ELECTRICAL AND PARASITIC LOAD TROUBLESHOOTING

Parasitic load problems don't have to be draining - on the technician, that is. Every so often, we tend to long for the days when life was simpler. Things are a little more sophisticated today when approaching an electrical problem that robs the battery of its power. Gone are the days when "just gimme a test light and a jumper wire; I'll fix 'er" technology applied. Armed with some proper test equipment, an understanding of vehicle systems and some solid knowledge of electrical theory, the process becomes less of a mystery. Whether you're working on a 1931 Model A or the most electronically advanced vehicle on the road today, the same basic procedures apply. First, don't get intimidated or frustrated by the type of vehicle or problem you're facing. Sure, the electrical system on the Model A was simpler and just looking at the schematic for that car was a confidence builder - not much to it. But keep this in mind: many times on today's vehicles it's actually easier to diagnose the problem than it is to actually physically repair the problem. Sometimes the greater challenge is just getting to the culprit component or problem area.

In this article, we'll explore some testing methods for various electrical problems including the elusive parasitic drains. You'll see how sometimes just through logical thinking, you can diagnose some problems without even raising the hood and we'll share some "tricks, tips and traps" of parasitic load troubleshooting.

First, how about a quick review of some basic electrical terms? I know, I know - been there, done that, right? Just let me cover a few basics to refresh your memory and if you haven't taken your fairly new DVOM out of the box recently, now is a good time to get the operator's manual out and reacquaint yourself with it. While you're at it, be sure to check what the meter's capabilities and limitations are. And if you are in the market for one, don't "undersell" yourself. There is nothing worse than making an investment in a tool, just to find out it can't do what you need it to do. If you are not sure, consult someone who can help you out that is knowledgeable in diagnostic tools and equipment.

First, let's take a look at some simple meter hook ups for some basic troubleshooting tests.

Testing for Voltage

First, connect the clip end of the test light to a good ground. Of course if you are using a voltmeter, connect the negative test lead to ground. Now touch the test light probe to your desired test point. Naturally, if the test light illuminates, there is voltage present. That's good for a quick test, but can you tell how much voltage there is just by looking at how bright the bulb is? Of course not (although I've heard some say they can), which is why the voltmeter is preferred when exact information is required. I'm getting ahead of myself by asking this next question: How many system draws or parasitic load problems have you successfully diagnosed with the use of a test light placed in series between the battery terminal and the cable end? Remember the Model A? You got away with it on earlier cats, with good results I might add, but you probably won't experience the same with a current vehicle. I'll explain why later.

Continuity Test

Make sure you disconnect the battery first and then connect one lead of a self-powered test light. Or if you prefer, an ohmmeter to one end of the circuit that you need to test. Attach the other end of the self-powered test light or ohmmeter to the other end of the circuit you are testing. If the light illuminates,

there is a complete circuit or continuity. But once again, if you need exact results of just how good the continuity is, the ohmmeter will give an exact resistance reading. Perhaps corrosion is beginning to affect the operation of a particular component. The test light will glow if there is continuity, but how bright is good? At least specific measurements can be obtained with the ohmmeter and then be compared to actual specs or known good parts.

Voltage Drop Test

This particular test is one of the most revealing tests in your "toolbox of tricks." This check is to see how much voltage is being lost in a circuit, either through the conductor, connection, switch or component. Using a voltmeter, connect the positive lead to the connector or wire end that is closest to the battery. Then connect the negative lead to the other end of the wire, connection or component being tested. Now activate the circuit. Voltage drop tests are live, dynamic readings. The voltage drop test can be used on virtually any circuit or component. From large starter motor cables to small computer circuits, the voltage drop test can help you locate resistance type problems. The proof is in the reading. Depending on the item being tested, you can expect readings well below one volt - sometimes one or two tenths of a volt. Lower is better. Check with manufacturers specifications for the component or circuit you are testing. Remember, a component or connection may appear to look all right, but sometimes the oxidation or corrosion is not detectable visually. Test, don't guess.

