WARNING > GENERAL WARNINGS

WARNINGS provide information to prevent personal injury and vehicle damage. Below is a list of general warnings that should be followed any time a vehicle is being serviced.

WARNING:

Always wear safety glasses for eye protection.

WARNING:

Use safety stands anytime a procedure requires being under a vehicle.

WARNING:

Be sure that the ignition switch is always in the off position, unless the procedure requires it to be on.

WARNING:

Set the parking brake when working on any vehicle. An automatic transmission should be in park. A manual transmission should be in neutral.

WARNING:

Operate the engine only in a well-ventilated area.

WARNING:

Keep away from moving parts when the engine is running, especially the fan and belts.

WARNING:

To prevent serious burns, avoid contact with hot parts such as the radiator, exhaust *manifold(s), tail pipe, catalytic converter and muffler.*

WARNING:

Do not allow flame or sparks near the battery. Gases are always present in and around the battery.

WARNING:

Always remove rings, watches, loose hanging jewelry and avoid loose clothing.

DESCRIPTION > CIRCUIT FUNCTIONS

All circuits in the wiring diagrams use an alpha/numeric code to identify the wire and its function. To identify which circuit code applies to a system, refer to the CIRCUIT IDENTIFICATION CODE CHART.

NOTE:

This chart shows the main circuits only and does not show the secondary codes that may apply to some models.

CIRCUIT IDENTIFICATION CODE CHART

CIRCUIT CODE	FUNCTION
A	BATTERY FEED
B	BRAKE CONTROLS
C	CLIMATE CONTROLS
D	DIAGNOSTIC CIRCUITS
E	DIMMING ILLUMINATION CIRCUITS
F	FUSED CIRCUITS
G	MONITORING CIRCUITS (GAUGES)
H	MULTIPLE
I	NOT USED
J	OPEN

K	POWERTRAIN CONTROL MODULE
L	EXTERIOR LIGHTING
M	INTERIOR LIGHTING
N	MULTIPLE
O	NOT USED
P	POWER OPTION (BATTERY FEED)
Q	POWER OPTIONS (IGNITION FEED)
R	PASSIVE RESTRAINT
S	SUSPENSION/STEERING
T	TRANSMISSION/TRANSAXLE/TRANSFER CASE
U	OPEN
V	SPEED CONTROL, WIPER/WASHER
W	WIPERS
X	AUDIO SYSTEMS
Y	TEMPORARY
Z	GROUNDS

DESCRIPTION > CIRCUIT INFORMATION

Each wire shown in the wiring diagrams contains a code which identifies the main circuit, a specific portion of the main circuit, gauge of wire, and color.

As an example, circuit **A 2 18 LB/YL** is decoded in the following manner:

Circuit Type:	**A** (Battery Feed Circuit)
Circuit Level:	**2** (Level Two)
Wire Size:	**18** (Eighteen Gauge Wire)
Wire Color:	**LB/YL** (Light Blue with Yellow Tracer)

WIRE COLOR CODE CHART

COLOR CODE	COLOR
BL	BLUE
BK	BLACK
BR	BROWN
DB	DARK BLUE

DG	DARK GREEN
GY	GRAY
LB	LIGHT BLUE
LG	LIGHT GREEN
OR	ORANGE
PK	PINK
RD	RED
TN	TAN
VT	VIOLET
WT	WHITE
YL	YELLOW
*	WITH TRACER

DIAGNOSIS AND TESTING > WIRING HARNESS TESTING > TROUBLESHOOTING TOOLS

When diagnosing a problem in an electrical circuit there are several common tools necessary. These tools are listed and explained below:

Voltmeter

The voltmeter is used to measure the electrical pressure or the voltage difference between two points. A voltmeter reads available voltages such as battery voltage, generator output voltage, and voltage drop across a component or conductor. A high voltage drop may indicate a high resistance in the circuit. The voltmeter can be used to locate an open circuit and circuits with an unintentional ground. Observing polarity, always connect a voltmeter in parallel to the existing circuit. If the leads are reversed on a digital multimeter, a minus sign appears in the display.

CAUTION:

Most of the electrical components used in today's vehicles are Solid State. When checking voltages in these circuits, use a meter with a 10 - megohm or greater impedance rating.

Ohmmeter

The ohmmeter is used to measure the resistance of a component or the resistance between two points in a circuit in ohms, and to check a portion of the circuit for continuity. Some meters have a built-in tone to indicate that the circuit has continuity. No resistance indicates a short circuit or unintentional ground whereas resistance that is higher than specification indicates a high resistance in the circuit such as a loose, dirty or corroded connection, or a defective component. An "OL" reading means that the circuit or component had infinite resistance; an open circuit or defective component is indicated. Ohmmeters have an internal battery and must never be connected to a power circuit. Connecting an ohmmeter to a powered circuit causes the meter fuse to blow and can damage its dry cell battery. Ohmmeters can be connected into a circuit without regard to polarity, unless the circuit contains a diode. When using an ohmmeter, the component or portion of the circuit must be isolated from other components or branches to avoid false readings.

CAUTION:

Most of the electrical components used in today's vehicles are Solid State. When checking resistance in these circuits use a meter with a 10 - megohm or greater impedance rating. In addition, make sure the power is disconnected from the circuit. Circuits that are powered up by the vehicle's electrical system can cause damage to the equipment and provide false readings.

Ammeter

Amperage or current is the measure of the rate of electron "flow" in a circuit. It is measured in the unit of the Ampere, simply called an Amp (A). In order to measure current in a circuit, the circuit must be broken or opened, and an ammeter must be inserted in series (in-line) with the circuit so that all the current that flows through the circuit will have to go through the meter. When measuring current in this manner, it requires the meter be made part of the circuit, this type of measurement is more difficult than measuring either voltage or resistance.

When an ammeter is placed in series with a circuit, it ideally drops no voltage as current goes through it. In other words, it acts very much like a piece of wire, with very little resistance from one test probe to the other. Consequently, an ammeter will act as a short circuit if placed in parallel (across the terminals of) a substantial source of voltage. If this is done, a surge in current will result, potentially damaging the meter. Ammeters are generally protected from excessive current by means of a small fuse located inside the meter housing. If the ammeter is accidently connected across a substantial voltage source, the resultant surge in current will "blow" the fuse and render the meter incapable of measuring current until the fuse is replaced.

Consult the owner's manual of the particular model of meter you own for details on measuring current.

CAUTION:

Do not crank the engine or turn on any accessories that may draw more than 10 Amps. You may open the protective fuse in the multimeter.

12-Volt Test Light

The 12-Volt test light when properly used, is one of the best and quickest pieces of test equipment available for troubleshooting 12-volt power systems. It's especially good for times when there are only two voltages, battery voltage and no voltage. For example, if you're checking to see if you have 12 volts on the Battery(+), the test light will immediately tell you if voltage is present or not.

With any test equipment, you should confirm that it's in good working order before you begin testing. For a test light, you have to have a voltage source. Connect the test light's ground clip to a good ground and touch it to a point where you believe that there is 12-volt supply. If the light doesn't light up, check the light by connecting it directly across the battery. Initially, make sure that you have the ground clip on the negative battery terminal. If you touch the probe to the positive terminal, the test light should light up. If it doesn't and the battery is not completely dead, the test light isn't working properly. The test light must be in proper working order before any circuit testing can occur.

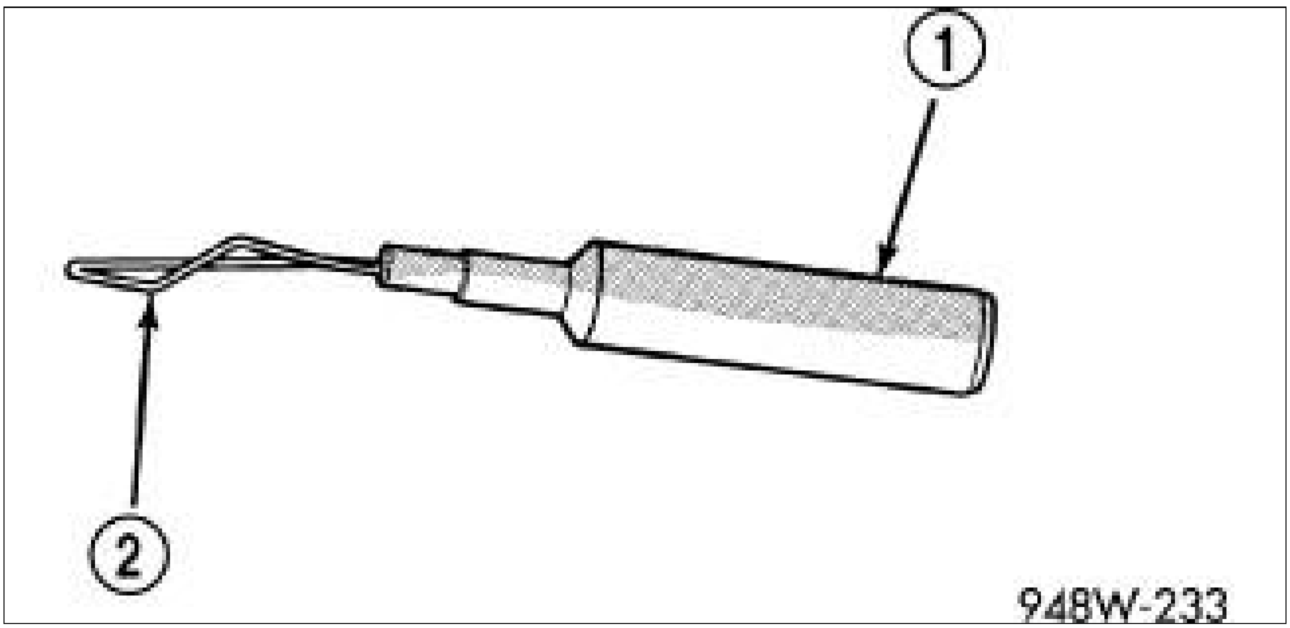
Jumper Wire

The sole purpose of the jumper wire is to complete a circuit. It is nothing more than a suitable length of insulated wire with terminals or connectors on each end. Jumper wires may be bought or made with various sizes of wire and styles of terminals including alligator clips, spade lugs and pin plugs, and should include a fuse device of some type for circuit and component protection. A jumper wire is used to verify a faulty conductor by substituting a known good one. It is jumped across a suspicious conductor in the circuit. If the circuit works with the jumper, but not without, there is an open somewhere in the area being jumped. A jumper wire is ONLY used to bypass a faulty conductor (including switches and connectors). NEVER bypass a load device with a jumper wire. The circuit needs the resistance from the load device and shorting across it causes high current flow, which could damage other components.

WARNING:

Never use a jumper wire across a load, such as a motor, connected between a battery feed and ground.

Fig 1: Probing Tool



Courtesy of CHRYSLER GROUP, LLC

1 - SPECIAL TOOL 6801	
2 - PROBING END	

Probing Tools

These tools are used for probing terminals in connectors. Select the proper size tool from Special Tool Package (special tool #6807, Terminal Tools) and insert the probing end (2) into the terminal being tested. Use the other end of the tool (1) to insert the meter probe.

DIAGNOSIS AND TESTING > WIRING HARNESS TESTING > INTERMITTENT AND POOR CONNECTIONS

Most intermittent electrical problems are caused by faulty electrical connections or wiring. It is also possible for a sticking component or relay to cause a problem.

Before condemning a component or wiring assembly, check the following items:

- Connectors are fully seated
- Spread terminals, or terminal push out
- Terminals in the wiring assembly are fully seated into the connector/component and locked into position
- Dirt or corrosion on the terminals. Any amount of corrosion or dirt could cause an intermittent problem
- Damaged connector/component casing exposing the item to dirt or moisture
- Wire insulation that has rubbed through causing a short to ground
- Some or all of the wiring strands broken inside of the insulation

DIAGNOSIS AND TESTING > WIRING HARNESS TESTING > TROUBLESHOOTING WIRING PROBLEMS

When troubleshooting wiring problems there are six steps which can aid in the procedure. The steps are listed and explained below. Always check for non-factory items added to the vehicle before doing any diagnosis. If the vehicle is equipped with these items, disconnect them to verify these add-on items are not the cause of the problem.

Perform the following Six Step Diagnosis Process:

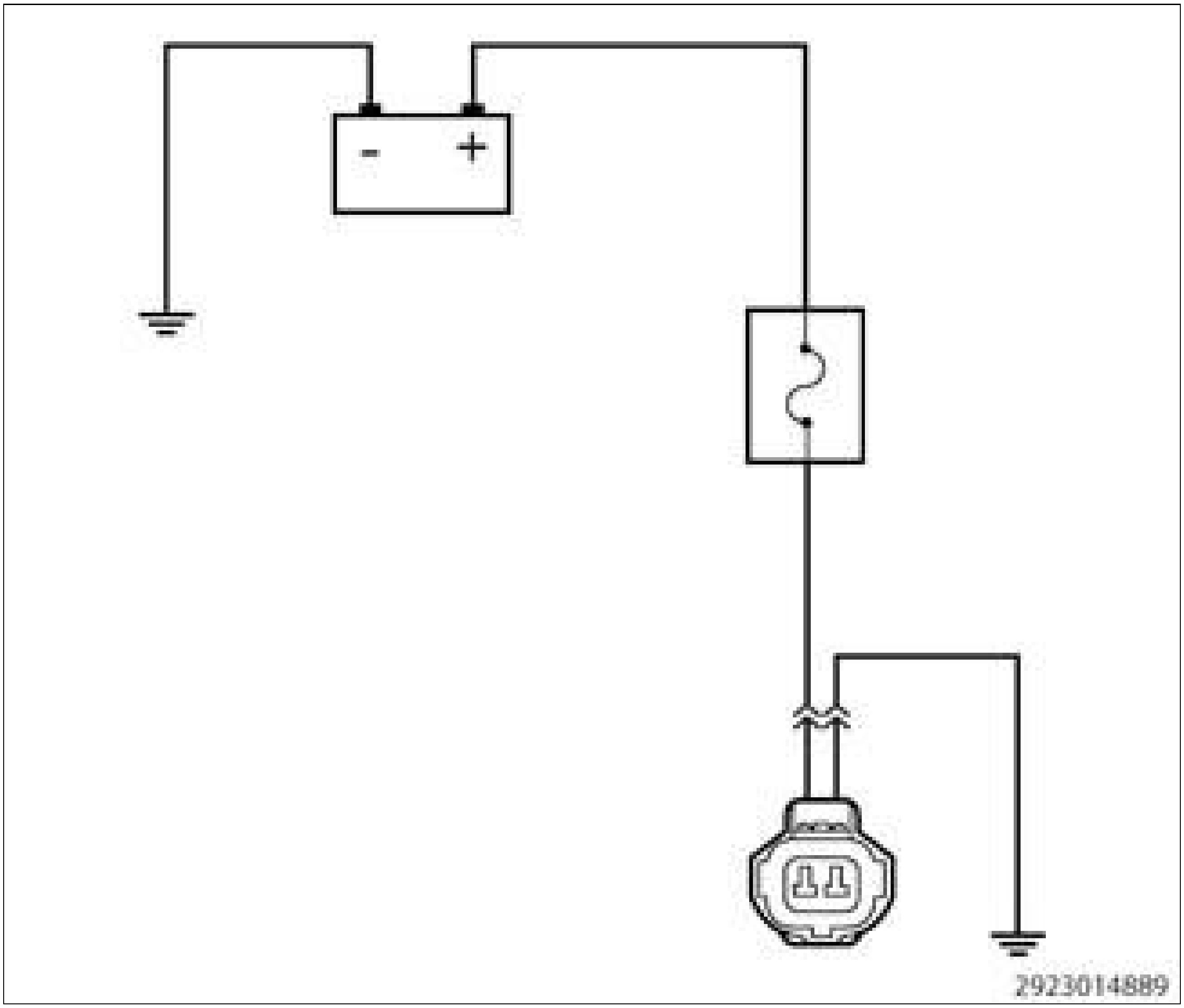
1. Verify the problem.
2. Verify any related symptoms. Do this by performing operational checks on components that are in the same circuit (Refer to the SYSTEM WIRING DIAGRAMS article).
3. Analyze the symptoms. Use the wiring diagrams to determine what the circuit is doing, where the problem most likely is occurring and where the diagnosis will continue.
4. Isolate the problem area.
5. Repair the problem area.
6. Verify the proper operation. For this step, check for proper operation of all items on the repaired circuit (Refer to the SYSTEM WIRING DIAGRAMS article).

NOTE:

The Six Step Diagnosis Process used by Chrysler is a time proven process. The basic concepts of this process have been used by others for problem solving for many years. The successful application of this process requires a solid understanding of the conditions that affect each step, and when its time to advance to the next step. These conditions based on experience formulate what is known as "Best Practices".

STANDARD PROCEDURE > CHECK A 12-VOLT FUSED BATTERY B(+) CIRCUIT FOR VOLTAGE > THEORY OF OPERATION

Fig 1: Checking 12-Volt Fused Battery B(+) Circuit For Voltage



Courtesy of CHRYSLER GROUP, LLC

The purpose of the following procedure(s) is to demonstrate how to check the voltage of a 12-volt fused battery B(+) circuit with a test light or voltmeter.

NOTE:

The circuit shown in illustration is an example, and is intended for demonstrational purpose only.

