Tech Tip

ESTABLISHING GOOD CONNECTIONS

Improper Connections Promote Electrical Challenges

Diagnosing electrical problems can be challenging, even for the most experienced technician. Unfortunately, few electrical problems are hard failures and instead fit the challenging category of intermittent failures. Intermittent problems may be affected by heat, cold, or vibration. These conditions present the greatest challenge, as the technician must create the same conditions in which the component failed. It may require numerous drive cycles to accomplish that same set of circumstances. And there is always that concern … did I make an accurate diagnosis and fix the problem? This is a major hurdle, as the last thing the technician wants is the customer returning with the same complaint. This results in a loss of integrity and billable labor hours for the shop.

When performing electrical diagnostics, it is imperative that the technician establish good electrical contact with the components and any power and ground circuits. He can eliminate many intermittent conditions including driveability concerns, hard starts, no-starts, inoperative gauges, or an intermittent Check Engine lamp, just by establishing good electrical contact with the circuits.

In some systems, computers and modules monitor and compare electrical values of the sensors and components to determine if the component or system is functioning properly. Resistance differences as minimal as measured in milliohms between connections may illuminate a Check Engine light and store diagnostic trouble codes. Many of the terminal resistance related conditions that affect the system or component operation are not measurable with the test instruments found in most repair shops. If intermittent codes are being stored, a connection clean-up should be performed prior to replacing a component. Consider both intermittent electrical connections and high resistance in the connections when diagnosing intermittent electrical problems. The integrity of the connections can be established with the use of a compatible terminal or a test tool, while performing a pull test on the connections.

ACCESSORY POWER SOURCE

Many electrical problems stem from aftermarket electrical accessories being installed by a novice and their selection of a power source to obtain current for the add-on accessory. Making an improper connection can create problems for the accessory component or other electrical circuits and components in the vehicle, resulting in a myriad of electrical related problems.

One such source for establishing a power source has always been the fuse block. Inserting a wire adjacent to a fuse blade is not an acceptable power source connection. Utilizing this method can result in a loose or intermittent connection and also result in permanent damage to the fuse junction block, requiring replacement of the fuse block. Forcing a multi-meter probe into the fuse block terminal when testing for current can damage the connector, resulting in the fuse not making full contact once it is reinstalled in the fuse block. Closely examine the blades of the fuse. Poor contact will be evidenced by lack of marks on the fuse blades once it has been installed.

BOTCHED ACCESSORY INSTALLATION

The owner of a 2007 Silverado encountered a battery discharge condition following the installation of an aftermarket sound system. His idea of a new battery was not the solution. The vehicle would fail to start after being parked overnight. Disconnecting the sound system eliminated the battery drain condition. Assuming the drain was due to a defective system, it was replaced with a new unit, but the condition prevailed.

The vehicle was eventually taken to a GM dealer where the technician performed an amp draw test on the vehicle's electrical system, revealing a 4 amp drain. The technician relocated the power source to the sound system and eliminated the amperage draw on the system. Here's the scoop: When the vehicle owner installed the system, he obtained a power source by wiring into the courtesy lamp circuit (6815 orange wire). When add-on electrical accessories are wired into this circuit, the power timer in the body control module (BCM) may repeatedly re-set itself instead of going to sleep. The BCM will remain awake and the amp draw may be steady around 4 amps, or momentarily drop down to a low milliamp reading, then rise to a 4 amp draw.

