

Engine Electrical

Specifications

Fastener Tightening Specifications

Application	Specification	
	Metric	English
ABS/SIR Electrical Ground Stud	14 N·m	10 lb ft
Accelerator and Cruise Control Servo Cable Adjuster Bolt (5.7 L)	7.5 N·m	66 lb in
Battery Hold Down Retainer Bolt	18 N·m	13 lb ft
Battery Side Terminal Adapters	15 N·m	11 lb ft
Coolant Recovery Reservoir Bolt	12 N·m	106 lb in
Engine Wiring Harness Ground Bolt to Engine Block (5.7 L)	25 N·m	18 lb ft
Forward Lamp Wiring Harness Grommet Bolt	2 N·m	71 lb in
Forward Lamp Harness Ground Stud	16 N·m	12 lb ft
Generator Brace Bracket Bolt (3.8 L)	50 N·m	37 lb ft
Generator Bracket Bolt (5.7 L)	50 N·m	37 lb ft
Generator Mounting Bolt (5.7 L)	50 N·m	37 lb ft
Generator Bolt (to drive belt tensioner lower) (3.8 L)	50 N·m	37 lb ft
Generator Bolt (to drive belt tensioner upper) (3.8 L)	30 N·m	22 lb ft
Generator Rear Brace Bolt (3.8 L)	25 N·m	20 lb ft
Generator Bolt (to rear brace) (3.8 L)	30 N·m	22 lb ft
Generator Mounting Bolt (5.7 L)	50 N·m	37 lb ft
Generator Mounting Bolt (rear to generator) (5.7 L)	25 N·m	18 lb ft
Ignition Coil Bolt (5.7 L)	12 N·m	106 lb in
Ignition Coil Bolt (3.8 L)	4 N·m	35 lb in
Ignition Control Module Bolt (3.8 L)	3 N·m	27 lb in
Ignition Control Module Nut	30 N·m	22 lb ft
Left Front Forward Lamp Wiring Ground Bolt	10 N·m	89 lb in
Lift Bracket to Ignition Control Module Bolt (3.8 L)	25 N·m	18 lb ft
Negative Battery Cable Bolt	15 N·m	11 lb ft
Negative Cable to Engine Block Stud Nut (3.8 L)	22 N·m	16 lb ft
Negative Cable to Engine Block Bolt (5.7 L)	32 N·m	24 lb ft
Negative Cable at Ground Terminal Nut	6 N·m	53 lb in
Positive Battery Cable Bolt	15 N·m	11 lb ft
Positive Cable RF Ground Nut (3.8 L)	25 N·m	18 lb ft
Positive Cable Nut to Generator Output Stud	22 N·m	16 lb ft
Positive Cable to Fuseblock Stud Nut	14 N·m	10 lb ft
Positive Cable to Starter Nut	10 N·m	89 lb in
Right Front Ground Bolt	10 N·m	89 lb in
Spark Plug (New Installation) (5.7 L)	20 N·m	15 lb ft
Spark Plug (Subsequent Installation) (5.7 L)	15 N·m	11 lb ft
Spark Plug (3.8 L)	27 N·m	20 lb ft
Starter Motor Bolt (3.8 L)	47 N·m	35 lb ft
Starter Motor Bolt (5.7 L)	50 N·m	37 lb ft
Starter Motor Stud (3.8 L)	45 N·m	33 lb ft
Starter Motor Shield Nut (3.8 L)	10 N·m	89 lb in
Starter Motor Shield Bolt (to transmission brace) (3.8 L)	10 N·m	89 lb in
Starter Motor Shield Bolt (to engine block) (3.8 L)	30 N·m	22 lb ft
Wiring Harness Ground Bolt	12 N·m	106 lb in
Wiring Harness Starter Lead Nut	2 N·m	18 lb in

Battery Usage

Application	Description
3.8 L (VIN K)	
Catalog Number	674
Cold Cranking Amperage (CCA)	690
Load Test (AMPS)	345
Replacement Model Number	75B-84
Reserve Capacity Minutes	90
5.7 L (VIN G)	
Catalog Number	670
Cold Cranking Amperage (AMPS)	525
Load Test (AMPS)	260
Replacement Model Number	75-60
Reserve Capacity Minutes	90

Battery Temperature vs Voltage Drop

Degrees Celsius (°C)	Degrees Fahrenheit (°F)	Voltage
Temperature vs Minimum Voltage		
21	70	9.6
10	50	9.4
0	32	9.1
-10	14	8.8
-18	0	8.5
Below -18	Below 0	8.0

Starter Motor Usage

Application	Description
No Load Test at 11.5 Volts	
Starter Motor	PG-260
Current Draw (AMPS)	60-125
Pinion Speed (RPM)	2900-3400
Pinion Clearance	0.25 mm (0.01 in)-4.06 mm (0.16 in)
Starter Solenoid Switch	
Hold-in Windings	5-15 Amps
Both Windings	30-50 Amps

Generator Usage

Application	Description
Engine	3.8 L (VIN K) and 5.7 L (VIN G)
Rated Amperes	105
Model Type	CS-130D

Spark Plug Usage

Engine Application	Spark Plug Type	Spark Plug Gap - Metric	Spark Plug Gap - English
3.8 L (VIN K)	41-921	1.524 mm	0.060 in
5.7 L (VIN G)	41-931	1.524 mm	0.060 in

Spark Plug Wire Resistance

Tools Required

J 39200 Digital Multimeter

1. Remove the spark plug wire to be tested.

Ensure that the plug wire terminals are clean before proceeding.

2. Use the J 39200 on the high scale.

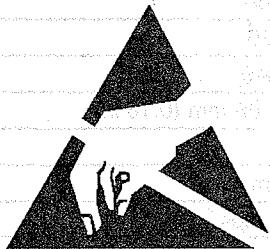
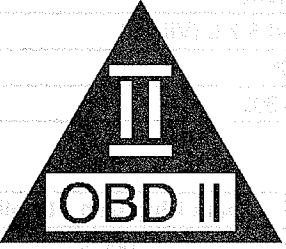
3. Connect an ohmmeter lead to each end of the plug wire.
4. Gently twist the wire while watching the ohmmeter reading.
5. If the ohmmeter reads above 10,000 ohms, replace the wire.
6. If the resistance of the wire being tested is not within 3,000 - 10,000 ohms replace the wire.

GM SPO Group Numbers

Application	GM SPO Group Number
Electronic Ignition Control Module	2.000
Generator	2.000
Generator Brace Bracket (3.8 L)	2.000
Generator Bracket (5.7 L)	2.000
Generator Rear Brace (3.8 L)	2.000
Generator Rear Bracket (5.7 L)	2.000
Ignition Coil	2.000
Negative Battery Cable	2.000
Positive Battery Cable	2.000
Starter Motor	2.000
Starter Motor Shield	2.000
Spark Plug	2.000
Spark Plug Wire	2.000

Schematic and Routing Diagrams

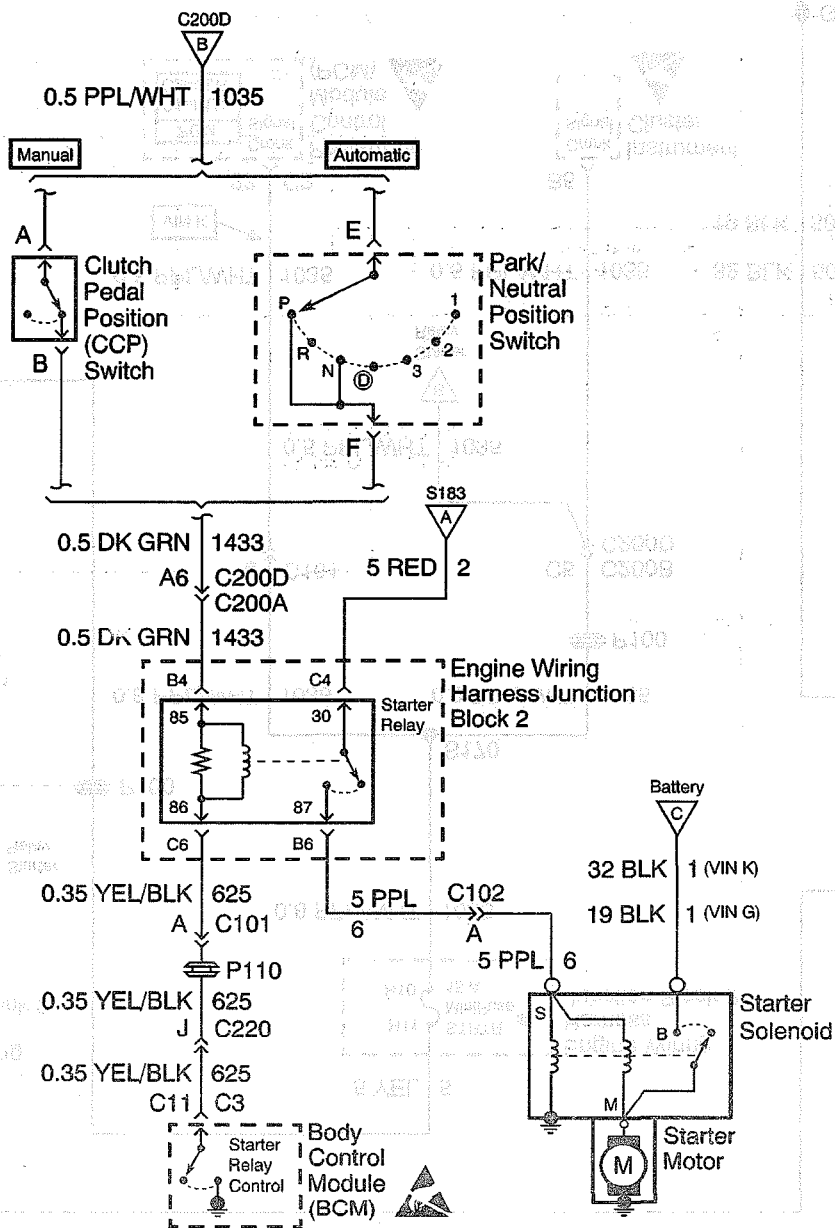
Engine Electrical Schematic Icons

Icon	Icon Definition
 19384	Refer to <i>ESD Notice</i> in Caution and Notices.
 19385	Refer to <i>OBD II Symbol Description Notice</i> in Caution and Notices.

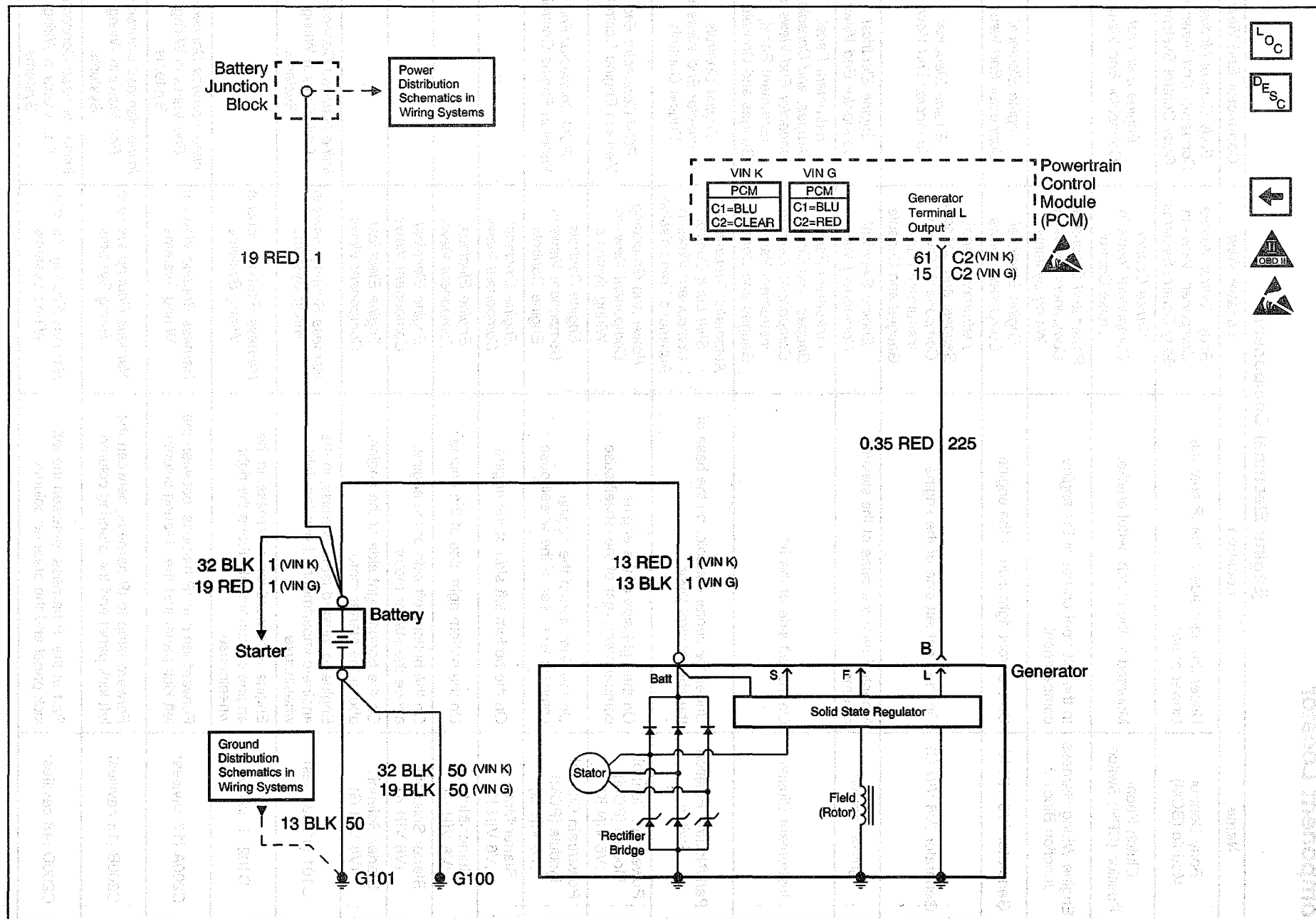
Engine



Starting and Charging Schematics (Starter Relay and Starter Solenoid)



Starting and Charging Schematics (Battery, Generator and Powertrain Control Module)



Component Locator

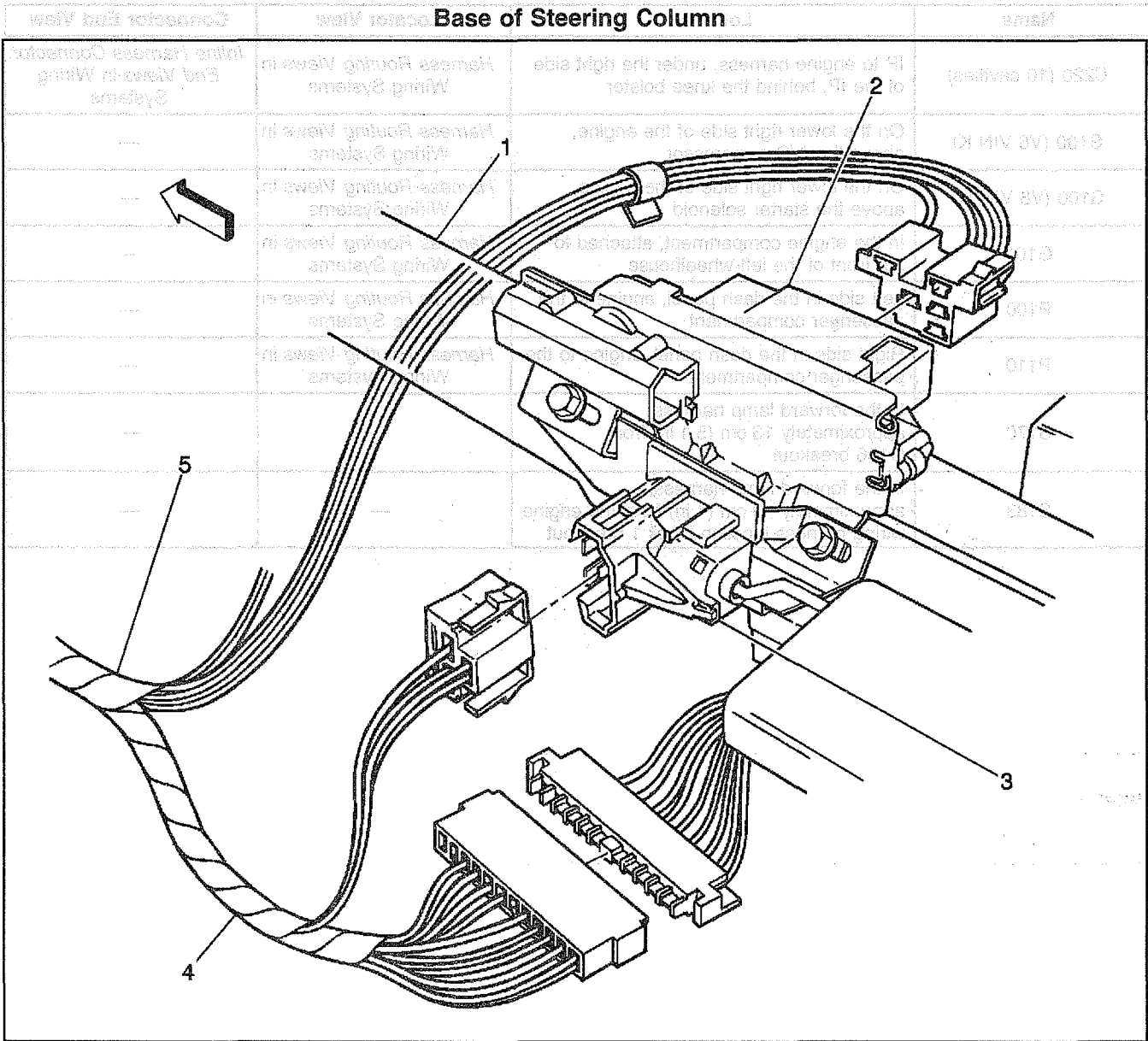
Engine Electrical Components

Name	Location	Locator View	Connector End View
Body Control Module (BCM)	Under the right side of the IP near the blower motor	Body Control Module Component Views in Body Control Systems	Body Control Module Connector End Views in Body Control Systems
Clutch Pedal Position (CPP) Switch	Mounted to the clutch pedal bracket	Cruise Control Component Views in Cruise Control	Engine Electrical Connector End Views
Engine Wiring Harness Junction Block 2	In the left front corner of the engine compartment	Power and Grounding Component Views in Wiring Systems	—
Generator (V6 VIN K)	On the front right side of the engine	Engine Electrical Component Views	Engine Electrical Connector End Views
Generator (V8 VIN G)	On the front left side of the engine	Instrument Panel, Gauges, and Console Component Views in Instrument Panel, Gauges and Console	Engine Electrical Connector End Views
Ignition Switch	Mounted near the base of the steering column	Engine Electrical Component Views	Engine Electrical Connector End Views
Instrument Cluster	On the left side of the IP	Instrument Panel, Gauges, and Console Component Views in Instrument Panel, Gauges and Console	Instrument Panel, Gauges, and Console Connector End Views in Instrument Panel, Gauges and Console
Park/Neutral Position Switch	Under the center console, on the base of the shift control lever	Automatic Transmission Shift Lock Control Component Views in Automatic Transmission	Engine Controls Connector End Views in Engine Controls
Powertrain Control Module (PCM) (V6 VIN K)	On the right side of the engine compartment, rear of the wheelhouse	Power and Grounding Component Views in Wiring Systems	PCM Connector End Views in Engine Controls
Powertrain Control Module (PCM) (V8 VIN G)	On the right side of the engine compartment, rear of the wheelhouse	Engine Controls Component Views in Engine Controls	PCM Connector End Views in Engine Controls
Starter Motor (V6 VIN K)	On the bottom left side of the engine	Engine Electrical Component Views	—
Starter Motor (V8 VIN G)	On the bottom right side of the engine	Engine Electrical Component Views	—
Starter Solenoid (V6 VIN K)	On the bottom left side of the engine, above the starter motor	Engine Electrical Component Views	—
Starter Solenoid (V8 VIN G)	On the bottom right side of the engine, above the starter motor	Engine Electrical Component Views	—
C101 (10 cavities)	Engine to forward lamp harness, in the engine compartment, above the right wheelhouse	Harness Routing Views in Wiring Systems	Inline Harness Connector End Views in Wiring Systems
C102 (1 cavity)	Engine to forward lamp harness, in the engine compartment, above the right wheelhouse	Harness Routing Views in Wiring Systems	—
C200A (17 cavities)	Forward lamp to IP harness, between the left kick panel and the steering column	Harness Routing Views in Wiring Systems	Inline Harness Connector End Views in Wiring Systems
C200B (18 cavities)	Forward lamp to IP harness, between the left kick panel and the steering column	Harness Routing Views in Wiring Systems	Inline Harness Connector End Views in Wiring Systems
C200D (48 cavities)	Part of the IP harness, between the left kick panel and the steering column	Harness Routing Views in Wiring Systems	Inline Harness Connector End Views in Wiring Systems

Engine Electrical Components (cont'd)

Name	Location	Locator View	Connector End View
C220 (10 cavities)	IP to engine harness, under the right side of the IP, behind the knee bolster	<i>Harness Routing Views in Wiring Systems</i>	<i>Inline Harness Connector End Views in Wiring Systems</i>
G100 (V6 VIN K)	On the lower right side of the engine, above the A/C compressor	<i>Harness Routing Views in Wiring Systems</i>	—
G100 (V8 VIN G)	On the lower right side of the engine, above the starter solenoid	<i>Harness Routing Views in Wiring Systems</i>	—
G101	In the engine compartment, attached to the front of the left wheelhouse	<i>Harness Routing Views in Wiring Systems</i>	—
P100	Left side in the dash panel, engine to the passenger compartment	<i>Harness Routing Views in Wiring Systems</i>	—
P110	Right side in the dash panel, engine to the passenger compartment	<i>Harness Routing Views in Wiring Systems</i>	—
S170	In the forward lamp harness, approximately 13 cm (5.1 in) from G106 breakout	—	—
S183	In the forward lamp harness, approximately 10 cm (4 in) from the engine wiring harness junction block 1 breakout	—	—

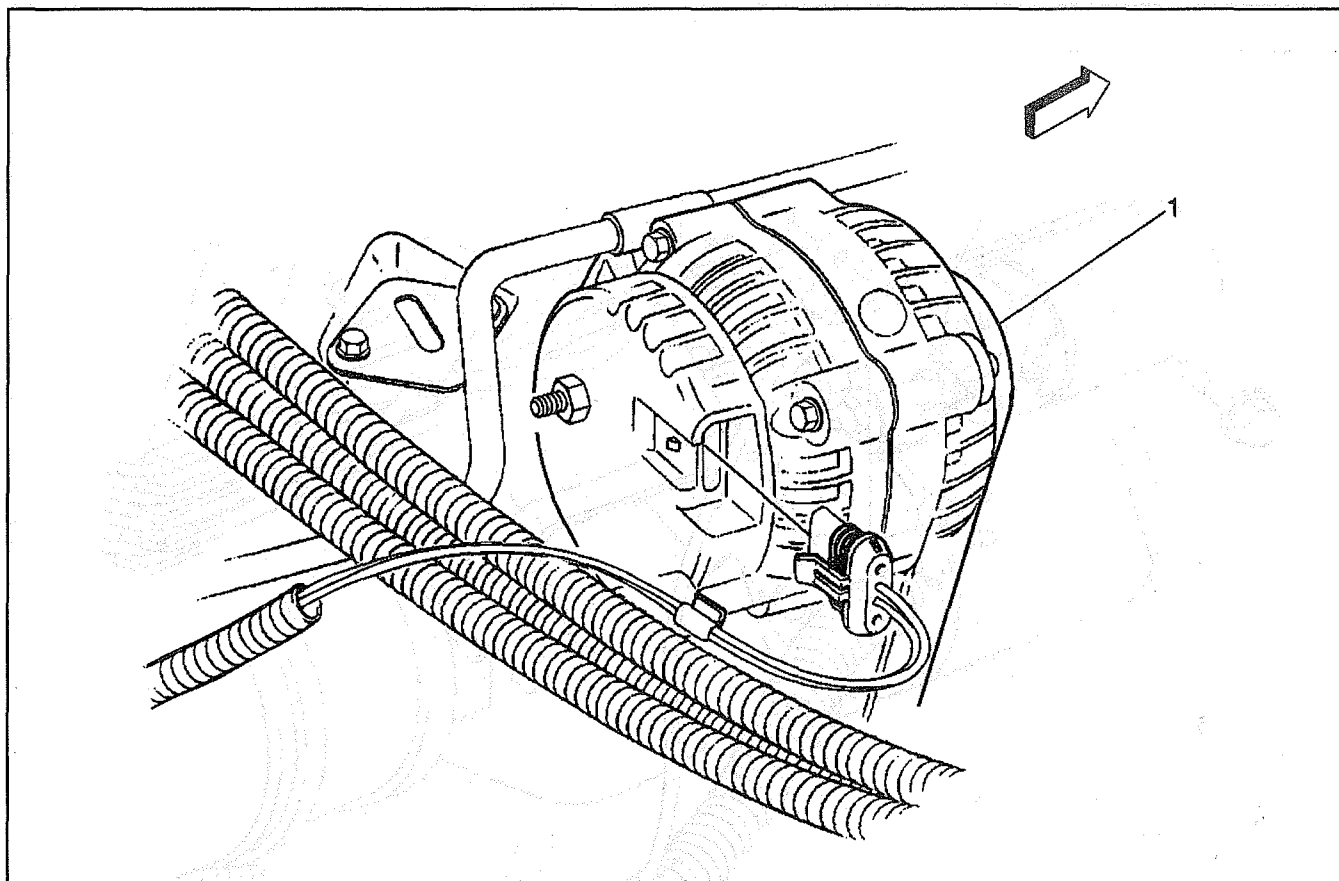
Engine Electrical Component Views



Legend

- (1) Steering Column
- (2) Ignition Switch
- (3) Headlamp Dimmer Switch
- (4) Isolation Diode (Wipers)
- (5) Forward Lamp Harness

Front Left Side of Engine (V6 VIN K)

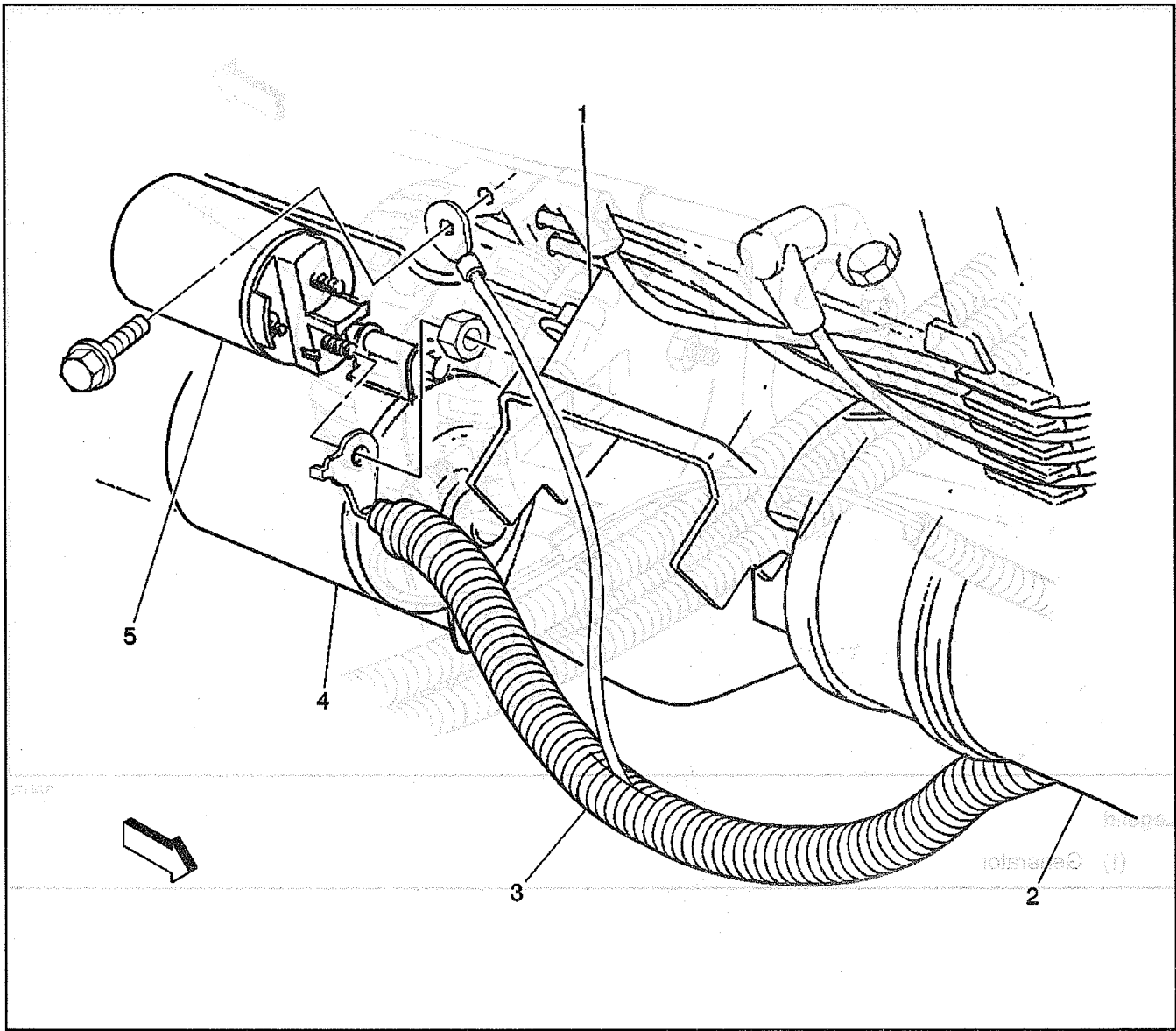


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Legend

(1) Generator

Lower Right Side of Engine (V8 VIN G)

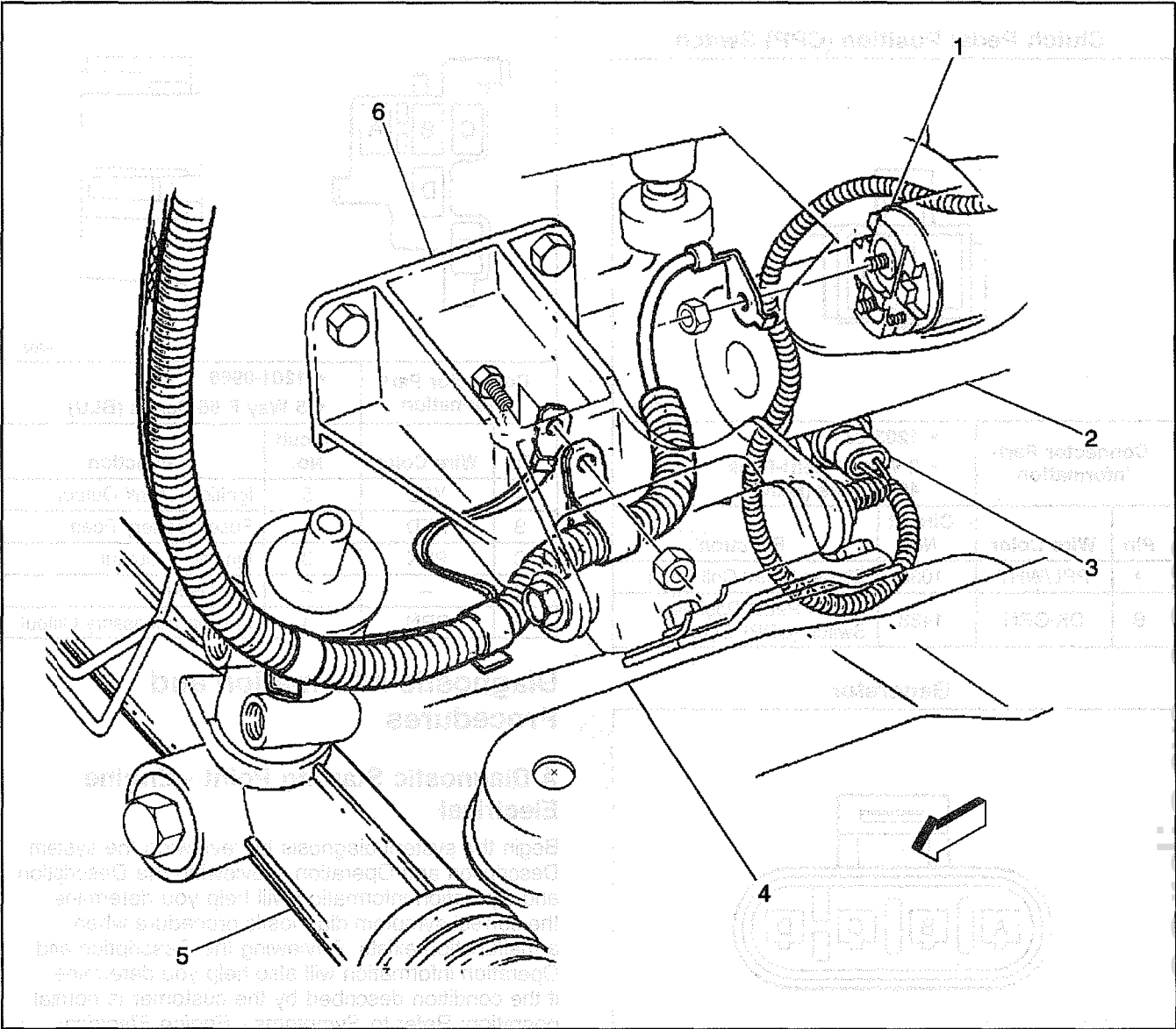


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Legend

- | | |
|--------------------------|----------------------|
| (1) Engine Mount Bracket | (4) Starter Motor |
| (2) A/C Compressor | (5) Starter Solenoid |
| (3) Battery Cable | |

Lower Left Side of Engine (V6 VIN K)



Legend

- (1) Starter Solenoid
- (2) Starter Motor
- (3) Oil Level Switch

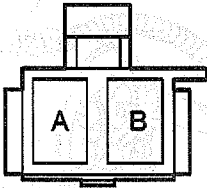
- (4) Lower Control Arm
- (5) Steering Gear
- (6) Left Engine Mount

Connector Part Information		Wire Color	Pin
1	Starter Solenoid	RED	1
2	Starter Motor	RED	1
3	Oil Level Switch	RED	1
4	Lower Control Arm	RED	1
5	Steering Gear	RED	1
6	Left Engine Mount	RED	1

Engine Electrical Connector End Views

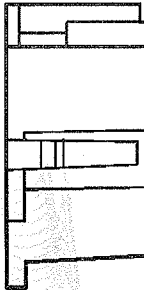
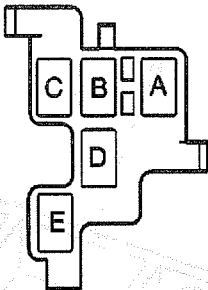
Ignition Switch (C2)

Clutch Pedal Position (CPP) Switch



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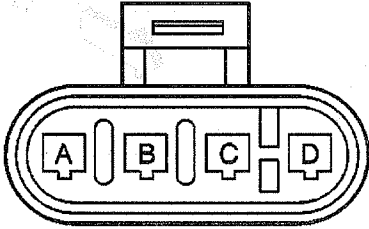
Connector Part Information				• 1203-3711 • 2 Way F Metri-Pack 480 Series (BLK)
Pin	Wire Color	Circuit No.	Function	
A	PPL/WHT	1035	Starter Relay Coil Feed	
B	DK GRN	1433	Clutch Pedal Position Switch (CPP) Output	



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Connector Part Information		• 1201-0966 • 5 Way F 56 Series (BLU)	
Pin	Wire Color	Circuit No.	Function
A	YEL	5	Ignition Crank Output
B	RED	2	Fused Battery Feed
C	PNK	3	Ignition 1 Output
D	—	—	Not Used
E	BRN	4	Ignition Accessory Output

Generator



289326

Connector Part Information				• 1218-6568 • 4 Way F Metri-Pack 150 Series Sealed (BLK)
Pin	Wire Color	Circuit No.	Function	
A	—	—	Not Used	
B	RED	225	Generator Regulator Reference Voltage	
C-D	—	—	Not Used	

Diagnostic Information and Procedures

A Diagnostic Starting Point - Engine Electrical

Begin the system diagnosis by reviewing the system Description and Operation. Reviewing the Description and Operation information will help you determine the correct symptom diagnostic procedure when a malfunction exists. Reviewing the Description and Operation information will also help you determine if the condition described by the customer is normal operation. Refer to *Symptoms - Engine Electrical* in order to identify the correct procedure for diagnosing the system and where the procedure is located.

Symptoms - Engine Electrical

Important: Review the system operation in order to familiarize yourself with the system functions. Refer to one of the following operations:

- *Starting System Operation*
- *Battery Operation*
- *Charging System Operation*
- *Ignition System Operation*

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the Engine Electrical System. 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 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/Cranks Slowly, but Does Not Start
- Starter Motor Noise Diagnosis
- Starter No Load Test
- Battery Common Causes of Failure
- Battery Check
- Battery Terminal Check
- Battery Hydrometer Displays Yellow Dot
- Battery Not Operating Properly
- Battery Electrical Drain/Parasitic Load Test
- Generator Not Operating Properly
- Generator Assembly Check
- Spark Plug Visual Diagnosis
- Spark Plug Wires Not Operating Properly

Starter Solenoid Does Not Click

Step	Action	Value(s)	Yes	No
1	Did you review the system operation and perform the necessary inspections?	—	Go to Step 2	Go to Symptoms - Engine Electrical
2	Attempt to start the vehicle. Does the starter solenoid click audibly?	—	Go to Testing for Intermittent and Poor Connections in Wiring Systems	Go to Step 3
3	1. Remove the starter relay from engine wiring harness junction block 2. 2. Connect a test lamp between the starter relay terminal C6 and battery voltage. Refer to <i>Circuit Testing</i> in Wiring Systems. 3. While observing the test lamp, turn the ignition switch to the START position. Does the test lamp illuminate?	—	Go to Step 4	Go to A Diagnostic System Check - Theft Deterrent
4	Connect a test lamp between the engine wiring harness junction block 2 terminal C4 and ground. Refer to <i>Circuit Testing</i> in Wiring Systems. Does the test lamp illuminate?	—	Go to Step 5	Go to Step 6
5	1. Connect a test lamp between the engine wiring harness junction block 2 terminal B4 and ground. Refer to <i>Circuit Testing</i> in Wiring Systems. 2. Place the transmission in PARK or NEUTRAL (automatic) or press the clutch pedal (manual). 3. While observing the test lamp, turn the ignition switch to the START position. Does the test lamp illuminate?	—	Go to Step 7	Go to Step 8
6	Repair the open in circuit 2 between the engine wiring harness junction block and S183. Refer to <i>Wiring Repairs</i> in Wiring Systems. Did you complete the repair?	—	Go to Step 18	—
7	1. Install the starter relay into the engine wiring harness junction block 2. 2. Disconnect circuit 6 (the PPL wire) from the starter solenoid. 3. Connect a test lamp between circuit 6 and ground. Refer to <i>Circuit Testing</i> in Wiring Systems. 4. Place the transmission in PARK or NEUTRAL (automatic) or press the clutch pedal (manual). 5. While observing the test lamp, turn the ignition switch to the START position. Does the test lamp illuminate?	—	Go to Step 15	Go to Step 12

Starter Solenoid Does Not Click (cont'd)

Step	Action	Value(s)	Yes	No
8	Test for and repair an open or a poor connection in circuit 1433 from the engine wiring harness junction block 2 terminal B4 to the transmission range switch terminal F (automatic) or the clutch pedal position switch terminal B (manual). Refer to <i>Circuit Testing</i> or <i>Testing for Intermittent and Poor Connections</i> and <i>Wiring Repairs</i> or <i>Connector Repairs</i> in Wiring Systems. Did you find and repair an open or a poor connection?	—	Go to Step 18	Go to Step 9
9	Test for and repair a poor connection at the transmission range switch (automatic) or the clutch pedal position switch (manual). Refer to <i>Testing for Intermittent and Poor Connections</i> and <i>Connector Repairs</i> in Wiring Systems. Did you find and repair a poor connection?	—	Go to Step 18	Go to Step 10
10	Test for and repair an open in circuit 1035 from the transmission range switch terminal E (automatic) or the clutch pedal position switch terminal A (manual) to C200D. Refer to <i>Circuit Testing</i> and <i>Wiring Repairs</i> in Wiring Systems. Did you find and repair an open?	—	Go to Step 18	Go to Step 11
11	Adjust or replace the transmission range switch (automatic) or the clutch pedal position switch. Refer to one of the following procedures: • <i>Park/Neutral Position Switch Adjustment</i> in Automatic Transmission - 4L60-E • <i>Park/Neutral Position Switch Replacement</i> in Automatic Transmission - 4L60-E • <i>Clutch Pedal Position Switch Replacement</i> in Clutch Did you complete the replacement or adjustment?	—	Go to Step 18	—
12	Test for and repair a poor connection at the starter relay. Refer to <i>Testing for Intermittent and Poor Connections</i> and <i>Connector Repairs</i> in Wiring Systems. Did you find and repair a poor connection?	—	Go to Step 18	Go to Step 13
13	Test for and repair an open or a poor connection in circuit 6. Refer to <i>Circuit Testing</i> or <i>Testing for Intermittent and Poor Connections</i> and <i>Wiring Repairs</i> or <i>Connector Repairs</i> in Wiring Systems. Did you find and repair an open or a poor connection?	—	Go to Step 18	Go to Step 14
14	Replace the starter relay. Refer to <i>Starter Motor Relay Replacement</i> . Did you complete the replacement?	—	Go to Step 18	—
15	Test for and repair a poor connection in circuit 1 at the positive battery terminal and the starter solenoid. Refer to <i>Testing for Intermittent and Poor Connections</i> and <i>Connector Repairs</i> in Wiring Systems. Did you find and repair a poor connection?	—	Go to Step 18	Go to Step 16
16	Test for and repair an open in circuit 1. Refer to <i>Circuit Testing</i> and <i>Wiring Repairs</i> in Wiring Systems. Did you find and repair an open?	—	Go to Step 18	Go to Step 17
17	Replace the starter. Refer to <i>Starter Motor Replacement (3.8 L)</i> or <i>Starter Motor Replacement (5.7 L)</i> . Did you complete the replacement?	—	Go to Step 18	—
18	Operate the system in order to verify the repair. Did you correct the condition?	—	System OK	Go to Step 3

Starter Solenoid Clicks, Engine Does Not Crank

Step	Action	Value(s)	Yes	No
Important: To avoid misdiagnosis, perform the following procedures: • Battery Terminal Check • Battery Check				
1	Did you review the system operation and perform the necessary inspections?	—	Go to Step 2	Go to Symptoms - Engine Electrical
2	Attempt to start the vehicle. Does engine crank?	—	Go to Testing for Intermittent and Poor Connections in Wiring Systems	Go to Step 3
3	1. (Automatic transmission) Set the gear selector to the PARK position. (Manual transmission) Set the park brake and place the transmission in neutral. 2. Turn the ignition switch to the START position. 3. Use a DMM to measure the voltage from the battery positive terminal to the starter solenoid terminal B. Refer to <i>Circuit Testing</i> in Wiring Systems. Is the voltage equal to the specified value?	0-0.5V	Go to Step 4	Go to Step 5
4	1. Turn the ignition switch to the START position. 2. Use a DMM to measure the voltage from the battery negative terminal to G100. B. Refer to <i>Circuit Testing</i> in Wiring Systems. Is the voltage equal to the specified value?	0-0.5V	Go to Step 7	Go to Step 6
5	Replace the battery positive cable. Refer to <i>Battery Cable Replacement (3.8 L Positive)</i> or <i>Battery Cable Replacement (5.7 L Positive)</i> . Did you complete the repair?	—	Go to Step 8	—
6	Replace the negative battery cable. Refer to <i>Battery Cable Replacement (3.8 L Negative)</i> or <i>Battery Cable Replacement (5.7 L Negative)</i> . Did you complete the repair?	—	Go to Step 8	—
7	Replace the starter. Refer to <i>Starter Motor Replacement (3.8 L)</i> or <i>Starter Motor Replacement (5.7 L)</i> . Did you complete the repair?	—	Go to Step 8	—
8	Operate the system in order to verify the repair. Did you correct the condition?	—	System OK	Go to Step 3

Engine Cranks/Cranks Slowly, but Does Not Start

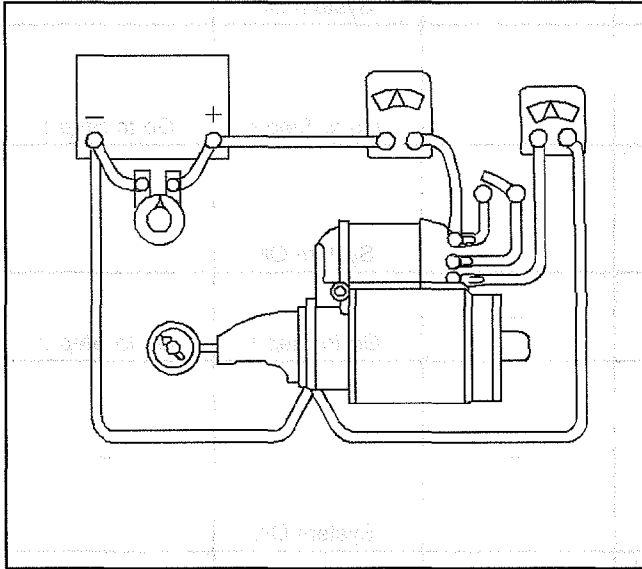
Step	Action	Value(s)	Yes	No
1	Did you review the system operation and perform the necessary inspections?	—	Go to Step 2	Go to Symptoms - Engine Electrical
2	Attempt to start the vehicle. Does the engine start?	—	Go to Testing for Intermittent and Poor Connections in Wiring Systems	Go to Step 3
3	1. The battery is fully charged. 2. Turn the ignition switch to the START position. 3. Wait 15 seconds and measure the voltage at the battery while cranking the engine. Refer to <i>Circuit Testing</i> in Wiring Systems. Is the reading greater than the specified value?	> 9.5 V	Go to Step 4	Go to Step 5
4	Measure the voltage between the negative battery terminal and the engine block while cranking the engine. Refer to <i>Circuit Testing</i> in Wiring Systems. Is the reading greater than the specified value?	> 0.5 V	Go to Step 6	Go to Step 7
5	Load test the battery. Refer to <i>Battery Electrical Drain/Parasitic Load Test</i> . Is the battery OK?	—	Go to Step 8	Go to Step 9
6	Replace the negative battery cable. Refer to <i>Battery Cable Replacement (3.8 L Negative)</i> or <i>Battery Cable Replacement (5.7 L Negative)</i> . Does the starter solenoid continue to click and the engine to crank slowly or not at all?	—	Go to Step 7	Go to Step 11
7	Measure the voltage between the B+ terminal and the starter solenoid terminal B while cranking the engine. Refer to <i>Circuit Testing</i> in Wiring Systems. Is the reading greater than the specified value?	> 0.5 V	Go to Step 10	Go to Step 8
8	Repair or replace the starter motor. Refer to <i>Starter Motor Replacement (3.8 L)</i> or <i>Starter Motor Replacement (5.7 L)</i> . Does the starter solenoid continue to click and the engine to crank slowly or not at all?	—	Go to Step 9	Go to Step 11
9	Replace the battery. Refer to <i>Battery Replacement</i> . Does the starter solenoid continue to click and the engine to crank slowly or not at all?	—	Go to Step 10	Go to Step 11
10	Replace the positive battery cable. Refer to <i>Battery Cable Replacement (3.8 L Positive)</i> or <i>Battery Cable Replacement (5.7 L Positive)</i> . 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

Starter Motor Noise Diagnosis

Step	Action	Value	Yes	No
1	Do you hear a high pitched whine during cranking (before the engine fires) but the engine cranks and fires normally?	—	Go to Step 2	Go to Step 3
2	Reduce the distance between the starter pinion and the flywheel. Has the noise stopped?	—	System OK	—
3	As the key is being turned, do you hear a high-pitched whine after the engine fires? (The engine cranks and fires normally. This is often diagnosed as starter hang-in or a weak solenoid.)	—	Go to Step 4	Go to Step 5
4	Increase the distance between the starter pinion and the flywheel. (Flywheel runout makes this appear to be intermittent.) Has the noise stopped?	—	System OK	—
5	Is there a loud "whoop" (It may sound like a siren if the engine is revved while the starter is engaged) after the engine fires, but while the starter is still held engaged?	—	Go to Step 6	Go to Step 7
6	1. Remove the starter motor. Refer to <i>Starter Motor Replacement (3.8 L)</i> or <i>Starter Motor Replacement (5.7 L)</i> . 2. Check the starter motor clutch. 3. Replace the worn parts. Has the noise stopped?	—	System OK	—
7	Do you hear a rumble, a growl, or in severe cases a knock as the starter is coasting down to a stop after starting the engine?	—	Go to Step 8	System OK
8	1. Remove the starter motor. Refer to <i>Starter Motor Replacement (3.8 L)</i> or <i>Starter Motor Replacement (5.7 L)</i> . 2. Check for a bent or unbalanced starter armature. 3. Replace worn parts. Has the noise stopped?	—	System OK	—

Starter No Load Test

1. Remove the starter motor. Refer to *Starter Motor Replacement (3.8 L)* or *Starter Motor Replacement (5.7 L)*.
2. Turn OFF the carbon pile.



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Caution: Keep fingers, tools, and any other objects away from the opening in the drive end housing while making electrical connections. The strong shifting action of the starter solenoid can cause severe personal injury or damage to components as the drive pinion moves into the cranking position.

3. Make connections as shown with the switch open.
4. Close the switch.
5. Adjust the carbon pile in order to obtain 10 Volts.
6. Compare the readings of the current, the RPM's, and the voltage. Refer to *Starter Motor Usage*.
7. If the pinion does not shift into the cranking position or the pinion does not rotate, then turn OFF the switch immediately. Ensure that the test electrical connections were properly made. If so, then replace the starter motor.

8. If the starter motor energizes and the pinion rotates, then, while maintaining 10 Volts on the voltmeter, check the current draw on the ammeter and the pinion speed on the RPM indicator.

- Turn OFF the switch.
- Compare the values to the starter specifications table. Refer to *Starter Motor Usage*.
 - If the current draw and the pinion speed (RPM) are within the specifications, then the starter motor is good.
 - If the current draw or the pinion speed (RPM) is not within the specifications, then replace the starter motor. Refer to *Starter Motor Replacement (3.8 L)* or *Starter Motor Replacement (5.7 L)*.

Battery Common Causes of Failure

If the vehicle's 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).
- 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:
 - An electrical short
 - A slipping belt
 - A bad generator
- The battery has not been properly maintained, including the following situations:
 - A failure to keep the terminals tight
 - A failure to keep the terminals clean
 - A loose battery hold-down
- Power failure caused by an existing mechanical condition in the electrical system, such as a short or pinched wire.
- The car is in storage for extended periods of time.
- Extended cranking periods caused by spark plug fouling.
- The hydrometer has been read incorrectly.
- There has been an insufficient ampere-hour charge rate for a discharged battery.
- There is a burned out charge indicator bulb causing a NO CHARGE condition.
- There is a continuous current draw on the battery through excessive parasitic drain.
- The battery is old.

Battery Check

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

- 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.

