

2008 Buick LaCrosse CXL

2008 ENGINE Engine Electrical - LaCrosse

2008 ENGINE**Engine Electrical - LaCrosse****SPECIFICATIONS****FASTENER TIGHTENING SPECIFICATIONS**

Application	Specification	
	Metric	English
Battery Cables to Battery Bolt	17 N.m	13 lb ft
Battery Hold Down Bolt	18 N.m	13 lb ft
Battery Negative Cable to Engine Block Bolt	50 N.m	37 lb ft
Battery Negative Cable to Side Rail Bolt	36 N.m	27 lb ft
Battery Negative Terminal Bolt	15 N.m	11 lb ft
Battery Positive Cable Junction Block Lead Nut	10 N.m	89 lb in
Battery Positive Cable to Starter Terminal Nut	12.5 N.m	111 lb in
Battery Positive Cable to Underhood Fuse Block Nut	15 N.m	11 lb ft
Battery Positive Terminal Bolt	15 N.m	11 lb ft
Battery Retainer Bolt	25 N.m	18 lb ft
Battery Side Terminal Adapter	15 N.m	11 lb ft
Battery Tray Bolt	5 N.m	44 lb in
Battery Tray Bolt (LY7)	6 N.m	53 lb in
Front Air Inlet Panel Assembly Bolt	6 N.m	53 lb in
Generator Bolt 3.8L	50 N.m	37 lb ft
Generator Brace Bolt 3.8L	30 N.m	22 lb ft
Generator Mounting Bolt	35 N.m	26 lb ft
Generator Output BAT Terminal Nut	20 N.m	15 lb ft
Generator Output BAT Terminal Nut (LY7)	12.5 N.m	111 lb in
Generator Rear Brace Bolt/Nut 3.8L	50 N.m	37 lb ft
Generator Rear Bracket Bolt 3.8L	50 N.m	37 lb ft

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Generator Stud 3.8L	50 N.m	37 lb ft
Ground Wire Bolt	10 N.m	89 lb in
Starter Bolt	43 N.m	32 lb ft
Starter Heat Shield Fastener	8 N.m	71 lb in
Starter Heat Shield Mounting Bracket Nut	8 N.m	71 lb in
Starter Motor Mounting Bolt	40 N.m	30 lb ft
Starter Solenoid BAT Terminal Nut	10 N.m	89 lb in
Starter Solenoid S Terminal Nut	3 N.m	27 lb in
Starter Solenoid S Terminal Nut (LY7)	5 N.m	44 lb in
Transaxle Stud Nut	30 N.m	22 lb ft

BATTERY USAGE

Application	Specification
L26, L32	
Cold Cranking Amperage	680 A
Amp Hour Rating	54 AH
Reserve Capacity Rating	105 Minutes
Replacement Battery Number	34P7YR
LS4	
Cold Cranking Amperage	625 A
Amp Hour Rating	66 AH
Reserve Capacity Rating	105 Minutes
Replacement Battery Number	85H7YR

GENERATOR USAGE

Application	Specification
L26, L32	
Generator Model	Bosch E6
Rated Output	125 A
Load Test Output	87 A
LS4	

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Generator Model	Denso SC1
Rated Output	135 A
Load Test Output	94 A

SCHEMATIC AND ROUTING DIAGRAMS

STARTING AND CHARGING SCHEMATICS

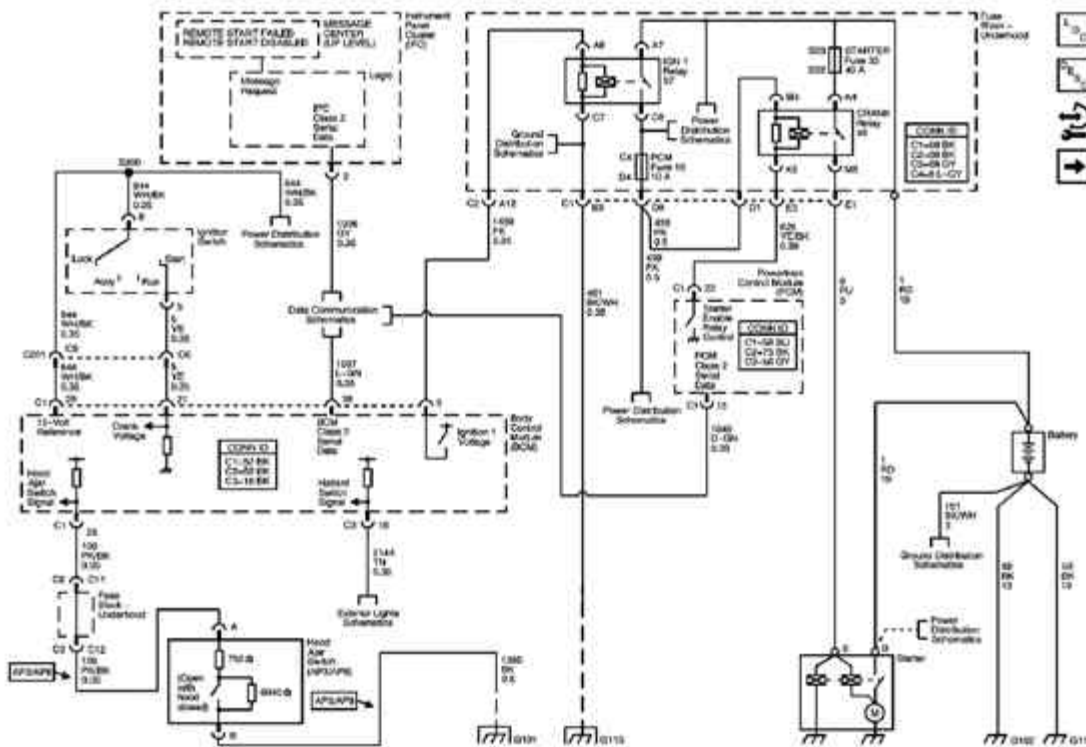


Fig. 1: Starting Schematic - L26
Courtesy of GENERAL MOTORS CORP.

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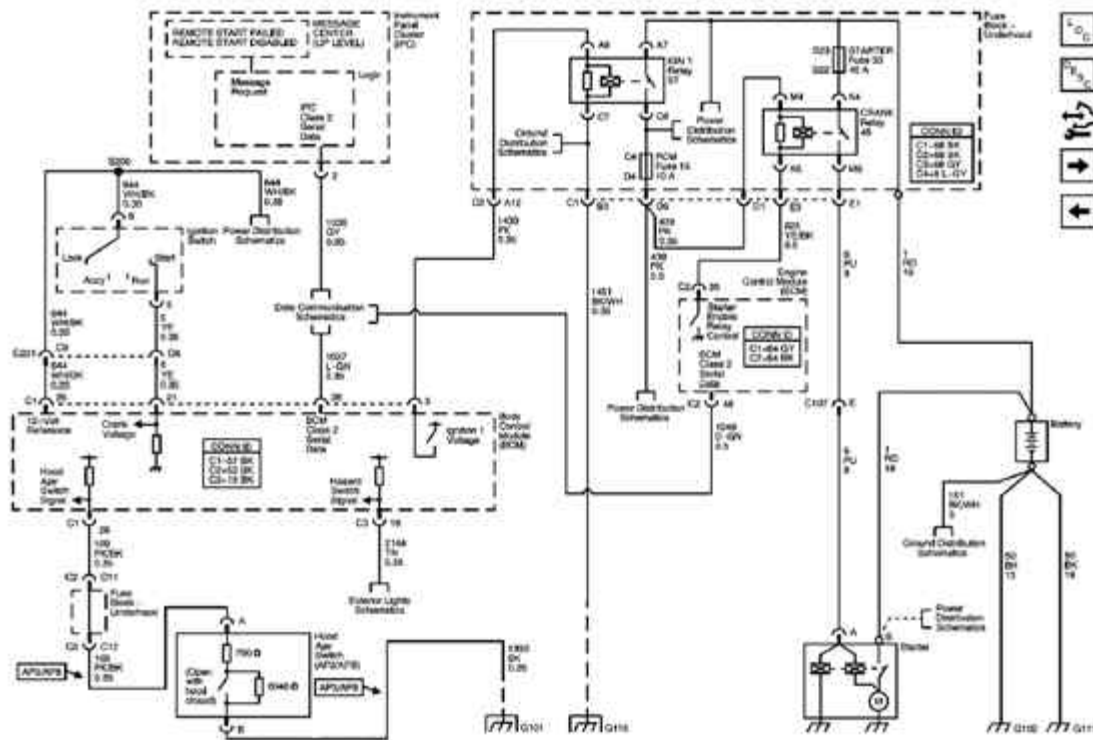


Fig. 2: Starting Schematic - LY7
Courtesy of GENERAL MOTORS CORP.

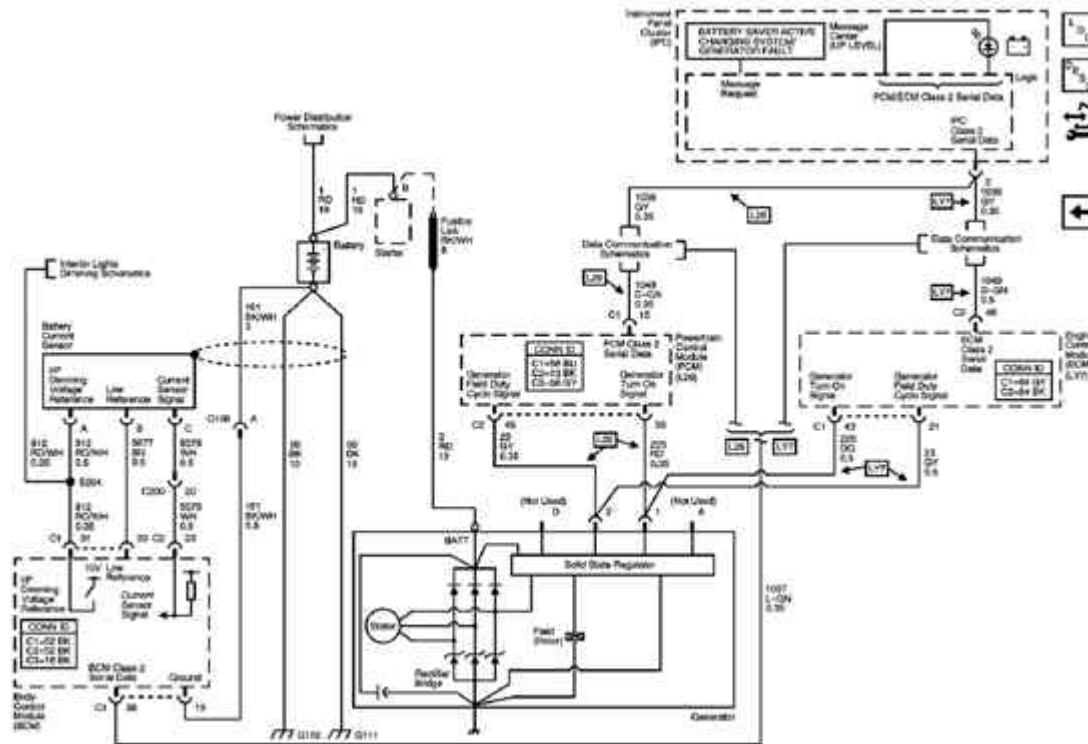


Fig. 3: Charging Schematic
Courtesy of GENERAL MOTORS CORP.

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
DTC B1327	B1327: Device Voltage Circuit Low
DTC B1328	B1328: Device Voltage Circuit High
DTC B1420	B1420: Device Voltage Circuit
DTC B1516	B1516 08: Battery Current Sensor Signal Invalid B1516 66: Battery Current Sensor Wrong Mounting Position
DTC C0896	C0896: Device Voltage Range/Performance
DTC P0560 (3.8L)	P0560: System Voltage
DTC P0560	P0560: System Voltage

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(3.6L/5.3L)	
DTC P0562	P0562: System Voltage Low
DTC P0563	P0563: System Voltage High
DTC P0615	P0615: Starter Relay Control Circuit
DTC P0616	P0616: Starter Relay Control Circuit Low Voltage
DTC P0617	P0617: Starter Relay Control Circuit High Voltage
DTC P0621	P0621: Generator L-Terminal Circuit
DTC P0622	P0622: Generator F-Terminal Circuit
DTC P0625	P0625: Generator F-Terminal Circuit Low Voltage
DTC P0626	P0626: Generator F-Terminal Circuit High Voltage
DTC P1668	P1668: Generator L-Terminal Control 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 B1327

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.

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DTC Descriptor

DTC B1327

Device Voltage Circuit Low

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Battery Positive Voltage	B1327	B1327	-	-
Ground Circuit	-	B1327	-	-

Circuit/System Description

The control modules on this vehicle monitor system voltage through the battery positive voltage circuits. Damage to components, and incorrect data can occur when the voltage is out of range. This vehicle has multiple modules that will set this DTC. For more information on which modules, refer to **Diagnostic Trouble Code (DTC) List - Vehicle**

Conditions for Running the DTC

- This DTC shall run only if the module has power, ground, and the ignition is not in START mode.
- This DTC shall execute regardless of the battery voltage.

Conditions for Setting the DTC

- This DTC shall be set as current when the voltage falls below 9 volts for 1.2 seconds
- When the vehicle exits START, the module shall delay checking the voltage for 2 seconds.

Action Taken When the DTC Sets

- A message shall be sent out to notify all other modules of low battery voltage.
- The modules disable the setting of U codes and other DTCs.

Conditions for Clearing the DTC

- The DTC will clear current status when the voltage is greater than 9.5 volts for 1.2 seconds.
- A history DTC will clear after 50 consecutive ignition cycles, if the condition for the malfunction is no longer present.

Reference Information**Schematic Reference****Control Module References****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**

- A low voltage DTC in multiple modules indicates a concern in the charging system.
- A low voltage value in multiple modules indicates a concern in the charging system.

Circuit/System Verification

1. Ignition OFF, measure the voltage at the battery terminals.
2. Ignition ON, observe the affected module scan tool Battery Positive Voltage parameter..
3. Verify that battery terminal voltage and Battery Positive Voltage parameter readings do not differ by more than 2 volts.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the affected module.
2. Ignition OFF, test for less than 1.0 ohm of resistance between the ground circuit and ground.
 - If greater than the specified range, test the ground circuit for an open/high resistance.
3. Ignition ON, measure between the Battery Positive Voltage circuit and ground. The readings should not differ by more than 2 volts than the battery terminal voltage.
 - If greater than the specified value, test the Battery Positive Voltage circuit for a short to ground or an open/high resistance.
4. If the circuit tests normal, replace the affected module.

Repair Procedures

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

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

DTC B1328

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.

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- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC B1328

Device Voltage Circuit High

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Battery Positive Voltage	B1327	B1327	-	-
Ground Circuit	-	B1327	-	-

Circuit/System Description

The control modules on this vehicle monitor system voltage through the battery positive voltage circuits. Damage to components, and incorrect data can occur when the voltage is out of range. This vehicle has multiple modules that will set this DTC. For more information on which modules, refer **Diagnostic Trouble Code (DTC) List - Vehicle**

Conditions for Running the DTC

- This DTC shall run only if the module has power, ground and the ignition is not in START mode.
- This DTC shall execute regardless of the battery voltage.

Conditions for Setting the DTC

This DTC shall be set as current when the voltage raises above 16 volts for 1.2 seconds.

Action Taken When the DTC Sets

- A message shall be sent out to notify all other modules of high battery voltage.
- The modules disable the setting of U codes and other DTCs.

Conditions for Clearing the DTC

- The DTC will clear current status when the voltage is less than 15.5 volts for 1.2 seconds.
- A history DTC will clear after 50 consecutive ignition cycles if the condition for the malfunction is no longer present.

Reference Information**Schematic Reference****Control Module References****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**

- A possible cause of this DTC could be overcharging with a battery charger or jump starting.
- A high voltage value in multiple modules indicates a concern in the charging system.

Circuit/System Verification

- 1. Verify DTC B1328 is set as current.
 - If the DTC is history, refer to **Charging System Test**.
- 2. Start the engine, record the voltage at the battery terminals. Observe the affected module scan tool Battery Positive Voltage parameter. Voltages should not differ by more than 2 volts
 - If not within the specified range, replace the affected module.

Repair Procedures

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

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

DTC B1420

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 B1420

Device Voltage Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Battery Positive Voltage Circuit	B1420	B1420	-	-

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Ground Circuit	-	B1420	-	-
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Circuit/System Description

The body control module (BCM) monitors the battery voltage through the battery voltage signal circuit. If the BCM senses that battery voltage is outside of its normal range, DTC B1420 will set. Damage to components, and incorrect data may occur when the voltage is out of range.

Conditions for Running the DTC

- The voltage supplied to the BCM are in the range of 7-26 volts.
- The ignition is ON.
- The engine is running.

Conditions for Setting the DTC

- The BCM senses a battery voltage above or below the specified range of 9-16 volts.
- The above condition lasts for 1 second.

Action Taken When the DTC Sets

- The BCM will disable all its outputs when a high voltage condition is detected.
- The setting of this DTC inhibits the setting of other DTCs.

Conditions for Clearing the DTC

The DTC clears when the system voltage returns to a normal range.

Reference Information

Schematic Reference

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

Diagnostic Aids

- A high or low voltage DTC set in multiple modules indicates a concern in the charging system.
- A possible cause of this DTC could be overcharging with a battery charger or jump starting.
- A high or low voltage value in multiple modules indicates a concern in the charging system.

Circuit/System Verification

1. Engine running measure and record the voltage at the battery terminals. Verify that the battery voltage is 12.5-15.5 volts.
 - If the battery voltage is not within the specified range, refer to **Charging System Test**
2. Engine running, observe the scan tool BCM Battery Positive Voltage parameter. Verify that the scan tool displays a value that is within 2 volts of the battery voltage recorded in step 1.
 - If the scan tool parameter is not within the specified range, refer to **Circuit/System Testing**.
3. Refer to **Diagnostic Aids**.

Circuit/System Testing

1. Ignition OFF. Disconnect the harness connectors at the BCM. Verify that there is less than 1.0 ohm between the ground circuits X1 17- 19- 20/X2 50 and the negative battery terminal.
 - If greater than the specified value, test the affected ground circuit for an open/high resistance.
2. Ignition ON. Test for 9.5-13.5 volts between the battery positive voltage circuits X1 terminals 50- 51- 52/ignition 1 circuits X1 terminals 22- 23 and the ground circuit X2 terminal 50 of the BCM.
 - If not within the specified range, test the affected battery positive voltage circuits/ignition 1 circuits for a short to ground or an open/high resistance.
3. If all the circuits test 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 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 Signal Invalid

DTC B1516 66

Battery Current Sensor Wrong Mounting Position

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Battery Current Sensor Supply Voltage	B1516 08	B1516 08	-	B1516 08
Battery Current Sensor Signal	B1516 08	B1516 08	-	B1516 08
Battery Current Sensor Low Reference	-	B1516 08	-	B1516 08

Circuit/System Description

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 body control module (BCM). It creates a 10 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.

Conditions for Running the DTC

- The ignition is ON.
- The engine is running.

Conditions for Setting the DTC

B1516 08

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

B1516 66

The BCM detects the battery current sensor is improperly installed.

Action Taken When the DTC Sets

The charge indicator illuminates in the instrument panel cluster (IPC) and the

SERVICE BATTERY CHARGING SYSTEM warning message will be displayed in the driver information center (DIC) if equipped.

Conditions for Clearing the DTC

The DTC clears as current status when the battery sensed current returns to normal range for more than 5 seconds.

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

B1516 08

1. Ignition OFF, disconnect the harness connector at the battery current sensor.
2. Ignition OFF, test for less than 1.0 ohm of resistance between the low reference

circuit terminal B and ground.

- If greater than the specified range, test the low reference circuit terminal B for an open/high resistance. If the circuit tests normal, replace the BCM.
- 3. Ignition ON, test for 9.8 - 10.2 volts between the battery current sensor supply voltage circuit terminal A and ground.
 - If less than the specified range, test the battery current sensor supply voltage circuit terminal A for a short to ground or an open/high resistance. If the circuit test normal, replace the BCM.
 - If greater than the specified range, test the battery current sensor supply voltage circuit for a short to voltage. If the circuit tests normal, replace the BCM.
- 4. Ignition ON, test for 9.8 - 10.2 volts between the battery current sensor signal circuit terminal C and ground.
 - If less than the specified range, test the battery current sensor signal circuit terminal C for a short to ground or an open/high resistance. If the circuit test normal, replace the BCM.
 - If greater than the specified range, test the battery current sensor signal circuit terminal C for a short to voltage. If the circuit tests normal, replace the BCM.
- 5. If all circuits test normal test or replace the battery current sensor.

B1516 66

When diagnosing B1516 66 verify that the battery current sensor is installed securely and positioned in the correct current flow direction.

- If the battery current sensor is not, remove and reinstall the sensor properly.

Repair Procedures

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

- **Control Module References** for BCM replacement, setup, and programming
- **Battery Current Sensor Replacement (L26)** or **Battery Current Sensor Replacement (LS4)**

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DTC C0896

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 C0896

Device Voltage Range/Performance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Battery Positive Voltage	C0896	C0896	-	-
Ground Circuit	-	C0896	-	-

Circuit/System Description

The electronic brake control module (EBCM) is required to operate within a specified range of voltage to function properly. During ABS and traction control system (TCS) operation, there are current requirements that will cause the voltage to drop. Because of this, voltage is monitored out of ABS/TCS control to indicate a good charging system condition, and also during ABS/TCS control when voltage may drop significantly. The engine control module (ECM) also monitors for high voltage conditions which could damage the EBCM.

Conditions for Running the DTC

- The ignition is ON.
- The vehicle speed is greater than 5 km/h (3 mph).

Conditions for Setting the DTC

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- The EBCM operating voltage at terminal 8 falls below 9.4 volts out of ABS/TCS control, or 8.8 volts during ABS/TCS control.
- The EBCM operating voltage at terminal 8 rises above 17.4 volts.
- The low voltage or the high voltage is detected for more than 500 milliseconds with the vehicle speed above 6 km/h (3.6 mph).

Action Taken When the DTC Sets

- The EBCM disables the ABS/TCS, and the vehicle stability enhancement system (VSES) and for the duration of the ignition cycle.
- A DTC will set.
- The ABS indicator turns ON.
- The Stability Off indicator turns ON.

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.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

ABS 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

- A high or low voltage DTC set in multiple modules indicates a concern in the charging system.
- A possible cause of this DTC could be overcharging with a battery charger or jump starting.
- A high or low voltage value in multiple modules indicates a concern in the charging system.

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 15.5 volts.
 - If not within the specified range, refer to **Charging System Test**
2. Observe the scan tool EBCM Ignition Voltage parameter. The reading should be between 12.6 and 15.5 volts.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the EBCM.
2. Test for less than 1.0 ohm of resistance between the ground circuits X1 terminals 12 and 15 and ground.
 - If greater than the specified range, test the ground circuits for an open/high resistance.
3. Ignition ON, measure between the Ignition Voltage circuit X1 terminal 8 and ground. The readings should not differ by more than 2 volts than the battery terminal voltage.
 - If less than the specified range, test the Ignition Voltage circuit for a short to ground or an open/high resistance.
4. If the circuit tests normal, 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 P0560 (3.8L)**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 P0560****System Voltage****Diagnostic Fault Information**

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition 1 Signal	P0560	P0560	-	-
Ground Circuit	-	P0560	-	-

Circuit/System Description

The powertrain control module (PCM) 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 below 40 km/h (25 mph).
- The system voltage is below 11 volts or above 16 volts.

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- Engine speed is above 1,500 RPM.

Conditions for Setting the DTC

The PCM detects a system voltage out of range for 2 seconds.

Action Taken When the DTC Sets

DTC P0560 is a C type DTC.

Conditions for Clearing the DTC

DTC P0560 is a C type DTC.

Reference Information

Schematic Reference

Engine Controls 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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information.

Diagnostic Aids

- A high or low voltage DTC set in multiple modules indicates a concern in the charging system.
- A possible cause of this DTC could be overcharging with a battery charger or jump starting.
- A high or low voltage value in multiple modules indicates a concern in the charging system.

Circuit/System Verification

1. Verify DTC P0560 is set as current, if the DTC is history refer to **Diagnostic Aids**.
2. Engine running, observe the scan tool PCM Ignition 1 signal parameter. The ignition 1 signal parameter should read between 11.5 volts - 15.5 volts.
 - If not within the specified range refer to **Charging System Test**
3. Measure the voltage at the battery terminals and compare it with the scan tool PCM Ignition 1 signal parameter. Verify that battery terminal and Ignition 1 signal readings do not differ more than 2.0 volts.
 - If not within the specified range refer to **Circuit/System Testing**.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connectors at the PCM.
2. Ignition OFF, test for less than 1.0 ohm between the ground circuit X2 terminal 73 to ground.
 - If greater than the specified value, test the ground circuit for an open/high resistance.
3. Ignition ON, measure between the Ignition 1 circuit X1 terminals 18-19 and the ground circuit X2 terminal 73. The readings should not differ by more than 2 volts than the battery terminal voltage.
 - If greater than the specified value, test the Ignition 1 circuits for an open/high resistance.
4. If the circuits test normal replace the PCM.

Repair Procedures

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

Control Module References for PCM replacement, setup, and programming

DTC P0560 (3.6L/5.3L)**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 P0560****System Voltage****Diagnostic Fault Information**

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition 1 Signal	P0560	P0560	-	-
Ground Circuit	-	P0560	-	-

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 below 40 km/h (25 mph).
- The system voltage is below 11 volts or above 16 volts.

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- Engine speed is above 1,500 RPM.

Conditions for Setting the DTC

The ECM detects a system voltage out of range for 5 seconds.

Action Taken When the DTC Sets

DTC P0560 is a C type DTC.

Conditions for Clearing the DTC

DTC P0560 is a C type DTC.

Reference Information

Schematic Reference

- Engine Controls Schematics for the 3.6L engine.
- Engine Controls Schematics for the 5.3L engine.

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Diagnostic Aids

- A high or low voltage DTC set in multiple modules indicates a concern in the charging system.
- A possible cause of this DTC could be overcharging with a battery charger or jump starting.
- A high or low voltage value in multiple modules indicates a concern in the charging system.

Circuit/System Verification

1. Verify DTC P0560 is set as current, if the DTC is history refer to **Diagnostic Aids**.
2. Engine running, observe the scan tool ECM Ignition 1 signal parameter. The ignition 1 signal parameter should read between 11.5 volts - 15.5 volts.
 - If not within the specified range refer to **Charging System Test**
3. Measure the voltage at the battery terminals and compare it with the scan tool ECM Ignition 1 signal parameter. Verify that battery terminal and Ignition 1 signal readings do not differ more than 2.0 volts.
 - If not within the specified range refer to **Circuit/System Testing**.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connectors at the ECM.
2. Ignition OFF, test for less than 1.0 ohm between the ground circuits to ground.
 - If greater than the specified value, test the ground circuit for an open/high resistance.
3. Ignition ON, measure between the Ignition 1 circuits and the ground circuits. The readings should not differ by more than 2 volts than the battery terminal voltage.
 - If greater than the specified value, test the Ignition 1 circuits for an open/high resistance. If the circuits test normal replace the ECM.

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- Ignition 1 signal 3.6L engine X2 terminals 1- 3- 17- 58.
- Ground circuit 3.6L engine X1 terminal 49.
- Ignition 1 signal 5.3L engine X1 terminal 19 and X2 terminal 13
- Ground circuit 5.3L engine X2 terminal 73

4. If the 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 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
Ignition 1 Signal	P0562	P0562	-	-
Ground Circuit	-	P0562	-	-

Circuit/System Description

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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 above 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 below 10 volts for 5 seconds.

Action Taken When the DTC Sets

DTC P0562 is a C type DTC.

Conditions for Clearing the DTC

DTC P0562 is a C type DTC.

Reference Information

Schematic Reference

Engine Controls 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**

DTC Type Reference**Powertrain Diagnostic Trouble Code (DTC) Type Definitions****Scan Tool Reference****Control Module References** for scan tool information**Circuit/System Verification**

Engine running, observe the scan tool ECM Ignition 1 Signal parameter. The Ignition 1 Signal parameter should read 10.5 volts or greater.

Circuit/System Testing

1. Verify P0562 DTC is set as current.
 - If the DTC is history, refer to **Charging System Test**
2. Engine running, measure the voltage at the battery terminals and compare it with the Ignition 1 Signal parameter. The battery and Ignition 1 signal readings do not differ more than 2 volts.
 - If greater than the specified value, test the Ignition 1 circuit and ground circuit for an open/high resistance.
 - Ignition 1 signal 3.6L engine X2 terminals 1- 3- 17- 58.
 - Ground circuit 3.6L engine X1 terminal 49.
 - Ignition 1 signal 5.3L engine X1 terminal 19 and X2 terminal 13
 - Ground circuit 5.3L engine X2 terminal 73
3. If the 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****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 above 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 less than 1 second.

Action Taken When the DTC Sets

DTC P0563 is a C type DTC.

Conditions for Clearing the DTC

DTC P0563 is a C type DTC.

Reference Information

Schematic Reference

Engine Controls 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**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Diagnostic Aids

- A possible cause of this DTC could be overcharging with a battery charger or jump starting.
- A high voltage value in multiple modules indicates a concern in the charging system.

Circuit/System Verification

1. Verify DTC P0563 is set as current.
 - If the DTC is history, refer to **Charging System Test**.

2. Engine running, record the voltage at the battery terminals. Observe the scan tool ECM Ignition 1 Signal parameter. Voltages should not differ by more than 2 volts.
 - If greater than specified value, 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 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
Starter Relay Control	P0615	P0615	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 powertrain control module

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(PCM)/engine control module (ECM) that crank has been requested. The PCM/ECM then verifies that the transmission is in Park or Neutral. If it is, the PCM/ECM then supplies a ground to the control circuit of the crank relay. When this occurs, battery voltage is supplied through the switch of the crank relay to S terminal of the starter solenoid.

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 PCM/ECM detects improper voltage on the control circuit of the starter 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.

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**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, verify that no theft deterrent or automatic transmission DTCs are set that would cause the PCM/ECM not to enable engine starting.

Circuit/System Testing

1. Ignition ON, verify DTC P0615 is set as current.
 2. Ignition OFF, disconnect the crank relay, test for 60-80 ohms of resistance between relay terminals 85 and 86.
 - If not within the specified range, replace the crank relay.
 3. Ignition ON, test for B+ between the crank relay coil supply voltage circuit terminal M4 and ground.
 - If less than the specified value, test the supply voltage circuit for a short to ground or an open/high resistance.
 4. Ignition ON, connect a test lamp between the crank relay coil supply voltage terminal M4 and the crank relay control circuit terminal K5. Turn the ignition to the start position. The test lamp should only illuminate when the ignition is held in the start position.
 - If the test lamp is always On, test the control circuit for short to ground.
- If the test lamp is always OFF, test the control circuit for a short to voltage or an open/high resistance.

- If the circuit tests normal replace the PCM/ECM.

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 PCM/ECM replacement, setup, and programming

DTC P0616

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 P0616

Starter Relay Control Circuit Low Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Starter Relay Control	P0616	P0616	-	-

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

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(ECM) that crank has been requested. The ECM then verifies that the transmission is in Park or Neutral from information received from the transmission control module (TCM). If it is, the ECM then supplies a ground to the control circuit of the crank relay. When this occurs, battery voltage is supplied through the switch of the crank relay to S terminal of the starter solenoid.

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 crank relay.

Action Taken When the DTC Sets

DTC P0616 is a C type DTC.

Conditions for Clearing the DTC

DTC P0616 is a C type DTC.

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, verify that no theft deterrent or automatic transmission DTCs are set that would cause the ECM not to enable engine starting.

Circuit/System Testing

1. Ignition ON, verify DTC P0616 is set as current.
2. Ignition OFF, disconnect the CRANK relay, test for 60-80 ohms of resistance between relay terminals 85 and 86.
 - If not within the specified range, replace the crank relay.
3. Ignition ON, test for B+ between the crank relay coil supply voltage circuit terminal M4 and ground.
 - If less than the specified value, test the supply voltage circuit for a short to ground or an open/high resistance.
4. Ignition ON, connect a test lamp between the crank relay coil supply voltage terminal M4 and the crank relay control circuit terminal K5. Turn the ignition to the start position. The test lamp should only illuminate when the ignition is held in the start position.
 - If the test lamp is always On, test the control circuit for short to ground.
 - If the test lamp is always OFF, test the control circuit for a short to voltage or an open/high resistance.
5. If the circuit tests normal, replace the ECM.

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 P0617**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 P0617****Starter Relay Control Circuit High Voltage****Diagnostic Fault Information**

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Starter Relay Control	-	-	P0617	-

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 transmission is in Park or Neutral from information received from the transmission control module (TCM). If it is, the ECM then supplies a ground to the control circuit of the crank relay. When this occurs, battery voltage is supplied through the switch of the crank relay to S terminal of the starter solenoid.

Conditions for Running the DTC

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- 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 crank relay.

Action Taken When the DTC Sets

DTC P0617 is a C type DTC.

Conditions for Clearing the DTC

DTC P0617 is a C type DTC.

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, verify that No theft deterrent or automatic transmission DTCs are that would cause the ECM not to enable engine starting.

Circuit/System Testing

1. Ignition ON, verify DTC P0617 is set as current.
2. Ignition OFF, disconnect the CRANK relay, test for 60-80 ohms of resistance between relay terminals 85 and 86.
 - If not within the specified range, replace the crank relay.
3. Ignition ON, test for B+ between the crank relay coil supply voltage circuit terminal M4 and ground.
 - If less than the specified value, test the supply voltage circuit for a short to ground or an open/high resistance.
4. Ignition ON, connect a test lamp between the crank relay coil supply voltage terminal M4 and the crank relay control circuit terminal K5. Turn the ignition to the start position. The test lamp should only illuminate when the ignition is held in the start position.
 - If the test lamp is always On, test the control circuit for short to ground.
 - If the test lamp is always OFF, test the control circuit for a short to voltage or an open/high resistance.
5. If the circuit tests normal, replace the ECM.

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

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 L-Terminal Circuit	P0621	P0621	P0621	-

Circuit/System Description

The engine control module (ECM)/powertrain control module (PCM) uses the generator turn ON signal circuit to control the load of the generator on the engine. A high side driver in the ECM/PCM applies a voltage to the voltage regulator. This signals the voltage regulator to turn the field circuit ON and OFF. The ECM/PCM monitors the state of the generator turn ON signal circuit. The ECM/PCM 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/PCM should detect high voltage on the generator turn on signal circuit. The ECM/PCM performs ignition ON and RUN tests to determine the status of the generator turn on signal circuit.

Conditions for Running the DTC

- No generator, crankshaft position (CKP) sensors, or camshaft position (CMP) sensor DTCs are set.

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- The ignition ON engine OFF for ignition on test.
- The engine is running for the run test.

Conditions for Setting the DTC

- During the ignition on test, the ECM/PCM detects high voltage on the generator turn on signal circuit for at least 5 seconds.
- During the run test, the ECM/PCM detects low voltage on the generator turn on signal circuit for at least 15 seconds.

Action Taken When the DTC Sets

DTC P0621 is a C type DTC.

Conditions for Clearing the DTC

DTC P0621 is a C type DTC.

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

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 generator turn on signal circuit terminal 1 and ground.
 - If greater than the specified range, test the generator turn on signal circuit for a short to voltage. If the circuit tests normal, replace the ECM/PCM.
3. Engine running, test for greater than 3.5 volts between the generator turn on signal circuit terminal 1 and ground.
 - If less than the specified range, test the generator turn on signal circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the ECM/PCM.
4. If the circuit tests normal, test or replace the generator.

Repair Procedures

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

- **Control Module References** for ECM/PCM replacement, setup, and programming
- **Generator Replacement (L26)** or **Generator Replacement (LY7)** or **Generator Replacement (LS4)**

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	P0622

Circuit/System Description

The engine control module (ECM)/powertrain control module (PCM) uses the generator field duty cycle signal 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/PCM uses the PWM signal input to determine the generator load on the engine. This allows the ECM/PCM to adjust the idle speed to compensate for high electrical loads. The ECM/PCM monitors the status of the generator field duty cycle signal circuit. When the ignition is in the RUN position and the engine is OFF, the ECM/PCM 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

- No generator, crankshaft position (CKP) sensors, or camshaft (CMP) sensor DTCs are set.
- Ignition ON engine OFF, for the Ignition ON test.
- Engine is running, engine speed less than 3,000 RPM for the Run test.

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Conditions for Setting the DTC

Ignition ON engine OFF, the ECM/PCM detects a PWM signal that is greater than 65 percent for 5 seconds.

Engine running, the ECM/PCM detects a PWM signal that is less than 5 percent for 15 seconds.

Action Taken When the DTC Sets

DTC P0622 is a C type DTC.

Conditions for Clearing the DTC

DTC P0622 is a C type DTC.

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**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

With the scan tool installed, ignition ON and the Engine running, observe the scan tool ECM/PCM GEN-F Terminal Signal parameter. 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 X1 terminal 2, harness side while monitoring the scan tool ECM GEN-F Terminal Signal Parameter. It 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 replace the generator.

Repair Procedures

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

- **Control Module References** for ECM/PCM replacement, setup, and programming
- **Generator Replacement (L26)** or **Generator Replacement (LY7)** or **Generator Replacement (LS4)**

DTC P0625

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 P0625****Generator F-Terminal Circuit Low Voltage****Diagnostic Fault Information**

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Generator F-Terminal	P0625	P0625	P0626	-

Circuit/System Description

The engine control module (ECM) uses the generator field duty cycle signal circuit to monitor the duty cycle of the generator and fault indication. The generator field duty cycle signal circuit connects to the high side of the field winding in the generator. A pulse width modulated (PWM) high side driver in the voltage regulator turns the field winding 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 state of the generator field duty cycle signal circuit. When the engine is running, the ECM should detect a duty cycle that varies up to 100 percent. The ECM monitors the PWM signal using a ignition ON test and a RUN test. During the tests, if the ECM detects an out of range PWM signal, a DTC will set.

Conditions for Running the DTC

- The vehicle speed is above 8 km/h (5 mph).
- The engine speed is less than 3,000 RPM.

Conditions for Setting the DTC

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The ECM detects a pulse width modulated (PWM) signal less than 5 percent for at least 15 seconds.

Action Taken When the DTC Sets

DTC P0625 is a C type DTC.

Conditions for Clearing the DTC

DTC P0625 is a C type DTC.

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Engine running, observe the scan tool GEN-F Terminal Signal parameter. The GEN-F Terminal Signal parameter should read between 5-95 percent.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the generator.
2. Ignition ON engine OFF, observe the scan tool GEN-F Terminal Signal parameter, while repeatedly probing the generator field duty cycle circuit with a test lamp connected to battery positive voltage. The parameter should change from 0 percent to above 95 percent.
 - If the parameter was not affected by the test lamp, test the GEN-F Terminal Signal circuit terminal 2 for a short to ground or an open/high resistance. If the circuit tests normal, replace the ECM.
3. If the circuit tested normal and the ECM parameter changed from 0 percent to above 95 percent, replace the generator.

Repair Procedures

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

- **Control Module References** for ECM replacement, setup, and programming
- **Generator Replacement (L26)** or **Generator Replacement (LY7)** or **Generator Replacement (LS4)**

DTC P0626

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 P0626

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Generator F-Terminal Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Generator F-Terminal	P0625	P0625	P0626	-

Circuit/System Description

The engine control module (ECM) uses the generator field duty cycle signal circuit to monitor the duty cycle of the generator and fault indication. The generator field duty cycle signal circuit connects to the high side of the field winding in the generator. A pulse width modulated (PWM) high side driver in the voltage regulator turns the field winding 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 state of the generator field duty cycle signal circuit. When the engine is running, the ECM should detect a duty cycle that varies up to 100 percent. The ECM monitors the PWM signal using a Ignition ON test and a RUN test. During the tests, if the ECM detects an out of range PWM signal, a DTC will set.

Conditions for Running the DTC

- The engine is not running.
- The ignition is in the ON position.

Conditions for Setting the DTC

The ECM detects a pulse width modulated (PWM) signal greater than 65 percent for at least 15 seconds.

Action Taken When the DTC Sets

DTC P0626 is a C type DTC.

Conditions for Clearing the DTC

DTC P0626 is a C type DTC.

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, engine running, observe the scan tool ECM GEN-F Terminal Signal parameter. The GEN-F Terminal Signal parameter should read between 5-95 percent.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the generator.
2. Ignition ON, engine OFF, observe the scan tool ECM GEN-F Terminal Signal parameter. It should display less than 10 percent.

- If the GEN-F Terminal Signal parameter was not affected by the disconnected generator harness, test the GEN-F Terminal Signal circuit terminal 2 for a short to voltage. If the circuit tests normal, replace the ECM.
- If the circuit tested normal and the ECM parameter changed from above 65 percent to less than 10 percent, replace the generator.

Repair Procedures

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

- **Control Module References** for ECM replacement, setup, and programming
- **Generator Replacement (L26)** or **Generator Replacement (LY7)** or **Generator Replacement (LS4)**

DTC P1668

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 P1668

Generator L-Terminal Control Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Generator L- Terminal	P1668	P1668	P1668	-

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Circuit				
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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 tests to determine the status of the generator turn ON signal circuit.

Conditions for Running the DTC

- No generator, crankshaft position (CKP) sensors, or camshaft position (CMP) sensor DTCs are set.
- The ignition ON, engine OFF for the ignition on test.
- The engine running for the run test.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

DTC P1668 is a C type DTC.

Conditions for Clearing the DTC

DTC P1668 is a C type DTC.

Reference Information

Schematic Reference

Starting and Charging Schematics

Connector End View Reference

Component Connector End Views

Electrical Information Reference

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

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the generator.
2. Ignition ON, test for less than 1 volt between the generator turn on signal circuit X1 terminal 1 and ground.
 - If greater than the specified value, test the generator turn on 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 generator turn on signal and ground.
 - If less than the specified value, test the generator turn on signal circuit for a short to ground, an open/high resistance. If the circuit tests normal, replace the ECM.
4. If the circuit tests normal, test or replace the generator.

Repair Procedures

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

Control Module References for ECM replacement, setup, and programming

Generator Replacement (L26) or **Generator Replacement (LY7)** or **Generator Replacement (LS4)**

SYMPTOMS - ENGINE ELECTRICAL

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

- Perform **Control Module References** 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 (L26/L32)****Battery Description and Operation (LS4/LY7)**
 - **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 (L26) or Starter Solenoid Does Not Click (LY7/LS4)**
- **Starter Solenoid Clicks, Engine Does Not Crank**
- **Engine Cranks Slowly**
- **Starter Motor Noise Diagnosis**

BATTERY INSPECTION/TEST

Tools Required

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: Refer to Battery Disconnect Caution .

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 (LY7) or Battery Positive Cable Replacement (L26)**
- **Battery Negative Cable Replacement (LY7) or Battery Negative Cable Replacement (L26)**

- **Battery Replacement (LY7)** or **Battery Replacement (L26)** or **Battery Replacement (LS4)**

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

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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

- Be sure to rule out any possible obvious influences, such as customer error or aftermarket equipment.
- 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 (L26/L32)** or **Battery Description and Operation (LS4/LY7)**.
- 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.
- 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

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2 A	0.4
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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 test switch on the J 38758 is marked ON and OFF. See Special Tools. When the test switch is in the ON position, the circuit is closed and electrical current will pass through the switch. When the test switch 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 (L26) or Battery Negative Cable Disconnection and Connection (LY7) or Battery Negative Cable Disconnection and Connection (LS4).
2. Install the male end of the J 38758 to the battery ground terminal. See Special Tools.
3. Turn the J 38758 test switch 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 test switch 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 10 A fused jumper wire to the test switch tool terminals.
9. Turn the **J 38758** test switch 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 to locate the current draw.
11. Turn the test switch to ON and then remove the fused jumper wire.
12. Set a digital multimeter to the 10 A scale.
13. Connect the digital multimeter to the test switch tool terminals.
14. Turn the **J 38758** test switch 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 2 A or less, turn the **J 38758** test switch 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 2 A scale for a more accurate reading when the **J 38758** test switch is turned OFF. See **Special Tools**.
16. Turn the **J 38758** test switch to the OFF position. See **Special Tools**. Wait up to 45 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, stop-and-go driving, 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 above 80 percent state of charge, 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, parasitic load, 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 the battery state of charge while storing the vehicle for more than 30 days:

CAUTION: Refer to BATTERY DISCONNECT CAUTION .

Disconnect the battery ground cable 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.

Reference Information

Description and Operation

Charging System Description and Operation

Electrical Information Reference

Testing for Intermittent Conditions and Poor Connections

Circuit/System Verification

Engine ON, observe the charge indicator on the instrument panel cluster (IPC) or message in the driver information center (DIC). The charge indicator on the IPC should be turned OFF and the DIC should not display charging system message

- If the charge indicator is not on the IPC and a charging system message is not displayed on the DIC, refer to **Testing for Intermittent Conditions and Poor**

Connections .

- If the charge indicator is on the IPC or a charging system message is displayed on the DIC, refer to **Circuit/System Testing**.

Circuit/System Testing

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, refer 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 specified value, refer to **Battery Inspection/Test**.
3. Connect a carbon pile tester to the battery.
4. Start the engine and increase the engine speed to 2,500 RPM. 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.
5. Adjust the carbon pile tester to the specified load test output value, refer to **Generator Usage**.
 - If not within specified value, replace the generator.

Repair Procedures

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

Generator Replacement (L26) or Generator Replacement (LY7) or Generator Replacement (LS4)

GENERATOR NOISE DIAGNOSIS

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. 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.
3. Ignition OFF, remove the engine drive belt. Verify the generator, idler pulley and tensioner pulley spin freely.
 - If any of the pulleys do not spin freely, replace the affected component.
4. Loosen all generator mounting bolts and ensure the generator is properly aligned. Tighten mounting bolts to specification, refer to **Generator Replacement (L26)** or **Generator Replacement (LY7)** or **Generator Replacement (LS4)**

Repair Procedures

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

- **Drive Belt Replacement** for the 3.6L engine.
- **Drive Belt Tensioner Replacement** for the 3.6L engine.
- **Drive Belt Idler Pulley Replacement** for the 3.6L engine.
- **Drive Belt Replacement (L26)** for the 3.8L engine.
- **Drive Belt Tensioner Replacement** for the 3.8L engine.
- **Drive Belt Idler Pulley Replacement - Upper** for the 3.8L engine.
- **Drive Belt Idler Pulley Replacement - Lower** for the 3.8L engine.
- **Drive Belt Replacement - Accessory** for the 5.3L engine.
- **Drive Belt Tensioner Replacement - Accessory** for the 5.3L engine.
- **Drive Belt Idler Pulley Replacement** for the 5.3L engine.

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- **Generator Replacement (L26)** or **Generator Replacement (LY7)** or **Generator Replacement (LS4)**

STARTER SOLENOID DOES NOT CLICK (L26)

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
PCM Park Neutral Signal	2	1	1	-
Relay Control Circuit (Terminal 86)	3	1	1	-
Relay Coil Voltage Supply Circuit (Terminal 85)	-	1	-	-
Relay Control Output Circuit (Terminal 87)	1	1	3	-
Relay Switch Voltage Supply Circuit (Terminal 30)	1	1	-	-
1. No crank 2. Cranks in any gear 3. Cranks all the time				

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 powertrain control module

(PCM) that crank has been requested. The PCM then verifies that the transmission is in Park or Neutral. If it is, the PCM then supplies a ground to the control circuit of the CRANK relay. When this occurs, battery voltage is supplied through the switch of the CRANK relay to S terminal of the starter solenoid.

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 starter relay, theft deterrent, or automatic transmission DTCs are set that would cause the PCM to disable starting.
 - If DTCs are set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
2. Ignition ON, observe the scan tool BCM Starter Switch parameter. Place ignition switch in the crank position, the parameter should display ON.
 - If not the specified value, refer to **Power Mode Mismatch** .

3. Transmission range selector in park, verify the scan tool PCM IMS parameters display Park/Neutral.
 - If the PCM IMS parameter does not indicate Park/Neutral, refer to **Range Selector Displays Incorrect Range**
4. Transmission range selector in park or neutral, attempt to start the vehicle. The crank relay should click and the engine should begin cranking.
 - If the crank relay does not click or the engine does not crank, refer to Crank Relay Circuit Malfunction.

Circuit/System Testing

Crank Relay Circuit Malfunction

1. Ignition OFF, disconnect the crank relay.
2. Ignition ON, verify a test lamp illuminates between the relay coil B+ circuit terminal M4 and ground.
 - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance.
3. Ignition ON, verify a test lamp illuminates between the relay switch B+ circuit terminal K4 and ground.
 - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance.
4. Connect a test lamp between the relay coil control circuit terminal K5 and the relay coil B+ circuit terminal M4.
5. With the transmission range selector in park or neutral, cycle the ignition key between the OFF and CRANK position. The test lamp should turn ON and OFF when changing between the commanded states.
 - If the test lamp is always ON, test the control circuit for a short to ground. If the circuit tests normal, replace the PCM.
 - If the test lamp is always OFF, test the control circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the PCM.
6. Ensure the parking brake is applied and the transmission is in PARK. Momentarily install a 40A fused jumper wire between the B+ circuit terminal K4 and the control output circuit terminal M5. The starter solenoid should

engage and the engine should begin cranking.

- If the solenoid does not engage, test the control output circuit for a short to ground or an open/high resistance. If the circuit tests normal, test or replace the starter motor.

7. If all circuits test normal, test or replace the crank relay.

Component Testing

1. Ignition OFF, disconnect the crank relay.
2. Test for 60-180 ohms of resistance between terminals 85 and 86.
 - If the resistance is 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 20A fused jumper wire between terminal 85 and 12 volts. Install a jumper wire between terminal 86 and ground. Test for less than 2.0 ohms of resistance between terminals 30 and 87.
 - If greater than the 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)**
- **Manual Shift Detent Lever with Shaft Position Switch Assembly Removal**
- **Starter Motor Replacement (LY7)** or **Starter Motor Replacement (L26)** or **Starter Motor Replacement (LS4)**
- **Control Module References** for PCM replacement, setup and programming

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
ECM Park Neutral Signal	2	1	1	-
Relay Control Circuit (Terminal 86)	3	1	1	-
Relay Coil Voltage Supply Circuit (Terminal 85)	-	1	-	-
Relay Control Output Circuit (Terminal 87)	1	1	3	-
Relay Switch Voltage Supply Circuit (Terminal 30)	1	1	-	-
1. No crank 2. Cranks in any gear 3. Cranks all the time				

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 transmission is in Park or Neutral from information received from the transmission control module (TCM). If it is, the ECM then supplies a ground to the control circuit of the crank relay. When this occurs, battery voltage is supplied through the switch of the crank relay to S terminal of the starter solenoid.

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 starter relay, theft deterrent, or automatic transmission DTCs are set that would cause the ECM to disable engine starting.
 - If DTCs are set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
2. Ignition ON, observe the scan tool BCM Starter Switch parameter. Place ignition switch in the crank position, the parameter should display ON.
 - If not the specified value, refer to **Power Mode Mismatch** .
3. Transmission range selector in park, verify the scan tool ECM PNP Switch and TCM IMS parameters display Park/Neutral.
 - If the TCM IMS parameter does not indicate Park/Neutral, refer to

Transmission Internal Mode Switch Logic

- If the ECM Park/Neutral parameter does not indicate Park/Neutral, refer to ECM Park Switch Circuit Malfunction in **Circuit/System Testing**.
- 4. Transmission range selector in park or neutral, attempt to start the vehicle. The crank relay should click and the engine should begin cranking.
 - If the crank relay does not click or the engine does not crank, refer to Crank Relay Circuit Malfunction in **Circuit/System Testing**.

Circuit/System Testing

ECM Park Switch Circuit Malfunction (4T65-E)

1. Ignition OFF, disconnect the harness connector at the AT inline 20-Way connector.
2. Ignition ON, install a 3A fused jumper wire between the signal circuit terminal W and ground. Verify the scan tool ECM PNP switch parameter displays Park/Neutral.
 - If not the specified value, test the signal circuit for an open/high resistance. If the circuit tests normal, replace the ECM.
3. If all circuits test normal, test or replace the internal mode switch (IMS).

Crank Relay Circuit Malfunction

1. Ignition OFF, disconnect the crank relay.
2. Ignition ON, verify a test lamp illuminates between the relay coil B+ circuit terminal 85 and ground.
 - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance.
3. Ignition ON, verify a test lamp illuminates between the relay switch B+ circuit terminal 30 and ground.
 - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance.
4. Connect a test lamp between the relay coil control circuit terminal 86 and the relay coil B+ circuit terminal 85.

5. With the transmission range selector in park or neutral, cycle the ignition key between the OFF and CRANK position. The test lamp should turn ON and OFF when changing between the commanded states.
 - If the test lamp is always ON, test the control circuit for a short to ground. If the circuit tests normal, replace the ECM.
 - If the test lamp is always OFF, test the control circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the ECM.
6. Ensure the parking brake is applied and the transmission is in PARK. Momentarily install a 40A fused jumper wire between the B+ circuit terminal 30 and the control output circuit terminal 87. The starter solenoid should engage and the engine should begin cranking.
 - If the solenoid does not engage, test the control output circuit for a short to ground or an open/high resistance. If the circuit tests normal, test or replace the starter motor.
7. If all circuits test normal, test or replace the crank relay.

Component Testing

1. Ignition OFF, disconnect the crank relay.
2. Test for 60-180 ohms of resistance between terminals 85 and 86.
 - If the resistance is 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 20A fused jumper wire between terminal 85 and 12 volts. Install a jumper wire between terminal 86 and ground. Test for less than 2.0 ohms of resistance between terminals 30 and 87.
 - If greater than the 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)**
- **Manual Shift Detent Lever with Shaft Position Switch Assembly Removal**
- **Starter Motor Replacement (LY7)** or **Starter Motor Replacement (L26)** or **Starter Motor Replacement (LS4)**
- **Control Module References** for 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 message to the engine control module (ECM)/powertrain control module (PCM) that crank has been requested. The ECM/PCM then verifies that the transmission is in Park or Neutral. If it is, the ECM/PCM then supplies a ground to the control circuit of the STARTER/CRANK relay. When this occurs, battery voltage is supplied through the switch of the STARTER/CRANK relay to S terminal of the starter solenoid.

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. Verify that battery is sufficiently charged and that the battery cables are clean and tight.
 - If battery not sufficiently charged, refer to **Battery Charging**.
 - If battery cables are not within specified range, refer to **Fastener Tightening Specifications**.
2. Turn the ignition switch to the start position. The starter solenoid should click.
 - If starter solenoid does not click, refer to **Starter Solenoid Does Not Click (L26)** or **Starter Solenoid Does Not Click (LY7/LS4)**.
3. Remove the drive belt, refer to **Drive Belt Replacement** for the 3.6L engine**Drive Belt Replacement (L26)** for the 3.8L engine**Drive Belt Replacement - Accessory** for the 5.3L engine
4. Turn the ignition switch to the START position.
 - If the engine cranks, inspect the engine and belt drive system for mechanical binding, seized engine, or seized generator, etc.
 - If the engine does not crank, refer to **Engine Will Not Crank - Crankshaft Will Not Rotate** for the 3.6L engine, **Engine Will Not**

Crank - Crankshaft Will Not Rotate for the 3.8L engine, or **Engine Will Not Crank - Crankshaft Will Not Rotate** for the 5.3L engine.

5. Using a DMM, measure between the positive battery cable and terminal B at the solenoid as the ignition switch is turned to the START position. Voltage should be less than 0.5 volts.
 - If greater than the specified value, replace the positive battery cable.
6. Using a DMM, measure the negative battery cable to the starter motor case as the ignition switch is turned to the START position. Voltage should be less than 0.5 volts.
 - If greater than the specified value, replace the negative battery cable.
7. If all circuits test normal, replace the starter motor.

Repair Procedures

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

- **Battery Positive Cable Replacement (LY7)** or **Battery Positive Cable Replacement (L26)**
- **Battery Negative Cable Replacement (LY7)** or **Battery Negative Cable Replacement (L26)**
- **Starter Motor Replacement (LY7)** or **Starter Motor Replacement (L26)** or **Starter Motor Replacement (LS4)**

ENGINE CRANKS SLOWLY

Inspect the following items:

- Battery-Perform the Battery Inspection/Test. Refer to **Battery Inspection/Test**
- Wiring-Inspect the wiring for damage. Inspect all connections to the starter motor, the solenoid, the battery, and all ground connections. Refer to:
 - **Circuit Testing**
 - **Wiring Repairs**
 - **Testing for Intermittent Conditions and Poor Connections**
 - **Connector Repairs**

- Engine-Verify that the engine is not seized.

