2007 ENGINE

Engine Electrical - Corvette

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Battery Hold Down Retainer Bolt	18 N.m	13 lb ft
Battery Positive/Negative Cable Ground Bolt (at engine)	40 N.m	30 lb ft
Battery Positive/Negative Cable Ground Bolt (at the frame rail)	25 N.m	18 lb ft
Battery Tray Bolt	12 N.m	106 lb in
Engine Harness Cable Nut	13 N.m	10 lb ft
Generator Bolt	50 N.m	37 lb ft
Generator Bracket Bolt	50 N.m	37 lb ft
Generator Shaft Nut	75 N.m	55 lb ft
Ground Strap Bolt	32 N.m	24 lb ft
Ground Strap Nut	8 N.m	71 lb in
Instrument Panel (IP) Wiring Harness Junction Block Nut	10 N.m	89 lb in
Negative Battery Cable to Battery Nut	8 N.m	71 lb in
Negative Battery Cable Ground Nut	8 N.m	71 lb in
Negative Battery Cable Bolt	25 N.m	18 lb ft
Positive Battery Cable to Battery Nut	8 N.m	71 lb in
Positive Battery Cable Nut (at starter solenoid)	10 N.m	89 lb in
Positive Battery Cable Nut (at fuse/relay center)	10 N.m	89 lb in
S Terminal Nut	4 N.m	35 lb in
Starter Motor Bolt	50 N.m	37 lb ft

BATTERY USAGE

Battery Usage

Application	Specification

Cold Cranking Amperage (CCA)	590 A
Reserve Capacity	110 Minutes
Replacement Model Number	86-3YR

GENERATOR USAGE

Generator Usage

Application	Specification
Generator Model	Valeo TG15
Rated Output	140 Amps
Load Test Output	98 Amps

SCHEMATIC AND ROUTING DIAGRAMS

STARTING AND CHARGING SCHEMATICS

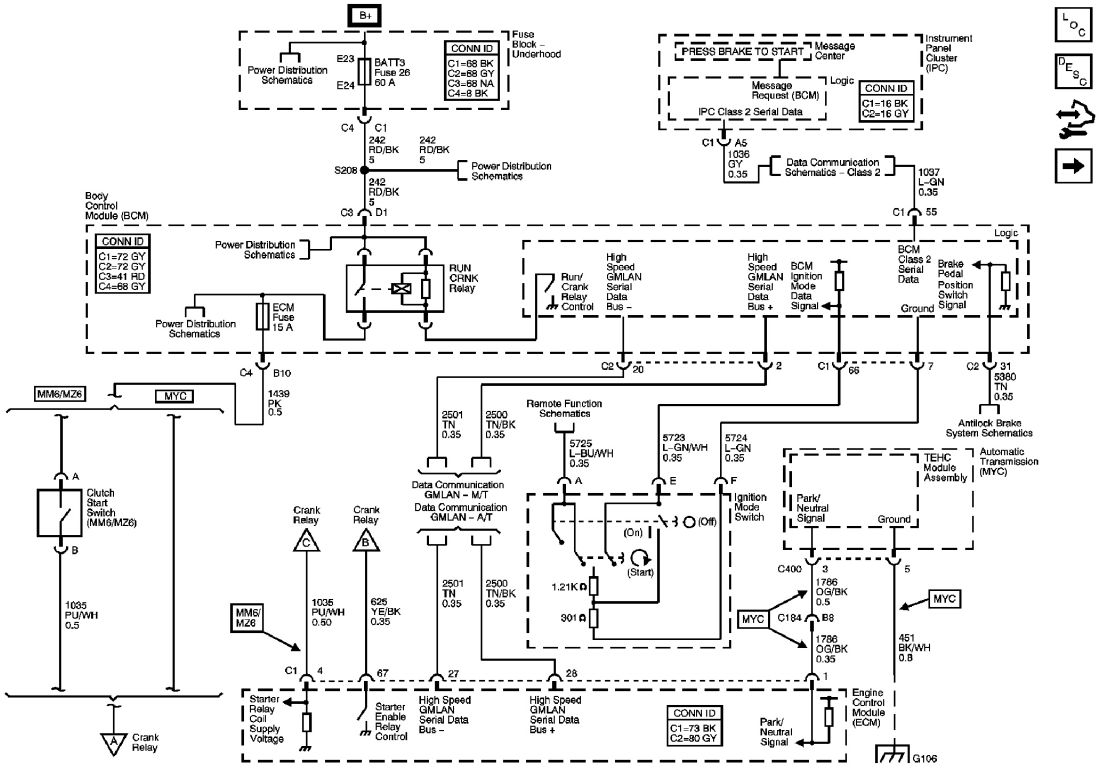


Fig. 1: Cranking Schematic 1 of 2
Courtesy of GENERAL MOTORS CORP.

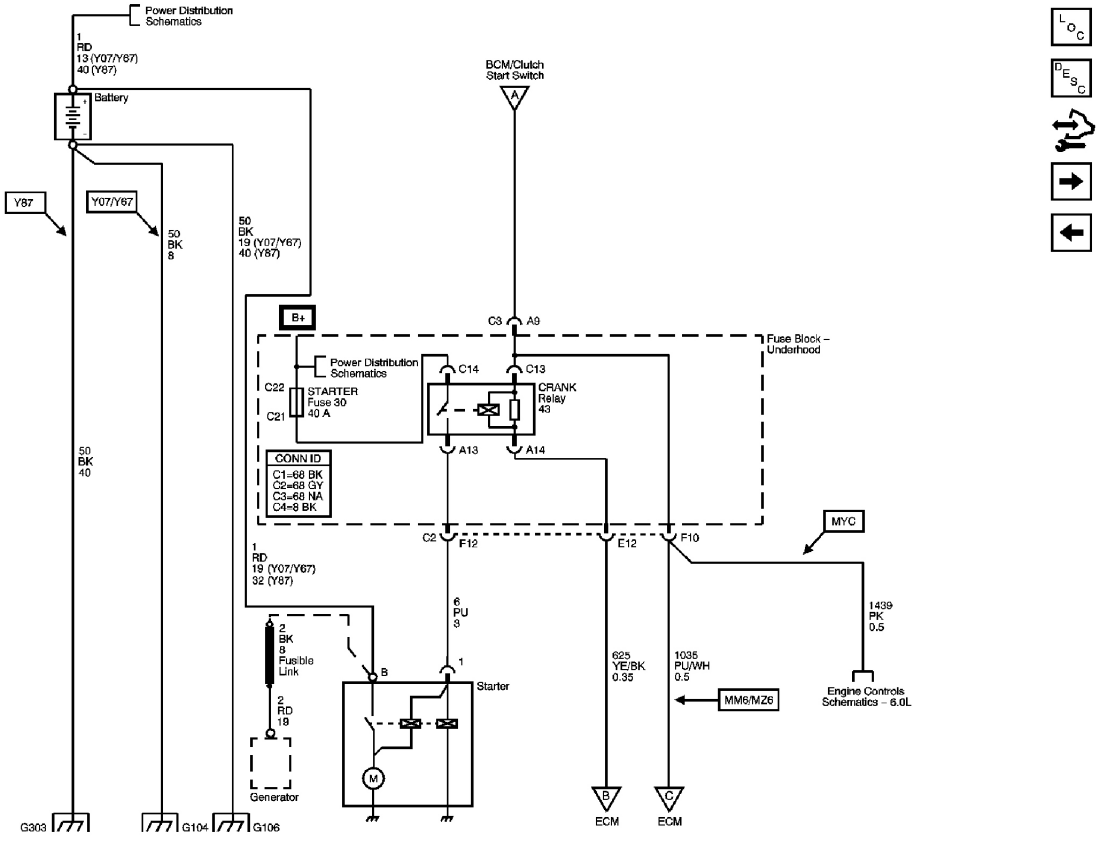


Fig. 2: Cranking Schematic 2 of 2
Courtesy of GENERAL MOTORS CORP.

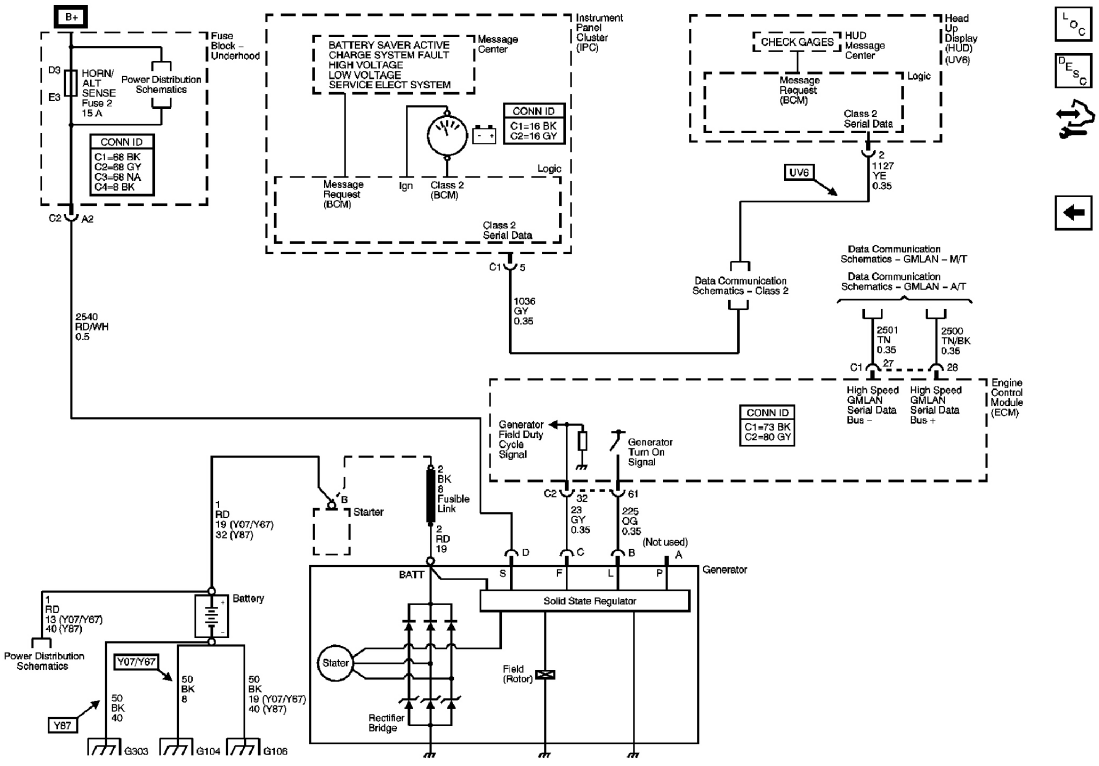


Fig. 3: Charging Schematic
Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

ENGINE ELECTRICAL COMPONENT VIEWS

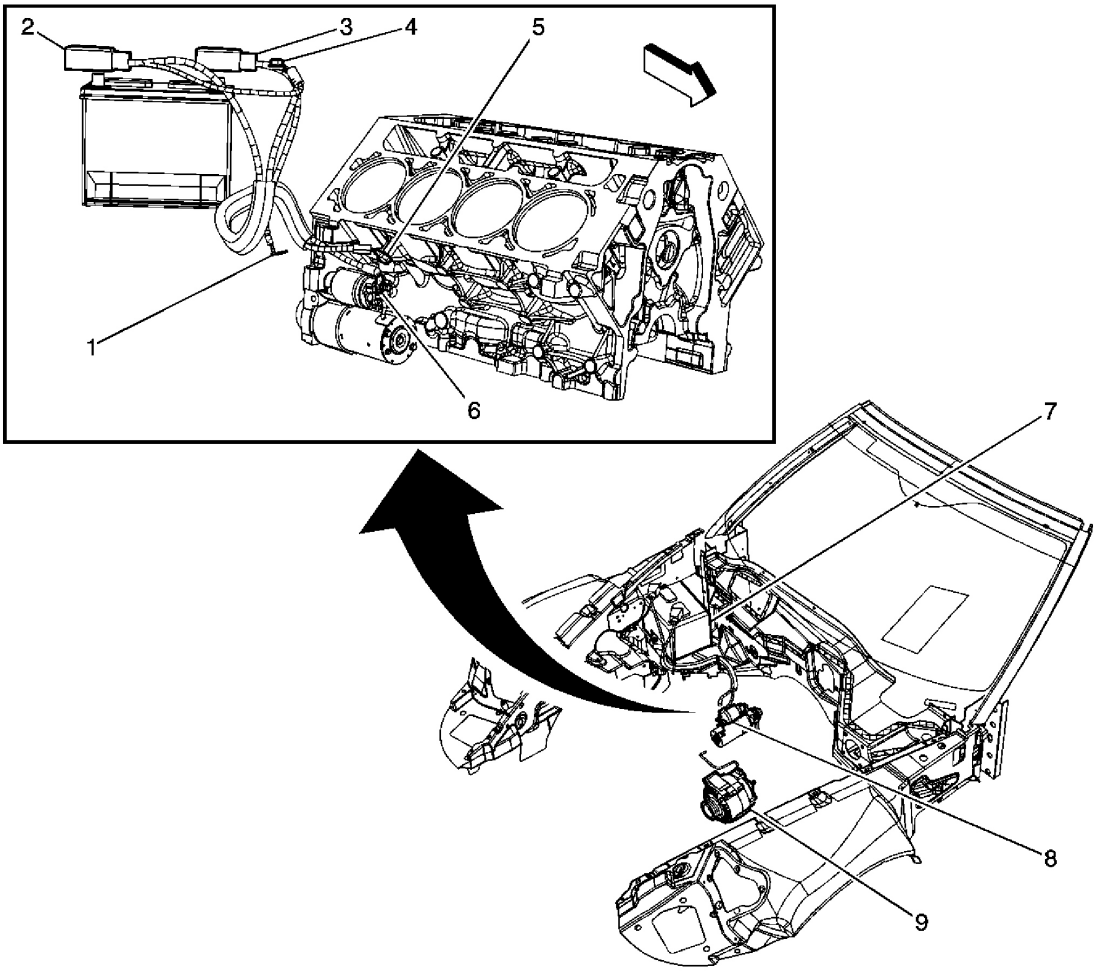


Fig. 4: Engine Electrical Components
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 4

Callout	Component Name
1	G104
2	Battery Positive Cable
3	Battery Negative Cable
4	Positive Stud (Fuse Block-Underhood)
5	G106
6	Starter Solenoid
7	Battery
8	Starter Solenoid
9	Generator

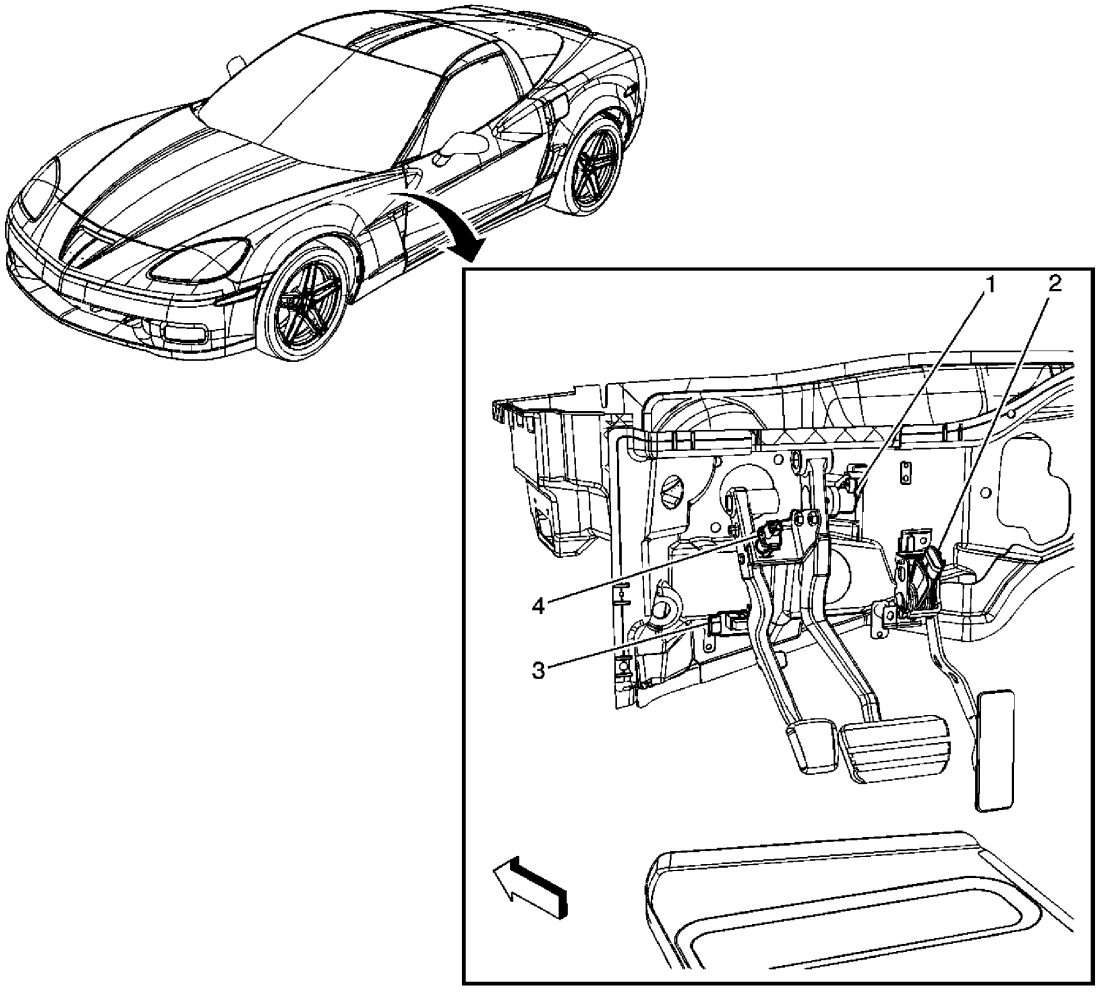


Fig. 5: Lower Left Side of I/P
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 5

Callout	Component Name
1	Brake Pedal Position Sensor
2	Accelerator Pedal Position (APP) Sensor
3	Clutch Start Switch (MM6/MZ6)
4	Clutch Pedal Position (CPP) Switch (MM6/MZ6)

ENGINE ELECTRICAL CONNECTOR END VIEWS

Clutch Start Switch (MM6/MZ6)

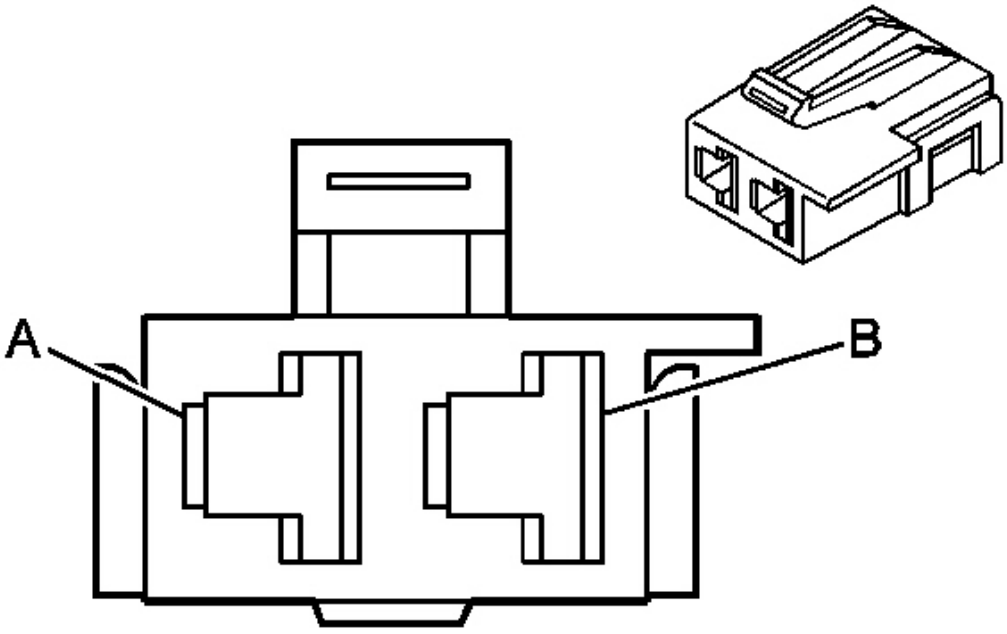


Fig. 6: Clutch Start Switch (MM6/MZ6) Connector End View
Courtesy of GENERAL MOTORS CORP.

Clutch Start Switch (MM6/MZ6) Connector Parts Information

Connector Part Information

- OEM: 12034417
- Service: 12102690
- Description: 2-Way F Metri-Pack 480 Series (BK)

Terminal Part Information

- Terminal/Tray: 12015860/4
- Core/Insulation Crimp: E/A
- Release Tool/Test Probe: 12094430/J-35616-40 (BU)

Clutch Start Switch (MM6/MZ6) Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function

A	PK	1439	Ignition 1 Voltage
B	PK/WH	1035	Starter Relay Coil Supply Voltage

Generator

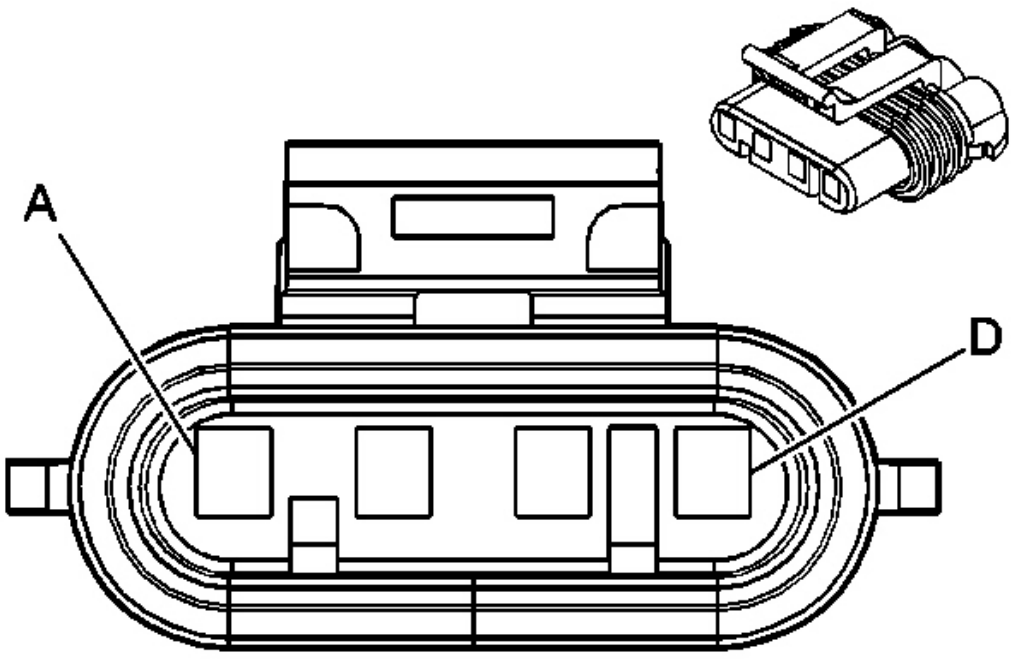


Fig. 7: Generator Connector End View
Courtesy of GENERAL MOTORS CORP.

Generator Connector Parts Information

Connector Part Information

- OEM: 12186684
- Service: 15306009
- Description: 4-Way F Metri-Pack 150 Series (BK)

Terminal Part Information

- Pins: B-D
- Terminal/Tray: 12048074/2

- Core/Insulation Crimp: E/1
- Release Tool/Test Probe: 12094429/J-35616-2A (GY)

Generator Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
A	-	-	Not Used
B	OG	225	Generator Turn On Signal
C	GY	23	Generator Field Duty Cycle Signal
D	RD/WH	2540	Battery Positive Voltage

Starter

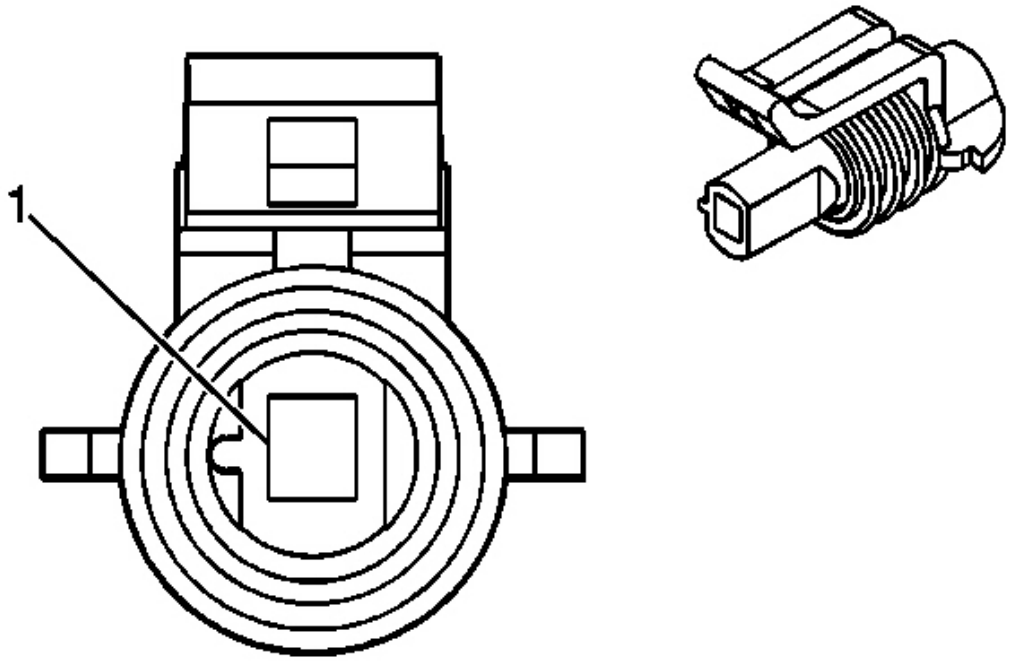


Fig. 8: Starter Connector End View
Courtesy of GENERAL MOTORS CORP.

Starter Connector Parts Information

Connector Part Information

- OEM: 15481001
- Service: 88988118
- Description: 1-Way F Metri-Pack 280 Series, Sealed (NA)

Terminal Part Information

- Terminal/Tray: 12176387/3
- Core/Insulation Crimp: See Terminal Repair Kit
- Release Tool/Test Probe: 12094430/J-35616-4A (PU)

Starter Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
1	PU	6	Starter Solenoid Crank Voltage

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
DTC B1325	Device Power 1 Circuit Voltage
DTC B1327	Device Power 1 Circuit Low
DTC B1328	Device Power 1 Circuit High
DTC C0895	Device Voltage
DTC C0899	Device Voltage Low
DTC C0900	Device Voltage High
DTC P0562	System Voltage Low
DTC P0563	System Voltage High
DTC P0615	Starter Relay Control Circuit
DTC P0621	Generator L-Terminal Circuit
DTC P0622	Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to **Testing for Intermittent Conditions and Poor Connections** .

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.

SCAN TOOL OUTPUT CONTROLS

Scan Tool Output Controls

Scan Tool Output Control	Additional Menu Selection(s)	Description
Engine Output Controls	GEN L-Terminal	The engine control module (ECM) commands the generator OFF by removing the 5-volt reference signal from the L-terminal of the voltage regulator when you select OFF. The generator will then stop generating an output voltage.
Engine Output Controls	Starter Relay	The ECM commands the Crank Relay OFF by removing the ground from the control circuit the Crank Relay when you select OFF. Voltage will then stop flowing through the switch of the Crank Relay.

SCAN TOOL DATA LIST

Body Control Module (BCM)

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition ON/Engine Running			
Battery Voltage Signal	Data	Volts	13.9 Volts
Ignition Mode Switch	Data	IDLE / ACC / OFF / CRANK	IDLE

Engine Control Module (ECM)

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition ON/Engine OFF			
Crank Request Signal	Engine Electrical	Yes/No	No

GEN F-Terminal Signal	Engine Electrical	%	0%
GEN L-Terminal Signal Command	Engine Electrical	%	0%
GEN L-Terminal Circuit Status	Engine Electrical	Incomplete / Short Gnd / Open / Short to B+ / OK	OK
Ignition 1 Signal	Engine Electrical	Volts	Varies
PNP Switch	Engine Electrical	Park / Neutral / In Gear	Park
Starter Relay Command	Engine Electrical	On/Off	Off
Starter Relay Circuit Status	Engine Electrical	Incomplete / Short Gnd / Open / Short to B+ / OK	OK

Sensing Diagnostic Module(SDM)

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition ON/Engine Running			
Battery Voltage Signal	Data	Volts	13.9 Volts

Transmission Control Module (TCM)

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition ON/Transmission in Park			
IMS	Data	Park, Park/Reverse, Reverse, Reverse/Neutral, Neutral, Neutral/Drive 4, Drive 4, Drive 4/Drive 3, Drive 3, Drive 3/Drive 2, Drive 2, Drive 2/Drive 1, Drive 1, INVALID, OPEN	Park

SCAN TOOL DATA DEFINITIONS

Battery Voltage Signal

The scan tool displays 0-20 Volts. The scan tool displays the voltage as received by the Module or the 72-08 battery voltage message from the BCM.

Crank Request Signal

The scan tool displays Yes/No. The scan tool displays No until the ignition is placed into the START position then Yes is displayed.

GEN F-Terminal Signal

The scan tool displays 0-100%. The scan tool displays 0-10% until the engine is started and the ECM receives a signal from the generator then OK is displayed.

GEN L-Terminal Signal Command

The scan tool displays On/Off. The scan tool displays Off until the engine is running, then the ECM supplies the percentage value varies depending on electrical loads

Ignition 1 Signal

The scan tool displays 0-20 Volts. The scan tool displays the voltage as received on the Ignition 1 circuit to the ECM.

IMS

The scan tool displays Park, Park/Reverse, Reverse, Reverse/Neutral, Neutral, Neutral/Drive 4, Drive 4, Drive 4/Drive 3, Drive 3, Drive 3/Drive 2, Drive 2, Drive 2/Drive 1, Drive 1, INVALID, and OPEN. The scan tool displays the physical position of the Internal Mode Switch (IMS) of the transmission.

Starter Relay Command

The scan tool displays ON/OFF. The scan tool displays Off until engine start has been requested, then it reads On.

Starter Relay Control Circuit

The scan tool displays Fault/OK/Invalid State. The scan tool displays Fault until the starter relay control circuit is grounded then OK is displayed.

DTC B1325

Circuit Description

The body control module (BCM) monitors the battery voltage through the Battery Voltage Signal circuit. Refer to **Body Control System Schematics** .

A type information accompanies the DTC. Refer to **DTC Symptom Description** .

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC B1325 Device Power 1 Circuit Voltage

Conditions for Running the DTC

The voltage supplied to the BCM is in the range of 7-26 volts.

Conditions for Setting the DTC

DTC B1325 03

- The BCM detects a system voltage below 9 volts.
- The above condition is present at least 5 seconds.

DTC B1325 07

- The BCM detects a system voltage above 18 volts.
- The above condition is present at least 5 seconds.

Action Taken When the DTC Sets

- The BCM immediately disables all outputs when a high voltage condition was detected, with the exception of GMLAN and Run/Crank relay that are disabled after a 3 minutes delay.
- The setting of other DTCs is inhibited.

Conditions for Clearing the DTC

- A current DTC clears when the malfunction is no longer present.
- A history DTC clears when the module ignition cycle counter reaches the reset threshold, without a repeat of the malfunction.

Diagnostic Aids

- The following may cause an intermittent:
  - A damaged terminal
  - A backed out terminal

- A poor terminal tension
- A chafed wire
- A broken wire inside the insulation

- When diagnosing an intermittent short or an open, manipulate the wire harness while watching the test equipment for changes.

DTC B1325

Step	Action	Values	Yes	No
Schematic Reference: Body Control System Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle**
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, observe the battery voltage signal parameters in the body control module (BCM) data list. Is the battery voltage signal parameter displayed in the specified range?	9.0-18.0 V	Go to **Step 3**	Go to **Step 4**
3	Is the DTC set as a current DTC?	-	Go to **Step 7**	Go to Diagnostic Aids
4	1. Disconnect the BCM harness connectors. 2. Measure the voltage between the Battery Voltage Signal circuit at the BCM harness connector and a good ground. Is the measured value in the specified range?	9.0-18.0 V	Go to **Step 6**	Go to **Step 5**
5	Test the Battery Voltage Signal circuit for a short to ground or an open. Refer to	-		Go to

	Circuit Testing and **Wiring Repairs** . Did you find and correct the condition?		Go to **Step 9**	**Charging System Test**
6	Test the all of ground circuits of the BCM for an open or high resistance. Refer To **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 9**	Go to **Step 7**
7	Inspect for poor connections at the module harness connectors. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	-	Go to **Step 9**	Go to **Step 8**
8	Replace the BCM. Refer to **Control Module References** for replacement, setup, and programming. Did you complete the replacement?	-	Go to **Step 9**	-
9	Operate the system in order to verify the repair. Did you find and correct the condition?	-	System OK	Go to **Step 2**

DTC B1327

Circuit 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** .

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC B1327 Device Power 1 Circuit Low

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.
- Use a scan tool.

DTC B1327

Step	Action	Value(s)	Yes	No
Schematic Reference: Starting and Charging Schematics or **Power Distribution Schematics** **Connector End View Reference: Data Communication Connector End Views** .				
1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle**
2	1. Install a scan tool. 2. Operate the vehicle within the conditions for running DTC B1327. Does the scan tool indicate that DTC B1327 is current in more than 1 module?	-	Go to **Step 6**	Go to **Step 3**
3	1. Turn ON the ignition, with the engine OFF. 2. With a scan tool, observe the Battery Voltage Signal parameter in the body control module (BCM) data list. Does the voltage measure greater than the	9.4 V	Go to **Step**	

	specified value?		**11**	Go to **Step 4**
4	1. Turn OFF the ignition. 2. Disconnect the BCM. 3. Turn ON the ignition, with the engine OFF. 4. Measure the voltage between the battery positive voltage circuit of the BCM and the ground circuit of the BCM. Does the voltage measure greater than the specified value?	9.4 V	Go to **Step 5**	Go to **Battery Inspection/Test**
5	Measure the voltage between the battery positive voltage circuit of the BCM and a good ground. Does the voltage measure greater than the specified value?	9.4 V	Go to **Step 9**	Go to **Step 8**
6	1. Turn OFF the ignition. 2. Disconnect the harness connector of the module setting the DTC B1327. 3. Turn ON the ignition, with the engine OFF 4. Measure the voltage between the battery positive voltage circuit of the module setting the DTC B1327 and the ground circuit of the module setting the DTC B1327. Does the voltage measure greater than the specified value?	9.4 V	Go to **Step 10**	Go to **Step 7**
7	Measure the voltage between the battery positive voltage circuit of the BCM or module setting DTC B1327 and a good ground. Does the voltage measure greater than the specified value?	9.4 V	Go to **Step 9**	Go to **Step 8**
	Test the battery positive voltage circuit of			

8	the BCM or module setting DTC B1327 for a high resistance or an open. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 10**
9	Test the ground circuit of the BCM or module setting DTC B1327 for a high resistance or an open. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 10**
10	Inspect for poor connections at the harness connector of the BCM or module setting DTC B1327. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
11	Replace the affected module. Refer to **Control Module References** for replacement, setup, and programming. Did you complete the replacement?	-	Go to **Step 12**	-
12	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the conditions for running the DTC. Does the DTC reset?	-	Go to **Step 3**	System OK

DTC B1328

Circuit 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** .