Battery Check

Step	Action	Normal Result(s)	Abnormal Result(s)*
1	1. Inspect the following areas for battery acid: • The battery case • The battery tray • The area around and underneath the battery tray 2. Inspect the battery for a cracked, broken, or damaged case.	• The battery case, the battery tray, and the surrounding area are dry. • The battery is not cracked, broken, or damaged.	Refer to <i>Battery Replacement</i> .
2	Compare the Cold Cranking Amperage (CCA) and the Reserve Capacity (RC) of the battery or the Original Equipment (OE) specification. Refer to <i>Battery Usage</i> .	The ratings of the vehicle battery meet or exceed the CCA and the RC of the original equipment specification.	Refer to <i>Battery Replacement</i> .
3	Inspect the battery hydrometer for a green dot.	The battery hydrometer displays a green dot.	• If the battery hydrometer has a dark dot (no green dot visible), test the condition of the battery. Refer to <i>Battery Not Operating Properly</i>. • If the battery hydrometer has a yellow dot, check the battery for low electrolyte. Refer to <i>Battery Hydrometer Displays Dark or Yellow Dot</i>.
4	Turn the ignition key to START and check to see if the engine cranks normally and starts.	The engine cranks normally and starts.	• Engine does not crank or cranks slowly, refer to <i>Battery Not Operating Properly</i>. • Engine cranks normally but does not start, refer to <i>Engine Cranks but Does Not Run</i> in Engine Controls - 3.8 L or <i>Engine Cranks but Does Not Run</i> in Engine Controls - 5.7 L. • Engine starts but does not start overnight or after a couple of days, refer to <i>A Diagnostic Starting Point - Engine Electrical and Battery Electrical Drain/Parasitic Load Test</i>.
5	1. Inspect the battery for proper installation and retention in the battery tray. 2. Inspect the battery terminals for clean and tight connections.	• The battery is firmly held in place in the tray and the hold-down bolt is properly tightened. • The battery terminals are clean and tight.	• Install the battery in the battery tray correctly. Refer to <i>Battery Replacement</i>. • Refer to <i>Battery Terminal Check</i>.

* Refer to the appropriate symptom diagnostic table for the applicable abnormal result.

Battery Terminal Check

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition key to the OFF position. 2. Attempt to rotate the negative battery cable connector clockwise with light finger pressure. Does the negative connector rotate?	—	Go to Step 2	Go to Step 3
2	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 (7 lb ft)	Go to Step 4	Go to Step 3
3	Disconnect the negative battery cable. Refer to <i>Battery Negative Cable Disconnect/Connect Procedure</i> . Is the cable disconnected?	—	Go to Step 5	—
4	Ensure the negative battery cable is disconnected. Inspect for the following conditions and repair as needed: • The cable bolt is too long or misformed 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. Is the repair complete?	—	Go to Step 5	—
5	Rotate the positive battery cable connector clockwise with light finger pressure. Does the positive connector rotate?	—	Go to Step 6	Go to Step 7
6	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 (7 lb ft)	Go to step 8	Go to Step 7
7	Disconnect the positive battery cable. Is the cable disconnected?	—	Go to Step 9	—
8	Ensure the positive battery cable is disconnected. Inspect for the following conditions and repair as needed: • The cable bolt is too long or misformed 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. Is the repair complete?	—	Go to Step 9	—
9	1. Clean and wire brush the lead face of both battery terminals and the metal contact rings in both cable connectors. 2. Remove the bolts from the cable connectors in order to provide access to the connector rings as needed. 3. If either the battery terminals or the cable rings are excessively damaged or corroded, replace as needed. Are the metal connecting parts clean and in good condition?	—	Go to Step 10	—
10	1. Connect the positive battery cable to the battery positive terminal. 2. Tighten the cable bolt to the specified value. Is the cable bolt properly tightened?	15 N·m (11 lb ft)	Go to Step 11	—
11	1. Connect the negative battery cable to the battery negative terminal. 2. Tighten the cable bolt to the specified value. Is the cable bolt properly tightened?	15 N·m (11 lb ft)	Battery Terminals OK	—

Battery Hydrometer Displays Yellow Dot

Step	Action	Value(s)	Yes	No
1	Was the Battery Check performed?	—	Go to Step 2	Go to Battery Check
2	Tap the hydrometer lightly on top with the handle of a small screwdriver to dislodge any air bubbles inside the battery. Is the hydrometer dot still yellow?	—	Go to Step 4	Go to Step 3
3	Does the hydrometer display a green or dark dot?	—	Hydrometer OK	Go to Step 4
4	Replace the battery. Refer to <i>Battery Replacement</i> . Did you complete the replacement?	—	Go to Step 5	—
5	Visually inspect the hydrometer in the new battery. Does the hydrometer display a green dot?	—	Go to Step 11	Go to Step 6
6	Does the hydrometer display a yellow dot?	—	Go to Step 7	Go to Step 9
7	Tap the hydrometer lightly on top with the handle of a small screwdriver to dislodge any air bubbles inside the battery. Is the hydrometer dot still yellow?	—	Go to Step 4	Go to Step 8
8	Does the hydrometer display a green dot?	—	Go to Step 11	Go to Step 9
9	Does the hydrometer display a dark dot?	—	Go to Step 10	—
10	Charge the battery. Refer to <i>Battery Charging</i> . Was the battery recharged?	—	Go to Step 11	—
11	Check the charging system for proper operation. Refer to <i>A Diagnostic Starting Point - Engine Electrical</i> . Is the charging system OK?	—	Hydrometer OK	—

Battery Not Operating Properly

Tools Required

- J 42000 Digital Battery Tester
- J 39200 Digital Multimeter
- GM P/N 12303040 Battery Side Terminal Adapters

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

Important: The battery test using the J 42000 Battery Tester requires correct connections to the battery terminals. A failure to obtain the correct connections during the test may result in replacing the battery unnecessarily. Adhere to the following instructions in order to avoid an incorrect diagnosis due to poor connections:

- When testing the vehicle with the battery cables still connected, rock the J 42000 clips back and forth on the terminal bolt in order to cut through any coating or 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 it is uncertain that correct connections can be made to the battery terminal bolts in the vehicle, perform the following steps:

1. Disconnect the battery cables.
 2. Install the test adapters on the terminals.
 3. Follow the instructions for testing the battery outside of the vehicle.
- If a REPLACE BATTERY result is obtained for a battery tested in the vehicle with the battery cables connected, perform the following steps:
1. Disconnect the battery cables.
 2. Install the approved adapters.

3. Follow the instructions for testing the battery outside of the vehicle.

4. Replace the battery only if the second test shows a REPLACE BATTERY result.

For warranty purposes, use the test code from the second test.

- Use the approved terminal adapters.

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

Use the test adapters that are provided with the J 42000 tester or GM part number 12303040 terminal adapters. If the adapters that are provided with the J 42000 tester require replacement, only use adapters with the GM part number 12303040. Any other adapters may not contact the correct areas of the battery terminal, causing resistance that may result in an invalid battery test result.

- In order to test the top terminal, threaded stud batteries outside of the vehicle, use GM part number 12303040 adapters.

Do not connect the tester to the plain threaded terminals.

Important: For warranty purposes, always place the test code displayed by the tester on the repair order. The number is a unique identifier that describes the test data for a particular battery at a particular time.

While the test code may occasionally repeat when retesting the same battery, it is more likely that a different code will result each time the battery is tested.

Battery Not Operating Properly

Step	Action	Value(s)	Yes	No
1	Has the Battery Check been performed?	—	Go to Step 2	Go to Battery Check
2	Is the battery in the vehicle, with the battery cables connected?	—	Go to Step 4	Go to Step 3
3	1. Lightly wire brush the lead faces of both battery terminals. 2. Install the terminal adapters to both of the terminals. Are the adapters installed?	—	Go to Step 5	—
4	1. Turn the ignition switch to the OFF position. 2. Turn the electrical loads and all accessory lights to the OFF position. Are all of the electrical loads and accessory lights OFF?	—	Go to Step 5	—

Battery Not Operating Properly (cont'd)

Step	Action	Value(s)	Yes	No
5	Important: When testing the battery in the vehicle, connect the tester directly to the cable bolts. Do not connect either of the tester clamps to a remote terminal, such as a junction block or a jump start terminal. The use of a remote terminal will cause invalid test results. 1. Connect the red clamp on the <i>J 42000</i> to the adapter or the cable bolt on the battery positive terminal. 2. Connect the black clamp on the tester to the adapter or cable bolt on the battery negative terminal. 3. Rock both of the tester clamps back and forth in order to cut through to the bare metal. The message GM MICRO 410 should appear for a short time on the tester display, and then change to SELECT TEST. Does the display read SELECT TEST?	—	Go to Step 9	Go to Step 6
6	Does a CHECK CONNECTION message appear on the <i>J 42000</i> display?	—	Go to Step 7	Go to Step 8
7	Inspect the tester connections to the battery terminal adapters or cable bolts for the following conditions: • Both sides of each tester clamp must make the correct contact. • Ensure that the red clamp is connected to the positive post and the black clamp is connected to the negative post. • If the adapters or the bolts appear corroded, rock the clamps back and forth in order to ensure a correct connection. Use a wire brush in order to clean the adapters or cable bolts, if needed. Does the tester display now read SELECT TEST?	—	Go to Step 16	Go to Step 11
8	Use <i>J 39200</i> in order to test the battery voltage with the <i>J 42000</i> tester connected. Is the voltage at or below the specified value?	5.5 V	Go to Step 24	Go to Step 28
9	Use the scroll keys on the <i>J 42000</i> tester in order to select either IN-VEHICLE or OUT-OF-VEHICLE testing, depending on the following conditions: • Use IN-VEHICLE testing if the battery cables are connected to the battery. • Use OUT-OF-VEHICLE testing if the battery cables are disconnected and the terminal adapters are installed. Was IN-VEHICLE testing selected?	—	Go to Step 10	Go to Step 11
10	The display on the tester will show ALWAYS TEST AT BATTERY TERMINAL, and then change to SELECT RATING. Does the display read SELECT RATING?	—	Go to Step 12	Go to Step 36
11	For OUT-OF-VEHICLE testing, the display on the tester will show USE TERMINAL ADAPTERS, and then change to SELECT RATING. Does the tester display read SELECT RATING?	—	Go to Step 12	Go to Step 36

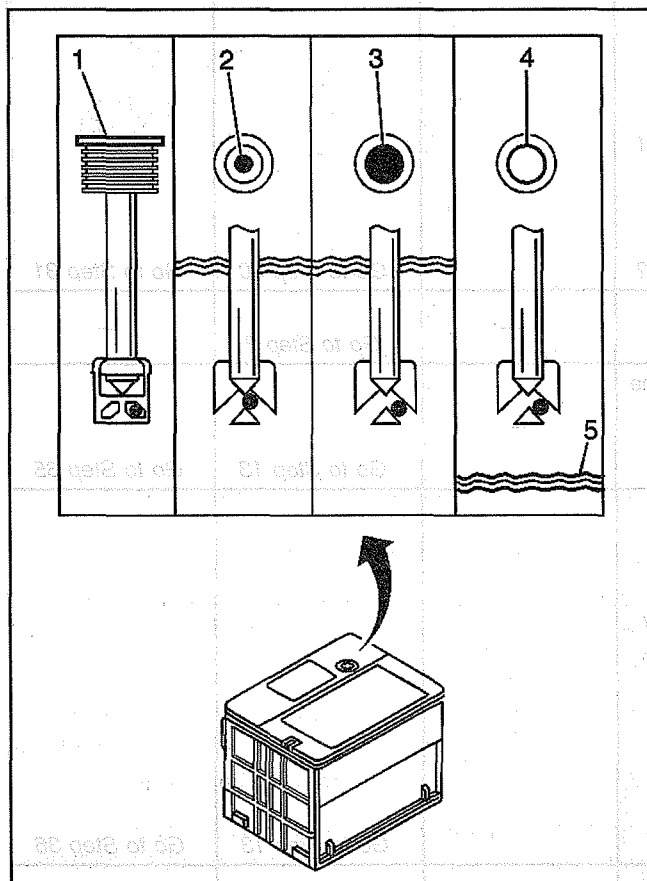
Battery Not Operating Properly (cont'd)

Step	Action	Value(s)	Yes	No
12	Important: Refer to <i>Battery Usage</i> for the correct rating for the vehicle's OE battery. If a battery with a lower CCA rating has been installed in the vehicle, the battery may not perform properly during the use of the vehicle even if the battery passes the test using the <i>J 42000</i> tester. 1. Use the scroll keys on the <i>J 42000</i> tester in order to select the CCA rating on the battery label. 2. Press the ENTER key on the tester. TESTING will appear briefly on the display, followed by the results of the test. Are the results of the test displayed?	—	Go to Step 13	—
13	Does GOOD BATTERY appear on the <i>J 42000</i> display?	—	Go to Step 13	Go to Step 14
14	Does GOOD-RECHARGE appear on the display?	—	Go to Step 24	Go to Step 15
15	Does CHARGE & RETEST appear on the display?	—	Go to Step 28	Go to Step 16
16	Does REPLACE BATTERY appear on the display?	—	Go to Step 25	Go to Step 17
17	Does BAD CELL-REPLACE appear on the display?	—	Go to Step 27	Go to Step 18
18	Does SURFACE CHARGE DETECTED appear on the display?	—	Go to Step 29	Go to Step 19
19	Does SELECT TEMP appear on the display?	—	Go to Step 32	Go to Step 20
20	Does SYSTEM NOISE-CHECK LOADS, alternating with RETESTING, appear on the display?	—	Go to Step 33	Go to Step 36
21	1. Press the CODE button on the <i>J 42000</i>. 2. For warranty purposes, write the displayed code on the repair order. Is the green dot visible in the battery's hydrometer?	—	Go to Step 23	Go to Step 22
22	Charge the battery. Refer to <i>Battery Charging</i>. Is the green dot visible in the hydrometer?	—	Go to Step 23	Go to Step 38
23	The battery is OK. Install the battery. Refer to <i>Battery Replacement</i>. Is the action complete?	—	System OK	—
24	1. Press the CODE button on the <i>J 42000</i>. 2. For warranty purposes, write the displayed code on the repair order. 3. Charge the battery. Refer to <i>Battery Charging</i>. Is the green dot visible in the hydrometer?	—	Go to Step 23	—
25	Was the battery tested in the vehicle with the battery cables still attached?	—	Go to Step 26	Go to Step 27
26	1. Turn the ignition key to the OFF position. 2. Disconnect the negative battery cable. Refer to <i>Battery Negative Cable Disconnect/Connect Procedure</i>. 3. Disconnect the positive battery cable. Are the actions complete?	—	Go to Step 3	—
27	1. Press the CODE button on the <i>J 42000</i>. 2. For warranty purpose, write the displayed code on the repair order. 3. Replace the battery. Refer to <i>Battery Replacement</i>. Is the action complete?	—	Go to Step 2	—
28	1. Press the CODE button on the <i>J 42000</i>. 2. For warranty purpose, write the displayed code on the repair order. 3. Charge the battery. Refer to <i>Battery Charging</i>. Is the green dot visible in the battery hydrometer?	—	Go to Step 2	—

Battery Not Operating Properly (cont'd)

Step	Action	Value(s)	Yes	No
29	Important: Surface charge removal is only necessary when the tester detects that a surface charge may affect the results of the test. The tester will not complete the testing sequence until the surface charge is removed. Follow the tester prompts in order to remove the surface charge by turning the vehicle's headlights ON and OFF. If the sequence is followed properly, the tester will automatically complete the test. If the sequence is not followed properly, the tester will display the message DISCONNECT AND RETEST. Does the DISCONNECT AND RETEST message appear?	—	Go to Step 30	Go to Step 31
30	Disconnect the tester from the battery terminals. Is the action complete?	—	Go to Step 2	—
31	The tester will display the word RETESTING and show the CCA rating that was selected for the test. If the test is successfully completed, the test results will be displayed. Do the test results appear on the display?	—	Go to Step 13	Go to Step 35
32	Important: Temperature compensation is only necessary when the tester detects that the battery temperature may affect the results of the test. 1. Use the scroll keys in order to indicate whether the internal temperature of the battery is above or below 0°C (32°F). Use the temperature of the battery to which the battery has been exposed for the past several hours in order to estimate the temperature. 2. Push the ENTER key. The tester will briefly display the RETESTING message and the CCA rating selected for the test. The test results will then show on the display. Do the test results show on the display?	—	Go to Step 13	Go to Step 36
33	The tester detects that a vehicle electrical load is not present (such as a light is on or the ignition key is not in the OFF position). Turn OFF all of the system electrical loads. Are all of the system electrical loads OFF?	—	Go to Step 34	—
34	The J 42000 automatically retests the battery. A RETESTING message and SYSTEM NOISE message on the display alternates up to 5 minutes while all circuits power down. The test results will then display on the tester. Are the test results displayed on the tester?	—	Go to Step 13	Go to Step 35
35	An undetected load or parasitic drain can cause the alternating RETESTING and SYSTEM NOISE messages to continue for more than 5 minutes. 1. Disconnect the J 42000 tester. 2. Eliminate all electrical drains. Refer to <i>Battery Electrical Drain/Parasitic Load Test</i>. Are all electrical loads and parasitic drains eliminated?	—	Go to Step 2	—
36	A J 42000 problem is indicated. Inspect the tester for correct operation. Is the tester operating properly?	—	Go to Step 2	Go to Step 37
37	Repair or replace the tester. Is the action complete?	—	Go to Step 1	—
38	A problem exists with the battery's built-in hydrometer. Replace the battery. Refer to <i>Battery Replacement</i>. Is the action complete?	—	System OK	—

Battery Hydrometer Displays Dark or Yellow Dot



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1. The battery has a built-in hydrometer (1). The hydrometer lens provides a visual indication of the condition of the electrolyte.
2. Tap lightly on the lens and observe the built-in hydrometer (1).
3. Under normal operation, one of three color conditions on the hydrometer (1) is possible:
 - Green ball visible (2).
This condition indicates a sufficient state of electrolyte (5) charge (65 percent or above) for normal charging system operation.
 - Dark lens (3) (Green ball not visible)
This condition indicates an insufficient state of electrolyte (5) charge below 65 percent). Recharge the battery before further testing.
 - Clear lens (4) (or Yellow lens).
This condition indicates that the electrolyte (5) is low. The battery electrolyte (5) cannot be refilled. Replace the battery.

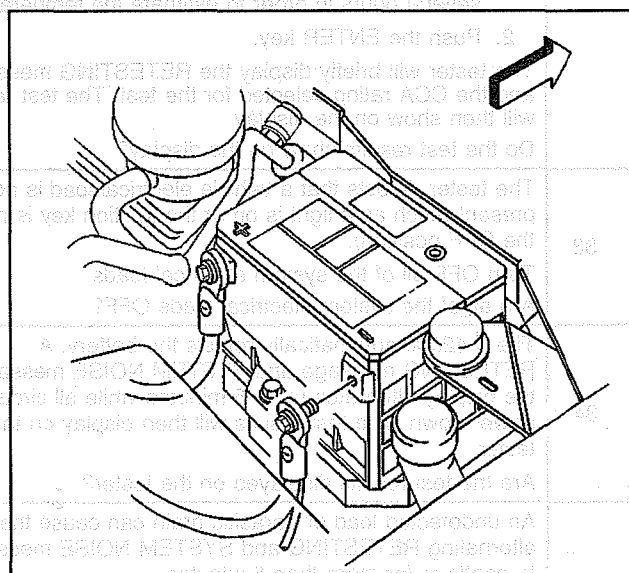
4. A low electrolyte (5) level can be caused by any of the following conditions:

- Prolonged charging
 - An excessive charge
 - A broken case
 - Excessive battery tipping
5. When finding a battery in this condition it may indicate high charging voltages caused by a faulty charging system. The charging and electrical systems should be checked.
 6. If there is a cranking complaint, inspect for trouble in the charging or electrical systems.
 7. If a cranking complaint exists and is caused by the battery, the battery should be replaced.

Battery Electrical Drain/Parasitic Load Test

Tools Required

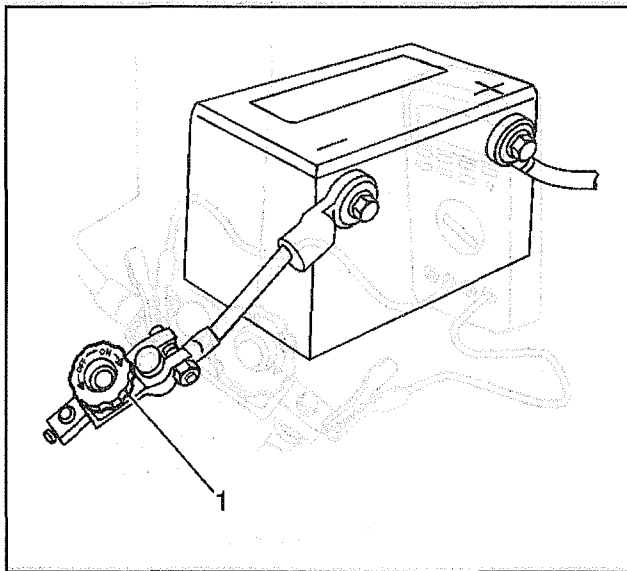
- J 38758 Parasitic Draw Test Switch
- J 39200 Digital Multimeter
- A Fused Jumper Wire



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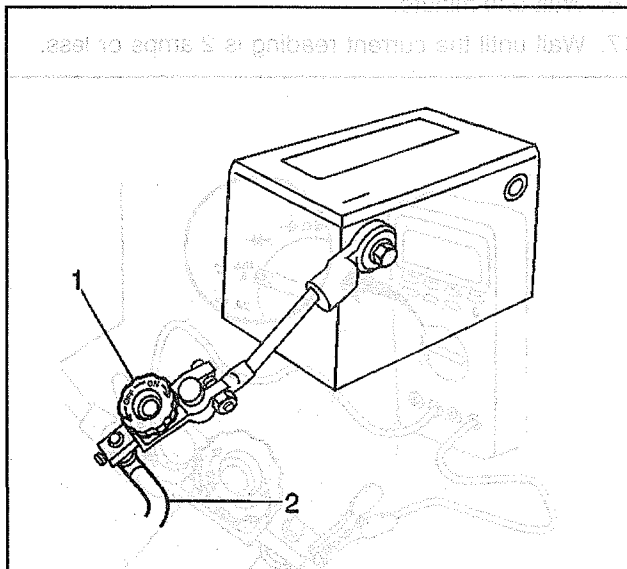
Caution: Refer to Battery Disconnect Caution in Cautions and Notices.

1. Disconnect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure*.



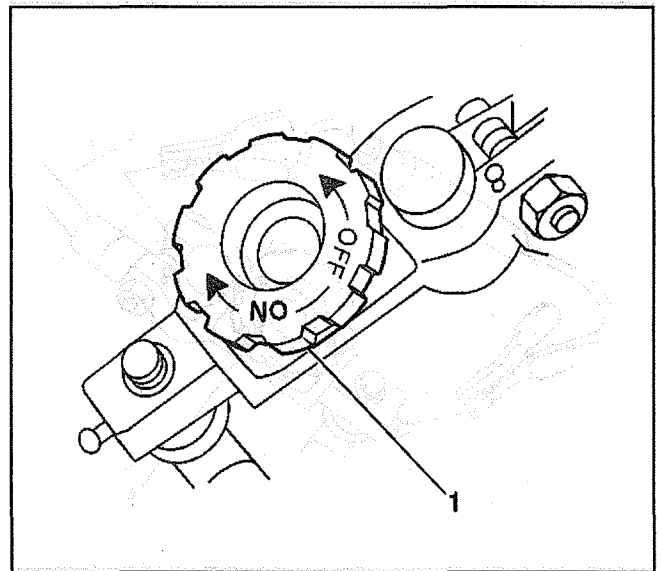
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2. Install the male end of the J 38758 (1) to the negative battery terminal.



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3. Turn the test switch (1) OFF.
4. Connect the negative battery cable (2) to the female end of the test switch.



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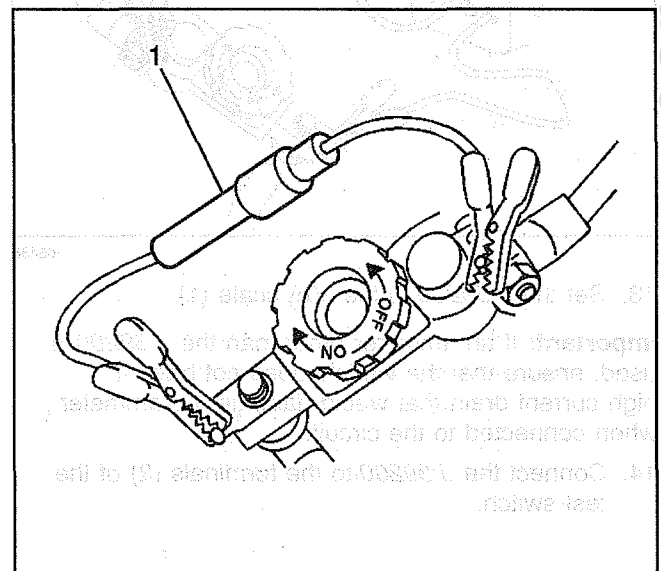
5. Turn the test switch (1) ON.

Notice: 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.

6. Road test the vehicle. Activate all accessories, including the air conditioning system and radio.
7. Turn OFF the ignition switch. Remove the key.

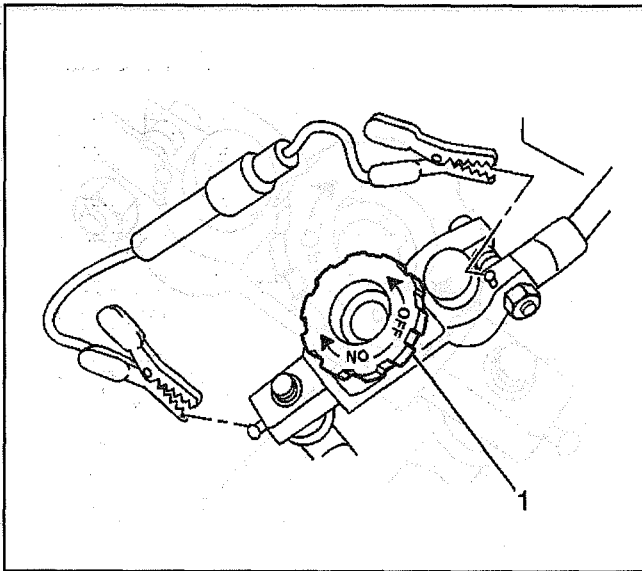
Important: This allows the electronically timed components to power down, preventing false parasitic drain readings.

8. Wait 15 minutes before continuing the test.



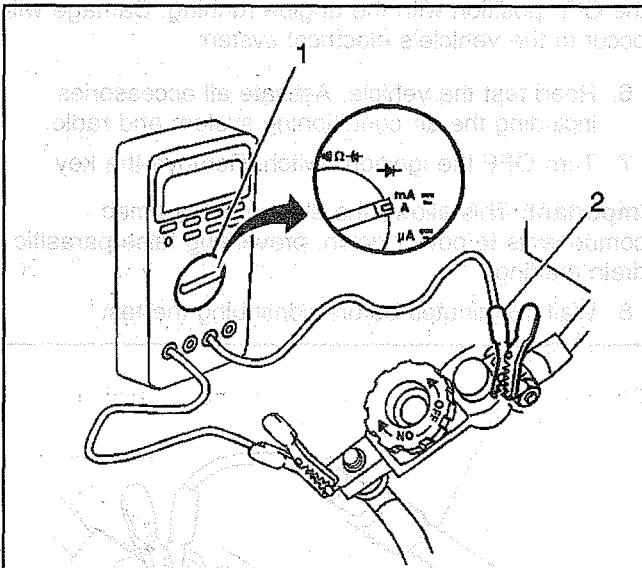
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9. Connect the fused jumper wire (1) to the terminals of the test switch.
10. If the fuse does not fail, the J 39200 can be installed. A current of less than 10 amps is present.



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11. Turn the test switch (1) ON.
12. Remove the fused jumper wire.

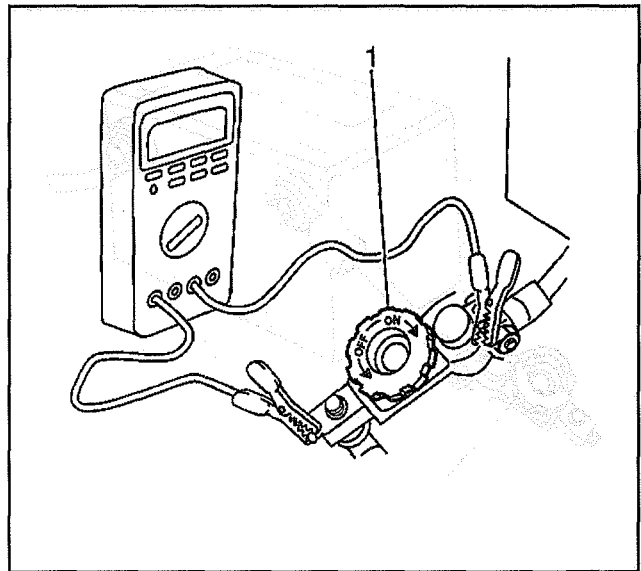


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13. Set the *J 39200* to the 10A scale (1).

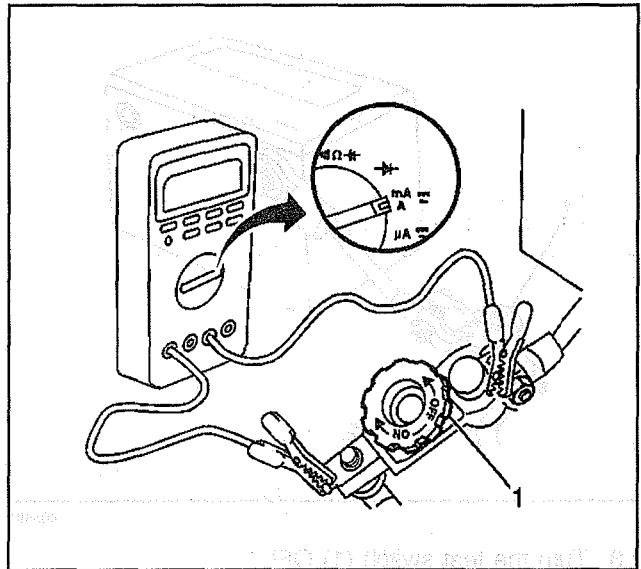
Important: If an ammeter other than the *J 39200* is used, ensure that the vehicle does not have a high current drain that would damage the ammeter when connected to the circuit.

14. Connect the *J 39200* to the terminals (2) of the test switch.



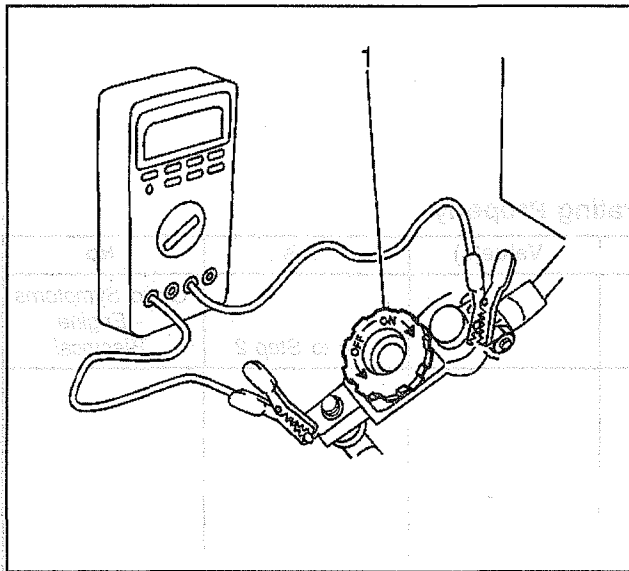
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15. Turn the test switch (1) OFF. Current is now flowing through the ammeter option of *J 39200*.
16. Wait one minute.
17. Wait until the current reading is 2 amps or less.



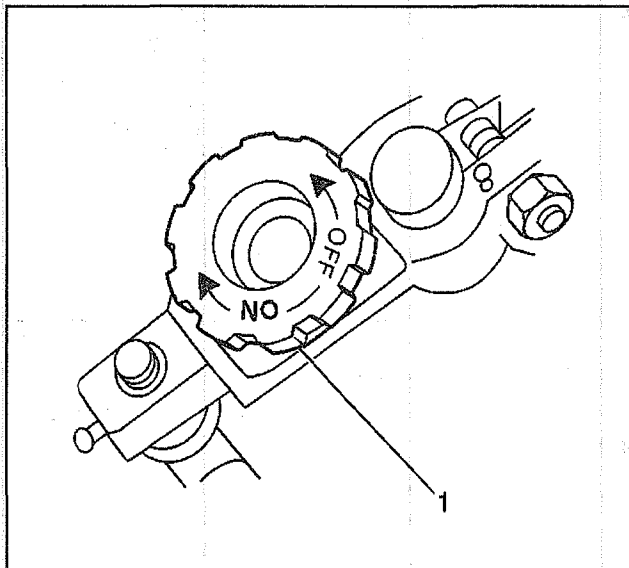
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18. Turn the test switch to (1) ON.
19. Switch the *J 39200* from the 10A setting to the 2A setting.



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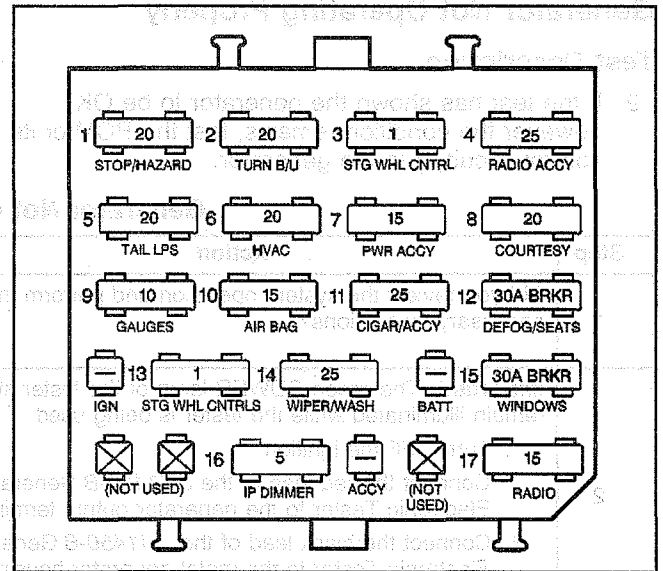
20. Turn the test switch (1) to OFF.
21. Read the current in milliamps. This is the parasitic drain value.
22. Note the battery reserve capacity. Refer to *Battery Usage*.
23. Divide the battery reserve capacity by 4, this will be the parasitic drain number.
24. The parasitic drain number should not exceed $\frac{1}{4}$ of the battery's reserve capacity.
25. If the parasitic drain number exceeds $\frac{1}{4}$ of the battery's reserve capacity go to step 27.



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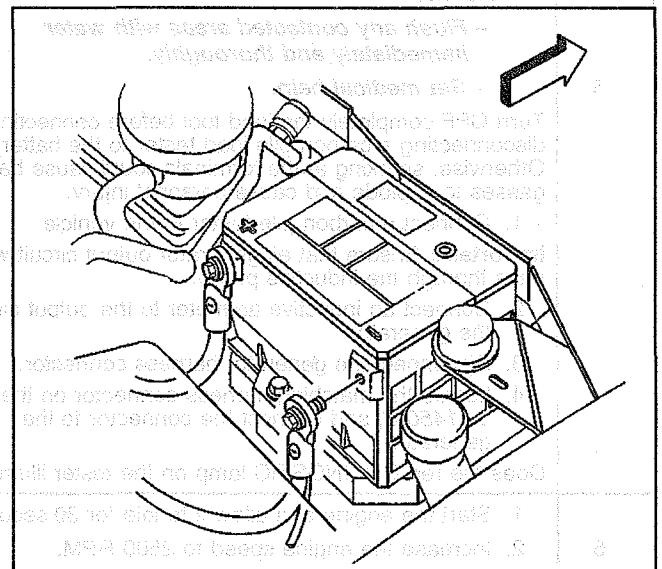
26. Turn the test switch (1) to ON.

Notice: 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.



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- 26.1. To find the source of the excessive load perform the following:
- 26.2. Remove the courtesy lamp fuse (number 8). Note the *J 39200* reading.
- 26.3. If the parasitic load is still excessive start removing the remaining fuses.
- 26.4. Keep the courtesy lamp fuse out during diagnosis, so the door can remain open.
27. Continue removing the fuses one at a time, starting with the fuses that are hot all the time. When the voltage drops across the *J 39200*, note the last fuse removed. The current drain comes from the circuit or circuits protected by that fuse.
28. Repair the circuit and perform the parasitic load test again to verify the repair.



208241

29. Connect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure*.

Generator Not Operating Properly

Test Description

9. If the test has shown the generator to be OK, however the condition remains, test the PCM or its control circuit(s) to the generator.

Generator Not Operating Properly

Step	Action	Value(s)	Yes	No
1	Did you review the system operation and perform the necessary inspections?	—	Go to Step 2	Go to Symptoms - Engine Electrical
2	Important: The green POWER lamp of the tester should remain illuminated while the tester is being used. 1. Turn OFF the ignition. - Connect the red lead of the J 41450-B Generator Electronic Tester to the generator output terminal. 2. Connect the black lead of the J 41450-B Generator Electronic Tester to the metal generator housing. Does the green POWER lamp on the tester illuminate?	—	Go to Step 5	Go to Step 3
3	Measure the voltage from the output terminal of the generator to the generator metal housing. Does the voltage measure equal to the specified value?	B +	Go to Step 13	Go to Step 4
4	Measure the voltage from the output terminal of the generator to the battery negative terminal. Does the voltage measure equal to the specified value?	B +	Go to Step 11	Go to Step 10
5	Caution: Batteries produce explosive gasses. Batteries contain corrosive acid. Batteries supply levels of electrical current high enough to cause burns. Therefore, to reduce the risk of personal injury while working near a battery: • 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. Turn OFF completely the load tool before connecting or disconnecting a carbon pile load tester to the battery. Otherwise, sparking at the terminals could cause battery gasses to explode and cause personal injury. 1. Connect a carbon pile tester to the vehicle Important: Ensure that all generator output circuit wires pass through the inductive probe. 2. Connect an inductive ammeter to the output circuit of the generator. 3. Disconnect the generator harness connector. 4. Locate the matching harness connector on the J 41450-B, and connect the connector to the generator. Does the red DIAGNOSTIC lamp on the tester illuminate?	—	Go to Step 6	Go to Step 12
6	1. Start the engine and allow it to idle for 30 seconds. 2. Increase the engine speed to 2500 RPM. Does the red DIAGNOSTIC lamp on the tester illuminate?	—	Go to Step 14	Go to Step 7

Generator Not Operating Properly (cont'd)

Step	Action	Value(s)	Yes	No
7	1. Maintain the engine speed at 2500 RPM. Important: If the generator is not capable of producing the Load Test amps, operate the generator at it's maximum possible output. 2. Turn ON the load of the carbon pile tester and increase the load until the generator output is equal to the Load Test value given in Generator Usage. Does the red DIAGNOSTIC lamp on the tester illuminate?		Go to Step 14	Go to Step 8
8	1. Maintain the engine speed at 2500 RPM and continue to operate the generator at the load test value. 2. Measure the voltage drop from the output terminal of the generator to the positive terminal on the battery. Refer to <i>Circuit Testing and Connector Repairs</i> in Wiring Systems. Does the voltage measure greater than the specified value?	0.5 V	Go to Step 10	Go to Step 9
9	1. Maintain the engine speed at 2500 RPM and continue to operate the generator at the load test value. 2. Measure the voltage drop from the battery negative terminal to the metal housing of the generator. Refer to <i>Circuit Testing and Connector Repairs</i> in Wiring Systems. Does the voltage measure greater than the specified value?	0.5 V	Go to Step 11	Go to Step 15
10	Repair the high resistance or an open in the output circuit of the generator. Refer to <i>Circuit Testing and Connector Repairs</i> in Wiring Systems. Did you complete the repair?	—	Go to Step 15	
11	Repair the high resistance or open in the ground circuit of the generator. Refer to <i>Circuit Testing and Connector Repairs</i> in Wiring Systems. Did you complete the repair?	—	Go to Step 15	
12	1. Disconnect the J 41450-B tester harness connector from the generator, but leave the alligator clips connected so that the green POWER lamp remains illuminated. 2. Connect a jumper lead, with an in-line 100-ohm resistor between the J 41450-B tester harness connector terminal B and a good ground. Does the red DIAGNOSTIC lamp illuminate?		Go to Step 14	Go to Step 13
13	There is a problem with the J 41450-B. Refer to the manufacturers instructions, how to test the J 41450-B for proper operation. Has the J 41450-B tester been replaced?	—	Go to Step 2	—
14	Replace the generator. Refer to <i>Generator Replacement</i> (3.8 L) or <i>Generator Replacement</i> (5.7 L). Did you complete the replacement?	—	Go to Step 15	—
15	Operate the vehicle in order to verify the repair. Did you correct the condition?	—	System OK	Go to Step 2

Generator Assembly Check

On Vehicle Inspection Procedure

When the charging system is operating normally, the voltmeter will read between 11–16 volts when the engine is running. If the voltmeter operates abnormally, or if an undercharged or overcharged battery condition occurs, the following procedure may be used to diagnosis the charging system.

An undercharged battery is often caused by accessories being left on overnight, or by a hood or instrument panel compartment lamp that stays on.

Noise from a generator may be caused by a loose drive pulley, loose mounting bolts, worn or dirty bearings, faulty diode or faulty stator. A magnetic whining noise may be heard from the CS-130D generator. This is considered a normal condition.

Precautions

To avoid damage to the electrical equipment, always observe the following precautions:

- Do not reverse the connections to the generator.
- Do not short across or ground any of the terminals in the charging circuit, unless otherwise directed by instructions.
- Never disconnect the generator BAT terminal while the generator is operating.
- When connecting a battery charger or a booster battery, follow the procedure in *Jump Starting in Case of Emergency*.
- Do not attempt to disassemble CS-130D generator. Damage to the generator could result.

Trouble in the charging system will show up as one or more of the following conditions:

- An abnormal voltmeter reading
- An undercharged battery condition (with slow cranking or a dark hydrometer)
- An overcharged battery condition (with electrolyte leaks or a yellow hydrometer). Refer to *Battery Hydrometer Displays Dark or Yellow Dot*.

Diagnosis

Tool Required

J 39200 Digital Multimeter

To diagnosis the CS-130D charging system, use the following procedure.

1. Inspect the accessory drive belt for damage or wear. Service or replace as necessary.
2. Inspect the wiring.

3. Check for an undercharged or overcharged battery condition (voltage lower than 11 volts or higher than 16 volts), refer to *Generator Not Operating Properly*.

- Detach the wiring harness connector from the generator.
- With the ignition switch in the ON position and the engine not running, connect the J 39200 as a voltmeter from a ground to the L terminal in the wiring harness connector. Connect the F or the I terminal for the gauge equipped vehicles. At least one terminal should have battery voltage.
- Zero volts indicates an open circuit between the terminal and the battery. Connect as required.
- Reconnect the wiring harness connector to the generator.

Important: Disconnect the negative battery cable before removing or installing a series-type ammeter at the generator battery terminal.

- Install an ammeter at the generator output terminal. With the load off, install a carbon pile load test across the battery terminals. Start the engine and run at 2500 RPM. Make sure this is done at ambient temperature.
- Measure the voltage across the battery, using the J 39200. If the voltage is above 16 volts, replace or repair the generator.
- Turn on the accessories and place a load on the battery with the carbon pile to obtain maximum generator output. Maintain voltage at 13 volts or above. Use an ammeter to check amperage. Compare output to amperage rating in *Generator Usage*.

Spark Plug Visual Diagnosis

Worn or dirty plugs give satisfactory operation at idling speed, but under operating conditions they frequently fail. Faulty plugs are indicated in a number of ways:

- Poor fuel economy
- Power loss
- Loss of speed
- Hard starting
- Poor engine performance

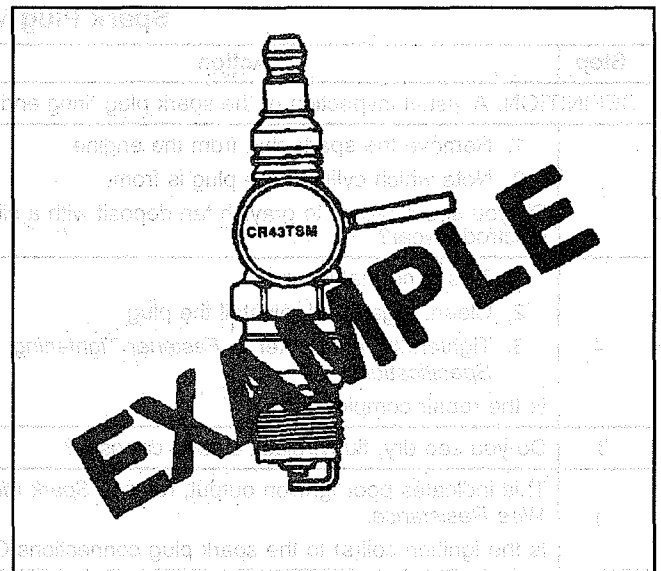
Spark plugs may also fail due to the following conditions:

- Carbon fouling
- Excessive plug gap
- Broken insulators

Fouled plugs are identified by black carbon deposits. The black deposits are usually the result of slow-speed driving and short runs where sufficient engine temperature is seldom reached. Worn pistons, rings, faulty ignition, over-rich air/fuel mixture and spark plugs which are too cold will also result in carbon deposits. Excessive gap wear, on plugs of low mileage usually indicated the engine is operating at high speeds or loads that are consistently greater than normal or that a plug which is too hot is being used. Electrode wear may also be the result of plug overheating due to insufficient spark plug torque or too much spark plug torque. An excessively lean air/fuel mixture will also result in excessive electrode wear.

Broken insulator are usually the result of improper installation or carelessness when regapping the plug. Broken upper insulators usually result from a poor fitting wrench or an outside impact. The cracked insulator may not show up right away, but will as soon as oil or moisture penetrates the crack. The crack may not be visible. Broken lower insulators usually result from carelessness when regapping and generally are visible. This type of break may result from the plug operating too hot, which may happen in periods of high-speed operation or under heavy loads. When regapping a spark plug, always make the gap adjustment by bending the ground (side) electrode. Spark plugs with broken insulators should always be replaced.

Resistor type spark plugs with tapered seats are used. No gasket is needed on these plugs. These spark plugs are a High Efficiency (HE) spark plug that has a fine wire electrode, nickel plated shell and a platinum pad across from the electrode.



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1. Normal service is a mixture of idling, low speed, and high speed operation.
 - Occasional high speed driving is essential to good spark plug performance.
 - Increased combustion heat burns away excess carbon deposits, which accumulate from frequent idling or stop-and-go driving.
2. The heat resistant, insulating boot covers the spark plug terminal.
 - The boot extends over a portion of the spark plug insulator.
 - These boots prevent engine misfiring.
3. Corona discharge is a steady blue light appearing (in darkness) around the insulator, just above the shell crimp.
 - Do not mistake this for a shorted insulator. This is visible evidence of a high-tension field.
 - This has no effect on ignition system performance.
 - This discharge repels dust particles.
 - This leaves a clear ring on the insulator just above the shell.
 - This is not evidence that combustion gases are escaping.

Spark Plug Visual Diagnosis

Step	Action	Value(s)	Yes	No
DEFINITION: A visual inspection of the spark plug firing end.				
1	1. Remove the spark plug from the engine. 2. Note which cylinder the plug is from. Do you see a brown to grayish tan deposit with a slight electrode wear?	—	Go to Step 2	Go to Step 3
2	1. This is normal wear. 2. Clean, regap and reinstall the plug. 3. Tighten the plug, refer to <i>Fastener Tightening Specifications</i> . Is the repair complete?	1.524 mm (0.060 in)	System OK	—
3	Do you see dry, fluffy, black carbon deposits?	—	Go to Step 4	Go to Step 6
4	This indicates poor ignition output, refer to <i>Spark Plug Wire Resistance</i> . Is the ignition coil(s) to the spark plug connections OK?	—	—	Go to Step 5
5	Repair or install new parts as necessary. Is the repair complete?	—	System OK	—
6	Do you see wet, oily deposits with very little electrode wear?	—	Go to Step 7	Go to Step 8
7	1. This results from either the break-in of a new or recently overhauled engine. 2. Or from failed piston rings. Degrease, gap and reinstall the spark plug.	1.524 mm 0.060 in	Go to Step 5	Go to Step 11
8	Do you see red, brown, yellow and/or white colored coatings on the insulator?	—	Go to Step 9	Go to Step 11
9	These are the by-products of combustion. Is the insulator heavily coated?	—	Go to Step 10	Go to Step 2
10	1. Gap and install new spark plug(s). 2. Tighten the spark plug, refer to <i>Fastener Tightening Specifications</i> . Is the repair complete?	1.524 mm (0.060 in)	System OK	—
11	Are there heavy deposits of dark colored coatings, especially on the side of the plug facing the intake valve?	—	Go to Step 12	Go to Step 13
12	1. This is the result of failed intake valve seals. 2. Or from excessive valve stem to valve guide clearances. 3. This may not occur in all cylinders. 4. Repair or install new parts as necessary. Is the repair complete?	—	System OK	—
13	Is there a shiny, yellow glaze coating on the spark plug insulator?	—	Go to Step 14	Go to Step 15
14	1. These are the melted by-products of combustion. 2. Avoid wide open throttle after long periods of low speed operation. 3. Gap and install new spark plug(s). Refer to <i>Fastener Tightening Specifications</i> . Is the repair complete?	1.524 mm (0.060 in)	System OK	—
15	Are the insulator tips blistered or burned?	—	Go to Step 17	—
16	Are the electrodes badly eroded?	—	Go To Step 17	—

Spark Plug Visual Diagnosis (cont'd)

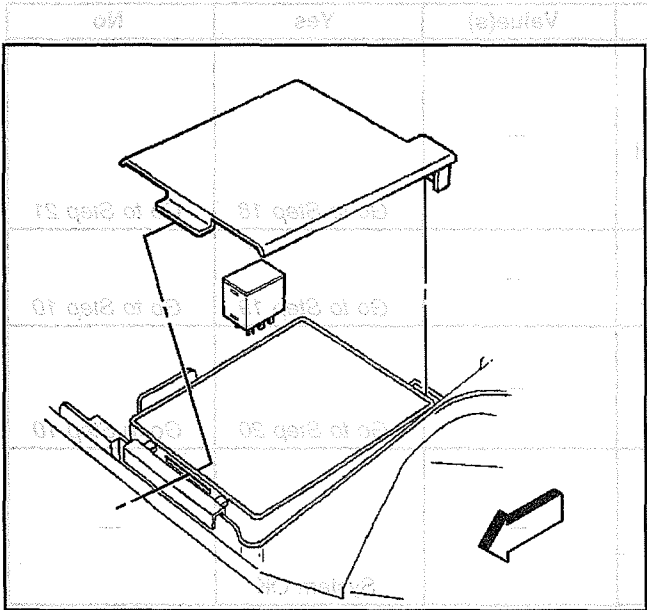
Step	Action	Value(s)	Yes	No
17	1. This is the result of overheating. 2. The spark plug heat range may be too hot. 3. The fuel octane rating may be too low for the application, refer the customer to the Owners Manual for correct fuel rating. Is the plug heat range correct?	—	Go to Step 18	Go to Step 21
18	Check the torque value to ensure good spark plug seat contact. Refer to <i>Fastener Tightening Specifications</i> . Are the spark plugs tightened according to specifications?	—	Go to Step 19	Go to Step 10
19	Check for a misfiring engine, refer to <i>DTC P0230 Fuel Pump Relay Control Circuit</i> for V6 or <i>DTC P0300 Engine Misfire Detected</i> for V8 in Engine Controls. Is the vehicle operating properly?	—	Go to Step 20	Go to Step 10
20	1. Check for a lean/rich fuel mixture, refer to <i>Fuel System Diagnosis</i> for V6 or <i>Fuel System Diagnosis</i> for V8 in Engine Controls. 2. Repair or install new parts as necessary. Is the repair complete?	—	System OK	—
21	Gap and install the correct spark plug(s). Refer to <i>Spark Plug Usage</i> . Is the repair complete?	—	System OK	—

Spark Plug Wires Not Operating Properly

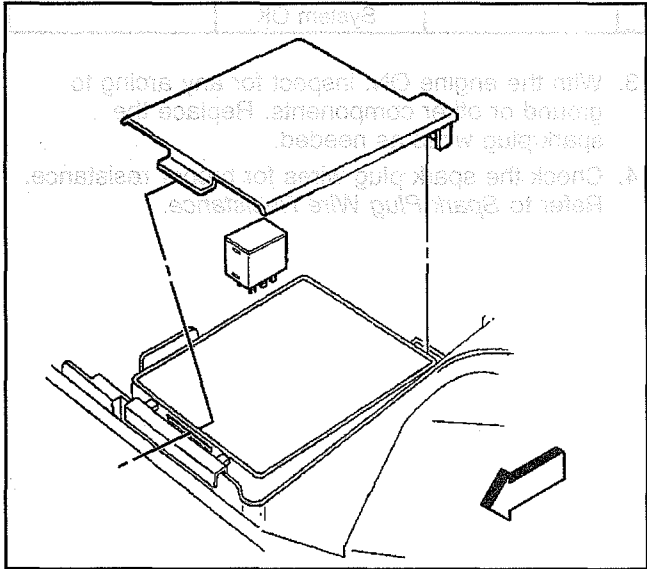
1. Inspect the spark plug gap. Adjust the gap as needed.
2. Inspect the spark plug wires for any obvious cuts, burns, or damage. Replace the wires as needed.