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 (LY7)** or **Starter Motor Replacement (L26)** or **Starter Motor Replacement (LS4)**

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 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
- If not within specifications, secure the flywheel bolts or replace the flywheel.
 - 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 3.6L engine
- **Fastener Tightening Specifications** for the 3.8L engine

2008 Buick LaCrosse CXL

2008 ENGINE Engine Electrical - LaCrosse

- **Fastener Tightening Specifications** for the 5.3L engine
- **Engine Flywheel Replacement** for the 3.6L engine
- **Engine Flywheel Replacement** for the 3.8L engine
- **Engine Flywheel Replacement** for the 5.3L engine
- **Starter Motor Replacement (LY7)** or **Starter Motor Replacement (L26)** or **Starter Motor Replacement (LS4)**

REPAIR INSTRUCTIONS

BATTERY NEGATIVE CABLE DISCONNECTION AND CONNECTION (L26)

Removal Procedure

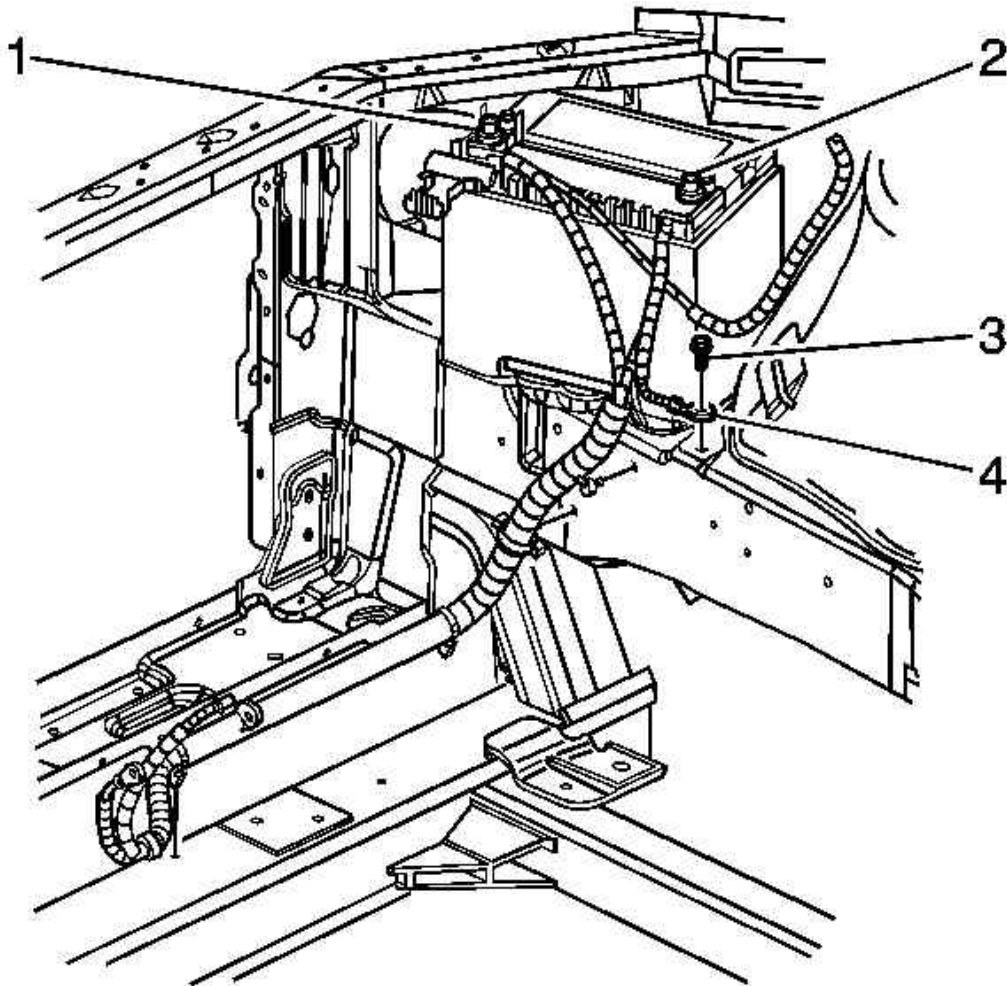


Fig. 4: Identifying Battery Terminals & Ground Wire
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to SIR Caution .

CAUTION: Refer to Battery Disconnect Caution .

1. Record all of the vehicle preset radio stations.

2. Turn OFF all the lamps and the accessories.
3. Ensure the ignition switch is in the OFF position.
4. Loosen the negative battery cable terminal nut.
5. Remove the negative battery terminal (2) from the battery.

Installation Procedure

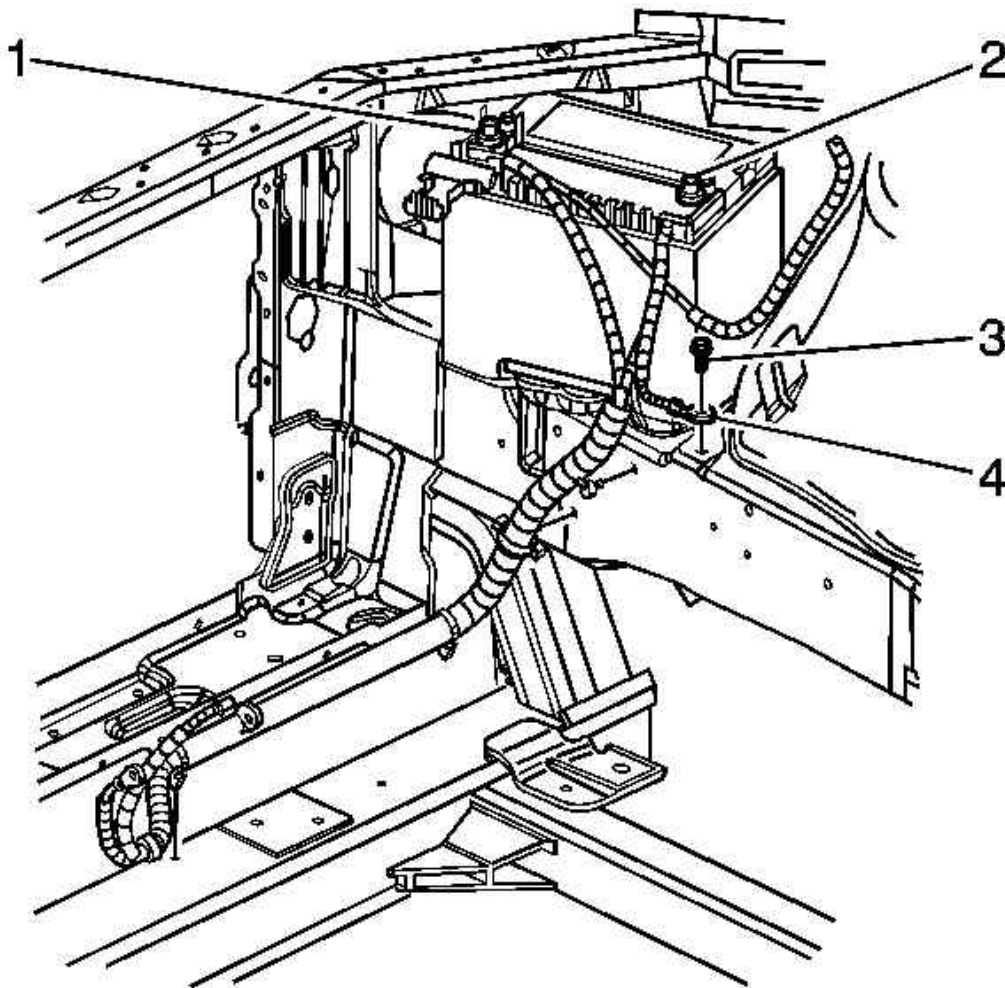


Fig. 5: Identifying Battery Terminals & Ground Wire
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

IMPORTANT: Clean any existing oxidation from the contact face of the battery terminal and battery cable using a wire brush before installing the battery cable to the battery terminal.

1. Install the negative battery terminal (2) to the battery.

Tighten: Tighten the negative battery terminal nut to 15 N.m (11 lb ft).

2. Set the clock and program the radio stations back into the radio as recorded at the beginning of the procedure for digital radios. Refer to Digital Radio Receiver Setup .

BATTERY NEGATIVE CABLE DISCONNECTION AND CONNECTION (LY7)

Removal Procedure

CAUTION: Refer to Battery Disconnect Caution .

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

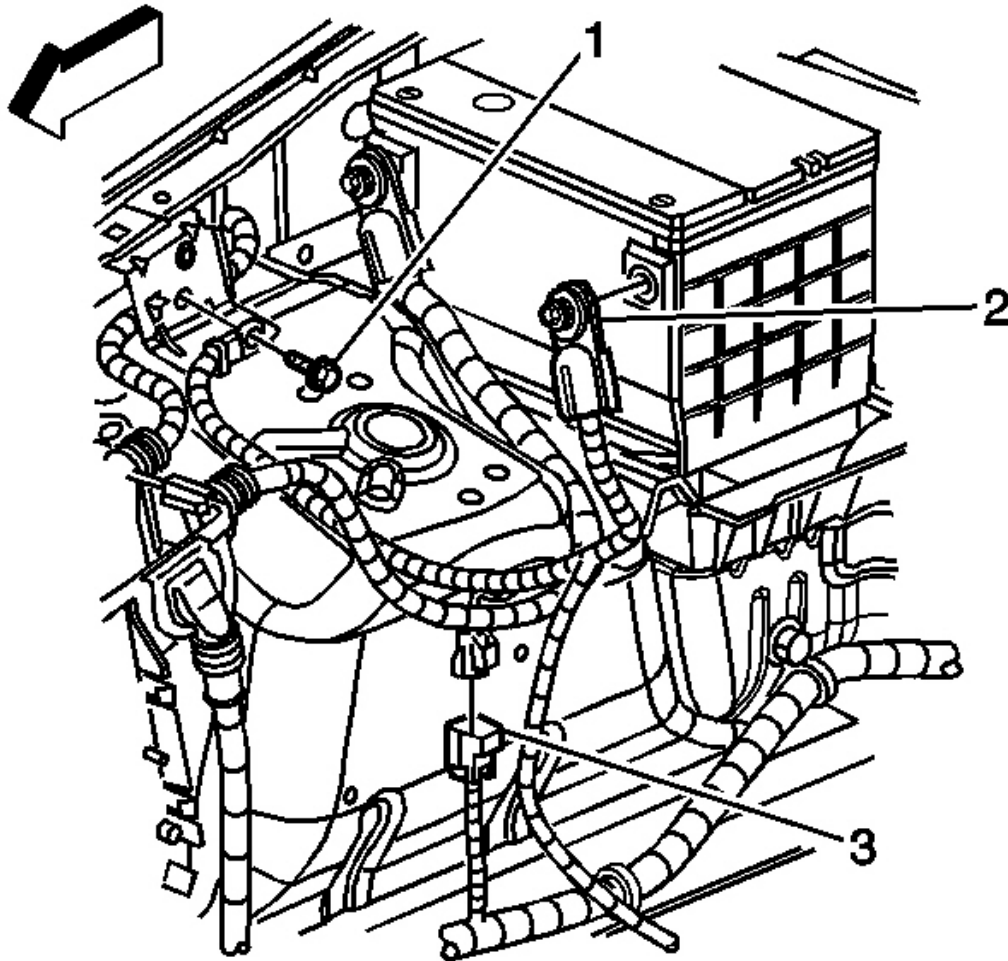


Fig. 6: View Of Battery Area Mounts And Connectors
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the battery negative cable (2) from the battery.

Installation Procedure

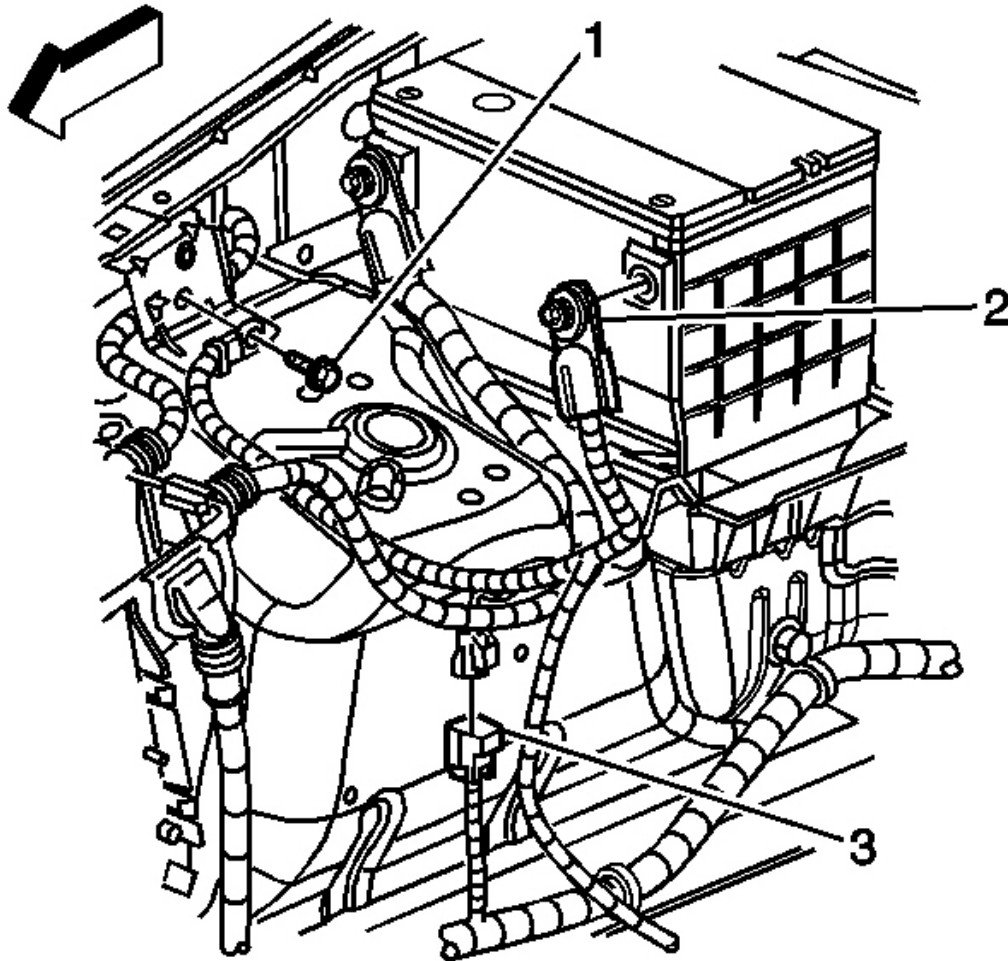


Fig. 7: View Of Battery Area Mounts And Connectors
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

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

1. Connect the battery negative (2) cable to the battery.

Tighten: Tighten the battery cable bolt to 17 N.m (13 lb ft).

2. Power Sunroof calibration:

1. Turn the ignition switch to the RUN position.
2. Turn the power sunroof switch to the closed position. After the sunroof fully closes and the motor stops, press and hold in the switch for 3 seconds.
3. Turn the power sunroof switch to the tilt position. After the sunroof reaches the tilt position and the motor stops, press and hold in the switch for 3 seconds.
4. Turn the power sunroof switch to the full open position. After the sunroof is fully open and the motor stops, press and hold in the switch for 3 seconds.
5. Turn the power sunroof switch to the closed position. After the sunroof fully closes and the motor stops, press and hold in the switch for 3 seconds.

3. Power Windows calibration:

1. Repeat these steps for each window.
2. Turn the ignition switch to the RUN position.
3. Press the power window switch to the down position. After the window is in the full down position, press and hold the switch in the down position for 3 seconds.
4. Press the power window switch to the up position. After the window is in the full up position, press and hold the switch in the up position for 3 seconds.

4. Heat and A/C Control Head calibration:

1. Turn the ignition switch to the RUN position.
2. Simultaneously press the AUTO and OFF buttons, located on the heat and A/C control head, for at least 5 seconds.
3. After initiation, the stepper motors will cycle from one stop to the other. You may hear the motors cycling while calibrating.

Removal Procedure

CAUTION: Refer to SIR Caution .

CAUTION: Refer to Battery Disconnect Caution .

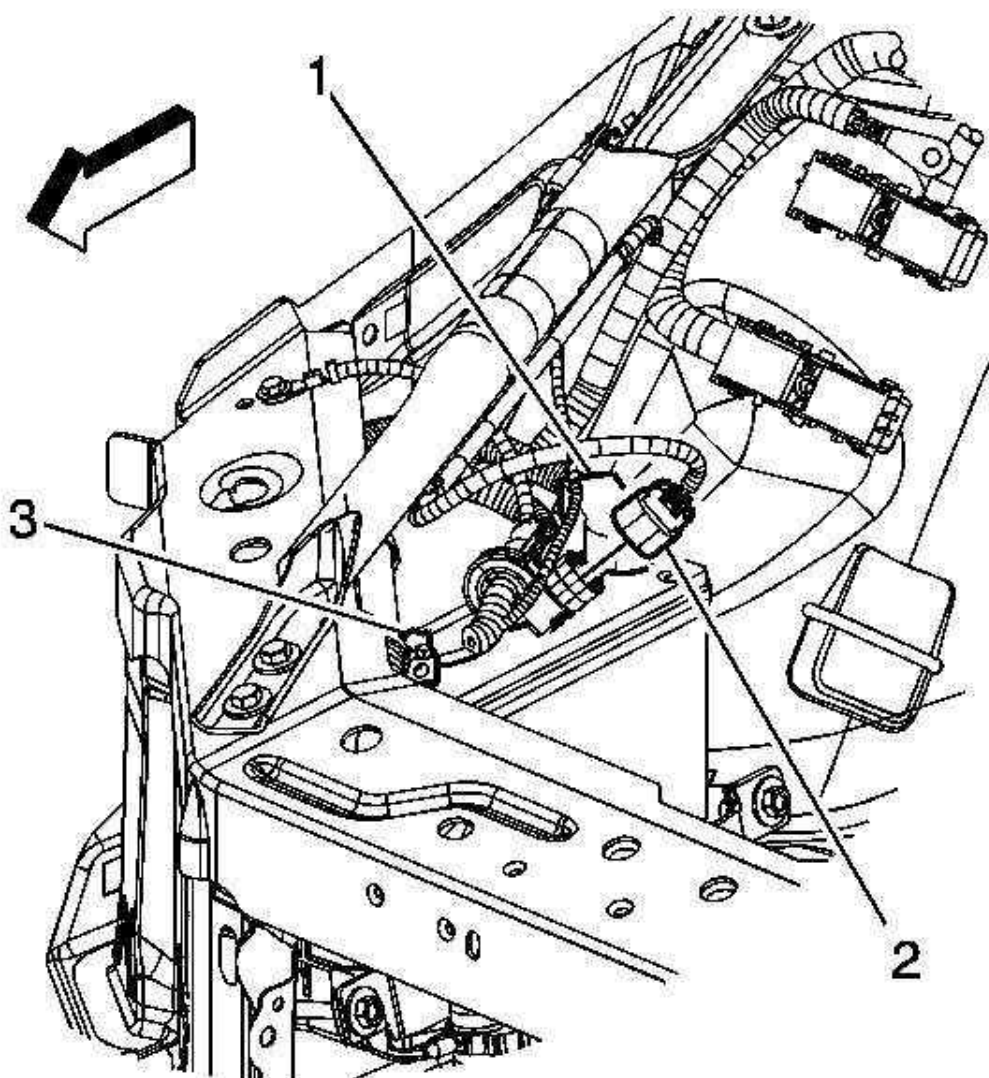


Fig. 8: Identifying Negative Battery Cable Terminal & Battery
Courtesy of GENERAL MOTORS CORP.

1. Record all of the vehicle's preset radio stations.
2. Turn OFF all lamps and accessories.
3. Turn the ignition switch to the OFF position.
4. Loosen the negative battery cable terminal nut.
5. Remove the negative battery cable terminal (3) from the battery.

Installation Procedure

IMPORTANT: Clean any existing oxidation from the contact face of the battery terminal and battery cable using a wire brush before installing the battery cable to the battery terminal.

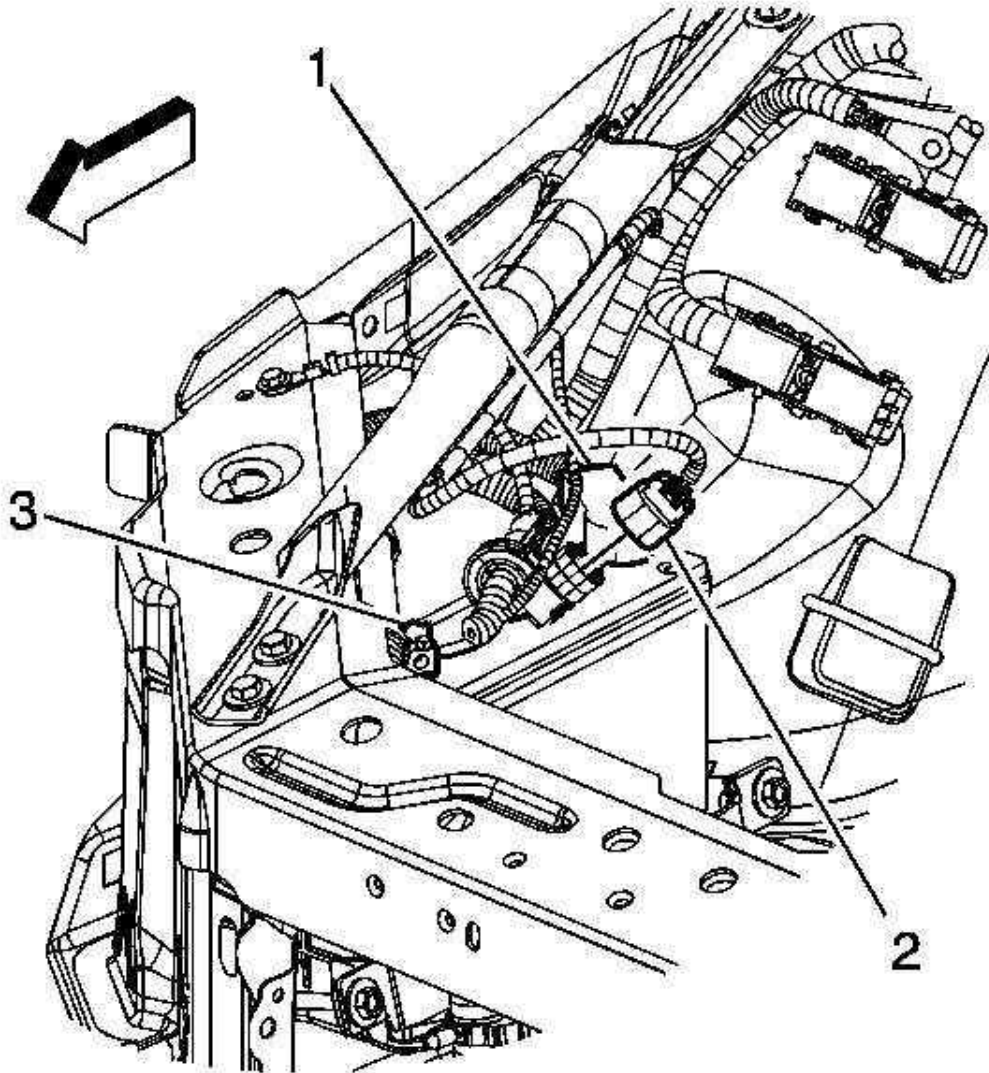


Fig. 9: Identifying Negative Battery Cable Terminal & Battery
Courtesy of GENERAL MOTORS CORP.

1. Install the negative battery cable terminal (2) to the battery.

NOTE: Refer to Fastener Notice .

2. Tighten the negative battery cable terminal nut.

Tighten: Tighten the nut to 15 N.m (11 lb ft).

3. Set the clock and program the radio stations back into the radio as recorded at the beginning of the procedure. Refer to **Radio/Audio System Description and Operation** .

BATTERY CURRENT SENSOR REPLACEMENT (L26)

Removal Procedure

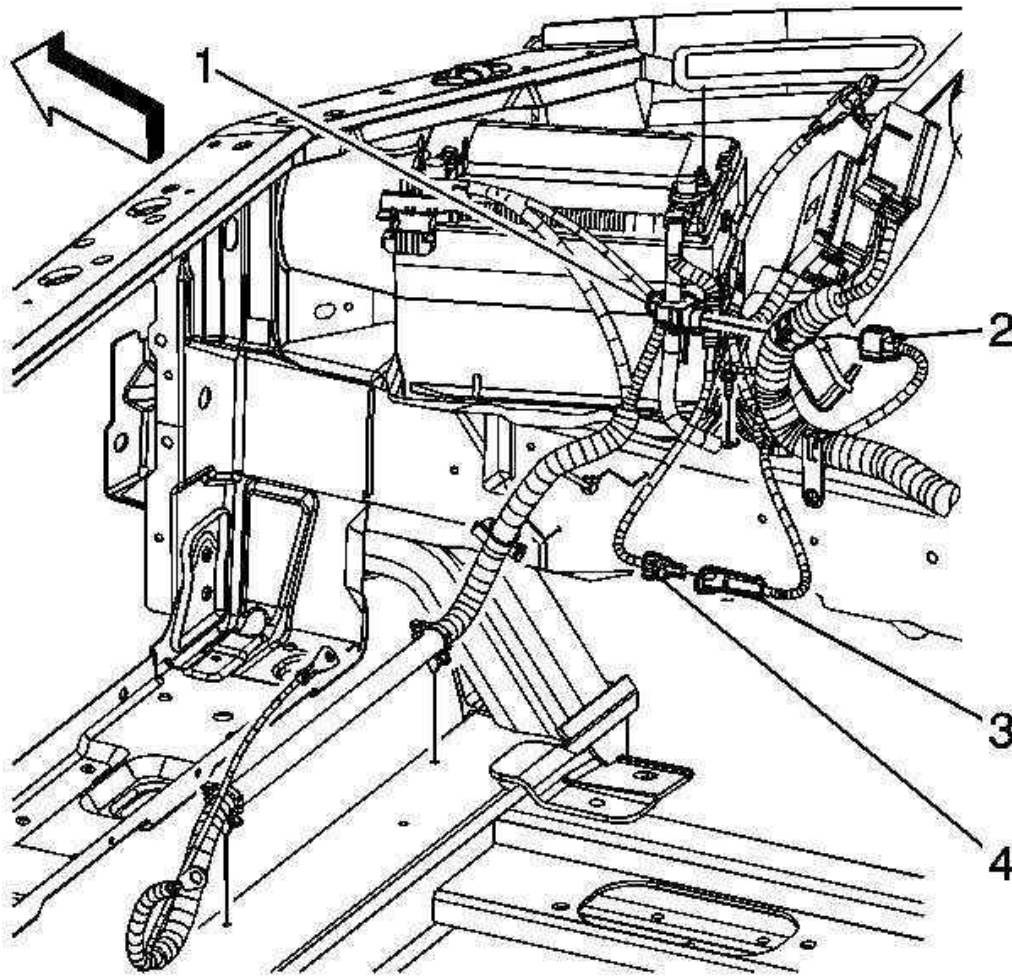


Fig. 10: View Of Right Side Of Engine Compartment
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the instrument panel (I/P) harness electrical connector (2) from the battery current sensor (1).
2. Remove the negative battery cable. Refer to **Battery Negative Cable Replacement (LY7)** or **Battery Negative Cable Replacement (L26)**.

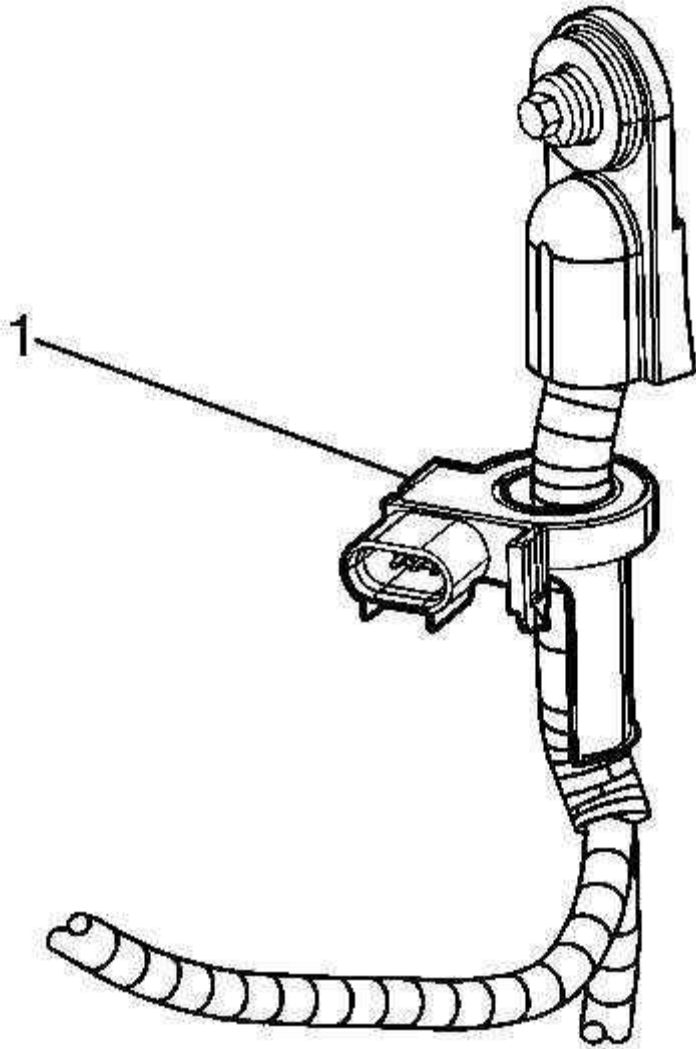


Fig. 11: View Of Battery Current Sensor
Courtesy of GENERAL MOTORS CORP.

3. Cut the tie straps and electrical tape attaching the battery current sensor to the battery cable.
4. Squeeze the negative battery cable branches together.

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

5. Slide the battery current sensor (1) off of the negative battery cable.

Installation Procedure

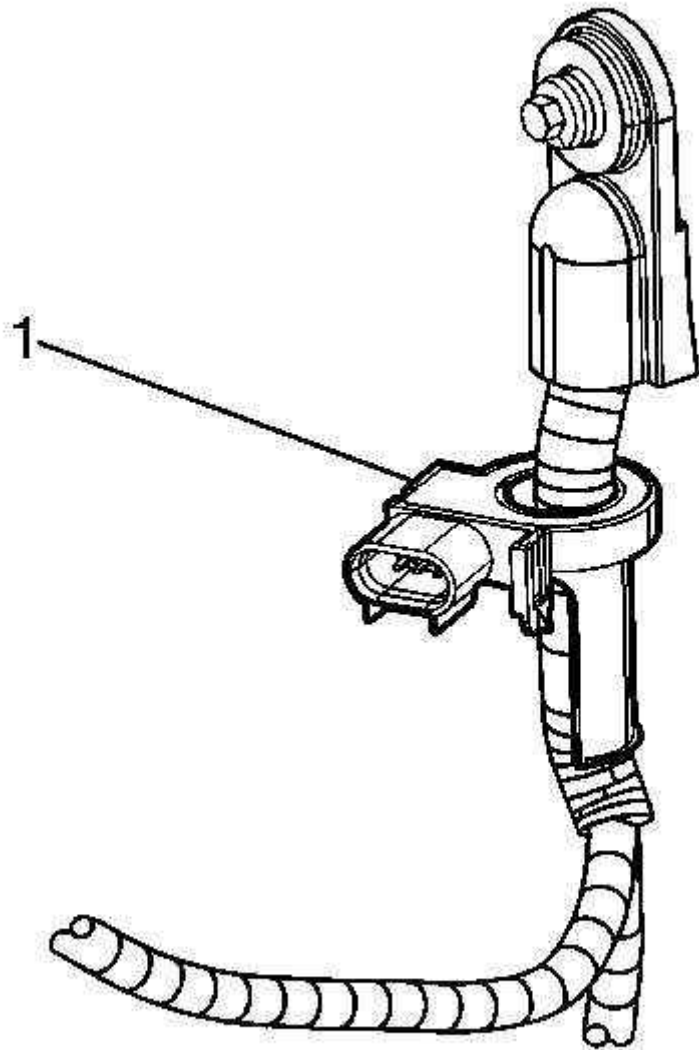


Fig. 12: View Of Battery Current Sensor

Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure that the tape tab is pointing away from the battery prior to installation.

1. Slide the NEW battery current sensor (1) up onto the negative battery cable.
2. Using NEW tie straps and electrical tape, attach the battery current sensor to the negative battery cable.

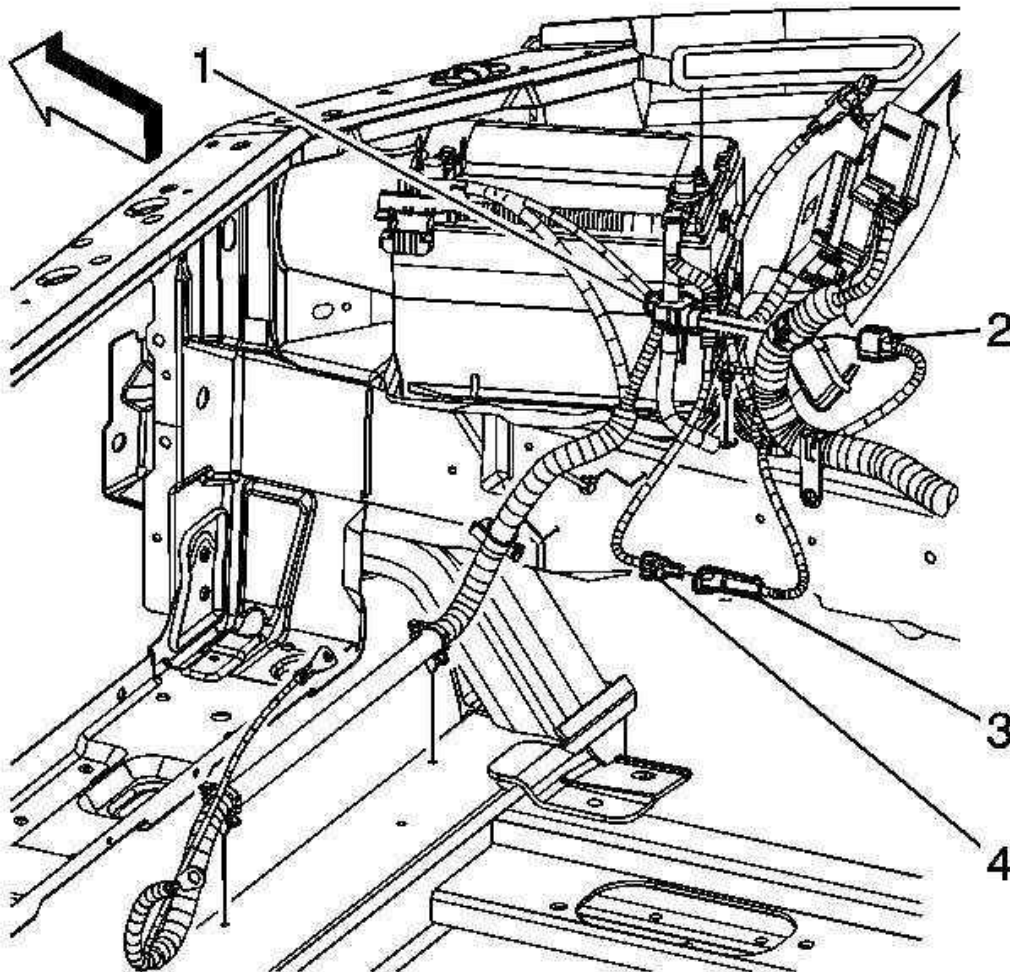


Fig. 13: View Of Right Side Of Engine Compartment

Courtesy of GENERAL MOTORS CORP.

3. Install the negative battery cable. Refer to **Battery Negative Cable Replacement (LY7)** or **Battery Negative Cable Replacement (L26)**.
4. Connect the I/P harness electrical connector (2) to the battery current sensor (1).

BATTERY CURRENT SENSOR REPLACEMENT (LS4)

Removal Procedure

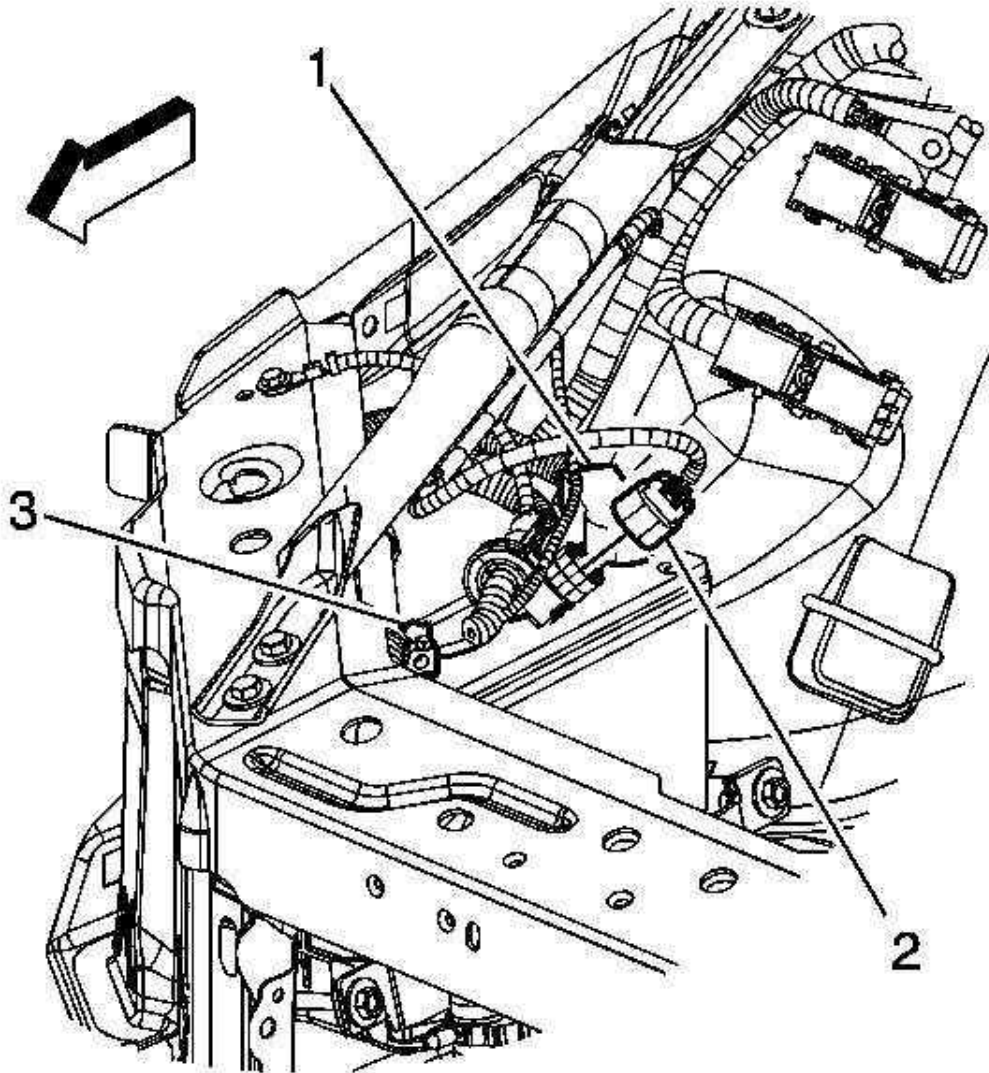


Fig. 14: Identifying Negative Battery Cable Terminal & Battery
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the instrument panel (I/P) harness electrical connector (2) from the battery current sensor.
2. Remove the positive and negative battery cable. Refer to **Battery Positive and Negative Cable Replacement (LS4)**.

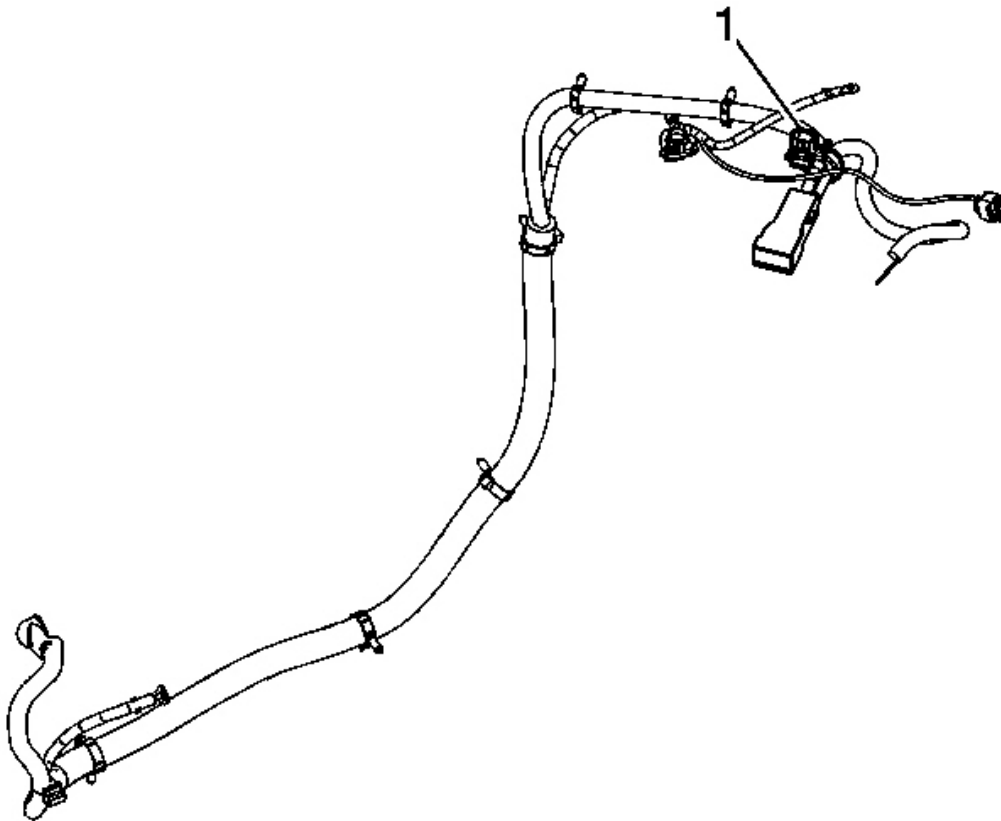


Fig. 15: Identifying Battery Current Sensor & Battery Cable
Courtesy of GENERAL MOTORS CORP.

3. Cut the tie straps and electrical tape attaching the battery current sensor to the positive battery cable.
4. Squeeze the battery cable branches together.

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

5. Slide the battery current sensor (1) off of the battery cable.

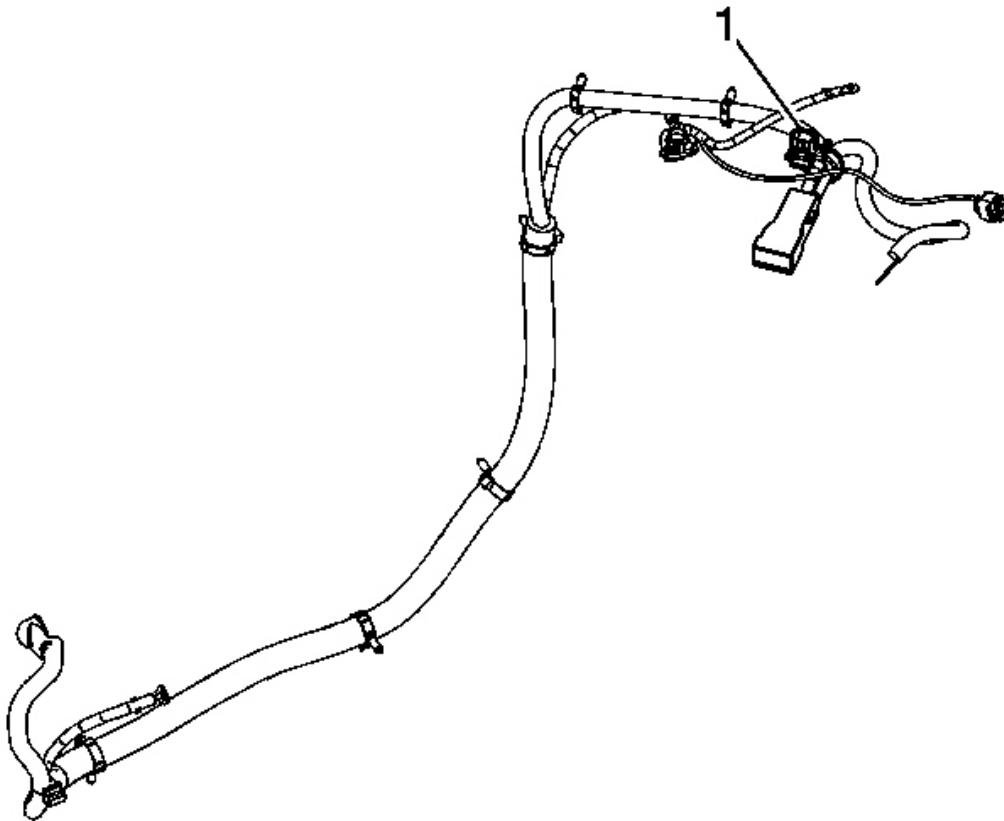


Fig. 16: Identifying Battery Current Sensor & Battery Cable
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure that the tape tab is pointing away from the battery prior to installation.

1. Slide the NEW battery current sensor (1) up onto the battery cable.
2. Using NEW tie straps and electrical tape, attach the battery current sensor to the positive battery cable.

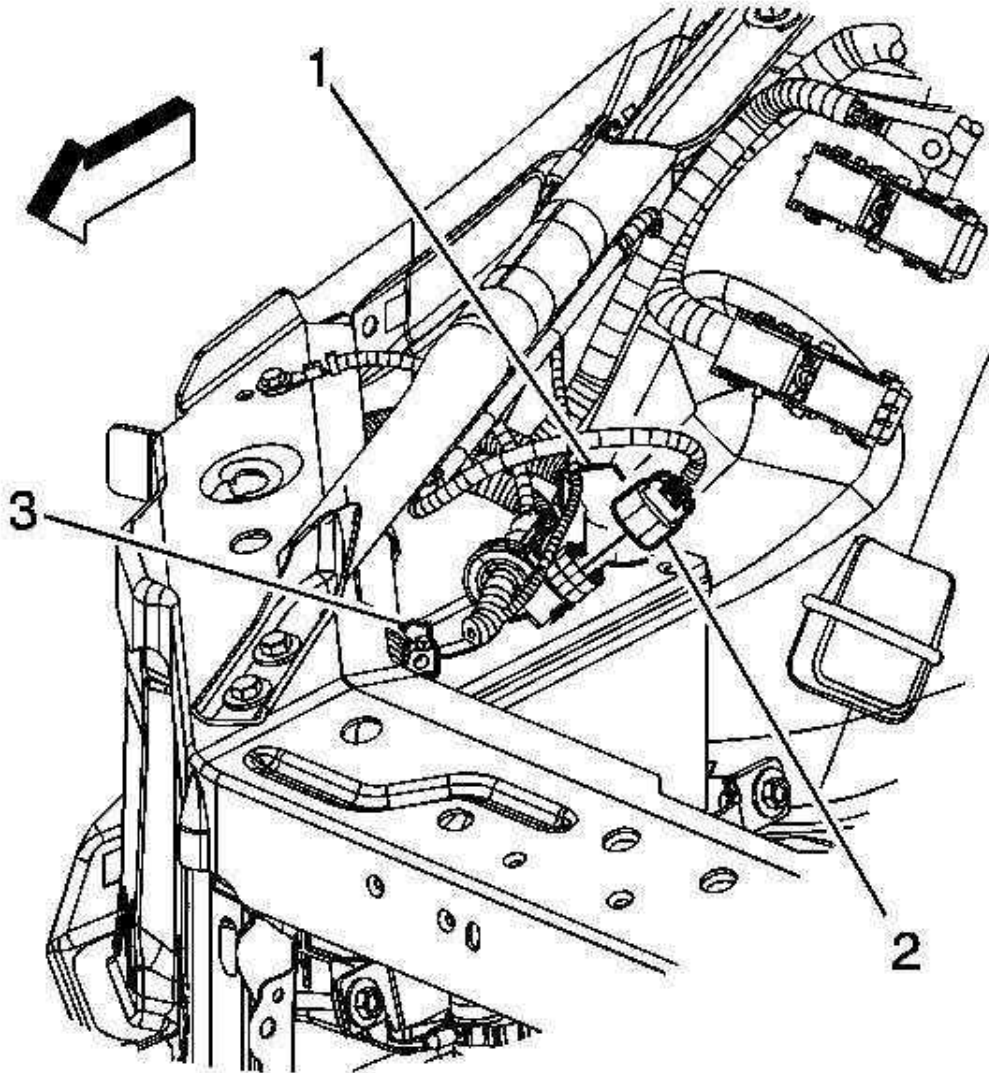


Fig. 17: Identifying Negative Battery Cable Terminal & Battery
Courtesy of GENERAL MOTORS CORP.

3. Install the positive and negative battery cable. Refer to **Battery Positive and Negative Cable Replacement (LS4)**.
4. Connect the I/P harness electrical connector (2) to the battery current sensor.

BATTERY POSITIVE AND NEGATIVE CABLE REPLACEMENT (LS4)

Removal Procedure

IMPORTANT: When replacing battery cables be sure to use replacement cables that are the same type, gage, and length.

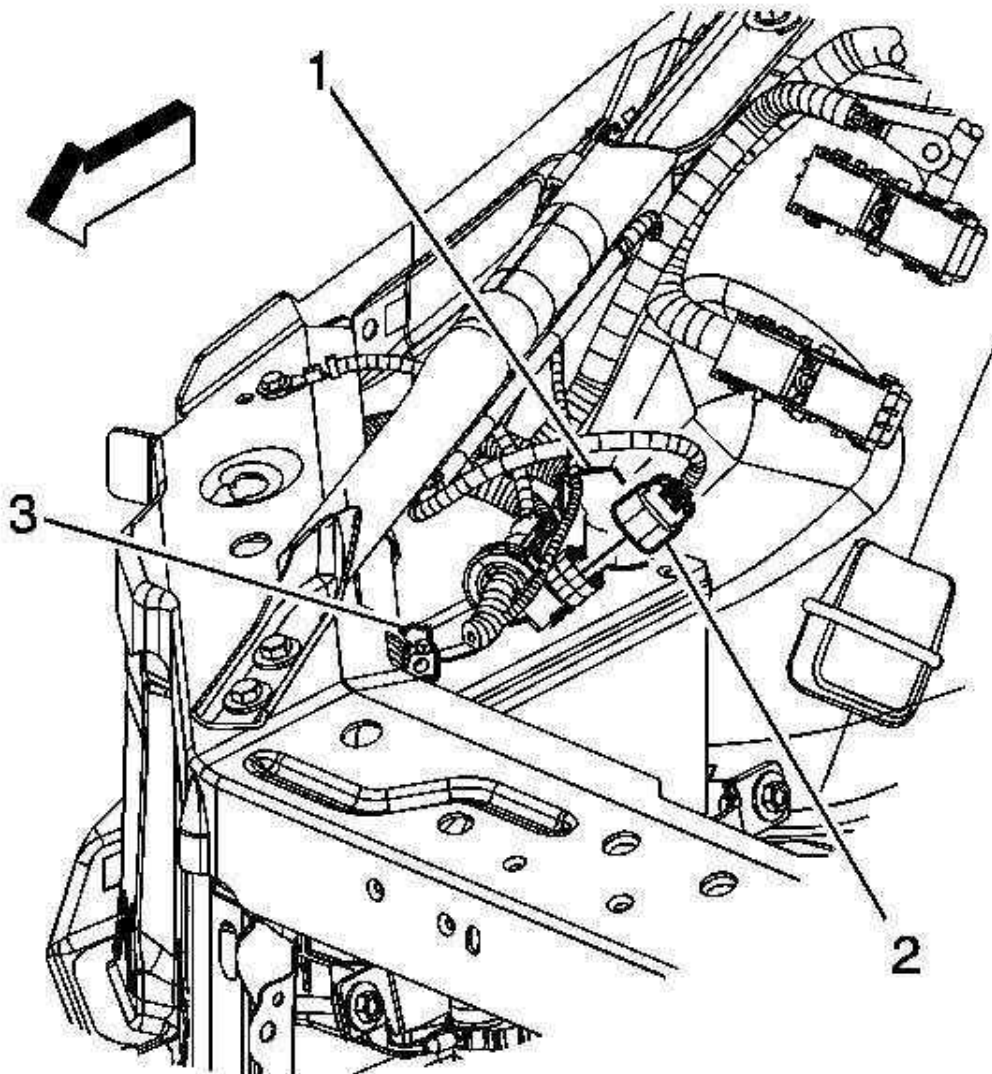


Fig. 18: Identifying Negative Battery Cable Terminal & Battery
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable (3). Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.
2. Open the positive battery cable terminal lead cover (1).
3. Loosen the positive battery cable terminal lead nut
4. Remove the positive battery cable terminal from the battery.
5. Disconnect the instrument panel (I/P) harness electrical connector (2) from the battery current sensor.

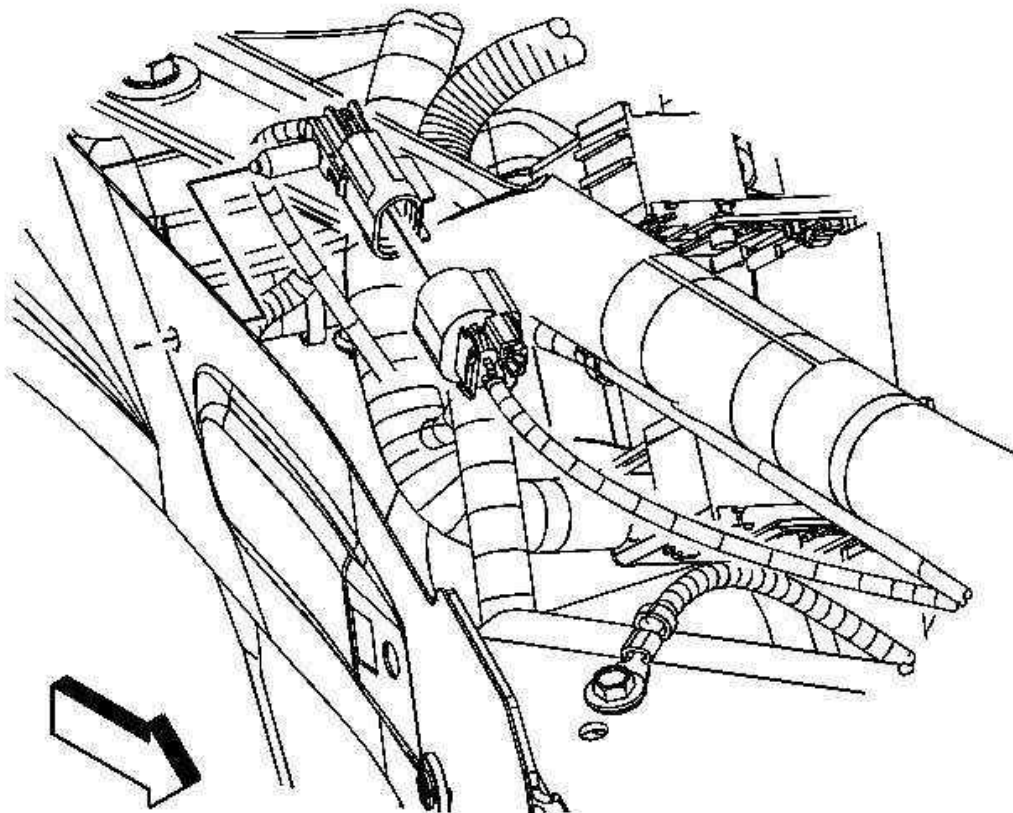


Fig. 19: View Of Battery Cable Connector & I/P Harness Electrical Connector

Courtesy of GENERAL MOTORS CORP.

6. Disconnect the battery cable connector from the I/P harness electrical connector.

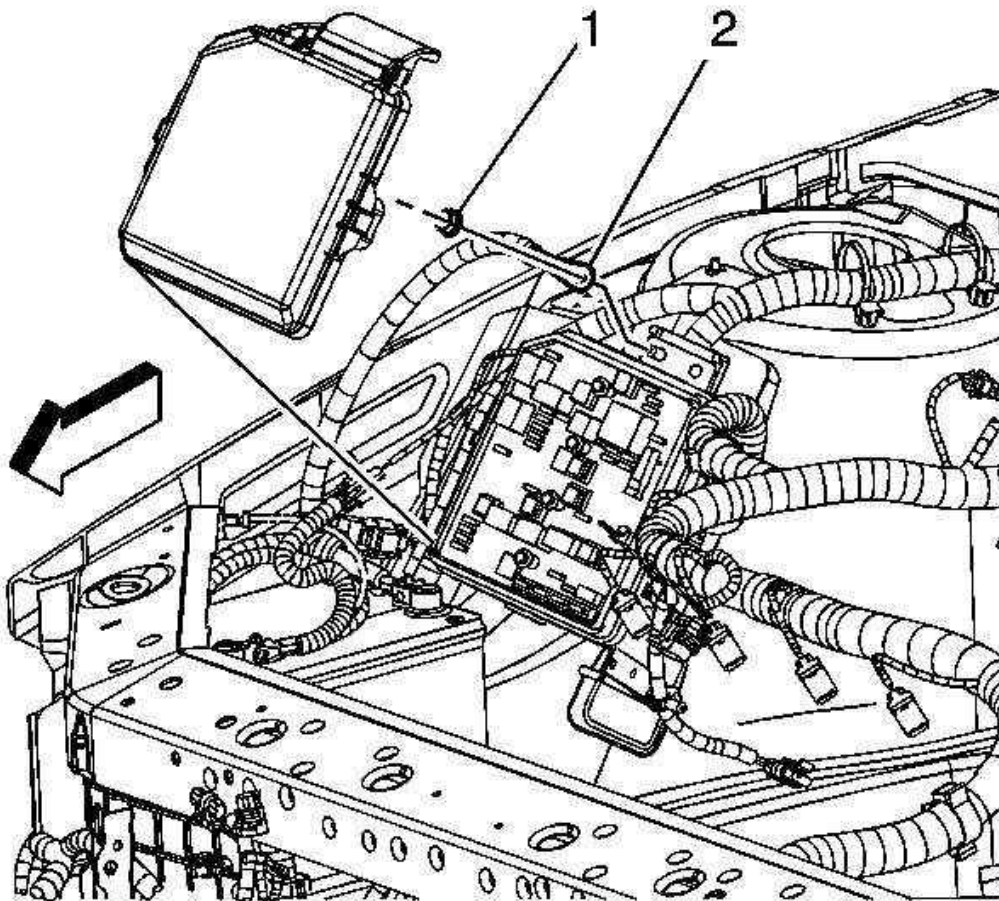


Fig. 20: View Of Bussed Electrical Center

Courtesy of GENERAL MOTORS CORP.

