacement (LC3)** in Engine

Electrical.

6. Position and secure the battery cables to the engine.
7. Remove the battery. Refer to **Battery Replacement** in Engine Electrical.
8. Remove the fuel injector sight shield. Refer to **Fuel Injector Sight Shield Replacement**.

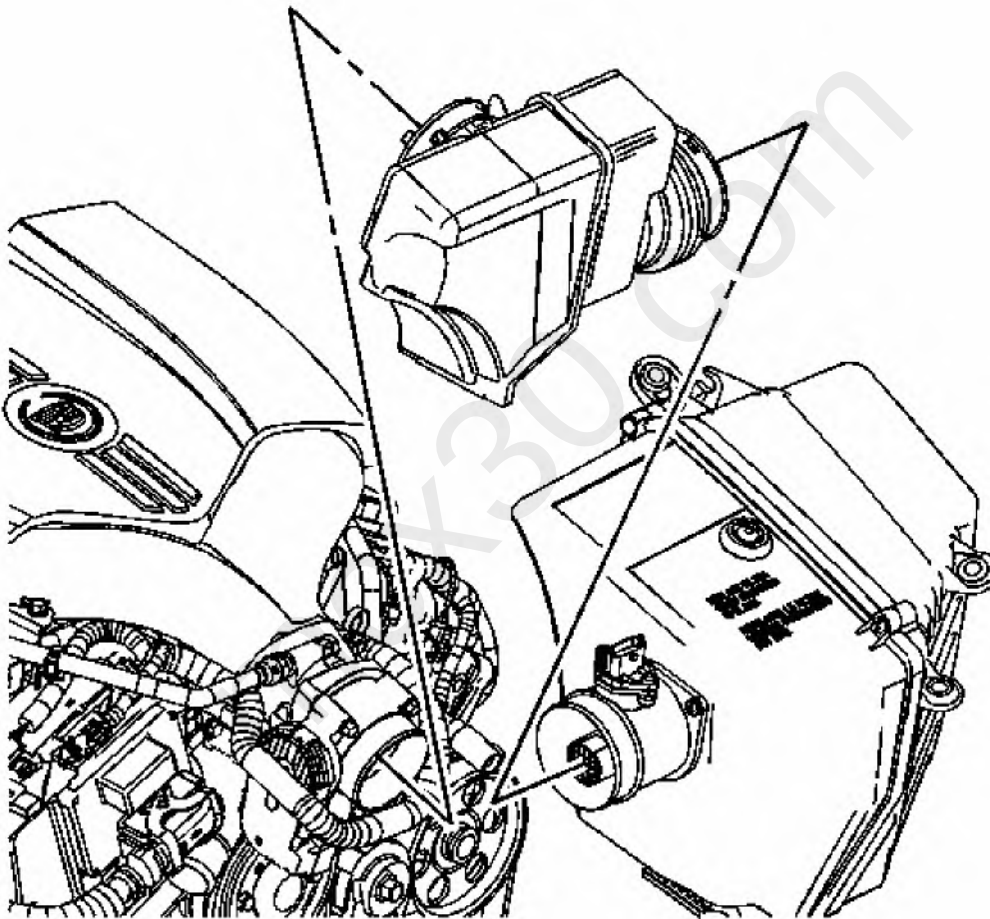


Fig. 31: View Of Air Inlet Duct
Courtesy of GENERAL MOTORS CORP.

9. Remove the air cleaner duct. Refer to **Air Cleaner Inlet Duct Replacement** in Engine Controls - 3.6L (LY7).

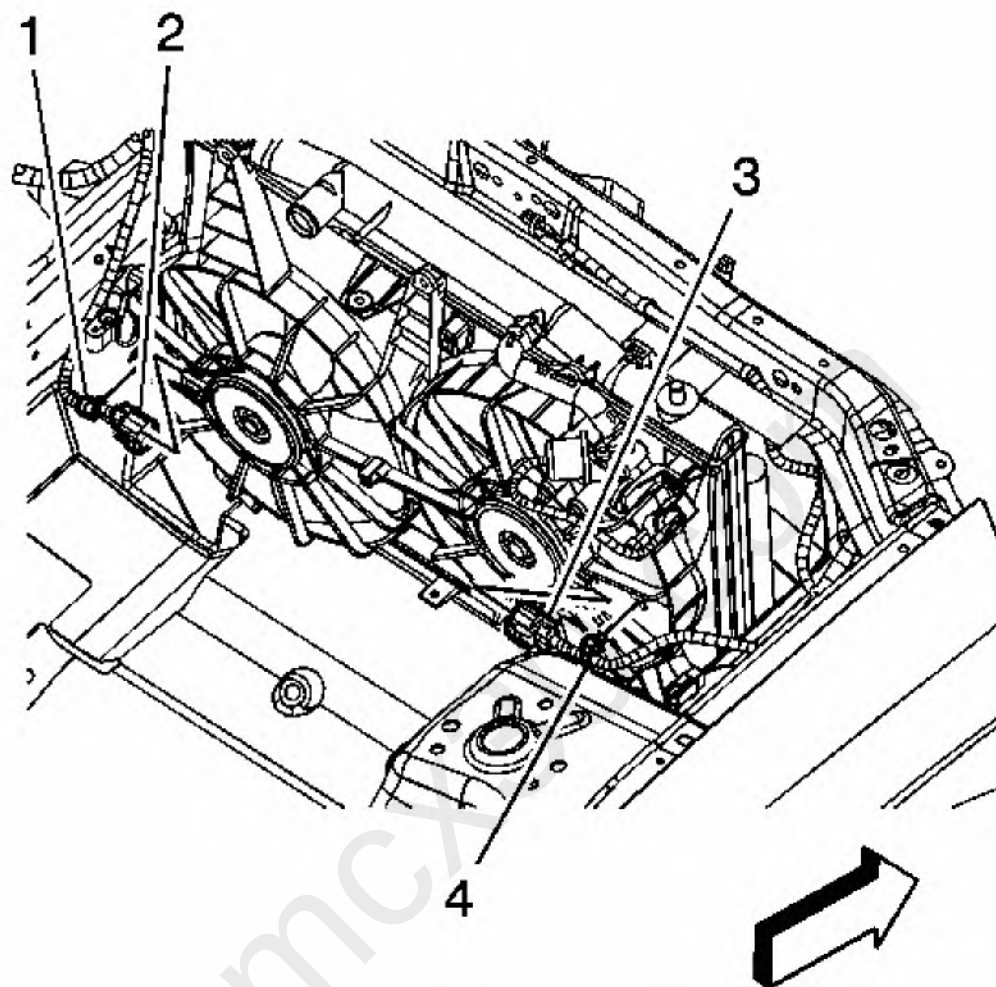


Fig. 32: View Of Cooling Fan Wiring Harness & Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

10. Disconnect the cooling fan electrical connectors (2, 3).
11. Remove the cooling fan wiring harnesses (1, 4) from the fan shroud.
12. Secure the wiring harnesses to the vehicle.
13. Drain the cooling system. Refer to **Cooling System Draining and Filling (Static Fill)** or **Cooling System Draining and Filling (GE 47719)** in Engine Cooling.

IMPORTANT: Do NOT disconnect the surge hoses from the engine or the radiator.

14. Disconnect the surge tank outlet hose from the surge tank. Refer to **Radiator Surge**

Tank Inlet Hose/Pipe Replacement (LY7) or Radiator Surge Tank Inlet Hose/Pipe Replacement (LH2) in Engine Cooling.

15. Position and secure the surge hose to the engine.
16. Disconnect the surge tank inlet hose from the water outlet housing and the radiator. Refer to **Radiator Surge Tank Outlet Hose/Pipe Replacement (LY7) or Radiator Surge Tank Outlet Hose/Pipe Replacement (LH2) in Engine Cooling.**
17. Position and secure the surge tank inlet hose to the vehicle.
18. Disconnect the heater hoses from the heater core. Refer to **Heater Inlet Hose Replacement (LY7) or Heater Inlet Hose Replacement (LH2)** and to **Heater Outlet Hose Replacement (LY7) or Heater Outlet Hose Replacement (LH2)** in Heating, Ventilation and Air Conditioning.

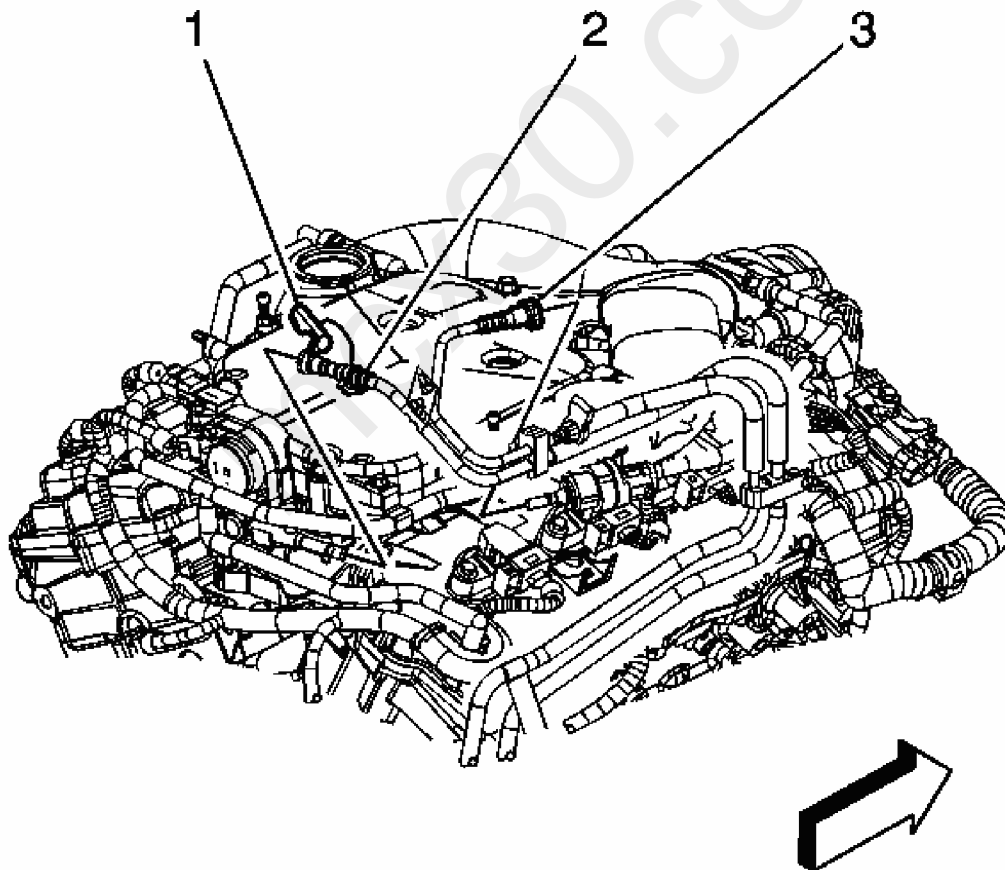


Fig. 33: Top Of Engine View
Courtesy of GENERAL MOTORS CORP.

19. Disconnect the purge line (3) from the purge solenoid.

20. Disconnect the fuel pipe (2) from the fuel rail. Refer to **Metal Collar Quick Connect Fitting Service** in Engine Controls - 3.6L (LY7).
21. Plug the fuel pipe and cap the fuel rail to prevent fuel loss or contamination.
22. Evacuate the air conditioning system. Refer to **Refrigerant Recovery and Recharging** in Heating, Ventilation and Air Conditioning.
23. Remove the wiper module. Refer to **Windshield Wiper System Module Replacement** .

IMPORTANT: Do NOT disconnect the suction hose from the A/C compressor.

24. Disconnect the air conditioning suction hose from the evaporator and remove the suction hose bracket from the shock tower. Refer to **Suction Hose Replacement (LY7)** or **Suction Hose Replacement (LH2)** in Heating, Ventilation and Air Conditioning.
25. Position and secure the suction hose to the engine.

IMPORTANT: Do NOT disconnect the liquid line from the condenser.

26. Disconnect the air conditioning pressure switch electrical connector and remove the liquid line. Refer to **Liquid Line Replacement (LY7)** or **Liquid Line Replacement (LH2)** in Heating, Ventilation and Air Conditioning.
27. Remove the radiator support brackets. Refer to **Radiator Support Bracket Replacement** in Engine Cooling.

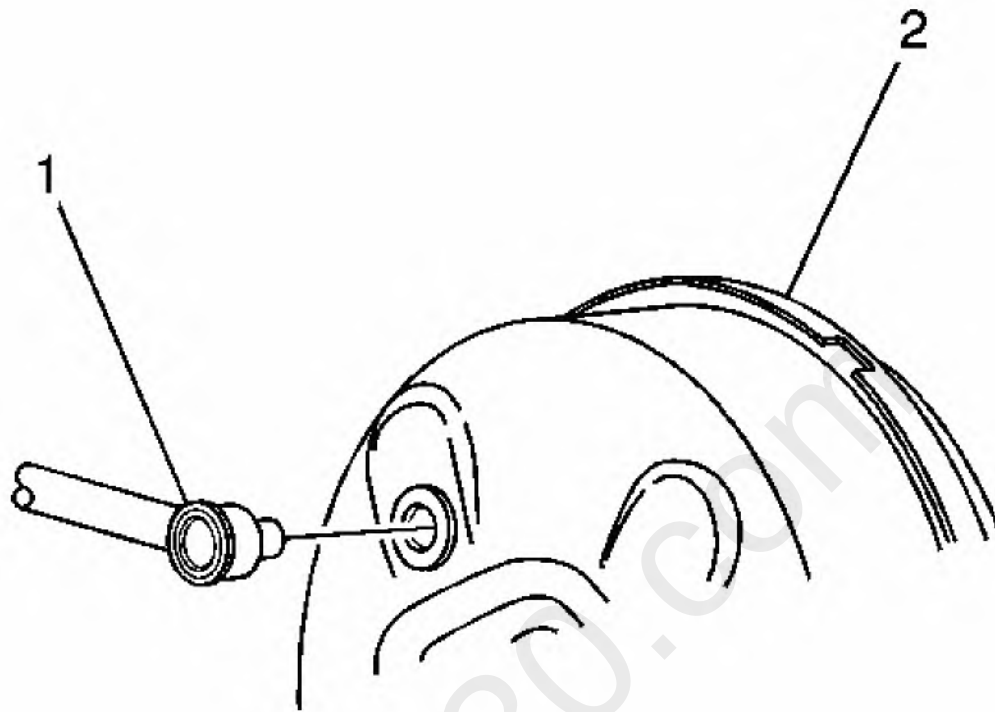


Fig. 34: View Of Vacuum Check Valve & Brake Booster
Courtesy of GENERAL MOTORS CORP.

28. Disconnect the brake booster check valve and vacuum hose (1) from the brake booster (2).
29. Position and secure the brake booster hose to the engine.
30. Disconnect the electrical connector to the brake fluid level switch from the master cylinder.
31. Disconnect the electrical connector to the mass air flow sensor.
32. Unlock and disconnect the instrument panel (I/P) electrical connector from the engine located at the rear of the left bank 2 cylinder head.
33. Position and secure the I/P harness to the vehicle.

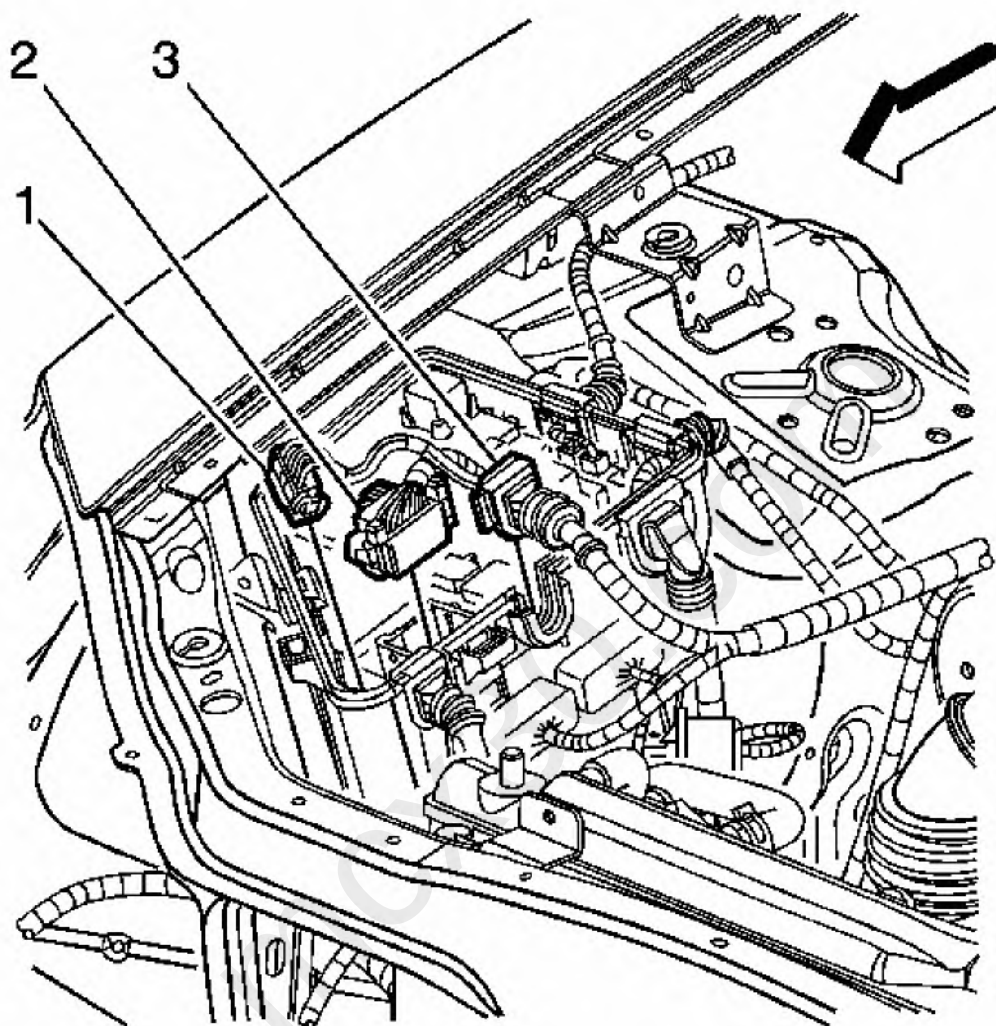


Fig. 35: View Of Engine Module Wiring Harness Connectors
Courtesy of GENERAL MOTORS CORP.

34. Disconnect the engine module wiring harness connectors (1-3) from the underhood electrical center. Refer to **Underhood Electrical Center or Junction Block Replacement** in Wiring Systems.
35. Disconnect the wiring harness from the transmission control module (TCM). Refer to **Transmission Control Module Replacement** in Automatic Transmission - 5L40-E/5L50-E.

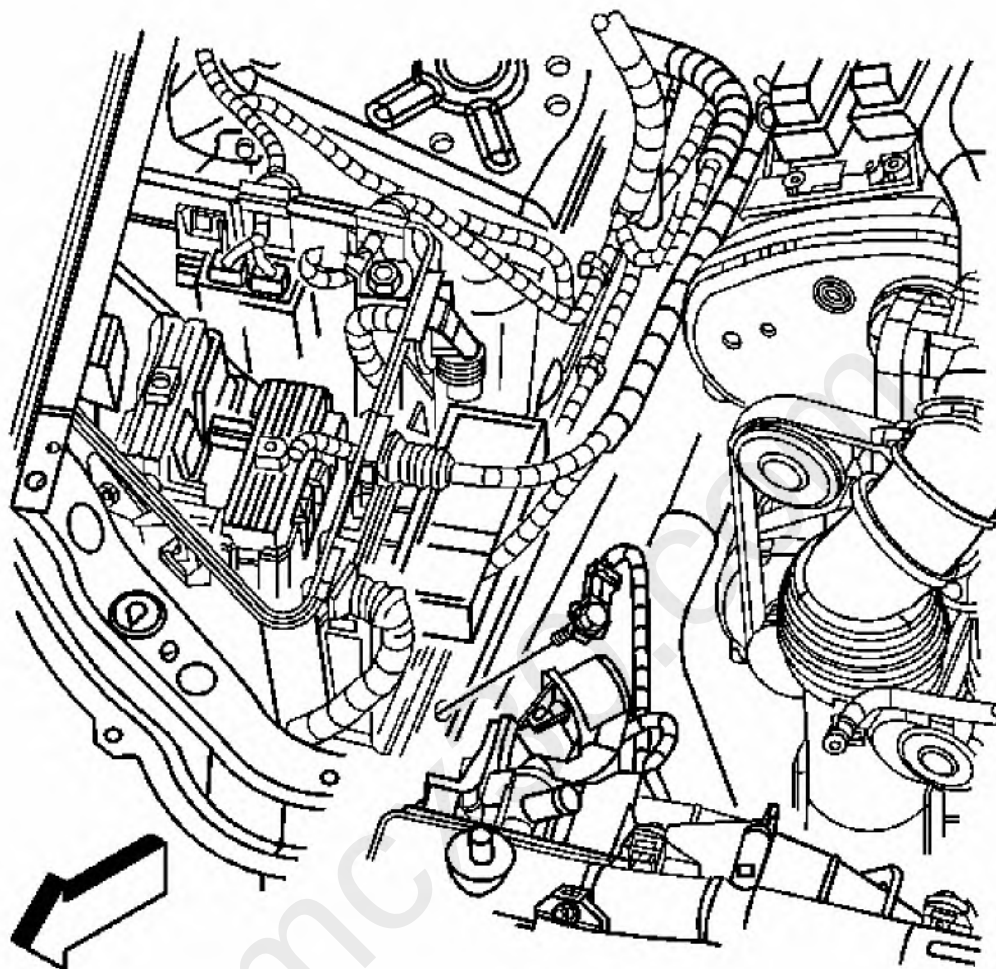


Fig. 36: View Of Ground Bolt & Wire
Courtesy of GENERAL MOTORS CORP.

36. Remove the ground bolt and wire from the longitudinal rail.

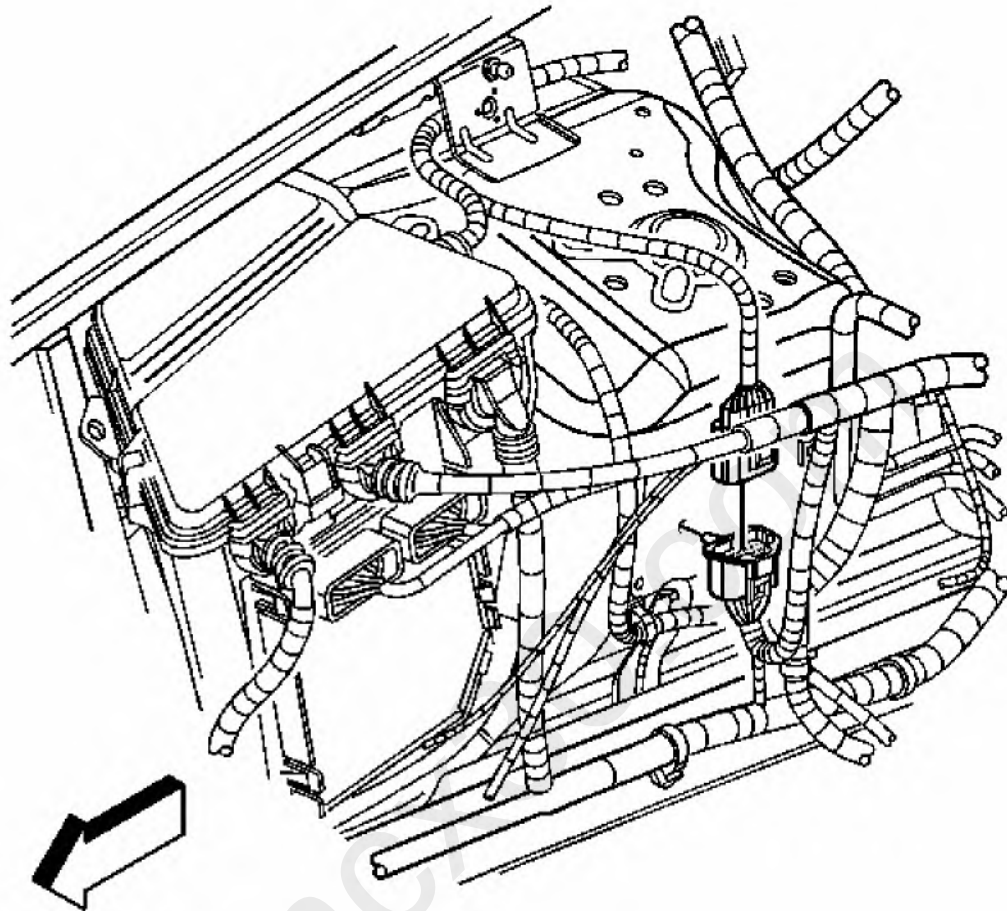


Fig. 37: View Of Longitudinal Rail Engine Harness Electrical Connector
Courtesy of GENERAL MOTORS CORP.

37. Disconnect the engine harness electrical connector at the longitudinal rail.
38. Position and secure the ground wire, the engine harness and the TCM harness to the engine.

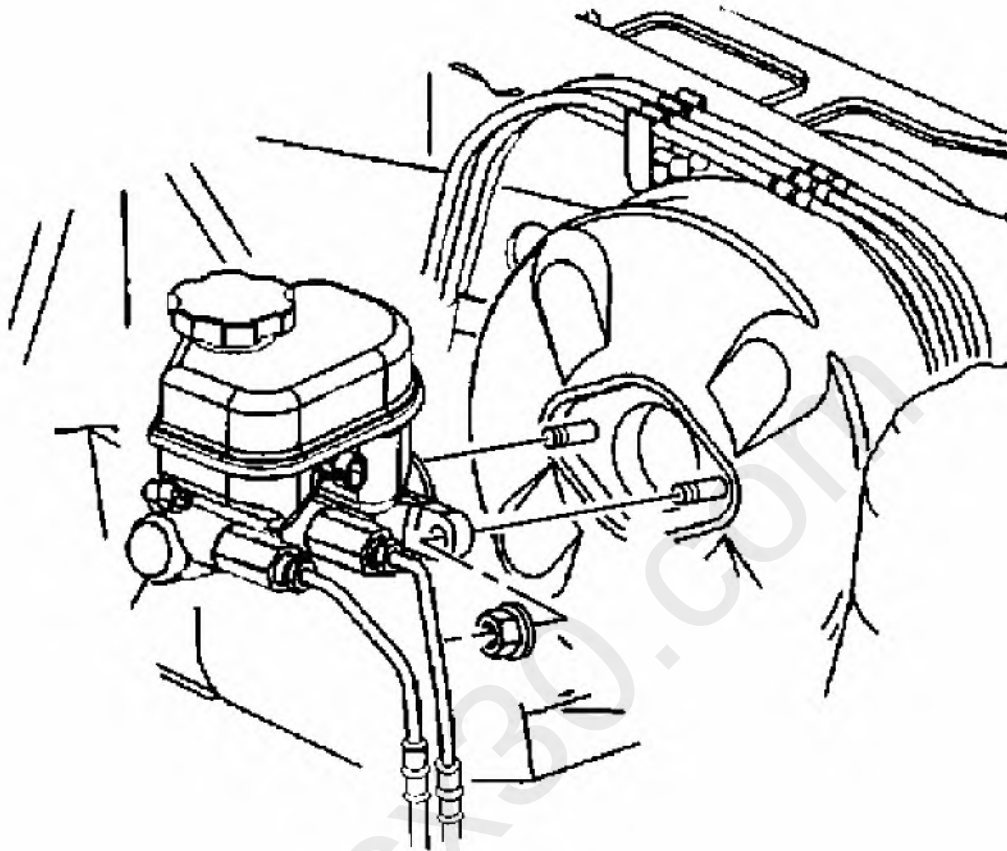


Fig. 38: Removing & Installing Master Cylinder
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do NOT disconnect the brake pipes from the master cylinder.

39. Remove the master cylinder nuts.
40. Reposition and secure the master cylinder to the engine.
41. Relieve the fuel system pressure. Refer to **Fuel Pressure Relief** in Engine Controls - 3.6L (LY7).
42. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
43. Remove the muffler assembly. Refer to **Exhaust System Replacement** in Engine Exhaust.
44. Remove the propeller shaft. Refer to **Rear Propeller Shaft Replacement (AWD)** or **Rear Propeller Shaft Replacement (RWD)** in Propeller Shaft.

45. Remove the air deflector. Refer to **Front Air Deflector Replacement** in Body Front End.

IMPORTANT: DO NOT remove the water bottle.

46. Remove the washer bottle bracket. Refer to **Solvent Container, Pump, Level Sensor Replacement - Windshield Washer** in Wipers/Washer Systems.
47. Disconnect the side air baffles from the radiator.
48. Disconnect the left front brake pipe retainer along with the brake pipe from the longitudinal rail.
49. Remove the right front brake pipe from the brake pipe bundle retainer.
50. Disconnect the rear brake pipes from the brake pressure modulator valve (BPMV). Refer to **Brake Pressure Modulator Valve Replacement** in Antilock Brake System.
51. Plug the brake pipes and the brake modulator valve in order to minimize brake fluid loss.
52. Remove the front tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
53. Remove the lower intermediate steering shaft. Refer to **Lower Intermediate Steering Shaft Replacement** in Steering Wheel and Column.

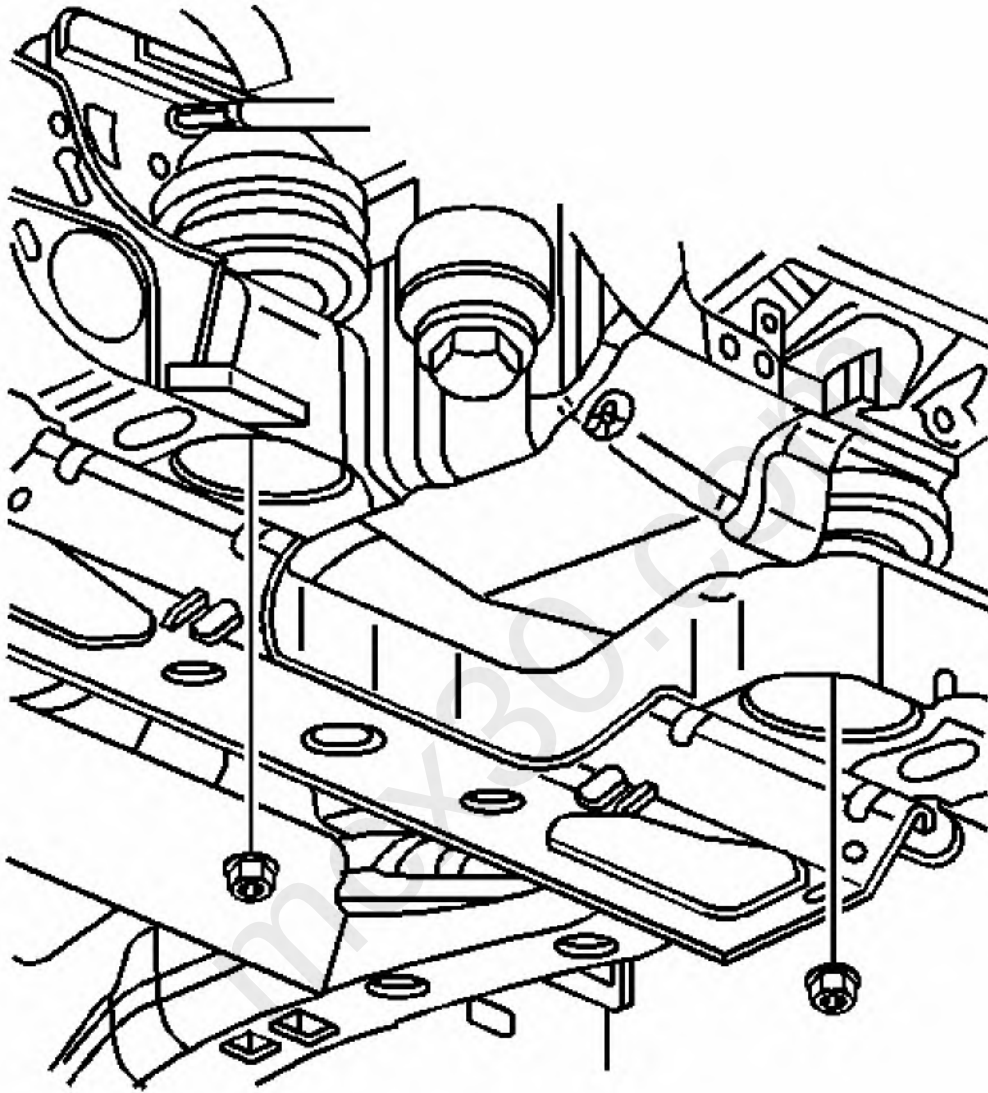


Fig. 39: Identifying Frame Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

54. Remove the lower engine mount nuts. Refer to **Engine Mount Replacement - Left Side** and to **Engine Mount Replacement - Right Side (w/RWD)** or **Engine Mount Replacement - Right Side (W/AWD)** in Engine Mechanical - 3.6L (LY7).

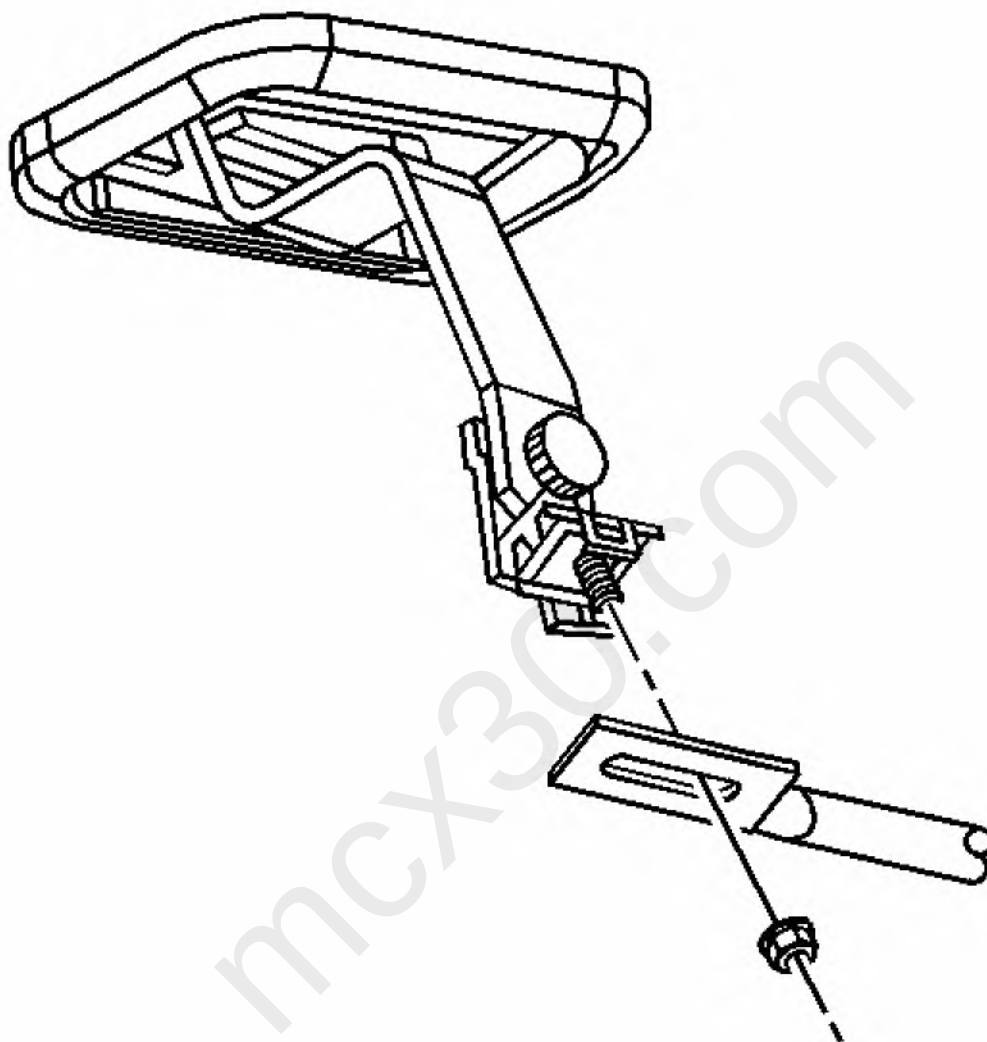


Fig. 40: View Of Transmission Shift Linkage
Courtesy of GENERAL MOTORS CORP.

55. Disconnect the transmission shift linkage from the transmission. Refer to **Shift Control Linkage Replacement (Rear Wheel Drive)** or **Shift Control Linkage Replacement (All Wheel Drive)** Automatic Transmission - 5L40-E/5L50-E.
56. Disconnect the electrical connector to the low oil level sensor.

Secure the electrical connector and the harness to the engine mount bracket.

57. Remove the headlamp leveling sensors. Refer to **Headlamp Leveling Front Suspension Height Sensor Replacement** in Lighting Systems.

58. Secure the shock modules to the lower control arms with a suitable strap in order to prevent damage to the front brake hoses.

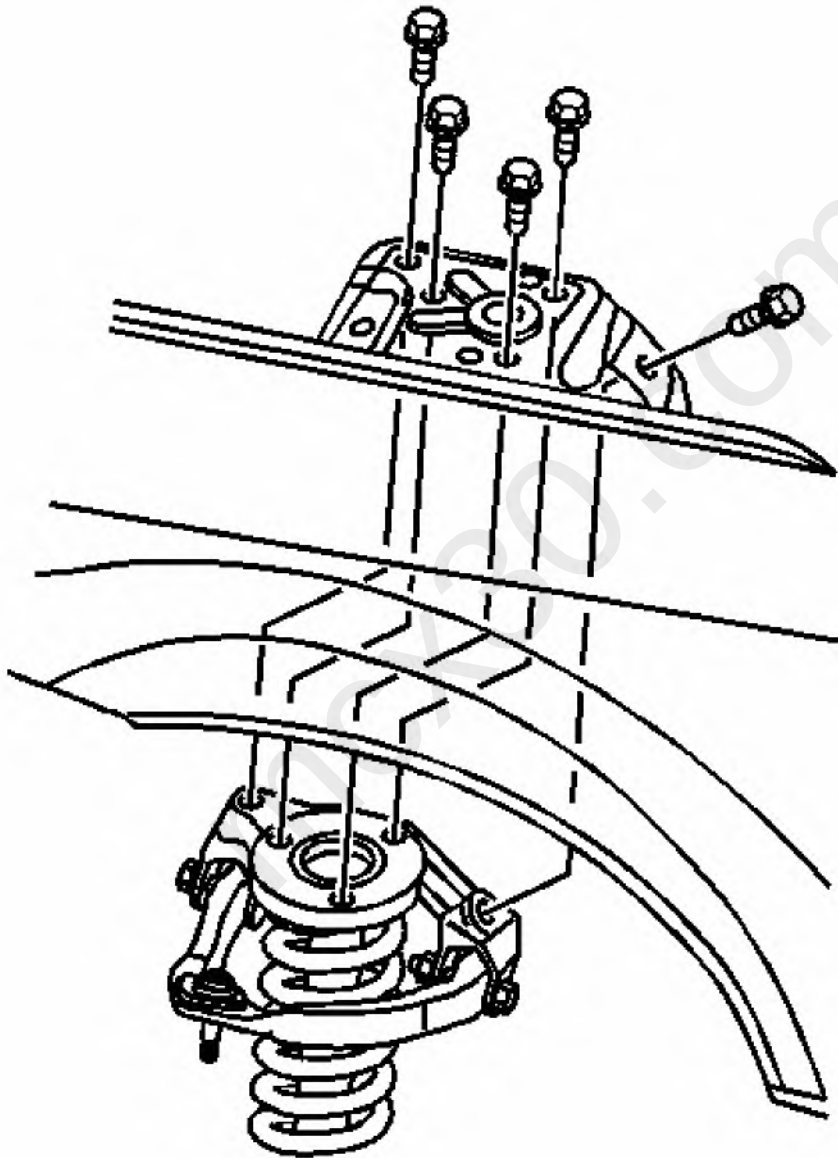


Fig. 41: View Of Shock Module & Upper Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

59. Remove the upper mounting bolts from the right and left shock module. Refer to **Shock Module Replacement** in Front Suspension.

60. Raise the vehicle enough to place a suitable lift table under the engine, transmission, front frame and front suspension assembly.
61. Position a suitable powertrain or engine lift table below the frame, engine and transmission.
62. Raise the lift table or lower the vehicle to support the frame, engine and transmission.
63. Remove the bolts which secure the transmission brace to the underbody. Refer to **Transmission Support Replacement** in Frame and Underbody.

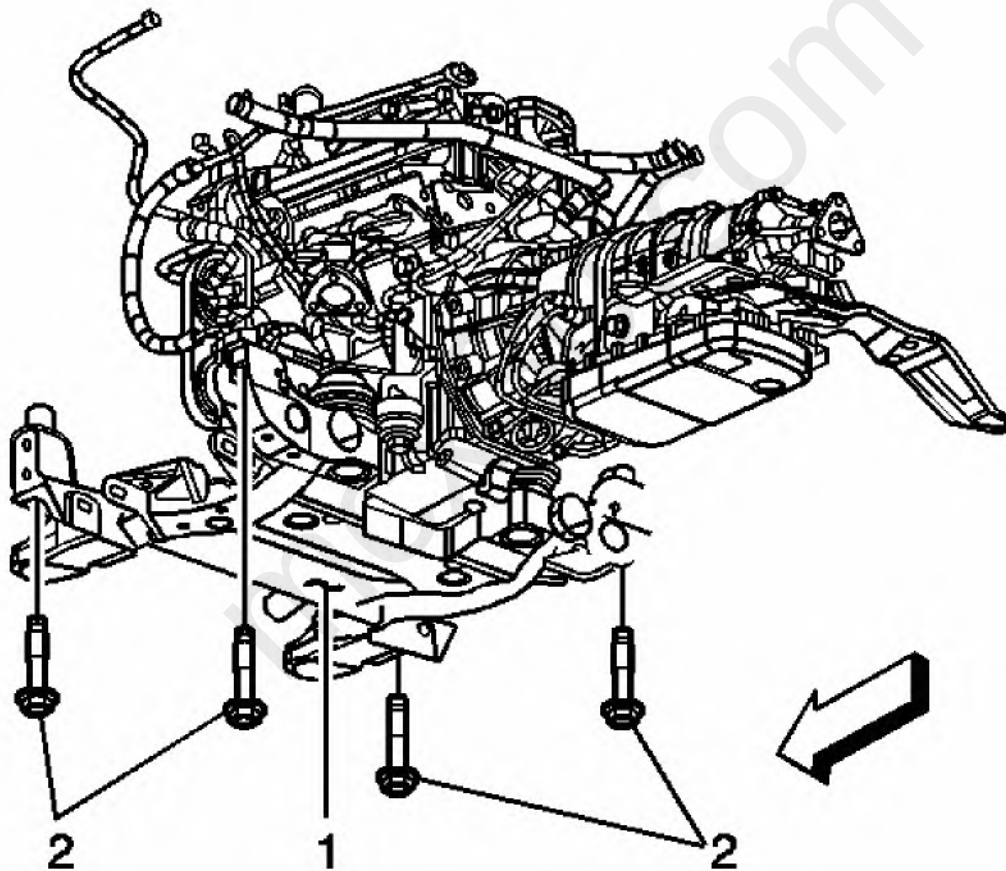


Fig. 42: Identifying Frame Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

64. Remove the front frame bolts (2).

IMPORTANT: Ensure that all the hoses, wires, pipes and shock modules clear the vehicle during the removal process.

65. With the aid of an assistant, lower the table or raise the vehicle to remove the engine, transmission, front frame and front suspension assembly from the vehicle.

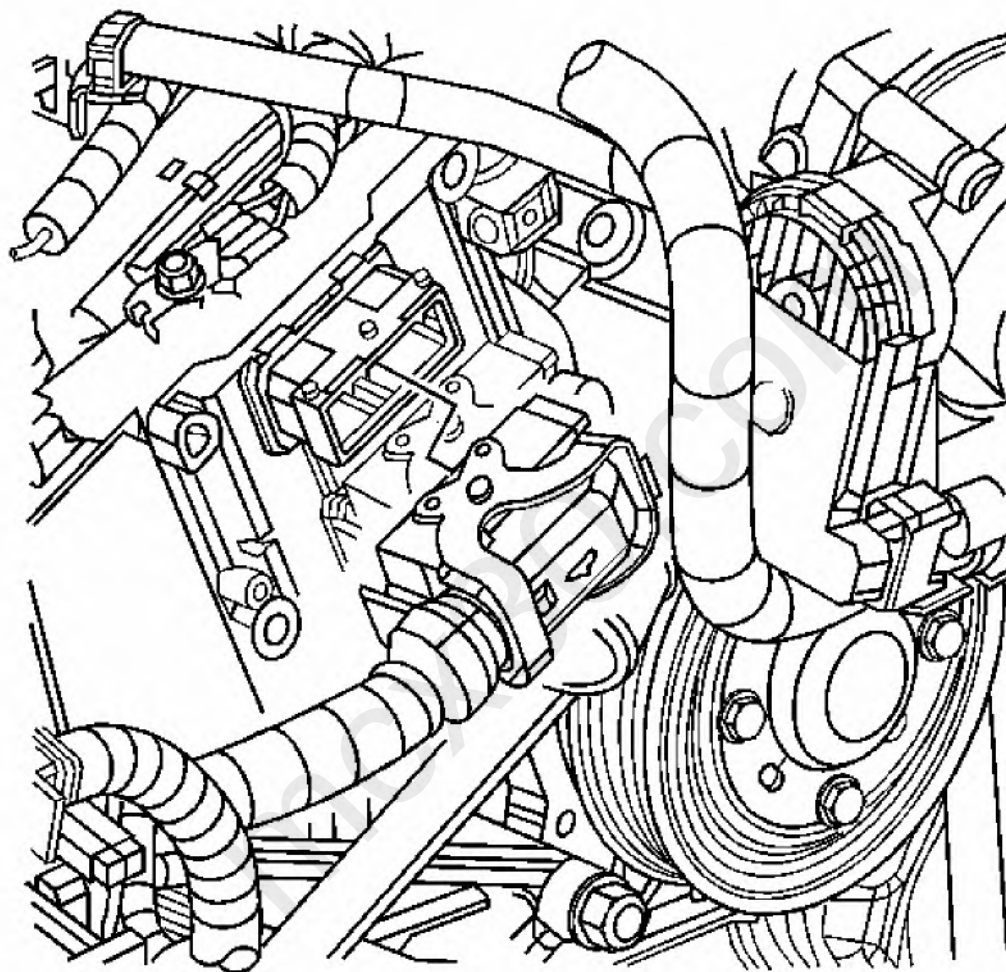


Fig. 43: View Of Upper ECM Connector
Courtesy of GENERAL MOTORS CORP.

66. Disconnect the engine control module (ECM) upper electrical connector. Refer to **Engine Control Module Replacement** in Engine Controls - 3.6L (LY7).

IMPORTANT: Do NOT remove the oxygen sensors.

67. Remove the catalytic converters with the oxygen sensors. Refer to **Catalytic Converter Replacement - Left Side (LY7)** and to **Catalytic Converter Replacement - Right Side (LY7)** in Engine Exhaust.

68. Remove the thermostat housing with the heater pipes, heater hoses and surge tank outlet hose. Refer to **Engine Coolant Thermostat Housing Removal**.
69. Remove the starter motor. Refer to **Starter Motor Replacement (LY7)** or **Starter Motor Replacement (LH2)** or **Starter Motor Replacement (LC3)** in Engine Electrical.
70. Remove the flywheel bolts.

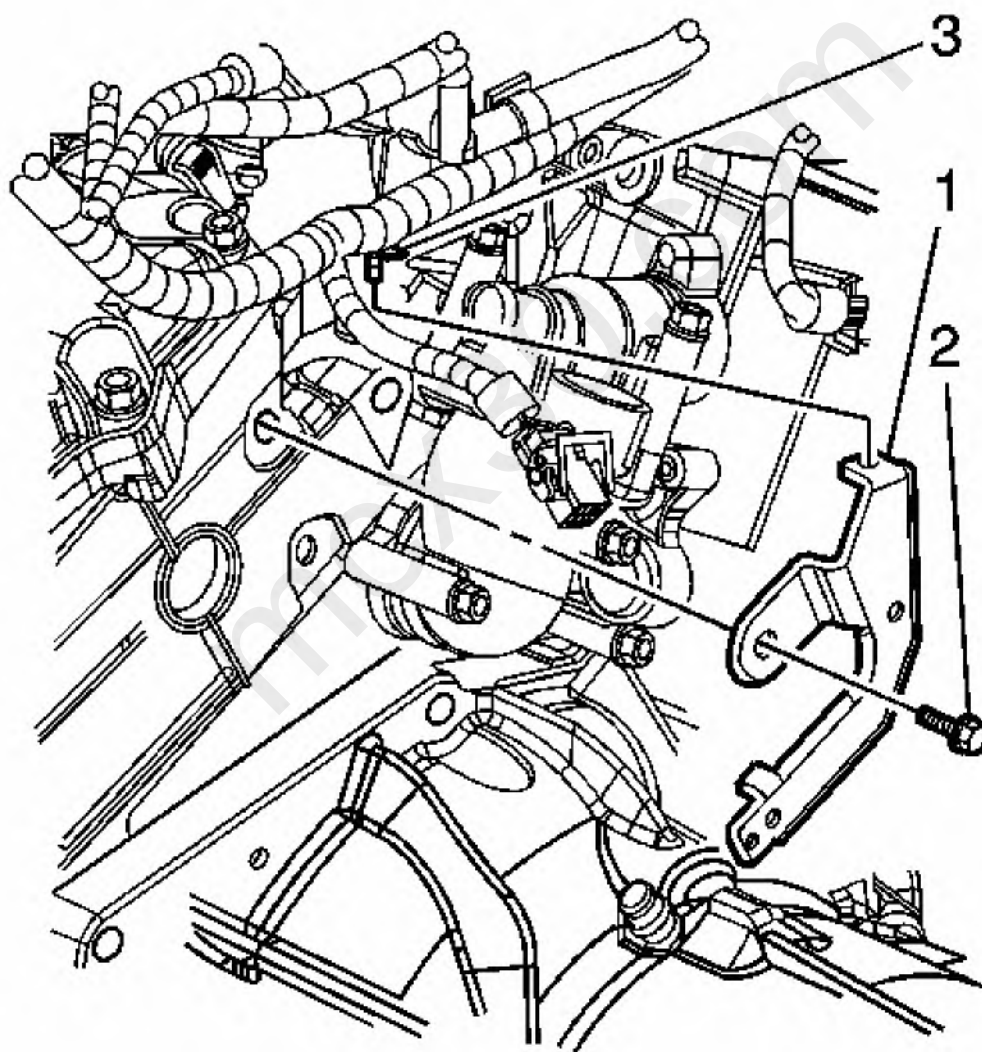


Fig. 44: View Of HO2S Connector Bracket
Courtesy of GENERAL MOTORS CORP.

71. Remove the heated oxygen sensor (HO2S) connector bracket (1) from the left cylinder

head.

72. Remove the engine wiring harness and related components. Refer to **Engine Wiring Harness Assembly Removal**.
73. Disconnect the transmission oil cooler pipes from the engine, radiator and the transmission. Refer to **Transmission Fluid Cooler Pipe Replacement - Front** and to **Transmission Fluid Cooler Pipe Replacement - Rear (w/AWD)** or **Transmission Fluid Cooler Pipe Replacement - Rear (w/RWD)** in Automatic Transmission - 5L40-E/5L50-E.
74. Disconnect the radiator hoses from the water outlet housing and the coolant inlet pipe. Refer to **Radiator Inlet Hose Replacement (LY7)** or **Radiator Inlet Hose Replacement (LH2)** in Engine Cooling.
75. Disconnect the power steering cooler hoses from the condenser radiator and fan module (CRFM). Refer to **Power Steering Cooler Pipe/Hose Replacement** in Power Steering System.
76. Plug the power steering hoses and pipes in order to prevent fluid loss and contamination.
77. Remove the CRFM with the radiator hoses from the frame.
78. Install **EN 46114** to the engine. See **Special Tools** . Refer to **Engine Support Fixture** .
79. Connect a floor crane to the engine lift brackets and raise the floor crane to partially support the engine.
80. Position a second powertrain lift table below the transmission.
81. Remove the bolts that secure the transmission to the engine. Refer to **Transmission Replacement (w/RPO LH2)** in Automatic Transmission - 5L40-E/5L50-E.
82. Remove the transmission from the engine.
83. Remove the drive belts. Refer to **Water Pump and Generator Belt Replacement** and to **Air Conditioning Compressor and Power Steering Pump Drive Belt Replacement** .
84. Remove the generator and water pump drive belt tensioner. Refer to **Drive Belt Tensioner Removal - Right Side**.
85. Remove the A/C compressor and power steering drive belt tensioner. Refer to **Drive Belt Tensioner Removal - Left Side**.
86. Remove the generator and the generator bracket. Refer to **Generator Removal**.
87. Remove the A/C compressor. Refer to **Air Conditioning (A/C) Compressor Removal**.
88. Remove the power steering pump. Refer to **Power Steering Pump Removal**.
89. Remove the power steering reservoir from the engine. Refer to **Remote Power Steering Fluid Reservoir Replacement (LH2)** or **Remote Power Steering Fluid Reservoir Replacement (LY7)** in Power Steering System.
90. Remove the oil level indicator. Refer to **Oil Level Indicator and Tube Removal**.

91. Remove the left exhaust manifold. Refer to **Exhaust Manifold Removal - Left Side**.
92. Remove the oil filter adapter. Refer to **Oil Filter Adapter Removal**.
93. Remove the right exhaust manifold. Refer to **Exhaust Manifold Removal - Right Side (RWD)** or **Exhaust Manifold Removal - Right Side (AWD)**.
94. Remove the crankshaft balancer. Refer to **Crankshaft Balancer Removal**.
95. Remove the flywheel. Refer to **Engine Flywheel Removal**.
96. Remove the intake manifold. Refer to **Intake Manifold Removal**.
97. Remove the water outlet. Refer to **Water Outlet Removal**.
98. Remove the block heater. Refer to **Coolant Heater Replacement (LH2 (KO5))** or **Coolant Heater Replacement (LH2 (KA3))** or **Coolant Heater Replacement (LY7, KO5)** or **Coolant Heater Replacement (LC3 (K05))** in Engine Cooling.
99. Remove the ECM with the ECM bracket. Refer to **Engine Control Module Replacement** in Engine Controls - 3.6L (LY7).
100. Use a floor crane in order to remove the engine from the frame.
101. Remove the engine mount brackets with the engine mounts. Refer to **Engine Mount Bracket Replacement - Left Side** and to **Engine Mount Bracket Replacement - Right Side (w/RWD)** or **Engine Mount Bracket Replacement - Right Side (w/AWD)**.

INSTALLATION PROCEDURE

1. Install the engine mount brackets with the engine mounts. Refer to **Engine Mount Bracket Replacement - Left Side** and to **Engine Mount Bracket Replacement - Right Side (w/RWD)** or **Engine Mount Bracket Replacement - Right Side (w/AWD)**.
2. Use a floor crane in order to install the engine to the frame.
3. Install the ECM with the ECM bracket. Refer to **Engine Control Module Replacement** in Engine Controls - 3.6L (LY7).
4. Install the water outlet. Refer to **Starter Installation**.
5. Install the block heater. Refer to **Coolant Heater Replacement (LH2 (KO5))** or **Coolant Heater Replacement (LH2 (KA3))** or **Coolant Heater Replacement (LY7, KO5)** or **Coolant Heater Replacement (LC3 (K05))** in Engine Cooling.
6. Install the flywheel. Refer to **Engine Flywheel Installation**.
7. Install the intake manifold. Refer to **Intake Manifold Installation**.
8. Install the crankshaft balancer. Refer to **Crankshaft Balancer Installation**.
9. Install the right exhaust manifold. Refer to **Exhaust Manifold Installation - Right Side (RWD)** or **Exhaust Manifold Installation - Right Side (AWD)**.
10. Install the oil filter adapter. Refer to **Oil Filter Adapter Installation**.
11. Install the left exhaust manifold. Refer to **Exhaust Manifold Installation - Left Side**.

12. Install the oil level indicator. Refer to **Oil Level Indicator and Tube Installation** .
13. Install the generator and the generator bracket. Refer to **Generator Installation** .
14. Install the power steering pump. Refer to **Power Steering Pump Installation** .
15. Install the power steering reservoir to the engine. Refer to **Remote Power Steering Fluid Reservoir Replacement (LH2)** or **Remote Power Steering Fluid Reservoir Replacement (LY7)** in Power Steering System.
16. Install the A/C compressor. Refer to **Air Conditioning (A/C) Compressor Installation** .
17. Install the A/C compressor and power steering drive belt tensioner. Refer to **Drive Belt Tensioner Installation - Left Side** .
18. Install the generator and water pump drive belt tensioner. Refer to **Drive Belt Tensioner Installation - Right Side** .
19. Install the drive belts. Refer to **Water Pump and Generator Belt Replacement** and to **Air Conditioning Compressor and Power Steering Pump Drive Belt Replacement** .
20. Install the bolts that secure the transmission to the engine and the flywheel to the torque convertor. Refer to **Transmission Replacement (w/RPO LH2)** in Automatic Transmission - 5L40-E/5L50-E.
21. Install the starter motor. Refer to **Starter Motor Replacement (LY7)** or **Starter Motor Replacement (LH2)** or **Starter Motor Replacement (LC3)** in Engine Electrical.
22. Remove EN 46114 from the engine. See **Special Tools** . Refer to **Engine Support Fixture** .
23. Install the CRFM with the radiator hoses to the frame.
24. Connect the power steering cooler hoses to the CRFM. Refer to **Power Steering Cooler Pipe/Hose Replacement** in Power Steering System.
25. Connect the radiator hoses to the water outlet housing and the coolant inlet pipe. Refer to **Radiator Inlet Hose Replacement (LY7)** or **Radiator Inlet Hose Replacement (LH2)** in Engine Cooling.
26. Install the transmission oil cooler pipes to the engine, radiator and the transmission. Refer to **Transmission Fluid Cooler Pipe Replacement - Front** and to **Transmission Fluid Cooler Pipe Replacement - Rear (w/AWD)** or **Transmission Fluid Cooler Pipe Replacement - Rear (w/RWD)** in Automatic Transmission - 5L40-E/5L50-E.
27. Install the engine wiring harness and related components. Refer to **Engine Wiring Harness Assembly Installation** .

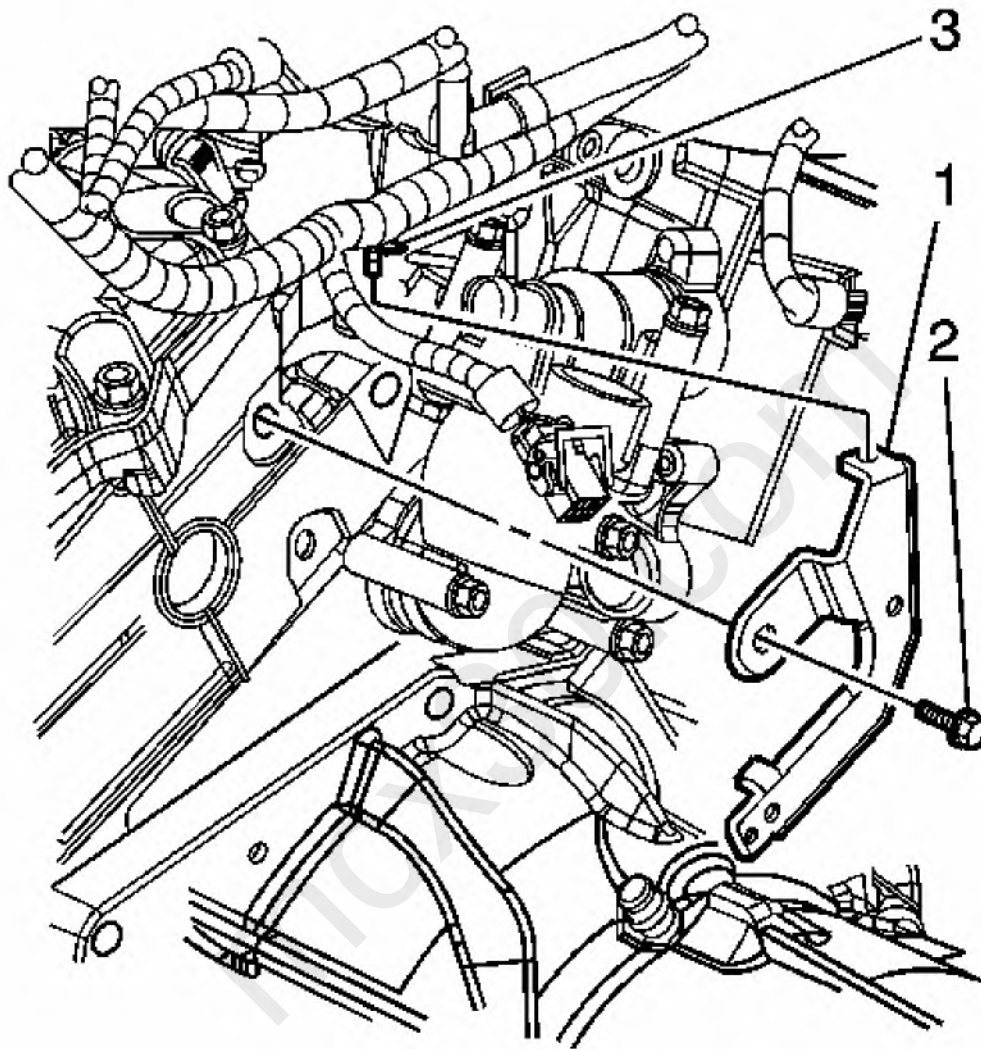


Fig. 45: View Of HO2S Connector Bracket
Courtesy of GENERAL MOTORS CORP.

28. Install the HO2S connector bracket (1) to the left cylinder head.
29. Install the thermostat housing with the heater pipes, heater hoses and surge tank outlet hose. Refer to **Engine Coolant Thermostat Housing Removal**.
30. Install the catalytic converters with the oxygen sensors. Refer to **Catalytic Converter Replacement - Left Side (LY7)** and to **Catalytic Converter Replacement - Right Side (LY7)** in Engine Exhaust.
31. Install the fuel lines to the fuel rail and the EVAP purge solenoid. Refer to **Metal Collar Quick Connect Fitting Service** in Engine Controls - 3.6L (LY7).

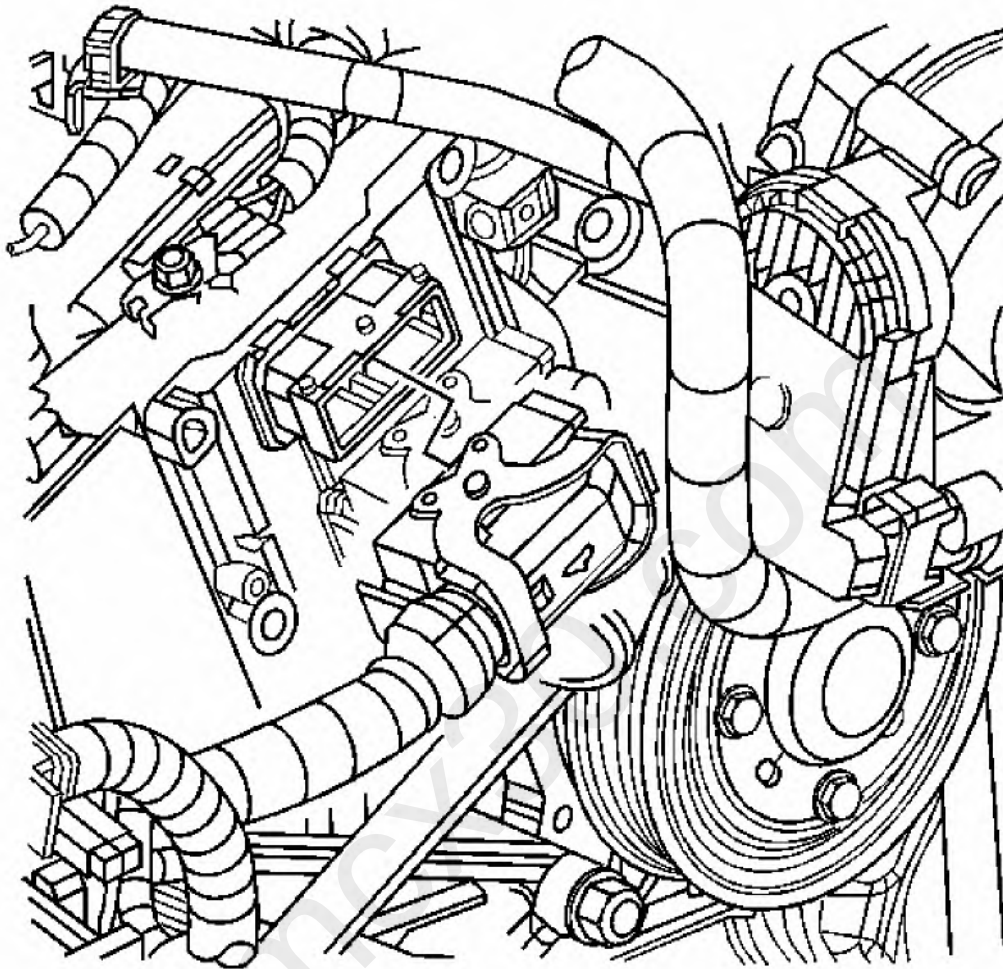


Fig. 46: View Of Upper ECM Connector
Courtesy of GENERAL MOTORS CORP.

32. Connect the ECM chassis side electrical connector. Refer to **Engine Control Module Replacement** in Engine Controls - 3.6L (LY7).

IMPORTANT: Ensure that all the hoses, wires, pipes and shock modules clear the vehicle during the installation process.

33. With the aid of an assistant, raise the table or lift the vehicle to install the engine, transmission, front frame and front suspension assembly to the vehicle.

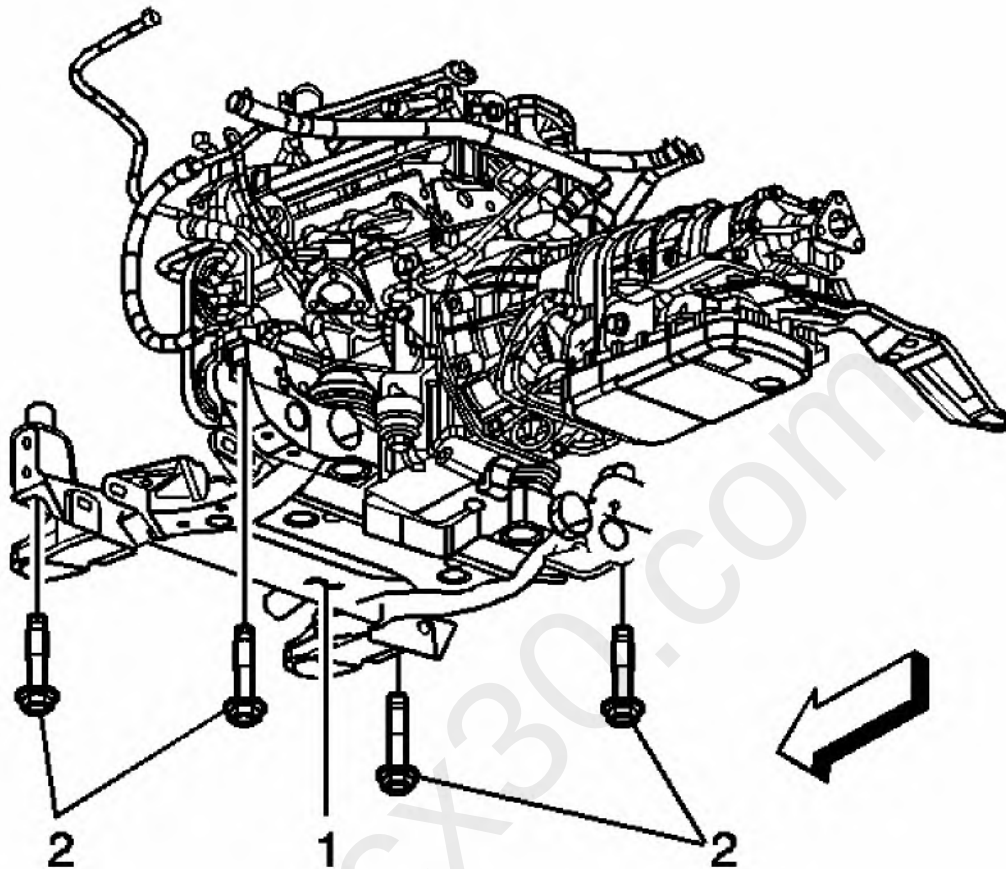


Fig. 47: Identifying Frame Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

34. Install the front frame bolts (2). Refer to **Front Frame Replacement** in Frame and Underbody.
35. Install the transmission support to underbody bolts. Refer to **Transmission Support Replacement** in Frame and Underbody.
36. Remove the powertrain lift/support table.

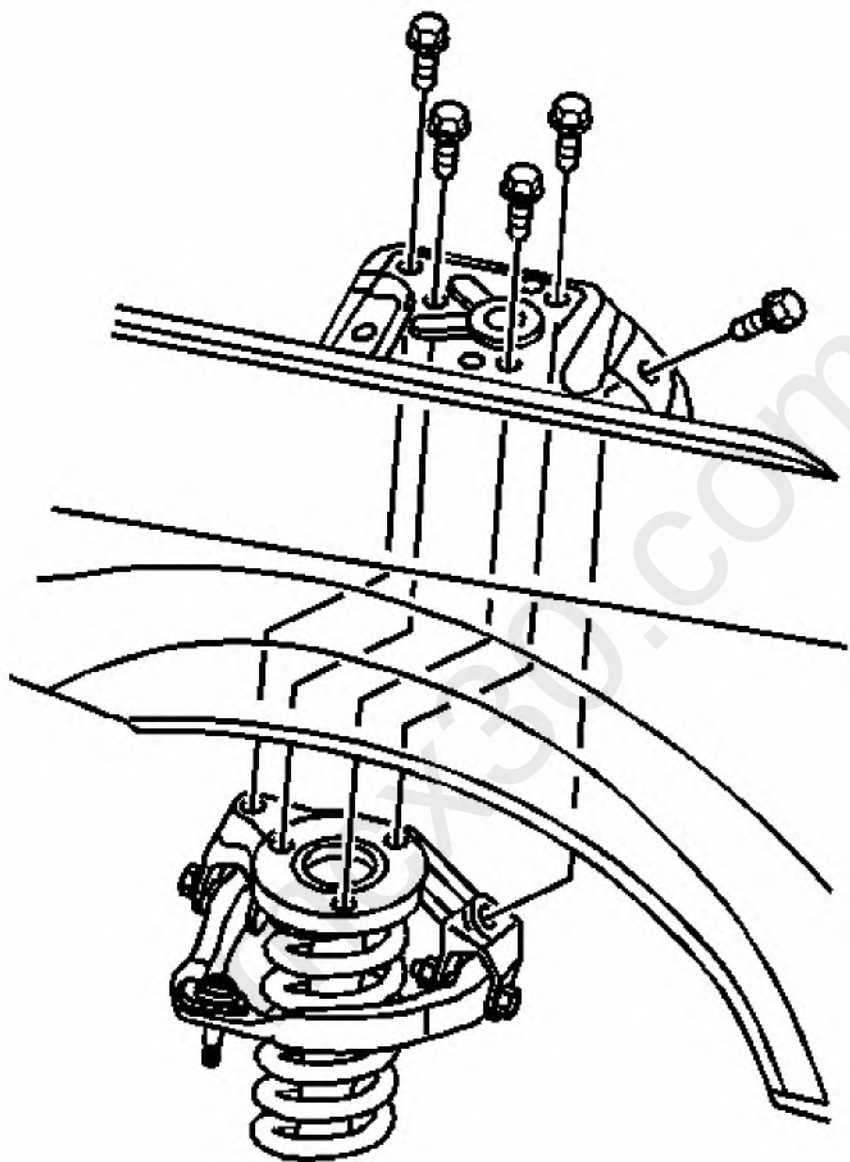


Fig. 48: View Of Shock Module & Upper Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

37. Install the upper mounting bolts to the right and left shock module. Refer to **Shock Module Replacement** in Front Suspension.
38. Secure the shock modules to the front frame with mechanics wire to avoid stretching the front brake hoses.
39. Install the headlamp leveling sensors. Refer to **Headlamp Leveling Front Suspension**

Height Sensor Replacement in Lighting Systems.

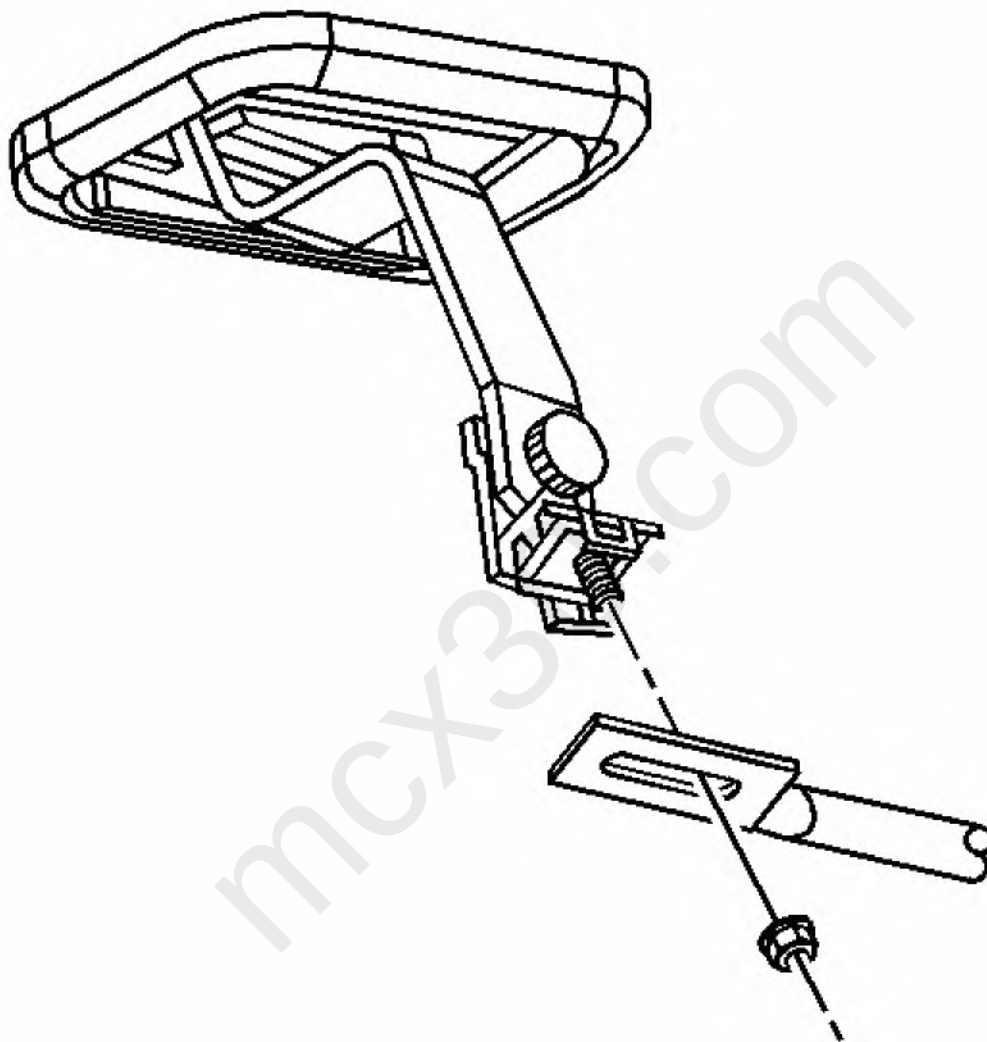


Fig. 49: View Of Transmission Shift Linkage
Courtesy of GENERAL MOTORS CORP.

40. Connect the transmission shift linkage to the transmission. Refer to **Shift Control Linkage Replacement (Rear Wheel Drive)** or **Shift Control Linkage Replacement (All Wheel Drive)** in Automatic Transmission - 5L40-E/5L50-E.
41. Connect electrical connector to the low oil level sensor.

