

2002 Cadillac Escalade

2002 STARTING & CHARGING SYSTEMS Starters - Avalanche, Escalade, Escalade EXT, Sierra, Silverado, Suburban, Tahoe, Yukon & Yukon XL

2002 STARTING & CHARGING SYSTEMS

Starters - Avalanche, Escalade, Escalade EXT, Sierra, Silverado, Suburban, Tahoe, Yukon & Yukon XL

DESCRIPTION & OPERATION

WARNING: Vehicles are equipped with air bag supplemental restraint system. Before attempting any repairs involving steering column, instrument panel or related components, see the following applicable procedures:

- For pickups, see AIR BAG SAFETY PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM .
- For utility vehicles, see AIR BAG SAFETY PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM .

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES before disconnecting battery.

The following models are non-repairable starter motors. See STARTER APPLICATION . It has pole pieces that are arranged around the armature within the starter housing. When the solenoid windings are energized, the pull-in winding circuit is completed to ground through the starter motor. The hold-in winding circuit is completed to ground through the solenoid. The windings work together magnetically to pull in and hold in the plunger. The plunger moves the shift lever. This action causes the starter drive assembly to rotate on the armature shaft spline as it engages with the flywheel ring gear on the engine. At the same time, the plunger 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, current stops flowing thorough the pull-in winding as battery voltage is now applied to both ends of the windings. The hold-in winding remains energized; its magnetic field is strong enough to hold the plunger, shift lever, starter drive assembly, and solenoid switch contacts in place to continue cranking the engine. When the engine starts, the pinion gear overrun sprag protects the armature from excessive speed until the switch is opened.

When the ignition switch is released from the CRANK position, voltage is removed from the starter solenoid S terminal. Current flows from the motor contacts through both windings to ground at the end of the hold-in winding. However, the direction of the current flow through the pull-in winding is now in the opposite direction of the current flow when the winding was first energized.

The magnetic fields of the pull-in and hold-in windings now oppose one another. This action of the windings, along with the help of the return spring, cause the starter drive assembly to disengage and the solenoid switch contacts to open simultaneously. As soon as the contacts open, the starter motor is turned off.

STARTER APPLICATION

2002 Cadillac Escalade

2002 STARTING & CHARGING SYSTEMS Starters - Avalanche, Escalade, Escalade EXT, Sierra, Silverado, Suburban, Tahoe, Yukon & Yukon XL

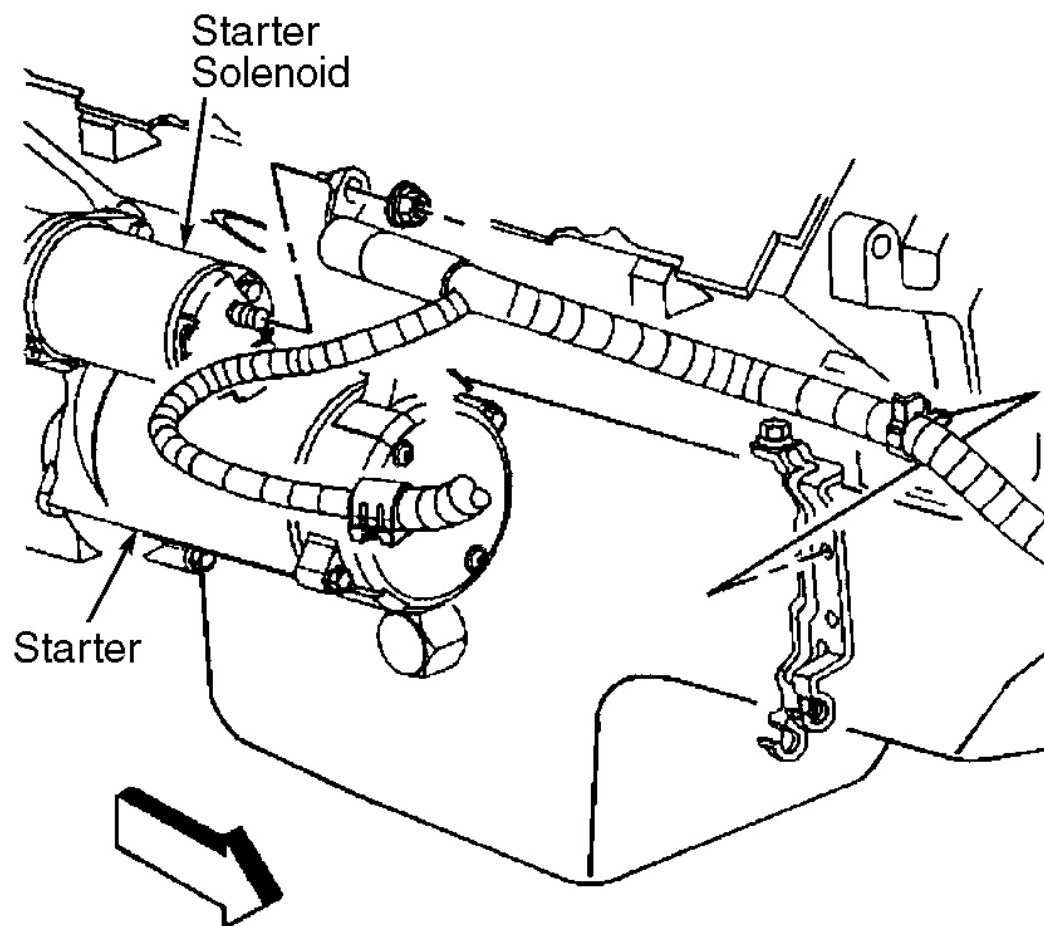
STARTER APPLICATION

Applications	Starter Model
Avalanche, Escalade, Escalade EXT, Suburban, Tahoe, Yukon, & Yukon XL	
4.3L	PG-260G
4.8L & 5.3L	PG-260F2
6.0L & 8.1L	PG-260M
6.6L Diesel	Hitachi-S14-100B
Cab & Chassis	
6.0L & 8.1L	PG-260M
6.6L Diesel	Hitachi-S14-100B
Sierra & Silverado	
4.3L, 4.8L, 5.3L, & 5.3L Methanol	PG-260G
6.0L & 8.1L	PG-260L
6.6L Diesel	Hitachi-S14-100B

COMPONENT LOCATIONS

2002 Cadillac Escalade

2002 STARTING & CHARGING SYSTEMS Starters - Avalanche, Escalade, Escalade EXT, Sierra, Silverado, Suburban, Tahoe, Yukon & Yukon XL

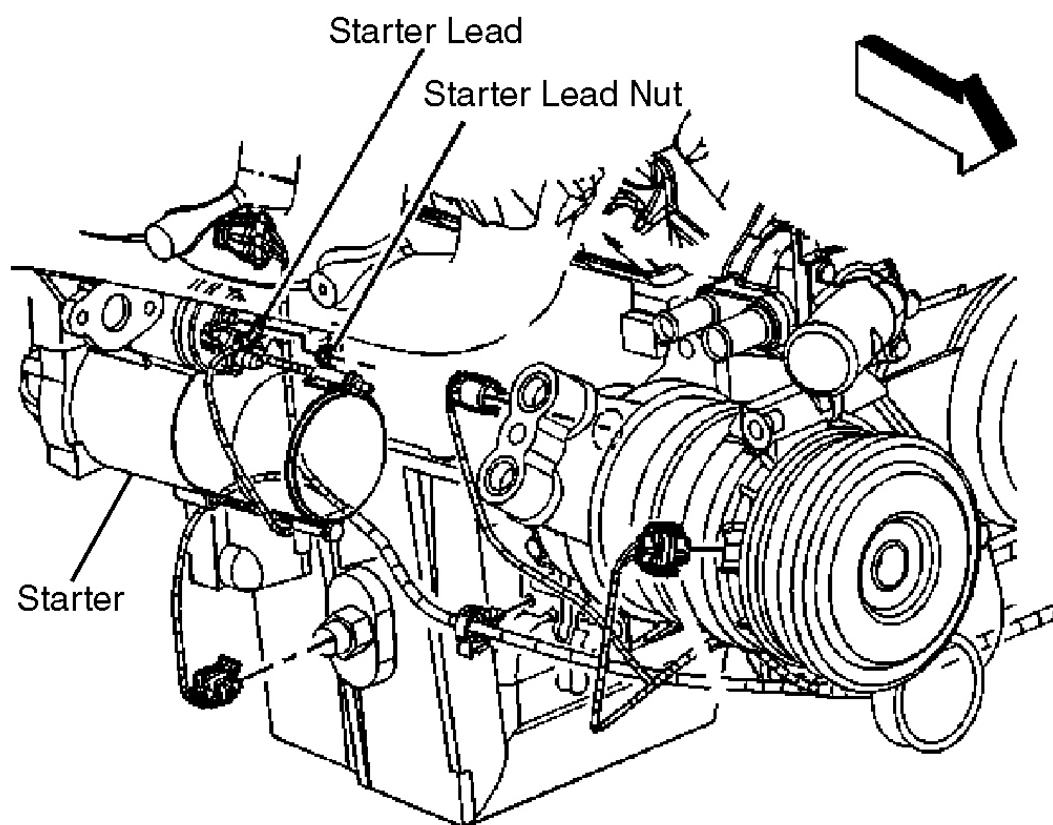


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Fig. 1: Locating Starter & Components (4.3L Engine)
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2002 Cadillac Escalade

2002 STARTING & CHARGING SYSTEMS Starters - Avalanche, Escalade, Escalade EXT, Sierra, Silverado, Suburban, Tahoe, Yukon & Yukon XL

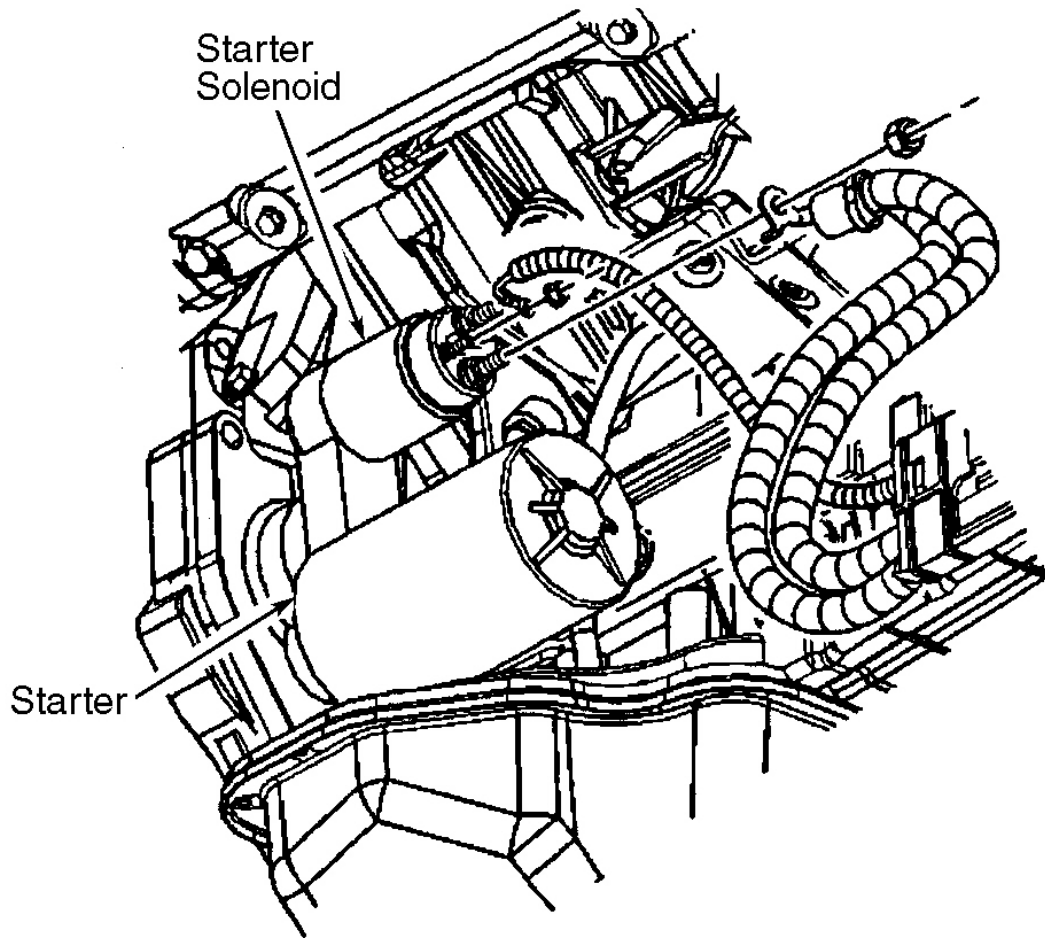


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Fig. 2: Locating Starter & Components (4.8L, 5.3L & 6.0L Engines)
Courtesy of GENERAL MOTORS CORP.

2002 Cadillac Escalade

2002 STARTING & CHARGING SYSTEMS Starters - Avalanche, Escalade, Escalade EXT, Sierra, Silverado, Suburban, Tahoe, Yukon & Yukon XL

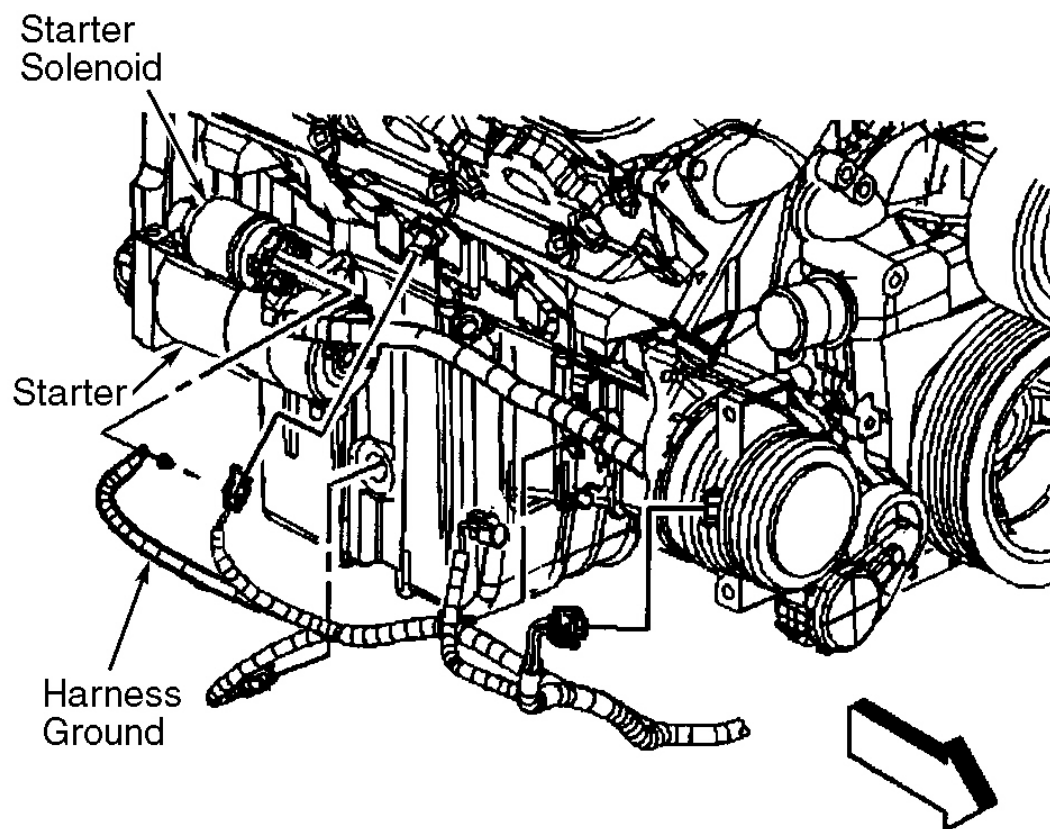


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Fig. 3: Locating Starter & Components (6.6L Diesel Engine)
Courtesy of GENERAL MOTORS CORP.

2002 Cadillac Escalade

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Fig. 4: Locating Starter & Components (8.1L Engine)

Courtesy of GENERAL MOTORS CORP.

TROUBLE SHOOTING

NOTE: For information not covered in this article, see * **STARTER - GENERAL TROUBLE SHOOTING** *.

Note condition and operation of SECURITY indicator light. If SECURITY indicator light stays on or flashes continuously, repair anti-theft system as necessary. See appropriate ANTI-THEFT SYSTEMS in DOOR LOCKS & ANTI-THEFT SYSTEMS. Verify customer complaint by operating suspected system. Visually inspect for obvious signs of mechanical and electrical damage. Inspect for loose or corroded connections, damaged wiring harnesses and/or switches. Check for a broken or partially broken wire inside insulation, which could cause system malfunction but prove good in a continuity/voltage check with system disconnected. Ensure any aftermarket electronic equipment is properly installed. If fault is found, repair as necessary. If no fault is found, perform self-diagnostics. See **SELF-DIAGNOSTIC SYSTEM** .

DIAGNOSTIC STARTING POINT (ENGINE ELECTRICAL)

2002 Cadillac Escalade

2002 STARTING & CHARGING SYSTEMS Starters - Avalanche, Escalade, Escalade EXT, Sierra, Silverado, Suburban, Tahoe, Yukon & Yukon XL

Begin the system diagnosis with the **DIAGNOSTIC SYSTEM CHECK (ENGINE ELECTRICAL)** . The diagnostic system check will provide the following information:

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

The use of the diagnostic system check will identify the correct procedure for diagnosing the system and where the procedure is located.

ON-VEHICLE TESTING

WARNING: Vehicles are equipped with air bag supplemental restraint system. Before attempting any repairs involving steering column, instrument panel or related components, see the following applicable procedures:

- For pickups, see **AIR BAG SAFETY PRECAUTIONS** and **DISABLING & ACTIVATING AIR BAG SYSTEM** .
- For utility vehicles, see **AIR BAG SAFETY PRECAUTIONS** and **DISABLING & ACTIVATING AIR BAG SYSTEM** .

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See **COMPUTER RELEARN PROCEDURES** before disconnecting battery.

NOTE: Some vehicles are equipped with optional dual batteries.

