2008 ENGINE

Engine Electrical - Cab & Chassis Sierra, Cab & Chassis Silverado, Sierra & Silverado

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	Specification	
	Metric	English
Air Conditioning (A/C) Compressor/Condenser Hose Bracket Bolt (4.3L)	25 N.m	18 lb ft
Auxiliary Battery Hold Down Bolt (6.2L, 6.6L)	25 N.m	18 lb ft
Auxiliary Battery Negative Cable Ground to Cylinder Head Bolt (6.2L)	25 N.m	18 lb ft
Auxiliary Battery Positive Cable Nut (6.2L)	7.5 N.m	66 lb in
Auxiliary Battery Positive Cable to Auxiliary Battery Relay Nut (6.2L)	9 N.m	80 lb in
Auxiliary Battery Positive Cable to Auxiliary Relay Nut (6.2L)	7.5 N.m	66 lb in
Auxiliary Battery Positive Cable to Mega Fuse Holder Nut (6.2L)	9 N.m	80 lb in
Auxiliary Battery Positive Cable to Underhood Junction Block Nut (6.2L)	5 N.m	44 lb in
Auxiliary Battery Relay Nut (6.2L)	9 N.m	80 lb in
Auxiliary Battery Tray Bolt (6.2L, 6.6L)	9 N.m	80 lb in
Auxiliary Generator Bolt (6.6L)	50 N.m	37 lb ft
Auxiliary Generator Bracket Bolt (6.6L)	50 N.m	37 lb ft
Auxiliary Negative Battery Cable Nut (6.2L, 6.6L)	7.5 N.m	66 lb in
Battery Hold Down Retainer Bolt	25 N.m	18 lb ft
Battery Tray to Battery Tray Bracket Nut	20 N.m	15 lb ft
Battery Tray to Front Fender Inner Panel Nut	9 N.m	80 lb in
Battery Tray Front Support Bolt	20 N.m	15 lb ft
Engine Ground Strap to Cylinder Head Bolt	16 N.m	12 lb ft
Engine Ground Strap to Front Plenum Panel Nut	9 N.m	80 lb in
Engine Wiring Harness to Generator Bracket Clip Bolt (6.6L)	10 N.m	89 lb in

Engine Wiring Harness to Generator Nut (4.3L, 6.6L)	9 N.m	80 lb in
Engine Wiring Harness Ground to Engine Block Bolt (6.6L)	25 N.m	18 lb ft
Engine Wiring Harness Clip to Generator Bracket Bolt (4.8L, 5.3L, 6.0L, 6.2L)	9 N.m	80 lb in
Engine Wiring Harness Lead Nut	3.4 N.m	30 lb in
Forward Lamp Wiring Harness Ground Bolt	25 N.m	18 lb ft
Front Fender Rear Upper Brace Bolt	9 N.m	80 lb in
Fuel Feed Pipe Bracket Bolt (6.6L)	24 N.m	18 lb ft
Generator Battery Jumper Cable to Generator Nut (4.8L, 5.3L, 6.0L, 6.2L)	9 N.m	80 lb in
Generator Battery Jumper Cable to Mega Fuse Nut (4.8L, 5.3L, 6.0L, 6.2L)	9 N.m	80 lb in
Generator Bolt (4.3L, 6.6L)	50 N.m	37 lb ft
Generator Bolt (4.8L, 5.3L, 6.0L, 6.2L)	55 N.m	41 lb ft
Generator Bracket Bolt (4.8L, 5.3L, 6.0L, 6.2L, 6.6L)	50 N.m	37 lb ft
Generator Bracket Bolt/Nut (4.3L)	41 N.m	30 lb ft
Heater Inlet Hose to Fuel Filter Adapter Nut (6.6L)	9 N.m	80 lb in
Heater Inlet Hose Bracket to Generator Bracket Nut (6.6L)	9 N.m	80 lb in
Heater Outlet Hose Clamp Bolt (4.3L)	25 N.m	18 lb ft
Idler Pulley Bolt (6.6L)	50 N.m	37 lb ft
M Terminal Stud Nut (6.6L)	8 N.m	71 lb in
Negative Battery Cable to Engine Block Bolt (4.3L)	25 N.m	18 lb ft
Negative Battery Cable Nut (w/Dual Batteries)	7.5 N.m	66 lb in
Negative Battery Cable Nut (Primary)	5 N.m	44 lb in
Negative Battery Cable to Cylinder Head Stud (4.8L, 5.3L, 6.0L, 6.2L)	25 N.m	18 lb ft
Oil Level Indicator Tube Bolt (6.6L)	21 N.m	15 lb ft
Oil Level Indicator Tube Bracket Bolt (6.6L)	21 N.m	15 lb ft
Oil Pan Skid Plate Bolt	28 N.m	21 lb ft
Positive Battery Cable Clip Nut (6.6L)	3 N.m	27 lb in
Positive Battery Cable to Mega Fuse Nut (6.6L)	7.5 N.m	66 lb in
Starter Motor Bolt (4.3L, 4.8L, 5.3L, 6.0L, 6.2L)	50 N.m	37 lb ft

Starter Solenoid Bolt (6.6L)	10 N.m	89 lb in
Starter Solenoid Cable Clip Bolt (4.3L, 4.8L, 5.3L, 6.0L, 6.2L)	10 N.m	89 lb in
Starter Solenoid Cable to Battery Nut	5 N.m	44 lb in
Starter Solenoid Cable Bracket Nut (6.6L)	8 N.m	71 lb in
Starter Solenoid Cable Channel Bolt (6.6L)	12 N.m	106 lb in
Starter Solenoid Cable to Engine Block Bolt (6.6L)	25 N.m	18 lb ft
Starter Solenoid Cable to Frame Bolt (6.6L)	25 N.m	18 lb ft
Starter Solenoid Cable Clip to Frame Bolt (6.6L)	16 N.m	12 lb ft
Starter Solenoid Cable to Mega Fuse Nut (4.3L, 4.8L, 5.3L, 6.0L, 6.2L)	9 N.m	80 lb in
Starter Solenoid Cable Nut	5 N.m	44 lb in
Starter Solenoid Cable to Positive Battery Nut (6.6L)	7.5 N.m	66 lb in
Starter Solenoid Cable to Starter Nut (6.6L)	9 N.m	80 lb in
Transmission Cover Bolt (4.8L, 5.3L, 6.0L, 6.2L)	9 N.m	80 lb in

BATTERY USAGE

Light Duty and Auxiliary Batteries

Cold Cranking Amperage (CCA)	615 A
Reserve Capacity Rating	120 Minutes
Replacement Battery Number	48-6YR

Heavy Duty, Snow Plow, and Dual Generators

Cold Cranking Amperage (CCA)	765 A
Reserve Capacity Rating	120 Minutes
Replacement Battery Number	48-7YR

GENERATOR USAGE

145-Amp Generator (KG3)

Generator Model	Remy DR44M
Rated Output	145 A
Load Test Output	102 A

160-Amp Generator (KW1)

Generator Model	Remy DR44M
Rated Output	160 A
Load Test Output	112 A

SCHEMATIC AND ROUTING DIAGRAMS

STARTING AND CHARGING SCHEMATICS

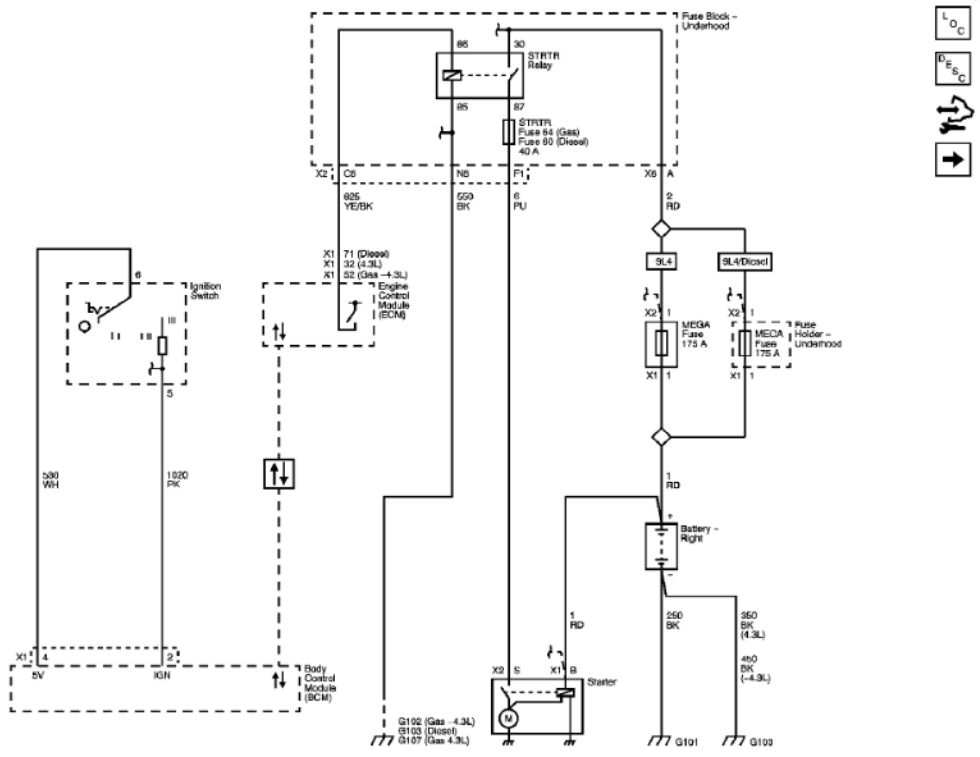


Fig. 1: Starting
Courtesy of GENERAL MOTORS CORP.

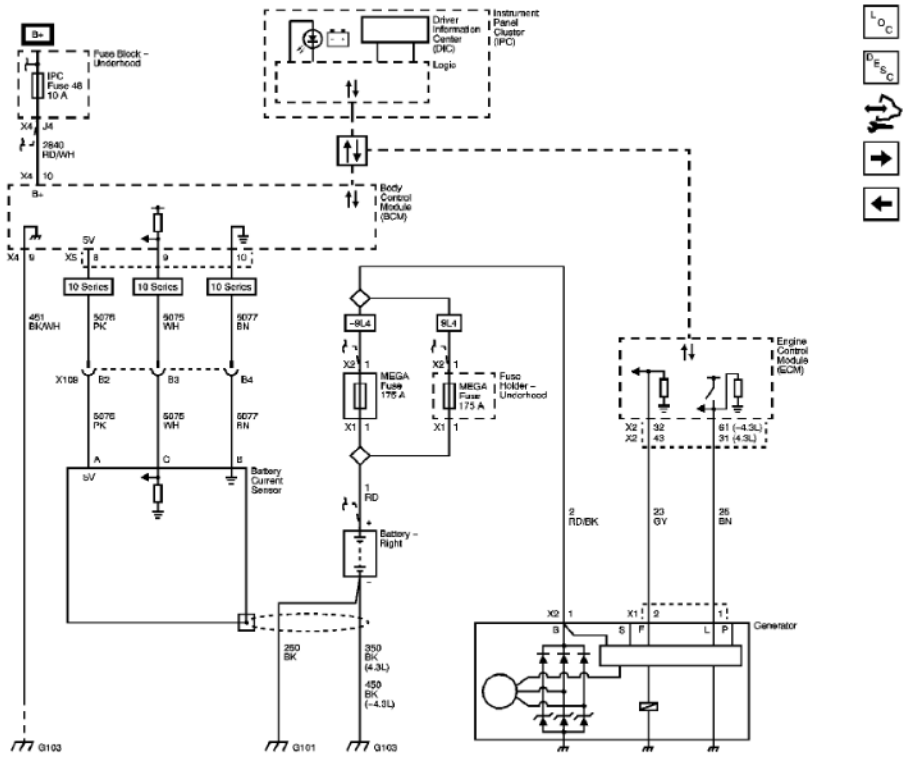


Fig. 2: Charging (Gas)
Courtesy of GENERAL MOTORS CORP.

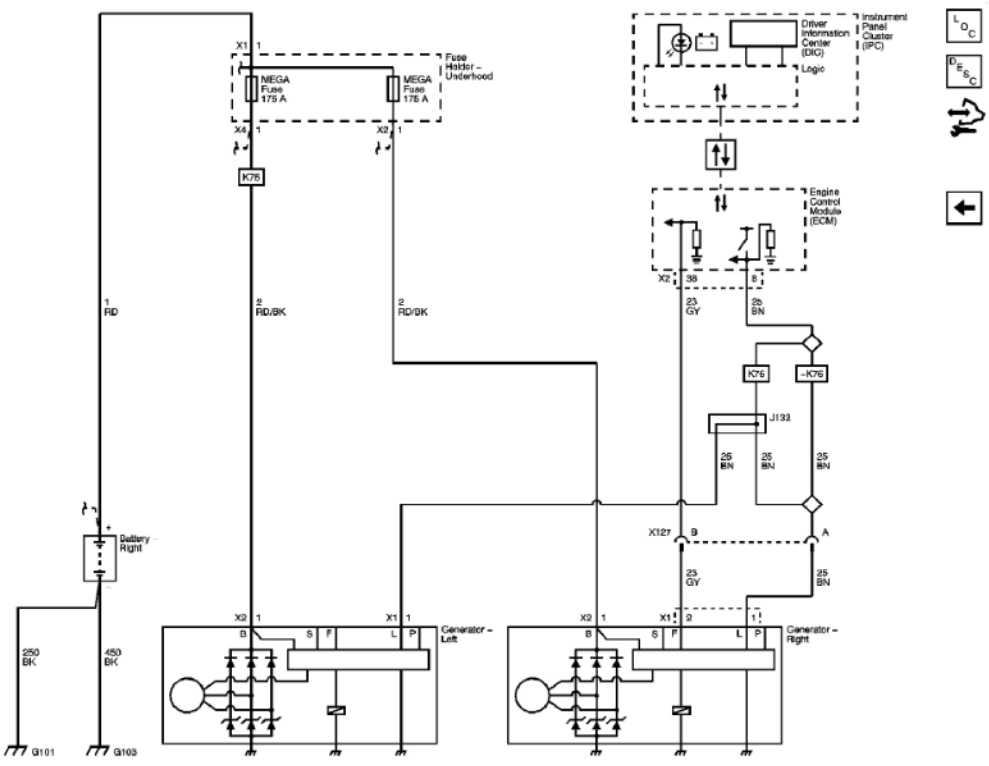


Fig. 3: Charging (Diesel)
Courtesy of GENERAL MOTORS CORP.

AUXILIARY BATTERY SCHEMATICS

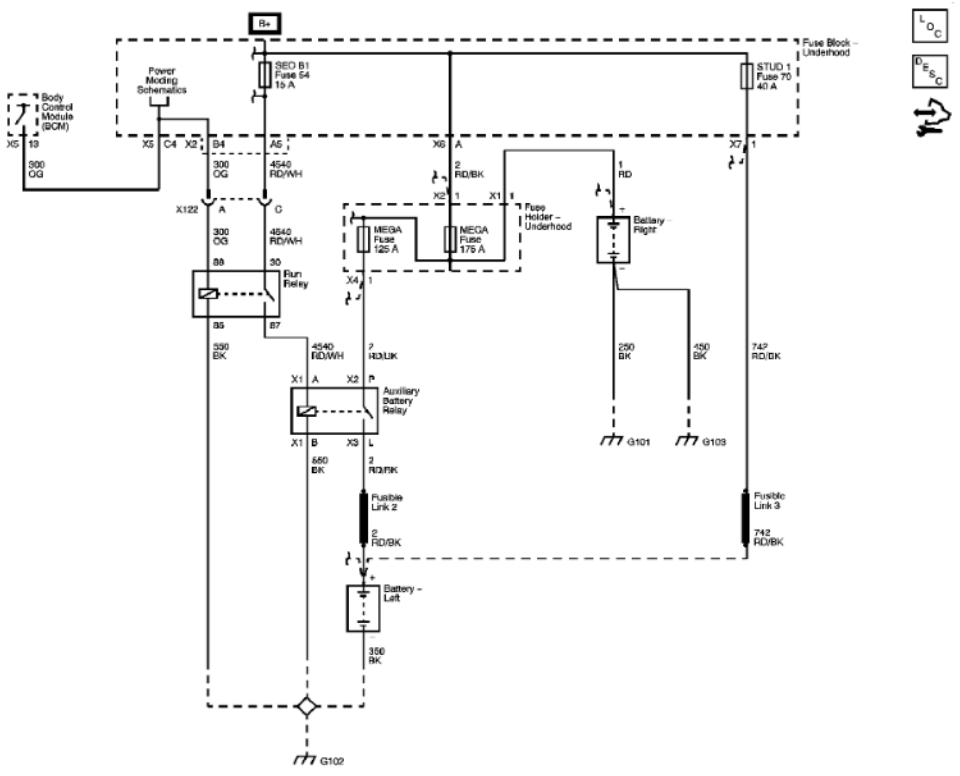


Fig. 4: Auxiliary Battery Schematic
Courtesy of GENERAL MOTORS CORP.

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
DTC B1325	B1325 03: Device Power Circuit Voltage Below Threshold B1325 07: Device Power Circuit Voltage Above Threshold B1325 4A: Device Power Circuit Checksum Error - IPC
DTC B1424	B1424 00: Device Voltage Low - Theft Deterrent Module
DTC B1516	B1516 08: Battery Current Sensor Performance Signal Invalid B1516 66: Battery Current Sensor Performance Wrong Mounting Position
DTC B1517	B1517 03: Battery Voltage Below Threshold - BCM B1517 07: Battery Voltage Above Threshold - BCM B1517 5A: Battery Voltage Plausibility Failure - BCM

DTC B1527	B1527 00: High Parasitic Load
DTC C0899	C0899 00: Device Voltage Low - EBCM (JF3/JF7/JH6/JH7) C0899 03: Device Voltage Low - EBCM (JL4), PTO (M1F)
DTC C0900	C0900 00: Device Voltage High - EBCM
DTC P0562	P0562: System Voltage Low
DTC P0563	P0563: System Voltage High
DTC P0615	P0615: Starter Relay Control Circuit
DTC P0621	P0621: Generator L-Terminal Circuit
DTC P0622	P0622: Generator F-Terminal Circuit

DIAGNOSTIC STARTING POINT - ENGINE ELECTRICAL

Begin the system diagnosis with **Diagnostic System Check - Vehicle** . The Diagnostic System Check - Vehicle will provide the following information:

- The identification of the control modules which command the system
- The ability of the control modules to communicate through the serial data circuit
- The identification of any stored diagnostic trouble codes (DTCs) and their status

The use of the Diagnostic System Check - Vehicle will identify the correct procedure for diagnosing the system and where the procedure is located.

DTC B1325

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC B1325 03

Device Power Circuit Voltage Below Threshold

DTC B1325 07

Device Power Circuit Voltage Above Threshold

DTC B1325 4A

Device Power Circuit Checksum Error - IPC

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+	B1325 03, 4A	B1325 03, 4A	-	-
Ground	-	B1325 03, 4A	-	-

Circuit/System Description

The control modules on this vehicle monitor the battery voltage through the battery positive (B+) voltage circuits. This vehicle has multiple modules that will set the DTC. For more information on which modules, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .

Conditions for Running the DTC

- The engine is running.
- The battery voltage supplied to the control modules is in the range of 7-26 volts.

Conditions for Setting the DTC

B1325 03

The control module detects that the system voltage is less than 9 volts for 5 seconds.

B1325 07

The control module detects that the system voltage is greater than 18 volts for 5 seconds.

B1325 4A

The instrument panel cluster (IPC) failed the power on checksum test, either due to low voltage or corrupted memory.

Action Taken When the DTC Sets

- The control module immediately disables all outputs when an out of range voltage condition has been detected, with the exception of GMLAN and the Run/Crank relay, which are disabled after a 3 minute delay.

- The setting of other DTCs is inhibited.

Conditions for Clearing the DTC

The DTC clears when the malfunction is no longer present.

Diagnostic Aids

- A high or low voltage value in multiple modules indicates a concern in the charging system.
- Overcharging with a battery charger or jump starting can cause this DTC to set.

Reference Information

Schematic Reference

- **Control Module References**
- **Power Distribution Schematics**
- **Ground Distribution Schematics**

Connector End View Reference

Component Connector End Views

Description and Operation

Charging System Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Engine running, accessories OFF, measure and record the battery voltage at the battery

terminals. The voltage should be between 12.6 and 15.0 volts.
   - If not within the specified range, refer to **Charging System Test**.
2. Observe the appropriate module scan tool Battery Voltage parameter. The reading should be between 12.6 and 15.0 volts.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connectors at the appropriate module.
2. Ignition OFF, test for less than 5 ohms of resistance between the ground circuit and ground.
   - If greater than the specified range, test the ground circuit for an open/high resistance.
3. Verify that a test lamp illuminates between the B+ circuit terminals and ground.
   - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance.
4. If all circuits tests normal, replace the appropriate module.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for the appropriate module replacement, setup, and programming.

DTC B1424

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC B1424 00

Device Voltage Low - Theft Deterrent Module

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+	B1424 00	B1424 00	-	-

Ground	-	B1424 00	-	-

Circuit/System Description

The theft deterrent module (TDM) monitors the battery positive (B+) voltage available to it. If the voltage at the TDM is between 6-9 volts, and the voltage being reported by a serial data message is greater than 9 volts, then DTC B1424 00 sets.

Conditions for Running the DTC

- The ignition switch is in Accessory or Run.
- This diagnostic runs every 100 milliseconds.

Conditions for Setting the DTC

- Voltage at the TDM B+ circuit is between 6-9 volts.
- Reported battery voltage received via serial data is valid and is greater than 9 volts.
- The above conditions have been met for 2 seconds.

Action Taken When the DTC Sets

- The security indicator turns ON.
- The driver information center (DIC) displays the SERVICE THEFT DETERRENT SYSTEM message.

Conditions for Clearing the DTC

- A current DTC clears when the battery voltage at the TDM is greater than 9 volts, or if the voltage reported by serial data is less than 9 volts.
- A history DTC clears after 100 consecutive ignition cycles, if no failures are reported by this diagnostic.

Diagnostic Aids

- A low voltage DTC in multiple modules indicates a concern in the charging system.
- Verify that the ground terminal G201 is clean and tight.

Reference Information

Schematic Reference

- **Immobilizer Schematics**

- **Power Distribution Schematics**
- **Ground Distribution Schematics**

Connector End View Reference

Component Connector End Views

Description and Operation

- **Immobilizer Description and Operation**
- **Charging System Description and Operation**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Engine running, accessories OFF, measure and record the battery voltage at the battery terminals. The voltage should be between 12.6 and 15.0 volts.
   - If not within the specified range, refer to **Charging System Test**.
2. Ignition OFF, disconnect the harness connector at the TDM. Refer to **Theft Deterrent Module Replacement** .
3. Ignition OFF, test for less than 5 ohms between the ground circuit terminal 3 and ground.
   - If greater than the specified range, test the ground circuit for an open/high resistance.
4. Verify that a test lamp illuminates between the B+ circuit terminal 1 and ground.
   - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance.
5. If all circuits tests normal, replace the TDM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for TDM replacement, set up, and programming.

DTC B1516

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC B1516 08

Battery Current Sensor Performance Signal Invalid

DTC B1516 66

Battery Current Sensor Performance Wrong Mounting Position

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5-Volt Reference	B1516 00	B1516 00	B1516 00	B1516 00, B1516 66
Signal	B1516 00	B1516 00	B1516 00	B1516 00, B1516 66
Low Reference	-	B1516 00	B1516 00	B1516 00, B1516 66

Circuit/System Description

The BCM supplies 5 volts and ground to the battery current sensor. The battery current sensor measures the amount of current flowing to or from the battery, and supplies a pulse width modulation (PWM) signal to the body control module (BCM).

Conditions for Running the DTC

- The ignition is ON.

- The engine is running.

Conditions for Setting the DTC

The BCM detects a duty cycle of PWM input signal is less than 4 percent or greater than 96 percent for 33 seconds.

Action Taken When the DTC Sets

The SERVICE BATTERY CHARGING SYSTEM warning message will be displayed on the driver information center (DIC).

Conditions for Clearing the DTC

- The DTC clears as current status when the battery sensed current returns to normal range for 5 seconds.
- A history DTC will clear after 100 ignition cycles.

Reference Information

Schematic Reference

- **Starting and Charging Schematics**
- **Body Control System Schematics**

Connector End View Reference

Component Connector End Views

Description and Operation

Charging System Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for Scan Tool Information

Circuit/System Verification

Verify that the current sensor is mounted correctly on the battery cable. Refer to **Battery Current Sensor Replacement (4.3L)** or **Battery Current Sensor Replacement (4.8L, 5.3L, 6.0L, and 6.2L)**.

Circuit/System Testing

1. Ignition ON, disconnect the battery current sensor.
2. Measure the voltage of the 5 volt reference circuit terminal A. Verify that the 5 volt reference circuit measures 5 volts.
    - If the voltage is less than 5 volts, test the current sensor 5 volt reference circuit for a short to ground, a high resistance, or an open circuit. If the circuit tests normal, replace the BCM.
3. Measure the voltage of the between the 5-volt reference circuit terminal A and the low reference circuit terminal B. Verify that there is 5 volts between the 5-volt reference circuit and the low reference circuit.
    - If the voltage is less than 5 volts, test the current sensor low reference circuit for a high resistance, or an open circuit. If the circuit tests normal, replace the BCM.
4. Measure the voltage of the signal circuit terminal C. Verify that the signal circuit measures 4-6 volts.
    - If the signal circuit voltage is less than 4 volts, test the current sensor signal circuit for a short to ground, a high resistance, or an open circuit. If the circuit tests normal, replace the BCM.
    - If the signal circuit voltage is greater than 6 volts, test the current sensor signal circuit for a short to voltage. If the circuit tests normal, replace the BCM.
5. If all 3 circuits test normal, replace the battery current sensor.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Battery Current Sensor Replacement (4.3L)** or **Battery Current Sensor Replacement (4.8L, 5.3L, 6.0L, and 6.2L)**
- **Control Module References** for BCM replacement, setup, and programming

DTC B1517

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC B1517 03

Battery Voltage Below Threshold - BCM

DTC B1517 07

Battery Voltage Above Threshold - BCM

DTC B1517 5A

Battery Voltage Plausibility Failure - BCM

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+	B1517 03, B1517 5A	B1517 03, B1517 5A	-	-
Ground	-	B1517 03, B1517 5A	-	-

Circuit/System Description

The body control module (BCM) has circuits for monitoring vehicle system voltage. The BCM monitors the system voltage to ensure that the voltage stays within the proper range. Damage to components, and incorrect data may occur when the voltage is out of range. The BCM monitors the system voltage over an extended length of time. If the BCM detects the system voltage is outside an expected range for the calibrated length of time, or the BCM battery sense circuits differ by 2 volts, DTC B1517 will set. The system voltage message is sent to the other modules. The message will default to 12.9 volts if there is a plausibility failure.

Conditions for Running the DTC

- The BCM has power and ground.

- The ignition is not in the START position.

Conditions for Setting the DTC

B1517 03

- The battery voltage is less than 11 volts.
- The engine speed is greater than 1,100 RPM.
- The above conditions are met for 15 seconds.

B1517 07

- The battery voltage is greater than 16 volts.
- The engine speed is greater than 1,100 RPM.
- The above conditions are met for 15 seconds.

B1517 5A

The voltage of the two BCM battery sense circuits differs by 2 volts for 10 seconds.

Action Taken When the DTC Sets

- The instrument panel cluster (IPC) illuminates the charge indicator.
- The driver information center (DIC) displays the SERVICE BATTERY CHARGING SYSTEM message.

Conditions for Clearing the DTC

- The DTC will clear current status when fault is no longer present.
- The history DTC will clear after 50 consecutive ignition cycles have occurred without a malfunction.

Diagnostic Aids

- A high or low voltage DTC in multiple modules indicates a concern in the charging system. Refer to **Charging System Test**.
- Inspect the ground connections G103 and G201, and insure that they are clean and tight.
- This DTC may be set by overcharging with a battery charger, or by jump starting.

Reference Information

Schematic Reference

- **Body Control System Schematics**
- **Power Distribution Schematics**
- **Ground Distribution Schematics**

Connector End View Reference

Component Connector End Views

Description and Operation

Charging System Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Engine running, accessories OFF, measure and record the battery voltage at the battery terminals. The voltage should be between 12.6 and 15.0 volts.
    - If not within the specified range, refer to **Charging System Test**.
2. Observe the scan tool BCM Battery Voltage Signal parameter and the Batt. Voltage High Res. parameter. The reading for both parameters should be between 12.6 and 15.0 volts.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connectors at the BCM.
2. Ignition OFF, test for less than 5 ohms between the ground circuit terminals listed below and ground.
    - Terminal 1 X3
    - Terminal 5 X3

- Terminal 9 X4
  - If greater than the specified range, test the ground circuit for an open/high resistance.

3. Verify that a test lamp illuminates between the B+circuit terminals listed below and ground.
   - Terminal 3 X3
   - Terminal 10 X4
     - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance.
4. If all circuits tests normal, replace the BCM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for BCM replacement, setup, and programming.

DTC B1527

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC B1527 00

High Parasitic Load

Circuit/System Description

The body control module (BCM) monitors the state of charge (SOC) of the electrical system. If the BCM senses that the current draw was greater than 2 amps and the SOC at key-on is 30 percent lower than it was when the engine was last running, DTC B1527 00 will set.

Conditions for Running the DTC

The ignition is turned from Off to Accessory or Run.

Conditions for Setting the DTC

- The SOC at key-on is 30 percent lower than when the engine was last running.
- The battery drain is more than 2 amps.

Action Taken When the DTC Sets

No actions are taken. This DTC serves only as an aid to the technician.

Conditions for Clearing the DTC

- The DTC will clear when the SOC is greater than or equal to 80 percent.
- A history DTC clears after 50 consecutive ignition cycles that the diagnostic runs and does not fail.

Reference Information

Schematic Reference

- **Starting and Charging Schematics**
- **Auxiliary Battery Schematics** (TP2)

Connector End View Reference

Component Connector End Views

Description and Operation

Charging System Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Diagnostic Aids

- This DTC indicates that the cause of a discharged battery is likely a parasitic current draw, rather than a defective battery.
- If the vehicle is equipped with an auxiliary battery (TP2), verify that there is not a fuse installed in the STUD 1 Fuse 70 position of the underhood fuse block. A plastic plug may be installed in this position instead of a fuse. If a fuse is installed in this position and any optional equipment is powered by the auxiliary battery, it will discharge the primary battery in addition to the auxiliary battery.
- Verify that all accessories are turned OFF, including optional accessories that the vehicle may have been wired for, but does not have installed, such as auxiliary lights. If an optional accessory swich is left in the ON position, it may energize a relay that will discharge the battery over time, even if the accessory is not installed on the vehicle.
- A battery discharging for no apparent reason while the vehicle is parked can be caused by an intermittent draw, such as a module waking up, or a continuous draw, such as a dome light or stuck relay. Look and listen for any components that may be operating when they should turn off, such as a fuel pump.

Circuit/System Verification

Ignition ON, compare the scan tool Prev. State of Charge and Start Up State of Charge parameters, in Body Control Module, Data Display, Charging Info. The readings should not differ by more than 30 percent.

Circuit/System Testing

Go to **Battery Electrical Drain/Parasitic Load Test**.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

DTC C0899

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of this diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0899 00

Device Voltage Low - EBCM (JF3/JF7/JH6/JH7)

DTC C0899 03

Device Voltage Low - EBCM (JL4), PTO (M1F)

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+	C0899 00, C0899 03	C0899 00, C0899 03	-	-
Ground	-	C0899 00, C0899 03	-	-

Circuit/System Description

The electronic brake control module (EBCM) and the power take off module (PTOM), if equipped, monitor the battery positive (B+) voltage level available for system operation. A low voltage condition prevents the system from operating properly. If low voltage is detected by the EBCM or PTOM, then DTC C0899 sets.

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

The ignition voltage available to the EBCM or PTOM is less than 9 volts for 100 msec.

Action Taken When the DTC Sets

Eletronic Brake Control Module (EBCM)

- The traction control system (TCS) and vehicle stability enhancement system (VSES) are disabled for the duration of the ignition cycle.
- The vehicle dynamics caution (VDC) indicator turns ON.

Power Take-Off Module (PTOM)

The PTO (M1F) is disabled for the duration of the ignition cycle.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

- A low voltage DTC in multiple modules indicates a concern in the charging system.
- Inspect the ground connections G103 and G300 to insure that they are clean and tight.

Reference Information

Schematic Reference

- **Starting and Charging Schematics**
- **Antilock Brake System Schematics**
- **Power Take-Off (PTO) Schematics**

Connector End View Reference

Component Connector End Views

Description and Operation

- **Charging System Description and Operation**
- **ABS Description and Operation (With JL4)** or **ABS Description and Operation (Without JL4)**
- **Power Take-Off (PTO) Description and Operation**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Engine running, accessories OFF, measure and record the battery voltage at the battery terminals. The voltage should be between 12.6 and 15.0 volts.
    - If not within the specified range, refer to **Charging System Test**.
2. Observe the scan tool Battery Voltage Signal (EBCM) or Ignition 1 Signal (PTO) parameter in the data list of the module setting the DTC. The reading should be between 12.6 and 15.0 volts.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the module that set the DTC.
2. Ignition OFF, test for less than 5 ohms between the ground circuit terminals listed below and ground.
    - Terminal 1 (M1F PTO)
    - Terminal 11 (JH6/JH7 EBCM)
    - Terminal 28 (JF3/JF7 EBCM)
    - Terminal 38 (JL4 EBCM)
    - If greater than the specified range, test the ground circuit for an open/high resistance.
3. Verify that a test lamp illuminates between the B+ circuit terminals listed below and ground.
    - Terminal 1 (JH6/JH7 EBCM)
    - Terminal 25 (JF3/JF7/JL4 EBCM)
    - Terminal 32 (M1F PTO)
    - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance.
4. If all circuits tests normal, replace the appropriate module.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for EBCM or PTOM replacement, setup and programming

DTC C0900

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.

- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0900 00

Device Voltage High - EBCM

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+	C0899 00, C0899 03	C0899 00, C0899 03	-	-
Ground	-	C0899 00, C0899 03	-	-

Circuit/System Description

The electronic brake control module (EBCM) monitors the battery positive (B+) voltage. If the voltage level is too high, damage may result in the system. When a high voltage condition is detected the EBCM turns OFF the system relay which removes battery voltage from the solenoid valves and pump motor, and DTC C0900 00 sets.

Conditions for Running the DTC

Ignition is ON.

Conditions for Setting the DTC

The system voltage is greater than 16 volts for 100 msec.

Action Taken When the DTC Sets

- The traction control system (TCS) and vehicle stability enhancement system (VSES) are disabled for the duration of the ignition cycle.
- The antilock brake system (ABS) is disabled if ignition voltage exceeds 19.5 volts.
- The stability system off and traction control off indicators turn ON.
- The ABS indicator turns ON if voltage exceeds 19.5 volts.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

- This DTC could be set by overcharging with a battery charger or jump starting.
- A high voltage DTC in multiple modules indicates a concern in the charging system.

Reference Information

Schematic Reference

- **Antilock Brake System Schematics**
- **Starting and Charging Schematics**
- **Power Distribution Schematics**
- **Ground Distribution Schematics**

Connector End View Reference

Component Connector End Views

Description and Operation

- **Charging System Description and Operation**
- **ABS Description and Operation (With JL4)** or **ABS Description and Operation (Without JL4)**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Engine running, accessories OFF, measure and record the voltage at the battery voltage at the battery terminals. The voltage should be between 12.6 and 15.0 volts.
   - If not within the specified range, refer to **Charging System Test**.
2. Observe the scan tool EBCM Battery Voltage parameter. The reading should be between 12.6 and 15.0 volts.
   - If not within the specified range, replace the EBCM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for EBCM replacement, setup and programming

DTC P0562

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC P0562

System Voltage Low

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+	P0562	P0562	-	-
Ground	-	P0562	-	-

Circuit/System Description

The engine control module (ECM) monitors the system voltage to ensure that the voltage stays within the proper range. Damage to components, and incorrect data may occur when the voltage is out of range.

Conditions for Running the DTC

- The vehicle speed is greater than 8 km/h (5 mph).
- The system voltage is between 9.5-18 volts.

Conditions for Setting the DTC

The ECM detects a system voltage less than 10 volts for 5 seconds.

Action Taken When the DTC Sets

- The ECM will command the charge indicator to be illuminated on the instrument panel cluster (IPC).
- The ECM will not illuminate the malfunction indicator lamp (MIL).
- The ECM will store conditions, which were present when the DTC set as Fail Records data only.

Conditions for Clearing the DTC

- The ECM will command the message OFF after one trip in which the diagnostic test has been run and passed.
- The history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.

Diagnostic Aids

- A low voltage DTC in multiple modules indicates a concern in the charging system.
- Inspect the ECM gound connection G106 (4.3L LU3) or G103 (all other engines) to insure that they are clean and tight.

Reference Information

Schematic Reference

- **Starting and Charging Schematics**
- **Engine Controls Schematics** 4.3L (LU3)
- **Engine Controls Schematics** 6.6L (LMM)
- **Engine Controls Schematics** all other engines (w/o LU3 or LMM)

Connector End View Reference

Component Connector End Views

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for Scan Tool Information

Circuit/System Verification

1. Ignition On. Measure and record the voltage at the battery terminals. Verify that the battery voltage is 12-17 volts. Repeat with the engine running.
    - If the battery voltage is not within the specified range, go to Charging System Test.
2. Engine running. Observe the Ignition 1 Signal parameter in the ECM scan tool data list. Verify that the scan tool displays a value that is within 1 volt of the battery voltage recorded in step 1.
    - If the scan tool parameter is not within the specified range, go to Circuit/System Testing.
3. Go to Diagnostic Aids.

Circuit/System Testing

1. Ignition OFF. Disconnect the harness connector of the ECM.
2. Probe the ground circuits with a test lamp that is connected to B+. The test lamp should illuminate.
    - If the test lamp does not illuminate, then test the ground circuit for an open/high resistance.
3. Test for 11-14 volts between the battery positive voltage and the ground circuits of the ECM.
    - If not within the specified range, test the battery positive voltage circuits for a short to ground or an open/high resistance.
4. If all circuits test normal, replace the ECM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for ECM replacement, setup, and programming.

DTC P0563

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC P0563

System Voltage High

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+	P0562	P0562	-	-

Circuit/System Description

The engine control module (ECM) monitors the system voltage to ensure that the voltage stays within the proper range. Damage to components, and incorrect data may occur when the voltage is out of range.

Conditions for Running the DTC

- The vehicle speed is greater than 8 km/h (5 mph).
- The system voltage is between 9.5-18 volts.

Conditions for Setting the DTC

The ECM detects a system voltage above 16 volts for 1 second.

Action Taken When the DTC Sets

- The ECM will command the charge indicator to be illuminated on the instrument panel

cluster (IPC).
- The ECM will not illuminate the malfunction indicator lamp (MIL).
- The ECM will store conditions, which were present when the DTC set as Fail Records data only.

Conditions for Clearing the DTC

- The ECM will command the indicator OFF after one trip in which the diagnostic test has been run and passed.
- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.

Reference Information

- **Starting and Charging Schematics**
- **Engine Controls Schematics** 4.3L (LU3)
- **Engine Controls Schematics** 6.6L (LMM)
- **Engine Controls Schematics** all other engines (w/o LU3 or LMM)

Connector End View Reference

Component Connector End Views

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Diagnostic Aids

- This DTC could be set by overcharging with a battery charger or jump starting.
- A high voltage DTC in multiple modules indicates a concern in the charging system.

Circuit/System Verification

1. Ignition On. Measure and record the voltage at the battery terminals. Verify that the battery voltage is 11-15 volts. Repeat with the engine running.
    - If the battery voltage is not within the specified range, go to **Charging System Test**.
2. Engine running. Observe the scan tool Ignition 1 Signal parameter in the ECM data list. Verify that the scan tool displays a value that is within 1 volt of the battery voltage recorded in step 1.
    - If the scan tool parameter is not within the specified range, replace the ECM.
3. Go to Diagnostic Aids.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for ECM replacement, setup, and programming

DTC P0615

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC P0615

Starter Relay Control Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
STRTR Relay Control	P0615	P0615	P0615	-
Ground	-	P0615	-	-

Circuit/System Description

When the ignition switch is placed in the START position, a discrete signal is supplied to the body control module (BCM) notifying it that the ignition is in the START position. The BCM

then sends a message to the engine control module (ECM) that crank has been requested. The ECM then verifies that the clutch is depressed for the manual transmission or that the automatic transmission is in Park or Neutral. If it is, the ECM then supplies 12 volts to the control circuit of the STRTR relay. When this occurs, battery voltage is supplied through the switch of the STRTR relay to the S terminal of the starter solenoid. The ECM monitors the voltage on the STRTR relay control circuit. If the ECM detects that the STRTR relay control circuit is open or shorted, then DTC P0615 sets.

Conditions for Running the DTC

- The Ignition is in the START position.
- The system voltage is between 9.5-18 volts.

Conditions for Setting the DTC

The ECM detects improper voltage on the control circuit of the STRTR relay.

Action Taken When the DTC Sets

DTC P0615 is a C type DTC.

Conditions for Clearing the DTC

DTC P0615 is a C type DTC.

Diagnostic Aids

- Verify that the ground connection for the STRTR relay ground circuit is clean and tight.
- Inspect the terminals for the STRTR relay in the underhood fuse block for poor connections.

Reference Information

Schematic Reference

Starting and Charging Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Starting System Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON. Verify that no theft deterrent or automatic transmission DTCs are set that would cause the ECM to disable engine starting.
   - If any DTCs are set that would cause the ECM to disable starting, then refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
2. Clear the DTCs. Start the engine. Verify that DTC P0615 does not set.

Circuit/System Testing

1. Ignition OFF, test for less than 5 ohms between the relay ground circuit terminal 85 and ground.
   - If greater than the specified range, test the ground circuit for an open/high resistance.
2. Ignition OFF. Connect a test lamp between the control circuit terminal 86 and the ground circuit terminal 85. Turn the ignition to the start position. The test lamp should turn ON when the ignition is in the START position, and OFF in all other positions.
   - If the test lamp is always on, test the control circuit for short to voltage. If the circuit tests normal, replace the ECM.
   - If the test lamp is always off, test the control circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the ECM.
3. If all circuits test normal, test or replace the STRTR relay.

Component Testing

STRTR Relay

1. Ignition OFF, disconnect the STRTR relay.
2. Test for 60-180 ohms between terminals 85 and 86 of the relay.

- If not within the specified range, replace the STRTR relay.

3. Test for infinite resistance between the following terminals:
   - 30 and 86
   - 30 and 87
   - 30 and 85
   - 85 and 87
   - If not the specified value, replace the relay.
4. Install a 20 amp fused jumper wire between relay terminal 85 and 12 volts. Install a jumper wire between relay terminal 86 and ground. Test for less than 2.0 ohms between terminals 30 and 87 of the relay.
   - If greater than specified range, replace the relay.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Relay Replacement (Attached to Wire Harness)** or **Relay Replacement (Within an Electrical Center)**
- **Control Module References** for ECM replacement, setup, and programming

DTC P0621

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC P0621

Generator L-Terminal Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Generator Turn On Signal	P0621	P0621	P0621	-

Circuit/System Description

The engine control module (ECM) uses the generator turn ON signal circuit to control the load of the generator on the engine. A high side driver in the ECM applies a voltage to the voltage regulator. This signals the voltage regulator to turn the field circuit ON and OFF. The ECM monitors the state of the generator turn ON signal circuit. The ECM should detect low voltage on generator turn on signal circuit when the ignition is ON and the engine is OFF, or when the charging system malfunctions. With the engine running, the ECM should detect high voltage on the generator turn on signal circuit. The ECM performs key ON and RUN tests to determine the status of the generator turn on signal circuit.

Conditions for Running the DTC

Key ON Test

- No generator, crankshaft position (CKP) sensors, or camshaft position (CMP) sensor DTCs are set.
- The ignition is in RUN position.
- The engine is not running.

RUN Test

- No generator, CKP sensors, CMP sensor DTCs are set.
- The engine is running.

Conditions for Setting the DTC

- During the key ON test, the ECM detects high voltage on the generator turn on signal circuit for 5 seconds.
- During the RUN test, the ECM detects low voltage on the generator turn on signal circuit for 15 seconds.

Action Taken When the DTC Sets

- The ECM will command the charge indicator and or warning message to be illuminated on the instrument panel cluster (IPC) and the driver information center (DIC), if equipped.
- The ECM will not illuminate the malfunction indicator lamp (MIL).
- The ECM will store conditions, which were present when the DTC set as Fail Records data only.

Conditions for Clearing the DTC

- A current DTC will clear when the conditions for setting the DTC are no longer met.
- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.

Reference Information

Schematic Reference

Starting and Charging Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Charging System Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the generator.
2. Ignition ON, test for less than 1 volt between the signal circuit terminal 1 and ground.
   - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the ECM.
3. Engine running, test for greater than 3.5 volts between the signal circuit terminal 1 and ground.
   - If less than the specified range, test the signal circuit for a short to ground, an open or a high resistance. If the circuit tests normal, replace the ECM.

4. If all circuit tests normal, test or replace the generator.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Generator Replacement (4.3L)** or **Generator Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Generator Replacement (6.6L)**
- **Control Module References** for ECM replacement, setup, and programming

DTC P0622

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC P0622

Generator F-Terminal Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Generator Field Duty Cycle Signal	P0622	P0622	P0622	-

Circuit/System Description

The engine control module (ECM) uses the generator field duty cycle signal circuit, or F-terminal circuit, to monitor the duty cycle of the generator. The generator field duty cycle signal circuit connects to high side of the field windings in the generator. A pulse width modulated (PWM) high side driver in the voltage regulator turns the field windings ON and OFF. The ECM uses the PWM signal input to determine the generator load on the engine. This allows the ECM to adjust the idle speed to compensate for high electrical loads. The ECM monitors the status of the generator field duty cycle signal circuit. When the key is in the RUN position and the engine is OFF, the ECM should detect a duty cycle near 0 percent. However, when the engine is running,

the duty cycle should be between 5-95 percent.

Conditions for Running the DTC

- The vehicle speed is greater than 8 km/h (5 mph).
- The system voltage is between 9.5-18 volts.

Conditions for Setting the DTC

- The ECM detects a PWM signal greater than 65 percent for 5 seconds during the KEY ON test.
- The ECM detects a PWM signal less than 5 percent for 15 seconds during the RUN test.

Action Taken When the DTC Sets

- The ECM will command the charge indicator to be illuminated on the instrument panel cluster (IPC).
- The ECM will not illuminate the malfunction indicator lamp (MIL).
- The ECM will store conditions, which were present when the DTC set as Fail Records data only.

Conditions for Clearing the DTC

- The ECM will command the charge indicator OFF after one trip in which the diagnostic test has been run and passed.
- The history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.

Reference Information

Schematic Reference

Starting and Charging Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Charging System Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Engine running, observe the GEN-F Terminal Signal parameter in the ECM data list. The parameter should read between 5 and 95 percent.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the generator.
2. Ignition ON, engine OFF, connect a test lamp to B+ and repeatedly probe the generator field duty cycle circuit terminal 2, while monitoring the GEN-F Terminal Signal Parameter. The parameter should change from 0 percent to above 95 percent.
    - If the parameter was not affected by the test lamp, test the circuit for a short to voltage, short to ground, or an open/high resistance. If the circuit tests normal, replace the ECM.
3. If the circuit tests normal, test or replace the generator.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Generator Replacement (4.3L)** or **Generator Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Generator Replacement (6.6L)**
- **Control Module References** for ECM replacement, setup, and programming

SYMPTOMS - ENGINE ELECTRICAL

IMPORTANT: The following steps must be completed before using the symptom tables.

- Perform **Diagnostic System Check - Vehicle** before using the Symptom Tables in order to verify that all of the following are true:
  - There are no DTCs set.
  - The control modules can communicate via the serial data link.
- Review the system descriptions and operations in order to familiarize yourself with the system functions. Refer to one of the following system operations:
  - **Battery Description and Operation**
  - **Charging System Description and Operation**
  - **Electrical Power Management Description and Operation**
  - **Starting System Description and Operation**

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the starting and charging systems. Refer to **Checking Aftermarket Accessories** .
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to **Testing for Intermittent Conditions and Poor Connections** .

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- **Battery Inspection/Test**
- **Battery Electrical Drain/Parasitic Load Test**
- **Battery Common Causes of Malfunction**
- **Charging System Test**
- **Generator Noise Diagnosis**
- **Starter Solenoid Does Not Click**
- **Starter Solenoid Clicks, Engine Does Not Crank**
- **Engine Cranks Slowly**
- **Starter Motor Noise Diagnosis**

BATTERY INSPECTION/TEST

Special Tools

J 42000 Battery Tester. See **Special Tools**.

Diagnostic Aids

CAUTION: Refer to Battery Disconnect Caution .

IMPORTANT:

- **The battery test using the J 42000 Battery Tester requires correct connections to the battery terminals. See Special Tools. A failure to obtain the correct connections during the test may result in a failed test on a good battery.**
- **Use the Out of Vehicle test for each battery when testing a vehicle with dual batteries.**

Follow these instructions in order to avoid an incorrect diagnosis because of connections:

- If testing the vehicle with the battery cables still connected, wiggle the **J 42000** clips on the terminal bolt. See **Special Tools**. This may cut through any coating or through any oxidation that may be present on the bolt.

  Even new bolts contain a protective coating that may insulate or cause a resistance in the test circuit.

- If correct connections to the battery terminal bolts in the vehicle are in doubt, perform the following steps:
  1. Disconnect the negative battery cable.
  2. Disconnect the positive battery cable.
  3. Install the test adapters on the terminals.
  4. Follow the instructions for testing a removed battery.
- If the tester displays a REPLACE BATTERY or BAD CELL-REPLACE result for a battery tested in the vehicle with the battery cables connected, perform the following steps:
  1. Disconnect the negative battery cable.
  2. Disconnect the positive battery cable.
  3. Install the tester adapters.

IMPORTANT: Always write the test code displayed by the tester on the repair order for any warranty purposes. The number is a unique code that describes the test data for a particular battery at a particular time. The test code may occasionally repeat when you retest the same battery. More often, each test will result in a different code. Use the test code from the second, or Out of Vehicle test.

4. Follow the instructions for testing a removed battery.
5. Replace the battery only if the second test shows a REPLACE BATTERY or BAD CELL-REPLACE result.

   Use the test code from the second test for any warranty purposes.

- Use the correct terminal adapters.

  Do not use any common bolts or a combination of bolts, of nuts, and of washers as adapters when testing the battery.

  Use the test adapters that are provided with the **J 42000** or GM P/N 12303040 terminal adapters. See **Special Tools**. If the adapters that are provided with the **J 42000** require replacement, use GM P/N 12303040. See **Special Tools**. Any other adapter may not contact the correct areas of the battery terminal, causing a resistance that may result in an invalid battery test result.

Circuit/System Testing

CAUTION: Unless directed otherwise, the ignition and start switch must be in the OFF or LOCK position, and all electrical loads must be OFF before servicing any electrical component. Disconnect the negative battery cable to prevent an electrical spark should a tool or equipment come in contact with an exposed electrical terminal. Failure to follow these precautions may result in personal injury and/or damage to the vehicle or its components.

1. Inspect the battery for a cracked, broken, or damaged case, which may be indicated by battery acid leakage.
   - If there is any apparent damage, replace the battery.

2. Verify the cold cranking amperage (CCA), and reserve capacity (RC) and/or amp hour (AH) rating of the battery to the original battery or original equipment (OE) specification. Refer to **Battery Usage**.
    - If the battery does not meet or exceed specifications, replace the battery.
3. Verify that the battery cables are clean and tight. The battery terminal bolts should be torqued as specified in **Fastener Tightening Specifications**.
    - If the battery cable(s) need to be cleaned, clean as required and tighten as specified.
    - If the battery cable(s) are damaged, replace then tighten as specified.
4. Install the **J 42000** and follow directions supplied by the tester. See **Special Tools**.
    - If the tester calls for charging the battery, refer to **Battery Charging**.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Battery Positive Cable Replacement (4.3L)** or **Battery Positive Cable Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Battery Positive Cable Replacement (6.6L)**
- **Battery Negative Cable Replacement (4.3L)** or **Battery Negative Cable Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Battery Negative Cable Replacement (6.6L)**
- **Battery Replacement**

BATTERY CHARGING

Tools Required

J 42000 Battery Tester. See **Special Tools**.

- For best results, use an automatic taper-rate battery charger with a voltage capability of 16 volts.
- The charging area should be well ventilated.
- Do not charge a battery that appears to be frozen. Allow the battery to warm to room temperature and test it using the **J 42000** before charging. See **Special Tools**.

Battery State of Charge

IMPORTANT: Using voltage to determine the batteries state of charge (SOC) is only accurate after the battery has been at rest for 24 hours. This is enough time for the acid in each cell to equalize. If the battery has been charged or discharged in the past 24 hours, the battery

SOC will only be an estimate.

The maintenance-free batteries SOC is estimated by reading the voltage of the battery across the battery terminals. Because the voltage is affected by current flow into or out of the battery, the engine must be stopped and all electrical loads turned OFF, including parasitic loads, when checking the voltage. The voltage can also be affected if the battery has just been charged or discharged, so it is important to consider what has happened to the battery in the time just before testing. Use the following procedure to determine the batteries SOC:

1. Be sure all electrical loads are turned OFF.
2. Determine whether the battery has been used in a vehicle or charged within the past 12 hours.
   - If the answer is no, the terminal voltage will be stabilized and no action is necessary before reading the voltage. Skip to step 3.
   - If the answer is yes, terminal voltage will not be stabilized and you should wait 12 hours since the last time the battery was used.
3. Estimate the battery temperature by determining the average temperature to which the battery has been exposed for the past 12 hours.

IMPORTANT: The table is accurate to 10 percent only after the battery has been at rest for 12 hours.

4. Measure the battery voltage at the battery terminals. Refer to the following table to determine the SOC according to the estimated battery temperature:

Battery Voltage	% Charge at 0°C (32°F)	% Charge at 25°C (75°F)
12.75 V	100%	100%
12.7 V	100%	90%
12.6 V	90%	75%
12.45 V	75%	65%
12.2 V	65%	45%
12.0 V	40%	20%

Use the SOC information as follows:

- A battery with a SOC that is below 65 percent must always be recharged before returning it to service or continuing storage.
- A battery with a SOC that is 65 percent or greater is generally considered to be charged

enough in order to be returned to normal service or in order to continue storage. However, if the battery is being used in slow traffic or with short drive times, or if the temperature is very hot or very cold, the battery should be fully charged, to at least 90 percent, before returning it to service or continuing storage.

Charging Time Required

The time required to charge a battery will vary depending upon the following factors:

- The battery charger capacity-The higher the charger amperage, the less time it will take to charge the battery.
- The SOC of the battery-A completely discharged battery requires more than twice as much charging time as a half charged battery. In a discharged battery with a voltage below 11 volts, the battery has a very high internal resistance and may only accept a very low current at first. Later, as the charging current causes the acid content to increase in the electrolyte, the charging current will increase. Extremely discharged batteries may not activate the reversed voltage protection in some chargers. Refer to the manufacturer's instructions for operating this circuitry.
- The temperature of the battery-The colder the battery is, the more time it takes to recharge the battery. The charging current accepted by a cold battery is very low at first. As the battery warms, the charging current will increase.

Charging Procedure

NOTE: Turn OFF the ignition when connecting or disconnecting the battery cables, the battery charger or the jumper cables. Failure to do so may damage the ECM/PCM or other electronic components.

NOTE: Refer to Fastener Notice.

When charging side-terminal batteries with the battery cables connected, connect the charger to the positive cable bolt and to a ground located away from the battery. When charging side-terminal batteries with the battery cables disconnected, install the battery side terminal adapters and connect the charger to the adapters.

Tighten: Tighten the battery side terminal adapters to 15 N.m (11 lb ft).

Use the following procedure to charge the battery:

1. Turn OFF the charger.

2. Ensure that all of the battery terminal connections are clean and tight.
3. Connect the charger positive lead to the battery positive terminal on the battery or the remote jumper stud underhood.

NOTE: Do not connect the negative charger lead to the housings of other vehicle electrical accessories or equipment. The action of the battery charger may damage such equipment.

4. Connect the negative charger lead to a solid engine ground or to a ground stud in the engine compartment that is connected directly to the battery negative terminal, but away from the battery. If the negative battery cable is disconnected and a terminal adapter is being used, connect directly to the adapter.
5. Turn ON the charger and set to the highest setting for normal charging.
6. Inspect the battery every half hour after starting the battery charger.
   - Charge the battery until the taper-rate charger indicates that the battery is fully charged.
   - Estimate the battery temperature by feeling the side of the battery. If it feels hot to the touch or its temperature is over 45°C (125°F), discontinue charging and allow the battery to cool before resuming charging.
7. After charging, test the battery. Refer to **Battery Inspection/Test**.

BATTERY ELECTRICAL DRAIN/PARASITIC LOAD TEST

Tools Required

J 38758 Parasitic Draw Test Switch. See **Special Tools**.

Diagnostic Aids

- If the vehicle is equipped with an auxiliary battery (TP2), verify that there is not a fuse installed in the STUD 1 Fuse 70 position of the underhood fuse block. A plastic plug may be installed in this position instead of a fuse. If a fuse is installed in this position and any optional equipment is powered by the auxiliary battery, it will discharge the primary battery in addition to the auxiliary battery.
- Verify that all accessories are turned OFF, including optional accessories that the vehicle may have been wired for, but does not have installed, such as auxiliary lights. If an optional accessory swich is left in the ON position, it may energize a relay that will discharge the battery over time, even if the accessory is not installed on the vehicle.
- Be sure to rule out any possible obvious influences, such as customer error or aftermarket

equipment. Anytime aftermarket accessories are installed into the courtesy lamp circuit, it can cause the inadvertent power timer in the body control module (BCM) to keep resetting. This would cause the BCM to remain awake and cause a current drain on the battery.

- Customer driving habits, such as regular short trips. This does not allow enough time to properly charge the battery. Refer to **Battery Description and Operation**.
- Verify that the battery and charging system are in proper working order. Refer to **Battery Charging** and **Charging System Test**.
- A battery discharging for no apparent reason while the vehicle is parked can be caused by an intermittent draw, such as a module waking up, or a continuous draw, such as a dome light or stuck relay. Look and listen for any components that may be operating when they should turn off, such as a fuel pump.
- Some systems and modules such as OnStar®, and regulated voltage control (RVC), if equipped, are designed to wake-up, perform a task, and go back asleep at regular intervals. Refer to **Body Control System Description and Operation** for the system or modules description and operation.
- Remote keyless entry (RKE) will wake up due to an outside input. Refer to **Keyless Entry System Description and Operation** for the system description and operation.

IMPORTANT: The battery specification listed below is a generic specification. Refer to Battery Usage when testing the battery.

- The battery run down time will vary depending on cold cranking amperage (CCA) and reserve capacity (RC). If the CCA and RC are higher, then the battery run down time would be longer. If the CCA and RC are lower, then the battery run down time would be shorter. The graph below indicates roughly how many days a 690 CCA battery with at 110 min. RC (60.5 AH) starting at 80 percent state of charge will last with a constant current draw until it reaches 50 percent state of charge. Differences in battery rating and temperature will affect the results.

Current Drain	Days
25 mA	30.5
50 mA	16.5
75 mA	11
100 mA	8.25
250 mA	3.3
500 mA	1.65

750 mA	1
1 A	0.8
2 A	0.4

Load Test

CAUTION: Refer to Battery Disconnect Caution .

NOTE: Do not turn the parasitic draw test switch to the OFF position with the engine running. Damage will occur to the vehicle's electrical system.

NOTE: The test switch must be in the ON position when removing the fuses in order to maintain continuity in the electrical system. This avoids damaging the digital multimeter due to accidental overloading, such as a door being opened to change a fuse.

IMPORTANT: The switch knob on the J 38758 is marked ON and OFF. See Special Tools. When the switch knob is in the ON position, the circuit is closed and electrical current will pass through the switch. When the switch knob is in the OFF position, the circuit is open and electrical current will not pass through the switch.

1. Disconnect the battery negative cable from the battery negative terminal. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.
2. Install the male end of the **J 38758** to the battery ground terminal. See **Special Tools**.
3. Turn the **J 38758** knob to the OFF position. See **Special Tools**.
4. Install the battery negative cable to the female end of the **J 38758** . See **Special Tools**.
5. Turn the **J 38758** knob to the ON position. See **Special Tools**.
6. Road test the vehicle and activate ALL of the accessories, including the radio and air conditioning. This may take up to 30 minutes.
7. Park the vehicle. Turn the ignition switch to the OFF position and remove the ignition switch key.
8. Connect a 10A fused jumper wire to the test switch tool terminals.

9. Turn the **J 38758** knob to the OFF position. See **Special Tools**. The current now flows through the jumper wire.
10. Wait 1 minute. If the fuse blows, install an inductive ammeter and go to step 19.
11. Remove the fused jumper wire.
12. Set a digital multimeter to the 10A scale.
13. Connect the digital multimeter to the test switch tool terminals.
14. Turn the **J 38758** knob to the OFF position. See **Special Tools**. The current flows now through the digital multimeter.
15. Wait 1 minute. Check and record the current reading.
    1. When there is a current reading of 2A or less, turn the **J 38758** knob to the ON position. See **Special Tools**. The electrical current will now pass through the switch.
    2. Then switch the digital multimeter down to the 2A scale for a more accurate reading when the **J 38758** knob is turned OFF. See **Special Tools**.
16. Turn the **J 38758** knob to the OFF position. See **Special Tools**. Wait 15 minutes for most vehicles.
17. Check and record the current reading.
18. Note the battery reserve capacity, amp hour rating. Refer to **Battery Usage**.
    1. Divide the reserve capacity by 4, amp hour rating by 2.4.
    2. Compare this to the multimeter milliampere reading taken in the previous step. The parasitic current drain should not exceed this number. Example: If a battery has a reserve capacity of 100 minutes, (60 A/H) the current drain should not exceed 25 mA.
19. If excessive current drain is not found at this time and there are no other apparent causes, complete the following:
    1. Using the MIN/MAX function of the digital multimeter, monitor the parasitic drain overnight or during the day. This will determine if something has been activated during that time frame.

NOTE: **The test switch must be in the ON position when removing the fuses in order to maintain continuity in the electrical system. This avoids damaging the digital multimeter due to accidental overloading, such as a door being opened to change a fuse.**

IMPORTANT: Removing fuses, relays, and connectors to determine the failure area may wake up modules. You must wait for

these modules to go to sleep or use the sleep function on the scan tool.

2. When the vehicle has an unacceptable amount of parasitic current drain, remove each fuse one at a time until the current drain falls to an acceptable level. This will indicate which circuit is causing the drain. Refer to **Power Distribution Schematics** to diagnose exactly which part of the suspect circuit is causing the parasitic drain. In some cases a non-fused circuit or component, such as a relay, is the cause of excessive parasitic current drain.
3. Repeat the parasitic current drain test procedure after any repair has been completed to make sure that the parasitic current drain is at an acceptable level.
4. When the cause of the excessive current drain has been located and repaired, remove the **J 38758** . See **Special Tools**.

20. Connect the battery negative cable to the battery negative terminal.

BATTERY COMMON CAUSES OF MALFUNCTION

A battery is not designed to last forever. With proper care, however, the battery will provide years of good service. If the battery tests good but still fails to perform well, the following are some of the more common causes:

- A vehicle accessory was left on overnight.
- The driving speeds have been slow with frequent stops with many electrical accessories in use, particularly air conditioning, headlights, wipers, heated rear window, cellular telephone, etc.
- The electrical load has exceeded the generator output, particularly with the addition of aftermarket equipment.
- Existing conditions in the charging system, including the following possibilities:
  - A slipping belt
  - A bad generator
- The battery has not been properly maintained, including a loose battery hold down or missing battery insulator if used.
- There are mechanical conditions in the electrical system, such as a short or a pinched wire, attributing to power failure. Refer to **General Electrical Diagnosis** .

Electrolyte Freezing

The freezing point of electrolyte depends on its specific gravity. A fully charged battery will not

freeze until the ambient temperature gets below -54°C (-65°F). However, a battery with a low state of charge may freeze at temperatures as high as -7°C (+20°F). Since freezing may ruin a battery, the battery should be protected against freezing by keeping it properly charged. As long as the green eye is visible in the hydrometer, the freezing point of the battery will be somewhere below -32°C (-25°F).

Battery Protection During Vehicle Storage

Certain devices on the vehicle maintain a small continuous current drain on the battery. A battery that is not used for an extended period of time will discharge. Eventually permanent damage will result. Discharged batteries will also freeze in cold weather. Refer to **Battery Inspection/Test**.

In order to maintain a battery state of charge while storing the vehicle for more than 30 days, disconnect the battery ground to protect the battery from discharge by parasitic current drains.

When the battery cannot be disconnected:

1. Maintain a high state of charge.
2. Establish a regular schedule for recharging the battery every 20-45 days.

A battery that has remained in a discharged state for a long period of time is difficult to recharge or may be permanently damaged.

CHARGING SYSTEM TEST

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

Generator

The generator is a serviceable component. If there is a diagnosed failure of the generator it must be replaced as an assembly. The engine drive belt drives the generator. When the rotor is spun it induces an alternating current (AC) into the stator windings. The AC voltage is then sent through a series of diodes for rectification. The rectified voltage has been converted into a direct current (DC) for use by the vehicles electrical system to maintain electrical loads and the battery charge. The voltage regulator integral to the generator controls the output of the generator. It is not serviceable. The voltage regulator controls the amount of current provided to the rotor. If the

generator has field control circuit failure, the generator defaults to an output voltage of 13.8 volts.

Auxiliary Battery (TP2)

The auxiliary battery provision (TP2) can be used to supply electrical power to additional equipment that the customer may choose to add, such as a slide-in camper or trailer, without discharging the vehicles primary battery. The auxiliary battery relay closes when the engine is running, in order to allow the generator to charge the auxiliary battery. The relay opens when the engine is off, so that the accessories will not discharge the vehicles primary battery, which is used for engine starting. If the vehicle is equipped with an auxiliary battery, the relay will be located on the driver's side of the vehicle, next to the underhood electrical center. Generally, a fuse should not be used in the STUD 1 Fuse 70 position of the underhood fuse block, if the vehicle is equipped with an auxiliary battery. A plastic plug may be installed in this position instead of a fuse. If a fuse is installed in this position, the accessories will discharge the primary battery in addition to the auxiliary battery.

Reference Information

Schematic Reference:

- Starting and Charging Schematics
- Auxiliary Battery Schematics

Connector End View Reference:

Component Connector End Views

Description and Operation

- Charging System Description and Operation
- Battery Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Circuit/System Verification

1. Ignition ON. Verify that no generator or battery current sensor DTCs are set that would cause a charging system concern.
    - If DTCs are set, go to **Diagnostic Trouble Code (DTC) List - Vehicle** .
2. Ignition OFF, measure the voltage across the battery terminals. The voltage should read 12.0 volts or greater at room temperature.
    - If not within the specified value, charge and test the battery before testing the charging system. Refer to **Battery Inspection/Test**.
3. Go to Circuit/System Testing.

Circuit/System Testing

Generator

1. Verify that the battery cable terminals are clean and tight.
2. Connect a carbon pile tester to the battery.
3. Start the engine and increase the engine speed to 2,500 RPM. Place the vehicle in tow/haul mode. Observe the voltage reading on the tester. The voltage should read between 12.6 - 15.0 volts.
    - If not within specified range, replace the generator.
4. Adjust the carbon pile tester to the specified load test output value, refer to **Generator Usage**.
    - If less than the specified value, replace the generator.
5. If equipped with an auxiliary generator, repeat this test, with the carbon pile tester's inductive pickup clamped around either generator harness.

Auxiliary Battery Charging/Isolation (TP2)

Perform this test if there is a concern with the charging of an auxiliary battery.

Do not perform this test if the vehicle is not equipped with an auxiliary battery (TP2).

1. Disconnect the auxiliary battery. Refer to **Auxiliary Battery Replacement (6.2L, and 6.6L)**.
2. Verify that there is not a fuse installed in the STUD 1 socket of the underhood fuse block. There may be a plastic plug installed in this position, instead of a fuse.
    - If there is a fuse installed, remove the fuse.
3. Verify that the trailer harness, or other accessory, is connected to the underhood fuse block stud 1 terminal X7-1, if desired. Verify that the connection is clean and tight.

4. Ignition OFF. Verify that there is 0 volts present at the underhood fuse block stud 1 terminal X7-1.
    - If there is voltage present at stud 1, test the auxiliary battery relay and the run relay for a stuck closed condition. If OK, test the auxiliary battery positive cable for a short to voltage.
5. Start the engine. Verify that there is greater than 12 volts present at the underhood fuse block stud 1 terminal X7-1.
    - If less than the specified value, test the following components for an open/high resistance:
        - SEO B1 fuse
        - 125 A MEGA fuse
        - Fusible link 2
        - Fusible link 3
        - Auxiliary battery relay
        - Run relay
6. Reconnect the auxiliary battery.

Component Testing

Auxiliary Battery Relay and Run Relay (TP2)

1. Ignition OFF, disconnect the relay.
2. Test for 60-180 ohms between terminals 85 and 86.
    - If not within the specified range, replace the relay.
3. Test for infinite resistance between the following terminals:
    - 30 and 86
    - 30 and 87
    - 30 and 85
    - 85 and 87
    - If not the specified value, replace the relay.
4. Install a 20 amp fused jumper wire between relay terminal 85 and 12 volts. Install a jumper wire between relay terminal 86 and ground. Test for less than 2.0 ohms between terminals 30 and 87.
    - If greater than specified range, replace the relay.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Auxiliary Battery Relay Replacement (6.2L)**
- **Auxiliary Generator Replacement (6.6L)**
- **Battery Positive Cable Fuse Replacement (w/Single Battery)** or **Battery Positive Cable Fuse Replacement (w/Auxiliary Battery)**
- **Generator Replacement (4.3L)** or **Generator Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Generator Replacement (6.6L)**
- **Generator Battery Jumper Cable Replacement**
- **Relay Replacement (Attached to Wire Harness)** or **Relay Replacement (Within an Electrical Center)**

GENERATOR NOISE DIAGNOSIS

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Diagnostic Aids

Noise from a generator may be due to electrical or mechanical noise. Electrical noise or magnetic whine usually varies with the electrical load placed on the generator and is a normal operating characteristic of all generators. When diagnosing a noisy generator, it is important to remember that loose or misaligned components around the generator may transmit the noise into the passenger compartment and that replacing the generator may not solve the problem.

Circuit/System Testing

1. Start the engine. Verify the noise can be heard. Compare the concern to a similar vehicle.
2. Perform a charging system test. Verify that the generator is charging properly. Refer to **Charging System Test**.
    - If the battery is discharged, charge the battery.
    - If the generator fails the charging system test, replace the generator.
3. Verify that the power steering fluid level is not low, if equipped. Refer to **Checking and Adding Power Steering Fluid (With Hydroboost)** or **Checking and Adding Power Steering Fluid (Without Hydroboost)** or **Checking and Adding Power Steering Fluid (With Hydroboost)** or **Checking and Adding Power Steering Fluid (Without**

Hydroboost) .

- If the power steering fluid level is low, go to **Power Steering Fluid Leaks** .

4. Inspect the generator, generator mounting, wiring harness, heater hoses, A/C lines, or other accessory equipment that may be misrouted or be the cause of noise being transmitted into the passenger compartment.
5. Ignition OFF, remove the engine drive belt(s). Refer to one of the following:
   - **Drive Belt Replacement** 4.3L (LU3)
   - **Drive Belt Replacement** 6.6L (LMM)
   - **Drive Belt Replacement - Accessory** all others (w/o LU3 or LMM)
   - **Air Conditioning Compressor Belt Replacement** all others (w/o LU3 or LMM)
6. Verify the generator, A./C compressor (if equipped), water pump pulley, power steering pump (if equipped), idler pulley(s), and tensioner pulley(s) spin freely, and that the pully bearings are not loose.
   - If any of the pulleys do not spin freely, or has a loose bearing, replace the affected component.
7. Start the engine, with the drive belt(s) removed. Verify that the noise goes away. Operate the engine for no longer than 30 seconds.
   - If the noise is still present, the generator is not the cause of the noise.
8. Loosen all generator mounting bolts and ensure the generator is properly aligned. Tighten the mounting bolts to specification, refer to **Generator Replacement (4.3L)** or **Generator Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Generator Replacement (6.6L)**.
9. If the noise is still present, replace the generator.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Generator Replacement (4.3L) or **Generator Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Generator Replacement (6.6L)**

STARTER SOLENOID DOES NOT CLICK

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Underhood Fuse Block B+	1	1	-	-
175 A MEGA Fuse	-	1	-	-
STRTR Fuse 60 (LMM) or 64 (w/o LMM)	-	1	-	-
Park Neutral Signal (Automatic)	2	1	1	-
Clutch Pedal Position Signal (TZ0 Manual)	P0807	P0807	P0808	P0806
Starter Relay Coil Control	1	1	3	-
Starter Solenoid Crank Voltage	1	1	3	-
Underhood Fuse Block Ground	-	1	-	-
1. No crank 2. Cranks in any gear 3. Cranks all the time				

Circuit/System Description

The engine control module (ECM) controls engine cranking based on a power mode input and the status of the park/neutral position (PNP) switch or clutch pedal position sensor. With the transmission in Park/Neutral, voltage at the ECM PNP switch signal circuit is low. This indicates to the ECM that conditions are acceptable for cranking. When a power mode crank request is seen, the ECM applies voltage to the starter relay coil control circuit. This energizes the coil side of the relay, which pulls the switch side of the relay closed, applying voltage to the starter X2-S terminal and engaging the starter solenoid.

Reference Information

Schematic Reference

- **Starting and Charging Schematics**
- **PSD SIE TITLE Error: SIE linked to empty Cell ID 167881** (TZ0 Manual)
- **Automatic Transmission Controls Schematics** (M30 4L60E, M70 4L70E)
- **Automatic Transmission Controls Schematics** (MYC 6L80E, MYD 6L90E)

- **Automatic Transmission Controls Schematics** (MW7 Allison)

Connector End View Reference

Component Connector End Views

Description and Operation

Starting System Description and Operation

Electrical Information Reference

- **Testing for Intermittent Conditions and Poor Connections**
- **Circuit Testing**
- **Wiring Repairs**
- **Connector Repairs**

Scan Tool Reference

Control Module References for Scan Tool Information

Diagnostic Aids

- Inspect the STRTR Fuse 60 (LMM) or 64 (w/o LMM), and the 175 A MEGA Fuse for an open.
- A misadjusted PNP switch (M30 4L60E, M70 4L70E) or range selector lever cable (automatic) may result in a starter solenoid does not click condition.

Circuit/System Verification

1. Ignition ON, transmission in Park or Neutral. Observe the PNP Switch parameter with a scan tool, in Engine Control Module, Data Display, Engine Data. Verify that the scan tool PNP Switch parameter is Park/Neutral (automatic only).
    - If the scan tool PNP Switch parameter is not Park/Neutral, refer to Circuit/System Testing: PNP Switch Circuit Malfunction below.
2. Command the Starter Relay ON with the scan tool, or turn the ignition switch to the START position. The starter solenoid should engage and the engine should crank.
    - If the solenoid does not engage, refer to Circuit/System Testing: STRTR Relay Circuit Malfunction below.

- If the solenoid engages but the engine does not crank, refer to **Starter Solenoid Clicks, Engine Does Not Crank**.

Circuit/System Testing

PNP Switch Circuit Malfunction (M30 4L60E, M70 4L70E)

1. Inspect the range selector lever cable for proper adjustment. Refer to **Range Selector Lever Cable Adjustment** .
2. Inspect the park/neutral position switch for proper adjustment. Refer to **Park/Neutral Position Switch Adjustment** .
3. Ignition OFF. Disconnect the harness connector from the park/neutral switch. Refer to **Park/Neutral Position Switch Replacement** .
4. Ignition ON. Probe the ground circuit terminal 7 with a test lamp that is connected to B+. Verify that the test lamp illuminates.
   - If the test lamp does not illuminate, test the ground circuit for an open/high resistance.
5. Verify that the scan tool PNP Switch parameter is In Gear.
   - If not the specified value, test the signal circuit terminal 3 for a short to ground. If the circuit tests normal, replace the ECM.
6. Install a 3 A fused jumper wire between the ground circuit terminal 7 and the signal circuit terminal 3. Verify that the scan tool PNP Switch parameter is Park/Neutral.
   - If not the specified value, test the signal circuit for an open/high resistance. If the circuit tests normal, replace the ECM.
7. If all circuits test normal, test or replace the park/neutral position switch.

PNP Switch Circuit Malfunction (MYC 6L80E, MYD 6L90E)

1. Inspect the range selector lever cable for proper adjustment. Refer to **Range Selector Lever Cable Adjustment** .
2. Ignition OFF. Disconnect the 16-way harness connector from the transmission.
3. Ignition ON. Measure voltage on the park/neutral signal circuit terminal 3 with a DMM. Verify that there is greater than 10 volts on the park/neutral signal circuit.
   - If there is less than 10 volts on the park/neutral signal circuit, test the circuit for an open or a short to ground. If OK, replace the ECM.
4. Ignition OFF, reconnect the 16-way harness connector to the transmission.
5. Remove the automatic transmission fluid pan. Refer to **Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement** .

6. Disconnect the manual shift shaft position switch connector at the control solenoid valve assembly. Refer to **Manual Shift Shaft Position Switch Replacement** .
7. Ignition ON, verify that the scan tool PNP Switch parameter displays In Gear.
    - If not the specified value, replace the ECM.
8. Connect a 3-amp fused jumper wire between the park/neutral signal terminal F at the control solenoid valve assembly and ground. The scan tool PNP Switch parameter should display Park/Neutral when the terminal is connected to ground.
    - If not the specified value, replace the ECM.
9. If all components test normal, test or replace the manual shift shaft position switch.

PNP Switch Circuit Malfunction (MW7 Allison)

1. Inspect the range selector lever cable for proper adjustment. Refer to **Range Selector Lever Cable Adjustment** .
2. Ignition OFF. Disconnect the engine chassis harness to transmission internal harness connector X175.
3. Verify that the scan tool PNP Switch parameter is In Gear.
    - If not the specified value, test the signal circuit terminal R for a short to ground. If the circuit tests normal, replace the ECM.
4. Install a 3A fused jumper wire between the signal circuit terminal R and ground. Verify that the scan tool PNP Switch parameter is Park/Neutral.
    - If not the specified value, test the signal circuit for an open/high resistance. If the circuit tests normal, replace the ECM.
5. If all circuits test normal, test or replace the transmission internal mode switch.

STRTR Relay Circuit Malfunction

1. Ignition OFF, disconnect the STRTR relay.
2. Ignition ON, transmission in Park/Neutral. Verify that a test lamp illuminates between the relay coil ground circuit terminal and B+.
    - If the test lamp does not illuminate, test the ground circuit for an open/high resistance.
3. Probe the STRTR Relay switch B+ circuit terminal with a test lamp that is connected to ground. Verify that the test lamp illuminates.
    - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance. Inspect the 175 A MEGA fuse for an open. If the circuit tests normal and the 175 A MEGA fuse is open, test the relay controlled output circuit for a short to ground.

4. Connect a test lamp between the relay coil ground circuit terminal and the relay coil control circuit terminal.

IMPORTANT: The engine may begin to crank.

5. Ignition ON, transmission in Park/Neutral. Command the Starter Relay ON and OFF with a scan tool, or turn the ignition switch between the START and RUN positions. The test lamp should turn ON and OFF when changing between the commanded states.
   - If the test lamp is always ON, test the relay coil control circuit for a short to voltage. If the circuit tests normal, replace the ECM.
   - If the test lamp is always OFF, test the relay coil control circuit for a short to ground or and open/high resistance. Inspect the STRTR fuse for an open. If the STRTR fuse is open, test the relay controlled output circuit for a short to ground, or replace the starter solenoid (LMM) or starter. If the circuit and fuse test normal, replace the ECM.
6. Connect the STRTR relay.
7. Install a test lamp between the starter X2-S terminal and ground.

IMPORTANT: The engine may begin to crank.

8. Ignition ON, transmission in Park/Neutral, command the Starter Relay ON with a scan tool, or turn the ignition switch to the START position. The test lamp should illuminate.
   - If the test lamp does not illuminate, test the relay controlled output circuit for an open/high resistance. If the circuit tests normal, test or replace the STRTR relay.
9. If all circuits test normal, test or replace the starter, or the starter solenoid (LMM 6.6L Diesel).

Component Testing

PNP Switch (M30 4L60E, M70 4L70E)

1. Inspect the range selector lever cable for proper adjustment. Refer to **Range Selector Lever Cable Adjustment** .
2. Inspect the park/neutral position switch for proper adjustment. Refer to **Park/Neutral Position Switch Adjustment** .
3. Ignition OFF. Disconnect the harness connector from the park/neutral switch. Refer to **Park/Neutral Position Switch Replacement** .
4. With the PNP switch in the following positions, test for infinite resistance between the ground terminal 7 and the signal terminal 3.

- R
- OD
- D
- 2
- 1
  - If not the specified value, replace the PNP switch.

5. With the PNP switch in the following positions, test for less than 2.0 ohms between the ground terminal 7 and the signal terminal 3.
   - P
   - N
   - If greater than the specified range, replace the PNP switch.

STRTR Relay

1. Ignition OFF, remove the STRTR relay. Refer to **Relay Replacement (Attached to Wire Harness)** or **Relay Replacement (Within an Electrical Center)** .
2. Test for 60-180 ohms between terminals 85 and 86.
   - If not within the specified range, replace the relay.
3. Test for infinite resistance between the following terminals:
   - 30 and 86
   - 30 and 87
   - 30 and 85
   - 85 and 87
   - If not the specified value, replace the relay.
4. Install a 20 amp fused jumper wire between relay terminal 85 and 12 volts. Install a jumper wire between relay terminal 86 and ground. Test for less than 2.0 ohms between terminals 30 and 87.
   - If greater than specified range, replace the relay.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Clutch Pedal Position Sensor Learn** (TZ0 Manual)
- **Range Selector Lever Cable Adjustment** (M30 4L60E, M70 4L70E)

- **Range Selector Lever Cable Adjustment** (MYC 6L80E, MYD 6L90E)
- **Range Selector Lever Cable Adjustment** (MW7 Allison)
- **Park/Neutral Position Switch Adjustment** (M30 4L60E, M70 4L70E)
- **Relay Replacement (Attached to Wire Harness)** or **Relay Replacement (Within an Electrical Center)**
- **Starter Solenoid Cable Replacement (4.3L)** or **Starter Solenoid Cable Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Starter Solenoid Cable Replacement (6.6L)** or **Starter Solenoid Cable Replacement (6.2L w/Auxiliary Battery)**
- **Clutch Pedal Engine Start Switch Replacement** (TZ0 Manual)
- **Park/Neutral Position Switch Replacement** (M30 4L60E, M70 4L70E)
- **Control Valve Body Assembly Removal** for shift shaft position switch replacement (MYC 6L80E, MYD 6L90E)
- **Control Valve Body Assembly Disassemble** for shift shaft position switch replacement (MYC 6L80E, MYD 6L90E)
- **Transmission Internal Mode Switch Replacement** (MW7 Allison)
- **Starter Motor Solenoid Replacement (6.6L)** 6.6L Diesel (LMM)
- **Starter Motor Replacement (4.3L)** or **Starter Motor Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Starter Motor Replacement (6.6L)**
- **Control Module References** for BCM or ECM replacement, setup and programming

STARTER SOLENOID CLICKS, ENGINE DOES NOT CRANK

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

When the ignition switch is placed in the START position, a discrete signal is supplied to the body control module (BCM) notifying it that the ignition is in the START position. The BCM then sends a serial data message to the engine control module (ECM) that crank has been requested. The ECM monitors the park/neutral position switch and the clutch pedal position sensor. If the transmission is in Park or Neutral, or the clutch pedal is pressed, and there are no DTCs that inhibit engine starting, then the ECM supplies voltage to the control circuit of the STRTR relay. When this occurs, battery voltage is supplied through the STRTR relay to the X2-S

terminal of the starter solenoid. The starter solenoid energizes, and supplies battery voltage to the starter from the B terminal to crank the engine.

Reference Information

Schematic Reference

Starting and Charging Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Starting System Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Circuit/System Verification

1. Attempt to start the engine. Verify that the starter solenoid clicks.
   - If the starter solenoid does not click, refer to **Starter Solenoid Does Not Click**.
   - If the engine cranks slowly, refer to **Engine Cranks Slowly**.
2. Go to Circuit/System Testing.

Circuit/System Testing

1. Verify that the battery is sufficiently charged and that the battery cables are clean and tight. Refer to **Charging System Test**.
   - If the battery is not sufficiently charged, refer to **Battery Charging**.
   - If the battery cables are not clean and tight, refer to **Fastener Tightening Specifications**.
2. Using a DMM, measure voltage between the positive battery terminal and X1 terminal B at the solenoid as the ignition switch is turned to the START position. Voltage should be less

than 0.5 volt.

- If greater than the specified value, replace the starter solenoid cable.

3. Using a DMM, measure voltage between the negative battery terminal and the starter motor case as the ignition switch is turned to the START position. Voltage should be less than 0.5 volt.
   - If greater than the specified value, replace the negative battery cable.
4. Remove the drive belt(s). Refer to one of the following:
   - **Drive Belt Replacement** for the 4.3L (LU3) engine
   - **Drive Belt Replacement** for the 6.6L Diesel (LMM) engine
   - **Drive Belt Replacement - Accessory** for all other engines (w/o LU3 or LMM)
   - **Air Conditioning Compressor Belt Replacement** for all other engines (w/o LU3 or LMM)
5. Attempt to start the engine, with the drive belt(s) removed.
   - If the engine cranks, inspect the engine accessories and belt drive system for mechanical binding.
6. Attempt to rotate the crankshaft using a breaker bar, or other suitable tool. Verify that the engine is not seized.
   - If the engine is seized, refer to one of the following:
     - **Engine Will Not Crank - Crankshaft Will Not Rotate** for the 4.3L (LU3) engine
     - **Engine Will Not Crank - Crankshaft Will Not Rotate** for the 6.6L Diesel (LMM) engine
     - **Engine Will Not Crank - Crankshaft Will Not Rotate** for all other engines (w/o LU3 or LMM)
7. If all circuits test normal, replace the starter motor, or the starter solenoid (LMM 6.6L Diesel).

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Battery Charging**
- **Starter Solenoid Cable Replacement (4.3L)** or **Starter Solenoid Cable Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Starter Solenoid Cable Replacement (6.6L)** or **Starter Solenoid Cable Replacement (6.2L w/Auxiliary Battery)**
- **Battery Negative Cable Replacement (4.3L)** or **Battery Negative Cable Replacement**

(4.8L, 5.3L, 6.0L, and 6.2L) or **Battery Negative Cable Replacement (6.6L)**

- **Starter Motor Solenoid Replacement (6.6L)** (LMM 6.6L Diesel)
- **Starter Motor Replacement (4.3L)** or **Starter Motor Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Starter Motor Replacement (6.6L)**

ENGINE CRANKS SLOWLY

Perform the following checks:

- Battery-Battery Inspection/Test. Refer to **Battery Inspection/Test**.
- Wiring-Inspect the wiring for damage. Inspect all connections to the starter motor, solenoid, battery, and all ground connections. Refer to **Circuit Testing** , **Wiring Repairs** , **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** .
- Engine-Make sure the engine is not seized. Refer to **Symptoms - Engine Mechanical** .

If the battery, the wiring and the engine are functioning properly and the engine continues to crank slowly, replace the starter motor. Refer to **Starter Motor Replacement (4.3L)** or **Starter Motor Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Starter Motor Replacement (6.6L)**.

STARTER MOTOR NOISE DIAGNOSIS

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

The PG starter motors are non-repairable. They have pole pieces that are arranged around the armature. Both solenoid windings are energized. The pull-in winding circuit is completed to the ground through the starter motor. The windings work together magnetically to pull and hold in the plunger. The plunger moves the shift lever. This action causes the starter drive assembly to rotate on the armature shaft spline as it engages with the flywheel ring gear on the engine. Moving at the same time, the plunger also closes the solenoid switch contacts in the starter solenoid. Full battery voltage is applied directly to the starter motor and it cranks the engine.

Reference Information

Description and Operation

Starting System Description and Operation

Circuit/System Verification

Start the engine. Listen to the starter noise while the engine is cranking. Compare the concern to a similar vehicle.

Circuit/System Testing

1. Remove the flywheel inspection cover.
2. Inspect the flywheel for the following:
    - Loose flywheel bolts
    - Chipped gear teeth
    - Missing gear teeth
    - Bent flywheel
    - Debris in the bell housing
    - If not within specifications, remove the debris, tighten the flywheel bolts, or repair or replace the flywheel.
3. If all inspections were within specification, replace the starter motor.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Fastener Tightening Specifications** for the 4.3L (LU3) engine
- **Fastener Tightening Specifications** for the 6.6L (LMM) engine
- **Fastener Tightening Specifications** for all other engines (w/o LU3 or LMM)
- **Engine Flywheel Replacement** for the 4.3L (LU3) engine
- **Engine Flywheel Replacement** for the 6.6L (LMM) engine
- **Automatic Transmission Flex Plate Replacement** for all other engines (w/o LU3 or LMM)
- **Starter Motor Replacement (4.3L)** or **Starter Motor Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Starter Motor Replacement (6.6L)**

REPAIR INSTRUCTIONS

BATTERY NEGATIVE CABLE DISCONNECTION AND CONNECTION (W/SINGLE BATTE BATTERY)

Disconnect Procedure

CAUTION: Refer to Battery Disconnect Caution .

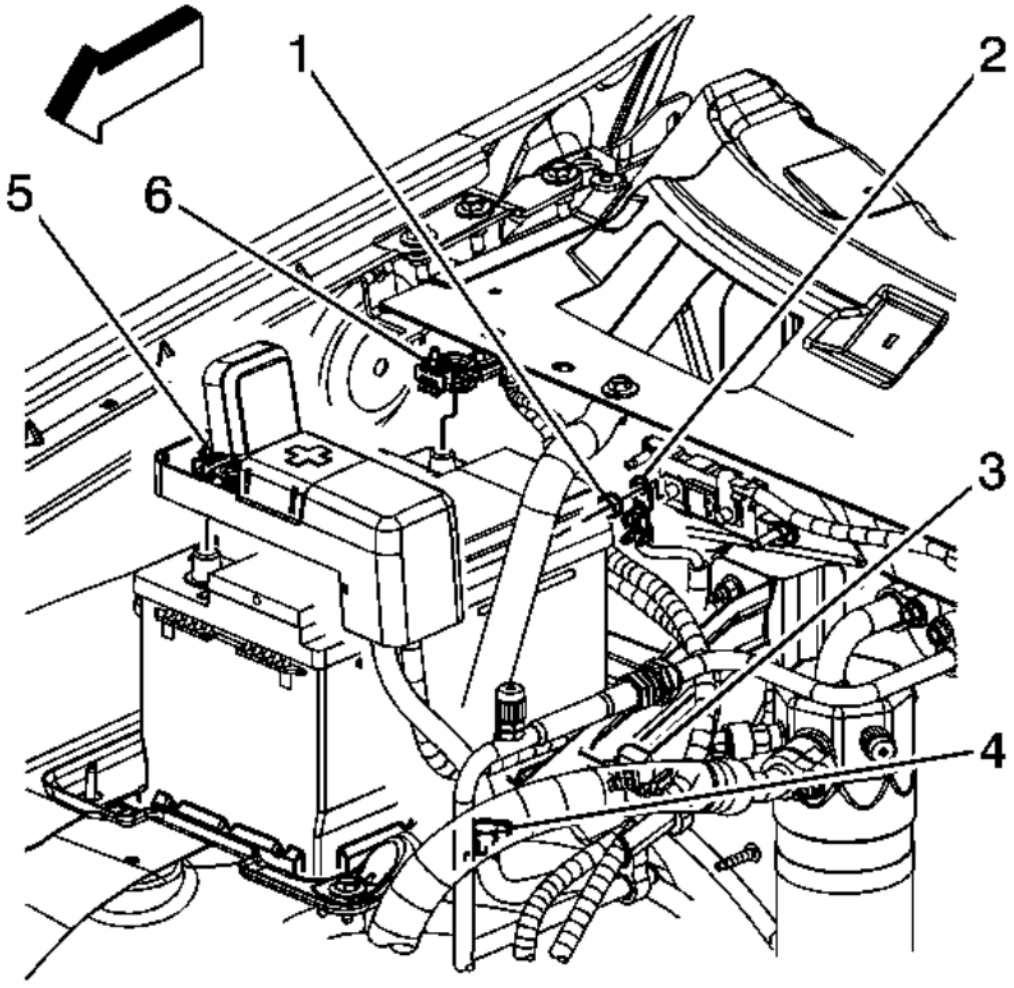


Fig. 5: View Of Battery Cable Components
Courtesy of GENERAL MOTORS CORP.

1. Turn off all the lamps and accessories.
2. Turn the ignition OFF.

3. Open the hood.
4. Loosen the negative cable nut (6).
5. Remove the negative battery cable from the battery terminal.
6. Reposition the negative battery cable away from the battery.

Connect Procedure

CAUTION: Refer to Battery Disconnect Caution .

IMPORTANT: Clean any existing corrosion from the battery terminal and the battery cable end.

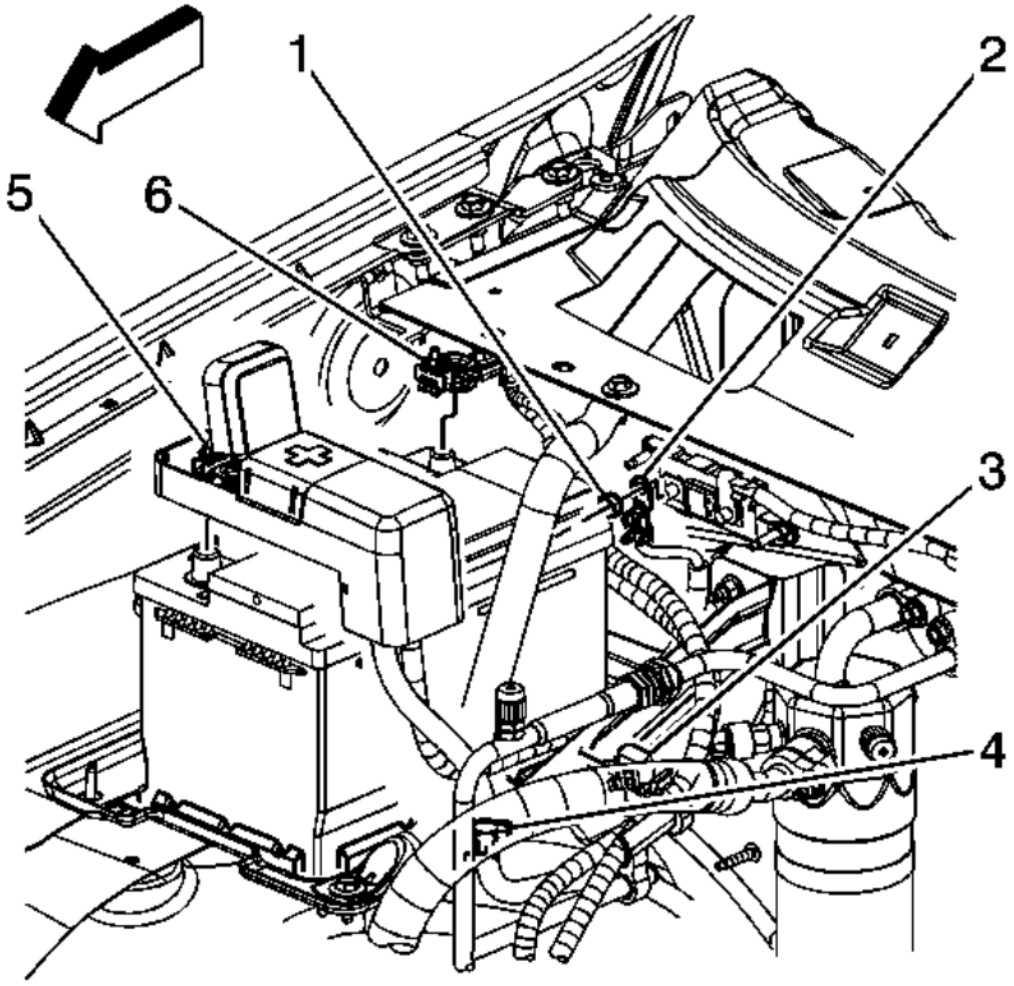


Fig. 6: View Of Battery Cable Components
Courtesy of GENERAL MOTORS CORP.

1. Position the negative battery cable to the battery.

NOTE: Refer to Fastener Notice .

2. Install the negative battery cable onto the battery terminal.
3. Tighten the negative cable nut (6).

Tighten: Tighten the nut to 5 N.m (44 lb in).

4. Close the hood.

BATTERY NEGATIVE CABLE DISCONNECTION AND CONNECTION (W/AUXILIARY BATTERY)

Disconnect Procedure

CAUTION: Refer to Battery Disconnect Caution .

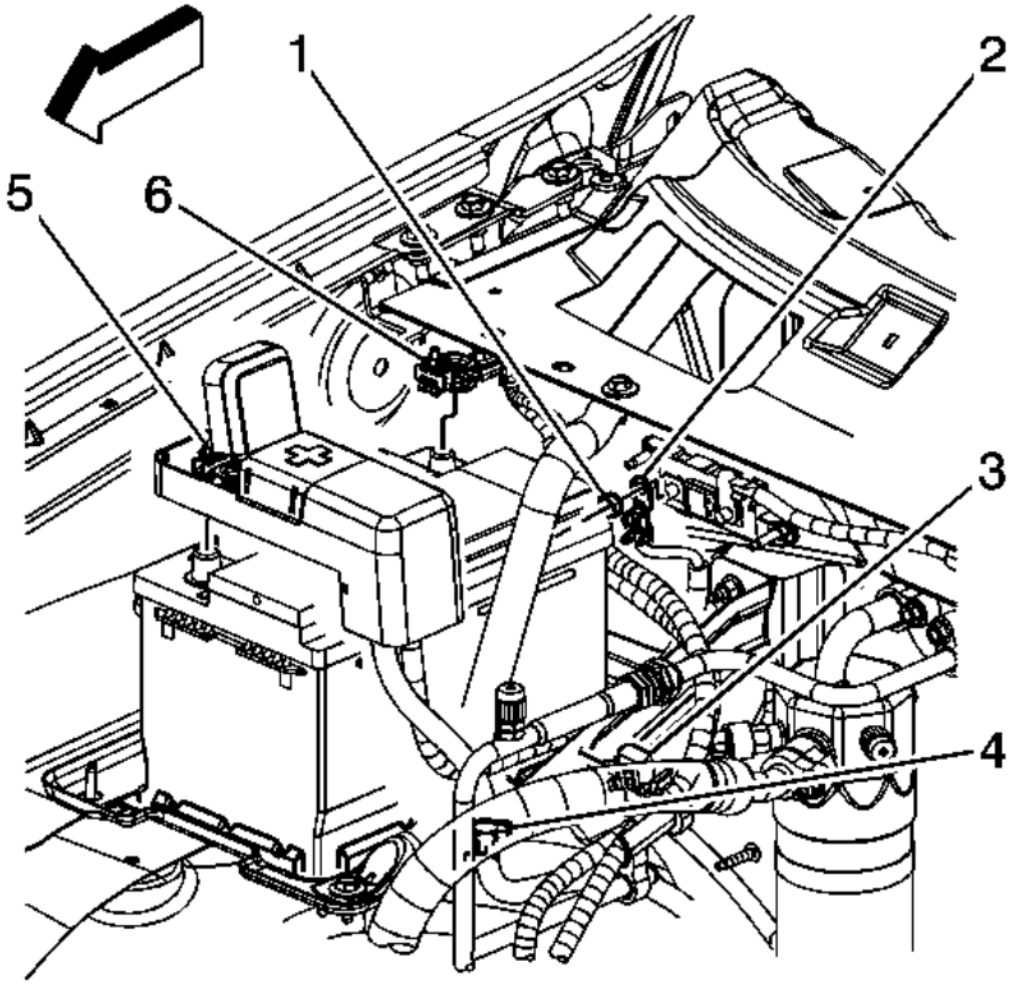


Fig. 7: View Of Battery Cable Components
Courtesy of GENERAL MOTORS CORP.

1. Turn off all the lamps and accessories.
2. Turn the ignition OFF.
3. Open the hood.
4. Loosen the primary negative battery cable nut (6).
5. Remove the primary negative battery cable from the battery negative post.
6. Reposition the primary battery cable away from the battery.

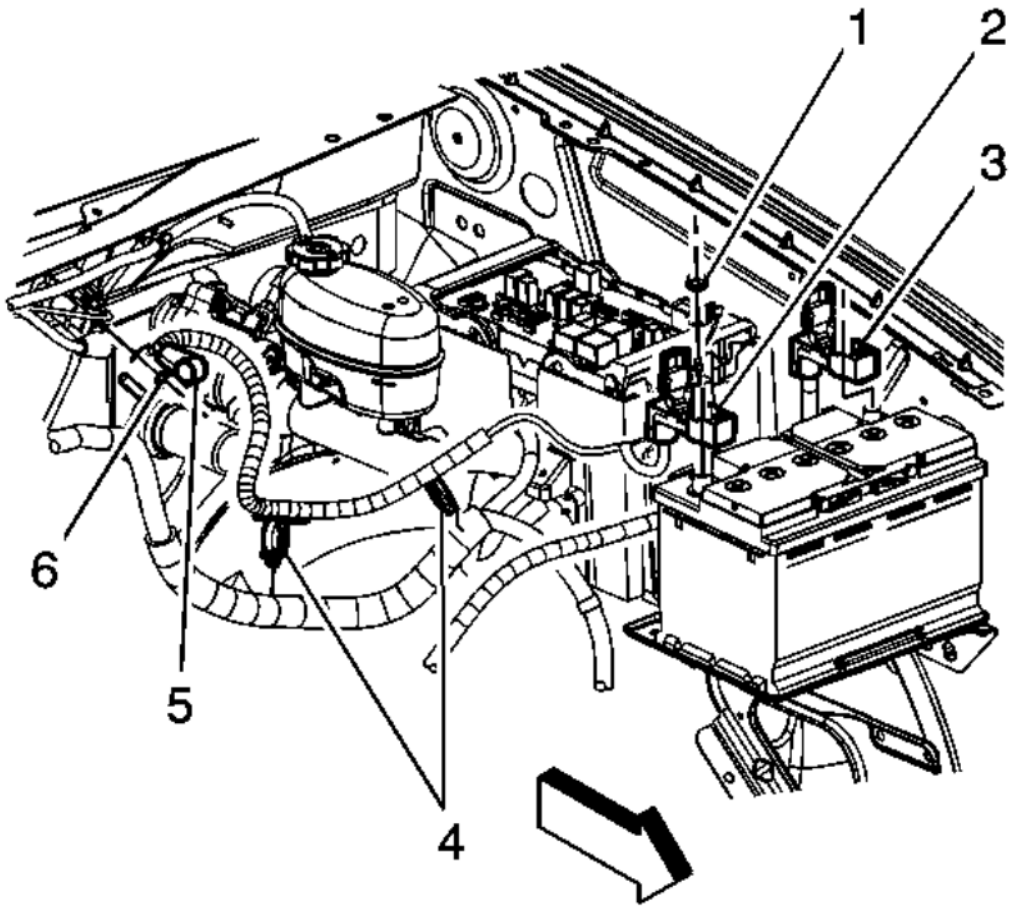


Fig. 8: View Of Battery & Battery Cable Fasteners
Courtesy of GENERAL MOTORS CORP.

7. Open the auxiliary battery negative cable post cover.
8. Loosen the auxiliary battery negative cable nut (3).
9. Remove the auxiliary negative battery cable from the battery negative post.
10. Reposition the auxiliary negative battery cable away from the battery.

Connect Procedure

CAUTION: Refer to Battery Disconnect Caution .

IMPORTANT: Clean any existing corrosion from the battery terminal and the battery cable end.

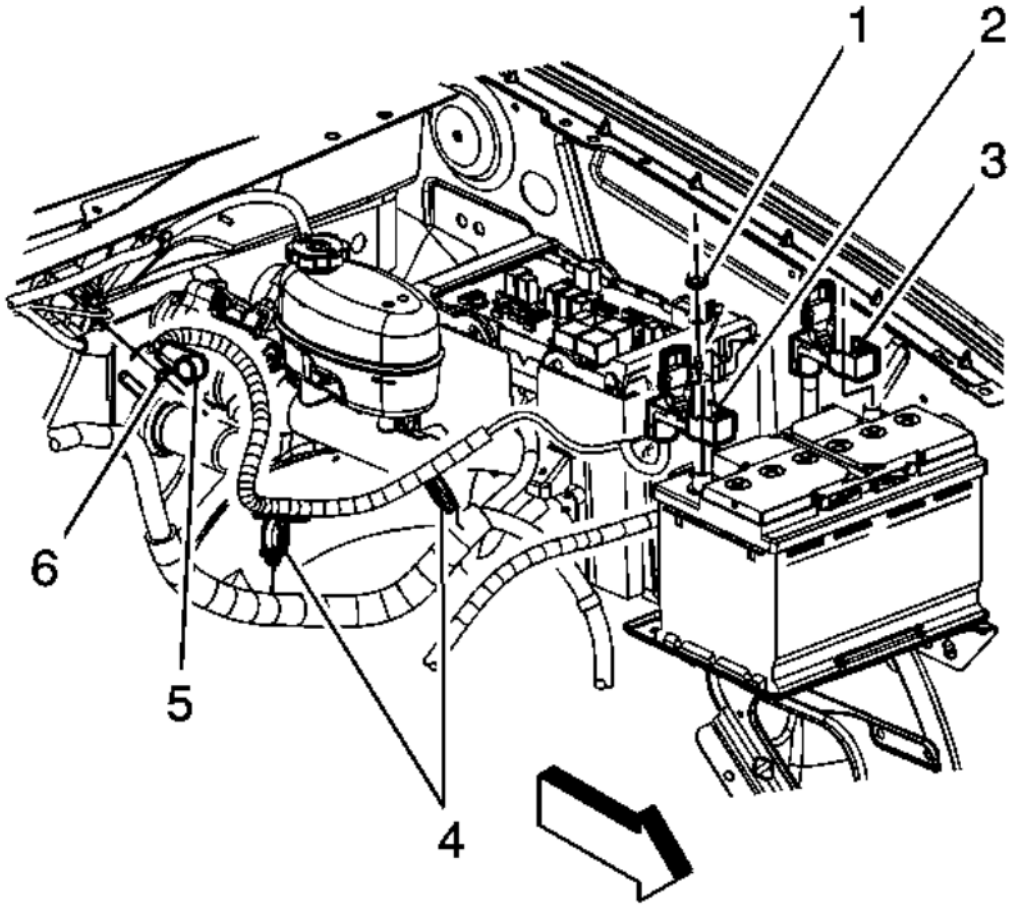


Fig. 9: View Of Battery & Battery Cable Fasteners
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Install the auxiliary negative battery cable onto the battery negative post.
2. Tighten the auxiliary negative battery cable nut (1).

Tighten: Tighten the nut to 7.5 N.m (66 lb in).

3. Close the auxiliary battery negative cable post cover.

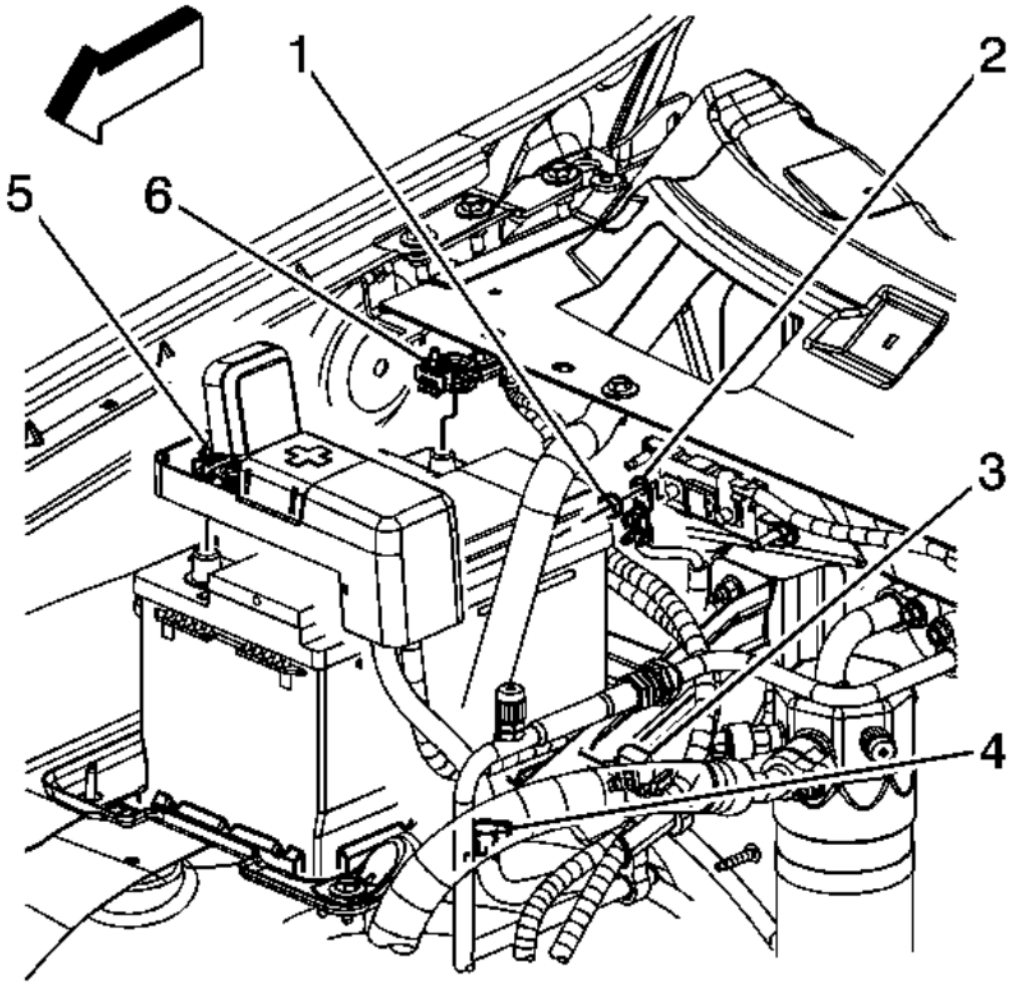


Fig. 10: View Of Battery Cable Components
Courtesy of GENERAL MOTORS CORP.

4. Install the primary negative battery cable onto the battery negative post.
5. Tighten the primary negative battery cable nut (6).

Tighten: Tighten the nut to 5 N.m (44 lb in).

6. Close the hood.

BATTERY NEGATIVE CABLE DISCONNECTION AND CONNECTION (W/DUAL BATTE BATTERIES)

Disconnect Procedure

CAUTION: Refer to Battery Disconnect Caution .

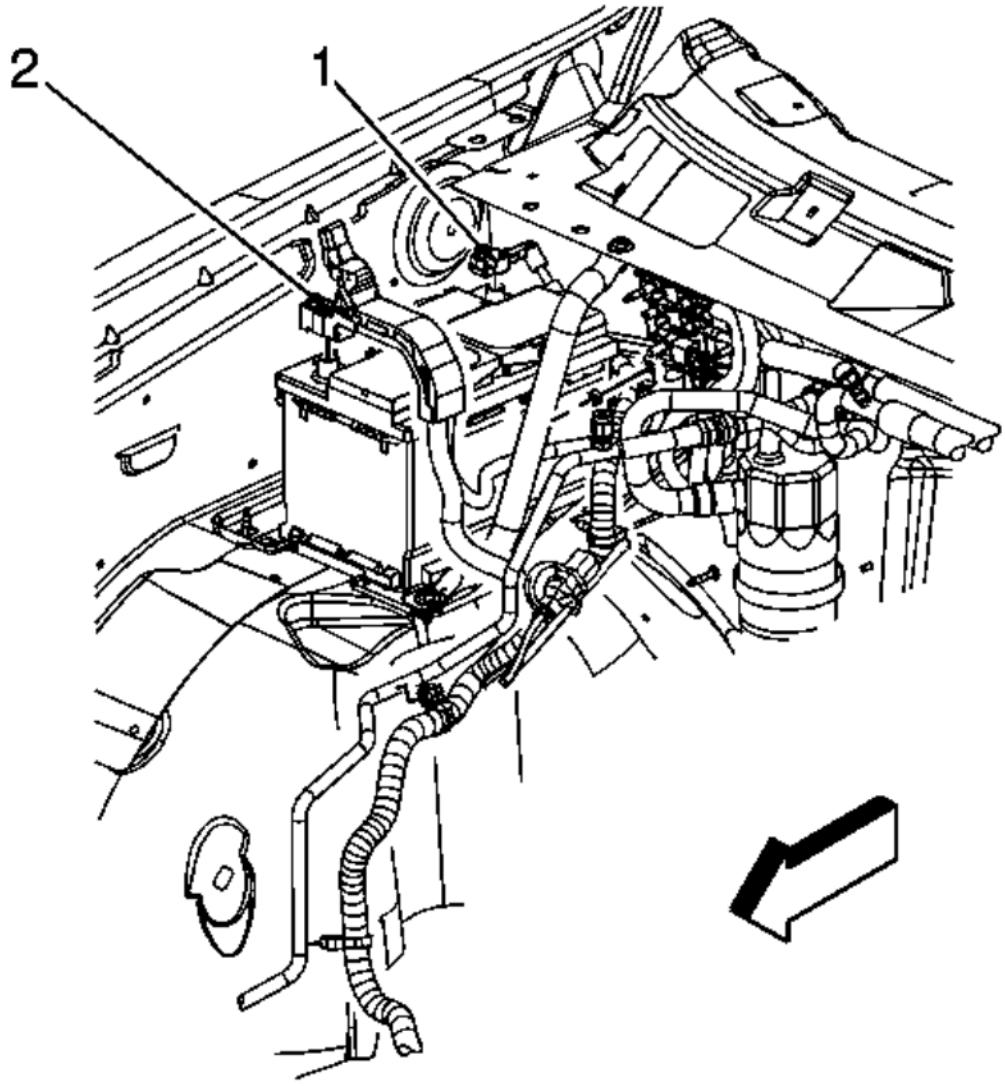


Fig. 11: View Of Negative Battery Cable & Components
Courtesy of GENERAL MOTORS CORP.

1. Turn off all the lamps and accessories.
2. Turn the ignition OFF.
3. Open the hood.
4. Loosen the starter solenoid cable nut (1).

5. Remove the starter solenoid cable from the battery negative post.
6. Reposition the starter solenoid cable away from the battery.

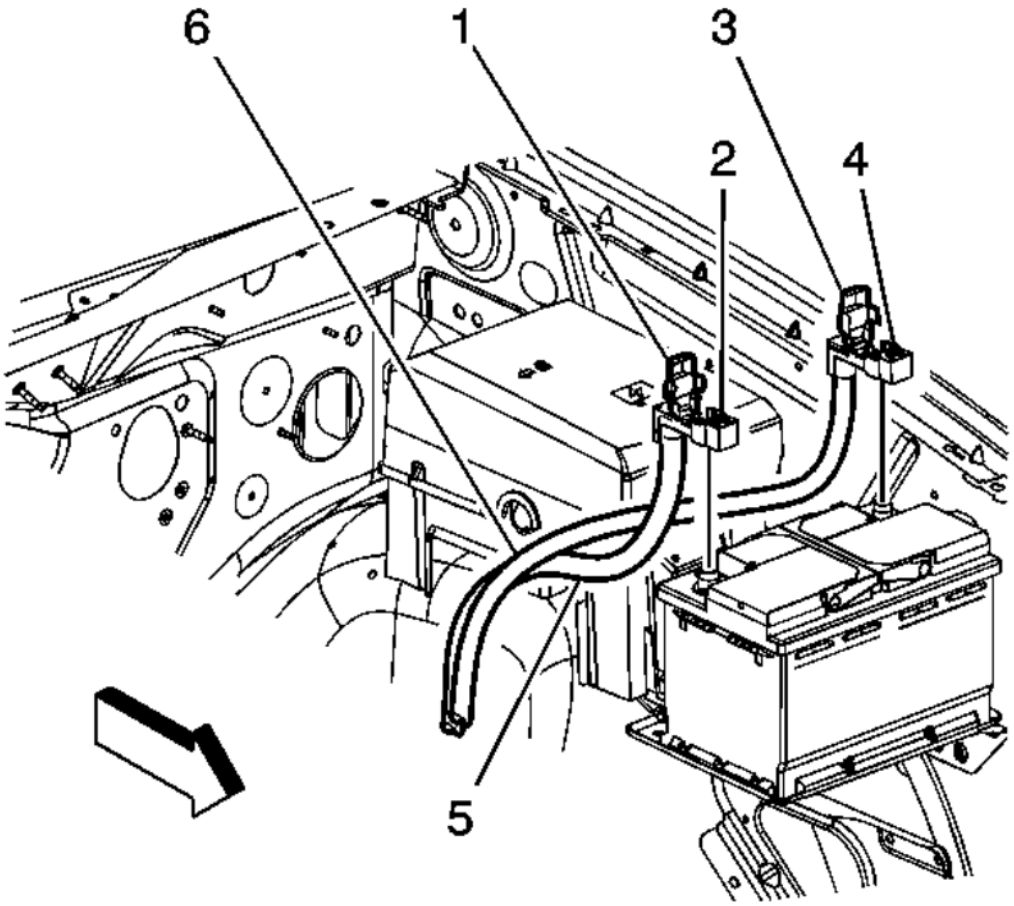


Fig. 12: View Of Battery Components
Courtesy of GENERAL MOTORS CORP.

7. Open the negative battery cable post cover (3).
8. Loosen the negative battery cable nut (4).
9. Remove the negative battery cable (6) from the battery negative post.
10. Reposition the negative battery cable away from the battery.

Connect Procedure

CAUTION: Refer to Battery Disconnect Caution .

NOTE: Refer to Fastener Notice .

IMPORTANT: Clean any existing corrosion from the battery terminal and the battery cable end.

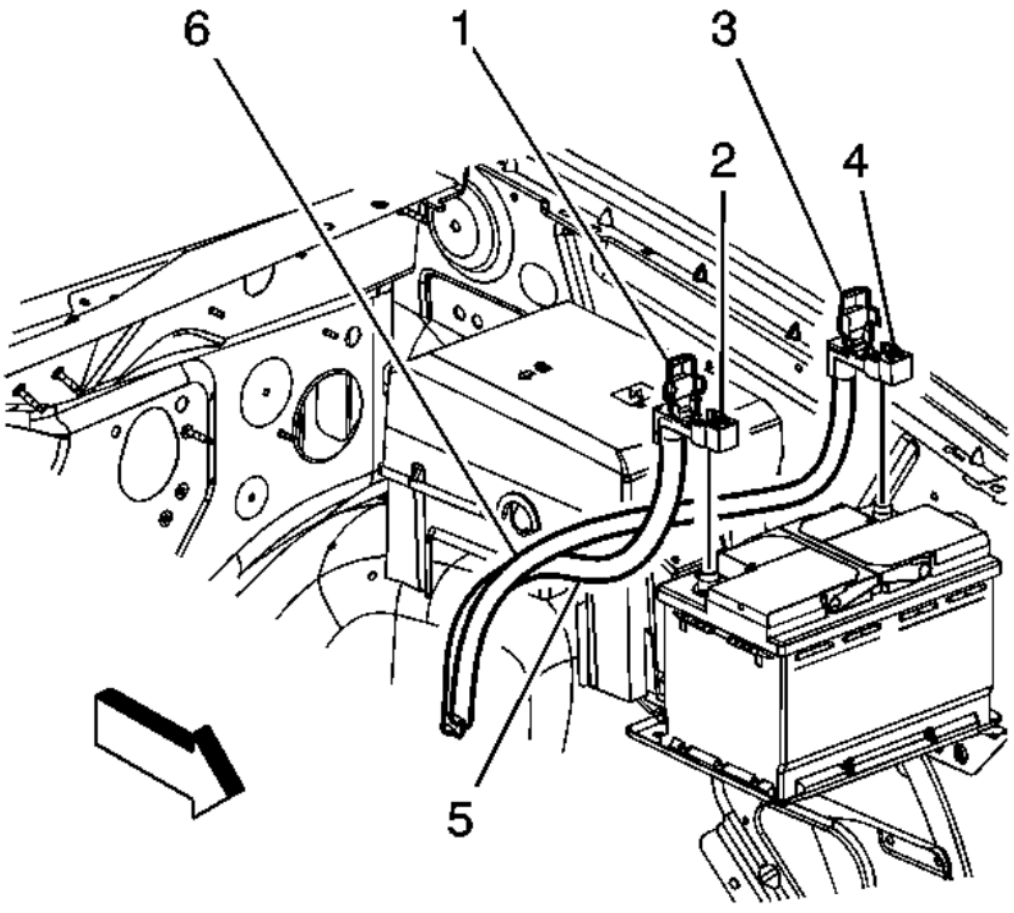


Fig. 13: View Of Battery Components
Courtesy of GENERAL MOTORS CORP.

1. Install the negative battery cable (6) onto the battery negative post.

2. Tighten the negative battery cable nut (4).

   Tighten: Tighten the nut to 7.5 N.m (66 lb in).

3. Close the negative battery cable post cover (3).

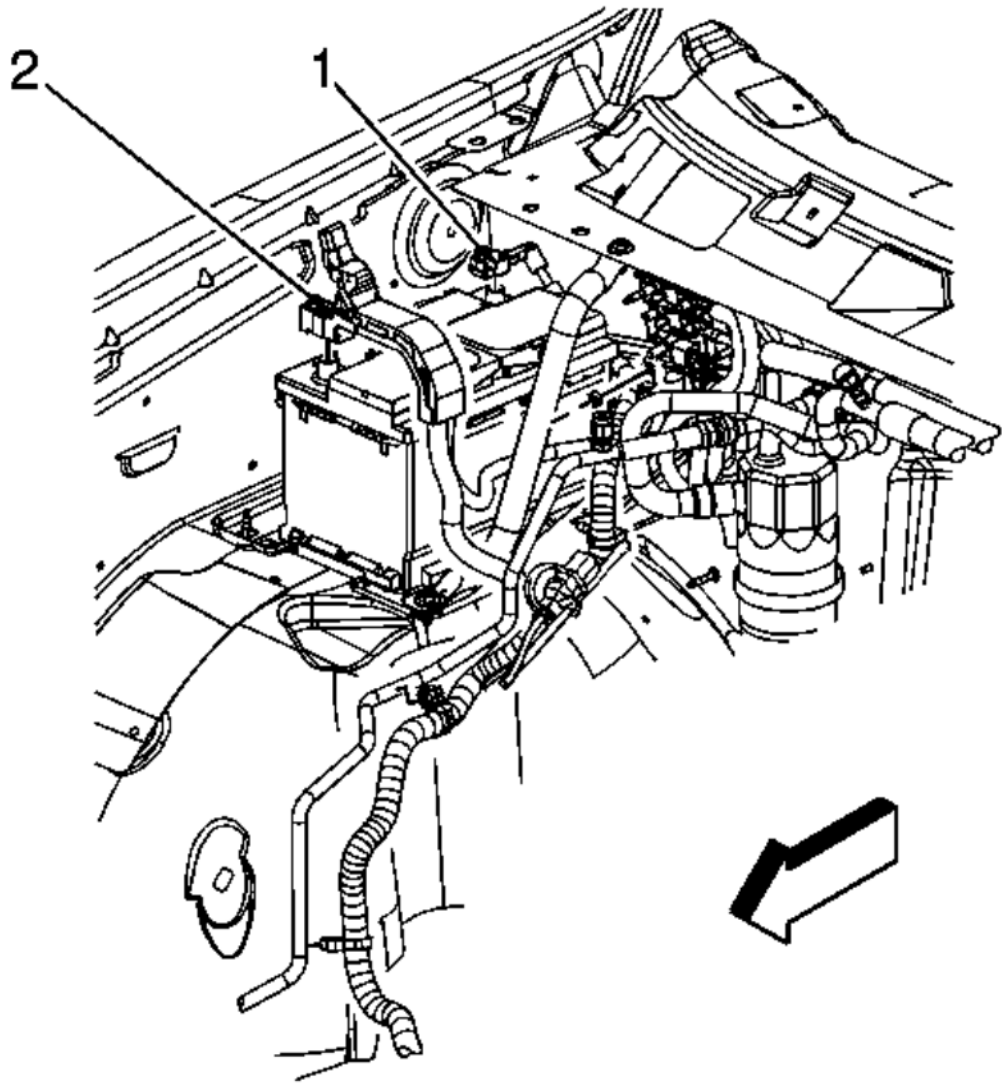


Fig. 14: View Of Negative Battery Cable & Components
Courtesy of GENERAL MOTORS CORP.

4. Install the starter solenoid cable onto the battery negative post.
5. Tighten the starter solenoid cable nut (1).

   Tighten: Tighten the nut to 5 N.m (44 lb in).

6. Close the hood.

BATTERY CURRENT SENSOR REPLACEMENT (4.3L)

Removal Procedure

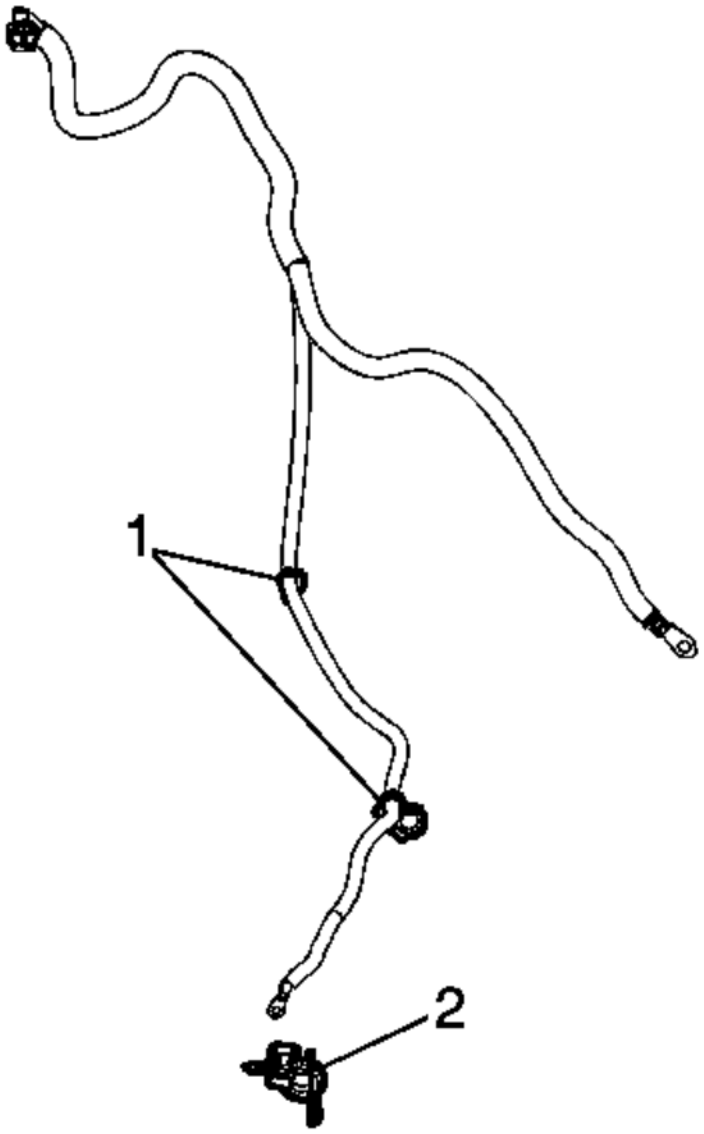


Fig. 15: View Of Negative Battery Cable Clips & Battery Current Sensor
Courtesy of GENERAL MOTORS CORP.

1. Remove the negative battery cable. Refer to **Battery Negative Cable Replacement (4.3L)** or **Battery Negative Cable Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Battery Negative Cable Replacement (6.6L)**.

2. Mark the location of the battery current sensor on the battery cable with tape for reference during installation.
3. Remove the tape securing the battery current sensor to the negative battery cable.
4. Mark the location of the negative battery cable clips (1) and remove the clips from the cable.
5. Squeeze the negative battery cable branches together.

IMPORTANT: Note the orientation of the battery current sensor prior to removal.

6. Slide the battery current sensor (2) off of the negative battery cable.

Installation Procedure

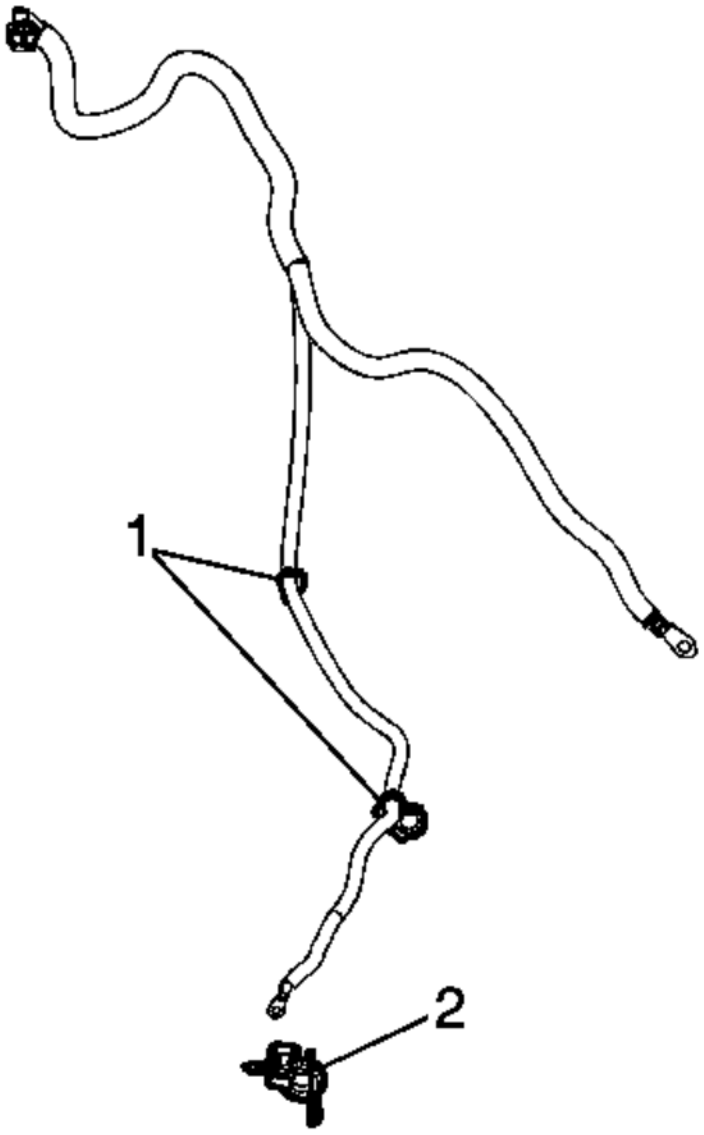


Fig. 16: View Of Negative Battery Cable Clips & Battery Current Sensor
Courtesy of GENERAL MOTORS CORP.

1. Squeeze the negative battery cable branches together.

IMPORTANT: Ensure the battery current sensor is installed in the correct

direction and location on the negative battery cable.

2. Slide the NEW battery current sensor (2) up onto the negative battery cable to the location previously marked during removal.
3. Wrap electrical tape around the battery current sensor leg in order to secure the sensor to the negative battery cable.
4. Install the negative battery cable clips (1) to the cable to the locations previously marked during removal.
5. Install the negative battery cable. Refer to **Battery Negative Cable Replacement (4.3L)** or **Battery Negative Cable Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Battery Negative Cable Replacement (6.6L)**.

BATTERY CURRENT SENSOR REPLACEMENT (4.8L, 5.3L, 6.0L, AND 6.2L)

Removal Procedure

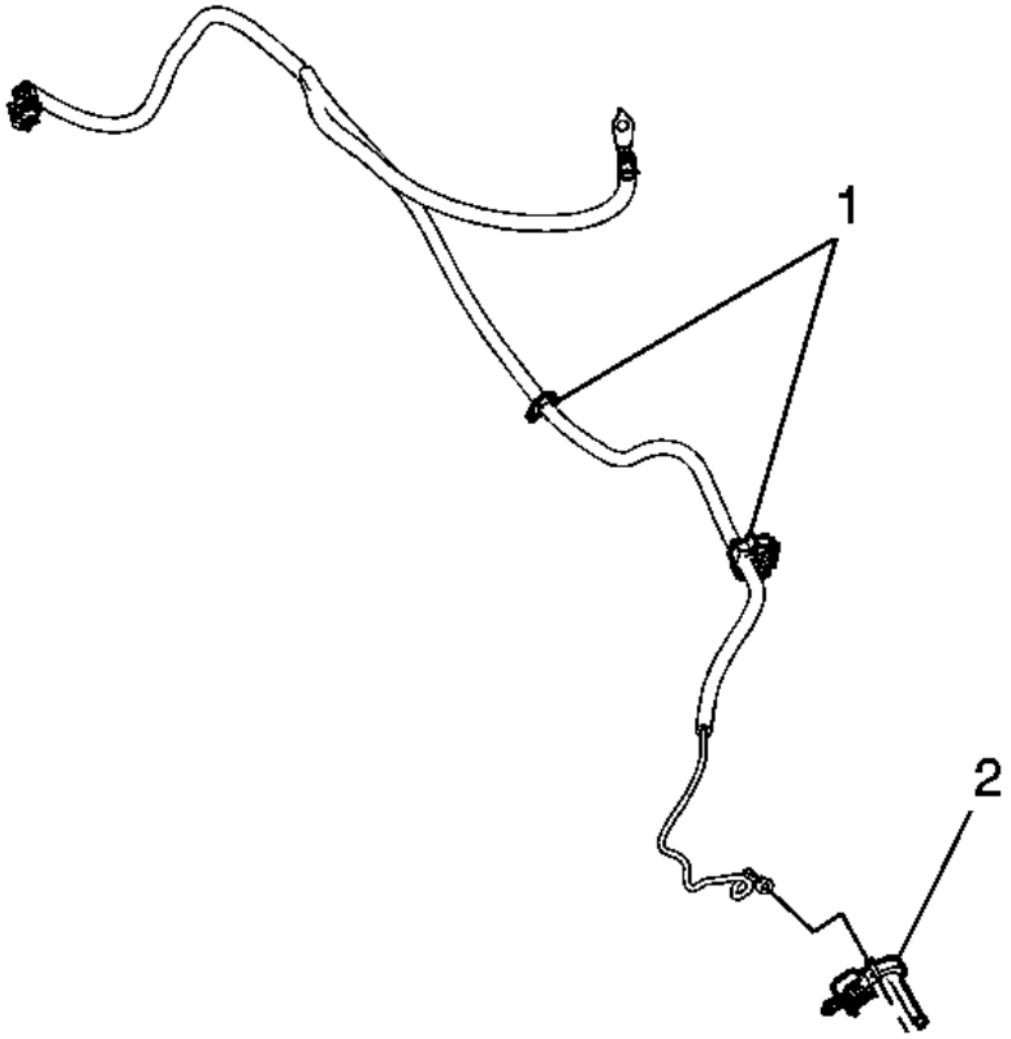


Fig. 17: View Of Battery Cable & Current Sensor
Courtesy of GENERAL MOTORS CORP.

1. Remove the negative battery cable. Refer to **Battery Negative Cable Replacement (4.3L)** or **Battery Negative Cable Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Battery Negative Cable Replacement (6.6L)**.
2. Mark the location of the battery current sensor on the battery cable with tape for reference during installation.
3. Remove the tape securing the battery current sensor to the negative battery cable.

4. Mark the location of the negative battery cable clips (1) and remove the clips from the cable.
5. Squeeze the negative battery cable branches together.

IMPORTANT: Note the orientation of the battery current sensor prior to removal.

6. Slide the battery current sensor (2) off of the negative battery cable.

Installation Procedure

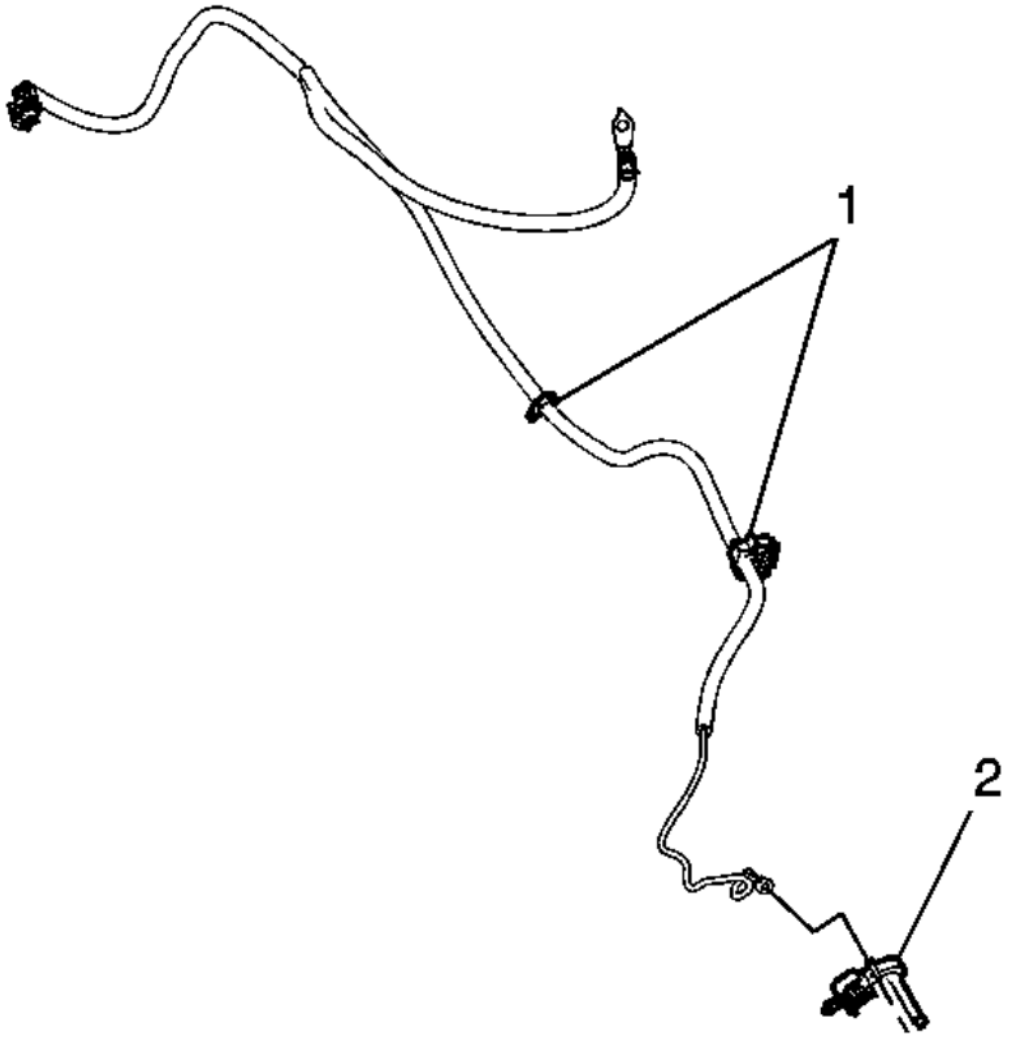


Fig. 18: View Of Battery Cable & Current Sensor
Courtesy of GENERAL MOTORS CORP.

1. Squeeze the negative battery cable branches together.

IMPORTANT: Ensure the battery current sensor is installed in the correct direction and location on the negative battery cable.

2. Slide the NEW battery current sensor (2) up onto the negative battery cable to the location

previously marked during removal.

3. Wrap electrical tape around the battery current sensor leg in order to secure the sensor to the negative battery cable.
4. Install the negative battery cable clips (1) to the cable to the locations previously marked during removal.
5. Install the negative battery cable. Refer to **Battery Negative Cable Replacement (4.3L)** or **Battery Negative Cable Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Battery Negative Cable Replacement (6.6L)**.

BATTERY NEGATIVE CABLE REPLACEMENT (4.3L)

Removal Procedure

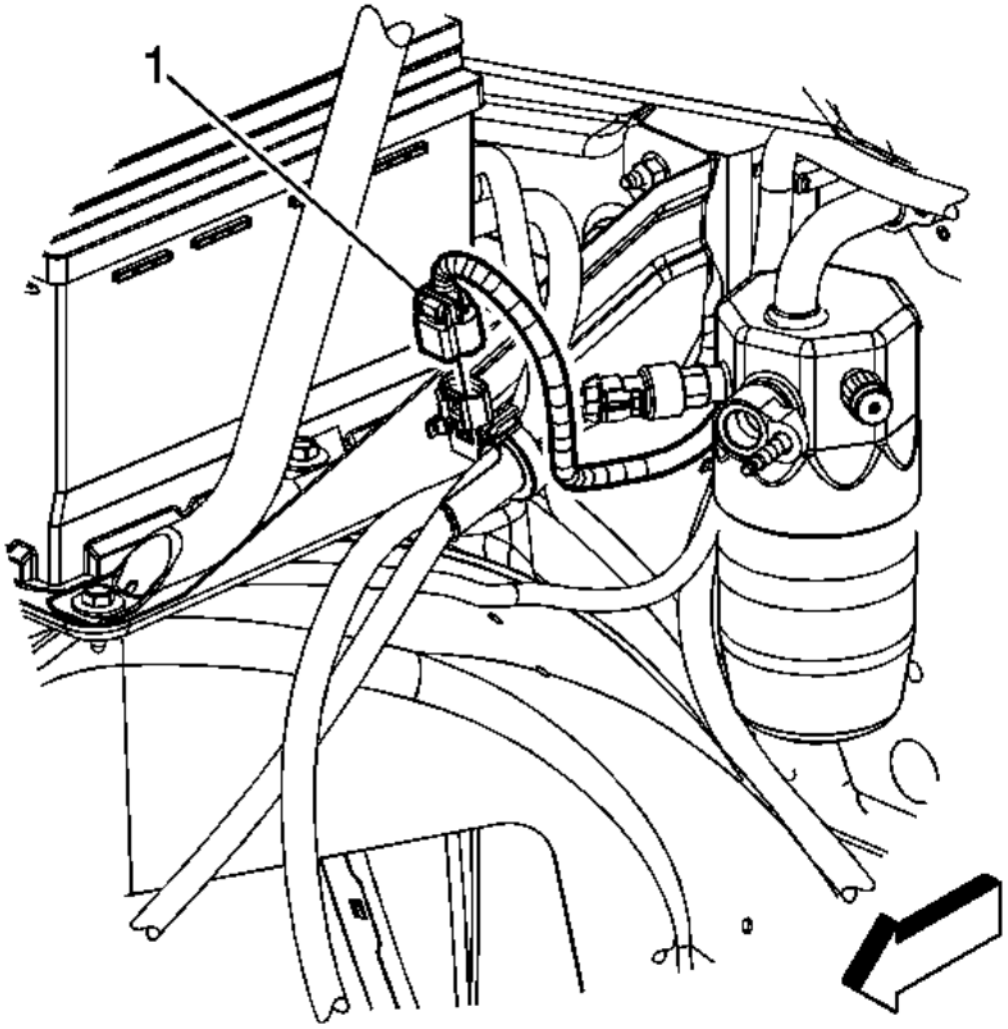


Fig. 19: View Of Engine Harness Electrical Connector & Battery Current Sensor
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.
2. Remove the air cleaner outlet resonator. Refer to **Air Cleaner Outlet Resonator Replacement** .