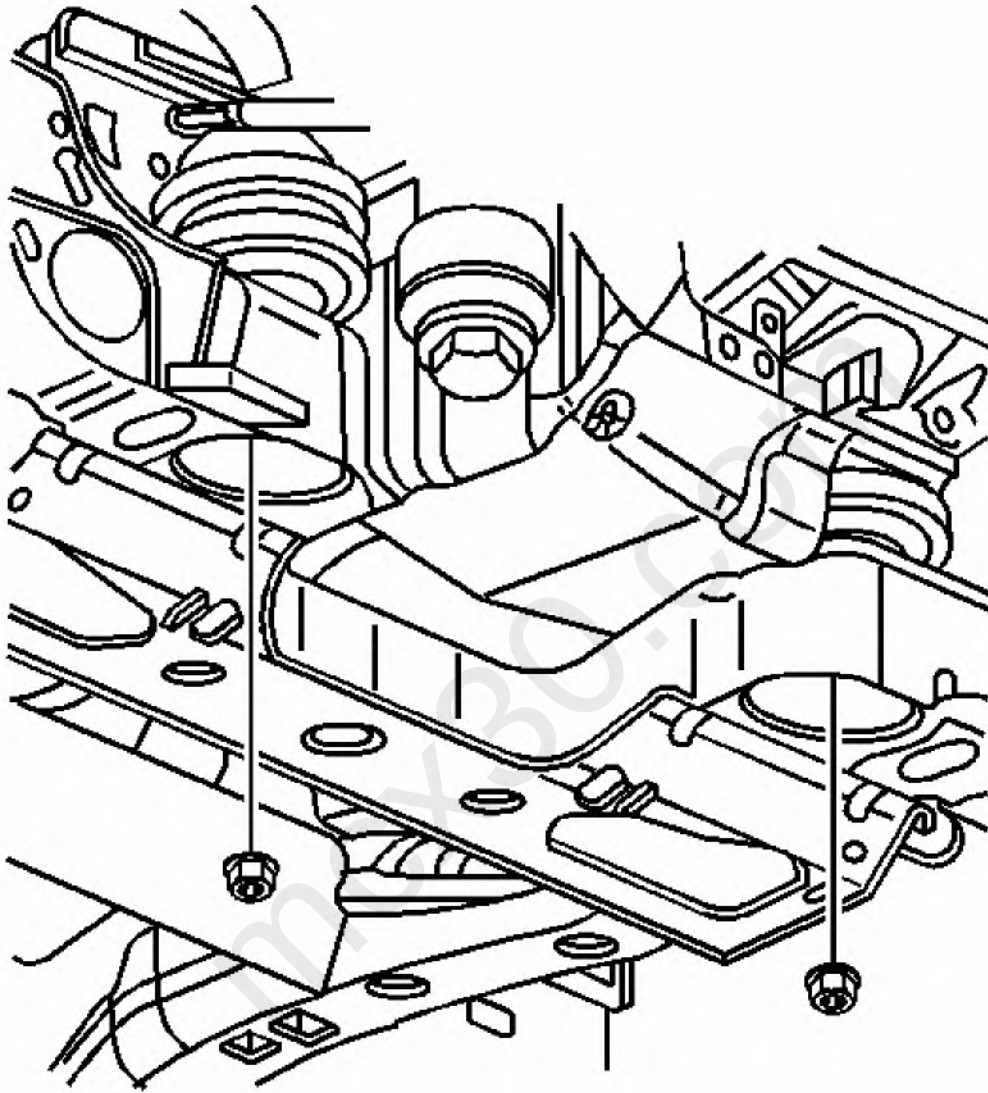


Fig. 50: Identifying Frame Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

42. Install the lower engine mount nuts. Refer to **Engine Mount Replacement - Left Side** and to **Engine Mount Replacement - Right Side (w/RWD)** or **Engine Mount Replacement - Right Side (W/AWD)** in Engine Mechanical - 3.6L (LY7).
43. Install the lower intermediate steering shaft. Refer to **Lower Intermediate Steering Shaft Replacement** in Steering Wheel and Column.
44. Install the front tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

45. Install the front brake pipes and retainers to the underbody.
46. Connect the rear brake pipes to the BPMV. Refer to **Brake Pressure Modulator Valve Replacement** in Antilock Brake System.
47. Connect the side air baffles to the radiator.
48. Install the washer bottle bracket. Refer to **Solvent Container, Pump, Level Sensor Replacement - Windshield Washer** in Wipers/Washer Systems.
49. Install the air deflector. Refer to **Front Air Deflector Replacement** in Body Front End.
50. Install the propeller shaft. Refer to **Rear Propeller Shaft Replacement (AWD)** or **Rear Propeller Shaft Replacement (RWD)** in Propeller Shaft.
51. Install the muffler assembly. Refer to **Exhaust System Replacement** in Engine Exhaust.

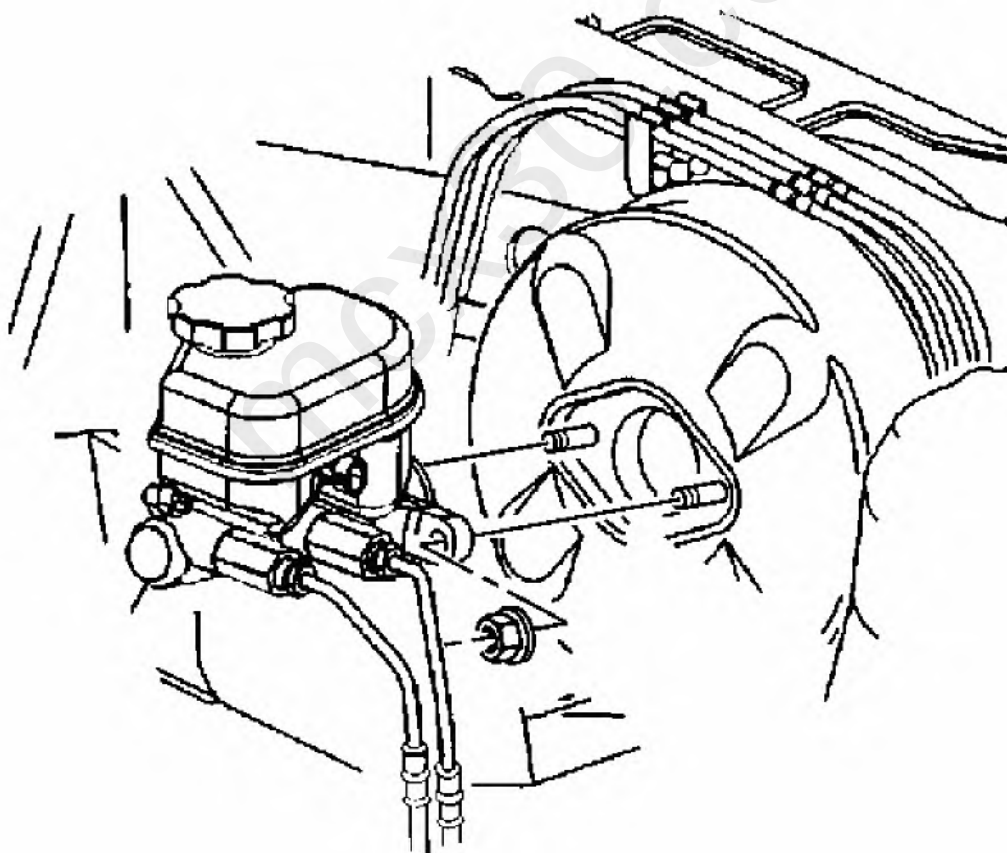


Fig. 51: Removing & Installing Master Cylinder
Courtesy of GENERAL MOTORS CORP.

52. Install the master cylinder. Refer to **Master Cylinder Replacement** in Hydraulic

Brakes.

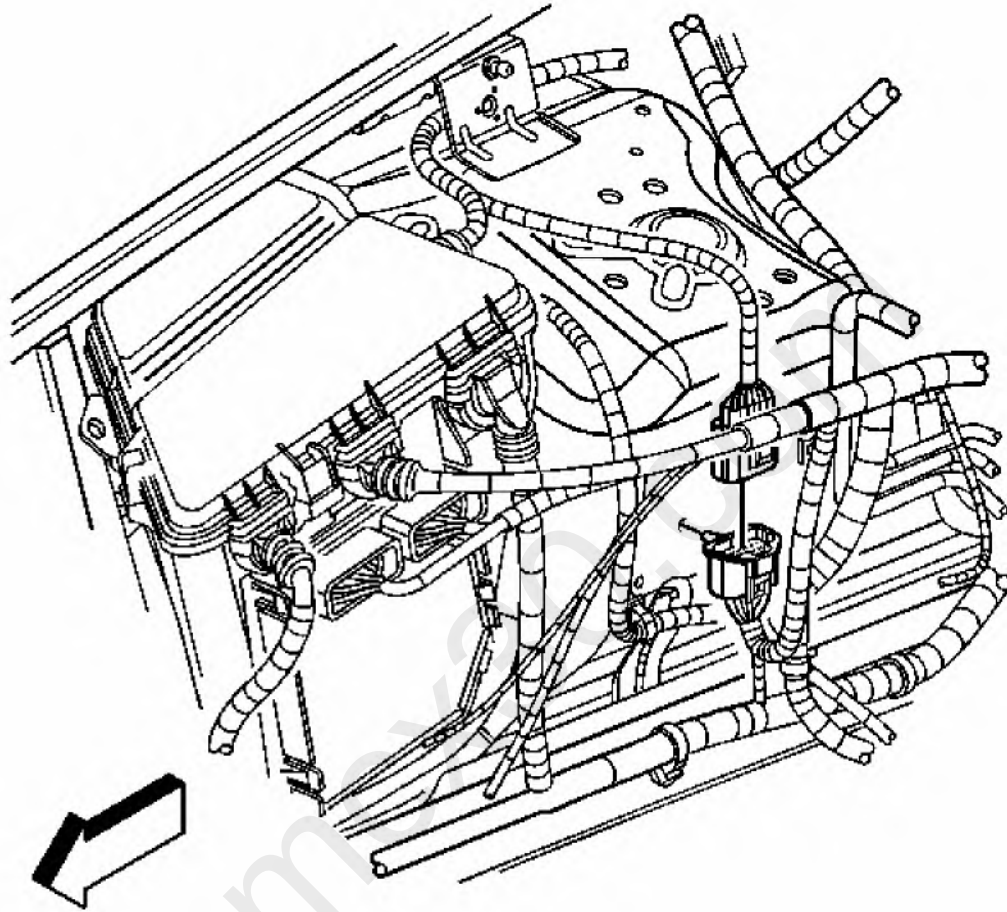


Fig. 52: View Of Longitudinal Rail Engine Harness Electrical Connector
Courtesy of GENERAL MOTORS CORP.

53. Connect the engine harness electrical connector at the longitudinal rail.

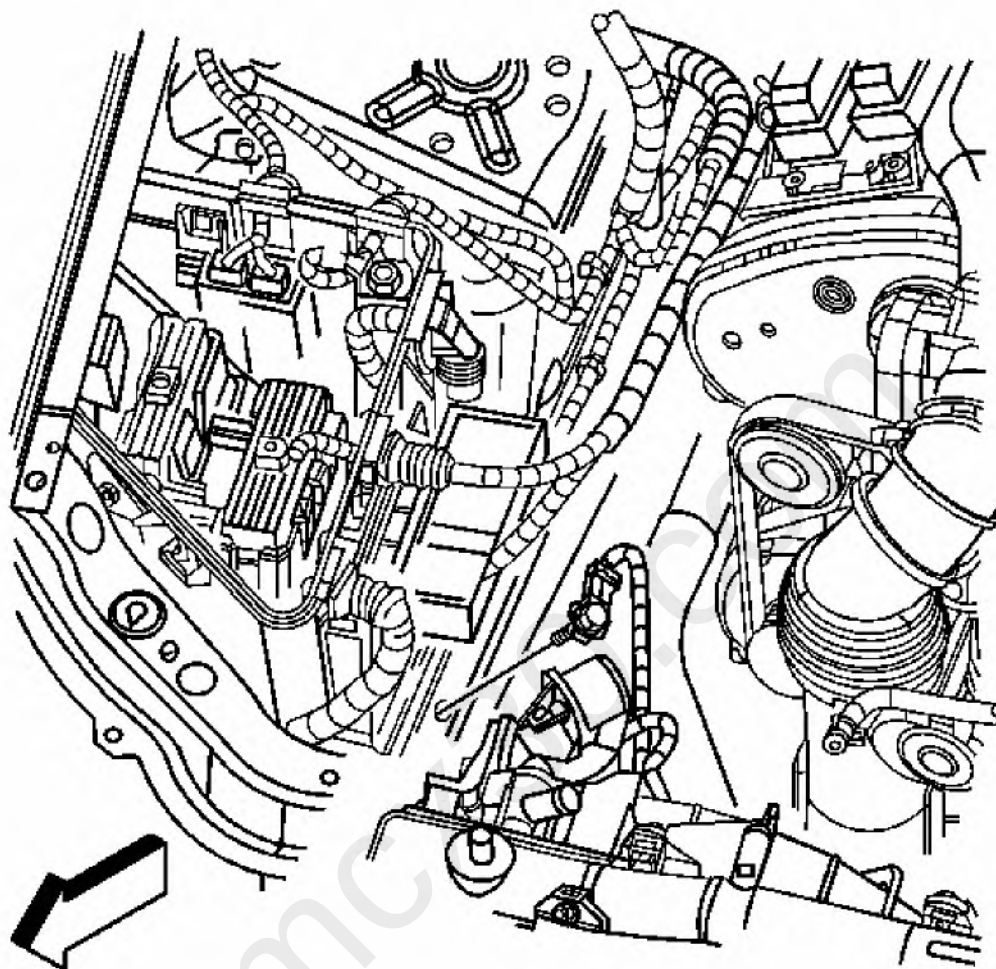


Fig. 53: View Of Ground Bolt & Wire
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

54. Install the ground wire and bolt to the longitudinal rail.

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

55. Connect the wiring harness to the transmission control module. Refer to Transmission Control Module Replacement in Automatic Transmission - 5L40-E/5L50-E.

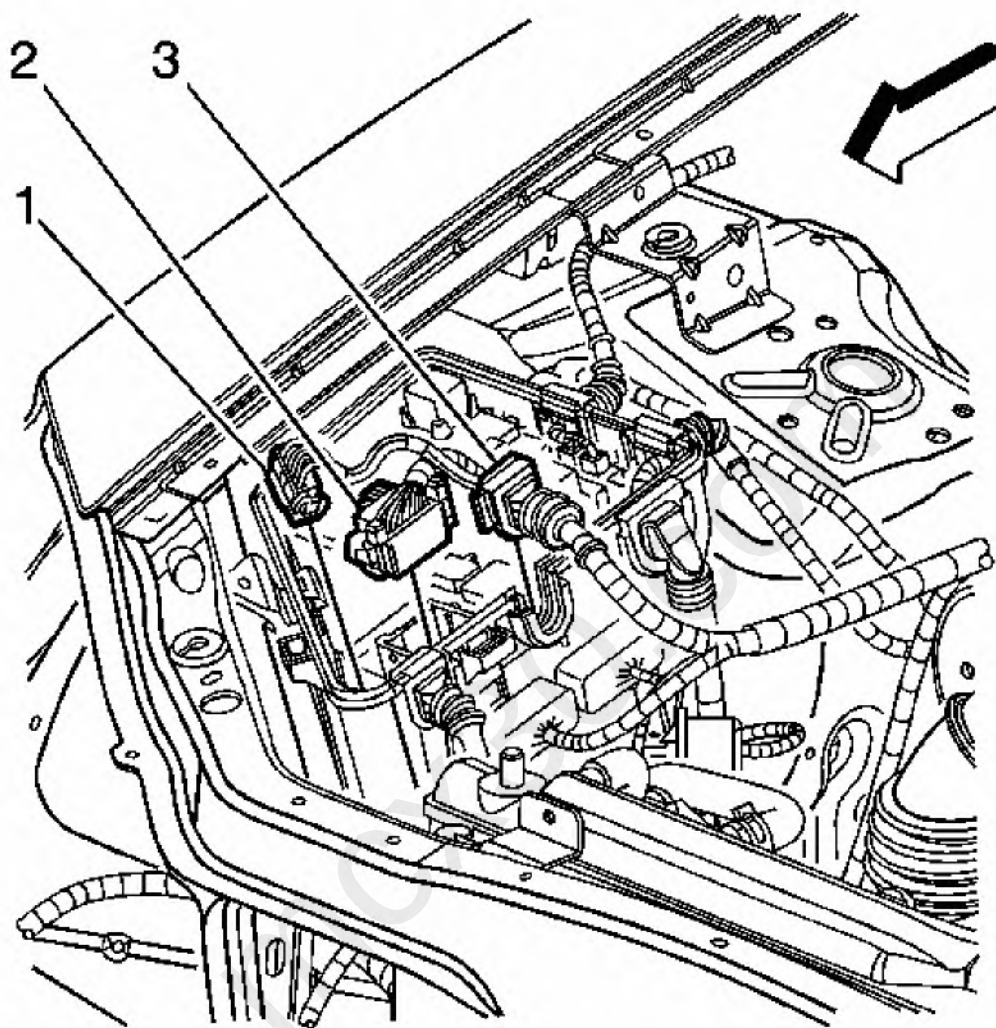


Fig. 54: View Of Engine Module Wiring Harness Connectors
Courtesy of GENERAL MOTORS CORP.

56. Connect the engine module wiring harness connectors (1-3) to the underhood electrical center. Refer to Underhood Electrical Center or Junction Block Replacement in Wiring Systems.
57. Connect and lock the I/P electrical connector to the engine at the rear of the left Bank 2 cylinder head.
58. Connect the mass air flow sensor electrical connector.
59. Connect the electrical connector for the brake fluid level switch from the master cylinder.

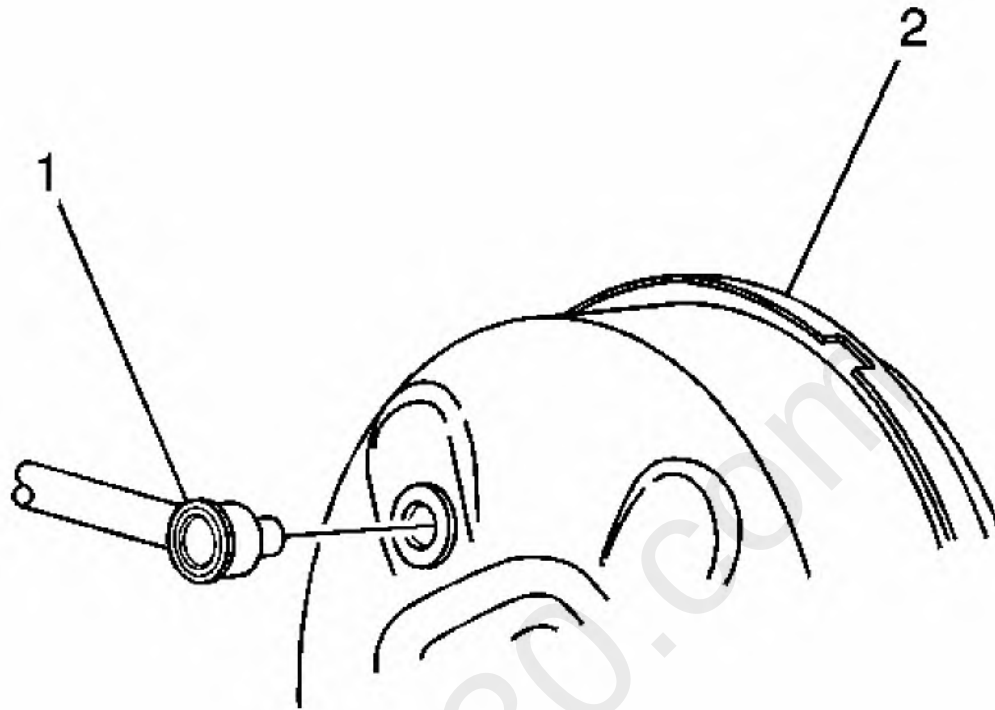


Fig. 55: View Of Vacuum Check Valve & Brake Booster
Courtesy of GENERAL MOTORS CORP.

60. Connect the brake booster vacuum hose (1) to the brake booster (2).
61. Install the radiator support brackets. Refer to **Radiator Support Bracket Replacement** in Engine Cooling.

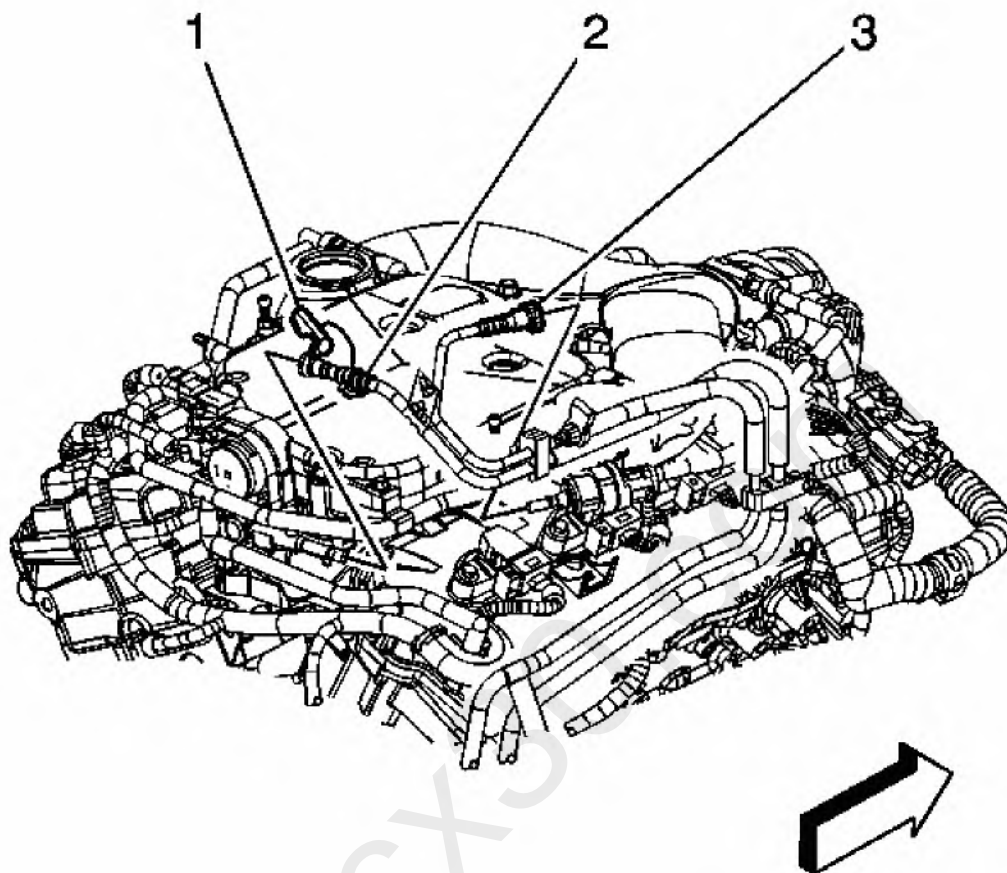


Fig. 56: Top Of Engine View
Courtesy of GENERAL MOTORS CORP.

62. Connect the purge line (3) to the purge solenoid.
63. Connect the fuel pipe (2) to the fuel rail. Refer to **Metal Collar Quick Connect Fitting Service** in Engine Controls - 3.6L (LY7).
64. Connect the heater hoses to the heater core. Refer to **Heater Inlet Hose Replacement (LY7)** or **Heater Inlet Hose Replacement (LH2)** and to **Heater Outlet Hose Replacement (LY7)** or **Heater Outlet Hose Replacement (LH2)** in Heating, Ventilation and Air Conditioning.
65. Install the air inlet duct.
66. Position and secure the surge tank inlet hose to the vehicle.
67. Connect the surge tank inlet hose to the water outlet housing and to the radiator. Refer to **Radiator Surge Tank Outlet Hose/Pipe Replacement (LY7)** or **Radiator Surge Tank Outlet Hose/Pipe Replacement (LH2)** in Engine Cooling.

68. Connect the outlet hose to the surge tank. Refer to **Radiator Surge Tank Inlet Hose/Pipe Replacement (LY7)** or **Radiator Surge Tank Inlet Hose/Pipe Replacement (LH2)** in Engine Cooling.
69. Connect the electrical connector for the air conditioning pressure switch and the liquid line to the evaporator. Refer to **Liquid Line Replacement (LY7)** or **Liquid Line Replacement (LH2)** in Heating, Ventilation and Air Conditioning.
70. Connect the air conditioning suction hose to the evaporator and install the suction hose bracket to the shock tower. Refer to **Suction Hose Replacement (LY7)** or **Suction Hose Replacement (LH2)** in Heating, Ventilation and Air Conditioning.

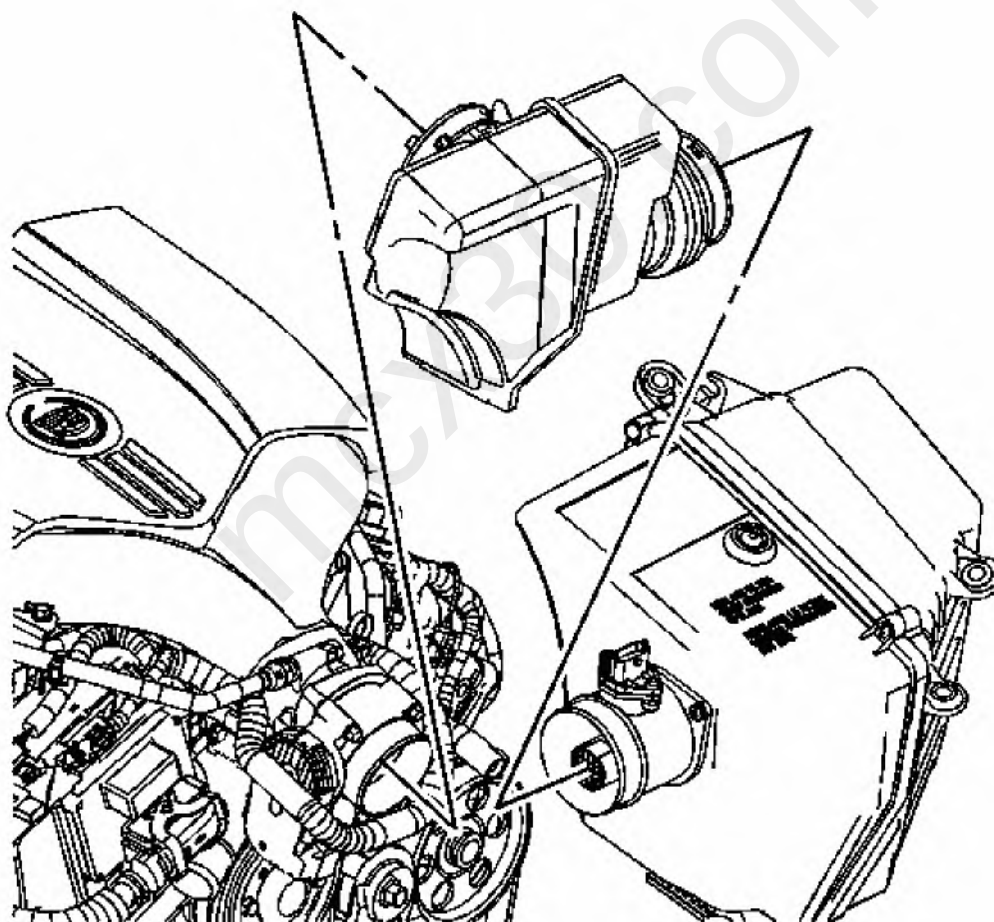


Fig. 57: View Of Air Inlet Duct
Courtesy of GENERAL MOTORS CORP.

71. Install the air cleaner duct. Refer to **Air Cleaner Inlet Duct Replacement** in Engine Controls - 3.6L (LY7).

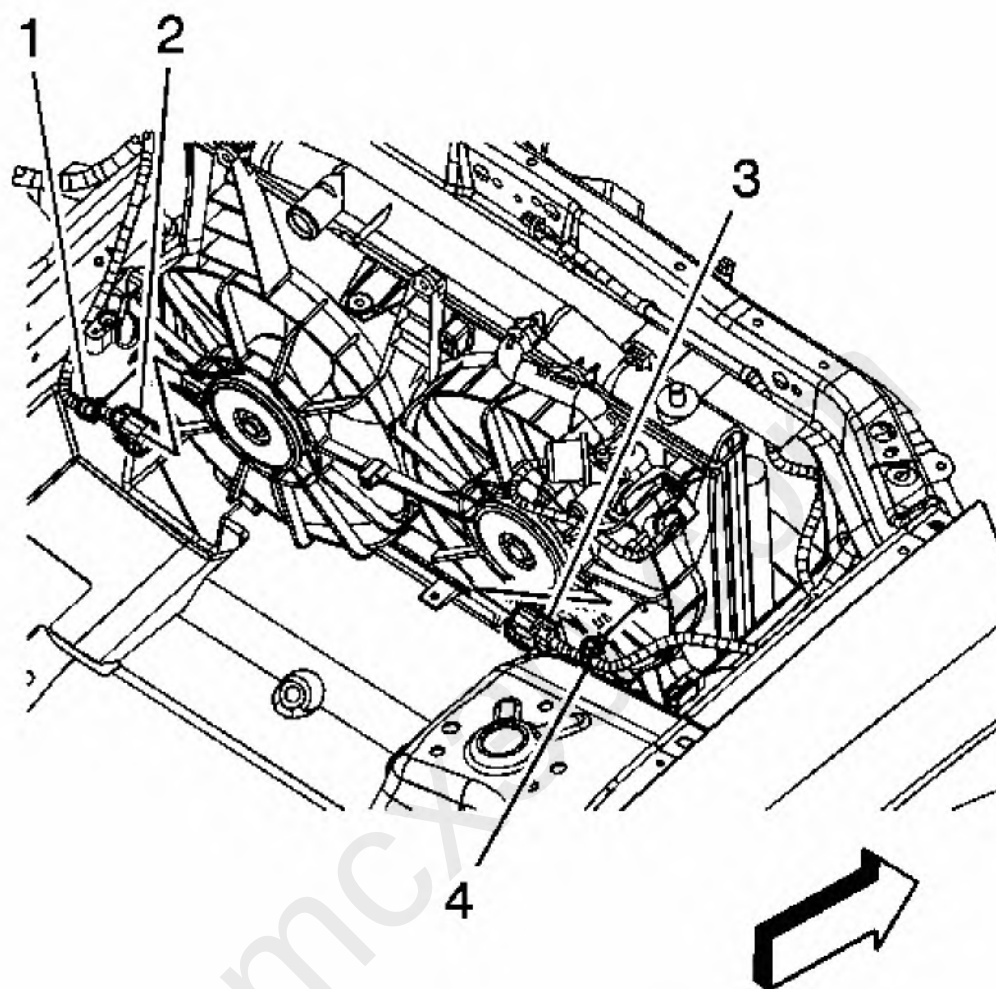


Fig. 58: View Of Cooling Fan Wiring Harness & Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

72. Install the cooling fan wiring harnesses (1, 4) to the fan shroud.
73. Install the cooling fan electrical connectors (2, 3).
74. Install the wiper module. Refer to **Windshield Wiper System Module Replacement**.
75. Install the battery. Refer to **Battery Replacement** in Engine Electrical.
76. Install the fuel injector sight shield. Refer to **Fuel Injector Sight Shield Replacement**.

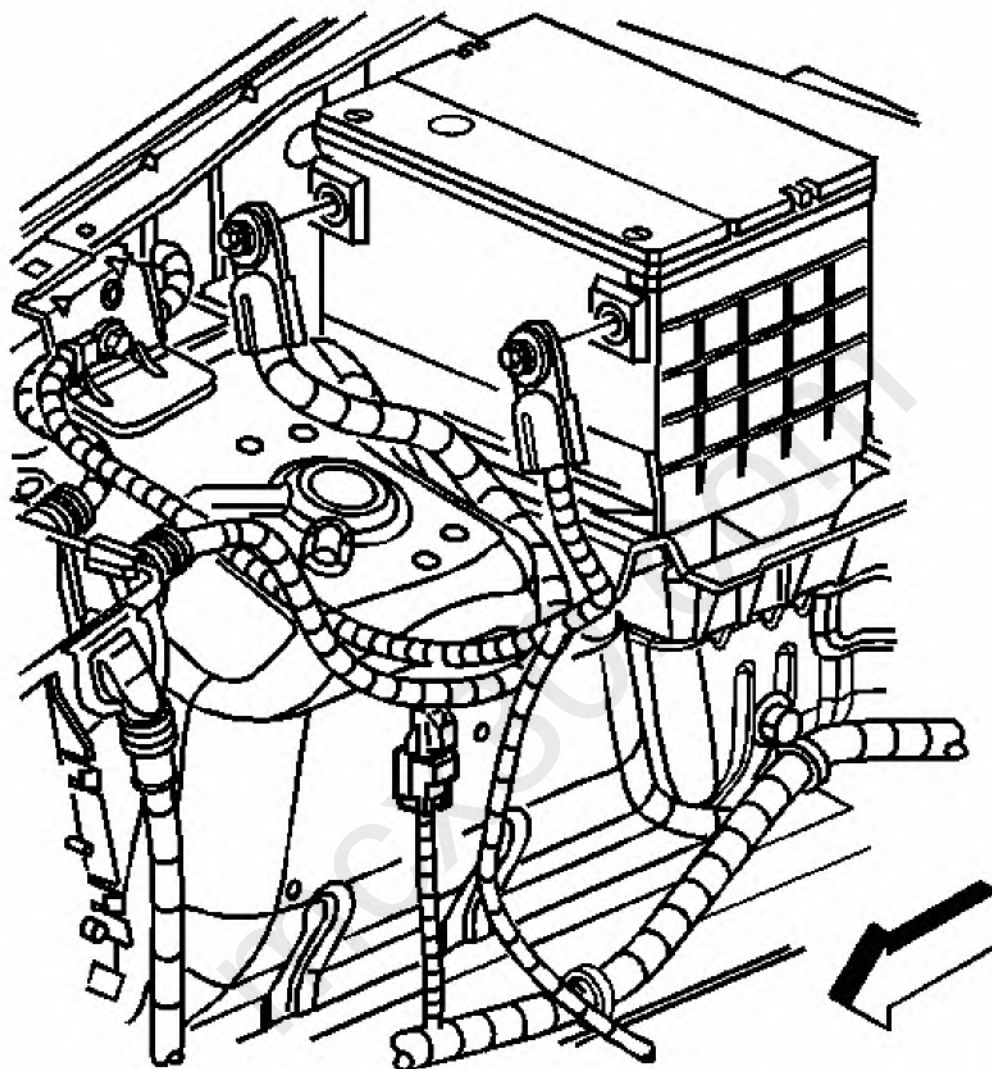


Fig. 59: View Of Battery Positive & Negative Cables
Courtesy of GENERAL MOTORS CORP.

77. Connect the positive cable to the battery and the underhood electrical center. Refer to **Battery Positive Cable Replacement (LY7)** or **Battery Positive Cable Replacement (LH2)** or **Battery Positive Cable Replacement (LC3)** in Engine Electrical.
78. Connect the negative cable from the battery and the body. Refer to **Battery Negative Cable Replacement (LY7)** or **Battery Negative Cable Replacement (LH2)** or **Battery Negative Cable Replacement (LC3)** in Engine Electrical.

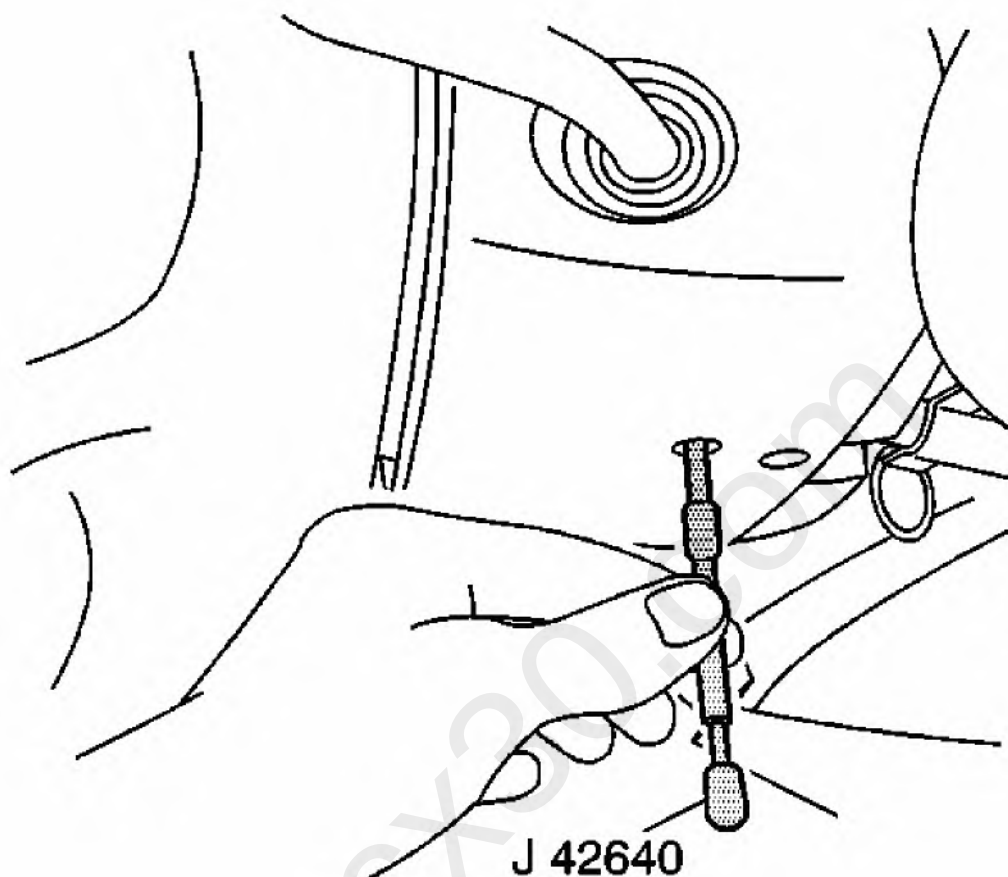


Fig. 60: Identifying J 42640

Courtesy of GENERAL MOTORS CORP.

79. Remove **J 42640** from the steering column. See **Special Tools** .
80. Fill the cooling system. Refer to **Cooling System Draining and Filling (Static Fill)** or **Cooling System Draining and Filling (GE 47719)** in Engine Cooling.
81. Charge the air conditioning system. Refer to **Refrigerant Recovery and Recharging** in Heating, Ventilation and Air Conditioning.
82. Bleed the brake rear circuits. Refer to **Hydraulic Brake System Bleeding (Manual)** or **Hydraulic Brake System Bleeding (Pressure)** in Hydraulic Brakes.

ENGINE OIL AND OIL FILTER REPLACEMENT

REMOVAL PROCEDURE

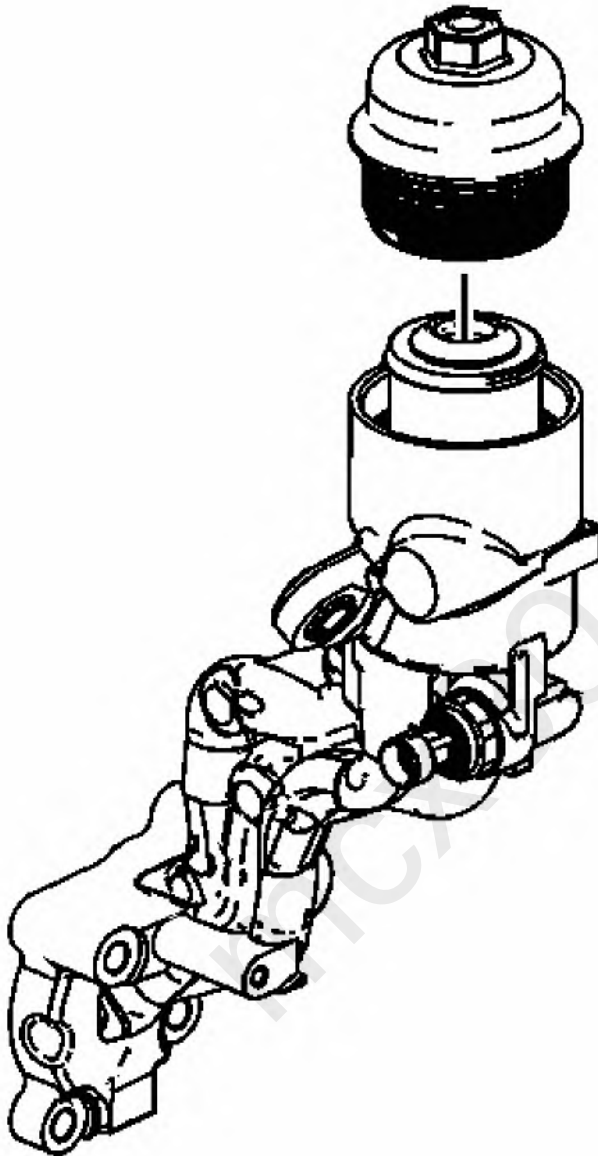


Fig. 61: View Of Oil Filter Cap
Courtesy of GENERAL MOTORS CORP.

1. Turn the ignition OFF.
2. Remove the front compartment sight shield as necessary. Refer to **Front Compartment Sight Shields Replacement** .

IMPORTANT: Use a 6-point socket to remove the oil filter cap.

3. Remove the oil filter cap.

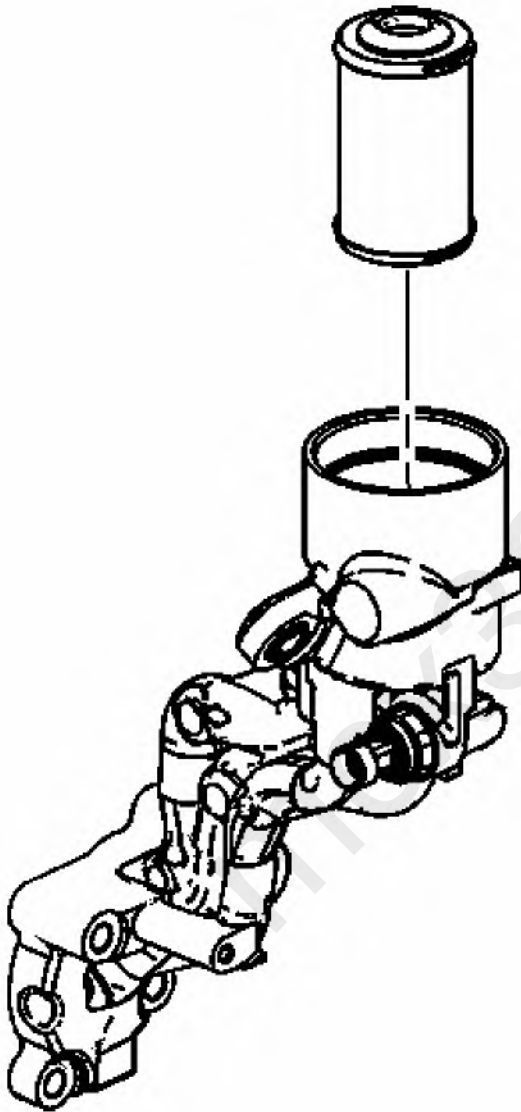


Fig. 62: View Of Oil Filter Cartridge
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: It is normal for oil to drain from the oil filter chamber in the oil filter adapter housing. Do NOT replace the oil filter adapter for this condition.

4. Remove and discard the oil filter cartridge.

5. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
6. Place a suitable drain below the oil pan drain plug.

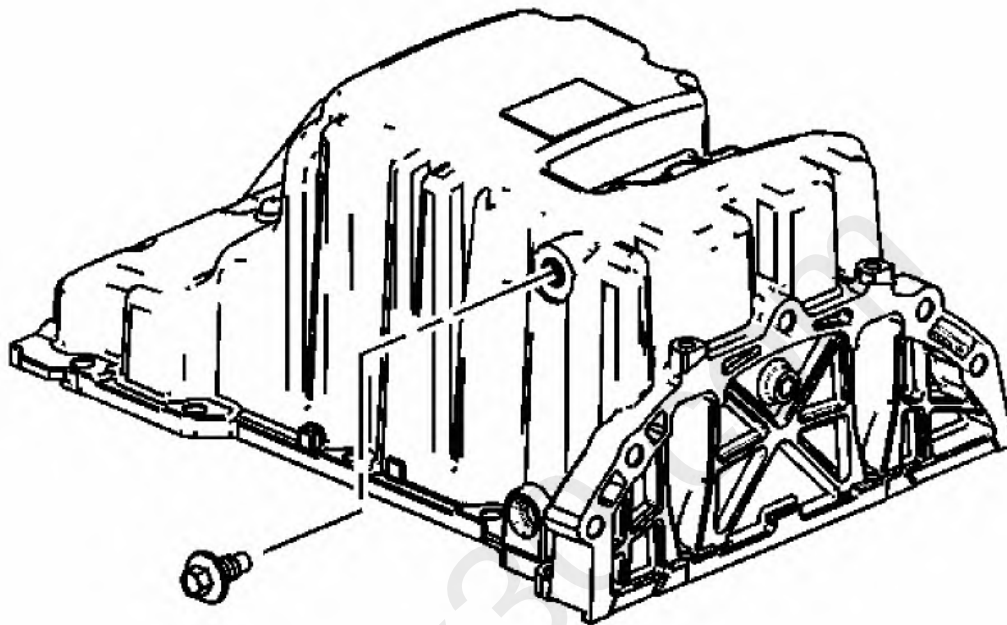


Fig. 63: View Of Oil Pan Drain Plug
Courtesy of GENERAL MOTORS CORP.

7. Remove the oil pan drain plug.
8. Allow the oil to drain completely.

INSTALLATION PROCEDURE

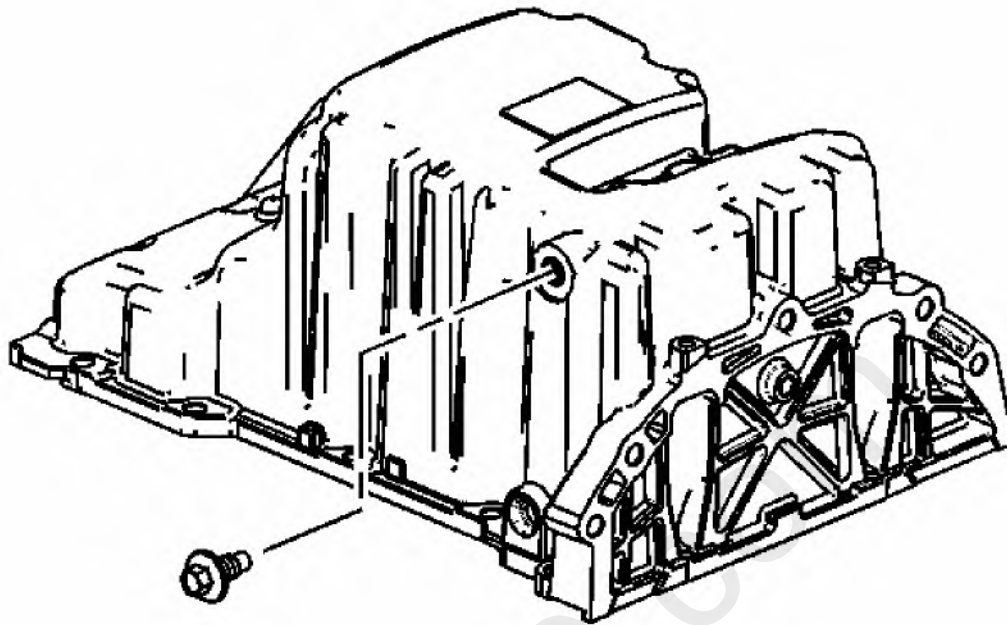


Fig. 64: View Of Oil Pan Drain Plug
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Install the oil pan drain plug and NEW O-ring seal.

Tighten: Tighten the oil pan drain plug to 20 N.m (15 lb ft).

2. Lower the vehicle.

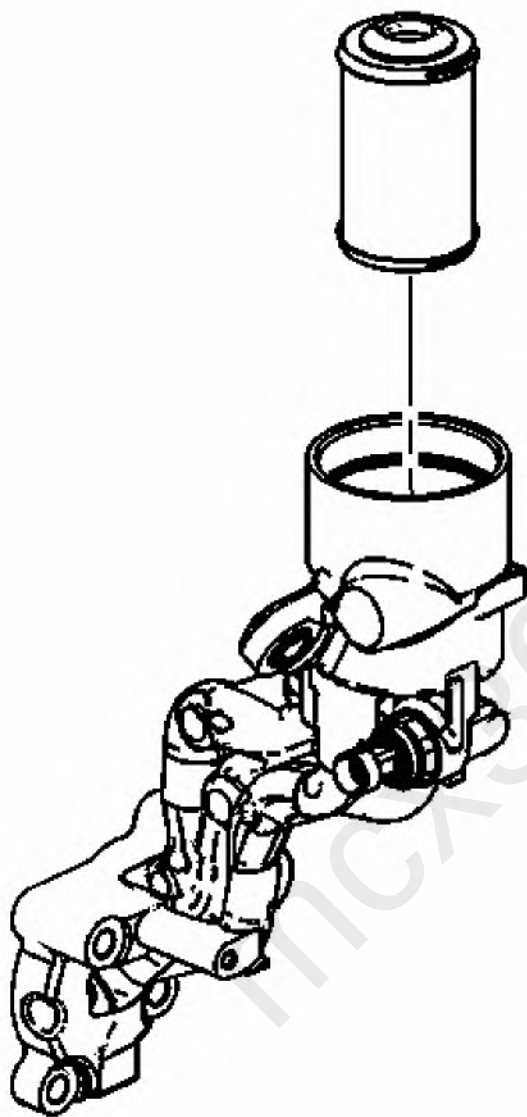


Fig. 65: View Of Oil Filter Cartridge
Courtesy of GENERAL MOTORS CORP.

3. Install the NEW oil filter cartridge.

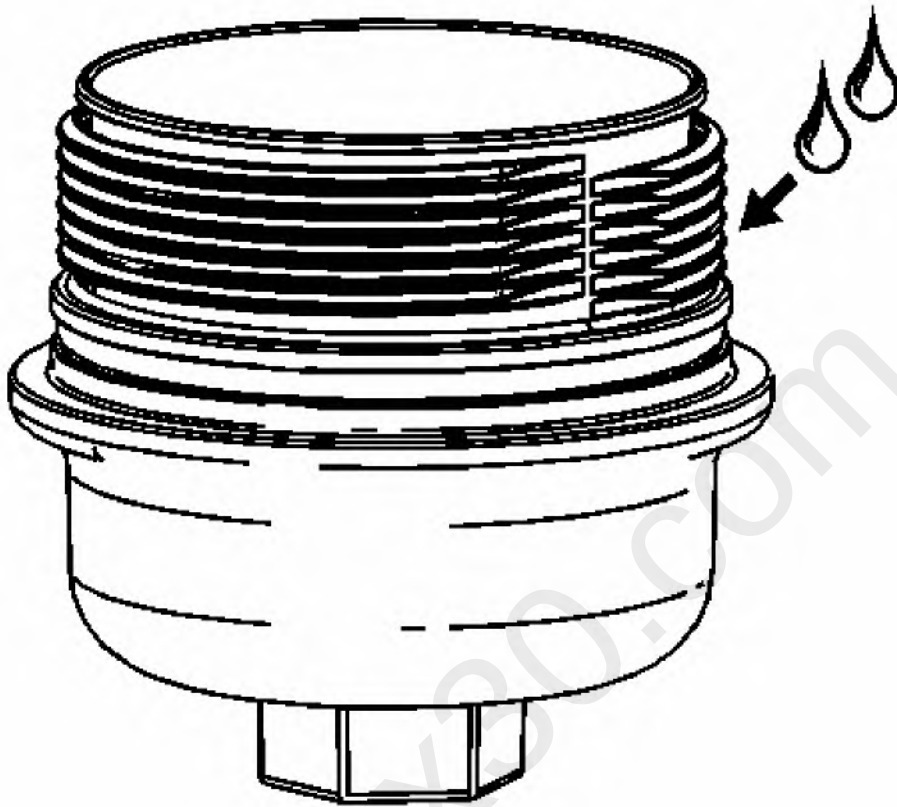


Fig. 66: Lubricating Threads Of Oil Filter Cap
Courtesy of GENERAL MOTORS CORP.

NOTE: Lubrication must be applied to the threads of the oil filter cap prior to installation. Failure to lubricate the oil filter cap threads can hinder later removal and cause possible oil filter cap damage.

4. Lubricate the oil filter cap threads with clean engine oil.

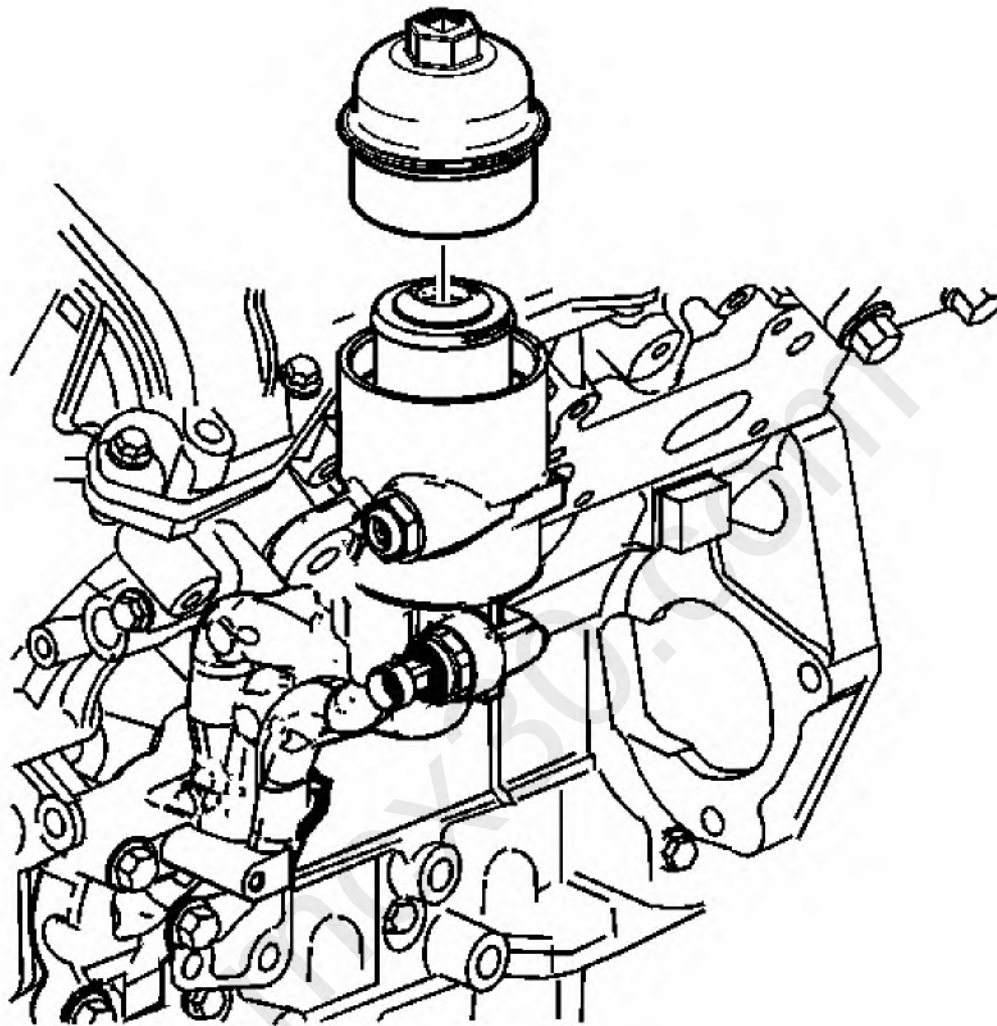


Fig. 67: View Of Oil Filter Cap
Courtesy of GENERAL MOTORS CORP.

NOTE: Proper oil filter cap tightening is mandatory. Failure to tighten the oil filter cap to the proper specification can hinder later removal and cause possible oil filter cap damage.

IMPORTANT: Use a 6-point socket to install the oil filter cap.

5. Install the oil filter cap.

Tighten: Tighten the oil filter cap to 25 N.m (18 lb in).

6. Install the oil fill cap.
7. Fill the engine with the appropriate oil type and quantity. Refer to **Fluid and Lubricant Recommendations** and **Approximate Fluid Capacities** .
8. Install the front compartment sight shield as necessary. Refer to **Front Compartment Sight Shields Replacement** .

ENGINE WIRING HARNESS ASSEMBLY REMOVAL - OFF VEHICLE

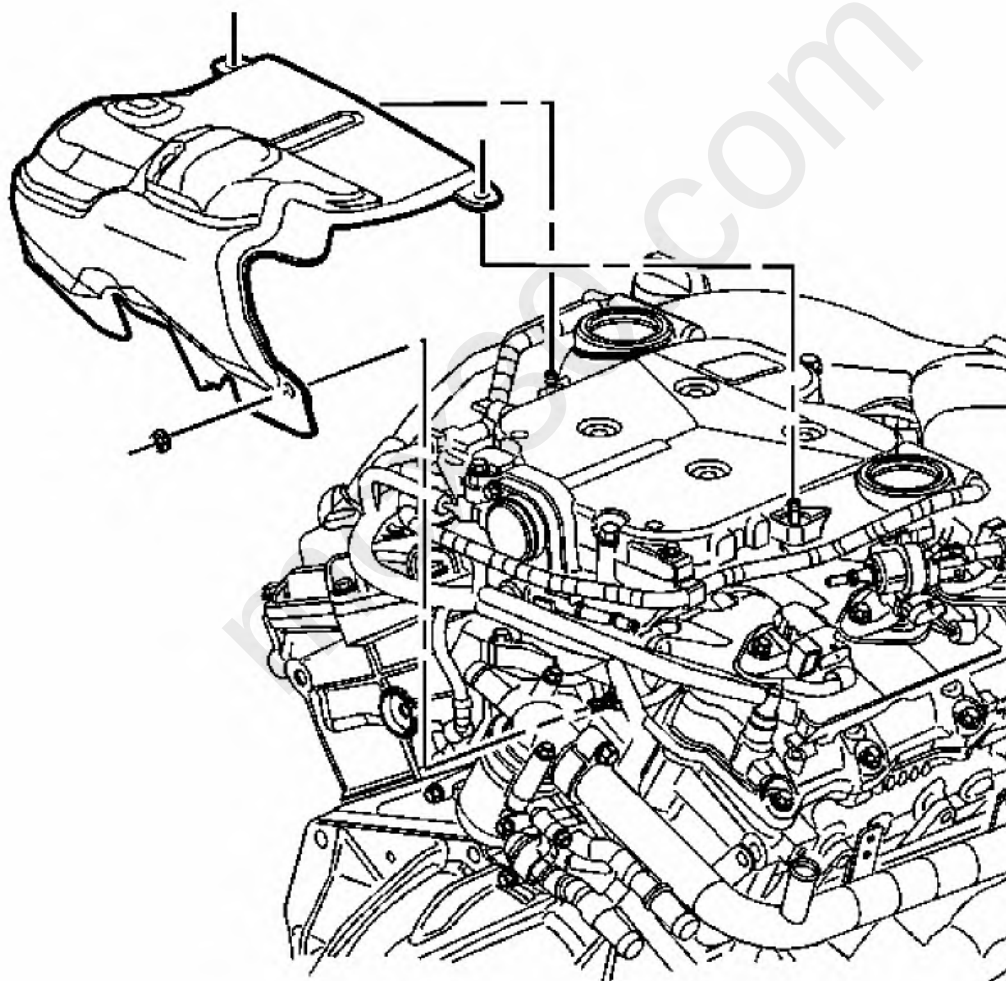


Fig. 68: View Of Intake Manifold Insulator
Courtesy of GENERAL MOTORS CORP.

1. Remove the intake manifold insulator nut.
2. Remove the intake manifold insulator.

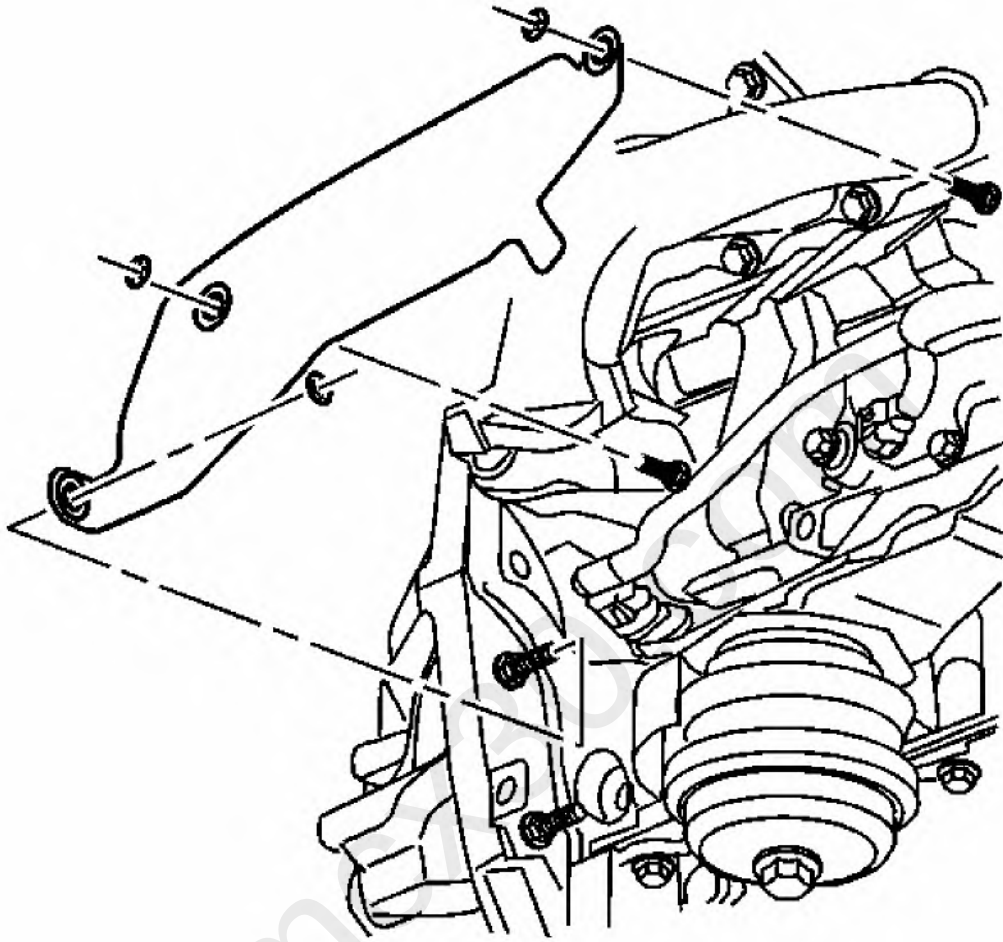


Fig. 69: View Of Exhaust Manifold Lower Insulator Shield
Courtesy of GENERAL MOTORS CORP.

3. Remove the right exhaust manifold lower insulator nuts.
4. Remove the right exhaust manifold lower insulator shield.

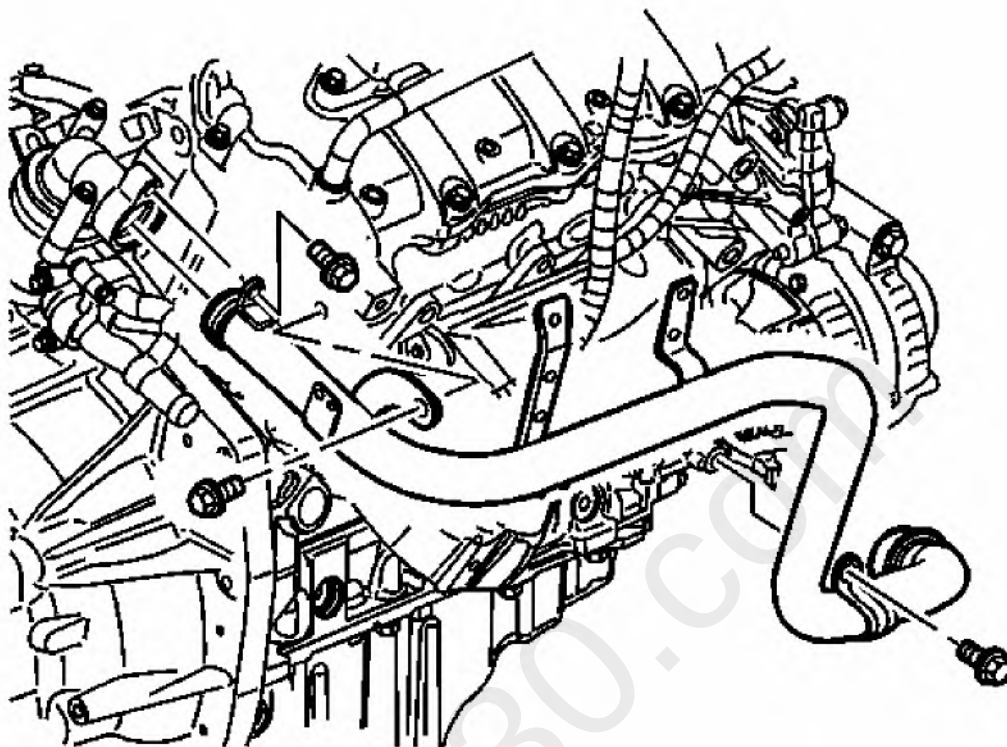


Fig. 70: View Of Radiator Outlet Pipe & Bolt
Courtesy of GENERAL MOTORS CORP.

5. Remove the radiator outlet pipe bolts.
6. Remove the radiator outlet pipe.

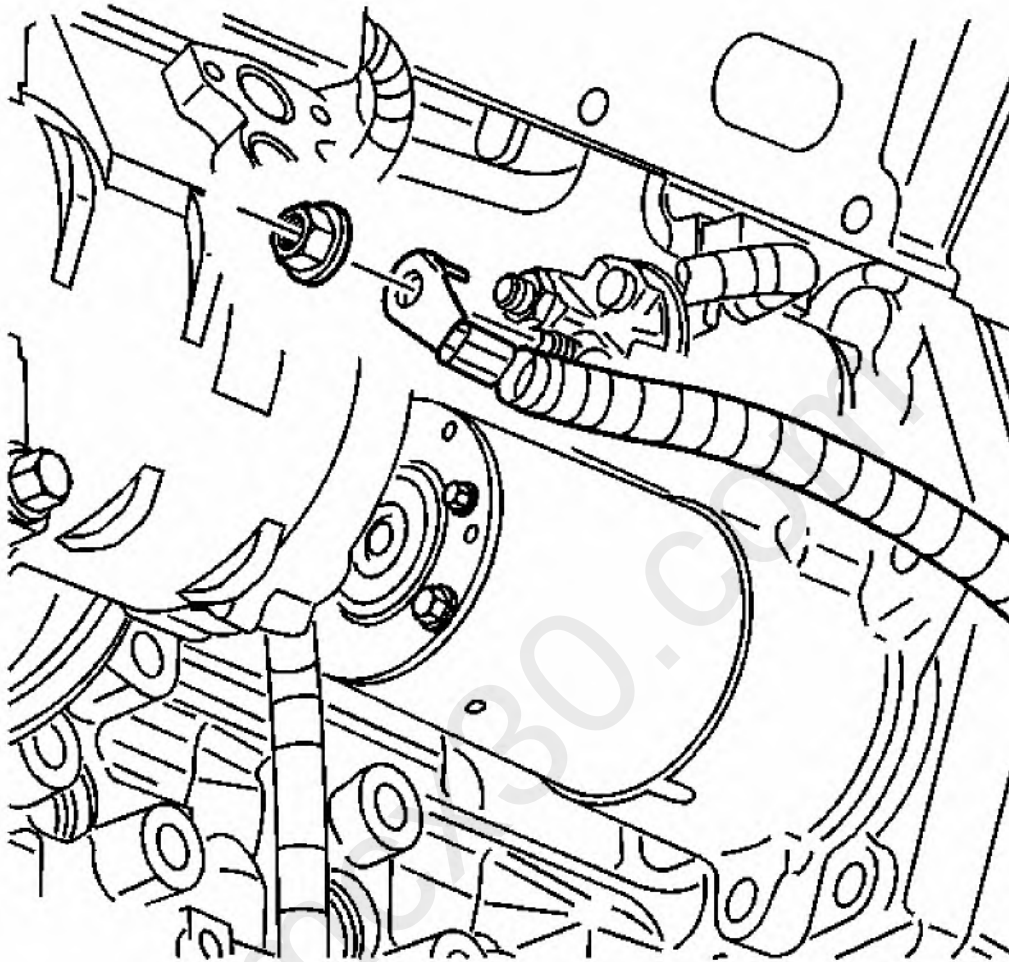


Fig. 71: View Of Battery Cable Harness
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the battery cable harness from the starter motor.

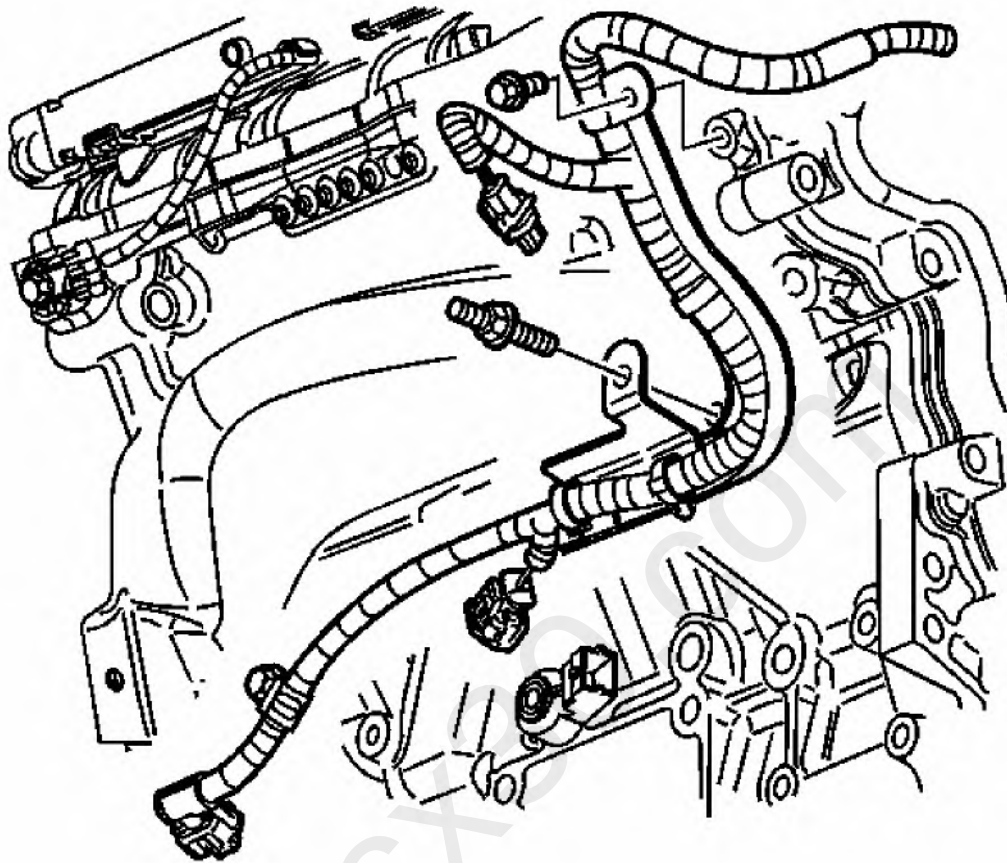


Fig. 72: Locating Engine Wiring Harness Bracket Bolt & Engine Wiring Harness Bracket Stud

Courtesy of GENERAL MOTORS CORP.

8. Remove the engine wiring harness bracket bolt and stud from the lower right side of the engine.

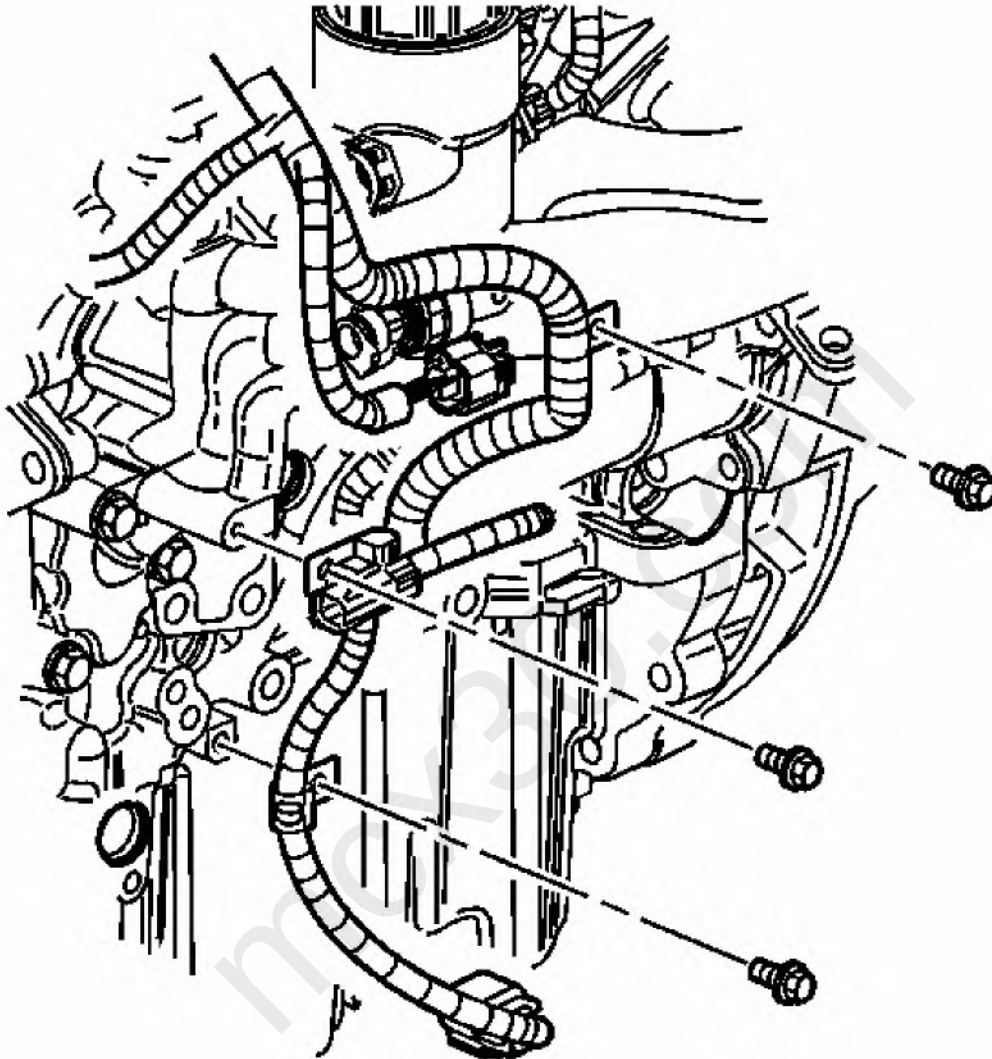


Fig. 73: View Of Left Wiring Harness Conduit
Courtesy of GENERAL MOTORS CORP.

9. Remove the engine wiring harness bracket bolts from the lower left side of the engine.

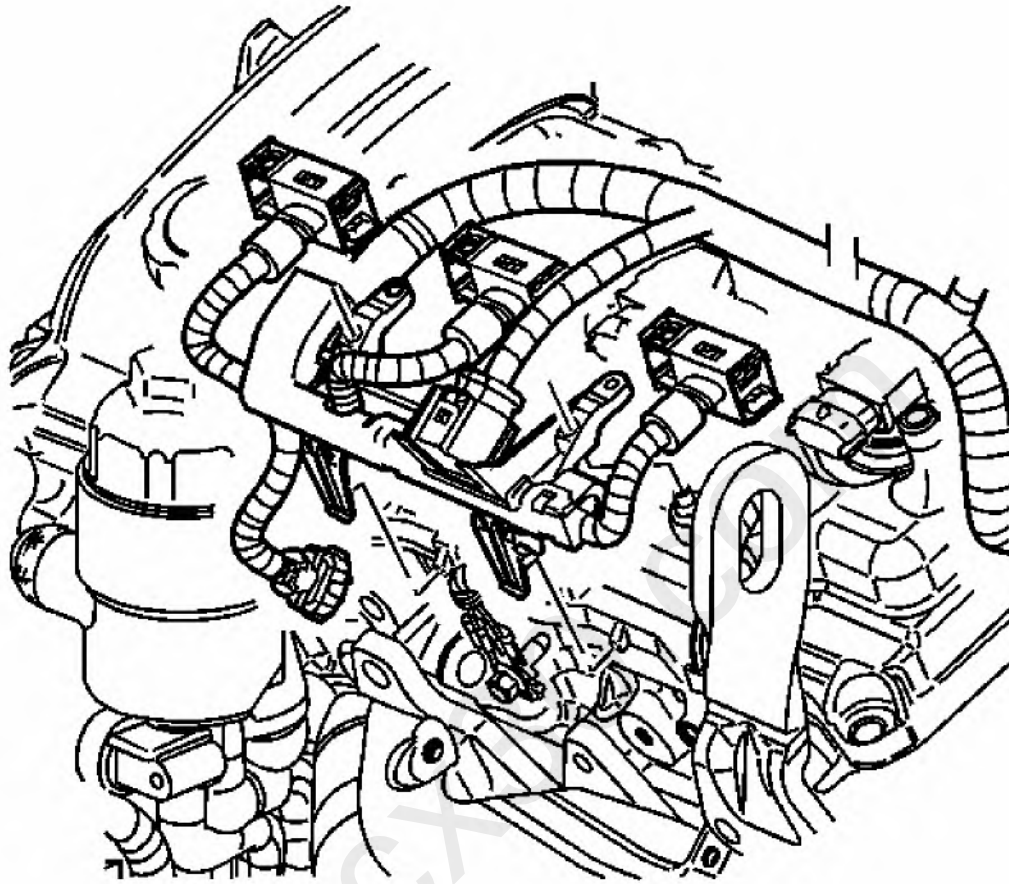


Fig. 74: View Of Left Camshaft Cover Wiring Harness Connectors
Courtesy of GENERAL MOTORS CORP.