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC B1328 Device Power 1 Circuit High

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 16.0 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.
- Use a scan tool.

DTC B1328

Step	Action	Value(s)	Yes	No
1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle**
2	1. Install a scan tool. 2. Operate the vehicle within the conditions for running DTC B1328. Does the scan tool indicate that DTC B1328 is current in more than 1 module?	-	Go to **Step 4**	Go to **Step 3**
3	With a scan tool, observe the Battery Voltage Signal parameter in the body control module (BCM). Does the scan tool indicate that the voltage is greater than the specified value?	16.0 V	Go to **Step 5**	Go to **Charging System Test**
	With a scan tool, observe the Battery			

4	Voltage Signal parameter in the affected module. Does the scan tool indicate that the voltage is greater than the specified value?	16.0 V	Go to **Step 5**	Go to **Charging System Test**
5	Replace the affected module. Refer to **Control Module References** for replacement, setup, and programming. Did you complete the replacement?	-	Go to **Step 6**	-
6	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	-	Go to **Step 2**	System OK

DTC C0895

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 C0895

Device Voltage

Circuit/System Description

Voltage is supplied to the electronic suspension control (ESC) module in the battery positive voltage circuit and the ignition voltage circuit. The ESC module monitors the supplied voltage to determine if it is within a valid operating range.

Conditions for Running the DTC

Ignition is ON.

Conditions for Setting the DTC

The DTC is set when the battery voltage is outside the normal range of 9-15.5 volts.

Action Taken When the DTC Sets

Disable All Functionality

Conditions for Clearing the DTC

The DTC is saved as history when the ESC module no longer sees battery voltage outside the normal range of 9-15.5 volts. The DTC will clear if the fault does not return after 50 consecutive ignition cycles.

Diagnostic Aids

DTC C0895 may set when the vehicle is placed on a battery charger, on fast charge, for a long period of time. It may also be set by an intermittent charging system malfunction.

Reference Information

Schematic Reference

Electronic Suspension Control Schematics

Connector End View Reference

Electronic Suspension Control Connector End Views

Electrical Information Reference

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

Circuit/System Testing

1. If the DTC is history, refer to **Charging System Test**.
2. If the DTC is current, turn ON the ignition, and with a DMM, measure the voltage between the battery positive voltage circuits of the ESC module and the ground circuits of the ESC module.
    - If the voltage is within 9.5-15 volts, replace the ESC.
    - If the voltage is not within 9.5-15 volts, measure the voltage between the battery

positive voltage circuits of the ESC module and a separate good ground.

- If the voltage is within 9.5-15 volts, test the battery positive ground circuits of the ESC module for high resistance or an open, and repair as necessary.

Repair Procedures

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

Control Module References for ESC module replacement, setup and programming

DTC C0899

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 C0899

Device Voltage Low

Diagnostic Fault Information

DTC C0899

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition 1 Signal	C0899	C0899	-	-

Circuit/System Description

The electronic brake control module (EBCM) monitors the ignition voltage level available for system operation. A low voltage condition prevents the system from operating properly.

Conditions for Running the DTC

Ignition is ON.

Conditions for Setting the DTC

This fault will be set if the ignition voltage to EBCM is less than 9 volts for 100 msec.

Action Taken When the DTC Sets

- Traction Control System (TCS) and Vehicle Stability Enhancement System (VSES) for the duration of the ignition cycle.
- The TCS indicator turns ON.
- The DIC displays the Service Stability System message.

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

Antilock Brake System Connector End Views

Electrical Information Reference

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

Scan Tool Reference

- Scan Tool Data List
- Scan Tool Data Definitions

Circuit/System Testing

1. Measure and record the voltage at the battery terminals. With scan tool, observe the battery voltage signal parameter. Verify that battery terminal voltage and battery voltage signal readings do not differ more than 1 volt.
    - If more than 1 volt, test the battery positive voltage and ground circuits of the EBCM

for an open/high resistance or replace the EBCM.

2. Go to **Charging System Test**.

Repair Procedures

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

Control Module References for EBCM replacement, setup and programming.

DTC C0900

Diagnostic Instructions

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

DTC Descriptor

DTC C0900

Device Voltage High

Circuit/System Description

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

Conditions for Running the DTC

Ignition is ON.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

- Traction Control System (TCS) and Vehicle Stability Enhancement System (VSES) disabled for the duration of the ignition cycle.
- ABS disabled if ignition voltage exceeds 19.5 volts.

- The TCS indicator turns ON.
- The Antilock Brake System (ABS) indicator turns ON if voltage exceeds 19.5 volts.
- The driver information center (DIC) displays the Service Stability System message.

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

Antilock Brake System Connector End Views

Electrical Information Reference

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

Scan Tool Reference

- Scan Tool Data List
- Scan Tool Data Definitions

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. If the DTC is history, refer to **Charging System Test**.
2. Start the engine, record the voltage at the battery terminals. Observe the battery voltage

signal parameter in the EBCM data list. Voltages should not differ by more than 1 volt.
- If more than 1 volt, replace the EBCM.

Repair Procedures

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

Control Module References for EBCM replacement, setup and programming.

DTC P0562

Circuit Description

The engine control module (ECM) checks the system voltage to make sure that the voltage stays within the proper range. Damage to components, and incorrect input can occur when the voltage is out of range. The ECM monitors the system voltage over an extended length of time. If the ECM detects an excessively low system voltage, DTC P0562 will set.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0562 System Voltage Low

Conditions for Running the DTC

- Engine speed above 1,500 RPM.
- System voltage 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

- The ECM will command a message to be displayed.
- The ECM will not illuminate the malfunction indicator lamp (MIL).
- The ECM will store conditions which were present when the DTC set as Fail Records data only.

Conditions for Clearing the DTC

- The ECM will command the message OFF after one trip in which the diagnostic test has

been run and passed.

- The history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using the scan tool Clear DTC Information function.

DTC P0562

Step	Action	Value(s)	Yes	No
Schematic Reference: Starting and Charging Schematics Engine Controls Schematics for the 6.0L (LS2) engine or **Engine Controls Schematics** for the 7.0L (LS7) engine **Connector End View Reference: Engine Control Module Connector End Views** for the 6.0L (LS2) engine, **Engine Control Module Connector End Views** for the 7.0L (LS7) engine, or **Power and Grounding Connector End Views**				
1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle**
2	1. Install a scan tool. 2. Start the engine. 3. Raise the engine speed above 1,500 RPM. 4. With a scan tool, observe the Ignition 1 Signal parameter in the engine control module (ECM) data list. Does the scan tool indicate that the Ignition 1 Signal parameter is greater than the specified range?	10.5 V	Go to **Step 6**	Go to **Step 3**
3	Using a scan tool compare the Battery Voltage Signal parameter in the body control module (BCM) data list with the Ignition 1 Signal parameter in the ECM data list. Is the Battery Voltage and Ignition 1 Signal parameter readings different by more than the value specified?	0.5 V	Go to **Step 4**	Go to **Charging System Test**
	Test the battery positive voltage circuit of			

4	the ECM for a high resistance. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 7**	Go to **Step 5**
5	Inspect for poor connections at the harness connector of the ECM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	-	Go to **Step 7**	Go to **Step 6**
6	Replace the ECM. Refer to **Control Module References** for replacement, setup, and programming. Did you complete the replacement?	-	Go to **Step 7**	-
7	1. Review and record the scan tool Fail Records data. 2. Use the scan tool in order to clear the DTC. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Using the scan tool, observe the Specific DTC Information for DTC P0562 until the test runs. Does the scan tool indicate that DTC P0562 failed this ignition?	-	Go to **Step 2**	System OK

DTC P0563

Circuit Description

The engine control module (ECM) checks the system voltage to make sure that the voltage stays within the proper range. Damage to components, and incorrect input can occur when the voltage is out of range. The ECM monitors the system voltage over an extended length of time. If the ECM detects an excessively high system voltage, DTC P0563 will set.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0563 System Voltage High

Conditions for Running the DTC

- Engine speed above 1,500 RPM.
- System voltage between 9.5-18 volts.

Conditions for Setting the DTC

The ECM detects a system voltage above 16 volts for less than one second.

Action Taken When the DTC Sets

- The ECM will command a message to be displayed.
- The ECM will not illuminate the malfunction indicator lamp (MIL).
- The ECM will store conditions which were present when the DTC set as Fail Records data only.

Conditions for Clearing the DTC

- The ECM will command the message OFF after one trip in which the diagnostic test has been run and passed.
- The history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using the scan tool Clear DTC Information function.

DTC P0563

Step	Action	Value(s)	Yes	No
Schematic Reference: Starting and Charging Schematics **Connector End View Reference: Engine Control Module Connector End Views** for the 6.0L (LS2) engine or **Engine Control Module Connector End Views** for the 7.0L (LS7) engine				
1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle**
	1. Install a scan tool. 2. Start the engine. 3. Raise the engine speed above 1,500 RPM.			

2	4. With a scan tool, observe the Ignition 1 Signal parameter in the engine control module (ECM) data list. Does the scan tool indicate that the Ignition 1 Signal parameter is less than the specified range?	16.0 V	Go to **Step 4**	Go to **Step 3**
3	Using a scan tool compare the Battery Voltage parameter in the body control module (BCM) data list with the Ignition 1 Signal parameter in the ECM data list. Is the Battery Voltage and Ignition 1 Signal parameter readings different by more than the value specified?	0.5 V	Go to **Step 4**	Go to **Charging System Test**
4	Replace the ECM. Refer to **Control Module References** for replacement, setup, and programming. Is the action complete?	-	Go to **Step 5**	-
5	1. Review and record the scan tool Fail Records data. 2. Use the scan tool in order to clear the DTC. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Using the scan tool, observe the Specific DTC Information for DTC P0563 until the test runs. Does the scan tool indicate that DTC P0563 failed this ignition?	-	Go to **Step 2**	System OK

DTC P0615

Circuit Description

The engine control module (ECM) supplies a ground path for the crank relay when start enable has been requested. The ECM monitors this circuit for conditions that are incorrect for the commanded state. If the ECM detects an improper circuit condition, crank relay DTC P0615 will

set.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0615 Starter Relay Control Circuit

Conditions for Running the DTC

System voltage is between 9-16 volts.

Conditions for Setting the DTC

- The ECM detects an improper voltage level on the control circuit that controls the crank relay.
- The condition exists for at least 2 seconds.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

- The history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using the scan tool Clear DTC Information function.

Diagnostic Aids

Ignition system DTCs set with the ignition switch in the START position if the crank relay or the starter is inoperative. When the ECM enables starter operation, the ECM also initiates the diagnostic test routines for DTCs P0335, P0340, and P0385. If a condition exists which prevents the engine from cranking, the ECM will not receive signal input from the crankshaft position (CKP) and camshaft position (CMP) sensors, and the DTCs will set.

Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may assist in diagnosing the condition. The information may help determine how often the condition that set the DTC occurs.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: Listen for an audible click when the crank relay operates. Press the ignition switch back and forth from the ON to START positions. Repeat this as necessary.

3: Tests for voltage at the coil side of the crank relay. The ECM IGN fuse supplies power to the coil side of the crank relay.

4: Verifies that the ECM is providing ground to the crank relay.

5: Tests if ground is constantly being applied to the crank relay.

DTC P0615

Step	Action	Yes	No
Schematic Reference: Starting and Charging Schematics **Connector End View Reference: Power and Grounding Connector End Views**			
1	Did you perform the Diagnostic System Check - Vehicle?	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle**
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. Press the ignition back and forth from the ON to START positions. Does the crank relay click with each command?	Go to **Step 3**	Go to **Starter Solenoid Does Not Click**
3	1. Turn OFF the ignition. 2. Remove the crank relay. 3. Turn ON the ignition, with the engine OFF. 4. Probe the battery positive voltage of the crank relay coil circuit with a test lamp that is connected to a good ground. Does the test lamp illuminate?	Go to **Step 4**	Go to **Step 8**
4	1. Connect a test lamp between the control circuit of the crank relay and the battery positive voltage of the crank relay coil circuit.		

	2. Turn the ignition back and forth from the ON to START positions. Does the test lamp turn ON and OFF with each command?	Go to **Step 6**	Go to **Step 5**
5	Test the control circuit of the crank relay for a short to voltage or an open. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	Go to **Step 11**	Go to **Step 7**
6	Inspect for poor connections at the crank relay. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	Go to **Step 11**	Go to **Step 9**
7	Inspect for poor connections at the engine control module (ECM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	Go to **Step 11**	Go to **Step 10**
8	Repair the battery positive voltage circuit of the crank relay. Refer to **Connector Repairs** . Did you complete the repair?	Go to **Step 11**	-
9	Replace the crank relay. Did you complete the replacement?	Go to **Step 11**	-
10	Replace the ECM. Refer to **Control Module References** for replacement, setup, and programming. Did you complete the replacement?	Go to **Step 11**	-
11	1. Review and record scan tool Fail Records data. 2. Clear DTCs. 3. Operate vehicle within Fail Records conditions as noted. 4. Using a scan tool, monitor the Specific DTC Information for DTC P0615. Does the scan tool indicate DTC P0615 failed		

	this ignition?	Go to **Step 2**	System OK

DTC P0621

Diagnostic Instructions

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

DTC Descriptor

DTC P0621 Generator L-Terminal Circuit

Diagnostic Fault Information

Diagnostic Fault Information

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

Circuit 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 Ignition ON and RUN tests to determine the status of the generator turn on signal circuit.

Conditions for Running the DTC

Key ON Test

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

Run Test

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

- The history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using the scan tool Clear DTC Information function.

Diagnostic Aids

On vehicles equipped with a sense circuit to the voltage regulator, this circuit is used as a reference to control system voltage. The sense circuit must operating correctly for the charging system to operate properly. All the circuits at the generator should be tested for proper operation before replacing components. Refer to the schematic to confirm if the vehicle being serviced uses the sense circuit as part of the charging system.

Reference Information

Schematic Reference

Starting and Charging Schematics

Connector End View Reference

Engine Electrical Connector End Views

Electrical Information Reference

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

Scan Tool Reference

- **Scan Tool Data List** for ECM
- **Scan Tool Data Definitions** for ECM

Circuit/System Testing

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

Repair Instructions

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

- **Generator Replacement**
- **Control Module References** for ECM replacement, setup, and programming.

DTC P0622

Circuit Description

The engine control module (ECM) 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 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 key is in the RUN position and the engine is OFF, the ECM should detect a duty cycle near 0 percent. However, when the engine is running, the duty cycle should be between 5 percent and 100 percent. The ECM monitors the PWM signal using a key ON test and a RUN test. During the tests, if the ECM detects an out of range PWM signal, DTC P0622 will set. When the DTC sets, the ECM will send a serial data message to the drivers information center (DIC) to display a warning message.

DTC Descriptor

This diagnostic procedure supports the following DTC: DTC P0622 Generator F-Terminal Circuit

Conditions for Running the DTC

Key ON Test

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

Run Test

- No generator, CKP sensors, or CMP sensor DTCs are set.
- The engine is less than 3,000 RPM.

Conditions for Setting the DTC

- During the key ON test, the ECM detects a PWM signal greater than 65 percent for at least 5 seconds.
- During the RUN test, the ECM detects a PWM signal less than 5 percent for at least 15 seconds.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

- The history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using the scan tool Clear DTC Information function.

DTC P0622

Step	Action	Values	Yes	No
Schematic Reference: Starting and Charging Schematics **Connector End View Reference: Engine Control Module Connector End Views** for the 6.0L (LS2) engine, or **Engine Control Module Connector End Views** for the 7.0L (LS7) engine, or **Engine Electrical Connector End Views**				
1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle**
2	1. Install a scan tool. 2. Start the engine. 3. With a scan tool, observe the GEN-F Terminal Signal parameter in the ECM data list. Does the scan tool indicate that the GEN-F Terminal Signal parameter is within the specified range?	5-95%	Go to **Step 3**	Go to **Step 4**
3	With the scan tool, command the generator OFF. Does the GEN-F Terminal Signal equal the specified value?	0%	Go to **Testing for Intermittent Conditions and Poor Connections**	Go to **Step 4**
	1. Turn OFF the ignition.			

4	2. Disconnect the generator connector. 3. Connect test lamp to battery positive voltage. 4. Turn ON the ignition, with the engine OFF. 5. Probe the F-Terminal in the generator connector. 6. Observe the GEN-F Terminal Signal parameter in the ECM data list. Is the GEN-F Terminal Signal parameter near the specified value?	100%	Go to **Charging System Test**	Go to **Step 5**
5	Test the generator field duty cycle signal circuit for a short or open. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 8**	Go to **Step 6**
6	Inspect for poor connections at the harness connector of the engine control module (ECM). Refer to **Connector Repairs** . Did you find and correct the condition?	-	Go to **Step 8**	Go to **Step 7**
7	**IMPORTANT:** **The replacement ECM must be programmed.** Replace the ECM. Refer to **Control Module References** for replacement, setup, and programming.Did you complete the replacement?	-	Go to **Step 8**	-
8	1. Review and record the scan tool Fail Records data. 2. Use the scan tool in order to clear the DTC. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Using the scan tool, observe the Specific DTC Information for DTC	-		

	P0622 until the test runs. Does the scan tool indicate that DTC P0622 failed this ignition?		Go to **Step 2**	System OK

SYMPTOMS - ENGINE ELECTRICAL

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

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

- **Starter Solenoid Does Not Click**
- **Starter Solenoid Clicks, Engine Does Not Crank**

- **Engine Cranks Slowly**
- **Charge Indicator Always On**
- **Charge Indicator Inoperative**
- **Battery Inspection/Test**
- **Battery Electrical Drain/Parasitic Load Test**
- **Battery Common Causes of Failure**
- **Starter Motor Noise Diagnosis**
- **Charging System Test**
- **Generator Noise Diagnosis**

BATTERY INSPECTION/TEST

Tools Required

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

Diagnostic Aids

IMPORTANT:

- **Failure to properly understand the battery and its function could lead to a misdiagnosis and unneeded repairs. Refer to Battery Description and Operation and Battery Common Causes of Failure for more information.**
- **If testing an AGM battery with the J 42000 , add 100 to the CCA rating of the battery and enter that amount into the tester when prompted for the CCA rating. See Special Tools. For instance, if the AGM batteries CCA rating is 500 amps, enter 600 into the J 42000 . See Special Tools. Perform this modification only if the J 42000 does not ask if you are testing an AGM battery. See Special Tools. If these instructions are not followed when testing an AGM battery, an invalid test result and invalid test code will be obtained on the J 42000 . See Special Tools.**
- **The battery test using the J 42000 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.**
- **When the J 42000 inquires " has the battery been charged",**

answer yes only if the battery has been charged on this visit to the dealership. See Special Tools.

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 an Out-of-Vehicle test.
- 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.
  4. Follow the instructions for an Out-of-Vehicle test.
  5. Replace the battery only if the Out-of-Vehicle test shows a REPLACE BATTERY or BAD CELL-REPLACE result. This prevents battery replacements that are due only to faulty battery cable connections.
- Use the correct terminal adapters. Do not use any common bolts or a combination of bolts, nuts, and or washers as adapters when testing the battery. Use the test adapters that are provided with the **J 42000** or P/N 12303040 terminal adapters. See **Special Tools**. If the adapters that are provided with the **J 42000** require replacement, use 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.

Battery Inspection/Test

Step	Action	Values	Yes	No
CAUTION: **Unless directed otherwise, the ignition and start switch must be in the OFF or LOCK position, and all electrical loads must be OFF before servicing any electrical component. Disconnect the negative battery cable to prevent an electrical spark should a tool or**				

equipment come in contact with an exposed electrical terminal. Failure to follow these precautions may result in personal injury and/or damage to the vehicle or its components.

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. If the battery is replaced due to failing the test, only an Out-of-Vehicle test code is valid for warranty purposes.

1	Inspect the battery for a cracked, broken, or damaged case, which may be indicated by battery acid leakage. Is the battery OK?	-	Go to **Step 2**	Go to **Step 15**
2	Compare 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**. Does the battery meet or exceed the specifications?	-	Go to **Step 3**	Go to **Step 15**
3	1. Turn OFF the ignition. 2. Attempt to rotate the negative battery cable connector clockwise with light finger pressure. Does the negative connector rotate?	-	Go to **Step 4**	Go to **Step 5**
4	Use a torque wrench in order to verify the torque to loosen the negative battery terminal bolt. Is the torque above the specified value?	10 N.m (88 lb in)	Go to **Step 9**	Go to **Step 8**
5	Attempt to rotate the positive battery cable connector clockwise with light finger pressure. Does the positive connector rotate?	-	Go to **Step 7**	Go to **Step 6**
	IMPORTANT: **Ensure that all of the electrical loads are turned OFF.** 1. Install the **J 42000** Battery Tester.			

6	See **Special Tools**. 2. Follow the directions supplied with the tester for an In-Vehicle test. 3. Follow any directions displayed on the tester. 4. If the tester calls for charging the battery, refer to **Battery Charging**. Did the tester pass the battery?	-	Go to **Step 14**	Go to **Step 8**
7	Use a torque wrench in order to verify the torque to loosen the positive battery terminal bolt. Is the torque above the specified value?	10 N.m (88 lb in)	Go to **Step 10**	Go to **Step 8**
8	1. Disconnect the negative battery cable. 2. Disconnect the positive battery cable. 3. Clean and wire brush the lead face of both battery terminals and the metal contact rings in both cable connectors. 4. Remove the bolts from the cable connectors in order to provide access to the connector rings as needed. 5. If either of the battery terminals or the cable rings are excessively damaged or corroded, replace as needed. Did you complete the repair?	-	Go to **Step 11**	-
	1. Disconnect the negative battery cable. 2. Inspect for the following conditions and repair as needed:			

9	• The cable bolt is too long or deformed at the end • There is foreign material present inside the nut in the battery terminal • Damage to the battery terminal face or cable connector ring Did you complete the repair?	Go to **Step 10**			-
10	1. Disconnect the positive battery cable. 2. Inspect for the following conditions and repair as needed: • The cable bolt is too long or deformed at the end • There is foreign material present inside the nut in the battery terminal • Damage to the battery terminal face or cable connector ring Did you complete the repair?	-	Go to **Step 11**	-	
11	**IMPORTANT:** **Ensure that both battery cables are disconnected and proper adapters are installed in the battery terminals.** 1. Install the **J 42000** . See **Special Tools**. 2. Follow the directions supplied with the tester for an Out-of-Vehicle test. 3. Follow any directions displayed on the tester. 4. If the tester calls for charging the	-			

	battery, refer to **Battery Charging**. Did the tester pass the battery?		Go to **Step 12**	Go to **Step 15**	
12	1. Press the CODE button on the **J 42000** . See **Special Tools**. 2. For warranty purposes, write the displayed code on the repair order. Did you complete this action?	Go to **Step 13**			-
13	1. Connect the positive battery cable to the batteries positive terminal. **NOTE:** **Refer to Fastener Notice .** 2. Tighten the positive battery cable bolt to the specified value. 3. Connect the negative battery cable to the battery negative terminal. 4. Tighten the negative battery cable bolt to the specified value. Are the cable bolts properly tightened?	17 N.m (13 lb ft)	Battery OK	-	
14	1. Press the CODE button on the **J 42000** . See **Special Tools**. 2. For warranty purposes, write the displayed code on the repair order. Did you complete the replacement?	Battery OK			-
15	Replace the battery. Refer to **Battery Replacement (6.0L)** or **Battery Replacement (7.0L)**. Did you complete the replacement?	-	Battery OK	-	

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**.

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's amperage, the less time it will take to charge the battery.
- The state-of-charge 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 manufacturers 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 PCM or other electronic components.

NOTE:

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 Fuse Block - 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**.
- 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** .
- 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 temperature and ratings will affect the results:

Battery Electrical Drain/Parasitic Load Test

Current Drain	Days
25 mA	30.5
50 mA	16.5
75 mA	11
100 mA	8.25
250 mA	3.3
500 mA	1.65
750 mA	1
1 A	0.8
2 A	0.4

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

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

IMPORTANT: The switch knob (1) on the J 38758 is marked ON and OFF. See Special Tools. When the switch knob is in the ON position, the circuit is closed and electrical current will pass through the

switch. When the switch knob is in the OFF position, the circuit is open and electrical current will not pass through the switch.

CAUTION: Refer to Battery Disconnect Caution .

1. Disconnect the battery negative cable from the battery negative terminal.
2. Install the male end of the **J 38758** to the battery ground terminal. See **Special Tools**.
3. Turn the **J 38758** knob to the OFF position. See **Special Tools**.
4. Install the battery negative cable to the female end of the **J 38758** . See **Special Tools**.
5. Turn the **J 38758** knob to the ON position. See **Special Tools**.
6. Road test the vehicle and activate ALL of the accessories, including the radio and air conditioning. This may take up to 30 minutes.
7. Park the vehicle. Turn the ignition switch to the OFF position and remove the ignition switch key.
8. Connect a 10A fused jumper wire to the test switch tool terminals.
9. Turn the **J 38758** knob to the OFF position. See **Special Tools**. The current now flows through the jumper wire.
10. Wait 1 minute. If the fuse blows, install an inductive ammeter and go to step 20.
11. Remove the fused jumper wire.
12. Set a digital multimeter to the 10A scale.
13. Connect the digital multimeter to the test switch tool terminals.
14. Turn the **J 38758** knob to the OFF position. See **Special Tools**. The current flows now through the digital multimeter.
15. Wait 1 minute. Check and record the current reading.
    1. When there is a current reading on 2A or less, turn the **J 38758** knob to the ON position. See **Special Tools**. The electrical current will now pass through the switch.
    2. Then switch the digital multimeter down to the 2A scale for a more accurate reading when the **J 38758** knob is turned OFF. See **Special Tools**.
16. Turn the **J 38758** knob to the OFF position. See **Special Tools**. Wait 15 minutes for most vehicles.
17. Check and record the current reading.
18. Note the battery Reserve Capacity (Amp Hour rating). Refer to **Battery Usage**.
    1. Divide the reserve capacity by 4 (Amp hour rating by 2.4).

2. Compare this to the multimeter milliampere reading taken in the previous step. The parasitic current drain should not exceed this number. Example: If a battery has a reserve capacity of 100 minutes, (60 A/H) the current drain should not exceed 25 mA.

19. If excessive current drain is not found at this time and there are no other apparent causes, complete the following:
    1. Using the MIN/MAX function of the digital multimeter, monitor the parasitic drain overnight or during the day. This will determine if something has been activated during that time frame.

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

IMPORTANT: Removing fuses, relays, and connectors to determine the failure area may wake up modules. You must wait for these modules to go to sleep or use the sleep function on the scan tool.

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

BATTERY COMMON CAUSES OF FAILURE

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. As long as the green eye is visible in the hydrometer, the freezing point of the battery will be somewhere below -32°C (-25°F).

Battery Protection During Vehicle Storage

Certain devices on the vehicle maintain a small continuous current drain, 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:

1. Ensure that the green dot is visible in the built-in hydrometer.

CAUTION: Unless directed otherwise, the ignition and start switch must be in the OFF or LOCK position, and all electrical loads must be OFF before servicing any electrical component. Disconnect the negative battery cable to prevent an electrical spark should a tool or equipment

come in contact with an exposed electrical terminal. Failure to follow these precautions may result in personal injury and/or damage to the vehicle or its components.

2. 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.

JUMP STARTING IN CASE OF EMERGENCY

CAUTION: Batteries produce explosive gases. Batteries contain corrosive acid. Batteries supply levels of electrical current high enough to cause burns. Therefore, in order to reduce the risk of personal injury while working near a battery, observe the following guidelines:

- **Always shield your eyes.**
- **Avoid leaning over the battery whenever possible.**
- **Do not expose the battery to open flames or sparks.**
- **Do not allow battery acid to contact the eyes or the skin.**
  - **Flush any contacted areas with water immediately and thoroughly.**
  - **Get medical help.**

NOTE: This vehicle has a 12 volt, negative ground electrical system. Make sure the vehicle or equipment being used to jump start the engine is also 12 volt, negative ground. Use of any other type of system will damage the vehicle's electrical components.

1. Position the vehicle with the booster battery so that the jumper cables will reach.
   - Do not let the 2 vehicles touch.

- Make sure that the jumper cables do not have loose ends, or missing insulation.

2. Place an automatic transmission in PARK. If equipped with a manual transmission, place in NEUTRAL and block the wheels.
3. Turn OFF all electrical loads on both vehicles that are not needed.
4. Turn OFF the ignition on both vehicles.

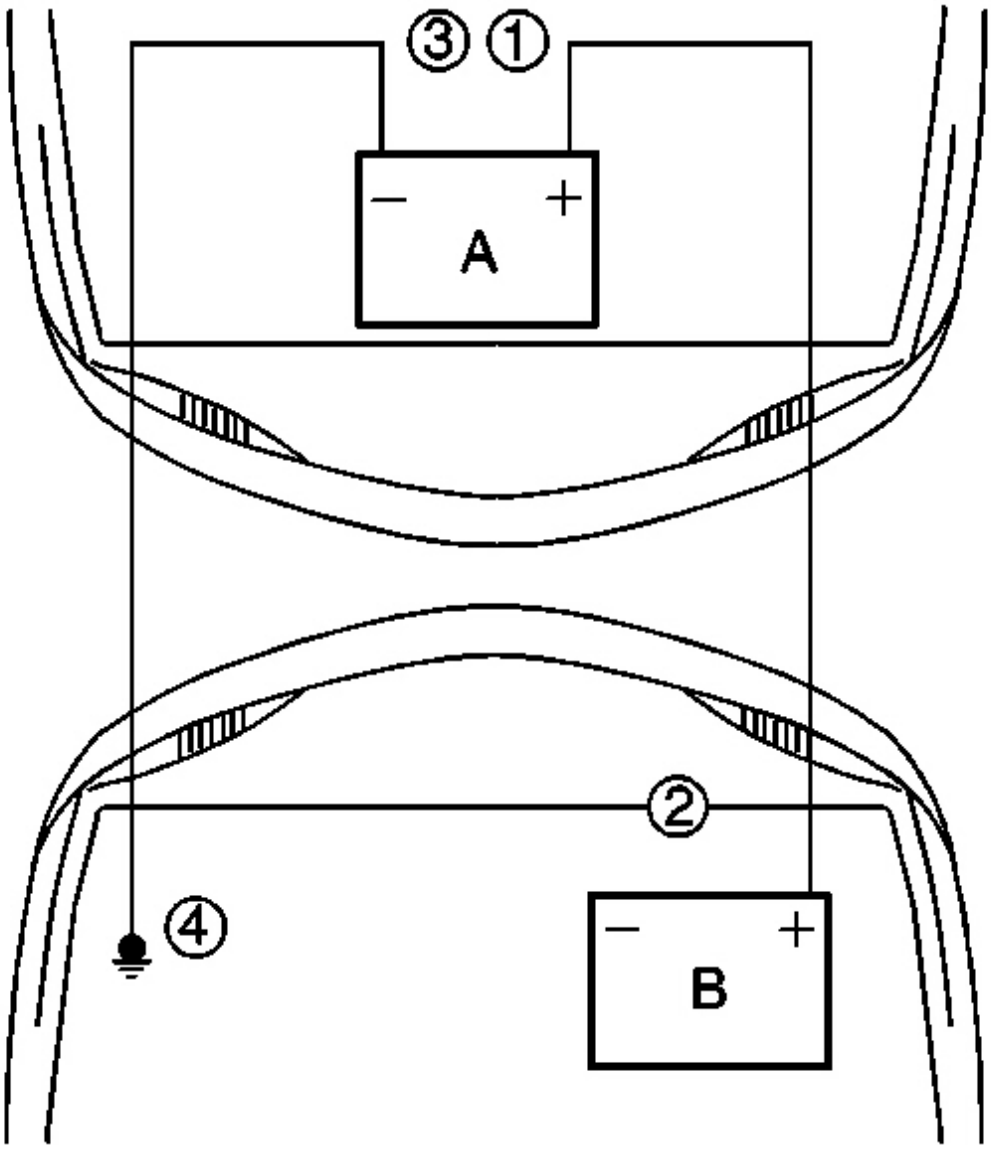


Fig. 9: Identifying Proper Jumper Cable Connection
Courtesy of GENERAL MOTORS CORP.

5. Connect the red positive (+) cable to the battery positive (+) terminal (2) of the vehicle with the discharged battery.

Use a remote positive (+) terminal if the vehicle has one.

6. Connect the red positive (+) cable to the positive (+) terminal (1) of the booster battery.

   Use a remote positive (+) terminal if the vehicle has one.

7. Connect the black negative (-) cable to the negative (-) terminal (3) of the booster battery.

   CAUTION: Do not connect a jumper cable directly to the negative terminal of a discharged battery to prevent sparking and possible explosion of battery gases.

8. The final connection is made to a heavy, unpainted metal engine part (4) of the vehicle with the discharged battery.

   This final attachment must be at least 46 cm (18 in) away from the dead battery.

9. Start the engine of the vehicle that is providing the boost.

   NOTE: Never operate the starter motor more than 15 seconds at a time without pausing in order to allow it to cool for at least 2 minutes. Overheating will damage the starter motor.

10. Crank the engine of the vehicle with the discharged battery.
11. The black negative (-) cable must be first disconnected from the vehicle that was boosted (4).
12. Disconnect the black negative (-) cable from the negative (-) terminal (3) of the booster battery.

    NOTE: Do not let the cable end touch any metal. Damage to the battery and other components may result.

13. Disconnect the red positive (+) cable from the positive (+) terminal (1) of the booster battery.
14. Disconnect the red positive (+) cable from the remote positive (+) terminal (2) of the vehicle with the discharged battery.

