TROUBLESHOOTING PROCEDURES

CONTENTS

BASIC KNOWLEDGE REQUIRED

Without a basic knowledge of electricity, it will be difficult to use the diagnostic procedures contained in this section. You should understand the basic theory of electricity and know the meaning of voltage, current (amps) and resistance (ohms). You should understand what happens in a circuit with an open or a shorted wire. You should be able to read and understand a wiring diagram.

The following four-step troubleshooting procedure is recommended:

Step 1: Check the Problem

Perform a System Check to determine a symptom. Don't waste time fixing part of the problem! Do not begin disassembly or testing until you have narrowed down the possible causes.

Step 2: Read the Electrical Schematic

Study the schematic. Read the Circuit Operation text if you do not understand how the circuit should work. Check circuits that share wiring with the problem circuit. (Shared circuits are shown on Power Distribution, Ground Distribution, Fuse Block Details and Light Switch Details pages.) Try to operate the shared circuits. If the shared circuits work, then the shared wiring is OK. The cause must be within the wiring used only by the problem circuit. If several circuits fail at the same time, chances are the power (fuse) or ground circuit is faulty.

Step 3: Find the fault and repair

- Narrow down the possible causes.
- Use the Troubleshooting Hints.
- Make the necessary measurements or checks as given in the System Diagnosis.
- Before replacing a component, check power, signal and ground wires at the component harness connector. If the checks and connections are OK, the most probable cause is component failure.

Step 4: Test the Repair

Repeat the System Check to verify that the fault has been corrected and that no other faults were induced during the repair.