BATTERY TESTING & INSPECTION

- For pickups, see **BATTERY TESTING & INSPECTION** .
- For utility vehicles, see **BATTERY TESTING & INSPECTION** .

BATTERY SPECIFICATIONS

BATTERY SPECIFICATIONS

Application ⁽¹⁾	Specification
Replacement Battery Number	78-6YR
Cold Cranking Amps	600 Amps
Reserve Capacity Rating	115 Minutes
Replacement Battery Number	78-7YR
Cold Cranking Amps	770 Amps
Reserve Capacity Rating	115 Minutes

2002 Cadillac Escalade

2002 STARTING & CHARGING SYSTEMS Starters - Avalanche, Escalade, Escalade EXT, Sierra, Silverado, Suburban, Tahoe, Yukon & Yukon XL

(1) Optional (Dual) GM P/N 19001814

SELF-DIAGNOSTIC SYSTEM

NOTE: Diagnostic trouble code tests are written specifically for use with GM Tech I or Tech II scan tools. Generic scan tool can be used but may have limited functions. This article only covers the portion of those systems which relates to starting system diagnosis. For further information, see appropriate SELF-DIAGNOSTICS.

DIAGNOSTIC SYSTEM CHECK (ENGINE ELECTRICAL)

1. Did you perform the Battery Inspection/Test? If so, go to next step. If not, go to **BATTERY TESTING & INSPECTION** under ON-VEHICLE TESTING.
2. Install a scan tool. Does the scan tool power up? If so, go to step 4 . If not, go to SCAN TOOL DOES NOT POWER UP in BODY CONTROL MODULES.

NOTE: The engine may start during the following step. Turn off the engine as soon as you have observed the CRANK POWER MODE.

3. Access the CLASS 2 POWER MODE in the DIAGNOSTIC CIRCUIT CHECK on the scan tool. Rotate the ignition switch through OFF, RUN, and CRANK positions while observing the CLASS 2 POWER MODE on the scan tool. Does the CLASS 2 POWER MODE reading match the ignition switch positions for OFF, RUN and CRANK positions? If so, go to next step. If not, go to POWER MODE MISMATCH in BODY CONTROL MODULES.

NOTE: Lack of communication may be due to a partial malfunction of the class 2 serial data circuit or due to a total malfunction of the class 2 serial data circuit. The specified procedure will determine the particular condition.

4. Turn on ignition, with engine off. Attempt to communicate with each module on the class 2 serial data circuit. If using a Tech 2, obtain this information using the CLASS 2 MESSAGE MONITOR feature. Does the scan tool communicate with any module on the class 2 serial data circuit? If so, go to next step. If not, go to SCAN TOOL DOES NOT COMMUNICATE WITH CLASS 2 DEVICE in BODY CONTROL MODULES.

NOTE: The symptom list will determine the correct diagnostic procedure to use.

5. Select the Display DTCs function for each module. If using a Tech 2, use the CLASS 2 DTC CHECK feature in order to determine which modules have DTCs set. Record all of the displayed DTCs, the DTC status and the module which set the DTC. Does the scan tool display any DTCs? If so, go to next step. If not, go to **SYMPTOMS (ENGINE ELECTRICAL)** .

NOTE: The presence of DTCs which begin with "U" indicate some other module is

2002 Cadillac Escalade

2002 STARTING & CHARGING SYSTEMS Starters - Avalanche, Escalade, Escalade EXT, Sierra, Silverado, Suburban, Tahoe, Yukon & Yukon XL

not communicating. The specified procedure will compile all the available information before tests are performed.

6. Does the scan tool display any DTC beginning with "U"? If so, go to DIAGNOSTIC TROUBLE CODE DEFINITIONS in SELF-DIAGNOSTICS. If not, go to next step.
7. Does the scan tool display any DTC beginning with "P"? If so, go to DIAGNOSTIC TROUBLE CODE DEFINITIONS in SELF-DIAGNOSTICS. If not, go to next step.
8. Does the scan tool display any DTC beginning with "B"? If so, go to DIAGNOSTIC TROUBLE CODE DEFINITIONS in BODY CONTROL MODULES.

SYMPTOMS (ENGINE ELECTRICAL)

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

1. Perform **DIAGNOSTIC SYSTEM CHECK (ENGINE ELECTRICAL)** before using the Symptom Tables in order to verify that all of the following are true:
 - There are no DTCs set.
 - The control module(s) can communicate via the serial data link.
2. Review the system operation in order to familiarize yourself with the system functions. Refer to one of the following system operations:
 - See **DESCRIPTION & OPERATION** .
 - For pickups, see DESCRIPTION & OPERATION in **CHARGING SYSTEM** . For utility vehicles, see DESCRIPTION & OPERATION in **CHARGING SYSTEM** .

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the starting and charging systems. See **CHECKING AFTERMARKET ACCESSORIES** .
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. See **INTERMITTENT OR POOR CONNECTIONS** .

Symptom List

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

- See **TEST A: STARTER SOLENOID DOES NOT CLICK** .
- See **TEST B: STARTER SOLENOID CLICKS, ENGINE DOES NOT CRANK** .
- See **TEST C: ENGINE CRANKS SLOWLY** .
- See **TEST D: STARTER NOISE DIAGNOSIS** .

2002 Cadillac Escalade

2002 STARTING & CHARGING SYSTEMS Starters - Avalanche, Escalade, Escalade EXT, Sierra, Silverado, Suburban, Tahoe, Yukon & Yukon XL

- See **BATTERY TESTING & INSPECTION** .

CHECKING AFTERMARKET ACCESSORIES

WARNING: Vehicles are equipped with air bag supplemental restraint system. Before attempting any repairs involving steering column, instrument panel or related components, see the following applicable procedures:

- For pickups, see **AIR BAG SAFETY PRECAUTIONS** and **DISABLING & ACTIVATING AIR BAG SYSTEM** .
- For utility vehicles, see **AIR BAG SAFETY PRECAUTIONS** and **DISABLING & ACTIVATING AIR BAG SYSTEM** .

CAUTION: The OBD II symbol is used on the wiring diagrams in order to alert the technician that the circuit is essential for proper OBD II emission control circuit operation. Any circuit which fails and causes the Malfunction Indicator Light (MIL) to turn on, or causes emissions-related component damage, is identified as an OBD II circuit.

DO NOT connect aftermarket accessories into the following circuits:

- SIR circuits, all such circuits are indicated on wiring diagrams with the SIR symbol.
- OBD II circuits, all such circuits are indicated on circuit diagrams with the OBD II symbol.

Always check for aftermarket accessories (non-OEM) as the first step in diagnosing electrical problems. If the vehicle is so equipped, disconnect the system to verify that these add-on accessories are not the cause of the problems.

Possible causes of vehicle problems related to aftermarket accessories include:

- Power feeds connected to points other than the battery.
- Antenna location.
- Transceiver wiring located too close to vehicle electronic modules or wiring.
- Poor shielding or poor connectors on antenna feed line.
- Check for recent Technical Service Bulletins (TSB) detailing installation guidelines for aftermarket accessories.

INTERMITTENT OR POOR CONNECTIONS

NOTE: **Tools Required:** GM-Approved Terminal Test Kit (J-35616-C) Terminal Repair Kit (J-38125-D), Instruction Manual (J-38125-4) and Flat-Wire Probe Adapter (J-42675).

Most intermittent conditions are caused by faulty electrical connections or wiring. Inspect for the following

2002 Cadillac Escalade

2002 STARTING & CHARGING SYSTEMS Starters - Avalanche, Escalade, Escalade EXT, Sierra, Silverado, Suburban, Tahoe, Yukon & Yukon XL

items:

- Wiring broken inside the insulation.
- Poor connection between the male and female terminal at a connector.
- Poor terminal to wire connection. Some conditions which fall under this description are poor crimps, poor solder joints, crimping over the wire insulation rather than the wire itself and corrosion in the wire to terminal contact area, etc.
- Wire insulation which is rubbed through. This causes an intermittent short as the bare area touches other wiring or parts of the vehicle.

Testing for Proper Terminal Contact

It is important to test terminal contact at the component and any in-line connectors before replacing a suspect component. Mating terminals must be inspected to ensure good terminal contact. A poor connection between the male and female terminal at a connector may be the result of contamination or deformation.

Contamination may be caused by the connector halves being improperly connected. A missing or damaged connector seal, damage to the connector itself, or exposing the terminals to moisture and dirt can also cause contamination. Contamination, usually in the underhood or underbody connectors, leads to terminal corrosion, causing an open circuit or intermittently open circuit.

Deformation is caused by probing the mating side of a connector terminal without the proper adapter. Always use the GM-approved terminal test kit when probing connectors. Other causes of terminal deformation are improperly joining the connector halves, or repeatedly separating and joining the connector halves.

Deformation, usually to the female terminal contact tang, can result in poor terminal contact causing an open or intermittently open circuit.

Round Wire Connectors

Follow the procedure to test terminal contact of Metri-Pack or 56 series terminals. Refer to the terminal repair kit or the instruction manual for terminal identification. Follow the procedure in order to test terminal contact.

1. Separate the connector halves.
2. Visually inspect the connector halves for contamination. Contamination may result in a White or Green build-up within the connector body or between terminals. This causes high terminal resistance, intermittent contact, or an open circuit. An underhood or underbody connector that shows signs of contamination should be replaced in its entirety: terminals, seals, and connector body.
3. Using an equivalent male terminal from the terminal repair kit, test that the retention force is significantly different between a good terminal and a suspect terminal. Replace the female terminal in question.

Flat Wire (Dock & Lock) Connectors

There are no serviceable parts for flat wire (dock and lock) connectors on the harness side or the component side. Follow the procedure below in order to test terminal contact.

1. Remove the component in question.

2002 Cadillac Escalade

2002 STARTING & CHARGING SYSTEMS Starters - Avalanche, Escalade, Escalade EXT, Sierra, Silverado, Suburban, Tahoe, Yukon & Yukon XL

2. Visually inspect each side of the connector for signs of contamination. Avoid touching either side of the connector as oil from your skin may be a source of contamination as well.
3. Visually inspect the terminal bearing surfaces of the flat wire circuits for splits, cracks, or other imperfections that could cause poor terminal contact. Visually inspect the component side connector to ensure that all of the terminals are uniform and free of damage or deformation.
4. Insert the appropriate adapter from the flat-wire probe adapter on the flat wire harness connector in order to test the circuit in question.

SYSTEM TESTS

WARNING: Vehicles are equipped with air bag supplemental restraint system. Before attempting any repairs involving steering column, instrument panel or related components, see the following applicable procedures:

- For pickups, see AIR BAG SAFETY PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM .
- For utility vehicles, see AIR BAG SAFETY PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM .

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES before disconnecting battery.

NOTE: The following tests assume that engine and battery are operating normally and are at normal operating temperature, battery is charged, there are no engine problems that would cause a no-start condition, and no diagnostic trouble codes are present.

SYMPTOM INDEX

Symptom	Perform Test
Starter Solenoid Does Not Click	<u>A</u>
Starter Solenoid Clicks, Engine Does Not Crank	<u>B</u>
Engine Cranks Slowly	<u>C</u>
Starter Noise Diagnosis	<u>D</u>

TEST A: STARTER SOLENOID DOES NOT CLICK

NOTE: The procedures within this test may refer to wiring information. When performing a test or repair on the systems wiring, see WIRING DIAGRAMS .

1. Did you perform the DIAGNOSTIC SYSTEM CHECK (ENGINE ELECTRICAL)? If yes, proceed to next step. If no, see DIAGNOSTIC SYSTEM CHECK (ENGINE ELECTRICAL) .

2002 Cadillac Escalade

2002 STARTING & CHARGING SYSTEMS Starters - Avalanche, Escalade, Escalade EXT, Sierra, Silverado, Suburban, Tahoe, Yukon & Yukon XL

2. Turn the ignition switch to the START position. Does the engine crank? If yes, see **INTERMITTENT OR POOR CONNECTIONS** . If no, proceed to next step.
3. Turn the ignition switch to the START position. Does the starter motor relay click? If yes, go to step 7 . If no, proceed to next step.
4. Remove the starter motor relay. Connect a test light from the supply voltage circuit of the starter motor relay coil circuit to ground. With the transmission in park, or clutch pedal depressed, turn the ignition switch to the START position. Does the test light illuminate? If yes, proceed to next step. If no, go to step 6 .
5. Connect a test light from the supply voltage circuit of the starter motor relay coil circuit to the control circuit of the starter motor relay coil circuit. With the transmission in park, or clutch pedal depressed, turn the ignition switch to the START position. Does the test light illuminate? If yes, go to step 13 . If no, go to step 10 .
6. Turn off ignition. Disconnect the Park Neutral Position (PNP) switch.
 - For Allison transmission, see **PARK/NEUTRAL POSITION SWITCH** .
 - For automatic transmission, see **PARK/NEUTRAL POSITION SWITCH** .
 - For manual transmission, see **CLUTCH START SWITCH** .

Turn on ignition, with engine off. Connect a 10 amp fused jumper between the starter motor relay coil control circuits of the PNP switch or clutch pedal position switch. With the transmission in park, or clutch pedal depressed, turn the ignition switch to the START position. Does the test lamp illuminate? If yes, go to step 14 . If no, go to step 11 .

7. Turn off ignition. Disconnect the starter motor relay. Connect a test lamp between the battery positive voltage circuit of the starter motor relay switch circuit and a good ground. Does the test lamp illuminate? If yes, proceed to next step. If no, go to step 17 .
8. Connect a 30 amp fused jumper between the battery positive voltage circuit of the starter motor relay switch circuit and the supply voltage circuit of the starter solenoid. Does the engine crank? If yes, go to step 13 . If no, proceed to next step.
9. Does the fuse in the jumper open? If yes, go to step 18 . If no, go to step 12 .
10. Test the control circuit of the starter motor relay for an open or high resistance. Did you find and correct the condition? If yes, go to step 23 . If no, go to step 19 .
11. Test the supply voltage circuit of the starter motor relay coil circuit for an open or high resistance. Did you find and correct the condition? If yes, go to step 23 . If no, go to step 15 .
12. Test the supply voltage circuit of the starter solenoid for an open or high resistance. Did you find and correct the condition? If yes, go to step 23 . If no, go to step 16 .
13. Inspect for poor connections at the starter motor relay. Did you find and correct the condition? If yes, go to step 23 . If no, go to step 19 .
14. If equipped with an automatic transmission, inspect for poor connection at the PNP switch harness connector. If okay, perform the park/neutral position switch adjustment.
 - For automatic transmission, see **PARK/NEUTRAL POSITION SWITCH** .
 - For Allison transmission, see **PARK/NEUTRAL POSITION SWITCH** .

If equipped with a manual transmission, inspect for poor connection at the clutch pedal position switch harness connector. Did you find and correct the condition? If yes, go to step 23 . If no, go to step 20 .

15. Inspect for poor connections at the ignition switch harness connector. Did you find and correct the

2002 Cadillac Escalade

2002 STARTING & CHARGING SYSTEMS Starters - Avalanche, Escalade, Escalade EXT, Sierra, Silverado, Suburban, Tahoe, Yukon & Yukon XL

condition? If yes, go to step 23 . If no, go to step 21 .

16. Inspect for poor connections at the starter solenoid. Did you find and correct the condition? If yes, go to step 23 . If no, go to step 22 .
17. Repair the open or high resistance in the battery positive voltage circuit of the starter motor relay switch circuit. When complete, go to step 23 .
18. Repair the short to ground in the supply voltage circuit of the starter solenoid. When complete, go to step 23 .
19. Replace the Starter Relay. When complete, go to step 23 .
20. Replace the PNP switch. Replace the clutch pedal position switch.
 - For Allison transmission, see **PARK/NEUTRAL POSITION SWITCH** .
 - For automatic transmission, see **PARK/NEUTRAL POSITION SWITCH** .
 - For manual transmission, see **CLUTCH PEDAL REPLACEMENT** .

When complete, go to step 23 .

21. Replace the ignition switch. When complete, go to step 23 .
22. Replace the starter. See **STARTER** . When complete, proceed to next step.
23. Operate the system for which the symptom occurred. Did you correct the condition? If yes, system is okay. If no, go to step 2 .

TEST B: STARTER SOLENOID CLICKS, ENGINE DOES NOT CRANK

For testing procedures, see **Fig. 5** .

2002 Cadillac Escalade

2002 STARTING & CHARGING SYSTEMS Starters - Avalanche, Escalade, Escalade EXT, Sierra, Silverado, Suburban, Tahoe, Yukon & Yukon XL

Step	Action	Yes	No
<i>For circuit reference, see WIRING DIAGRAMS.</i>			
1	Did you perform the Engine Electrical Diagnostic System Check?	Go to Step 2	Go to ENGINE ELECTRICAL DIAGNOSTIC SYSTEM CHECK under SELF-DIAGNOSTIC SYSTEM
2	Turn the ignition to the START position. Did the starter solenoid click?	Go to Step 3	Go to STARTER SOLENOID DOES NOT CLICK
3	Inspect the engine and belt drive system for mechanical binding (seized engine, seized generator). Does the engine move freely?	Go to Step 4	Go to GASOLINE ENGINE - MECHANICAL TROUBLE SHOOTING under ENGINE MECHANICAL in BASIC TROUBLE SHOOTING article in GENERAL INFORMATION
4	Test the battery positive cable between the battery and the starter solenoid for high resistance. Did you find and correct the condition?	Go to Step 8	Go to Step 5
5	Test the ground circuit between the battery and the starter motor for a high resistance. Did you find and correct the condition?	Go to Step 8	Go to Step 6
6	Inspect for poor connections at the starter. See INTERMITTENT OR POOR CONNECTIONS under SELF-DIAGNOSTIC SYSTEM. Did you find and correct the condition?	Go to Step 8	Go to Step 7
7	Replace the starter. See STARTER MOTOR under REMOVAL & INSTALLATION. Did you complete the replacement?	Go to Step 8	--
8	Operate the system for which the symptom occurred. Did you correct the condition?	System OK	Go to Step 2

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Fig. 5: Testing Starter Solenoid Clicks, Engine Does Not Crank Symptom
Courtesy of GENERAL MOTORS CORP.

