

2004 ENGINE

Engine Electrical - Aztek & Rendezvous

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Battery Ground (Negative) Cable Bolt to Engine Block (LY7)	25 N.m	18 lb ft
Battery Ground (Negative) Cable Nut to Transaxle Stud (LA1)	25 N.m	18 lb ft
Battery Ground (Negative) Cable to Core Support Bolt (All)	5 N.m	44 lb in
Battery Hold-Down Retainer Bolt (All)	25 N.m	18 lb ft
Battery Positive Cable to Underhood Electrical Center Nut (All)	10 N.m	89 lb in
Battery Terminal Bolt (LA1)	16 N.m	12 lb ft
Battery Terminal Nut (LY7)	9 N.m	80 lb in
Battery Tray Bolt (All)	10 N.m	89 lb in
Generator B+ Terminal Nut (LA1)	13 N.m	115 lb in
Generator B+ Terminal Nut (LY7)	20 N.m	15 lb ft
Generator Bolt (All)	50 N.m	37 lb ft
Generator Bracket Bolt (LA1)	50 N.m	37 lb ft
Starter Motor Bolt	47 N.m	35 lb ft
Starter Motor Bolt	50 N.m	37 lb ft
Starter Motor BAT Terminal Nut (LA1)	10 N.m	89 lb in
Starter Motor BAT Terminal Nut (LY7)	13 N.m	115 lb in
Starter Motor S Terminal Nut (LA1)	3 N.m	27 lb in

BATTERY USAGE

Battery Usage

Application	Specification
Cold Cranking Amperage (CCA)	600 A (LA1) 690 A (LY7)
Reserve Capacity	115 Minutes
Replacement Model Number	78A-72

STARTER MOTOR USAGE

Starter Motor Usage

Application	Specification
LA1/L Y7	PG-260D

GENERATOR USAGE

Generator Usage

Application	Specification
3.4L w/K68	
Generator Model	Valeo SG10
Rated Output	105 A
Load Test Output	73 A
3.4L w/KG7	
Generator Model	Valeo SG12
Rated Output	125 A
Load Test Output	87 A

SCHEMATIC AND ROUTING DIAGRAMS

STARTING AND CHARGING SCHEMATICS

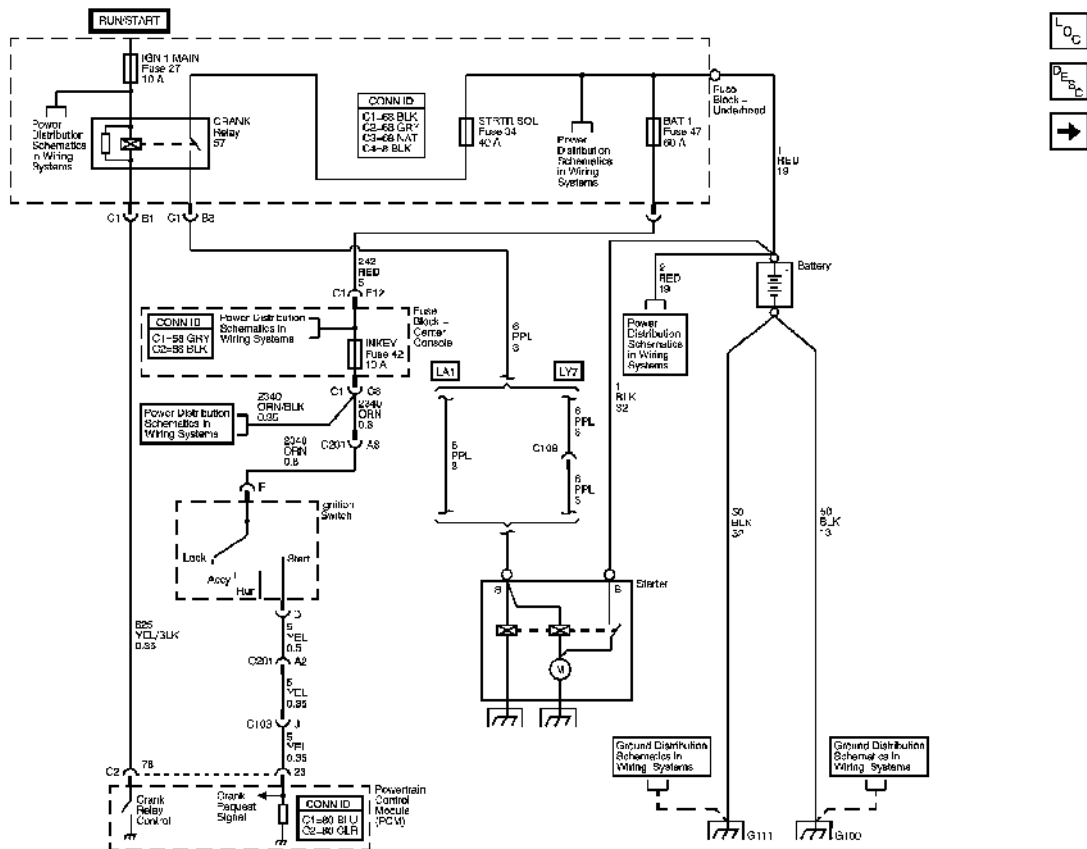


Fig. 1: Engine Cranking Schematic
Courtesy of GENERAL MOTORS CORP.

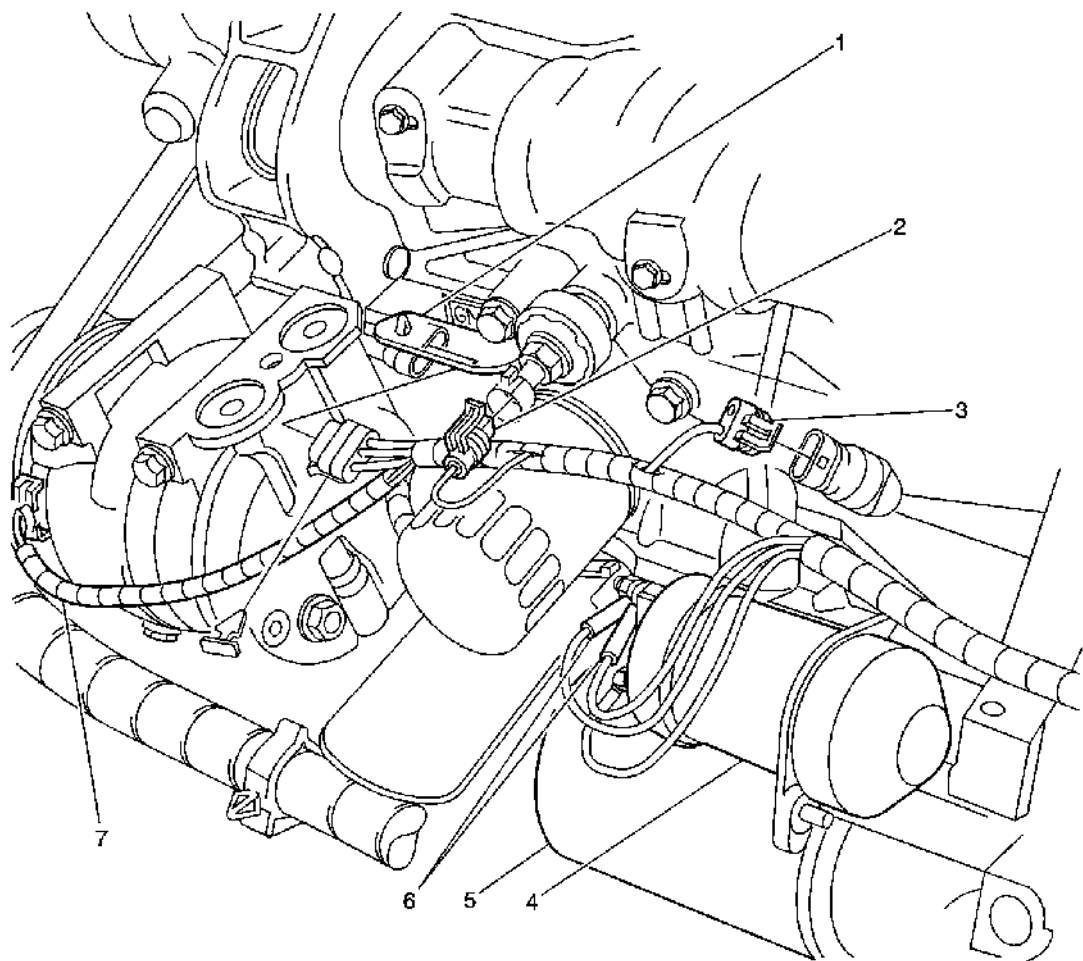


Fig. 3: Lower Front Of Engine Component View (LA1)
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 3

Callout	Component Name
1	Crankshaft Position (CKP) Sensor A Connector and Bracket
2	Knock Sensor (KS) Connector
3	Engine Oil Pressure (EOP) Switch Connector
4	Starter Solenoid
5	Starter Motor
6	Fusible Links (Starter)
7	A/C Compressor Clutch Diode

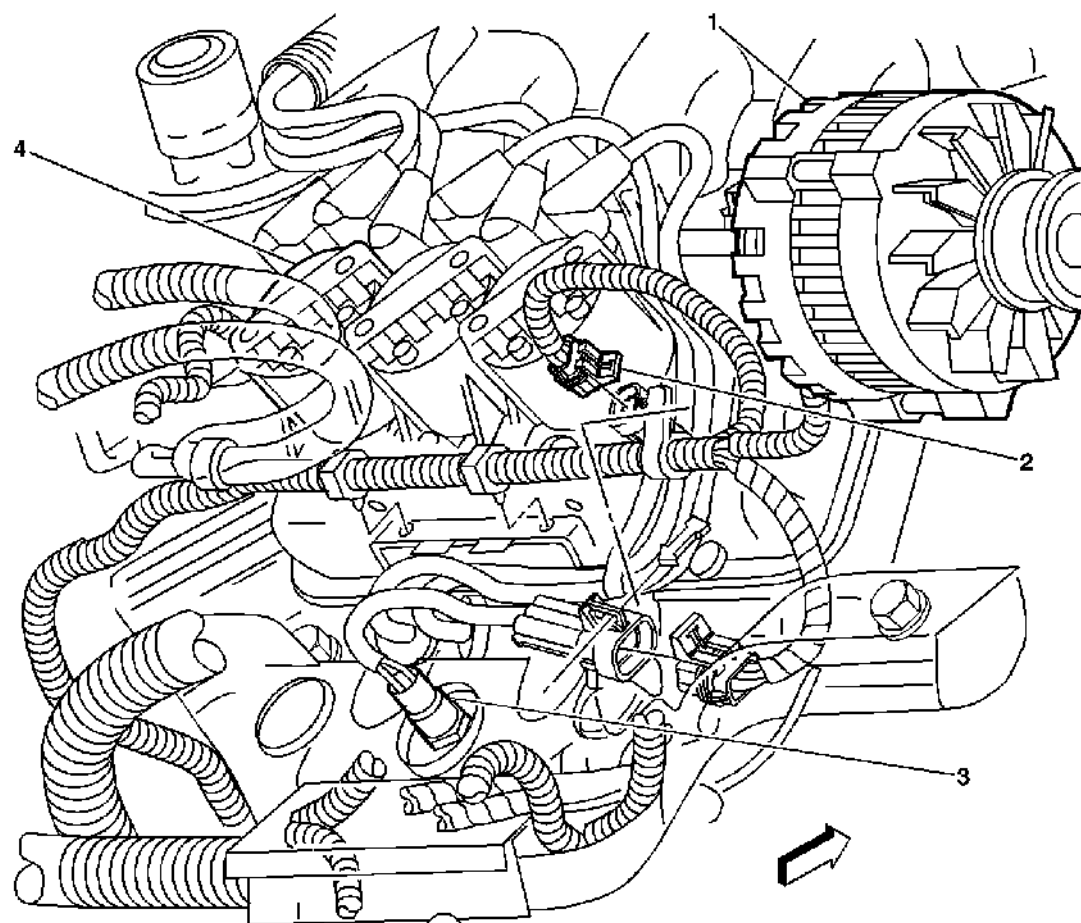


Fig. 4: LH Side of Engine Component View (LA1)
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 4

Callout	Component Name
1	Generator
2	Ignition Control Module (ICM)
3	Heated Oxygen Sensor (HO2S) 1
4	Ignition Coils

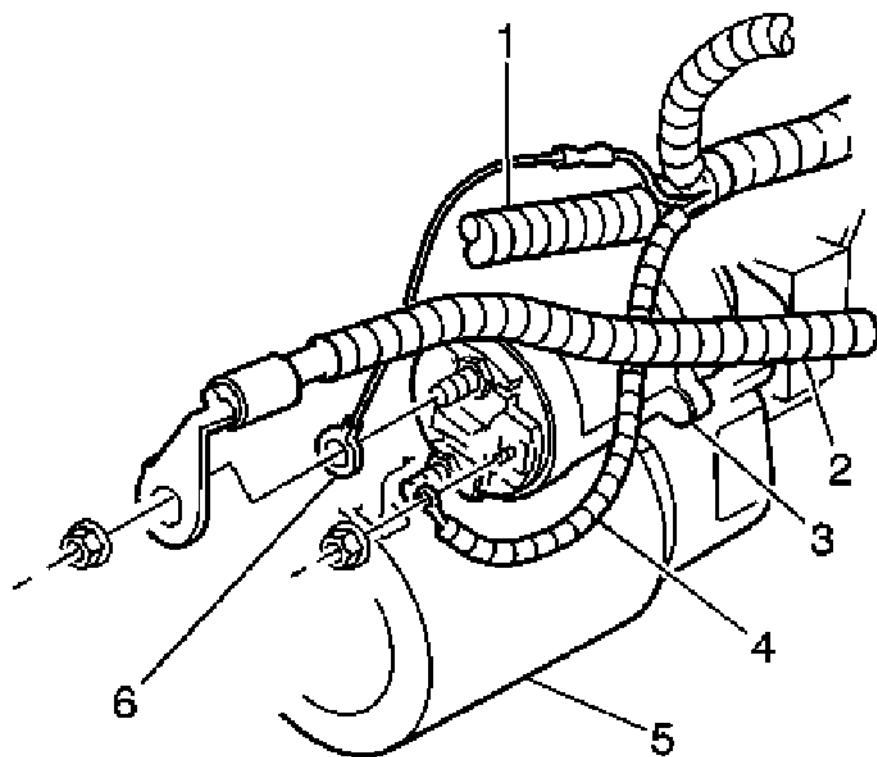


Fig. 5: Starter Component View
 Courtesy of GENERAL MOTORS CORP.

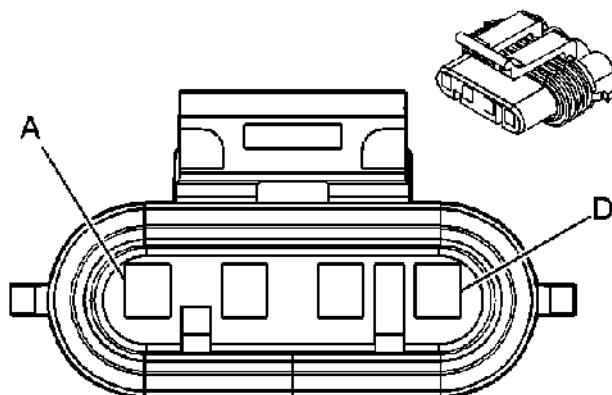
Callouts For Fig. 5

Callout	Component Name
1	To A/C Compressor Clutch
2	Positive Battery Cable
3	Starter Solenoid
4	Starter Solenoid Ground
5	Starter
6	Battery Positive

ENGINE ELECTRICAL CONNECTOR END VIEWS

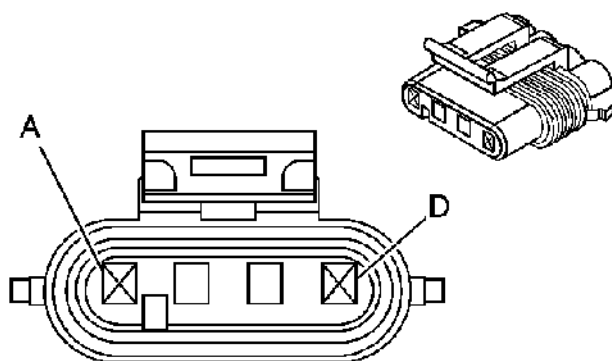
Generator Connector End View (LA1)

--



Connector Part Information		• 12186568 • 4-Way F Metri-Pack 150 Series (BLK)	
Pin	Wire Color	Circuit No.	Function
A	-	-	Not Used
B	RED	225	Generator Turn On Signal
C-D	-	-	Not Used

Generator Connector End View (LY7)



Connector Part Information		• 15355066 • 4-Way F Metri-Pack 150 Series (BG)	
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	-	-	Not Used

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC STARTING POINT - ENGINE ELECTRICAL

Begin the system diagnosis with the **Diagnostic System Check - Engine Electrical**. The Diagnostic System Check 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 will identify the correct procedure for diagnosing the system and where the procedure is located.

DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL

Test Description

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

- 4:** Lack of communication may be because of a partial malfunction of the class 2 serial data circuit or due to a total malfunction of the class 2 serial data circuit. The specified procedure will determine the particular condition.
- 5:** The symptom list in Symptoms will determine the correct diagnostic procedure to use.
- 6:** The presence of DTCs which begin with "U" indicate some other module is not communicating. The specified procedure will collect all the available information before you perform tests.

Diagnostic System Check - Engine Electrical

Step	Action	Yes	No
1	Perform the Battery Inspection/Test. Refer to <u>Battery Inspection/Test</u> . Does the battery pass the test?	Go to Step 2	-
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. Does the scan tool power up? IMPORTANT: The engine may start during the following step. Turn OFF the engine as soon as you have observed the Crank power mode.	Go to Step 3	Go to <u>Scan Tool Does Not Power Up</u> in Data Link Communications

2	1. Install a scan tool. 2. Access the Class 2 Power Mode in the Diagnostic Circuit Check on the scan tool.	Go to Step 3	Go to <u>Scan Tool Does Not Up</u> in Data Link
3	2. Rotate the ignition switch through all positions while observing the Class 2 Power Mode parameter. Does the ignition switch parameter reading match the ignition switch position for all switch positions?	Go to Step 4	Go to <u>Power Mode Mismatch</u> in Body Control System
4	1. Turn ON the ignition, with the engine OFF. 2. Attempt to communicate with each of the following modules on the class 2 serial data circuit: • Body Control Module (BCM) • Instrument Panel Cluster (IPC) • Powertrain Control Module (PCM) Does the scan tool communicate with any module on the class 2 serial data circuit?	Go to Step 5	Go to <u>Scan Tool Does Not Communicate with Class 2 Device</u> in Data Link Communications
5	1. Select the Display DTCs function for each module. If using a Tech 2, use the Class 2 DTC Check feature in order to determine which modules have DTCs set. 2. Record all of the displayed DTCs, the DTC status, and the module which set the DTC. Does the scan tool display any DTCs?	Go to Step 6	Go to <u>Symptoms - Engine Electrical</u>
6	Does the scan tool display any DTCs which begin with a "U"? Does the scan tool display DTC B1000?	Go to <u>Scan Tool Does Not Communicate with Class 2 Device</u> in Data Link Communications Go to	Go to Step 7

76	Does the scan tool display any DTCs which	Diagnostic Trouble Code (DTC) List in Body With Class System Device	Go to Diagnostic Trouble Code (DTC) List
----	---	--	---

SCAN TOOL OUTPUT CONTROLS

Scan Tool Output Controls

Scan Tool Output Control	Additional Menu Selection(s)	Description
GEN L-Terminal	Engine Output Controls/GEN L-Terminal	The powertrain control module (PCM) 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.
Starter Relay Control	Engine Output Controls/Starter Relay Control	The engine control module (ECM) grounds the starter relay control circuit when ON is selected. When Off is selected, ground is removed from the circuit.

SCAN TOOL DATA LIST

Body Control Module (BCM) Scan Tool Data List

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition ON/Engine OFF			
Electronics Battery Fd	Data	Volts	12.6 Volts
Load Shed	Inputs	None/Load 1//Load 2/Load 3	None
Inadvertent Power Relay	Outputs	On/Off	Off
Load Management Relay	Outputs	On/Off	Off

Powertrain Control Module (PCM, 3.4L LA1) Scan Tool Data List

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition ON/Engine OFF			
Crank Request Signal	Engine Data 2	Yes/No	No
GEN F-Terminal Signal	Engine Data 2	%	0%
GEN L-Terminal Signal			

Command	Engine Data 2	On/Off	Typical Data
Ignition 1 Signal	Engine Data 1	Volts	12.6 Volts
Starter Enable Relay Circuit	Ignition ON/Engine OFF	OK/Invalid	
Starter Request Signal	Engine Data 2	Yes/No	OK/No
Starter Relay Command	Engine Data 2	On/Off	Off/0%

Engine Control Module (ECM 3.6L LY7) Scan Tool Data List

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition ON/Engine OFF			
Crank Request Signal	Electrical/Theft Data	Yes/No	No
GEN F-Terminal Signal	Electrical/Theft Data	%	0%
GEN L-Terminal Signal Command	Electrical/Theft Data	On/Off	Off
Ignition 1 Signal	Electrical/Theft Data	Volts	12.6 Volts
Starter Relay Command	Electrical/Theft Data	On/Off	Off

SCAN TOOL DATA DEFINITIONS

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.

Electronics Battery FD

The scan tool displays 0-20 Volts. The scan tool displays the voltage as received on the battery positive voltage E circuit of the BCM.

GEN F-Terminal Signal

The scan tool displays 0%-100%. The scan tool displays 0%-10% until the engine is started and the PCM 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 PCM supplies then 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 PCM.

Inadvertent Power Relay

The scan tool displays On/Off. The scan tool displays On when the key is in the ACCY. or ON position.

Load Management Relay

The scan tool displays On/Off. The scan tool displays On unless the BCM has entered Load Management or Idle Boost.

Load Shed

The scan tool displays None/Load 1/Load 2/Load 3. The scan tool displays None unless Load management has been entered.

Starter Enable Relay Circuit Status

The scan tool displays Fault/OK/Invalid State. The scan tool displays Fault until the ignition is placed into the START position then OK is displayed.

Starter Relay Command

The scan tool displays ON/OFF. The scan tool displays Off until the ignition is placed into the CRANK position, then it reads On.

DIAGNOSTIC TROUBLE CODE (DTC) LIST

Diagnostic Trouble Code (DTC) List

DTC	Diagnostic Procedure	Module(s)
B1327	<u>DTC B1327</u>	VTD
B1328	<u>DTC B1328</u>	BCM
P0560	<u>DTC P0560</u>	PCM
P0562	<u>DTC P0562</u>	ECM
P0563	<u>DTC P0563</u>	ECM
P0615	<u>DTC P0615</u>	ECM
P0616	<u>DTC P0616</u>	ECM
P0617	<u>DTC P0617</u>	ECM
P0620	<u>DTC P0620</u>	PCM

DTC	DTC P0625 Diagnostic Procedure	ECM Module(s)
B1627	<u>DTC B1627</u>	ECM
B1638	<u>DTC B1638</u>	ECM

DTC B1327

Circuit Description

The BCM monitors the battery positive voltage and battery negative circuit voltage to determine if it is between 9.0-15.0 volts and sends this information out as a class 2 message to the VTD.

Conditions for Running the DTC

This DTC shall run only if the BCM has power, ground and the ignition in not in START mode.

Conditions for Setting the DTC

This DTC shall be set as current when the voltage falls below 9.0 volts for 1.2 milliseconds.

Action Taken When the DTC Sets

A message shall be sent out on the class 2 lines to illuminate the charge indicator and security lamp.

Conditions for Clearing the MIL/DTC

In order to clear the DTC from a current status the voltage shall be greater than 9.54 volts for 1200 milliseconds.

Test Description

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

3: Tests for the proper operation of the complete circuit.

4: Tests for the proper operation of the signal input circuit.

DTC B1327

Step	Action	Value(s)	Yes	No
Schematic Reference: <u>Theft Deterrent System Schematics</u> in Theft Deterrent Connector End View Reference: <u>Body Control System Connector End Views</u> in Body Control Systems				
	Did you perform the Engine Electrical Diagnostic System Check?			Go to Diagnostic

Step	Action	Value(s)	Yes	System
Schematic Reference: Theft Deterrent System Schematics in Theft Deterrent Connector End View Reference: Body Control System Connector End View Body Control Systems				
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, observe the Electronic Battery FD in the BCM data list. Does the scan tool indicate the battery voltage is greater than the specified value?	9.0 volts	Go to Step 2	Check - Engine Electrical
3	Replace the VTD. Refer to Theft Deterrent Control Module Replacement in Theft Deterrent. Did you complete the replacement?	-	Go to Step 4	-
4	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 B1328

Circuit Description

The BCM has an internal voltage sensor with a dedicated circuit that monitors the battery positive voltage circuit to determine if it is below 18 volts.

Conditions for Running the DTC

This DTC shall run only if no communication codes are set.

Conditions for Setting the DTC

The ignition positive voltage level is greater than 18 volts for approximately 1/2 seconds or more.

Action Taken When the DTC Sets

The BCM sets a DTC and disables the following State of Health (SOH) DTCs:

- DTC U1096
- DTC U1255
- DTC U1300
- DTC U1301

The BCM illuminates the charge lamp indicator.

Conditions for Clearing the DTC

- The battery positive voltage level is less than 17.9 volts for approximately 1/2 seconds.
- A history DTC clears after 100 malfunction free ignition cycles.
- The BCM receives the clear code command from the scan tool.

Diagnostic Aids

This DTC may set when the vehicle is placed on a battery charger, on fast charge, for a long period of time.

DTC B1328

Step	Action	Value(s)	Yes	No
1	Did you perform the Engine Electrical Diagnostic System Check?	-		Go to <u>Diagnostic System Check - Engine Electrical</u>
2	1. Install a scan tool. 2. Start the engine. 3. With a scan tool, observe the Electronics Battery Fd parameter in the BCM data list.	18.0 volts	Go to Step 2	
3	Does the scan tool indicate the battery voltage is greater than the specified value? Measure the voltage across the battery terminals. Is the battery voltage greater than the specified value? IMPORTANT:	18.0 volts	Go to Step 3 Go to <u>Charging System Test</u>	Go to Step 4 Go to Step 4

1	1. Do not start the engine. Refer to Body Control Module (BCM) Programming/RPO Configuration in Body Control System.	-			Go to Diagnostic System check - Engine
4	Replace the BCM. Refer to Body Control Module Replacement in Body Control System. Did you complete the replacement?	-		Go to Step 2	
	3. With a scan tool, observe the			Go to Step 5	-
2	1. Use the scan tool to observe the BCM data list.	18.0 volts			
5	2. Operate the vehicle within the conditions for running the DTC as specified in the supporting text. Does the scan tool indicate the battery voltage is greater than the specified value?	Go to Step 2	Go to Step 3	Go to Step 3	
	Does the DTC reset?	2	System OK		

DTC P0560

Circuit Description

The PCM monitors the system voltage to make sure that the voltage stays within the proper range. Damage to components, and incorrect data input can occur when the voltage is out of range. The PCM monitors the system voltage over an extended length of time. If the PCM detects a system voltage outside an expected range for the calibrated length of time, DTC P0560 will set.

Conditions for Running the DTC

- System voltage below 9.0 volts or above 16.0 volts.
- Engine speed above 650 RPM.
- Vehicle speed below 40 Km/h (25 mph).

Conditions for Setting the DTC

The PCM detects a system voltage out of range for 30 seconds.

Action Taken When the DTC Sets

- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).
- The PCM will command a message to be displayed.
- The PCM will store conditions which were present when the DTC set as Fail Records data only.

Conditions for Clearing the DTC

- The PCM 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 P0560

Step	Action	Value	Yes	No
Schematic Reference: <u>Engine Controls Schematics</u> in Engine Controls - 3.4L Connector End View Reference: <u>Engine Controls Connector End Views</u> in Engine Controls - 3.4L				
1	Did you perform the Engine Electrical Diagnostic System Check?	-	Go to Step 2	Go to <u>Diagnostic System Check - Engine Electrical</u>
2	1. Install a scan tool. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 3. Using the scan tool, observe the Specific DTC Information for DTC P0560 until the test runs.	-	Go to <u>Testing for Intermittent Conditions and Poor Connections</u> in Wiring Systems	Go to Step 3
3	Does the scan tool indicate that DTC P0560 has passed this ignition cycle? 1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, observe the Ignition 1 Signal parameter in the PCM data list.	9.0 V-16.0 V	Go to Step 7	Go to Step 4
	Does the scan tool indicate that the Ignition 1 Signal parameter is greater than the specified range? Using a scan tool compare the battery			

	voltage with the Ignition 1 Signal parameter in the PCM data list			Go to Step 2	Go to
4	1. Install a scan tool. 2. Is the battery voltage and PCM Ignition 1 readings different by more than the value specified? as specified in the supporting text.	0.5 V		Go to Step 5	Go to Charging System Test
2	3. Test the battery positive voltage circuit of the PCM for a high resistance or open. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition? Does the scan tool indicate that DTC P0560 has passed this ignition cycle?	-		Go to Step 8 in Wiring Systems	Go to Step 6
5	4. Inspect for poor connections at the harness connector of the PCM. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Using the scan tool, observe the Ignition 1 Signal parameter in the PCM data list. Did you find and correct the condition?	-			
6	1. Install a scan tool. 2. Is the battery voltage and PCM Ignition 1 Signal parameter in the PCM data list? Did you find and correct the condition?	9.0 V-16.0 V		Go to Step 8	Go to Step 7
3	3. Does the scan tool indicate that the Ignition 1 Signal PCM must be programmed? Is the Ignition 1 Signal PCM must be programmed in the specified range?			Go to Step 7	Go to Step 7
7	Replace the PCM. Refer to Powertrain Control Module (PCM) Replacement in Engine Controls - 3.4L. Is the action complete?	-		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 P0560 until the test runs. Does the scan tool indicate that DTC P0560 failed this ignition?	-			
				Go to Step 3	System OK

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.

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: <u>Engine Controls Schematics</u> in Engine Controls - 3.6L (LY7) Connector End View Reference: <u>Engine Control Module (ECM) Connector End Views</u> in Engine Controls - 3.6L (LY7)				
1	Did you perform the Vehicle Diagnostic System Check?	-	Go to Step 2	Go to <u>Diagnostic System Check - Engine Electrical</u>

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics in Engine Controls - 3.6L (LY7) Connector End View Reference: Engine Control Module (ECM) Connector End Views in Engine Controls - 3.6L (LY7)				
2	1. Install a scan tool. 2. Start the engine. 3. Raise the engine speed above 1,500 RPM.			
1	4. With a scan tool, observe the Ignition 1 Signal parameter in the ECM data list. Did you perform the Vehicle Diagnostic System Check? Does the scan tool indicate that the Ignition 1 Signal parameter is greater than the specified range?	10.5 V -	Go to Step 2 Go to Step 1	Go to <u>Diagnostic System Check - Engine Electrical</u>
			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 engine control module (ECM) data list. Is the Battery Voltage and Ignition 1 Signal parameter readings different by more than the value specified? Test the battery positive voltage circuit of the ECM for a high resistance. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> in Wiring Systems. Did you find and correct the condition?	0.5 V	Go to Step 4	Go to <u>Charging System Test</u>
4	Inspect for poor connections at the harness connector of the ECM. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> in Wiring Systems. Did you find and correct the condition?	-	Go to Step 7	Go to Step 5
5	IMPORTANT: The replacement ECM must be programmed.	-	Go to Step 7	Go to Step 6
6	Replace the ECM. Refer to <u>Engine Control Module (ECM) Replacement</u> in Engine Controls - 3.6L (LY7). Did you complete the replacement? 1. Review and record the scan tool Fail Records data.	-	Go to Step 7	-

3	2. Use the scan tool to compare the Battery age Signal parameter in the body control module (BCM) data list with the engine control module (ECM) data list, as specified in the supporting text. 3. Operate the vehicle within the Conditions for Running the DTC.	0.5 V			Go to Step 4	Go to Charging System Test
7	4. Test the battery positive voltage circuit of the ECM for a high resistance. Refer to Circuit Testing and Wiring Repairs in the Wiring Systems section. 5. Did you find and correct the condition?	-			Go to Step 7	Go to Step 7
4	6. Does the scan tool indicate that DTC P0562 failed this ignition? 7. Inspect for poor connections at the ECM.	-			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.

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 1 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: <u>Engine Controls Schematics</u> in Engine Controls - 3.6L (LY7) Connector End View Reference: <u>Engine Control Module (ECM) Connector End Views</u> in Engine Controls - 3.6L (LY7)				
1	Did you perform the Vehicle Diagnostic System Check?	-	Go to Step 2	Go to <u>Diagnostic System Check - Engine Electrical</u>
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 ECM data list.	16.0 V	Go to Step 4	Go to Step 3
3	Does the scan tool indicate that the Ignition 1 Signal parameter is less than the specified range? 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 engine control module (ECM) data list. Is the Battery Voltage and Ignition 1 Signal parameter readings different by more than the value specified? IMPORTANT: The replacement ECM must be programmed.	0.8 V	Go to Step 4	Go to <u>Charging System Test</u>
4	Replace the ECM. <u>Engine Control Module (ECM) Replacement</u> in Engine Controls - 3.6L (LY7). Did you complete the replacement? 1. Review and record the scan tool Fail Records data. 2. Use the scan tool in order to clear	-	Go to Step 5	-

	the DTC.			Go to Step 2	Go to
	1. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text.				
5	2. Start the engine.				
	3. Raise the engine speed above 1,500 RPM.	-			
2	4. Using the scan tool, observe the Specific DTC Information for DTC P0563 until the test runs.	16.0 V			
	4. With a scan tool, observe the Ignition 1 Signal parameter in the ECM data list.				
	Does the scan tool indicate that DTC P0563 failed this ignition?			Go to Step 2	System OK
	Does the scan tool indicate that the				

DTC P0615

Circuit Description

The engine control module (ECM) supplies a ground path for the STARTER 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, STARTER relay DTC P0615 will set.