3. With the engine ON, inspect for any arcing to ground or other components. Replace the spark plug wires as needed.
4. Check the spark plug wires for proper resistance. Refer to *Spark Plug Wire Resistance*.

Repair Instructions



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Starter Motor Relay Replacement

Removal Procedure

1. Open and remove the cover to the number 2 underhood electrical center.
2. Remove the starter motor relay. Refer to *Electrical Center Identification Views in Wiring Systems*.

Installation Procedure

1. Install the starter motor relay. Refer to *Electrical Center Identification Views in Wiring Systems*.
2. Install and close the cover on the number 2 underhood electrical center.

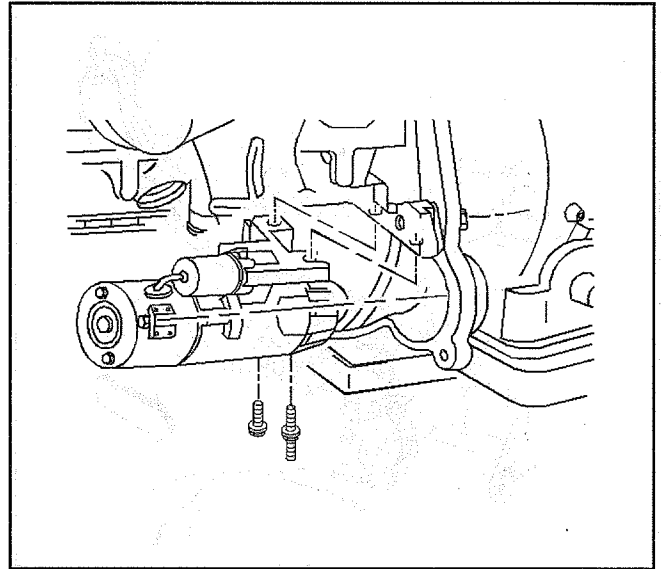
Starter Motor Replacement (3.8 L)

Removal Procedure

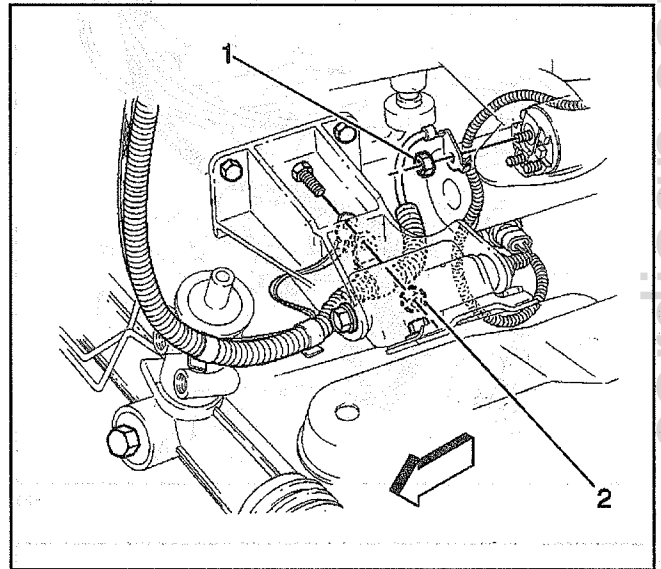
Caution: Refer to *Battery Disconnect Caution in Cautions and Notices*.

Important: This engine was designed for starter motor mounting without shims. However, if single or double shims have been added to correct a noise or engagement condition, reinstall the shims in their original location to ensure proper pinion-to-flywheel engagement.

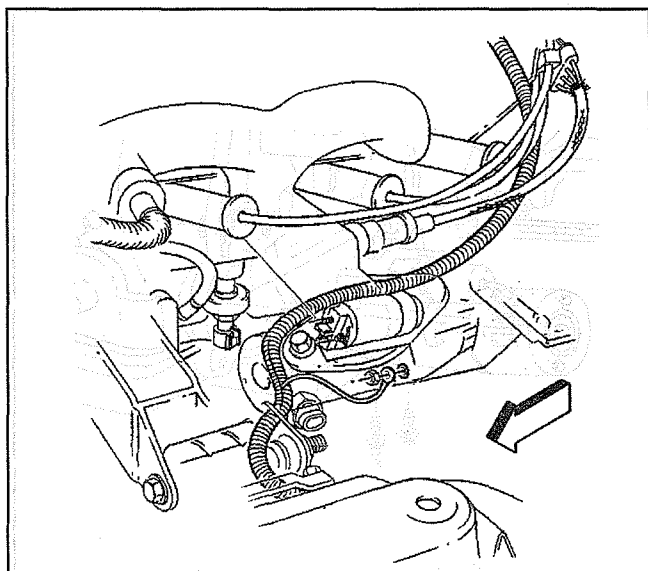
1. Disconnect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure*.
2. Raise and suitably support the vehicle. Refer to *Lifting and Jacking the Vehicle in General Information*.
3. Remove the starter motor shield. Refer to *Starter Shield Replacement (3.8 L)*.
4. Remove the starter motor bolt.
5. Remove the starter motor stud.
6. Lower the starter motor from the engine block.
7. Remove the positive cable to starter motor nut (1).
8. Remove the positive cable from the starter motor.



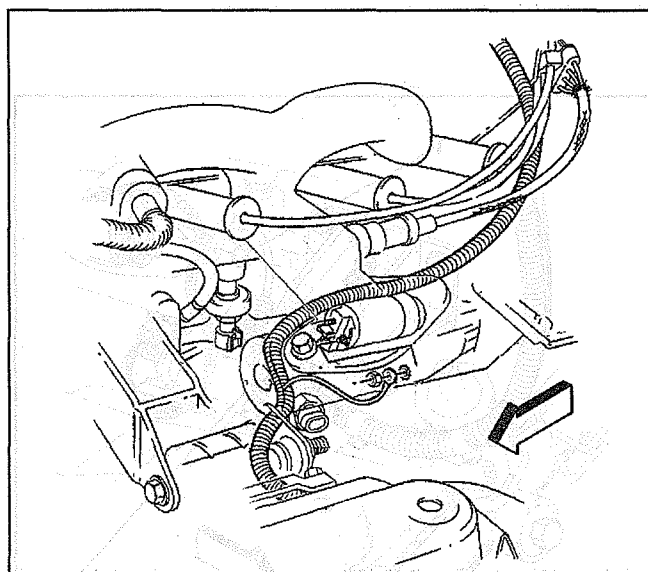
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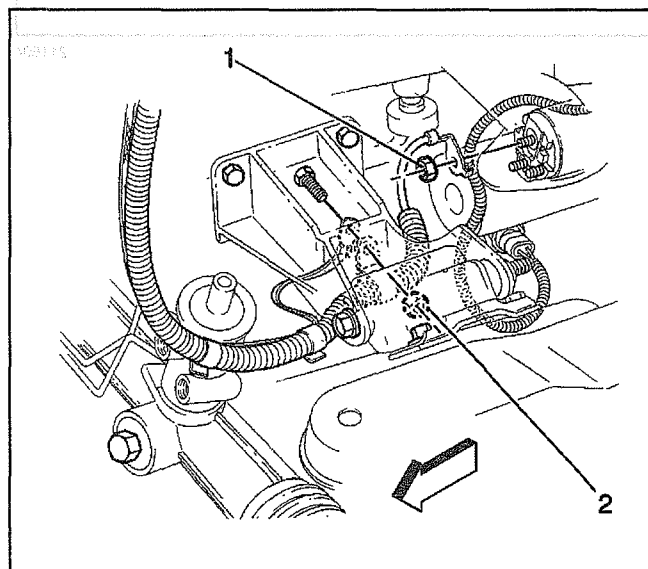
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9. Remove the wiring harness starter lead nut from the starter.
10. Remove the starter lead and washer.
11. Remove the starter motor.

Important: This engine was designed for starter motor mounting without shims. However, if single or double shims have been added to control a noise or engagement condition, reinstall the shims in their original location to ensure proper pinion-to-flywheel engagement.

1. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnect Procedure.
2. Raise and suitably support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.

3. Remove the starter motor shield. Refer to Starter Shield Replacement (3.9 L).
4. Remove the starter motor bolt.

Installation Procedure

1. Lift the starter motor into position.
2. Install the starter lead and washer to the starter.

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

3. Install the wiring harness starter lead nut.

Tighten

Tighten the wiring harness starter lead nut to 2 N·m (17 lb in).

4. Install the positive cable to the starter.
5. Install the positive cable to starter motor nut (1).

Tighten

Tighten the positive cable to starter motor nut (1) to 10 N·m (89 lb in).

6. Raise the starter motor to the engine block.

7. Install the starter motor bolt.

Tighten

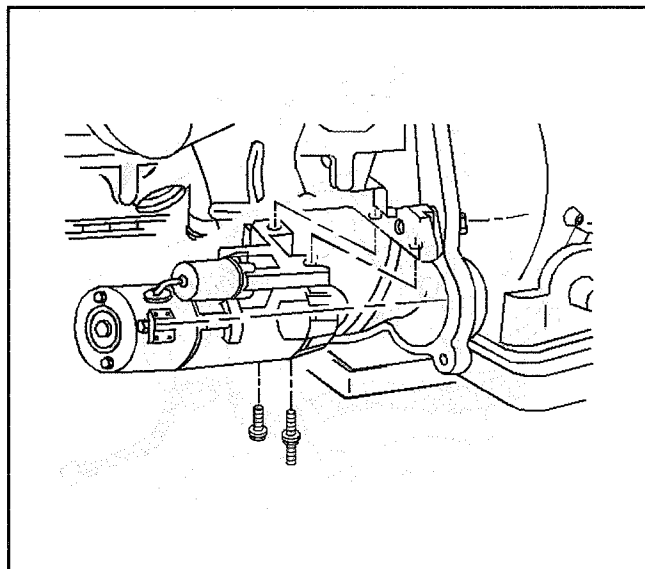
Tighten the starter motor bolt to 47 N·m (35 lb ft).

8. Install the starter motor stud.

Tighten

Tighten the starter motor stud to 45 N·m (33 lb ft).

9. Install the starter motor shield. Refer to *Starter Shield Replacement (3.8 L)*.
10. Lower the vehicle.
11. Connect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure*.



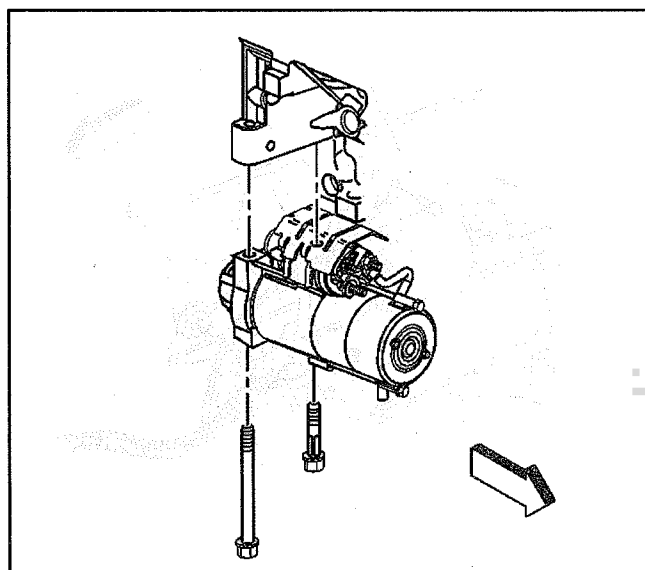
Starter Motor Replacement (5.7 L)

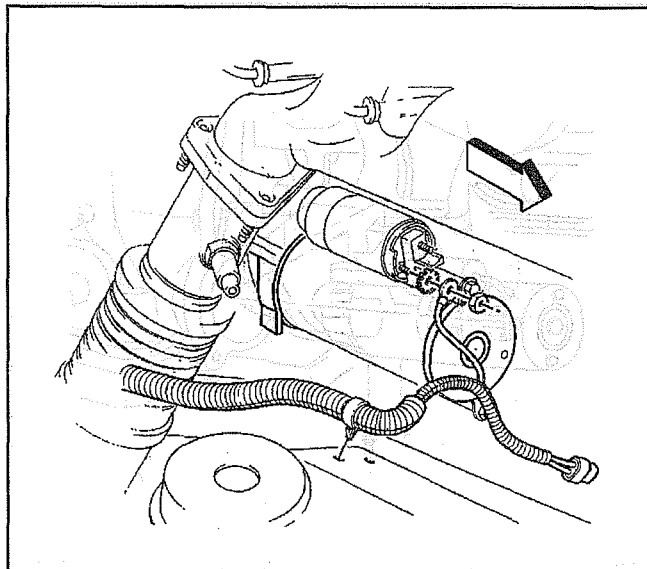
Removal Procedure

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

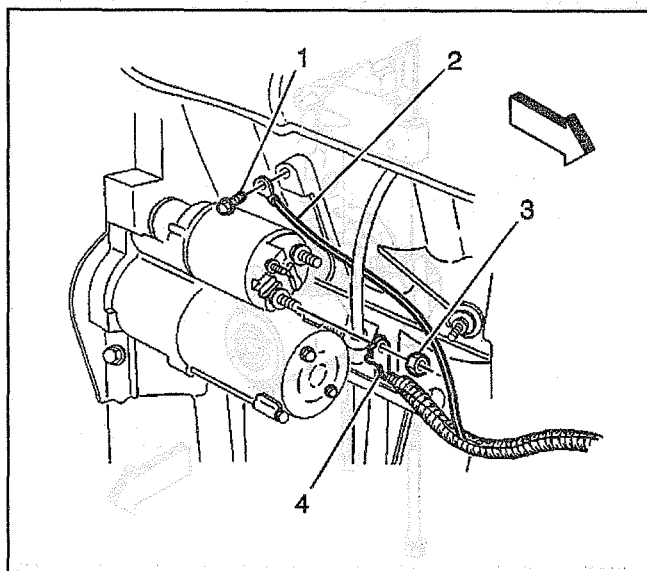
Important: This engine was designed for starter motor mounting without shims. However, if single or double shims have been added to correct a noise or engagement condition, reinstall the shims in their original location to ensure proper pinion-to-flywheel engagement.

1. Disconnect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure*.
2. Raise and suitably support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
3. Remove the left side oxidation catalytic converter. Refer to *Oxidation Catalytic Converter Replacement (5.7 L Left)* in Engine Exhaust.
4. Remove the starter motor bolts.
5. Lower the starter motor from the engine block.

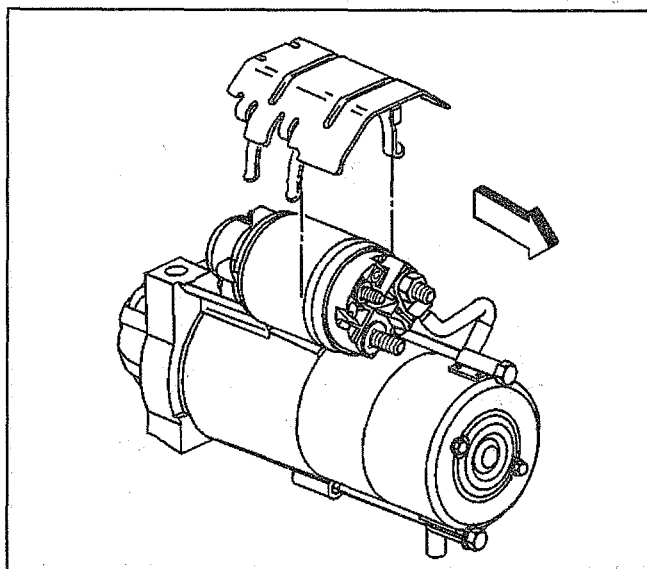




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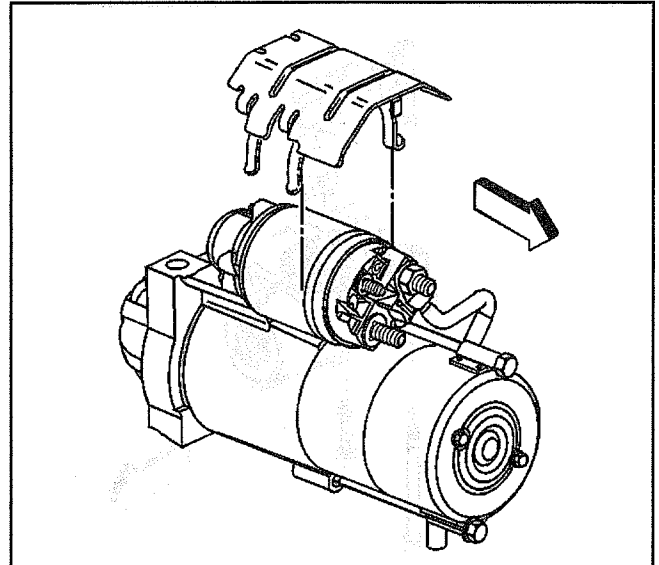
6. Remove the wiring harness starter lead nut from the starter.
7. Remove the wiring harness starter lead and washer from the starter.

8. Install the starter motor shield. Refer to Shield Replacement (3.8 L).
9. Tighten the starter motor stud to 45 N·m (33 ft·lb).
10. Lower the vehicle.
11. Connect the negative battery cable. Refer to Battery Negative Cable Disconnect/Connect Procedure.

8. Remove the positive cable to starter motor nut (3).
9. Remove the positive cable (4) from the starter motor.
10. Remove the starter motor.
11. Remove the starter motor shield, if necessary.

Installation Procedure

1. Install the starter motor shield, if necessary.



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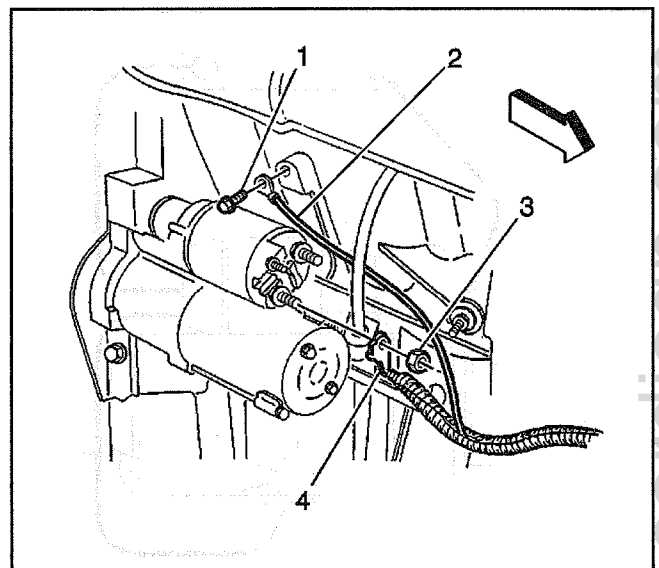
2. Lift the starter motor into position.
3. Install the positive cable (4) to the starter motor.

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

4. Install the positive battery cable to starter motor nut (3).

Tighten

- Tighten the positive battery cable to starter motor nut (3) to 10 N·m (89 lb in).



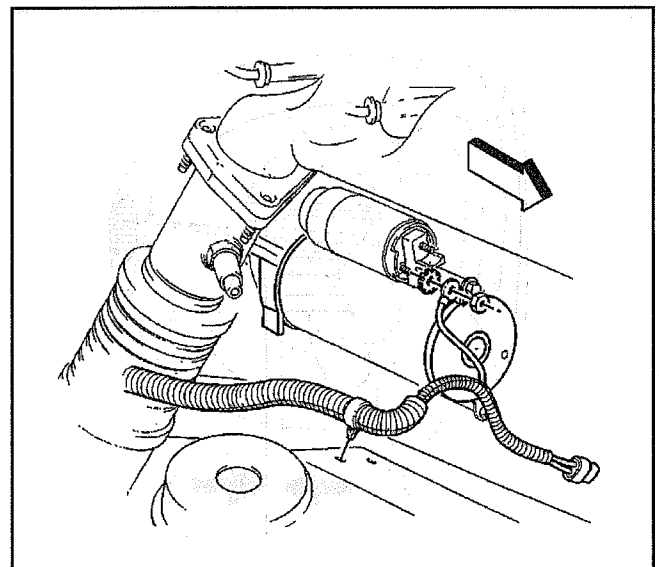
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5. Install the wiring harness starter lead and washer to the starter motor.
6. Install the wiring harness starter lead nut.

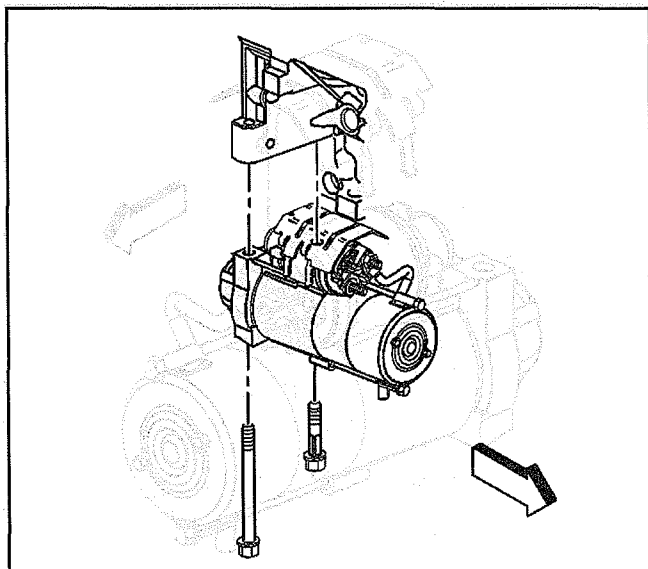
Tighten

- Tighten the wiring harness starter lead nut to 2 N·m (18 lb in).

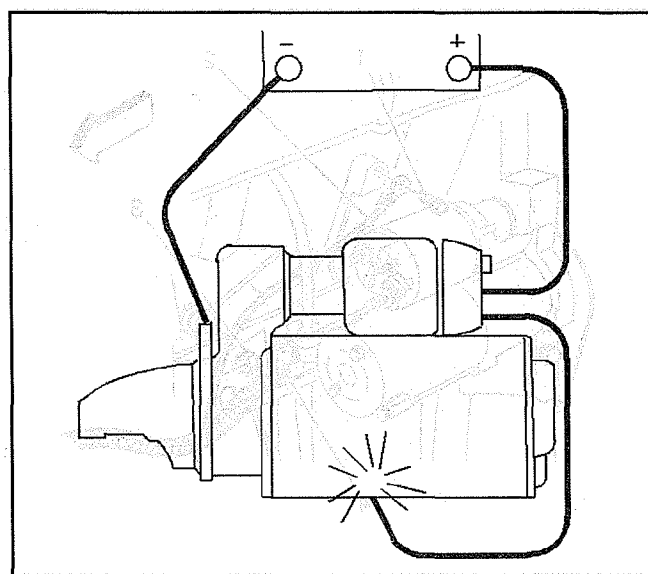
7. Raise the starter motor to the engine block.



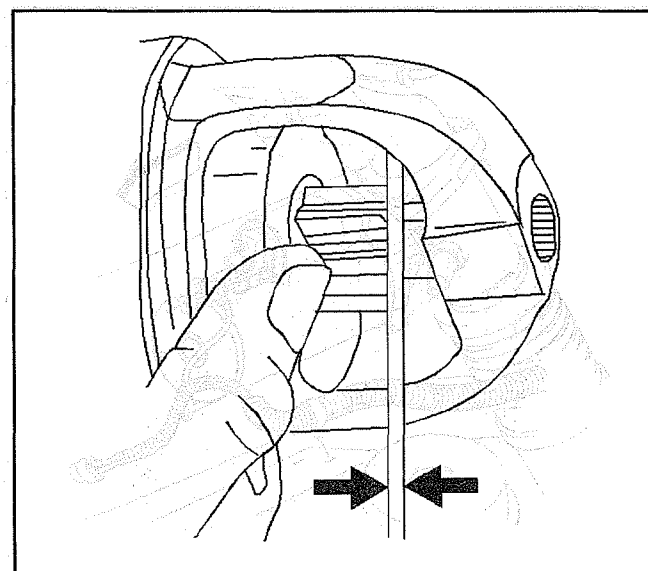
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8. Install the starter motor bolts.

Tighten

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

9. Install the left side oxidation catalytic converter. Refer to *Oxidation Catalytic Converter Replacement (5.7 L Left) In Engine Exhaust*.

10. Lower the vehicle.

11. Connect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure*.

Starter Pinion Clearance Check

The pinion clearance cannot be adjusted. Improper clearance is an indication of worn parts. In order to check the pinion clearance, perform the following procedure:

1. Disconnect the starter motor field connector from the solenoid M terminal.
2. Insulate the starter motor field connector carefully.
3. Connect a 12 V battery from the solenoid switch terminal to the solenoid frame.
4. Momentarily flash a jumper lead from the solenoid motor terminal to the solenoid frame. This will shift the pinion into the cranking position. The pinion will remain in the cranking position until the battery is disconnected.
5. Push the pinion back toward the commutator end to eliminate thrust movement.

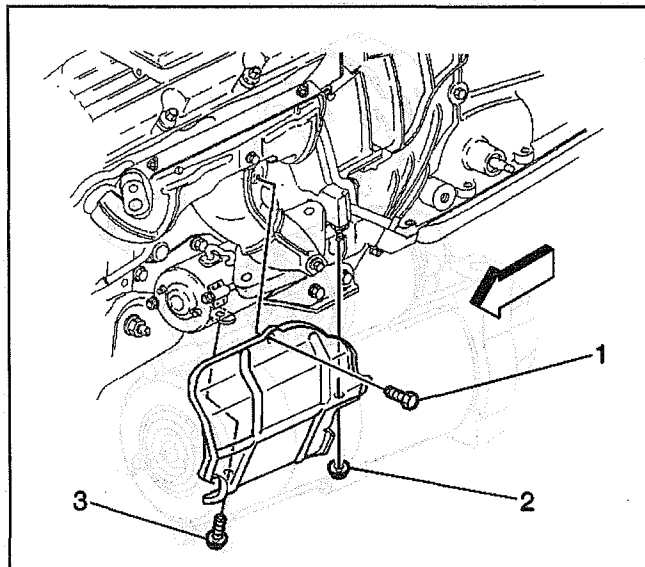
6. Measure the distance between the pinion and the pinion stop collar.

The clearance should be from 0.25–4.06 mm (0.010–0.160 in).

Starter Shield Replacement (3.8 L)

Removal Procedure

1. Raise and suitably support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Remove the starter motor shield bolts (1 and 3) and nut (2).
3. Remove the starter motor shield from the vehicle.



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Installation Procedure

1. Install the starter motor shield to the vehicle.

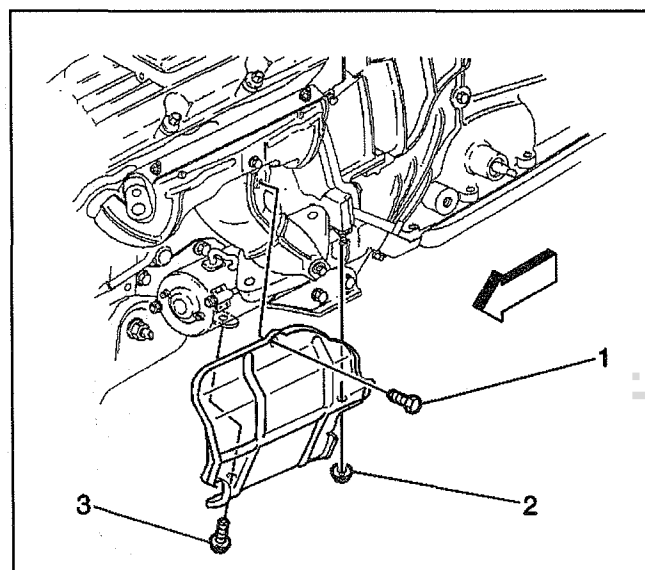
Notice: Refer to *Fastener Notice* in Cautions and Notices.

2. Install the starter shield nut (2) and bolts (1 and 3).

Tighten

- Tighten to starter motor shield bolt (1) to 30 N·m (22 lb ft).
- Tighten the starter motor shield bolt (3) to 10 N·m (89 lb in).
- Tighten the starter motor shield nut (2) to 10 N·m (89 lb in).

3. Lower the vehicle.

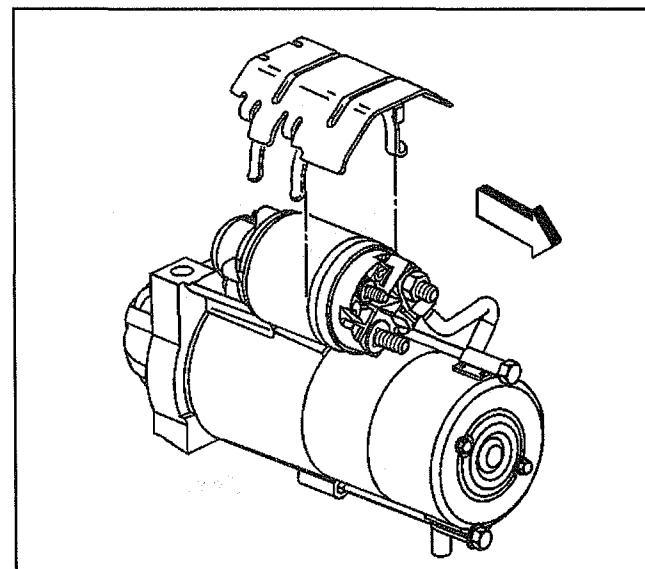


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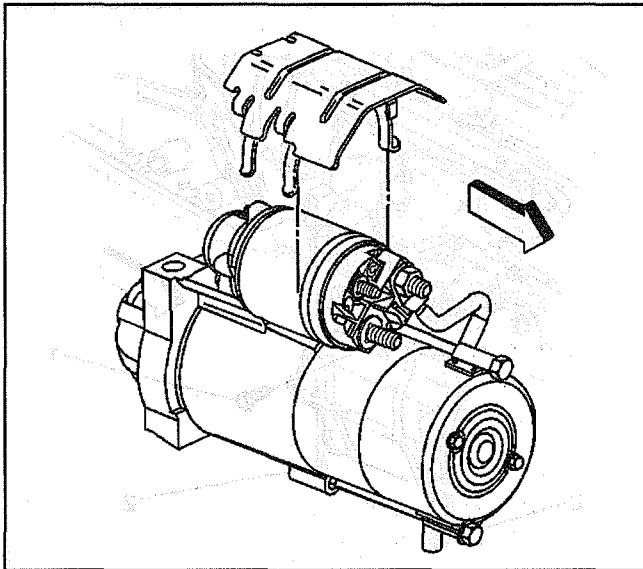
Starter Shield Replacement (5.7 L)

Removal Procedure

1. Remove the starter motor. Refer to *Starter Motor Replacement (5.7 L)*.
2. Unsnap the starter motor shield from the starter solenoid.



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Installation Procedure

1. Snap the starter motor shield to the starter solenoid.
2. Install the starter motor. Refer to *Starter Motor Replacement* (5.7 L).

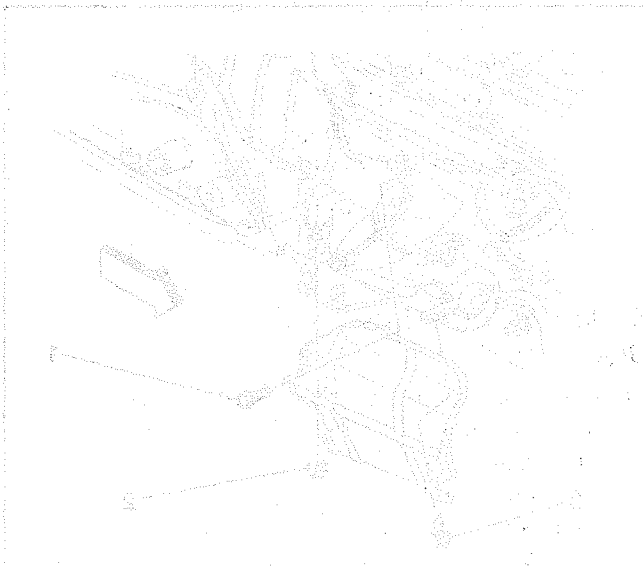
Battery Charging

Before Charging

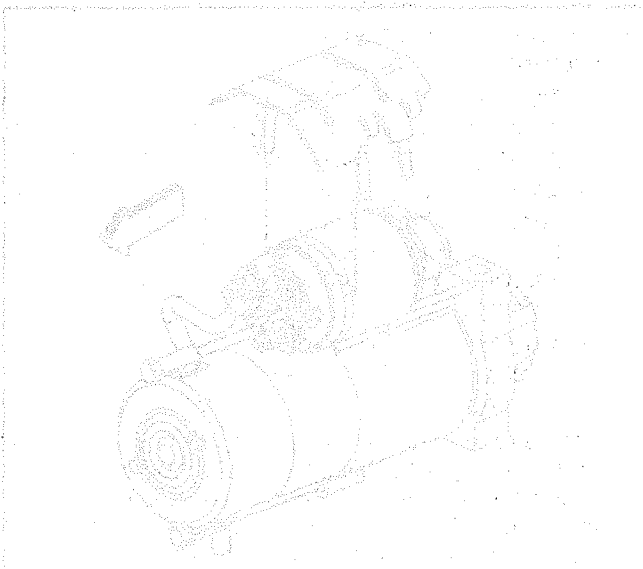
Notice: Turn OFF the ignition when connecting or disconnecting the battery cables, the battery charger or the jumper cables. Failure to do so may damage the PCM or other electronic components.

Important: Do not use the boost, the jump start or the crank setting for prolonged charging of batteries if the charger is equipped with these settings. Using any of these settings for a prolonged period may cause gassing or spewing of electrolyte through the vent hole.

1. Ensure that the electrolyte and the plates are at room temperature before charging the battery. An extremely cold battery may not accept the current for several hours after the charger is started.
2. Always stop charging, or reduce the charging rate, if either of the following conditions exists:
 - The battery temperature is 52°C (125°F) or higher.
 - Electrolyte spews or gasses violently through the vent holes.
3. Replace the battery when either of the following conditions exist:
 - The hydrometer is clear or yellow.
 - The battery is frozen.



550624



550624

Charge Time Required

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

- The size of the battery; A higher capacity battery which is completely discharged requires more time to charge than a smaller capacity battery.
- The battery temperature; The colder the battery, the more time it takes to charge.
- The battery charger capacity (in Amperes); The higher the charger amperage, the less time it will take to charge the battery.
- The battery state-of-charge; A completely discharged battery requires more than twice as much charge as a half-charged battery.

While Charging

Tools Required

GM P/N 12303040 Battery Terminal Adapters

1. Do not charge a battery with a green hydrometer dot unless it has just been discharged, such as in cranking.
2. When charging, the adapters should be snug against the battery terminals to keep resistance to a minimum.
3. Make sure all battery terminals are clean and tight.

Tighten

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

4. Best results occur when charging a battery that is at room temperature. A battery that is extremely cold may not accept current for several hours.
5. Charge the battery until the hydrometer has a green dot.
6. Inspect the battery every half hour after starting the battery charger.
7. Tap the hydrometer lightly to dislodge any air bubbles. The bubbles may cause a false indication.
8. After charging, load test the battery.

Charging Procedure

1. Measure the battery voltage:
 - Measure the voltage at the battery terminals using a voltmeter.
 - A reading of less than 11 Volts indicates that the charge current is low.
 - The battery will take longer to accept a current higher than 2 milliamperes.
2. Set the battery charger on the highest setting.
3. If necessary, disable the polarity protection circuitry:
 - This circuitry, available on most chargers, prevents charging unless the charger leads are properly connected to the battery terminals.
 - A completely discharged battery may not have enough voltage to activate this circuitry, even though the leads are properly connected, implying that the battery will not accept a charge.

- Most chargers have an override or a bypass function so that the charger will turn on and charge a low voltage battery.
4. The required battery charge time varies according to the voltage capabilities of the battery charger. Replace the battery only if the charge current is not measurable after the following charge times.
 - 16 Volts or more - up to 4 hours
 - 14-15.9 Volts - up to 8 hours
 - Less than 13.9 Volts - up to 16 hours
 5. Reserve capacity rating:
 - The reserve capacity rating on the battery label is the number of Ampere-hours of charge required in order to produce the green hydrometer dot.
 - For example, if the battery has a reserve capacity rating of 90 (expressed in Ampere-hours), the battery would be recharged as follows:
 - 10 Ampere charge × 9 hours = 90 Ampere hours
 - 30 Ampere charge × 3 hours = 90 Ampere hours
 - If the green hydrometer dot is not visible after an Ampere-hour charge equal to twice the reserve capacity rating, replace the battery.
 6. After charging, load test the battery. Refer to *Battery Electrical Drain/Parasitic Load Test*.

Battery Charge Low or Completely Discharged

1. Measure the battery voltage at the battery terminals using a digital multimeter (DMM).
 - A reading of less than 11 V indicates that the initial charging will be very low.
 - It could take some time before the battery accepts current in excess of a few milliamperes.
2. Set the battery charger on the highest setting.
3. If necessary, disable the polarity protection circuitry:
 - This circuitry, available on most chargers, prevents charging unless the charger leads are properly connected to the battery terminals.
 - A completely discharged battery may not have enough voltage to activate this circuitry, even though the leads are properly connected, implying that the battery will not accept a charge.
 - Most chargers have an override or a bypass function so that the charger will turn ON and charge a low voltage battery.
4. The required battery charge time varies according to the voltage capabilities of the battery charger. A charger of less than 14 volts could take up to 16 hours before it appears to be accepting current, followed up by several hours of the appearance of charging.

5. To determine the amount of hours the battery may need to be charged, the following calculation can be made:

- The reserve capacity rating on the battery label is the number of ampere-hours of charge required in order to produce the green hydrometer dot.
 - After the meter on the charger starts to show current flow, note the number of amps being accepted.
 - Determine the reserve capacity of the battery. Refer to *Battery Usage*.
 - Divide the reserve capacity by the number of amps shown on the meter to determine how many hours of charging is needed.
6. When the green dot appears in the hydrometer, discontinue charging.
7. If the green hydrometer dot is not visible after an ampere-hour charge equal to twice the reserve capacity rating, replace the battery. Refer to *Battery Replacement*.
8. After charging, load test the battery. Refer to *Battery Electrical Drain/Parasitic Load Test*.

Jump Starting in Case of Emergency

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

- **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.**

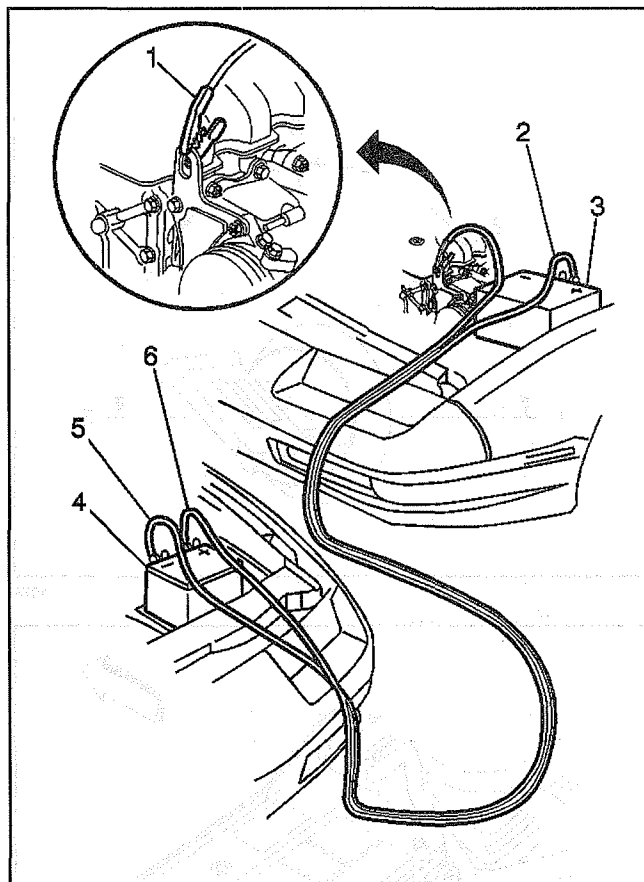
Notice: Push starting the vehicle can, under some conditions, cause damage to the catalytic converter and an automatic transmission.

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. The following procedure is a typical battery to battery hookup for jump starting.
2. The booster battery (4) and the discharged battery (3) should be treated carefully when using jumper cables. Do not cause sparks.
3. Position the vehicle with the charged (booster) battery (4) so that the jumper cables will reach. Do not let the vehicles touch.
4. Attach the end of one jumper cable (6) to the positive terminal of the booster battery (4).
5. Attach the other end of the same cable (2) to the positive terminal of the discharged battery (3).
6. Attach one end of the second jumper cable (5) to the negative terminal of the booster battery (4).

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.

7. Attach the other end of the second jumper cable (1) to a good engine ground (engine lift hook or generator bracket) at the discharged battery (3).

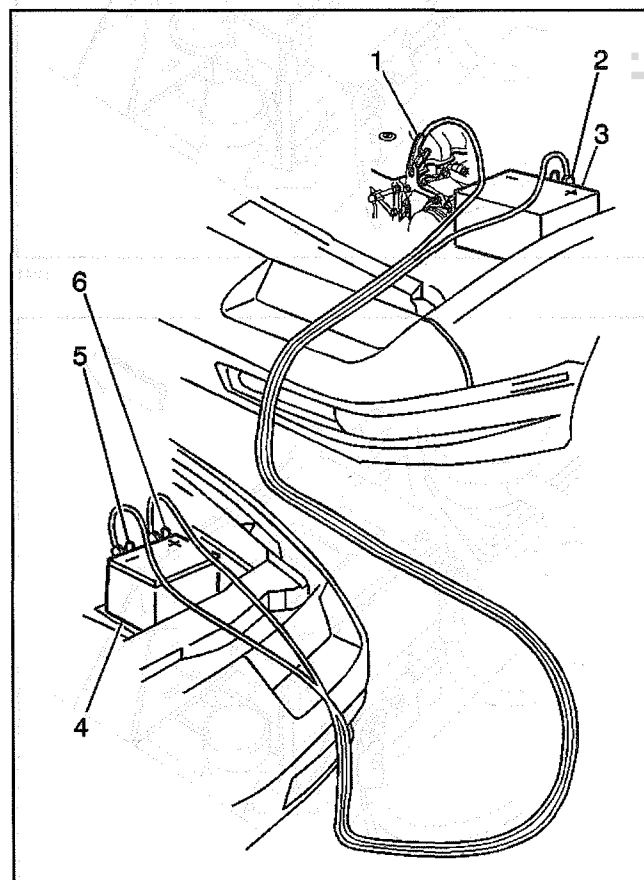


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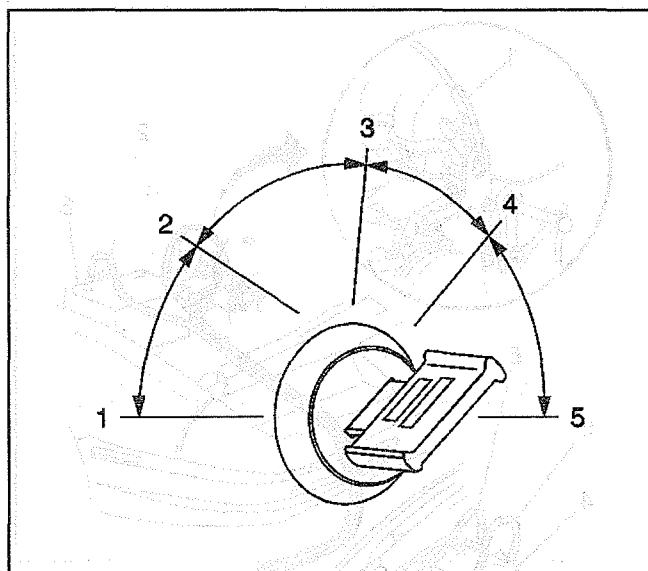
8. Start the engine of the vehicle that is providing the boost (4).
9. Start the engine of the vehicle with the discharged battery (3).
10. Disconnect the negative jumper cable (1) from the engine ground of the battery (3) that was boosted.
11. Remove the other end of the negative jumper cable (5) from the booster battery (4).
12. Remove the positive jumper cable (6) from the booster battery (4).

Important: Do not let the cable end touch any metal while the other cable end is still connected.

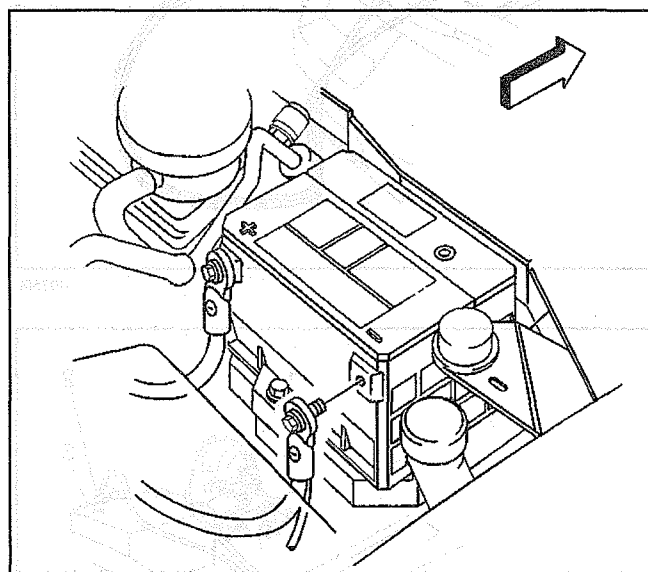
13. Remove the positive jumper cable (2) from the other battery (3).



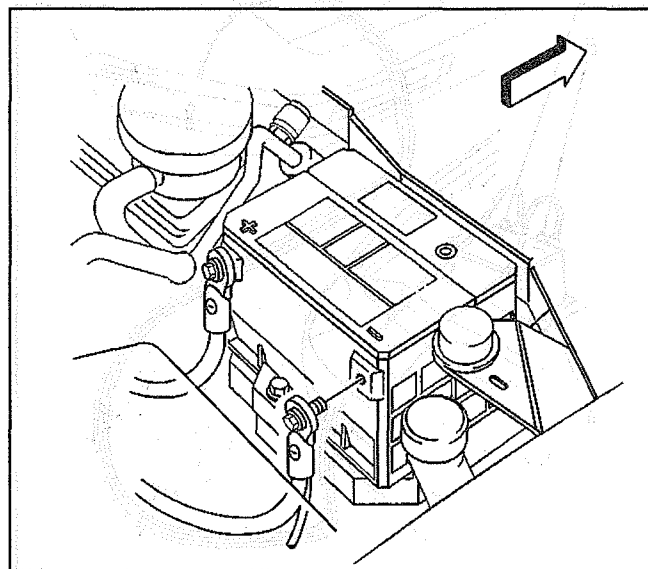
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Battery Negative Cable Disconnect/Connect Procedure

Removal Procedure

Caution: Refer to **SIR Caution in Cautions and Notices.**

1. Record all the vehicle preset radio stations.
2. Record the customers's radio Theftlock® code (if applicable).
3. Turn all the lamps and accessories off.
4. Turn the ignition switch to the OFF position (3).

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

5. Disconnect the negative battery cable bolt.

Installation Procedure

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

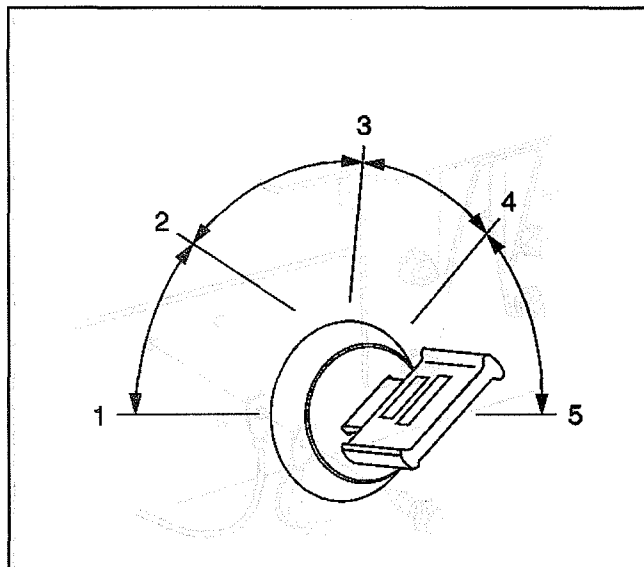
Important: Clean any existing oxidation from the contact face of the battery terminal and battery cable using a wire brush before installing.

1. Install the negative battery cable bolt.

Tighten

Tighten the negative battery cable bolt to 15 N·m (11 lb ft).

2. Turn the ignition switch to the ACC position (1).
3. Unlock the Theftlock® radio (if applicable). Refer to *Radio/Audio System Operation-Theftlock* in Entertainment.
4. Reprogram the radio stations to the previous settings.
5. Set the clock to the current time.
6. Turn the ignition key to the LOCK position (2) and remove the key.