10. Disconnect the engine wiring harness from the top of the left camshaft cover.

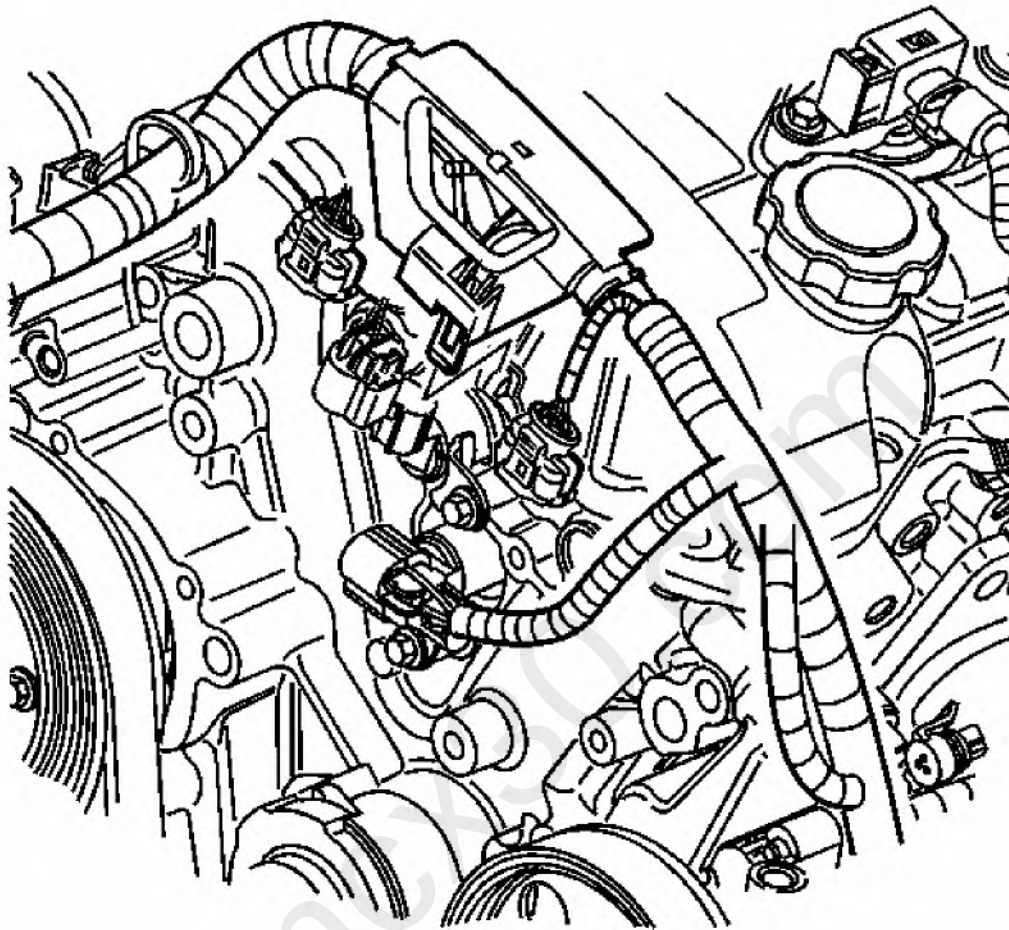


Fig. 75: View Of Left Camshaft Cover Wiring Harness Connector - Front
Courtesy of GENERAL MOTORS CORP.

11. Disconnect the engine wiring harness from the front of the left camshaft cover.

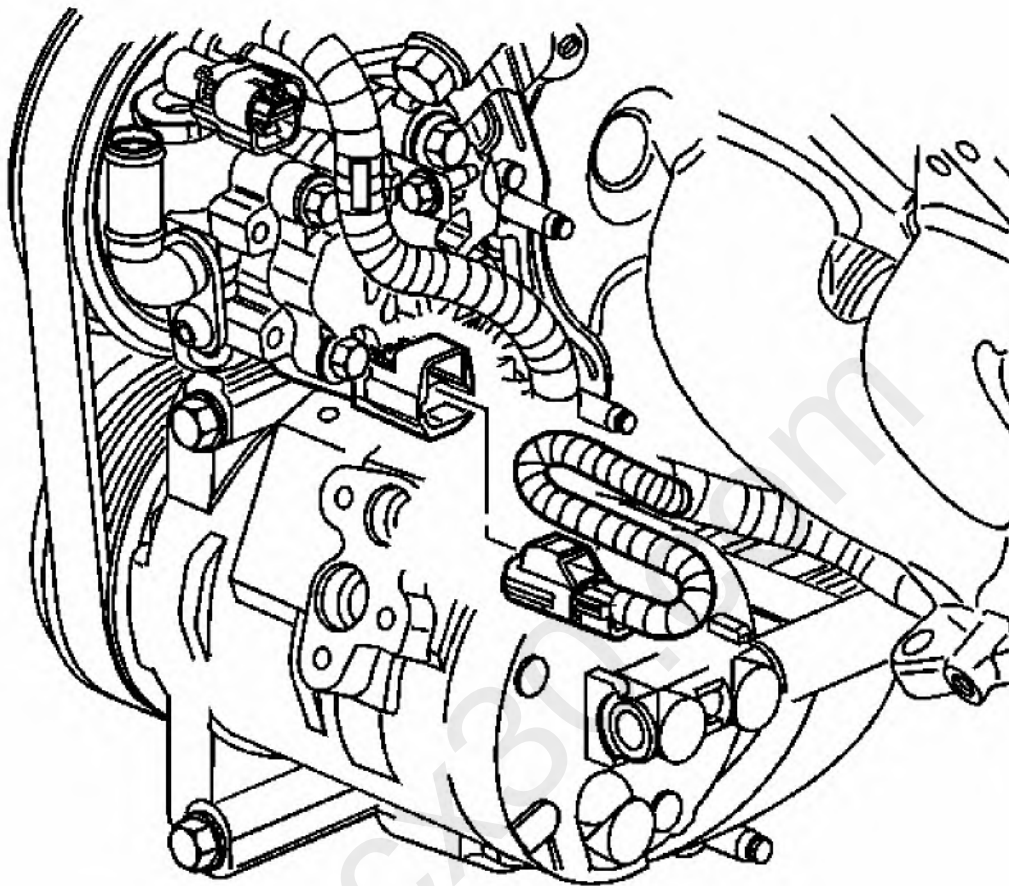


Fig. 76: View Of A/C Compressor Electrical Connector
Courtesy of GENERAL MOTORS CORP.

12. Disconnect the engine wiring harness from the A/C compressor.

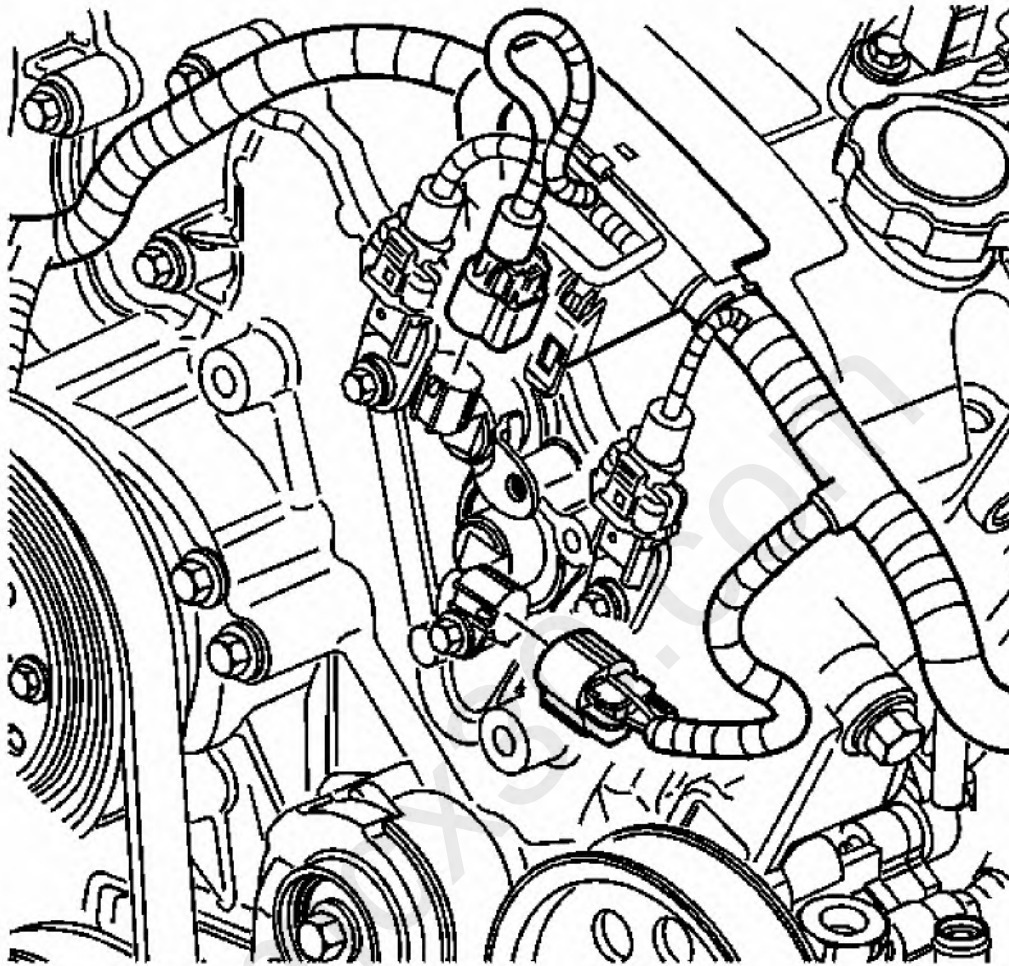


Fig. 77: View Of Left Camshaft Position Actuator Valve Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

13. Disconnect the engine wiring harness from the left camshaft position actuator valves.

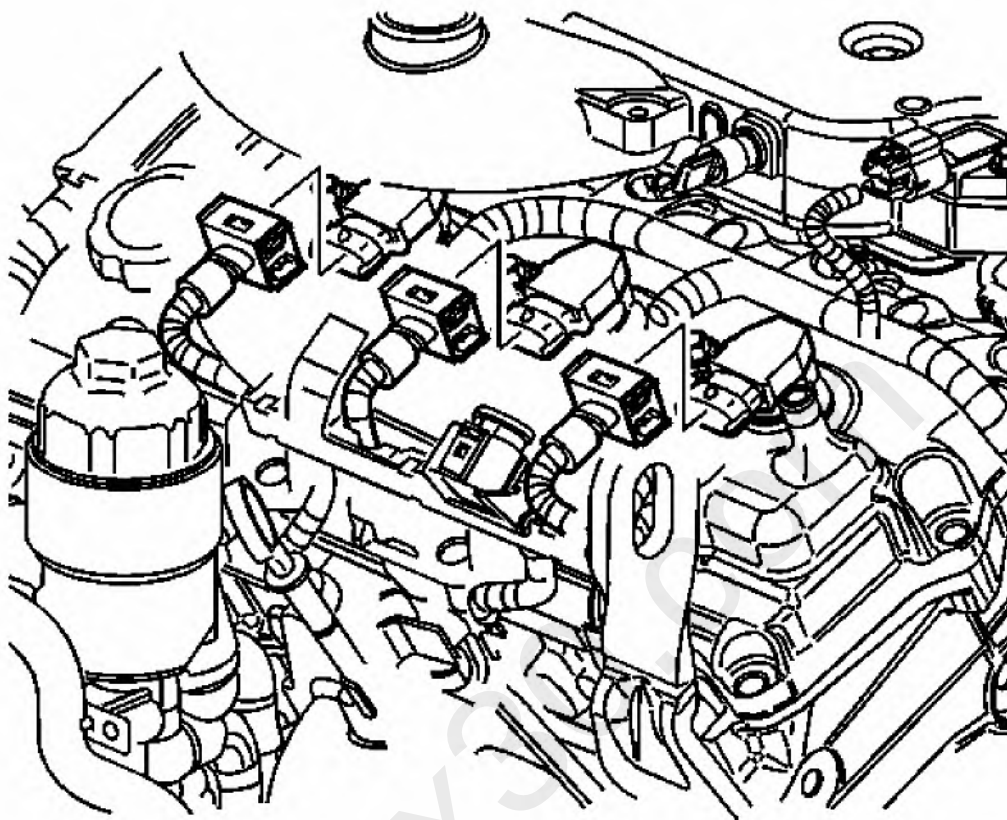


Fig. 78: View Of Left Ignition Coils Wiring Harness Connectors
Courtesy of GENERAL MOTORS CORP.

14. Disconnect the engine wiring harness from the left ignition coils.

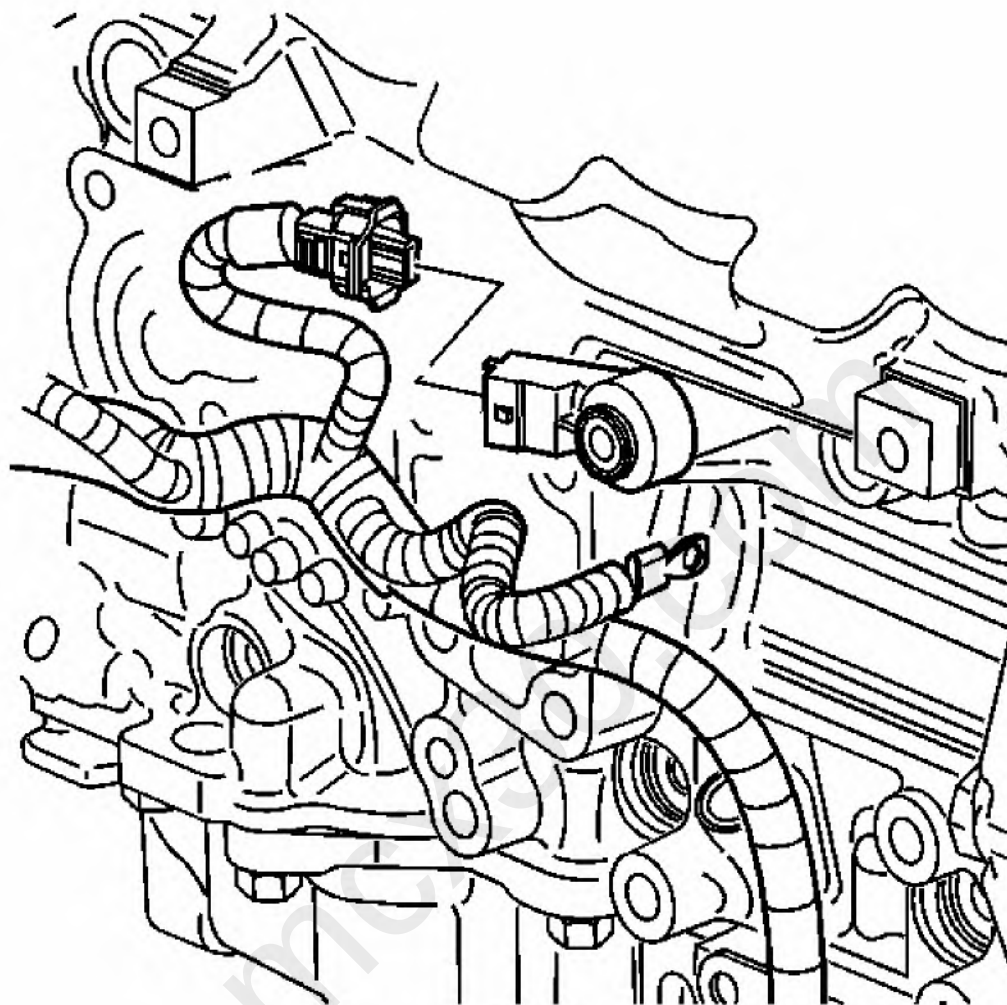


Fig. 79: View Of Left Knock Sensor And Electrical Connector
Courtesy of GENERAL MOTORS CORP.

15. Disconnect the engine wiring harness from the left knock sensor.

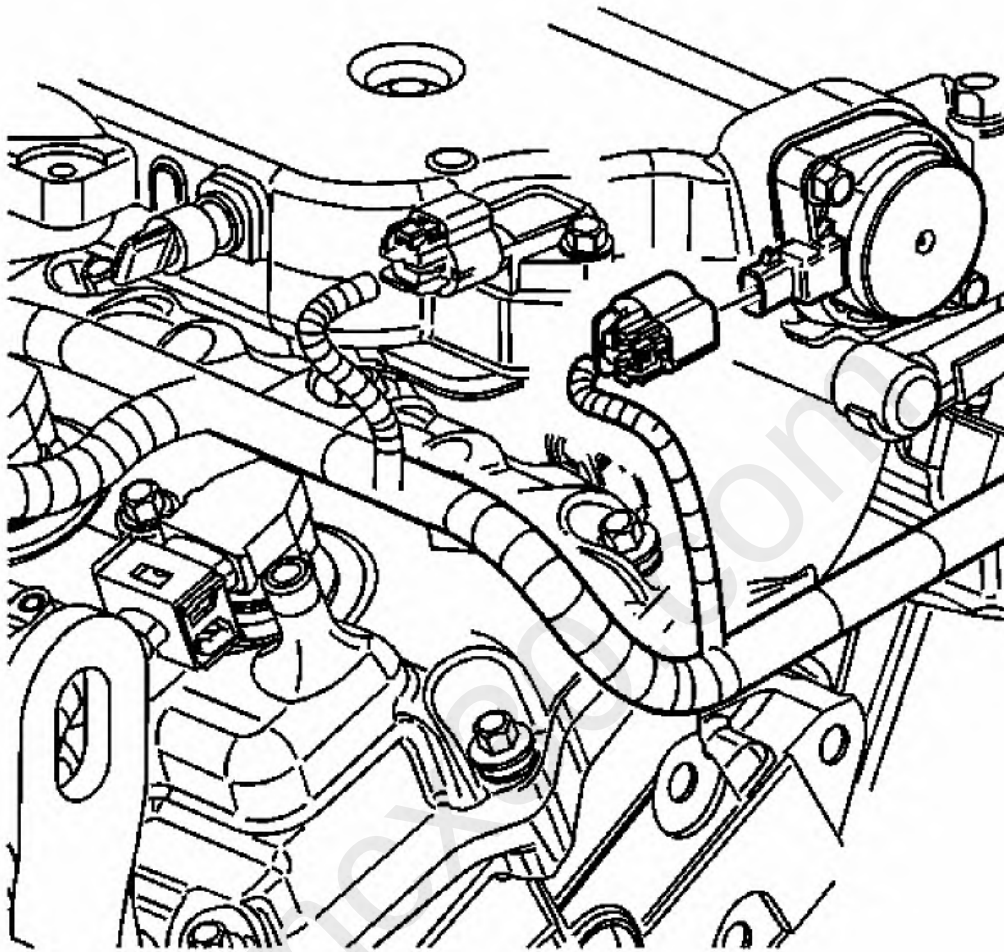


Fig. 80: View Of Communicator And Intake Manifold Runner Control Solenoid Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

16. Disconnect the engine wiring harness from the communicator valve.

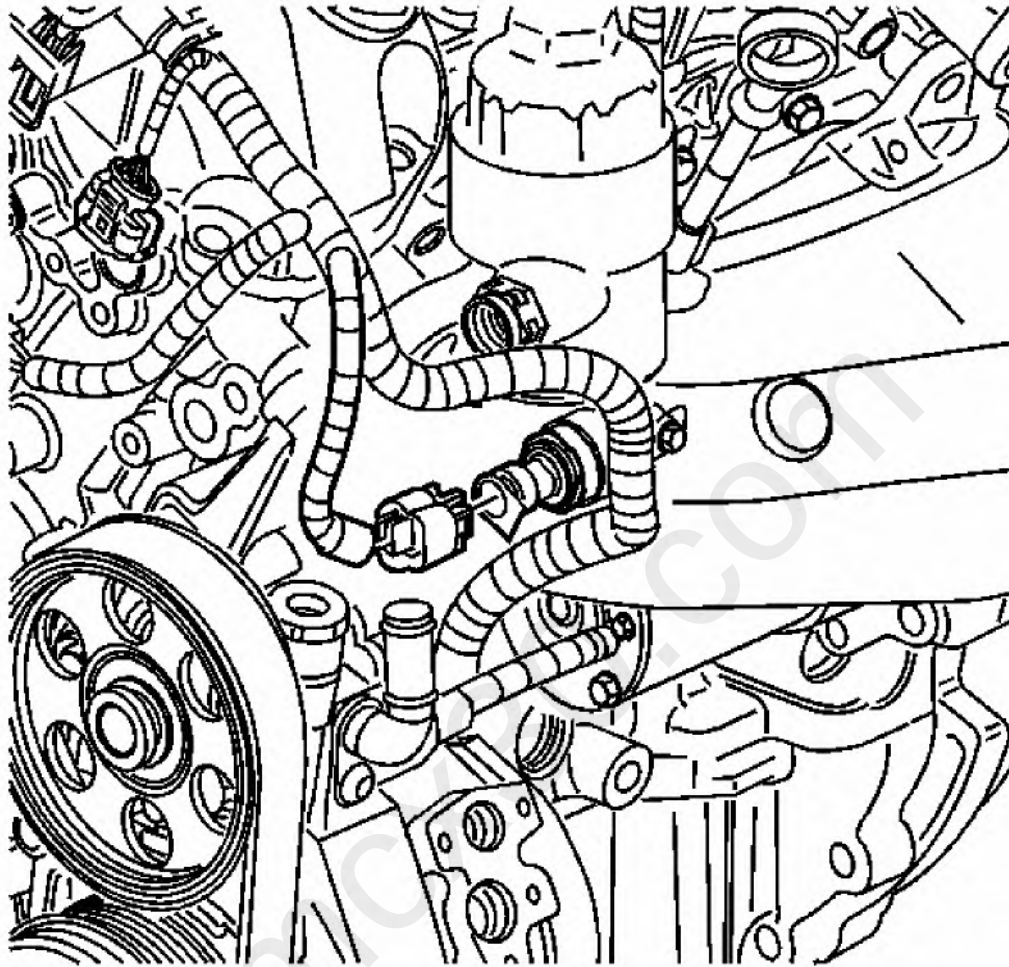


Fig. 81: View Of Oil Pressure Sensor Wiring Harness
Courtesy of GENERAL MOTORS CORP.

17. Disconnect the engine wiring harness from the oil pressure sender.

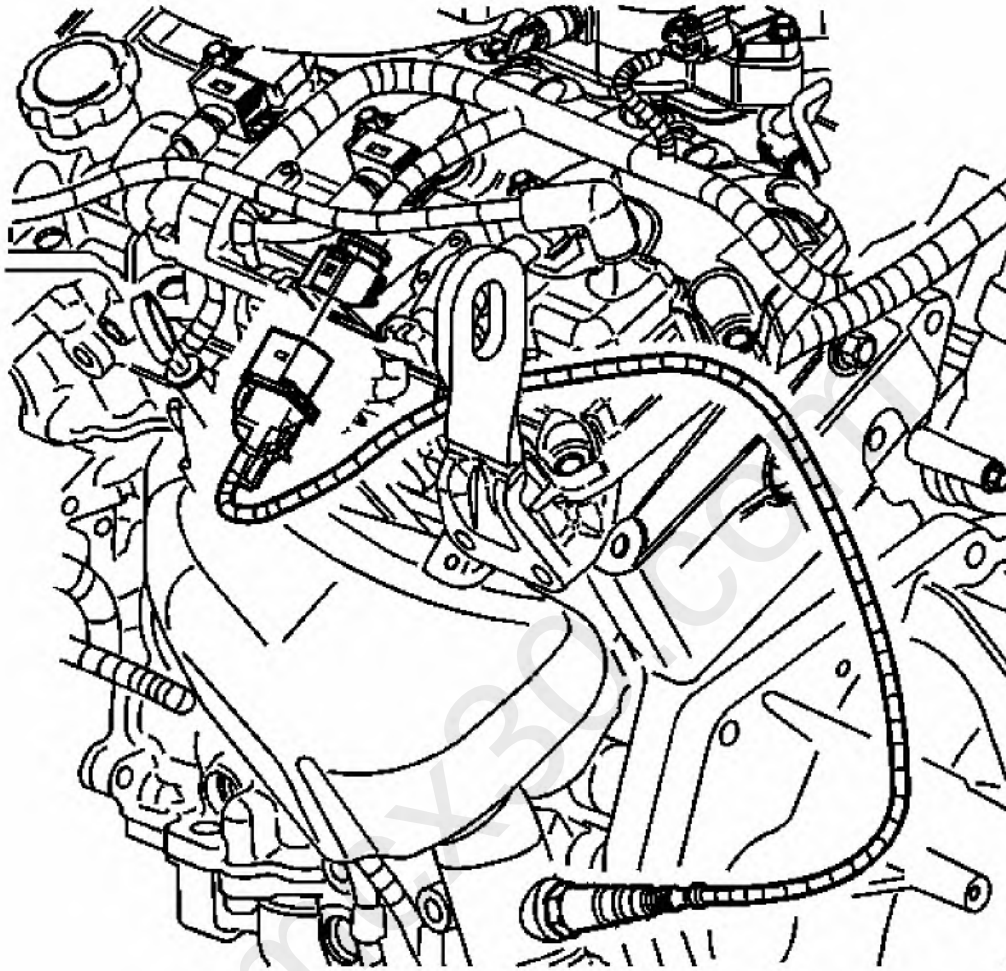


Fig. 82: View Of Left Oxygen Sensor Harness Electrical Connector
Courtesy of GENERAL MOTORS CORP.

18. Disconnect the engine wiring harness from the left oxygen sensor harness.

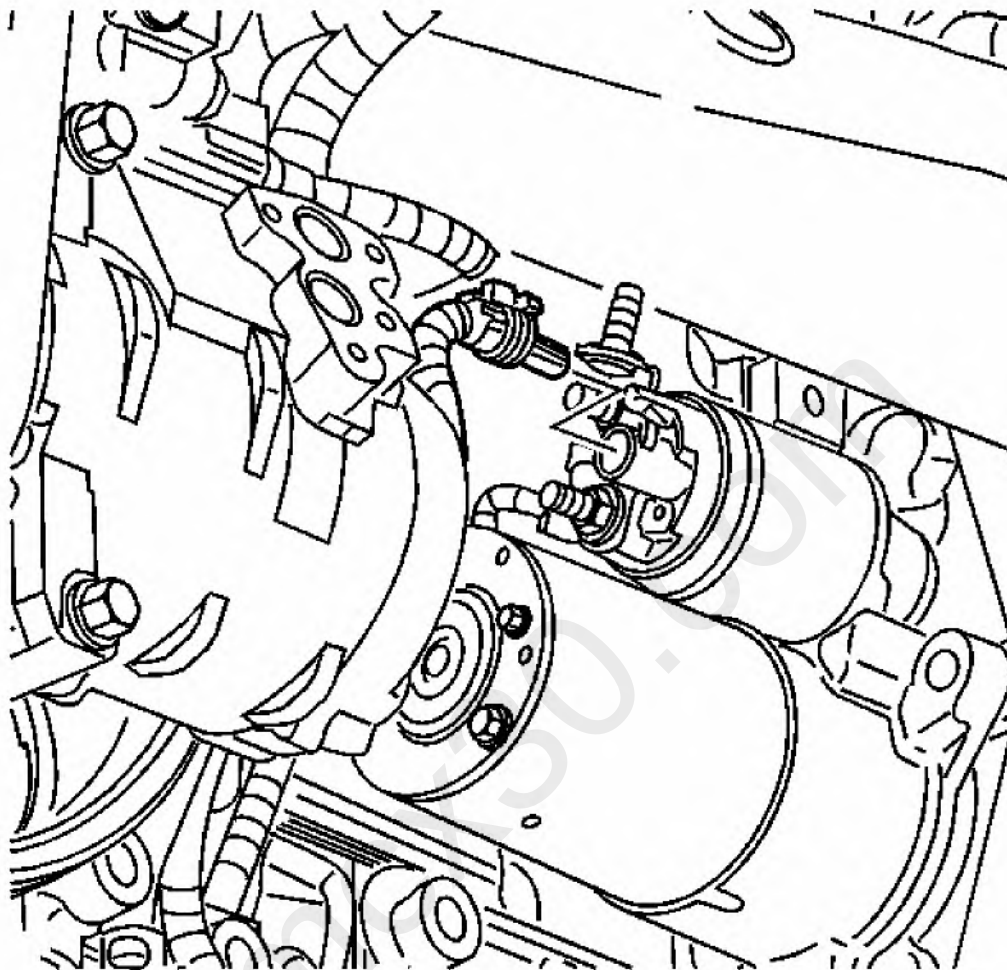


Fig. 83: View Of Starter Motor Solenoid Electrical Connector
Courtesy of GENERAL MOTORS CORP.

19. Disconnect the engine wiring harness from the starter motor solenoid.

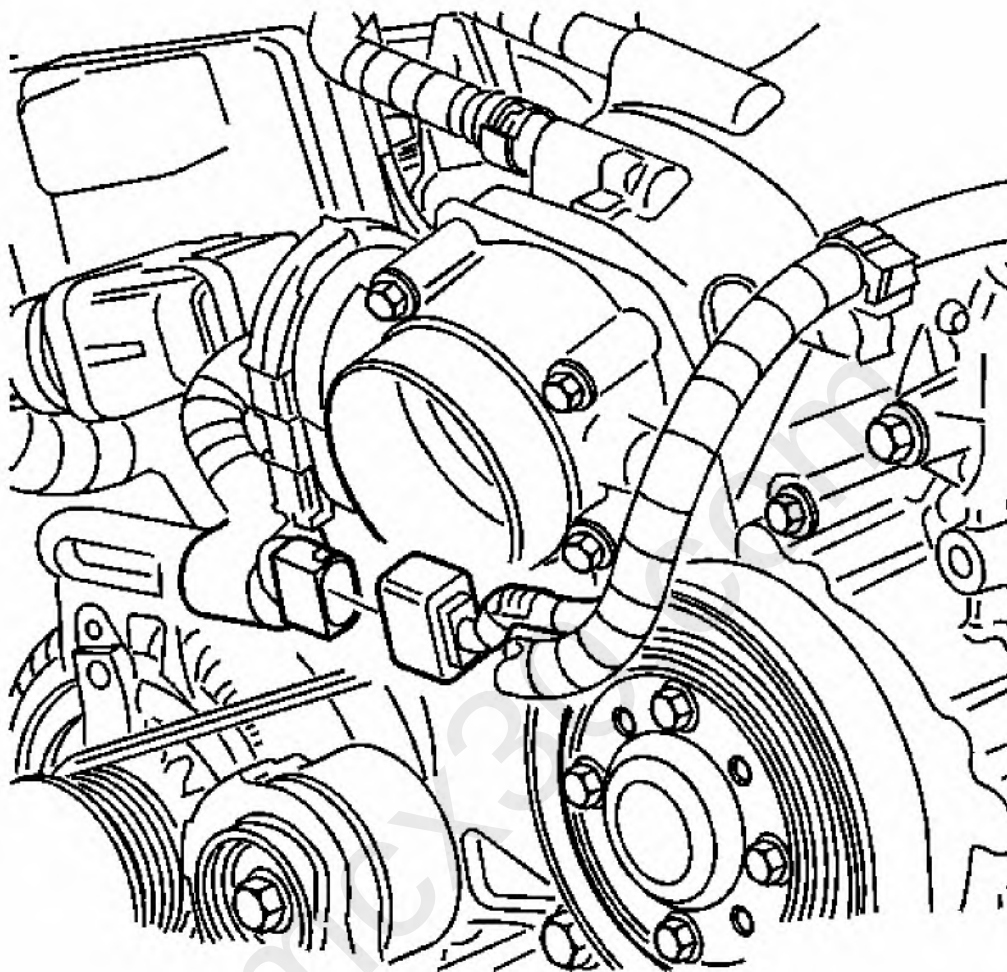


Fig. 84: View Of Throttle Body Electrical Connector
Courtesy of GENERAL MOTORS CORP.

NOTE: DO NOT use any mechanical device such as pliers or screwdrivers to disengage the connector. In order to prevent damage to the connector or harness wiring, both of the latches on the connector must be depressed with finger pressure only. When the latches are depressed the connector must then be pulled straight back without pulling on the wires in order to disengage. Failure to follow this procedure can lead to connector or wiring harness damage and failure.

20. Disconnect the engine wiring harness from the throttle body connector.

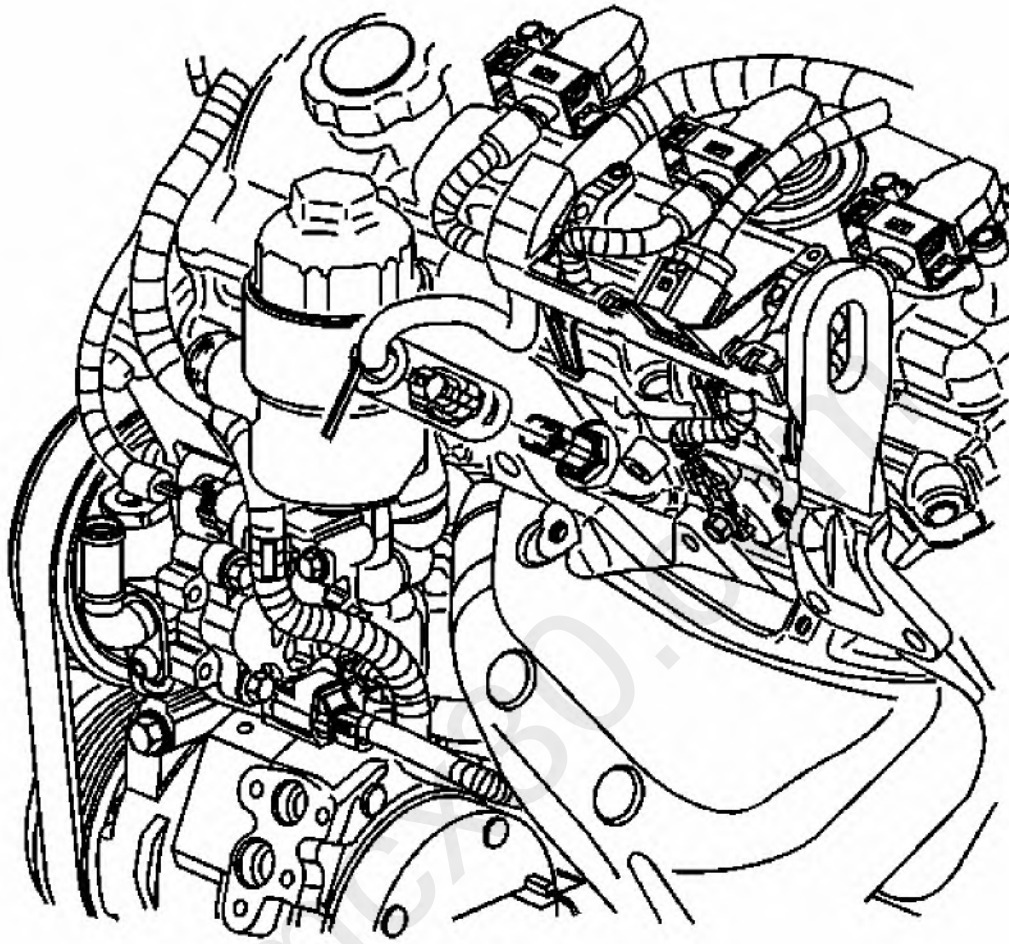


Fig. 85: View Of Coolant Temperature Sensor And Electrical Connector
Courtesy of GENERAL MOTORS CORP.

21. Disconnect the engine wiring harness from the engine coolant temperature (ECT) sensor.

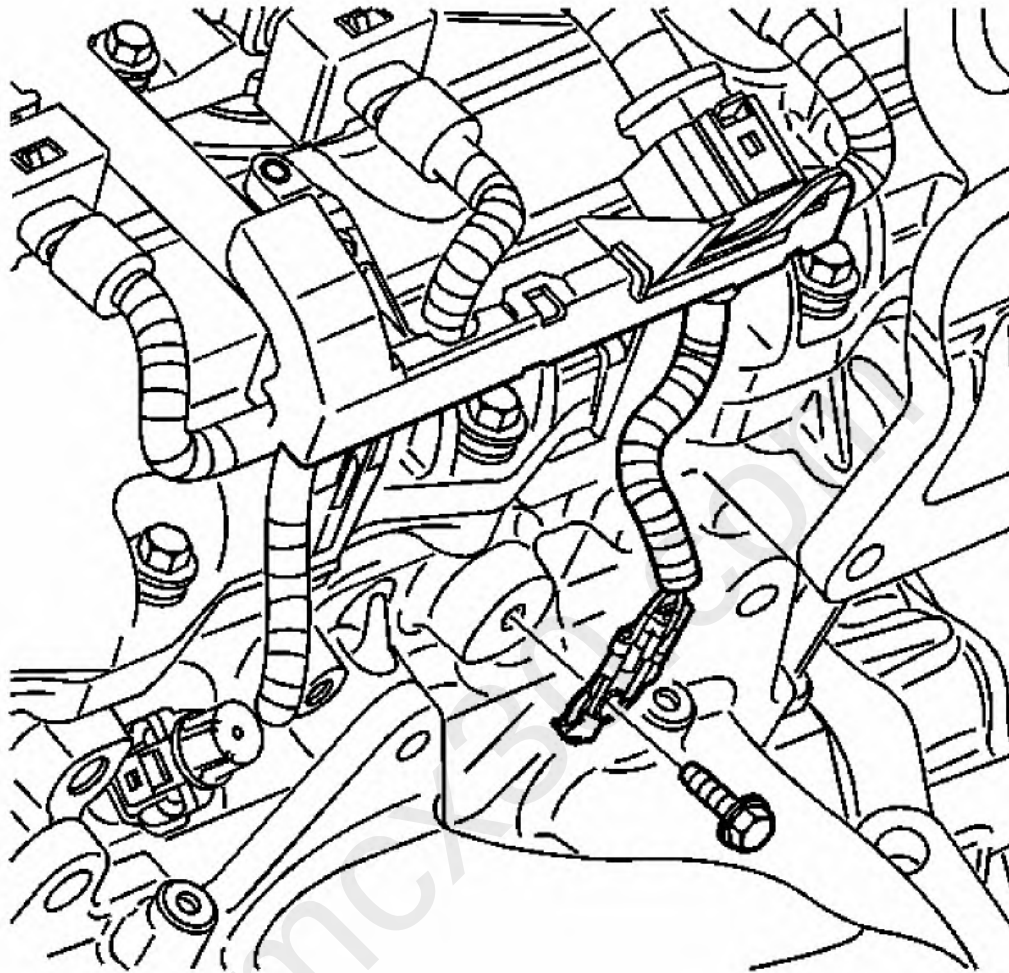


Fig. 86: View Of Left Cylinder Head Wiring Harness Ground Bolt
Courtesy of GENERAL MOTORS CORP.

22. Remove the engine wiring harness ground bolt from the left cylinder head.

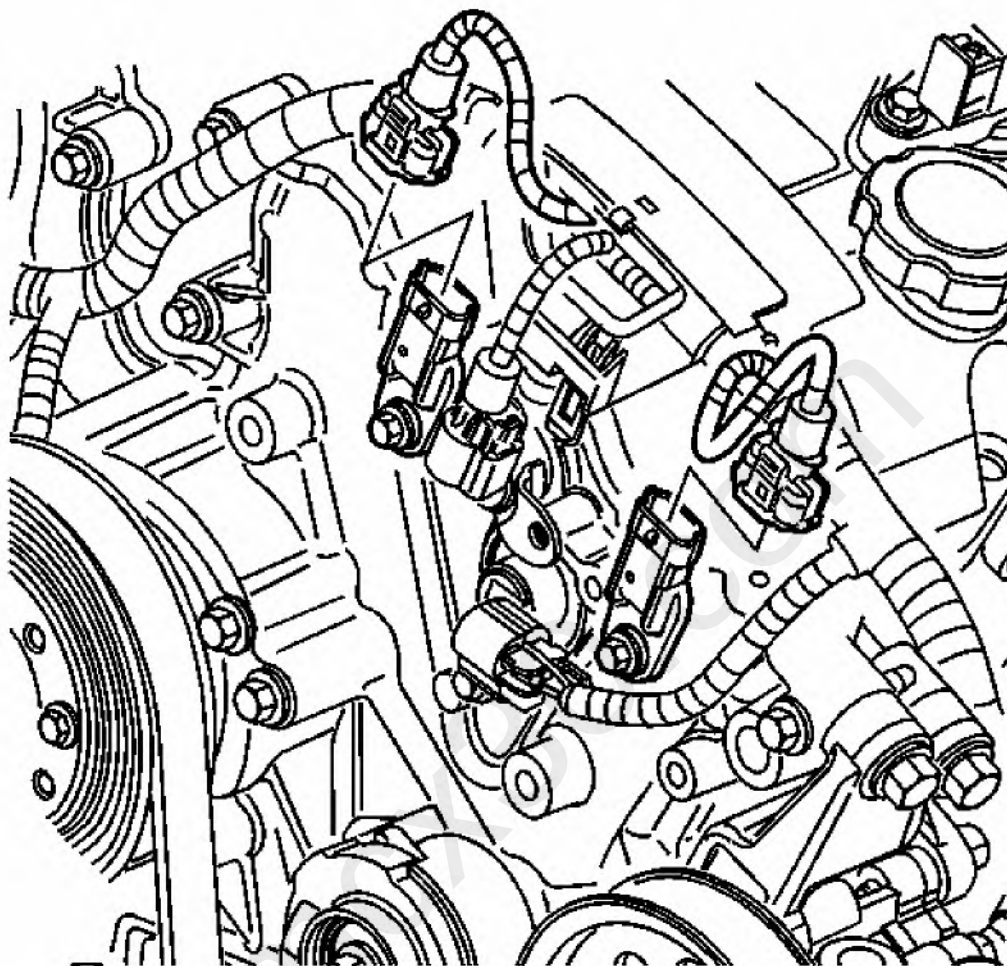


Fig. 87: View Of Left Camshaft Position Sensors Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

23. Disconnect the engine wiring harness from the left camshaft position sensors.

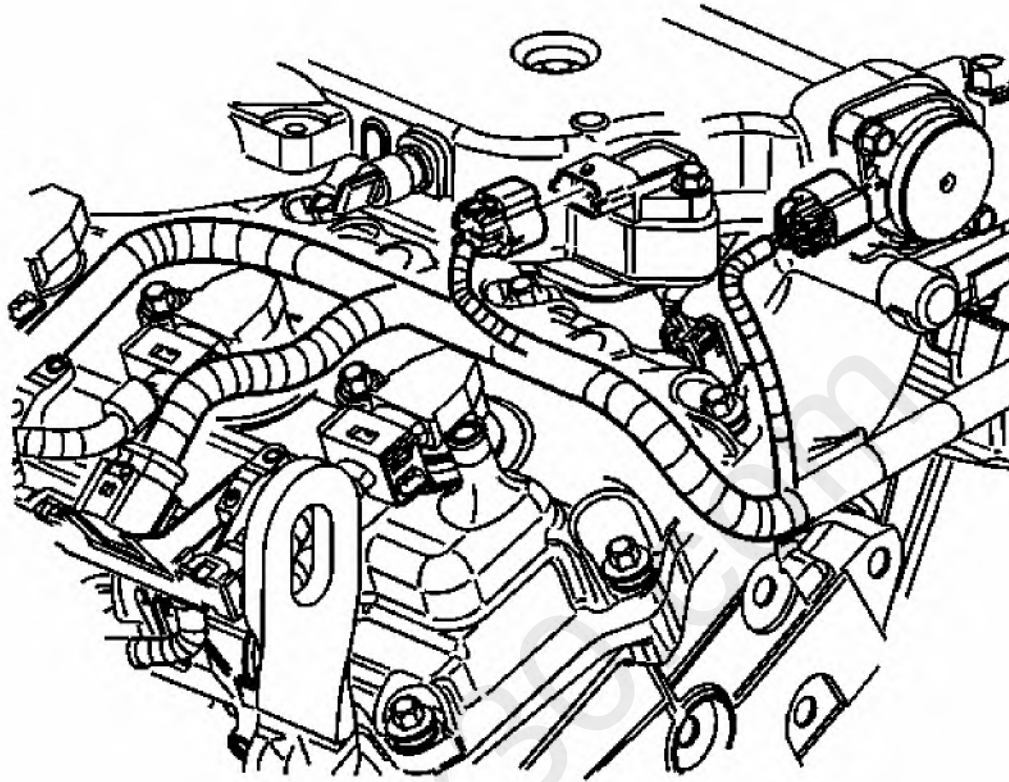


Fig. 88: Identifying Barometric Pressure Sensor And Electrical Connector
Courtesy of GENERAL MOTORS CORP.

24. Disconnect the engine wiring harness from the barometric (BARO) sensor.

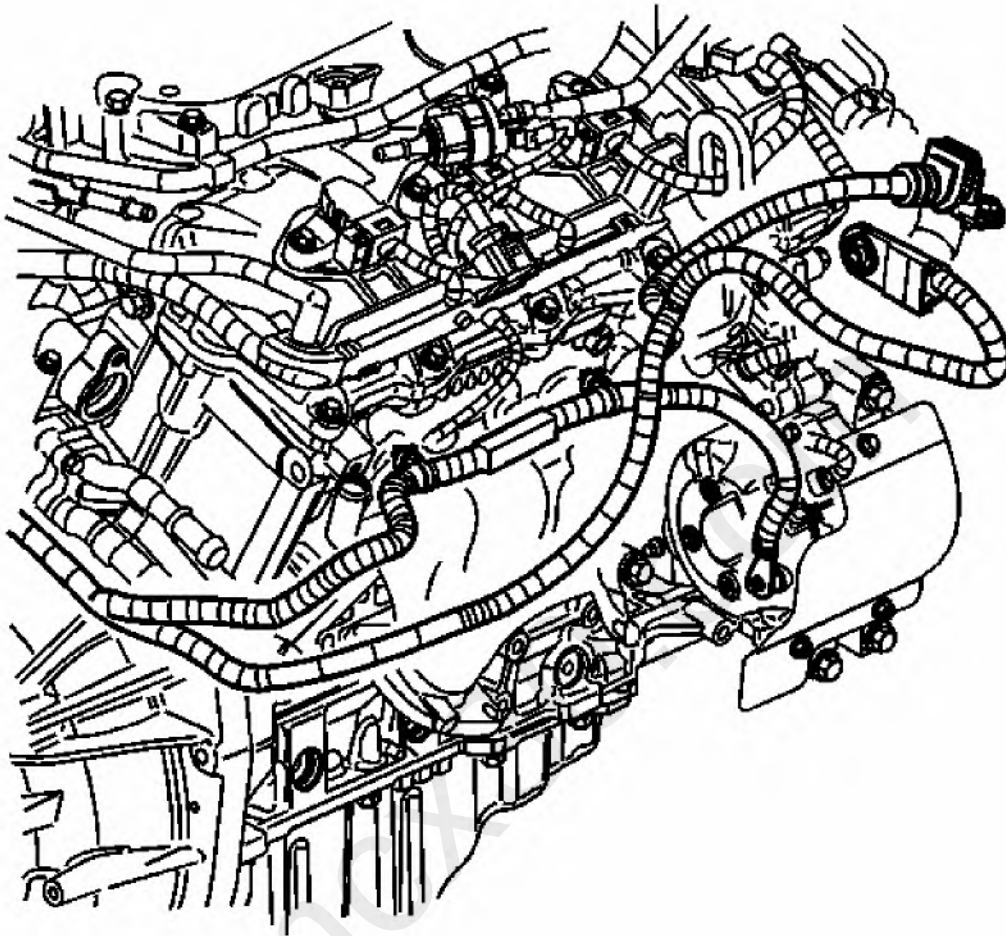


Fig. 89: View Of Right Battery Cable Harness
Courtesy of GENERAL MOTORS CORP.

25. Disconnect the battery cable harness from the right side of the engine.

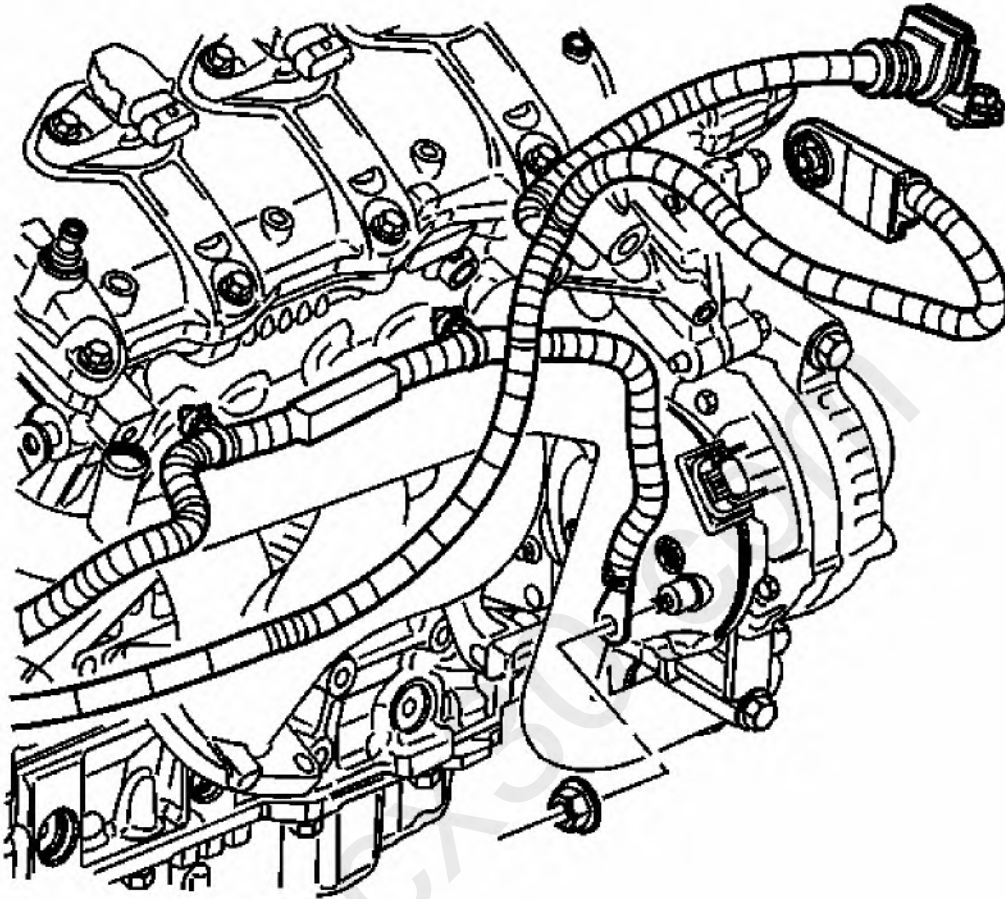


Fig. 90: View Of Generator Battery Cable
Courtesy of GENERAL MOTORS CORP.

26. Remove the battery cable/generator nut from the generator.
27. Disconnect the battery cable from the generator.

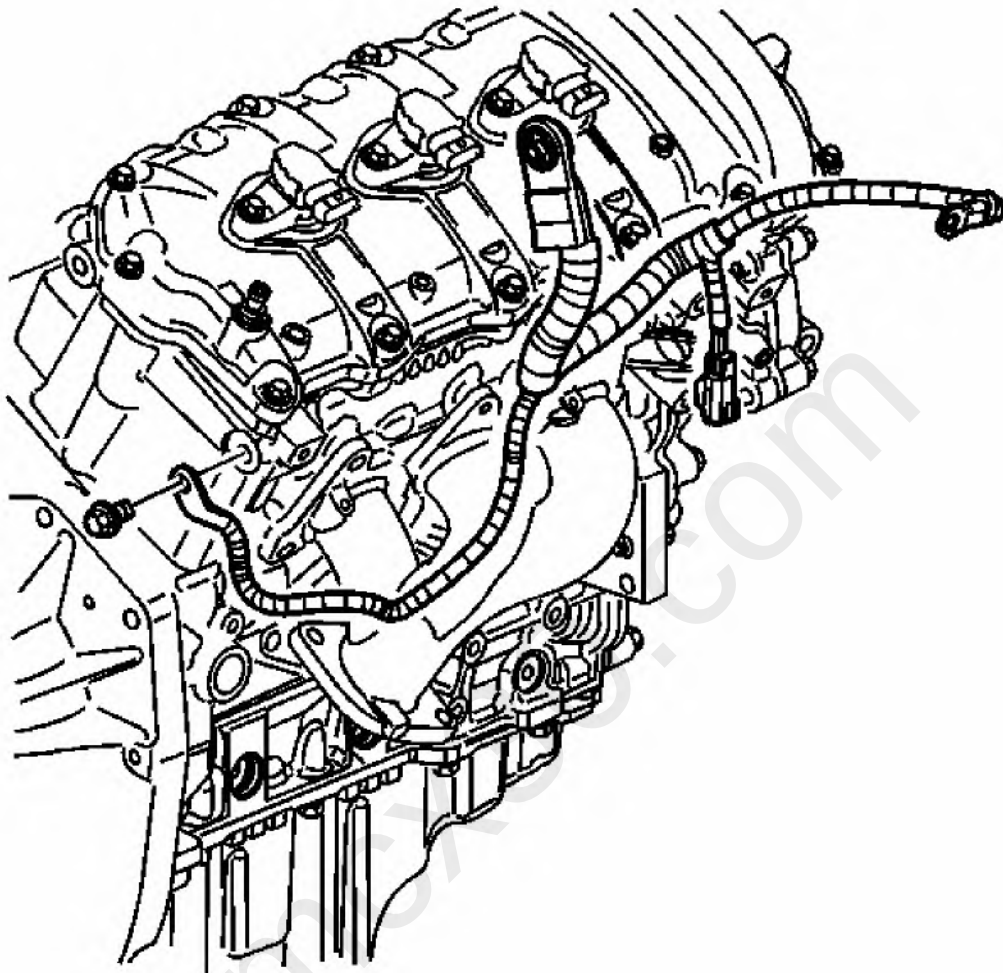


Fig. 91: View Of Battery Cable Ground
Courtesy of GENERAL MOTORS CORP.

28. Remove the battery cable ground bolt from the rear of the right cylinder head.
29. Remove the battery cable ground.

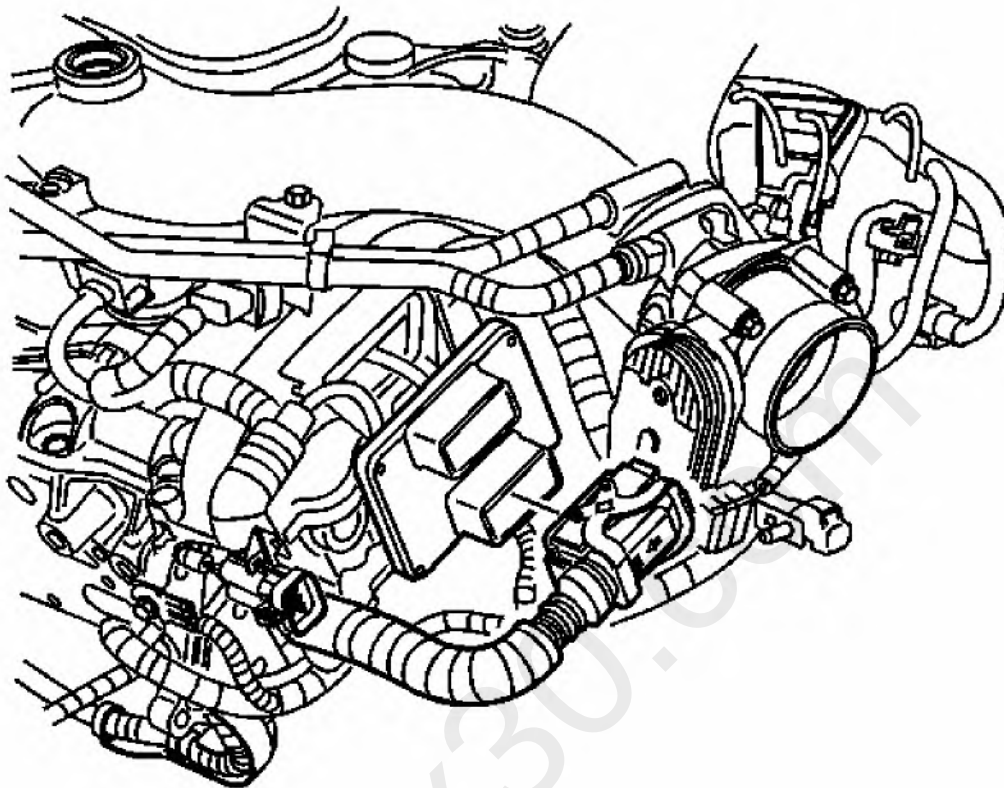


Fig. 92: View Of ECM Wiring Harness Connector
Courtesy of GENERAL MOTORS CORP.

30. Disconnect the engine wiring harness from the engine control module (ECM).

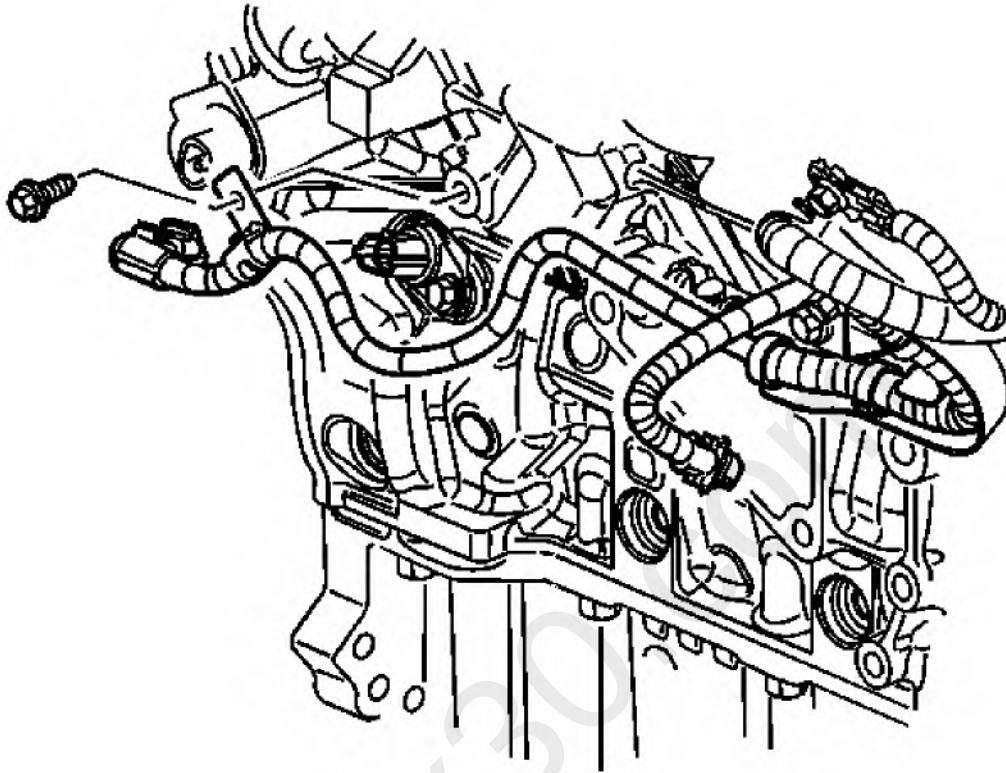


Fig. 93: View Of Engine Wiring Harness Bracket Bolt
Courtesy of GENERAL MOTORS CORP.

31. Disconnect the engine wiring harness from the crankshaft position sensor.
32. Remove the engine wiring harness bracket bolt.

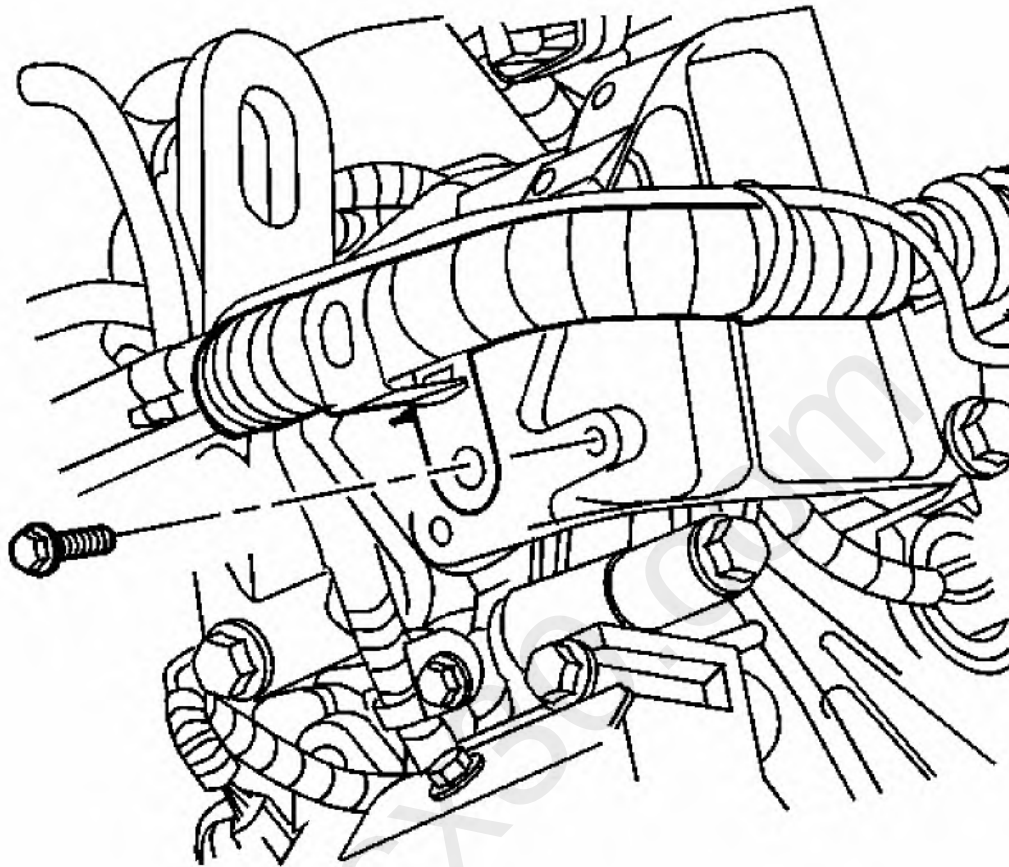


Fig. 94: View Of Engine Wiring Harness Bracket Bolt - Side Of ECM Bracket
Courtesy of GENERAL MOTORS CORP.

33. Remove the engine wiring harness bracket bolt from the side of the ECM bracket.

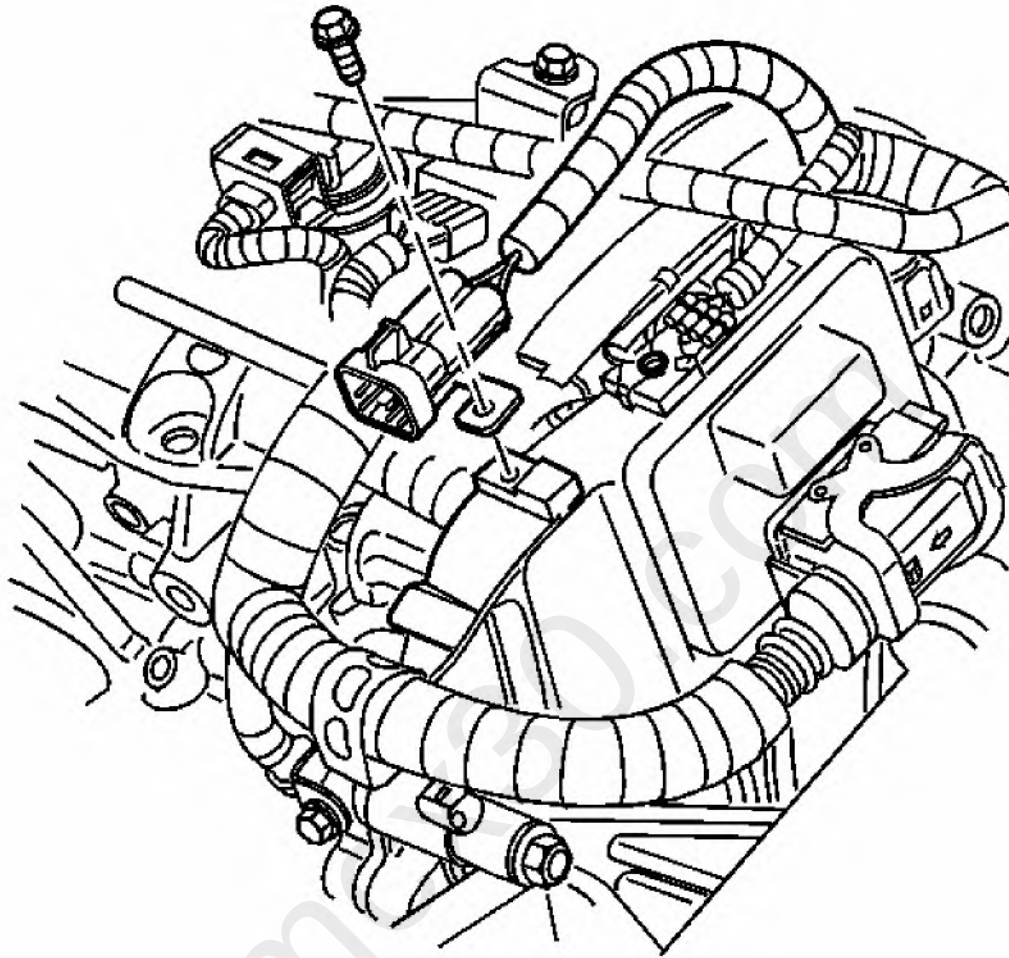


Fig. 95: View Of Engine Wiring Harness Bracket Bolt - Top Of ECM Bracket
Courtesy of GENERAL MOTORS CORP.

34. Remove the engine wiring harness bracket bolt from the top of the ECM bracket.

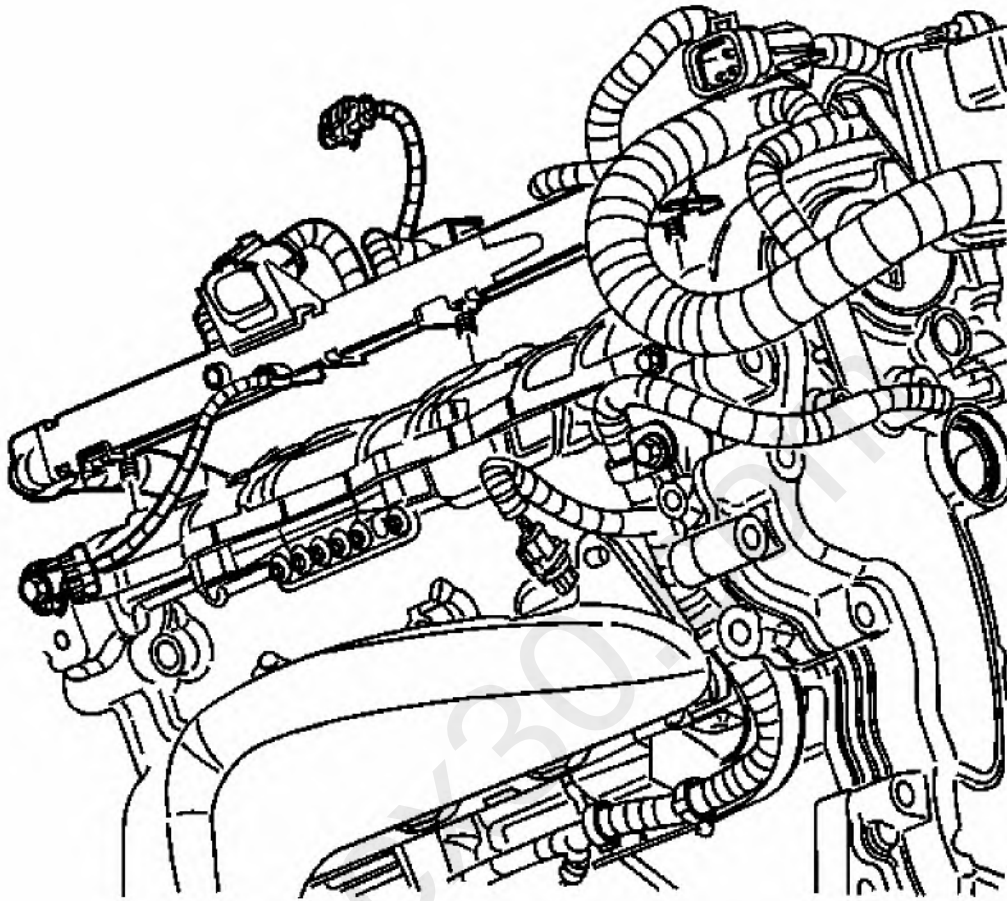


Fig. 96: View Of Right Camshaft Cover Wiring Harness Connector - Top
Courtesy of GENERAL MOTORS CORP.

35. Disconnect the engine wiring harness from the top of the right camshaft cover.

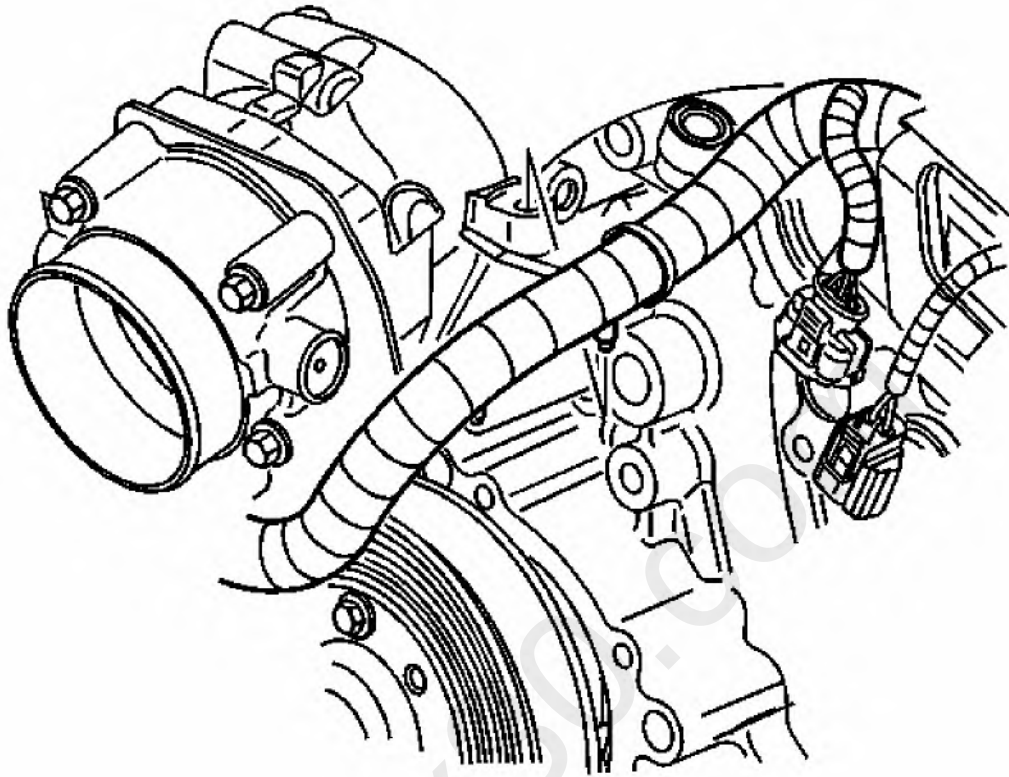


Fig. 97: View Of Engine Wiring Harness At Left Side Of Throttle Body/Intake Manifold

Courtesy of GENERAL MOTORS CORP.

36. Disconnect the engine wiring harness from the left side of the throttle body/intake manifold.

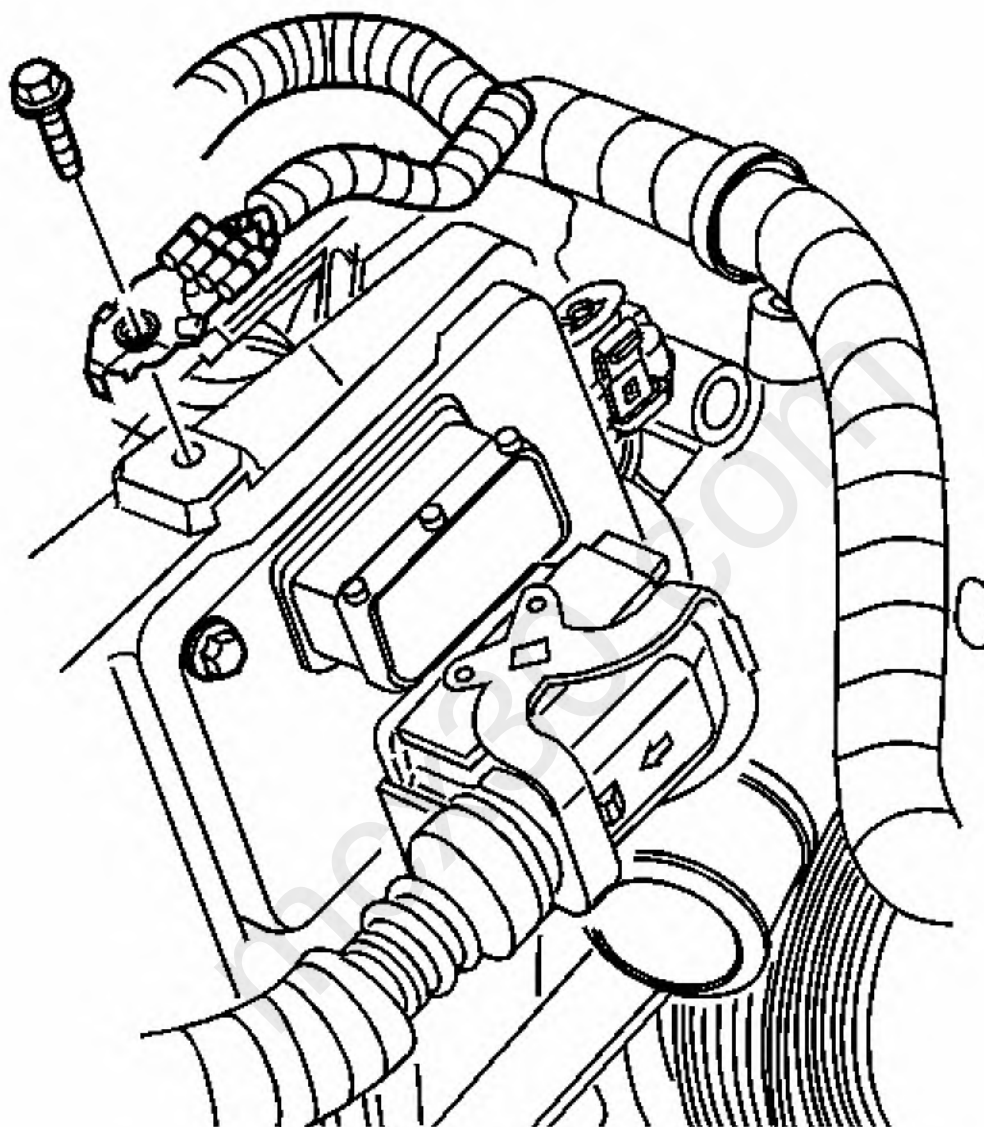


Fig. 98: View Of ECM Ground Harness Terminal Screw
Courtesy of GENERAL MOTORS CORP.

37. Remove the ECM ground harness terminal screw from the ECM lug.

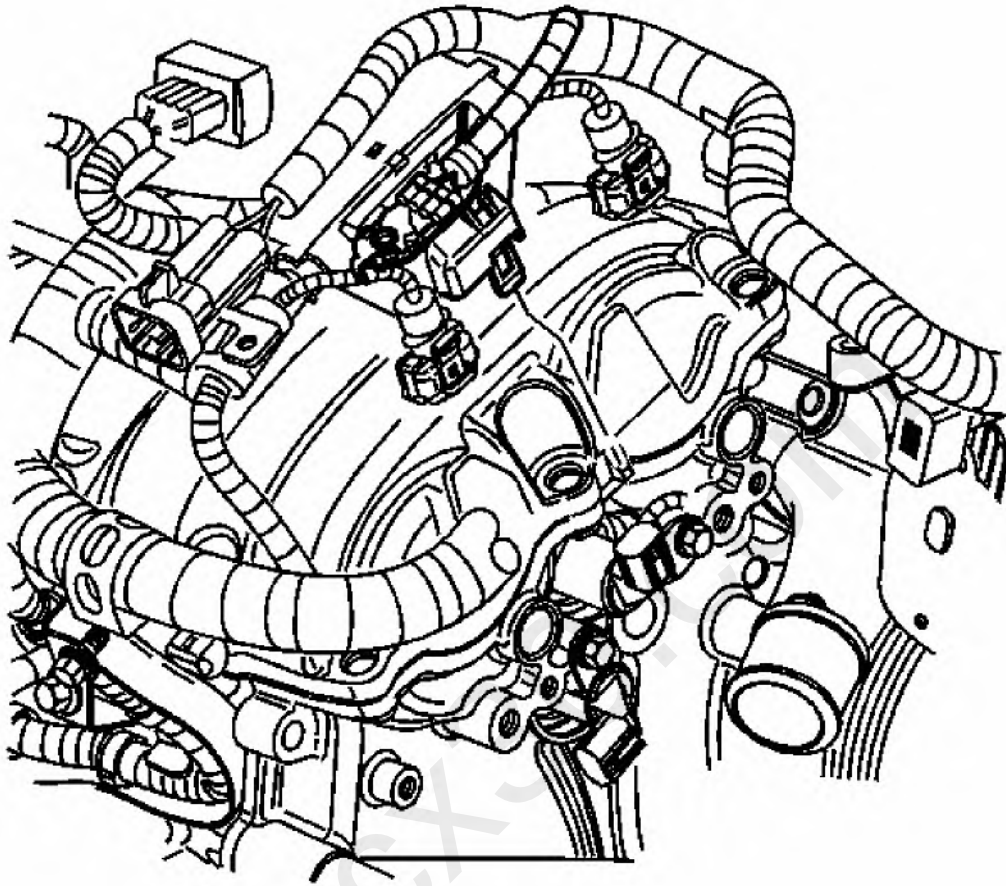


Fig. 99: View Of Right Camshaft Cover Wiring Harness Connector - Front
Courtesy of GENERAL MOTORS CORP.