The following are circuit tests covered in this procedure:

- Testing 12-Volt Fused Battery B(+) Circuit Voltage With A Test Light
- Testing 12-Volt Fused Battery B(+) Circuit Voltage With A Voltmeter

NOTE:

Perform the following test using a known good test light or functioning multimeter:

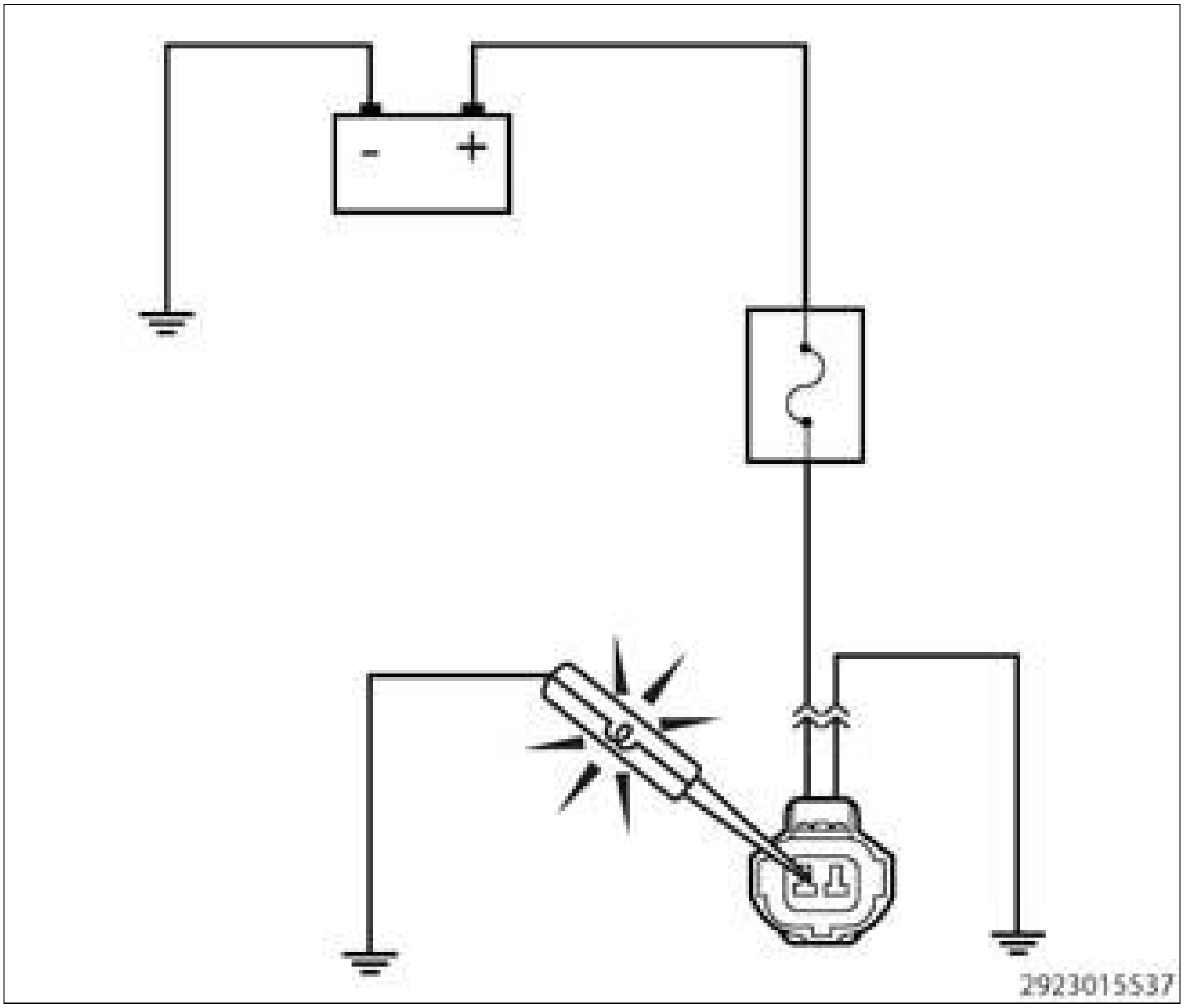
Below is a list of possible causes that could be related to a No Voltage condition.

Possible Causes
OPEN CIRCUIT (CHAFED, PIERCED, PINCHED OR BROKEN WIRES)
OPEN FUSE
OPEN IN-LINE CONNECTOR (BENT, PUSHED OUT OR CORRODED TERMINALS)

STANDARD PROCEDURE > CHECK A 12-VOLT FUSED BATTERY B(+) CIRCUIT FOR VOLTAGE > DIAGNOSTIC TEST

1. **TESTING 12-VOLT FUSED BATTERY B(+) CIRCUIT VOLTAGE WITH A TEST LIGHT**

Fig 1: Testing 12-Volt Fused Battery B(+) Circuit Voltage With Test Light



Courtesy of CHRYSLER GROUP, LLC

NOTE:

Before testing any circuits, first verify the 12-volt test light is operating properly. Connect the 12-volt test light to battery ground or to any other known good ground. Touch the lead of the test light to Battery(+). If the test light is operational, it should illuminate brightly.

1. Turn the ignition off.
2. Disconnect the wire harness connector from the component that is being tested.

   NOTE:

   Check connectors - Clean/repair as necessary.

3. At this time, leave all in-line connectors connected.

4. Connect the 12-volt test light to a known good ground.
5. Use the test light lead to carefully probe the Battery or Ignition voltage circuit in the harness connector.
6. First check with the ignition off, next check with the ignition on, and lastly check while cranking the engine.

   Does the test light illuminate brightly?

   Yes

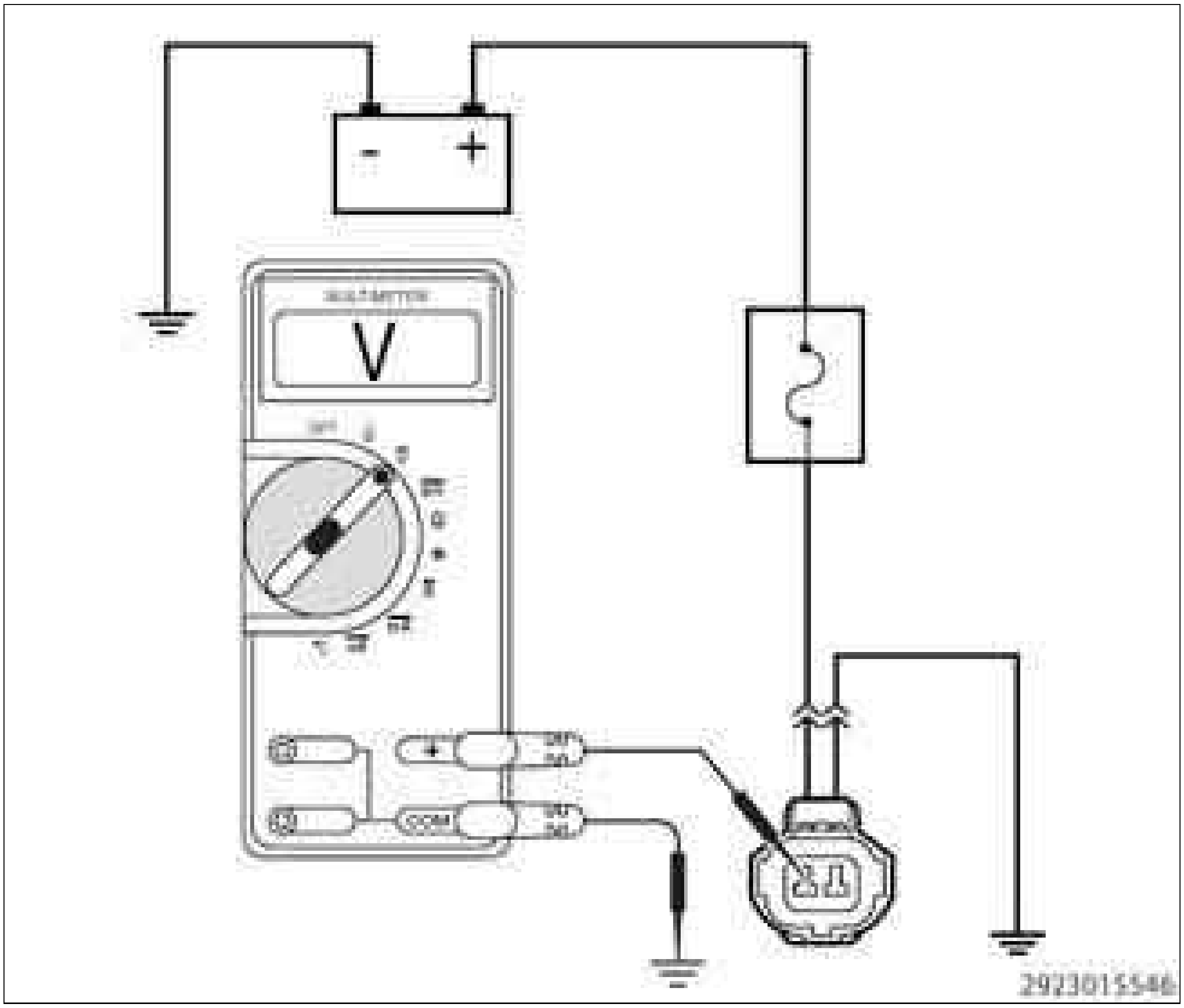
   1. The circuit is not open at this time or the condition that originally caused the open may not be present at this time. Continue to monitor the test light and wiggle the wire harness and connectors to check for an intermittent open or excessive resistance condition.
   2. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the open could occur intermittently.
   3. Look for any chafed, pierced, pinched, or partially broken wires.
   4. Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related wire harness connectors.
   5. Perform any Technical Service Bulletins (TSBs) that may apply.

   No

   1. Repair the open in the circuit. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors where the open could occur.
   2. One method to help isolate the open is to disconnect any in-line connectors and measure the resistance from one side of the in-line connector to the matching component harness connector. If the open goes away, the open is on the other side of the in-line connector.
   3. If this is a fused circuit, make sure to inspect the fuse. If the fuse is open, check the circuit for a short to ground before installing a new fuse. The circuit may have a short to ground causing the fuse to open. This short to ground could be in the wire harness or in one of the components the circuit is supplying voltage to.

2. **TESTING 12-VOLT FUSED BATTERY B(+) CIRCUIT VOLTAGE WITH A VOLTMETER**

Fig 2: Testing 12-Volt Fused Battery B(+) Circuit Voltage With Voltmeter



Courtesy of CHRYSLER GROUP, LLC

> *NOTE:*
>
> *The connector displayed in the graphics are only an example.*

1. Turn the ignition off.
2. Disconnect the wire harness connector from the component that is being tested.

   > *NOTE:*
   >
   > *Check connectors - Clean/repair as necessary.*

3. At this time leave all in-line connectors connected.
4. Use a multimeter set to measure DC voltage.

5. Connect the ground lead of the meter to a known good ground.
6. Use the positive lead of the multimeter and probe the circuit that is being checked for voltage.
7. Ignition on, engine not running.

   Is the voltage within specifications for this circuit?

   Yes

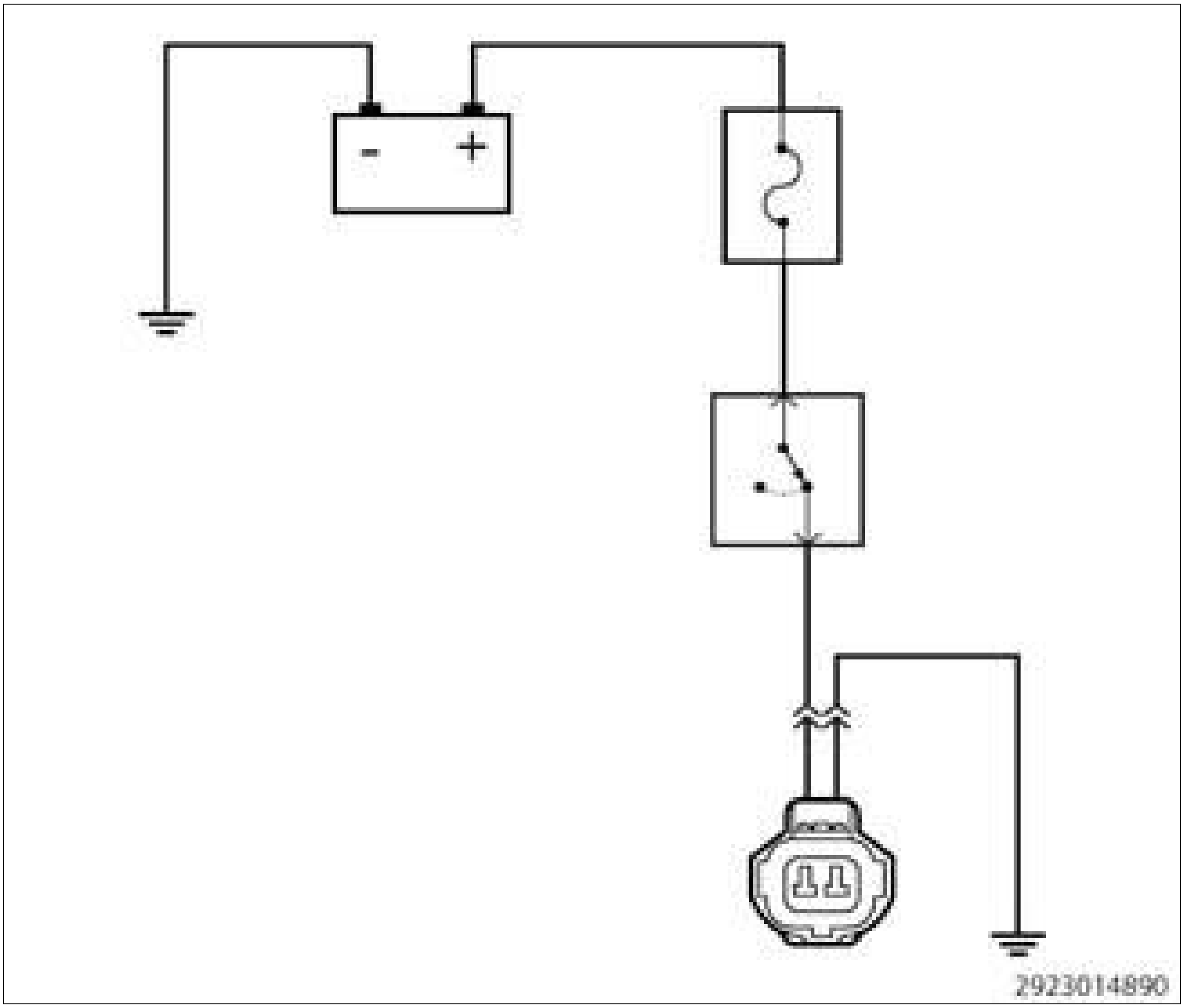
   1. The circuit is functioning properly or the condition that originally caused the open or short may not be present at this time. Continue to measure the voltage and wiggle the wire harness and connectors while checking for an intermittent open or short.
   2. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the short could occur intermittently.
   3. Look for any chafed, pierced, pinched, or partially broken wires.
   4. Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related wire harness connectors.
   5. Perform any Technical Service Bulletins (TSBs) that may apply.

   No

   1. Repair the open or short to ground in the circuit. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the short could occur.
   2. One method to help isolate the open or short is to disconnect any in-line connectors that the circuit being checked runs through and check for the voltage again. If the voltage is present, the open or short is on the other side of the in-line connector.

STANDARD PROCEDURE > CHECK A 12-VOLT SWITCHED BATTERY B(+) CIRCUIT FOR VOLTAGE > THEORY OF OPERATION

Fig 1: Checking 12-Volt Switched Battery B(+) Circuit For Voltage



Courtesy of CHRYSLER GROUP, LLC

The purpose of the following procedure is to demonstrate how to check the voltage of a 12-Volt switched battery B(+) circuit with a test light or voltmeter.

NOTE:

The circuit shown in illustration is an example, and is intended for demonstrational purpose only.

The following are circuit tests covered in this procedure:

- Testing 12-Volt Switched Battery B(+) Circuit Voltage With A Test Light
- Testing 12-Volt Switched Battery B(+) Circuit Voltage With A Voltmeter

NOTE:

Perform the following test using a known good test light or functioning multimeter:

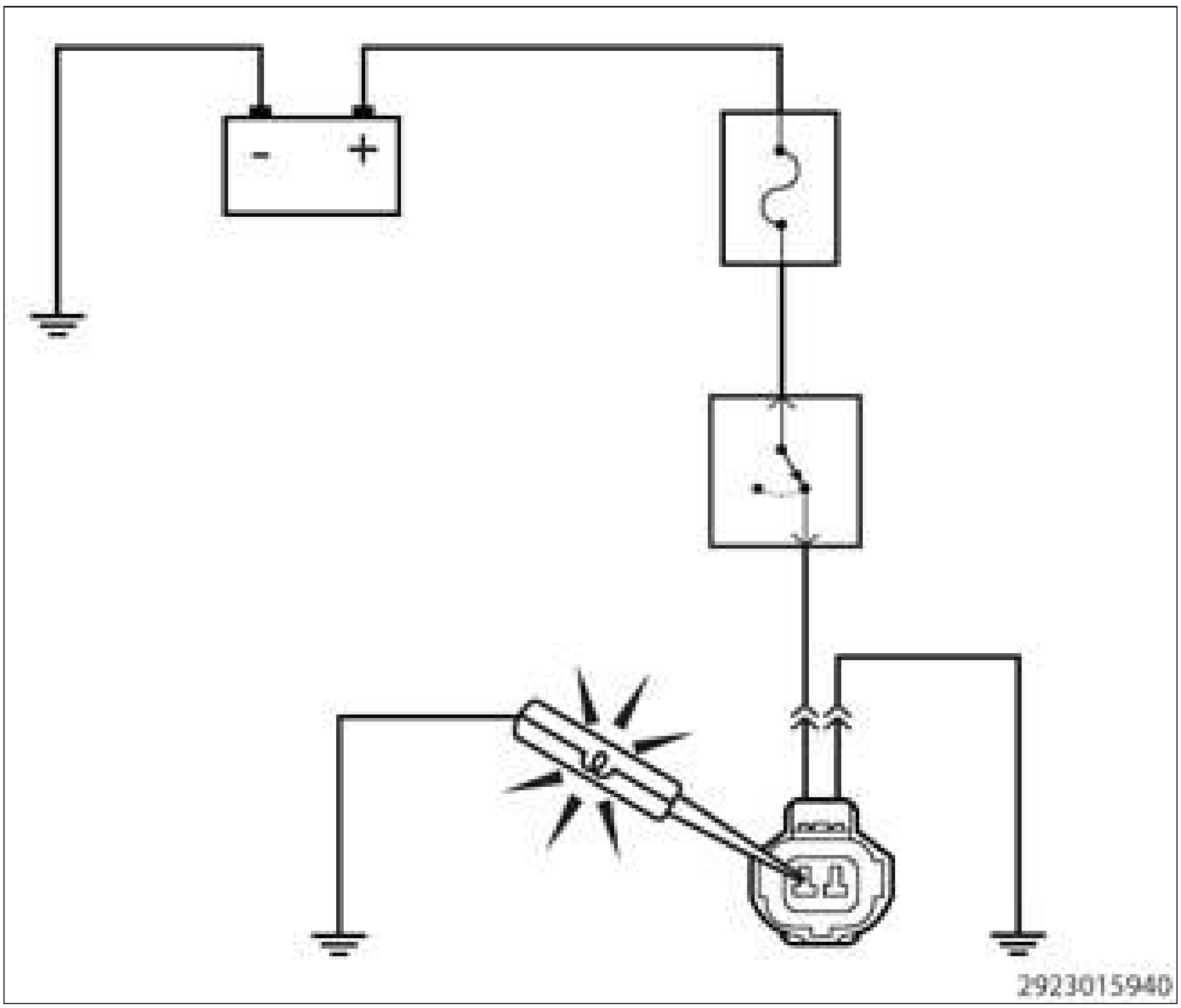
Below is a list of possible causes that could be related to a No Voltage condition.