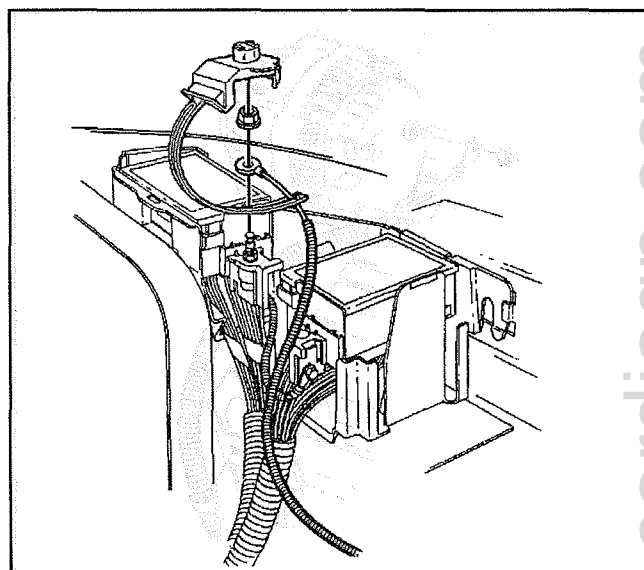
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Battery Cable Replacement (3.8 L Positive)

Removal Procedure

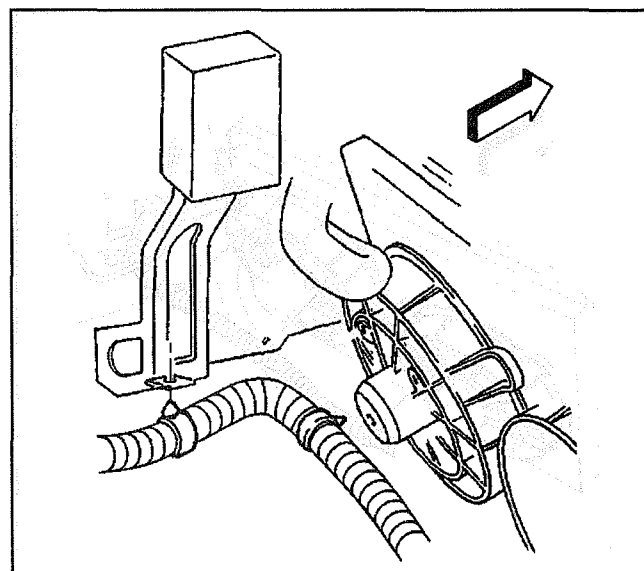
1. Remove the battery. Refer to *Battery Replacement*.
2. Remove the positive cable from the stud on the fuseblock:
 - Open the positive cable cap.
 - Remove the positive cable to fuseblock stud nut.
 - Remove the positive cable from the fuseblock stud.



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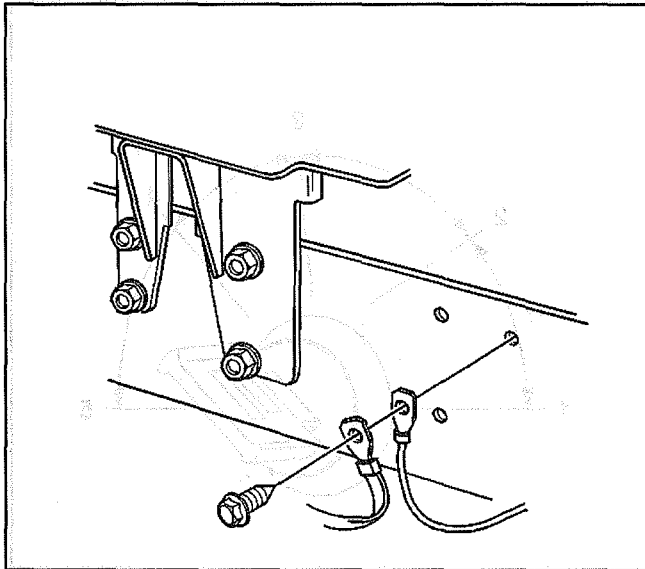
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3. Remove the positive cable from the rosebud clip at the power steering reservoir.



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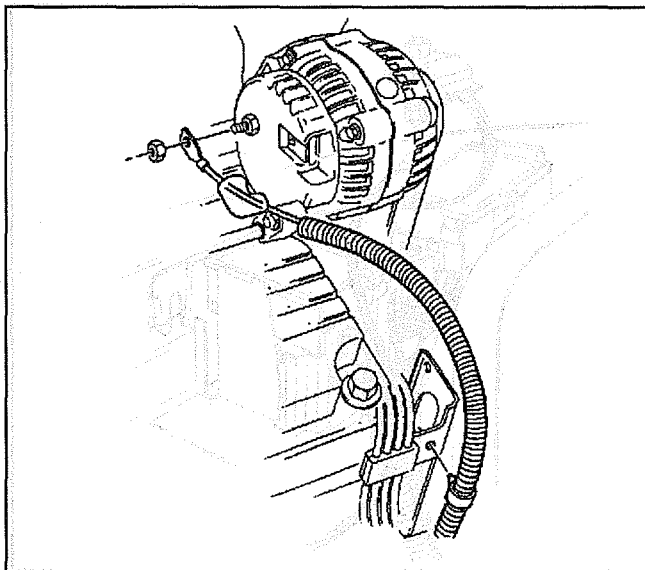
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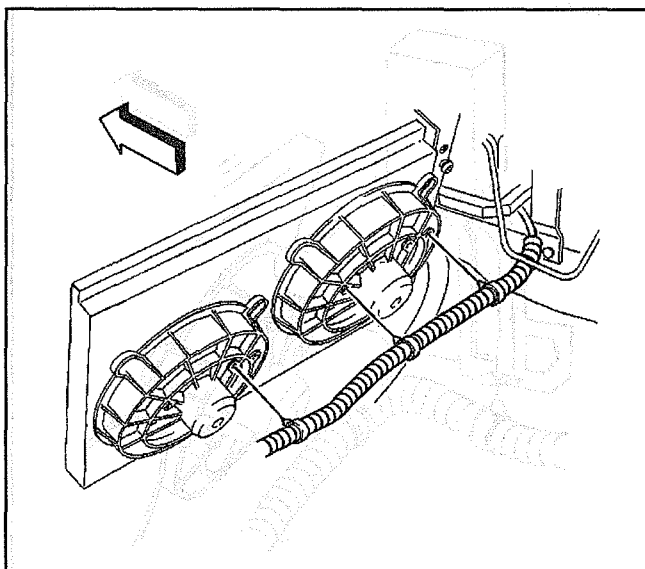
4. Remove the wiring harness ground bolt and radio frequency (RF) ground strap and cruise control ground lead from the front rail.



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5. Remove the positive cable from the generator.
 - Slide the boot down revealing the positive terminal stud.
 - Remove the positive cable nut from the generator input stud.
 - Remove the positive cable.
6. Remove the positive cable rosebud clip from the engine lift bracket.

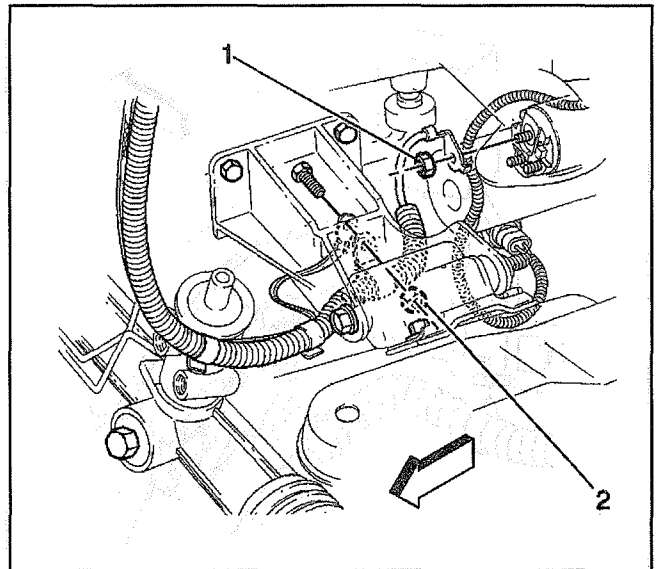


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7. Remove the positive cable rosebud clips from the cooling fans.
8. Raise and suitably support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.

9. Remove the positive/negative cable from the engine mount stud:
 - Remove the positive cable RF ground nut (2).
 - Remove the harness clamp from the stud.
 - Remove the RF ground strap.
10. Remove the starter motor shield. Refer to *Starter Shield Replacement (3.8 L)*.
11. Remove the positive cable from the starter solenoid:
 - Remove the positive cable to starter motor nut (1).
 - Remove the positive cable from the harness conduit.



211604

Installation Procedure

1. Install the positive cable to the harness conduit.

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

2. Install the positive cable to starter motor nut (1).

Tighten

Tighten the positive cable to starter motor nut (1) to 10 N·m (89 lb in).

3. Install the starter motor shield. Refer to *Starter Shield Replacement (3.8 L)*.

4. Install the positive/negative cable to the engine mount stud:

- Install the RF ground strap.
- Install the harness clamp to the stud.
- Install the positive cable RF ground nut (2).

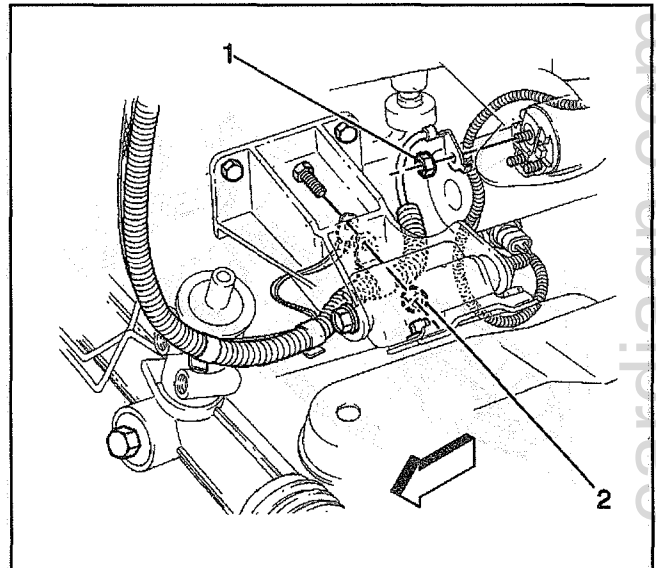
Tighten

Tighten the positive cable RF ground nut to 25 N·m (18 lb ft).

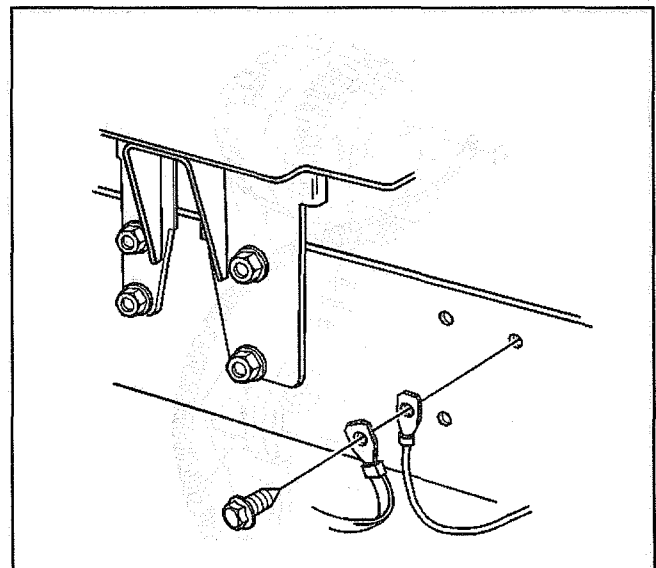
5. Install the wiring harness bolt and RF ground strap and cruise control ground lead to the front rail.

Tighten

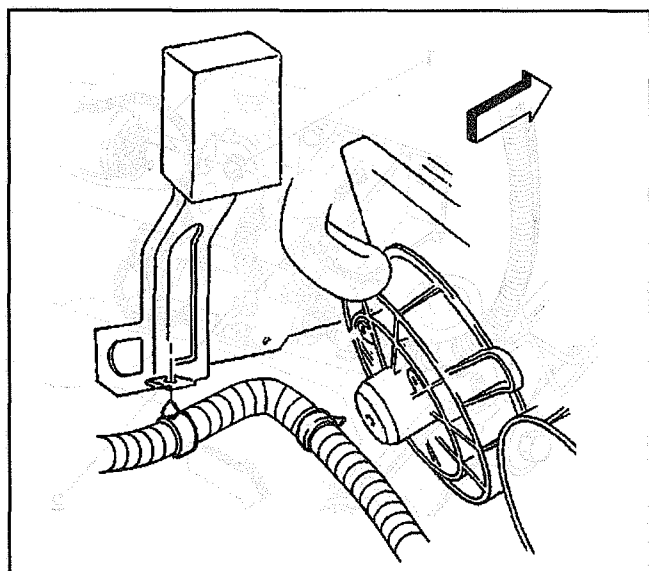
Tighten the wiring harness ground bolt to 12 N·m (106 lb in).



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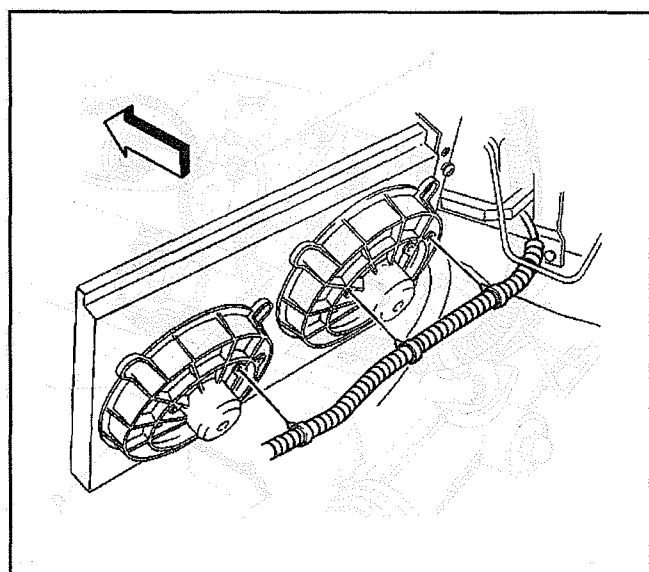


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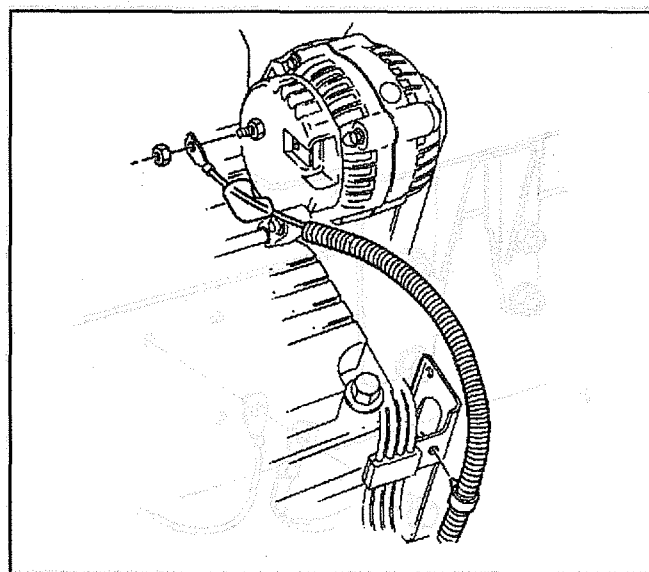
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6. Install the positive cable rosebud clip at the power steering reservoir.

7. Lower the vehicle.

- Remove the positive cable from the stud.
- Remove the harness clamp from the stud.
- Remove the RF ground strap.
- Remove the starter motor shield. Refer to Shield Replacement (A8.1).
- Remove the positive cable from the starter solenoid.
- Remove the positive cable to starter motor nut (1).
- Remove the positive cable from the harness conduit.

8. Install the positive cable rosebud clips at the engine cooling fans.

1. Install the positive cable to the fan housing.
2. Install the positive cable to starter motor nut (1).
3. Tighten the positive cable to starter motor nut (1) to 10 N·m (89 lb ft).
4. Install the starter motor shield. Refer to Shield Replacement (A8.1).
5. Install the positive/negative cable to the engine mount stud.
6. Install the RF ground strap.
7. Install the harness clamp to the stud.
8. Install the positive cable RF ground nut (2).
9. Tighten the positive cable RF ground nut (2) to 22 N·m (16 lb ft).

9. Install the positive cable rosebud clip to the engine lift bracket.

10. Install the positive cable to the generator.

- Install the positive cable to the stud.
- Install the positive cable nut to the generator output stud.

Tighten

Tighten the positive cable nut to generator output stud to 22 N·m (16 lb ft).

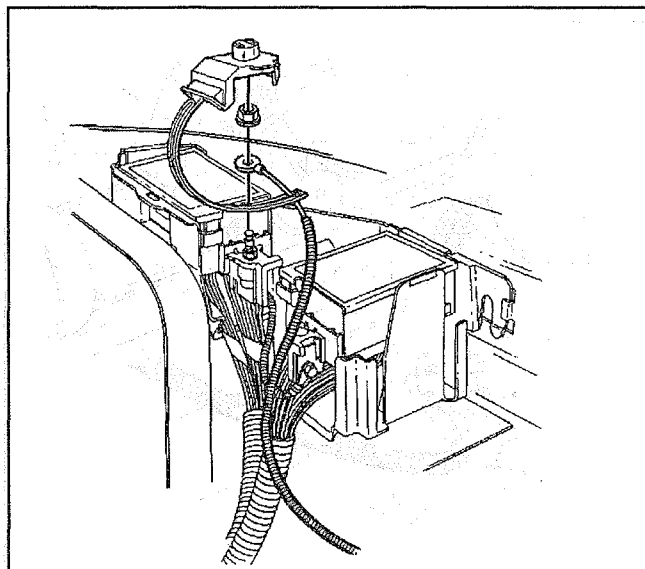
- Slide the boot over the generator output stud.

11. Install the positive cable to the stud on the fuseblock:
 - Install the positive cable to the fuseblock stud.
 - Install the positive cable to fuseblock stud nut.

Tighten

Tighten the positive cable to fuseblock stud nut to 14 N·m (10 lb ft).

- Close the positive cable cap.
12. Install the battery. Refer to *Battery Replacement*.

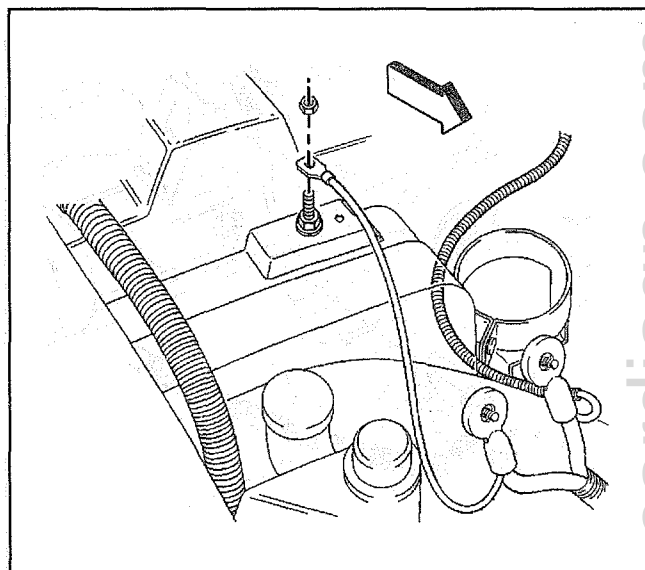


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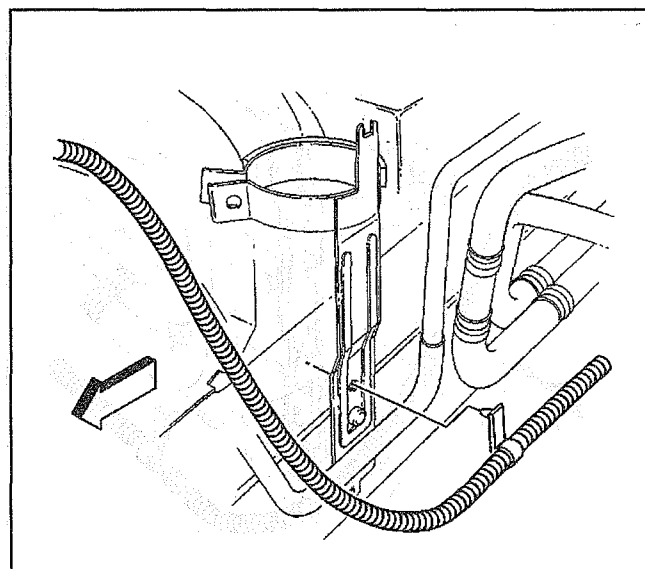
Battery Cable Replacement (3.8 L Negative)

Removal Procedure

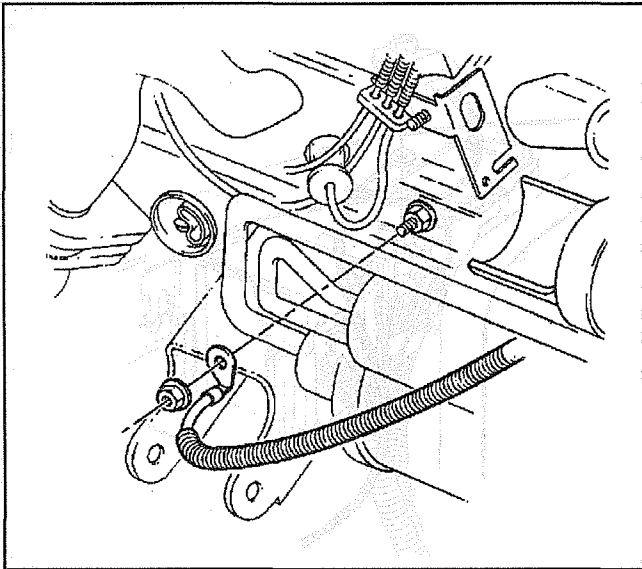
1. Remove the battery. Refer to *Battery Replacement*.
2. Remove the negative cable nut at the ground terminal.
3. Remove the ground lead from the wheelhouse stud
4. Remove the battery cable rosebud clip from the accumulator bracket.



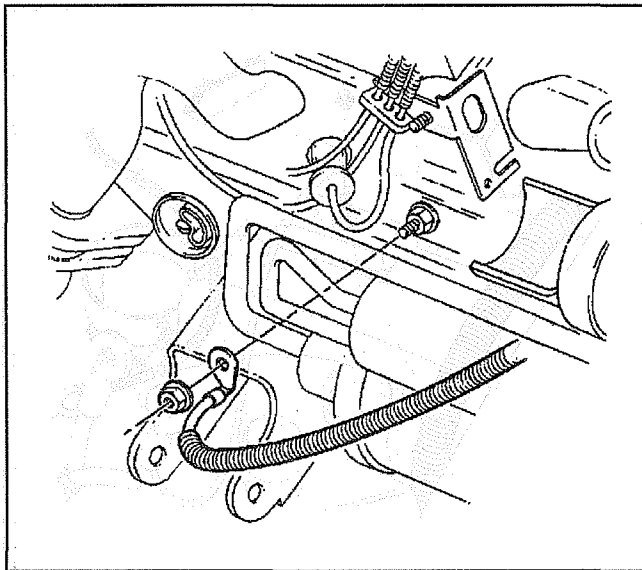
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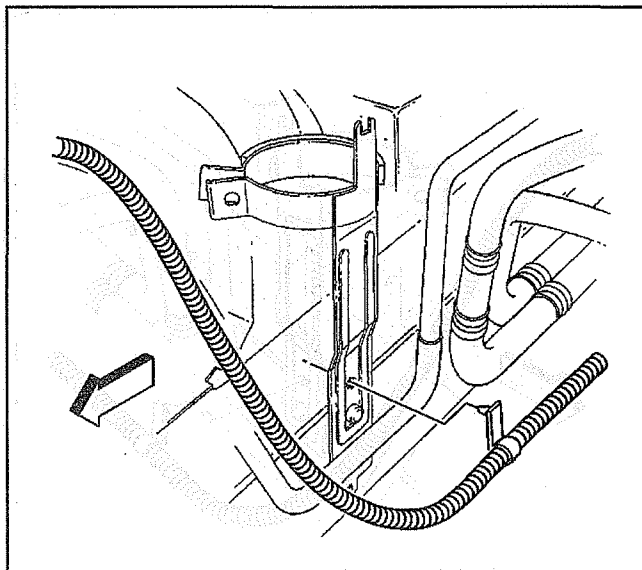
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5. Remove the negative cable nut from the engine block stud.

6. Remove the negative cable from the harness conduit.

• Tighten the positive cable nut to 14 N-m (10 lb ft).

• Close the positive cable cap.

12. Install the battery. Refer to Battery Replacement.

Installation Procedure

1. Install the negative battery cable to the harness conduit.
2. Install the negative cable to the engine block stud.

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

3. Install the negative cable nut to the engine block stud.

Tighten

Tighten the negative cable nut to engine block stud to 22 N-m (16 lb ft).

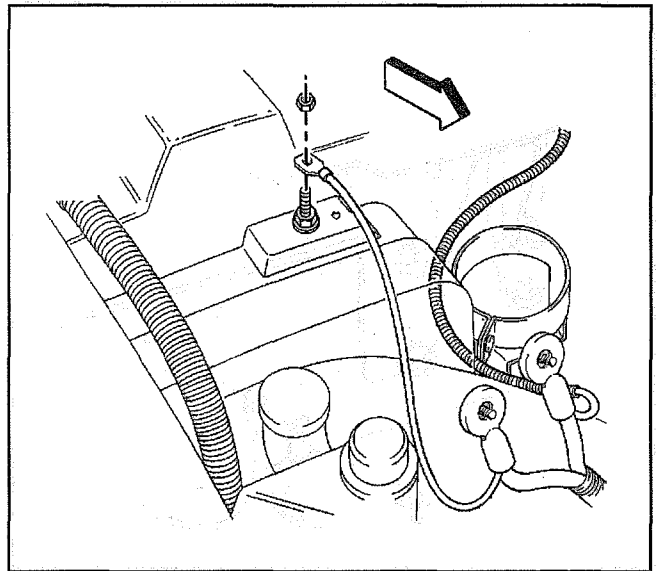
4. Install the battery cable rosebud clip to the accumulator bracket.

5. Install the ground lead to the wheelhouse stud.
6. Install the negative cable nut at the ground terminal.

Tighten

Tighten the negative cable nut at the ground terminal to 6 N·m (53 lb in).

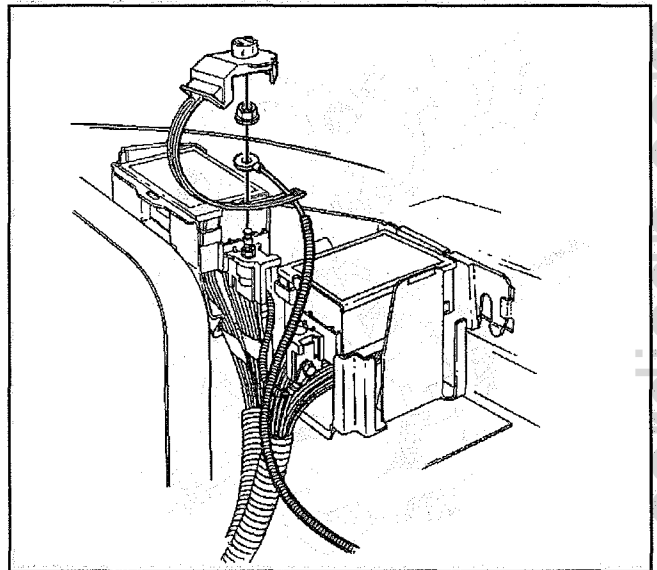
7. Install the battery. Refer to *Battery Replacement*.



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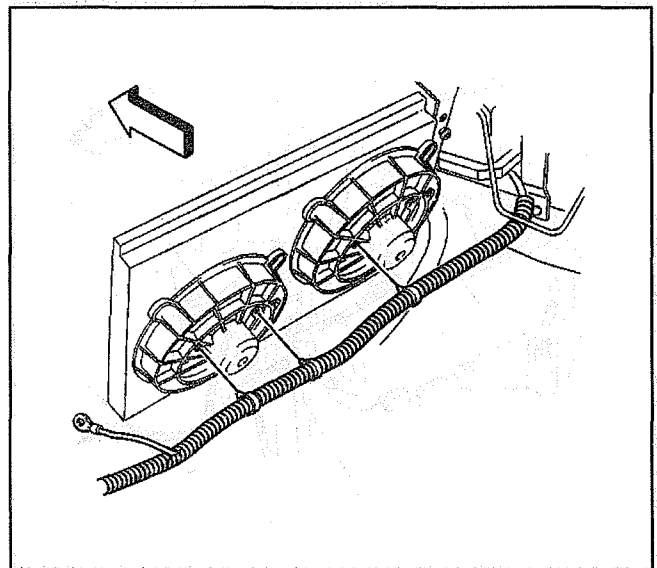
Battery Cable Replacement (5.7 L Positive)**Removal Procedure**

1. Remove the battery. Refer to *Battery Replacement*.
2. Remove the positive cable from the stud on the fuseblock.
 - Open the positive cable cap.
 - Remove the battery cable to fuseblock stud nut.
 - Remove the positive cable from the fuseblock stud.
3. Raise and suitably support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.

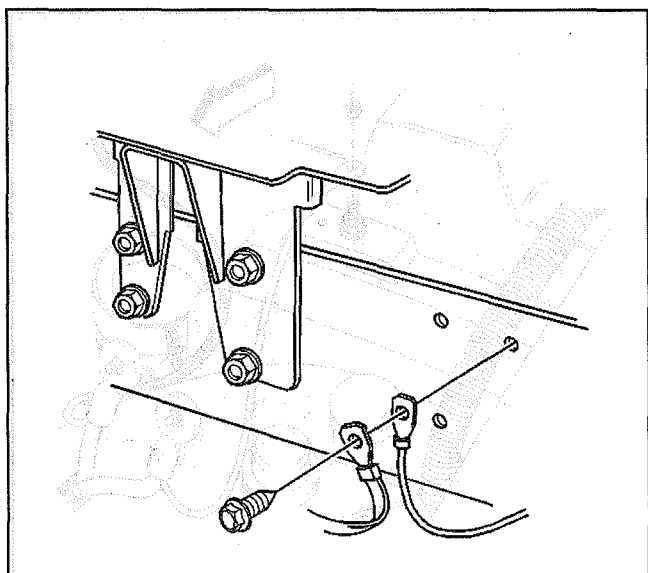


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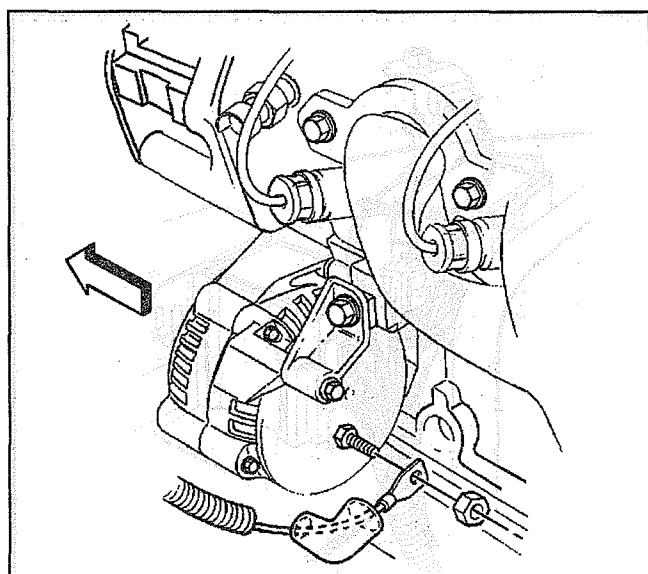
4. Remove the conduit rosebud clips at the cooling fans.



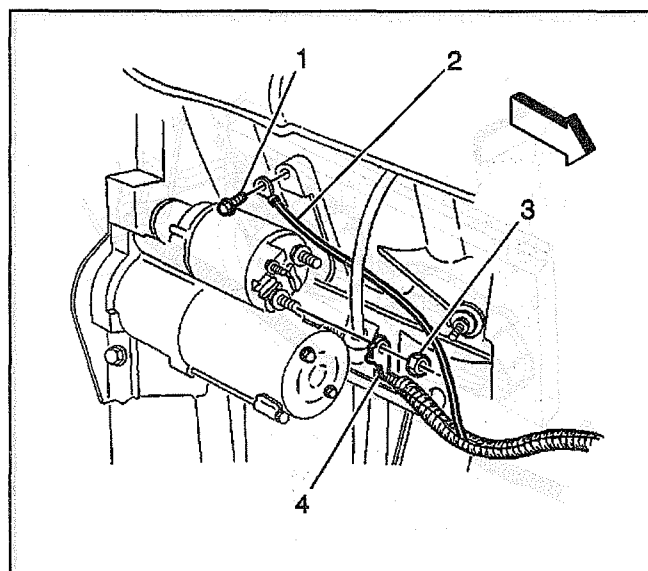
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5. Remove the wiring harness ground bolt and radio frequency (RF) ground strap and cruise control ground lead at the front rail.

6. Remove the positive cable from the generator.

- Slide the boot down revealing the positive terminal stud.
- Remove the positive cable nut from the generator output stud.
- Remove the positive cable.

7. Remove the positive cable to starter motor nut (3).
8. Remove the positive cable (4) from the starter motor.
9. Remove the positive cable from the harness conduit.

Installation Procedure

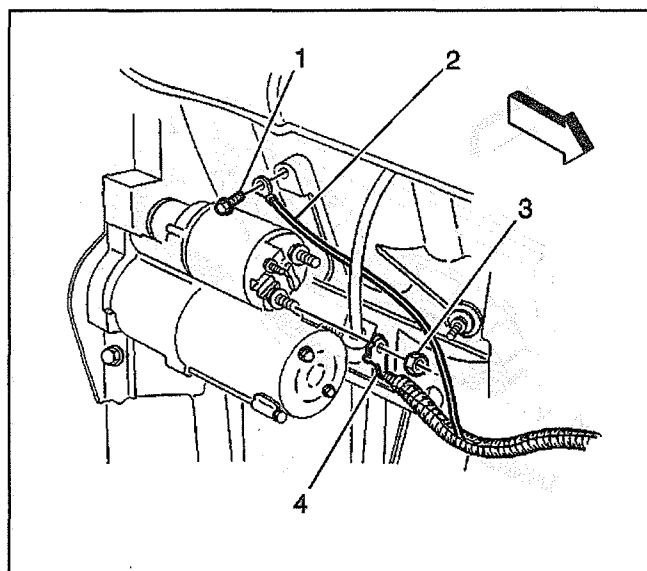
1. Install the positive cable to the harness conduit.
2. Install the positive cable (4) to the starter motor.

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

3. Install the positive cable to starter motor nut (3).

Tighten

Tighten the positive cable to starter motor nut (3) to 10 N·m (89 lb in).



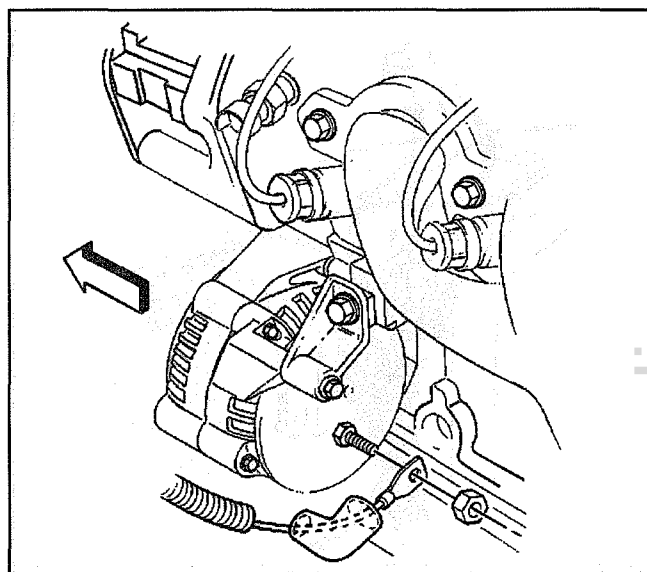
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4. Install the positive cable to the generator:
 - Install the positive cable.
 - Install the positive cable nut to the generator output stud.

Tighten

Tighten the positive cable nut to the generator output stud to 22 N·m (16 lb ft).

- Slide the boot over the positive terminal stud.

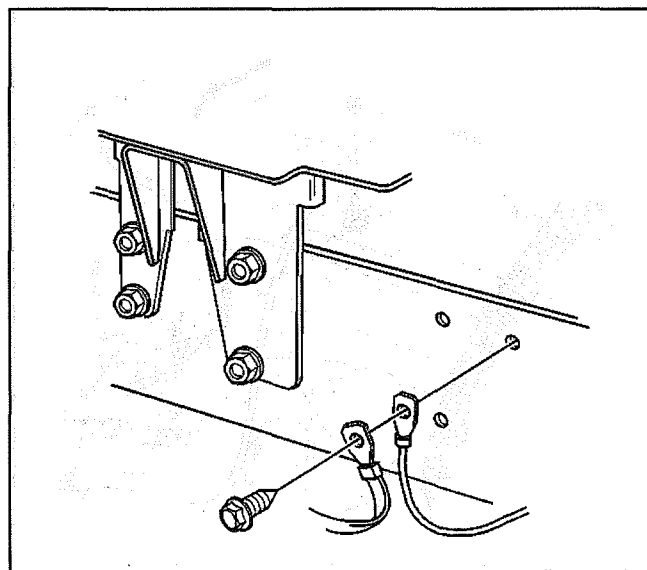


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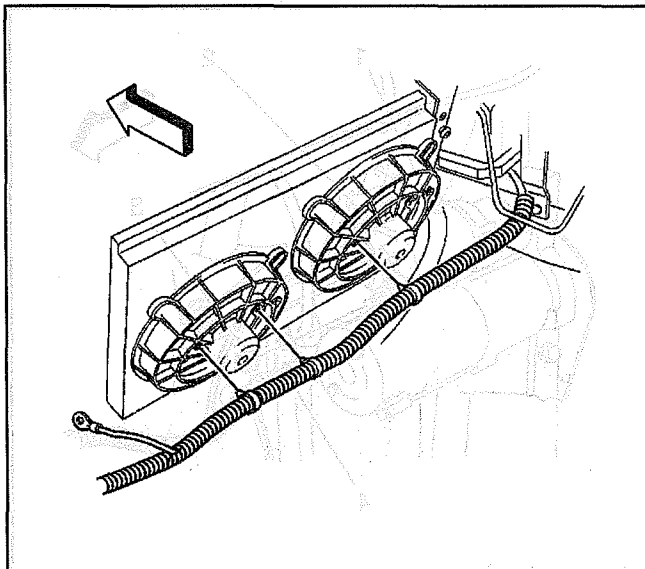
5. Install the wiring harness ground and RF ground strap and cruise control ground lead bolt to the front rail.

Tighten

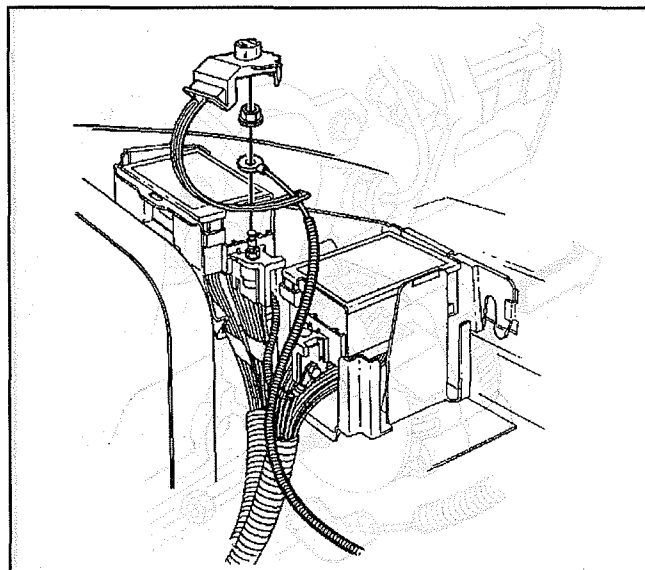
Tighten the wiring harness ground and RF ground strap and cruise control ground lead bolt to 12 N·m (106 lb in).



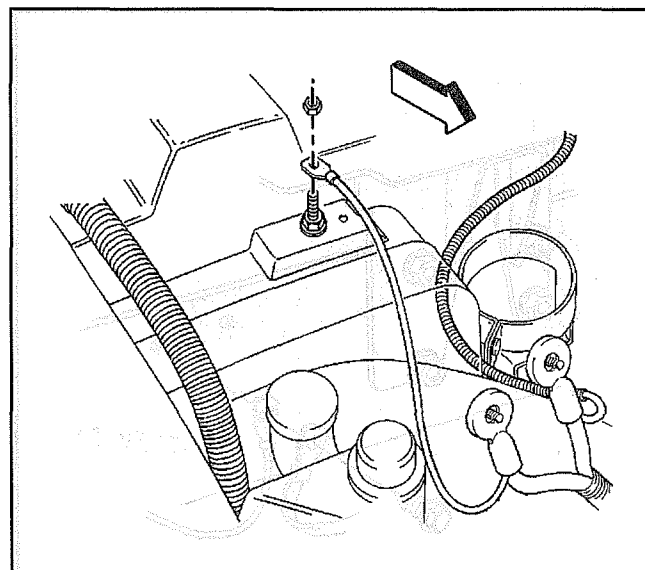
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6. Install the conduit rosebud clips at the cooling fans.
7. Lower the vehicle.

8. Install the positive cable to the stud on the fuseblock:
 - Install the positive cable to the fuseblock stud.
 - Install the positive cable to fuseblock stud nut.

Tighten
Tighten the positive cable to fuseblock stud nut to 14 N·m (10 lb ft).

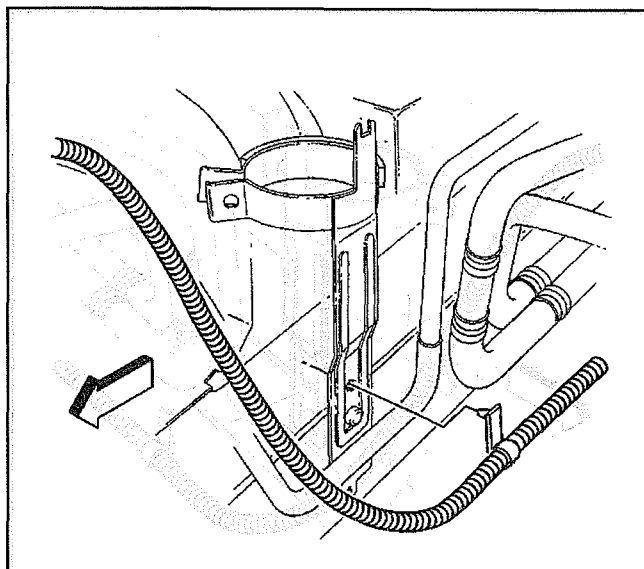
- 9. Install the battery. Refer to *Battery Replacement*.

Battery Cable Replacement (5.7 L Negative)

Removal Procedure

1. Remove the battery. Refer to *Battery Replacement*.
2. Remove the negative cable nut at the ground terminal.
3. Remove the ground lead from the wheelhouse stud.

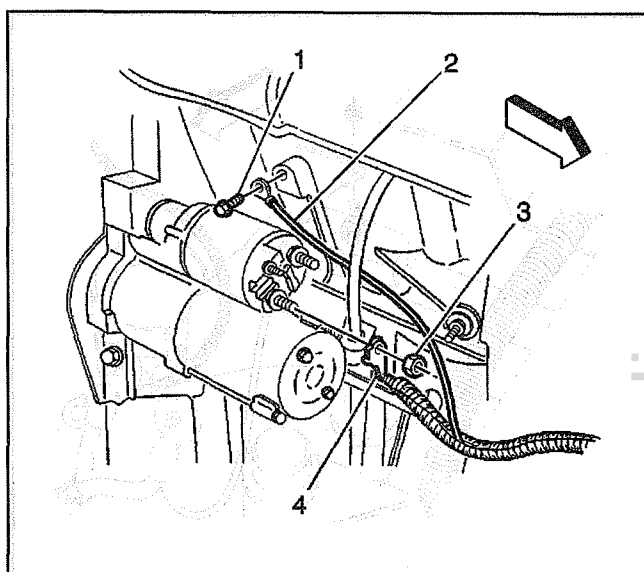
4. Remove the battery cable rosebud clip from the accumulator bracket.



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5. Remove the negative cable to engine block bolt (1).
6. Remove the ground lead (2) from the engine block.
7. Remove the negative battery cable from the harness conduit.



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Installation Procedure

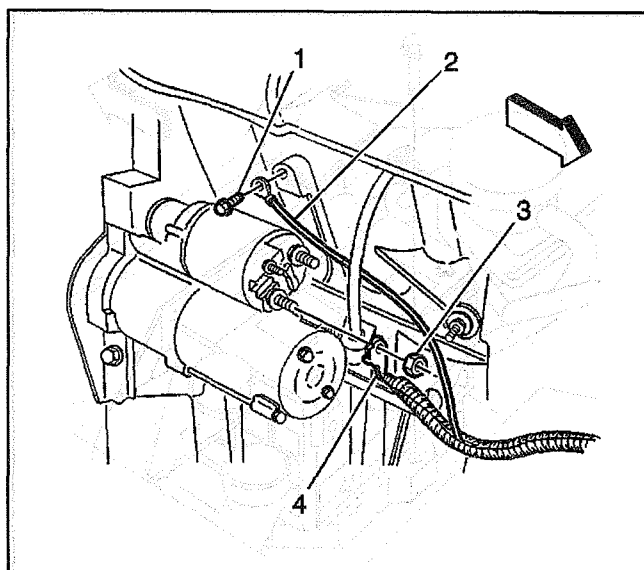
1. Install the negative cable to the harness conduit.
2. Install the ground lead (2) to the engine block.

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

3. Install the negative cable to engine block bolt (1).

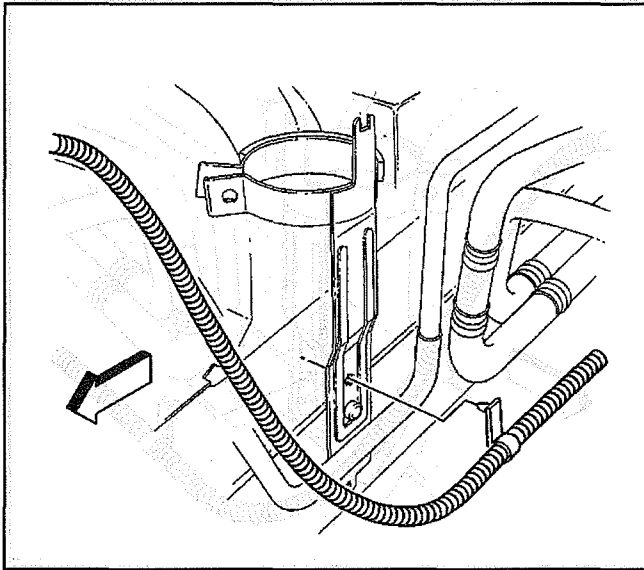
Tighten

Tighten the negative cable to engine block bolt (1) to 32 N·m (24 lb ft).



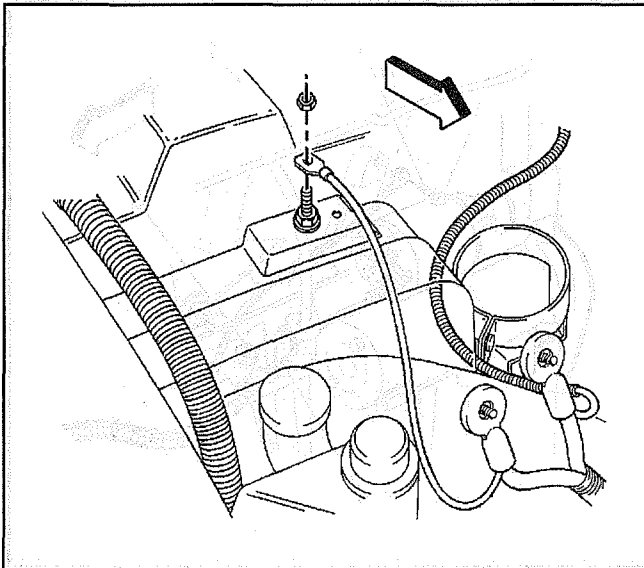
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4. Install the battery cable rosebud clip at the accumulator bracket.



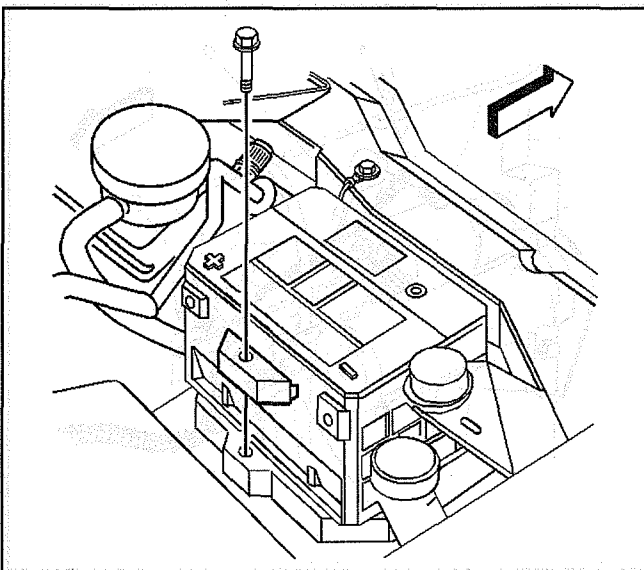
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5. Install the ground lead to the wheelhouse stud.
6. Install the negative cable nut at the ground terminal.

Tighten

Tighten the negative at cable ground terminal nut to 6 N·m (53 lb in).

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



43660

Battery Hold Down Retainer Replacement

Removal Procedure

1. Loosen the battery hold down retainer bolt.
2. Remove the battery hold down retainer and bolt.

Installation Procedure

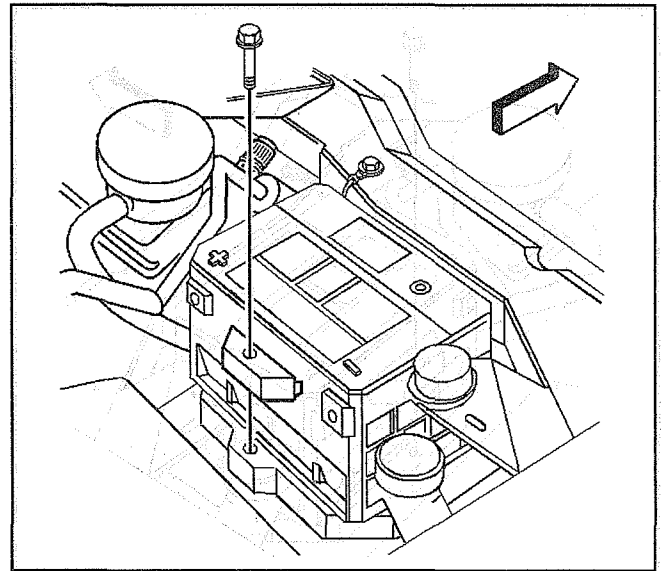
1. Install the battery hold down retainer and bolt.