TEST C: ENGINE CRANKS SLOWLY

Perform the following checks:

- **Battery** - See **BATTERY TESTING & INSPECTION** .
- **Wiring** - Inspect the wiring for damage. Inspect all connections to the starter motor, solenoid, battery, and all ground connections. See **INTERMITTENT OR POOR CONNECTIONS** .
- **Engine** - Make sure the engine is not seized. See **GASOLINE ENGINE - MECHANICAL TROUBLE SHOOTING** .

If the battery, the wiring and the engine are functioning properly and the engine continues to crank slowly, replace the starter motor. See **STARTER** .

TEST D: STARTER NOISE DIAGNOSIS

2002 Cadillac Escalade

2002 STARTING & CHARGING SYSTEMS Starters - Avalanche, Escalade, Escalade EXT, Sierra, Silverado, Suburban, Tahoe, Yukon & Yukon XL

NOTE: Inspect the flywheel ring gear for damage or unusual wear.

NOTE: Shim the starter if applicable.

NOTE: In order to add pinion to ring gear clearance a full size shim must be used. Do not shim only one starter mounting bolt. There are 3 shims available in different shapes for clearance. All are 0.039" (1 mm) thick.

1. Did you preform the **DIAGNOSTIC SYSTEM CHECK (ENGINE ELECTRICAL)**? If yes, proceed to next step. If no, see **DIAGNOSTIC SYSTEM CHECK (ENGINE ELECTRICAL)** .
2. Start the engine. Does the starter operate normally? If yes, see **INTERMITTENT OR POOR CONNECTIONS** . If no, proceed to next step.
3. Start the engine while listening to the starter motor turn. Is there a loud "whoop" which may sound like a siren if the engine is revved while the starter is engaged after the engine starts, but while the starter is still held in the engaged position? If yes, go to step 6 . If no, proceed to next step.
4. Do you hear a "rumble", a "growl", or, in some cases, a "knock" as the starter is coasting down to a stop after starting the engine? If yes, go to step 7 . If no, proceed to next step.
5. This is often diagnosed as a starter drive gear hang-in or a weak solenoid. When the engine is cranked, do you hear a high-pitched whine after the engine cranks and starts normally? If yes, go to step 8 . If no, go to step 7 .
6. Inspect the flywheel ring gear for chipped gear teeth, missing gear teeth or milled teeth. Is the flywheel bent, or does it have damaged teeth? If yes, go to step 9 . If no, go to step 10 .
7. Remove the starter motor. See **STARTER** . Inspect the starter motor bushings and clutch gear. Does the clutch gear have chipped or milled teeth or worn bushings? If yes, go to step 10 . If no, go to step 9 .
8. Shim the starter motor away from the flywheel by adding shims between the starter motor and the engine block one at a time. Flywheel runout may make this noise appear to be intermittent. When complete, go to step 11 .
9. Replace the flywheel. See **ENGINE FLYWHEEL** in **ENGINE MECHANICAL**. When complete, go to step 11 .
10. Replace the starter motor. See **STARTER** . When complete, proceed to next step.
11. Operate the system in order to verify the repair. Did you correct the condition? If yes, system is okay. If no, go to step 3 .

BENCH TESTING

Information is not available from manufacturer. Starter is not serviceable and must be replaced as a single unit to repair.

REMOVAL & INSTALLATION

WARNING: Vehicles are equipped with air bag supplemental restraint system. Before attempting any repairs involving steering column, instrument panel or related components, see the following applicable procedures:

2002 Cadillac Escalade

2002 STARTING & CHARGING SYSTEMS Starters - Avalanche, Escalade, Escalade EXT, Sierra, Silverado, Suburban, Tahoe, Yukon & Yukon XL

- For pickups, see AIR BAG SAFETY PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM .
- For utility vehicles, see AIR BAG SAFETY PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM .

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES before disconnecting battery.

CAUTION: Use the correct fastener in the correct location. Replacement fasteners must be the correct part number for that application. Fasteners requiring replacement or fasteners requiring the use of thread locking compound or sealant are identified in the service procedure. Do not use paints, lubricants, or corrosion inhibitors on fasteners or fastener joint surfaces unless specified. These coatings affect fastener torque and joint clamping force and may damage the fastener. Use the correct tightening sequence and specifications when installing fasteners in order to avoid damage to parts and systems.

STARTER

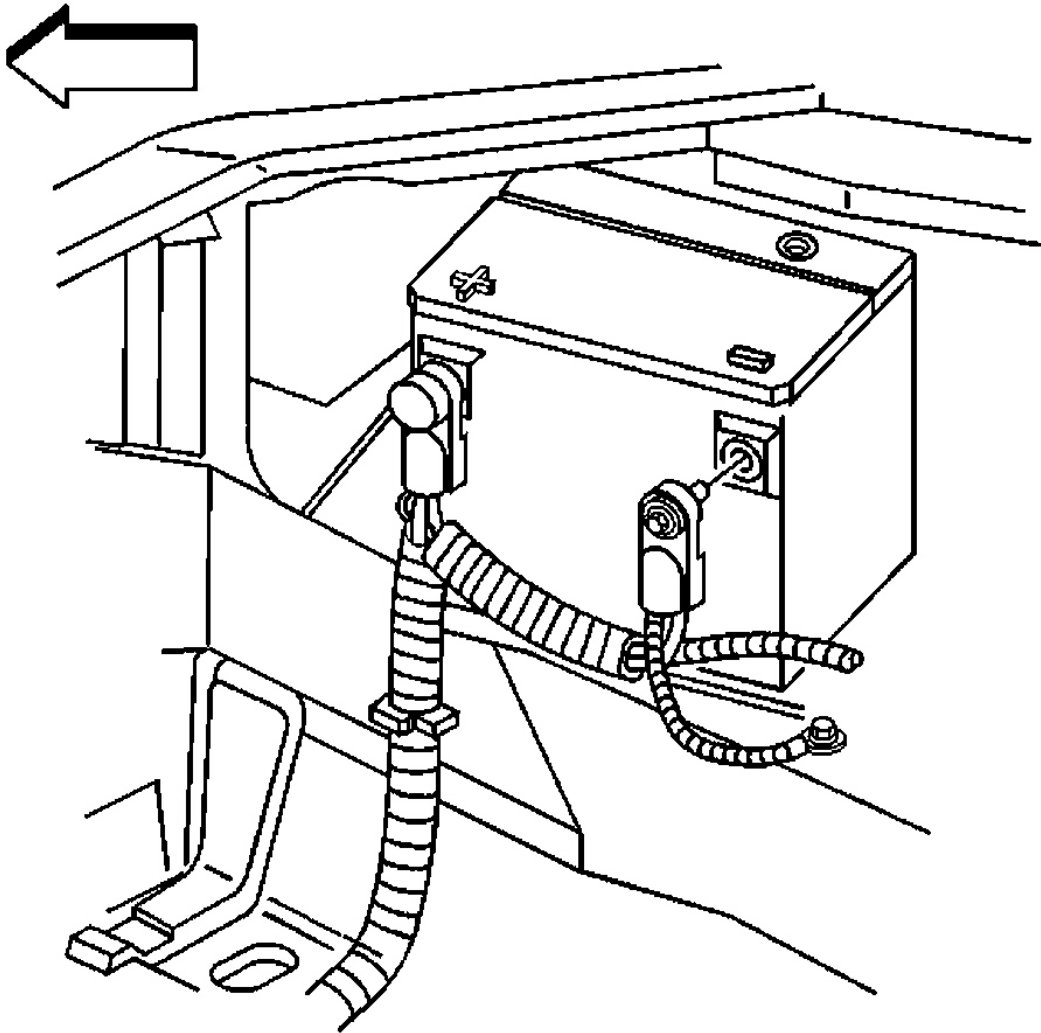
WARNING: Before servicing any electrical component, the ignition key must be in the OFF or LOCK position and all electrical loads must be OFF, unless instructed otherwise in these procedures. If a tool or equipment could easily come in contact with a live exposed electrical terminal, also disconnect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

Removal (4.3L Engine)

1. Turn off all lamps and accessories. Turn ignition off. Disconnect negative battery cable. See Fig. 6 .
2. Raise and suitably support vehicle.
3. Remove starter motor bolts. See Fig. 7 .
4. Remove starter lead nut.
5. Remove positive cable from starter.
6. Remove starter solenoid nut. See Fig. 8 .
7. Remove harness from starter.
8. Remove starter from vehicle.

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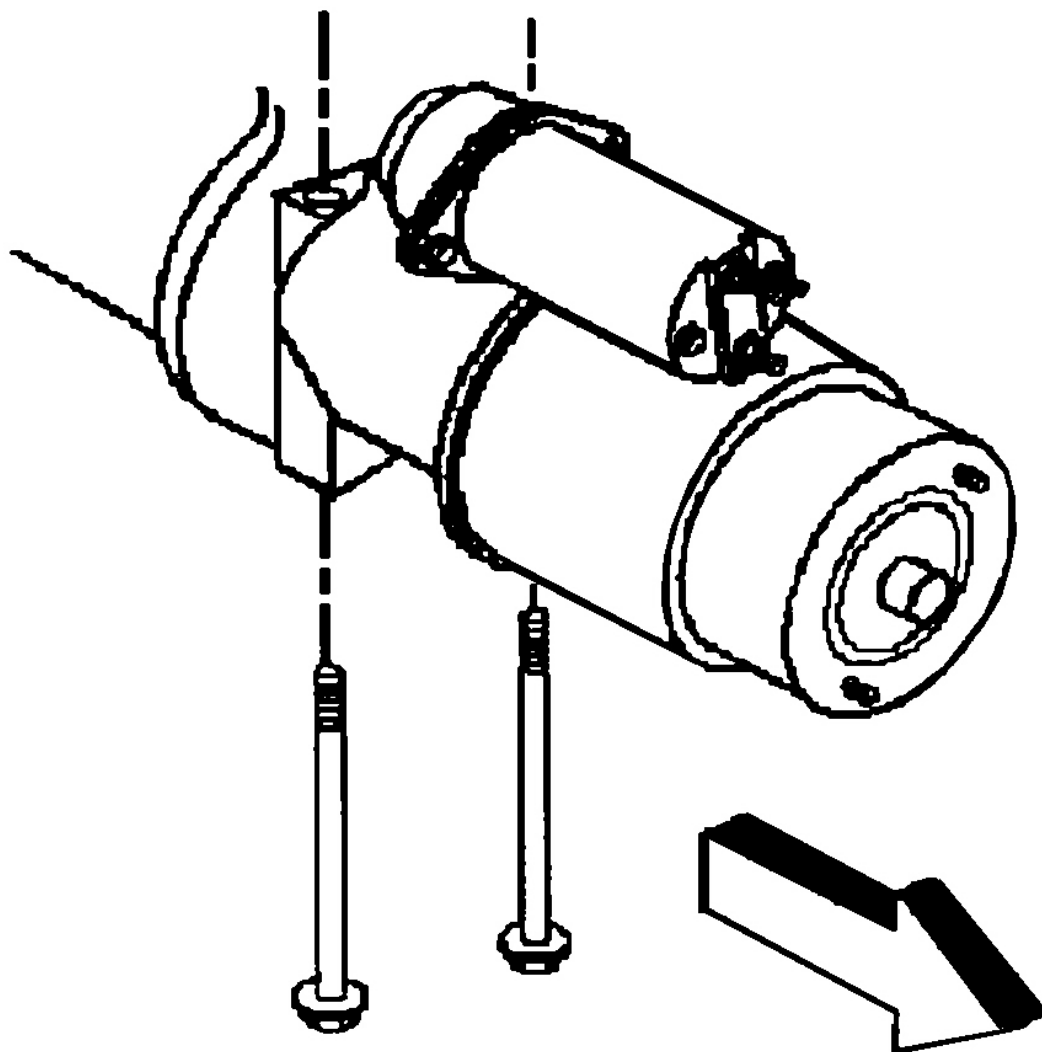


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Fig. 6: Disconnecting Negative Battery Cable
Courtesy of GENERAL MOTORS CORP.

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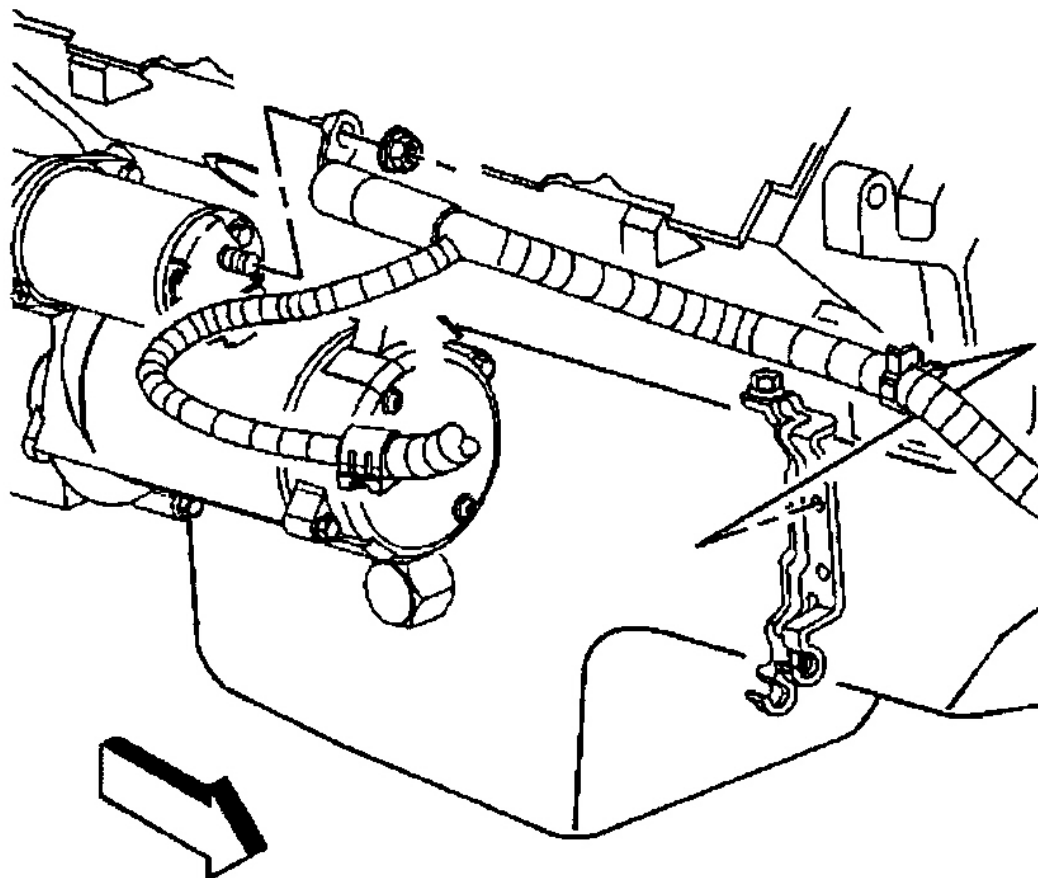


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Fig. 7: Removing Starter Motor Bolts
Courtesy of GENERAL MOTORS CORP.

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G00357905

Fig. 8: Removing Starter Solenoid Nut
Courtesy of GENERAL MOTORS CORP.

Removal (4.8L, 5.3L & 6.0L Engine)

1. Turn off all lamps and accessories. Turn ignition off. Disconnect negative battery cable. See **Fig. 6** .
2. Raise and suitably support vehicle.
3. Remove transmission cover bolt. See **Fig. 9** .
4. Remove front axle mounting bracket nut. See **Fig. 10** .

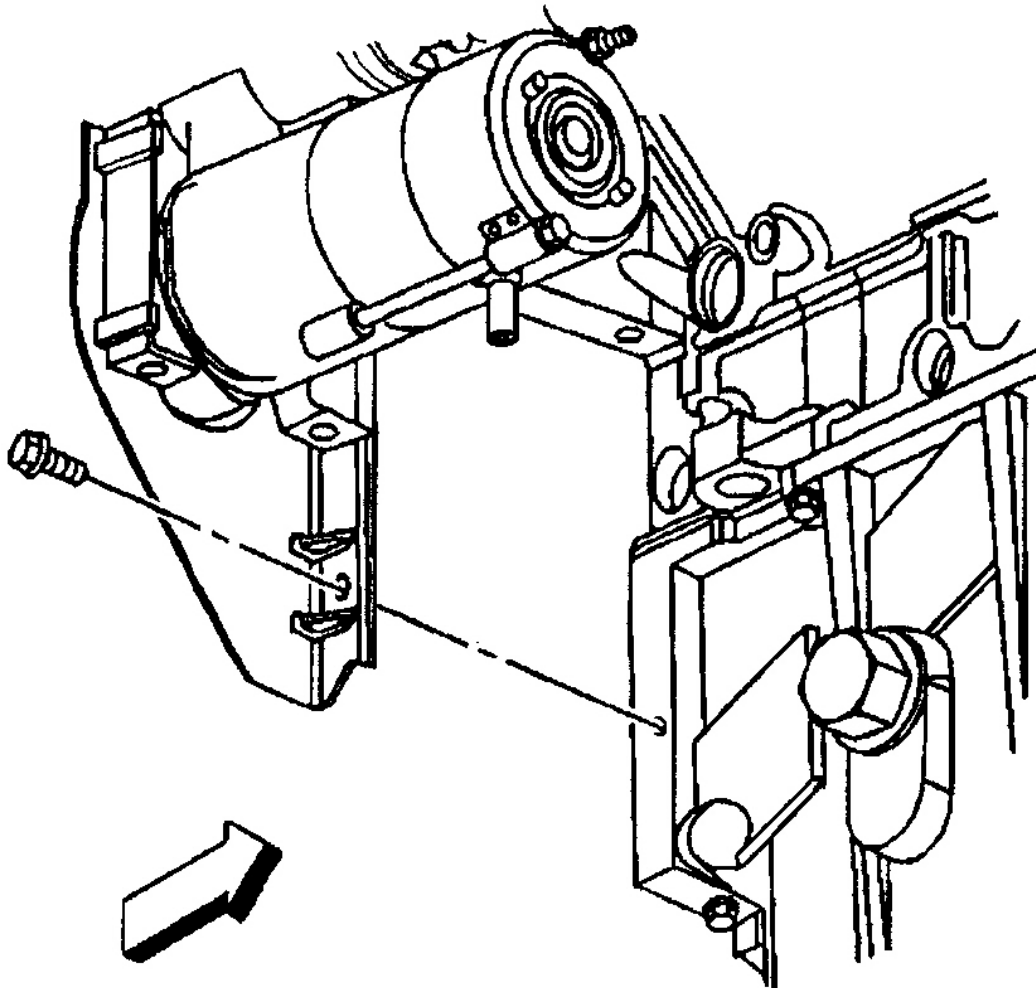
NOTE: Do not remove bolt.