Possible Causes
OPEN CIRCUIT (CHAFED, PIERCED, PINCHED OR BROKEN WIRES)
OPEN FUSE
FAULTY SWITCH
OPEN IN-LINE CONNECTOR (BENT, PUSHED OUT OR CORRODED TERMINALS)

STANDARD PROCEDURE > CHECK A 12-VOLT SWITCHED BATTERY B(+) CIRCUIT FOR VOLTAGE > DIAGNOSTIC TEST

1. **TESTING 12-VOLT SWITCHED BATTERY B(+) CIRCUIT VOLTAGE WITH A TEST LIGHT**

   Fig 1: Testing 12-Volt Switched Battery B(+) Circuit Voltage With Test Light



Courtesy of CHRYSLER GROUP, LLC

NOTE:

Before testing any circuits, first verify the 12-volt test light is operating properly. Connect the 12-volt test light to battery ground or to any other known good ground. Touch the lead of the test light to Battery(+). If the test light is operational, it should illuminate brightly.

1. Turn the ignition off.
2. Disconnect the wire harness connector from the component that is being tested.

   NOTE:

   Check connectors - Clean/repair as necessary.

3. At this time, leave all in-line connectors connected.
4. Connect the 12-volt test light to a known good ground.
5. Use the test light lead to carefully probe the Battery or Ignition voltage circuit in the harness connector.
6. First check with the ignition off, next check with the ignition on, and lastly check while cranking the engine.

   Does the test light illuminate brightly?

   Yes

   1. The circuit is not open at this time or the condition that originally caused the open may not be present at this time. Continue to monitor the test light and wiggle the wire harness and connectors to check for an intermittent open or excessive resistance condition.
   2. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the open could occur intermittently.
   3. Look for any chafed, pierced, pinched, or partially broken wires.
   4. Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related wire harness connectors.
   5. Perform any Technical Service Bulletins (TSBs) that may apply.

   No

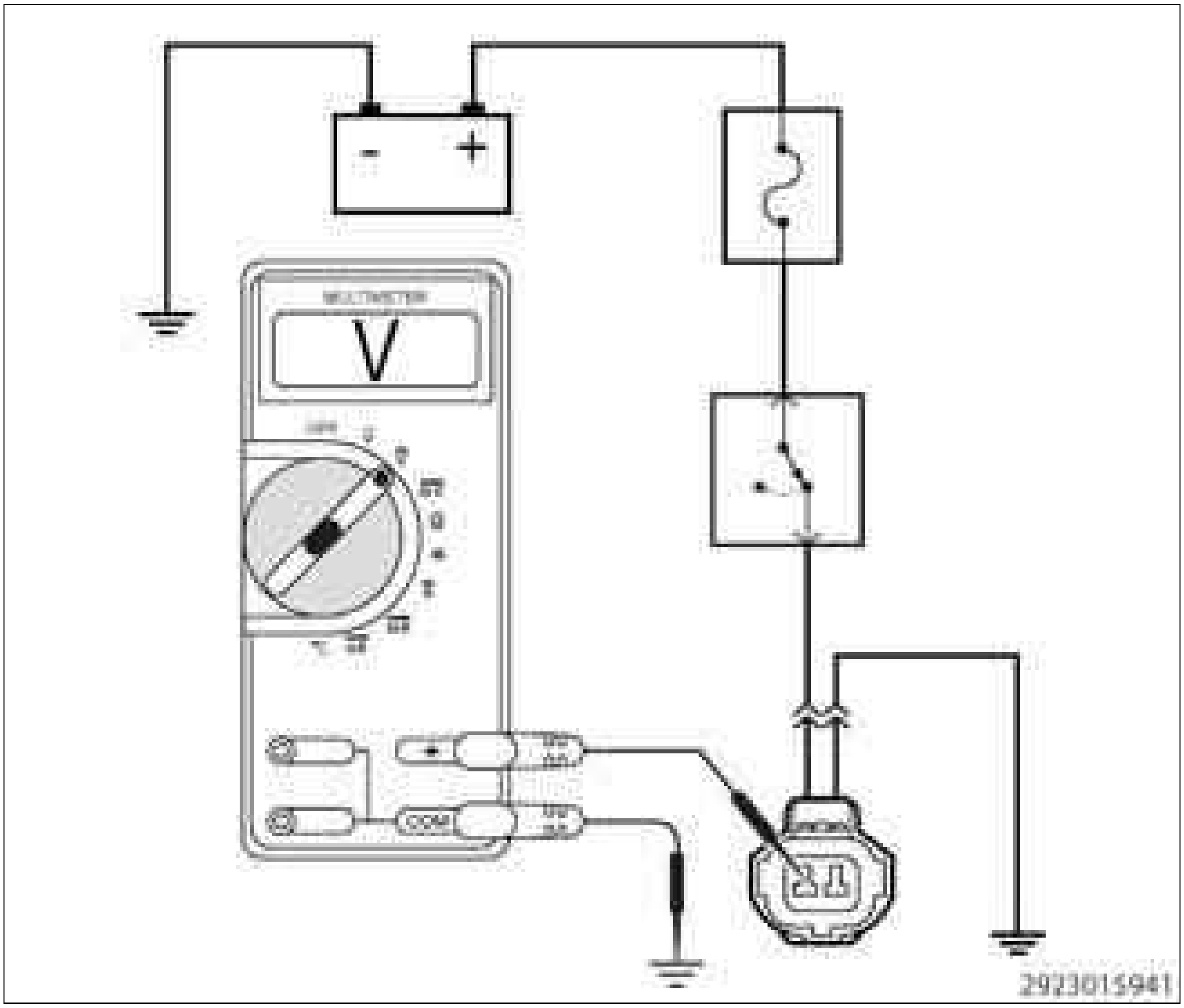
   1. Repair the open in the circuit. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors where the open could occur.
   2. One method to help isolate the open is to disconnect any in-line connectors and measure the resistance from one side of the in-line connector to the matching component harness connector. If the open goes away, the open is on

the other side of the in-line connector.

3. If this is a fused circuit, make sure to inspect the fuse. If the fuse is open, check the circuit for a short to ground before installing a new fuse. The circuit may have a short to ground causing the fuse to open. This short to ground could be in the wire harness or in one of the components the circuit is supplying voltage to.

2. **TESTING 12-VOLT SWITCHED BATTERY B(+) CIRCUIT VOLTAGE WITH A VOLTMETER**

Fig 2: Testing 12-Volt Switched Battery B(+) Circuit Voltage With Voltmeter



Courtesy of CHRYSLER GROUP, LLC

NOTE:

The connector displayed in the graphics are only an example.

1. Turn the ignition off.
2. Disconnect the wire harness connector from the component that is being tested.

> NOTE:
>
> *Check connectors - Clean/repair as necessary.*

3. At this time leave all in-line connectors connected.
4. Use a multimeter set to measure DC voltage.
5. Connect the ground lead of the meter to a known good ground.
6. Use the positive lead of the multimeter and probe the circuit that is being checked for voltage.
7. Ignition on, engine not running.

   Is the voltage within specifications for this circuit?

   Yes

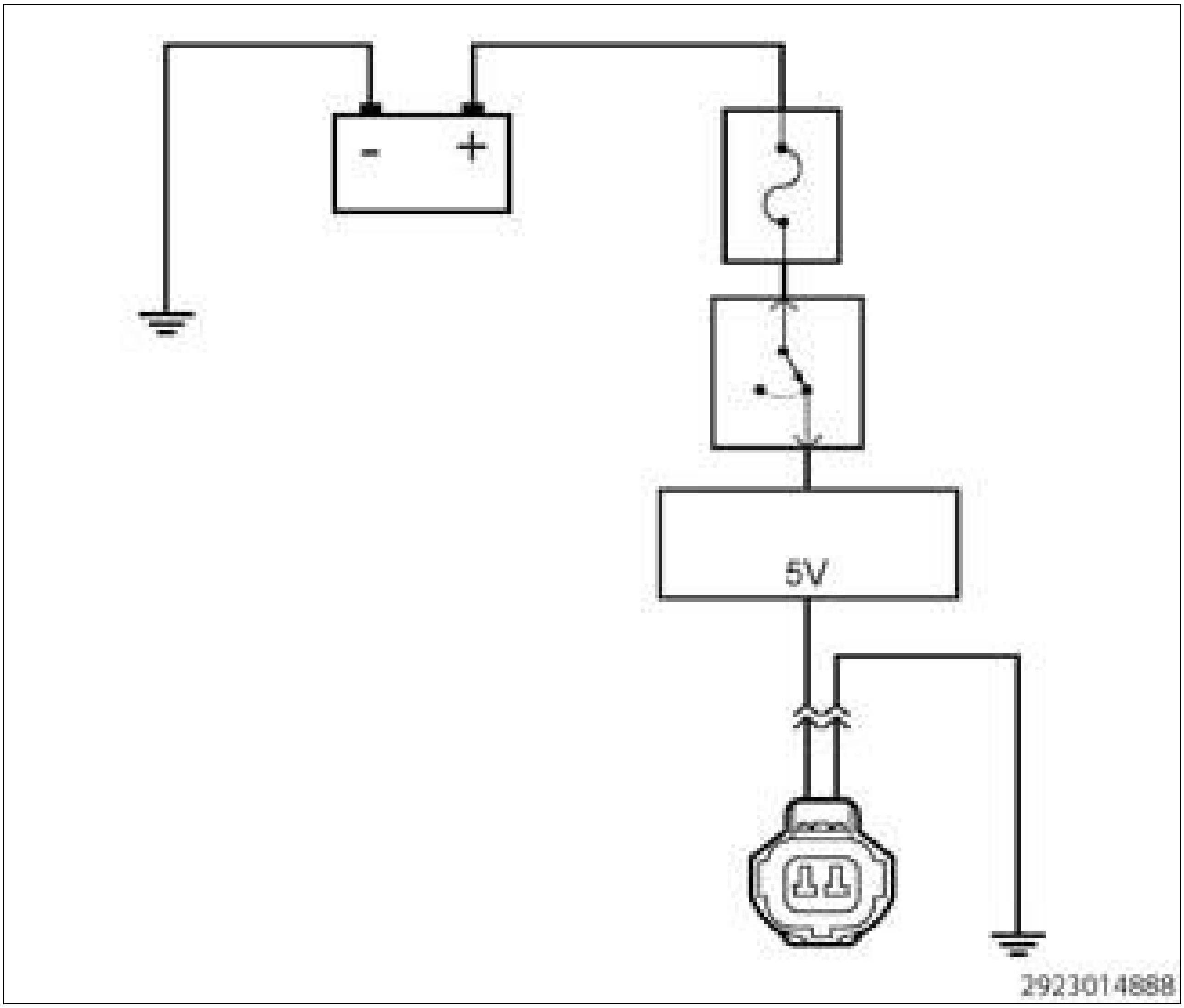
   1. The circuit is functioning properly or the condition that originally caused the open or short may not be present at this time. Continue to measure the voltage and wiggle the wire harness and connectors while checking for an intermittent open or short.
   2. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the short could occur intermittently.
   3. Look for any chafed, pierced, pinched, or partially broken wires.
   4. Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related wire harness connectors.
   5. Perform any Technical Service Bulletins (TSBs) that may apply.

   No

   1. Repair the open or short to ground in the circuit. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the short could occur.
   2. One method to help isolate the open or short is to disconnect any in-line connectors that the circuit being checked runs through and check for the voltage again. If the voltage is present, the open or short is on the other side of the in-line connector.

STANDARD PROCEDURE > CHECK A 5-VOLT SUPPLY CIRCUIT FOR VOLTAGE > THEORY OF OPERATION

Fig 1: Checking 5-Volt Supply Circuit For Voltage



Courtesy of CHRYSLER GROUP, LLC

The purpose of the following procedure is to demonstrate how to check the voltage of a 5-Volt supply circuit with a voltmeter.

NOTE:

The circuit shown in illustration is an example, and is intended for demonstrational purpose only.

The following are circuit tests covered in this procedure:

- Testing A 5-Volt Supply Circuit For Voltage
- Testing A 5-Volt Supply Circuit And Sensor Ground Circuit

NOTE:

Perform the following test using a known good multimeter:

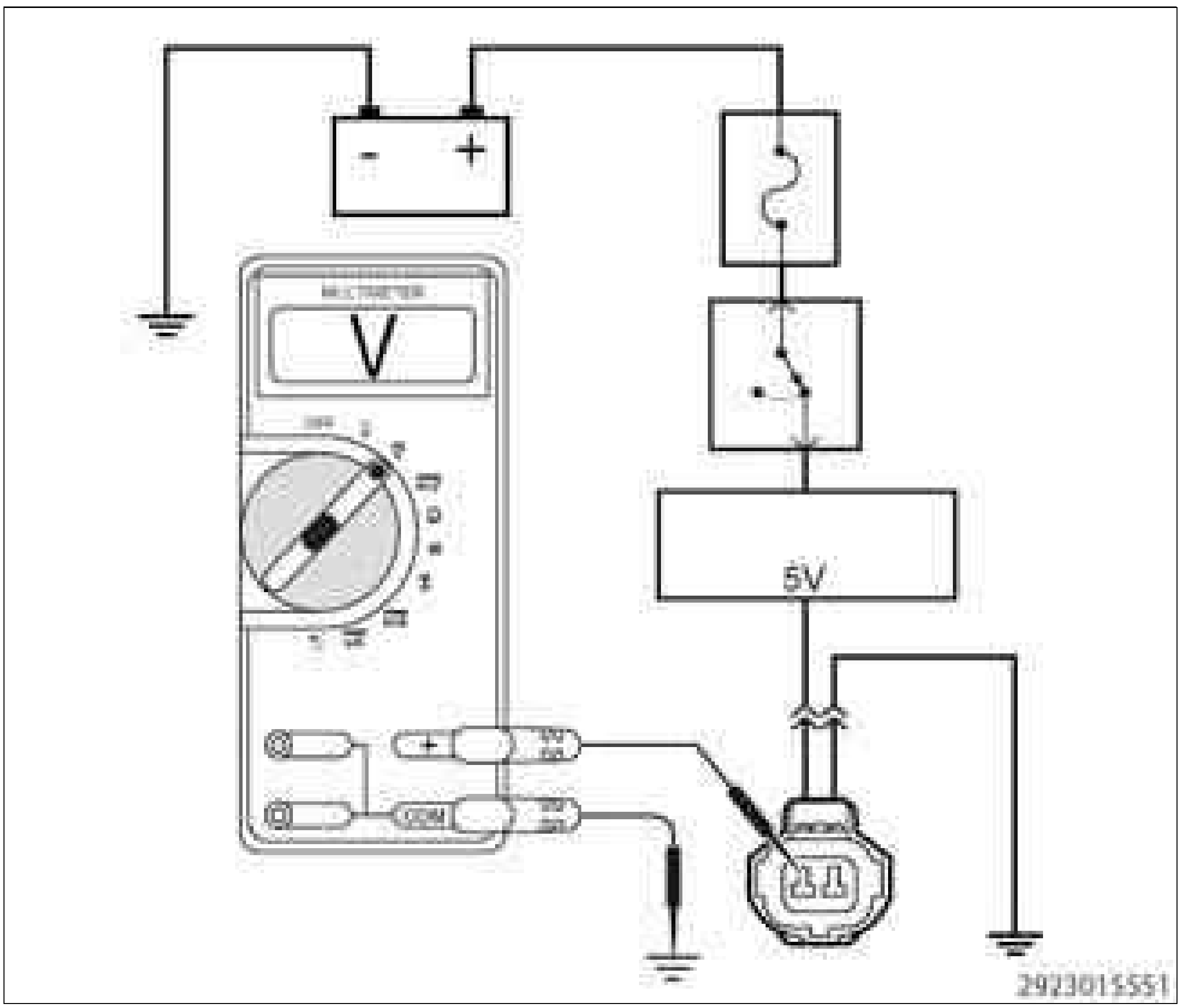
Below is a list of possible causes that could be related to a No Voltage condition.

Possible Causes
OPEN CIRCUIT (CHAFED, PIERCED, PINCHED OR BROKEN WIRES)
OPEN IN-LINE CONNECTOR (BENT, PUSHED OUT OR CORRODED TERMINALS)
ELECTRONIC CONTROL MODULE (5-VOLT SUPPLY OUTPUT)

STANDARD PROCEDURE > CHECK A 5-VOLT SUPPLY CIRCUIT FOR VOLTAGE > DIAGNOSTIC TEST

1. **TESTING A 5-VOLT SUPPLY CIRCUIT FOR VOLTAGE**

   Fig 1: Testing 5-Volt Supply Circuit For Voltage With Voltmeter



Courtesy of CHRYSLER GROUP, LLC

   1. Turn the ignition off.

2. Disconnect the sensor harness connector.

> *NOTE:*
>
> *Check connectors - Clean/repair as necessary.*

3. Turn the ignition on.
4. Set the multimeter to measure DC voltage.
5. Connect the negative lead of the multimeter to a known good ground.
6. With the positive lead of the multimeter, carefully probe the 5-volt supply circuit.

   Is the voltage between 4.7 and 5.2 volts?