7. Remove the bussed electrical center (BEC) cover.
8. Remove the positive battery cable junction block lead nut (1).

9. Remove the positive battery cable terminal (2) from the BEC.

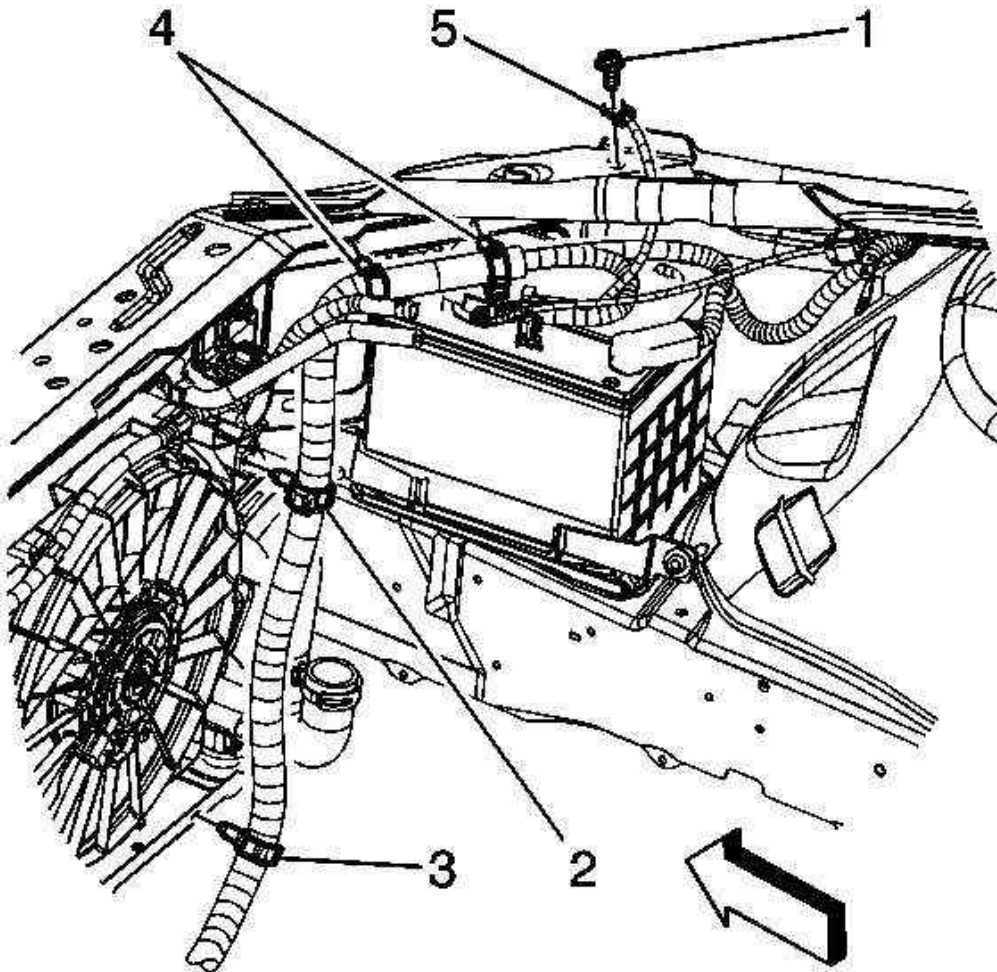


Fig. 21: View Of Ground Wire Bolt & Battery Cable Harness Retaining Clips

Courtesy of GENERAL MOTORS CORP.

10. Remove the ground wire bolt (1) and reposition the wire (5) from the top rail.
11. Remove the battery cable harness retaining clips (2, 3, and 4) from the front rail and fan shroud.

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

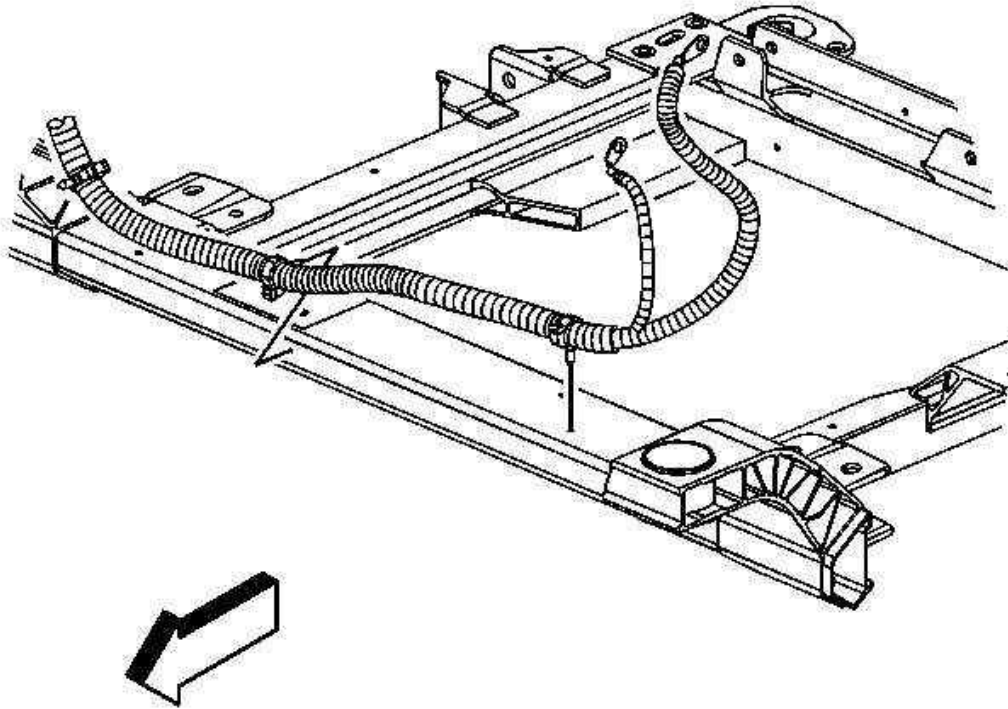


Fig. 22: View Of Battery Cable Harness Retainers
Courtesy of GENERAL MOTORS CORP.

13. Remove the battery cable harness retainers from the engine cradle.

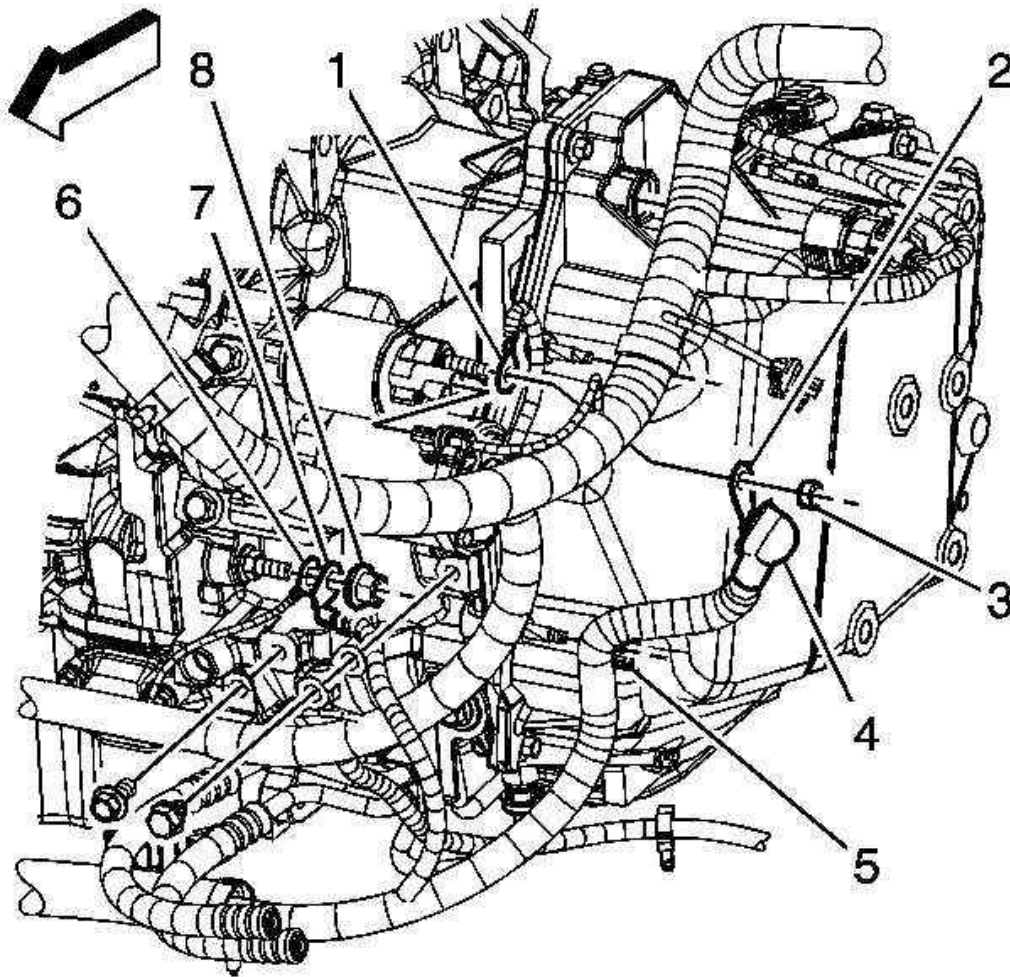


Fig. 23: View Of Battery Current Sensor, Bat Terminal Nut, Battery Cable Boot & Cable Clip
Courtesy of GENERAL MOTORS CORP.

14. Remove the transaxle stud nut (8).
15. Remove the battery cable ground (7) from the transaxle stud.
16. Reposition the positive battery cable boot (4) at the starter solenoid.
17. Remove the starter solenoid BAT terminal nut (3) from the starter.
18. Remove the positive battery cable (2) from the starter motor.

19. Remove the positive battery cable clip (5) from the transmission stud.
20. Lower the vehicle.
21. Remove the positive and negative battery cable from the vehicle.

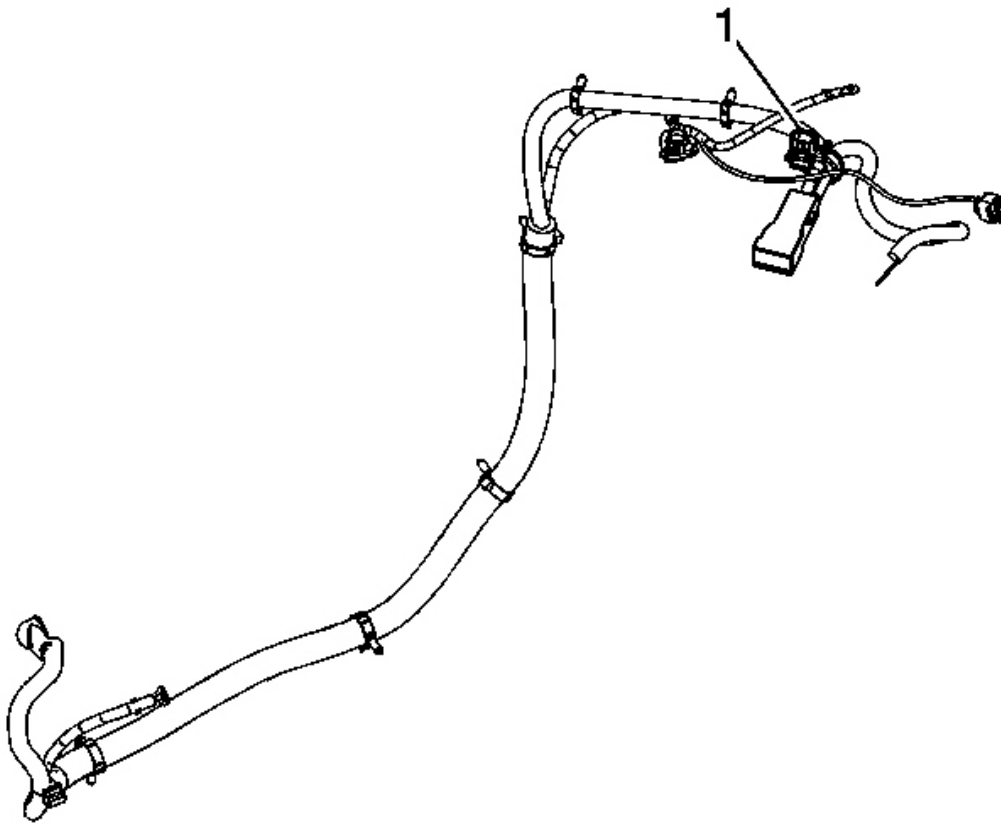


Fig. 24: Identifying Battery Current Sensor & Battery Cable
Courtesy of GENERAL MOTORS CORP.

22. If replacing the positive and negative battery cable, perform the following:
 1. Cut the tie straps and electrical tape attaching the battery current sensor to the battery cable.
 2. Squeeze the battery cable branches together.

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

3. Slide the battery current sensor (1) off of the battery cable.

Installation Procedure

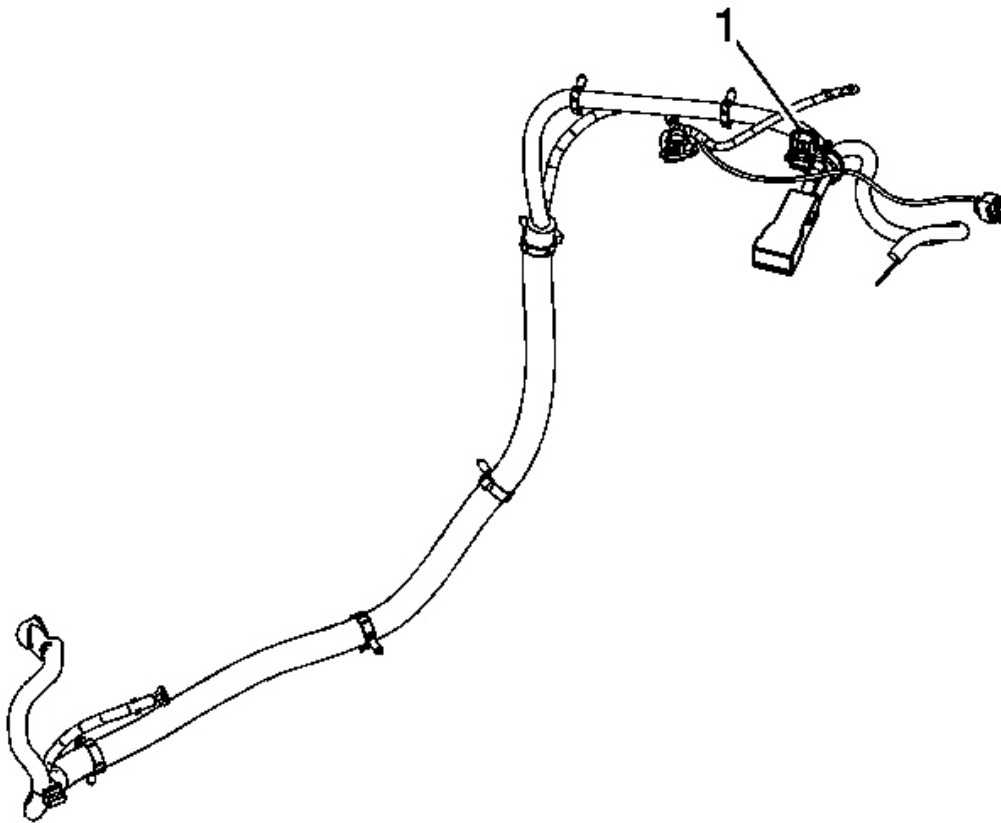


Fig. 25: Identifying Battery Current Sensor & Battery Cable
Courtesy of GENERAL MOTORS CORP.

1. If the positive and negative battery cable was replaced, perform the following:
 1. Slide the battery current sensor (1) onto the battery cable.

IMPORTANT: Ensure that the tape tab is pointing away from the negative cable terminal.

2. Using NEW tie straps and electrical tape, attach the battery current sensor to the battery cable.

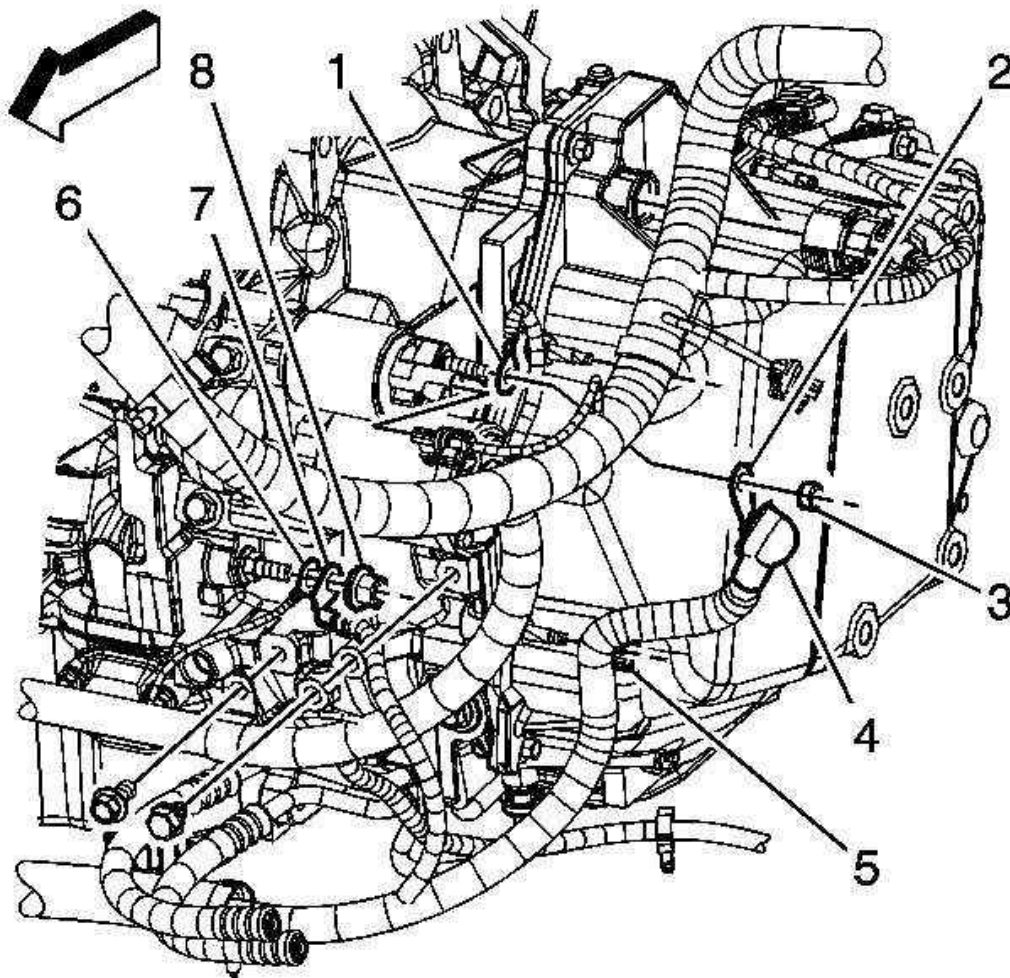


Fig. 26: View Of Battery Current Sensor, Bat Terminal Nut, Battery Cable Boot & Cable Clip
Courtesy of GENERAL MOTORS CORP.

2. Install the positive and negative battery cable to the vehicle.
3. Raise and support the vehicle.
4. Install the positive battery cable (2) to the starter motor.

NOTE: Refer to Fastener Notice .

5. Install the starter solenoid BAT terminal nut (3) to the starter.

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

6. Position the positive battery cable boot (4) at the starter solenoid.
7. Install the positive battery cable clip (5) to the transmission stud.
8. Install the battery cable ground (7) to the transaxle stud.
9. Install the transaxle stud nut (8).

Tighten: Tighten the nut to 30 N.m (22 lb ft).

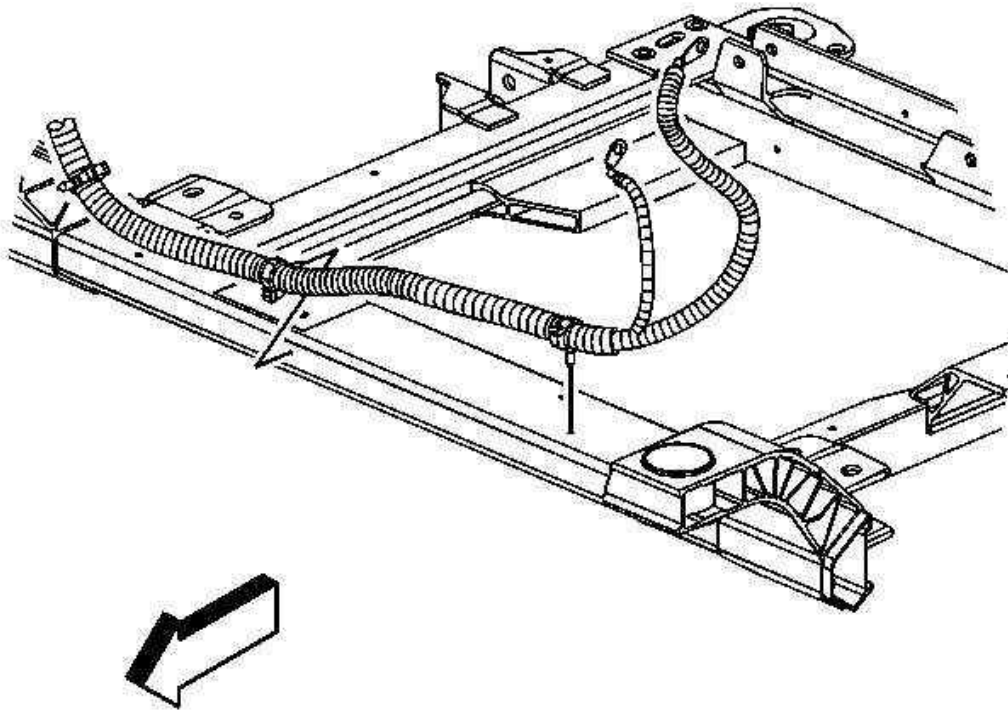


Fig. 27: View Of Battery Cable Harness Retainers
Courtesy of GENERAL MOTORS CORP.

10. Install the battery cable harness retainers from the engine cradle.
11. Lower the vehicle.

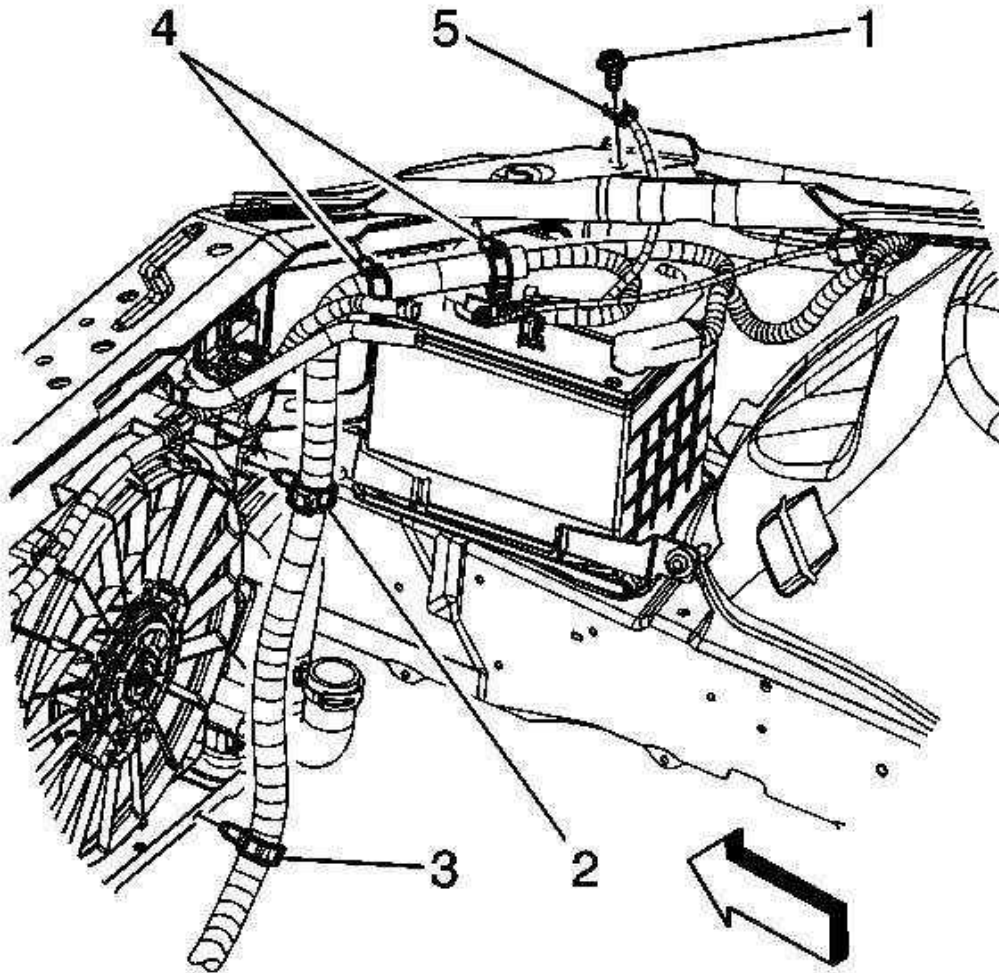


Fig. 28: View Of Ground Wire Bolt & Battery Cable Harness Retaining Clips

Courtesy of GENERAL MOTORS CORP.

12. Position the ground wire (5) and install the ground wire bolt (1) to the top rail.

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

13. Install the battery cable harness retaining clips (2, 3, and 4) to the front rail and fan shroud.

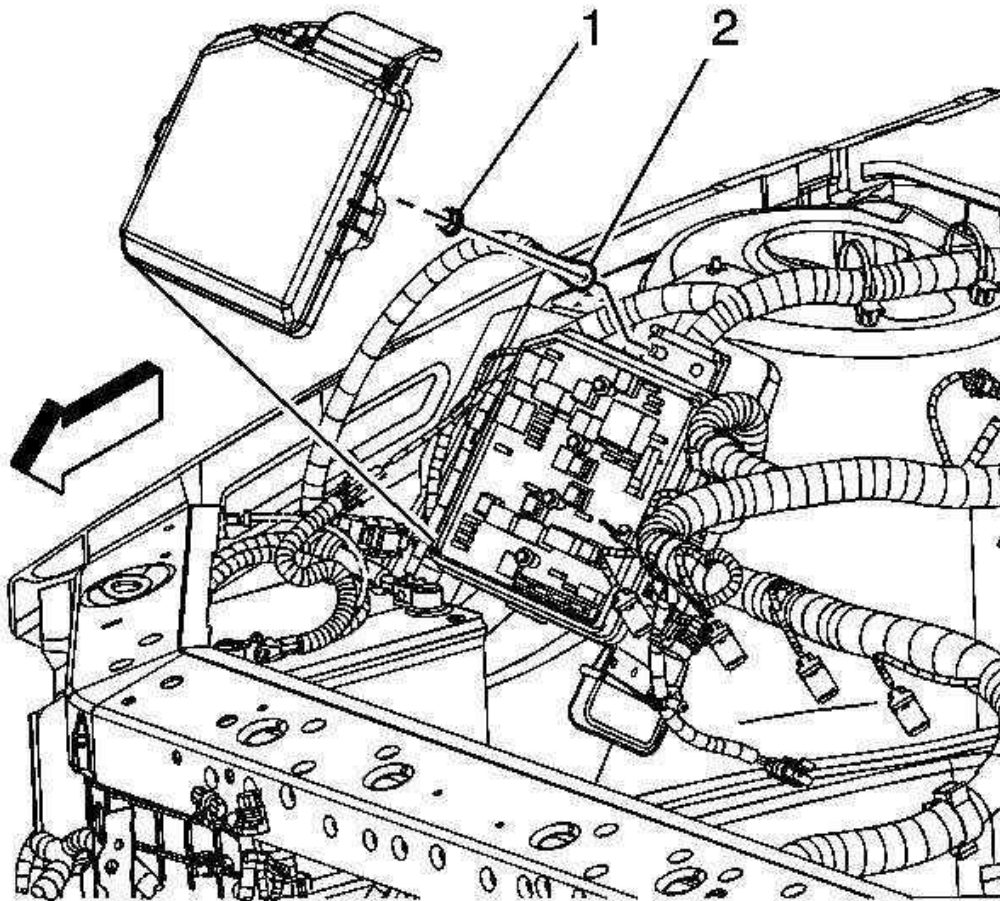


Fig. 29: View Of Bussed Electrical Center
Courtesy of GENERAL MOTORS CORP.

14. Install the positive battery cable terminal (2) to the BEC.
15. Install the positive battery cable junction block lead nut (1).

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

16. Install the BEC cover.

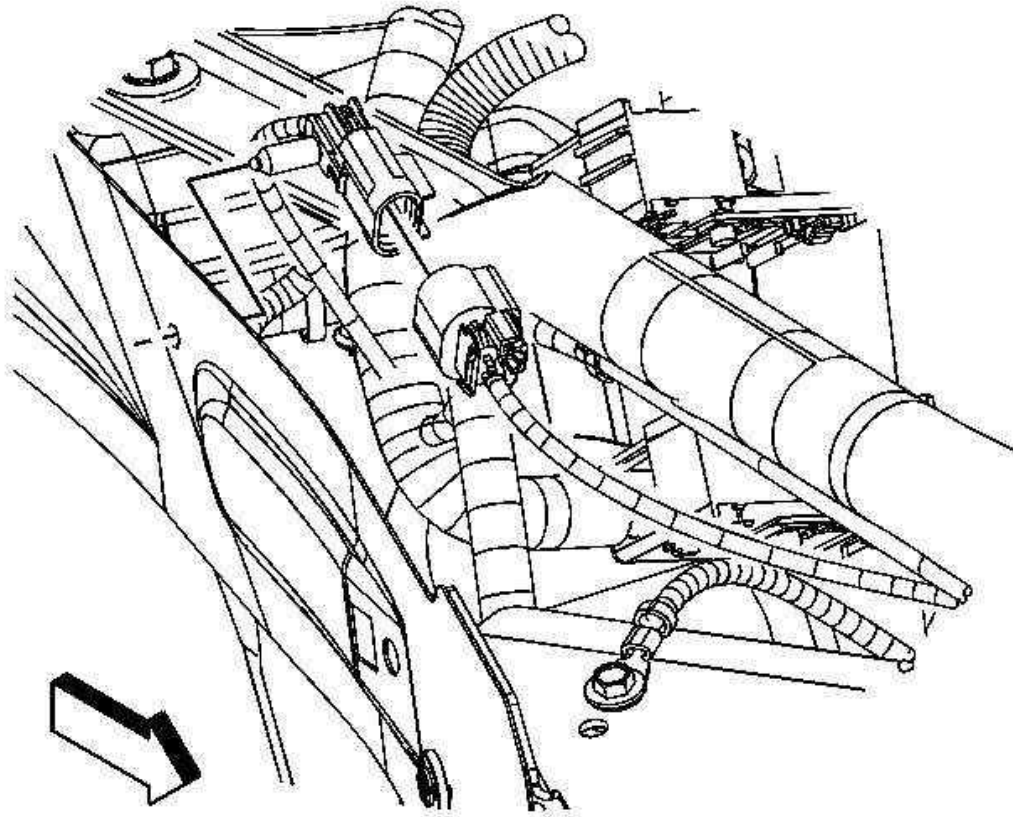


Fig. 30: View Of Battery Cable Connector & I/P Harness Electrical Connector

Courtesy of GENERAL MOTORS CORP.

17. Connect the battery cable connector to the I/P harness electrical connector.

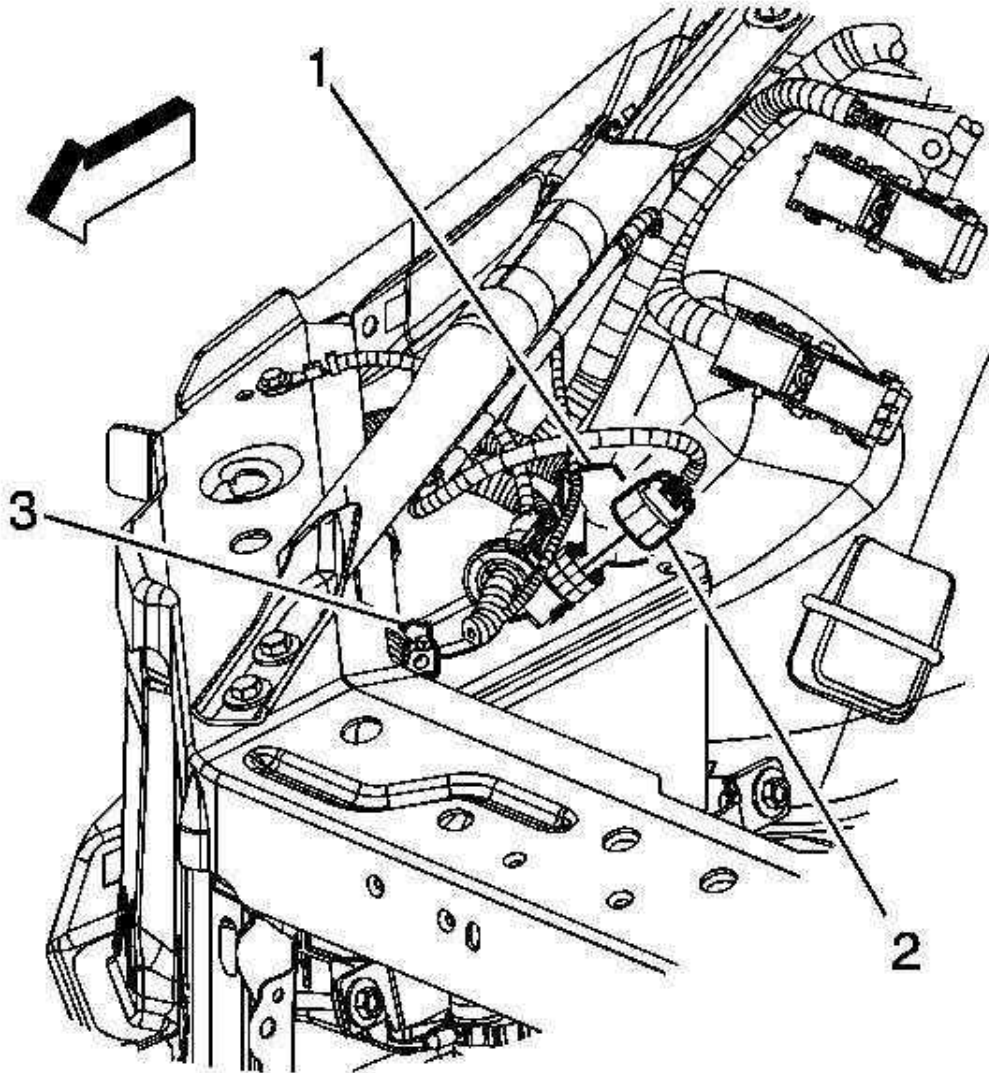


Fig. 31: Identifying Negative Battery Cable Terminal & Battery
Courtesy of GENERAL MOTORS CORP.

18. Connect the I/P harness electrical connector (2) to the battery current sensor.
19. Install the positive battery cable terminal to the battery.
20. Tighten the positive battery cable terminal lead nut.

Tighten: Tighten the nut to 15 N.m (11 lb ft).

21. Snap closed the positive battery cable terminal lead cover (1).
22. Connect the negative battery cable (3). Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.

BATTERY NEGATIVE CABLE REPLACEMENT (LY7)

Removal Procedure

- IMPORTANT:**
- Always use replacement cables that are of the same type, diameter and length of the cables that you are replacing.
 - Always route the replacement cable the same as the original cable.

1. Disconnect the battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.

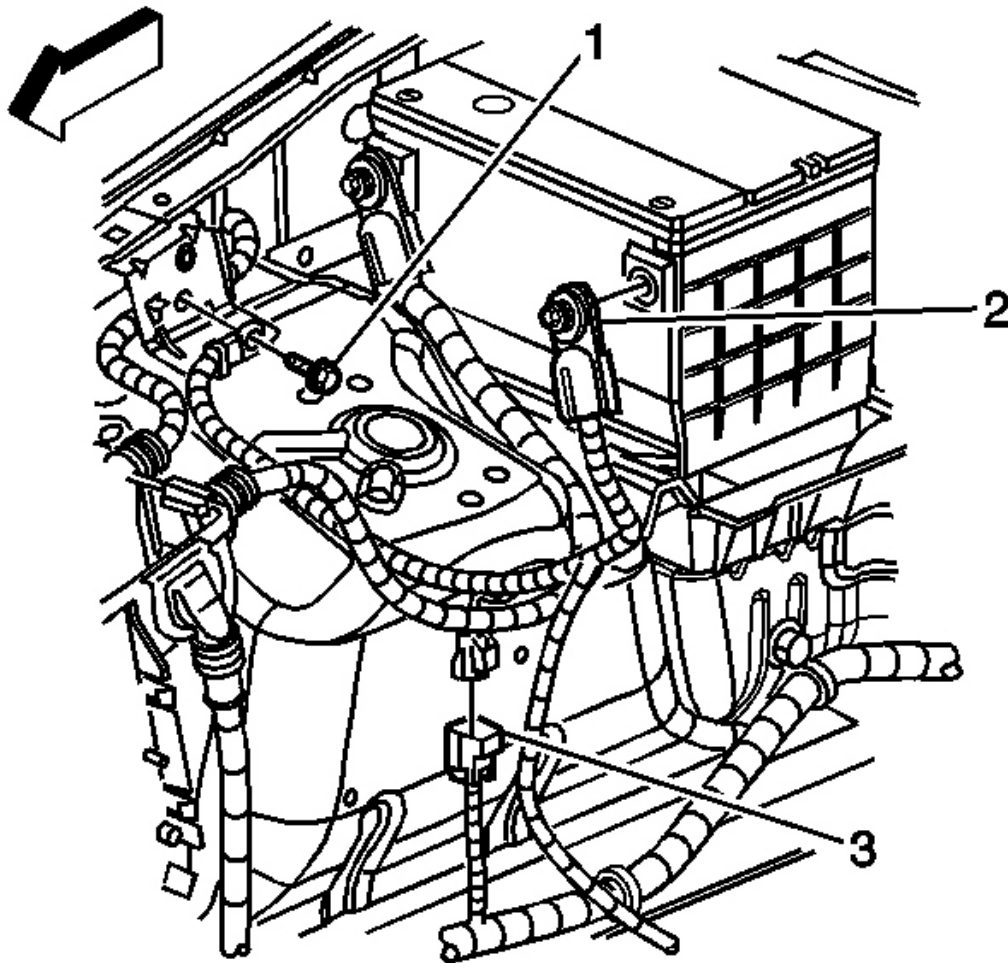


Fig. 32: View Of Battery Area Mounts And Connectors
Courtesy of GENERAL MOTORS CORP.

2. Remove the bolt (1) securing the battery negative cable to the side rail.
3. Disconnect the body harness connector (3) from the battery negative cable.

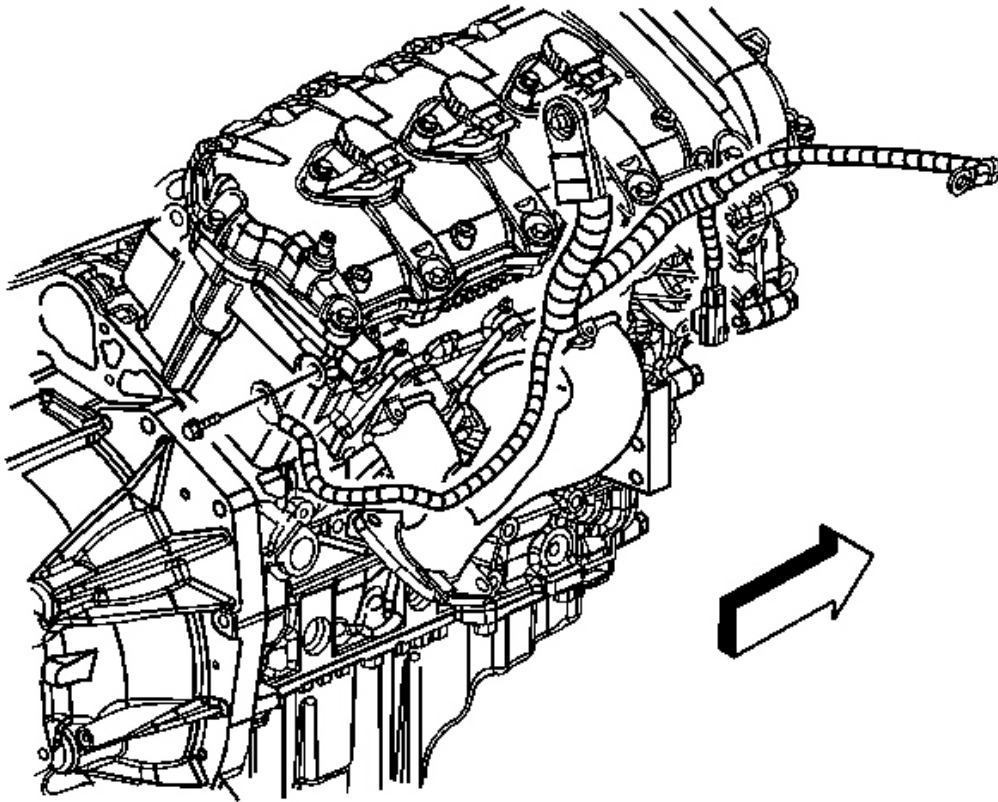


Fig. 33: View Of Battery Negative Cable-To-Engine Block Bolt
Courtesy of GENERAL MOTORS CORP.

4. Remove the bolt securing the battery negative cable to the engine block.
5. Lower the vehicle.
6. Remove the battery negative cable from the engine.

Installation Procedure

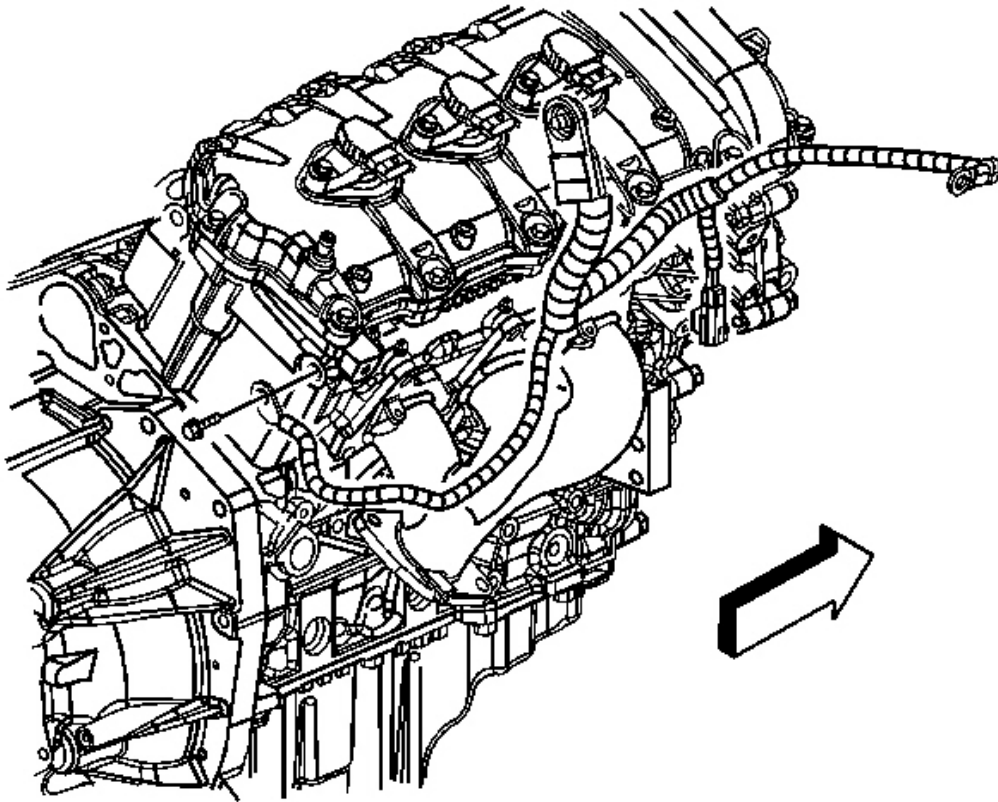


Fig. 34: View Of Battery Negative Cable-To-Engine Block Bolt
Courtesy of GENERAL MOTORS CORP.

1. Position the battery negative cable to the engine.

NOTE: Refer to Fastener Notice .

2. Install the battery negative cable to engine bolt.

Tighten: Tighten the battery negative cable to engine bolt to 50 N.m (37 lb ft).

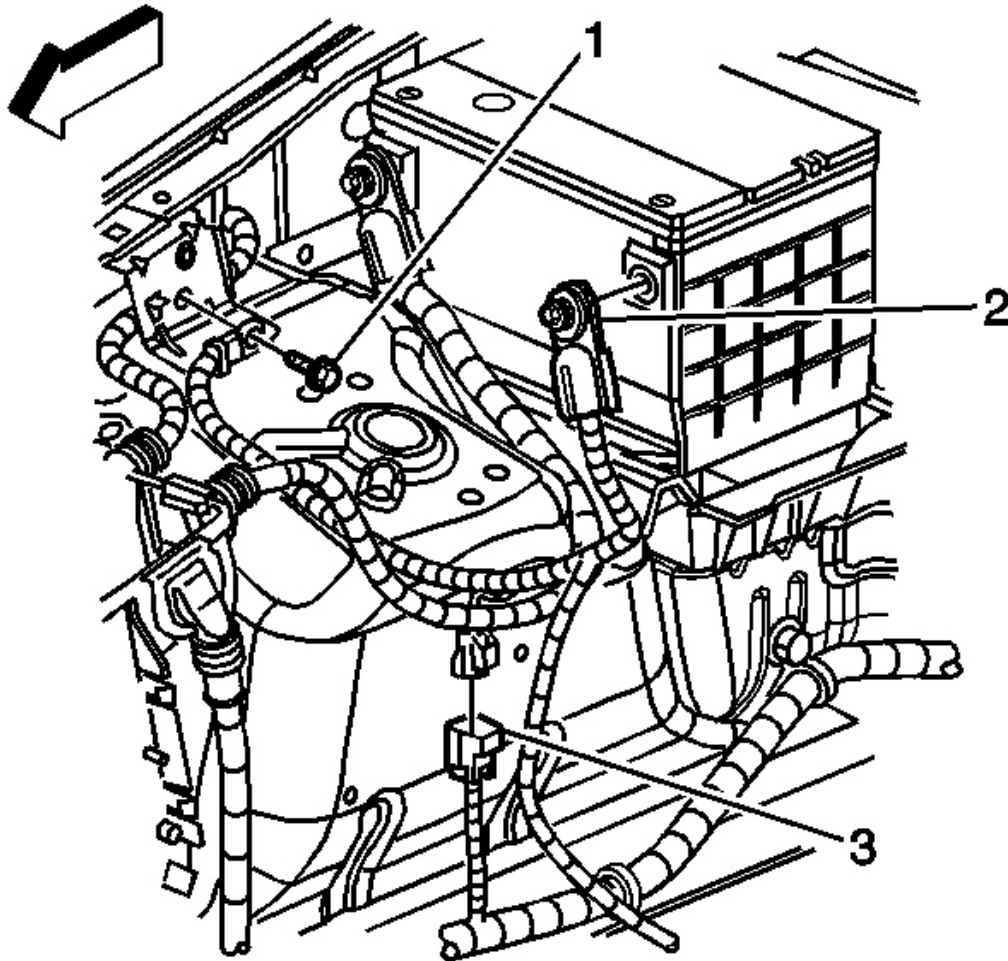


Fig. 35: View Of Battery Area Mounts And Connectors
Courtesy of GENERAL MOTORS CORP.

3. Install the bolt (1) securing the battery negative cable to the side rail.

Tighten: Tighten the battery negative cable to side rail bolt to 36 N.m (27 lb ft).

4. Connect the body harness connector (3) to the battery negative cable.
5. Connect the battery negative cable. Refer to **Battery Negative Cable**

Disconnection and Connection (L26) or Battery Negative Cable Disconnection and Connection (LY7) or Battery Negative Cable Disconnection and Connection (LS4).

BATTERY NEGATIVE CABLE REPLACEMENT (L26)

Removal Procedure

IMPORTANT: When replacing battery cables be sure to use replacement cables that are the same type, gauge and length.

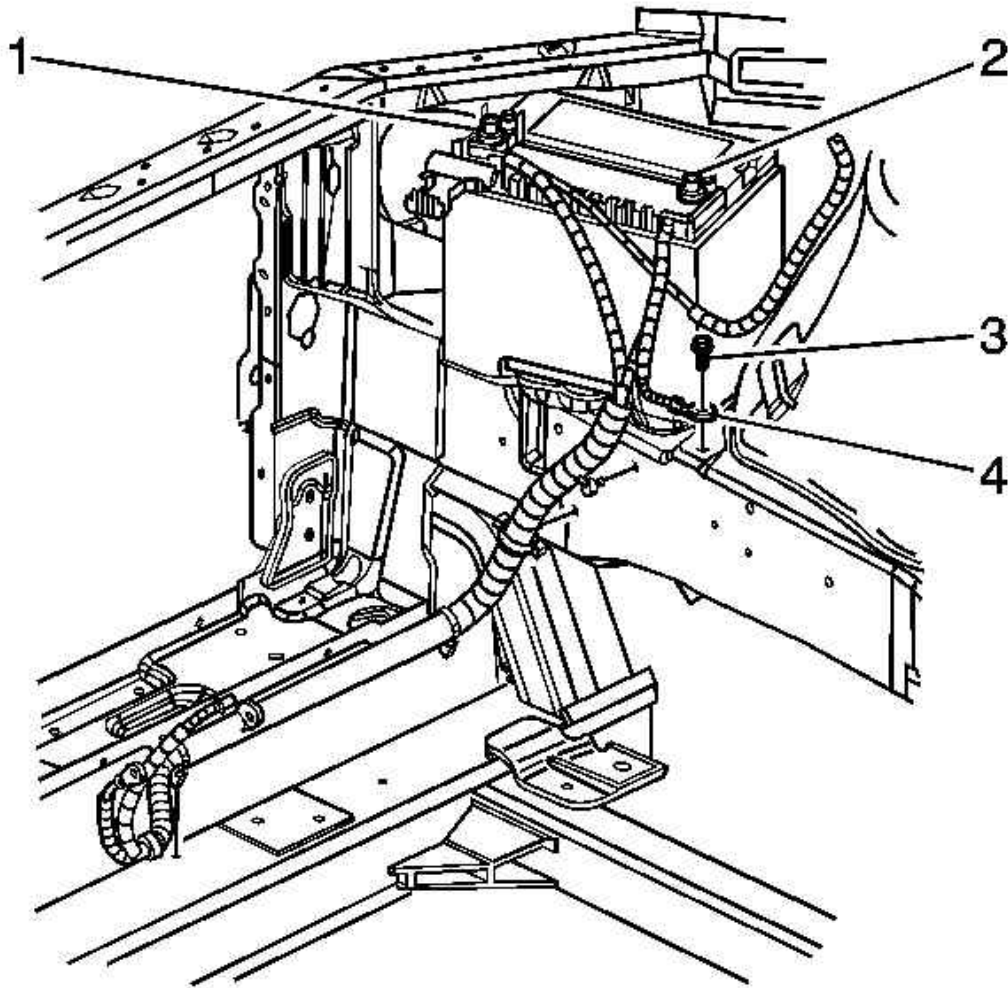


Fig. 36: Identifying Battery Terminals & Ground Wire
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.
2. Loosen the positive battery terminal nut.
3. Remove the positive battery terminal (1) from the battery.

4. Remove the ground wire bolt (3) and the wire (4) from the frame.

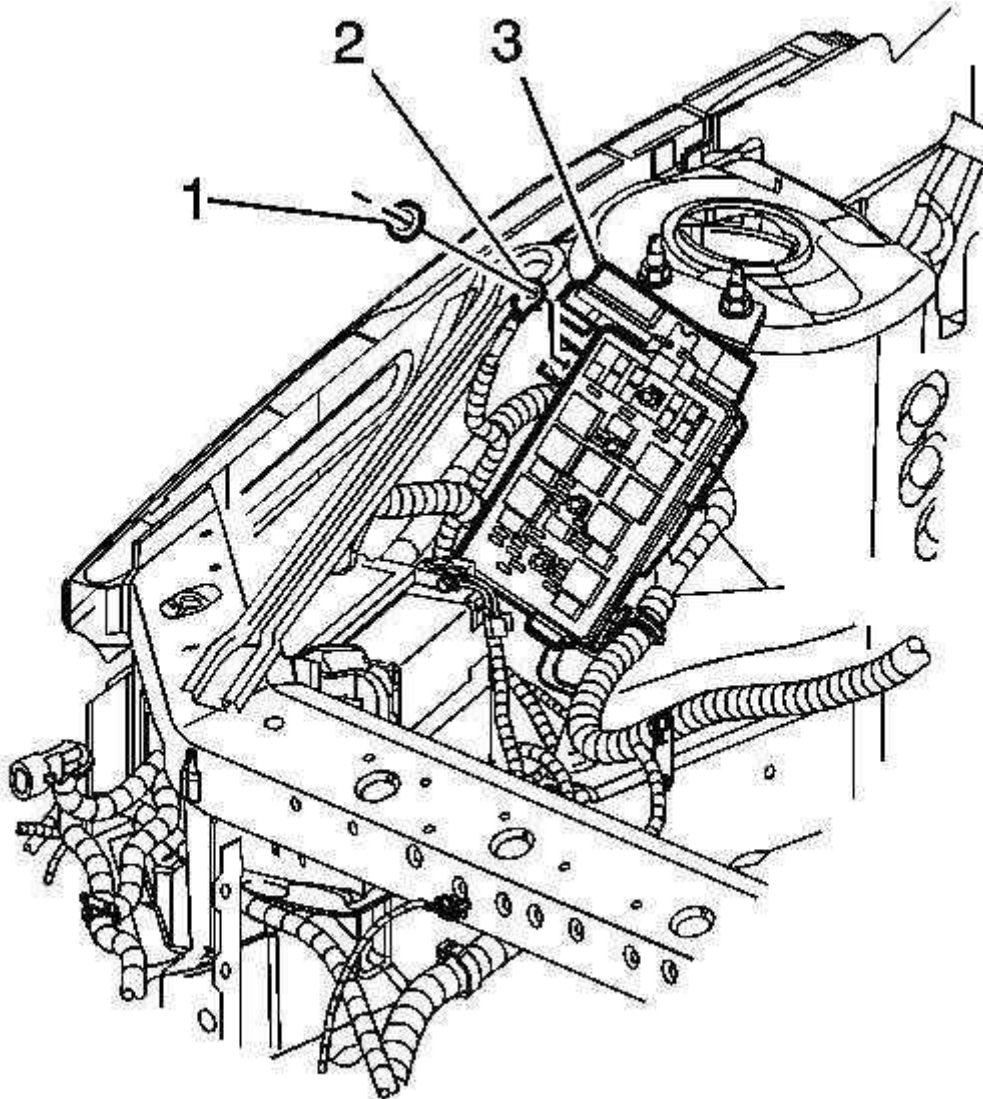


Fig. 37: Identifying Positive Battery Cable, Junction Block Lead Nut & Bussed Electrical Center
Courtesy of GENERAL MOTORS CORP.

5. Remove the positive battery cable junction block lead nut (1).
6. Remove the positive battery cable (2) from the bussed electrical center (BEC).
7. Remove the BEC (3) from the strut tower.
8. Unclip and remove the positive battery cable harness from the BEC.
9. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
10. Remove the front lower air deflector. Refer to **Radiator Air Lower Baffle and Deflector Replacement** .