Conditions for Running the DTC

System voltage is between 9 and 16 volts.

Conditions for Setting the DTC

- The ECM detects an improper voltage level on the output circuit that controls the STARTER 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 Crank position if the STARTER 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 CKP and 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 STARTER relay operates. Press the ignition switch back and forth from the ON to Crank positions. Repeat this as necessary.
- 3:** Tests for voltage at the coil side of the STARTER 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 STARTER relay.
- 5:** Tests if ground is constantly being applied to the STARTER relay.

DTC P0615

Step	Action	Yes	No
Schematic Reference: <u>Starting and Charging Schematics</u> Connector End View Reference: <u>Engine Control Module (ECM) Connector End Views</u> in Engine Controls - 3.6L (LY7)			
1	Did you perform the Vehicle Diagnostic System Check?	Go to Step 2	Go to <u>Diagnostic System Check - Engine Electrical</u>
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 Crank positions. Does the STARTER relay click with each command? 1. Turn OFF the ignition. 2. Disconnect the STARTER relay. 3. Turn ON the ignition, with the engine OFF.	Go to <u>Testing for Intermittent Conditions and Poor Connections</u> in Wiring Systems	Go to Step 3

Step	Action	Yes	No
Schematic Reference: Starting and Charging Schematics Connector End View Reference: Engine Control Module (ECM) Connector End Views in Engine Grounds - 3.6L (LY7)			
1	Does the test lamp illuminate? Did you perform the Vehicle Diagnostic System Check? Connect a test lamp between the battery positive voltage of the	Go to Step 4 Go to Step 2	Go to Diagnosis Step 8 Engine Electrical
4 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 Crank positions. Does the test lamp turn ON and OFF with each command? Does the STARTER relay click with each command? Test the control circuit of the STARTER relay for a short to voltage or an open. Refer to Circuit Testing and Wiring Repairs in Wiring Systems.	Go to Testing for Intermittent Conditions and Poor Connections in Wiring Systems Go to Step 6	Go to Step 5 Go to Step 3
5	Did you find and correct the condition? Inspect for poor connections at the STARTER relay. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems.	Go to Step 11	Go to Step 7
6	Did you find and correct the condition? Inspect for poor connections at the engine control module (ECM). Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems.	Go to Step 11	Go to Step 9
7	Did you find and correct the condition? Repair the battery positive voltage circuit of the STARTER relay. Refer to Connector Repairs in Wiring Systems.	Go to Step 11	Go to Step 10
8	Did you complete the repair?	Go to Step 11	-
9	Replace the STARTER relay. Did you complete the replacement.	Go to Step 11	-
IMPORTANT: The replacement ECM must be programmed.			

10	Replace the ECM. Refer to Engine Control Module (ECM) Replacement in Engine Controls - STARTER relay.	Go to Step 4	Go to Step 8
4	1. Connect a test lamp between the battery positive voltage of the STARTER relay coil circuit and the control circuit of the STARTER relay. 2. Clear DTCs. 3. Turn the ignition back and forth from the ON to Crank positions. Operate vehicle within Fail Records conditions as noted.	Go to Step 11	-
11	4. Using a scan tool, monitor the Specific DTC Information for DTC P0615. 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 STARTER relay. Does the scan tool indicate DTC P0615 for a short to voltage or an open. Refer to Circuit Testing and Wiring Repairs in	Go to Step 2	System OK

DTC P0616

Circuit Description

The engine control module (ECM) supplies a ground path for the STARTER 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, starter relay DTC P0616 will set.

Conditions for Running the DTC

- System voltage is between 8-16 volts.
- The engine is running.

Conditions for Setting the DTC

- The ECM detects an improper voltage level on the output circuit that controls the STARTER 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.

DTC P0616

Step	Action	Yes	No
Schematic Reference: <u>Starting and Charging Schematics</u> Connector End View Reference: <u>Engine Control Module (ECM) Connector End Views</u> in Engine Controls - 3.6L (LY7)			
1	Did you perform the Vehicle Diagnostic System Check?	Go to Step 2	Go to <u>Diagnostic System Check - Engine Electrical</u>
2	1. Install a scan tool. 2. Operate the vehicle within the conditions for running the DTC. 3. Using the scan tool, observe the specific DTC information for DTC P0616 until the test runs.	Go to <u>Testing for Intermittent Conditions and Poor Connections</u> in Wiring Systems	Go to Step 3
3	Does the scan tool indicate that DTC P0616 has passed this ignition cycle? Test the control circuit of the STARTER relay for a short to ground. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> in Wiring Systems.	Go to Step 6	Go to Step 4
4	Did you find and correct the condition? Inspect for poor connections at the engine control module (ECM). Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> in Wiring Systems.	Go to Step 6	Go to Step 5
5	Did you find and correct the condition? IMPORTANT: The replacement ECM must be programmed. Replace the ECM. Refer to <u>Engine Control Module (ECM) Replacement</u> in Engine Controls - 3.6L (LY7). Did you complete the replacement? 1. Review and record the scan tool Fail Records data.	Go to Step 6	-

Step	Action	Yes	No
Schematic Reference: Starting and Charging Schematics			
Connector End View Reference: Engine Control Module (ECM) Connector End Views			
6	2. Use the scan tool in order to clear the DTC as specified in the supporting text. 3. Operate the vehicle within the conditions for running the DTC as specified in the supporting text. 4. Did you perform the Vehicle Diagnostic System Check? 5. Using the scan tool, observe the specific DTC Information for DTC P0616 until the test runs	Go to Step 2	Go to Diagnosis System Check Engine Electrical
	1. Install a scan tool. Does the scan tool indicate that DTC P0616 failed this ignition? 2. Operate the vehicle within the conditions for running the DTC	Go to Step 2	System OK

DTC P0617

Circuit Description

The engine control module (ECM) supplies a ground path for the starter 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, starter relay DTC P0617 will set.

Conditions for Running the DTC

- System voltage is between 8-16 volts.
- The engine is running.

Conditions for Setting the DTC

- The ECM detects an improper voltage level on the output circuit that controls the starter 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.

DTC P0617

Step	Action	Yes	No
Schematic Reference: <u>Engine Controls Schematics</u> in Engine Controls - 3.6L (LY7)			
Connector End View Reference: <u>Engine Control Module (ECM) Connector End Views</u> in Engine Controls - 3.6L (LY7)			

1	Did you perform the Vehicle Diagnostic System Check?	Go to Step 2	Go to <u>Diagnostic System Check - Engine Electrical</u>
2	1. Install a scan tool. 2. Operate the vehicle within the conditions for running the DTC. 3. Using the scan tool, observe the specific DTC information for DTC P0617 until the test runs.	Go to <u>Testing for Intermittent Conditions and Poor Connections</u> in Wiring Systems	Go to Step 3
3	Does the scan tool indicate that DTC P0617 has passed this ignition cycle?		
	Test the control circuit of the Starter relay for a short to battery. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> in Wiring Systems.		
4	Did you find and correct the condition?	Go to Step 6	Go to Step 4
	Inspect for poor connections at the engine control module (ECM). Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> in Wiring Systems.		
	Did you find and correct the condition?	Go to Step 6	Go to Step 5
	IMPORTANT: The replacement ECM must be programmed.		
5	Replace the ECM. Refer to <u>Engine Control Module (ECM) Replacement</u> in Engine Controls - 3.6L (LY7). Did you complete the replacement?	Go to Step 6	-
	1. Review and record the scan tool Fail Records data. 2. Use the scan tool in order to clear the DTC.		

Step	Action	Yes	No
3.	Operate the vehicle within the conditions for Running the DTC Schematics in Engine Controls - 3.6L (LY7)		
4.	Using the scan tool, observe the specific DTC information for DTC P0617 until the test runs.		
5.	Did you perform the Vehicle Diagnostic System Check?		
6.	Did the scan tool indicate that DTC P0617 failed this ignition?	Go to Step 2	Go to Diagnosis System Check Engine Electrical

DTC P0620

Circuit Description

The powertrain control module (PCM) uses the generator turn on signal circuit to control the generator. A high side driver within the PCM allows the PCM to turn the generator ON and OFF. When Generator operation is desired, the PCM sends a 5 volt signal to the voltage regulator via the generator turn on signal circuit. This causes the voltage regulator to begin controlling the generator field circuit. Once the Generator is enabled by the PCM, the voltage regulator controls generator output independently of the PCM. Under certain operating conditions, the PCM can turn Off the generator by turning Off the 5 volt signal on the generator turn on signal circuit. The PCM has fault detection circuitry which monitors the state of the generator turn on signal circuit. If the fault detection circuit senses a voltage other than what is expected, this DTC will set. The voltage regulator also contains fault detection circuitry. If the regulator detects a problem, the regulator will ground the generator turn on signal circuit, pulling the voltage low. This also causes the PCM to set the DTC.

Conditions for Running the DTC

The engine is running.

Conditions for Setting the DTC

- The generator turn on signal circuit voltage is low while the PCM is commanding the generator on.
- The above condition is present for more than 30 seconds.

OR

- The engine RPM is less than 2500.
- The above conditions are present for more than 30 seconds.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.

- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.
- The PCM sends a class 2 message to the IPC to illuminate the charge indicator.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after forty consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- The current DTC will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL diagnostic trouble code.

DTC P0620

Step	Action	Yes	No
Schematic Reference: <u>Starting and Charging Schematics</u> Connector End View Reference: <u>Engine Electrical Connector End Views</u> or <u>Engine Controls Connector End Views</u> in Engine Controls - 3.4L			
1	Did you perform the Engine Electrical Diagnostic System Check?	Go to Step 2	Go to <u>Diagnostic System Check - Engine Electrical</u>
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, monitor the DTC Information for DTC P0620 in Engine Controls.	Go to <u>Testing for Intermittent Conditions and Poor Connections</u> in Wiring Systems	Go to Step 3
3	Does the scan tool indicate that DTC P0620 has passed? Test the generator turn on signal circuit for a short to ground. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> in Wiring Systems. Did you find and correct the condition?	Go to Step 6	Go to Step 4
4	Inspect for poor connections at the harness connector of the PCM. Refer to <u>Connector Repairs</u> in Wiring Systems. Did you find and correct the condition?	Go to Step 6	Go to Step 5
	IMPORTANT: The replacement PCM must be programmed.		

Step	Replace the PCM. Refer to <u>Powertrain</u>	Yes	No
Schematic	Control Module SRPM Replacement Schematics		
Connector	Engine Controls 3.4L Is the action complete? <u>Engine Electrical</u>	Go to Step 6	Go to Step 6
Controls	Connector End Views in Engine Controls - 3.4L		
1	1. Review and record the scan tool Fail Diagnostic System Check? 2. Clear any DTCs. 3. Operate the vehicle within the Fail Records conditions as noted.	Go to Step 2	Go to Diagnostic System Check - Engine Electrical
2	4. Install a scan tool, monitor the Specific DTC info for this DTC. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, monitor the DTC. Does the scan tool indicate that this DTC failed this ignition? Information for DTC P0620 in Engine Controls	Go to Testing for Intermittent	System OK

DTC P0625

Circuit Description

The engine control module (ECM) uses the generator field duty cycle signal circuit to monitor the duty cycle of the generator and fault indication. The generator field duty cycle signal circuit connects to the high side of the field winding in the generator. A pulse width modulated (PWM) high side driver in the voltage regulator turns the field winding ON and OFF. The ECM uses the PWM signal input to determine the generator load on the engine. This allows the ECM to adjust the idle speed to compensate for high electrical loads.

The ECM monitors the state of the generator field duty cycle signal circuit. When the engine is running, the ECM should detect a duty cycle that varies up to 100 percent. The ECM monitors the PWM signal using a key ON test and a RUN test. During the tests, if the ECM detects an out of range PWM signal, a DTC will set. When the DTC sets, the ECM will send a class 2 serial data message to the IPC and DIC to illuminate the charge indicator or display a charging message.

Conditions for Running the DTC

- No generator, CKP sensors, or CMP sensor DTCs are set.
- The engine is less than 3,000 RPM.
- The generator has not been commanded OFF by the ECM or scan tool.

Conditions for Setting the DTC

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.
- The ECM will send a class 2 serial data message to the IPC and DIC to illuminate the charge indicator or display a charging message.

Conditions for Clearing the MIL/DTC

- The conditions for setting DTC P0625 are not present.
- The DTC can be cleared by using the scan tool Clear DTC Information function.

DTC P0625

Step	Action	Values	Yes	No
Schematic Reference: <u>Starting and Charging Schematics</u> Connector End View Reference: <u>Engine Control Module (ECM) Connector End Views</u> in Engine Controls - 3.6L (LY7)				
1	Did you perform the Engine Electrical Diagnostic System Check?	-	Go to Step 2	Go to <u>Diagnostic System Check - Engine Electrical</u>
2	1. Install a scan tool. 2. Start the engine. 3. With a scan tool, observe the GEN - F Terminal Signal parameter in the engine control module (ECM) data list. Does the scan tool indicate that the GEN - F Terminal parameter is within the specified range?	5-100%	Go to <u>Testing for Intermittent Conditions and Poor Connections</u> in Wiring Systems	Go to Step 3
3	1. Turn OFF the ignition. 2. Disconnect the generator harness connector. 3. Turn ON the ignition, with the engine OFF. 4. Connect a test lamp to battery positive voltage and repeatedly probe the generator field duty cycle signal circuit in the harness	-		

Step	Action	Values	Yes	No
Schematic Reference: Starting and Charging Schematics				
Connector End View Reference: Engine Control Module (ECM) Connector End Views				
1	Is the GEN - F Terminal Signal parameter on the scan tool in Engine Controls - 3.6L (LY7) Diagnostic System Check?	-	Go to Step 5	Go to Step 4
4	Test the generator field duty cycle signal circuit for a short to ground or open. Refer to Circuit Testing and Wiring Repairs in Wiring Systems.	-	Go to Step 2	Go to Step 4, Diagnostic System Check - Engine Electrical
5	Did you find and correct the condition? Test the battery positive voltage cable for an open or high resistance. Refer to Circuit Testing and Wiring Repairs in Wiring Systems.	-	Go to Step 9	Go to Step 7
6	Did you find and correct the condition? Inspect for poor connections at the harness connector of the generator. Refer to Connector Repairs in Wiring Systems.	-	Go to Step 9	Go to Step 6
7	Did you find and correct the condition? Inspect for poor connections at the harness connector of the ECM. Refer to Connector Repairs in Wiring Systems.	-	Go to Step 9	Go to Step 6
8	Did you find and correct the condition? IMPORTANT: The replacement ECM must be programmed. Replace the ECM. Refer to Engine Control Module (ECM) Replacement in Engine Controls - 3.6L (LY7). Did you complete the replacement?	-	Go to Step 9	Go to Step 8
	1. Review and record the scan tool Fail Records data. 2. Use the scan tool in order to			

2	1. clear the DTC 2. Install a scan tool. 3. Operate the vehicle within the conditions for running DTC P0625. 4. With a scan tool, observe the GEN - F Terminal Signal parameter in the engine control module (ECM) specific DTC information for DTC P0625 until the test runs. Does the scan tool indicate that the GEN - F Terminal parameter is within the specified range?	5=100%	Go to Testing for Intermittent Conditions and Poor Connections in Wiring Systems Go to Step 2	System OK Go to Step
---	---	--------	---	---

DTC P0626

Circuit Description

The engine control module (ECM) uses the generator field duty cycle signal circuit to monitor the duty cycle of the generator and fault indication. The generator field duty cycle signal circuit connects to the high side of the field winding in the generator. A pulse width modulated (PWM) high side driver in the voltage regulator turns the field winding ON and OFF. The ECM uses the PWM signal input to determine the generator load on the engine. This allows the ECM to adjust the idle speed to compensate for high electrical loads.

The ECM monitors the state of the generator field duty cycle signal circuit. When the key is in the ON position, with the engine OFF, the ECM should detect a duty cycle that is 0 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, a DTC will set.

Conditions for Running the DTC

- No generator, CKP sensors, or CMP sensor DTCs are set.
- The engine is not running.
- The key is in the ON position.

Conditions for Setting the DTC

The ECM detects a PWM signal greater 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.
- The ECM will send a class 2 serial data message to the IPC and DIC to illuminate the charge indicator or display a charging message.

Conditions for Clearing the MIL/DTC

- The conditions for setting DTC P0626 are not present.
- The DTC can be cleared by using the scan tool Clear DTC Information function.

DTC P0626

Step	Action	Values	Yes	No
Schematic Reference: <u>Starting and Charging Schematics</u> Connector End View Reference: <u>Engine Control Module (ECM) Connector End Views</u> in Engine Controls - 3.6L (LY7)				
1	Did you perform the Engine Electrical Diagnostic System Check?	-	Go to Step 2	Go to <u>Diagnostic System Check - Engine Electrical</u>
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF 3. With a scan tool, observe the GEN - F Terminal Signal parameter in the engine control module (ECM) data list. Does the scan tool indicate that the GEN - F Terminal parameter is within the specified range? 1. Turn OFF the ignition. 2. Disconnect the generator harness connector. 3. Turn ON the ignition, with the engine OFF. 4. Connect a test lamp to battery positive voltage and repeatedly probe the generator field duty cycle signal circuit in the harness connector while monitoring the GEN - F Terminal Signal parameter on the scan tool.	0-5%	Go to <u>Testing for Intermittent Conditions and Poor Connections</u> in Wiring Systems	Go to Step 3
3	Is the GEN - F Terminal Signal	-		

Step	parameter affected	Action	Values	Go to Step 5	Go to Step 4
Schematic Reference to Starting and Charging Schematics					
Connector End View for Reference to Engine Control Module (ECM) Connector End Views in Engine Control Circuit Testing and					
1	Wiring Repairs in Wiring Systems	Did you find and correct the condition?	-	Go to Step 8	Go to Diagnostic Step 6
5	Inspect for poor connections at the harness connector of the generator. Refer to Connector Repairs in			Go to Step 2	Check - Engine Electrical
6	Wiring Systems 1. Install a scan tool. 2. Turn ON the ignition, with the condition? Inspect for poor connections at the harness connector of the ECM. Refer to Connector Repairs in Wiring Systems. Did you find and correct the condition?		-	Go to Step 8	Go to Charging System Test
7	IMPORTANT: The replacement ECM must be programmed. Replace the ECM. Refer to Engine Control Module (ECM) Replacement in Engine Controls - 3.6L (LY7). Did you complete the replacement?		-	Go to Step 8	Go to Step 7
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 DTC. 4. Using the scan tool, observe the specific DTC information for DTC P0626 until the test runs.		-	Go to Step 8	-
	Does the scan tool indicate that DTC P0626 failed?			Go to Step 2	System OK

Circuit Description

The engine control module (ECM) uses the generator turn-on signal circuit to control the voltage output of the generator. When a different voltage is desired, the ECM will change the pulse width modulation (PWM) signal to the voltage regulator via the generator turn-on signal circuit. This causes the voltage regulator to the voltage output of the generator. The ECM has fault detection circuitry which monitors the state of the generator turn-on signal circuit. If the fault detection circuit senses a voltage other than what is expected, this DTC will set. The voltage regulator also contains fault detection circuitry. If the regulator detects a problem, the regulator will ground the generator turn-on signal circuit, pulling the voltage low. This also causes the ECM to set the DTC.

Conditions for Running the DTC

Key ON Test

- The key is in the ON position for 5 seconds.
- The engine is OFF.

Engine Run Test

- The engine is running.
- The engine speed is less than 3,000 RPM.

Conditions for Setting the DTC

Key ON Test

- The ECM detects a high signal voltage on the generator turn on signal circuit for at least 5 seconds.
- The engine must be started.

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

Action Taken When the DTC Sets

- The ECM sends a class 2 message to the instrument panel cluster (IPC) to illuminate the charge indicator and/or turn on a message.
- 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 P1668

Step	Action	Value	Yes	No
Schematic Reference: <u>Starting and Charging Schematics</u> Connector End View Reference: <u>Engine Control Module (ECM) Connector End Views</u> in Engine Controls - 3.6L (LY7)				
1	Did you perform the Engine Electrical Diagnostic System Check?	-	Go to Step 2	Go to <u>Diagnostic System Check - Engine Electrical</u>
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. Wait 5 seconds. 4. Start the engine. 5. With a scan tool, monitor the DTC information for DTC P1668 in Engine Controls. Does the scan tool indicate that DTC P1668 has passed?	-	Go to <u>Testing for Intermittent Conditions and Poor Connections</u> in Wiring Systems	Go to Step 3
3	1. Turn OFF the engine. 2. Disconnect the generator harness connector. 3. Start the engine. 4. Measure the pulse width modulation (PWM) signal between the generator turn on signal circuit and ground. Is the PWM signal within the specified value?	15-87%	Go to Step 5	Go to Step 4
4	Test the generator turn on signal circuit for a short or open. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> in Wiring Systems.	-		

Step	Action	Value	Yes	No
	Did you find and correct the condition? Schematic Reference: Starting and Charging Schematics Test and View Reference: Engine Control Module (ECM) Connector End Views In Engine Controls - 3.6L (high) resistance or open. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition? Inspect for poor connections at the harness connector of the generator. Refer to Connector Repairs in Wiring Systems. Did you find and correct the condition? 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 in Wiring Systems. Did you find and correct the condition?		Go to Step 10	Go to Step 5
5	1	-		Go to Diagnostic System Check
6		-	Go to Step 10	Go to Step 6
7		-	Go to Step 10	Go to Step 8
8	Replace the generator. Refer to Generator Replacement (LA1) or Generator Replacement (LY7) . Did you complete the replacement?	-	Go to Step 10	-
9	IMPORTANT: The replacement ECM must be programmed. Replace the ECM. Refer to Engine Control Module (ECM) Replacement in Engine Controls - 3.6L (LY7). Did you complete the replacement?	-	Go to Step 10	-
10	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 3
If System OK, Engine Electrical

SYMPTOMS - ENGINE ELECTRICAL

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

- Perform **Diagnostic System Check - Engine Electrical** 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** in Wiring Systems.
- 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** in Wiring Systems.

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 and Equipment**.

Diagnostic Aids

CAUTION: Refer to Battery Disconnect Caution in Cautions and Notices.

IMPORTANT: The battery test using the J 42000 requires correct connections to the battery terminals. See Special Tools and Equipment. A failure to obtain the correct connections during the test may result in a failed test on a good battery.

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 and Equipment**. 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:
 - Disconnect the negative battery cable.
 - Disconnect the positive battery cable.
 - Install the test adapters on the terminals.
 - 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:
 - Disconnect the negative battery cable.

- Disconnect the positive battery cable.
- Install the tester adapters.
- Follow the instructions for an Out-of-Vehicle test.
- 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 and Equipment**. If the adapters that are provided with the **J 42000** require replacement, use P/N 12303040. See **Special Tools and Equipment**. 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: Refer to Battery Disconnect Caution in Cautions and Notices.				
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) 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
	1. Turn OFF the ignition. 2. Attempt to rotate the negative battery cable connector clockwise			

3	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
6	IMPORTANT: Ensure that all of the electrical loads are turned OFF. 1. Install the J 42000 Battery Tester. See <u>Special Tools and Equipment</u> . 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 <u>Battery Charging</u> . 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	-		

Step	Access to the Action	Values	Yes	No
	CAUTION: needed. Refer to Battery Disconnection Caution in Cautions and Notices. the cable rings are excessively IMPORTANT: damaged or corroded, replace as needed. 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. Disconnect the negative battery			
1	Inspect the battery for a cracked, broken, or damaged case, which may be indicated by battery acid leakage and repair as needed: Is the battery OK? • The cable bolt is too long or deformed at the end	-	Go to Step 2	Go to Step 15
9	Compare the cold cranking amperage (CCA) and reserve capacity (RC) 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
	connector ring 1. Turn OFF the ignition. 2. Attempt to rotate the negative		Go to Step 10	-
3	1. Disconnect the positive battery cable. 2. Inspect for the following conditions and repair as needed:	-	Go to Step 4	Go to Step 11
10	• 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	-
	IMPORTANT: Ensure that both battery cables are disconnected and proper adapters are installed in the battery terminals.			

4	Use a torque wrench in order to verify the torque to loosen the negative battery terminal bolt. 1. Install the J-42000. See Special Tools and Equipment. 2. Follow the directions supplied with the tester above the specified value? Is the torque above the specified value?	10 N.m (88 lb in)	Go to Step 9	Go to Step 9
5	Attempt to rotate the positive battery cable connector clockwise with light finger pressure. 3. Follow any directions displayed on the tester. Does the positive connector rotate?	-	Go to Step 7	Go to Step 7
6	IMPORTANT: Ensure that all of the electrical loads are turned Off. 4. If the tester calls for charging the battery, refer to Battery Charging. Did the tester pass the battery? 1. Install the J-42000 Battery Tester. 2. Press the CODE button on the J-42000. See Special Tools and Equipment. 3. Follow any directions displayed on the tester. 4. If the tester calls for charging the battery, refer to Battery Charging.	-	Go to Step 12	Go to Step 15
12	Did you complete this action? 1. Connect the positive battery cable to the battery's positive terminal.	Go to Step 13	-	
	1. Connect the positive battery cable to the battery's positive terminal. Did the tester pass the battery?		Go to Step 14	Go to Step 14
7	Use a torque wrench in order to verify the torque to loosen the positive battery terminal bolt. NOTE: Refer to Fastener Notice in Cautions and Notices. Is the torque above the specified value?	10 N.m (88 lb in)	Go to Step 10	Go to Step 10
13	1. Disconnect the negative battery cable. 2. Tighten the positive battery cable bolt to the specified value. 3. Disconnect the positive battery cable. 4. Connect the negative battery cable to the battery negative terminal.	15 N.m (11 lb ft)		
8	3. Clean and wire brush the lead face of both battery terminals and the metal contact rings in both cable connectors. 4. Tighten the negative battery cable bolt to the specified value. Are the cable bolts properly tightened?	-	Battery OK	-
14	4. Remove the bolts from the cable connectors in order to provide access to the battery terminals. 1. Press the CODE button on the J-42000. See Special Tools and Equipment. 5. If the tester calls for charging the battery, refer to Battery Charging. 2. For warranty purposes, write the displayed code on the repair order.			

15	Did the cable clamps become excessively damaged or corroded, replace as needed. Refer to Battery Replacement. Did you complete the replacement?	Battery OK -	- Go to Step 4	-
----	--	----------------------------	------------------------------	----------

BATTERY CHARGING

Tools Required

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

- 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 and Equipment**.

Battery State of Charge

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

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

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

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

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

Battery Charging

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

Use the SOC information as follows:

- A battery with a SOC that is below 65 percent must always be recharged before returning it to service or continuing storage.
- A battery with a SOC that is 65 percent or greater is generally considered to be charged enough in order to be returned to normal service or in order to continue storage. However, if the battery is being used in slow traffic or with short drive times, or if the temperature is very hot or very cold, the battery should be fully charged, to at least 90 percent, before returning it to service or continuing storage.

Charging Time Required

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

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

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: Refer to Fastener Notice in Cautions and Notices.

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

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

Use the following procedure to charge the battery:

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

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

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

BATTERY ELECTRICAL DRAIN/PARASITIC LOAD TEST

Tools Required

J 38758 Parasitic Draw Test Switch. See Special Tools and Equipment.

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 in Body Control System 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 in Keyless Entry.

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

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

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

CAUTION: Refer to Battery Disconnect Caution in Cautions and Notices.

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

1. Disconnect the battery negative cable from the battery negative terminal.
2. Install the male end of the J 38758 to the battery ground terminal. See Special Tools and Equipment.
3. Turn the J 38758 knob to the OFF position. See Special Tools and Equipment.
4. Install the battery negative cable to the female end of the J 38758 . See Special Tools and Equipment.
5. Connect a 10A fused jumper wire to the test switch tool terminals.
6. Turn the J 38758 knob to the ON position. See Special Tools and Equipment.
7. Road test the vehicle and activate ALL of the accessories, including the radio and air conditioning. This may take up to 30 minutes.
8. Park the vehicle. Turn the ignition switch to the OFF position and remove the ignition switch key.
9. Turn the J 38758 knob to the OFF position. See Special Tools and Equipment. 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 and Equipment**. 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 and Equipment**. 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 and Equipment**.
16. Turn the **J 38758** knob to the OFF position. See **Special Tools and Equipment**. 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 milliamperere 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:
20. 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.**

21. 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** in Wiring Systems 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.

22. 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.
23. When the cause of the excessive current drain has been located and repaired, remove the **J 38758**. See **Special Tools and Equipment**.
24. 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 Procedures** in Wiring Systems.

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: Refer to Battery Disconnect Caution in Cautions and Notices.

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.

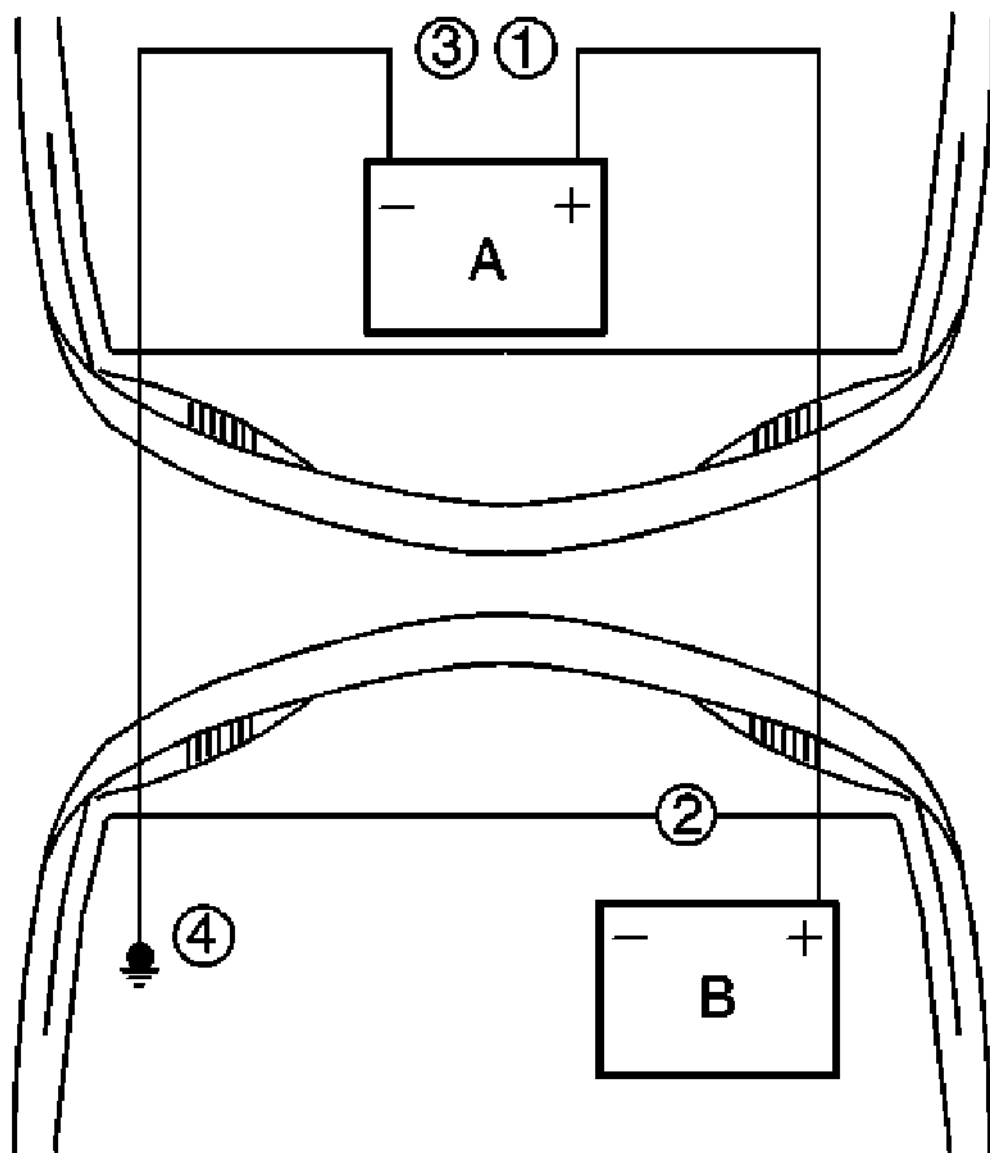


Fig. 6: Identifying Proper Jumper Cable Connection
Courtesy of GENERAL MOTORS CORP.

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 for Engine Electrical?	-	Go to Step 2	Go to <u>Diagnostic System Check - Engine Electrical</u>
	IMPORTANT:			

2	The battery must be above a 70 percent state of charge. Did you perform the Battery Inspection Test?	-	Go to Step 3	Go to <u>Battery Inspection/Test</u>
3	1. Install a scan tool. 2. Start the engine. 3. With a scan tool, command the GEN-L Terminal OFF and ON. 4. Observe the Ignition 1 Signal parameter. Does the voltage change with each command?	-	Go to Step 4	Go to Step 8
4	1. Turn ON the following accessories: • Headlights - high beams • A/C on Max • Blower fan - ON high • Heated seats - if equipped 2. With a scan tool, observe the ignition 1 signal parameter in the engine data list. 3. Increase engine speed to 2,500 RPM. Is the voltage within the specified value?	12.0-15.5 V	Go to Step 5	Go to Step 6
	1. Turn OFF all accessories. 2. Turn OFF the ignition. CAUTION: Make sure that the load is completely turned off before connecting or			

5	disconnecting a carbon pile load tester to the battery. Otherwise, sparking could ignite battery gasses which are extremely flammable and may explode violently. 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. With a scan tool, command the GEN-L Terminal ON. 7. Increase engine speed to 2,500 RPM. 8. 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 7
6	Is the voltage measured greater than 15.5 volts?	-	Go to Step 12	Go to Step 7
	1. Leave the vehicle accessories ON or maintain load test value. 2. Maintain engine speed at 2,500 RPM.			