CHARGING SYSTEM TEST

Charging System Test

Step	Action	Value(s)	Yes	No
1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle**
2	With ignition OFF, install the Midtronics Digital Battery Analyzer and verify the condition of the battery. Is the battery sufficiently charged for testing?	-	Go to **Step 3**	Go to **Battery Inspection/Test**
3	1. Disconnect the Midtronics Digital Battery Analyzer. 2. Connect the Sun Vat 40 tester or equivalent to the battery. 3. Turn the ignition to the OFF/LOCK position. 4. Observe and record the battery voltage reading at the battery terminals on the Sun Vat 40 tester. 5. Start the engine and observe the system voltage reading on the tester. Does the voltage increase from the first specified (engine OFF) to the second (engine ON specified range?	Engine Off = B+ Engine On = 13.9 - 15.5 V	Go to **Step 4**	Go to **Step 6**
4	1. Turn ON the following accessories: • Headlights - Hi beams • A/C on Max • Blower Fan - ON high • Rear window defogger • Heated seats (If equipped)	13.9 - 15.5 V		

	2. Maintain engine speed at 2500 RPM. Is voltage still within the specified value?		Go to **Step 5**	Go to **Step 6**	
5	1. Turn OFF all accessories. 2. Turn OFF the ignition. 3. Connect a carbon pile tester to the vehicle. **IMPORTANT:** **When measuring generator output current, be sure the inductive probe encircles the generator output wire.** 4. Connect an inductive ammeter probe to the output circuit of the generator. 5. Start the engine. 6. Increase engine speed to 2,500 RPM. 7. Adjust the carbon pile as necessary in order to obtain the maximum current output. Is the generator output greater than or equal to the load test value as specified in **Generator Usage** ?	System OK			Go to **Step 10**
6	1. Turn the engine OFF. 2. Disconnect the generator harness connector. 3. Turn the ignition to the ON position. 4. Using a DMM, measure the voltage on the L-terminal circuit.	0V			

	Is the voltage greater than the specified value		Go to **Step 11**	Go to **Step 7**
7	1. Turn the engine OFF. 2. Start the engine and measure the voltage on the L-terminal. Is the voltage near the specified value?	5V	Go to **Step 8**	Go to **Step 12**
8	1. Turn engine OFF. 2. Turn ignition switch to ON position. 3. Using the scan tool, observe the duty cycle in the F-terminal signal parameter. Does the scan tool display the indicated value?	0 %	Go to **Step 9**	Go to **Step 13**
9	Connect a test lamp to B+ and repeatedly touch the F-terminal at the generator harness connector while monitoring the GEN-F terminal signal parameter on the scan tool. Does the scan tool indicate that the generator pulse width modulation (PWM) is above the specified range?	90 %	Go to **Step 10**	Go to **Step 14**
10	1. Turn the engine OFF. 2. Inspect the generator B+ output terminal at the generator for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 15**
	Test the L-terminal circuit for a			

11	short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 16**	
12	Test the L-terminal circuit for open or short to ground. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 16**	
13	Test the GEN-F terminal for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 16**	
14	Test the GEN-F terminal circuit for an open or short to ground. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 16**	
15	Inspect for poor connections at the generator. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 18**	
16	Inspect for poor connections at the harness connector of the engine control module (ECM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	Go to **Step 19**			Go to **Step 17**
	IMPORTANT: **The replacement ECM must be programmed.**				

17	Replace the ECM. Refer to **Control Module References** for replacement, setup, and programming.Did you complete the replacement?	-	Go to **Step 19**	-	
18	Replace the generator. Refer to **Generator Replacement (6.0L)** or **Generator Replacement (7.0L)**. Did you complete the replacement?	-	Go to **Step 19**	-	
19	Operate the vehicle in order to verify the repair. Did you correct the condition?	-	System OK	Go to **Step 2**	

CHARGE INDICATOR ALWAYS ON

Charge Indicator Always On

Step	Action	Value(s)	Yes	No
Schematic Reference: Starting and Charging Schematics **Connector End View Reference: Engine Electrical Connector End Views**				
1	Did you perform the Diagnostic System Check - Vehicle ?	-	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle** in Vehicle DTC Information
2	1. Start the engine. 2. Turn OFF all accessories. Does the battery charge indicator remain illuminated?	-	Go to **Step 3**	Go to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems
	1. Install a scan tool. 2. Start the engine. 3. Turn OFF all accessories.			

3	4. Increase engine speed to 1,500 RPM. 5. With a scan tool, observe the Battery Voltage parameter in the body control module (BCM) data list, engine control module (ECM) data list, and the instrument panel cluster (IPC) data list. 6. Compare the voltages. Are all of the voltages within the specified range?	1.0-1.5 V	Go to **Step 4**	Go to **Step 5**
4	Are the voltages displayed within the specified range?	11-16 V	Go to **Step 5**	Go to **Charging System Test**
5	Test the battery positive voltage and ground circuits of the affected module for a high resistance or open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 8**	Go to **Step 6**
6	Inspect for poor connections at the harness connector of the affected module. Refer to **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 8**	Go to **Step 7**
7	Replace the affected module. Refer to **Control Module References** in Computer/Integrating Systems for replacement, setup, and programming. Did you complete the replacement?	-	Go to **Step 8**	-
8	Operate the system in order to verify the repair. Did you correct the condition?	-	System OK	Go to **Step 2**

CHARGE INDICATOR INOPERATIVE

Charge Indicator Inoperative

Step	Action	Yes	No
	Did you perform the Diagnostic System Check -		Go to

1	Vehicle?	Go to **Step 2**	**Diagnostic System Check - Vehicle** in Vehicle DTC Information
2	1. Turn OFF the ignition. 2. Turn ON the ignition, with the engine OFF. 3. Observe the battery charge indicator on the instrument cluster (IPC) during the bulb check. Does the battery charge indicator illuminate during the bulb check?	Go to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems	Go to **Step 3**
3	Replace the IPC. Refer to **Control Module References** in Computer/Integrating Systems for replacement, setup, and programming. Did you complete the repair?	Go to **Step 4**	-
4	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 2**

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.

Generator Noise Diagnosis

Step	Action	Yes	No
1	Test the generator for proper operation using the Generator Tester. Refer to **Charging System Test**. Did the generator pass the test?	Go to **Step 2**	-
	1. Start the engine. Verify that the noise can be heard.		

2	2. Turn OFF the engine. 3. Disconnect the harness connector from the generator. 4. Start the engine. 5. Listen for the noise. Has the noise stopped?	Go to **Step 11**	Go to **Step 3**
3	1. Turn OFF the engine. 2. Remove the drive belt. Refer to the following: • **Drive Belt Replacement - Accessory** for the 6.0L (LS2) engine. • **Drive Belt Replacement - Accessory** for the 7.0L (LS7) engine. 3. Spin the generator pulley by hand. Does the generator shaft spin smoothly and without any roughness or grinding noise?	Go to **Step 4**	Go to **Step 11**
4	Inspect the generator for a loose pulley and/or pulley nut. Is the generator pulley or pulley nut loose?	Go to **Step 11**	Go to **Step 5**
5	1. Loosen all of the generator mounting bolts. 2. Tighten the generator mounting bolts to specifications and in the proper sequence, if necessary. Refer to **Generator Replacement (6.0L)** or **Generator Replacement (7.0L)**. 3. Install the drive belt. Refer to the following: • **Drive Belt Replacement - Accessory** for the 6.0L (LS2) engine • **Drive Belt Replacement - Accessory** for the 7.0L (LS7) engine 4. Start the engine. Has the noise decreased or stopped?	System OK	Go to **Step 6**
	Inspect the generator for the following conditions:		

6	• Strained or stretched electrical connections • Hoses or other vehicle equipment resting on the generator, which may cause the noise to be transmitted into the passenger compartment Are any electrical connections pulling on the generator or are any hoses, etc. resting on the generator?	Go to **Step 7**	Go to **Step 8**
7	1. Reroute the electrical connections to relieve the tension. 2. Reroute the hoses, etc. away from the generator. 3. Start the engine. Has the noise decreased or stopped?	System OK	Go to **Step 8**
8	Inspect the drive belt for proper tension. Refer to the following: • **Drive Belt Tensioner Diagnosis** for the 6.0L (LS2) engine • **Drive Belt Tensioner Diagnosis** for the 7.0L (LS7) engine Is the drive belt loose?	Go to **Step 9**	Go to **Step 10**
9	1. Replace the drive belt tensioner. Refer to the following: • **Drive Belt Tensioner Replacement - Accessory** for the 6.0L (LS2) engine • **Drive Belt Tensioner Replacement - Accessory** for the 7.0L (LS7) engine 2. Start the engine. Has the noise decreased or stopped?	System OK	Go to **Step 11**
10	Compare the vehicle with a known good vehicle.		

	Do both vehicles make the same noise?	System OK	Go to **Step 11**
11	**IMPORTANT:** **If no definite generator problems were found, be sure that all other possible sources of objectionable noise are eliminated before replacing the generator. Replacing the generator may not change the noise level if the noise is a normal characteristic of the generator or the generator mounting.** Replace the generator. Refer to **Generator Replacement (6.0L)** or **Generator Replacement (7.0L)**.Has the noise decreased or stopped?	System OK	-

STARTER SOLENOID DOES NOT CLICK

Starter Solenoid Does Not Click

Step	Action	Yes	No
Schematic Reference: Starting and Charging Schematics **Connector End View Reference: Power and Grounding Connector End Views**			
1	Did you perform the Diagnostic System Check - Vehicle?	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle**
2	1. Apply the brake and press the Start button. 2. If equipped with a manual transmission, fully depress the clutch pedal. Does the engine crank?	Go to **Testing for Intermittent Conditions and Poor Connections**	Go to **Step 3**
3	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF, are DTCs B2515,C0277,C0278,P0615 or P1875 Current?	Go to **Diagnostic Trouble Code (DTC) List - Vehicle**	Go to **Step 4**
	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, observe the starter relay Command parameter in the engine control		

4	module (ECM) data list. 4. Apply the brake and press the Start button. 5. If equipped with a manual transmission, fully depress the clutch pedal Does the scan tool display ON?	Go to **Step 6**	Go to **Step 5** for the automatic transmission Go to **Step 6** for the manual transmission
5	1. Turn ON the ignition, with the engine OFF. 2. Verify that the transmission is in Park or Neutral. 3. With a scan tool, observe the PNP switch parameter in the engine control module (ECM) data list. Does the scan tool display Park/Neutral?	Go to **Step 6**	Go to **Diagnostic Trouble Code (DTC) List - Vehicle**
6	1. Apply the brake and press the Start button. 2. If equipped with a manual transmission, fully depress the clutch pedal, and observe the clutch start switch parameter in the (ECM) data list. Does the scan tool display applied?	Go to **Step 9**	Go to **Step 7**
7	**IMPORTANT:** **This circuit feeds the crank relay coil.** 1. Turn OFF the ignition. 2. Disconnect the crank relay. 3. Turn ON the ignition, with the engine OFF. 4. Fully depress the clutch pedal on a manual transmission. 5. Connect a test lamp between the battery positive voltage circuit of the crank relay coil and a good ground. Does the test lamp illuminate?	Go to **Step 8**	Go to **Step 17**
	IMPORTANT:		

8	**This circuit feeds the crank relay coil.** 1. Connect a test lamp between the battery positive voltage circuit of the crank relay coil and the control circuit of the crank relay. 2. Fully depress the clutch pedal on a manual transmission. 3. Apply the brake and press the Start button. Does the test lamp illuminate?	Go to **Step 14**	Go to **Step 13**
9	1. Turn OFF the ignition. 2. Disconnect the crank relay. 3. Connect a test lamp between the battery positive voltage circuit of the crank relay switch circuit and a good ground. Does the test lamp illuminate?	Go to **Step 10**	Go to **Step 18**
10	**IMPORTANT:** **Ensure the parking brake is applied and the transmission is in park equipped with an automatic transmission or neutral on a manual transmission.** Connect a 30-amp fused jumper between the battery positive voltage circuit of the crank relay switch circuit and the supply voltage circuit of the starter solenoidDoes the engine crank?	Go to **Step 14**	Go to **Step 11**
11	Does the fuse in the jumper open?	Go to **Step 19**	Go to **Step 12**
12	Test the supply voltage circuit of the starter solenoid for a high resistance or open. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	Go to **Step 23**	Go to **Step 15**
13	Test the crank relay control circuit of the ECM for a high resistance or open. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	Go to **Step 23**	Go to **Step 16**
	Inspect for poor connections at the crank relay. Refer to **Testing for Intermittent Conditions**		

14	**and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	Go to **Step 23**	Go to **Step 20**
15	Inspect for poor connections at the starter solenoid. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	Go to **Step 23**	Go to **Step 21**
16	Inspect for poor connections at the harness connector of the ECM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	Go to **Step 23**	Go to **Step 22**
17	Repair an open or high resistance in the battery positive voltage circuit of the crank relay coil. Refer to **Wiring Repairs** . Did you complete the repair?	Go to **Step 23**	-
18	Repair the open or high resistance in the battery positive voltage circuit of the crank relay switch. Refer to **Wiring Repairs** . Did you complete the repair?	Go to **Step 23**	-
19	Repair the short to ground in the supply voltage circuit of the starter solenoid. Refer to **Wiring Repairs** . Did you complete the repair?	Go to **Step 23**	-
20	Replace the crank relay. Did you complete the replacement?	Go to **Step 23**	-
21	Replace the Starter Motor. Refer to **Starter Motor Replacement**. Did you complete the replacement?	Go to **Step 23**	-
22	Replace the ECM. Refer to **Control Module References** for replacement, setup, and programming. Did you complete the replacement?	Go to **Step 23**	-
23	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 2**

STARTER SOLENOID CLICKS, ENGINE DOES NOT CRANK

Starter Solenoid Clicks, Engine Does Not Crank

Step	Action	Yes	No
Schematic Reference: Starting and Charging Schematics **Connector End View Reference: Master Electrical Component List**			
1	Did you perform the Diagnostic System Check - Vehicle?	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle**
2	Apply the brake and press the start button. Did the starter solenoid click?	Go to **Step 3**	Go to **Starter Solenoid Does Not Click**
3	Inspect the engine and belt drive system for mechanical binding, seized engine, or seized generator. Does the engine move freely?	Go to **Step 4**	Go to **Engine Will Not Crank - Crankshaft Will Not Rotate** for the 6.0L (LS2) engine or **Engine Will Not Crank - Crankshaft Will Not Rotate** for the 7.0L (LS7) engine
4	Test the battery positive cable between the battery and the starter solenoid for high resistance. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	Go to **Step 8**	Go to **Step 5**
5	Test the ground circuit between the battery and the starter motor for a high resistance. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	Go to **Step 8**	Go to **Step 6**
6	Inspect for poor connections at the starter. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	Go to **Step 8**	Go to **Step 7**
	Replace the starter. Refer to **Starter Motor**		

7	**Replacement**. Did you complete the replacement?	Go to **Step 8**	-
8	Operate the system for which the symptom occurred. Did you correct the condition?	System OK	Go to **Step 2**

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 the following:
  - **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**.

STARTER MOTOR NOISE DIAGNOSIS

Diagnostic Aids

Inspect the flywheel ring gear for damage or unusual wear.

Starter Motor Noise Diagnosis

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Vehicle?	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle**
2	Start the engine. Does the starter operate normally?	Go to **Testing for Intermittent Conditions and Poor Connections**	Go to **Step 3**

3	Start the engine while listening to the starter motor turn. Is there a loud "whoop", that may sound like a siren if the engine is revved while the starter is engaged, after the engine starts, but while the starter is still held in the engaged position?	Go to **Step 6**	Go to **Step 4**
4	Do you hear a "rumble", a "growl", or, in some cases, a "knock" as the starter is coasting down to a stop after starting the engine?	Go to **Step 7**	Go to **Step 5**
5	**IMPORTANT:** **This is often diagnosed as a starter drive gear hang-in or a weak solenoid.** When the engine is cranked, do you hear a high-pitched whine after the engine cranks and starts normally?	Go to **Step 8**	Go to **Step 7**
6	Inspect the flywheel ring gear for the following: • Chipped gear teeth • Missing gear teeth • Milled teeth Is the flywheel bent, or does it have damaged teeth?	Go to **Step 8**	Go to **Step 7**
7	1. Remove the starter motor. Refer to **Starter Motor Replacement**. 2. Inspect the starter motor bushings and clutch gear. Does the clutch gear have chipped or milled teeth or worn bushings?	Go to **Step 9**	Go to **Step 10**
8	Replace the flywheel. Refer to the following: • **Engine Flywheel Replacement** for the 6.0L (LS2) engine • **Engine Flywheel Replacement** for the 7.0L (LS7) engine		

	Did you complete the replacement?	Go to **Step 10**	-
9	Replace the starter motor. Refer to **Starter Motor Replacement**. Did you complete the replacement?	Go to **Step 10**	-
10	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

REPAIR INSTRUCTIONS

BATTERY NEGATIVE CABLE DISCONNECTION AND CONNECTION (6.0L)

Removal Procedure

CAUTION: When performing service on or near the SIR components or the SIR wiring, the SIR system must be disabled. Refer to SIR Disabling and Enabling . Failure to observe the correct procedure could cause deployment of the SIR components, personal injury, or unnecessary SIR system repairs.

CAUTION: Before servicing any electrical component, the ignition and start switch must be in the OFF or LOCK position and all electrical loads must be OFF, unless instructed otherwise in these procedures. If a tool or equipment could easily come in contact with a live exposed electrical terminal, also disconnect the negative battery cable. Failure to follow these precautions may cause personal injury and/or damage to the vehicle or its components.

1. Record all of the vehicle preset radio stations.
2. Record the radio Theftlock® code (if applicable). Refer to **Radio/Audio System Description and Operation** .
3. Turn OFF all the lamps and the accessories.
4. Make sure the ignition switch is in the OFF position.

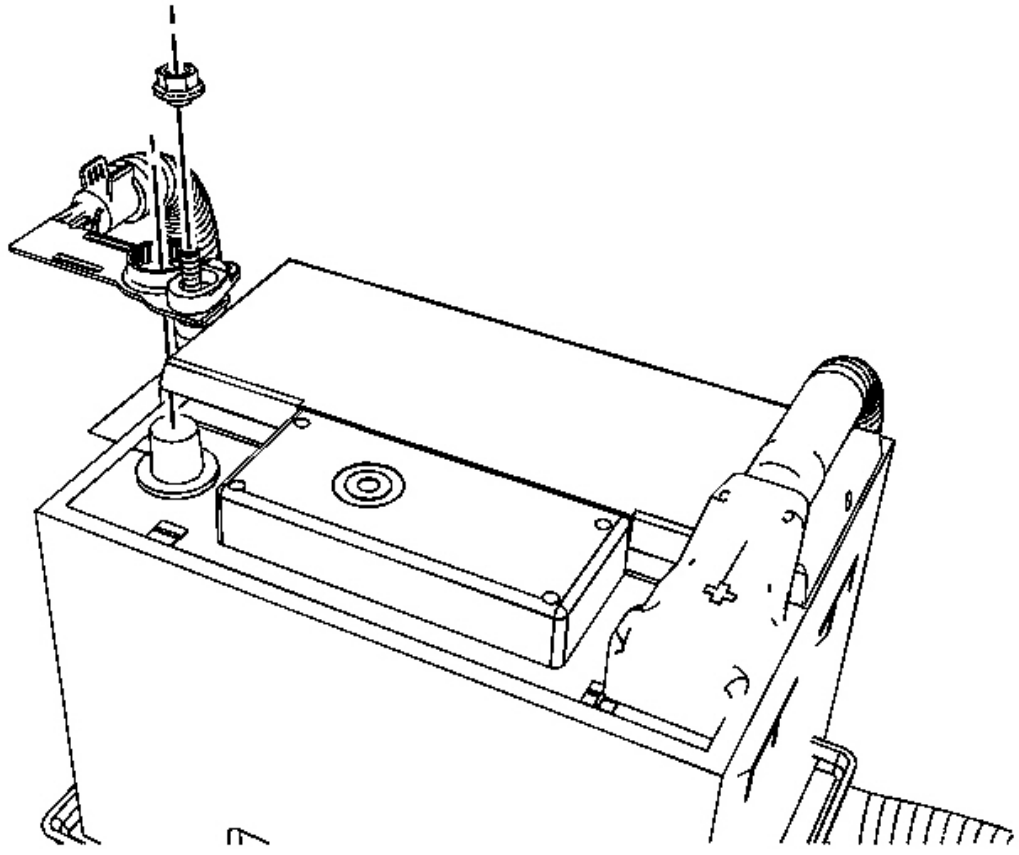


Fig. 10: View Of Battery, Negative Cable & Nut
Courtesy of GENERAL MOTORS CORP.

5. Remove the negative battery cable to battery nut and separate the cable from the battery.

Installation Procedure

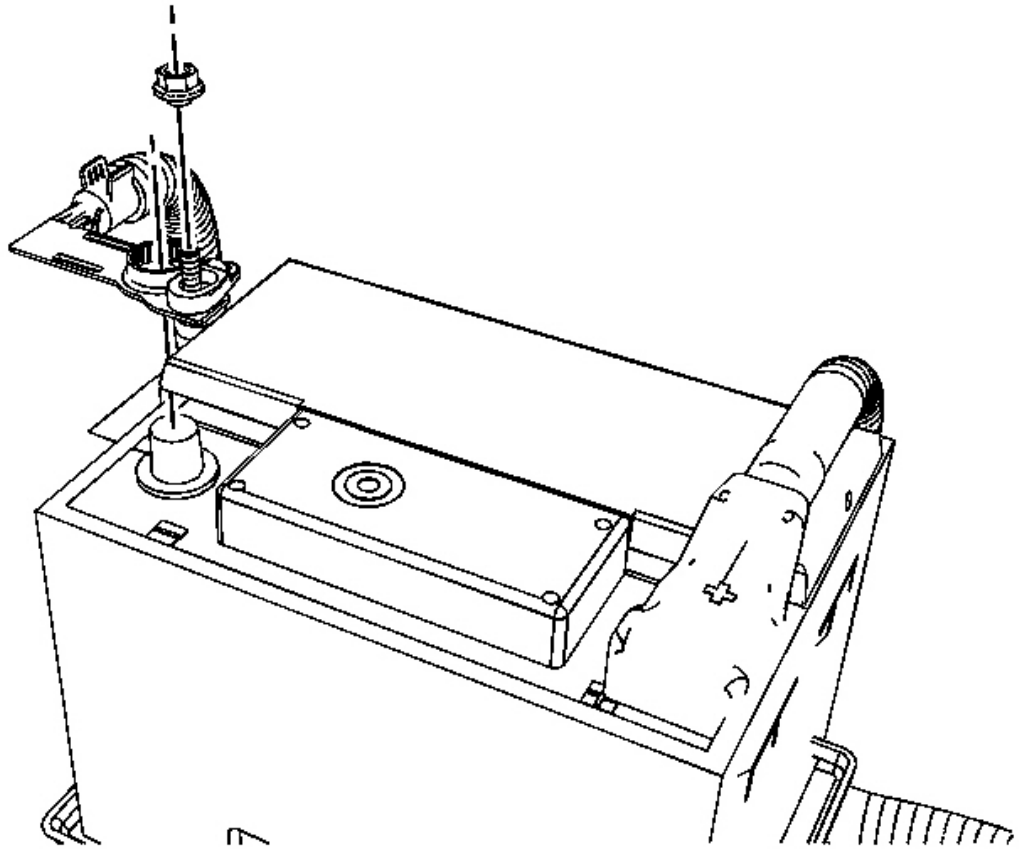


Fig. 11: View Of Battery, Negative Cable & Nut
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

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

1. Connect the battery negative cable to the battery.

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

2. Unlock the Theftlock® radio (if applicable).

3. Program the radio stations back into the radio as recorded at the beginning of the procedure.
4. Set the clock to the current time. Refer to **Radio/Audio System Description and Operation** .
5. Perform the reinitialization of the power windows. Refer to **Power Window Reinitialization** .

BATTERY NEGATIVE CABLE DISCONNECTION AND CONNECTION (7.0L)

Removal Procedure

CAUTION: When performing service on or near the SIR components or the SIR wiring, the SIR system must be disabled. Refer to SIR Disabling and Enabling . Failure to observe the correct procedure could cause deployment of the SIR components, personal injury, or unnecessary SIR system repairs.

1. Record all of the vehicle preset radio stations.
2. Record the radio Theftlock® code, if applicable. Refer to **Radio/Audio System Description and Operation** .
3. Turn OFF all the lamps and the accessories.
4. Make sure the ignition switch is in the OFF position.
5. Open the RH rear compartment storage bin to access the battery.

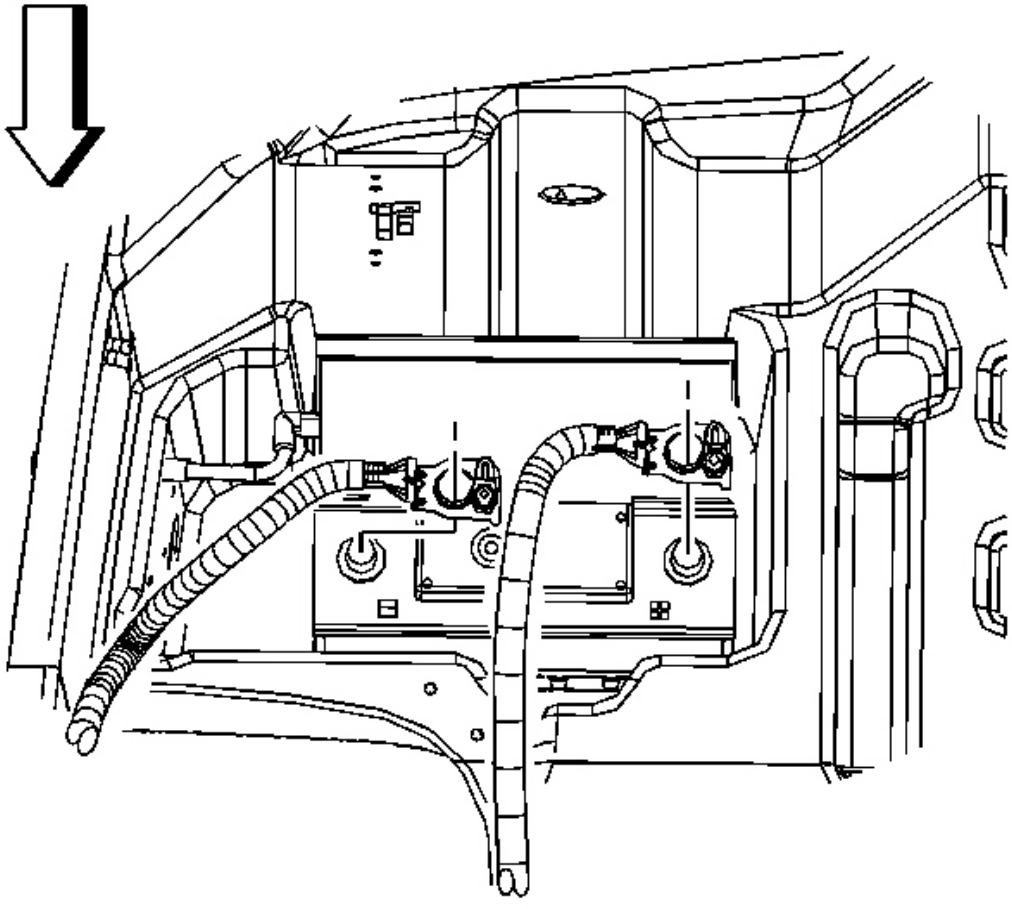


Fig. 12: View Of Battery, Negative Cable & Nut
Courtesy of GENERAL MOTORS CORP.

6. Remove the negative battery cable to battery nut and separate the cable from the battery.

Installation Procedure

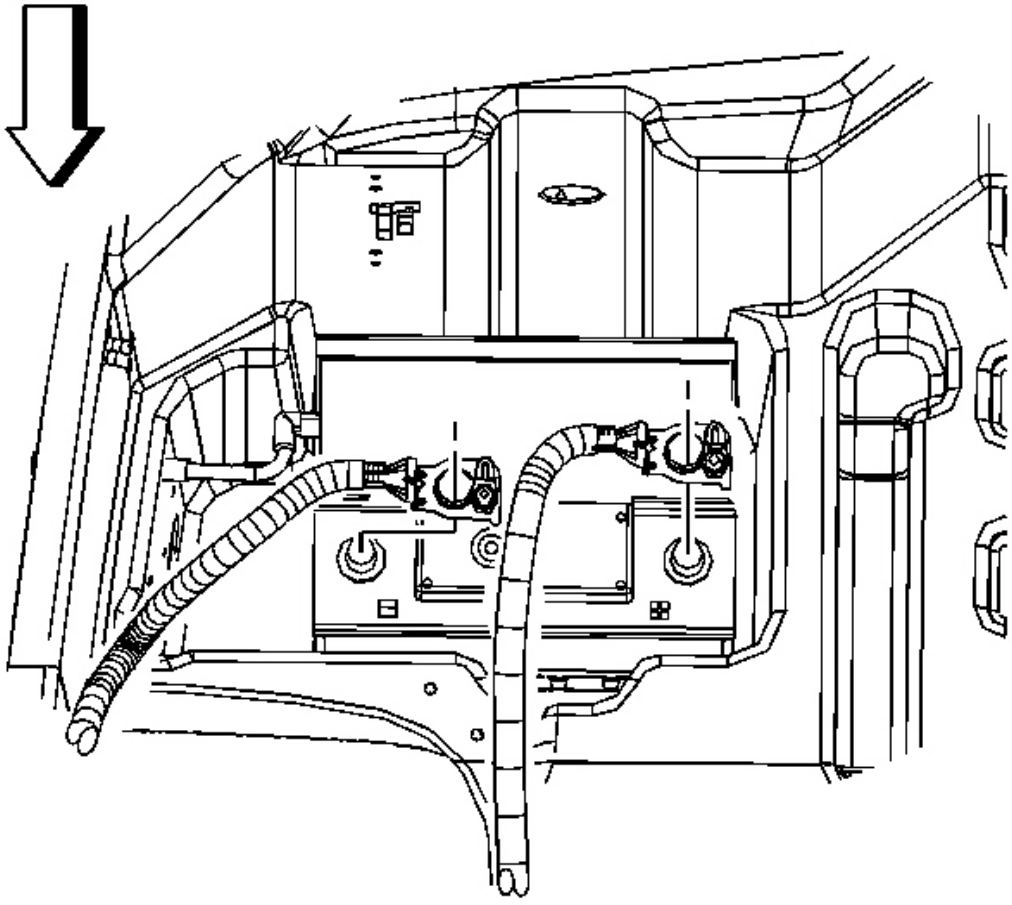


Fig. 13: View Of Battery, Negative Cable & Nut
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

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

1. Connect the battery negative cable to the battery and install the negative battery cable nut.

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

2. Close the RH rear compartment storage bin.
3. Unlock the Theftlock® radio, if applicable.
4. Program the radio stations back into the radio as recorded at the beginning of the procedure.
5. Set the clock to the current time. Refer to **Radio/Audio System Description and Operation** .
6. Perform the reinitialization of the power windows. Refer to **Power Window Reinitialization** .

BATTERY POSITIVE AND NEGATIVE CABLE REPLACEMENT (6.0L)

Removal Procedure

1. Disconnect the negative cable lead from the battery. Refer to **Battery Negative Cable Disconnection and Connection (6.0L)** or **Battery Negative Cable Disconnection and Connection (7.0L)**.

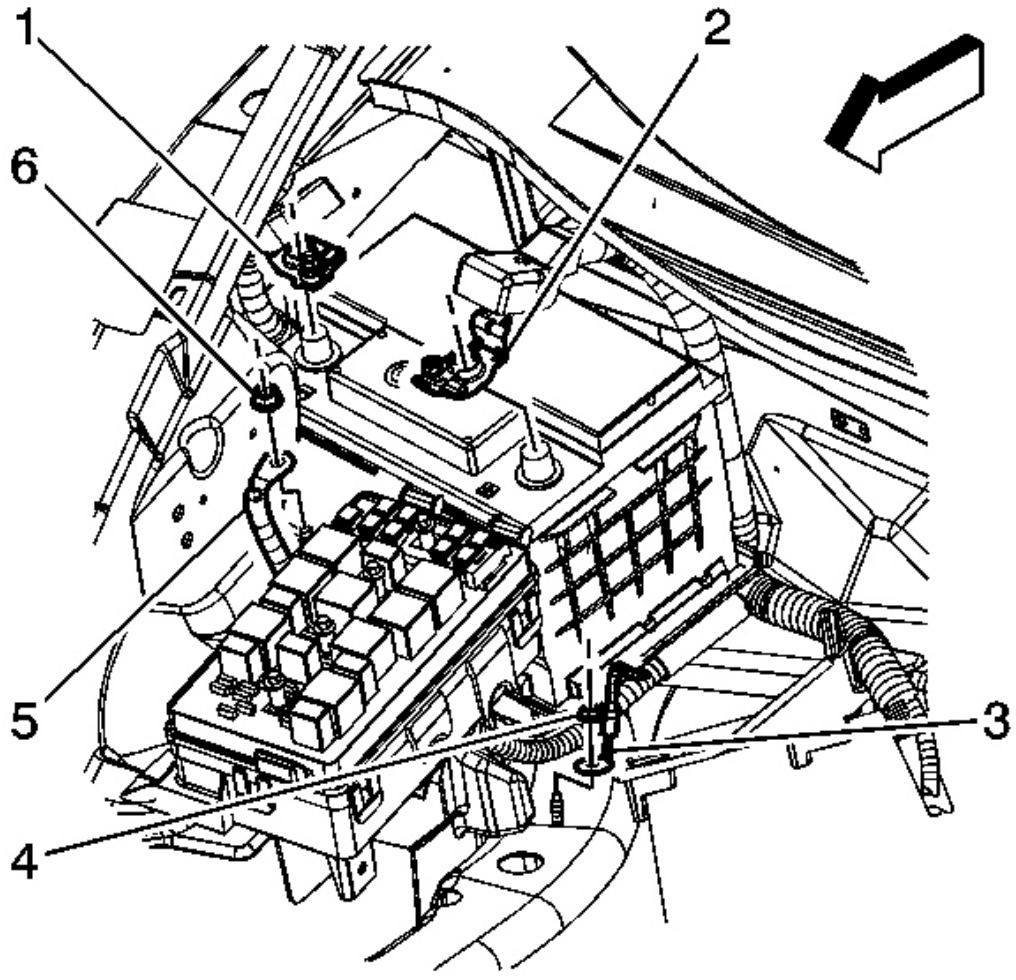


Fig. 14: View Of Battery & Related Components
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the positive cable lead (2) from the battery.
3. Remove the battery positive cable to fuse/relay center nut (6) and disconnect the cable (5) from the stud.
4. Remove the battery ground cable nut (4) and disconnect the cable (3) from the stud.
5. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

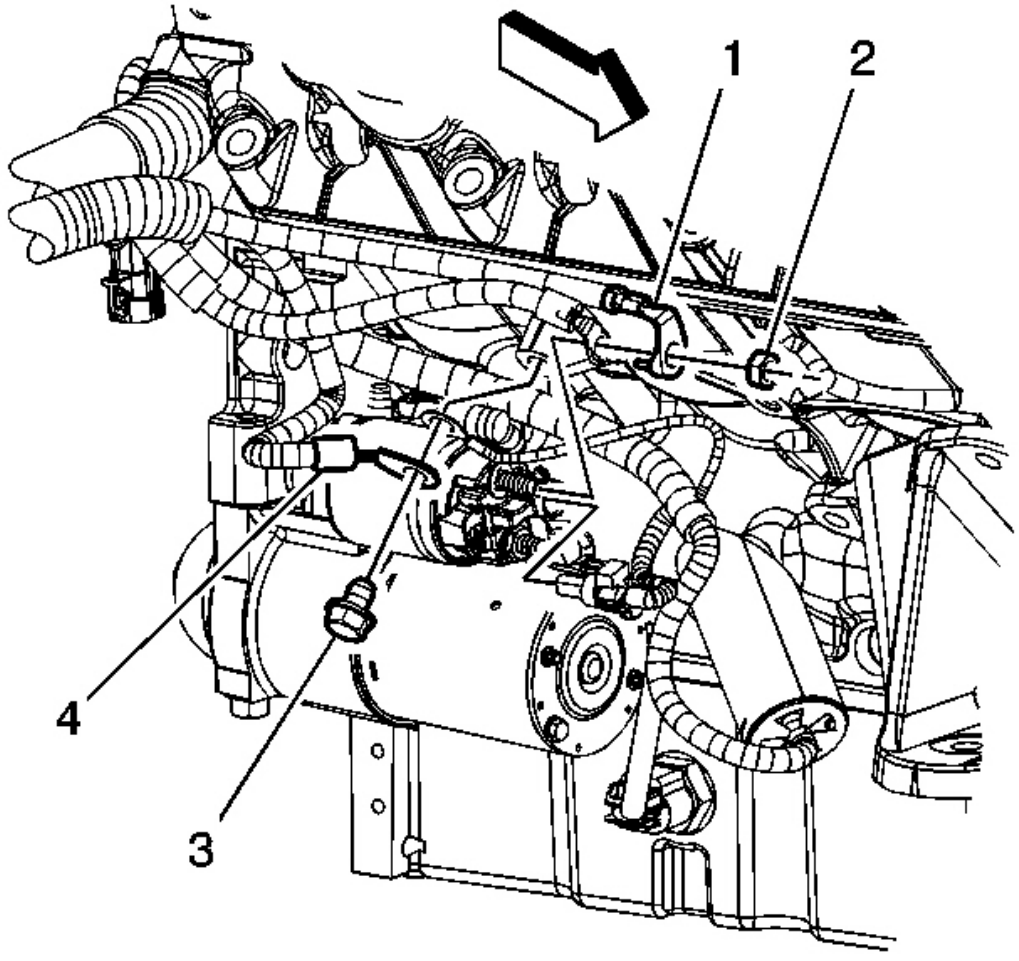


Fig. 15: View Of Battery Cables & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Remove the battery positive/negative cable to engine bolt (3).
7. Remove the positive battery cable to starter solenoid nut and disconnect the cable (1) from the stud.
8. Remove the battery positive/negative cable from the vehicle.