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

2. Tighten the battery hold down retainer bolt.

Tighten

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

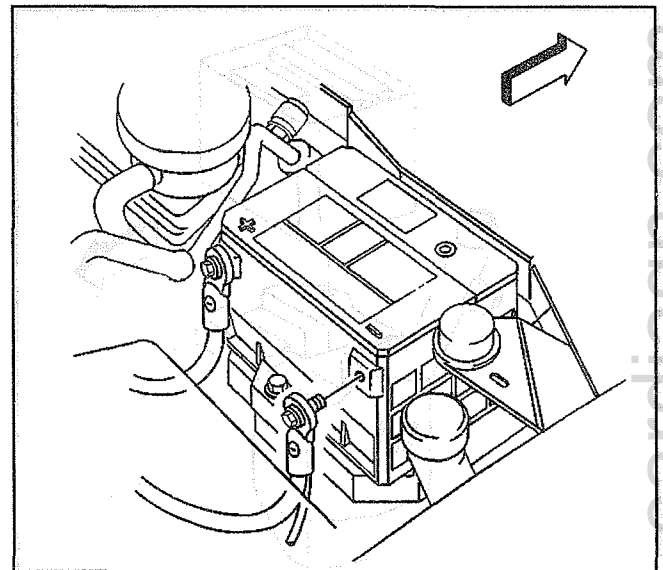


43660

Battery Replacement**Removal Procedure**

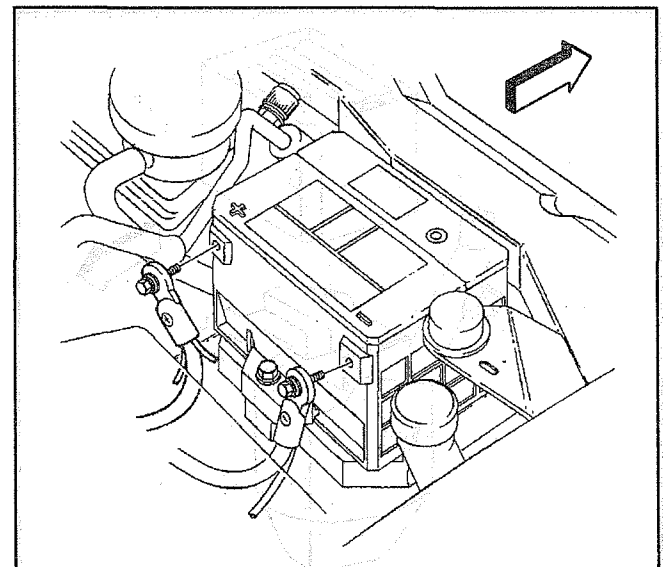
Caution: Refer to *Battery Disconnect Caution* in Cautions and Notices.

1. Disconnect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure*.

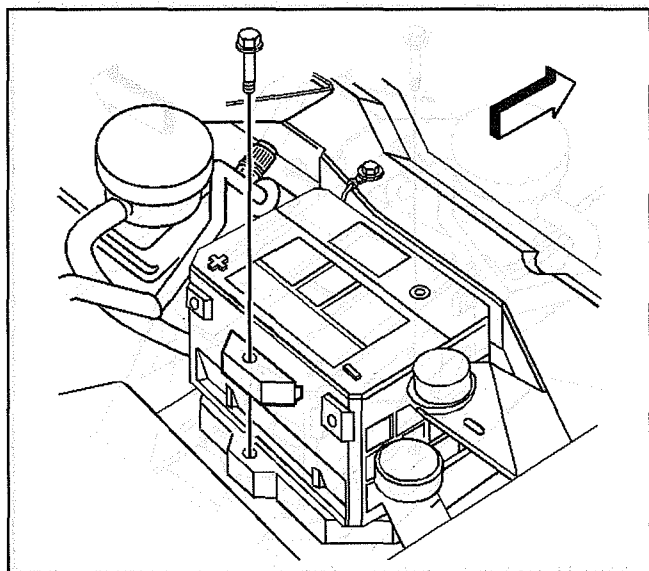


208241

2. Disconnect the positive battery cable bolt.



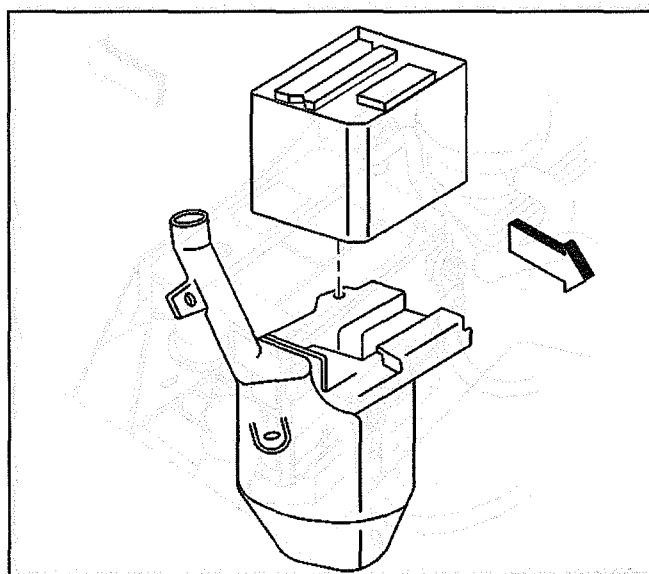
211587



43660

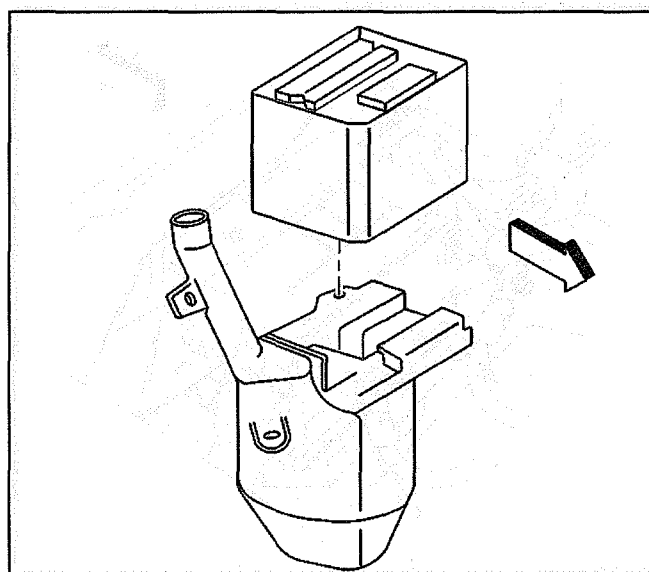
3. Remove the battery hold down retainer bolt.

4. Remove the battery hold down retainer.



221643

5. Remove the battery from the battery tray/coolant recovery reservoir.



221643

Installation Procedure

1. Install the battery to the battery tray/coolant recovery reservoir.

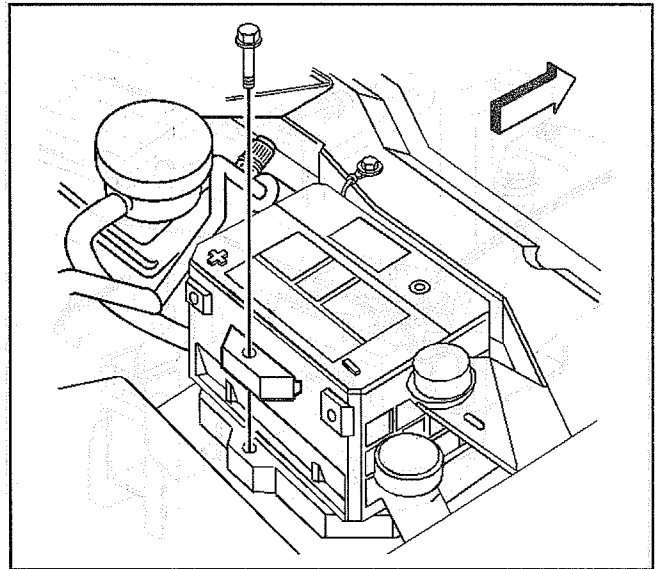
2. Install the battery hold down retainer.

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

3. Install the battery hold down retainer bolt.

Tighten

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

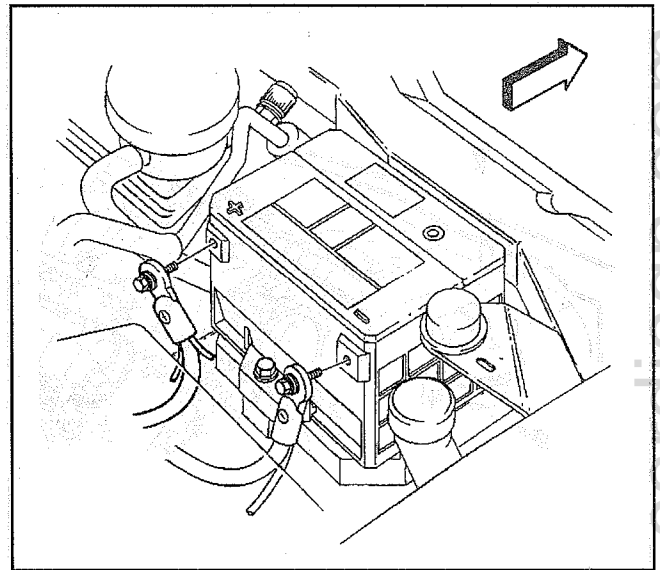


43660

4. Connect the positive battery cable bolt.

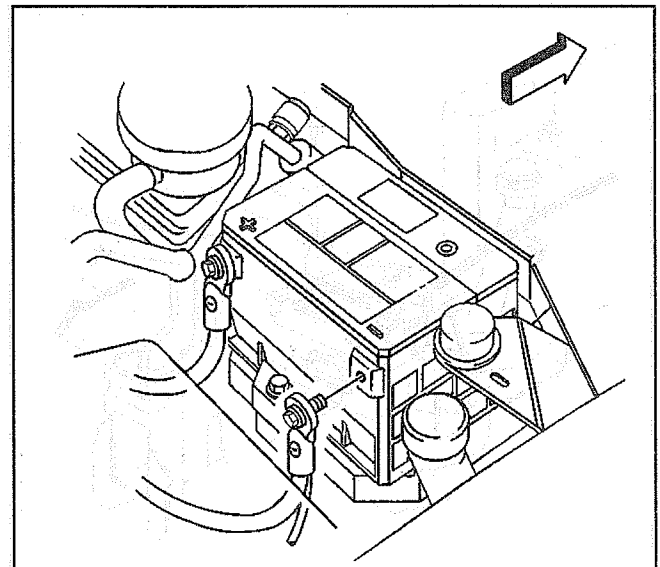
Tighten

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

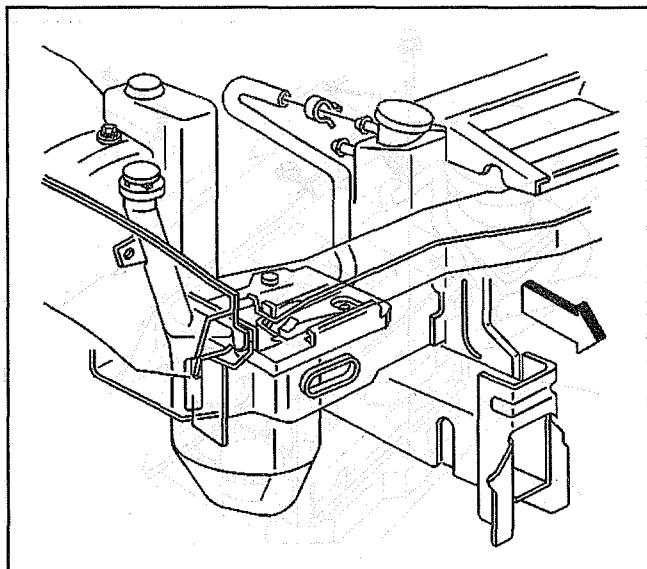


211587

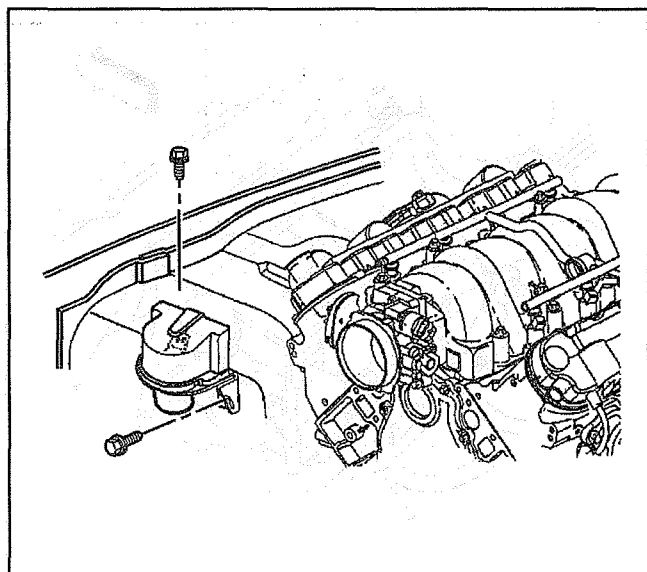
5. Connect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure*.



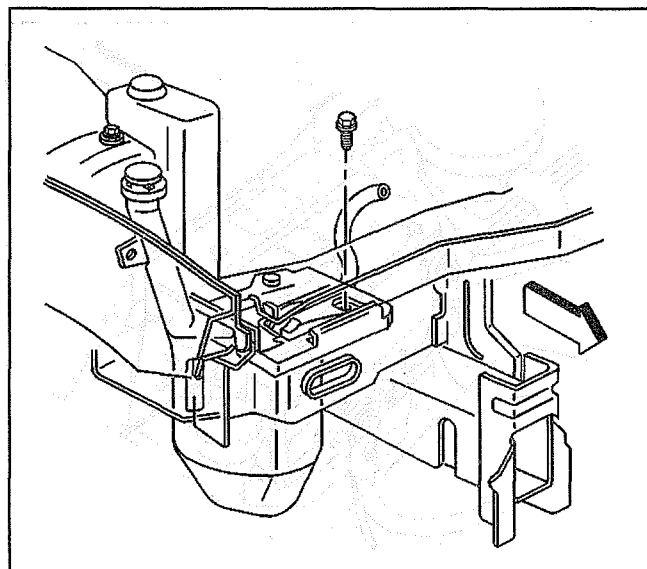
208241



221645



221646



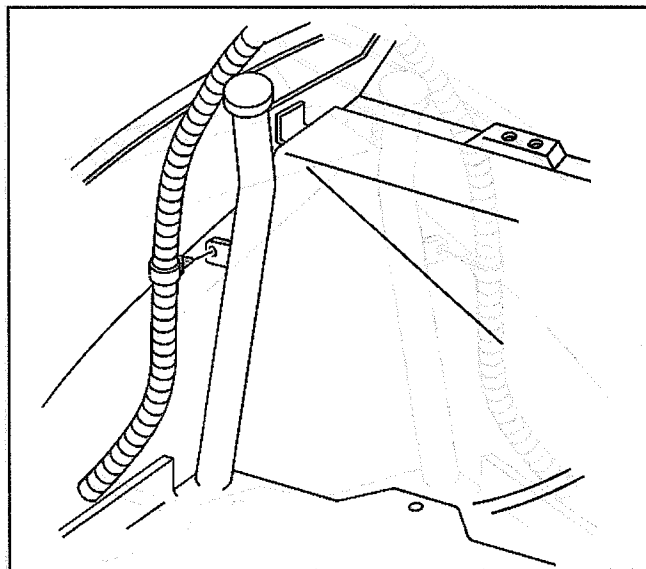
221653

Battery Tray Replacement

Removal Procedure

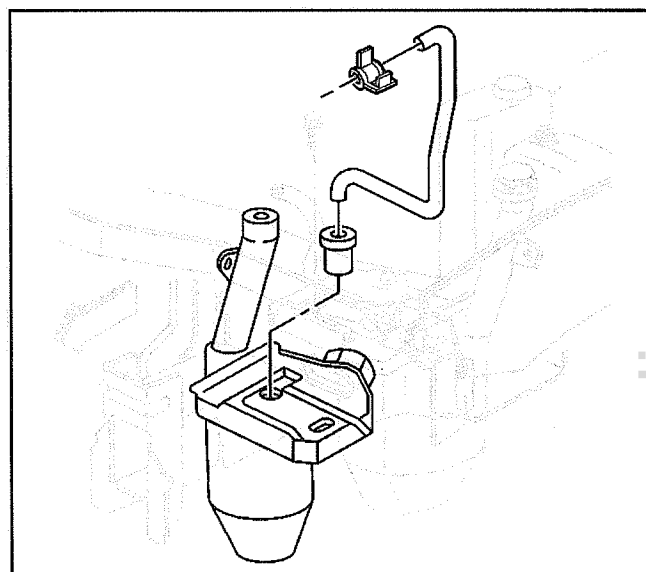
1. Remove the battery. Refer to *Battery Replacement*.
2. Remove the coolant recovery reservoir hose from the radiator.
3. Remove the accelerator and cruise control servo cable adjuster bolts, if equipped with a 5.7 L engine.
4. Reposition the accelerator and cruise control servo cable adjuster.
5. Remove the coolant recovery reservoir bolt.

6. Remove the wiring harness rosebud clip from the reservoir neck.
7. Remove the coolant recovery reservoir/battery tray.



221650

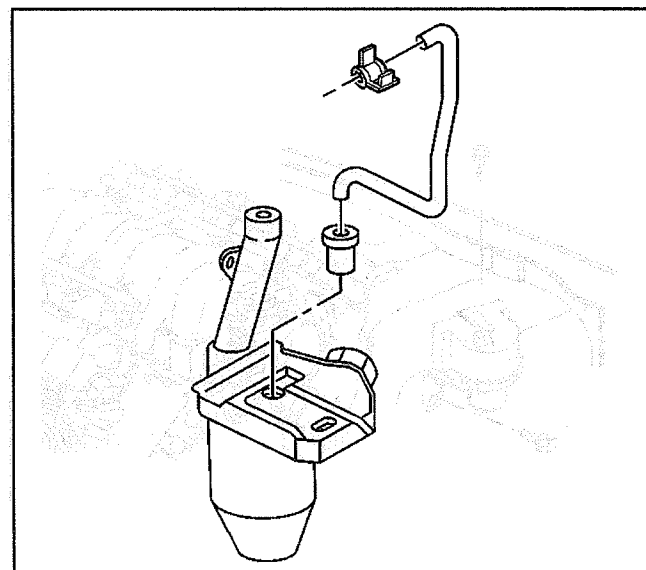
8. Remove the coolant recovery reservoir hose from the reservoir/battery tray.



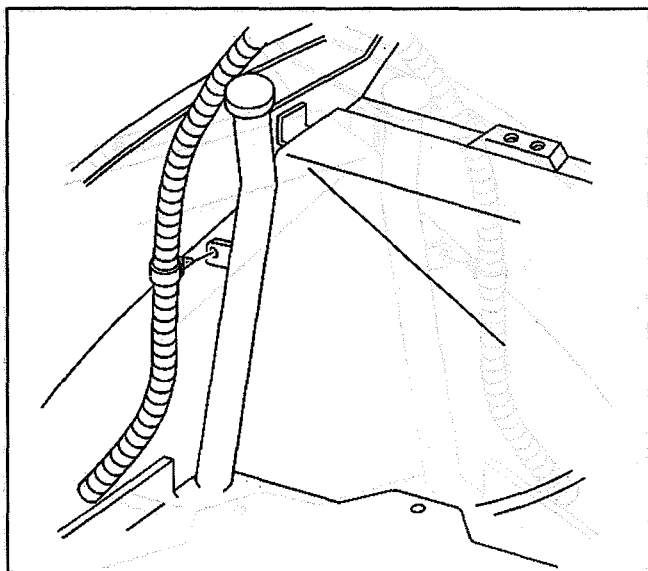
221663

Installation Procedure

1. Install the coolant recovery reservoir hose to the reservoir/battery tray.
2. Install the coolant recovery reservoir/battery tray.



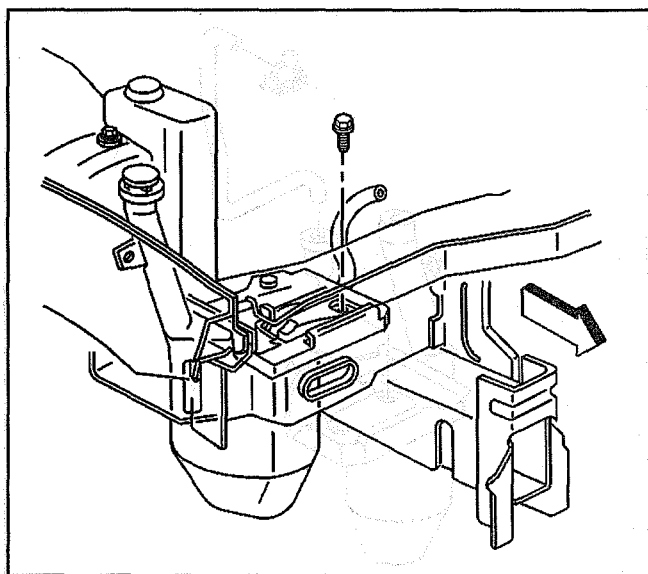
221663



221650

221650

3. Install the wiring harness rosebud clip to the reservoir neck.



221653

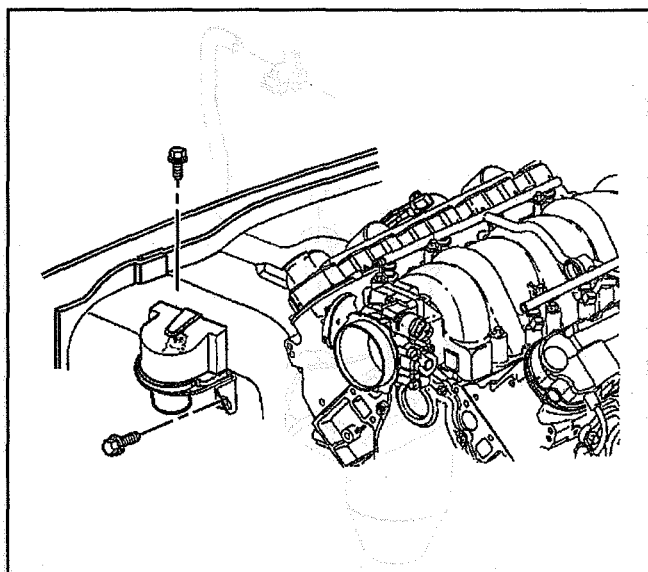
221653

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

4. Install the coolant recovery reservoir bolt.

Tighten

Tighten the coolant recovery reservoir bolt to 12 N·m (106 lb in).



221646

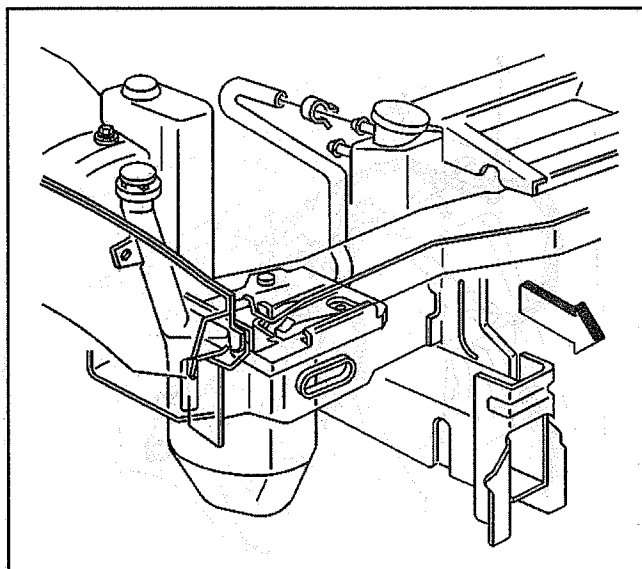
221646

5. Position the accelerator and cruise control servo cable adjuster, if equipped with a 5.7 L engine.
6. Install the accelerator and cruise control servo cable adjuster bolts.

Tighten

Tighten the accelerator and cruise control servo cable adjuster bolts to 7.5 N·m (66 lb in).

7. Install the coolant recovery reservoir hose to the radiator.
8. Install the battery. Refer to *Battery Replacement*.
9. Add engine coolant to the FULL COLD mark on the reservoir.



221645

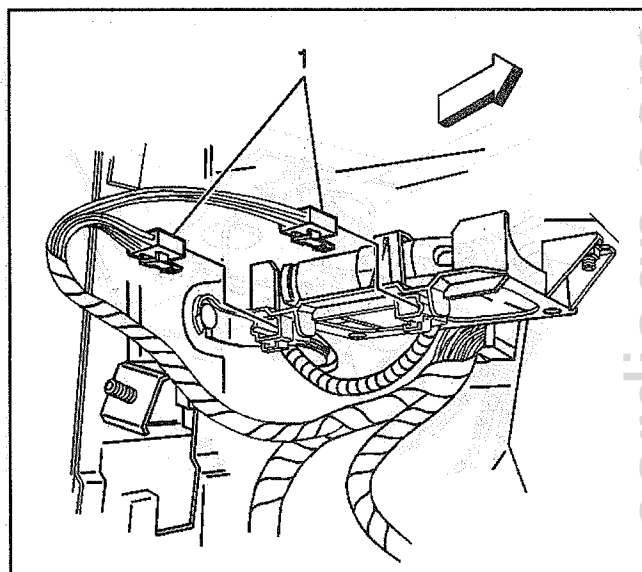
Underhood Fuse Block Replacement

Removal Procedure

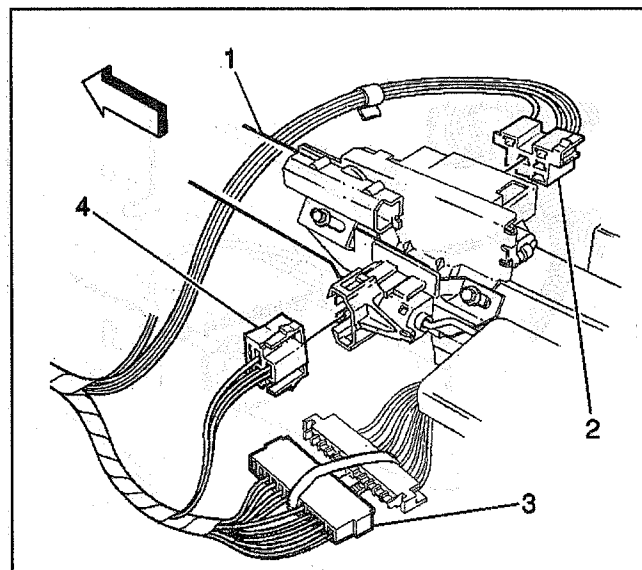
The underhood electrical center is part of the forward lamp wiring harness. The underhood electrical center and harness must be replaced as a complete assembly.

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

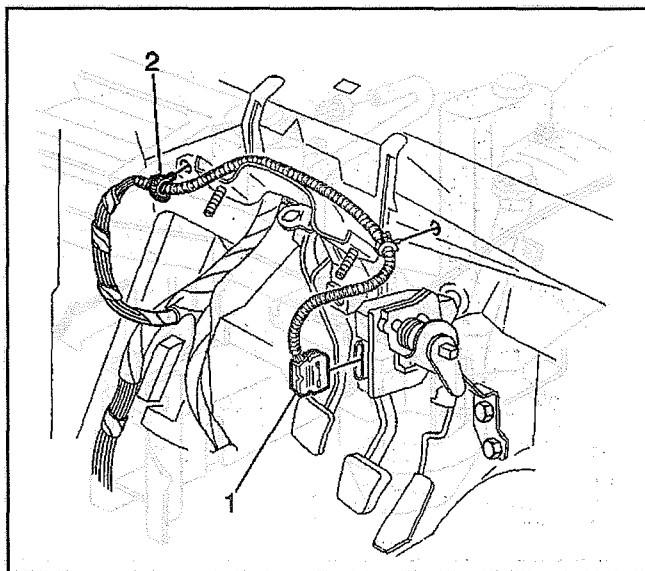
1. Disconnect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure*.
2. Starting inside the vehicle, disconnect the accel/cruise servo cable adjuster electrical connectors (1).
3. Disconnect the following connectors from the steering column (1):
 - Ignition switch (2)
 - Wiper/washer (3)
 Cut the insulator from around the connector.
 - Dimmer switch (4)



407641



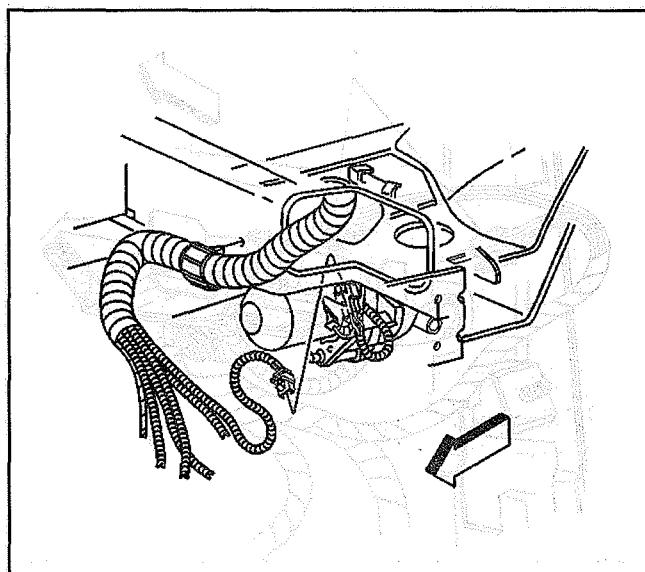
407643



407645

407645

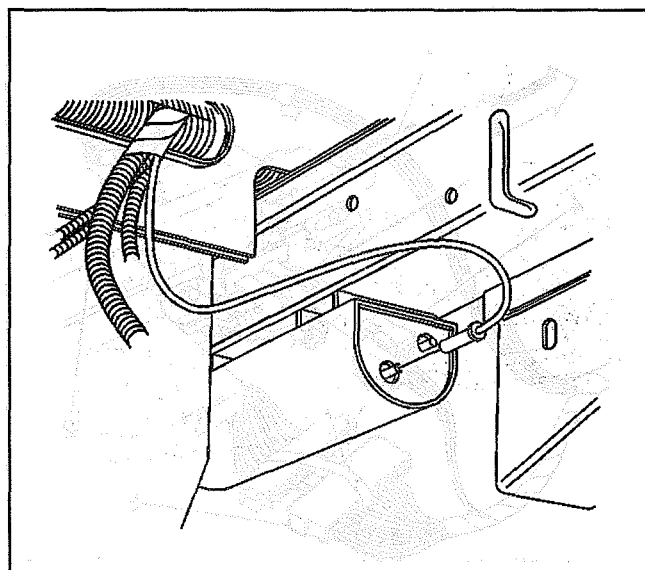
4. Disconnect the electronic throttle control (ETC) electrical connector (1), if equipped with a 3.8 L engine.
5. Disconnect the rosebud clips (2) from the dash mat.
6. Raise and suitably support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.



550628

550628

7. Disconnect the secondary air injection (AIR) pump connector, if equipped with a 5.7 L engine.

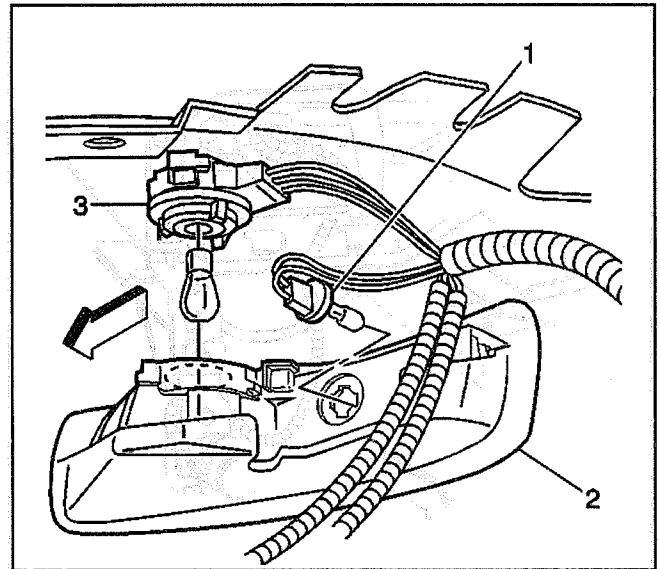


282928

282928

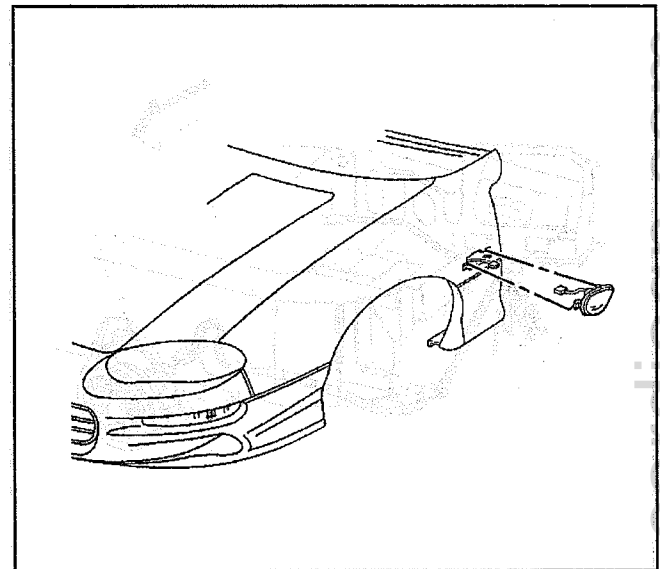
8. Disconnect the vacuum tank hose from the vacuum tank.

9. Remove the park/turn signal (3) and marker lamp (1) connector from the lamp (2).
10. On Pontiac, disconnect the side marker lamp connector.



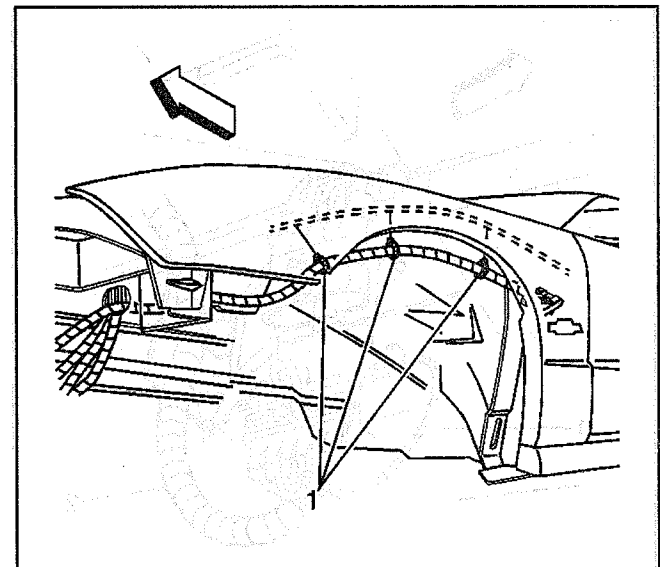
407630

11. Remove the side repeater lamp (Export only):

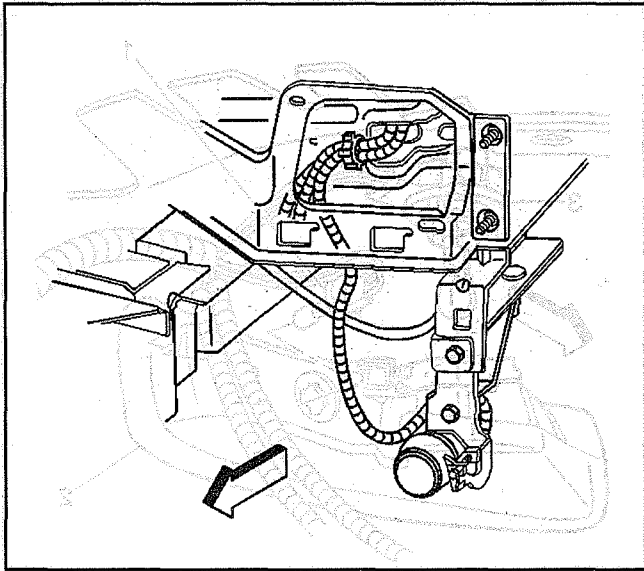


379374

12. Remove the harness clips (1) from the fender rail. (Export only)

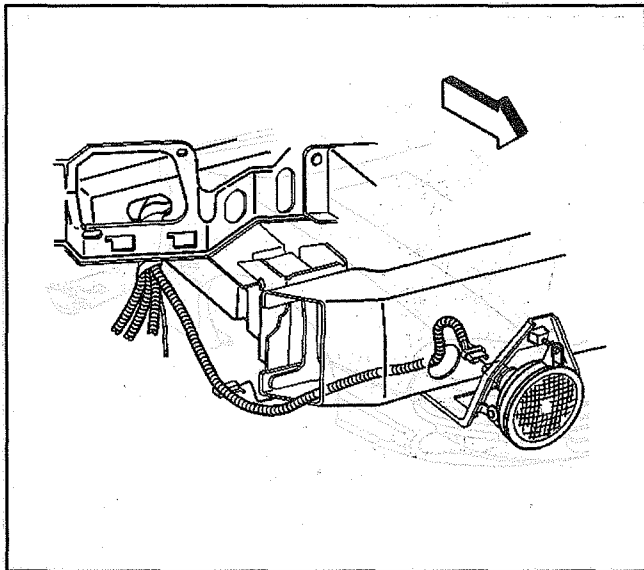


407632



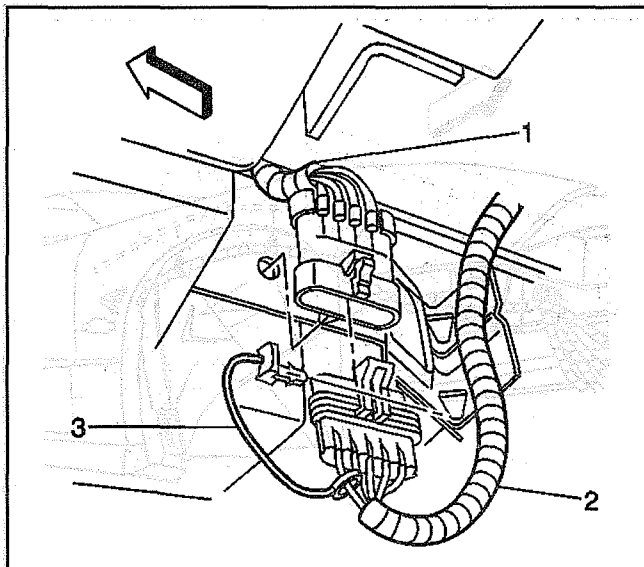
550635

13. On Chevrolet, disconnect the connector from the fog lamp.
14. Remove the rosebud clip from the front bumper beam.



550631

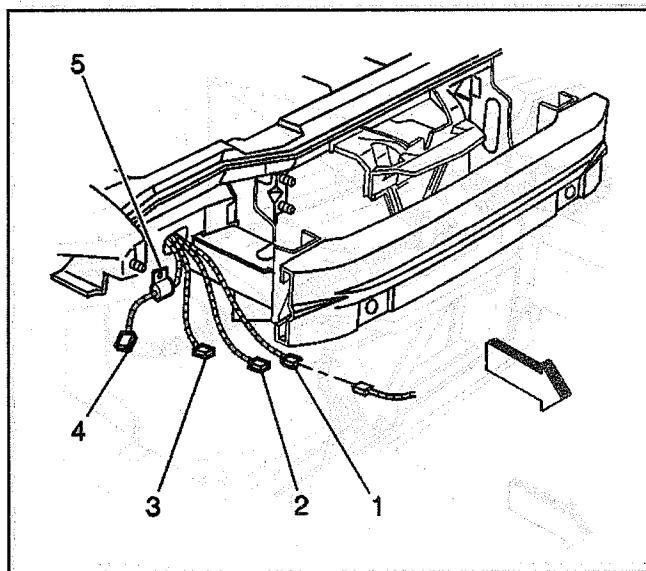
15. On Pontiac, disconnect the connector from the fog lamp.
16. Remove the clip from the front bumper beam.



407626

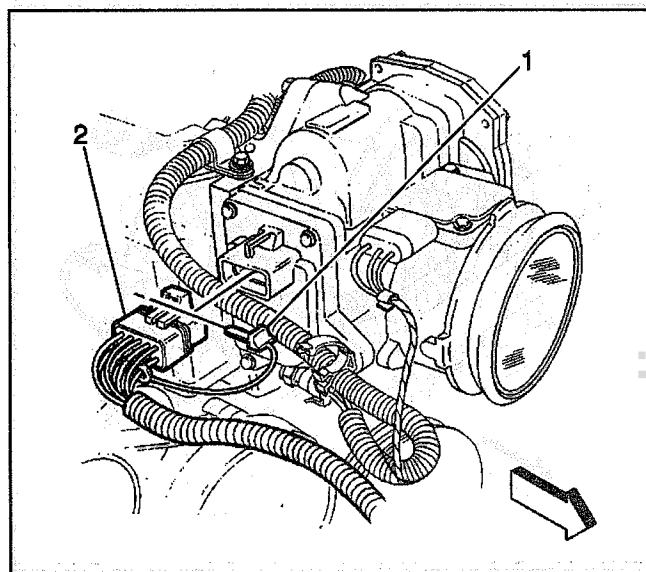
17. Remove the secondary lock retainer (3).
18. Disconnect the headlamp jumper harness (2) from the forward lamp harness (1).

19. Disconnect the inline headlamp connector (1) from the forward lamp harness.
20. Disconnect the rosebud clip (5) from the front end panel.
21. Route the following through the front end panel hole.
 - Fog lamp connector (2)
 - Park/turn signal connector (3)
 - Side marker connector (4), Pontiac only
22. Lower the vehicle.



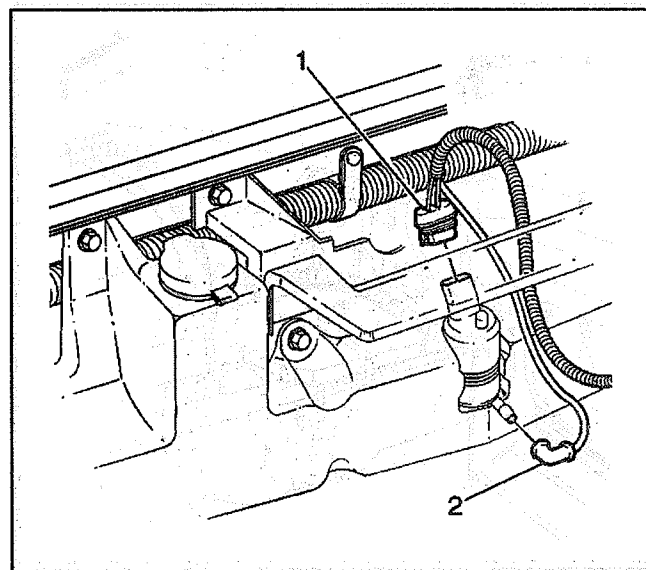
407623

23. Remove the captured secondary lock (1) from the connector.
24. Disconnect the ETC connector (2) from the throttle body, if equipped with a 3.8 L engine.

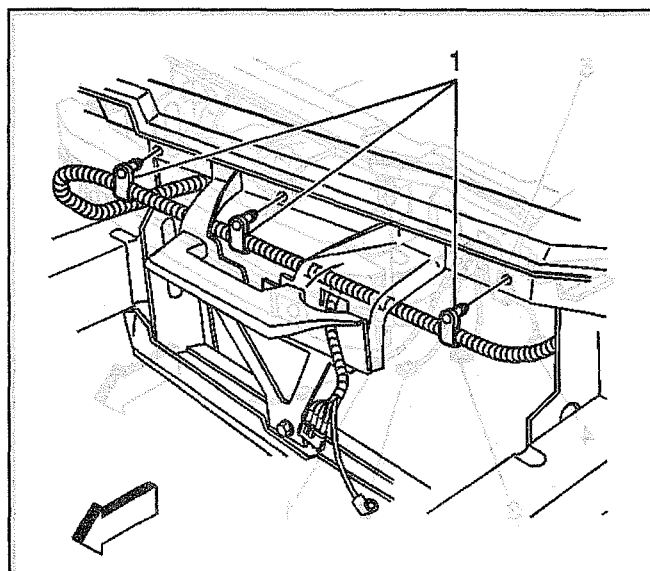


407647

25. Disconnect the washer pump electrical connector (1).
26. Disconnect the windshield washer fluid hose (2) from the pump.

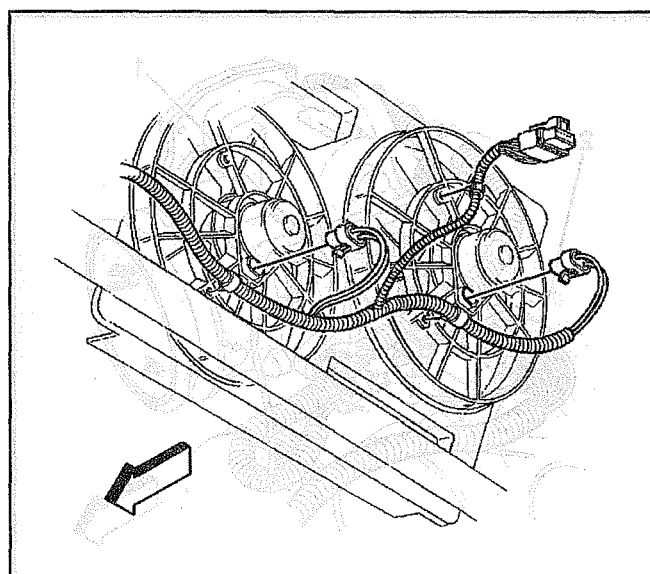


407637



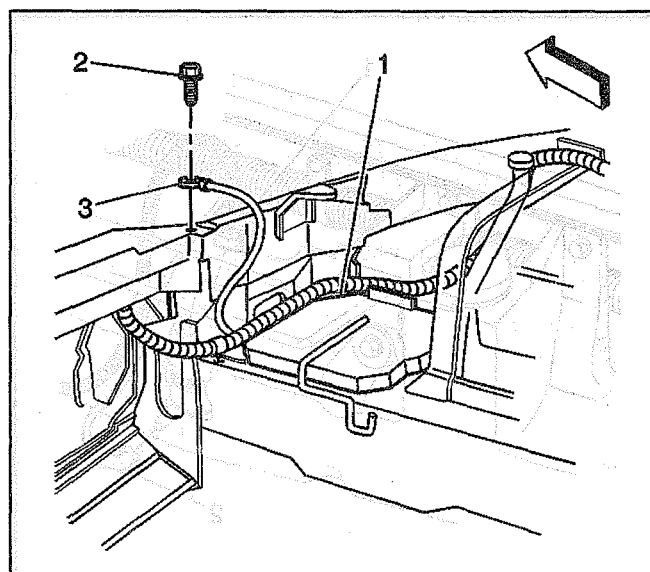
407640

27. Disconnect the forward lamp wiring harness rosebud clips (1) from the tie bar.
28. Disconnect the cooling fan electrical connectors.
29. Disconnect the harness rosebud clips.
30. Remove the battery. Refer to *Battery Replacement*.
31. Remove the right front ground bolt (2).
32. Remove the forward lamp wiring ground (3) from the tie bar.
33. Remove the harness from the outboard of the battery tray (1).
34. Remove the forward lamp harness headlamp branch through the hole in the front panel.



550332

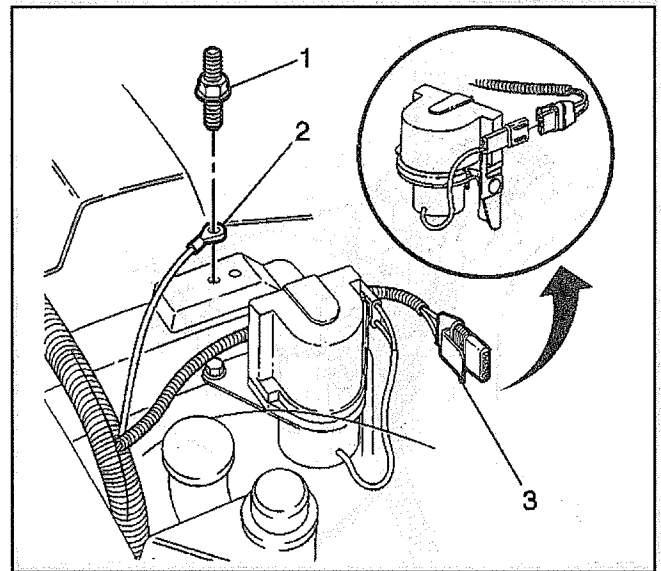
28. Disconnect the cooling fan electrical connectors.
29. Disconnect the harness rosebud clips.
30. Remove the battery. Refer to *Battery Replacement*.



407633

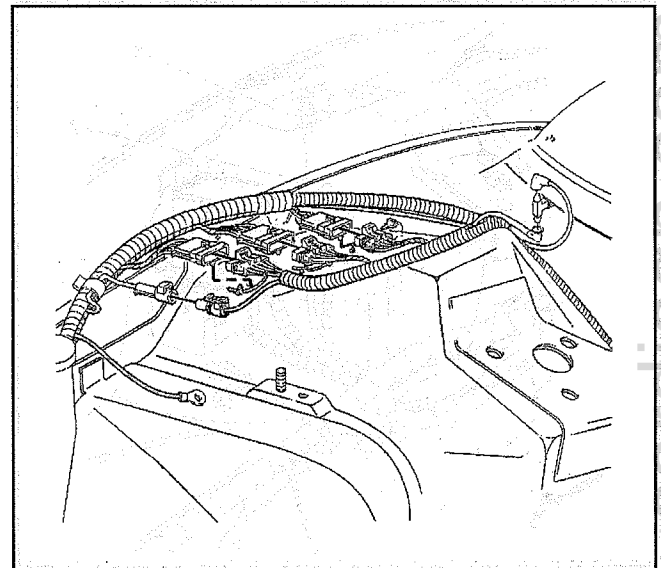
31. Remove the right front ground bolt (2).
32. Remove the forward lamp wiring ground (3) from the tie bar.
33. Remove the harness from the outboard of the battery tray (1).
34. Remove the forward lamp harness headlamp branch through the hole in the front panel.

35. Remove the forward lamp harness ground stud (1).
36. Remove the forward lamp harness ground (2).
37. Disconnect the electronic throttle actuator electrical connector (3), if equipped with a 5.7 L engine.



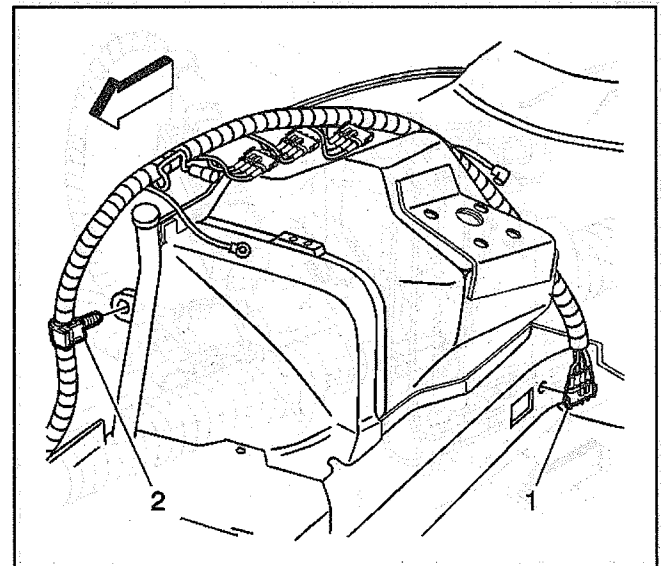
407622

38. Disconnect the secondary captured locks.
39. Disconnect the forward lamp harness from the engine harness.
40. Disconnect the forward lamp harness vacuum tube from the top of the vacuum check valve.