Short to Ground Test

Depending where in the circuit this problem is, this may be a very easy draw to locate. Or, it may just be affecting the operation of a component. For this test, remove the fuse and connect a test light or voltmeter in its place. Power up the circuit and start moving the wire(s) and connectors beginning near the fuse block and working back. Keep moving onward at about 6- to 12-inch intervals while observing the test light or voltmeter. Also keep an eye out for telltale signs of evidence of shorting as you move down the wiring. When the test light glows or the voltmeter shows a reading, there is a problem near that point.

Using a Short Finder

A short finder is designed to "pulse" the current through the circuit. Here's what you do: Remove the blown fuse and leave the battery connected. Connect the short finder in place of the fuse and close all switches (in series) associated with the circuit that you are testing. As the short finder pulses the current to the short, there is a magnetic field traveling along the circuit wiring between the fuse block and wherever the short is located. Like before, start at the fuse block, this time using an inductive ammeter and slowly move the meter along the wiring. The meter can even show current pulses through sheet metal and body trim. When you move past the point of the short, the meter will stop reading. You now have isolated the general area of the short.

Load Testing

Okay, now that we've covered some other basic electrical problem tests, let's take a look at the seemingly mysterious problem of parasitic load problems. Knowing how to test for them is probably the most important part of the test sequence.

First, a typical draw (non-parasidic) test. This can be rather obvious. A trunk light that stays on or an accessory that is inadvertently left on, etc., will usually take the battery down in a relatively short time. To locate the problem area, you can simply connect an ammeter to either battery cable (negative

preferred) and observe the meter as you deactivate or open one circuit at a time, usually at the fuse block. Remember, some meters have an inductive clamp that does not require the circuit to be opened for the meter to be connected. Other meters require series connections. Make sure the ammeter is set to an appropriate scale so that the ampere reading from the draw can be interpreted. Also, be sure that the interior light is not on due to the door that you have open! Look for the obvious.

Now, (depending on the meter) if you are using an inductive type ammeter connection, the amp draw reading may be too small to be accurately read or detected, so you may have to use a 10X multiplier. You may have one that came as an accessory to your shop's volt/amp tester or they're available as a separate item. In a pinch, you could make one in a few minutes. All you need is a soda can and some wire. Leave about a 12-inch lead-in wire, then begin to wrap the wire around the soda can 10 times. Be sure to wrap it snugly, then leave another 12-inch piece when you are done wrapping. Slide the soda can out of the loop of wire you just created and use electrical tape to secure it. Wrap the electrical tape around the loop in several places so it doesn't unravel. You should have a loop of wire with a foot of wire hanging out each end. Attach test clips to the ends and you're ready to go. Especially helpful on the lower amperage current draws, the 10X multiplier actually makes the reading on the ammeter, well, 10 times greater. So, if you had only a one amp draw, depending on the meter, it may be difficult to read. But connecting the 10X multiplier in series with the negative battery cable, then connecting your inductive ammeter clamp around the loop, it will increase the reading, i.e. one amp will read as 10 amps. Oh, by the way, don't get trapped into a false sense of accuracy or security by using a test light for a draw test. It probably would be okay on the Model A, but...

Parasitic Loads

Ever since computers and other electronic devices that require some sort of memory started to make their appearance, we have seen more things that can draw the battery down. Back in the early days, the battery would just simply discharge over a long period of time. Now, with today's systems, it has a little help in loosing its power. So much help in fact, that if a late model vehicle (with a fair amount of electronic goodies) is going to be parked for even a short period of time, it's recommended that the battery be disconnected.

Some recommendations I have read or heard about suggest if the vehicle is sitting over three weeks, the battery should be disconnected. Do your customers know this? Have you been looking at a "problem" that's inherent to that particular vehicle that's not really a problem at all? But yes, there are some problems that do crop up that cause a higher-than normal draw that may not level the battery overnight, but in a few days time. These lower, parasitic type draws need instruments that can read in lower values and procedures that won't damage your meter or give you wrong readings. I'll give you some guidelines to follow regarding procedures and specifications. The maximum acceptable battery draw on a typical later model vehicle is 50 milliamps, or for you digital folks, .050 amps. Now, several things determine this specification. Some systems should be lower, while others are allowed to be higher. It depends greatly on the type and amount of accessories on the vehicle. A word of diagnostic caution: Some systems may appear to have a parasitic load for a while after the ignition is turned off. Be aware of this fact and the system you are working on. This time out period may be as long as 15 to 20 minutes and is considered normal.