   Yes

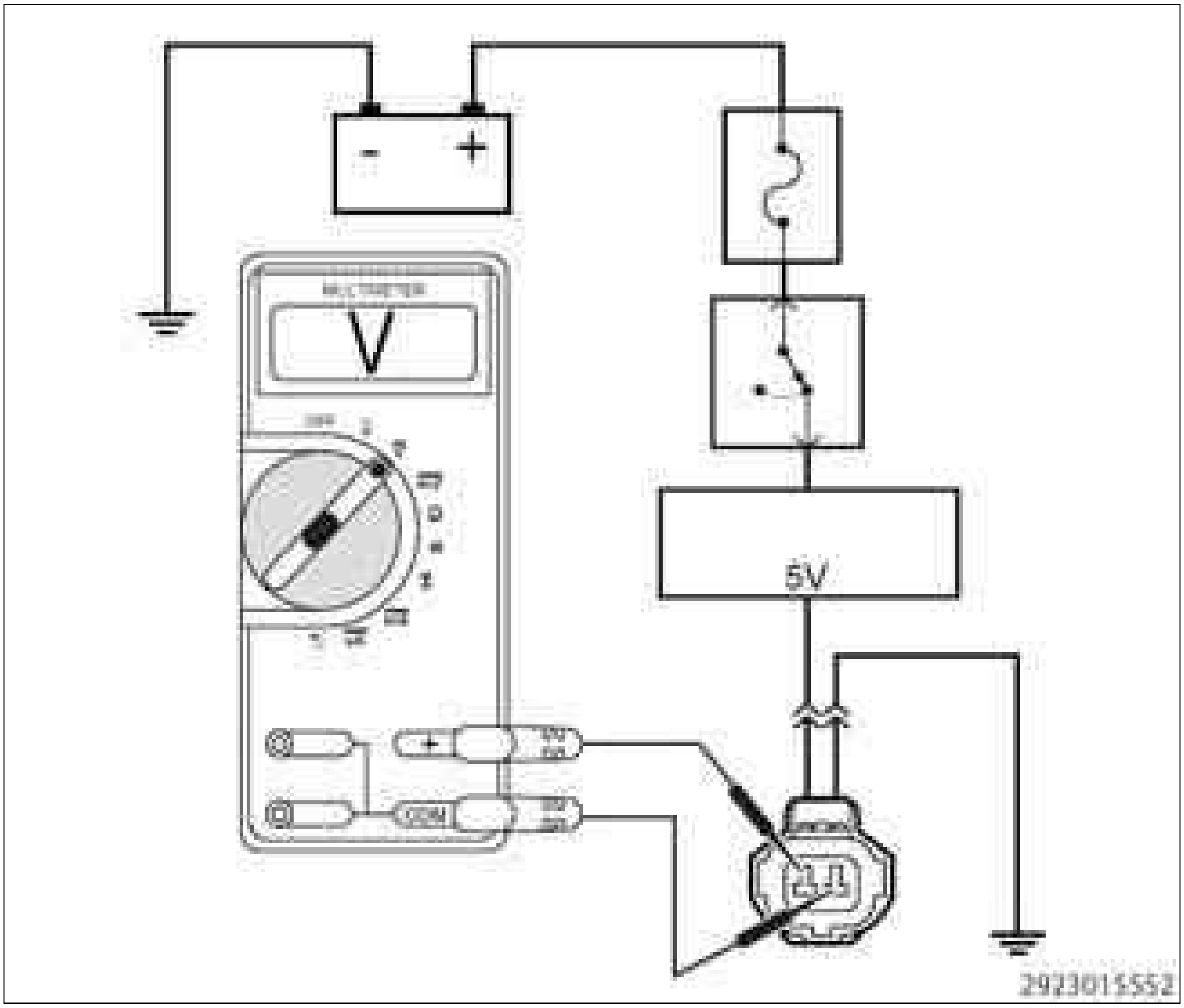
   1. Go To Step 2

   No

   1. Check the 5-volt supply circuit for an open or short to ground. For further assistance, perform the appropriate Sensor Reference Voltage DTC diagnostic procedure.

2. **TESTING A 5-VOLT SUPPLY CIRCUIT AND SENSOR GROUND CIRCUIT**

Fig 2: Testing 5-Volt Supply Circuit And Sensor Ground Circuit



Courtesy of CHRYSLER GROUP, LLC

1. With the multimeter set to measure DC voltage.
2. Move the negative lead of the multimeter to carefully probe the sensor ground or sensor return circuit in the harness connector.
3. With the positive lead of the multimeter, carefully probe the 5-volt supply circuit.

   Is the voltage between 4.7 and 5.2 volts?

   Yes

   1. At this time the 5-Volt Supply and sensor ground circuit are working properly. Continue to measure the voltage between the wires, wiggle the wire harness and connectors while checking for an intermittent condition.
   2. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the open could occur intermittently.
   3. Look for any chafed, pierced, pinched, or partially broken wires.
   4. Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related wire harness connectors.

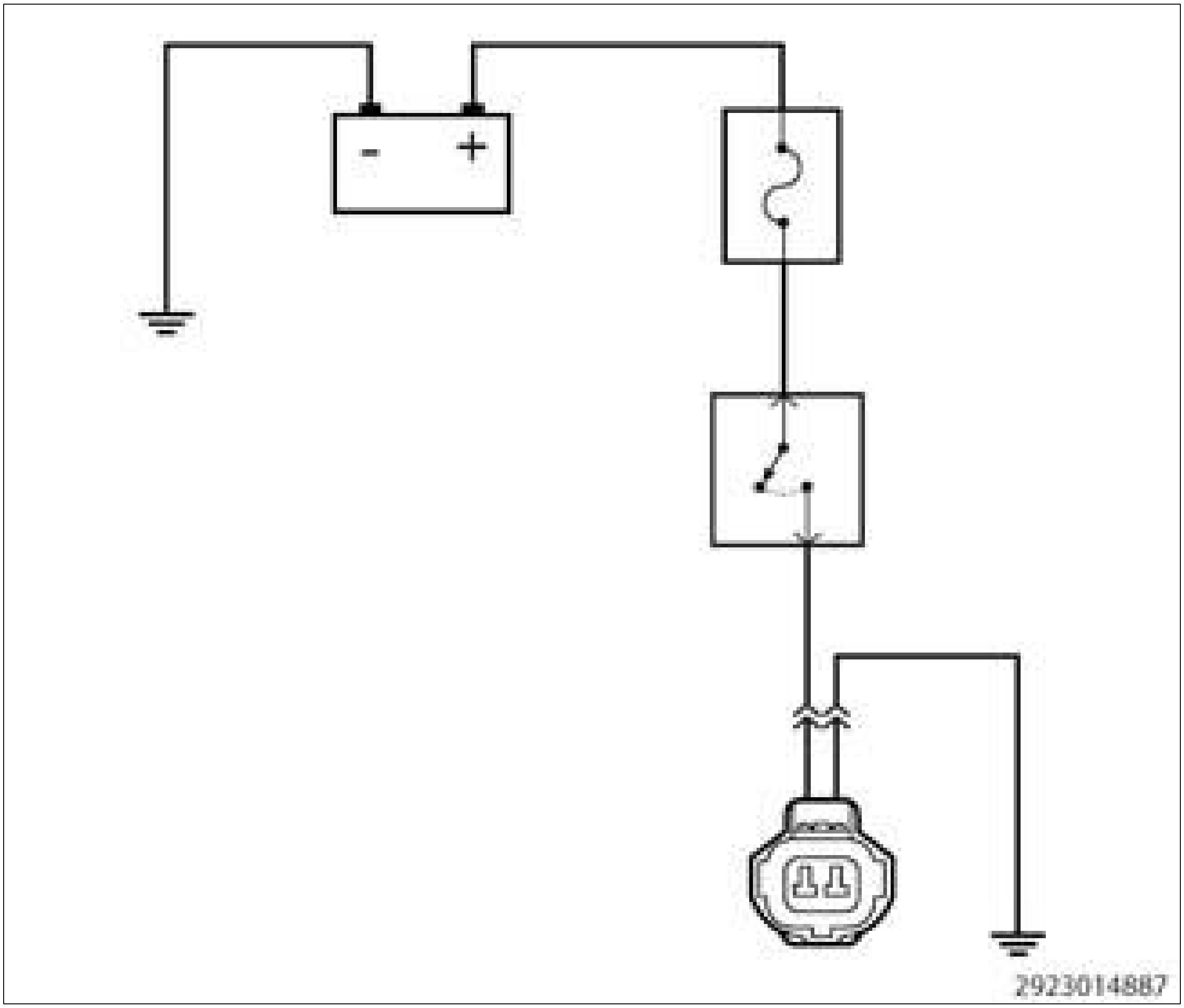
5. Perform any Technical Service Bulletins (TSBs) that may apply.

No

1. Repair the open or excessive resistance in the Sensor Ground (Sensor Return) circuit.

STANDARD PROCEDURE > CHECK A CIRCUIT FOR A SHORT TO GROUND > THEORY OF OPERATION

Fig 1: Checking Circuit For A Short To Ground



Courtesy of CHRYSLER GROUP, LLC

The purpose of the following procedure is to demonstrate how to check a circuit for a Short to Ground.

NOTE:

The circuit shown in illustration is an example, and is intended for demonstrational purpose *only.*

The following are circuit tests covered in this procedure:

- Testing For A Short To Ground Using An Ohmmeter

NOTE:

Perform the following test using a known good multimeter:

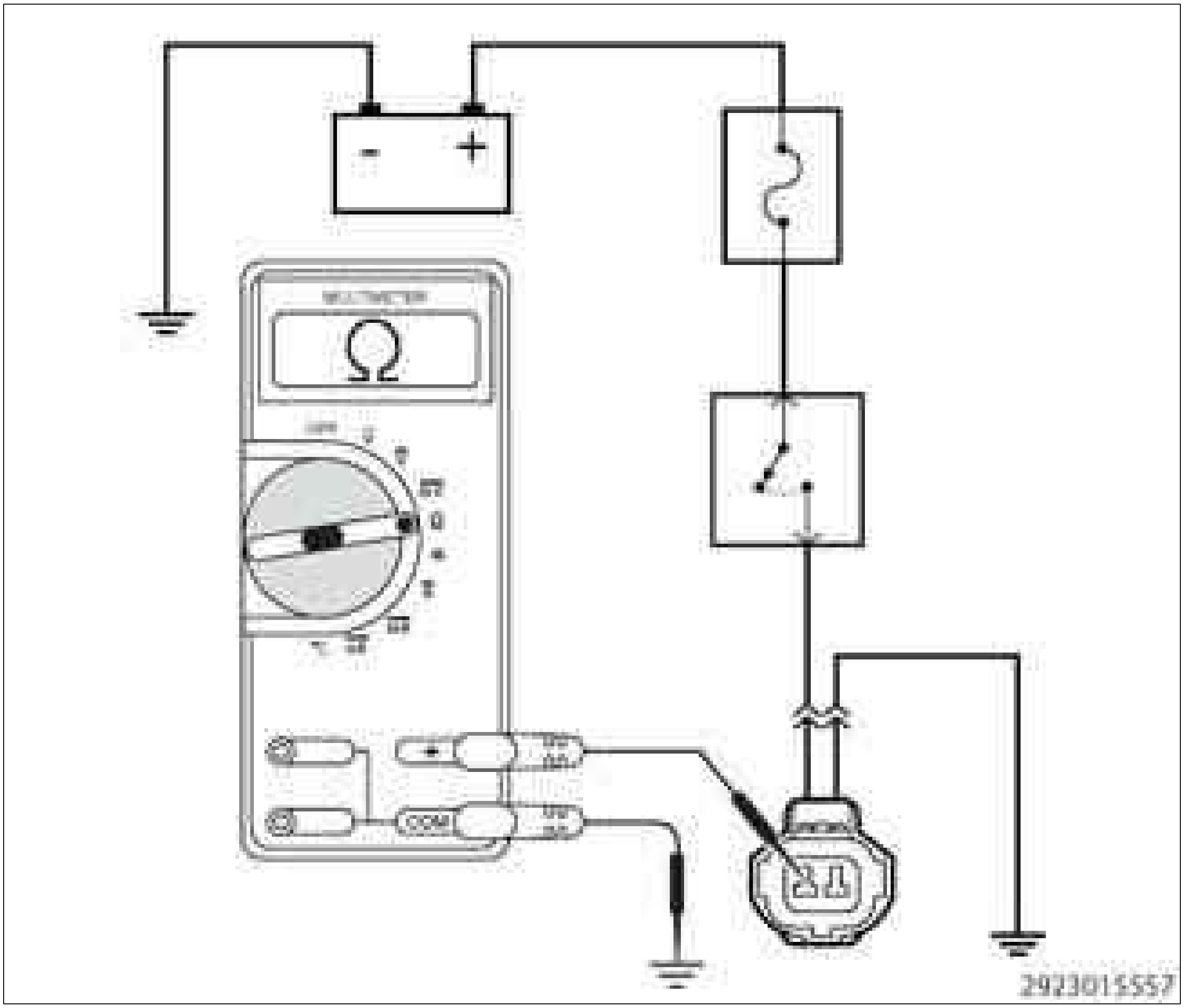
Below is a list of possible causes that could be related to a Short to Ground condition.

Possible Causes
SHORTED CIRCUIT (CHAFED, PIERCED OR PINCHED WIRES)
SHORTED IN-LINE CONNECTOR (BENT, PUSHED OUT OR CORRODED TERMINALS)

STANDARD PROCEDURE > CHECK A CIRCUIT FOR A SHORT TO GROUND > DIAGNOSTIC TEST

TESTING FOR A SHORT TO GROUND USING AN OHMMETER

Fig 1: Testing For A Short To Ground Using An Ohmmeter



Courtesy of CHRYSLER GROUP, LLC

NOTE:

Before measuring the resistance of any circuit, first measure the resistance between the two leads of the multimeter. Take this value and subtract it from the value recorded when measuring the resistance of the circuit being checked (The meter leads can add 0.5 ohm or more of total resistance).

1. Turn the ignition off.
2. Disconnect the wire harness connectors from the module and component for the suspected circuit being shorted to ground.

> *NOTE:*
>
> *Check connectors - Clean/repair as necessary.*

3. With the component wire harness connectors disconnected, use a meter set to measure Ohms (Ω), and measure the resistance between the circuit and a known good ground.
4. Use the negative lead of the meter and touch a known good ground.
5. Use the positive lead of the meter and carefully probe the circuit suspected of having the short.

   Is the resistance to ground below 10k ohms ?

   Yes

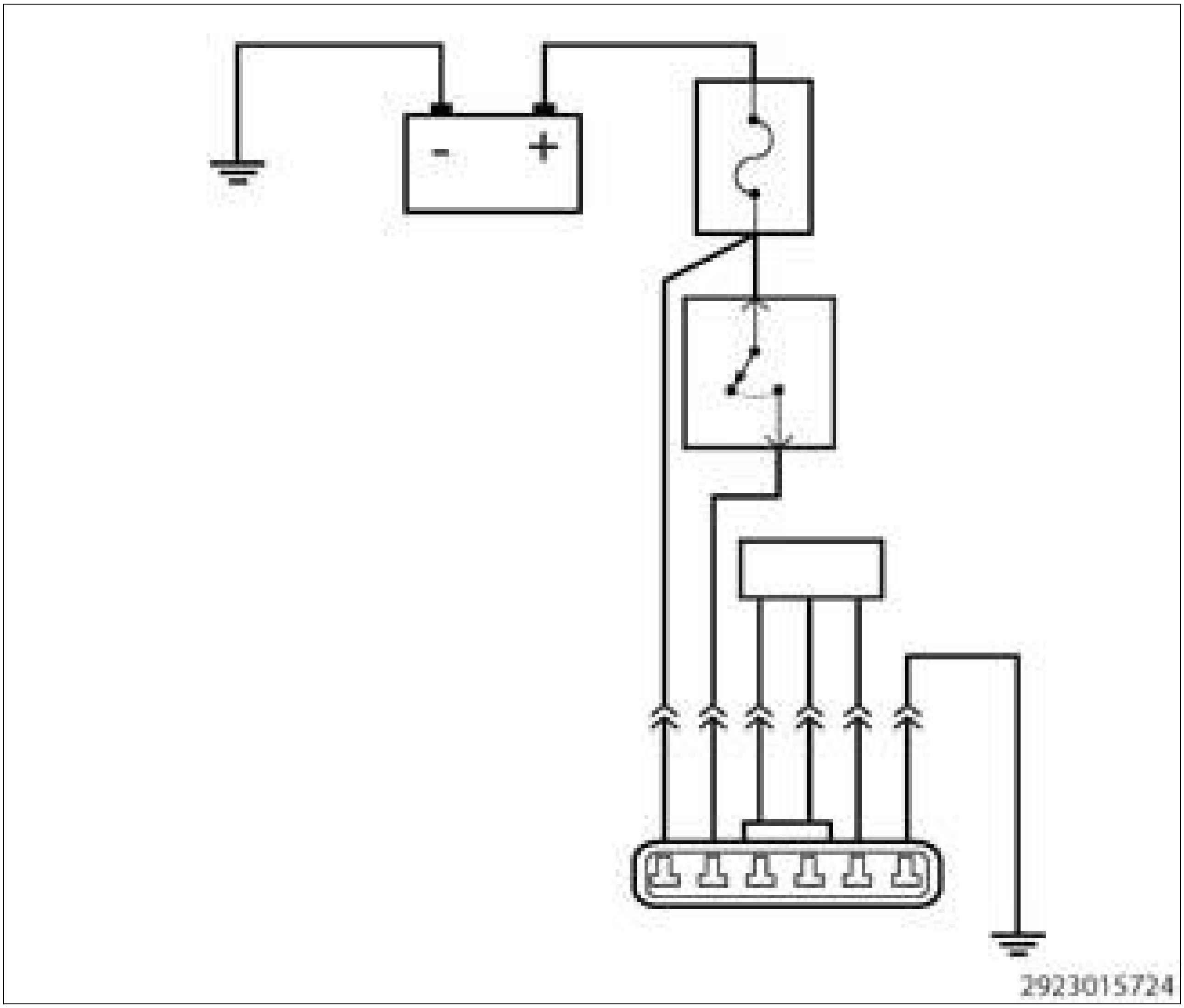
   1. Repair the short to ground. Use the wiring diagram as a guide to follow the path of the circuit.
   2. One method to help isolate the short is to disconnect any in-line connectors that the circuit being tested runs through and measure for the short again. If the short goes away, the short is on the other side of the in-line connector.

   No

   1. The circuit is not shorted to ground or the condition that originally caused the short may not be present at this time. Continue to measure the resistance, wiggle the wire harness and connectors while checking for an intermittent short.
   2. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the short could occur intermittently.
   3. Look for any chafed, pierced, pinched, or partially broken wires.
   4. Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related wire harness connectors.
   5. Perform any Technical Service Bulletins (TSBs) that may apply.

STANDARD PROCEDURE > CHECK A CIRCUIT FOR A SHORT TO VOLTAGE > THEORY OF OPERATION

Fig 1: Battery Circuit Diagram



Courtesy of CHRYSLER GROUP, LLC

The purpose of the following procedure is to demonstrate different methods of checking for a short to voltage in a circuit. When diagnosing a DTC it might be necessary to verify that proper voltage is on a circuit or that a circuit is not shorted high.