5. Reposition front axle mounting bracket bolt until bolt tip is flush with support bushing.
6. Remove starter bolts. See **Fig. 11** .

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7. Disconnect oil level sensor electrical connector.
8. Slide starter forward until starter clears transmission.
9. Remove starter lead nut. See **Fig. 12**.
10. Remove starter lead from starter.
11. Remove positive cable nut. See **Fig. 13**.
12. Remove positive cable from starter.
13. Place starter on a workbench.
14. If necessary, unsnap transmission cover from starter. See **Fig. 14**.
15. If necessary, remove starter heat shield. See **Fig. 15**.



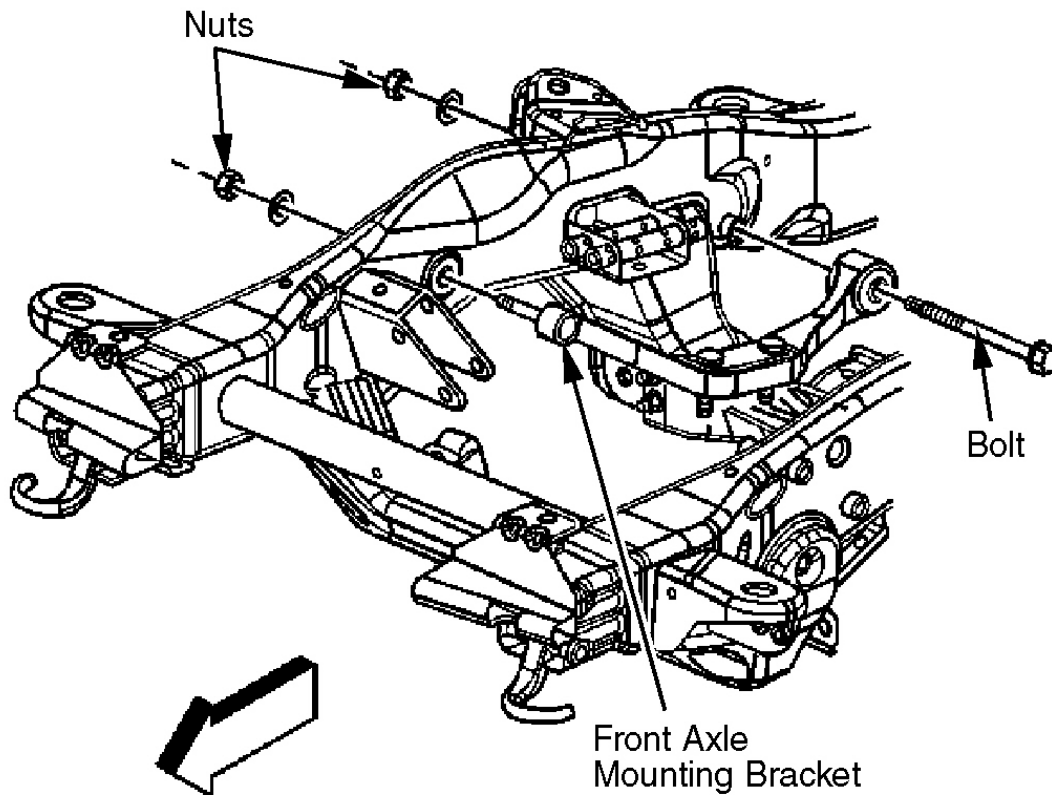
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Fig. 9: Removing Flywheel Cover Bolt

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Courtesy of GENERAL MOTORS CORP.

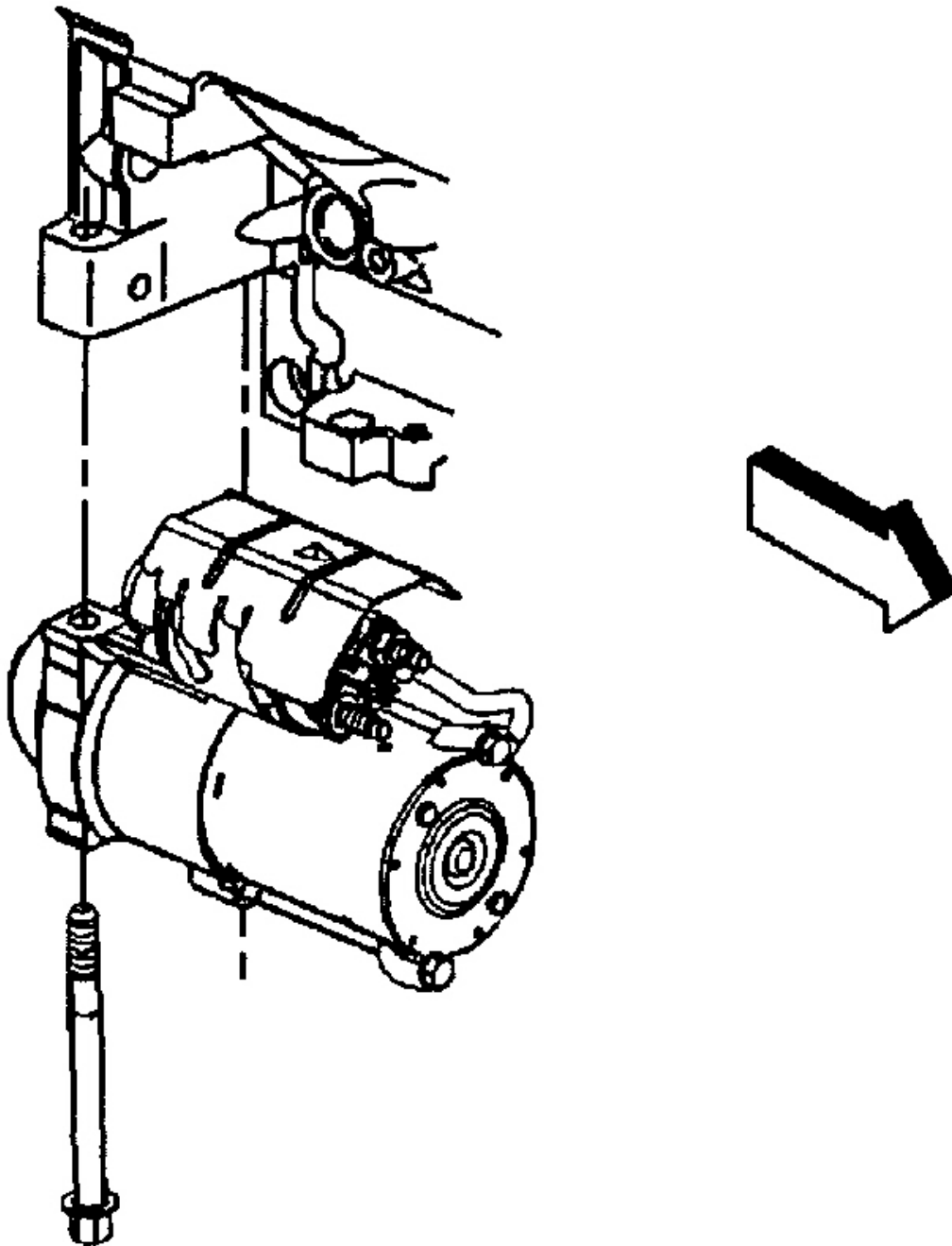


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Fig. 10: Identifying Front Axle Mounting Bracket
Courtesy of GENERAL MOTORS CORP.

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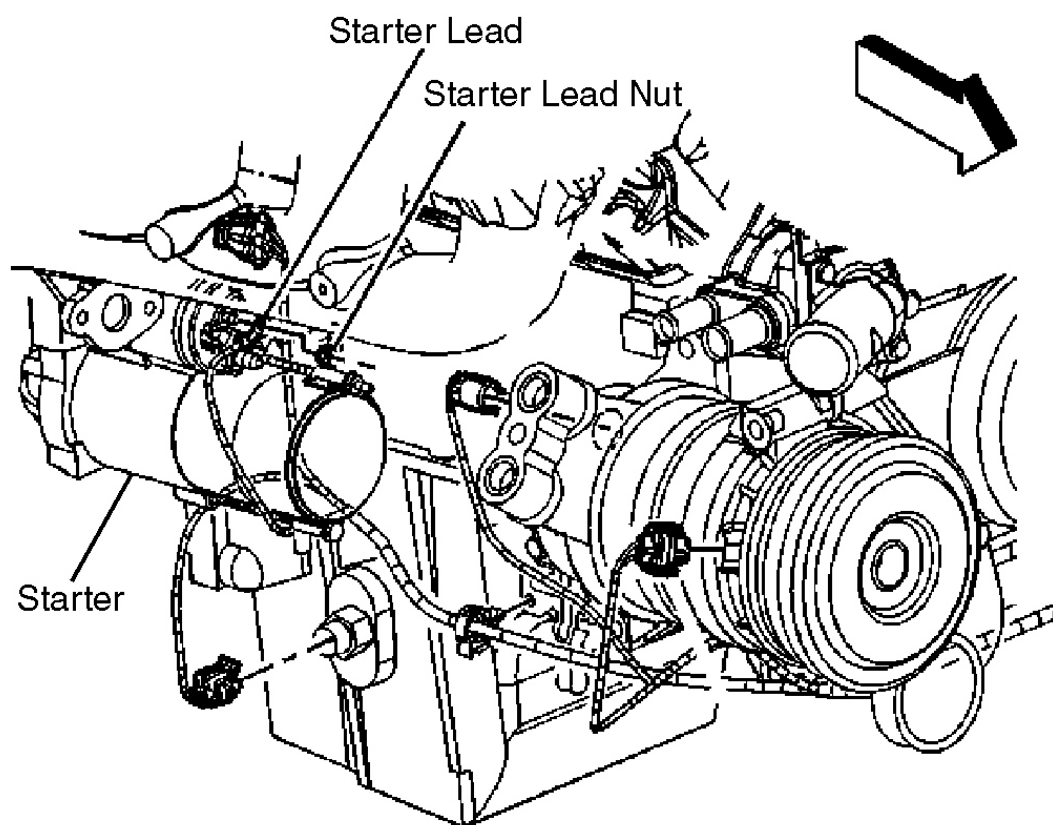


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Fig. 11: Removing/Installing Starter Bolts
Courtesy of GENERAL MOTORS CORP.

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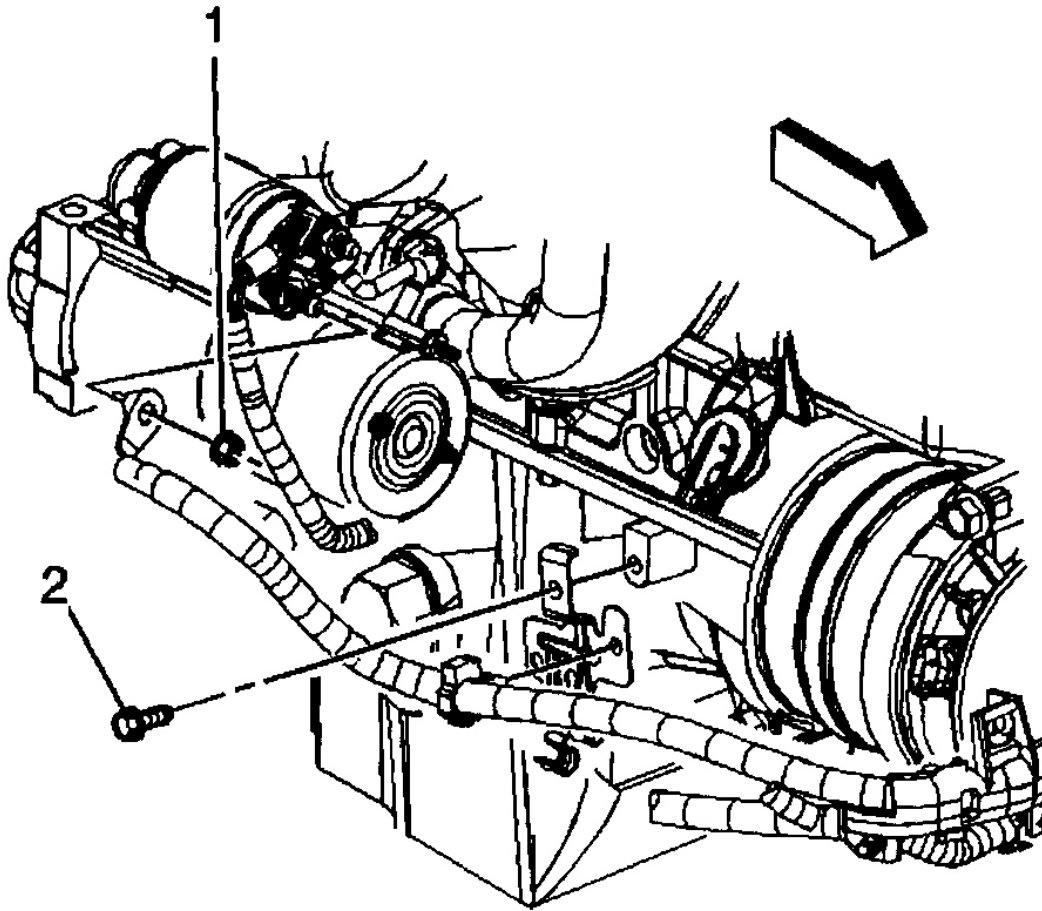
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Fig. 12: Identifying Starter Lead

Courtesy of GENERAL MOTORS CORP.

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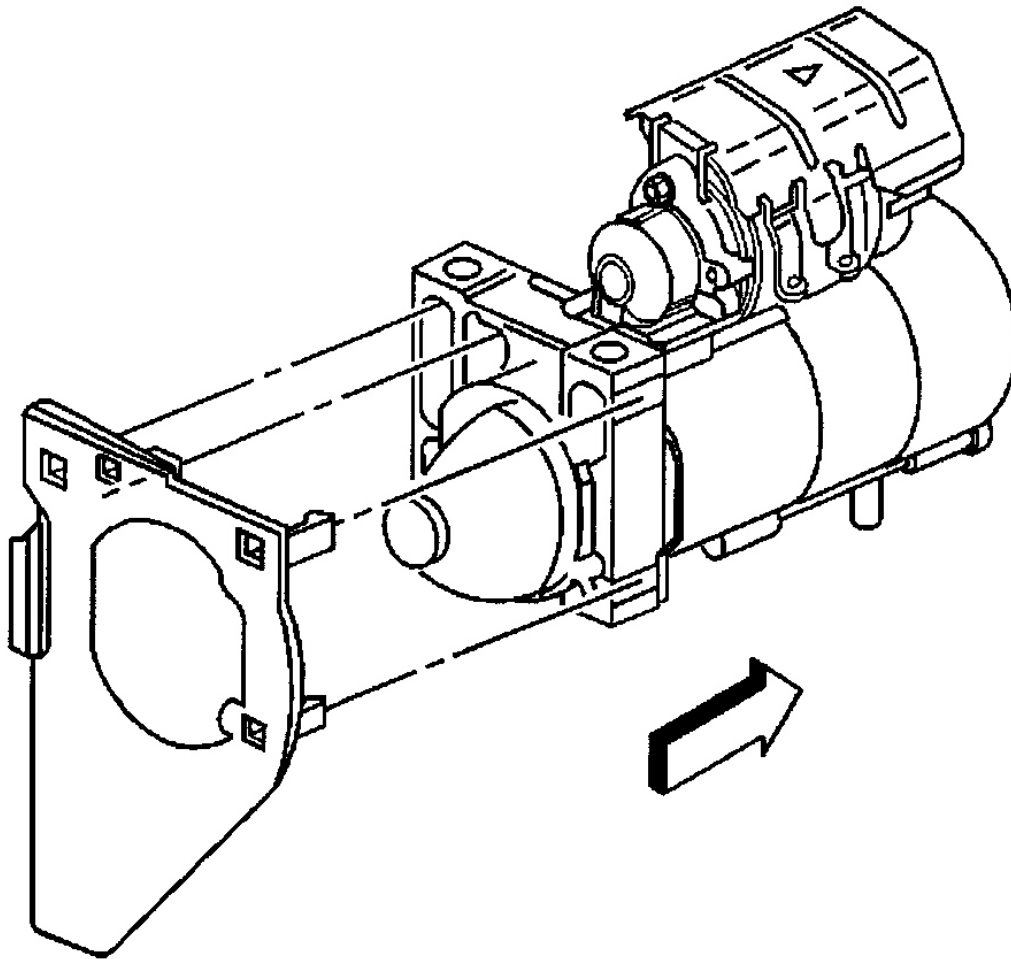


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Fig. 13: Removing Positive Cable Nut
Courtesy of GENERAL MOTORS CORP.