Installation Procedure

1. Position the battery positive/negative cable to the vehicle.

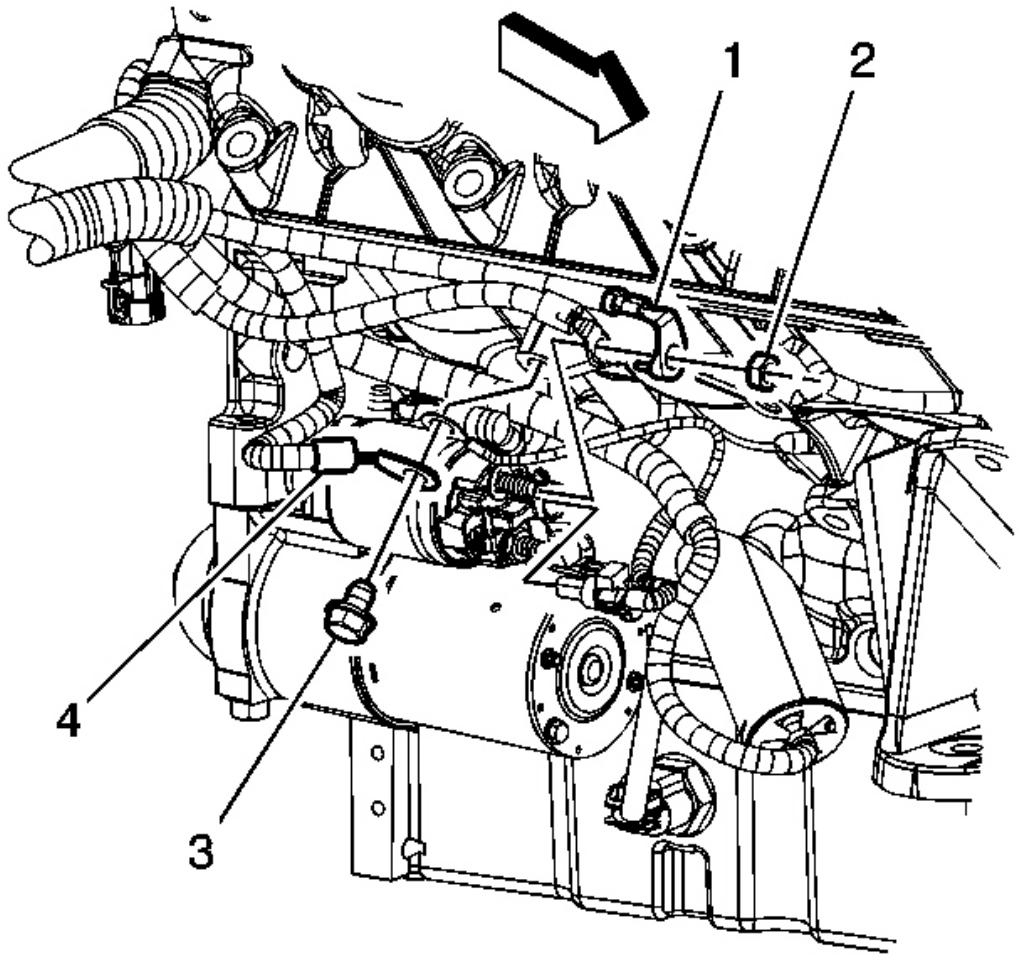


Fig. 16: View Of Battery Cables & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

2. Install the positive battery cable (1) to the stud and install the positive battery cable to starter solenoid nut (2).

   Tighten: Tighten the positive battery cable to starter solenoid nut to 10 N.m (89 lb in).

3. Position the negative battery cable (4) and install the battery positive/negative cable to engine bolt.

Tighten: Tighten the battery positive/negative cable to engine bolt to 40 N.m (30 lb ft).

4. Lower the vehicle.

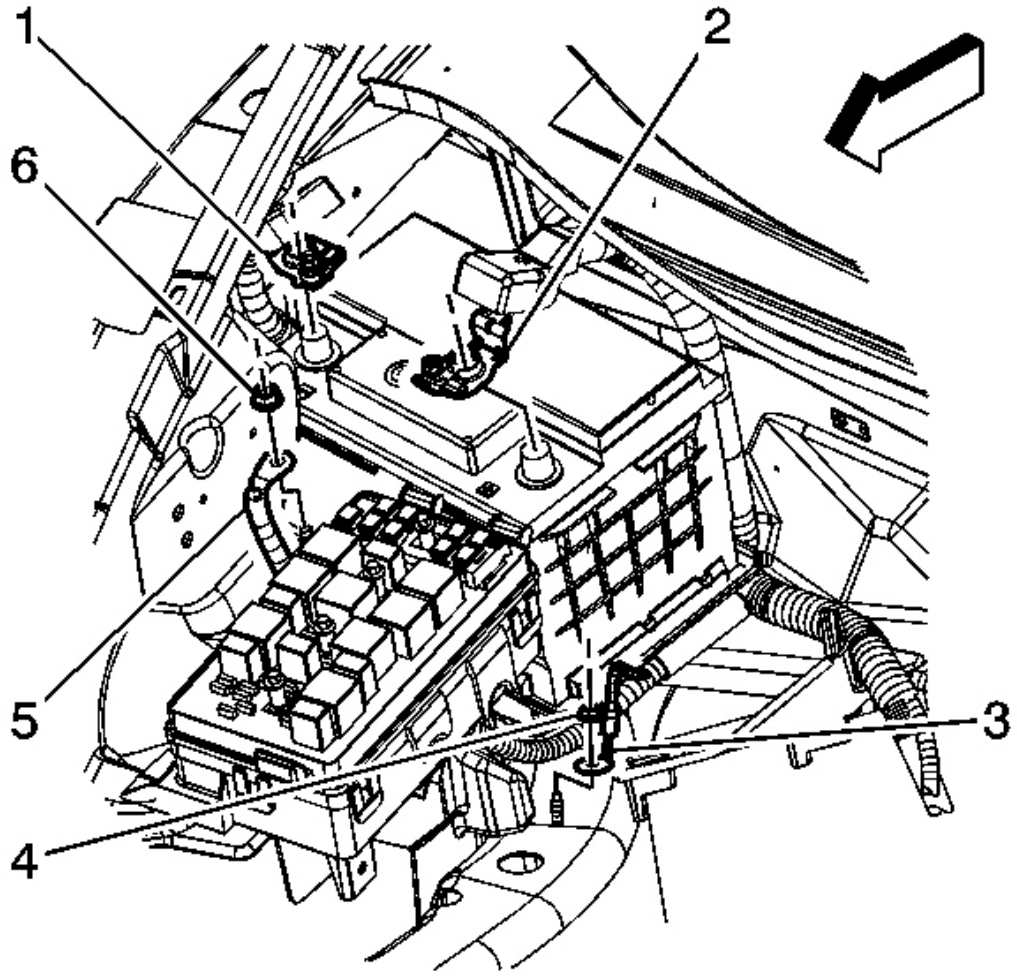


Fig. 17: View Of Battery & Related Components
Courtesy of GENERAL MOTORS CORP.

5. Position the battery ground cable (3) and install the battery ground cable nut (4).

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

6. Position the battery positive cable (5) to the stud and install the battery positive cable to fuse/relay center nut (6).

   Tighten: Tighten the battery positive cable to fuse/relay center nut to 10 N.m (89 lb in).

7. Connect the positive cable lead (2) to the battery.

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

8. Connect the negative cable lead to the battery. Refer to **Battery Negative Cable Disconnection and Connection (6.0L)** or **Battery Negative Cable Disconnection and Connection (7.0L)**.

BATTERY POSITIVE AND NEGATIVE CABLE REPLACEMENT (7.0L)

Removal Procedure

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (6.0L)** or **Battery Negative Cable Disconnection and Connection (7.0L)**.

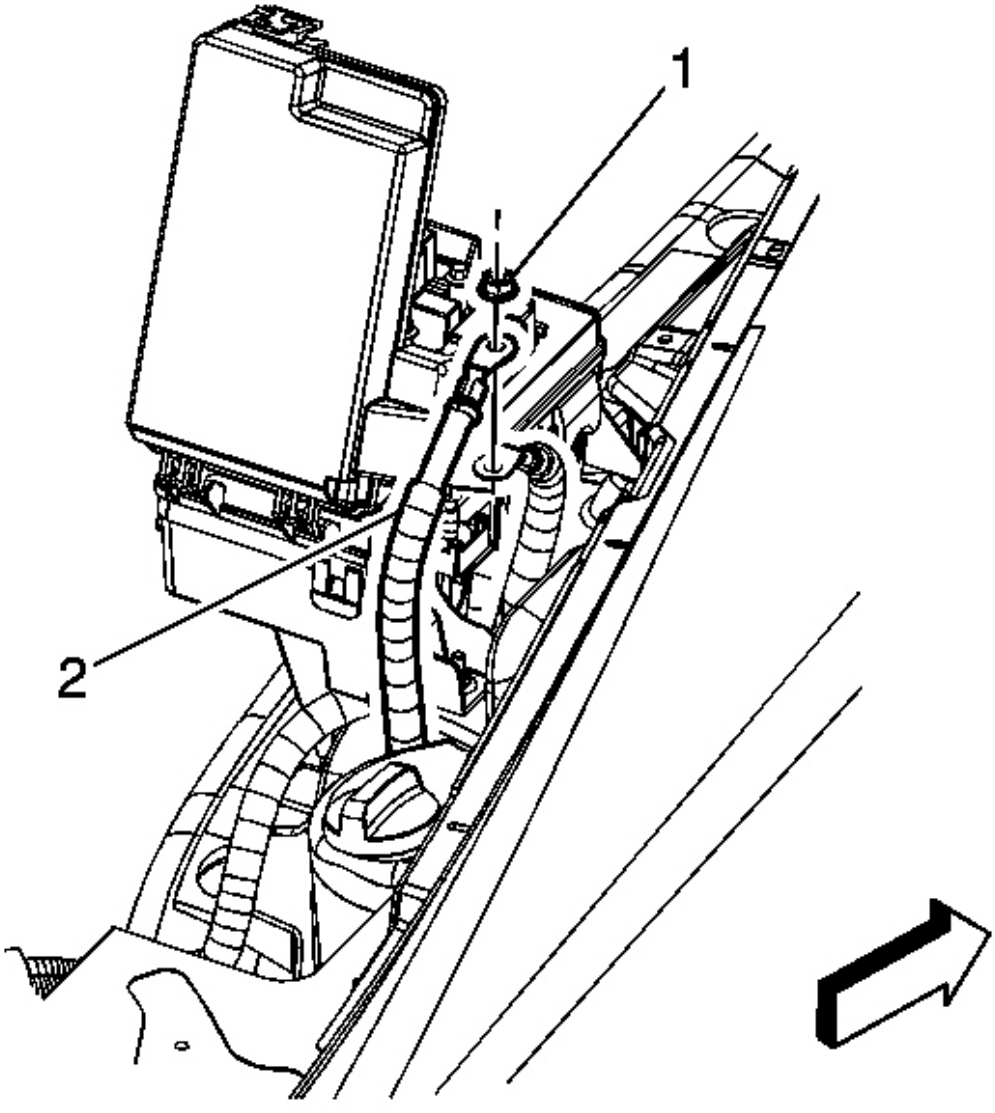


Fig. 18: View Of Battery Positive/Negative Cable Lead & Nut
Courtesy of GENERAL MOTORS CORP.

2. Remove the battery positive cable nut (1) and remove the battery positive/negative cable lead (2).

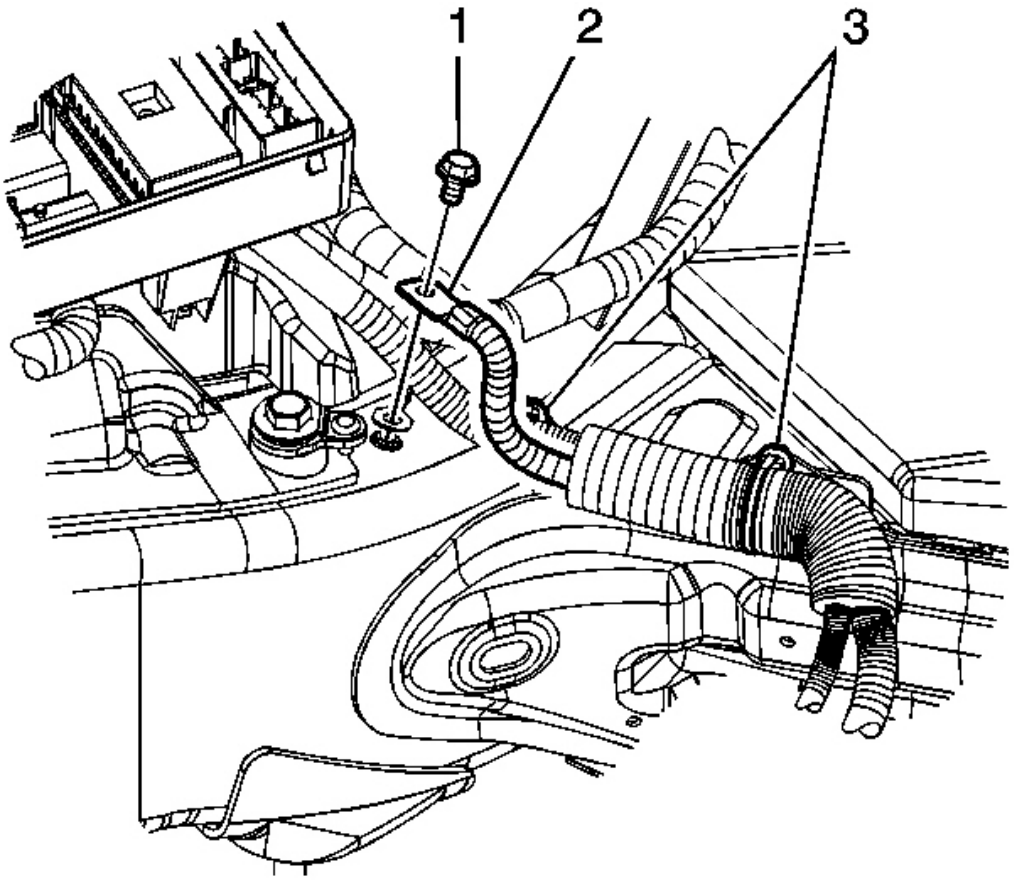


Fig. 19: View Of Battery Positive/Negative Cable Lead, Wiring Harness Retainer & Bolt
Courtesy of GENERAL MOTORS CORP.

3. Remove the battery positive/negative cable bolt (1) and release the wiring harness retainers (3).
4. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

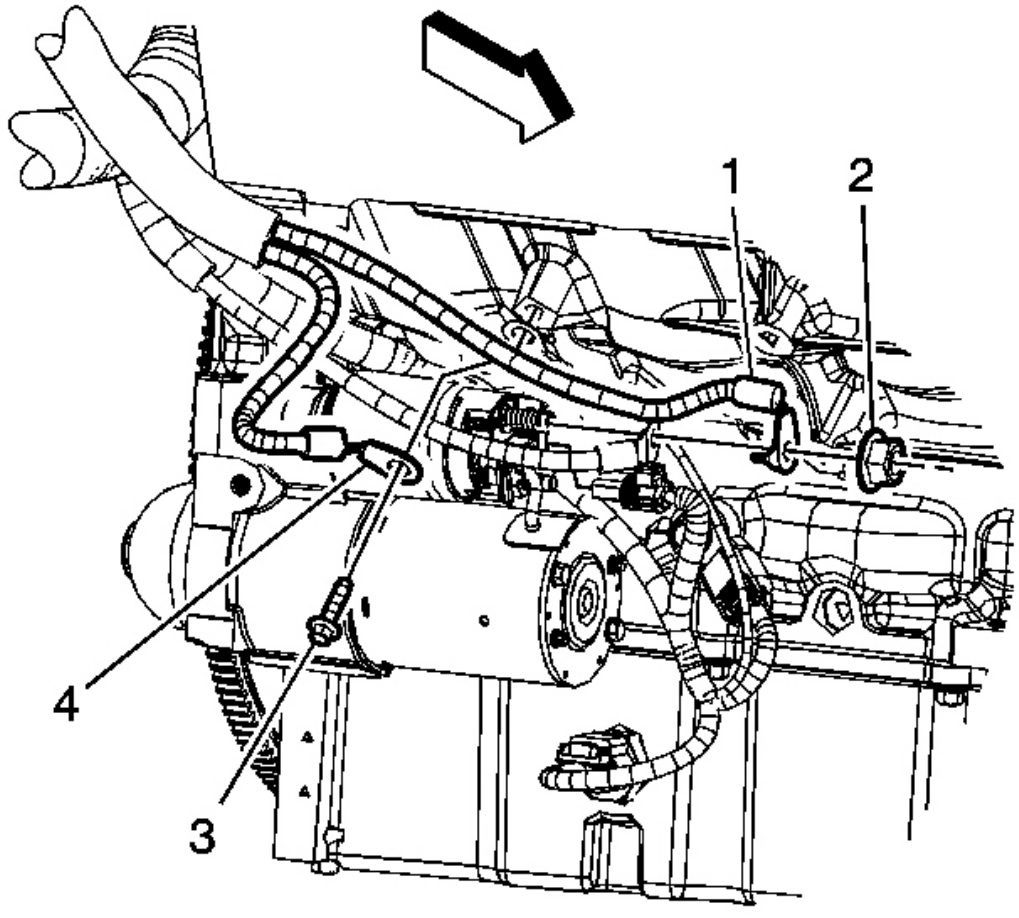


Fig. 20: View Of Battery & Related Components
Courtesy of GENERAL MOTORS CORP.

5. Remove the battery positive/negative cable bolt (3) from the engine block.
6. Remove the battery positive/negative cable nut (2) from the starter solenoid.
7. Remove the battery positive/negative cable from the vehicle.

Installation Procedure

1. Position the battery positive/negative cable into the vehicle.

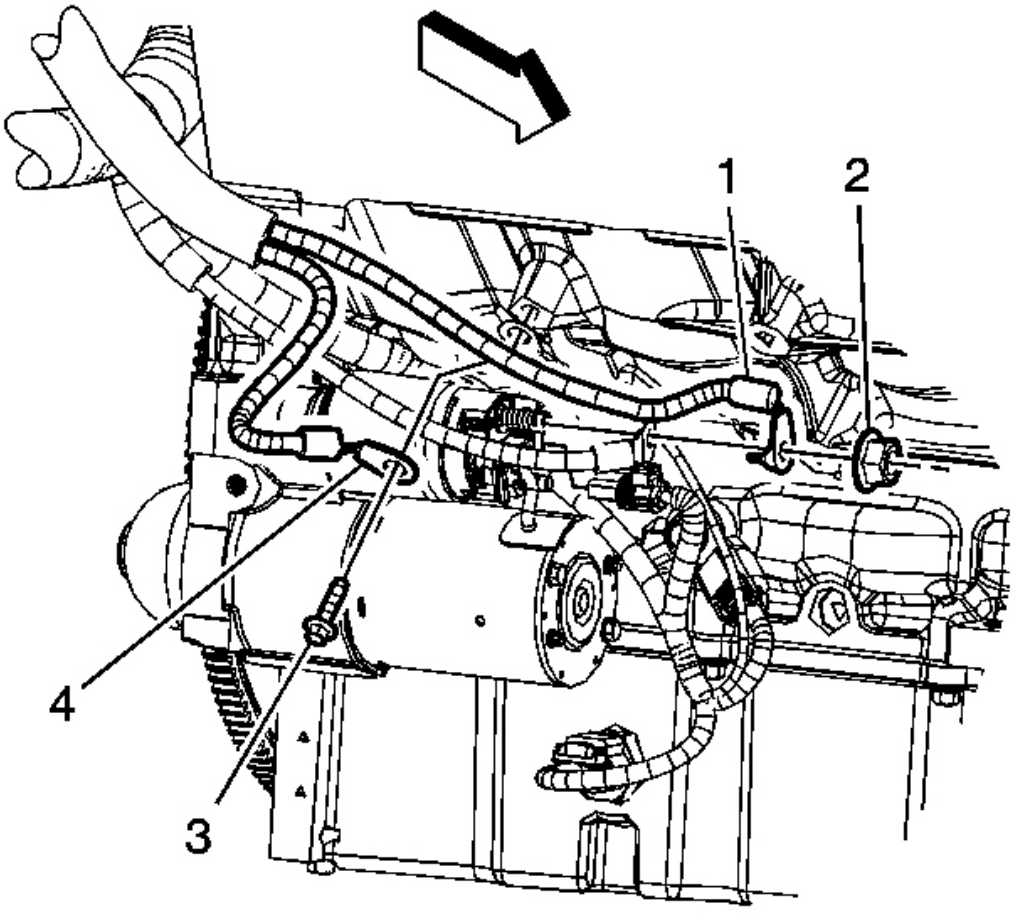


Fig. 21: View Of Battery & Related Components
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

2. Install the battery positive/negative cable nut (2) to the starter solenoid.

   Tighten: Tighten the battery positive/negative cable nut to 10 N.m (89 lb in).

3. Install the battery positive/negative cable bolt (3) to the engine block.

   Tighten: Tighten the battery positive/negative cable to engine block bolt to 40 N.m (30 lb ft).

4. Lower the vehicle.

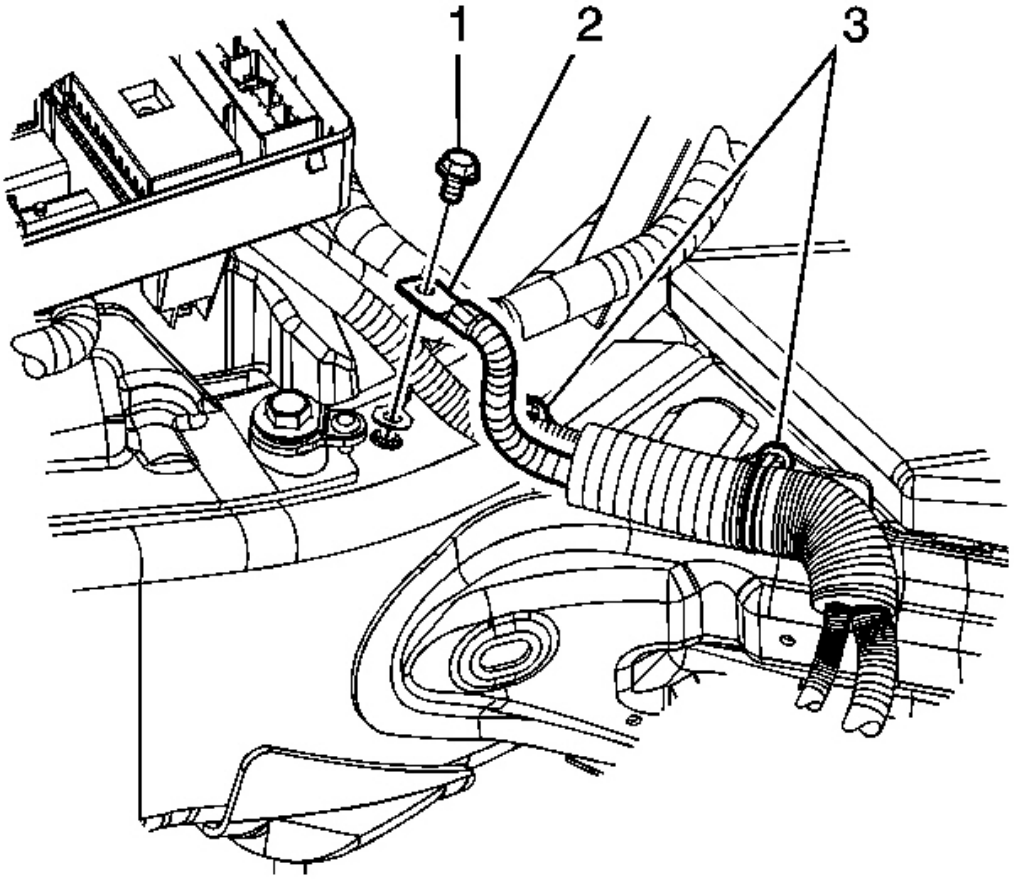


Fig. 22: View Of Battery Positive/Negative Cable Lead, Wiring Harness Retainer & Bolt
Courtesy of GENERAL MOTORS CORP.

5. Install the battery positive/negative cable bolt (1) and attach the wiring harness retainers (3).

   Tighten: Tighten the battery positive/negative cable to frame rail bolt to 25 N.m (18 lb ft).

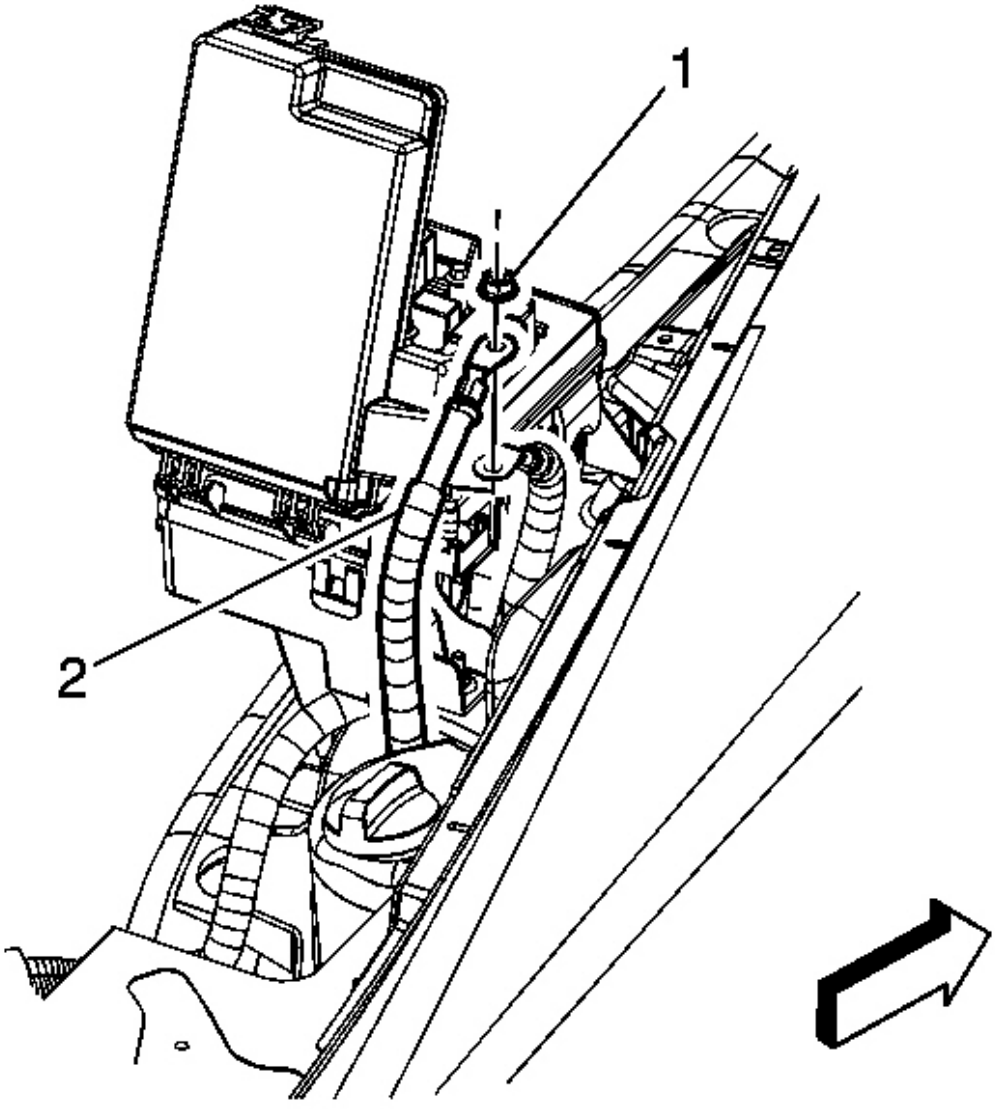


Fig. 23: View Of Battery Positive/Negative Cable Lead & Nut
Courtesy of GENERAL MOTORS CORP.

6. Install the battery positive cable nut (1).

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

7. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (6.0L)** or **Battery Negative Cable Disconnection and Connection (7.0L)**.

BATTERY NEGATIVE CABLE REPLACEMENT (7.0L)

Removal Procedure

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (6.0L)** or **Battery Negative Cable Disconnection and Connection (7.0L)**.
2. Remove the rear compartment carpet. Refer to **Rear Compartment Floor Panel Carpet Replacement (Convertible)** or **Rear Compartment Floor Panel Carpet Replacement (Coupe)** .
3. Remove the passenger rear compartment front side trim panel. Refer to **Rear Compartment Side Trim Panel Replacement** .

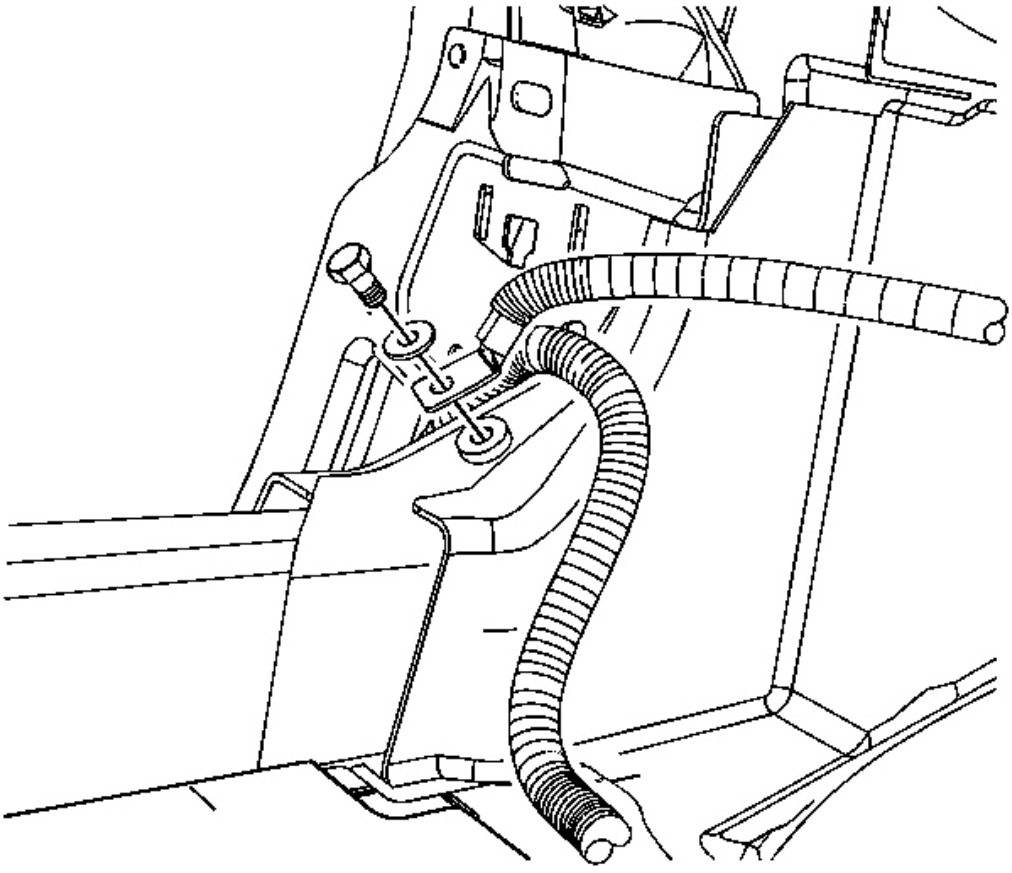


Fig. 24: View Of Negative Cable Ground Lead At Chassis
Courtesy of GENERAL MOTORS CORP.