> *NOTE:*
>
> *The circuit shown in illustration is an example, and is intended for demonstrational purpose only.*

The following are circuit tests covered in this procedure:

- Testing For A Short To Battery Voltage Using A Voltmeter
- Testing For A Short To Switched Battery Voltage Using A Voltmeter
- Testing For A Short To Battery Voltage Using A 12-Volt Test Light

- Testing For A Short To Switched Battery Voltage Using A 12-Volt Test Light

> *NOTE:*
>
> *Perform the following test using a known good test light or functioning multimeter:*

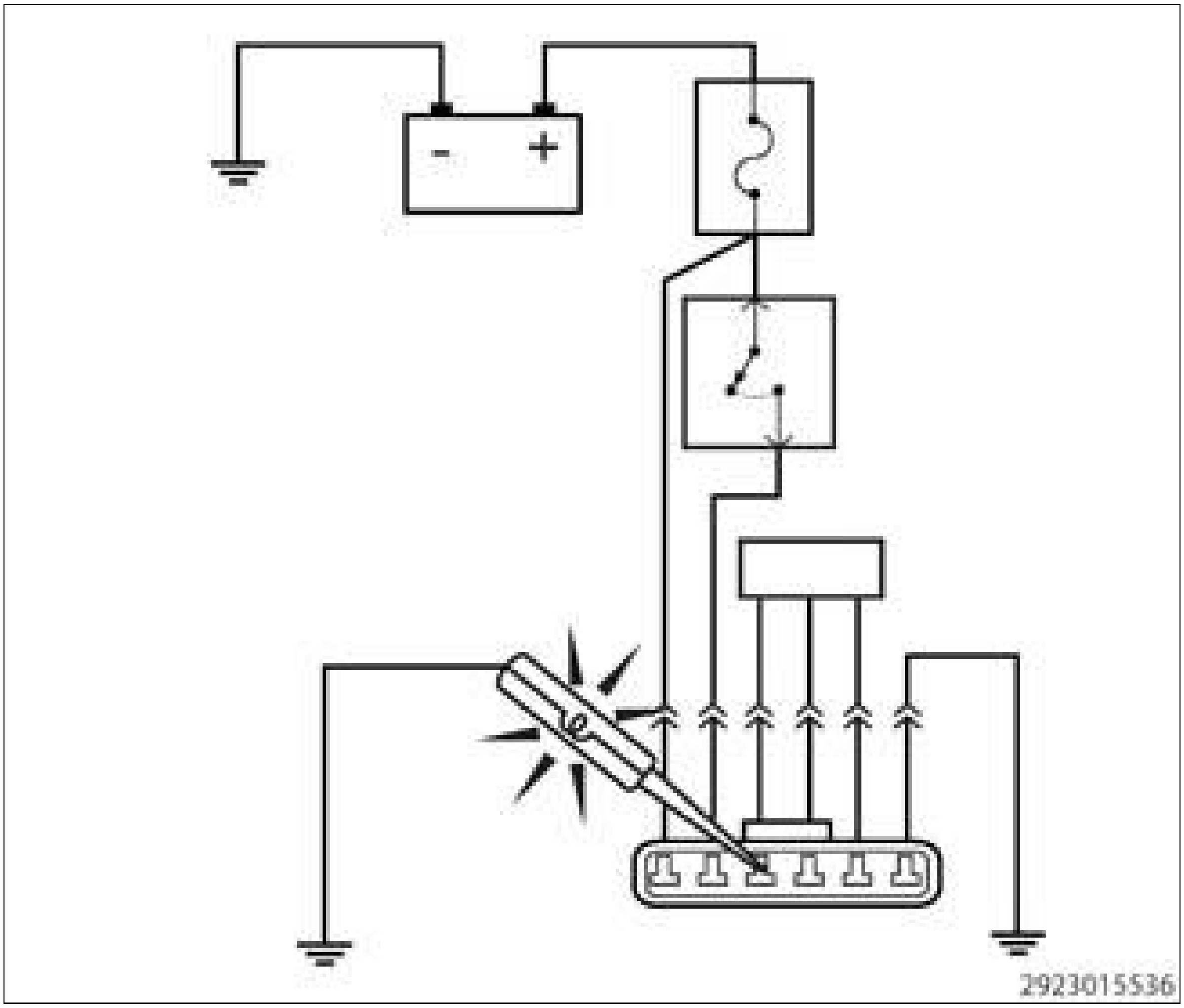
Below is a list of possible causes that could be related to a Short To Voltage condition.

Possible Causes
SHORTED CIRCUIT (CHAFED, PIERCED OR PINCHED WIRES)
SHORTED IN-LINE CONNECTOR (BENT, PUSHED OUT OR CORRODED TERMINALS)

STANDARD PROCEDURE > CHECK A CIRCUIT FOR A SHORT TO VOLTAGE > DIAGNOSTIC TEST

1. **TESTING FOR A SHORT TO BATTERY VOLTAGE USING A TEST LIGHT**

Fig 1: Testing For A Short To Battery Voltage Using A Test Light



Courtesy of CHRYSLER GROUP, LLC

NOTE:

Before testing any circuits, first verify the 12-volt test light is operating properly. Connect the 12-volt test light to battery ground or to any other known good ground. Touch the lead of the test light to Battery(+). If the test light is operational, it should illuminate brightly.

1. Turn the ignition off.
2. Disconnect the wire harness connectors of all components that contain the circuits that are suspected of having the short.

    NOTE:

    Check connectors - Clean/repair as necessary.

3. At this time leave all in-line connectors connected.
4. Connect the 12-volt test light to a known good ground.
5. Use the lead of the test light and carefully probe the circuit suspected of having the short.

> *WARNING:*
>
> *When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing. Failure to follow these instructions may result in possible serious or fatal injury.*

6. First, check with the ignition off, next with the ignition on, and lastly while cranking the engine.

   Does the test light illuminate brightly?

   Yes

   1. Repair the short to voltage. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the short could occur.
   2. One method to help isolate the short is to disconnect any in-line connectors that the circuit being checked runs through and check for the short again. If the short goes away, the short is on the other side of the in-line connector.

   No

   1. The circuit is not shorted to voltage or the condition that originally caused the short may not be present at this time. Continue to measure the resistance and wiggle the wire harness to check for an intermittent short.

      > *NOTE:*
      >
      > *By disconnecting the wire harness connectors you may have eliminated the source of the voltage causing the short. Use the wiring diagram as a guide, check to see if there are any battery circuits in the same wire harness as the circuit you are testing. It is necessary to check for a short to those circuits using an ohmmeter. Perform the Check for a Short Between Multiple Circuits diagnostic procedure. Refer to STANDARD PROCEDURE .*

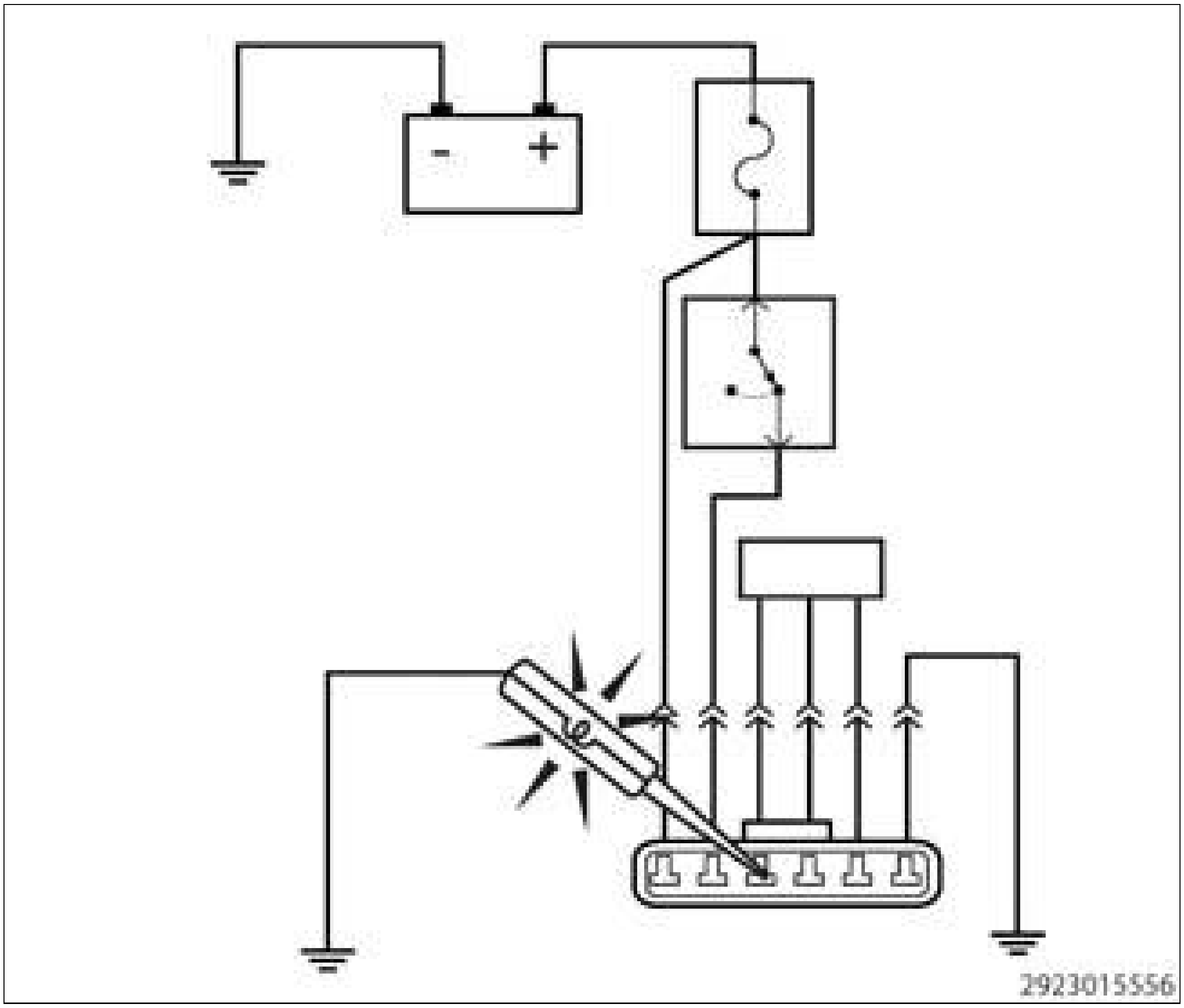
   2. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the short could occur intermittently.
   3. Look for any chafed, pierced, pinched, or partially broken wires.
   4. Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related component and wire harness

connectors.

5. Perform any Technical Service Bulletins (TSBs) that may apply.

2. **TESTING FOR A SHORT TO SWITCHED IGNITION VOLTAGE USING A TEST LIGHT**

Fig 2: Testing For A Short To Switched Ignition Voltage Using A Test Light



Courtesy of CHRYSLER GROUP, LLC

NOTE:

Before testing any circuits, first verify the 12-volt test light is operating properly. Connect the 12-volt test light to battery ground or to any other known good ground. Touch the lead of the test light to Battery(+). If the test light is operational, it should illuminate brightly.

1. Turn the ignition off.
2. Disconnect the wire harness connectors of all components that contain the circuits that are suspected of having the short.

> NOTE:
>
> *Check connectors - Clean/repair as necessary.*

3. At this time leave all in-line connectors connected.
4. Connect the 12-volt test light to a known good ground.
5. Use the lead of the test light and carefully probe the circuit suspected of having the short.

> WARNING:
>
> *When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing. Failure to follow these instructions may result in possible serious or fatal injury.*

6. First, check with the ignition off, next with the ignition on, and lastly while cranking the engine.

   Does the test light illuminate brightly?

   Yes

   1. Repair the short to voltage. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the short could occur.
   2. One method to help isolate the short is to disconnect any in-line connectors that the circuit being checked runs through and check for the short again. If the short goes away, the short is on the other side of the in-line connector.

   No

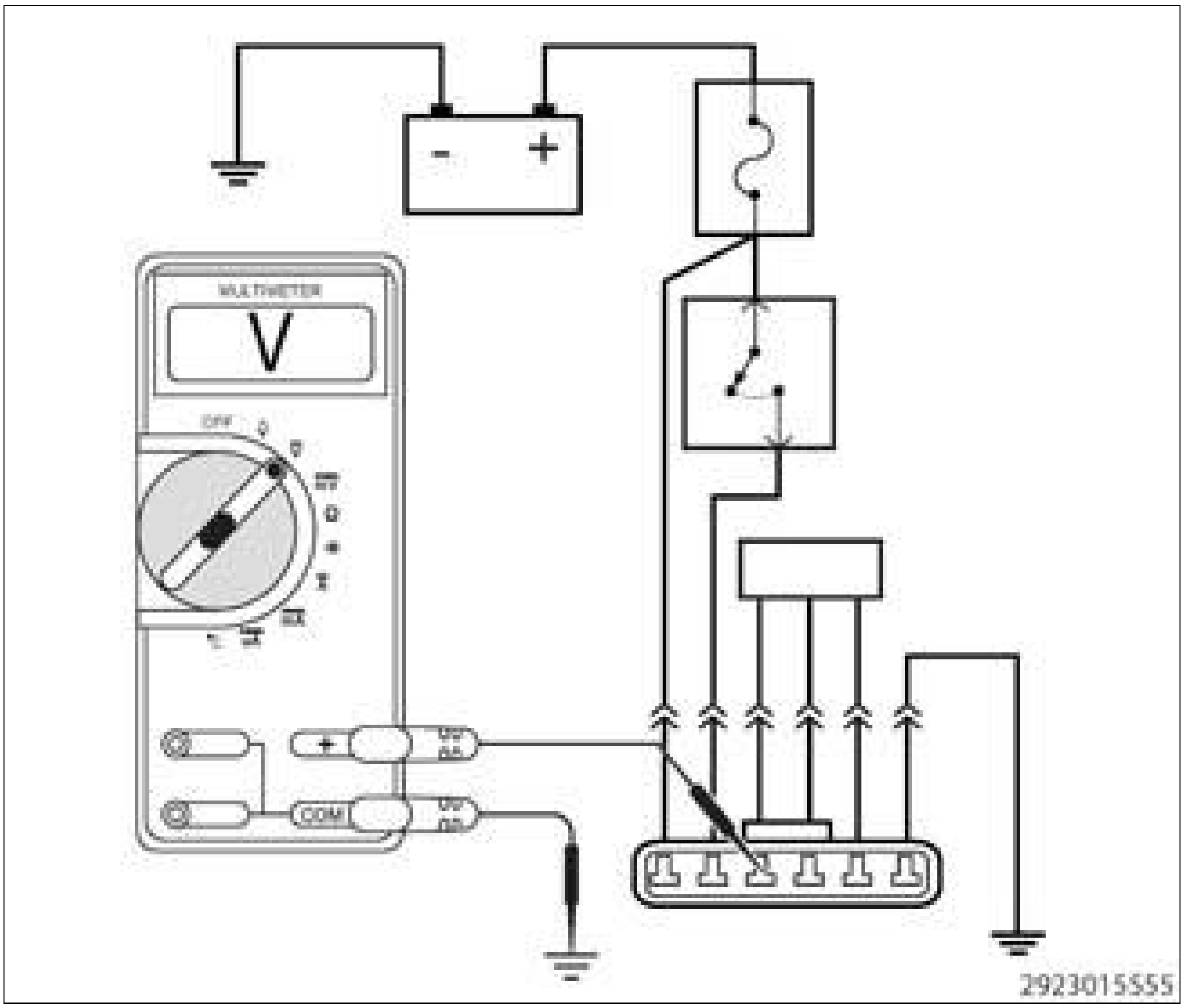
   1. The circuit is not shorted to voltage or the condition that originally caused the short may not be present at this time. Continue to measure the resistance and wiggle the wire harness to check for an intermittent short.

      > NOTE:
      >
      > *By disconnecting the wire harness connectors you may have eliminated the source of the voltage causing the short. Use the wiring diagram as a guide, check to see if there are any battery circuits in the same wire harness as the circuit you are testing. It is necessary to check for a short to those circuits using an ohmmeter. Perform the Check for a Short Between Multiple Circuits diagnostic procedure. Refer to STANDARD PROCEDURE .*

2. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the short could occur intermittently.
3. Look for any chafed, pierced, pinched, or partially broken wires.
4. Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related component and wire harness connectors.
5. Perform any Technical Service Bulletins (TSBs) that may apply.

3. **TESTING FOR A SHORT TO BATTERY VOLTAGE USING A VOLTMETER**

Fig 3: Testing For A Short To Battery Voltage Using A Voltmeter



Courtesy of CHRYSLER GROUP, LLC

1. Turn the ignition off.
2. Disconnect the wire harness connectors of the components that contain the circuit that is suspected as having a short.

> *NOTE:*
>
> *Check connectors - Clean/repair as necessary.*

3. At this time leave all in-line connectors connected.
4. With all the component wire harness connectors disconnected, use a multimeter set to measure DC voltage.
5. Connect the ground lead of the meter to a known good ground.
6. Use the positive lead of the multimeter and probe the circuit that is being checked for a short.

   Is there any voltage present?

   Yes

   1. Repair the short to battery voltage. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the short could occur.
   2. One method to help isolate the short is to disconnect any in-line connectors that the circuit being checked runs through and measure for the short again. If the short goes away, the short is on the other side of the in-line connector.