38. Disconnect the engine wiring harness from the front of the right camshaft cover.

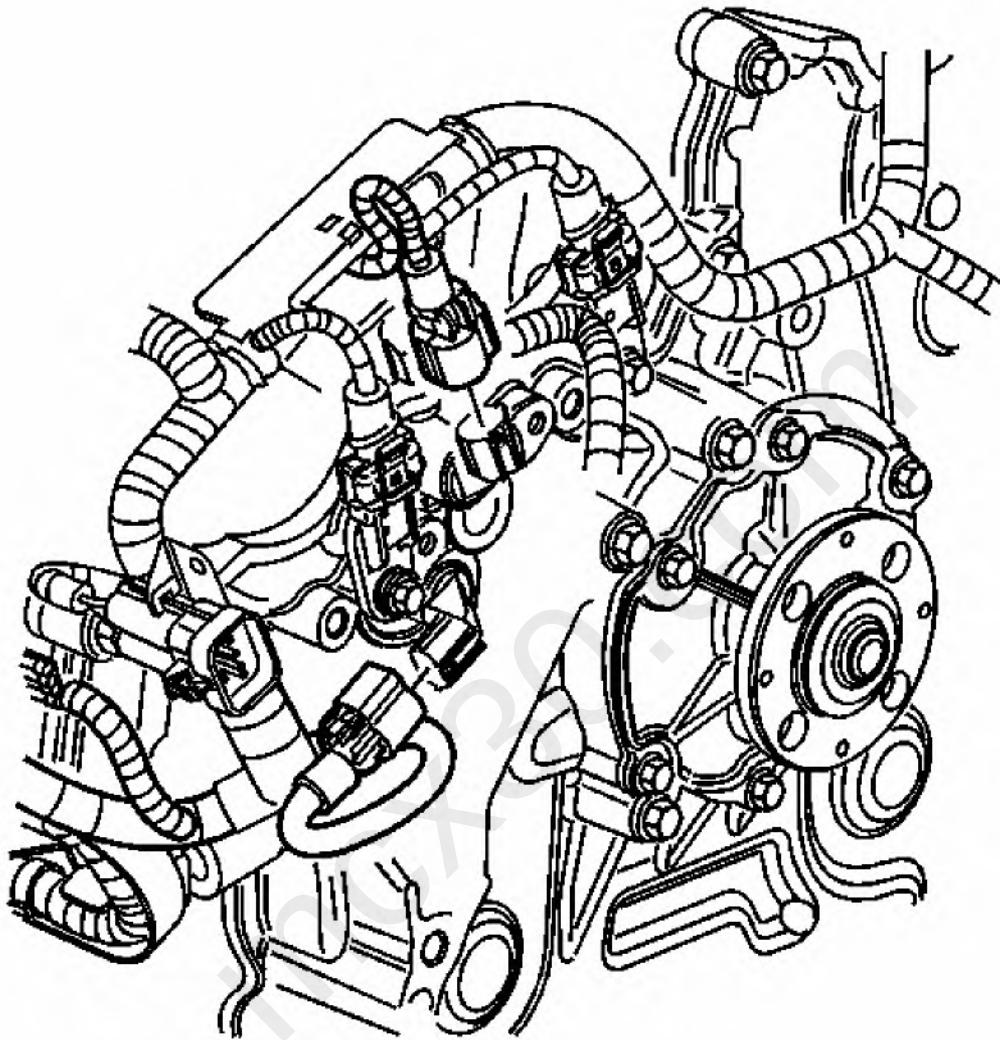


Fig. 100: View Of Right Camshaft Position Actuator Valves Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

39. Disconnect the engine wiring harness from the right camshaft position actuator valves.

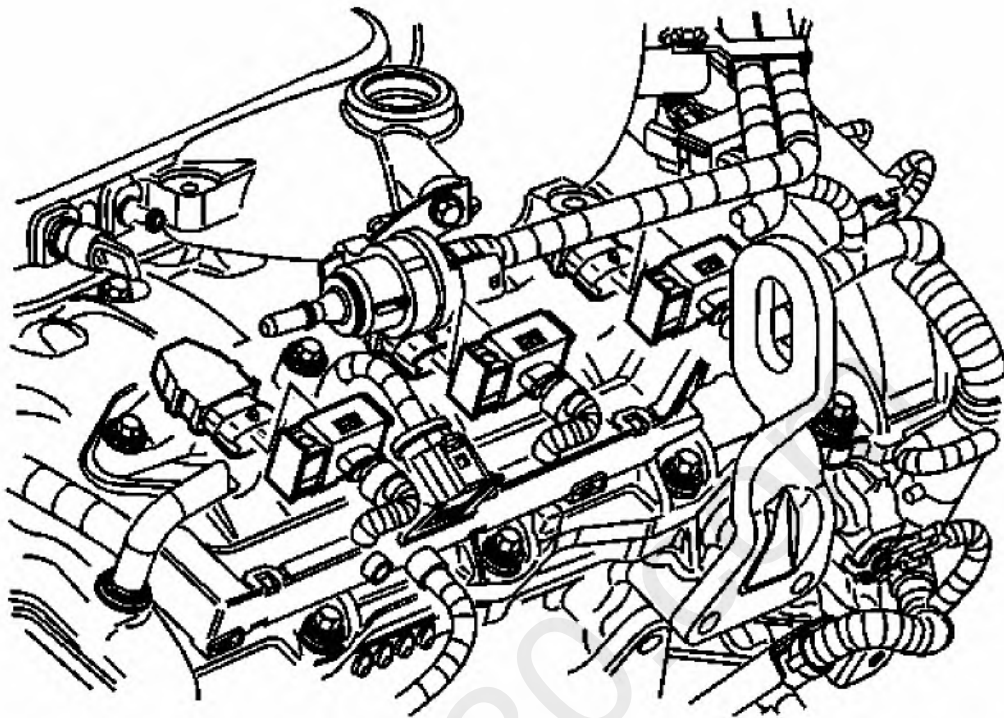


Fig. 101: View Of Right Ignition Coils Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

40. Disconnect the engine wiring harness from the right ignition coils.

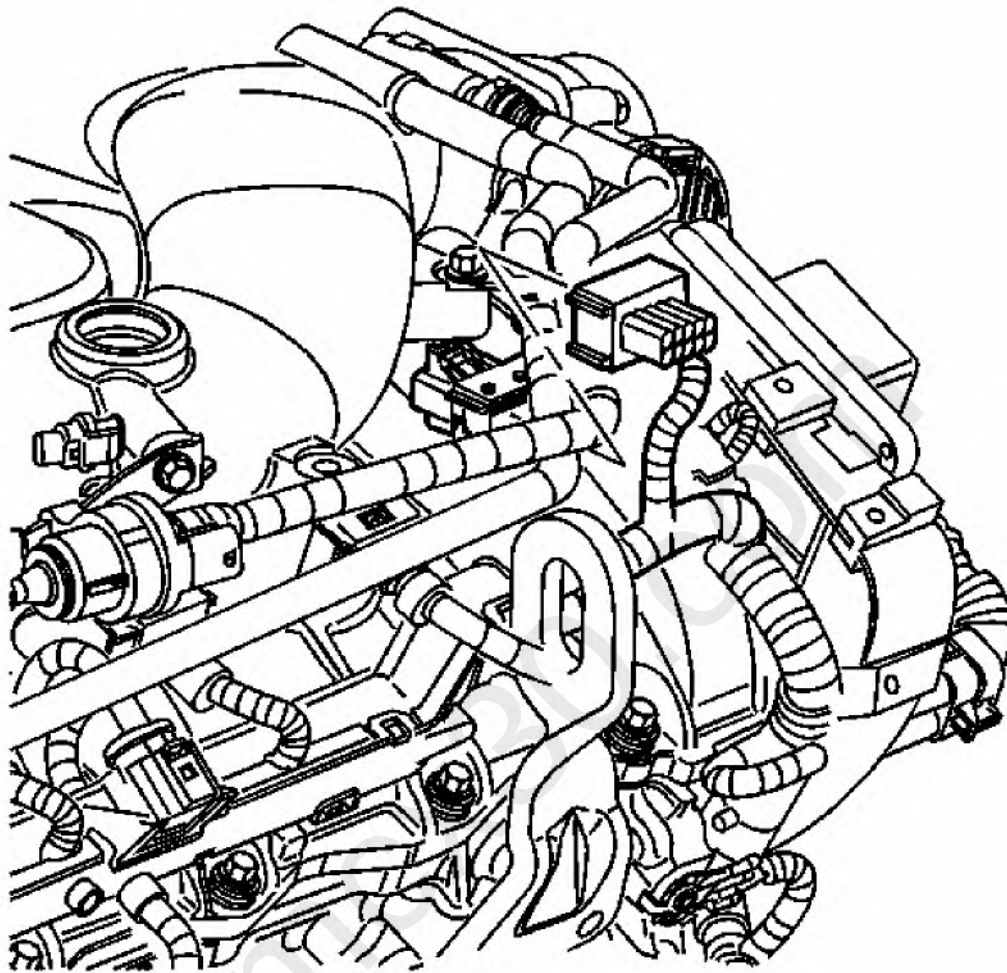


Fig. 102: View Of Fuel Injector Harness Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

41. Disconnect the engine wiring harness from the fuel injector harness.

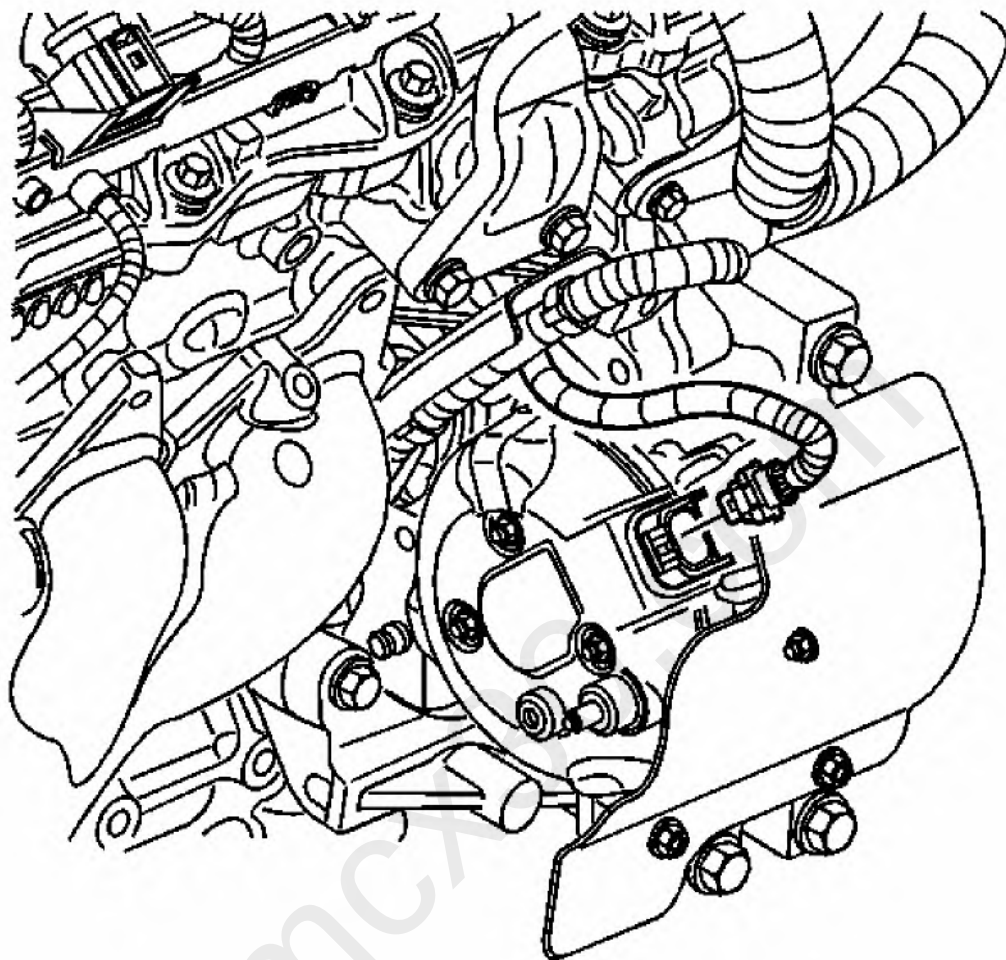


Fig. 103: View Of Generator Electrical Connector
Courtesy of GENERAL MOTORS CORP.

42. Disconnect the engine wiring harness from the generator.

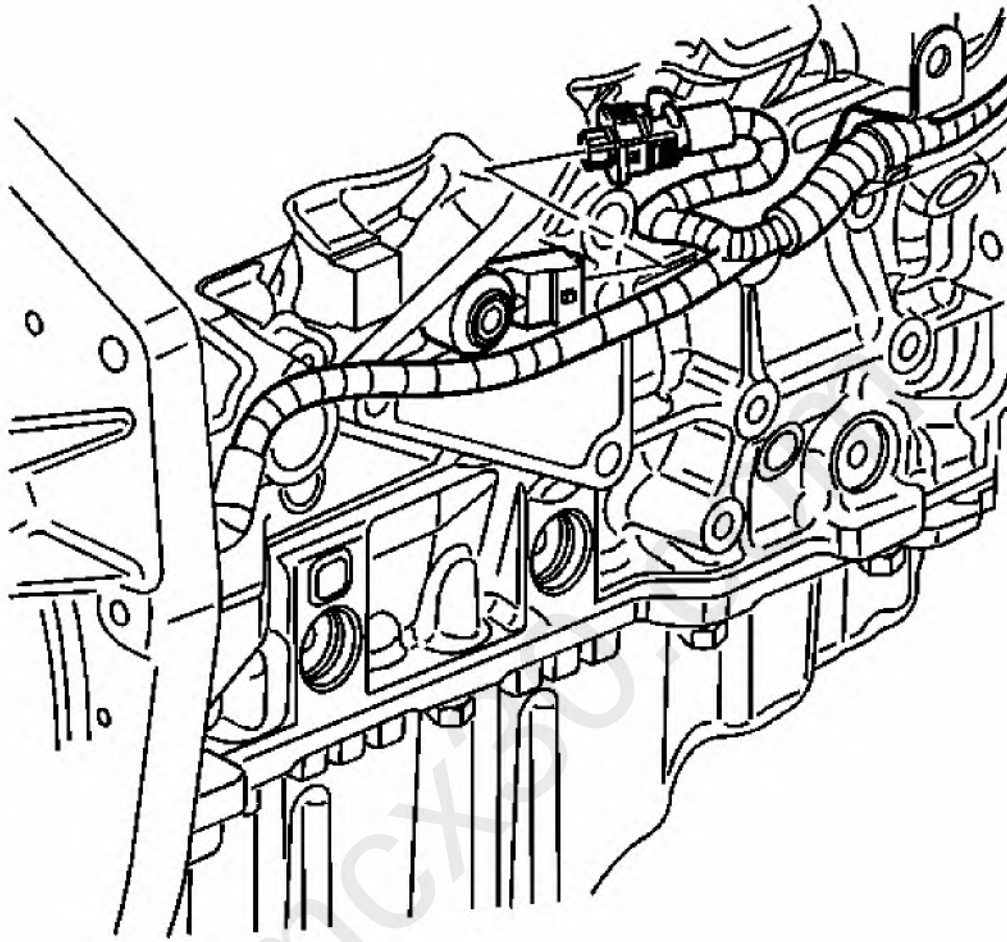


Fig. 104: View Of Right Knock Sensor And Electrical Connector
Courtesy of GENERAL MOTORS CORP.

43. Disconnect the engine wiring harness from the right knock sensor.

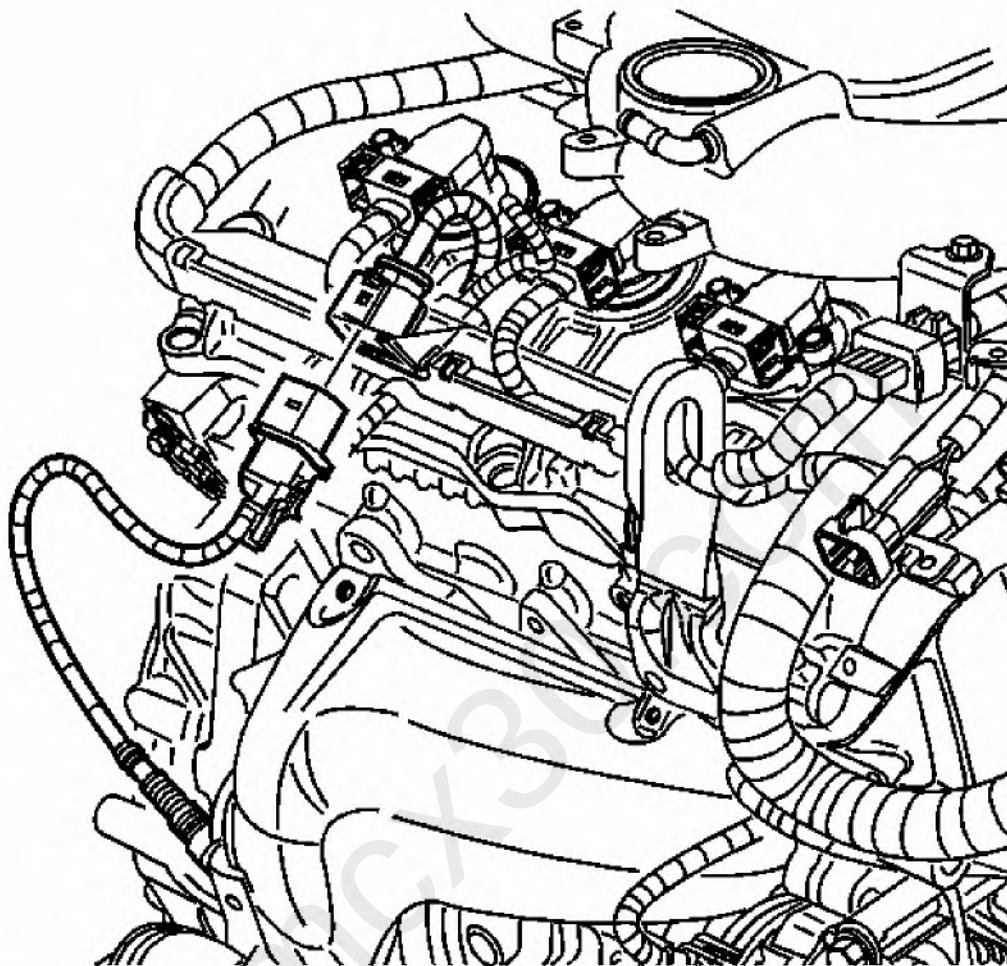


Fig. 105: View Of Right Oxygen Sensor Harness Electrical Connector
Courtesy of GENERAL MOTORS CORP.

44. Disconnect the engine wiring harness from the right oxygen sensor harness.

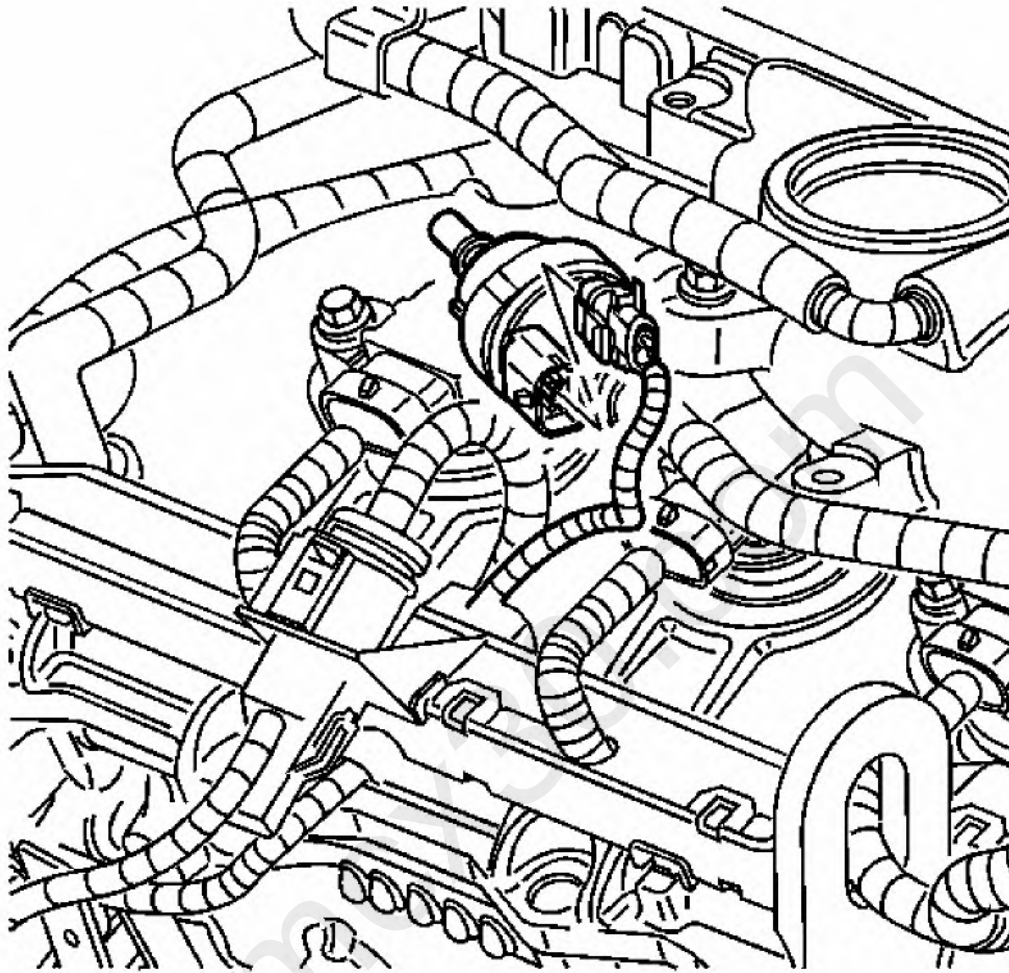


Fig. 106: View Of EVAP Solenoid Electrical Connector
Courtesy of GENERAL MOTORS CORP.

45. Disconnect the engine wiring harness from the evaporative emission (EVAP) solenoid.

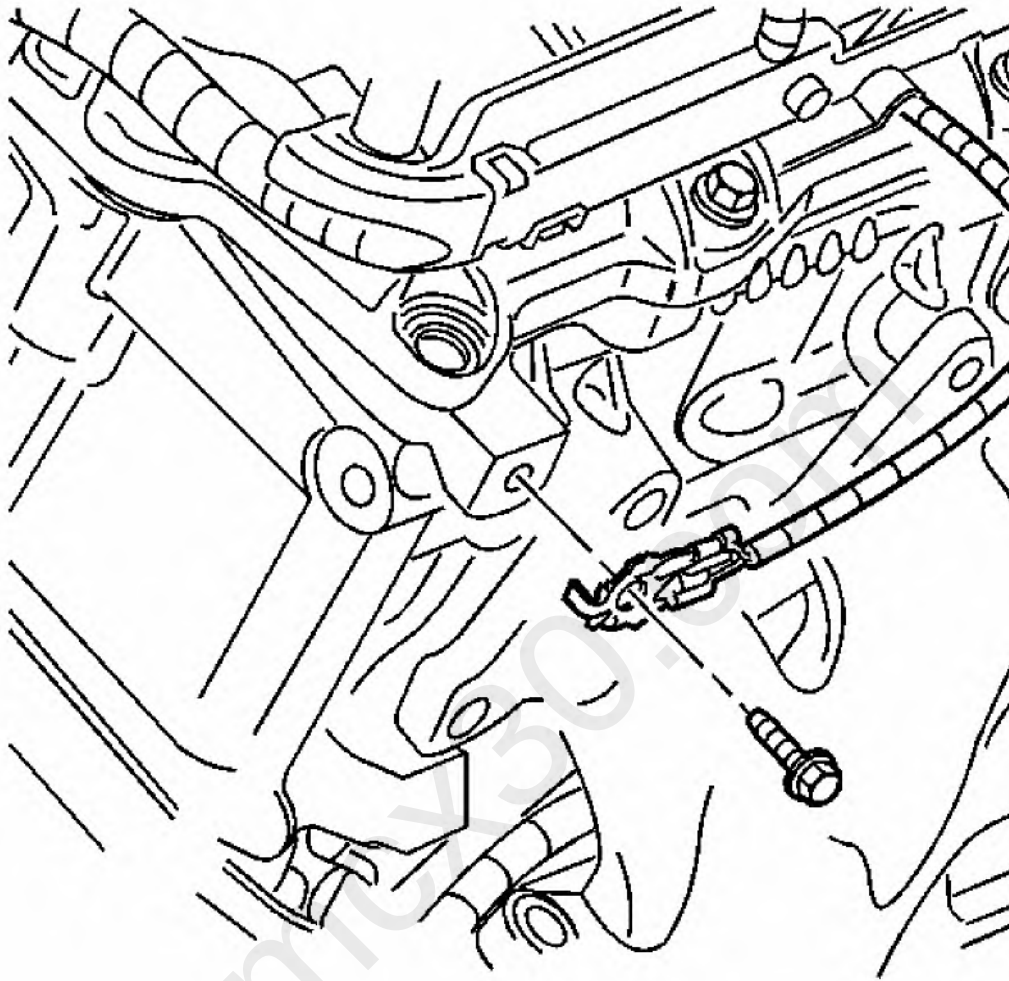


Fig. 107: View Of Wiring Harness Ground Bolt At Side Of Right Cylinder Head
Courtesy of GENERAL MOTORS CORP.

46. Remove the engine wiring harness ground bolt from the side of the right cylinder head.

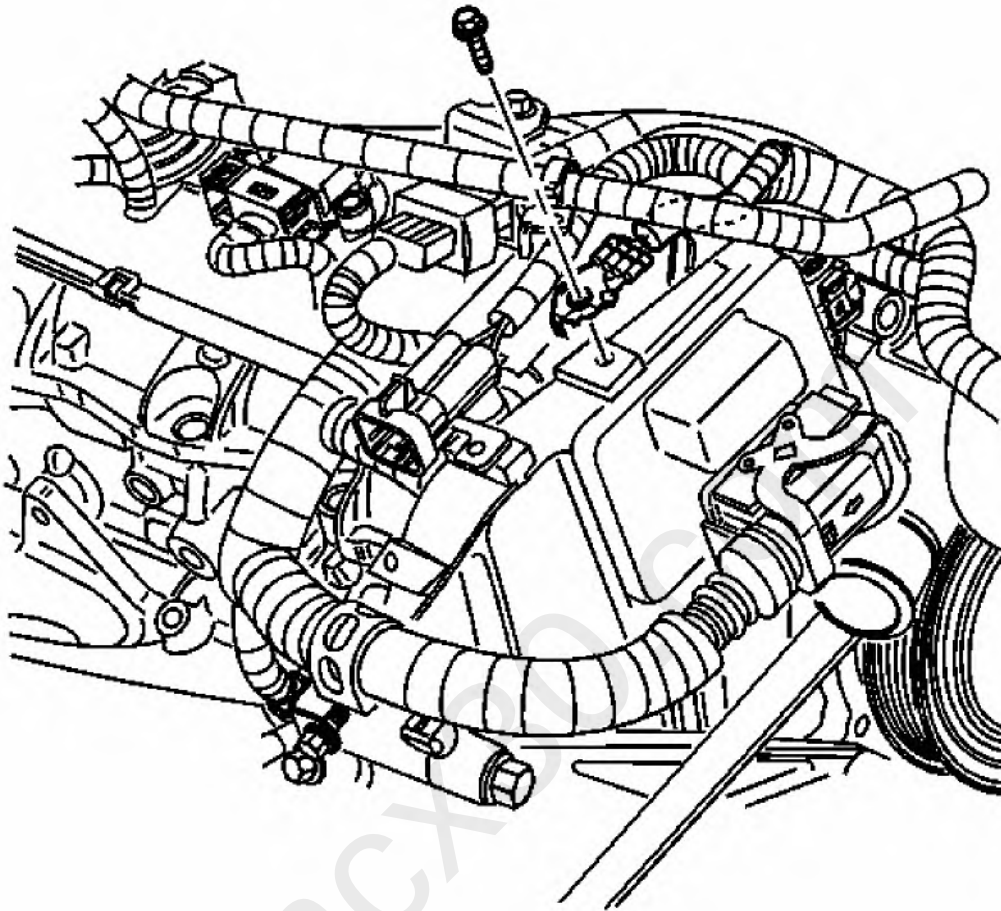


Fig. 108: View Of ECM Bracket Wiring Harness Ground Bolt
Courtesy of GENERAL MOTORS CORP.

47. Remove the engine wiring harness ground bolt from the ECM bracket.

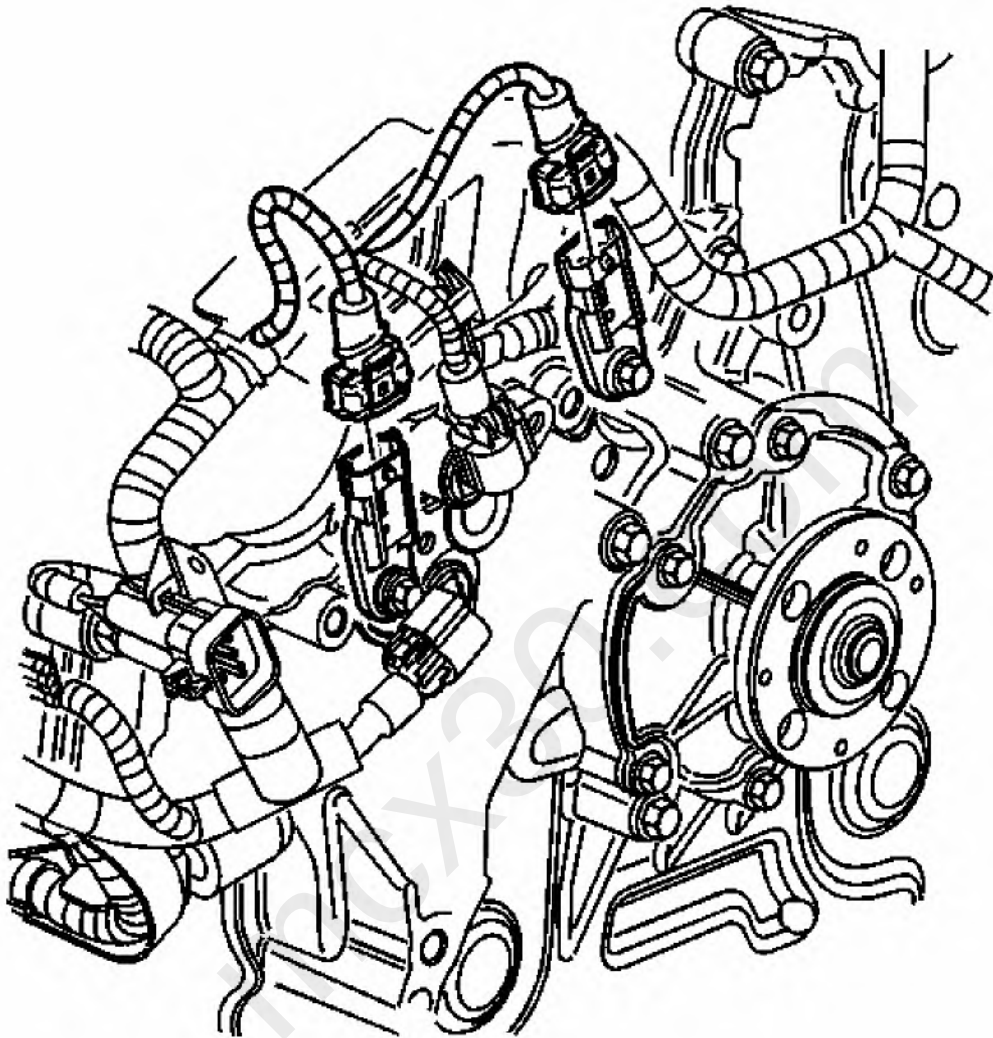


Fig. 109: View Of Right Camshaft Position Sensors Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

48. Disconnect the engine wiring harness from the right camshaft position sensors.

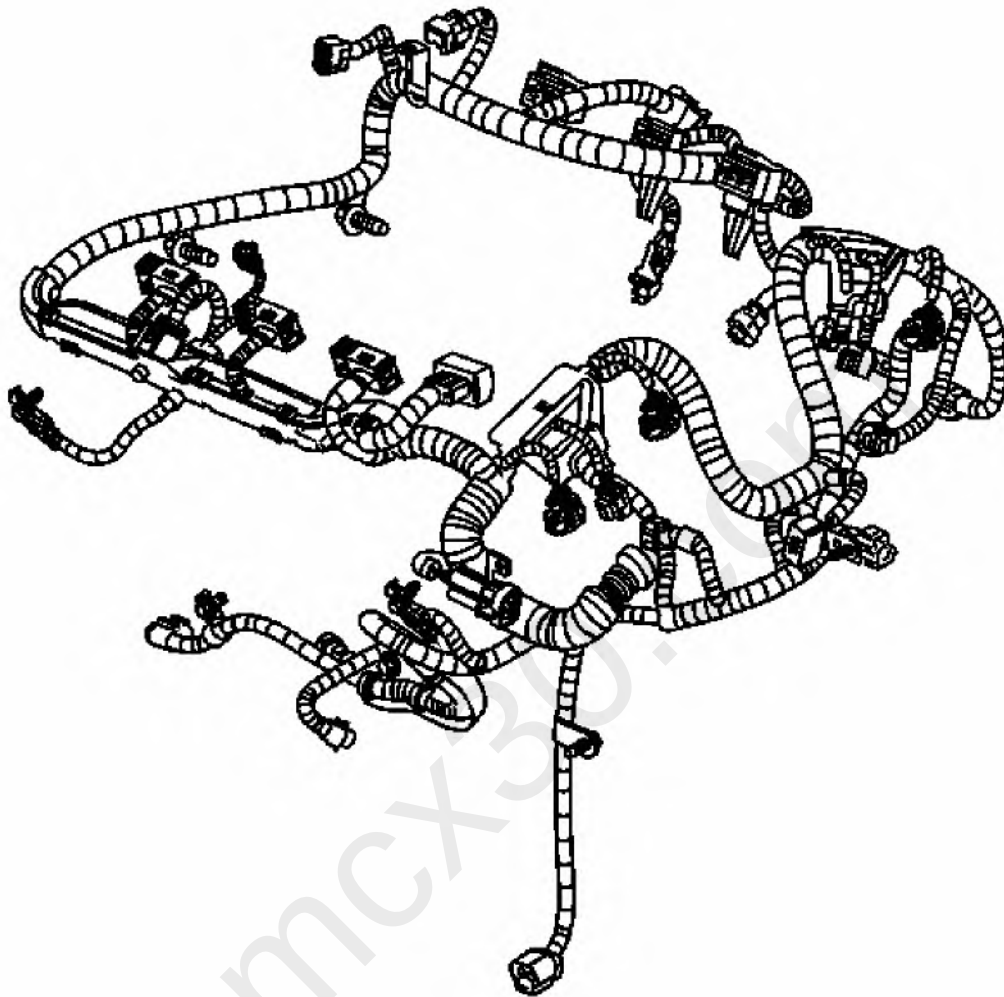


Fig. 110: View Of Engine Wiring Harness
Courtesy of GENERAL MOTORS CORP.

49. Remove the engine wiring harness from the engine.

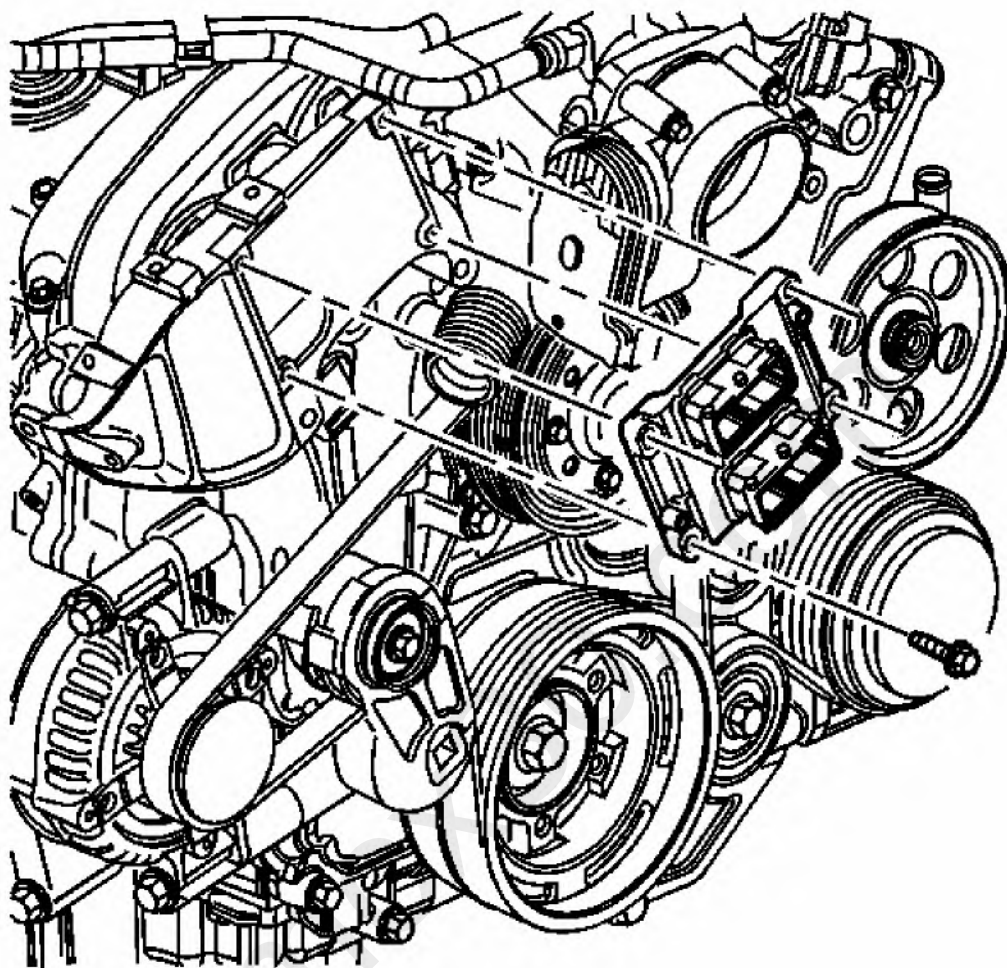


Fig. 111: View Of ECM Module
Courtesy of GENERAL MOTORS CORP.

50. Remove the ECM module bolts.
51. Remove the ECM module from the ECM bracket.

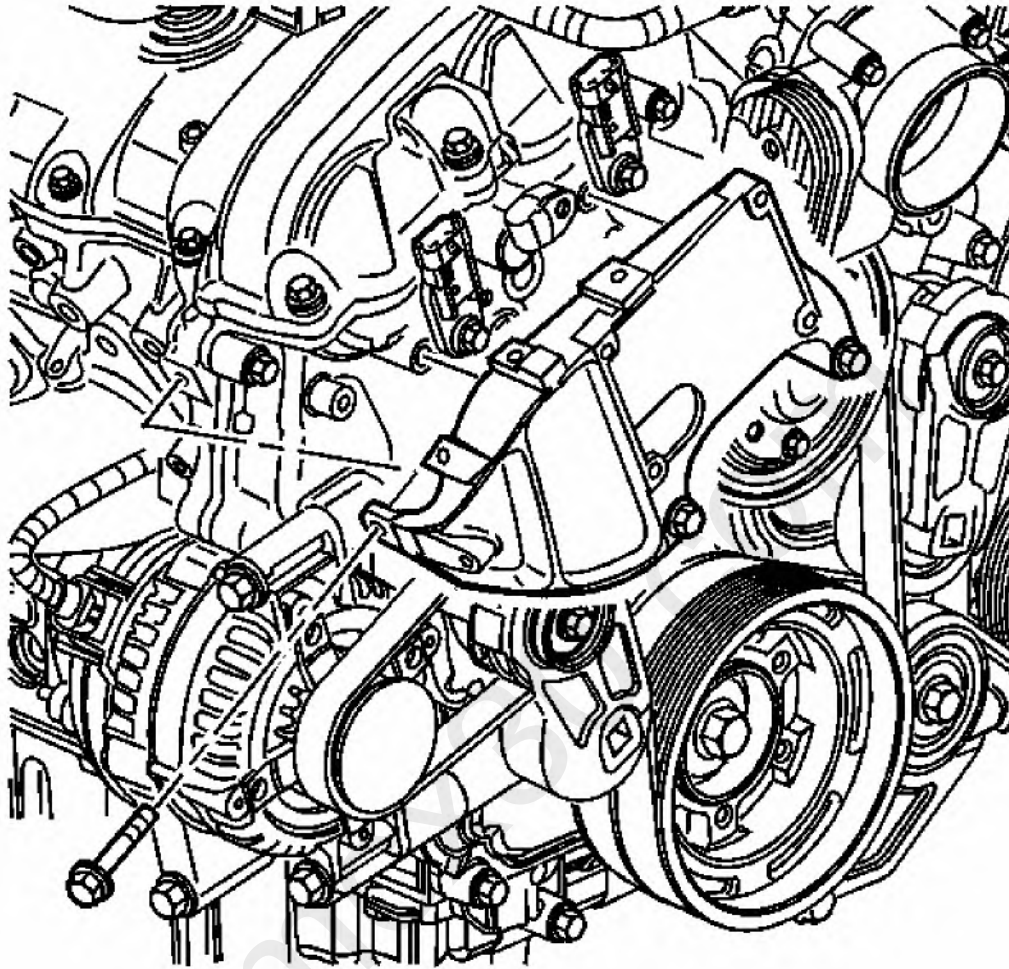


Fig. 112: View Of ECM Bracket
Courtesy of GENERAL MOTORS CORP.

52. Remove the ECM bracket bolts.
53. Remove the ECM bracket.

DRIVE BELT REMOVAL - OFF VEHICLE

OUTER DRIVE BELT

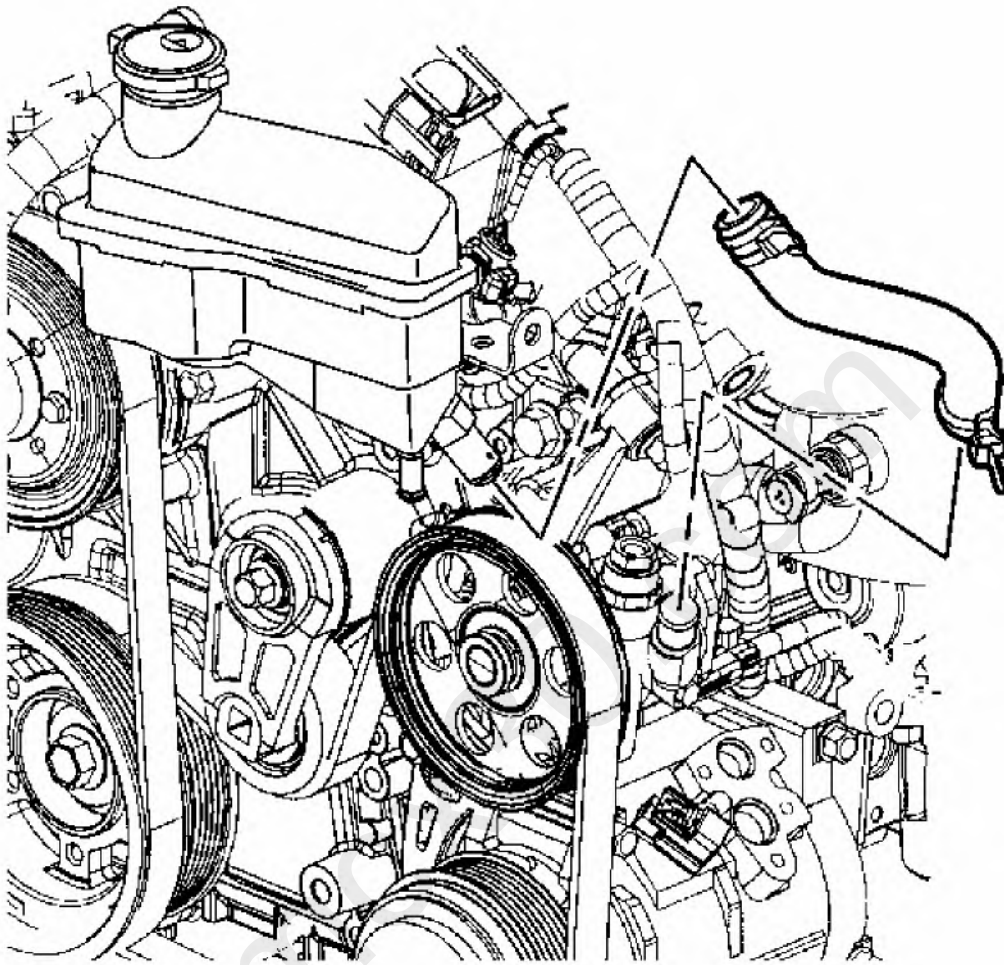


Fig. 113: View Of Power Steering Reservoir Hose
Courtesy of GENERAL MOTORS CORP.

1. Compress and reposition the clamp on the power steering reservoir hose in order to remove the hose from the power steering pump.
2. Remove the power steering reservoir hose from the power steering pump.

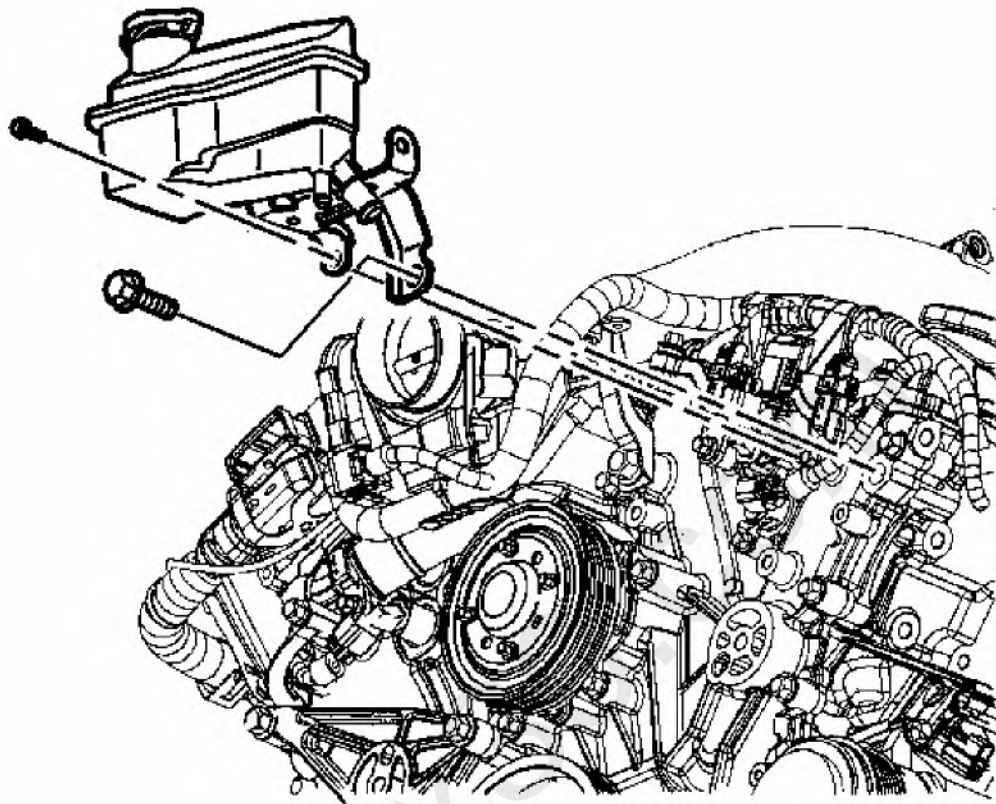


Fig. 114: View Of Power Steering Pump Reservoir
Courtesy of GENERAL MOTORS CORP.

3. Remove the power steering pump reservoir bolts.
4. Remove the power steering pump reservoir.

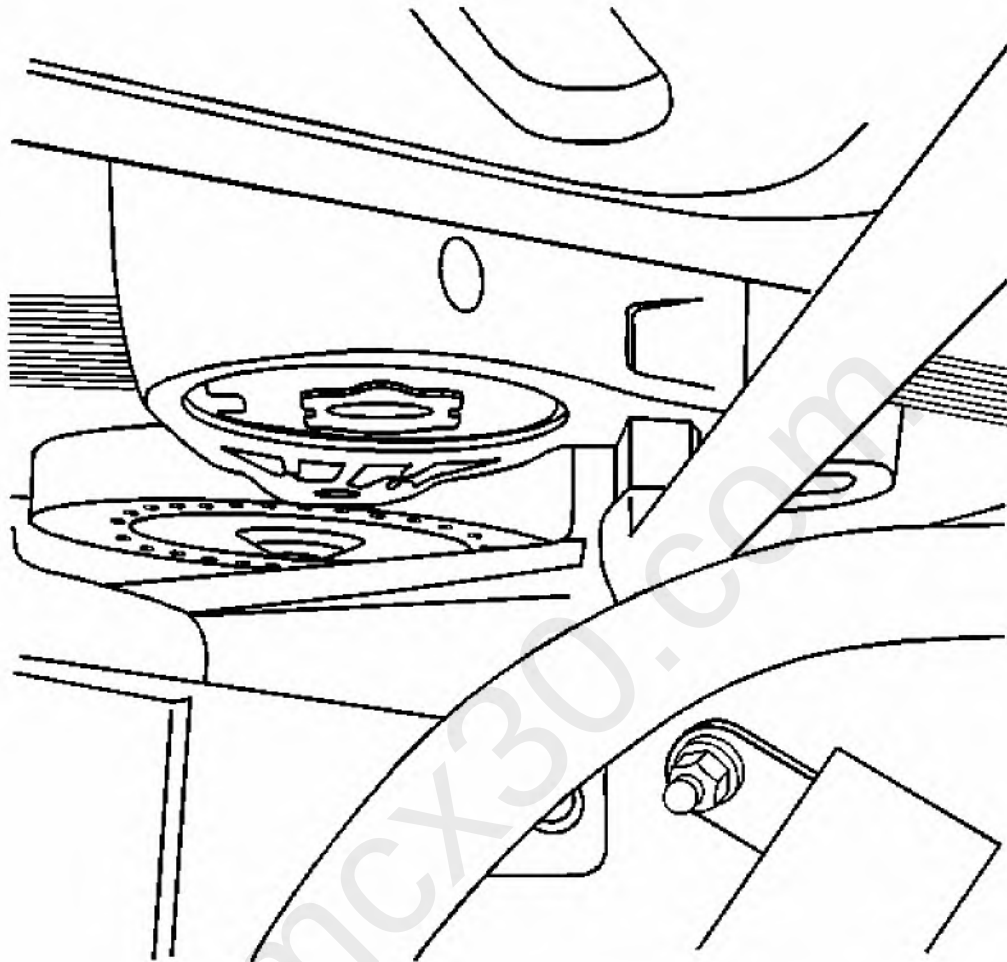


Fig. 115: View Of Drive Belt Tensioner & Pulleys
Courtesy of GENERAL MOTORS CORP.

5. Insert a 1/2 inch drive ratchet into the outer drive belt tensioner.
6. Rotate the drive belt tensioner clockwise.
7. Remove the drive belt from around the drive belt tensioner.
8. Slowly rotate the drive belt tensioner counterclockwise.
9. Remove the 1/2 inch drive ratchet.

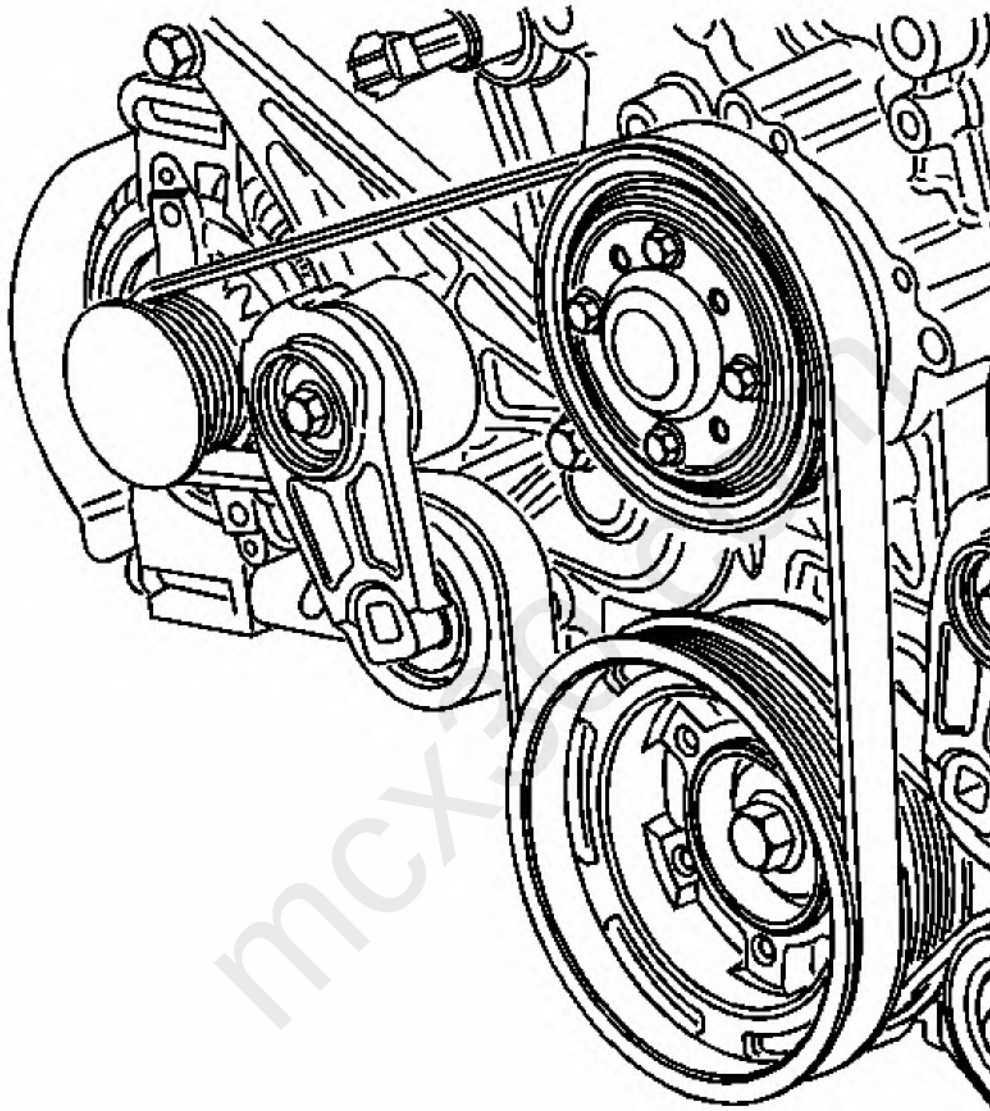


Fig. 116: View Of Outer Drive Belt
Courtesy of GENERAL MOTORS CORP.

10. Remove the outer drive belt from around the following:
 - Crankshaft balancer
 - Generator
 - Water pump pulley

INNER DRIVE BELT

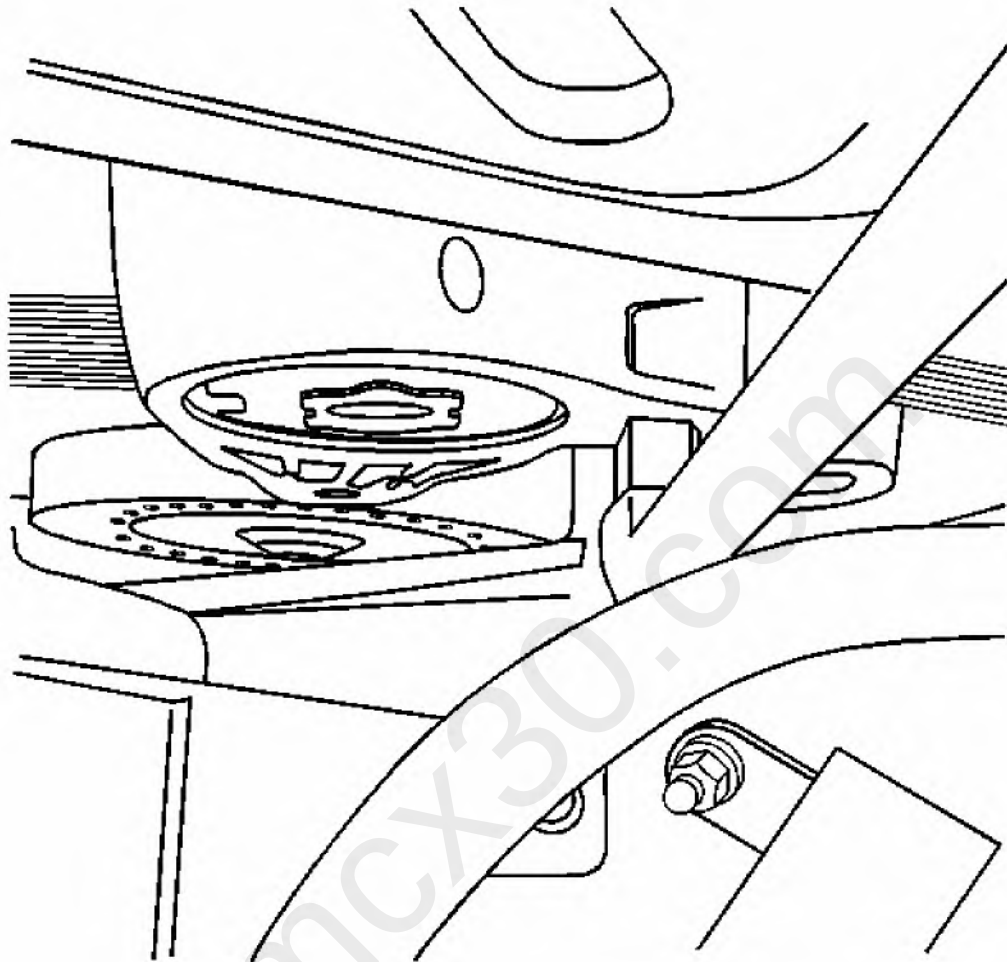


Fig. 117: View Of Drive Belt Tensioner & Pulleys
Courtesy of GENERAL MOTORS CORP.

1. Insert a 1/2 inch drive ratchet into the inner drive belt tensioner.
2. Rotate the drive belt tensioner clockwise.
3. Remove the drive belt from around the drive belt idler.
4. Slowly rotate the drive belt tensioner counter-clockwise.
5. Remove the 1/2 inch drive ratchet.

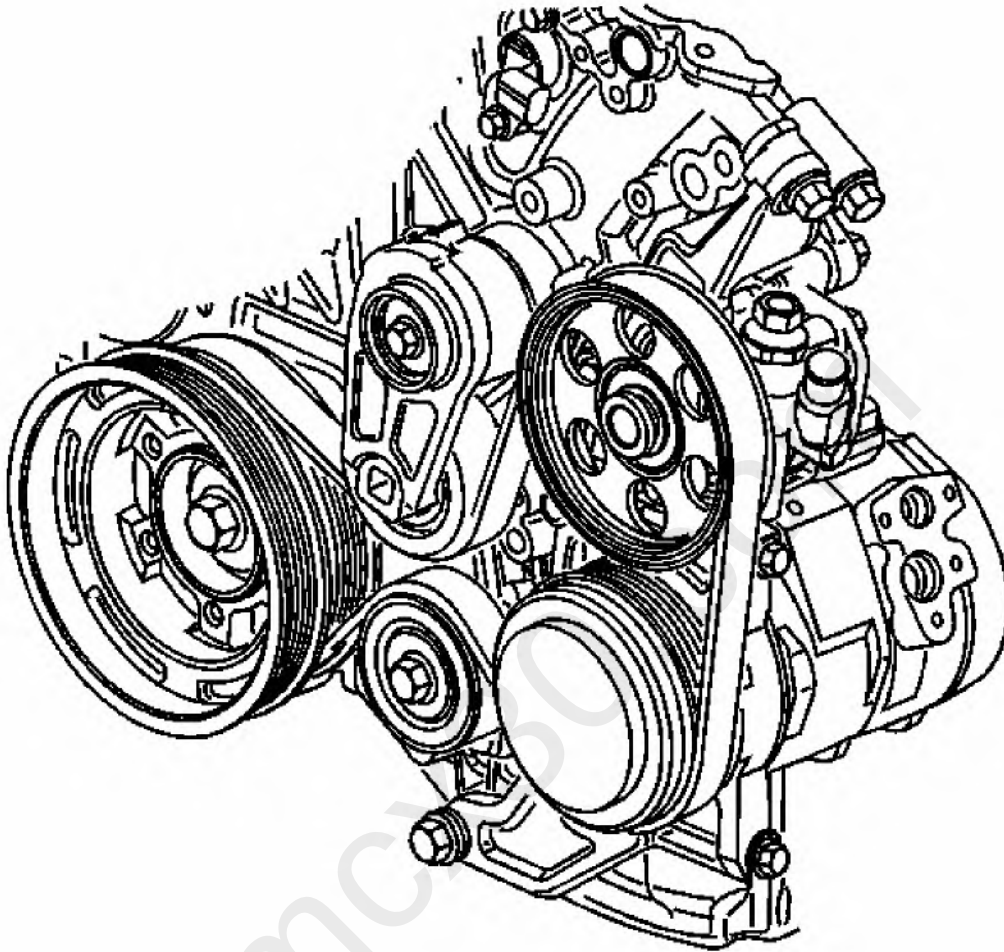


Fig. 118: View Of Inner Drive Belt
Courtesy of GENERAL MOTORS CORP.

6. Remove the inner drive belt from around the following:
 - Crankshaft balancer
 - Air conditioning compressor
 - Drive belt tensioner
 - Power steering pump

DRIVE BELT TENSIONER REMOVAL - RIGHT SIDE - OFF VEHICLE

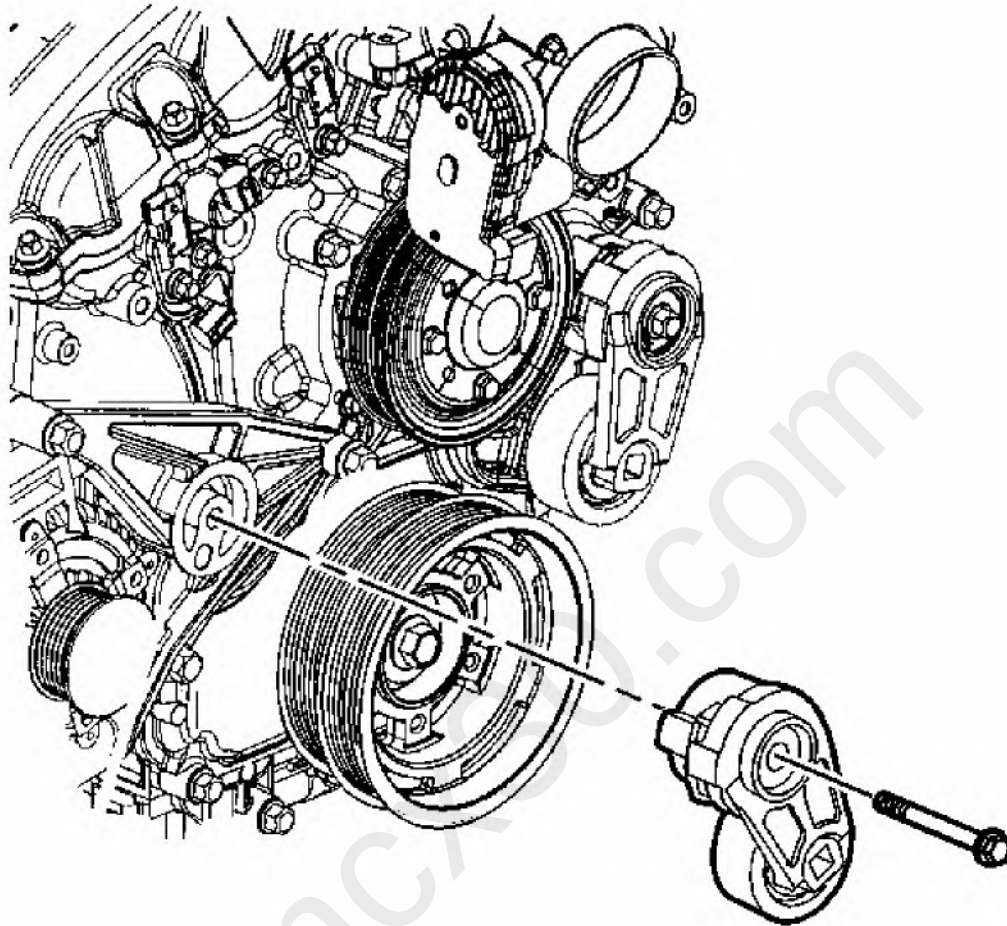


Fig. 119: View Of Right Drive Belt Tensioner
Courtesy of GENERAL MOTORS CORP.

1. Remove the drive belt tensioner bolt.
2. Remove the drive belt tensioner.

DRIVE BELT TENSIONER REMOVAL - LEFT SIDE - OFF VEHICLE

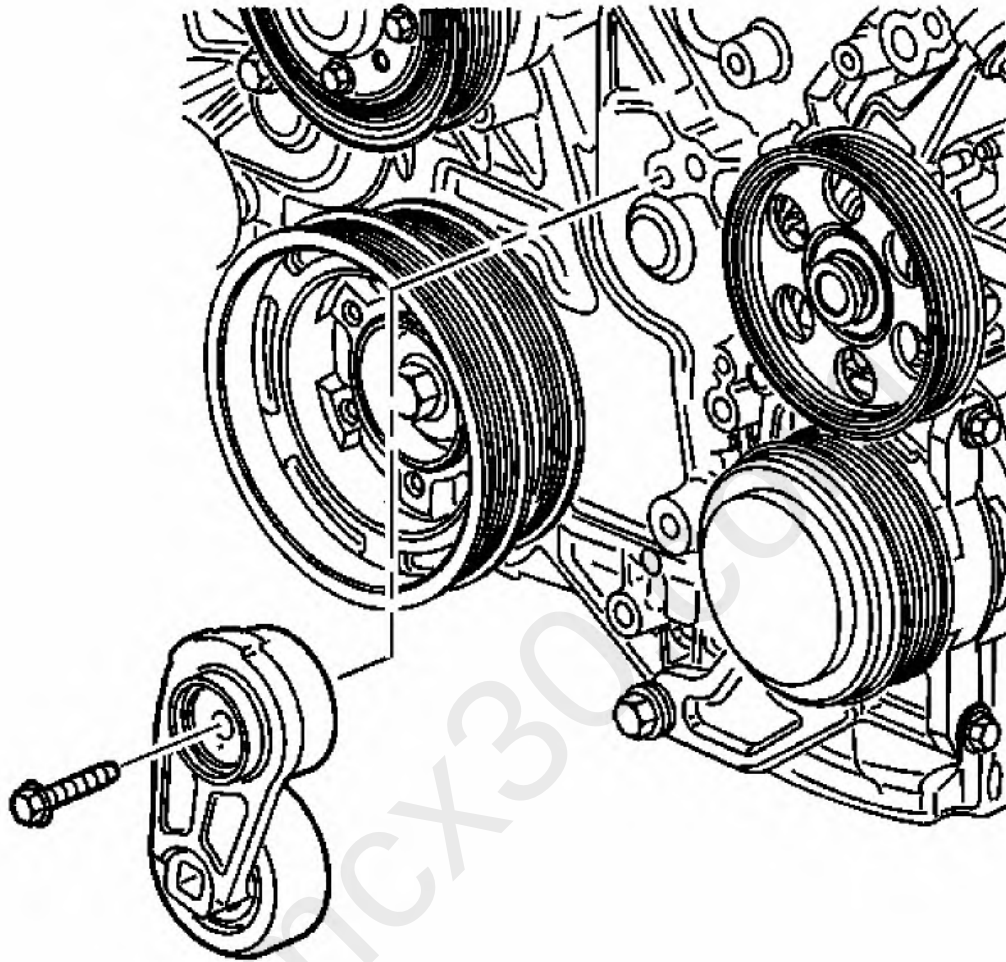


Fig. 120: View Of Left Drive Belt Tensioner
Courtesy of GENERAL MOTORS CORP.

1. Remove the drive belt tensioner bolt.
2. Remove the drive belt tensioner.

GENERATOR REMOVAL - OFF VEHICLE

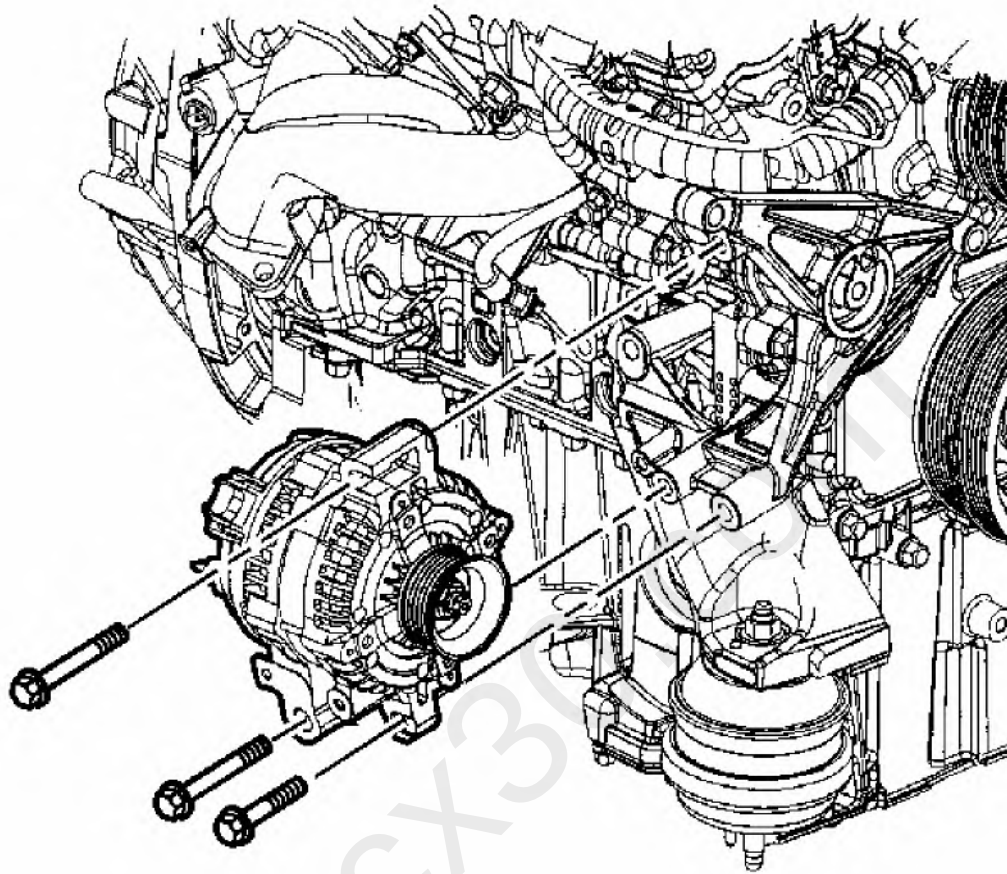


Fig. 121: View Of Generator
Courtesy of GENERAL MOTORS CORP.

1. Remove the generator bolts.
2. Remove the generator.

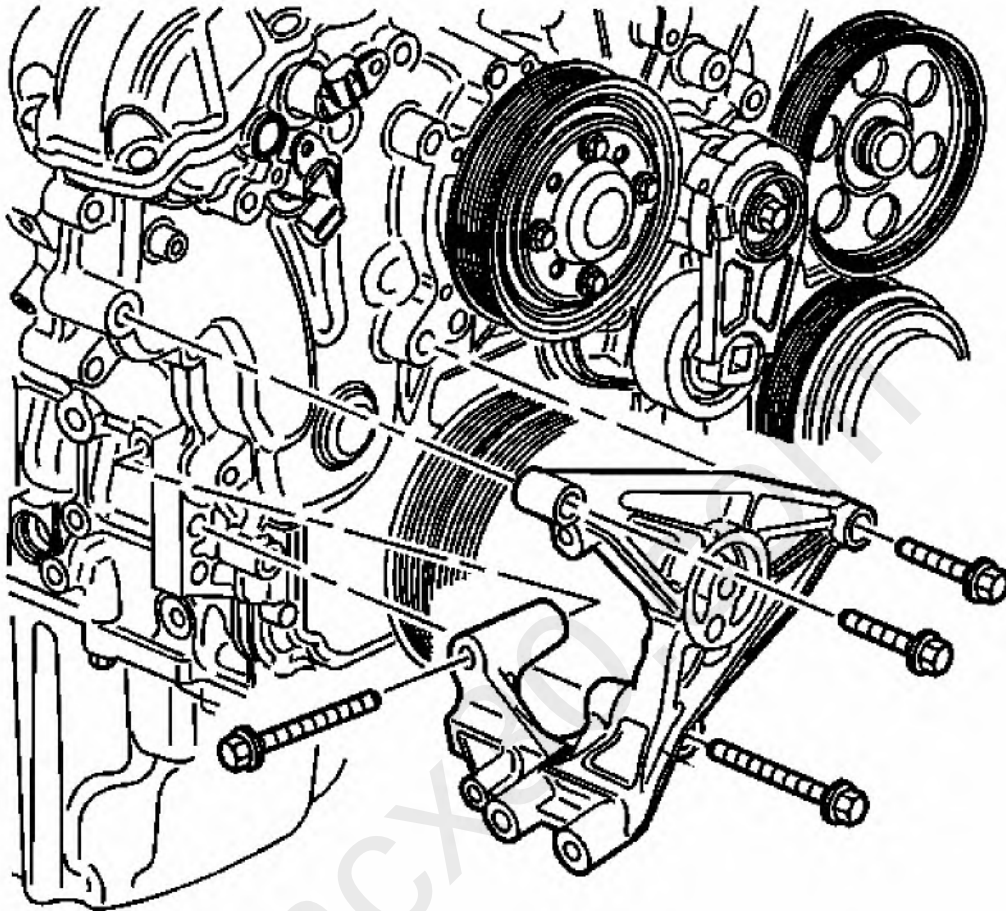


Fig. 122: View Of Generator Bracket
Courtesy of GENERAL MOTORS CORP.

3. Remove the generator bracket bolts.
4. Remove the generator bracket.

AIR CONDITIONING (A/C) COMPRESSOR REMOVAL - OFF VEHICLE

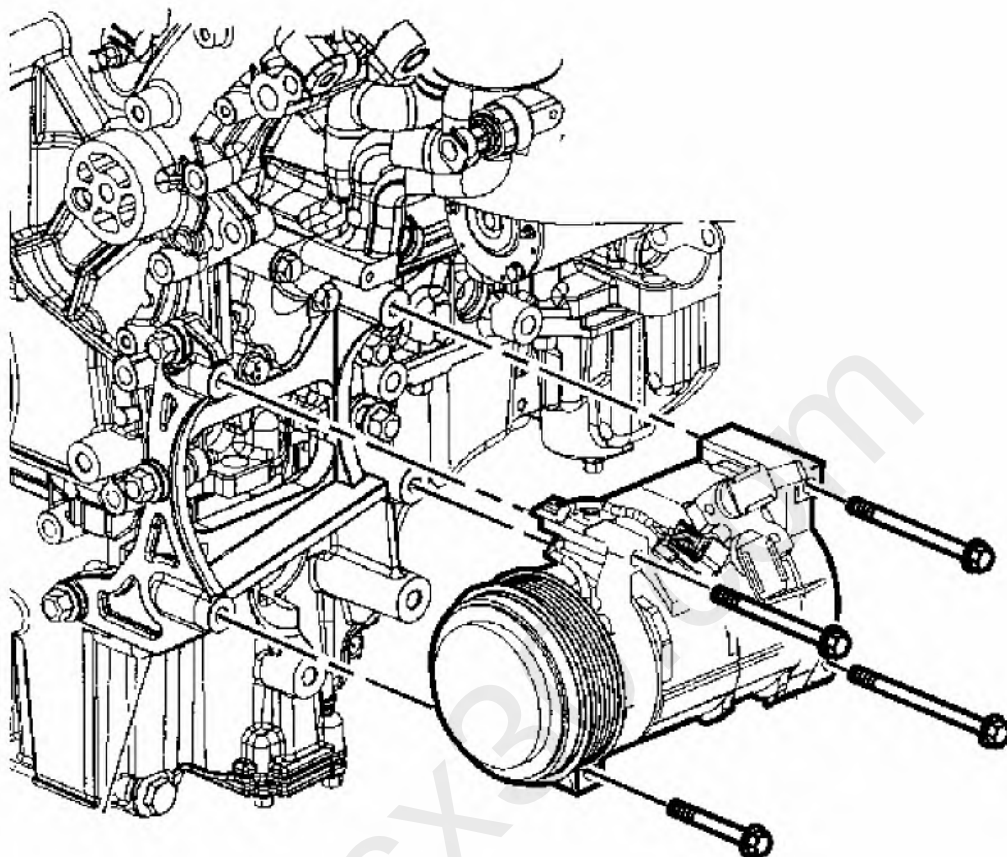


Fig. 123: View Of A/C Compressor
Courtesy of GENERAL MOTORS CORP.

1. Remove the air conditioning compressor bolts.
2. Remove the air conditioning compressor.

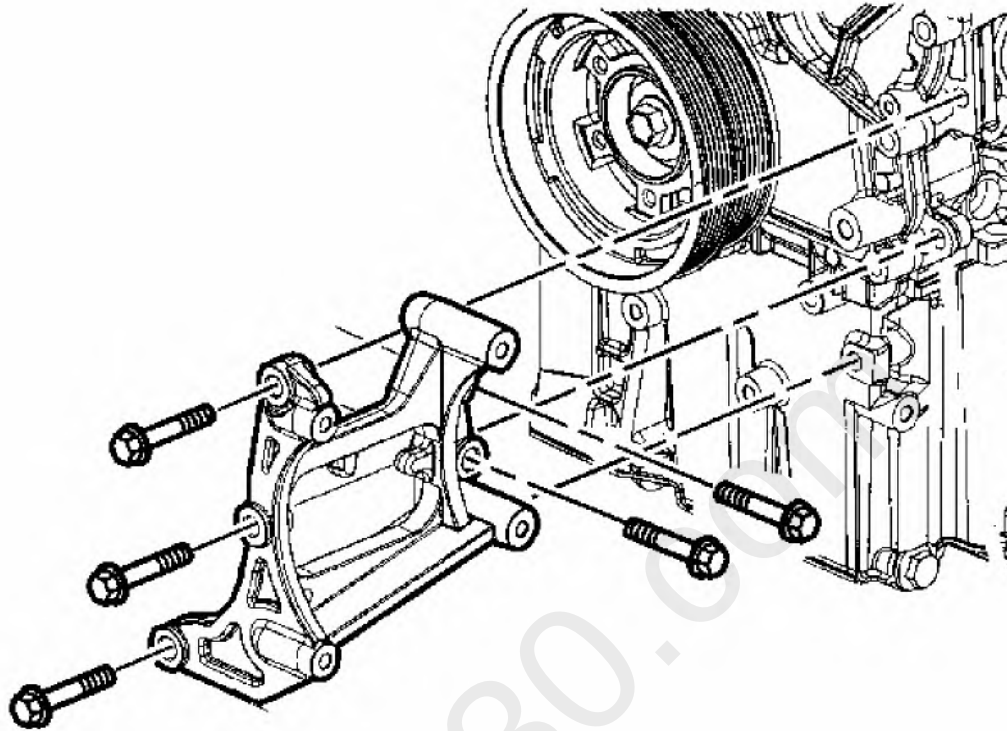


Fig. 124: View Of A/C Compressor Bracket
Courtesy of GENERAL MOTORS CORP.