4. Remove the negative cable ground bolt from the chassis.
5. Remove the negative battery cable.

Installation Procedure

1. Install the negative battery cable.

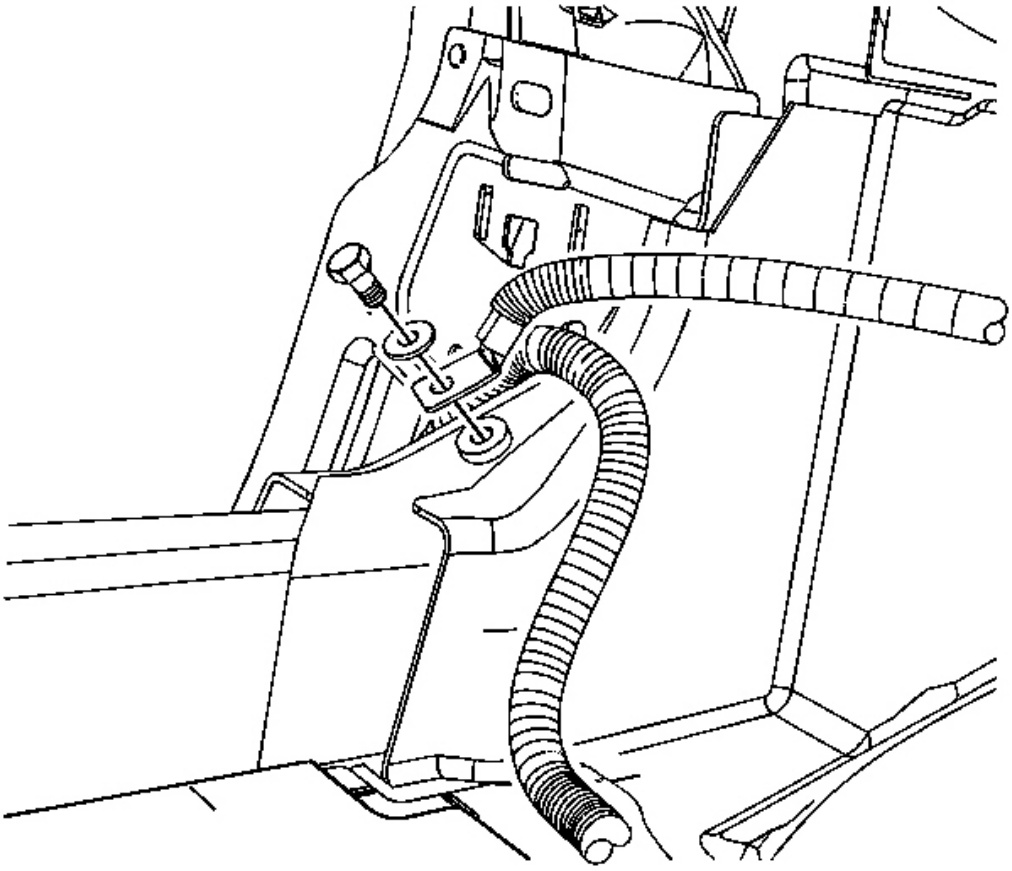


Fig. 25: View Of Negative Cable Ground Lead At Chassis
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

2. Install the negative cable ground bolt to the chassis.

   Tighten: Tighten the battery negative cable ground bolt to 25 N.m (18 lb ft).

3. Install the passenger rear compartment front side trim panel. Refer to **Rear Compartment Side Trim Panel Replacement** .
4. Install the rear compartment carpet. Refer to **Rear Compartment Floor Panel Carpet Replacement (Convertible)** or **Rear Compartment Floor Panel Carpet Replacement**

(Coupe) .

5. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (6.0L)** or **Battery Negative Cable Disconnection and Connection (7.0L)**.

BATTERY POSITIVE CABLE REPLACEMENT (7.0L)

Removal Procedure

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (6.0L)** or **Battery Negative Cable Disconnection and Connection (7.0L)**.
2. Disconnect the positive battery cable from the battery.
3. Remove the rear compartment carpet. Refer to **Rear Compartment Floor Panel Carpet Replacement (Convertible)** or **Rear Compartment Floor Panel Carpet Replacement (Coupe)** .
4. Remove the passenger rear compartment front side trim panel. Refer to **Rear Compartment Side Trim Panel Replacement** .
5. Remove the right door sill plate. Refer to **Door Sill Plate Replacement** .
6. Lift up the carpet to access the battery cables.

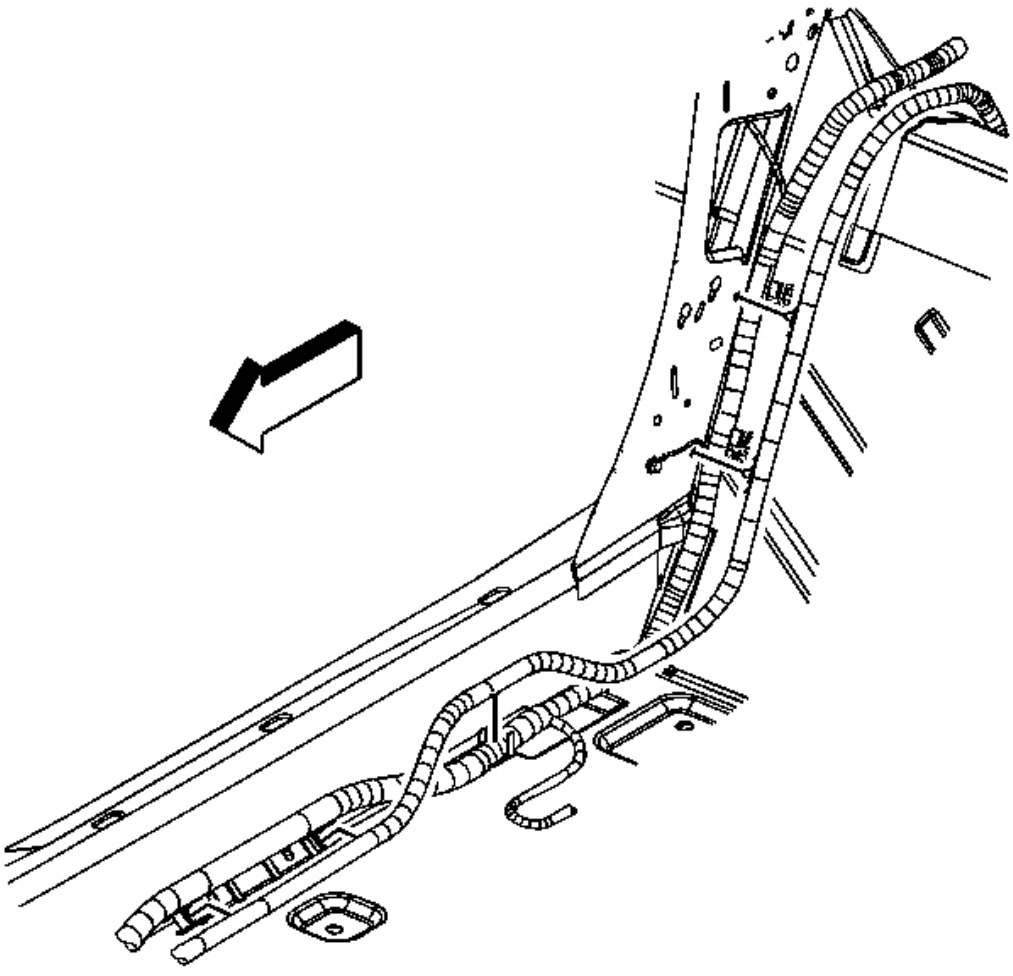


Fig. 26: View Of Positive Battery Cable Retainers
Courtesy of GENERAL MOTORS CORP.

7. Remove the positive battery cable retainers.

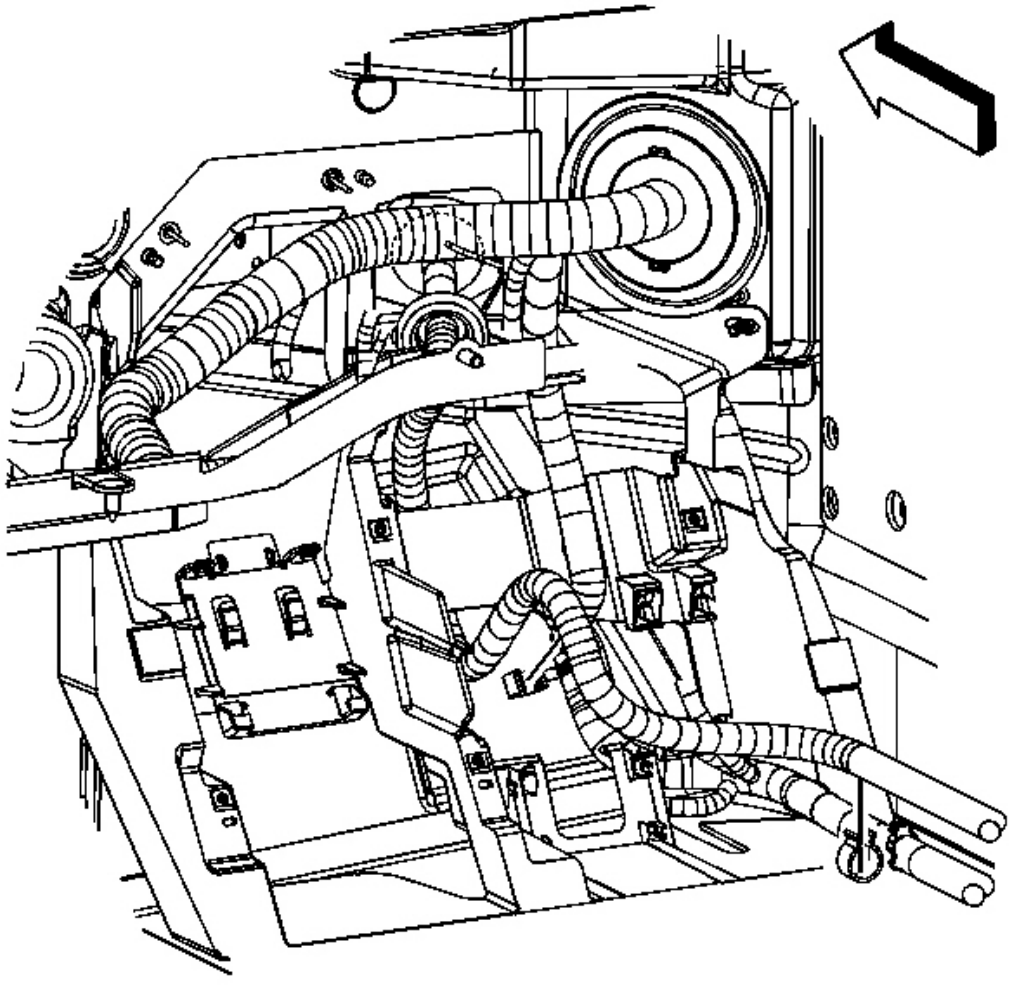


Fig. 27: View Of Positive Cable & Grommet
Courtesy of GENERAL MOTORS CORP.

8. Open the carpet on the fuse/relay center.

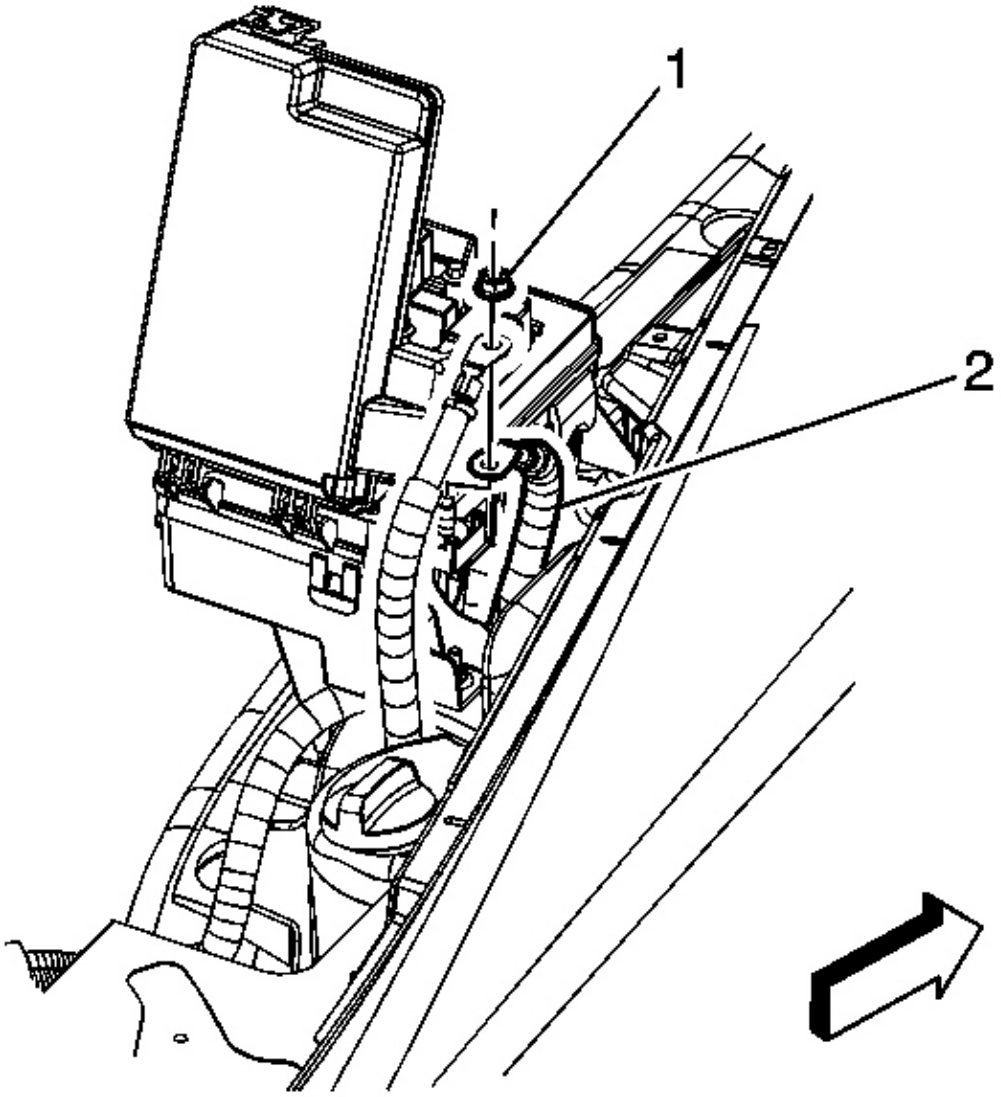


Fig. 28: View Of Positive Battery Cable Lead & Nut
Courtesy of GENERAL MOTORS CORP.

9. Remove the positive battery cable nut (1) from the fuse/relay center stud.
10. Remove the positive battery cable lead (2) from the fuse/relay center stud.
11. Remove the positive battery cable grommet from the dash panel.
12. Pull the positive cable through the dash panel.

13. Remove the positive battery cable.

Installation Procedure

1. Position the positive battery cable.

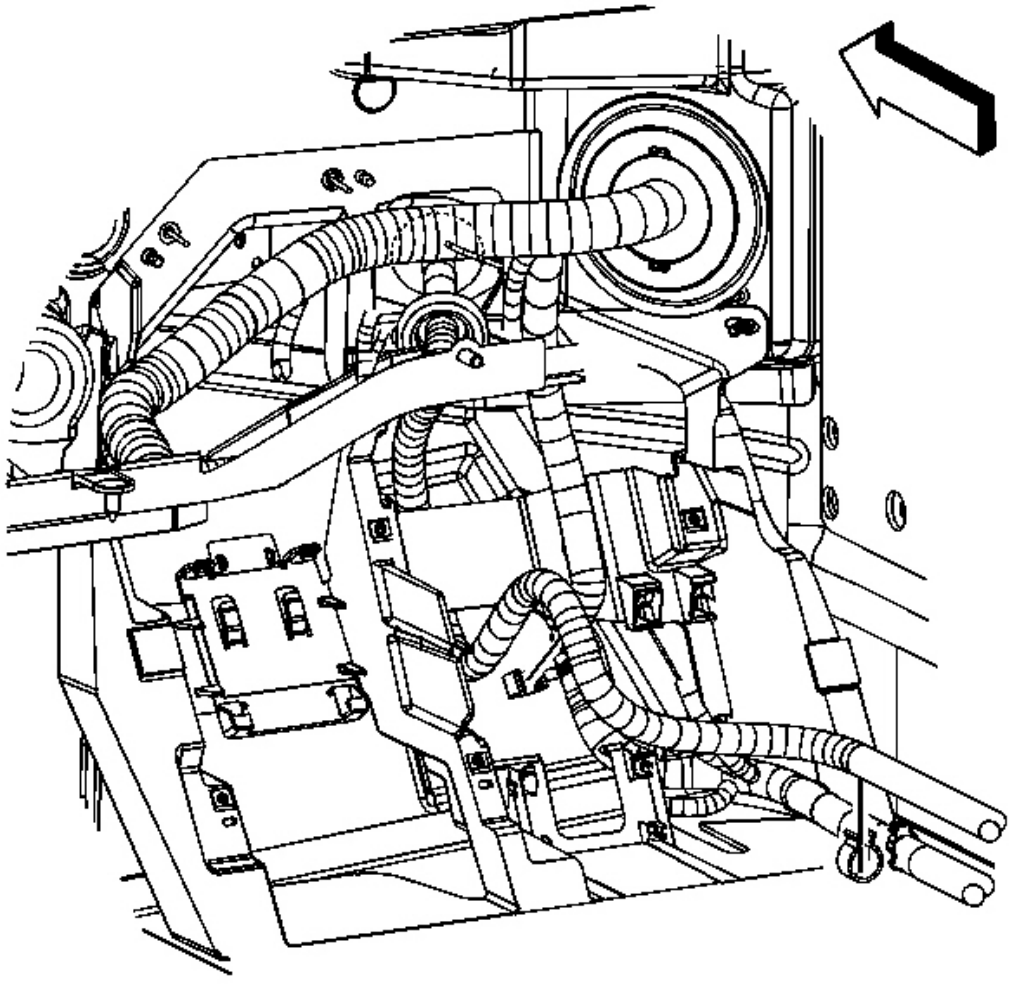


Fig. 29: View Of Positive Cable & Grommet
Courtesy of GENERAL MOTORS CORP.

2. Push the positive cable grommet into place in the dash panel.

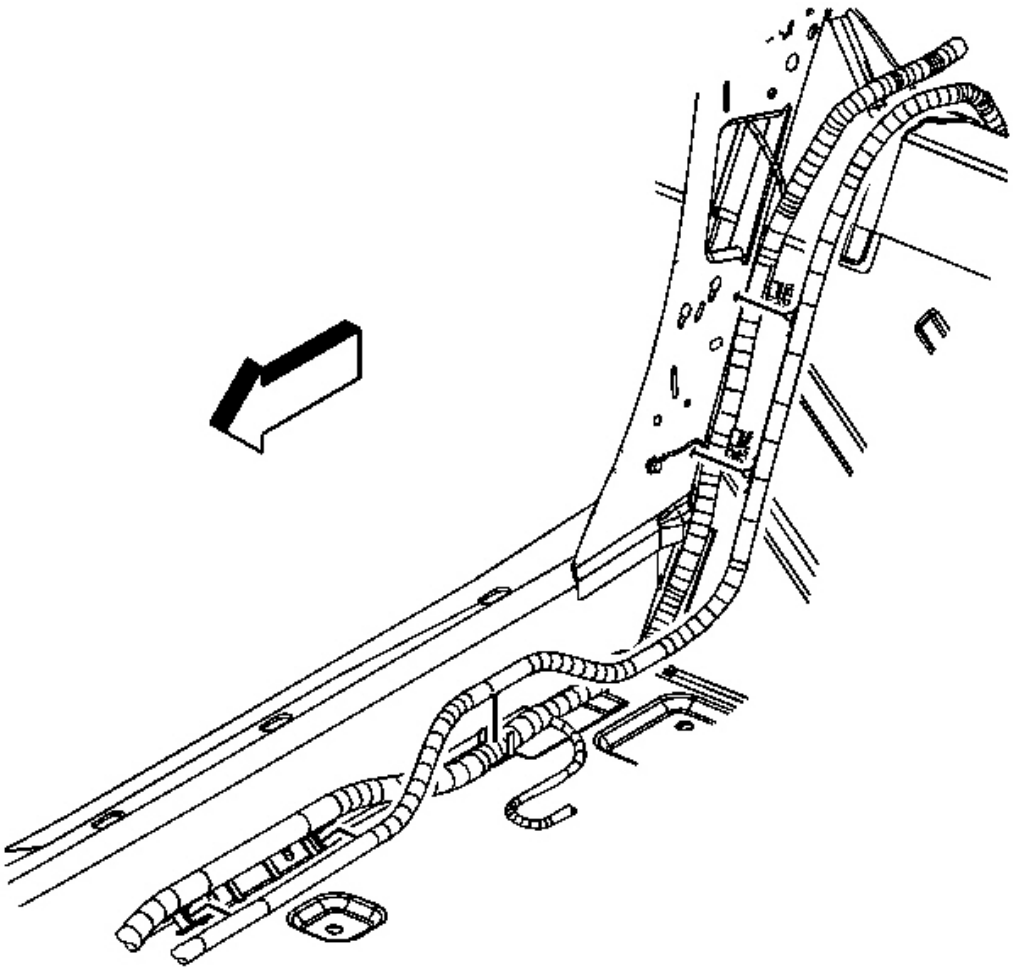


Fig. 30: View Of Positive Battery Cable Retainers
Courtesy of GENERAL MOTORS CORP.

3. Position the positive battery cable to retainers.
4. Position the carpet back.
5. Install the right door sill plate. Refer to **Door Sill Plate Replacement** .
6. Install the passenger rear compartment front side trim panel. Refer to **Rear Compartment Side Trim Panel Replacement** .
7. Install the rear compartment carpet. Refer to **Rear Compartment Floor Panel Carpet Replacement (Convertible)** or **Rear Compartment Floor Panel Carpet Replacement**

(Coupe) .

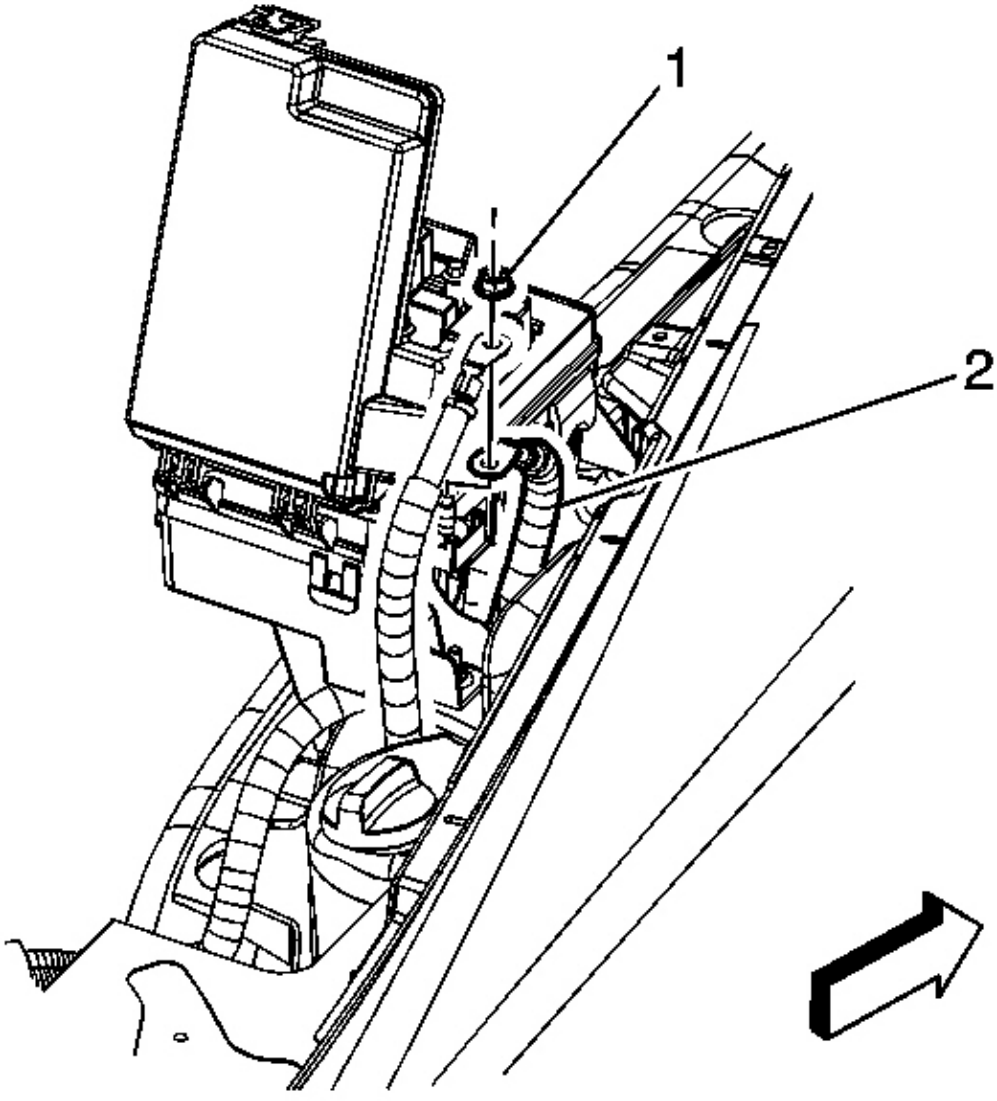


Fig. 31: View Of Positive Battery Cable Lead & Nut
Courtesy of GENERAL MOTORS CORP.

8. Install the positive cable lead (2) to the fuse/relay center stud.

NOTE: Refer to Fastener Notice .

9. Install the positive battery cable nut (1) to the fuse/relay center stud.

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

10. Close the stud cover on the fuse/relay center.
11. Connect the positive battery cable to the battery.
12. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (6.0L)** or **Battery Negative Cable Disconnection and Connection (7.0L)**.

BATTERY POSITIVE FUSE BLOCK CABLE REPLACEMENT

Removal Procedure

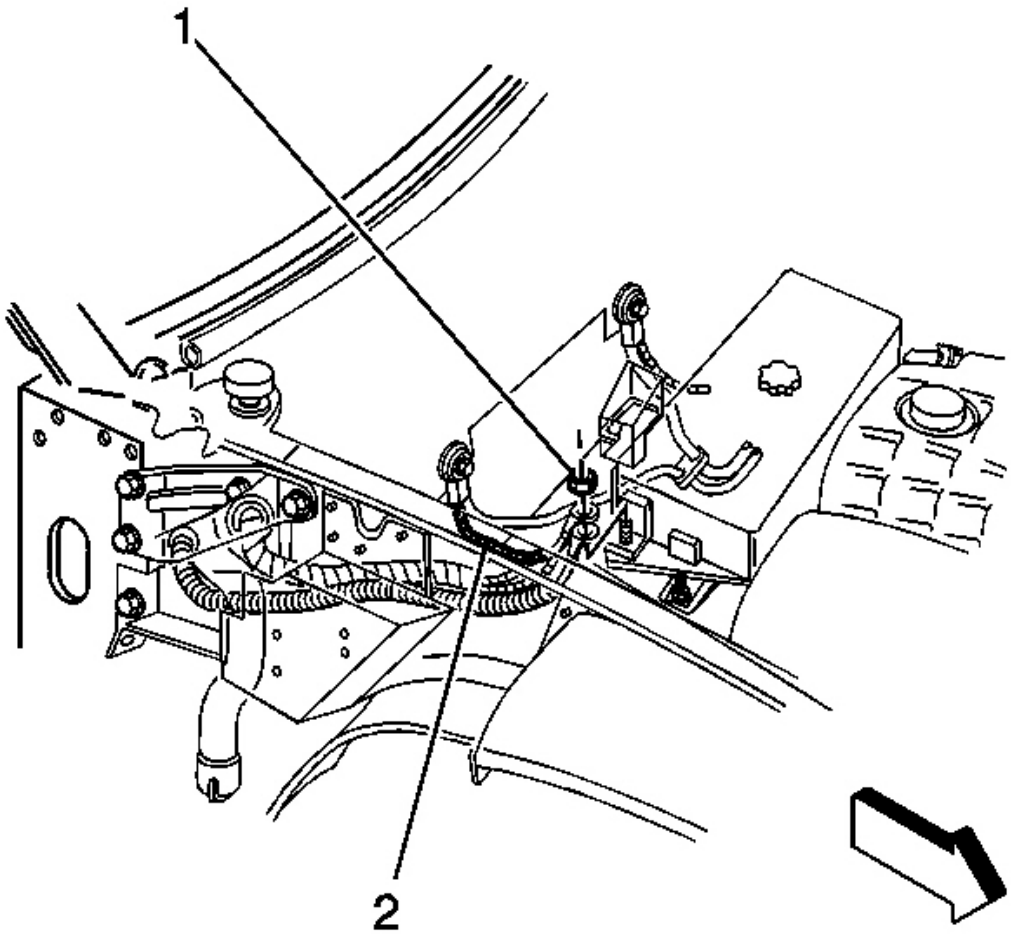


Fig. 32: Fuse/Relay Center Stud & Positive Battery Cable Lead
Courtesy of GENERAL MOTORS CORP.

1. Remove the battery tray. Refer to **Battery Tray Replacement**.
2. Open the stud cover on the fuse/relay center cover.
3. Remove the positive battery cable nut (1).
4. Remove the positive battery cable lead from the stud.
5. Remove the battery positive fuse block cable from the stud.

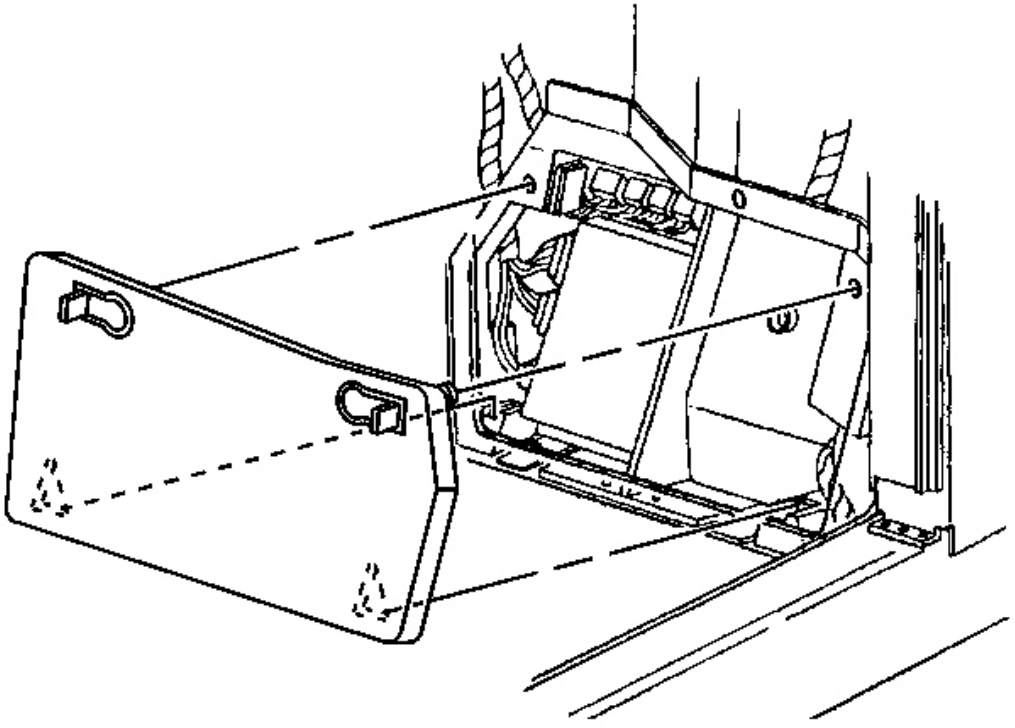


Fig. 33: Kick-Up Panel Upper Latches
Courtesy of GENERAL MOTORS CORP.

6. Disengage the kick-up panel latches inside the vehicle.
7. Open the panel.
8. Lift the panels bottom edge up and out of the slots in the multi-use relay bracket.
9. Remove the kick-up panel.

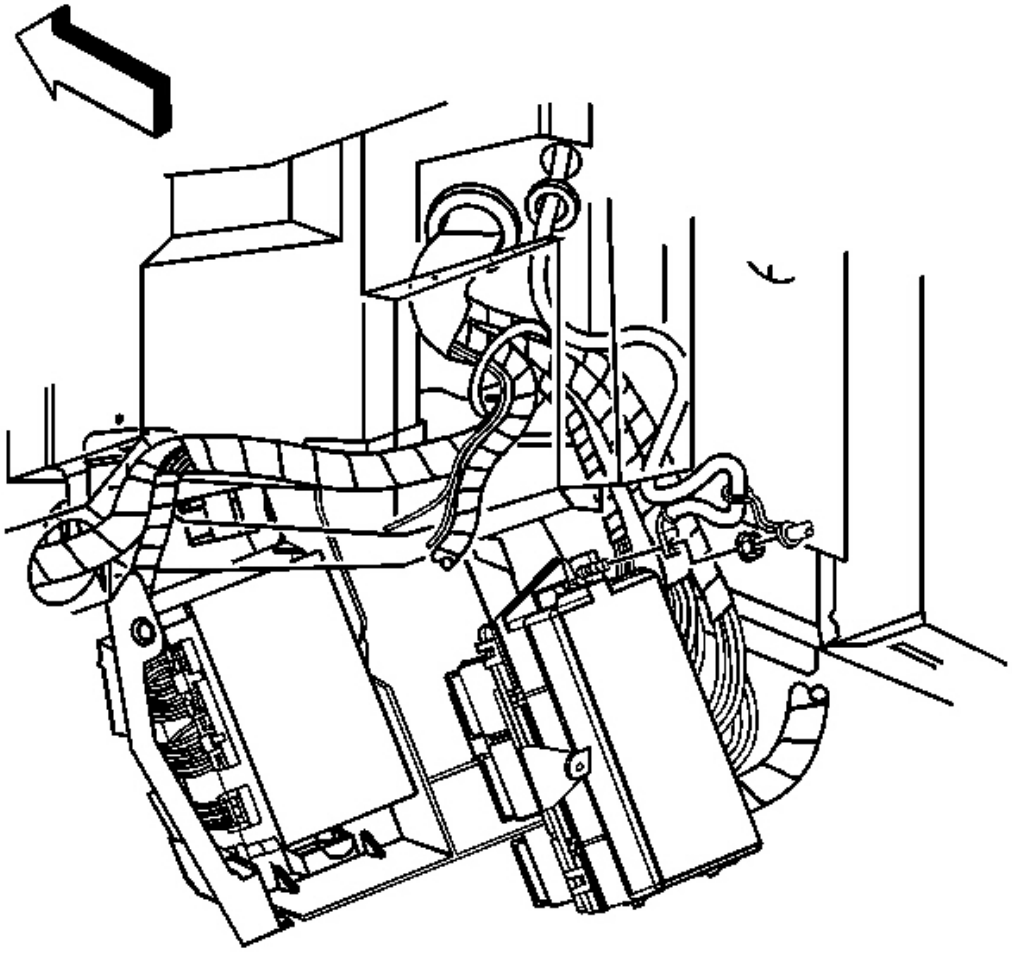


Fig. 34: I/P Wiring Harness Junction Block & Nut
Courtesy of GENERAL MOTORS CORP.

10. Unsnap the junction block from the bracket.
11. Reposition the junction block nut boot.
12. Remove the instrument panel (I/P) wiring harness junction block nut.
13. Remove the battery positive fuse block cable from the stud.
14. Route the fuse block cable through the front of dash and remove the cable.