3. Disconnect the engine wiring harness electrical connector (1) from the battery current sensor.

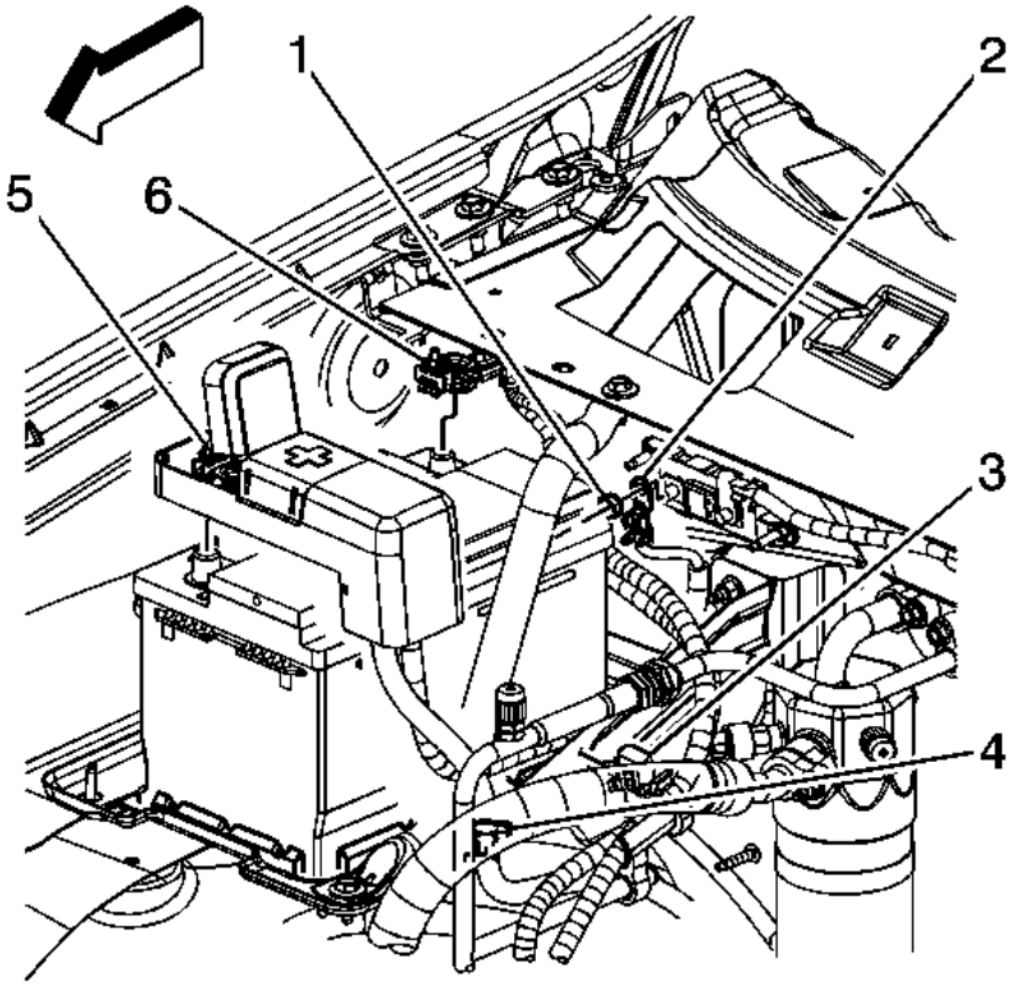


Fig. 20: View Of Battery Cable Components
Courtesy of GENERAL MOTORS CORP.

4. Remove the battery current sensor (3) clip from the battery tray.

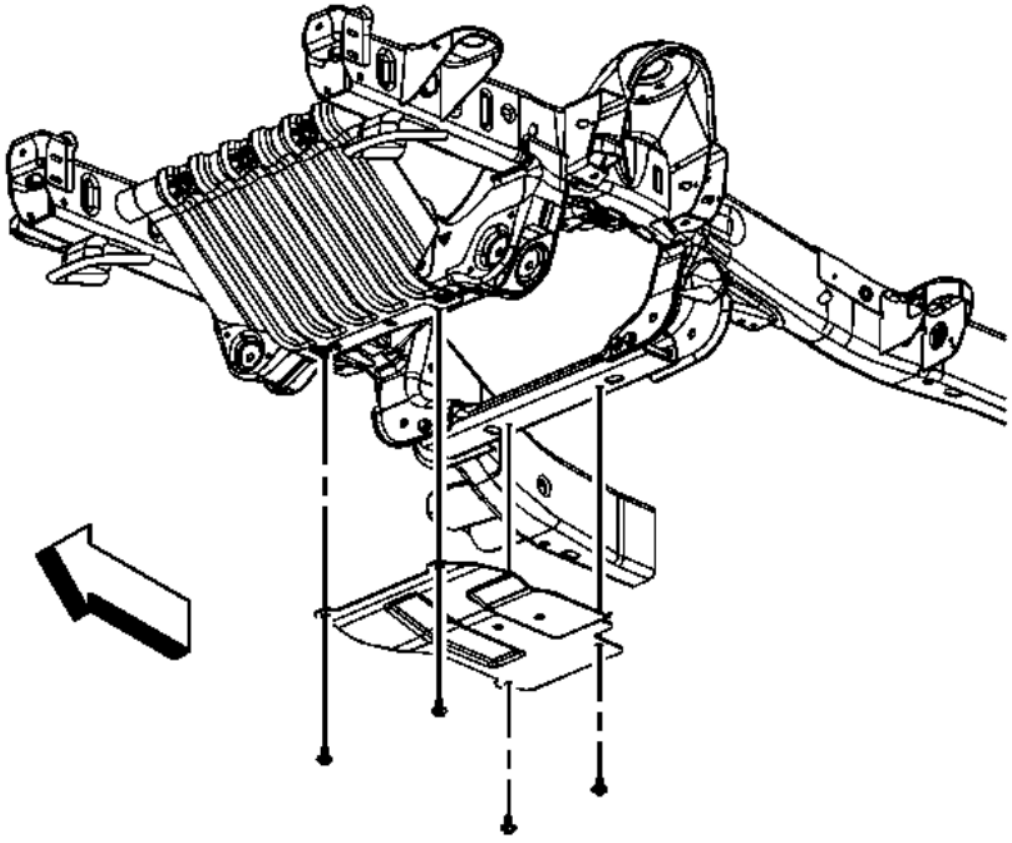


Fig. 21: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

5. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
6. Remove the oil pan skid plate and bolts, if equipped.

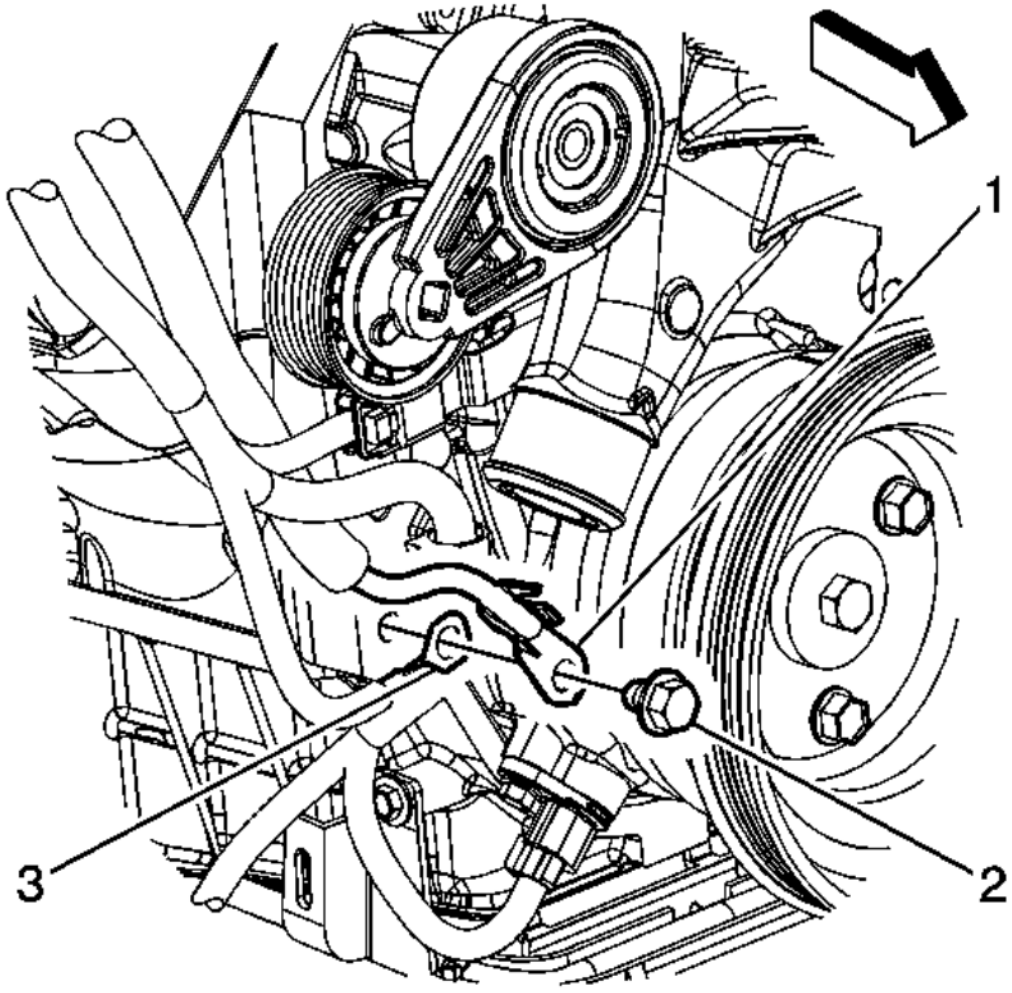


Fig. 22: View Of Battery Cable Terminal, Battery Cable Bolt & Wiring Harness Terminal
Courtesy of GENERAL MOTORS CORP.

7. Remove the negative battery cable bolt (2) from the front of the engine block.
8. Reposition the negative battery cable terminal (1) and the engine wiring harness terminal (3) from the engine block.

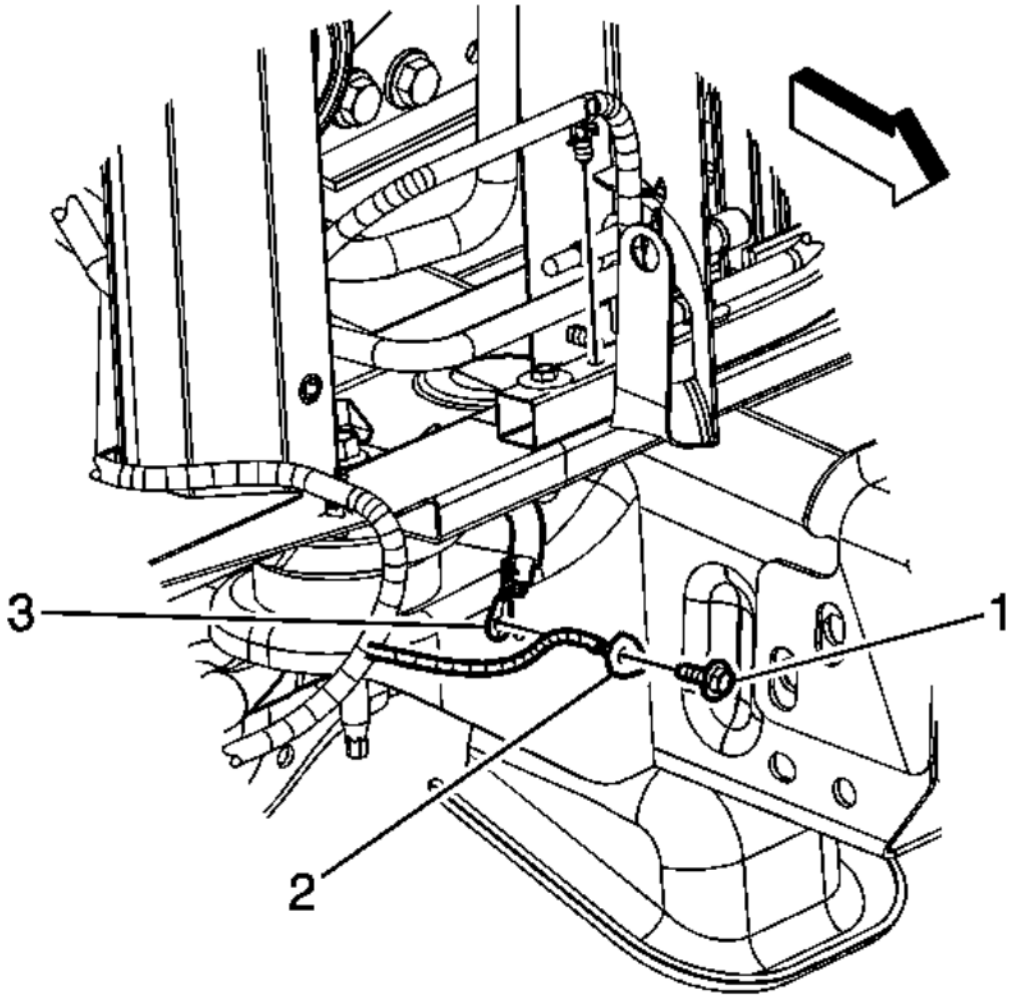


Fig. 23: View Of Negative Battery Cable Terminal, Forward Lamp Wiring Harness Terminal & Ground Bolt
Courtesy of GENERAL MOTORS CORP.

9. Remove the forward lamp wiring harness ground bolt (1).
10. Remove the forward lamp wiring harness terminal (2) from the frame.
11. Remove the negative battery cable terminal (3) out through the opening between the radiator support and frame.

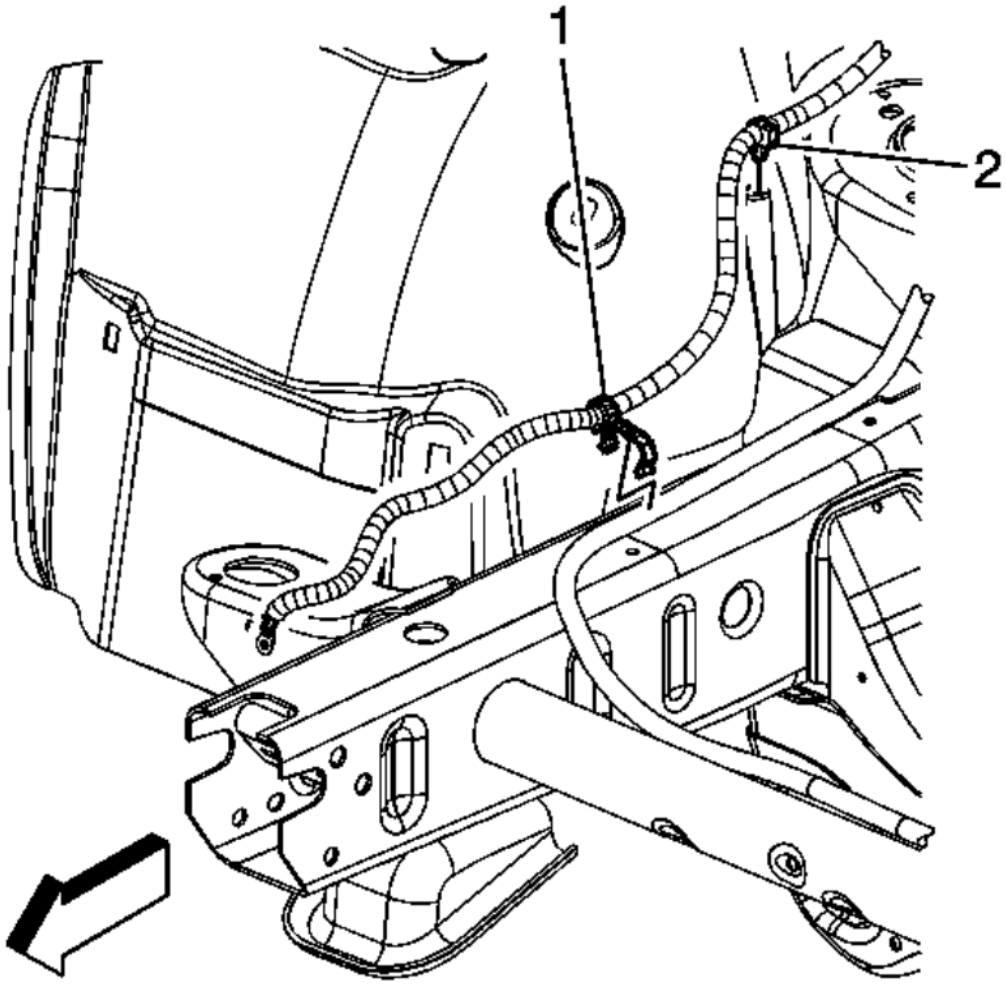


Fig. 24: View Of Battery Cable Clips
Courtesy of GENERAL MOTORS CORP.

12. Remove the negative battery cable clip (1) from the chassis harness.
13. Lower the vehicle.
14. Remove the negative battery cable clip (2) from the right wheelhouse liner.

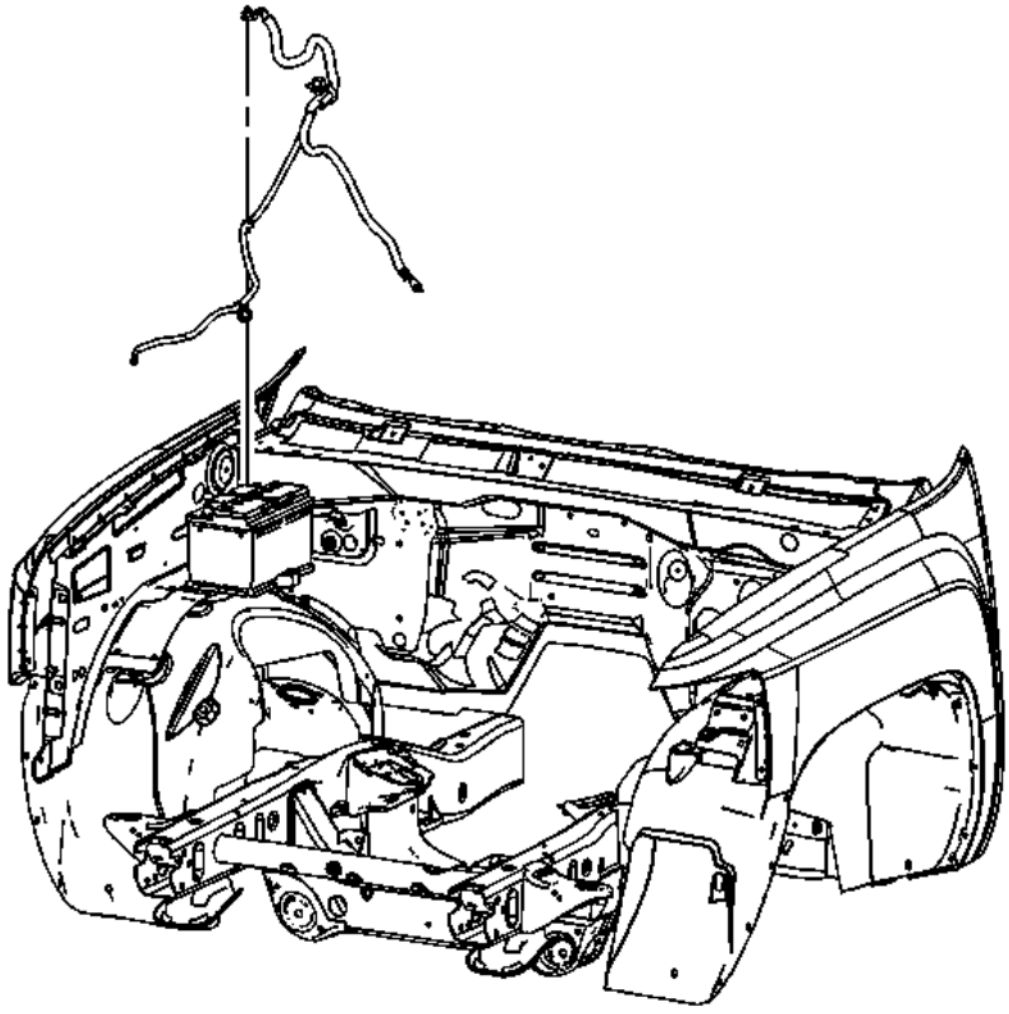


Fig. 25: View Of Negative Battery Cable
Courtesy of GENERAL MOTORS CORP.

15. Remove the negative battery cable from the vehicle.
16. If replacing the negative battery cable, remove the battery current sensor. Refer to **Battery Current Sensor Replacement (4.3L)** or **Battery Current Sensor Replacement (4.8L, 5.3L, 6.0L, and 6.2L)**.

Installation Procedure

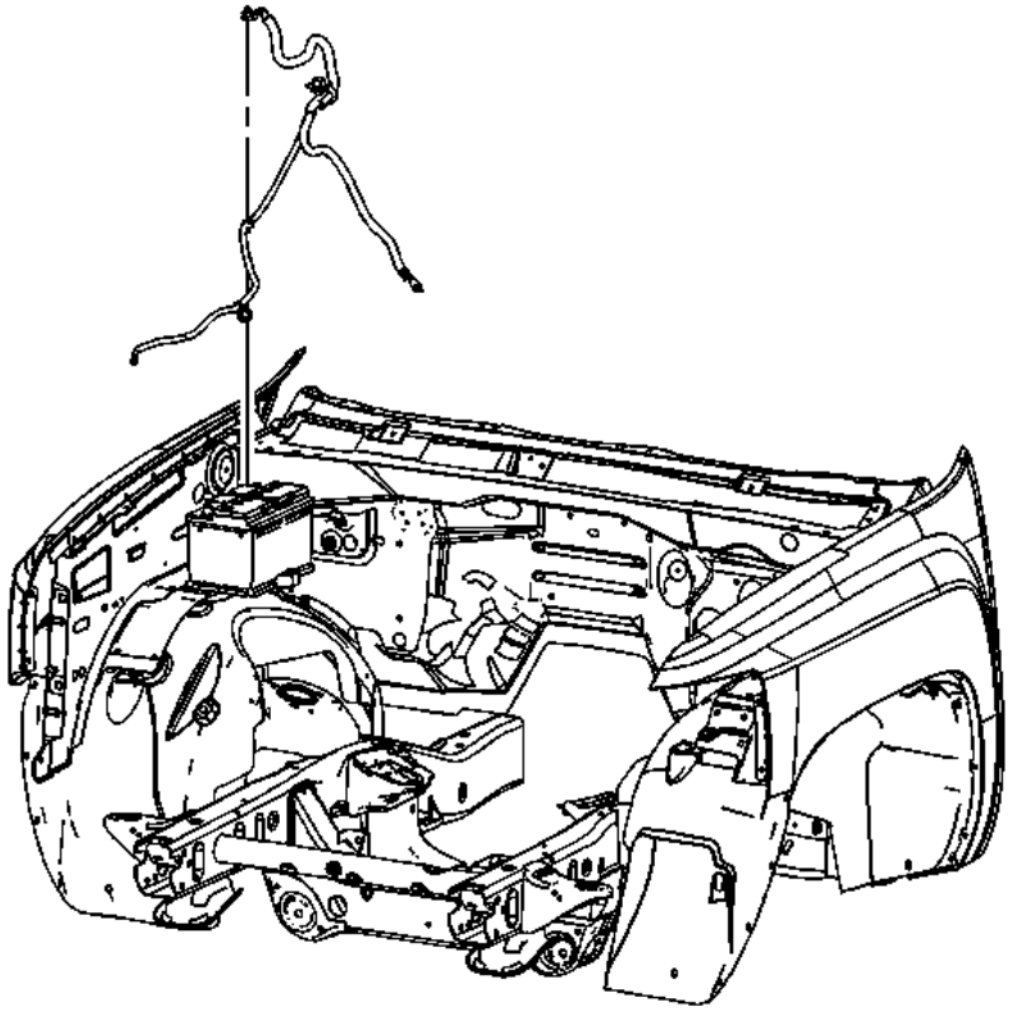


Fig. 26: View Of Negative Battery Cable
Courtesy of GENERAL MOTORS CORP.

1. If the negative battery cable was replaced, install the battery current sensor. Refer to **Battery Current Sensor Replacement (4.3L)** or **Battery Current Sensor Replacement (4.8L, 5.3L, 6.0L, and 6.2L)**.
2. Install the negative battery cable to the vehicle.

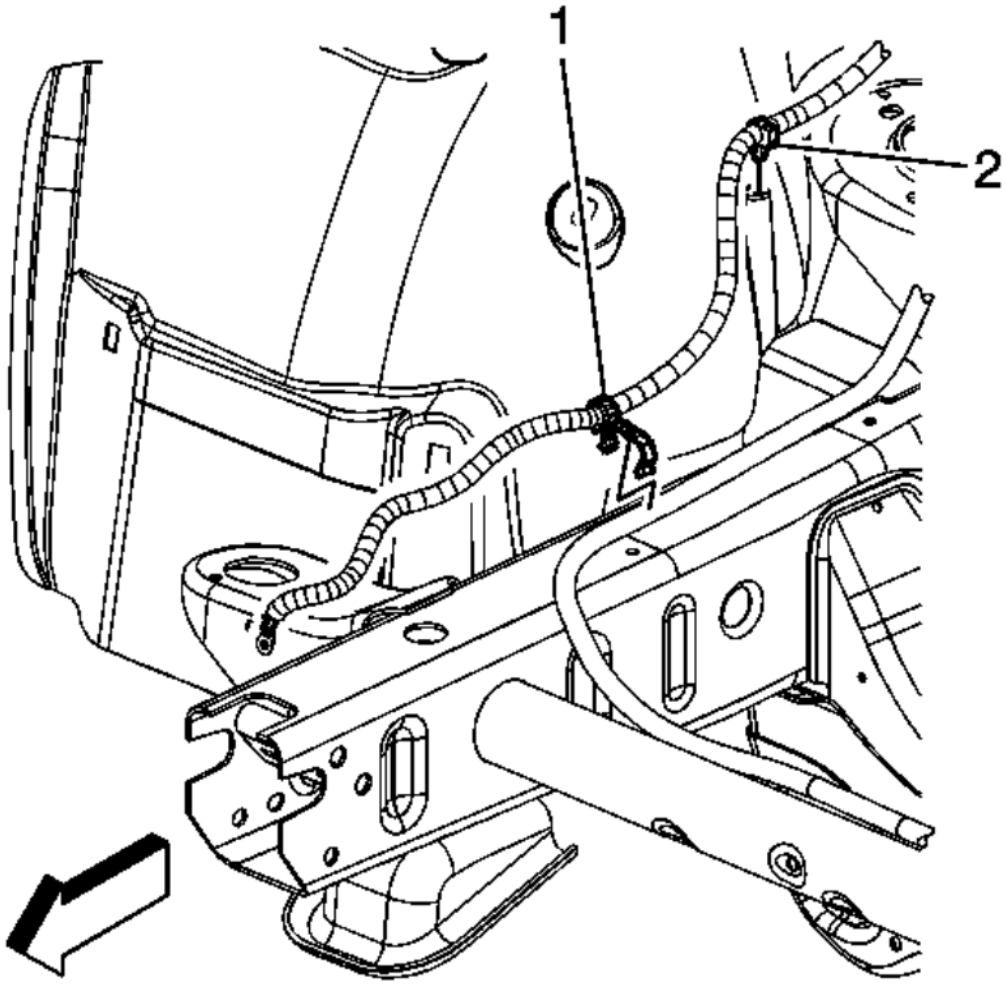


Fig. 27: View Of Battery Cable Clips
Courtesy of GENERAL MOTORS CORP.

3. Install the negative battery cable clip (2) to the right wheelhouse liner.
4. Raise and support the vehicle.
5. Install the negative battery cable clip (1) to the chassis harness.

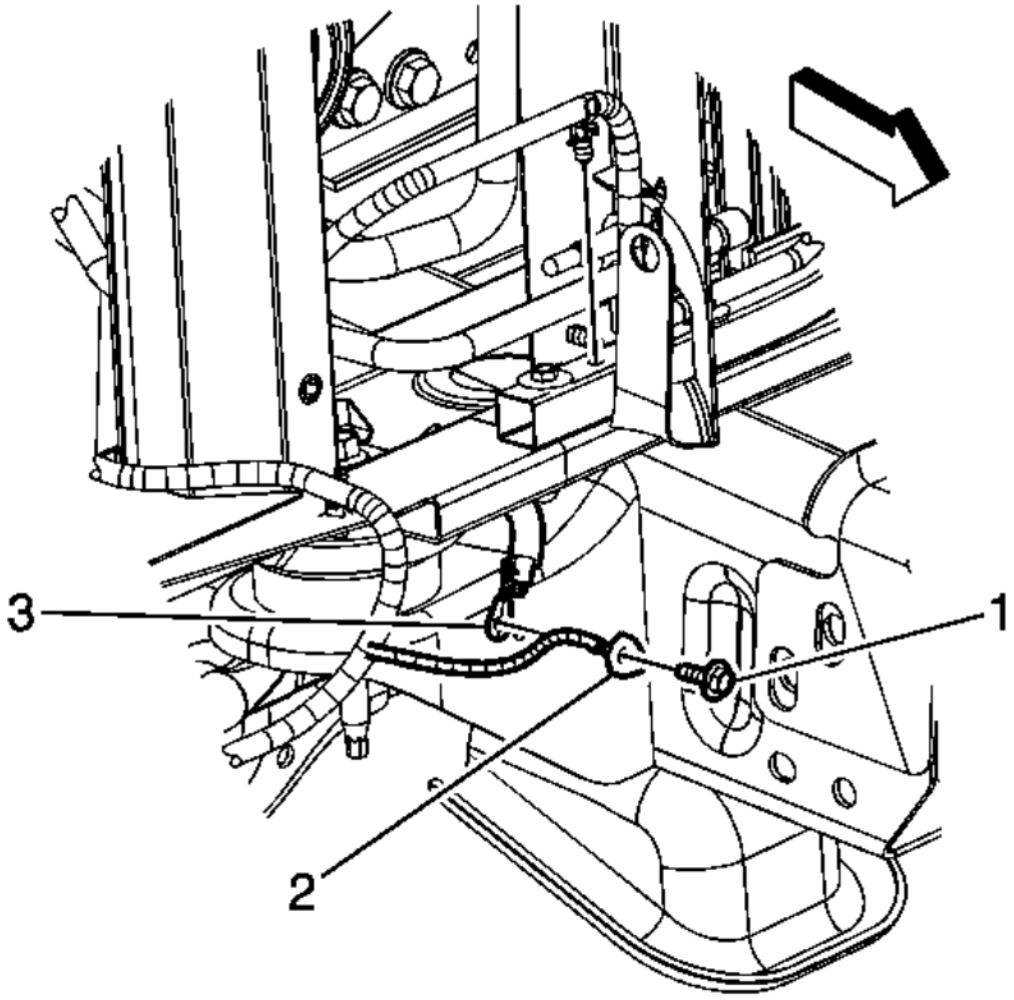


Fig. 28: View Of Negative Battery Cable Terminal, Forward Lamp Wiring Harness Terminal & Ground Bolt
Courtesy of GENERAL MOTORS CORP.

6. Route the negative battery cable terminal (3) through the opening between the radiator support and frame.
7. Ensure that the negative battery cable is positioned behind the forward lamp harness.
8. Install the forward lamp wiring harness terminal (2) to the frame. Ensure that the anti-rotation tab is inserted into the hole in the frame.

9. Install the forward lamp wiring harness ground bolt (1).

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

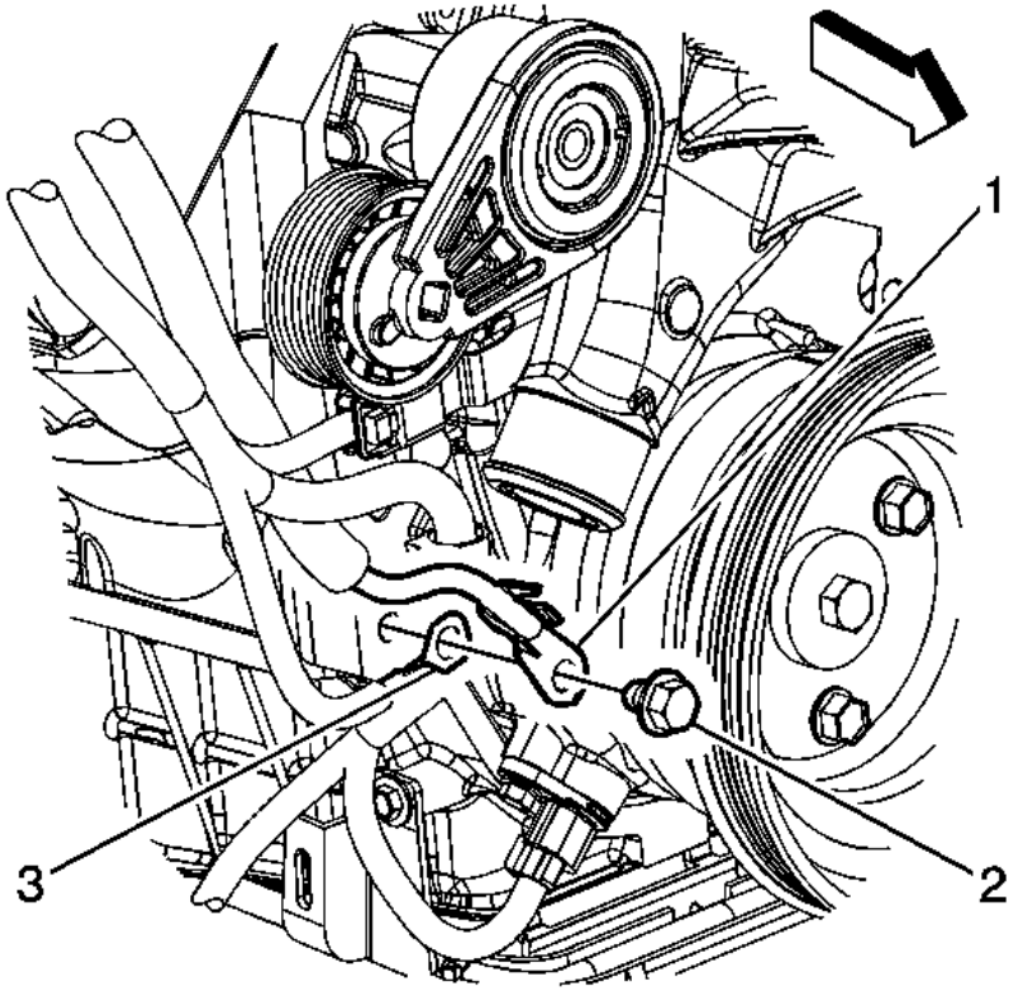


Fig. 29: View Of Battery Cable Terminal, Battery Cable Bolt & Wiring Harness Terminal
Courtesy of GENERAL MOTORS CORP.

10. Position the engine wiring harness terminal (3) against the engine block and position the negative battery cable terminal (1) on top of the engine wiring harness terminal.

11. Install the negative battery cable bolt (2) to the front of the engine block.

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

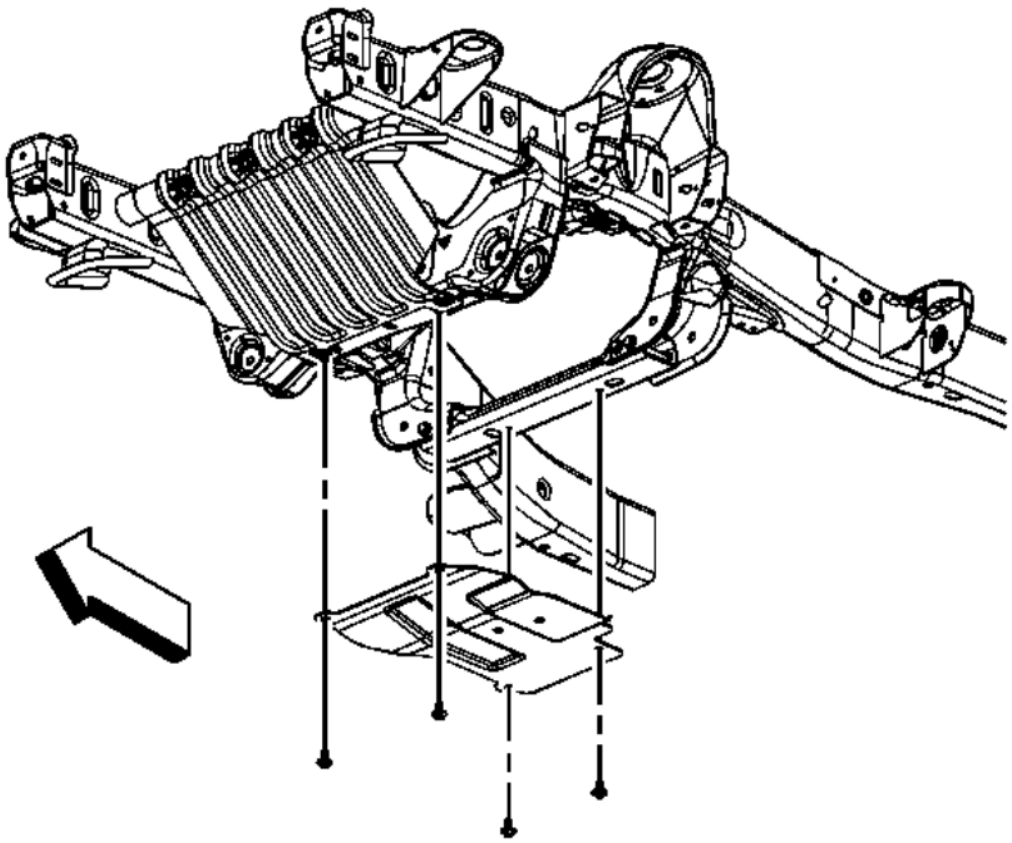


Fig. 30: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

12. Position the oil pan skid plate and install the bolts, if equipped.

    Tighten: Tighten the bolt to 28 N.m (21 lb ft).

13. Lower the vehicle.

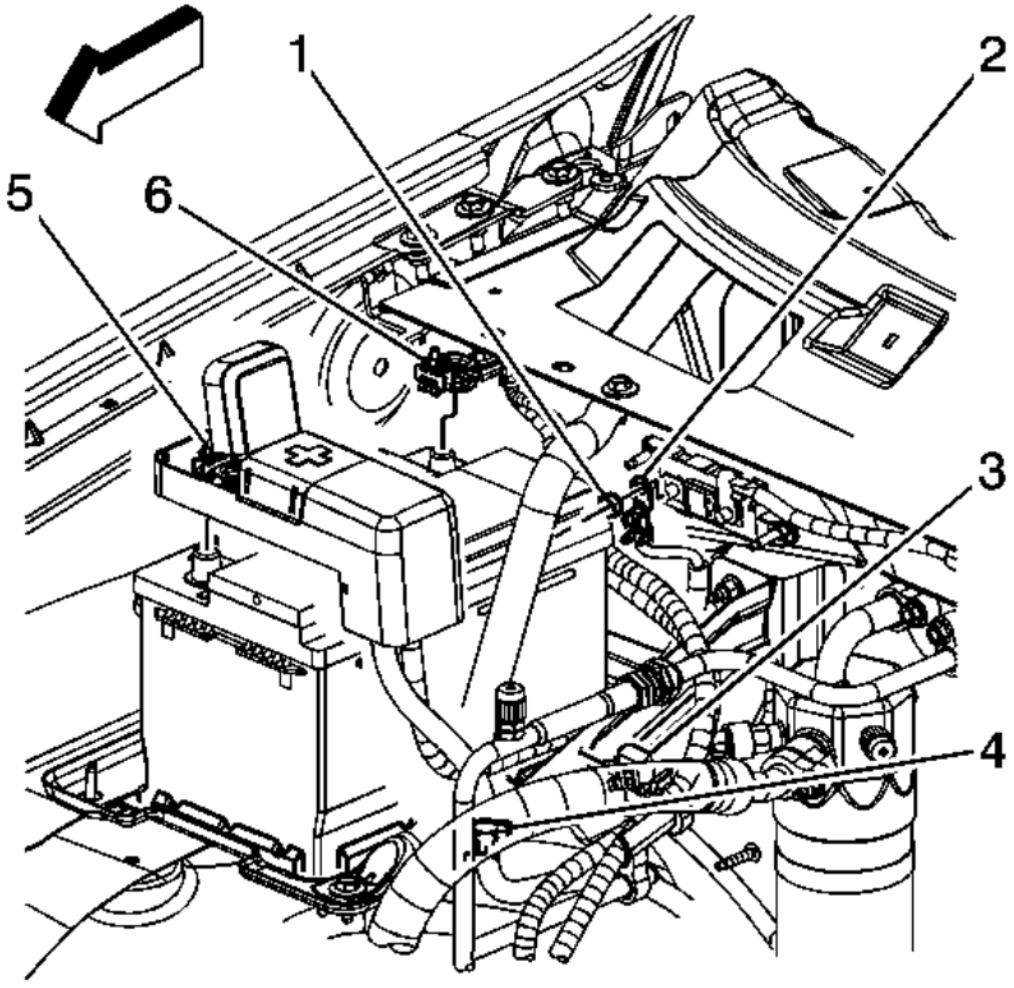


Fig. 31: View Of Battery Cable Components
Courtesy of GENERAL MOTORS CORP.

14. Install the battery current sensor (3) clip to the battery tray.

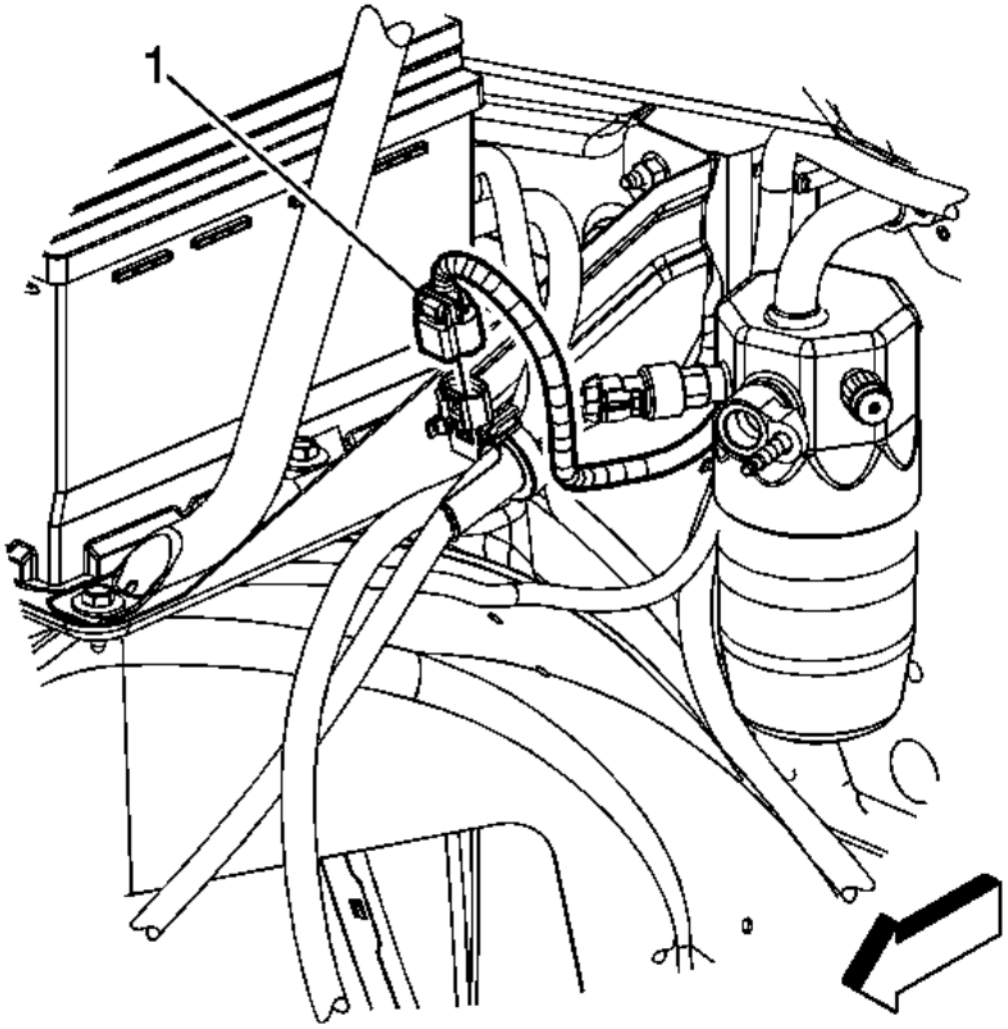


Fig. 32: View Of Engine Harness Electrical Connector & Battery Current Sensor
Courtesy of GENERAL MOTORS CORP.

15. Connect the engine wiring harness electrical connector (1) to the battery current sensor.
16. Install the air cleaner outlet resonator. Refer to **Air Cleaner Outlet Resonator Replacement** .
17. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and**

Connection (w/Dual Batteries).

BATTERY NEGATIVE CABLE REPLACEMENT (4.8L, 5.3L, 6.0L, AND 6.2L)

Removal Procedure

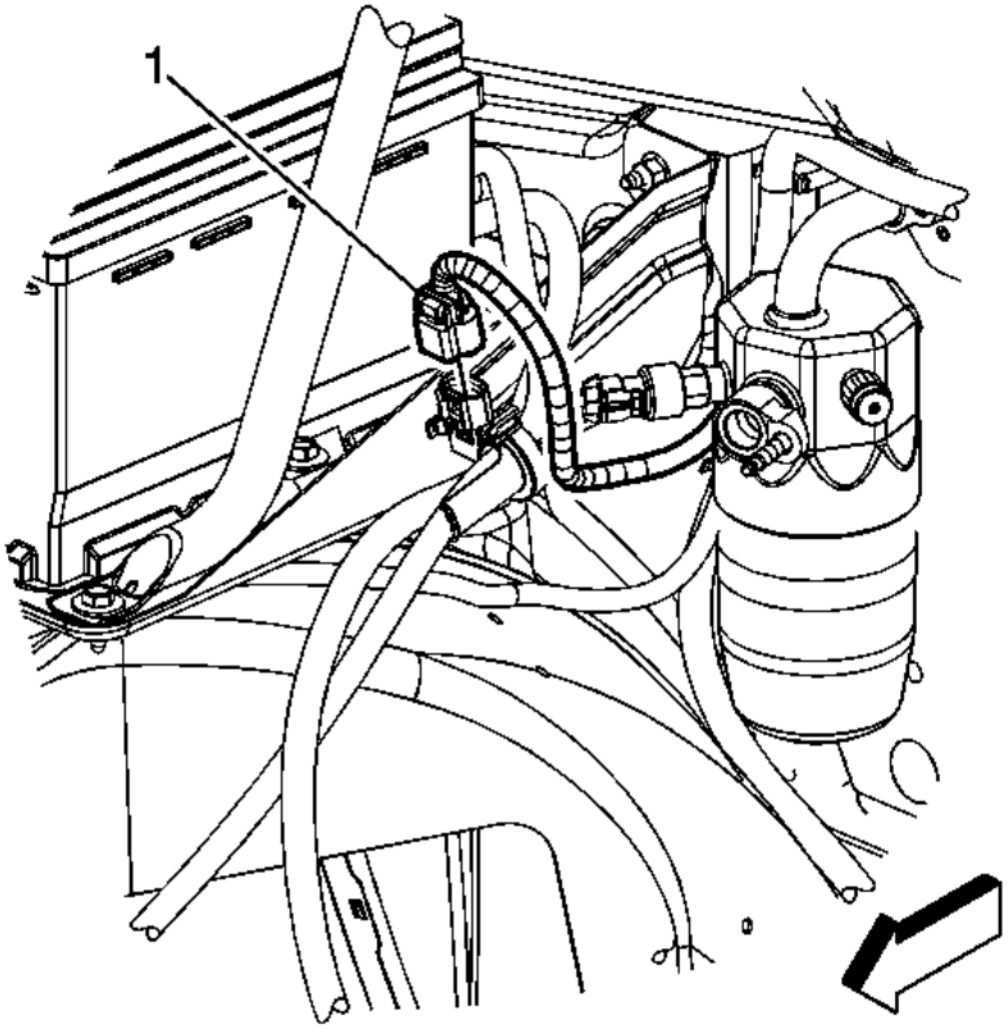


Fig. 33: View Of Engine Harness Electrical Connector & Battery Current Sensor
Courtesy of GENERAL MOTORS CORP.

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

and Connection (w/Single Battery) or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

2. Remove the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
3. Disconnect the engine harness electrical connector (1) from the battery current sensor.

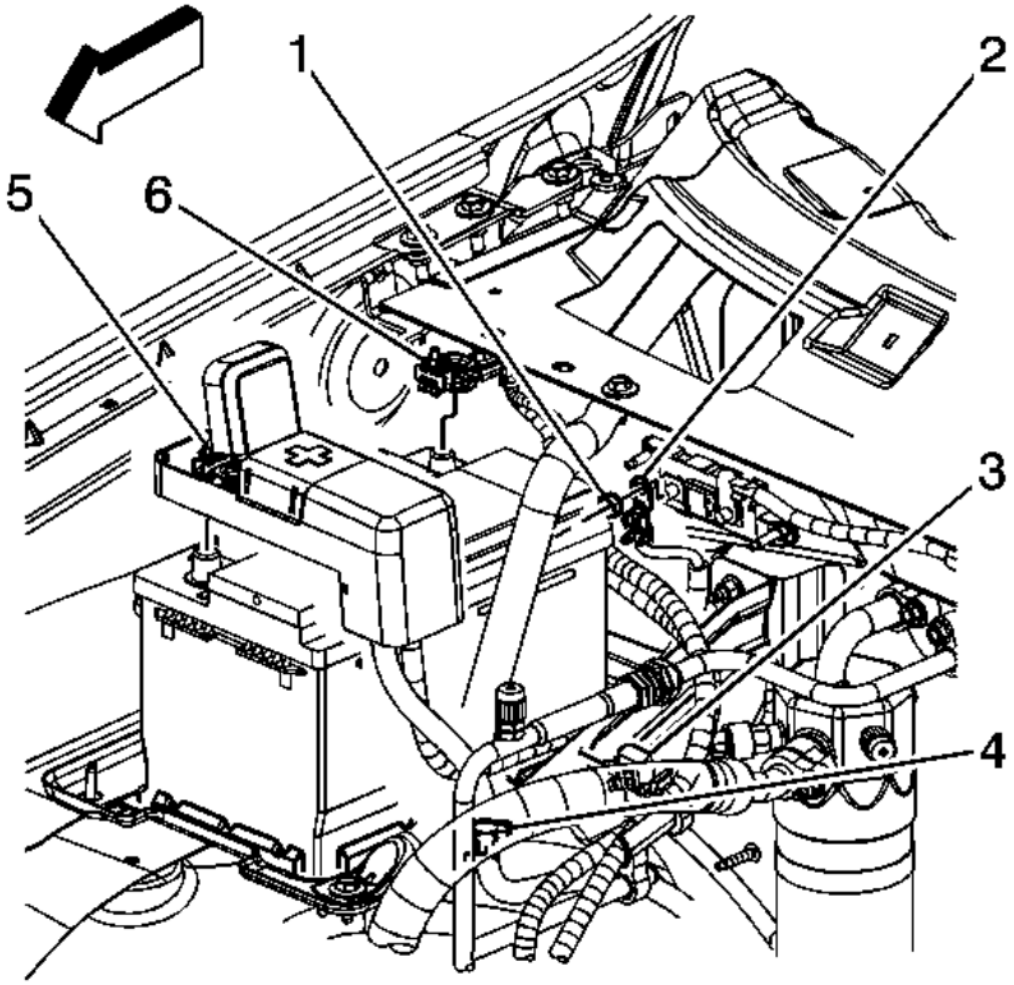


Fig. 34: View Of Battery Cable Components
Courtesy of GENERAL MOTORS CORP.

4. Remove the battery current sensor (3) clip from the battery tray, if equipped with a battery current sensor.

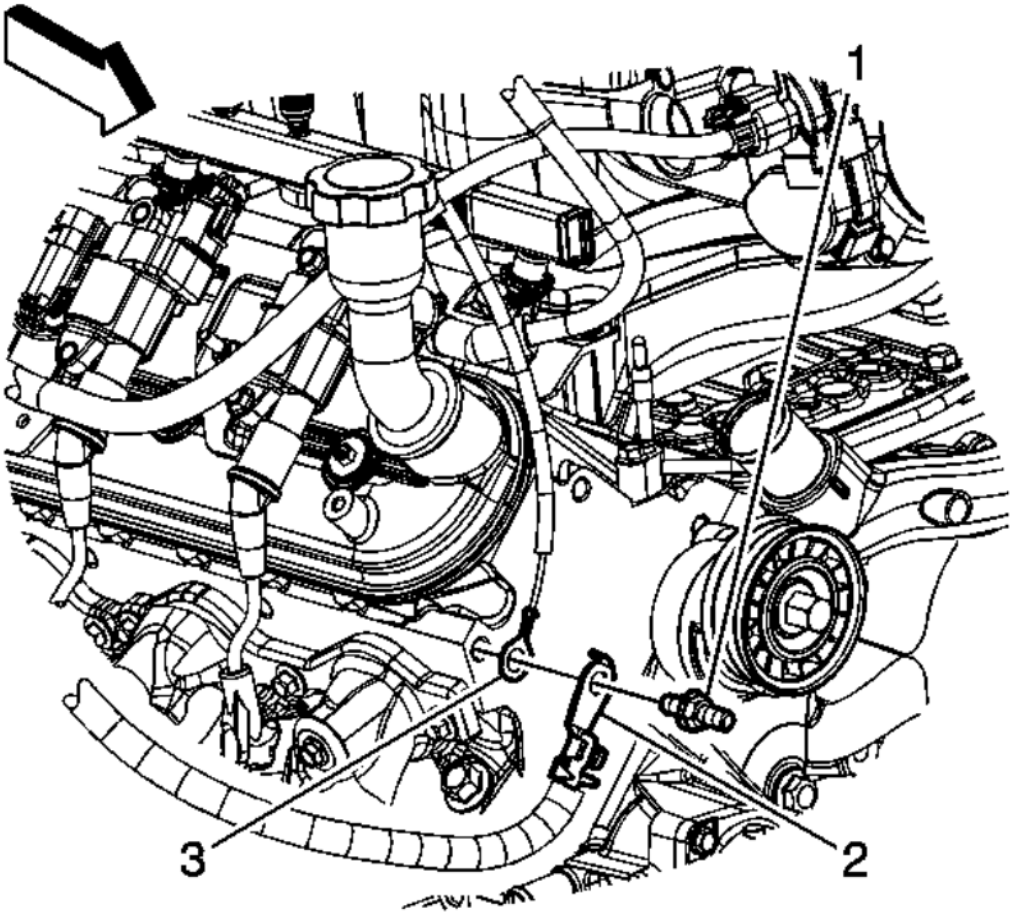


Fig. 35: View Of Battery Cable Terminals & Stud
Courtesy of GENERAL MOTORS CORP.

5. Remove the negative battery cable stud (1) from the front of the right cylinder head.
6. Remove the negative battery cable terminal (2) from the cylinder head.

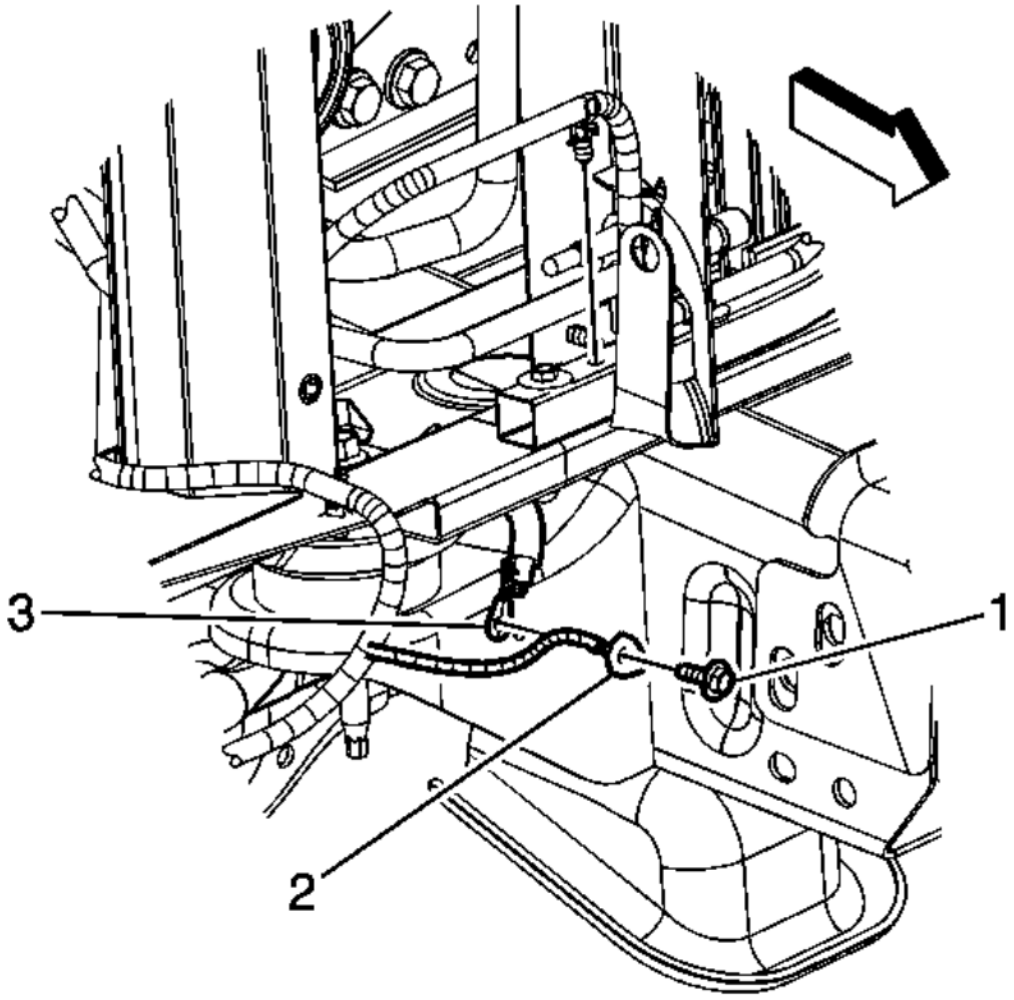


Fig. 36: View Of Negative Battery Cable Terminal, Forward Lamp Wiring Harness Terminal & Ground Bolt
Courtesy of GENERAL MOTORS CORP.

7. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
8. Remove the forward lamp wiring harness ground bolt (1).
9. Remove the forward lamp wiring harness terminal (2) from the frame.
10. Remove the negative battery cable terminal (3) out through the opening between the radiator support and frame.

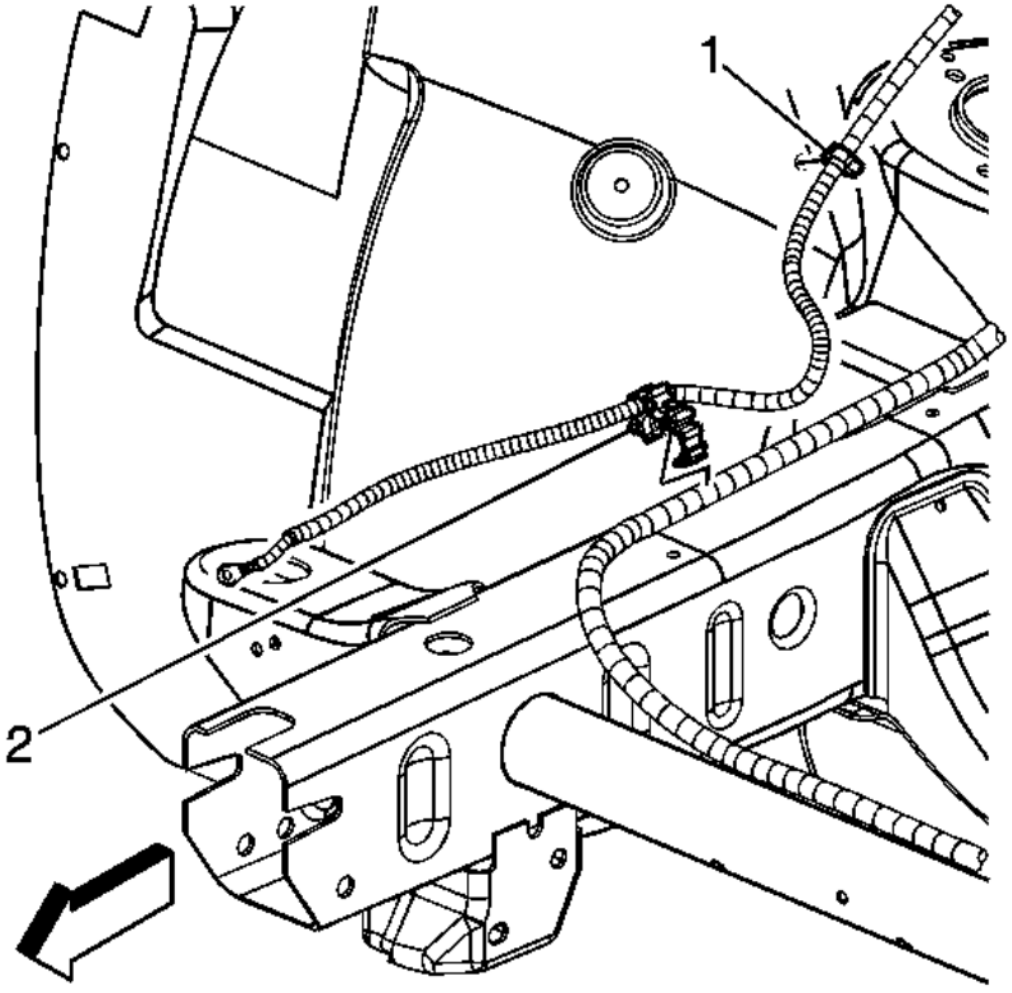


Fig. 37: Locating Battery Cable Clips
Courtesy of GENERAL MOTORS CORP.

11. Remove the negative battery cable clip (2) from the chassis harness.
12. Lower the vehicle.
13. Remove the negative battery cable clip (1) from the right wheelhouse liner.

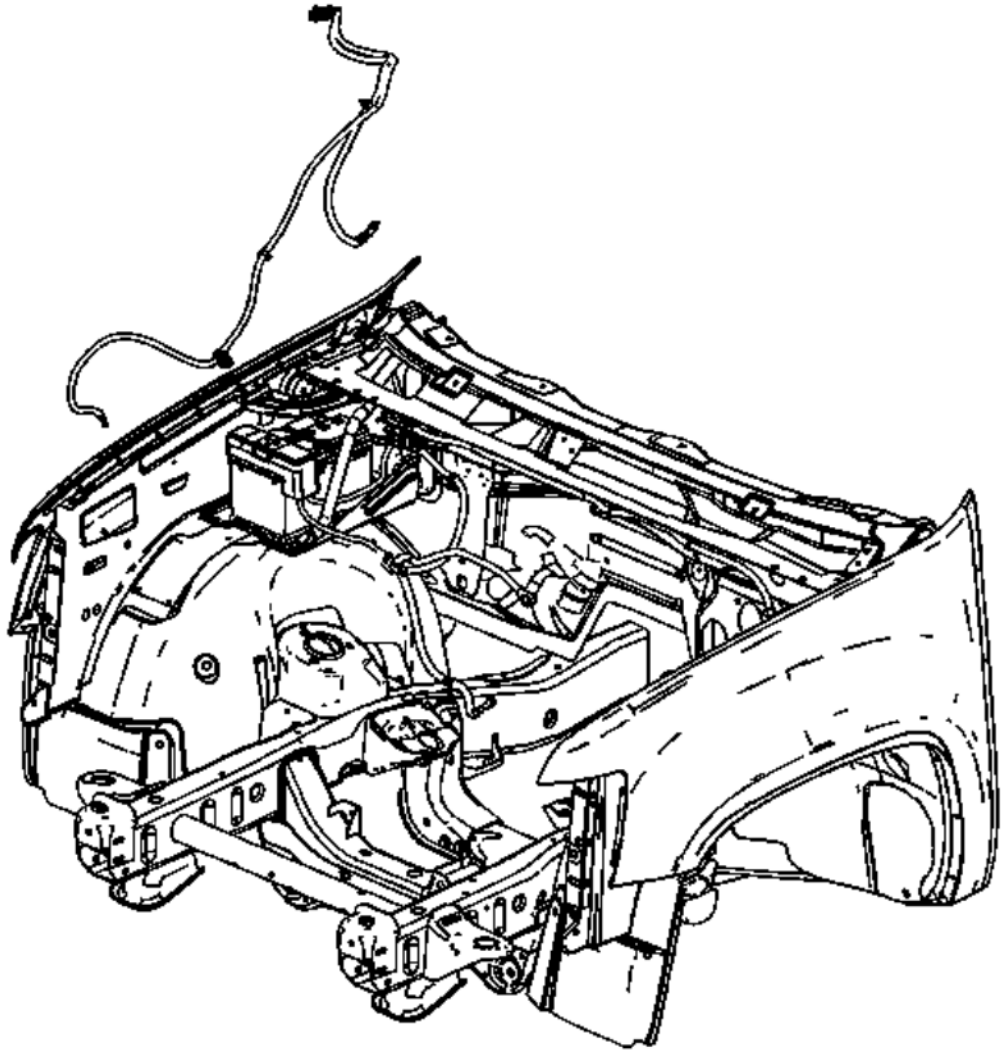


Fig. 38: View Of Negative Battery Cable
Courtesy of GENERAL MOTORS CORP.

14. Remove the negative battery cable from the vehicle, if equipped without a battery current sensor.

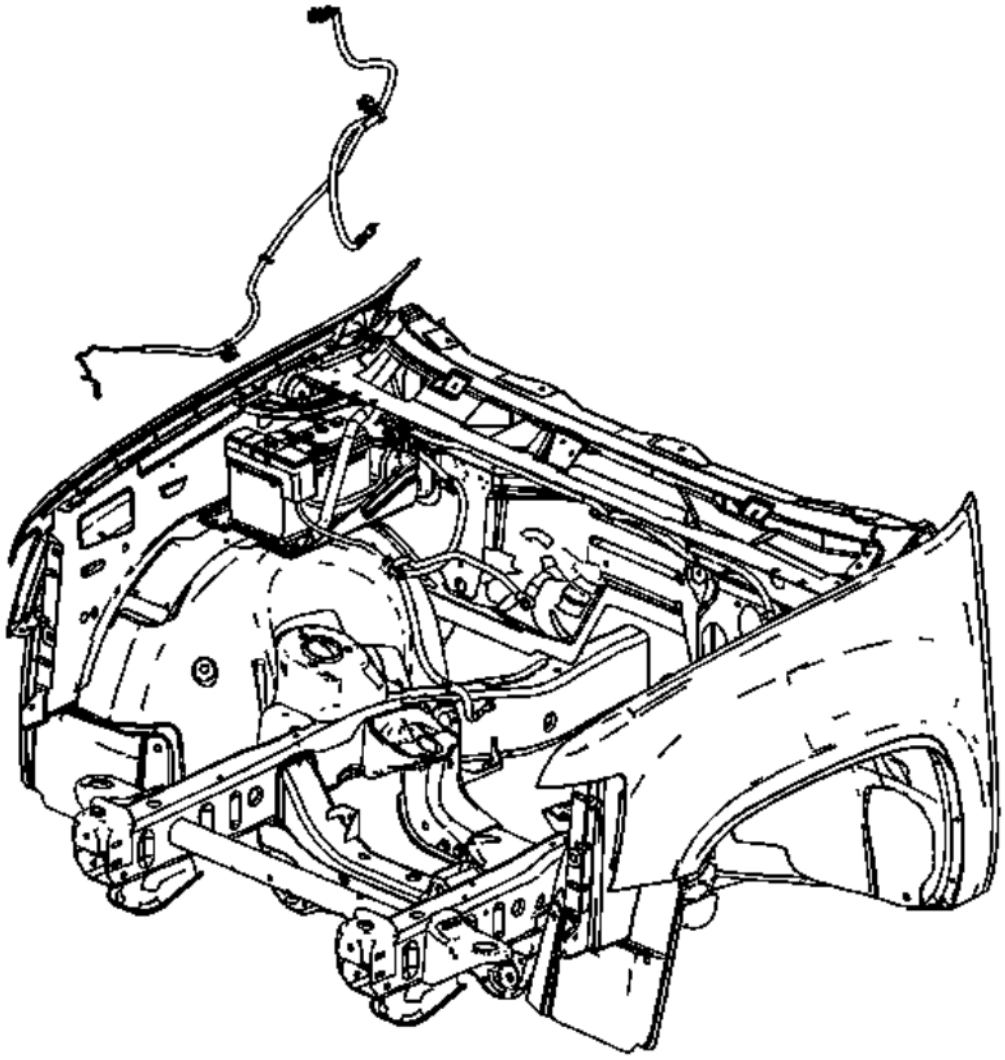


Fig. 39: View Of Negative Battery Cable
Courtesy of GENERAL MOTORS CORP.

15. Remove the negative battery cable from the vehicle, if equipped with a battery current sensor.
16. If replacing the negative battery cable, remove the battery current sensor, if equipped. Refer to **Battery Current Sensor Replacement (4.3L)** or **Battery Current Sensor Replacement (4.8L, 5.3L, 6.0L, and 6.2L)**.

Installation Procedure

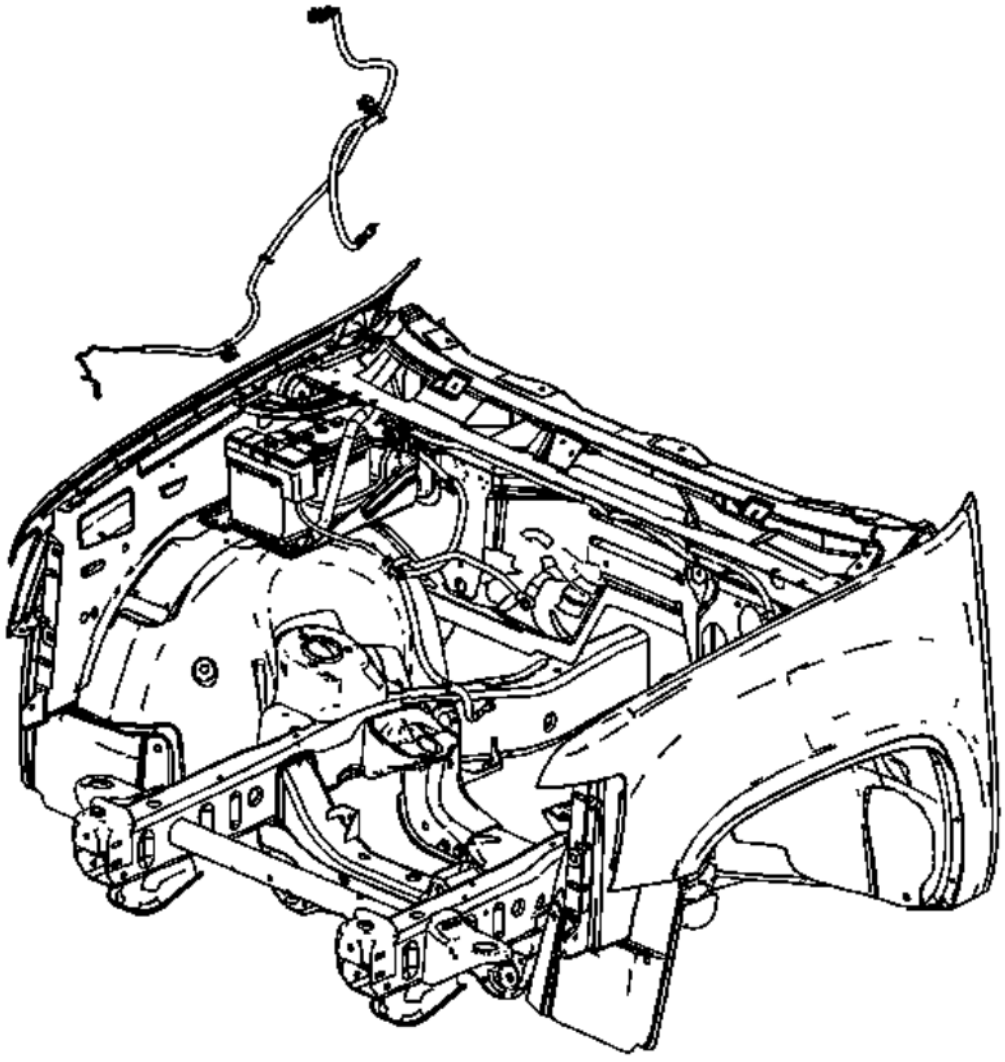


Fig. 40: View Of Negative Battery Cable
Courtesy of GENERAL MOTORS CORP.

1. If the negative battery cable was replaced, install the battery current sensor, if equipped. Refer to **Battery Current Sensor Replacement (4.3L)** or **Battery Current Sensor Replacement (4.8L, 5.3L, 6.0L, and 6.2L)**.
2. Install the negative battery cable to the vehicle, if equipped with a battery current sensor.

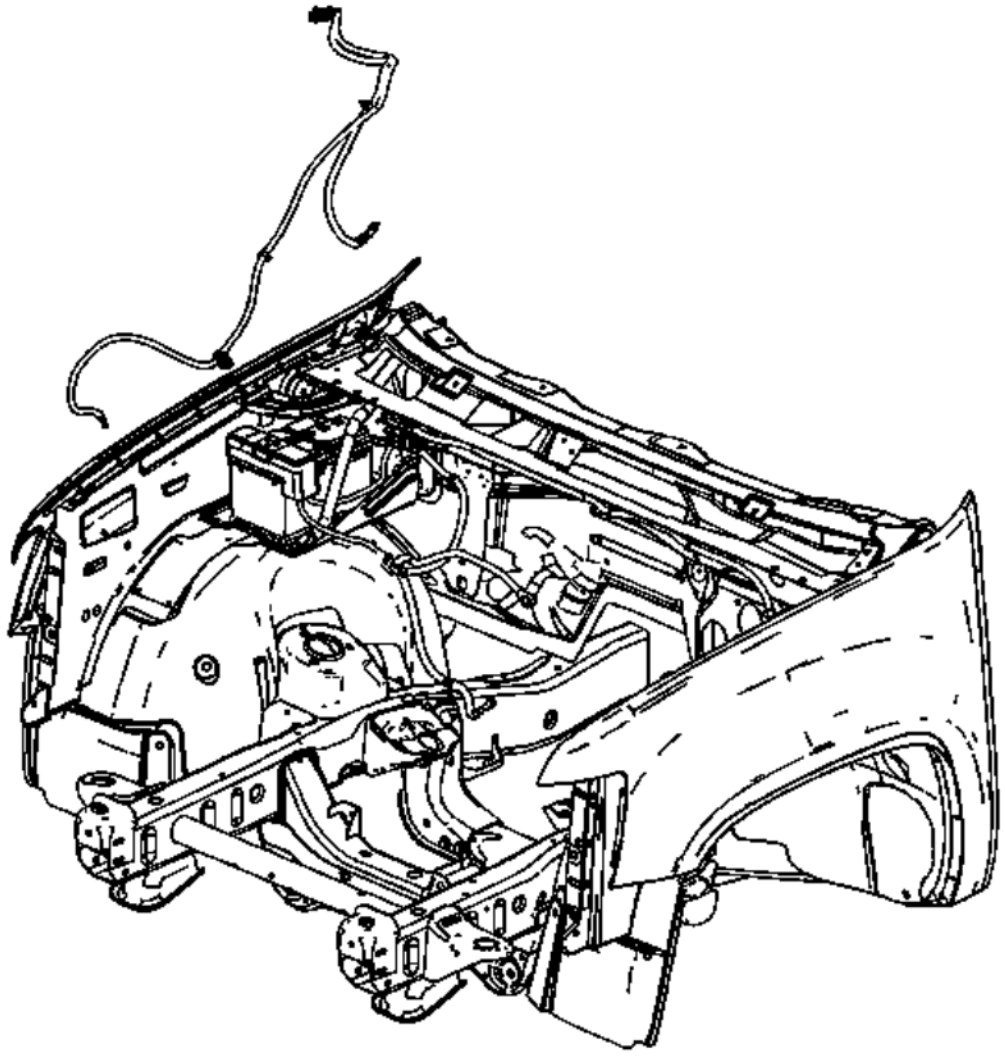


Fig. 41: View Of Negative Battery Cable
Courtesy of GENERAL MOTORS CORP.

3. Install the negative battery cable to the vehicle, if equipped without a battery current sensor.

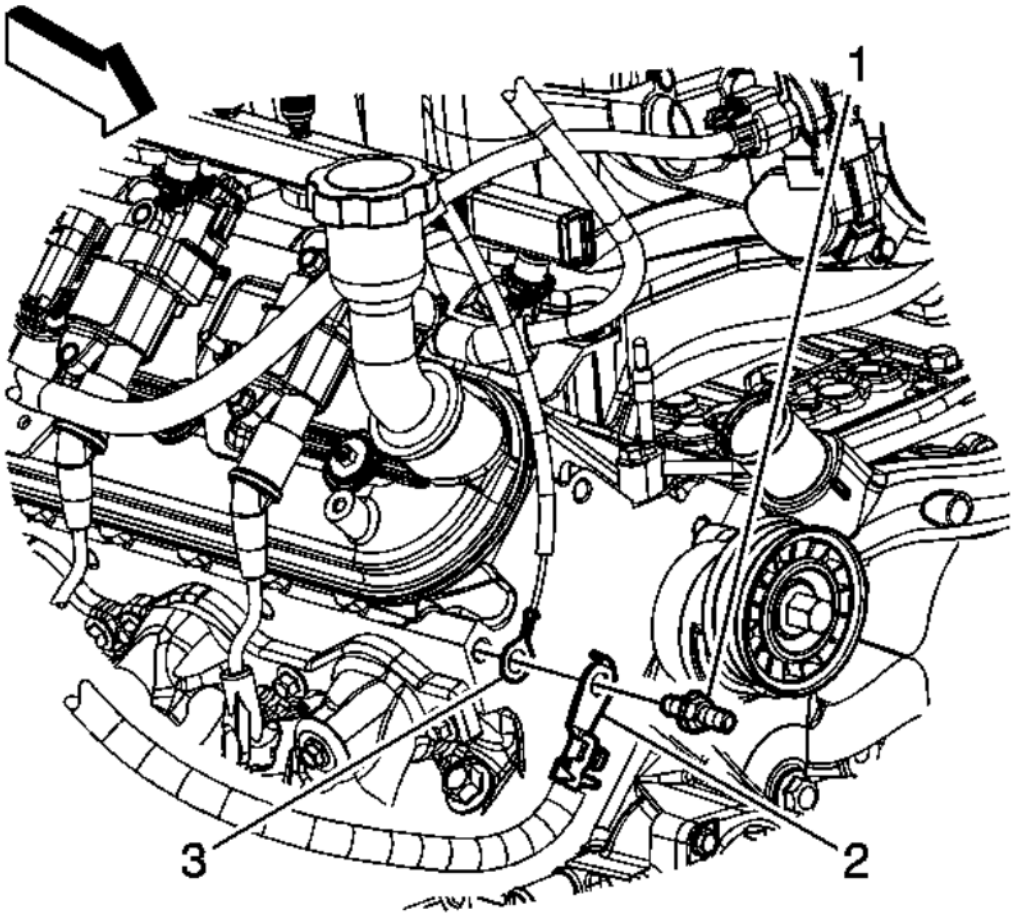


Fig. 42: View Of Battery Cable Terminals & Stud
Courtesy of GENERAL MOTORS CORP.

4. Ensure that the engine harness terminal (3) is position behind the negative battery terminal (2).
5. Position the negative battery cable terminal (2) to the cylinder head.

NOTE: Refer to Fastener Notice .

6. Install the negative battery cable stud (1) to the front of the right cylinder head.

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

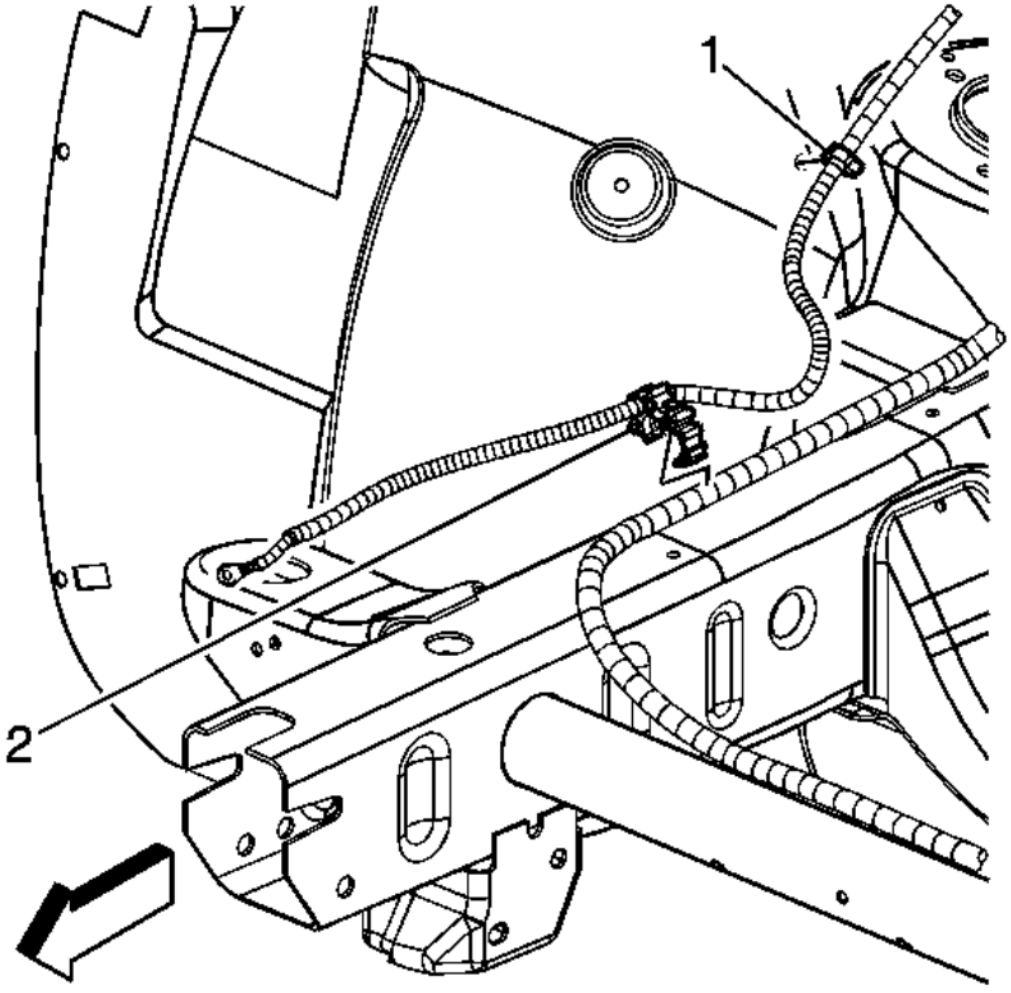


Fig. 43: Locating Battery Cable Clips
Courtesy of GENERAL MOTORS CORP.

7. Install the negative battery cable clip (1) to the right wheelhouse liner.
8. Raise the vehicle.
9. Install the negative battery cable clip (2) to the chassis harness.

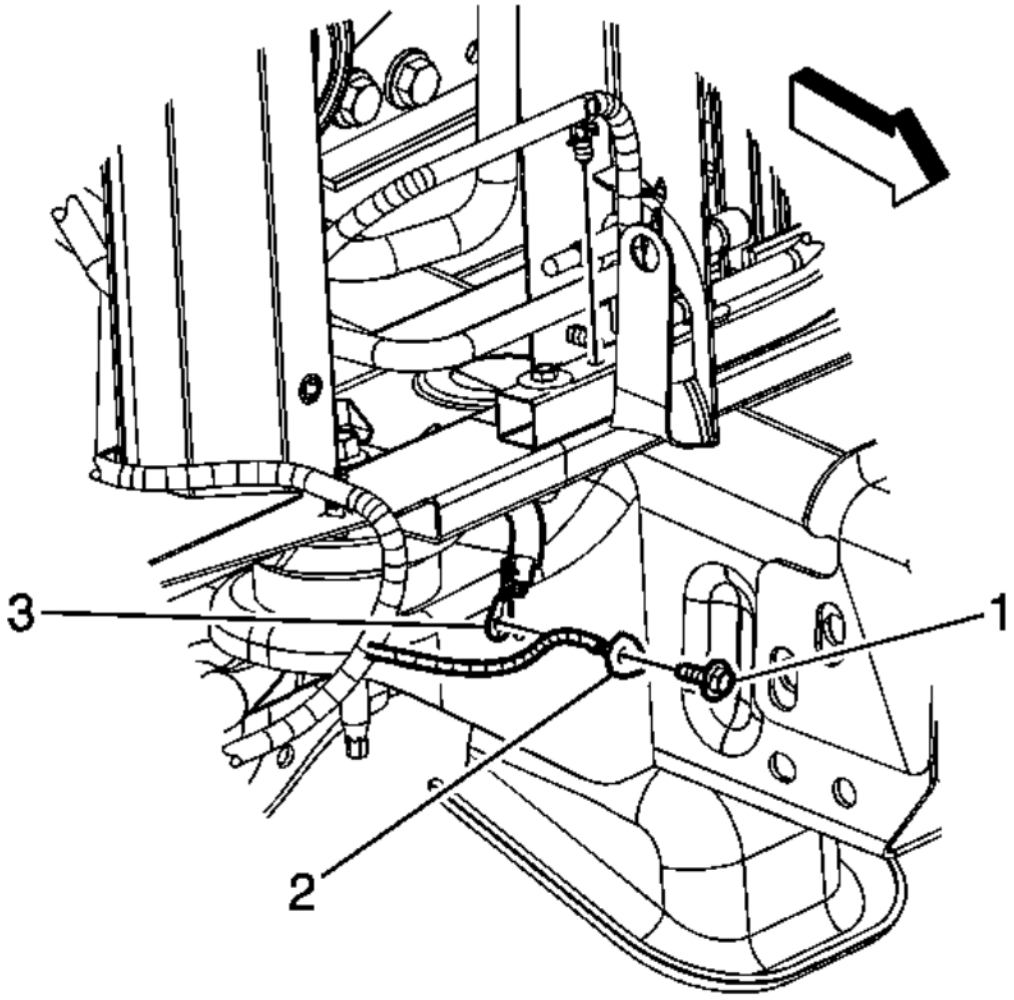


Fig. 44: View Of Negative Battery Cable Terminal, Forward Lamp Wiring Harness Terminal & Ground Bolt
Courtesy of GENERAL MOTORS CORP.

10. Route the negative battery cable terminal (3) through the opening between the radiator support and frame.
11. Ensure that the negative battery cable is positioned behind the forward lamp harness.
12. Install the forward lamp wiring harness terminal (2) to the frame. Ensure that the anti-rotation tab is inserted into the hole in the frame.

13. Install the forward lamp wiring harness ground bolt (1).

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

14. Lower the vehicle.

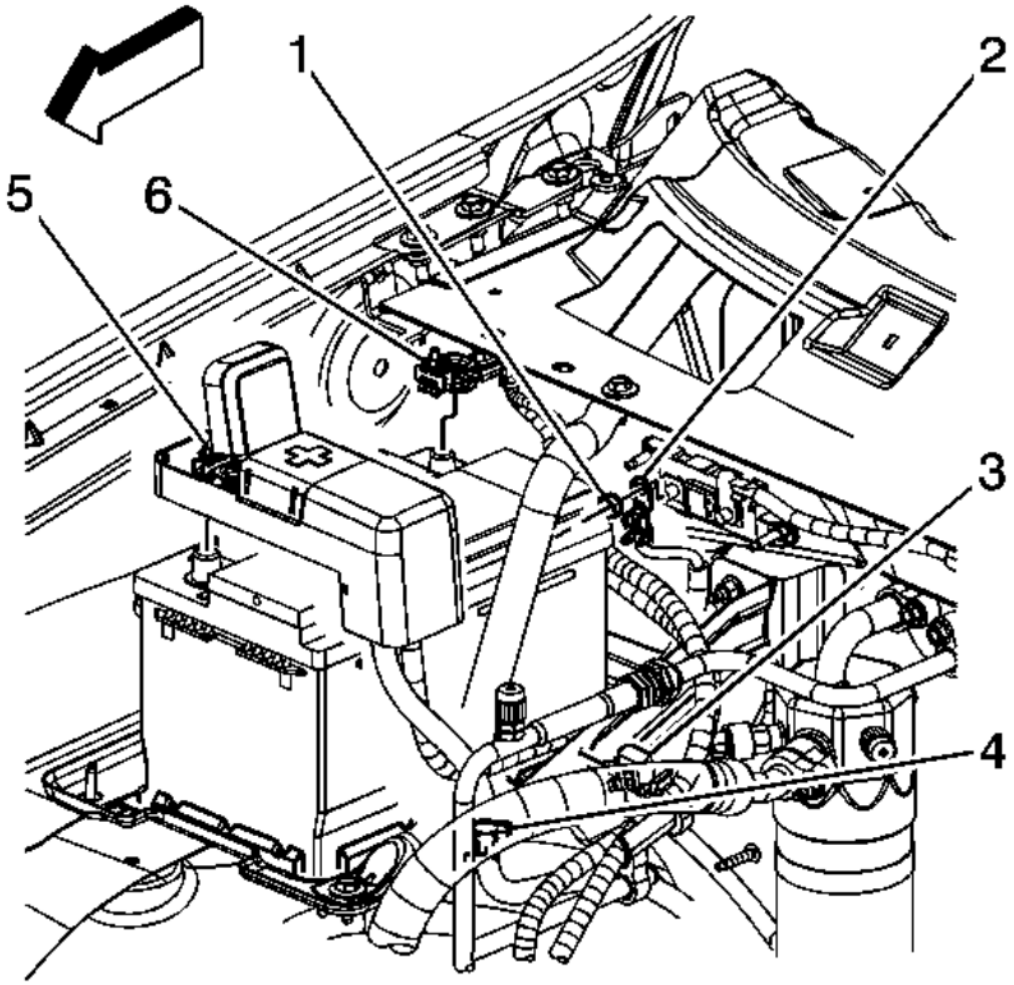


Fig. 45: View Of Battery Cable Components
Courtesy of GENERAL MOTORS CORP.

15. Install the battery current sensor (3) clip to the battery tray, if equipped with a battery current sensor.

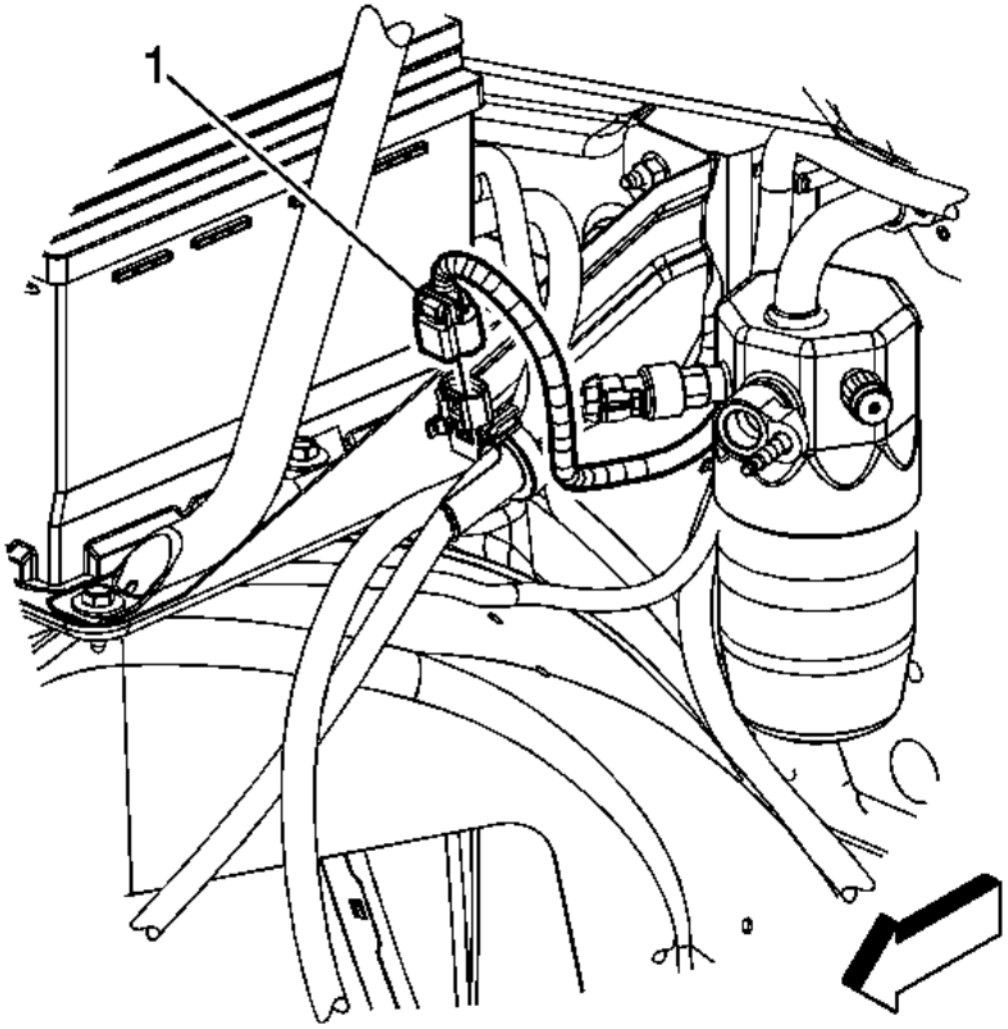


Fig. 46: View Of Engine Harness Electrical Connector & Battery Current Sensor
Courtesy of GENERAL MOTORS CORP.

16. Connect the engine harness electrical connector (1) to the battery current sensor.
17. Install the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
18. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and**

Connection (w/Dual Batteries).

BATTERY NEGATIVE CABLE REPLACEMENT (6.6L)

Removal Procedure

CAUTION: Refer to Battery Disconnect Caution.

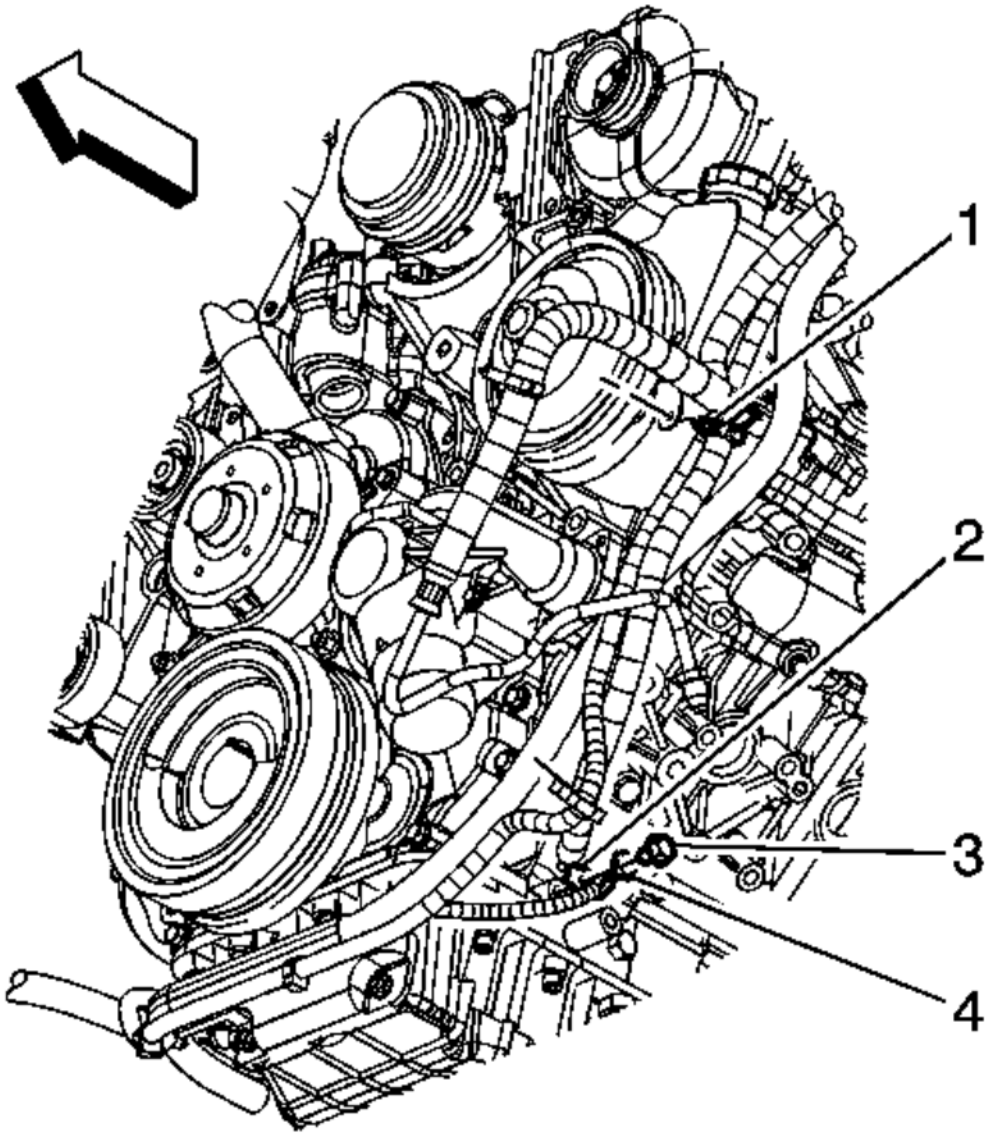


Fig. 47: View Of Negative Battery Cable, Clip, Wiring Harness Ground & Bolt
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and**

Connection (w/Dual Batteries).

2. Remove the negative battery cable clip (1) from the positive and negative cable bracket.
3. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Remove the engine wiring harness ground bolt (3).
5. Reposition the engine wiring harness ground (4) and remove the negative battery cable (2) from the engine block.

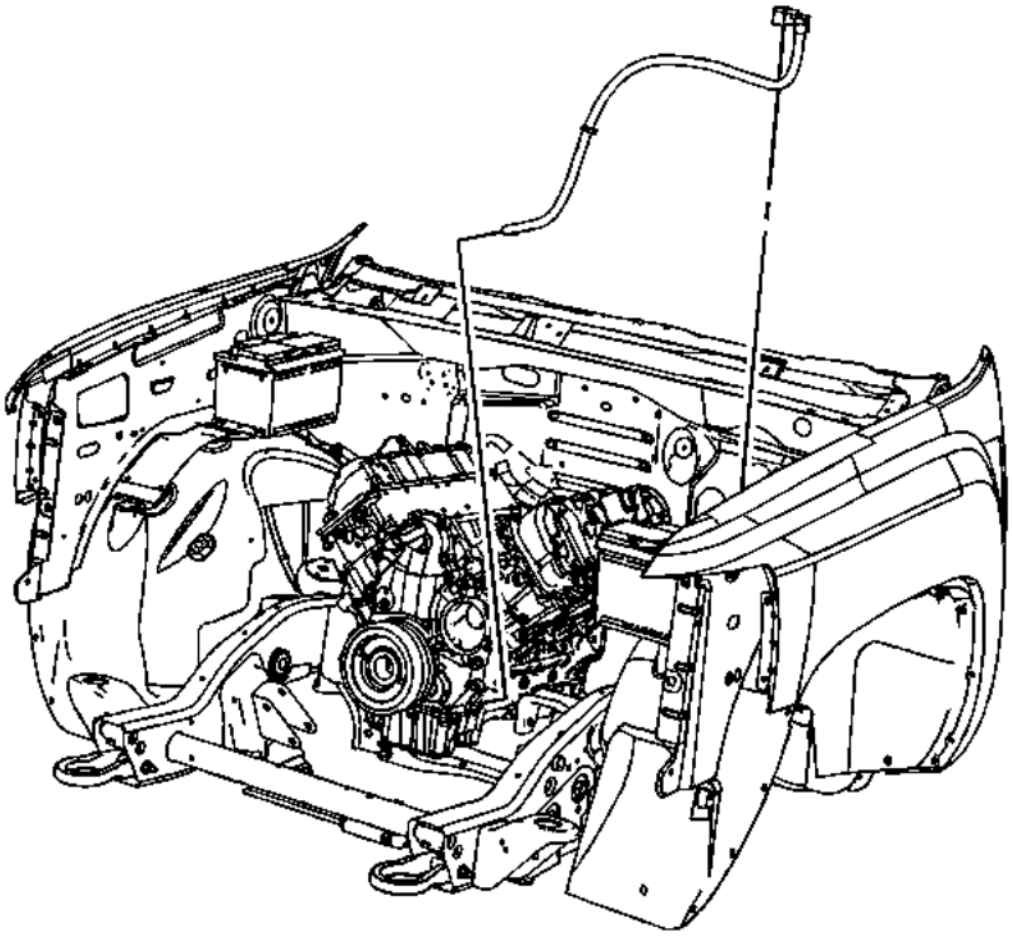


Fig. 48: View Of Negative Battery Cable
Courtesy of GENERAL MOTORS CORP.

6. Lower the vehicle.

7. Remove the negative battery cable from the vehicle.

Installation Procedure

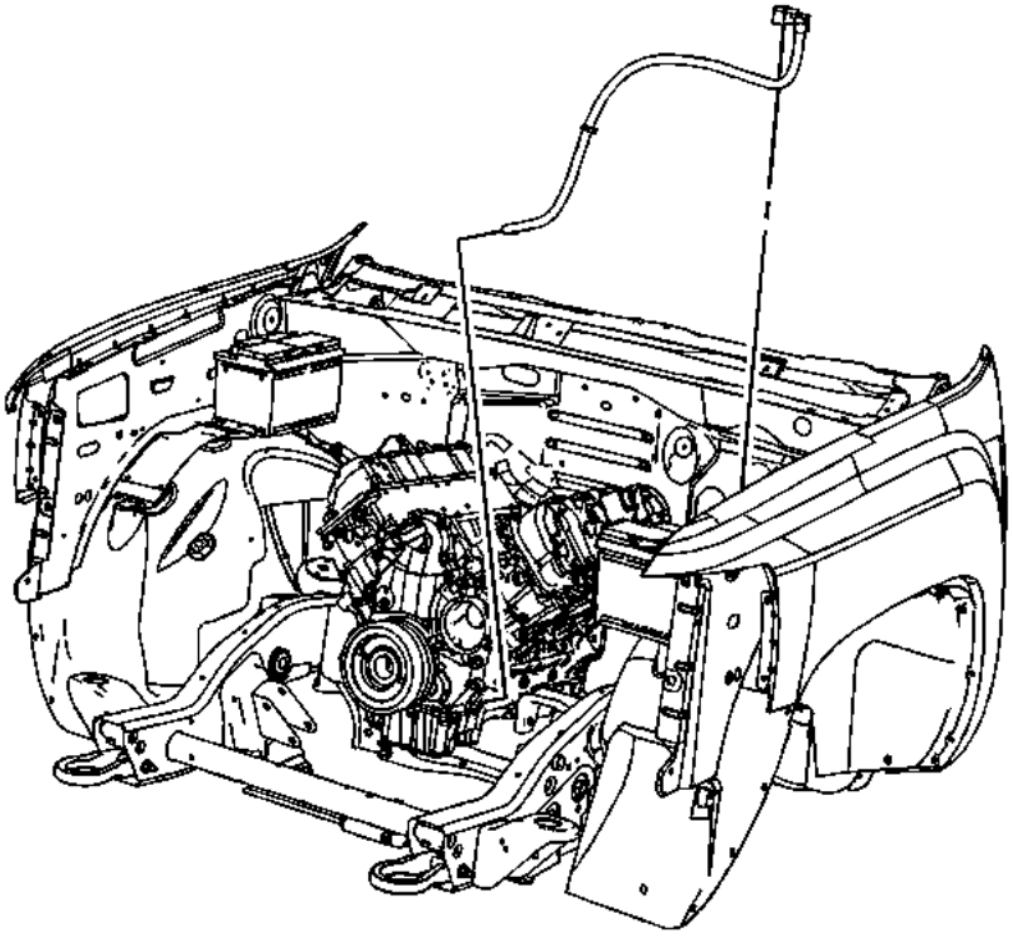


Fig. 49: View Of Negative Battery Cable
Courtesy of GENERAL MOTORS CORP.

1. Install the negative battery cable to the vehicle.
2. Raise the vehicle.

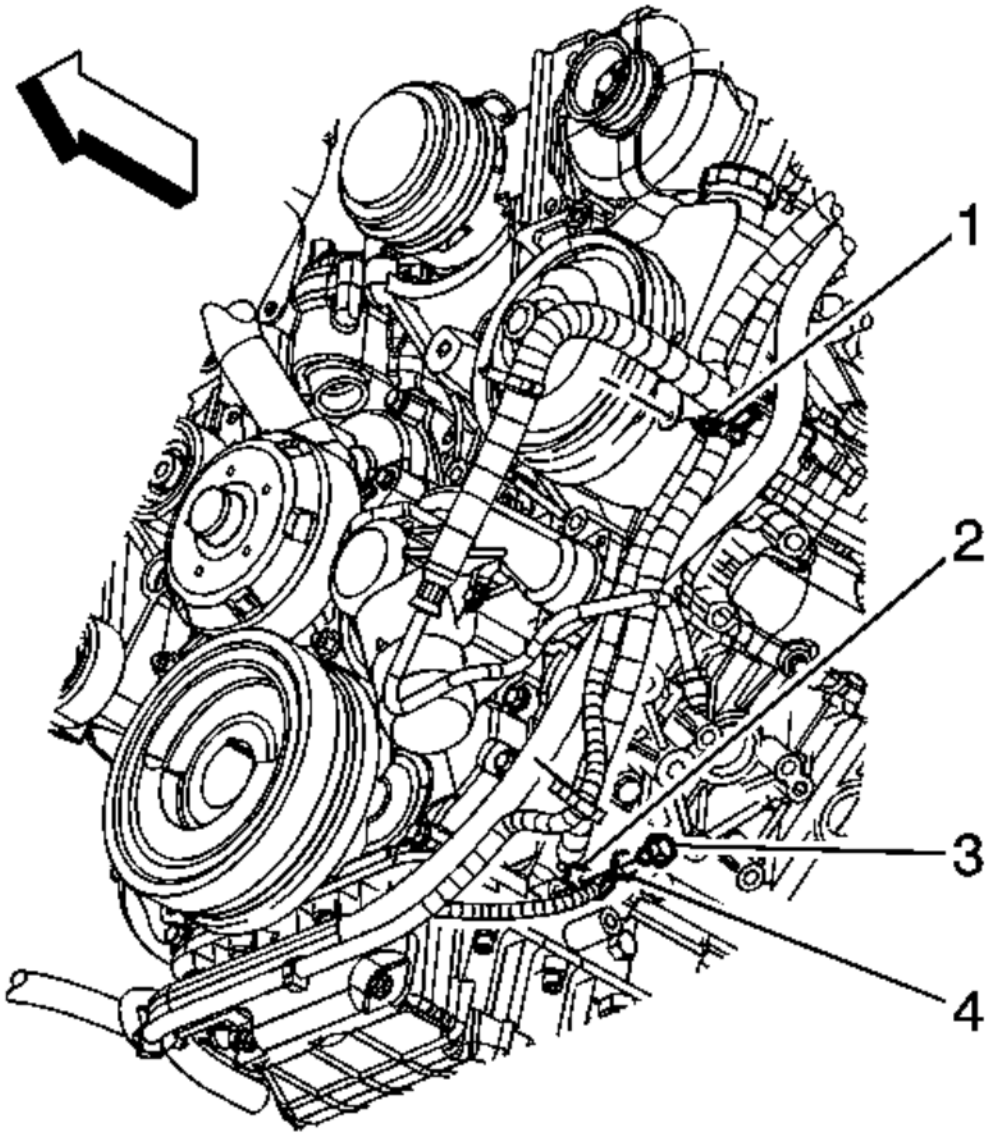


Fig. 50: View Of Negative Battery Cable, Clip, Wiring Harness Ground & Bolt
Courtesy of GENERAL MOTORS CORP.

3. Position the negative battery cable (2) to the engine block and position the engine wiring harness ground (4) on top of the negative battery cable terminal.

NOTE: Refer to Fastener Notice .

4. Install the engine wiring harness ground bolt (3).

   Tighten: Tighten to bolt to 25 N.m (18 lb ft).

5. Lower the vehicle.
6. Install the negative battery cable clip (1) to the positive and negative cable bracket.
7. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

AUXILIARY BATTERY NEGATIVE CABLE REPLACEMENT (6.2L)

Removal Procedure

CAUTION: Refer to BATTERY DISCONNECT CAUTION .

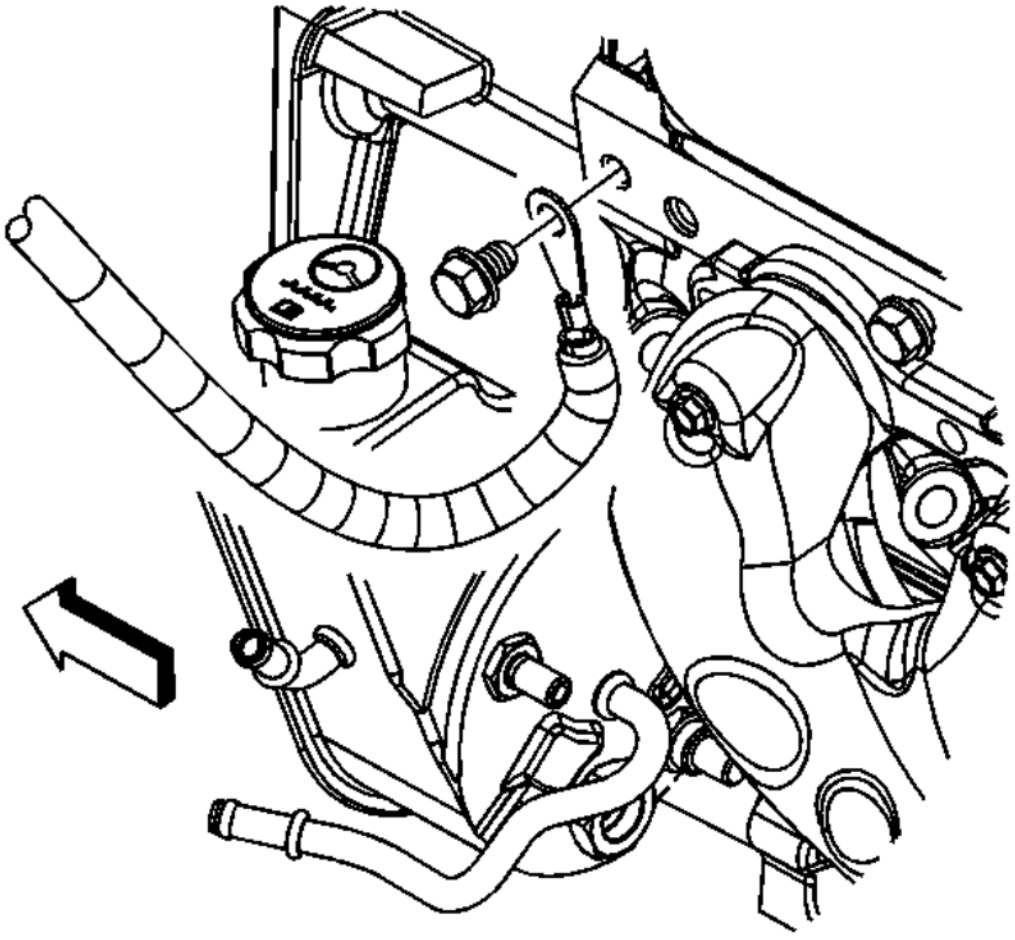


Fig. 51: View Of Auxiliary Battery Negative Cable & Cable Ground Terminal Bolt
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the auxiliary battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.
2. Remove the auxiliary battery negative cable ground terminal bolt from the left cylinder head.

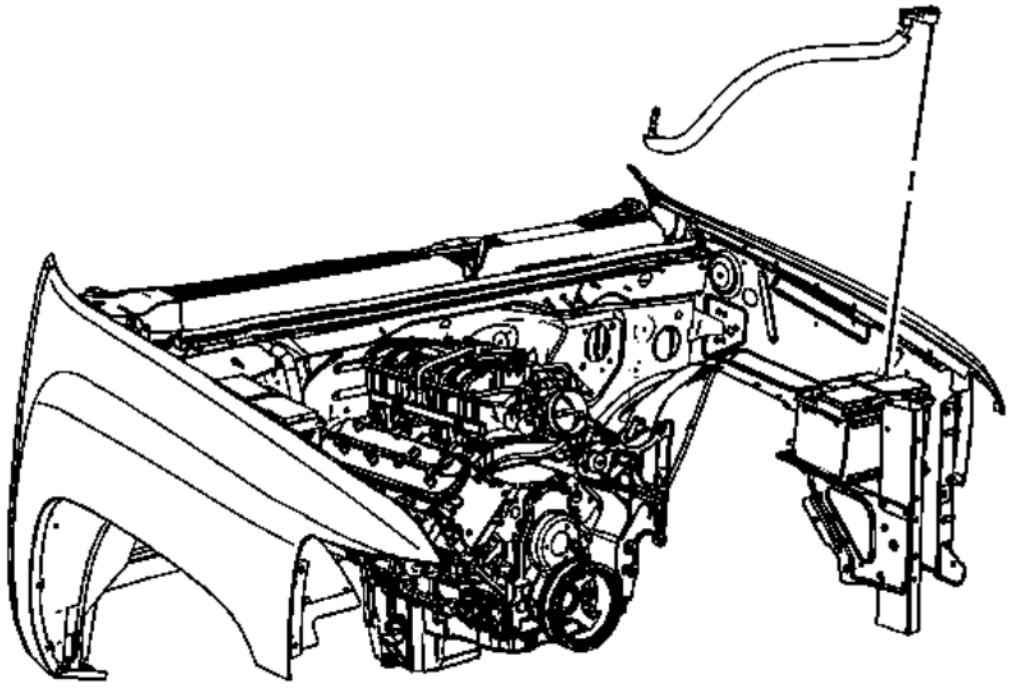


Fig. 52: View Of Auxiliary Battery Negative Cable
Courtesy of GENERAL MOTORS CORP.

3. Remove the auxiliary battery negative cable from the vehicle.

Installation Procedure

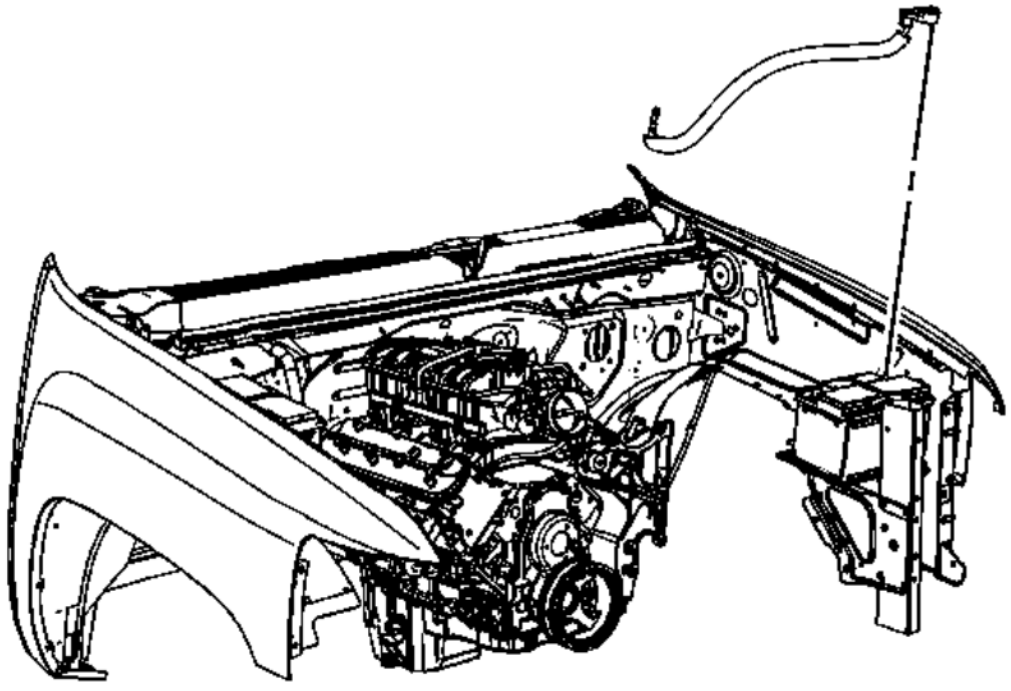


Fig. 53: View Of Auxiliary Battery Negative Cable
Courtesy of GENERAL MOTORS CORP.

1. Install the auxiliary battery negative cable to the vehicle.

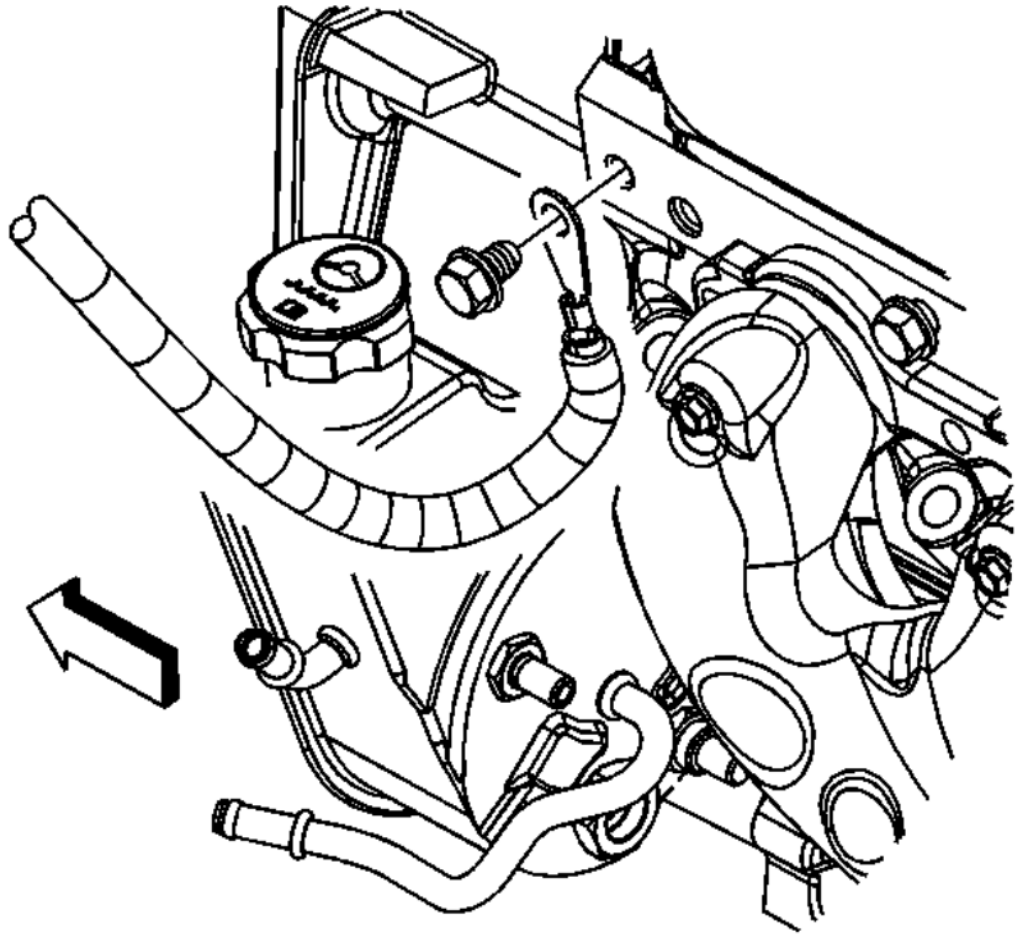


Fig. 54: View Of Auxiliary Battery Negative Cable & Cable Ground Terminal Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

2. Position the auxiliary battery negative cable ground terminal to the left cylinder head and install the bolt.

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

3. Connect the auxiliary battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable**

Disconnection and Connection (w/Auxiliary Battery) or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

BATTERY POSITIVE CABLE REPLACEMENT (4.3L)

Removal Procedure

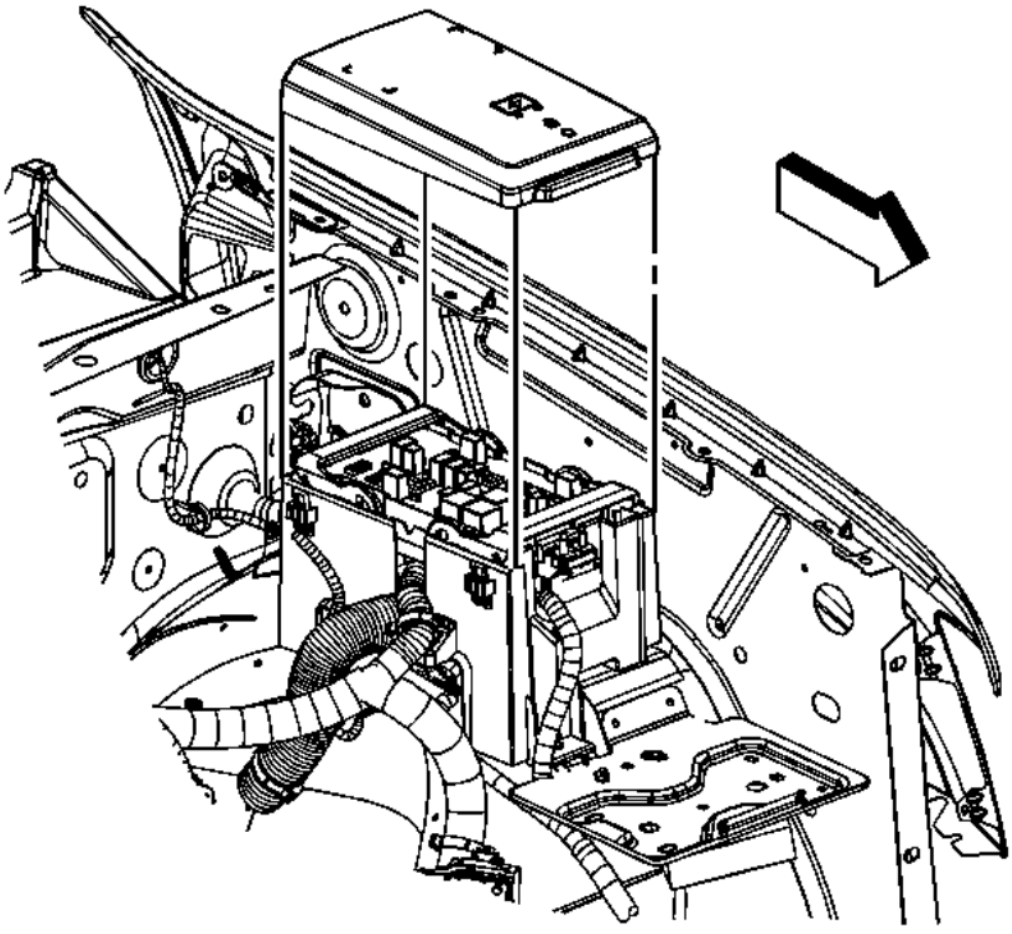


Fig. 55: View Of Under Hood Junction Block Cover
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and**

Connection (w/Dual Batteries).

2. Remove the under hood junction block cover.

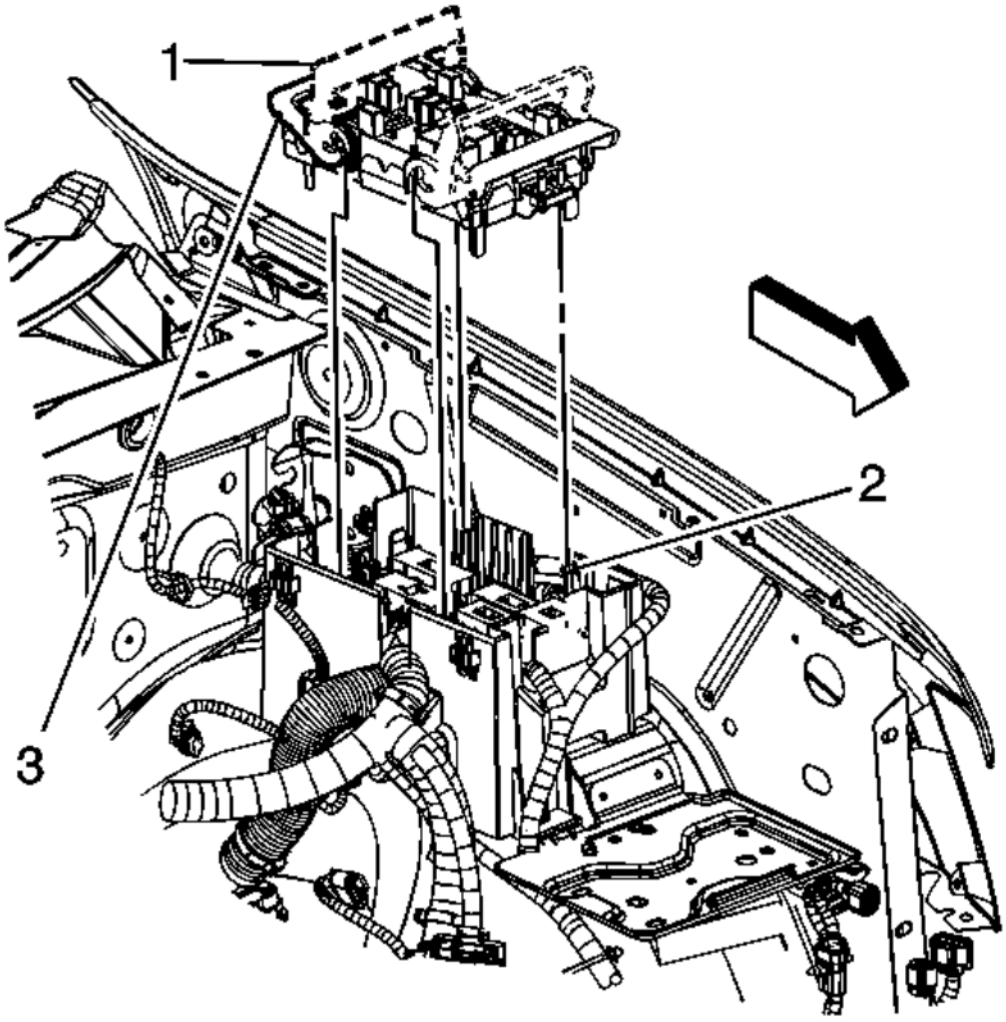


Fig. 56: View Of Junction Block & Retainers
Courtesy of GENERAL MOTORS CORP.

3. Lift the junction block retainers from the locked position (3) and rotate the retainers to the open position (1).
4. Remove the junction block.

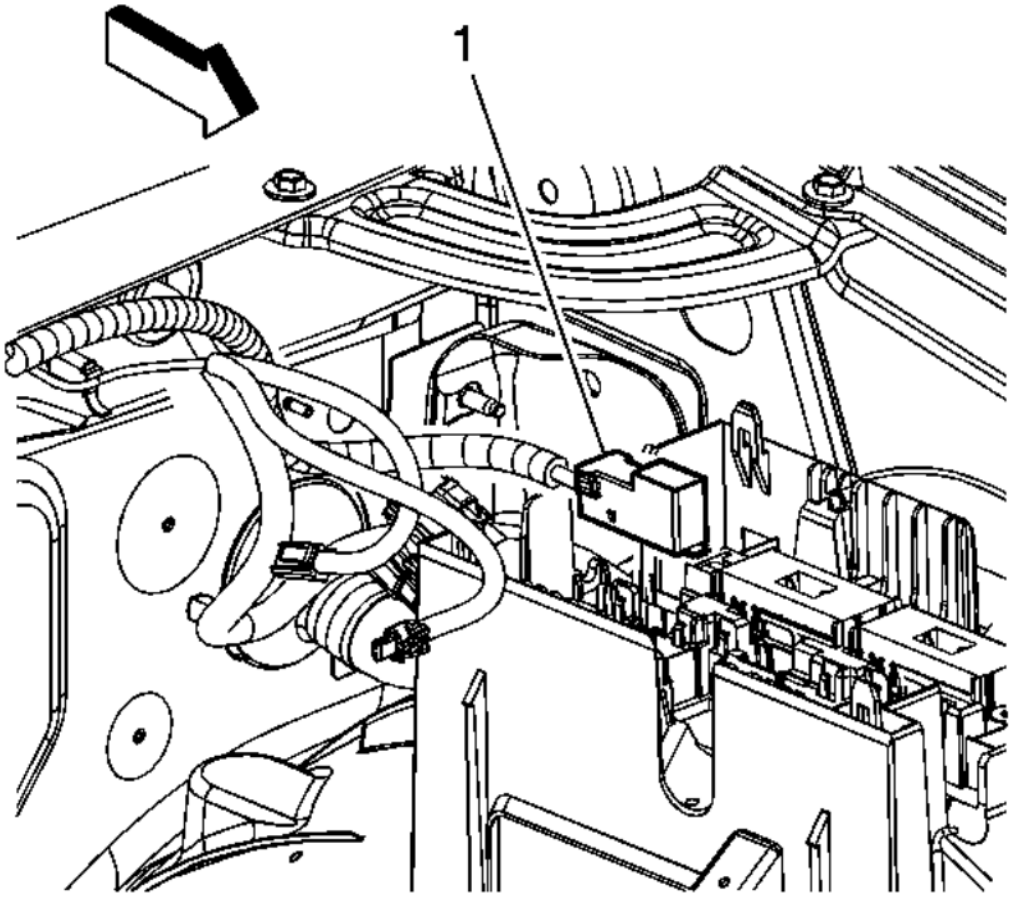


Fig. 57: View Of Positive Battery Cable Connector & (UBEC)
Courtesy of GENERAL MOTORS CORP.

5. Remove the positive battery cable connector (1) from the underhood bussed electrical center (UBEC).

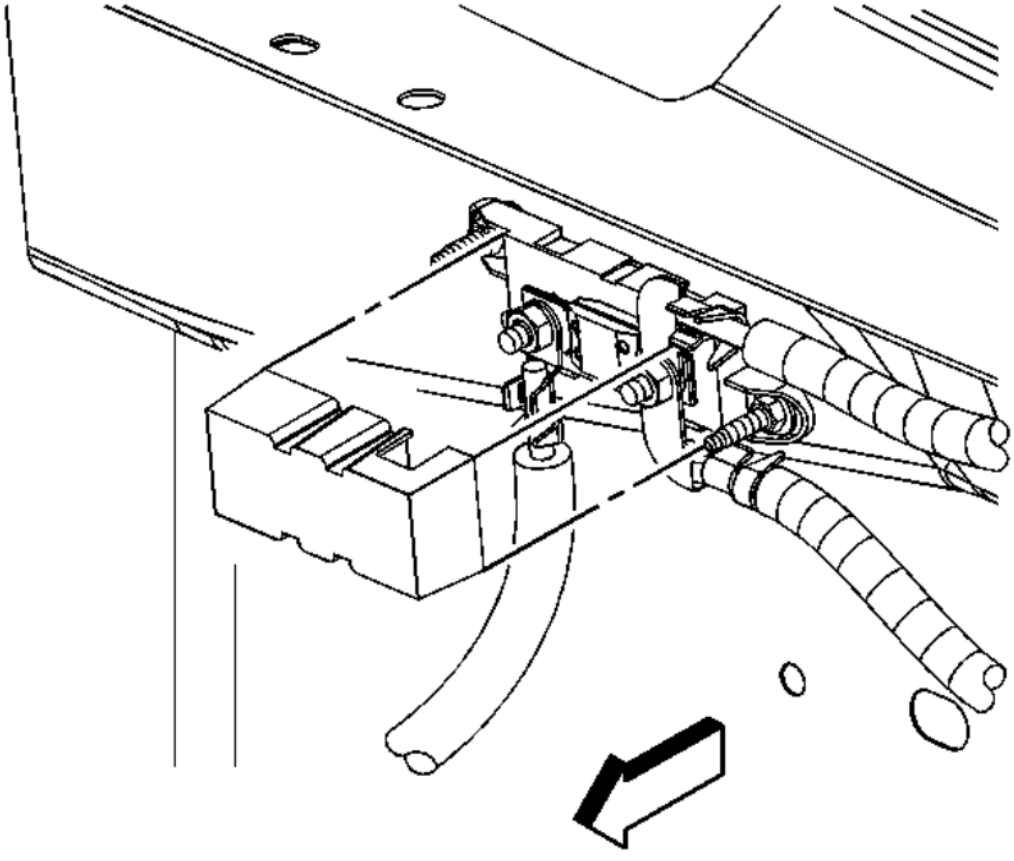


Fig. 58: View Of Mega Fuse Cover
Courtesy of GENERAL MOTORS CORP.

6. Remove the mega fuse cover.

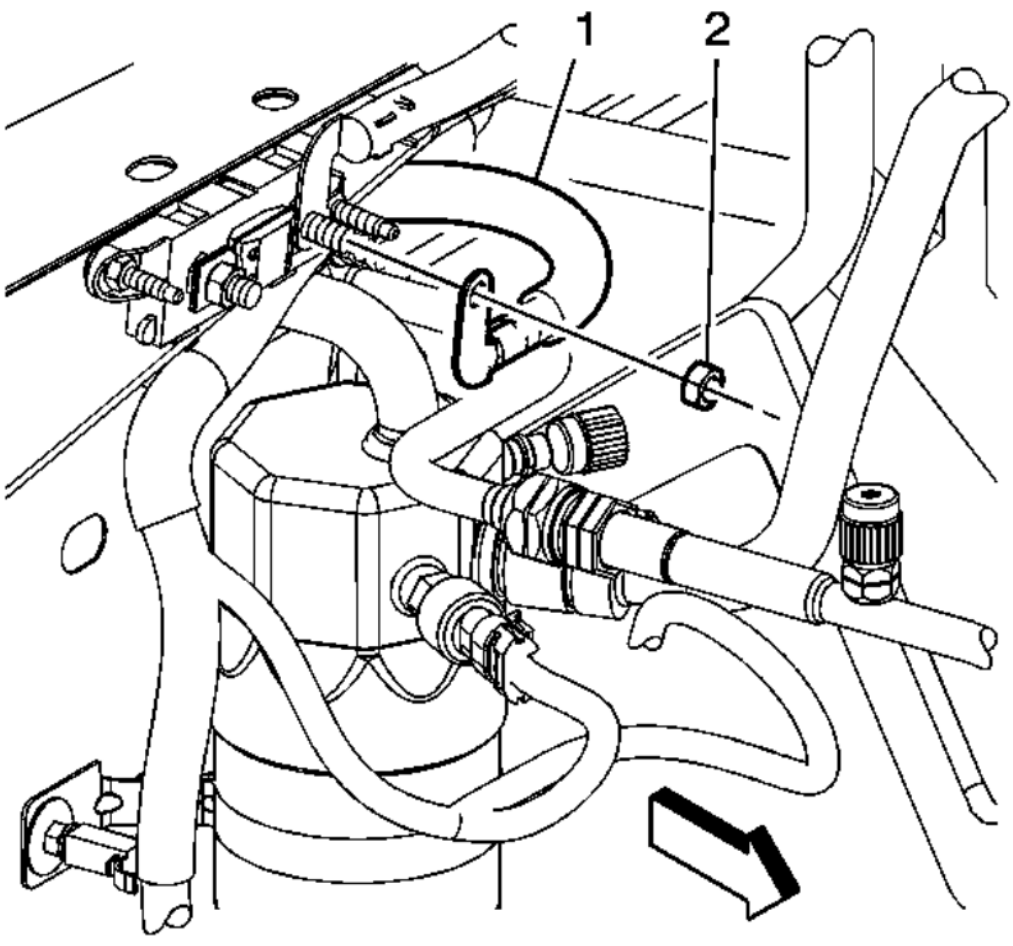


Fig. 59: View Of Starter Solenoid Cable & Nut
Courtesy of GENERAL MOTORS CORP.

7. Remove the starter solenoid cable nut (2) from the mega fuse.
8. Remove the starter solenoid cable (1) terminal from the mega fuse stud.

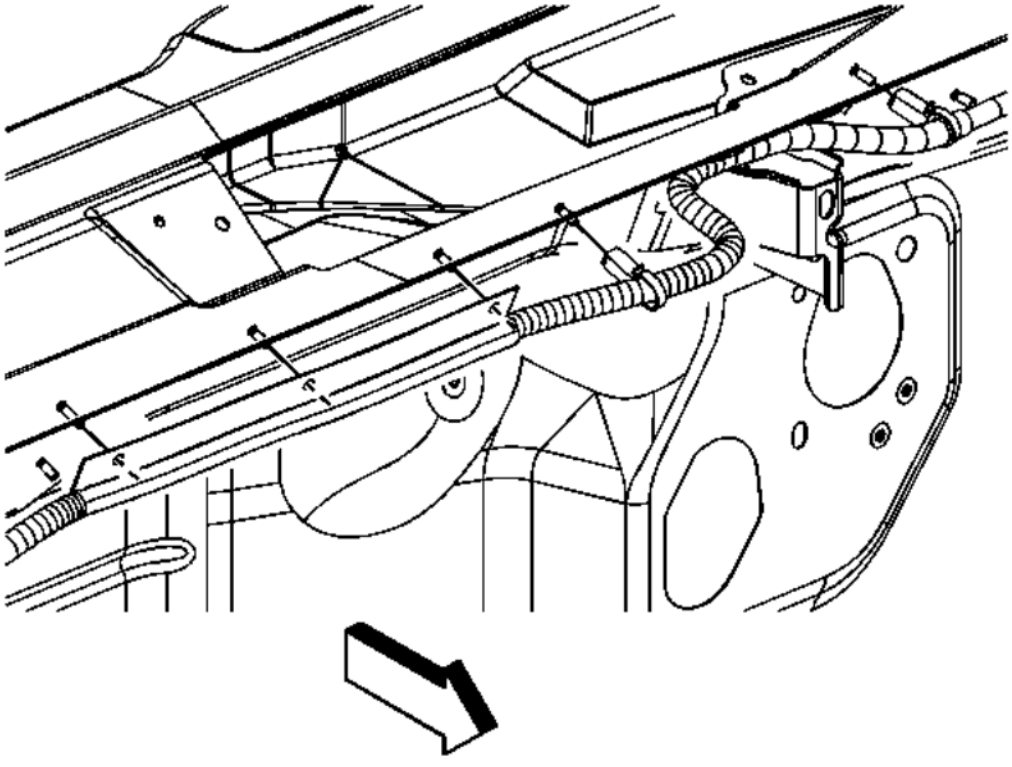


Fig. 60: View Of Positive Battery Cable Channel, Clips & Studs
Courtesy of GENERAL MOTORS CORP.

9. Remove the positive battery cable channel from the studs on the plenum front panel.
10. Remove the positive battery cable clips from the studs on the plenum front panel.

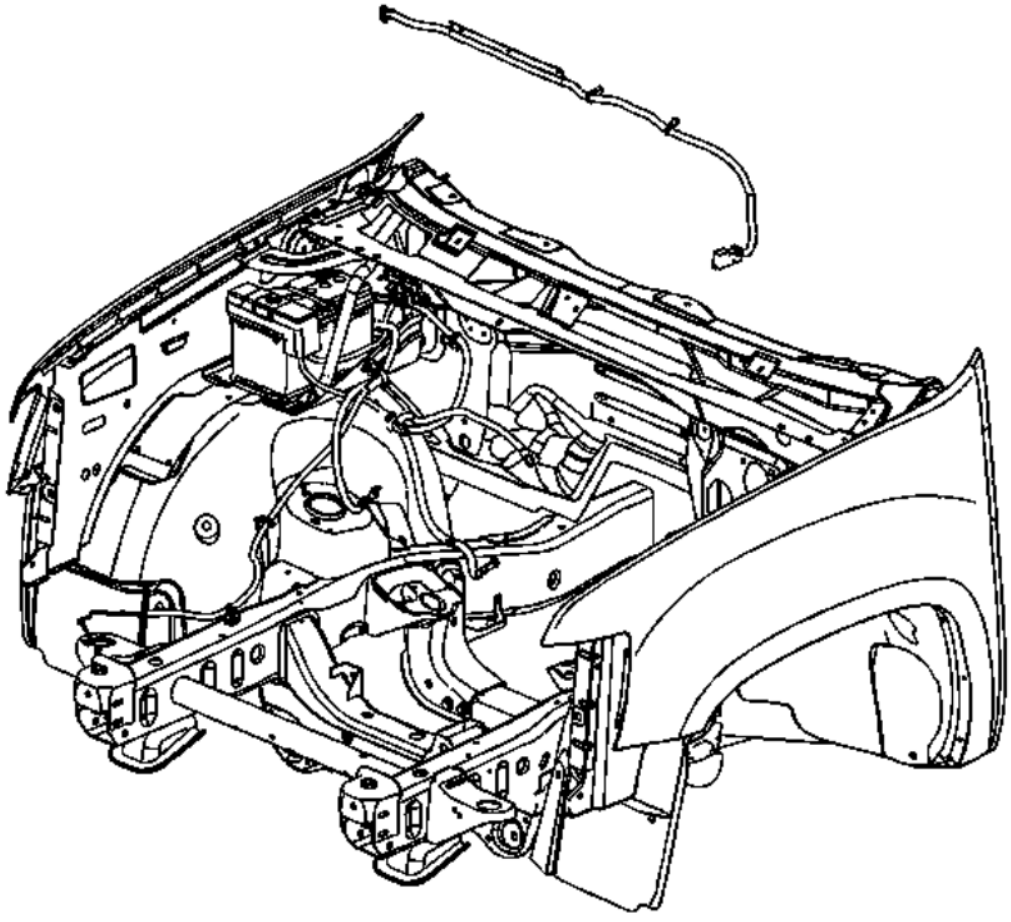


Fig. 61: View Of Positive Battery Cable
Courtesy of GENERAL MOTORS CORP.