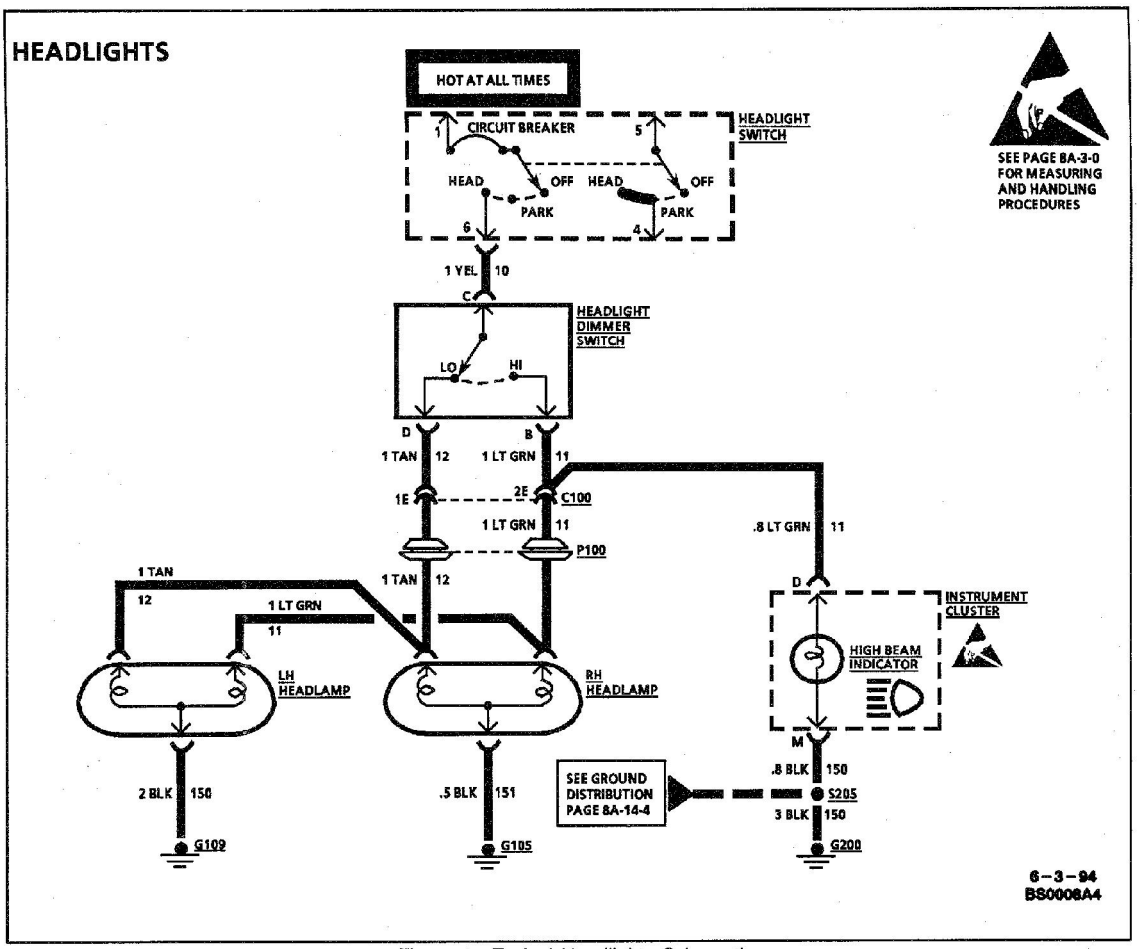


Figure 1—Typical Headlights Schematic

Example:

A customer brings in a vehicle and says that the HI beams do not work.

Step 1: Perform a System Check on the Headlight Circuit

You may discover that both LO beams operate. In "HI," you may notice that the HI Beam Indicator comes on, but neither HI beam operates.

Step 2: Read the Headlights Electrical Schematic (Figure 1).

This is the step that will save time and labor. Remember, it is essential to understand how a circuit should work, before trying to figure out why it doesn't.

After you understand how the circuit should operate, read the schematic again, this time keeping in mind what you have learned by operating the circuit.

Since both LO beams work, you know that the Headlight Switch, the YEL wire, the LO contacts of the Headlight Dimmer Switch, terminal "1E" of C100, the TAN wires and grounds G105 and G109 are all good.

Furthermore, since you saw that the HI Beam Indicator came on when the Headlight Dimmer Switch was moved to "HI," you know that the HI contacts of the Headlight Dimmer Switch and the LT GRN wire between the Headlight Dimmer Switch and C100 are good.

At this point, you could test for voltage at the RH Headlamp with the Headlight Dimmer Switch in "HI." However, it is extremely unlikely that the HI beam filaments have burned out in both headlamps, or that both headlamps connections are bad. The cause must be a bad connection at C100, or a break in the LT GRN wire between C100 and the RH Headlamp.

You have quickly narrowed the possible causes down to one specific area, and have done absolutely no work on the vehicle itself.

TROUBLESHOOTING PROCEDURES

Step 3: Find the fault and repair it.

Using the Component Location List and the corresponding figure, you can quickly find C100 and the LT GRN wire, locate the exact trouble point and make the repair.

Step 4: Check the repair by performing a System Check on the Headlights Circuit.

This, of course, means making sure that both HI beams, both LO beams and the HI Beam Indicator are all working.

Now suppose that the symptoms were different. You may have operated the Headlamps and found that the LO beams were working, but neither the HI beams nor the HI Beam Indicator were working. Looking at the schematic, you might conclude that it is unlikely that both HI beam filaments and the HI Beam Indicator have all burned out at once. The cause is probably the Headlight Dimmer Switch or its connector.

TROUBLESHOOTING TOOLS

Electrical troubleshooting requires the use of common electrical test equipment.

TEST LIGHT/DIGITAL VOLTMETER

Use a test light to check for voltage. A Test Light (J 34142-B) is made up of a 12 volt light bulb with a pair of leads attached. After grounding one lead, touch the other lead to various points along the circuit where voltage should be present. When the bulb goes on, there is voltage at the point being tested.

A DVM can be used instead of a test light. While a test light shows whether or not voltage is present, a DVM indicates how much voltage is present.

An increasing number of circuits include solid state control modules. One example is the Engine Control Module (ECM). Voltages in these circuits should be tested only with a 10-megohm or higher impedance DVM or multimeter (J 39200). Unless directed to within the diagnostics, never use a test light on circuits that contain solid state components, since damage to these components may result.