Installation Procedure

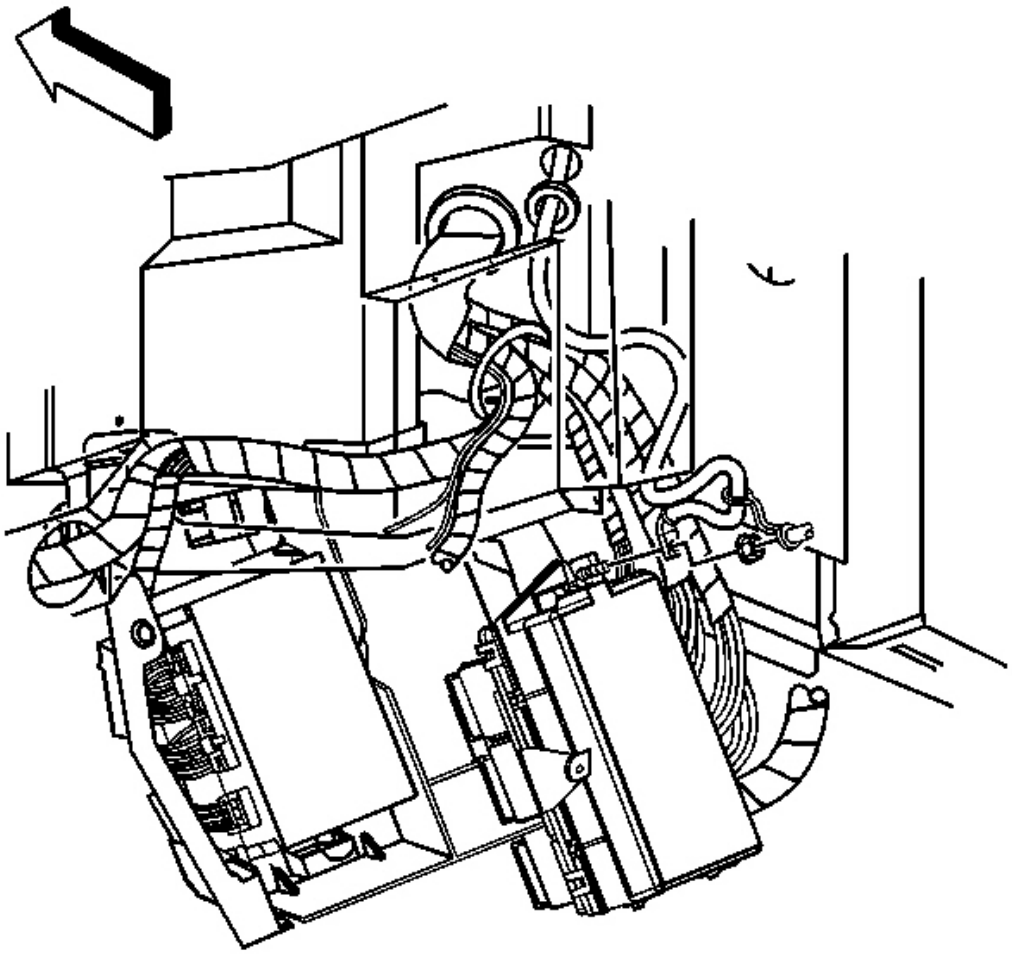


Fig. 35: I/P Wiring Harness Junction Block & Nut
Courtesy of GENERAL MOTORS CORP.

1. Install and route the fuse block cable through the front of dash.
2. Install the battery positive fuse block cable to the stud.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the I/P wiring harness junction block nut.

Tighten: Tighten the I/P wiring harness junction block nut to 10 N.m (89 lb in).

4. Reposition the junction block nut boot.
5. Snap the junction block to the bracket.

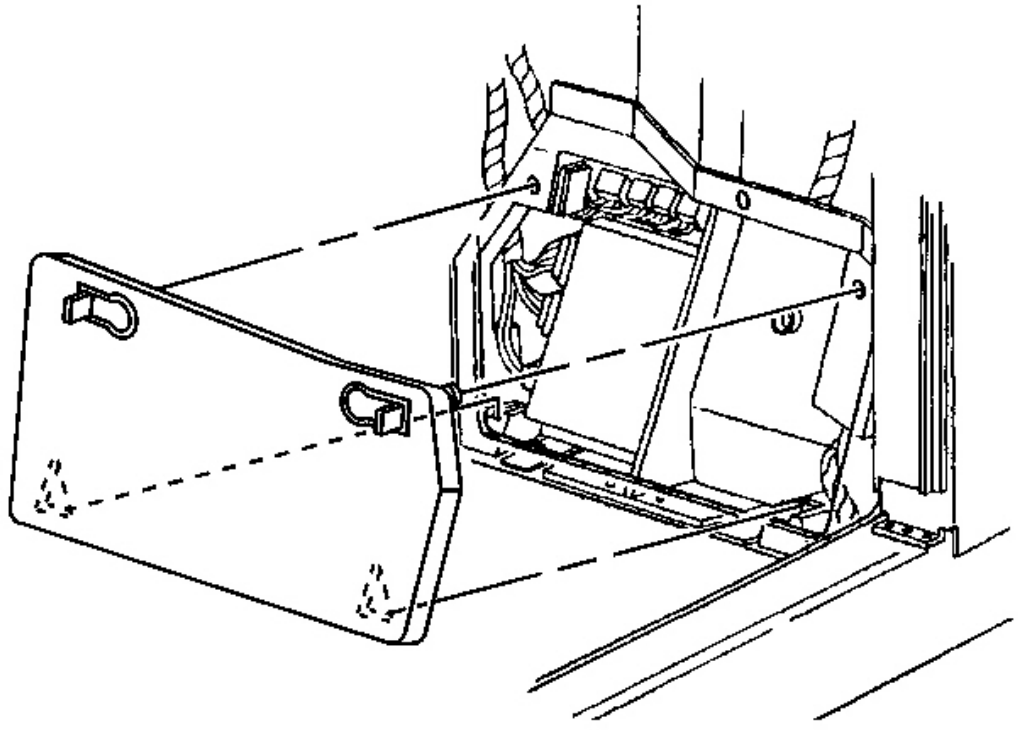


Fig. 36: Kick-Up Panel Upper Latches
Courtesy of GENERAL MOTORS CORP.

6. Ensure the latches on the kick-up panel are open.
7. Insert the kick-up panel lower tabs into the slots in the bracket.
8. Close the panel and push the latches into the holes.

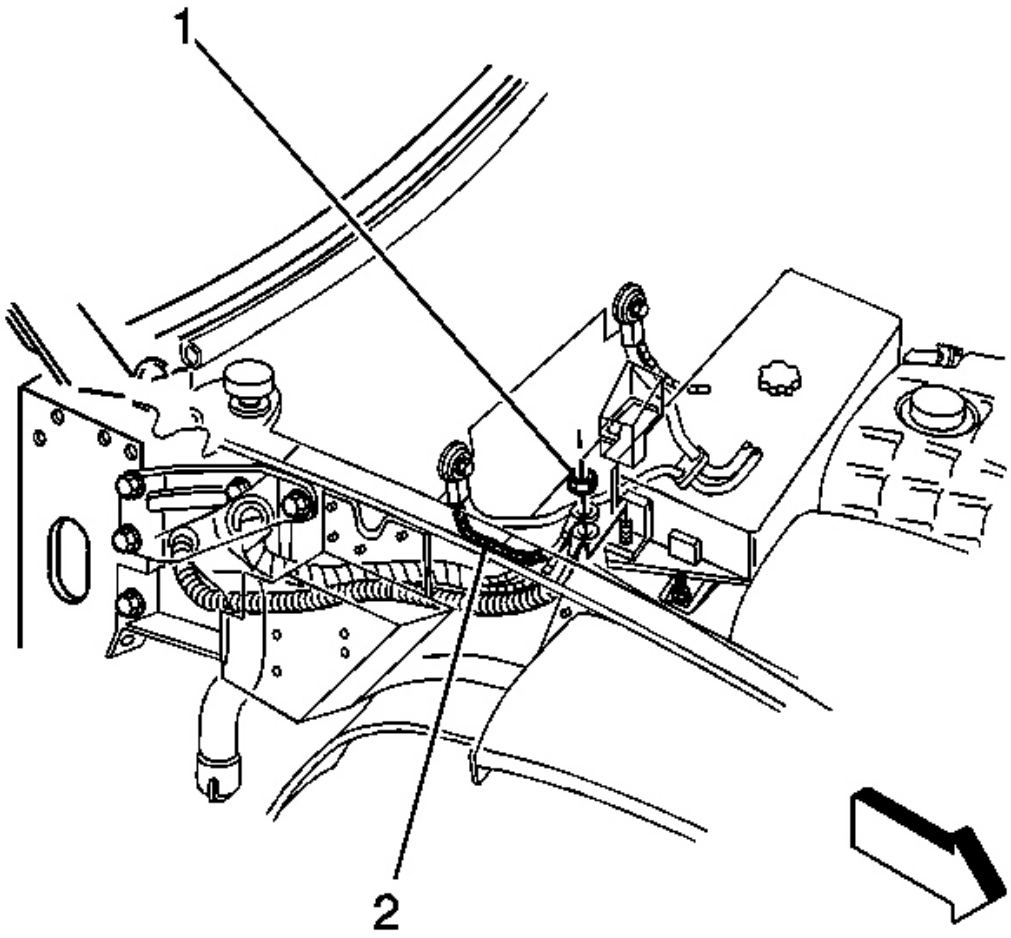


Fig. 37: Fuse/Relay Center Stud & Positive Battery Cable Lead
Courtesy of GENERAL MOTORS CORP.

9. Install the battery positive fuse block cable to the stud.
10. Install the positive battery cable lead to the stud.
11. Install the positive battery cable nut (1).

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

12. Close the stud cover on the fuse/relay center cover.
13. Install the battery tray. Refer to **Battery Tray Replacement**.

BATTERY REPLACEMENT (6.0L)

Removal Procedure

CAUTION: Refer to Battery Disconnect Caution .

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (6.0L)** or **Battery Negative Cable Disconnection and Connection (7.0L)**.
2. Disconnect the positive battery cable.

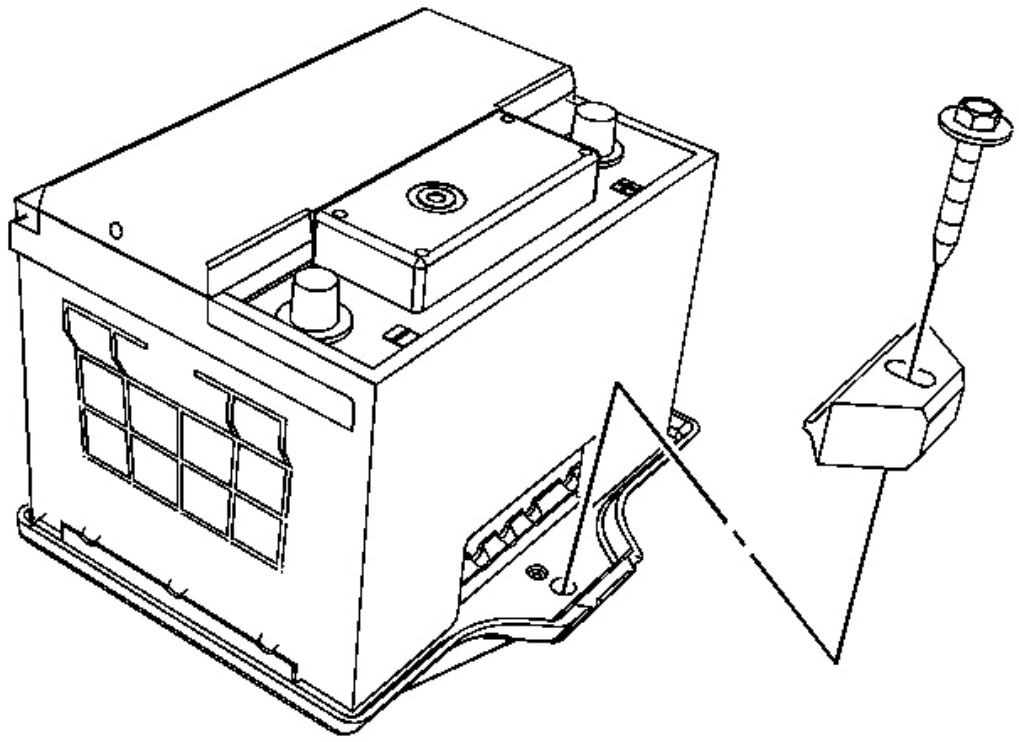


Fig. 38: View Of Battery, Hold Down Retainer & Bolt
Courtesy of GENERAL MOTORS CORP.

3. Remove the battery hold down retainer bolt and retainer.
4. Remove the battery.

Installation Procedure

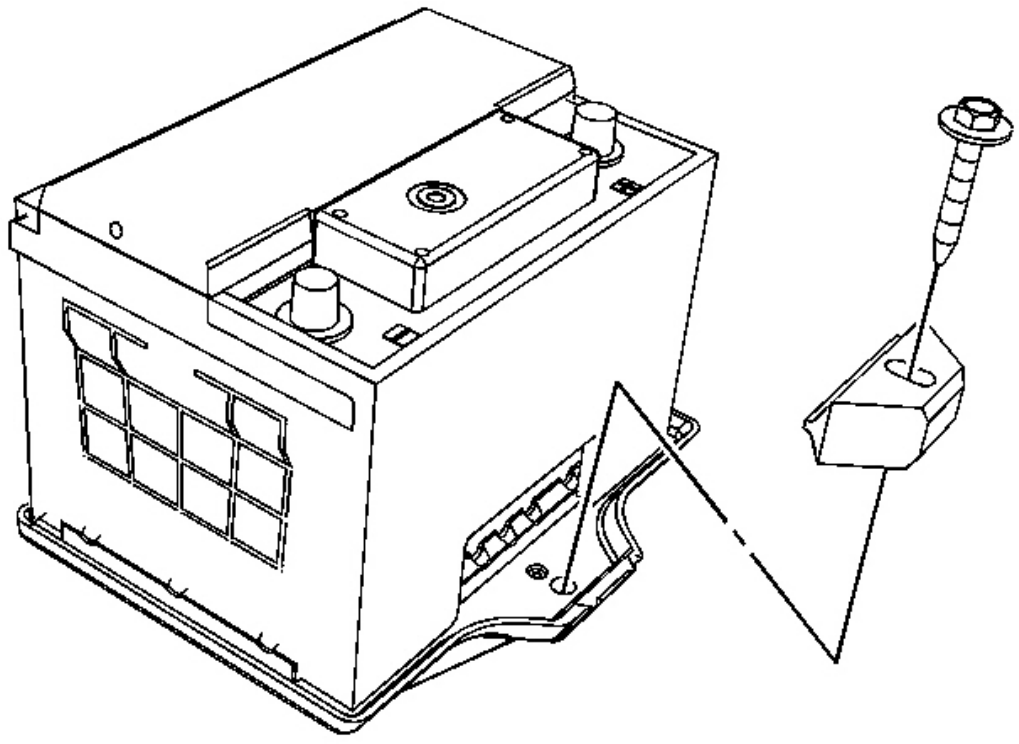


Fig. 39: View Of Battery, Hold Down Retainer & Bolt
Courtesy of GENERAL MOTORS CORP.

1. Install the battery.

   NOTE: Refer to Fastener Notice .

2. Install the battery hold down retainer and bolt.

   Tighten: Tighten the battery hold down retainer bolt to 18 N.m (13 lb ft).

3. Connect the positive battery cable.

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

4. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (6.0L)** or **Battery Negative Cable Disconnection and Connection (7.0L)**.

BATTERY REPLACEMENT (7.0L)

Removal Procedure

1. Open the RH rear compartment storage bin to access the battery.

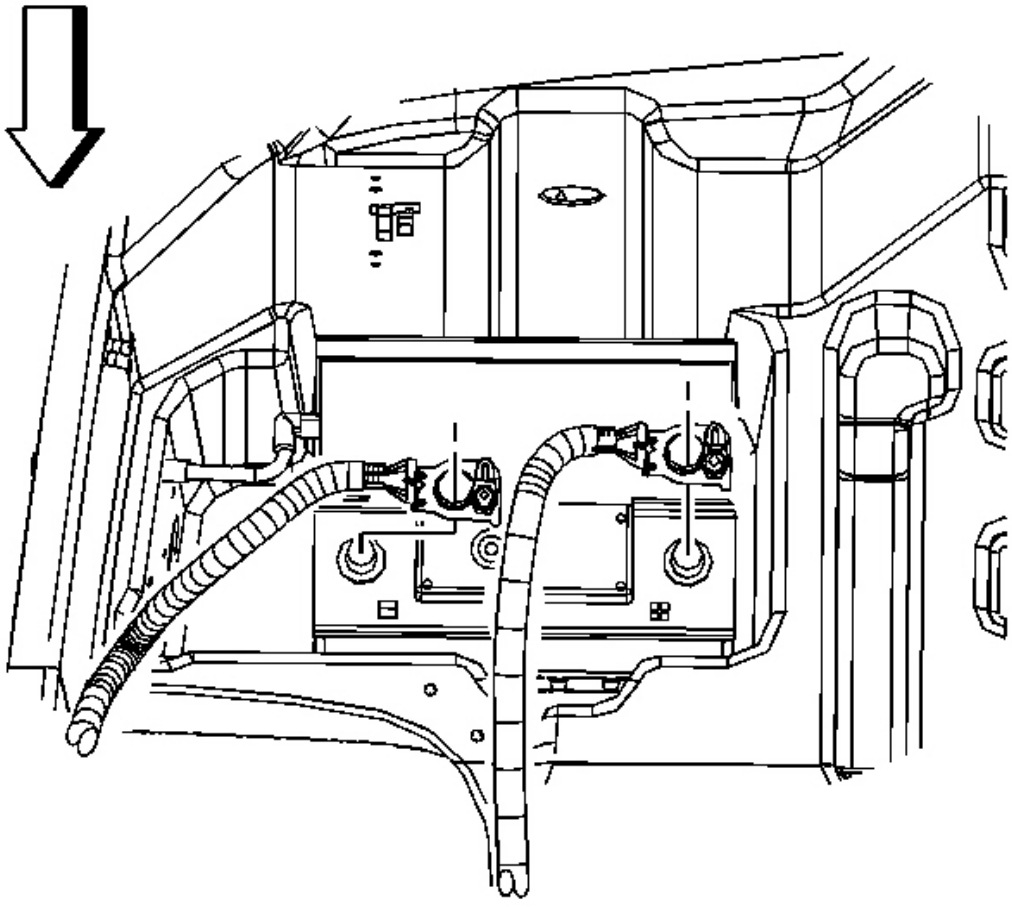


Fig. 40: View Of Battery, Negative Cable & Nut
Courtesy of GENERAL MOTORS CORP.

CAUTION: Unless directed otherwise, the ignition and start switch

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

2. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (6.0L)** or **Battery Negative Cable Disconnection and Connection (7.0L)**.
3. Disconnect the positive battery cable.

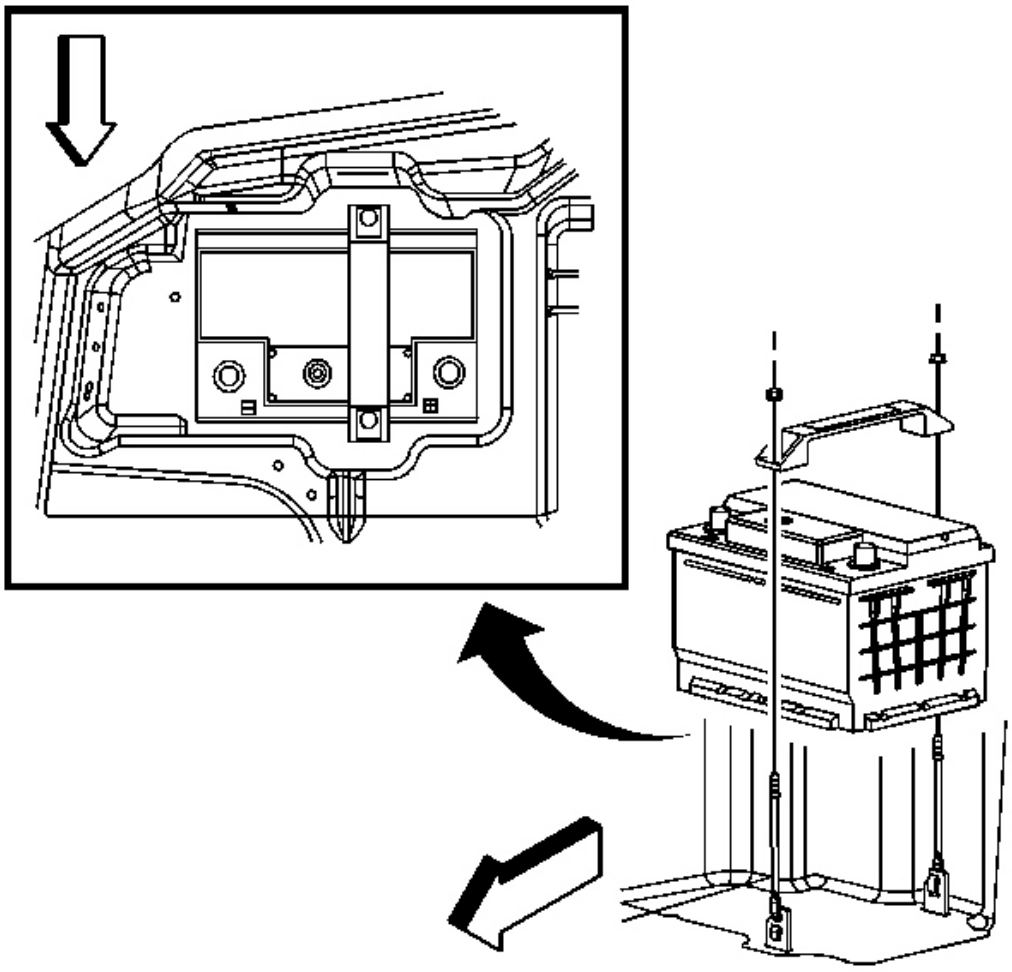


Fig. 41: View Of Battery Hold Down Retainer & Nuts
Courtesy of GENERAL MOTORS CORP.

4. Remove the battery hold down retainer nuts and retainer.
5. Remove the battery.

Installation Procedure

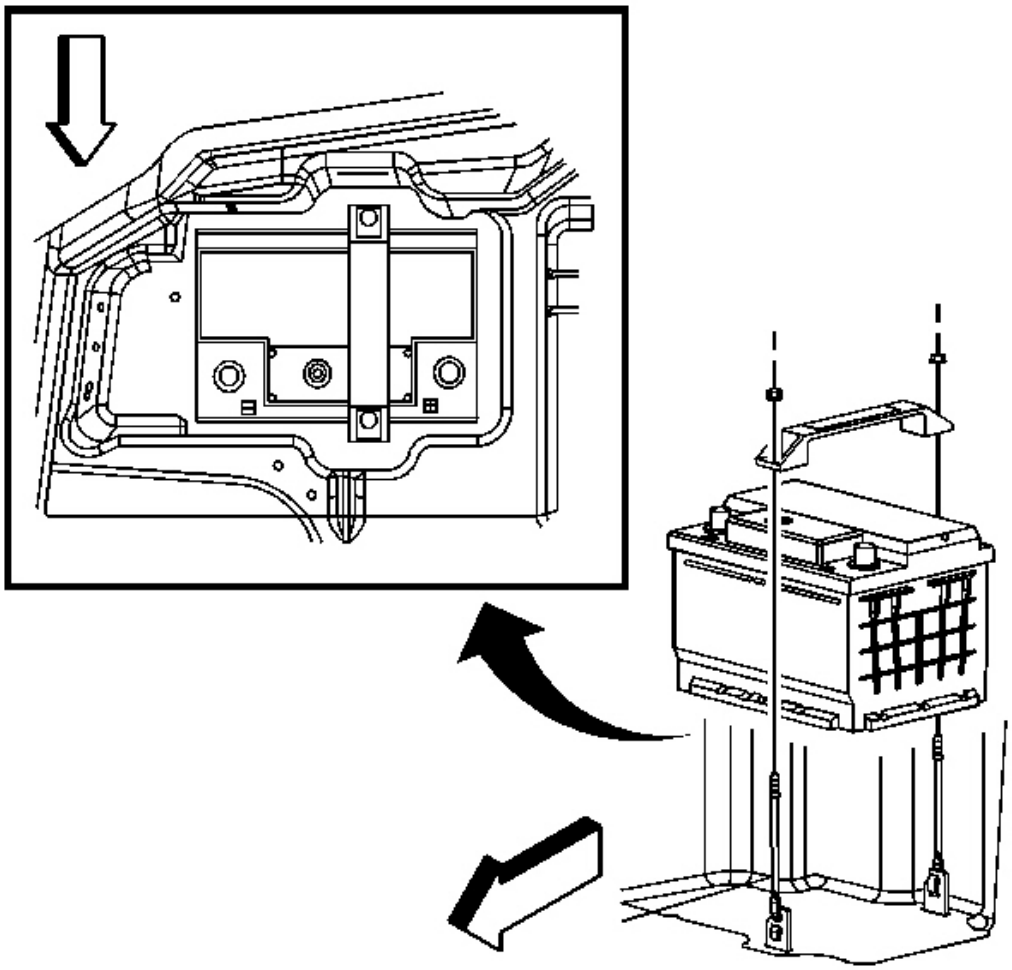


Fig. 42: View Of Battery Hold Down Retainer & Nuts
Courtesy of GENERAL MOTORS CORP.

1. Install the battery.

NOTE: **Use the correct fastener in the correct location. Replacement fasteners must be the correct part number for that application. Fasteners requiring replacement or fasteners requiring the use of thread locking compound or sealant are identified in the service procedure. Do not use paints, lubricants, or corrosion inhibitors on fasteners or fastener joint surfaces unless**

specified. These coatings affect fastener torque and joint clamping force and may damage the fastener. Use the correct tightening sequence and specifications when installing fasteners in order to avoid damage to parts and systems.

2. Install the battery hold down retainer and bolts.

   Tighten: Tighten the battery hold down retainer bolt to 18 N.m (13 lb ft).

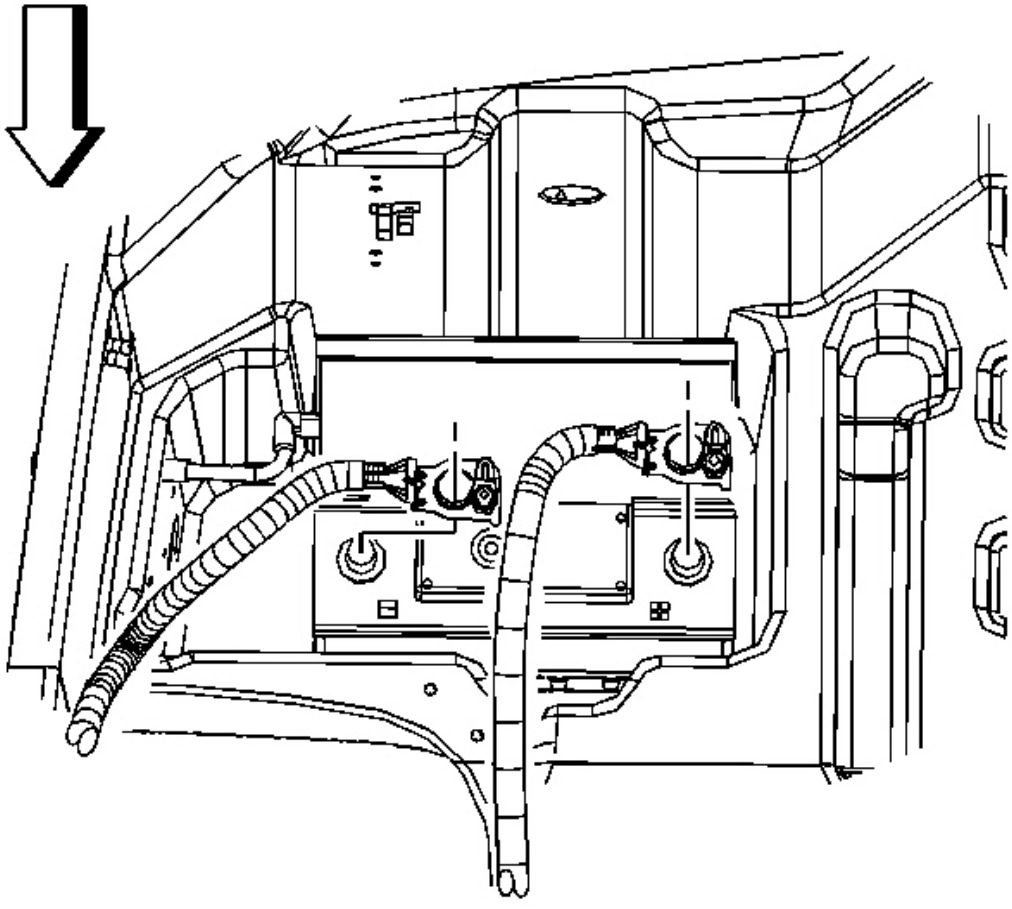


Fig. 43: View Of Battery, Negative Cable & Nut
Courtesy of GENERAL MOTORS CORP.

3. Connect the positive battery cable.

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

4. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (6.0L)** or **Battery Negative Cable Disconnection and Connection (7.0L)**.
5. Close the RH rear compartment storage bin.

BATTERY TRAY REPLACEMENT

Removal Procedure

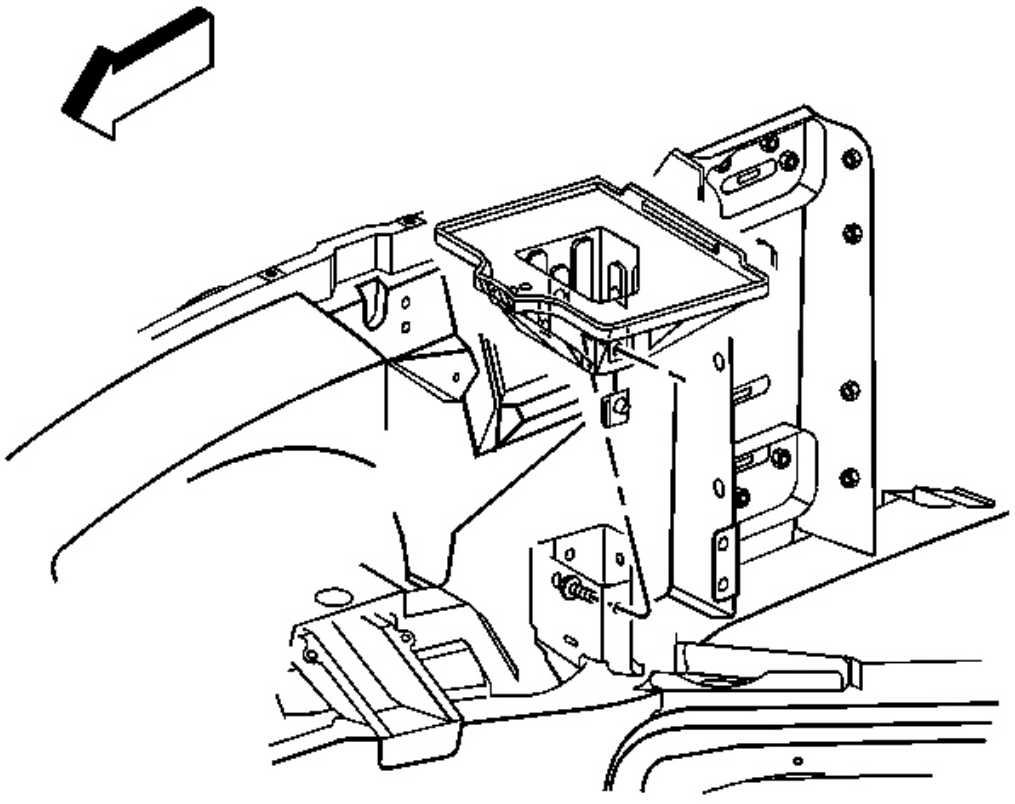


Fig. 44: View Of Battery Tray
Courtesy of GENERAL MOTORS CORP.

1. Remove the battery. Refer to **Battery Replacement (6.0L)** or **Battery Replacement (7.0L)**.

2. Remove the battery tray bolts.
3. Remove the battery tray.

Installation Procedure

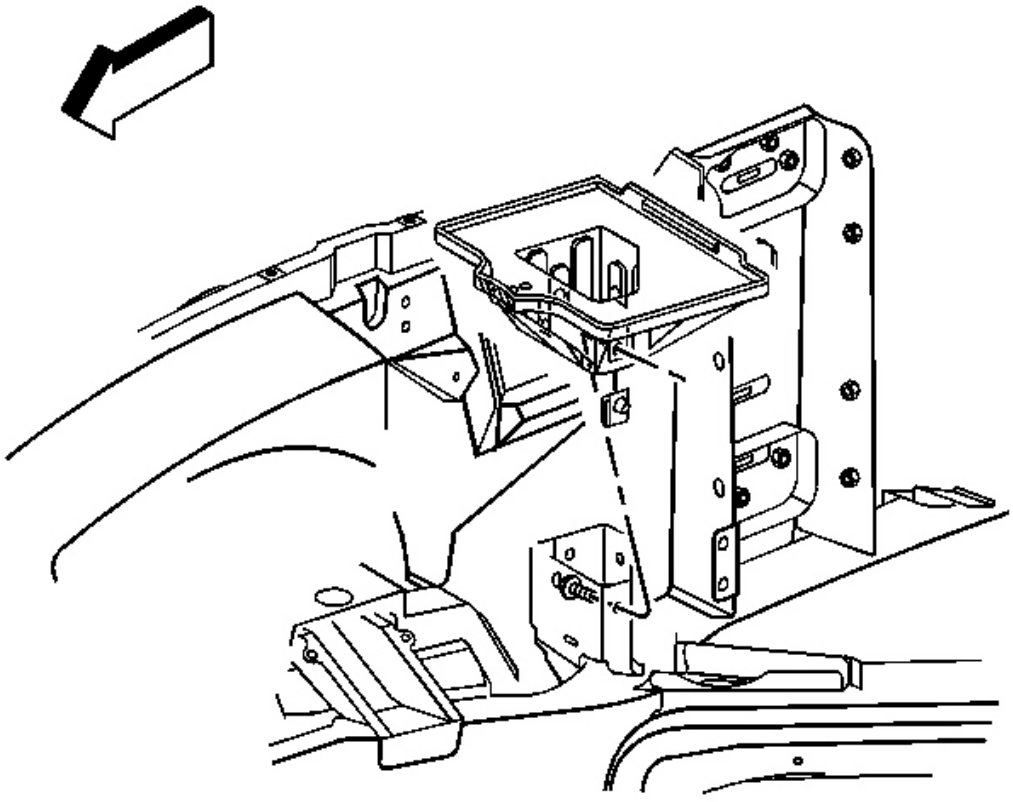


Fig. 45: View Of Battery Tray
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Install the battery tray.
2. Install the battery tray bolts.