11. Remove the positive battery cable terminal from the mega fuse stud.
12. Remove the positive battery cable channel from the studs.
13. Remove the positive battery cable from the vehicle.

Installation Procedure

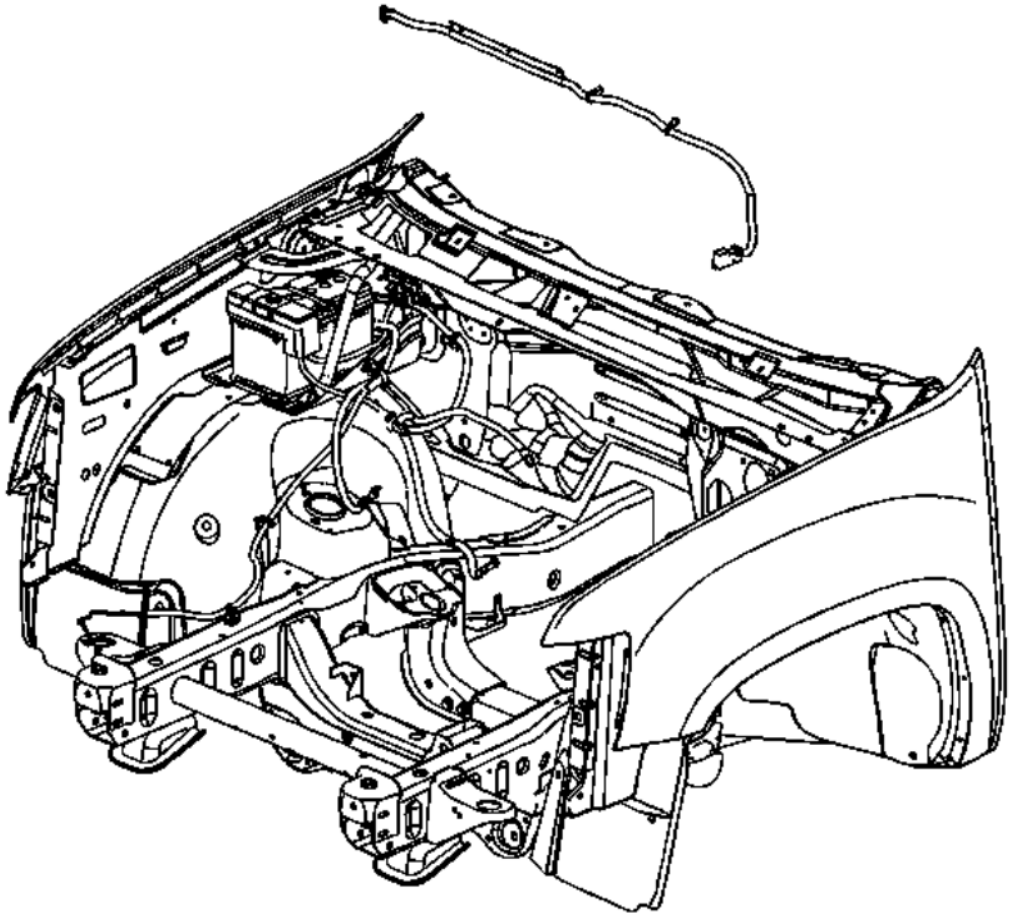


Fig. 62: View Of Positive Battery Cable
Courtesy of GENERAL MOTORS CORP.

1. Install the positive battery cable to the vehicle.
2. Install the positive battery cable terminal to the mega fuse stud.

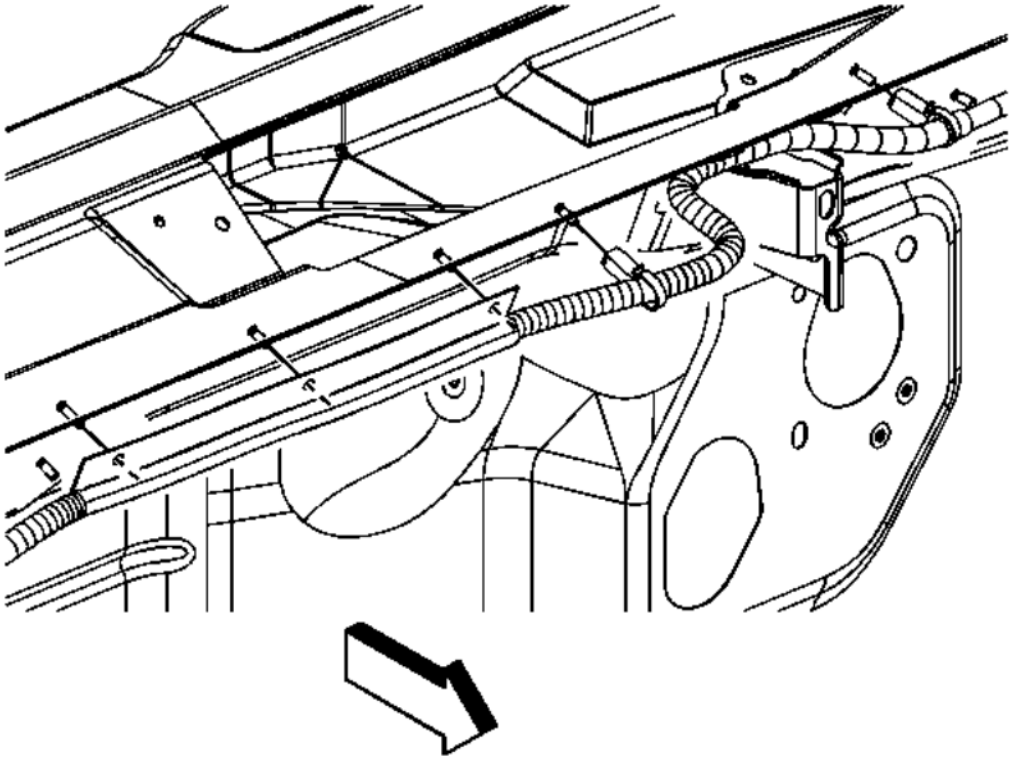


Fig. 63: View Of Positive Battery Cable Channel, Clips & Studs
Courtesy of GENERAL MOTORS CORP.

3. Install the positive battery cable channel at the plenum front panel.
4. Install the positive battery cable clips to the studs on the plenum front panel.

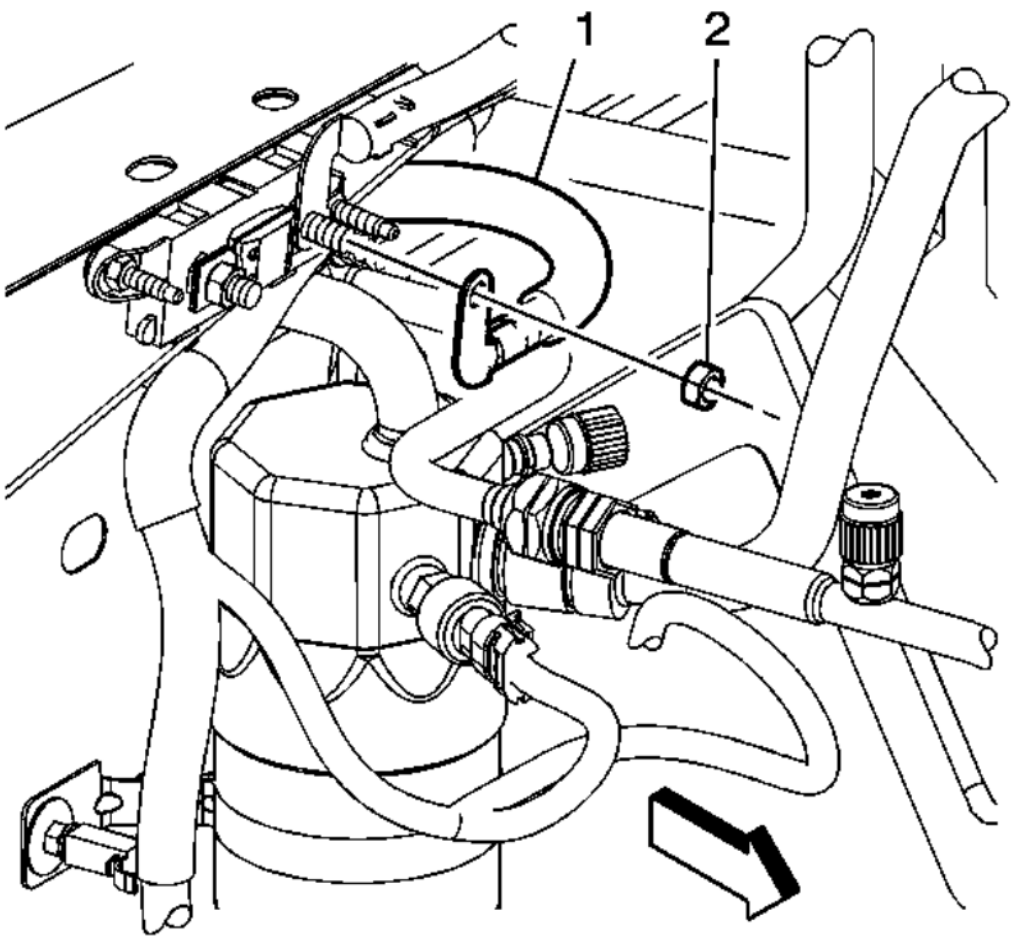


Fig. 64: View Of Starter Solenoid Cable & Nut
Courtesy of GENERAL MOTORS CORP.

5. Install the starter solenoid cable (1) terminal to the mega fuse stud.

NOTE: **Refer to Fastener Notice .**

6. Install the starter solenoid cable nut (2) to the mega fuse.

Tighten: Tighten the nut to 9 N.m (80 lb in).

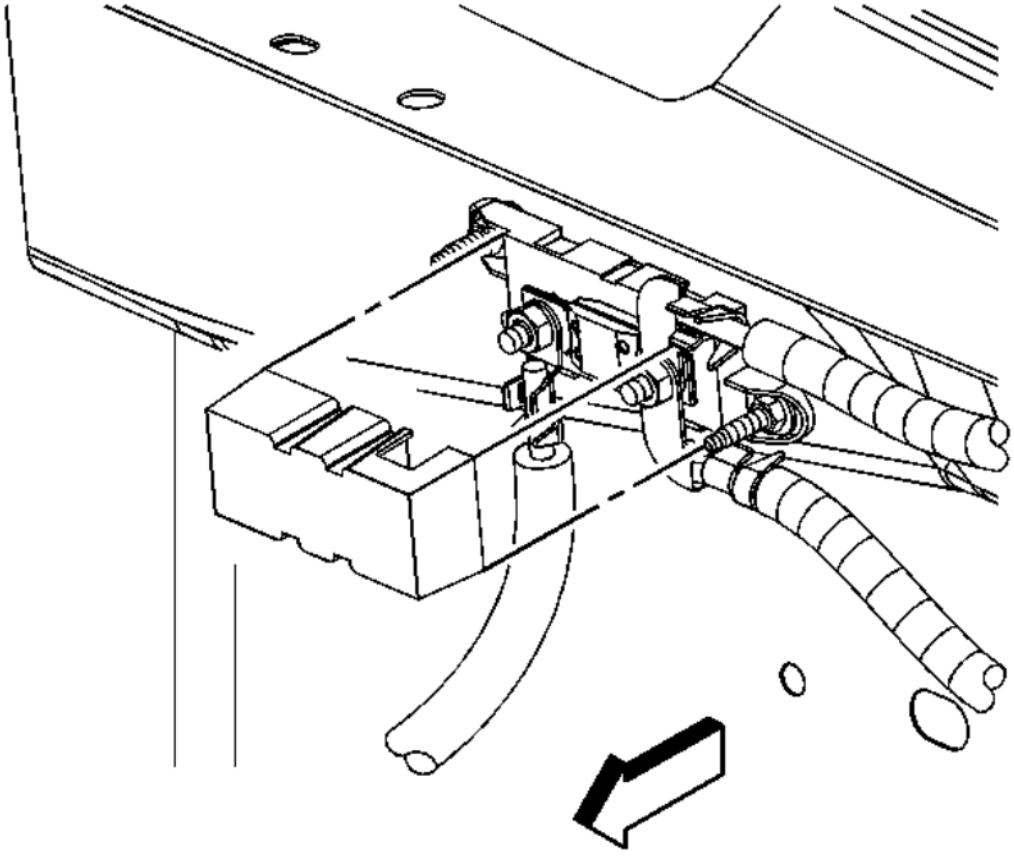


Fig. 65: View Of Mega Fuse Cover
Courtesy of GENERAL MOTORS CORP.

7. Install the mega fuse cover.

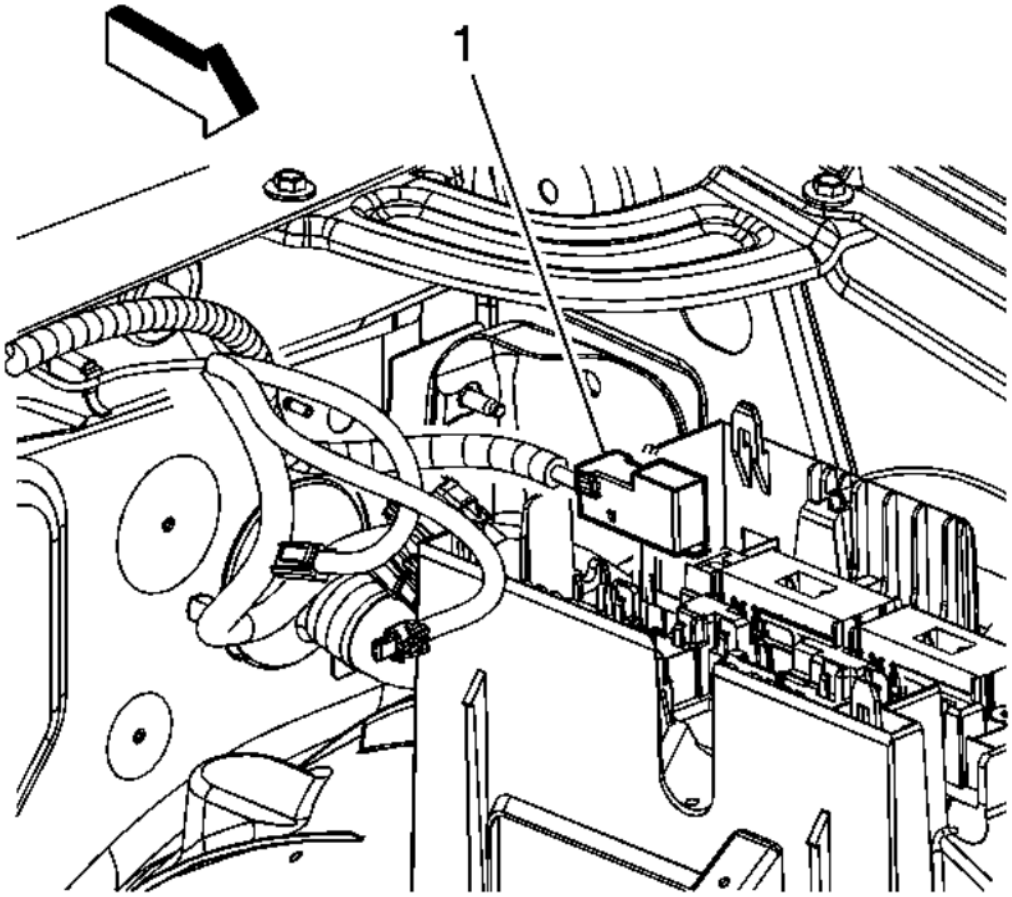


Fig. 66: View Of Positive Battery Cable Connector & (UBEC)
Courtesy of GENERAL MOTORS CORP.

8. Install the positive battery cable connector (1) to the UBEC.

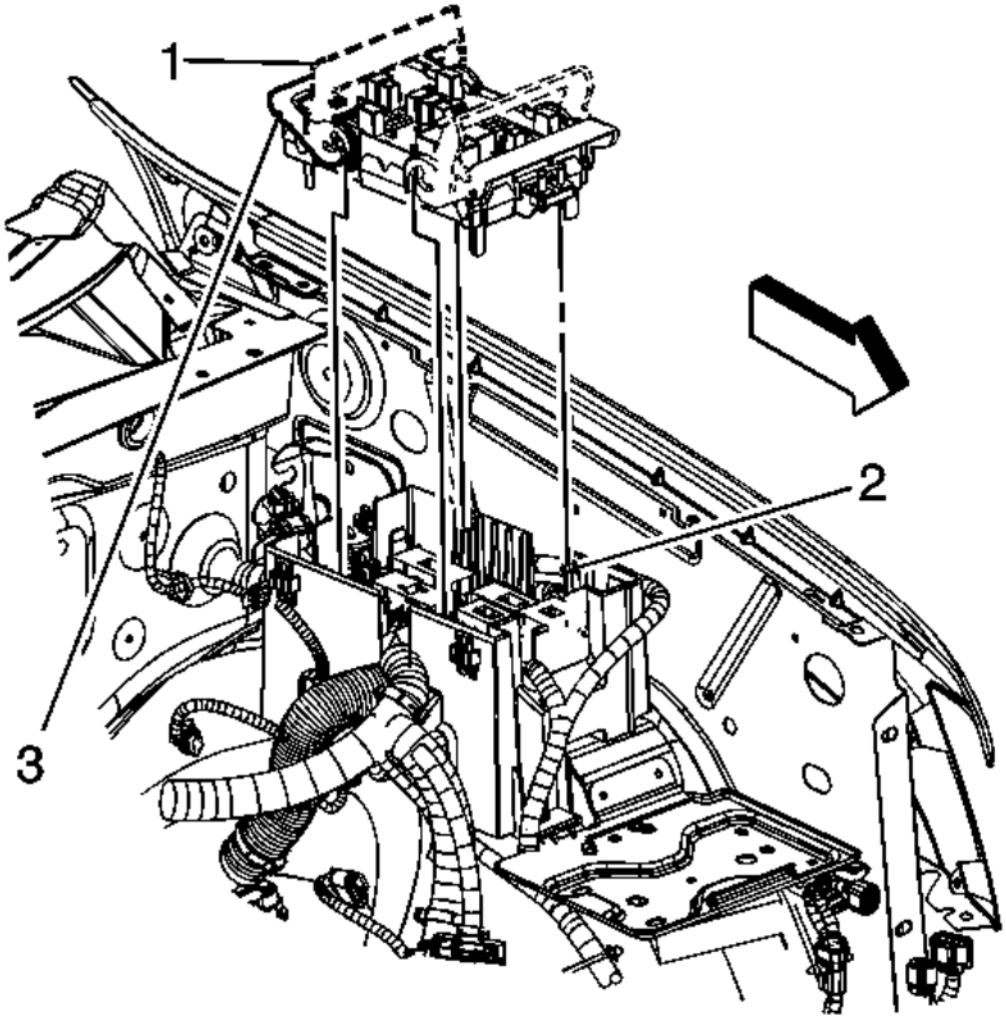


Fig. 67: View Of Junction Block & Retainers
Courtesy of GENERAL MOTORS CORP.

9. Ensure the junction block retainers are in the open position (1).
10. Position and align the junction block to the 4 bracket pivots (2), once the pivots are engaged, push the retainer down into the locked position (3).

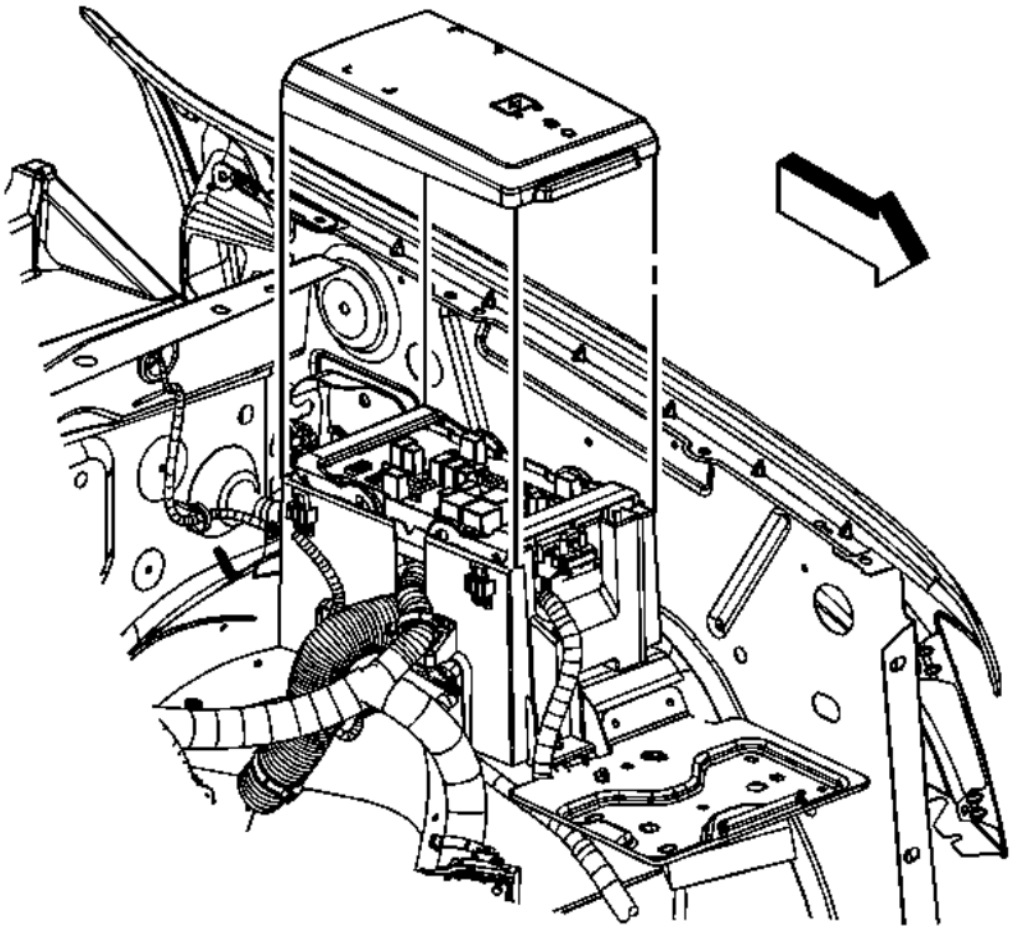


Fig. 68: View Of Under Hood Junction Block Cover
Courtesy of GENERAL MOTORS CORP.

11. Install the under hood junction block cover.
12. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

BATTERY POSITIVE CABLE REPLACEMENT (4.8L, 5.3L, 6.0L, AND 6.2L)

Removal Procedure

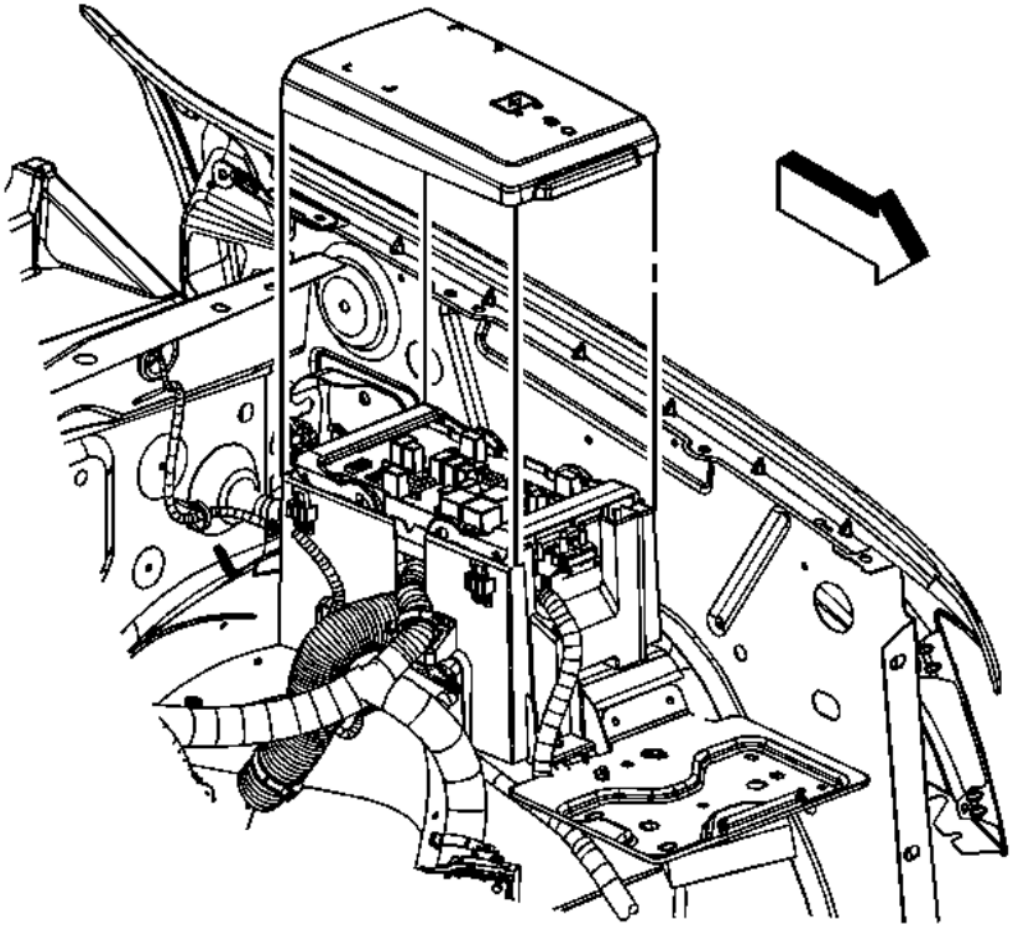


Fig. 69: View Of Under Hood Junction Block Cover
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.
2. Remove the under hood junction block cover.

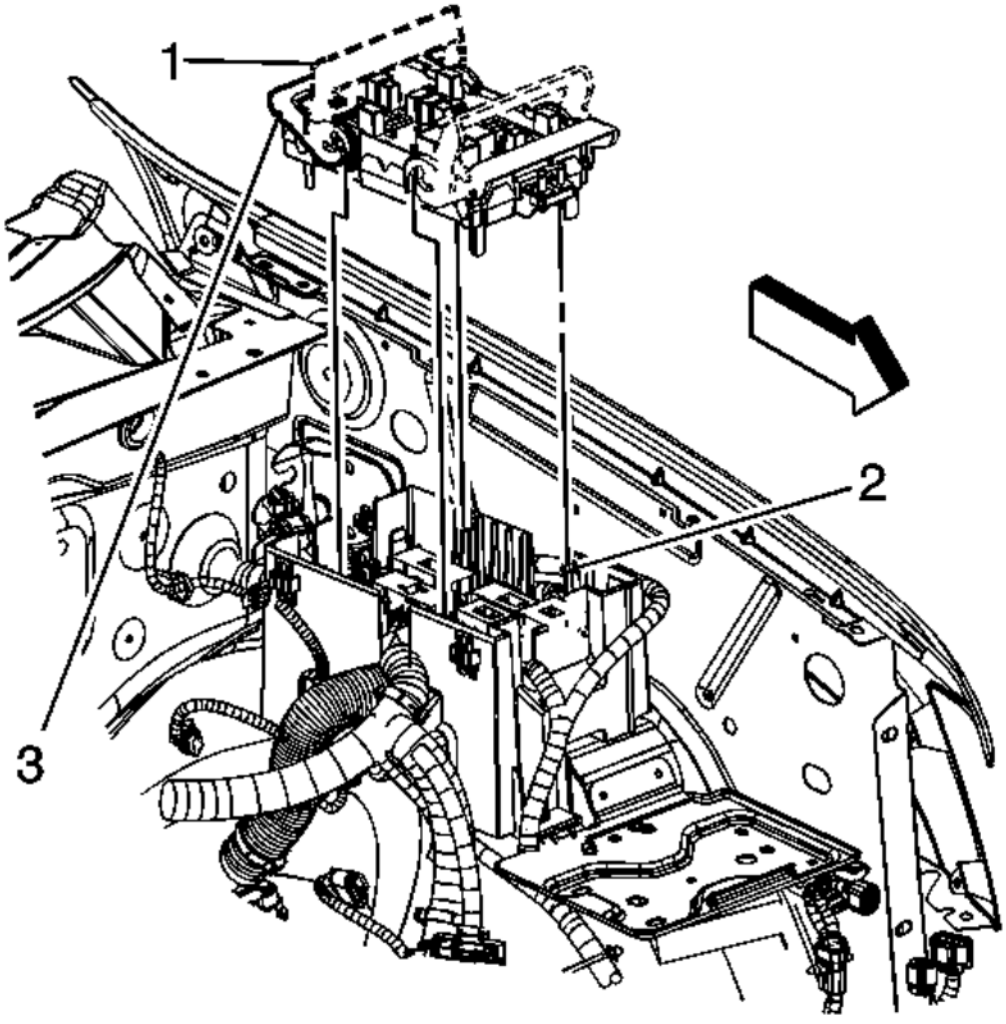


Fig. 70: View Of Junction Block & Retainers
Courtesy of GENERAL MOTORS CORP.

3. Lift the junction block retainers from the locked position (3) and rotate the retainers to the open position (1).
4. Remove the junction block.

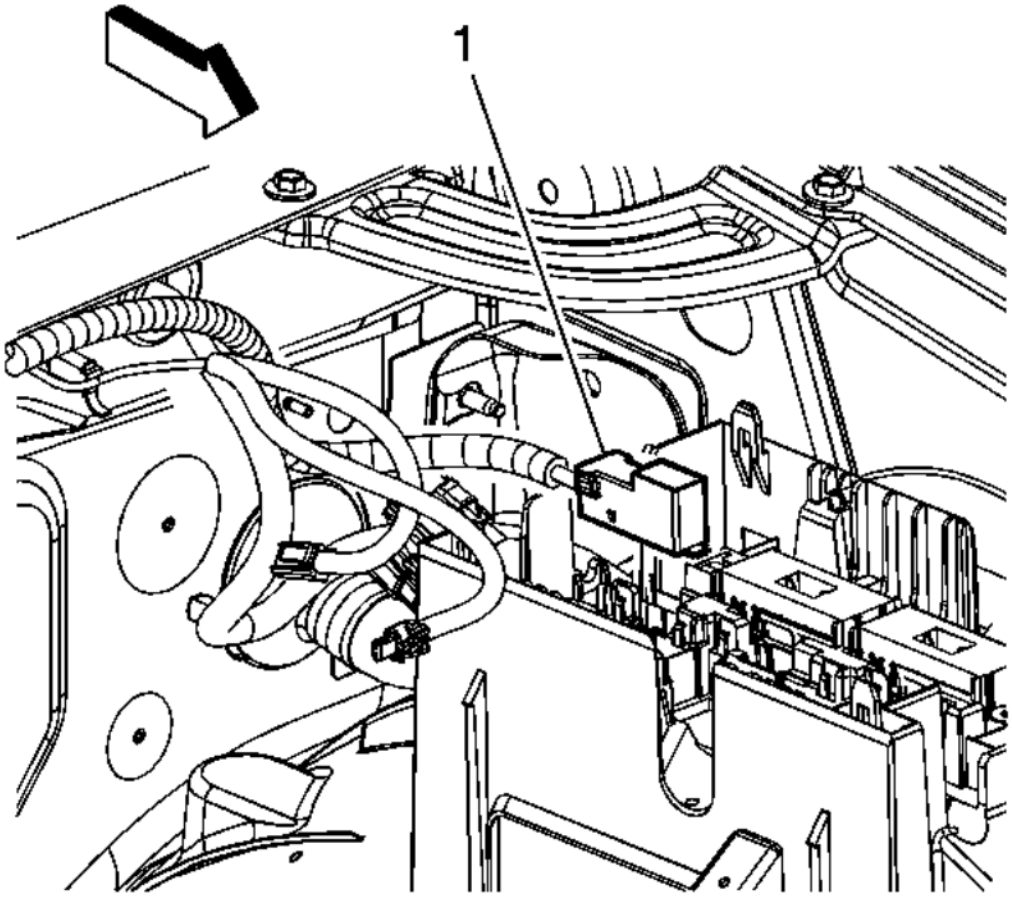


Fig. 71: View Of Positive Battery Cable Connector & (UBEC)
Courtesy of GENERAL MOTORS CORP.

5. Remove the positive battery cable connector (1) from the underhood bussed electrical center (UBEC).

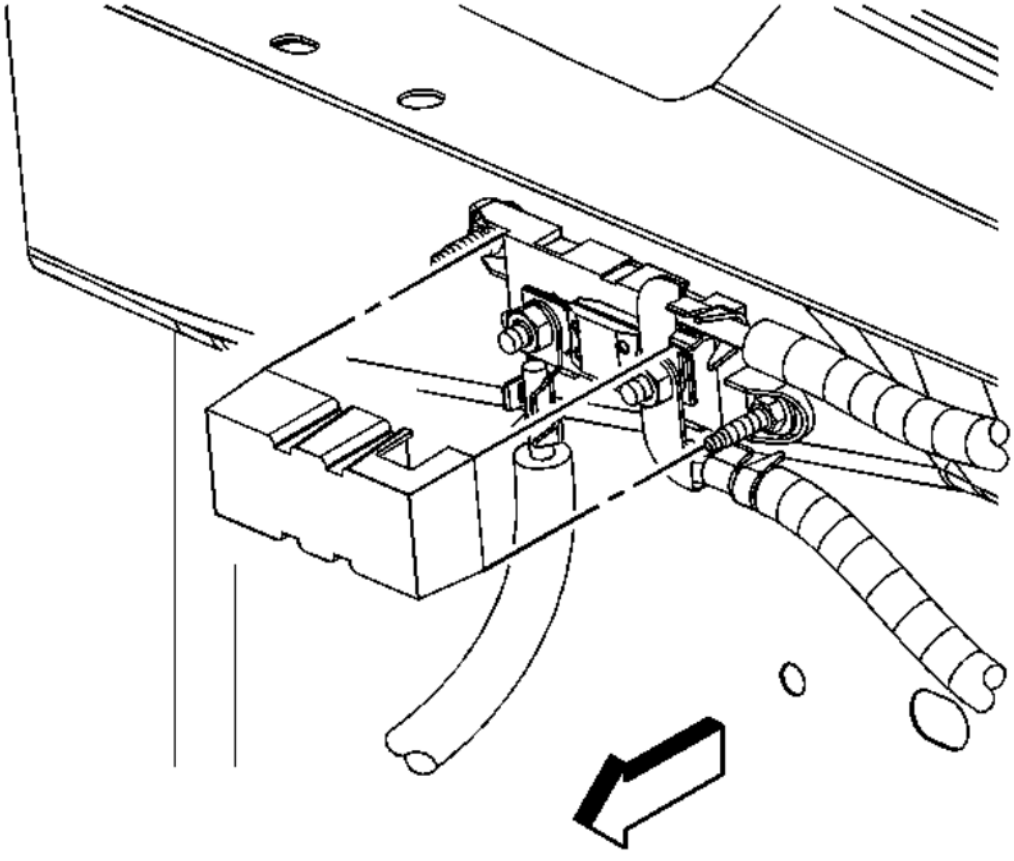


Fig. 72: View Of Mega Fuse Cover
Courtesy of GENERAL MOTORS CORP.

6. Remove the mega fuse cover.

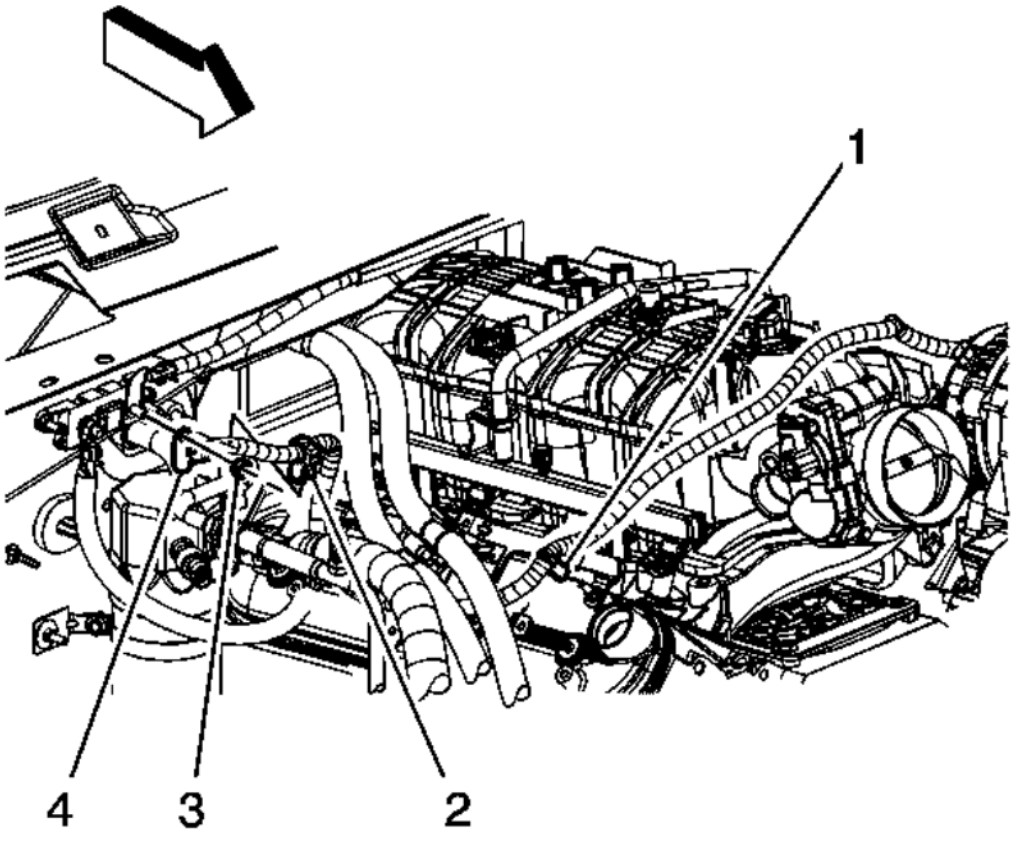


Fig. 73: View Of Generator Battery Jumper Cable & Components
Courtesy of GENERAL MOTORS CORP.

7. Remove the generator battery jumper cable to mega fuse nut (3).
8. Remove the generator battery jumper cable terminal (4) from the mega fuse stud.

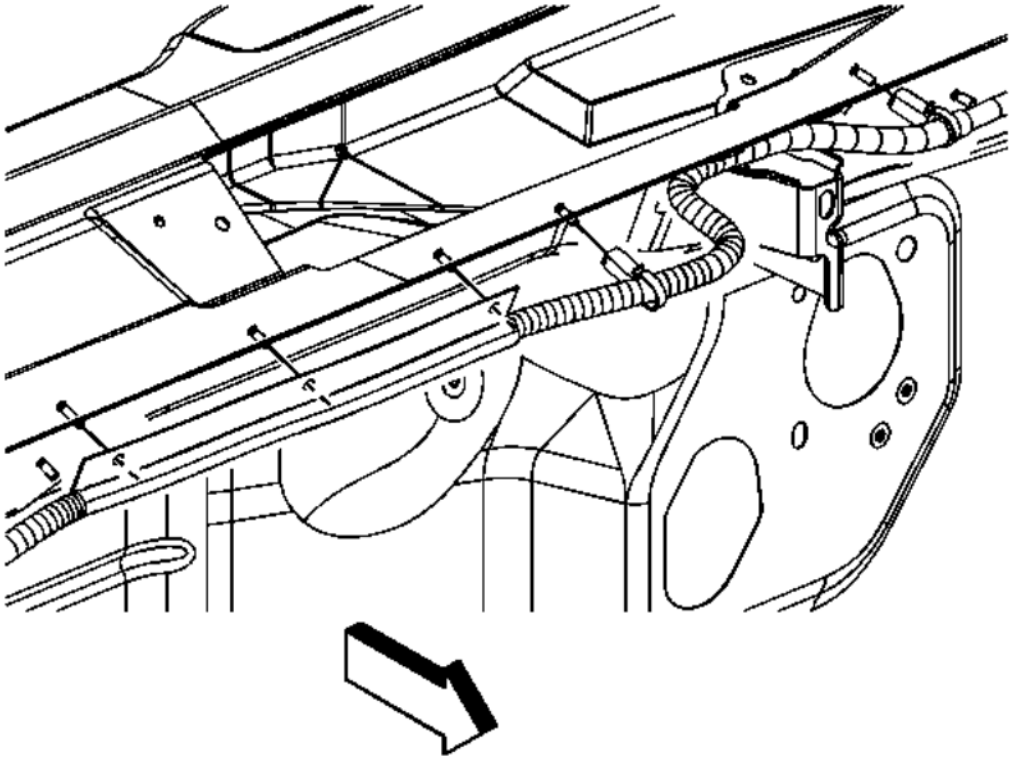


Fig. 74: View Of Positive Battery Cable Channel, Clips & Studs
Courtesy of GENERAL MOTORS CORP.

9. Remove the positive battery cable channel from the studs on the plenum front panel.
10. Remove the positive battery cable clips from the studs on the plenum front panel.

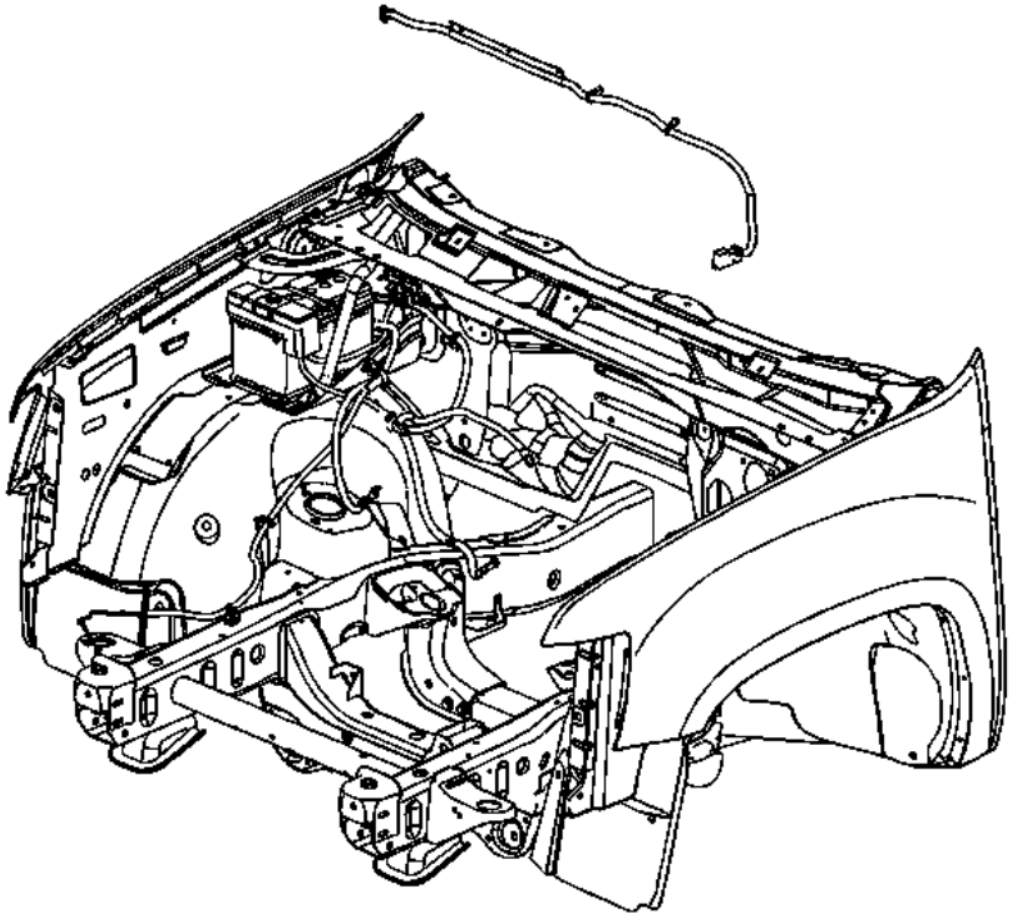


Fig. 75: View Of Positive Battery Cable
Courtesy of GENERAL MOTORS CORP.

11. Remove the positive battery cable terminal from the mega fuse stud.
12. Remove the positive battery cable channel from the studs.
13. Remove the positive battery cable from the vehicle.

Installation Procedure

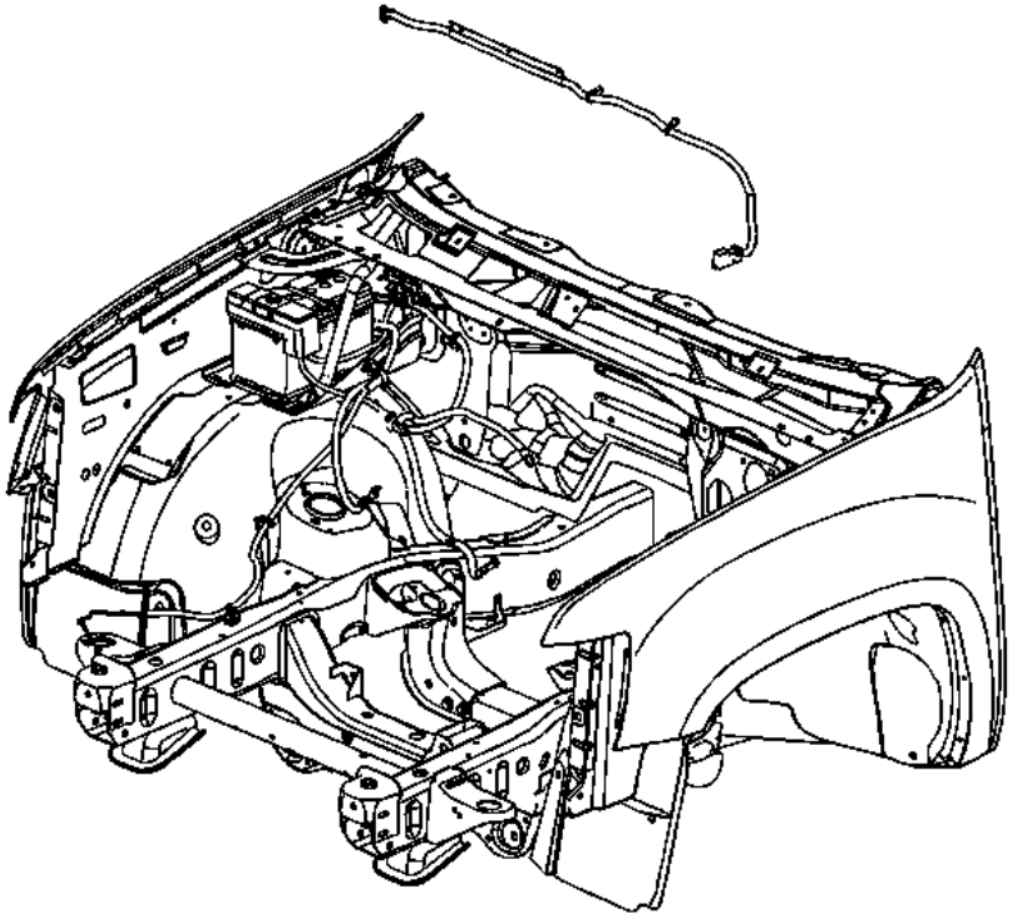


Fig. 76: View Of Positive Battery Cable
Courtesy of GENERAL MOTORS CORP.

1. Install the positive battery cable to the vehicle.
2. Install the positive battery cable terminal to the mega fuse stud.

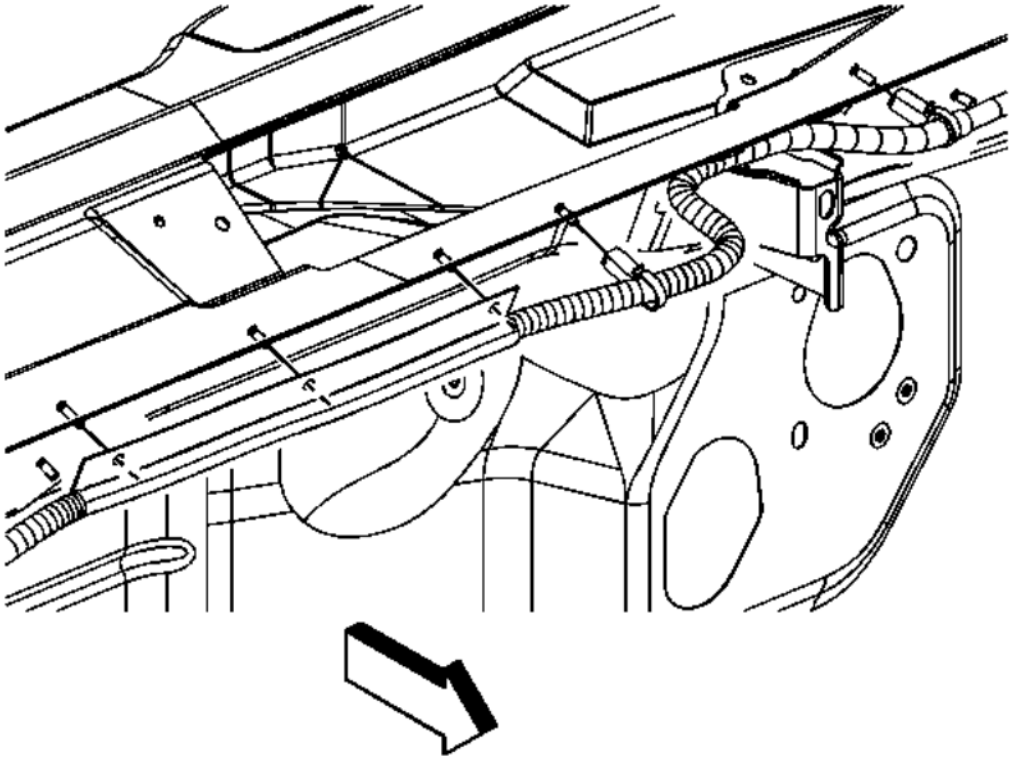


Fig. 77: View Of Positive Battery Cable Channel, Clips & Studs
Courtesy of GENERAL MOTORS CORP.

3. Install the positive battery cable channel at the plenum front panel.
4. Install the positive battery cable clips to the studs on the plenum front panel.

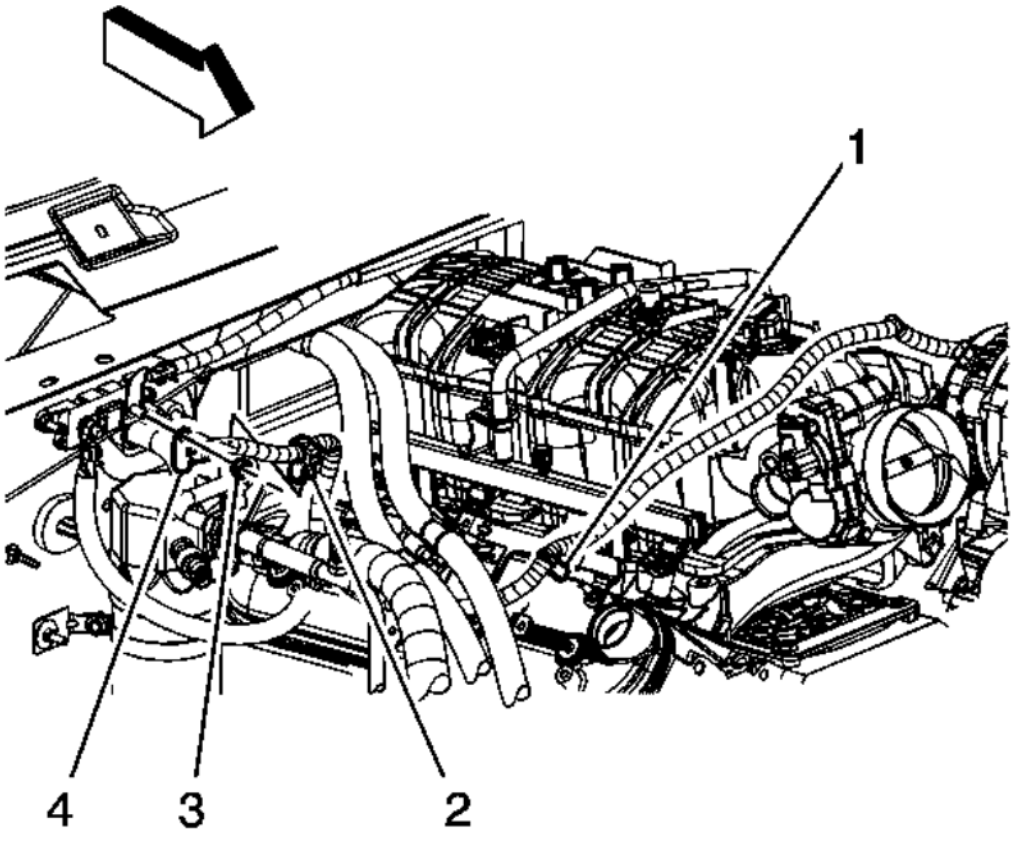


Fig. 78: View Of Generator Battery Jumper Cable & Components
Courtesy of GENERAL MOTORS CORP.

5. Install the generator battery jumper cable terminal (4) to the mega fuse stud.

NOTE: **Refer to Fastener Notice .**

6. Install the generator battery jumper cable to mega fuse nut (3).

Tighten: Tighten the nuts to 9 N.m (80 lb in).

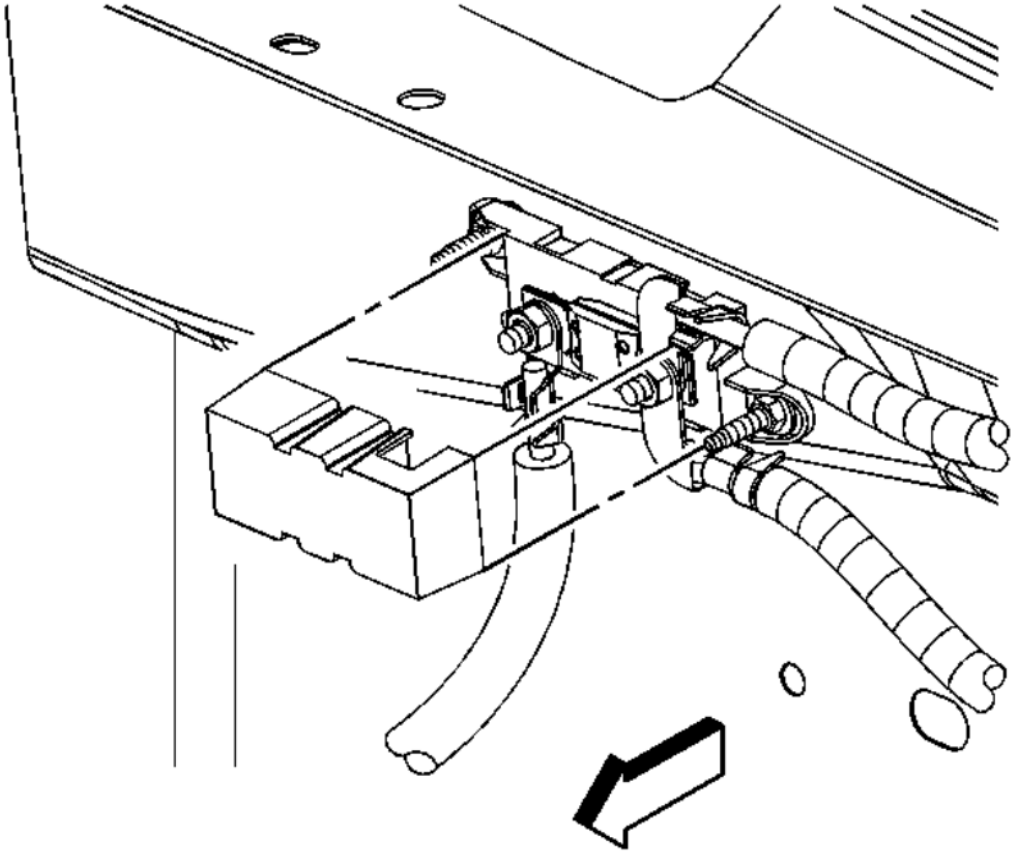


Fig. 79: View Of Mega Fuse Cover
Courtesy of GENERAL MOTORS CORP.

7. Install the mega fuse cover.

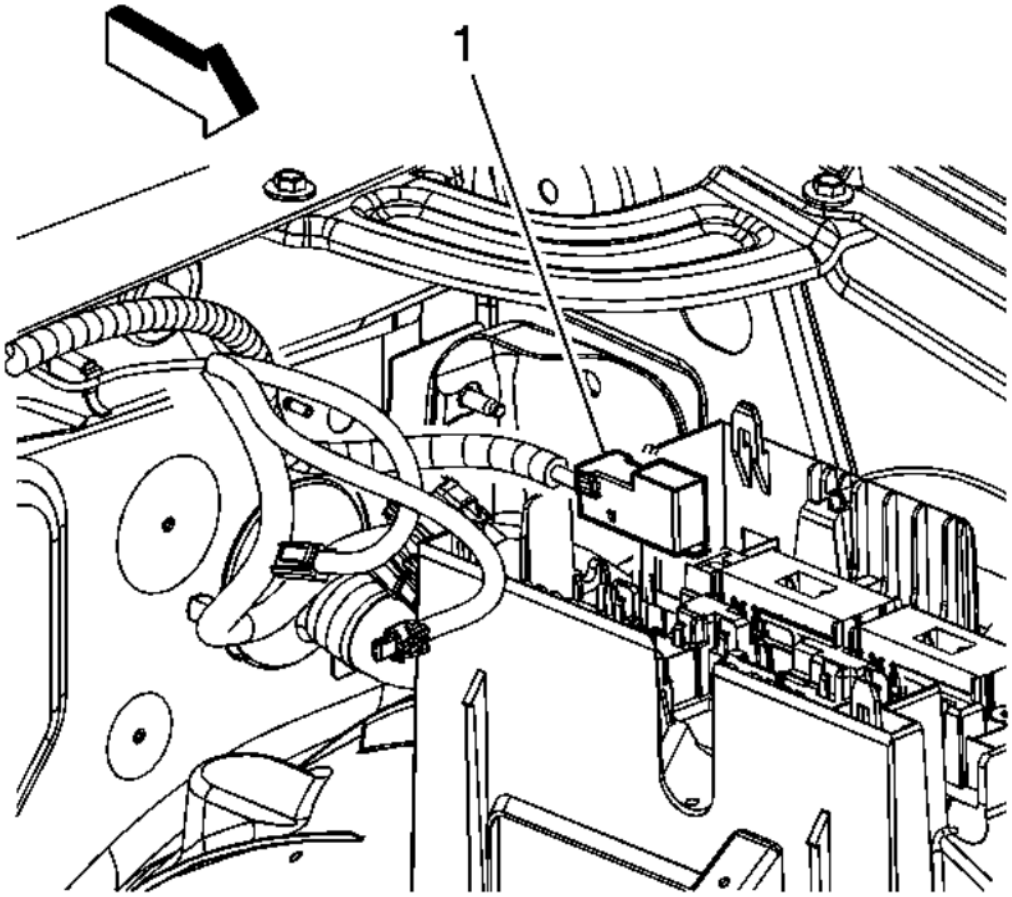


Fig. 80: View Of Positive Battery Cable Connector & (UBEC)
Courtesy of GENERAL MOTORS CORP.

8. Install the positive battery cable connector (1) to the UBEC.

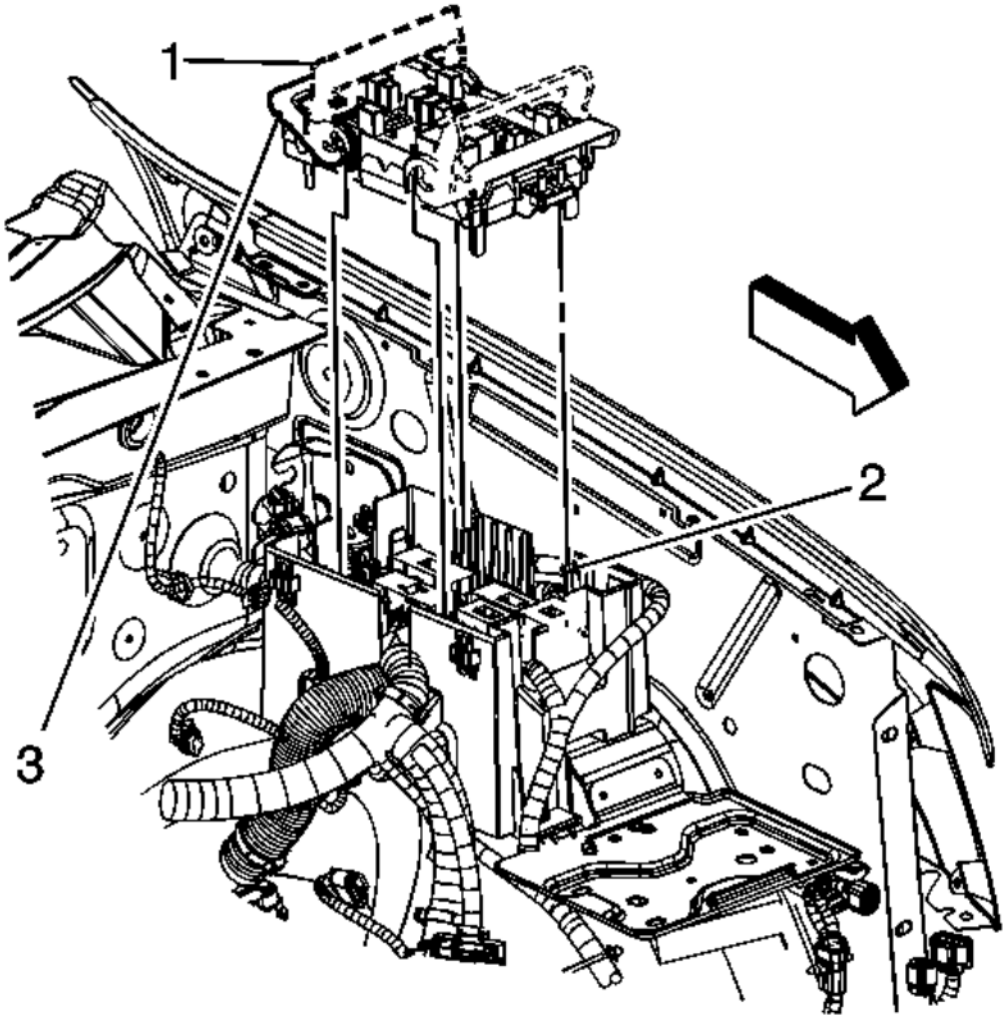


Fig. 81: View Of Junction Block & Retainers
Courtesy of GENERAL MOTORS CORP.

9. Ensure the junction block retainers are in the open position (1).
10. Position and align the junction block to the 4 bracket pivots (2), once the pivots are engaged, push the retainer down into the locked position (3).

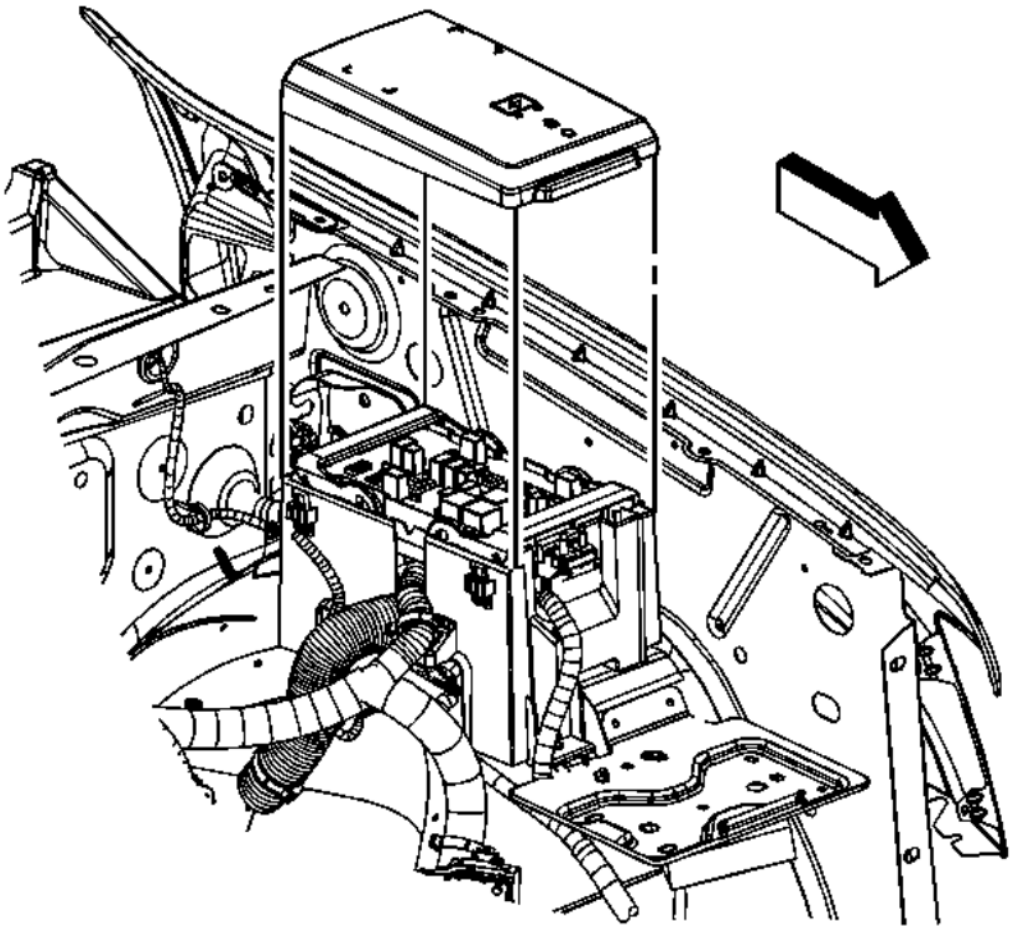


Fig. 82: View Of Under Hood Junction Block Cover
Courtesy of GENERAL MOTORS CORP.

11. Install the under hood junction block cover.
12. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

BATTERY POSITIVE CABLE REPLACEMENT (6.6L)

Removal Procedure

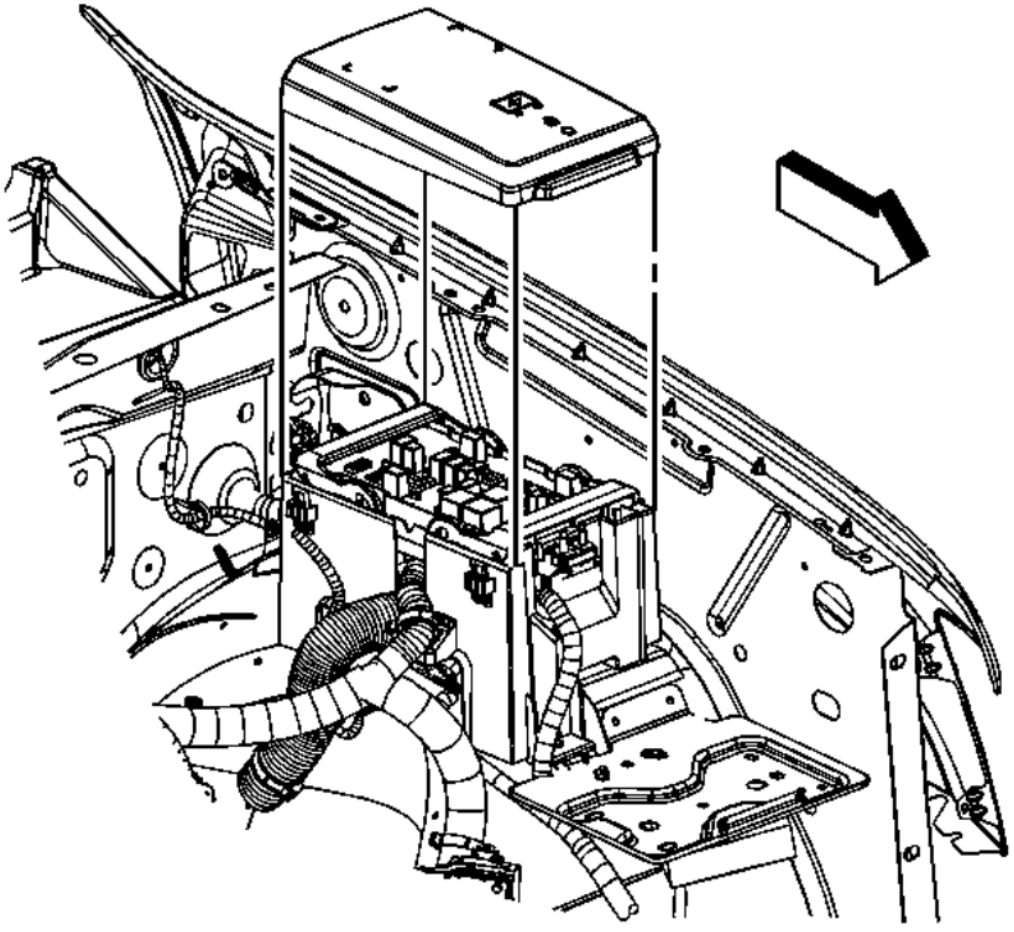


Fig. 83: View Of Under Hood Junction Block Cover
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.
2. Remove the intake manifold cover. Refer to **Intake Manifold Cover Replacement** .
3. Remove the underhood junction block cover.

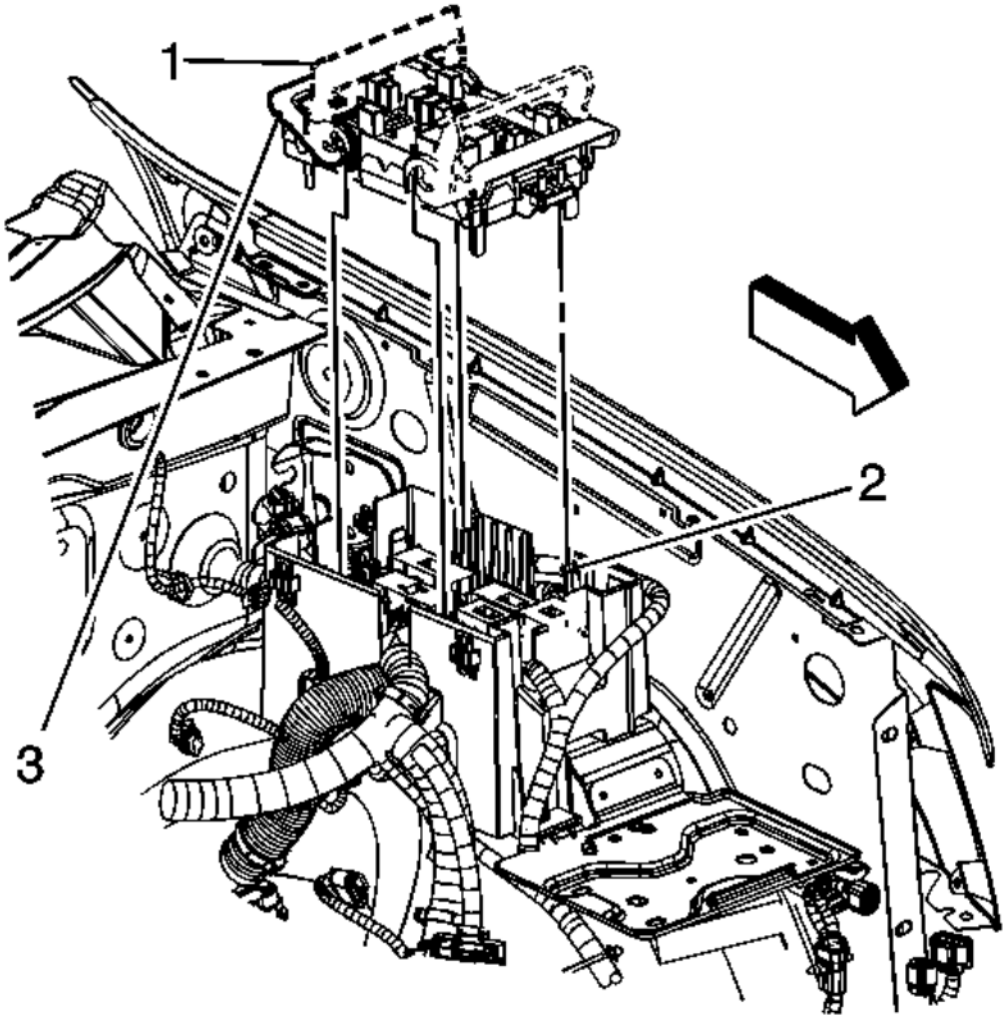


Fig. 84: View Of Junction Block & Retainers
Courtesy of GENERAL MOTORS CORP.

4. Lift the junction block retainers from the locked position (3) and rotate the retainers to the open position (1).
5. Reposition the junction block.

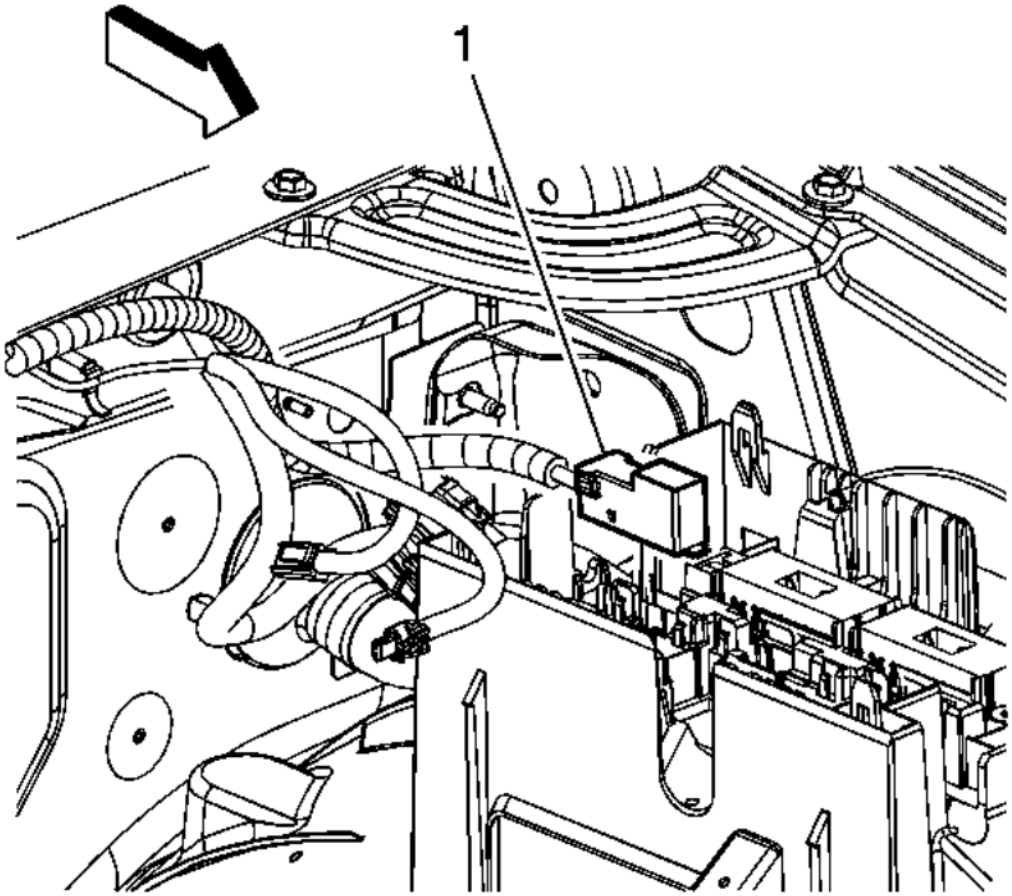


Fig. 85: View Of Positive Battery Cable Connector & (UBEC)
Courtesy of GENERAL MOTORS CORP.

6. Remove the positive battery cable connector (1) from the underhood bussed electrical center (UBEC).

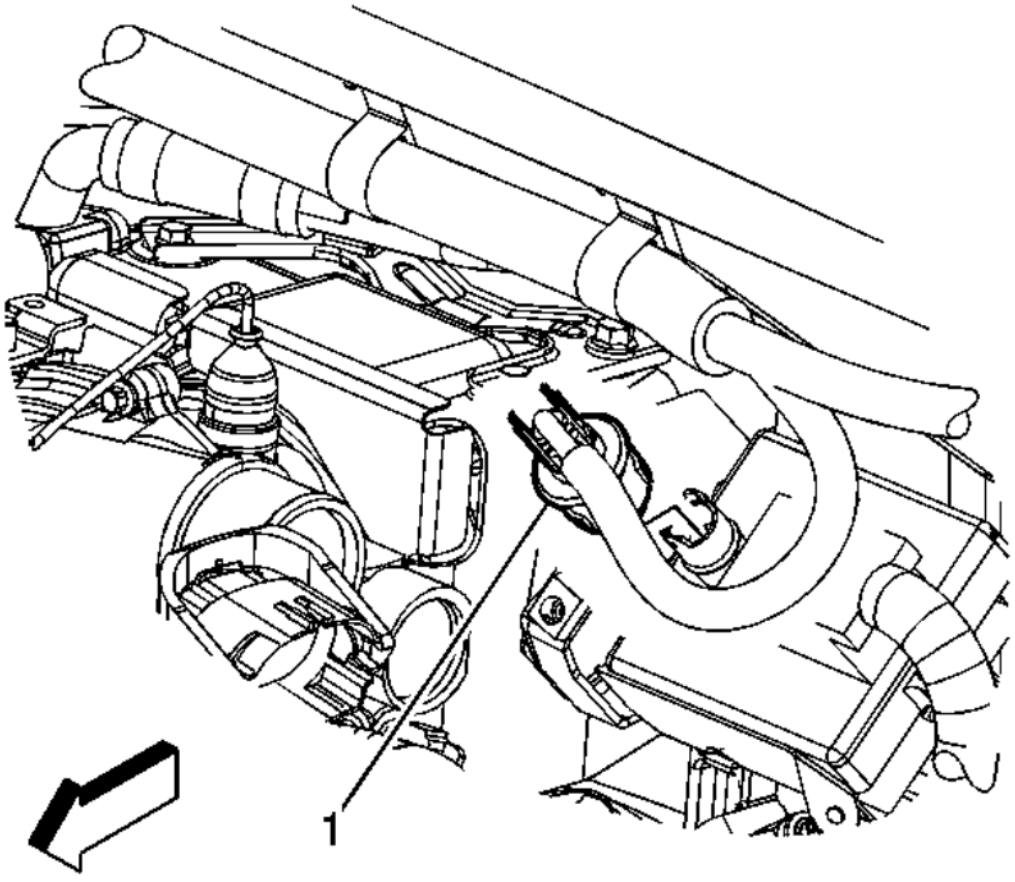


Fig. 86: View Of Positive Battery Cable
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the positive battery cable (1) from the glow plug control module.

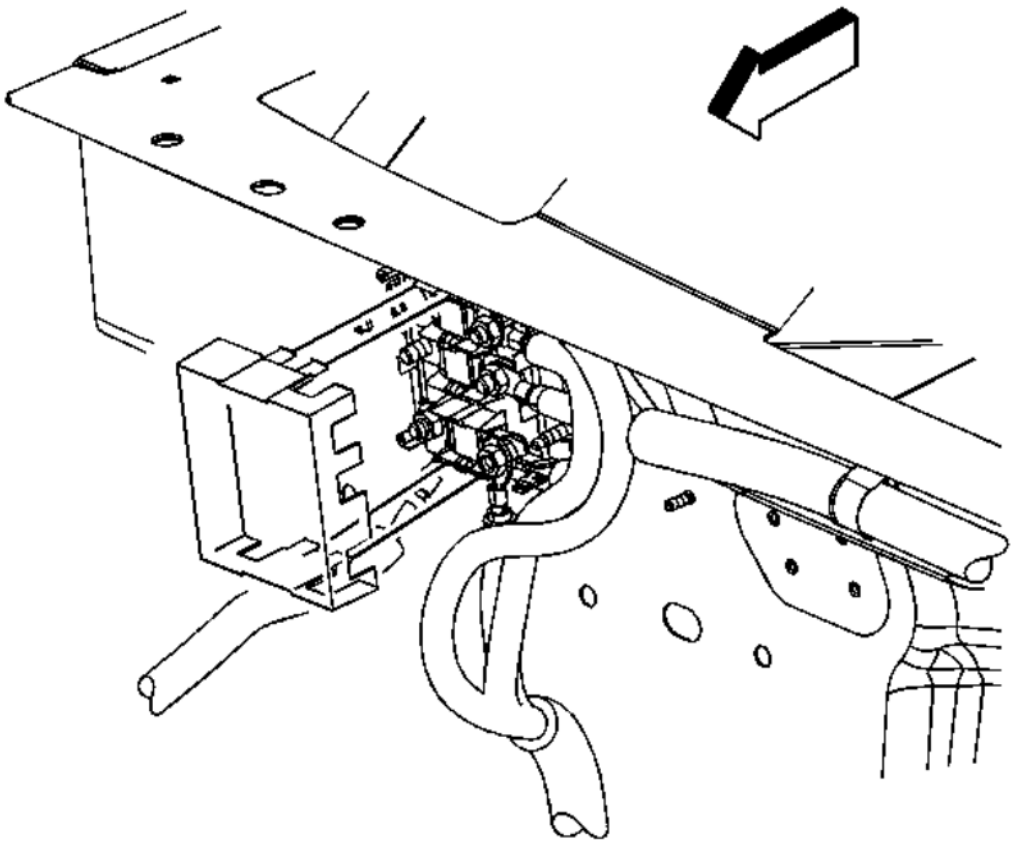


Fig. 87: View Of Mega Fuse Cover
Courtesy of GENERAL MOTORS CORP.

8. Remove the mega fuse cover.

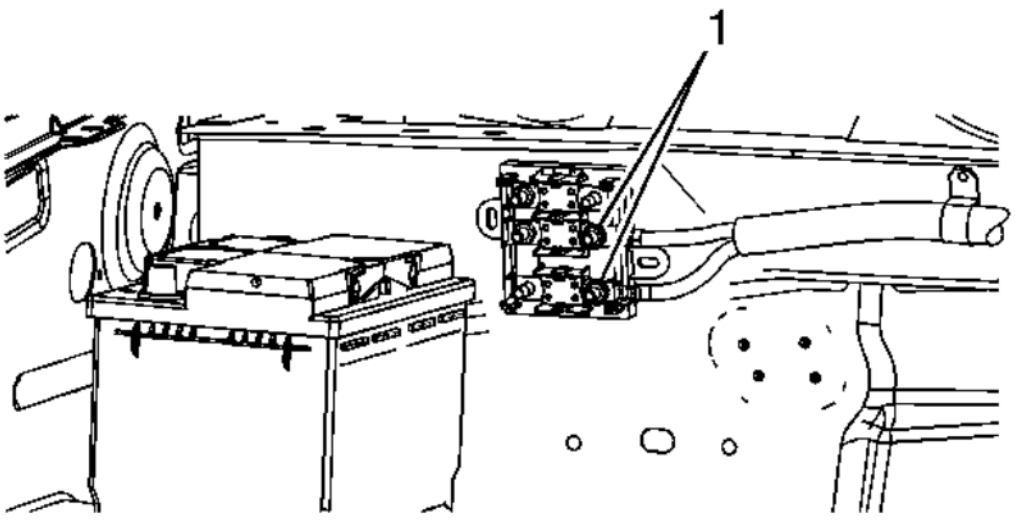


Fig. 88: View Of Mega Fuse Nuts
Courtesy of GENERAL MOTORS CORP.

9. Remove the positive battery cable to mega fuse nuts (1).
10. Remove the positive battery cable terminals from the mega fuse studs.

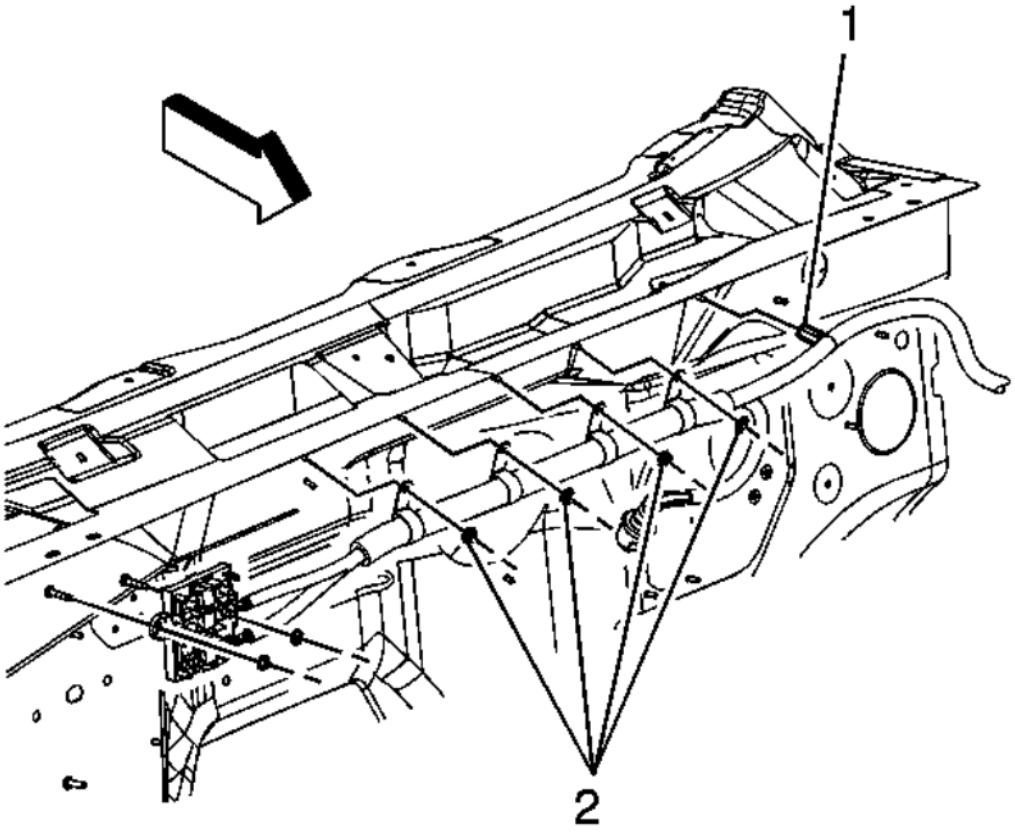


Fig. 89: View Of Positive Battery Cable Clip & Nuts
Courtesy of GENERAL MOTORS CORP.

11. Remove the positive battery cable clip nuts (2) from the studs on the plenum front panel.
12. Remove the positive battery cable clip (1) from the stud on the plenum front panel.

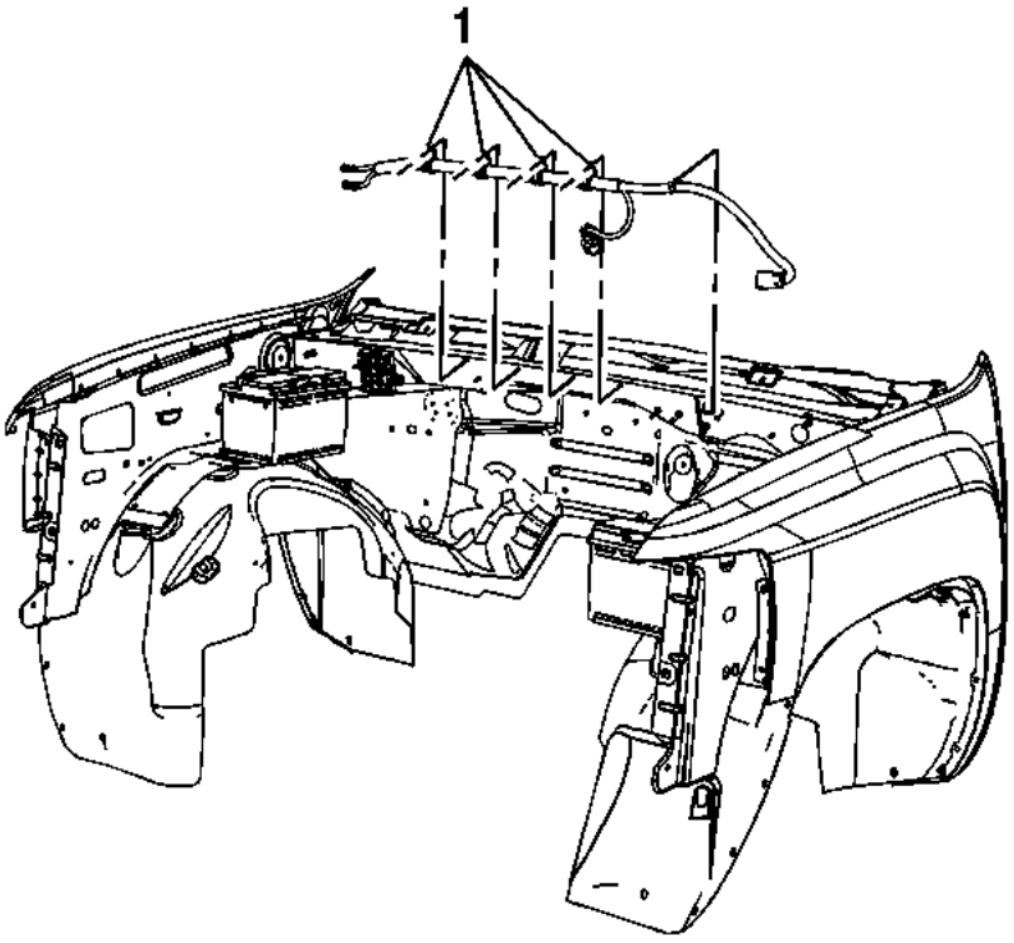


Fig. 90: View Of Positive Battery Cable Clips
Courtesy of GENERAL MOTORS CORP.

13. Remove the positive battery cable clips (1) from the studs on the plenum front panel.
14. Remove the positive battery cable from the vehicle.

Installation Procedure

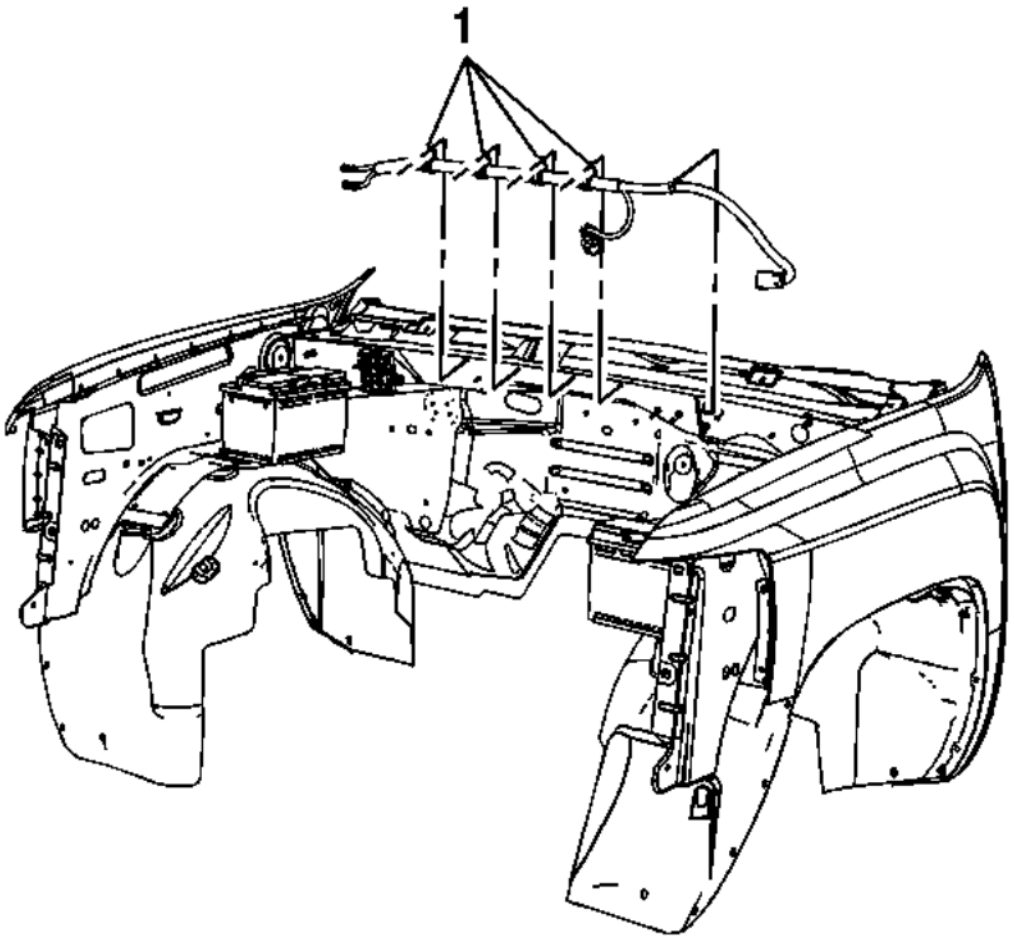


Fig. 91: View Of Positive Battery Cable Clips
Courtesy of GENERAL MOTORS CORP.

1. Install the positive battery cable to the vehicle.
2. Install the positive battery cable clips (1) onto the studs on the plenum front panel.

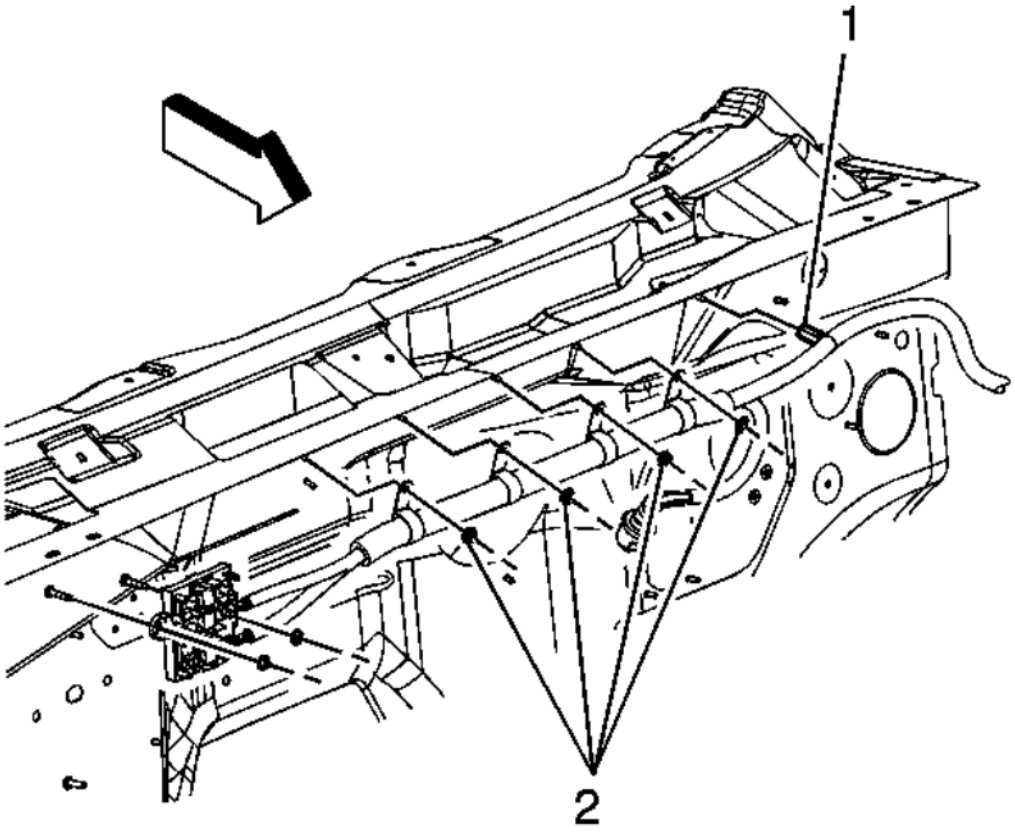


Fig. 92: View Of Positive Battery Cable Clip & Nuts
Courtesy of GENERAL MOTORS CORP.

3. Install the positive battery cable clip (1) onto the stud on the plenum front panel.

NOTE: Refer to Fastener Notice .

4. Install the positive battery cable clip nuts (2) to the studs on the plenum front panel.

Tighten: Tighten the nuts to 3 N.m (27 lb in).

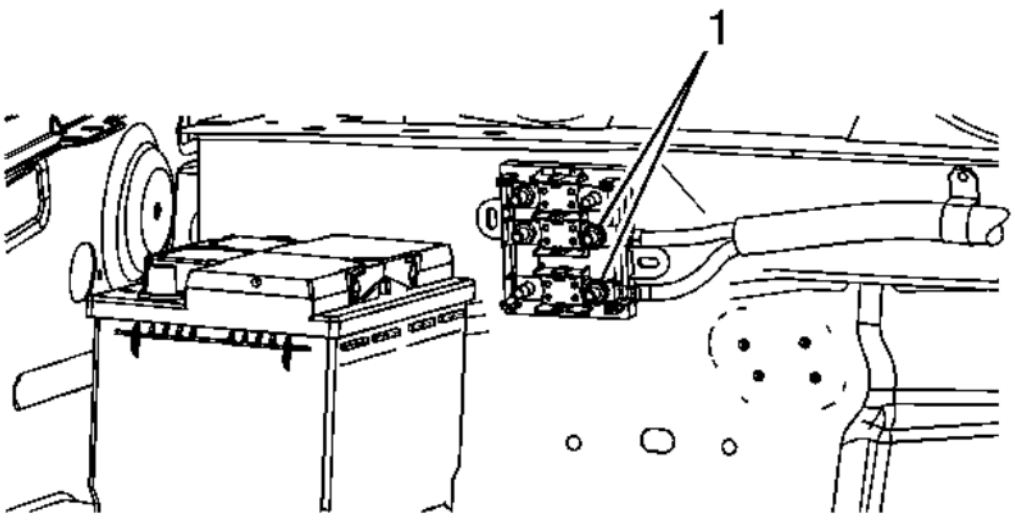


Fig. 93: View Of Mega Fuse Nuts
Courtesy of GENERAL MOTORS CORP.

5. Install the positive battery cable terminals onto the mega fuse studs.
6. Install the positive battery cable to mega fuse nuts (1).

Tighten: Tighten the nuts to 7.5 N.m (66 lb in).

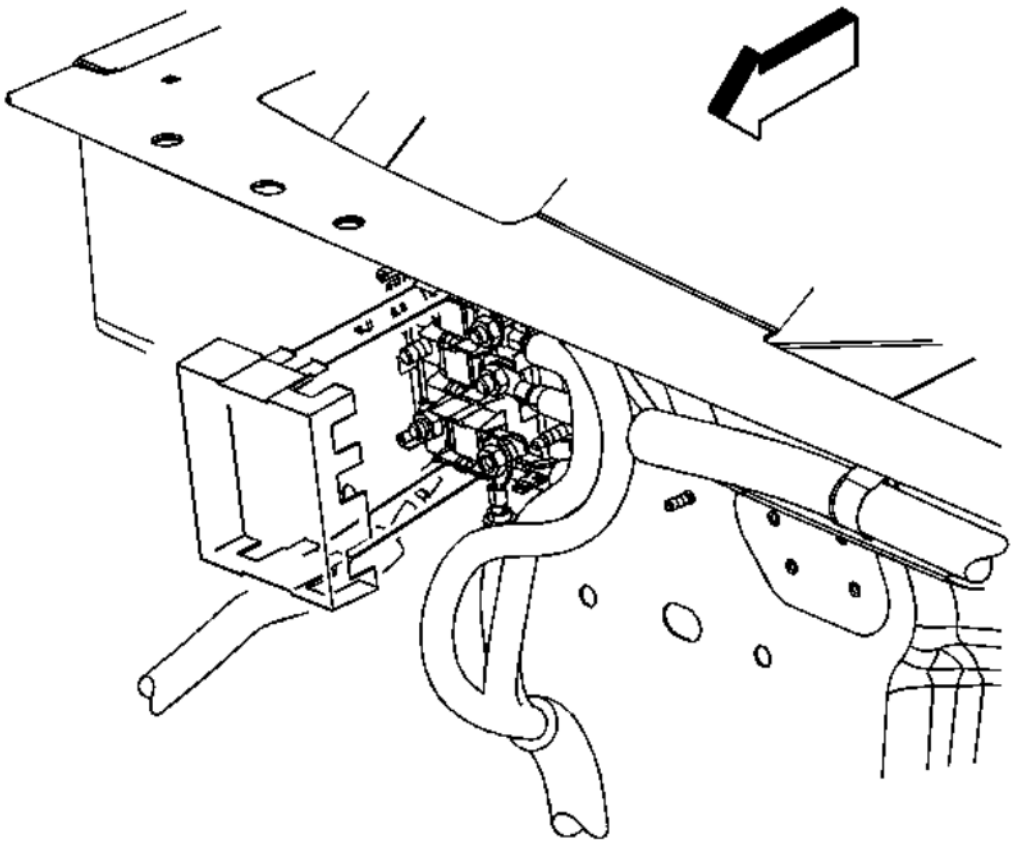


Fig. 94: View Of Mega Fuse Cover
Courtesy of GENERAL MOTORS CORP.

7. Install the mega fuse cover.

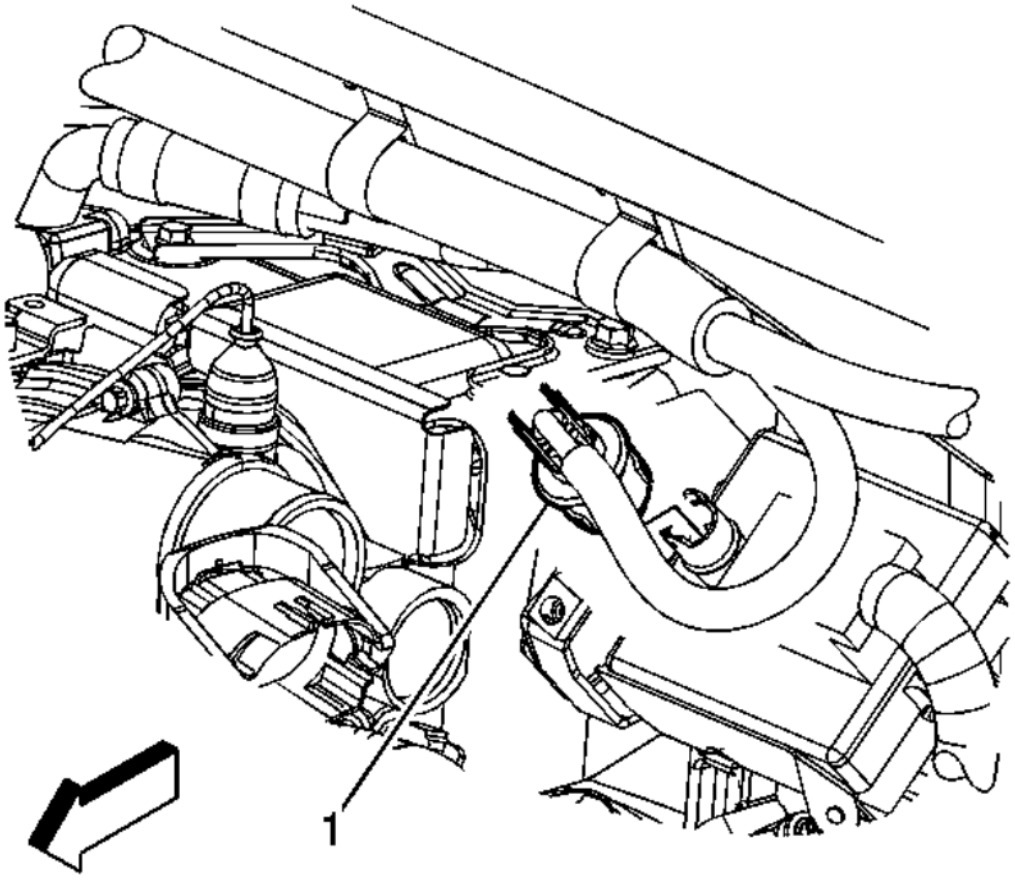


Fig. 95: View Of Positive Battery Cable
Courtesy of GENERAL MOTORS CORP.

8. Connect the positive battery cable (1) to the glow plug control module.

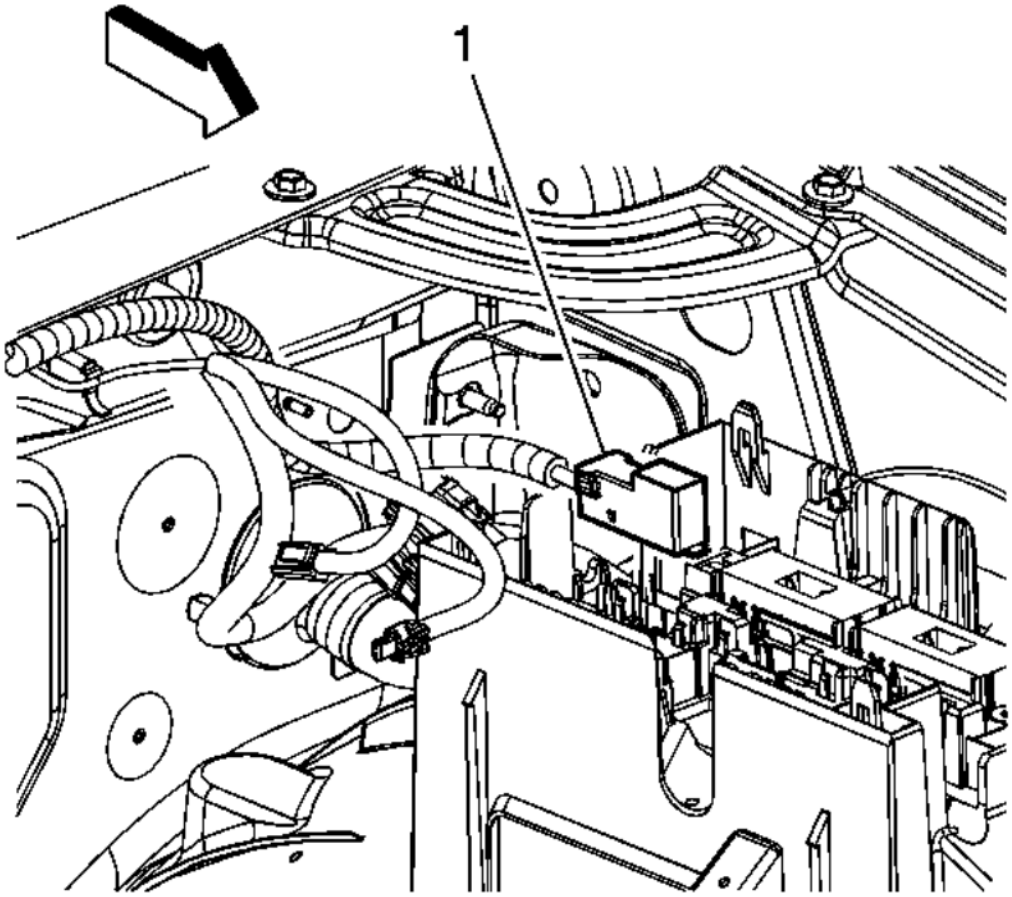


Fig. 96: View Of Positive Battery Cable Connector & (UBEC)
Courtesy of GENERAL MOTORS CORP.

9. Install the positive battery cable connector (1) to the UBEC.

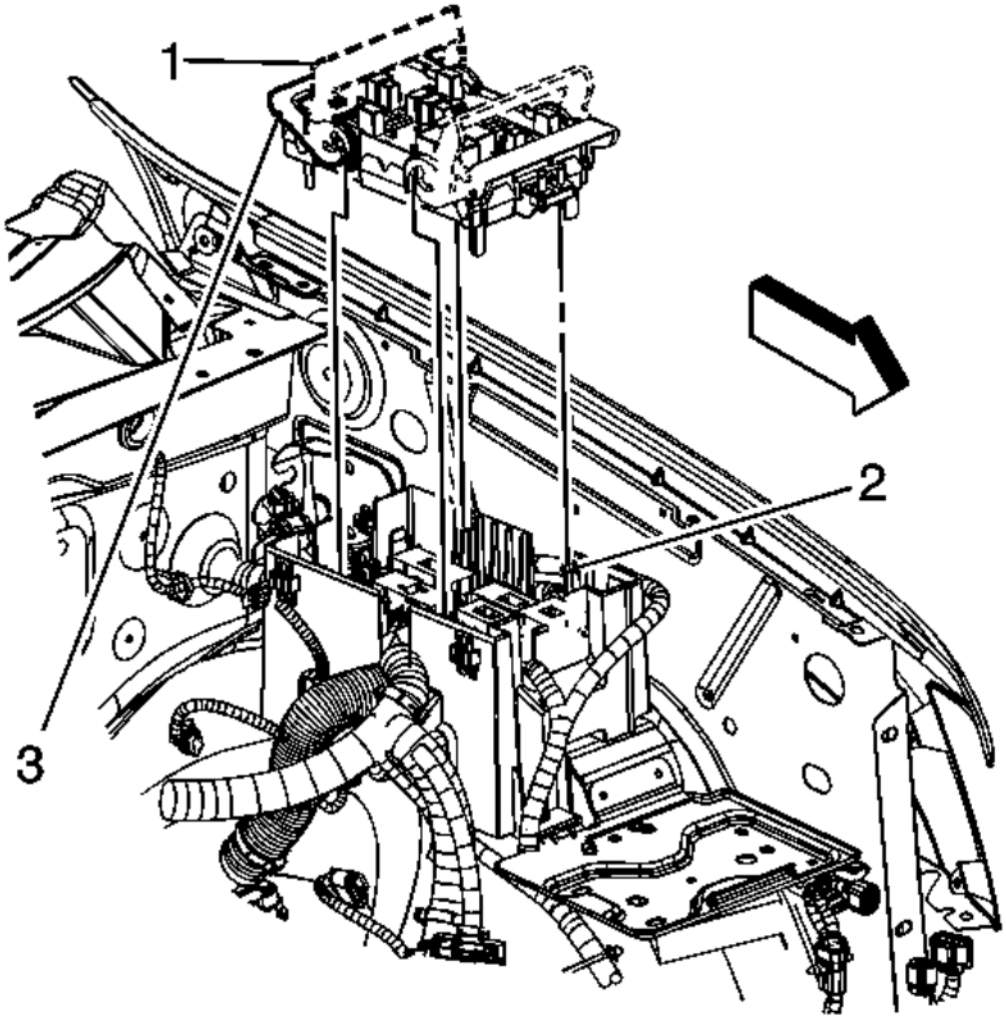


Fig. 97: View Of Junction Block & Retainers
Courtesy of GENERAL MOTORS CORP.

10. Ensure that the junction block retainers are in the open position (1).
11. Position and align the junction block to the 4 bracket pivots (2), once the pivots are engaged, push the retainers down into the locked position (3).

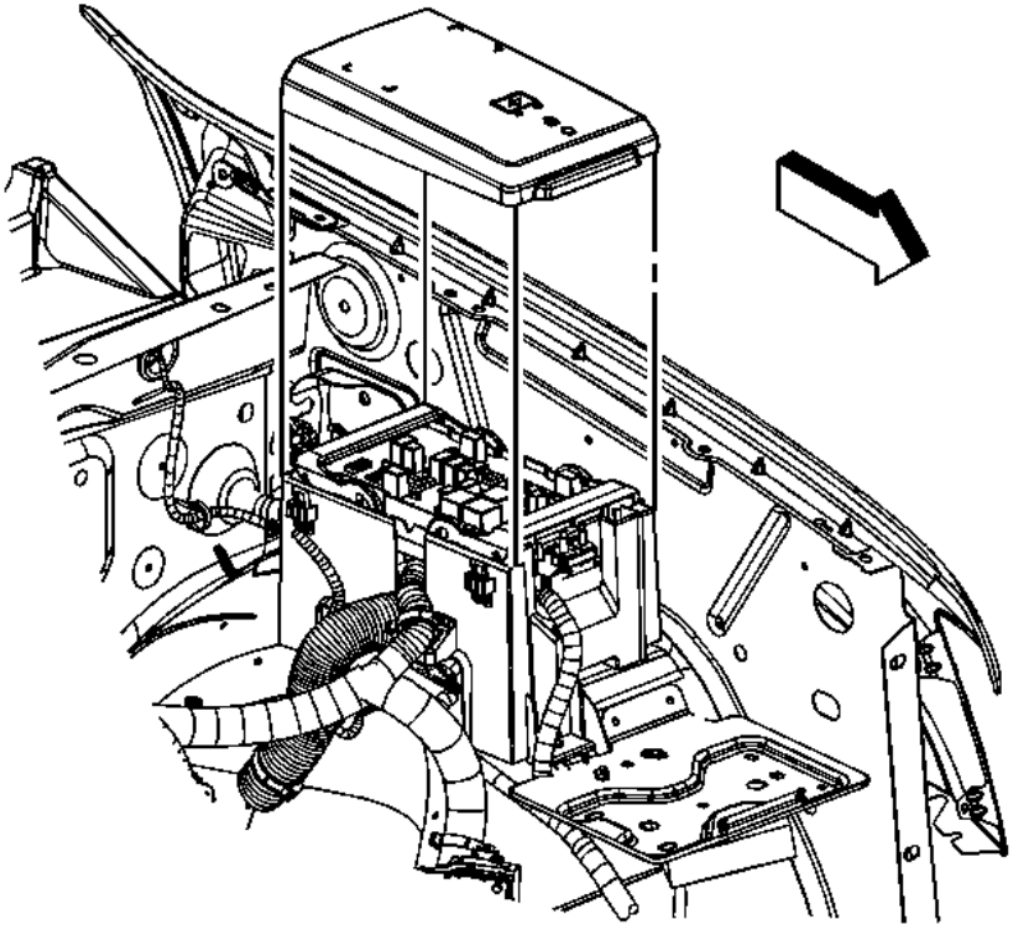


Fig. 98: View Of Under Hood Junction Block Cover
Courtesy of GENERAL MOTORS CORP.

12. Install the underhood junction block cover.
13. Install the intake manifold cover. Refer to **Intake Manifold Cover Replacement** .
14. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

AUXILIARY BATTERY POSITIVE CABLE REPLACEMENT (6.2L)

Removal Procedure

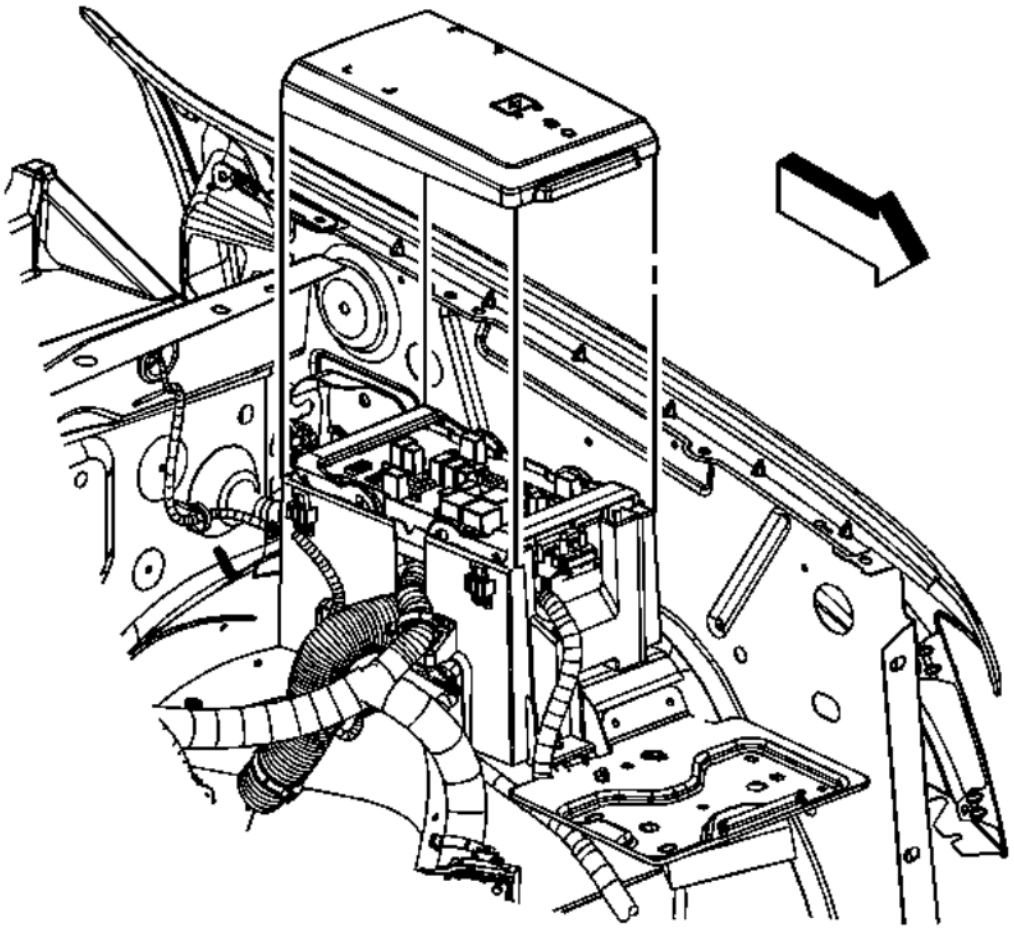


Fig. 99: View Of Under Hood Junction Block Cover
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the auxiliary battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.
2. Remove the underhood junction block cover.

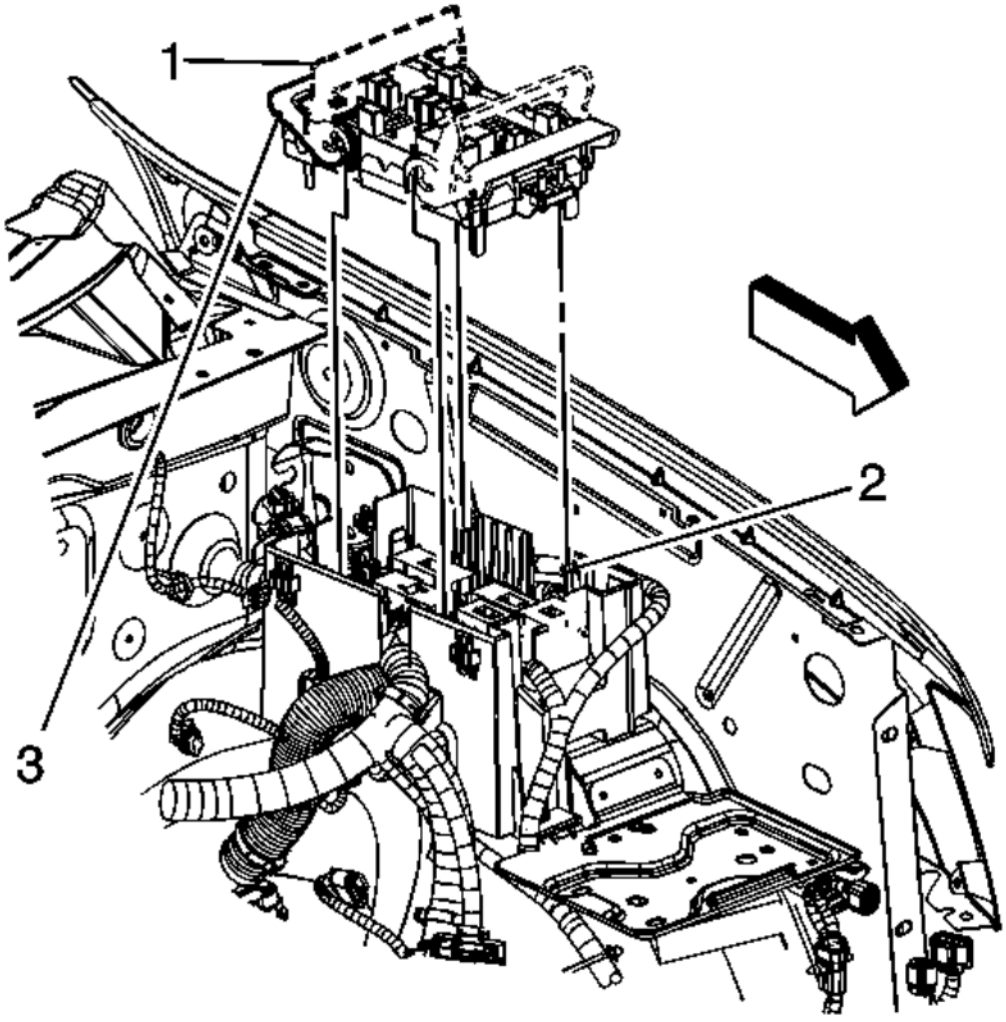


Fig. 100: View Of Junction Block & Retainers
Courtesy of GENERAL MOTORS CORP.

3. Lift the junction block retainers from the locked position (3) and rotate the retainers to the open position (1).
4. Remove the junction block.

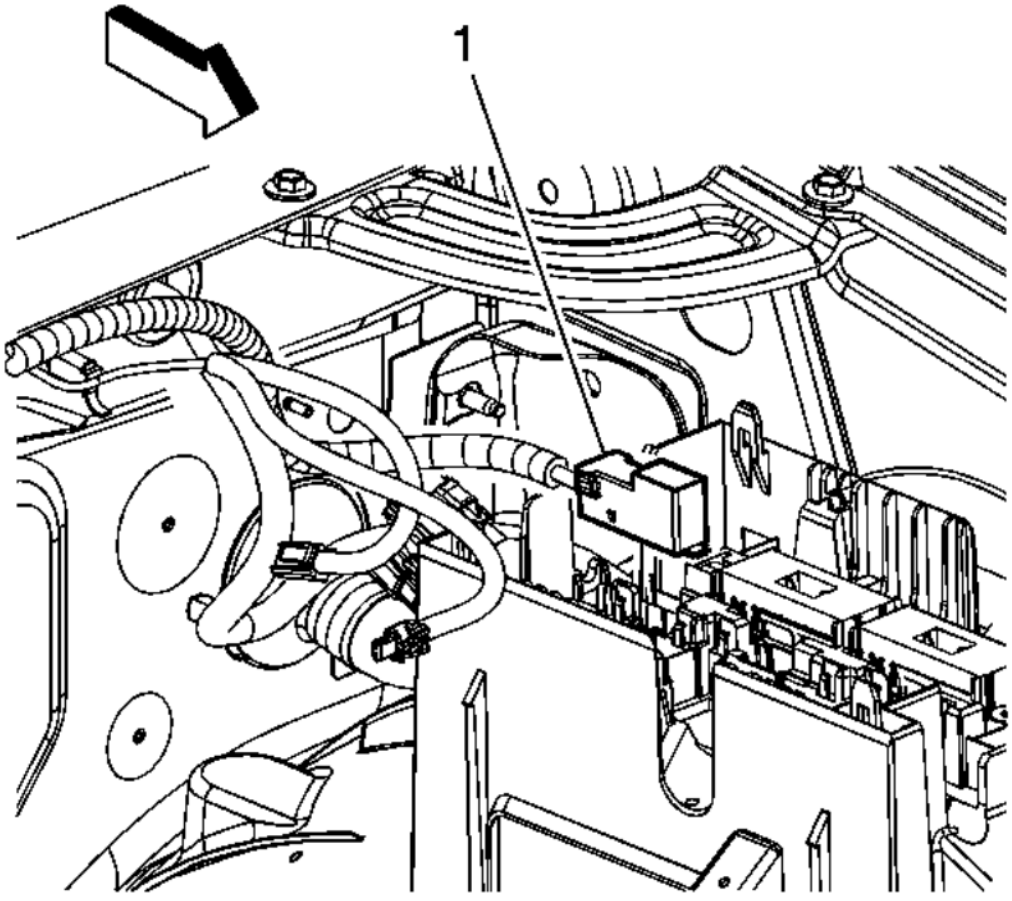


Fig. 101: View Of Positive Battery Cable Connector & (UBEC)
Courtesy of GENERAL MOTORS CORP.

5. Remove the auxiliary battery positive cable connector (1) from the underhood bussed electrical center (UBEC).

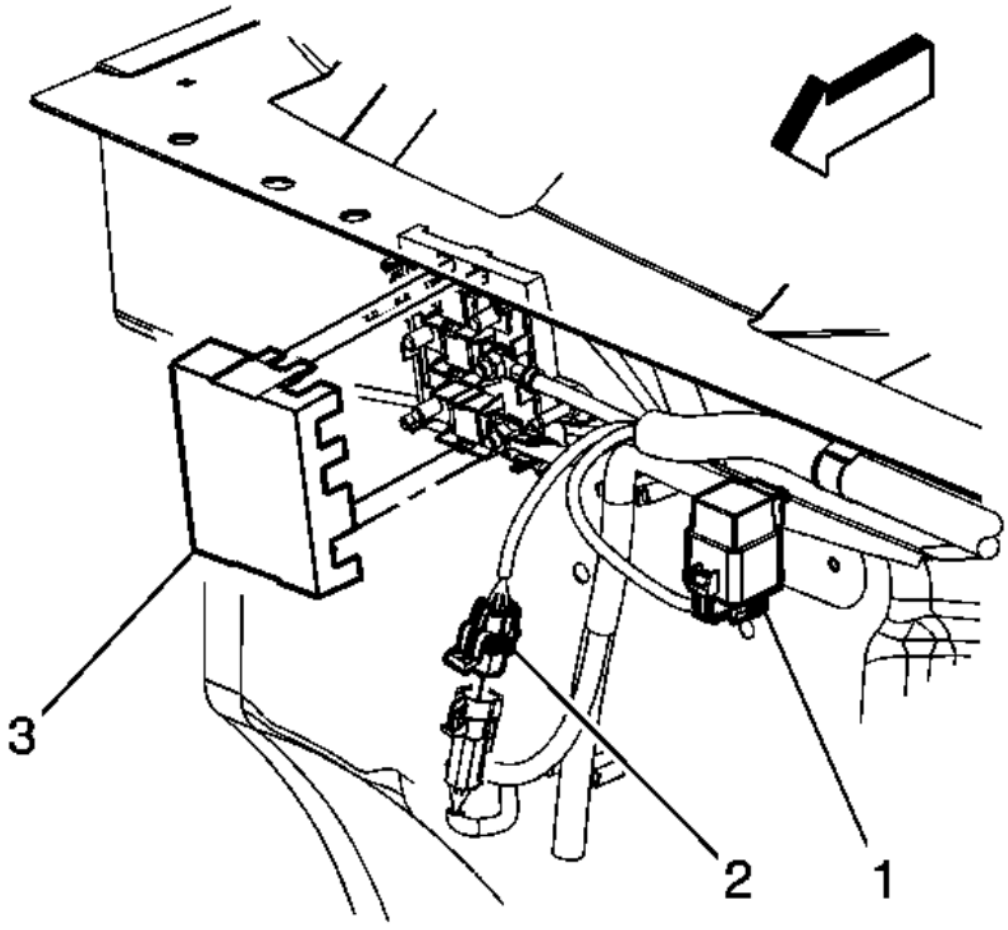


Fig. 102: View Of Fuse Cover & Connectors
Courtesy of GENERAL MOTORS CORP.

6. Remove the mega fuse cover (3).
7. Disconnect the auxiliary battery positive cable electrical connector (2) from the engine wiring harness connector.
8. Remove the relay (1) clip from the stud on the front of dash.

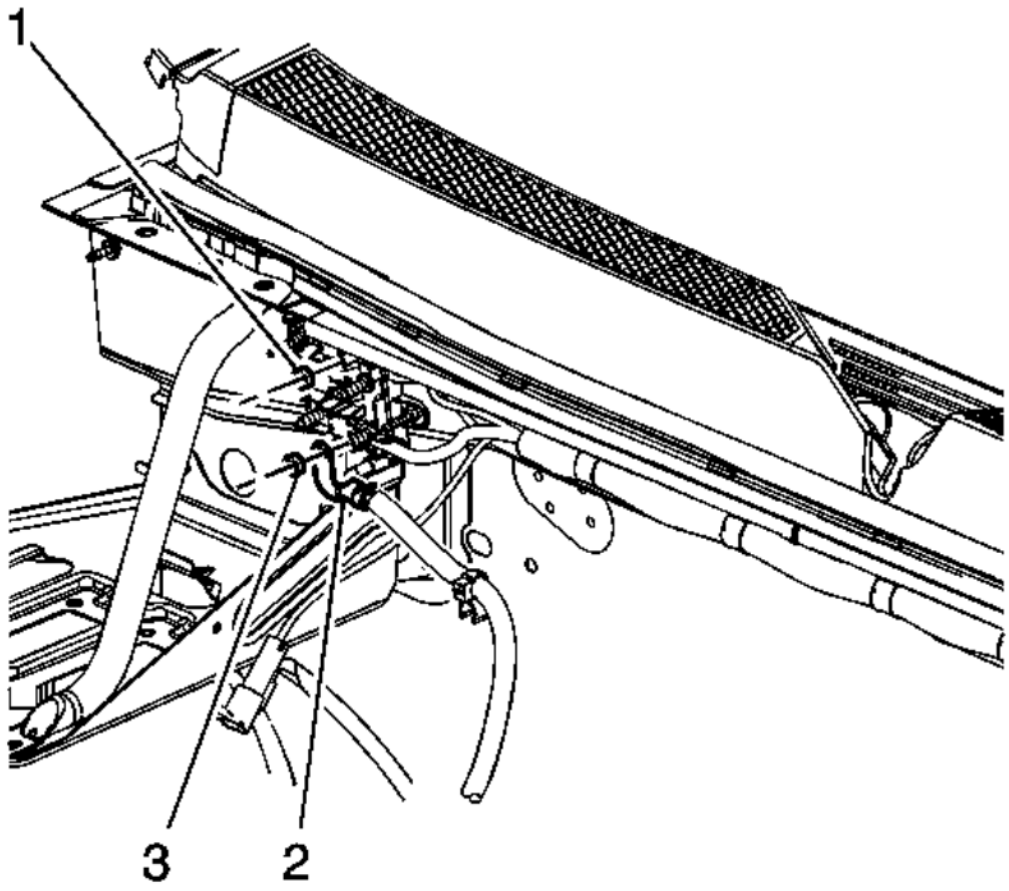


Fig. 103: View Of Positive Cable Nut, Jumper Cable Terminal & Fuse Nut
Courtesy of GENERAL MOTORS CORP.

9. Remove the auxiliary battery positive cable nut (1) from the mega fuse holder.
10. Remove the generator battery jumper cable nut (3) from the mega fuse holder.
11. Remove the generator battery jumper cable terminal (2) from the mega fuse stud.
12. Remove the auxiliary battery positive cable from the mega fuse holder.

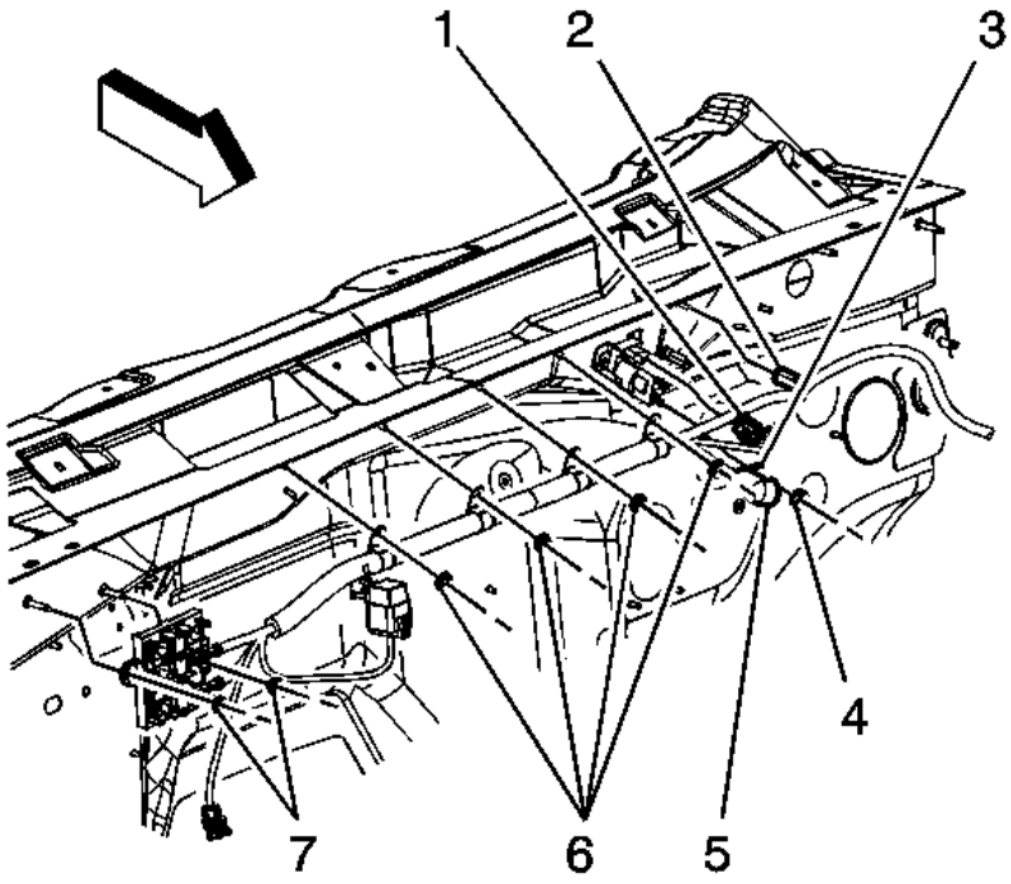


Fig. 104: View Of Battery Cable Nuts, Retainers & Bolts
Courtesy of GENERAL MOTORS CORP.

13. Disconnect auxiliary battery positive cable electrical connector (1) from the auxiliary battery relay.
14. Reposition the auxiliary battery positive cable boot (5).
15. Remove the auxiliary battery positive cable nut (4) and cable from the battery relay.
16. Remove the auxiliary battery positive cable retainer (2) from the stud on the front of dash.
17. Remove the auxiliary battery positive cable push nuts (6).

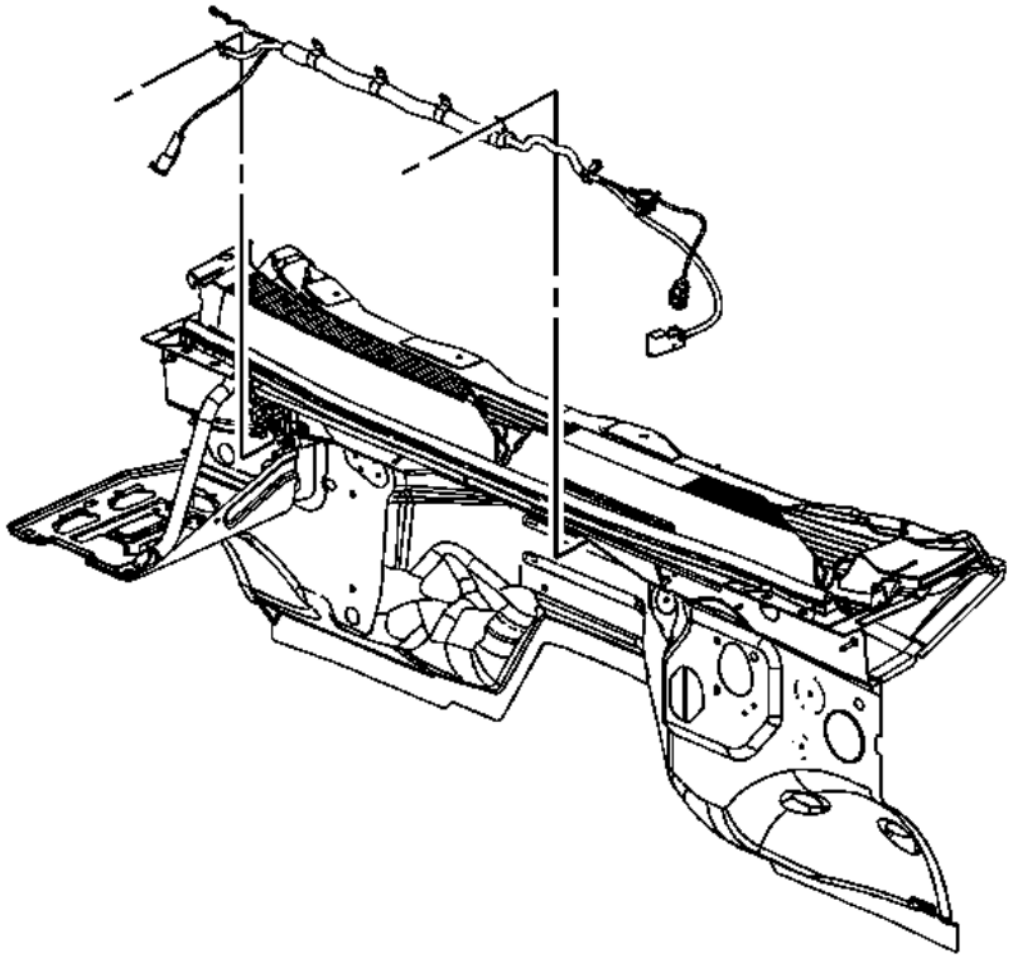


Fig. 105: View Of Auxiliary Battery Positive Cable
Courtesy of GENERAL MOTORS CORP.

18. Remove the auxiliary battery positive cable from the vehicle.

Installation Procedure

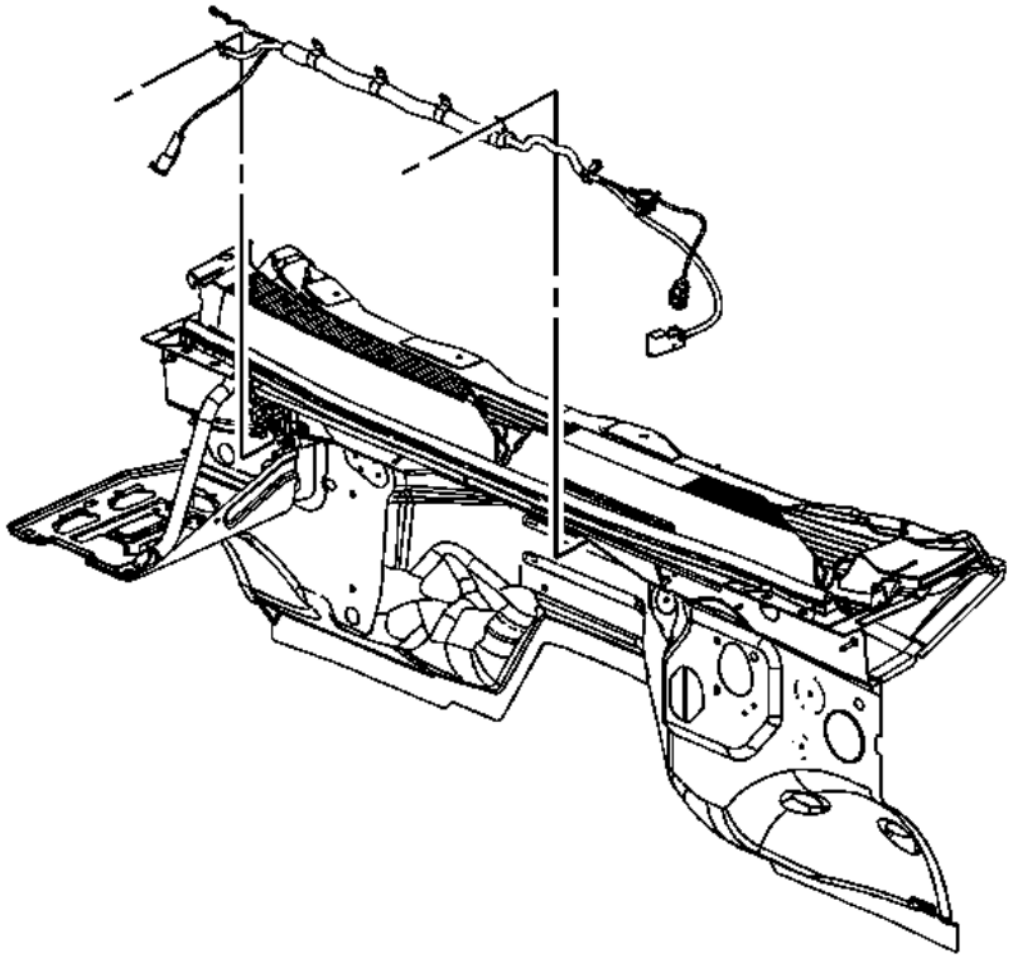


Fig. 106: View Of Auxiliary Battery Positive Cable
Courtesy of GENERAL MOTORS CORP.