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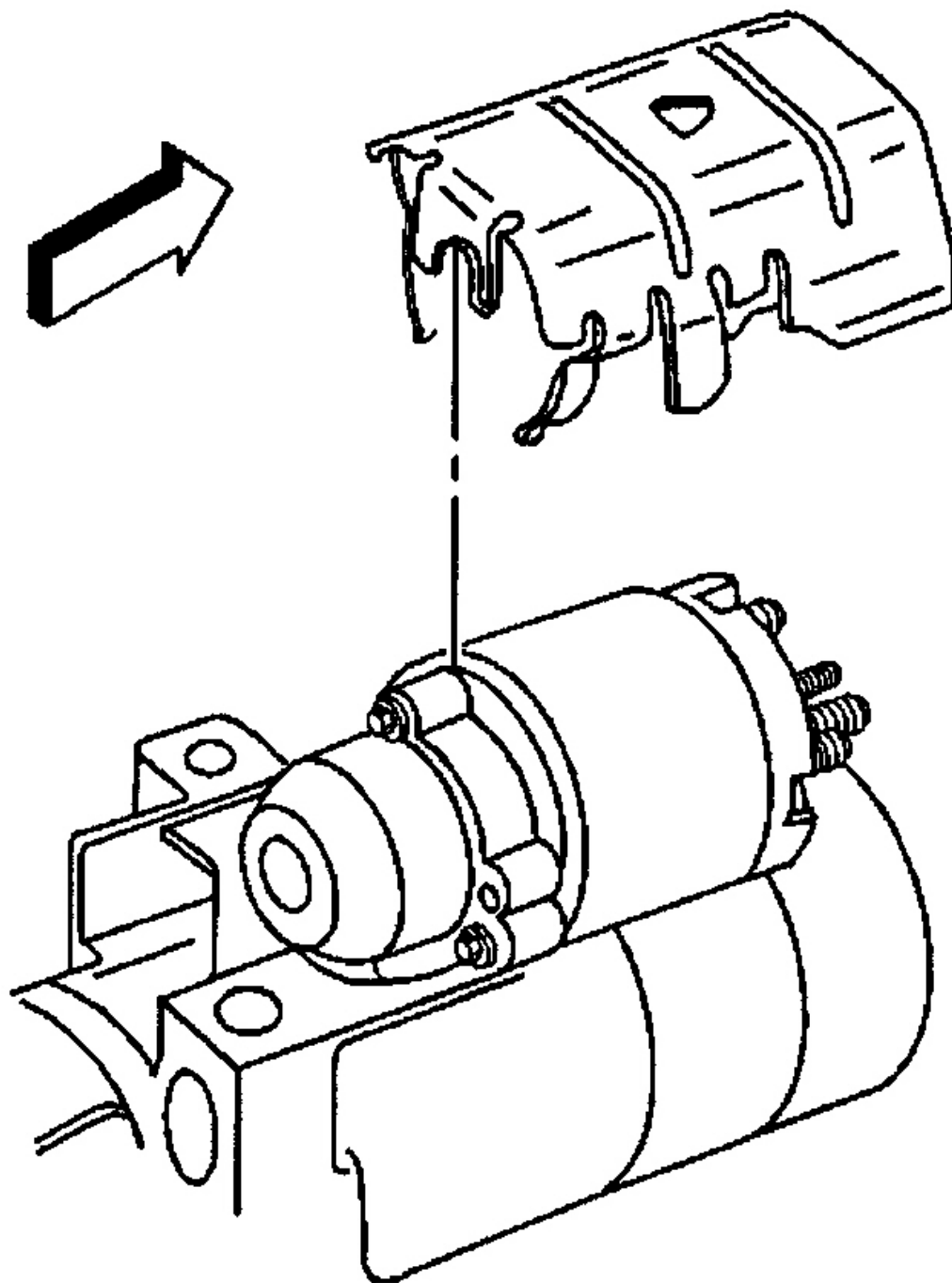


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Fig. 14: Unsnapping Transmission Cover From Starter
Courtesy of GENERAL MOTORS CORP.

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Fig. 15: Removing Starter Shield

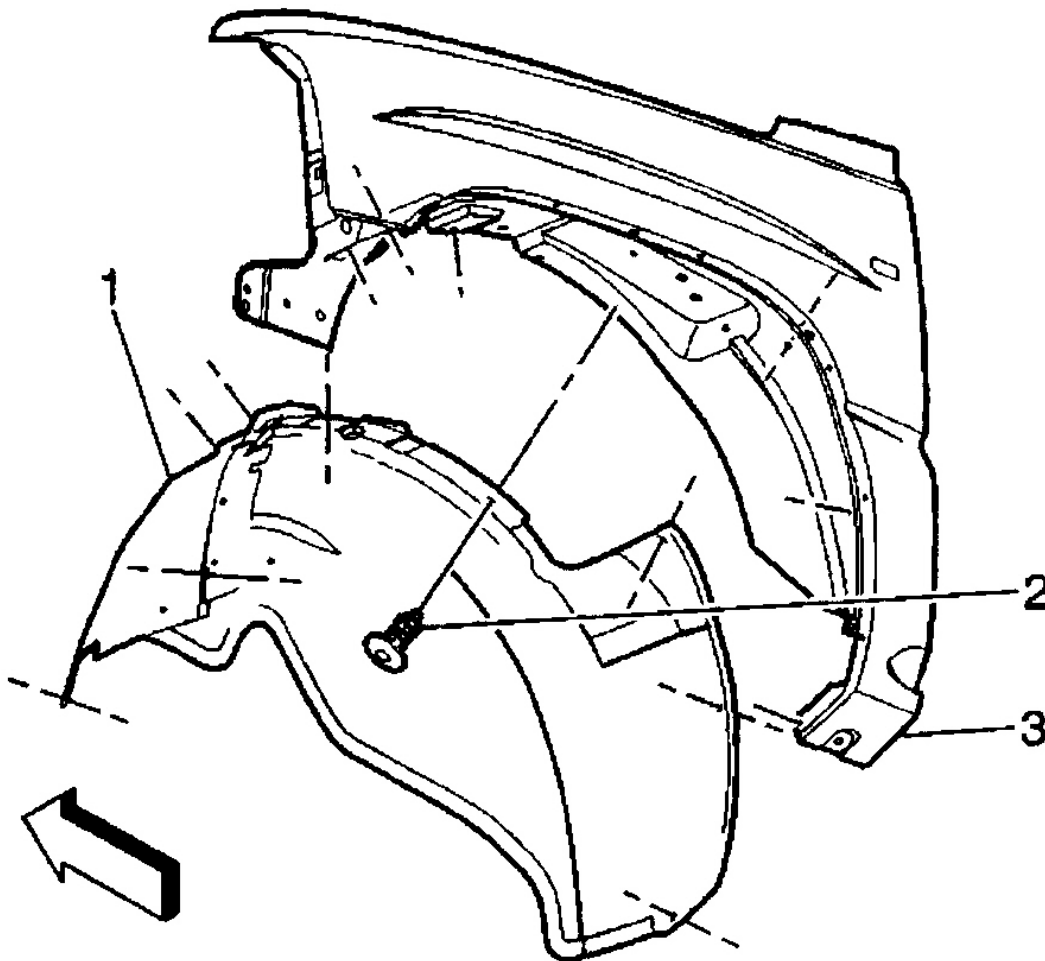
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Courtesy of GENERAL MOTORS CORP.

Removal (6.6L Engine)

1. Turn off all lamps and accessories. Turn ignition off. Disconnect negative battery cable. See **Fig. 6**.
2. Raise the vehicle.
3. If equipped with 4WD, remove the right front tire and wheel.
4. If equipped with 4WD, remove the right front fender wheelhouse inner panel. See **Fig. 16**.
5. Remove the battery positive cable from the starter motor. See **Fig. 17**.
6. Remove the solenoid wires.
7. Remove the starter motor bolts. See **Fig. 18**.
8. Remove the starter motor assembly.

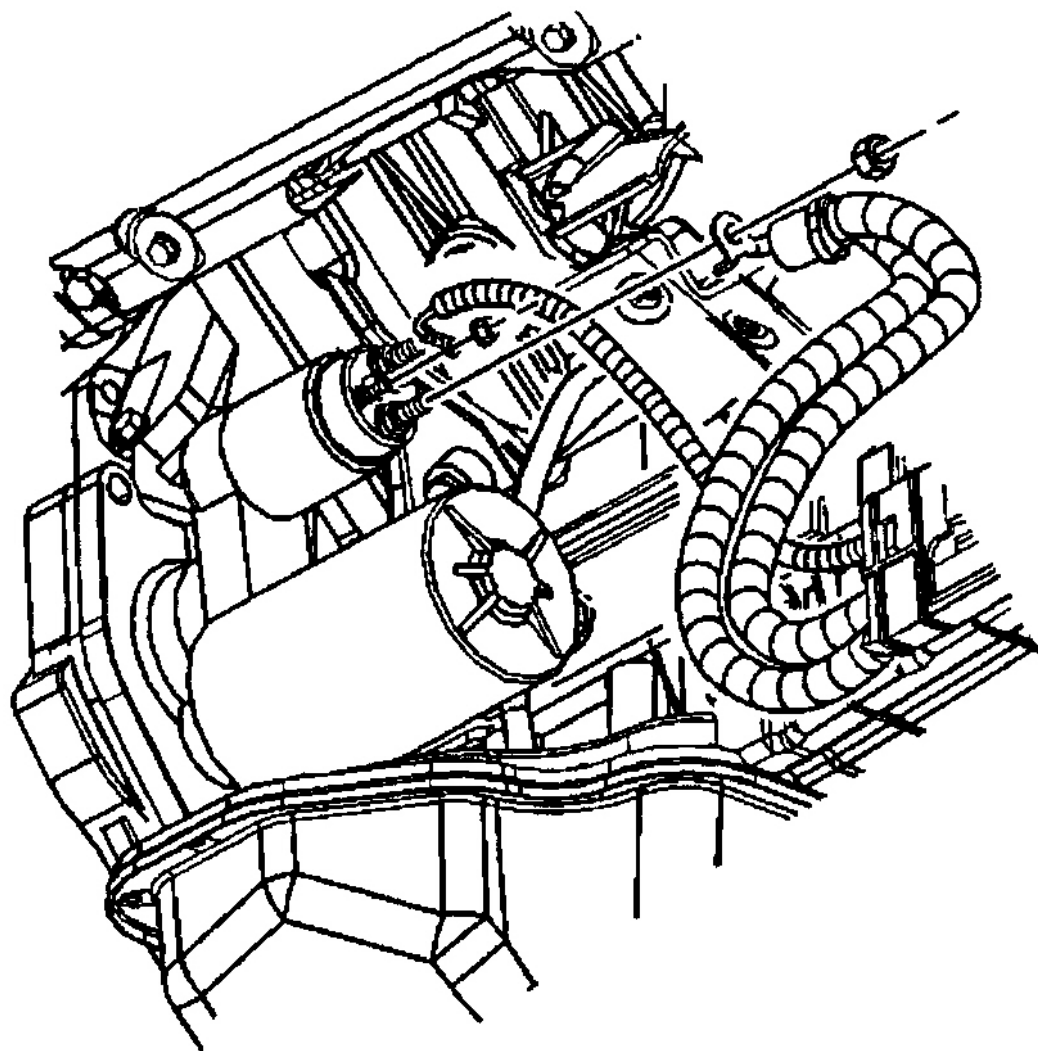


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Fig. 16: Removing RF Fender Wheelhouse Inner Panel
Courtesy of GENERAL MOTORS CORP.

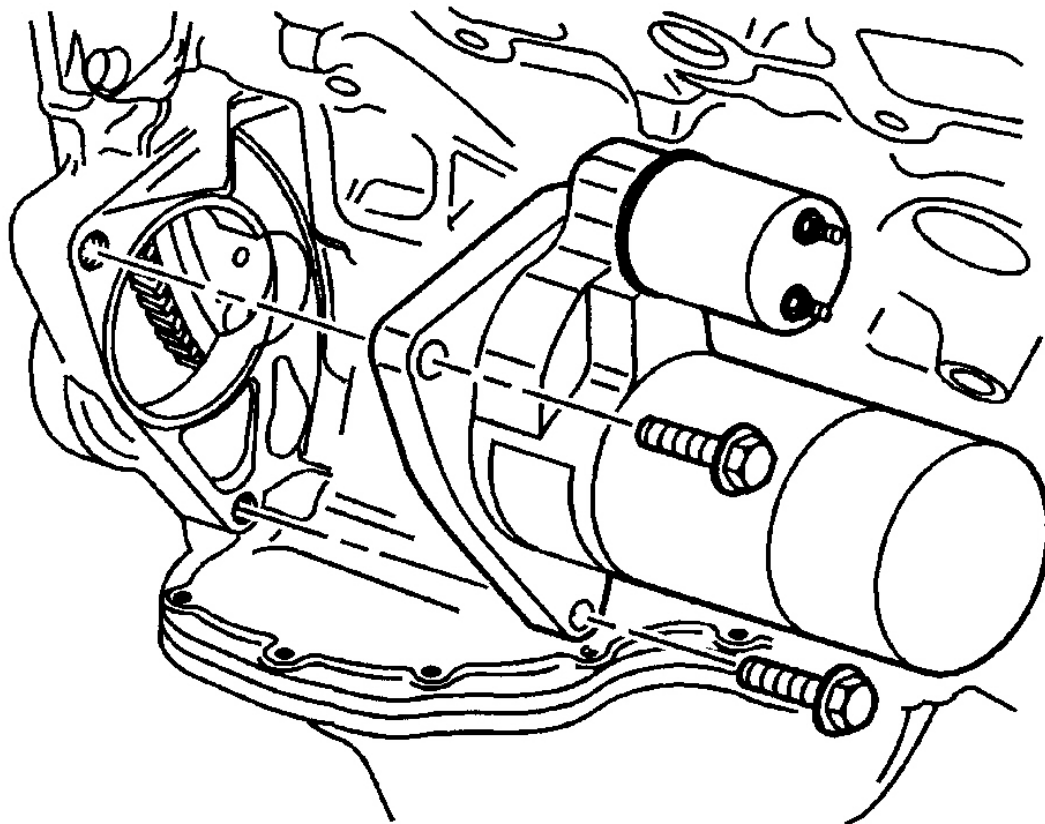


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Fig. 17: Removing Starter Battery Positive Cable
Courtesy of GENERAL MOTORS CORP.

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Fig. 18: Removing Starter Motor Bolts
Courtesy of GENERAL MOTORS CORP.

Removal (8.1L Engine)

1. Turn off all lamps and accessories. Turn ignition off. Disconnect negative battery cable. See **Fig. 6** .
2. Raise and suitably support the vehicle with safety stands.
3. If necessary, remove the engine shield bolts and shield. See **Fig. 19** .
4. If necessary, remove the oil pan skid plate bolts and plate. See **Fig. 20** .
5. Remove the front axle mounting bracket nut. See **Fig. 10** .

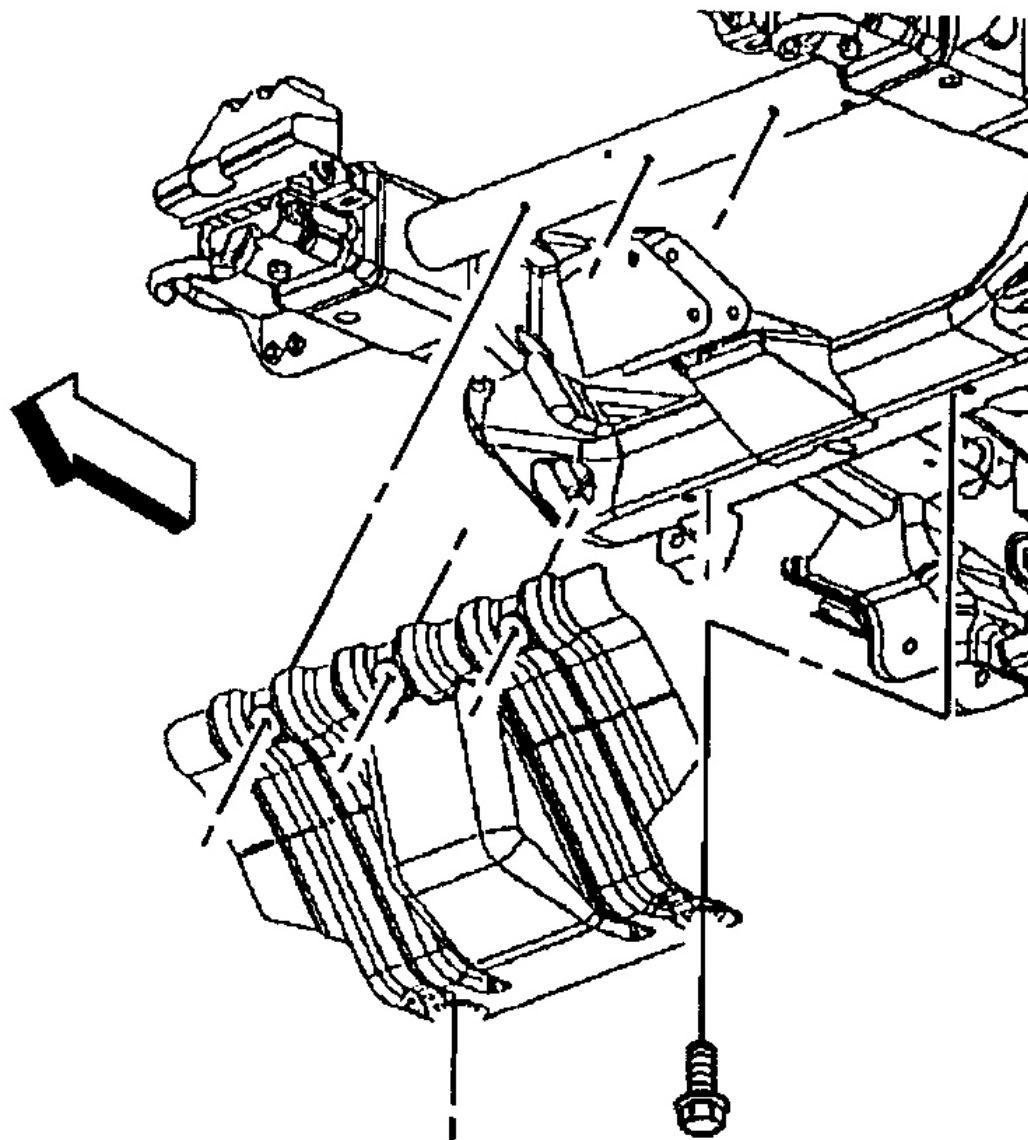
NOTE: **Do not remove the bolt.**

6. Reposition the front axle mounting bracket bolt until the bolt tip is flush with the support bushing.
7. Remove the starter bolts. See **Fig. 21** .
8. Slide the starter forward until the starter clears the transmission.