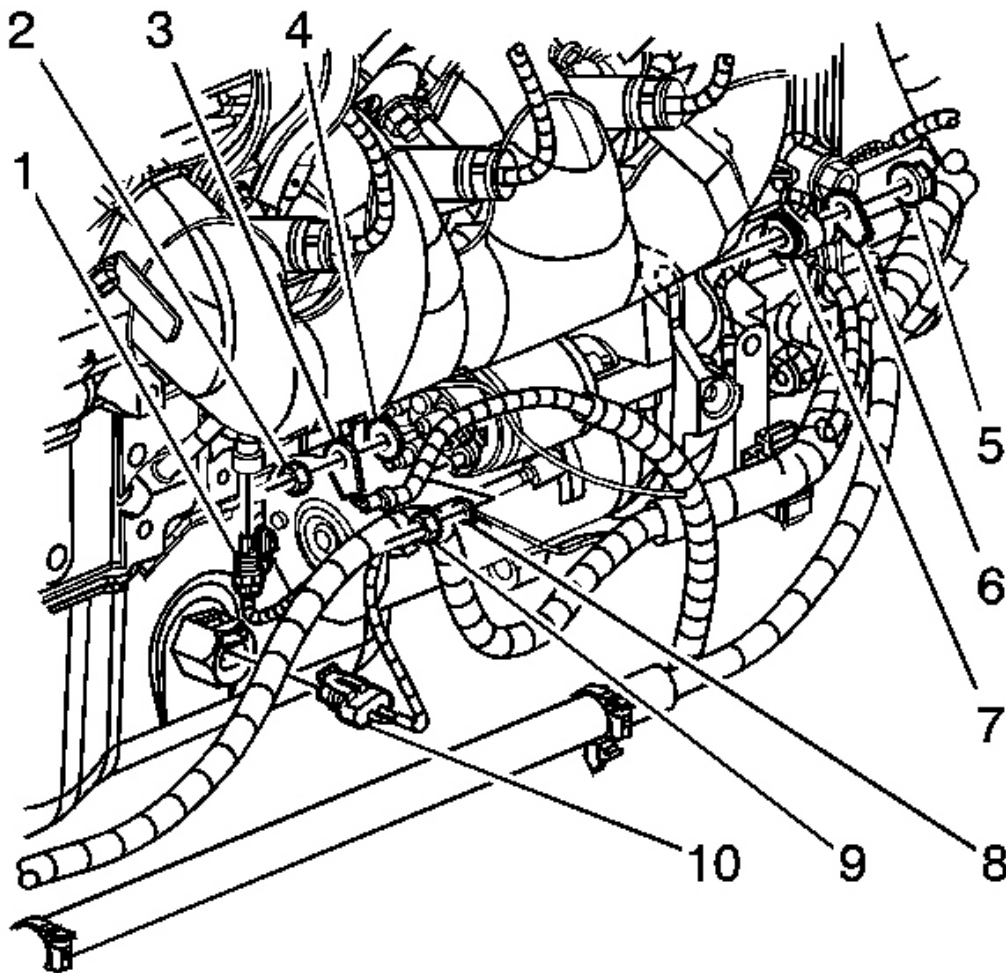


Fig. 38: View Of Engine Electrical Connectors (Left Side)
Courtesy of GENERAL MOTORS CORP.

11. Remove the positive battery cable nut (2) from the starter.
12. Remove the positive battery cable (3) from the starter motor BAT terminal.
13. Remove the transaxle stud nut (5).
14. Remove the engine ground cable (6) from the transaxle stud.
15. Unclip and remove the battery cable harness from the retainers.
16. Remove the battery cable harness from the vehicle.
17. Remove the negative battery cable from the wiring harness conduit.

Installation Procedure

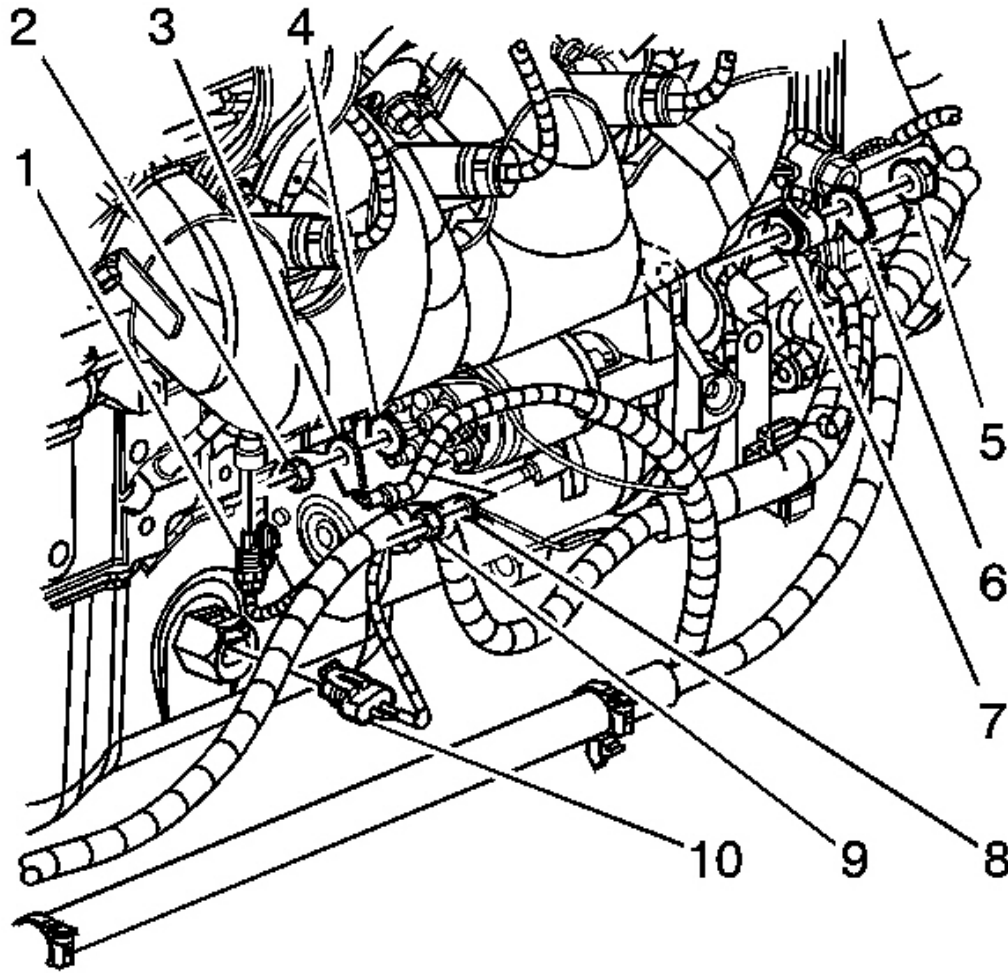


Fig. 39: View Of Engine Electrical Connectors (Left Side)
Courtesy of GENERAL MOTORS CORP.

1. Install the negative battery cable into the wiring harness conduit.
2. Install the battery cable harness to the vehicle.
3. Install the battery cable harness to the retainers.
4. Install the engine ground cable (6) to the transaxle stud.

NOTE: Refer to Fastener Notice .

5. Install the transaxle stud nut (5).

Tighten: Tighten the nut to 30 N.m (22 lb ft).

6. Install the positive battery cable to the starter motor BAT terminal.

7. Install the starter solenoid BAT terminal nut.

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

8. Install the front lower air deflector. Refer to **Radiator Air Lower Baffle and Deflector Replacement** .

9. Lower the vehicle.

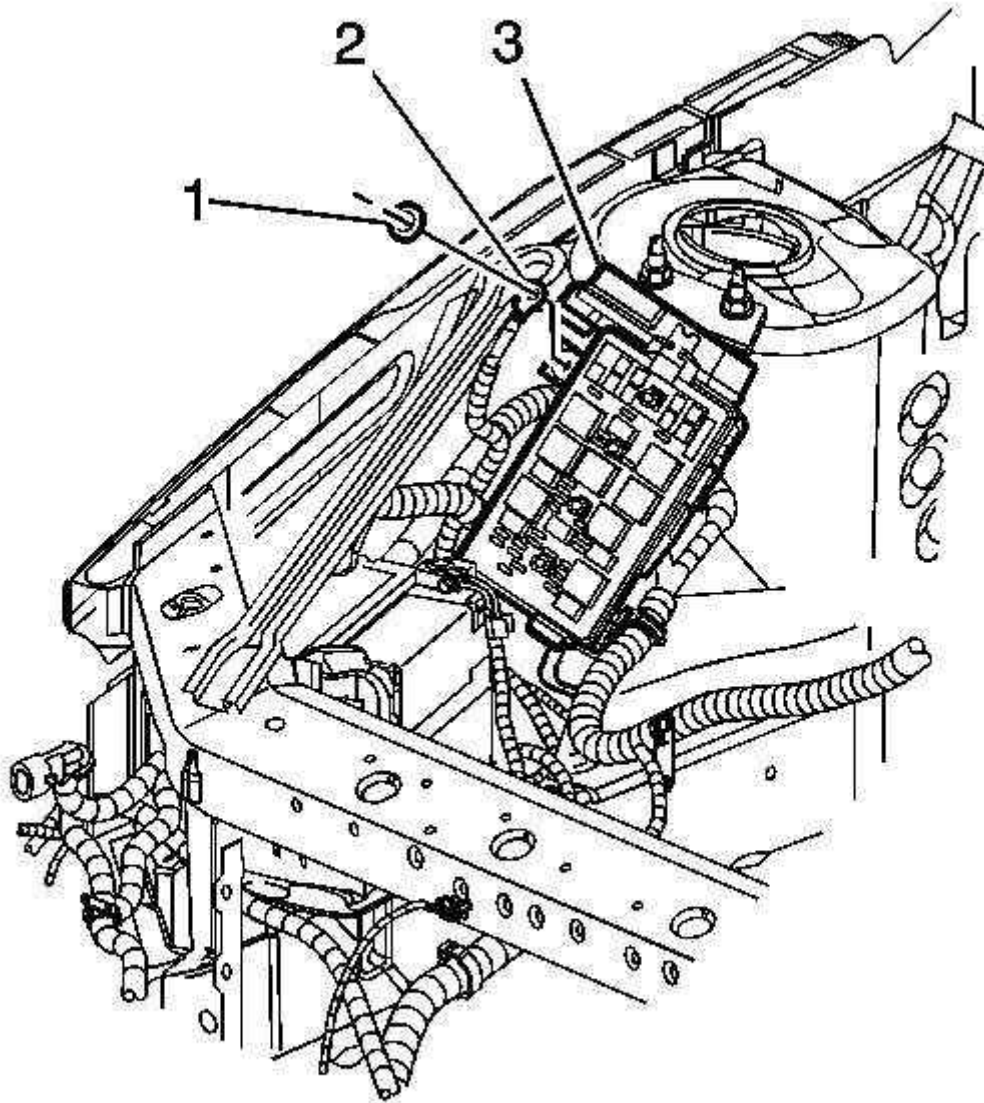


Fig. 40: Identifying Positive Battery Cable, Junction Block Lead Nut & Bussed Electrical Center
Courtesy of GENERAL MOTORS CORP.

10. Install the positive battery cable harness to the BEC.
11. Install the BEC to the strut tower.

12. Install the positive battery cable (2) to the BEC (3).
13. Install the positive battery cable junction block lead nut (1).

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

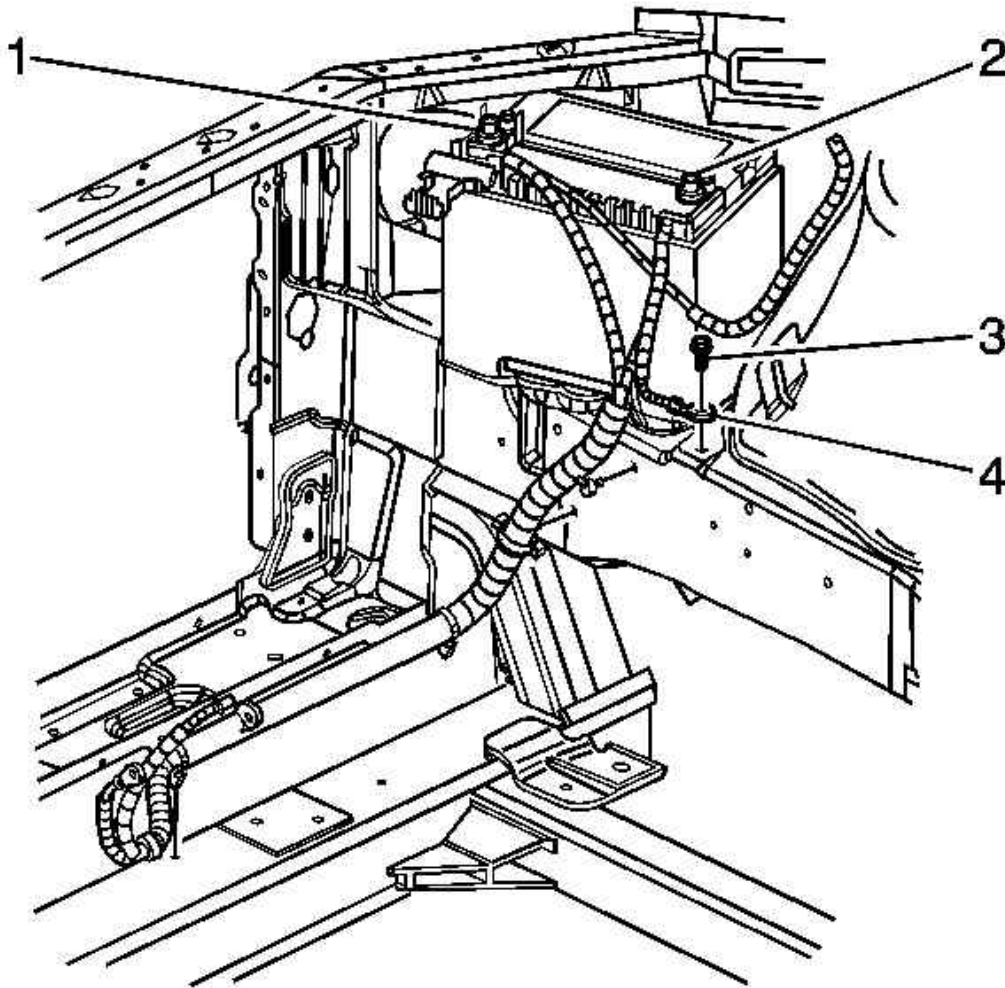


Fig. 41: Identifying Battery Terminals & Ground Wire
Courtesy of GENERAL MOTORS CORP.

14. Install the ground wire (4) and the bolt (3) to the frame.

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

15. Install the positive battery terminal (1) to the battery.

Tighten: Tighten the nut to 15 N.m (11 lb ft).

16. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.

BATTERY POSITIVE CABLE REPLACEMENT (LY7)

Removal Procedure

- IMPORTANT:**
- Always use replacement cables that are of the same type, diameter and length of the cables that you are replacing.
 - Always route the replacement cable the same as the original cable.

1. Disconnect the battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.

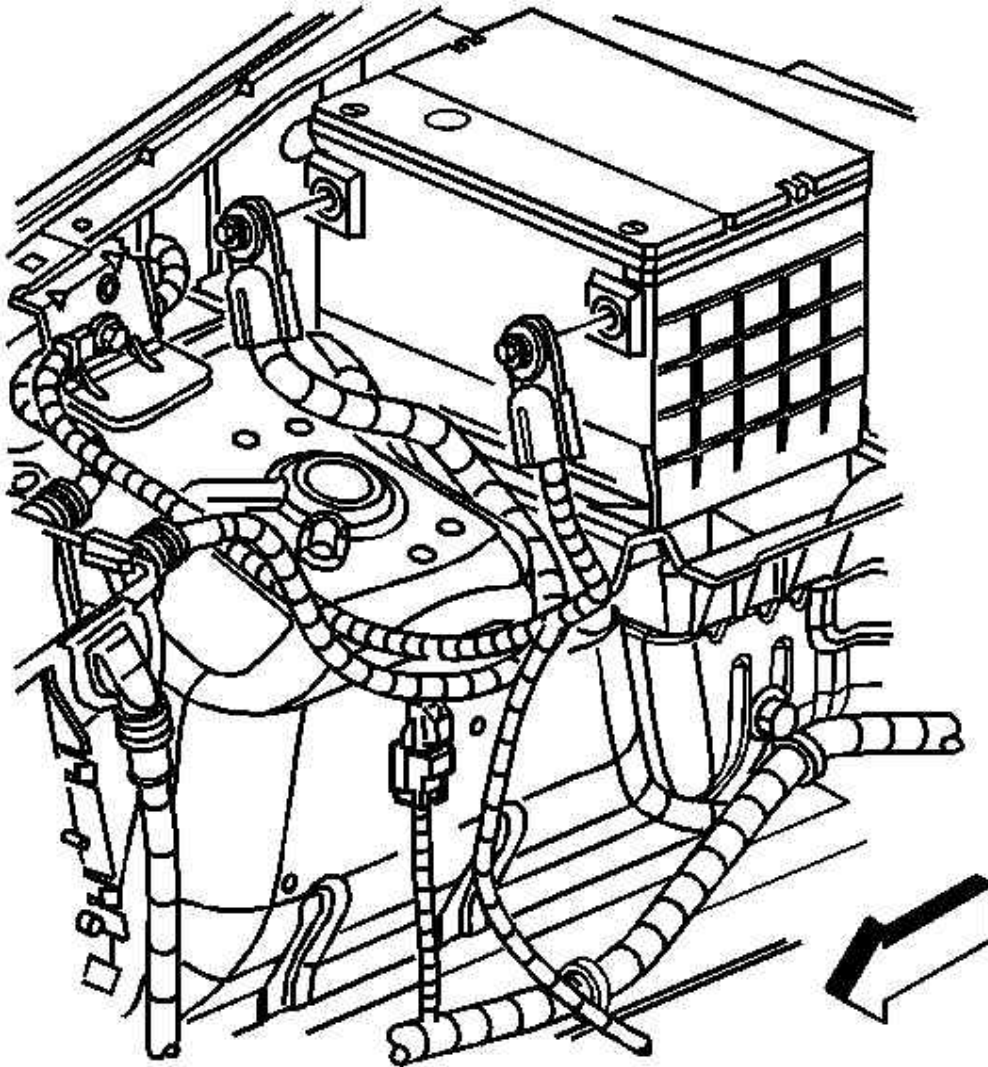


Fig. 42: View Of Battery Positive & Negative Cables
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the battery positive cable from the battery.

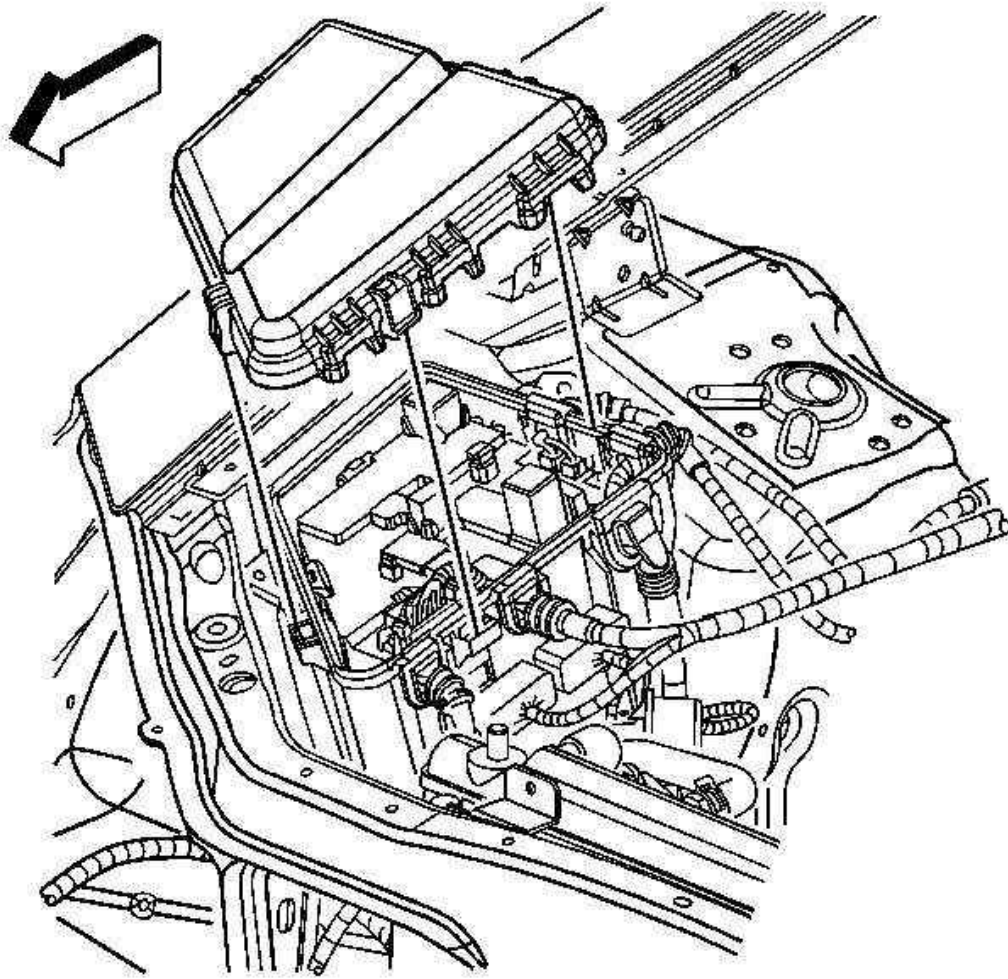


Fig. 43: View Of Underhood Fuse Box
Courtesy of GENERAL MOTORS CORP.

3. Depress the tabs in order to remove the cover from the electrical center.

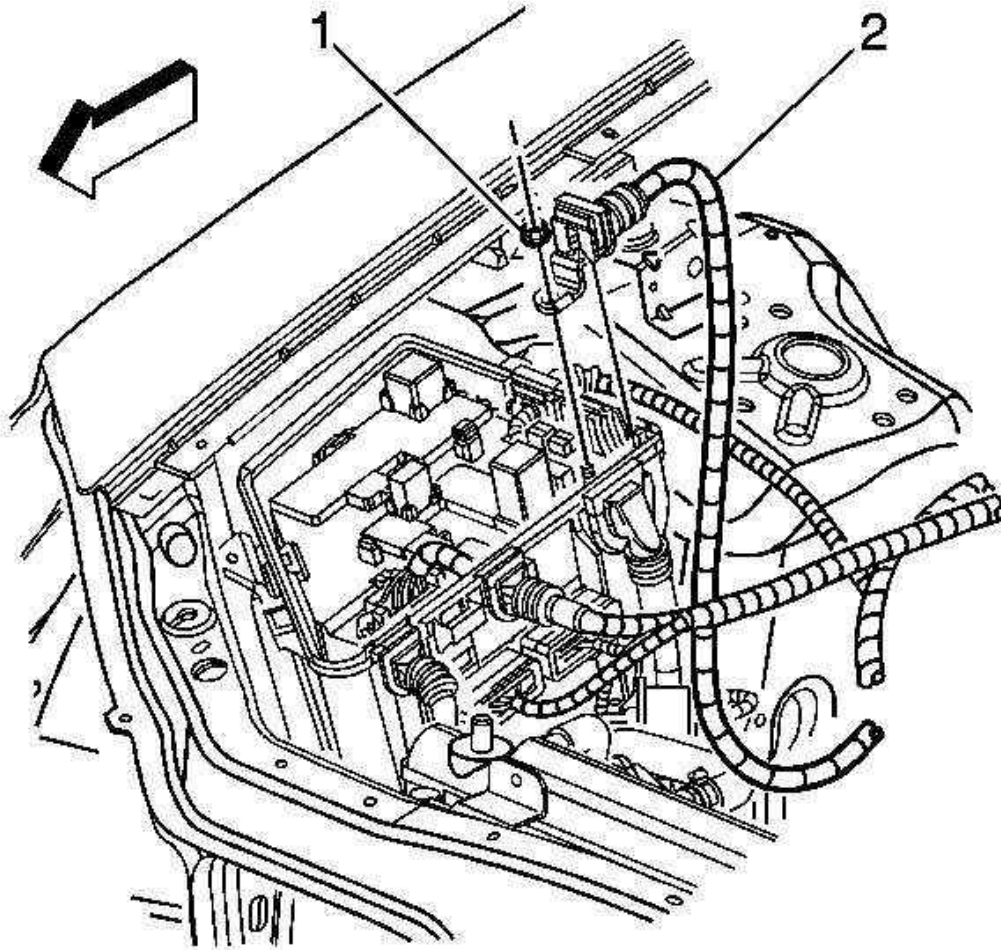


Fig. 44: Identifying Battery Positive Cable To Underhood Fuse Block
Courtesy of GENERAL MOTORS CORP.

4. Remove the nut (1) securing the battery positive cable (2) to the electrical center.

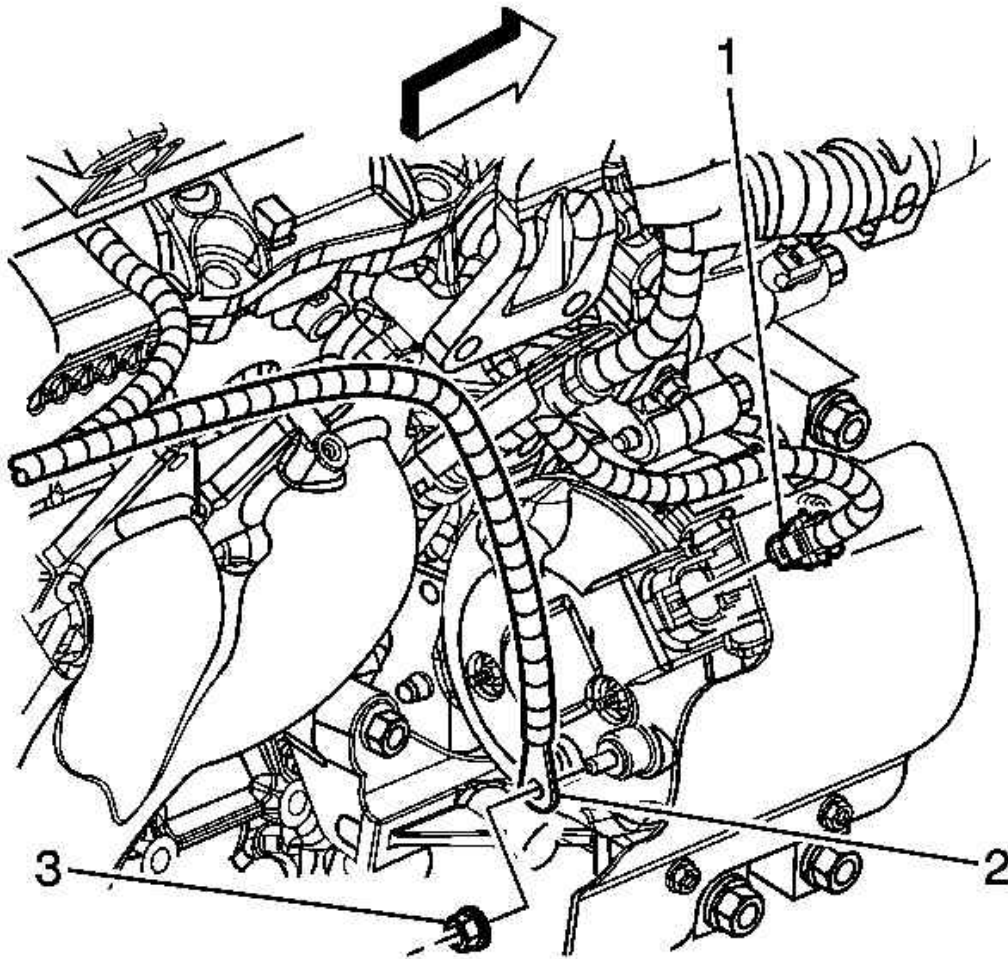


Fig. 45: View Of Battery Positive Lead & Generator BAT Terminal Nut
Courtesy of GENERAL MOTORS CORP.

5. Reposition the protective boot from the generator output BAT terminal for access.
6. Remove the generator output BAT terminal nut (3) and disconnect the battery positive lead (2) from the generator.

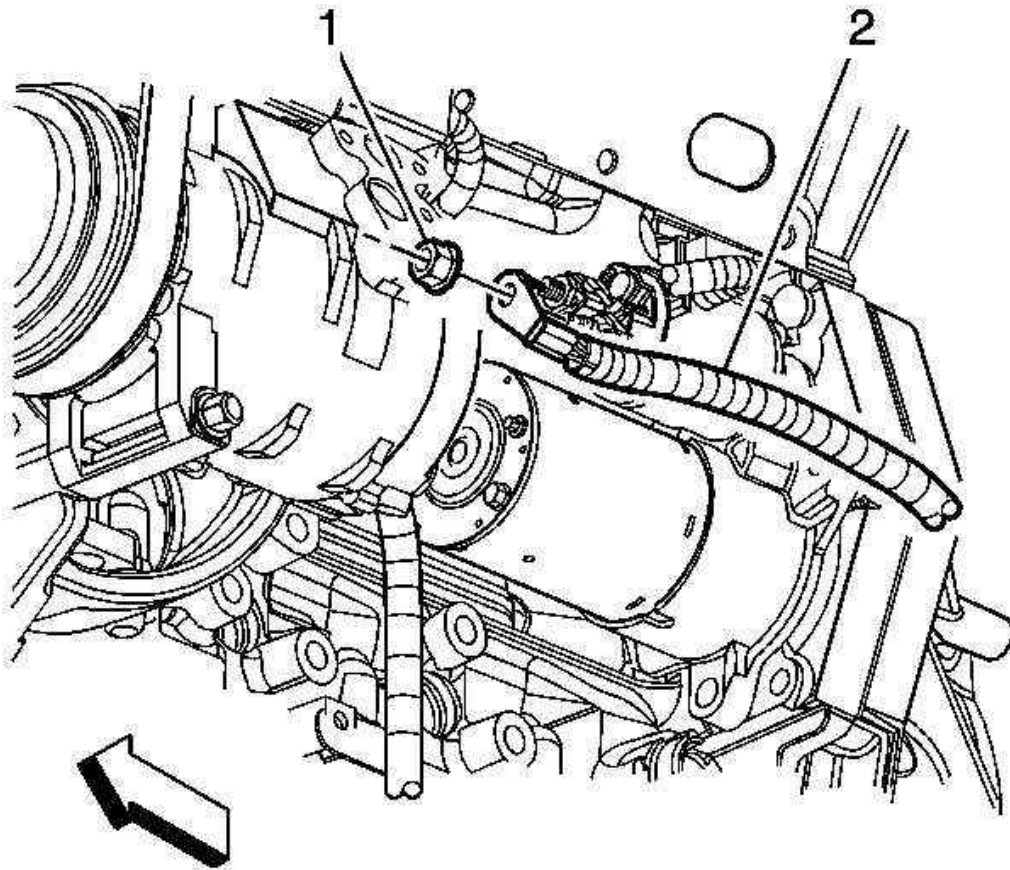


Fig. 46: View Of Starter Terminal Nut & Battery Positive Cable
Courtesy of GENERAL MOTORS CORP.

7. Remove the starter terminal nut (1) and disconnect the battery positive cable (2) from the starter.
8. Lower the vehicle.
9. Remove the battery positive cable from the engine.

Installation Procedure

1. Position the battery positive cable to the engine.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

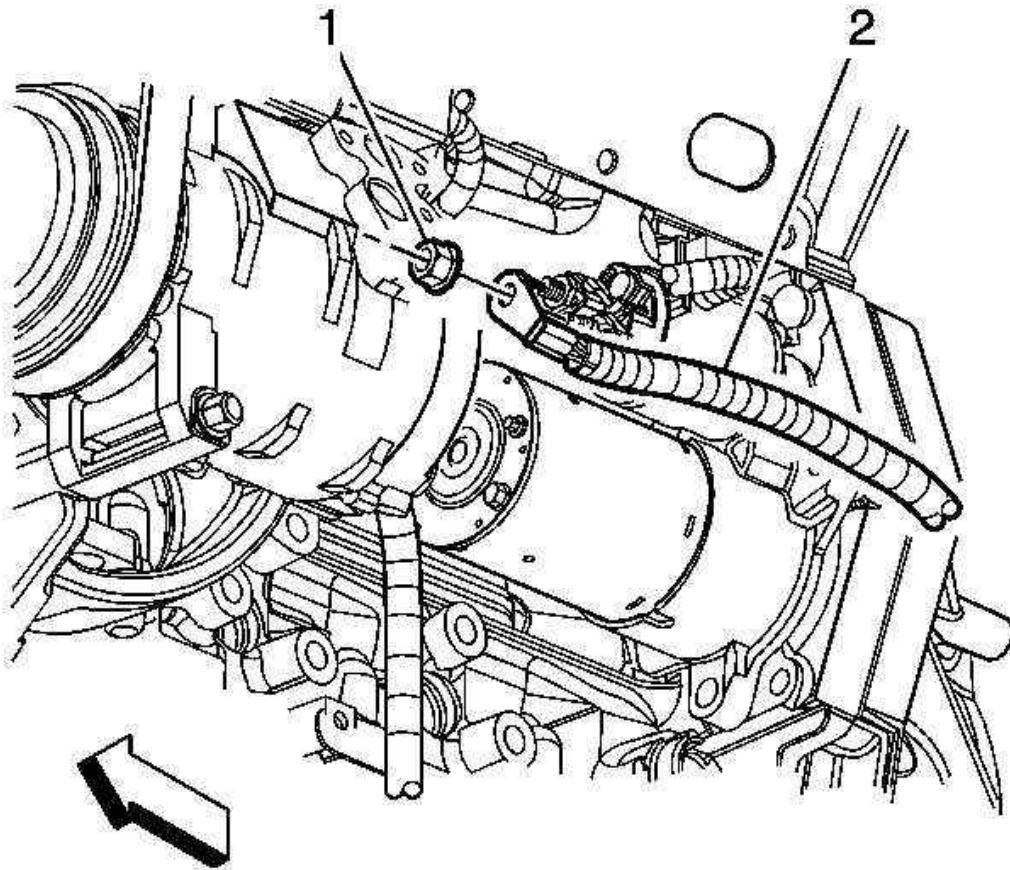


Fig. 47: View Of Starter Terminal Nut & Battery Positive Cable
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

3. Connect the battery positive cable (2) to the starter and install the starter terminal nut (1).

Tighten: Tighten the battery positive cable nut to 13 N.m (115 lb in).

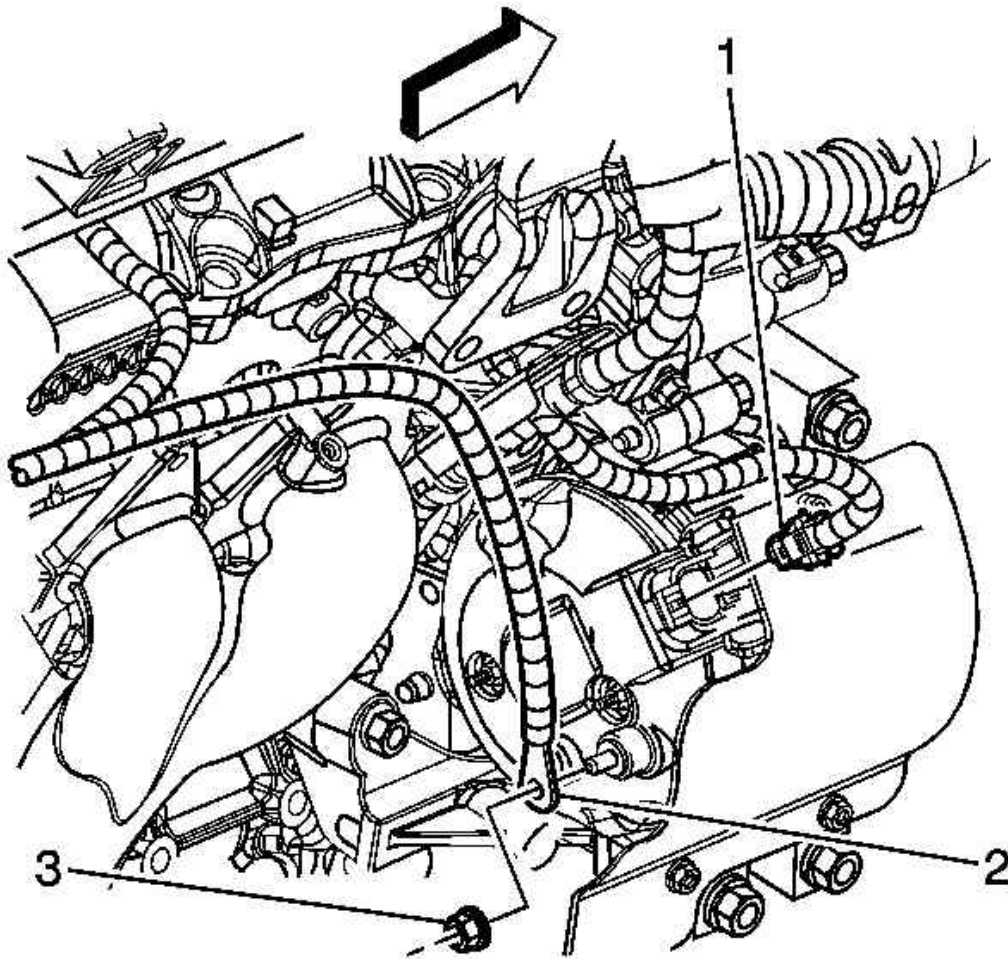


Fig. 48: View Of Battery Positive Lead & Generator BAT Terminal Nut
Courtesy of GENERAL MOTORS CORP.

4. Connect the battery positive lead (2) to the generator and install the generator BAT terminal nut (3).

Tighten: Tighten the generator BAT terminal nut to 13 N.m (115 lb in).

5. Install the protective boot to the generator output BAT terminal.
6. Lower the vehicle.

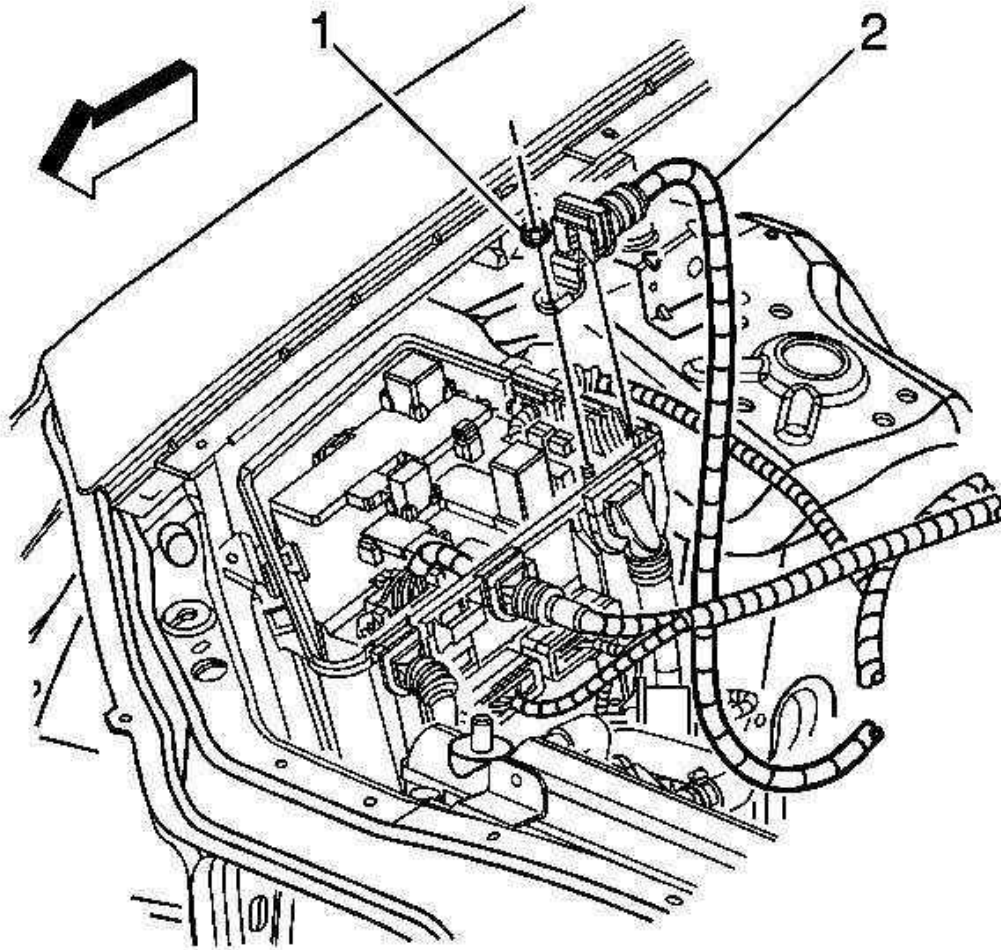


Fig. 49: Identifying Battery Positive Cable To Underhood Fuse Block
Courtesy of GENERAL MOTORS CORP.

7. Install the nut (1) securing the battery positive cable (2) to the electrical center.

Tighten: Tighten the battery positive cable to electrical center nut to 15 N.m (11 lb ft).

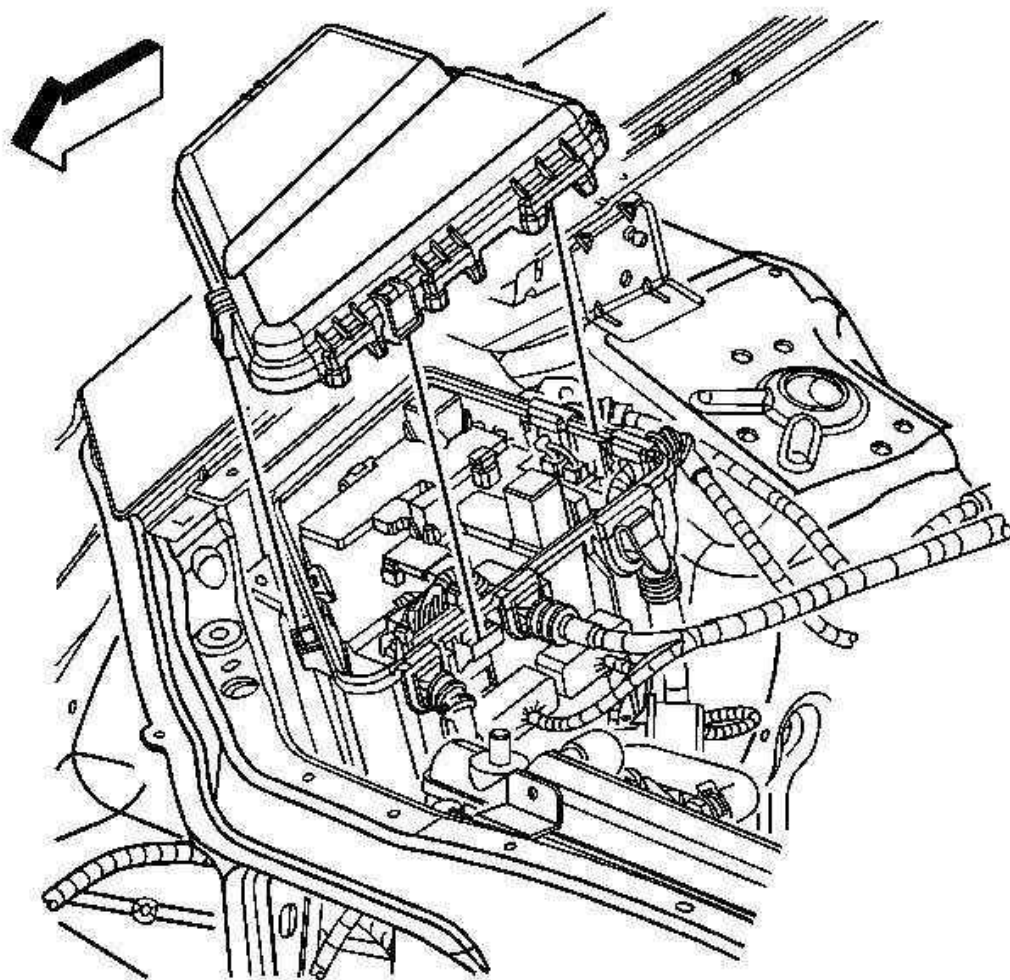


Fig. 50: View Of Underhood Fuse Box
Courtesy of GENERAL MOTORS CORP.

8. Install the electrical center cover.

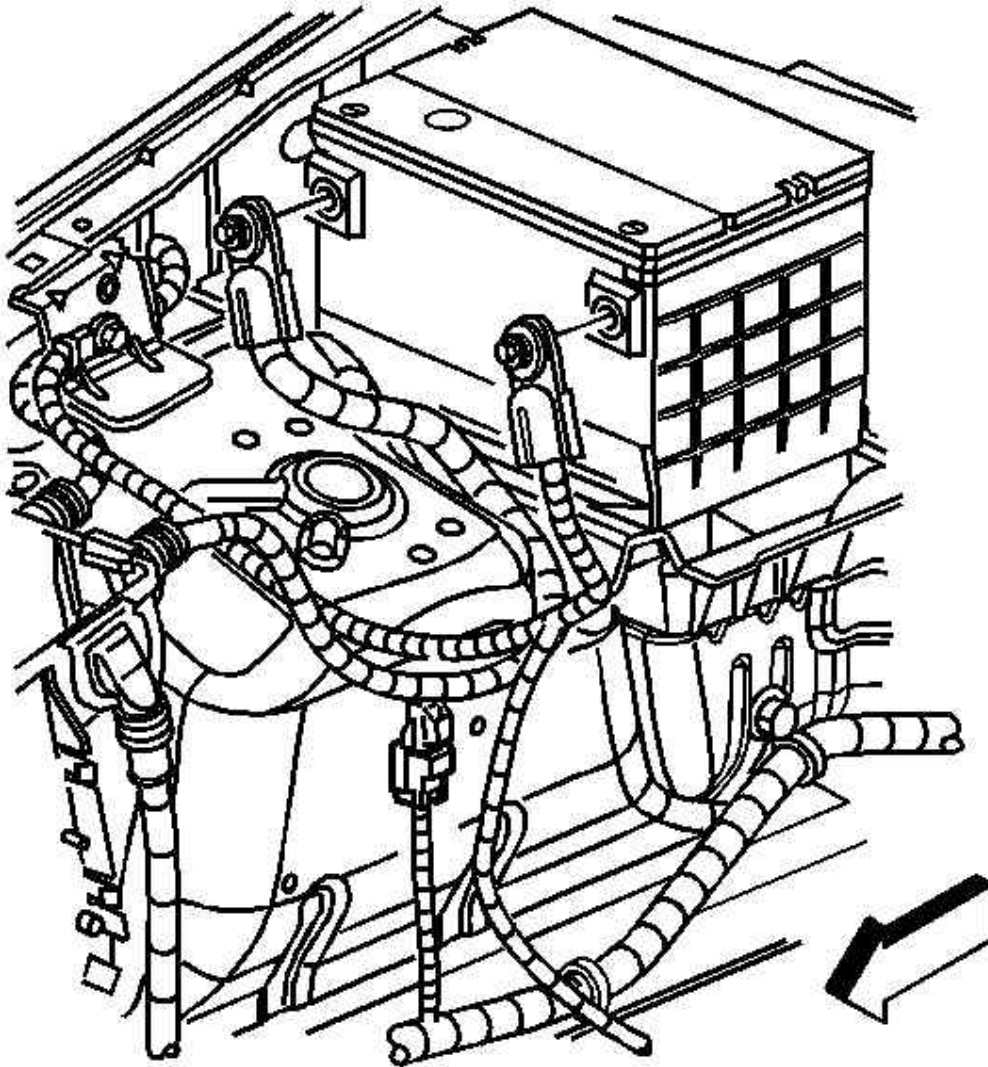


Fig. 51: View Of Battery Positive & Negative Cables
Courtesy of GENERAL MOTORS CORP.

9. Connect the battery positive cable to the battery.

Tighten: Tighten the battery cable to 17 N.m (13 lb ft).

10. Connect the battery negative cable. Refer to **Battery Negative Cable**

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Disconnection and Connection (L26) or Battery Negative Cable Disconnection and Connection (LY7) or Battery Negative Cable Disconnection and Connection (LS4).

BATTERY POSITIVE CABLE REPLACEMENT (L26)

Removal Procedure

IMPORTANT: When replacing battery cables be sure to use replacement cables that are the same type, gage and length.

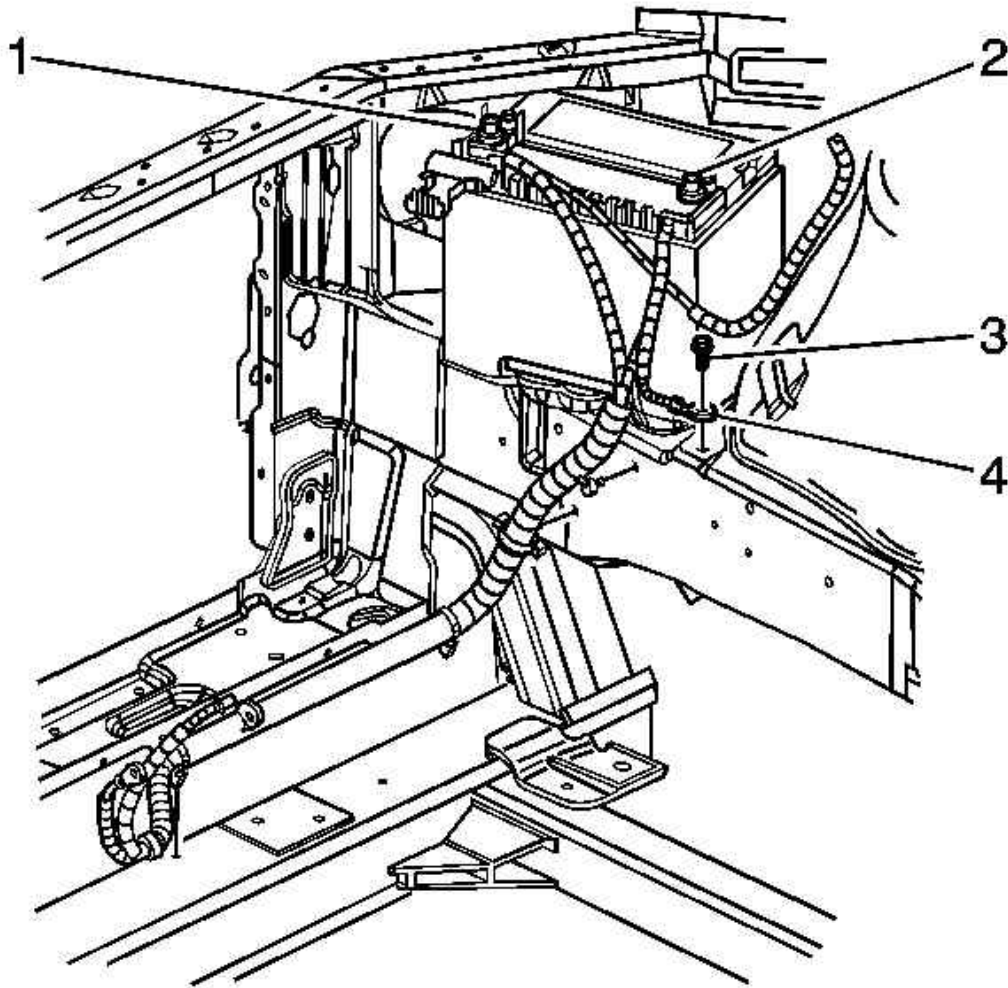


Fig. 52: Identifying Battery Terminals & Ground Wire
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.
2. Loosen the positive battery terminal nut.
3. Remove the positive battery terminal (1) from the battery.

4. Remove the ground wire bolt (3) and the wire (4) from the frame.

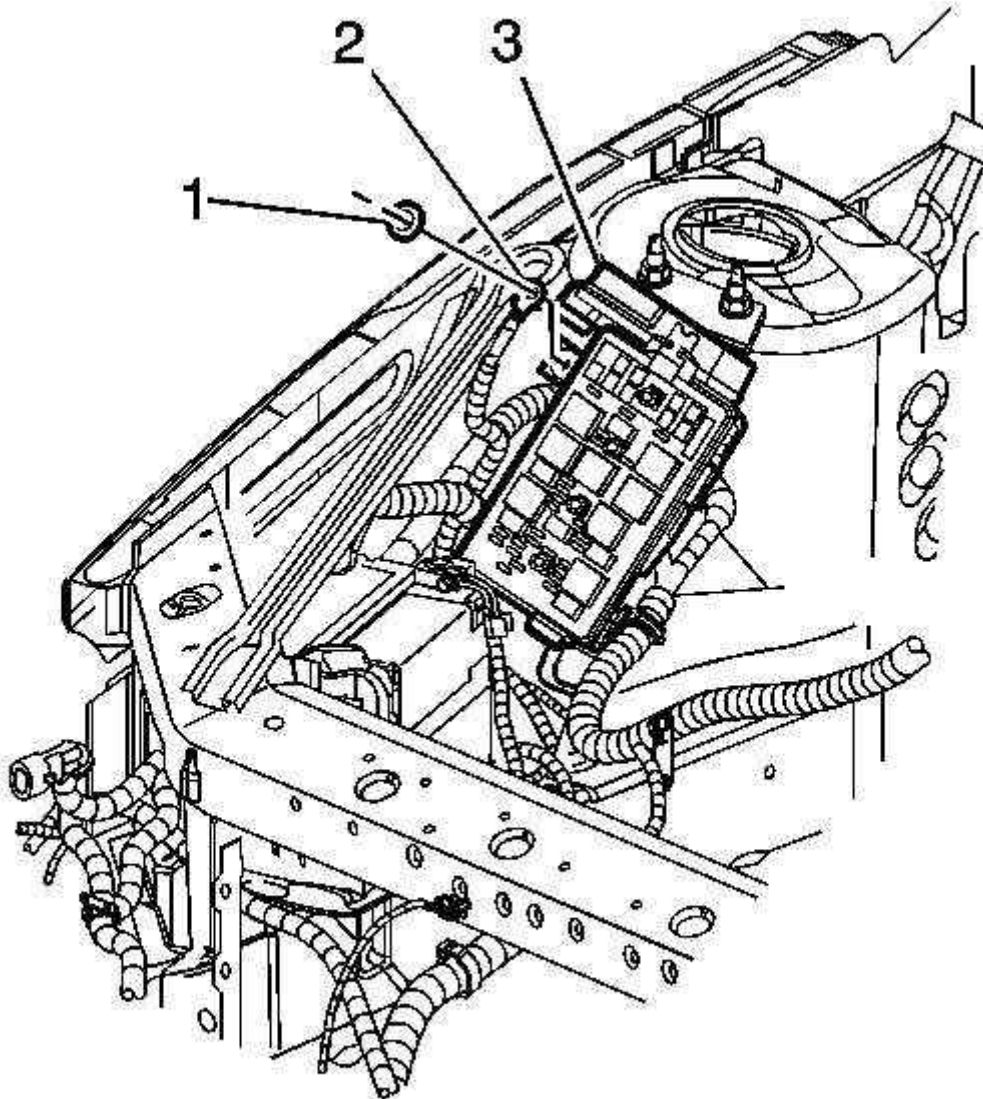


Fig. 53: Identifying Positive Battery Cable, Junction Block Lead Nut & Bussed Electrical Center
Courtesy of GENERAL MOTORS CORP.

5. Remove the positive battery cable junction block lead nut (1).
6. Remove the positive battery cable (2) from the bussed electrical center (BEC).
7. Remove the BEC (3) from the strut tower.
8. Unclip and remove the positive battery cable harness from the BEC.
9. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
10. Remove the front lower air deflector. Refer to **Radiator Air Lower Baffle and Deflector Replacement** .

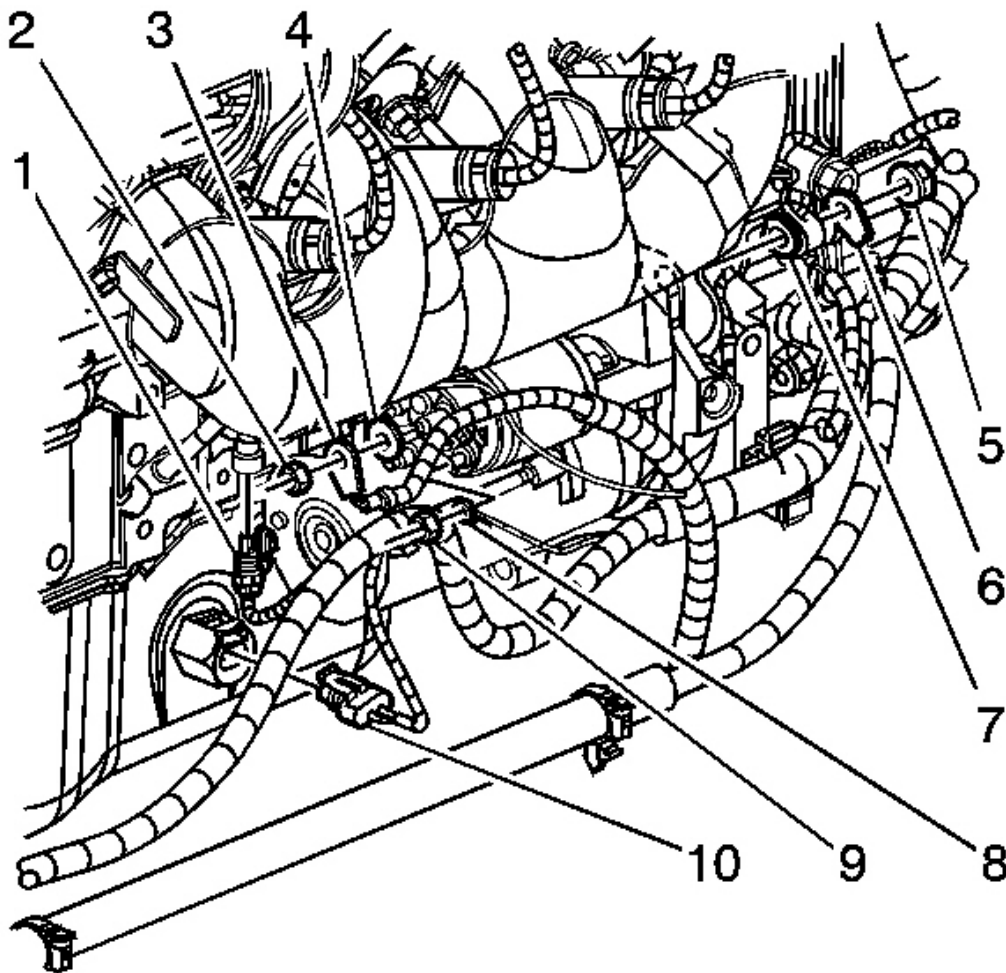


Fig. 54: View Of Engine Electrical Connectors (Left Side)
Courtesy of GENERAL MOTORS CORP.