1. Install the auxiliary battery positive cable to the vehicle.

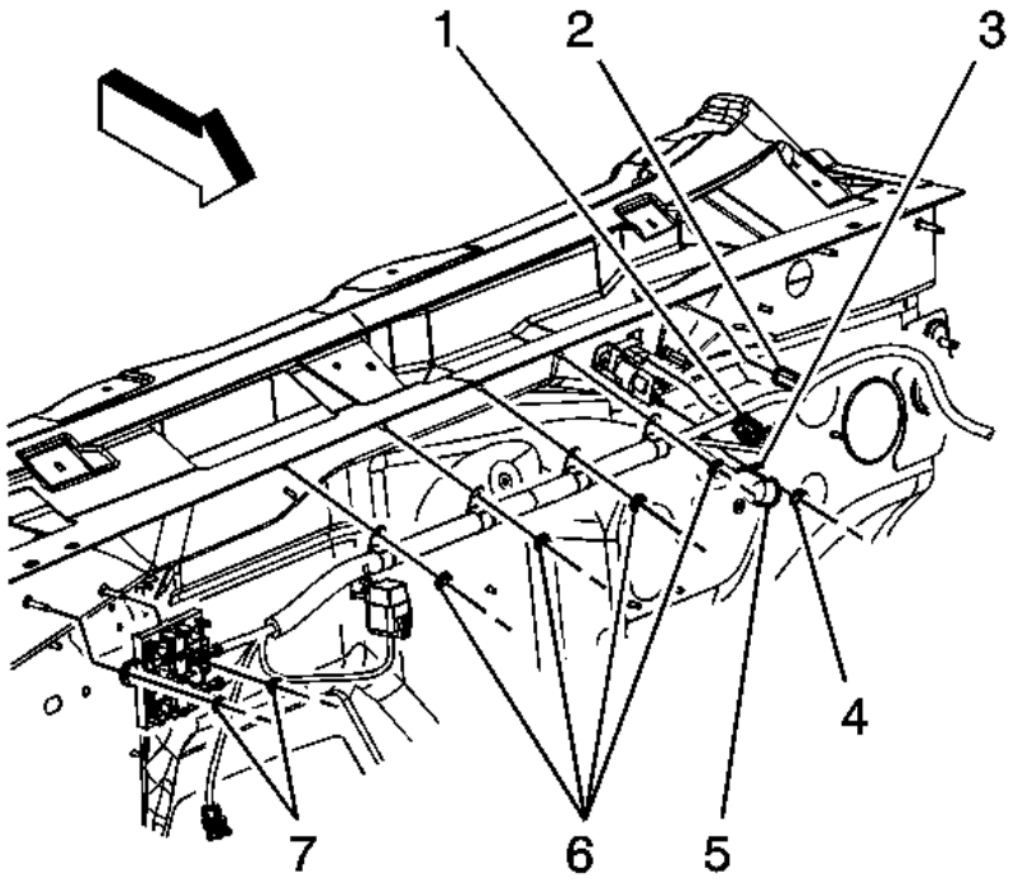


Fig. 107: View Of Battery Cable Nuts, Retainers & Bolts
Courtesy of GENERAL MOTORS CORP.

2. Install the auxiliary battery positive cable push nuts (6).
3. Install the auxiliary battery positive cable retainer (2) to the stud on the front of dash.

NOTE: Refer to Fastener Notice .

4. Install the auxiliary battery positive cable and nut (4) to the battery relay.

   Tighten: Tighten the nut to 9 N.m (80 lb in).

5. Position the auxiliary battery positive cable boot (5).

6. Connect auxiliary battery positive cable electrical connector (1) to the auxiliary battery relay.

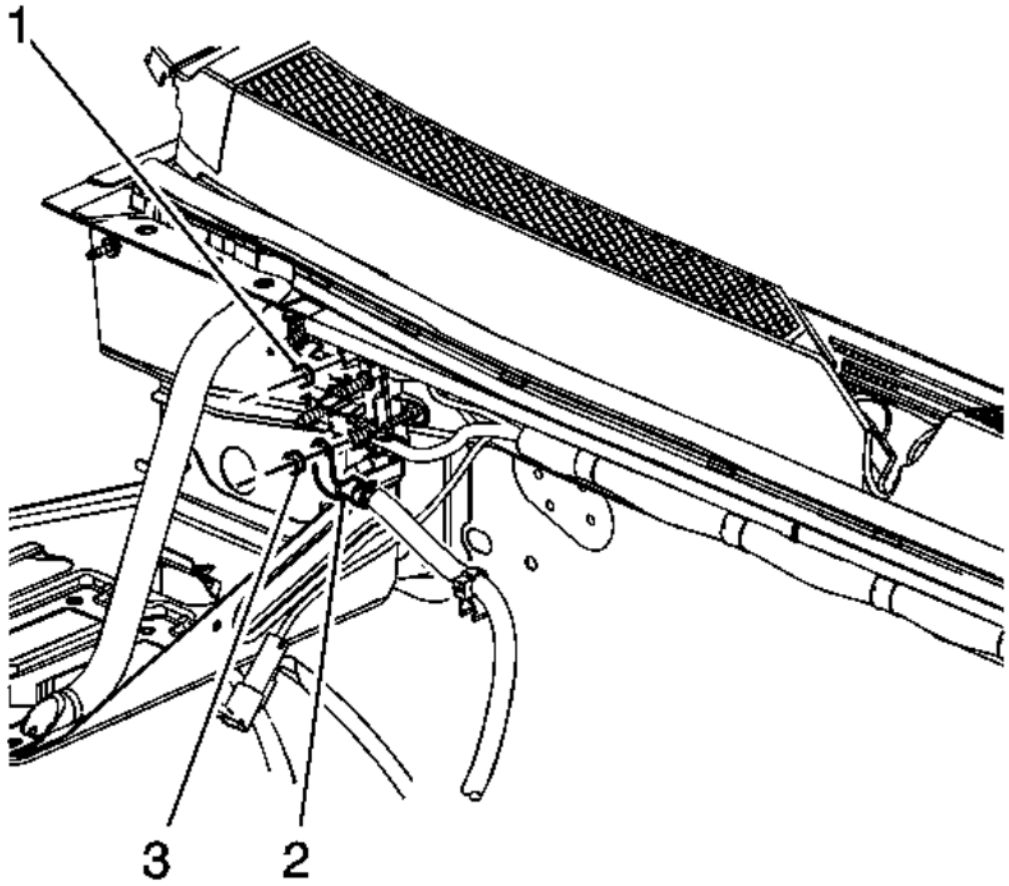


Fig. 108: View Of Positive Cable Nut, Jumper Cable Terminal & Fuse Nut
Courtesy of GENERAL MOTORS CORP.

7. Install the auxiliary battery positive cable to the mega fuse holder.
8. Install the generator battery jumper cable terminal (2) to the mega fuse stud.
9. Install the generator battery jumper cable nut (3) to the mega fuse holder.

Tighten: Tighten the nut to 9 N.m (80 lb in).

10. Install the auxiliary battery positive cable nut (1) to the mega fuse holder.

Tighten: Tighten the nut to 9 N.m (80 lb in).

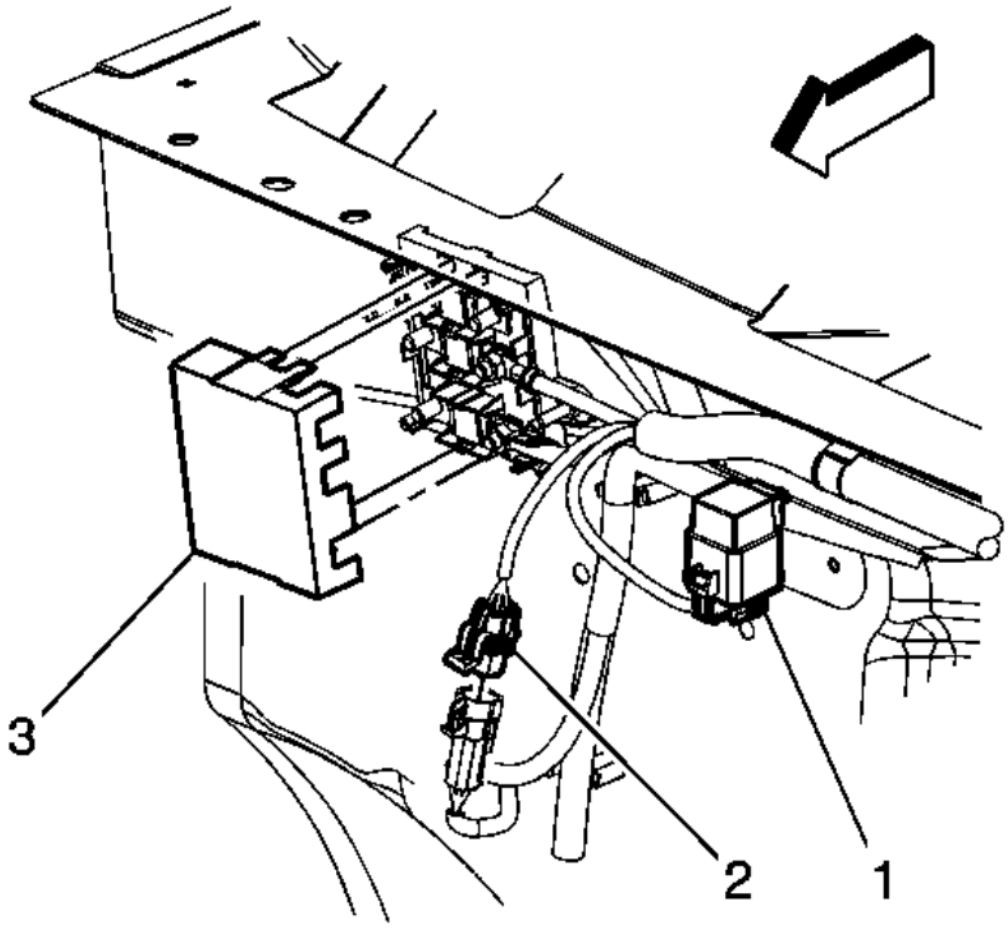


Fig. 109: View Of Fuse Cover & Connectors
Courtesy of GENERAL MOTORS CORP.

11. Connect the auxiliary battery positive cable electrical connector (2) to the engine wiring harness connector.
12. Install the relay (1) clip to the stud on the front of dash.
13. Install the mega fuse cover (3).

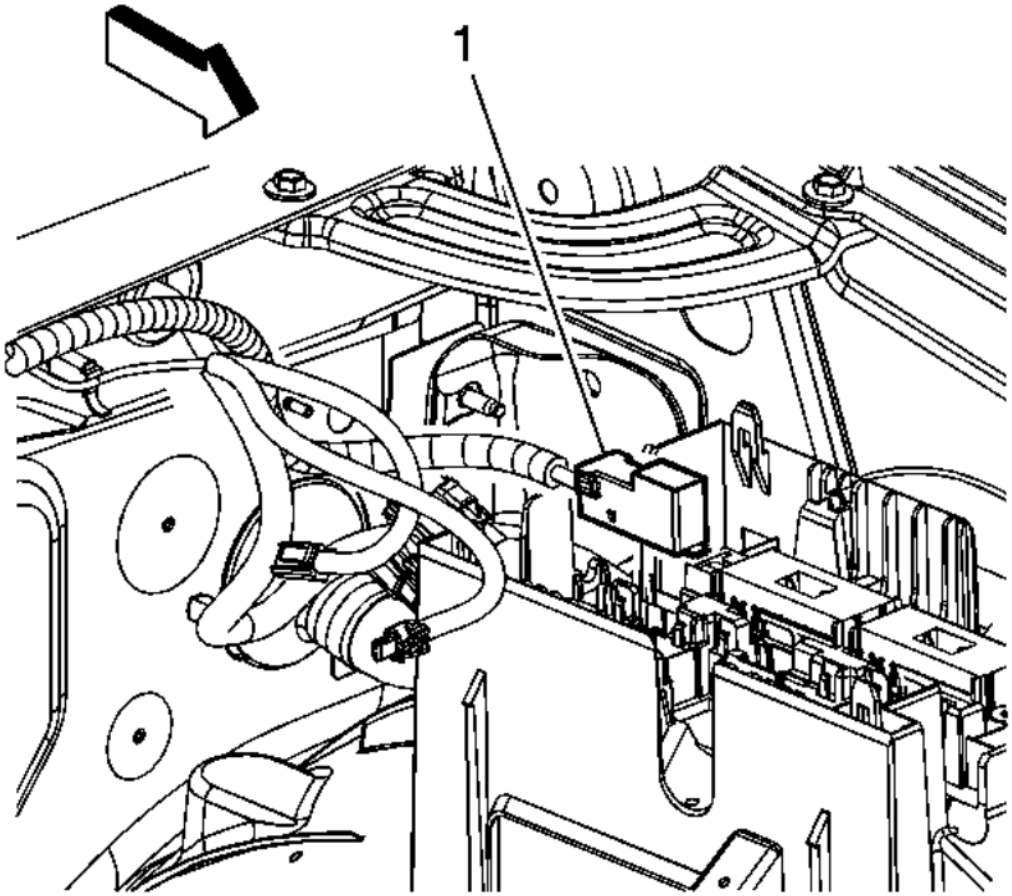


Fig. 110: View Of Positive Battery Cable Connector & (UBEC)
Courtesy of GENERAL MOTORS CORP.

14. Install the auxiliary battery positive cable connector (1) to the UBEC.

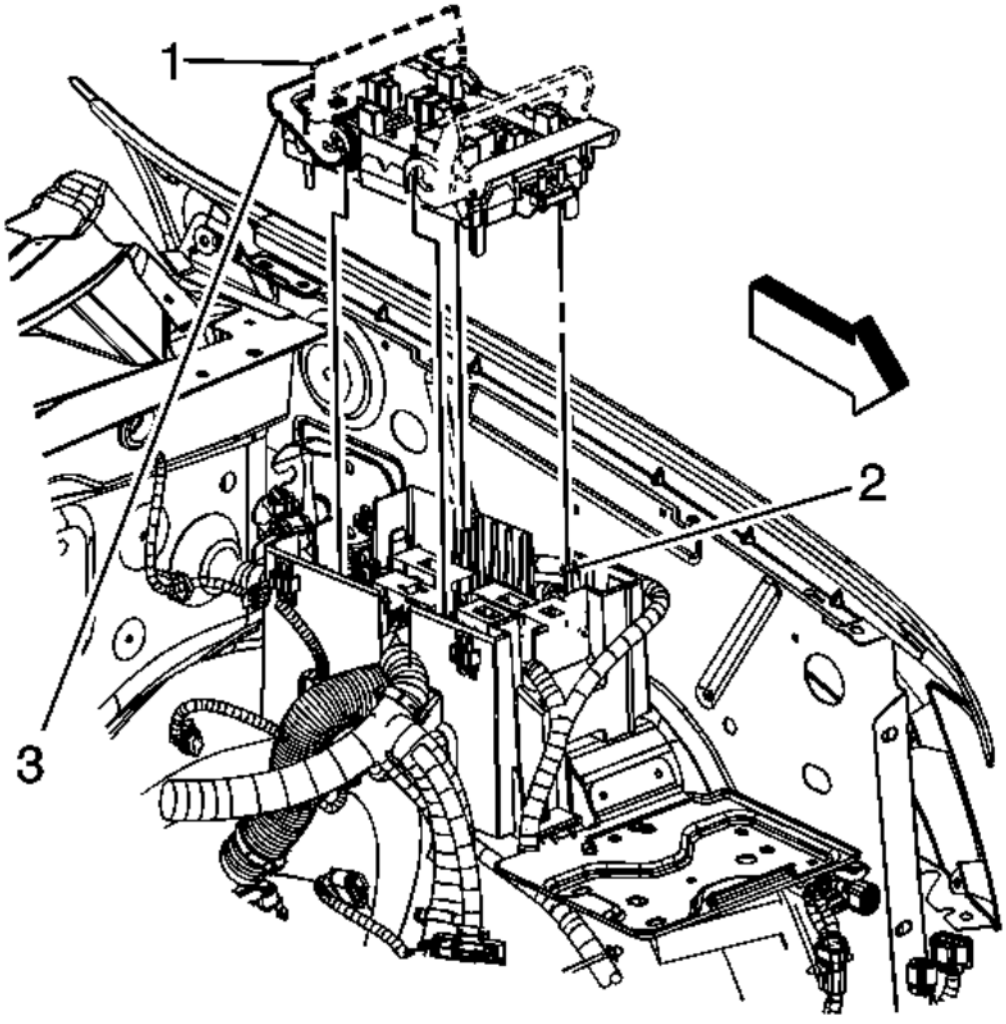


Fig. 111: View Of Junction Block & Retainers
Courtesy of GENERAL MOTORS CORP.

15. Ensure that the junction block retainers are in the open position (1).
16. Position and align the junction block to the 4 bracket pivots (2), once the pivots are engaged, push the retainers down into the locked position (3).

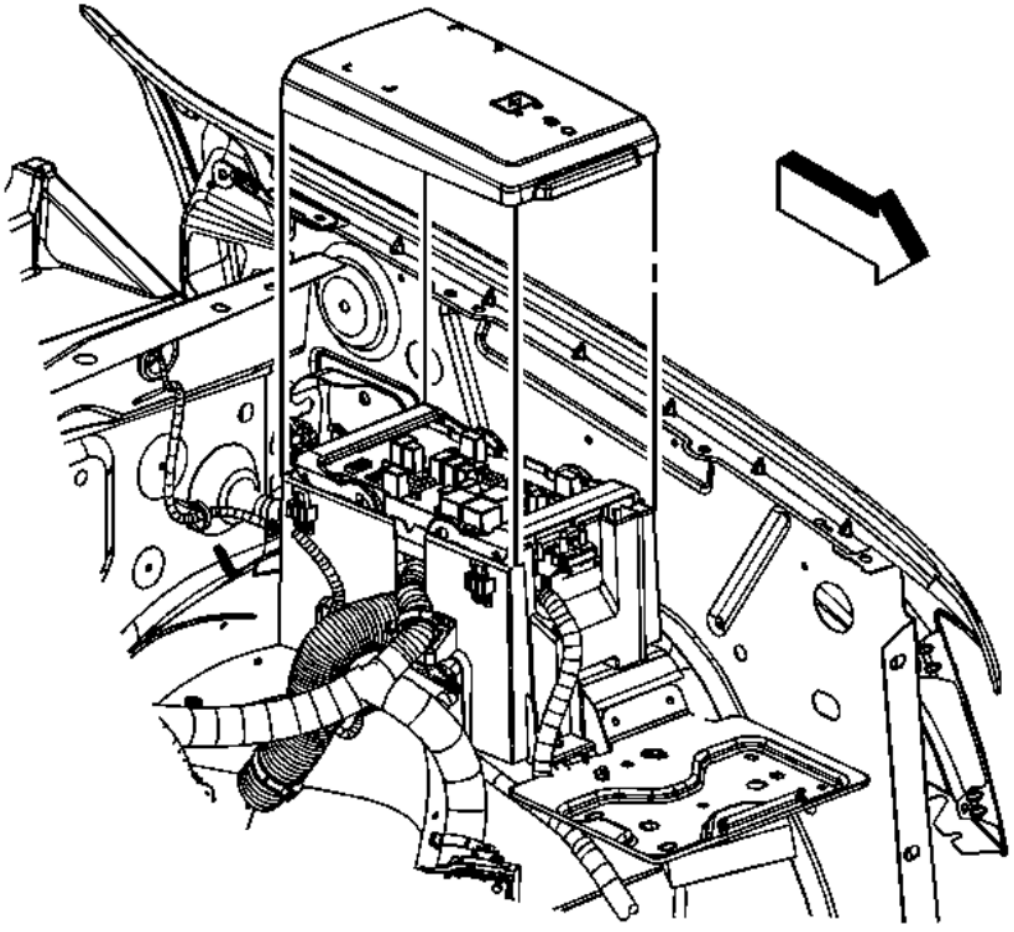


Fig. 112: View Of Under Hood Junction Block Cover
Courtesy of GENERAL MOTORS CORP.

17. Install the underhood junction block cover.
18. Connect the auxiliary battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

AUXILIARY BATTERY POSITIVE CABLE REPLACEMENT - BATTERY TO BATTERY RELAY RELAY (6.2L)

Removal Procedure

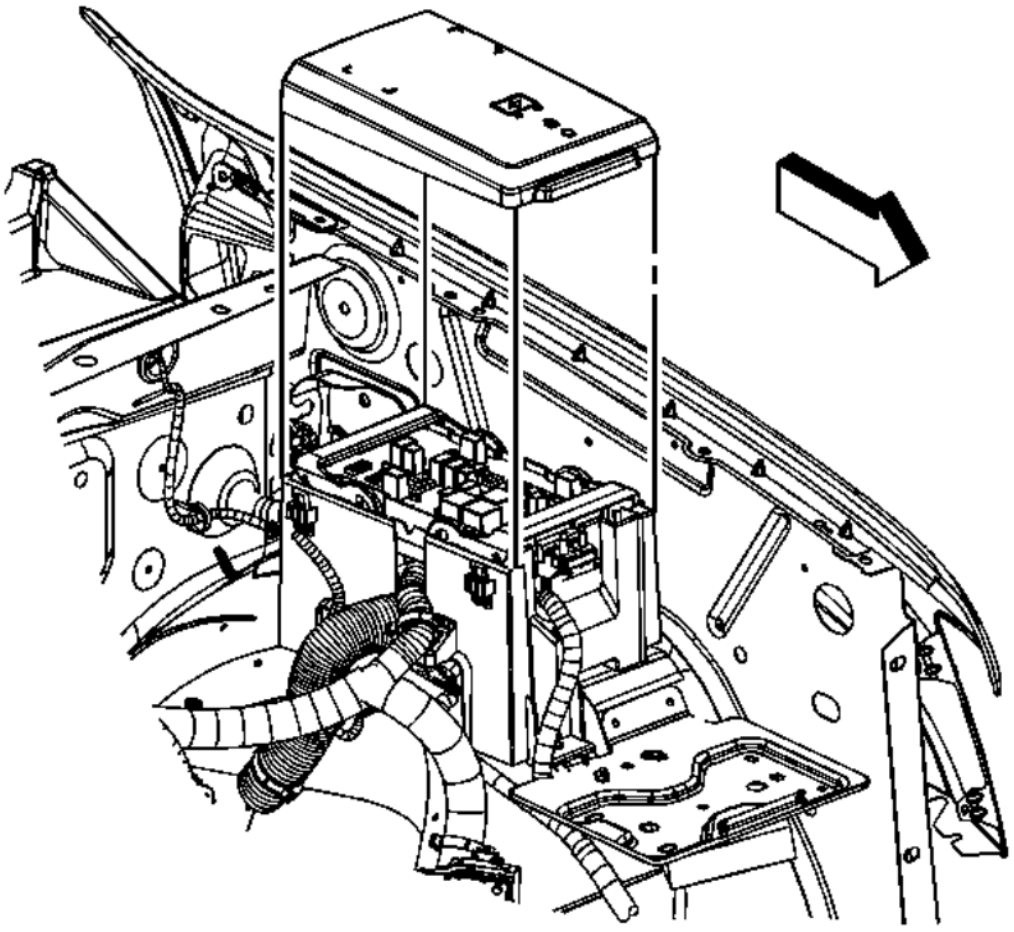


Fig. 113: View Of Under Hood Junction Block Cover
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the auxiliary battery. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.
2. Remove the underhood junction block cover.

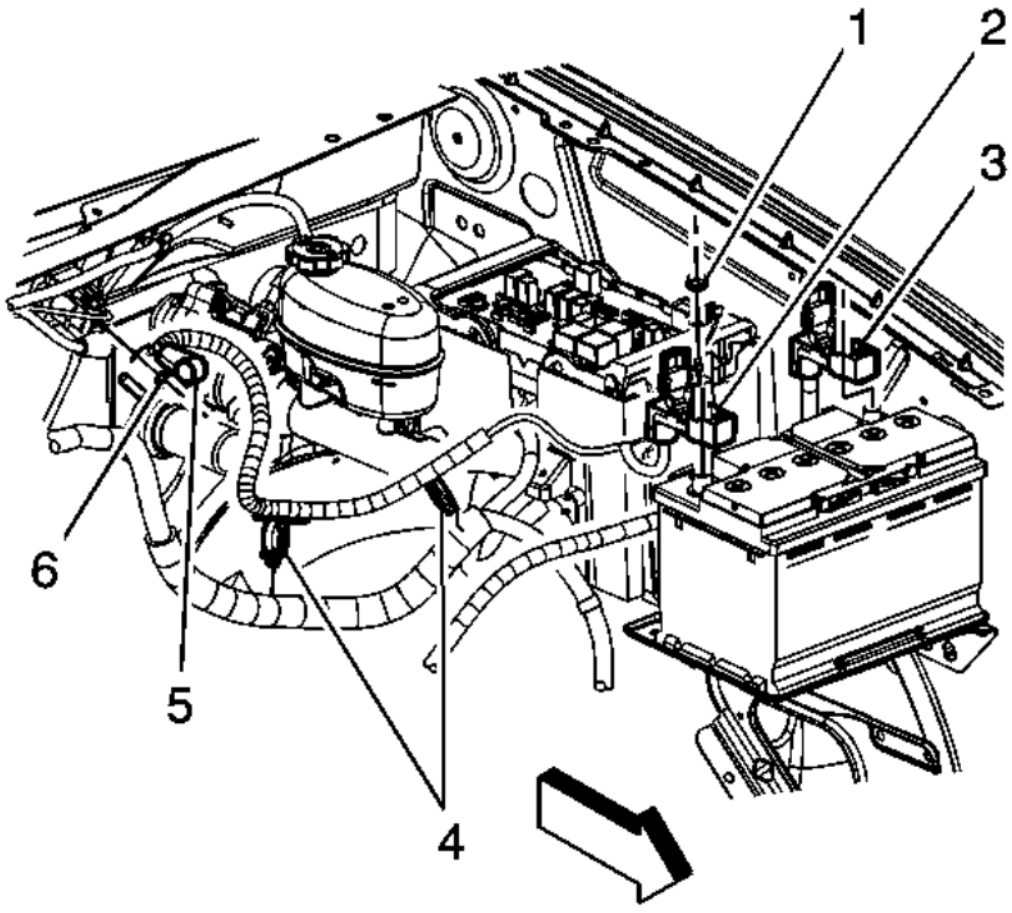


Fig. 114: View Of Battery & Battery Cable Fasteners
Courtesy of GENERAL MOTORS CORP.

3. Open the auxiliary battery positive cable post cover.
4. Loosen the auxiliary battery positive cable nut (2).
5. Remove the auxiliary battery positive cable from the battery positive post.
6. Remove the auxiliary battery positive cable nut (1) from the underhood junction block stud.
7. Remove the auxiliary battery positive cable terminal from the underhood junction block stud.
8. Reposition the auxiliary battery positive cable boot (5) at the auxiliary battery relay.
9. Remove the auxiliary battery positive cable nut (6) from the rely stud.

10. Remove the auxiliary battery positive cable terminal from the relay stud.
11. Remove the auxiliary battery positive cable clips (4) from the engine wiring harness and remove the cable from the vehicle.

Installation Procedure

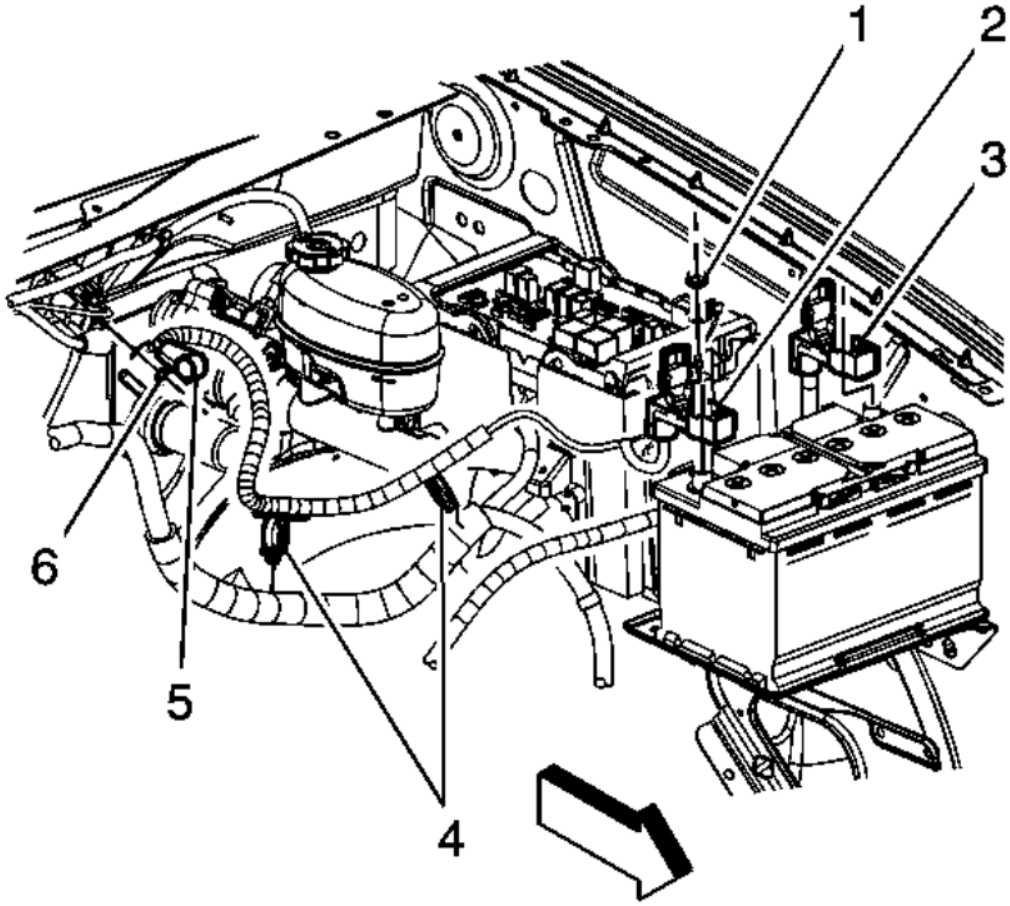


Fig. 115: View Of Battery & Battery Cable Fasteners
Courtesy of GENERAL MOTORS CORP.

1. Install the auxiliary battery positive cable to the vehicle.
2. Install the auxiliary battery positive cable terminal to the relay stud.

NOTE: Refer to Fastener Notice .

3. Install the auxiliary battery positive cable nut (6) to the rely stud.

   Tighten: Tighten the nut to 7.5 N.m (66 lb in).

4. Position the auxiliary battery positive cable boot (5) at the auxiliary battery relay.
5. Install the auxiliary battery positive cable to the battery positive post.
6. Tighten the auxiliary battery positive cable nut (2).

   Tighten: Tighten the nut to 7.5 N.m (66 lb in).

7. Install the auxiliary battery positive cable terminal to the underhood junction block stud.
8. Install the auxiliary battery positive cable nut (1) to the underhood junction block stud.

   Tighten: Tighten the nut to 5 N.m (44 lb in).

9. Install the auxiliary battery positive cable clips (4) to the engine wiring harness.
10. Close the auxiliary battery positive cable post cover.

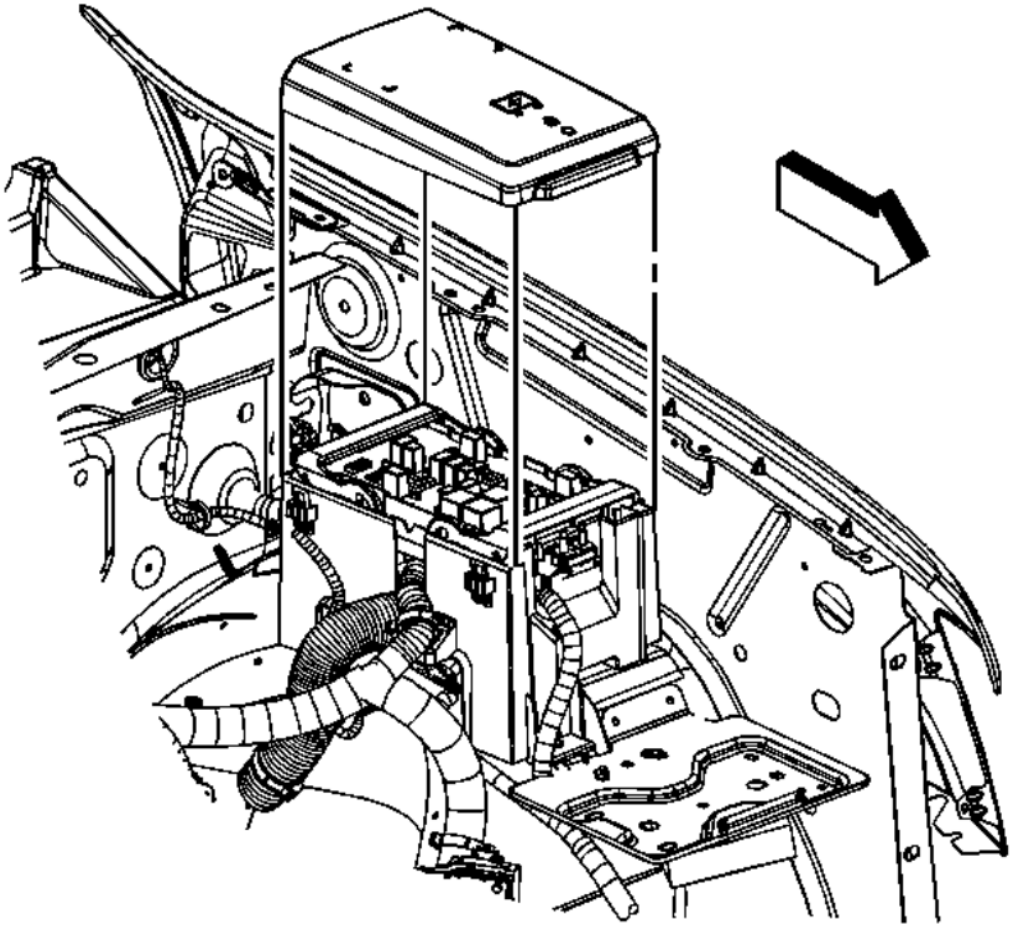


Fig. 116: View Of Under Hood Junction Block Cover
Courtesy of GENERAL MOTORS CORP.

11. Install the underhood junction block cover.
12. Connect the auxiliary battery. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

GENERATOR BATTERY JUMPER CABLE REPLACEMENT

Removal Procedure

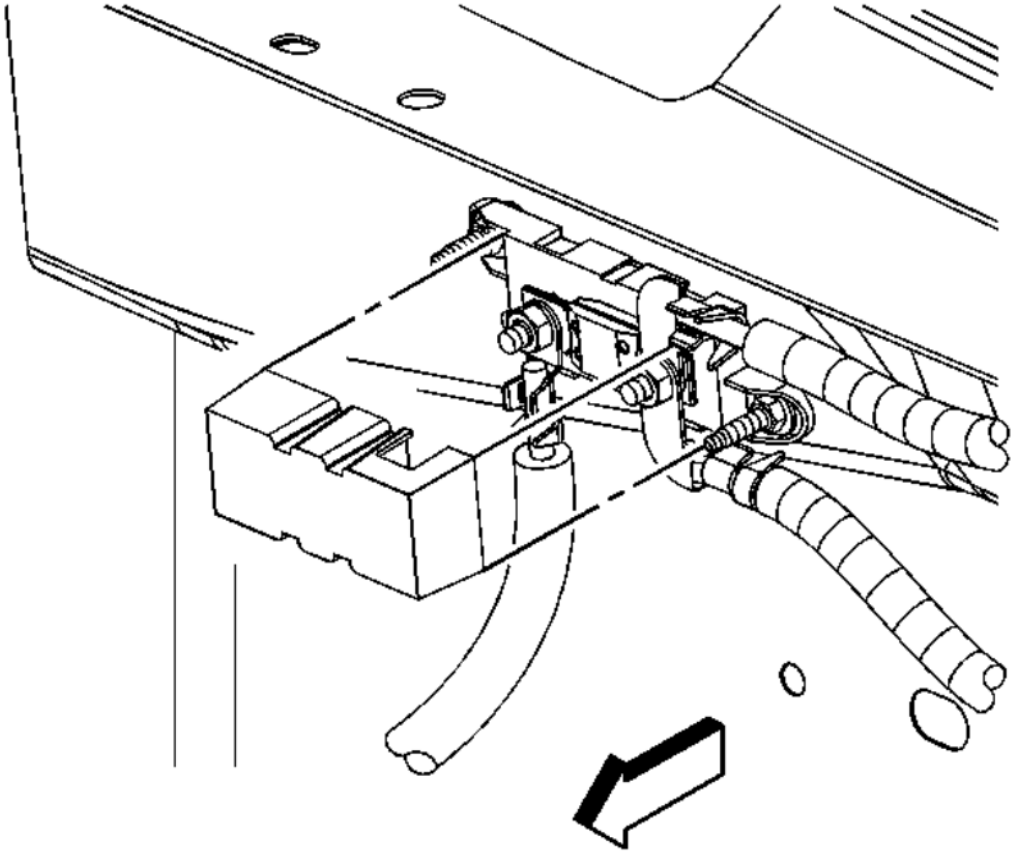


Fig. 117: View Of Mega Fuse Cover
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.
2. Remove the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
3. Remove the intake manifold cover. Refer to **Intake Manifold Cover Replacement** .
4. Remove the mega fuse cover.

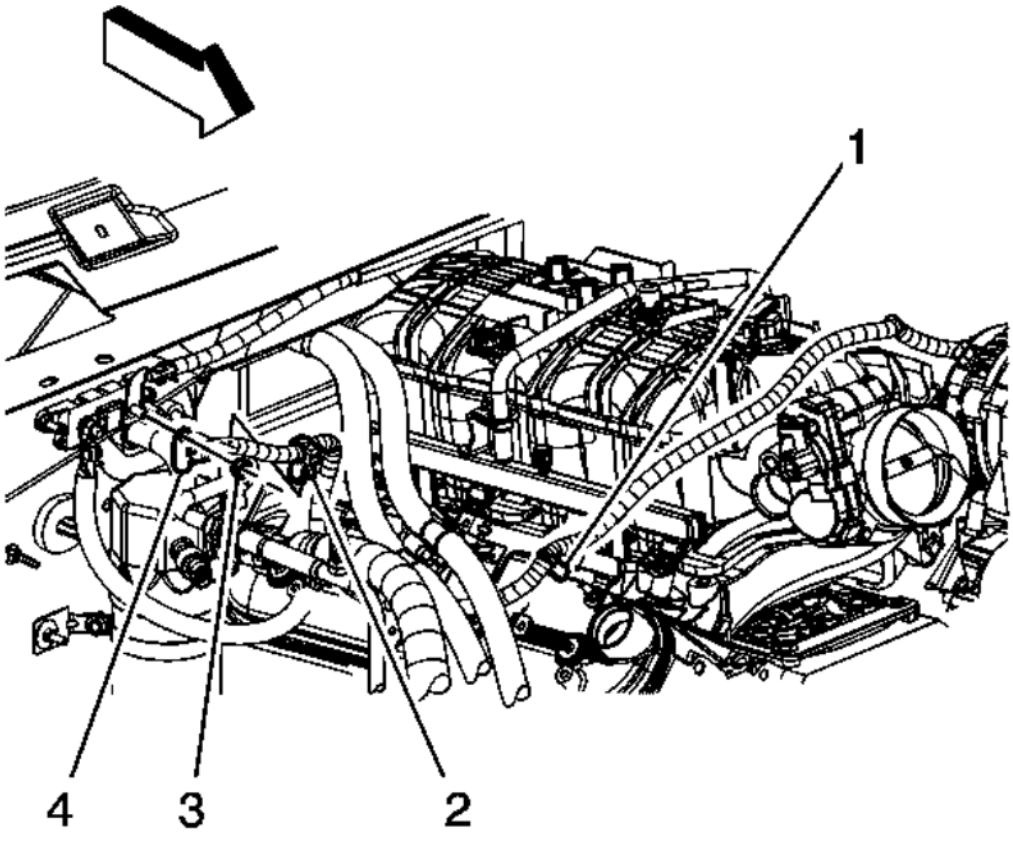


Fig. 118: View Of Generator Battery Jumper Cable & Components
Courtesy of GENERAL MOTORS CORP.

5. Remove the generator battery jumper cable to mega fuse nut (3).
6. Remove the generator battery jumper cable terminal (4) from the mega fuse stud.
7. Remove the generator battery jumper cable clip (2) from air conditioning (A/C) evaporator tube.
8. Remove the generator battery jumper cable clip (1) from the stud.

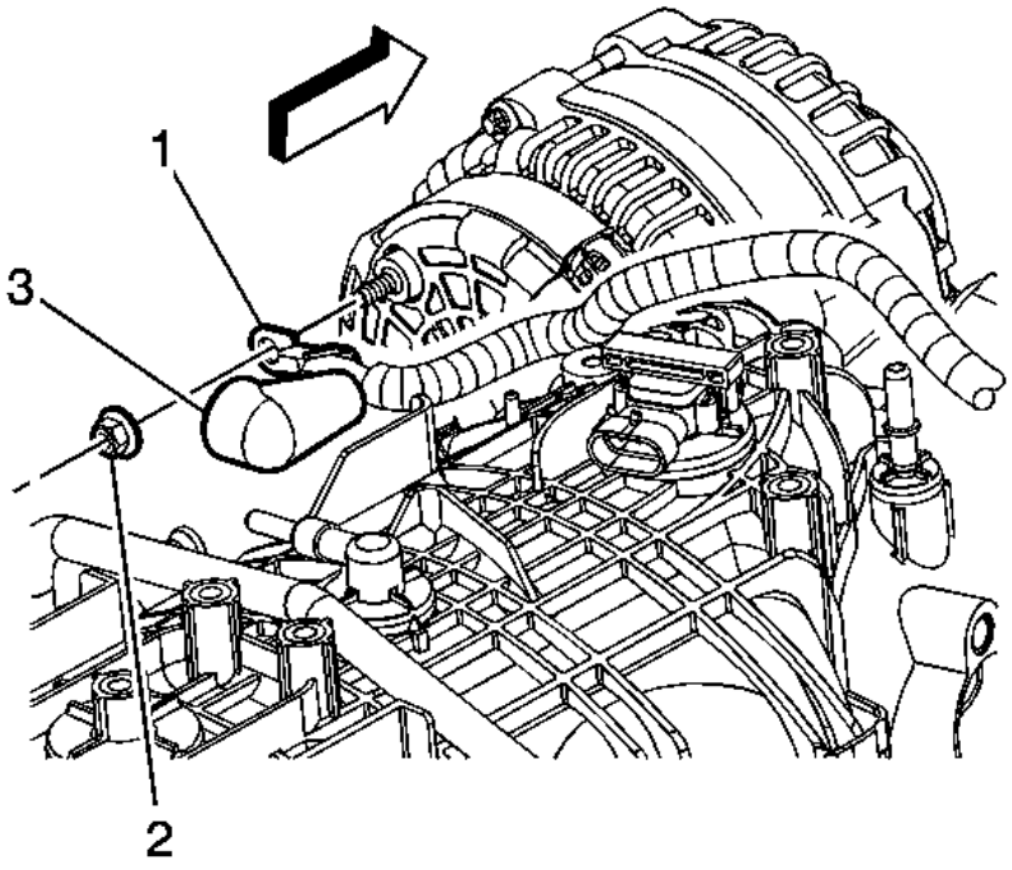


Fig. 119: View Of Battery Jumper Cable Terminal, Nut & Bolt
Courtesy of GENERAL MOTORS CORP.

9. Reposition the generator battery jumper cable boot (3).
10. Remove the generator battery jumper cable nut (2) from the generator.
11. Remove the generator battery jumper cable terminal (1) from the generator stud.

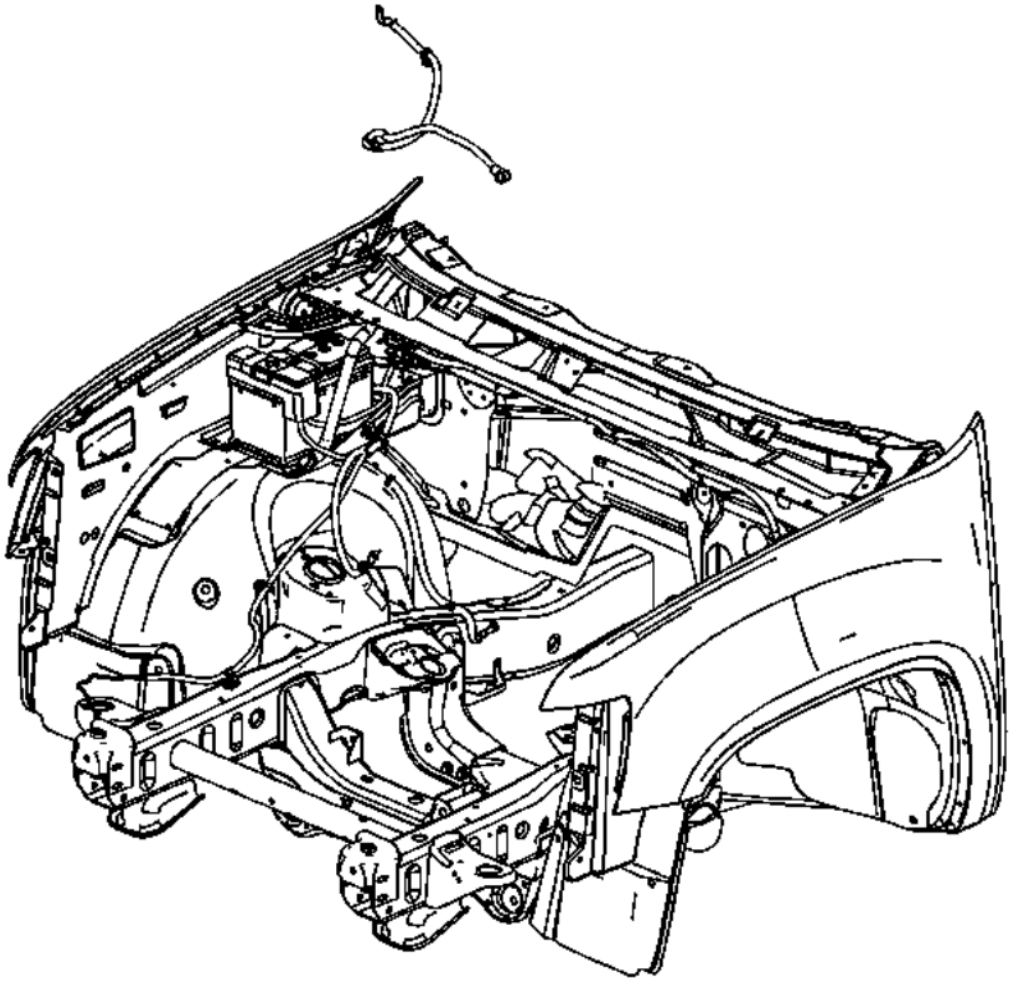


Fig. 120: View Of Generator Battery Jumper Cable
Courtesy of GENERAL MOTORS CORP.

12. Remove the generator battery jumper cable from the vehicle.

Installation Procedure

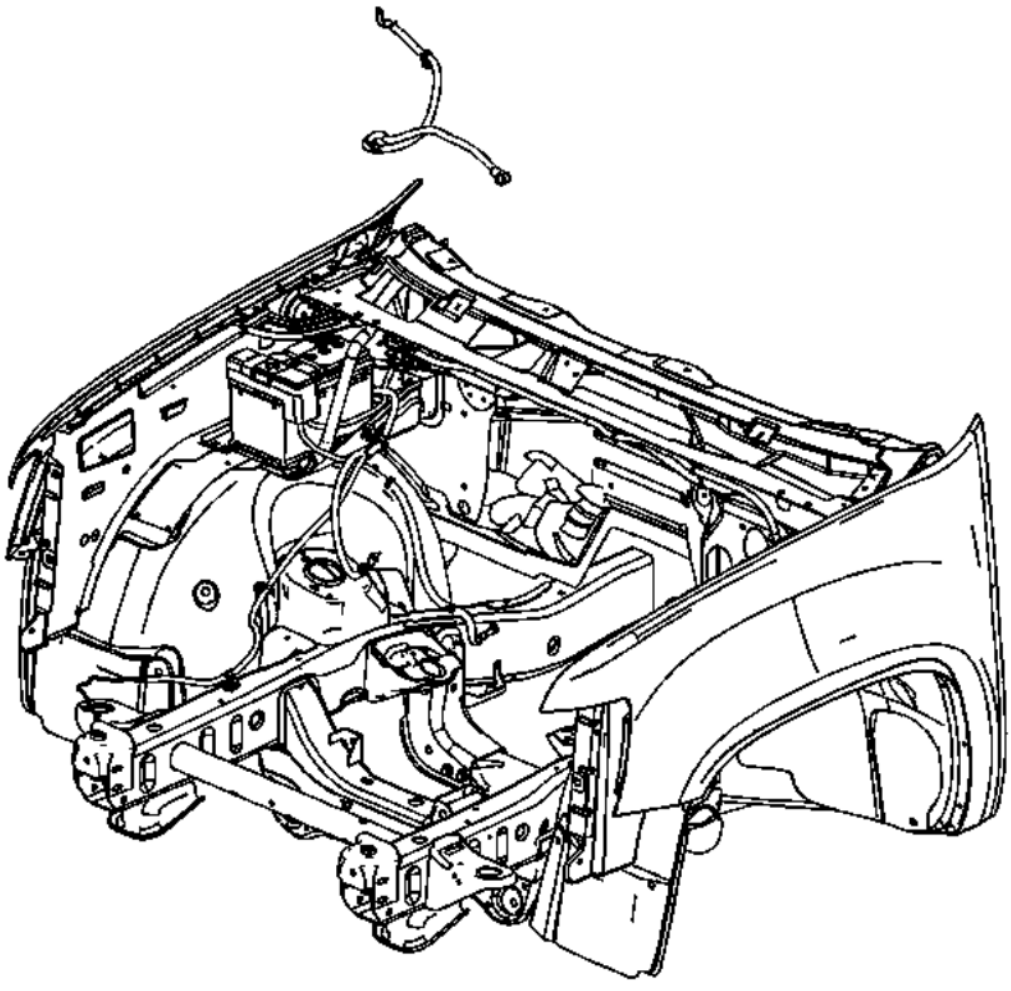


Fig. 121: View Of Generator Battery Jumper Cable
Courtesy of GENERAL MOTORS CORP.

1. Install the generator battery jumper cable to the vehicle.

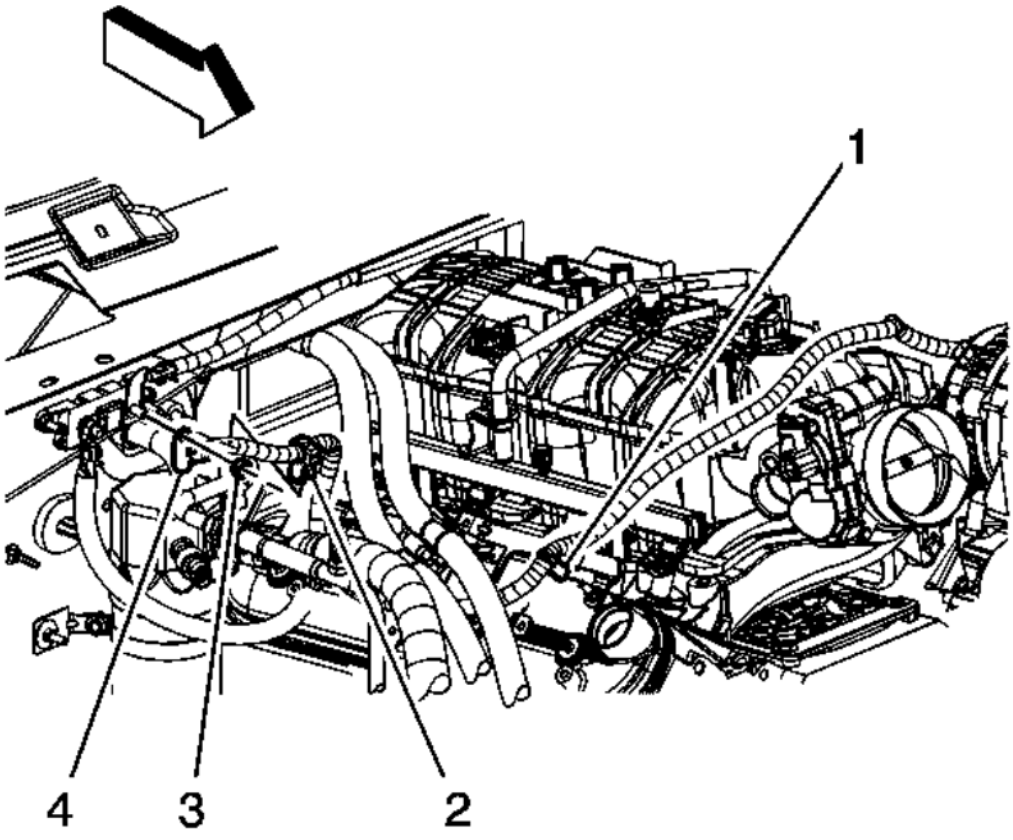


Fig. 122: View Of Generator Battery Jumper Cable & Components
Courtesy of GENERAL MOTORS CORP.

2. Install the generator battery jumper cable terminal (4) to the mega fuse stud.

NOTE: Refer to Fastener Notice .

3. Install the generator battery jumper cable to mega fuse nut (3).

Tighten: Tighten the nut to 9 N.m (80 lb in).

4. Install the generator battery jumper cable clip (2) to A/C evaporator tube.
5. Install the generator battery jumper cable clip (1) to the stud.

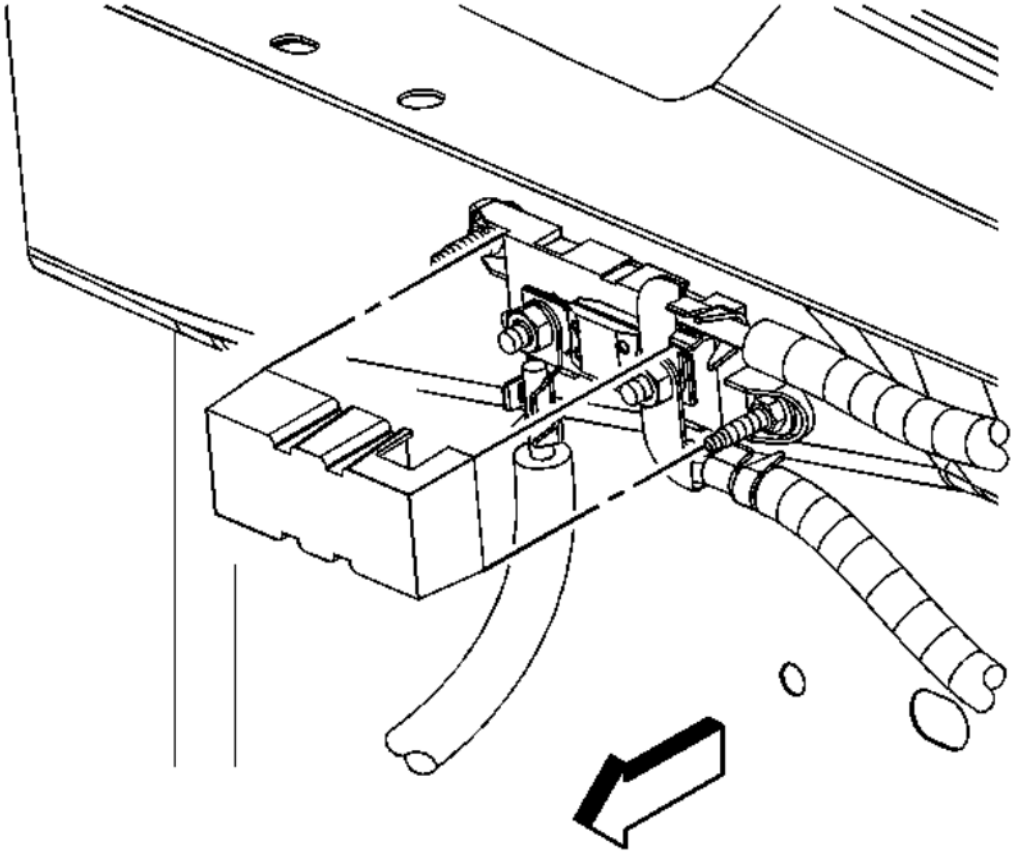


Fig. 123: View Of Mega Fuse Cover
Courtesy of GENERAL MOTORS CORP.

6. Install the mega fuse cover.

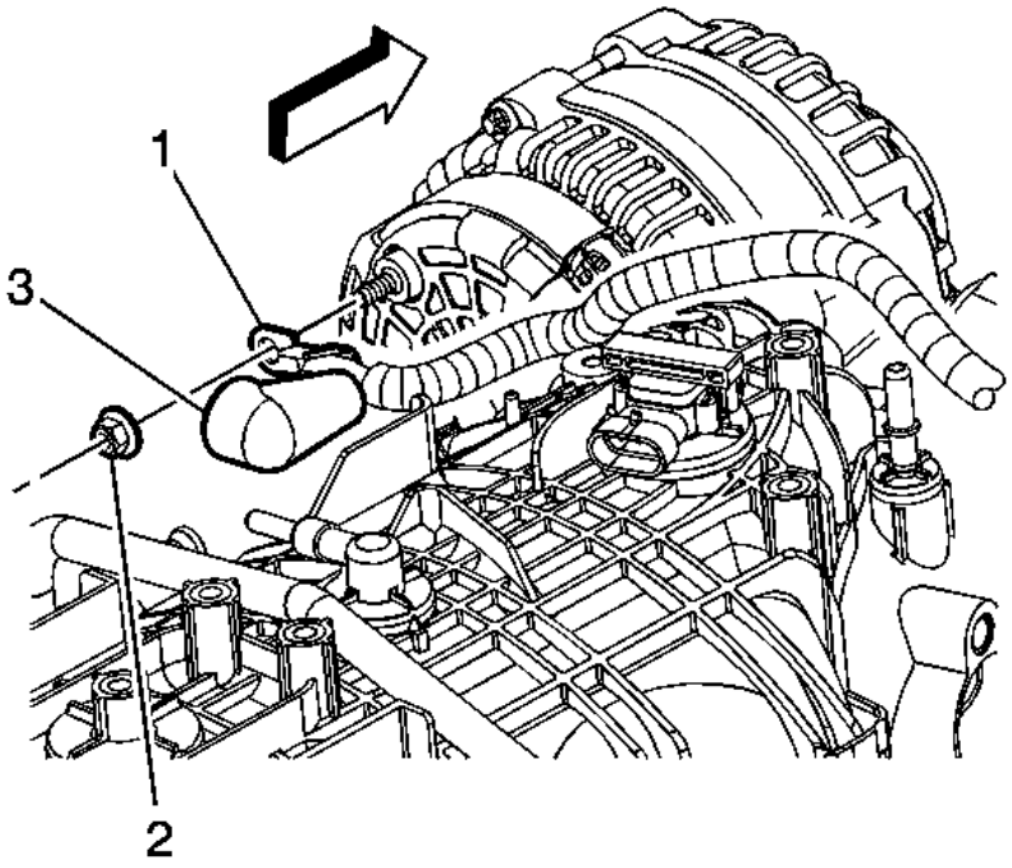


Fig. 124: View Of Battery Jumper Cable Terminal, Nut & Bolt
Courtesy of GENERAL MOTORS CORP.

7. Install the generator battery jumper cable terminal (1) to the generator stud.
8. Install the generator battery jumper cable nut (2) to the generator.

   Tighten: Tighten the nut to 9 N.m (80 lb in).

9. Position the generator battery jumper cable boot (3).
10. Install the intake manifold cover. Refer to **Intake Manifold Cover Replacement** .
11. Install the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
12. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and**

Connection (w/Single Battery) or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

STARTER SOLENOID CABLE REPLACEMENT (4.3L)

Removal Procedure

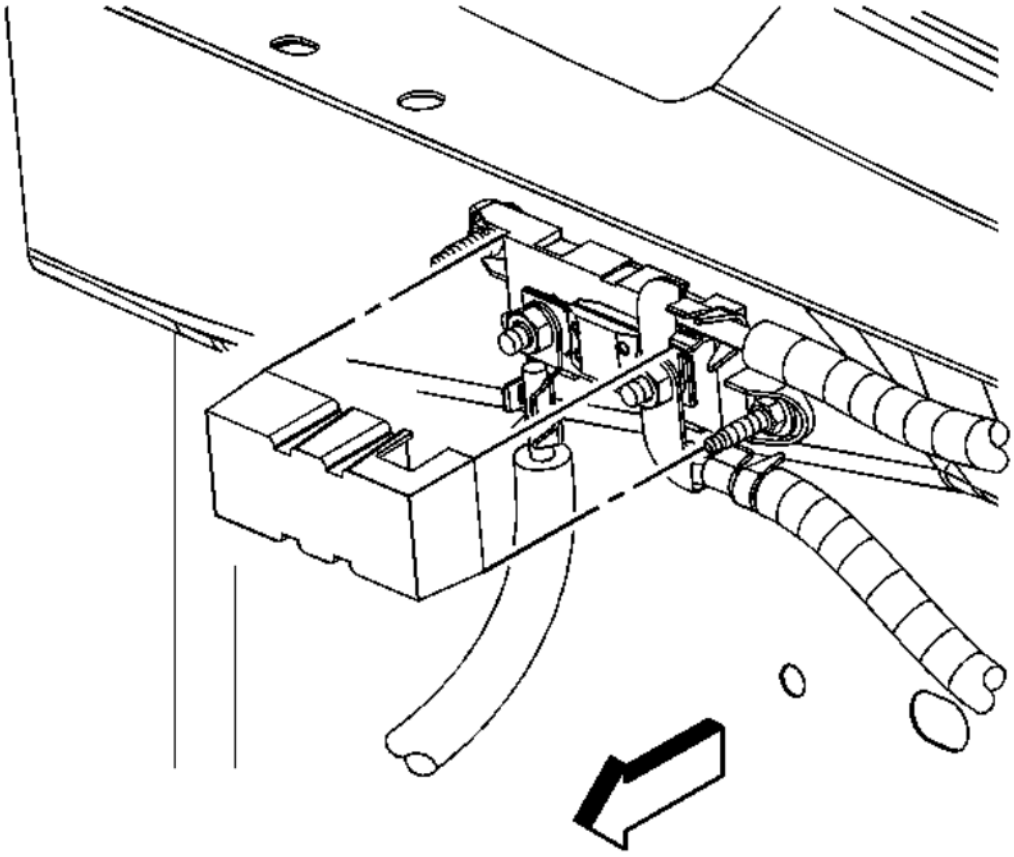


Fig. 125: View Of Mega Fuse Cover
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and**

Connection (w/Dual Batteries).

2. Remove the air cleaner outlet resonator. Refer to **Air Cleaner Outlet Resonator Replacement** .
3. Remove the mega fuse cover.

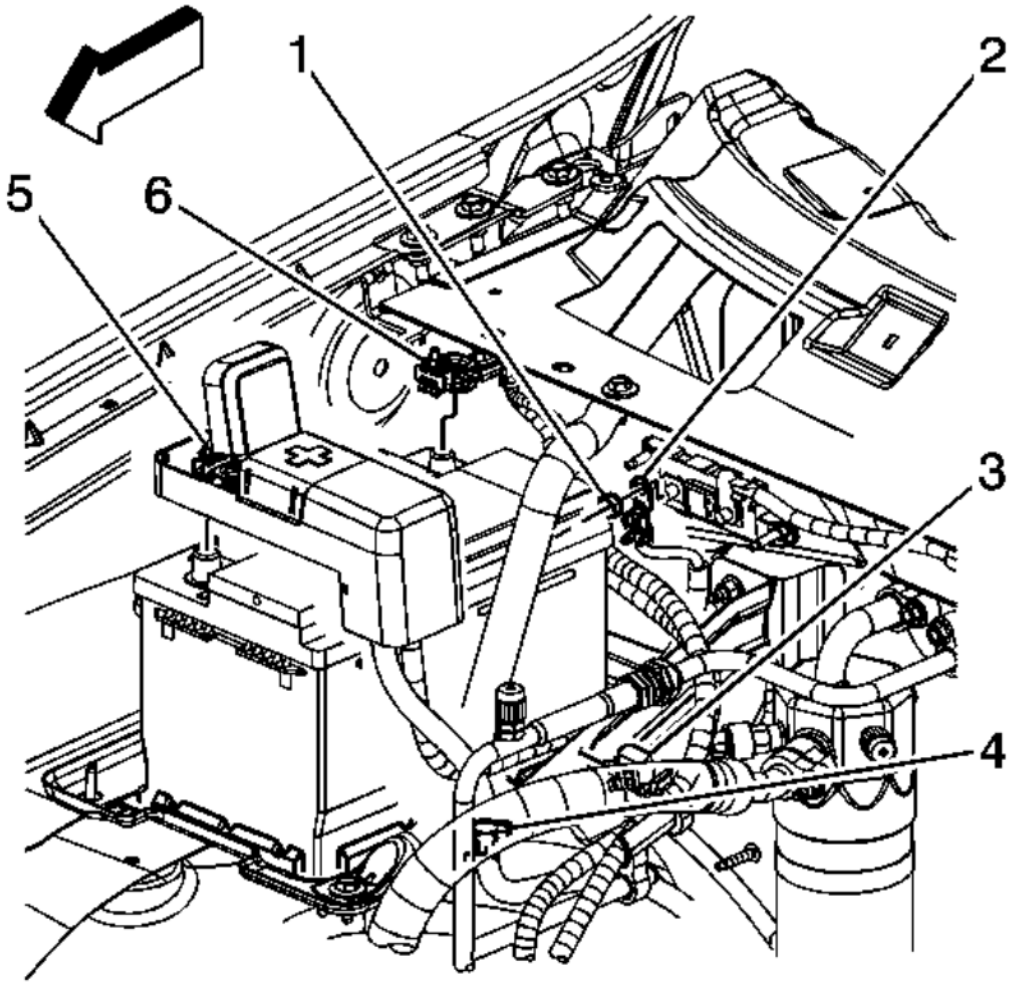


Fig. 126: View Of Battery Cable Components
Courtesy of GENERAL MOTORS CORP.

4. Remove the starter solenoid cable nut (1) from the mega fuse stud.
5. Remove the starter solenoid cable terminal (2) from the mega fuse stud.

6. Open the starter solenoid cable cover at the positive battery terminal.
7. Loosen the starter solenoid cable nut (5).
8. Remove the starter solenoid cable from the positive battery terminal.
9. Remove the starter solenoid cable clip (4) from the air conditioning (A/C) evaporator tube.

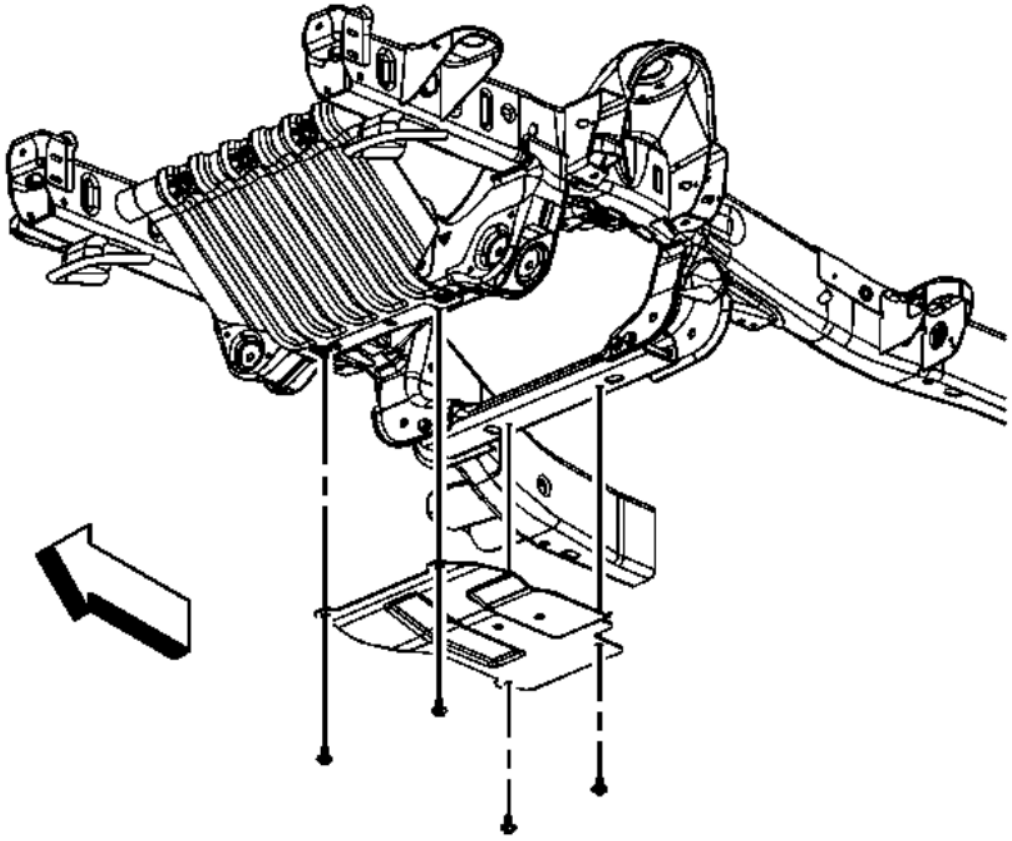


Fig. 127: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

10. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
11. Remove the oil pan skid plate bolts and plate, if equipped.

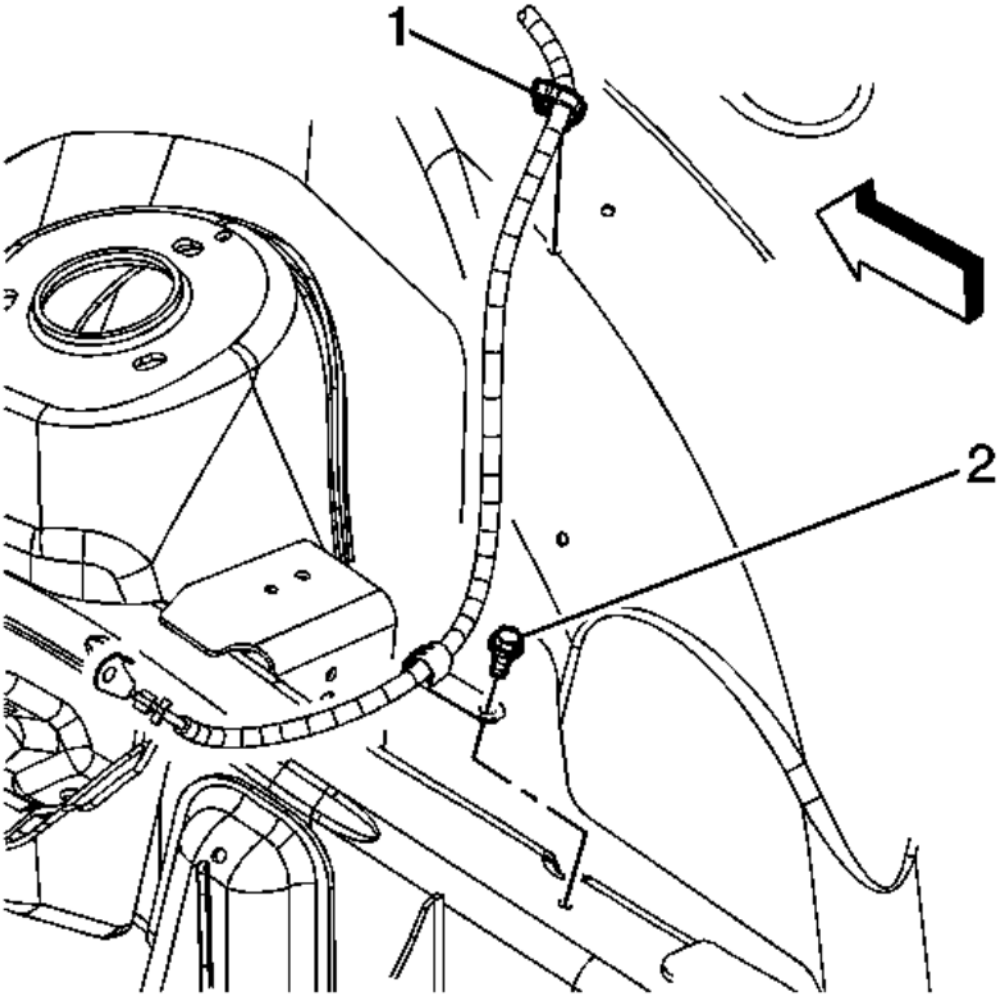


Fig. 128: View Of Starter Solenoid Cable Clip & Bolt
Courtesy of GENERAL MOTORS CORP.

12. Remove the starter solenoid cable clip (1) from the wheelhouse panel.
13. Remove the starter solenoid cable clip bolt (2) from the frame.

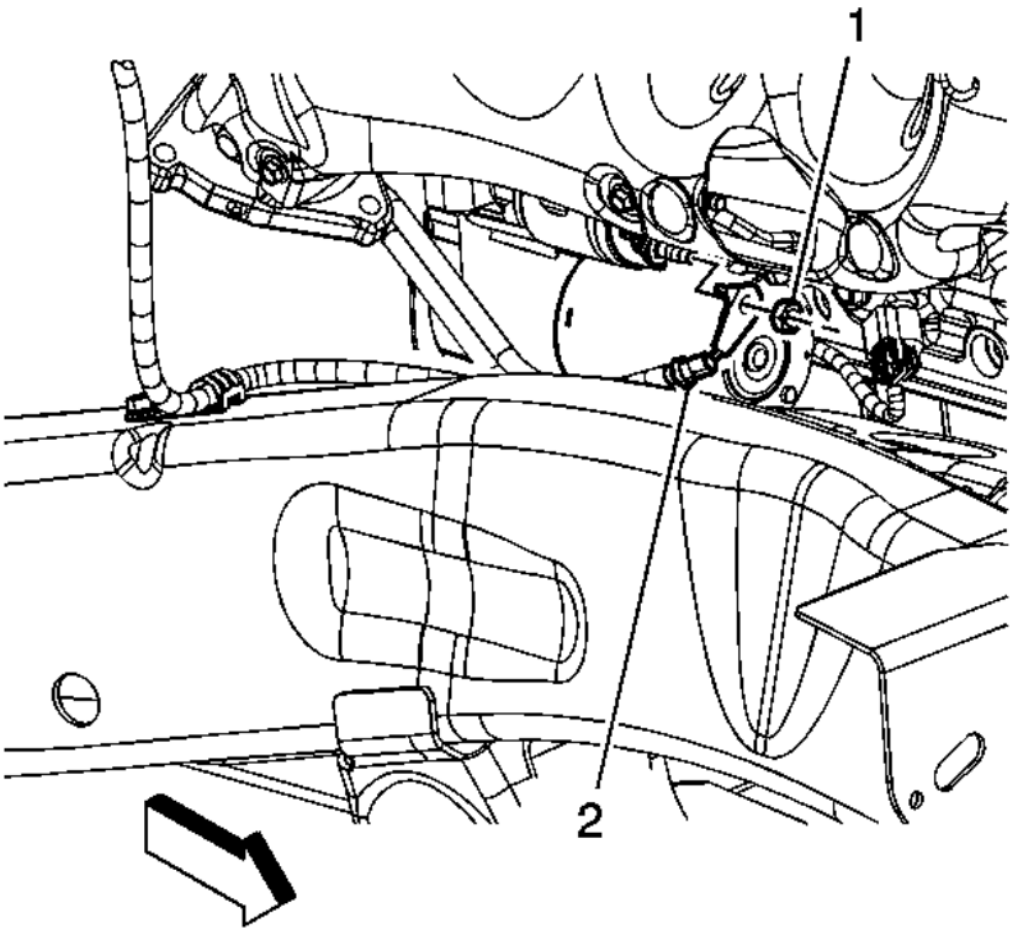


Fig. 129: View Of Starter Solenoid Cable & Nut
Courtesy of GENERAL MOTORS CORP.

14. Remove the starter solenoid cable nut (1) from the starter.
15. Remove the starter solenoid cable (2) from the starter.
16. Lower the vehicle.

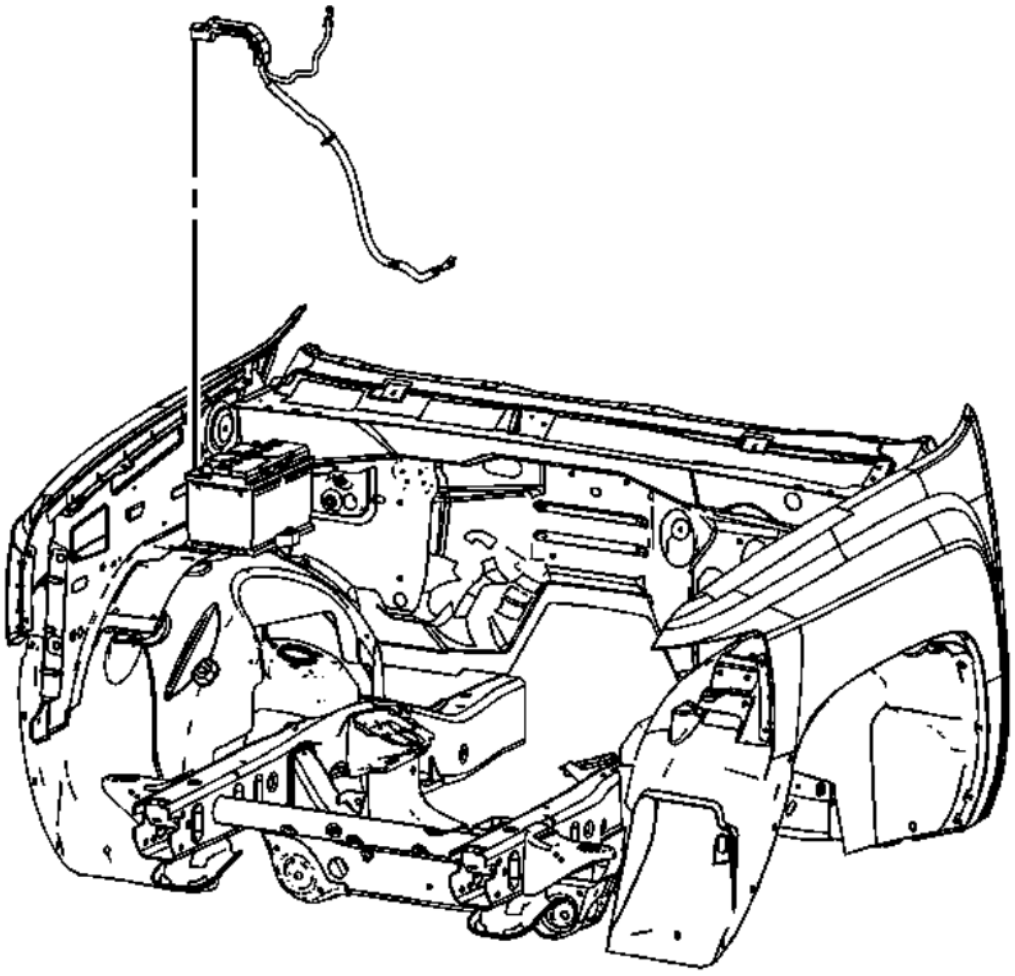


Fig. 130: View Of Starter Solenoid Cable
Courtesy of GENERAL MOTORS CORP.

17. Remove the starter solenoid cable from the vehicle.

Installation Procedure

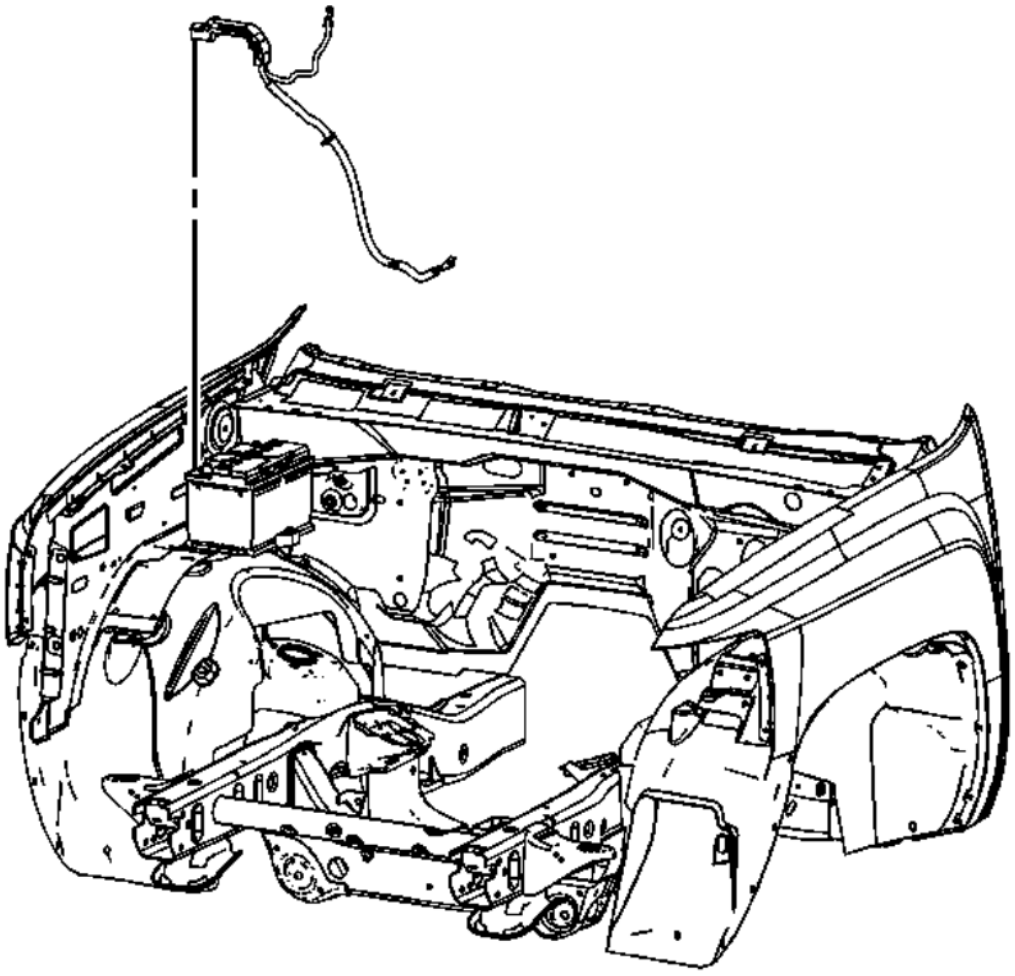


Fig. 131: View Of Starter Solenoid Cable
Courtesy of GENERAL MOTORS CORP.

1. Install the starter solenoid cable to the vehicle.

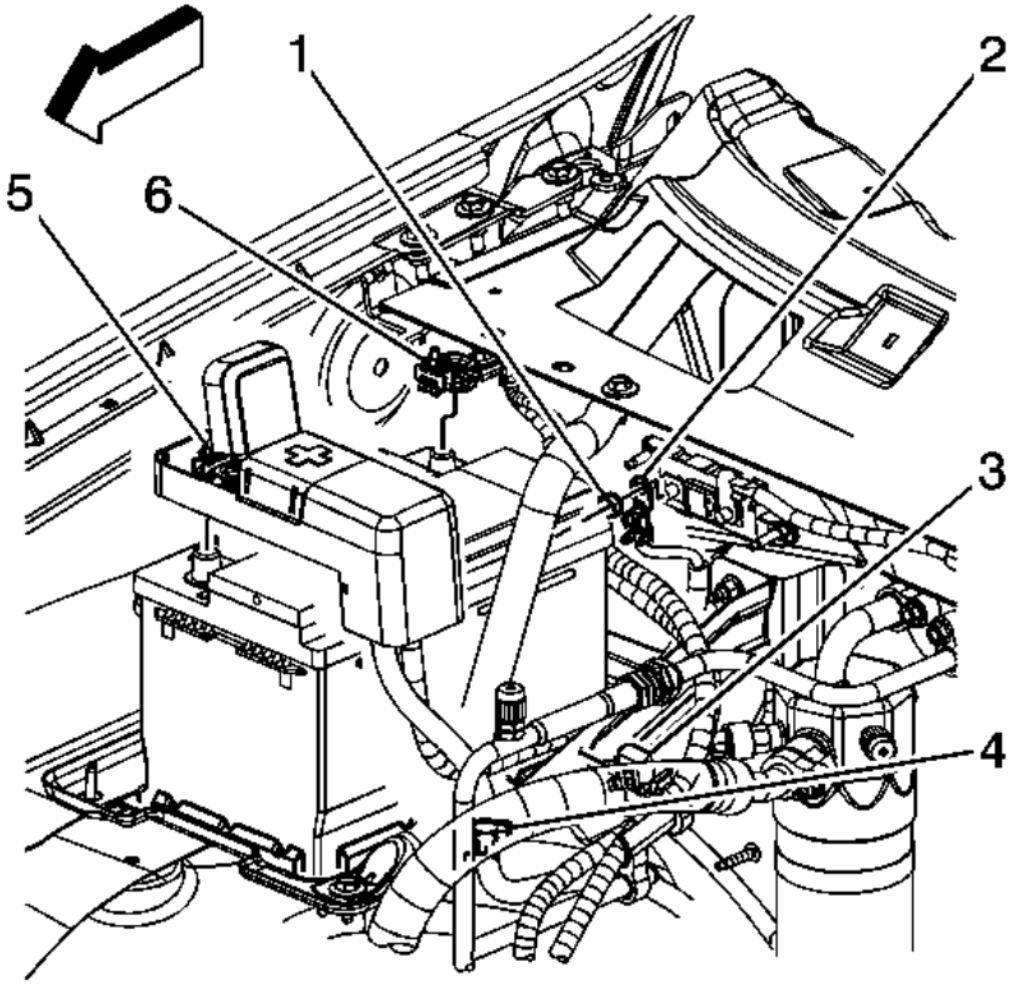


Fig. 132: View Of Battery Cable Components
Courtesy of GENERAL MOTORS CORP.

2. Install the starter solenoid cable to the positive battery terminal.

NOTE: Refer to Fastener Notice .

3. Tighten the starter solenoid cable nut (5).

Tighten: Tighten the nut to 5 N.m (44 lb in).

4. Close the starter solenoid cable cover at the positive battery terminal.
5. Install the starter solenoid cable terminal (2) to the mega fuse stud.
6. Install the starter solenoid cable nut (1) to the mega fuse stud.

   Tighten: Tighten the nut to 9 N.m (80 lb in).

7. Install the starter solenoid cable clip (4) to the A/C evaporator tube.

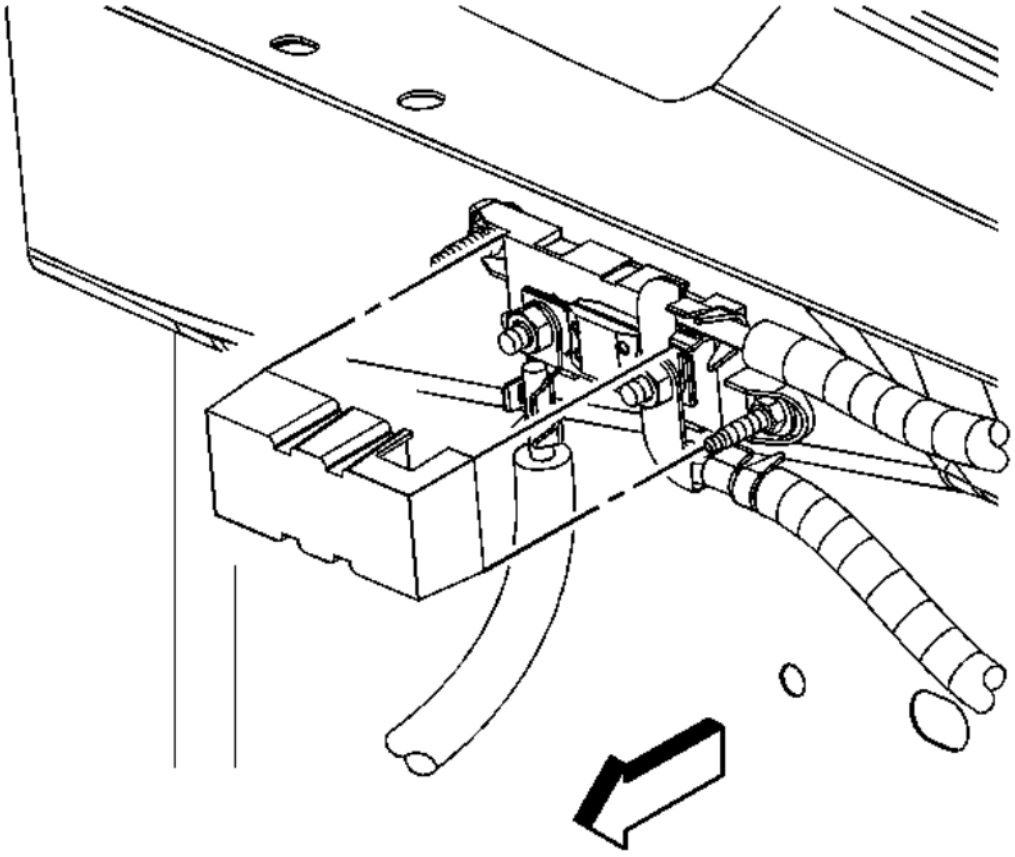


Fig. 133: View Of Mega Fuse Cover
Courtesy of GENERAL MOTORS CORP.

8. Install the mega fuse cover.
9. Raise the vehicle.

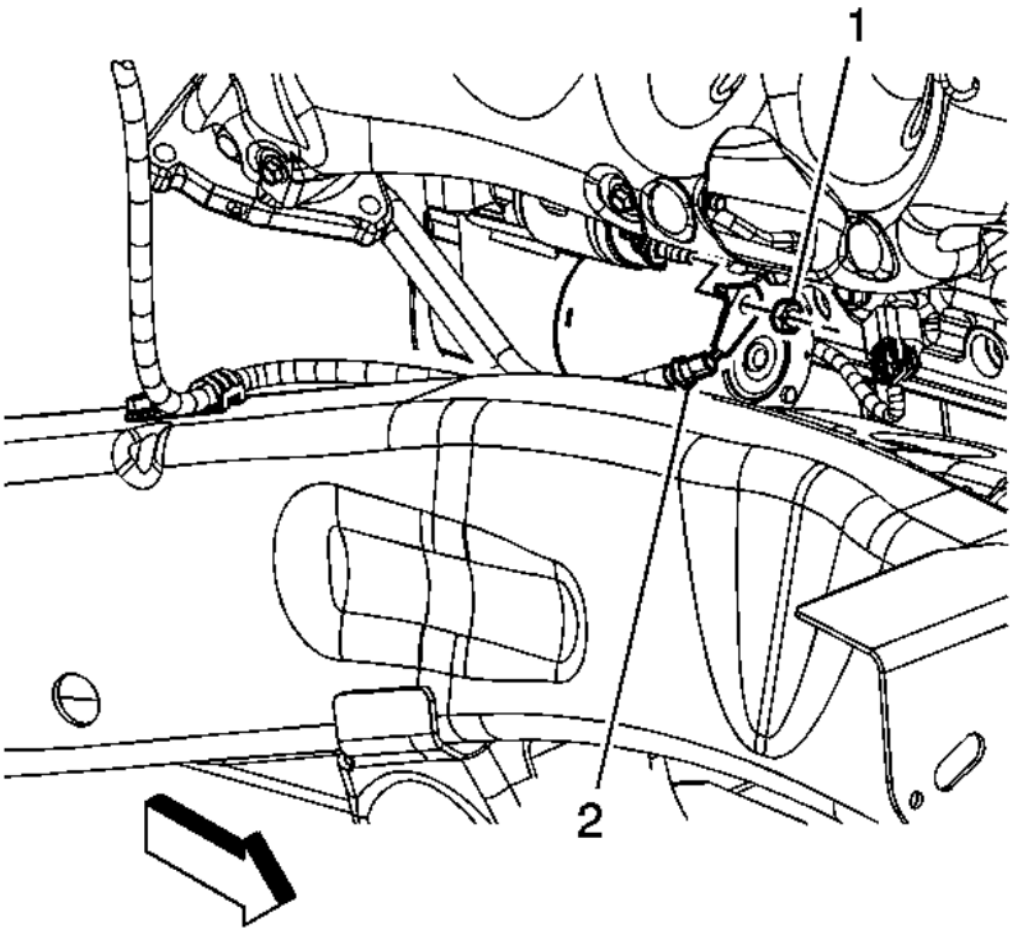


Fig. 134: View Of Starter Solenoid Cable & Nut
Courtesy of GENERAL MOTORS CORP.

10. Install the starter solenoid cable (2) to the starter.
11. Install the starter solenoid cable nut (1) to the starter.

Tighten: Tighten the nut to 9 N.m (80 lb in).

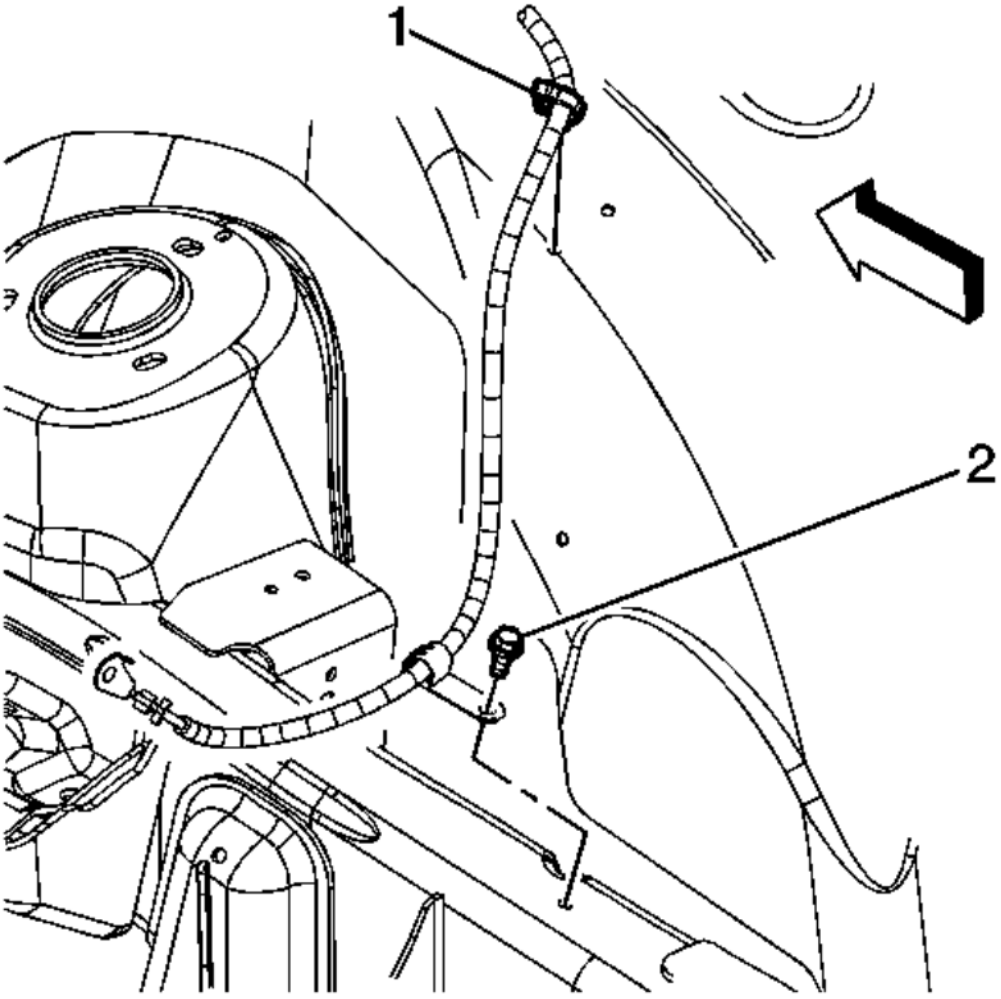


Fig. 135: View Of Starter Solenoid Cable Clip & Bolt
Courtesy of GENERAL MOTORS CORP.

12. Position the starter solenoid cable clip to the frame and install the starter solenoid cable clip bolt (2).
13. Install the starter solenoid cable clip (1) to the wheelhouse panel.

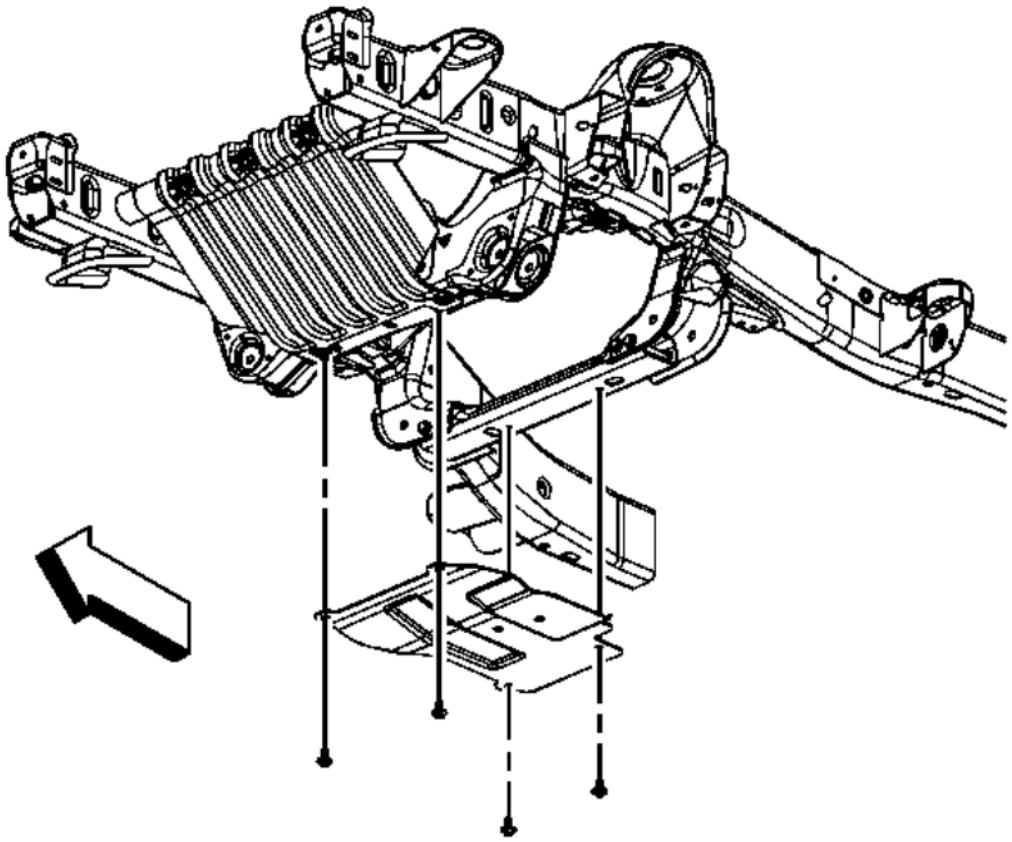


Fig. 136: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

14. Position the oil pan skid plate and install the bolts.

    Tighten: Tighten the bolts to 28 N.m (21 lb ft).

15. Lower the vehicle.
16. Install the air cleaner outlet resonator. Refer to **Air Cleaner Outlet Resonator Replacement** .
17. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

STARTER SOLENOID CABLE REPLACEMENT (4.8L, 5.3L, 6.0L, AND 6.2L)

Removal Procedure

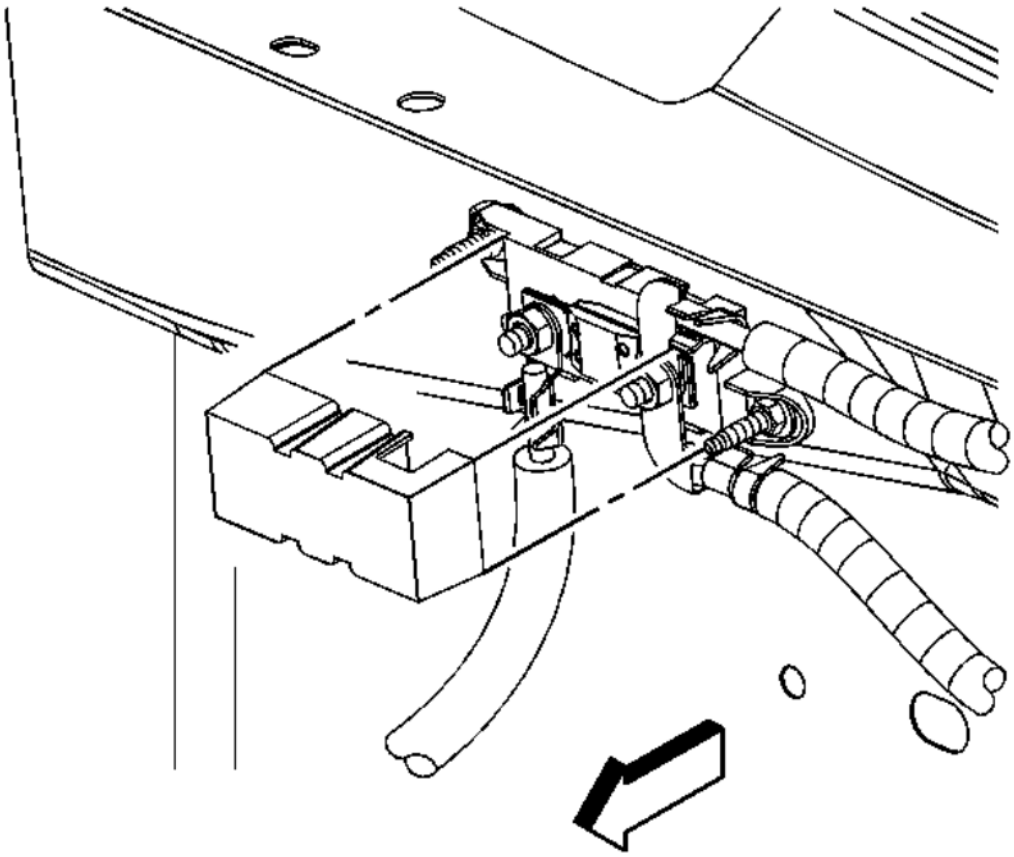


Fig. 137: View Of Mega Fuse Cover
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.
2. Remove the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
3. Remove the mega fuse cover.

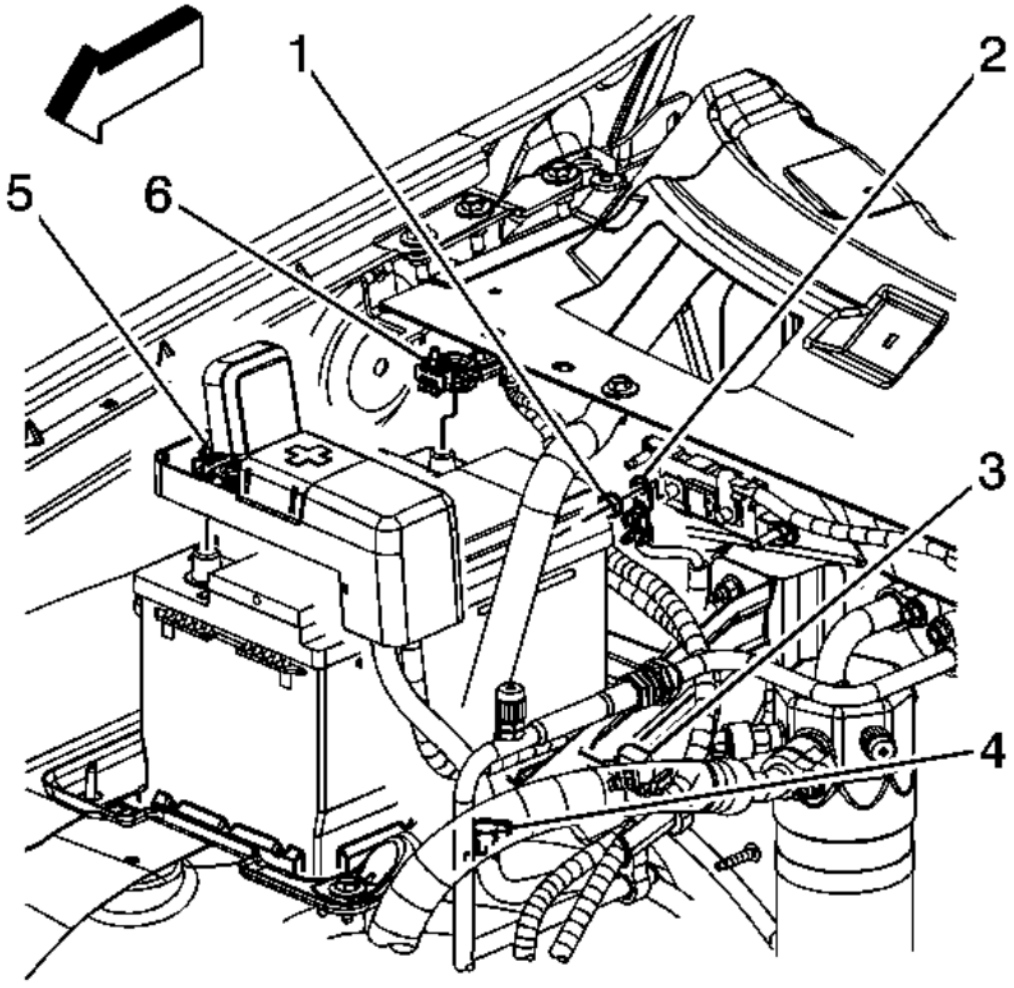


Fig. 138: View Of Battery Cable Components
Courtesy of GENERAL MOTORS CORP.

4. Remove the starter solenoid cable nut (1) from the mega fuse stud.
5. Remove the starter solenoid cable terminal (2) from the mega fuse stud.
6. Open the starter solenoid cable cover at the positive battery terminal.
7. Loosen the starter solenoid cable nut (5).
8. Remove the starter solenoid cable from the positive battery terminal.
9. Remove the starter solenoid cable clip (4) from the air conditioning (A/C) evaporator tube.

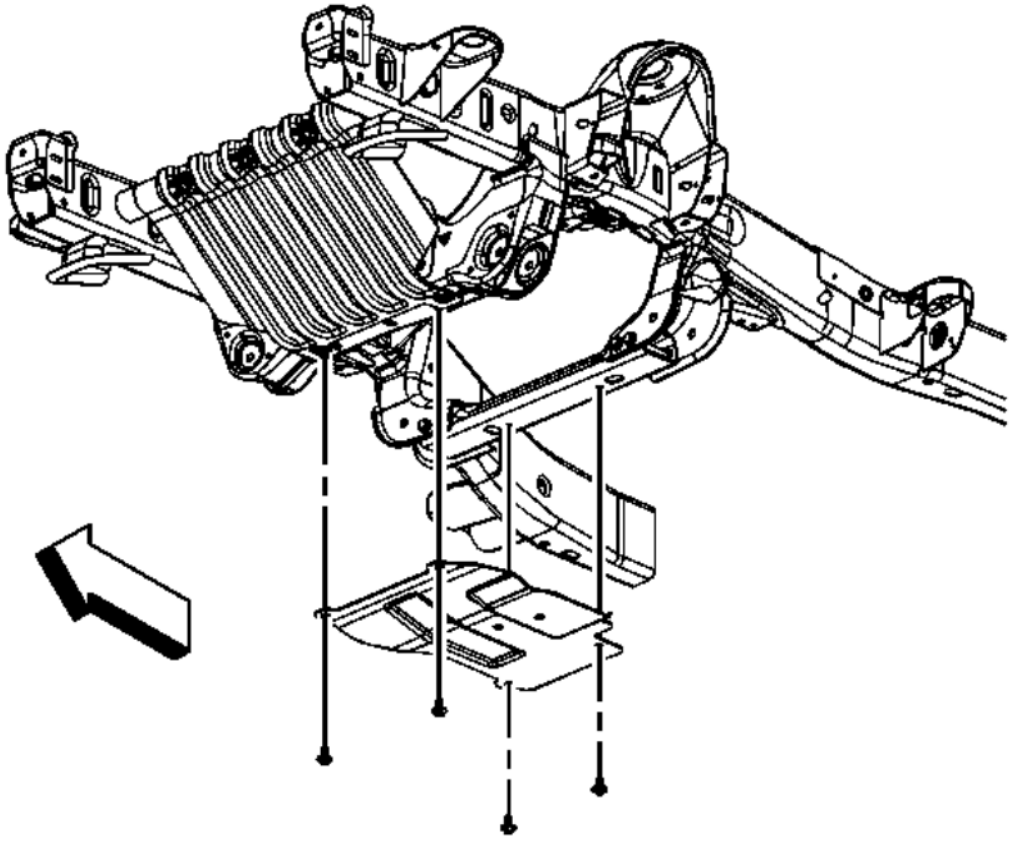


Fig. 139: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

10. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
11. For 1500 series vehicles, remove the oil pan skid plate bolts and plate.

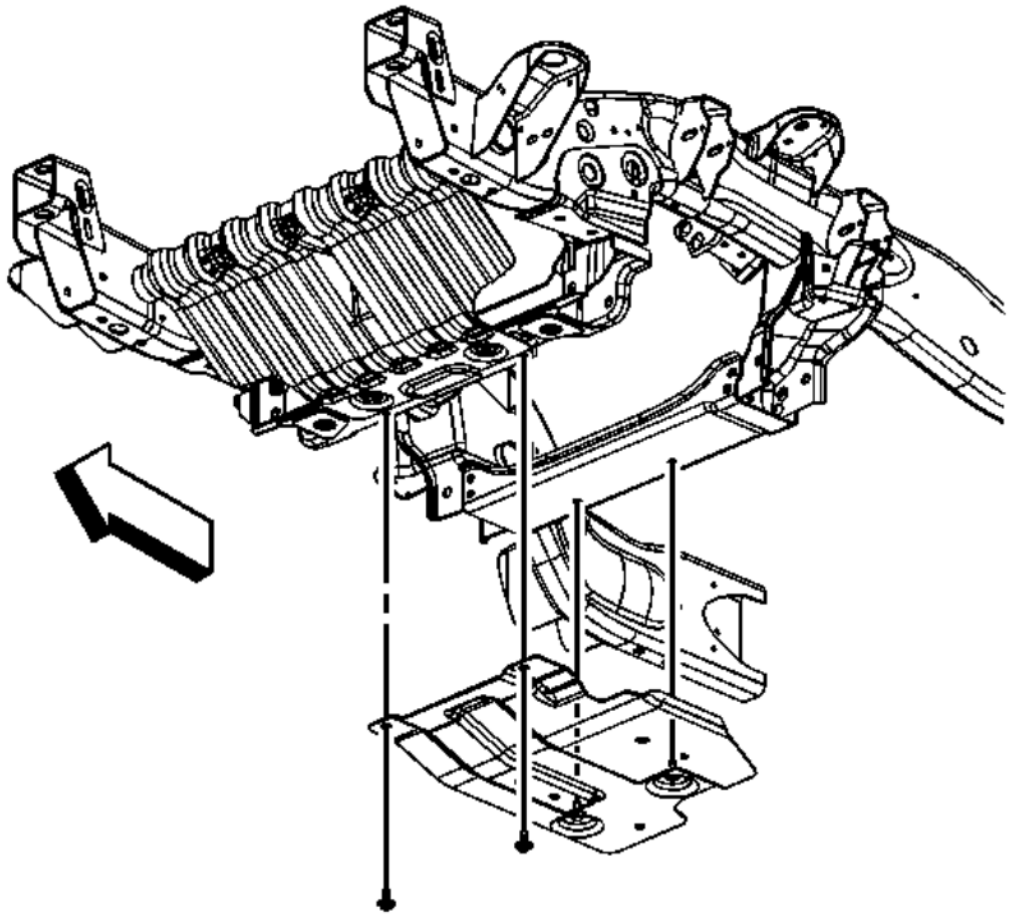


Fig. 140: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

12. For 2500 series vehicles, remove the front 2 oil pan skid plate bolts, loosen the rear 2 bolts and remove the skid plate.

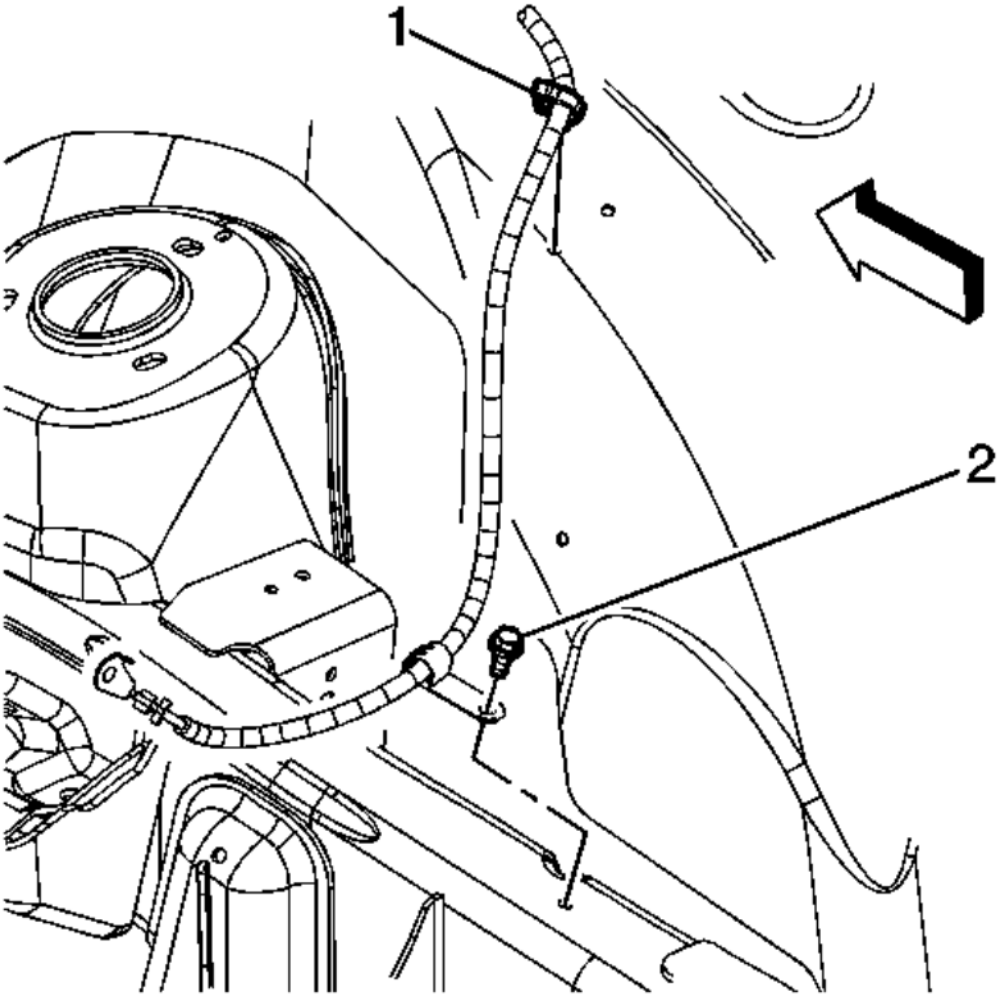


Fig. 141: View Of Starter Solenoid Cable Clip & Bolt
Courtesy of GENERAL MOTORS CORP.

13. Remove the starter solenoid cable clip (1) from the wheelhouse panel.
14. Remove the starter solenoid cable clip bolt (2) from the frame.

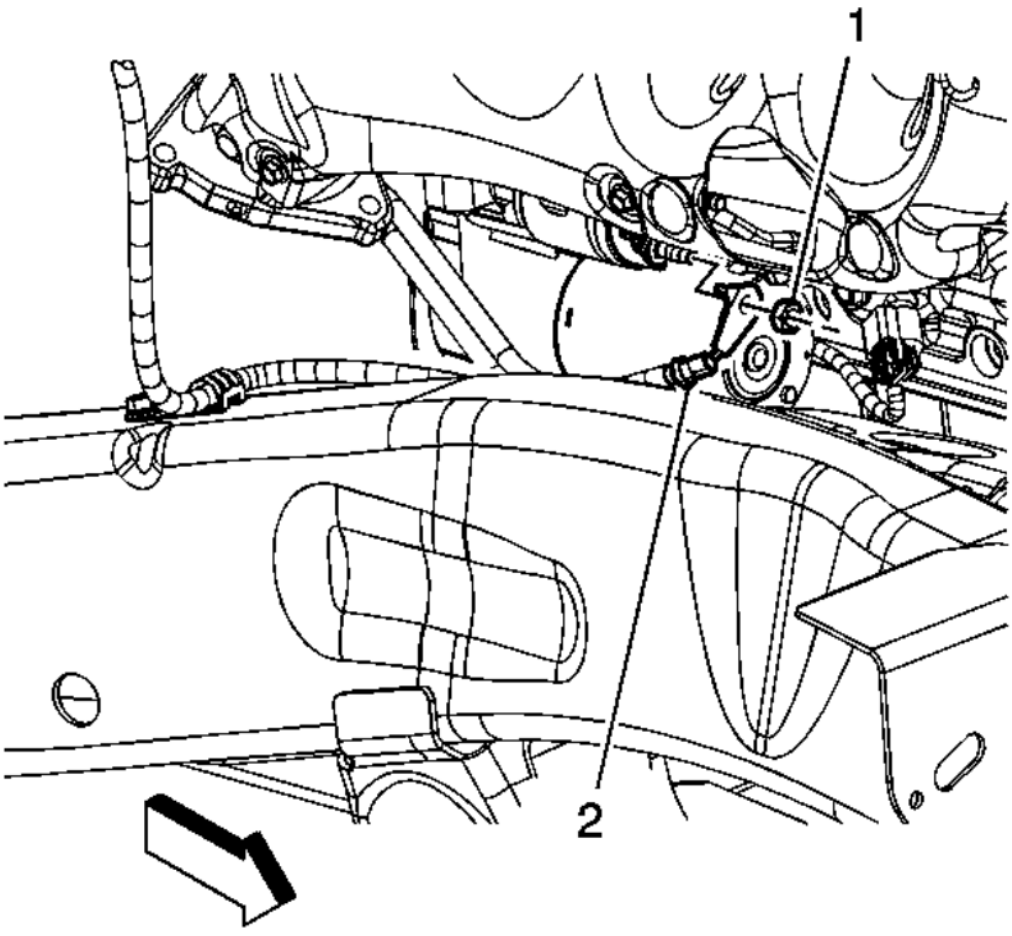


Fig. 142: View Of Starter Solenoid Cable & Nut
Courtesy of GENERAL MOTORS CORP.

15. Remove the starter solenoid cable nut (1) from the starter.
16. Remove the starter solenoid cable (2) from the starter.
17. Lower the vehicle.

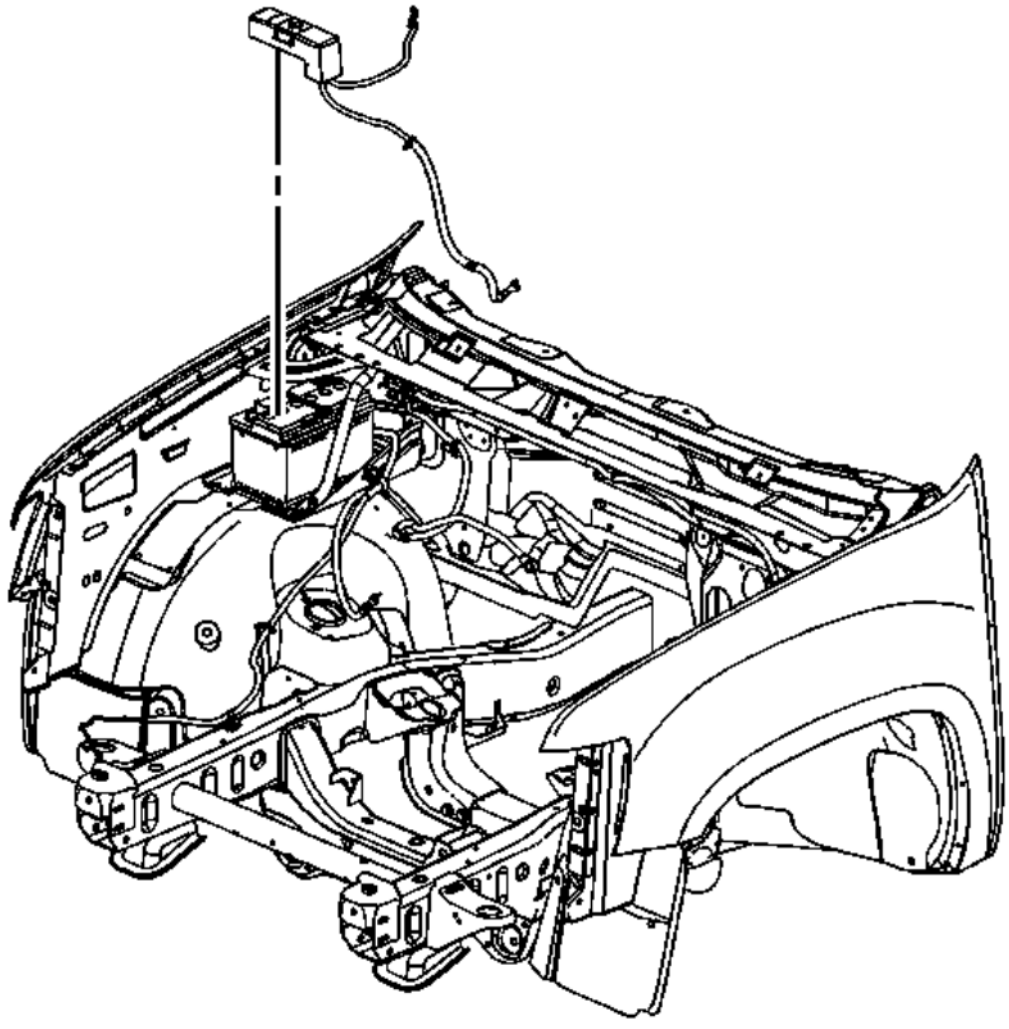


Fig. 143: View Of Starter Solenoid Cable
Courtesy of GENERAL MOTORS CORP.

18. Remove the starter solenoid cable from the vehicle.

Installation Procedure

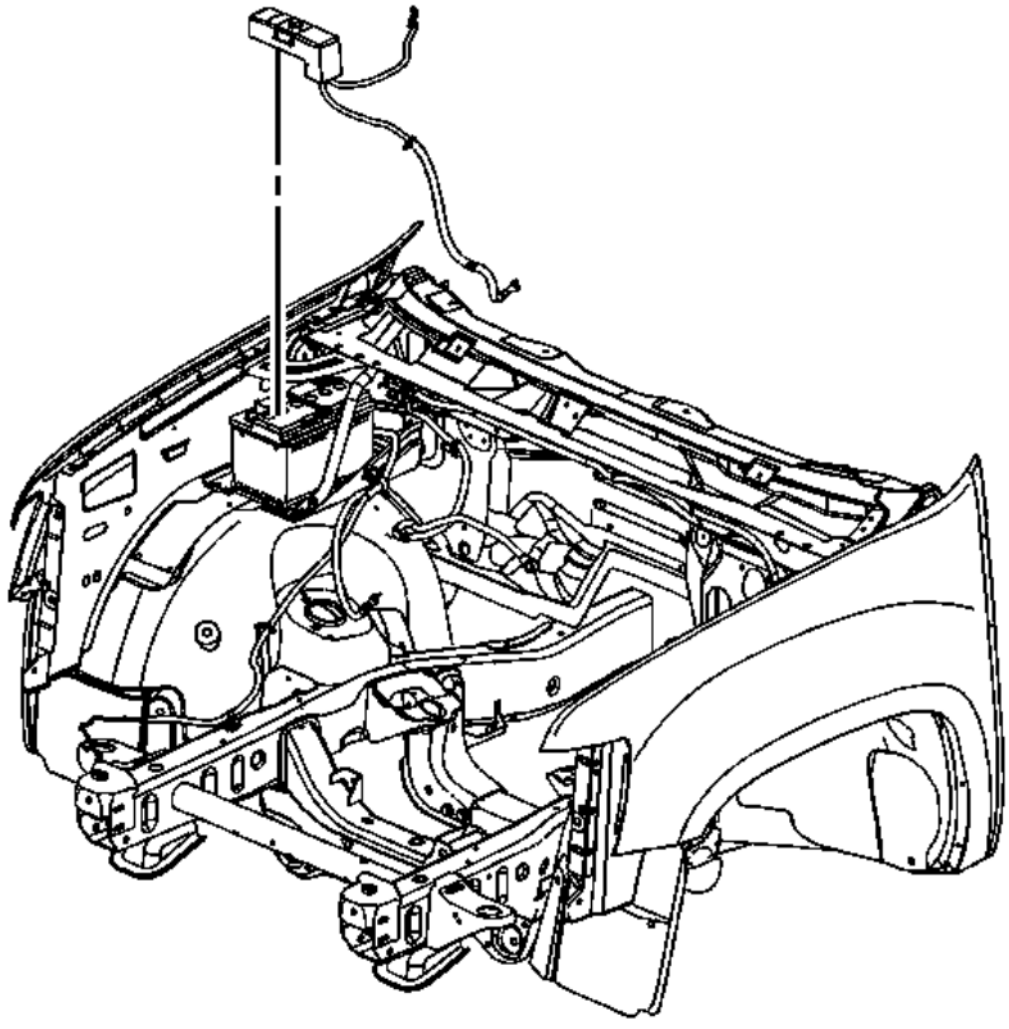


Fig. 144: View Of Starter Solenoid Cable
Courtesy of GENERAL MOTORS CORP.

1. Install the starter solenoid cable to the vehicle.

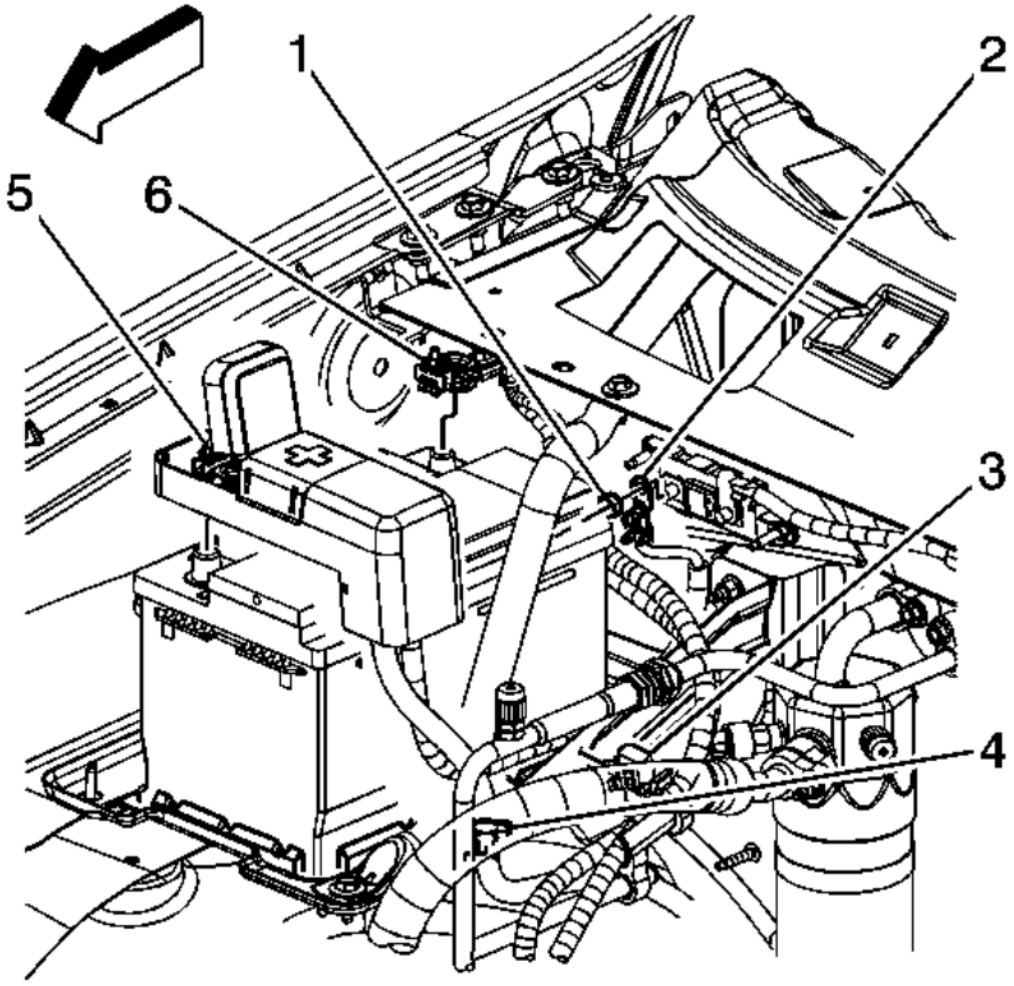


Fig. 145: View Of Battery Cable Components
Courtesy of GENERAL MOTORS CORP.

2. Install the starter solenoid cable to the positive battery terminal.

NOTE: Refer to Fastener Notice .

3. Tighten the starter solenoid cable nut (5).

Tighten: Tighten the nut to 5 N.m (44 lb in).

4. Close the starter solenoid cable cover at the positive battery terminal.
5. Install the starter solenoid cable terminal (2) to the mega fuse stud.
6. Install the starter solenoid cable nut (1) to the mega fuse stud.

   Tighten: Tighten the nut to 9 N.m (80 lb in).

7. Install the starter solenoid cable clip (4) to the A/C evaporator tube.

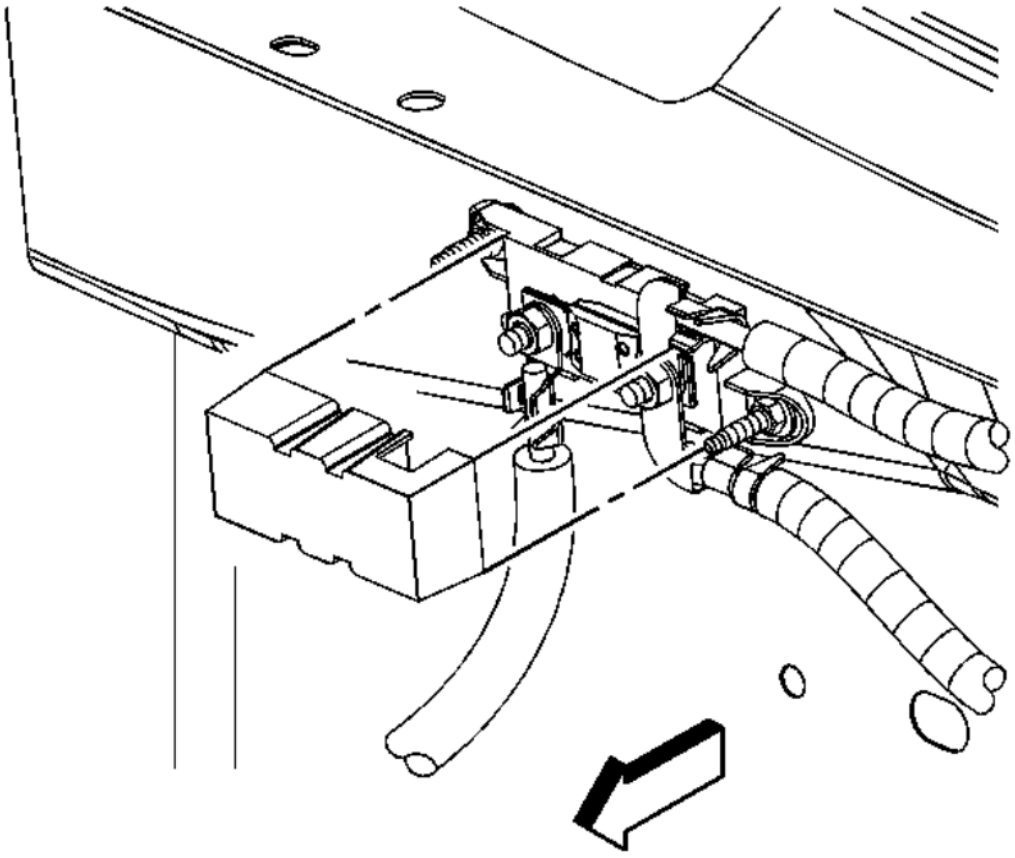


Fig. 146: View Of Mega Fuse Cover
Courtesy of GENERAL MOTORS CORP.

8. Install the mega fuse cover.
9. Raise the vehicle.

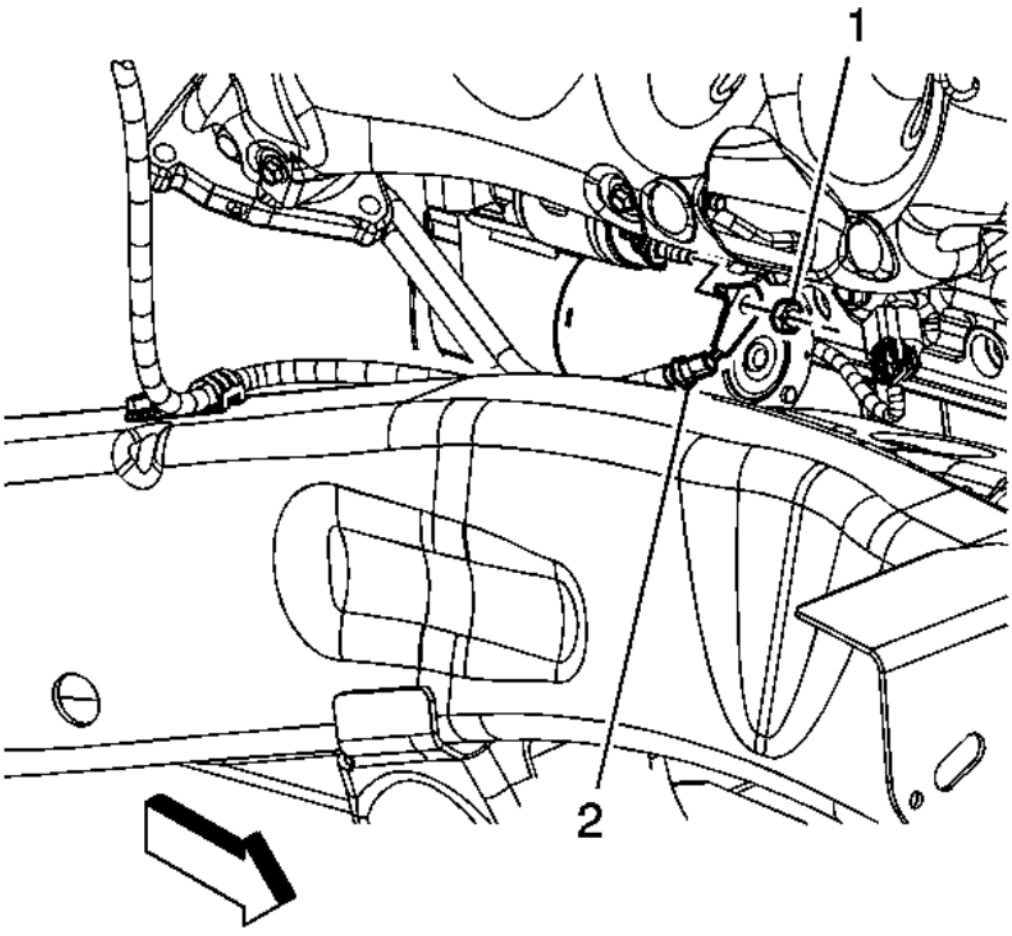


Fig. 147: View Of Starter Solenoid Cable & Nut
Courtesy of GENERAL MOTORS CORP.

10. Install the starter solenoid cable (2) to the starter.
11. Install the starter solenoid cable nut (1) to the starter.

Tighten: Tighten the nut to 9 N.m (80 lb in).

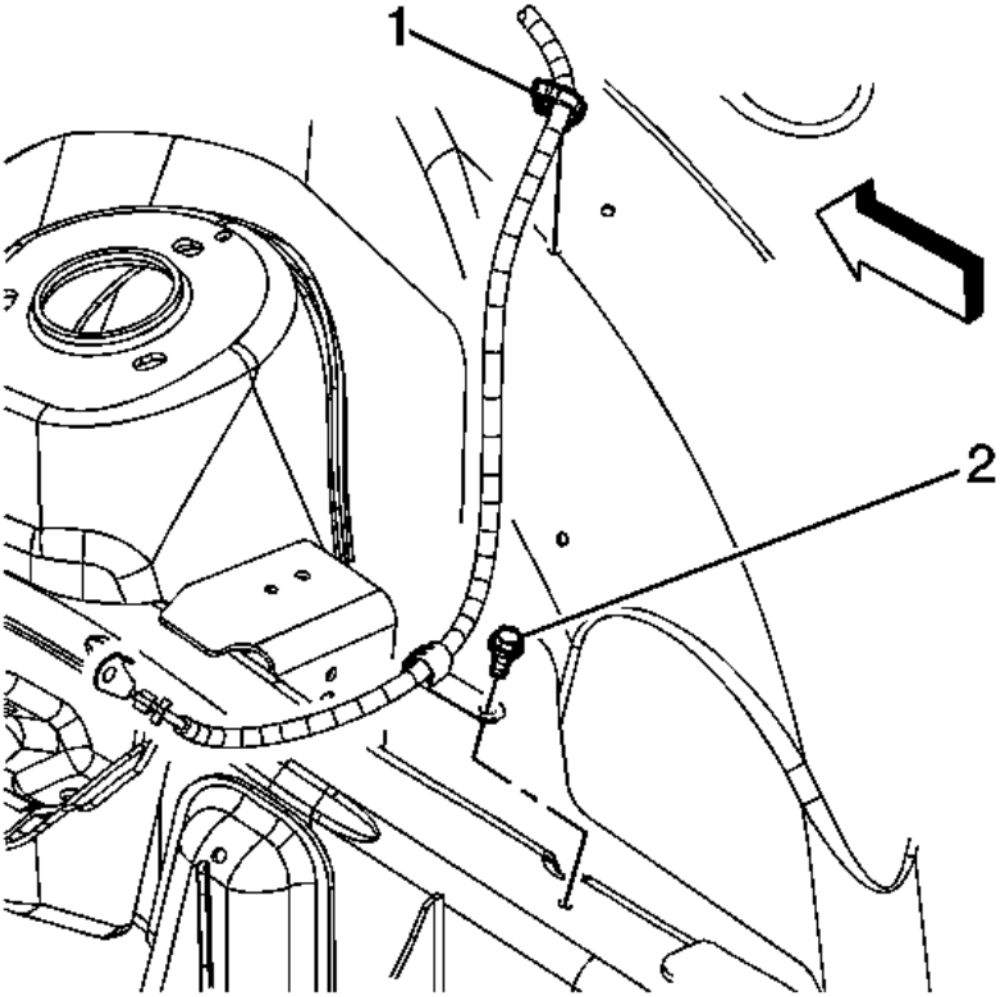


Fig. 148: View Of Starter Solenoid Cable Clip & Bolt
Courtesy of GENERAL MOTORS CORP.

12. Position the starter solenoid cable clip to the frame and install the starter solenoid cable clip bolt (2).
13. Install the starter solenoid cable clip (1) to the wheelhouse panel.

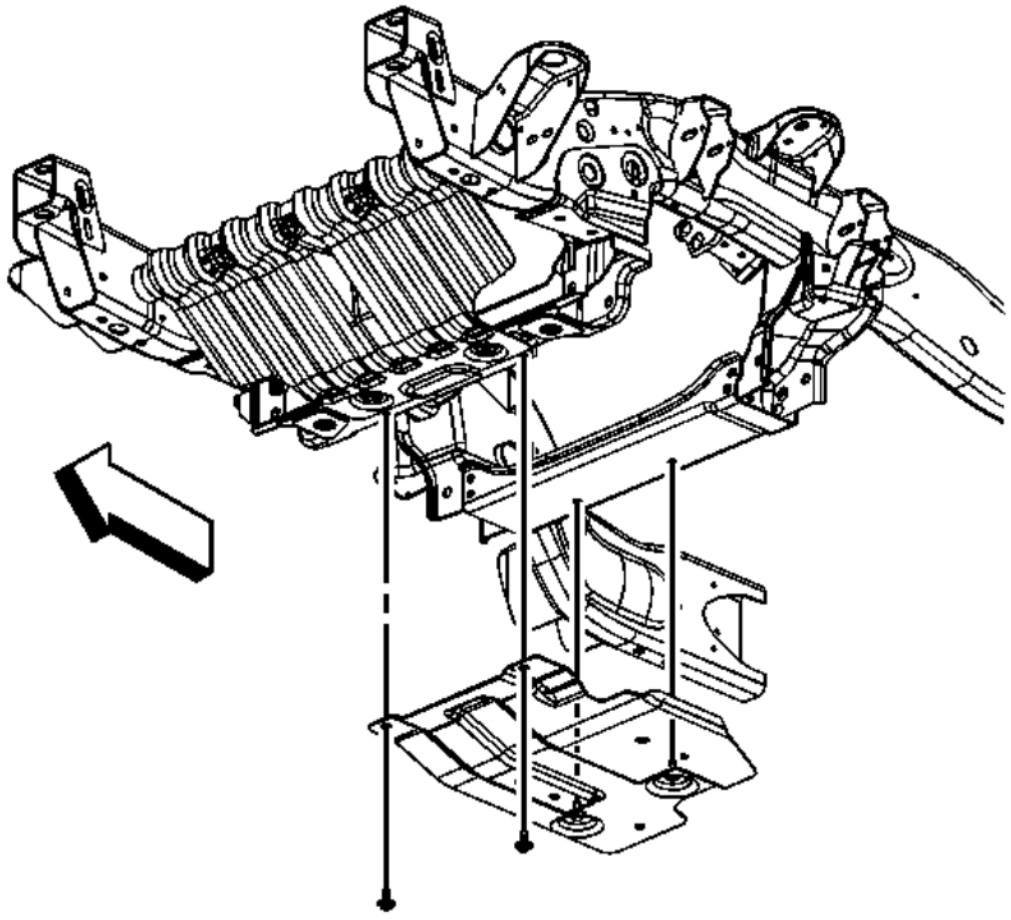


Fig. 149: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

14. For 2500 series vehicles, install the oil pan skid plate and tighten the rear 2 bolts and install and tighten the front 2 bolts.

    Tighten: Tighten the bolts to 28 N.m (21 lb ft).