Testing Parasific Loads

First, you'll end up interrupting power to the vehicle when you disconnect the battery to connect your ammeter, which is capable of measuring in milliamps. Keep in mind when doing this, the timer circuits have been momentarily interrupted by the removal of the battery (negative) cable. Watch what could happen next. Because they no longer are being powered, they lose the existing charge they had prior to you disconnecting the battery cable. With me so far? So guess what happens when you connect your DVOM to the battery terminal, then on to the battery cable, thus completing the circuit? The timer circuits will want to recharge through your meter, drawing current through it that exceeds the meter's capability. What then? The protection fuse in the meter blows, but the digital display may still, however, display numbers - all zeros. This may be interpreted as no load present. The safeguard is to properly connect your meter.

Here's how:

Make sure the ignition switch and all accessories are off. Don't forget the obvious things like the doors, trunk and underhood lamps are off, too. Next, disconnect the battery cable and install a 12-volt test light or a jumper wire between the battery terminal and the battery cable. If you're using the test light, it will light brightly, then should dim in a second or so.

Quick Tip:

If the test light goes out, usually there is not enough of a current draw to keep that bulb lit, meaning there is probably less than a 500 mA draw. Or, as mentioned, you can use a jumper wire to do the re-connection between the cable and battery. The purpose? To protect your meter. If the meter is used to complete the circuit once the cable is disconnected from the battery, all the current required by those seemingly harmless little silicone things are going to pull too much through your meter. Using the test light or jumper wire will "absorb' the surge, then once dissipated, disconnect the test light or jumper, so the current flows through the meter so you can read what's happening.

Got it? Okay, another warning. If you get the feeling you want to open a door or activate some other circuit during the test, protect your meter. Use the jumper wire and connect it parallel to your meter. Just remember, the timer and memory circuits and think about what's running through your meter, especially before activating any accessories or even opening a door. A meter with a 10 amp position should be used for this type of test. Once connected, observe how the draw decreases quickly and indicates that the memory and/or timer circuit(s) is (are) charging. Once this has stabilized, scale down the meter until the actual current draw is displayed. After you are stabilized with the connections and readings, begin to eliminate one circuit at a time until the reading drops to an acceptable level. Don't reactivate any circuit until you reconnect your jumper lead to protect your meter!

How Much is Too Much?

Again, various publications have a specification range anywhere between 25 to 75 milliamps (mA). Consider how many options are on the vehicle and just figure the more options the higher the allowable draw. Now enter the battery. A perfect case for "one size does not fit all!" It would stand to reason that the more option content of a vehicle, the higher the reserve capacity of the battery. Beware of smaller, economical batteries of a suspect vehicle. That bargain battery may turn out to be no bargain at all.

Here's the simple formula to calculate the acceptable parasitic load a vehicle can have. First and foremost, you must start with the proper battery in the vehicle. Regardless if it's OEM or not, look for the Reserve Capacity Rating in minutes.

You may have to reference a spec chart for some batteries that don't have that information printed on top of the battery. Once you have confirmed the proper battery and the Reserve Capacity in minutes, you're ready for the math. Multiply the RC minutes by 0.25 to give you a guideline, in milliamps, as to what the allowable parasitic load you could expect for that vehicle. For example, if the battery has an RC minute capacity of 100, you would multiply that by 0.25 to get 25 milliamps. Or, a battery with an RC minute rating of 160 x 0.25 = 40 mA.

Following these simple yet important procedures can take the mystery out of parasitic load diagnosis. The Model A had a long list of accessories to include such luxuries like headlamps, stop and tail lamp and even a dome light. Technology has made us keep current in our troubleshooting and diagnostic skills, all in the effort of the "creature features" we all enjoy now. Who would have thought?