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9. Remove the starter lead nut. See [Fig. 22](#) .
10. Remove the starter lead from the starter.
11. Remove the positive cable nut. See [Fig. 23](#) .
12. Remove the positive cable from the starter.
13. If necessary, remove the starter heat shield bolts, nut, and shield. See [Fig. 24](#) .



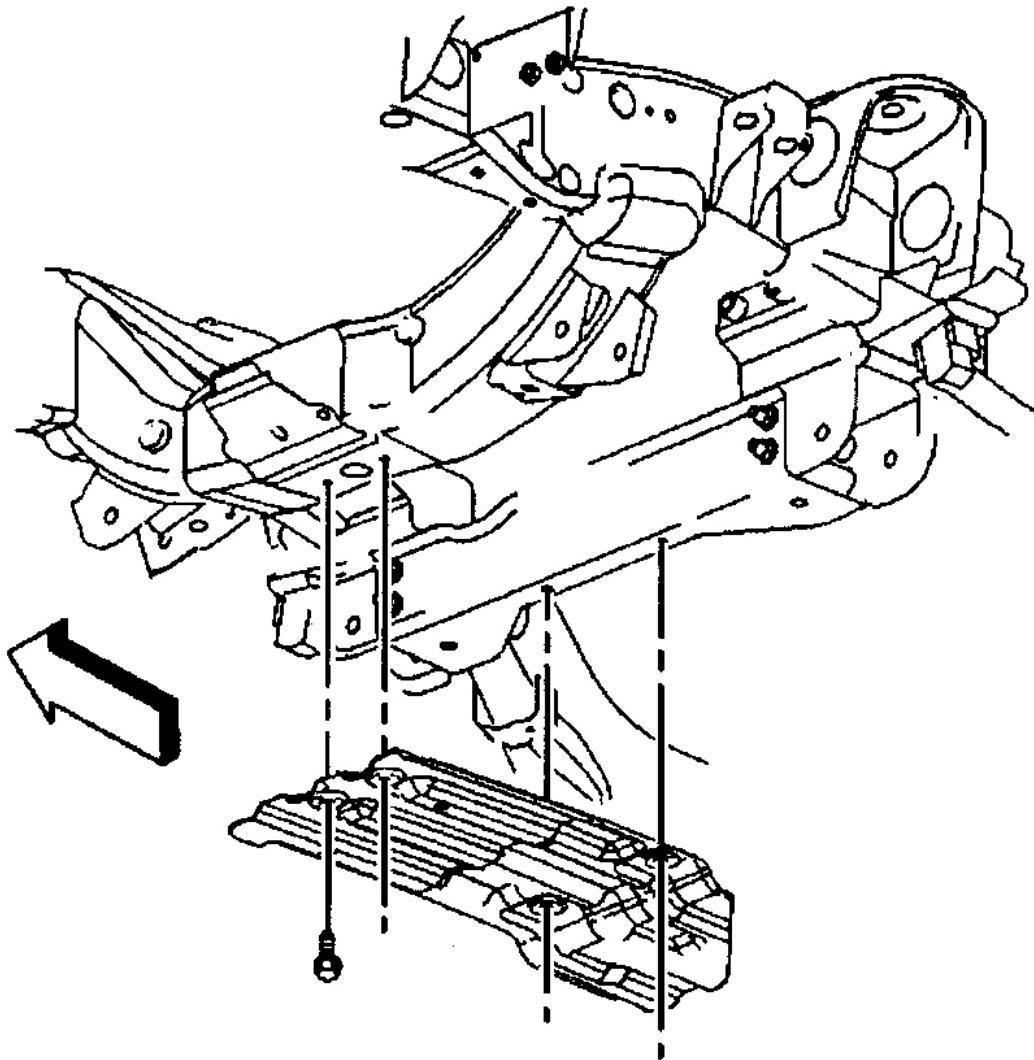
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Fig. 19: Installing Engine Shield & Bolts

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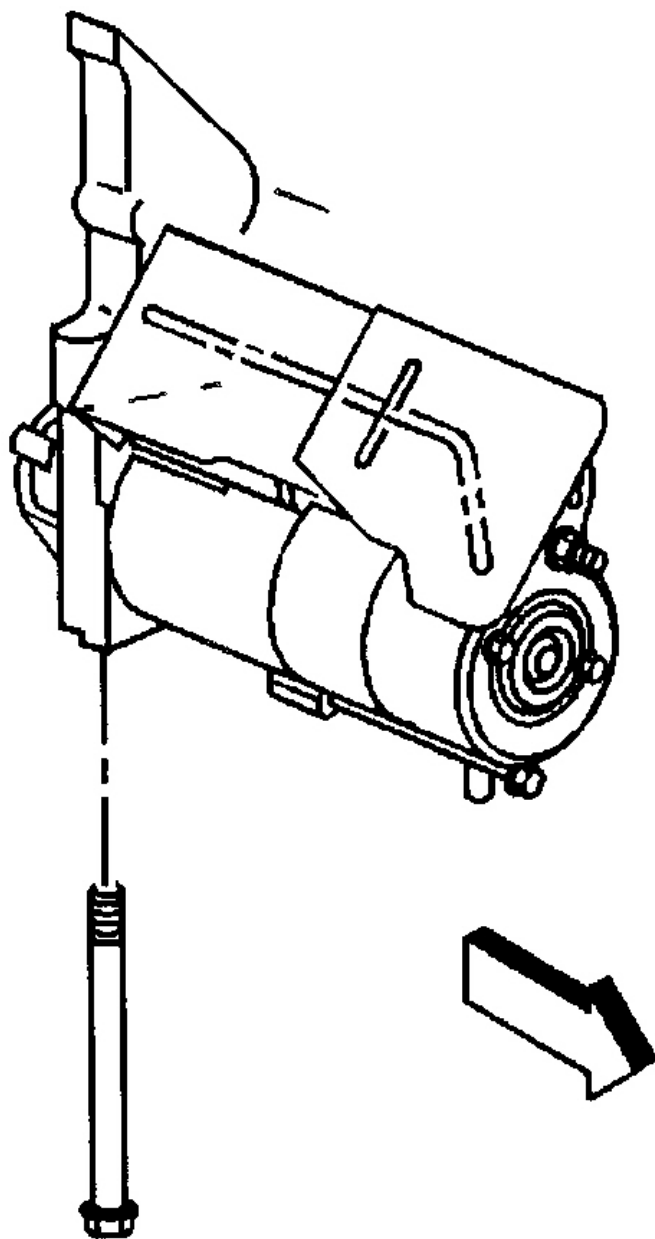


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Fig. 20: Installing Oil Pan Skid Plate Bolts
Courtesy of GENERAL MOTORS CORP.

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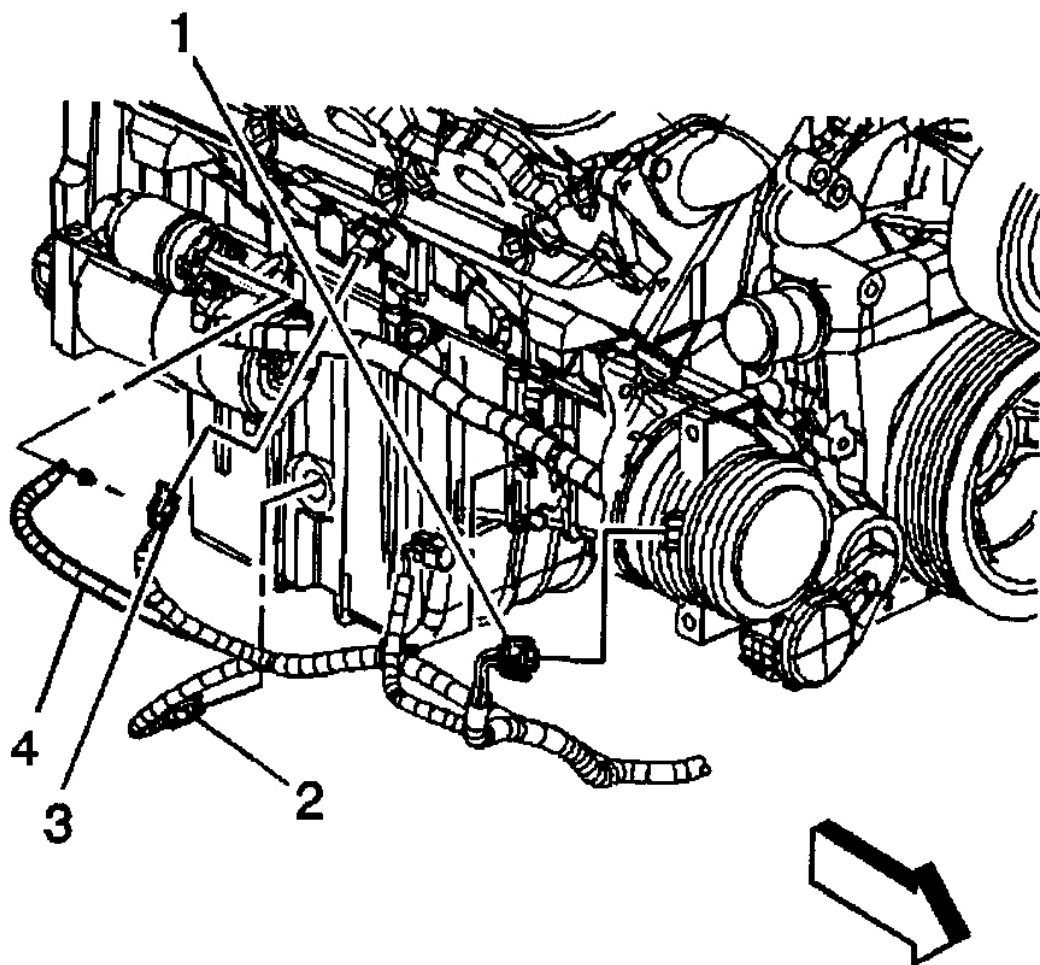


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Fig. 21: Removing Starter Bolts
Courtesy of GENERAL MOTORS CORP.

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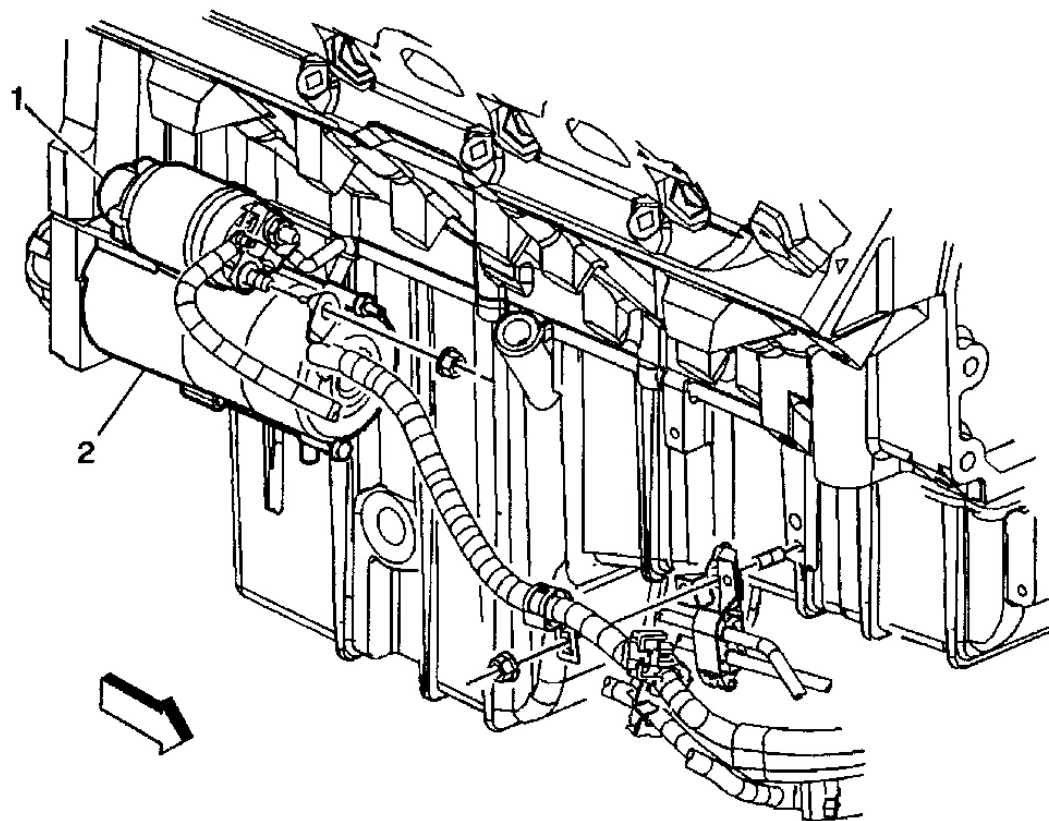


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Fig. 22: Removing Starter Lead Nut
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- (1) Starter Solenoid
- (2) Starter

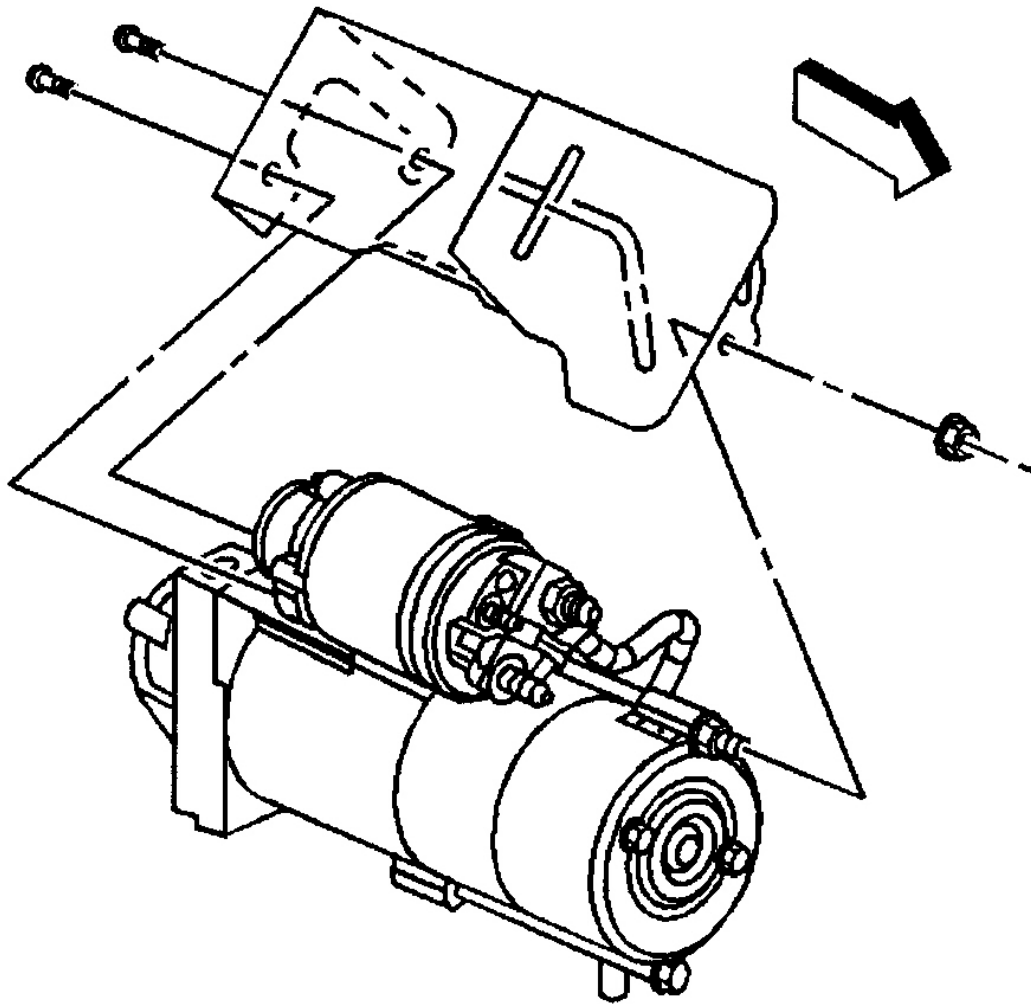
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Fig. 23: Locating Starter Motor

Courtesy of GENERAL MOTORS CORP.

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Fig. 24: Removing Starter Heat Shield
Courtesy of GENERAL MOTORS CORP.

Installation (4.3L Engine)

1. Install starter to vehicle. See **Fig. 8** .
2. Install harness to starter.
3. Install starter solenoid nut. Tighten starter solenoid nut to specification. See **TORQUE SPECIFICATIONS** .
4. Install positive cable to starter.
5. Install starter lead nut. Tighten starter lead nut to specification. See **TORQUE SPECIFICATIONS** .
6. Install starter motor bolts. See **Fig. 7** . Tighten starter motor bolts to specification. See **TORQUE**

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SPECIFICATIONS .

7. Lower the vehicle.

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

8. Connect negative battery cable. See Fig. 6 . Tighten battery terminal bolt to specification. See TORQUE SPECIFICATIONS .

Installation (4.8L, 5.3L & 6.0L Engine)

1. If necessary, install starter heat shield. See Fig. 15 .
2. If necessary, snap transmission cover to starter. See Fig. 14 .
3. Install positive cable to starter. See Fig. 13 .
4. Install positive cable nut. Tighten positive cable nut to specification. See TORQUE SPECIFICATIONS .
5. Install starter lead to starter. See Fig. 12 .
6. Install starter lead nut. Tighten starter lead nut to specification. See TORQUE SPECIFICATIONS .
7. Position starter into place. See Fig. 11 .
8. Install starter bolts. Tighten starter bolts to specification. See TORQUE SPECIFICATIONS .
9. Connect oil level sensor electrical connector.
10. Position front axle mounting bracket bolt until bolt is fully seated. See Fig. 10 .
11. Install front axle mounting bracket nut. Tighten front axle mounting bracket nut to specification. See TORQUE SPECIFICATIONS .
12. Install transmission cover bolt. See Fig. 9 . Tighten transmission cover bolt to specification. See TORQUE SPECIFICATIONS .
13. If necessary, install oil pan skid plate and bolts. See Fig. 20 . Tighten oil pan skid plate bolts to specification. See TORQUE SPECIFICATIONS .
14. If necessary, install engine shield and bolts. See Fig. 19 . Tighten engine shield bolts to specification. See TORQUE SPECIFICATIONS .
15. Lower vehicle.