Step	Action	Value(s)	Yes	No
1 7	3. Measure the voltage between the Diagnostic System Check for Engine Electrical generator metal housing.	- B+	Go to Step 2	Go to Diagnostic System Check - Engine Electrical
2	IMPORTANT: Is the voltage measured equal to percent state of charge?	-	Go to Step 14	Go to Step 9
2	1. Turn ON the ignition. Did you perform the Battery Inspection Test?	-	Go to Step 3	Go to Battery Inspection/Test
8	2. Disconnect the generator harness connector. 1. Install a scan tool. 2. Start the engine. 3. Measure the voltage between the generator terminal and the GEN-L terminal OFF and ON. 4. When the ignition is ON, does the voltage change with the terminal ON and OFF. Does the voltage change with each terminal measure	4.7 V 0 V	Go to Step 4	Go to Step 8
	greater than the first value ON and near the second value OFF?		Go to Step 14	Go to Step 11
4 9	• Headlights - high beams • A/C on Max • Blower fan - ON high • Heated seats - if equipped 1. Maintain the engine speed at 2,500 RPM and continue to operate the generator at the load test value. 2. Measure the voltage drop from the battery negative terminal to the generator housing of the signal terminal. Refer to Circuit Testing and Wiring Repairs in Wiring Systems 3. With the engine speed to 2,500 RPM. Is the voltage measured less than the specific value?	12.0-15.5 V 0.5 V	Go to Step 10 Go to Step 10	Go to Step 15
	1. Maintain the engine speed at 2,500 RPM and continue to operate the			

	specified value at the load test		5	Go to Step 6
10	1. Turn OFF all accessories. 2. Measure the voltage drop from the output terminal of the generator to the positive terminal on the battery. Refer to Circuit CAUTION: Make sure that the load is completely removed before disconnecting a carbon pile load tester to the battery. Otherwise, sparking could ignite battery gasses which are extremely flammable and may explode violently. Is the voltage drop more than the specified value?	0.5 V	Go to Step 14	Go to Step 16
11	3. Connect a carbon pile signal circuit for a short, or open. Refer to Circuit Testing and Wiring Repairs IMPORTANT: When measuring generator output current, be sure the inductive probe encircles the generator output wire. Did you find and correct the condition?	-	Go to Step 19	Go to Step 13
12	4. Connect an inductive ammeter probe to the output circuit of the generator. 5. Start the engine. 6. With a scan tool,	-	Go to Step 19	Go to Step 14
13	Inspect for poor connections at the harness connector of the powertrain control module (PCM). Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. 7. Increase engine speed to 2,500 RPM. 8. Adjust the carbon pile as necessary in order to obtain the maximum current output. Did you find and correct the condition? Is the generator output greater than the specified value?	-	Go to Step 19	Go to Step 17
	Inspect for poor connections at the generator. Refer to Testing for Intermittent Conditions and Poor Connections and			

Connector Repair in Generator System?					
14	Is the voltage measured greater than 15.5 volts?	-	Go to Step 12	System OK	Go to Step 7
6	Repair the high resistance or open in the ground circuit of the generator. Refer to Wiring Repairs in Wiring Systems. Maintain engine speed at 2,500 RPM. Did you complete the repair?	-	Go to Step 19		Go to Step 7
15	Repair the high resistance or open in the generator output circuit. Refer to Wiring Repairs in Wiring Systems. Did you complete the repair?	B+ -	Go to Step 19		-
7	Replace the PCM. Refer to Control Module References in Body Control System. Did you complete the replacement?	-	Go to Step 14		Go to Step 9
16	Turn ON the ignition, with the engine OFF. Did you complete the replacement?	-	Go to Step 19		-
17	Replace the generator. Refer to Generator Replacement (LA1) or Generator Replacement (LV7) . Did you complete the replacement?	-	Go to Step 19		-
18	Operate the vehicle in order to verify the repair. Did you correct the condition?	4.7 V 0 V	Go to Step 19		-
8	With a scan tool, command the GEN-L terminal ON and OFF. Did you correct the condition?	-	System OK		Go to Step 2
19					

CHARGE INDICATOR ALWAYS ON

Charge Indicator Always On

Step	Action	Value(s)	Yes	No
1	Did you perform the Engine Electrical Diagnostic System Check?	-	Go to Step 2	Go to Diagnostic System Check - Engine Electrical
	Start the engine. Does the battery charge indicator remain illuminated after the 5 second			Go to Testing for Intermittent

2	bulb check?	-	Go to Step 3	<u>Conditions and Poor Connections</u> in Wiring Systems
3	1. Install a scan tool 2. With a scan tool, observe the Ignition 1 Signal parameter in the PCM data list. Does the voltage measure within the normal operating range?	10-15 V	Go to Step 4	Go to <u>Charging System Test</u>
4	Replace the instrument panel cluster. Refer to <u>Instrument Panel Cluster (IPC) Replacement</u> in Instrument Panel, Gages, and Console. Did you complete the replacement?	-	Go to Step 5	-
5	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
1	Did you perform the Engine Electrical Diagnostic System Check?	Go to Step 2	Go to <u>Diagnostic System Check - Engine Electrical</u>
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 <u>Testing for Intermittent Conditions and Poor Connections</u> in Wiring Systems	Go to Step 3
	Replace the instrument cluster (IPC). Refer to <u>Instrument Panel Cluster (IPC)</u>		

3	Replacement in Instrument Panel, Gages, and Console. 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, 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 . Is the generator operating properly?	Go to Step 2	Go to Step 11
2	1. Start the engine. Verify that the noise can be heard. 2. Turn OFF the engine. 3. Disconnect the 4-way 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 Drive Belt Replacement in Engine Mechanical - 3.4L. 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
	Inspect the generator for a loose pulley and/or		

4	pulley nut. Is the generator pulley or pulley nut loose?	Go to Step 11	Go to Step 5
5	- Loosen all of the generator mounting bolts. - Tighten the generator mounting bolts to specifications and in the proper sequence, if necessary. Refer to <u>Generator Replacement (LA1)</u> or <u>Generator Replacement (LY7)</u>. - Install the drive belt. Refer to <u>Drive Belt Replacement</u> in Engine Mechanical - 3.4L. - Start the engine. Has the noise decreased or stopped?	System OK	Go to Step 6
6	Inspect the generator for the following conditions: - 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	- Reroute the electrical connections to relieve the tension. - Reroute the hoses, etc. away from the generator. - 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 in Engine Mechanical - 3.4L. Is the drive belt loose?	Go to Step 9	Go to Step 10
	Replace the drive belt tensioner. Refer to <u>Drive Belt Tensioner Replacement</u> in		

Step	Action	Yes	No
9	Test the generator for proper operation using the test light. 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 <u>Generator Replacement (LA1)</u> or <u>Generator Replacement (LY7)</u> . Has the noise decreased or stopped?	Go to Step 12	-
12	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 2

STARTER SOLENOID DOES NOT CLICK

Starter Solenoid Does Not Click

Step	Action	Yes	No
Schematic Reference: <u>Starting and Charging Schematics</u> Connector End View Reference: <u>Master Electrical Component List</u> in Wiring Systems			
1	Did you perform the Engine Electrical Diagnostic System Check?	Go to Step 2	Go to <u>Diagnostic System Check - Engine Electrical</u>
2	Turn the ignition switch to the START position. Does the engine crank?	Go to <u>Testing for Intermittent Conditions and Poor Connections</u> in Wiring Systems	Go to Step 3
	IMPORTANT: A flashing or illuminated security lamp indicates a theft deterrent malfunction. A theft	Go to <u>Diagnostic</u>	

3	deterrent malfunction may disable starter operation. Is the security lamp flashing?	<u>System Check - Theft Deterrent</u> in Theft Deterrent	Go to Step 4
4	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, observe the Crank Request Signal parameter in the powertrain control module (PCM) data list. 4. Turn the ignition switch to the START position. Does the scan tool display Yes?	Go to Step 5	Go to Step 14
5	Turn the ignition switch to the START position. Does the Starter relay click?	Go to Step 6	Go to Step 9
6	1. Turn OFF the ignition. 2. Disconnect the Starter relay. 3. Connect a test lamp between the battery positive voltage circuit of the Starter relay switch circuit and a good ground. Does the test lamp illuminate?	Go to Step 7	Go to Step 25
7	Connect a 30-amp fused jumper between the battery positive voltage circuit of the Starter relay switch circuit and the supply voltage circuit of the starter solenoid. Does the engine crank?	Go to Step 19	Go to Step 8
8	Does the fuse in the jumper open?	Go to Step 15	Go to Step 16
9	1. Turn OFF the ignition. 2. Disconnect the Starter relay. 3. Turn ON the ignition, with the engine OFF. 4. Connect a test lamp between the battery positive voltage circuit of the Starter relay coil and a good ground.		

	Does the test lamp illuminate?	Go to Step 10	Go to Step 12
10	1. Connect a test lamp between the battery positive voltage circuit of the Starter relay coil and the control circuit of the Starter relay. 2. Turn the ignition ON, with the engine OFF.		
	Does the test lamp illuminate?	Go to Step 26	Go to Step 11
11	Turn the ignition to the START position. Does the test lamp illuminate?	Go to Step 19	Go to Step 17
12	1. Turn OFF the ignition. 2. Disconnect the park neutral position (PNP) switch. 3. Connect a 3-amp fused jumper between the PNP switch signal circuit and the ignition 1 voltage circuit of the PNP switch. 4. Turn ON the ignition, with the engine OFF.		
	Does the test lamp illuminate?	Go to Step 20	Go to Step 13
13	Connect a test lamp between the ignition 1 voltage circuit of the PNP switch and a good ground. Does the test lamp illuminate?	Go to Step 27	Go to Step 28
14	1. Turn OFF the ignition. 2. Disconnect the PCM. 3. Connect a test lamp between the crank request signal circuit of the PCM and a good ground. 4. Turn the ignition to the start position		
	Does the test lamp illuminate?	Go to Step 22	Go to Step 18
15	Test the supply voltage circuit of the starter solenoid for a short to ground. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 34	Go to Step 23
	Test the supply voltage circuit of the starter		

Step	Action	Yes	No
16	Inspect for a high resistance or open. Refer to <u>Circuit Testing and Wiring Repairs</u> in Wiring Systems. Schematic Reference: Master Electrical Component List in Wiring Systems. Did you find and correct the condition?	Go to Step 34	Go to Step 23
17	Test the control circuit of the Starter relay for a high resistance or open. Refer to <u>Circuit Testing and Wiring Repairs</u> in Wiring Systems. Did you find and correct the condition?	Go to Step 2	Go to Diagnostic System Check - Engine Electrical
18	Turn the ignition switch to the START position. Test the crank request circuit of the PCM for a high resistance or open. Refer to <u>Circuit Testing and Wiring Repairs</u> in Wiring Systems. Did you find and correct the condition?	Go to Step 34	Go to Step 22
19	IMPORTANT: Poor connections at the Starter relay, or a malfunctioning security lamp, indicates a <u>Condition and Poor Connections and Connector Repairs</u> in Wiring Systems. Did you find and correct the condition? Is the security lamp flashing?	Go to Diagnostic System Check - Theft Deterrent in Theft Deterrent	Go to Step 29
20	Inspect the PNP switch for proper operation. Install a scan tool. Did you find and correct the condition?	Go to Step 34	Go to Step 21
21	Turn ON the ignition, with the engine OFF. Inspect for poor connection at the PNP switch. Refer to <u>Testing for Intermittent Conditions and Poor Connections and Connector Repairs</u> in Wiring Systems. With a scan tool, observe the crank request signal parameter in the powertrain (PCM) data. Did you find and correct the condition?	Go to Step 34	Go to Step 30
22	Inspect for poor connections at the PCM. Turn the ignition switch to the START position. Refer to <u>Testing for Intermittent Conditions and Poor Connections and Connector Repairs</u> in Wiring Systems. Did you find and correct the condition?	Go to Step 5	Go to Step 1
23	Turn the ignition switch to the START position. Inspect for poor connections at the starter solenoid. Refer to <u>Testing for Intermittent Conditions and Poor Connections and Connector Repairs</u> in Wiring Systems. Did you find and correct the condition?	Go to Step 34	Go to Step 32
24	Inspect for poor connections at the ignition switch. Refer to <u>Testing for Intermittent Conditions and Poor Connections and Connector Repairs</u> in Wiring Systems.		

5	Did you find and correct the condition?	Go to Step 34	Go to Step 33
	Does the Starter relay click?	Go to Step 6	Go to Step 9
25	Repair the high resistance or open in the battery positive voltage circuit of the Starter relay switch. Refer to Wiring Repairs in Wiring Systems.		
6	2. Disconnect the Starter relay. 3. Connect a test lamp between the battery positive voltage circuit of the Starter relay switch circuit and a good ground.	Go to Step 34	-
26	Did you complete the repair?	Go to Step 7	Go to Step 2
	Repair the short to ground in the control circuit of the Starter relay. Refer to Wiring Repairs in Wiring Systems.	Go to Step 34	-
	Does the test lamp illuminate?		
	Did you complete the repair?		
7	Connect a 30 amp fused jumper between the battery positive voltage circuit of the Starter relay switch circuit and the supply voltage circuit of the starter solenoid. Refer to Wiring Repairs in Wiring Systems.		
27	Does the engine crank?	Go to Step 19	Go to Step 8
	Did you complete the repair?	Go to Step 34	
8	Does the fuse in the jumper open?	Go to Step 15	Go to Step 1
	Repair the high resistance or open in the ignition circuit of the PNP switch. Refer to Wiring Repairs in Wiring Systems.		
28	1. Turn OFF the ignition. 3. Turn ON the ignition, with the engine OFF.	Go to Step 34	-
29	Replace the Starter relay.		
	Did you complete the replacement?	Go to Step 34	-
30	4. Connect a test lamp between the battery positive voltage circuit of the Starter relay and a good ground.	Go to Step 34	-
	Did you complete the replacement?		
	IMPORTANT: Does the test lamp illuminate?	Go to Step 10	Go to Step 1
	Perform the set up procedures for the PCM.		
31	1. Connect a test lamp between the battery positive voltage circuit of the Starter relay coil and the control circuit of the Starter relay. 3.4L.		
10	Did you complete the replacement?	Go to Step 34	-
	2. Turn the ignition ON, with the engine OFF.		
32	Replace the starter motor. Refer to Starter Motor Replacement (LA1) or Starter Motor Replacement (LY7) .	Go to Step 26	Go to Step 1
	Did you complete the replacement?	Go to Step 34	-
11	Turn the ignition to the START position.	Go to Step 19	Go to Step 1
	Does the test lamp illuminate?		
33	1. Turn OFF the ignition. 2. Disconnect the park neutral position.	Go to Step 34	-
	Did you complete the replacement?		
34	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

Test Description

The steps below refer to the test steps in the diagnostic table.

3: Inspect the engine for mechanical failure, or the binding of driven components including driveline related components.

Starter Solenoid Clicks, Engine Does Not Crank

Step	Action	Yes	No
Connector End View Reference: <u>Engine Electrical Connector End Views</u>			
1	Did you perform the Engine Electrical Diagnostic System Check?	Go to Step 2	Go to <u>Diagnostic System Check - Engine Electrical</u>
2	Turn the ignition to the START position. Does the starter solenoid click only one time?	Go to Step 3	Go to <u>Starter Solenoid Does Not Click</u>
3	Inspect the engine and the belt drive system for mechanical binding (seized engine, seized generator). Does the engine move freely?	Go to Step 4	Go to <u>Engine Will Not Crank - Crankshaft Will Not Rotate</u> in Engine Mechanical - 3.4L
4	Test the battery positive voltage circuit between the battery and the starter motor for an open or high resistance. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> in Wiring Systems. 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 an open or high resistance. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> in Wiring Systems. Did you find and correct the condition?	Go to Step 8	Go to Step 6
	Inspect for poor connections at the starter. Refer to <u>Testing for Intermittent Conditions</u>		

6	<u>and Poor Connections</u> and <u>Connector Repairs</u> in Wiring Systems. Did you find and correct the condition?	Go to Step 8	Go to Step 7
7	Replace the starter motor. Refer to <u>Starter Motor Replacement (LA1)</u> or <u>Starter Motor Replacement (LY7)</u> . 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

ENGINE CRANKS SLOWLY

Inspect the following items:

- Battery - Perform the Battery Inspection/Test. Refer to **Battery Inspection/Test**.
- Wiring - Inspect the wiring for damage. Inspect all connections to the starter motor, the solenoid, the battery, and all ground connections. Refer to **Circuit Testing**, **Wiring Repairs**, **Testing for Intermittent Conditions and Poor Connections**, and **Connector Repairs** in Wiring Systems.
- 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 (LA1)** or **Starter Motor Replacement (LY7)**.

STARTER MOTOR NOISE DIAGNOSIS

Diagnostic Aids

- Inspect the flywheel ring gear for damage or unusual wear.
- Shim the starter as required.
- In order to add pinion to ring gear clearance a full size shim must be used. Do not shim only one starter mounting bolt. There are three shims available in different shapes, for clearance, all are 1 mm (0.039 in.) thick.

Starter Motor Noise Diagnosis

Step	Action	Yes	No
1	Did you perform the Engine Electrical Diagnostic System Check?	Go to Step 2	Go to <u>Diagnostic System Check - Engine Electrical</u>

2	Start the engine. Does the starter operate normally?	Go to Testing for Intermittent Conditions and Poor Connections in Wiring Systems	Go to Step 3
3	Start the engine while listening to the starter motor turn. Is there a loud "whoop" (it 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 9	Go to Step 10
7	1. Remove the starter motor. Refer to Starter Motor Replacement (LA1) or Starter Motor Replacement (LY7). 2. Inspect the starter motor bushings and clutch gear. Does the clutch gear have chipped or milled teeth or worn bushings?	Go to Step 10	Go to Step 9

8	1. Shim the starter motor away from the flywheel by adding shims between the starter motor and the engine block one at a time. 2. Flywheel runout may make this noise appear to be intermittent.		
	Did you complete the repair?	Go to Step 11	-
9	Replace the flywheel. Refer to <u>Engine Flywheel Replacement</u> in Engine Mechanical - 3.4L. Did you complete the replacement?	Go to Step 11	-
10	Replace the starter motor. Refer to <u>Starter Motor Replacement (LA1)</u> or <u>Starter Motor Replacement (LY7)</u> . Did you complete the replacement?	Go to Step 11	-
11	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 DISCONNECT/CONNECT PROCEDURE (LA1)

Removal Procedure

CAUTION: Refer to Battery Disconnect Caution in Cautions and Notices.

1. Record all of the customer's radio station presets.
2. Turn off all the lamps and accessories.
3. Turn the ignition OFF.

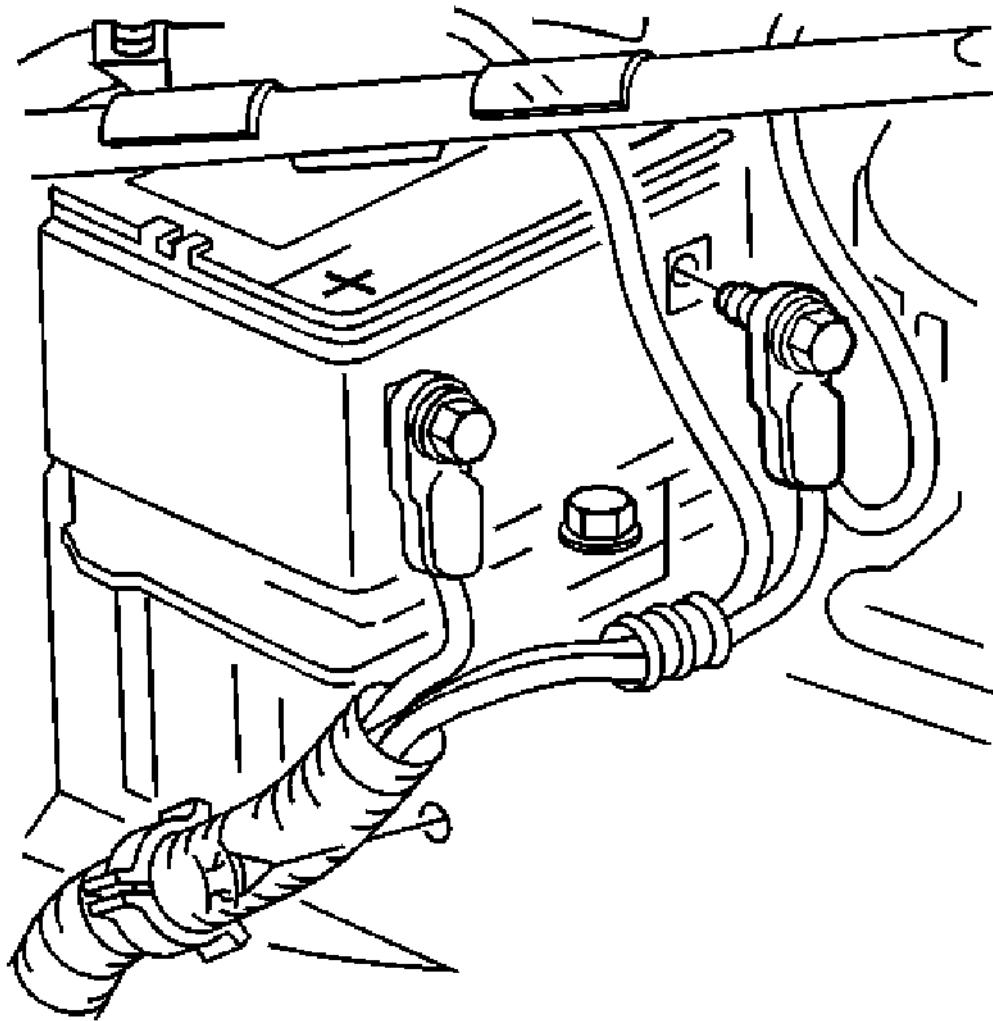


Fig. 7: View Of Battery Ground (Negative) Cable And Bolt
Courtesy of GENERAL MOTORS CORP.

4. Remove the battery ground (negative) cable and bolt from the battery.

Installation Procedure

NOTE: Refer to Fastener Notice in Cautions and Notices.

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

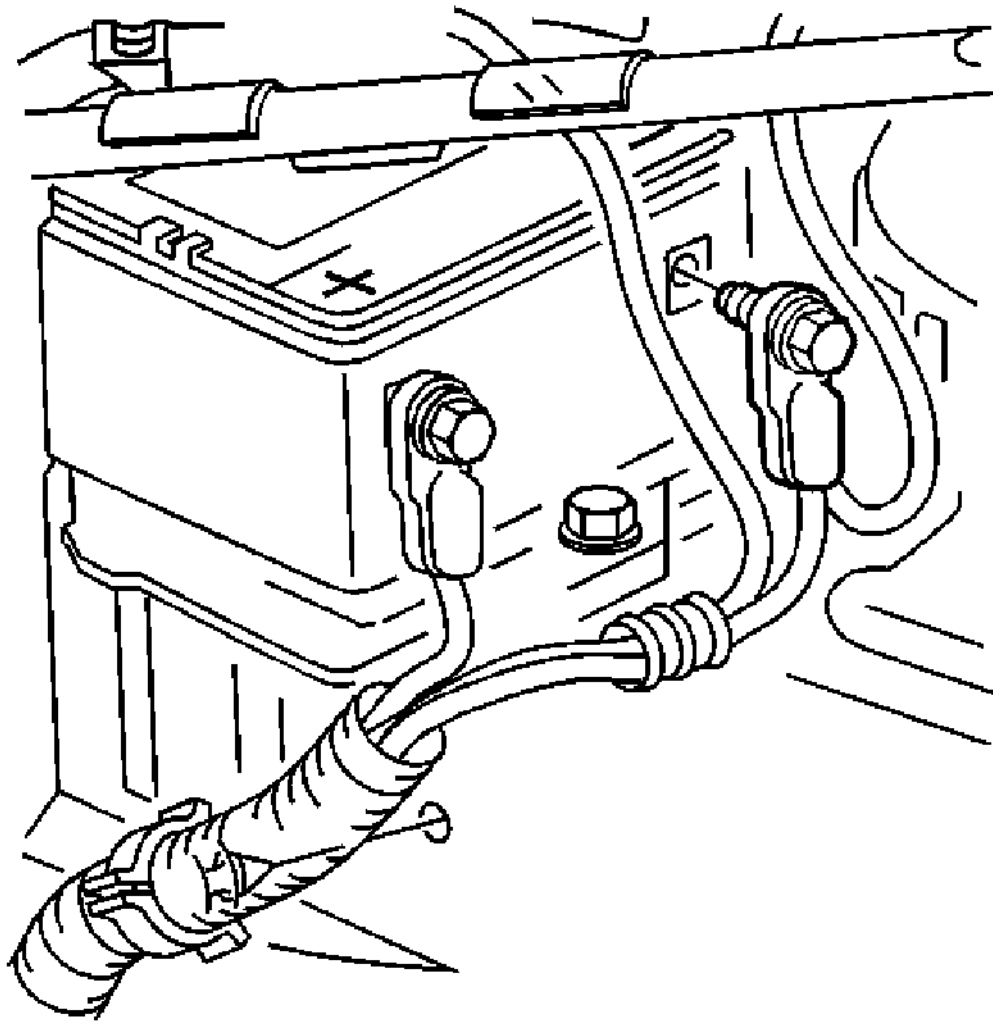


Fig. 8: View Of Battery Ground (Negative) Cable And Bolt
Courtesy of GENERAL MOTORS CORP.

1. Install the battery ground (negative) cable and bolt to the battery.

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

2. Program all of the customer's radio station presets and set the radio clock to the current time.

BATTERY NEGATIVE CABLE DISCONNECT/CONNECT PROCEDURE (LY7)

Removal Procedure

CAUTION: Refer to Battery Disconnect Caution in Cautions and Notices.

1. Record all of the customer's radio station presets.
2. Turn off all the lamps and accessories.
3. Turn the ignition OFF.

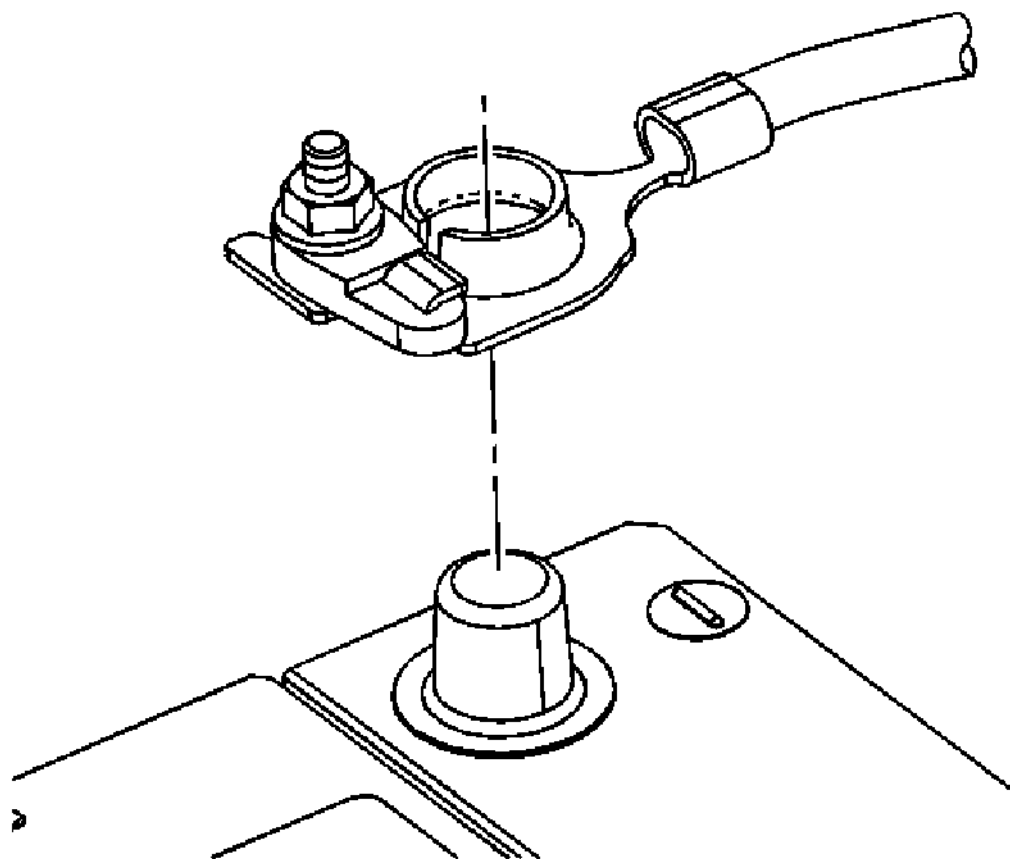


Fig. 9: Identifying Battery Ground (Negative) Cable Terminal
Courtesy of GENERAL MOTORS CORP.

4. Loosen the battery ground (negative) cable terminal nut.
5. Remove the battery negative cable from the battery.

Installation Procedure

NOTE: Refer to Fastener Notice in Cautions and Notices.

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

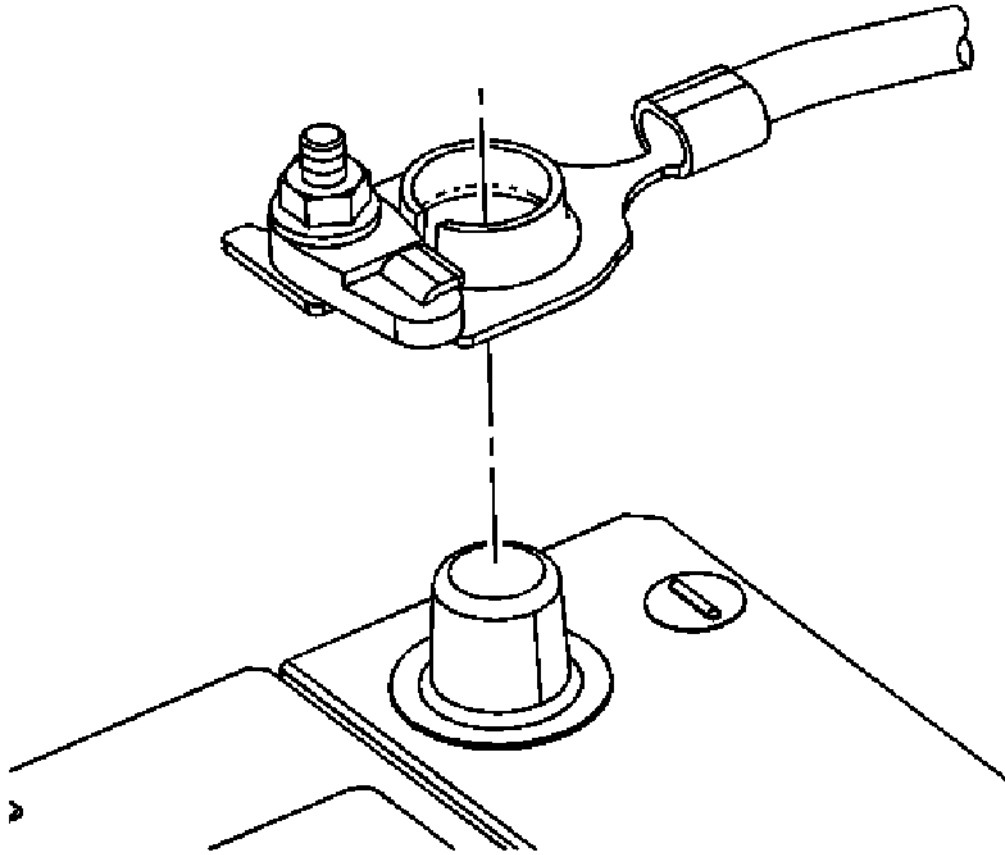


Fig. 10: Identifying Battery Ground (Negative) Cable Terminal
Courtesy of GENERAL MOTORS CORP.

1. Install the battery ground (negative) cable to the battery.

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

2. Program all of the customer's radio station presets and set the radio clock to the current time.

BATTERY NEGATIVE CABLE REPLACEMENT (LA1)

Removal Procedure

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

1. Remove the battery ground (negative) cable from the battery. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable Disconnect/Connect Procedure (LY7)**.

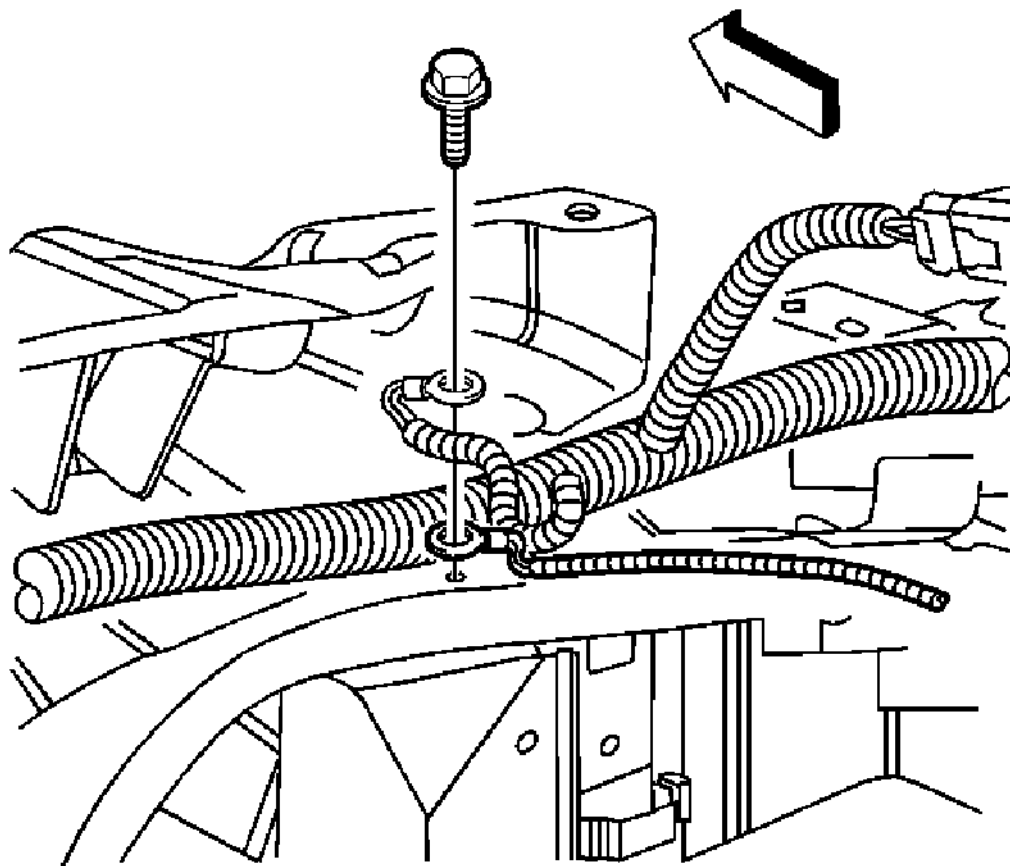


Fig. 11: Locating Battery Ground (Negative) Cable Bolt
Courtesy of GENERAL MOTORS CORP.