3. Remove the air conditioning compressor bracket bolts.
4. Remove the air conditioning compressor bracket.

POWER STEERING PUMP REMOVAL - OFF VEHICLE

Tools Required

J 25034-C Pulley Remover. See Special Tools .

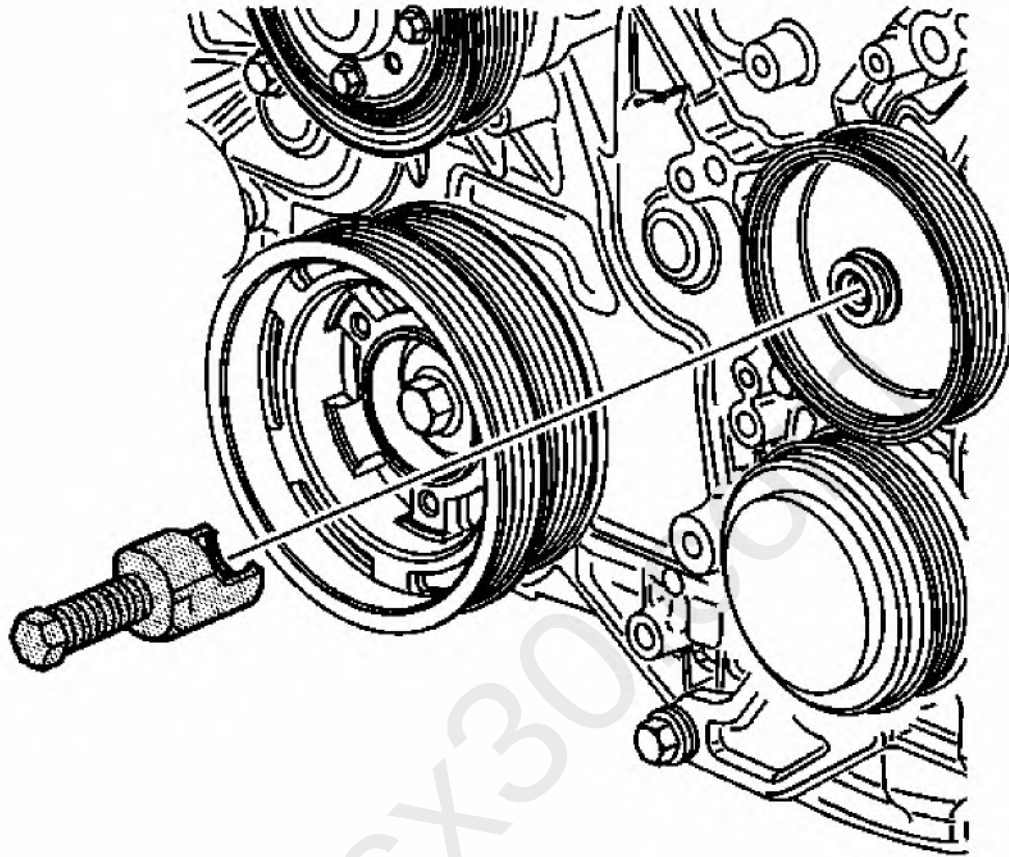


Fig. 125: Identifying J 25034-C
Courtesy of GENERAL MOTORS CORP.

1. If necessary, using the **J 25034-C** , remove the power steering pump pulley in order to access the power steering pump mounting bolts. See **Special Tools** .

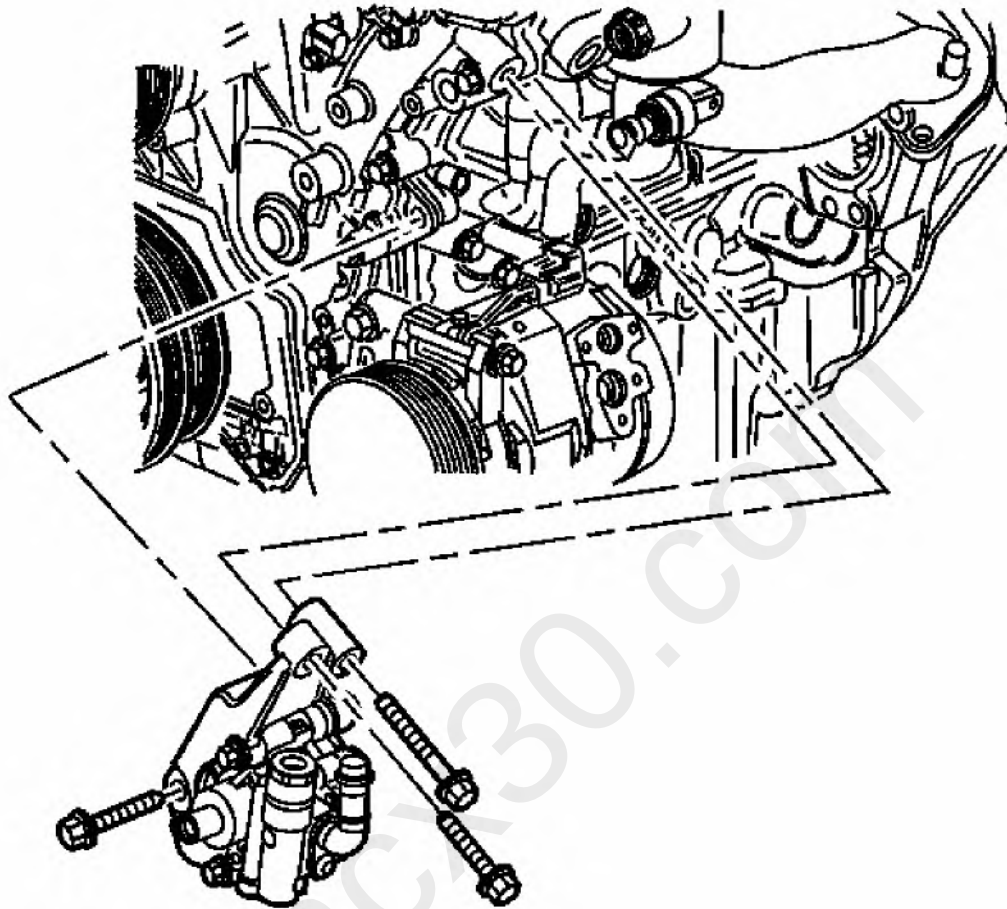


Fig. 126: View Of Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

2. Remove the power steering pump bolts.
3. Remove the power steering pump.

STARTER REMOVAL - OFF VEHICLE

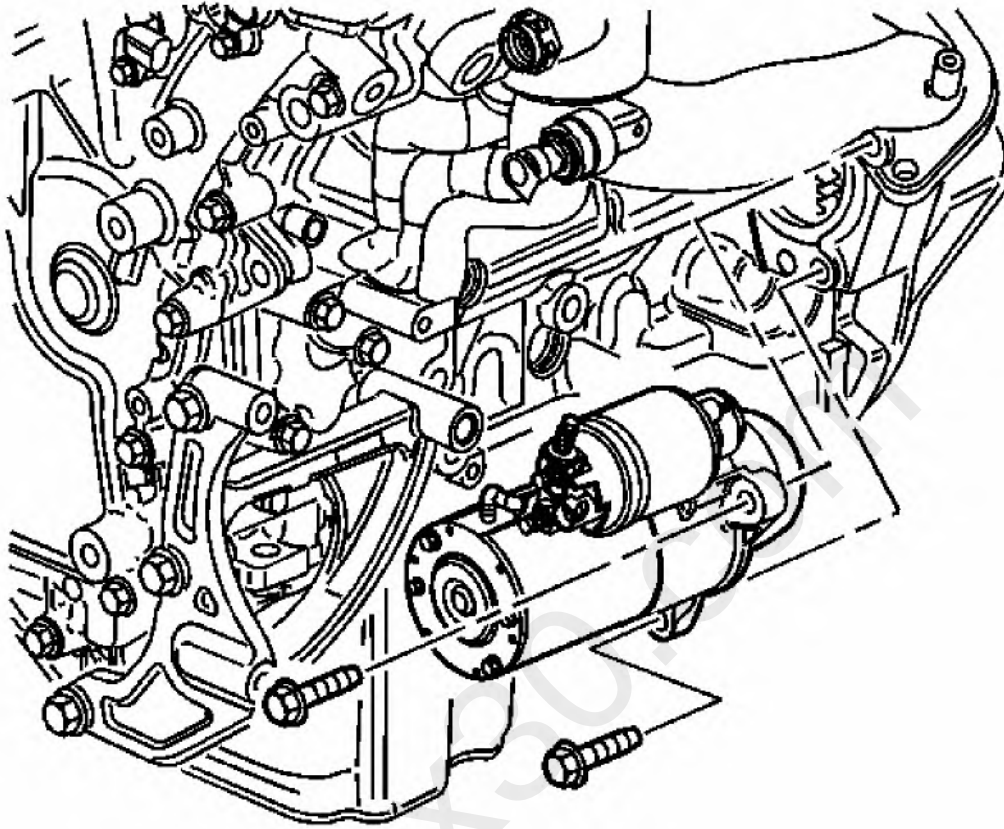


Fig. 127: View Of Starter Motor
Courtesy of GENERAL MOTORS CORP.

1. Remove the starter motor bolts.
2. Remove the starter motor.

OIL LEVEL INDICATOR AND TUBE REMOVAL - OFF VEHICLE

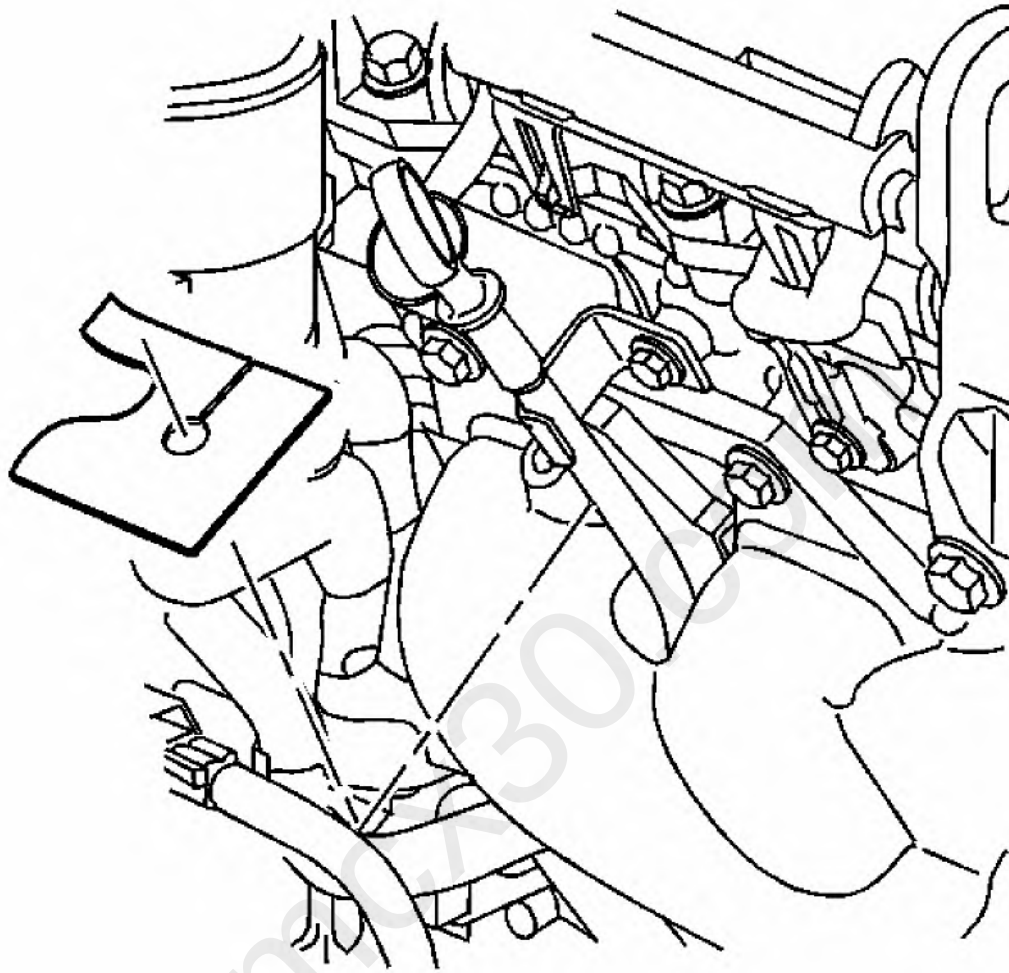


Fig. 128: View Of Left Exhaust Manifold Upper Insulator
Courtesy of GENERAL MOTORS CORP.

1. Remove the left exhaust manifold upper insulator from the oil level indicator tube.

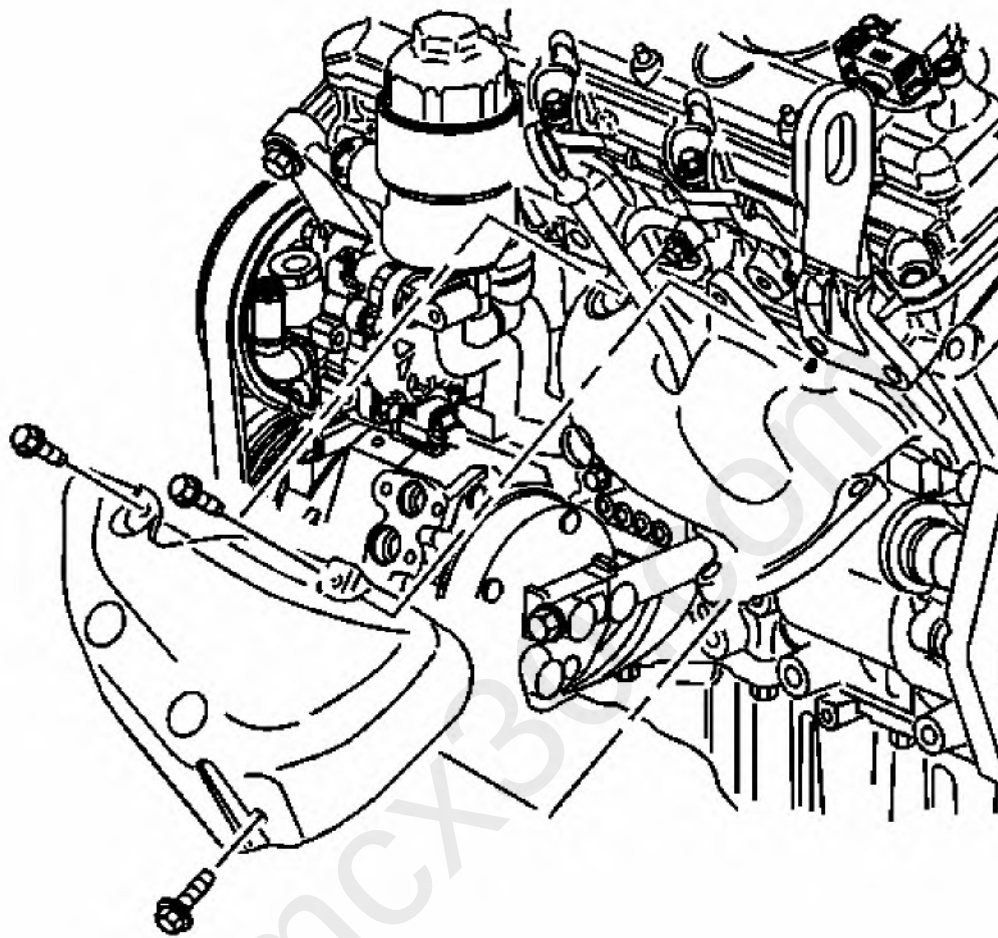


Fig. 129: View Of Left Exhaust Manifold Heat Shield
Courtesy of GENERAL MOTORS CORP.

2. Remove the left exhaust manifold heat shield bolts.
3. Remove the left exhaust manifold heat shield.

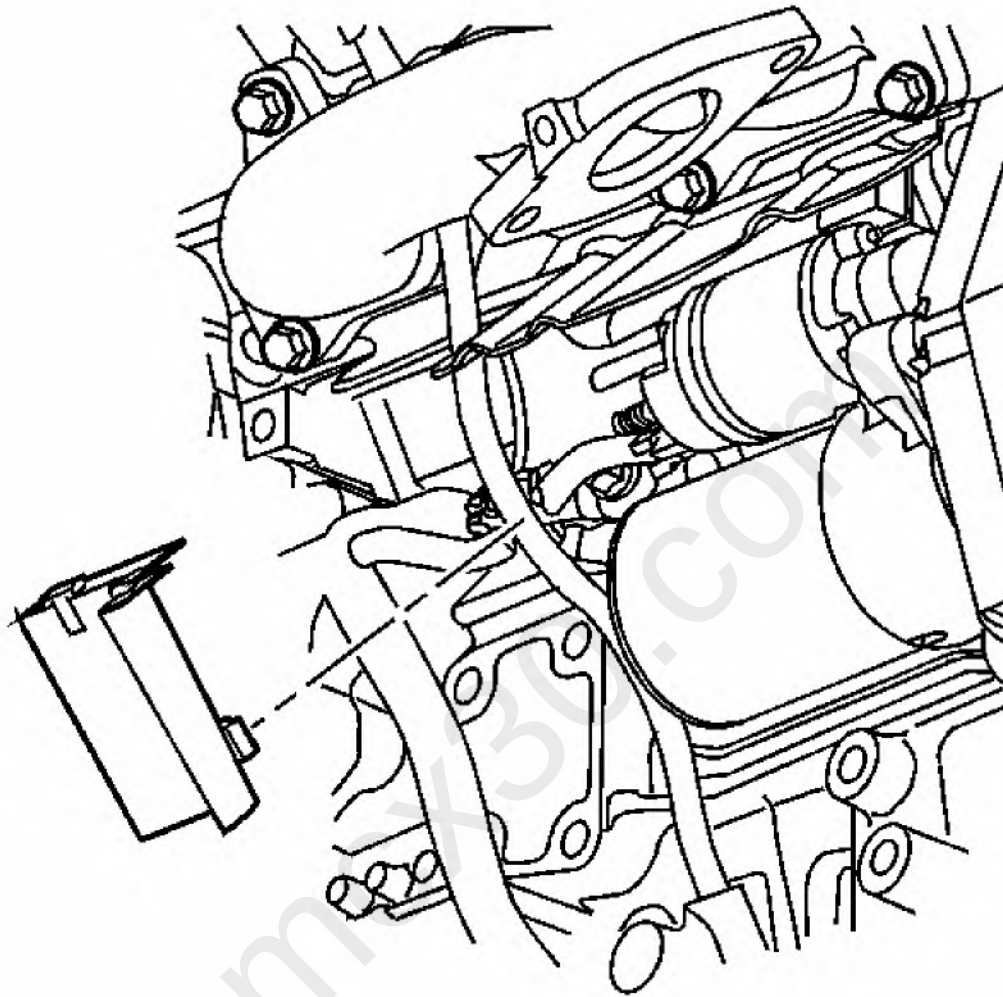


Fig. 130: View Of Left Exhaust Manifold Lower Insulator
Courtesy of GENERAL MOTORS CORP.

4. Remove the left exhaust manifold lower insulator from the oil level indicator tube.

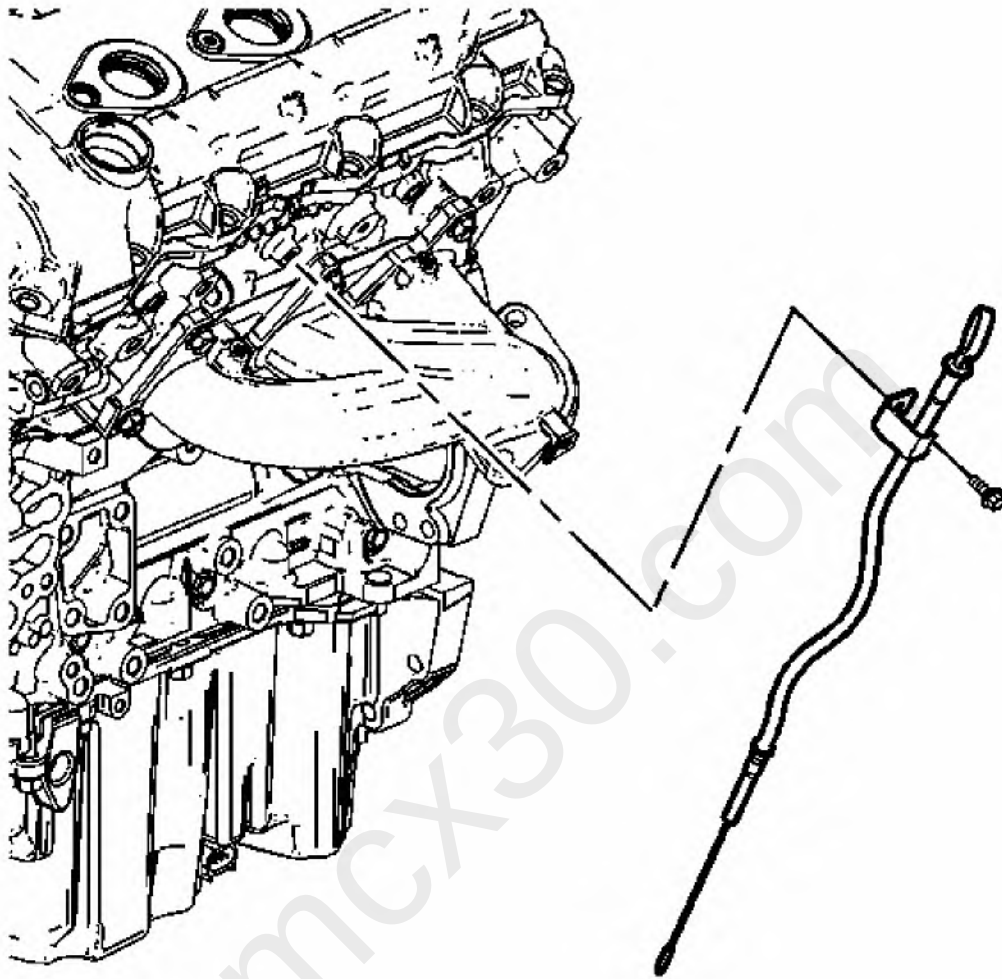


Fig. 131: View Of Oil Level Indicator Tube
Courtesy of GENERAL MOTORS CORP.

5. Remove the oil level indicator tube bracket bolt.
6. Remove the oil level indicator and tube by sliding the tube out from the lower crankcase hole.

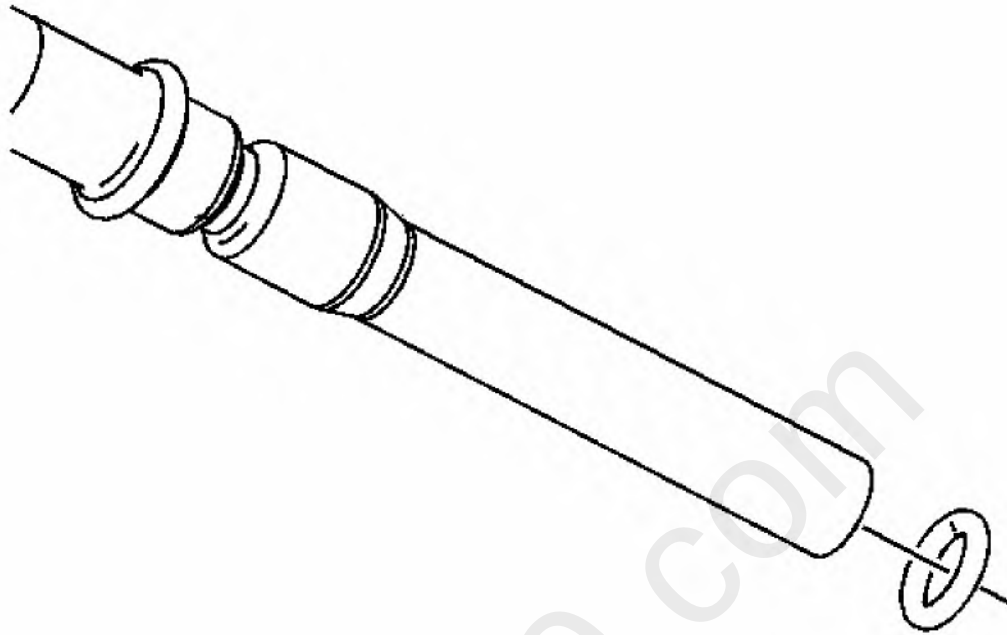


Fig. 132: View Of Oil Level Indicator Tube O-Ring
Courtesy of GENERAL MOTORS CORP.

7. Remove and discard the O-ring from the oil level indicator tube if damaged.

EXHAUST MANIFOLD REMOVAL - LEFT SIDE - OFF VEHICLE

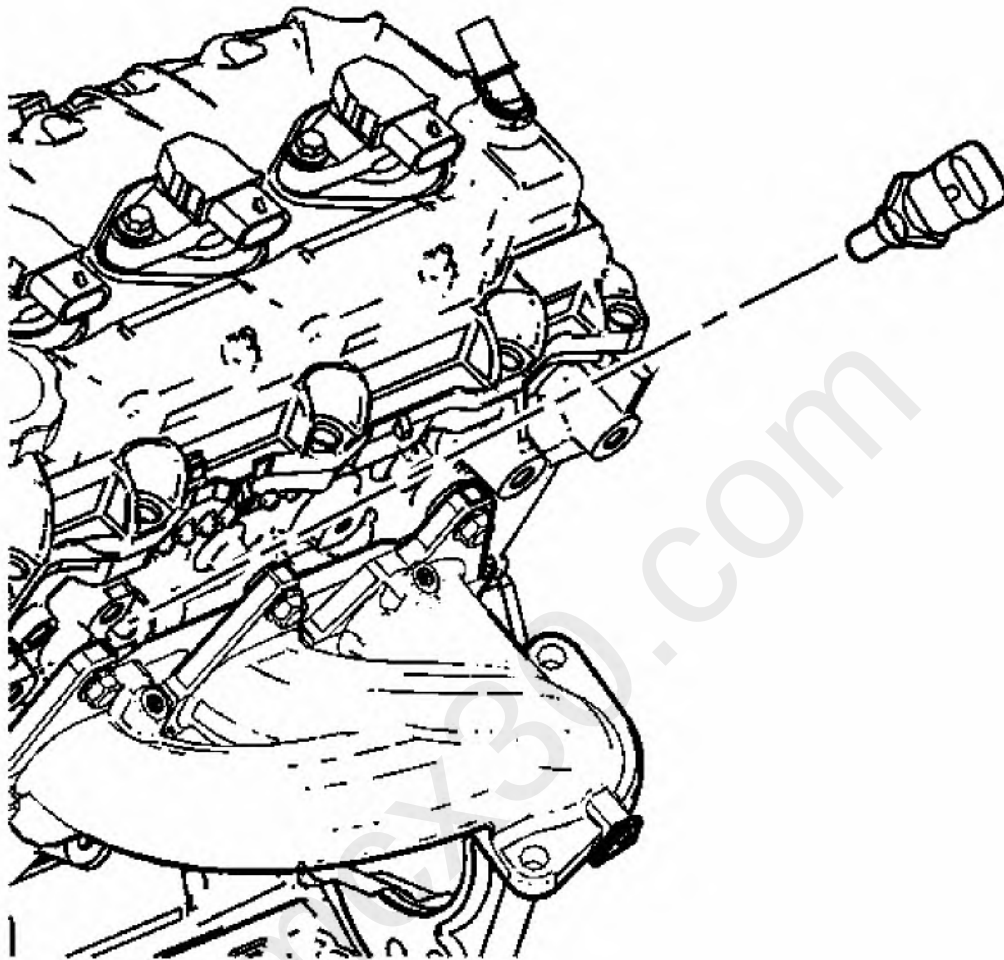


Fig. 133: View Of ECT Sensor
Courtesy of GENERAL MOTORS CORP.

1. Remove the engine coolant temperature (ECT) sensor.

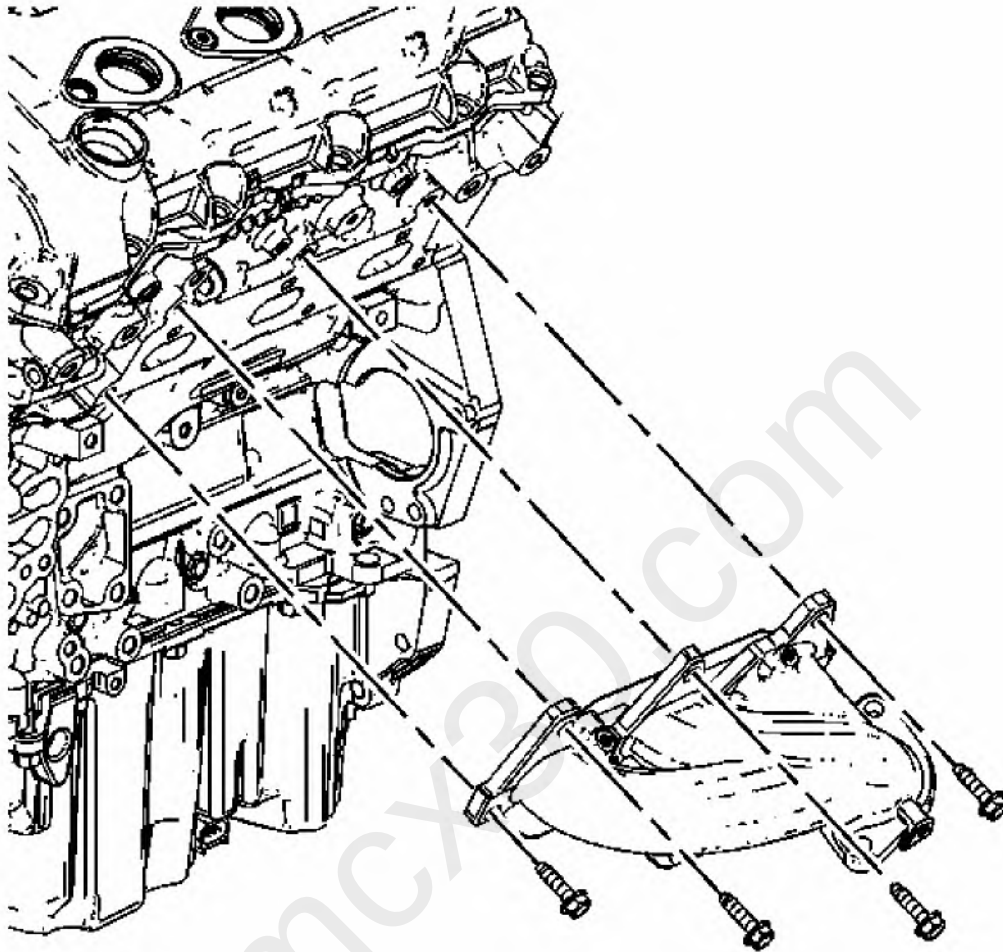


Fig. 134: View Of Left Exhaust Manifold
Courtesy of GENERAL MOTORS CORP.

2. Remove the exhaust manifold bolts from the left cylinder head.
3. Remove the left exhaust manifold.
4. Remove and discard the exhaust manifold gasket from the left cylinder head.

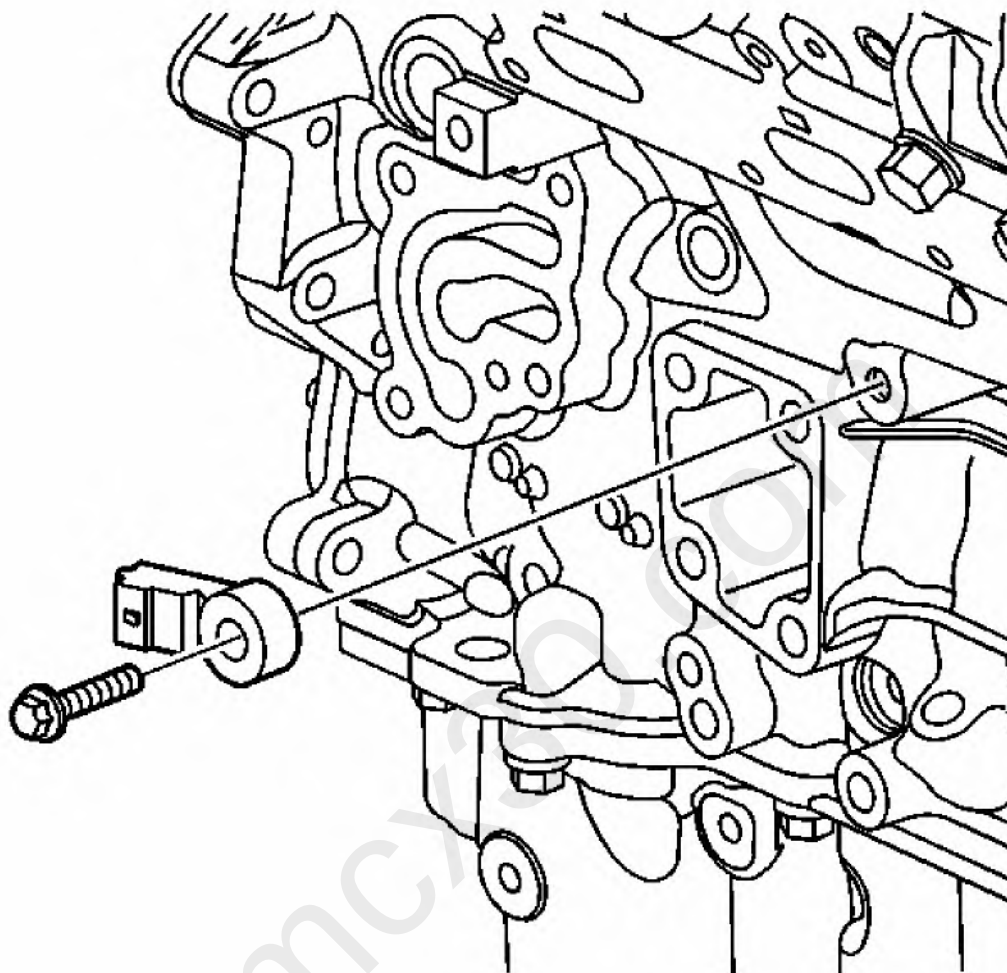


Fig. 135: View Of Left Knock Sensor
Courtesy of GENERAL MOTORS CORP.

5. Remove the left knock sensor bolt.
6. Remove the left knock sensor.

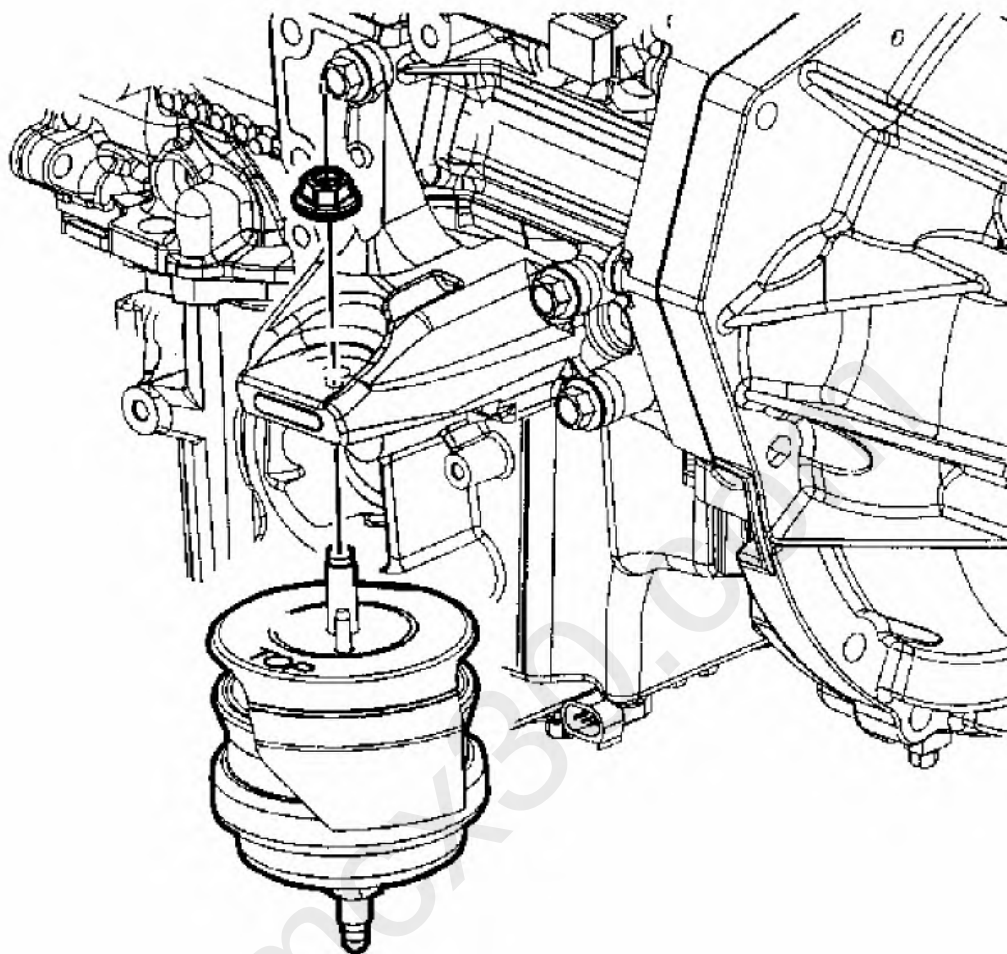


Fig. 136: View Of Left Engine Mount
Courtesy of GENERAL MOTORS CORP.

7. Remove the left engine mount nut.
8. Remove the left engine mount.

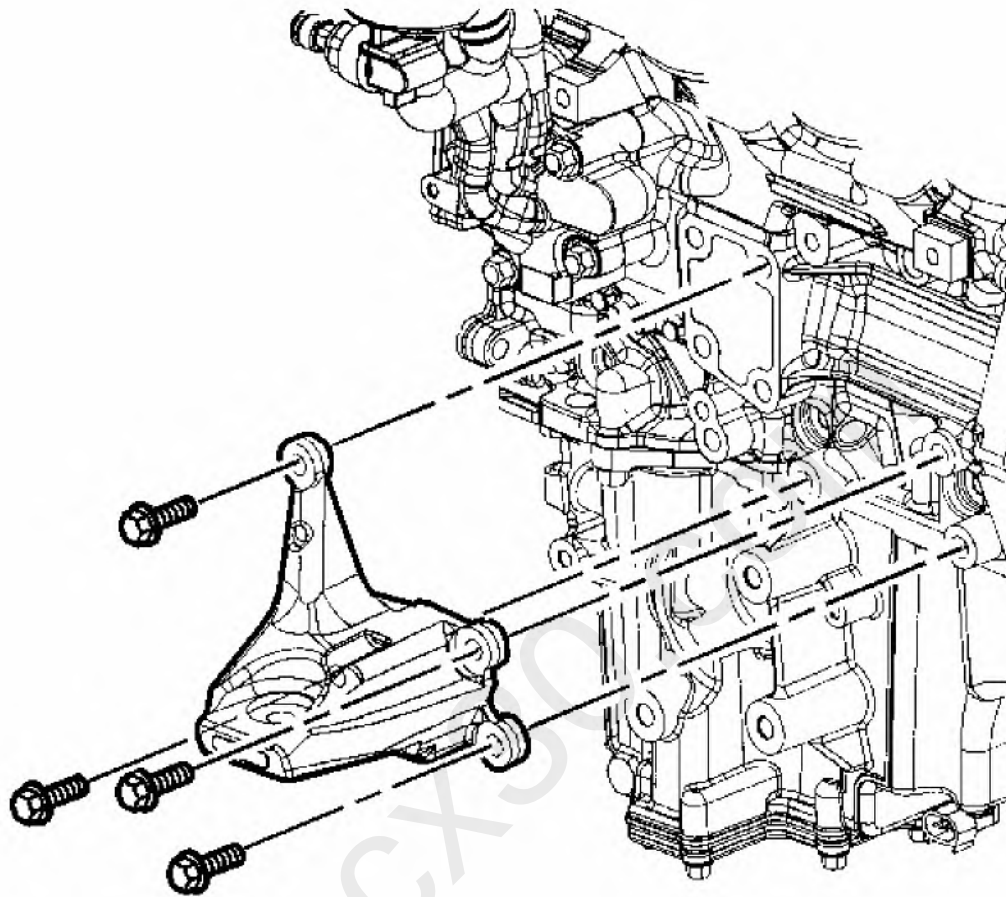


Fig. 137: View Of Left Engine Mount Bracket
Courtesy of GENERAL MOTORS CORP.

9. Remove the left engine mount bracket bolt.
10. Remove the left engine mount bracket.

OIL FILTER ADAPTER REMOVAL - OFF VEHICLE

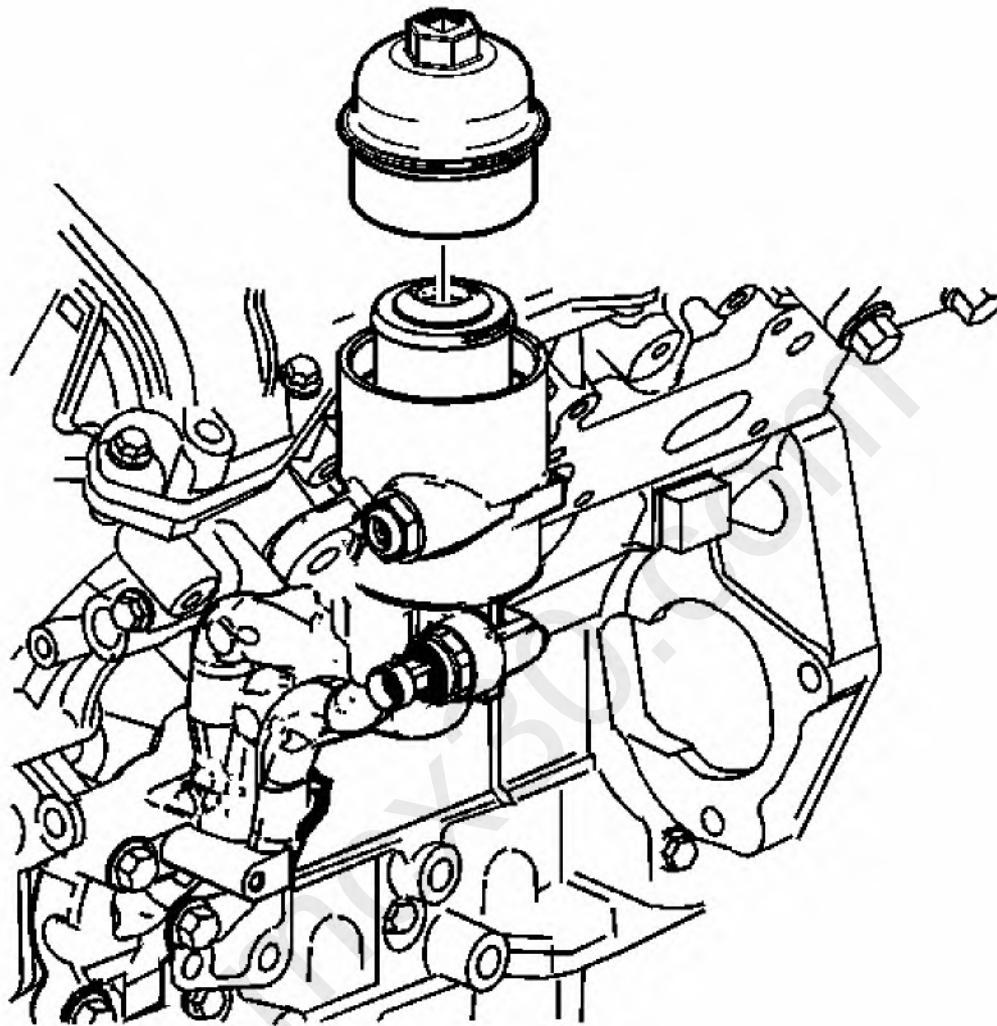


Fig. 138: View Of Oil Filter Cap
Courtesy of GENERAL MOTORS CORP.

1. Remove the oil filter cap.

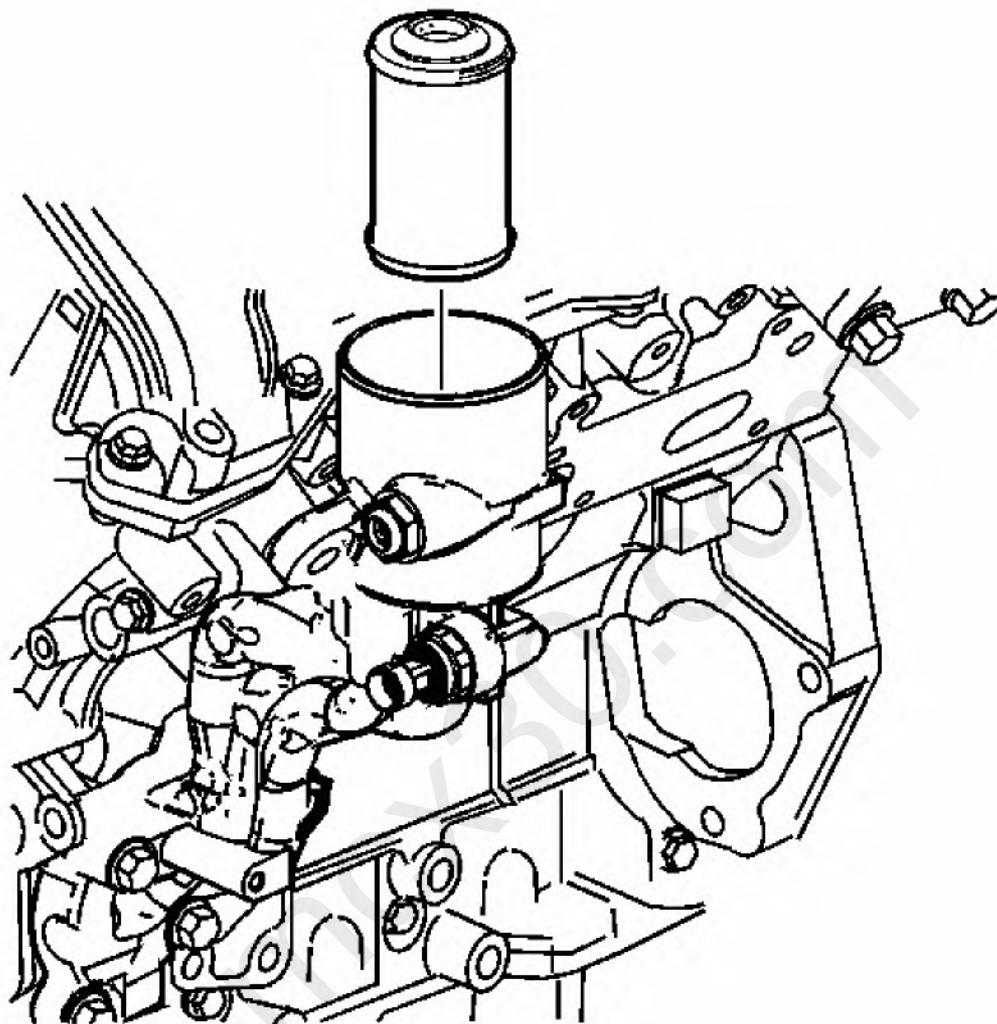


Fig. 139: View Of Oil Filter Cartridge
Courtesy of GENERAL MOTORS CORP.

2. Remove and properly dispose of the oil filter cartridge.
3. Re-install the oil filter cap.

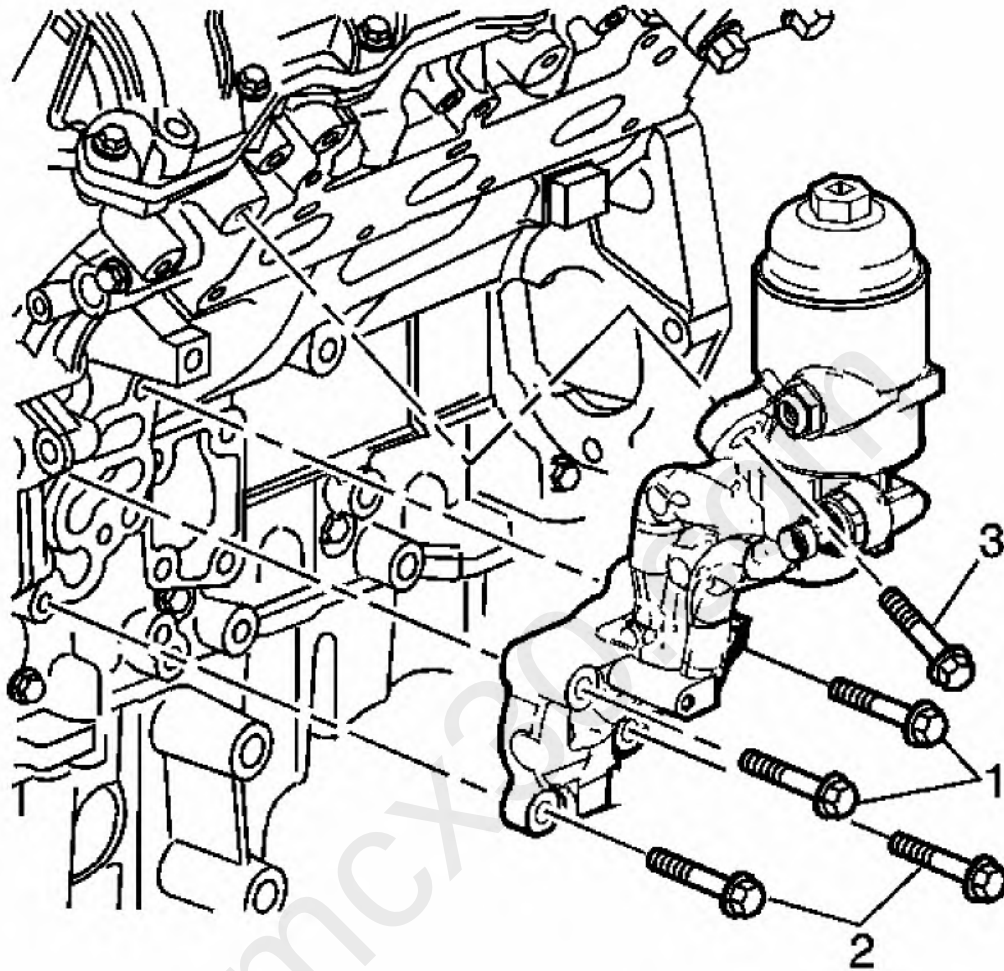


Fig. 140: View Of Oil Filter Adapter & Bolts
Courtesy of GENERAL MOTORS CORP.

4. Remove the oil filter adapter bolts (1-3) from the engine block.
5. Remove the oil filter adapter.

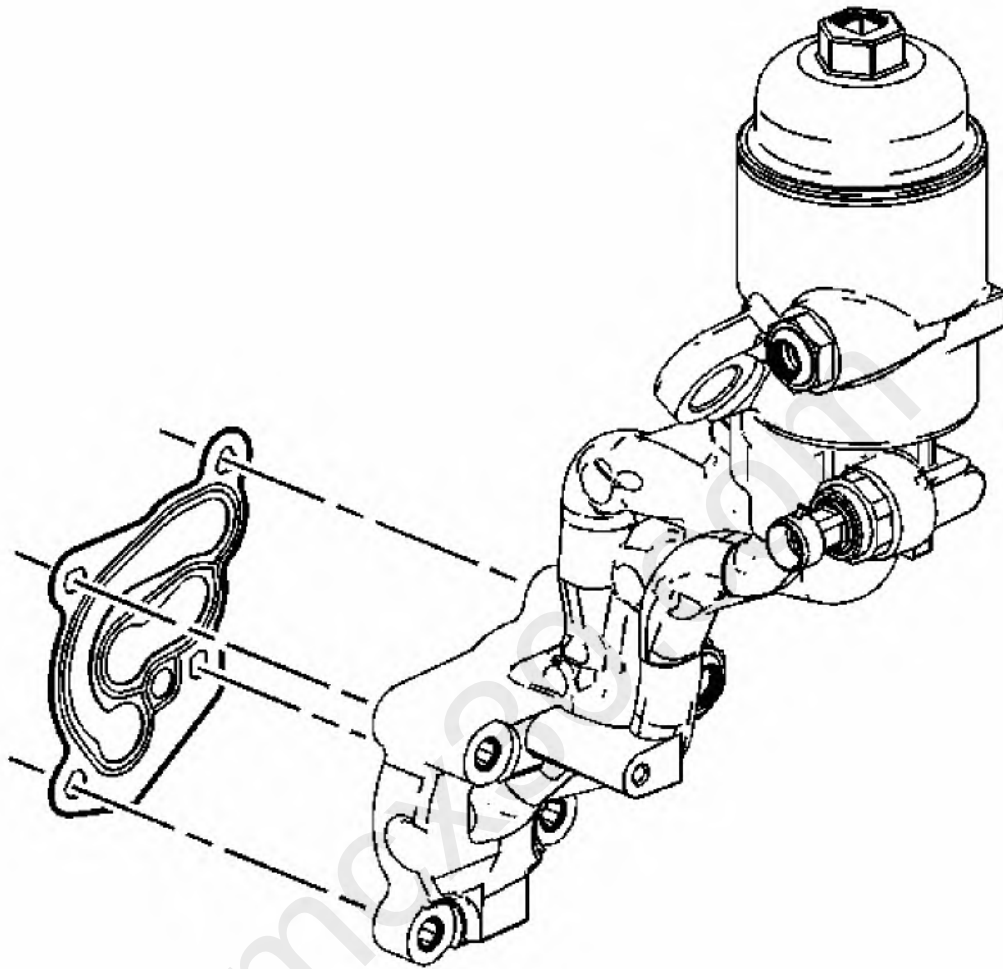


Fig. 141: View Of Oil Filter Adapter & Gasket
Courtesy of GENERAL MOTORS CORP.

6. Remove and discard the oil filter adapter gasket.

EXHAUST MANIFOLD REMOVAL - RIGHT SIDE (RWD) - OFF VEHICLE

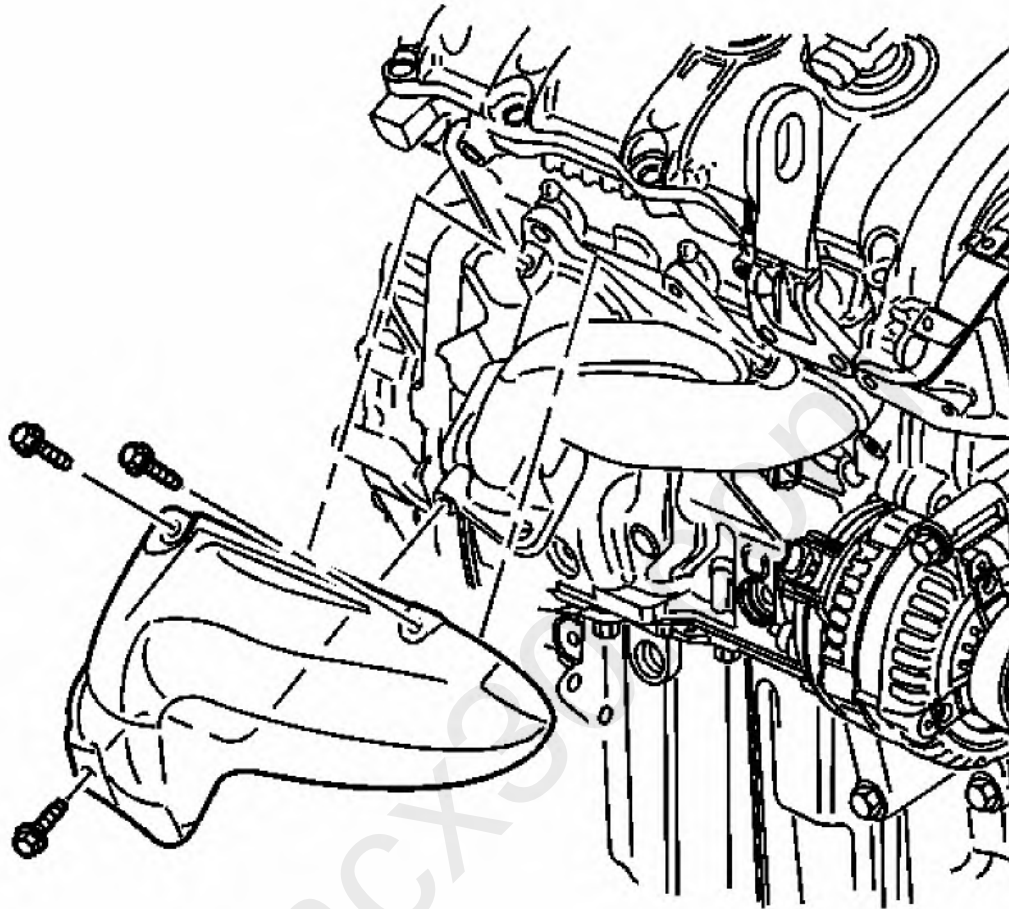


Fig. 142: View Of Right Exhaust Manifold Heat Shield
Courtesy of GENERAL MOTORS CORP.

1. Remove the right exhaust manifold heat shield bolts.
2. Remove the right exhaust manifold heat shield.

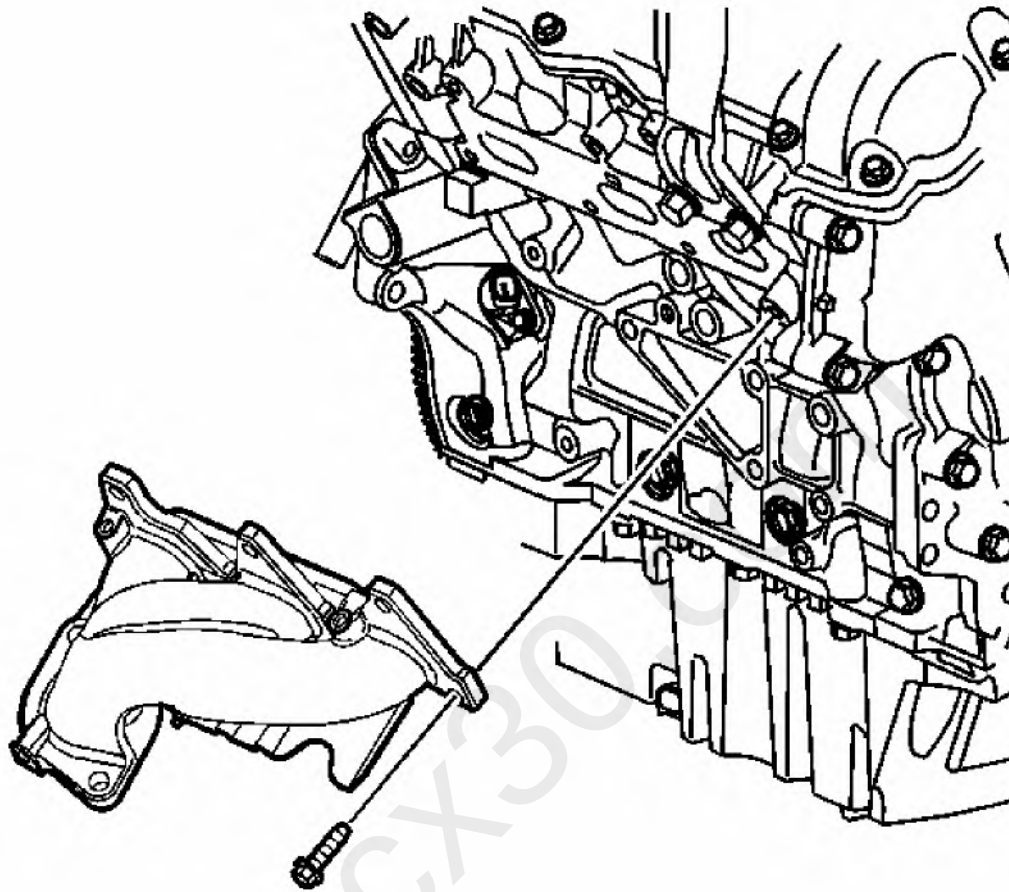


Fig. 143: Removing & Installing Right Exhaust Manifold
Courtesy of GENERAL MOTORS CORP.

3. Remove the exhaust manifold bolts from the right cylinder head.
4. Remove the right exhaust manifold.
5. Remove and discard the exhaust manifold gasket from the right cylinder head.

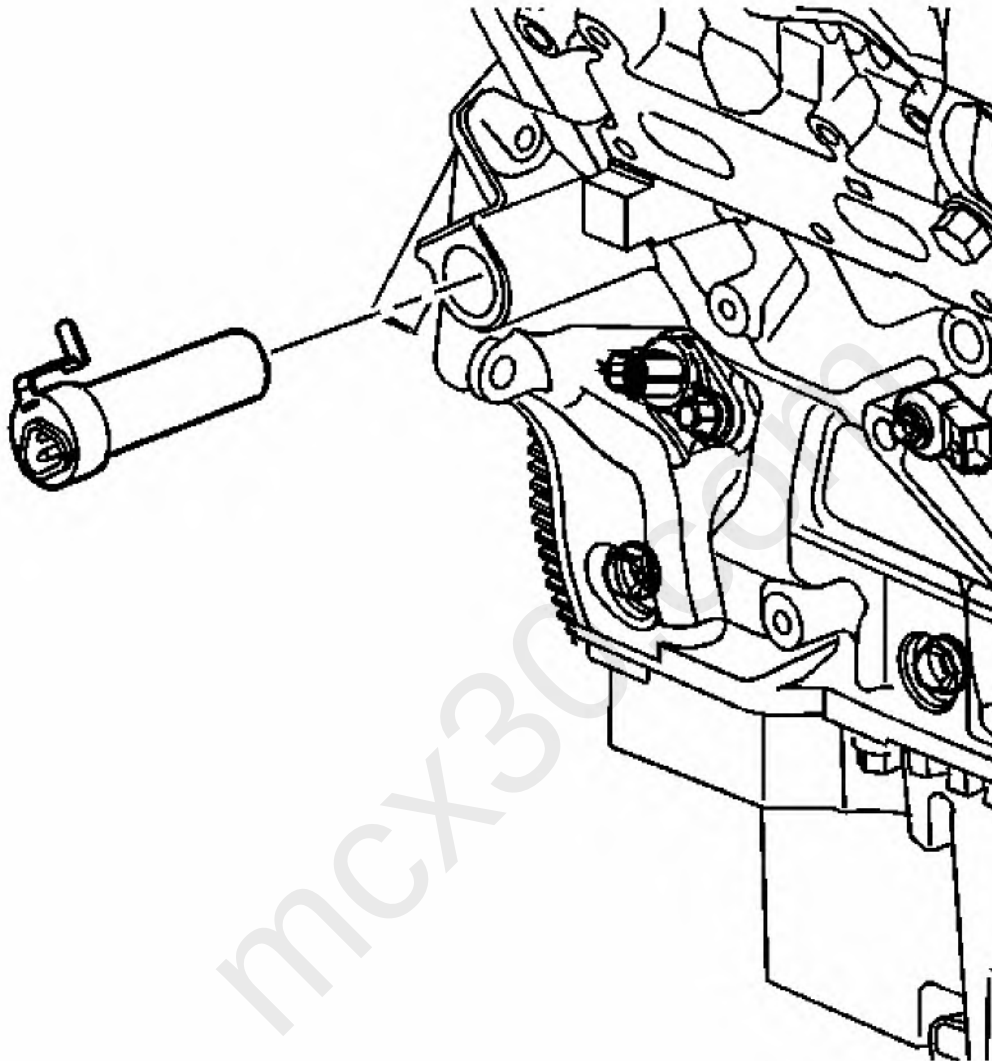


Fig. 144: View Of Block Heater Cartridge
Courtesy of GENERAL MOTORS CORP.

6. Remove the block heater cartridge.

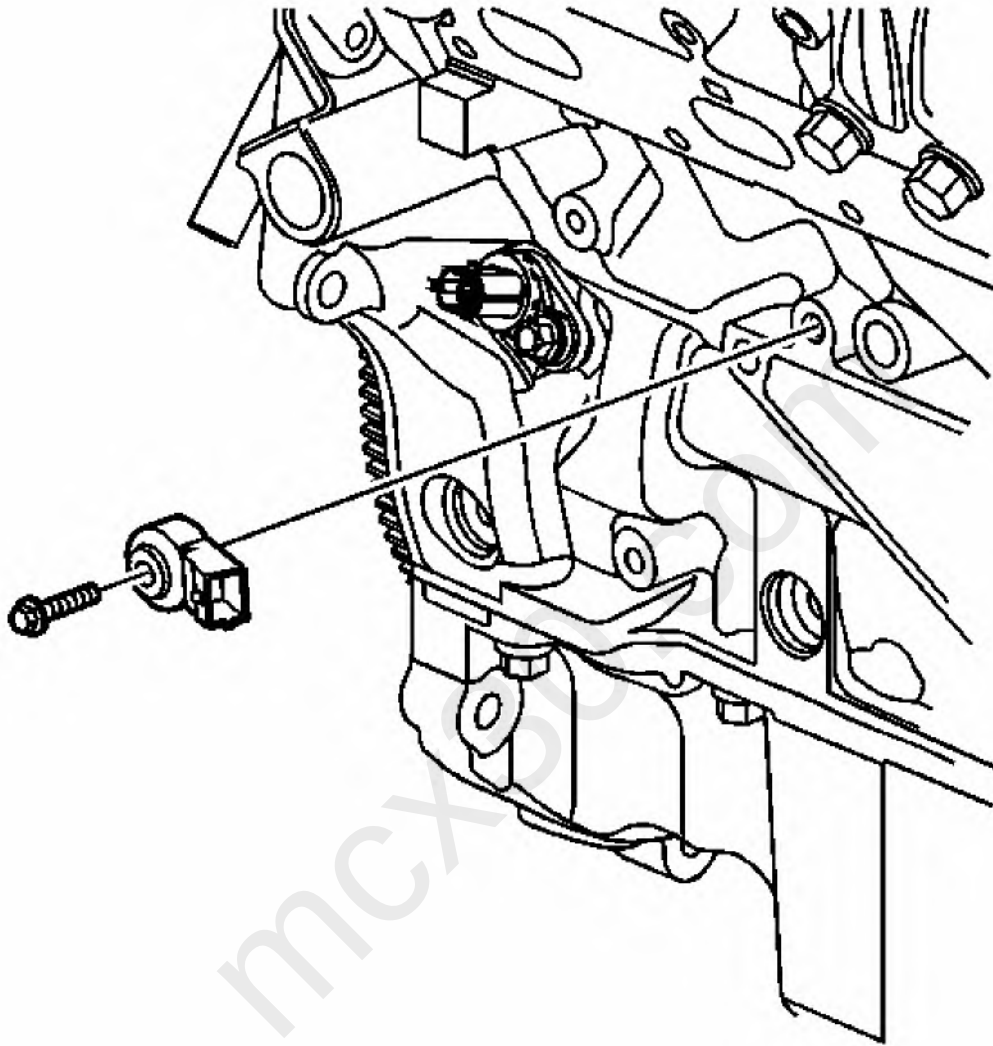


Fig. 145: View Of Right Knock Sensor & Bolt
Courtesy of GENERAL MOTORS CORP.

7. Remove the right knock sensor bolt.
8. Remove the right knock sensor.

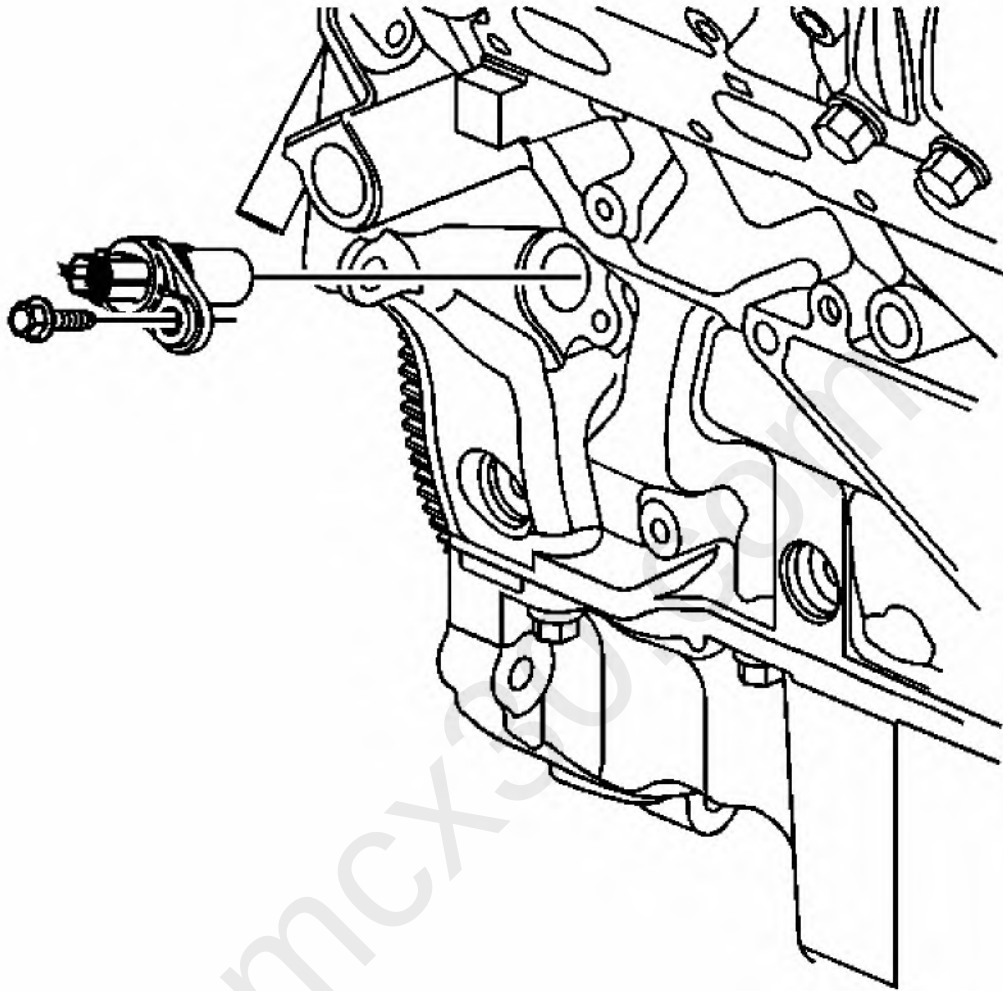


Fig. 146: View Of Crankshaft Position Sensor & Bolt
Courtesy of GENERAL MOTORS CORP.

9. Remove the crankshaft position sensor bolt.
10. Remove the crankshaft position sensor.

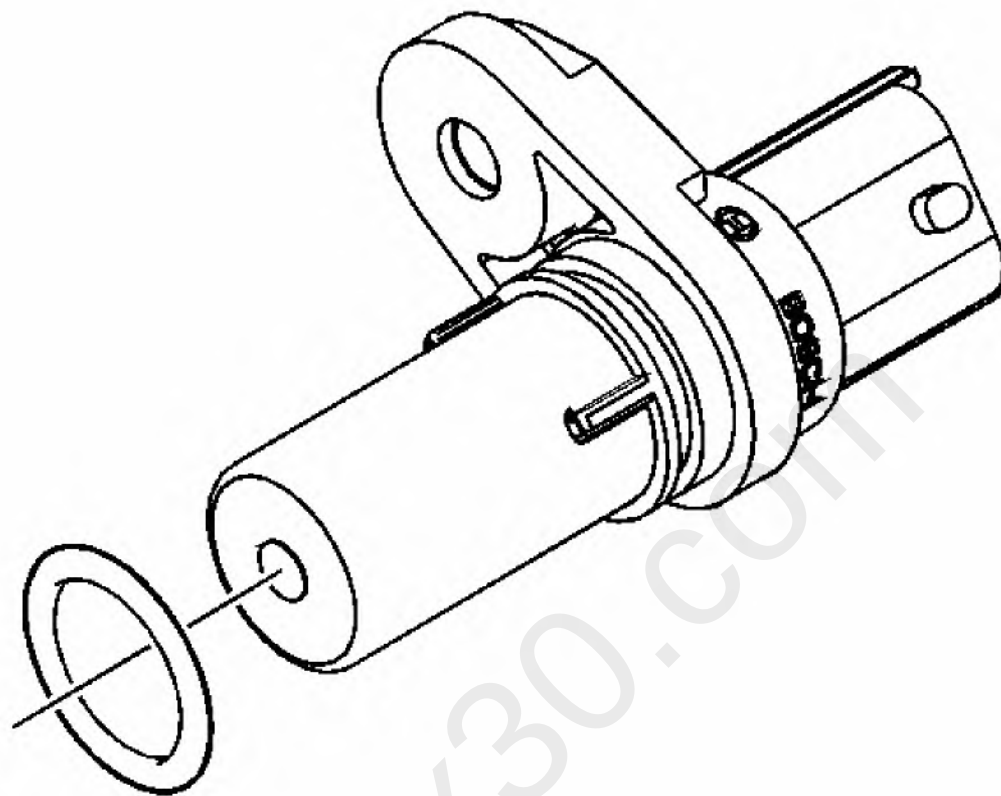


Fig. 147: View Of Crankshaft Position Sensor O-Ring
Courtesy of GENERAL MOTORS CORP.

11. Remove and discard the crankshaft position sensor O-ring, if damaged.

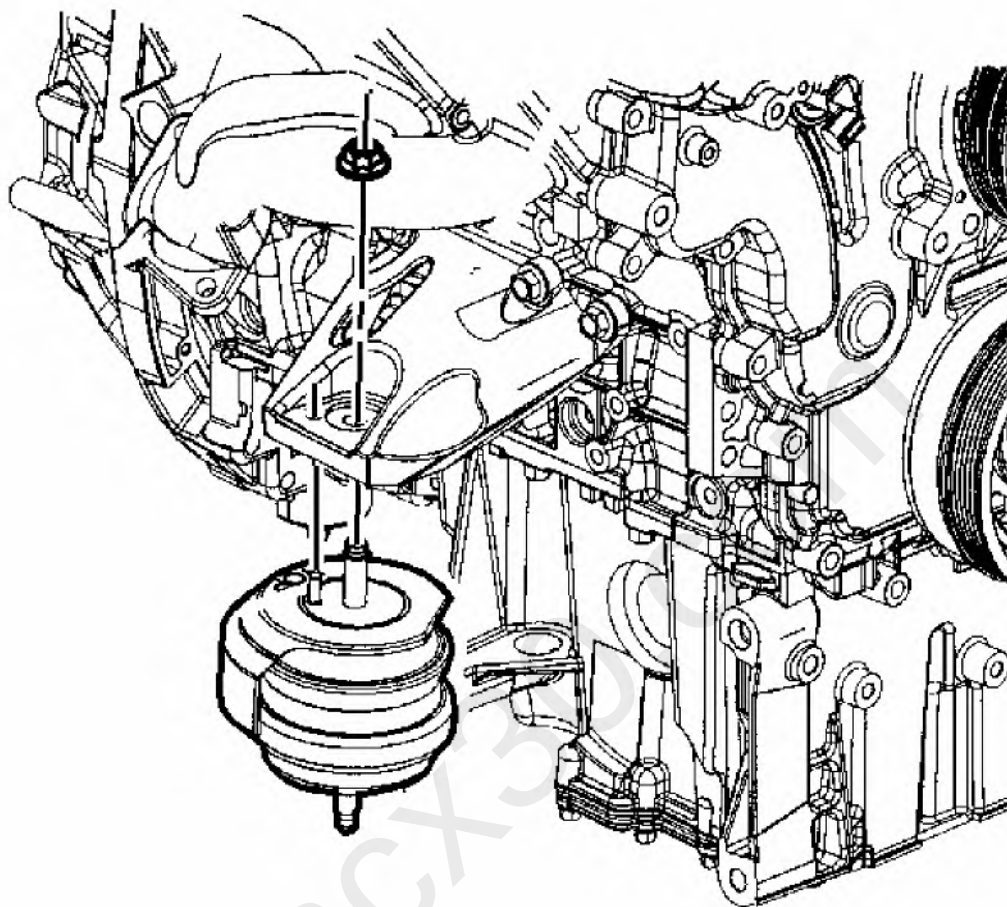


Fig. 148: View Of Right Engine Mount - RWD
Courtesy of GENERAL MOTORS CORP.

12. Remove the engine mount nut.
13. Remove the engine mount.

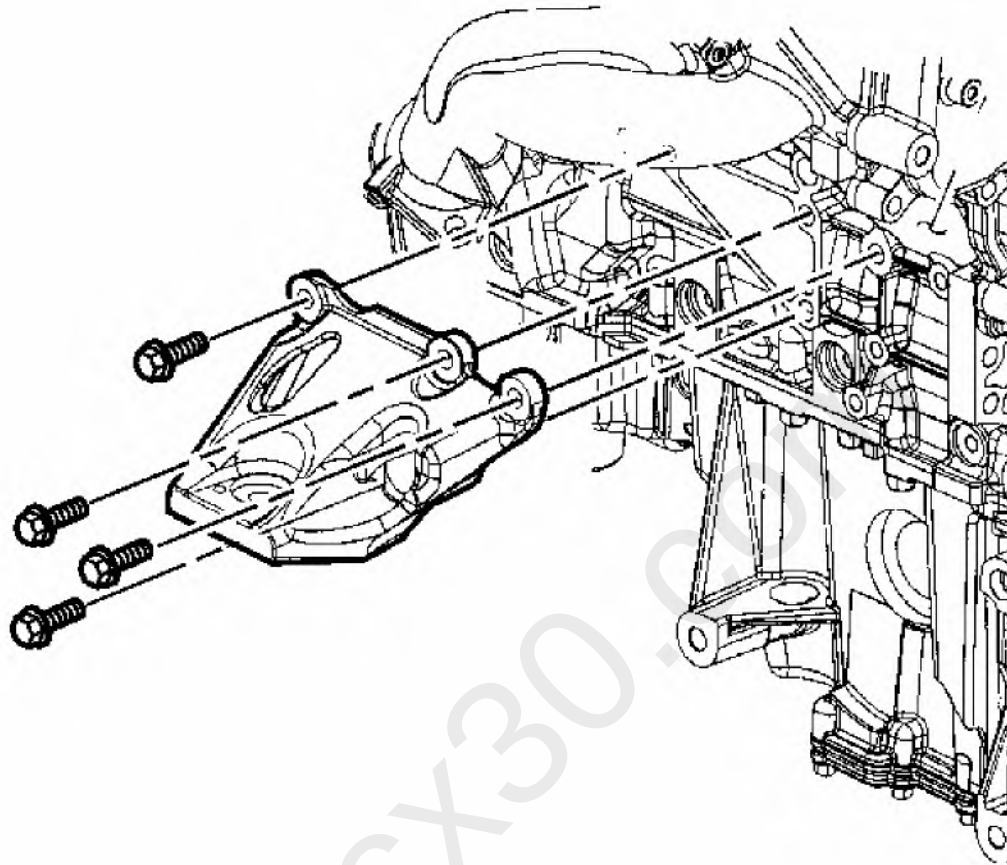


Fig. 149: View Of Right Engine Mount Bracket
Courtesy of GENERAL MOTORS CORP.