11. Remove the positive battery cable nut (2) from the starter.
12. Remove the positive battery cable (3) from the starter motor BAT terminal.
13. Remove the transaxle stud nut (5).
14. Remove the engine ground cable (6) from the transaxle stud.
15. Unclip and remove the battery cable harness from the retainers.
16. Remove the battery cable harness from the vehicle.
17. Remove the positive battery cable from the wiring harness conduit.

Installation Procedure

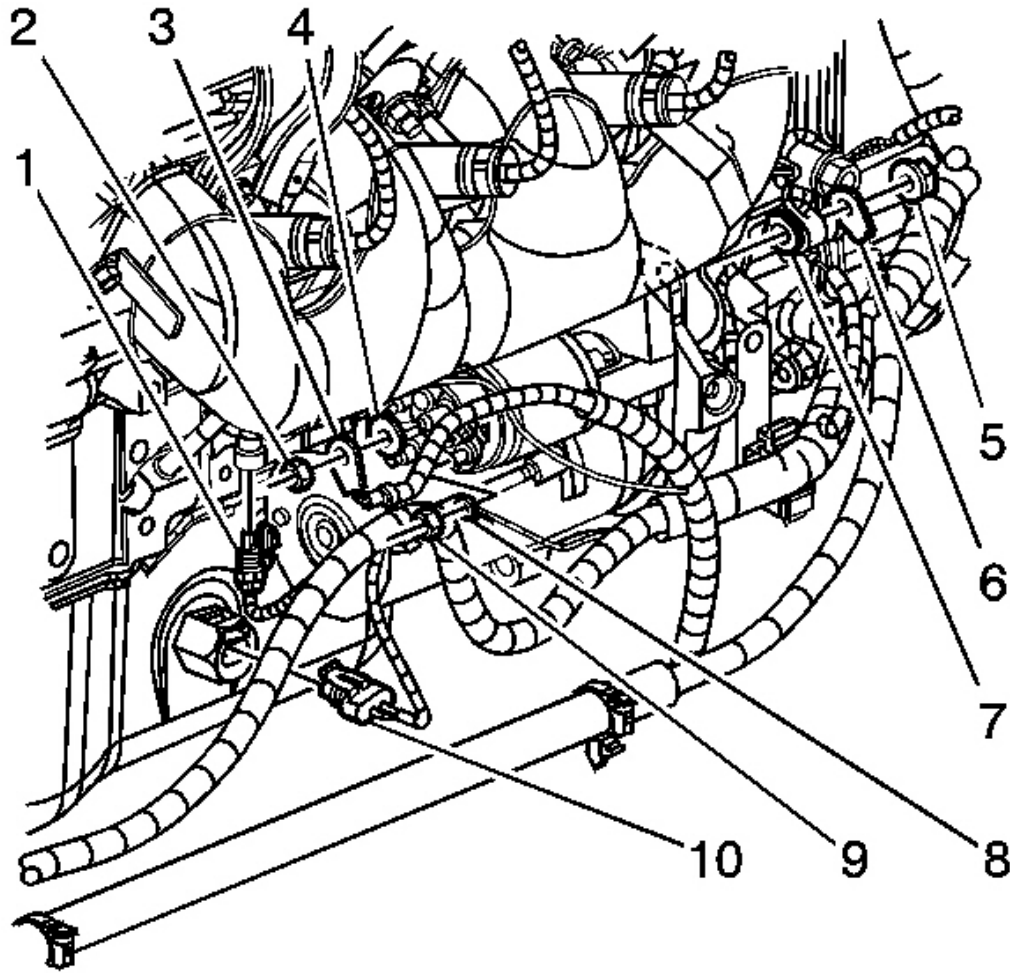


Fig. 55: View Of Engine Electrical Connectors (Left Side)
Courtesy of GENERAL MOTORS CORP.

1. Install the positive battery cable into the wiring harness conduit.
2. Install the battery cable harness to the vehicle.
3. Install the battery cable harness to the retainers.
4. Install the engine ground cable (6) to the transaxle stud.

NOTE: Refer to Fastener Notice .

5. Install the transaxle stud nut (5).

Tighten: Tighten the nut to 30 N.m (22 lb ft).

6. Install the positive battery cable to the starter motor BAT terminal.

7. Install the starter solenoid BAT terminal nut.

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

8. Install the front lower air deflector. Refer to **Radiator Air Lower Baffle and Deflector Replacement** .

9. Lower the vehicle.

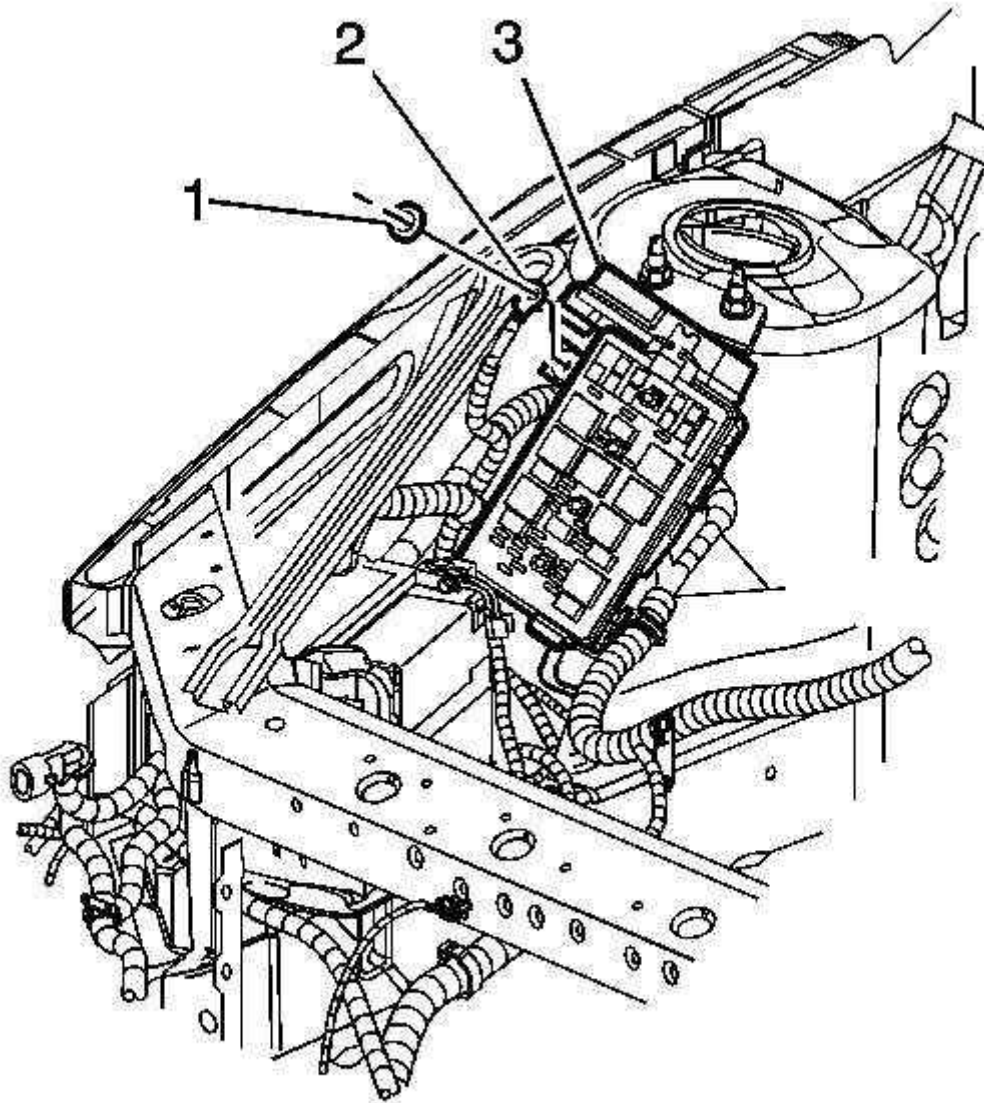


Fig. 56: Identifying Positive Battery Cable, Junction Block Lead Nut & Bussed Electrical Center
Courtesy of GENERAL MOTORS CORP.

10. Install the positive battery cable harness to the BEC.
11. Install the BEC to the strut tower.

12. Install the positive battery cable (2) to the BEC (3).
13. Install the positive battery cable junction block lead nut (1).

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

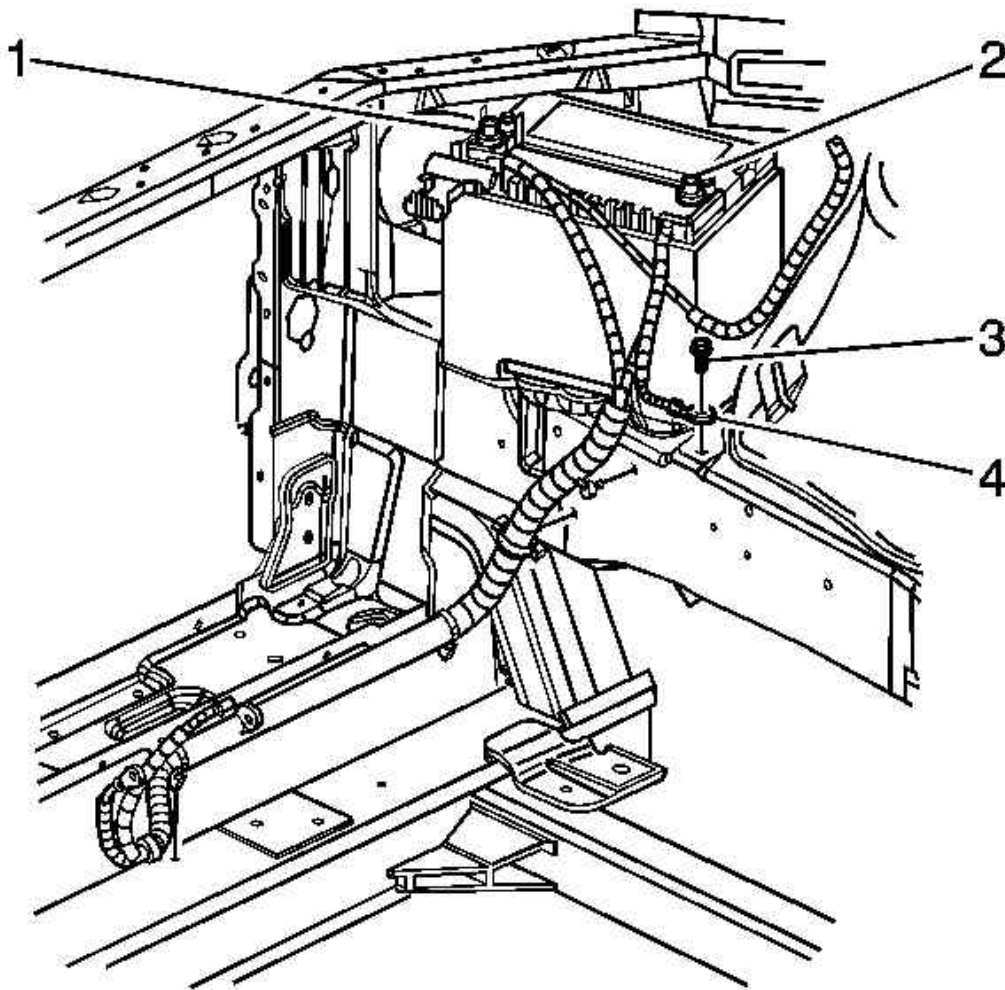


Fig. 57: Identifying Battery Terminals & Ground Wire
Courtesy of GENERAL MOTORS CORP.

14. Install the ground wire (4) and the bolt (3) to the frame.

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

15. Install the positive battery terminal (1) to the battery.

Tighten: Tighten the nut to 15 N.m (11 lb ft).

16. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.

BATTERY REPLACEMENT (LY7)

Removal Procedure

1. Disconnect the battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.

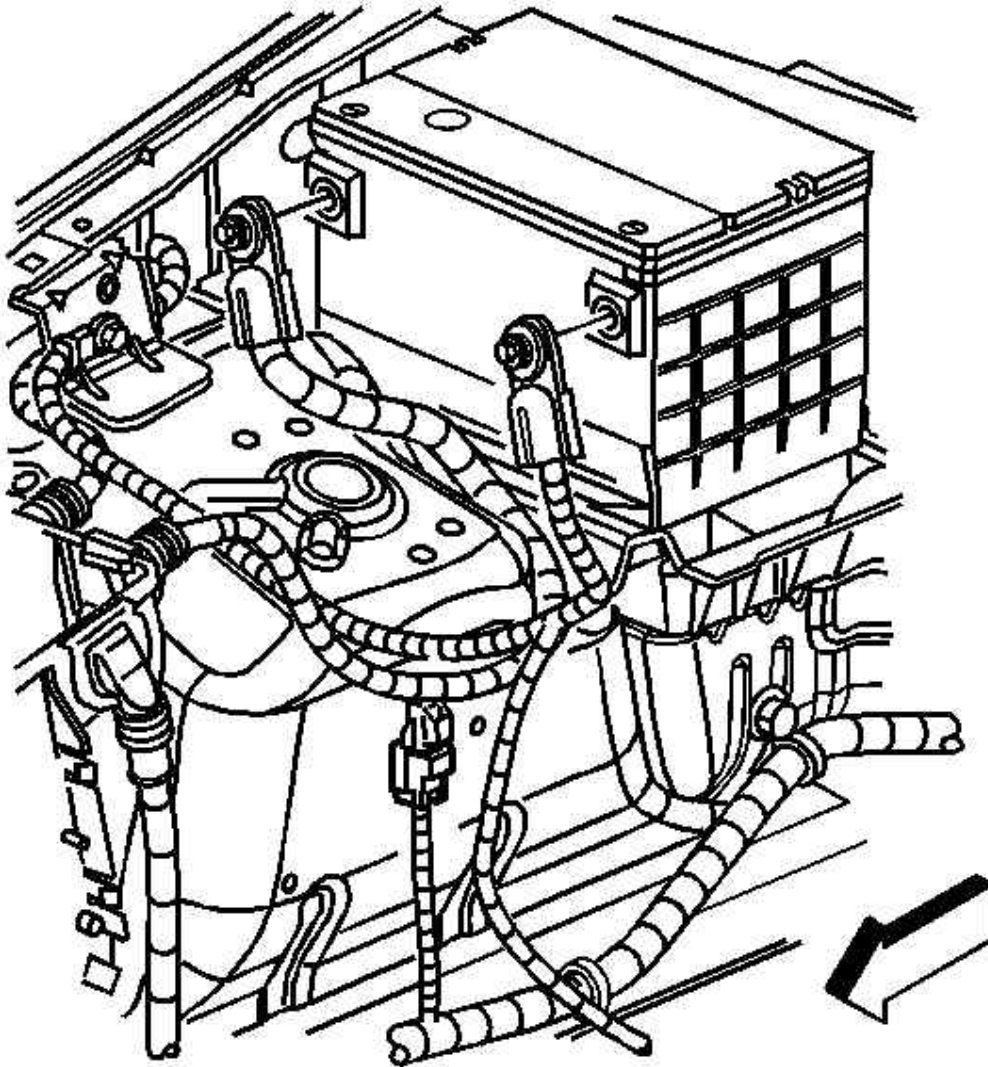


Fig. 58: View Of Battery Positive & Negative Cables
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the battery positive cable from the battery.

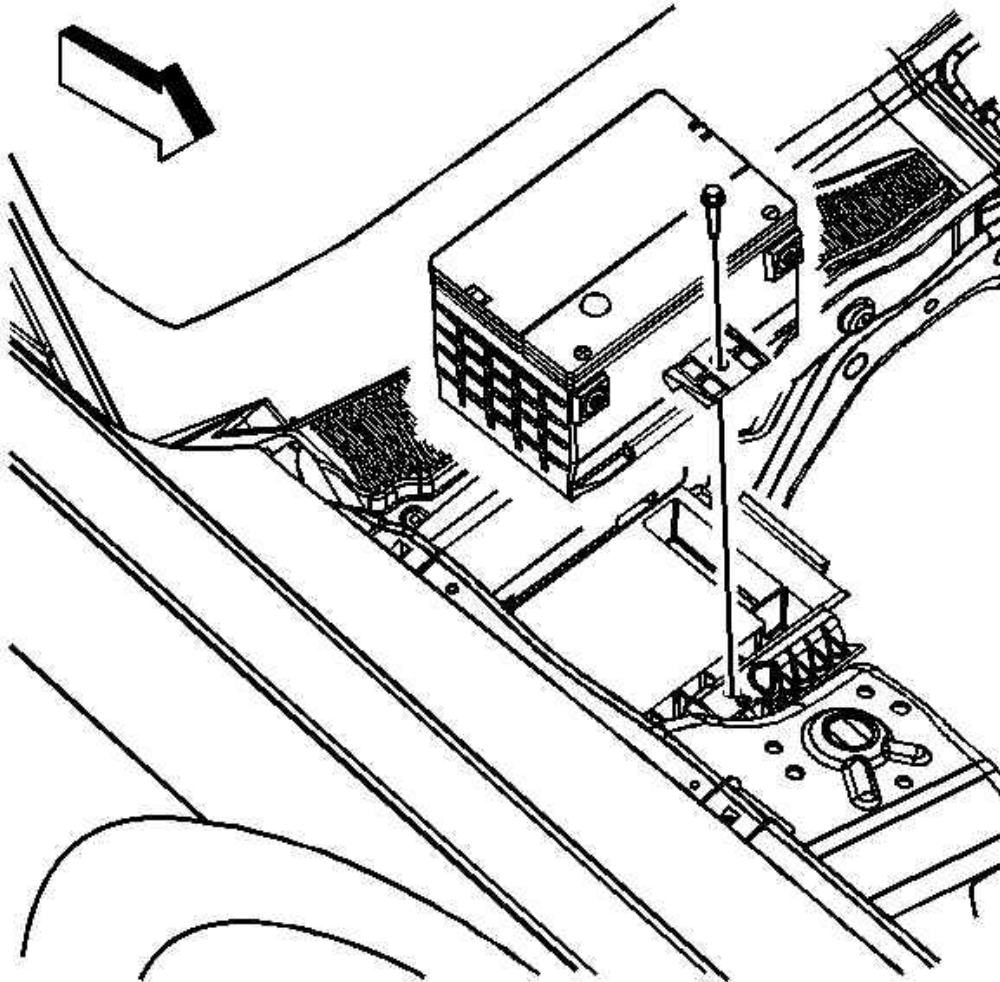


Fig. 59: Identifying Battery Tray & Bolt
Courtesy of GENERAL MOTORS CORP.

3. Remove the battery retainer bolt and battery retainer.
4. Remove the battery from the vehicle.
5. Remove the battery heat shield. Refer to **Battery Heat Shield Replacement (LY7)**.

1. Install the battery heat shield. Refer to **Battery Heat Shield Replacement (LY7)**.

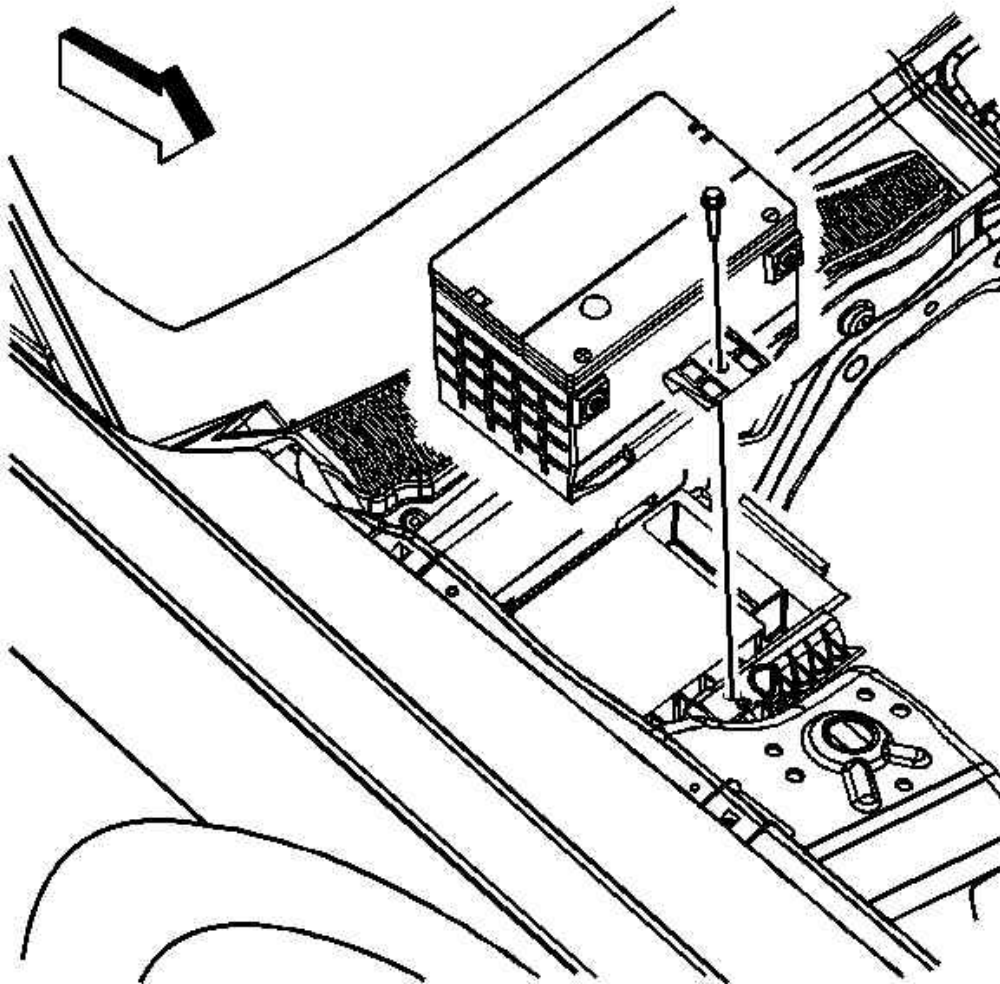


Fig. 60: Identifying Battery Tray & Bolt
Courtesy of GENERAL MOTORS CORP.

2. Install the battery into the vehicle.

NOTE: Refer to **Fastener Notice** .

3. Install the battery retainer and bolt.

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

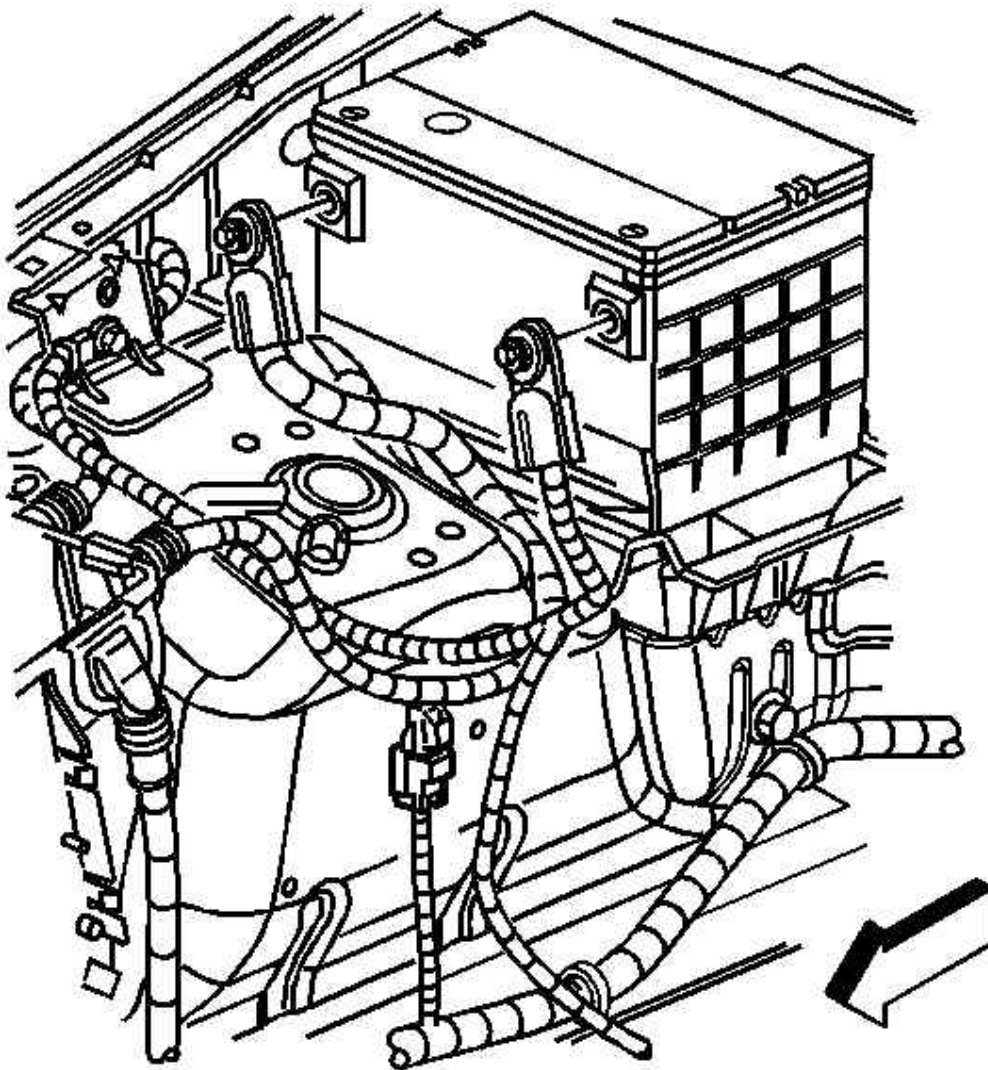


Fig. 61: View Of Battery Positive & Negative Cables
Courtesy of GENERAL MOTORS CORP.

4. Connect the battery positive cable to the battery.

Tighten: Tighten the battery cable bolt to 17 N.m (13 lb ft).

5. Connect the battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.

BATTERY REPLACEMENT (L26)

Removal Procedure

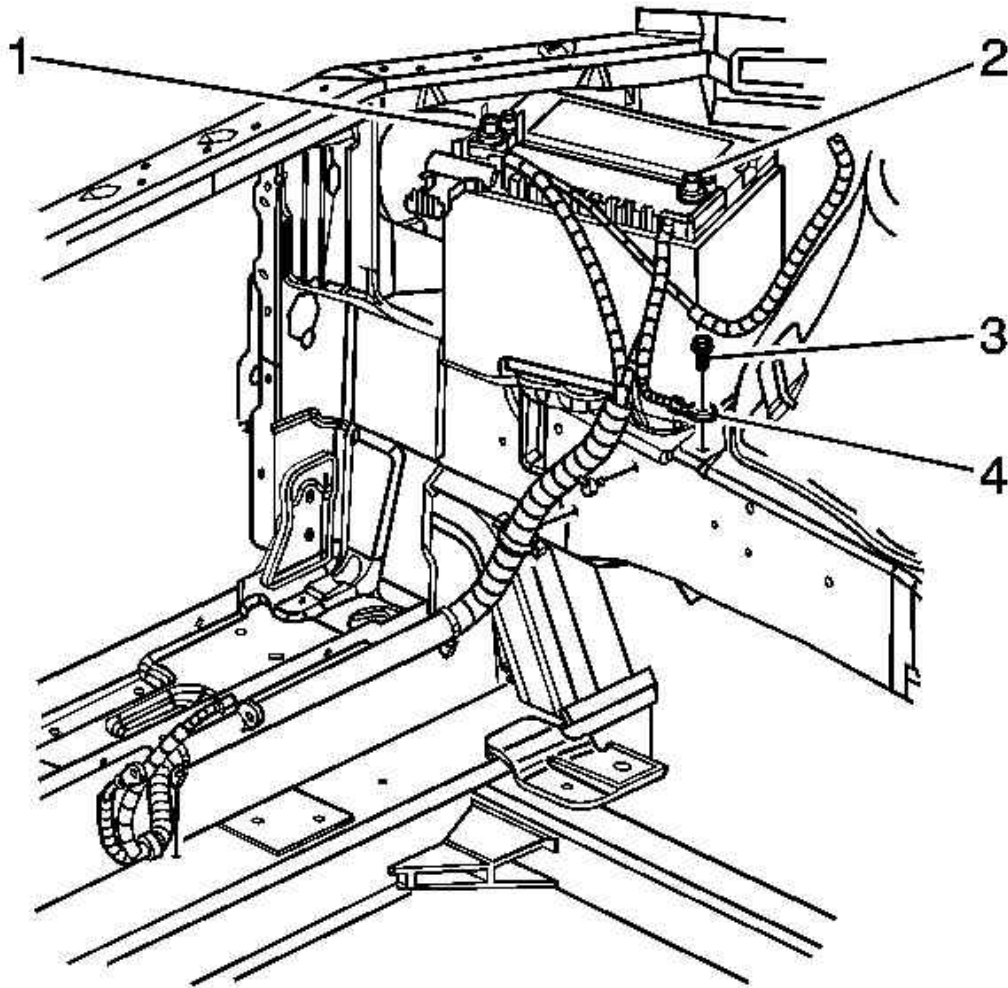


Fig. 62: Identifying Battery Terminals & Ground Wire
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.
2. Remove the right front diagonal brace. Refer to **Front Fender Upper Diagonal Brace Replacement** .

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3. Loosen the positive battery terminal nut.
4. Remove the positive battery terminal (1) from the battery.
5. Remove the battery hold down.

IMPORTANT: Do not tip the battery more than 40 degrees during removal.

6. Remove the battery.
7. Remove the insulator from the battery.

Installation Procedure

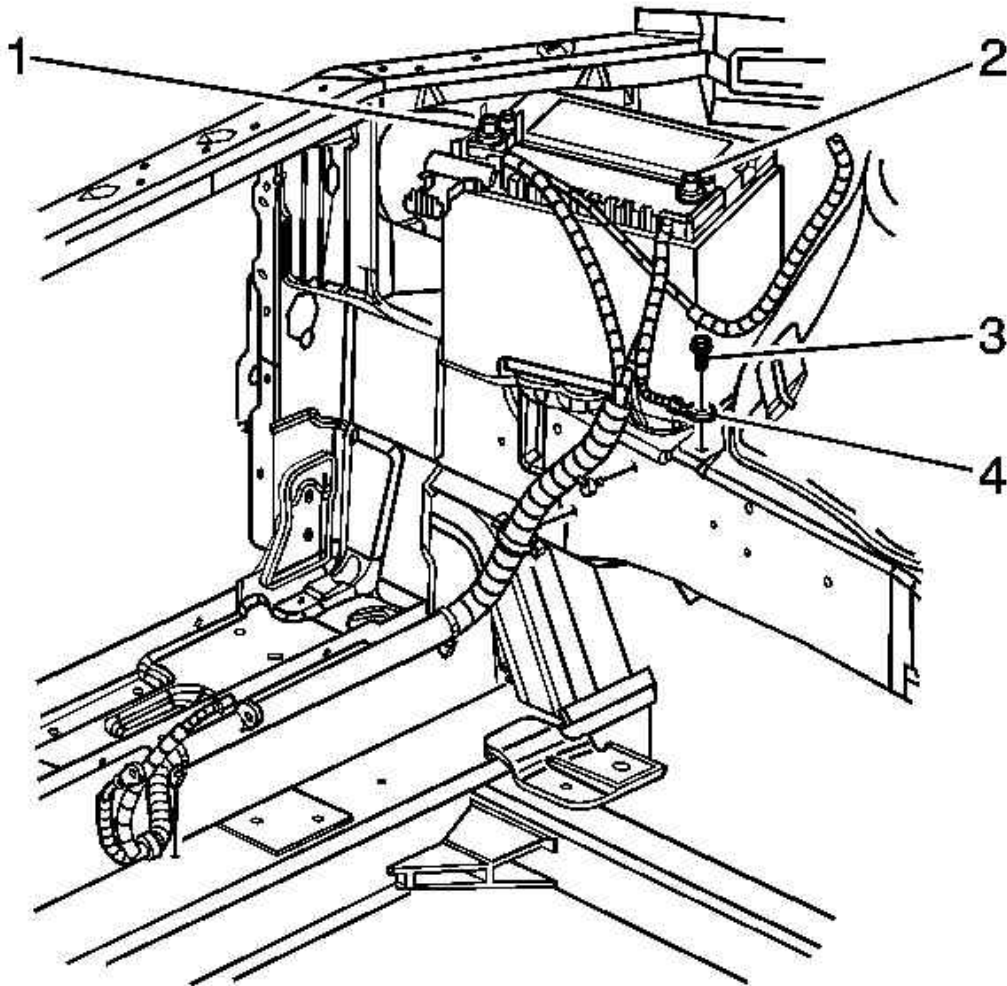


Fig. 63: Identifying Battery Terminals & Ground Wire
Courtesy of GENERAL MOTORS CORP.

1. Install the insulator to the battery.

IMPORTANT: Do not tip the battery more than 40 degrees during installation.

2. Install the battery.

3. Install the battery hold down.

NOTE: Refer to Fastener Notice .

4. Install the battery hold down bolt.

Tighten: Tighten the bolt to 18 N.m (13 lb ft).

5. Install the positive battery terminal (1) to the battery.

Tighten: Tighten the nut to 15 N.m (11 lb ft).

6. Install the right front diagonal brace. Refer to Front Fender Upper Diagonal Brace Replacement .
7. Connect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection (L26) or Battery Negative Cable Disconnection and Connection (LY7) or Battery Negative Cable Disconnection and Connection (LS4).

BATTERY REPLACEMENT (LS4)

Removal Procedure

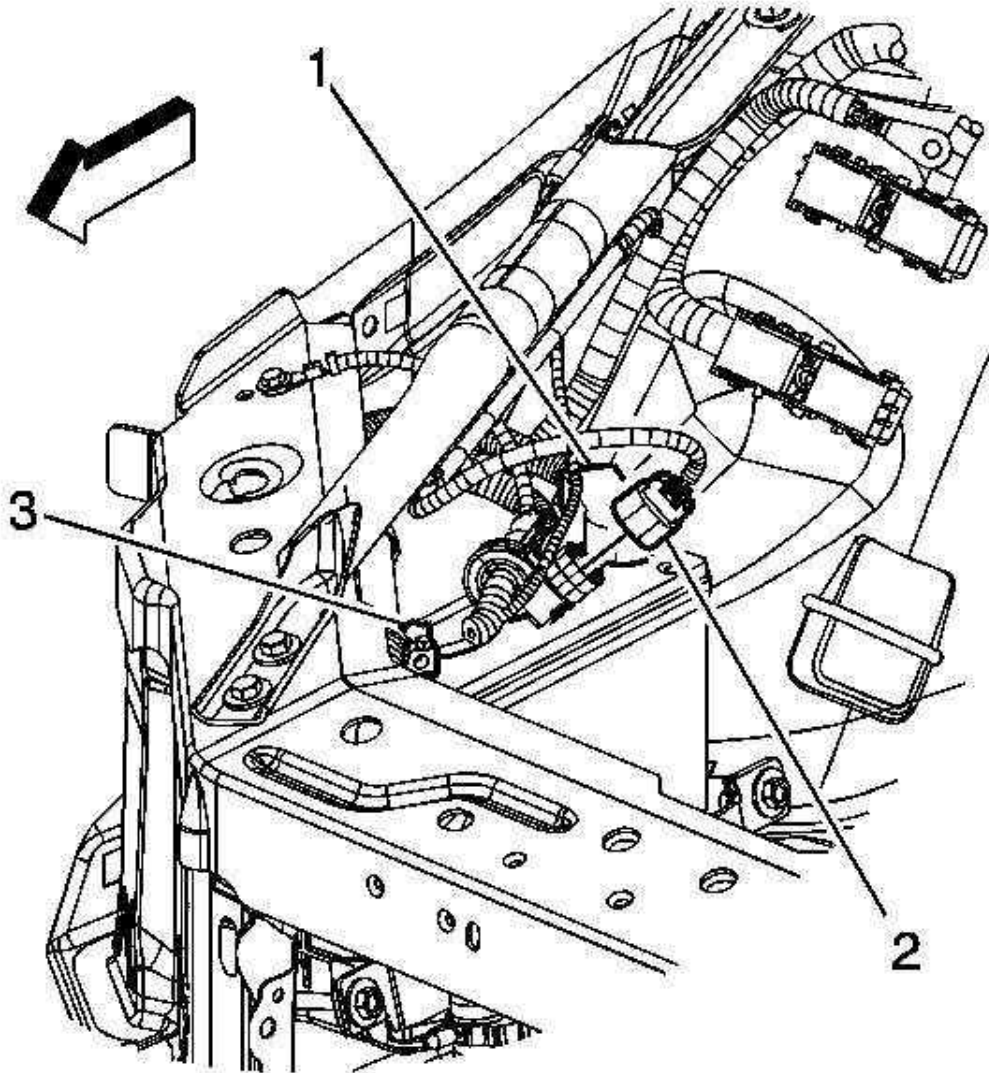


Fig. 64: Identifying Negative Battery Cable Terminal & Battery
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.

2. Remove the right front diagonal brace. Refer to **Front Fender Upper Diagonal Brace Replacement** .
3. Reposition the positive battery cable terminal cover (1).
4. Loosen the positive battery cable terminal nut.
5. Remove the positive battery cable terminal from the battery.
6. Reposition the underhood accessory wiring junction block. Refer to **Underhood Electrical Center or Junction Block Replacement** .

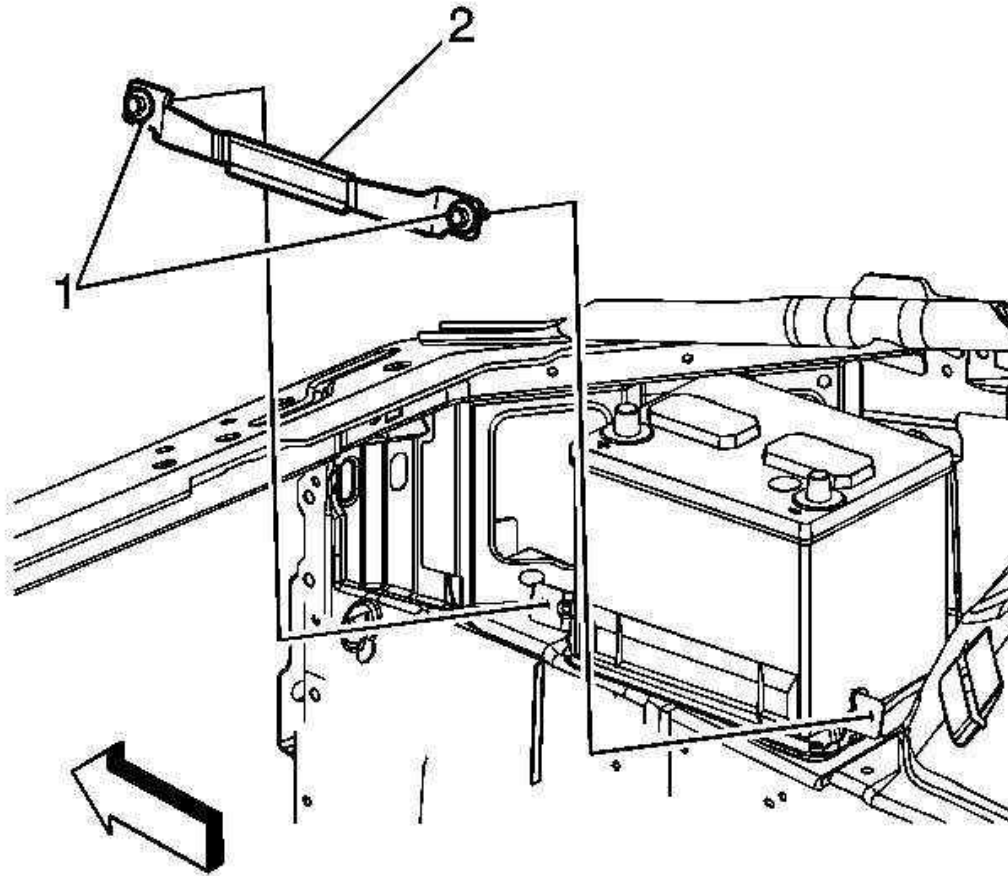


Fig. 65: View Of Battery Retainer & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Remove the battery retainer bolts (1) and retainer (2).
8. With the aid of an assistant, remove the battery.

Installation Procedure

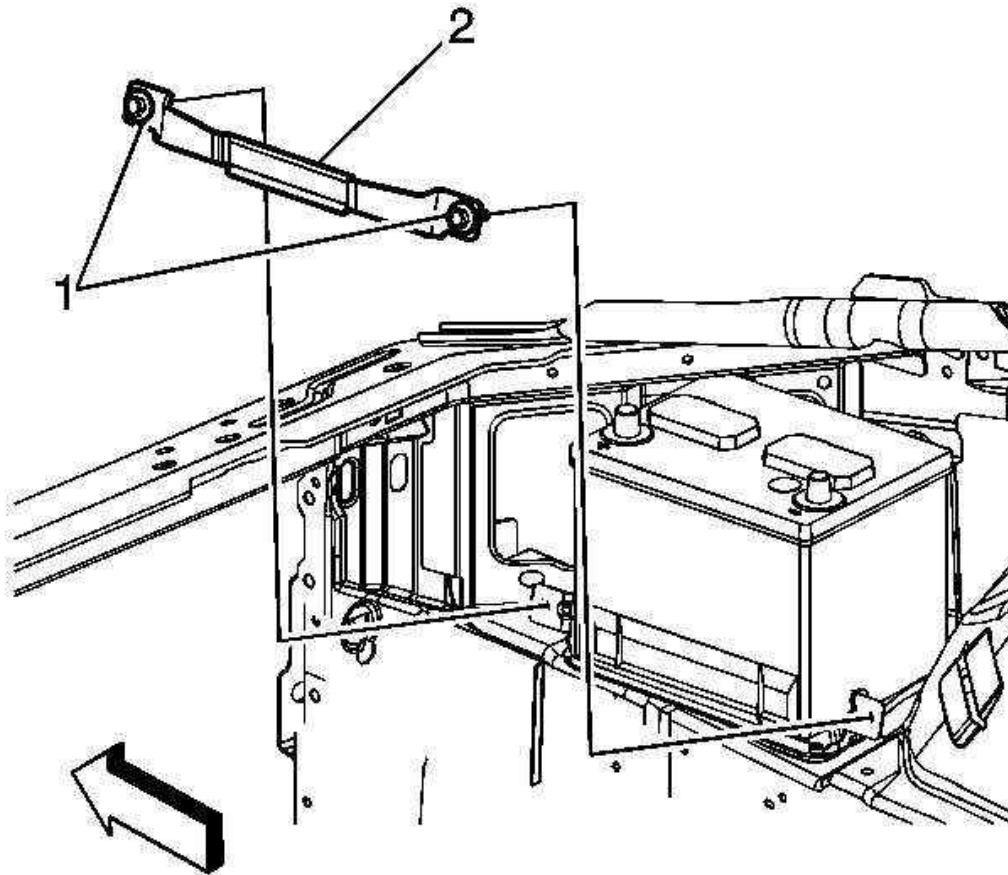


Fig. 66: View Of Battery Retainer & Bolts
Courtesy of GENERAL MOTORS CORP.

1. With the aid of an assistant, install the battery.
2. Install the underhood accessory wiring junction block. Refer to **Underhood Electrical Center or Junction Block Replacement** .

NOTE: Refer to Fastener Notice .

3. Install the battery retainer (2) and bolts (1).

Tighten: Tighten the bolts to 18 N.m (13 lb ft).

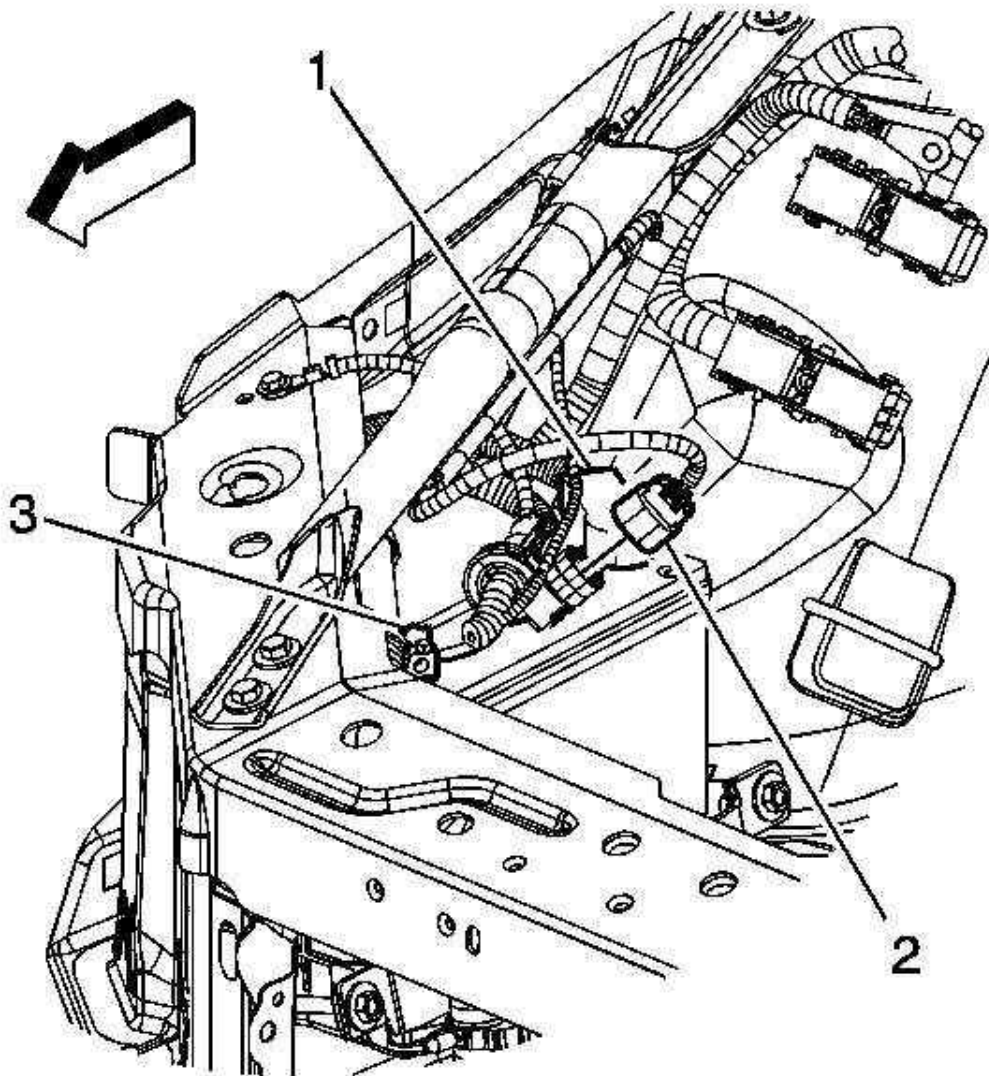


Fig. 67: Identifying Negative Battery Cable Terminal & Battery

Courtesy of GENERAL MOTORS CORP.

4. Install the positive battery cable terminal to the battery.
5. Tighten the positive battery cable terminal nut.

Tighten: Tighten the nut to 15 N.m (11 lb ft).

6. Position the positive battery cable terminal cover (2).
7. Install the right front diagonal brace. Refer to **Front Fender Upper Diagonal Brace Replacement** .
8. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.

BATTERY TRAY REPLACEMENT (LY7)

Removal Procedure

1. Remove the battery. Refer to **Battery Replacement (LY7)** or **Battery Replacement (L26)** or **Battery Replacement (LS4)**.
2. Remove the right air inlet grill panel only. Refer to **Air Inlet Grille Panel Replacement** .

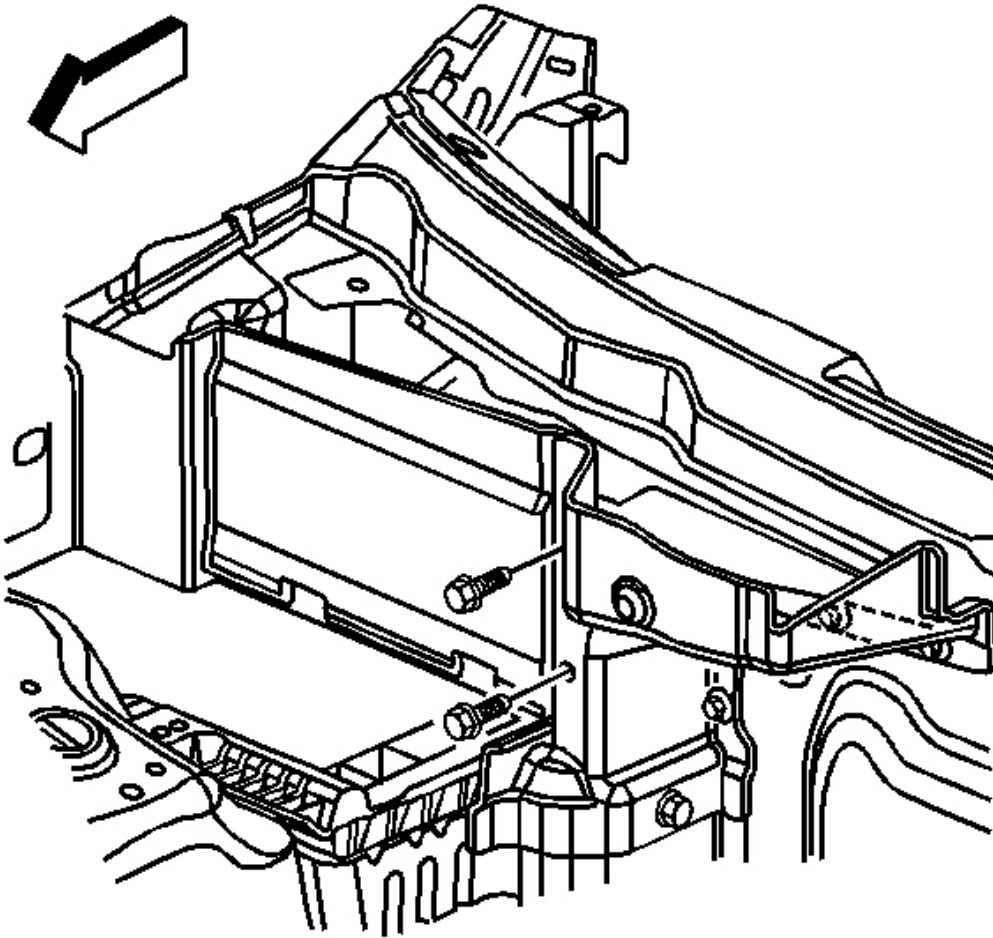


Fig. 68: Identifying Bolts To Front Air Inlet Panel Assembly To Battery Tray

Courtesy of GENERAL MOTORS CORP.

3. Remove the 2 bolts securing the front air inlet panel assembly to the battery tray.

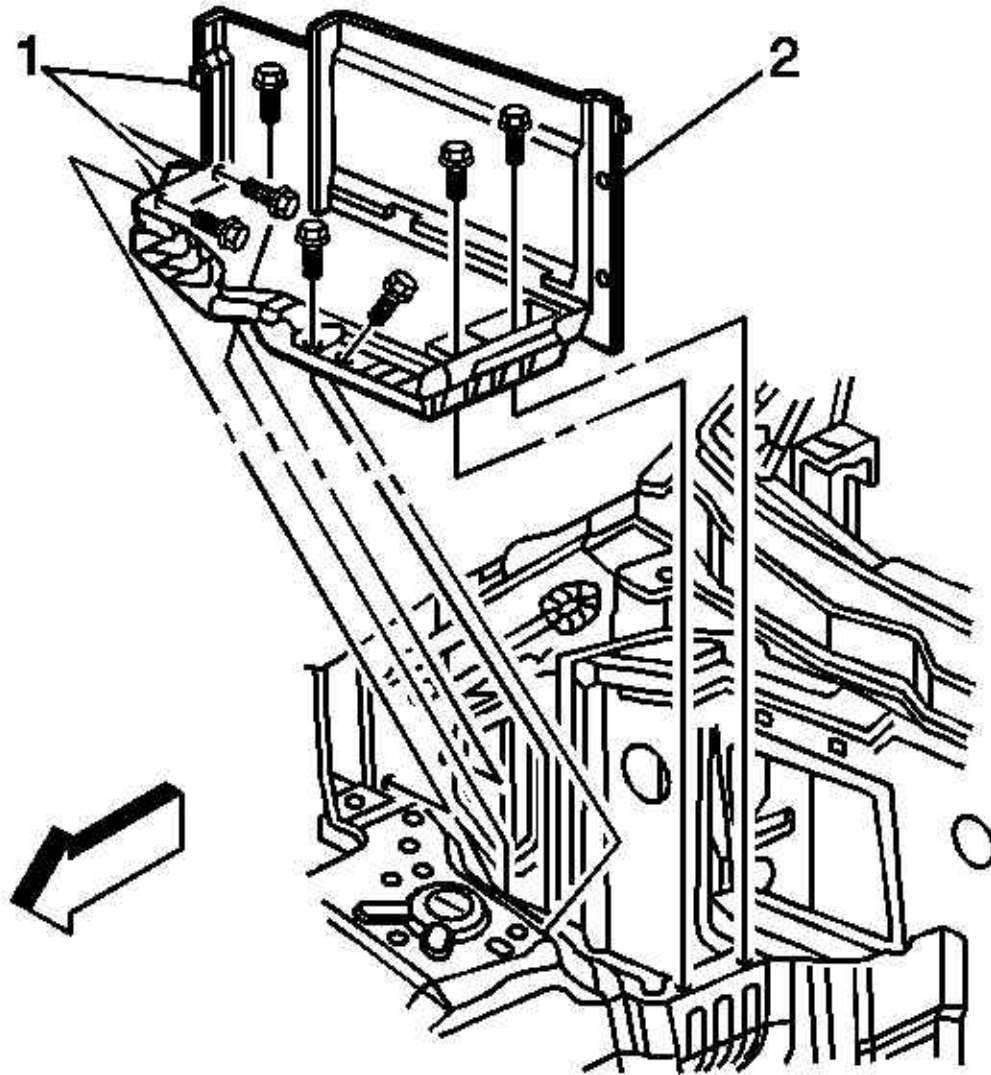


Fig. 69: View Of Battery Tray & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

4. Remove the battery tray bolts from the following:
 - The inner fender panel
 - The shock tower

- The lower air inlet panel assembly
5. Remove the battery tray (2) from the vehicle.