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

3. Install the battery. Refer to **Battery Replacement (6.0L)** or **Battery Replacement (7.0L)**.

BATTERY HEAT SHIELD REPLACEMENT

Removal Procedure

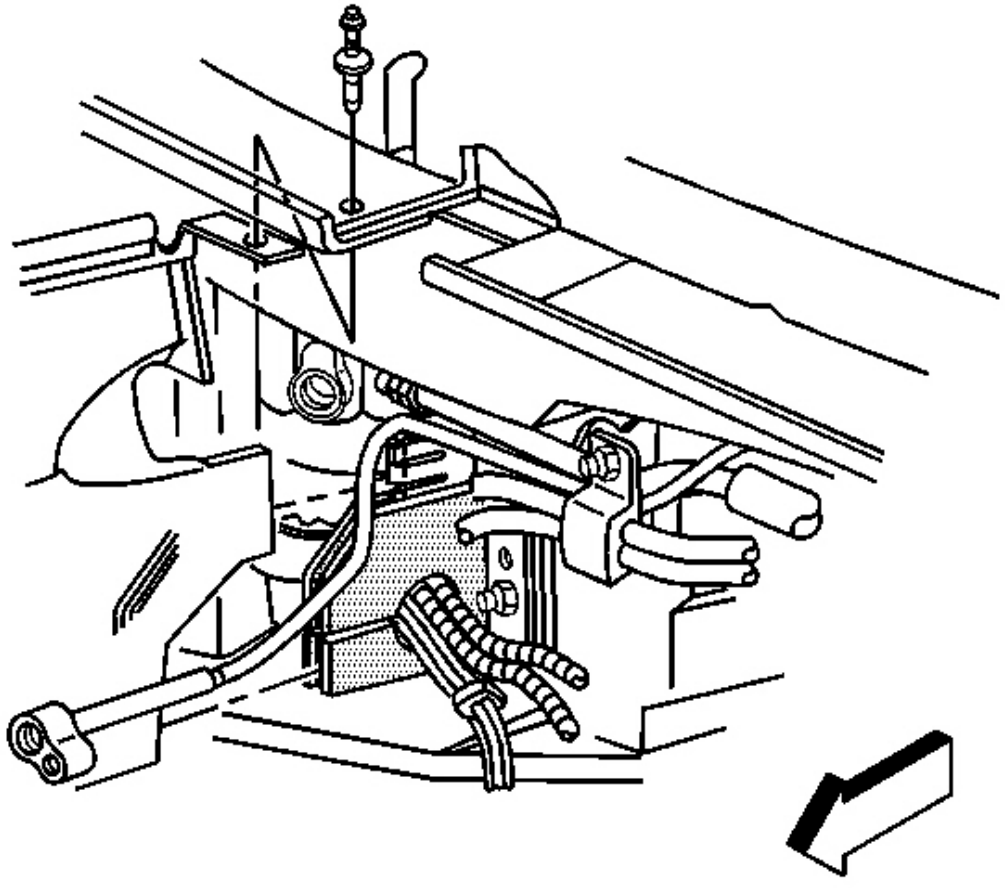


Fig. 46: View Of Upper Plenum Heat Shield Retainer
Courtesy of GENERAL MOTORS CORP.

1. Remove the push-in retainer attaching the air inlet screen and battery heat shield to the plenum panel.

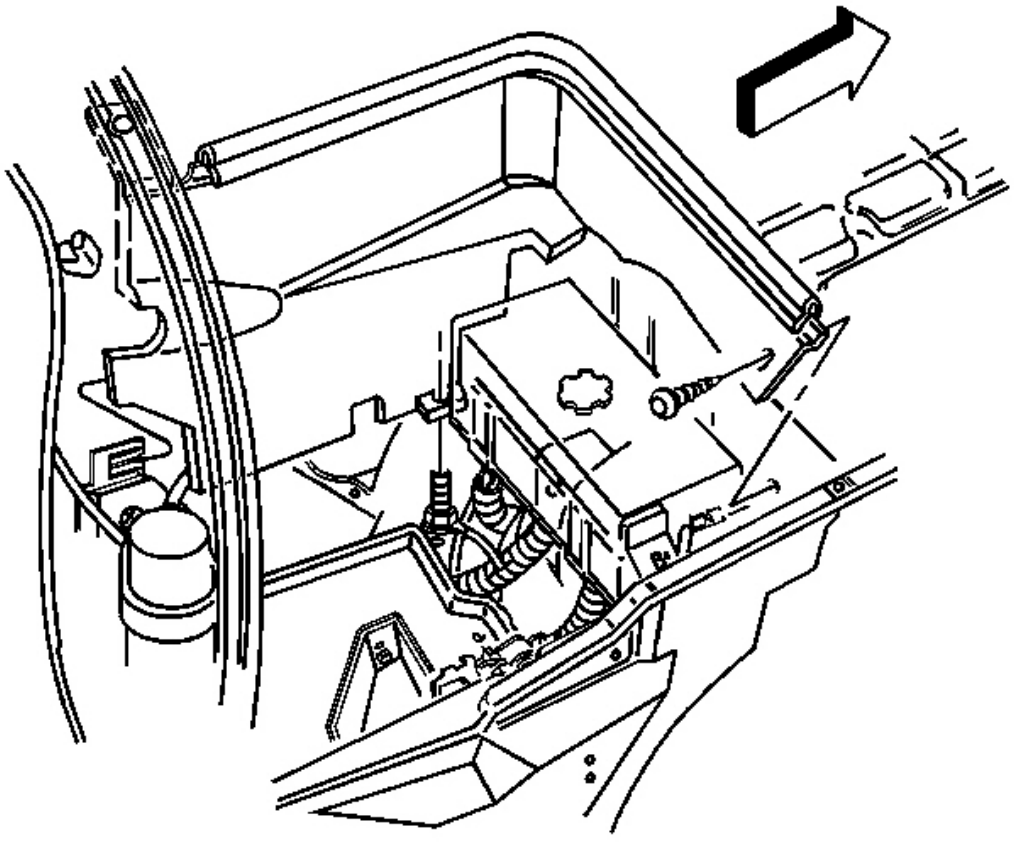


Fig. 47: View Of Battery Heat Shield
Courtesy of GENERAL MOTORS CORP.

2. Remove the push-in retainer attaching the battery heat shield to the wheelhouse panel.
3. Lift the battery heat shield from the ground stud and remove the shield.

Installation Procedure

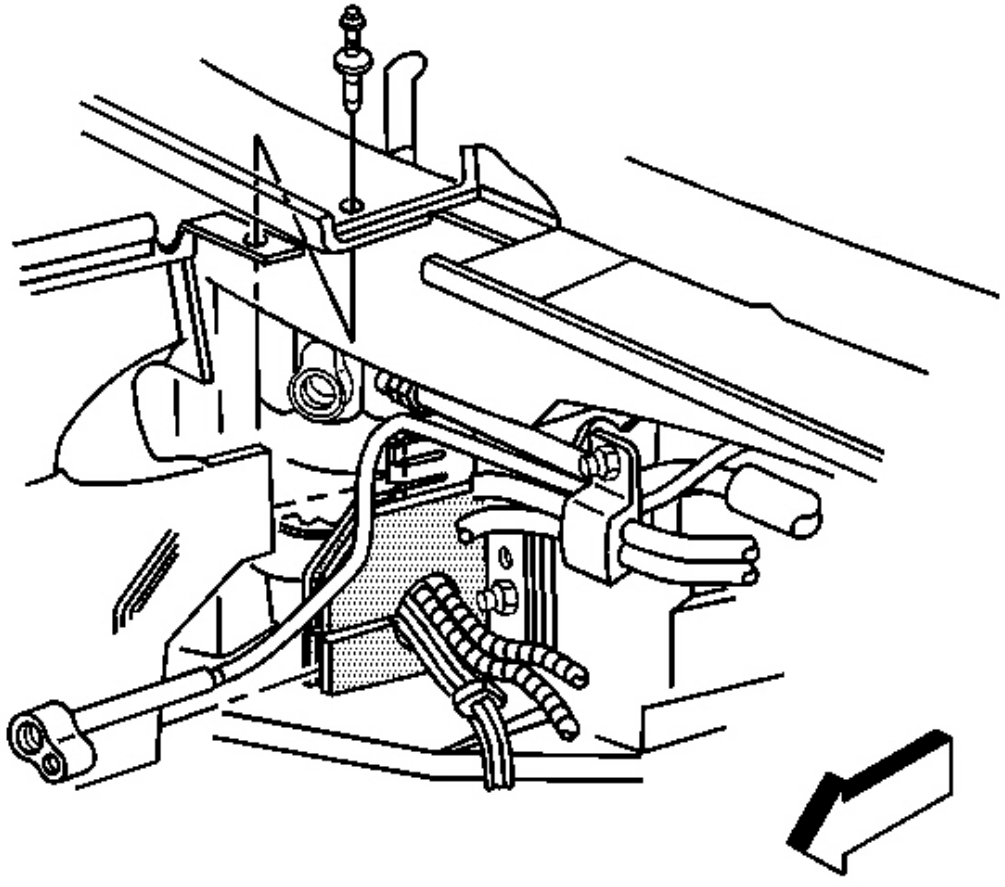


Fig. 48: View Of Upper Plenum Heat Shield Retainer
Courtesy of GENERAL MOTORS CORP.

1. Position the heat shield with the rearward edge between the retention fingers.
2. Position the shield onto the ground stud.
3. Install the push-in retainer attaching the heat shield to the wheelhouse panel.

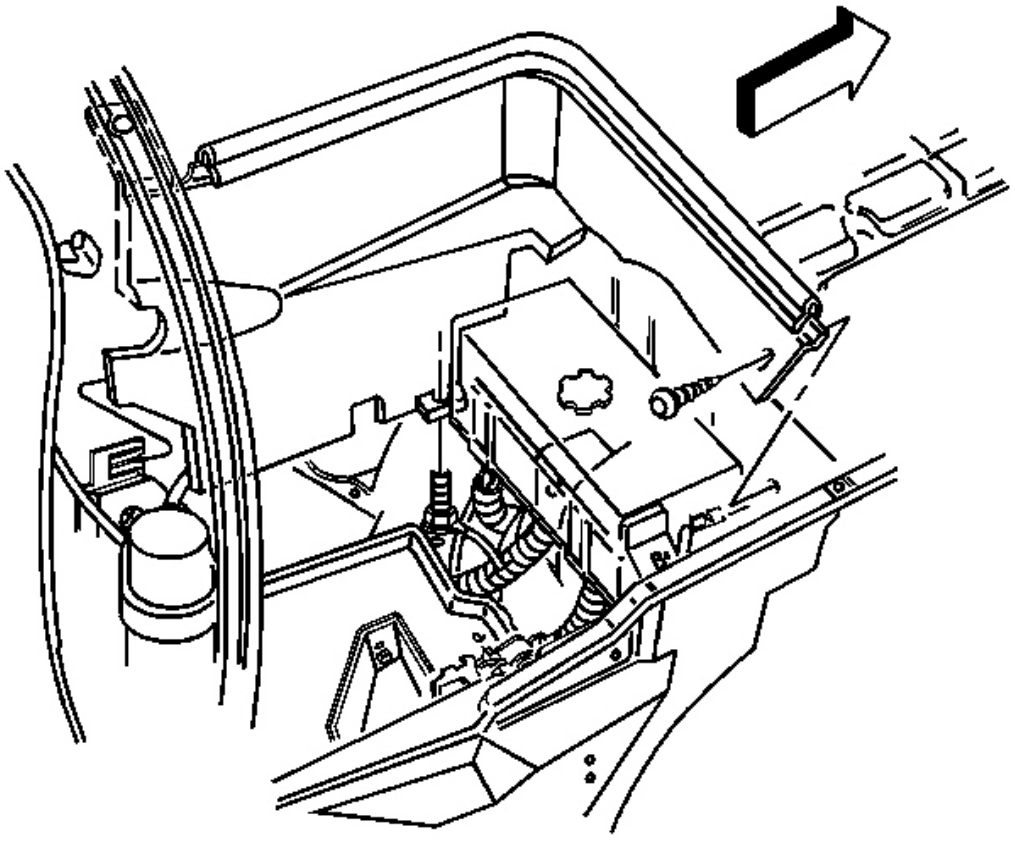


Fig. 49: View Of Battery Heat Shield
Courtesy of GENERAL MOTORS CORP.

4. Install the push-in retainer attaching the air inlet screen and the battery heat shield to the plenum panel.

STARTER MOTOR REPLACEMENT

Removal Procedure

CAUTION: Refer to Battery Disconnect Caution .

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (6.0L)** or **Battery Negative Cable Disconnection and Connection**

(7.0L).

2. Remove the right catalytic converter. Refer to **Catalytic Converter Replacement - Right Side (6.0L)** or **Catalytic Converter Replacement - Right Side (7.0L)** .

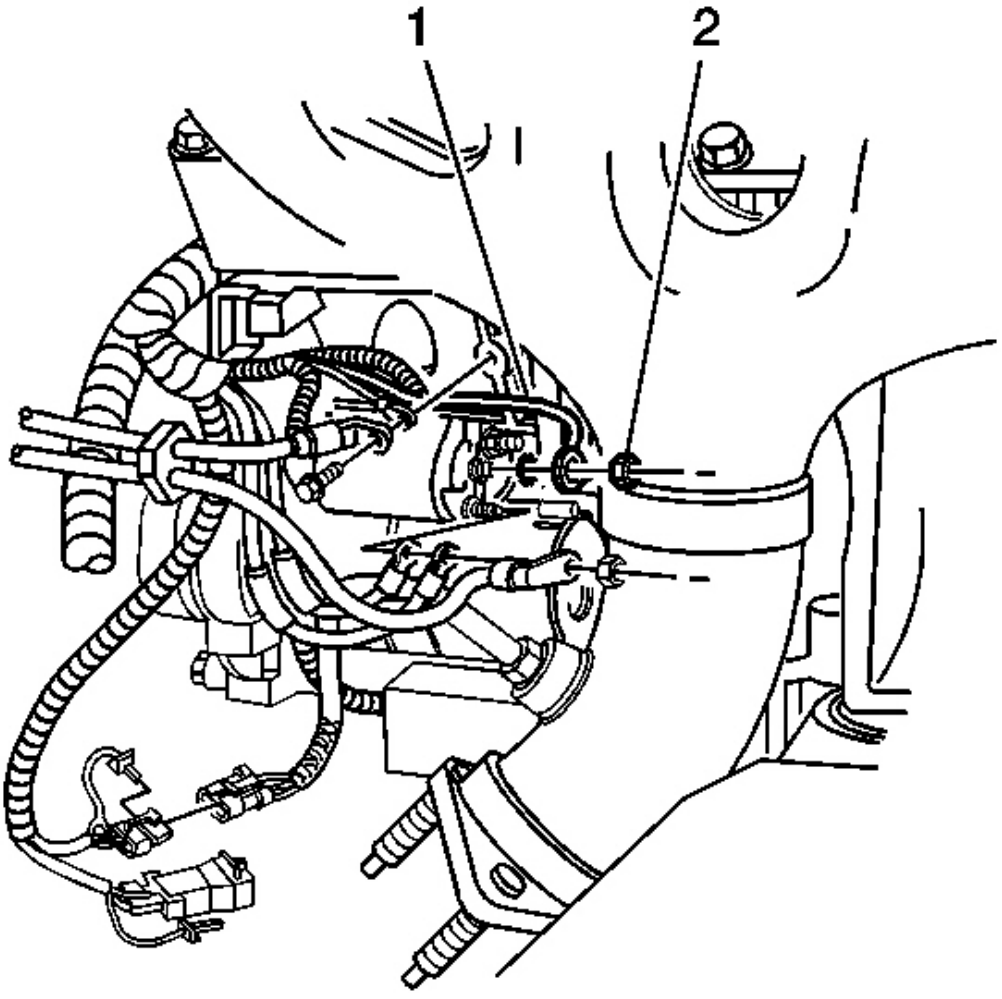


Fig. 50: Solenoid Engine Harness Leads & Positive Battery Cable Terminal
Courtesy of GENERAL MOTORS CORP.

3. Remove the positive battery cable nut.
4. Remove the positive battery cable terminal and the engine harness leads from the solenoid.

5. Remove the S terminal nut (2).
6. Remove the purple wire lead (1) and washer from the solenoid.

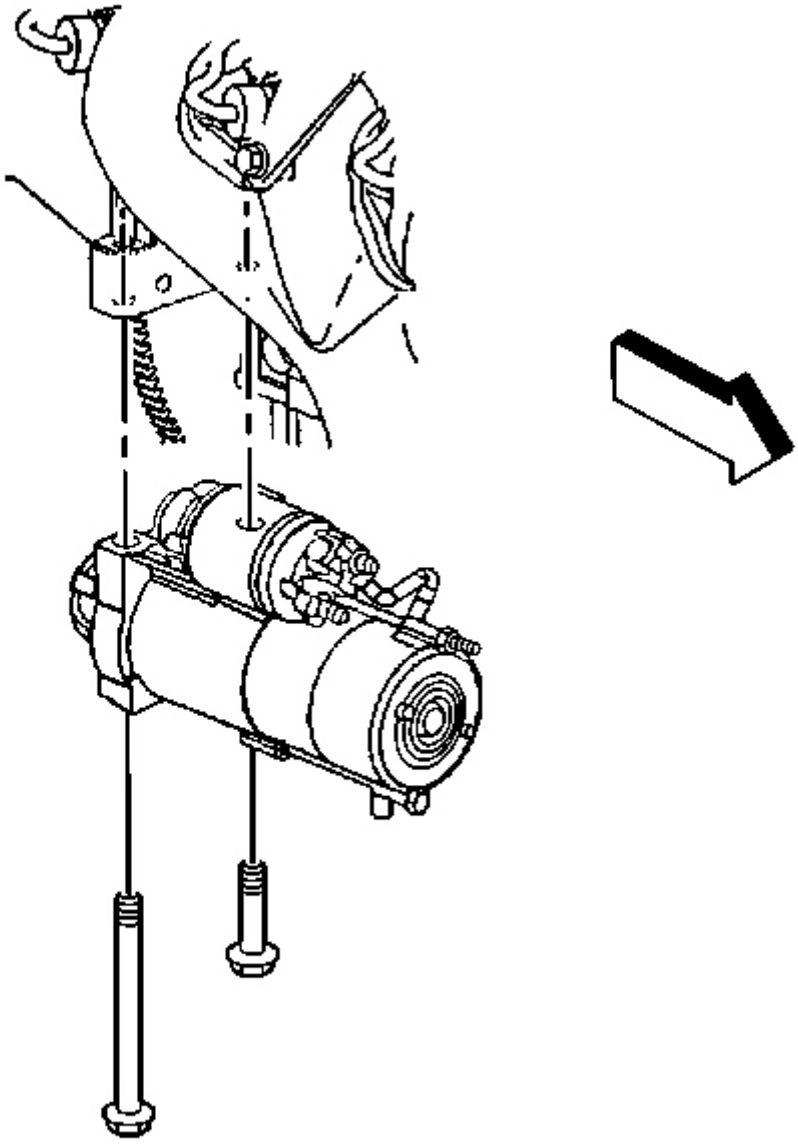


Fig. 51: View Of Starter Motor Bolts
Courtesy of GENERAL MOTORS CORP.

7. Support the starter motor.
8. Remove the starter motor bolts.
9. Remove the starter motor.

Installation Procedure

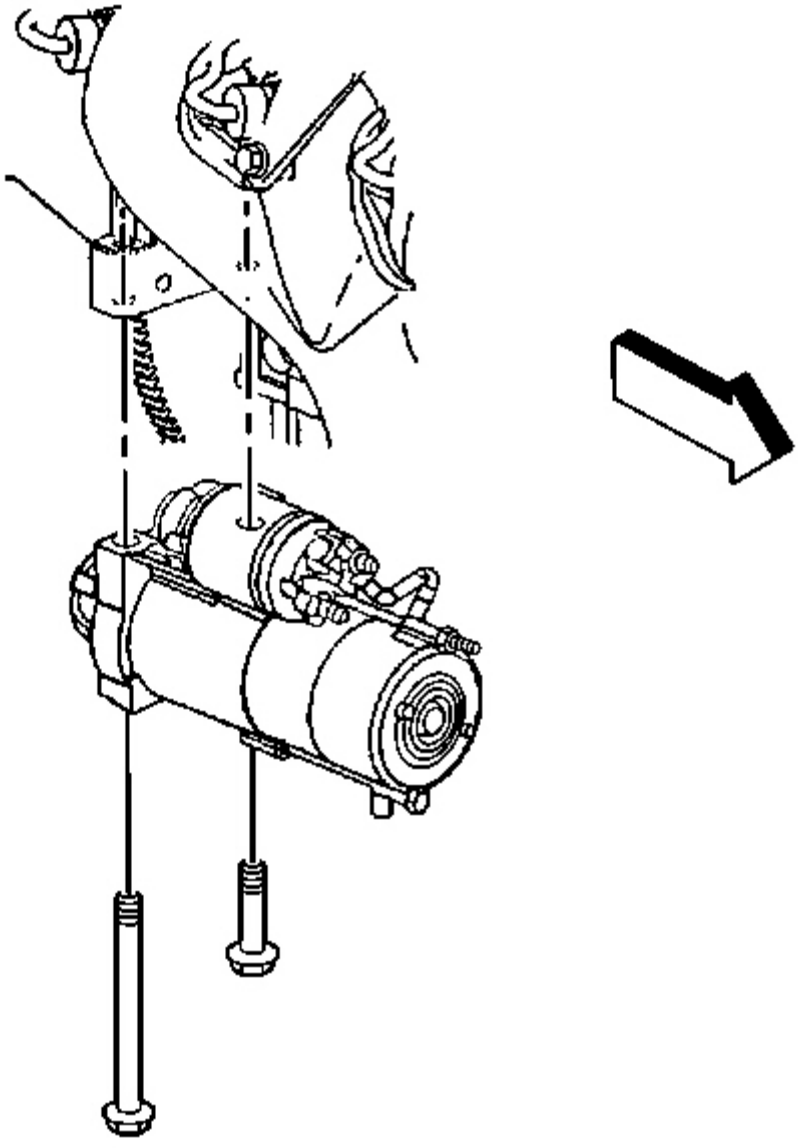


Fig. 52: View Of Starter Motor Bolts
Courtesy of GENERAL MOTORS CORP.

1. Position the starter motor to the block.

NOTE: Refer to Fastener Notice .

2. Install the starter motor bolts.

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

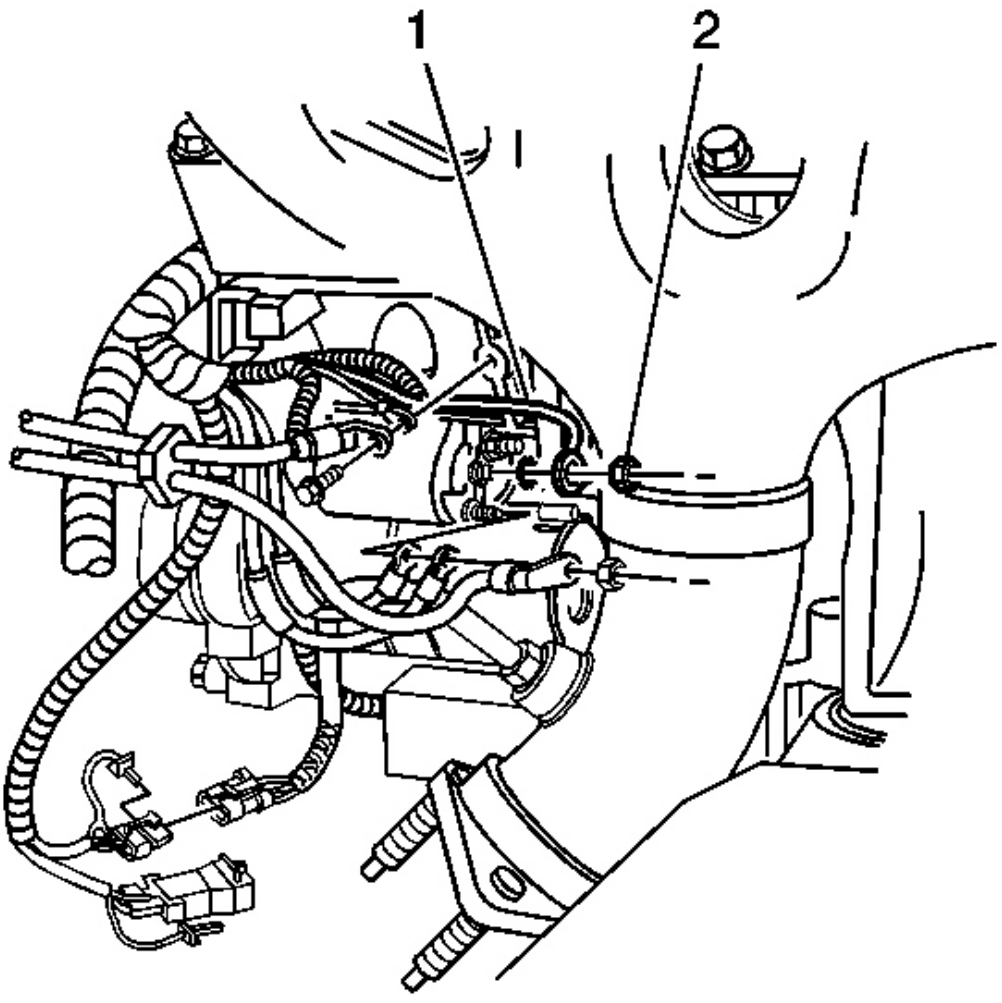


Fig. 53: Solenoid Engine Harness Leads & Positive Battery Cable Terminal
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Orient the purple lead wire to the 10 o'clock position when installing.

3. Install the starter motor S terminal washer and purple lead wire (1).
4. Install the S terminal nut (2).

Tighten: Tighten the S terminal nut to 4 N.m (35 lb in).

IMPORTANT: Orient gray and rust harness leads to the 6 o'clock and 7 o'clock position.

5. Install the gray and rust harness leads to the solenoid.
6. Install the positive battery cable terminal to the solenoid.
7. Install the positive battery cable nut.

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

8. Install the right catalytic converter. Refer to **Catalytic Converter Replacement - Right Side (6.0L)** or **Catalytic Converter Replacement - Right Side (7.0L)** .
9. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (6.0L)** or **Battery Negative Cable Disconnection and Connection (7.0L)**.

GENERATOR BRACKET REPLACEMENT

Removal Procedure

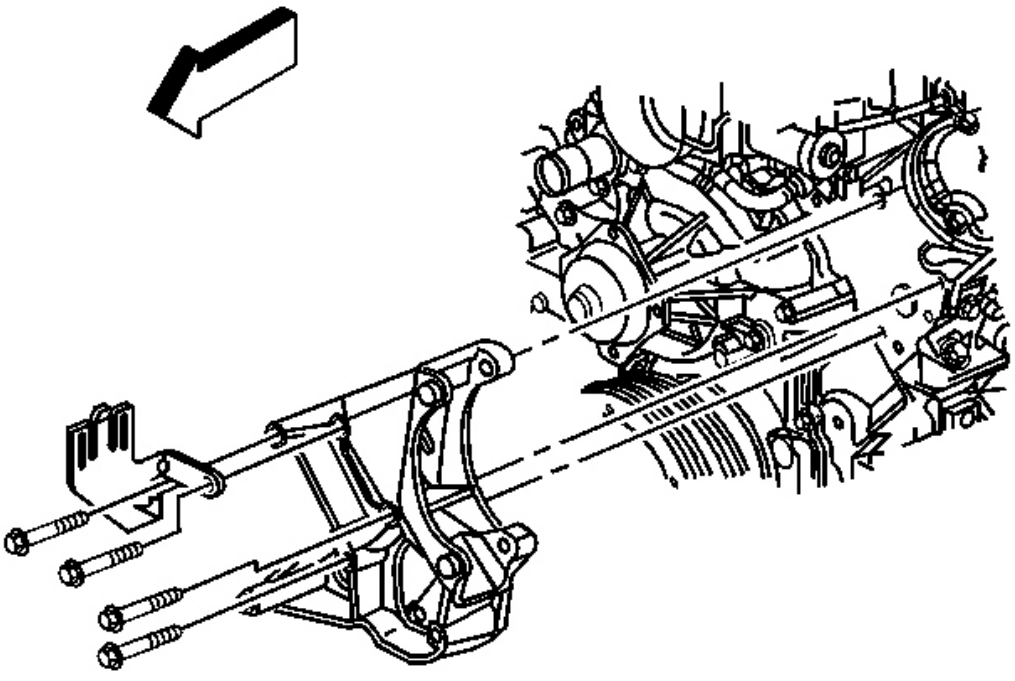


Fig. 54: Generator Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the generator. Refer to **Generator Replacement (6.0L)** or **Generator Replacement (7.0L)**.
2. Remove the power steering pump. Refer to **Power Steering Pump Replacement** .
3. Remove the generator bracket bolts, bracket, and power steering reservoir bracket.

Installation Procedure

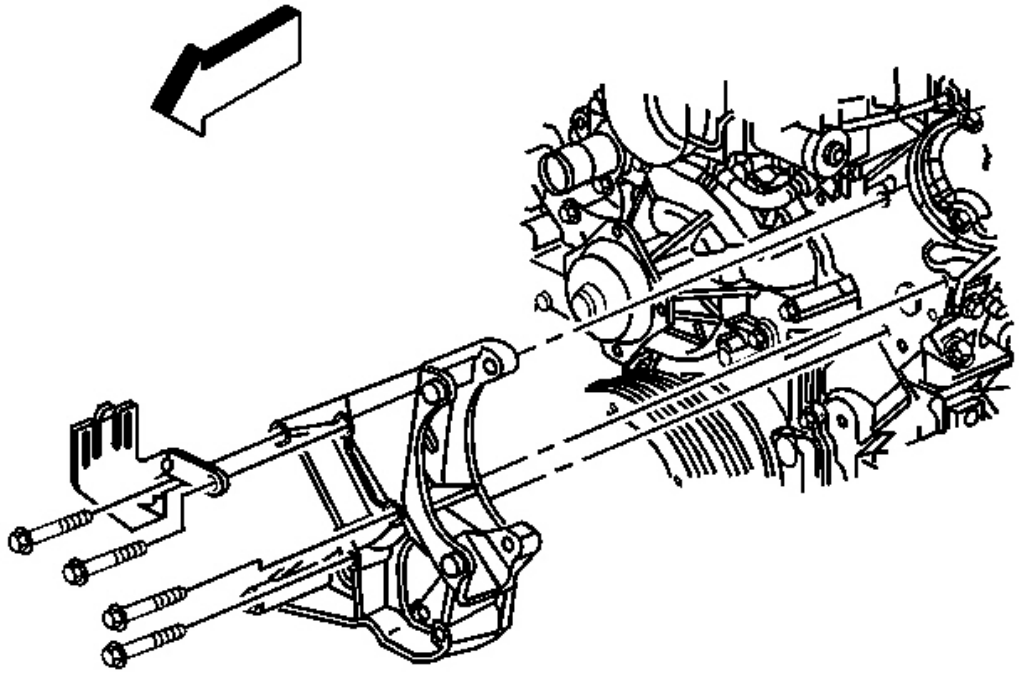


Fig. 55: Generator Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Install the generator bracket, power steering reservoir bracket and generator bracket bolts to the cylinder head.

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

2. Install the power steering pump. Refer to **Power Steering Pump Replacement** .
3. Install the generator. Refer to **Generator Replacement (6.0L)** or **Generator Replacement (7.0L)**.

GENERATOR REPLACEMENT (6.0L)

Removal Procedure

1. Remove the drive belt. Refer to **Drive Belt Replacement - Accessory** .

CAUTION: Refer to Battery Disconnect Caution .

2. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (6.0L)** or **Battery Negative Cable Disconnection and Connection (7.0L)**.

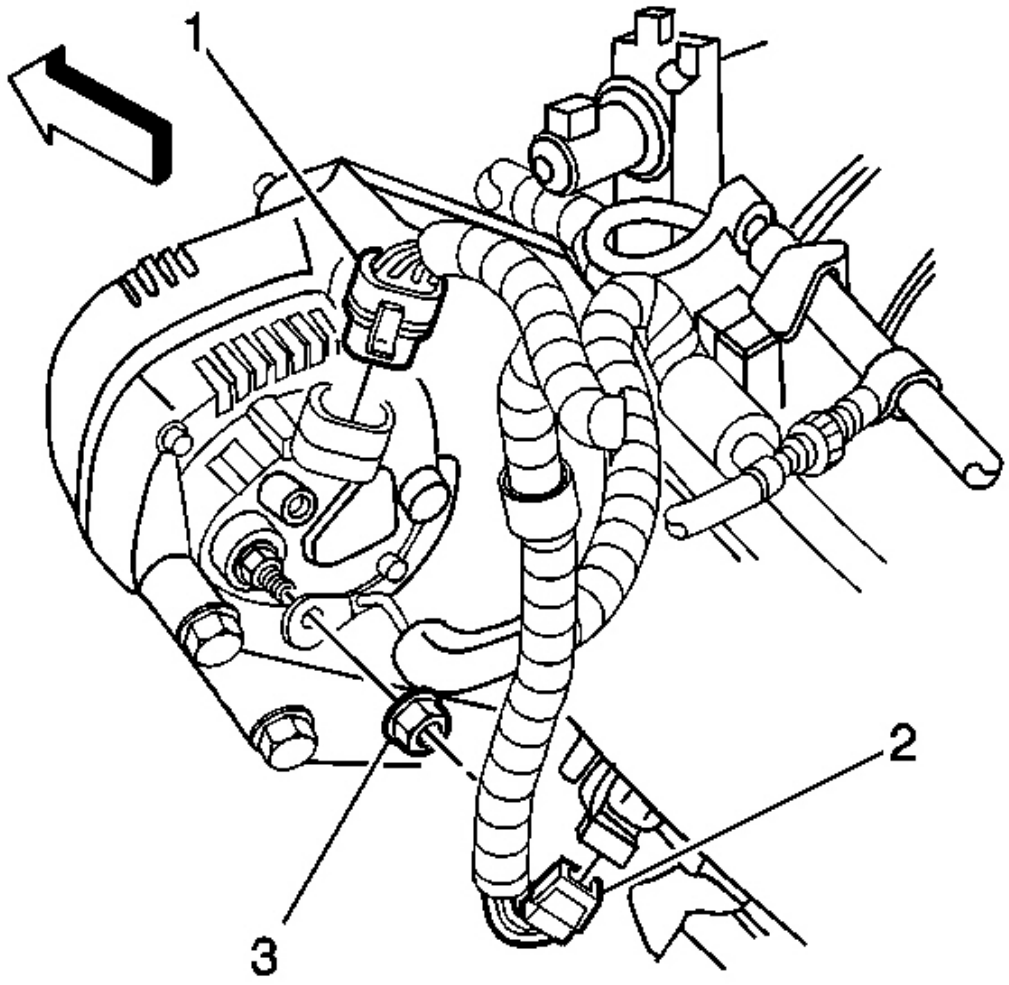


Fig. 56: Engine Wiring Harness Generator Lead Nut & Generator Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the generator electrical connector (1 and 2).
4. Remove the battery feed terminal nut (3) from the generator.
5. Remove the battery feed cable.