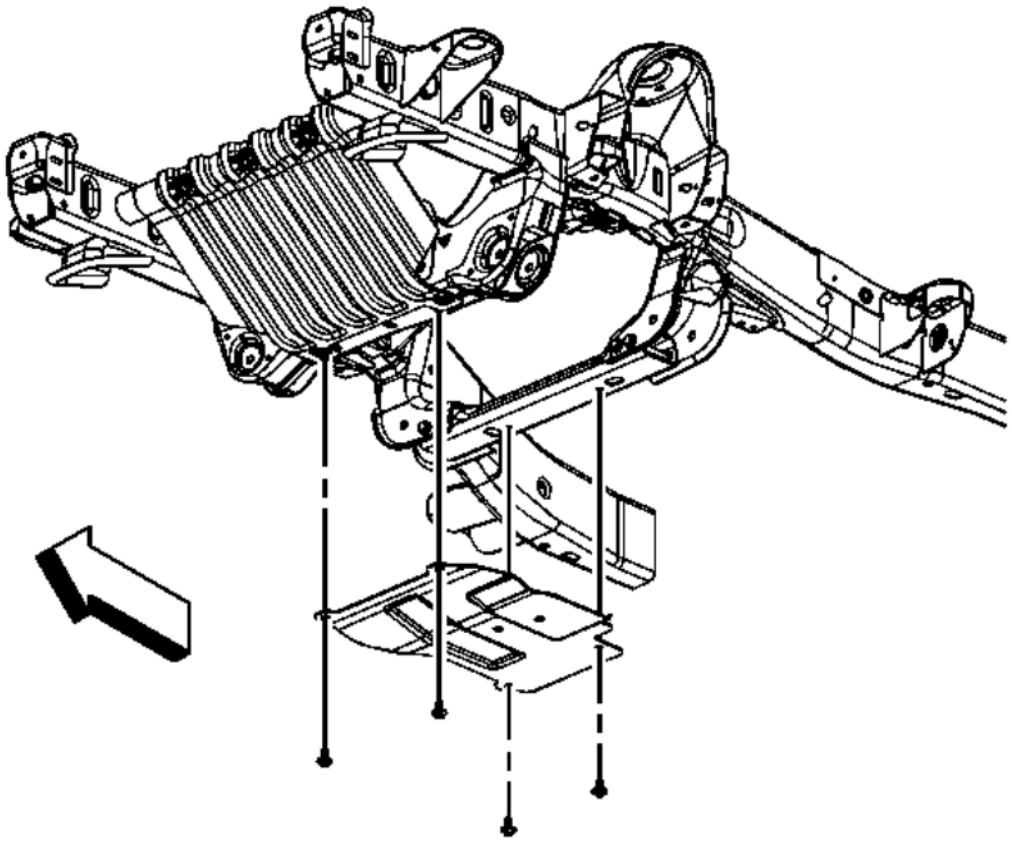


Fig. 150: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

15. For 1500 series vehicles, install the oil pan skid plate and bolts.

    Tighten: Tighten the bolts to 28 N.m (21 lb ft).

16. Lower the vehicle.
17. Install the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
18. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

STARTER SOLENOID CABLE REPLACEMENT (6.6L)

Removal Procedure

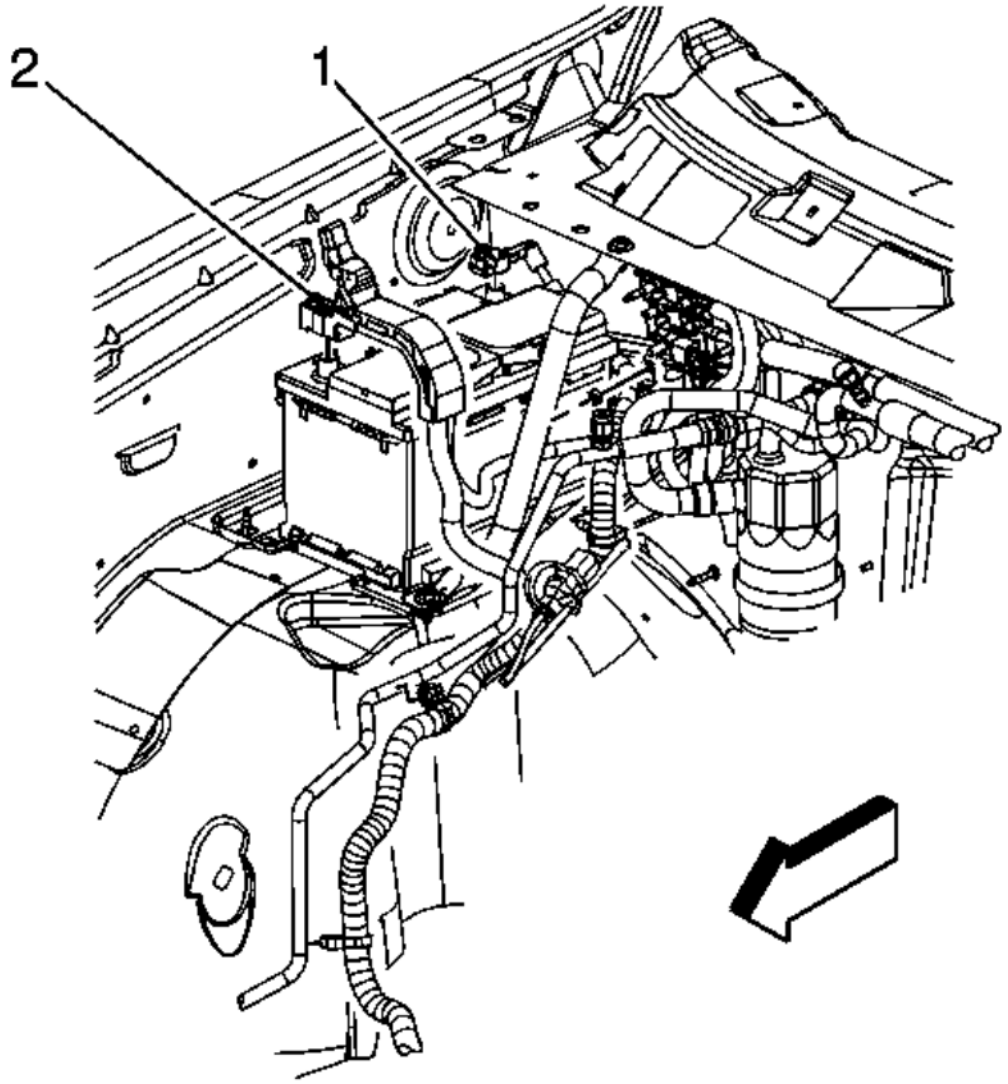


Fig. 151: View Of Negative Battery Cable & Components
Courtesy of GENERAL MOTORS CORP.

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

and Connection (w/Single Battery) or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

2. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** .
3. Open the starter solenoid cable positive battery post cover.
4. Loosen the starter solenoid cable nut (1).
5. Remove the starter solenoid cable from the battery positive post.

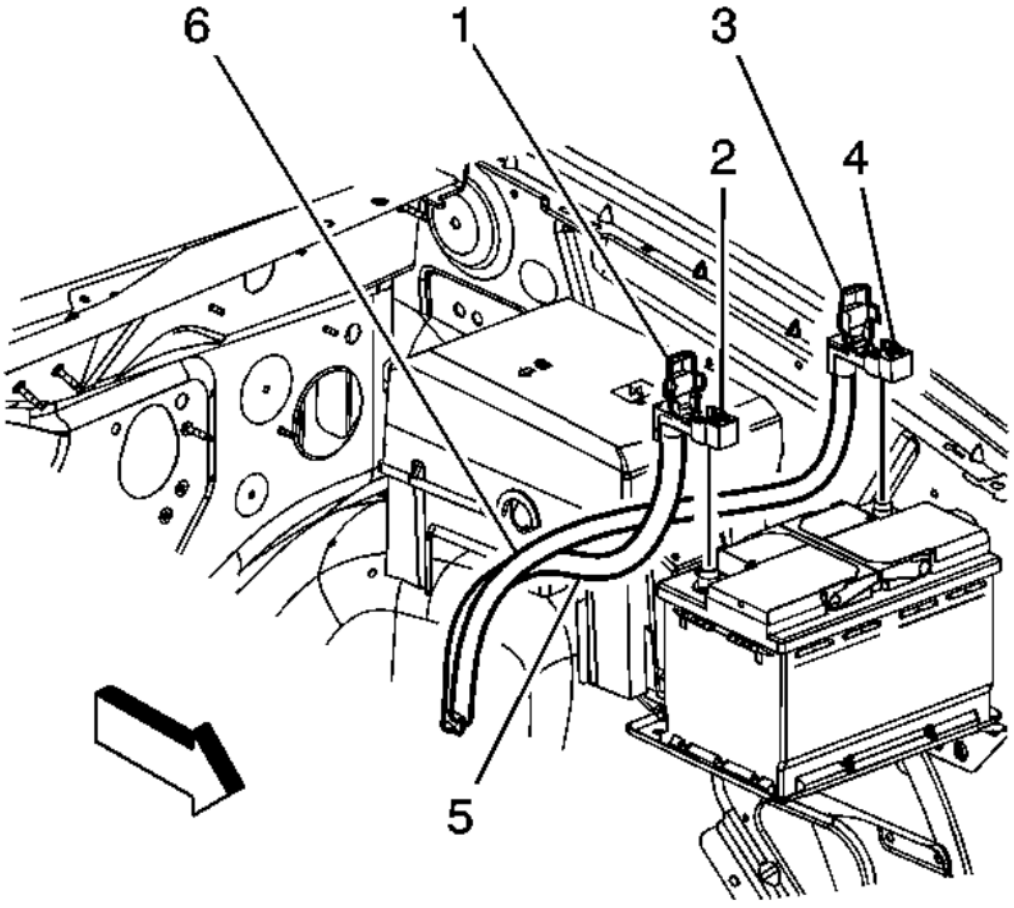


Fig. 152: View Of Battery Components
Courtesy of GENERAL MOTORS CORP.

6. Open the starter solenoid cable positive battery post cover (1).

7. Loosen the starter solenoid cable nut (2).
8. Remove the starter solenoid cable (5) from the battery positive post.

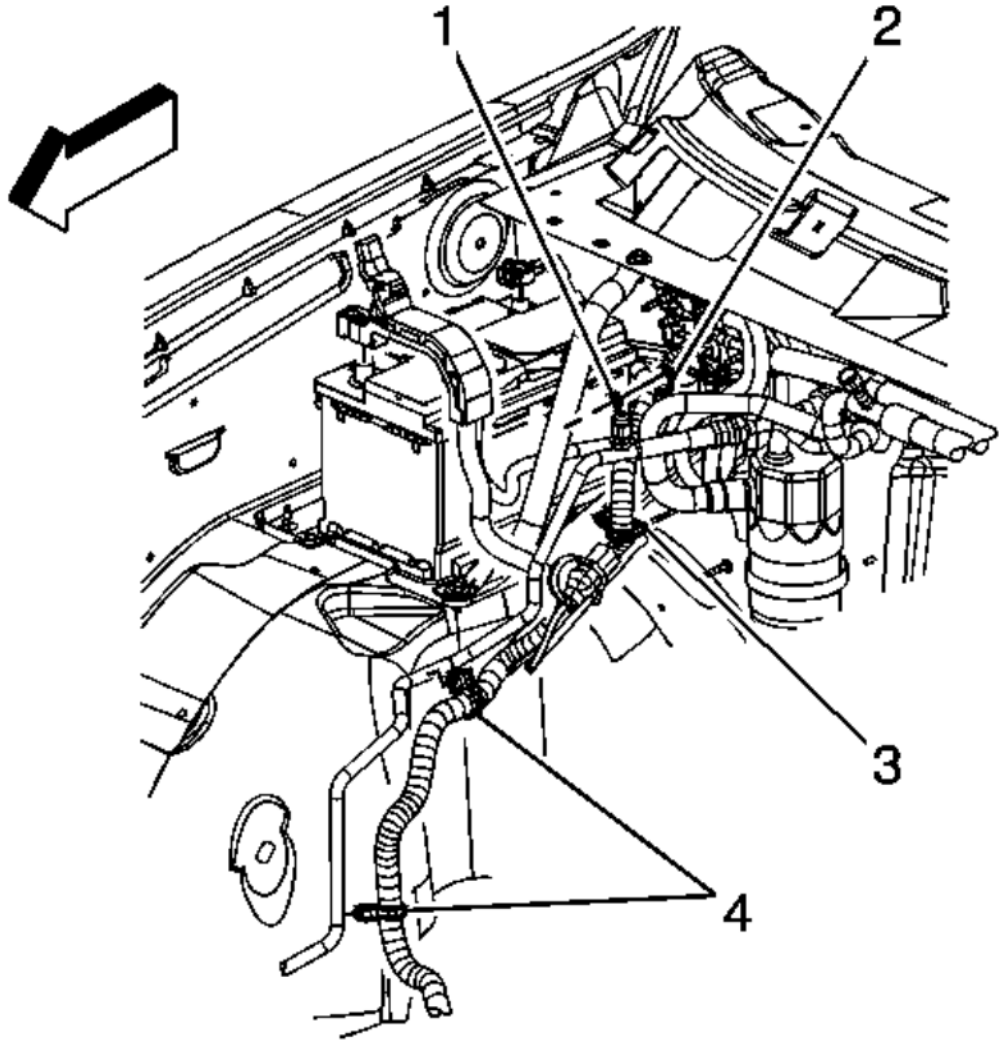


Fig. 153: View Of Starter Solenoid Cable Clips
Courtesy of GENERAL MOTORS CORP.

9. Remove the starter solenoid cable clip (3) from the battery tray.
10. Remove the starter solenoid cable clips (4) from the air conditioning (A/C) evaporator tube.

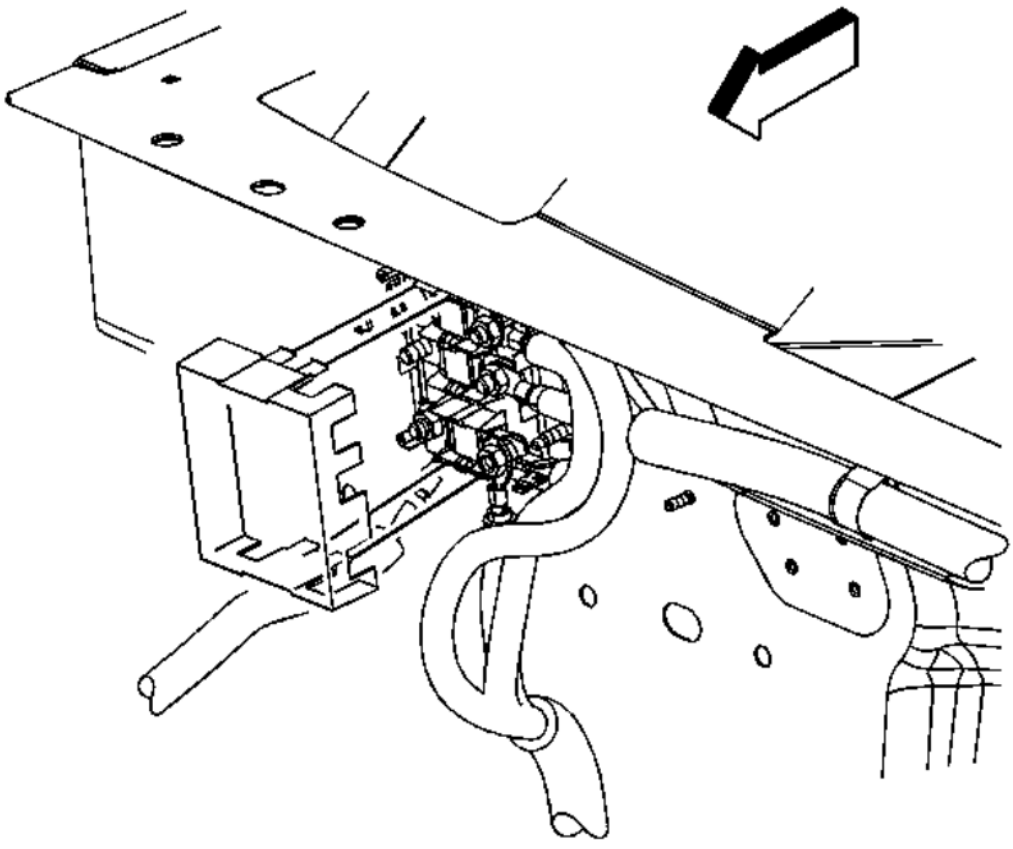


Fig. 154: View Of Mega Fuse Cover
Courtesy of GENERAL MOTORS CORP.

11. Remove the mega fuse cover.

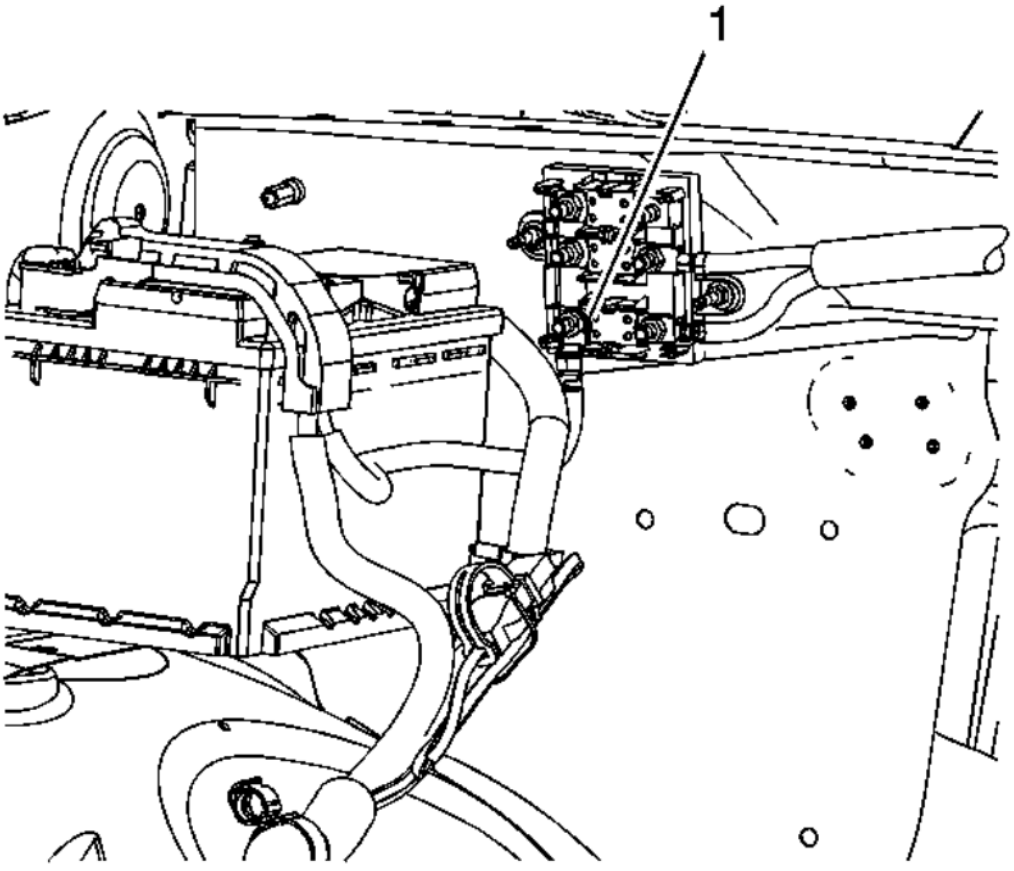


Fig. 155: View Of Mega Fuse Nut
Courtesy of GENERAL MOTORS CORP.

12. Remove the starter solenoid cable to mega fuse nut (1).
13. Remove the starter solenoid cable branch from the mega fuse stud.
14. Remove the wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement - Right Side (GMC)** or **Front Wheelhouse Liner Replacement - Right Side (Chevrolet)** .

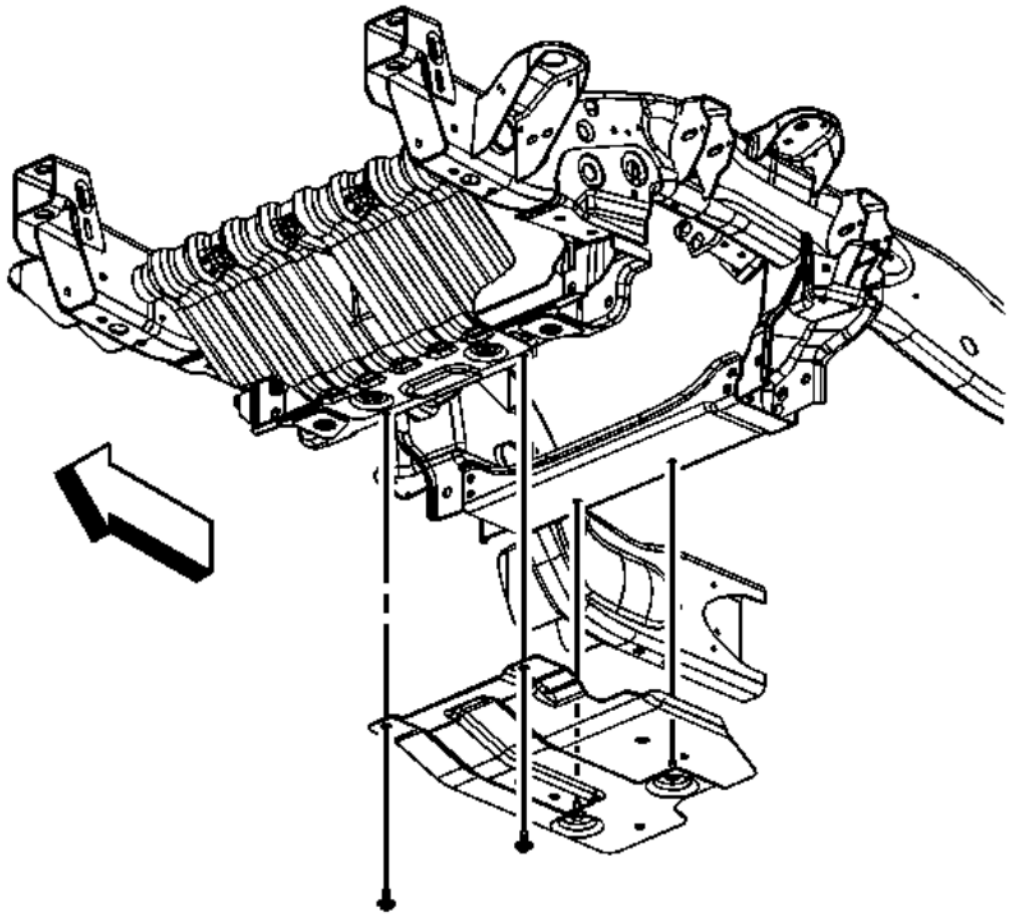


Fig. 156: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

15. Remove the front 2 oil pan skid plate bolts, loosen the rear 2 bolts and remove the skid plate.

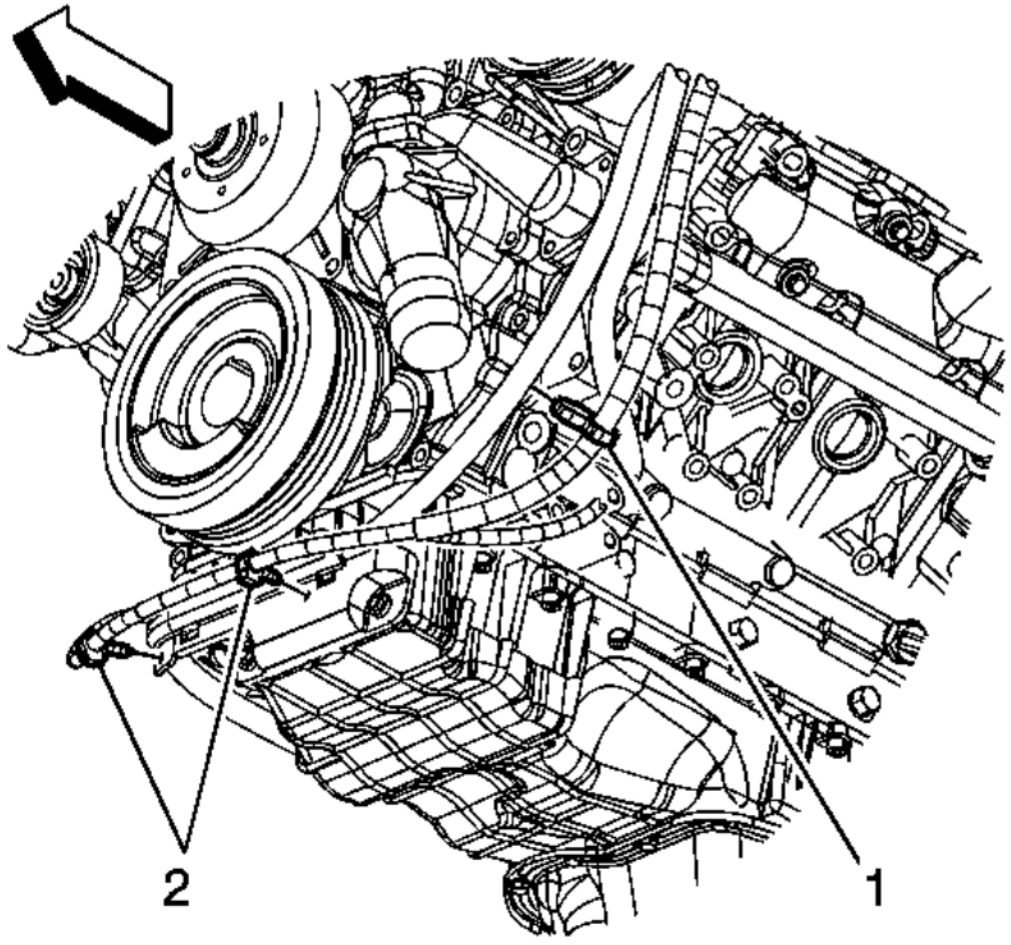


Fig. 157: View Of Engine Wiring Harness Clips
Courtesy of GENERAL MOTORS CORP.

16. Remove the engine wiring harness clip (1) from the starter solenoid cable.
17. Remove the engine wiring harness clips (2) from the starter solenoid cable channel.

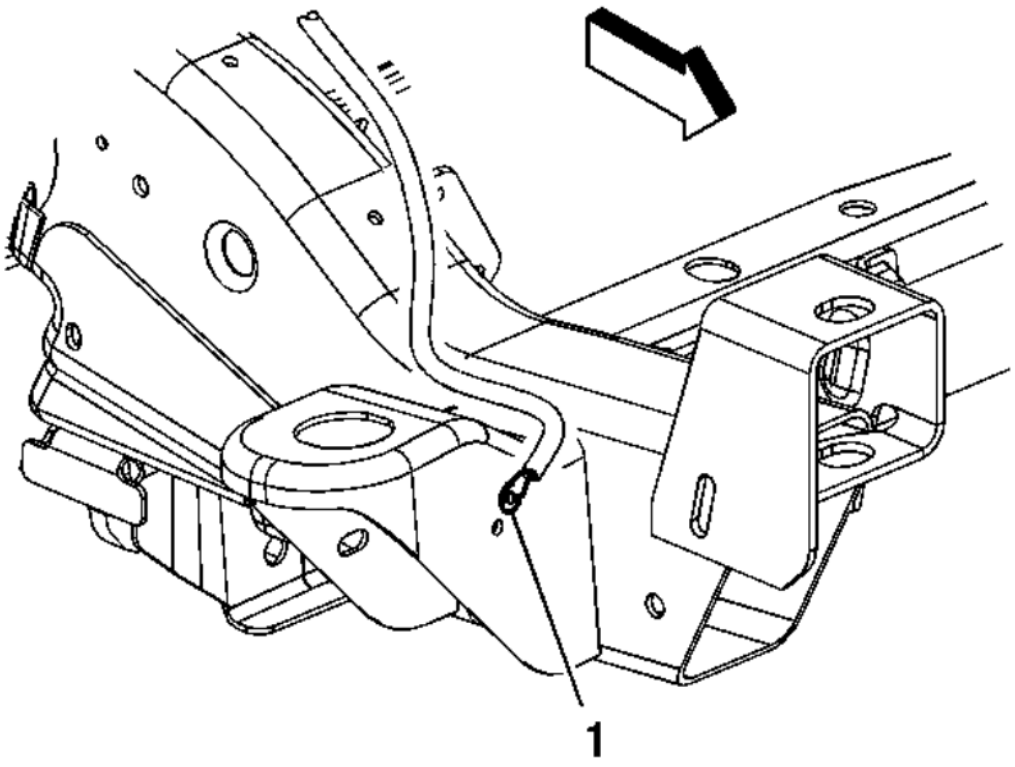


Fig. 158: View Of Starter Solenoid Cable At Frame
Courtesy of GENERAL MOTORS CORP.

18. Remove the starter solenoid cable bolt from the frame.
19. Reposition the starter solenoid cable (1) from the frame.

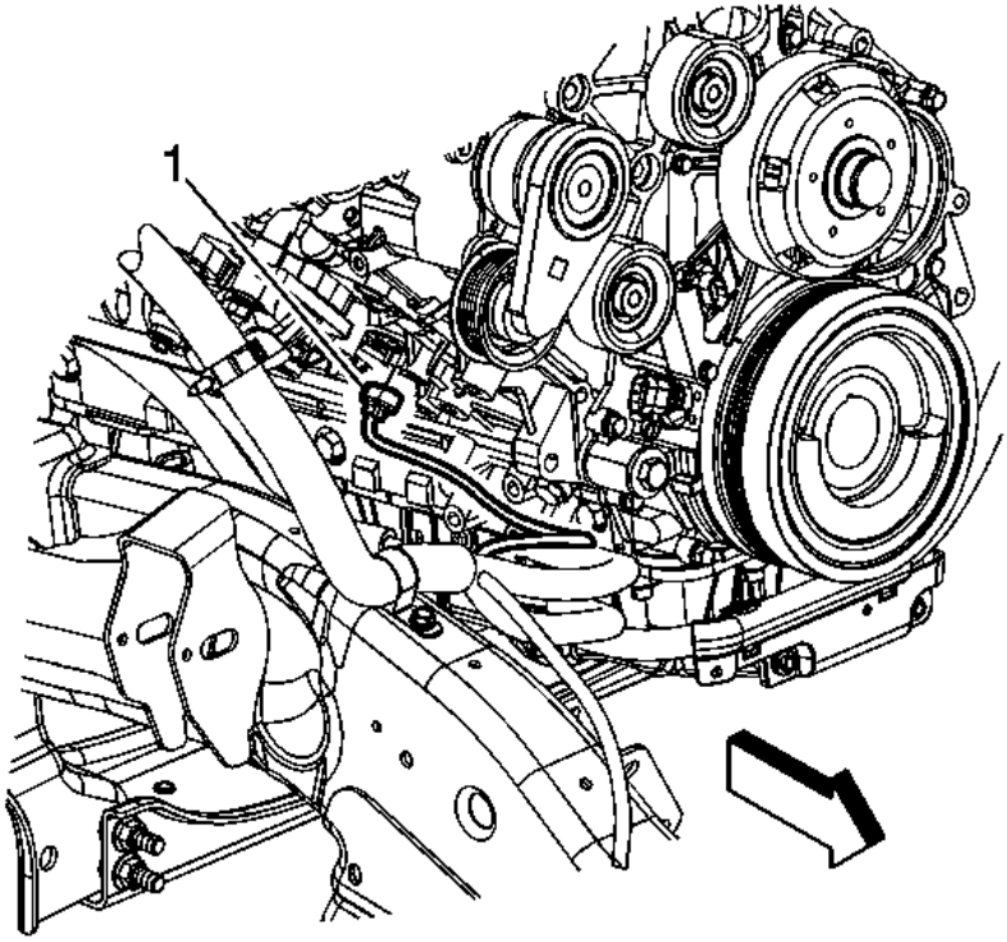


Fig. 159: View Of Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

20. Disconnect the coolant heater cord (1) from the coolant heater.

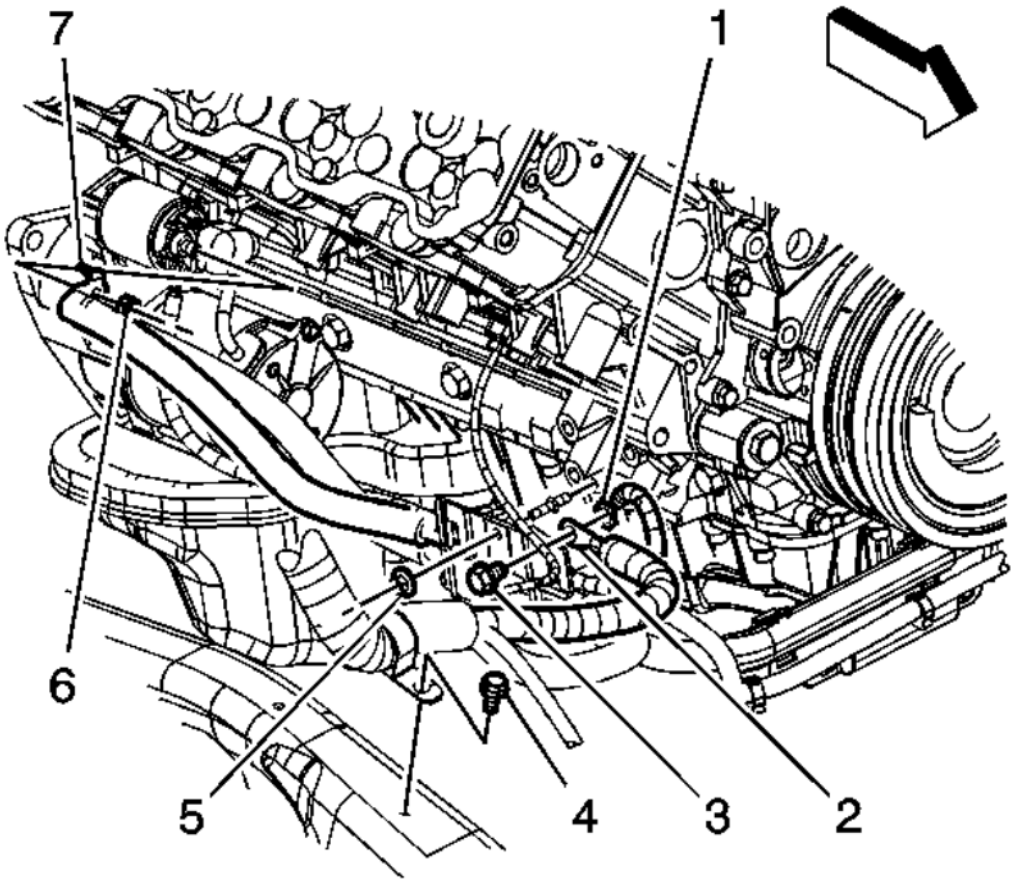


Fig. 160: View Of Starter Solenoid Cable & Components
Courtesy of GENERAL MOTORS CORP.

21. Remove the starter solenoid cable nut (6) from the starter.
22. Remove the starter solenoid cable (7) from the starter.
23. Remove the starter solenoid cable bolt (3) from the engine block.
24. Reposition the starter solenoid cable terminal (2) from the engine wiring harness ground terminal (1).
25. Remove the starter solenoid cable bracket nut (5) and bracket from the stud.
26. Remove the starter solenoid cable clip bolt (4) from the frame.

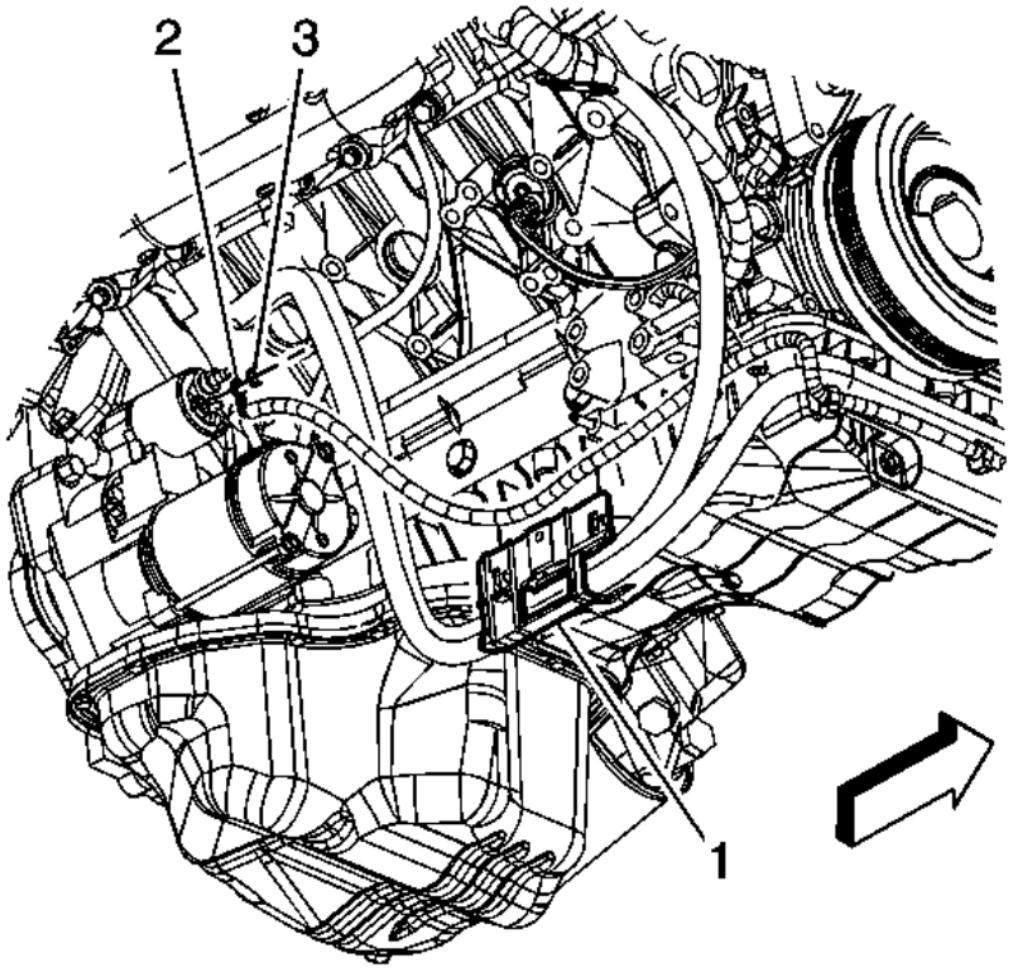


Fig. 161: View Of Starter Solenoid Cable Terminal, Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

27. Reposition the starter solenoid cable bracket (1) and remove the engine wiring harness from the rear clips on the bracket.

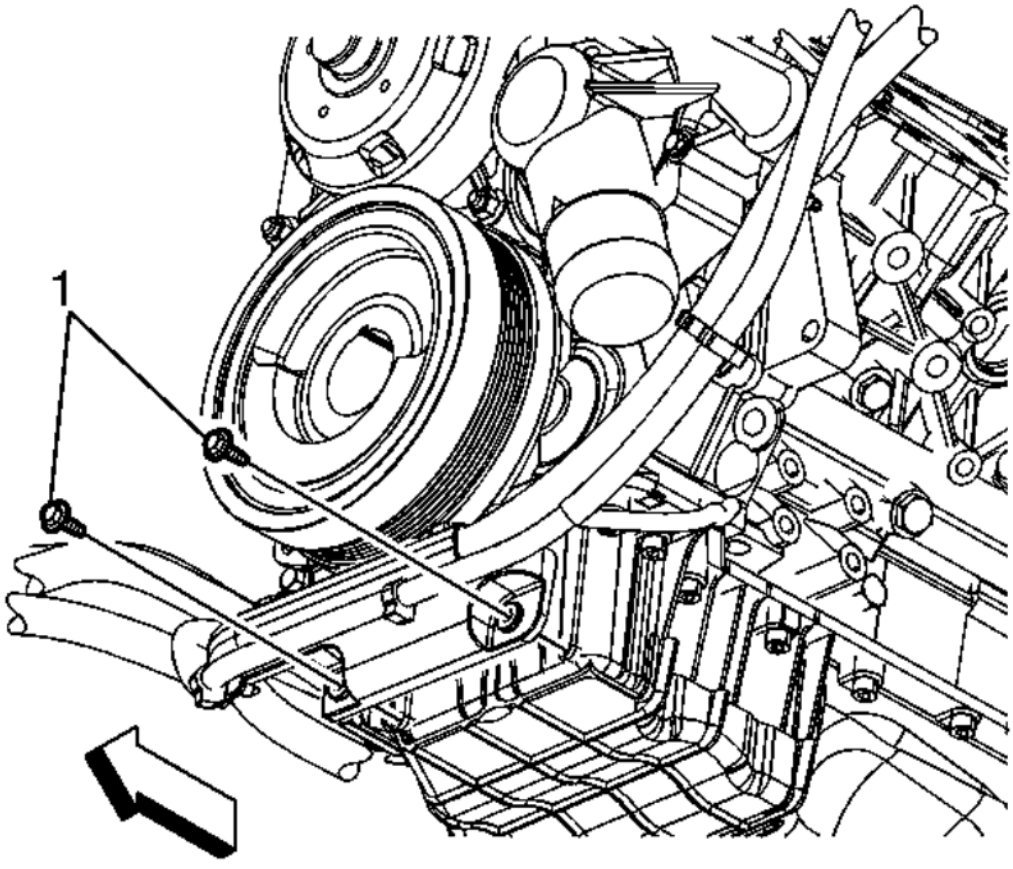


Fig. 162: View Of Starter Solenoid Cable Channel Bolts
Courtesy of GENERAL MOTORS CORP.

28. Remove the starter solenoid cable channel bolts (1).
29. Lower the vehicle.

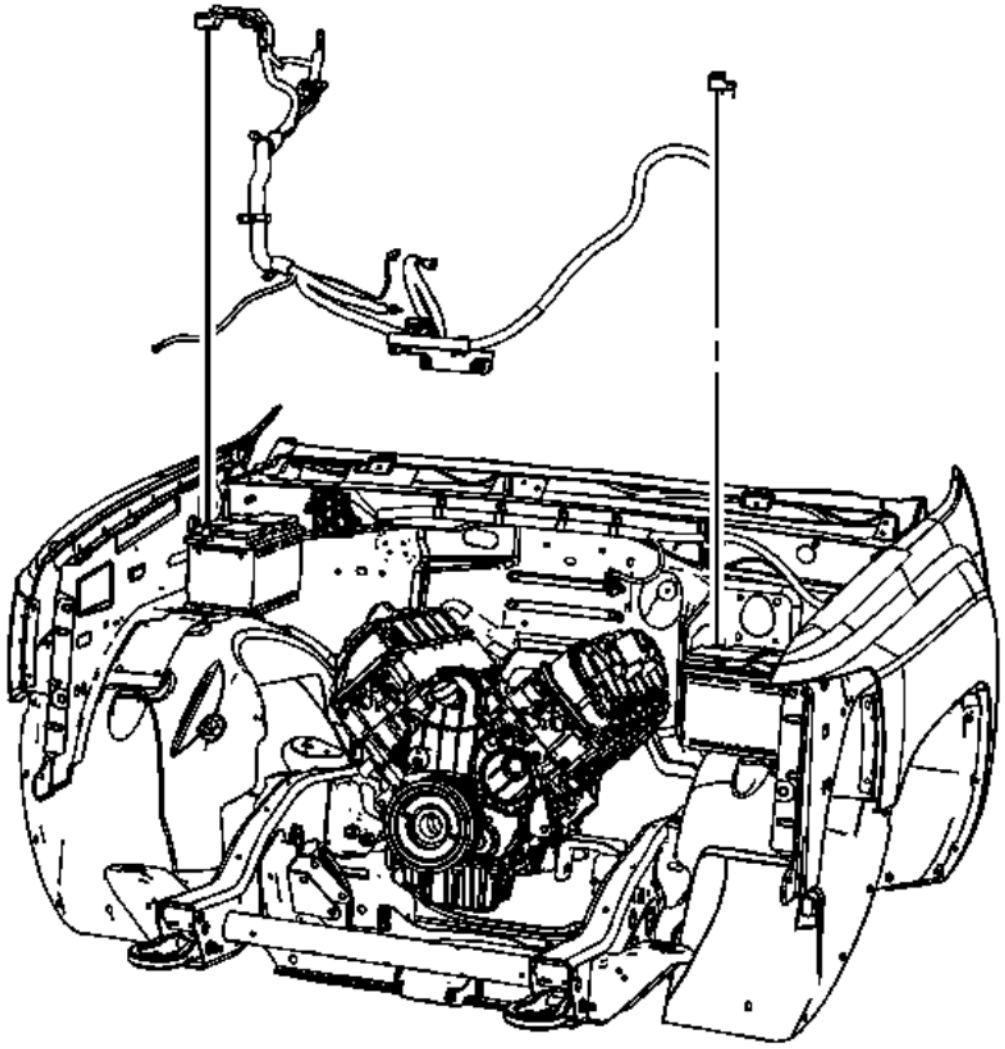


Fig. 163: View Of Starter Solenoid Cable
Courtesy of GENERAL MOTORS CORP.

30. Remove the starter solenoid cable from the vehicle.

Installation Procedure

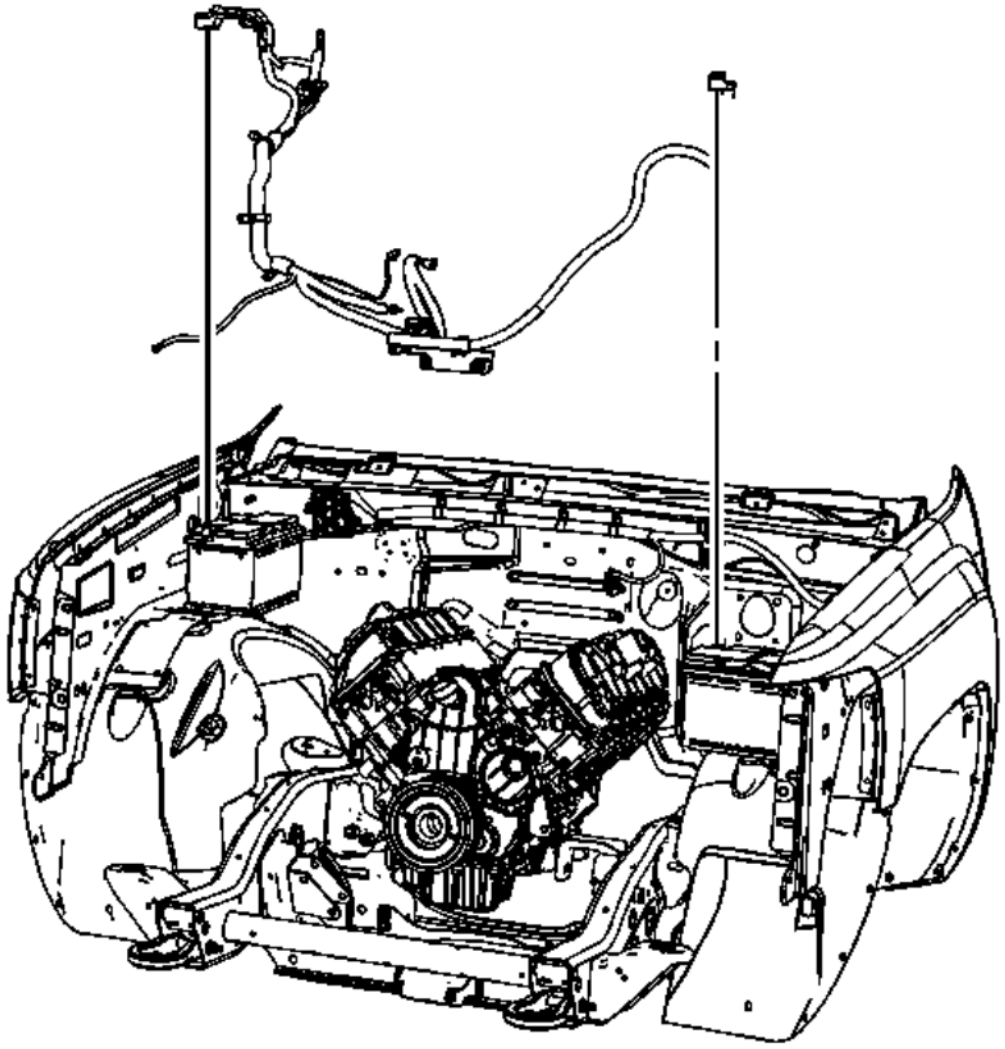


Fig. 164: View Of Starter Solenoid Cable
Courtesy of GENERAL MOTORS CORP.

1. Install the starter solenoid cable to the vehicle.

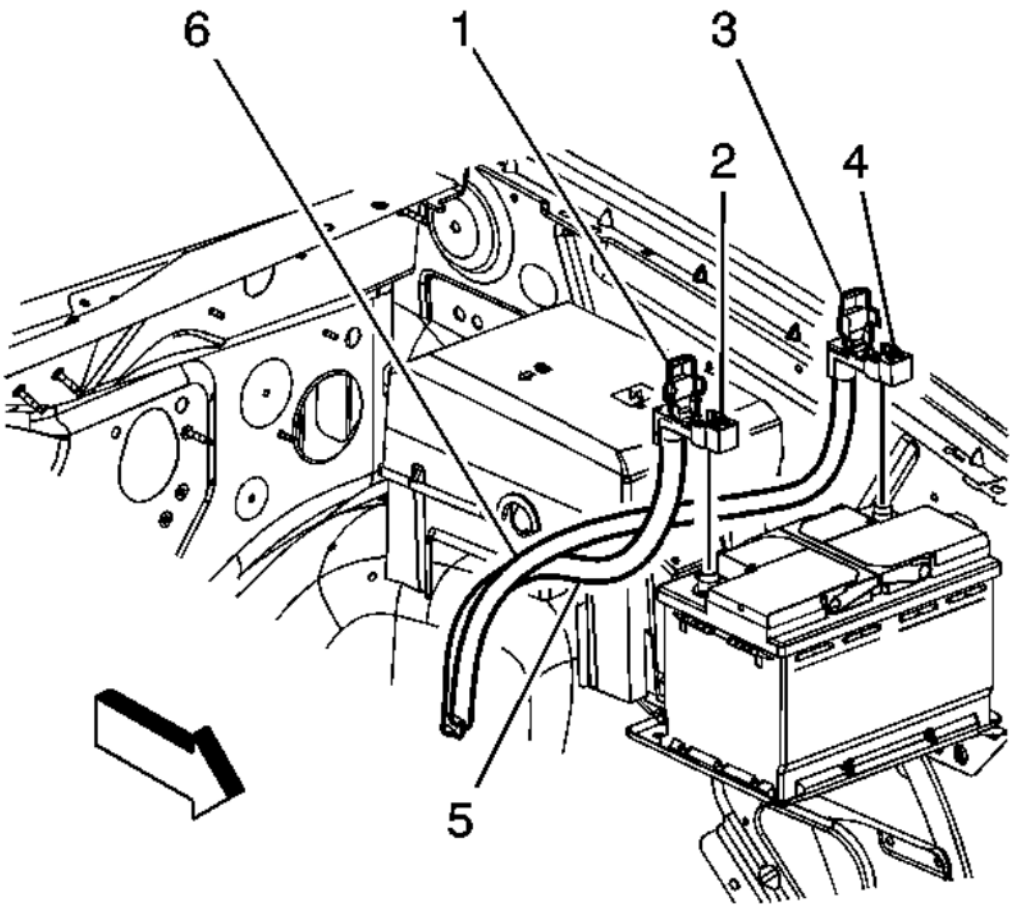


Fig. 165: View Of Battery Components
Courtesy of GENERAL MOTORS CORP.

2. Install the starter solenoid cable (5) to the battery positive post.

NOTE: Refer to Fastener Notice .

3. Tighten the starter solenoid cable nut (2).

Tighten: Tighten the nut to 5 N.m (44 lb in).

4. Close the starter solenoid cable positive battery post cover (1).

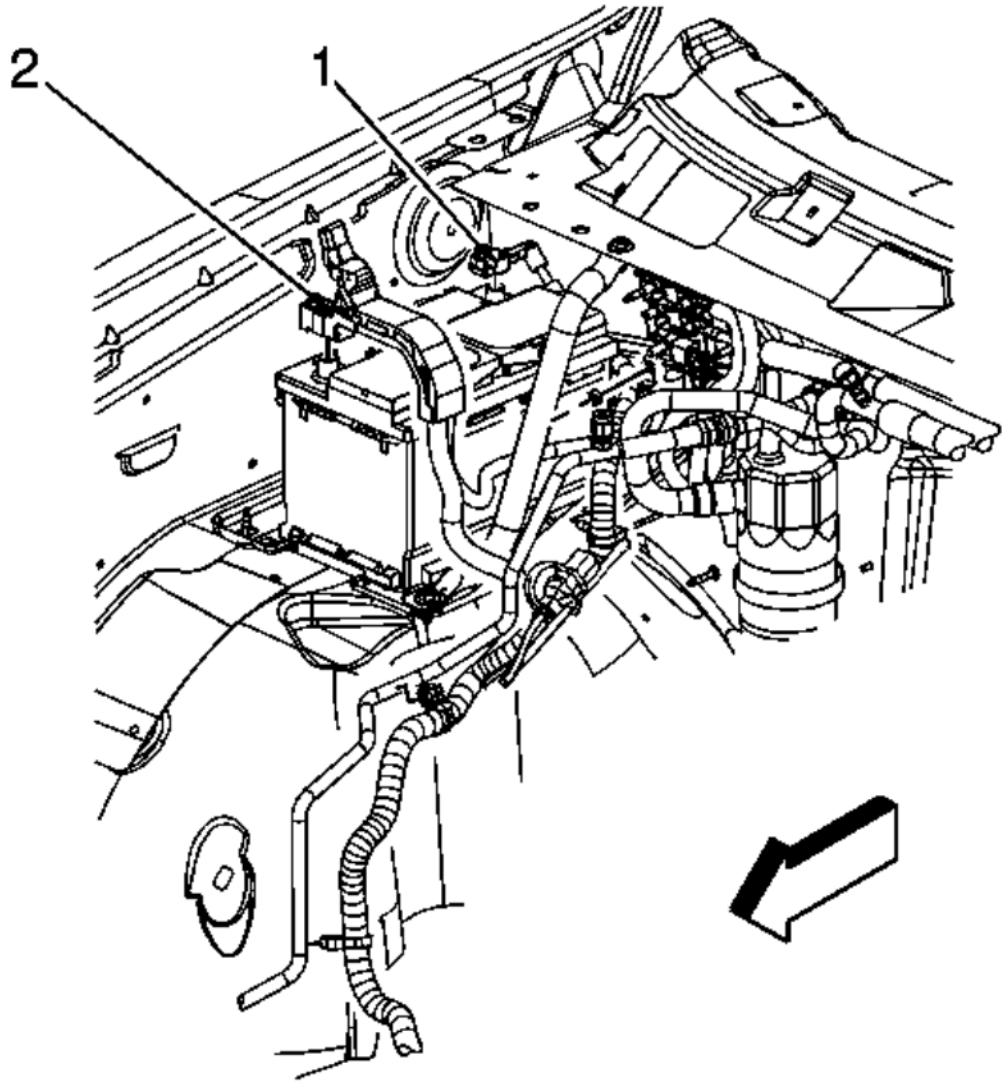


Fig. 166: View Of Negative Battery Cable & Components
Courtesy of GENERAL MOTORS CORP.

5. Install the starter solenoid cable to the battery positive post.
6. Tighten the starter solenoid cable nut (1).

Tighten: Tighten the nut to 7.5 N.m (66 lb in).

7. Close the starter solenoid cable positive battery post cover.
8. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

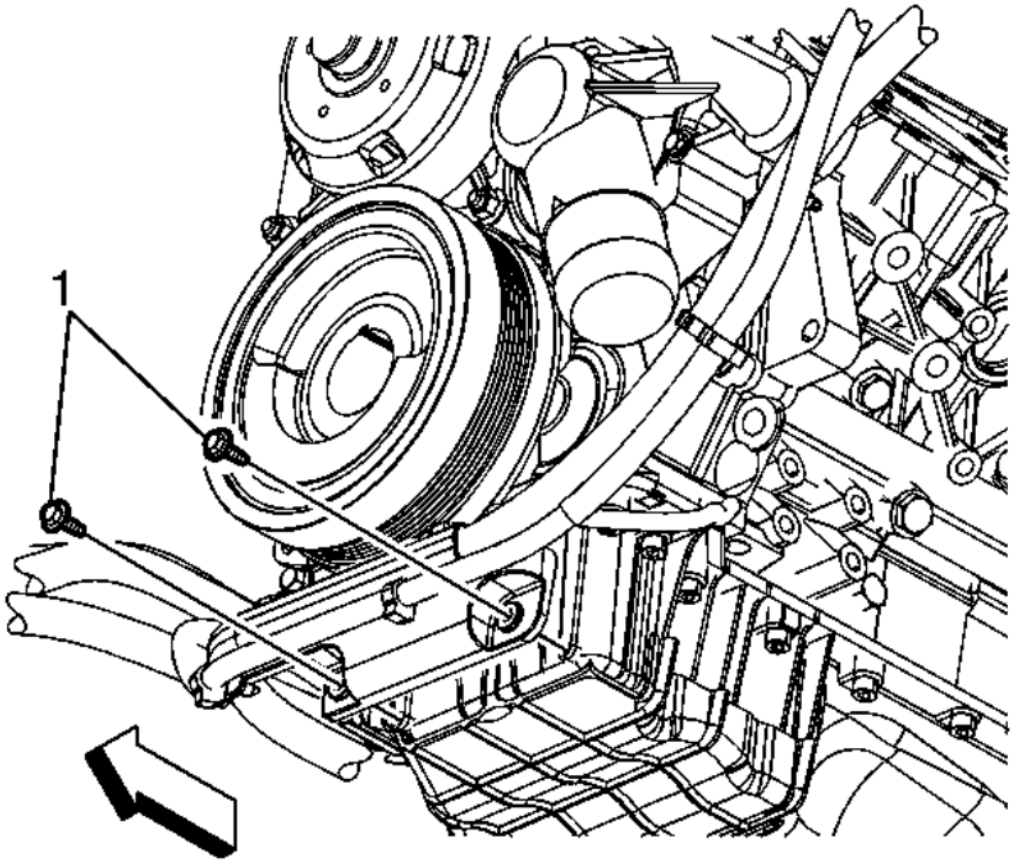


Fig. 167: View Of Starter Solenoid Cable Channel Bolts
Courtesy of GENERAL MOTORS CORP.

9. Position the starter solenoid cable to the oil pan and install the starter solenoid cable channel bolts (1).

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

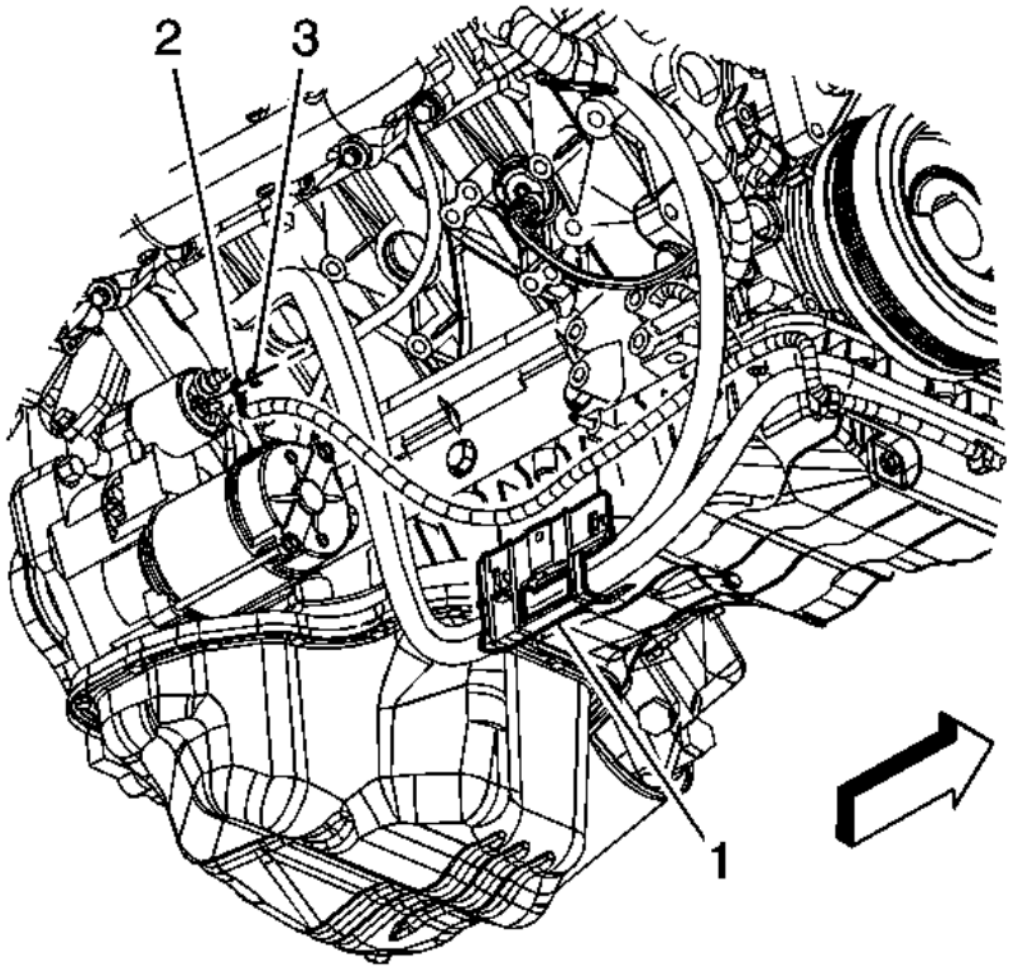


Fig. 168: View Of Starter Solenoid Cable Terminal, Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

10. Reposition the starter solenoid cable bracket (1) and install the engine wiring harness to the clips on the rear of the bracket.

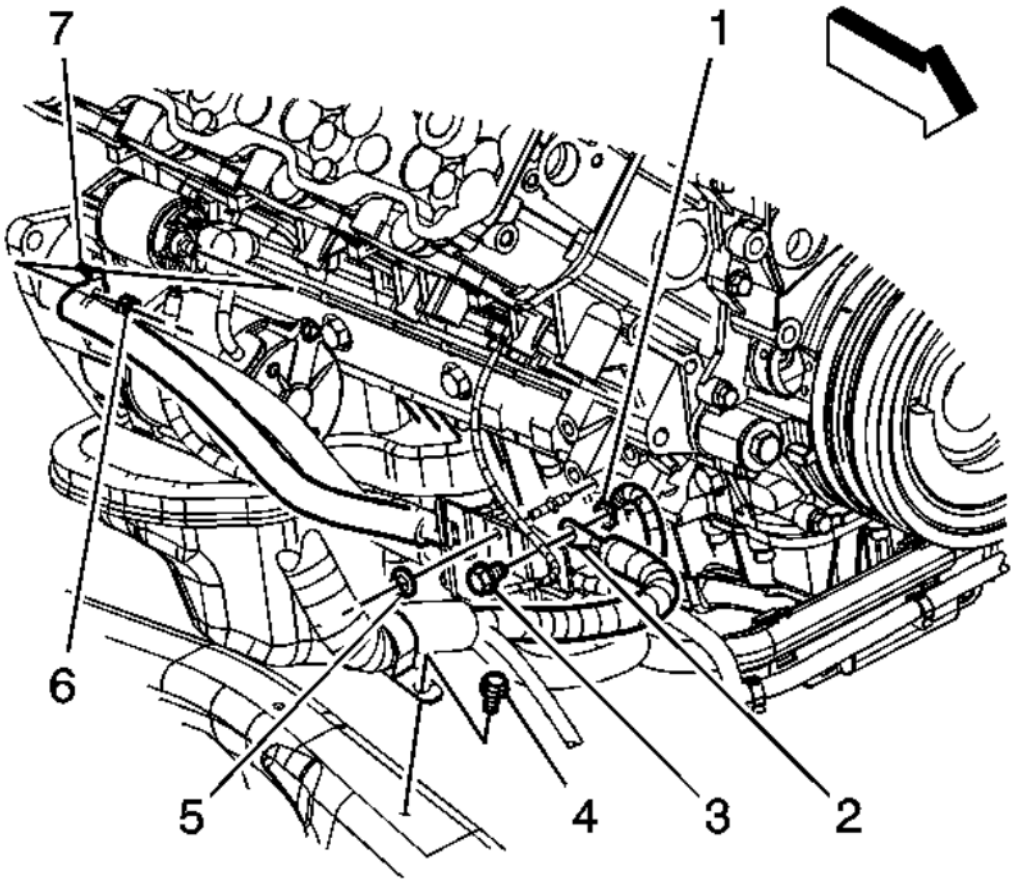


Fig. 169: View Of Starter Solenoid Cable & Components
Courtesy of GENERAL MOTORS CORP.

11. Position the starter solenoid cable clip to the frame and install the bolt (4).

    Tighten: Tighten the bolt to 16 N.m (12 lb ft).

12. Install the starter solenoid cable bracket onto the stud and install the nut (5).

    Tighten: Tighten the nut to 8 N.m (71 lb in)

13. Position the engine wiring harness ground terminal (1) behind the starter solenoid cable terminal (2) and against the engine block.

14. Install the starter solenoid cable bolt (3) to the engine block.

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

15. Install the starter solenoid cable (7) onto the starter.
16. Install the starter solenoid cable nut (6) to the starter.

    Tighten: Tighten the nut to 9 N.m (80 lb in).

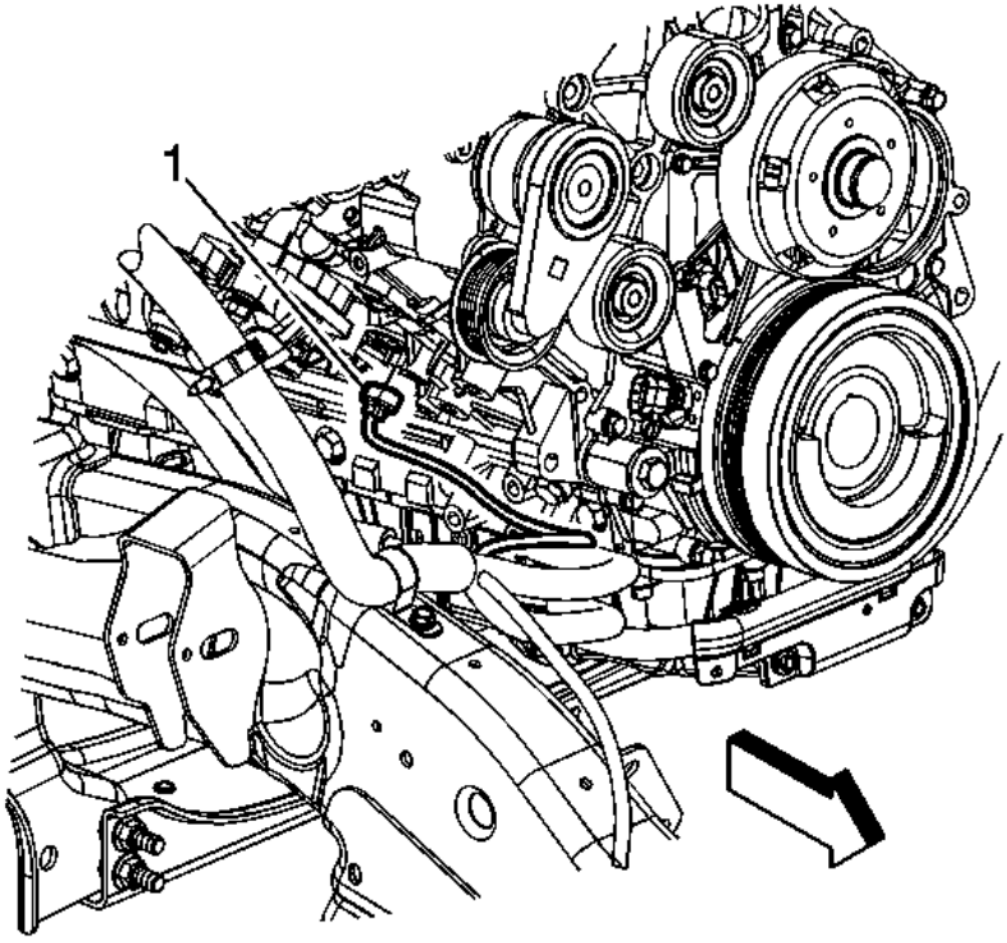


Fig. 170: View Of Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

17. Connect the coolant heater cord (1) to the coolant heater.

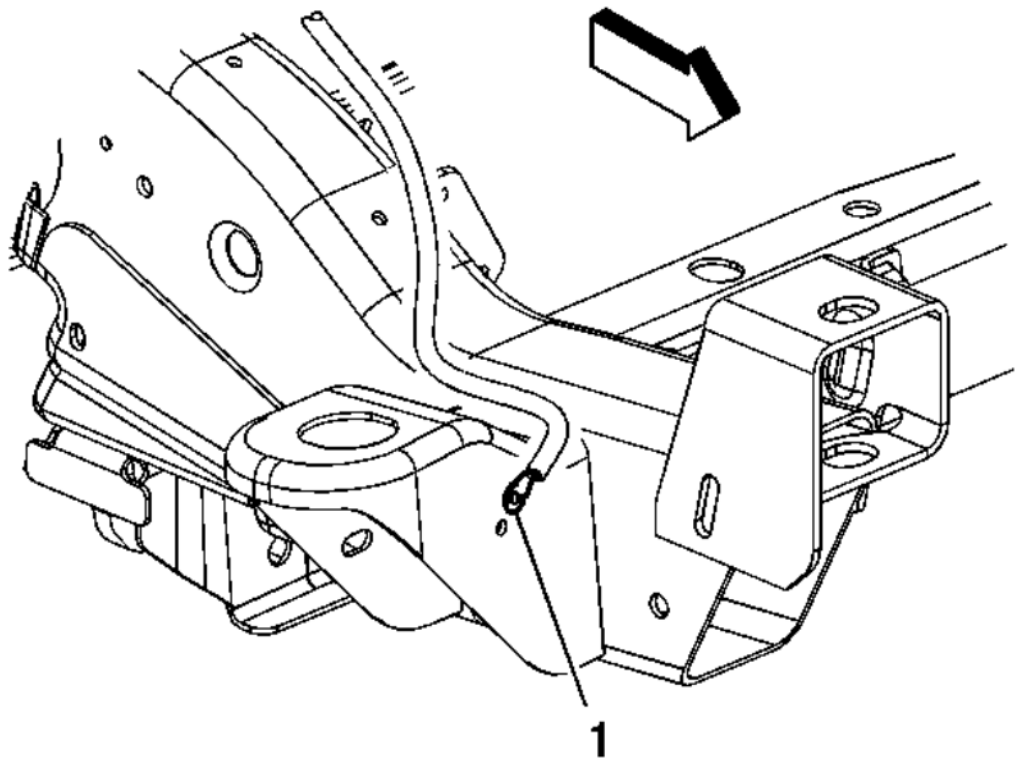


Fig. 171: View Of Starter Solenoid Cable At Frame
Courtesy of GENERAL MOTORS CORP.

18. Position the starter solenoid cable (1) to the frame.
19. Install the starter solenoid cable bolt to the frame.

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

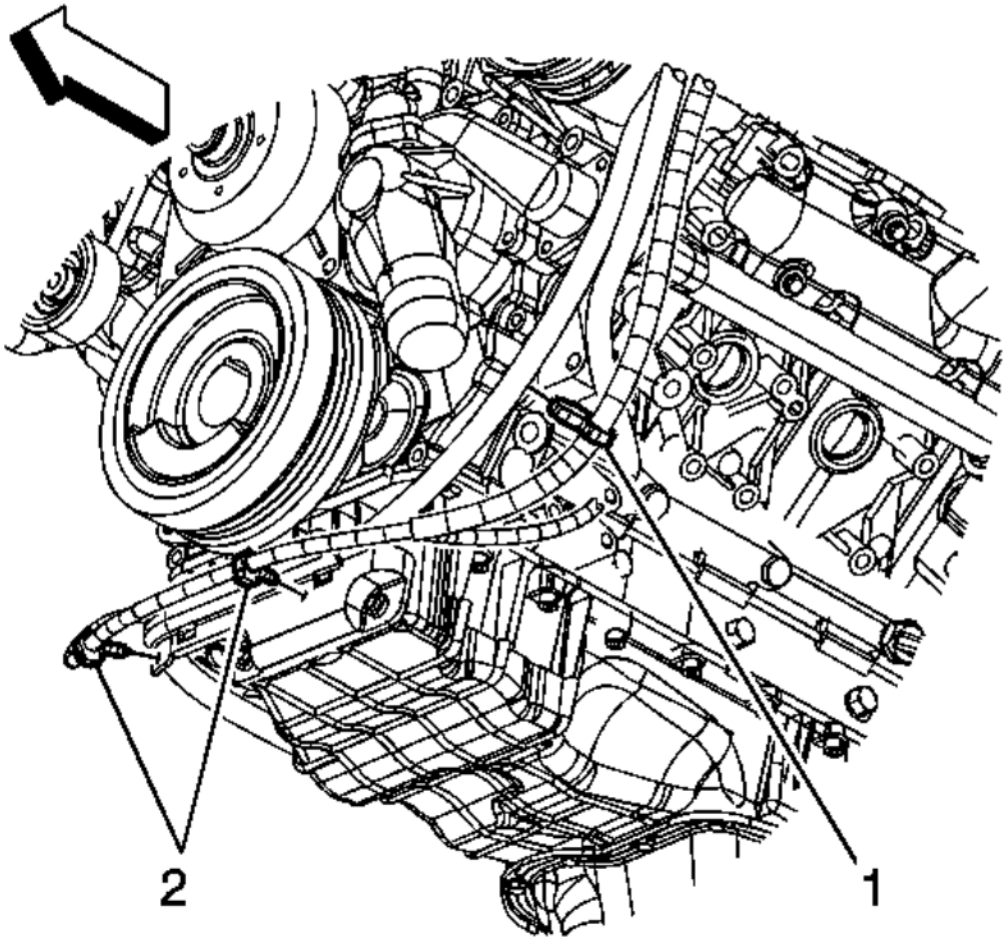


Fig. 172: View Of Engine Wiring Harness Clips
Courtesy of GENERAL MOTORS CORP.

20. Install the engine wiring harness clip (1) to the starter solenoid cable.
21. Install the engine wiring harness clips (2) to the starter solenoid cable channel.

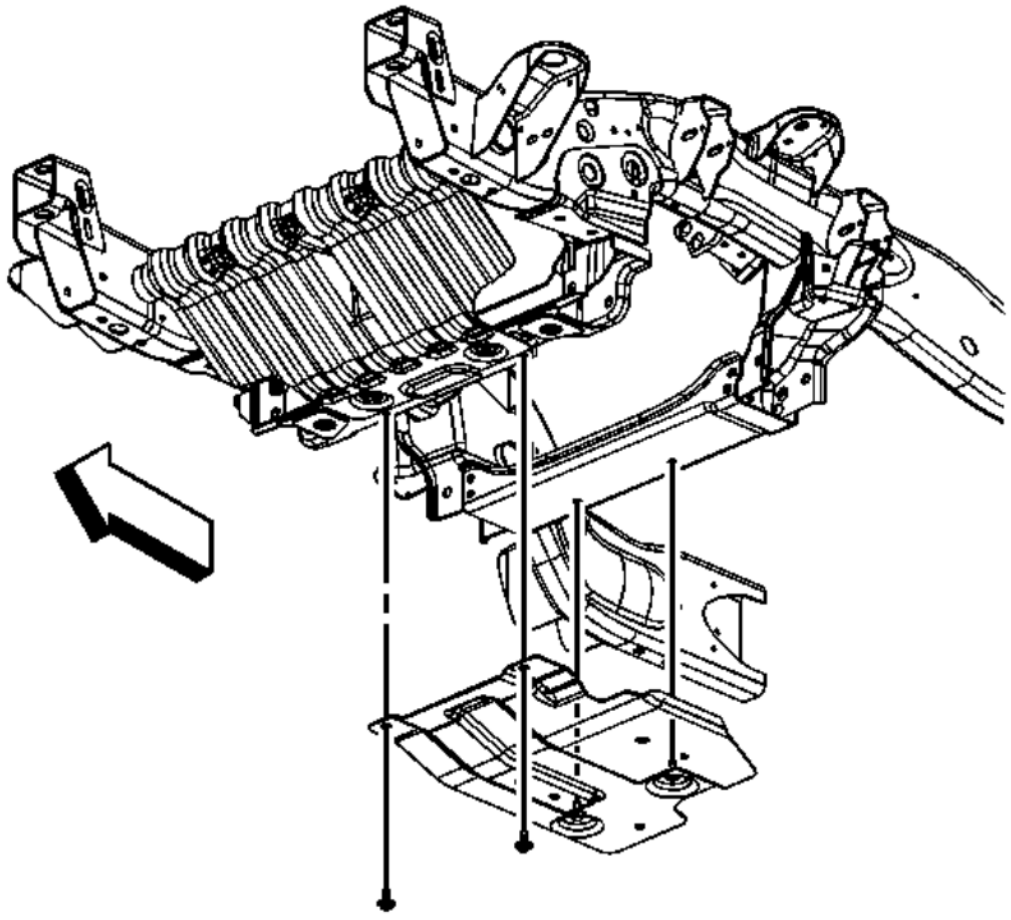


Fig. 173: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

22. Install the oil pan skid plate and tighten the rear 2 bolts and install and tighten the front 2 bolts.

    Tighten: Tighten the bolts to 28 N.m (21 lb ft).

23. Install the wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement - Right Side (GMC)** or **Front Wheelhouse Liner Replacement - Right Side (Chevrolet)** .

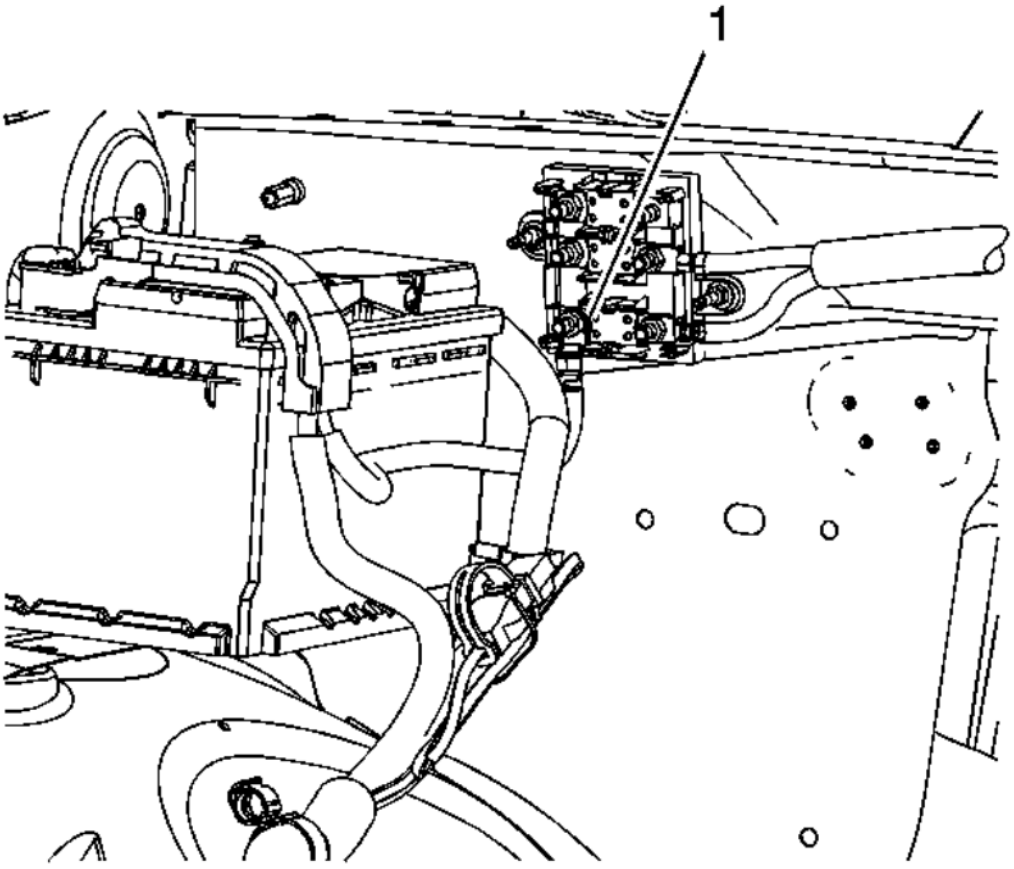


Fig. 174: View Of Mega Fuse Nut
Courtesy of GENERAL MOTORS CORP.

24. Install the starter solenoid cable branch terminal to the mega fuse stud.
25. Install the starter solenoid cable to mega fuse nut (1).

Tighten: Tighten the nut to 9 N.m (80 lb in).

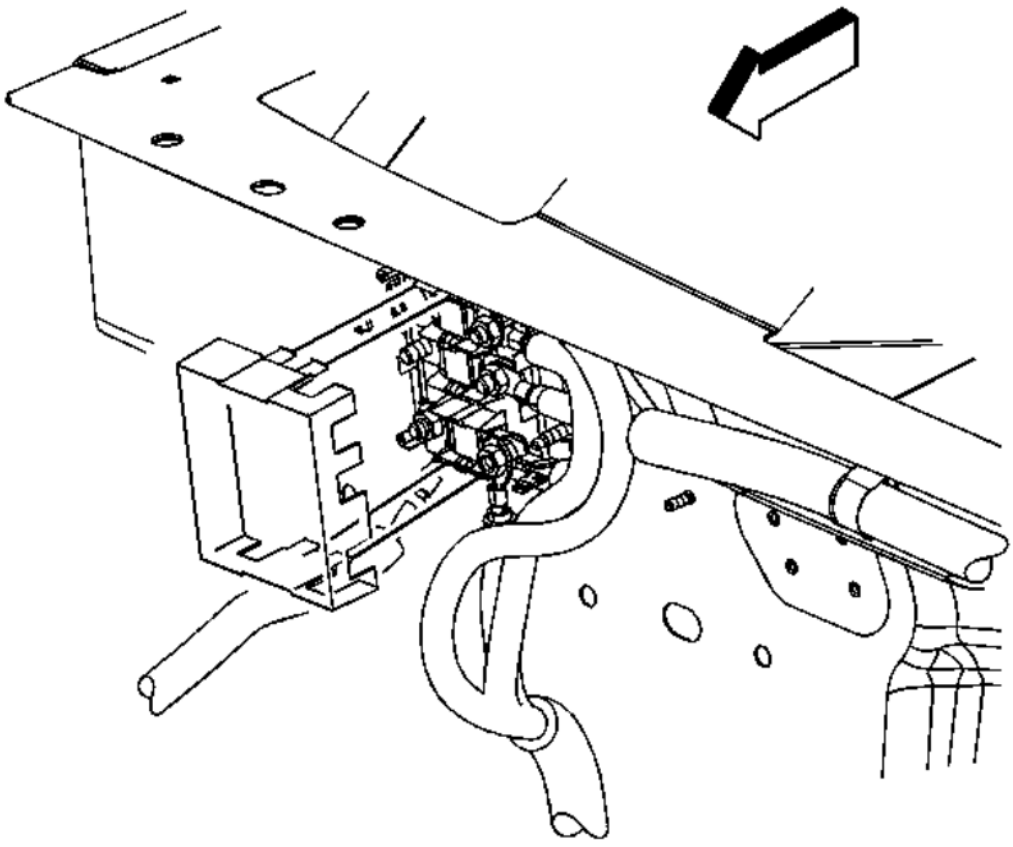


Fig. 175: View Of Mega Fuse Cover
Courtesy of GENERAL MOTORS CORP.

26. Install the mega fuse cover.

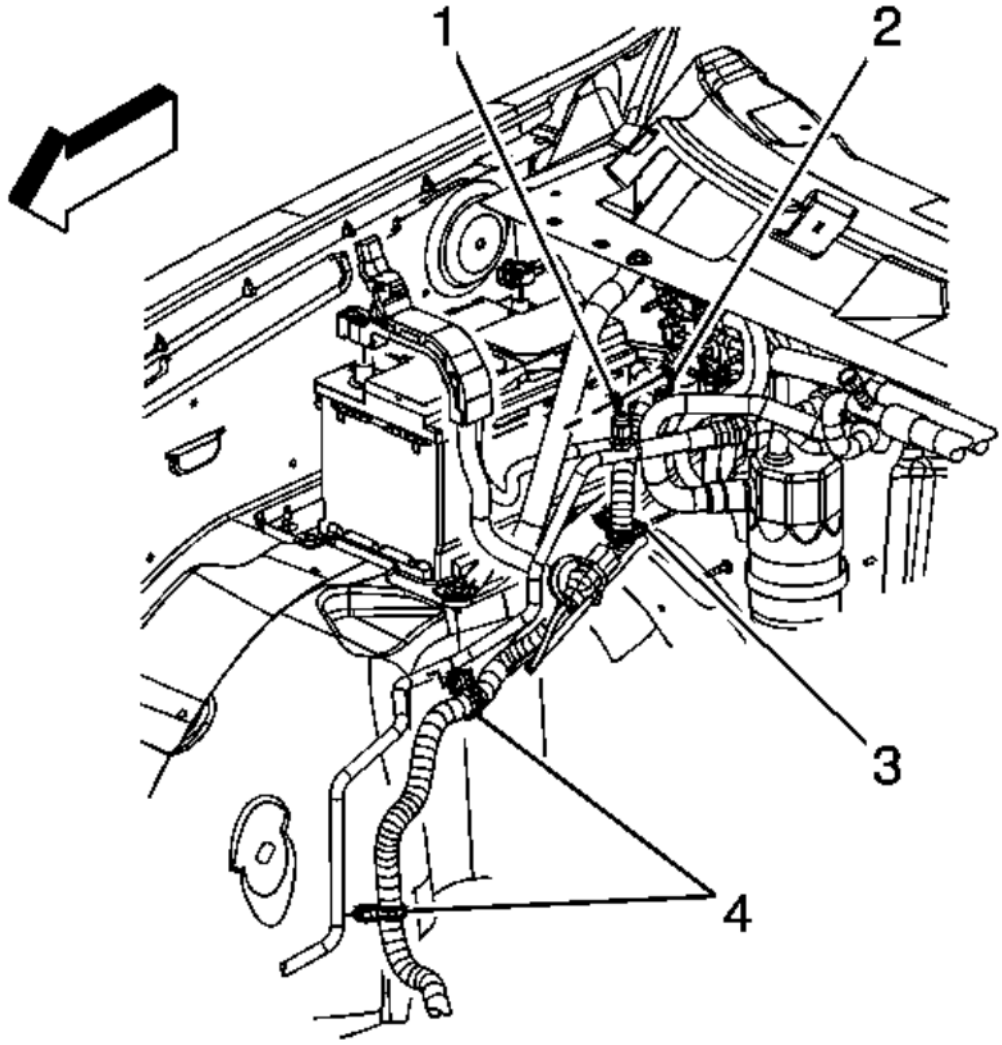


Fig. 176: View Of Starter Solenoid Cable Clips
Courtesy of GENERAL MOTORS CORP.

27. Install the starter solenoid cable clip (3) to the battery tray.
28. Install the starter solenoid cable clips (4) to the A/C evaporator tube.
29. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** .
30. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and**

Connection (w/Auxiliary Battery) or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

STARTER SOLENOID CABLE REPLACEMENT (6.2L W/AUXILIARY BATTERY)

Removal Procedure

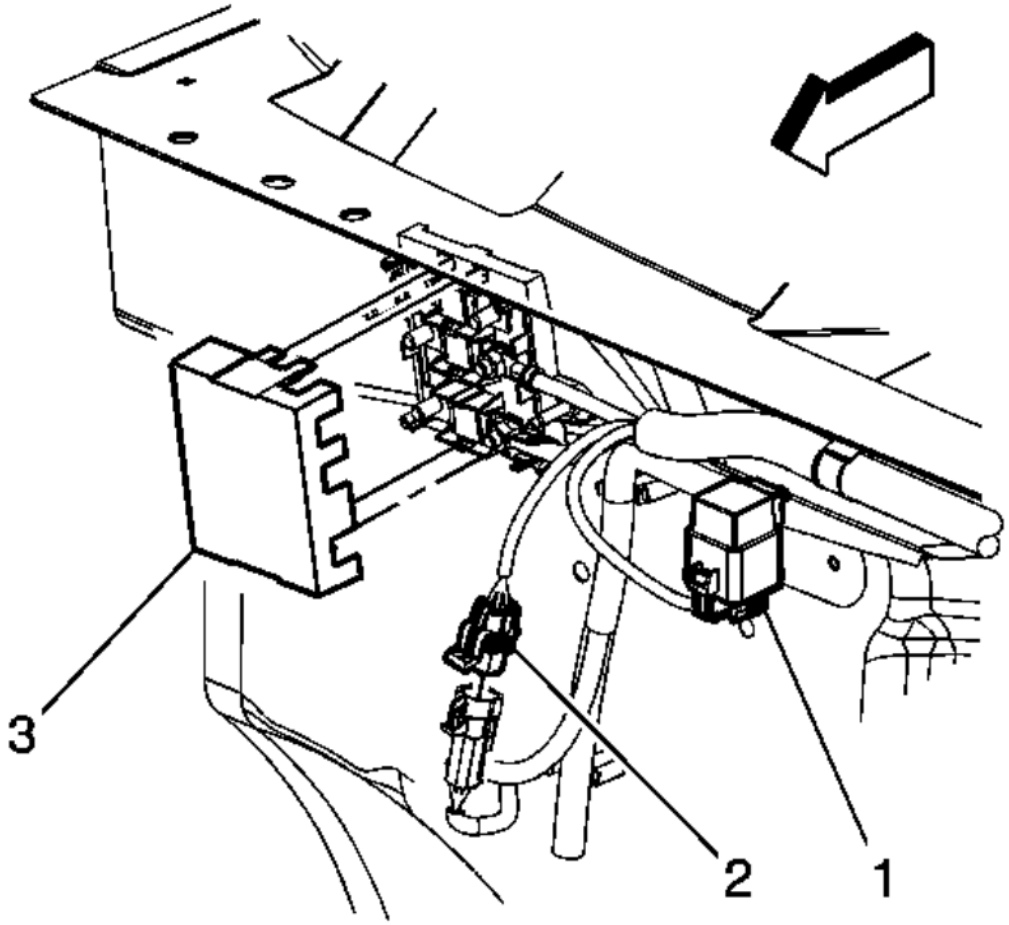


Fig. 177: View Of Fuse Cover & Connectors
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the auxiliary battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable**

Disconnection and Connection (w/Auxiliary Battery) or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

2. Remove the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
3. Remove the mega fuse cover (3).

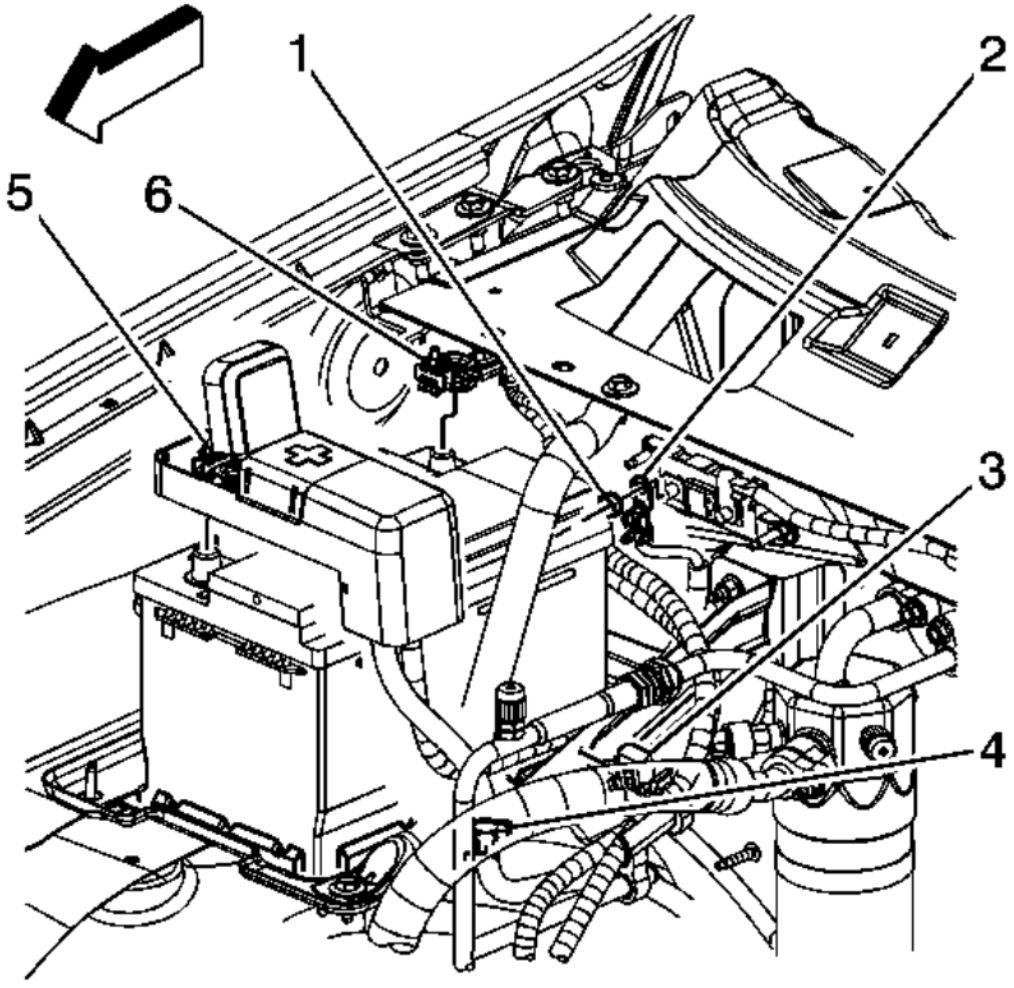


Fig. 178: View Of Battery Cable Components
Courtesy of GENERAL MOTORS CORP.

4. Open the starter solenoid cable cover at the positive battery terminal.

5. Loosen the starter solenoid cable nut (5).
6. Remove the starter solenoid cable from the positive battery terminal.
7. Remove the starter solenoid cable clip (4) from the air conditioning (A/C) evaporator tube.

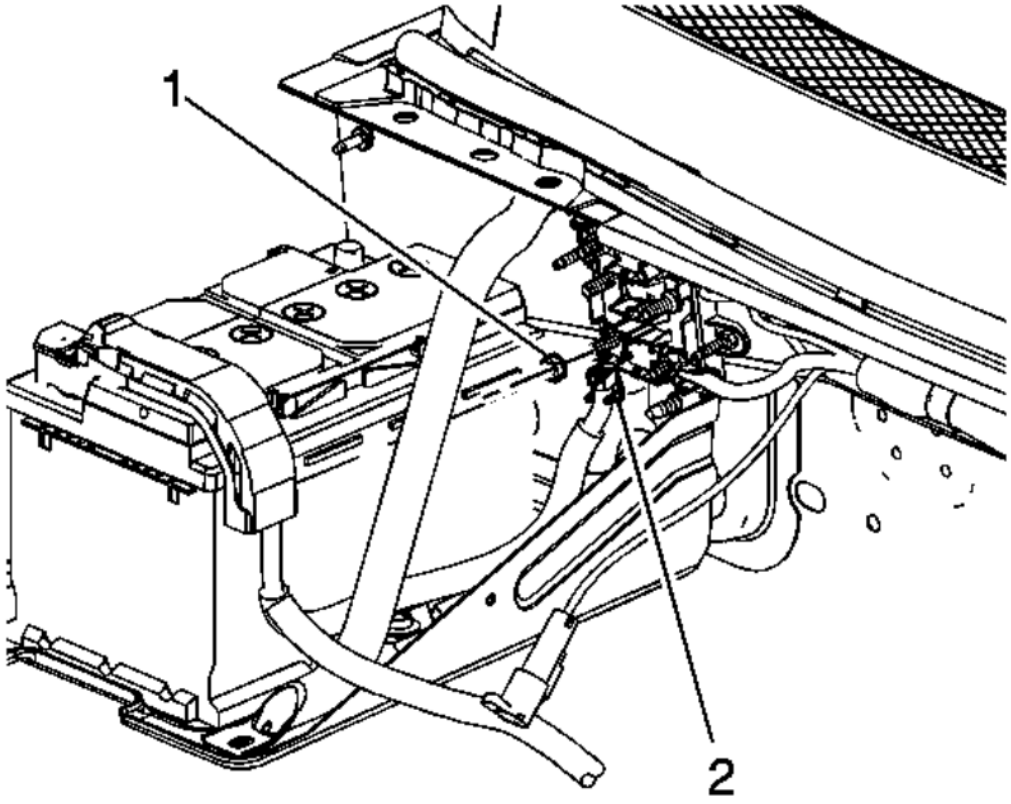


Fig. 179: View Of Solenoid Cable Terminal & Nut
Courtesy of GENERAL MOTORS CORP.

8. Remove the starter solenoid cable nut (1) from the mega fuse stud.
9. Remove the starter solenoid cable terminal (2) from the mega fuse stud.

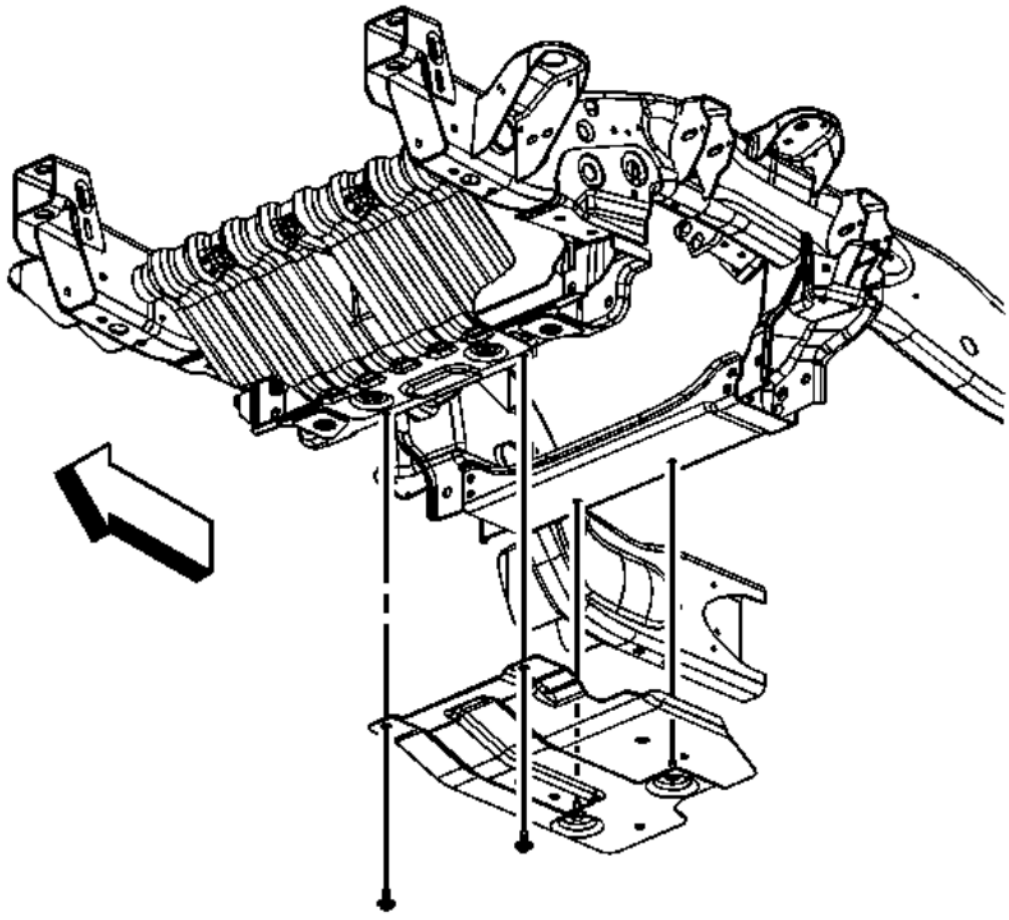


Fig. 180: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

10. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
11. Remove the front 2 oil pan skid plate bolts, loosen the rear 2 bolts and remove the skid plate.

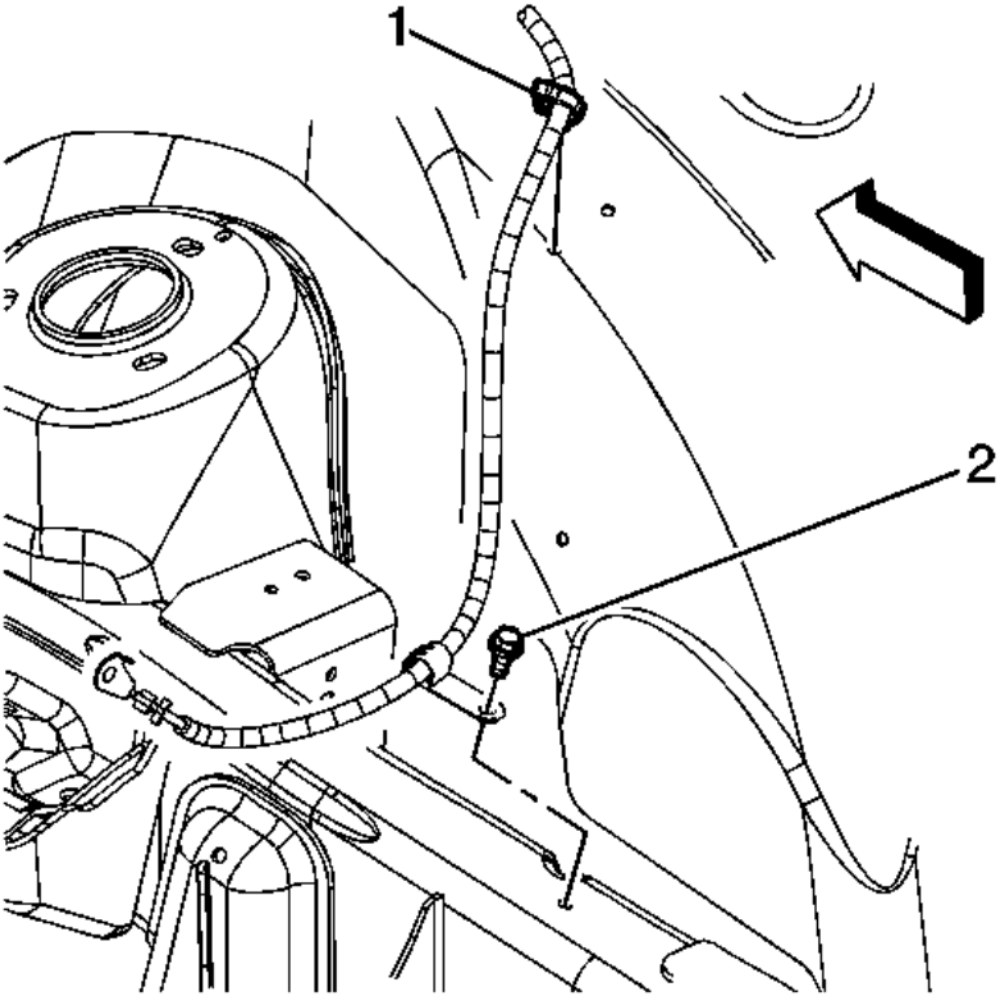


Fig. 181: View Of Starter Solenoid Cable Clip & Bolt
Courtesy of GENERAL MOTORS CORP.

12. Remove the starter solenoid cable clip (1) from the wheelhouse panel.
13. Remove the starter solenoid cable clip bolt (2) from the frame.

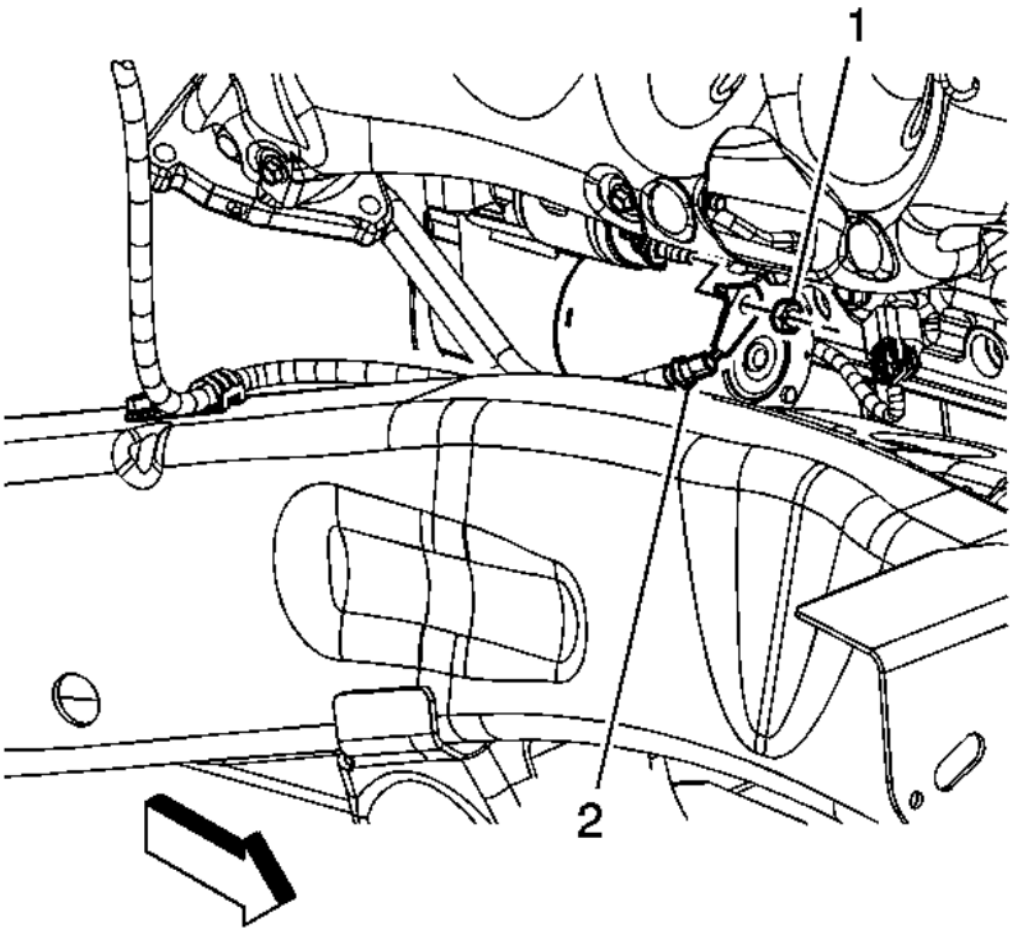


Fig. 182: View Of Starter Solenoid Cable & Nut
Courtesy of GENERAL MOTORS CORP.

14. Remove the starter solenoid cable nut (1) from the starter.
15. Remove the starter solenoid cable (2) from the starter.
16. Lower the vehicle.

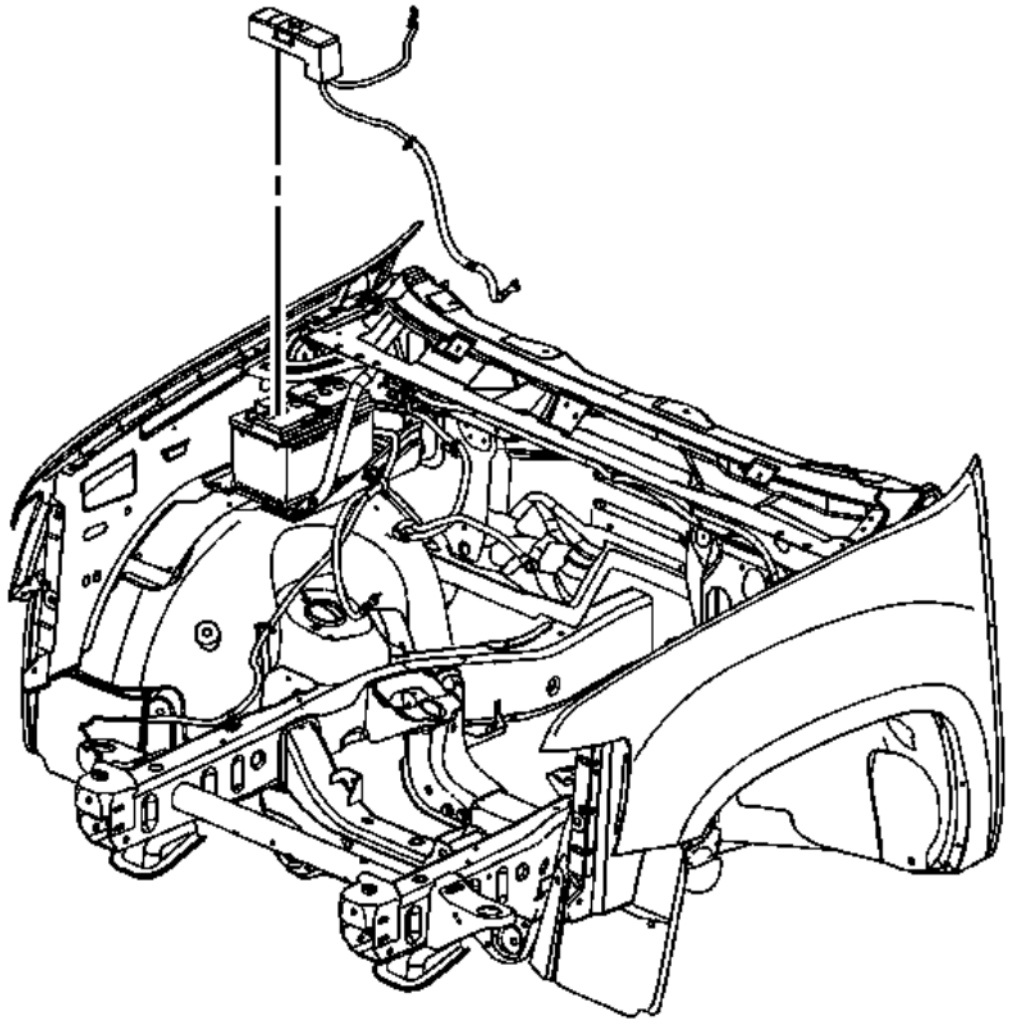


Fig. 183: View Of Starter Solenoid Cable
Courtesy of GENERAL MOTORS CORP.

17. Remove the starter solenoid cable from the vehicle.

Installation Procedure

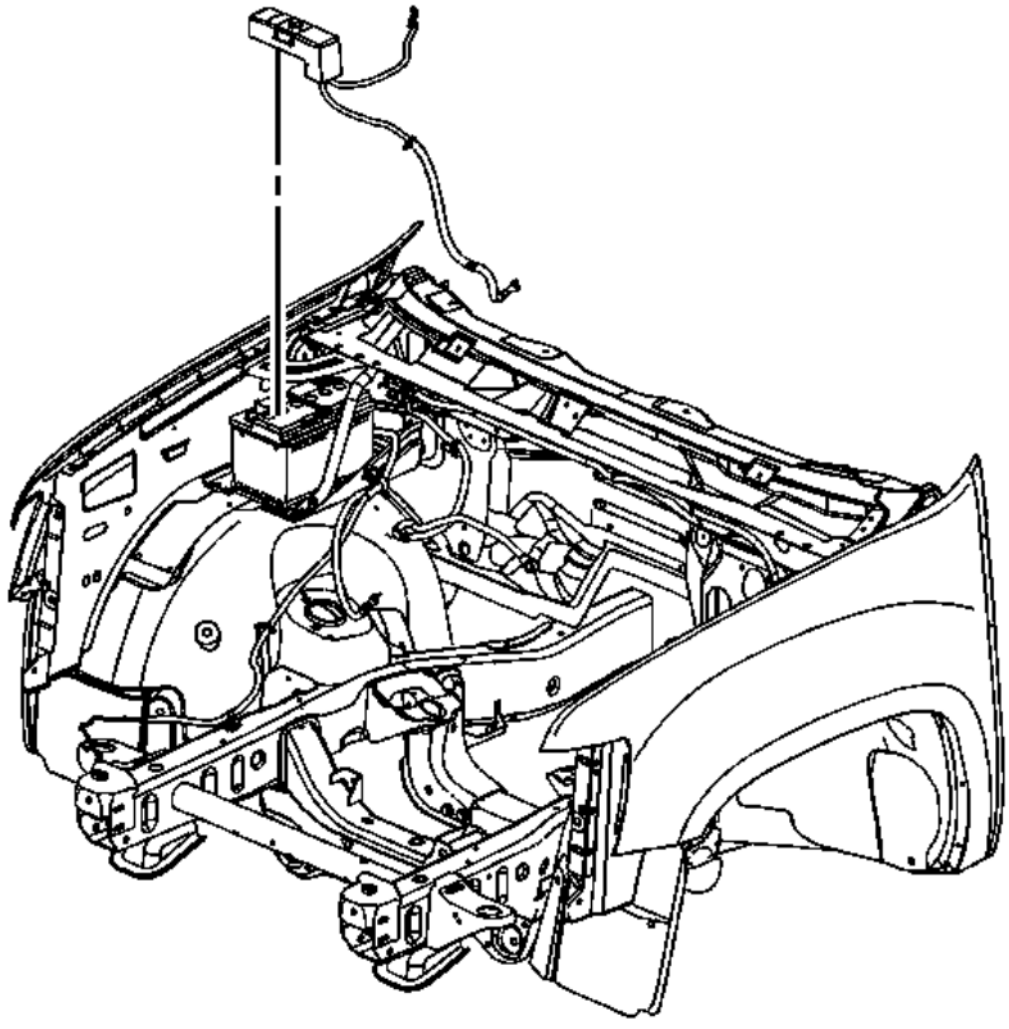


Fig. 184: View Of Starter Solenoid Cable
Courtesy of GENERAL MOTORS CORP.

1. Install the starter solenoid cable to the vehicle.

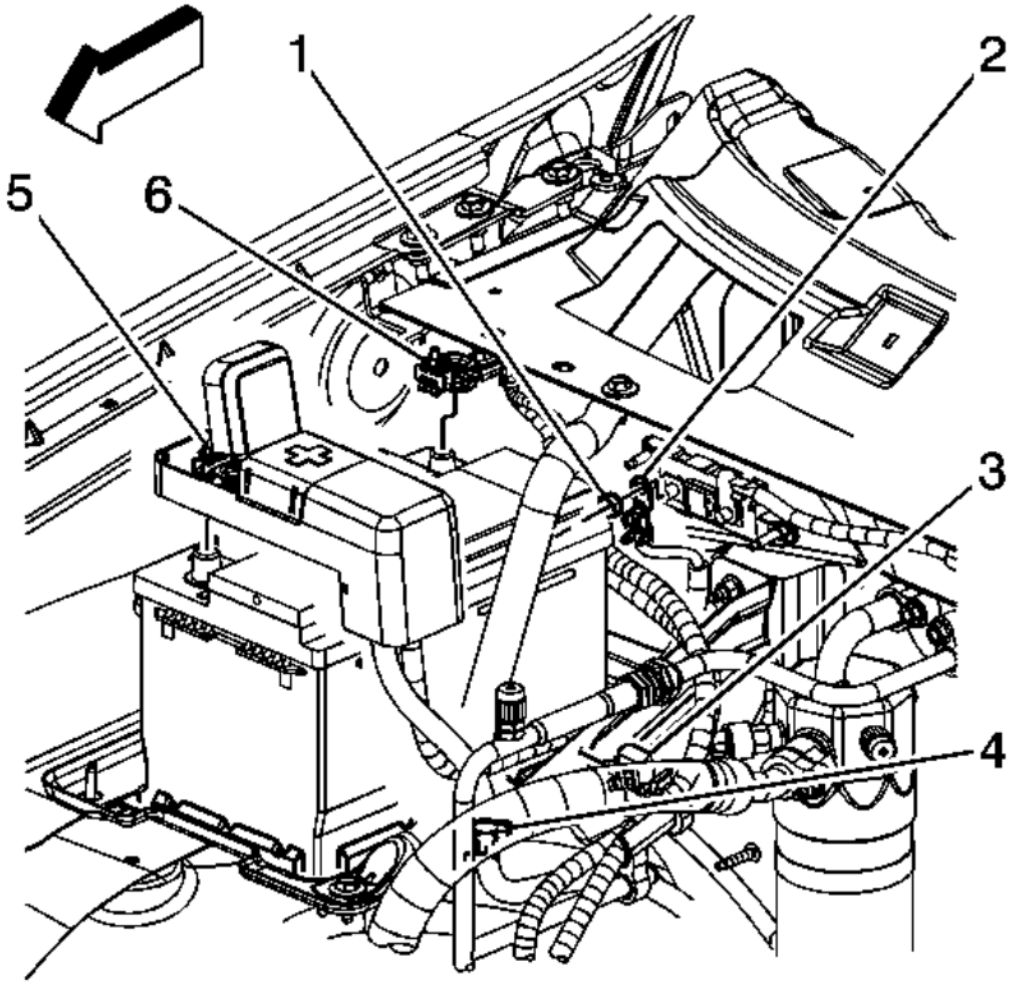


Fig. 185: View Of Battery Cable Components
Courtesy of GENERAL MOTORS CORP.

2. Install the starter solenoid cable to the positive battery terminal.

NOTE: Refer to Fastener Notice .

3. Tighten the starter solenoid cable nut (5).

Tighten: Tighten the nut to 5 N.m (44 lb in).

4. Close the starter solenoid cable cover at the positive battery terminal.
5. Install the starter solenoid cable clip (4) to the A/C evaporator tube.

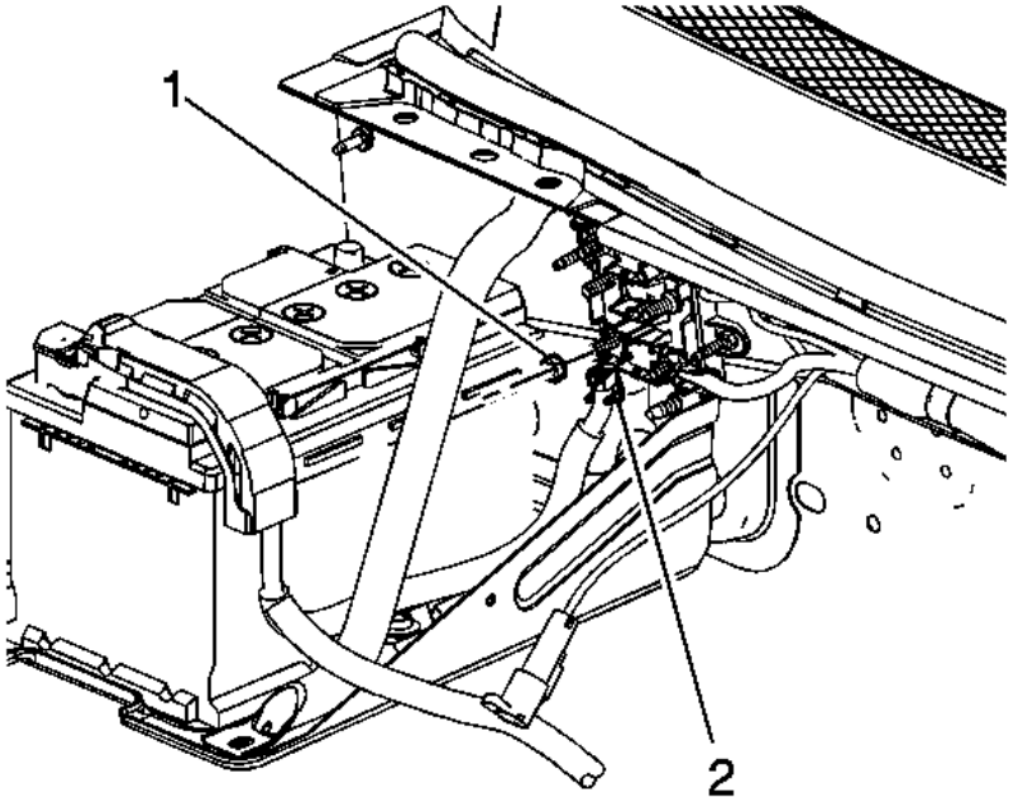


Fig. 186: View Of Solenoid Cable Terminal & Nut
Courtesy of GENERAL MOTORS CORP.

6. Install the starter solenoid cable terminal (2) to the mega fuse stud.
7. Install the starter solenoid cable nut (1) to the mega fuse stud.

Tighten: Tighten the nut to 9 N.m (80 lb in).

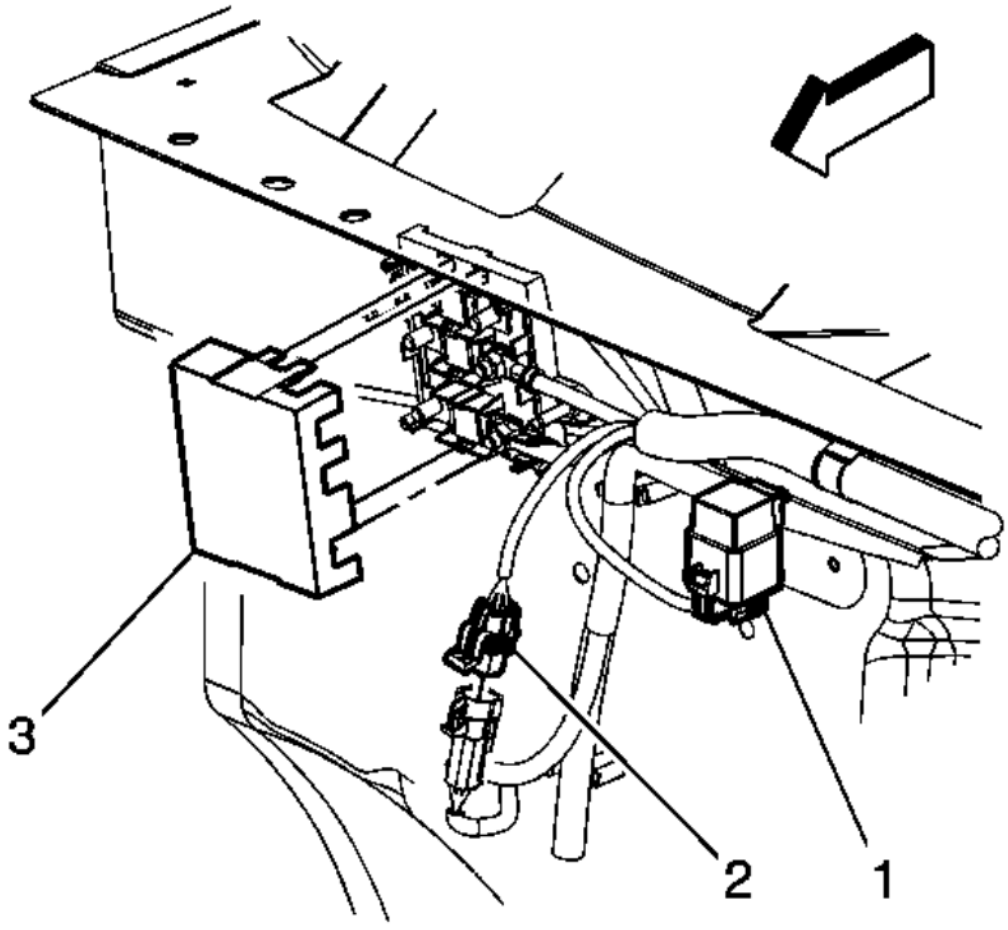


Fig. 187: View Of Fuse Cover & Connectors
Courtesy of GENERAL MOTORS CORP.

8. Install the mega fuse cover (3).
9. Raise the vehicle.

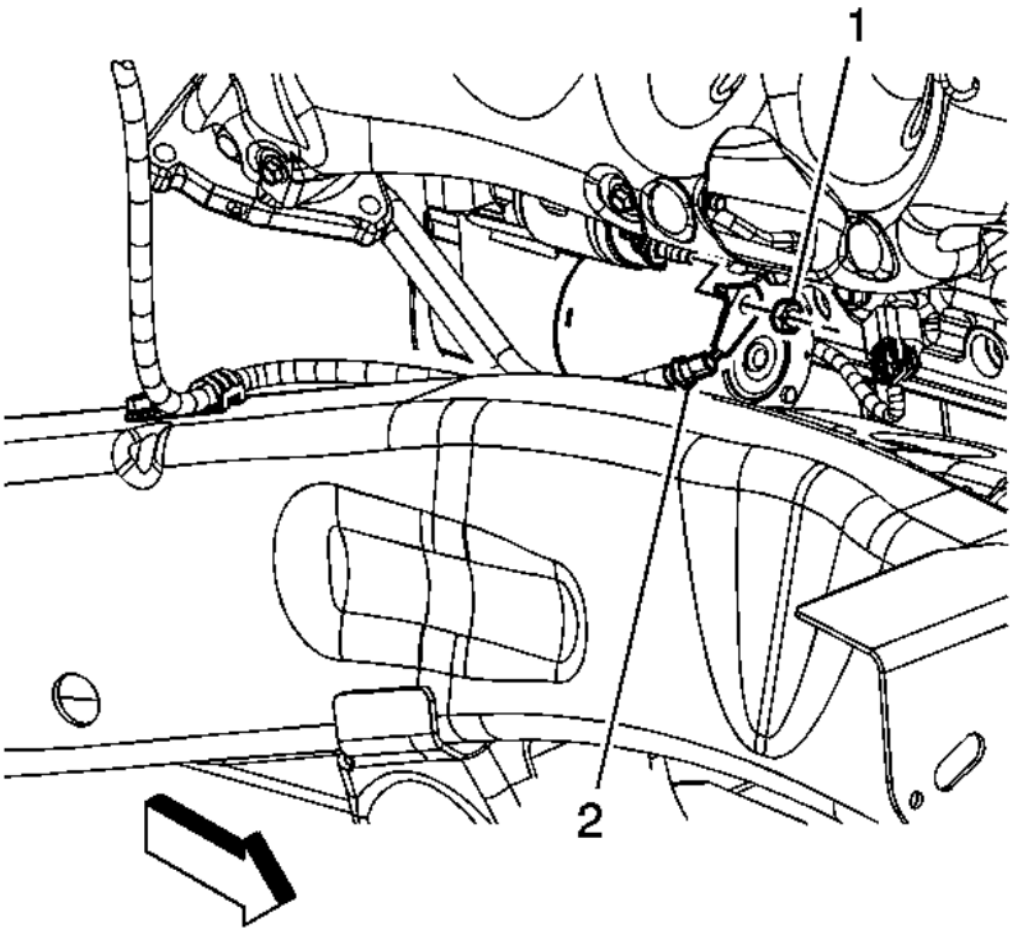


Fig. 188: View Of Starter Solenoid Cable & Nut
Courtesy of GENERAL MOTORS CORP.

10. Install the starter solenoid cable (2) to the starter.
11. Install the starter solenoid cable nut (1) to the starter.

Tighten: Tighten the nut to 9 N.m (80 lb in).

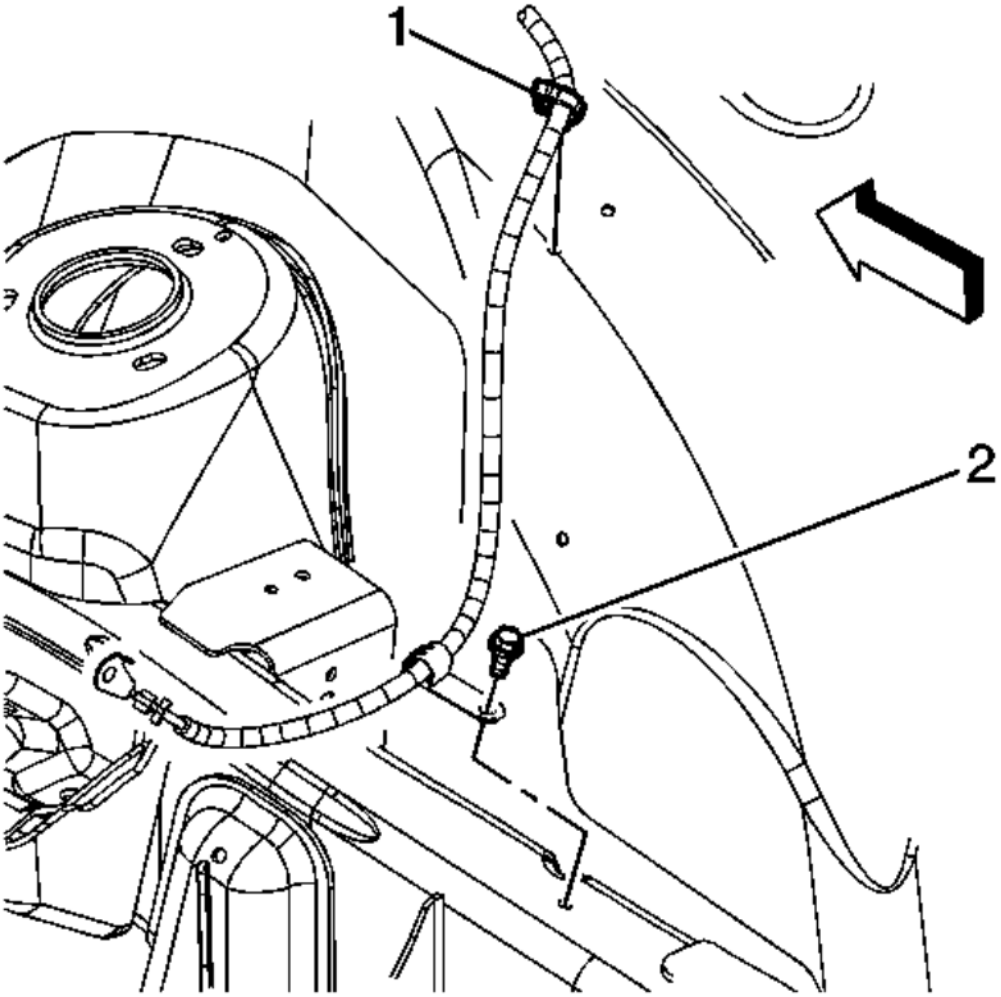


Fig. 189: View Of Starter Solenoid Cable Clip & Bolt
Courtesy of GENERAL MOTORS CORP.

12. Position the starter solenoid cable clip to the frame and install the starter solenoid cable clip bolt (2).
13. Install the starter solenoid cable clip (1) to the wheelhouse panel.

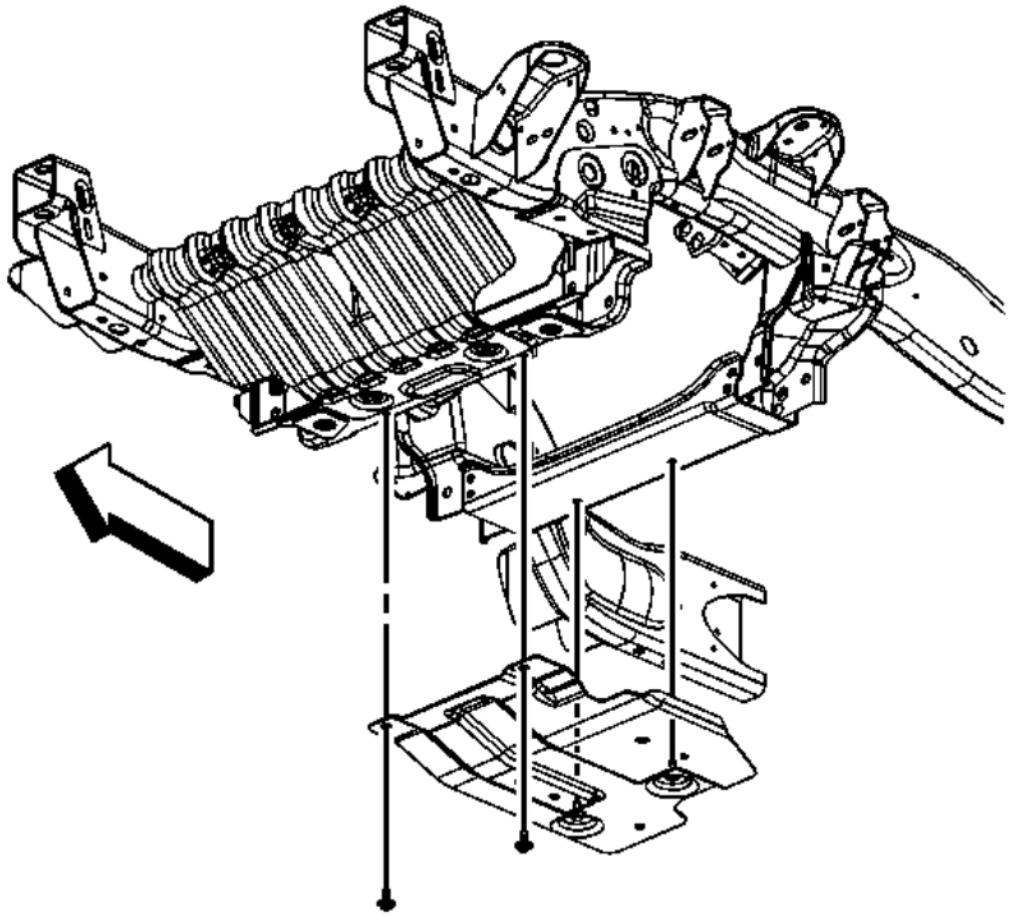


Fig. 190: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

14. Install the oil pan skid plate and tighten the rear 2 bolts and install and tighten the front 2 bolts.

    Tighten: Tighten the bolts to 28 N.m (21 lb ft).

15. Lower the vehicle.
16. Install the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
17. Connect the auxiliary battery negative cable. Refer to **Battery Negative Cable**

Disconnection and Connection (w/Single Battery) or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

BATTERY REPLACEMENT

Removal Procedure

CAUTION: Refer to Battery Disconnect Caution.

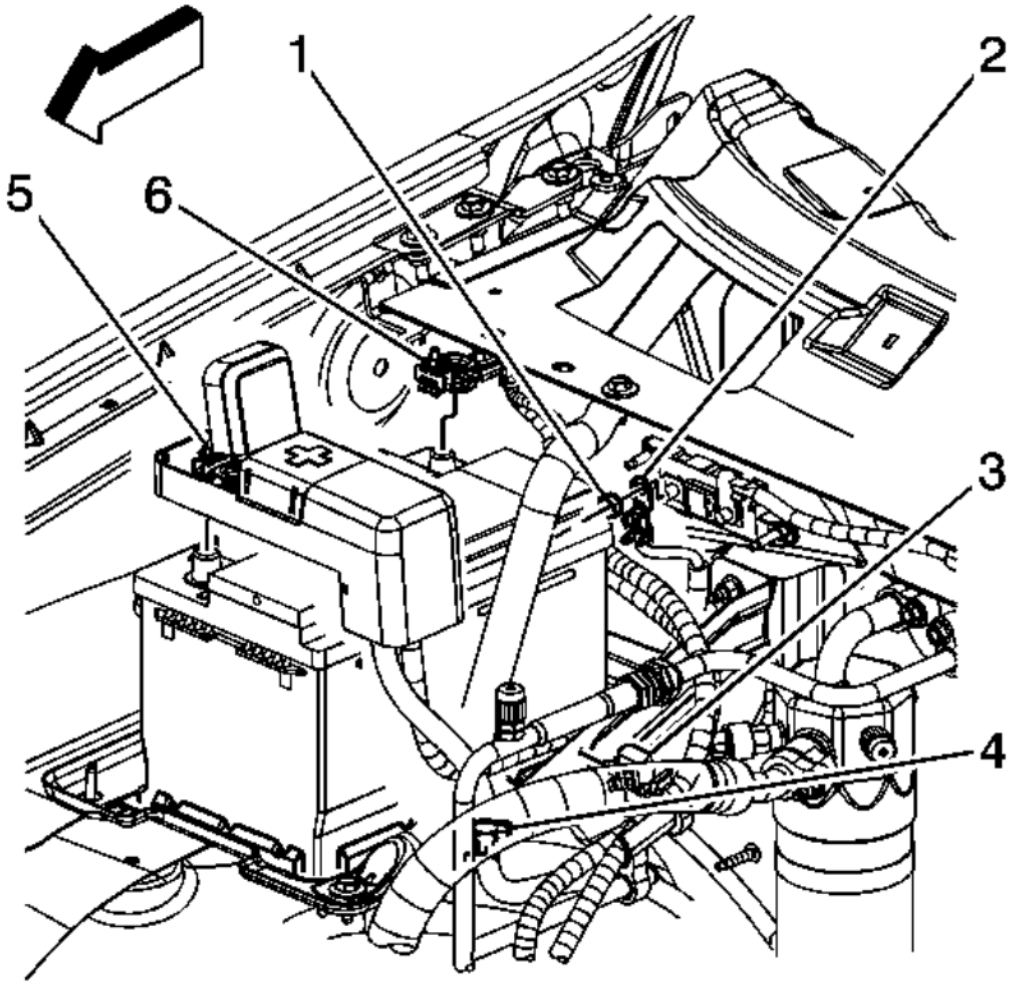


Fig. 191: View Of Battery Cable Components
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.
2. Open the starter solenoid cable cover at the positive battery terminal.
3. Loosen the starter solenoid cable nut (5).
4. Remove the starter solenoid cable from the positive battery terminal.
5. Reposition the starter solenoid cable out of the way.

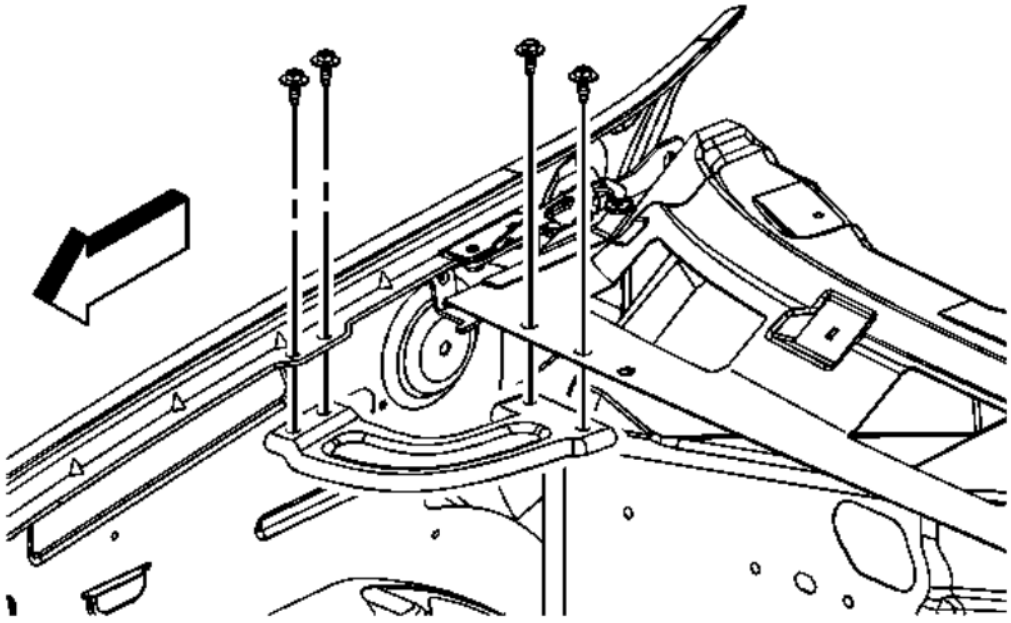


Fig. 192: View Of Front Fender Rear Upper Brace & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Remove the front fender rear upper brace bolts and brace.

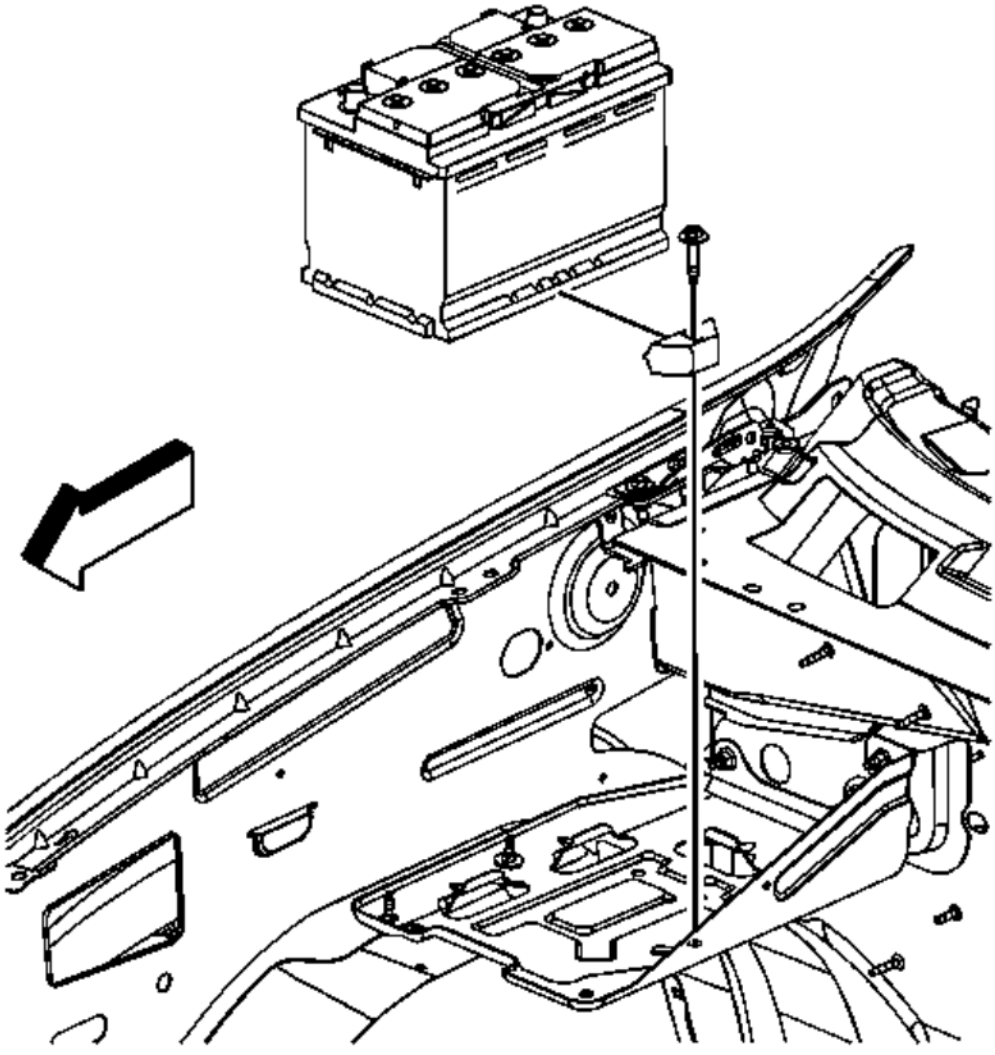


Fig. 193: View Of Battery Hold Down Retainer & Bolt
Courtesy of GENERAL MOTORS CORP.