   No

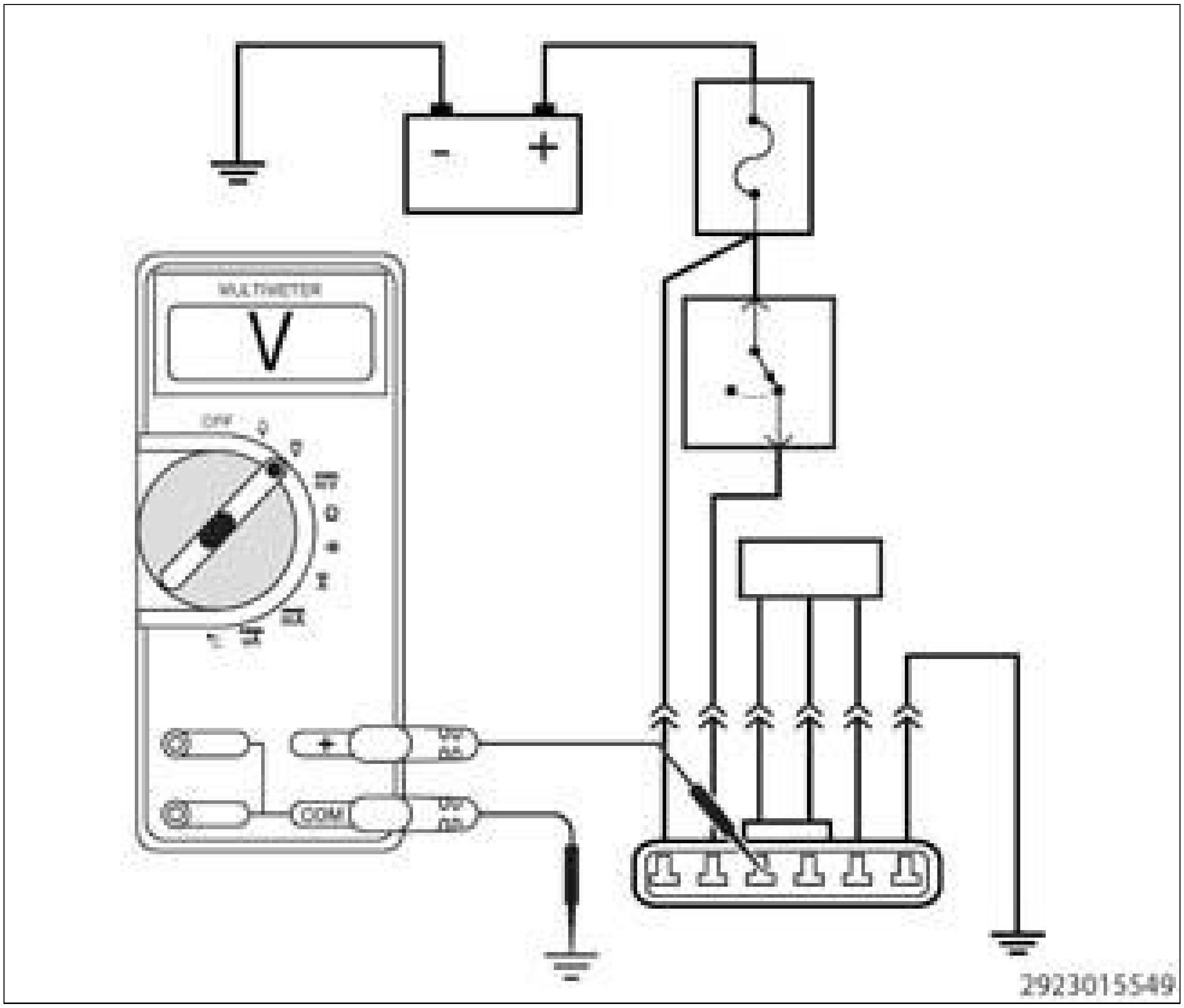
   1. The circuit is not shorted to voltage or the condition that originally caused the short may not be present at this time. Continue to measure the voltage and wiggle the wire harness to check for an intermittent short.

      > *NOTE:*
      >
      > *By disconnecting the wire harness connectors you may have eliminated the source of the voltage causing the short. Use the wiring diagram as a guide, check to see if there are any battery circuits in the same wire harness as the circuit you are testing. It is necessary to check for a short to those circuits using an ohmmeter. Perform the Check for a Short Between Multiple Circuits diagnostic procedure. Refer to STANDARD PROCEDURE .*

   2. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the short could occur intermittently.
   3. Look for any chafed, pierced, pinched, or partially broken wires.
   4. Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related wire harness connectors.
   5. Perform any Technical Service Bulletins (TSBs) that may apply.

4. **TESTING FOR A SHORT TO SWITCHED IGNITION VOLTAGE USING A VOLTMETER**

Fig 4: Testing For A Short To Switched Ignition Voltage Using A Voltmeter



Courtesy of CHRYSLER GROUP, LLC

1. Turn the ignition off.
2. Disconnect the wire harness connectors of all components that contain the circuits that are suspected as being shorted.

> *NOTE:*
>
> *Check connectors - Clean/repair as necessary.*

3. At this time leave all in-line connectors connected.
4. With all the component wire harness connectors disconnected, use a multimeter set to measure DC voltage.
5. Connect the ground lead of the meter to a known good ground.
6. Use the positive lead of the multimeter and probe the circuit suspected of having the short.

7. Ignition on, engine not running.

   Is any voltage present?

   Yes

   1. Repair the short to ignition voltage. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the short could occur.
   2. One method to help isolate the short is to disconnect any in-line connectors that the circuit being checked runs through and check for the short again. If the short goes away, the short is on the other side of the in-line connector.

   No

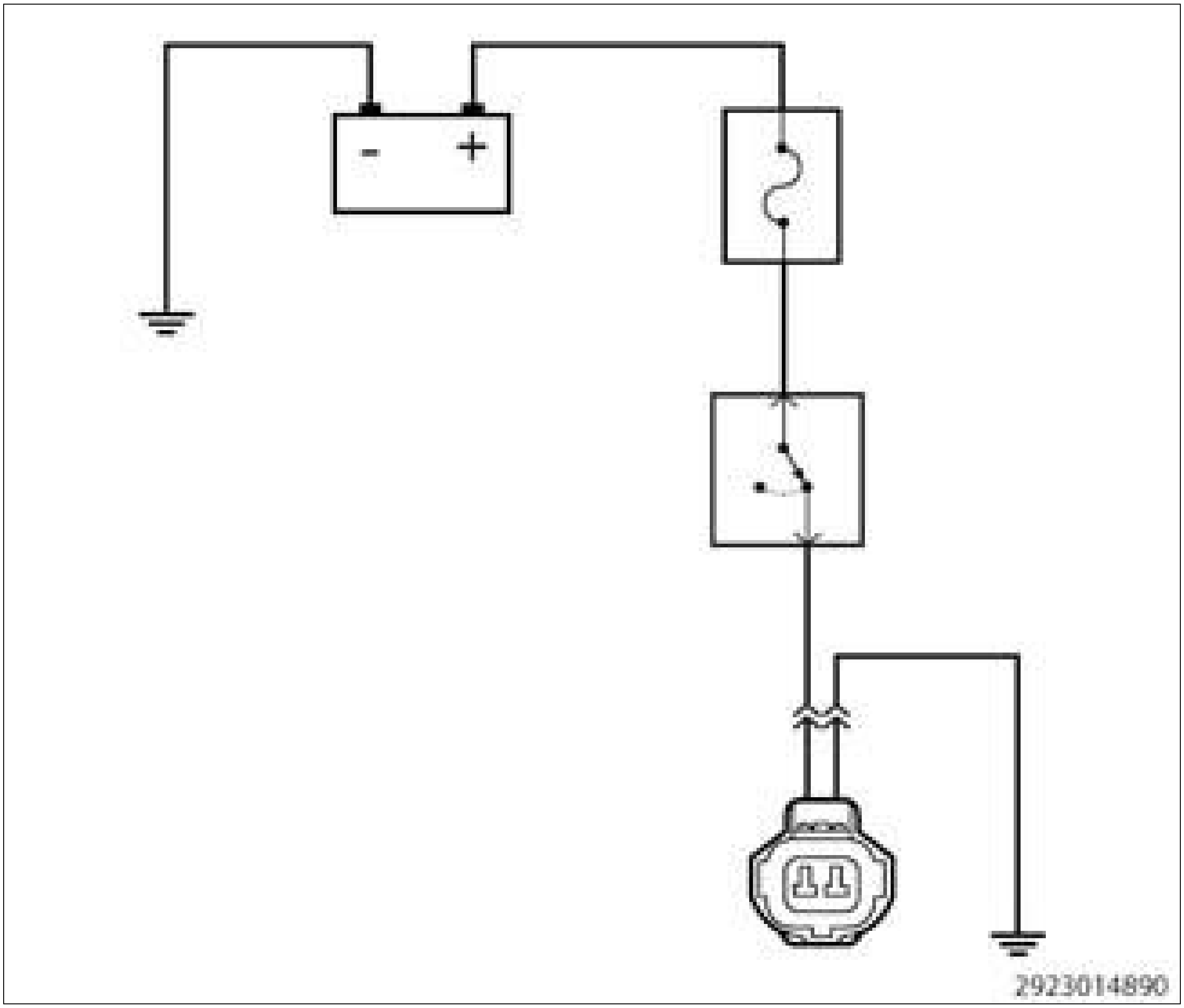
   1. The circuit is not shorted to voltage or the condition that originally caused the short may not be present at this time. Continue to measure the voltage and wiggle the wire harness to check for an intermittent short.

      > *NOTE:*
      >
      > *By disconnecting the wire harness connectors you may have eliminated the source of the voltage causing the short. Use the wiring diagram as a guide, check to see if there are any battery circuits in the same wire harness as the circuit you are testing. It is necessary to check for a short to those circuits using an ohmmeter. Perform the Check for a Short Between Multiple Circuits diagnostic procedure. Refer to STANDARD PROCEDURE .*

   2. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the short could occur intermittently.
   3. Look for any chafed, pierced, pinched, or partially broken wires.
   4. Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related wire harness connectors.
   5. Perform any Technical Service Bulletins (TSBs) that may apply.

STANDARD PROCEDURE > CHECK FOR AN OPEN GROUND CIRCUIT > THEORY OF OPERATION

Fig 1: Checking 12-Volt Switched Battery B(+) Circuit For Voltage



Courtesy of CHRYSLER GROUP, LLC

The purpose of the following procedure is to demonstrate how to check the operation of a generic ground circuit with a test light.

> *NOTE:*
>
> *The circuit shown in illustration is an example, and is intended for demonstrational purpose only.*

The following are circuit tests covered in this procedure:

- Testing Ground Circuit With Test Light

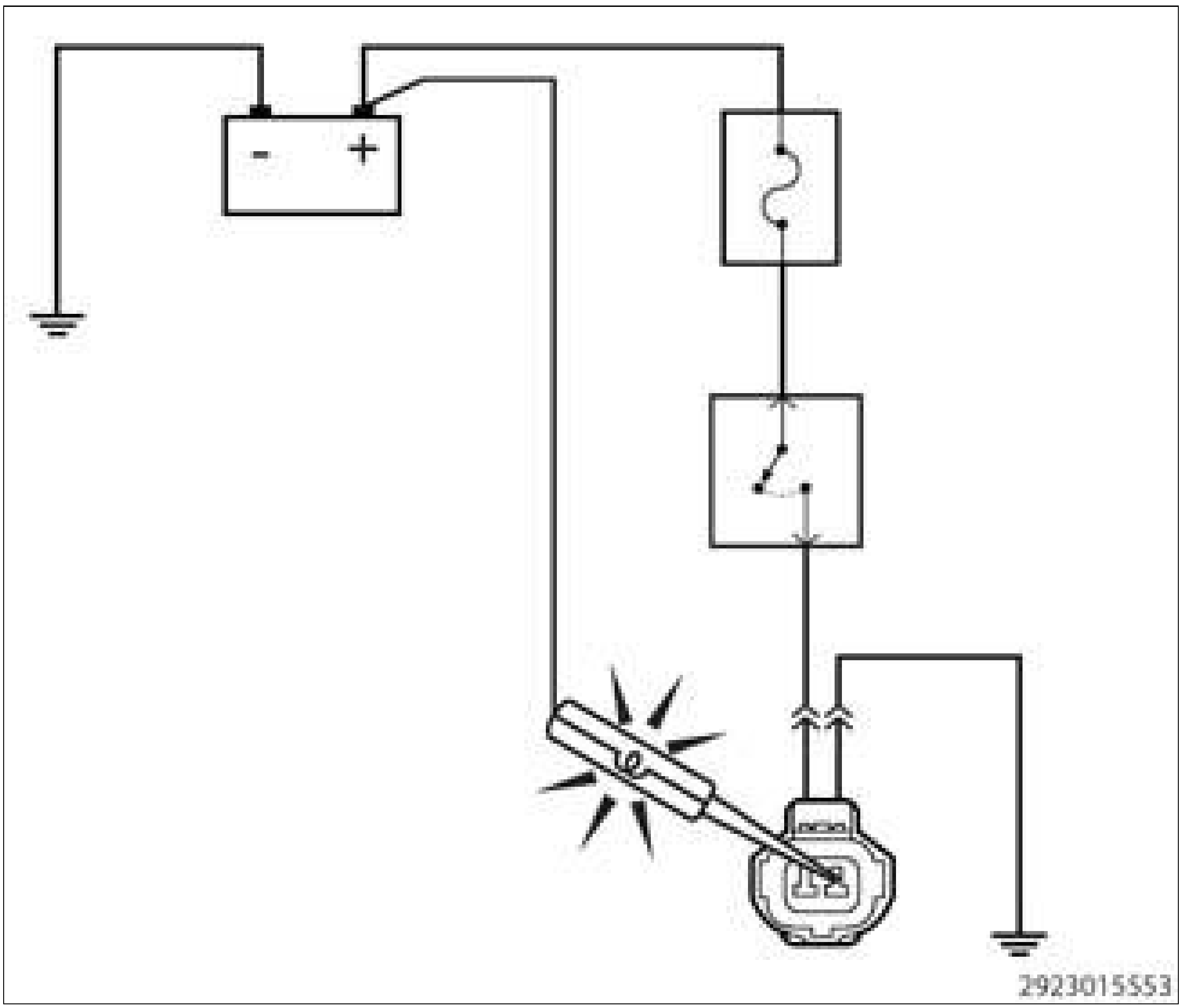
> **NOTE:**
>
> *Perform the following test using a known good test light:*

Possible Causes
OPEN GROUND CIRCUIT (CHAFED, PIERCED, PINCHED OR BROKEN WIRE)
OPEN IN-LINE CONNECTOR (BENT, PUSHED OUT OR CORRODED TERMINALS)

STANDARD PROCEDURE > CHECK FOR AN OPEN GROUND CIRCUIT > DIAGNOSTIC TEST

TESTING GROUND CIRCUIT WITH TEST LIGHT

Fig 1: Testing Ground Circuit With Test Light



Courtesy of CHRYSLER GROUP, LLC

NOTE:

Before testing any circuits, first verify the 12-volt test light is operating properly. Connect the 12-volt test light to battery ground or to any other known good ground. Touch the lead of the test light to Battery(+). If the test light is operational, it should illuminate brightly.

1. Turn the ignition off.
2. Disconnect the wire harness connectors of the components that contain the ground circuit suspected of containing excessive resistance.

   NOTE:

   Check connectors - Clean/repair as necessary.

3. At this time leave all in-line connectors connected.
4. With all the component wire harness connectors disconnected, connect the 12-volt test light to Battery(+).
5. Use the test light lead to lightly probe the ground circuit in the harness connector.

   Does the test light illuminate brightly?

   Yes

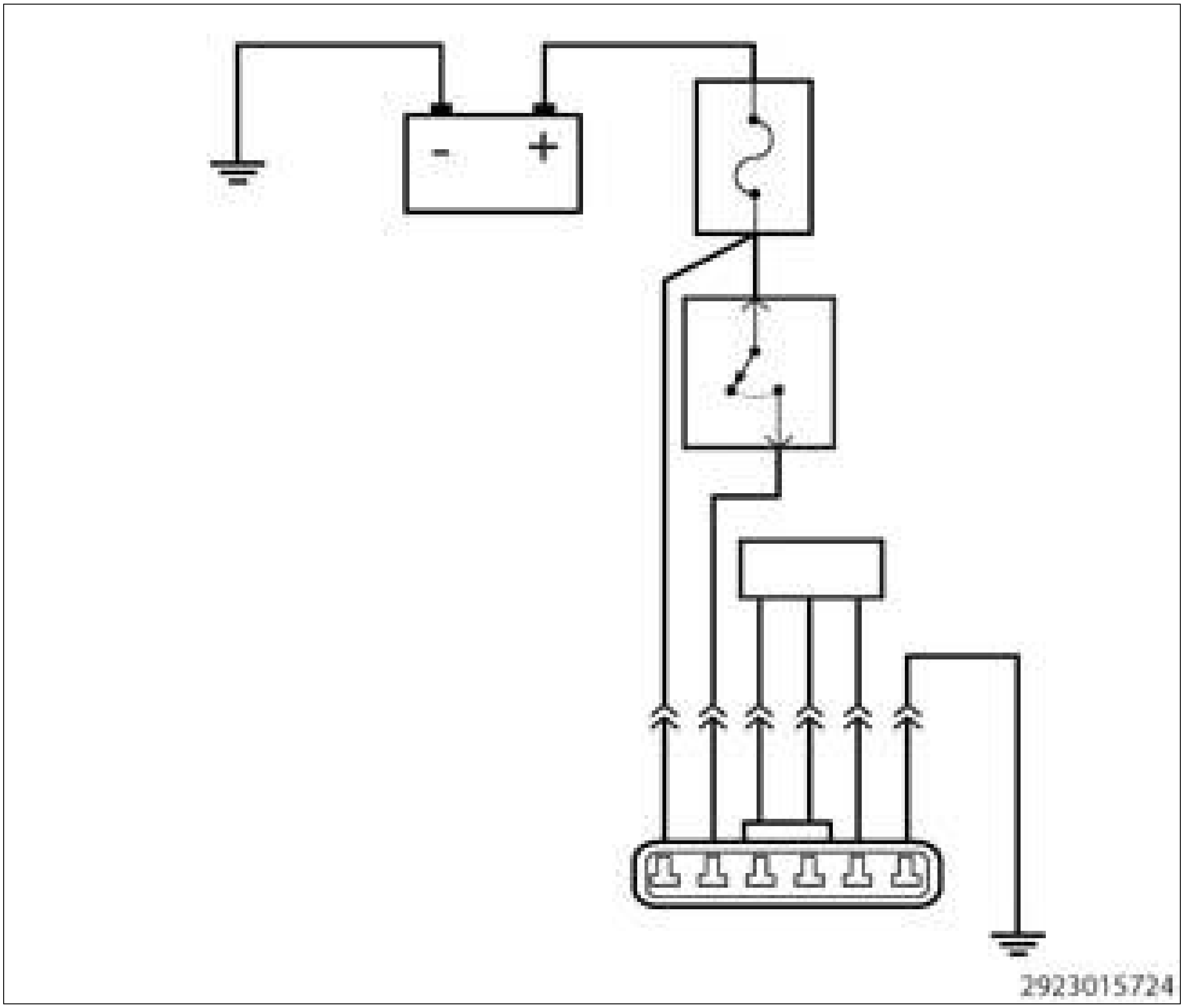
   1. The suspected ground circuit is not open or the condition that originally caused the open or excessive resistance is not present at this time. Another way to check for an open would be to use an ohmmeter and measure the resistance of the ground circuit. While continuing to measure the resistance of the circuit, wiggle the wire harness and connectors to check for an intermittent open or poor connection.
   2. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the open could occur intermittently.
   3. Look for any chafed, pierced, pinched, or partially broken wires.
   4. Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related wire harness connectors.
   5. Perform any Technical Service Bulletins (TSBs) that may apply.