When testing for voltage or continuity at the connection, it is not necessary to separate the two halves of the connector. Unless testing a Weather Pack® or a Metri Pack® connector 150 series and below, always probe the connector from the back. Always check both sides of the connector. An accumulation of dirt and corrosion between contact surfaces is sometimes a cause of electrical problems. A terminal contact checking procedure can be found on page 8A-4-5.

CONNECTOR TEST ADAPTERS

Connector Test Adapter Kit (J 35616-A) is available for making tests and measurements at separated connectors. This kit contains an assortment of probes which mate with many of the types of terminals you will see. Avoid using paper clips and other substitutes since they can damage terminals and cause incorrect measurements.

SELF-POWERED TEST LIGHT

A self-powered test light (J 21008-A) can be used to check for continuity. This tool is made up of a light bulb, Battery and two leads. If the leads are touched together, the bulb will go on.

A self-powered test light is used only on an unpowered circuit. First remove the fuse which feeds the circuit you're working on. Select two specific points along the circuit through which there should be continuity. Connect one lead of the self-powered test light to each point. If there is continuity, the test light circuit will be completed and the bulb will go on.

Never use a self-powered test light on circuits that contain solid state components, since damage to these components may result.

OHMMETER

An ohmmeter can be used instead of a self-powered test light. The ohmmeter shows how much resistance there is between two points along a circuit. Low resistance means good continuity.

Circuits which include any solid state control modules, such as the Engine Control Module (ECM), should be tested only with a 10-megohm or higher impedance digital multimeter (J 39200).

When measuring resistance with a DVM, the vehicle Battery should be disconnected. This will prevent incorrect readings. DVMs apply such a small voltage to measure resistance that the presence of voltages can upset a resistance reading.

Diodes and solid state components in a circuit can cause an ohmmeter to give a false reading. To find out if a component is affecting a measurement, take a reading once, reverse the leads and take a second reading. If the readings differ, the solid state component is affecting the measurement.

FUSED JUMPER WIRE

A fused jumper (J 36169) is available with small clamp connectors providing adaptation to most connectors without damage. This fused jumper wire is supplied with a 20 amp fuse which may not be suitable for some circuits. Do not use a fuse with a higher rating than the fuse that protects the circuit being tested.

NOTICE: A fused jumper may not protect solid state components from being damaged.

SHORT FINDER

Short Finders (J 8681-A) are available to locate hidden shorts to ground. The short finder creates a pulsing magnetic field in the shorted circuit and shows you the location of the short through body trim or sheet metal.

FUSE TESTER

A simple tester (J 34764) can detect a blown fuse. To check a fuse, the tester is applied directly to the fuse in the Fuse Block. Two probes contact the fuse, either into the slots of a flat fuse or to the metal ends of a glass fuse. With power on, a red LED in the tester lights if the fuse is open. The handle of the tester is a tool for removing either type of fuse.

TROUBLESHOOTING TESTS

AFTERMARKET ACCESSORIES

Do not tie aftermarket accessories into SIR circuits. All such circuits are indicated on circuit diagrams with the SIR symbol. (See SECTION 8A-3.)

Do not tie aftermarket accessories into OBDII circuits. All such circuits are indicated on circuit diagrams with the OBDII symbol. (See SECTION 8A-3.)

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.

Some possible causes of vehicle problems related to aftermarket accessories include:

1. Power feeds connected to points other than the Battery.
2. Antenna location.
3. Transceiver wiring located too close to vehicle electronic modules or wiring.
4. Poor shielding or poor connectors on antenna feed line.

Refer to 1990/1991 model year bulletin entitled, "Installation Guidelines for Aftermarket Accessories" for specific information.

PROBING

After probing, when reconnecting connectors or replacing terminals, always be sure to reinstall Connector Position Assurance (CPA) and Terminal Position Assurance (TPA).