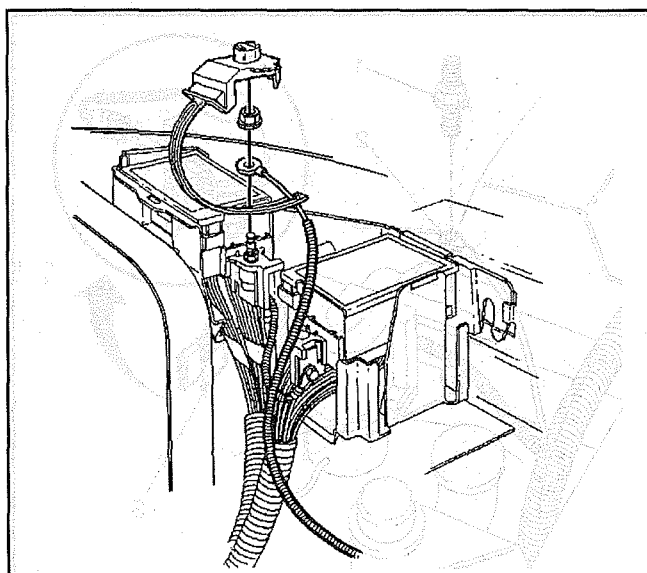


346047

41. Remove the speed sensor connector (1) from the mid rail.
42. Disconnect the harness rosebud (2) clip at the coolant fill neck.

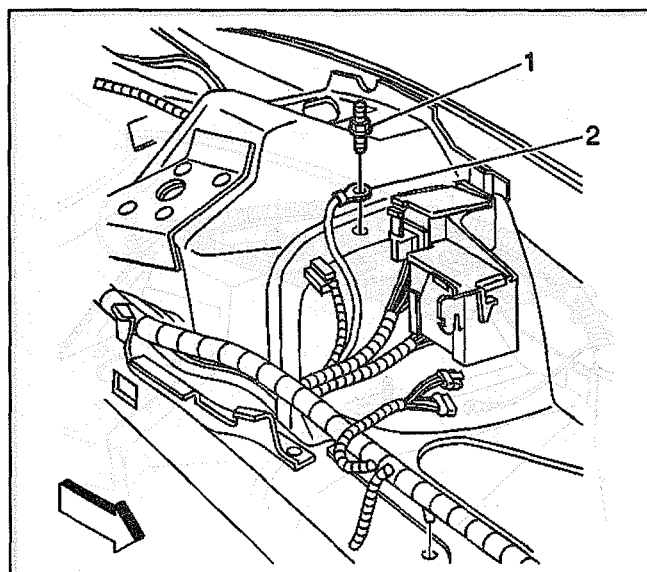


407621



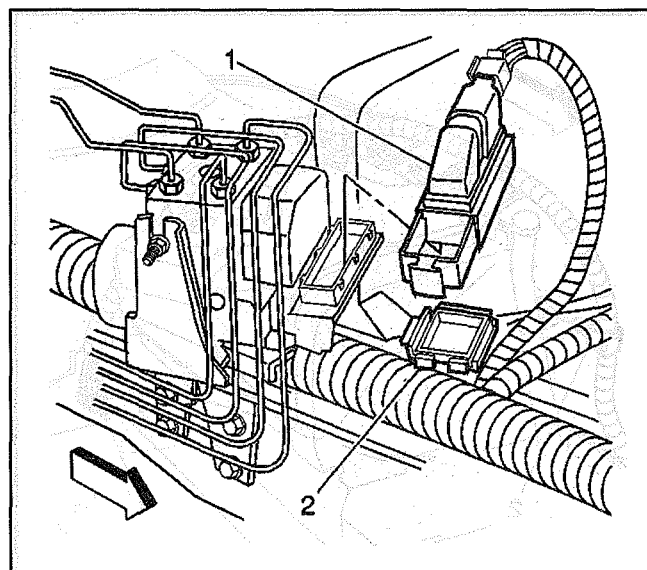
211614

43. Remove the positive battery cable from the stud on the fuseblock:
 - 43.1. Open the positive cable cap.
 - 43.2. Remove the positive cable to fuseblock stud nut.
 - 43.3. Remove the positive cable from the fuseblock stud.



407616

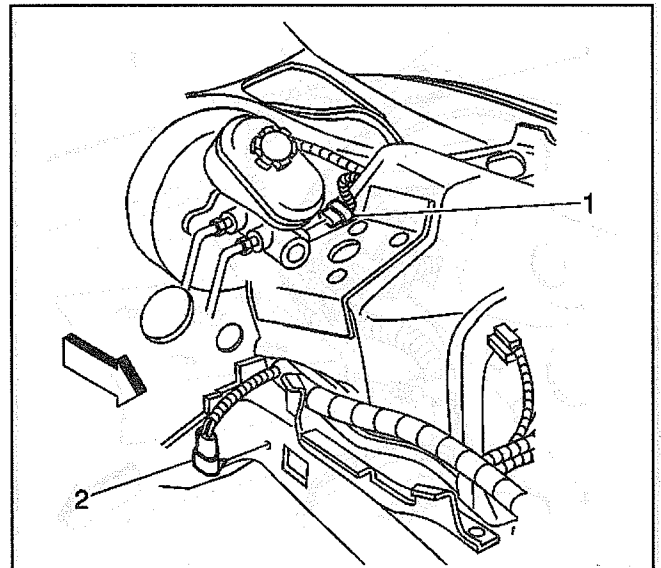
44. Remove the ABS/SIR electrical ground stud (1) from the wheelhouse panel.
45. Remove the ABS/SIR electrical ground terminal (2) from the wheelhouse.



407617

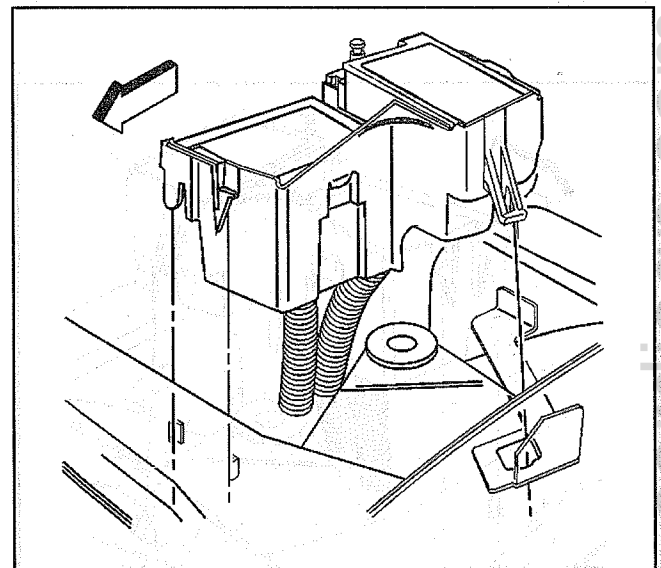
46. Disconnect the 30 way connector (1) from the brake pressure module valve.

47. Disconnect the brake fluid level sensor connector (1) from the master cylinder.
48. Remove the wheel speed sensor connector (2) from the mid rail.



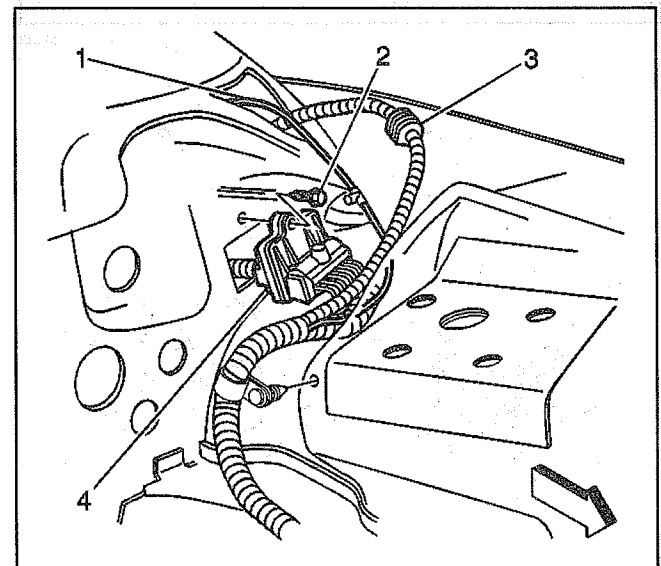
407618

49. Remove the underhood electrical center from the wheelhouse bracket.
50. Remove the air inlet grille panel. Refer to *Air Inlet Grille Panel Replacement* in Body Front End.
51. Disconnect the wiper motor electrical connector.

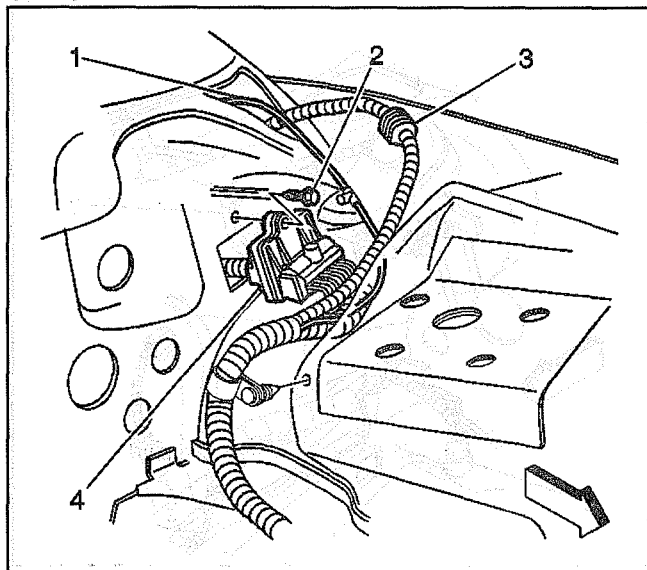


406433

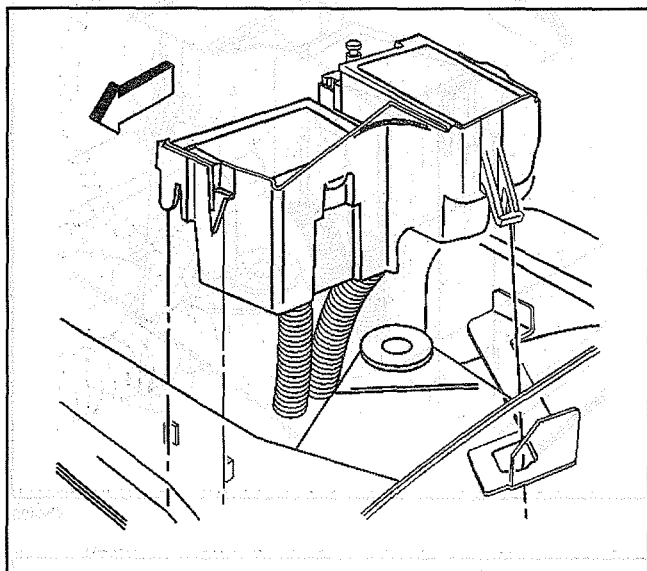
52. Remove the wipe motor harness branch from the plenum extension.
53. Remove the windshield washer fluid hose from the plenum extension.
54. Remove the forward lamp wiring harness grommet bolt (2).
55. Remove the harness rosebud clip at the left wheelhouse panel.
56. Gently, remove the forward lamp harness from inside the vehicle through the front of dash opening.
57. Remove the forward lamp wiring harness from the vehicle.



407620



407620



406433

Installation Procedure

1. Install the forward lamp wiring harness to the vehicle.
2. Route the forward lamp harness through the front of dash in the interior of the vehicle.
3. Install the harness rosebud clip to the left wheelhouse panel.

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

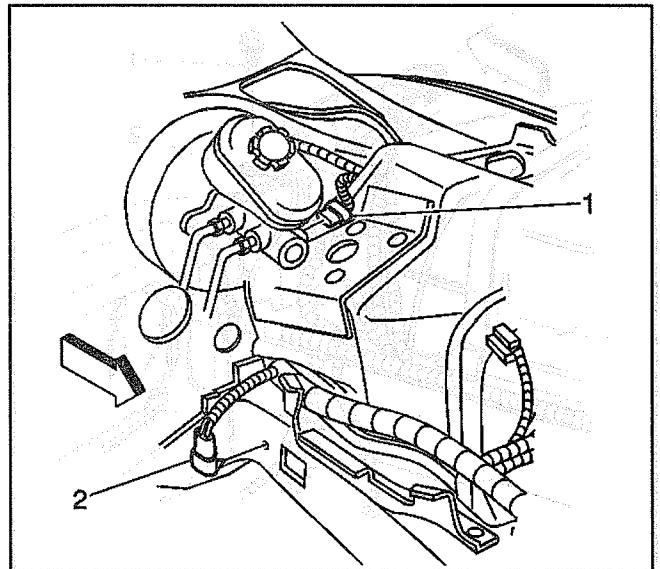
4. Install the forward lamp wiring harness grommet bolt (2).

Tighten

Tighten the forward lamp wiring harness grommet bolt (2) to 2 N·m (18 lb in).

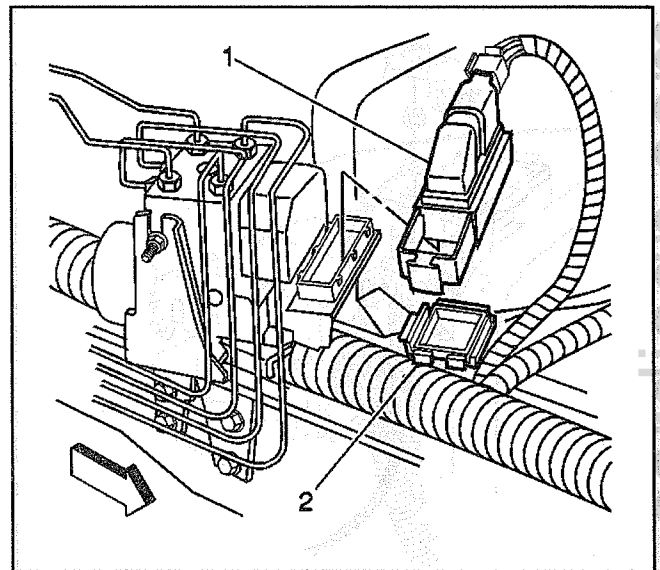
5. Install the windshield washer fluid hose to the plenum extension.
6. Install the wiper motor branch to the plenum extension.
7. Connect the wiper motor electrical connector.
8. Install the air inlet grille panel. Refer to *Air Inlet Grille Panel Replacement* in Body Front End.
9. Perform the following to install the underhood electrical center to the wheelhouse bracket:
 - 9.1. Tilt the forward lamp harness bracket outboard.
 - 9.2. Insert the tab on the bracket into the hole in the wheelhouse bracket.
 - 9.3. Roll bracket back inboard.
 - 9.4. Secure bracket by sliding down into tabs on tie bar.

10. Install the wheel speed sensor connector (2) to the mid rail.
11. Connect the brake fluid level sensor connector (1) to the master cylinder.



407618

12. Connect the 30 way connector (1) to the brake pressure module valve.

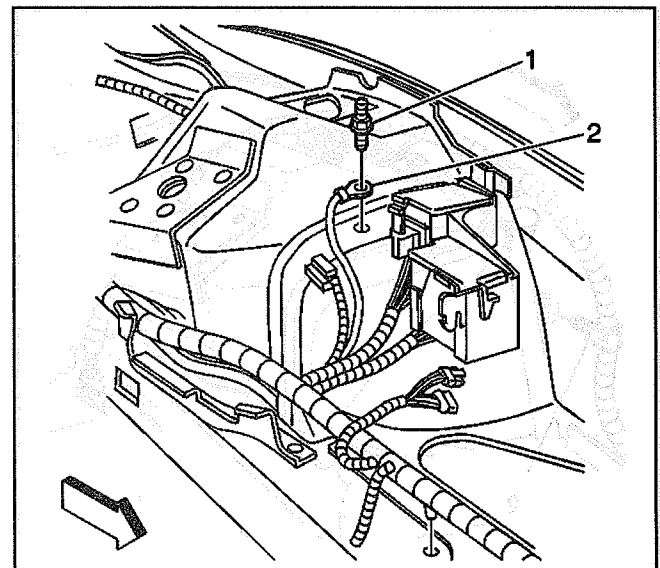


407617

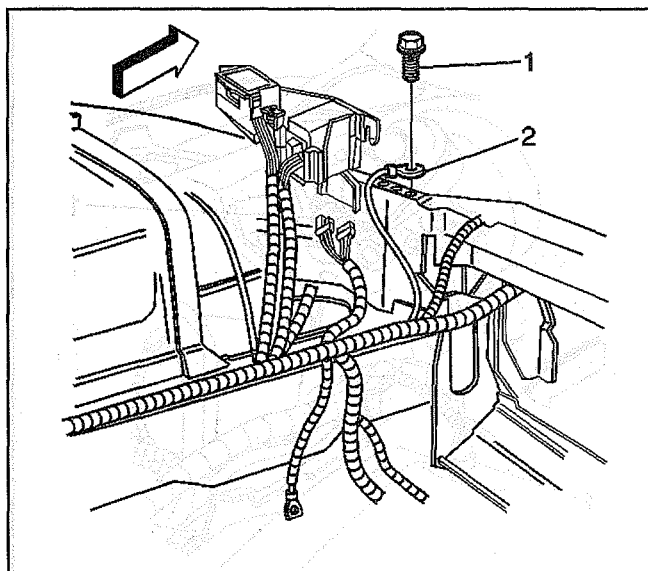
13. Install the ABS/SIR electrical ground terminal (2) to the wheelhouse.
14. Install the ABS/SIR electrical ground stud (1) to the wheelhouse panel.

Tighten

Tighten the ABS/SIR electrical ground stud (1) to 14 N·m (10 lb ft).



407616

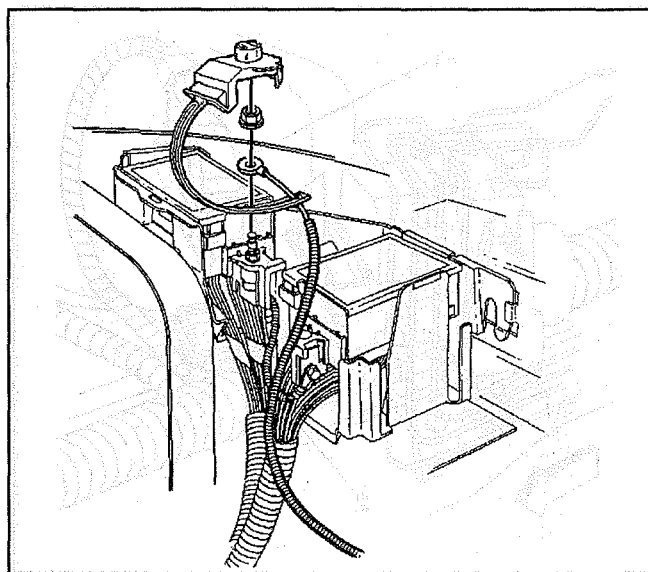


407614

15. Install the harness ground wire (2) to the tie bar.
16. Install the left front forward lamp wiring ground bolt (1).

Tighten

Tighten the left front forward lamp wiring ground bolt (1) to 10 N·m (89 lb in).



211614

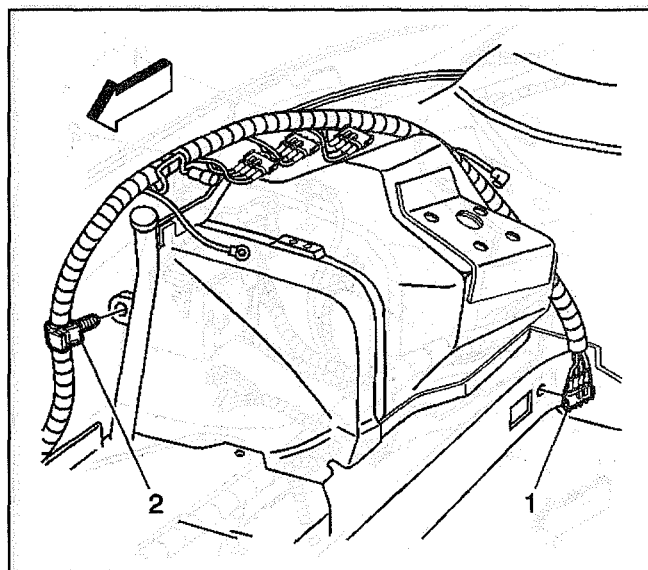
17. Install the positive battery to the stud on the fuseblock:

- 17.1. Install the positive cable to the fuseblock stud.
- 17.2. Install the positive cable to fuseblock stud nut.

Tighten

Tighten the positive cable nut to fuseblock stud to 14 N·m (10 lb ft).

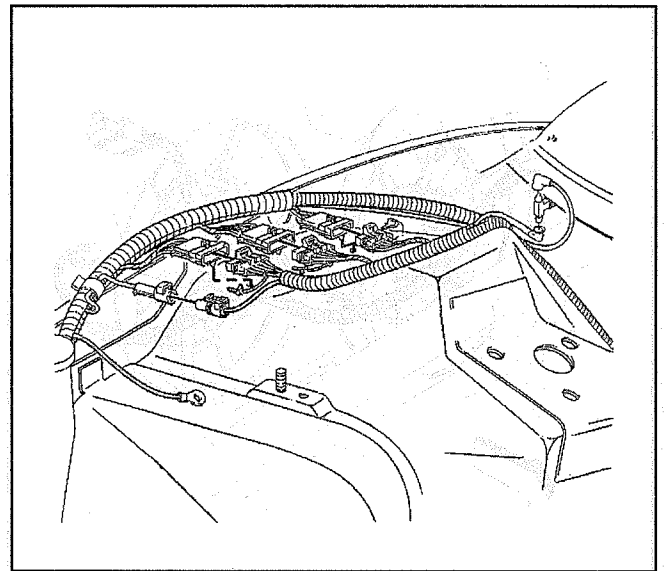
- 17.3. Install the positive battery cable cover.



407621

18. Connect the harness rosebud (2) clip to the coolant fill neck.
19. Install the speed sensor connector (1) to the mid rail.

20. Connect the forward lamp harness vacuum tube to the top of the vacuum check valve.
21. Connect the forward lamp harness to the engine harness.
22. Connect the secondary captured locks.

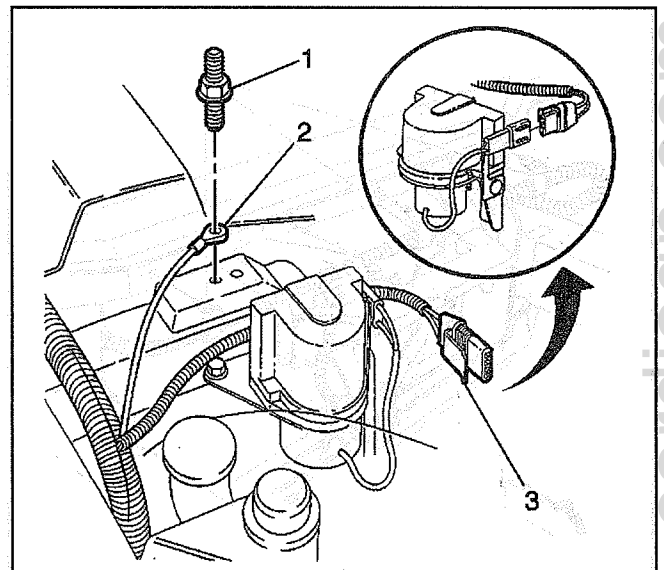


346047

23. Connect the electronic throttle actuator electrical connector (3), if equipped with a 5.7 L engine.
24. Install the forward lamp harness ground (2).
25. Install the forward lamp harness ground stud (1).

Tighten

Tighten the forward lamp harness ground stud (1) to 16 N·m (12 lb ft).



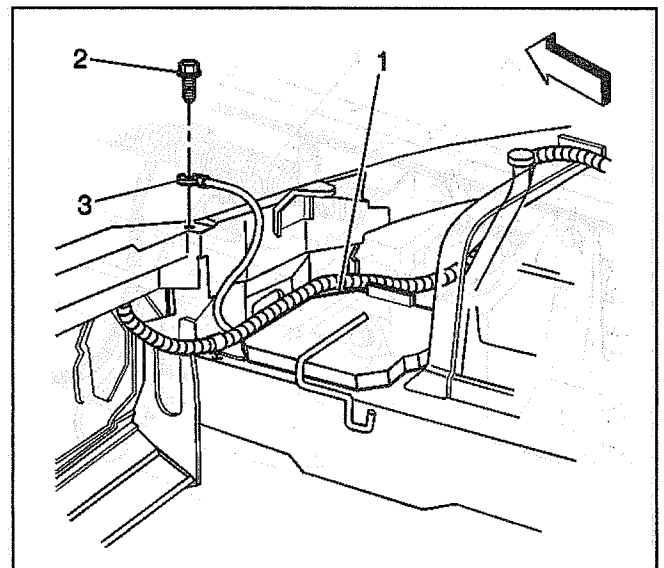
407622

26. Route the forward lamp harness headlamp branch through the hole in the front panel.
27. Tuck the harness into the opening forward of the battery tray (1).
28. Install the forward lamp wiring ground (3) to the tie bar.
29. Install the right front ground bolt (2).

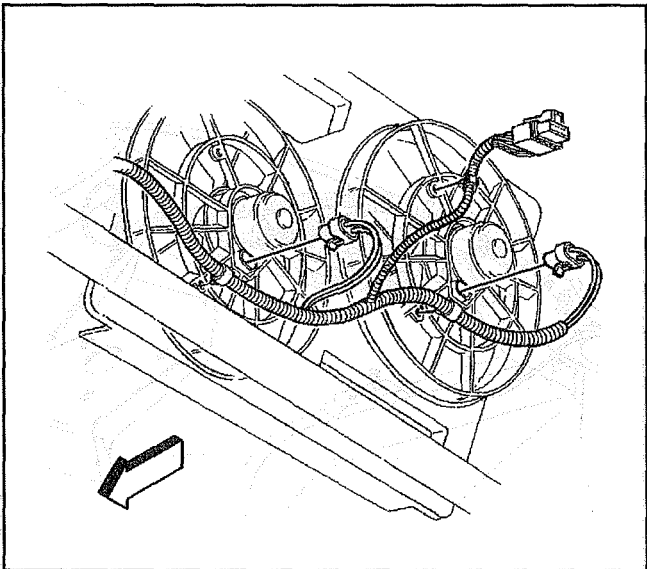
Tighten

Tighten the right front ground bolt (2) to 10 N·m (89 lb in).

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

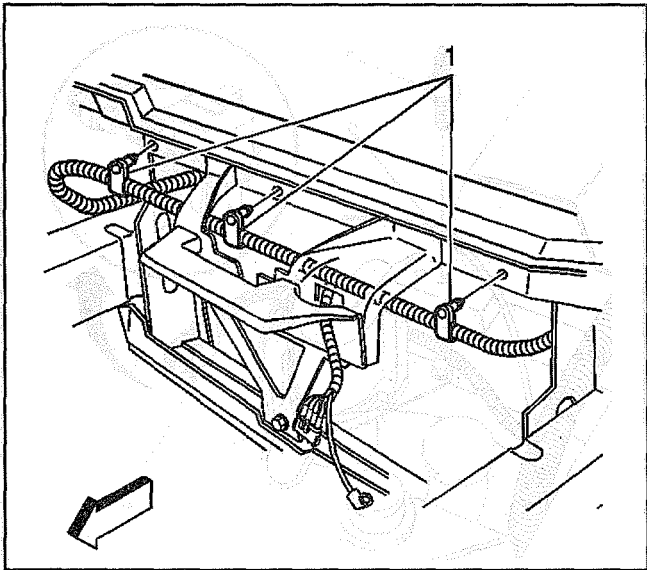


407633



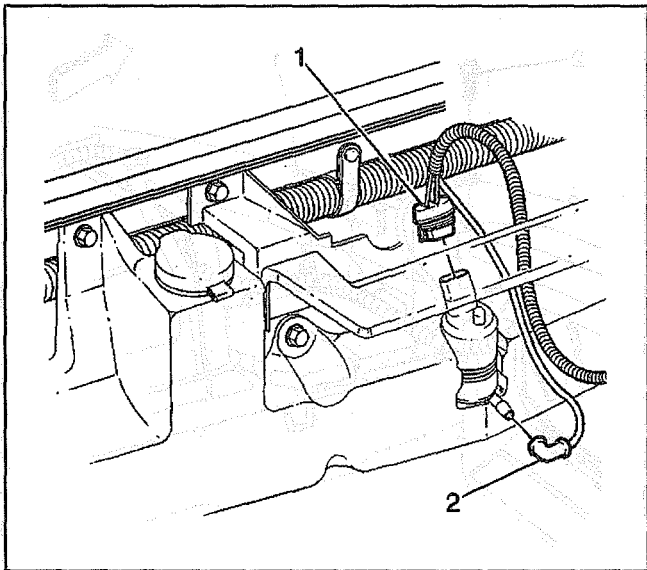
550332

- 31. Connect the rosebud clips.
- 32. Connect the cooling fan electrical connectors.



407640

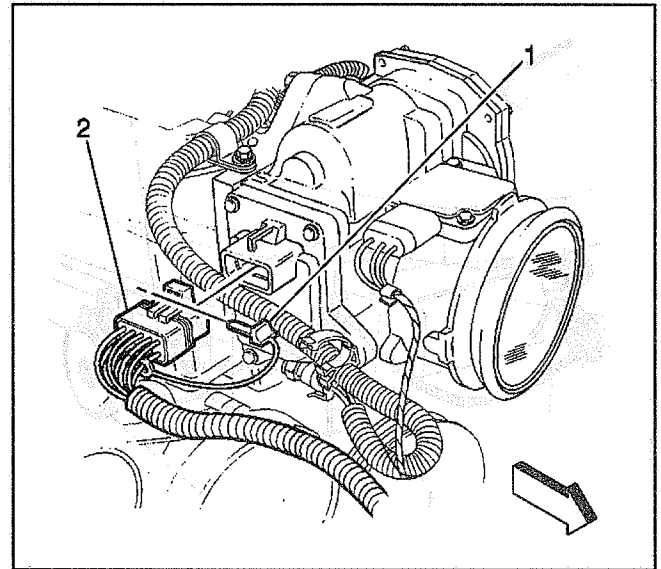
- 33. Connect the forward lamp wiring harness rosebud clips (1) to the tie bar.



407637

- 34. Connect the windshield washer fluid hose (2) to the pump.
- 35. Connect the washer pump electrical connector (1).

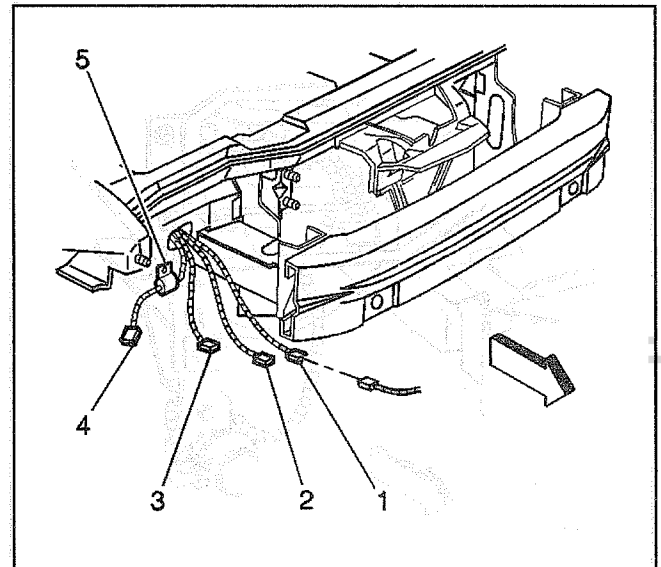
36. Connect the ETC connector (2) to the throttle body, if equipped with 3.8 L engine.
37. Install the captured secondary lock (1) to the connector.
38. Raise and suitably support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.



407647

407647

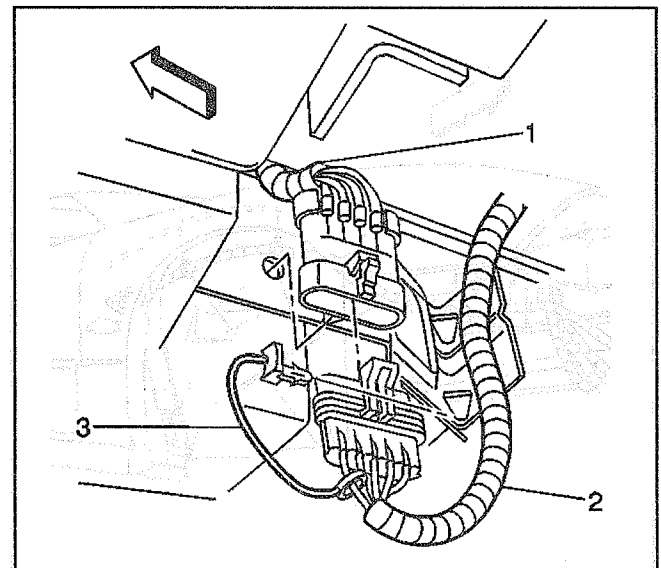
39. Route the following through the front end panel hole:
 - Side marker connector (4), Pontiac only
 - Park/turn signal connector (3)
 - Fog lamp connector (2)
40. Connect the rosebud clip (5) to the front end panel.
41. Connect the inline headlamp connector (1) to the forward lamp harness.



407623

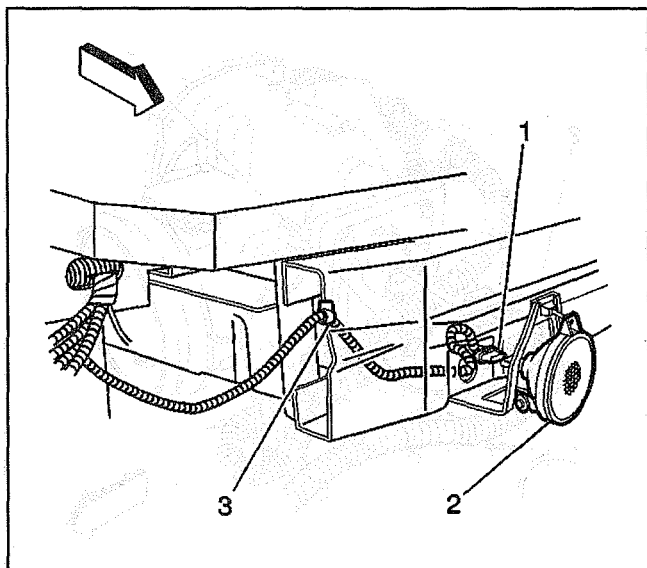
407623

42. Connect the headlamp jumper harness (2) to the forward lamp harness (1).
43. Install the secondary lock retainer (3).



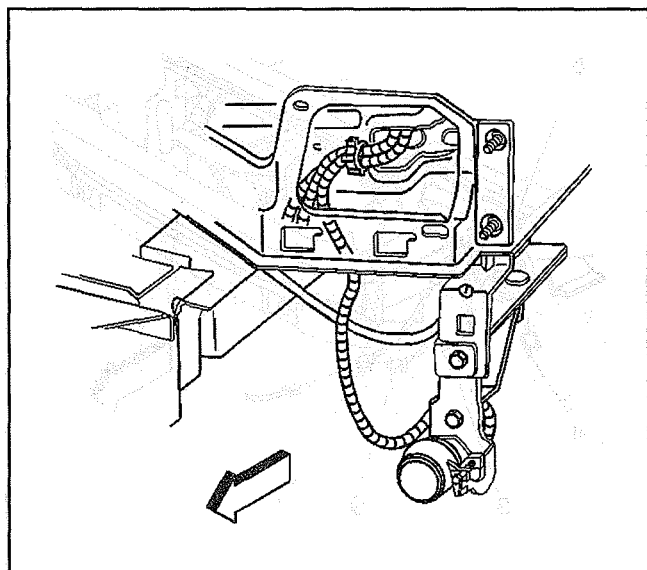
407626

407626



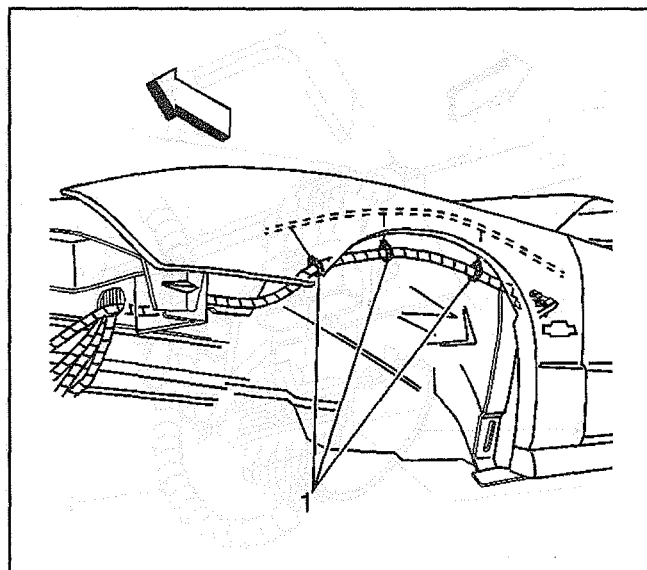
407629

44. On Pontiac, install the clip (3) to the front bumper beam.
45. Connect the fog lamp connector (2) to the lamp.



550635

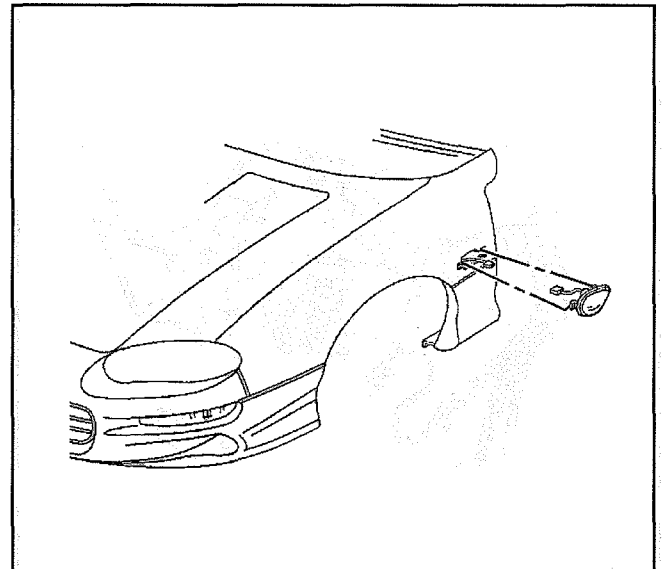
46. On Chevrolet, install the rosebud clip to the front bumper beam.
47. Connect the fog lamp connector to the lamp.



407632

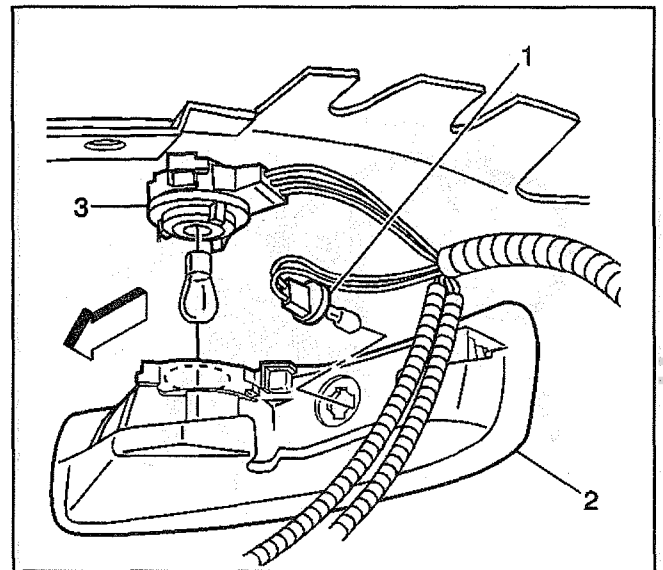
48. Install the harness clips (1) to the fender rail. (Export only)

49. Install the side repeater lamp. (Export only)



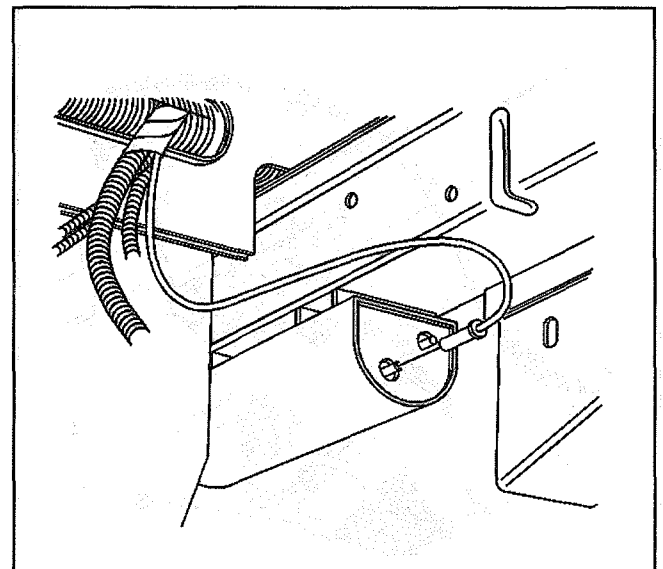
379374

50. Install the park/turn signal (3) and marker (1) connector to the lamp (2).
51. On Pontiac, connect the side marker lamp connector.

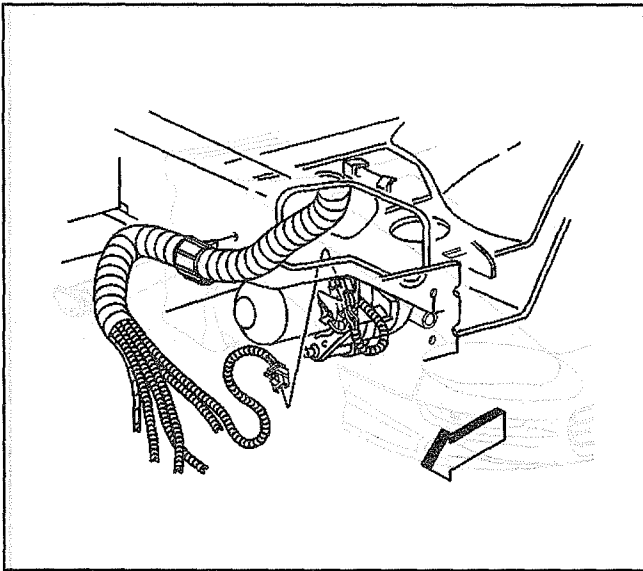


407630

52. Connect the vacuum tank hose to the vacuum tank.

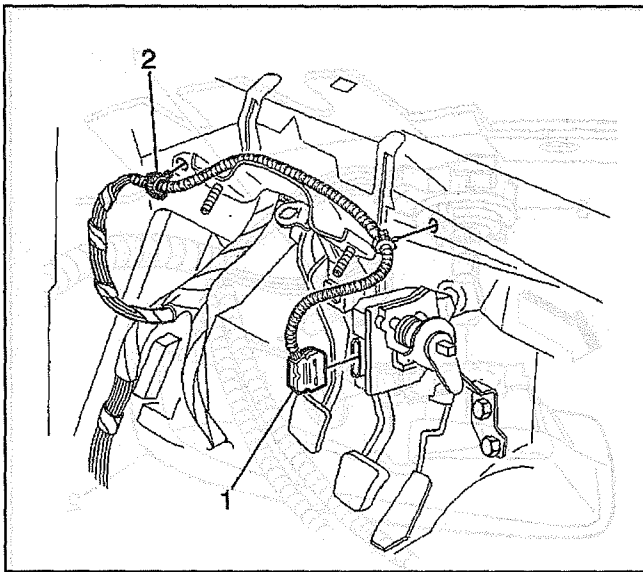


282928



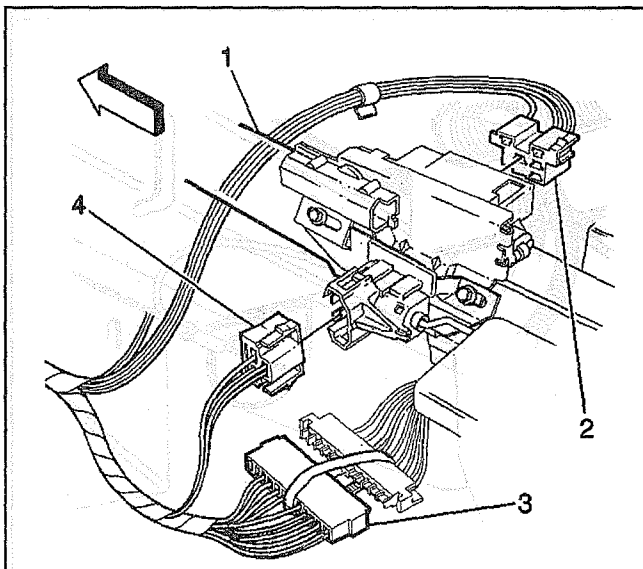
550628

53. Connect the AIR pump connector, if equipped with a 5.7 L engine.
54. Lower the vehicle.



407645

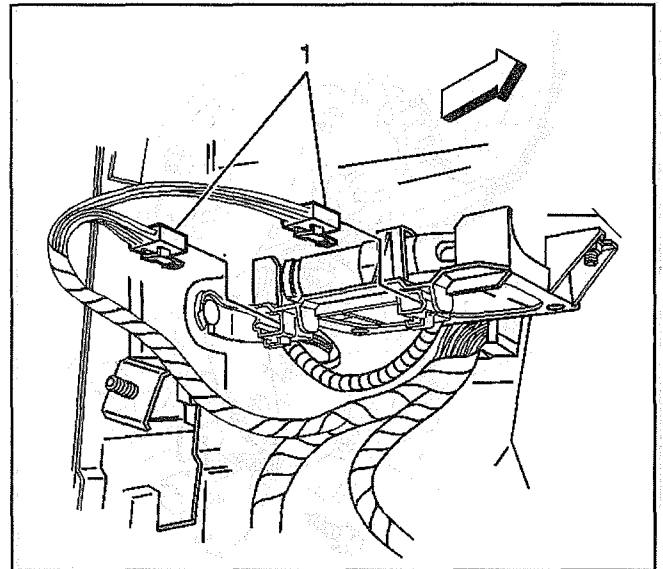
55. Connect the rosebud clips (2) to the dash mat.
56. Connect the ETC electrical connector (1), if equipped with a 3.8 L engine.



407643

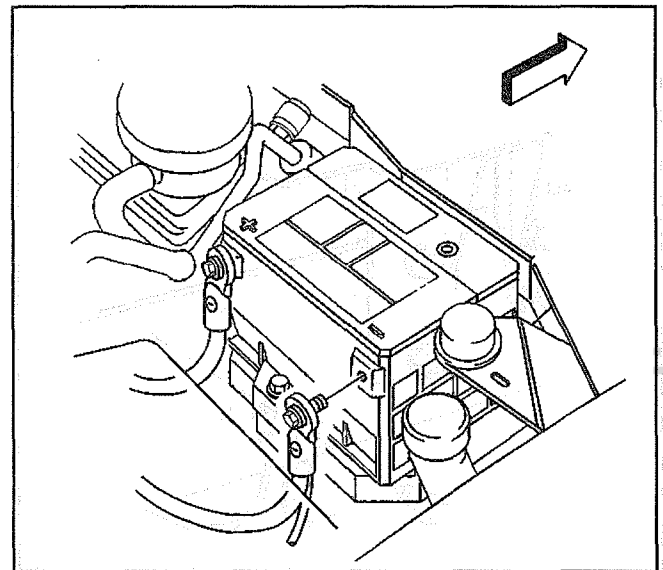
57. Connect the following connector to the steering column (1):
 - Dimmer switch (4)
 - Wiper/washer (3)
 Install a tie strap around the connector between the black and pink wires.
 - Ignition switch (2)

58. Connect the accel/cruise servo cable adjuster electrical connectors (1).



407641

59. Connect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure*.

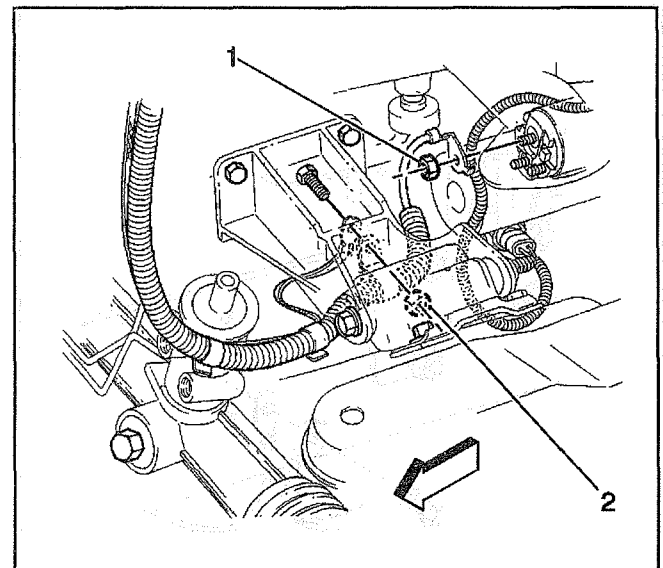


208241

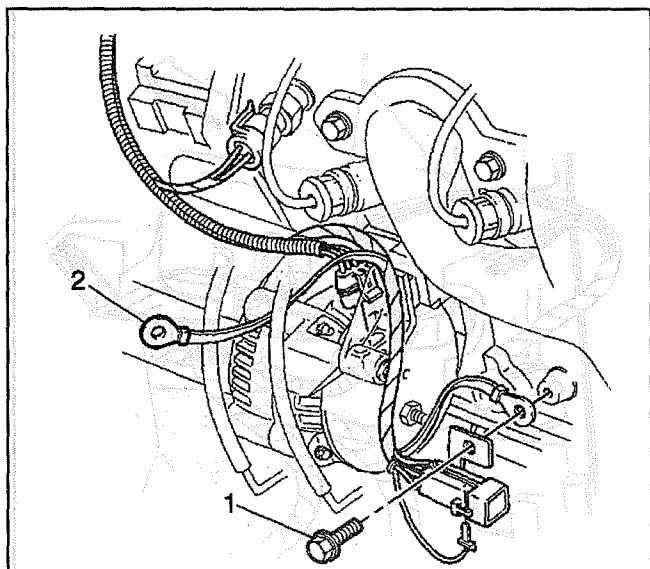
Ground Strap Replacement

Removal Procedure

- On the 3.8 L engine, remove the positive/negative cable from the engine mount stud.
 - Remove the positive cable radio frequency (RF) ground nut (2).
 - Remove the harness clamp from the stud.
 - Remove the RF ground strap.

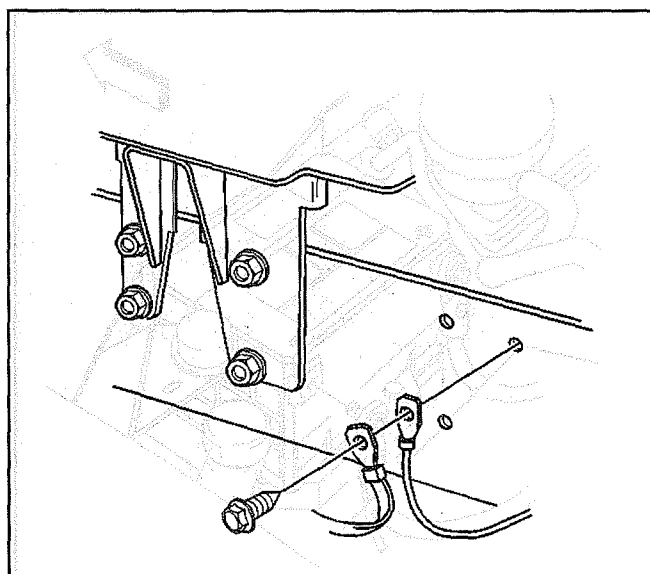


211604



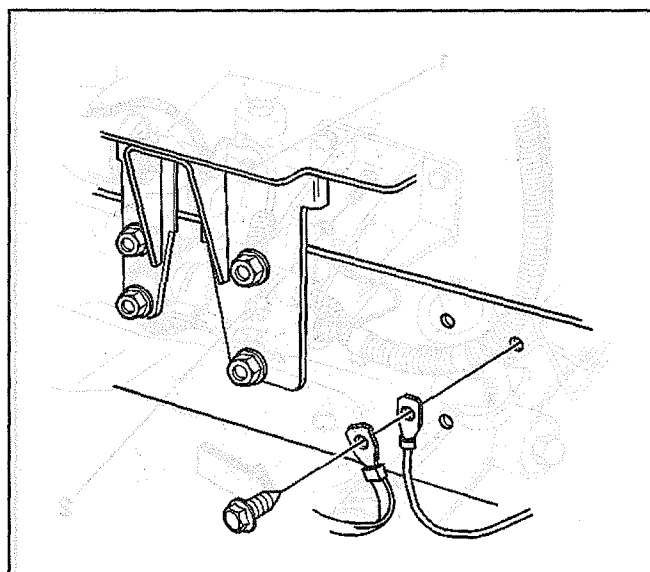
353688

2. On the 5.7 L engine, remove the engine wiring harness ground bolt from the block (1).
3. Disconnect and reposition the oxygen sensor electrical connector.