14. Remove the engine mount bracket bolts.
15. Remove the engine mount bracket.

EXHAUST MANIFOLD REMOVAL - RIGHT SIDE (AWD) - OFF VEHICLE

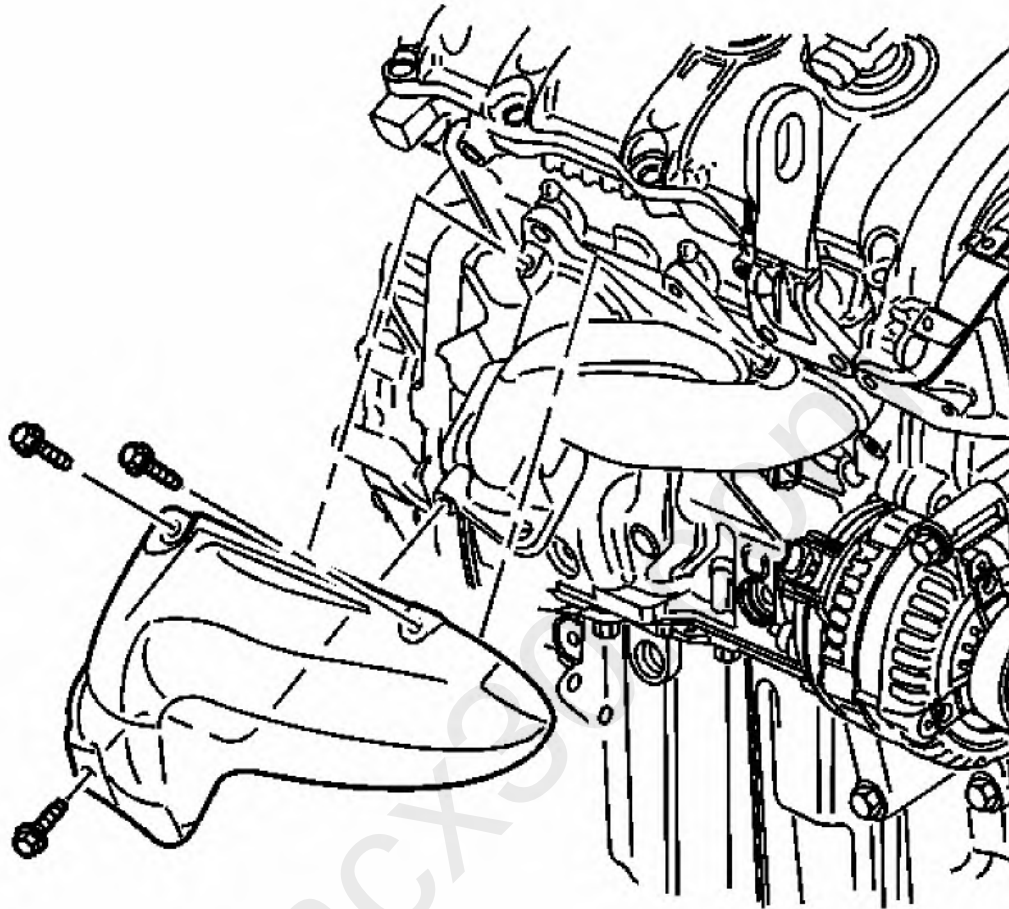


Fig. 150: View Of Right Exhaust Manifold Heat Shield
Courtesy of GENERAL MOTORS CORP.

1. Remove the right exhaust manifold heat shield bolts.
2. Remove the right exhaust manifold heat shield.

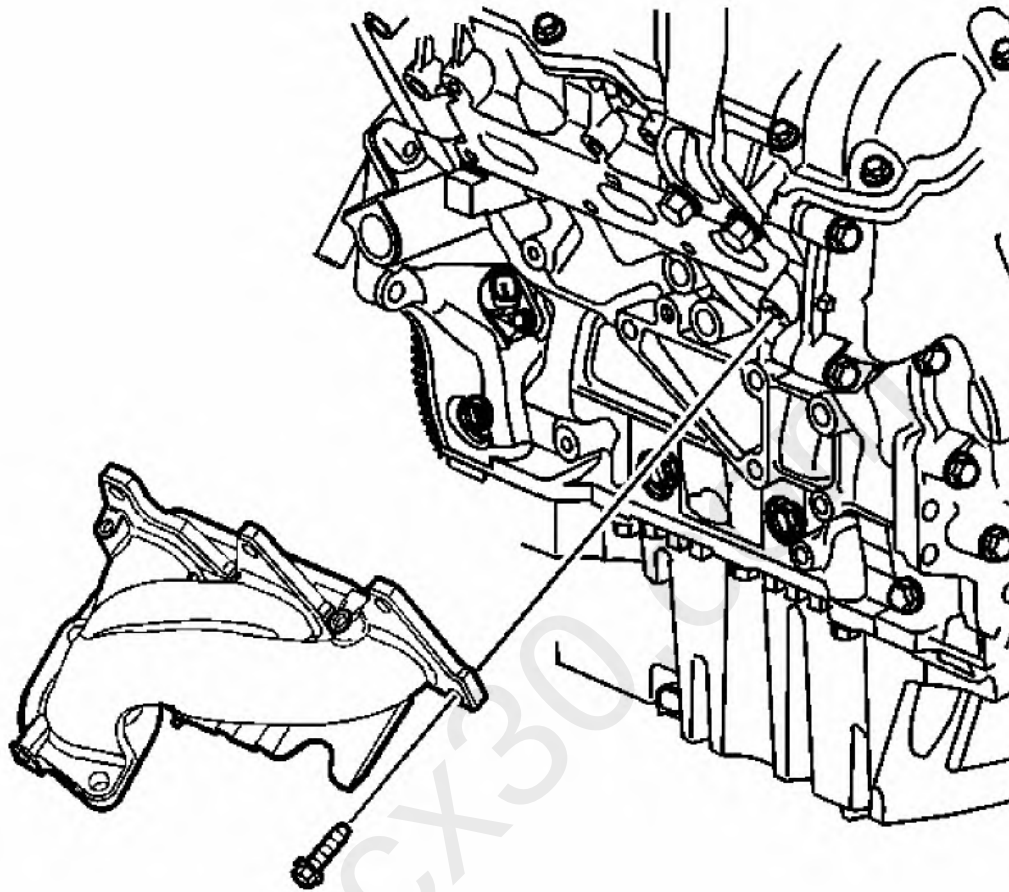


Fig. 151: Removing & Installing Right Exhaust Manifold
Courtesy of GENERAL MOTORS CORP.

3. Remove the exhaust manifold bolts from the right cylinder head.
4. Remove the right exhaust manifold.
5. Remove and discard the exhaust manifold gasket from the right cylinder head.

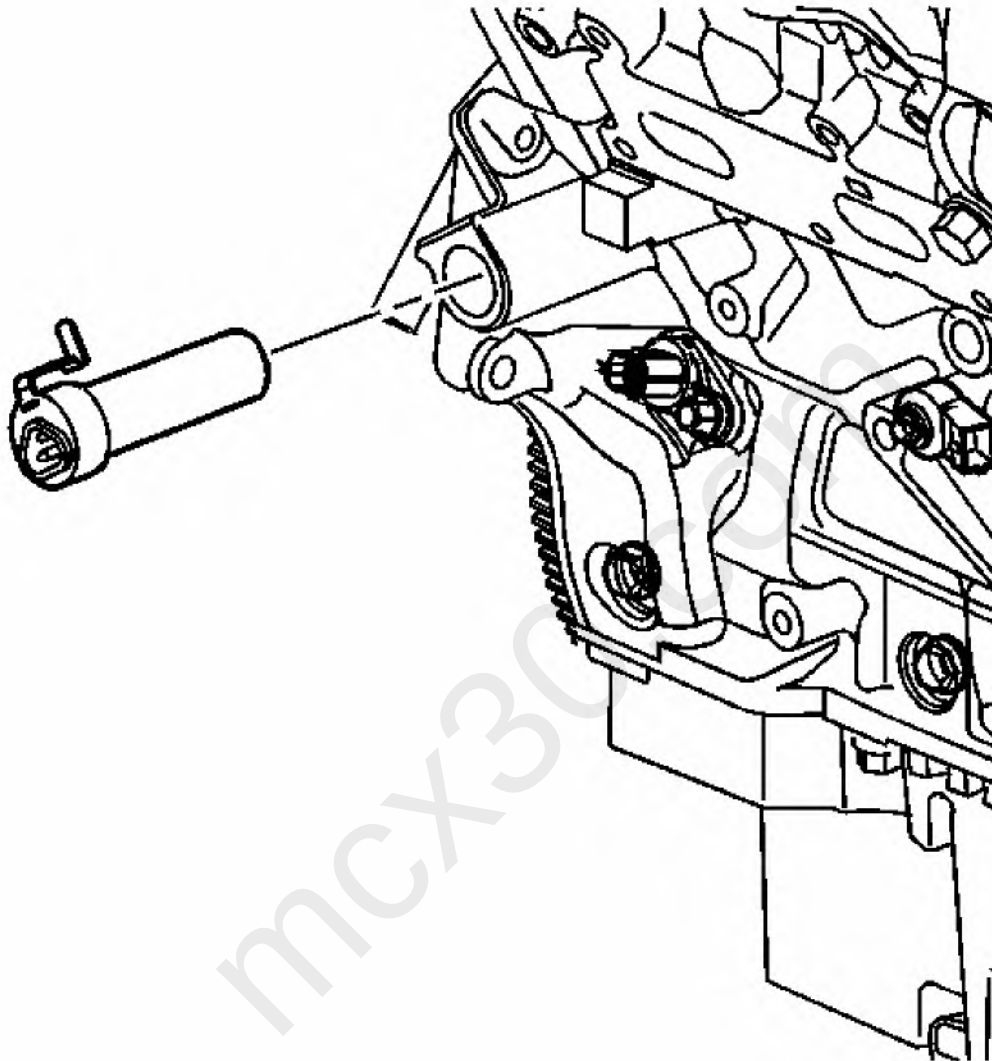


Fig. 152: View Of Block Heater Cartridge
Courtesy of GENERAL MOTORS CORP.

6. Remove the block heater cartridge.

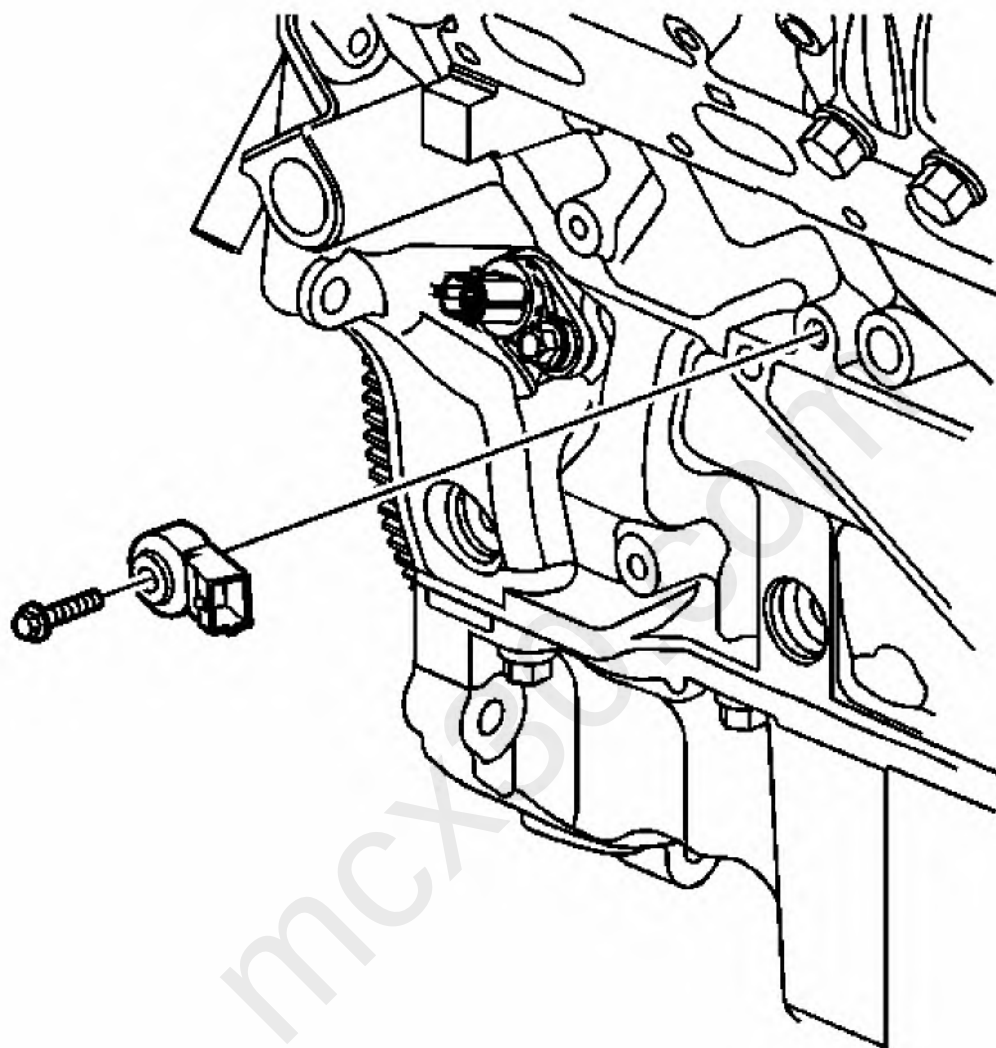


Fig. 153: View Of Right Knock Sensor & Bolt
Courtesy of GENERAL MOTORS CORP.

7. Remove the right knock sensor bolt.
8. Remove the right knock sensor.

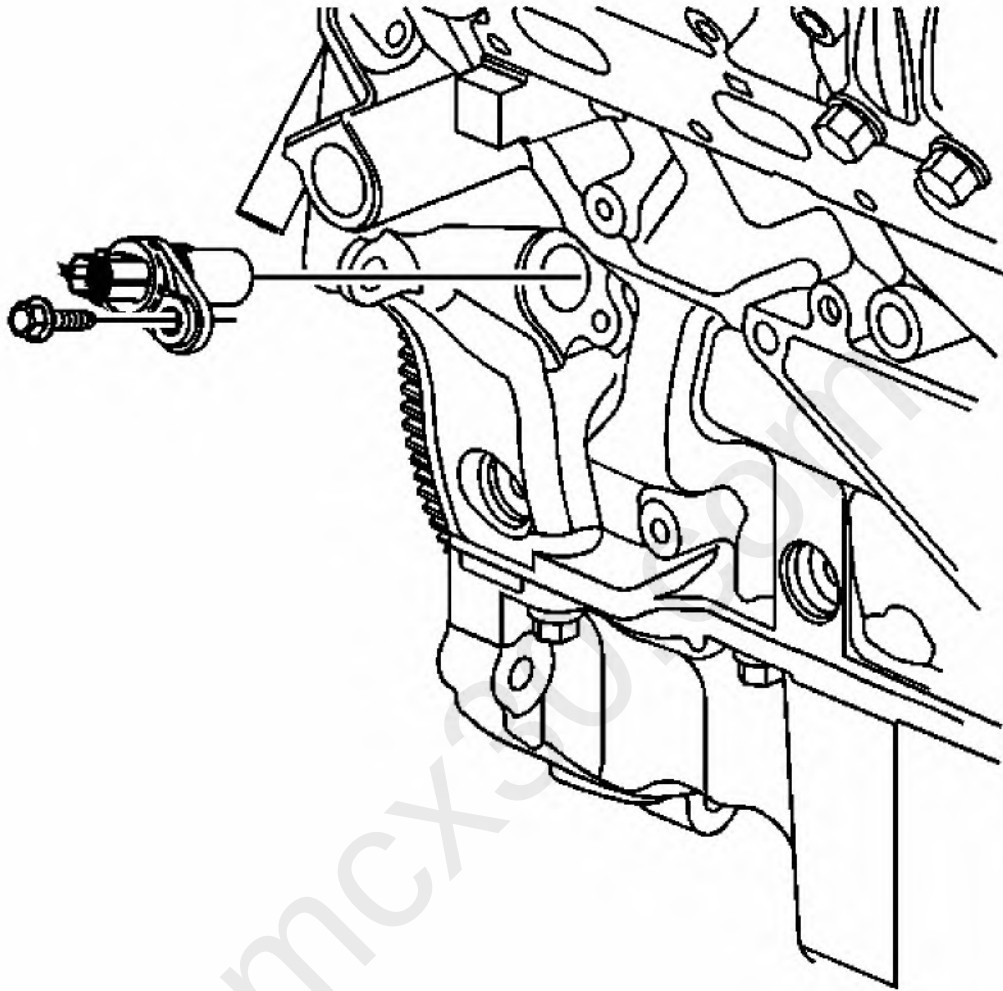


Fig. 154: View Of Crankshaft Position Sensor & Bolt
Courtesy of GENERAL MOTORS CORP.

9. Remove the crankshaft position sensor bolt.
10. Remove the crankshaft position sensor.

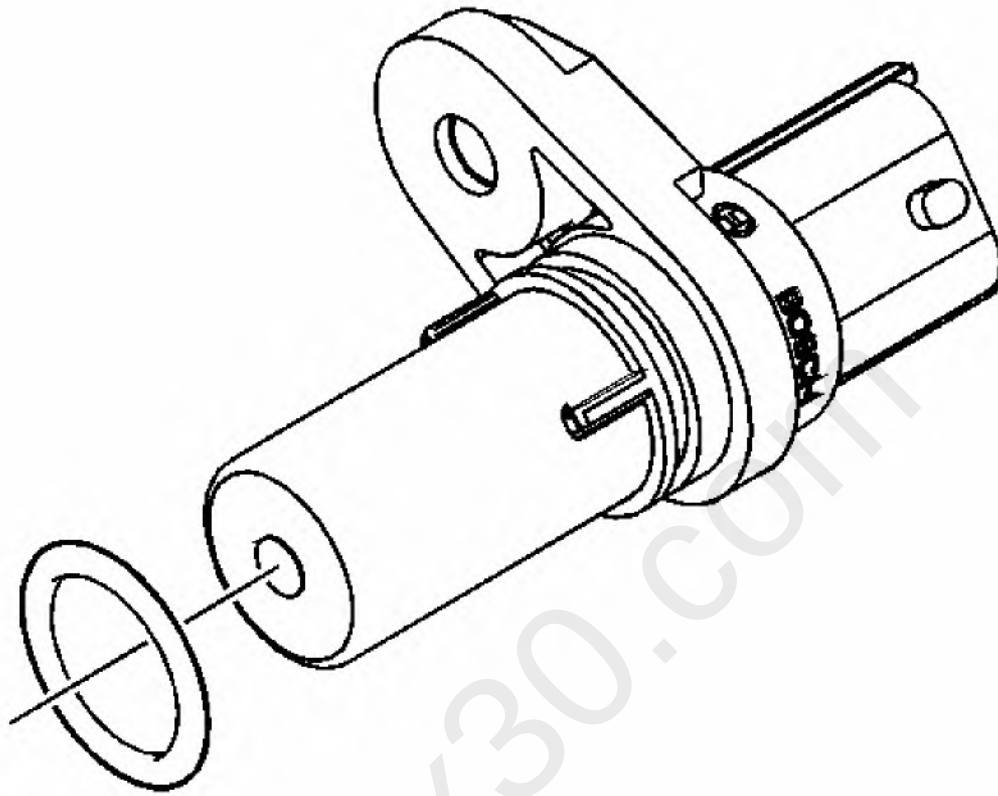


Fig. 155: View Of Crankshaft Position Sensor O-Ring
Courtesy of GENERAL MOTORS CORP.

11. Remove and discard the crankshaft position sensor O-ring, if damaged.

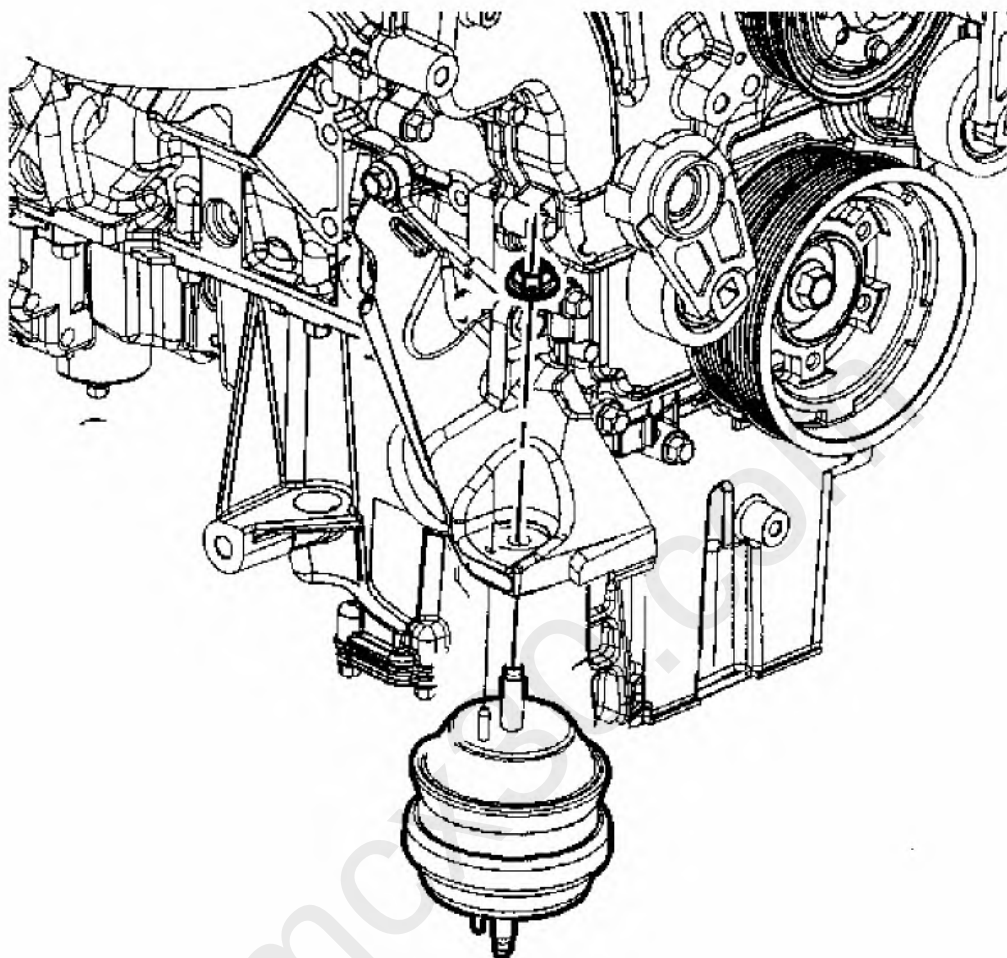


Fig. 156: View Of Right Engine Mount - AWD
Courtesy of GENERAL MOTORS CORP.

12. Remove the engine mount nut.
13. Remove the engine mount.

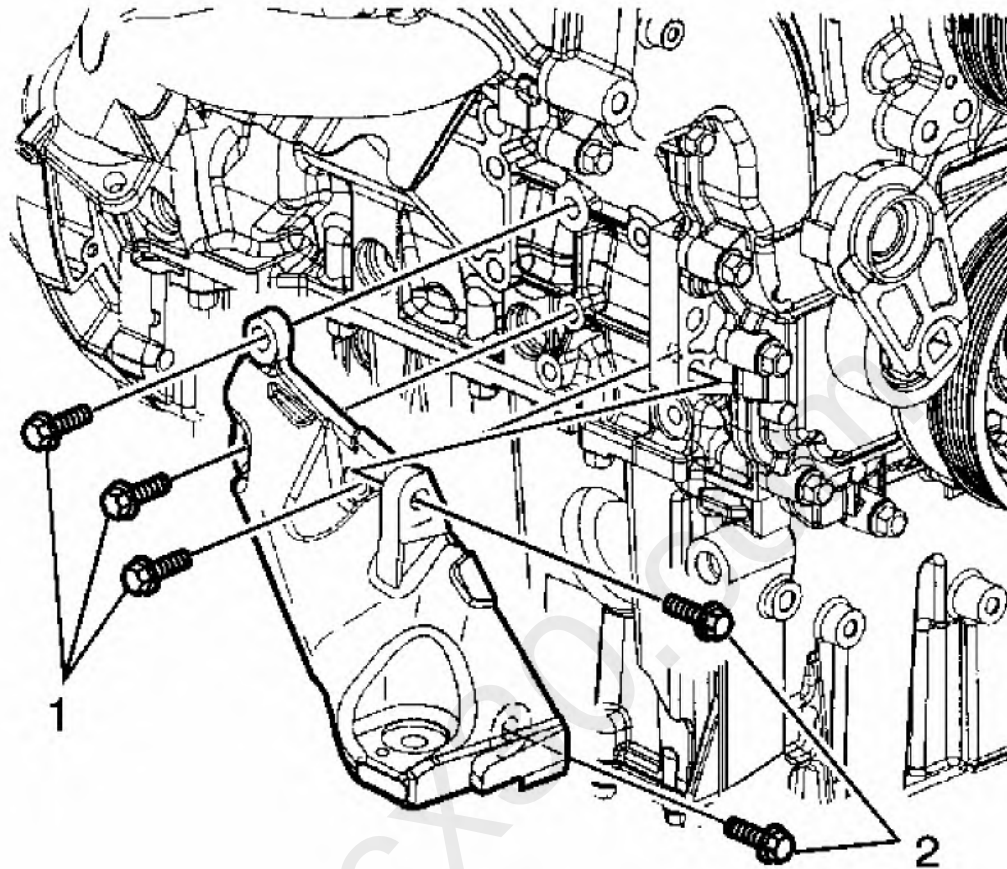


Fig. 157: View Of Right Engine Mount Bracket - AWD
Courtesy of GENERAL MOTORS CORP.

14. Remove the engine mount bracket bolts (1, 2).
15. Remove the engine mount bracket.

WATER OUTLET REMOVAL - OFF VEHICLE

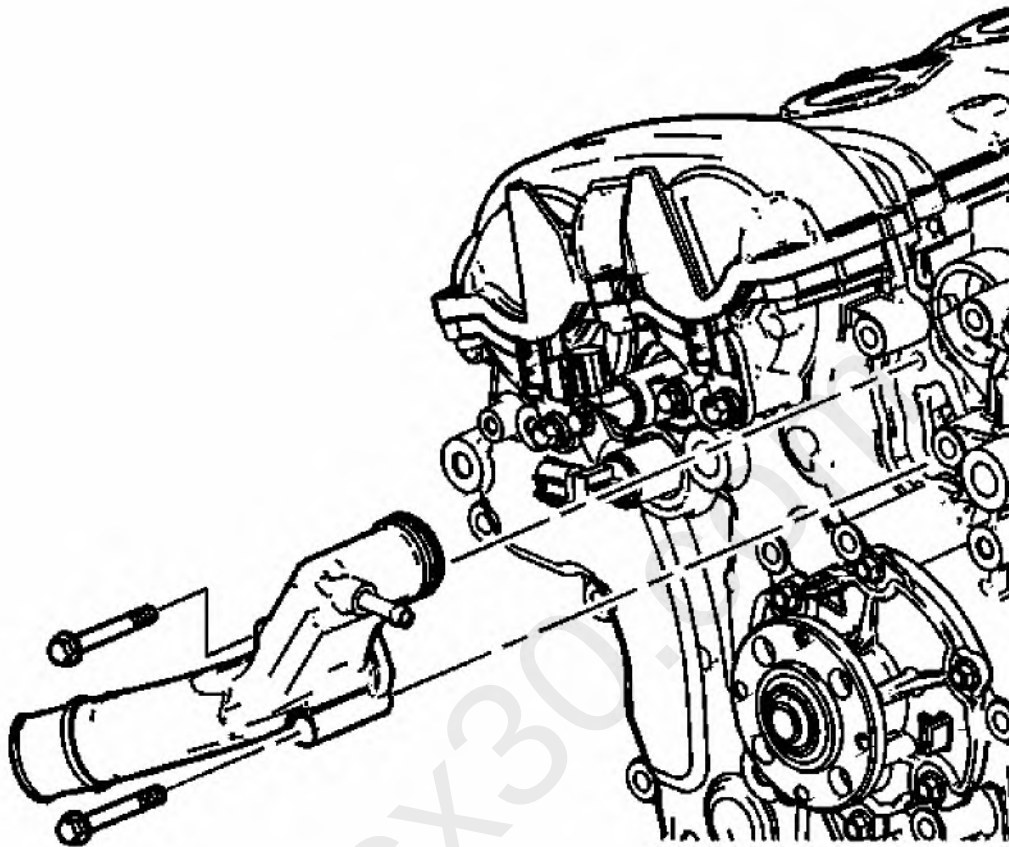


Fig. 158: View Of Water Outlet Housing
Courtesy of GENERAL MOTORS CORP.

1. Remove the water outlet bolts.
2. Remove the water outlet.
3. Remove the water outlet gasket.

ENGINE COOLANT THERMOSTAT HOUSING REMOVAL - OFF VEHICLE

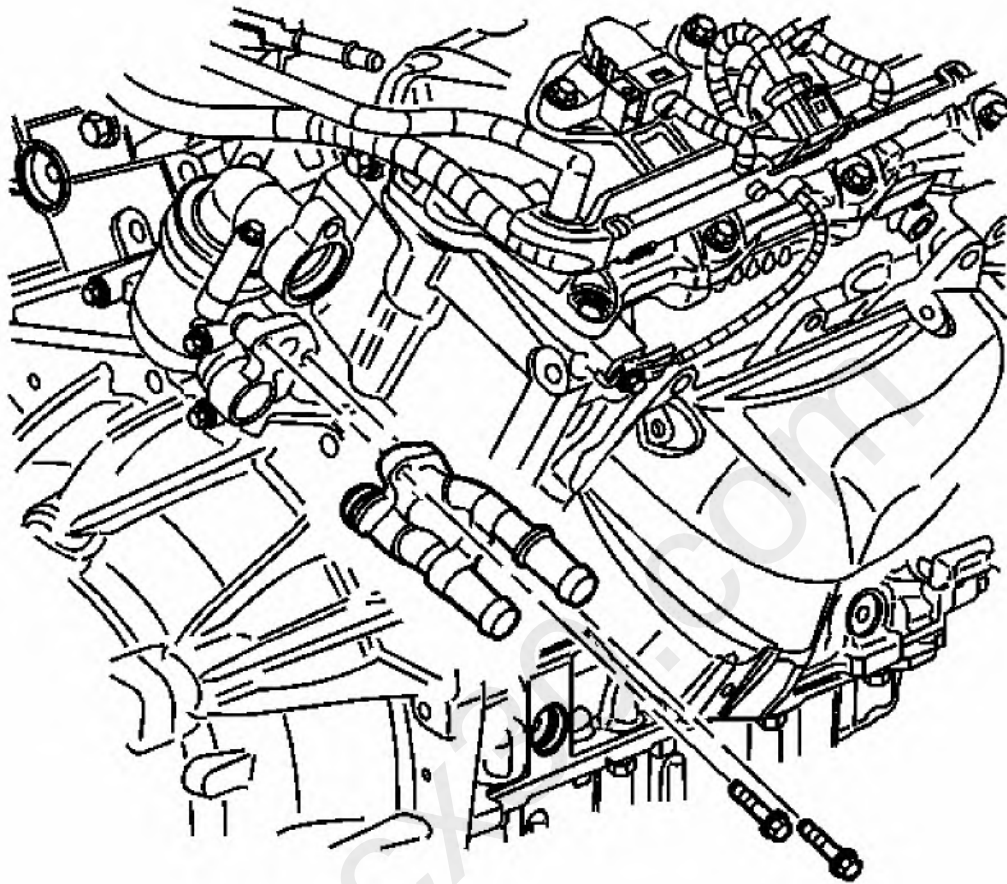


Fig. 159: View Of Heater Inlet/Outlet Pipe Assembly
Courtesy of GENERAL MOTORS CORP.

1. Remove the heater inlet/outlet pipe assembly bolts.
2. Remove the heater inlet/outlet pipe assembly.

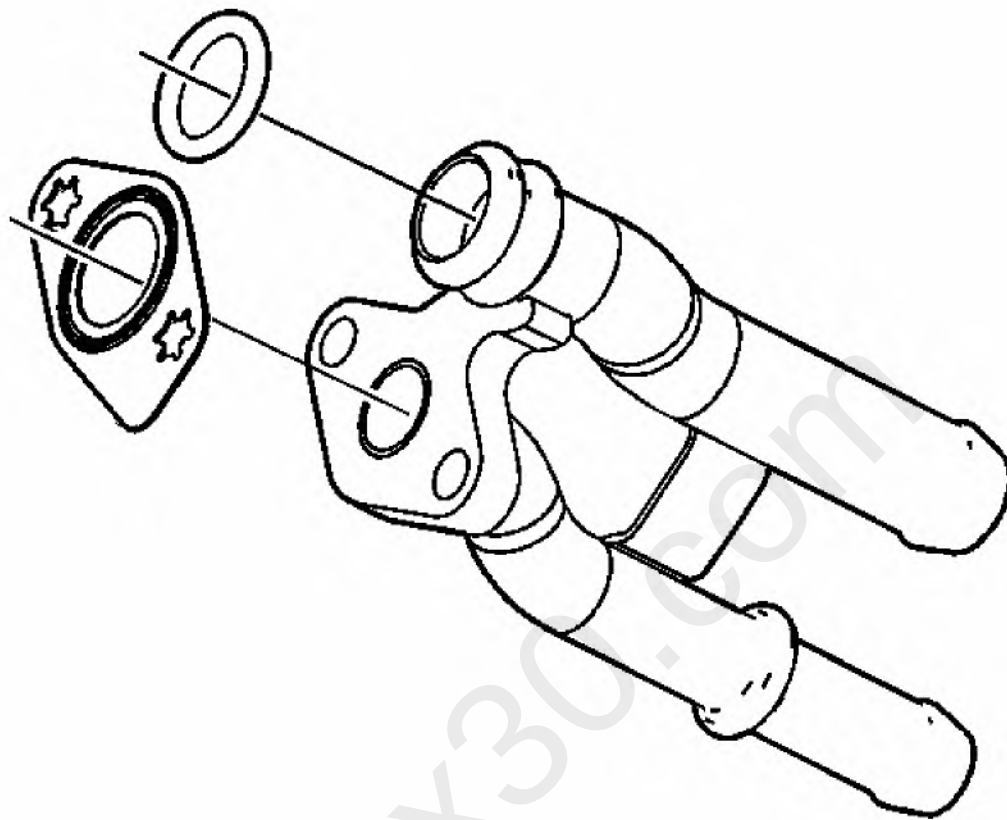


Fig. 160: Heater Inlet/Outlet Pipe Assembly
Courtesy of GENERAL MOTORS CORP.

3. Remove and discard the heater inlet/outlet pipe assembly O-ring and gasket.

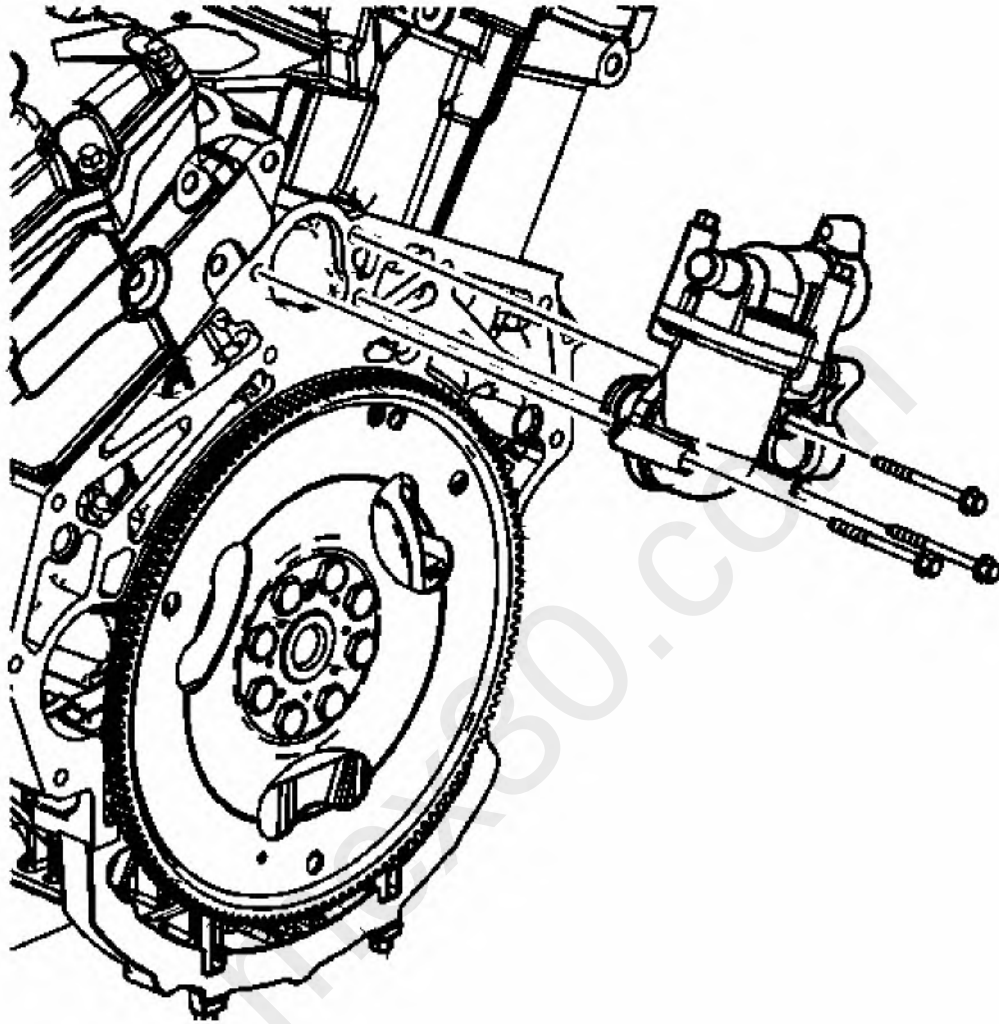


Fig. 161: View Of Thermostat Housing With Heater Pipes, Heater Hoses, Gasket & Bolts

Courtesy of GENERAL MOTORS CORP.

4. Remove the thermostat housing assembly bolts.
5. Remove the thermostat housing assembly.

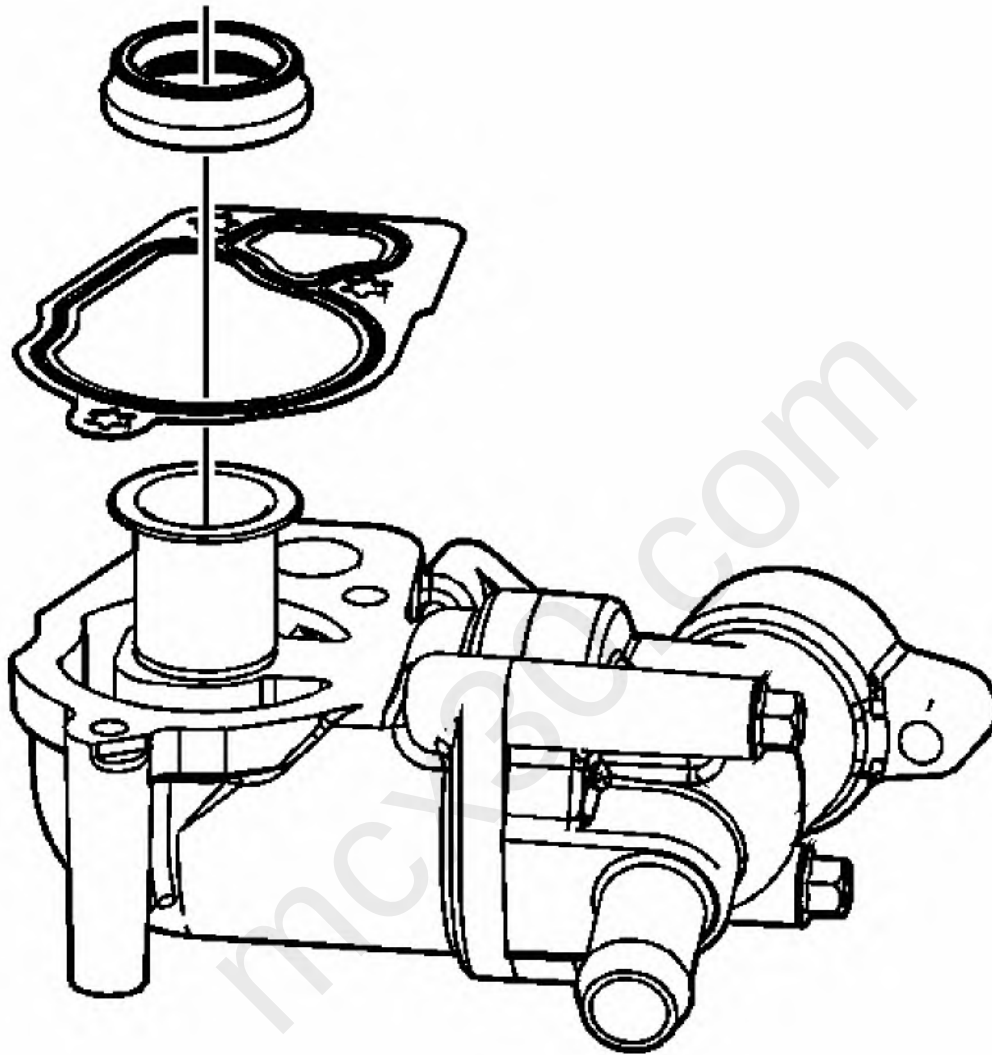


Fig. 162: Thermostat Housing Assembly O-Ring & Gasket
Courtesy of GENERAL MOTORS CORP.

6. Remove and discard the thermostat housing assembly O-ring and gasket.

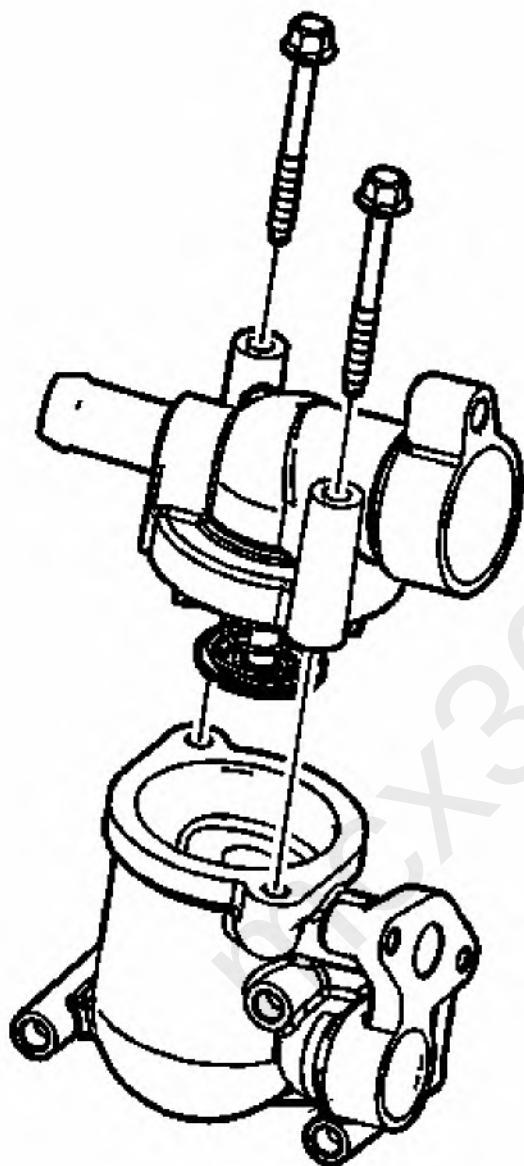


Fig. 163: Thermostat Housing
Courtesy of GENERAL MOTORS CORP.

7. Remove the thermostat housing bolts.
8. Remove the thermostat housing.

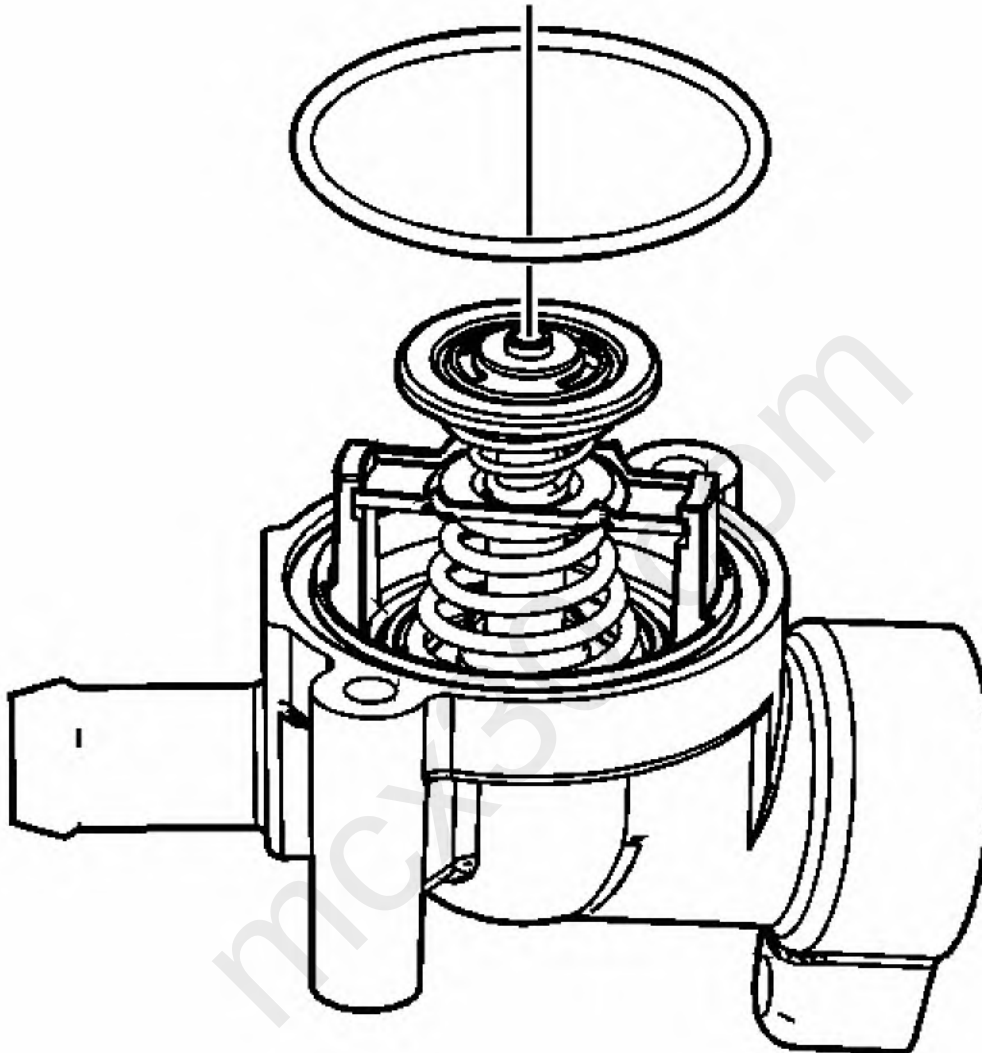


Fig. 164: Thermostat Housing O-Ring
Courtesy of GENERAL MOTORS CORP.

9. Remove and discard the thermostat housing O-ring.

CRANKSHAFT BALANCER REMOVAL - OFF VEHICLE

Tools Required

- **EN 46106** Flywheel Holding Tool. See **Special Tools** .
- **J 24420-C** Harmonic Balancer Puller. See **Special Tools** .

- **J 38416-2** Crankshaft Button. See **Special Tools** .

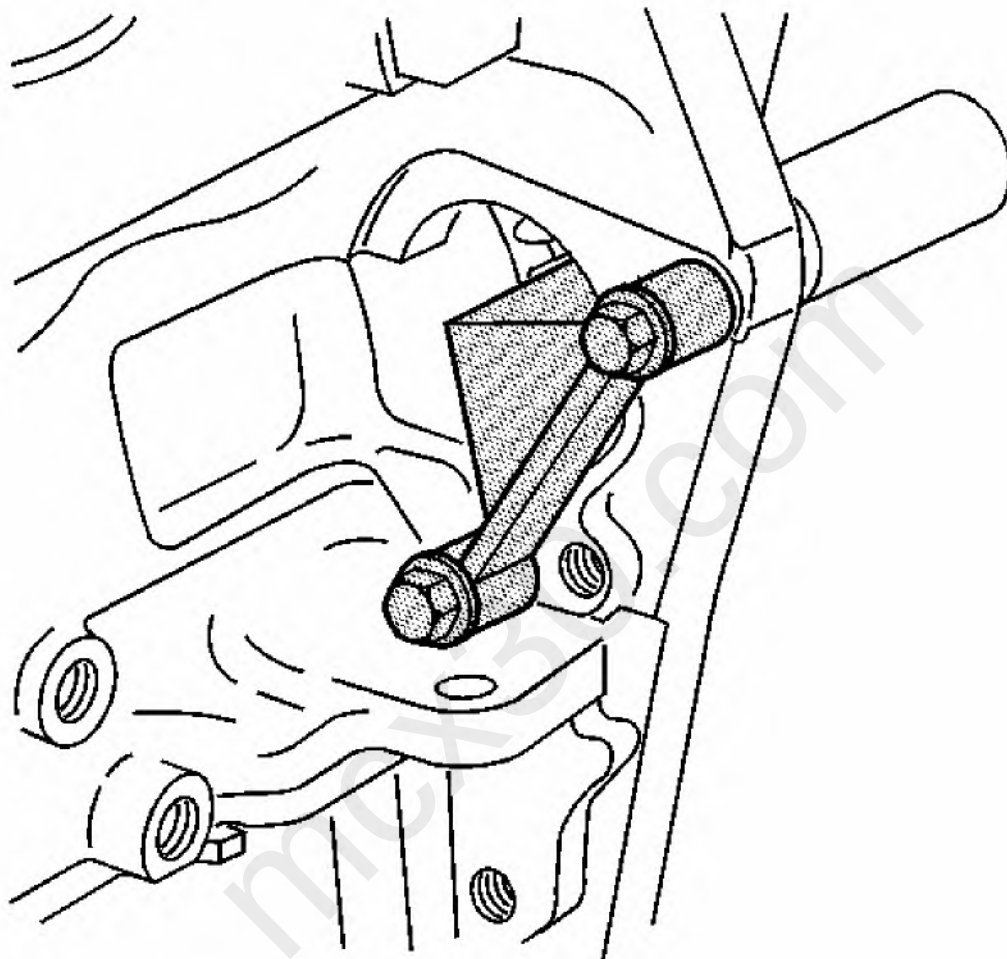


Fig. 165: View Of Tool EN 46106
Courtesy of GENERAL MOTORS CORP.

1. Install the **EN 46106** through the starter mounting hole. See **Special Tools** .

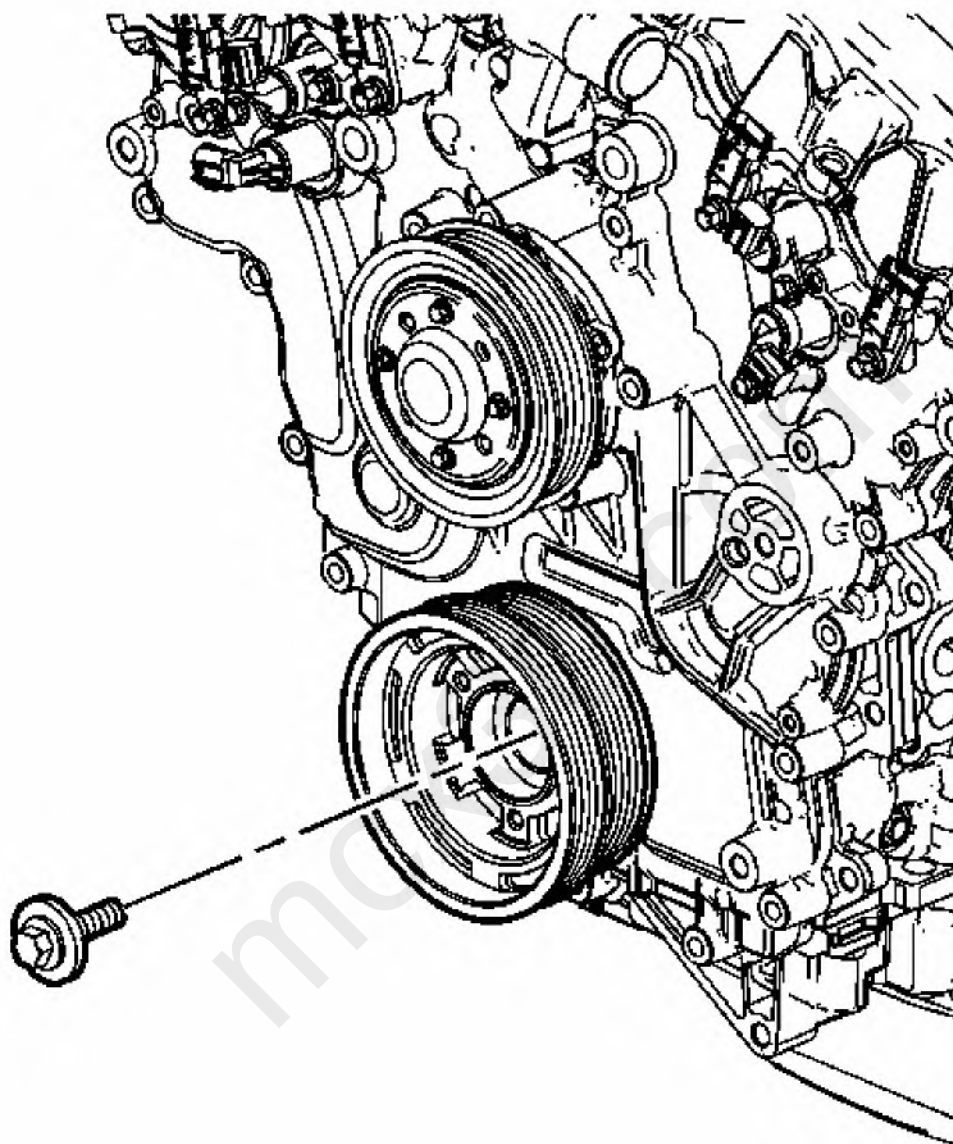


Fig. 166: View Of Crankshaft Balancer & Bolt
Courtesy of GENERAL MOTORS CORP.

2. Remove the crankshaft balancer bolt.

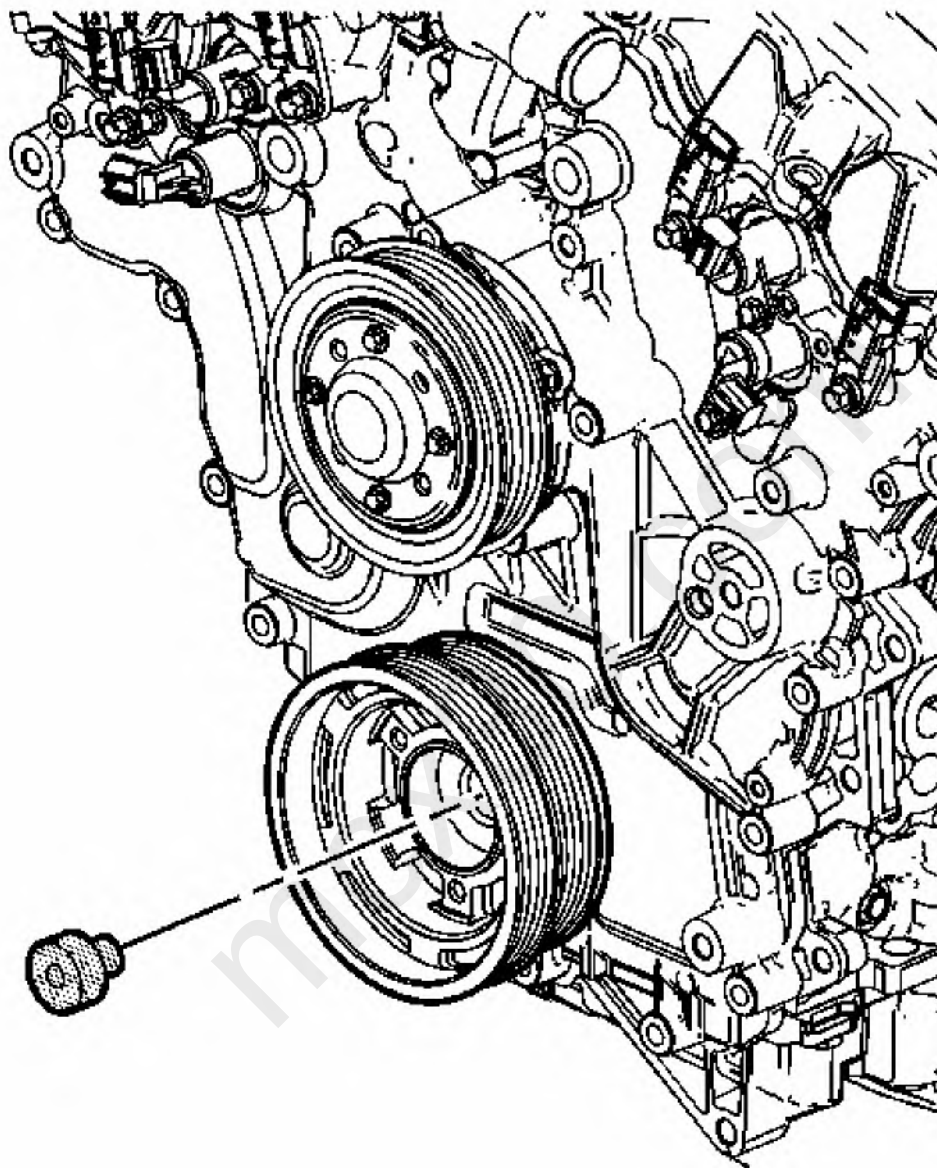


Fig. 167: Installing J 38416-2
Courtesy of GENERAL MOTORS CORP.

3. Install the **J 38416-2** in the nose of the crankshaft. See **Special Tools** .

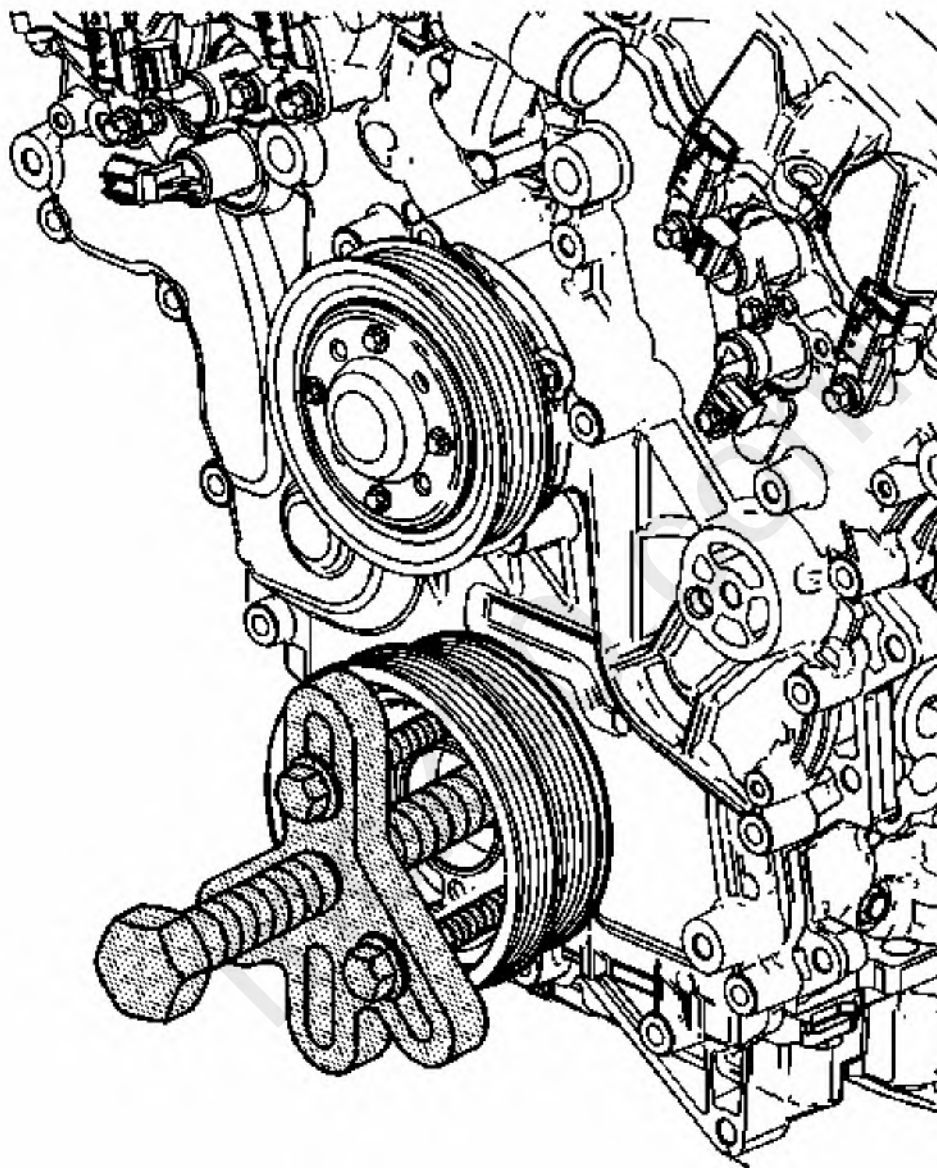


Fig. 168: Installing J 24420-C
Courtesy of GENERAL MOTORS CORP.

4. Install the **J 24420-C** in order to remove the crankshaft balancer. See **Special Tools** .

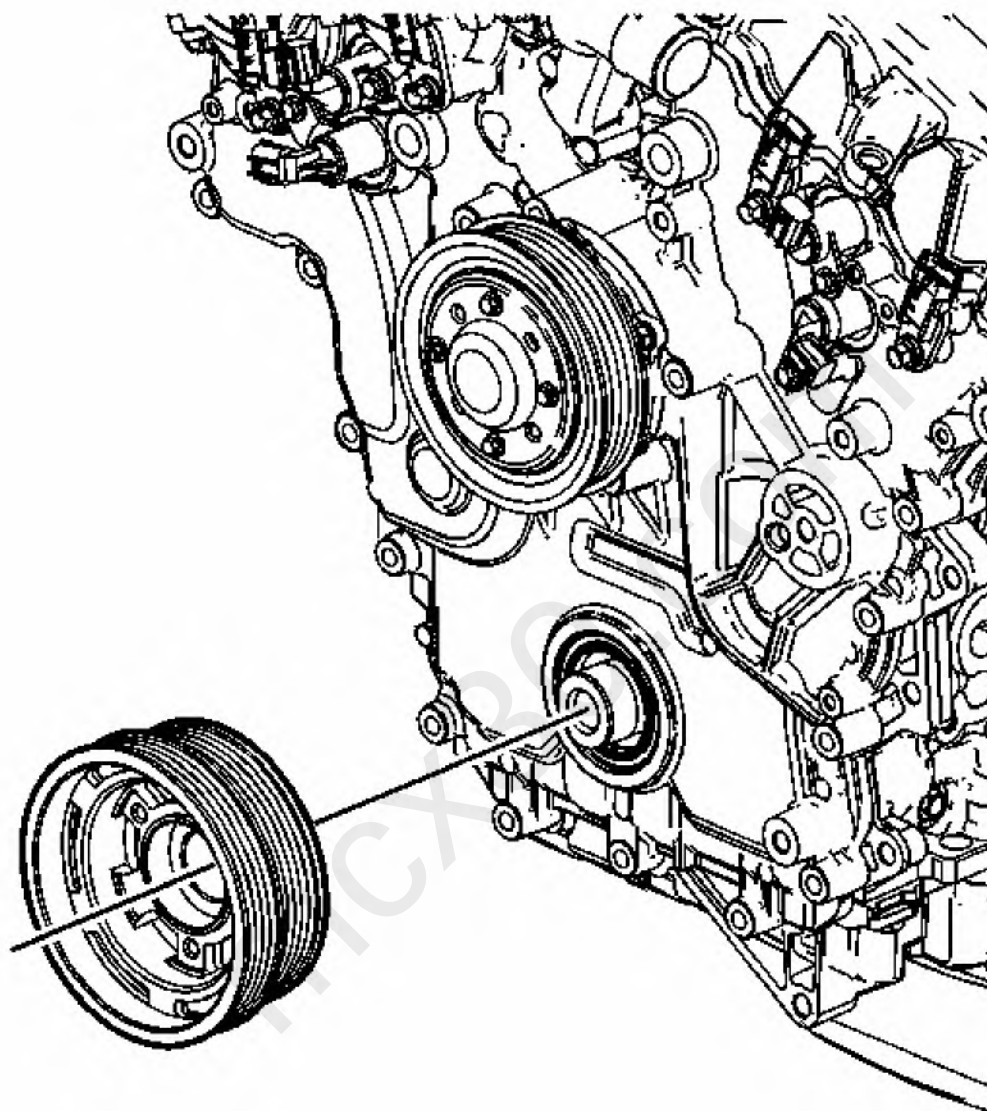


Fig. 169: View Of Crankshaft Balancer
Courtesy of GENERAL MOTORS CORP.

5. Pull the crankshaft balancer off by tightening the center bolt on the **J 24420-C** until the crankshaft balancer pulls off of the crankshaft end. See **Special Tools** .
6. Remove the **J 24420-C** from the crankshaft balancer. See **Special Tools** .

ENGINE FLYWHEEL REMOVAL - OFF VEHICLE

Tools Required

EN 46106 Flywheel Holding Tool. See **Special Tools** .

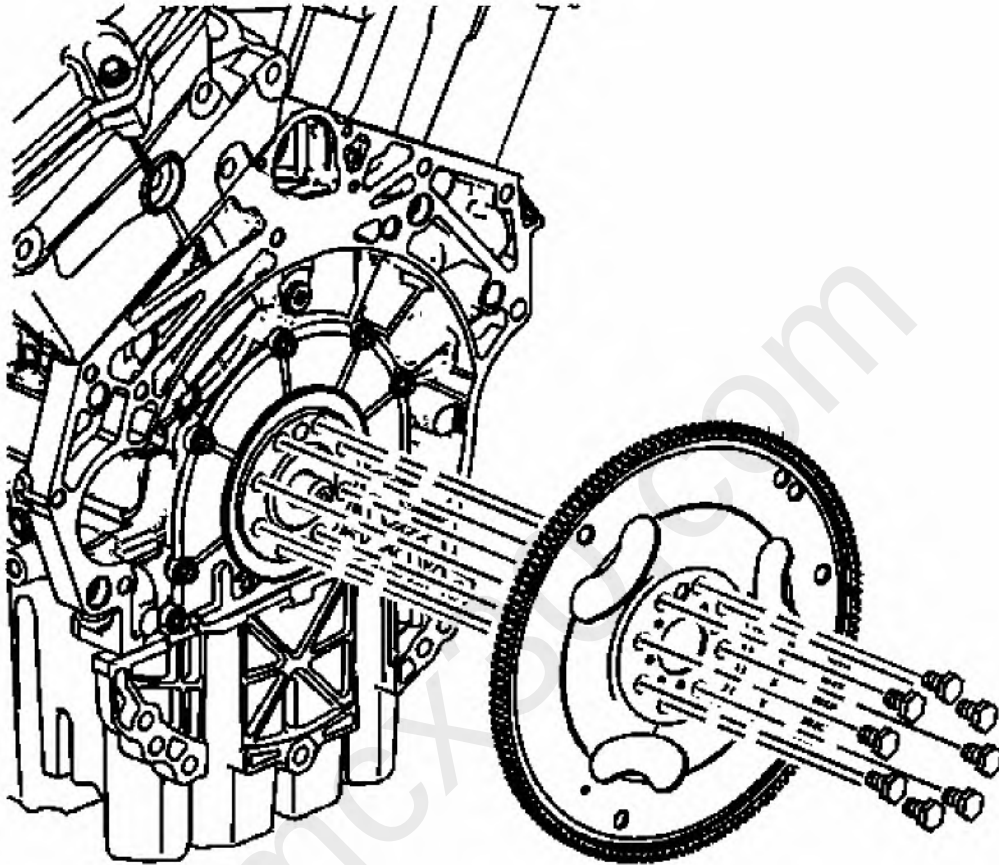


Fig. 170: View Of Engine Flywheel
Courtesy of GENERAL MOTORS CORP.

1. Remove the engine flywheel bolts and discard.
2. Remove the engine flywheel from the crankshaft.

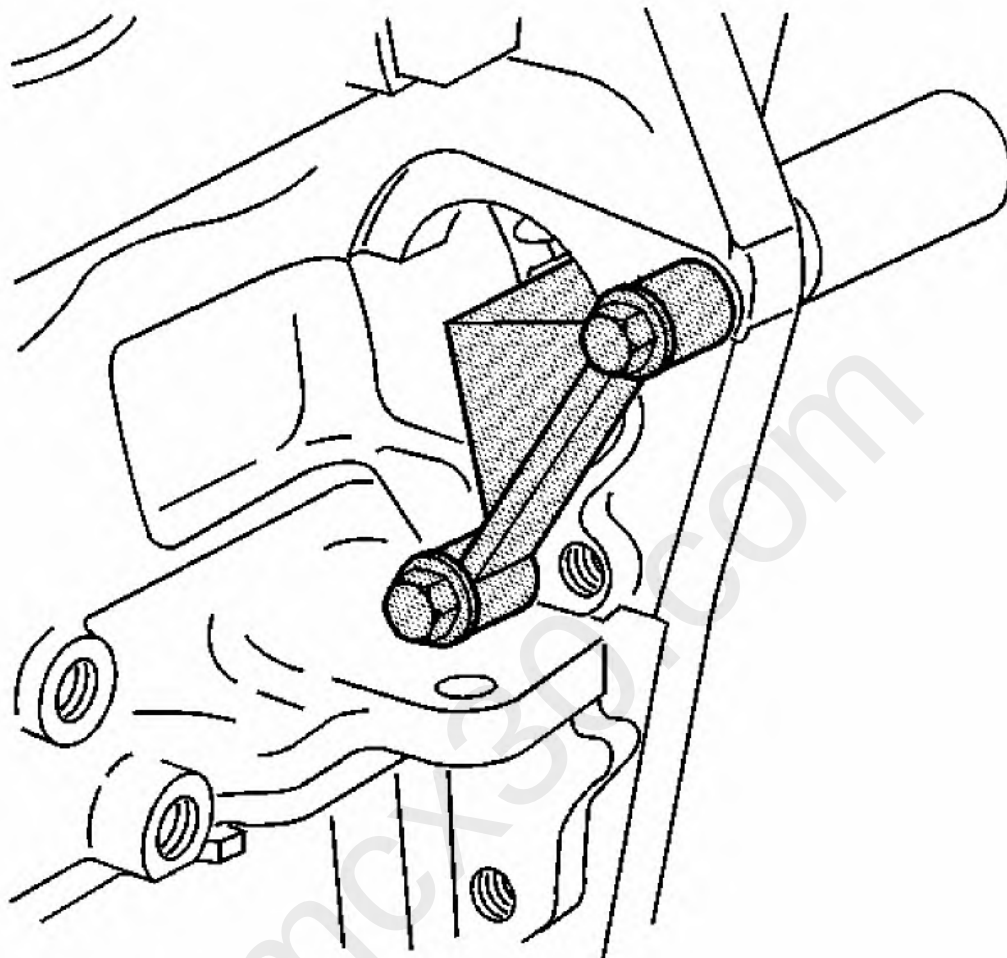


Fig. 171: View Of Tool EN 46106
Courtesy of GENERAL MOTORS CORP.

3. Remove the EN 46106 . See Special Tools .

INTAKE MANIFOLD REMOVAL - OFF VEHICLE

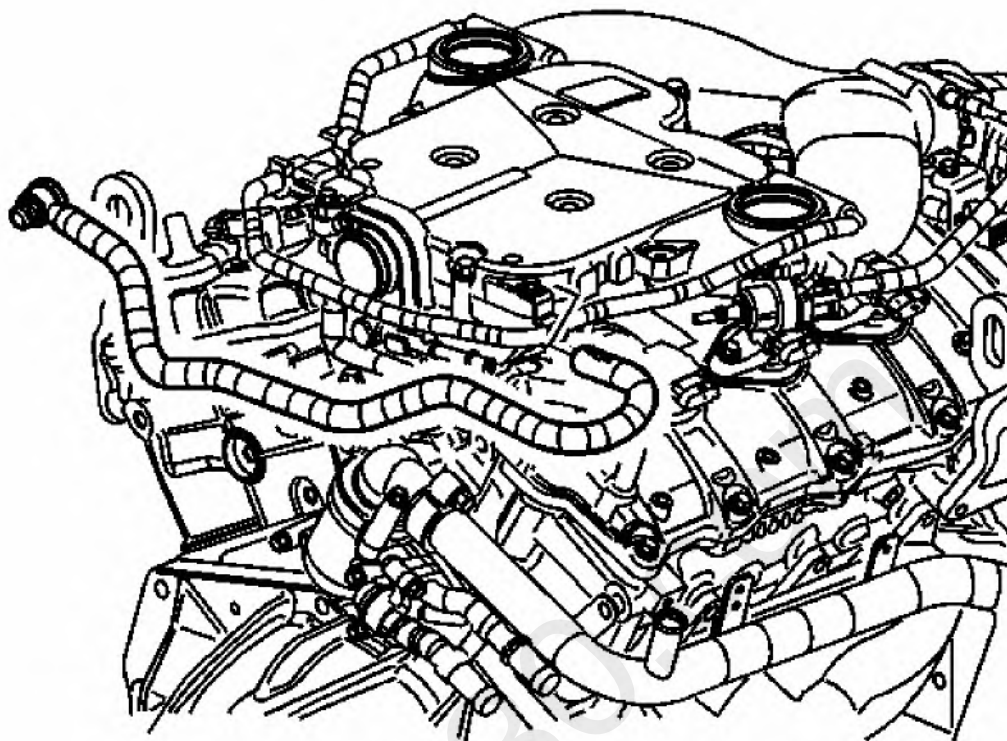


Fig. 172: View Of Brake Booster Hose
Courtesy of GENERAL MOTORS CORP.

1. Disconnect and remove the brake booster hose from the upper intake manifold.

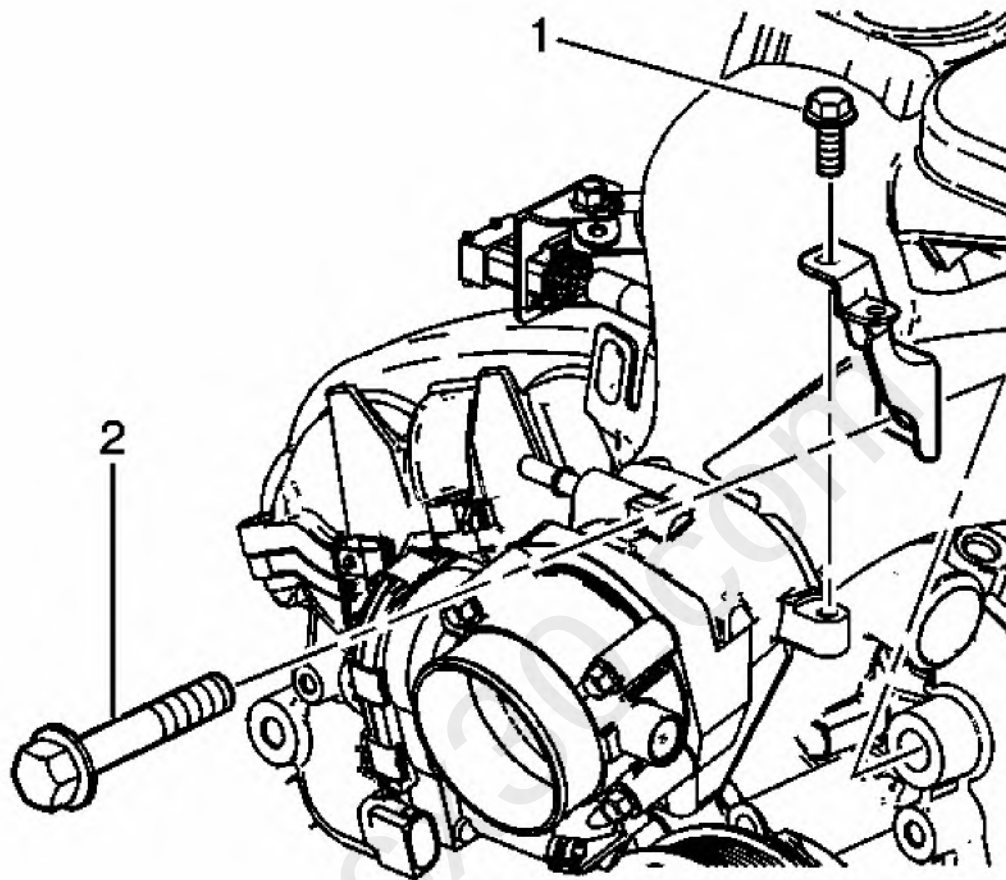


Fig. 173: View Of Intake Manifold Brace & Bolts
Courtesy of GENERAL MOTORS CORP.