2. Remove the battery ground (negative) cable bolt from the core support.
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
4. Remove the lower radiator baffle. Refer to **Radiator Air Baffle Assemblies and Deflectors** in Engine Cooling.
5. Remove the battery cable conduit from the conduit retainers.

6. Remove the battery cable from the conduit.

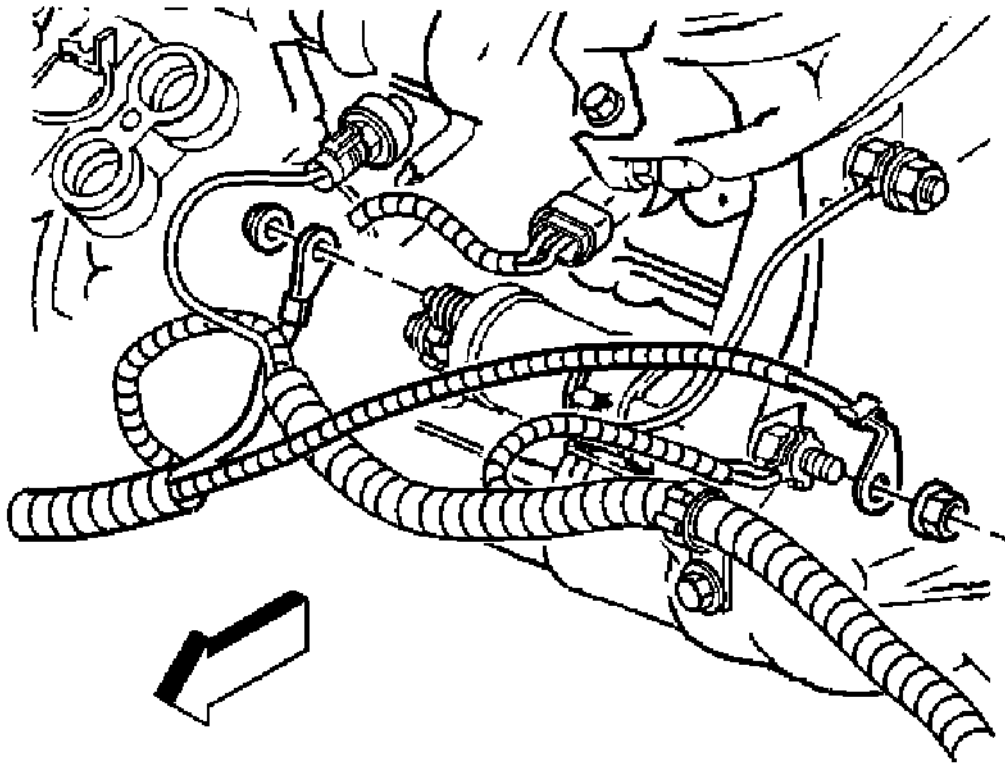


Fig. 12: View Of Battery Ground (Negative) Cable Nut & Cable From Transaxle Stud

Courtesy of GENERAL MOTORS CORP.

7. Remove the battery ground (negative) cable nut and cable from the transaxle stud.
8. Lower the vehicle.
9. Remove the battery ground (negative) cable from the vehicle.

Installation Procedure

1. Install the battery ground (negative) cable to the vehicle.
2. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

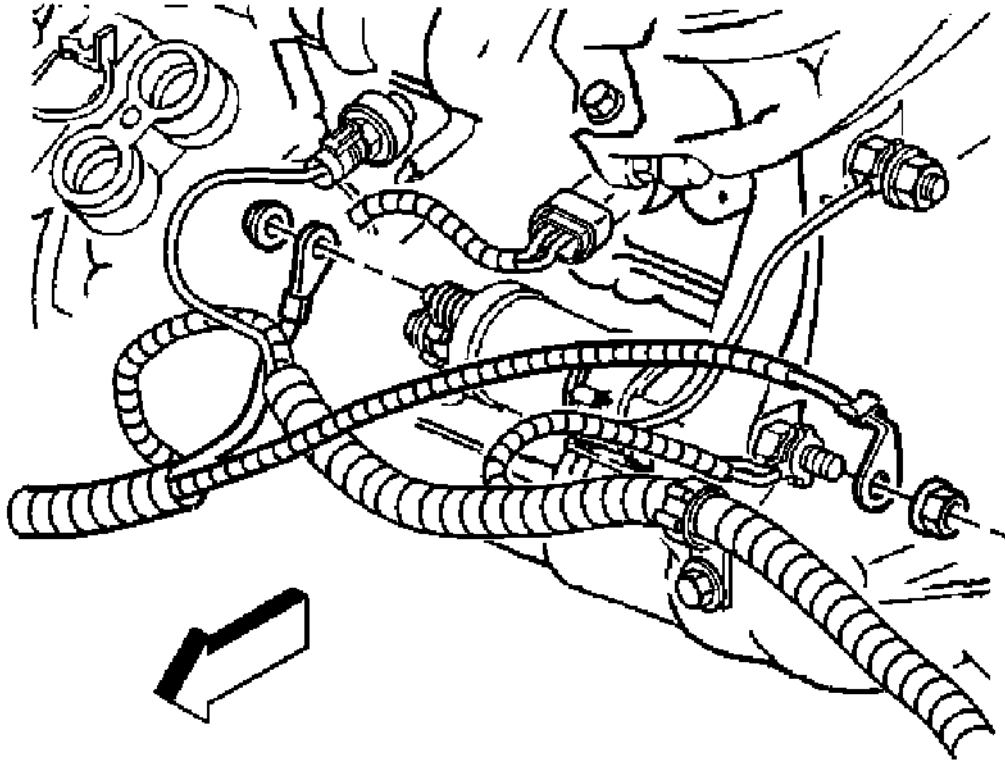


Fig. 13: View Of Battery Ground (Negative) Cable Nut & Cable From Transaxle Stud

Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the battery ground (negative) cable and nut to the transaxle stud.

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

4. Install the battery cable to the conduit.
5. Install the battery cable conduit to the conduit retainers.
6. Install the lower radiator baffle. Refer to Radiator Air Baffle Assemblies and Deflectors in Engine Cooling.
7. Lower the vehicle.

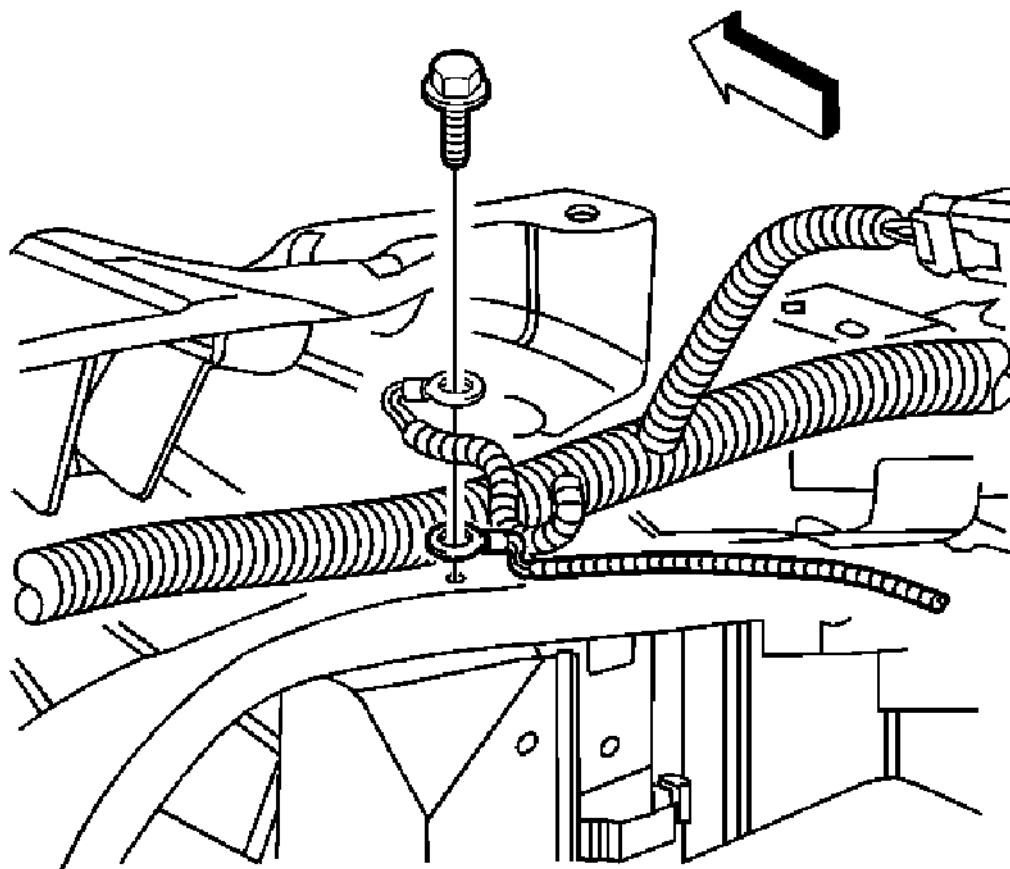


Fig. 14: Locating Battery Ground (Negative) Cable Bolt
Courtesy of GENERAL MOTORS CORP.

8. Install the battery ground (negative) cable and bolt to the inner fender.

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

9. Install the battery ground (negative) cable to the battery. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable Disconnect/Connect Procedure (LY7)**.

BATTERY NEGATIVE CABLE REPLACEMENT (LY7)

Removal Procedure

1. Remove the battery ground (negative) cable from the battery. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable**

Disconnect/Connect Procedure (LY7).

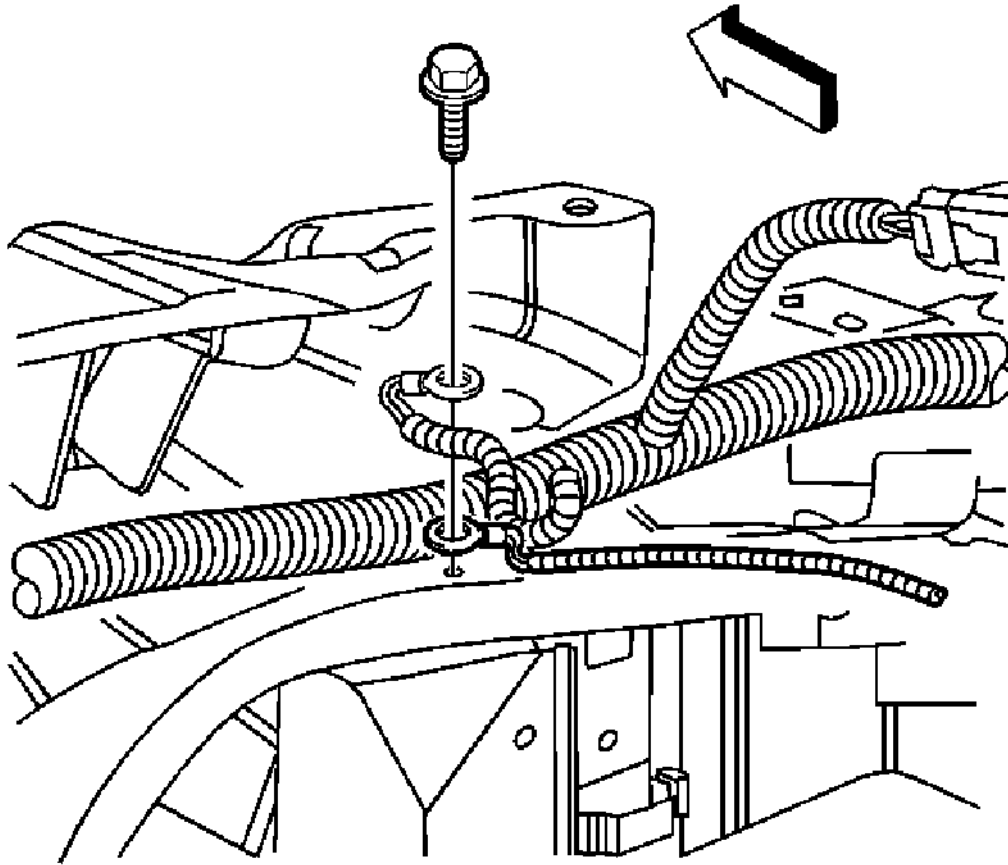


Fig. 15: Locating Battery Ground (Negative) Cable Bolt
Courtesy of GENERAL MOTORS CORP.

2. Remove the battery ground (negative) cable bolt from the core support.
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
4. Remove the lower radiator baffle. Refer to **Radiator Air Baffle Assemblies and Deflectors** in Engine Cooling.
5. Remove the battery cable conduit from the conduit retainers.
6. Remove the battery cable from the conduit.

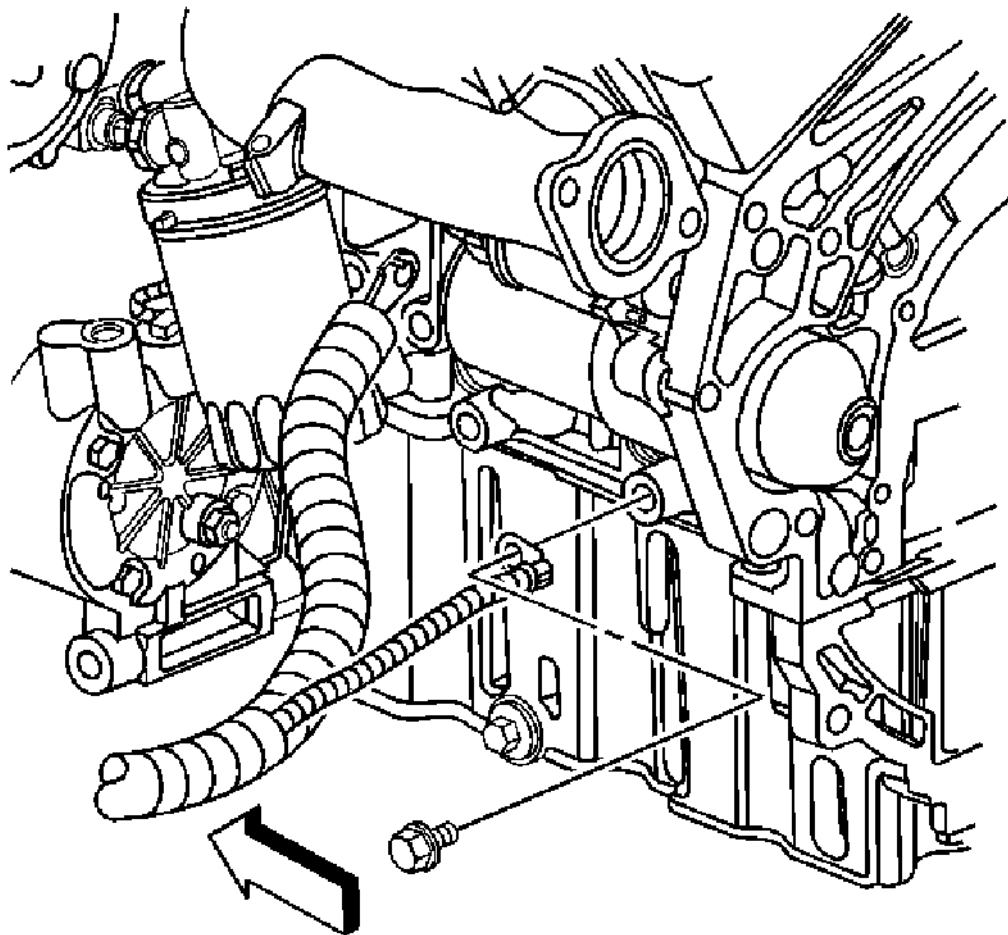


Fig. 16: Locating Battery Ground (Negative) Cable Bolt & Cable At Engine Block
Courtesy of GENERAL MOTORS CORP.

7. Remove the battery ground (negative) cable bolt and cable from the engine block.
8. Lower the vehicle.
9. Remove the battery ground (negative) cable from the vehicle.

Installation Procedure

1. Install the battery ground (negative) cable to the vehicle.
2. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

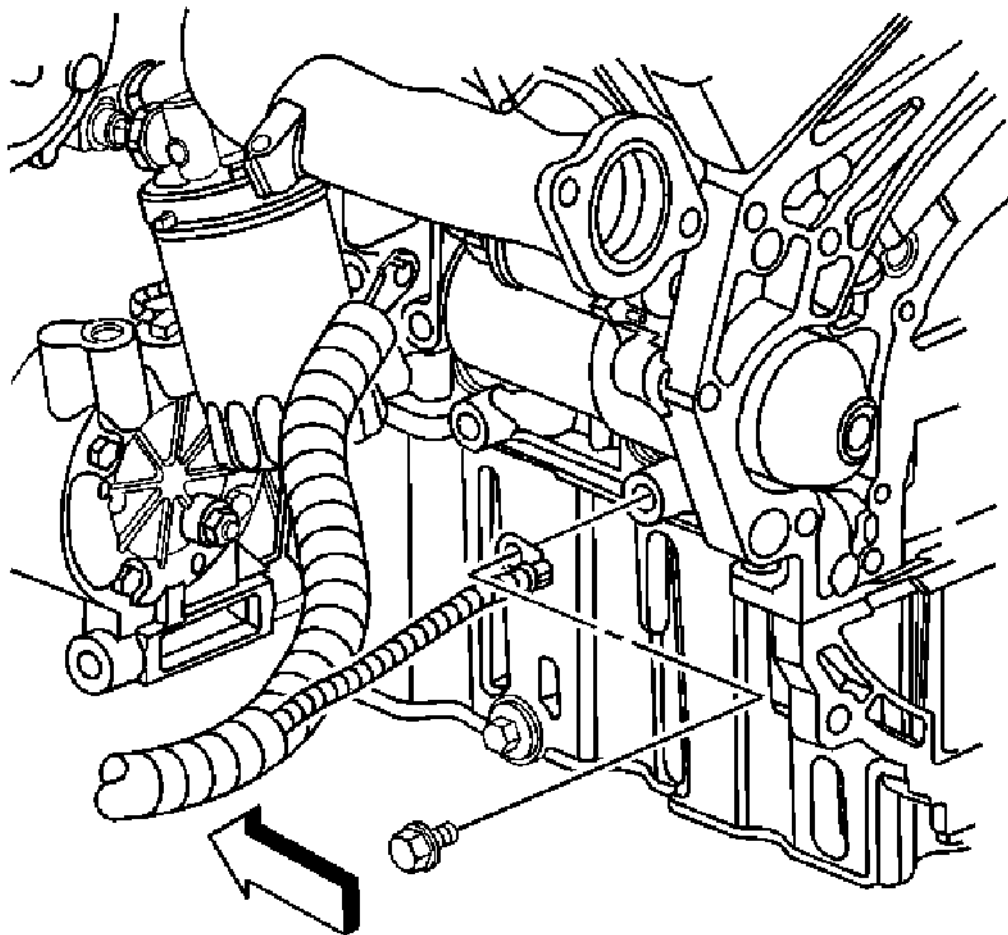


Fig. 17: Locating Battery Ground (Negative) Cable Bolt & Cable At Engine Block
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the battery ground (negative) cable and bolt to the engine block.

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

4. Install the battery cable to the conduit.
5. Install the battery cable conduit to the conduit retainers.
6. Install the lower radiator baffle. Refer to Radiator Air Baffle Assemblies and Deflectors in Engine Cooling.
7. Lower the vehicle.

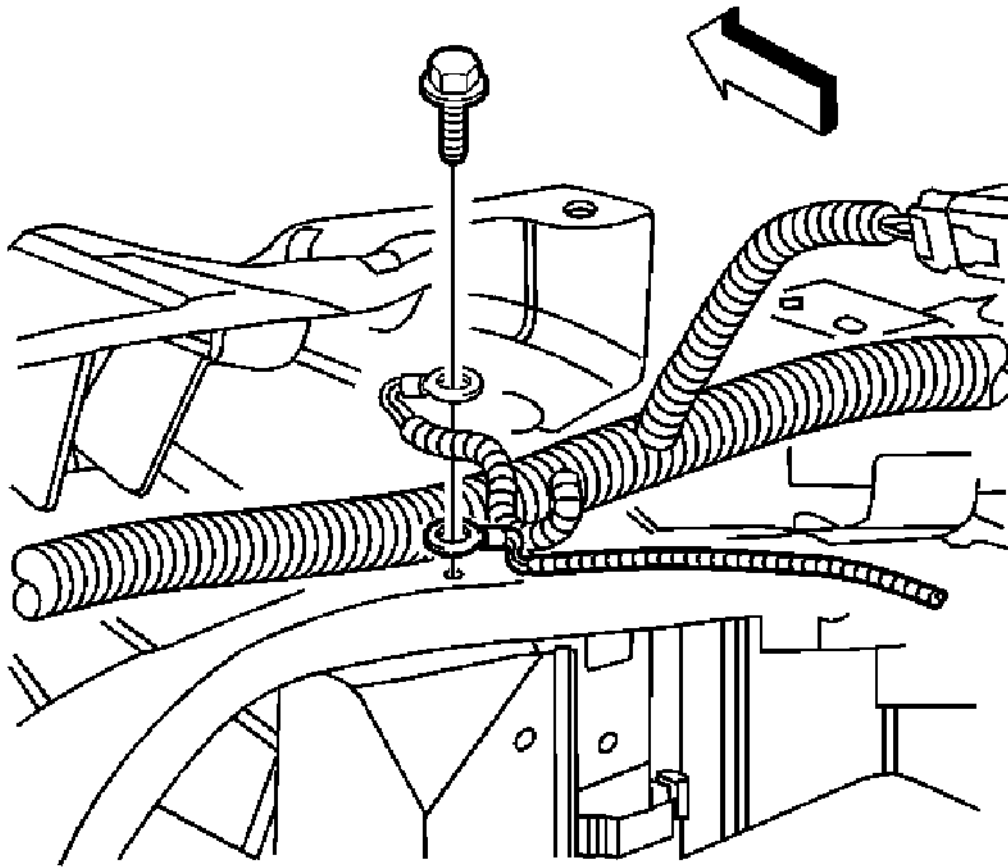


Fig. 18: Locating Battery Ground (Negative) Cable Bolt
Courtesy of GENERAL MOTORS CORP.

8. Install the battery ground (negative) cable and bolt to the core support.

Tighten: Tighten the battery ground (negative) cable at core support bolt to 5 N.m (44 lb in).

9. Install the battery ground (negative) cable to the battery. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable Disconnect/Connect Procedure (LY7)**.

BATTERY POSITIVE CABLE REPLACEMENT (LA1)

Removal Procedure

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

1. Remove the battery ground (negative) cable from the battery. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable Disconnect/Connect Procedure (LY7)**.

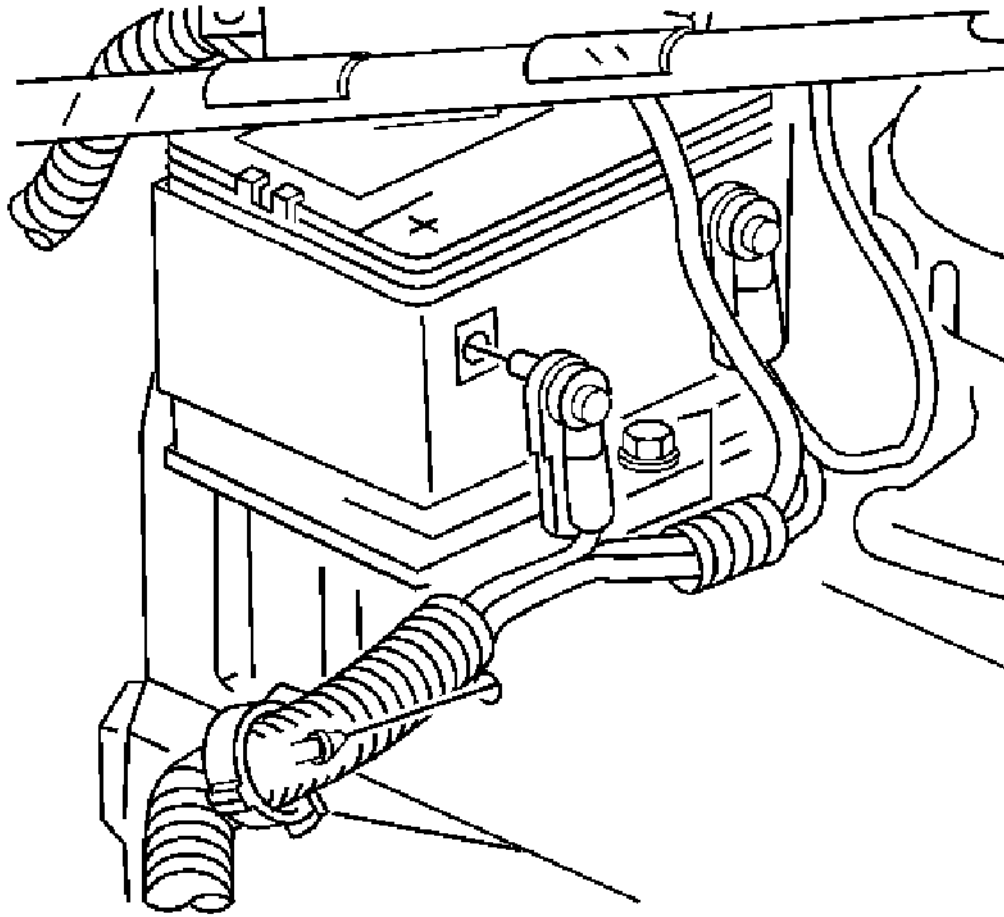


Fig. 19: Identifying Battery Positive Cable
Courtesy of GENERAL MOTORS CORP.

2. Remove the battery positive cable from the battery.

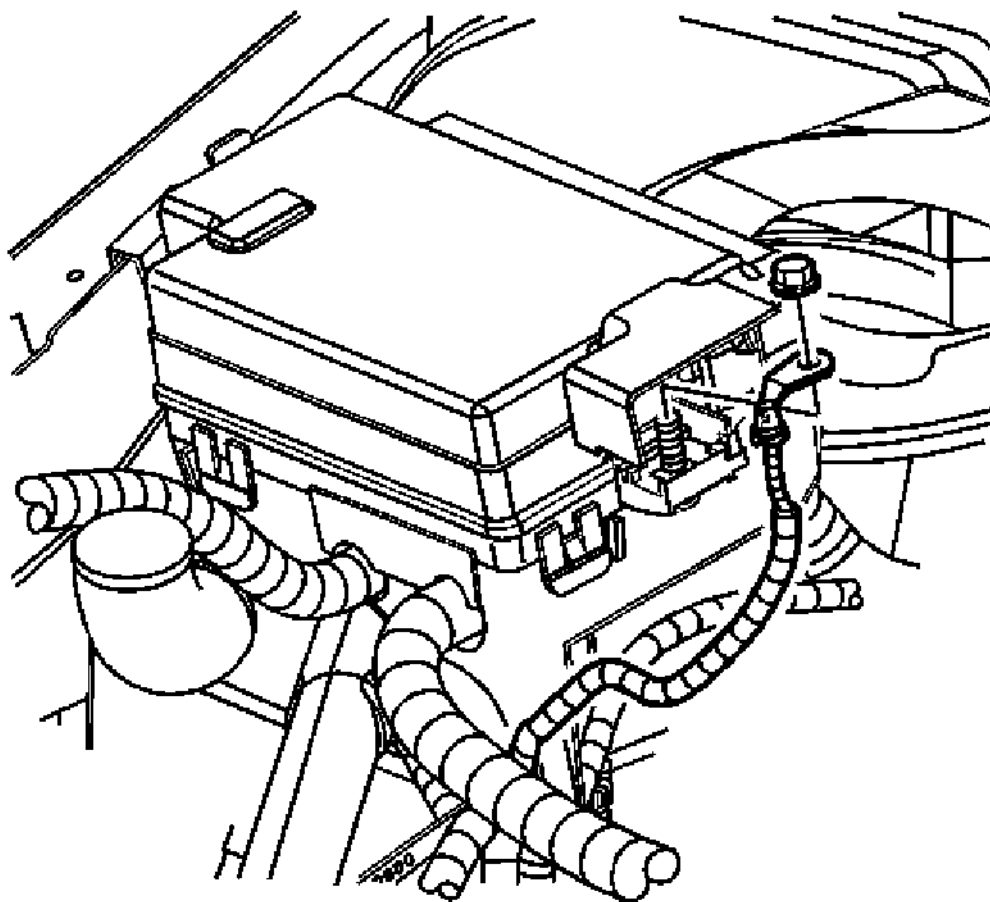


Fig. 20: Locating Battery Positive Cable Nut & Cable
Courtesy of GENERAL MOTORS CORP.

3. Remove the battery positive cable nut and cable from the underhood electrical center.
4. Remove the battery positive cable nut and cable from the generator.
5. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
6. Remove the lower radiator baffle. Refer to **Radiator Air Baffle Assemblies and Deflectors** in Engine Cooling.
7. Remove the battery cable conduit from the conduit retainers.

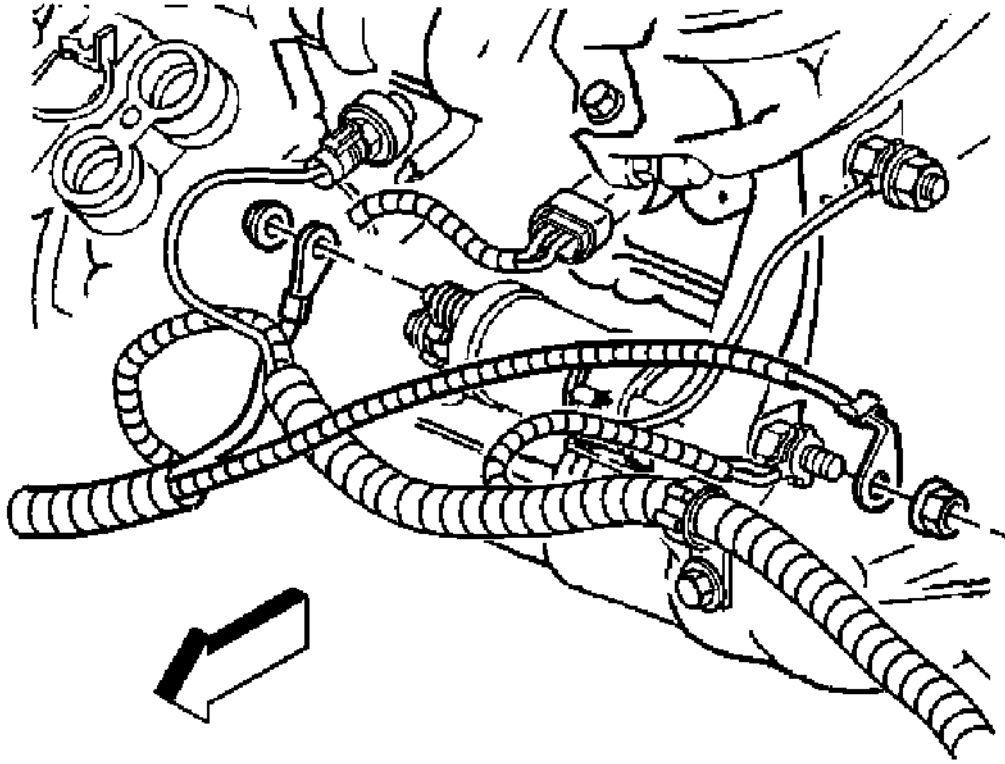


Fig. 21: View Of Battery Ground (Negative) Cable Nut & Cable From Transaxle Stud

Courtesy of GENERAL MOTORS CORP.

8. Remove the starter motor BAT terminal nut from the starter motor.
9. Remove the battery positive cable from the starter motor BAT terminal.
10. Lower the vehicle.
11. Remove the battery positive cable from the vehicle.

Installation Procedure

1. Install the battery positive cable to the vehicle.
2. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

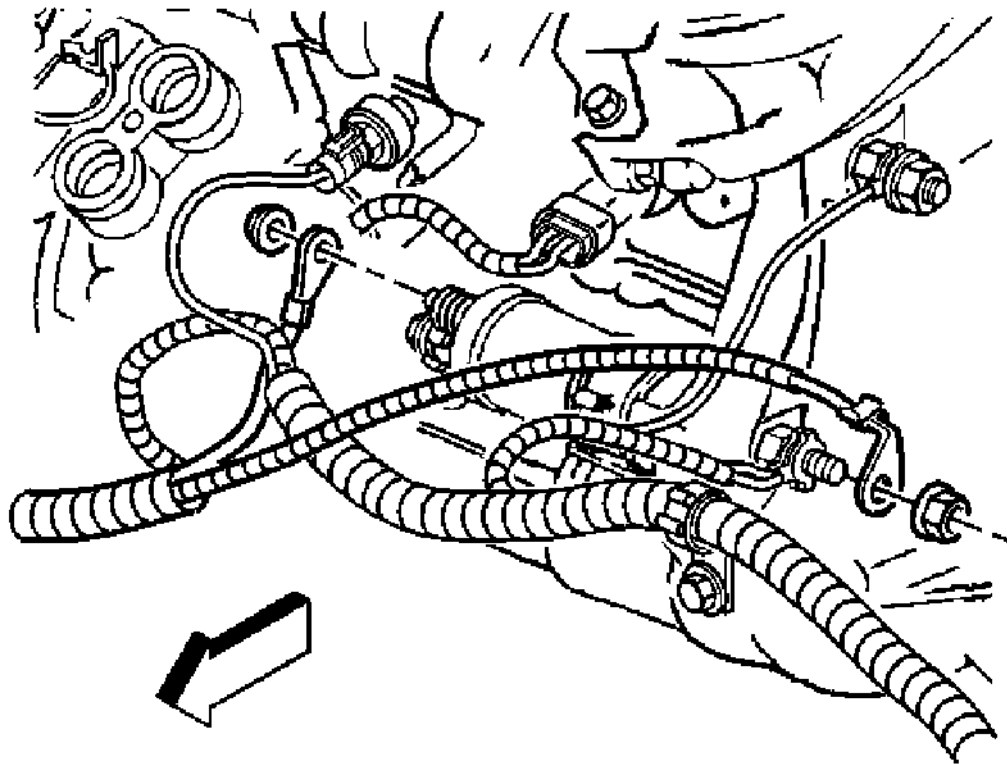


Fig. 22: View Of Battery Ground (Negative) Cable Nut & Cable From Transaxle Stud

Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the battery positive cable and nut to the starter motor BAT terminal.