Frontprobe

When frontprobing of connectors is required, always use a mating terminal adapter from Connector Test Adapter Kit (J 35616-A). The use of proper adapters will ensure that proper terminal contact integrity is maintained. For a terminal contact checking procedure, refer to page 8A-4-5.

Backprobe

Only backprobe connector terminals when specifically called for in diagnostic procedures. Since backprobing can be a source of damage to connector terminals, extra care must be taken to avoid deforming the terminal, either by forcing the test probe too far into the cavity or by using too large a test probe.

After backprobing any connector, always check for terminal damage. If terminal damage is suspected, check for proper terminal contact (refer to "Checking Terminal Contact," page 8A-4-5).

TESTING FOR VOLTAGE (Figure 2)

1. Connect one lead of a test light to a known good ground. When using a DVM, be sure the voltmeter's negative lead is connected to ground.
2. Connect the other lead of the test light or voltmeter to a selected test point (connector or terminal).
3. If the test light illuminates, there is voltage present. When using a DVM, note the voltage reading.

TESTING FOR CONTINUITY (Figure 3)

1. Remove the fuse to the circuit involved.
2. Connect one lead of a self-powered test light or ohmmeter to one end of the part of the circuit you wish to test.
3. Connect the other lead to the other end of the circuit.
4. If the self-powered test light glows, there is continuity. When using an ohmmeter, low or no resistance means good continuity.

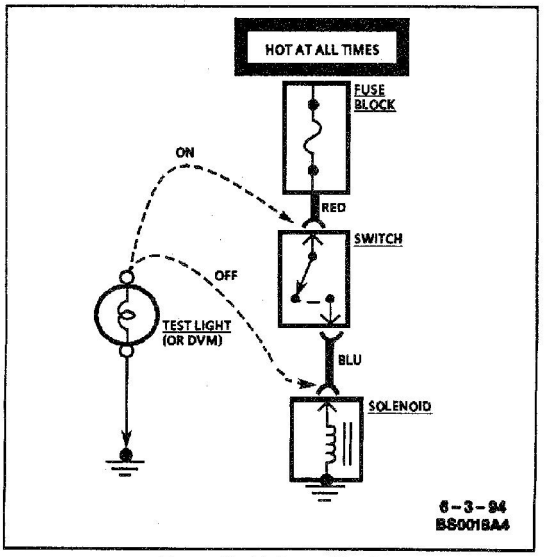


Figure 2—Voltage Check

TROUBLESHOOTING PROCEDURES

TESTING FOR VOLTAGE DROP (Figure 4)

This test checks for voltage being lost along a wire, or through a connection or switch.

1. Connect the positive lead of a DVM to the end of the wire (or to one side of the connection or switch) which is closer to the Battery.
2. Connect the negative lead to the other end of the wire (or the other side of the connection or switch).
3. Operate the circuit.
4. The DVM will show the difference in voltage between the two points.