   No

   1. Repair the open in the ground circuit. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors where the open could occur.
   2. One method to help isolate the open is to disconnect any in-line connectors and measure the resistance from one side of the in-line connector to the matching component harness connector. If the open goes away, the open is on the other side of the in-line connector.

STANDARD PROCEDURE > CHECK FOR A SHORT BETWEEN MULTIPLE CIRCUITS > THEORY OF OPERATION

Fig 1: Battery Circuit Diagram



Courtesy of CHRYSLER GROUP, LLC

The purpose of the following procedure is to demonstrate how to check for a short circuit between multiple circuits.

> *NOTE:*
>
> *The circuit shown in illustration is an example, and is intended for demonstrational purpose only.*

The following are circuit tests covered in this procedure:

- Testing For A Short Between Multiple Circuits

NOTE:

Perform the following test using a known good multimeter:

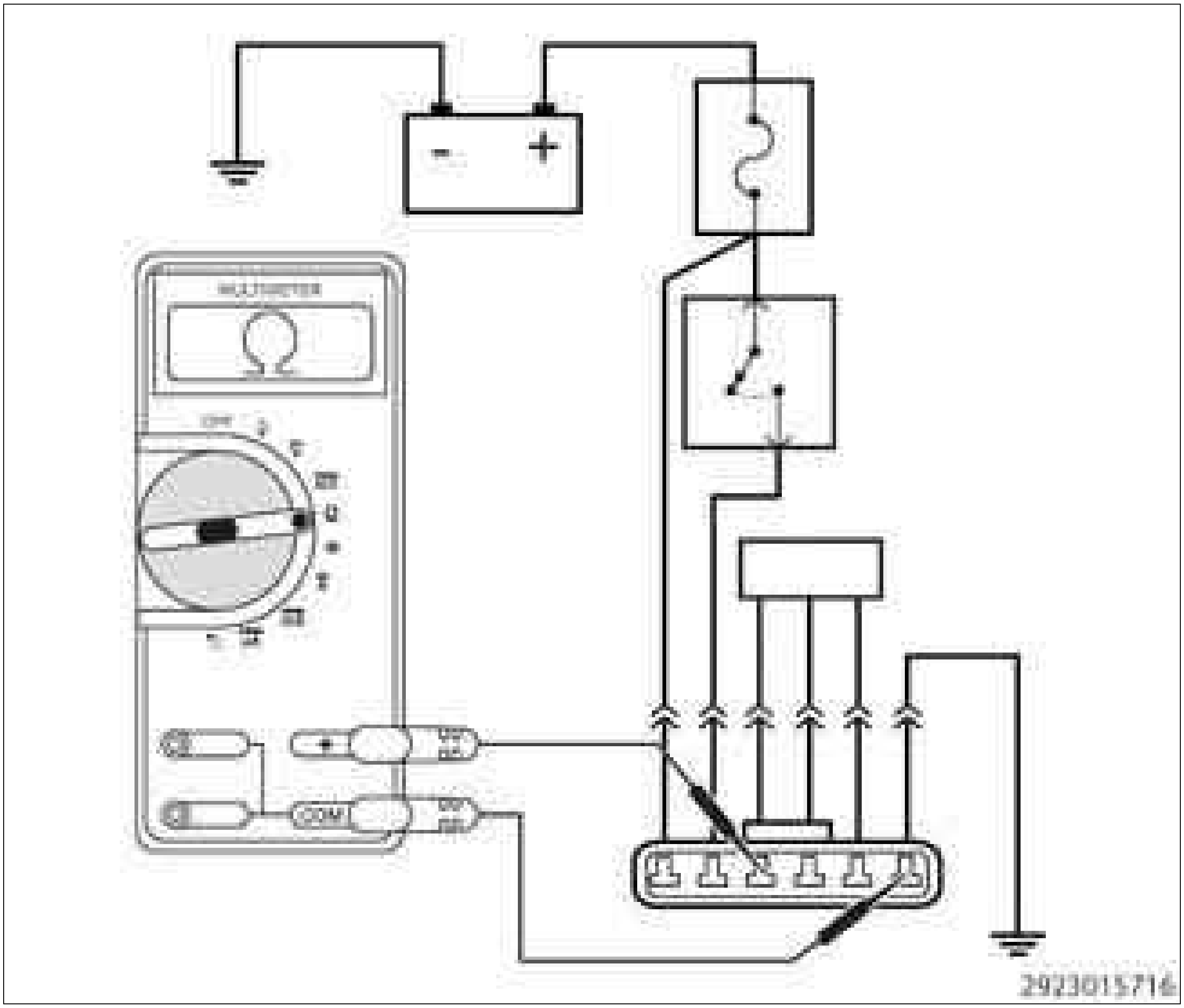
Below is a list of possible causes that could be related to a Multiple Short condition.

Possible Causes
SHORTED CIRCUIT (CHAFED, PIERCED OR PINCHED WIRES)
SHORTED IN-LINE CONNECTOR (BENT, PUSHED OUT OR CORRODED TERMINALS)

STANDARD PROCEDURE > CHECK FOR A SHORT BETWEEN MULTIPLE CIRCUITS > DIAGNOSTIC TEST

TESTING FOR A SHORT BETWEEN MULTIPLE CIRCUITS

Fig 1: Testing For A Short Between Multiple Circuits



Courtesy of CHRYSLER GROUP, LLC

> *NOTE:*
>
> *Before measuring the resistance of any circuit, first measure the resistance between the two leads of the multimeter. Take this value and subtract it from the value recorded when measuring the resistance of the circuit being checked (The meter leads can add 0.5 ohm or more of total resistance).*

1. Turn the ignition off.
2. Disconnect the wire harness connectors of the components that contain the circuits that are suspected of being shorted together.

> NOTE:
>
> *Check connectors - Clean/repair as necessary.*

3. At this time leave all in-line connectors connected.
4. With all the component wire harness connectors disconnected, use a multimeter set to Ohms (Ω), and measure the resistance between the applicable circuits in one of the harness connectors.
5. Use one lead of the multimeter and carefully probe the circuit suspected of being shorted.
6. Use the other lead of the meter and one at a time, carefully probe the other circuits in the harness connector.

   Is the resistance below 10k ohms when probing any two circuits?

   Yes

   1. Repair the short between the circuits. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the short could occur.
   2. One method to help isolate the short is to disconnect any in-line connectors that the circuit being tested runs through and measure for the short again. If the short goes away, the short is on the other side of the in-line connector.

   No

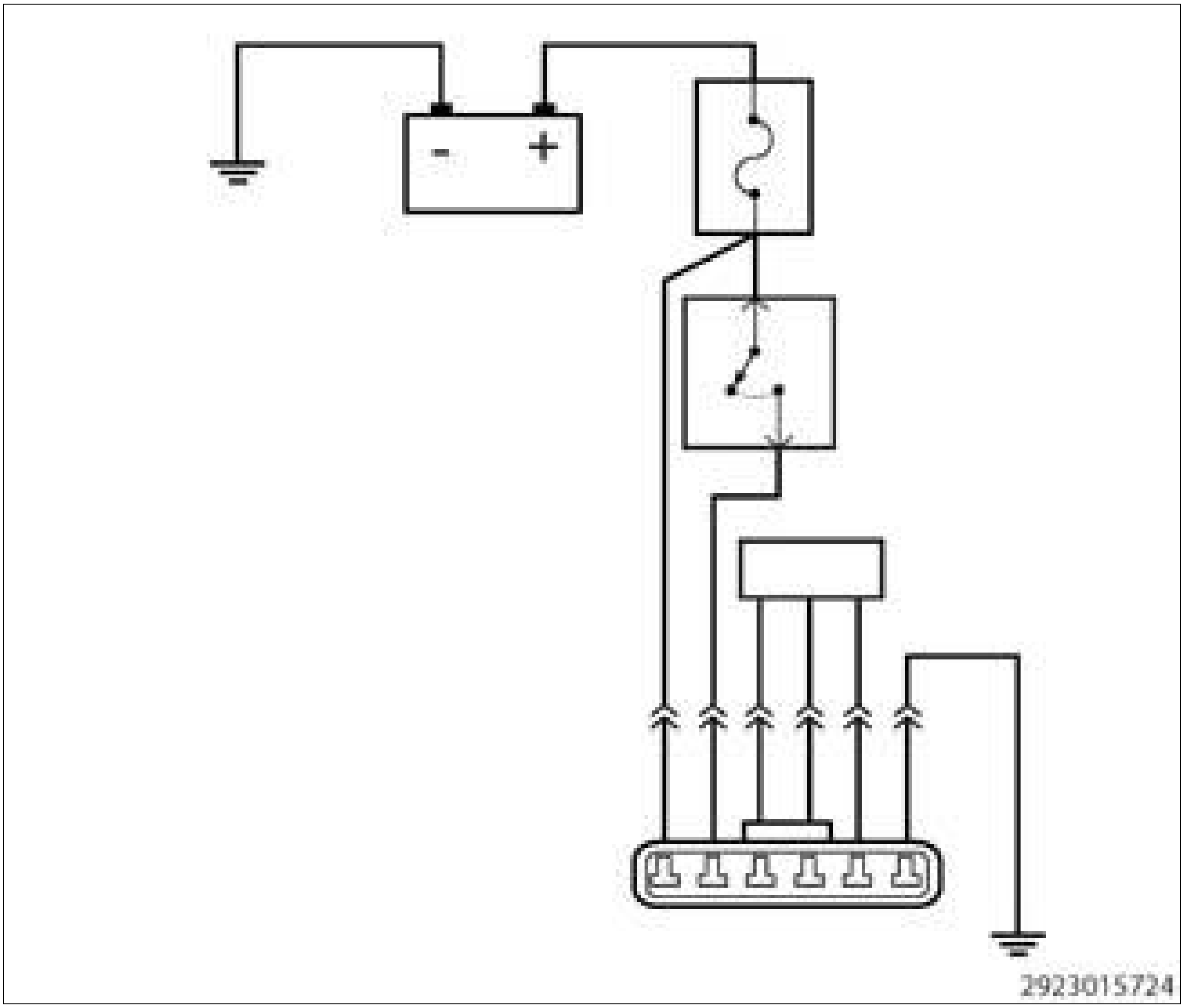
   1. The circuit is not shorted or the condition that originally caused the short may not be present at this time. Continue to measure the resistance and wiggle the wire harness and connectors while checking for an intermittent short.

      > NOTE:
      >
      > *By disconnecting the wire harness connectors you may have eliminated the source that was causing the short.*

   2. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the short could occur intermittently.
   3. Look for any chafed, pierced, pinched, or partially broken wires.
   4. Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related wire harness connectors.
   5. Perform any Technical Service Bulletins (TSBs) that may apply.

STANDARD PROCEDURE > CHECK THE RESISTANCE OF A CIRCUIT USING AN OHMMETER > THEORY OF OPERATION

Fig 1: Battery Circuit Diagram



Courtesy of CHRYSLER GROUP, LLC

The purpose of the following procedure is to demonstrate how to check the resistance of a circuit with an ohmmeter.

> *NOTE:*
>
> *The circuit shown in illustration is an example, and is intended for demonstrational purpose only.*

The following are circuit tests covered in this procedure:

- Testing For An Open Circuit Using An Ohmmeter

> NOTE:
>
> *Perform the following test using a known good multimeter:*

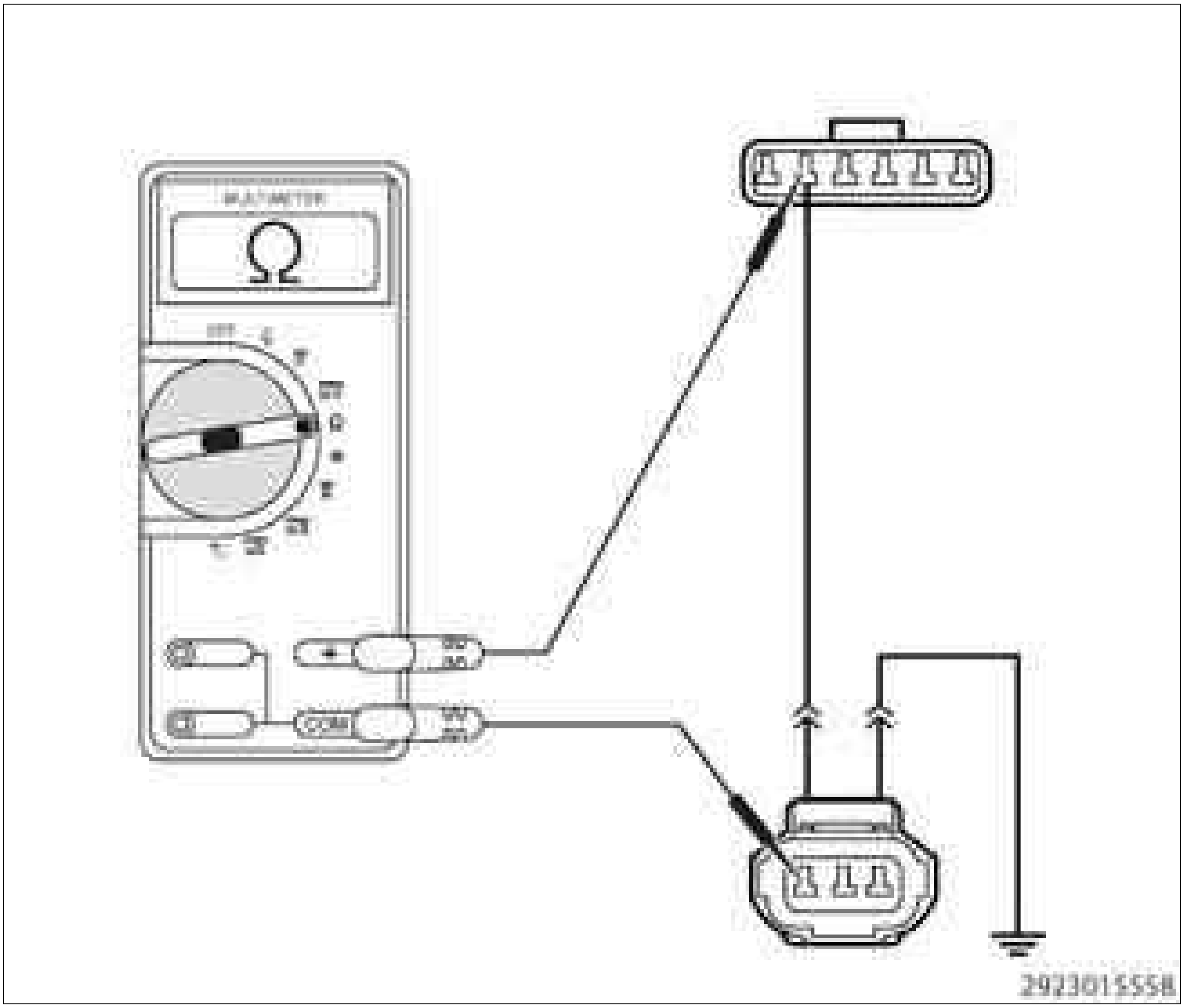
Below is a list of possible causes that could be related to an Open Circuit condition.

Possible Causes
OPEN CIRCUIT (CHAFED, PIERCED, PINCHED OR BROKEN WIRES)
OPEN IN-LINE CONNECTOR (BENT, PUSHED OUT OR CORRODED TERMINALS)

STANDARD PROCEDURE > CHECK THE RESISTANCE OF A CIRCUIT USING AN OHMMETER > DIAGNOSTIC TEST

TESTING FOR AN OPEN CIRCUIT USING AN OHMMETER

Fig 1: Testing For An Open Circuit Using An Ohmmeter



Courtesy of CHRYSLER GROUP, LLC

NOTE:

Before measuring the resistance of any circuit, first measure the resistance between the two leads of the multimeter. Take this value and subtract it from the value recorded when measuring the resistance of the circuit being checked (The meter leads can add 0.5 ohm or more of total resistance).

1. Turn the ignition off.
2. Disconnect the wire harness connectors of the components that contain the circuit suspected of being open.

> *NOTE:*
>
> *Check connectors - Clean/repair as necessary.*

3. At this time leave all in-line connectors connected.
4. With the component wire harness connectors disconnected, use a multimeter set to Ohms (Ω), and measure the resistance of the circuit.
5. Use one lead of the meter and probe the circuit in one harness connector.
6. Use the other lead of the meter and probe the same circuit in the other harness connector.

   Is the resistance in the circuit below 10k ohms?

   Yes

   1. The circuit does not contain any excessive resistance or the condition that originally caused the excessive resistance may not be present at this time. Continue to measure the resistance of the circuit, wiggle the wire harness and connectors to check for an intermittent open or poor connection.
   2. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the open could occur intermittently.
   3. Look for any chafed, pierced, pinched, or partially broken wires.
   4. Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related wire harness connectors.
   5. Perform any Technical Service Bulletins (TSBs) that may apply.

   No

   1. Repair the excessive resistance in the circuit between the two wire harness connectors. Using the wiring diagram as a guide, trace the circuit and check for any in-line connectors where the open or excessive resistance could occur.
   2. One method to help isolate the open is to disconnect any in-line connectors and measure the resistance from one side of the in-line connector to the matching component harness connector. If the open or excessive resistance is not present, the open or excessive resistance is on the other side of the in-line connector.

STANDARD PROCEDURE > CHECK FOR EXCESSIVE CURRENT DRAW > THEORY OF OPERATION

What is current draw?

Current draw, or parasitic draw is an electrical load that draws current from the battery when the ignition is turned off. Some are considered normal, some above normal. Normal draw comes from various electronic devices connected to battery positive at all times. Many vehicle modules draw a few mA (milliamps) as a means to "Keep Alive Memory". Whether it's the clock in the radio or the last known position of the memory mirrors, these tiny amounts of current typically will only add up to 20 or 30 mA. The vehicle can sit parked for days, even a few weeks without any problems of excessive battery drain that might prevent starting. As long as the vehicle is driven periodically in order for the alternator to recharge the battery there is no problem. A problem may occur, in situations such as new vehicles in dealer stock or long term airport parking situations.