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

4. Install the battery positive cable to the conduit.
5. Install the battery cable conduit to the conduit retainers.
6. Install the lower radiator baffle. Refer to **Radiator Air Baffle Assemblies and Deflectors** in Engine Cooling.
7. Lower the vehicle.
8. Connect the battery positive cable to the generator. Refer to **Generator Replacement (LA1)** or **Generator Replacement (LY7)**.

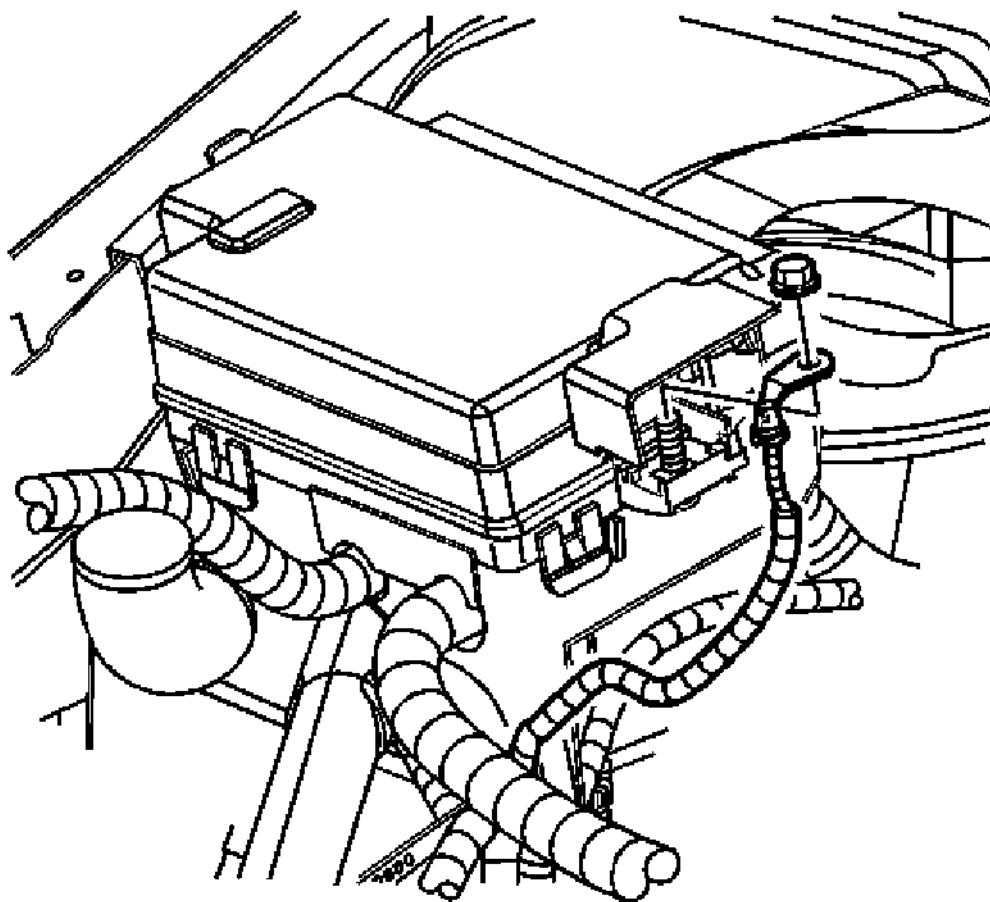


Fig. 23: Locating Battery Positive Cable Nut & Cable
Courtesy of GENERAL MOTORS CORP.

9. Install the battery positive cable and nut to the underhood electrical center.

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

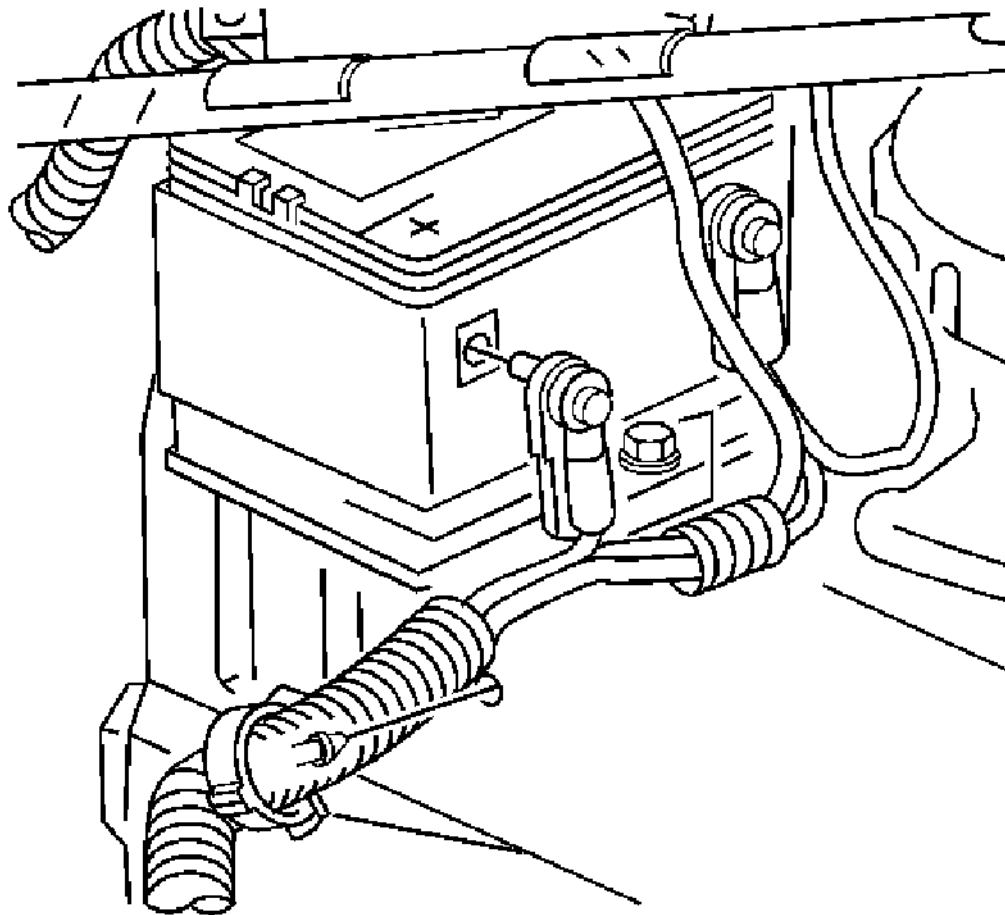


Fig. 24: Identifying Battery Positive Cable
Courtesy of GENERAL MOTORS CORP.

10. Install the battery positive cable and bolt to the battery.

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

11. Install the battery ground (negative) cable to the battery. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable Disconnect/Connect Procedure (LY7)**.

BATTERY POSITIVE CABLE REPLACEMENT (LY7)

Removal Procedure

When replacing battery cables, be sure to use replacement cables that are the same type, gage

and length.

1. Remove the battery ground (negative) cable from the battery. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable Disconnect/Connect Procedure (LY7)**.

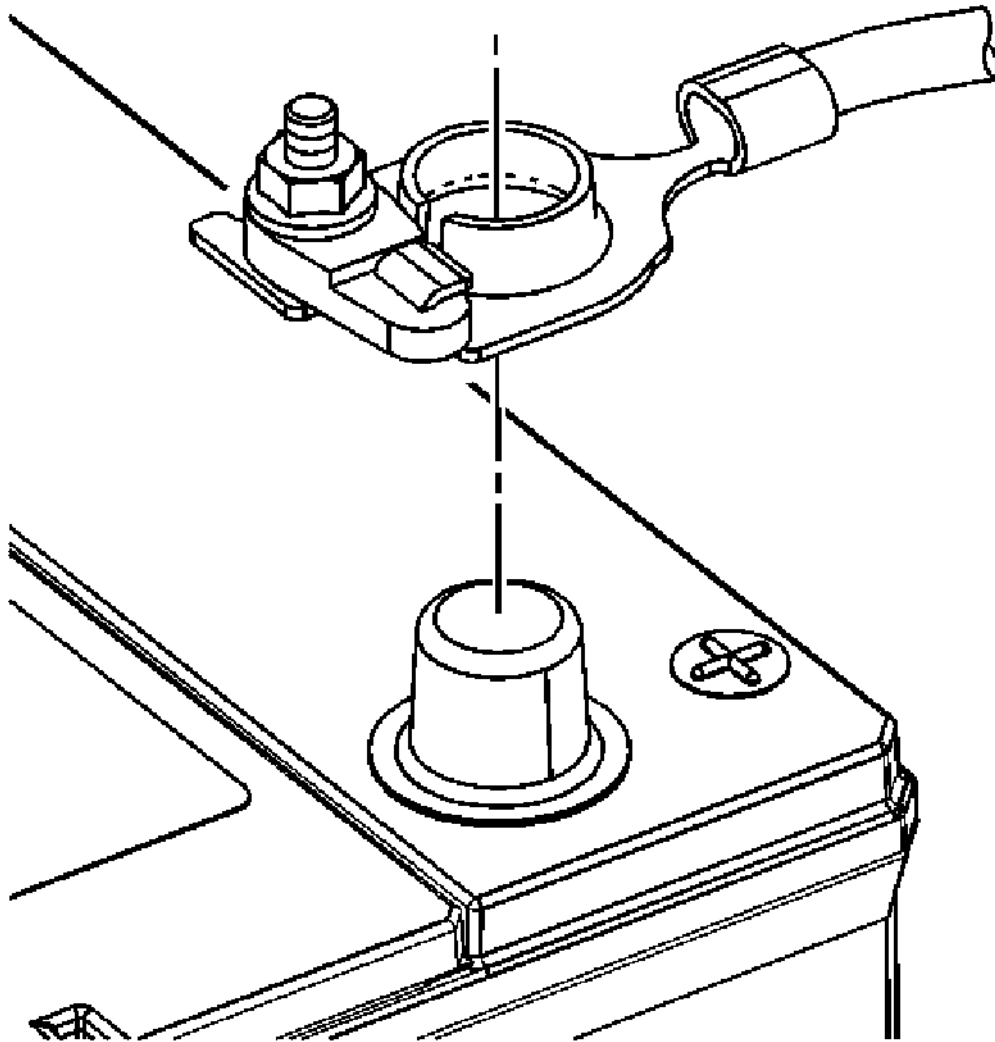


Fig. 25: View Of Battery Positive Cable
Courtesy of GENERAL MOTORS CORP.

2. Loosen the battery terminal nut.
3. Remove the battery positive cable from the battery.

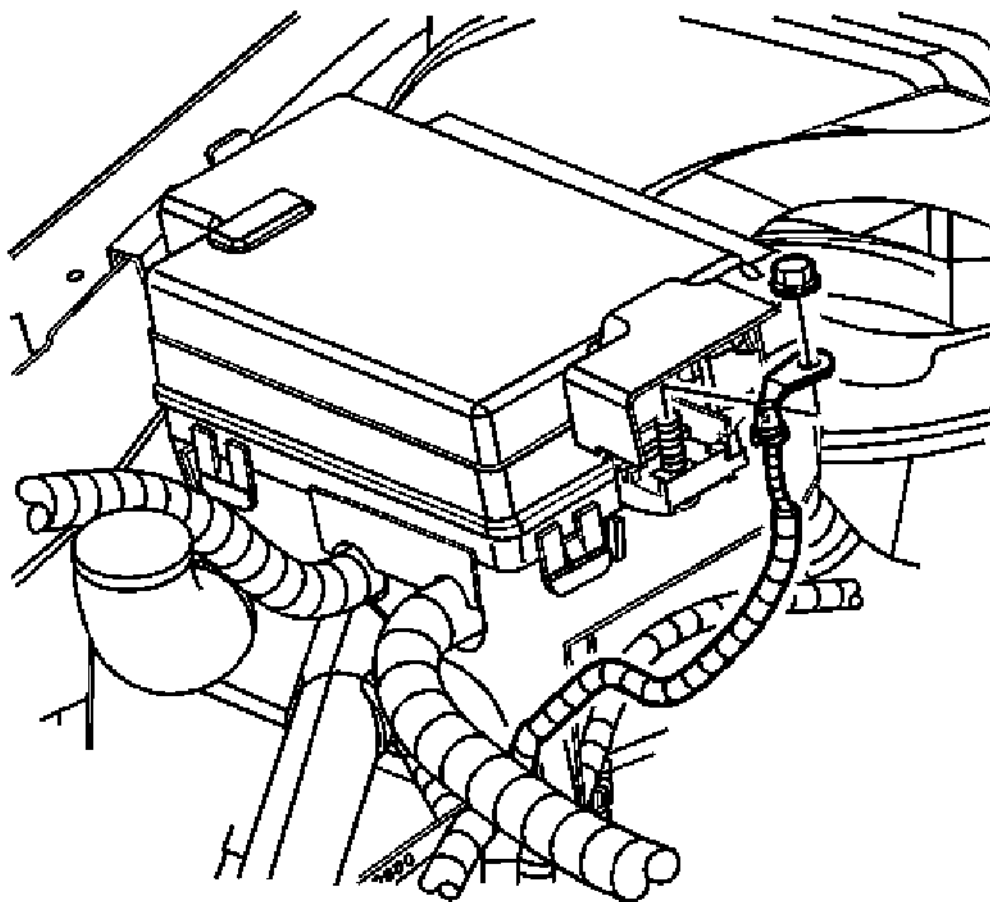


Fig. 26: Locating Battery Positive Cable Nut & Cable
Courtesy of GENERAL MOTORS CORP.

4. Remove the battery positive cable nut and cable from the underhood electrical center.

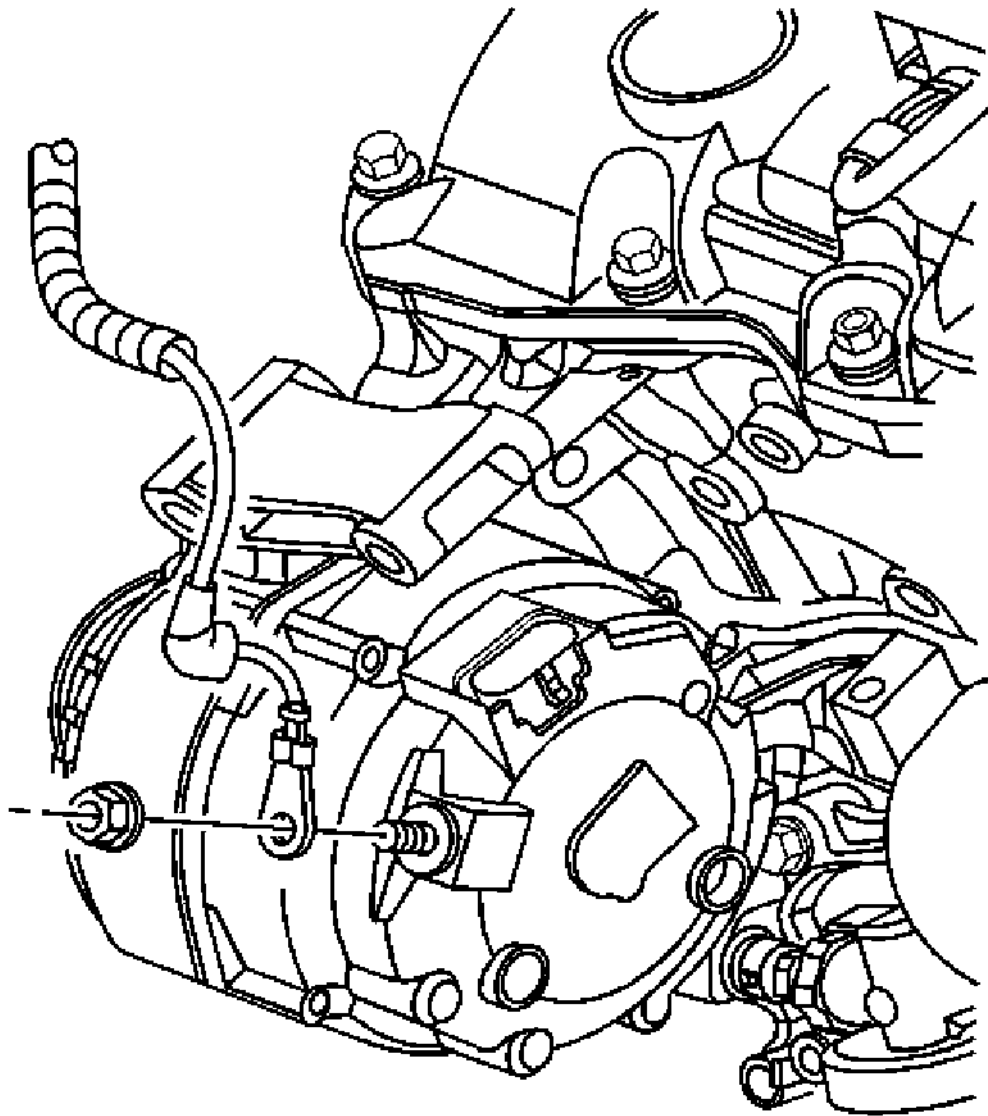


Fig. 27: Identifying Battery Positive Cable Nut And Cable At The Generator
Courtesy of GENERAL MOTORS CORP.

5. Remove the battery positive cable nut and cable from the generator.
6. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
7. Remove the lower radiator baffle. Refer to **Radiator Air Baffle Assemblies and Deflectors** in Engine Cooling.
8. Remove the battery cable conduit from the conduit retainers.

9. Remove the starter motor BAT terminal nut from the starter motor.
10. Remove the battery positive cable from the starter motor BAT terminal.
11. Lower the vehicle.
12. Remove the battery positive cable from the vehicle.

Installation Procedure

1. Install the battery positive cable to the vehicle.
2. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

NOTE: Refer to **Fastener Notice** in Cautions and Notices.

3. Install the battery positive cable and nut to the starter motor BAT terminal.

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

4. Install the battery positive cable to the conduit.
5. Install the battery cable conduit to the conduit retainers.
6. Install the lower radiator baffle. Refer to **Radiator Air Baffle Assemblies and Deflectors** in Engine Cooling.
7. Lower the vehicle.

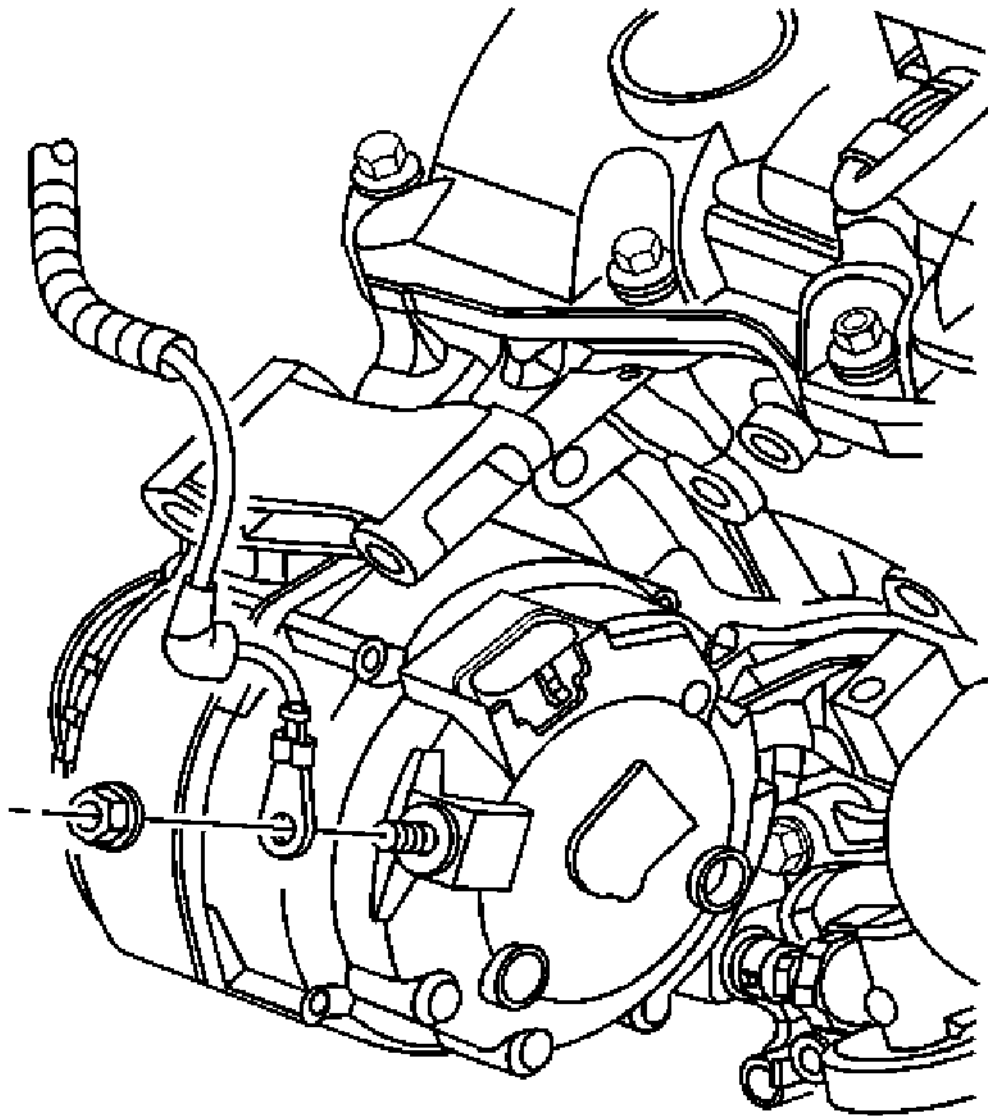


Fig. 28: Identifying Battery Positive Cable Nut And Cable At The Generator
Courtesy of GENERAL MOTORS CORP.

8. Connect the battery positive cable to the generator. Refer to **Generator Replacement (LA1)** or **Generator Replacement (LY7)**.

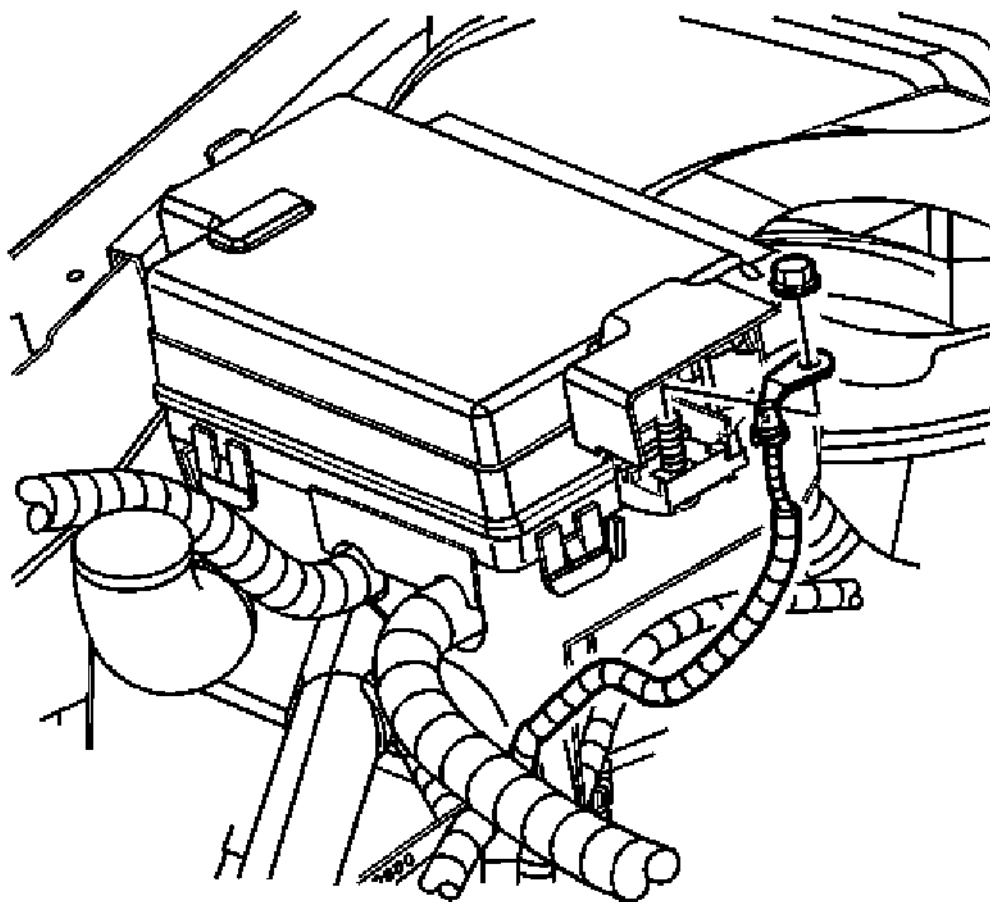


Fig. 29: Locating Battery Positive Cable Nut & Cable
Courtesy of GENERAL MOTORS CORP.

9. Install the battery positive cable and nut to the underhood electrical center.

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

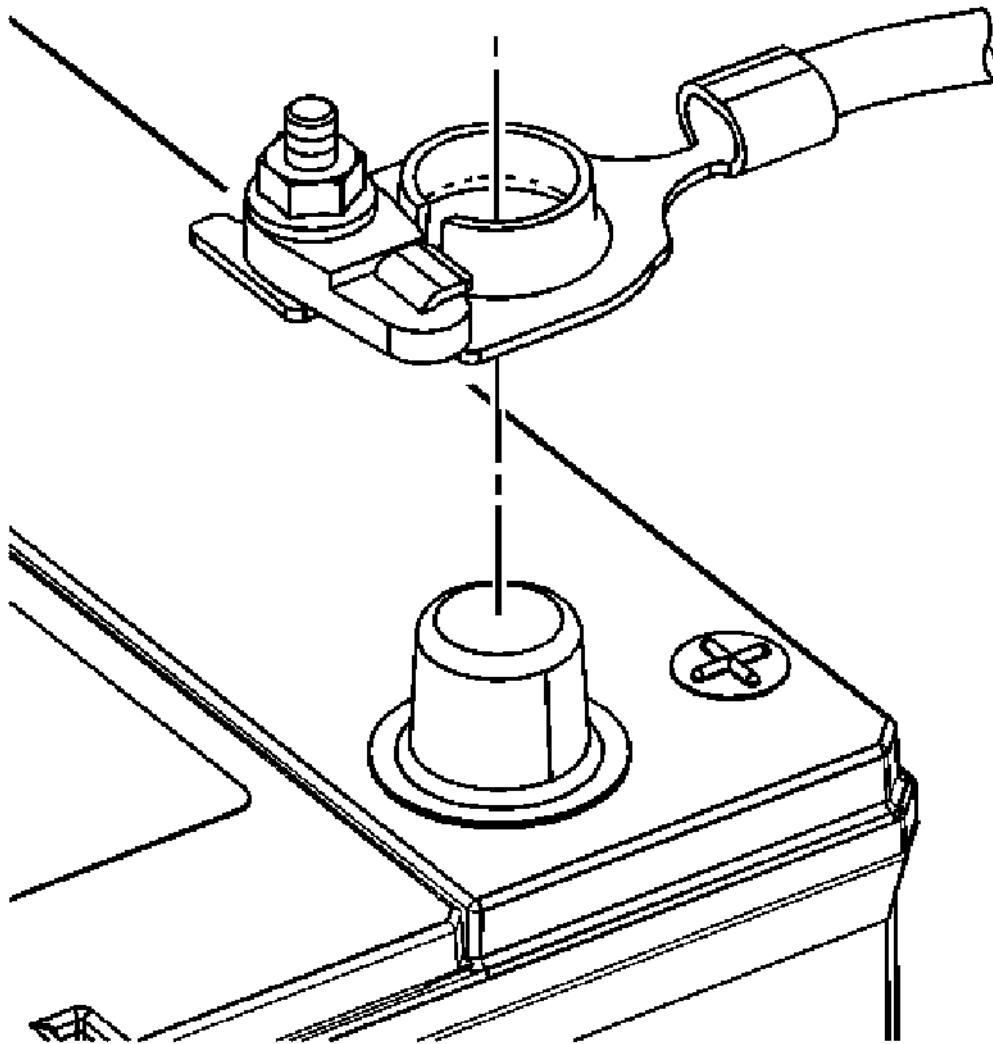


Fig. 30: View Of Battery Positive Cable
Courtesy of GENERAL MOTORS CORP.

10. Install the battery positive cable to the battery.

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

11. Install the battery ground (negative) cable to the battery. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable Disconnect/Connect Procedure (LY7)**.

BATTERY REPLACEMENT

CAUTION: Refer to Battery Disconnect Caution in Cautions and Notices.

CAUTION: Batteries generate hydrogen gas, which is extremely flammable and may explode violently if ignited by a spark or a flame. Battery acid is extremely corrosive and causes severe personal injury if the acid comes into contact with the skin, and blindness if the acid comes into contact with the eyes. In order to avoid severe personal injury, use extreme caution when servicing the battery or battery-related components.

Removal Procedure

1. Remove and reposition the underhood electrical center. Refer to **Underhood Electrical Center or Junction Block Replacement** in Wiring Systems.
2. Remove the front end sheet metal diagonal brace. Refer to **Brace Replacement - Front Fender Upper Diagonal - Right** in Body Front End.
3. Remove the battery ground (negative) cable from the battery. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable Disconnect/Connect Procedure (LY7)**.
4. Remove the battery positive cable from the battery.

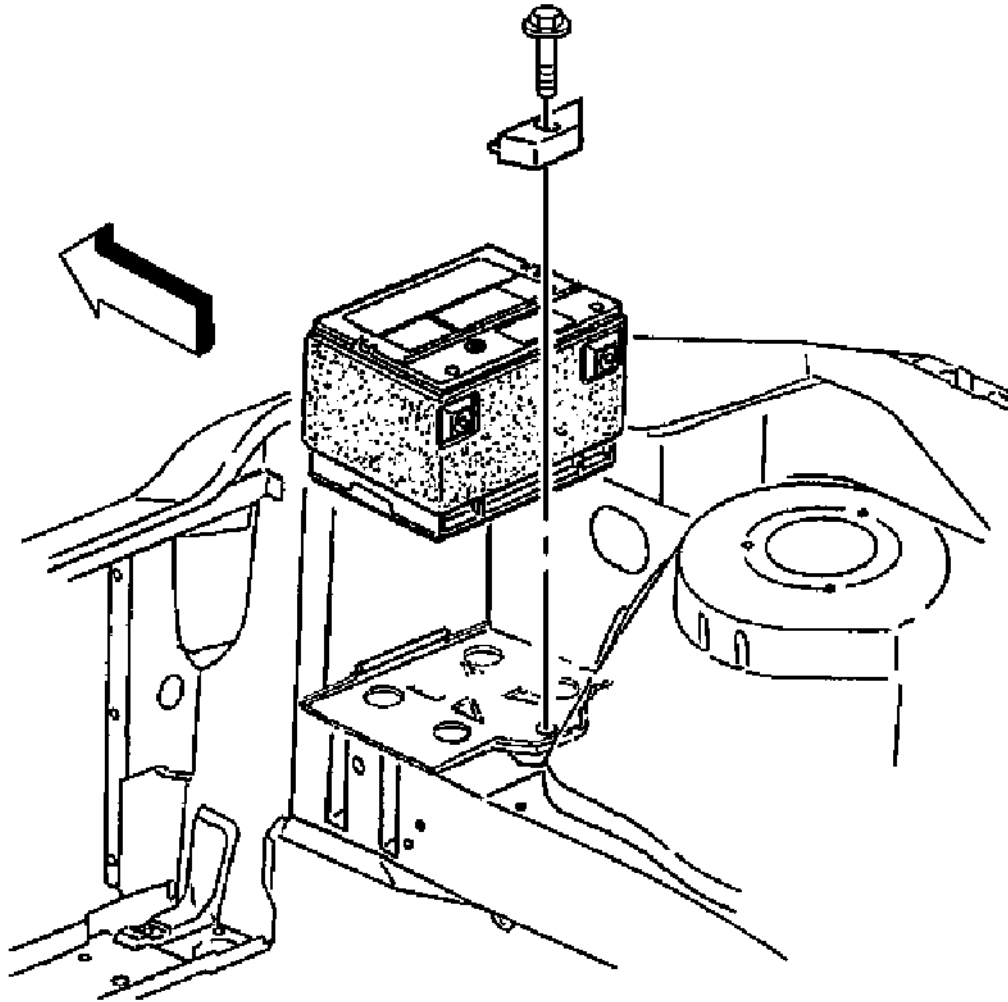


Fig. 31: View Of Battery

Courtesy of GENERAL MOTORS CORP.