7. Remove the battery hold down retainer bolt and retainer.
8. Remove the battery.

Installation Procedure

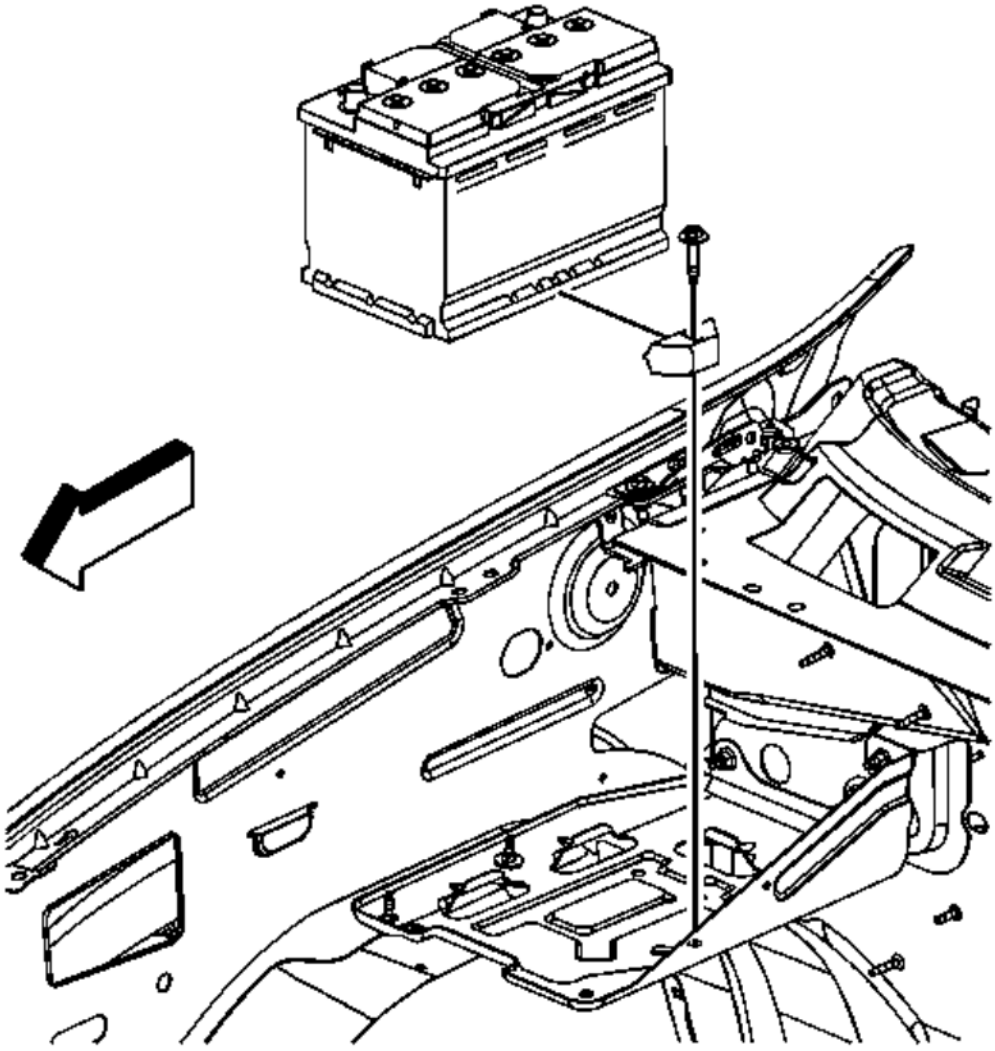


Fig. 194: View Of Battery Hold Down Retainer & Bolt
Courtesy of GENERAL MOTORS CORP.

1. Install the battery.

NOTE: Refer to Fastener Notice .

2. Install the battery hold down retainer and bolt.

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

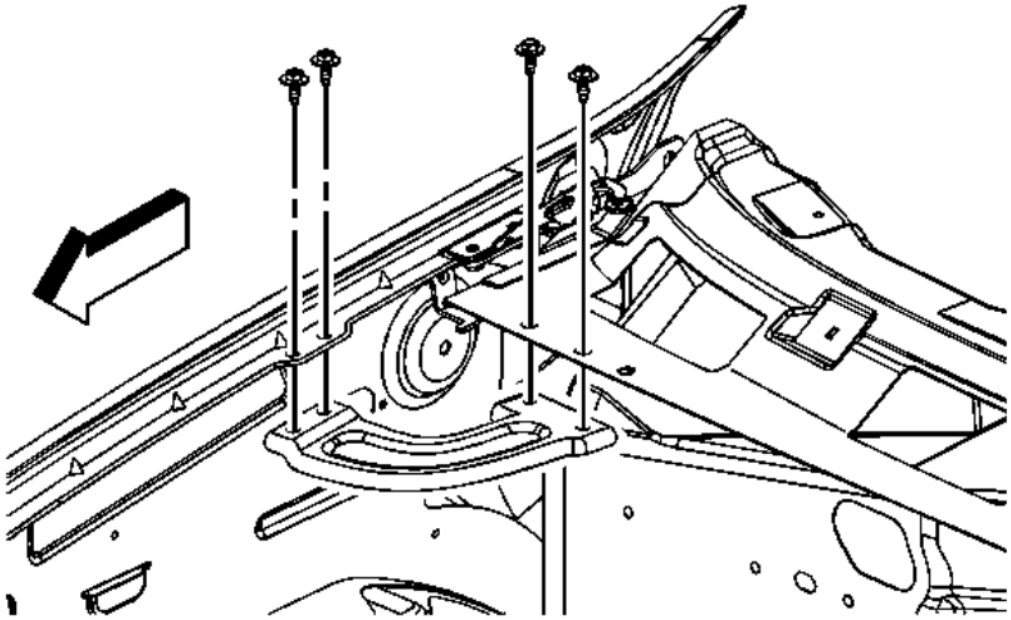


Fig. 195: View Of Front Fender Rear Upper Brace & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Install the front fender rear upper brace and bolts.

   Tighten: Tighten the bolts to 9 N.m (80 lb in).

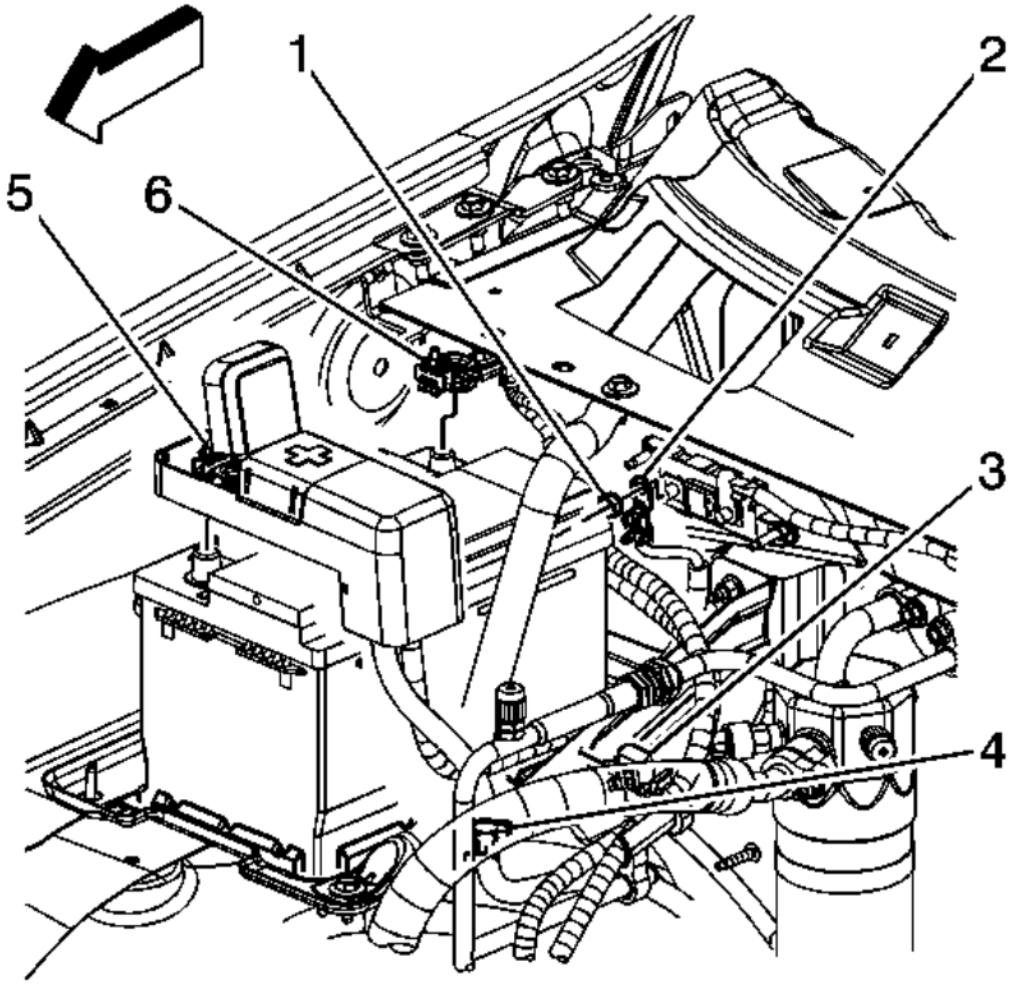


Fig. 196: View Of Battery Cable Components
Courtesy of GENERAL MOTORS CORP.

4. Position the starter solenoid cable to the battery.
5. Install the starter solenoid cable to the positive battery terminal.
6. Tighten the starter solenoid cable nut (5).

   Tighten: Tighten the nut to 5 N.m (44 lb in).

7. Close the starter solenoid cable cover at the positive battery terminal.

8. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

AUXILIARY BATTERY REPLACEMENT (6.2L, AND 6.6L)

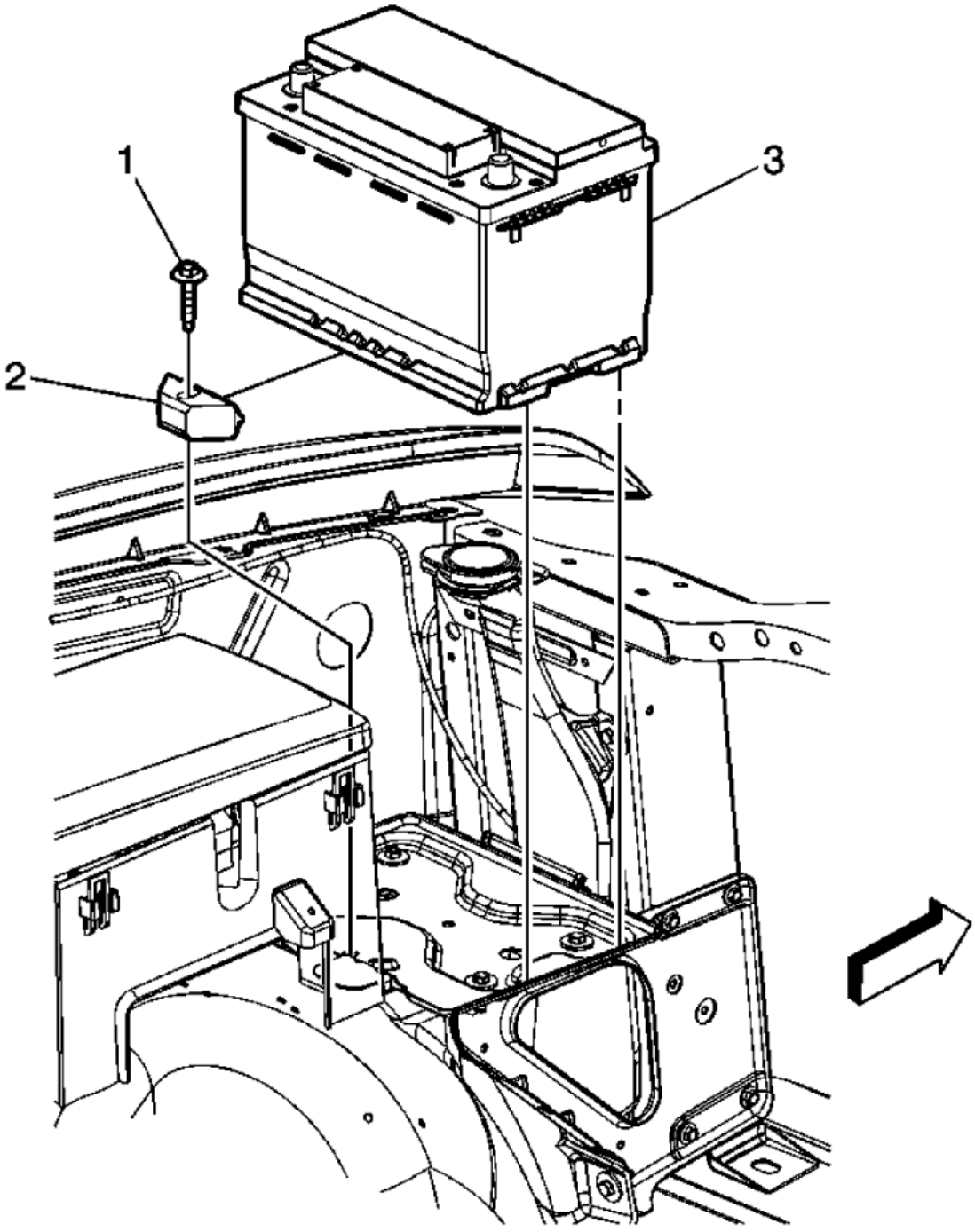


Fig. 197: Auxiliary Battery Replacement (6.2L, and 6.6L)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure	

1. Disconnect the battery cables. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.
2. Remove the front end sheet metal diagonal brace. Refer to **Front End Sheet Metal Diagonal Brace Replacement** .

1	Auxiliary Battery Hold Down Bolt **NOTE:** **Refer to Fastener Notice .** **Tighten:** 25 N.m (18 lb ft)
2	Auxiliary Battery Hold Down
3	Auxiliary Battery

BATTERY TRAY REPLACEMENT

Removal Procedure

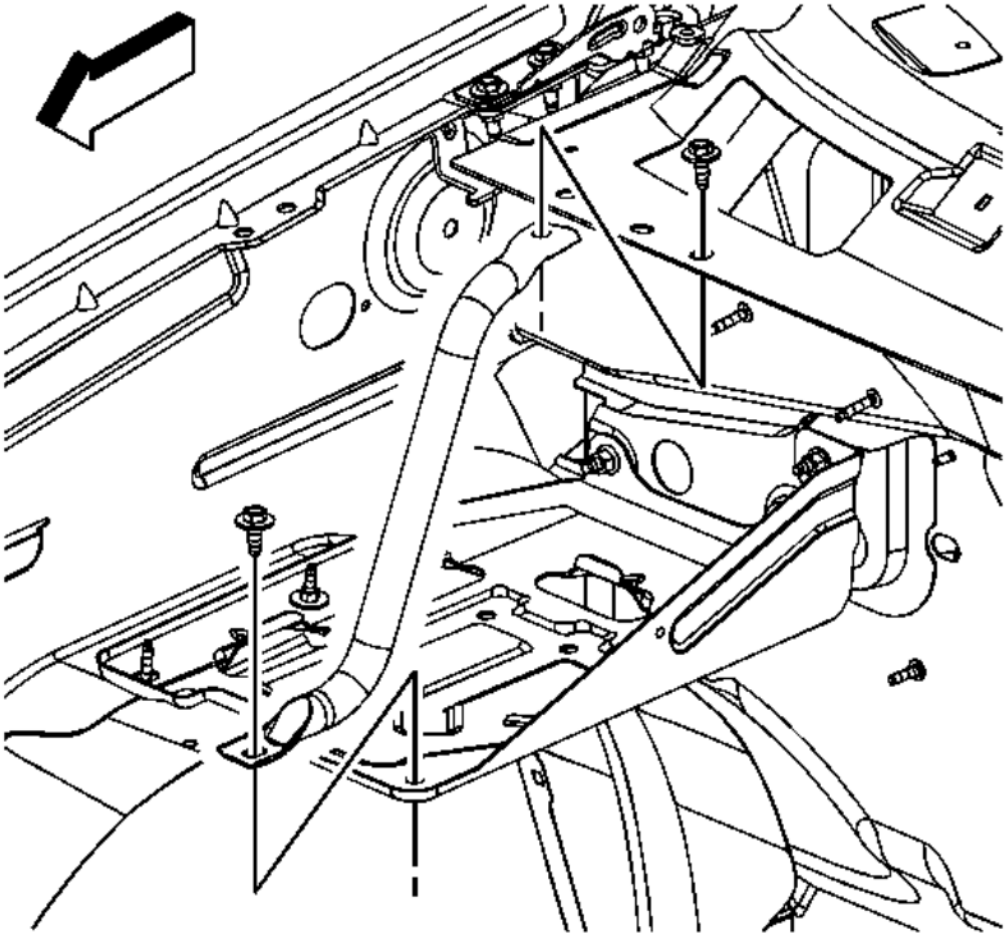


Fig. 198: View Of Battery Tray Front Support & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the battery. Refer to **Battery Replacement**.
2. Remove the battery tray front support bolts.
3. Remove the battery tray front support.

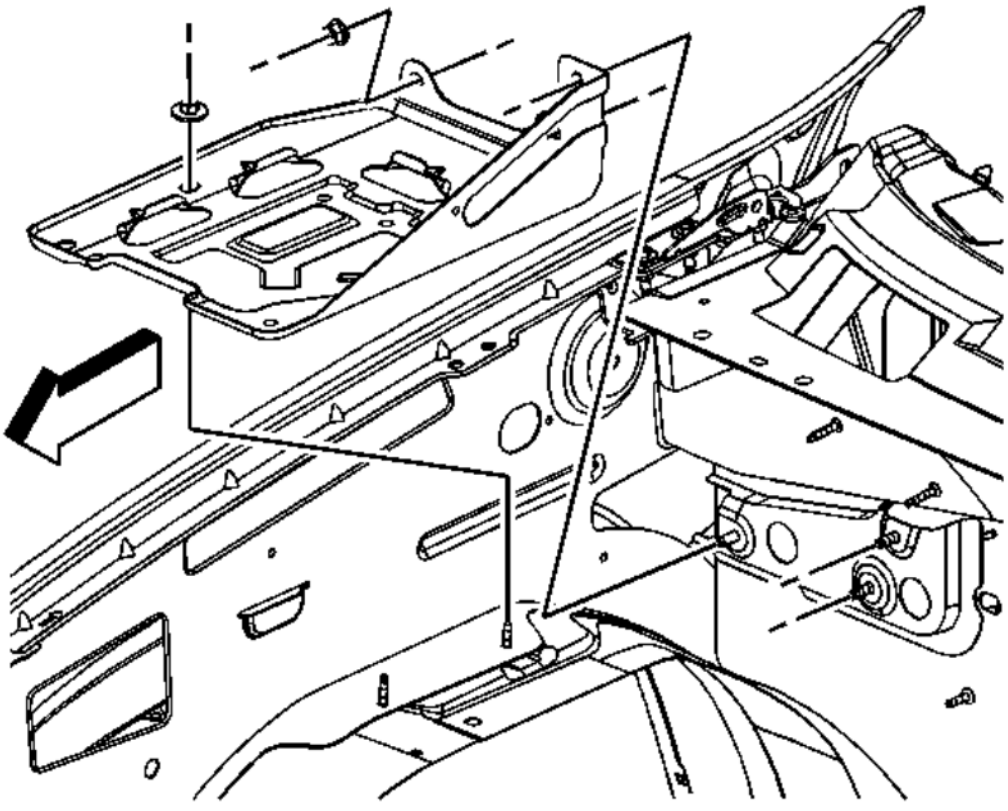


Fig. 199: View Of Battery Tray, Brackets & Nuts
Courtesy of GENERAL MOTORS CORP.

4. Remove the nut securing the battery tray to the front fender inner panel.
5. Remove the 3 nuts securing the battery tray to the battery tray bracket.
6. Remove the battery tray from the vehicle.

Installation Procedure

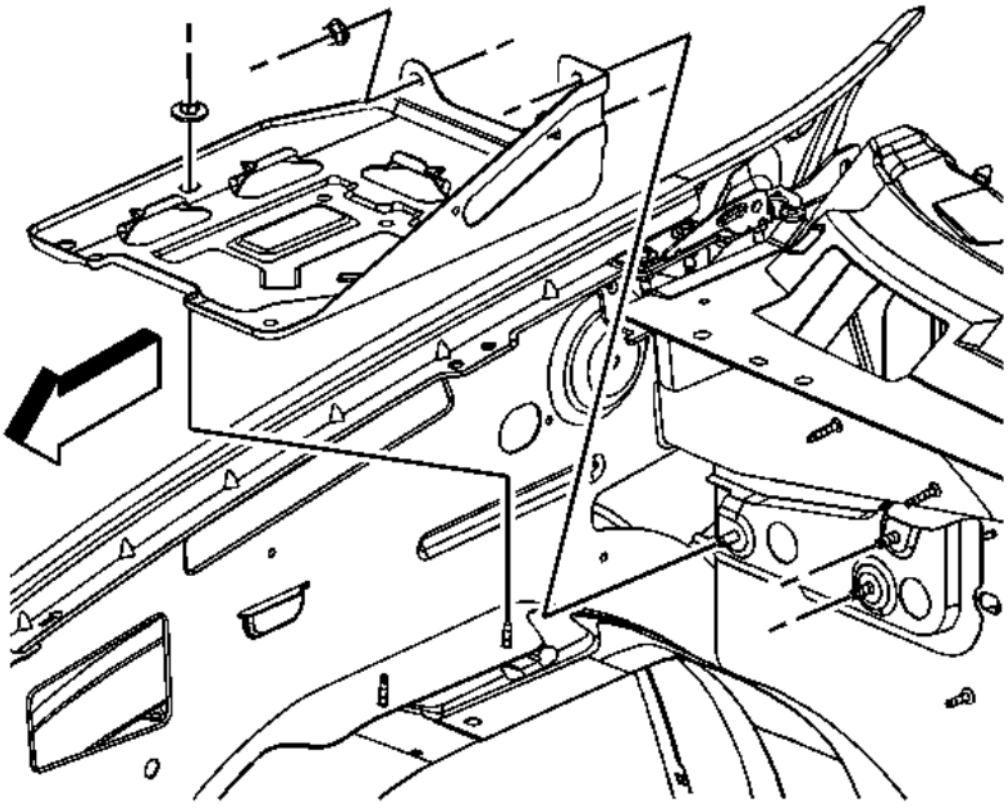


Fig. 200: View Of Battery Tray, Brackets & Nuts
Courtesy of GENERAL MOTORS CORP.

1. Install the battery tray to the vehicle.

NOTE: **Refer to Fastener Notice .**

2. Install the 3 nuts securing the battery tray to the battery tray bracket.

   Tighten: Tighten the nuts to 20 N.m (15 lb ft).

3. Install the nut securing the battery tray to the front fender inner panel.

   Tighten: Tighten the nut to 9 N.m (80 lb in).

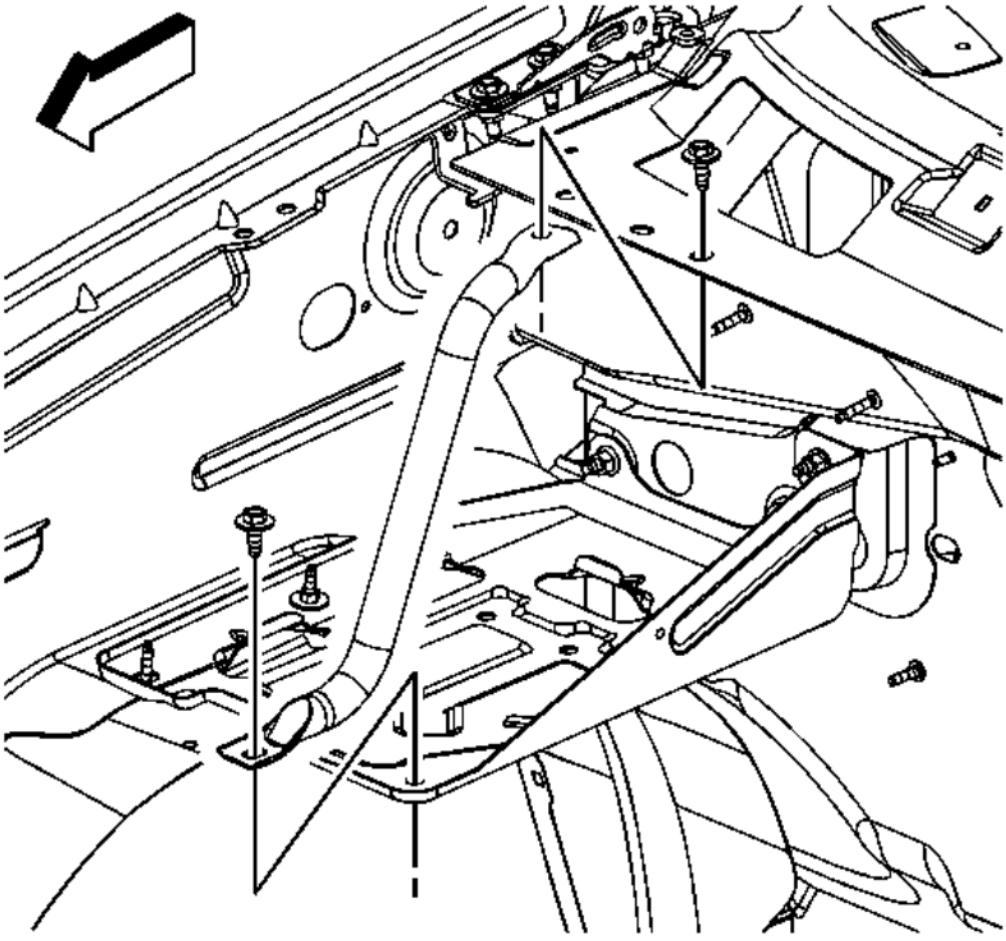


Fig. 201: View Of Battery Tray Front Support & Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the battery tray front support.
5. Install the battery tray front support bolts.

   Tighten: Tighten the bolts to 20 N.m (15 lb ft).

6. Install the battery. Refer to **Battery Replacement**.

AUXILIARY BATTERY TRAY REPLACEMENT (6.2L, AND 6.6L)

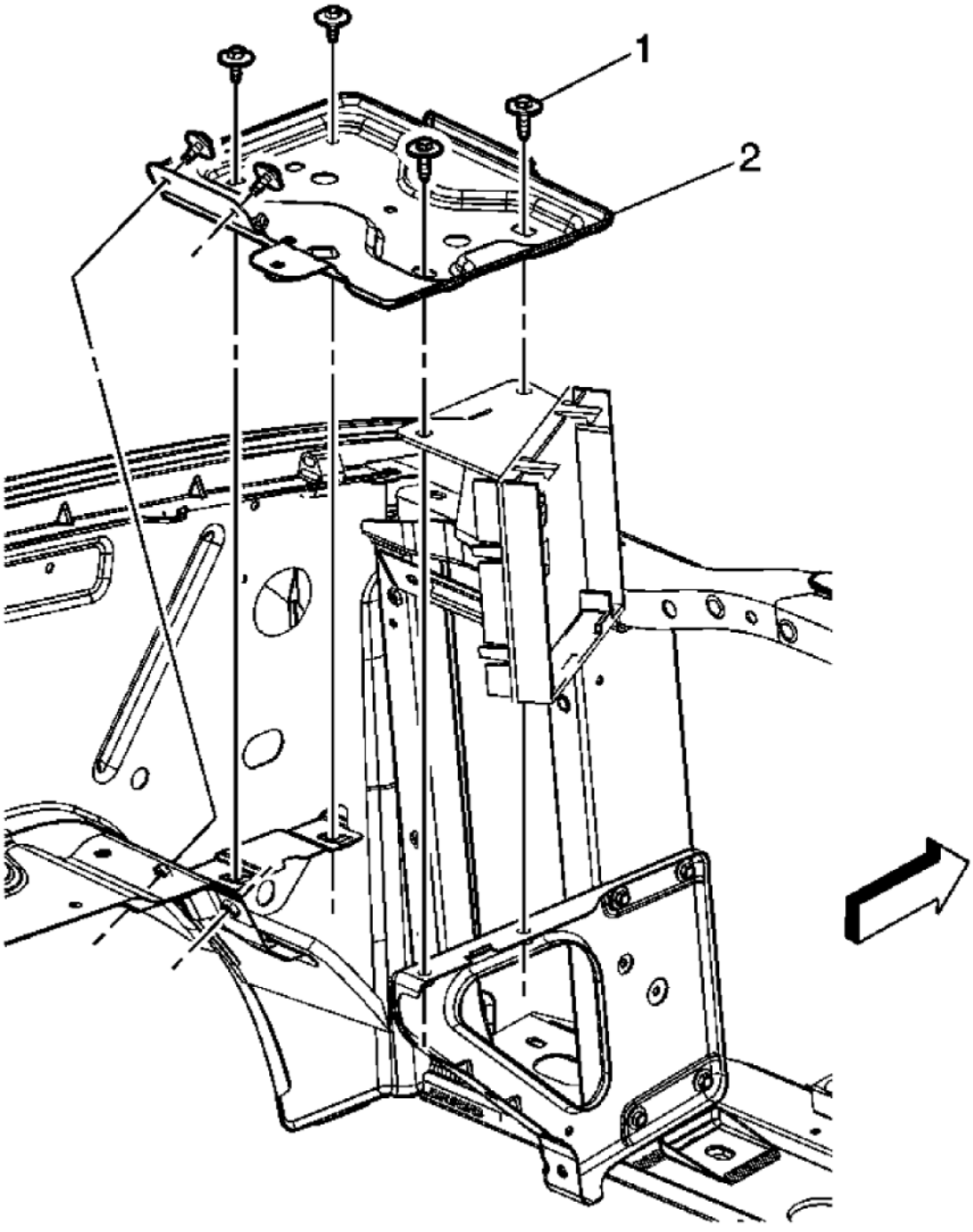


Fig. 202: Auxiliary Battery Tray Replacement (6.2L, and 6.6L)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure:	

Remove the auxiliary battery if equipped. Refer to **Auxiliary Battery Replacement (6.2L, and 6.6L)**.	
1	Auxiliary Battery Tray Bolts (Qty: 6) **NOTE:** **Refer to Fastener Notice .** **Tip:** Note the length of bolts when removing for proper reinstallation. The auxiliary battery tray bolts vary in length. **Tighten:** 9 N.m (80 lb in)
2	Auxiliary Battery Tray

AUXILIARY BATTERY RELAY REPLACEMENT (6.2L)

Removal Procedure

CAUTION: Refer to BATTERY DISCONNECT CAUTION

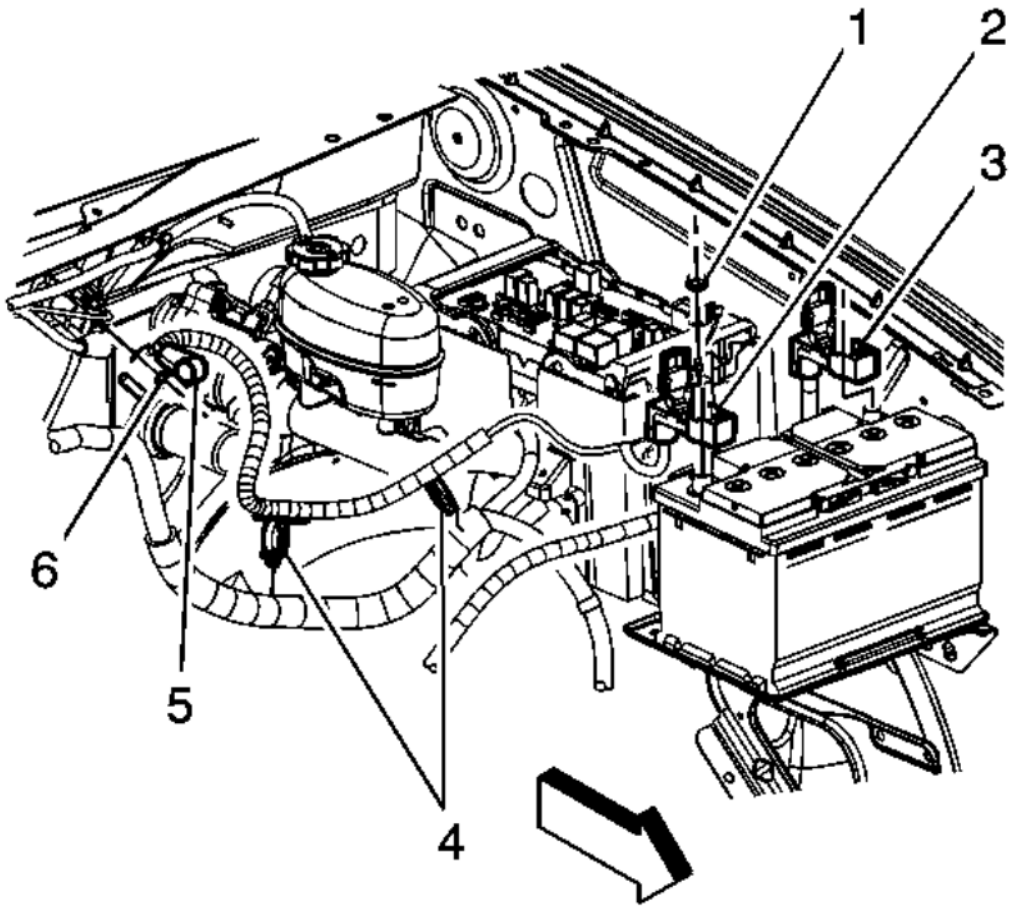


Fig. 203: View Of Battery & Battery Cable Fasteners
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the auxiliary battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.
2. Reposition the auxiliary battery positive cable boot (5) from the auxiliary battery relay stud.
3. Remove the auxiliary battery positive cable nut (6) from the battery relay stud.
4. Remove the auxiliary battery positive cable from the auxiliary battery relay.

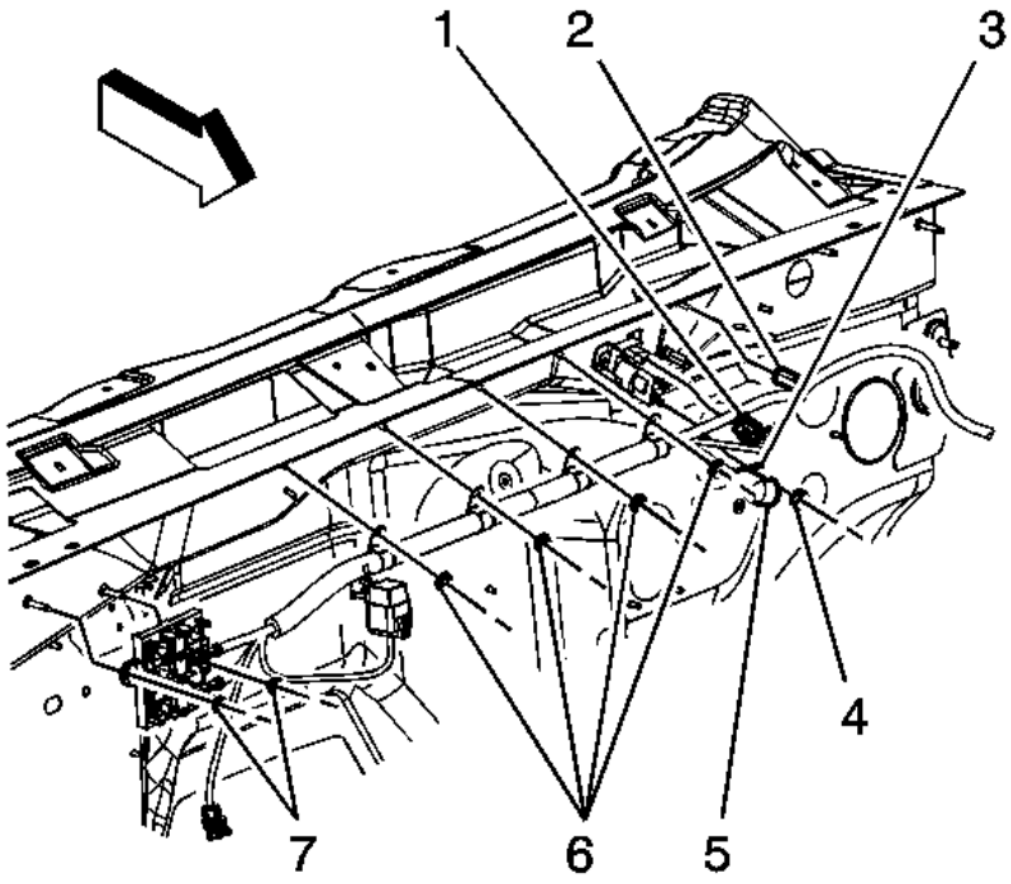


Fig. 204: View Of Battery Cable Nuts, Retainers & Bolts
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the auxiliary battery positive cable electrical connector (1) from the battery relay.
6. Reposition the auxiliary battery positive cable boot (5) from the auxiliary battery relay stud.
7. Remove the auxiliary battery positive cable nut (4) from the battery relay stud.
8. Remove the auxiliary battery positive cable from the auxiliary battery relay.

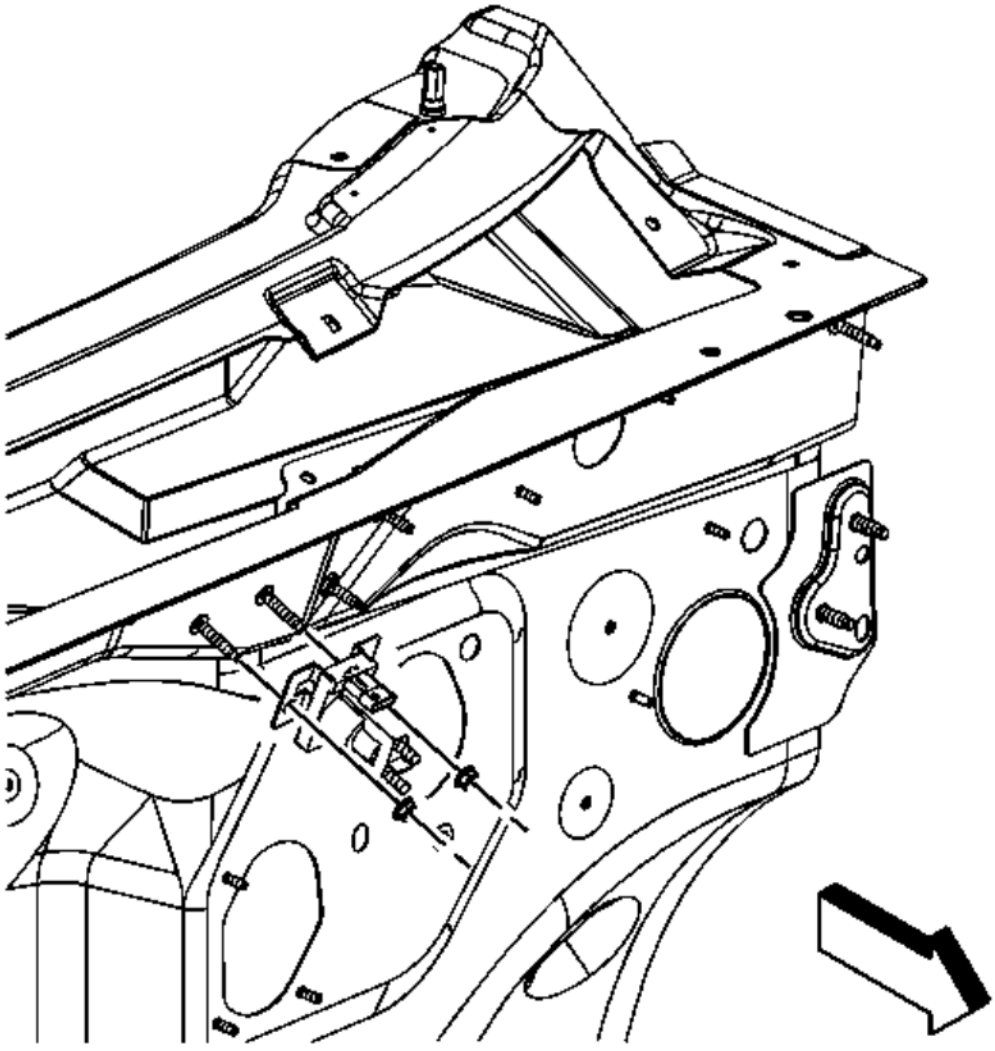


Fig. 205: View Of Auxiliary Battery Relay & Nuts
Courtesy of GENERAL MOTORS CORP.

9. Remove the auxiliary battery relay nuts and relay.

Installation Procedure

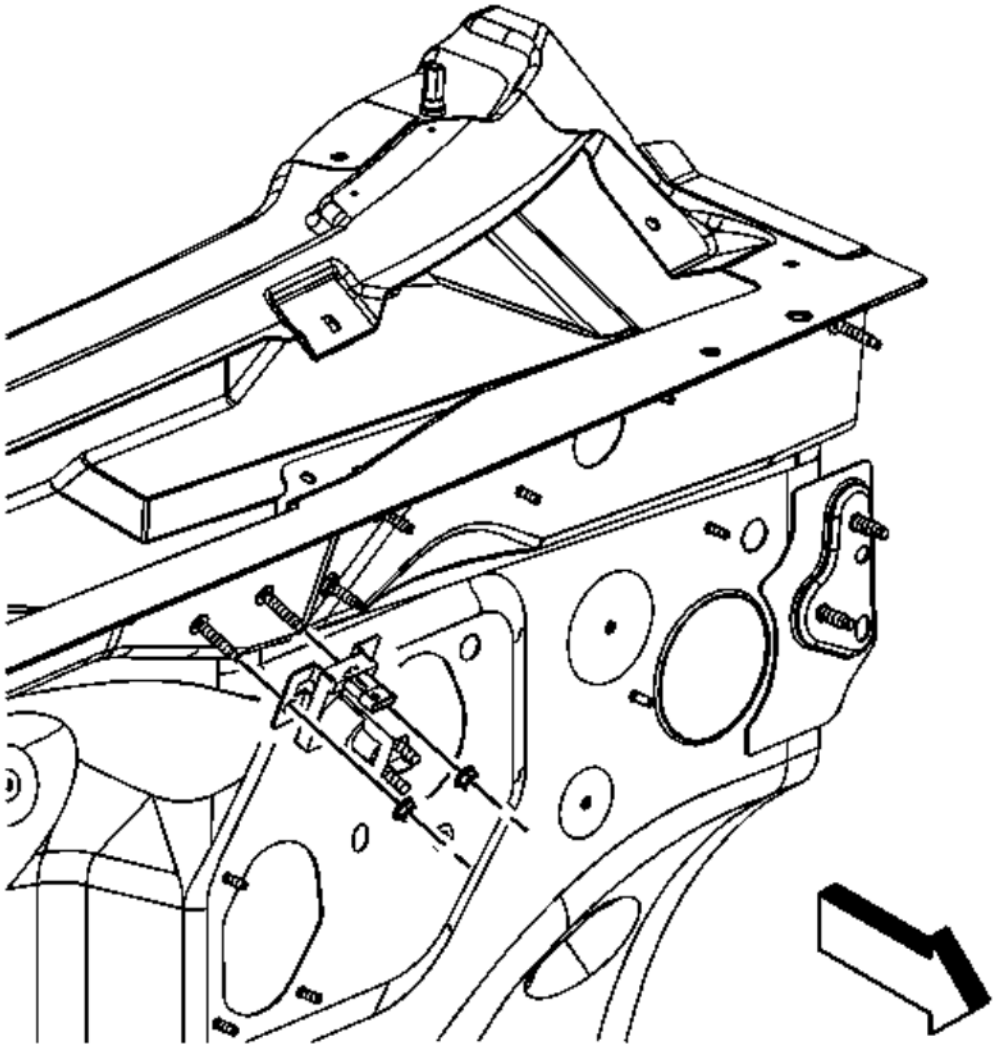


Fig. 206: View Of Auxiliary Battery Relay & Nuts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Install the auxiliary battery relay and nuts.

   Tighten: Tighten the nuts to 9 N.m (80 lb in).

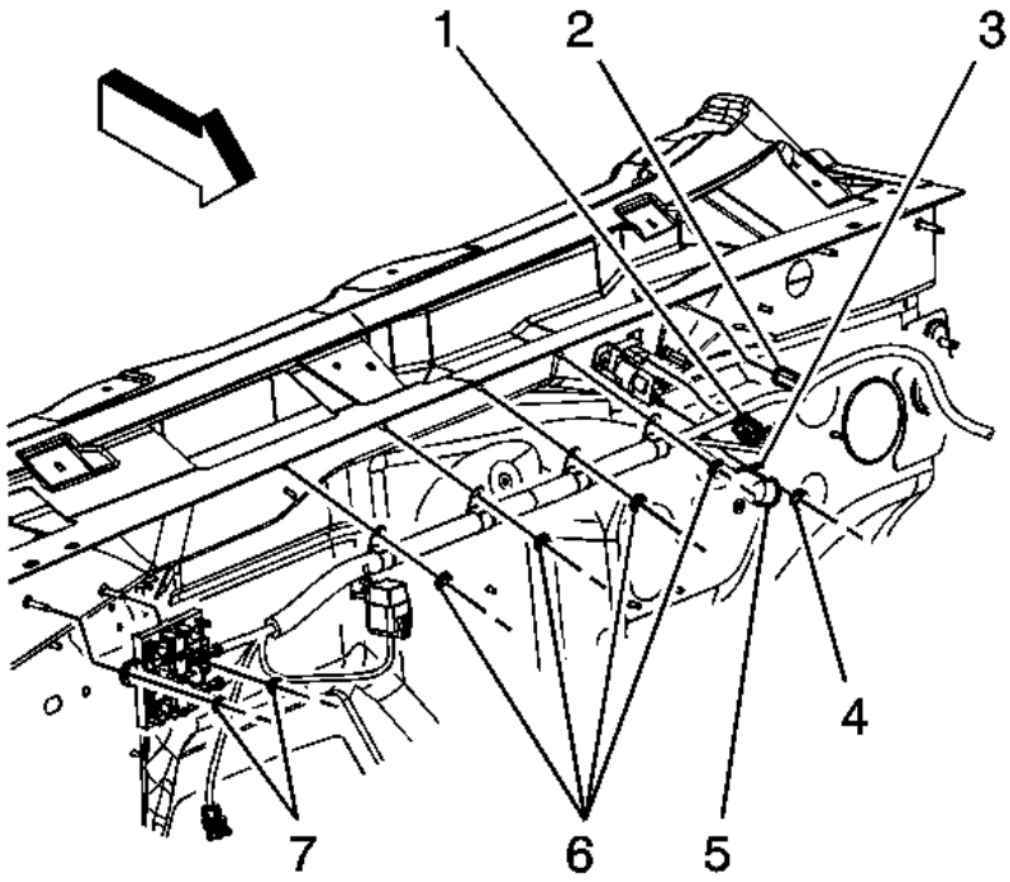


Fig. 207: View Of Battery Cable Nuts, Retainers & Bolts
Courtesy of GENERAL MOTORS CORP.

2. Install the auxiliary battery positive cable to the auxiliary battery relay.
3. Install the auxiliary battery positive cable nut (4) to the battery relay stud.

   Tighten: Tighten the nut to 9 N.m (80 lb in).

4. Position the auxiliary battery positive cable boot (5) to the auxiliary battery relay stud.
5. Connect the auxiliary battery positive cable electrical connector (1) to the battery relay.

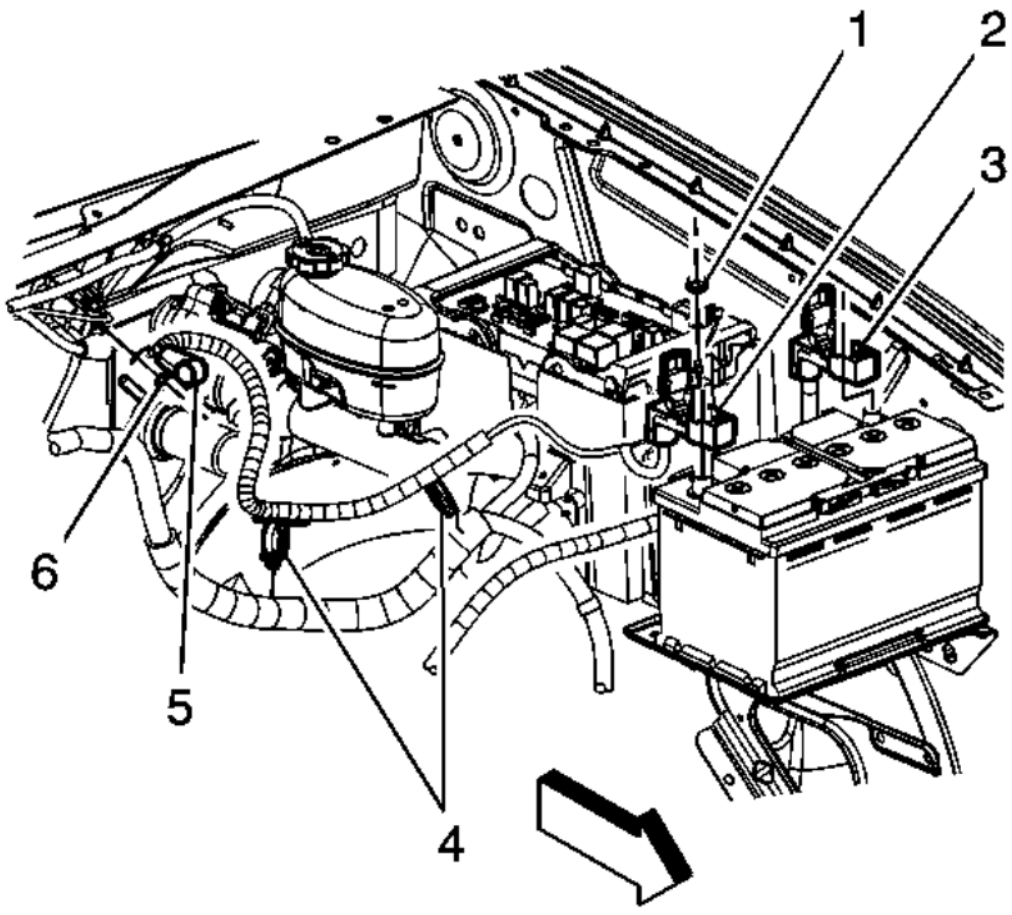


Fig. 208: View Of Battery & Battery Cable Fasteners
Courtesy of GENERAL MOTORS CORP.

6. Install the auxiliary battery positive cable to the auxiliary battery relay.
7. Install the auxiliary battery positive cable nut (6) to the battery relay stud.

   Tighten: Tighten the nut to 9 N.m (80 lb in).

8. Position the auxiliary battery positive cable boot (5) to the auxiliary battery relay stud.
9. Connect the auxiliary battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable**

Disconnection and Connection (w/Dual Batteries).

ENGINE GROUND STRAP REPLACEMENT (4.3L)

Removal Procedure

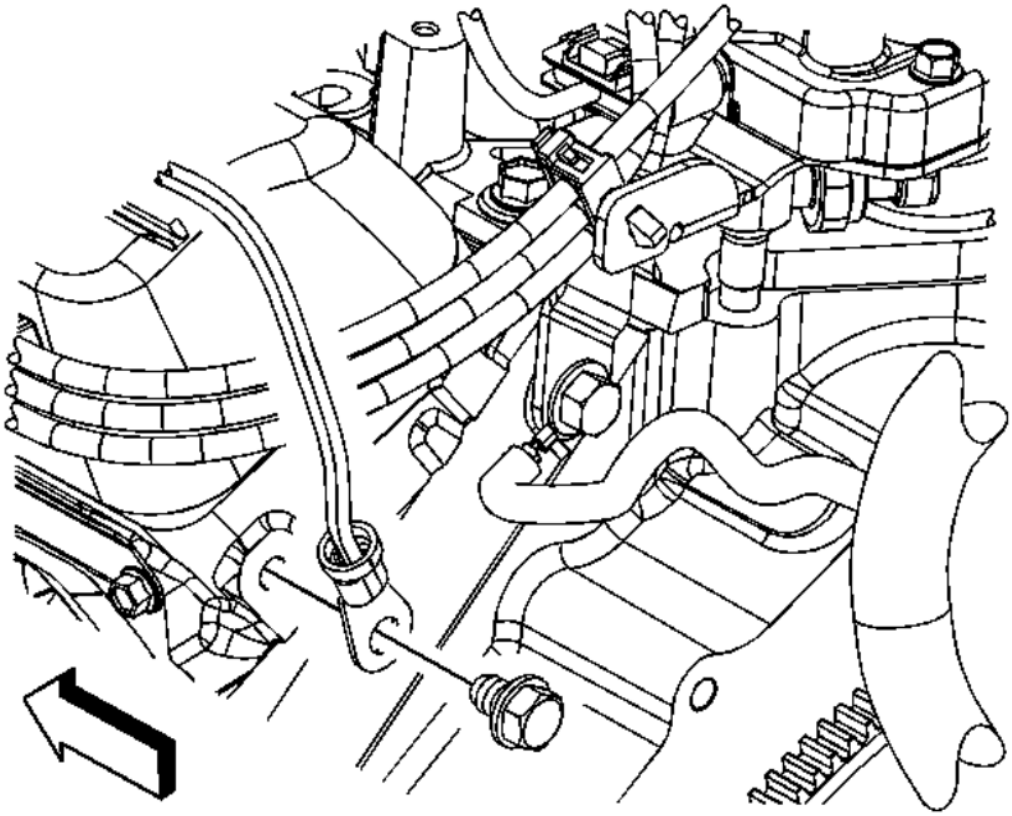


Fig. 209: View Of Ground Strap Bolt
Courtesy of GENERAL MOTORS CORP.

1. Remove the ground strap bolt from the rear of the left cylinder head.
2. Reposition the ground strap from the cylinder head.

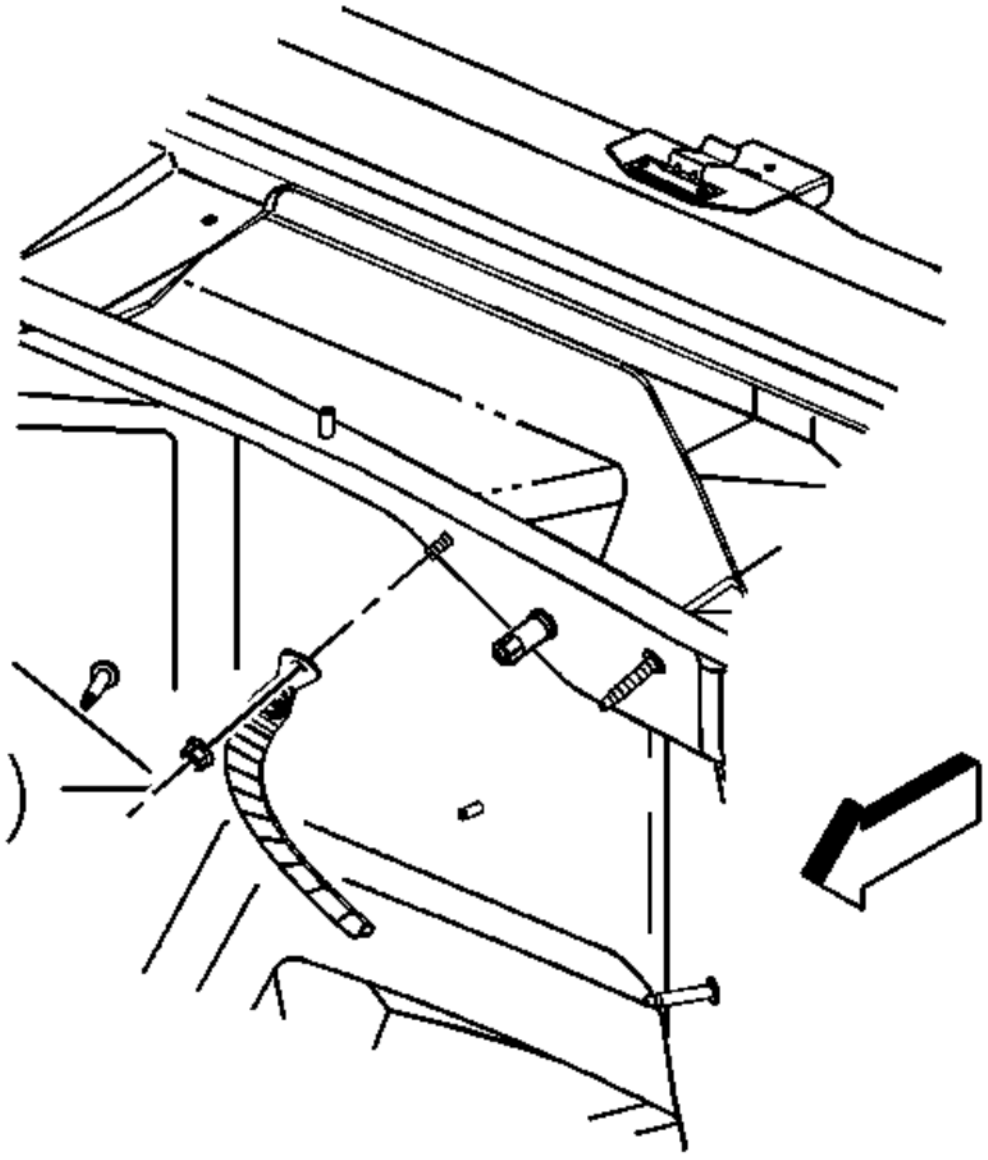


Fig. 210: View Of Ground Strap Nut At Front Of Dash Stud
Courtesy of GENERAL MOTORS CORP.

3. Remove the ground strap nut from the stud at the front of dash.
4. Remove the ground strap from the stud.

Installation Procedure

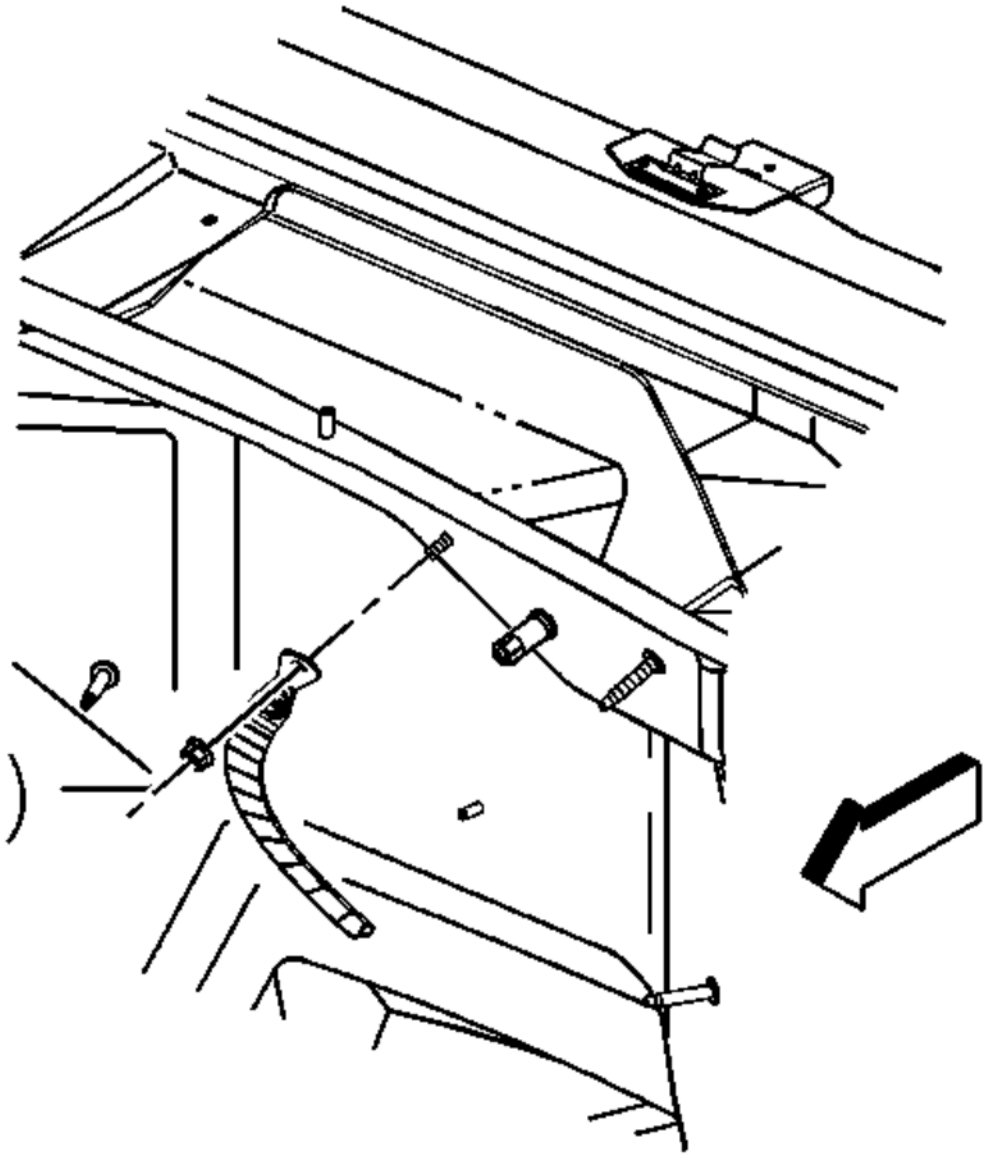


Fig. 211: View Of Ground Strap Nut At Front Of Dash Stud
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Install the ground strap to the stud.
2. Install the ground strap nut to the stud at the front of dash.

Tighten: Tighten the nut to 9 N.m (80 lb in).

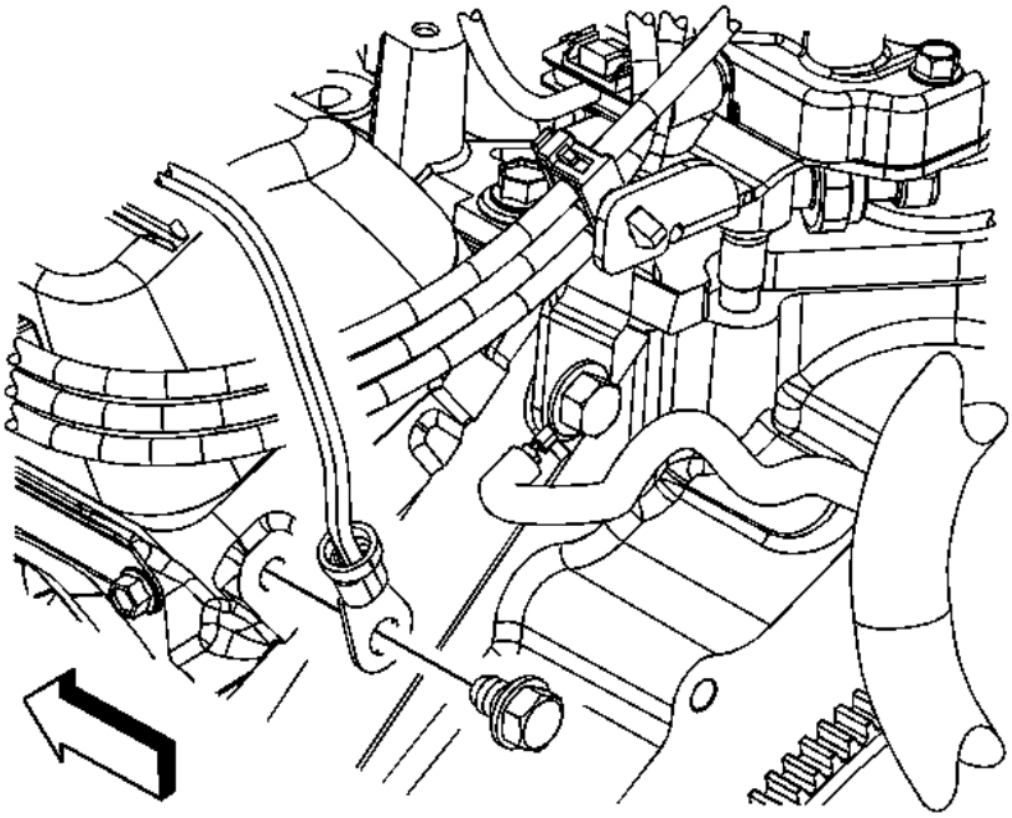


Fig. 212: View Of Ground Strap Bolt
Courtesy of GENERAL MOTORS CORP.

3. Position the ground strap to the rear of the left cylinder head.
4. Install the ground strap bolt.

Tighten: Tighten the bolt to 16 N.m (12 lb ft).

ENGINE GROUND STRAP REPLACEMENT (4.8L, 5.3L, 6.0L, AND 6.2L)

Removal Procedure

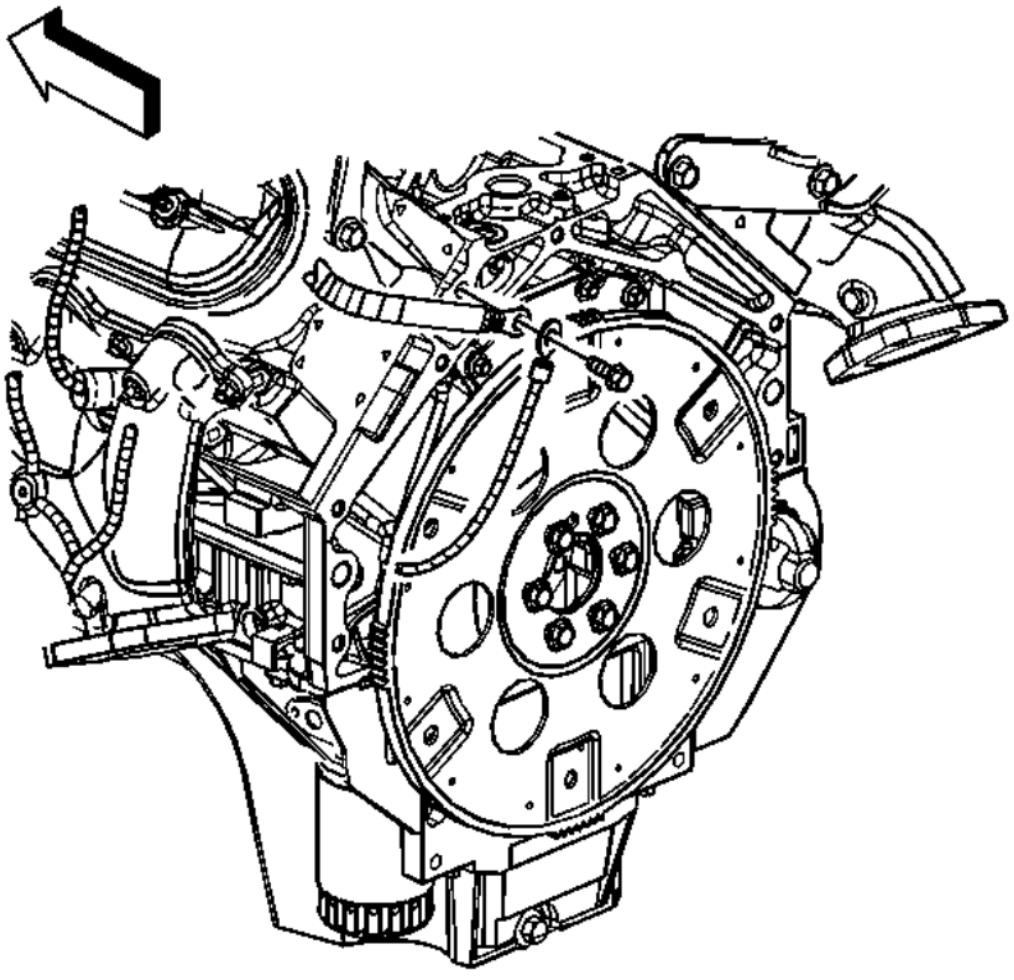


Fig. 213: View Of Ground Cable Bolt At Engine Block
Courtesy of GENERAL MOTORS CORP.

1. Remove the engine wiring harness ground bolt.
2. Reposition the engine wiring harness ground and ground strap.

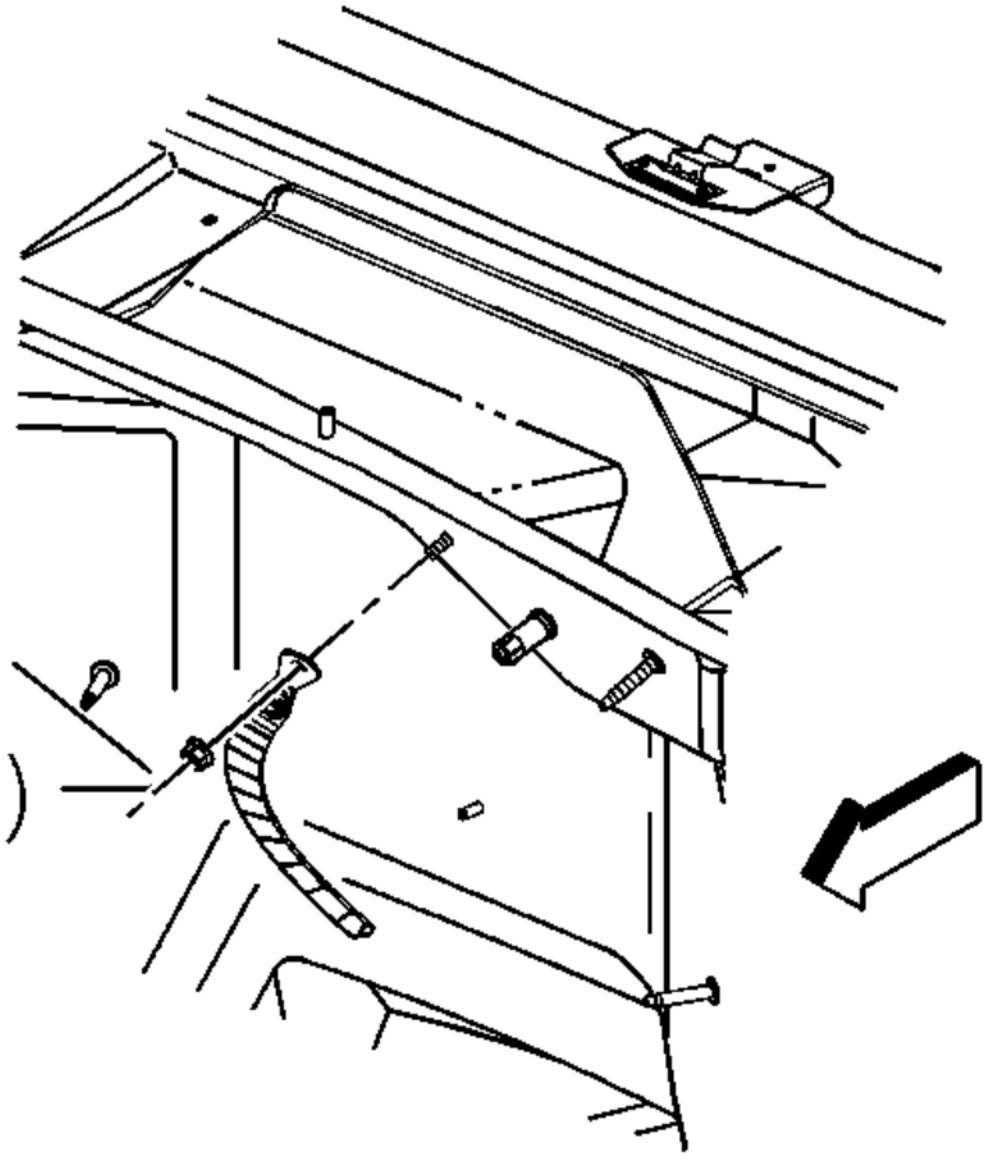


Fig. 214: View Of Ground Strap Nut At Front Of Dash Stud
Courtesy of GENERAL MOTORS CORP.

3. Remove the ground strap nut from the stud at the front of dash.
4. Remove the ground strap from the stud.

Installation Procedure

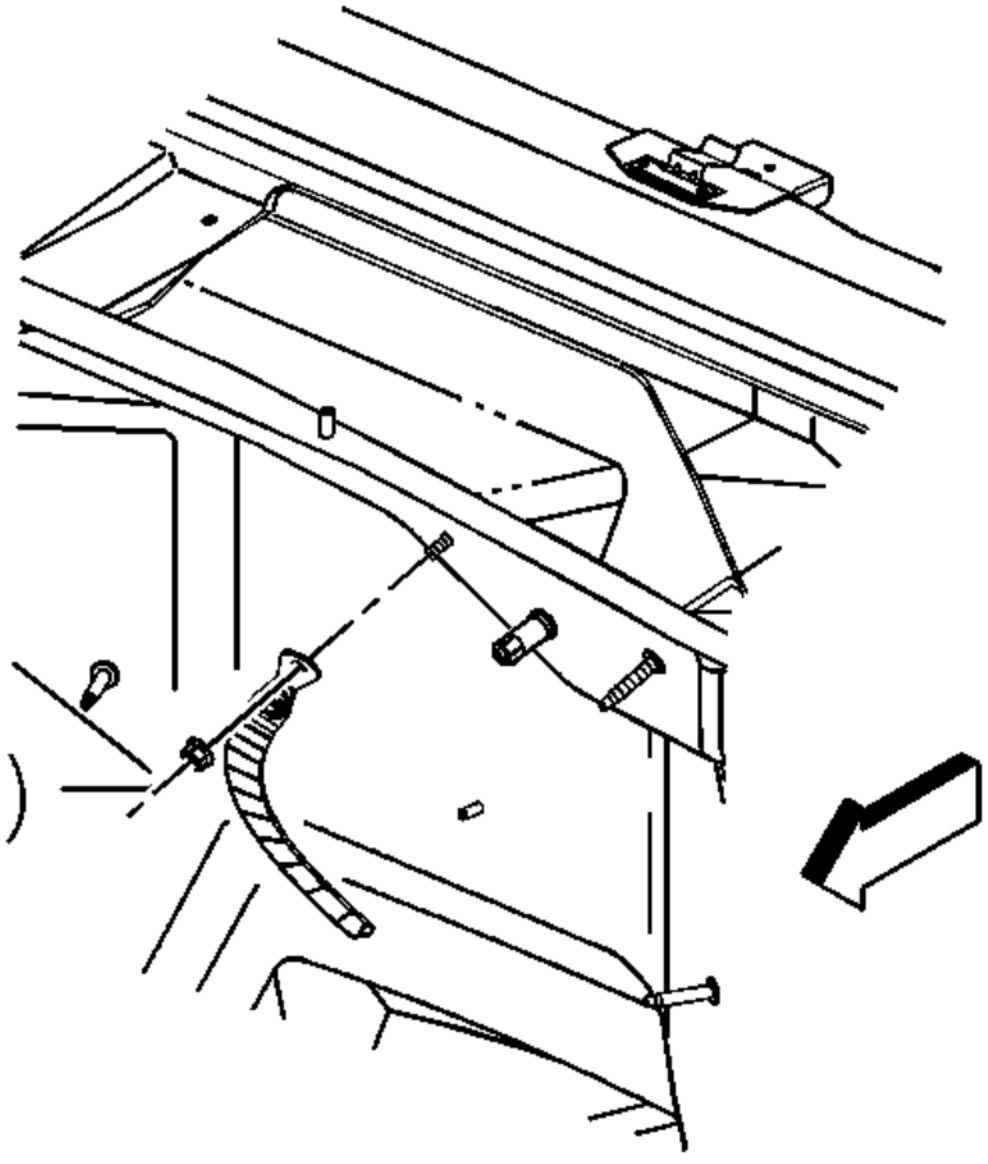


Fig. 215: View Of Ground Strap Nut At Front Of Dash Stud
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Install the ground strap to the stud.
2. Install the ground strap nut to the stud at the front of dash.

   Tighten: Tighten the nut to 9 N.m (80 lb in).

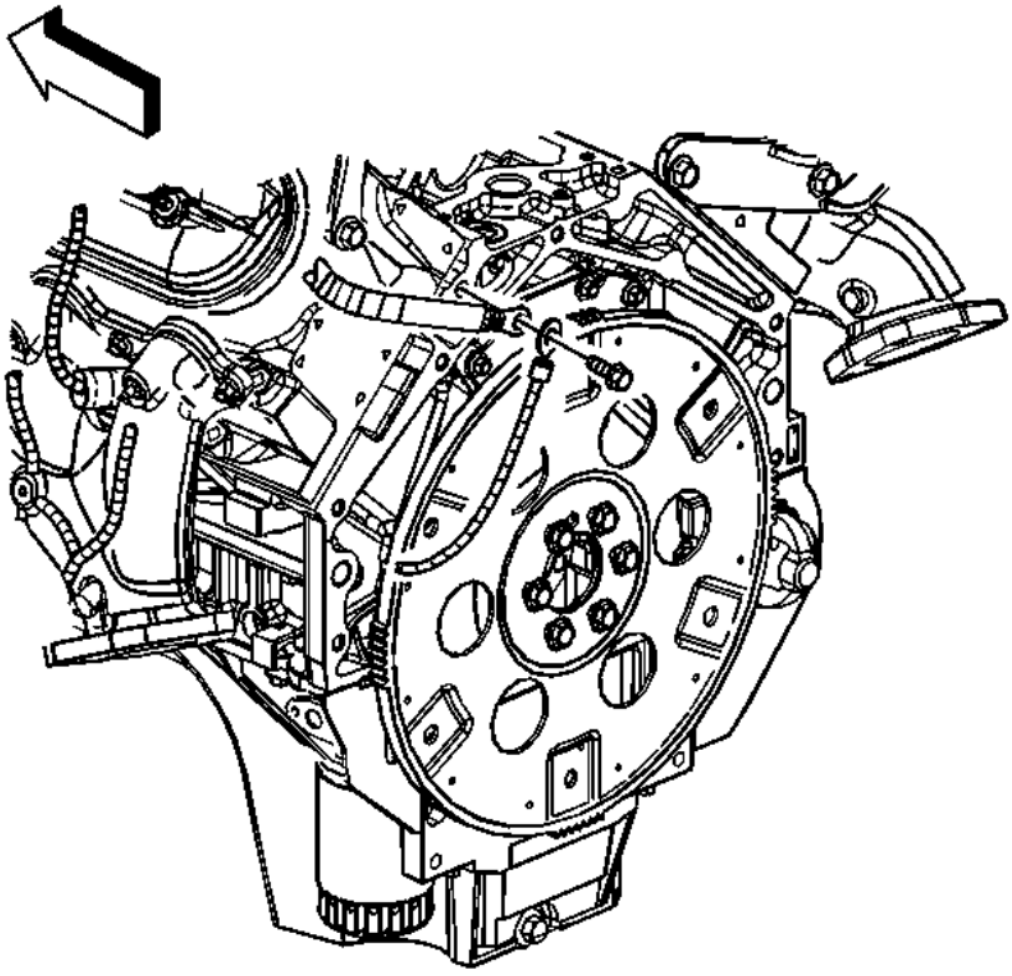


Fig. 216: View Of Ground Cable Bolt At Engine Block
Courtesy of GENERAL MOTORS CORP.

3. Position the ground strap and engine wiring harness ground.
4. Install the engine wiring harness ground bolt.

Tighten: Tighten the bolt to 16 N.m (12 lb ft).

ENGINE GROUND STRAP REPLACEMENT (6.6L)

Removal Procedure

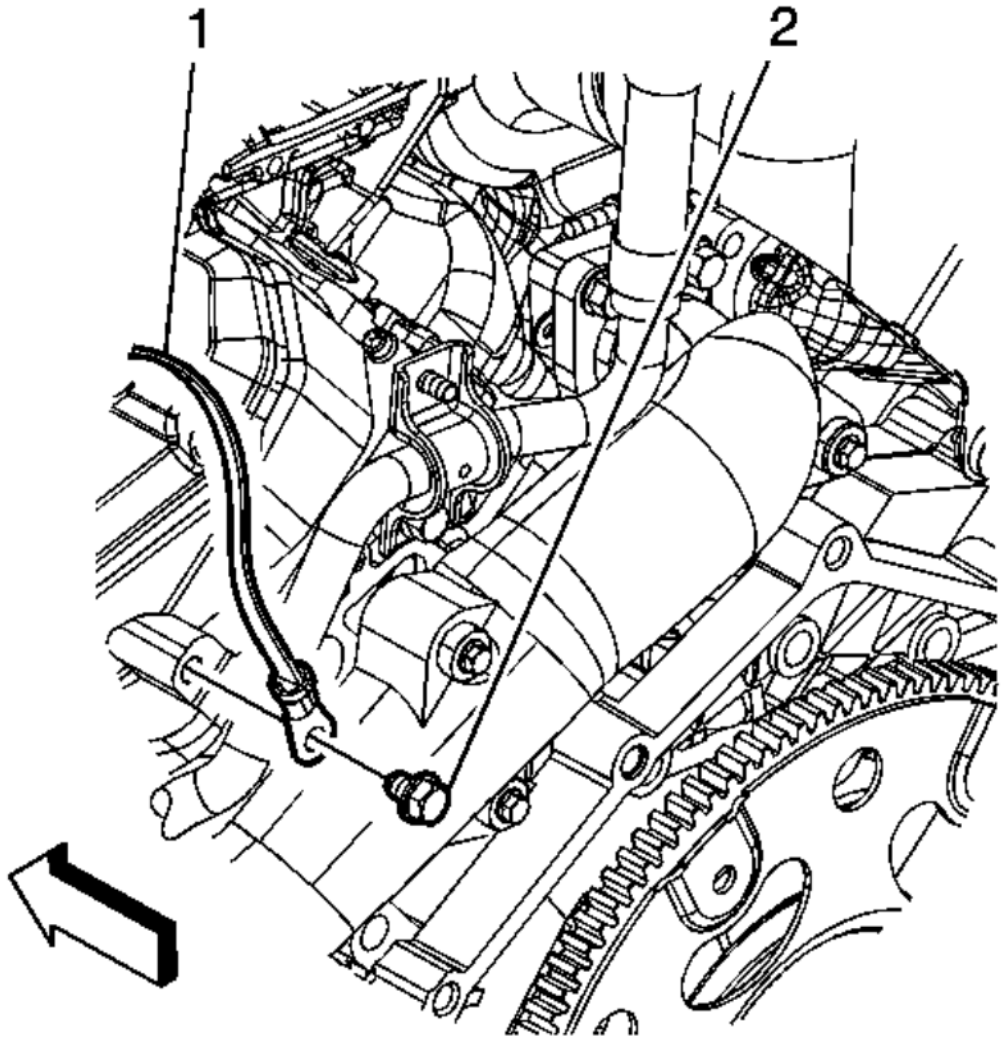


Fig. 217: View Of Engine Ground Strap & Bolt
Courtesy of GENERAL MOTORS CORP.

1. Remove the engine ground strap bolt (2) from the rear of the cylinder head.

2. Reposition the engine ground strap (1) from the cylinder head.

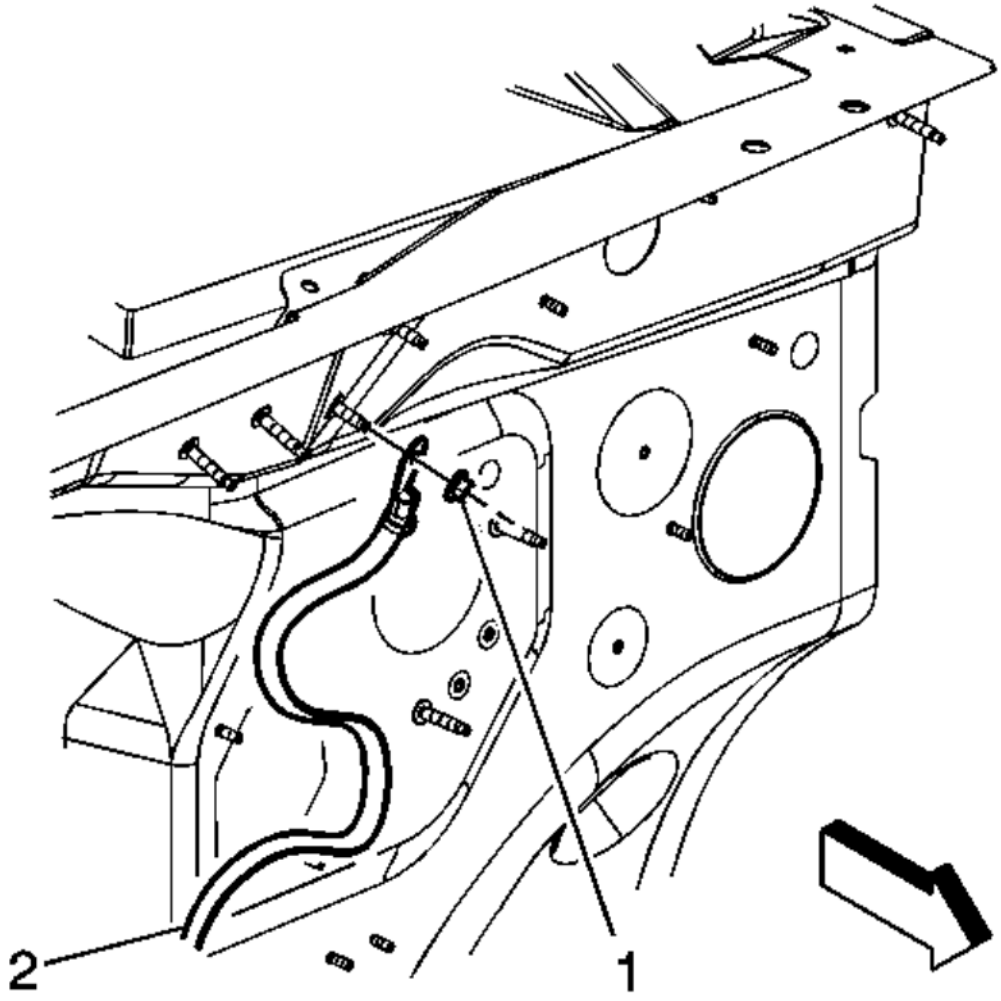


Fig. 218: View Of Ground Strap & Nut
Courtesy of GENERAL MOTORS CORP.

3. Remove the ground strap nut (1) from the stud on the plenum front panel.
4. Remove the ground strap (2) from the stud and the vehicle.

Installation Procedure

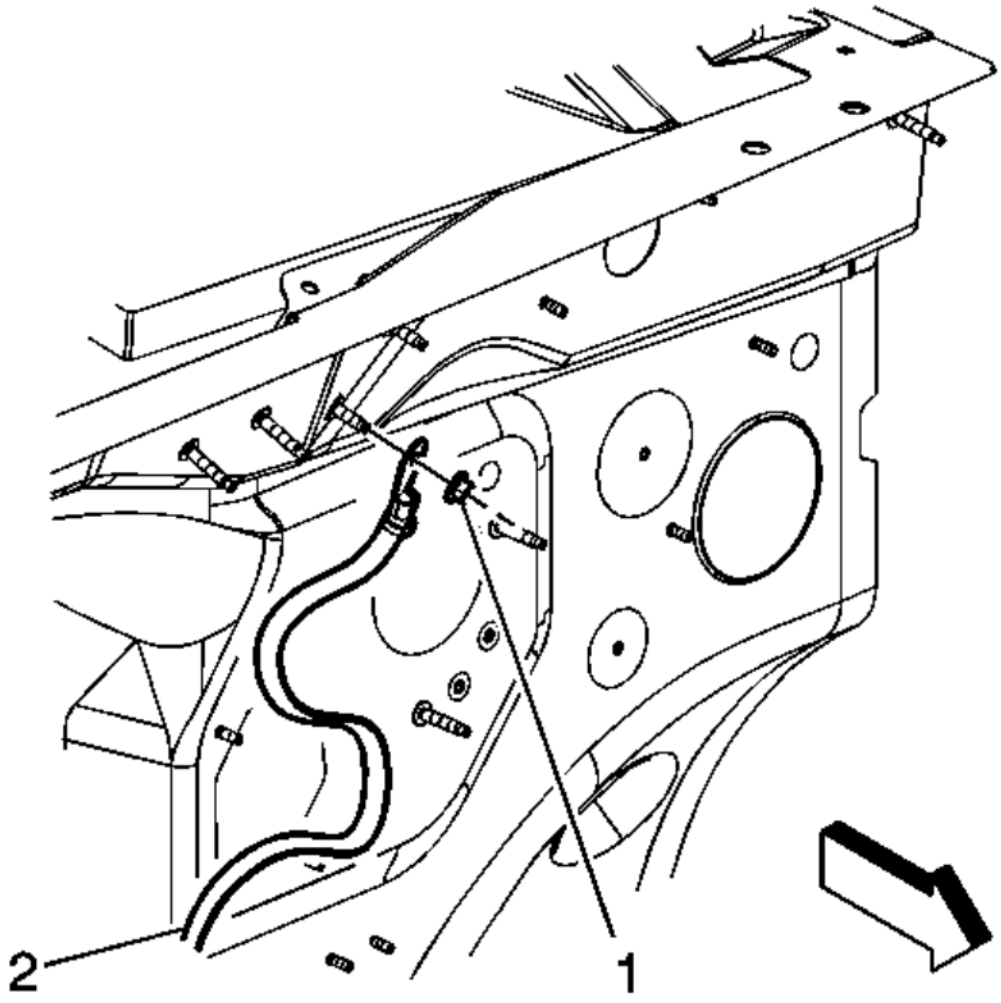


Fig. 219: View Of Ground Strap & Nut
Courtesy of GENERAL MOTORS CORP.

1. Install the ground strap (2) to the vehicle and the stud on the plenum front panel.
2. Install the ground strap nut (1) to the stud on the plenum front panel.

Tighten: Tighten the nut to 9 N.m (80 lb in).

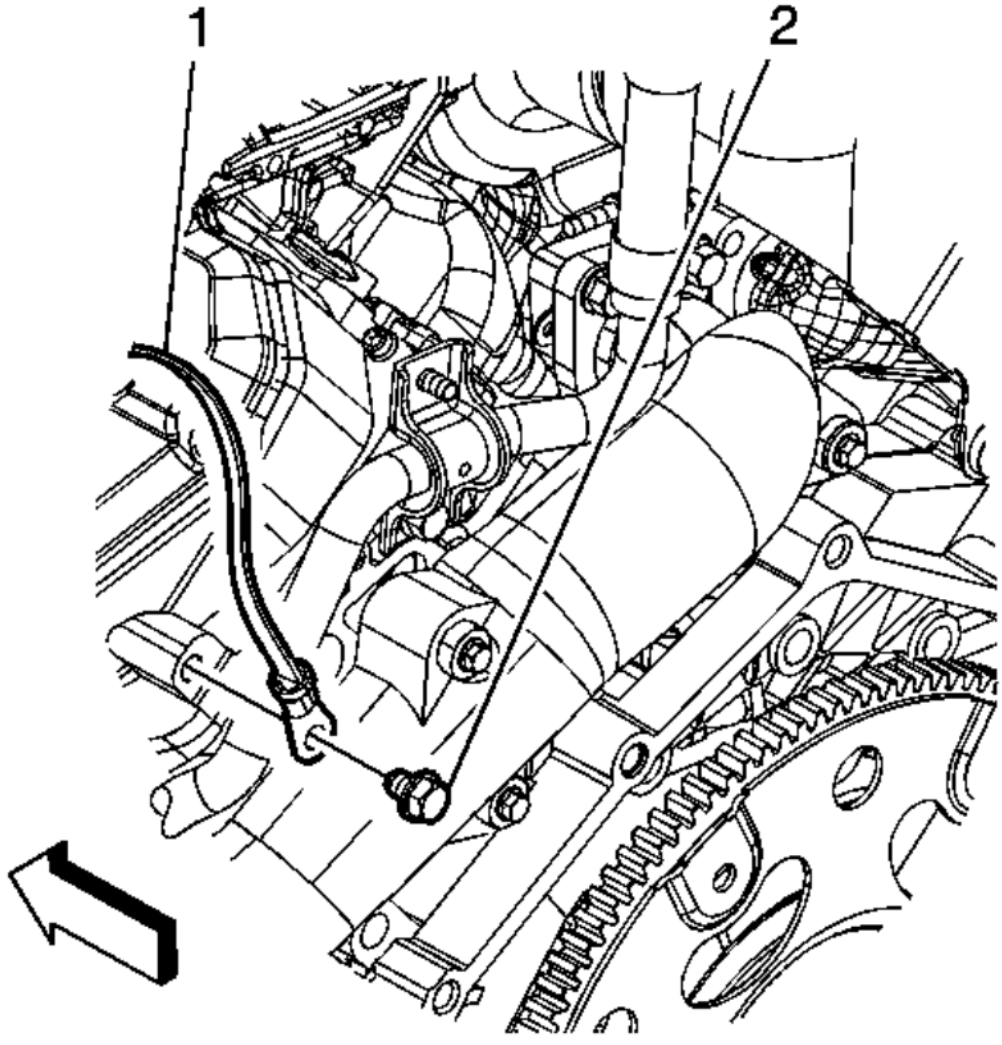


Fig. 220: View Of Engine Ground Strap & Bolt
Courtesy of GENERAL MOTORS CORP.

3. Position the ground strap (1) to the cylinder head.
4. Install the ground strap bolt (2) to the cylinder head.

Tighten: Tighten the bolt to 16 N.m (12 lb ft).

STARTER MOTOR REPLACEMENT (4.3L)

Removal Procedure

CAUTION: Refer to BATTERY DISCONNECT CAUTION .

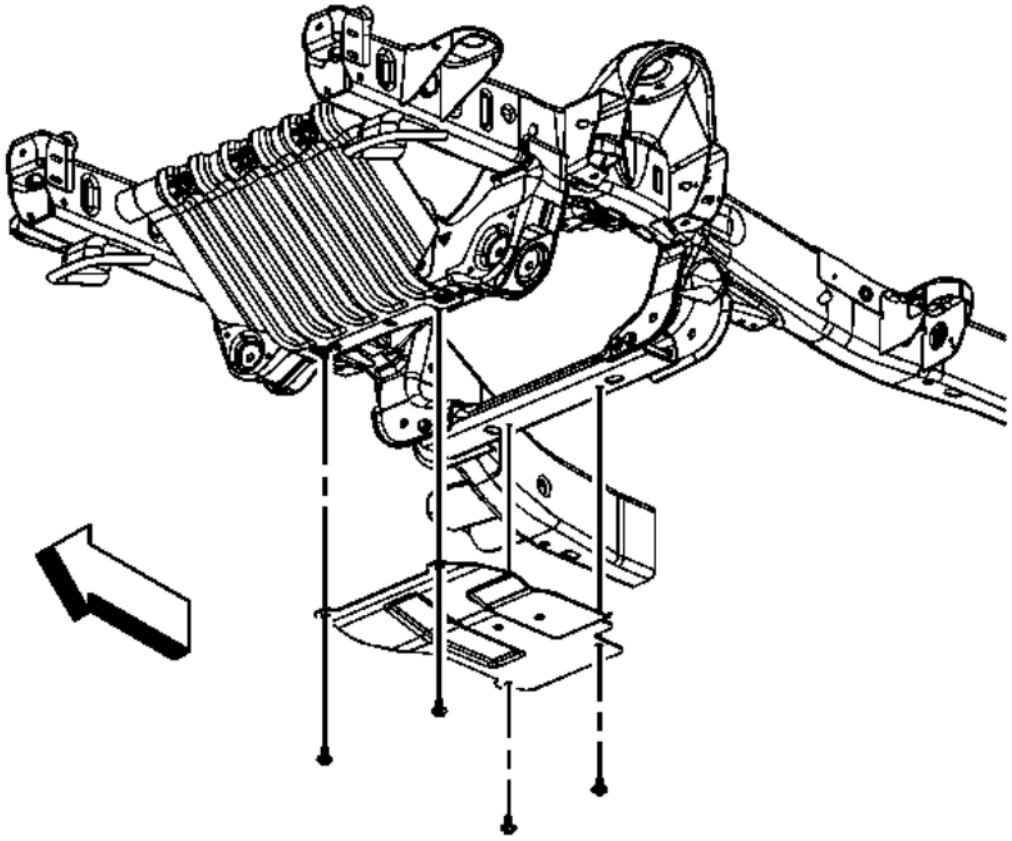


Fig. 221: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.
2. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Remove the oil pan skid plate bolts and plate, if equipped.

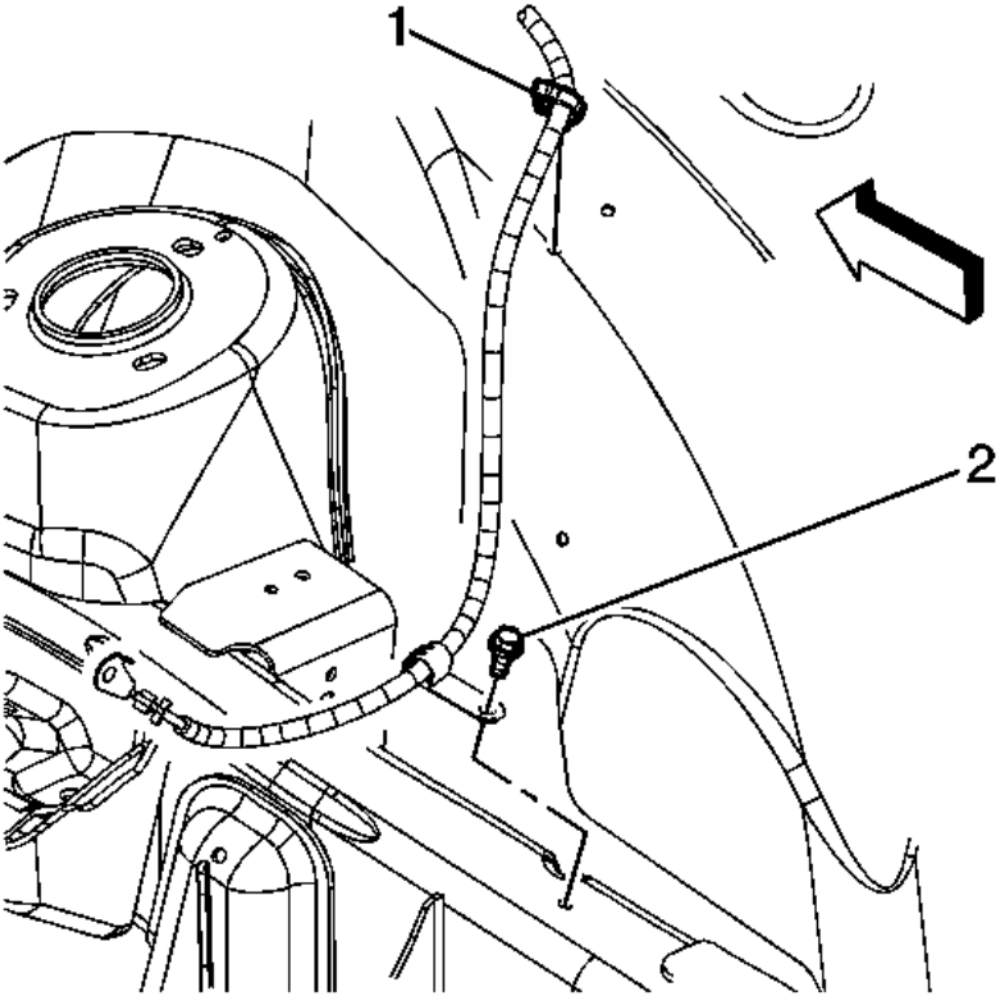


Fig. 222: View Of Starter Solenoid Cable Clip & Bolt
Courtesy of GENERAL MOTORS CORP.

4. Remove the starter solenoid cable clip bolt (2) from the frame.

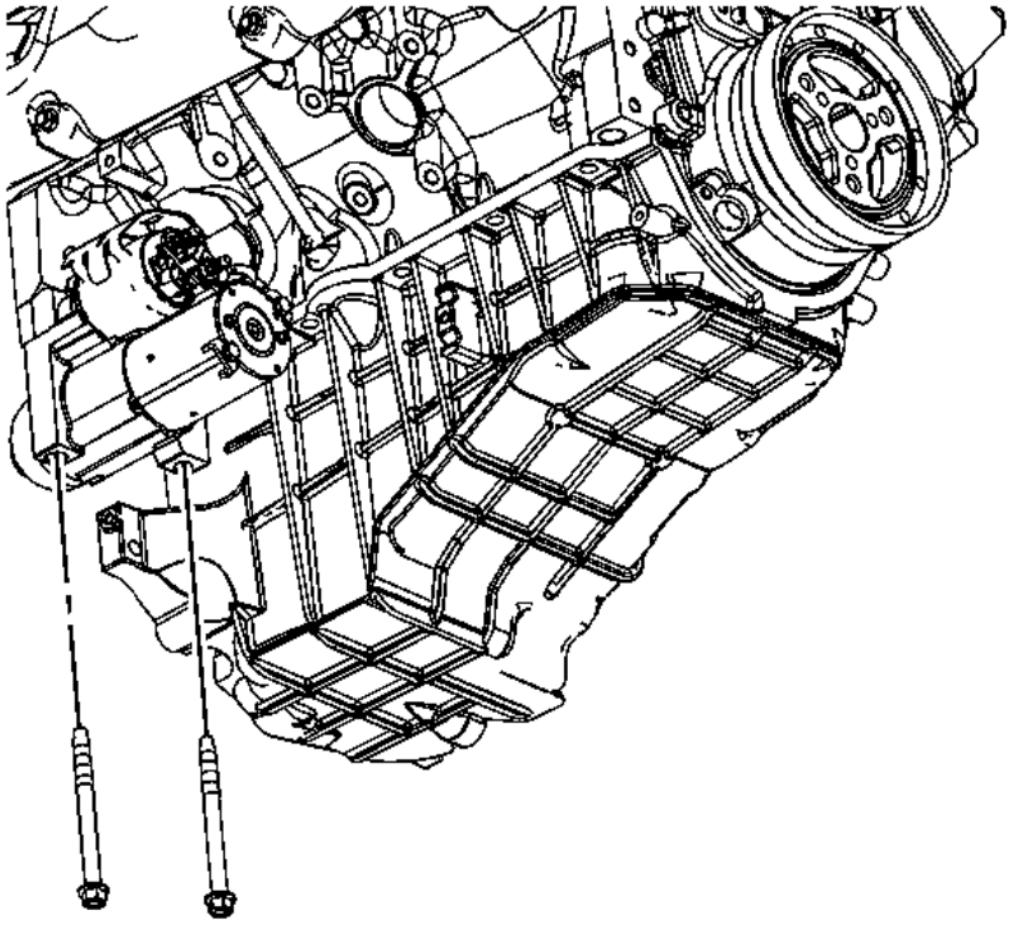


Fig. 223: View of Starter Motor Bolts
Courtesy of GENERAL MOTORS CORP.

5. Remove the starter motor bolts.

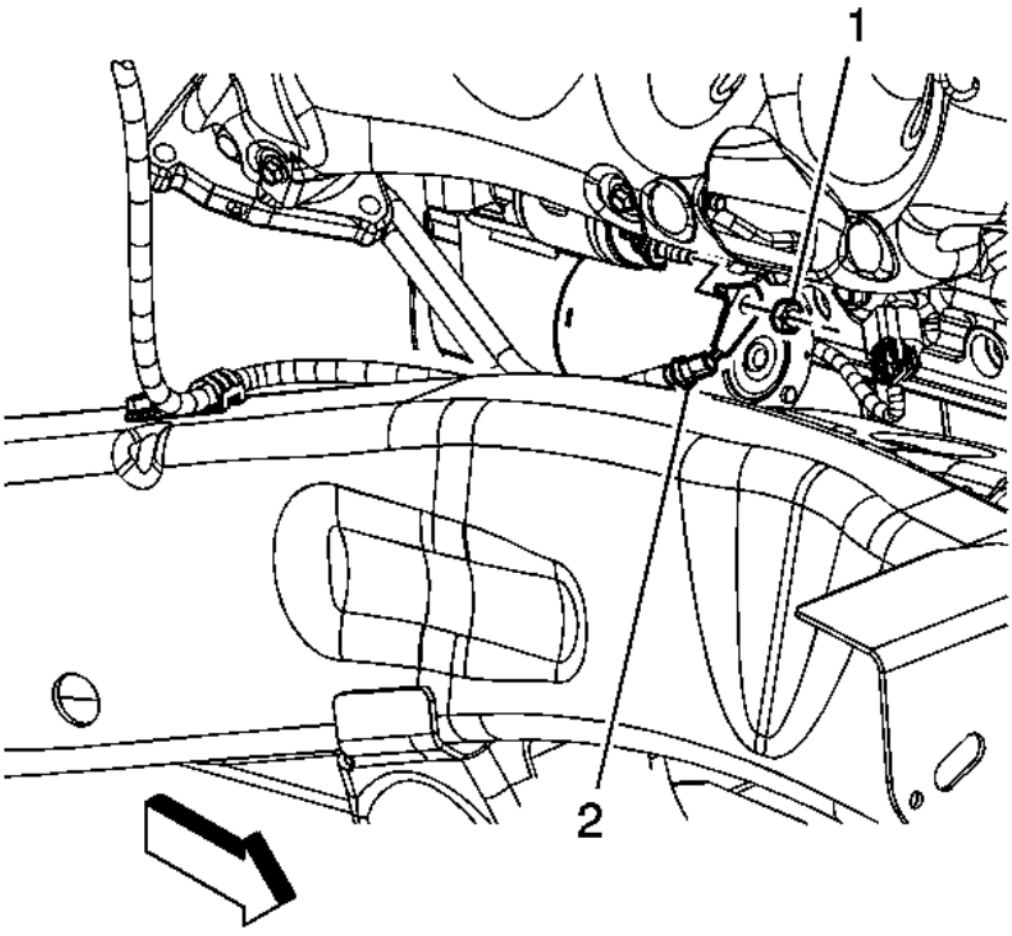


Fig. 224: View Of Starter Solenoid Cable & Nut
Courtesy of GENERAL MOTORS CORP.

6. Remove the starter solenoid cable lead nut (1).
7. Remove the starter solenoid cable lead (2) from the starter.

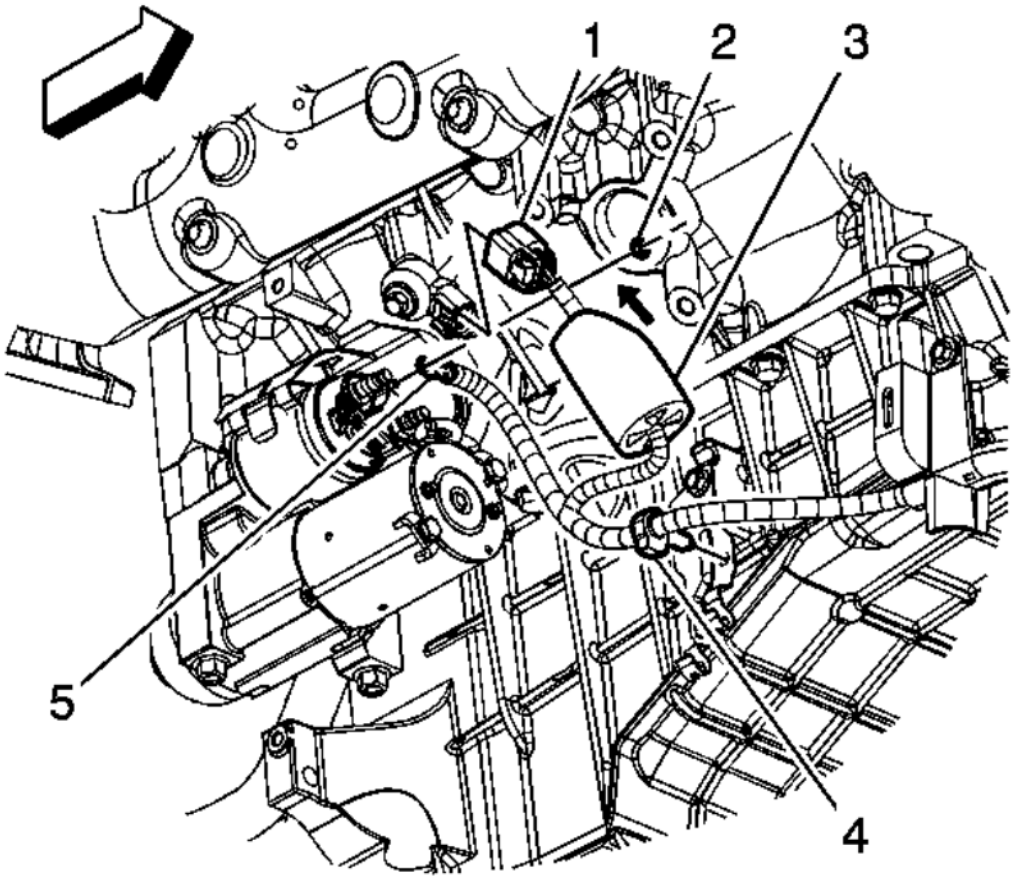


Fig. 225: View Of Engine Wiring Harness & Components
Courtesy of GENERAL MOTORS CORP.

8. Remove the engine wiring harness lead nut (2).
9. Remove the engine wiring harness lead (5) from the starter.

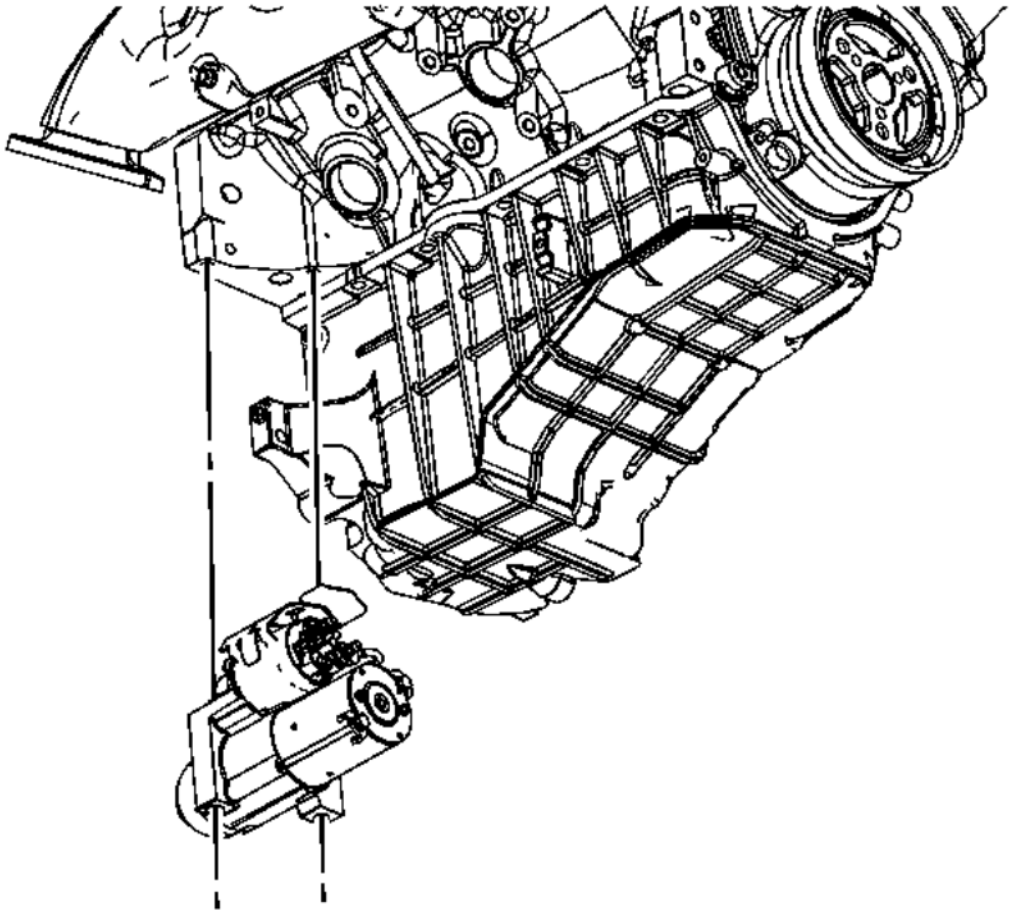


Fig. 226: View Of Starter
Courtesy of GENERAL MOTORS CORP.

10. Remove the starter from the vehicle.

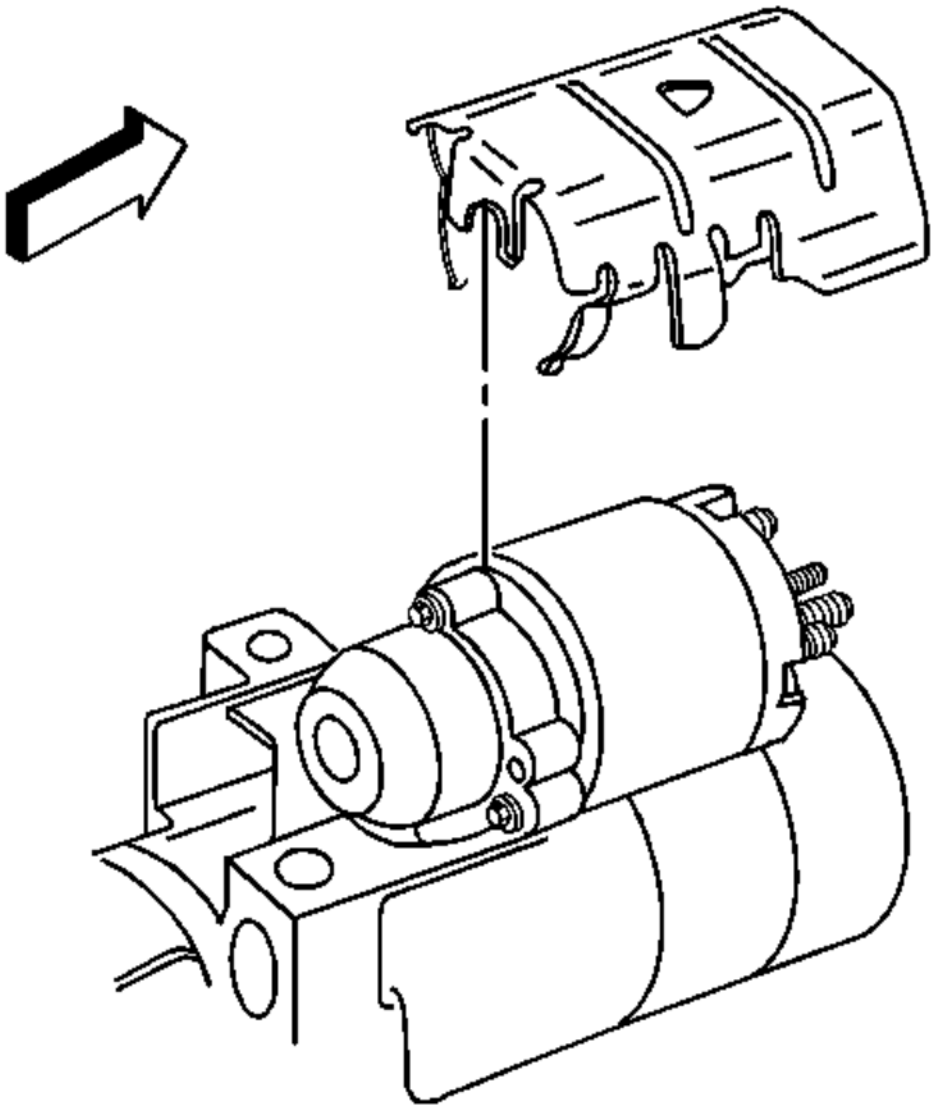


Fig. 227: View Of Starter & Heat Shield
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: If the starter shield is damaged, replace the starter shield.

11. If replacing the starter, remove the starter heat shield.

Installation Procedure

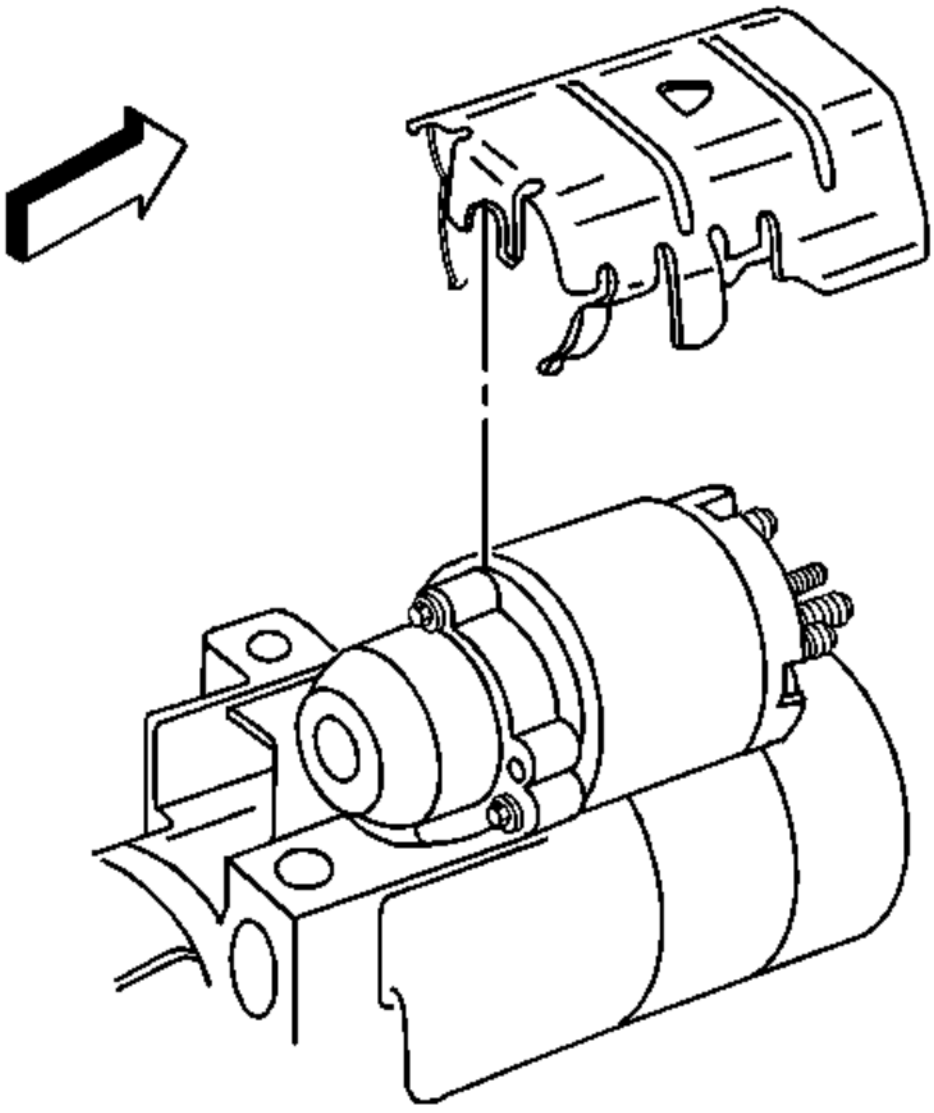


Fig. 228: View Of Starter & Heat Shield
Courtesy of GENERAL MOTORS CORP.

1. If the starter was replaced, install the starter heat shield to the starter.

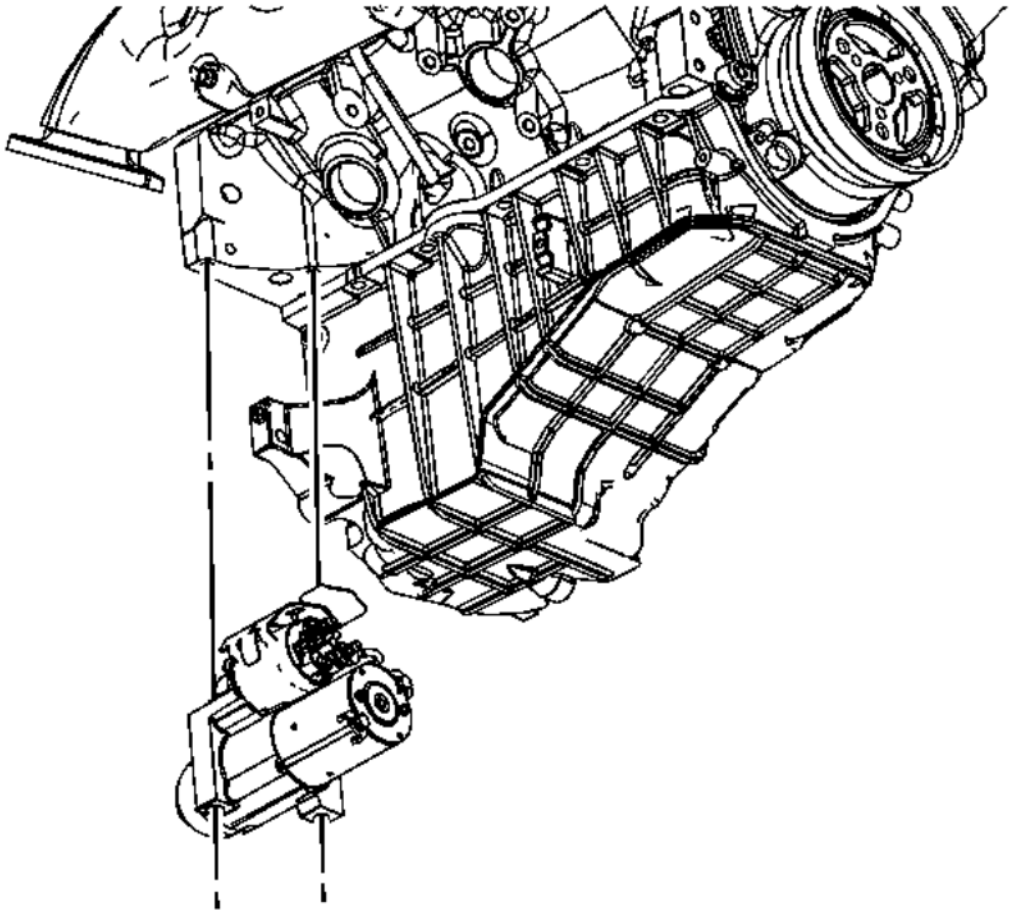


Fig. 229: View Of Starter
Courtesy of GENERAL MOTORS CORP.

2. Position the starter to the vehicle.

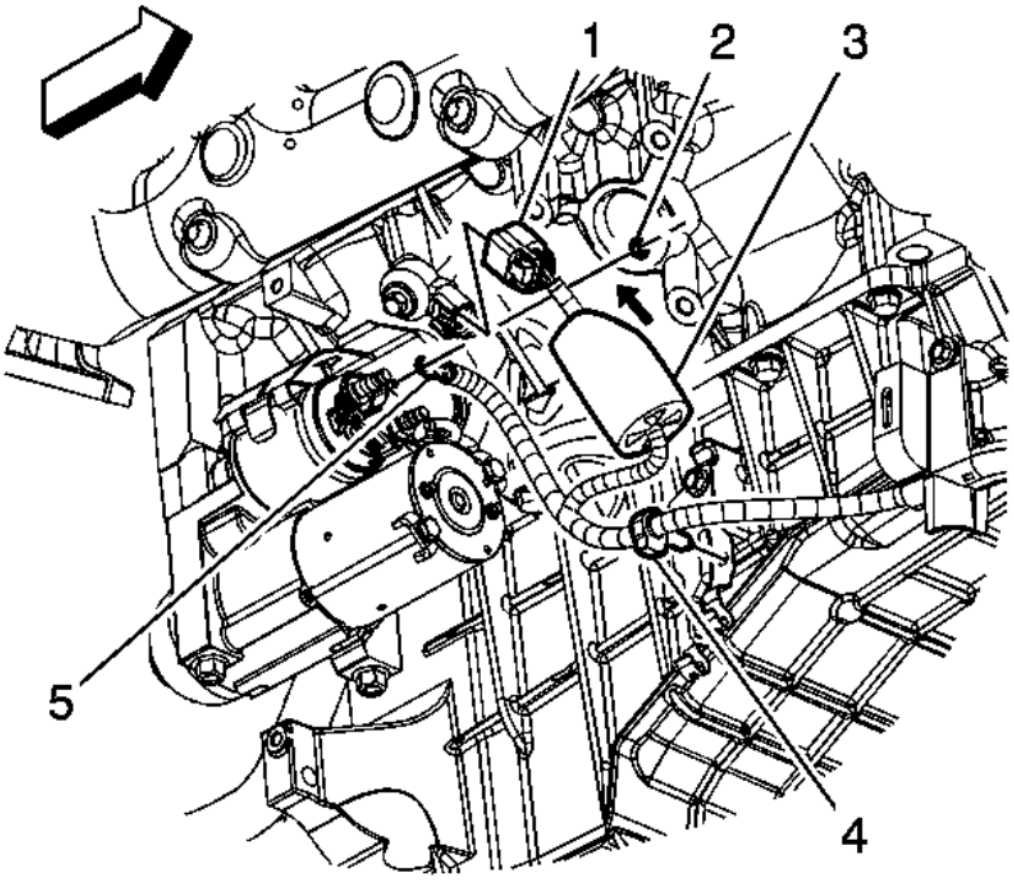


Fig. 230: View Of Engine Wiring Harness & Components
Courtesy of GENERAL MOTORS CORP.

3. Install the engine wiring harness lead (5) to the starter.

NOTE: **Refer to Fastener Notice .**

4. Install the engine wiring harness lead nut (2).

Tighten: Tighten the nut to 3.4 N.m (30 lb in).

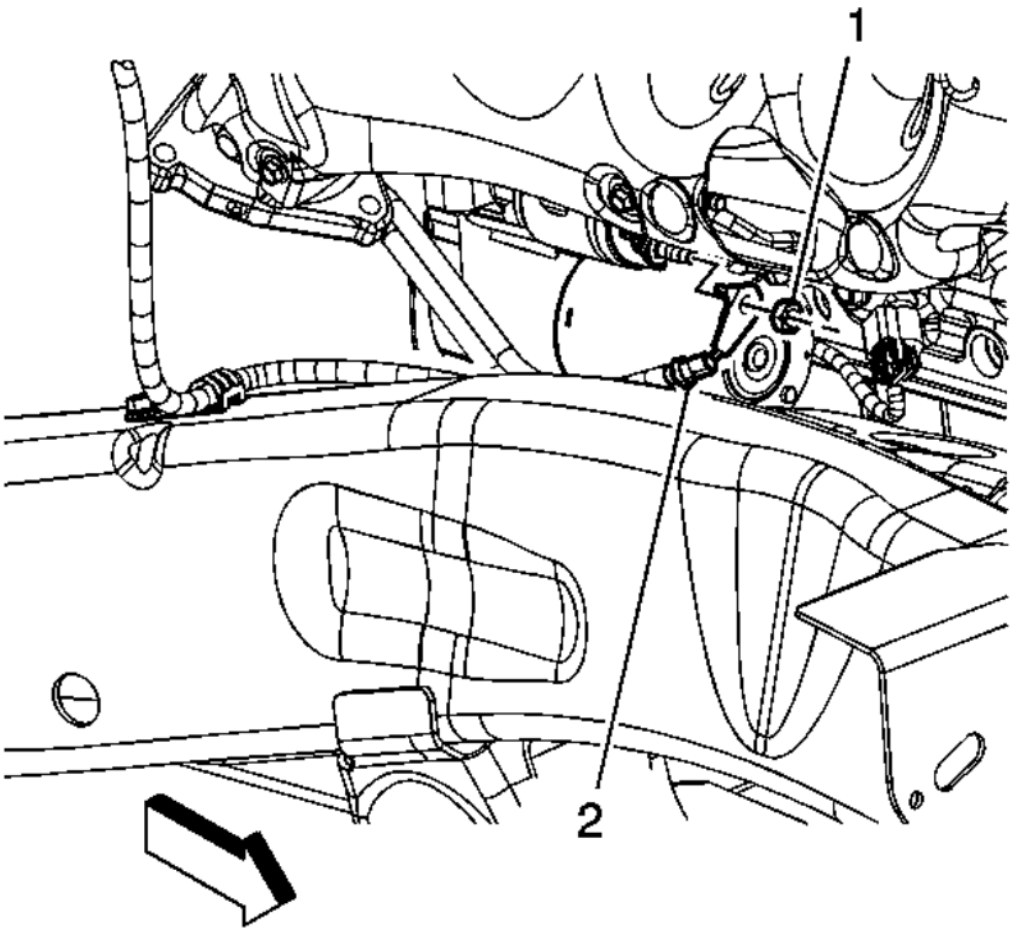


Fig. 231: View Of Starter Solenoid Cable & Nut
Courtesy of GENERAL MOTORS CORP.

5. Install the starter solenoid cable lead (2) to the starter.
6. Install the starter solenoid cable (1) nut.

Tighten: Tighten the nut to 9 N.m (80 lb in).

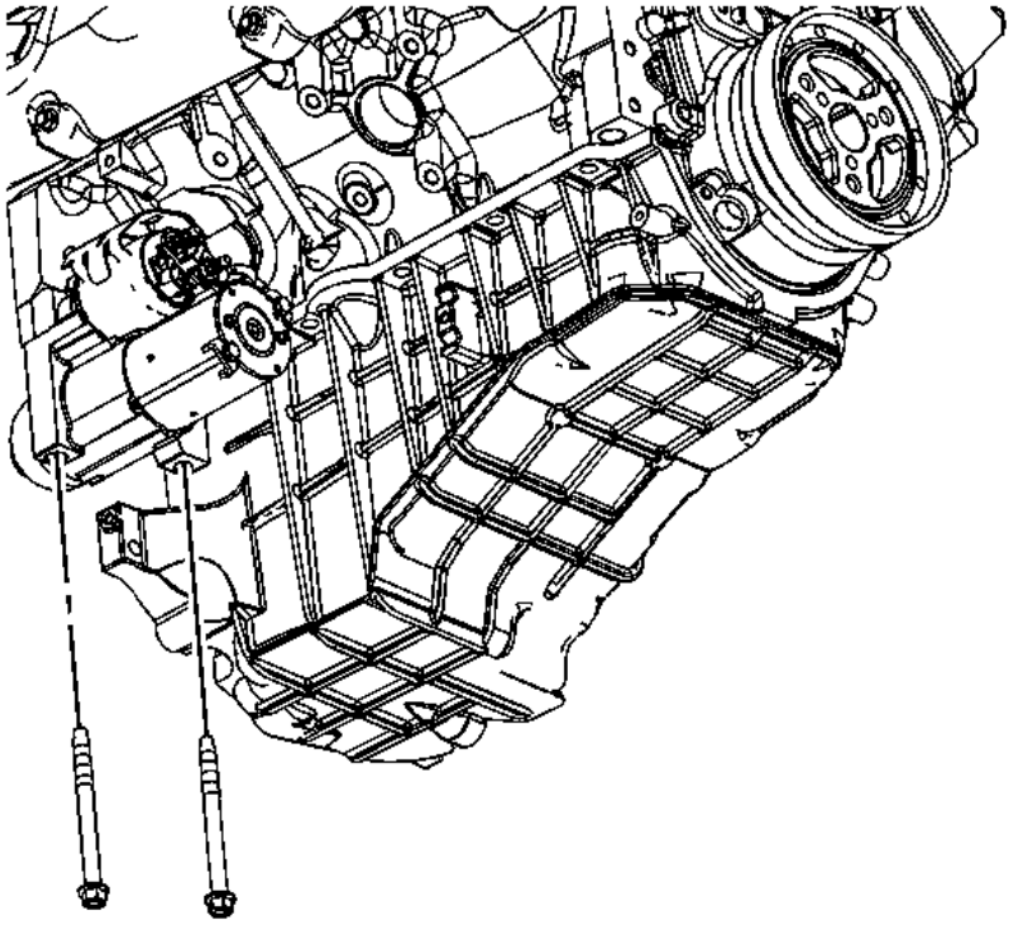


Fig. 232: View of Starter Motor Bolts
Courtesy of GENERAL MOTORS CORP.

7. Install the starter motor bolts.

   Tighten: Tighten the bolts to 50 N.m (37 lb ft).

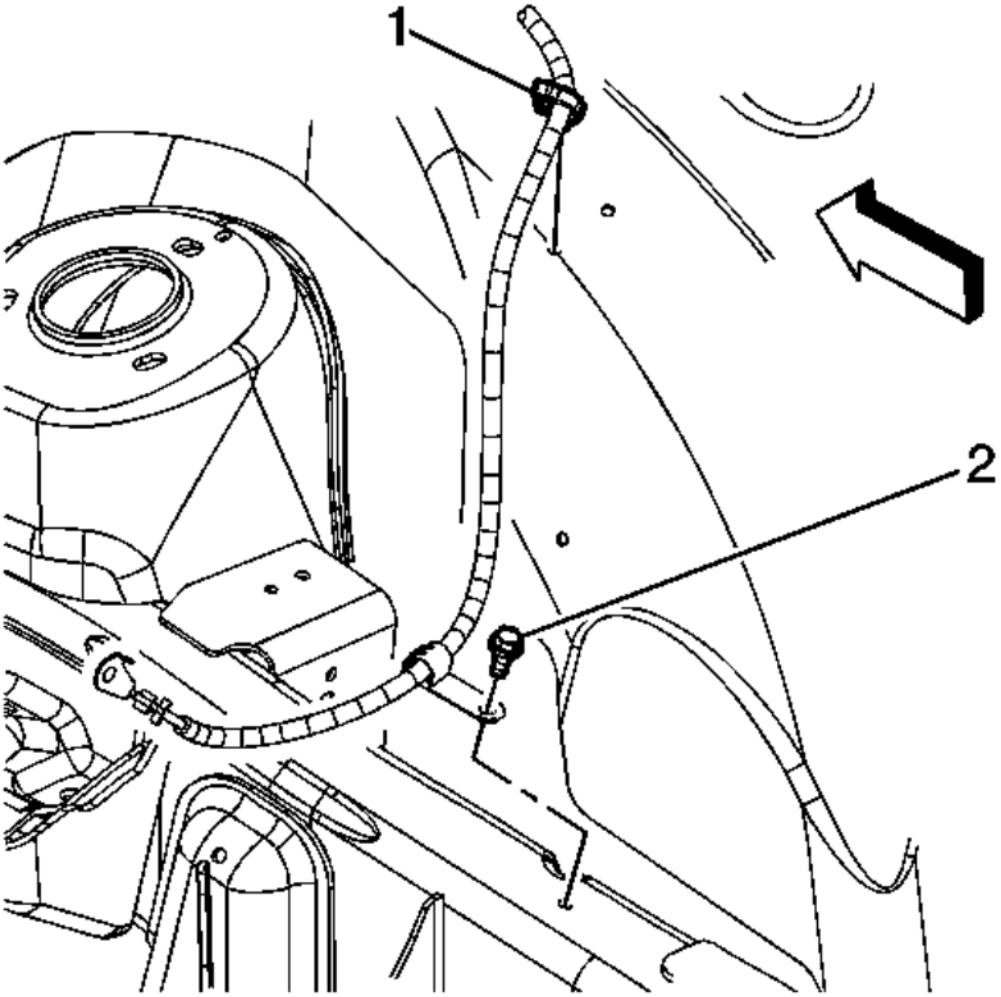


Fig. 233: View Of Starter Solenoid Cable Clip & Bolt
Courtesy of GENERAL MOTORS CORP.

8. Position the starter solenoid cable clip to the frame and install the starter solenoid cable clip bolt (2).

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

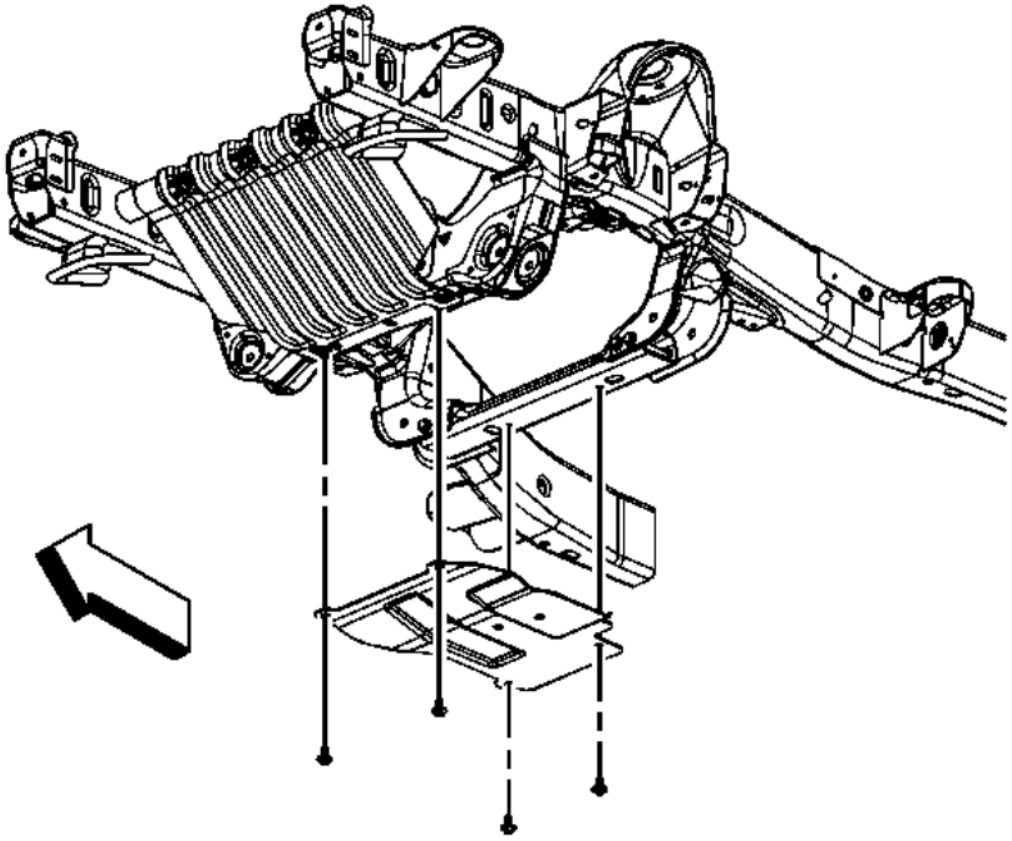


Fig. 234: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

9. Position the oil pan skid plate and install the bolts, if equipped.

   Tighten: Tighten the bolts to 28 N.m (21 lb ft).

10. Lower the vehicle.
11. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

STARTER MOTOR REPLACEMENT (4.8L, 5.3L, 6.0L, AND 6.2L)

Removal Procedure

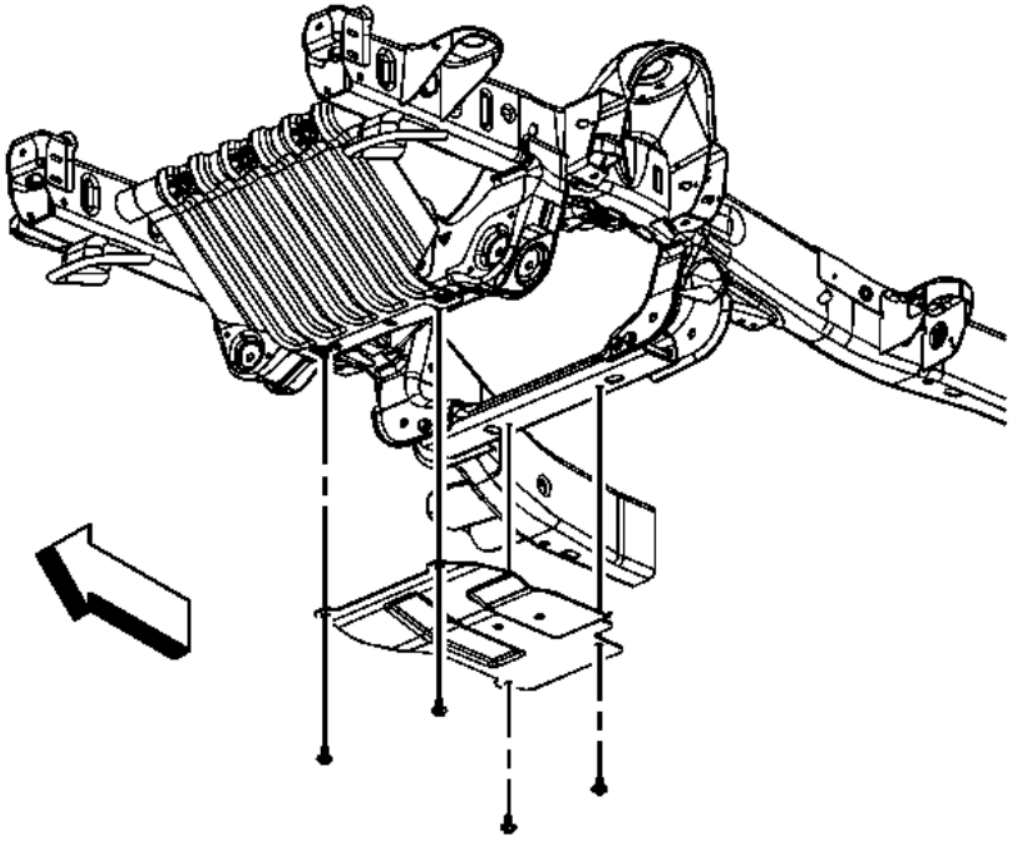


Fig. 235: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

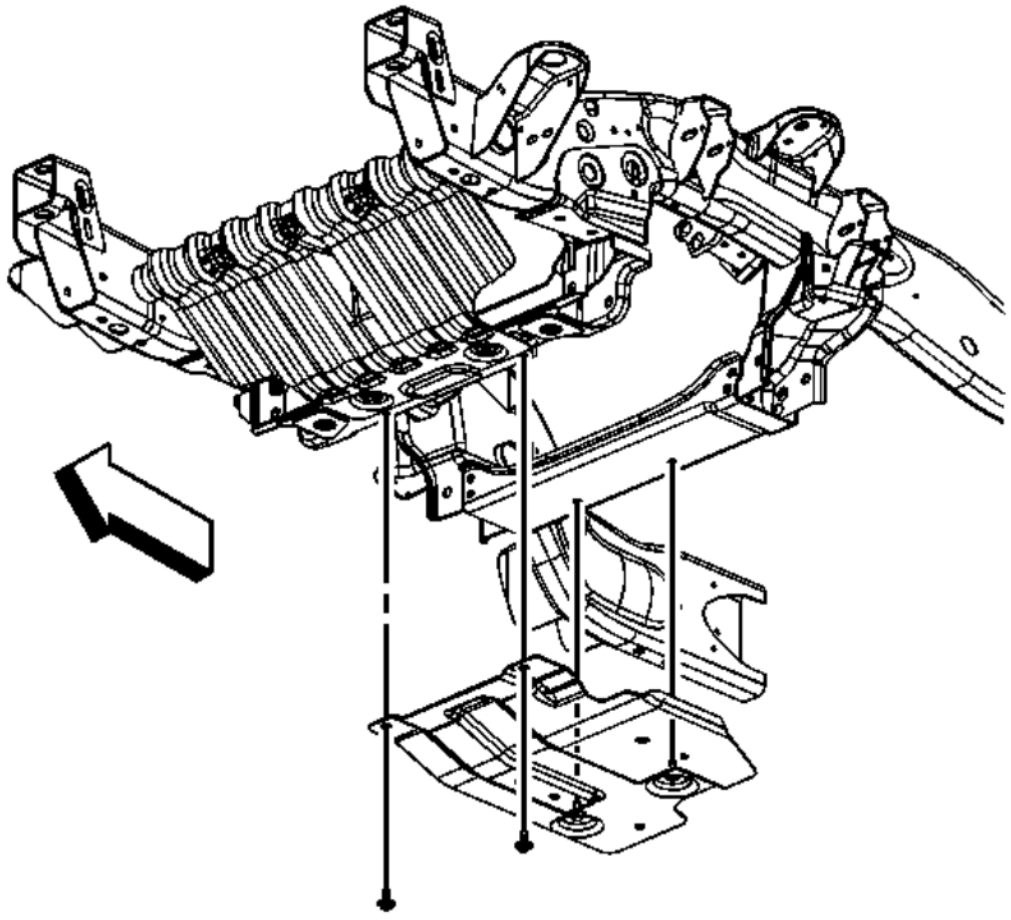


Fig. 236: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

3. For 2500 series vehicles, remove the front 2 oil pan skid plate bolts, loosen the rear 2 bolts and remove the skid plate, if equipped.