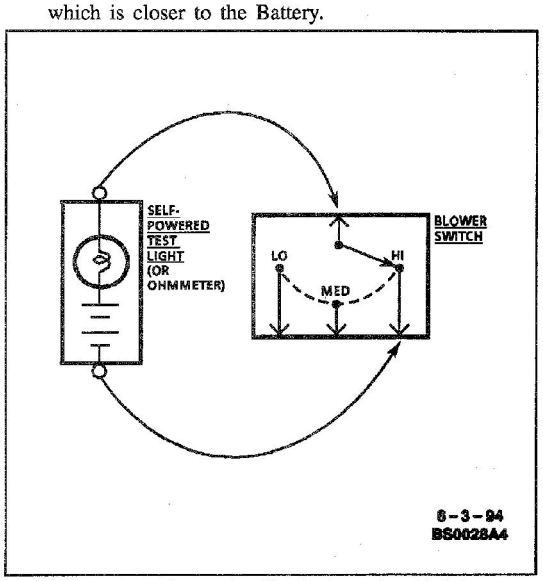


Figure 3—Continuity Check through a Switch

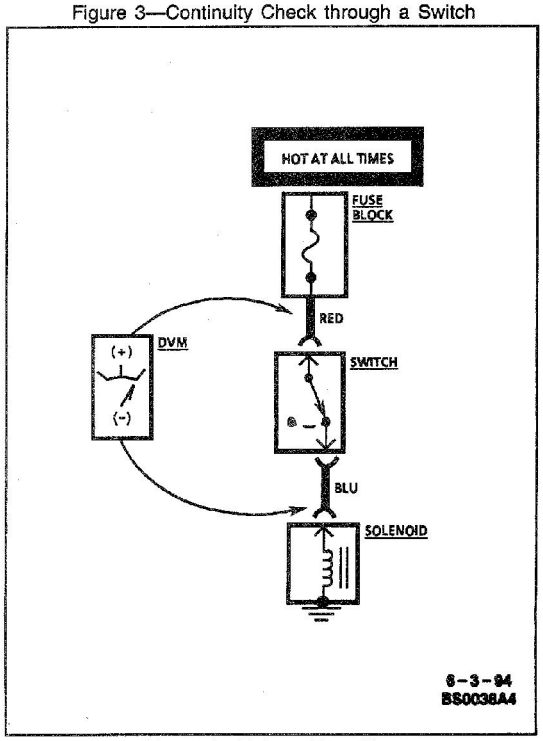


Figure 4—Voltage Drop Test

TESTING FOR SHORT TO GROUND

With a Test Light or DVM (Figure 5)

1. Remove the blown fuse and disconnect the load.
2. Connect a test light or voltmeter across the fuse terminals (be sure that the fuse is powered).
3. Beginning near the Fuse Block, wiggle the harness from side to side. Continue this at convenient points (about 6 inches apart) while watching the test light or DVM.
4. When the test light glows, or the DVM registers, there is a short to ground in the wiring near that point.

With a Self-Powered Test Light or Ohmmeter (Figure 6)

1. Remove the blown fuse and disconnect the Battery and load.
2. Connect one lead of a self-powered test light or ohmmeter to the fuse terminal on the load side.
3. Connect the other lead to a known good ground.