Installation Procedure

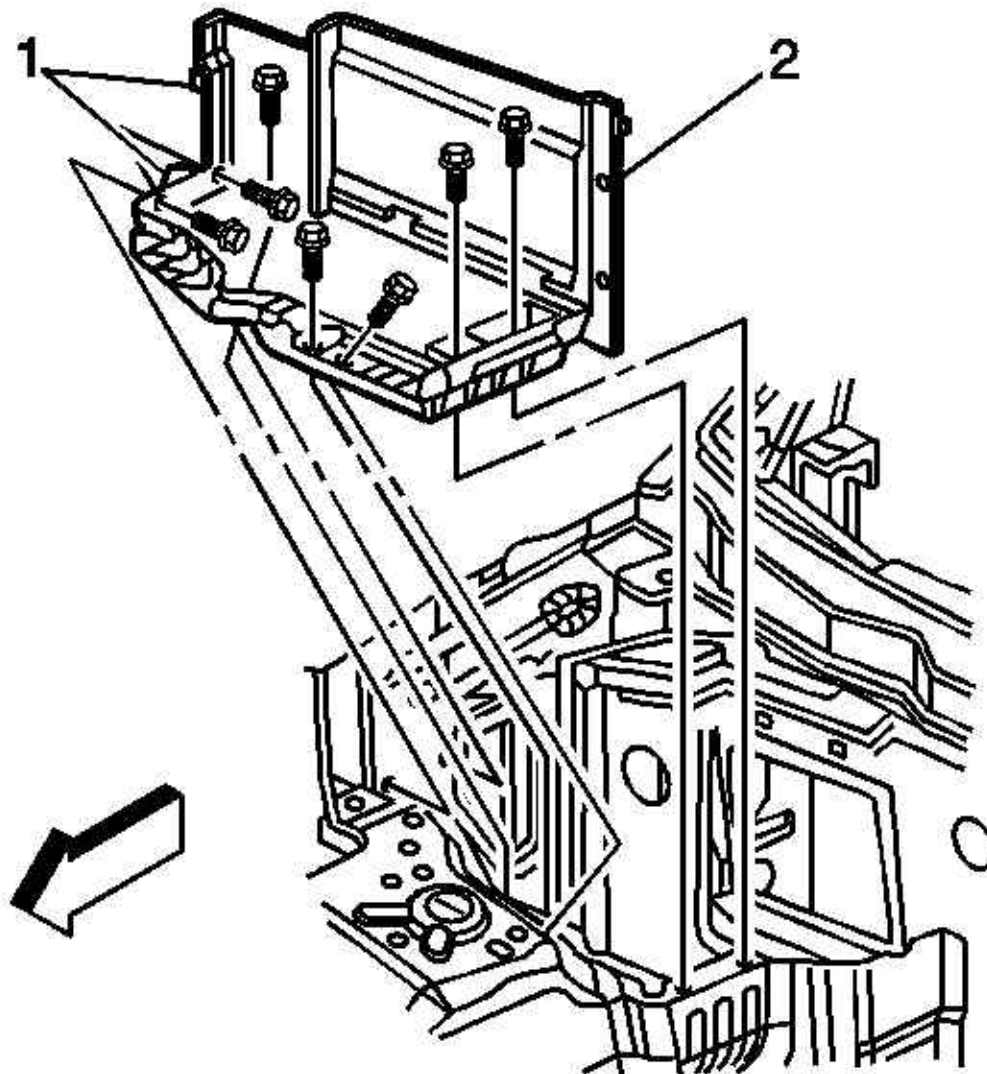


Fig. 70: View Of Battery Tray & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Position the battery tray (2) to the vehicle, locating the alignment datums (1) with the holes in the inner fender.
2. Install the battery tray bolts to the following:
 - The inner fender panel
 - The shock tower
 - The lower air inlet panel assembly

Tighten: Tighten the battery tray bolts to 6 N.m (53 lb in).

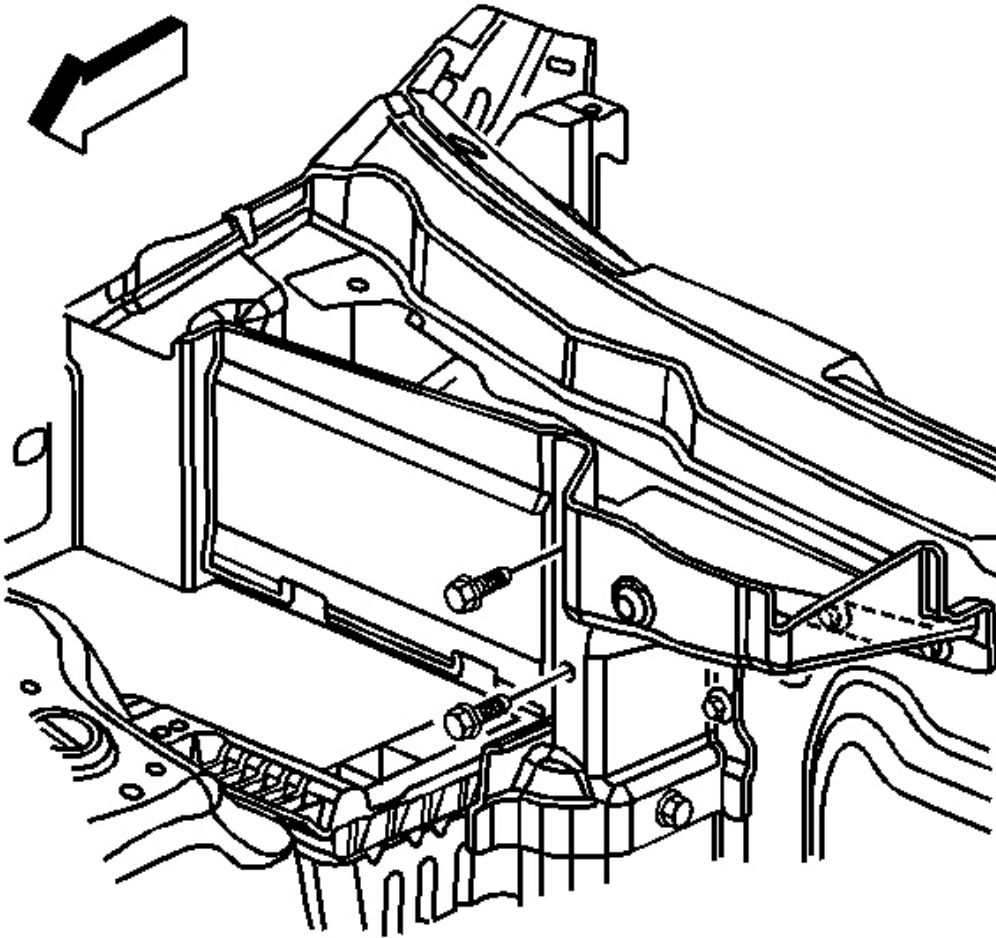


Fig. 71: Identifying Bolts To Front Air Inlet Panel Assembly To Battery Tray

Courtesy of GENERAL MOTORS CORP.

3. Install the 2 bolts securing the front air inlet panel assembly to the battery tray.

Tighten: Tighten the front air inlet panel assembly bolts to 6 N.m (53 lb in).

4. Install the right air inlet grill panel. Refer to **Air Inlet Grille Panel Replacement**.
5. Install the battery. Refer to **Battery Replacement (LY7)** or **Battery**

Replacement (L26) or Battery Replacement (LS4).

BATTERY TRAY REPLACEMENT (L26)

Removal Procedure

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.
2. Remove the battery. Refer to **Battery Replacement (LY7)** or **Battery Replacement (L26)** or **Battery Replacement (LS4)**.

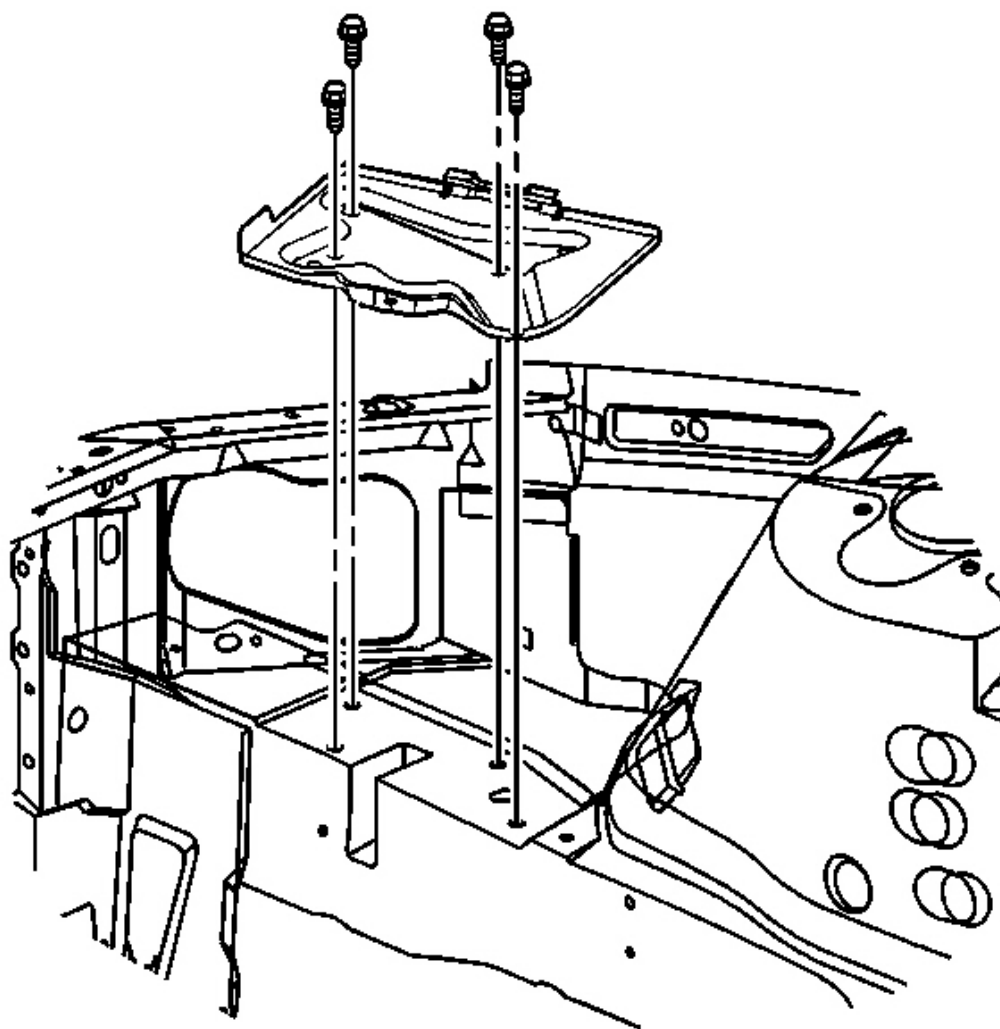


Fig. 72: Identifying Battery Tray & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the battery tray bolts.
4. Remove the battery tray.

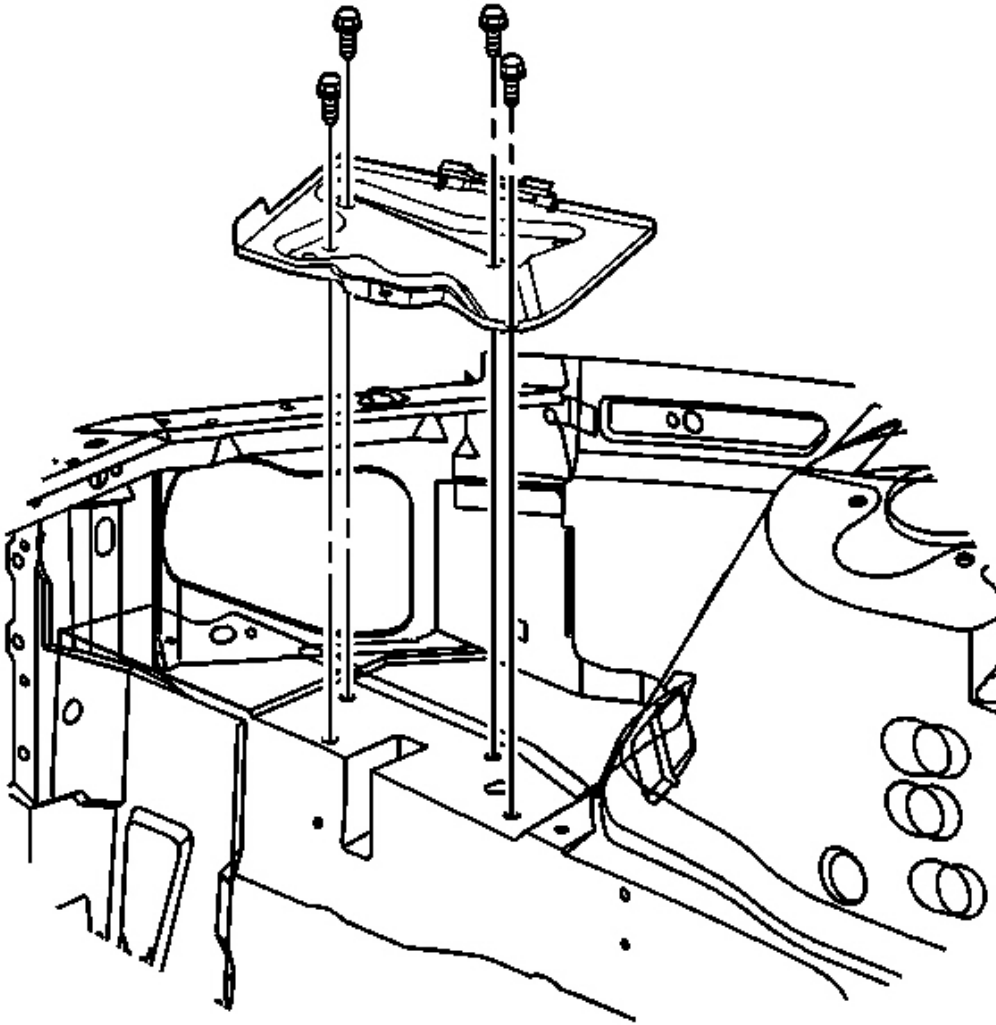


Fig. 73: Identifying Battery Tray & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the battery tray.

NOTE: Refer to **FASTENER NOTICE** .

2. Install the battery tray bolts.

Tighten: Tighten the battery tray bolts to 5 N.m (44 lb in).

3. Install the battery. Refer to **Battery Replacement (LY7)** or **Battery Replacement (L26)** or **Battery Replacement (LS4)**.
4. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.

BATTERY TRAY REPLACEMENT (LS4)

Removal Procedure

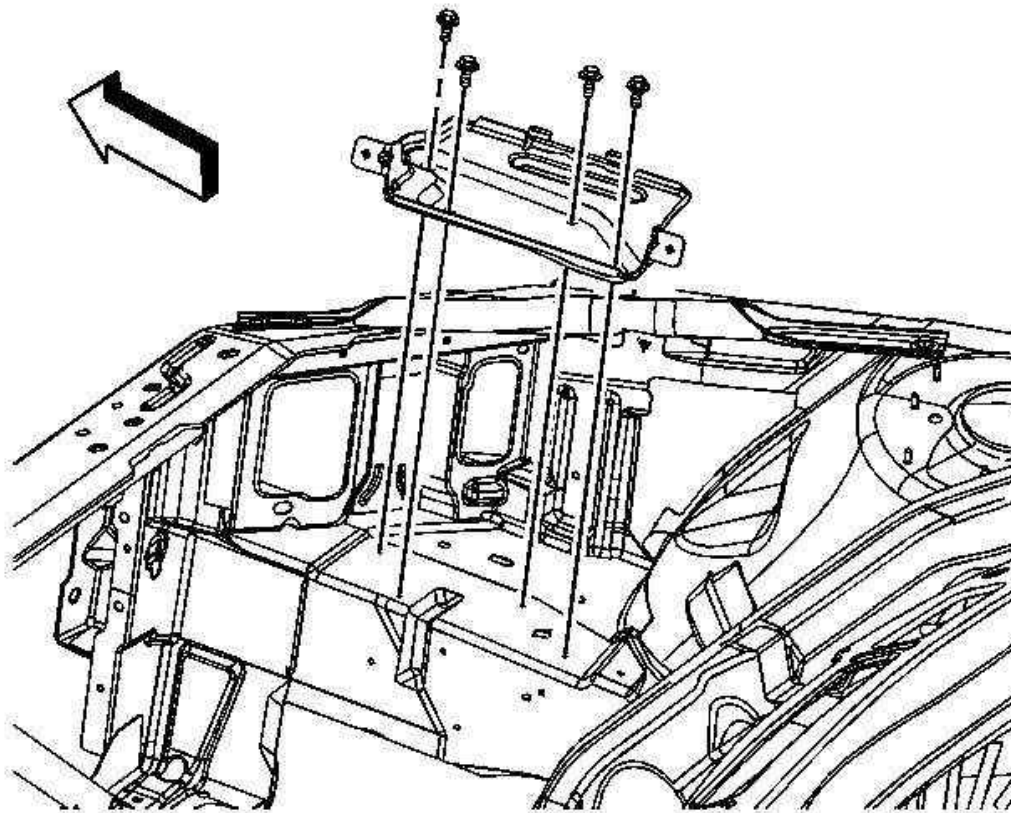


Fig. 74: Identifying Battery Tray & Bolts

Courtesy of GENERAL MOTORS CORP.

1. Remove the battery. Refer to **Battery Replacement (LY7)** or **Battery Replacement (L26)** or **Battery Replacement (LS4)**.
2. Remove the battery tray bolts.
3. Remove the battery tray.

Installation Procedure

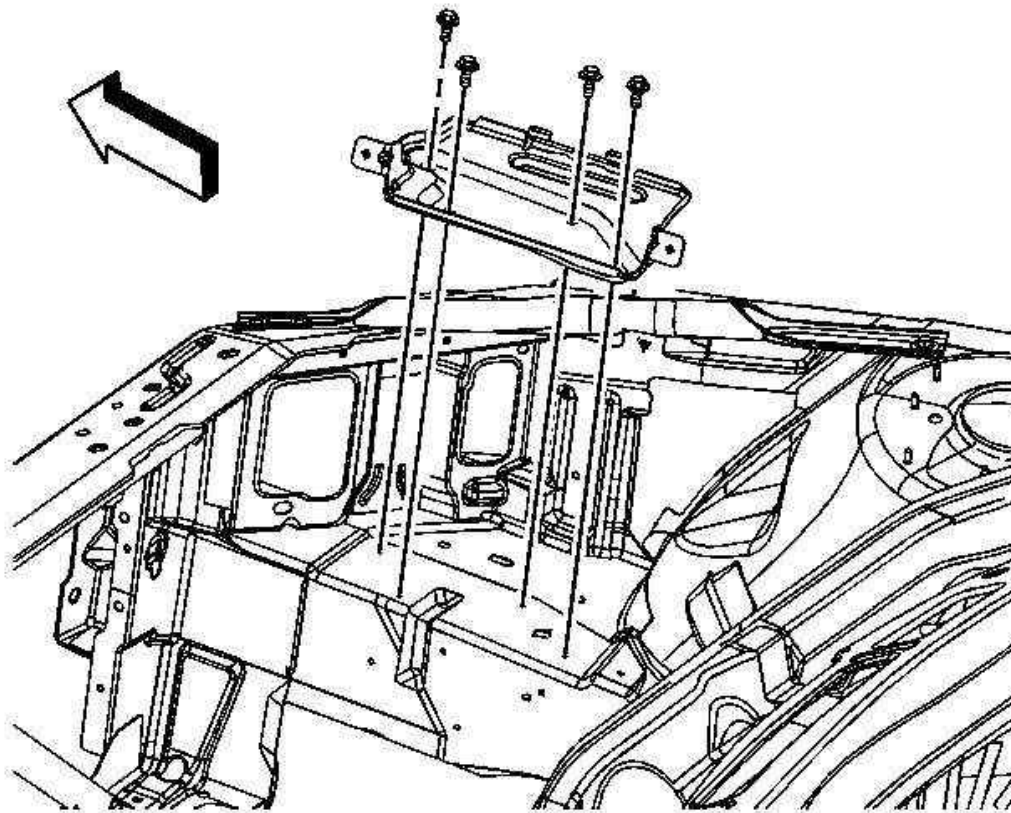


Fig. 75: Identifying Battery Tray & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the battery tray.

NOTE: Refer to Fastener Notice .

2. Install the battery tray bolts.

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

3. Install the battery. Refer to Battery Replacement (LY7) or Battery Replacement (L26) or Battery Replacement (LS4).

BATTERY HEAT SHIELD REPLACEMENT (LY7)

Removal Procedure

1. Remove the battery. Refer to Battery Replacement (LY7) or Battery Replacement (L26) or Battery Replacement (LS4).

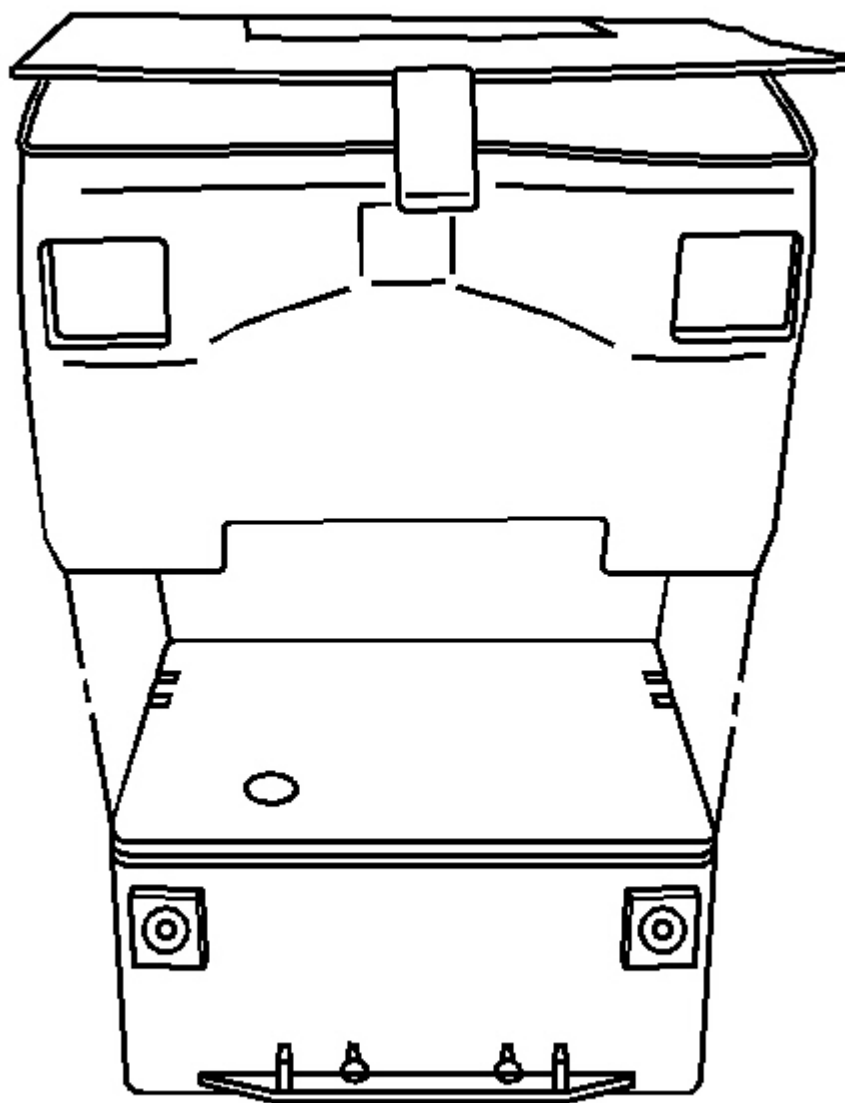


Fig. 76: Aligning Battery Heat Shield Downward
Courtesy of GENERAL MOTORS CORP.

2. Lift the battery heat shield upward from the battery.

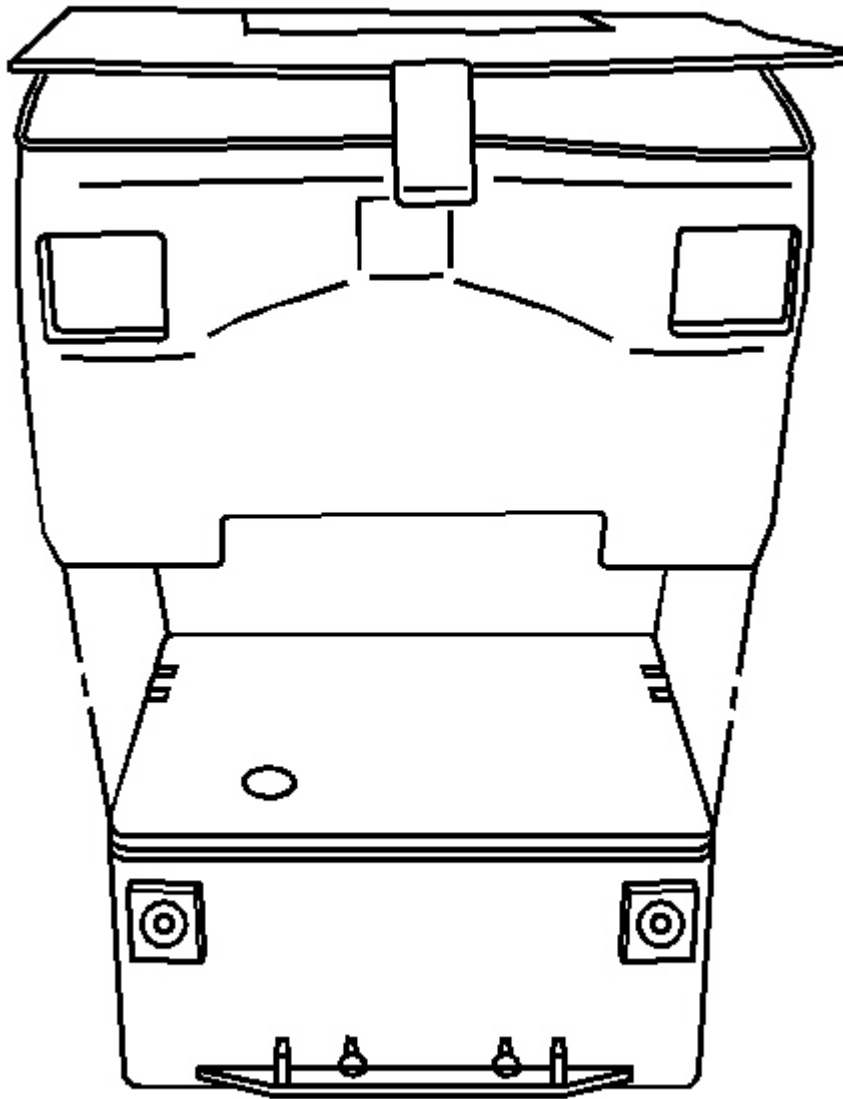


Fig. 77: Aligning Battery Heat Shield Downward
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure the openings in the heat shield are aligned with the battery terminal bosses.

1. Position the battery heat shield downward over the battery.
2. Install the battery. Refer to **Battery Replacement (LY7)** or **Battery Replacement (L26)** or **Battery Replacement (LS4)**.

STARTER MOTOR REPLACEMENT (LY7)

Removal Procedure

1. Turn the ignition OFF.
2. Disconnect the battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.

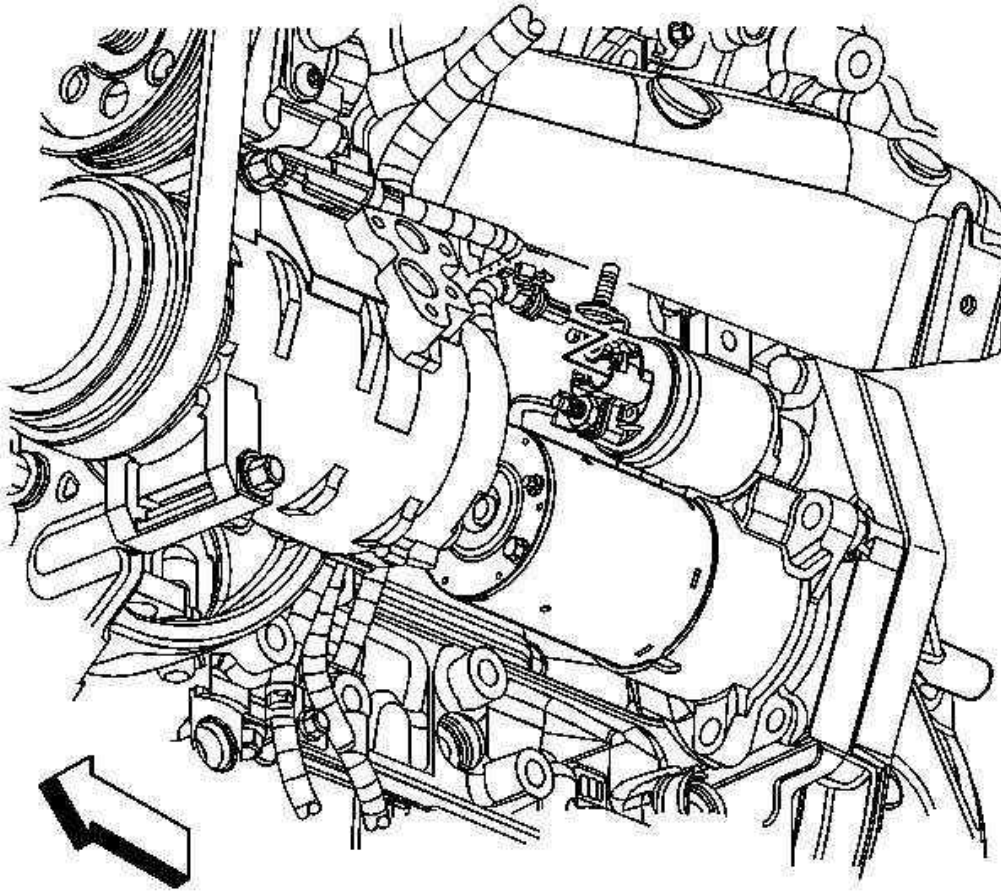


Fig. 78: View Of Starter Solenoid Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Remove the starter solenoid electrical connector from the starter.

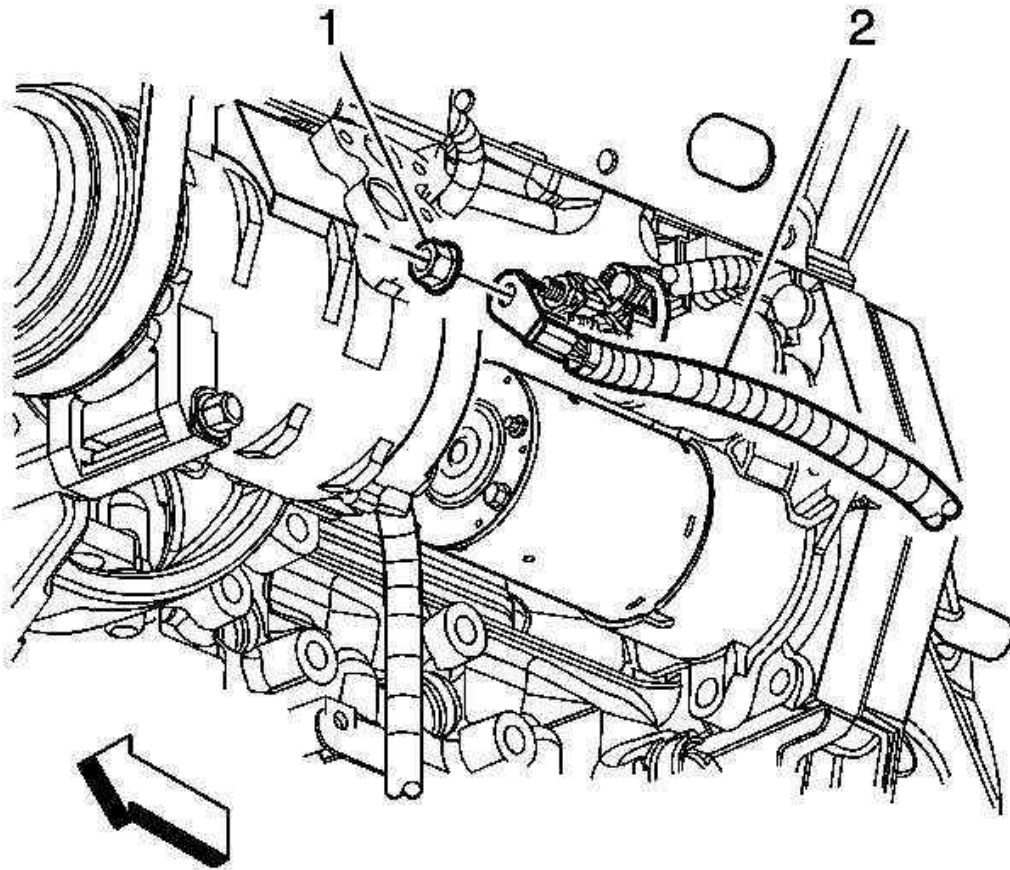


Fig. 79: View Of Starter Terminal Nut & Battery Positive Cable
Courtesy of GENERAL MOTORS CORP.

4. Remove the starter terminal nut (1) and the battery positive cable (2) from the starter.

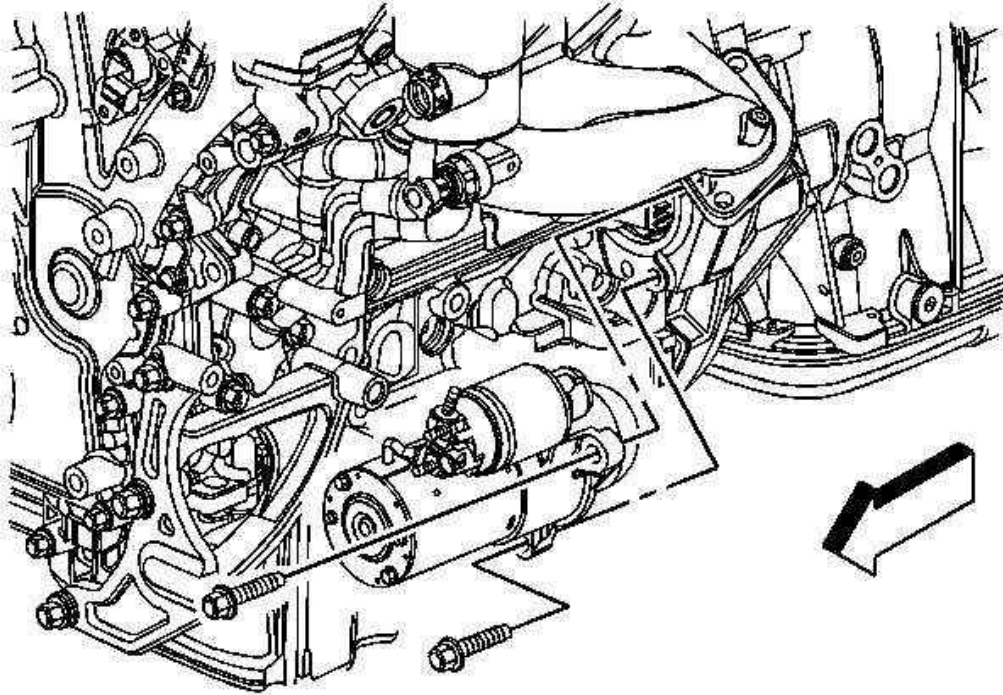


Fig. 80: View Of Starter Motor - LY7
Courtesy of GENERAL MOTORS CORP.

5. Remove the starter motor bolts.
6. Remove the starter motor.

Installation Procedure

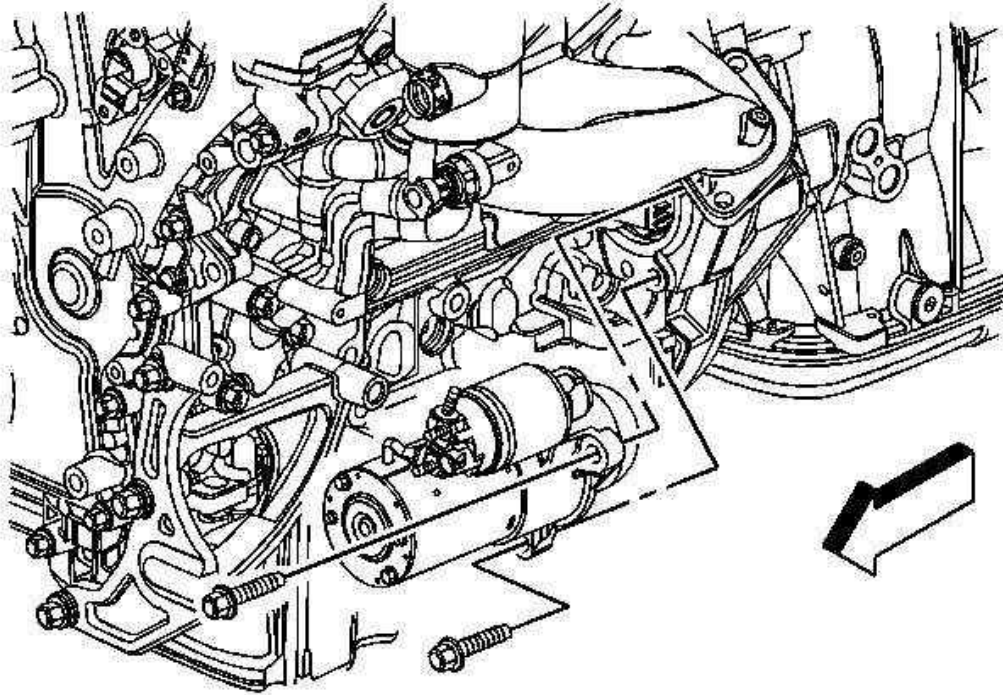


Fig. 81: View Of Starter Motor - LY7
Courtesy of GENERAL MOTORS CORP.

1. Install the starter motor.

NOTE: Refer to Fastener Notice .

2. Install the starter motor mounting bolts

Tighten: Tighten the starter motor mounting bolts to 50 N.m (37 lb ft).

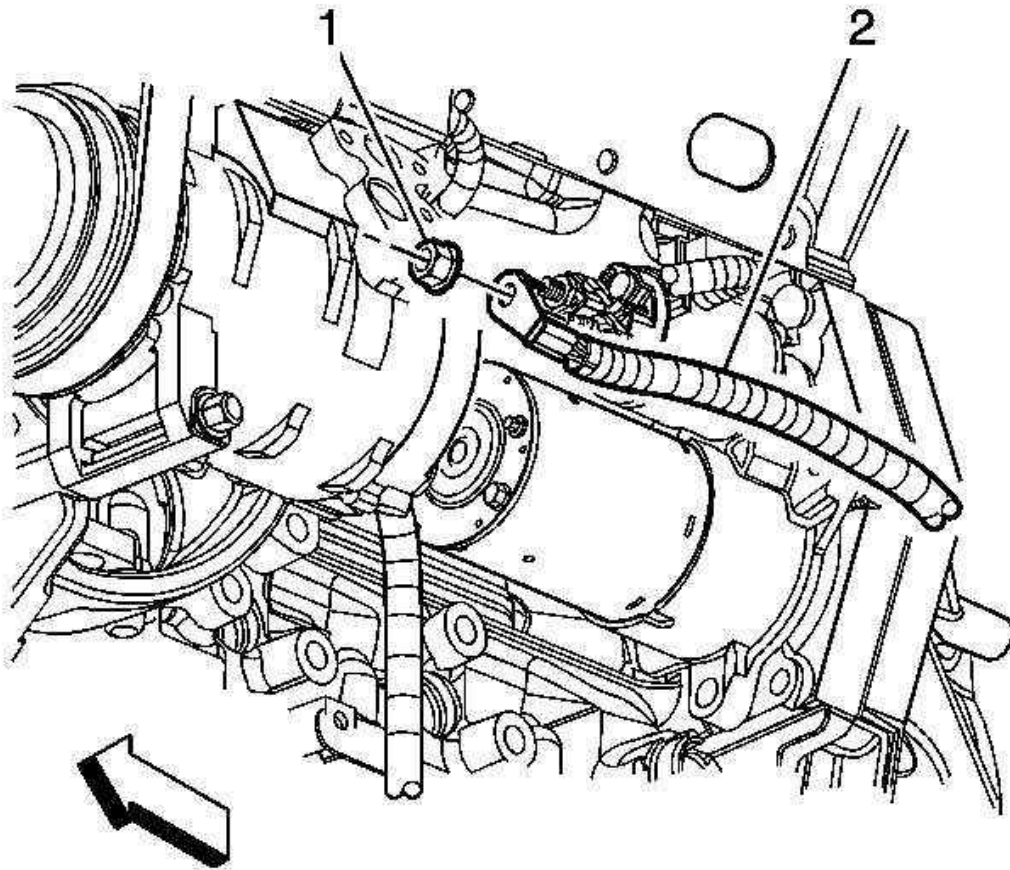


Fig. 82: View Of Starter Terminal Nut & Battery Positive Cable
Courtesy of GENERAL MOTORS CORP.

3. Install the battery positive cable (2) to the starter and install the starter terminal nut (1).

Tighten: Tighten the battery positive cable nut to 13 N.m (115 lb in).

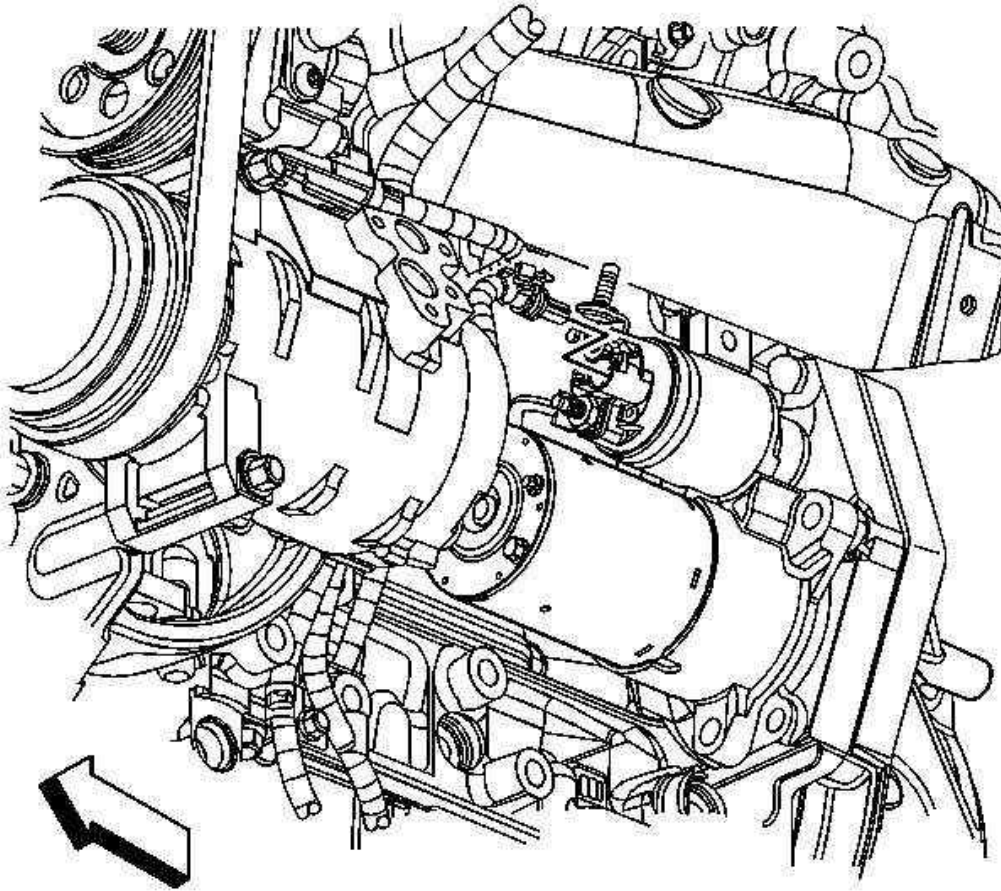


Fig. 83: View Of Starter Solenoid Electrical Connector
Courtesy of GENERAL MOTORS CORP.

4. Install the electrical connector to the starter solenoid.

STARTER MOTOR REPLACEMENT (L26)

Removal Procedure

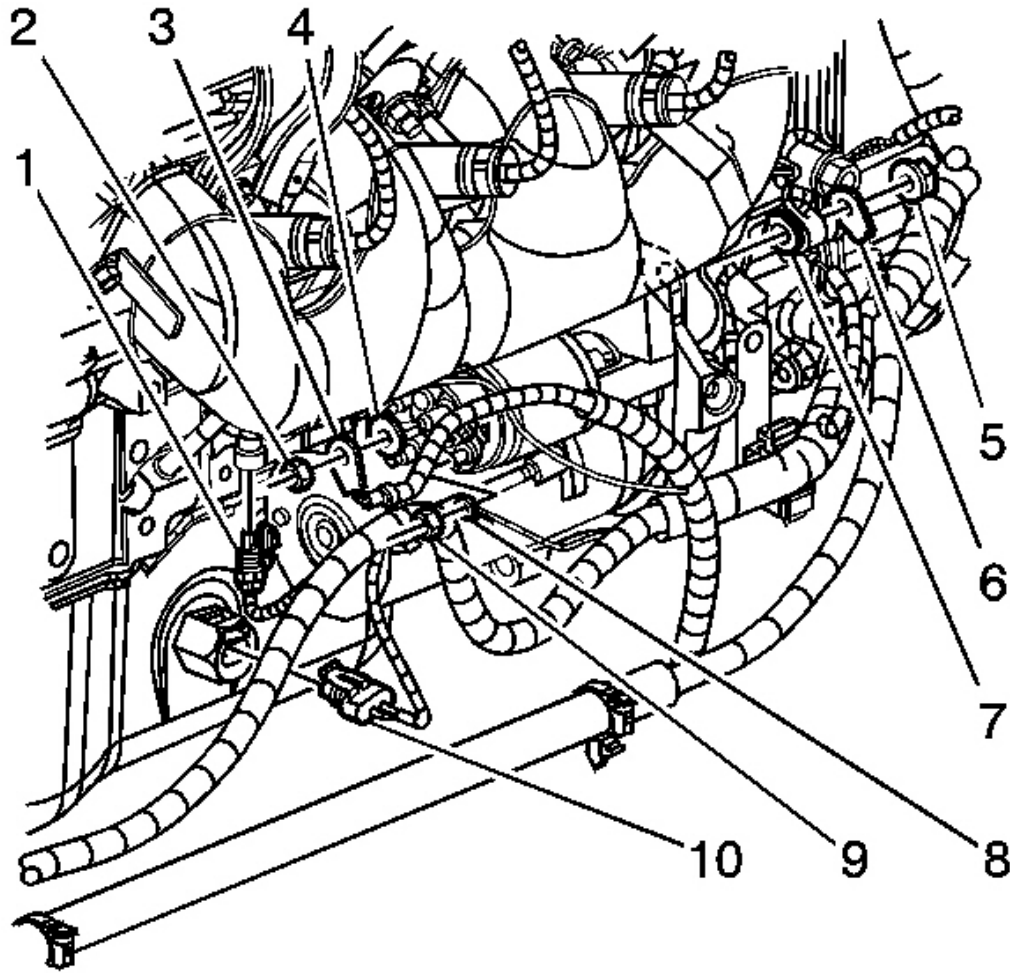


Fig. 84: View Of Engine Electrical Connectors (Left Side)
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Remove the front lower air deflector panel. Refer to **Radiator Air Lower**

Baffle and Deflector Replacement .

4. Remove the torque converter covers. Refer to **Torque Converter Cover Replacement** .
5. Remove the starter solenoid S terminal nut (9) and remove the starter solenoid wire (8) from the starter motor.
6. Remove the starter solenoid BAT terminal nut (2) and remove the positive battery cable (3) from the starter motor.

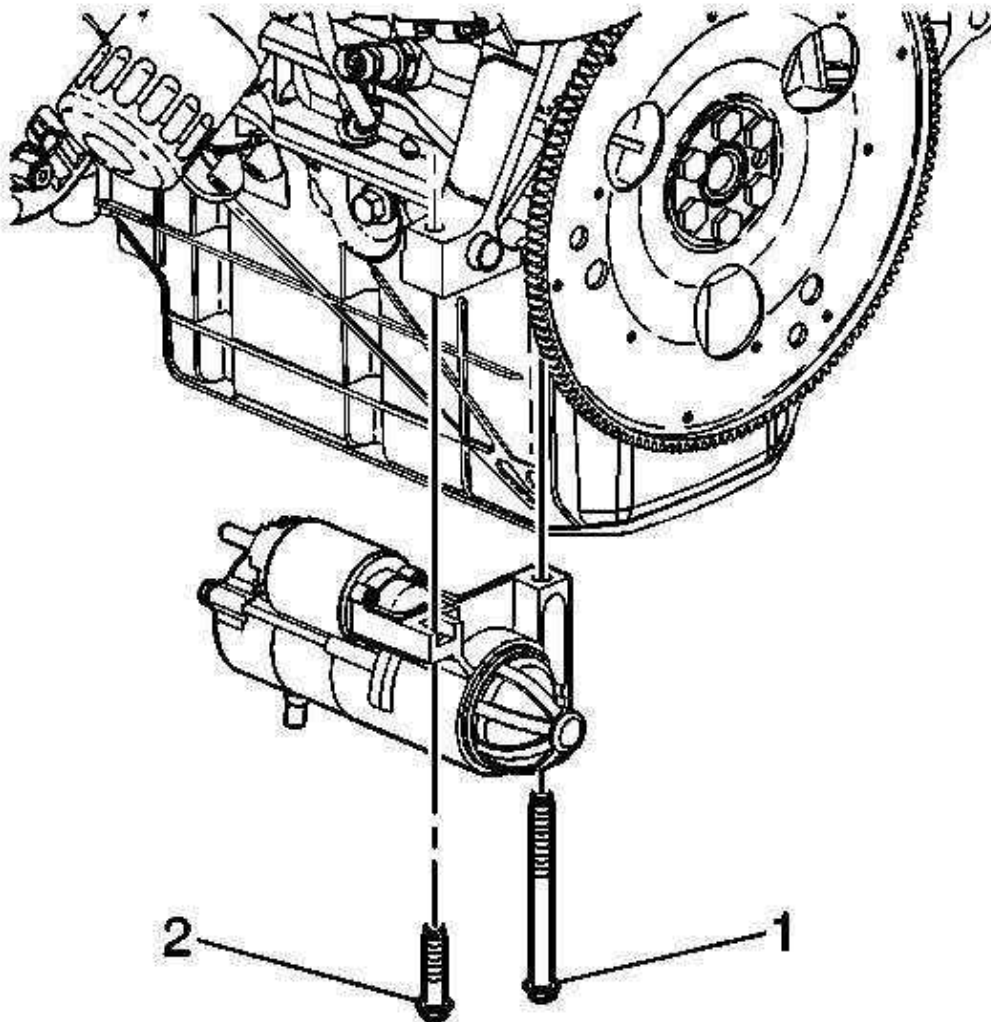


Fig. 85: Identifying Starter Motor & Bolts (3.8L)
Courtesy of GENERAL MOTORS CORP.

7. Remove the starter bolts (1, 2) and the starter motor.

Installation Procedure

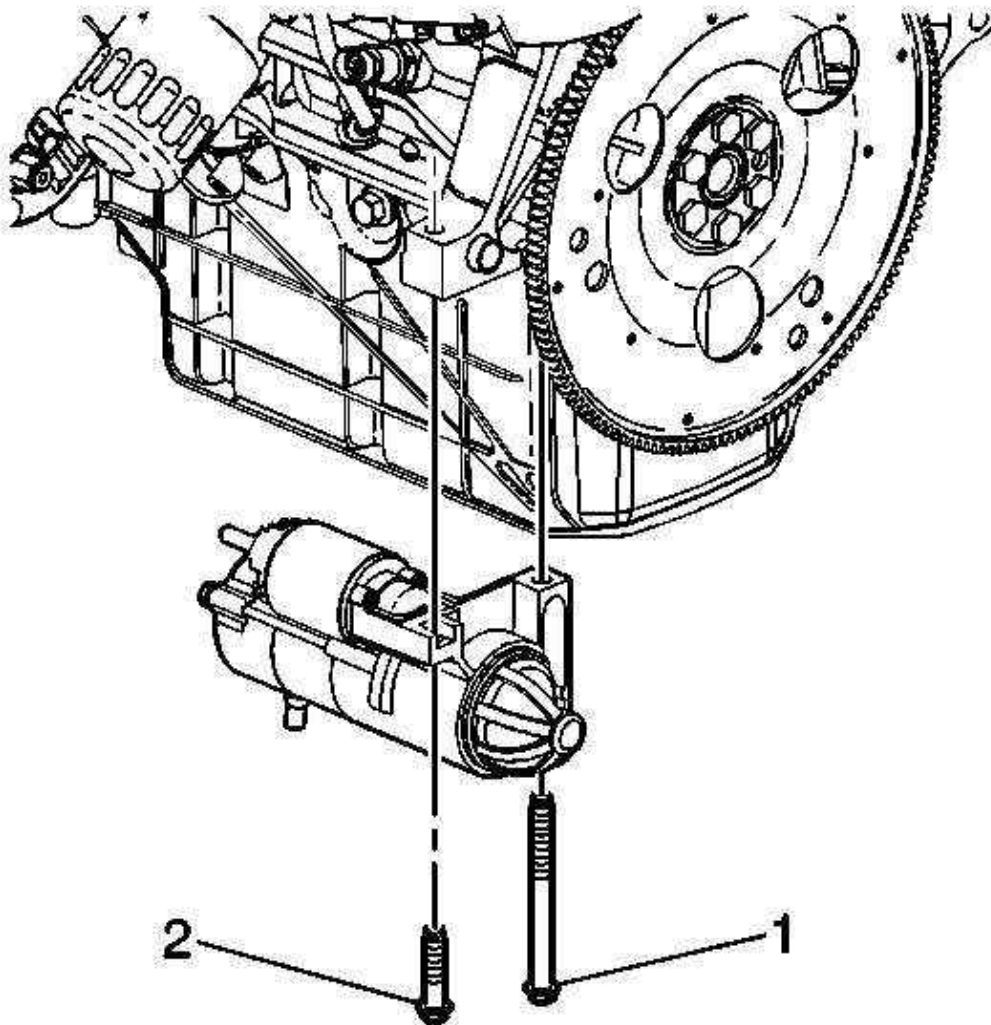


Fig. 86: Identifying Starter Motor & Bolts (3.8L)
Courtesy of GENERAL MOTORS CORP.

1. Align the starter motor to the engine.

NOTE: Refer to Fastener Notice .

2. Install the starter bolts (1, 2) finger tight until seated.

Tighten: Tighten the starter bolts to 43 N.m (32 lb ft).

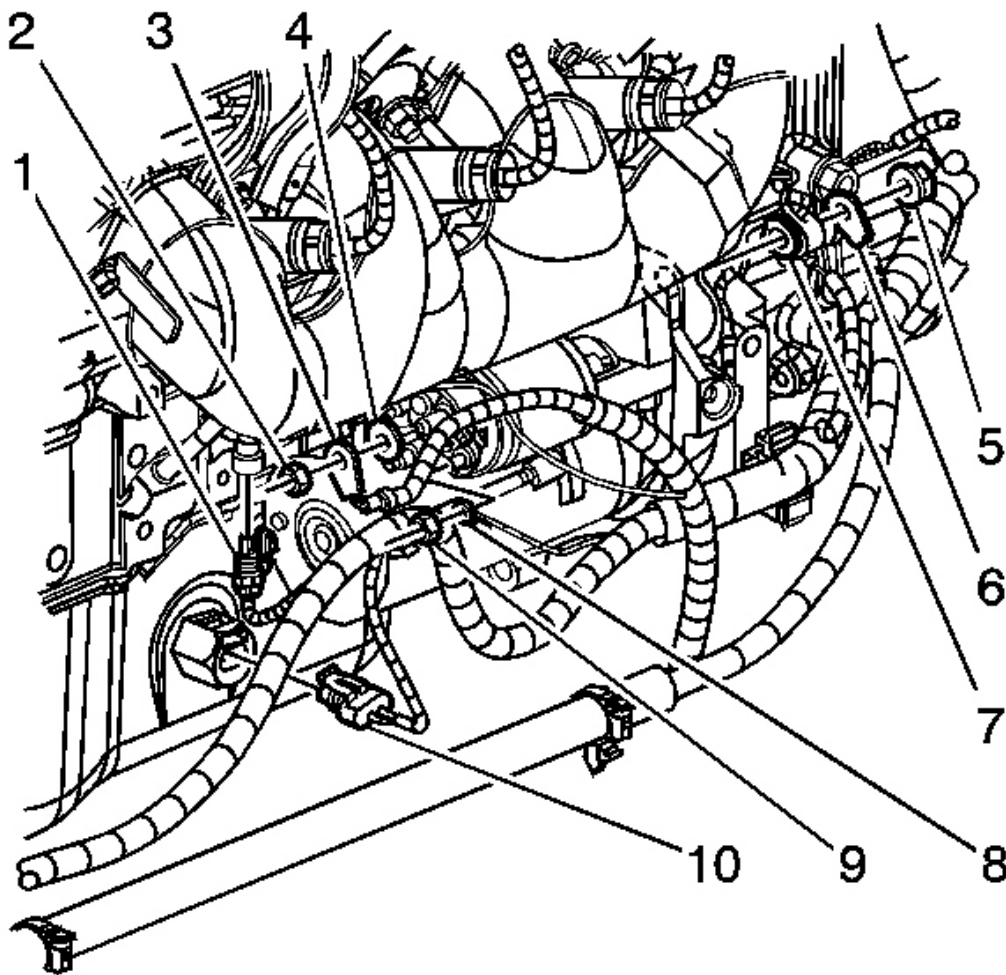


Fig. 87: View Of Engine Electrical Connectors (Left Side)
Courtesy of GENERAL MOTORS CORP.

3. Install the positive battery cable (3) and the solenoid BAT terminal nut (2). Tighten finger tight to the starter motor.
4. Install the starter solenoid wire (8) and the starter solenoid S terminal nut (9). Tighten finger tight to the starter motor.

Tighten:

1. Tighten the solenoid BAT terminal nut (2) to 9.5 N.m (84 lb in).
2. Tighten the starter solenoid S terminal nut (9) to 2.3 N.m (20 lb in).
5. Install the torque converter covers. Refer to **Torque Converter Cover Replacement** .
6. Install the front lower air deflector panel. Refer to **Radiator Air Lower Baffle and Deflector Replacement** .
7. Lower the vehicle.
8. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.