5. Remove the battery hold down retainer.

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

6. Remove the battery.

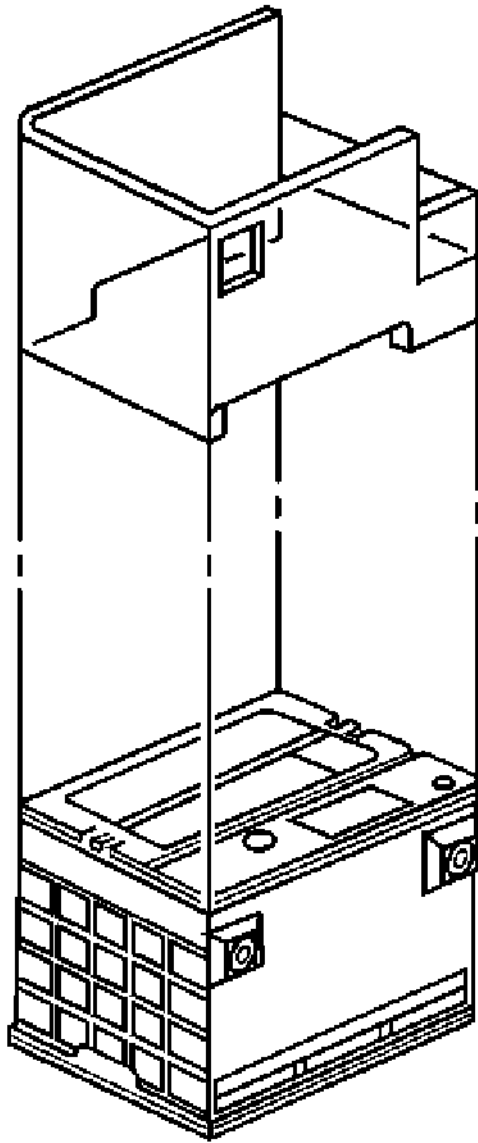


Fig. 32: Identifying Battery Insulator
Courtesy of GENERAL MOTORS CORP.

7. Remove the battery insulator from the battery.

Installation Procedure

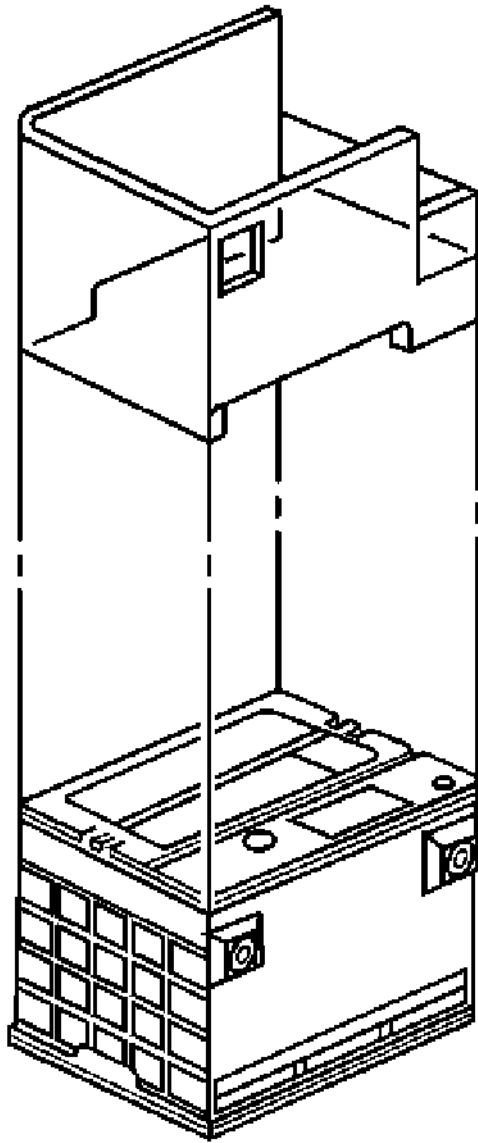


Fig. 33: Identifying Battery Insulator
Courtesy of GENERAL MOTORS CORP.

1. Install the battery insulator to the battery.

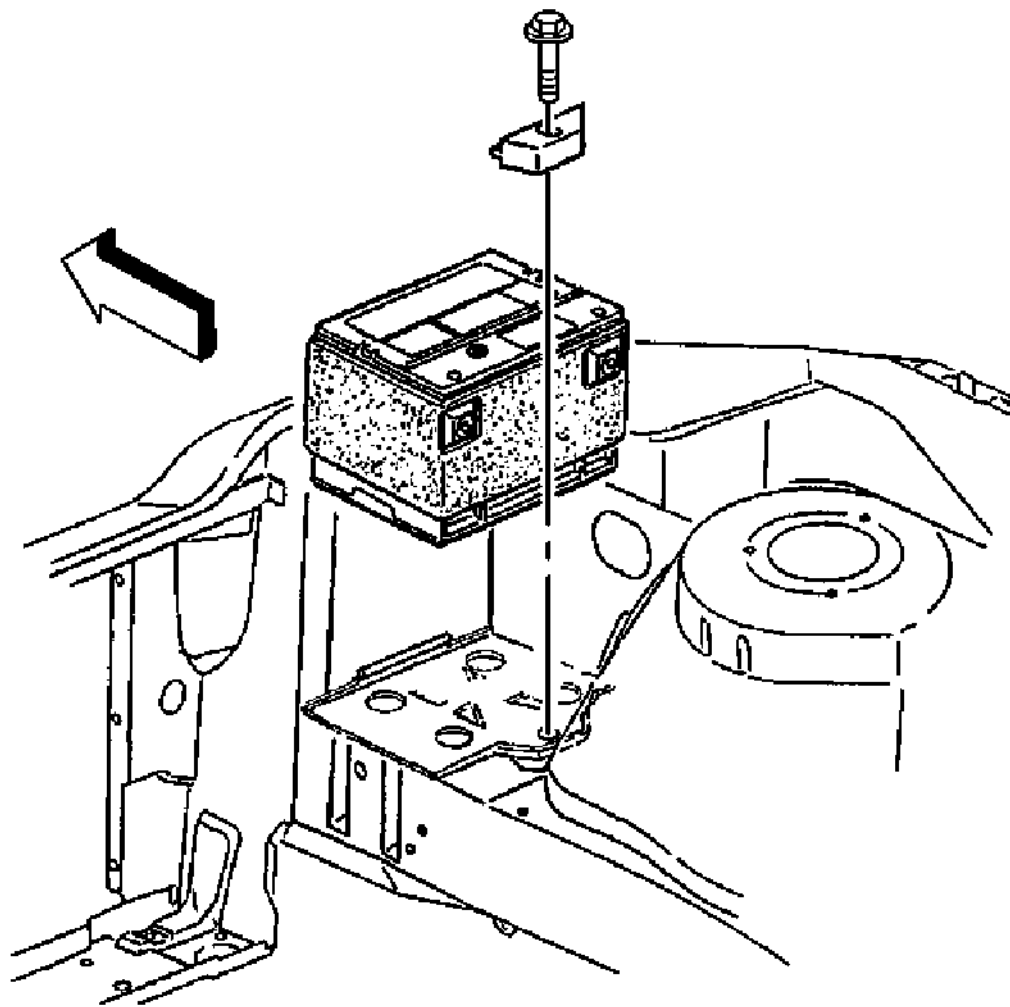


Fig. 34: View Of Battery

Courtesy of GENERAL MOTORS CORP.

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

2. Install the battery and ensure that the battery is positioned properly in the battery tray.
3. Install the battery hold down retainer.
4. Install the battery hold down retainer bolt.

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

5. Install the battery positive cable and bolt to the battery.

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

6. Install the battery ground (negative) cable to the battery. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable Disconnect/Connect Procedure (LY7)**.
7. Install the front end sheet metal diagonal brace. Refer to **Brace Replacement - Front Fender Upper Diagonal - Right** in Body Front End.
8. Install the underhood electrical center. Refer to **Underhood Electrical Center or Junction Block Replacement** in Wiring Systems.

BATTERY TRAY REPLACEMENT

Removal Procedure

1. Remove the battery. Refer to **Battery Replacement**.

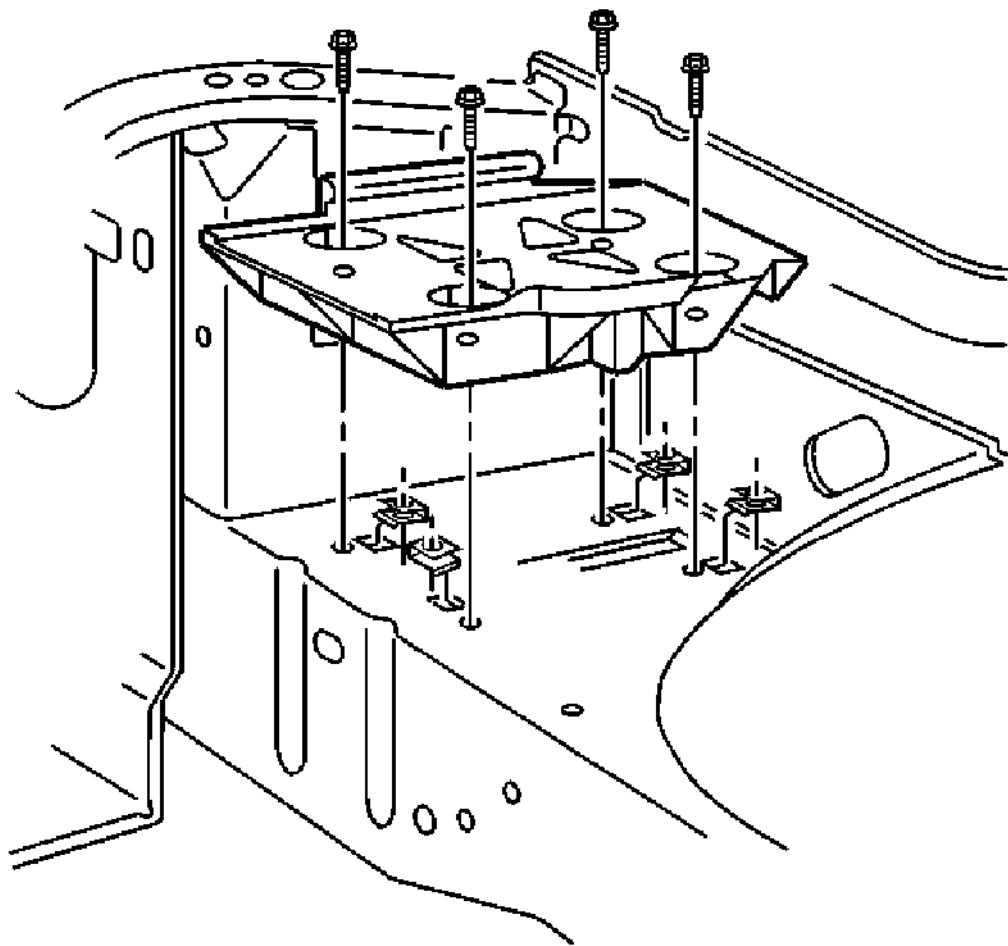


Fig. 35: Identifying Battery Tray & Bolts
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

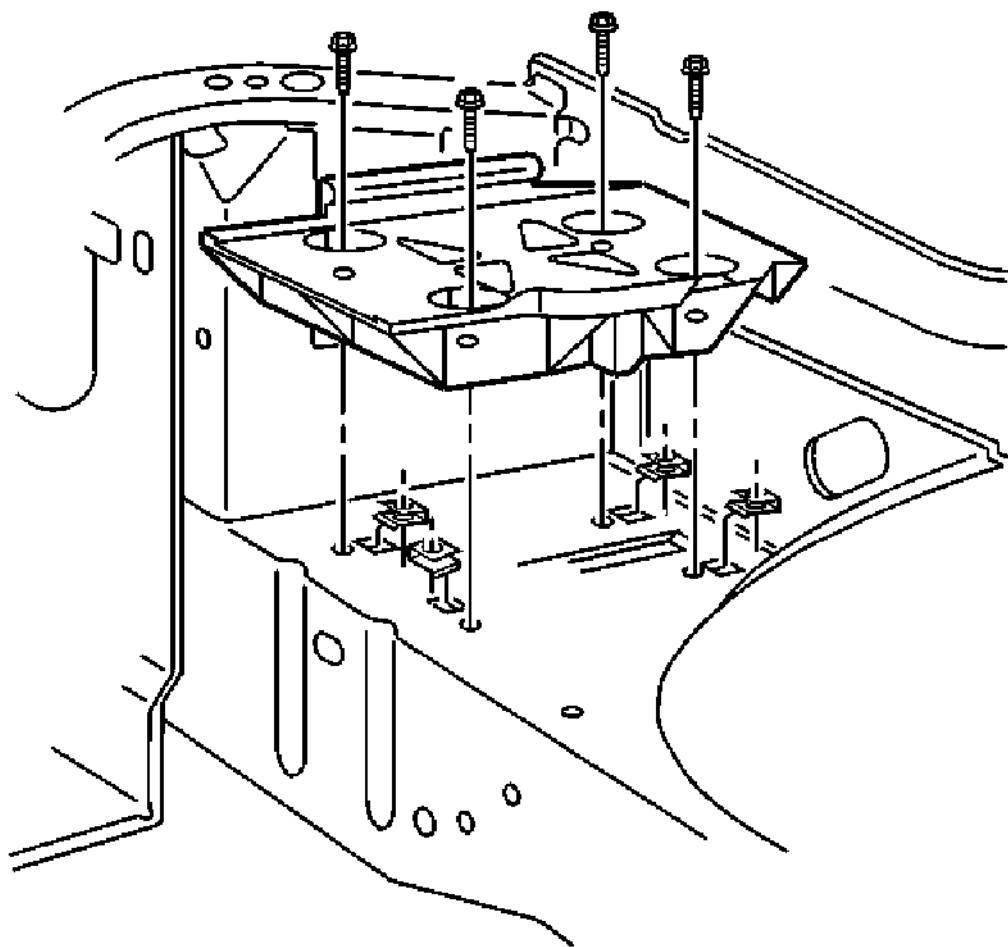


Fig. 36: Identifying Battery Tray & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the battery tray.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the battery tray bolts.

Tighten: Tighten the battery tray bolts to 10 N.m (89 lb in).

3. Install the battery. Refer to **Battery Replacement**.

STARTER MOTOR REPLACEMENT (LA1)

Removal Procedure

IMPORTANT: This vehicle uses the PG260 F1 starter motor. The starter motor is serviced only as a complete unit.

1. Disconnect the battery ground (negative) cable from the battery. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable Disconnect/Connect Procedure (LY7)**.
2. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
3. Remove radiator air baffle assembly. Refer to **Radiator Air Baffle Assemblies and Deflectors** in Engine Cooling.

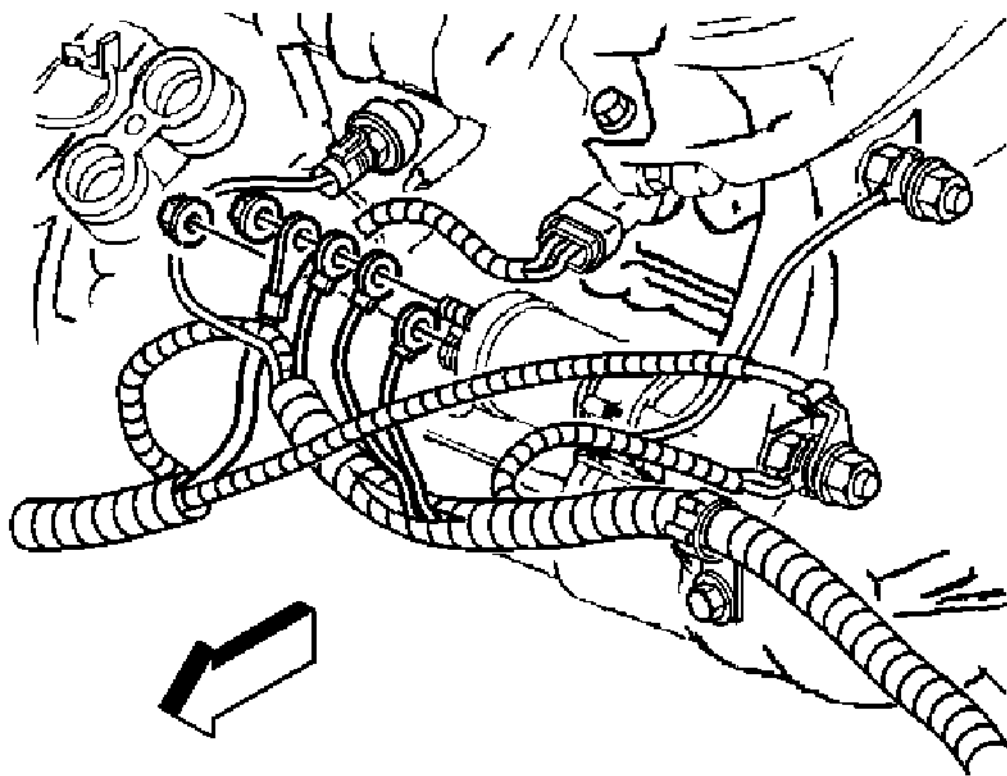


Fig. 37: View Of Starter Motor BAT Terminal Nut And Electrical Leads (LA1)
Courtesy of GENERAL MOTORS CORP.

4. Remove the starter motor BAT terminal nut and electrical leads.
5. Remove the starter motor S terminal nut and electrical lead.
6. Remove the torque converter cover. Refer to **Torque Converter Cover Replacement (LA1)** or **Torque Converter Cover Replacement (LY7)** in Automatic Transaxle -

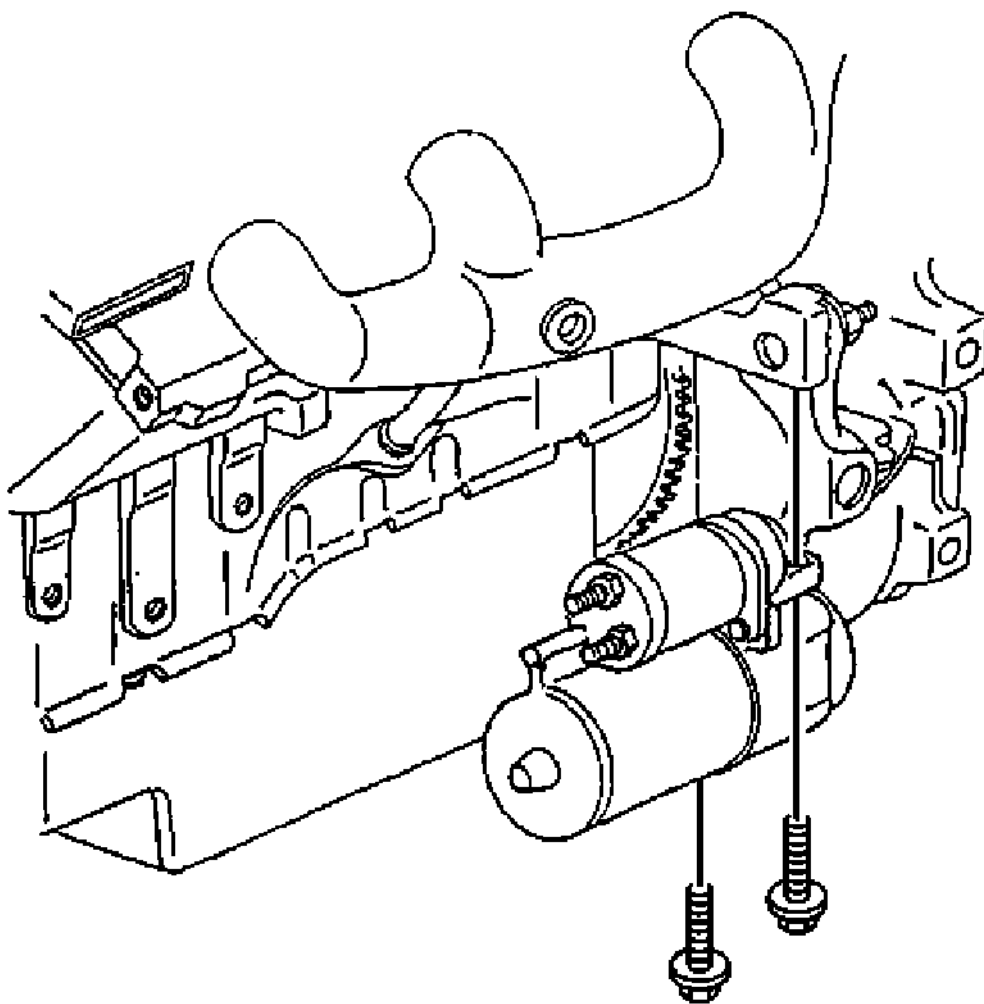


Fig. 38: Locating Starter Motor & Bolts (LA1)
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

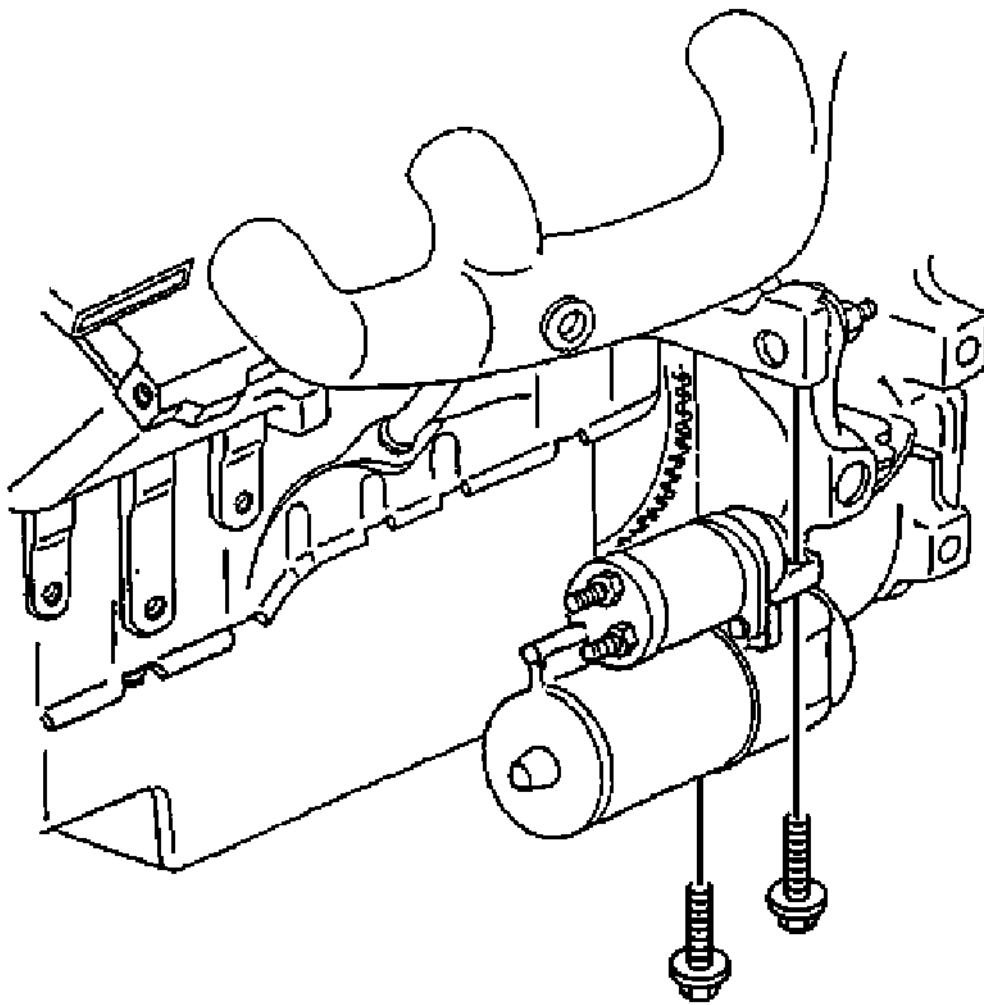


Fig. 39: Locating Starter Motor & Bolts (LA1)
Courtesy of GENERAL MOTORS CORP.

1. Install the starter motor.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the starter motor bolts.

Tighten: Tighten the starter motor bolts to 47 N.m (35 lb ft).

3. Install the torque converter cover. Refer to Torque Converter Cover Replacement (LA1) or Torque Converter Cover Replacement (LY7) in Automatic Transaxle -

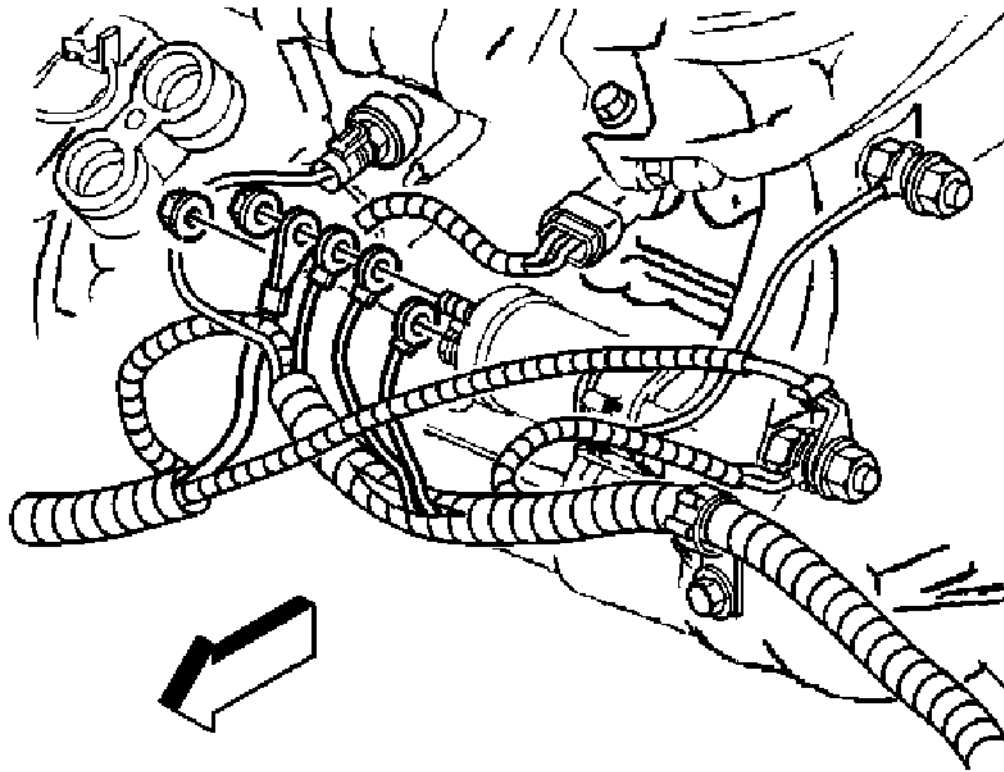


Fig. 40: View Of Starter Motor BAT Terminal Nut And Electrical Leads (LA1)
Courtesy of GENERAL MOTORS CORP.

4. Install the starter motor S terminal electrical lead and nut.

Tighten: Tighten the starter motor solenoid S terminal nut to 3 N.m (27 lb in).

5. Install the starter motor BAT terminal electrical leads and nut.

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

6. Install radiator air baffle assembly. Refer to **Radiator Air Baffle Assemblies and Deflectors** in Engine Cooling.
7. Lower the vehicle.
8. Install the battery ground (negative) cable to the battery. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable Disconnect/Connect Procedure (LY7)**.

STARTER MOTOR REPLACEMENT (LY7)

Removal Procedure

1. Disconnect the battery ground (negative) cable from the battery. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable Disconnect/Connect Procedure (LY7)**.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
3. Remove the radiator air baffle. Refer to **Radiator Air Baffle Assemblies and Deflectors** in Engine Cooling.

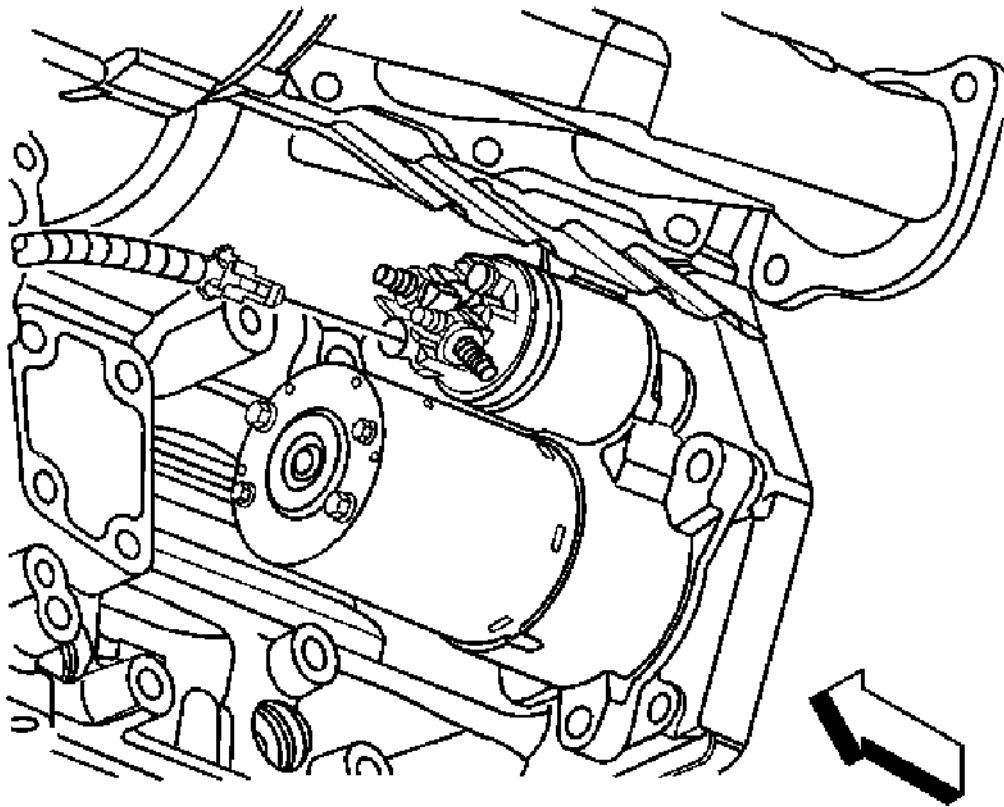


Fig. 41: Identifying Starter Motor BAT Terminal Nut (LY7)
Courtesy of GENERAL MOTORS CORP.

4. Remove the starter motor BAT terminal nut and electrical leads.

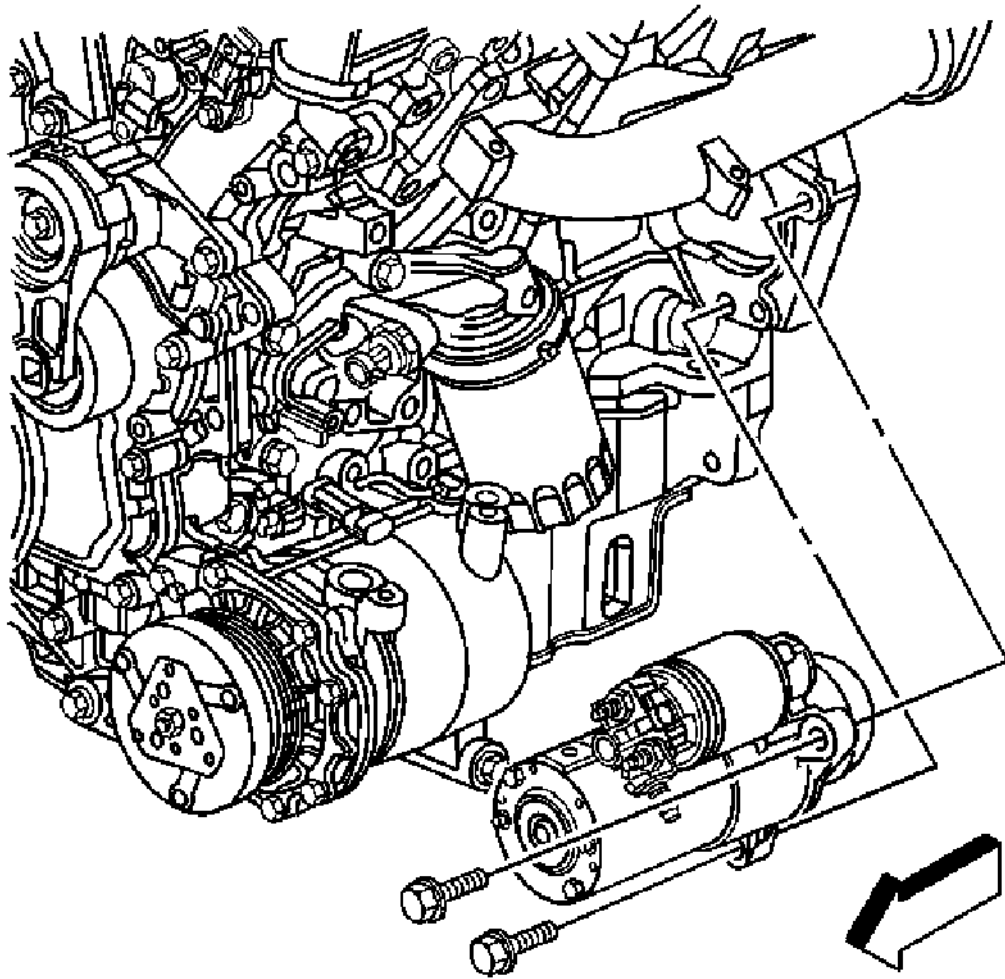


Fig. 42: Locating Starter Motor & Bolts (LY7)
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

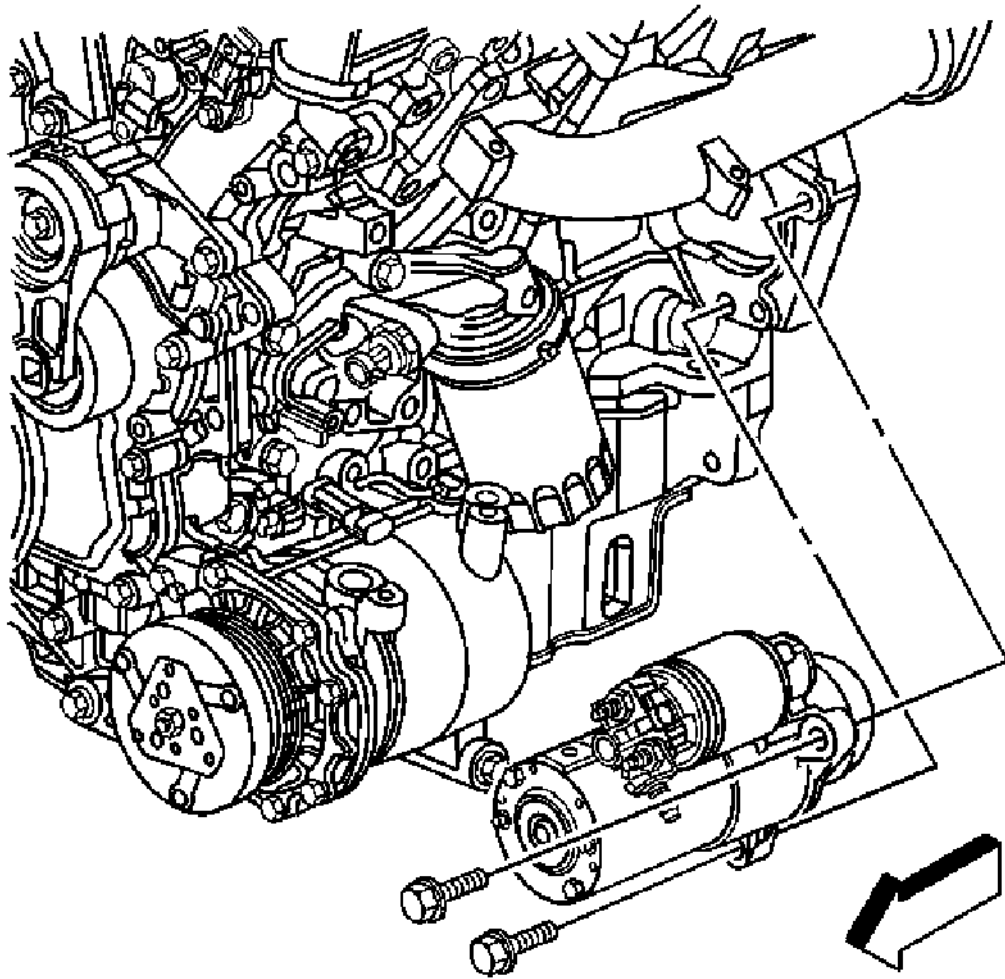


Fig. 43: Locating Starter Motor & Bolts (LY7)
Courtesy of GENERAL MOTORS CORP.