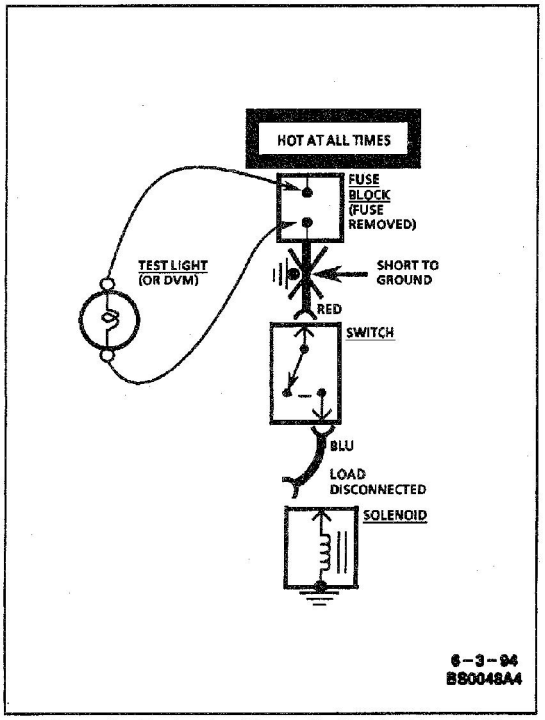


Figure 5 - Testing for Short with Test Light or DVM

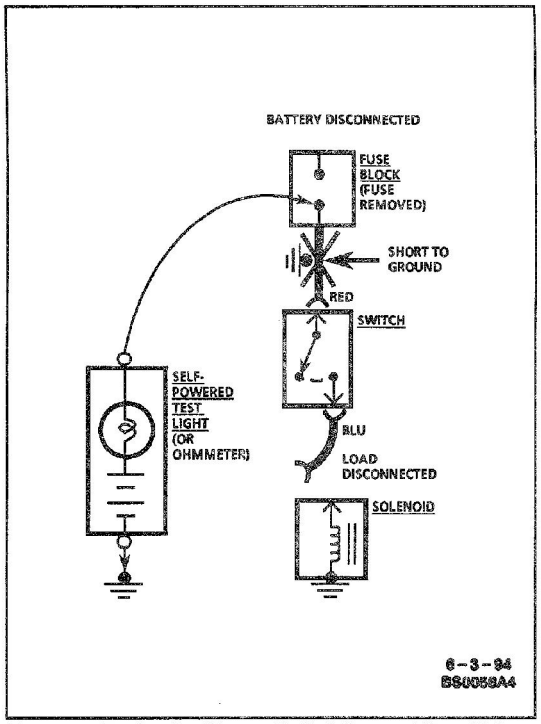


Figure 6 - Testing for Short with Self-Powered Test Light or Ohmmeter

4. Beginning near the Fuse Block, wiggle the harness from side to side. Continue this at convenient points (about 6 inches apart) while watching the self-powered test light or ohmmeter.
5. When the self-powered test light glows, or the ohmmeter registers, there is a short to ground in the wiring near that point.

Fuses Powering Several Loads

1. Find the schematic in "Fuse Block Details," page 8A-11-0, for the fuse that has blown.
2. Open the first connector or switch leading from the fuse to each load.
3. Replace the fuse.
   - If the fuse blows, the short is in the wiring leading to the first connector or switch. Use a test light or meter as described on previous page.
   - If fuse does not blow, refer to next step.
4. Close each connector or switch until the fuse blows in order to find which circuit has the short. Connect test lamp or meter at the connector to the suspect circuit (disconnected) rather than at the fuse terminals.

JUMP STARTING PROCEDURE

Refer to SECTION 6D-1 for jump starting procedure.

INTERMITTENT AND POOR CONNECTIONS

Most intermittents are caused by faulty electrical connections or wiring, although occasionally a sticking relay or solenoid can be a problem. Some items to check are:

- Poor mating of connector halves, or terminals not fully seated in the connector body (backed out).
- Dirt or corrosion on the terminals. The terminals must be clean and free of any foreign material which could impede proper terminal contact.
- Damaged connector body, exposing the terminals to moisture and dirt, as well as not maintaining proper terminal orientation with the component or mating connector.
- Improperly formed or damaged terminals. All connector terminals in problem circuits should be checked carefully to ensure good contact tension. Use a corresponding mating terminal to check for proper tension. Refer to "Checking Terminal Contact" in this section for the specific procedure.
- The J 35616-A Connector Test Adapter Kit must be used whenever a diagnostic procedure requests checking or probing a terminal. Using the adapter will ensure that no damage to the terminal will occur, as well as giving an idea of whether contact tension is sufficient. If contact tension seems incorrect, refer to "Checking Terminal Contact" in this section for specifics.
- Poor terminal-to-wire connection. Some conditions which fall under this description are poor crimps, poor solder joints, crimping over wire insulation rather than the wire itself, corrosion in the wire-to-terminal contact area, etc.
- Wire insulation which is rubbed through, causing an intermittent short as the bare area touches other wiring or parts of the vehicle.
- Wiring broken inside the insulation. This condition could cause a continuity check to show a good circuit, but if only 1 or 2 strands of a multi-strand type wire are intact, resistance could be far too high.

To avoid any of the above problems when making wiring or terminal repairs, always follow the instructions for wiring and terminal repair outlined in SECTION 8A-5.

CHECKING TERMINAL CONTACT

When diagnosing an electrical system that utilizes Metri-Pack 150/280/480/630 series terminals (refer to Terminal Repair Kit, J 38125-A, instruction manual, J 38125-4 for terminal identification), it is important to check terminal contact between a connector and component, or between in-line connectors, before replacing a suspect component.