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

16. Connect negative battery cable. See Fig. 6 . Tighten battery terminal bolt to specification. See TORQUE SPECIFICATIONS .

Installation (6.6L Engine)

1. Install the starter motor to the engine rear cover. See Fig. 18 .
2. Install the starter motor bolts. Tighten the starter bolts to specification. See TORQUE

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SPECIFICATIONS .

3. Install the solenoid wires. See **Fig. 17** .
4. Install the starter solenoid nut. Tighten the starter solenoid nut to specification. See **TORQUE SPECIFICATIONS** .
5. Install the battery positive cable to the solenoid stud.
6. Install the battery positive cable nut. Tighten the starter battery positive cable nut to specification. See **TORQUE SPECIFICATIONS** .
7. Install the right front fender wheelhouse inner panel, if equipped with 4WD. See **Fig. 16** .
8. Install the right front tire and wheel, if equipped with 4WD.
9. Lower the vehicle.

NOTE: **Clean any existing corrosion from battery terminal bolt flange and battery cable end.**

10. Connect negative battery cable. See **Fig. 6** . Tighten battery terminal bolt to specification. See **TORQUE SPECIFICATIONS** .

Installation (8.1L Engine)

1. If necessary, install the starter heat shield, nut and bolts. See **Fig. 24** .
 - Tighten the bolts to specification. See **TORQUE SPECIFICATIONS** .
 - Tighten the nut to specification. See **TORQUE SPECIFICATIONS** .
2. Install the positive cable to the starter. See **Fig. 23** .
3. Install the positive cable nut. Tighten the nut to specification. See **TORQUE SPECIFICATIONS** .
4. Install the starter lead to the starter. See **Fig. 22** .
5. Install the starter lead nut. Tighten the nut to specification. See **TORQUE SPECIFICATIONS** .
6. Position the starter into place. See **Fig. 21** .
7. Install the starter bolts. Tighten the bolts to specification. See **TORQUE SPECIFICATIONS** .
8. Position the front axle mounting bracket bolt until the bolt is fully seated. See **Fig. 10** .
9. Install the front axle mounting bracket nut. Tighten the nut to specification. See **TORQUE SPECIFICATIONS** .
10. If necessary, install the oil pan skid plate and bolts. See **Fig. 20** . Tighten the bolts to specification. See **TORQUE SPECIFICATIONS** .
11. If necessary, install the engine shield and bolts. See **Fig. 19** . Tighten the bolts to specification. See **TORQUE SPECIFICATIONS** .
12. Lower the vehicle.

NOTE: **Clean any existing corrosion from battery terminal bolt flange and battery cable end.**

13. Connect negative battery cable. See **Fig. 6** . Tighten battery terminal bolt to specification. See **TORQUE**

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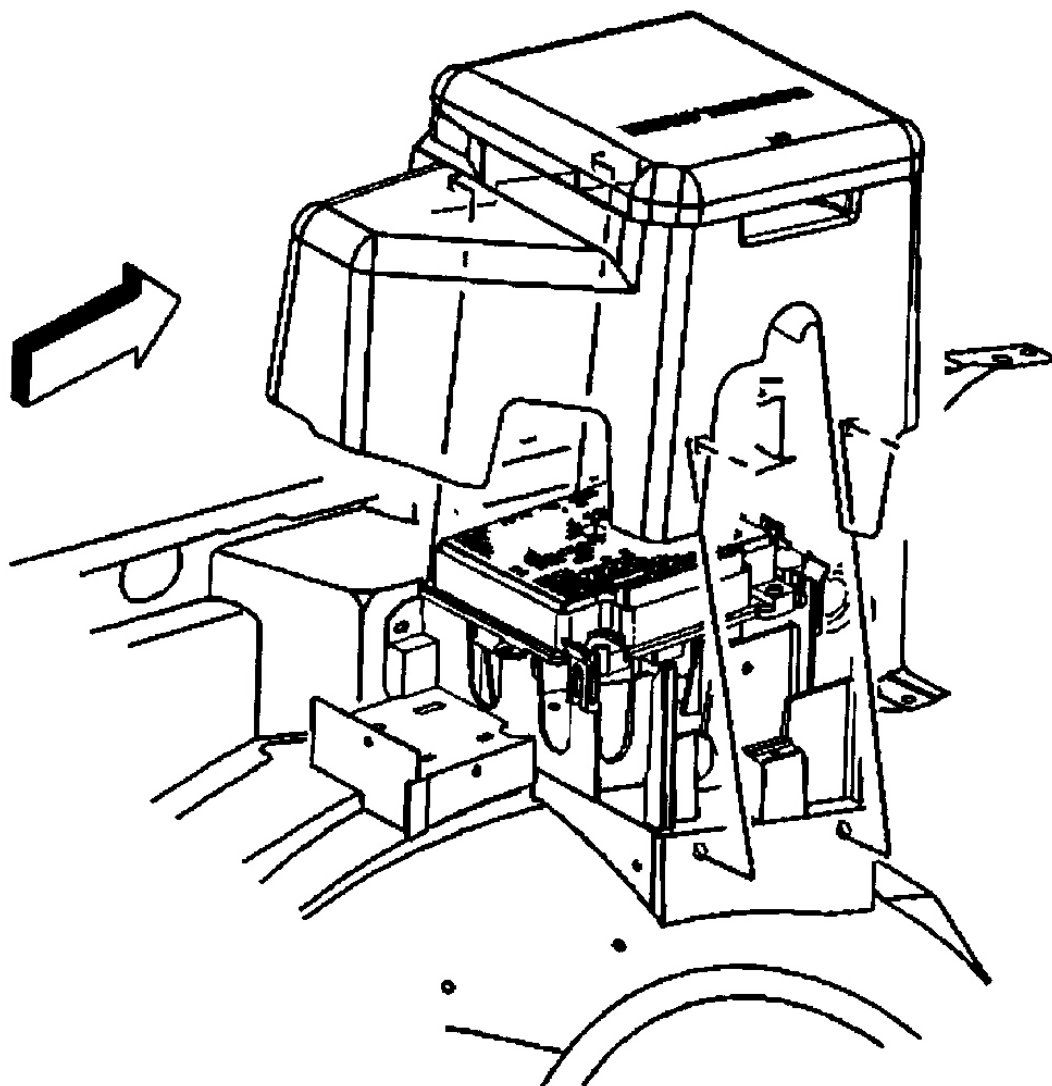
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SPECIFICATIONS .

STARTER RELAY

Removal & Installation

1. Remove the Underhood Bussed Electrical Center (UBEC) cover. See **Fig. 25** .
2. Remove the starter motor relay.
3. To install, insert the starter motor relay.
4. Install the UBEC cover. See **Fig. 25** .



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Fig. 25: Removing UBEC cover

Courtesy of GENERAL MOTORS CORP.

STARTER SHIELD

Removal

1. Remove the starter motor. See **STARTER** .
2. If equipped with a 4.8L, 5.3L, or 6.0L engine, remove the starter heat shield. See **Fig. 15** .
3. If equipped with a 8.1L engine, remove the starter heat shield bolts and nut. See **Fig. 24** .
4. Remove the starter heat shield.

Installation

1. If equipped with a 8.1L engine, install the starter heat shield. See **Fig. 24** .
2. Install the starter heat shield bolts, and nut.
 - Tighten the starter heat shield bolts to specification. See **TORQUE SPECIFICATIONS** .
 - Tighten the starter heat shield nut to specification. See **TORQUE SPECIFICATIONS** .
3. If equipped with a 4.8L, 5.3L, or 6.0L engine, install the starter heat shield. See **Fig. 15** .
4. Install the starter motor. See **STARTER** .

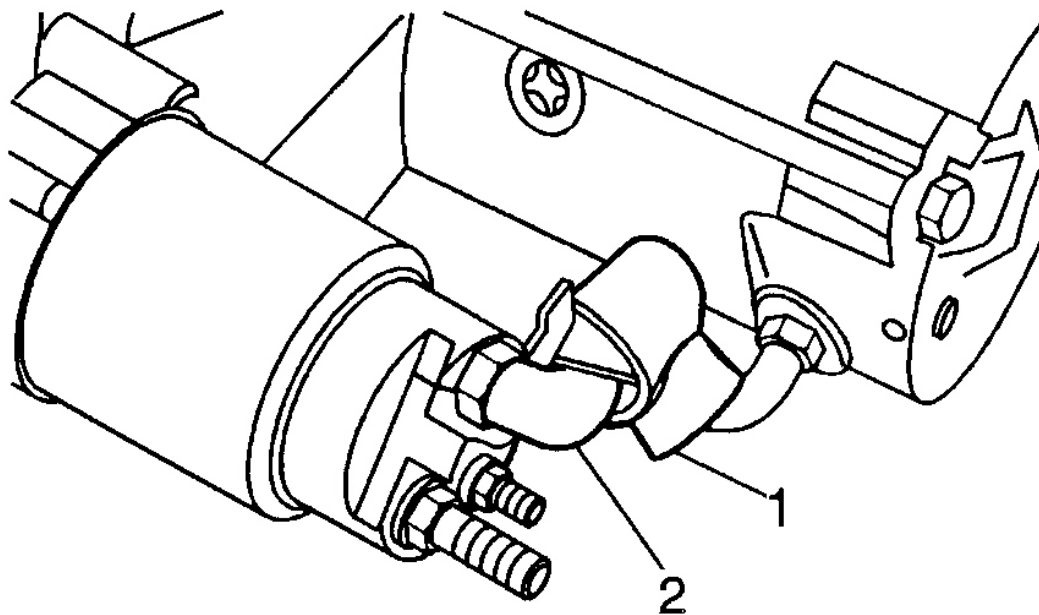
STARTER SOLENOID (6.6L ENGINE)

Removal

1. Remove the starter motor. See **STARTER** .
2. Reposition the M-terminal stud weather cover. See **Fig. 26** .
3. Clean the epoxy coating from the M-terminal stud.
4. Loosen the M-terminal stud nut. See **Fig. 27** .
5. Remove the cable from the M-terminal stud.
6. Remove the solenoid bolts. See **Fig. 28** .
7. Separate the solenoid from the housing and unhook the solenoid plunger from the drive gear lever. See **Fig. 29** .
8. Note that the spring is positioned against the drive gear lever and the drive gear lever is placed inside the solenoid plunger loop. See **Fig. 30** .
9. Remove the solenoid housing. See **Fig. 31** .
10. If necessary, remove the solenoid plunger and spring. See **Fig. 32** .

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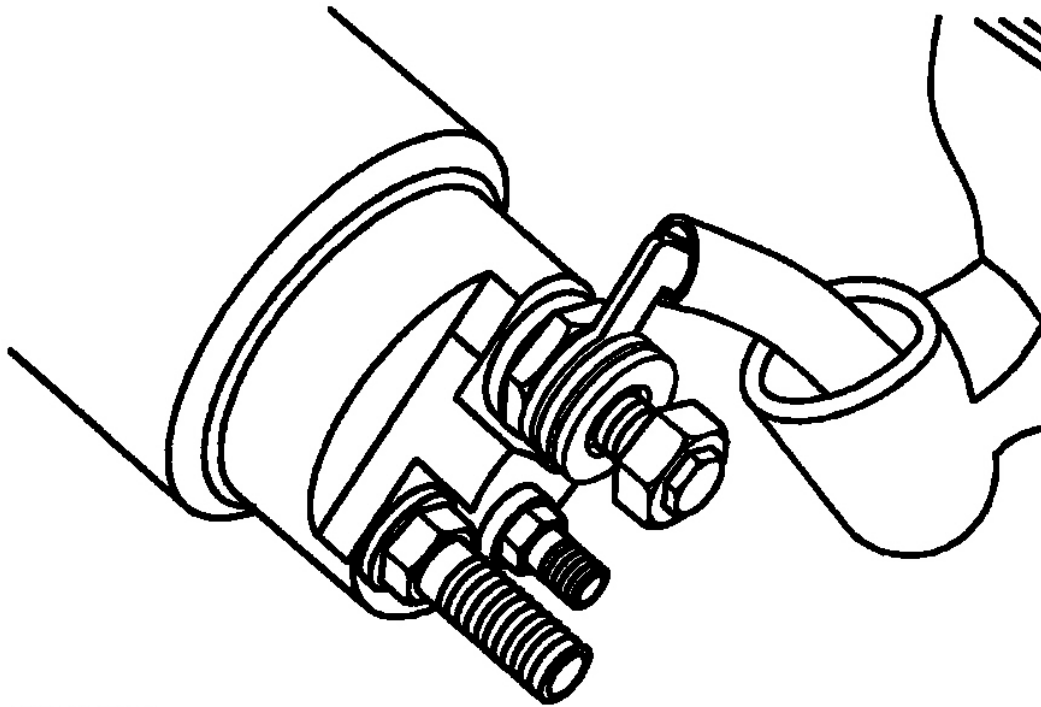


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Fig. 26: Repositioning M-Terminal Stud Weather Cover
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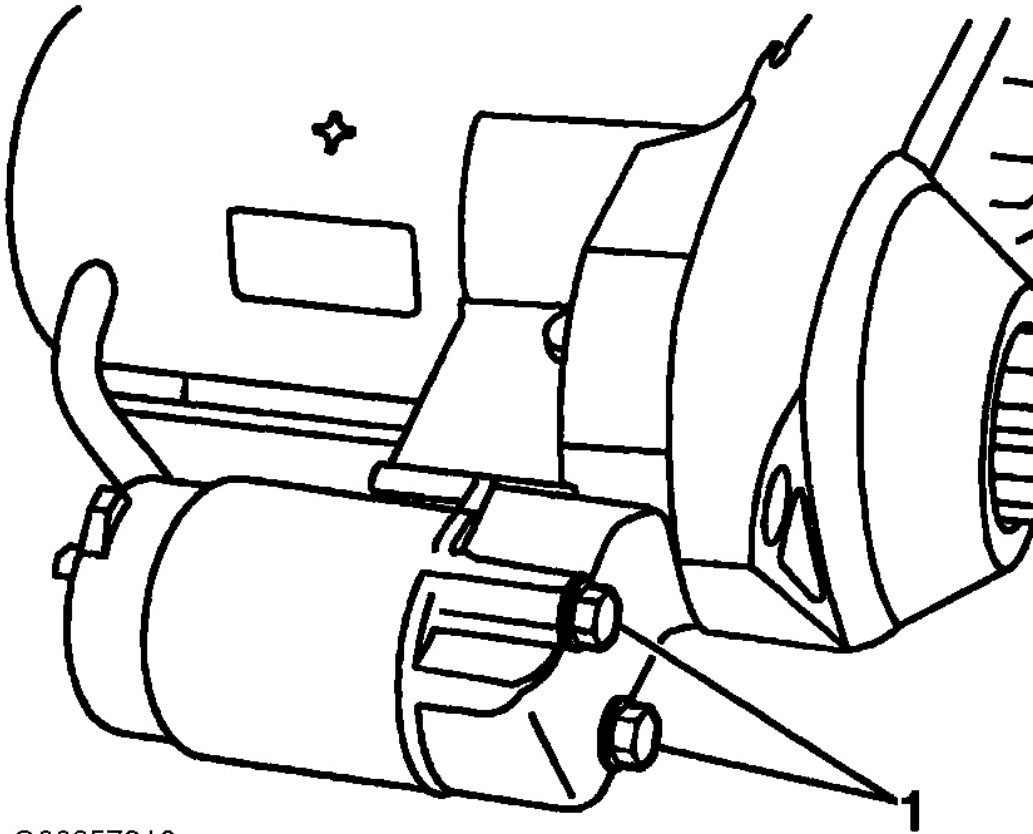


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Fig. 27: Loosening M-Terminal Stud Nut
Courtesy of GENERAL MOTORS CORP.

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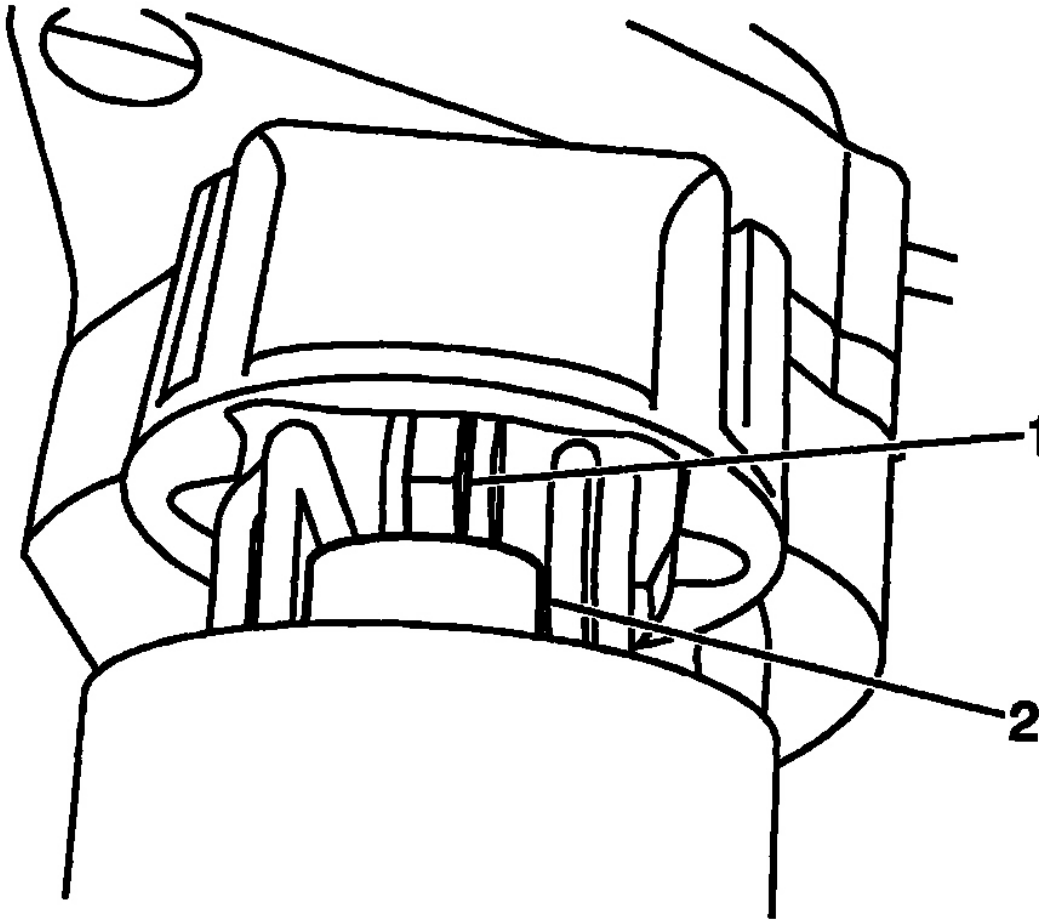
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Fig. 28: Removing Solenoid Bolts

Courtesy of GENERAL MOTORS CORP.