1. Install the starter motor.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the starter motor bolts.

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

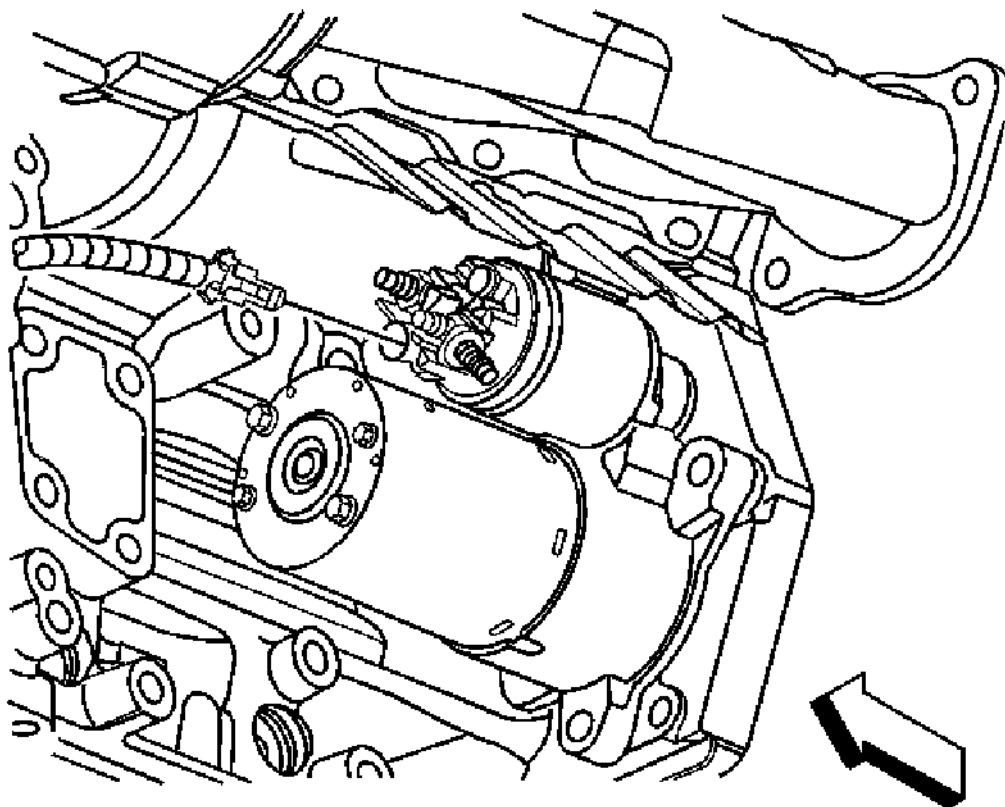


Fig. 44: Identifying Starter Motor BAT Terminal Nut (LY7)
Courtesy of GENERAL MOTORS CORP.

3. Install the starter motor S terminal electrical connector.
4. Install the battery positive cable and the BAT terminal nut to the starter motor BAT terminal.

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

5. Install radiator air baffle assembly. Refer to **Radiator Air Baffle Assemblies and Deflectors** in Engine Cooling.
6. Lower the vehicle.
7. Install the battery ground (negative) cable to the battery. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable Disconnect/Connect Procedure (LY7)**.

Removal Procedure

1. Remove the generator. Refer to **Generator Replacement (LA1)** or **Generator Replacement (LY7)**.
2. Remove the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement** in Engine Mechanical-3.4L.

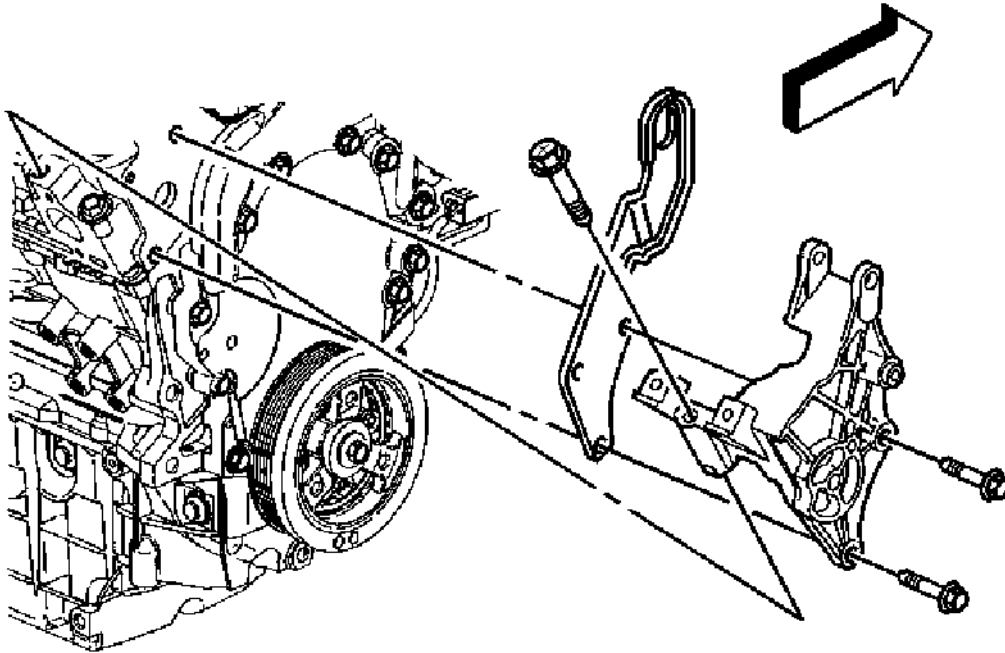


Fig. 45: View Of Generator Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

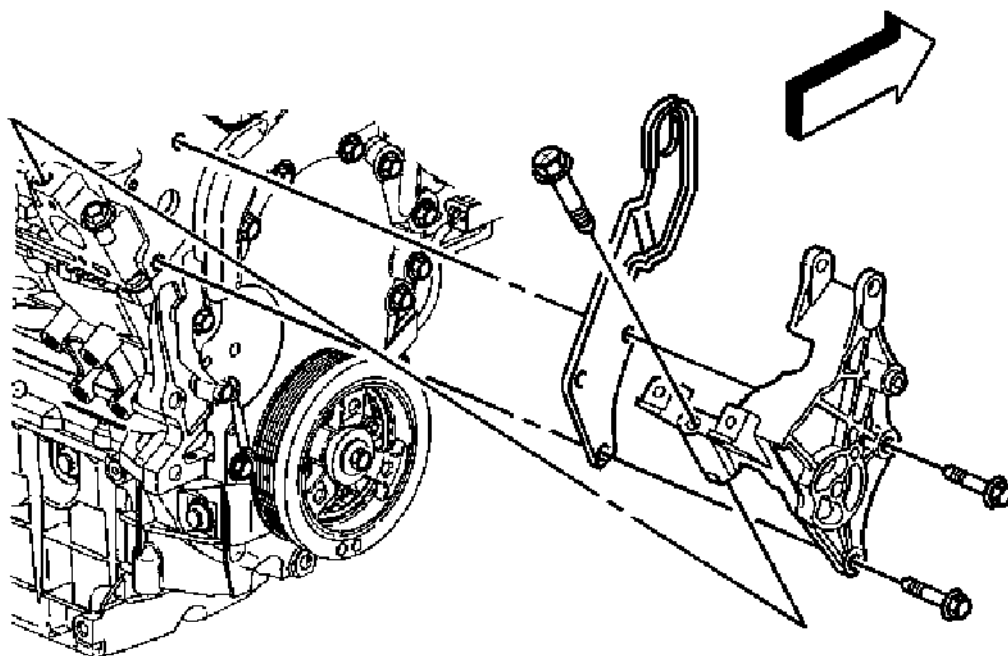


Fig. 46: View Of Generator Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the generator bracket.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the generator bracket bolts.

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

3. Install the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement** in Engine Mechanical-3.4L.
4. Install the generator. Refer to **Generator Replacement (LA1)** or **Generator Replacement (LY7)**.

GENERATOR REPLACEMENT (LA1)

Removal Procedure

1. Remove the battery ground (negative) cable from the battery. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable**

Disconnect/Connect Procedure (LY7).

2. Rotate and secure the engine forward to access rear generator bolts. Refer to **Rotating the Engine for Service Access** in Engine Mechanical - 3.4L.

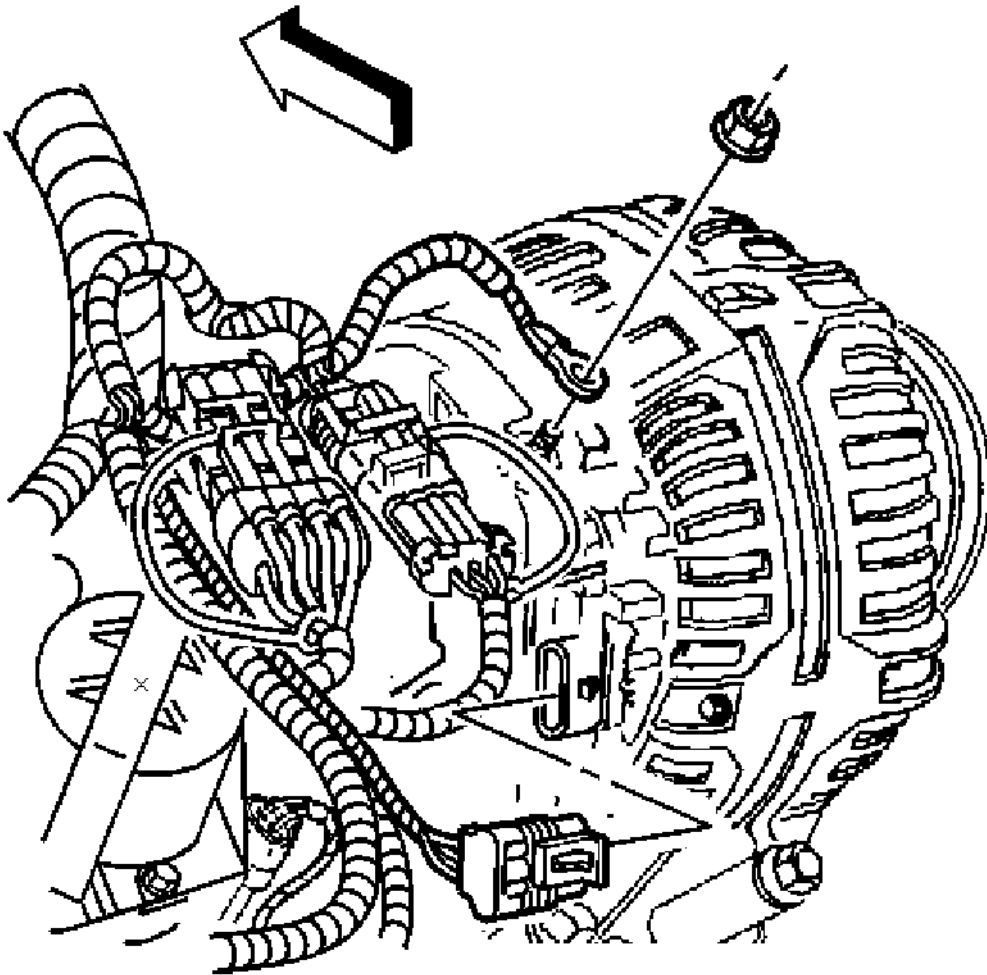


Fig. 47: View Of Generator Electrical Leads, Connectors & Terminal Nut
Courtesy of GENERAL MOTORS CORP.

3. Remove the generator B+ terminal nut.
4. Remove the generator B+ lead.
5. Remove the generator electrical connector.
6. Remove the drive belt from the generator. Refer to **Drive Belt Replacement** in Engine Mechanical - 3.4L.

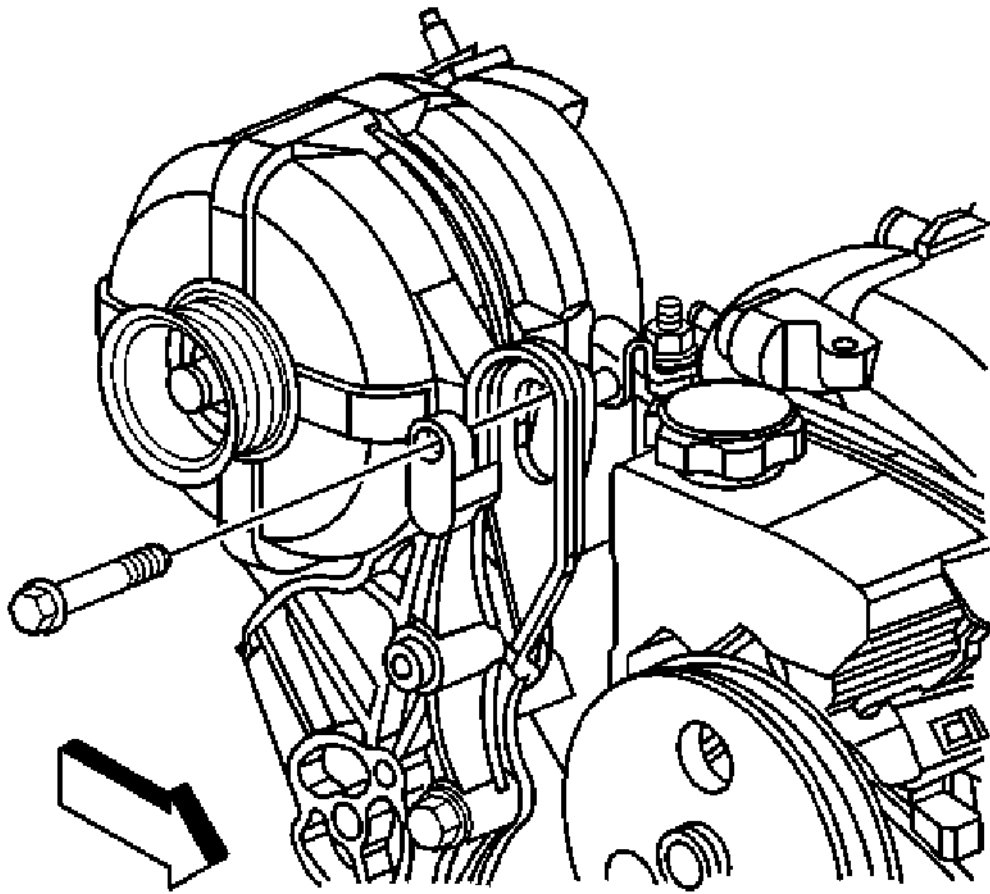


Fig. 48: Locating Generator Front Bolt
Courtesy of GENERAL MOTORS CORP.

7. Remove the generator front bolt.

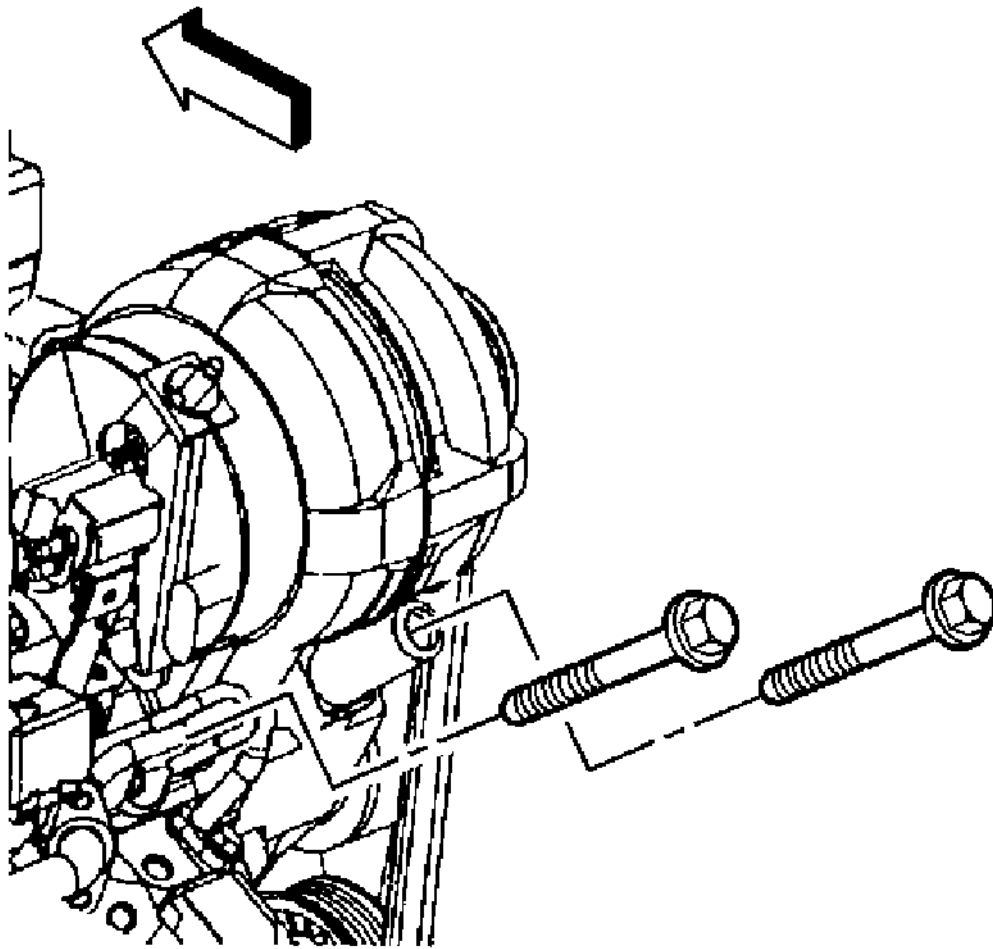


Fig. 49: Identifying Generator Rear Bolts
Courtesy of GENERAL MOTORS CORP.

8. Remove the generator rear bolts.

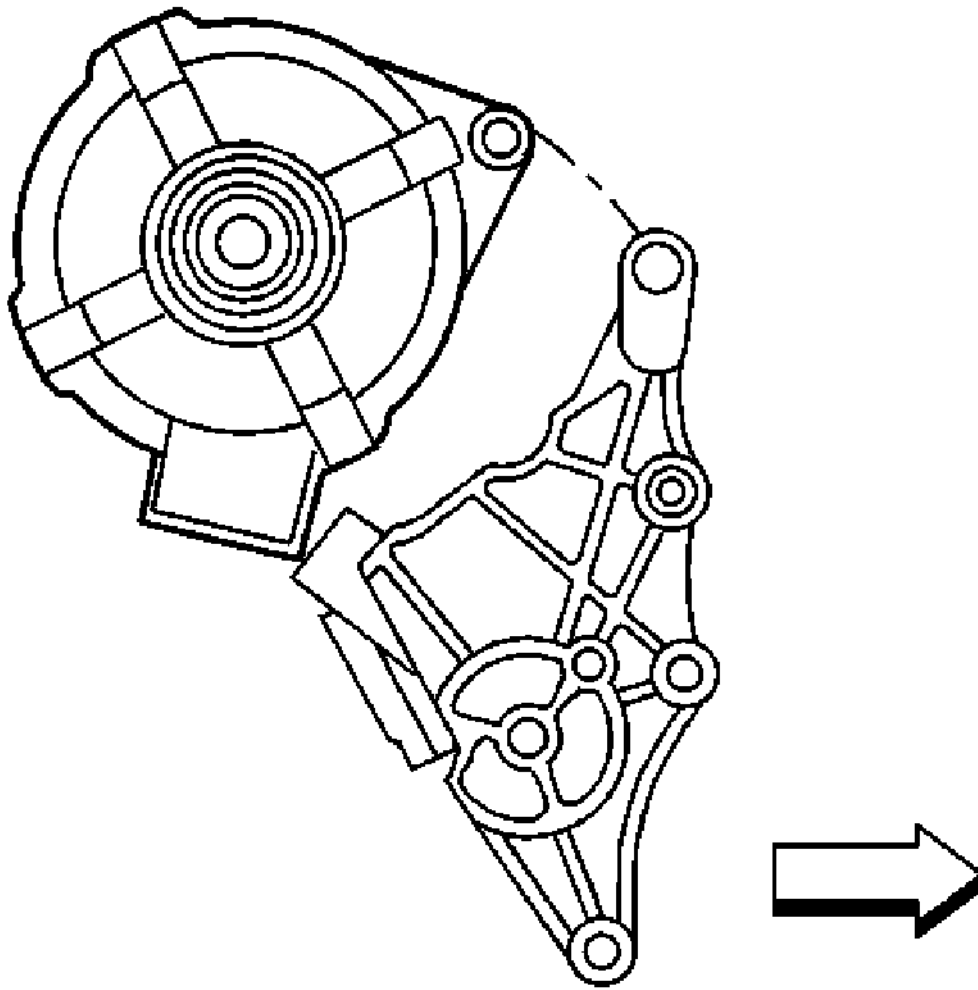


Fig. 50: Aligning Generator To Generator Bracket
Courtesy of GENERAL MOTORS CORP.

9. Remove the generator from the generator bracket and position the generator above the drive axle.
10. Remove the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement** in Engine Mechanical-3.4L.
11. Remove the generator bracket. Refer to **Generator Bracket Replacement**.
12. Remove the power steering pipes from the power steering pipe retainer.
13. Remove the fuel pressure test port (schrader valve) cap from the fuel injector rail.

IMPORTANT: Do not disconnect the power steering pipes from the

power steering pump.

14. Remove the power steering pump and reposition the power steering pump in front of the timing chain cover in order to provide access for the generator. Refer to **Power Steering Pump Replacement (LA1)** or **Power Steering Pump Replacement (LY7)** in Power Steering System.
15. Remove electrical harness from retainer on right fender well and position aside.
16. Remove the generator from the vehicle.

Installation Procedure

1. Install the generator to the vehicle and position the generator above the drive axle.
2. Install electrical harness to retainer on right fender well.
3. Install the power steering pump to the engine. Refer to **Power Steering Pump Replacement (LA1)** or **Power Steering Pump Replacement (LY7)** in Power Steering System.
4. Install the fuel pressure test port (schrader valve) cap to the fuel injector rail.
5. Install the power steering pipes from the power steering pipe retainer.
6. Install the generator bracket. Refer to **Generator Bracket Replacement**.
7. Install the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement** in Engine Mechanical - 3.4L.

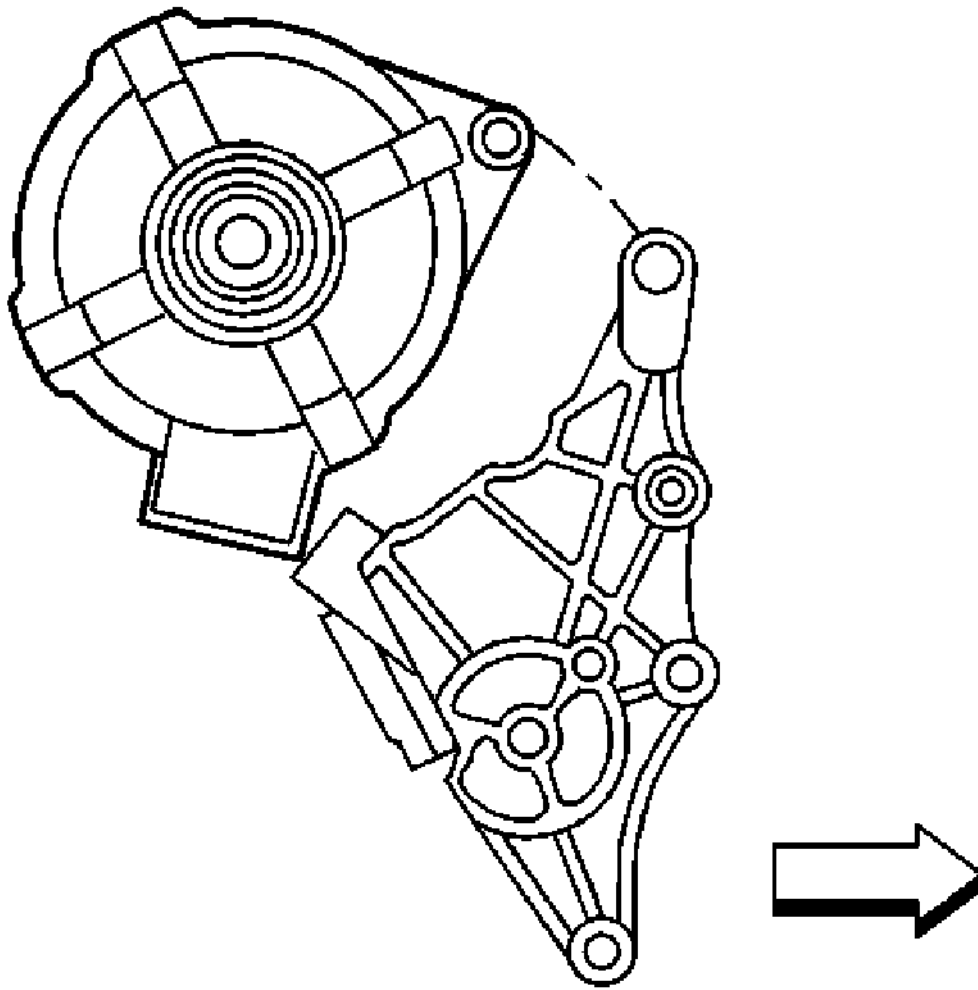


Fig. 51: Aligning Generator To Generator Bracket
Courtesy of GENERAL MOTORS CORP.

8. Install the generator to the generator bracket and position the generator above the drive axle.
9. Install the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement** in Engine Mechanical - 3.4L.
10. Install the generator to the generator bracket.

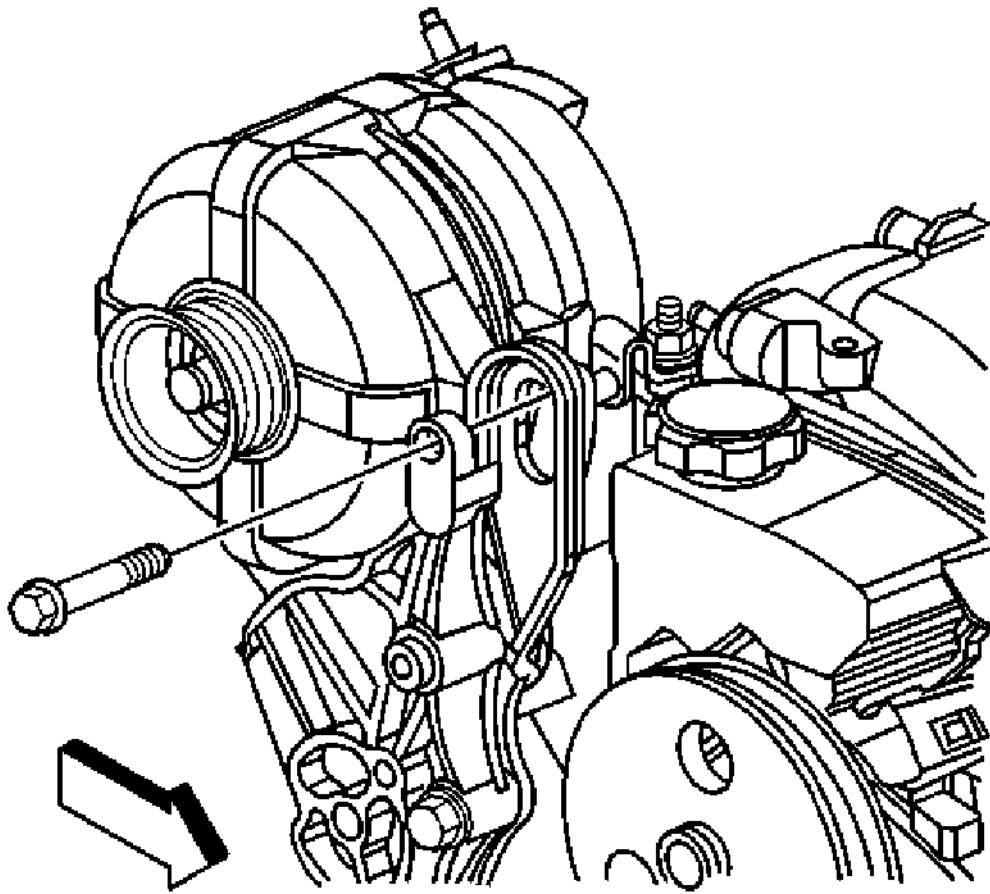


Fig. 52: Locating Generator Front Bolt
Courtesy of GENERAL MOTORS CORP.

11. Install the generator front bolt.

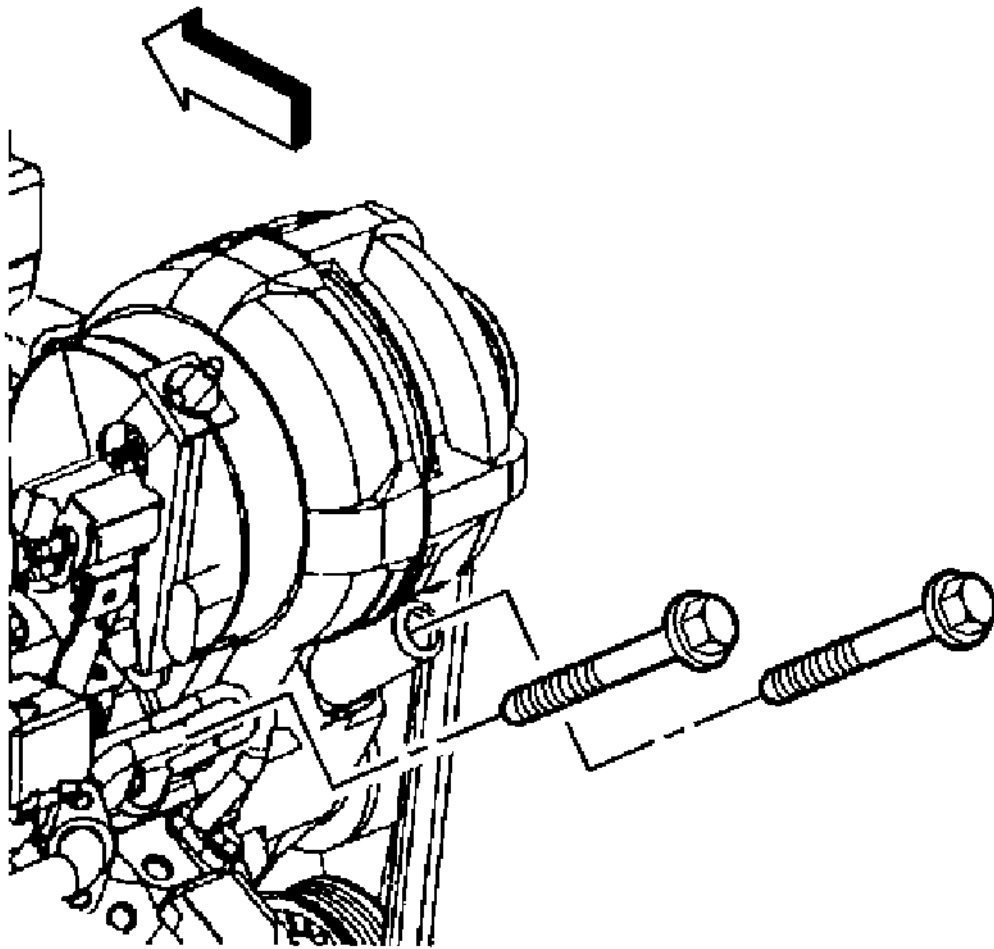


Fig. 53: Identifying Generator Rear Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

12. Install the generator rear bolts.

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

13. Install the drive belt. Refer to **Drive Belt Replacement** in Engine Mechanical - 3.4L.

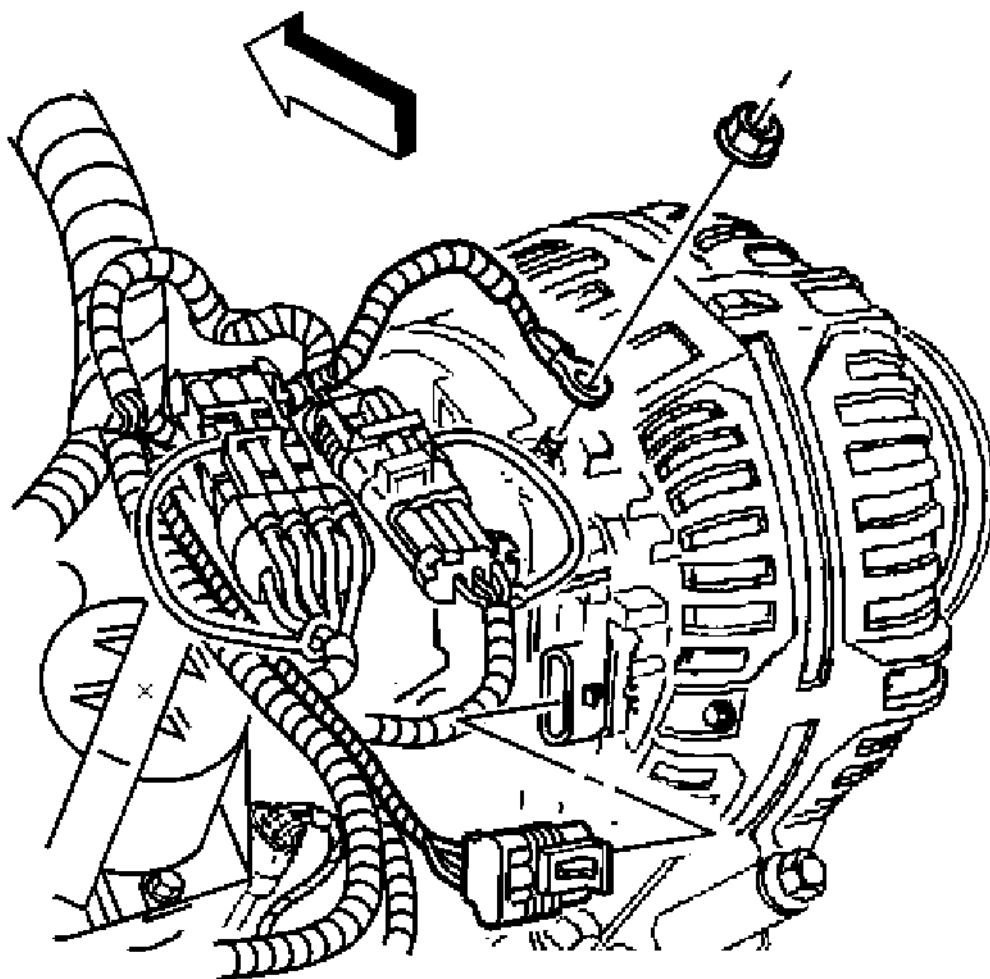


Fig. 54: View Of Generator Electrical Leads, Connectors & Terminal Nut
Courtesy of GENERAL MOTORS CORP.