TROUBLESHOOTING PROCEDURES

Frequently, a diagnostic chart leads to a step that reads: "Check for poor connection." Mating terminals must be inspected to assure good terminal contact. A poor connection between the male and female terminal at a connector may be the result of contamination or deformation.

Contamination is caused by the connector halves being improperly connected, a missing or damaged connector seal, or damage to the connector itself, exposing the terminals to moisture and dirt. Contamination, usually in 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, 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 (see Figure 7), causing an open or intermittently open circuit.

Follow the procedure below to check terminal contact.

1. Separate the connector halves. Refer to Terminal Repair Kit, J 38125-A, instruction manual, J 38125-4.
2. Inspect the connector halves for contamination. Contamination will result in a white or green build-up within the connector body or between terminals, causing 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, J 38125-A, check the retention force of the female terminal in question by inserting and removing the male terminal to the female terminal in the connector body. Good terminal contact will require a certain amount of force to separate the terminals.
4. Using an equivalent female terminal from the Terminal Repair Kit, J 38125-A, compare the retention force of this terminal to the female terminal in question by joining and separating the male terminal to the good female terminal, and then joining and separating the male terminal to the female terminal in question. If the retention force is significantly different between the two female terminals, replace the female terminal in question (refer to Terminal Repair Kit, J 38125-A).

If a visual (physical) check does not reveal the cause of the problem, the vehicle may be able to be driven with a DVM connected to the suspected circuit. An abnormal voltage reading when the problem occurs indicates the problem may be in that circuit.

DETECTING ELECTRICAL INTERMITTENTS

Use the following procedure to detect intermittent terminal contact or a broken wire with an intermittent connection inside the insulation.

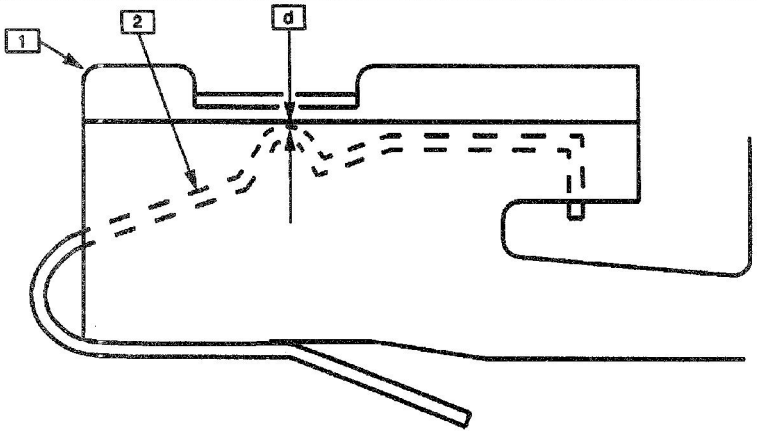
The J 39200 Digital Multimeter has the ability to monitor current, resistance, or voltage while recording the minimum (MIN) and maximum (MAX) values measured. The meter can also be set to display the average (AVG) value measured.

When diagnosing circuits that have voltage applied, use the voltage setting to monitor a connector (or length of a circuit) which is suspected of having an intermittent connection but is currently operating normally.