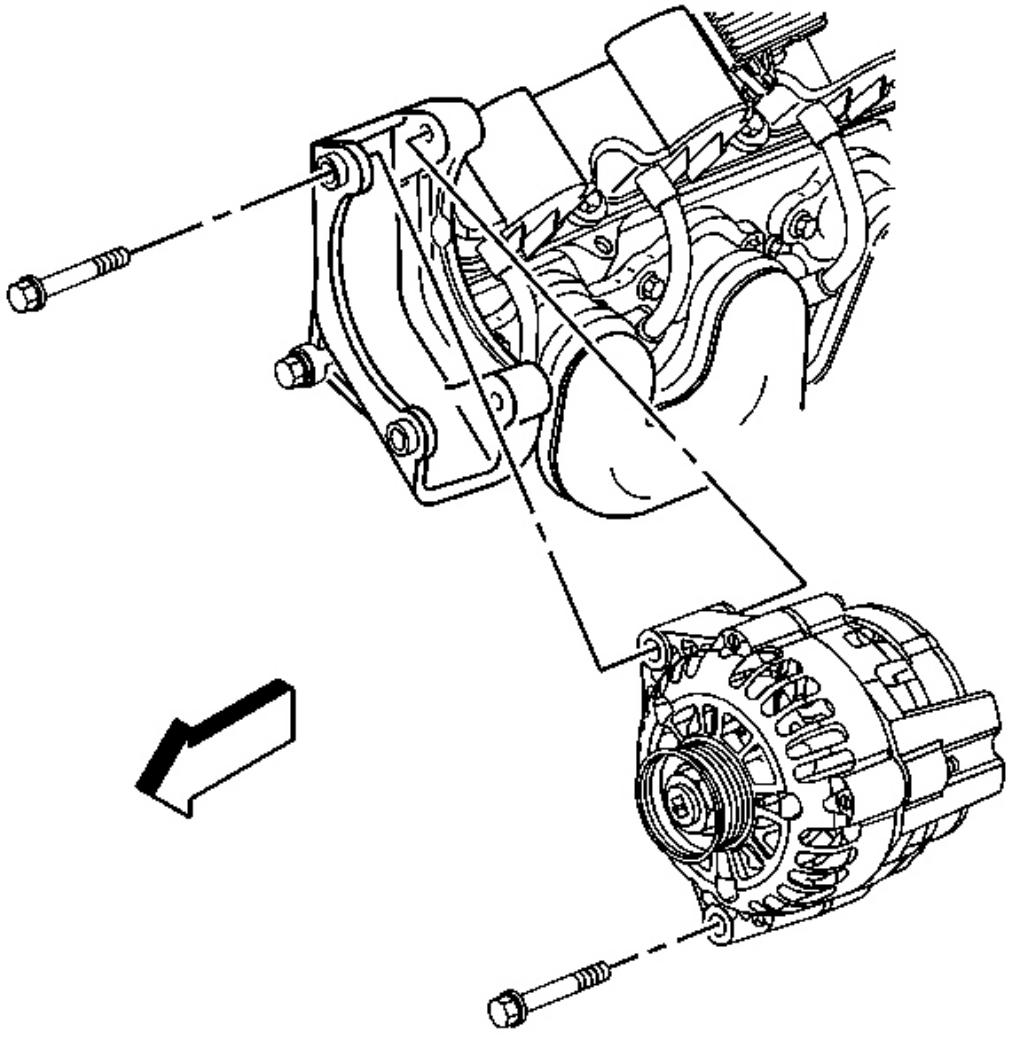


Fig. 57: View Of Generator Bolts & Generator
Courtesy of GENERAL MOTORS CORP.

6. Remove the generator mounting bolts.
7. Remove the generator.

Installation Procedure

1. Position the generator on the mounting bracket.

NOTE: Refer to Fastener Notice .

2. Install the generator bolts.

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

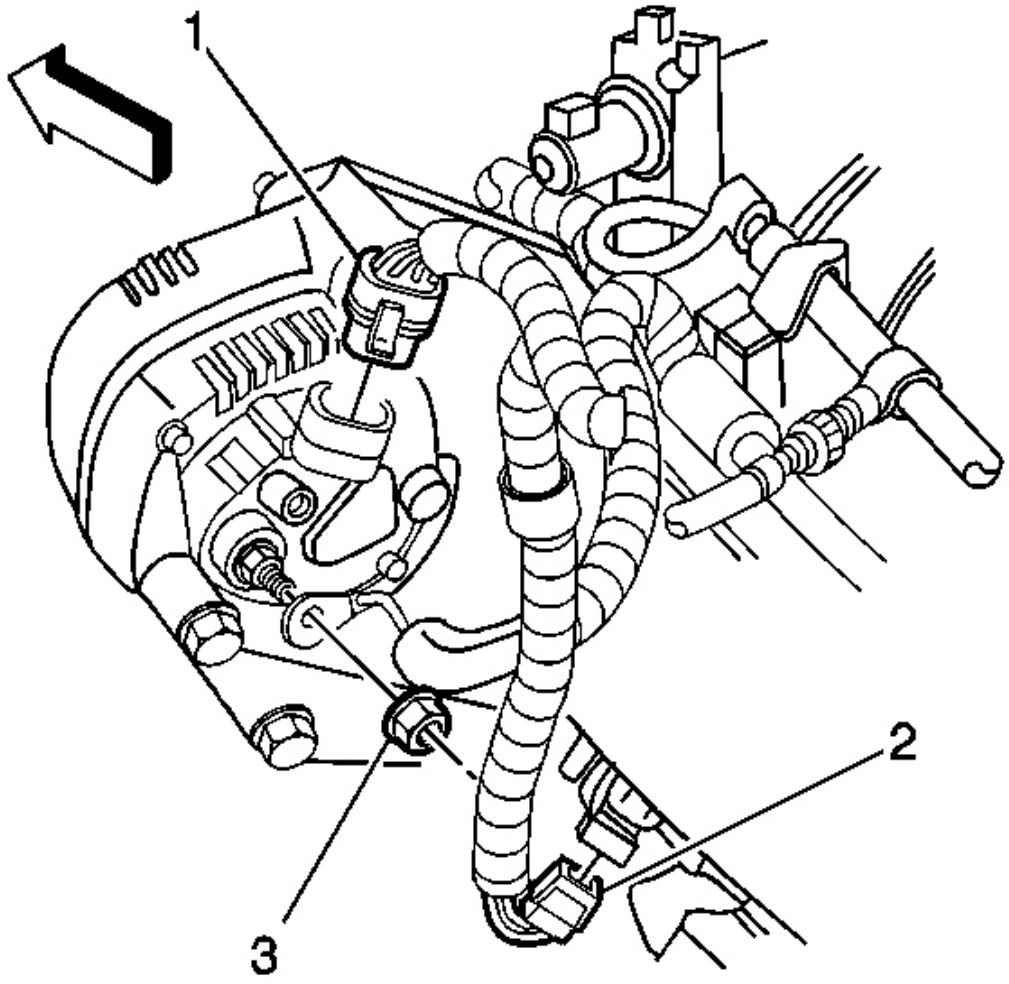


Fig. 58: Engine Wiring Harness Generator Lead Nut & Generator Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Connect the generator electrical connector (1 and 2).

4. Install the battery feed cable.
5. Install the battery feed terminal nut (3).

   Tighten: Tighten the battery feed cable nut to 13 N.m (10 lb ft).

6. Install the drive belt. Refer to **Drive Belt Replacement - Accessory** .
7. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (6.0L)** or **Battery Negative Cable Disconnection and Connection (7.0L)**.

GENERATOR REPLACEMENT (7.0L)

Removal Procedure

1. Remove the drive belt. Refer to **Drive Belt Replacement - Accessory** .

   CAUTION: Refer to Battery Disconnect Caution .

2. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (6.0L)** or **Battery Negative Cable Disconnection and Connection (7.0L)**.

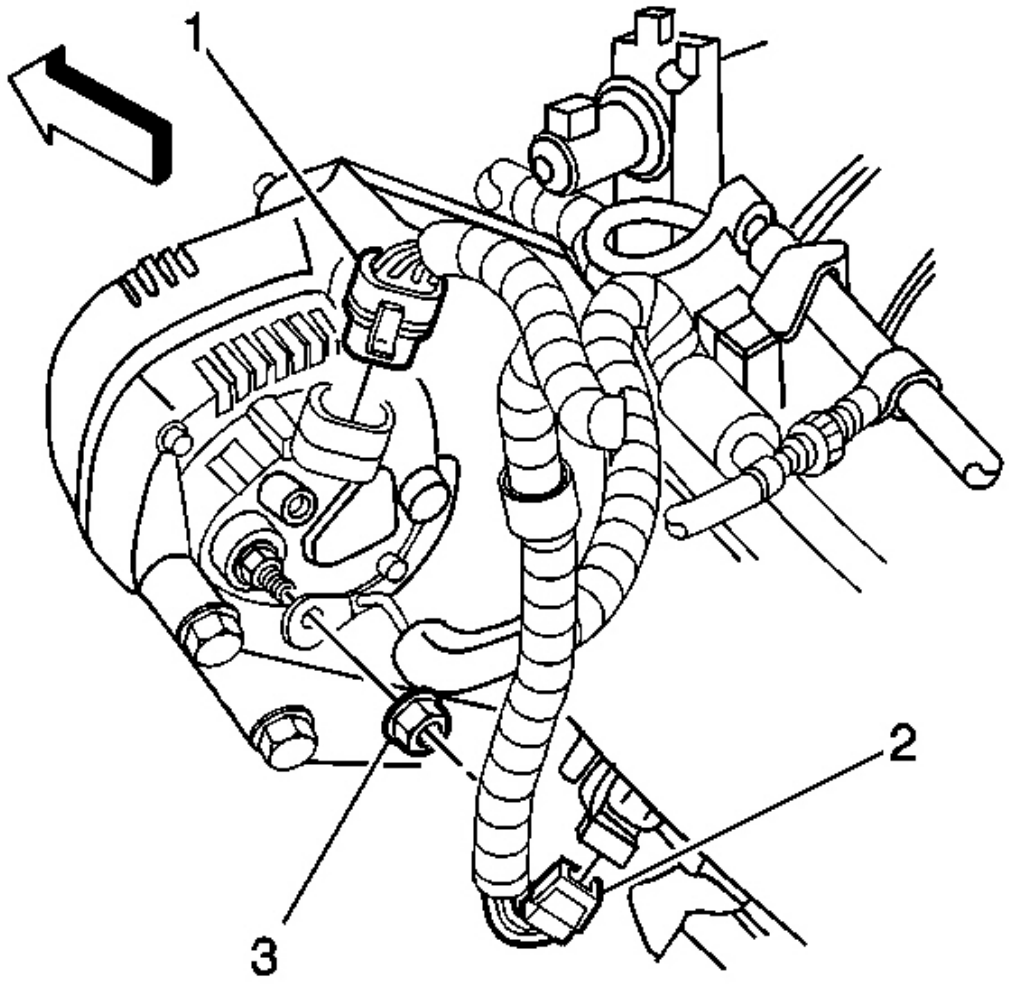


Fig. 59: Engine Wiring Harness Generator Lead Nut & Generator Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the generator electrical connector (1 and 2).
4. Remove the battery feed terminal nut (3) from the generator.
5. Remove the battery feed cable.

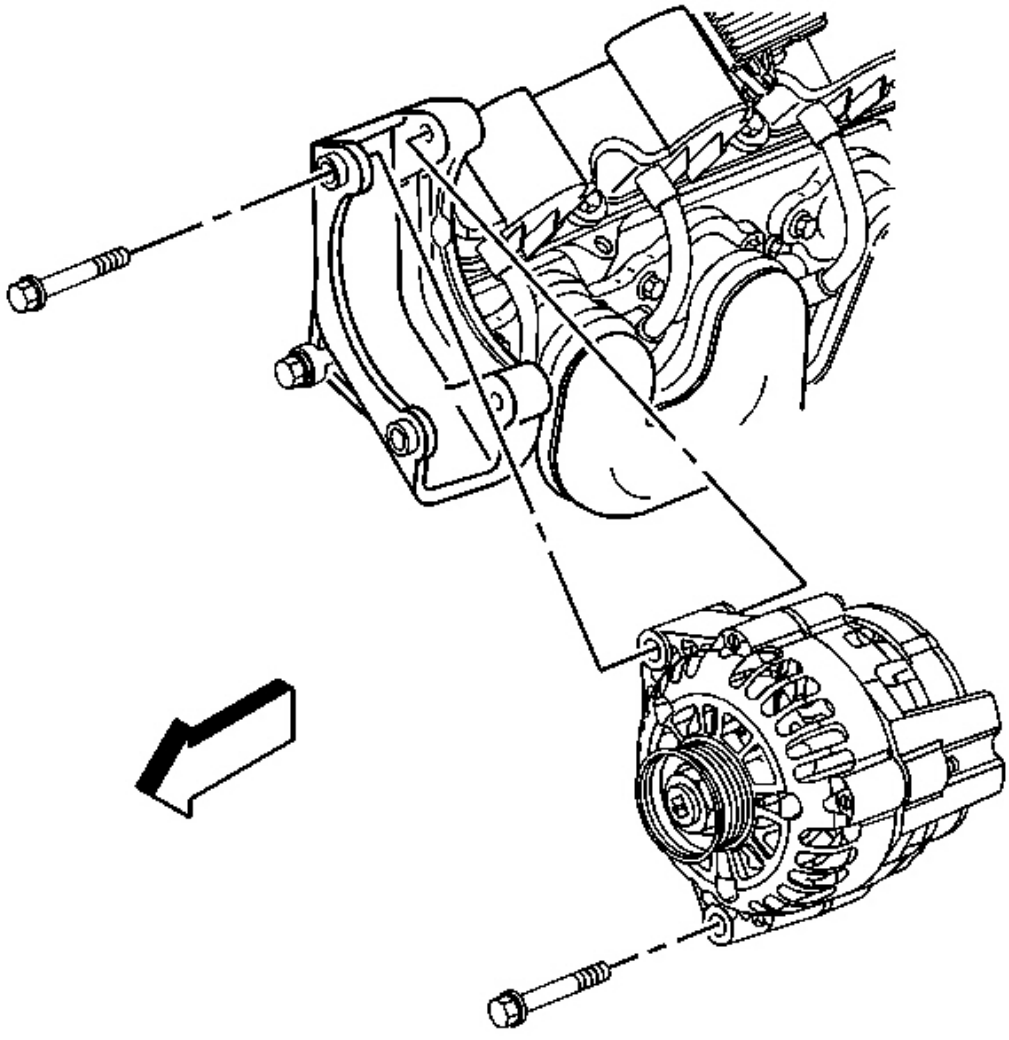


Fig. 60: View Of Generator Bolts & Generator
Courtesy of GENERAL MOTORS CORP.

6. Remove the generator mounting bolts.
7. Remove the generator.

Installation Procedure

1. Position the generator on the mounting bracket.

NOTE: Refer to Fastener Notice .

2. Install the generator bolts.

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

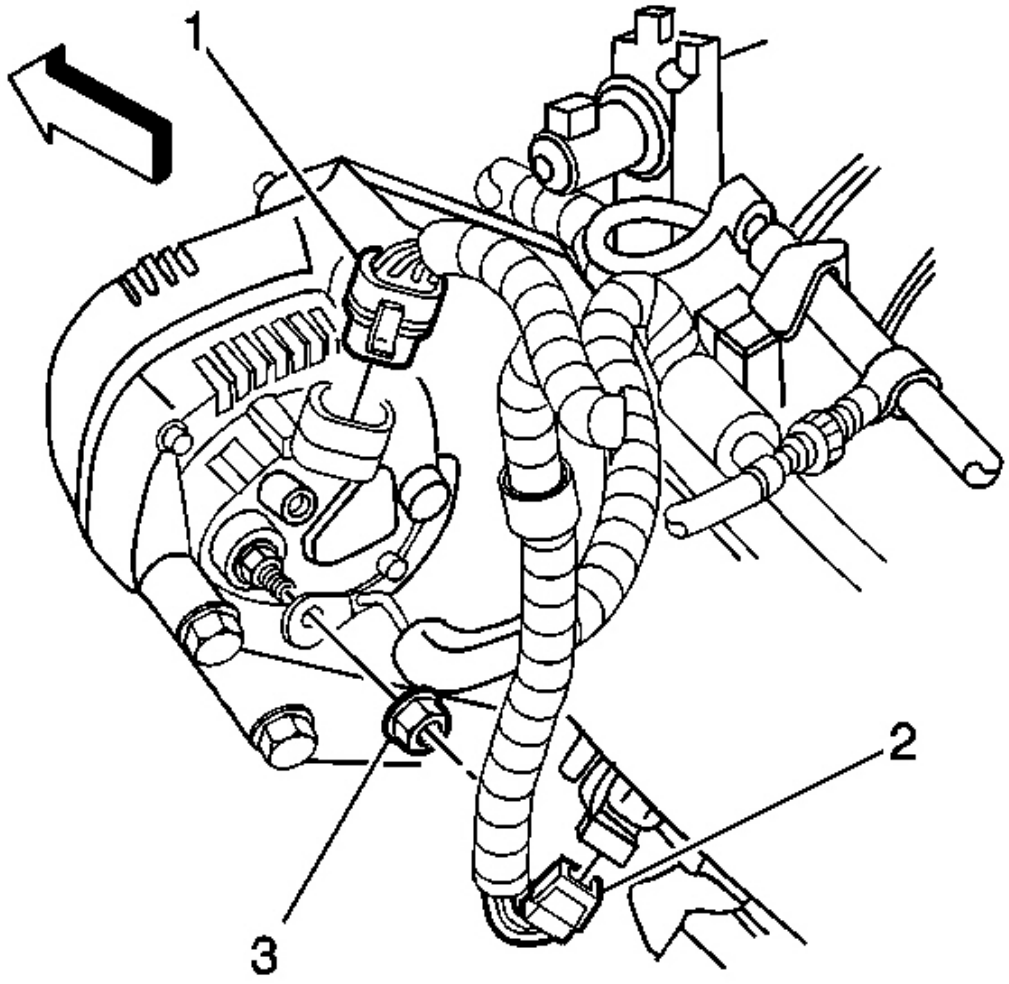


Fig. 61: Engine Wiring Harness Generator Lead Nut & Generator Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Connect the generator electrical connector (1 and 2).

4. Install the battery feed cable.
5. Install the battery feed terminal nut (3).

   Tighten: Tighten the battery feed cable nut to 13 N.m (10 lb ft).

6. Install the drive belt. Refer to **Drive Belt Replacement - Accessory** .
7. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (6.0L)** or **Battery Negative Cable Disconnection and Connection (7.0L)**.

DESCRIPTION AND OPERATION

BATTERY DESCRIPTION AND OPERATION

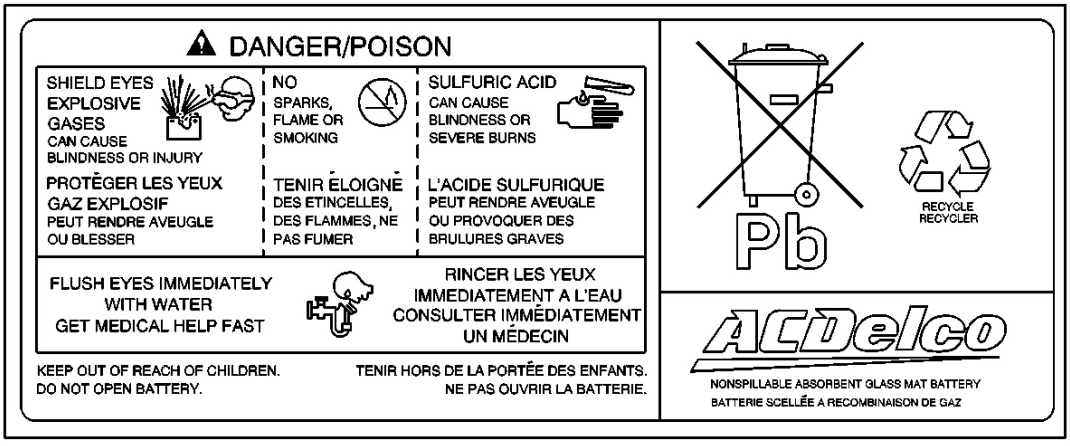


Fig. 62: Battery Warning Label
Courtesy of GENERAL MOTORS CORP.

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

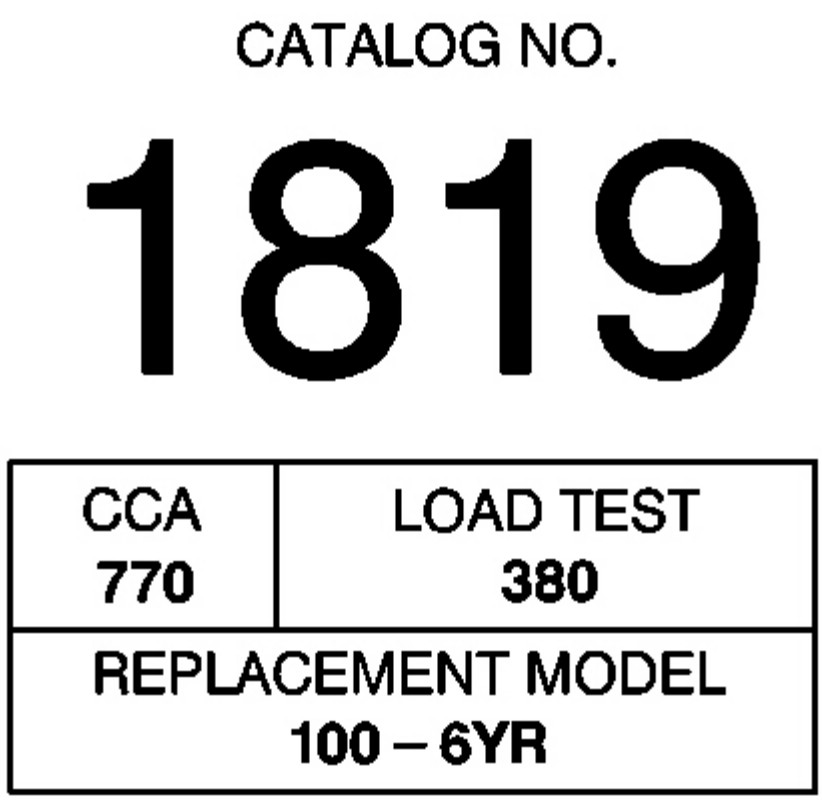


Fig. 63: View Of Battery Specification Label
Courtesy of GENERAL MOTORS CORP.

Battery Ratings

A battery may have 3 ratings:

- Amp hour
- Reserve capacity
- Cold cranking amperage

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

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

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

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

Generator

The generator features the following major components:

- The delta stator
- The rectifier bridge
- The rotor with slip rings and brushes
- A conventional pulley
- The regulator

The slip ring and the frame are liquid cooled.

The generator features permanently lubricated bearings. Service should only include tightening of mount components. Otherwise, replace the generator as a complete unit.

Regulator

The voltage regulator controls the rotor field current in order to limit the system voltage. When the field current is on, the regulator switches the current on and off at a rate of 400 cycles per second in order to perform the following functions:

- Radio noise control
- Obtain the correct average current needed for proper system voltage control

At high speeds, the on-time may be 10 percent with the off-time at 90 percent. At low speeds, the on-time may be 90 percent and the off-time 10 percent.

Circuit Description

The generator provides voltage to operate the vehicle's electrical system and to charge its battery. A magnetic field is created when current flows through the rotor. This field rotates as the rotor is driven by the engine, creating an AC voltage in the stator windings. The AC voltage is converted to DC by the rectifier bridge and is supplied to the electrical system at the battery terminal.

When the engine is running, the generator turn-on signal is sent to the generator from the engine control module (ECM), turning on the regulator. The generator's voltage regulator controls current to the rotor, thereby controlling the output voltage. The rotor current is proportional to the electrical pulse width supplied by the regulator. When the engine is started, the regulator senses generator rotation by detecting AC voltage at the stator through an internal wire. Once the engine is running, the regulator varies the field current by controlling the pulse width. This regulates the generator output voltage for proper battery charging and electrical system operation. The generator F-terminal is connected internally to the voltage regulator and externally to the ECM. When the voltage regulator detects a charging system problem, it grounds this circuit to signal the ECM that a problem exists. The ECM monitors the generator field duty cycle signal circuit. The system voltage sense circuit receives B+ voltage that is Hot At All Times through the HORN ALT / SENSE fuse in the underhood junction block. This voltage is used by the regulator as the reference for system voltage control. On vehicles that use a sense circuit connected to the voltage regulator, this circuit must be operating properly for the charging system work correctly, when there is a charging system concern all circuits at the generator should be tested.

Charging System Messages

The DIC displays a charging system message the when the following occurs:

- The engine control module (ECM) detects that the generator output is less than 11 volts or greater than 16 volts. The DIC receives a message from the ECM requesting illumination of the charge indicator / charging system warning message.
- The IPC determines that the system voltage is less than 11 volts or greater than 16 volts. The IPC receives a message from the body control module (BCM) indicating the system voltage.

BATTERY SAVER ACTIVE

The DIC displays the BATTERY SAVER ACTIVE message when the body control module (BCM) reduces or disables the performance of some vehicle systems in order to reduce the load on the charging system. The DIC receives a message from the BCM requesting illumination.

BATTERY VOLTAGE HIGH

The DIC displays the BATTERY VOLTAGE HIGH message when the IPC determines that the system voltage is greater than 16 volts. The IPC receives a message from the body control module (BCM) indicating the system voltage.

BATTERY VOLTAGE LOW

The DIC displays the BATTERY VOLTAGE LOW message when the IPC determines that the system voltage is less than 11 volts. The IPC receives a message from the body control module (BCM) indicating the system voltage.

SERVICE CHARGING SYS

The DIC displays the SERVICE CHARGING SYS message when the ECM detects a malfunction with the generator output. The IPC receives a message from the ECM requesting illumination.

STARTING SYSTEM DESCRIPTION AND OPERATION

The starter motors on this vehicle are non-repairable. It has 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 engine control module (ECM) sees an engine run flag, the ground is removed from the control circuit of the Crank relay. The switch side of the Crank 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

When the ignition mode switch is placed in the START position, a discrete input is sent to the body control module (BCM) notifying it that engine start has been requested. The BCM then verifies that the brake pedal has been depressed with a discrete input from the brake pedal position sensor and that the key fob, with the correct code, is in the vehicle. After this information has been verified the BCM grounds the control side of the RUN/CRANK relay closing the switch side of it and allowing battery positive voltage to flow from the BATT 3 fuse through the RUN/CRANK relay switch, engine control module (ECM) fuse to the battery positive voltage side of the CRANK relay coil. The BCM also sends a high speed GMLAN message to the ECM requesting engine start. The ECM will then verify that the internal mode switch (IMS) is in Park / Neutral or the clutch pedal is fully depressed. After this has been verified the ECM the supplies ground to the control circuit of the CRANK relay closing the CRANK relay switch circuit and allowing battery positive voltage to flow through the STARTER fuse, the CRANK relay switch to the S-terminal of the Starter solenoid cranking the engine. Ground is supplied through the engine block.

LOAD SHED SYSTEM DESCRIPTION AND OPERATION

Electrical Load Management

Electrical load management is designed to maintain battery voltage and covers more than load-shed. The body control module (BCM) will request increases in idle speed from the engine control module (ECM), when the vehicle is in park or neutral, as well as turn off loads in order to manage the electrical system and preserve the vehicle electrical power availability. The BCM calculates the battery temperature, voltage and charging rate at all times while the engine is running.

The BCM calculates the battery temperature by factoring in:

- The current intake manifold air temperature compared to the last temperature recorded when the ignition switch was turned OFF
- The current battery voltage compared to the last battery voltage recorded when the ignition

switch was turned OFF

- The length of time since the last battery temperature calculation

If the calculated battery temperature is below -15°C (+5°F), the PMM institutes steps to control the load.

The BCM calculates the voltage of the battery by making constant voltage measurements and using the measurements to calculate the true battery voltage. If the BCM detects a low voltage, the BCM institutes steps to control the load.

The BCM calculates the net charge rate on the electrical system by making constant voltage measurements and using the measurements to calculate the charge rate in amp/hours. If the BCM detects a negative charge rate, equal to a discharge from the battery, the PMM institutes steps to control the load.

The BCM will either request an increase in the engine idle speed from the ECM or the BCM will turn off loads, called the load-shed function, in order to preserve the vehicle electrical system operation. The criteria used by the BCM to regulate this electrical load management are outlined below:

Load Shed System Description and Operation

Function	Battery Temperature Calculation	Battery Voltage Calculation	Amp-hour Calculation	Action Taken
Idle Boost 1 Start	Less Than -15°C (5°F)	-	-	First level Idle boost requested
Idle Boost 1 Start	-	-	Battery has a net loss of 0.6 AH	First level Idle boost requested
Idle Boost 1 End	Greater Than -15° C (5°F)		Battery has a net loss of less than 0.2 AH	First level Idle boost request cancelled
Idle Boost 1 End	-	14.0 V	Battery has a net loss of less than 0.2 AH	First level Idle boost request cancelled
Load Shed 1 Start	-	-	Battery has a net loss of 1.6 AH	Controlled outputs cycled OFF for 20% of their cycle
			Battery has a net	Clear Load Shed

Load Shed 1 End	-	-	loss of less than 0.8 AH	1
Idle Boost 2 Start	-	-	Battery has a net loss of 5.0 AH	Second level Idle boost requested
Idle Boost 2 End	-	-	Battery has a net loss of less than 2.0 AH	Second level Idle boost request cancelled
Idle Boost 3 Start	-	-	Battery has a net loss of 10.0 AH	Third level Idle boost requested
Idle Boost 3 Start	-		-	Third level Idle boost requested
Idle Boost 3 End	-	Greater Than 13.0 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 of 20.0 AH -	Controlled outputs cycled OFF for 100% of their cycle, Battery Indicator or Battery Saver Indicator ON request sent
Load Shed 2 End	-	Greater Than 13.0 V	battery has a net loss of less than 10.5 AH	Clear Load Shed 2

Each load management function, either idle boost or load-shed, is discrete. No two functions are implemented at the same time.

During each load management function, the BCM checks the battery temperature, battery voltage and amp-hour calculations and determines if the BCM should implement a different power management function.

The highest loads on the electrical system are the resistance load of heating elements. The BCM controls the heating elements in the outside rear view mirrors, the rear window and the heated seats, either directly or by sending messages to any module controlling power to these devices.

The second highest load on the electrical system are the blowers used in the HVAC system. The BCM will send messages to the HVAC system controller that will result in reducing the blower

operation on vehicles equipped with automatic HVAC systems.

Idle Boost Functions

The body control module (BCM) sends a serial data request to the engine control module (ECM) to increase the idle speed. The ECM then adjusts the idle speed by using a special program and idle speed ramp calculations in order to prevent driveability and safety concerns. The idle speed boost and cancel function will vary from vehicle to vehicle and from one moment to another on the same vehicle. This happens because the ECM responds to changes in the inputs from the sensors used to control the powertrain.

Load Shed System Description and Operation

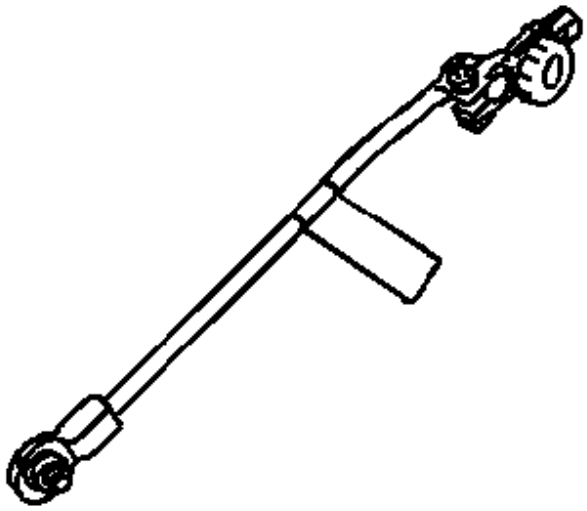
Load Shed Level	Affected Systems	Action Taken
Load-Shed Level 0	No systems affected	Normal operation
Load-Shed Level 1	Heated Outside Rear View Mirrors, Heated Rear Window/Rear Window Defrost, Heated Seats	Cycled at 80% duty cycle, OFF for 4 of every 20 second cycle. Indicator and timer not affected.
	Message Center, Instrument Cluster	No messages or indicators are displayed. Data (DPID) indicating that the Load-Shed 1 was entered is stored and may be accessed with a scan tool. DPID will reset after 40 ignition switch cycles with no repeated load-shed 1 action or with a battery disconnection.
Load-Shed Level 2	Heated Outside Rear View Mirrors, Heated Rear Window/Rear Window Defrost, Heated Seats	Turned OFF. Indicator and timer are not affected. The indicators and timers are controlled by the BCM.The operator must turn ON system when load-shed level is exited. System will not respond to operator input until current load-shed level is exited. This system will respond to only one Load-Shed Level 2 command per ignition switch cycle.

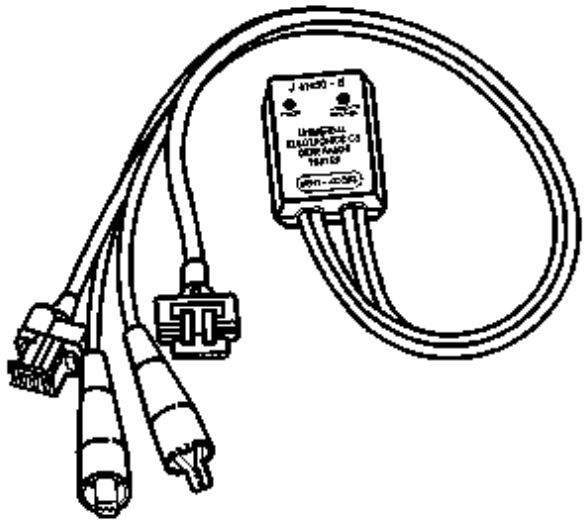
	Message Center, Instrument Cluster	"Battery Saver Action" message is displayed. Charge indicator is illuminated. Data (DPID) indicating that the Load-Shed Level 2 was entered is stored and may be accessed with a scan tool. DPID will reset after 40 ignition switch cycles with no repeated Load-Shed 2 actions or with a battery disconnection.

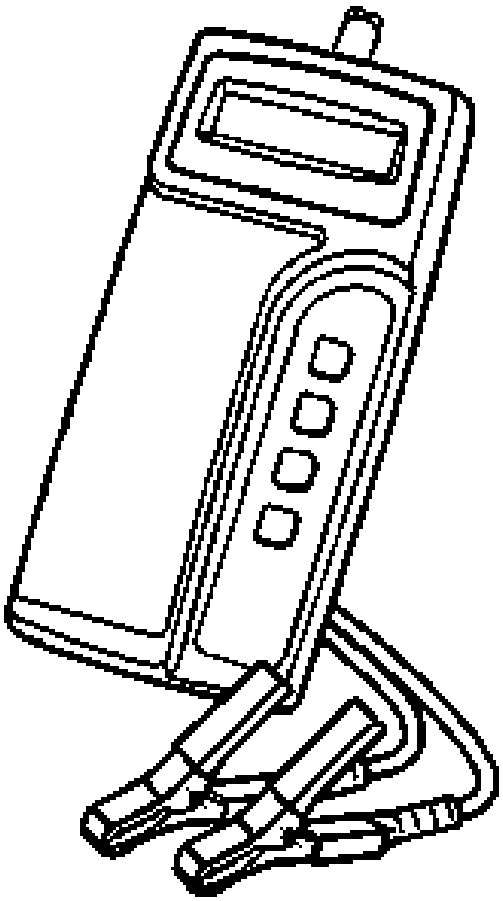
SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Special Tools

Illustration	Tool Number/Description
	J 38758 Parasitic Draw Test Switch

	J 41450-B Universal CS Generator Tester Harness
	J 42000 Battery Tester



J 45681

	Jumper Harness