14. Install the generator electrical connector.
15. Install the generator B+ lead.
16. Install the generator B+ terminal nut.

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

17. Rotate the engine rearward and install the engine mount strut bracket bolts. Refer to **Rotating the Engine for Service Access** in Engine Mechanical - 3.4L.
18. Install the battery ground (negative) cable to the battery. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable**

Disconnect/Connect Procedure (LY7).

GENERATOR REPLACEMENT (LY7)

Removal Procedure

1. Disconnect the battery ground (negative) cable from the battery. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable Disconnect/Connect Procedure (LY7)**.
2. Remove the torque struts and rotate the engine in order to provide access to remove the generator. Refer to and in Engine Mechanical - 3.6L (LY7).

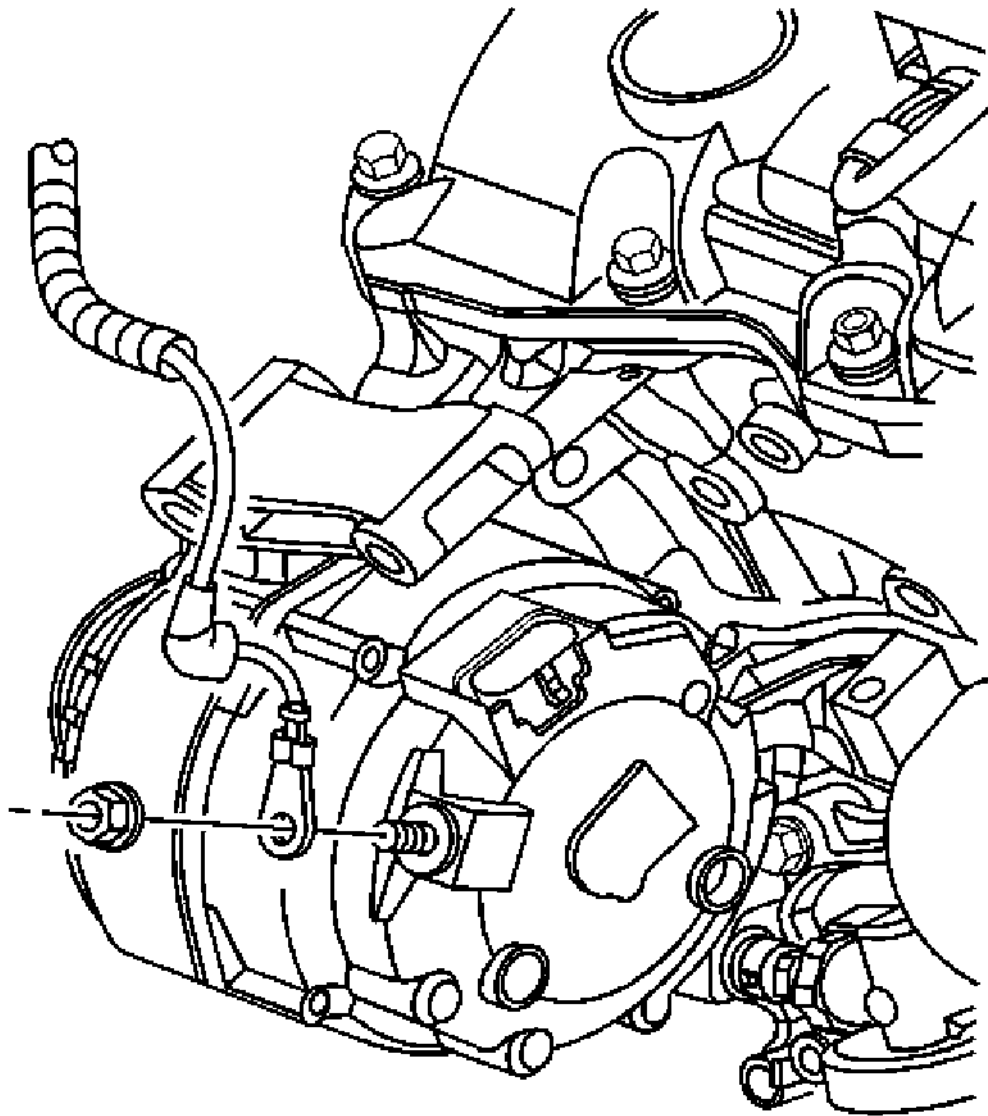


Fig. 55: Identifying Battery Positive Cable Nut And Cable At The Generator
Courtesy of GENERAL MOTORS CORP.

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

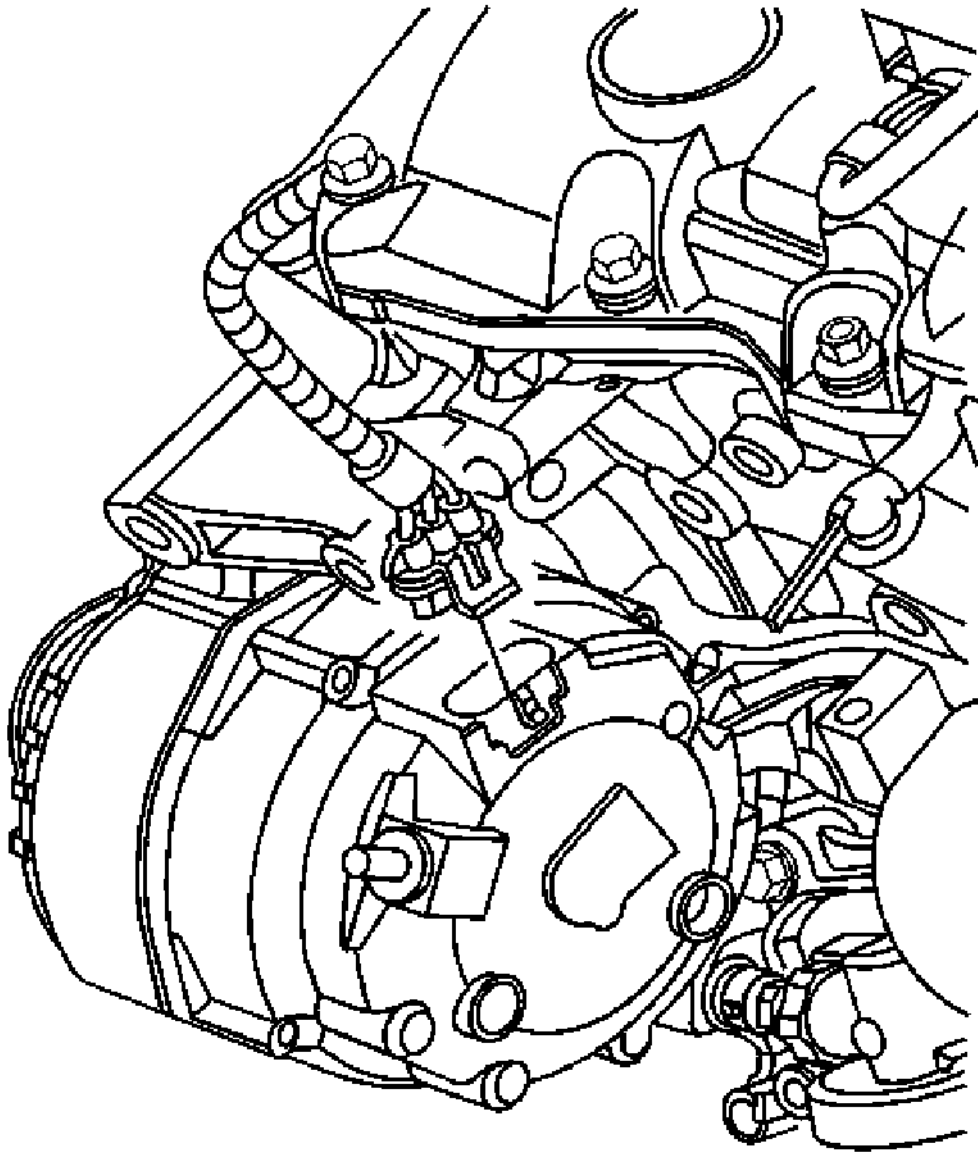


Fig. 56: Locating Generator Electrical Connector
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the generator electrical connector.
5. Remove the drive belt from the generator. Refer to **Drive Belt Replacement** in Engine Mechanical - 3.6L (LY7).
6. Remove the idler pulley. Refer to **Drive Belt Idler Pulley Replacement** in Engine Mechanical - 3.6L (LY7).

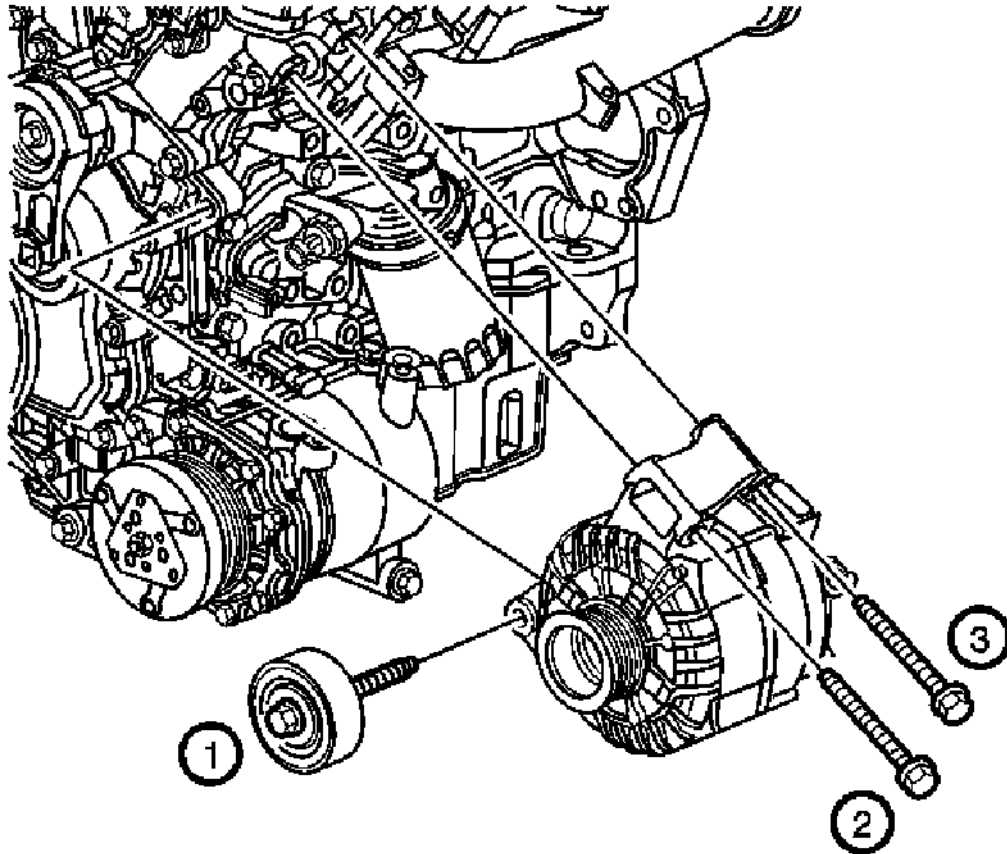


Fig. 57: View Of Generator Bolts
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

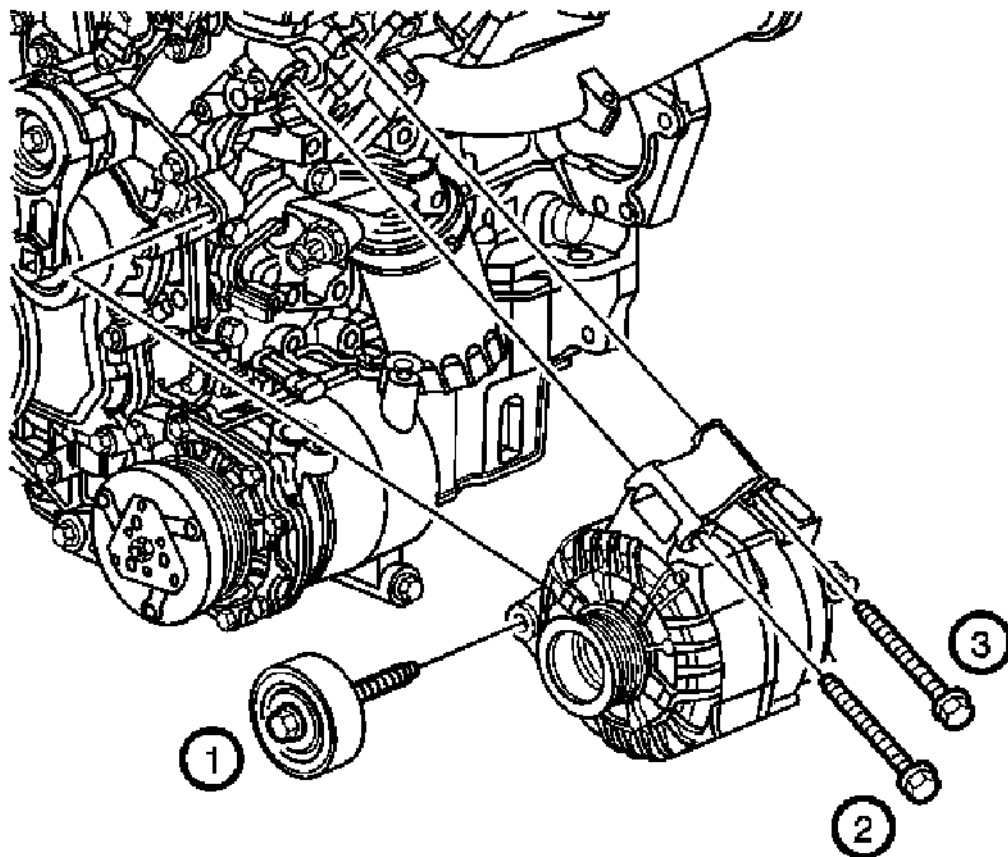


Fig. 58: View Of Generator Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the generator to the vehicle.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the generator bolts.

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

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

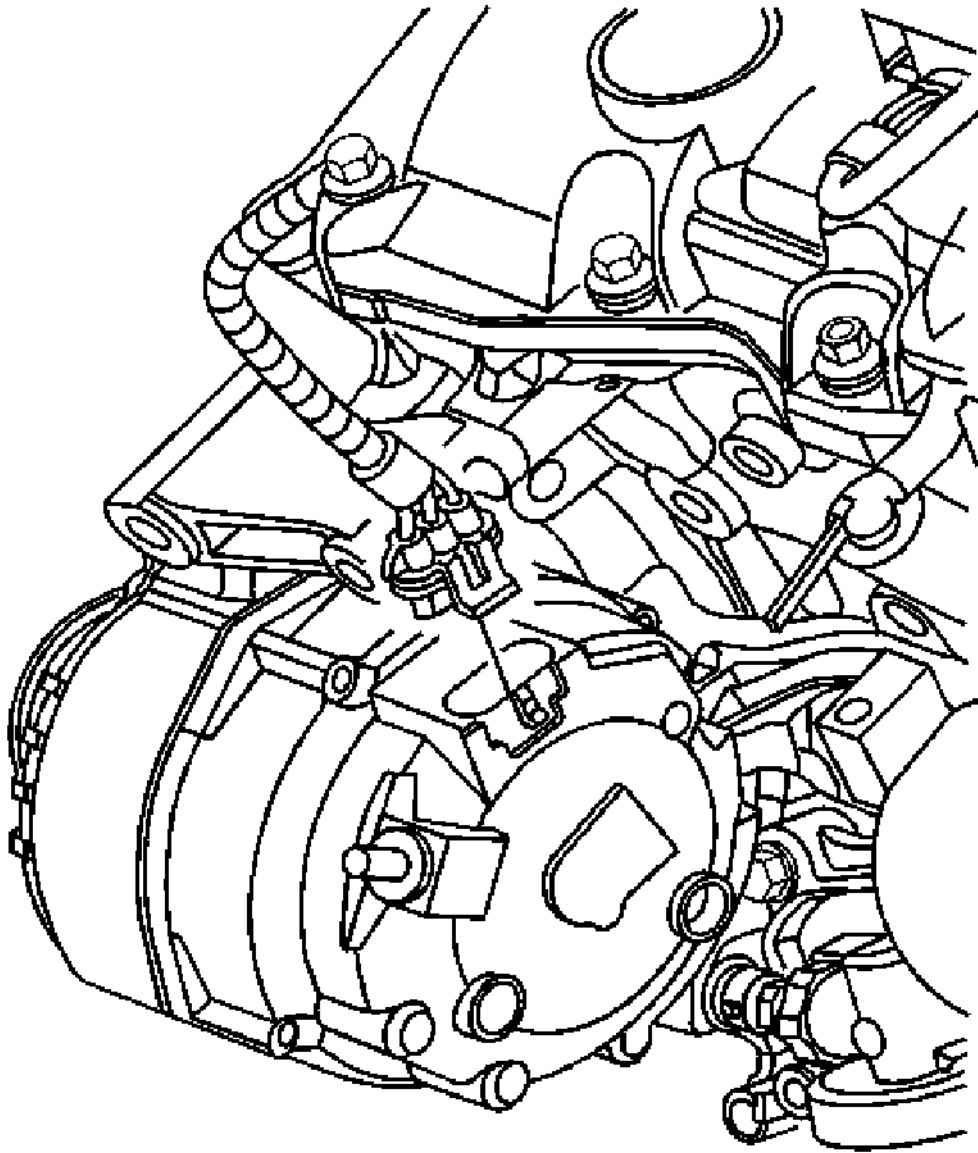


Fig. 59: Locating Generator Electrical Connector
Courtesy of GENERAL MOTORS CORP.

5. Connect the generator electrical connector.

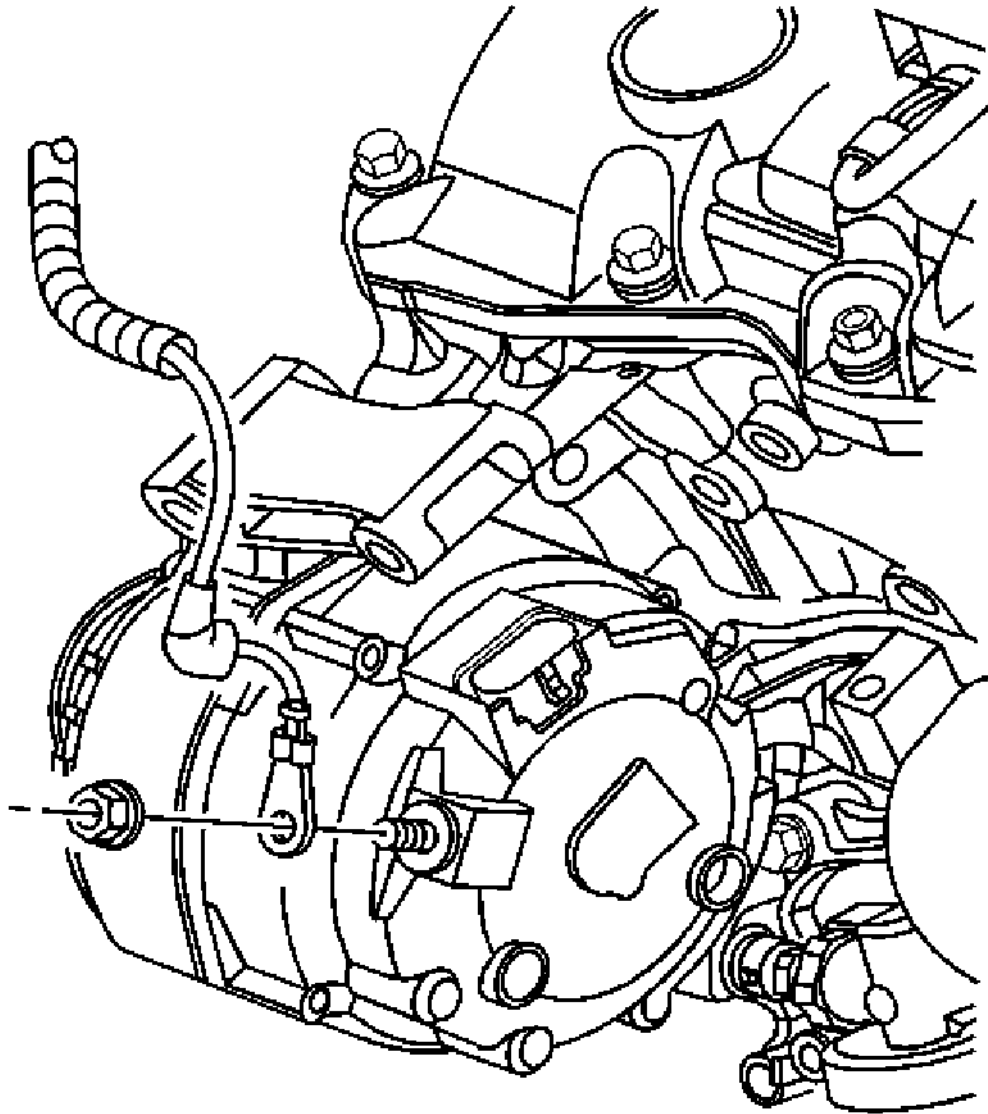


Fig. 60: Identifying Battery Positive Cable Nut And Cable At The Generator
Courtesy of GENERAL MOTORS CORP.

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

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

7. Install the torque struts. Refer to and in Engine Mechanical - 3.6L (LY7).
8. Connect the battery ground (negative) cable to the battery. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable**

Disconnect/Connect Procedure (LY7).

DESCRIPTION AND OPERATION

BATTERY DESCRIPTION AND OPERATION

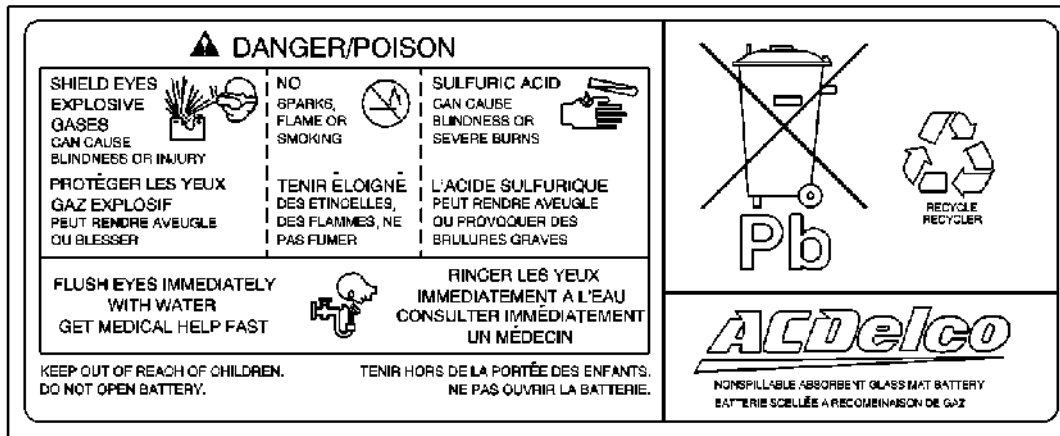


Fig. 61: Battery Warning Label

Courtesy of GENERAL MOTORS CORP.

CAUTION: Batteries produce explosive gases, contain corrosive acid, and supply levels of electrical current high enough to cause burns. Therefore, to reduce the risk of personal injury when working near a battery:

- Always shield your eyes and avoid leaning over the battery whenever possible.
- Do not expose the battery to open flames or sparks.
- Do not allow the battery electrolyte to contact the eyes or the skin. Flush immediately and thoroughly any contacted areas with water and get medical help.
- Follow each step of the jump starting procedure in order.
- Treat both the booster and the discharged batteries carefully when using the jumper cables.

IMPORTANT: Because of the materials used in the manufacture of automotive lead-acid batteries, dealers and service shops that handle them are subject to various regulations issued by

OSHA, EPA, DOT, and various state or local agencies. Other regulations may also apply in other locations. Always know and follow these regulations when handling batteries.

Batteries that are no longer wanted must be disposed of by an approved battery recycler and must never be thrown in the trash or sent to a landfill.

Batteries that are not part of the vehicle itself, not the battery under the hood, must only be transported on public streets for business purposes via approved hazardous material transportation procedures.

Battery storage, charging, and testing facilities in repair shops must meet various requirements for ventilation, safety equipment, material segregation, etc.

The maintenance-free battery is standard. There are no vent plugs in the cover. The battery is completely sealed except for 2 small vent holes in the side. These vent holes allow the small amount of gas that is produced in the battery to escape.

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

- Engine cranking
- Voltage stabilizer
- Alternate source of energy with generator overload

The battery specification label, example below, contains information about the following:

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

CATALOG NO.

1819

CCA 770	LOAD TEST 380
REPLACEMENT MODEL 100 – 6YR	

Fig. 62: 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 Valeo SG10 and SG12 generators are electrically similar to earlier models. The generators feature the following major components:

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

The pulley and the fan cool the slip ring and the frame.

The generators feature 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 at the body control module (BCM). This voltage is used by the regulator as the reference for system voltage control.

When the ignition switch is turned to RUN, the charge indicator turns on for a few seconds (bulb check), then turns off. The ECM commands the bulb of the charge indicator on by sending a class 2 serial data line message to the instrument panel cluster (IPC) when the ECM detects a charging system problem.

Charge Indicator

The instrument panel cluster (IPC) illuminates the battery indicator in the message center 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 IPC receives a class 2 message from the ECM requesting illumination.
- The IPC performs the displays test at the start of each ignition cycle. The indicator illuminates for approximately 3 seconds.
- The ignition is ON, with the engine OFF.

The IPC sends a class 2 message to the radio for audible warning when this indicator is on.

Regulated Voltage Control (RVC)

The LY7 engine comes equipped with GEN II RVC. Regulated voltage control (RVC) is used to more accurately control the amount of voltage put into the battery based upon the battery state of charge (SOC) and battery temperature.

The main components of the RVC system is a new voltage regulator, the body control module (BCM), and the engine control module (ECM).

- Voltage regulator - uses a pulse width modulation (PWM) signal on the generator L-terminal circuit instead of a 5-volt reference signal from the ECM to determine voltage output of the generator.
- ECM - controls the PWM signal to the regulator and provides diagnostics for the generator L-terminal and generator F-terminal. It also provides feedback of the generator F-terminal to the BCM for its calculations.
- BCM - calculates an estimate of the battery SOC and battery temperature based upon, battery voltage and internal calibrations. When the BCM has determined what voltage the battery should receive, a message is sent to the ECM. This message tells the ECM what percentage to set the PWM signal at.

With RVC in closed loop control of the generator, it can vary the voltage at the battery from 13.4 volts, battery temperature above 70°C (158°F) and battery SOC 95 percent or higher, to 14.9 volts, battery temperature below -30°C (-22°F) and battery SOC 65 percent or lower. If RVC loses control of the generator because of a failure the voltage regulator will default to 13.9 volts at the battery and function as a normal generator.

Circuit Description (LY7)

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 ECM sends a PWM signal to the voltage regulator. The generator's voltage regulator then controls the current to the rotor according to the PWM signal received, thereby controlling the output voltage. The rotor current is proportional to the electrical pulse width supplied by the regulator. The PWM signal may vary between 12 percent and 88 percent. The lower the PWM signal percentage the lower the generator voltage output will be. Below 12 percent and above 88 percent the voltage regulator defaults to 13.9 volts. This generator is self starting and does not require voltage on the L-terminal circuit to initiate battery charging. This also means that the generator cannot be commanded OFF with the scan tool. When the voltage regulator detects a charging system problem, it grounds the generator L-terminal circuit to signal the ECM that a problem exists. The ECM also monitors

the generator field duty cycle signal circuit for failures.

STARTING SYSTEM DESCRIPTION AND OPERATION

The PG-260 D is a non-repairable starter motor. 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 ignition switch is released from the START position, 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

Moving the ignition switch to the START position sends a 12 V signal to the PCM Ignition Crank Sense. The PCM then grounds the control circuit, which travels through the Park Neutral Position switch, of the CRANK relay. When the CRANK relay is energized it allows voltage to the starter solenoid S terminal.

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 powertrain control module (PCM), 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 BCM institutes steps to control the load.

The BCM makes constant voltage measurements. If the BCM detects a low voltage steps are taken 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 for the battery, the BCM institutes steps to control the load.

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 PMM 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	$<-15^{\circ}\text{C}$ (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	$>-15^{\circ}\text{C}$ (5°F)	Battery has a net loss of less than 0.2 AH	First level Idle boost request cancelled	First level Idle boost request cancelled
Idle Boost 1 End	-	14.0 V	Battery has a net loss of less than 0.2 AH	
				Controlled

Load Shed 1 Start	-	-	Battery has a net loss of 1.6 AH	outputs cycled OFF for 20% of their cycle
Load Shed 1 End	-	-	Battery has a net loss of less than 0.8 AH	Clear Load Shed 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	-	<10.9 V	-	Third level Idle boost requested
Idle Boost 3 End	-	>13.0 V	Battery has a net loss of less than 6.0 AH	Third level Idle boost request cancelled
Load Shed 2 Start	-	-	Battery has a net loss of 12.0 AH	Controlled outputs cycled OFF for 50% of their cycle
Load Shed 2 End	-	-	Battery has a net loss of less than 10.5 AH	Clear Load Shed 2
Load Shed 3 Start	-	<11.9 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 3 Start	-	<10.9 V	-	Controlled outputs cycled OFF for 100% of their cycle, Battery

				Indicator or Battery Saver Indicator ON request sent
Load Shed 3 End	-	>13.0 V	Battery has a net loss of less than 15.0 AH	Clear Load Shed 3

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 a different power management function should be implemented.

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 the module controlling power to these devices.

Idle Boost Functions

The BCM sends a serial data request to the PCM to increase the idle speed. The PCM 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 one moment to another. This happens because the PCM responds to changes in the inputs from the sensors used to control the powertrain.

Load-Shed

This vehicle uses the following load-shed actions:

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.
		No messages or indicators are displayed. Data (DPID) indicating that the Load-Shed 1 was entered is stored and

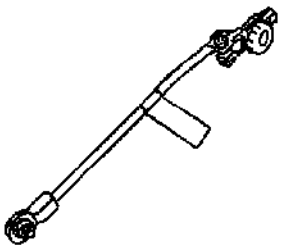
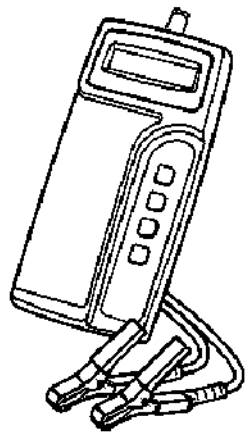
	Message Center, Instrument Cluster	may be accessed with a scan tool. DPID will reset after 40 ignition switch cycles with no repeated load-shed 1 action or with a battery disconnection.
Load-Shed Level 2	Heated Outside Rear View Mirrors, Heated Rear Window/Rear Window Defrost, Heated Seats	Cycled at 50% duty cycle, OFF for 10 of every 20 second cycle. Indicator and timer not affected.
	Message Center, Instrument Cluster	"Battery Saver Action" message or flashing indicators is displayed. Data (DPID) indicating that the Load-Shed 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 action or with a battery disconnection.
Load-Shed Level 3	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 not 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 3 command per ignition switch cycle.
	Message Center, Instrument Cluster	"Battery Saver Action" message is displayed. Battery/Charging System Failure icon is illuminated. Chime may be activated constantly until the load-shed level is exited. Data (DPID) indicating that the Load-Shed

Level 3 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 3 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 42000 Battery Tester