STARTER MOTOR REPLACEMENT (LS4)

Removal Procedure

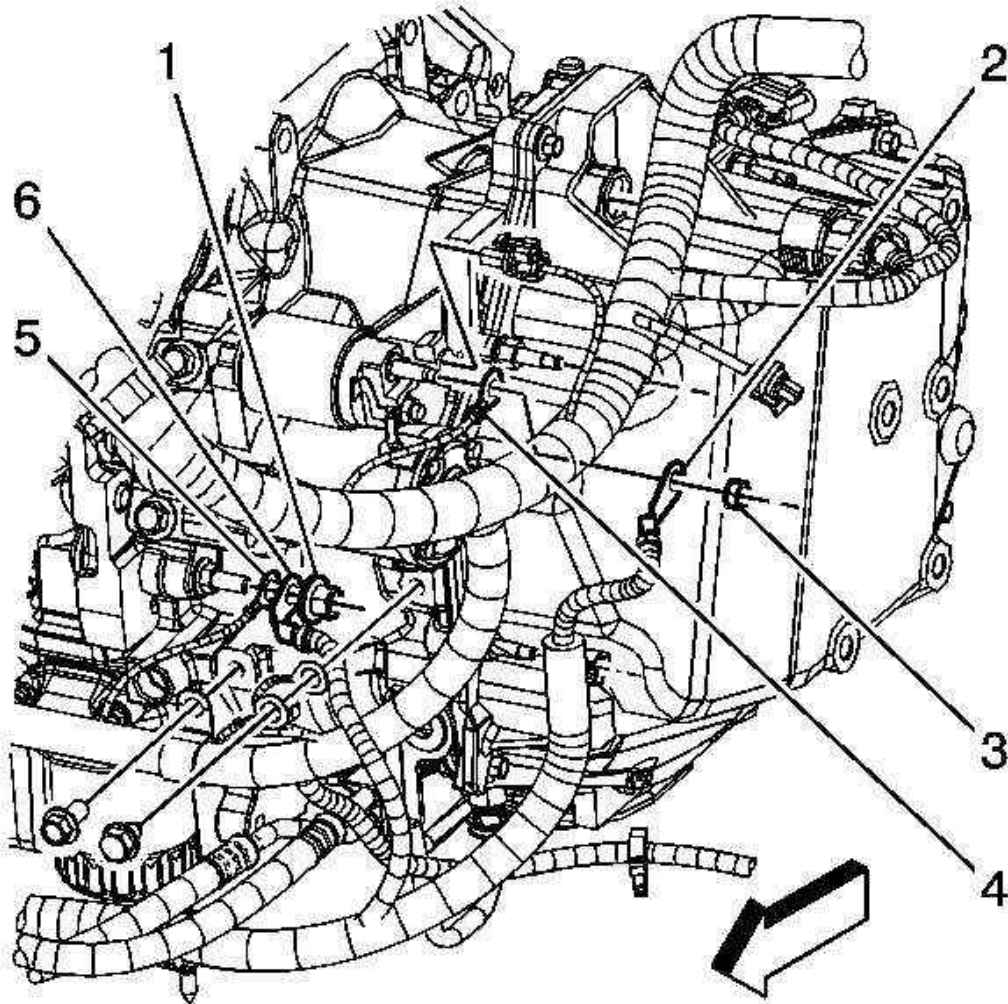


Fig. 88: View Of Battery Positive & Negative Cables
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.
2. Remove the starter solenoid BAT terminal nut (3) and remove the positive battery cable (2) from the starter motor.

3. Remove the engine harness terminal (4) from the starter motor.

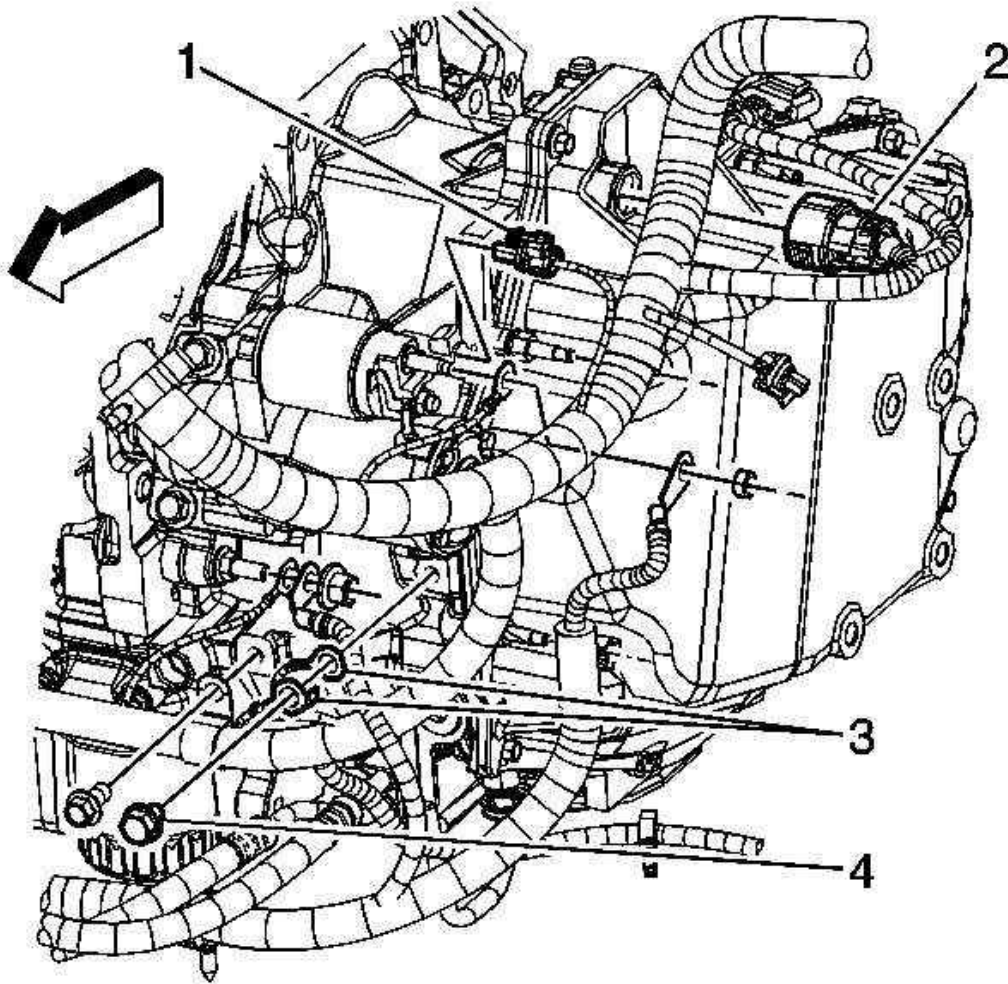


Fig. 89: View Of Engine Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the starter motor electrical connector (1).
5. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** .

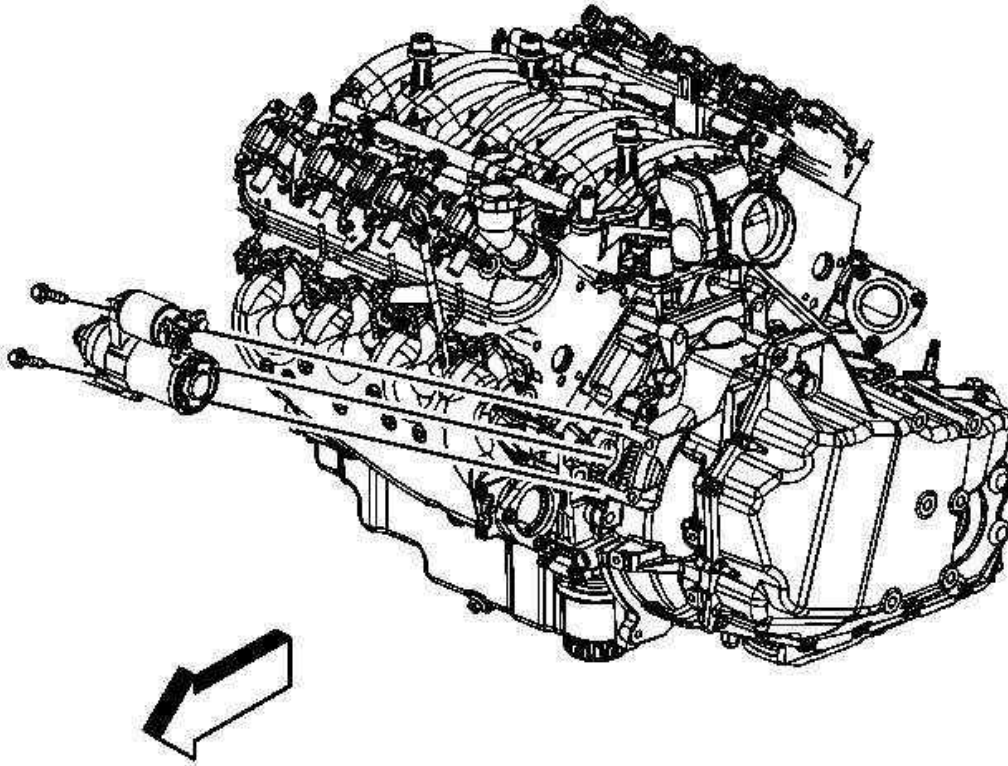


Fig. 90: View Of Starter Motor
Courtesy of GENERAL MOTORS CORP.

6. Remove the starter motor bolts and starter motor.

Installation Procedure

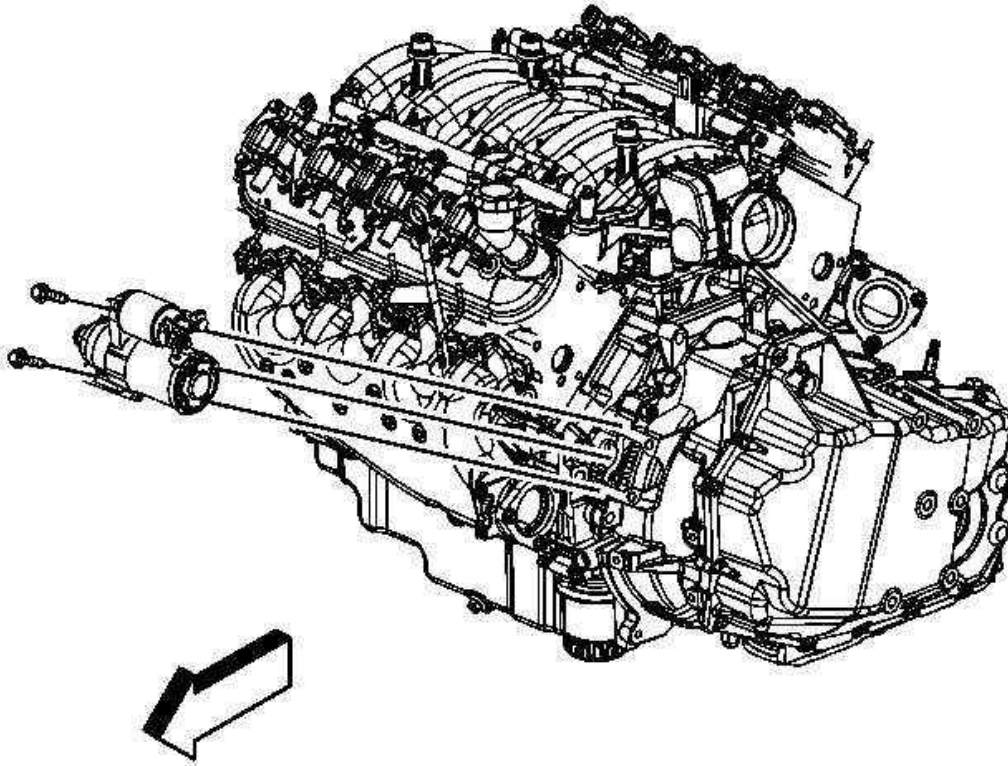


Fig. 91: View Of Starter Motor
Courtesy of GENERAL MOTORS CORP.

1. Position the starter motor to the engine.

NOTE: Refer to Fastener Notice .

2. Install the starter bolts.

Tighten: Tighten the bolts to 50 N.m (37 lb ft).

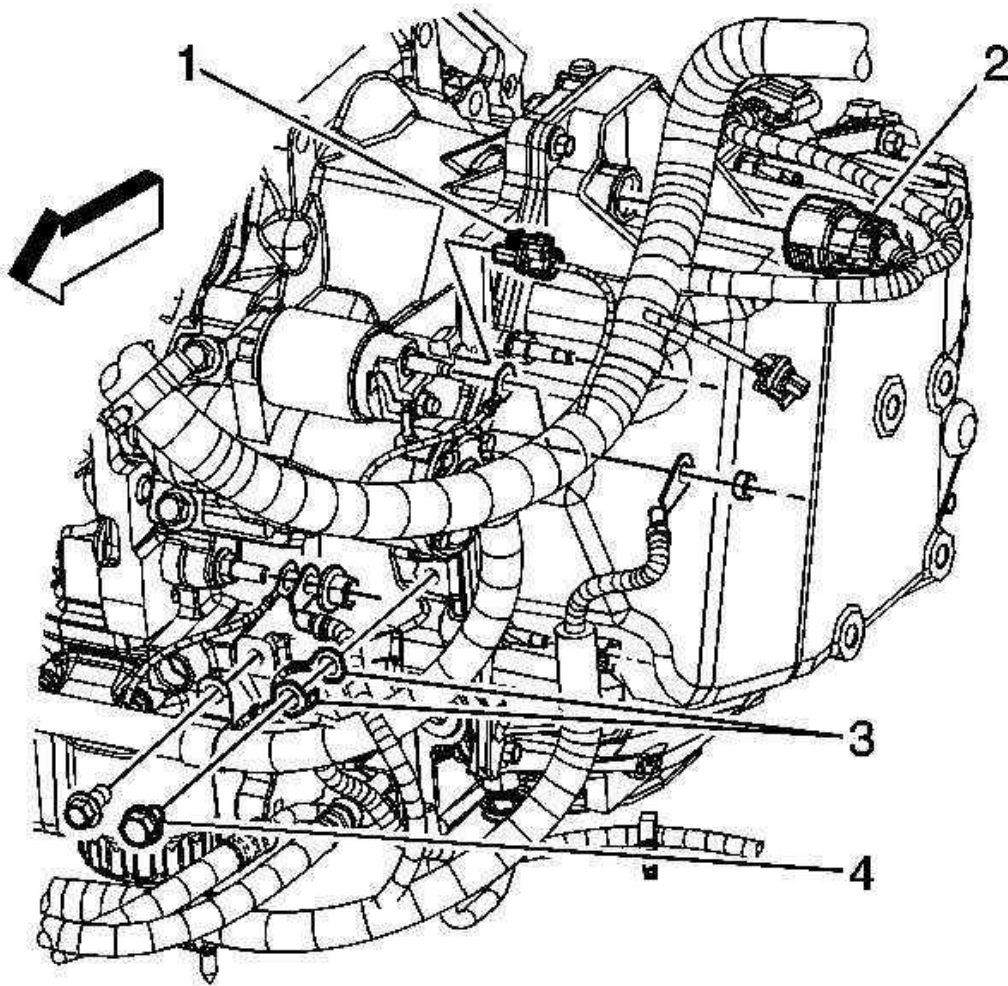


Fig. 92: View Of Engine Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

3. Connect the starter motor electrical connector (1).

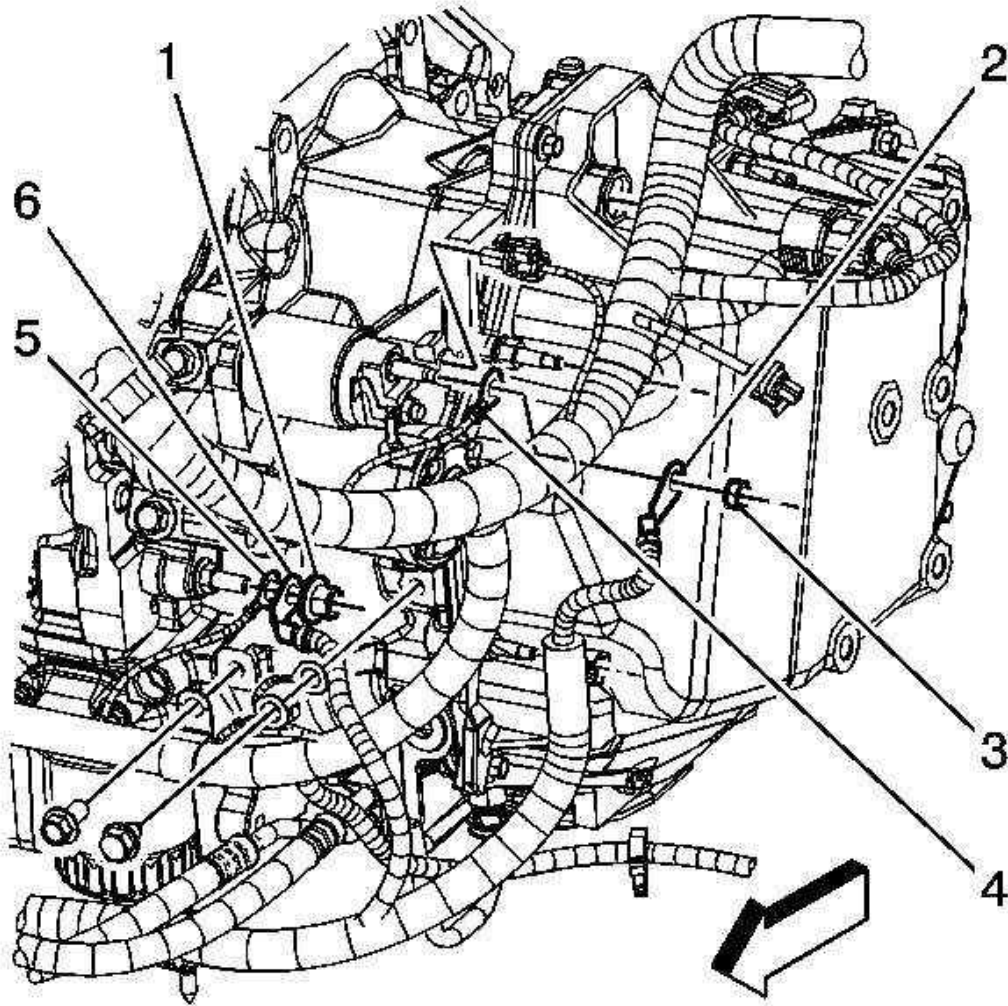


Fig. 93: View Of Battery Positive & Negative Cables
Courtesy of GENERAL MOTORS CORP.

4. Install the engine harness terminal (4) to the starter motor.
5. Install the positive battery cable (2) and the starter solenoid BAT terminal nut (3) to the starter motor.

Tighten: Tighten the solenoid BAT terminal nut to 10 N.m (89 lb in).

6. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** .
7. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.

STARTER SHIELD REPLACEMENT

Removal Procedure

1. Disconnect the battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.

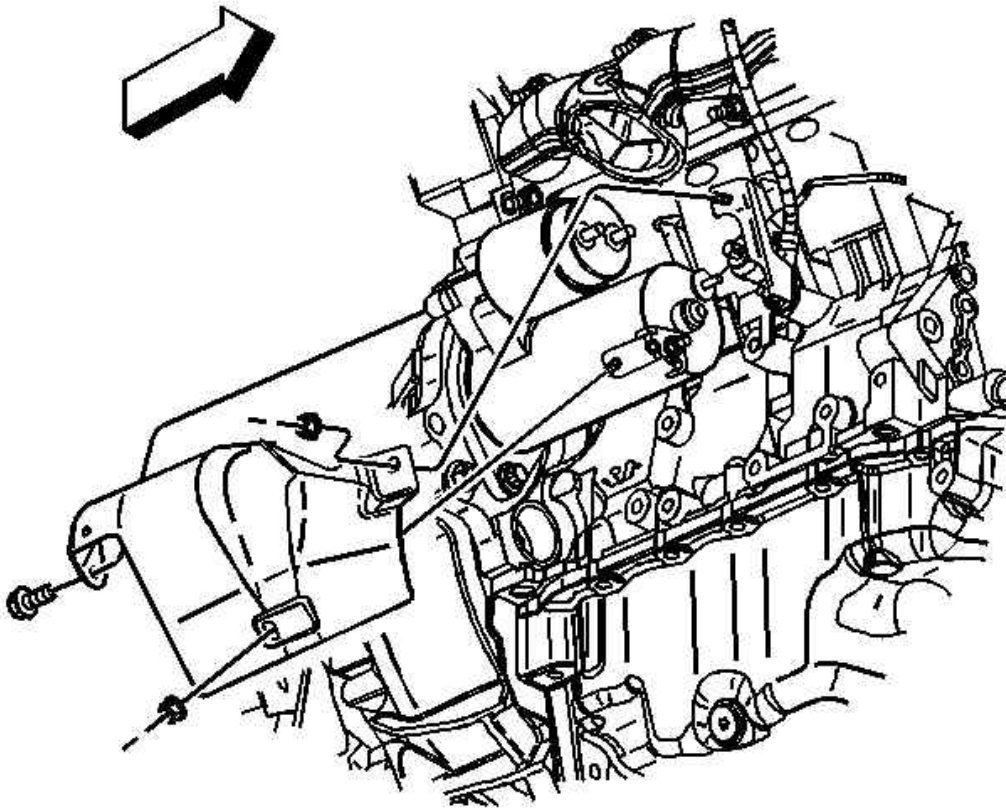


Fig. 94: Aligning Starter Heat Shield To Starter Motor & Brackets
Courtesy of GENERAL MOTORS CORP.

2. Remove the fasteners securing the starter heat shield to the starter.
3. Remove the starter heat shield.

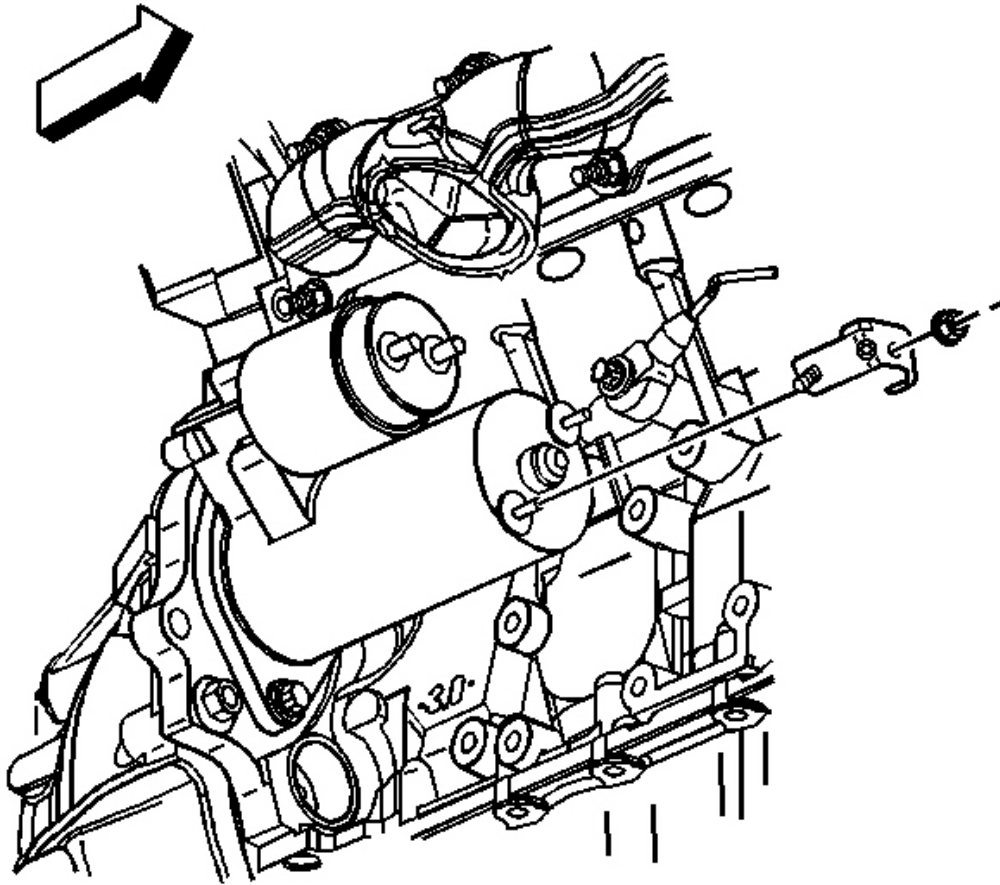


Fig. 95: View Of Starter Heat Shield Mounting Bracket Retaining Nut
Courtesy of GENERAL MOTORS CORP.

4. Remove the nut securing the starter heat shield mounting bracket to the starter.
5. Remove the starter heat shield mounting bracket.

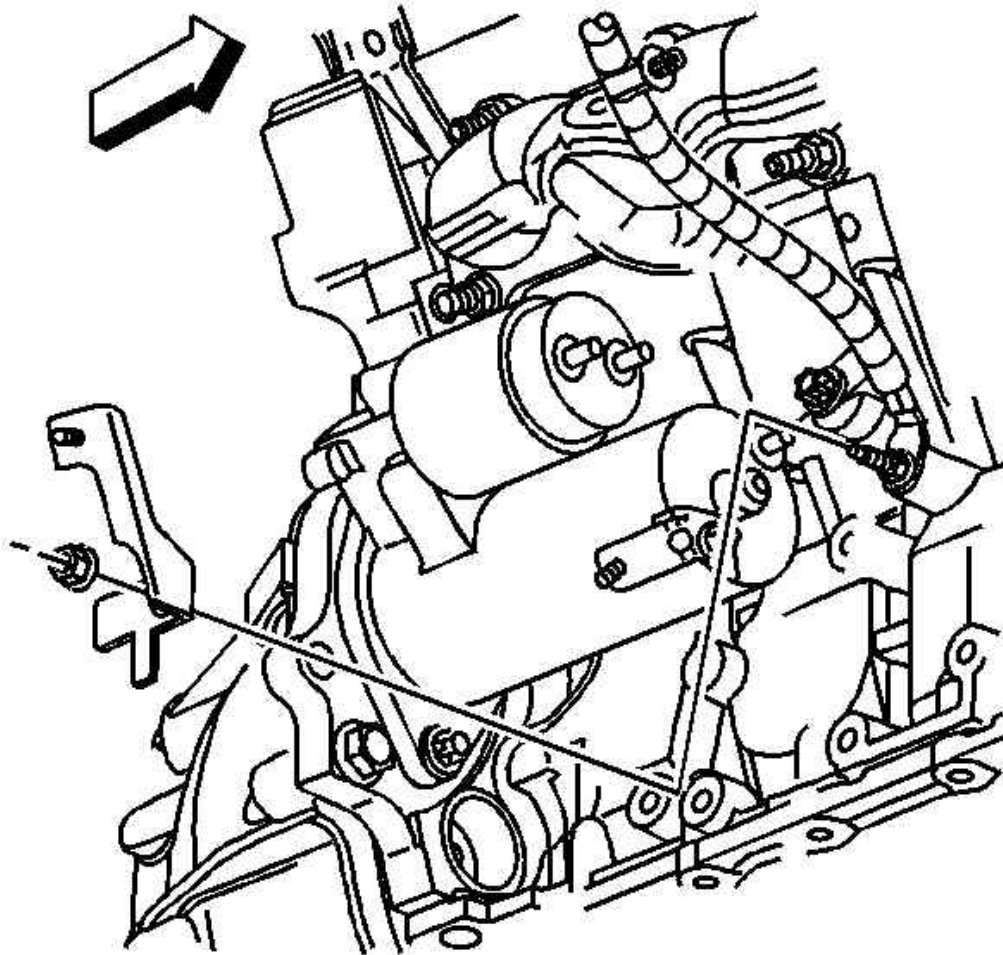


Fig. 96: Locating Starter Heat Shield Mounting Bracket To Engine Block Retaining Nut
Courtesy of GENERAL MOTORS CORP.

6. Remove the nut securing the starter heat shield mounting bracket to the engine block.
7. Remove the starter heat shield mounting bracket.

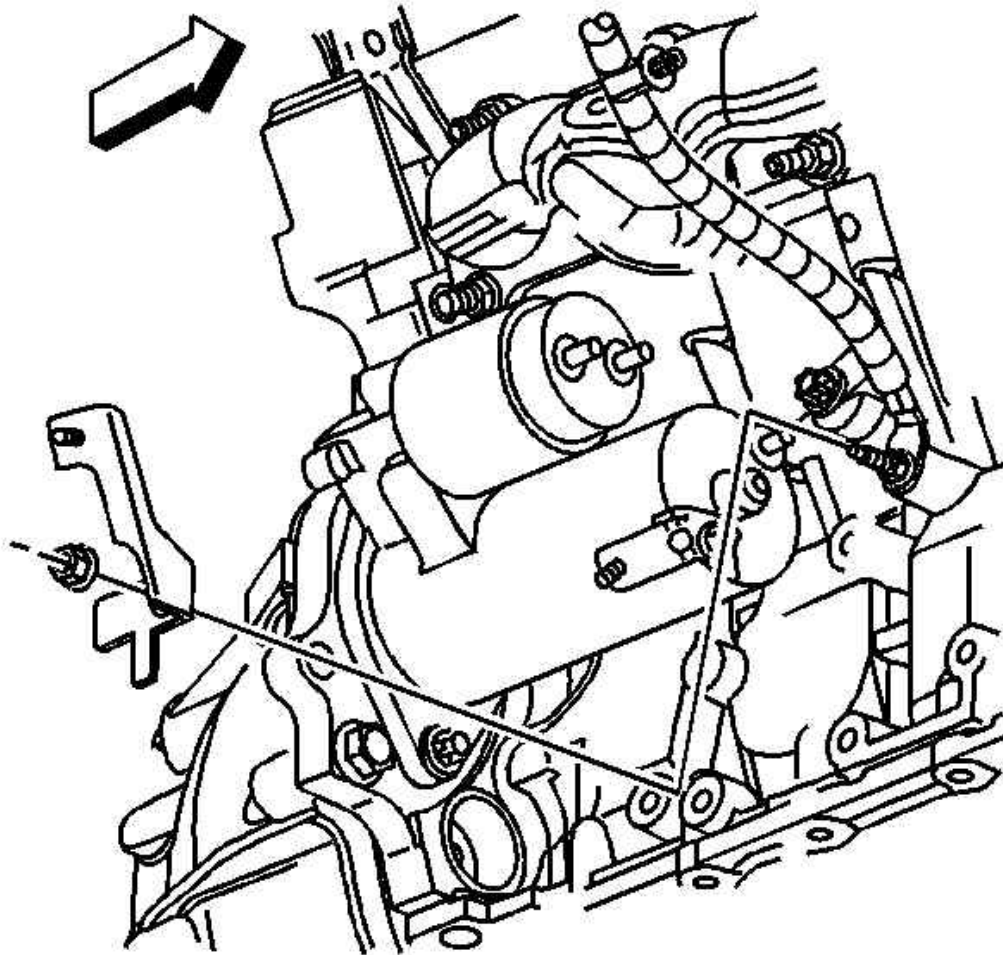


Fig. 97: Locating Starter Heat Shield Mounting Bracket To Engine Block Retaining Nut

Courtesy of GENERAL MOTORS CORP.

1. Install the starter heat shield mounting bracket to the stud located at the engine block.

NOTE: Refer to Fastener Notice .

2. Install the nut securing the starter heat shield mounting bracket to the engine

block.

Tighten: Tighten the starter heat shield mounting bracket nut to 8 N.m (71 lb in).

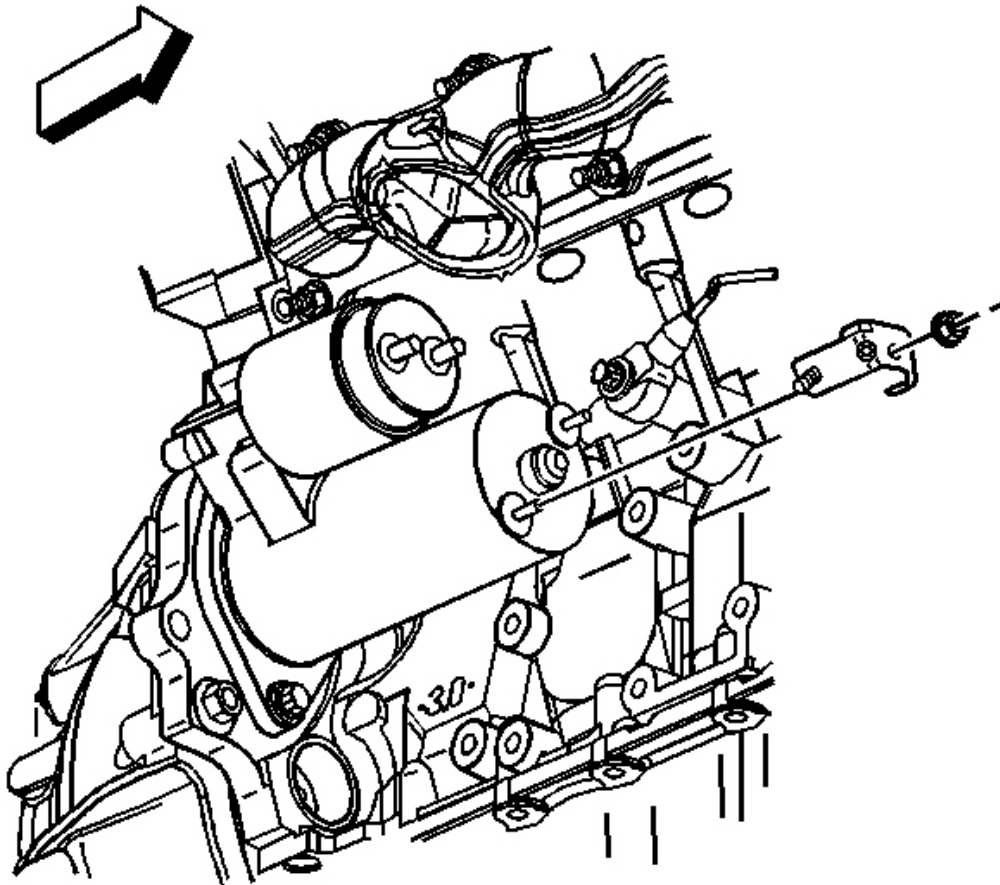


Fig. 98: View Of Starter Heat Shield Mounting Bracket Retaining Nut
Courtesy of GENERAL MOTORS CORP.

3. Install the starter heat shield mounting bracket to the stud located at the rear of the starter motor.
4. Install the nut securing the starter heat shield mounting bracket to the starter.

Tighten: Tighten the starter heat shield mounting bracket nut to 8 N.m (71 lb in).

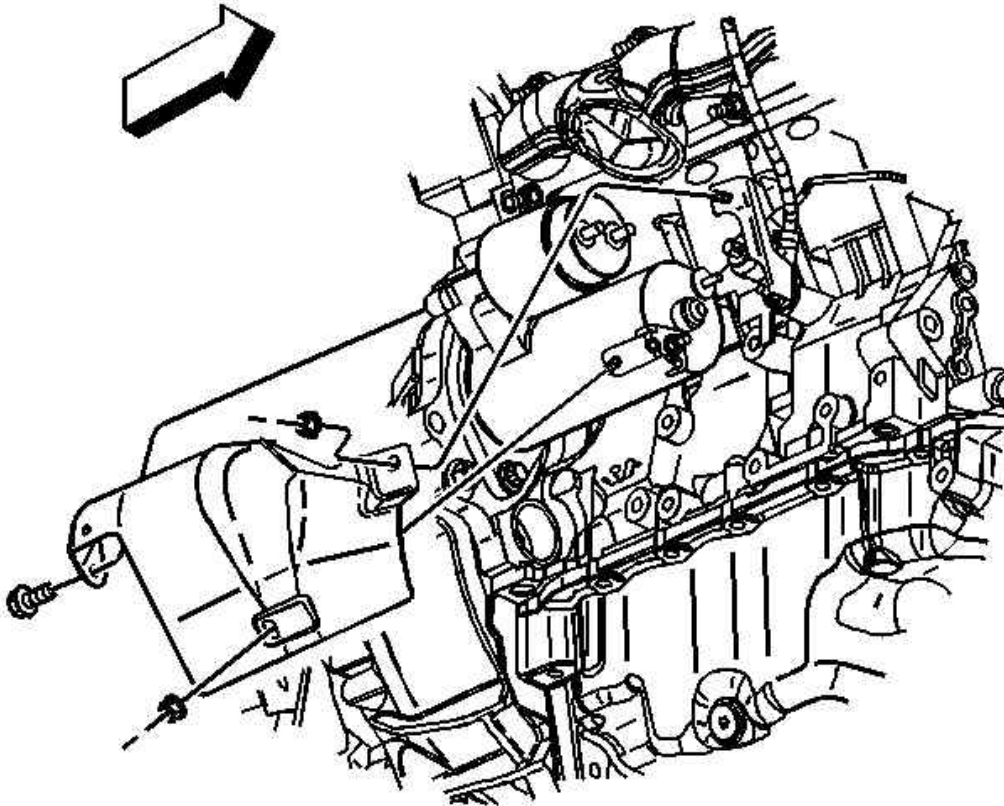


Fig. 99: Aligning Starter Heat Shield To Starter Motor & Brackets
Courtesy of GENERAL MOTORS CORP.

5. Position the starter heat shield to the starter motor and brackets.
6. Install the fasteners securing the starter heat shield to the starter motor and brackets.

Tighten: Tighten the starter heat shield fasteners to 8 N.m (71 lb in).

7. Connect the battery negative cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable**

Disconnection and Connection (LY7) or Battery Negative Cable Disconnection and Connection (LS4).

GENERATOR BRACKET REPLACEMENT (L26, LY7)

Removal Procedure

1. Turn the ignition OFF.
2. Remove the generator. Refer to **Generator Replacement (L26)** or **Generator Replacement (LY7)** or **Generator Replacement (LS4)**.
3. Remove the coolant inlet pipe lower bolt from the generator bracket.
4. Remove the belt tensioner. Refer to **Drive Belt Tensioner Replacement** .

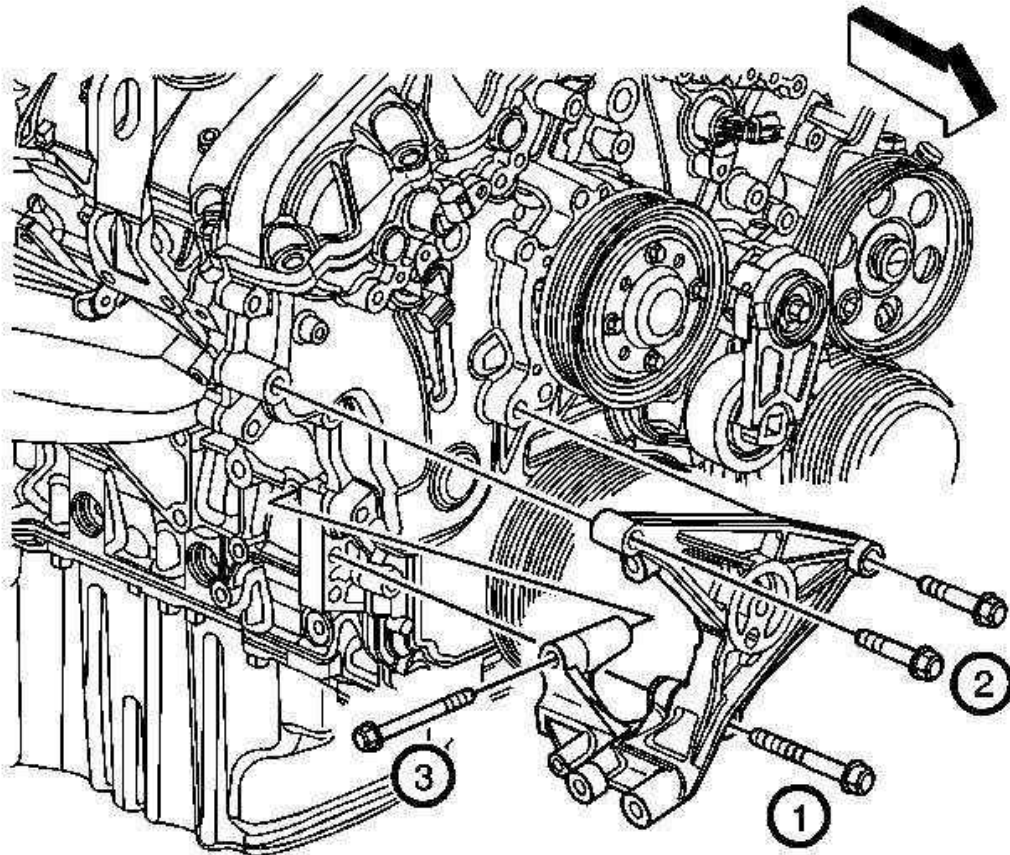


Fig. 100: View Of Generator Bracket Bolts - LY7
Courtesy of GENERAL MOTORS CORP.

5. Remove the generator bracket bolts.
6. Remove the generator bracket.

Installation Procedure

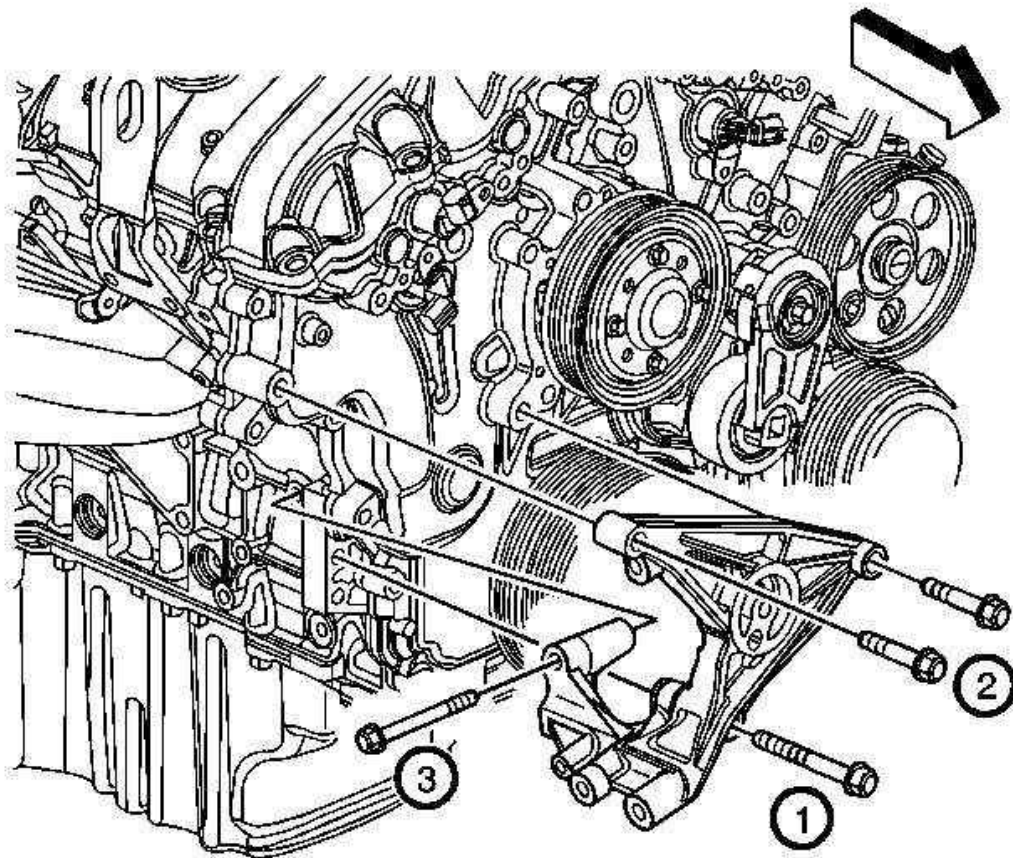


Fig. 101: View Of Generator Bracket Bolts - LY7
Courtesy of GENERAL MOTORS CORP.

1. Install the generator bracket.

NOTE: Refer to Fastener Notice .

2. Install the generator bracket bolts.

Tighten the generator bracket bolts in the sequence shown:

Tighten:

1. Tighten the generator bracket bolts (1) to 50 N.m (37 lb in).
 2. Tighten the generator bracket bolts (2) to 50 N.m (37 lb in).
 3. Tighten the generator bracket bolt (3) to 23 N.m (17 lb in).
3. Install the belt tensioner. Refer to Drive Belt Tensioner Replacement .
 4. Install the coolant inlet pipe lower bolt from the generator bracket.
 5. Install the generator. Refer to Generator Replacement (L26) or Generator Replacement (LY7) or Generator Replacement (LS4).

GENERATOR BRACKET REPLACEMENT (LS4)

Removal Procedure

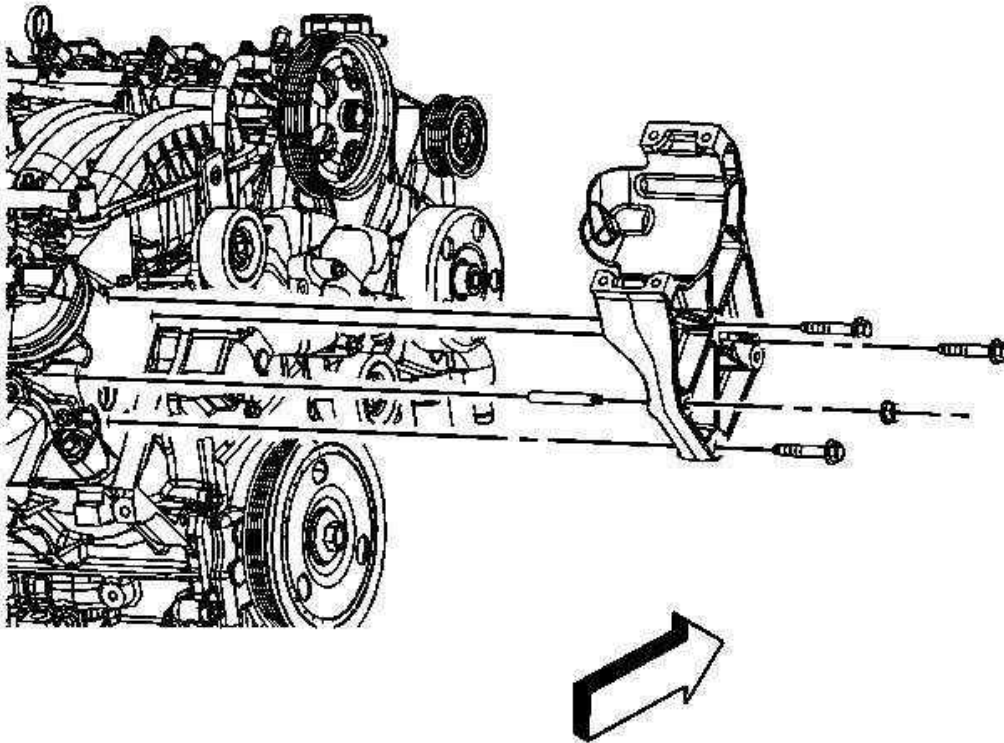


Fig. 102: View Of Generator Bracket
Courtesy of GENERAL MOTORS CORP.

1. Remove the generator. Refer to **Generator Replacement (L26)** or **Generator Replacement (LY7)** or **Generator Replacement (LS4)**.
2. Remove the idle pulley. Refer to **Drive Belt Idler Pulley Replacement** .
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Remove the lower tensioner bolt and rotate the tensioner to access the generator bracket bolt.
5. Lower the vehicle.
6. Remove the generator bracket bolts.
7. Remove the generator bracket from the stud.

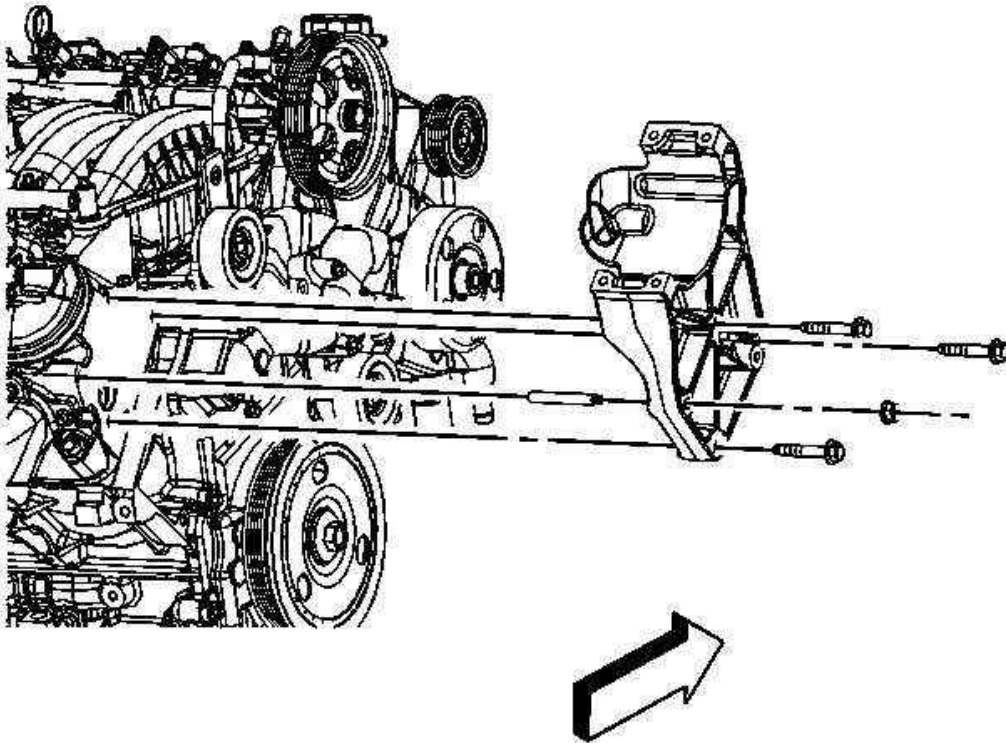


Fig. 103: View Of Generator Bracket
Courtesy of GENERAL MOTORS CORP.

1. Install the generator bracket to the stud.

NOTE: Refer to Fastener Notice .

2. Install the generator bracket bolts.

Tighten: Tighten the bolts to 50 N.m (37 lb ft).

3. Raise the vehicle.
4. Install the lower generator bracket bolt.

Tighten: Tighten the bolt to 50 N.m (37 lb ft).

5. Install the lower tensioner bolt.

Tighten: Tighten the bolt to 50 N.m (37 lb ft).

6. Lower the vehicle.

7. Install the idler pulley. Refer to **Drive Belt Idler Pulley Replacement** .

8. Install the generator. Refer to **Generator Replacement (L26)** or **Generator Replacement (LY7)** or **Generator Replacement (LS4)**.

GENERATOR BRACE REPLACEMENT (L26)

Removal Procedure

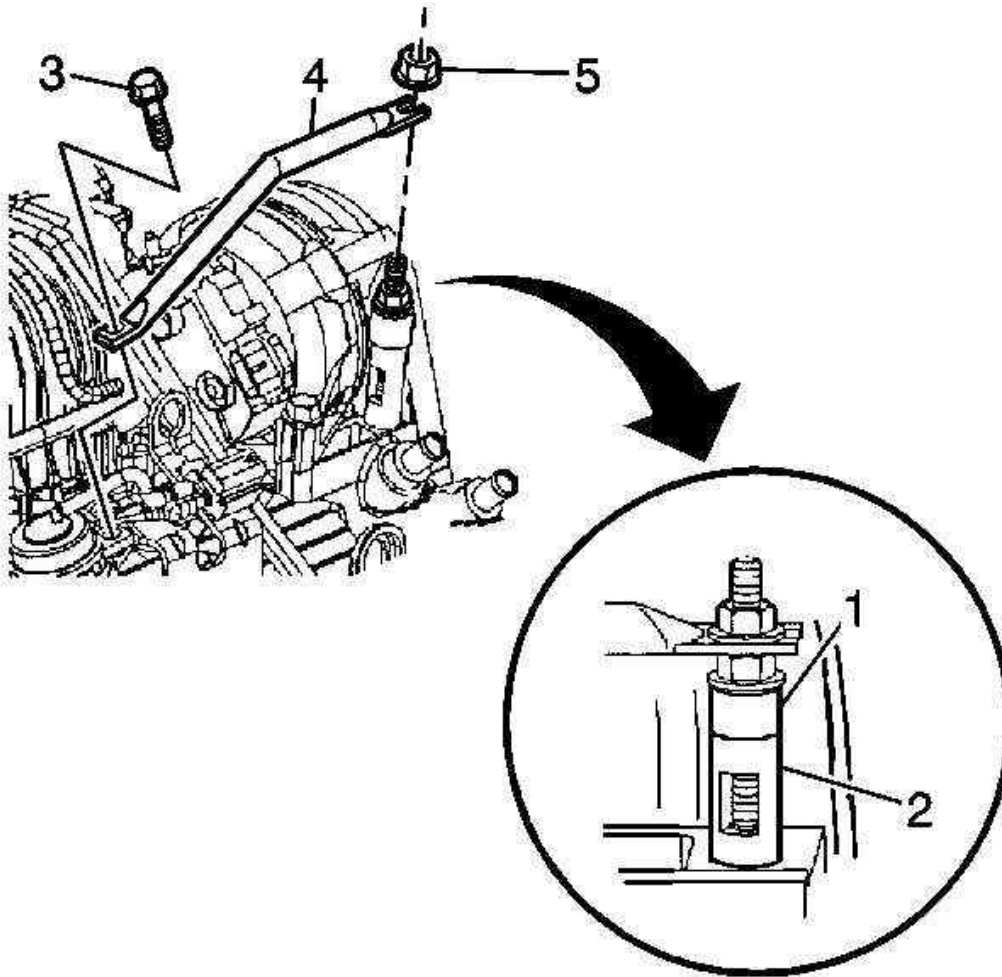


Fig. 104: Identifying Generator Brace & Retainers
Courtesy of GENERAL MOTORS CORP.

1. Remove the generator rear brace nut (5).
2. Remove the generator rear brace bolt (3).
3. Remove the generator rear brace (4).

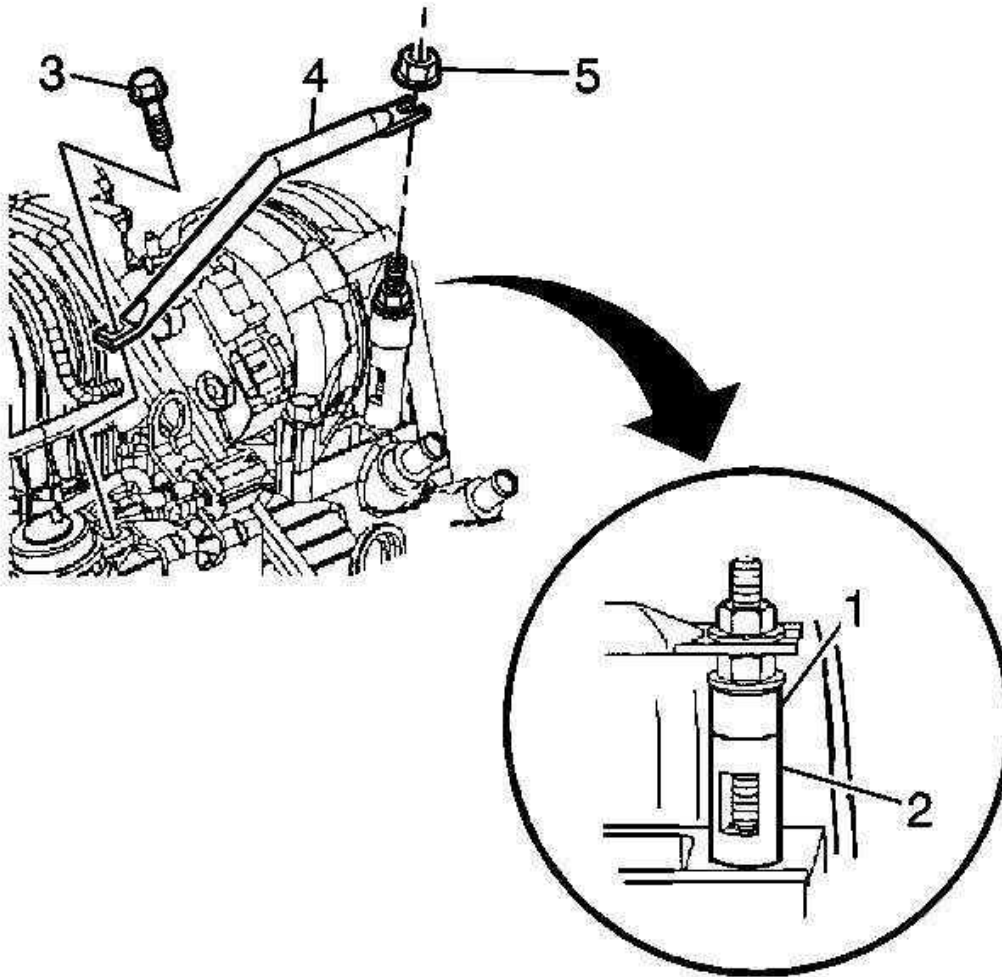


Fig. 105: Identifying Generator Brace & Retainers
Courtesy of GENERAL MOTORS CORP.

1. Install the generator rear brace (4).
2. Install the generator rear brace bolt (3).
3. Install the generator rear brace nut (5).

NOTE: Refer to **FASTENER NOTICE** .

4. Tighten the generator bolts in the order described. The following is a mandatory torque sequence:

Tighten:

1. Tighten the generator rear brace bolt (3) to 50 N.m (37 lb ft).
2. Tighten the generator rear brace nut (5) to 50 N.m (37 lb ft).