346034

4. Remove the wiring harness ground bolt and RF ground strap and cruise control ground lead from the frame rail.
5. Remove the tape attaching the ground strap to the wiring harness.
6. Remove the ground strap from the vehicle.



346034

Installation Procedure

1. Install the ground strap to the vehicle.
2. Wrap new tape around the ground strap and the wiring harness.

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

3. Install the wiring harness ground bolt and RF ground strap and cruise control ground lead to the frame rail.

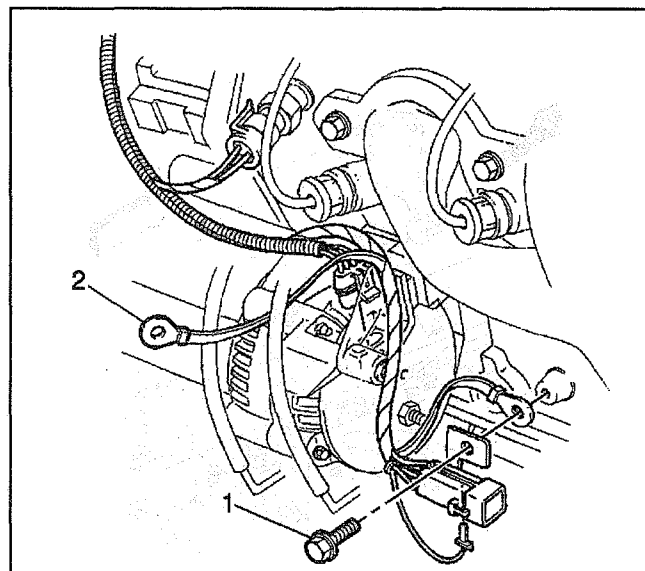
Tighten

Tighten the wiring harness ground bolt to 12 N·m (106 lb in).

4. On the 5.7 L engine, connect and position the oxygen sensor electrical connector.
5. Install the engine wiring harness ground bolt (1) to the block.

Tighten

Tighten the engine wiring harness ground bolt (1) to 25 N·m (18 lb ft).

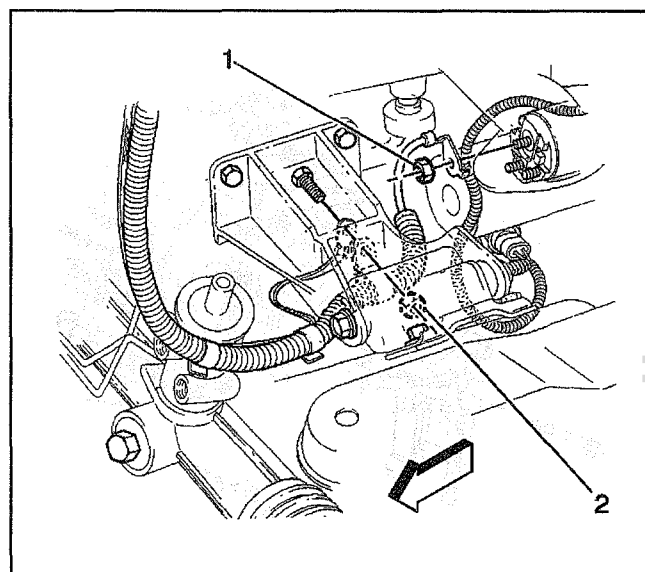


353688

6. On the 3.8 L engine, install the positive/negative cable to the engine mount stud.
 - Install the RF ground strap.
 - Install the harness clamp from the stud.
 - Install the positive cable RF ground nut (2).

Tighten

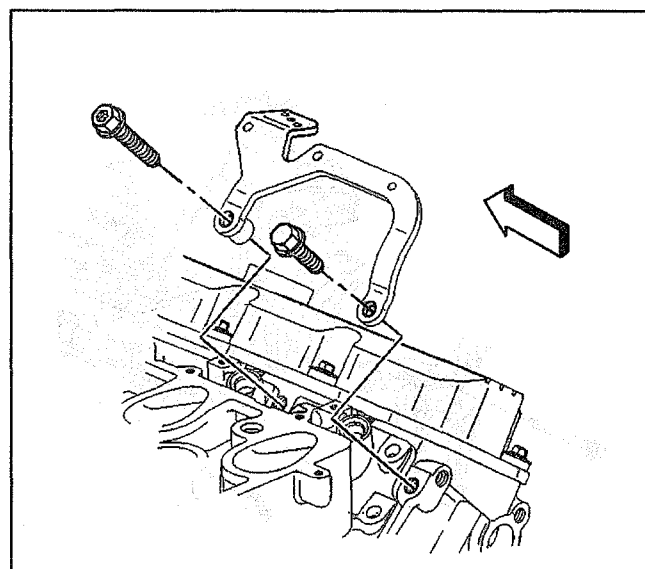
Tighten the positive cable RF ground nut (2) to 25 N·m (18 lb ft).



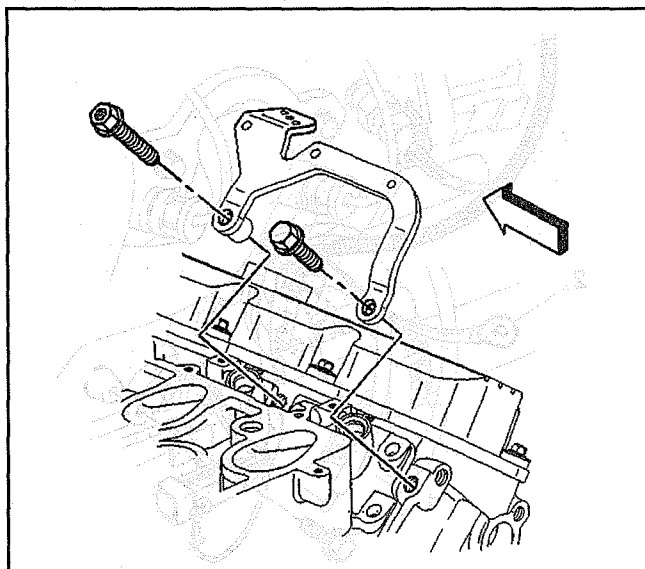
211604

Generator Bracket Replacement (3.8 L)**Removal Procedure**

1. Remove generator rear brace. Refer to *Generator Brace Replacement*.
2. Remove the fuel rail from the upper intake manifold. Refer to *Fuel Rail Assembly Replacement* in Engine Controls - 3.8 L.
3. Remove the generator brace bracket bolts.
4. Remove the generator bracket from the cylinder head.



165246



165246

Installation Procedure

1. Install the generator bracket to the cylinder head.

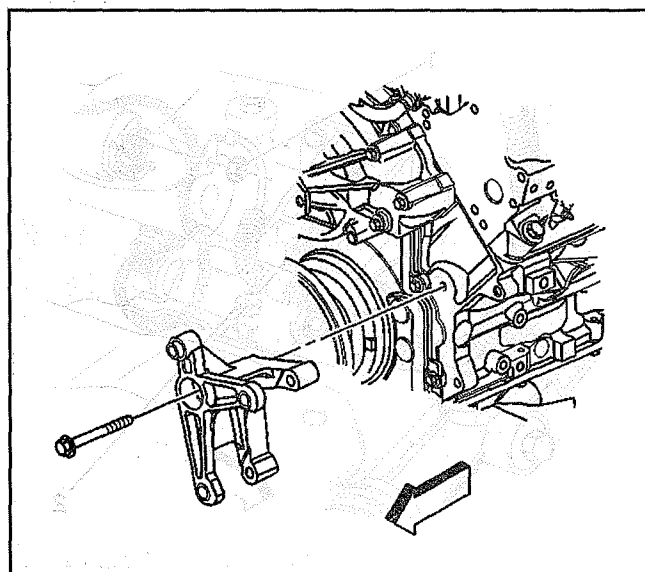
Notice: Refer to *Fastener Notice* in Cautions and Notices.

2. Install the generator brace bracket bolts.

Tighten

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

3. Install the fuel rail to the upper intake manifold. Refer to *Fuel Rail Assembly Replacement* in Engine Controls - 3.8 L.
4. Install the generator rear brace. Refer to *Generator Brace Replacement*.

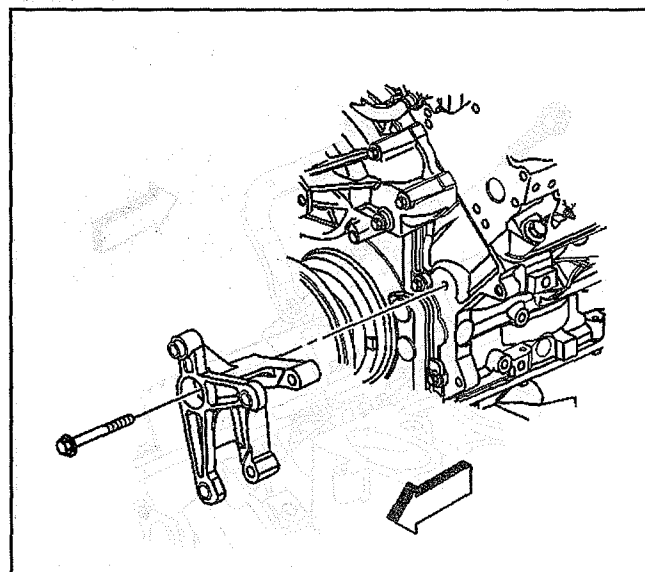


550637

Generator Bracket Replacement (5.7 L Front)

Removal Procedure

1. Remove the accessory drive belt idler pulley. Refer to *Drive Belt Idler Pulley Replacement - Accessory* in Engine Mechanical - 5.7 L.
2. Remove the generator. Refer to *Generator Replacement (5.7 L)*.
3. Remove the generator bracket bolt and bracket.



550637

Installation Procedure

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

1. Install the generator bracket and bolt.

Tighten

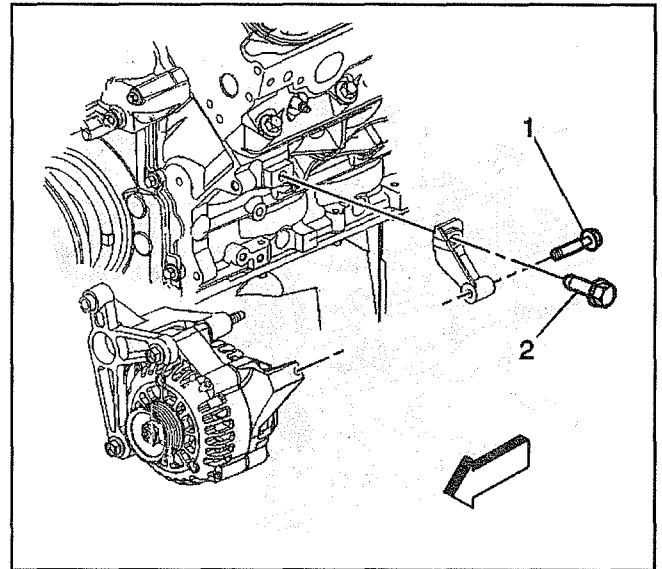
Tighten the generator bracket bolt to 50 N·m (37 lb ft).

2. Install the generator. Refer to *Generator Replacement (5.7 L)*.
3. Install the accessory drive belt idler pulley. Refer to *Drive Belt Idler Pulley Replacement - Accessory* in Engine Mechanical - 5.7 L.

Generator Bracket Replacement (5.7 L Rear)

Removal Procedure

1. Remove the generator rear mounting bolt (to generator) (1).
2. Remove the generator rear mounting bolt (to engine) (2).
3. Remove the generator rear bracket.



211626

Installation Procedure

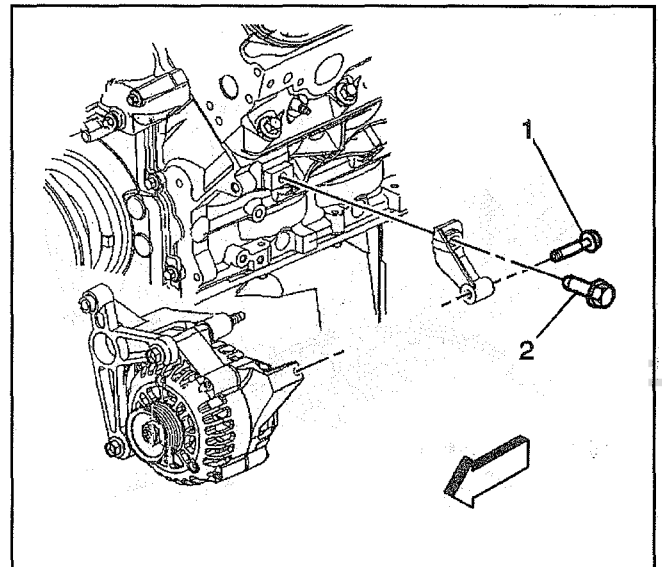
1. Install the generator rear bracket.
2. Install the generator rear mounting bolt (to generator) (1) hand tight.

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

3. Install the generator rear mounting bolt (to engine) (2).

Tighten

- Tighten the generator rear mounting bolt (to generator) (1) to 25 N·m (18 lb ft).
- Tighten the generator rear mounting bolt (to engine) (2) to 50 N·m (37 lb ft).

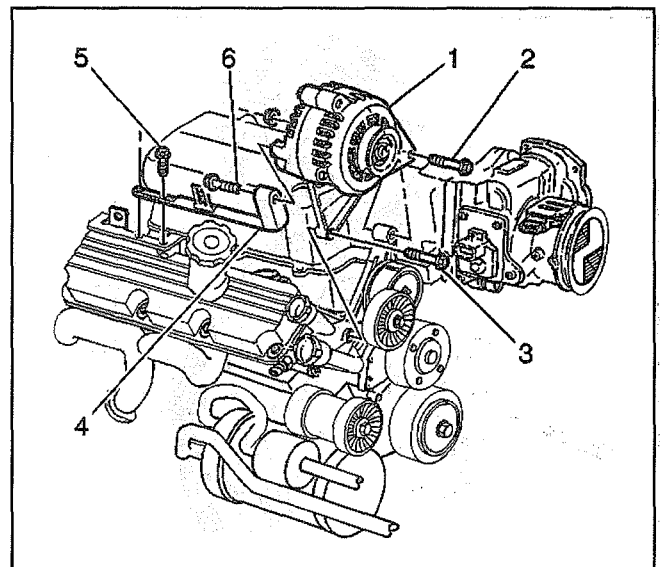


211626

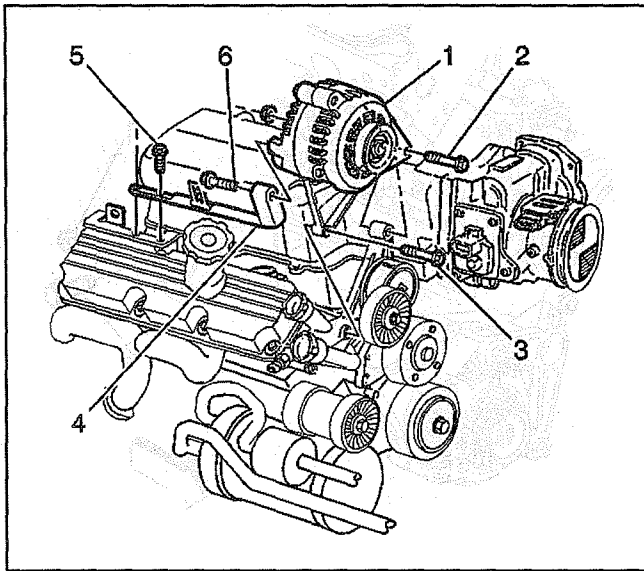
Generator Brace Replacement

Removal Procedure

1. Remove the generator. Refer to *Generator Replacement (3.8 L)*.
2. Remove the canister purge solenoid. Refer to *EVAP Canister Purge Valve Replacement* in Engine Controls - 3.8 L.
3. Remove the generator rear brace bolts (5).
4. Remove the generator rear brace (4) from the vehicle.



487452



487452

Installation Procedure

1. Install the generator rear brace (4) to vehicle.

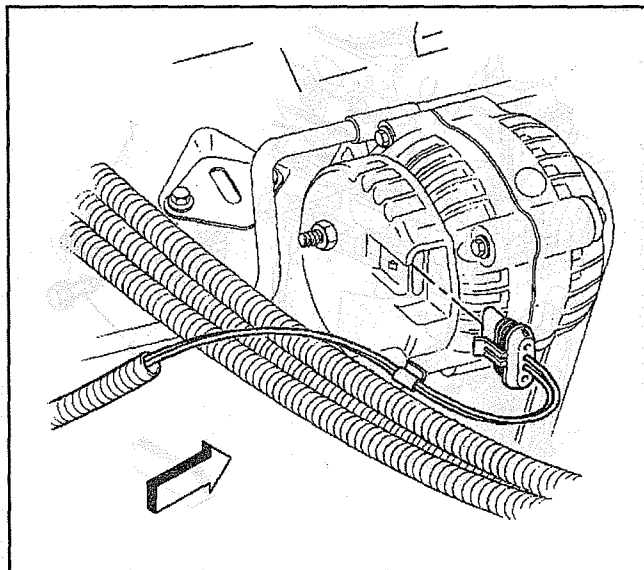
Notice: Refer to *Fastener Notice* in *Cautions and Notices*.

2. Install generator rear brace bolts (5).

Tighten

Tighten the generator rear brace bolts (5) to 25 N·m (18 lb ft).

3. Install the canister purge solenoid. Refer to *EVAP Canister Purge Valve Replacement* in *Engine Controls - 3.8 L*.
4. Install the generator. Refer to *Generator Replacement* (3.8 L).



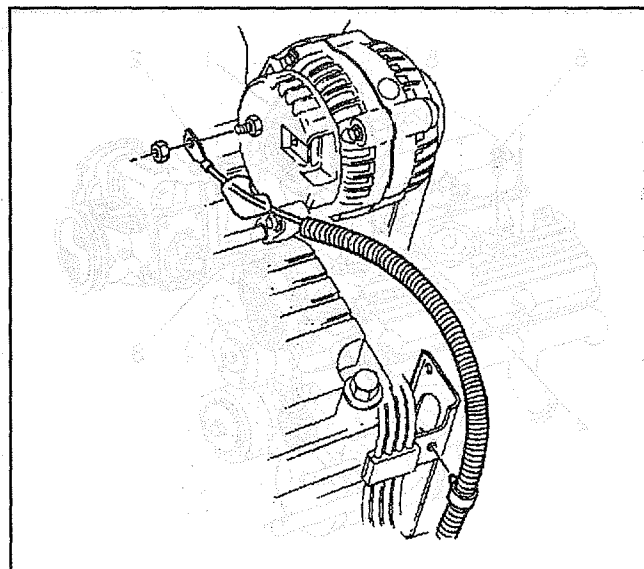
211637

Generator Replacement (3.8 L)

Removal Procedure

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

1. Disconnect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure*.
2. Remove the accessory drive belt. Refer to *Drive Belt Replacement* in *Engine Mechanical - 3.8 L*.
3. Disconnect the generator electrical connector.



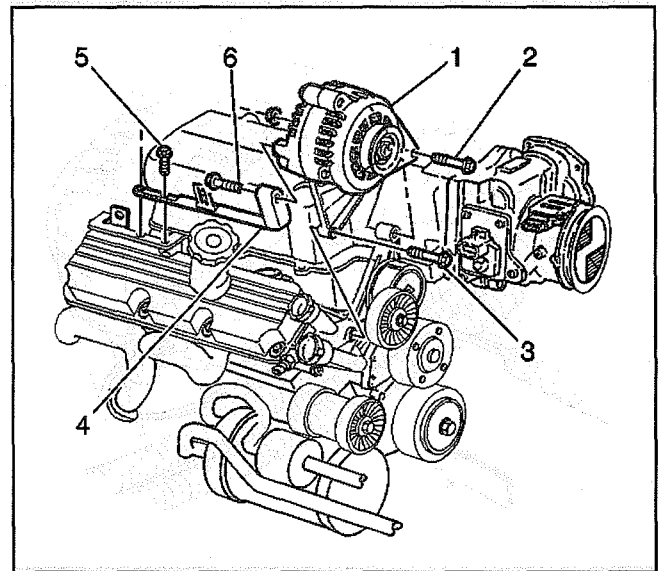
43670

4. Remove the positive cable from the generator:

- Slide the boot down revealing the positive terminal stud.
- Remove the positive cable nut from the generator output stud.
- Remove the positive cable.

5. Remove the canister purge solenoid. Refer to *EVAP Canister Purge Valve Replacement* in *Engine Controls - 3.8 L*.

6. Remove the generator rear brace bolt (6).
7. Remove the generator bolts (2, 3).
8. Remove the generator (1) from the drive belt tensioner.



487452

Installation Procedure

1. Install the generator (1) to the drive belt tensioner.

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

2. Install the generator bolts (2, 3).

Tighten

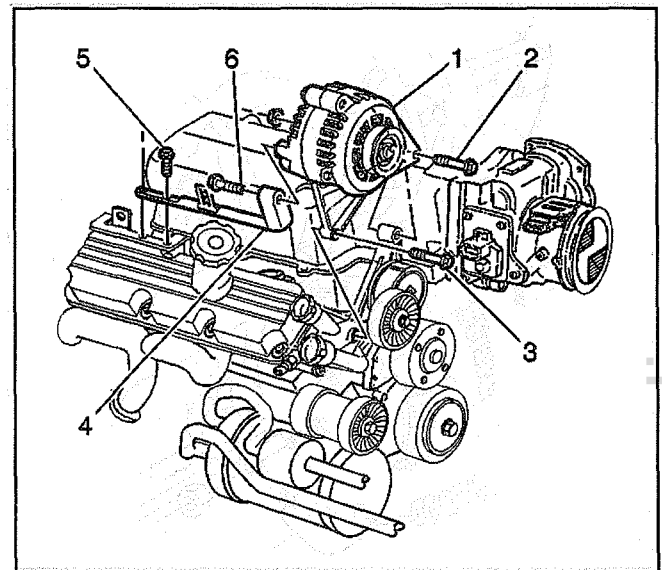
- Tighten the generator bolt (2) to 30 N·m (22 lb ft).
- Tighten the generator bolt (3) to 50 N·m (37 lb ft).

3. Install the generator brace bolt (6).

Tighten

Tighten the generator brace bolt (6) to 30 N·m (22 lb ft).

4. Install the canister purge solenoid. Refer to *EVAP Canister Purge Valve Replacement* in Engine Controls-3.8 L.



487452

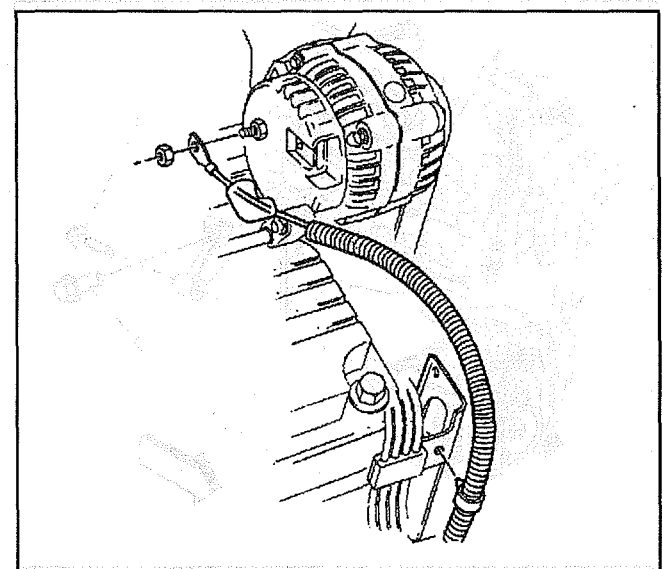
5. Install the positive cable to the generator.

- Install the positive cable to the generator output stud.
- Install the positive cable to the generator output stud nut.

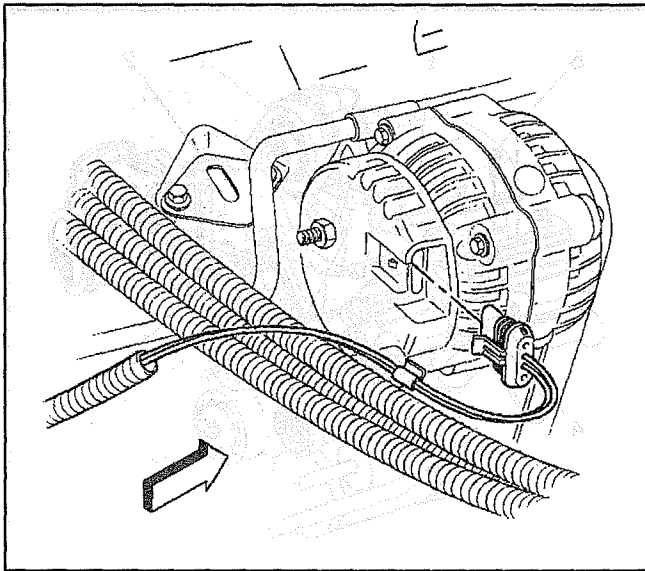
Tighten

Tighten the positive cable nut to generator output stud to 22 N·m (16 lb ft).

- Slide the boot over the generator output stud.

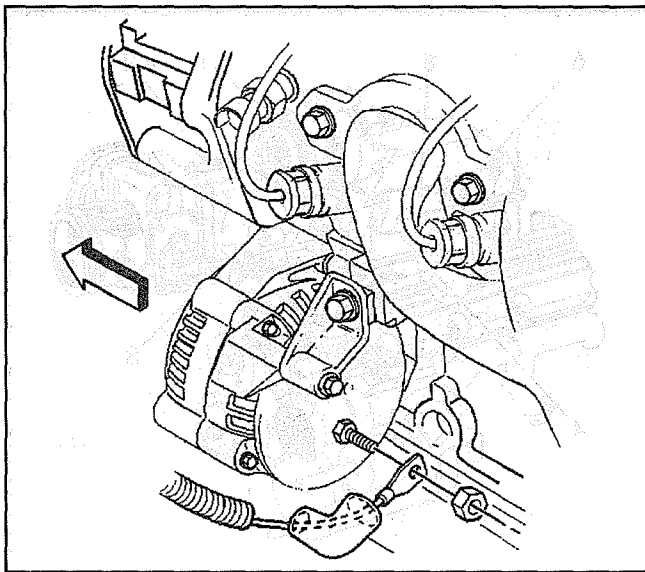


43670



211637

6. Connect the electrical connector to the generator.
7. Install the accessory drive belt. Refer to *Drive Belt Replacement* in Engine Mechanical-3.8 L.
8. Connect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure*.



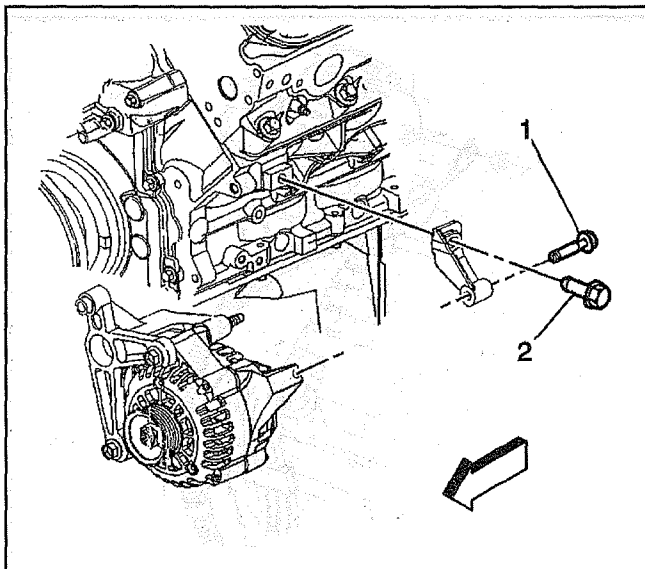
211599

Generator Replacement (5.7 L)

Removal Procedure

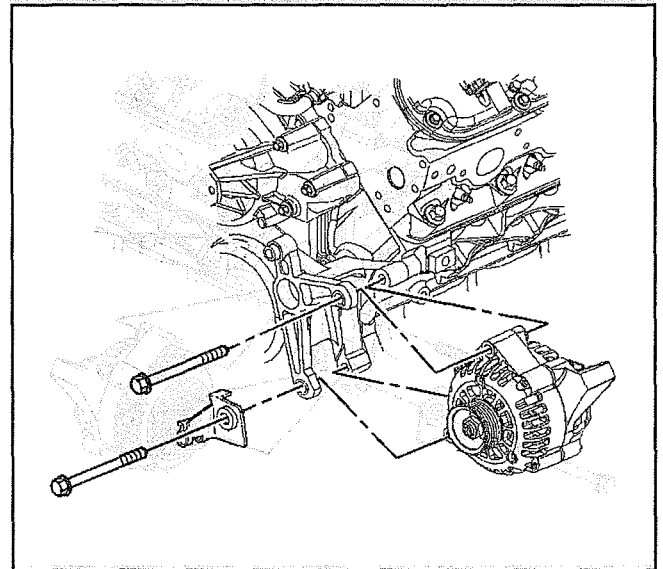
Caution: Refer to *Battery Disconnect Caution in Cautions and Notices*.

1. Disconnect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure*.
2. Remove the accessory drive belt. Refer to *Drive Belt Replacement - Accessory* in Engine Mechanical-5.7 L.
3. Raise and suitably support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
4. Remove the positive cable from the generator:
 - Slide the boot down revealing the positive terminal stud.
 - Remove the positive cable nut from the generator output stud.
 - Remove the positive cable.
5. Remove the generator rear bracket mounting bolt (1).
6. Remove the transmission oil cooler lines from the oil cooler clip.



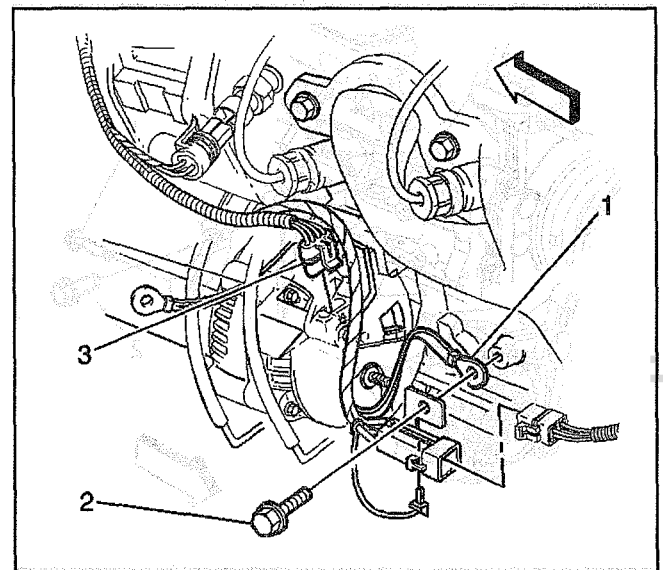
211626

7. Remove the front generator mounting bolts and oil cooler clip.



211628

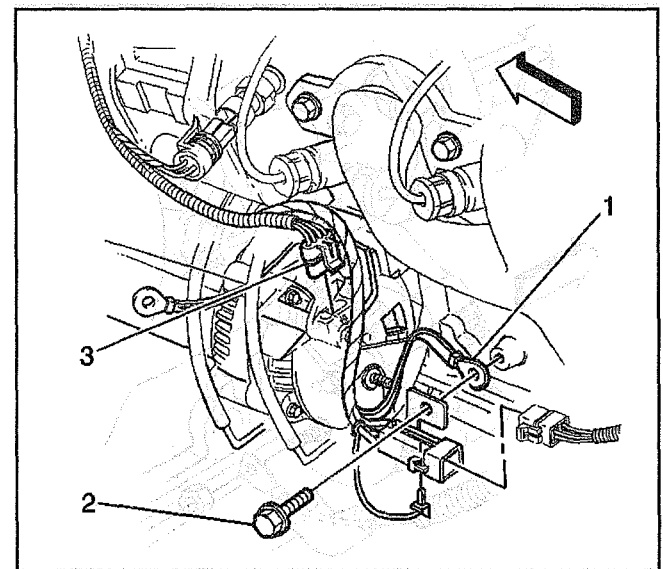
8. Disconnect the generator electrical connector (3).
9. Remove the generator from the vehicle.



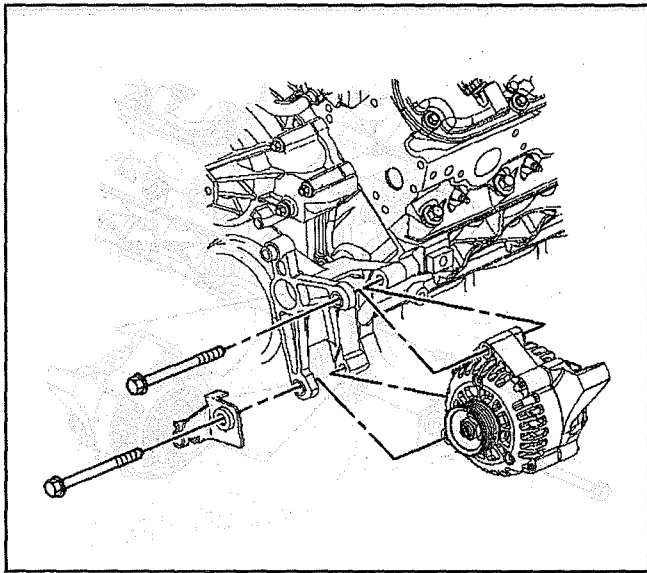
211624

Installation Procédure

1. Install the generator to the vehicle.
2. Connect the generator electrical connector (3).



211624



211628

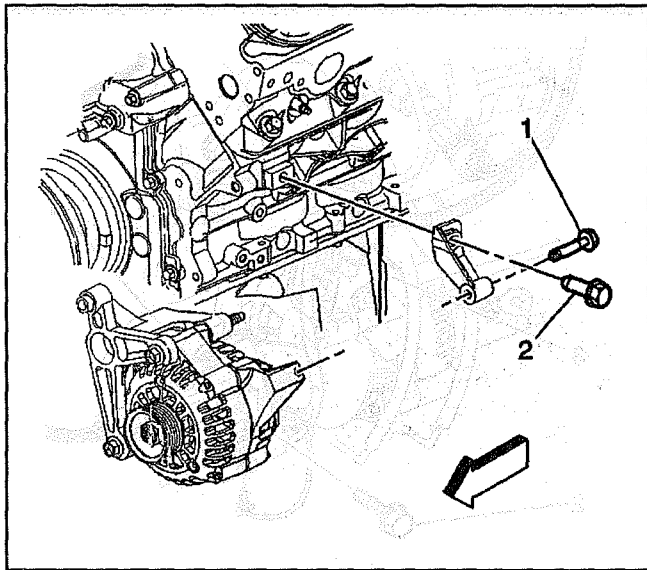
Notice: Refer to *Fastener Notice* in Cautions and Notices.

3. Install the front generator mounting bolts and oil cooler clip.

Tighten

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

4. Install the transmission oil cooler lines to the oil cooler clip.

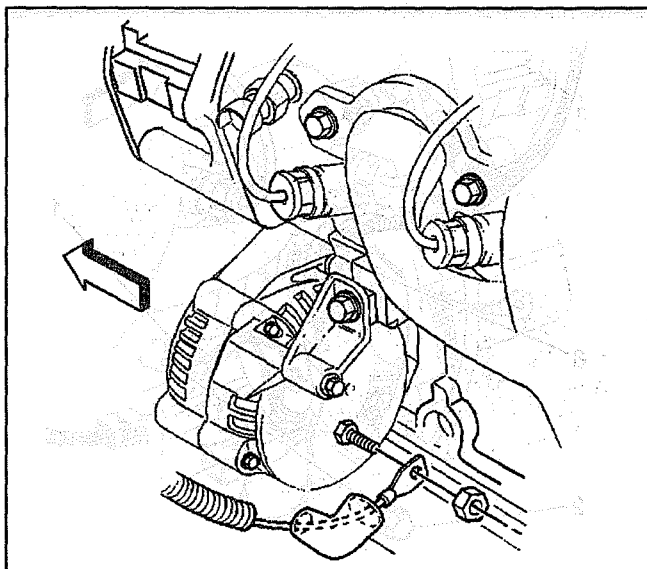


211626

5. Install the generator rear bracket mounting bolt (1).

Tighten

Tighten the rear bracket mounting bolt (1) to 25 N·m (18 lb ft).



211599

6. Install the positive cable to the generator:

- Install the positive cable.
- Install the positive cable nut to the generator output stud.

Tighten

Tighten the positive cable nut to the generator output stud to 22 N·m (16 lb ft).

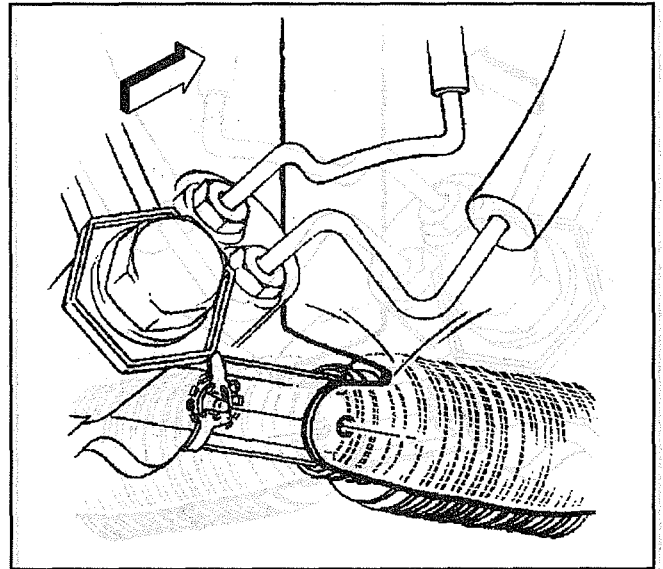
- Slide the boot over the positive terminal stud.

7. Lower the vehicle.
8. Install the accessory drive belt. Refer to *Drive Belt Replacement - Accessory* in Engine Mechanical-5.7 L.
9. Connect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure*.

Generator Splash Shield Replacement

Removal Procedure

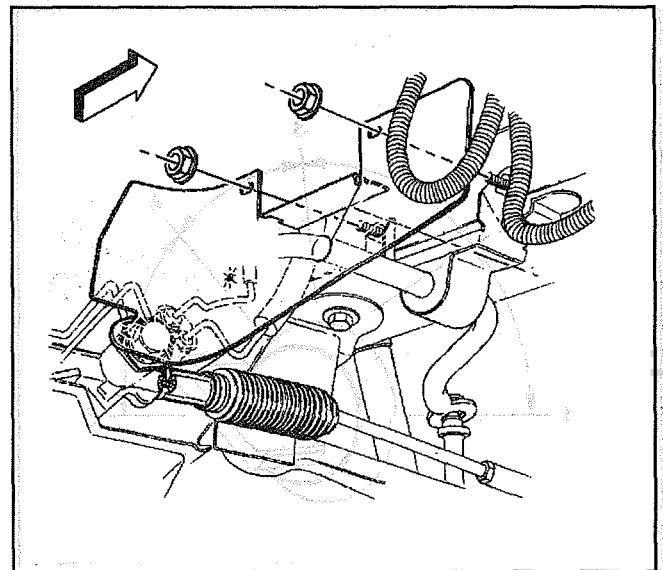
1. Remove the generator splash shield from the tie strap on the steering rack.



211633

211633

2. Remove the generator splash shield nuts.
3. Remove the generator splash shield.

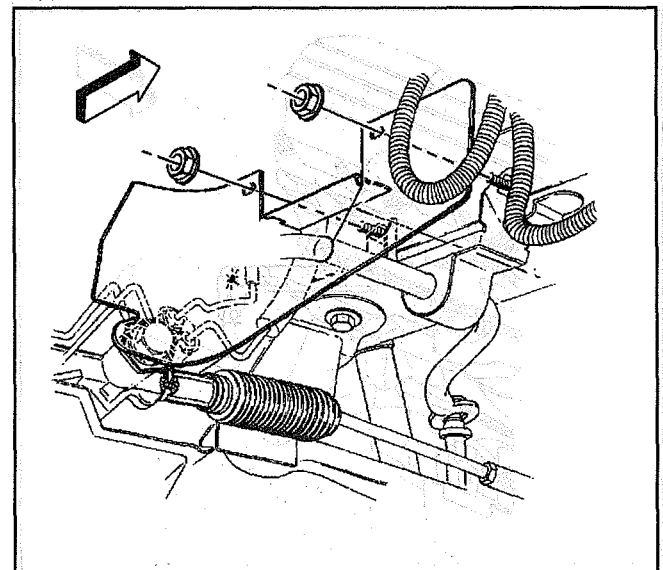


211632

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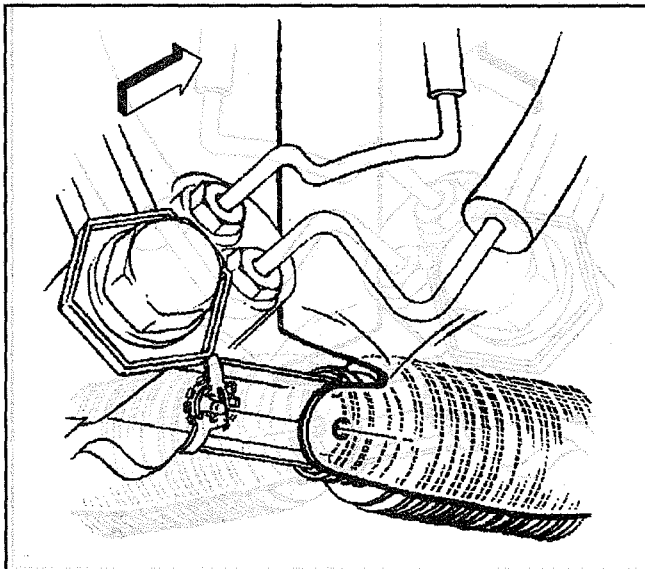
Installation Procedure

1. Install the generator splash shield.
2. Install the generator splash shield nuts.



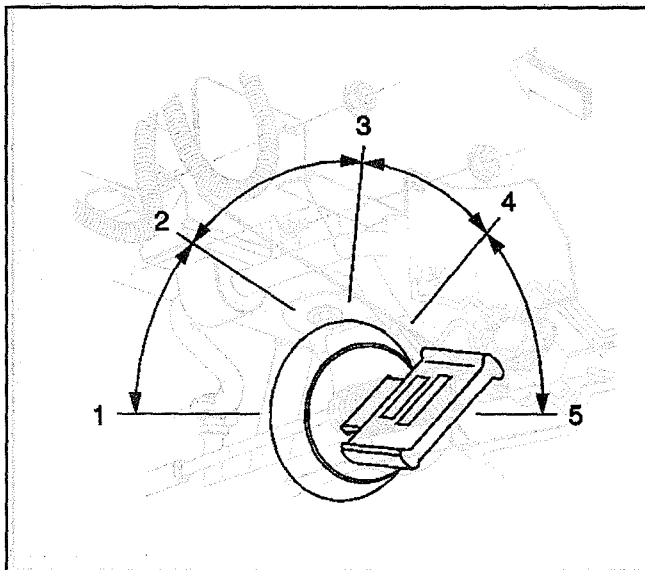
211632

211632



211633

3. Install the generator splash shield to the tie strap on the steering rack.

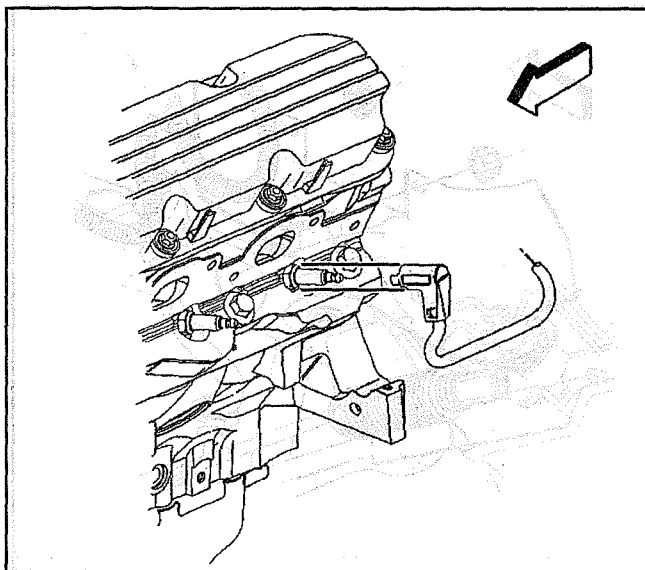


341078

Spark Plug Wire Harness Replacement (3.8 L Right Bank)

Removal Procedure

1. Turn the ignition to OFF (3) or to LOCK (2).
2. Raise and suitably support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.

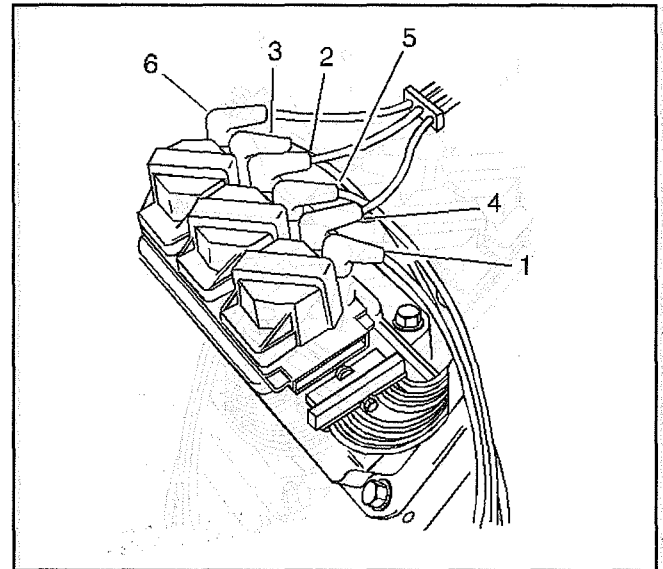


211645

Notice: Twist the spark plug boot one-half turn in order to release the boot. Pull on the spark plug boot only. Do not pull on the spark plug wire or the wire could be damaged.

3. Disconnect the number 4 and number 6 plug wires from the spark plugs.
4. Lower the vehicle.
5. Disconnect the number 2 plug wire from the spark plug.

6. Disconnect the even (2, 4, 6) spark plug wires from the ignition coils.
7. Remove the spark plug wire harness.

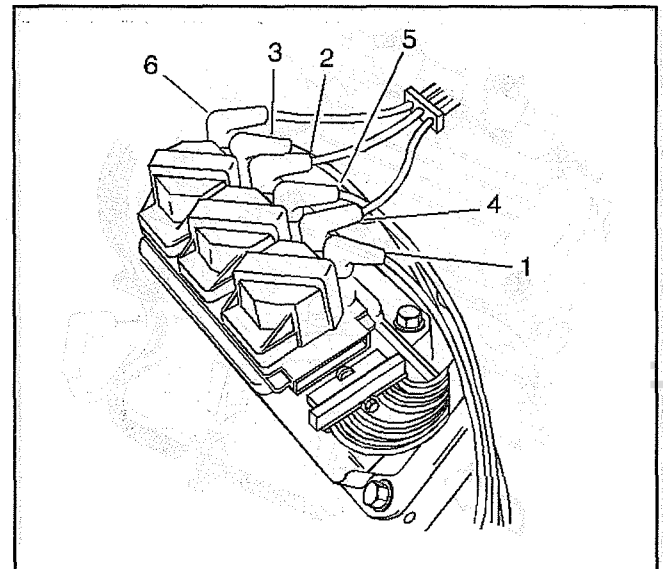


43661

Installation Procedure

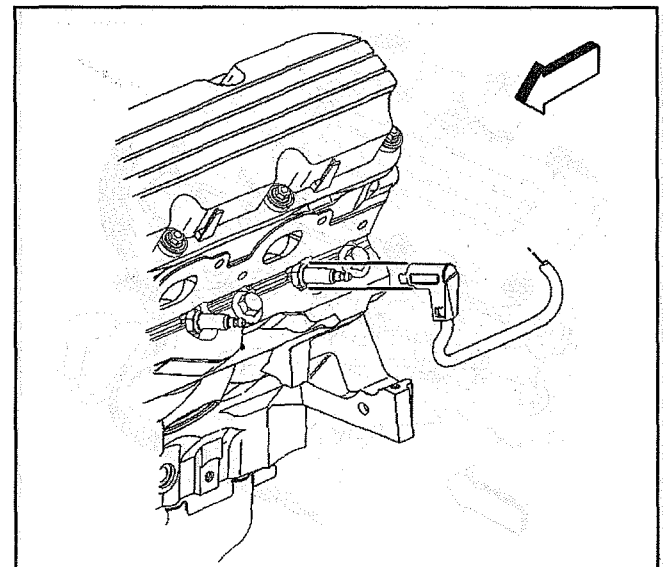
Important: The lower tabs of the heat shield must extend over the hex on the spark plug in order to complete installation of the heat shield and the boot on the spark plug.

1. Install the spark plug wire harness.
2. Connect the even (2, 4, 6) spark plug wires to the ignition coils.
3. Connect the number 2 plug wire from the spark plug.
4. Raise and suitably support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.



43661

5. Connect the number 4 and number 6 plug wires to the spark plugs.
6. Lower the vehicle.



211645

Spark Plug Wire Harness Replacement (3.8 L Left Bank)

Removal Procedure

1. Disconnect the odd numbered plug wires (1, 3, 5) from the ignition coils.

Notice: Twist the spark plug boot one-half turn in order to release the boot. Pull on the spark plug boot only. Do not pull on the spark plug wire or the wire could be damaged.

2. Raise and suitably support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.

3. Remove the plug wires from the spark plugs.
4. Remove the spark plug wire harness from the vehicle.

1. Twist the spark plug boot one-half turn in order to release the boot. Pull on the spark plug boot only. Do not pull on the spark plug wire or the wire could be damaged.