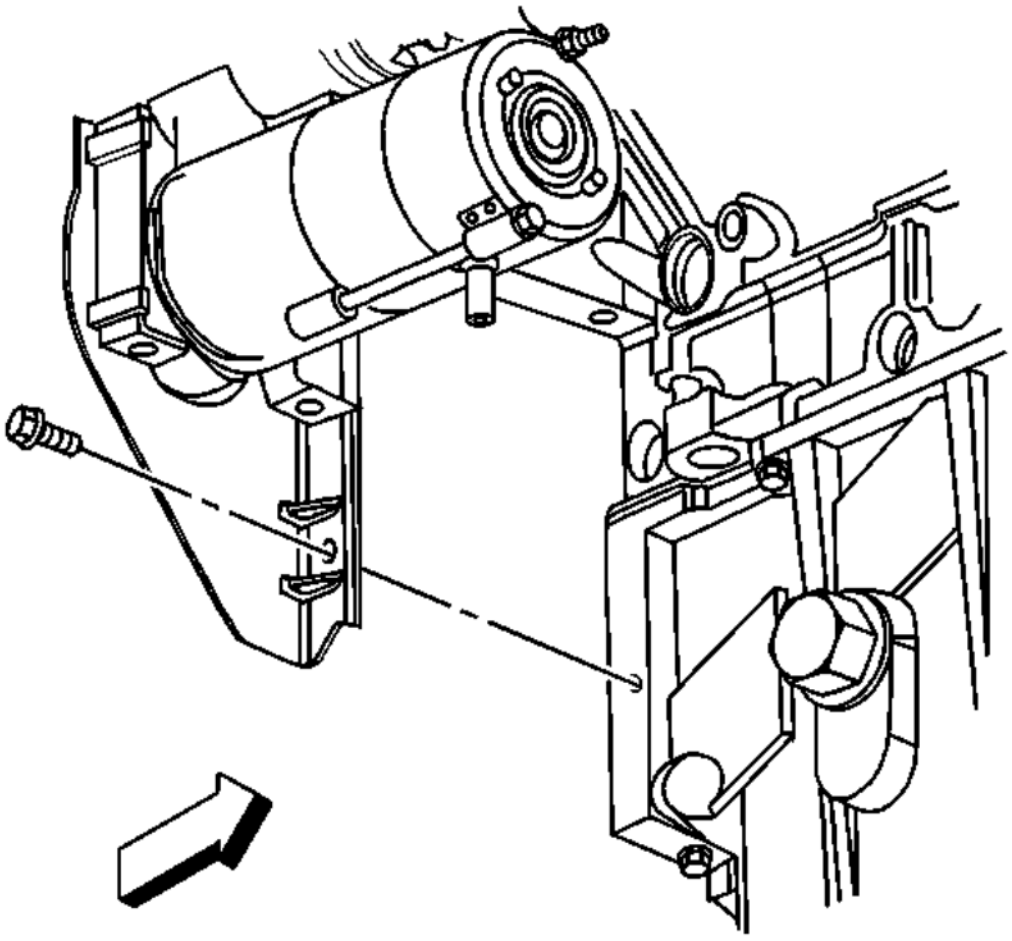


Fig. 237: View Of Transmission Cover Bolt
Courtesy of GENERAL MOTORS CORP.

4. Remove the transmission cover bolt.

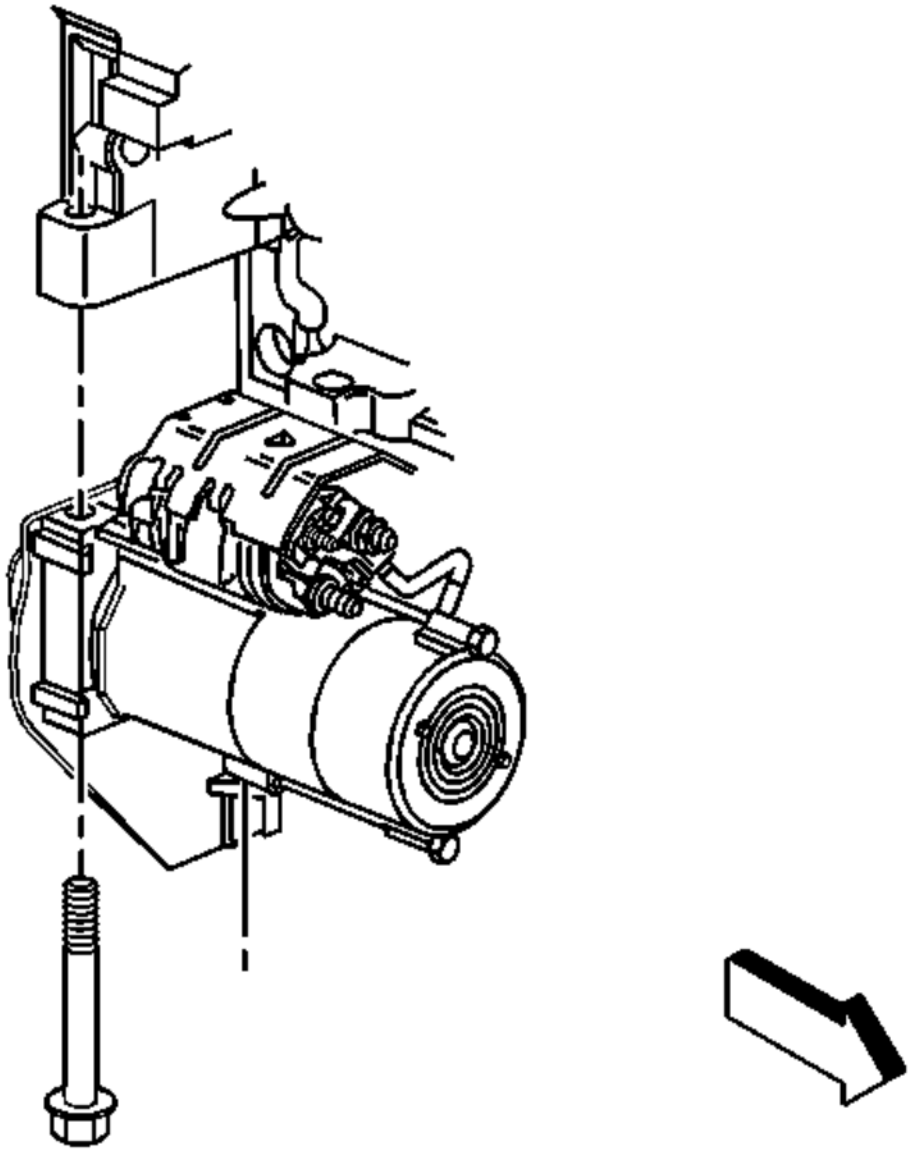


Fig. 238: View Of Starter & Bolts (4.8L, 5.3L & 6.0L)
Courtesy of GENERAL MOTORS CORP.

5. Remove the starter bolts.

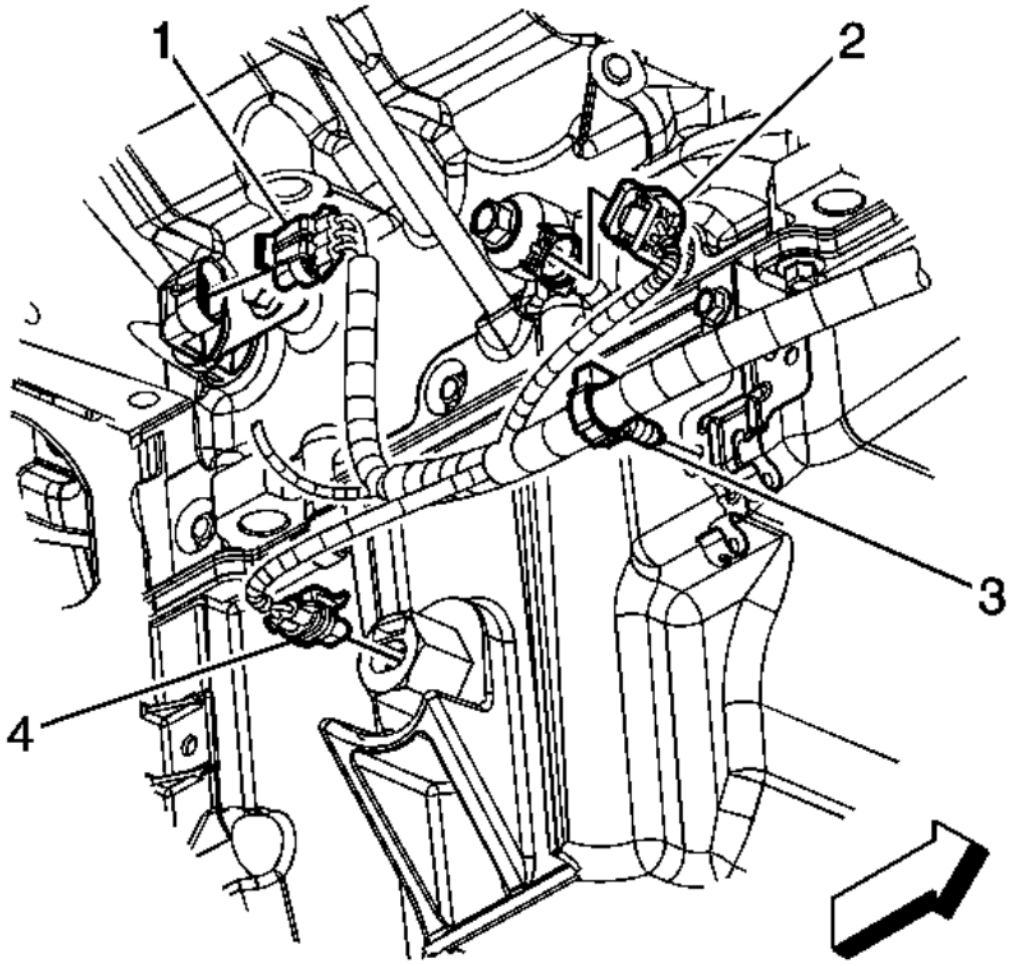


Fig. 239: View Of Engine Wiring Harness Electrical Connector & Components
Courtesy of GENERAL MOTORS CORP.

6. Disconnect the engine wiring harness electrical connector (4) from the oil level sensor.

NOTE: Avoid cable and wiring damage. DO NOT suspend the starter by the cables or wires attached to the solenoid terminals. Use a rope or mechanics wire to suspend the starter.

7. Slide the starter forward until the starter clears the transmission and properly support the starter.

8. Lower the vehicle half way.
9. Remove the right front wheel and tire. Refer to **Tire and Wheel Removal and Installation** .
10. Remove the right front wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement - Right Side (GMC)** or **Front Wheelhouse Liner Replacement - Right Side (Chevrolet)** .

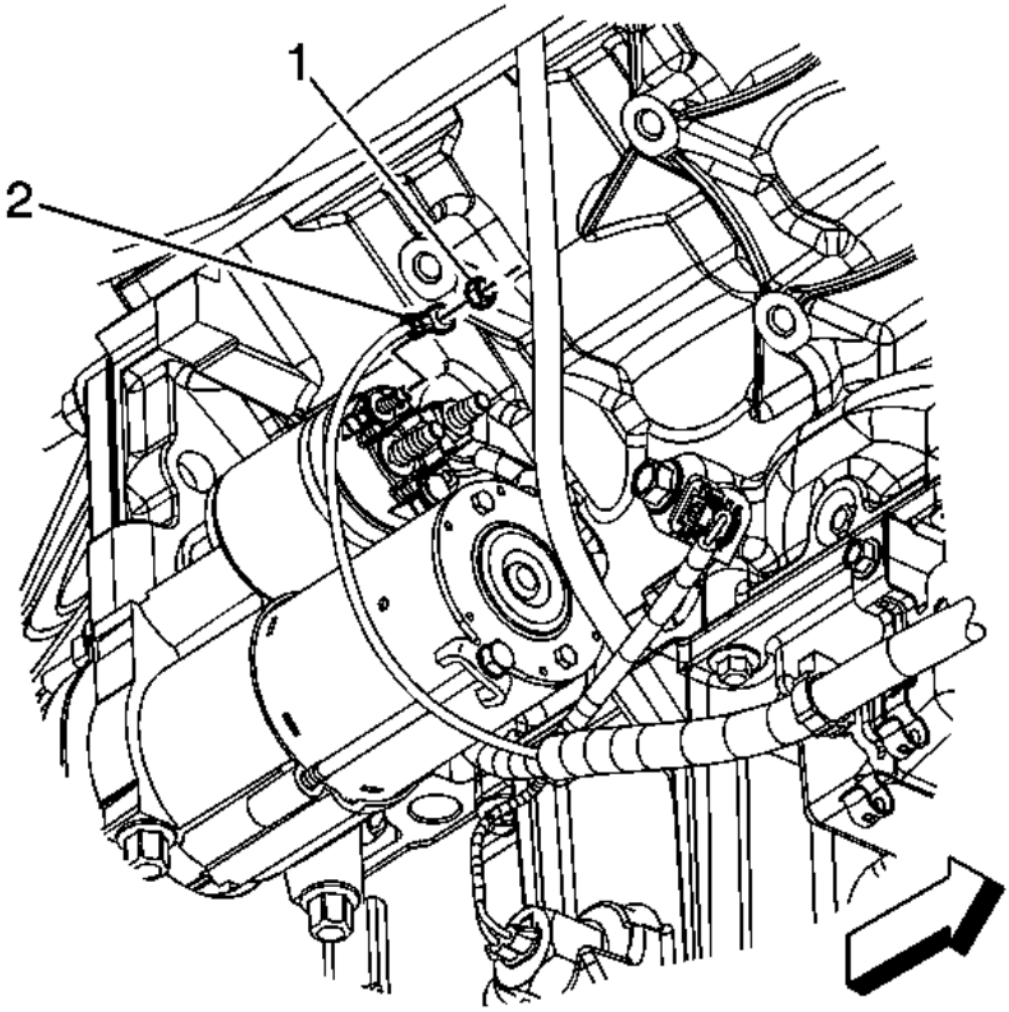


Fig. 240: View Of Engine Wiring Harness Lead Terminal & Nut
Courtesy of GENERAL MOTORS CORP.

11. Remove the engine wiring harness lead nut (1).
12. Remove the engine wiring harness lead terminal (2) from the starter.

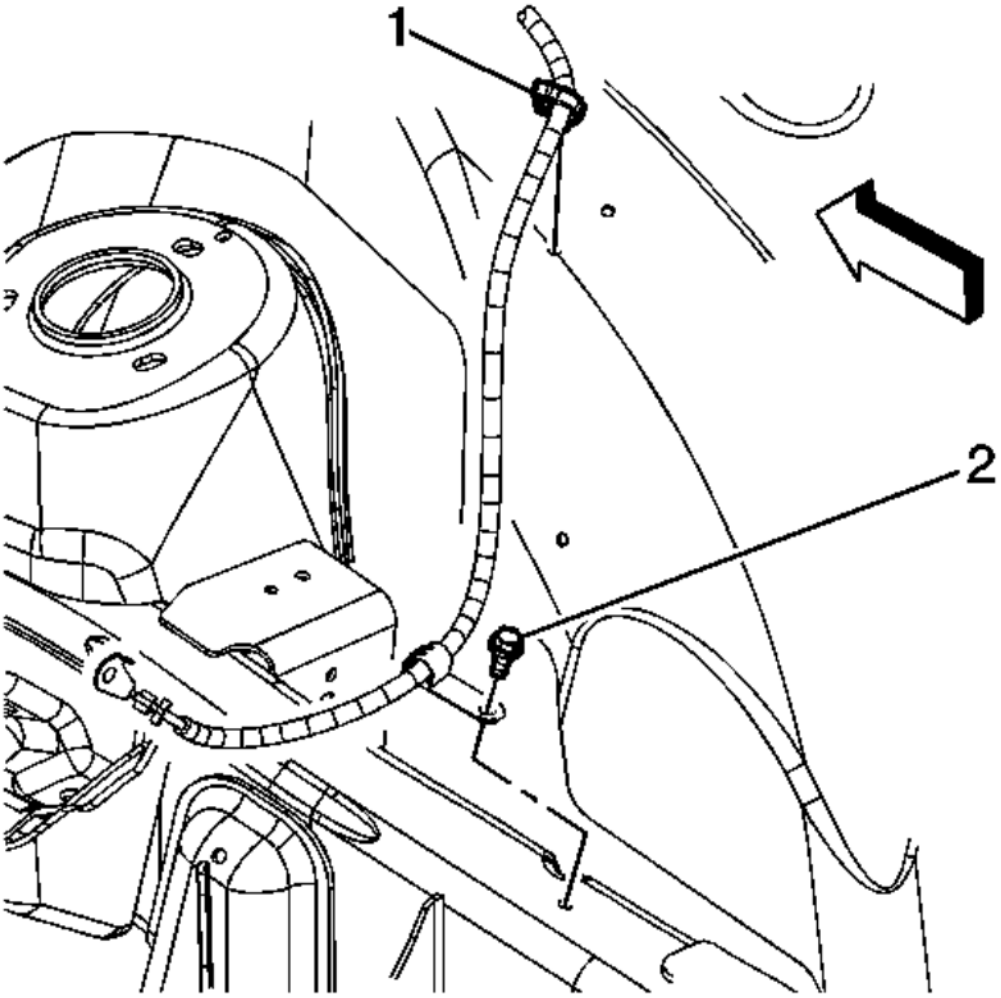


Fig. 241: View Of Starter Solenoid Cable Clip & Bolt
Courtesy of GENERAL MOTORS CORP.

13. Remove the starter solenoid cable clip bolt (2) from the frame.

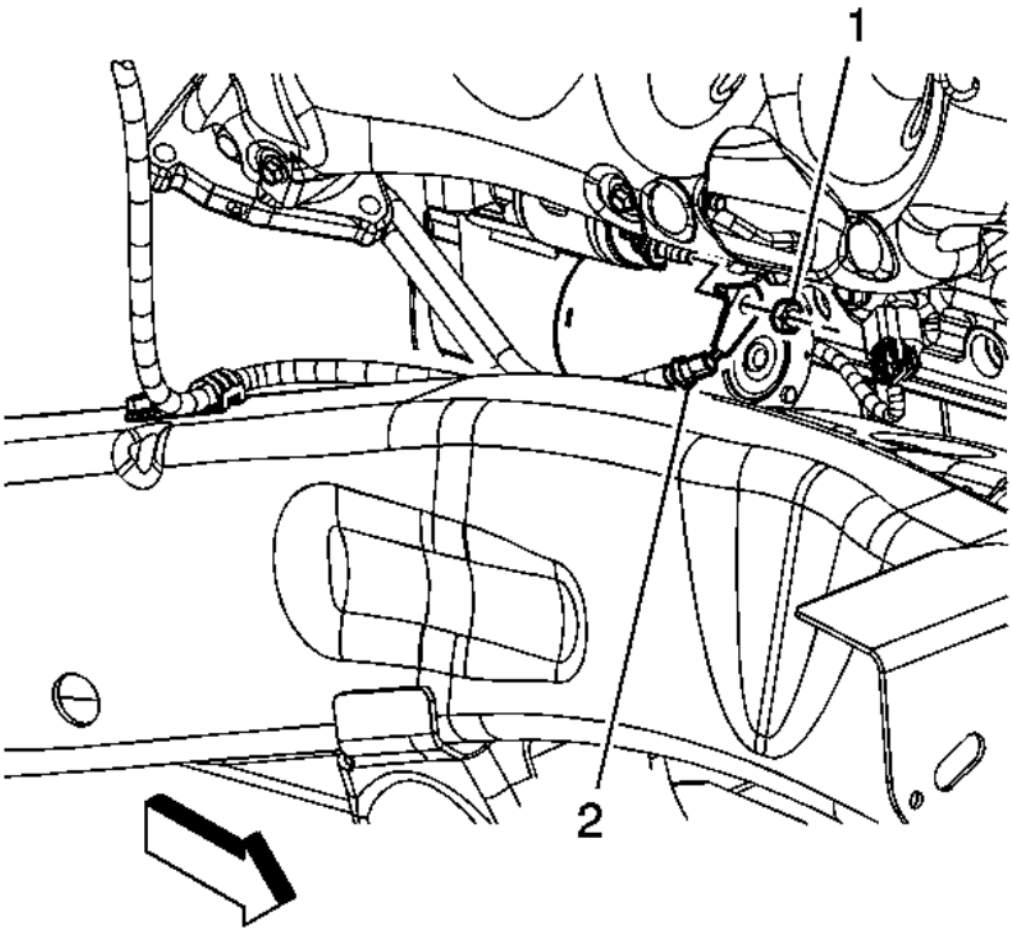


Fig. 242: View Of Starter Solenoid Cable & Nut
Courtesy of GENERAL MOTORS CORP.

14. Remove the starter solenoid cable nut (1).
15. Remove the starter solenoid cable (2) from the starter.
16. Remove the starter out through the wheel well opening.

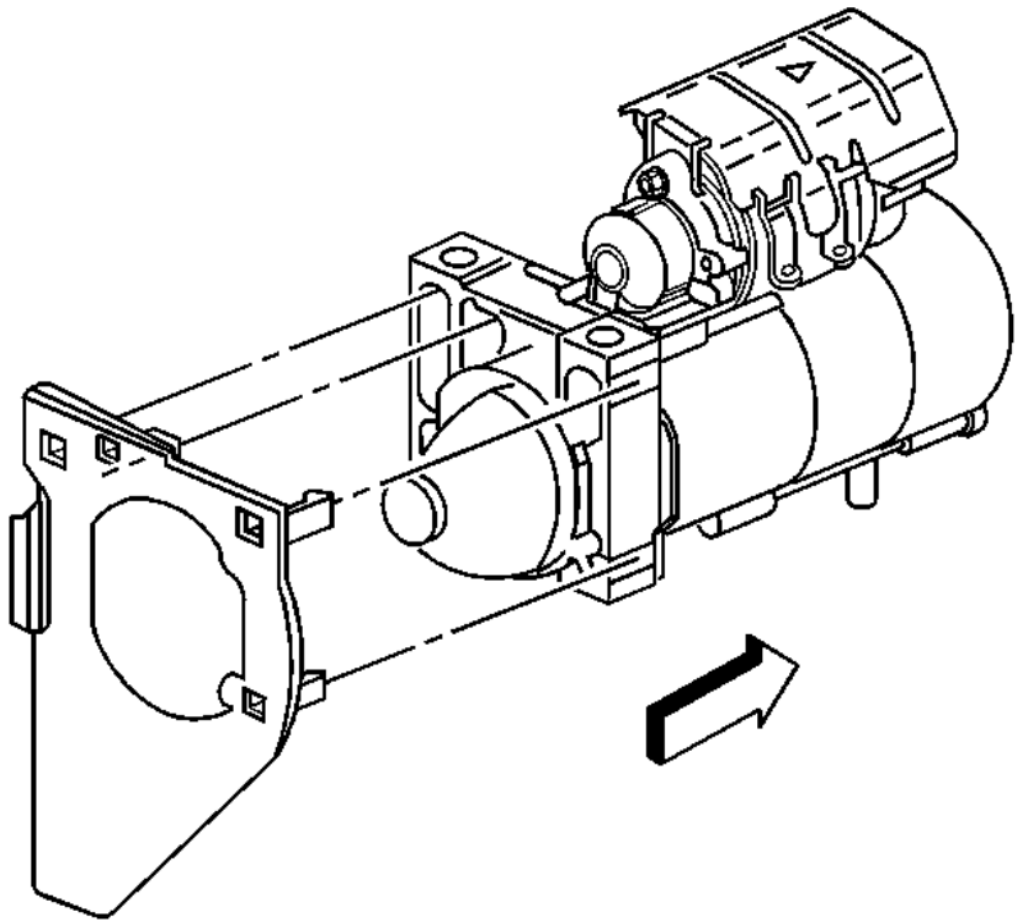


Fig. 243: View Of Transmission Cover & Starter
Courtesy of GENERAL MOTORS CORP.

17. If replacing the starter, unsnap the transmission cover from the starter.

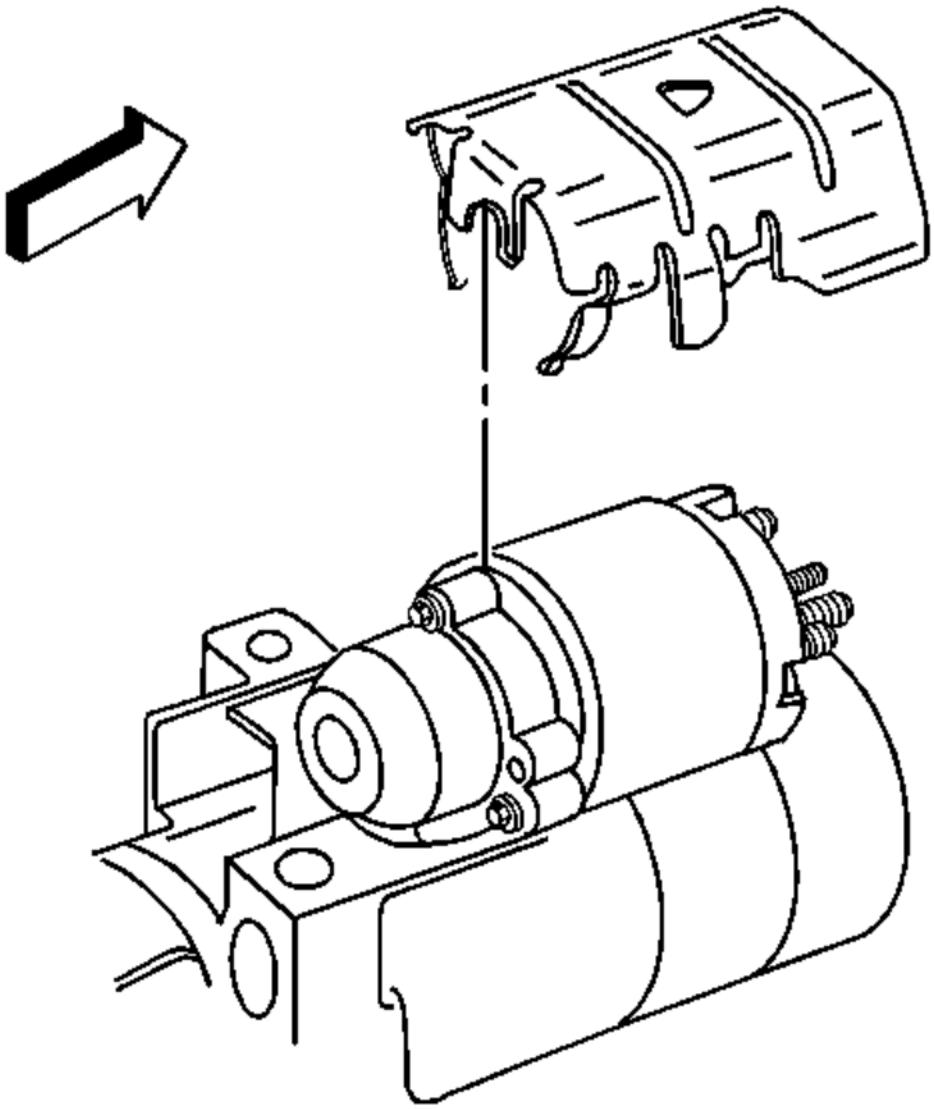


Fig. 244: View Of Starter & Heat Shield
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: If the starter shield is damaged, replace the starter shield.

18. If replacing the starter, remove the starter heat shield.

Installation Procedure

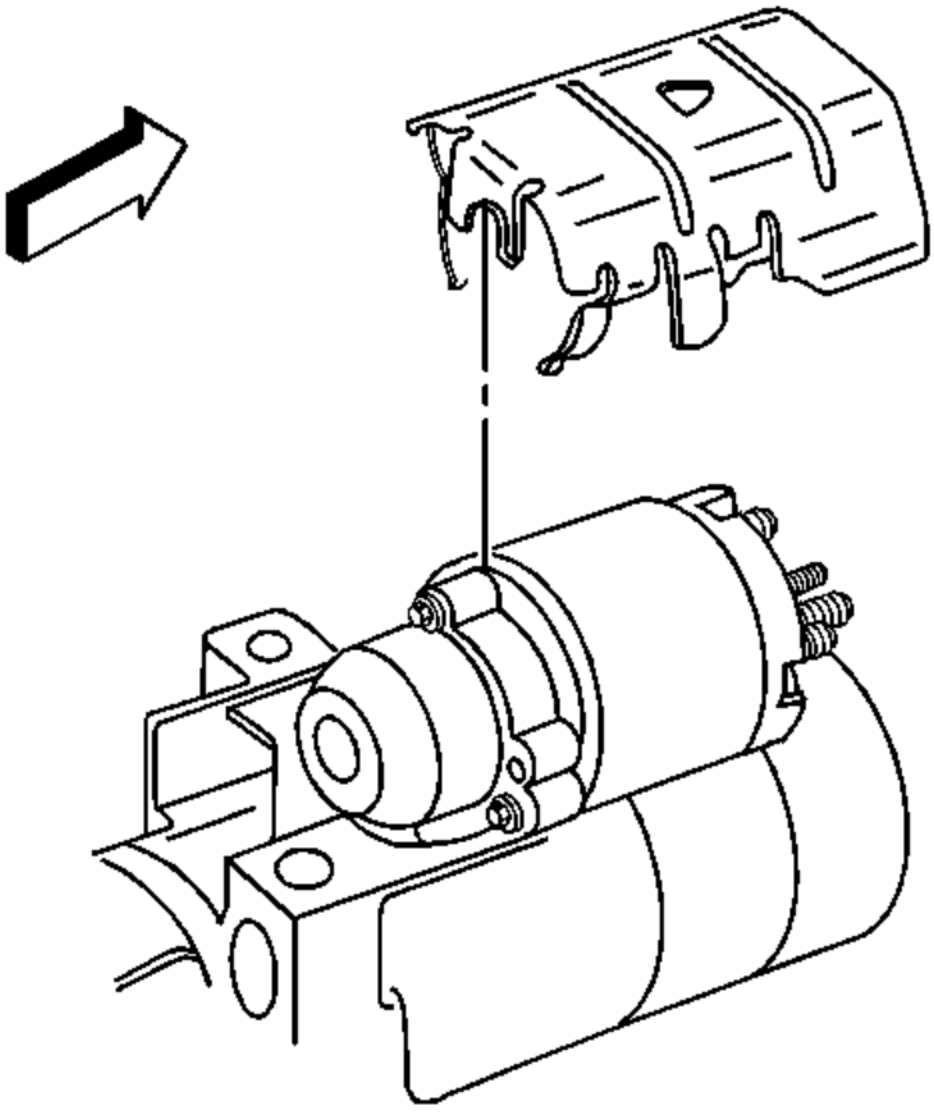


Fig. 245: View Of Starter & Heat Shield
Courtesy of GENERAL MOTORS CORP.

1. If the starter was replaced, install the starter heat shield.

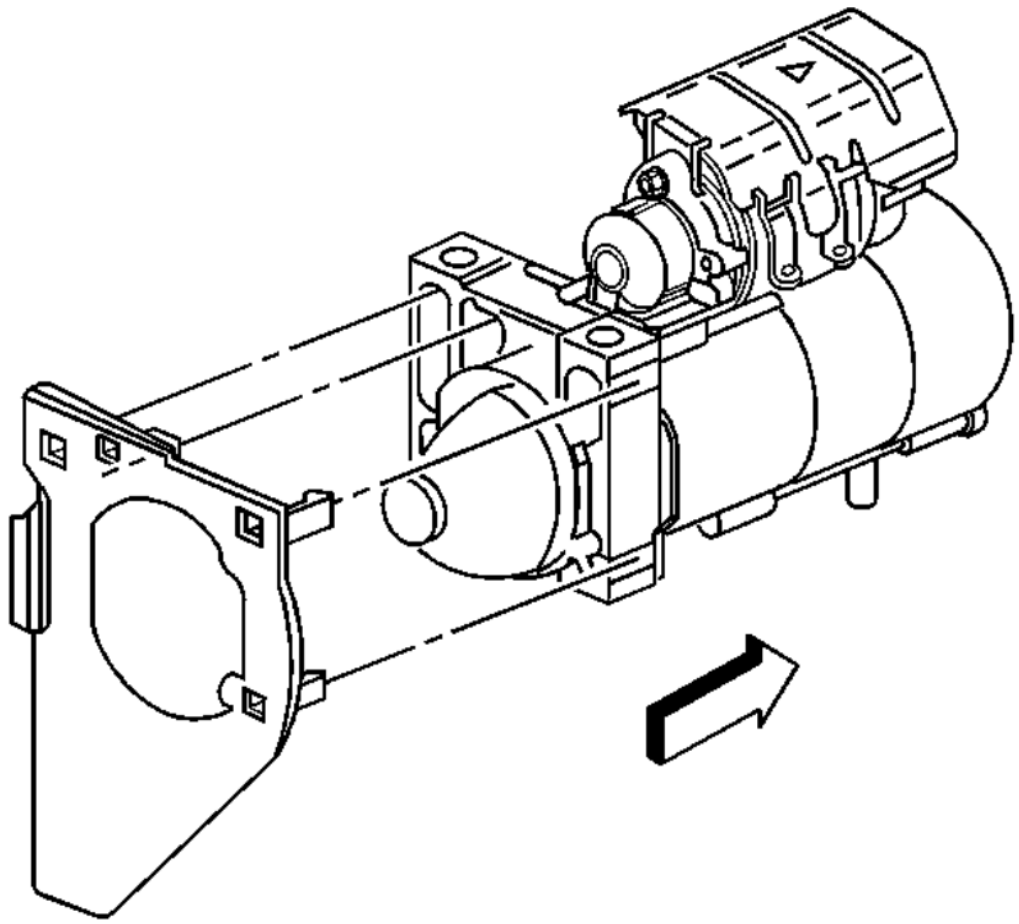


Fig. 246: View Of Transmission Cover & Starter
Courtesy of GENERAL MOTORS CORP.

2. If the starter was replaced, snap the transmission cover onto the starter.

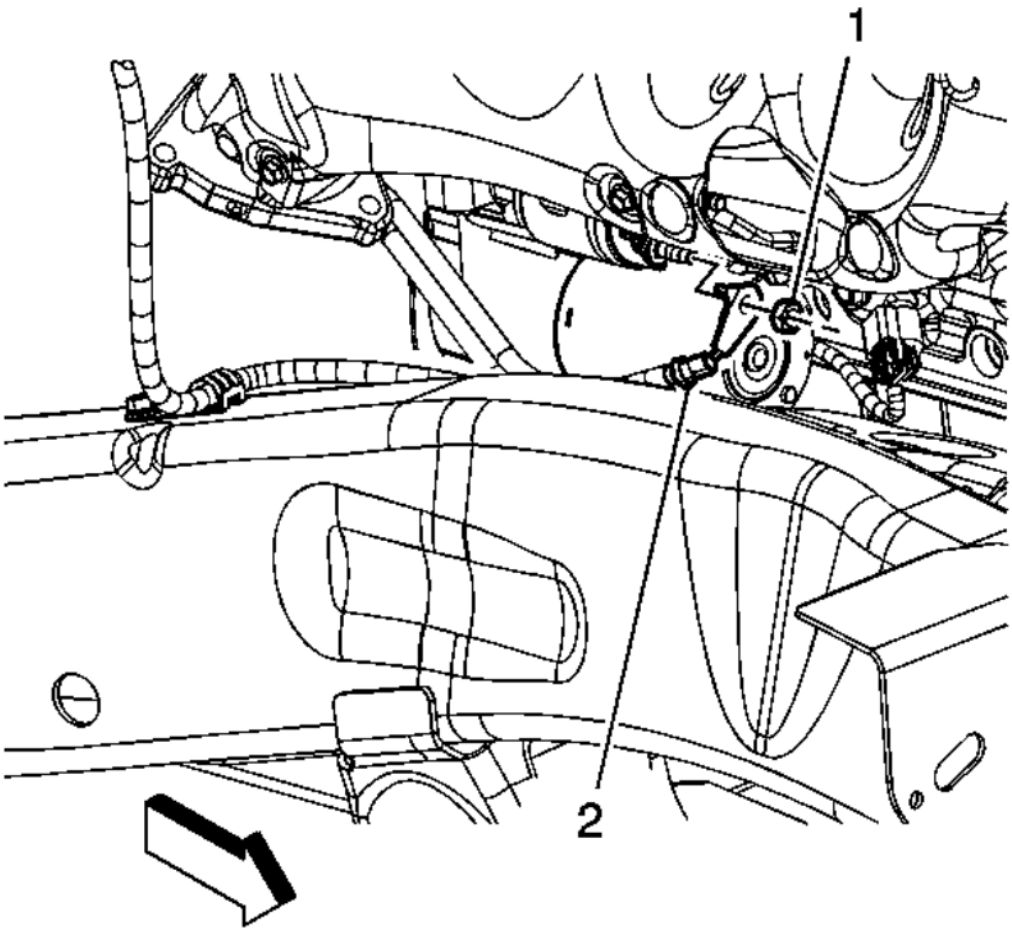


Fig. 247: View Of Starter Solenoid Cable & Nut
Courtesy of GENERAL MOTORS CORP.

3. Install the starter in through the wheel well opening.
4. Install the starter solenoid cable to the starter.

NOTE: **Refer to Fastener Notice .**

5. Install the starter solenoid cable nut (1).

Tighten: Tighten the nut to 9 N.m (80 lb in).

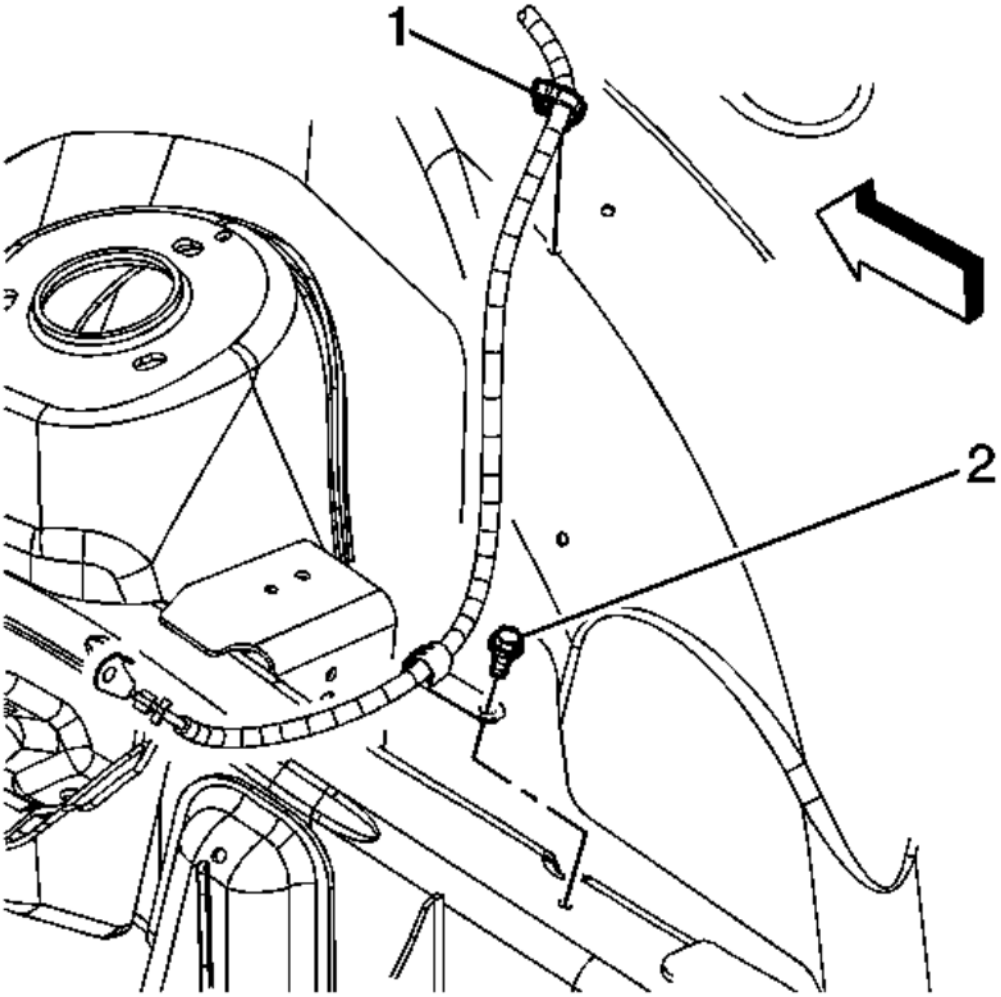


Fig. 248: View Of Starter Solenoid Cable Clip & Bolt
Courtesy of GENERAL MOTORS CORP.

6. Position the starter solenoid cable clip to the frame and install the starter solenoid cable clip bolt (2).

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

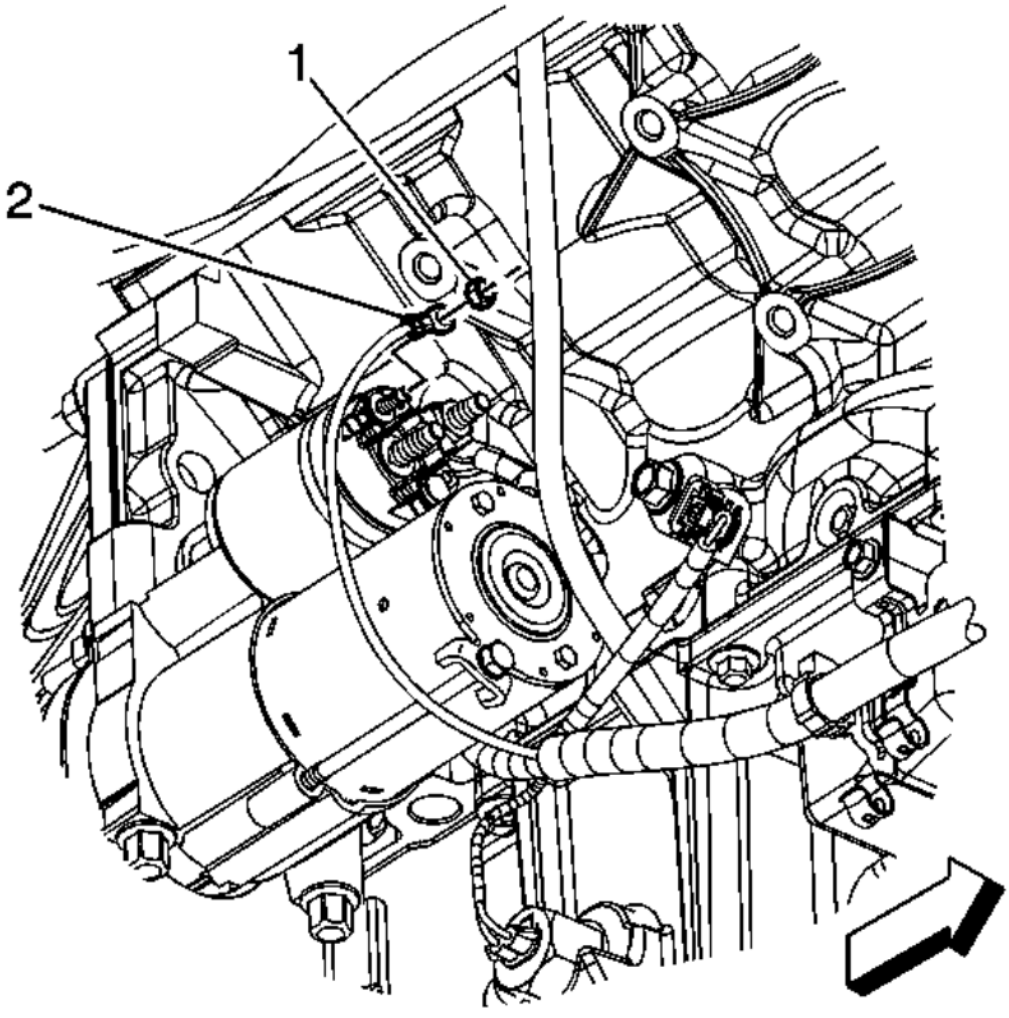


Fig. 249: View Of Engine Wiring Harness Lead Terminal & Nut
Courtesy of GENERAL MOTORS CORP.

7. Install the engine wiring harness lead terminal (2) to the starter.
8. Install the engine wiring harness lead nut (1).

Tighten: Tighten the nut to 3.4 N.m (30 lb in).

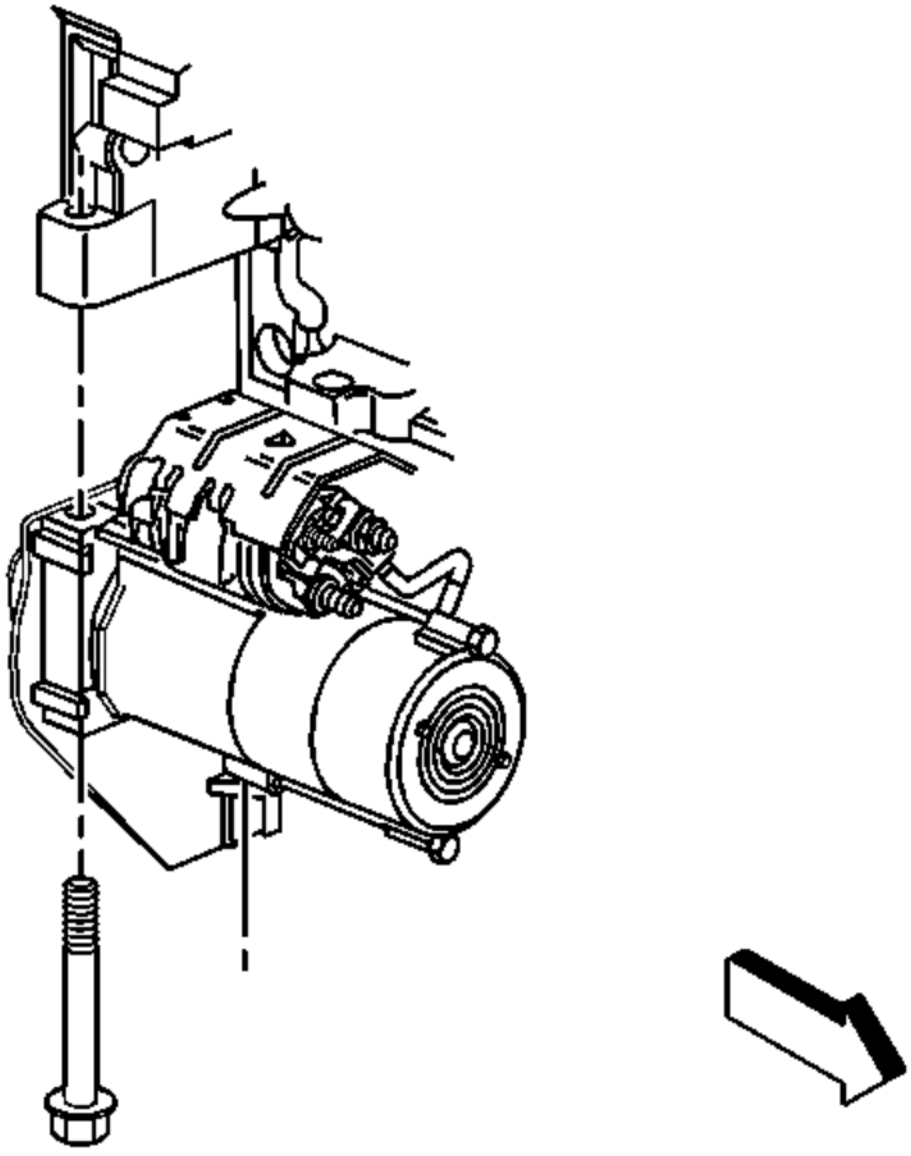


Fig. 250: View Of Starter & Bolts (4.8L, 5.3L & 6.0L)
Courtesy of GENERAL MOTORS CORP.

9. Position the starter into place.
10. Install the starter bolts.

Tighten: Tighten the bolts to 50 N.m (37 lb ft).

11. Install the right front wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement - Right Side (GMC)** or **Front Wheelhouse Liner Replacement - Right Side (Chevrolet)** .
12. Install the right front wheel and tire. Refer to **Tire and Wheel Removal and Installation** .
13. Raise and support the vehicle.

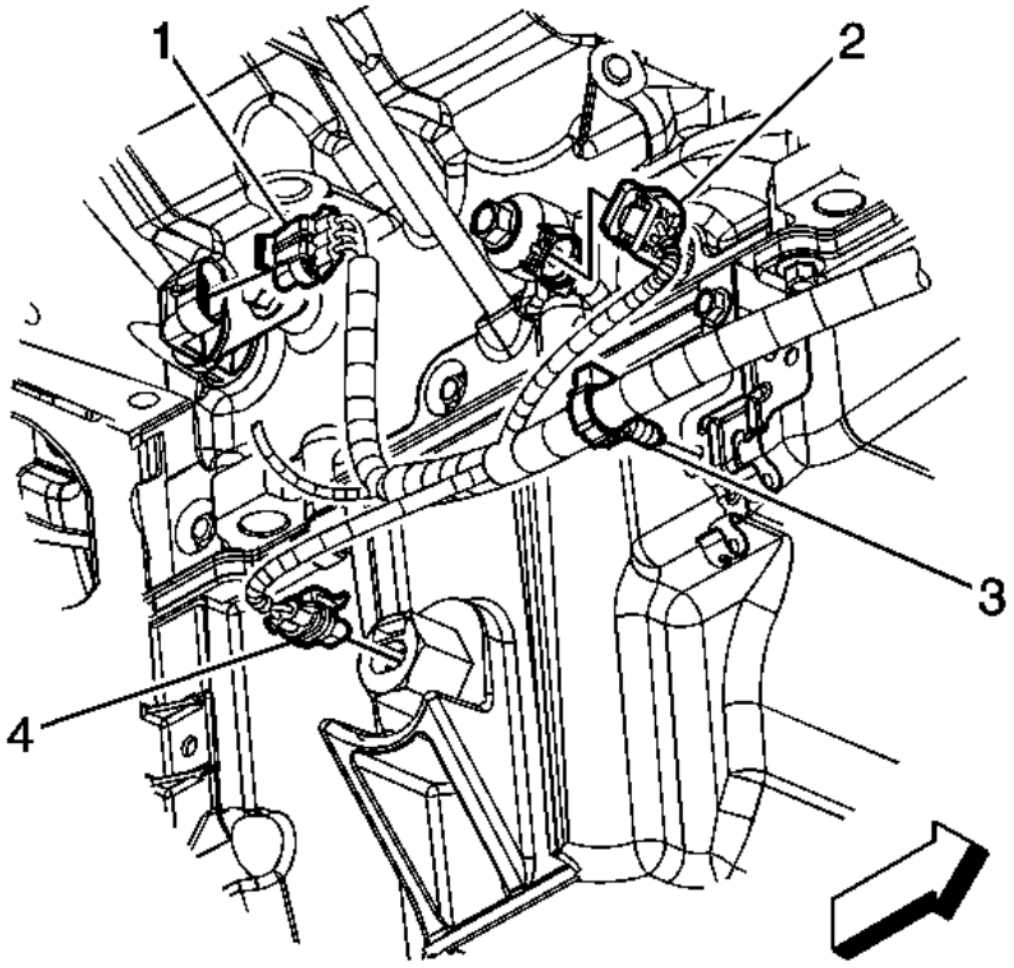


Fig. 251: View Of Engine Wiring Harness Electrical Connector & Components
Courtesy of GENERAL MOTORS CORP.

14. Connect the engine wiring harness electrical connector (4) to the oil level sensor.

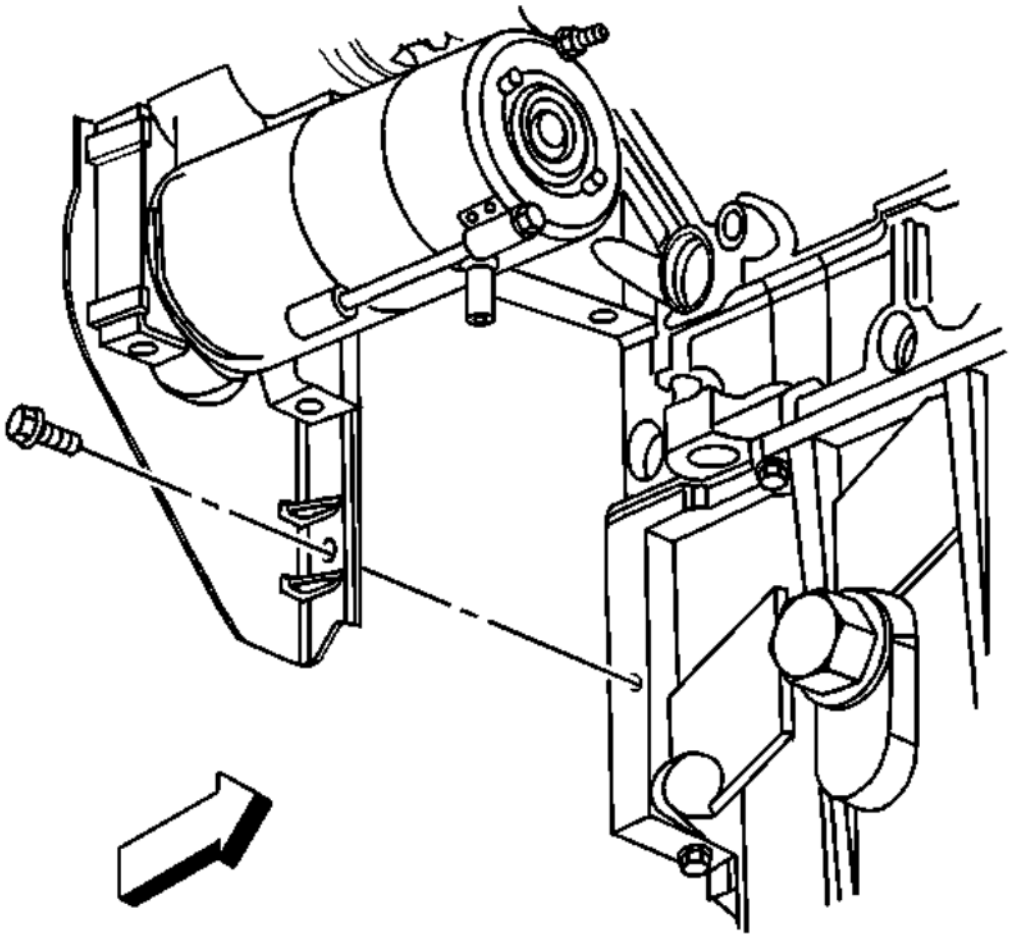


Fig. 252: View Of Transmission Cover Bolt
Courtesy of GENERAL MOTORS CORP.

15. Install the transmission cover bolt.

    Tighten: Tighten the bolt to 9 N.m (80 lb in).

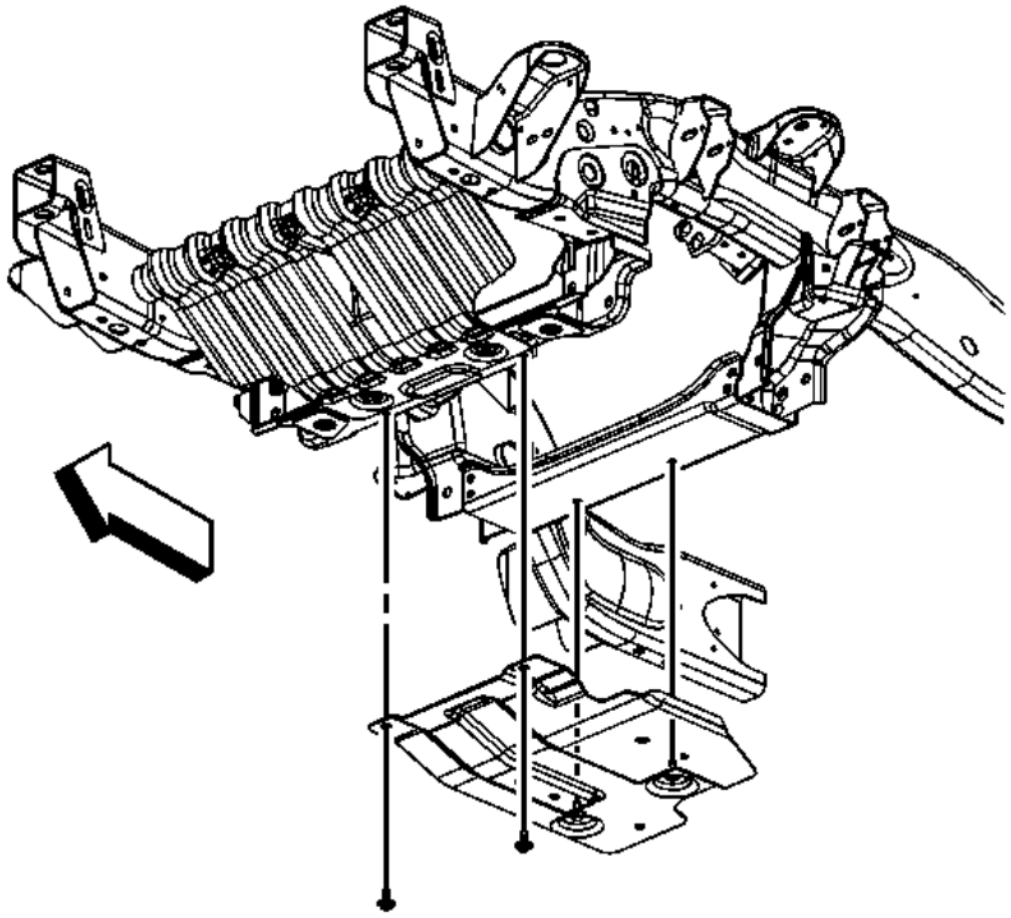


Fig. 253: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

16. For 2500 series vehicles, install the oil pan skid plate and tighten the rear 2 bolts and install and tighten the front 2 bolts, if equipped.

    Tighten: Tighten the bolts to 28 N.m (21 lb ft).

17. Lower the vehicle.
18. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and**

Connection (w/Dual Batteries).

STARTER MOTOR REPLACEMENT (6.6L)

Removal Procedure

CAUTION: Refer to BATTERY DISCONNECT CAUTION .

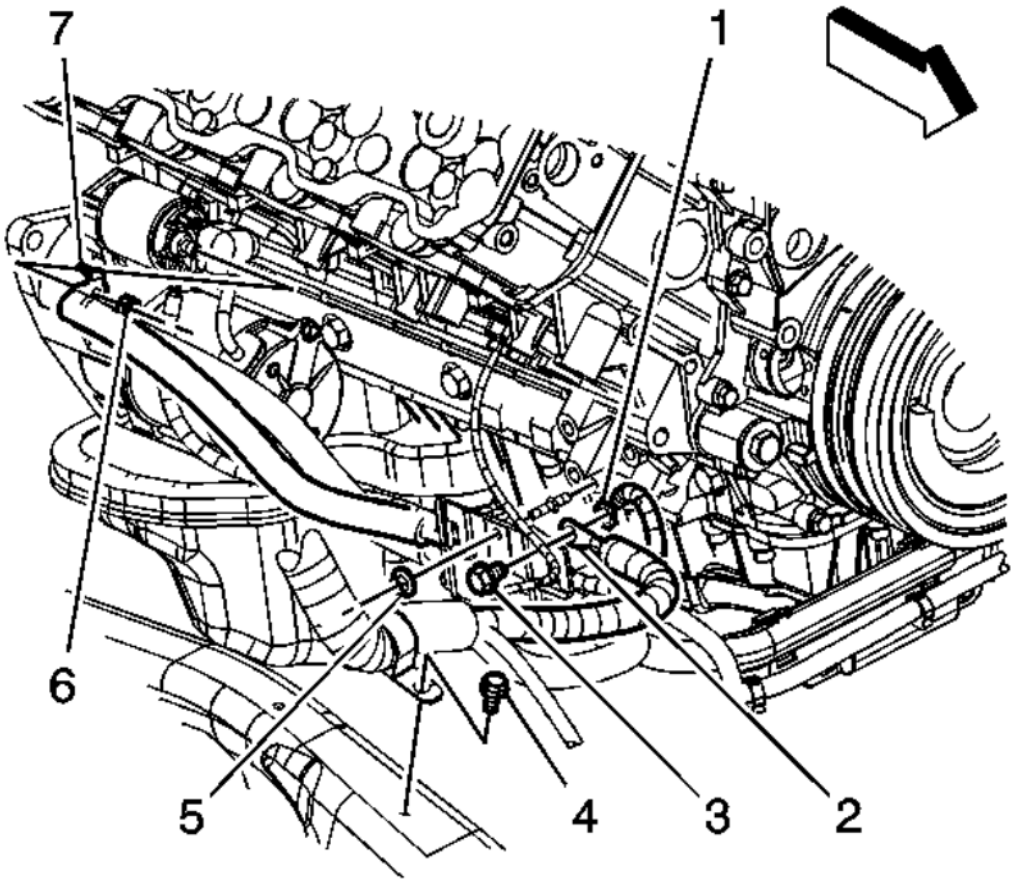


Fig. 254: View Of Starter Solenoid Cable & Components
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and**

Connection (w/Auxiliary Battery) or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

2. Remove the wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement - Right Side (GMC)** or **Front Wheelhouse Liner Replacement - Right Side (Chevrolet)** .
3. Working through the wheelhouse, remove the starter solenoid cable nut (6) from the starter.
4. Remove the starter solenoid cable (7) from the starter.

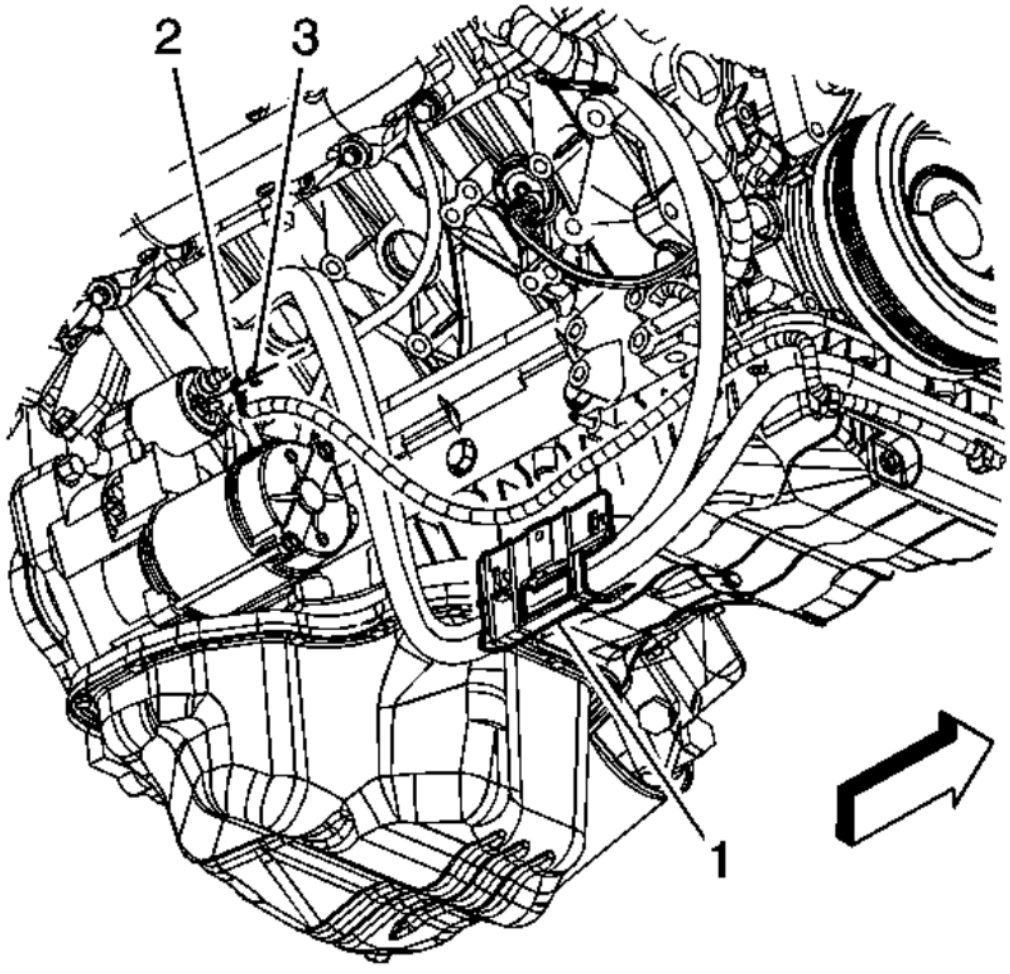


Fig. 255: View Of Starter Solenoid Cable Terminal, Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

5. Working through the wheelhouse, remove the engine wiring harness lead nut (3).
6. Remove the engine wiring harness lead (2) from the starter motor.
7. Remove the turbocharger exhaust pipe. Refer to **Turbocharger Exhaust Pipe Replacement (6.6L)** .

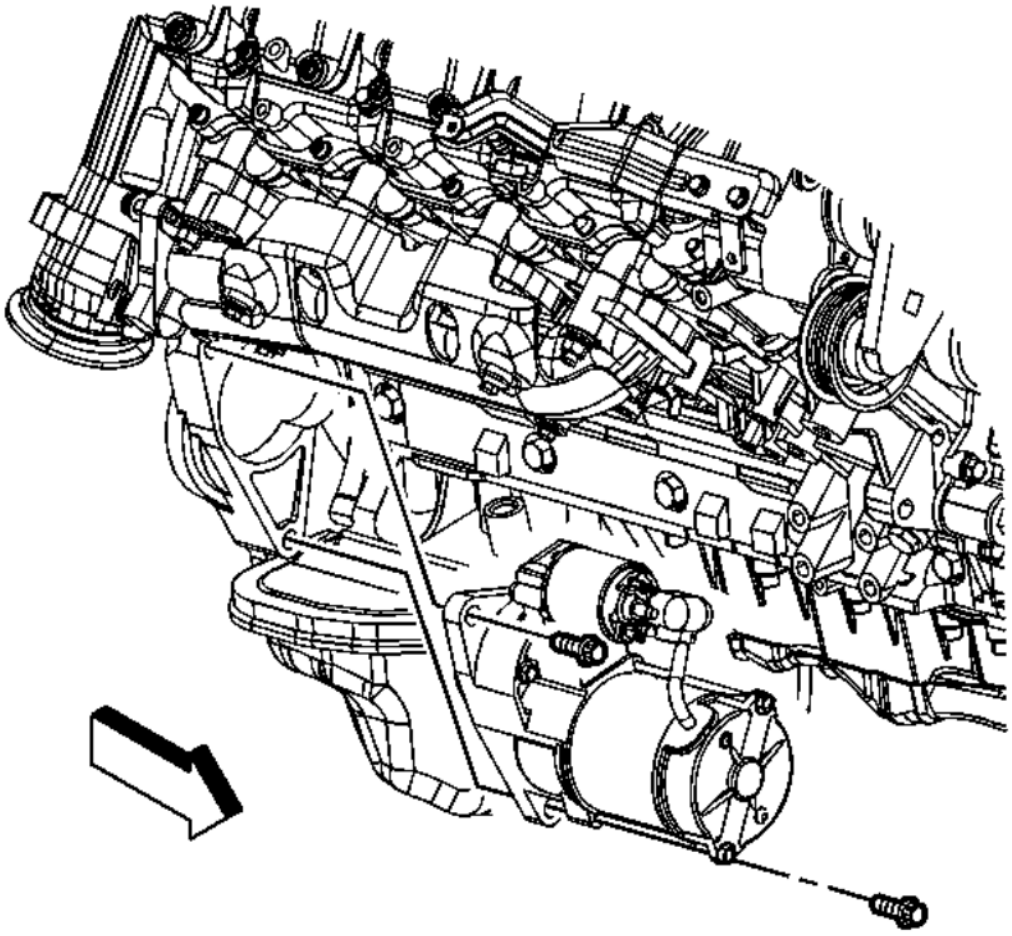


Fig. 256: View Of Starter Motor & Bolts
Courtesy of GENERAL MOTORS CORP.

8. From under the vehicle, remove the starter motor bolts (1).
9. Remove the starter motor.

Installation Procedure

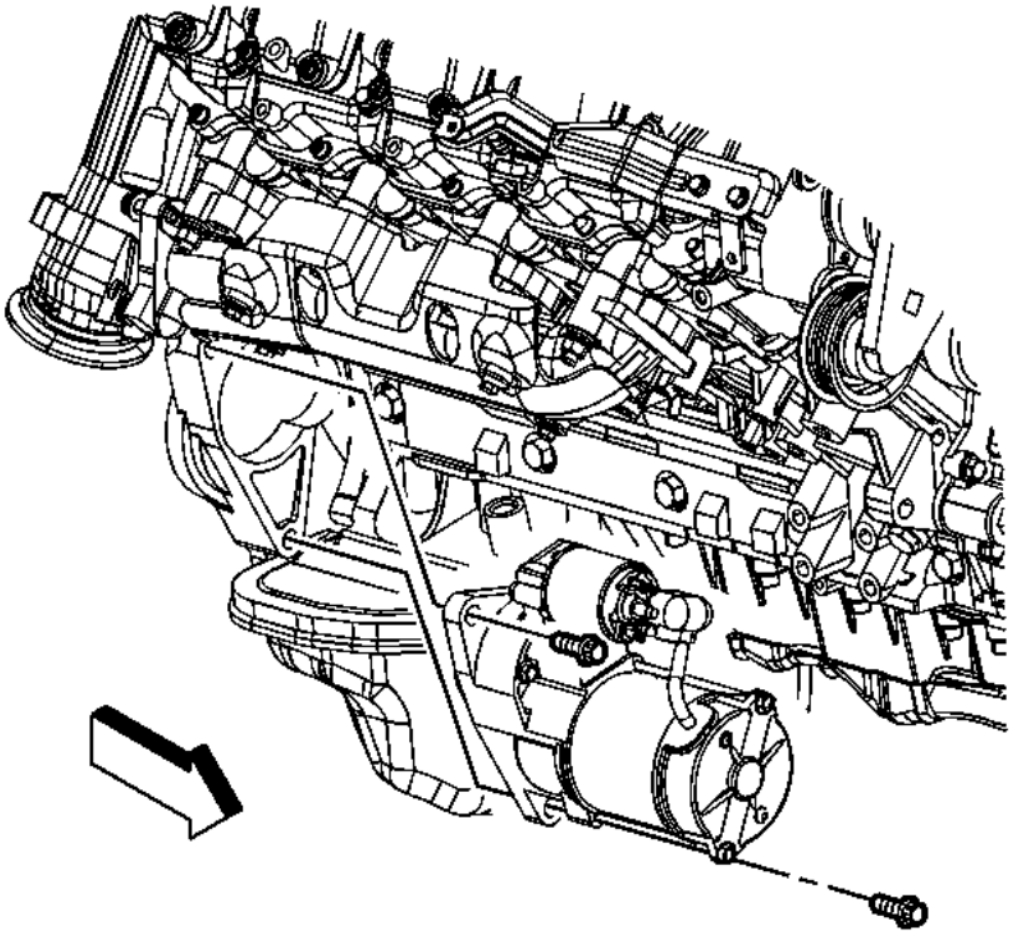


Fig. 257: View Of Starter Motor & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the starter motor.

NOTE: **Refer to Fastener Notice .**

2. Install the starter motor bolts (1).

Tighten: Tighten the bolts to 85 N.m (63 lb ft).

3. Install the turbocharger exhaust pipe. Refer to **Turbocharger Exhaust Pipe Replacement (6.6L)** .

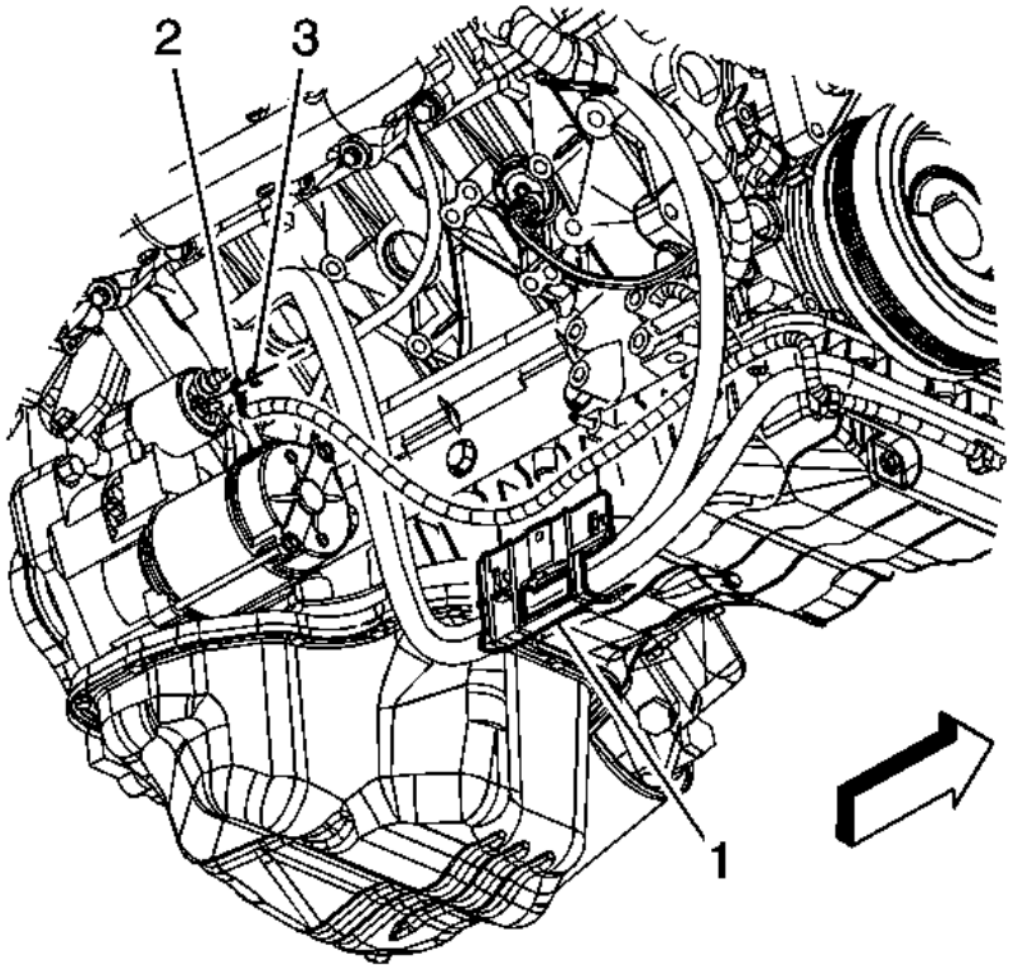


Fig. 258: View Of Starter Solenoid Cable Terminal, Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the engine wiring harness lead (2) to the starter motor.
5. Install the engine wiring harness lead nut (3).

Tighten: Tighten the nut to 3.4 N.m (30 lb in).

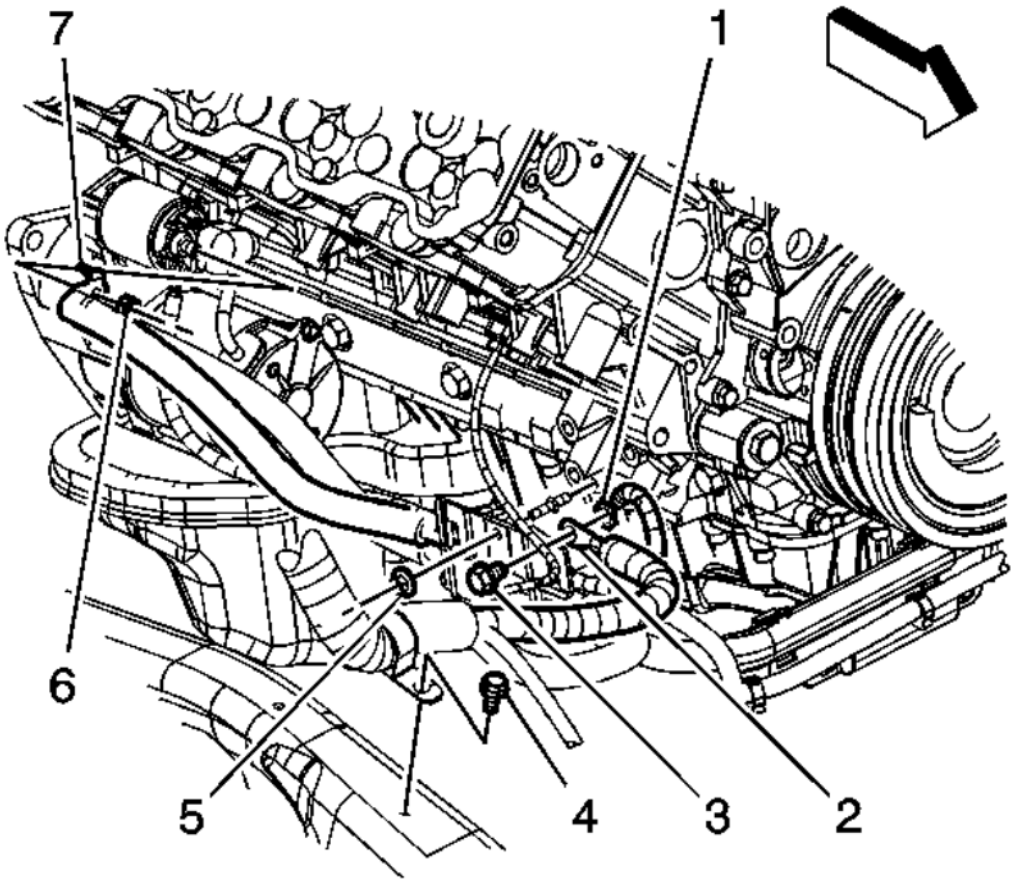


Fig. 259: View Of Starter Solenoid Cable & Components
Courtesy of GENERAL MOTORS CORP.

6. Install the starter solenoid cable (7) to the starter.
7. Install the starter solenoid cable nut (6) to the starter.

   Tighten: Tighten the nut to 9 N.m (80 lb in).

8. Install the wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement - Right Side (GMC)** or **Front Wheelhouse Liner Replacement - Right Side (Chevrolet)** .
9. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and**

Connection (w/Dual Batteries).

STARTER MOTOR SOLENOID REPLACEMENT (6.6L)

Removal Procedure

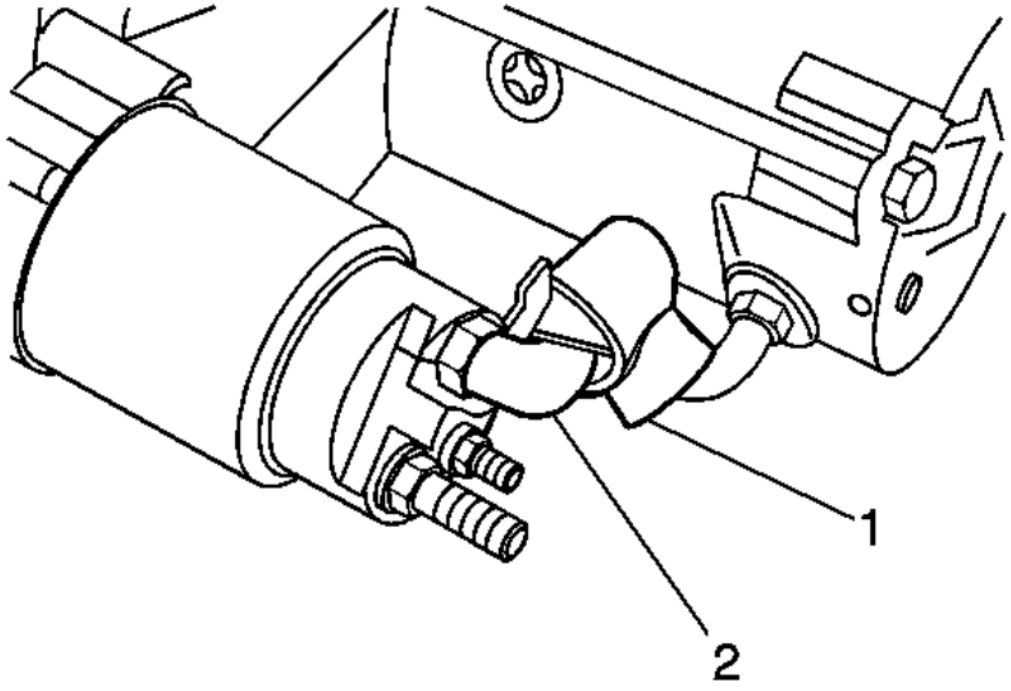


Fig. 260: View Of M-Terminal Stud Weather Cover & Epoxy Coating (6.6L (LB7) Engine)
Courtesy of GENERAL MOTORS CORP.

1. Remove the starter motor. Refer to **Starter Motor Replacement (4.3L)** or **Starter Motor Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Starter Motor Replacement (6.6L)**.
2. Reposition the M-terminal stud weather cover (1).
3. Clean the epoxy coating (2) from the M-terminal stud.

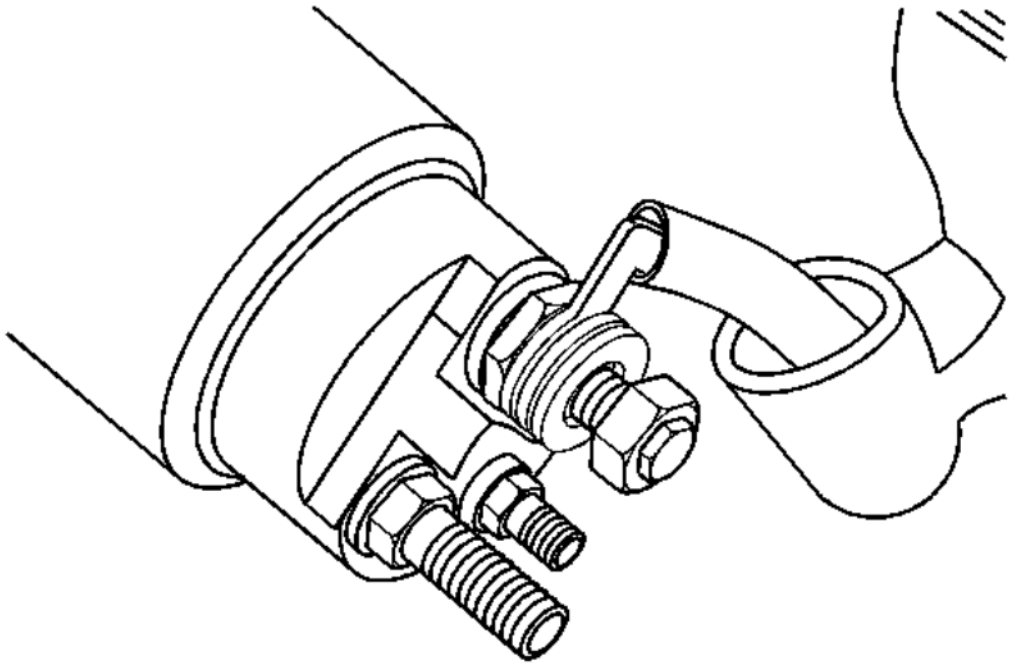


Fig. 261: View Of M-Terminal Stud, Nut & Cable (6.6L (LB7) Engine)
Courtesy of GENERAL MOTORS CORP.

4. Loosen the M-terminal stud nut.
5. Remove the cable from the M-terminal stud.

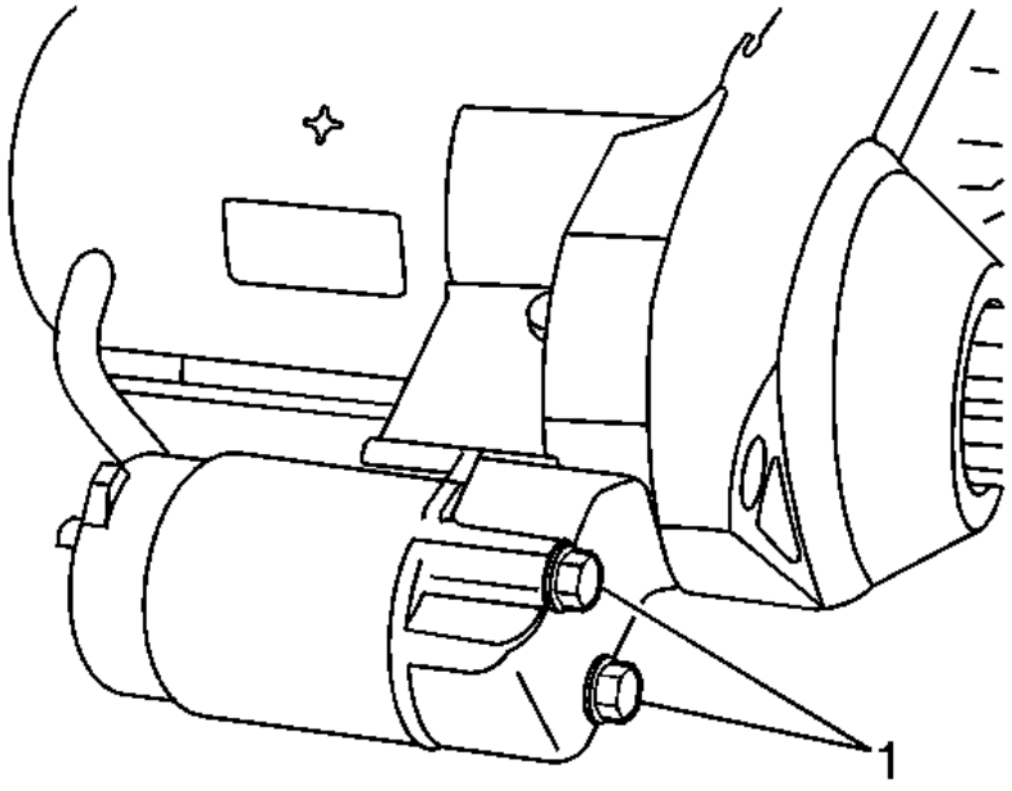


Fig. 262: View Of Solenoid Bolts (6.6L (LB7) Engine)
Courtesy of GENERAL MOTORS CORP.

6. Remove the solenoid bolts (1).

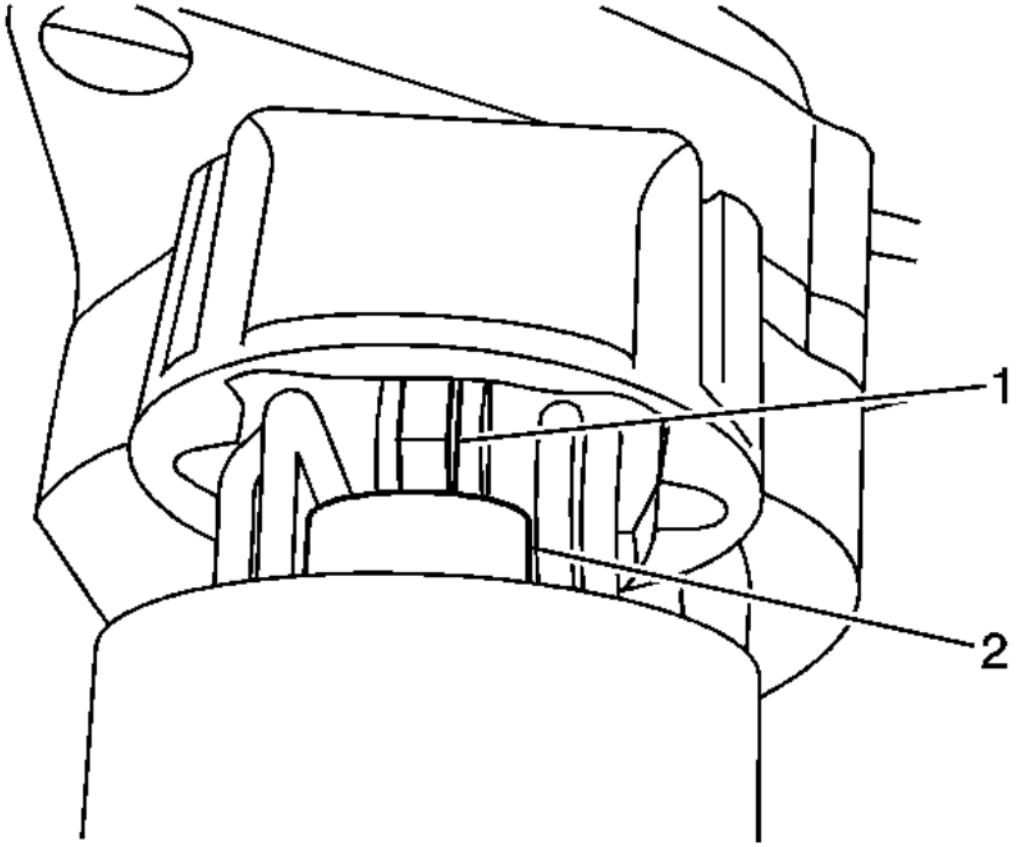


Fig. 263: View Of Solenoid Plunger & Drive Gear Lever (6.6L (LB7) Engine)
Courtesy of GENERAL MOTORS CORP.

7. Separate the solenoid from the housing and unhook the solenoid plunger (2) from the drive gear lever (1).

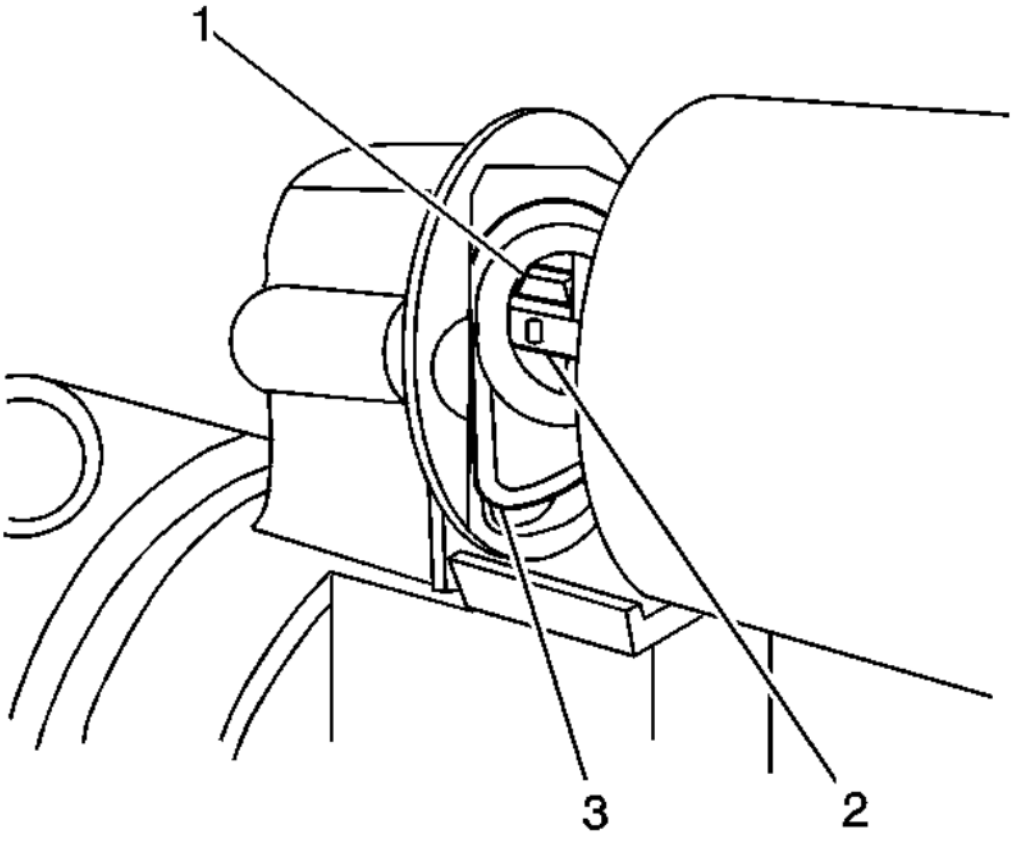


Fig. 264: View Of Drive Gear Lever, Solenoid Plunger Loop & Spring (6.6L (LB7) Engine)
Courtesy of GENERAL MOTORS CORP.

8. Note that the spring (3) is positioned against the drive gear lever (1) and the drive gear lever is placed inside the solenoid plunger loop (2).

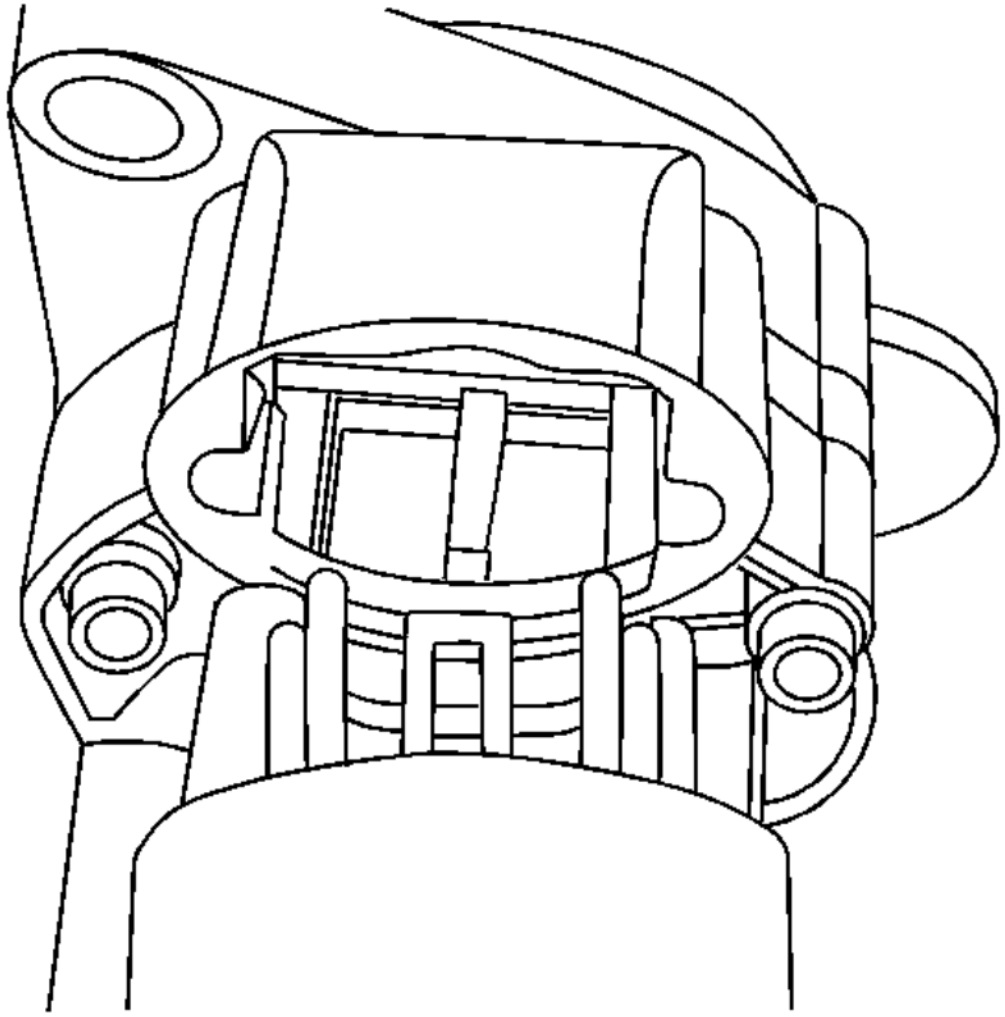


Fig. 265: View Of Solenoid Housing (6.6L (LB7) Engine)
Courtesy of GENERAL MOTORS CORP.

9. Remove the solenoid housing.

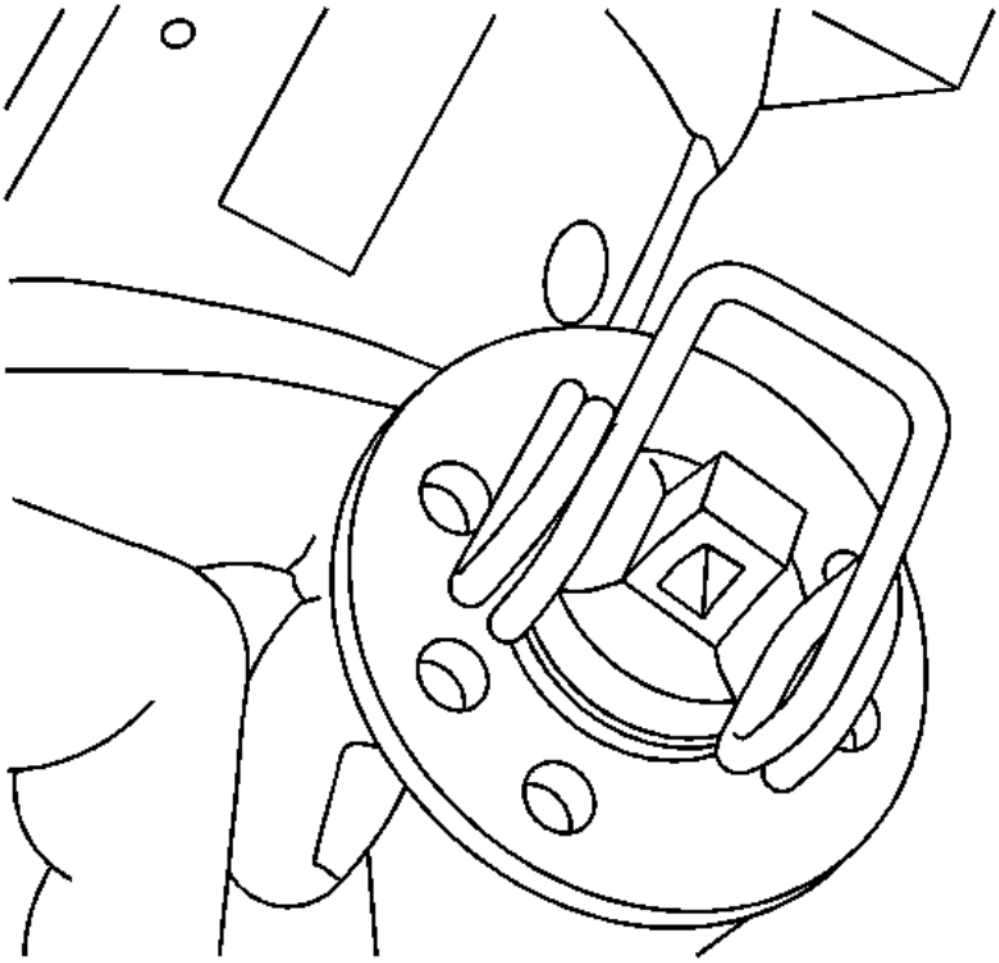


Fig. 266: View Of Solenoid Plunger & Spring (6.6L (LB7) Engine)
Courtesy of GENERAL MOTORS CORP.

10. If necessary, remove the solenoid plunger and spring.

Installation Procedure

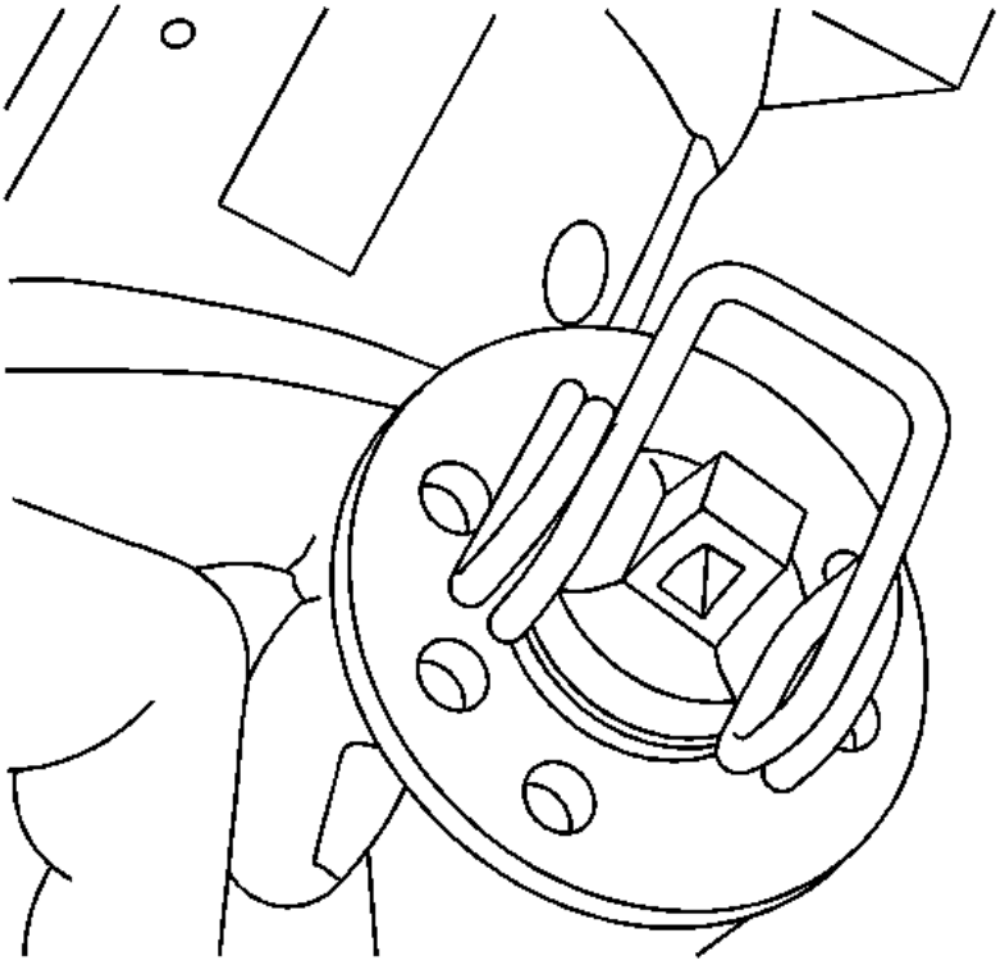


Fig. 267: View Of Solenoid Plunger & Spring (6.6L (LB7) Engine)
Courtesy of GENERAL MOTORS CORP.

1. If necessary, install the solenoid plunger and spring.

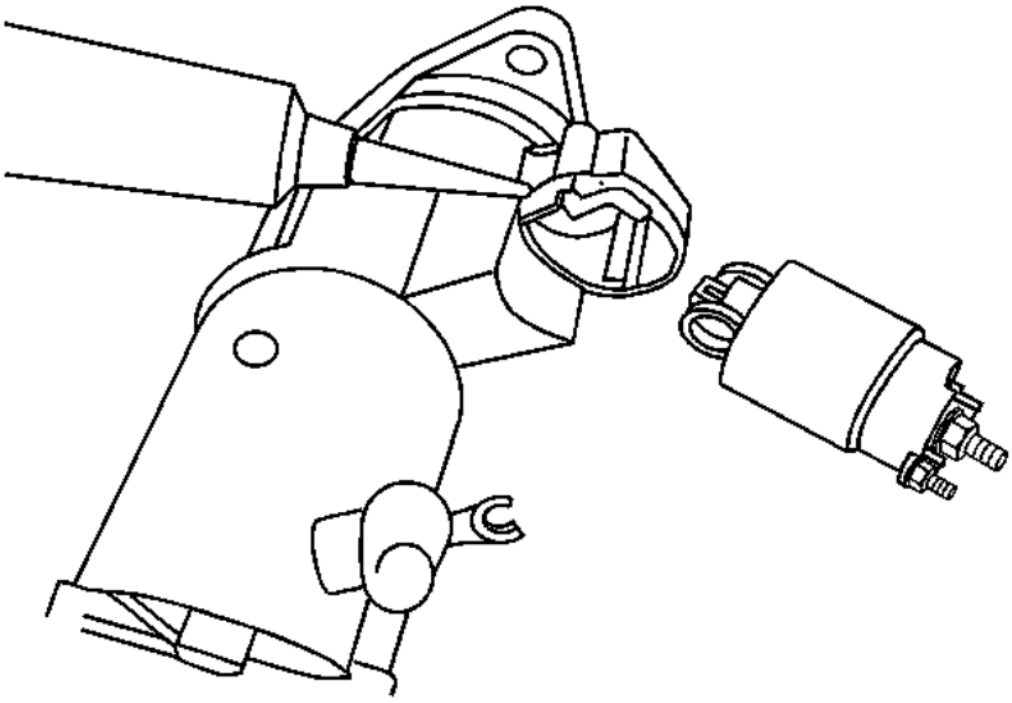


Fig. 268: Sealing Starter Solenoid Attachment Area (6.6L (LB7) Engine)
Courtesy of GENERAL MOTORS CORP.

2. Using Three Bond silicone 1207B, GM P/N 97720043, seal the starter solenoid attachment area.

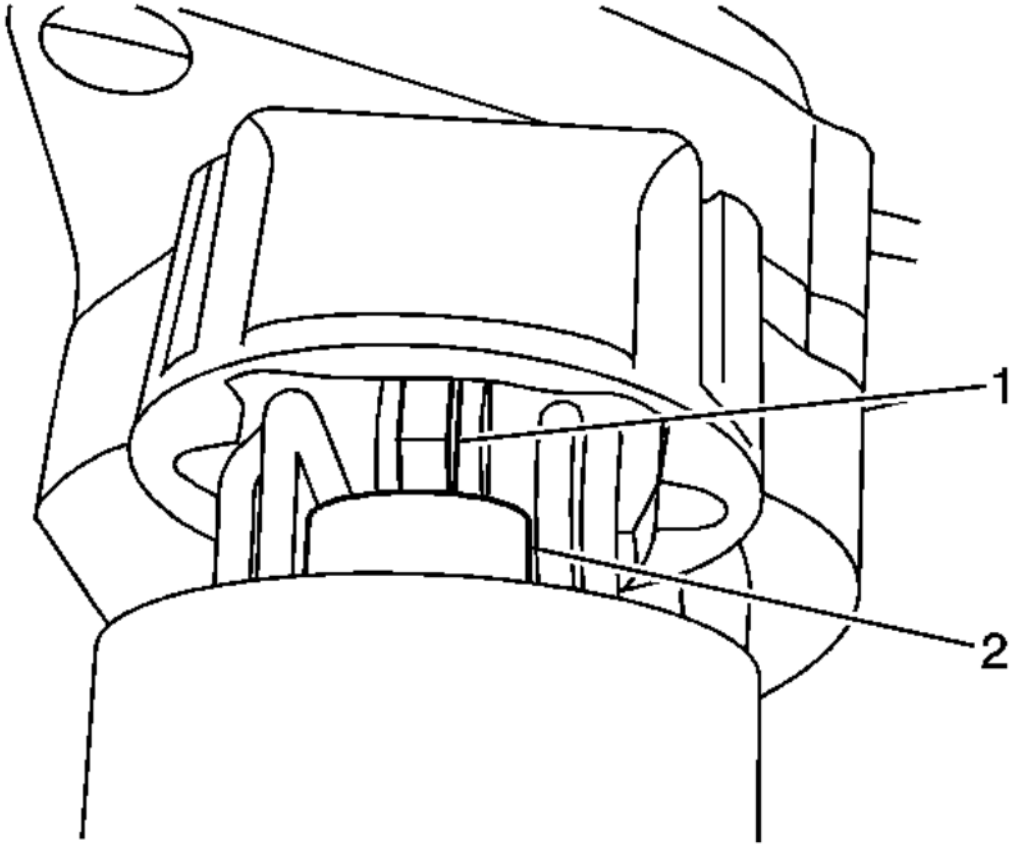


Fig. 269: View Of Solenoid Plunger & Drive Gear Lever (6.6L (LB7) Engine)
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure that the drive gear lever (1) is properly installed into the solenoid plunger (2) loop. Improper installation of the drive gear lever will cause an abnormal or no operation condition of the starter.

3. Install the solenoid, making sure to insert the drive gear lever (1) into the solenoid plunger (2) loop, perform the following:
    1. Pull the gear lever (1) out away from the starter housing and pull the plunger (2) out away from the solenoid.
    2. Tip the solenoid and insert the lever into the loop, push the solenoid against the

housing.

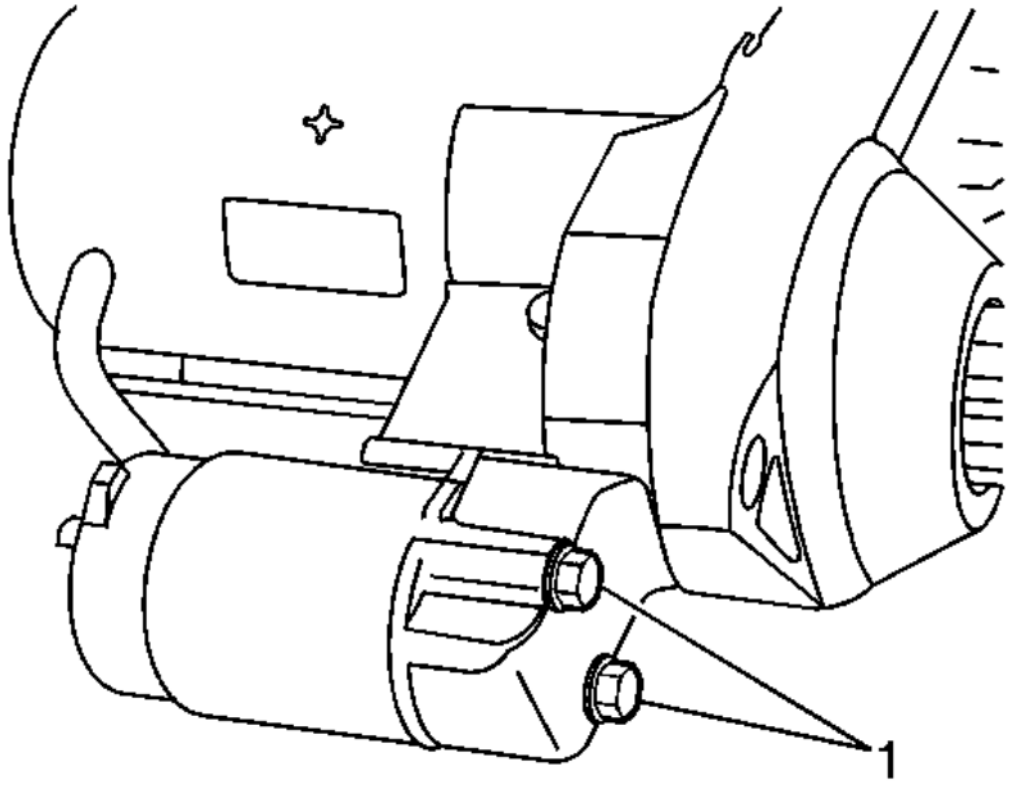


Fig. 270: View Of Solenoid Bolts (6.6L (LB7) Engine)
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

4. Install the solenoid bolts (1).

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

5. Wipe the excess silicone pressed out during the solenoid installation from around the base of the solenoid to make a weather proof seal.

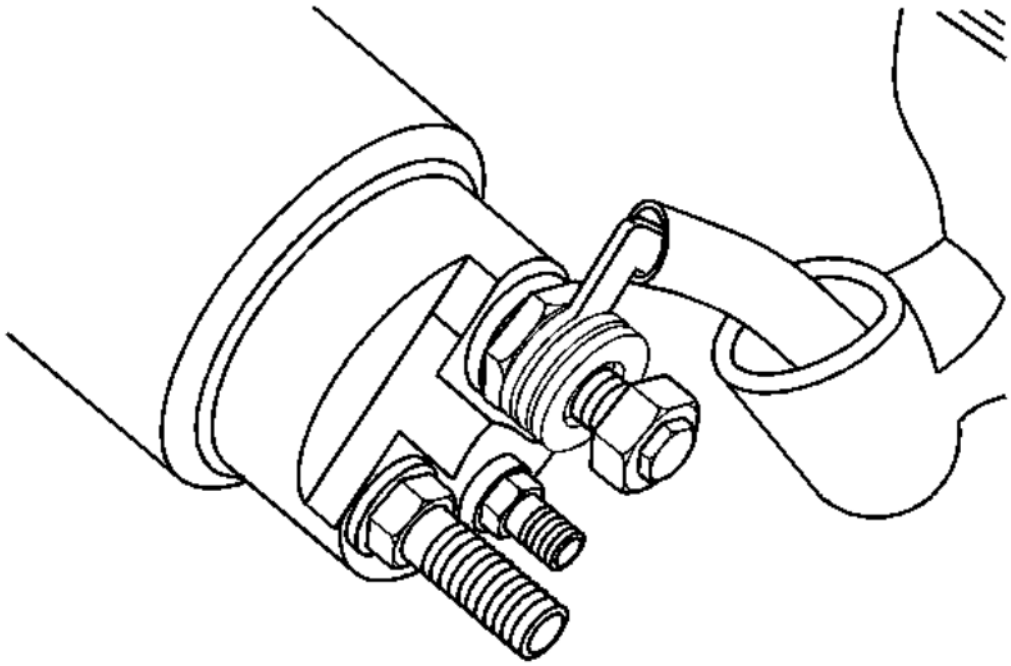


Fig. 271: View Of M-Terminal Stud, Nut & Cable (6.6L (LB7) Engine)
Courtesy of GENERAL MOTORS CORP.

6. Install the cable to the M-terminal stud between the washers and terminal nut.
7. Tighten the M-terminal stud nut.

Tighten: Tighten the nut to 8 N.m (71 lb in).

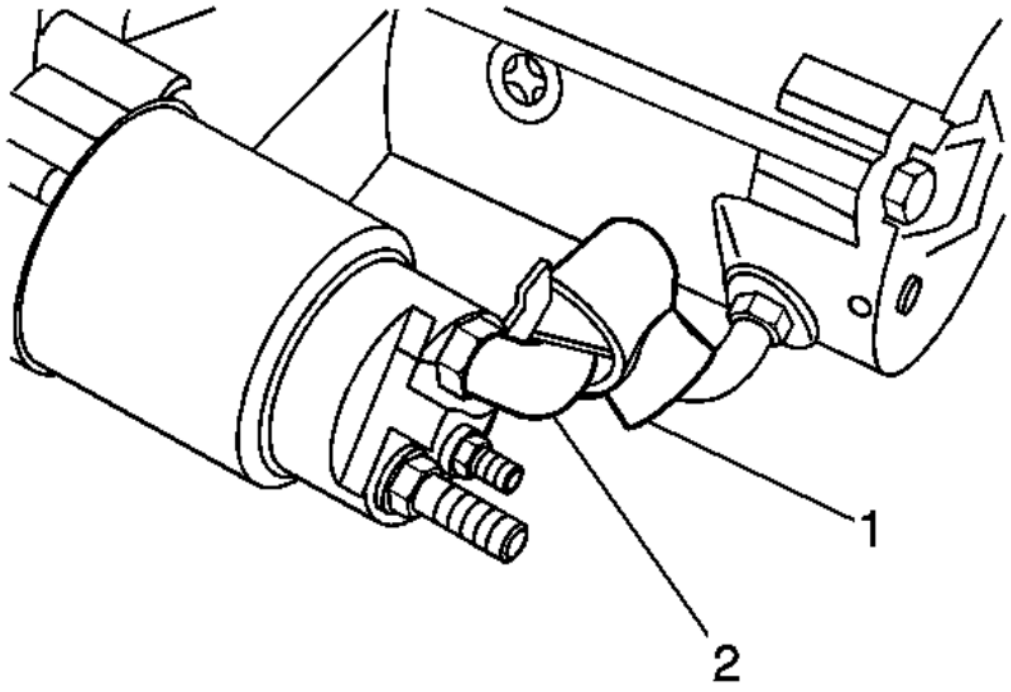


Fig. 272: View Of M-Terminal Stud Weather Cover & Epoxy Coating (6.6L (LB7) Engine)
Courtesy of GENERAL MOTORS CORP.

8. Using Three Bond silicone 1207B, GM P/N 97720043, seal the M-terminal stud connection (2).
9. Reposition the M-terminal stud weather cover (1).
10. Bench test the starter in a free-run condition prior to installation.
11. Install the starter motor. Refer to **Starter Motor Replacement (4.3L)** or **Starter Motor Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Starter Motor Replacement (6.6L)**.

GENERATOR BRACKET REPLACEMENT (4.3L)

Removal Procedure

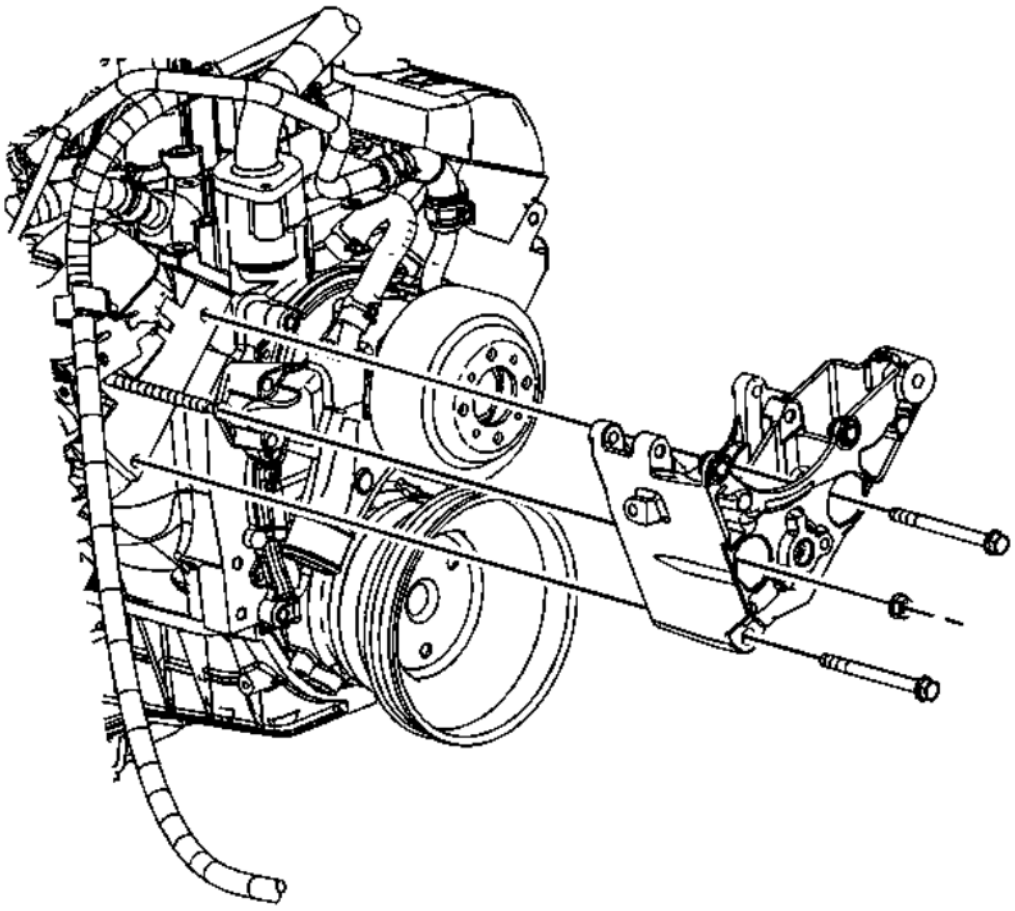


Fig. 273: View Of Generator, Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the generator. Refer to **Generator Replacement (4.3L)** or **Generator Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Generator Replacement (6.6L)**.
2. Remove the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement** .
3. Remove the drive belt idler pulley. Refer to **Drive Belt Idler Pulley Replacement - Right Side** .
4. Remove the generator bracket bolts and nut.
5. Remove the generator bracket.

Installation Procedure

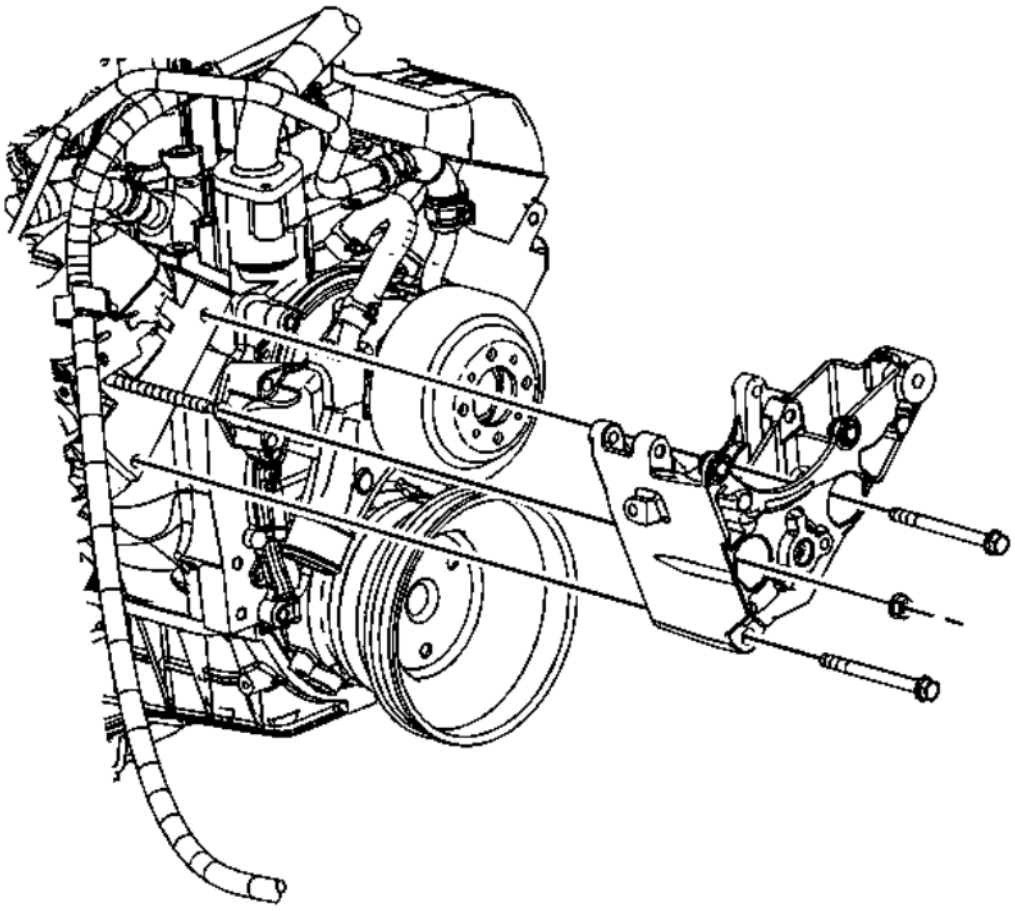


Fig. 274: View Of Generator, Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the generator bracket onto the stud.

   NOTE: Refer to Fastener Notice .

2. Install the generator bracket bolts and nut.

   Tighten: Tighten the bolts/nut to 41 N.m (30 lb ft).

3. Install the drive belt idler pulley. Refer to **Drive Belt Idler Pulley Replacement - Right Side** .

4. Install the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement** .
5. Install the generator. Refer to **Generator Replacement (4.3L)** or **Generator Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Generator Replacement (6.6L)**.

GENERATOR BRACKET REPLACEMENT (4.8L, 5.3L, 6.0L, AND 6.2L)

Removal Procedure

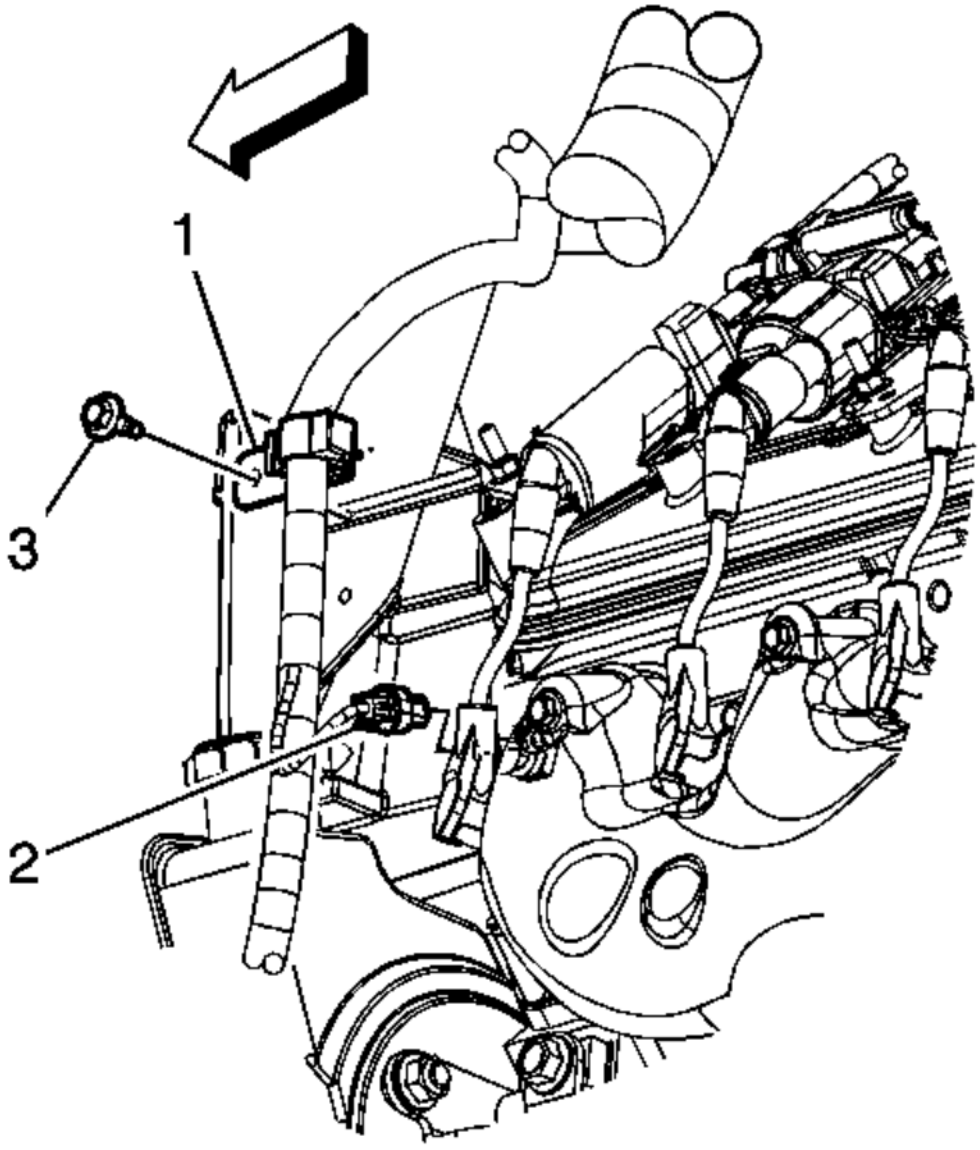


Fig. 275: View Of Engine Wiring Harness, Clip, Bolt & Connector
Courtesy of GENERAL MOTORS CORP.

1. Remove the generator. Refer to **Generator Replacement (4.3L)** or **Generator Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Generator Replacement (6.6L)**.
2. Remove the power steering pump. Refer to **Power Steering Pump Replacement (4.3L)** or

Power Steering Pump Replacement (4.8L, 5.3L, 6.0L, and 6.2L) or **Power Steering Pump Replacement (6.6L)** .

3. Remove the engine wiring harness clip bolt (3) are reposition the clip (1) away from the generator bracket.

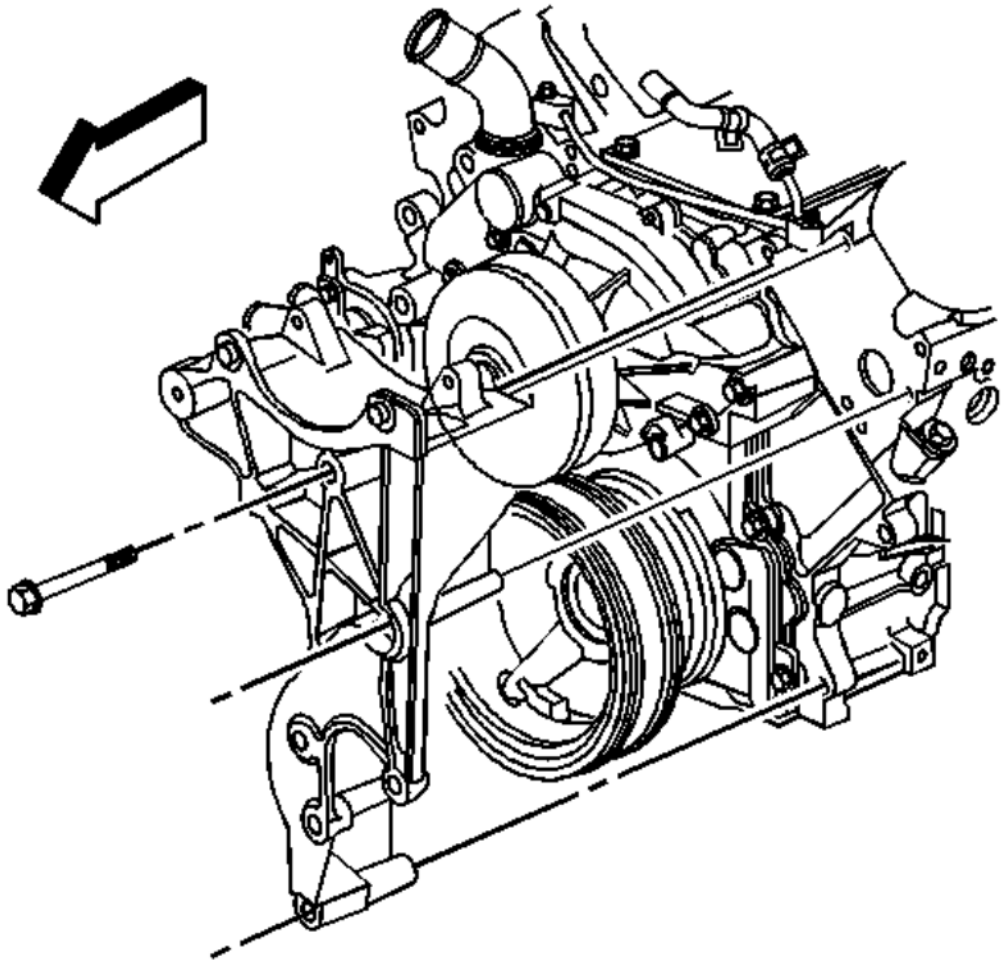


Fig. 276: View Of Generator Bracket & Bolts (4.8L, 5.3L & 6.0L)
Courtesy of GENERAL MOTORS CORP.

4. Remove the generator bracket bolts.
5. Remove the generator bracket.

Installation Procedure

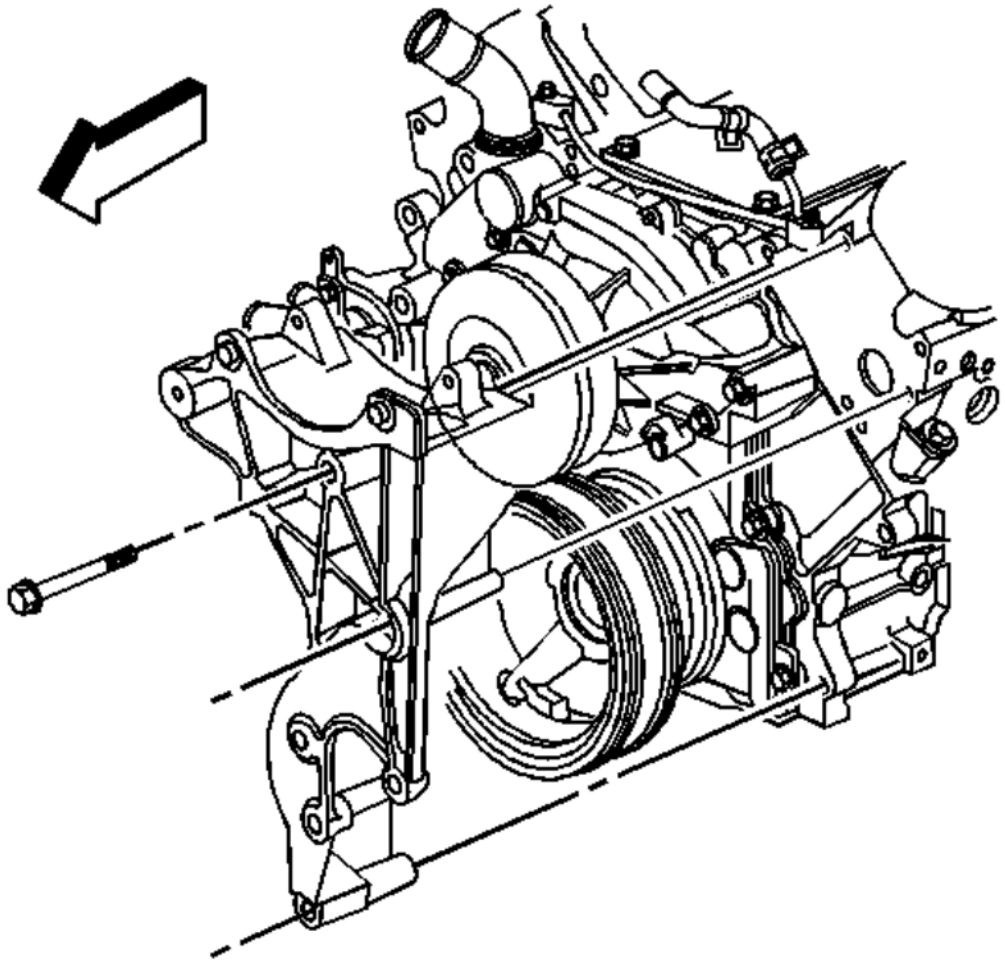


Fig. 277: View Of Generator Bracket & Bolts (4.8L, 5.3L & 6.0L)
Courtesy of GENERAL MOTORS CORP.

1. Position the generator bracket to the engine.

NOTE: Refer to Fastener Notice .

2. Install the generator bracket bolts.

Tighten: Tighten the bolts to 50 N.m (37 lb ft).

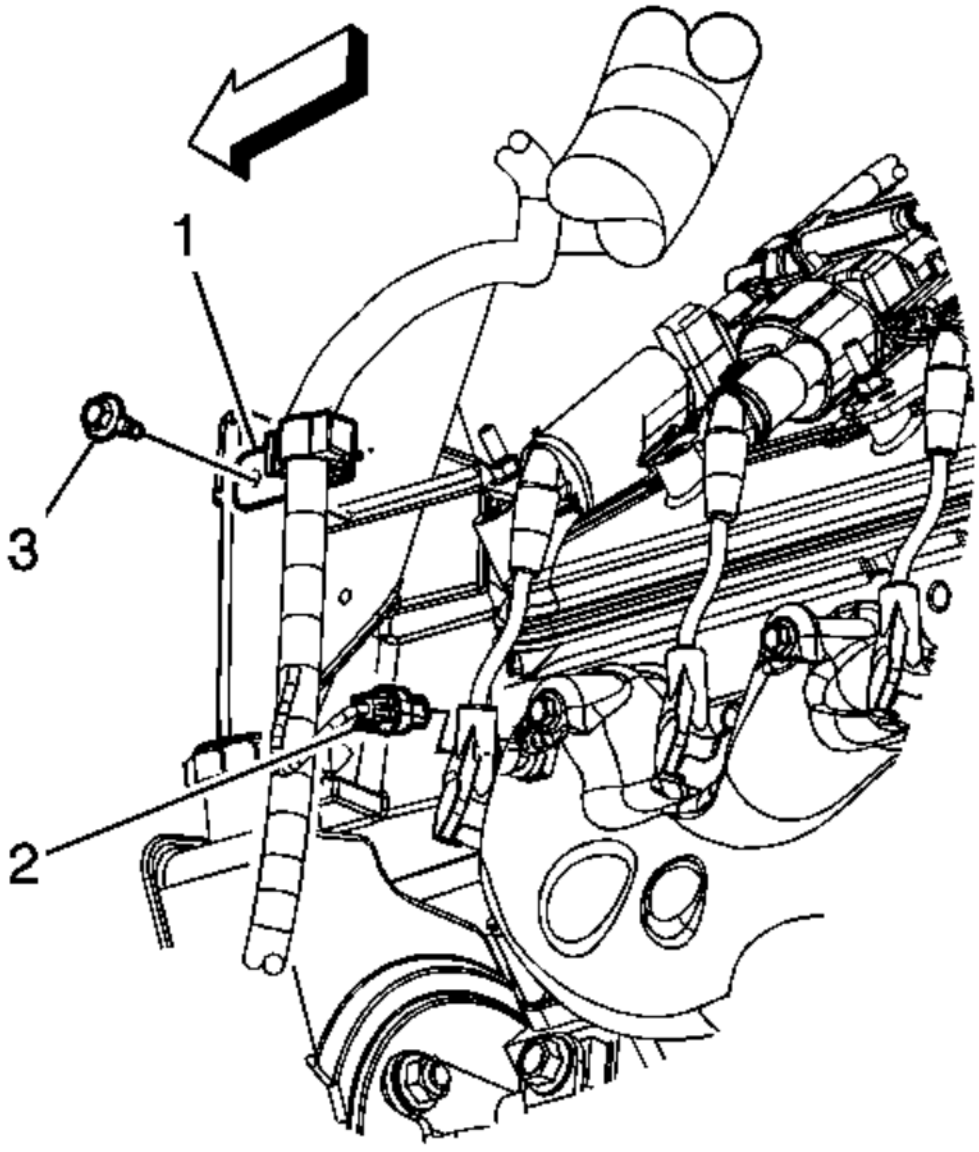


Fig. 278: View Of Engine Wiring Harness, Clip, Bolt & Connector
Courtesy of GENERAL MOTORS CORP.

3. Position the engine wiring harness clip (1) to the generator bracket and install the engine

harness clip bolt (3).

Tighten: Tighten the bolt to 9 N.m (80 lb in).

4. Install the power steering pump. Refer to **Power Steering Pump Replacement (4.3L)** or **Power Steering Pump Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Power Steering Pump Replacement (6.6L)** .
5. Install the generator. Refer to **Generator Replacement (4.3L)** or **Generator Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Generator Replacement (6.6L)**.

GENERATOR BRACKET REPLACEMENT (6.6L)

Removal Procedure

CAUTION: Refer to Battery Disconnect Caution.

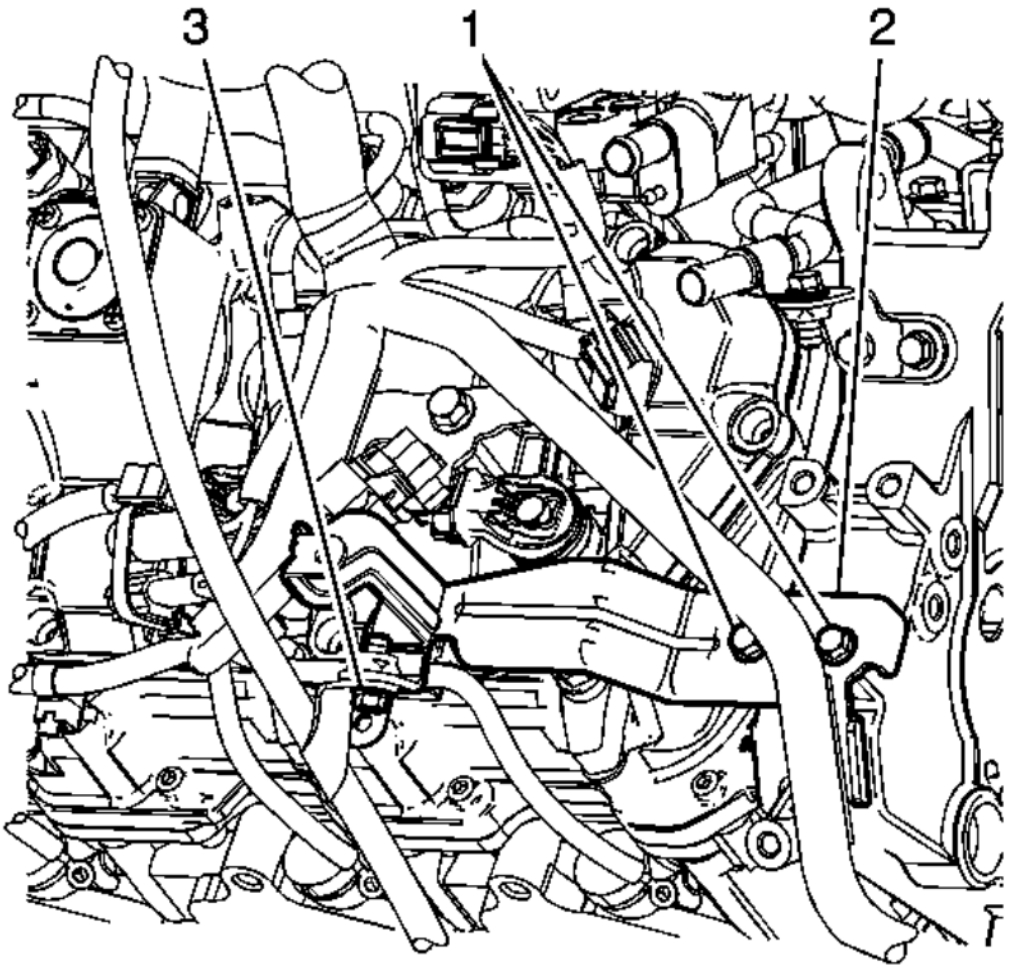


Fig. 279: View Of Indicator Tube Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.
2. Remove the upper fan shroud. Refer to **Engine Coolant Fan Upper Shroud Replacement (Mechanical)** or **Engine Coolant Fan Upper Shroud Replacement (Automatic Transmission - Diesel)** .