GENERATOR REPLACEMENT (L26)

Removal Procedure

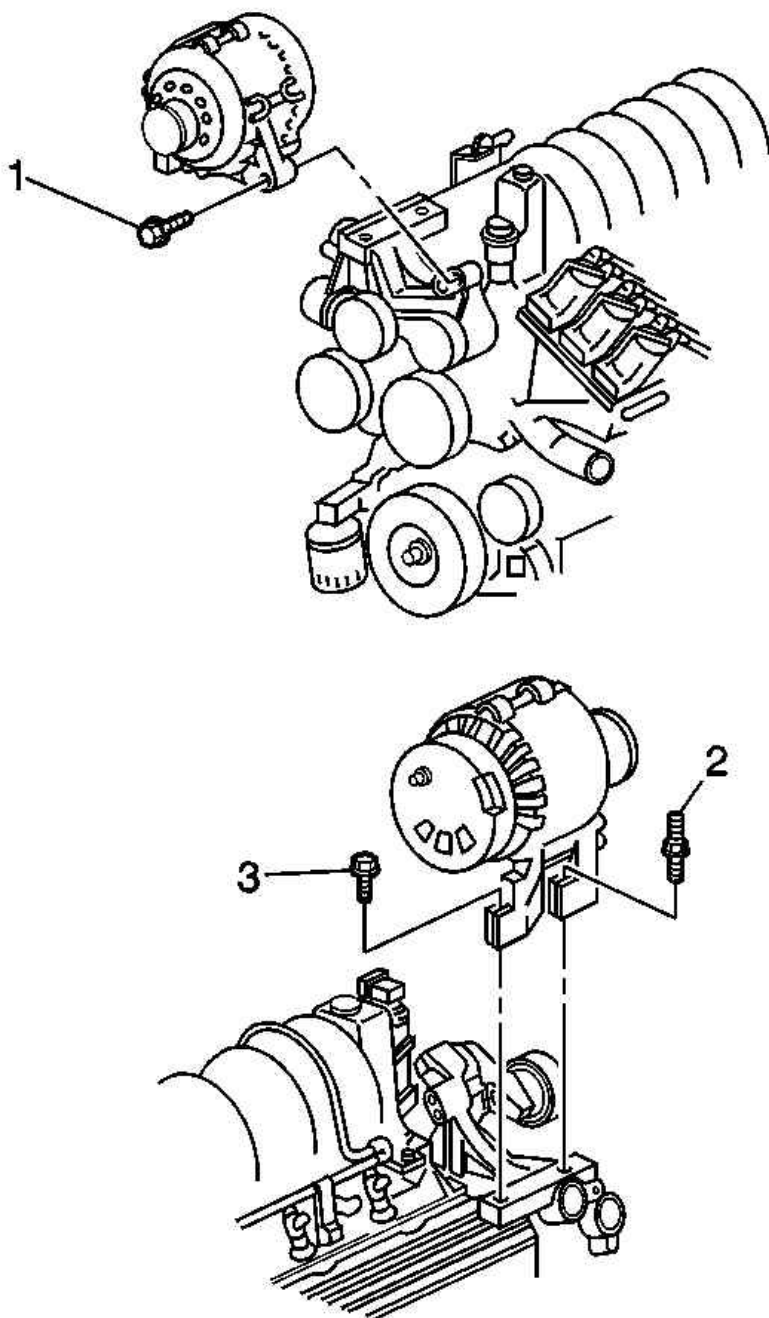


Fig. 106: Identifying Generator & Bolts (3.8L)
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.
2. Remove the drive belt from the generator. Refer to **Drive Belt Replacement (L26)** .
3. Remove the generator rear brace. Refer to **Generator Brace Replacement (L26)**.
4. Remove the bolts (1, 3) and the stud (2) from the generator.
5. Disconnect the electrical connector from the generator.
6. Position aside the protective boot from the generator output BAT terminal for access.
7. Remove the generator output BAT terminal nut and remove the positive battery lead from the generator.
8. Remove the generator.

Installation Procedure

1. Position the generator to the engine.

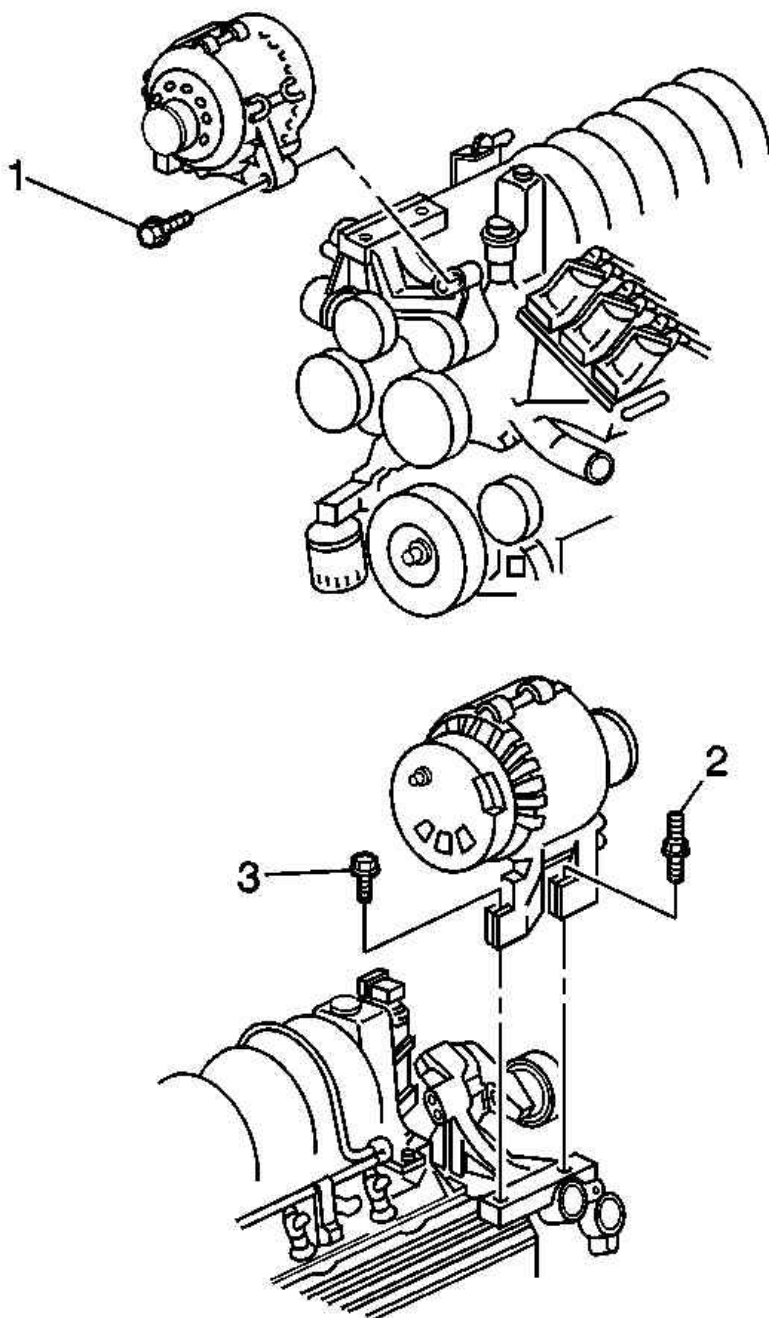


Fig. 107: Identifying Generator & Bolts (3.8L)
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to FASTENER NOTICE .

2. Install the positive battery lead to the generator.
3. Install the generator output BAT terminal nut.

Tighten: Tighten the generator output BAT terminal nut to 20 N.m (15 lb ft).

4. Install the protective boot to the generator output BAT terminal.
5. Connect the electrical connector to the generator.

IMPORTANT: Do not tighten the stud.

6. Install the generator stud (2) to the generator bracket.

IMPORTANT: Do not tighten the bolts.

7. Install the generator bolts (1, 3) to the generator bracket.
8. Tighten the generator bolts and stud in the order described. The following is a mandatory torque sequence:

Tighten:

1. Tighten the generator bolt (1) to 50 N.m (37 lb ft).
 2. Tighten the generator stud (2) to 50 N.m (37 lb ft).
 3. Tighten the generator rear bracket bolt (3) to 50 N.m (37 lb ft).
9. Install the generator rear brace. Refer to Generator Brace Replacement (L26).
 10. Install the drive belt. Refer to Drive Belt Replacement (L26) .
 11. Connect the negative battery negative cable. Refer to Battery Negative Cable Disconnection and Connection (L26) or Battery Negative Cable Disconnection and Connection (LY7) or Battery Negative Cable Disconnection and Connection (LS4).

GENERATOR REPLACEMENT (LY7)**Removal Procedure**

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1. Disconnect the battery ground (negative) cable from the battery. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.
2. Remove the torque struts and rotate the engine in order to provide access to remove the generator. Refer to **Engine Mount Strut Replacement - Left Side** and **Engine Mount Strut Replacement - Right Side** in Engine Mechanical - 3.6L (LY7).

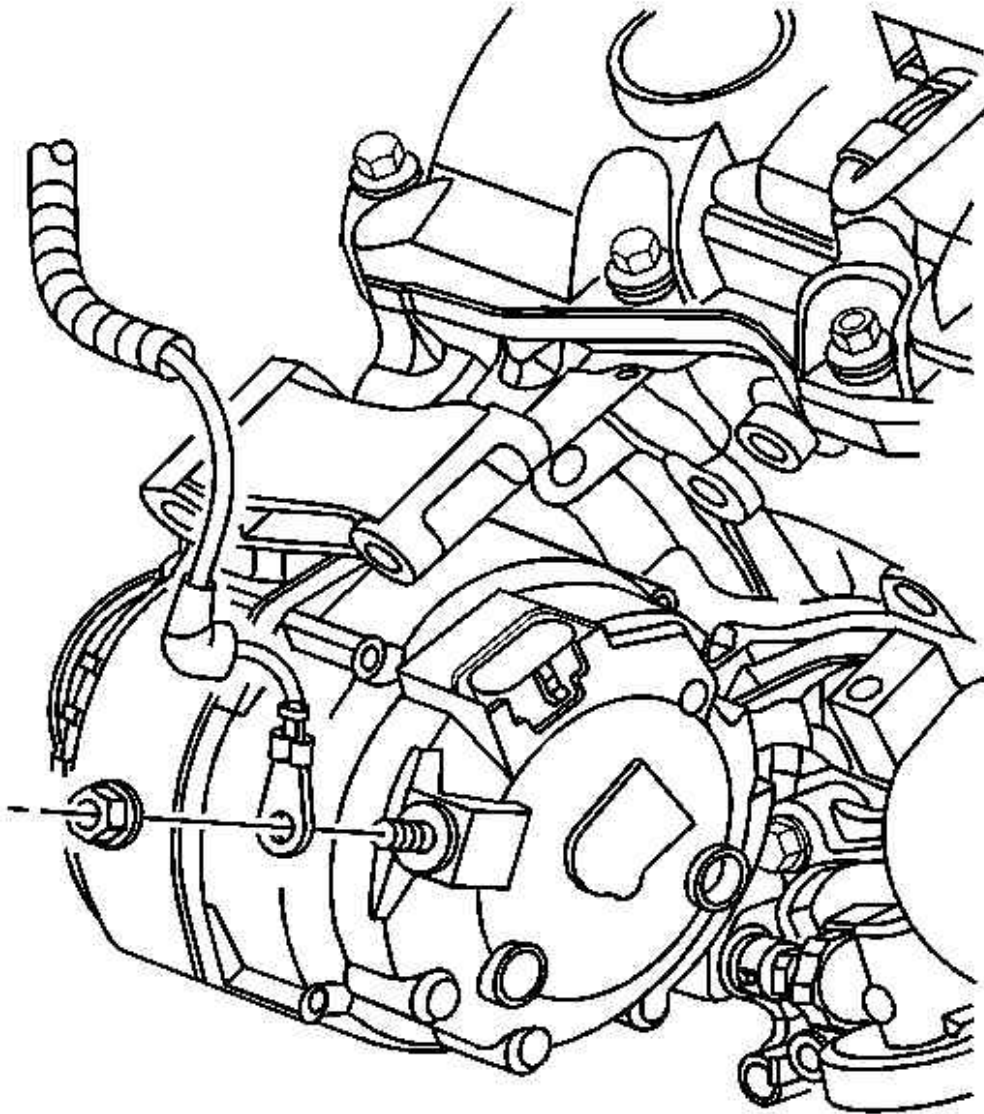


Fig. 108: Identifying Battery Positive Cable Nut & Cable At Generator
Courtesy of GENERAL MOTORS CORP.

3. Remove the generator B+ terminal nut and the battery cable from the generator.

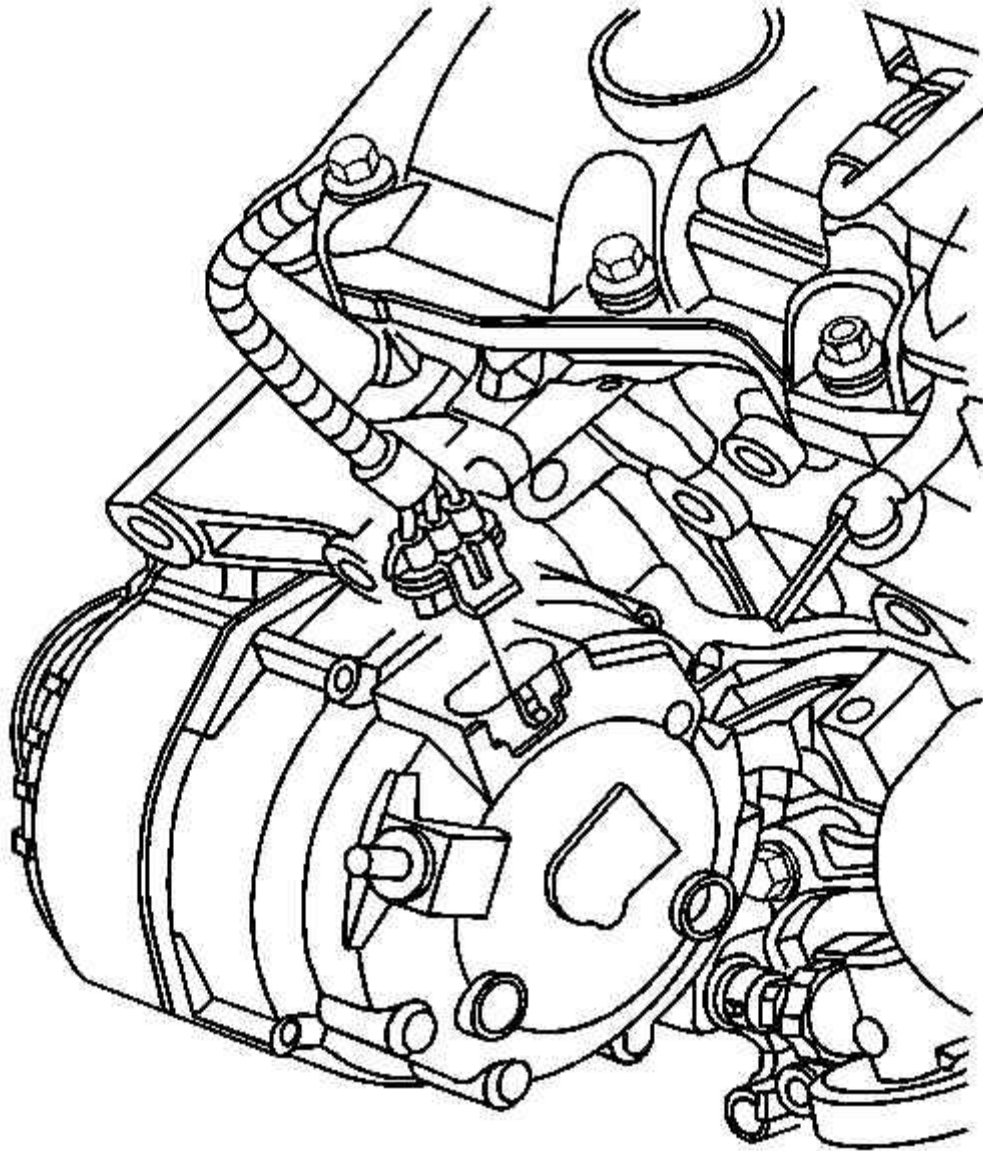


Fig. 109: Locating Generator Electrical Connector
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the generator electrical connector.
5. Remove the drive belt from the generator. Refer to **Drive Belt Replacement** in

Engine Mechanical - 3.6L (LY7).

6. Remove the idler pulley. Refer to **Drive Belt Idler Pulley Replacement** in Engine Mechanical - 3.6L (LY7).

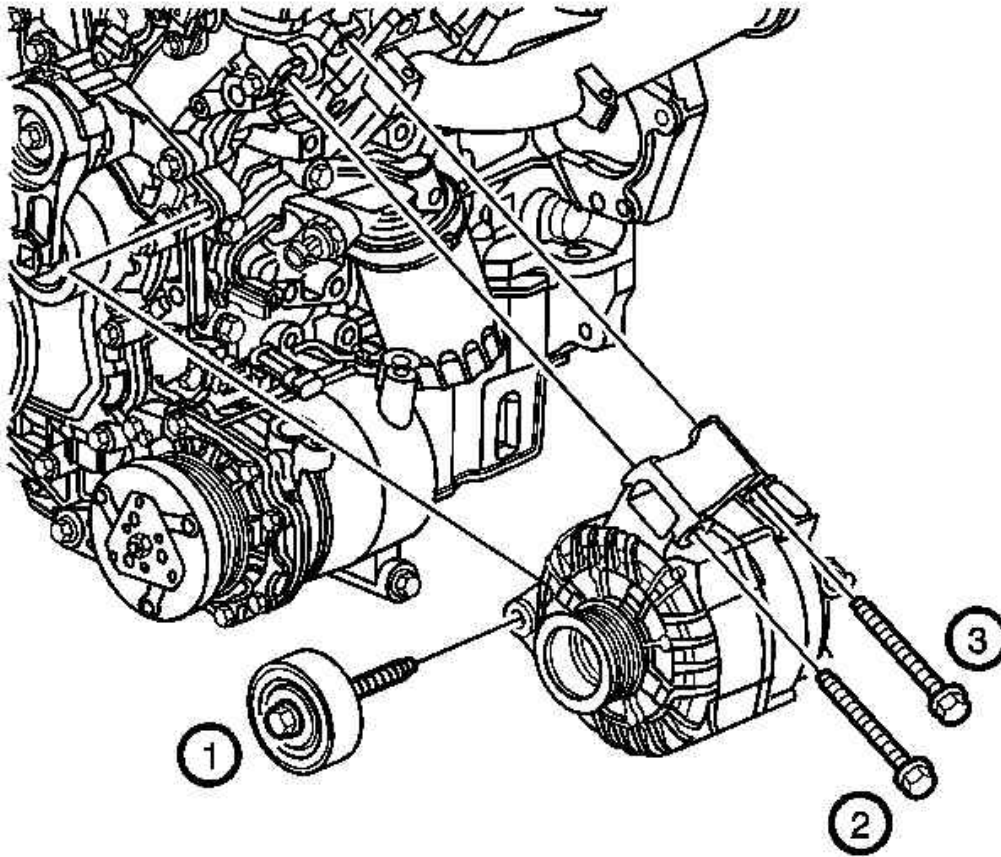


Fig. 110: View Of Generator Bolts
Courtesy of GENERAL MOTORS CORP.

7. Remove the generator bolts.
8. Remove the generator from the vehicle.

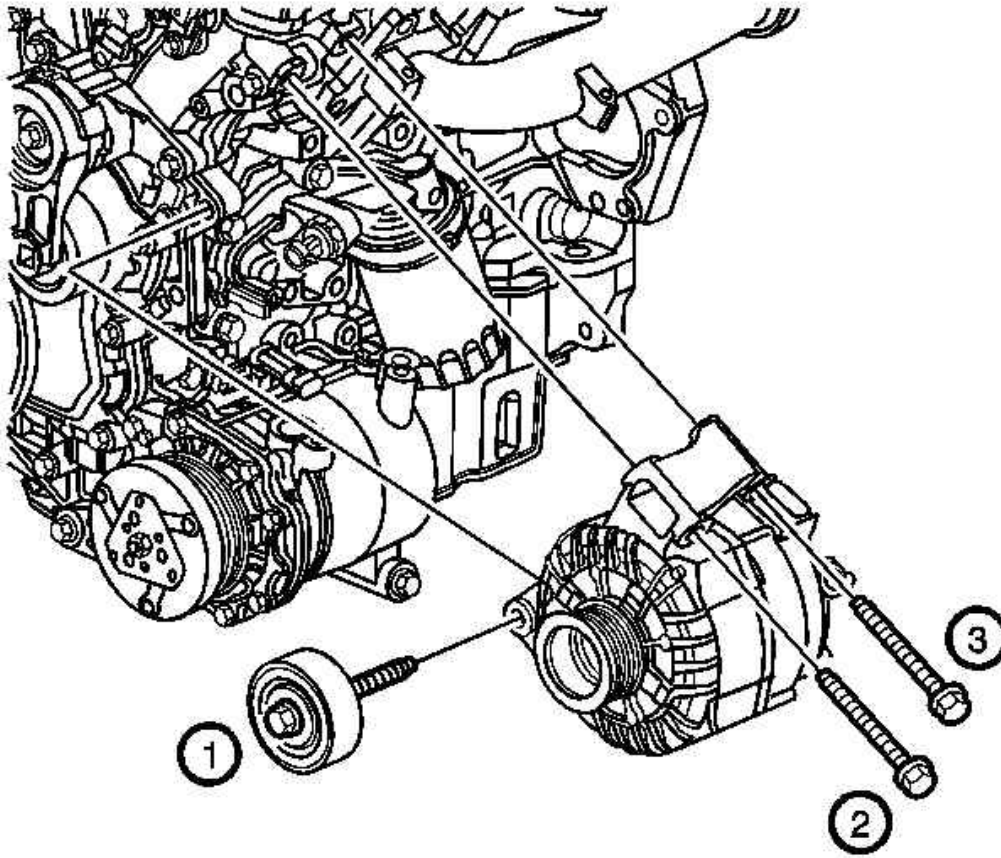


Fig. 111: View Of Generator Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the generator to the vehicle.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the generator bolts.

Tighten: Tighten the generator bolts to 50 N.m (37 lb ft).

3. Install the idler pulley. Refer to Drive Belt Idler Pulley Replacement in Engine Mechanical - 3.6L (LY7).

4. Install the drive belt. Refer to **Drive Belt Replacement** in Engine Mechanical - 3.6L (LY7).

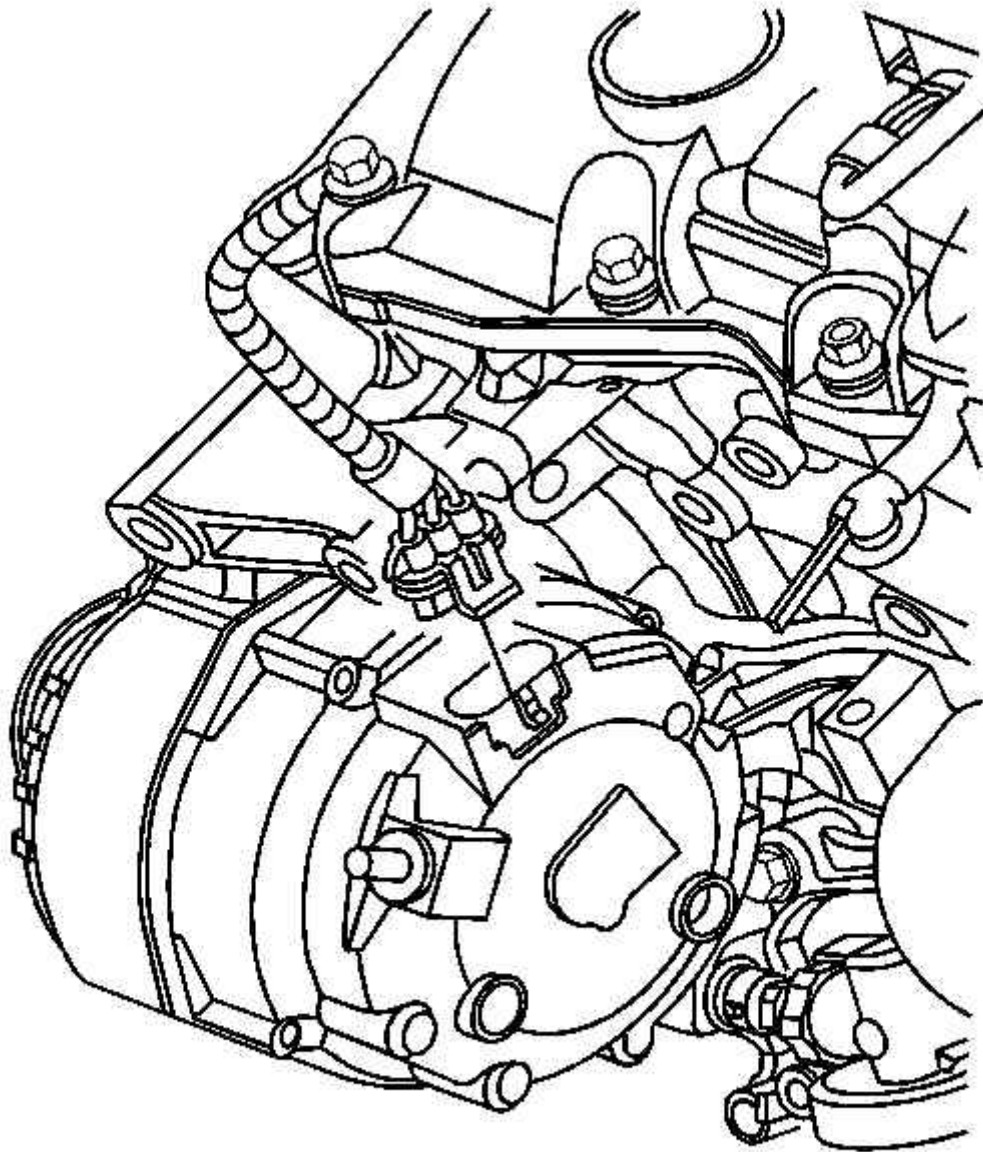


Fig. 112: Locating Generator Electrical Connector
Courtesy of GENERAL MOTORS CORP.

5. Connect the generator electrical connector.

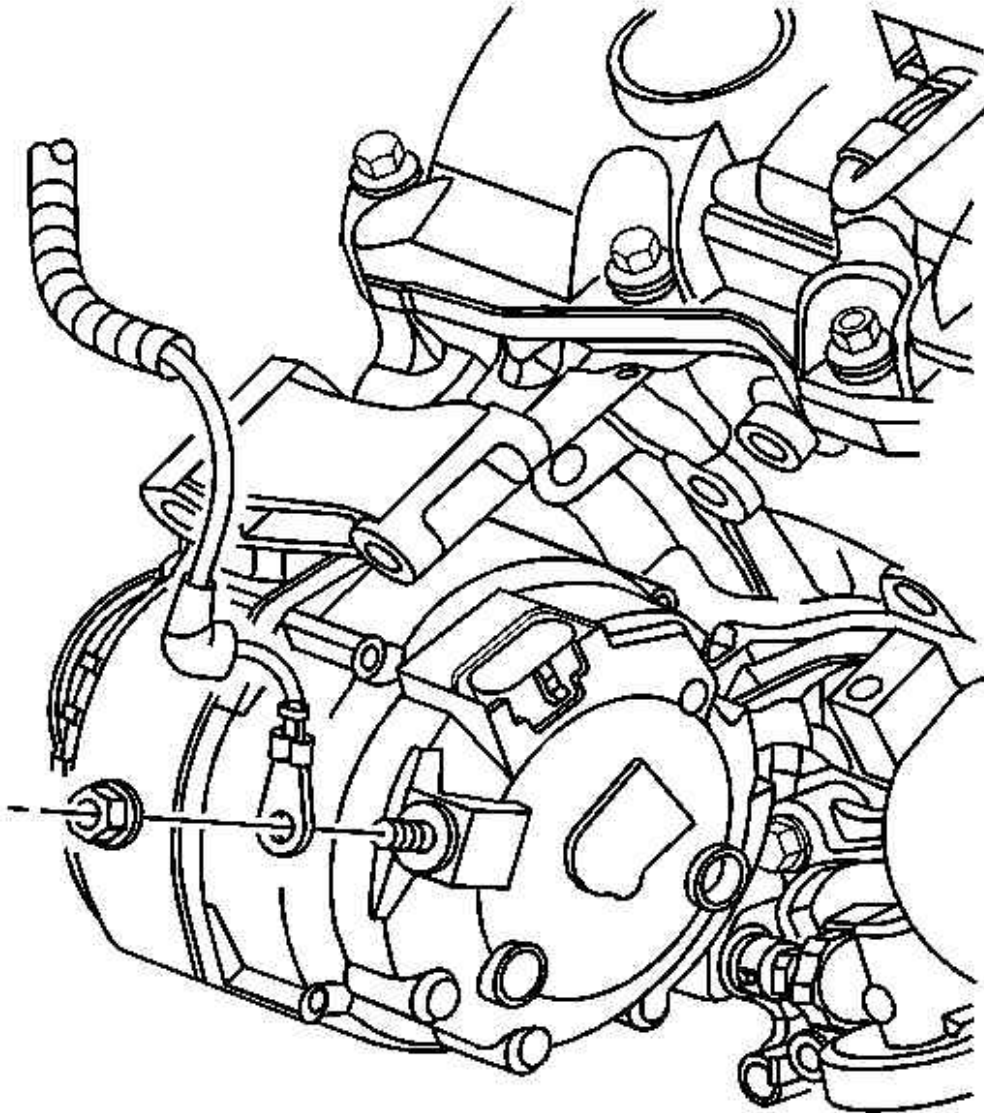


Fig. 113: Identifying Battery Positive Cable Nut & Cable At Generator
Courtesy of GENERAL MOTORS CORP.

6. Install the battery cable and the generator B+ terminal nut to the generator.

Tighten: Tighten the generator B+ terminal nut 20 N.m (15 lb ft).

7. Install the torque struts. Refer to **Engine Mount Strut Replacement - Left Side** and **Engine Mount Strut Replacement - Right Side** in Engine Mechanical - 3.6L (LY7).
8. Connect the battery ground (negative) cable to the battery. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.

GENERATOR REPLACEMENT (LS4)

Removal Procedure

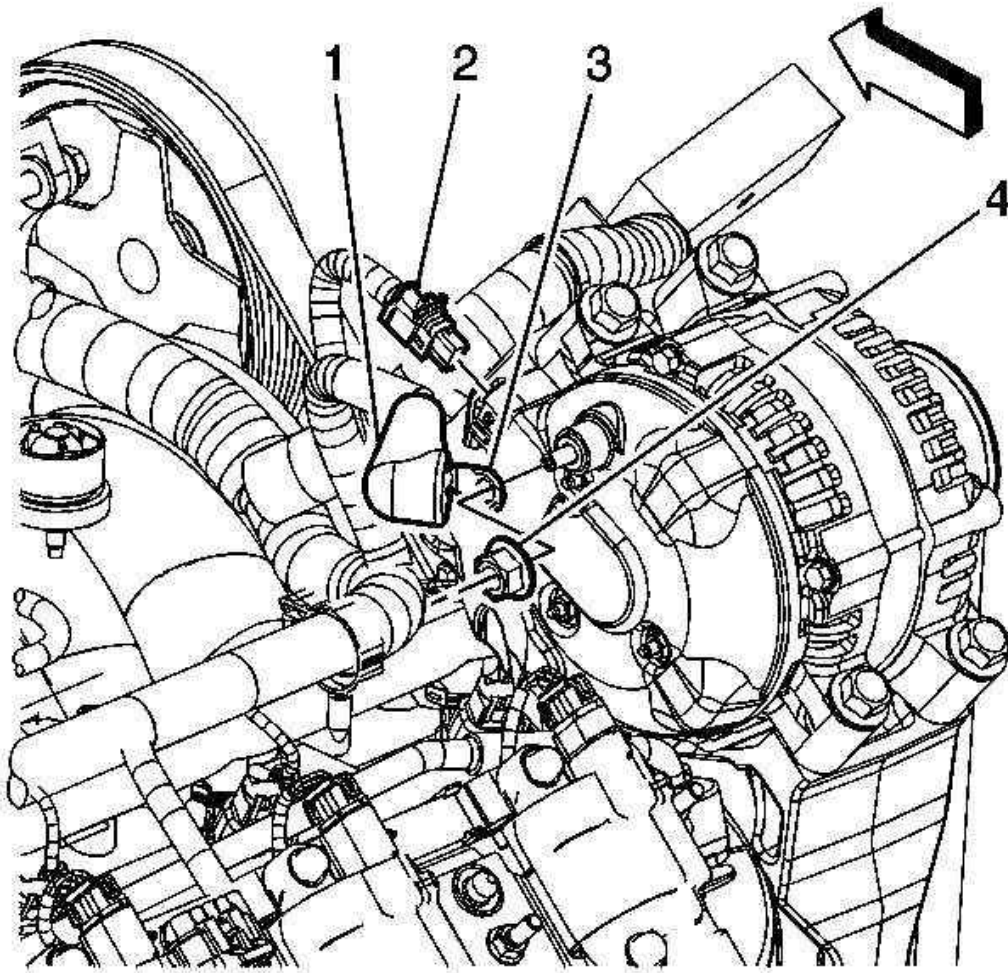


Fig. 114: View Of Generator Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.
2. Remove the engine sight shield. Refer to **Upper Intake Manifold Sight Shield Replacement** .
3. Remove the drive belt. Refer to **Drive Belt Replacement - Accessory** .

4. Disconnect the generator electrical connector (2).
5. Position aside the protective boot (1) from the generator output BAT terminal for access.
6. Remove the generator output BAT terminal nut (4) and remove the positive battery lead (3) from the generator.

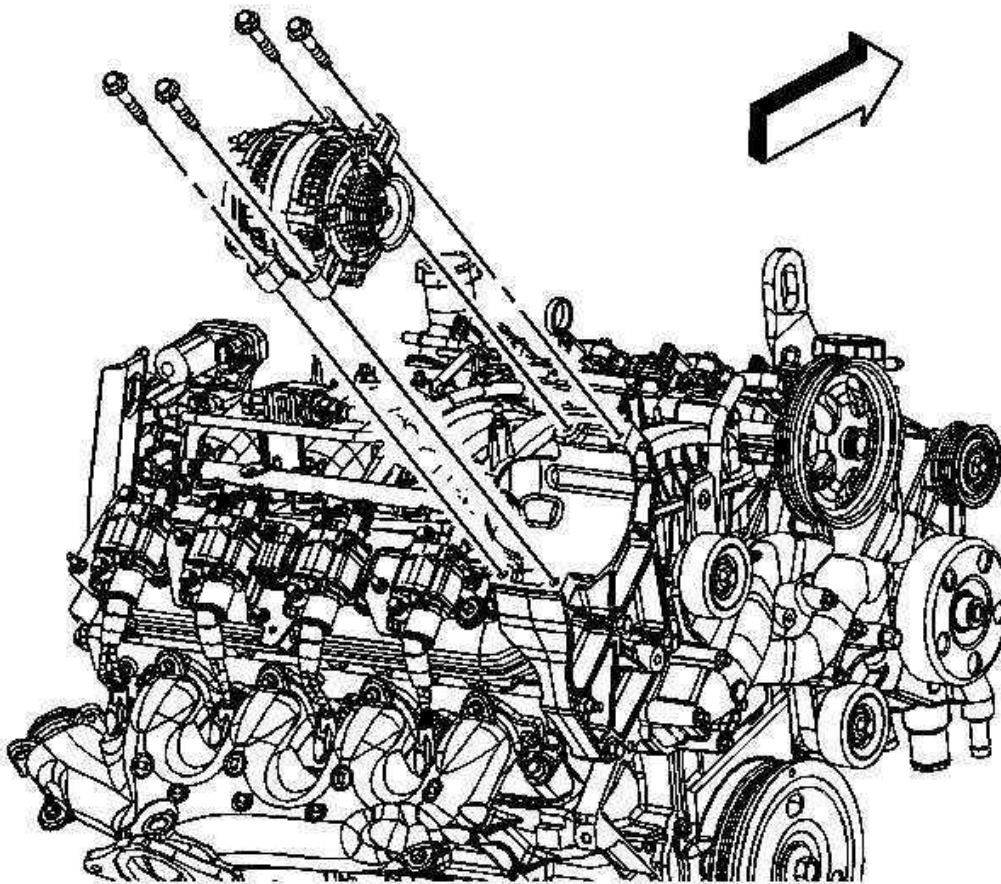


Fig. 115: View Of Generator & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Remove the generator bolts and generator.

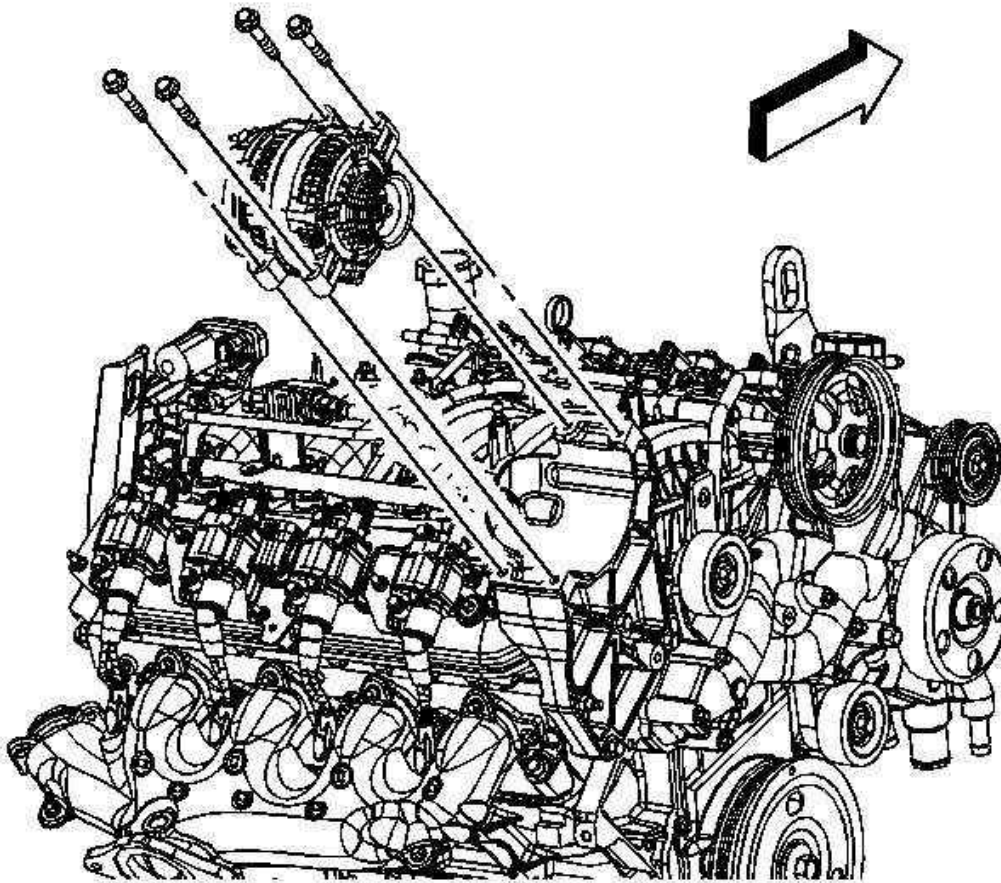


Fig. 116: View Of Generator & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Install the generator and bolts.

Tighten: Tighten the bolts to 50 N.m (37 lb ft).

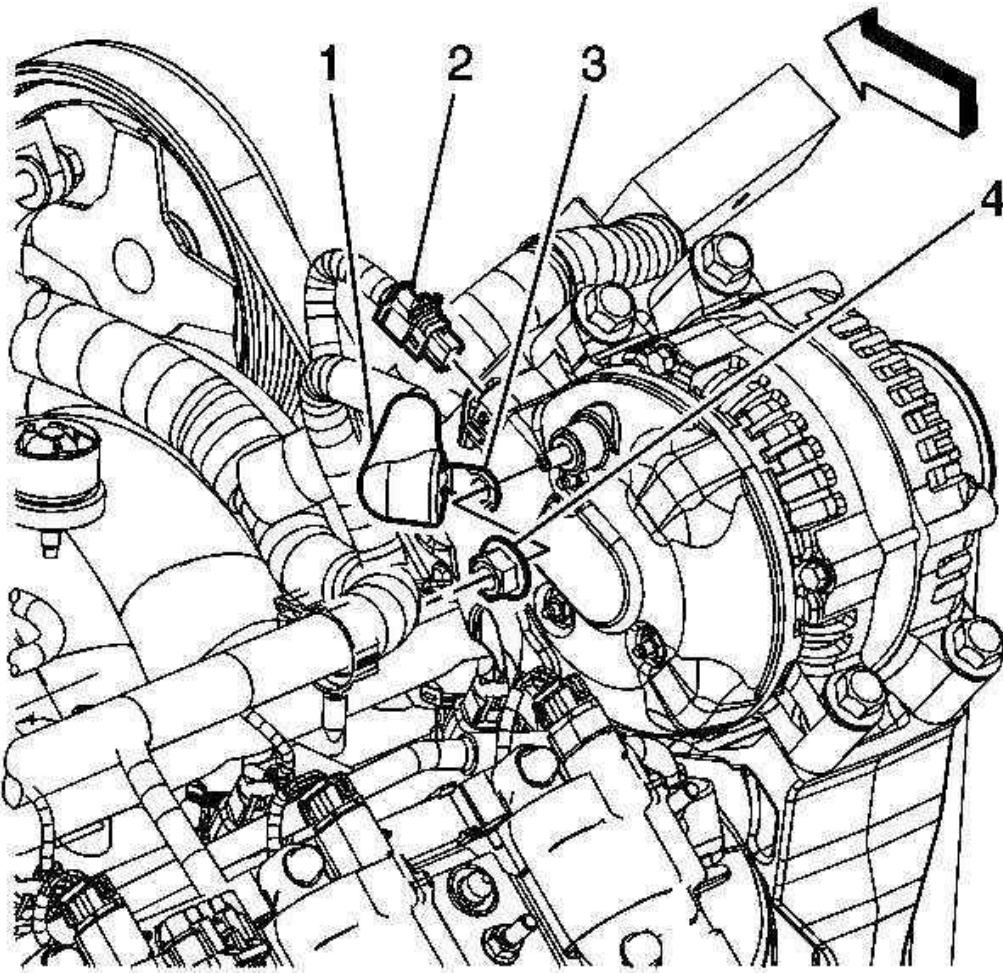


Fig. 117: View Of Generator Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

2. Install the positive battery lead (3) and generator output BAT terminal nut (4) to the generator.

Tighten: Tighten the nut to 20 N.m (15 lb ft).

3. Position the protective boot (1) to the generator output BAT terminal.
4. Connect the generator electrical connector (2).

5. Install the drive belt. Refer to **Drive Belt Replacement - Accessory** .
6. Install the engine sight shield. Refer to **Upper Intake Manifold Sight Shield Replacement** .
7. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)**.

DESCRIPTION AND OPERATION

BATTERY DESCRIPTION AND OPERATION (L26/L32)

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.

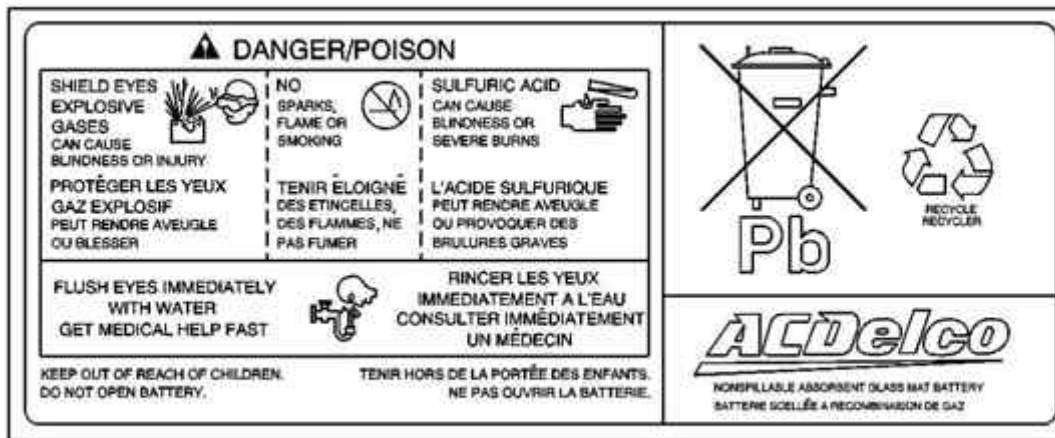


Fig. 118: View Of Battery Warning Label
Courtesy of GENERAL MOTORS CORP.

The maintenance free Absorbent Glass Mat (AGM) battery is the standard original equipment battery. The battery is completely sealed except for one vent port in the end of the cover. The vent port allows the small amount of gas that is produced in the battery to escape when pressures exceed 2 psi. The AGM battery is a lead-acid battery that is similar to current batteries. They use glass mats that absorb electrolyte that are pressed between the plates instead of immersing the plates in electrolyte. This allows a smaller, lighter battery with the same amount of power which is less susceptible to heat.

The battery has 3 functions as a major source of energy:

- Engine cranking
- Voltage stabilizer
- Alternate source of energy with generator overload and during key off.

The battery specification label (see typical figure) contains information about the following:

- The test ratings
- The original equipment catalog number
- The recommended replacement model number



Fig. 119: Identifying Battery Rating
Courtesy of GENERAL MOTORS CORP.

Battery Ratings

A battery has 2 ratings:

- 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**.

Reserve Capacity (RC)

The RC is an indication of the battery ability to produce a relatively low amount of current over a long period of time and is also an indication of the battery energy storage capability. The RC rating is the amount of time in minutes it takes a fully charged battery at 27°C (80°F) to reach a terminal voltage of 10.5 volts when it is being discharged at a constant rate of 25 amperes. 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 provide high power 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 across its terminals. Refer to **Battery Usage** for the cold cranking amperage rating for this vehicle.

Circuit Description

The battery positive terminal supplies battery positive voltage to the under hood fuse block and the rear fuse block. The under hood fuse block provides a cable connection for the generator and a cable connection for the starter.

BATTERY DESCRIPTION AND OPERATION (LS4/LY7)

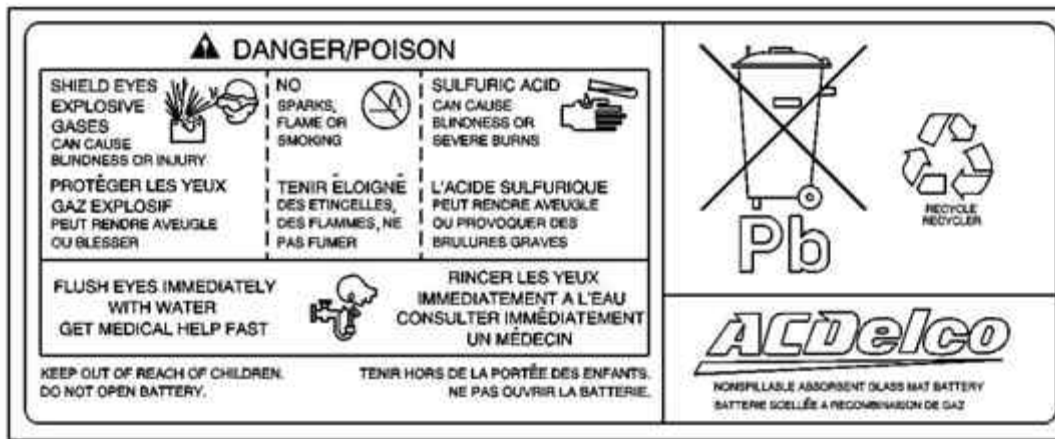


Fig. 120: View Of Battery Warning Label
 Courtesy of GENERAL MOTORS CORP.

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

CATALOG NO.

1819

CCA 770	LOAD TEST 380
REPLACEMENT MODEL 100 – 6YR	

Fig. 121: 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.

CHARGING SYSTEM DESCRIPTION AND OPERATION**Electrical Power Management (EPM) Overview**

The 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 (SOC) and life, and minimize the system's impact on fuel economy. The EPM system performs three functions:

- It monitors the battery voltage and estimates the battery condition.
- It takes corrective actions by adjusting the regulated voltage.
- It performs diagnostics and driver notification.

The battery's condition is estimated during key-off and during key-on. During key-off the 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 key-on the algorithm continuously estimates SOC based on adjusted net amp hours, battery capacity, initial SOC, and temperature.

While running, the battery's 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's 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 operation of the charge indicator, driver information center 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 BCM is a class 2 device. It communicates with the engine control module (ECM)/powertrain control module (PCM) and the instrument panel cluster for EPM operation. The BCM determines the output of the generator and sends the information to the ECM/PCM for control of the generator field control circuit. It monitors the generator field duty cycle signal circuit information sent from the ECM/PCM for control of the generator. It monitors a battery current sensor, the battery positive voltage circuit, and estimated battery temperature to determine battery SOC. The BCM performs idle boost and load management operations.

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 10 volt PWM signal of 128 Hz with a duty cycle of 0-100%. Normal duty cycle is between 5-95%. Between 0-5% and 95-100% are for diagnostic purposes.

Engine Control Module (ECM)/Powertrain Control Module (PCM)

The ECM/PCM directly controls the generator field control circuit input to the generator. It monitors the generators generator field duty cycle signal circuit and sends the information to the BCM. The ECM/PCM will over ride the BCM control of the generator when one of the following conditions are met:

- The engine cooling fans are on high speed.
- There is a high fuel demand.
- The calculated ambient air temperature is less than 0°C (32°F).

Instrument Panel Cluster (IPC)

The IPC provides a means of customer notification in case of a failure and a voltmeter. There is two means of notification, a charge indicator and a driver information center message of SERVICE CHARGING SYSTEM and CHARGING SYSTEM FAULT.

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:

- Charge Mode
- Fuel Economy Mode
- Voltage Reduction Mode
- Start Up Mode
- Windshield Deice Mode
- Battery Sulfation Mode

The ECM/PCM controls the generator through the generator field control circuit. It monitors the generator performance through the generator field duty cycle signal circuit. The signal is a 5 volt PWM signal of 128 Hz with a duty cycle of 0-100%. Normal duty cycle is between 5-95%. Between 0-5% and 95-100% 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 %	11.0 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/PCM, this information is sent to the BCM. The signal is a 5 volt PWM signal of 128 Hz with a duty cycle of 0-100%. Normal duty cycle is between 5-99%. Between 0-5% and 100% are for diagnostic purposes.

The BCM will enter Charge Mode when ever one of the following conditions are met:

- The interpreted fuel rate is greater than 21 g/s and the throttle position is greater than 90%.
- The headlamps are ON, low or high beam.
- The wipers are ON for more than 8 seconds.
- The electric cooling fans are on high speed.
- The rear defogger is ON.

Once one of these conditions are met, the generator battery control module will set the targeted generator output voltage to 13.4 volts and then ramp that voltage up to 14.5 volts at a rate of 50 mV per second.

Fuel Economy Mode

The BCM will enter Fuel Economy Mode when the calculated ambient air temperature is above 0°C (32°F), the calculated battery current is less than 15 amperes and greater than -8 amperes, and the battery SOC is greater than 80%. Its targeted generator output voltage is 13.0 volts. The BCM will exit this mode once the criteria are met for Charge Mode.

Voltage Reduction Mode

The BCM will enter Voltage Reduction Mode when the calculated ambient air temperature is above 0°C (32°F); the calculated battery current is less than 2 amperes and greater than -7 amperes, and the generator field duty cycle is less than 99%. Its targeted generator output voltage is 12.9 volts. The BCM will exit this mode once the criteria are met for Charge Mode.

Start Up Mode

After the engine has started the BCM sets a targeted generator output voltage of 14.5 volts for 20 seconds.

Windshield Deice Mode

After the engine has run for more than 10 seconds the BCM sets a targeted

generator output voltage of 13.8 volts if the calculated ambient air temperature is less than 0°C (32°F). The BCM will stay in this mode until the engine coolant temperature reaches 75°C (167°F) for 10 minutes.

Battery Sulfation Mode

The BCM will enter this mode when the interpreted generator output voltage is less than 13.2 volts for 45 minutes. Once in this mode the BCM will set a targeted output voltage of 13.8 volts for 5 minutes. The BCM will then determine which mode to enter depending on voltage requirements.

Instrument Panel Cluster (IPC) Operation

Charge Indicator Operation

The IPC illuminates the charge indicator in the message center when the one or more of the following occurs:

- The ECM/PCM detects that the generator output is less than 11 volts or greater than 16 volts. The IPC receives a class 2 message from the ECM/PCM requesting illumination.
- The IPC determines that the system voltage is less than 11 volts or greater than 16 volts for more than 30 seconds. The IPC receives a class 2 message from the 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.

Charging System Failure

The BCM and the ECM/PCM will send a class 2 message to the IPC for the CHARGING SYSTEM FAILURE 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.

Battery Voltage

The IPC displays the system voltage as received from the BCM over the class 2 serial data circuit. If there is no communication with the BCM then the display will

read all dashes until communication is restored.

Battery Saver Active

The BATTERY SAVER ACTIVE message will display on the DIC when the vehicle enters a load shed 2 event. Refer to appropriate information for load shed 2 setting criteria.

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, and manages system electrical loads.

The load shed operation is a means of reducing electrical loads during a low voltage or low battery SOC condition.

The idle boost operation is a means of improving generator performance during a low voltage or low battery SOC condition.

Each EPM function, either idle boost or load-shed, is discrete. No 2 functions are active at the same time. 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:

Idle Boost/Load Shed Operation Reference Table

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	-	-	Battery has a net loss greater	First level Idle boost

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Start			than 0.6 AH	requested
Idle Boost 1 Start	-	Less Than 10.9 V	-	First level Idle boost requested
Idle Boost 1 End	Greater Than - 15°C (5°F)	Greater Than 12.0 V	Battery has a net loss less than 0.2 AH	First level Idle boost request cancelled
Load Shed 1 Start	-	-	Battery has a net loss of 4.0 AH	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 20% of their cycle
Load Shed 1 Start	-	Less Than 10.9 V	-	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 20% of their cycle
Load Shed 1 End	-	Greater Than 12.0 V	Battery has a net loss of less than 2.0 AH	Clear Load Shed 1
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 12.0 V	Battery has a net loss less than 0.8 AH	Second level Idle boost request cancelled

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Idle Boost 3 Start	-	-	Battery has a net loss of 10.0 AH	Third level Idle boost requested
Idle Boost 3 Start	-	Less Than 10.9 V	-	Third level Idle boost requested
Idle Boost 3 End	-	Greater Than 12.0 V	Battery has a net loss of less than 6.0 AH	Third level Idle boost request cancelled
Load Shed 2 Start	-	Less Than 10.9 V	Battery has a net loss greater than 12 AH	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 50% of their cycle. The BATTERY SAVER ACTIVE message will be displayed on the DIC
Load Shed 2 Start	-	Less Than 10.9 V	-	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 50% of their cycle. The BATTERY SAVER ACTIVE message will be displayed

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				on the DIC
Load Shed 2 End	-	Greater Than 12.6 V	Battery has a net loss of less than 10.5 AH	Clear Load Shed 2
Load Shed 3 Start	-	Less Than 11.9 V	Battery has a net loss greater than 20 AH	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 100% of their cycle. The BATTERY SAVER ACTIVE message will be displayed on the DIC
Load Shed 3 End	-	Greater Than 12.6 V	Battery has a net loss of less than 15 AH	Clear Load Shed 3

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 CRANK Relay/STRTR 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

For ignition switch power modes refer to **Body Control System Description and Operation** . When the ignition switch is placed in the Start position a discrete 12 volts signal is supplied to the body control module (BCM) notifying it that the ignition is in the Start position. The BCM then sends message to the engine control module (ECM)/powertrain control module (PCM) notifying it that CRANK has been requested. At the same time the BCM is supplying 12 volts for the IGN 1 Relay/IGNITION MAIN PCM Relay closing it and supplying battery positive voltage for the CRANK Relay/STRTR Relay coil. The ECM/PCM verifies that the transmission is in Park or Neutral. If it is, the ECM/PCM grounds the control circuit of the CRANK Relay/STRTR Relay. When this occurs battery positive voltage is supplied through the switch side of the CRANK Relay/STRTR Relay to the S terminal of the starter solenoid. For remote vehicle start (RVS) information, refer to **Keyless Entry System Description and Operation** .

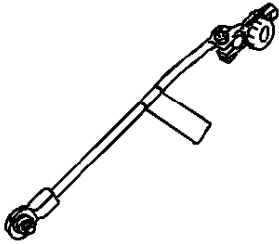
SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

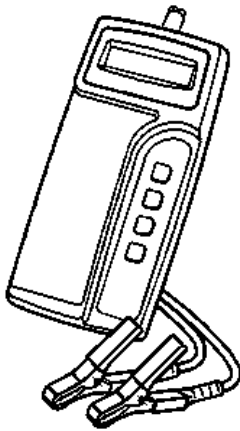
Illustration	Tool Number/Description

2008 Buick LaCrosse CXL

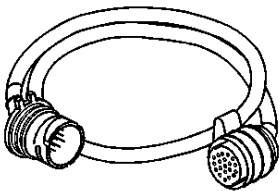
2008 ENGINE Engine Electrical - LaCrosse



J 38758
Parasitic Draw Test Switch



J 42000
Battery Tester



J 45681
Jumper Harness