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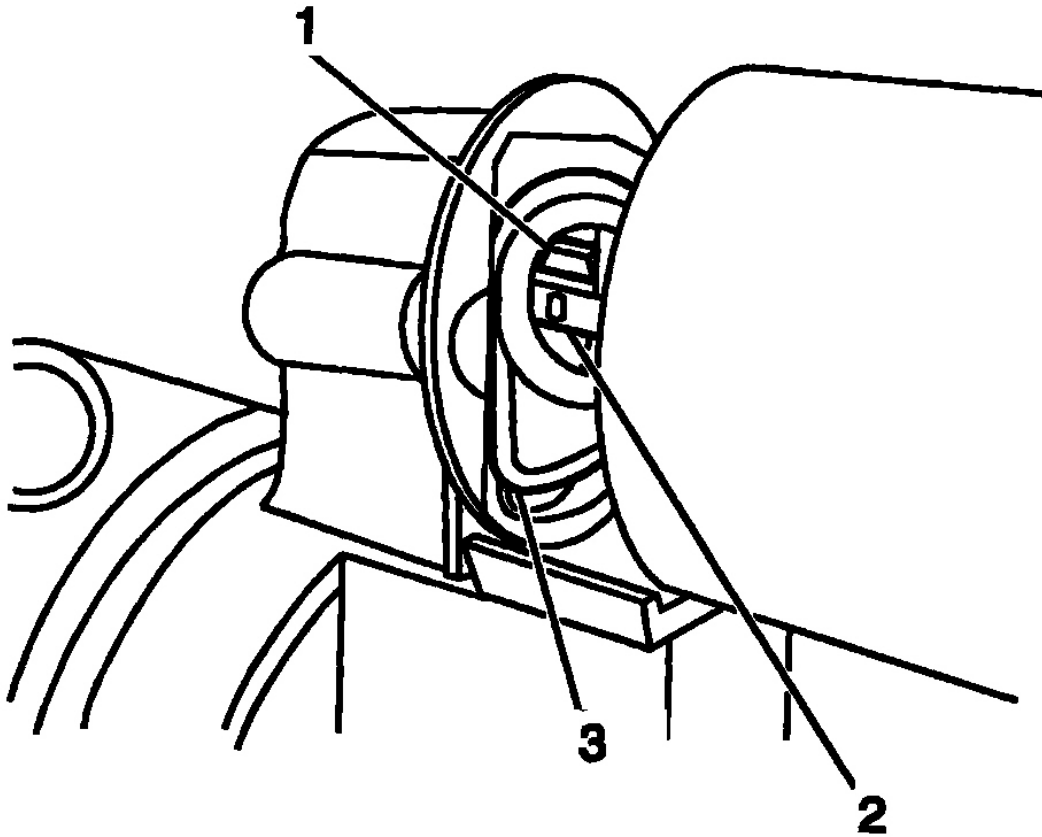


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Fig. 29: Unhooking Solenoid Plunger
Courtesy of GENERAL MOTORS CORP.

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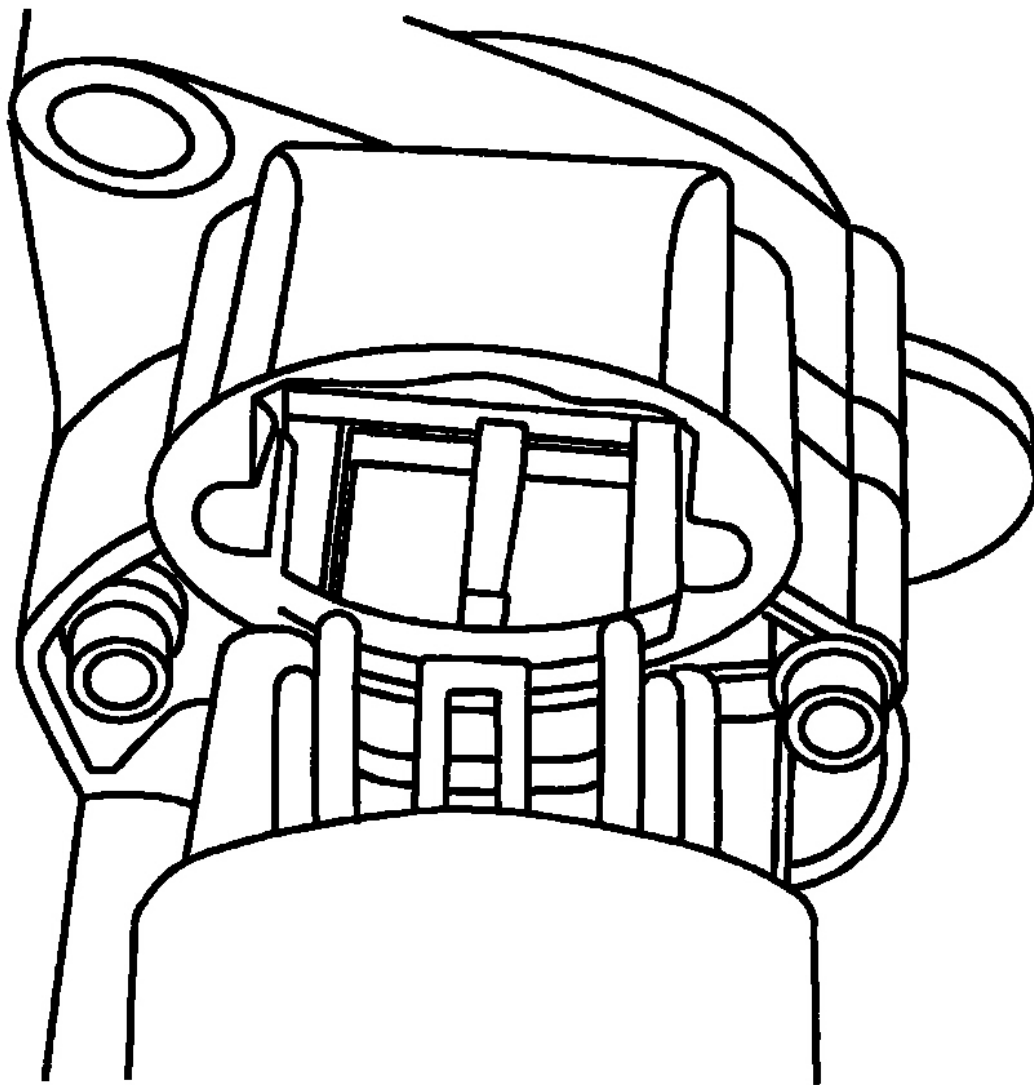


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Fig. 30: Noting Spring, Lever & Loop Positioning
Courtesy of GENERAL MOTORS CORP.

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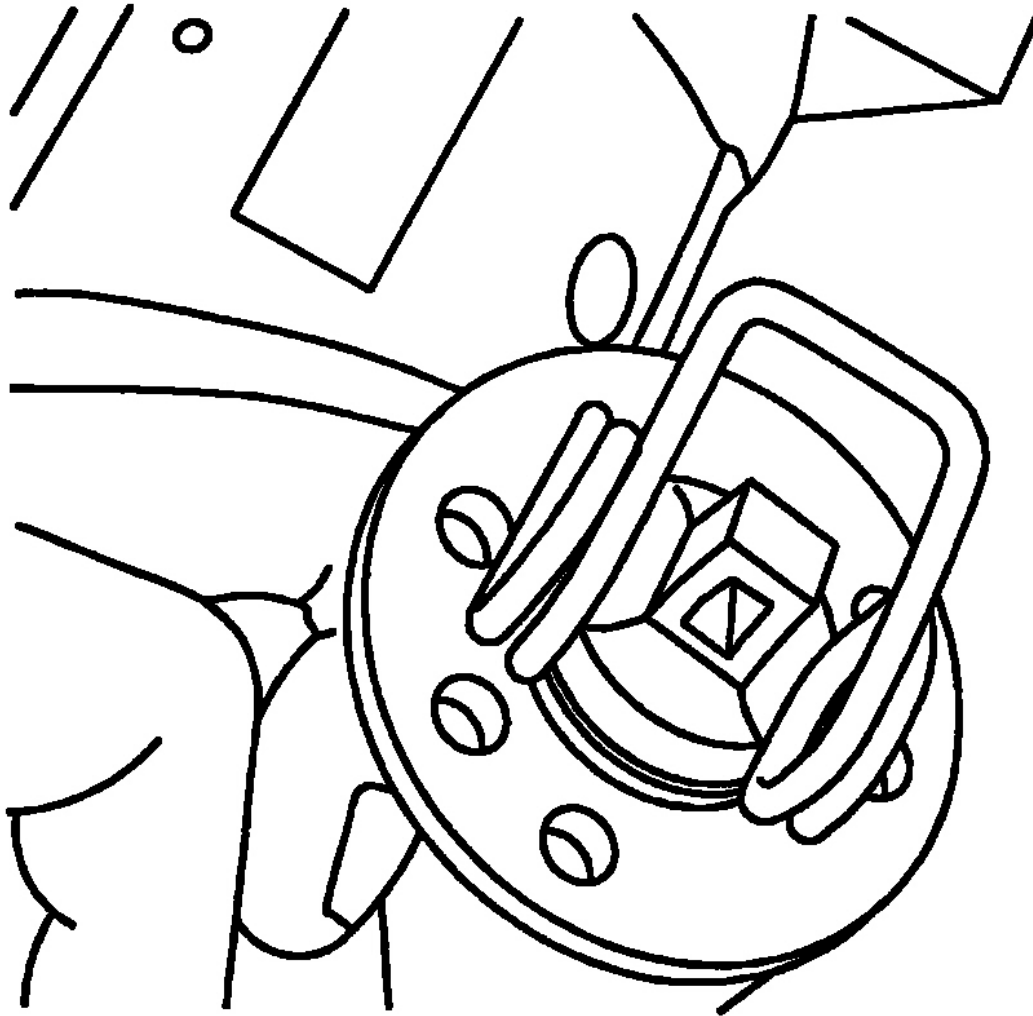


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Fig. 31: Removing Solenoid Housing
Courtesy of GENERAL MOTORS CORP.

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G00357920

Fig. 32: Removing Solenoid Plunger & Spring
Courtesy of GENERAL MOTORS CORP.

Installation

1. If necessary, install the solenoid plunger and spring. See **Fig. 32** .
2. Using Three Bond Silicone 1207B (GM P/N 97720043), seal the starter solenoid attachment area. See **Fig. 33** .

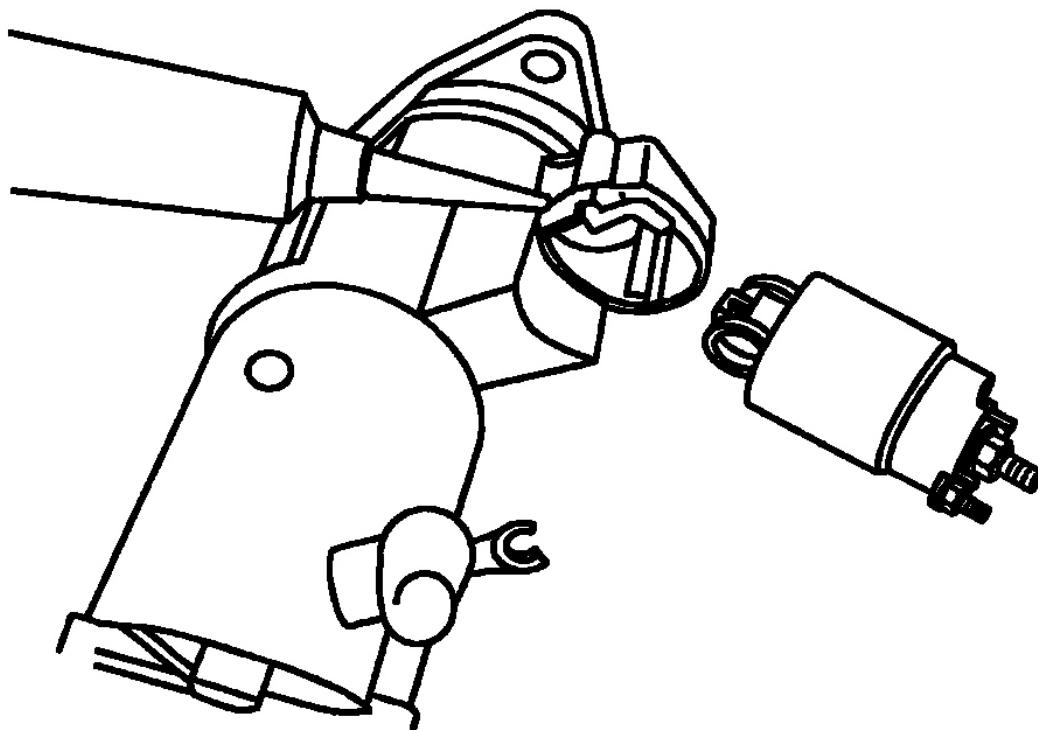
CAUTION: Ensure that the drive gear lever is properly installed into the solenoid plunger loop. Improper installation of the drive gear lever will cause

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an abnormal or no operation condition of the starter. See Fig. 29 .

3. Install the solenoid, making sure to insert the drive gear lever into the solenoid plunger loop, perform the following:
 - A. Pull the gear lever out away from the starter housing and pull the plunger out away from the solenoid.
 - B. Tip the solenoid and insert the lever into the loop, push the solenoid against the housing.
4. Install the solenoid bolts. See **Fig. 28** . Tighten the bolts to specification. See **TORQUE SPECIFICATIONS** .
5. Wipe the excess silicone pressed out during the solenoid installation from around the base of the solenoid to make a weather proof seal.
6. Install the cable to the M-terminal stud between the washers and terminal nut. See **Fig. 27** .
7. Tighten the M-terminal stud nut. Tighten the nut to specification. See **TORQUE SPECIFICATIONS** .
8. Using Three Bond silicone 1207B, seal the M-terminal stud connection. See **Fig. 26** .
9. Reposition the M-terminal stud weather cover.
10. Bench test the starter in a free-run condition prior to installation.
11. Install the starter motor. See **STARTER** .



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2002 Cadillac Escalade

2002 STARTING & CHARGING SYSTEMS Starters - Avalanche, Escalade, Escalade EXT, Sierra, Silverado, Suburban, Tahoe, Yukon & Yukon XL

Fig. 33: Sealing Solenoid Attachment Area
Courtesy of GENERAL MOTORS CORP.

OVERHAUL

NOTE: Starter motor assemblies are not serviceable and should be replaced as complete units.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Battery Terminal Bolt (4.3L)	13 (17)
Engine Shield Bolts	15 (20)
Front Axle Mounting Bracket Nut	70 (95)
Oil Pan Skid Plate Bolts	15 (20)
Starter Bolts	
4.3L	32 (43)
4.8L, 5.3L, 6.0L, & 8.1L	37 (50)
6.6L	58 (78)
INCH Lbs. (N.m)	
M-Terminal Stud Nut (6.6L)	71 (8)
Solenoid Bolts (6.6L)	89 (10)
Starter Battery Positive Cable Nut	80 (9)
Starter Heat Shield	
Bolts	35 (3)
Nut	44 (5)
Starter Lead Nut	
4.3L	80 (9)
4.8L, 5.3L, 6.0L, & 8.1L	30 (3.4)
Starter Solenoid Nut	30 (3.4)
Transmission Cover Bolt (4.8L, 5.3L & 6.0L)	80 (9)

WIRING DIAGRAMS

For appropriate vehicles wiring schematic, refer to one of the following:

- For Avalanche, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS article in WIRING in ELECTRICAL.
- For Escalade, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS article in WIRING in ELECTRICAL.
- For Escalade EXT, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS article in

2002 Cadillac Escalade

2002 STARTING & CHARGING SYSTEMS Starters - Avalanche, Escalade, Escalade EXT, Sierra, Silverado, Suburban, Tahoe, Yukon & Yukon XL

WIRING in ELECTRICAL.

- For Sierra 1500, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS article in WIRING in ELECTRICAL.
- For Sierra 2500, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS article in WIRING in ELECTRICAL.
- For Sierra 2500 HD, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS article in WIRING in ELECTRICAL.
- For Sierra 3500, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS article in WIRING in ELECTRICAL.
- For Silverado 1500, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS article in WIRING in ELECTRICAL.
- For Silverado 2500, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS article in WIRING in ELECTRICAL.
- For Silverado 2500 HD, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS article in WIRING in ELECTRICAL.
- For Silverado 3500, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS article in WIRING in ELECTRICAL.
- For Suburban, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS article in WIRING in ELECTRICAL.
- For Tahoe, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS article in WIRING in ELECTRICAL.
- For Yukon, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS article in WIRING in ELECTRICAL.
- For Yukon XL, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS article in WIRING in ELECTRICAL.