2. Remove the intake manifold brace bolts (1 and 2).
3. Remove the intake manifold brace.

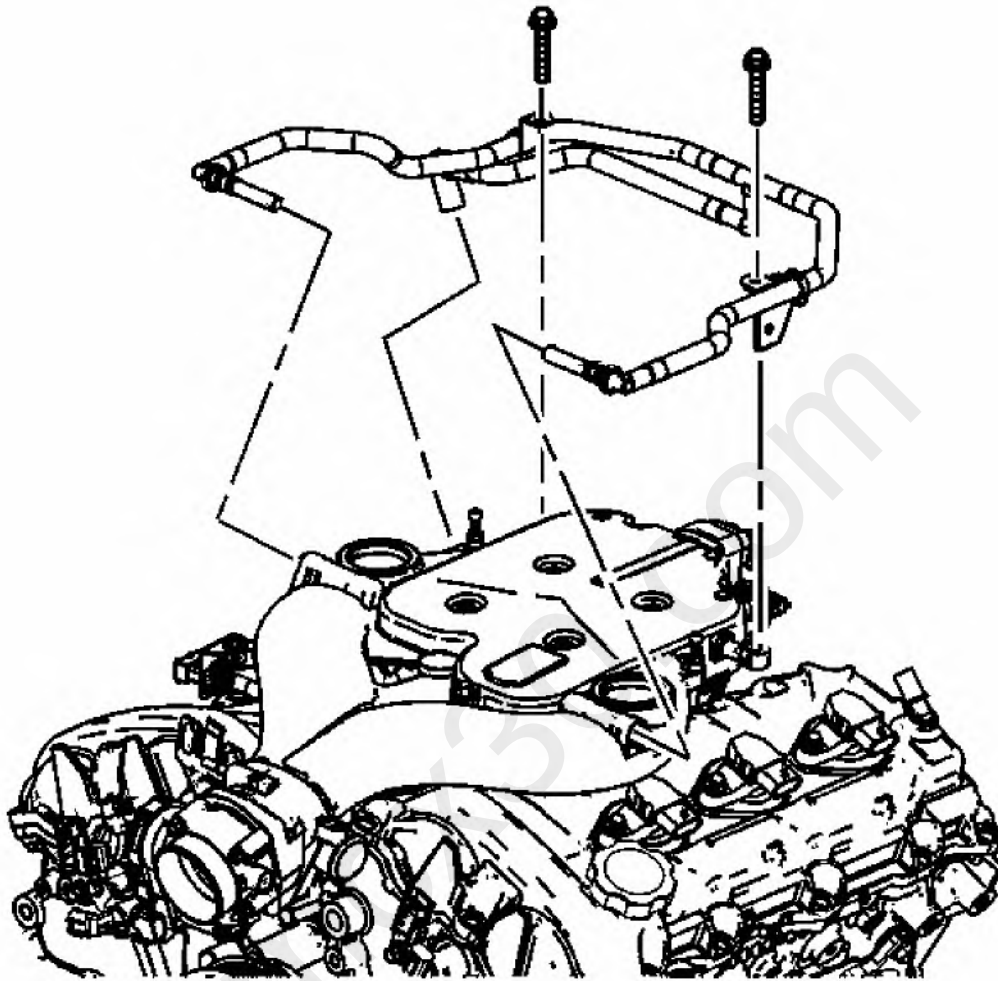


Fig. 174: View Of PCV Dirty Air Tube
Courtesy of GENERAL MOTORS CORP.

4. Remove the positive crankcase ventilation (PCV) tube assembly bracket bolts.
5. Disconnect and remove the PCV tube assembly from the upper intake manifold and right camshaft cover.

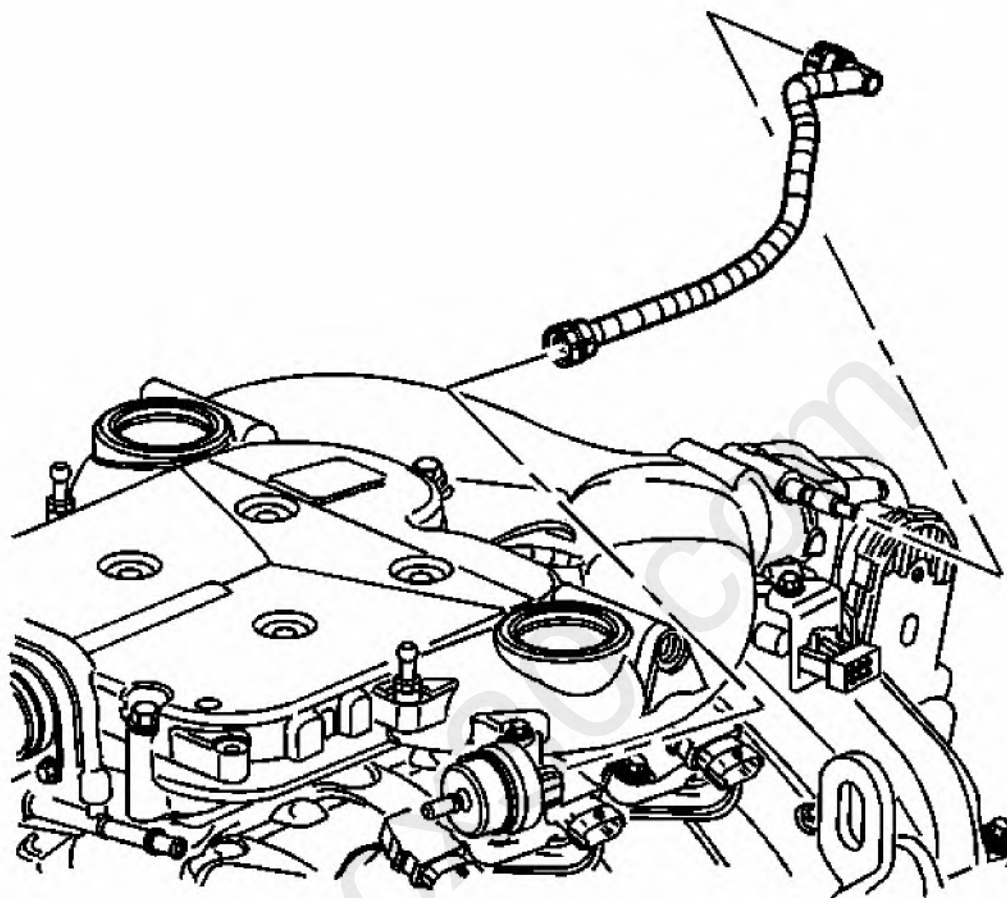


Fig. 175: View Of EVAP Hose
Courtesy of GENERAL MOTORS CORP.

6. Disconnect the (EVAP) hose from the upper intake manifold and EVAP solenoid.

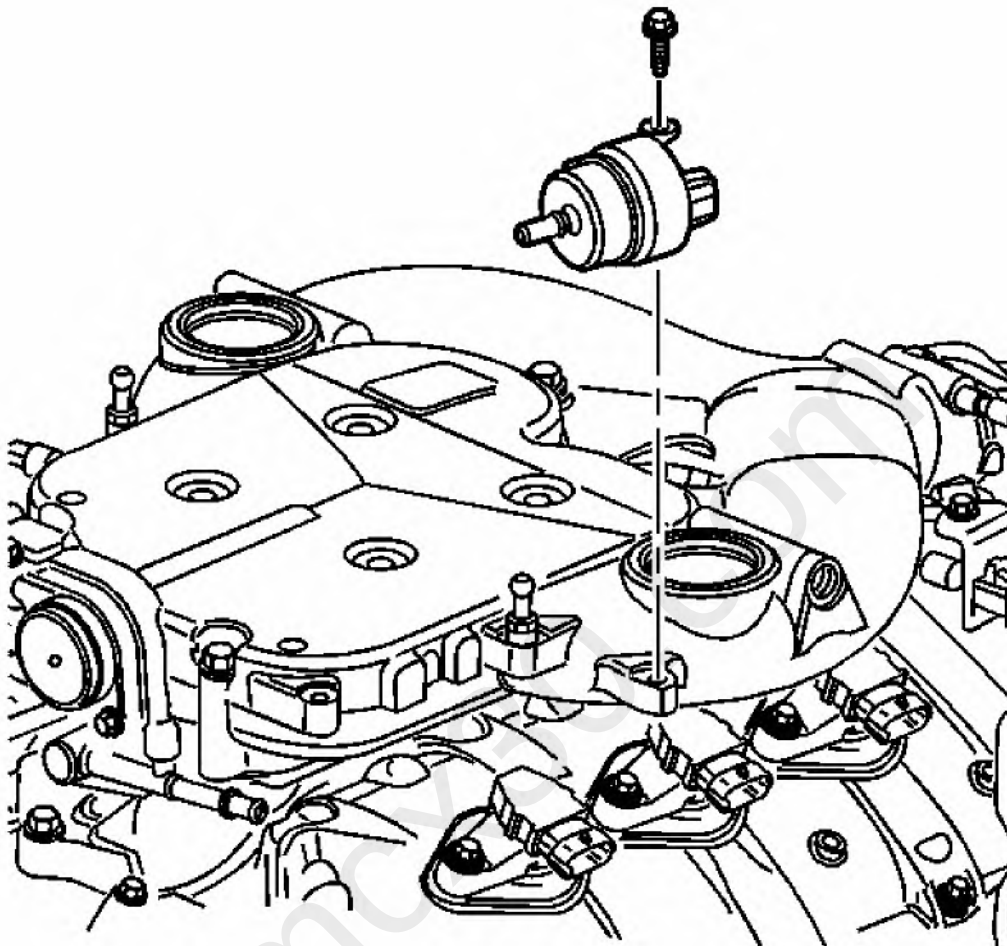


Fig. 176: View Of EVAP Solenoid
Courtesy of GENERAL MOTORS CORP.

7. Remove the EVAP solenoid bolt.
8. Remove the EVAP solenoid.

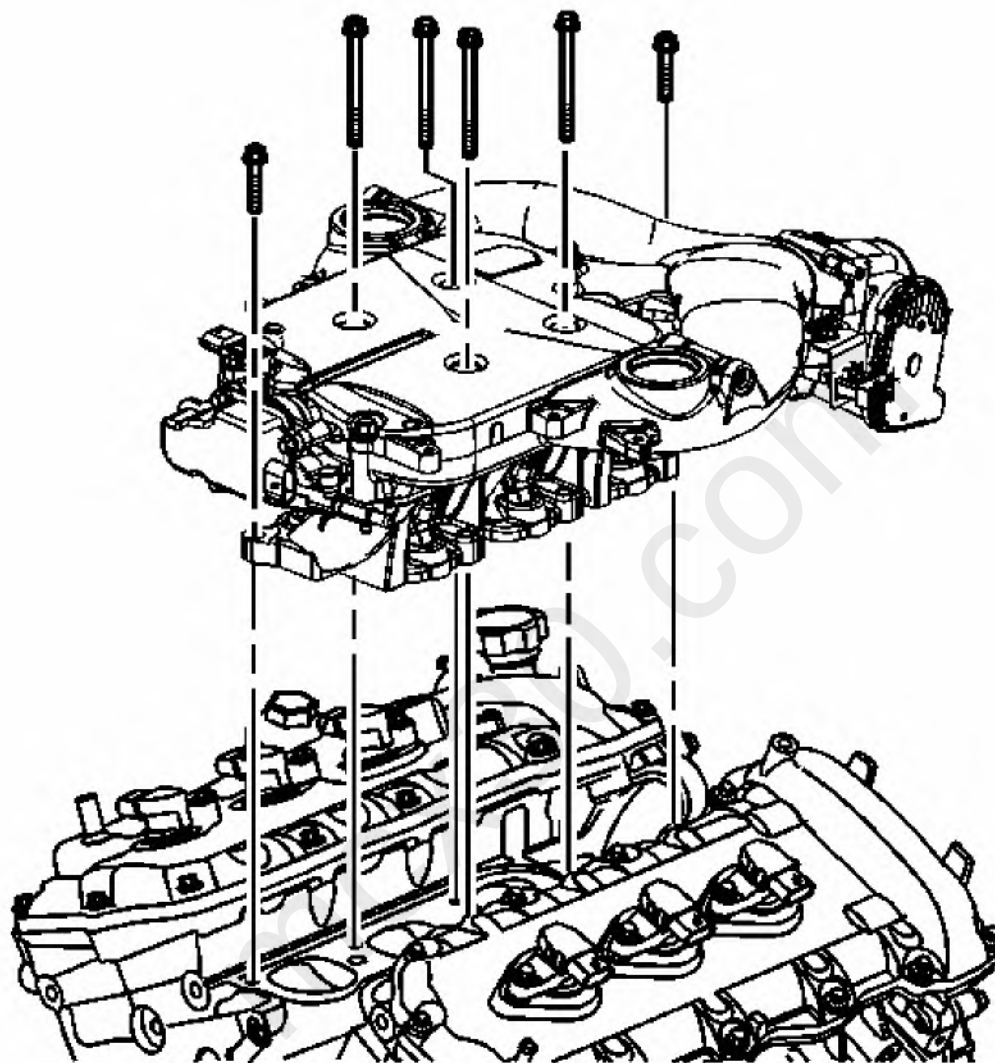


Fig. 177: View Of Intake Manifold Assembly
Courtesy of GENERAL MOTORS CORP.

9. Remove the intake manifold bolts.
10. Remove the intake manifold assembly.

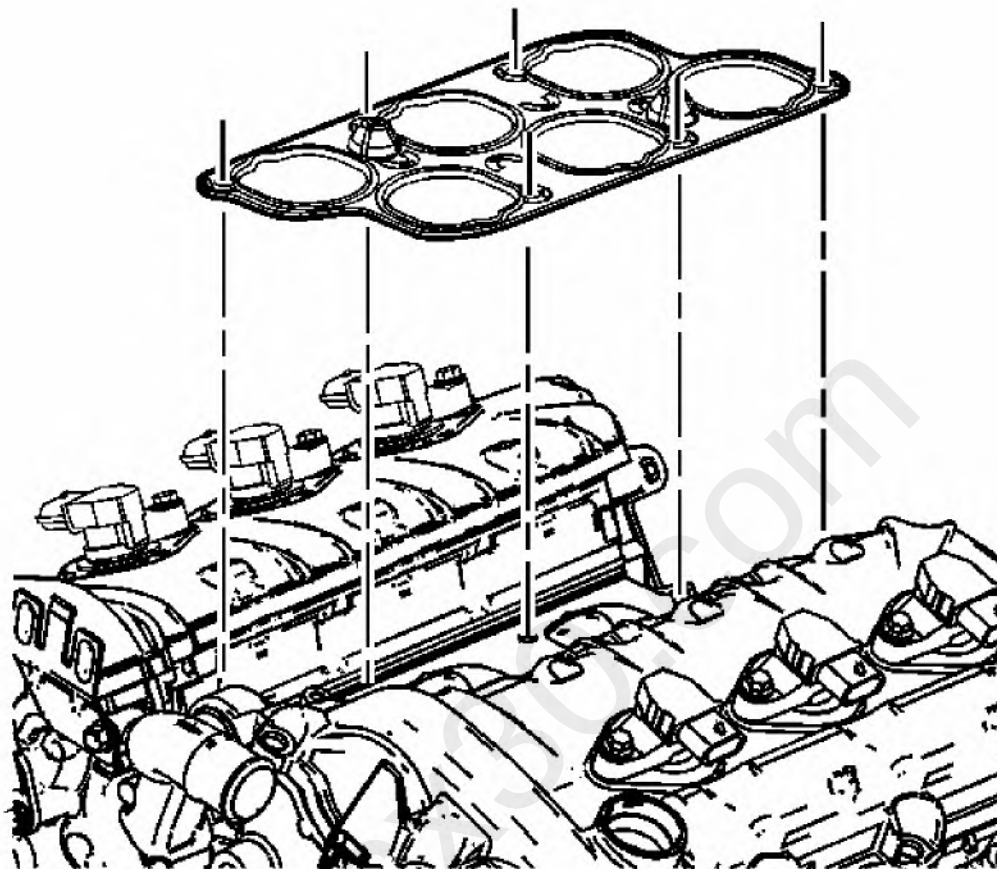


Fig. 178: View Of Lower Intake Manifold Gasket
Courtesy of GENERAL MOTORS CORP.

11. Remove the lower intake manifold gasket.

CAMSHAFT COVER REMOVAL - LEFT SIDE - OFF VEHICLE

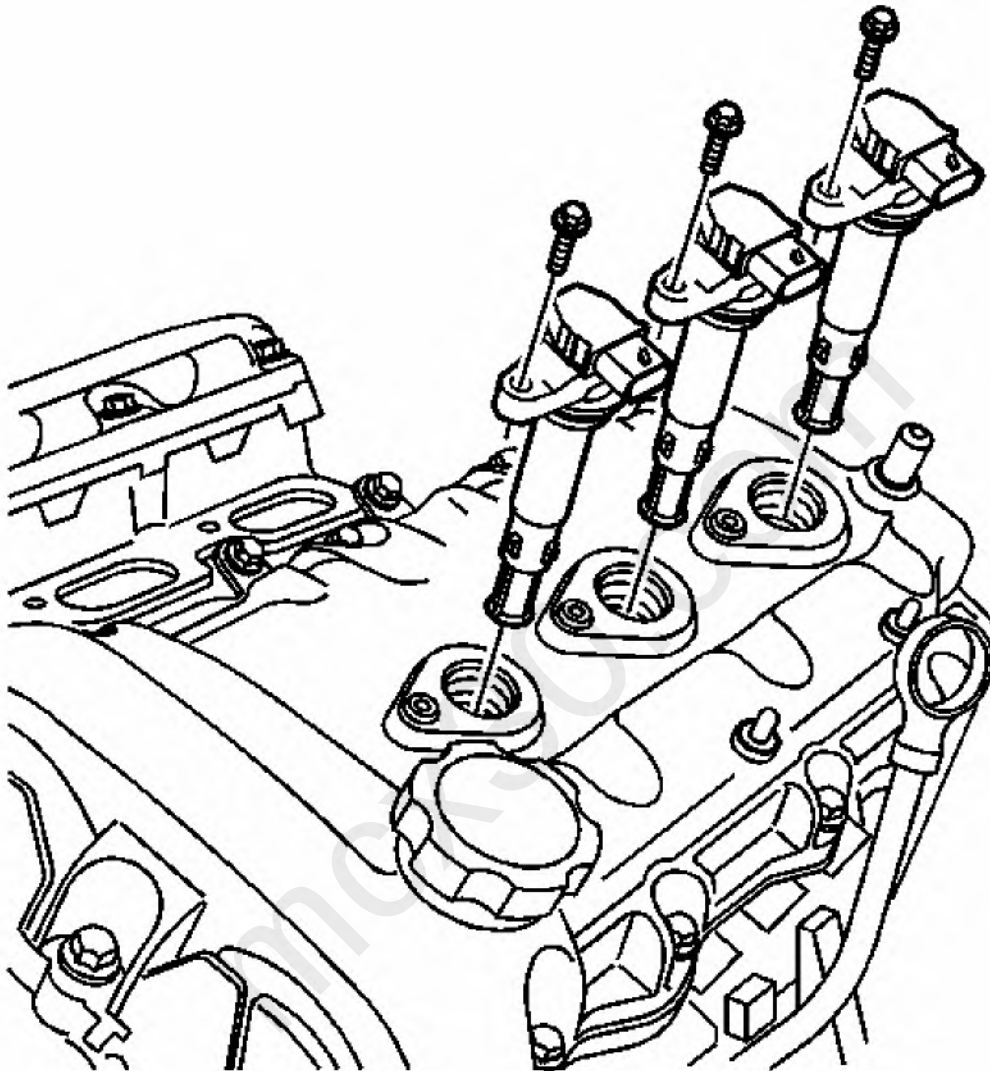


Fig. 179: Identifying Left Cylinder Head Ignition Coils
Courtesy of GENERAL MOTORS CORP.

1. Remove each ignition coil bolt.
2. Raise each ignition coil through the camshaft cover from the spark plug tube. DO NOT damage the spark plug or ignition coil perimeter seals.

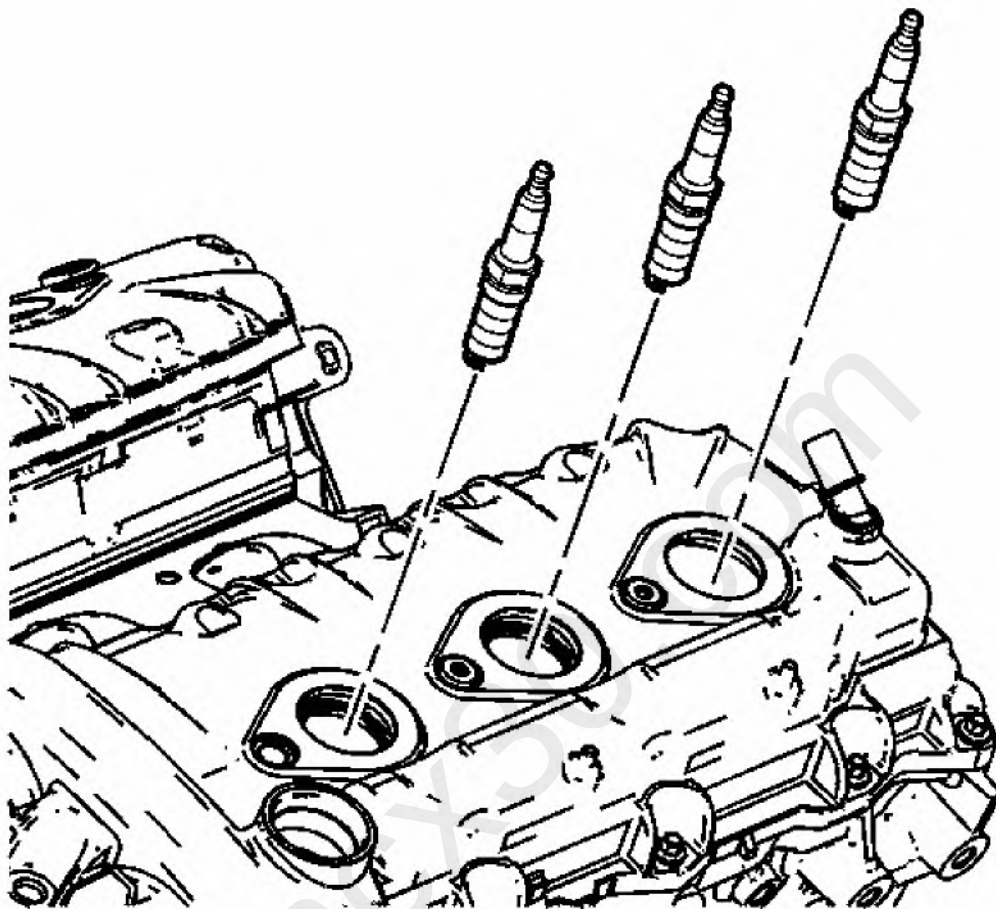


Fig. 180: View Of Spark Plugs
Courtesy of GENERAL MOTORS CORP.

3. Remove the spark plugs.

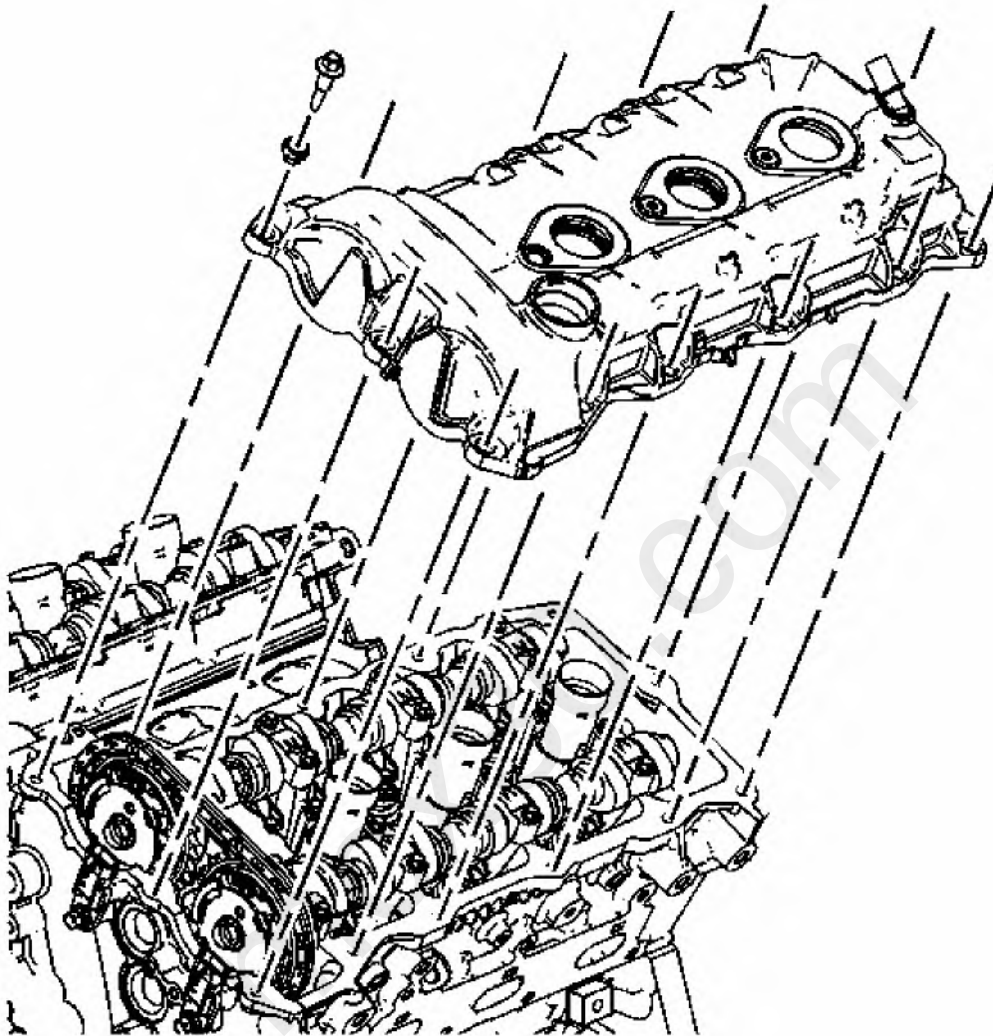


Fig. 181: Removing & Installing Left Camshaft Cover
Courtesy of GENERAL MOTORS CORP.

4. Remove the left camshaft cover bolts.
5. Remove the left camshaft cover from the left cylinder head.

CAMSHAFT COVER REMOVAL - RIGHT SIDE - OFF VEHICLE

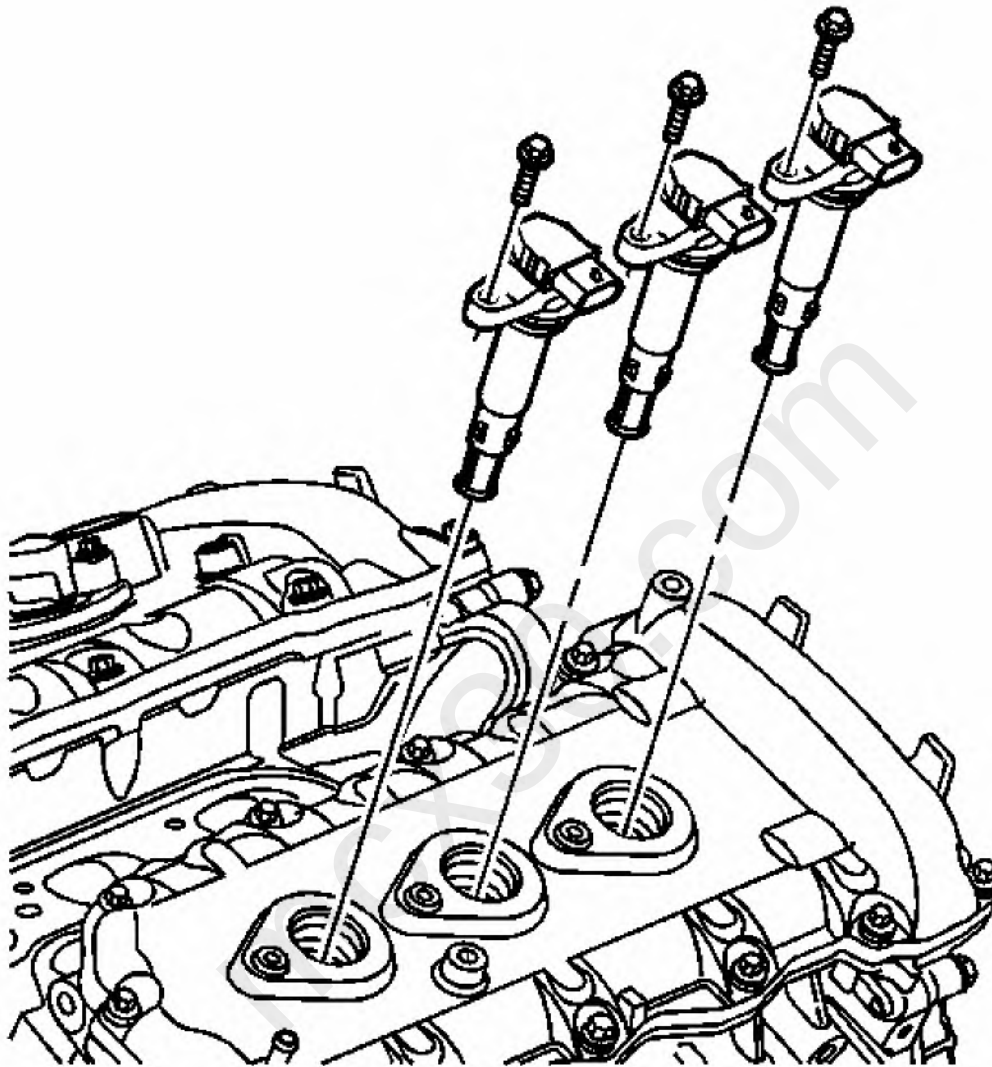


Fig. 182: Ignition Coil View
Courtesy of GENERAL MOTORS CORP.

1. Remove each ignition coil bolt.
2. Raise each ignition coil through the camshaft cover from the spark plug tube. DO NOT damage the spark plug or ignition coil perimeter seals.

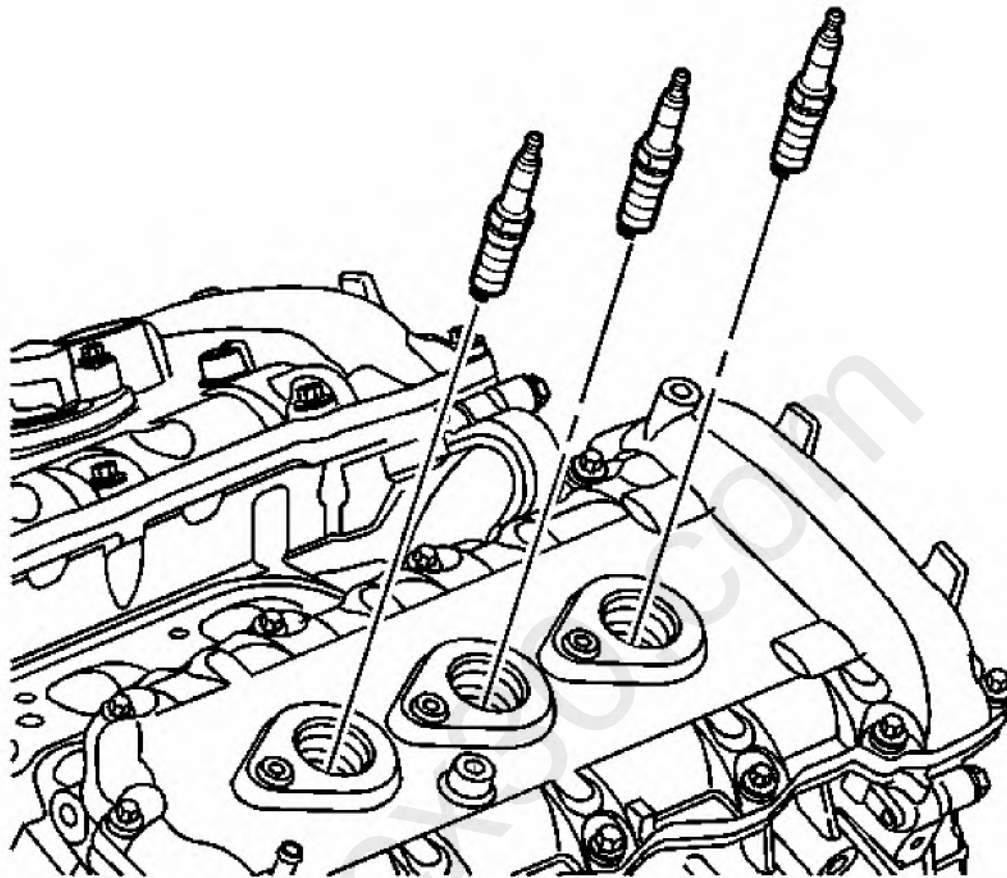


Fig. 183: View Of Spark Plugs
Courtesy of GENERAL MOTORS CORP.

3. Remove the spark plugs.

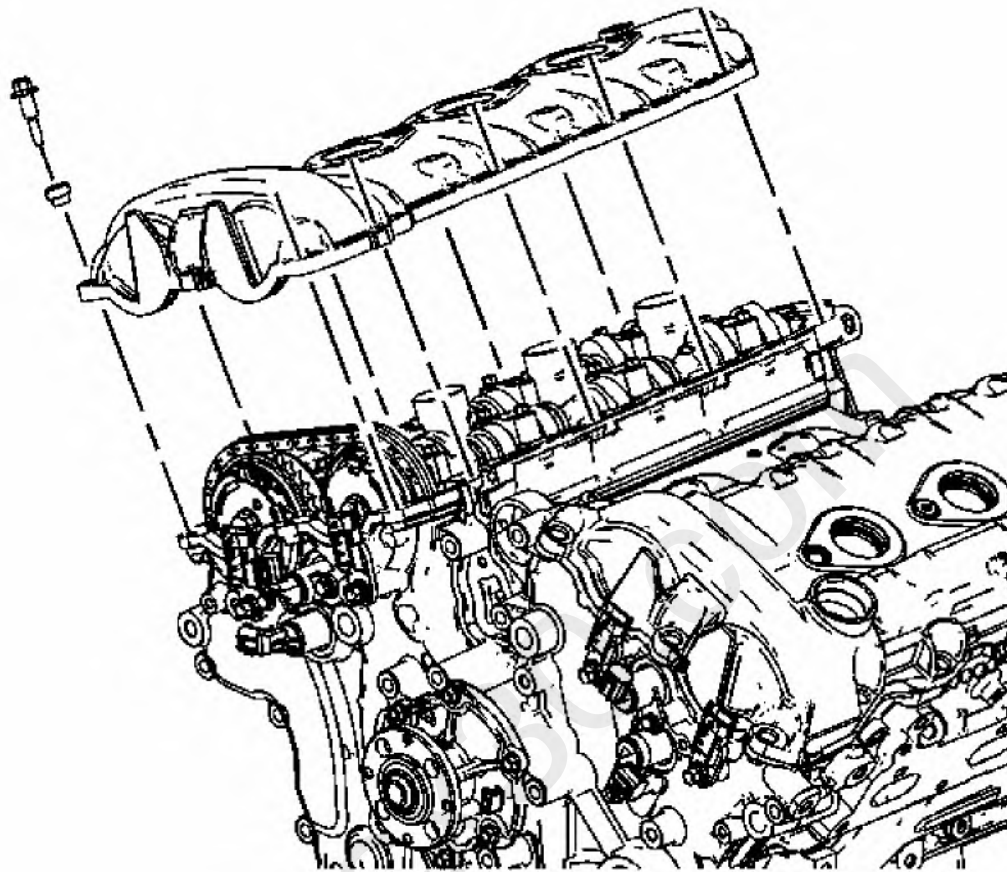


Fig. 184: Removing & Installing Camshaft Cover
Courtesy of GENERAL MOTORS CORP.

4. Remove the right camshaft cover bolts.
5. Remove the right camshaft cover from the right cylinder head.

WATER PUMP REMOVAL - OFF VEHICLE

Tools Required

EN 46104 Water Pump Pulley Holding Tool. See **Special Tools** .

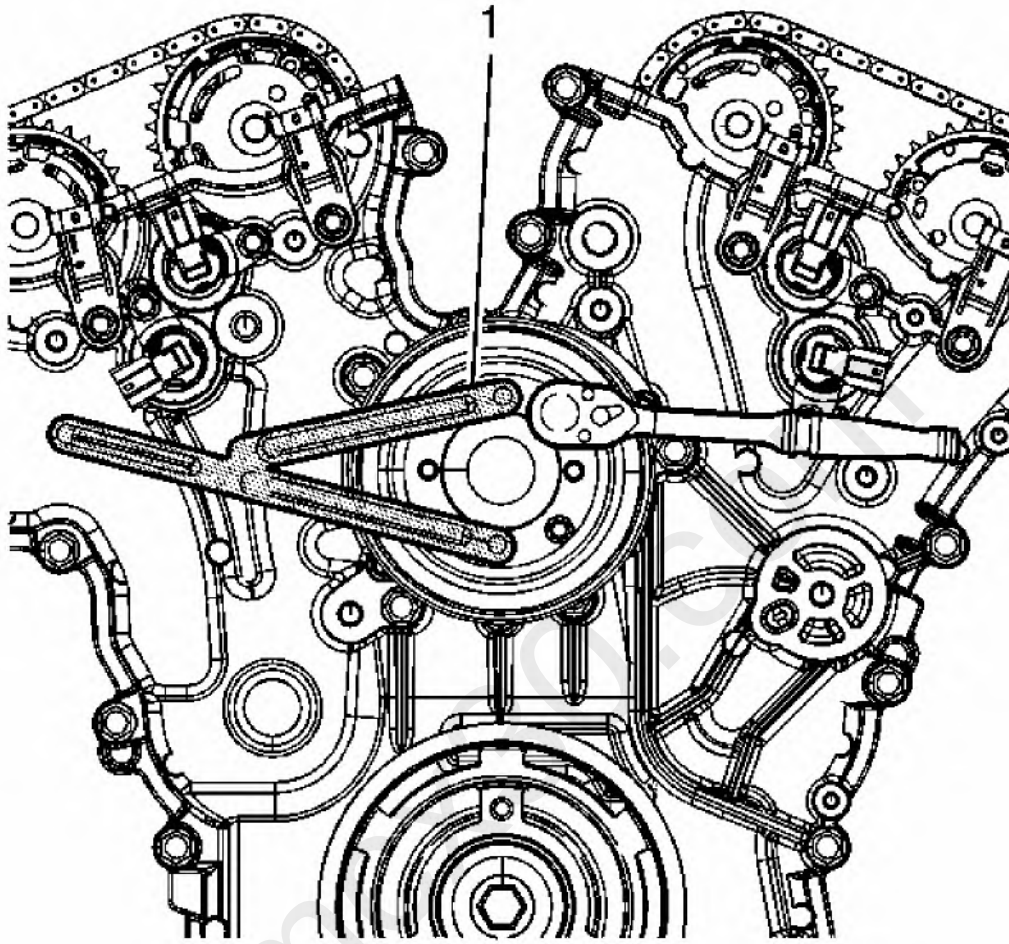


Fig. 185: View Of EN 46104

Courtesy of GENERAL MOTORS CORP.

1. Install the **EN 46104** (1) onto the water pump pulley. See **Special Tools** .

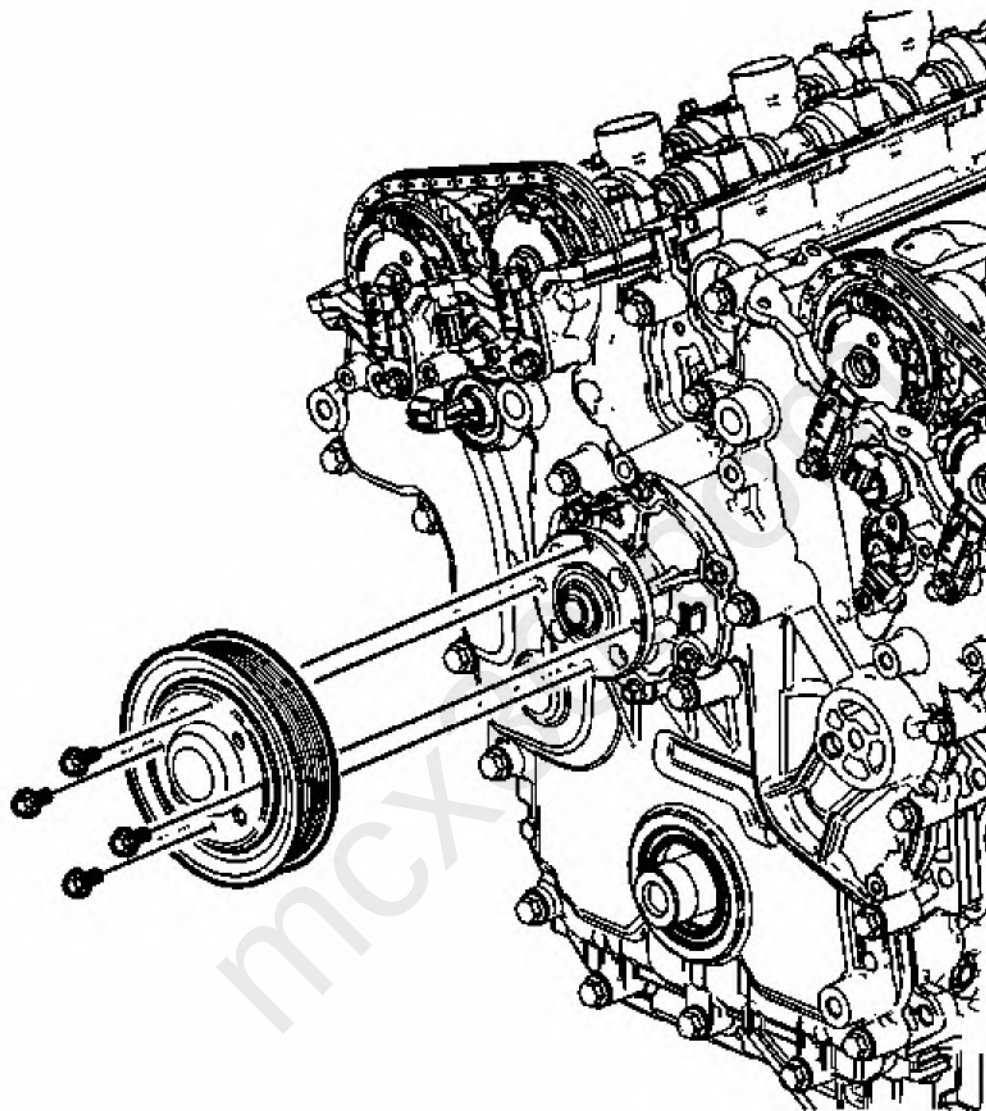


Fig. 186: View Of Water Pump Pulley
Courtesy of GENERAL MOTORS CORP.

2. Remove the water pump pulley bolts.
3. Remove the water pump pulley.

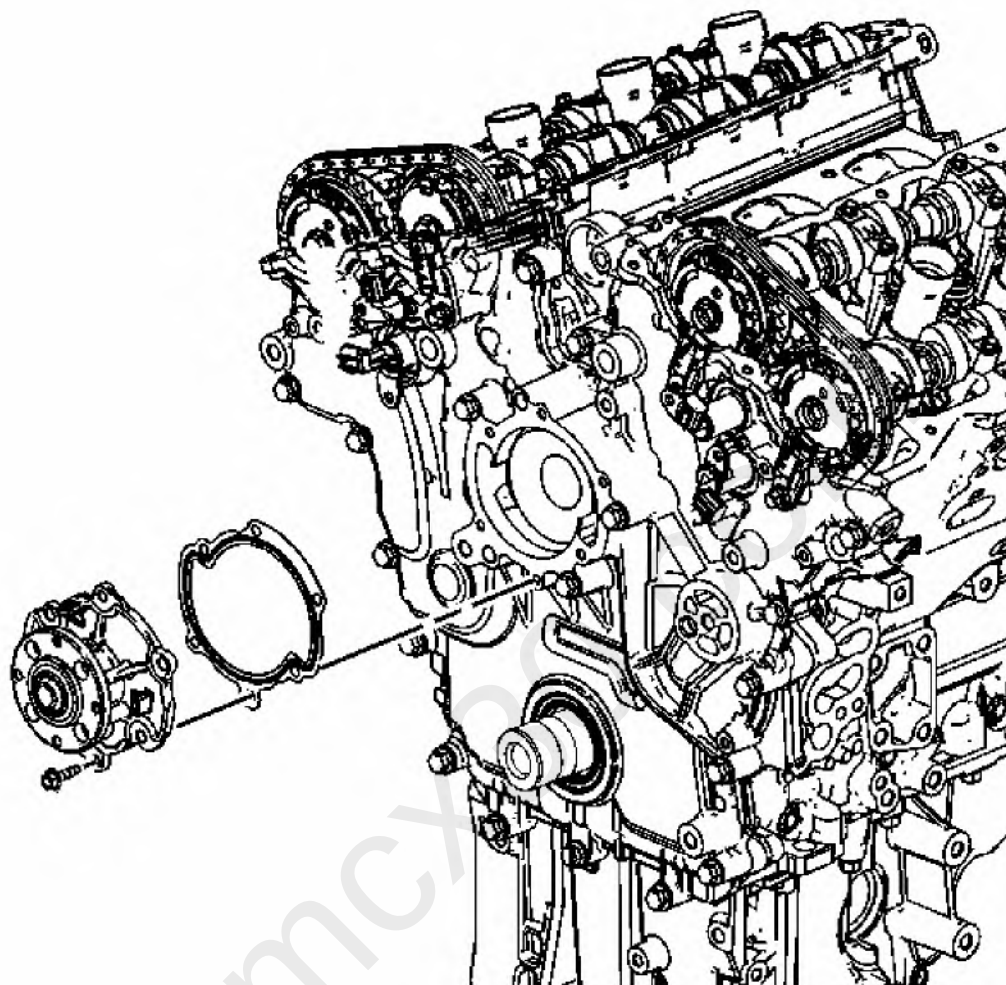


Fig. 187: View Of Water Pump
Courtesy of GENERAL MOTORS CORP.

4. Remove the water pump bolts.
5. Remove the water pump from the front cover.
6. Remove the water pump gasket.

ENGINE FRONT COVER REMOVAL (SECOND DESIGN) - OFF VEHICLE

Tools Required

- EN 46105 Camshaft Locking Tool. See Special Tools .
- EN 46111 Crankshaft Rotation Socket. See Special Tools .

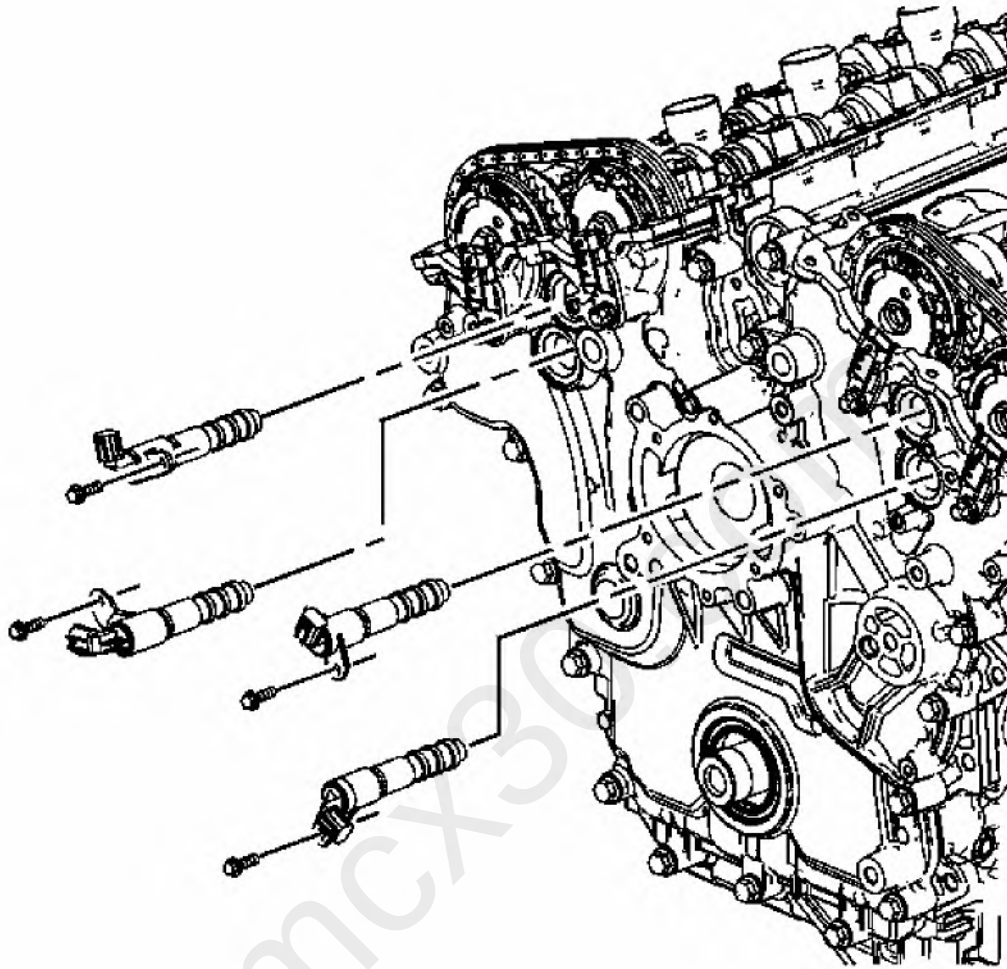


Fig. 188: View Of Camshaft Position Actuator Valves
Courtesy of GENERAL MOTORS CORP.

1. Remove the camshaft position actuator valve bolts.
2. Remove the camshaft position actuator valves from the front cover.

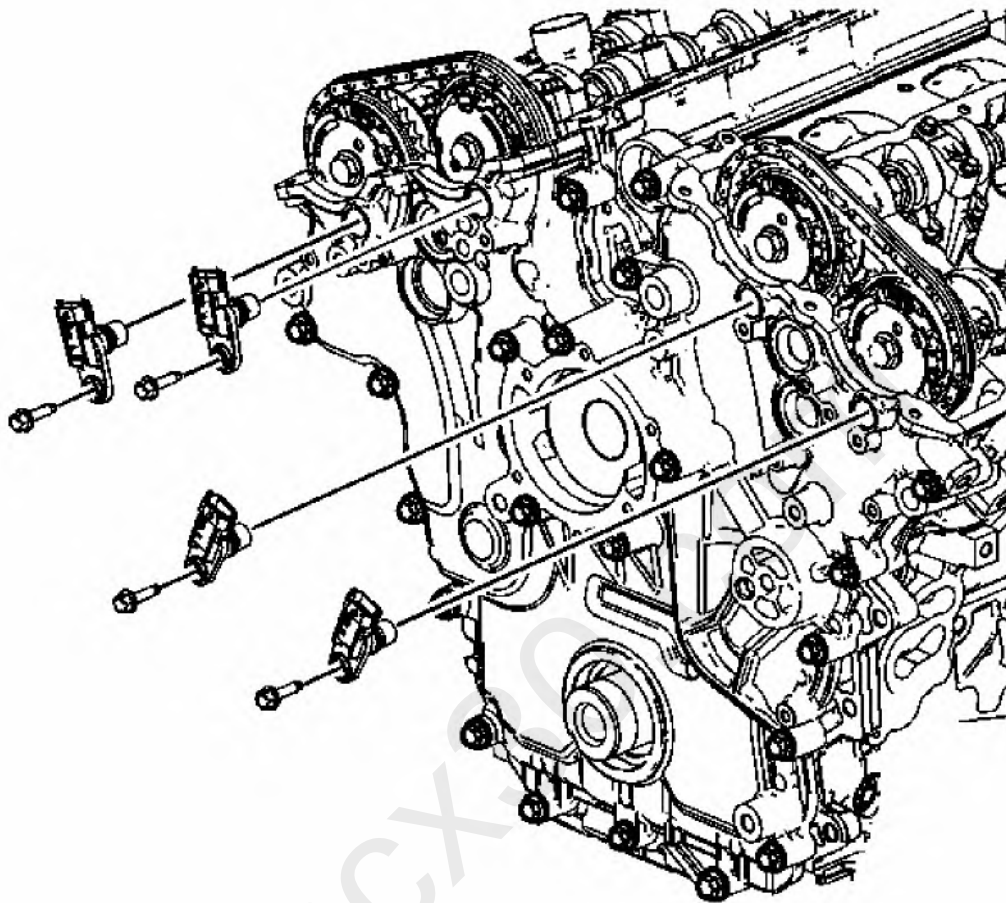


Fig. 189: View Of Camshaft Position Sensors
Courtesy of GENERAL MOTORS CORP.

3. Remove the camshaft position sensor bolts.
4. Remove the camshaft position sensors.

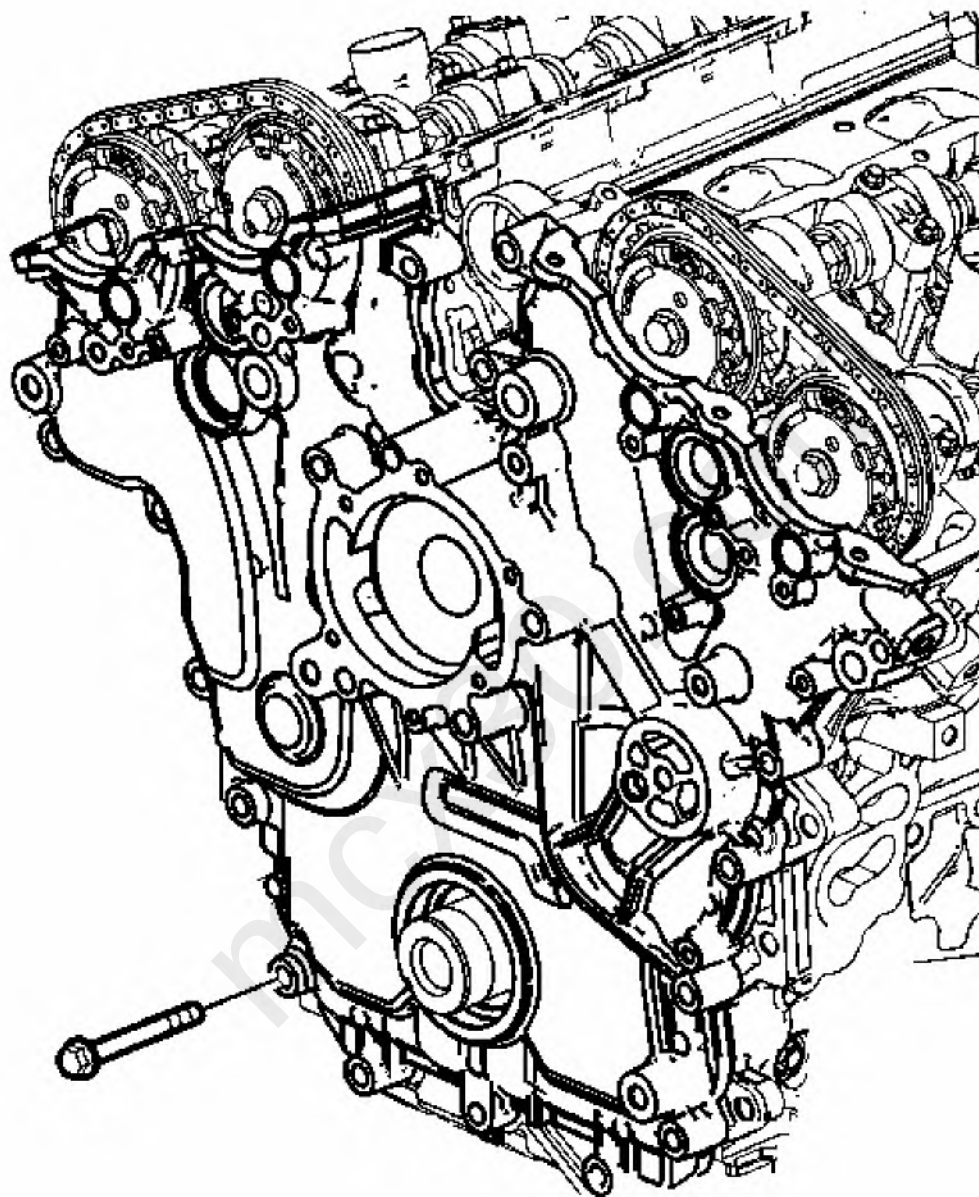


Fig. 190: View Of Engine Front Cover Bolt
Courtesy of GENERAL MOTORS CORP.

5. Remove the engine front cover bolts.

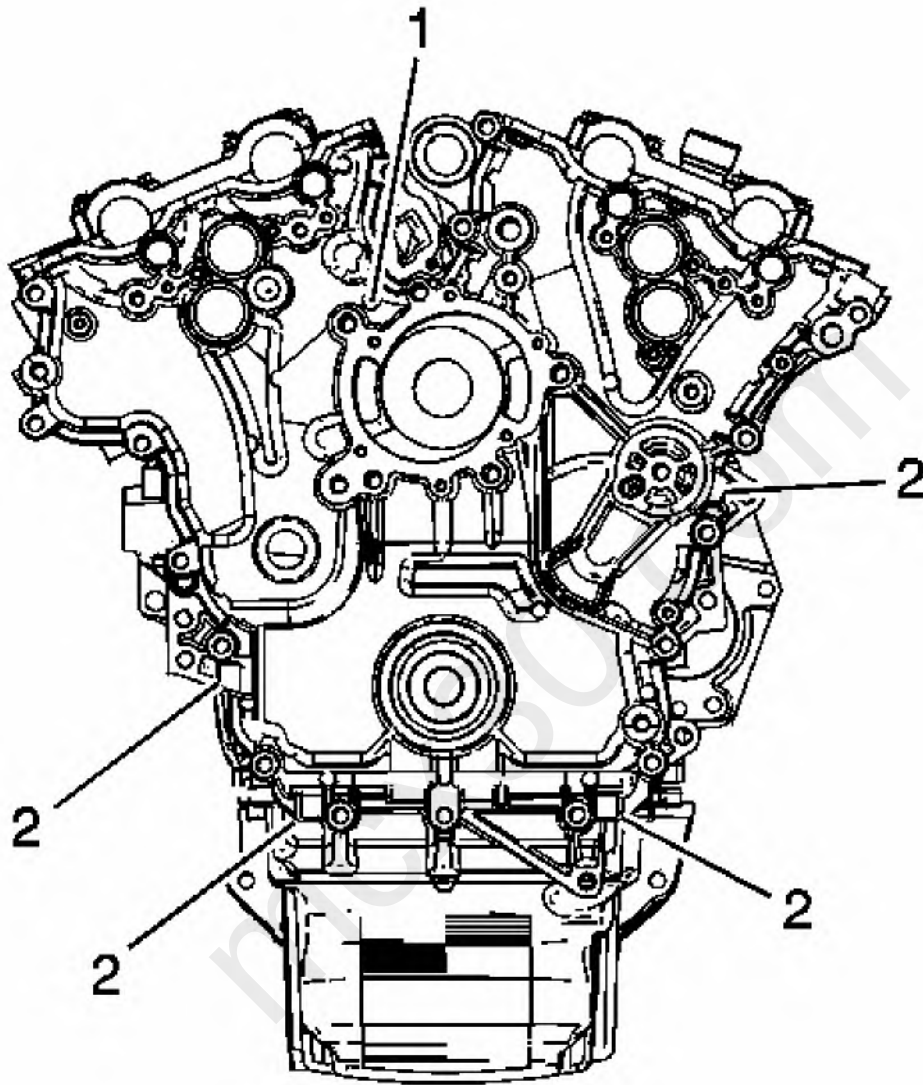


Fig. 191: Locating Jackscrew Hole & Pry Points
Courtesy of GENERAL MOTORS CORP.

NOTE: Do not pry between the engine front cover and the camshaft position sensors or the camshaft position actuators in order to shear the RTV. Use the pry points and a bolt in the jackscrew hole in order to remove the engine front cover. Damage to the camshaft position sensors or the camshaft position actuators may occur if the camshaft position sensors or the camshaft position actuators are used to pry

against in order to remove the engine front cover.

6. Loosely install a 10 x 1.5 mm bolt in the jackscrew hole (1).
7. Using the pry points (2) located at the edge of the front cover and the jackscrew, shear the room temperature vulcanizing (RTV) sealant.

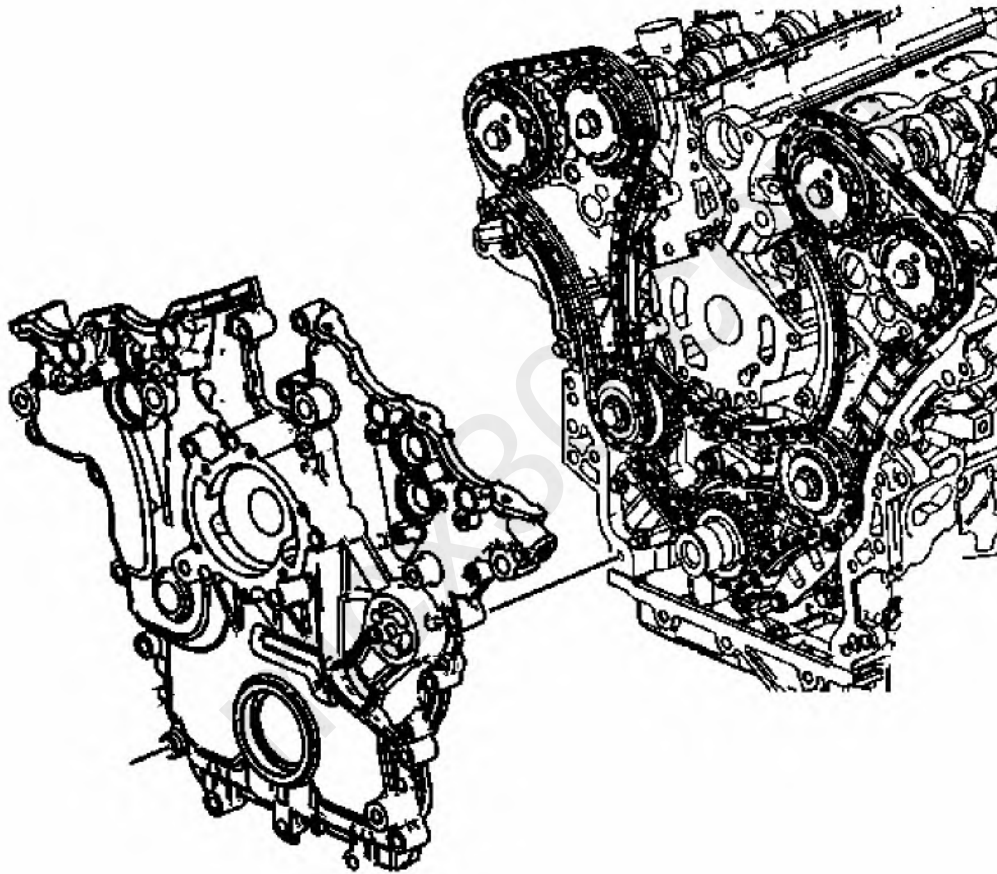


Fig. 192: Engine Front Cover
Courtesy of GENERAL MOTORS CORP.

8. Remove the engine front cover.

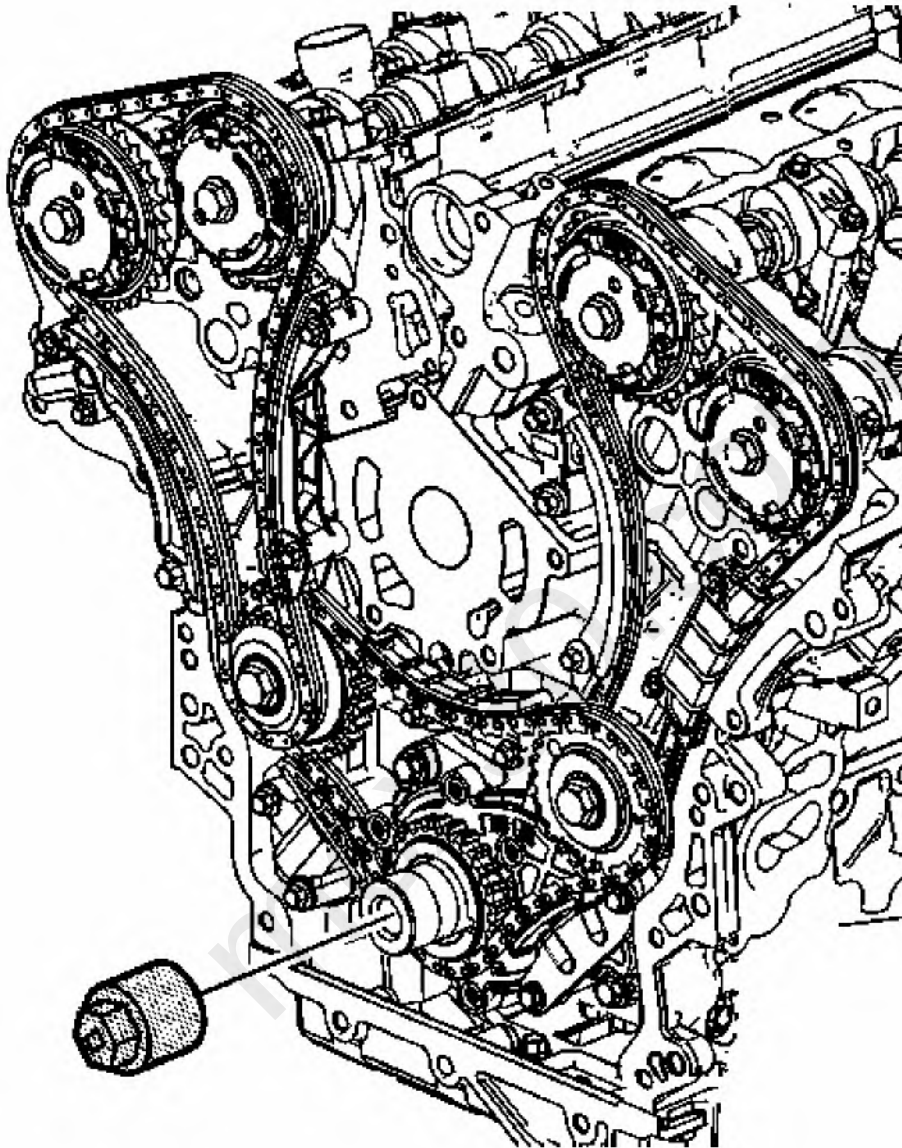


Fig. 193: EN 46111

Courtesy of GENERAL MOTORS CORP.

9. Using the **EN 46111** , rotate the crankshaft until the left cylinder head camshafts align with the EN 46105-2 and the right cylinder head camshafts align with the EN 46105-1. See Special Tools .

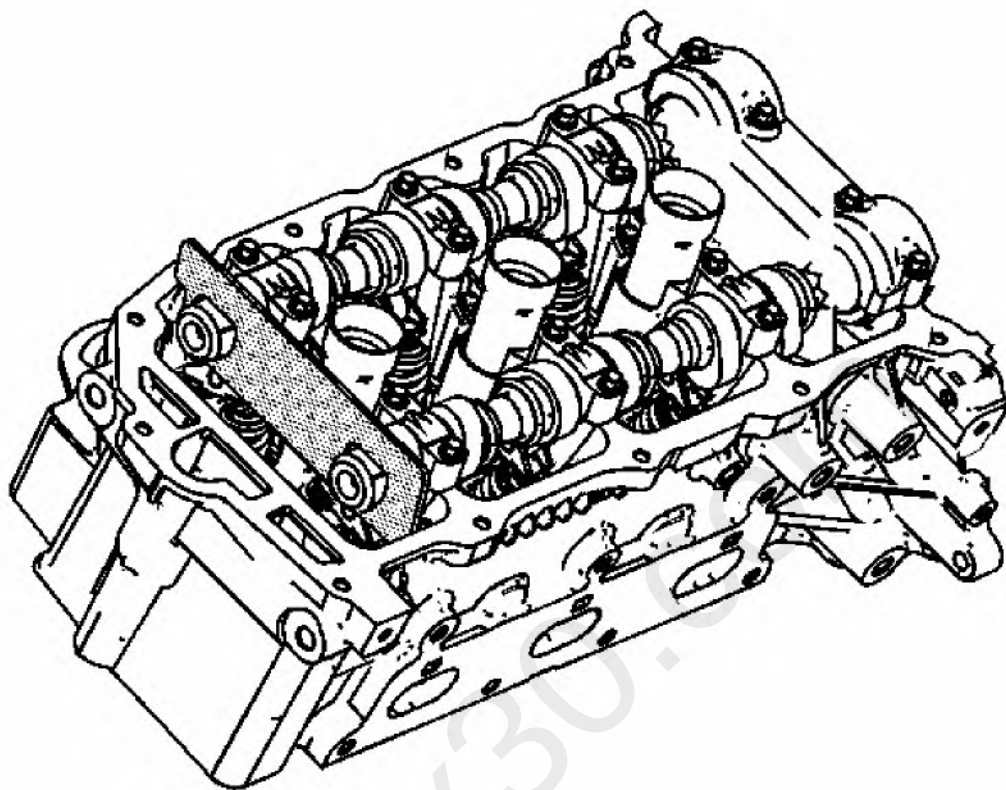


Fig. 194: EN 46105-1 Installed To Right Camshafts
Courtesy of GENERAL MOTORS CORP.

10. Install the EN 46105-1 to the right camshafts.

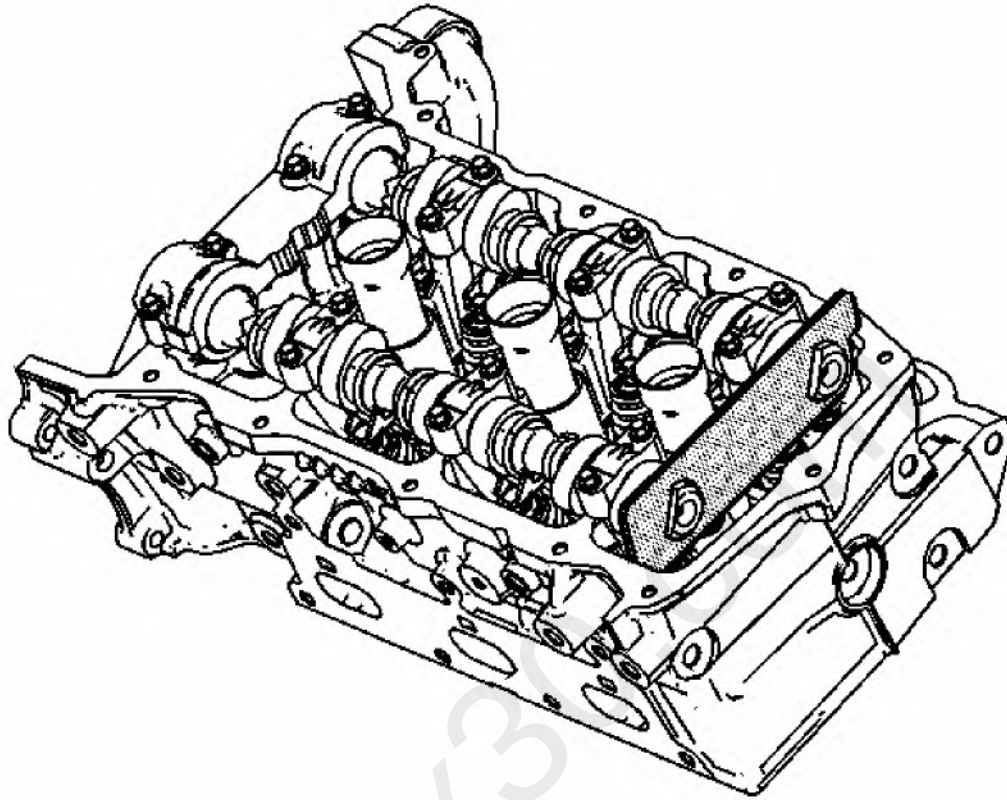


Fig. 195: EN 46105-2 Installed To Left Camshafts
Courtesy of GENERAL MOTORS CORP.

11. Install the EN 46105-2 to the left camshafts.

SECONDARY CAMSHAFT DRIVE CHAIN TENSIONER REMOVAL - RIGHT SIDE (SECOND DESIGN) - OFF VEHICLE

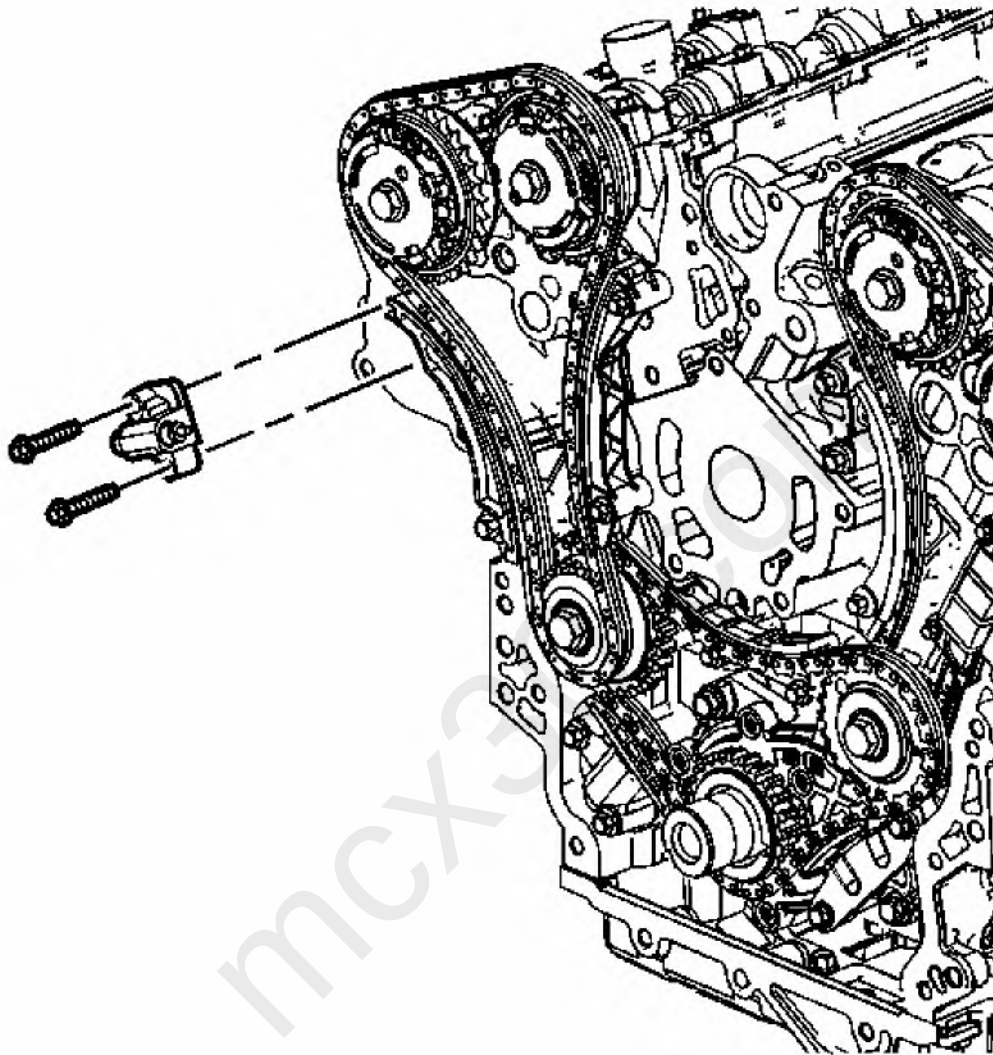


Fig. 196: Right Secondary Camshaft Drive Chain Tensioner
Courtesy of GENERAL MOTORS CORP.

1. Remove the right secondary camshaft drive chain tensioner bolts.
2. Remove the right secondary camshaft drive chain tensioner.

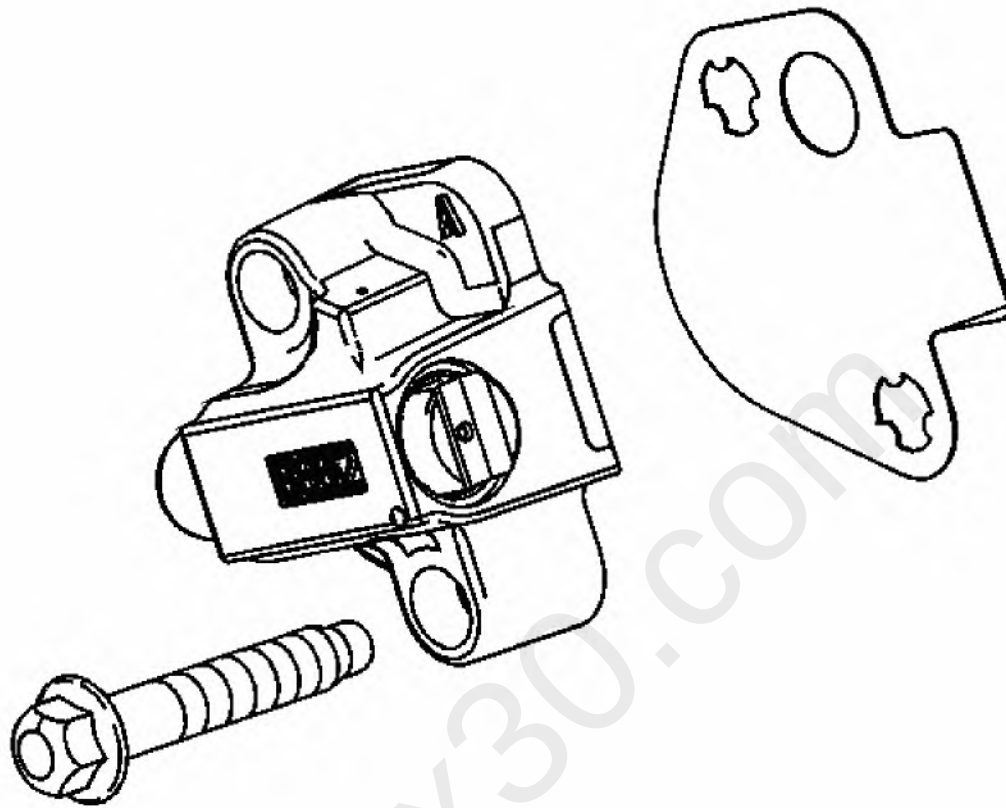


Fig. 197: Identifying Right Secondary Camshaft Drive Chain Tensioner Gasket
Courtesy of GENERAL MOTORS CORP.