3. Remove the intake air heater. Refer to **Intake Air Heater Replacement** .
4. Remove the generator. Refer to **Generator Replacement (4.3L)** or **Generator Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Generator Replacement (6.6L)**.
5. Remove the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement** .
6. Remove the engine wiring harness clip from the oil level indicator tube bracket (2).
7. Remove the oil level indicator tube bolt (3).
8. Remove the oil level indicator tube bracket bolts (1).
9. Remove the oil level indicator tube bracket (2).

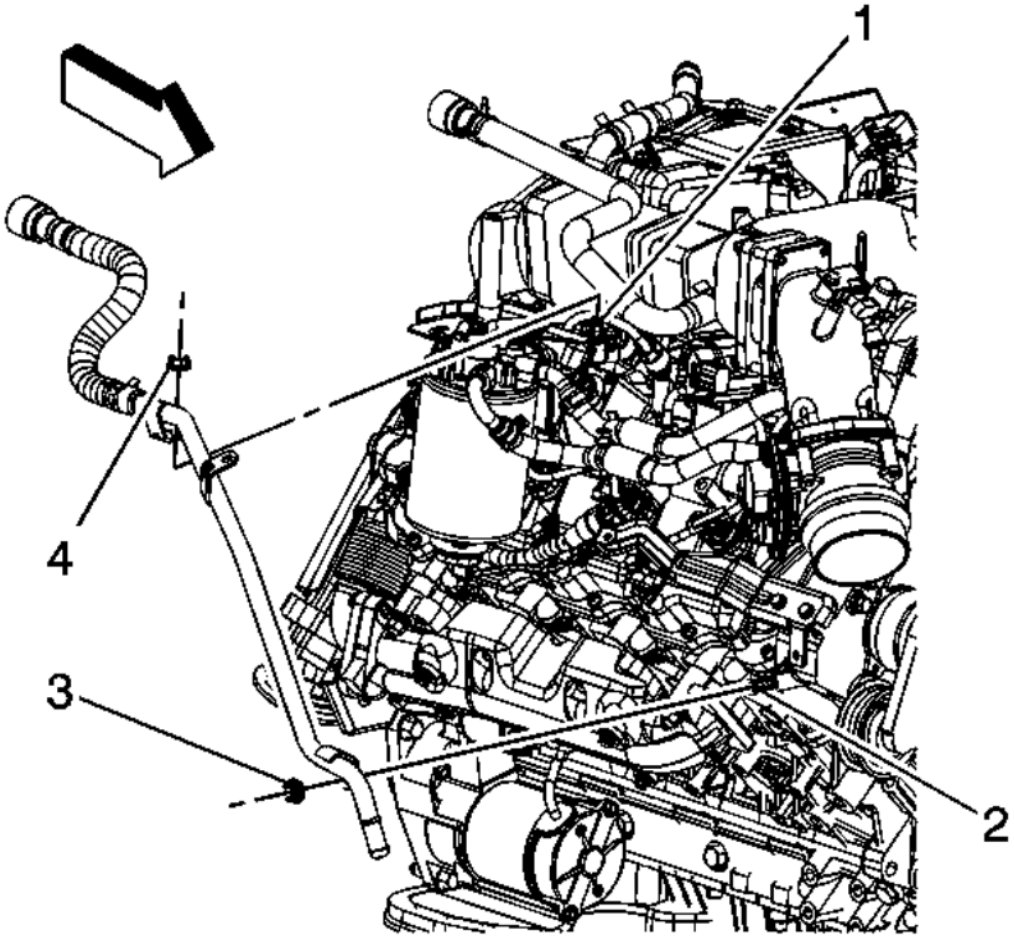


Fig. 280: View Of Fuel Filter Adapter Stud, Generator Bracket Stud & Inlet Hose

Bracket Nuts
Courtesy of GENERAL MOTORS CORP.

10. Remove the heater inlet hose bracket nut (4) from the fuel filter adapter stud (1).
11. Remove the heater inlet hose bracket nut (3) from the generator bracket stud (2).
12. Reposition the heater inlet hose/pipe out of the way.

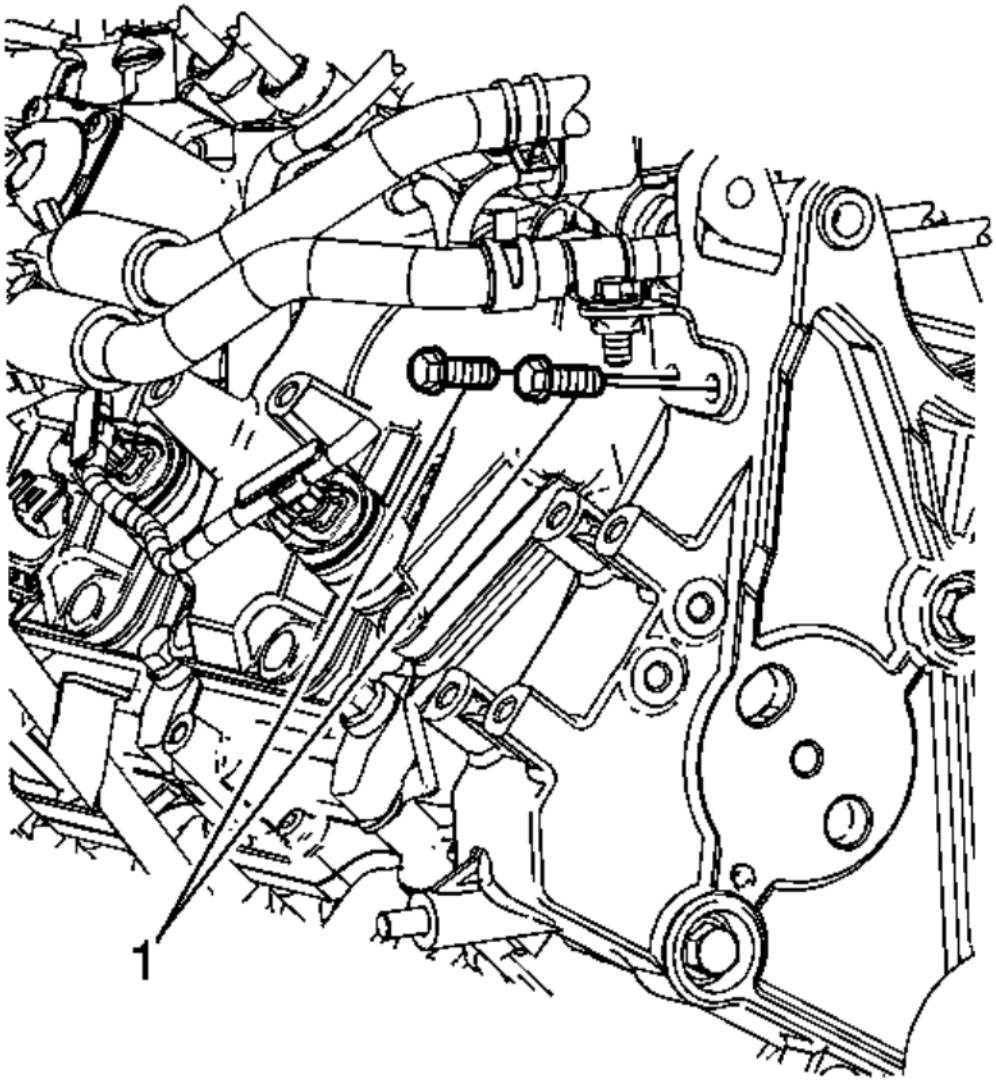


Fig. 281: View Of Fuel Feed Pipe Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

13. Remove the fuel feed pipe bracket bolts (1).

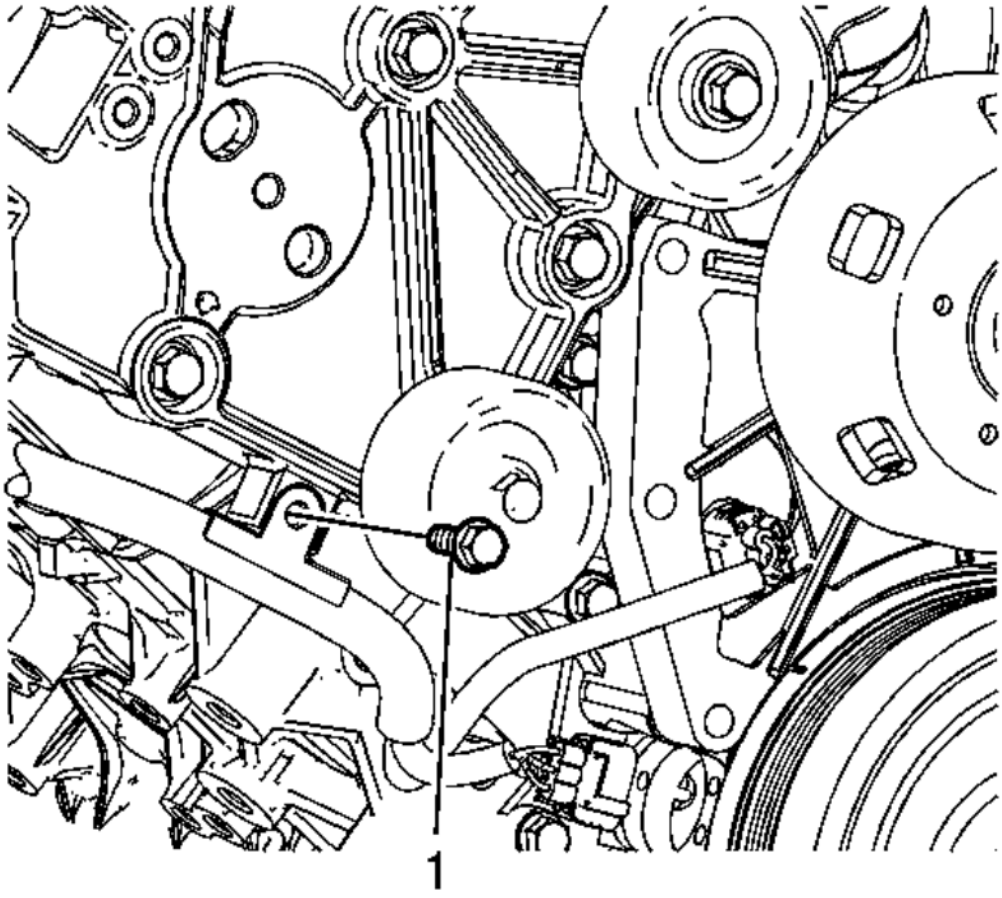


Fig. 282: View Of Engine Wiring Harness Clip Bolt
Courtesy of GENERAL MOTORS CORP.

14. Remove the engine wiring harness clip bolt (1).
15. Reposition the engine wiring harness out of the way.

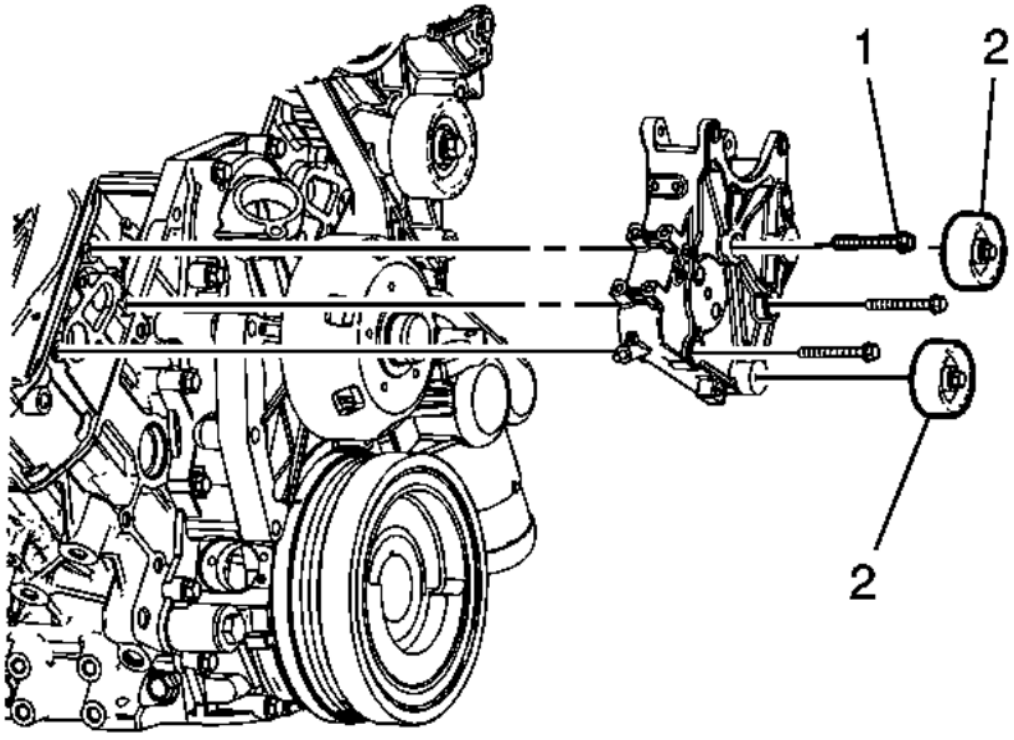


Fig. 283: View Of Generator Bracket Bolts & Idler Pulley Bolts
Courtesy of GENERAL MOTORS CORP.

16. Remove the generator bracket bolts (1) and bracket.
17. Loosen the idler pulley bolts (2) and remove the pulleys from the generator bracket, if necessary.

Installation Procedure

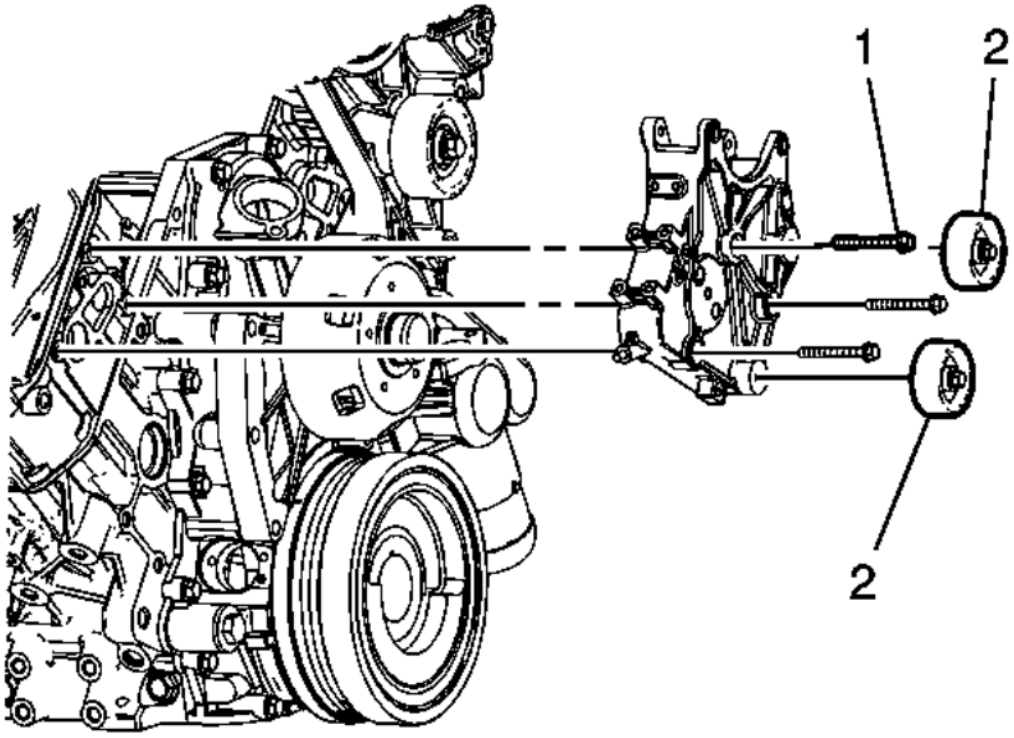


Fig. 284: View Of Generator Bracket Bolts & Idler Pulley Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Position the idler pulleys to the generator bracket and tighten the pulley bolts (2), if necessary.

   Tighten: Tighten the bolts to 50 N.m (37 lb ft).

2. Position the generator bracket to the engine and install the bolts (1).

   Tighten: Tighten the bolts to 50 N.m (37 lb ft).

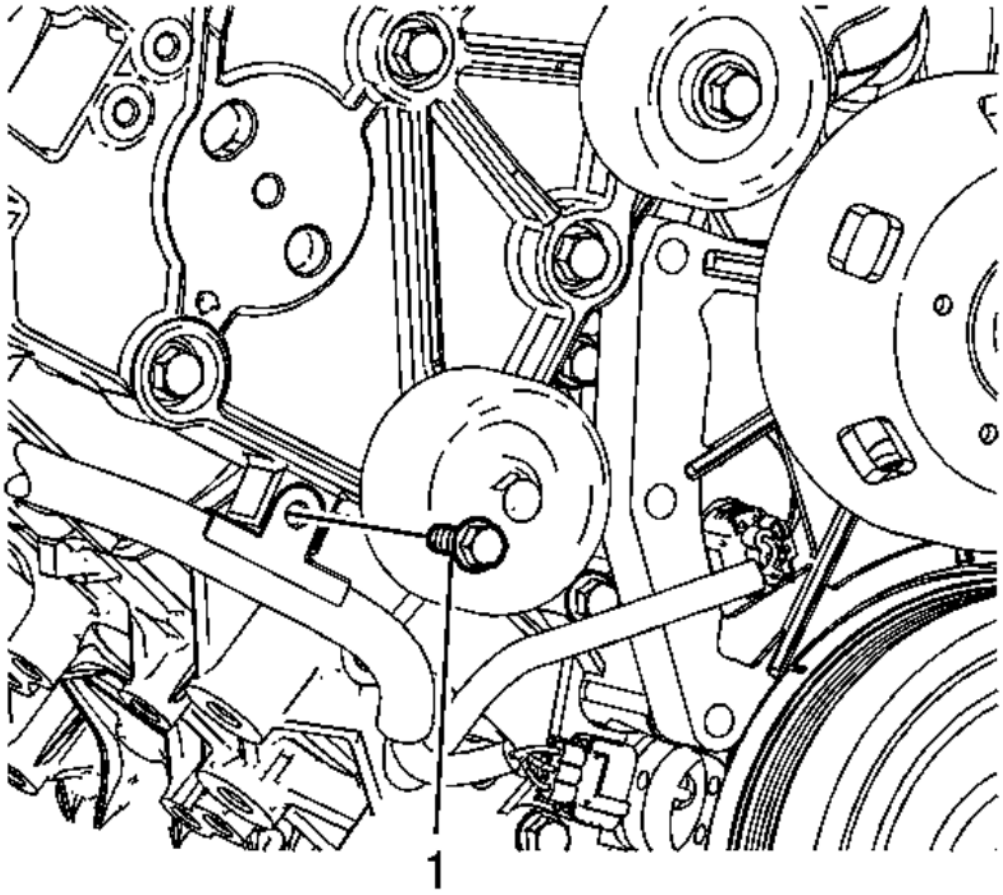


Fig. 285: View Of Engine Wiring Harness Clip Bolt
Courtesy of GENERAL MOTORS CORP.

3. Position the engine wiring harness and install the engine wiring harness clip bolt (1).

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

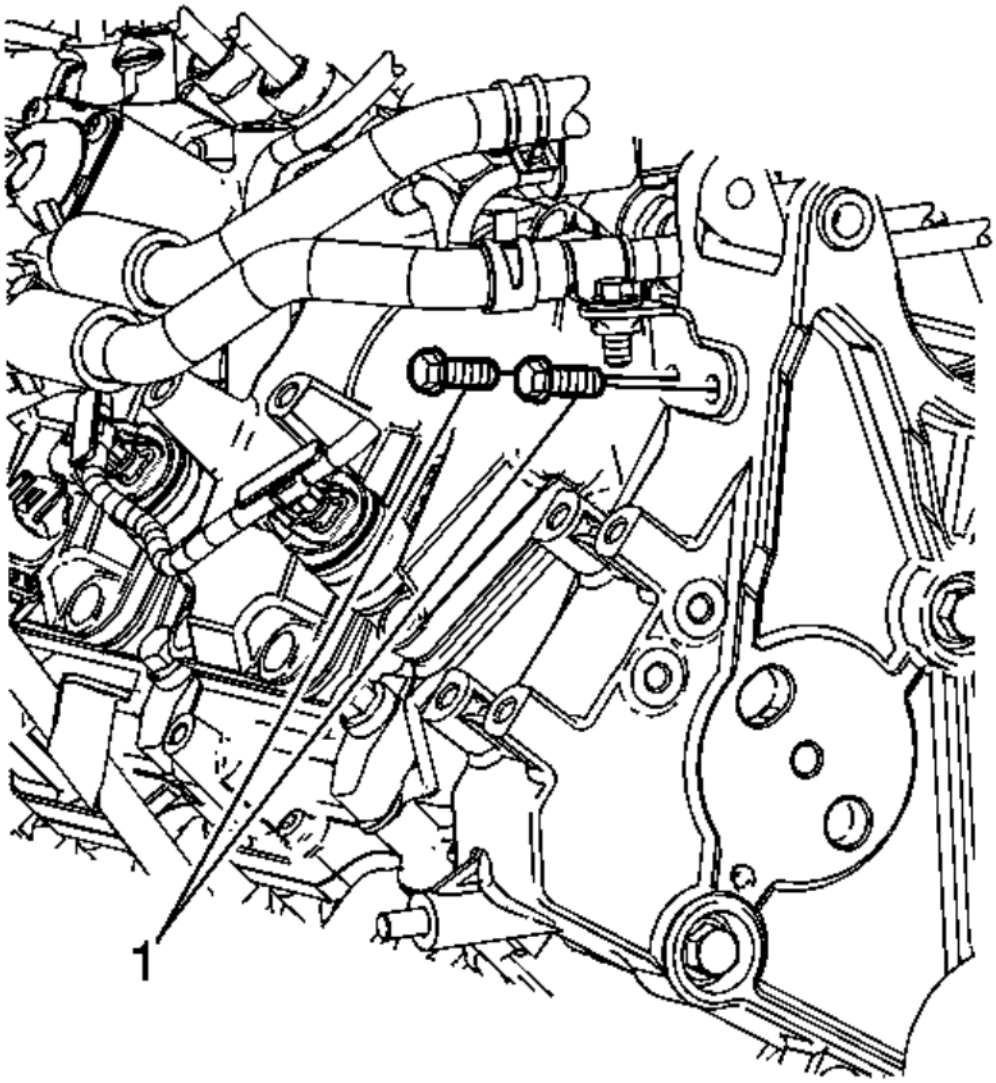


Fig. 286: View Of Fuel Feed Pipe Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the fuel feed pipe bracket bolts (1).

   Tighten: Tighten the bolts to 24 N.m (18 lb ft).

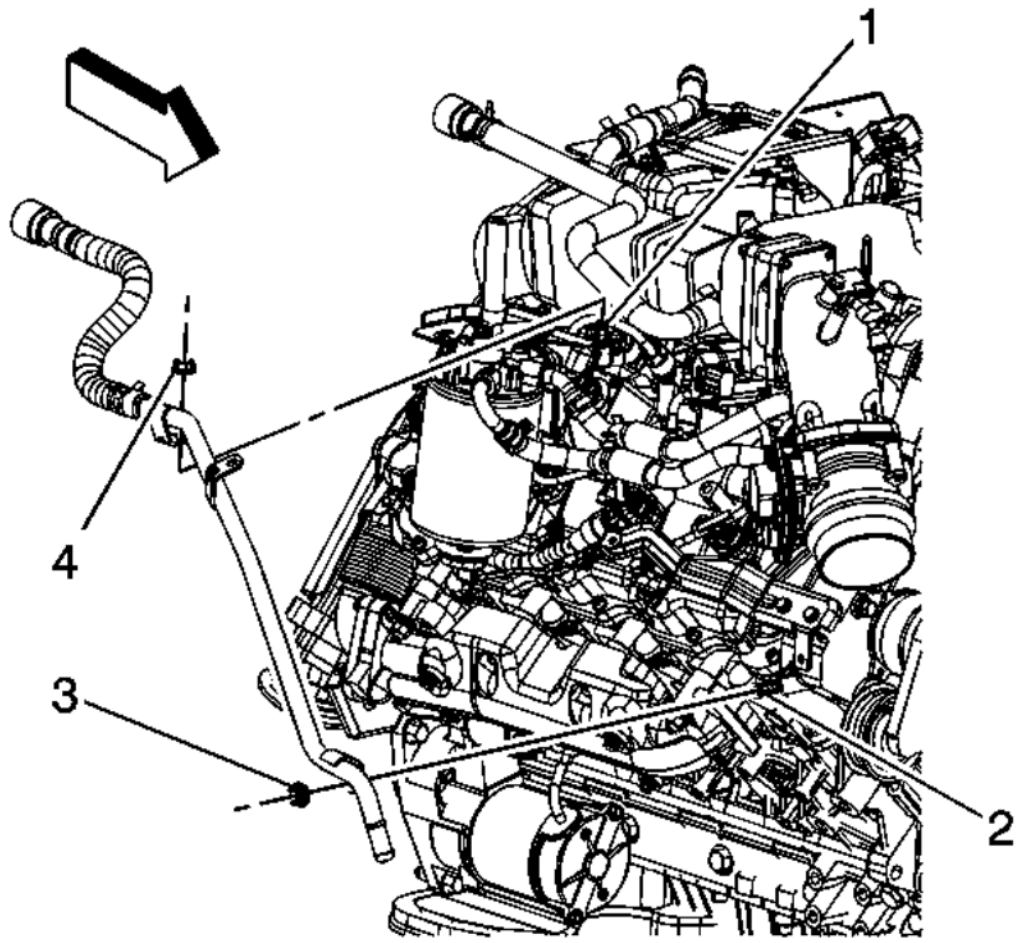


Fig. 287: View Of Fuel Filter Adapter Stud, Generator Bracket Stud & Inlet Hose Bracket Nuts
Courtesy of GENERAL MOTORS CORP.

5. Position the heater inlet hose/pipe to the engine.
6. Install the heater inlet hose bracket to the generator bracket stud (2) and install the bracket nut (3).

   Tighten: Tighten the nut to 9 N.m (80 lb in).

7. Install the heater inlet hose to the fuel filter adapter stud (1) and install the bracket nut (4).

Tighten: Tighten the nut to 9 N.m (80 lb in).

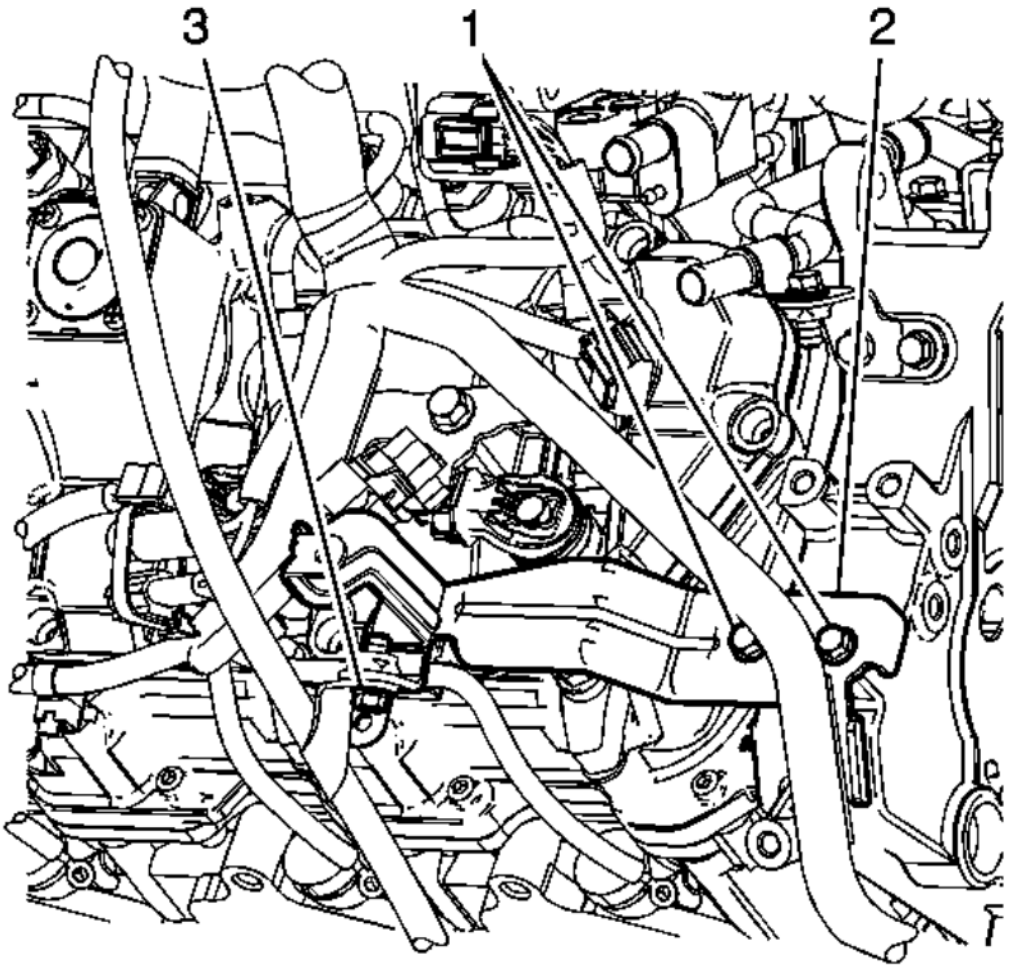


Fig. 288: View Of Indicator Tube Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

8. Install the oil level indicator tube bracket (2).
9. Install the oil level indicator tube bracket bolts (1).

   Tighten: Tighten the bolts to 21 N.m (15 lb ft).

10. Install the oil level indicator tube bolt (3).

Tighten: Tighten the bolts to 21 N.m (15 lb ft).

11. Install the engine wiring harness clip to the oil level indicator tube bracket (2).
12. Install the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement** .
13. Install the generator. Refer to **Generator Replacement (4.3L)** or **Generator Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Generator Replacement (6.6L)**.
14. Install the intake air heater. Refer to **Intake Air Heater Replacement** .
15. Install the upper fan shroud. Refer to **Engine Coolant Fan Upper Shroud Replacement (Mechanical)** or **Engine Coolant Fan Upper Shroud Replacement (Automatic Transmission - Diesel)** .
16. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

AUXILIARY GENERATOR BRACKET REPLACEMENT (6.6L)

Removal Procedure

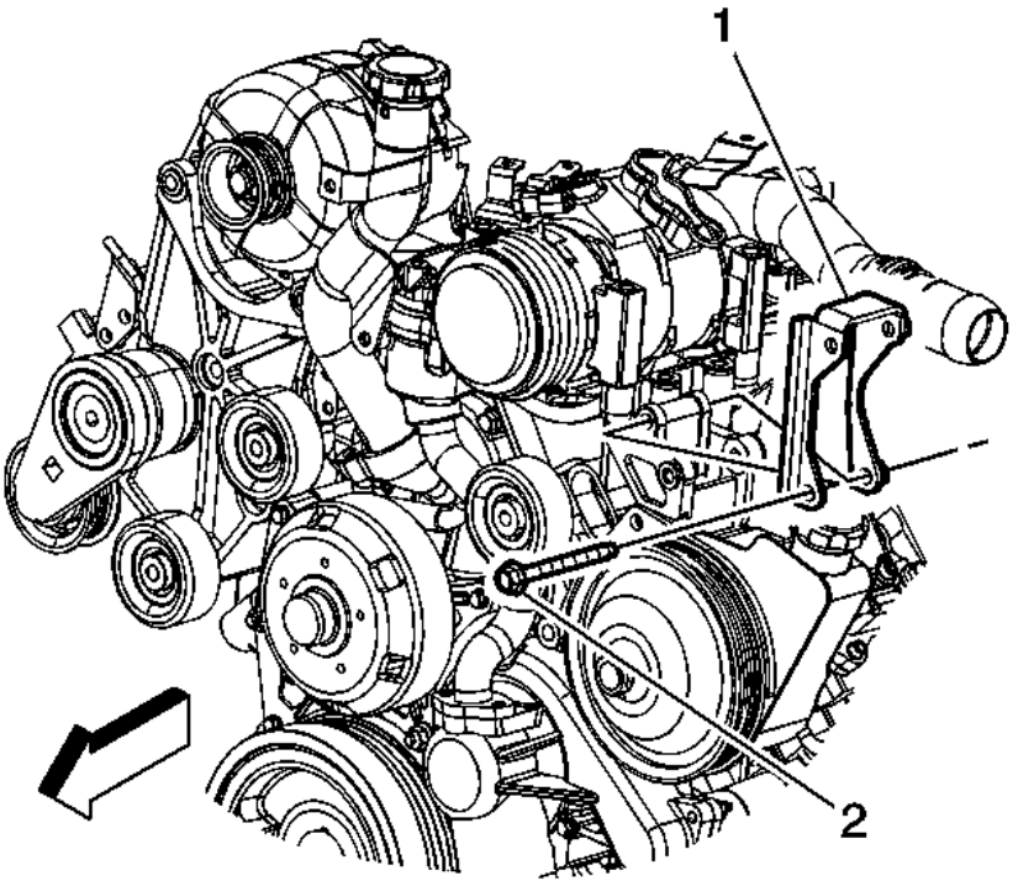


Fig. 289: View Of Auxiliary Generator Bracket & Bolt
Courtesy of GENERAL MOTORS CORP.

1. Remove the auxiliary generator. Refer to **Auxiliary Generator Replacement (6.6L)**.
2. Remove the auxiliary generator bracket bolt (2).
3. Remove the auxiliary generator bracket (1).

Installation Procedure

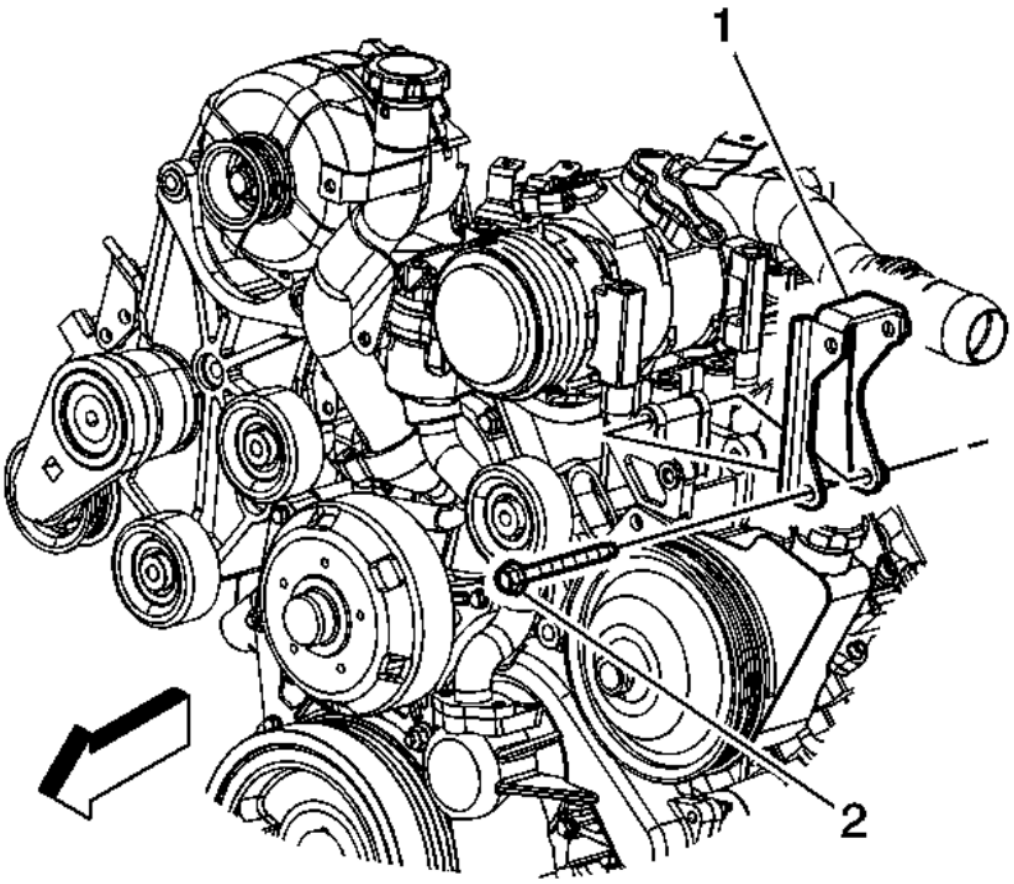


Fig. 290: View Of Auxiliary Generator Bracket & Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Position the auxiliary generator bracket (2) to the air conditioning (A/C) bracket.
2. Install the auxiliary generator bracket bolt (1).

   Tighten: Tighten the bolt to 50 N.m (37 lb ft).

3. Install the auxiliary generator. Refer to **Auxiliary Generator Replacement (6.6L)**.

GENERATOR REPLACEMENT (4.3L)

Removal Procedure

CAUTION: Refer to BATTERY DISCONNECT CAUTION

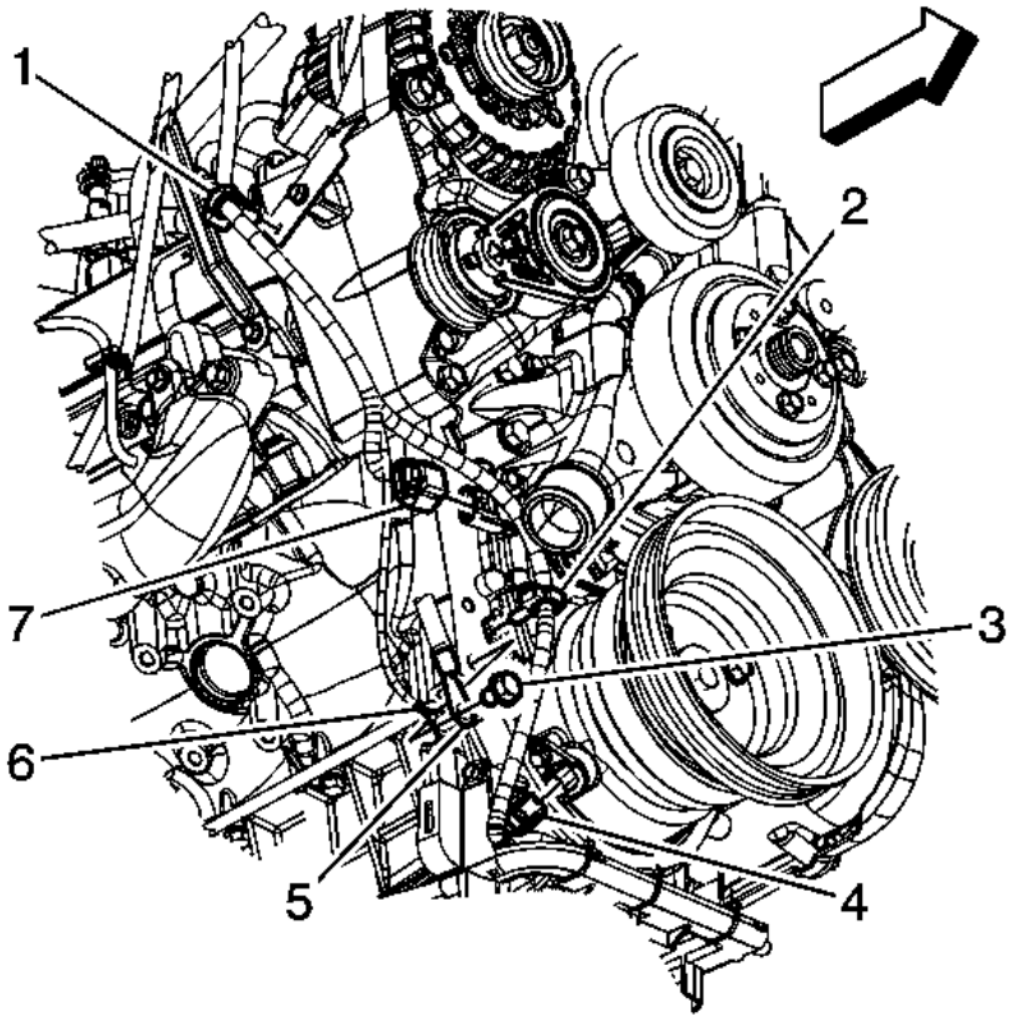


Fig. 291: View Of Engine Wiring Harness & Components
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and**

Connection (w/Auxiliary Battery) or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

2. Remove the air cleaner outlet resonator. Refer to **Air Cleaner Outlet Resonator Replacement** .
3. Remove the drive belt. Refer to **Drive Belt Replacement** .
4. Remove the engine wiring harness clip (1) from the air conditioning (A/C) compressor/condenser hose bracket.

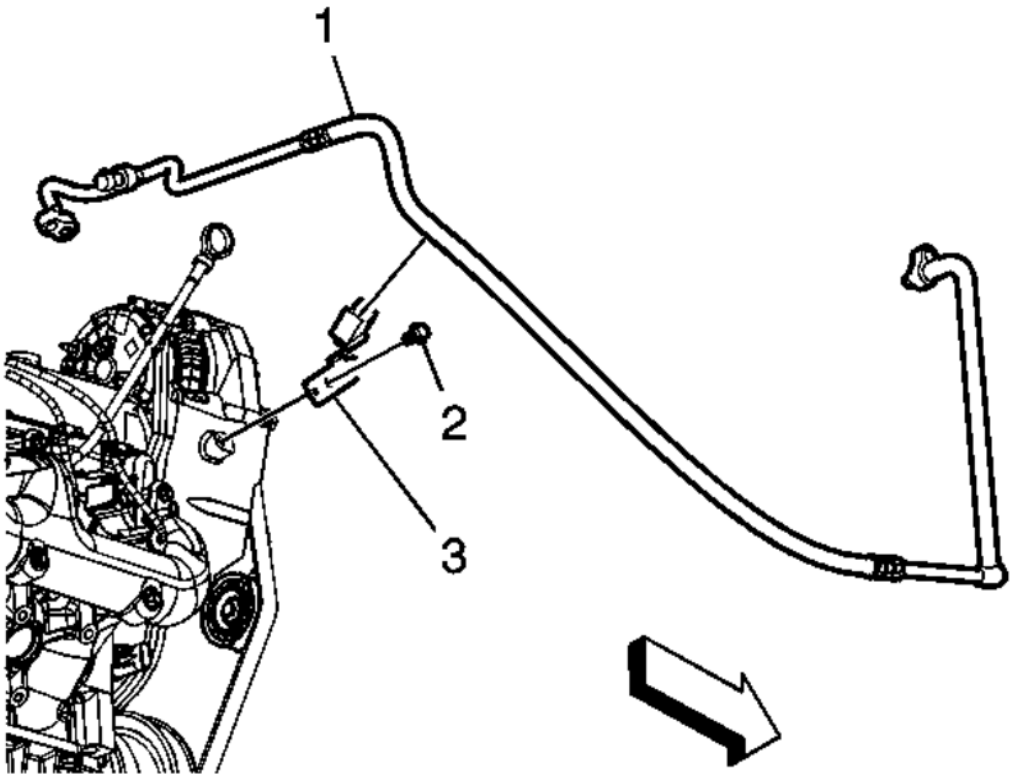


Fig. 292: View Of A/C Compressor & Condenser Hose Bracket & Bolt
Courtesy of GENERAL MOTORS CORP.

5. Remove the A/C compressor and condenser hose bracket bolt (2).

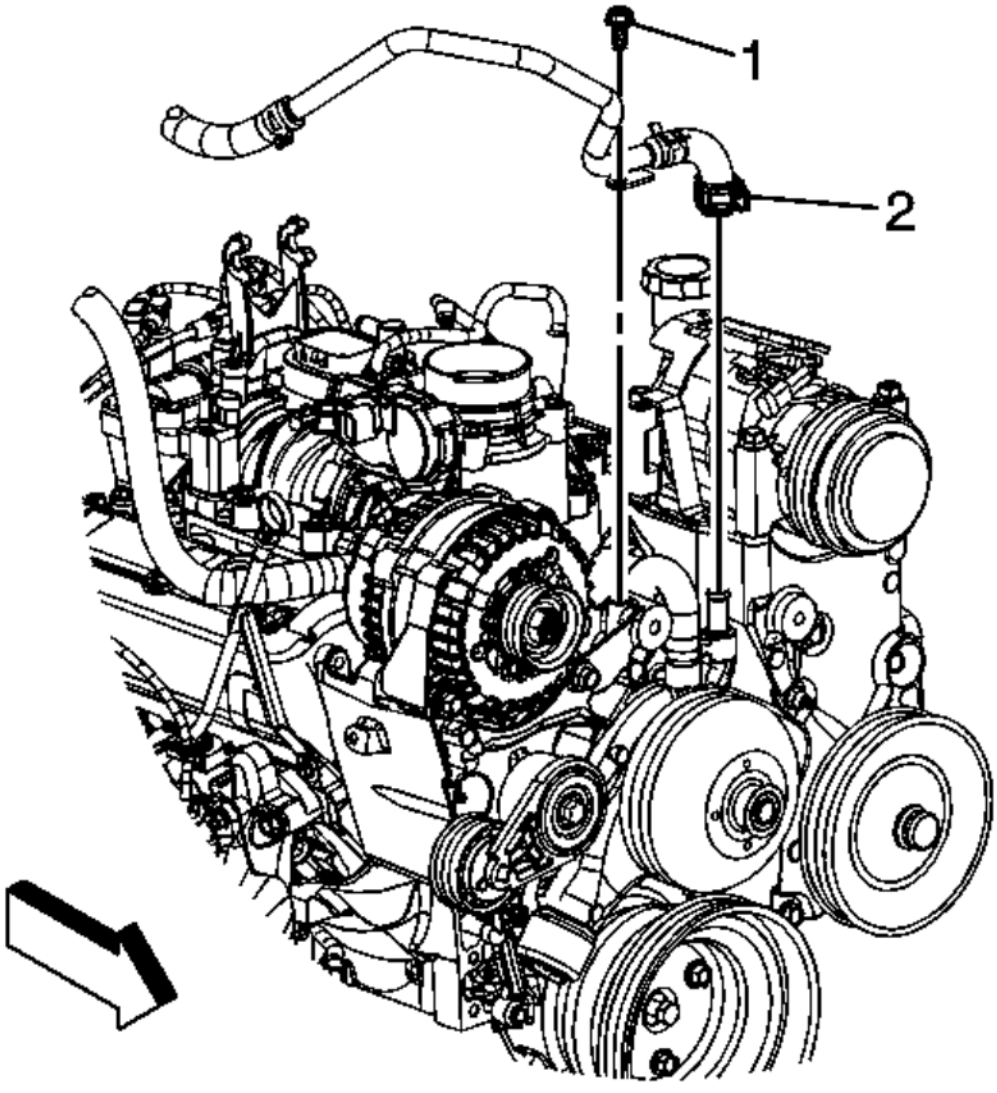


Fig. 293: View Of Heater Outlet Hose & Clamp Bolt
Courtesy of GENERAL MOTORS CORP.

6. Remove the heater outlet hose clamp bolt (1) at the generator bracket.

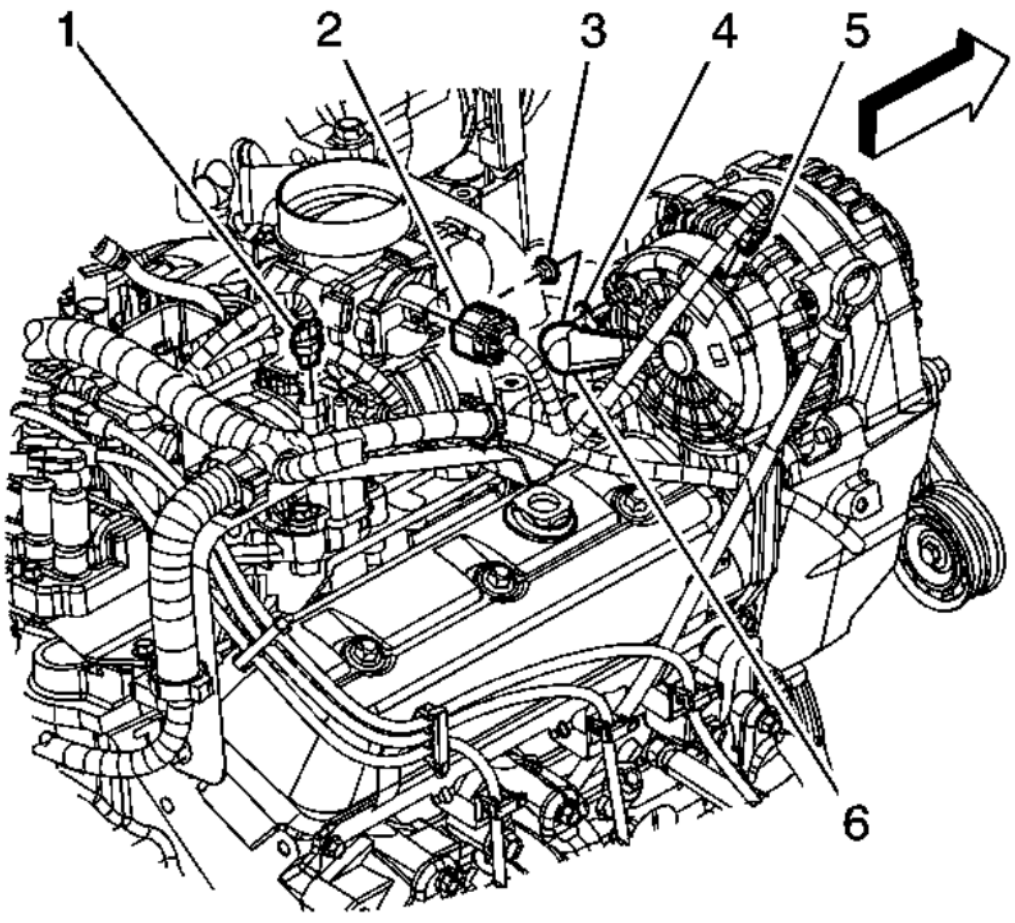


Fig. 294: View Of Engine Wiring Harness & Components
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the engine wiring harness electrical connector (5) from the generator.
8. Reposition the engine wiring harness boot (6).
9. Remove the engine wiring harness nut (3) from the generator.
10. Remove the engine wiring harness lead (4) from the generator stud.

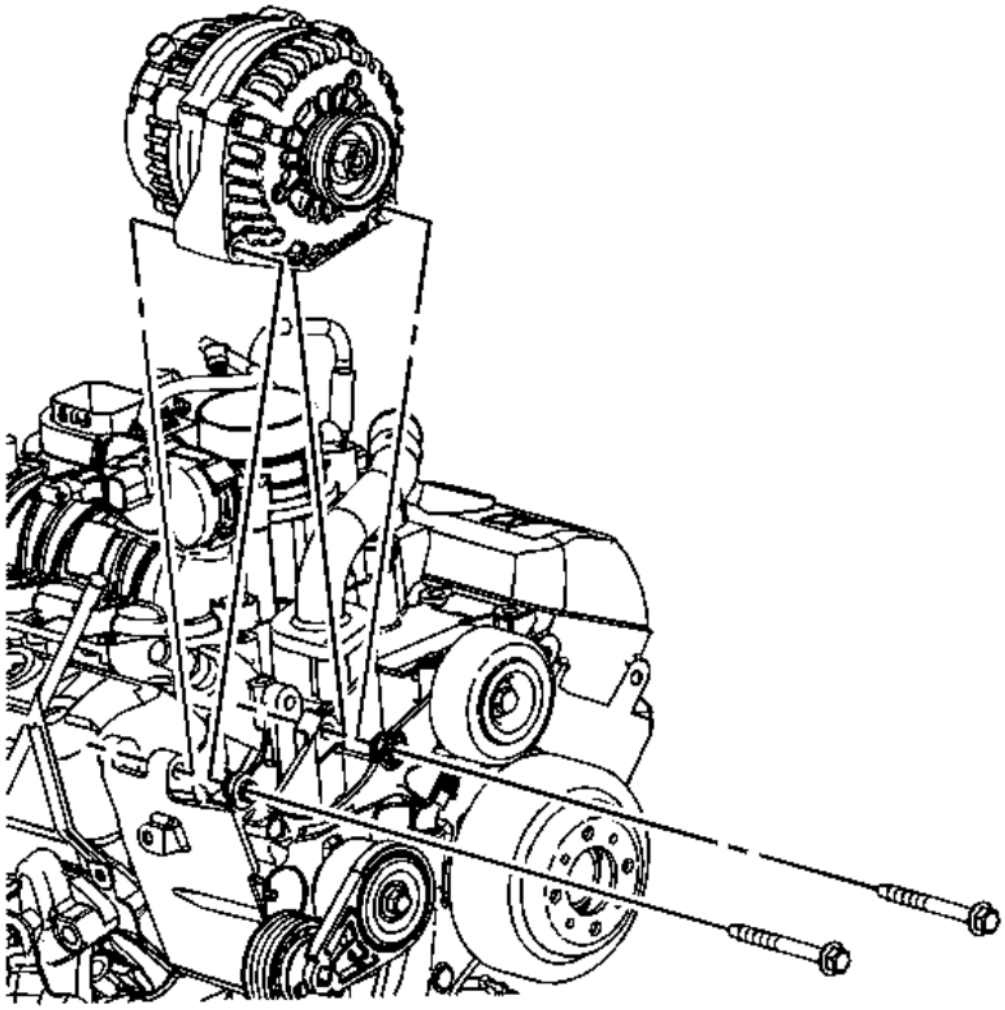


Fig. 295: View Of Generator & Bolts
Courtesy of GENERAL MOTORS CORP.

11. Remove the generator bolts.
12. Reposition the heater outlet, and AC compressor/condenser hoses as necessary in order to remove the generator.
13. Remove the generator from the generator bracket.

Installation Procedure

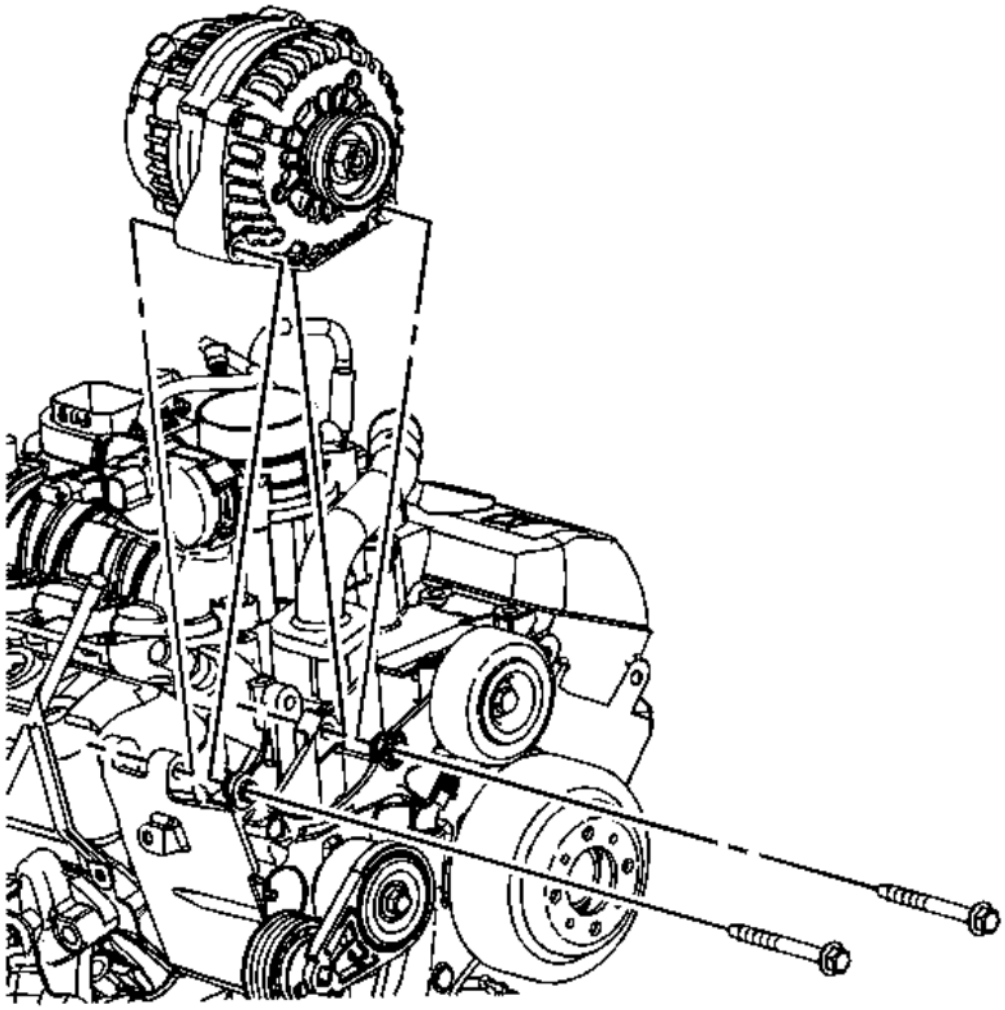


Fig. 296: View Of Generator & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the generator into the generator bracket.
2. Position the heater outlet, and AC compressor/condenser hoses as necessary.

NOTE: Refer to Fastener Notice .

3. Install the generator bolts.

Tighten: Tighten the bolts to 50 N.m (37 lb ft).

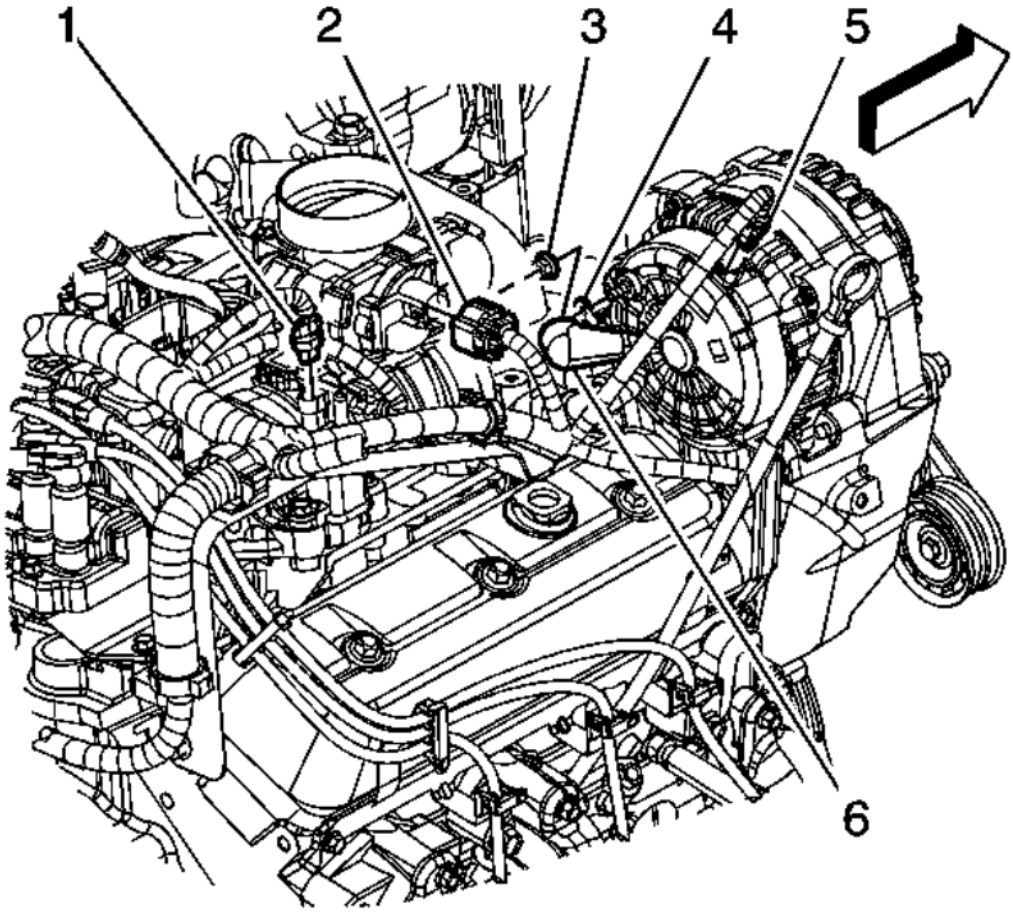


Fig. 297: View Of Engine Wiring Harness & Components
Courtesy of GENERAL MOTORS CORP.

4. Install the engine wiring harness lead (4) to the generator stud.
5. Install the engine wiring harness nut (3) to the generator.

Tighten: Tighten the nut to 9 N.m (80 lb in).

6. Position the engine wiring harness boot (6) over the generator stud.
7. Connect the engine wiring harness electrical connector (5) to the generator.

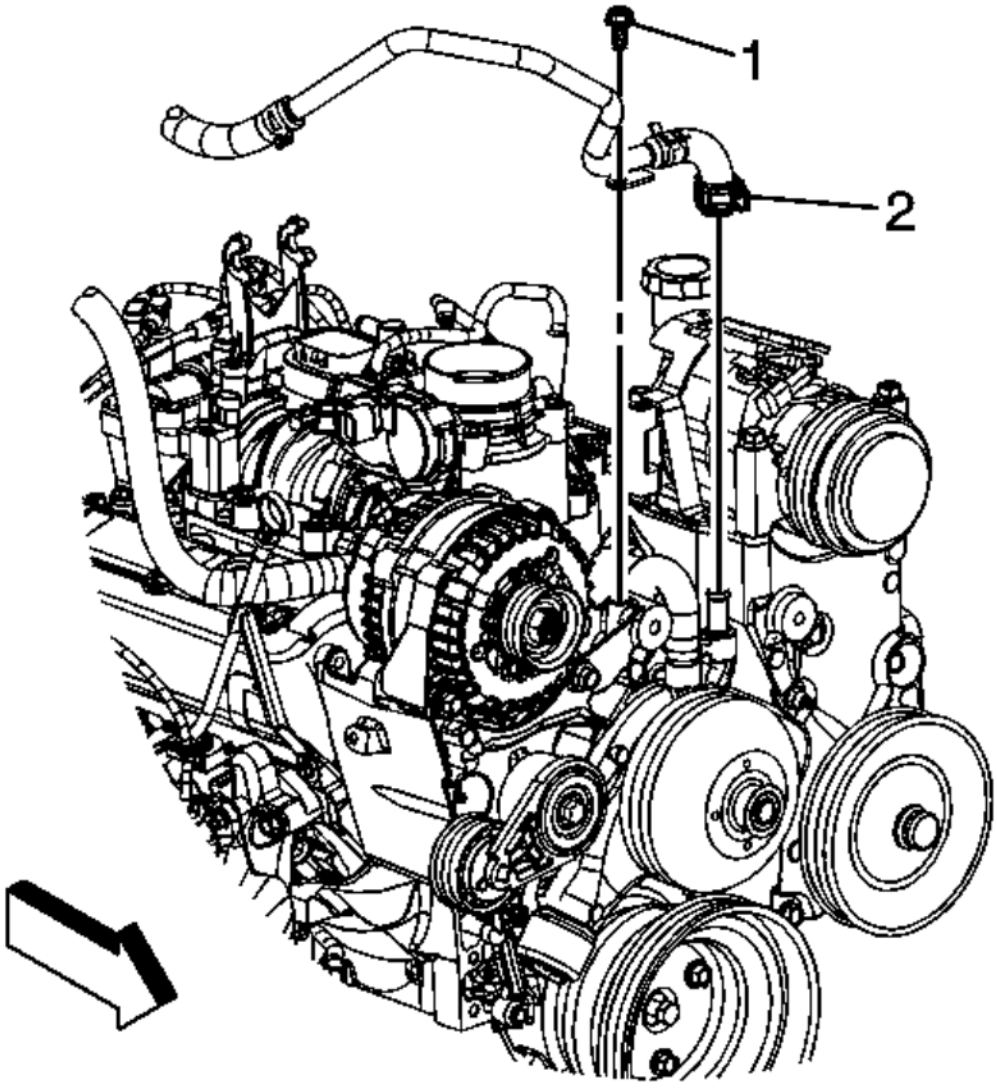


Fig. 298: View Of Heater Outlet Hose & Clamp Bolt
Courtesy of GENERAL MOTORS CORP.

8. Install the heater outlet hose clamp bolt (1) at the generator bracket.

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

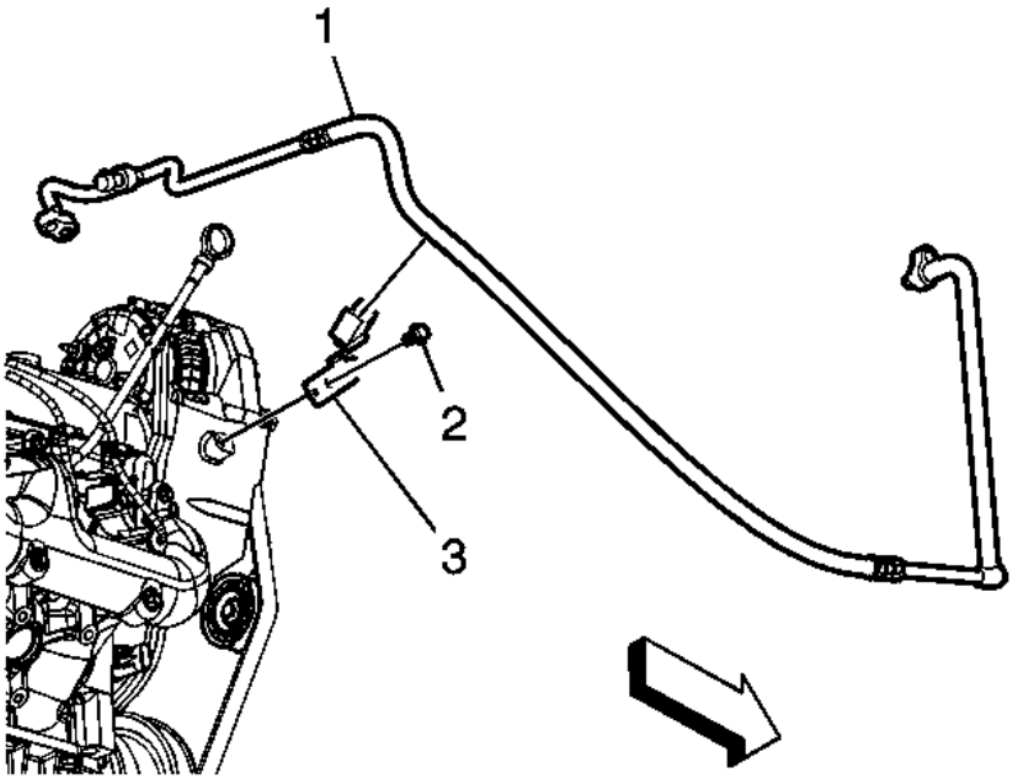


Fig. 299: View Of A/C Compressor & Condenser Hose Bracket & Bolt
Courtesy of GENERAL MOTORS CORP.

9. Install the A/C compressor and condenser hose bracket bolt (2).

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

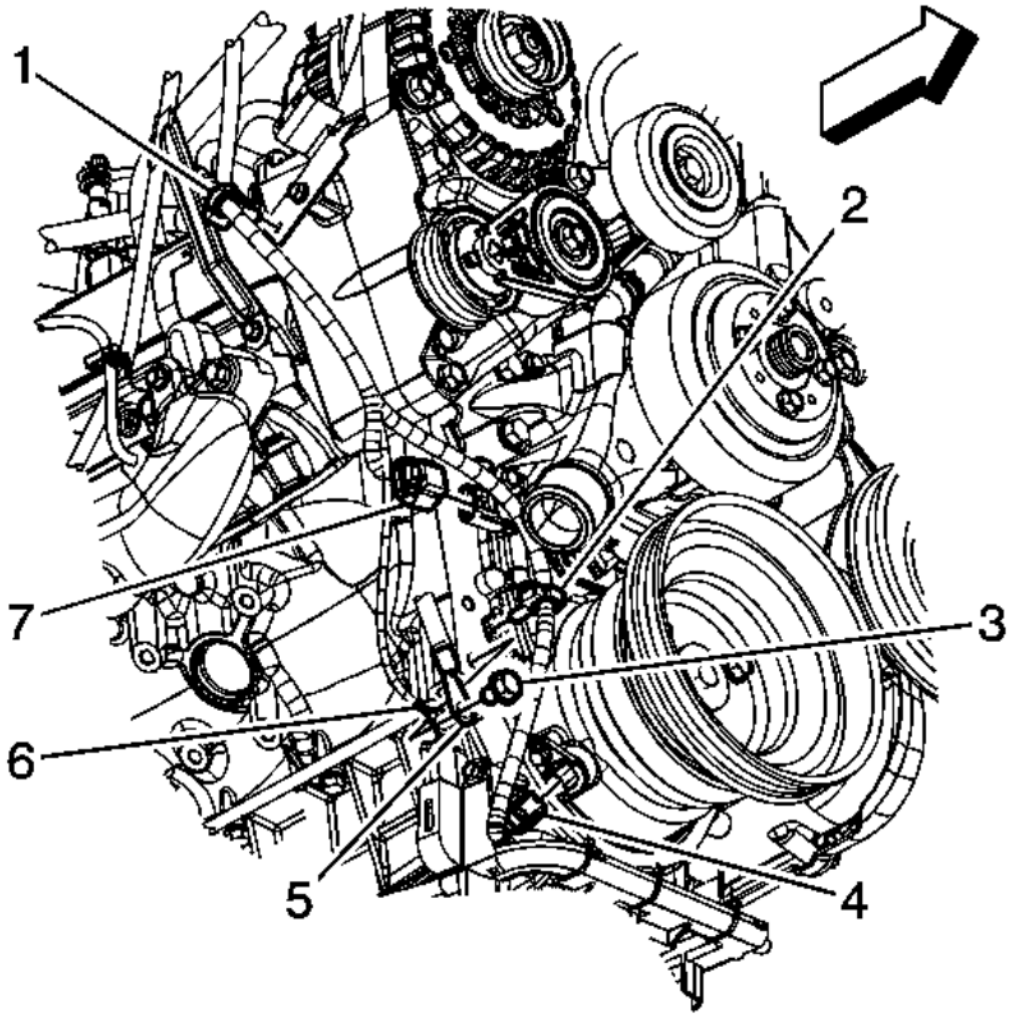


Fig. 300: View Of Engine Wiring Harness & Components
Courtesy of GENERAL MOTORS CORP.

10. Instal the engine wiring harness clip (1) to the A/C compressor/condenser hose bracket.
11. Install the drive belt. Refer to **Drive Belt Replacement** .
12. Install the air cleaner outlet resonator. Refer to **Air Cleaner Outlet Resonator Replacement** .
13. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and**

Connection (w/Auxiliary Battery) or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

GENERATOR REPLACEMENT (4.8L, 5.3L, 6.0L, AND 6.2L)

Removal Procedure

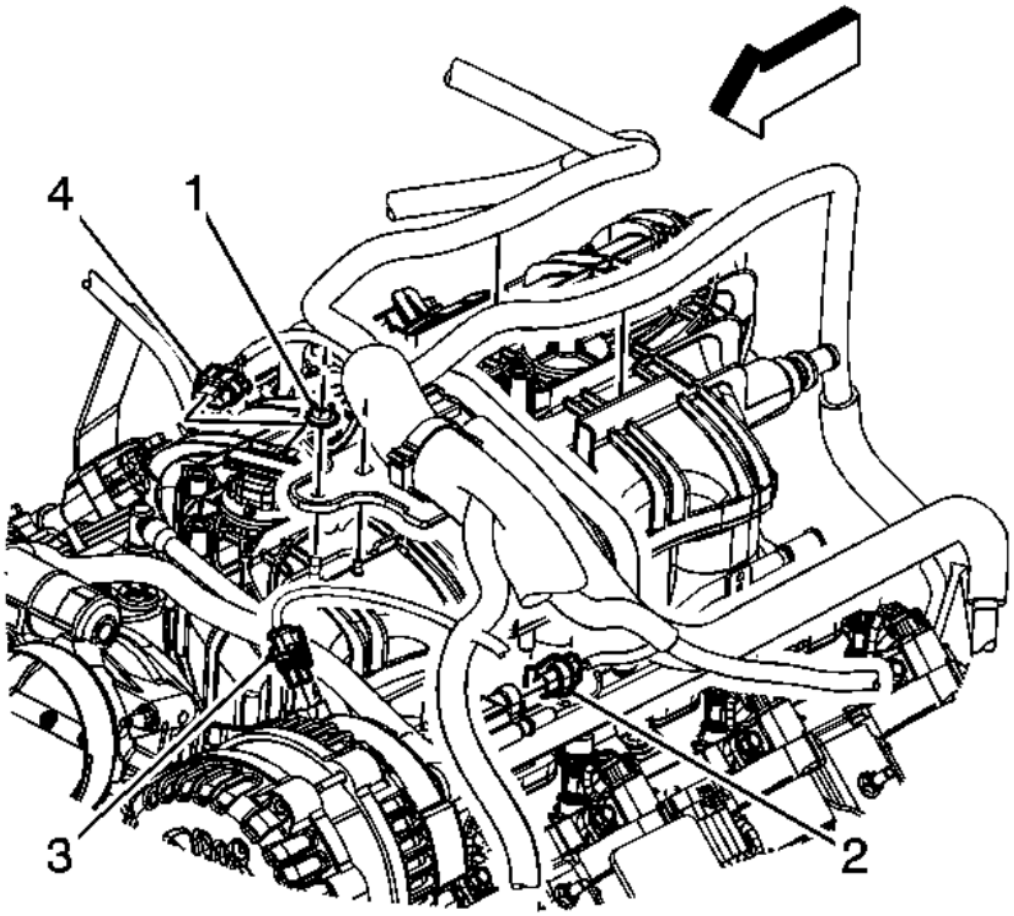


Fig. 301: View Of Generator & Related Connectors
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and**

Connection (w/Dual Batteries).

2. Remove the intake manifold sight shield. Refer to **Upper Intake Manifold Sight Shield Replacement** .
3. Remove the accessory drive belt. Refer to **Drive Belt Replacement - Accessory** .
4. Disconnect the engine harness electrical connector (3) from the generator.

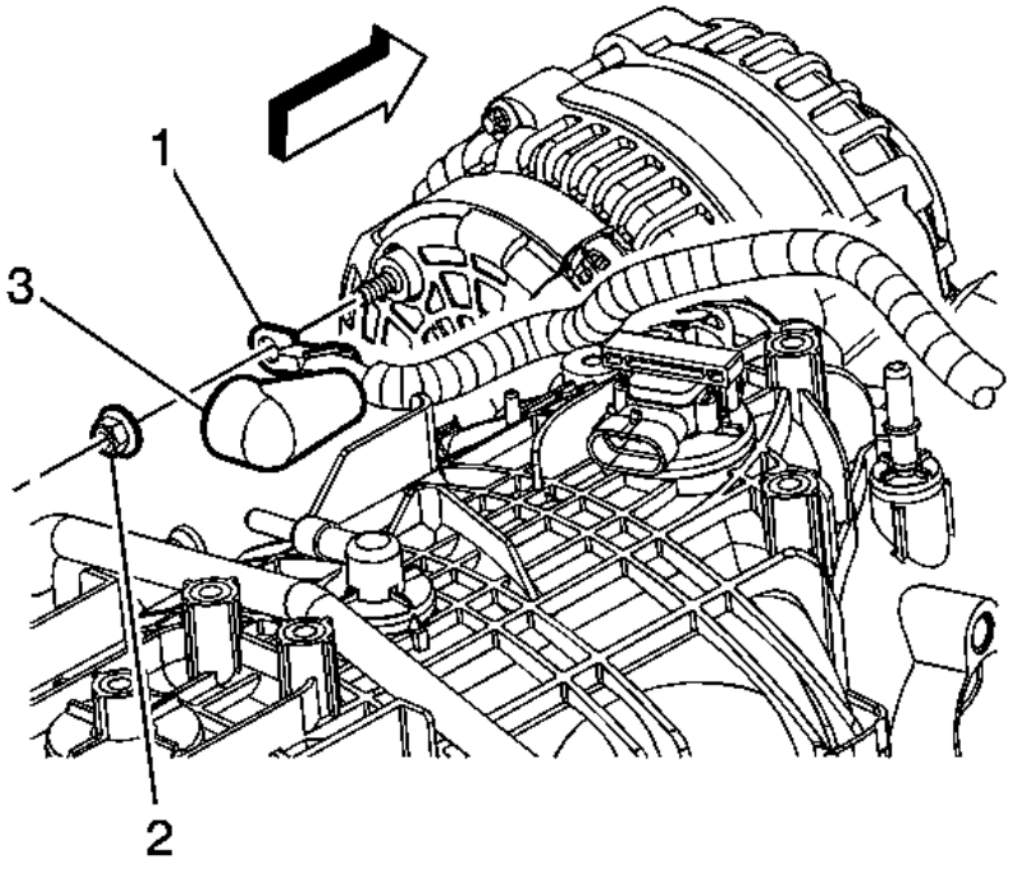


Fig. 302: View Of Battery Jumper Cable Terminal, Nut & Bolt
Courtesy of GENERAL MOTORS CORP.

5. Reposition the generator battery jumper cable boot (3).
6. Remove the generator battery jumper cable nut (2) from the generator.
7. Remove the generator battery jumper cable terminal (1) from the generator stud.

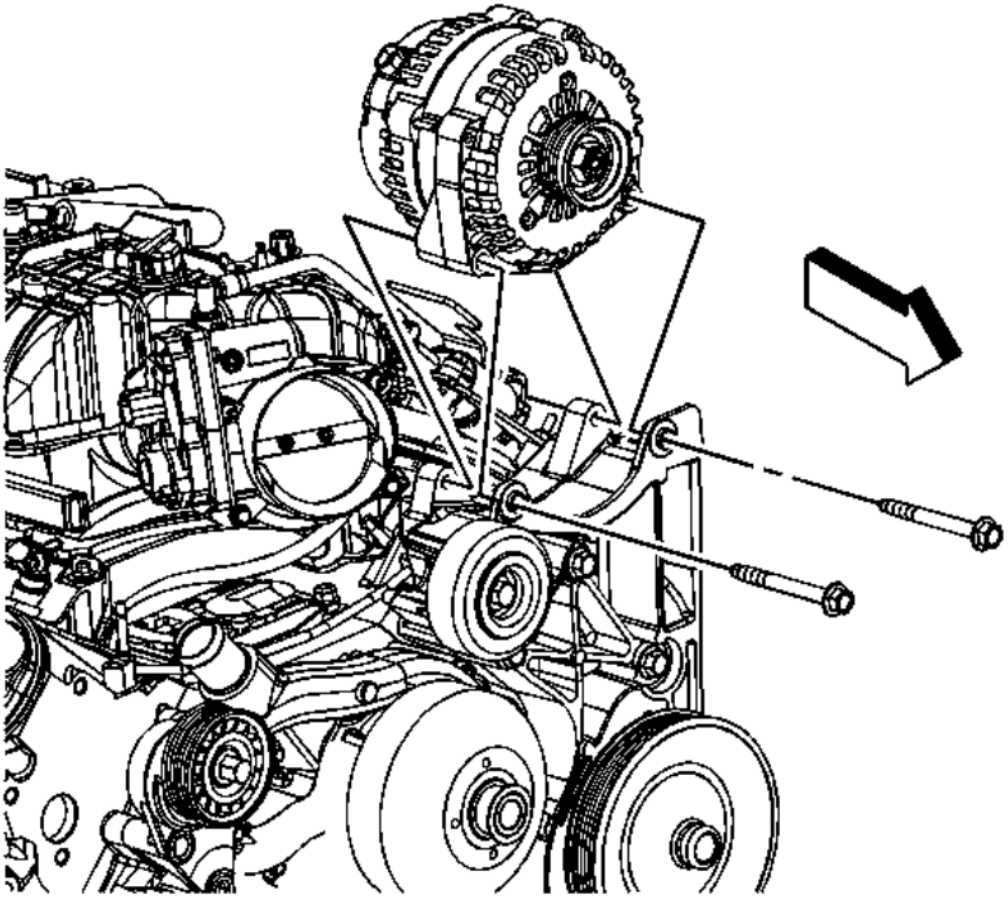


Fig. 303: View Of Generator & Bolts
Courtesy of GENERAL MOTORS CORP.

8. Remove the generator bolts.
9. Remove the generator.

Installation Procedure

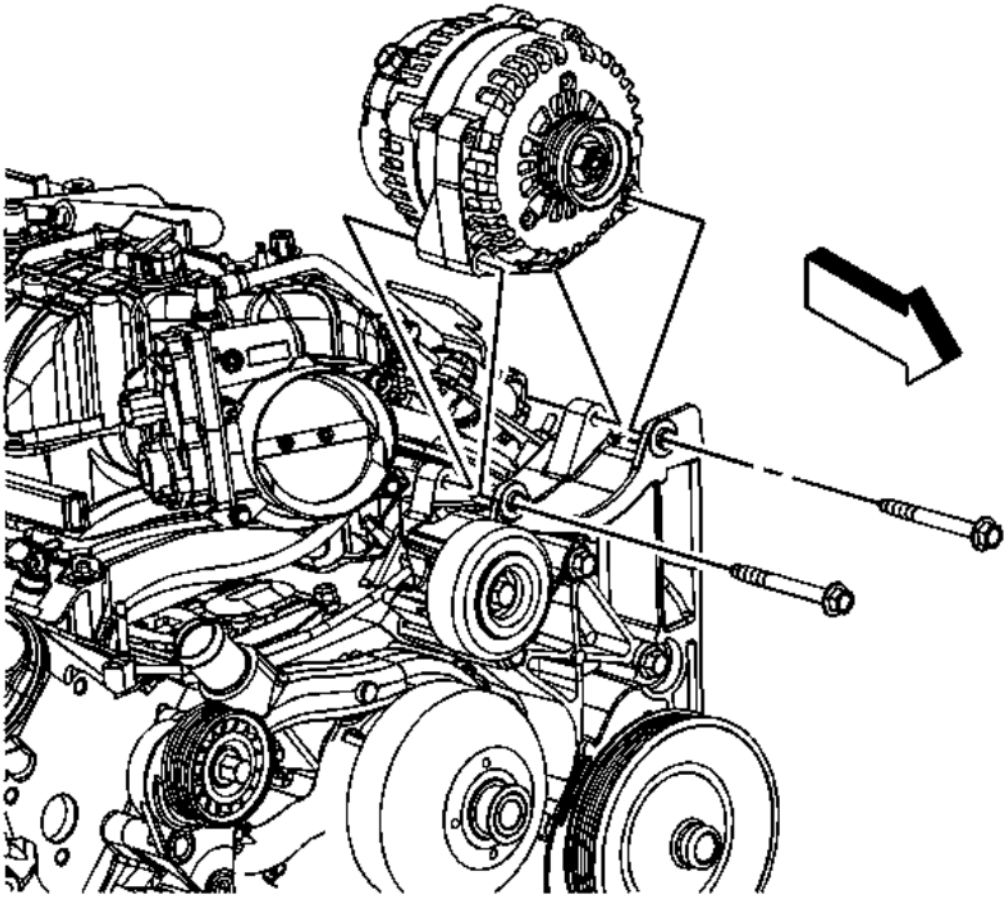


Fig. 304: View Of Generator & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the generator.

NOTE: Refer to Fastener Notice .

2. Install the generator bolts.

Tighten: Tighten the bolts to 55 N.m (41 lb ft).

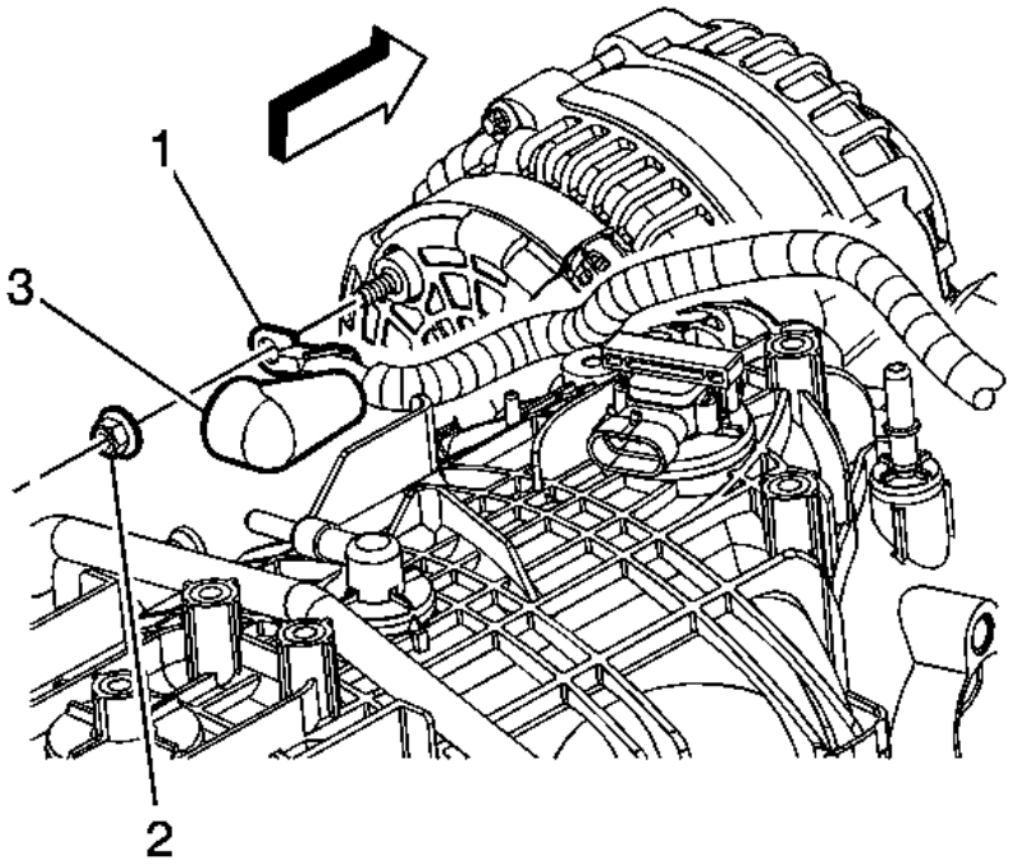


Fig. 305: View Of Battery Jumper Cable Terminal, Nut & Bolt
Courtesy of GENERAL MOTORS CORP.

3. Install the generator battery jumper cable terminal (1) to the generator stud.
4. Install the generator battery jumper cable nut (2) to the generator.

   Tighten: Tighten the nut to 9 N.m (80 lb in).

5. Position the generator battery jumper cable boot (3).

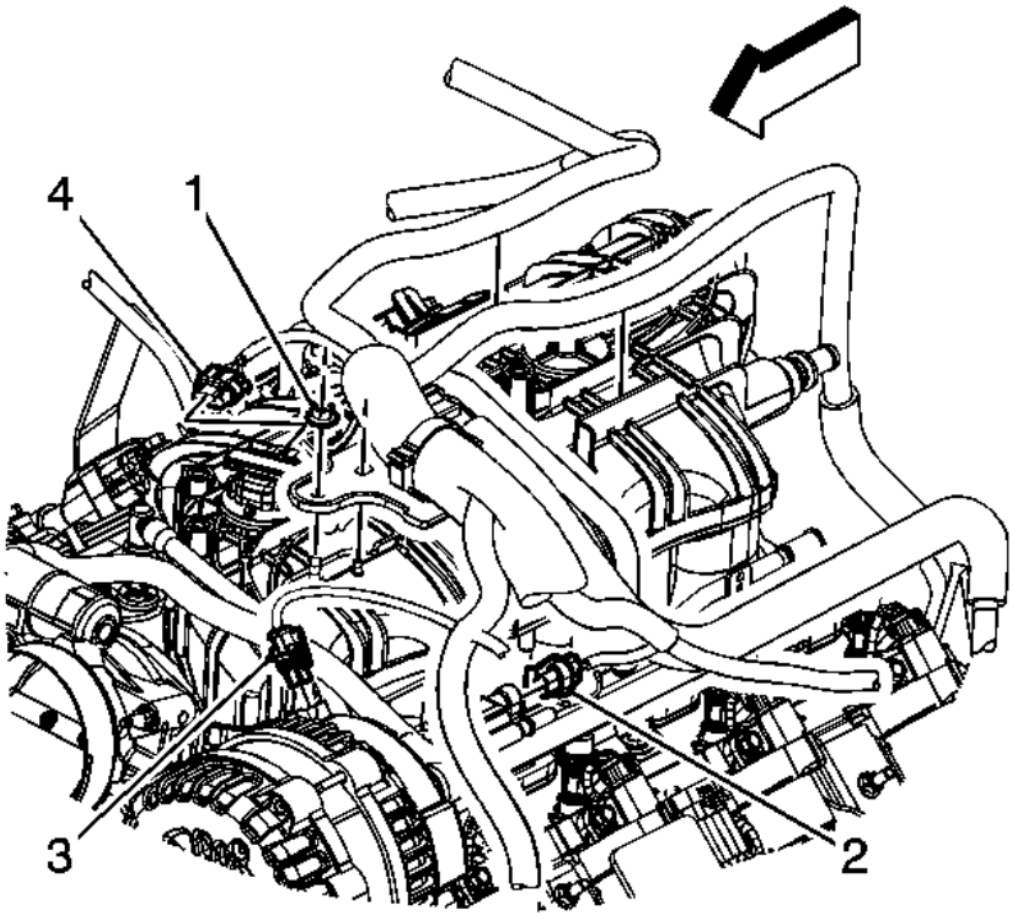


Fig. 306: View Of Generator & Related Connectors
Courtesy of GENERAL MOTORS CORP.

6. Connect the engine harness electrical connector (3) to the generator.
7. Install the accessory drive belt. Refer to **Drive Belt Replacement - Accessory** .
8. Install the intake manifold sight shield. Refer to **Upper Intake Manifold Sight Shield Replacement** .
9. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

GENERATOR REPLACEMENT (6.6L)

Removal Procedure

CAUTION: Refer to BATTERY DISCONNECT CAUTION .

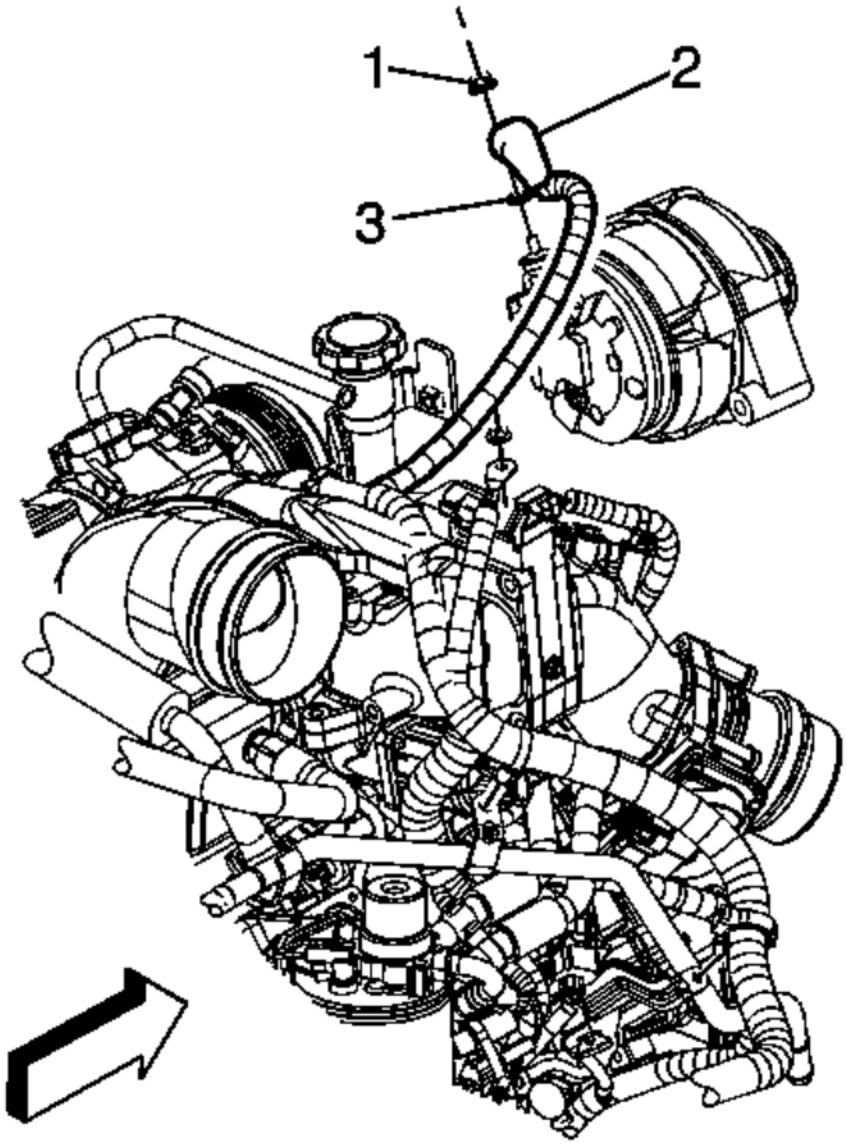


Fig. 307: View Of Engine Wiring Harness Terminal, Boot & Nut
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and**

Connection (w/Dual Batteries).

2. Remove the drive belt. Refer to **Drive Belt Replacement** .
3. Reposition the engine wiring harness boot (2) in order to access the terminal stud.
4. Remove the engine wiring harness nut (1).
5. Remove the engine wiring harness terminal (3) from the generator.
6. Reposition the engine wiring harness out of the way.

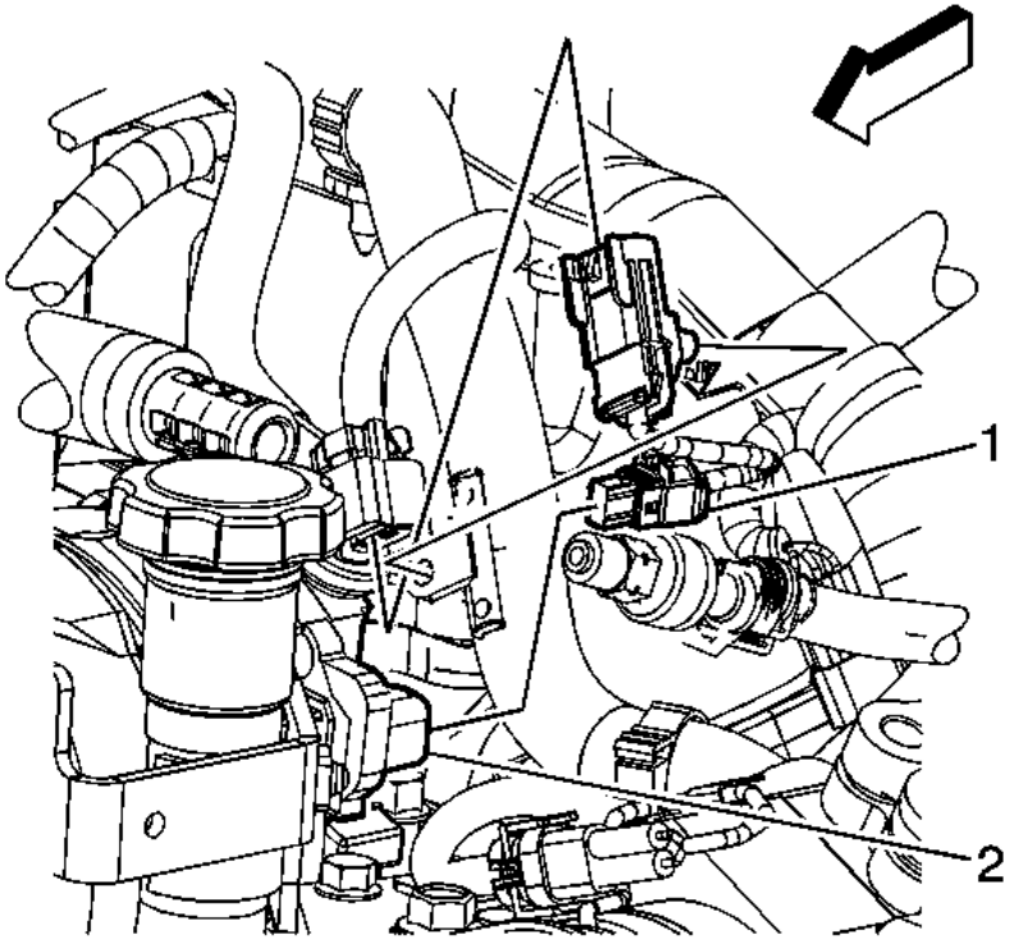


Fig. 308: View Of Engine Wiring Harness Electrical Connector & Generator
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the engine wiring harness electrical connector (1) from the generator (2).

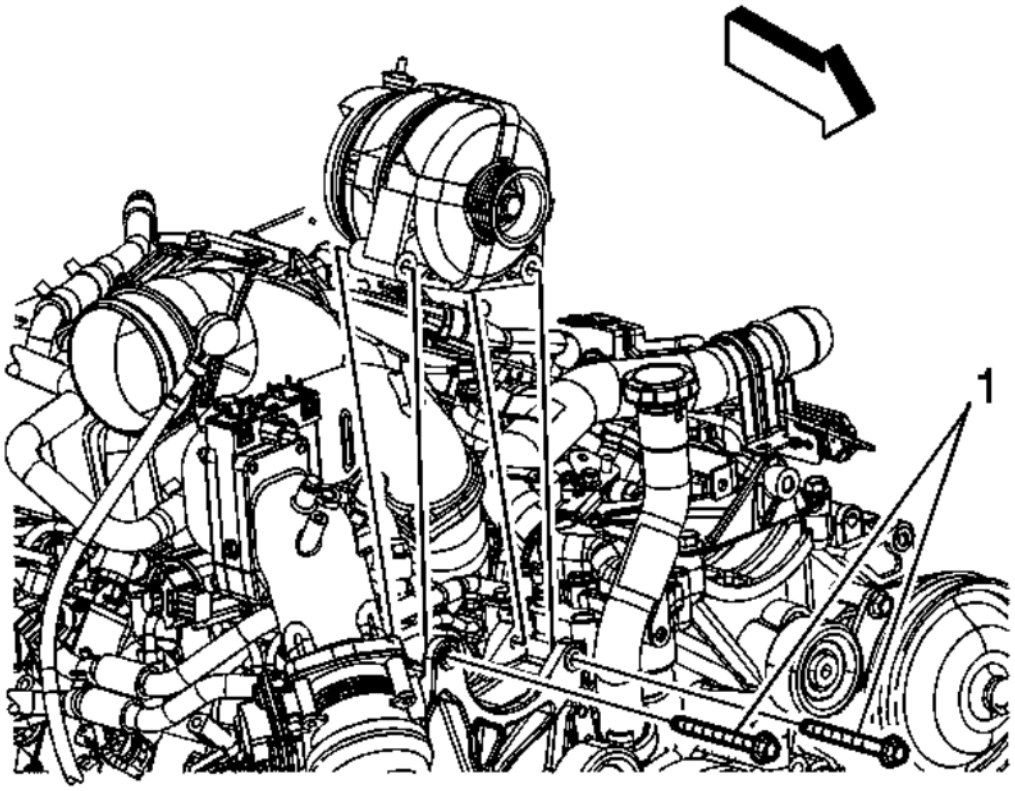


Fig. 309: View Of Generator & Bolts
Courtesy of GENERAL MOTORS CORP.

8. Remove the generator bolts (1).
9. Remove the generator.

Installation Procedure

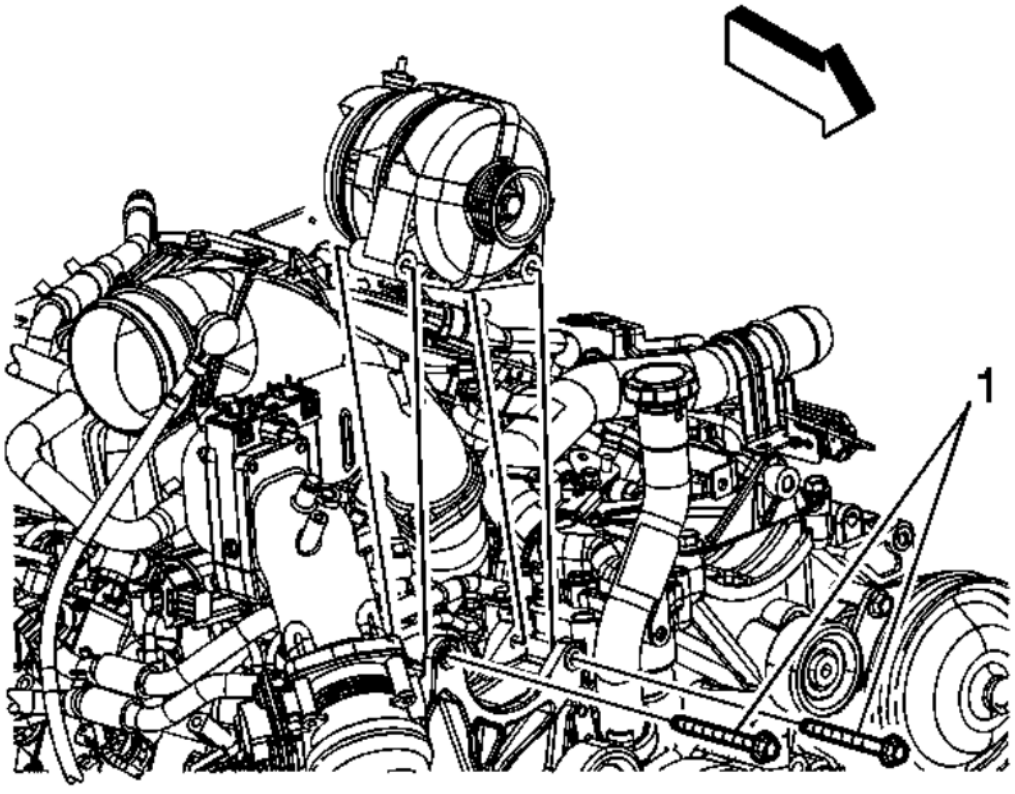


Fig. 310: View Of Generator & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Install the generator.
2. Install the generator bolts (1).

Tighten: Tighten the bolts to 50 N.m (37 lb ft).

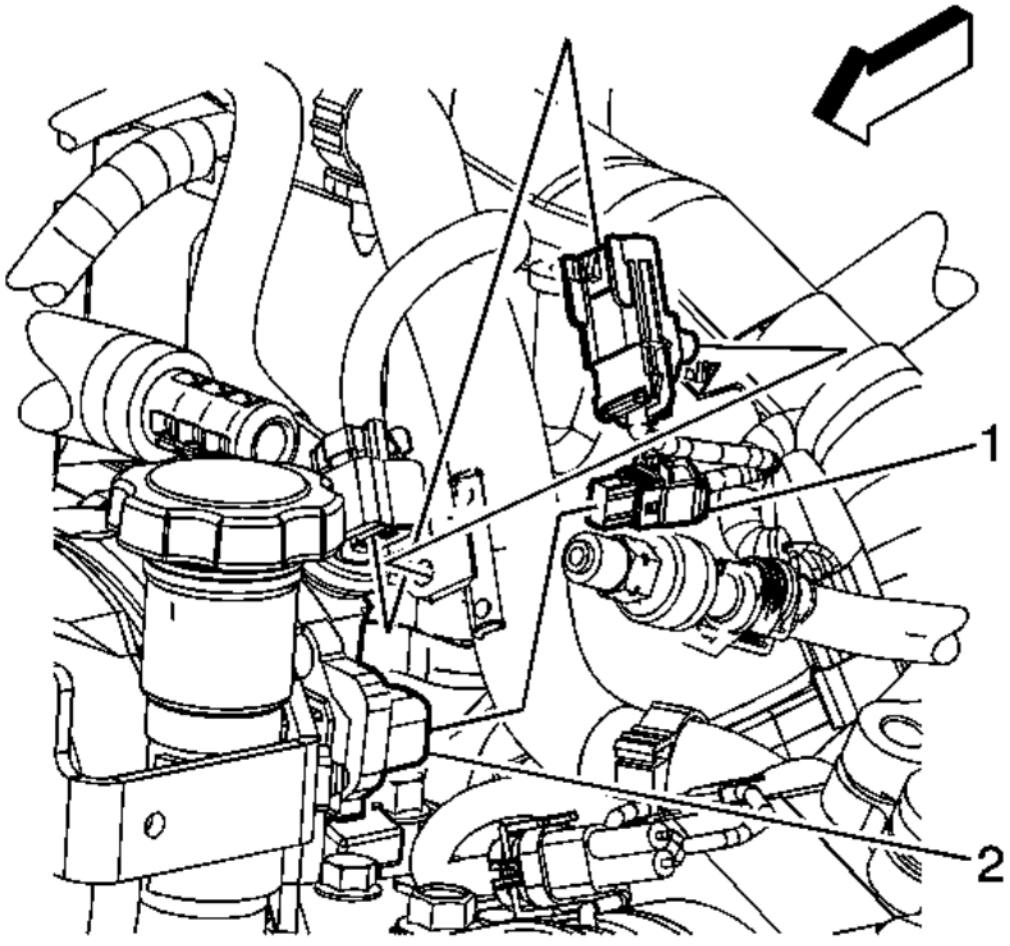


Fig. 311: View Of Engine Wiring Harness Electrical Connector & Generator
Courtesy of GENERAL MOTORS CORP.

3. Connect the engine wiring harness electrical connector (1) to the generator (2).

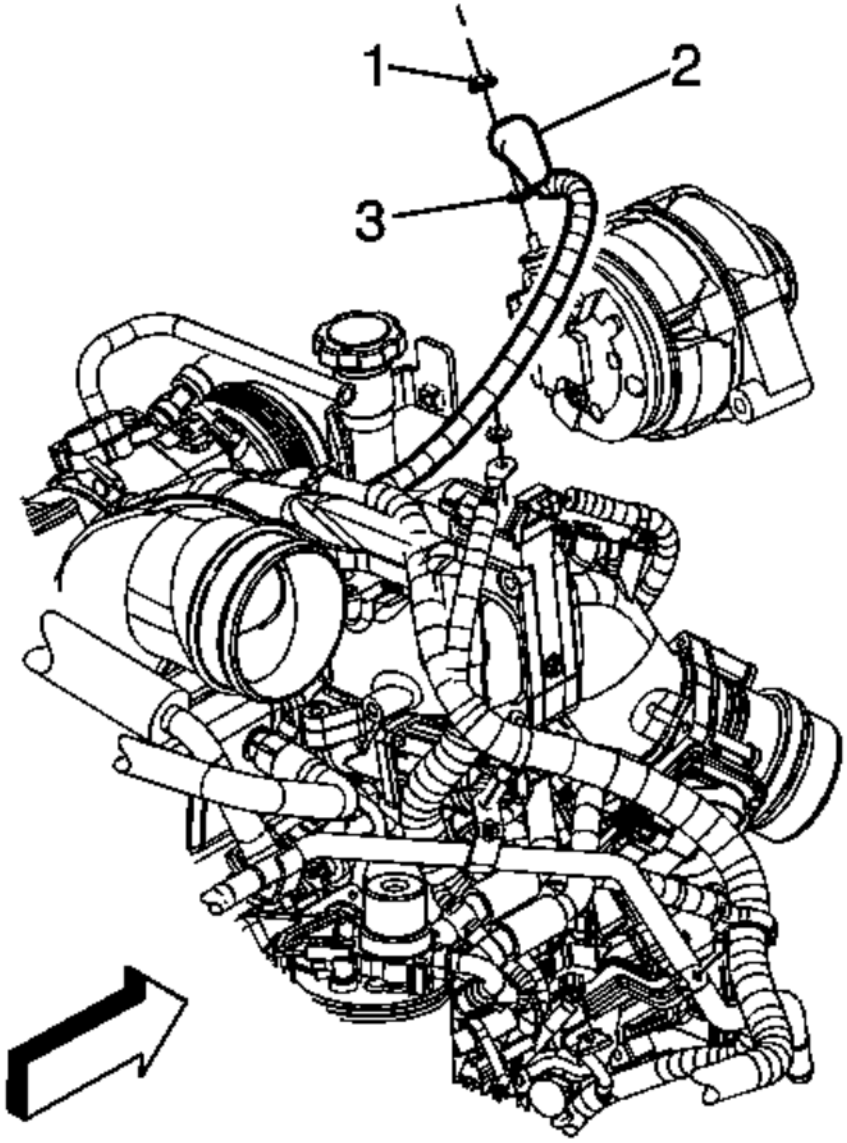


Fig. 312: View Of Engine Wiring Harness Terminal, Boot & Nut
Courtesy of GENERAL MOTORS CORP.

4. Install the engine wiring harness terminal (3) to the generator.
5. Install the engine wiring harness nut (1).

Tighten: Tighten the nut to 9 N.m (80 lb in).

6. Position the engine wiring harness boot (2) in order to cover the terminal stud.
7. Install the drive belt. Refer to **Drive Belt Replacement** .
8. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

AUXILIARY GENERATOR REPLACEMENT (6.6L)

Removal Procedure

CAUTION: Refer to BATTERY DISCONNECT CAUTION .

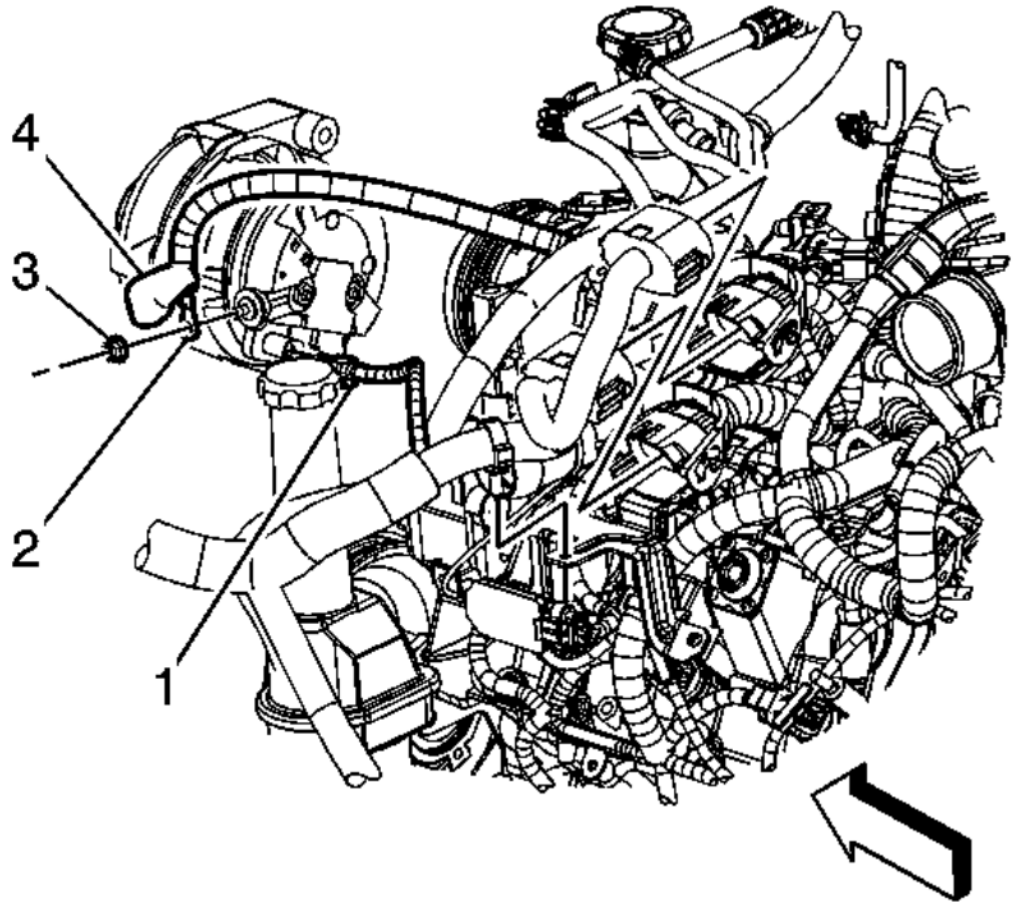


Fig. 313: View Of Engine Wiring Harness Electrical Connector, Terminal, Boot & Nut
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.
2. Remove the drive belt. Refer to **Drive Belt Replacement** .
3. Disconnect the engine wiring harness electrical connector (1) from the generator.
4. Reposition the engine wiring harness boot (4) in order to access the terminal stud.

5. Remove the engine wiring harness nut (3).
6. Remove the engine wiring harness terminal (2) from the generator.

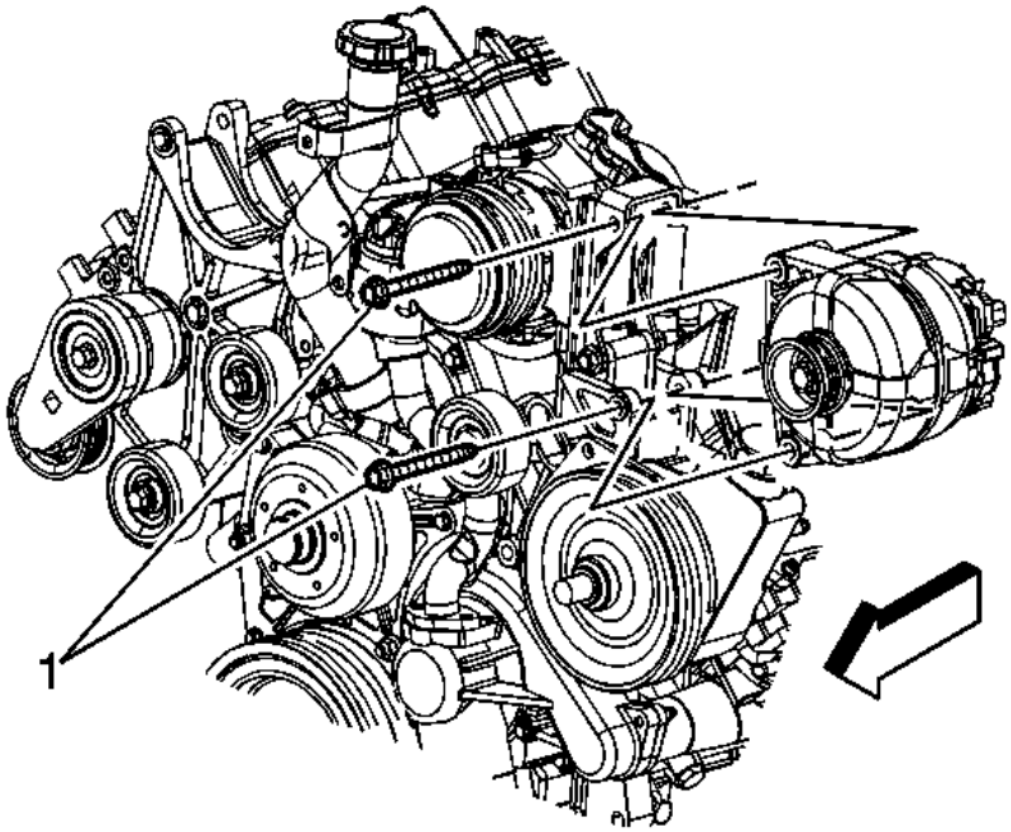


Fig. 314: View Of Generator & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Remove the generator bolts (1).
8. Remove the generator.

Installation Procedure

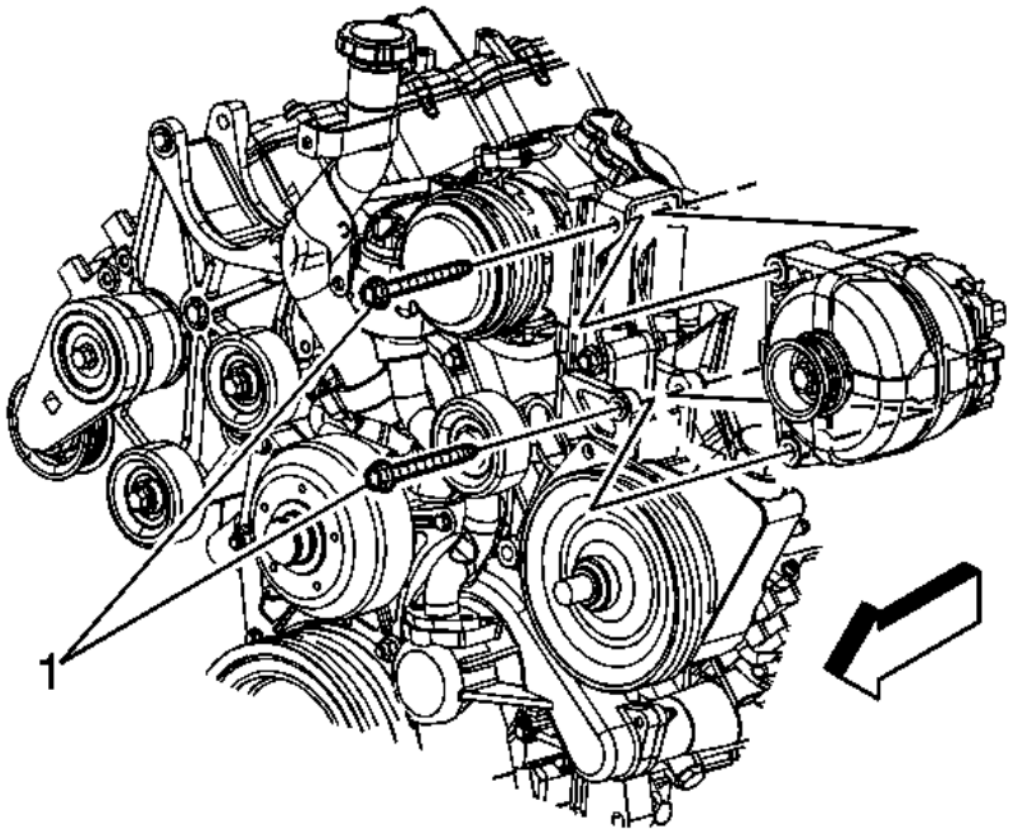


Fig. 315: View Of Generator & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Install the generator.
2. Install the generator bolts (1).

Tighten: Tighten the bolts to 50 N.m (37 lb ft).

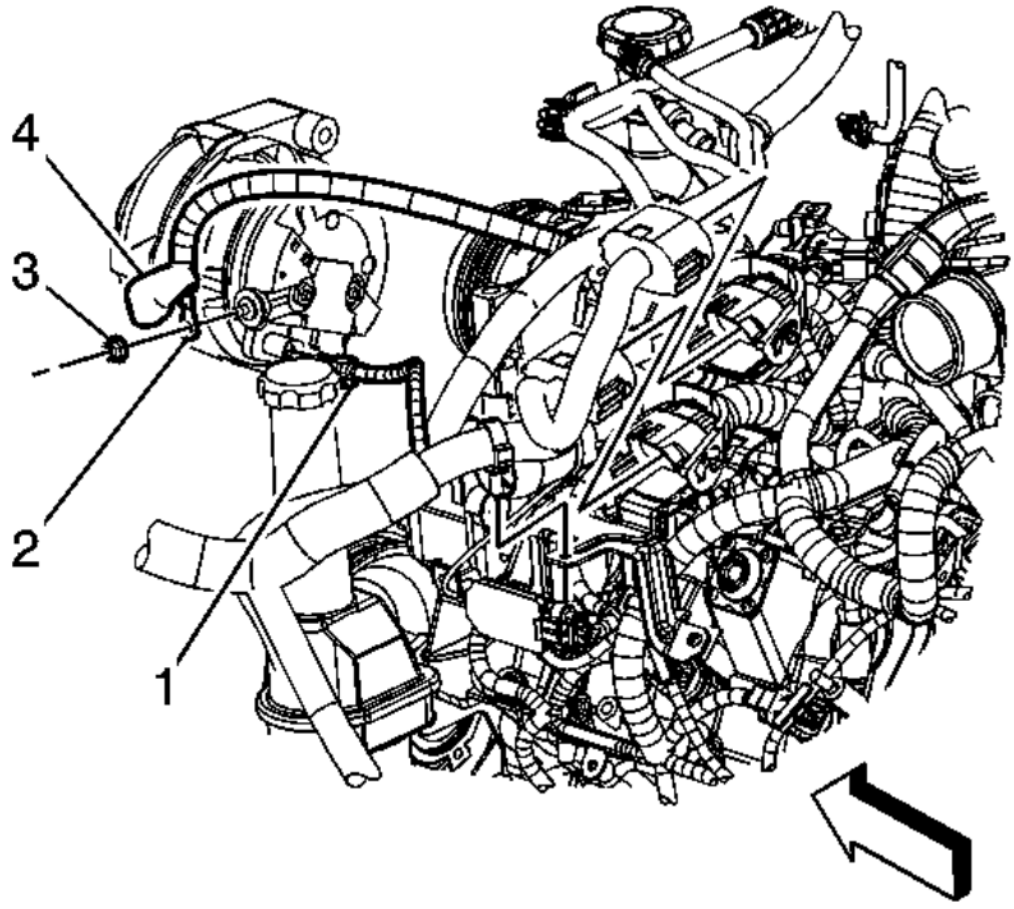


Fig. 316: View Of Engine Wiring Harness Electrical Connector, Terminal, Boot & Nut
Courtesy of GENERAL MOTORS CORP.

3. Install the engine wiring harness terminal (2) to the generator.
4. Install the engine wiring harness nut (3).

   Tighten: Tighten the nut to 9 N.m (80 lb in).

5. Position the engine wiring harness boot (4) in order to cover the terminal stud.
6. Connect the engine wiring harness electrical connector (1) to the generator.
7. Install the drive belt. Refer to **Drive Belt Replacement** .

8. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**.

DESCRIPTION AND OPERATION

BATTERY DESCRIPTION AND OPERATION

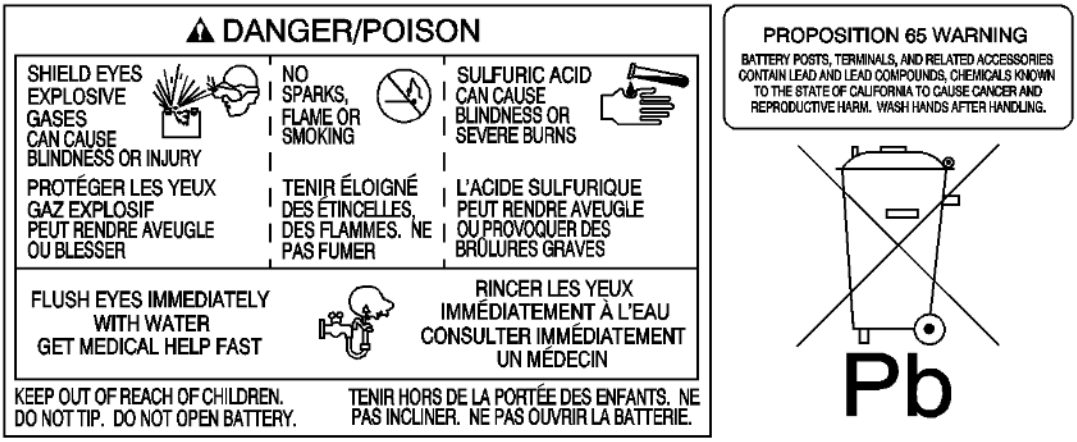


Fig. 317: View Of Battery Danger Label
Courtesy of GENERAL MOTORS CORP.

CAUTION: Batteries produce explosive gases, contain corrosive acid, and supply levels of electrical current high enough to cause burns. Therefore, to reduce the risk of personal injury when working near a battery:

- **Always shield your eyes and avoid leaning over the battery whenever possible.**
- **Do not expose the battery to open flames or sparks.**
- **Do not allow the battery electrolyte to contact the eyes or the skin. Flush immediately and thoroughly any contacted areas with water and get medical help.**
- **Follow each step of the jump starting procedure in order.**
- **Treat both the booster and the discharged batteries**

carefully when using the jumper cables.

IMPORTANT: Because of the materials used in the manufacture of automotive lead-acid batteries, dealers and service shops that handle them are subject to various regulations issued by OSHA, EPA, DOT, and various state or local agencies. Other regulations may also apply in other locations. Always know and follow these regulations when handling batteries.

Batteries that are no longer wanted must be disposed of by an approved battery recycler and must never be thrown in the trash or sent to a landfill.

Batteries that are not part of the vehicle itself, not the battery under the hood, must only be transported on public streets for business purposes via approved hazardous material transportation procedures.

Battery storage, charging, and testing facilities in repair shops must meet various requirements for ventilation, safety equipment, material segregation, etc.

The maintenance-free battery is standard. There are no vent plugs in the cover. The battery is completely sealed except for 2 small vent holes in the side. These vent holes allow the small amount of gas that is produced in the battery to escape.

The battery has 3 functions as a major source of energy:

- Engine cranking
- Voltage stabilizer
- Alternate source of energy with generator overload

The battery specification label, example below, contains information about the following:

- The test ratings
- The original equipment catalog number
- The recommended replacement model number

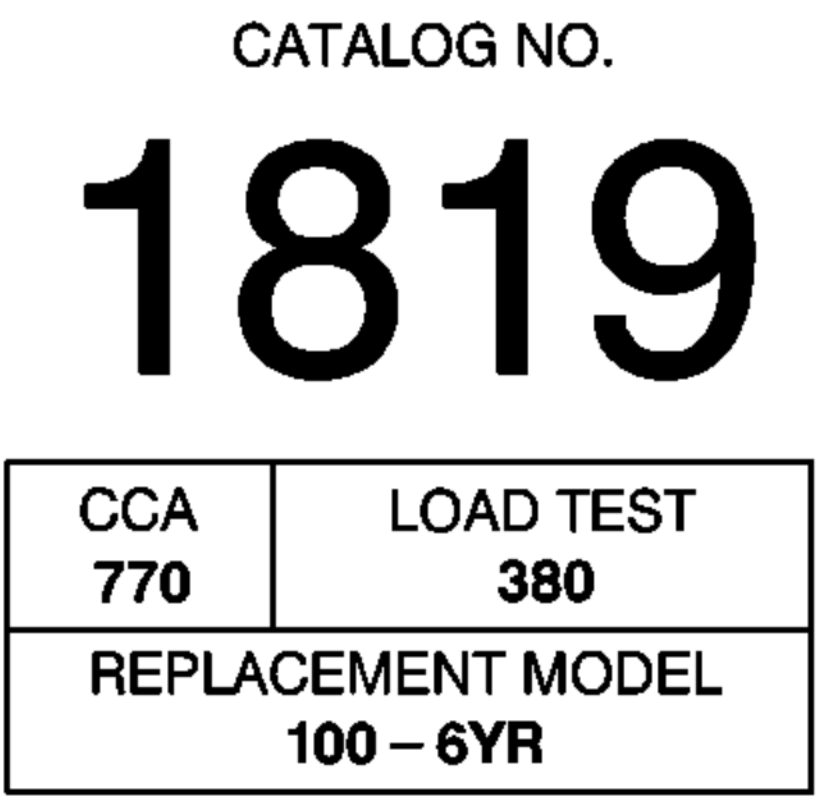


Fig. 318: View Of Battery Specification Label
Courtesy of GENERAL MOTORS CORP.

Battery Ratings

A battery may have 3 ratings:

- Amp hour (AH)
- Reserve capacity (RC)
- Cold cranking amperage (CCA)

When a battery is replaced, use a battery with similar ratings. Refer to the battery specification label on the original battery or refer to **Battery Usage**.

Amp Hour (AH)

The amp hour rating of a battery is the amount of time it takes a fully charged battery, being discharged at a constant rate of 1 amperes and a constant temperature of 27°C (80°F), to reach a terminal voltage of 10.5 volts. Refer to **Battery Usage** for the amp hour rating of the original equipment battery.

Reserve Capacity (RC)

Reserve capacity is the amount of time in minutes it takes a fully charged battery, being discharged at a constant rate of 25 amperes and a constant temperature of 27°C (80°F), to reach a terminal voltage of 10.5 volts. Refer to **Battery Usage** for the reserve capacity rating of the original equipment battery.

Cold Cranking Amperage (CCA)

The cold cranking amperage is an indication of the ability of the battery to crank the engine at cold temperatures. The cold cranking amperage rating is the minimum amperage the battery must maintain for 30 seconds at -18°C (0°F) while maintaining at least 7.2 volts. Refer to **Battery Usage** for the cold cranking amperage rating for this vehicle.

Auxiliary Battery

Auxiliary batteries are an available option on vehicles where many accessories can be utilized such as TVs, radios, lights, computers, etc. The charging of these batteries is explained in charging system description and operation. Also, the auxiliary battery is only for accessory use and not part of the starting system.

CHARGING SYSTEM DESCRIPTION AND OPERATION

Electrical Power Management (EPM) Overview

The electrical power management (EPM) system is designed to monitor and control the charging system and send diagnostic messages to alert the driver of possible problems with the battery and generator. This EPM system primarily utilizes existing on-board computer capability to maximize the effectiveness of the generator, to manage the load, improve battery state-of-charge and life, and minimize the system's impact on fuel economy. The EPM system performs 3 functions:

- It monitors the battery voltage and estimates the battery condition.
- It takes corrective actions by boosting idle speeds, and adjusting the regulated voltage.
- It performs diagnostics and driver notification.

The battery condition is estimated during ignition-off and during ignition-on. During ignition-off the state-of-charge (SOC) of the battery is determined by measuring the open-circuit voltage. The

SOC is a function of the acid concentration and the internal resistance of the battery, and is estimated by reading the battery open circuit voltage when the battery has been at rest for several hours.

The SOC can be used as a diagnostic tool to tell the customer or the dealer the condition of the battery. Throughout ignition-on, the algorithm continuously estimates SOC based on adjusted net amp hours, battery capacity, initial SOC, and temperature.

While running, the battery degree of discharge is primarily determined by a battery current sensor, which is integrated to obtain net amp hours.

In addition, the EPM function is designed to perform regulated voltage control (RVC) to improve battery SOC, battery life, and fuel economy. This is accomplished by using knowledge of the battery SOC and temperature to set the charging voltage to an optimum battery voltage level for recharging without detriment to battery life.

The Charging System Description and Operation is divided into 3 sections. The first section describes the charging system components and their integration into the EPM. The second section describes charging system operation. The third section describes the instrument panel cluster (IPC) operation of the charge indicator, driver information center (DIC) messages, and voltmeter operation.

Charging System Components

Generator

The generator is a serviceable component. If there is a diagnosed failure of the generator it must be replaced as an assembly. The engine drive belt drives the generator. When the rotor is spun it induces an alternating current (AC) into the stator windings. The AC voltage is then sent through a series of diodes for rectification. The rectified voltage has been converted into a direct current (DC) for use by the vehicles electrical system to maintain electrical loads and the battery charge. The voltage regulator integral to the generator controls the output of the generator. It is not serviceable. The voltage regulator controls the amount of current provided to the rotor. If the generator has field control circuit failure, the generator defaults to an output voltage of 13.8 volts.

Body Control Module (BCM)

The body control module (BCM) is a GMLAN device. It communicates with the engine control module (ECM) and the instrument panel cluster (IPC) for electrical power management (EPM) operation. The BCM determines the output of the generator and sends the information to the ECM for control of the generator field control circuit. It monitors the generator field duty cycle

signal circuit information sent from the ECM for control of the generator. It monitors a battery current sensor, the battery positive voltage circuit, and estimated battery temperature to determine battery state of charge (SOC). The BCM sends idle boost requests to the ECM.

Battery Current Sensor

The battery current sensor is a serviceable component that is connected to the negative battery cable at the battery. The battery current sensor is a 3-wire hall effect current sensor. The battery current sensor monitors the battery current. It directly inputs to the BCM. It creates a 5 volt pulse width modulation (PWM) signal of 128 Hz with a duty cycle of 0-100 percent. Normal duty cycle is between 5-95 percent. Between 0-5 percent and 95-100 percent are for diagnostic purposes.

Engine Control Module (ECM)

The ECM directly controls the generator field control circuit input to the generator. The ECM receives control decisions based on messages from the BCM. It monitors the generators generator field duty cycle signal circuit and sends the information to the BCM.

Instrument Panel Cluster (IPC)

The IPC provides a means of customer notification in case of a failure and a voltmeter. There are 2 means of notification, a charge indicator and the driver information center (DIC) SERVICE BATTERY CHARGING SYSTEM message.

Charging System Operation

The purpose of the charging system is to maintain the battery charge and vehicle loads. There are 6 modes of operation and they include:

- Battery Sulfation Mode
- Charge Mode
- Fuel Economy Mode
- Headlamp Mode
- Start Up Mode
- Voltage Reduction Mode

The engine control module (ECM) controls the generator through the generator turn on signal. It monitors the generator performance though the generator field duty cycle signal circuit. The signal is a 5 volt pulse width modulation (PWM) signal of 128 Hz with a duty cycle of 0-100 percent. Normal duty cycle is between 5-95 percent. Between 0-5 percent and 95-100 percent are

for diagnostic purposes. The following table shows the commanded duty cycle and output voltage of the generator:

Commanded Duty Cycle	Generator Output Voltage
10%	11 V
20%	11.56 V
30%	12.12 V
40%	12.68 V
50%	13.25 V
60%	13.81 V
70%	14.37 V
80%	14.94 V
90%	15.5 V

The generator provides a feedback signal of the generator voltage output through the generator field duty cycle signal circuit to the ECM. This information is sent to the body control module (BCM). The signal is a 5 volt PWM signal of 128 Hz with a duty cycle of 0-100 percent. Normal duty cycle is between 5-99 percent. Between 0-5 percent and 100 percent are for diagnostic purposes.

Battery Sulfation Mode

The BCM will enter this mode when the interpreted generator output voltage is less than 13.2 volts for 45 minutes. When this condition exists the BCM will enter Charge Mode for 2-3 minutes. The BCM will then determine which mode to enter depending on voltage requirements.

Charge Mode

The BCM will enter Charge Mode when ever one of the following conditions are met.

- The wipers are ON for more than 3 seconds.
- The GMLAN Climate Control Voltage Boost Mode Request is true, as sensed by the HVAC control head. High speed cooling fan, rear defogger and HVAC high speed blower operation can cause the BCM to enter the Charge Mode.
- The estimated battery temperature is less than 0°C (32°F).
- Battery state of charge is less than 80 percent.
- Vehicle speed is greater than 145 km/h (90 mph)
- Current sensor fault exists

- System voltage was determined to be below 12.56 volts
- Tow/Haul mode is enabled

When any one of these conditions is met, the system will set targeted generator output voltage to a charging voltage between 13.9-15.5 volts, depending on the battery state of charge and estimated battery temperature.

Fuel Economy Mode

The BCM will enter Fuel Economy Mode when the ambient air temperature is at least 0°C (32° F) but less than or equal to 80°C (176°F), the calculated battery current is less than 15 amps and greater than -8 amps, and the battery state of charge (SOC) is greater than or equal to 80 percent. Its targeted generator output voltage is the open circuit voltage of the battery and can be between 12.5-13.1 volts. The BCM will exit this mode and enter Charge Mode when any of the conditions described above are present.

Headlamp Mode

The BCM will enter Headlamp Mode when the headlamps are ON. Voltage will be regulated between 13.9-14.5 volts

Start Up Mode

When the engine is started the BCM sets a targeted generator output voltage of 14.3 volts for 30 seconds.

Voltage Reduction Mode

The BCM will enter Voltage Reduction Mode when the calculated battery temperature is above 0°C (32°F). The calculated battery current is less than 1 amp and greater than -7 amps, and the generator field duty cycle is less than 99 percent. Its targeted generator output voltage is 13 volts. The BCM will exit this mode once the criteria are met for Charge Mode.

Auxiliary Battery Charging (TP2)

The auxiliary battery provision (TP2) can be used to supply electrical power to additional equipment that the customer may choose to add, such as a slide-in camper or trailer, without discharging the vehicles primary battery. The auxiliary battery relay closes when the engine is running, in order to allow the generator to charge the auxiliary battery. The relay opens when the engine is off, so that the accessories will not discharge the vehicles primary battery, which is used for engine starting. If the vehicle is equipped with an auxiliary battery, the relay will be located on the driver's side of the vehicle, next to the underhood electrical center. Generally, a fuse

should not be used in the STUD 1 Fuse 70 position of the underhood fuse block, if the vehicle is equipped with an auxiliary battery. A plastic plug may be installed in this position instead of a fuse. If a fuse is installed in this position, the accessories will discharge the primary battery in addition to the auxiliary battery.

Instrument Panel Cluster (IPC) Operation

Charge Indicator Operation

The instrument panel cluster (IPC) illuminates the charge indicator and displays a warning message in the driver information center (DIC) when the one or more of the following occurs:

- The engine control module (ECM) detects that the generator output is less than 11 volts or greater than 16 volts. The IPC receives a GMLAN message from the ECM requesting illumination.
- The BCM determines that the system voltage is less than 11 volts or greater than 16 volts.
- The IPC receives a GMLAN message from the body control module (BCM) indicating there is a system voltage range concern.
- The IPC performs the displays test at the start of each ignition cycle. The indicator illuminates for approximately 3 seconds.
- The ignition is ON, with the engine OFF.

Battery Voltage Gauge Operation

The IPC displays the system voltage as received from the BCM over the GMLAN serial data circuit. If there is no communication with the BCM then the gauge will indicate minimum.

This vehicle is equipped with a regulated voltage control (RVC) system. This system turns off the generator when it is not required in order to improve fuel economy. The generator will turn back on when additional voltage is required. This will cause the voltmeter to fluctuate between 12 and 14 volts as opposed to non-regulated systems which usually maintain a more consistent reading of 14 volts. This fluctuation with the RVC system is normal system operation and NO repairs should be attempted.

SERVICE BATTERY CHARGING SYSTEM

The BCM and the ECM will send a GMLAN message to the DIC for the SERVICE BATTERY CHARGING SYSTEM message to be displayed. It is commanded ON when a charging system DTC is a current DTC. The message is turned OFF when the conditions for clearing the DTC have been met.

ELECTRICAL POWER MANAGEMENT DESCRIPTION AND OPERATION

Electrical Power Management

The electrical power management (EPM) is used to monitor and control the charging system and alert the driver of possible problems within the charging system. The EPM system makes the most efficient use of the generator output, improves the battery state of charge (SOC), extends battery life.

The idle boost operation is a means of improving generator performance during a low voltage or low battery SOC condition.

Idle boost is activated in incremental steps, idle boost 1 must be active before idle boost 2 can be active. The criteria used by the body control module (BCM) to regulate EPM are outlined below.

Function	Battery Temperature Calculation	Battery Voltage Calculation	Amp-hour Calculation	Action Taken
Idle Boost 1 Start	Less Than -15°C (+5°F)	Less Than 13 V	-	First level idle boost requested
Idle Boost 1 Start	-	-	Battery has a net loss greater than 0.6 AH	First level idle boost requested
Idle Boost 1 Start	-	Less Than 10.9 V	-	First level idle boost requested
Idle Boost 1 End	Greater Than -10° C (+5°F)	Greater Than 12 V	Battery has a net loss less than 0.2 AH	First level idle boost request cancelled
Idle Boost 2 Start	-	-	Battery has a net loss greater than 1.6 AH	Second level idle boost requested
Idle Boost 2 Start	-	Less Than 10.9 V	-	Second level idle boost requested
Idle Boost 2 End	-	Greater Than 12 V	Battery has a net loss less than 0.8 AH	Second level idle boost request cancelled
Idle Boost 3 Start	-	-	Battery has a net loss of 10.0 AH	Third level idle boost requested
Idle Boost 3	-	Less Than 10.9 V	-	Third level idle

Start				boost requested
Idle Boost 3 End	-	Greater Than 12 V	Battery has a net loss of less than 6 AH	Third level idle boost request cancelled

STARTING SYSTEM DESCRIPTION AND OPERATION

The starter motors are non-repairable starter motors. They have pole pieces that are arranged around the armature. Both solenoid windings are energized. The pull-in winding circuit is completed to the ground through the starter motor. The windings work together magnetically to pull and hold in the plunger. The plunger moves the shift lever. This action causes the starter drive assembly to rotate on the armature shaft spline as it engages with the flywheel ring gear on the engine. Moving at the same time, the plunger also closes the solenoid switch contacts in the starter solenoid. Full battery voltage is applied directly to the starter motor and it cranks the engine.

As soon as the solenoid switch contacts close, current stops flowing thorough the pull-in winding because battery voltage is applied to both ends of the windings. The hold-in winding remains energized. Its magnetic field is strong enough to hold the plunger, shift lever, starter drive assembly, and solenoid switch contacts in place to continue cranking the engine. When the engine starts, pinion overrun protects the armature from excessive speed until the switch is opened.

When the ignition switch is released from the START position, the START relay opens and battery voltage is removed from the starter solenoid S terminal. Current flows from the motor contacts through both windings to the ground at the end of the hold-in winding. However, the direction of the current flow through the pull-in winding is now opposite the direction of the current flow when the winding was first energized.

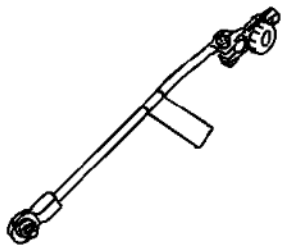
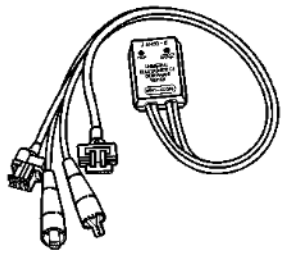
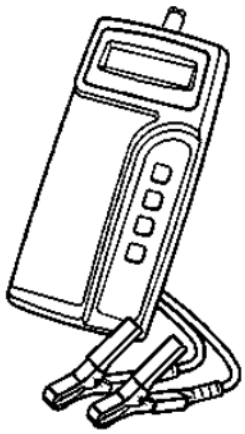
The magnetic fields of the pull-in and hold-in windings now oppose one another. This action of the windings, along with the help of the return spring, causes the starter drive assembly to disengage and the solenoid switch contacts to open simultaneously. As soon as the contacts open, the starter circuit is turned off.

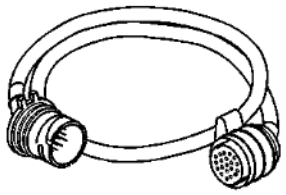
Circuit Description (Key Start)

When the ignition switch is placed in the Start position, a discrete 12-volt signal is supplied to the body control module (BCM) notifying it that the ignition is in the Start position. The BCM then sends a message to the engine control module (ECM) notifying it that CRANK has been requested. The ECM verifies that the transmission is in Park or Neutral. If it is, the ECM then supplies 12 volts to the control circuit of the crank relay. When this occurs, battery positive voltage is supplied through the switch side of the crank relay to the S terminal of the starter solenoid.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/Description
	J 38758 Parasitic Draw Test Switch
	J 41450-B Universal CS Generator Tester Harness
	J 42000 Battery Tester

	J 45681 Jumper Harness