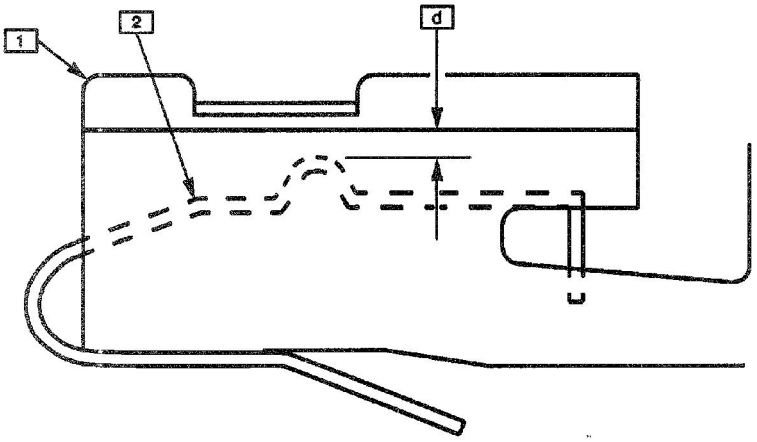
1. Connect the J 39200 Digital Multimeter to both sides of a suspect connector (still connected) or from one end of a suspect circuit to the other. This will continuously monitor the terminal contacts or length of wire being checked. See "Meter Connections" for examples of the various methods for connecting the meter to the circuit.
2. Set the meter for voltage. Since the "MIN MAX" mode does not use auto ranging, manually select the voltage range necessary before proceeding.
3. Press the "MIN MAX" button. The meter should read "100 ms RECORD" (100 millisecond record) and emit a 1/4 second beep. The meter is now ready to record and will generate an audible tone for any change in voltage. At this point, you may wish to press the "PEAK MIN MAX" button, which will record any voltage variations that occur for at least 1 millisecond.
4. Try to simulate the condition that is potentially causing an intermittent connection, either by wiggling connections or wiring, test driving or performing other operations. If an open or resistance is created, a voltage will be present and the meter will emit a tone for as long as the open or resistance exists. Any change in voltage will cause the meter to emit a tone for no less than 1/4 second. (Listening for a tone while manipulating wiring is very helpful for narrowing down an intermittent connection.)

   Use the MIN and MAX values when the meter is out of sight or sound range, in noisy areas or for test driving when it may not be possible to monitor the meter.

   To check the MIN and MAX recorded voltages press "MIN MAX" once for MAX and twice for MIN. A variation between MIN and MAX recorded voltages (unless nearly 0 volts) suggests an intermittent open or that resistance exists and should be repaired as necessary. Refer to SECTION 8A-5 of any current GM Service Manual for approved repair procedures.



d ABOUT EQUAL TO 0, GOOD TERMINAL CONTACT



d MUCH GREATER THAN 0, POOR TERMINAL CONTACT

1 TYPICAL METRI – PACK 150/280/480/630 SERIES FEMALE TERMINAL (150 SERIES PUSH – TO – SEAT SHOWN)

2 CONTACT TANG

d AMOUNT OF DEFORMATION

6-1-94
BS0068A4

Figure 7 - Deformation of a Typical Metri-Pack 150/280/480/630 Series Female Terminal

TROUBLESHOOTING PROCEDURES

Important:

- The "100 ms RECORD" (100 millisecond record) mode is NOT the amount of time allowed to perform a specific procedure. It is the amount of time used to record each snapshot of information used for calculating "AVG" when in the "MIN MAX" mode.

METER CONNECTIONS

The previous diagnostic procedure was written to detect intermittents using the meter set to voltage. Whether using the current, voltage or resistance setting to detect intermittents, it is necessary to connect the meter to the circuit.

Following are examples of the various methods of connecting the meter to the circuit to be checked:

- Backprobe both ends of the connector and either hold the leads in place while manipulating the connector or tape the leads to the harness for continuous monitoring while performing other operations or test driving. (Do not backprobe "Weather Pack®" type connectors.)
- Disconnect the harness at both ends of the suspect circuit where it connects either to a component or to other harnesses.
- Use Connector Test Adapter Kit J 35616-A to connect the meter to the circuit.
- If the system being diagnosed has a specified pinout or breakout box, it may be used to simplify connecting the meter to the circuit or for checking multiple circuits quickly.

ADDITIONAL INFORMATION

NOTICE: Turn off power to the test circuit before attempting in-circuit resistance measurements to prevent false readings or damage to the meter. Do not use the meter to measure resistance through a solid state module.

Continuity tests that work well for detecting intermittent shorts to ground can be performed by setting the meter to "ohms" then pressing the "PEAK MIN MAX" button. An audible tone will be heard whenever the meter detects continuity for at least 1 millisecond.

The J 39200 Instruction Manual is a good source of information and should be read thoroughly upon receipt of the meter as well as kept on hand for reference during new procedures.

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