3. Remove and discard the right secondary camshaft drive chain tensioner gasket.
4. Inspect the right secondary camshaft drive chain tensioner mounting surface on the right cylinder head for burrs or any defects that would degrade the sealing of the NEW right secondary camshaft drive chain tensioner gasket.

SECONDARY CAMSHAFT DRIVE CHAIN SHOE REMOVAL - RIGHT SIDE (SECOND DESIGN) - OFF VEHICLE

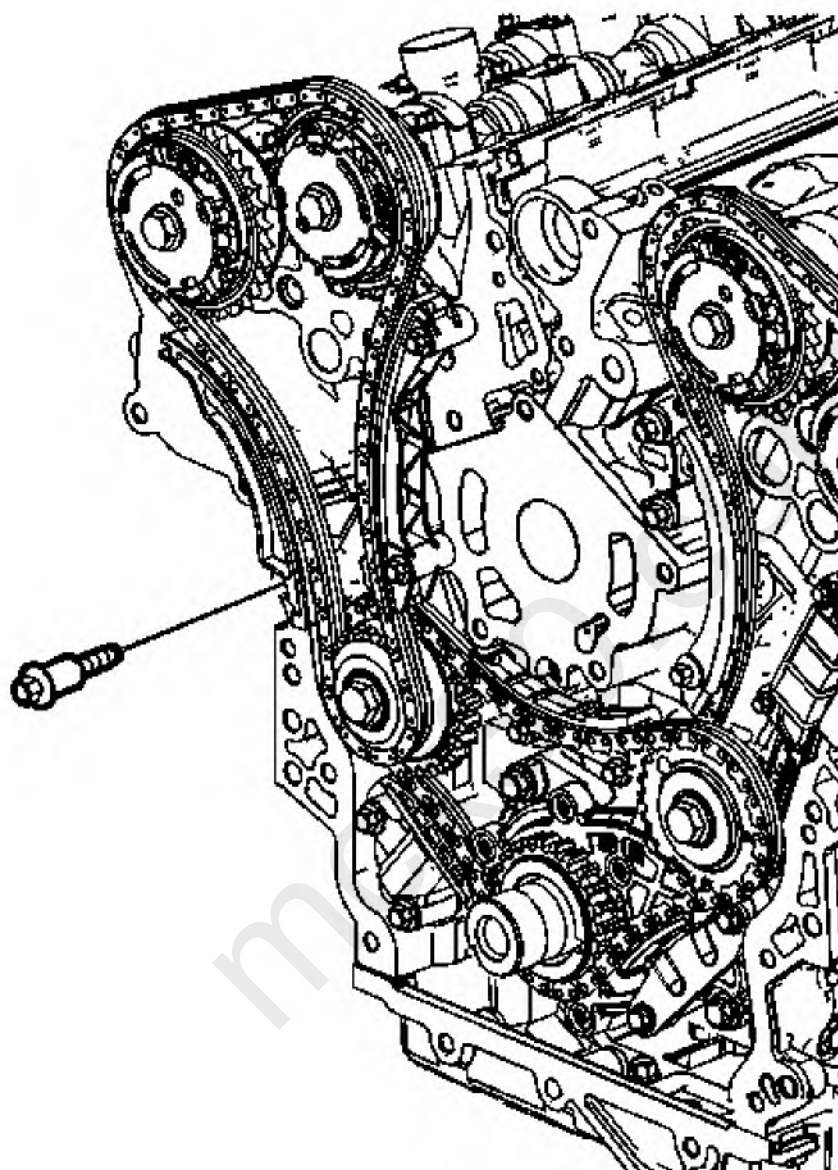


Fig. 198: Secondary Camshaft Drive Chain Shoe Bolt
Courtesy of GENERAL MOTORS CORP.

1. Remove the right secondary camshaft drive chain shoe bolt.

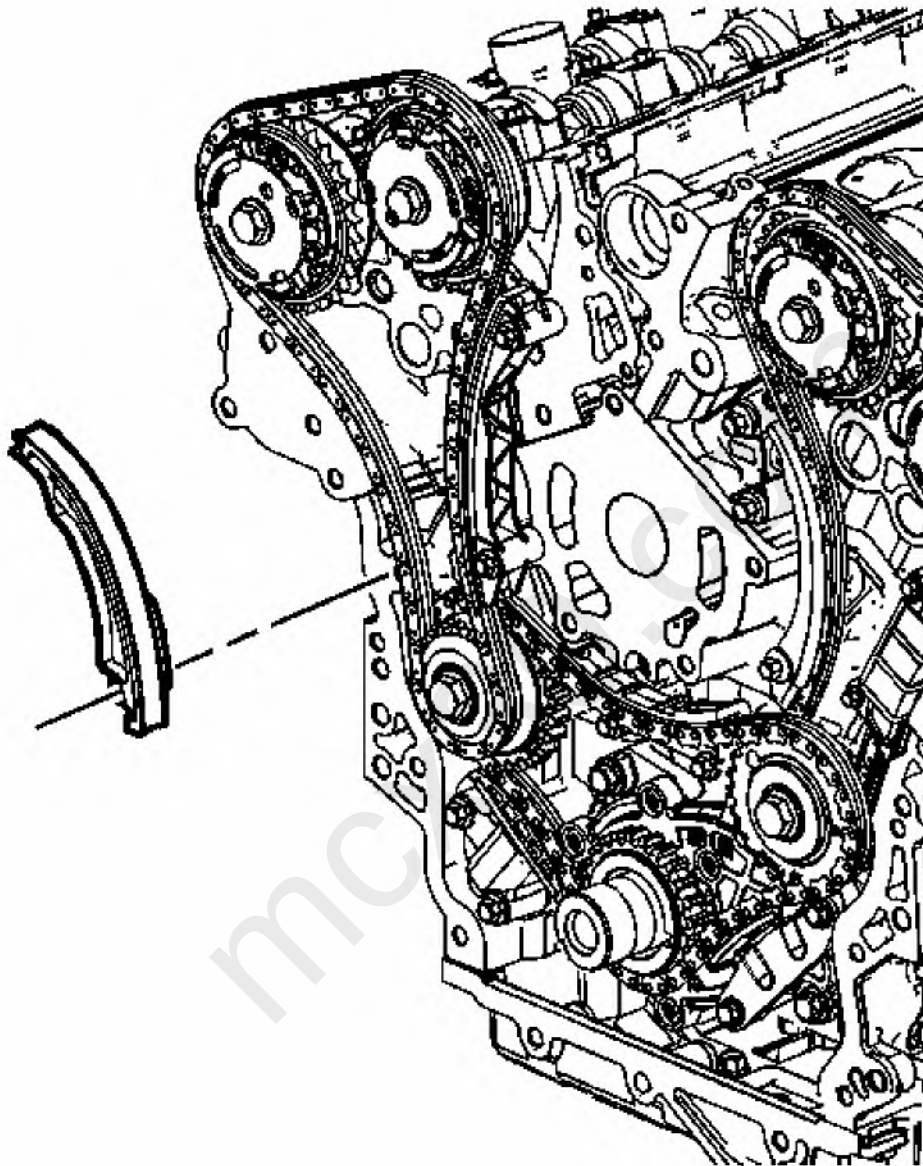


Fig. 199: Right Secondary Camshaft Drive Chain Shoe
Courtesy of GENERAL MOTORS CORP.

2. Remove the right secondary camshaft drive chain shoe.

SECONDARY CAMSHAFT DRIVE CHAIN GUIDE REMOVAL - RIGHT SIDE (SECOND DESIGN) - OFF VEHICLE

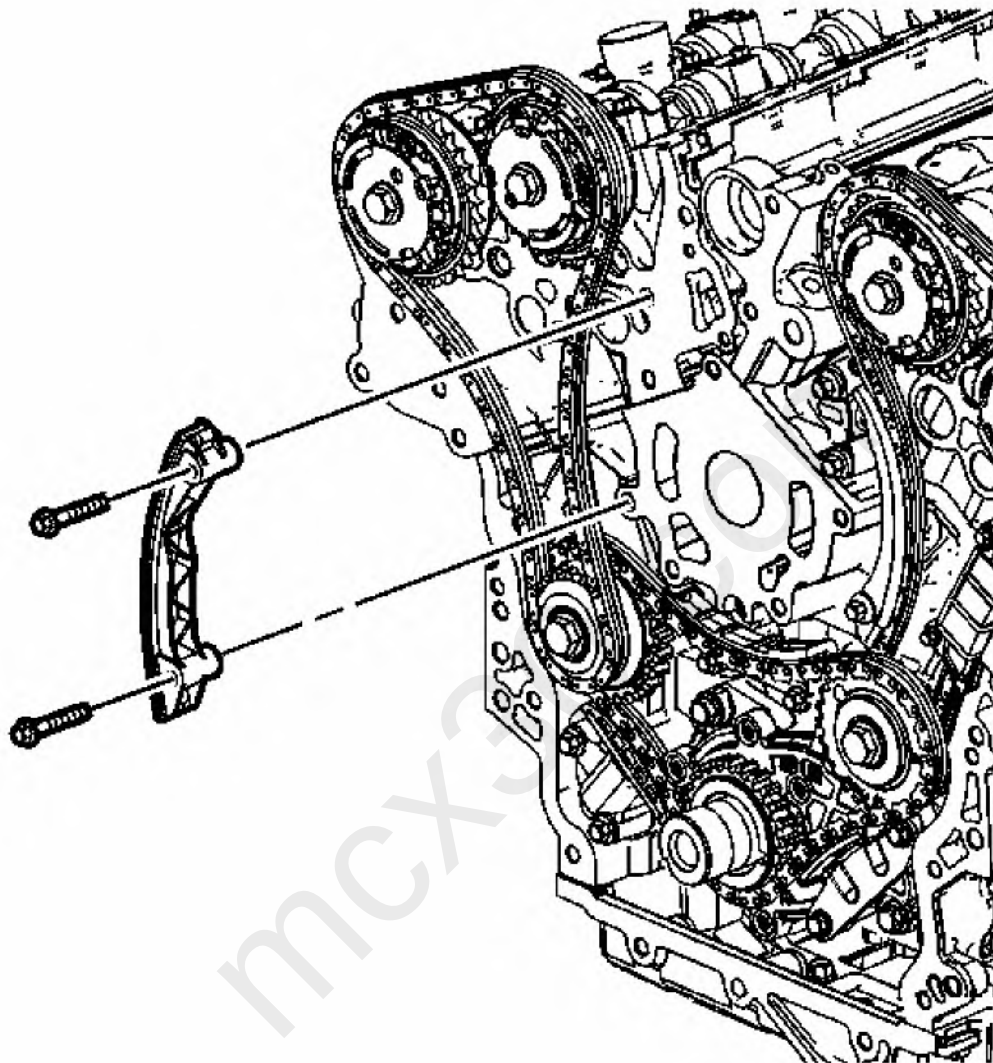


Fig. 200: Right Secondary Camshaft Drive Chain Guide
Courtesy of GENERAL MOTORS CORP.

1. Remove the right secondary camshaft drive chain guide bolts.
2. Remove the right secondary camshaft drive chain guide.

**SECONDARY CAMSHAFT DRIVE CHAIN REMOVAL - RIGHT SIDE
(SECOND DESIGN) - OFF VEHICLE**

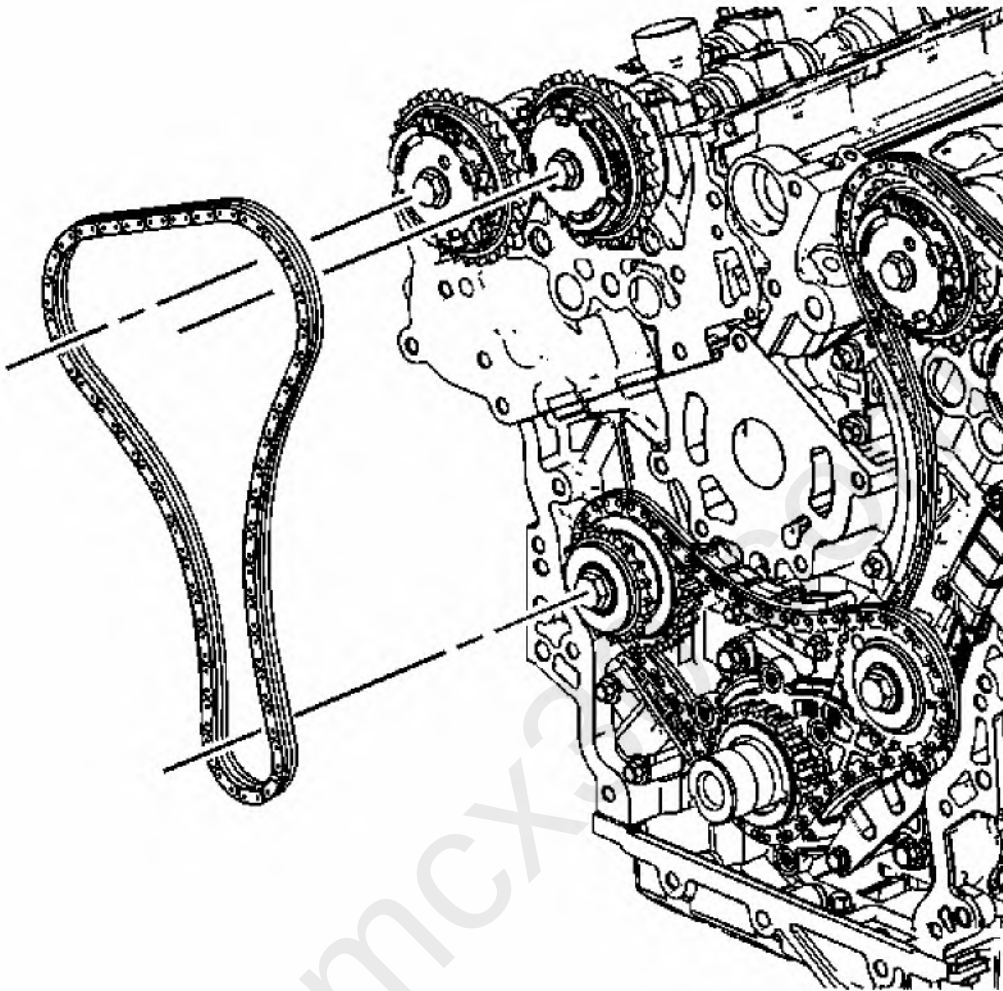


Fig. 201: Right Secondary Camshaft Drive Chain
Courtesy of GENERAL MOTORS CORP.

Remove the right secondary camshaft drive chain from the right camshaft position actuators and the right camshaft intermediate drive chain idler sprocket.

PRIMARY CAMSHAFT DRIVE CHAIN TENSIONER REMOVAL (SECOND DESIGN) - OFF VEHICLE

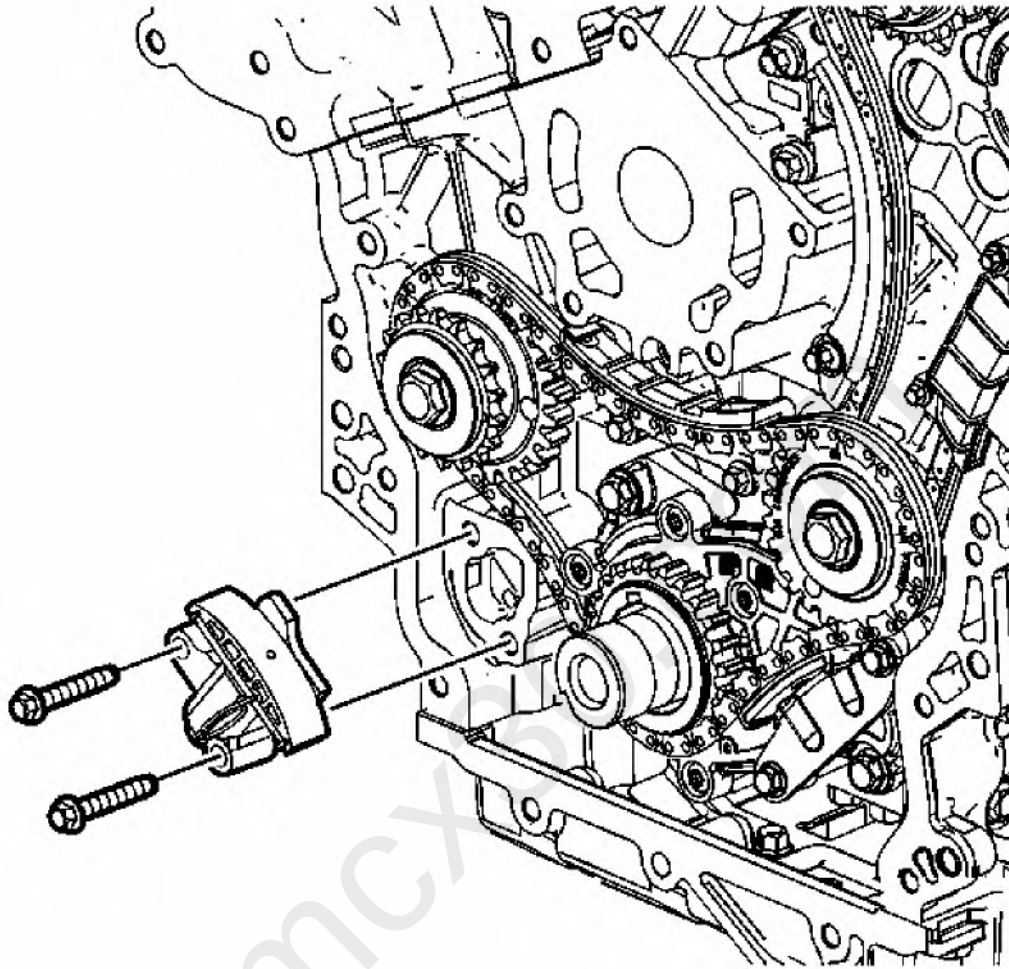


Fig. 202: Primary Camshaft Drive Chain Tensioner
Courtesy of GENERAL MOTORS CORP.

1. Remove the primary camshaft drive chain tensioner bolts.
2. Remove the primary camshaft drive chain tensioner.

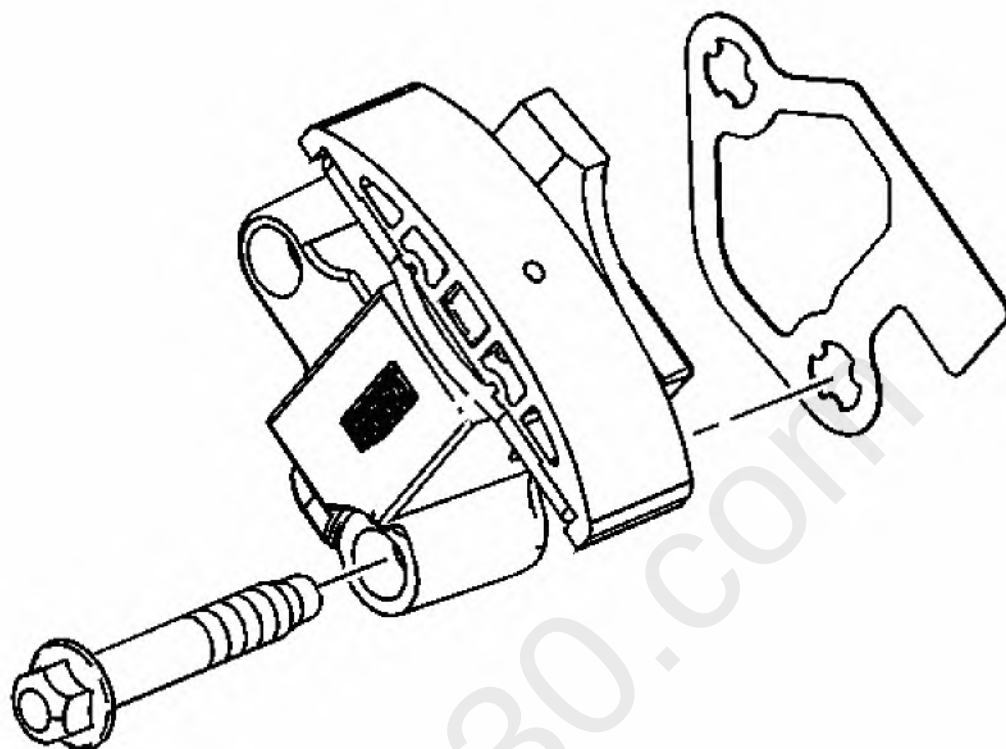


Fig. 203: Identifying Primary Camshaft Drive Chain Tensioner Gasket
Courtesy of GENERAL MOTORS CORP.

3. Remove and discard the primary camshaft drive chain tensioner gasket.
4. Inspect the primary camshaft drive chain tensioner mounting surface on the engine block for burrs or any defects that would degrade the sealing of the NEW primary camshaft drive chain tensioner gasket.

PRIMARY CAMSHAFT DRIVE CHAIN GUIDE REMOVAL - UPPER (SECOND DESIGN) - OFF VEHICLE

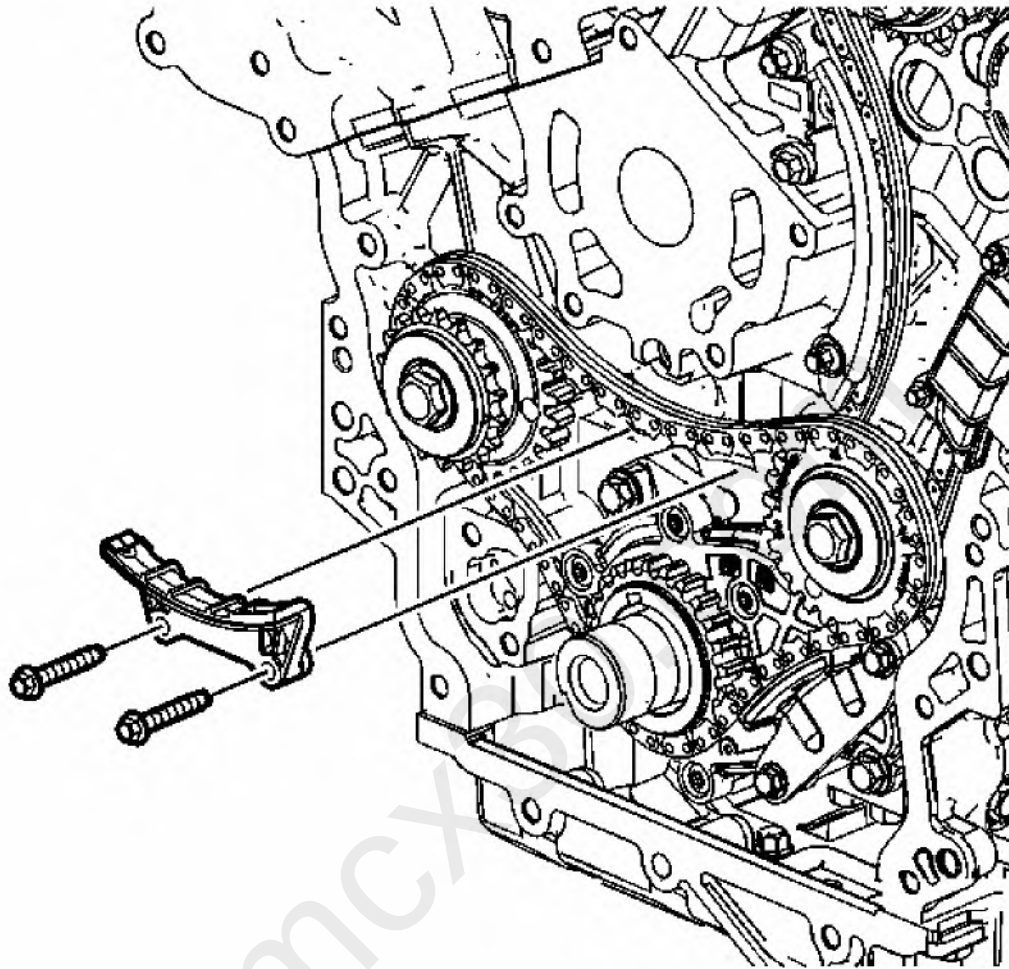


Fig. 204: Upper Primary Camshaft Drive Chain Guide
Courtesy of GENERAL MOTORS CORP.

1. Remove the primary camshaft drive chain upper guide bolts.
2. Remove the primary camshaft drive chain upper guides.

**PRIMARY CAMSHAFT DRIVE CHAIN GUIDE REMOVAL - LOWER
(SECOND DESIGN) - OFF VEHICLE**

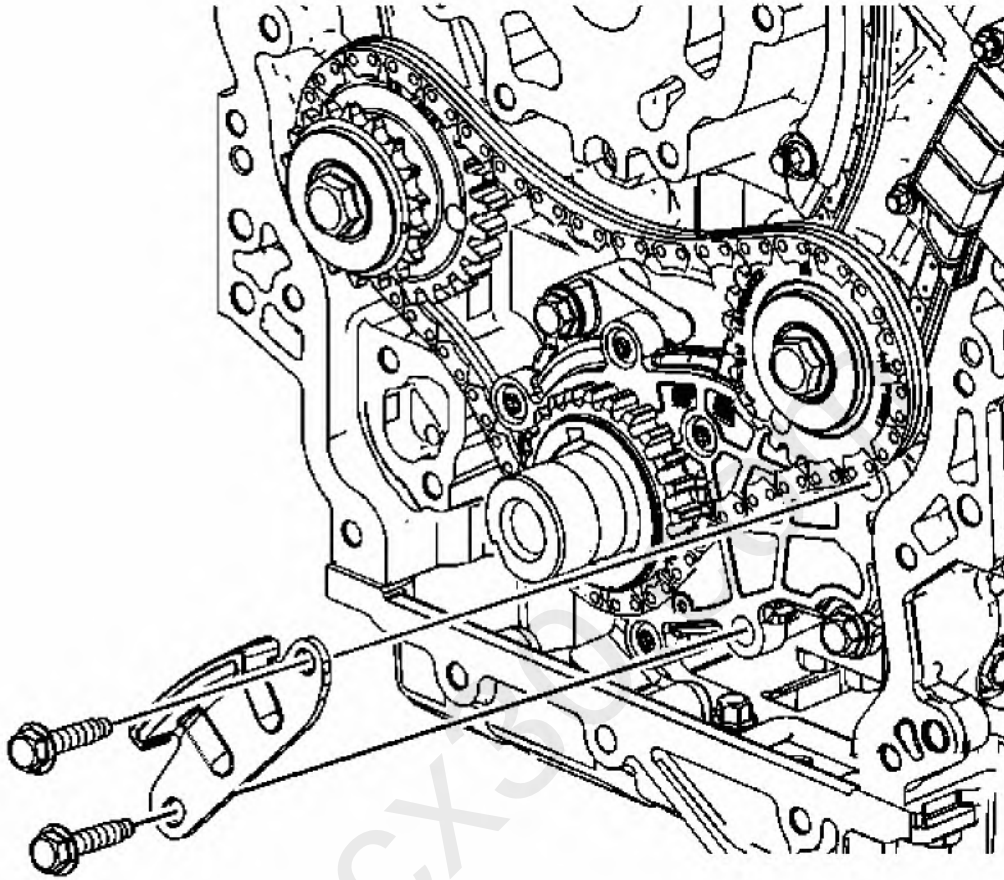


Fig. 205: Primary Camshaft Drive Chain Lower Guide
Courtesy of GENERAL MOTORS CORP.

1. Remove the primary camshaft drive chain lower guide bolts.
2. Remove the primary camshaft drive chain lower guide.

PRIMARY CAMSHAFT DRIVE CHAIN REMOVAL (SECOND DESIGN) - OFF VEHICLE

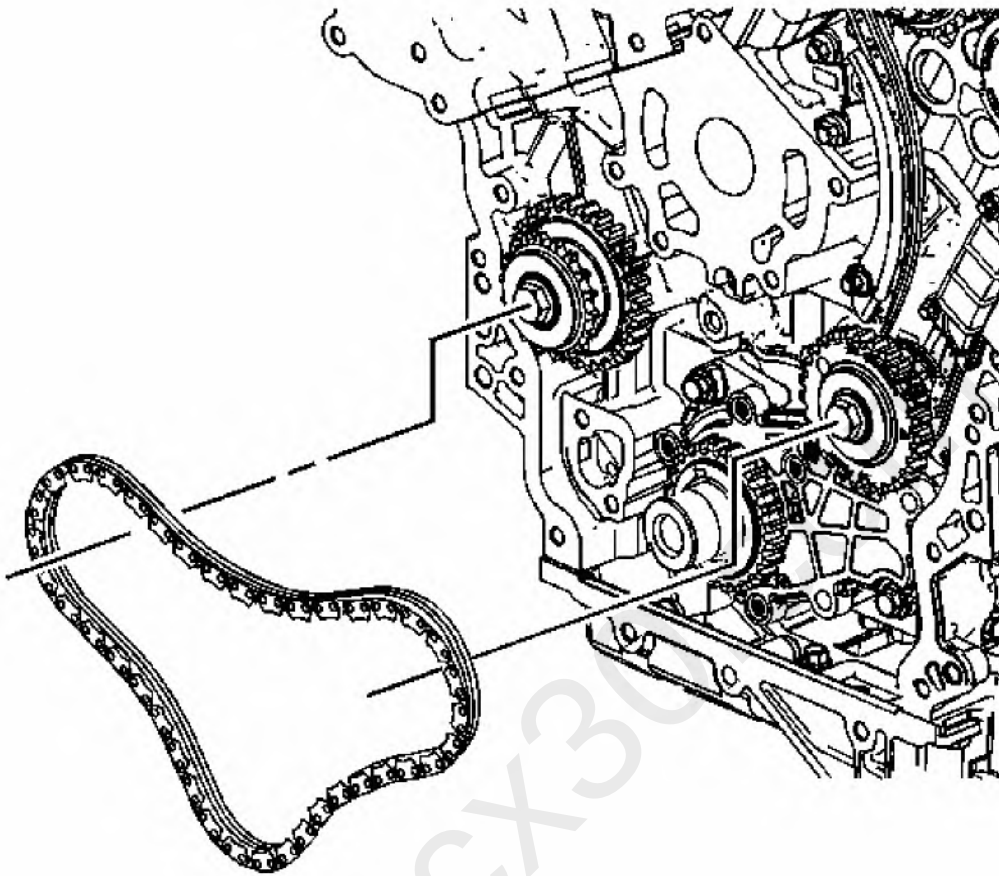


Fig. 206: Primary Camshaft Drive Chain
Courtesy of GENERAL MOTORS CORP.

Remove the primary camshaft drive chain.

**CAMSHAFT INTERMEDIATE DRIVE CHAIN IDLER REMOVAL - RIGHT
SIDE (SECOND DESIGN) - OFF VEHICLE**

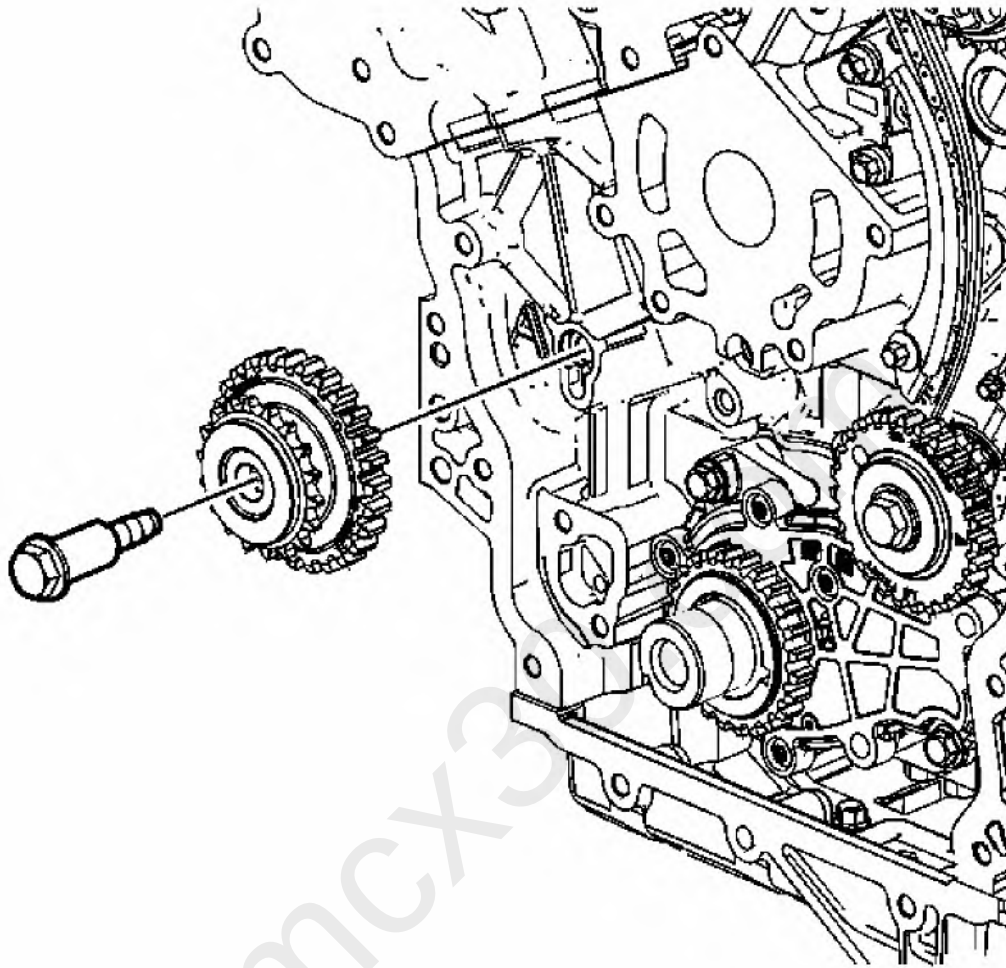


Fig. 207: Right Camshaft Intermediate Drive Chain Idler
Courtesy of GENERAL MOTORS CORP.

1. Remove the right camshaft intermediate drive chain idler bolt.
2. Remove the right camshaft intermediate drive chain idler.

SECONDARY CAMSHAFT DRIVE CHAIN TENSIONER REMOVAL - LEFT SIDE (SECOND DESIGN) - OFF VEHICLE

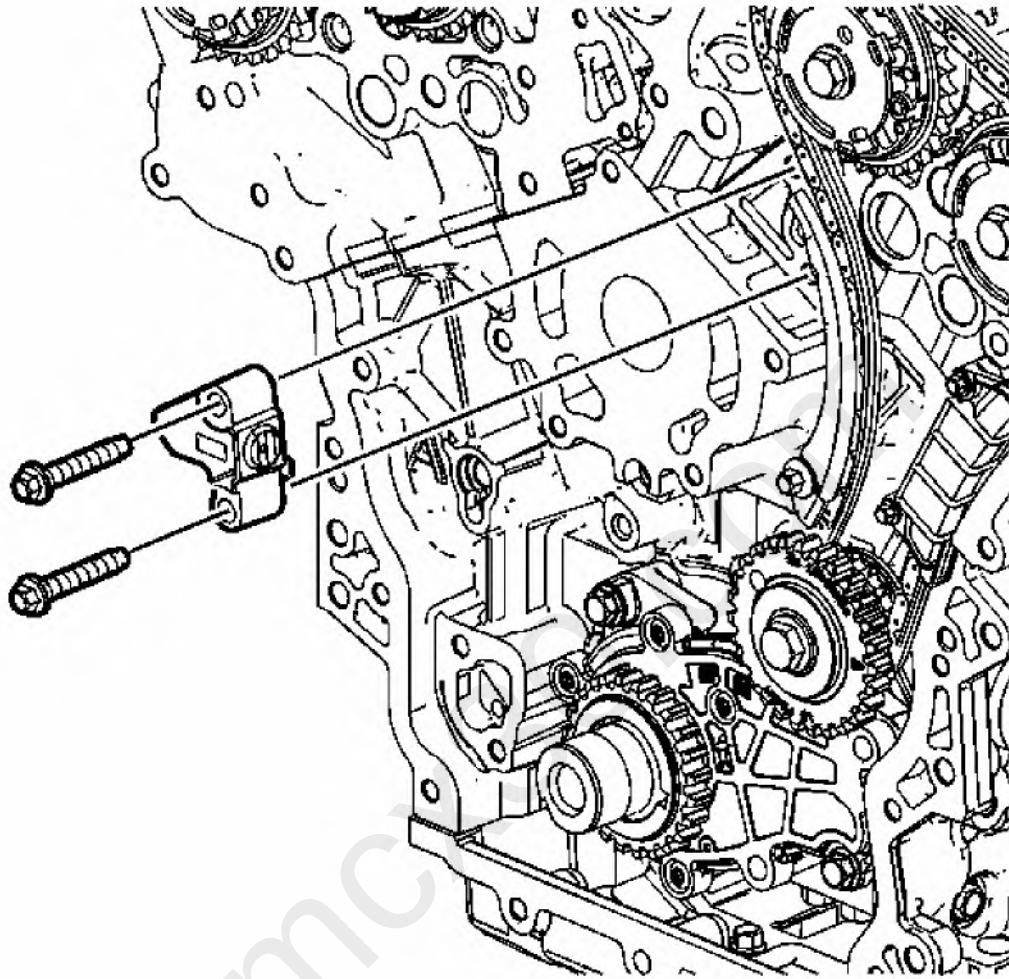


Fig. 208: Left Secondary Camshaft Drive Chain Tensioner
Courtesy of GENERAL MOTORS CORP.

1. Remove the left secondary camshaft drive chain tensioner bolts.
2. Remove the left secondary camshaft drive chain tensioner.

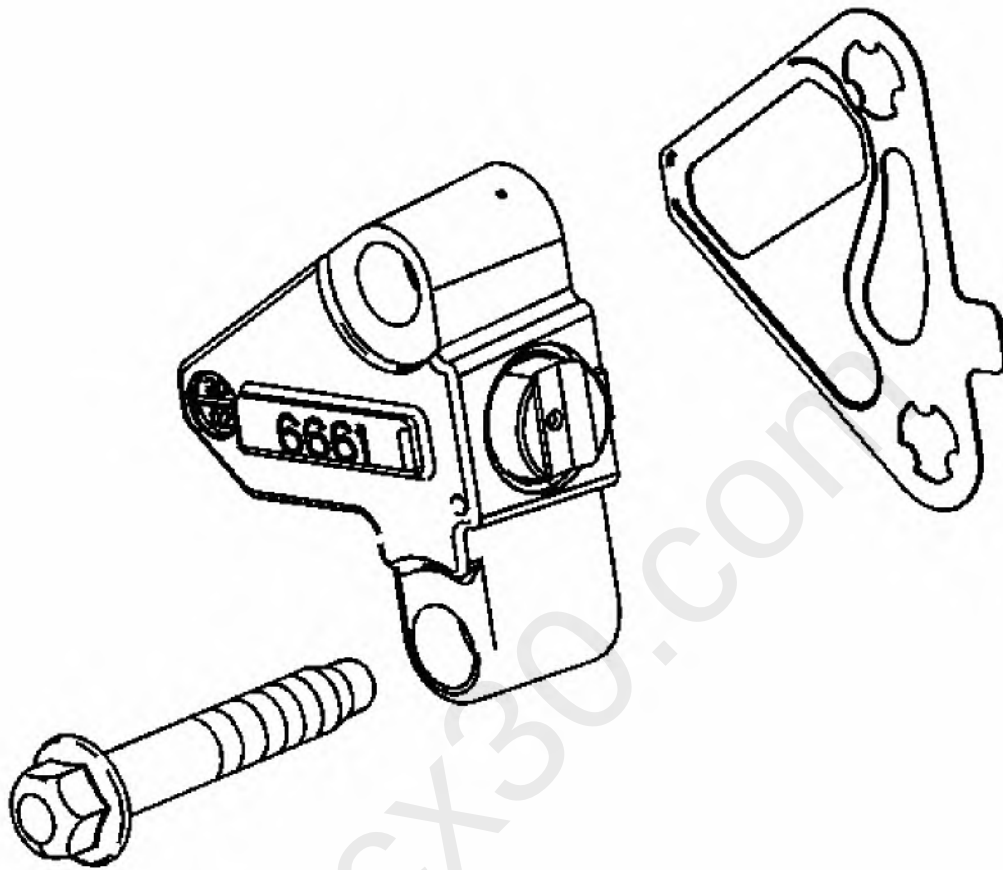


Fig. 209: Identifying Left Secondary Camshaft Drive Chain Tensioner Gasket
Courtesy of GENERAL MOTORS CORP.

3. Remove and discard the left secondary camshaft drive chain tensioner gasket.
4. Inspect the left secondary camshaft drive chain tensioner mounting surface on the left cylinder head for burrs or any defects that would degrade the sealing of the NEW left secondary camshaft drive chain tensioner gasket.

SECONDARY CAMSHAFT DRIVE CHAIN SHOE REMOVAL - LEFT SIDE (SECOND DESIGN) - OFF VEHICLE

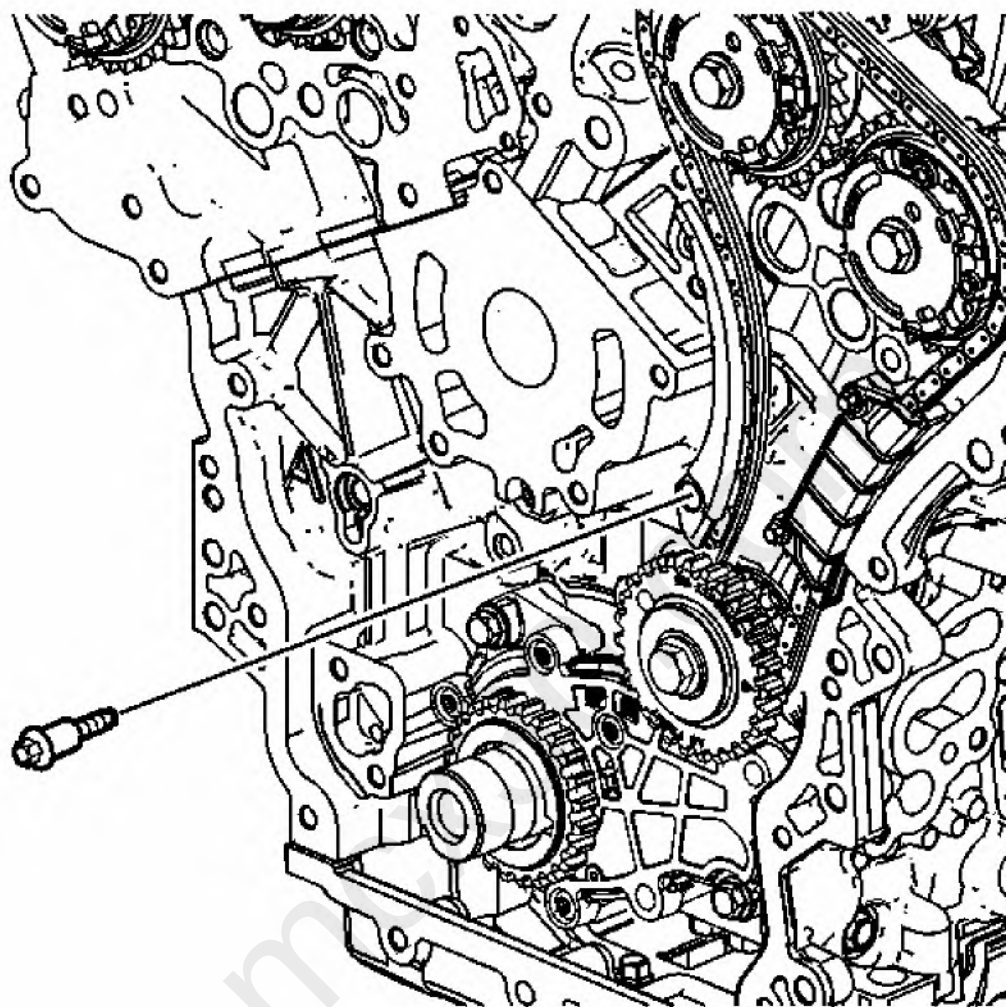


Fig. 210: Secondary Camshaft Drive Chain Shoe Bolt
Courtesy of GENERAL MOTORS CORP.

1. Remove the left secondary camshaft drive chain shoe bolt.

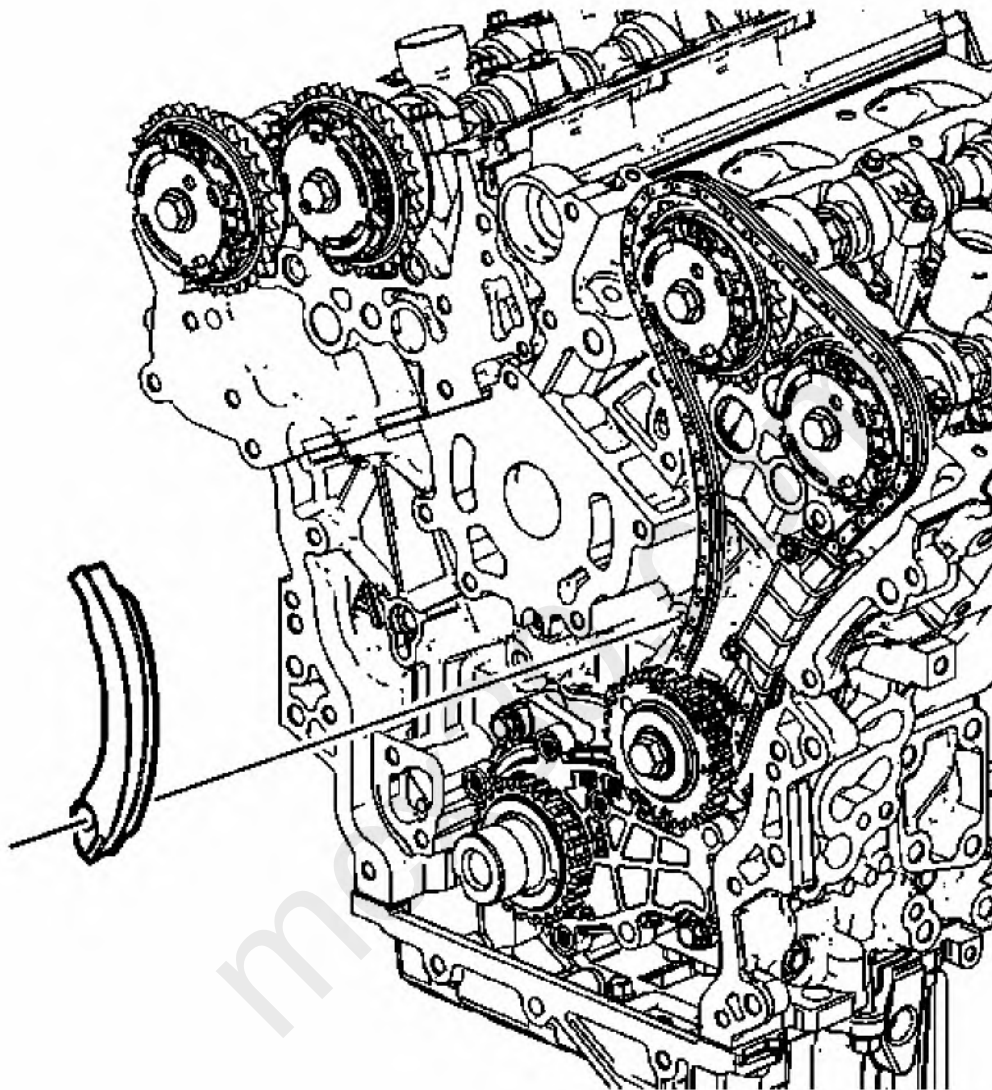


Fig. 211: Left Secondary Camshaft Drive Chain Shoe
Courtesy of GENERAL MOTORS CORP.

2. Remove the left secondary camshaft drive chain shoe.

**SECONDARY CAMSHAFT DRIVE CHAIN GUIDE REMOVAL - LEFT SIDE
(SECOND DESIGN) - OFF VEHICLE**

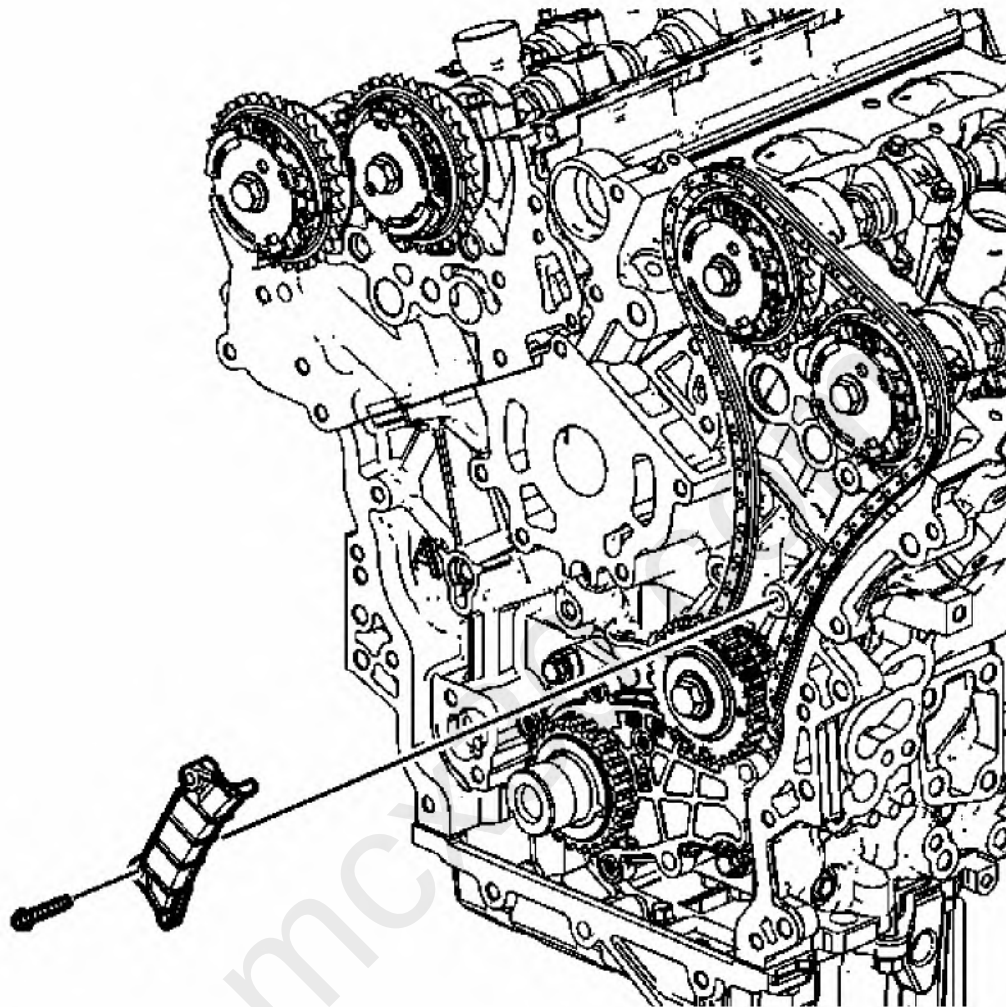


Fig. 212: Left Secondary Camshaft Drive Chain Guide
Courtesy of GENERAL MOTORS CORP.

1. Remove the left secondary camshaft drive chain guide bolts.
2. Remove the left secondary camshaft drive chain guide.

**SECONDARY CAMSHAFT DRIVE CHAIN REMOVAL - LEFT SIDE
(SECOND DESIGN) - OFF VEHICLE**

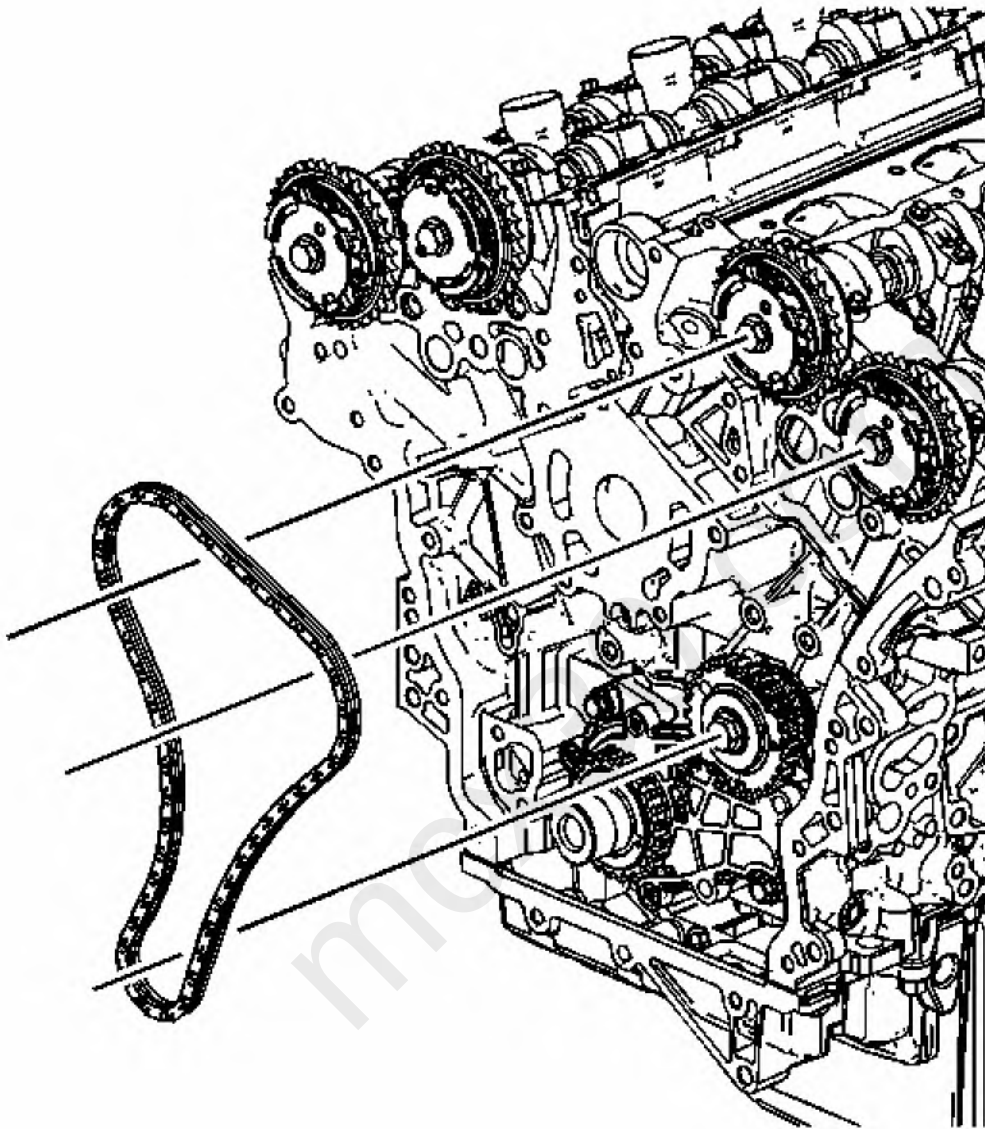


Fig. 213: Left Secondary Camshaft Drive Chain
Courtesy of GENERAL MOTORS CORP.

Remove the left secondary camshaft drive chain from the left camshaft position actuators and the left camshaft intermediate drive chain idler sprocket.

**CAMSHAFT INTERMEDIATE DRIVE CHAIN IDLER REMOVAL - LEFT SIDE
(SECOND DESIGN) - OFF VEHICLE**

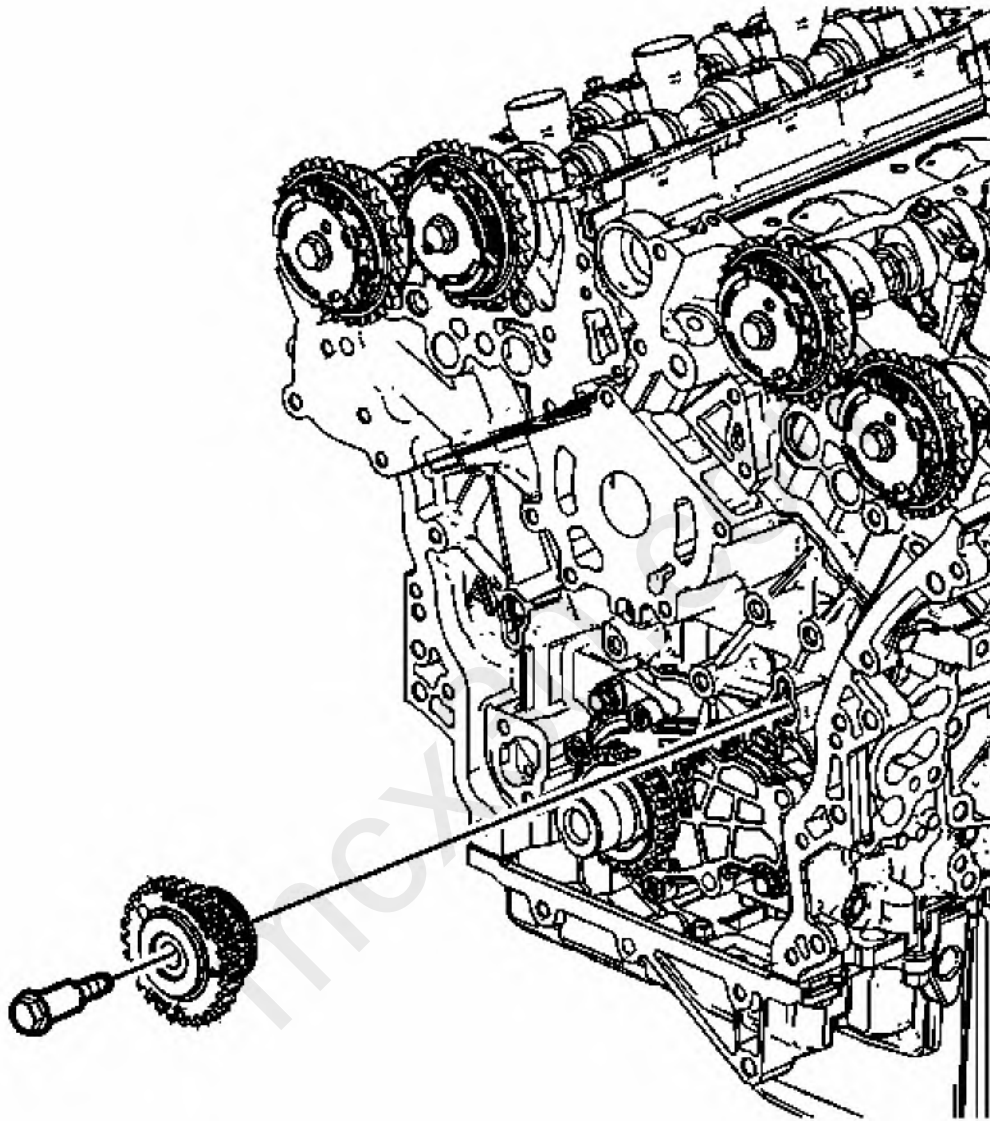


Fig. 214: Left Camshaft Intermediate Drive Chain Idler
Courtesy of GENERAL MOTORS CORP.

1. Remove the left camshaft intermediate drive chain idler bolt.
2. Remove the left camshaft intermediate drive chain idler.

CRANKSHAFT SPROCKET REMOVAL (SECOND DESIGN) - OFF VEHICLE

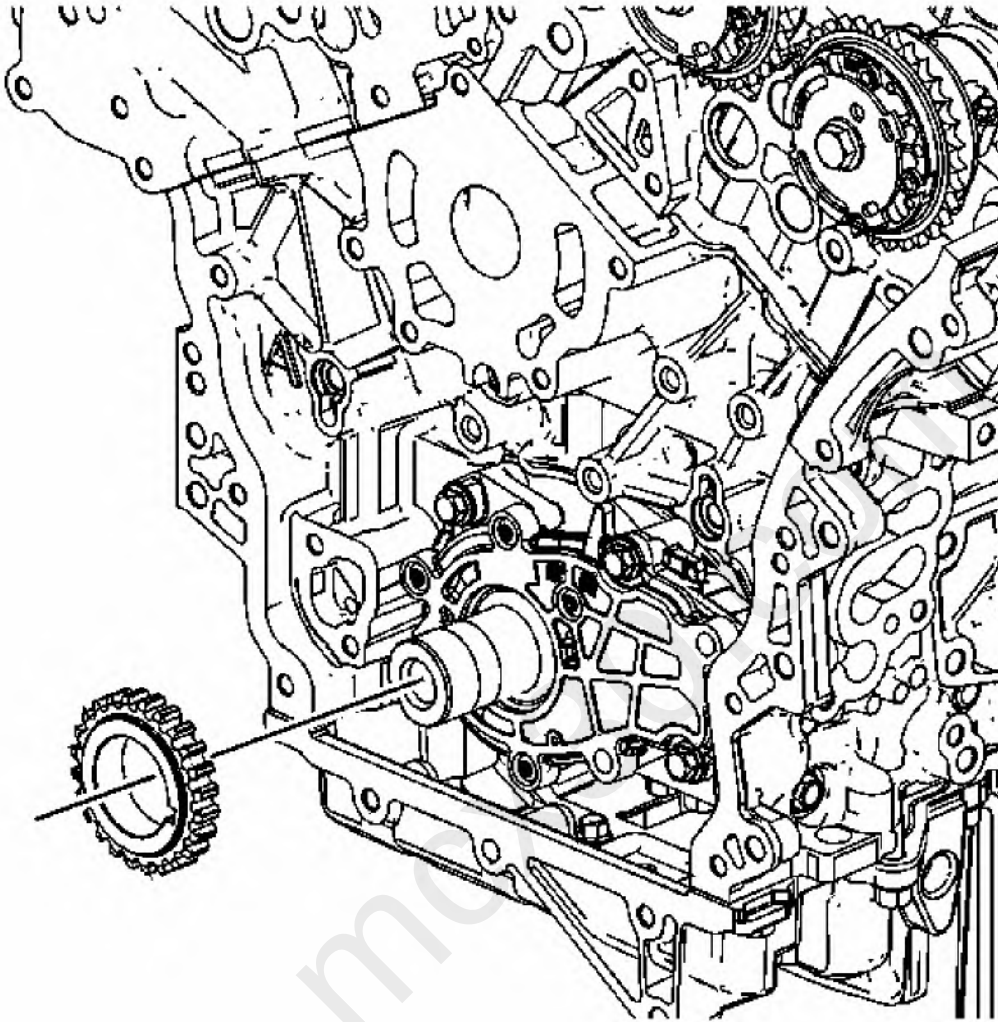


Fig. 215: Crankshaft Sprocket
Courtesy of GENERAL MOTORS CORP.

Remove the crankshaft sprocket from the nose of the crankshaft.

**CAMSHAFT POSITION ACTUATOR REMOVAL - LEFT SIDE EXHAUST
(SECOND DESIGN) - OFF VEHICLE**

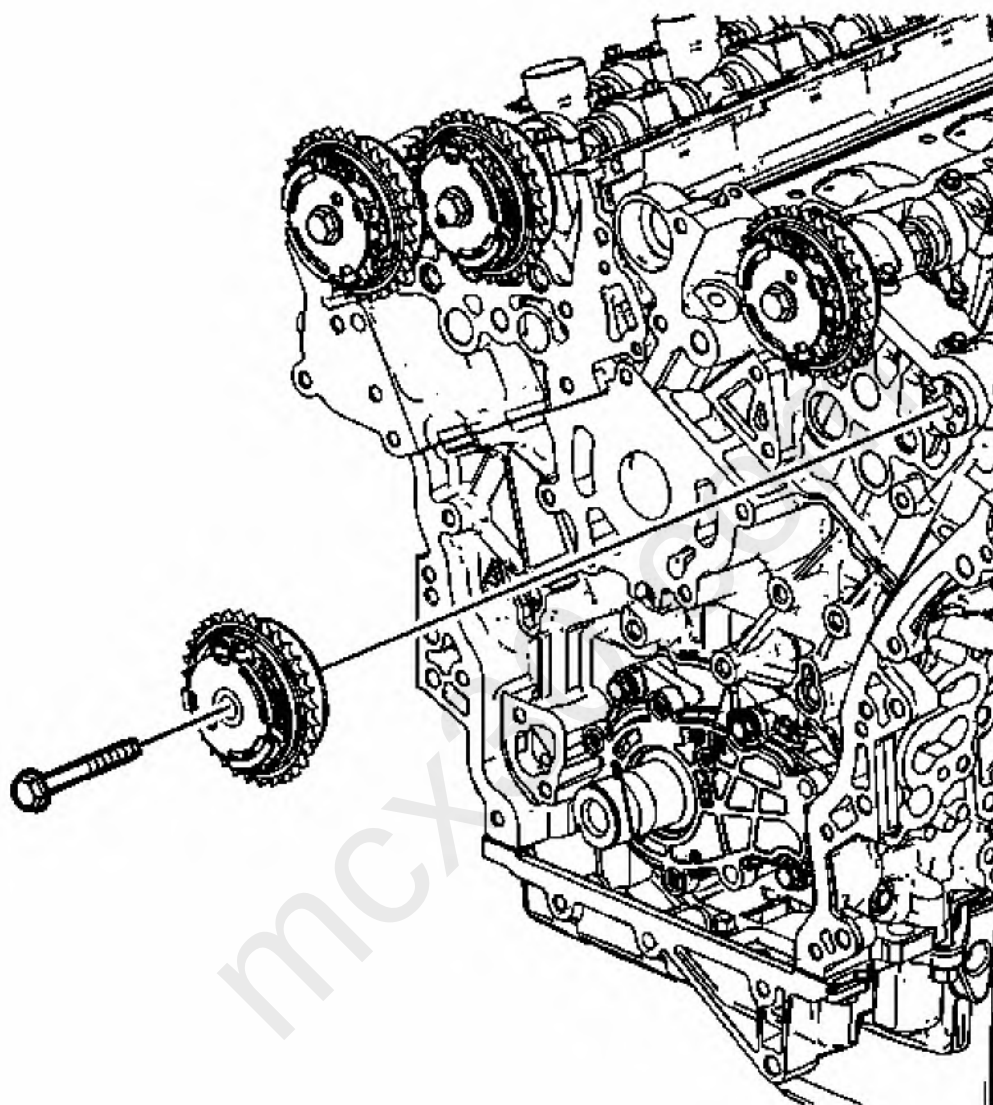


Fig. 216: Camshaft Position (CMP) Actuator
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

1. Use an open wrench on the hex cast into the camshaft in order to prevent engine rotation when loosening the camshaft position actuator bolt.
2. Remove the left exhaust camshaft position actuator bolt.
3. Remove the left exhaust camshaft position actuator.

CAMSHAFT POSITION ACTUATOR REMOVAL - LEFT SIDE INTAKE (SECOND DESIGN) - OFF VEHICLE

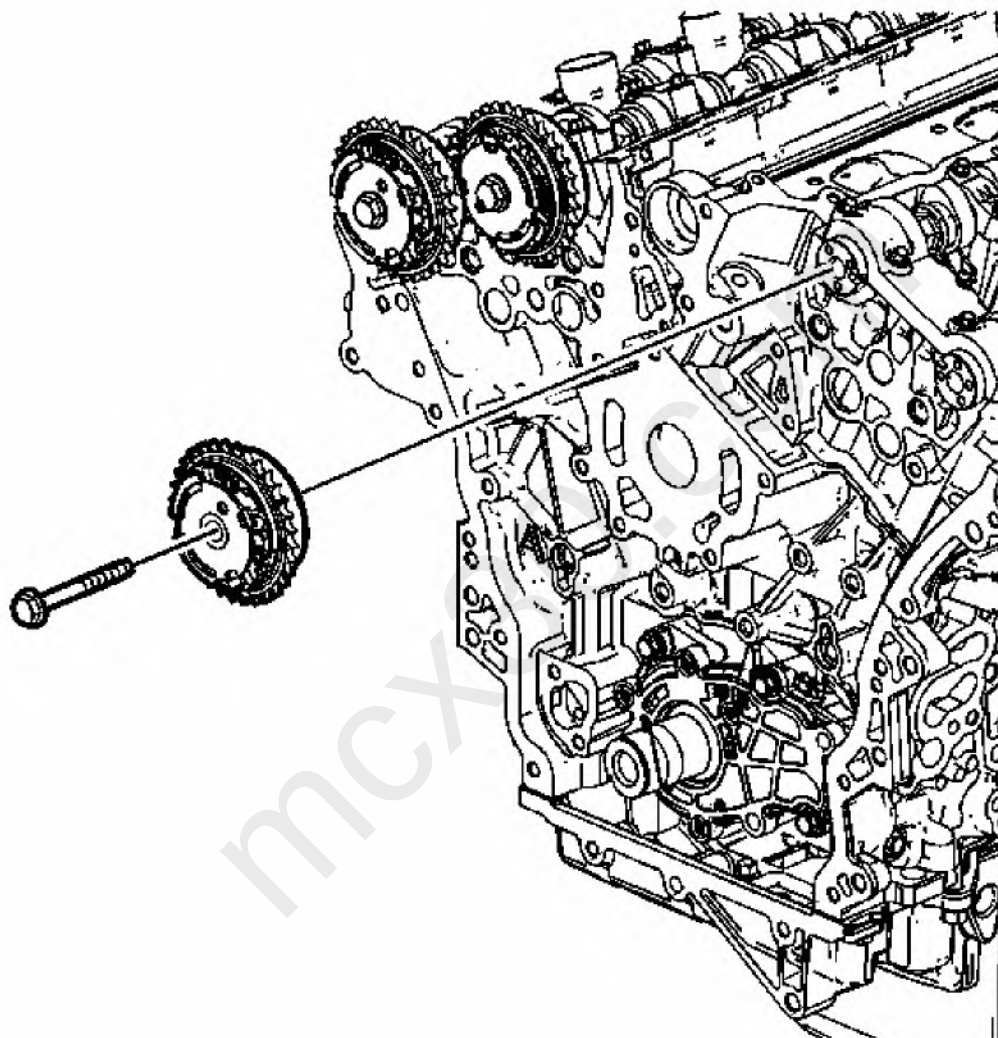


Fig. 217: Camshaft Position (CMP) Actuator
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

1. Use an open wrench on the hex cast into the camshaft in order to prevent engine rotation when loosening the camshaft position actuator bolt.
2. Remove the left intake camshaft position actuator bolt.
3. Remove the left intake camshaft position actuator.

CAMSHAFT POSITION ACTUATOR REMOVAL - RIGHT SIDE EXHAUST (SECOND DESIGN) - OFF VEHICLE

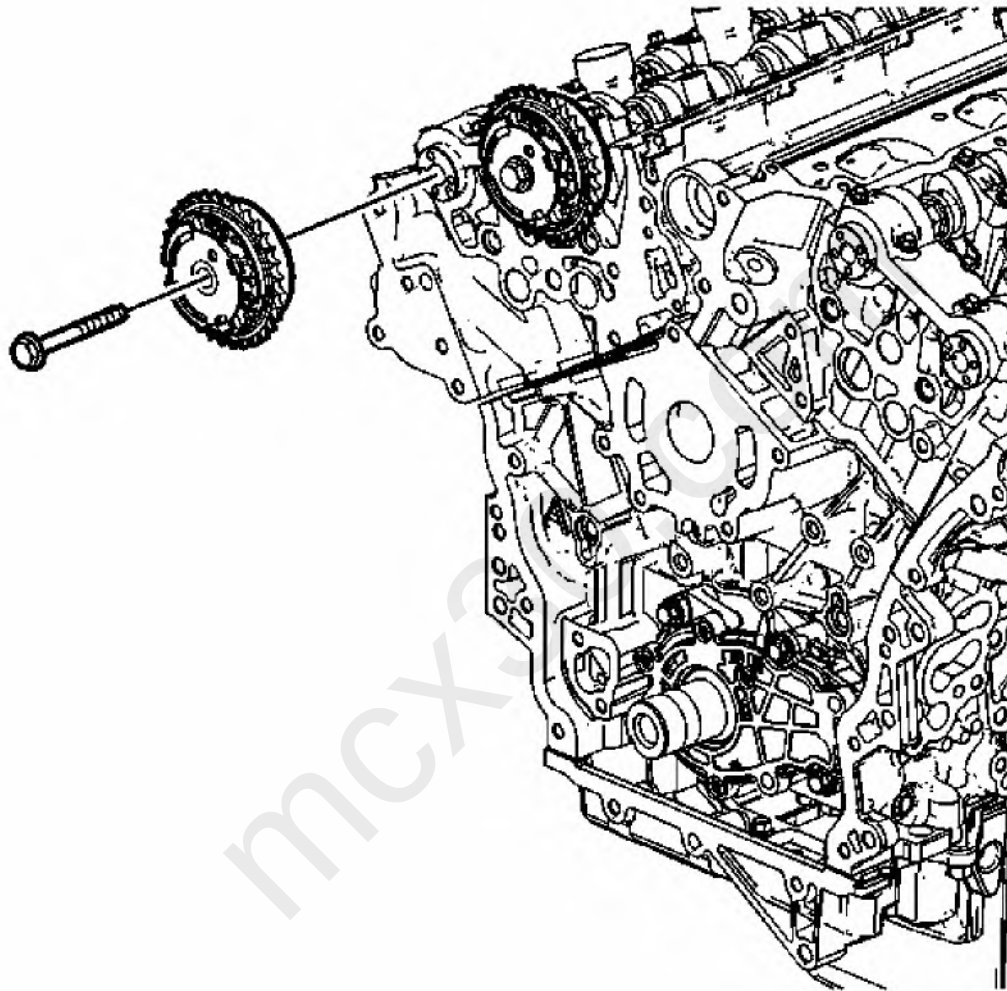


Fig. 218: Camshaft Position (CMP) Actuator
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

1. Use an open wrench on the hex cast into the camshaft in order to prevent engine rotation when loosening the camshaft position actuator bolt.
2. Remove the right exhaust camshaft position actuator bolt.
3. Remove the right exhaust camshaft position actuator.

CAMSHAFT POSITION ACTUATOR REMOVAL - RIGHT SIDE INTAKE (SECOND DESIGN) - OFF VEHICLE

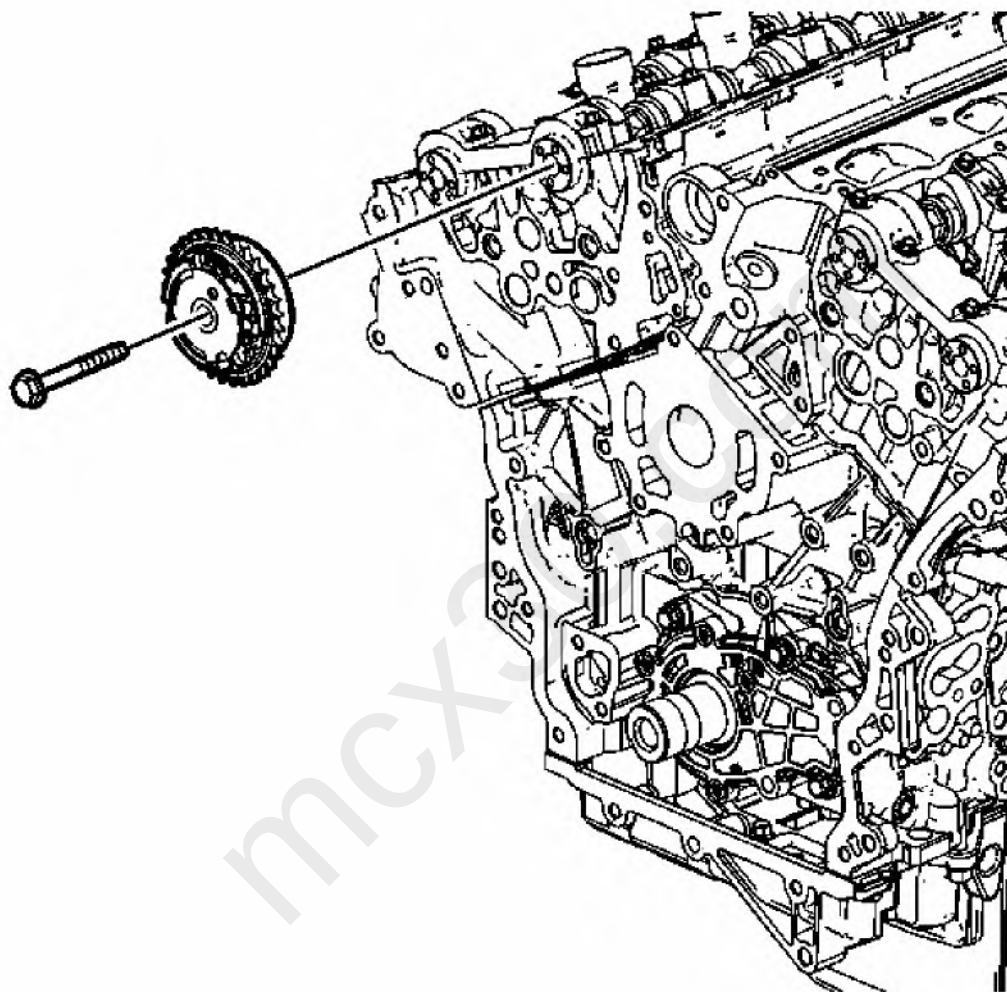


Fig. 219: Camshaft Position (CMP) Actuator
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

1. Use an open wrench on the hex cast into the camshaft in order to prevent engine rotation when loosening the camshaft position actuator bolt.
2. Remove the right intake camshaft position actuator bolt.
3. Remove the right intake camshaft position actuator.