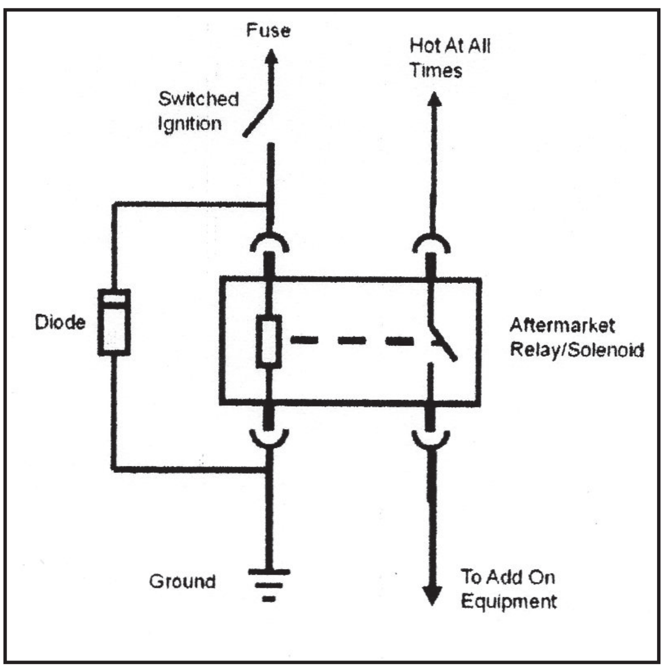
SUPPRESSING VOLTAGE SPIKES

The Nissan Pathfinder developed a no-start condition. The vehicle owner replaced the starter, starter solenoid and the ignition switch, to no avail. Later, it was determined that the anti-theft system had malfunctioned and only low voltage was getting to the starter solenoid. Rather than troubleshoot the anti-theft deterrent system, a local electrical rebuilder by-passed the system by installing a remote fender-well mounted starter solenoid. This eliminated the starter related symptoms, but some major electrical problems resulted from the use of the remote solenoid due to the absence of a protection diode, which allowed transient voltage interference.

For those who have been turning wrenches since the mid 70s, you may recall the 1978 Lincoln Continental that required a special starter solenoid. Its physical appearance looked exactly like the standard fender-well mounted solenoid that Ford had used for years. The difference was that it contained a protection diode to prevent transient voltage interference with the Lincoln's electronic engine control (EEC) system. By 1986 all Fords equipped with the EEC system specified the solenoid with the internal protection diode.

Protection Diode… With the newer vehicles, when electrical accessories are added that incorporate an electromechanical solenoid or relay, it is imperative that a protection diode be used to suppress the voltage spikes that occur when the solenoid or relay is cycled. When this occurs, the collapsing magnetic field produces a transient voltage spike. These spikes occur at the positive terminal when the solenoid or relay is de-energized. If the solenoid or relay is wired into the crank or run circuit, the transient voltage spikes can be transferred into that circuit. The transient voltage interference can result in permanent damage to the system's electronics, including costly electronic control modules. This is especially a concern with the newer vehicles that incorporate bussed circuits. It is imperative that the solenoid or relay contains a protection diode in the control circuit (see illustration). In this illustration, the striped end of the diode is connected to the positive/switch terminal of the solenoid, and the opposite end of the diode should be connected to ground. Make certain the diode is properly insulated with heat shrink tubing.

ELECTROLYSIS



Electrical problems can create cooling system problems, affecting components such as radiators, heater cores and other soft engine metals. Electrolysis occurs when current takes the path of least resistance and travels through the engine coolant seeking a ground. The coolant becomes electrically charged from the stray current and becomes an electrolyte. Many of the electrolysis related problems stem from accessory add-ons and improper grounding. Poorly grounded engine components, such as the starter motor, may damage a radiator or heater core in a matter of weeks, while improperly grounded add-on electrical accessories may require months to damage the components. Adding grounds to the heater core or radiator may further complicate the condition. Electric cooling fans or accessory components grounded near the radiator are potential problem circuits; however, the condition could be due to other electrical accessories anywhere in the system.

Different metals in the cooling system react with the coolant, making some voltage a normal characteristic. The voltage should not exceed 0.1 volts.

To test the system for electrolysis, obtain a digital voltmeter and place the selector on the 12V DC scale. Place the negative lead of the meter on the battery negative post and the positive lead directly into the radiator coolant, being careful not to allow the test lead to make contact with the filler neck or radiator core. Take the necessary safety precautions, as the cooling system may be hot and under pressure. With the engine running at approximately 2000 rpm and all electrical accessories on, observe the voltmeter reading. Voltage in excess of 0.3 volts confirms there is electrical leakage into the cooling system. If this condition is present, flush the system, install new coolant and re-test. If the condition is still present, a thorough ground inspection should be performed. Individually turning off electrical accessories one at a time while observing the voltmeter will help identify the problem circuit. If the voltage condition is still present after turning off the electrical accessories, individually pull the fuses while observing the voltmeter. If you pull a fuse and it reduces the voltage to 0.1 volt or less, obtain a wiring diagram to identify which circuits receive power from that fuse. Be aware that some components, such as the cooling fans, may not function until the engine reaches a given temperature. Add-on electrical accessories should always be the first suspect.

When installing electrical accessories or devices, precautions must be taken to prevent electrical interference with other systems. Simple mistakes in obtaining a power feed circuit can create major electrical and engine performance symptoms that are very difficult to trouble-shoot and seemingly almost impossible to pin-point.

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