2. Raise and suitably support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.

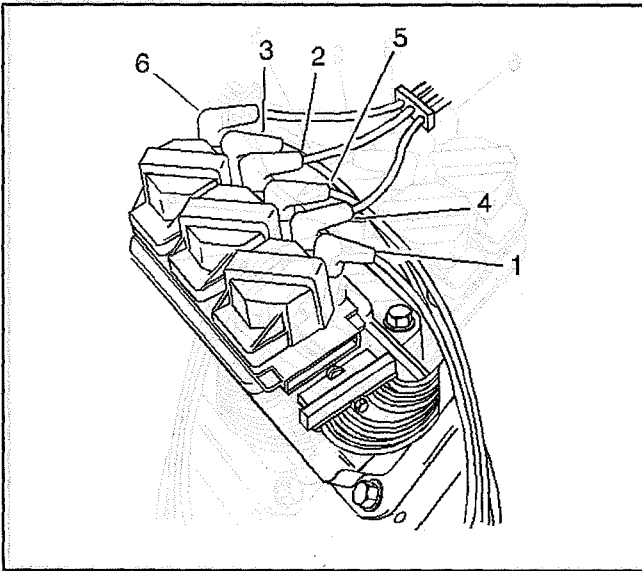
3. Remove the plug wires from the spark plugs.

4. Remove the spark plug wire harness from the vehicle.

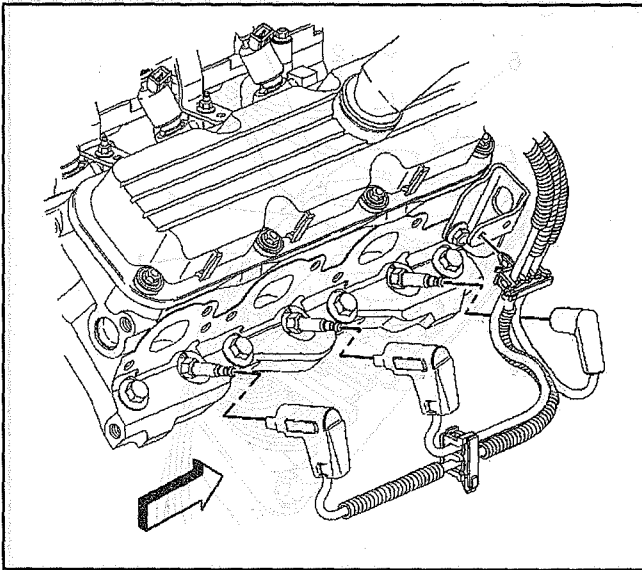
Installation Procedure

Important: The lower tabs of the heat shield must extend over the hex on the spark plug in order to complete installation of the heat shield and the boot on the spark plug.

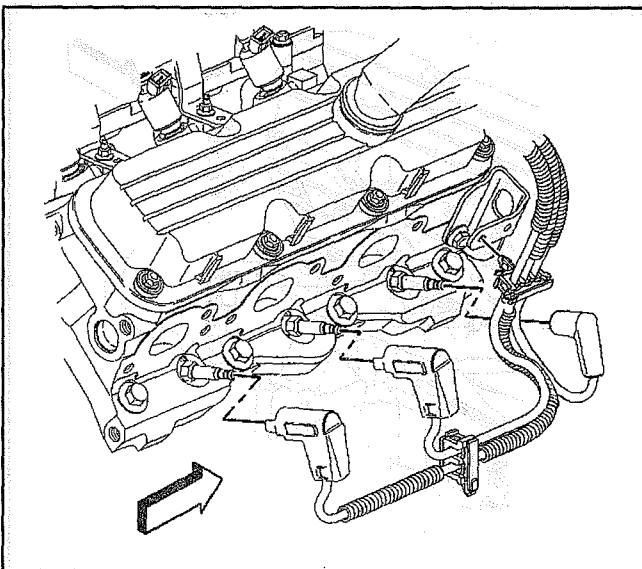
1. Install the spark plug wire harness to the vehicle.
2. Install the spark plug wires to the spark plugs.
3. Lower the vehicle.



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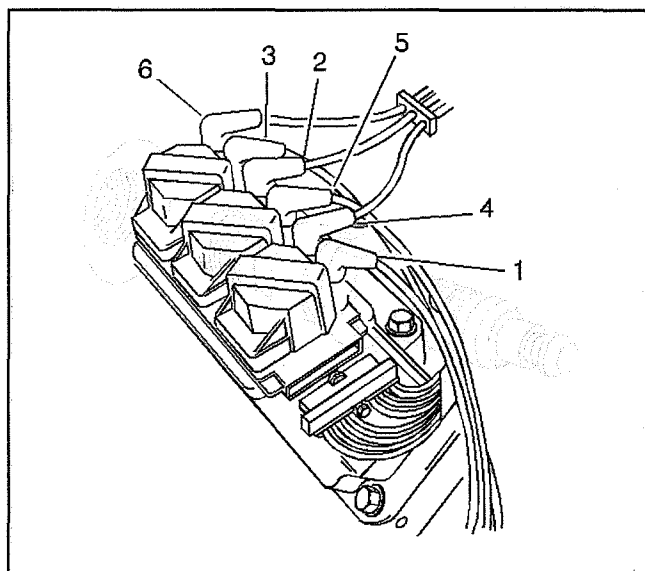


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4. Connect the odd numbered plug wires (1, 3, 5) to the ignition coils.



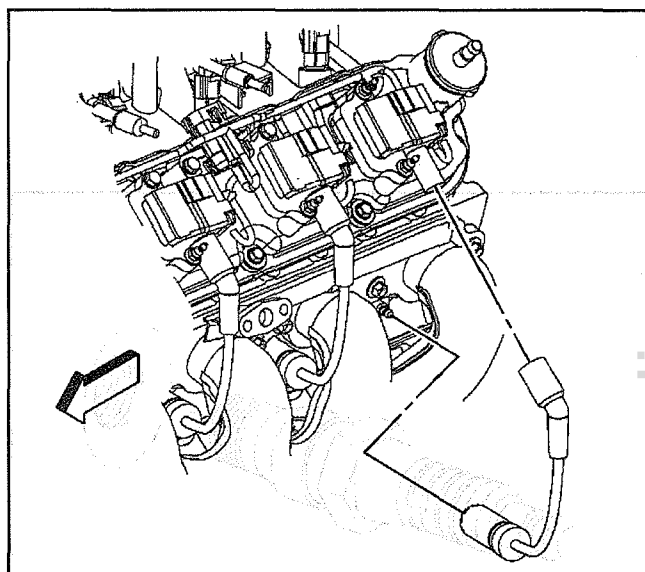
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Spark Plug Wire Harness Replacement (5.7 L)

Removal Procedure

Notice: Twist the spark plug boot one-half turn in order to release the boot. Pull on the spark plug boot only. Do not pull on the spark plug wire or the wire could be damaged.

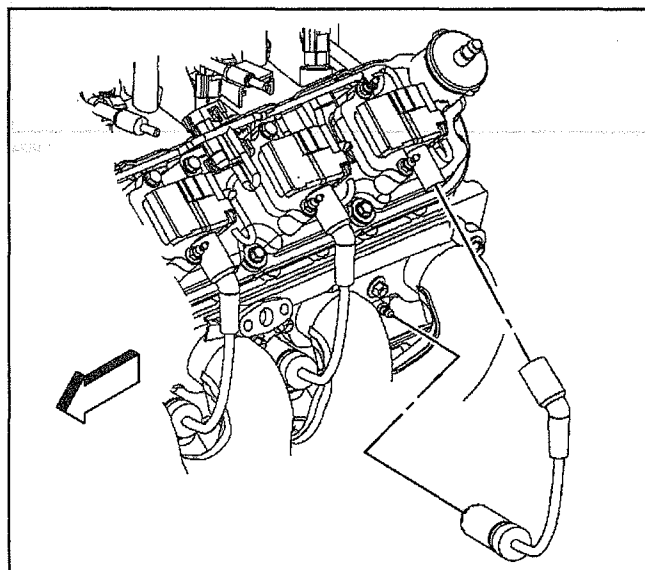
1. Disconnect the spark plug wire at each spark plug.
 - Twist each spark plug 1/2 turn.
 - Pull only on the boot in order to remove the wire from each spark plug.
2. Disconnect the spark plug wire from the ignition coil.
 - Twist each spark plug boot 1/2 turn.
 - Pull only on the boot in order to remove the wires from the ignition coil.



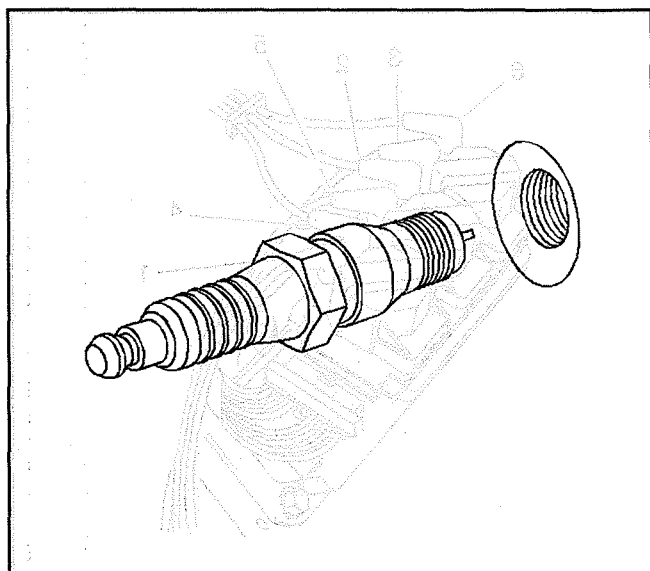
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Installation Procedure

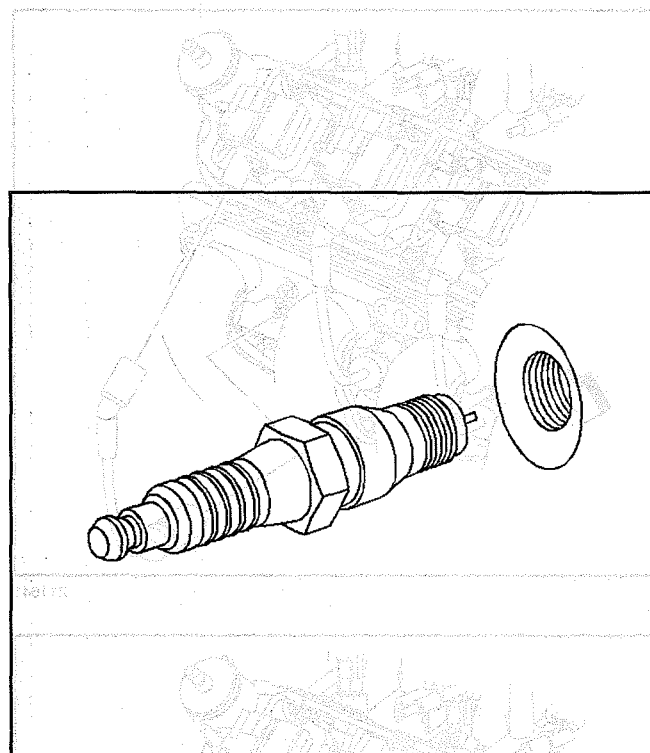
1. Install the spark plug wires at the ignition coil.
2. Install the spark plug wire to each spark plug.
3. Inspect the wires for proper installation:
 - Push sideways on each boot in order to inspect the seating.
 - Reinstall any loose boot.



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Spark Plug Replacement

Removal Procedure

1. Remove the spark plug wires. Refer to *Spark Plug Wire Harness Replacement (3.8 L Right Bank)*, *Spark Plug Wire Harness Replacement (3.8 L Left Bank)* or *Spark Plug Wire Harness Replacement (5.7 L)*.

Notice: Allow the engine to cool before removing the spark plugs. Attempting to remove the spark plugs from a hot engine may cause the plug threads to seize, causing damage to cylinder head threads.

Notice: Clean the spark plug recess area before removing the spark plug. Failure to do so could result in engine damage because of dirt or foreign material entering the cylinder head, or by the contamination of the cylinder head threads. The contaminated threads may prevent the proper seating of the new plug. Use a thread chaser to clean the threads of any contamination.

2. Loosen each spark plug one or two turns.
3. Brush or use compressed air to remove any dirt from around the spark plugs.
4. Remove the spark plugs one at a time and place each plug in a tray marked with the corresponding cylinder numbers.

Installation Procedure

1. Inspect each spark plug gap. Adjust each plug as needed.

Specification

Spark plug gap: 1.524 mm (0.060 in).

2. Hand start the spark plugs in the corresponding cylinders.

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

3. Tighten the spark plugs.

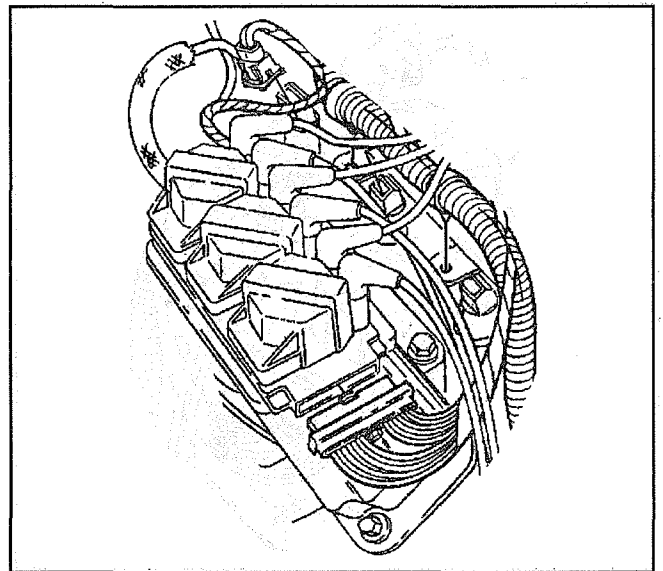
Tighten

- Tighten the 3.8 L engine spark plugs to 27 N·m (20 lb ft).
 - Tighten the 5.7 L engine spark plug on a NEW cylinder head to 20 N·m (15 lb ft).
 - Tighten the 5.7 L engine spark plug on subsequent installations to 15 N·m (11 lb ft).
4. Install the spark plug wires. Refer to *Spark Plug Wire Harness Replacement (3.8 L Right Bank)*, *Spark Plug Wire Harness Replacement (3.8 L Left Bank)* or *Spark Plug Wire Harness Replacement (5.7 L)*.

Ignition Coil Replacement (3.8 L)

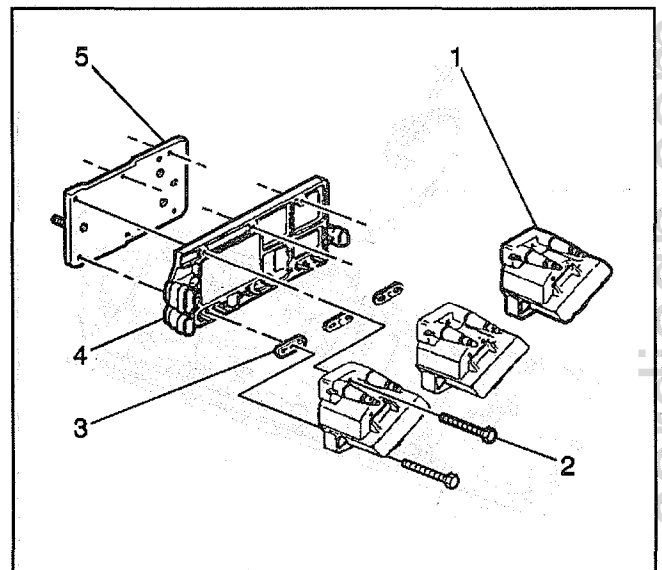
Removal Procedure

1. Disconnect the electrical connector from the control module.
2. Disconnect the spark plug wires from the coil being serviced.



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3. Remove the ignition coil bolts (2).
4. Remove the ignition coil (1) from the module (4).
5. Remove the ignition coil seal (3), if required.



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Installation Procedure

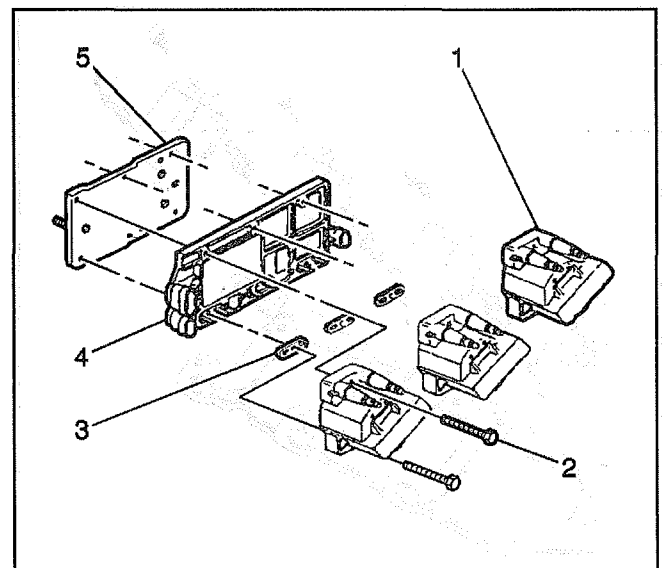
1. Install the ignition coil seal (3), if removed.
2. Install the ignition coil (1) to the module (4).

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

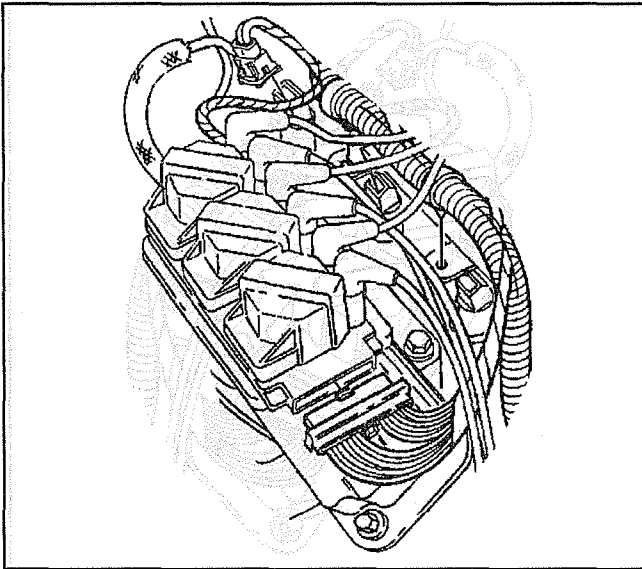
3. Install the ignition coil bolts (2).

Tighten

Tighten the ignition coil bolts (2) to 4 N·m (35 lb in).



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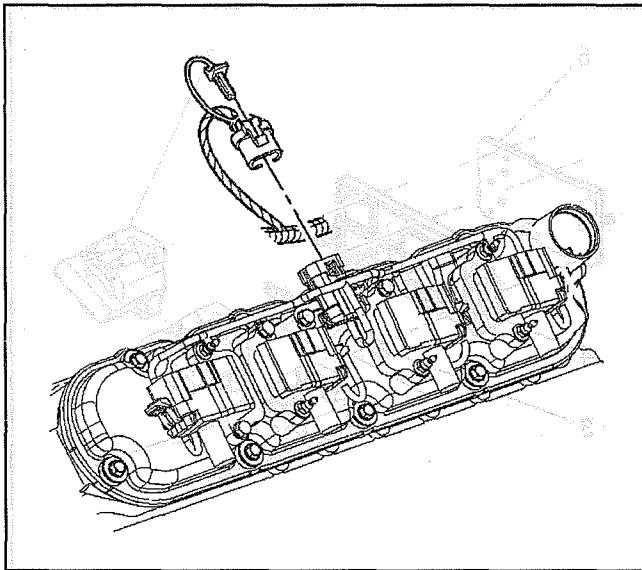
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4. Connect the spark plug wires to the coil.
5. Connect the electrical connector from the control module.

Tighten

Tighten the ignition control module bolt to 2.5 N·m (22 lb in).

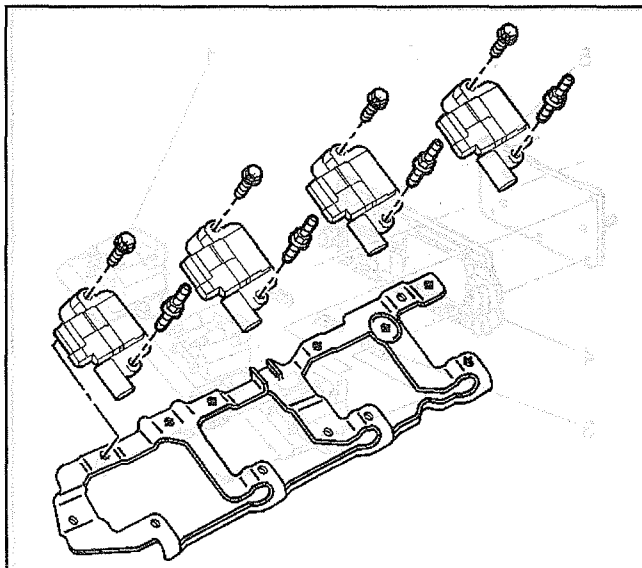


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Ignition Coil Replacement (5.7 L)**Removal Procedure**

1. Disconnect the main electrical connector feeding the ignition coils.
2. Disconnect the ignition coil harness connectors.
3. Disconnect the spark plug wire at the ignition coil.



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4. Remove the ignition coil mounting bolts.
5. Remove the ignition coil.

Installation Procedure

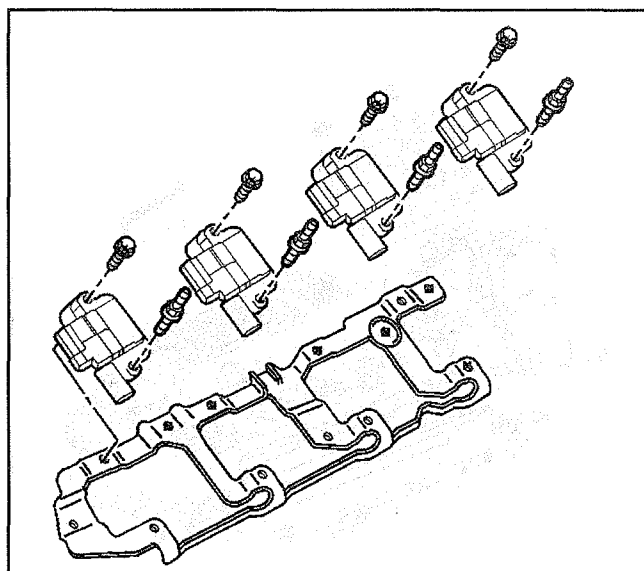
1. Install the ignition coil.

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

2. Install the ignition coil mounting bolts.

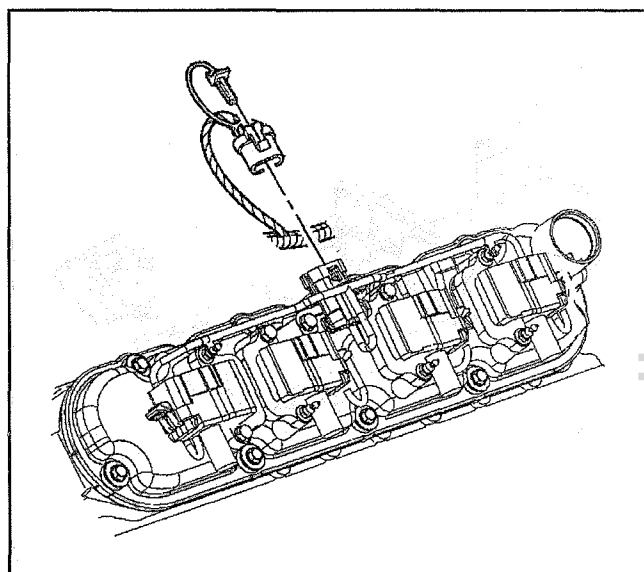
Tighten

Tighten the ignition coil mounting bolts to 12 N·m (106 lb in).



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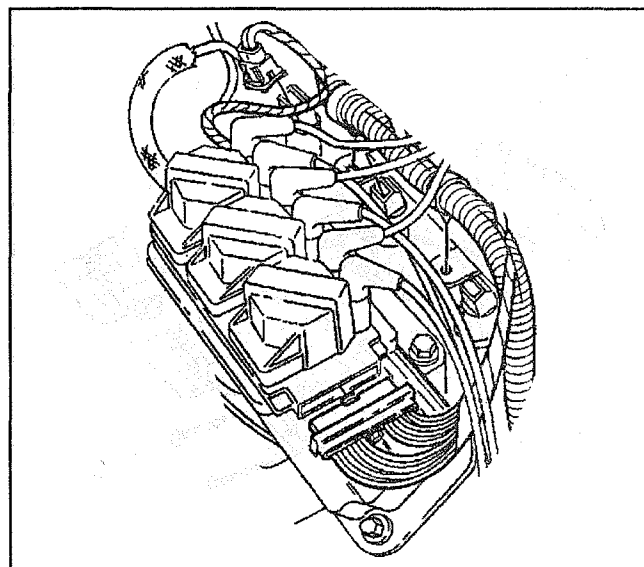
3. Connect the spark plug wire at the ignition coil.
4. Connect the ignition coil harness connector.
5. Connect the main electrical connector feeding the ignition coils.



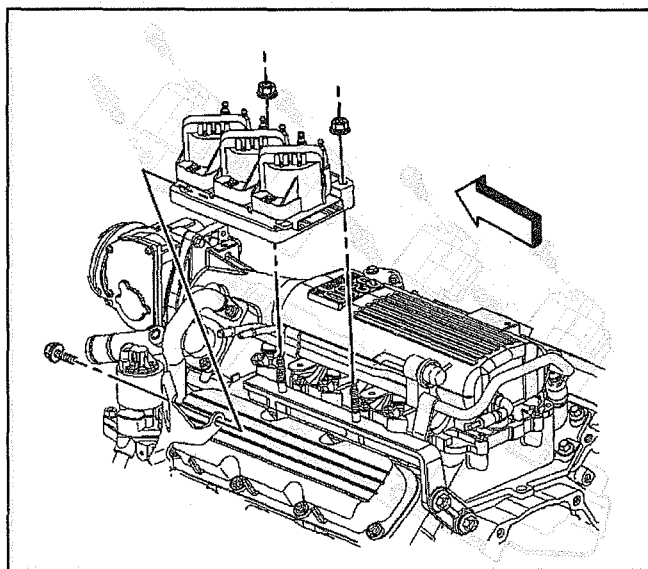
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Ignition Coil Module Replacement (3.8 L)**Removal Procedure**

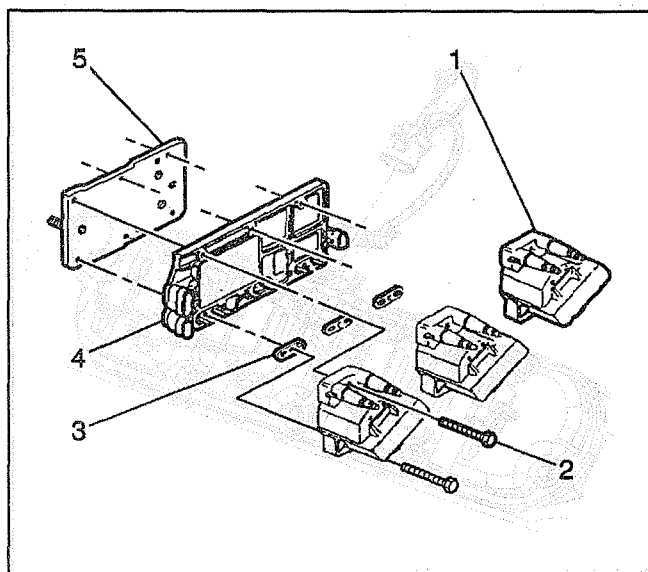
1. Loosen the control module electrical connector bolt.
2. Remove the control module electrical connector from the module.
3. Remove the spark plug wires from the ignition control module.



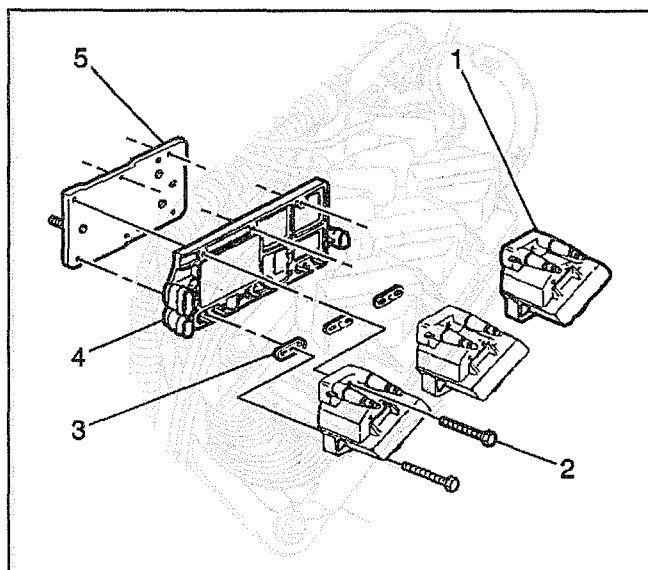
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4. Remove the ignition control module nuts.
5. Remove the engine lift bracket to ignition control module bolt.
6. Remove the ignition control module/coils.

7. Lay the module/coils on a clean work surface.
8. Remove the ignition coil bolts (2) from all the coils (1).
9. Remove the ignition coils (1) from the module (4).
10. Remove the ignition coil seals (3).
11. Remove the module (4) from the module bracket (5).

Installation Procedure

1. Install the module (4) to the module bracket (5).
2. Install the ignition coil seals (3).
3. Install the ignition coils (1) to the module (4).

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

4. Install the ignition coil bolts (2).

Tighten

Tighten the ignition coil bolts (2) to 4 N·m (35 lb in).

5. Install the ignition control module/coils.
6. Loosely install the engine lift bracket to ignition control module bolt.
7. Install the ignition control module nuts.

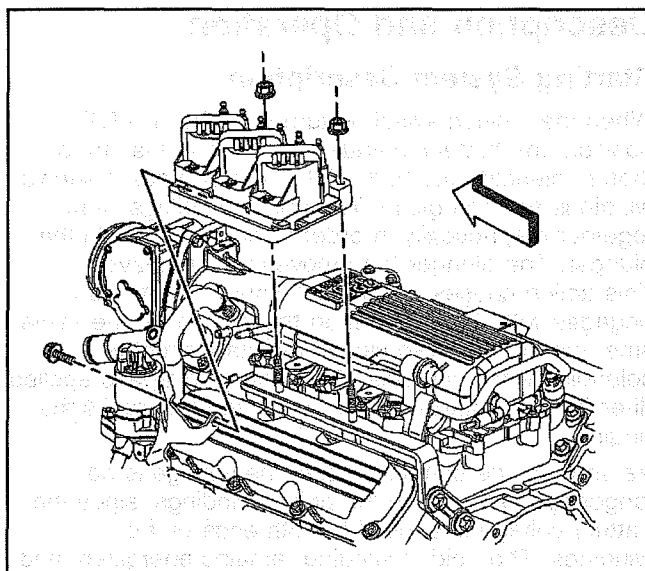
Tighten

- Tighten the ignition control module nuts to 30 N·m (22 lb ft).
- Tighten the engine lift bracket to ignition control module bolt to 25 N·m (18 lb ft).

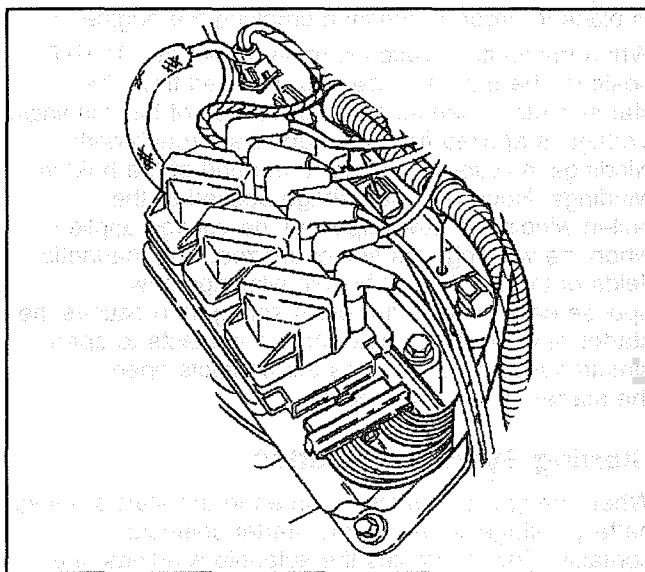
8. Install the spark plug wires to the ignition control module.
9. Install the control module electrical connector to the module.
10. Tighten the control module electrical connector bolt.

Tighten

Tighten the ignition control module bolt to 3 N·m (27 lb in).



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Description and Operation

Starting System Description

When the ignition switch is turned to the START position, the battery voltage is applied to the starter motor solenoid, and both of the starter motor solenoid windings are energized. The pull-in windings work together magnetically in order to pull in and hold the plunger. The plunger then moves the shift lever. This action causes the starter drive to rotate as it engages with the flywheel on the engine. At the same time, the plunger also closes the starter motor solenoid switch contacts. Full battery voltage is applied directly to the starter motor, which in turn cranks the engine.

As soon as the contacts close, the voltage is no longer applied through the pull-in windings, since the battery voltage is applied to both ends of the windings. The hold-in winding remains energized, and the magnetic field is strong enough to hold the plunger, the shift lever, and the starter drive contacts in place in order to continue cranking the engine.

When the ignition switch is moved from the START position, the battery voltage is removed from the starter motor solenoid and the junction of the windings. Voltage is applied from the contacts through both windings in order to ground at the end of the hold-in windings. However, the voltage applied to the pull-in winding is now opposing the voltage applied when the winding was first energized. The magnetic fields of the pull-in and hold-in windings now oppose each other. The return spring then causes the starter drive to disengage and the contacts to open simultaneously. As soon as the contacts open, the starter circuit is turned off.

Starting System Operation

When the ignition switch is turned to the start position, battery voltage is sent to the starter solenoid contacts. This energizes the solenoid windings and causes movement of the solenoid plunger and shift lever which causes the drive pinion to engage the engine flywheel ring gear and the solenoid switch contacts to close. When the solenoid switch contacts close, the starter motor is energized and cranking takes place. As the engine starts, the pinion overrun clutch protects the motor armature from excessive speed until the ignition switch is opened. Once the solenoid windings are de-energized, the return spring causes the pinion to disengage. In order to prevent excessive overrun, the ignition switch should be opened immediately when the engine starts.

Starting System Circuit Description

Starter Circuit Operation

When the ignition switch is moved to the START position, voltage is applied to the normally open contacts of the starter relay. Voltage is also applied through either the park neutral position switch (automatic transmission) when in park or neutral or the clutch pedal position switch (manual transmission) when the clutch pedal is depressed, to the starter relay coil. The body control module (BCM) energizes the starter relay by grounding one side of the relay coil only when the theft deterrent system has not been activated.

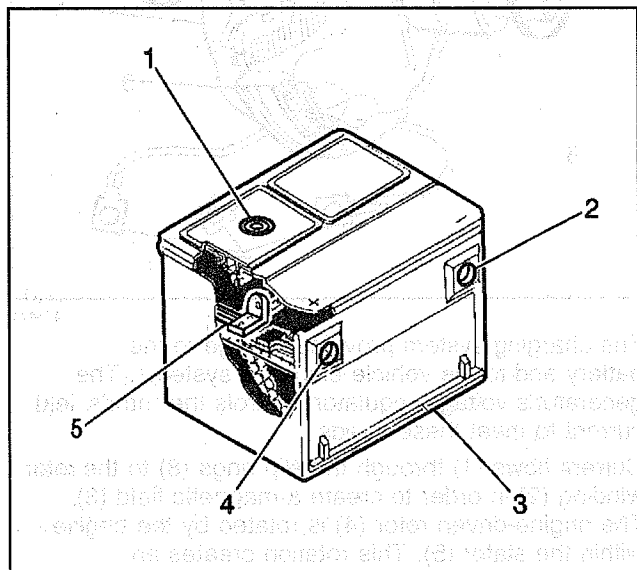
When the starter relay is energized, the normally open contacts close completing the circuit to the starter solenoid. When the starter solenoid circuit is completed, both the hold-in windings and the pull-in windings are energized. The circuit through the pull-in winding is completed through the starter motor. The windings work together magnetically to pull in and hold in the plunger. The plunger moves the shift lever. This action causes the drive assembly to rotate as it engages the flywheel ring gear on the engine. At the same time the plunger also closes the solenoid switch contacts in the starter solenoid. Full battery voltage is then applied directly to the starter motor and it cranks the engine.

As soon as the solenoid switch contacts close, voltage is no longer applied to the pull-in winding since battery voltage is applied to both ends of the winding. The hold-in winding remains energized and continues to hold the plunger, the shift lever, and the drive assembly solenoid switch contacts in place to continue cranking the engine.

When the ignition switch is released from the START position, battery voltage is removed from the two windings. Voltage is applied through the motor contacts and both windings to ground. However, the direction of current flow through the windings is reversed. The magnetic fields of the two windings now oppose one another. The return spring, aided by the opposing magnetic fields of the windings, disengages the drive assembly which opens the solenoid switch contacts. Once the contacts open, the starter circuit is turned off.

Battery Description

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- blindness if the acid comes into contact with the eyes. In order to avoid severe personal injury, use extreme precaution when servicing the battery or battery-related components.



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A maintenance free battery is standard on all vehicles. There are no vent plugs in the cover. The battery is completely sealed except for two 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 consists of the following components:

- Hydrometer lens (1)
- Negative terminal (2)
- Hold-down ramp (3)
- Positive terminal (4)
- Battery grids (5)

The battery has three functions in the electrical system:

- Provides electrical current when the vehicle's electrical needs exceed the generator's output.
- Stabilizes current surges in the charging system in order to protect electrical systems.
- Stores electrical energy for the starting system.

The battery specification label contains important information about the following:

- The test ratings
- The original model number
- The recommended replacement model number
- The cold cranking Amps (CCA)

Battery Diagnosis

If the battery tests good but still fails to perform satisfactorily, 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).
- 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:
 - An electrical short
 - A slipping belt
 - A bad generator
 - A bad generator voltage regulator
- The battery has not been properly maintained, including the following situations:
 - A failure to keep the terminals tight
 - A failure to keep the terminals clean
 - A loose battery hold-down
- Existing mechanical conditions in the electrical system, such as any short or pinched wires, attributing to power failure.
- The car is in storage for extended periods of time.
- Plug fouling, causing extended cranking periods.
- The hydrometer has been read incorrectly.
- There has been an insufficient Ampere-hour charge rate for a discharged battery.
- There is a burned out charge indicator bulb causing a NO CHARGE condition.
- There is a continuous current draw on the battery through excessive parasitic drain.
- The battery is old.

Battery Operation

The battery supplies current to operate the starting motor and the ignition system when the engine is being started. The battery has three major functions in the electrical system:

1. Provides a source of energy for cranking the engine
2. Acts as a voltage stabilizer for the electrical system
3. For a limited time, it can provide energy when the electrical load used exceeds the output of the generator

The battery is an electrochemical device. This means the battery uses chemicals to produce electricity. The amount of electricity it can produce is limited. As the chemicals in the battery are used up, the battery runs down, or is discharged. It can be recharged by supplying it with electric current from a battery charger, or from the vehicle generator. The used up chemicals are then returned to their original condition, so the battery becomes recharged.

Battery Tray and Hold-Down Retainer

Description

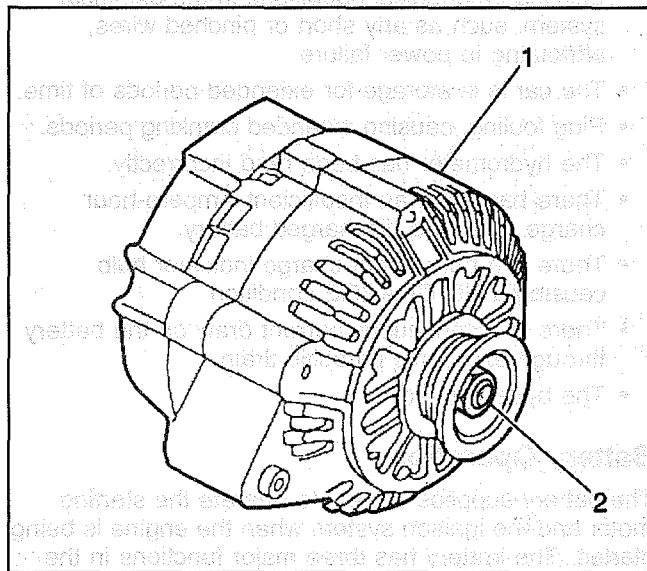
Clean any corrosion from the battery tray/coolant recovery reservoir and the hold down clamp prior to installing the battery. Ensure the carrier is in good condition in order to hold the battery securely and keep the battery level. Ensure there are no parts or tools in the battery tray/coolant recovery reservoir before installing the battery. In order to prevent the battery from shaking in the tray, tighten the hold down bolt to the specification noted. Refer to *Fastener Tightening Specifications*.

Charging System Description

The charging system consists of the following components:

- The battery
- The generator (CS-130D)
- A voltage regulator
- Indicator lamp or voltmeter circuitry

CS-Series Generators

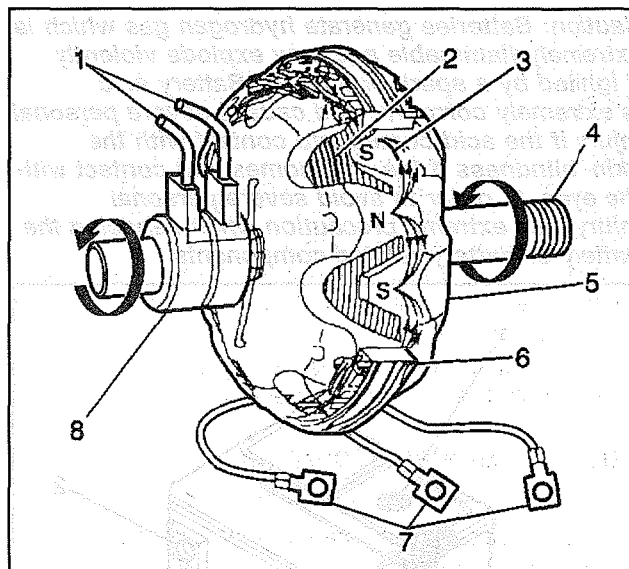


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Model CS-Series generators (1) feature a high ampere output per pound of weight. The CS stands for charging systems. The 130 is the measurement, in millimeters, of the outside diameter of the stator laminations and the D is for dual internal fans. The delta stator, rectifier bridge, and the rotor with slip rings and brushes, are electrically similar to other CS series generators. The CS-130D generator uses a conventional pulley and dual internal fans to cool the slip ring end frame, rectifier bridge and voltage regulator.

The generator's rotor shaft (2) is rotated by the engine drive belt. The rotor shaft rotates the generator's rotor. The generator produces the electrical current that charges the battery. The generator also provides energy to the vehicle's electrical systems when the engine is running.

Charging System Operation



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The charging system provides voltage to the battery and to the vehicle electrical systems. The generator's voltage regulator controls the rotor's field current to meet these needs.

Current flows (1) through the slip rings (8) to the rotor winding (2) in order to create a magnetic field (3). The engine-driven rotor (4) is rotated by the engine within the stator (5). This rotation creates an alternating current (AC) voltage in the stator windings (6). The AC voltage goes to the rectifier bridge (7). The rectifier bridge converts this AC voltage to direct current (DC) voltage. The DC voltage is delivered from the generator's output terminal to the battery and the electrical systems through a fusible link (11). The regulator grounds circuit 225 (10) when the charging system voltage is abnormal. This information causes the PCM to send a class 2 message to the instrument panel cluster, which activates the CHECK GAGES lamp.

The voltage regulator limits system voltage by controlling the rotor field current. When the field current is on, the regulator switches the rotor field on and off at a fixed rate of about 400 cycles per second. By varying the overall on/off time, correct average field current for proper system voltage control is maintained. At high speeds, the on time may be 10 percent and the off time may be 90 percent. At low speeds, and with high electrical loads, the on/off time may be 90 percent and 10 percent respectively. The voltmeter reads battery voltage when the engine is not running and reads charging system voltage when the engine is running. The normal indication is between 11 and 16 volts.

The generator uses only two connections-battery positive and the L terminal, in addition to the ground path through the generator bracket. Use of P, I, and S terminals is optional. The P terminal is connected to the stator and may be connected externally to a tachometer or other device. The I terminal can be connected directly to battery voltage to power the generator instead of, or in addition to, the L terminal which must be stepped down. This S terminal may be connected to an external voltage source, such as voltage near the battery, for voltage control. If the S terminal is not used, internal generator voltage is used for control.

The CS-130D generator must be replaced. Do not disassemble the CS-130D generator.

Charging System Operation

The charging system has two jobs:

1. To put back into the battery the current used to start the engine
2. To handle the load of the lights, ignition, radio, and other electrical and electronic equipment while the engine is running.

The charging system includes the generator, regulator, and battery, with connecting wires.

The generator converts mechanical energy from the engine into electrical energy. It keeps the battery in a charged condition and handles electrical loads while the engine is running. The alternator produces alternating current (ac) inside the stator windings. Diodes convert this ac into direct current (dc).

Charging System Circuit Description

Charging Circuit Operation

The generator provides voltage to operate the electrical system and to charge the battery. A magnetic field is created when current flows through the rotor windings. This field rotates as the rotor is driven by the engine, creating an AC voltage in the stator windings. The AC voltage is then converted to a DC voltage by a rectifier bridge. This DC voltage is then supplied through circuit 1 to the electrical system at the battery terminal.

The amount of output voltage is controlled by the current supplied to the rotor. The solid state regulator in the generator controls the current supplied to the rotor. The rotor current is a series of electrical pulses supplied by the regulator. When the ignition switch is first placed in the RUN position, the pulse width is very narrow. This causes the rotor to produce a weak magnetic field. This will produce a lower output voltage to the vehicle's electrical system. Once the engine is running, the regulator monitors the output voltage through an internal wire and changes the pulse width accordingly.

Ignition System Description (3.8 L)

The electronic ignition system controls fuel combustion by providing a spark to ignite the compressed air/fuel mixture at the correct time. To provide optimum engine performance, fuel economy, and control of exhaust emissions, the PCM controls the spark advance of the ignition system. The electronic ignition system does not use the conventional distributor and coil. The electronic ignition system has the following advantages over the conventional mechanical distributor system:

- No moving parts
- Less maintenance required
- Remove mounting capability
- No mechanical load on the engine
- More coil cool down time between firing
- Elimination of mechanical timing adjustments
- Increased available ignition coil saturation time

The electronic ignition system consists of three twin-tower ignition coils, an ignition control module, a dual Hall-effect crankshaft position sensor, an engine crankshaft balancer with interrupter rings attached to the rear, related connecting wires, and the Ignition Control (IC) and fuel metering portion of the PCM.

The three twin-tower ignition coils are individually mounted to the ignition control module. Each end of a coils secondary winding is attached to a spark plug. Each cylinder is paired with the cylinder that is opposite it. These two spark plugs are on top dead center at the same time. When the ignition coil fires, both plugs fire at the same time to complete the circuit. The cylinder on compression is said to be the event cylinder and the one on exhaust is the waste cylinder. The cylinder on the exhaust stroke requires very little of the available energy to fire the plug. The remaining energy will be used as required by the cylinder on the compression stroke. The same process is repeated when the cylinders reverse roles. This method of ignition is called a waste spark ignition system.

The electronic ignition system consists of the following components:

- Crankshaft position sensor
- Crankshaft balancer interrupter rings
- Camshaft position sensor
- Ignition coils
- Ignition control module
- Powertrain control module (PCM)

For a more complete and detailed description of the above information refer to *Electronic Ignition (EI) System Description* in Engine Controls-3.8 L

Ignition System Description (5.7 L)

The electronic ignition system controls fuel combustion by providing a spark to ignite the compressed air/fuel mixture at the correct time. To provide optimum engine performance, fuel economy, and control of exhaust emissions, the PCM controls the spark advance of the ignition system. The electronic ignition system does not use the conventional distributor and coil. The electronic ignition system has the following advantages over a conventional mechanical distributor system:

- No moving parts
- Less maintenance required
- Remove mounting capability
- No mechanical load on the engine
- More coil cool down time between firing
- Elimination of mechanical timing adjustments
- Increased available ignition coil saturation time

The ignition system on this vehicle feature a multiple coil ignition and is known as coil near plug. The secondary ignition wires are short compared with a distributor ignition system wire. Eight ignition coils/module are individually mounted above each cylinder on the rocker covers. The coil/modules are fired sequentially. There is an Ignition Control (IC) circuit for each ignition coil/module. The eight ignition control circuits are connected to the PCM. All timing decisions are made by the PCM, which triggers each coil/module individually.

The electronic ignition system consists of the following components:

- Crankshaft position sensor
- Crankshaft position sensor reluctor wheel
- Camshaft position sensor
- Ignition coils
- Powertrain control module (PCM)

For a more complete and detailed description of the above information refer to *Electronic Ignition (EI) System Description* in Engine Controls-5.7 L

Ignition System Operation

The ignition system supplies high-voltage surges to the spark plugs in the engine cylinders. These surges produce electric sparks across the spark plug gaps. The heat from the sparks ignites, or sets fire to, the compressed air-fuel mixture in the combustion chambers. When the engine is idling, the spark appears at the plug gap just as the piston nears top dead center (TDC) on the compression stroke. When the engine is operating at higher speeds, or with part throttle, the spark is advanced. It is moved ahead and occurs earlier in the compression stroke. This gives the compressed mixture more time to burn and deliver its energy to the pistons.

Special Tools and Equipment

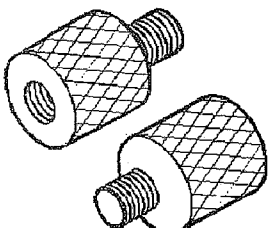
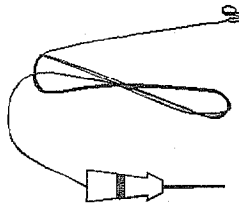
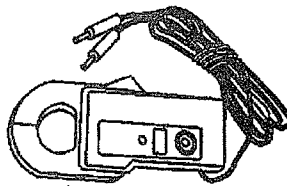
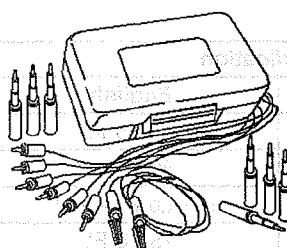
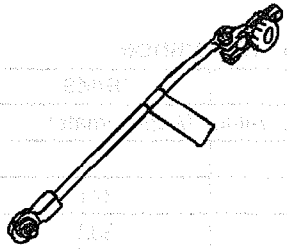
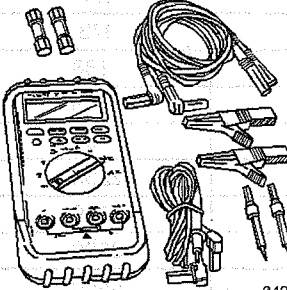
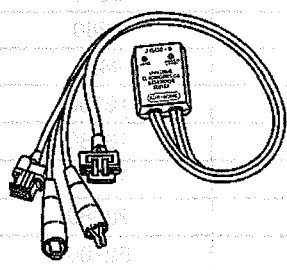
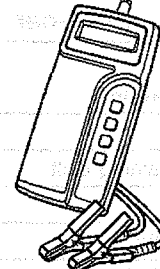
Illustration	Tool Number/ Description
 3431	GM P/N 12303040 Battery Side Terminal Adapters
 8439	J 21008 Self Powered Test Light
 95591	J 35590 Current Clamp
 8917	J 35616-A Connector Test Adapter Kit

Illustration	Tool Number/ Description
 3432	J 38758 Parasitic Draw Test Switch
 3430	J 39200 Digital Multimeter
 162176	J 41450-B CS Electronic Generator Tester
 404758	J 42000 Digital Battery Tester