Below are some examples of modules and components that require keep alive memory:

- Powertrain Control Module (PCM)
- Body Control Module (BCM)
- Memory Seat Module (MSM)
- Radio

What is excessive current draw?

Excessive current draw can be determined by an ammeter reading in excess of 50 mA. The typical "normal" current draw will not exceed 20 or 30 mA.

How to locate the problem?

Locating the problem involves a process of elimination. If the problem is not obvious, like the trunk light staying on, you will have to start troubleshooting:

- Start by removing one fuse at a time until you see the reading on the meter drop off (be careful to reinstall the fuses in their proper location).
- Once you've determined the high-draw circuit, there still may be a half-dozen loads, each individually drawing current from the battery.
- To zero in on that circuit or circuits, use the schematic diagram and disconnect each device on the circuit one-at-a-time and check the meter.
- When the milliamp reading drops off significantly, you've found the problem.

Perform the following test to determine where the cause of the draw is located:

Possible Causes
INSTALLED AFTERMARKET ACCESSORIES (AUDIO SYSTEMS, VEHICLE ALARMS, ETC.)
COURTESY LIGHTS REMAINING ON (INTERIOR, TRUNK, HOOD, ETC.)
BATTERY CHARGERS PLUGGED INTO THE CIGARETTE LIGHTER/POWER OUTLETS

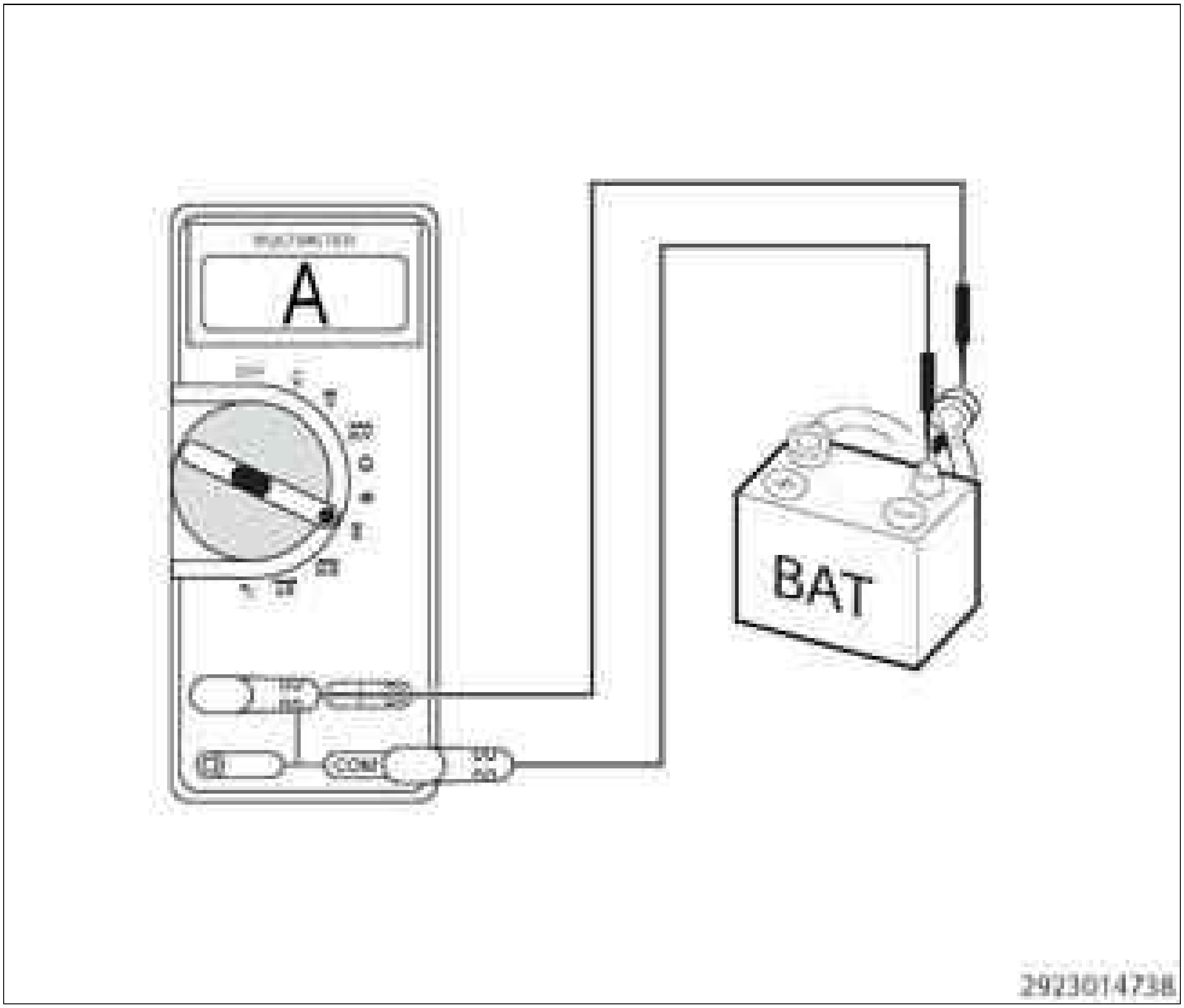
STANDARD PROCEDURE > CHECK FOR EXCESSIVE CURRENT DRAW > DIAGNOSTIC TEST

TESTING FOR PARASITIC DRAW

NOTE:

For a more accurate current draw reading, wait 20 minutes to make sure all modules have powered down before continuing. Some modules may stay powered up longer than others.

Fig 1: Testing For Parasitic Draw Using Multimeter



Courtesy of CHRYSLER GROUP, LLC

Turn the ignition off.

1. Disconnect the Negative battery cable (ground).
2. Using a multimeter, set the multimeter leads up to properly measure Amperage.
3. Connect the ground lead that is plugged into the COM port of the multimeter to the Negative battery post/terminal.
4. Connect the other lead of the multimeter that is plugged into the Amp port of the multimeter to the Negative battery cable.

CAUTION:

Do not crank the engine or turn on any accessories that may draw more than 10 Amps. You may open the protective fuse in the multimeter.

5. While monitoring the amperage reading on the multimeter, begin to remove fuses (one at a time) from each fuse location on the vehicle and see if the amperage drops.

NOTE:

1. *Only remove one fuse at a time until the cause of the voltage draw is determined.*
2. *Many vehicles have multiple fuse locations on the vehicle.*

6. If the amperage does not drop, install the fuse you just removed and remove the next fuse.

   Does the amperage drop to between 0.02 to 0.04 of an Amp when removing any fuses?

   Yes

   1. Use the wiring diagram as a guide to help indicate what components or modules are powered by the fuse.
   2. At this point you can install the fuse and begin disconnecting the components powered by the fuse.
      1. When the amperage drops after disconnecting a component this will indicate which component is at fault.
      2. It is important to know how long some modules are designed to remain awake.
      3. You don't want to replace a component that is operating normally.
      4. The condition that originally caused the draw may not be present at this time.

   No

   1. The condition that originally caused the draw may not be present at this time.
   2. Look for any chafed, pierced, pinched, or partially broken wires.
   3. Look for broken, bent, pushed out or corroded ground terminals.
   4. Perform any Technical Service Bulletins (TSBs) that may apply.

STANDARD PROCEDURE > CIRCUIT LOAD TESTING PROCEDURE

YouTube	A multimedia supplement to the instructions contained in this article is available. To view the multimedia example of the condition described go to; **http://www.youtube.com, search for "Mitchell1Videos" then type, "A00705195.vid.1" into the "Search Channel" box.**

STANDARD PROCEDURE > CIRCUIT LOAD TESTING PROCEDURE > THEORY OF OPERATION

A circuit load test can be performed to test the ability of a circuit to carry the current required to operate a connected device. A circuit load test should be performed after a circuit has passed a resistance test using a DVOM and the circuit is still suspected of a failure.

- A single copper wire strand will carry enough current to light a test light bulb, while showing very low resistance using a DVOM.
- Some test lights are insufficient for load testing because of the very low resistance bulb being used.
- The Load Test tool listed below will require higher current flow to power the bulb; and this will test the ability of the circuit to carry a load.
- This test will indicate if the circuit being tested can carry the current required to operate a connected device.

WARNING:

To avoid possible serious or fatal injury, DO NOT load test any air bag/restraint system components or circuits using the procedures listed here. Refer to the RESTRAINTS - SERVICE INFORMATION article for proper air bag/restraint system testing procedures.

CAUTION:

Do not load test any circuits with components still connected to the circuit.

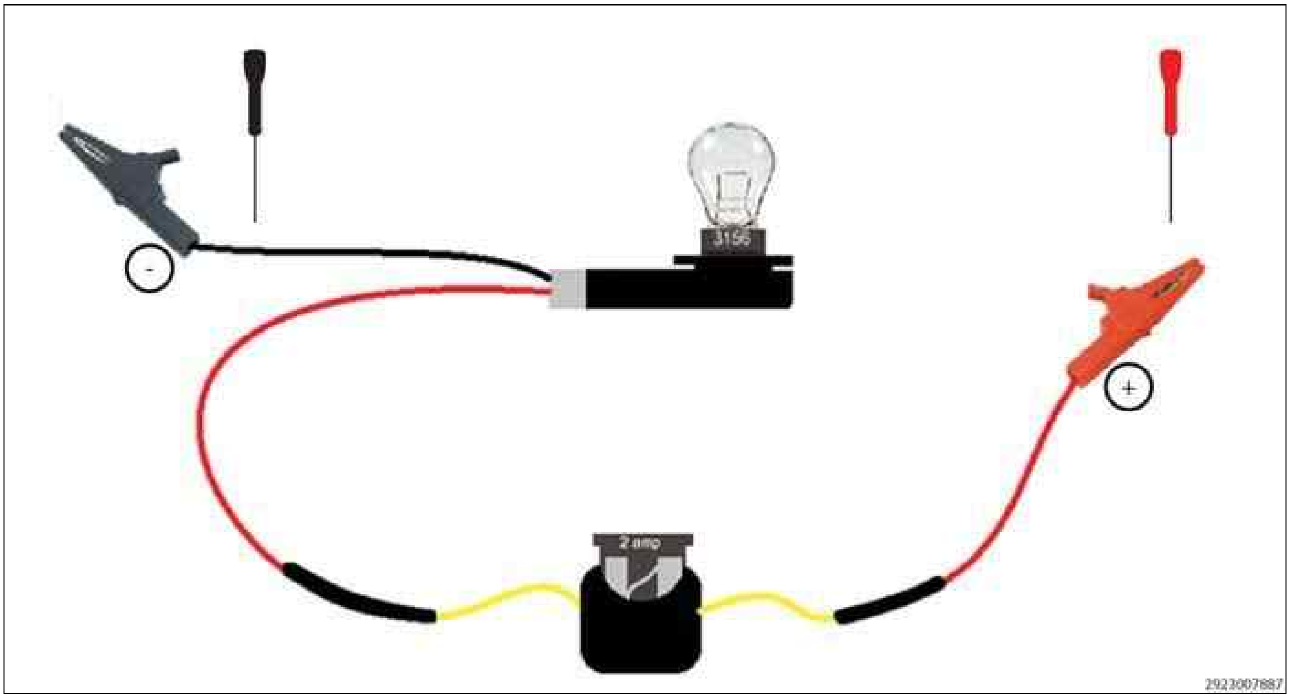
NOTE:

Depending upon the location of the circuit in question, this test may require jumper wires.

NOTE:

Use the wiring diagrams as a guide to trace the circuits and look for any in-line connectors where the circuit failure could occur intermittently. Look for any chafed, pierced, pinched, or partially broken wires. Look for broken, bent, pushed out or corroded terminals - clean/repair as necessary. Verify that there is good pin to terminal contact in the related wire harness connectors.

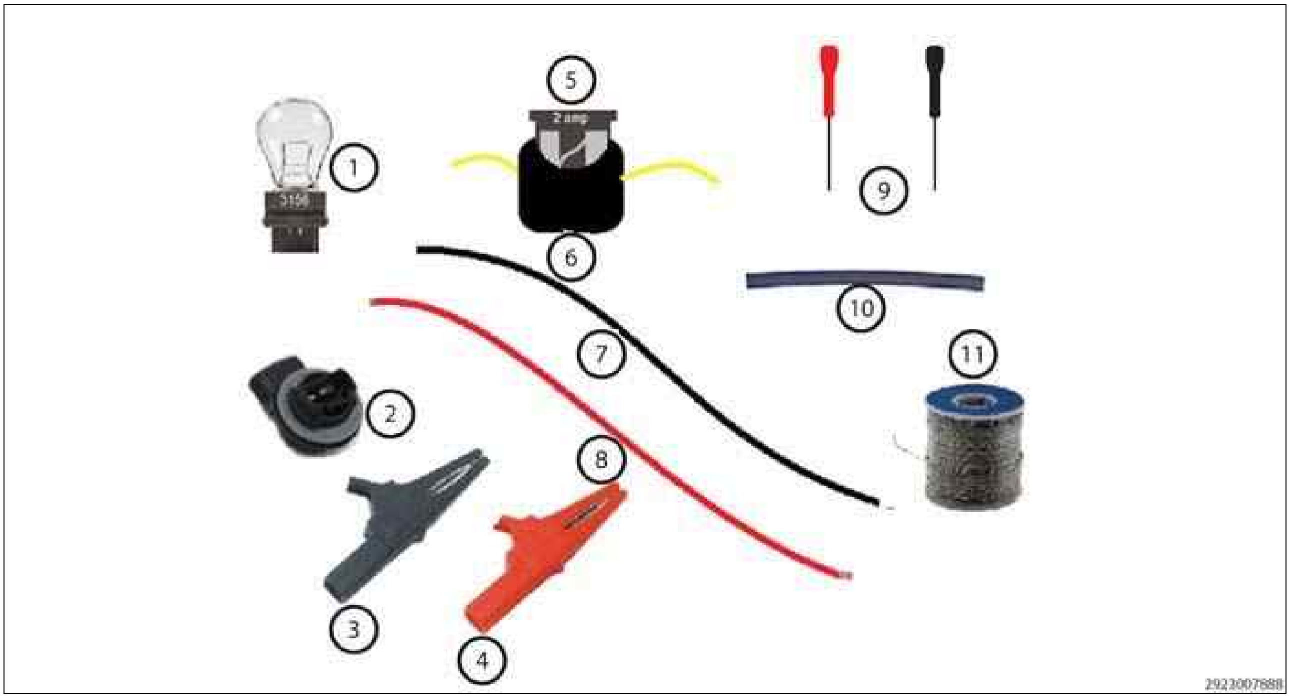
Fig 1: Load Test Tool



Courtesy of CHRYSLER GROUP, LLC

Here is an example of a simple tool you can build to test a circuit`s ability to carry a load.

Fig 2: Load Test Tool Components



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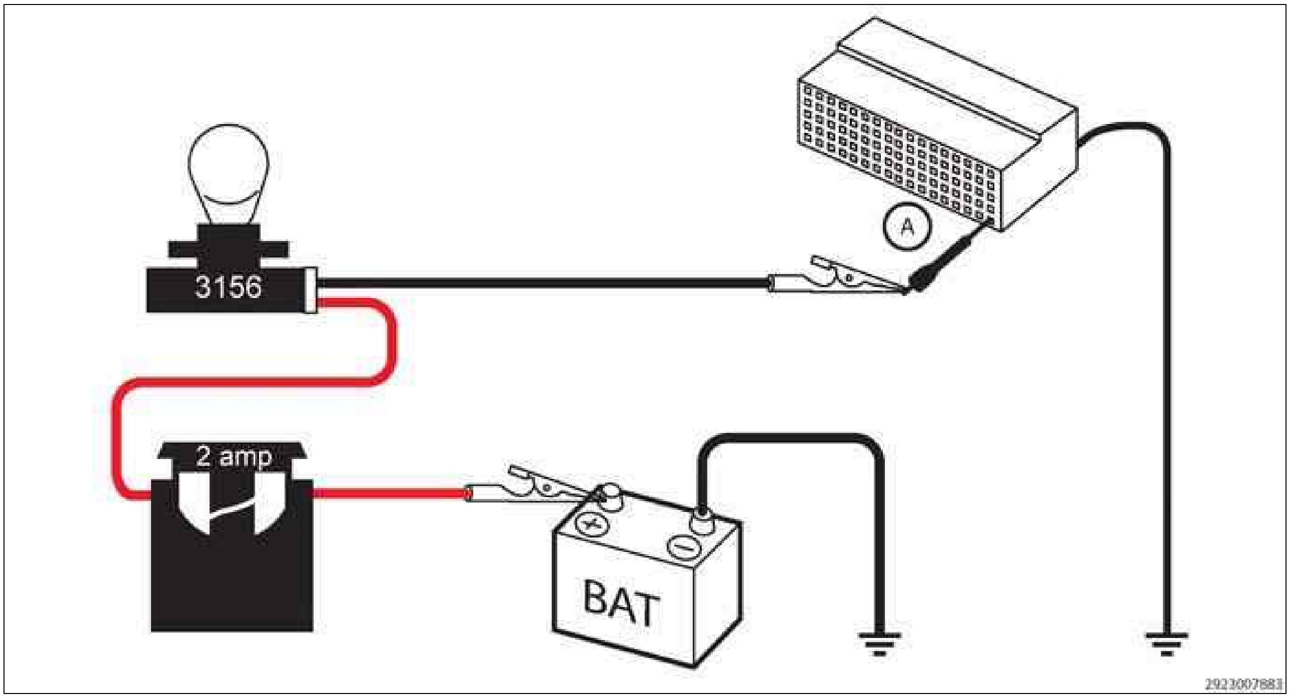
The following is a list of components required to build a load test tool:

1. 3156 Bulb
2. 3156 Bulb socket
3. Negative alligator clip with covers
4. Positive alligator clip with covers
5. 2 Amp mini fuse
6. Mini fuse holder
7. 2' to 4' of Black 16ga wire
8. 2' to 4' of Red 16ga wire
9. Approved back probe tool
10. Shrink tubing
11. Solder

STANDARD PROCEDURE > CIRCUIT LOAD TESTING PROCEDURE > LOAD TESTING A GROUND CIRCUIT

DIAGNOSTIC LOAD TEST (GROUND CIRCUIT)

Fig 1: Performing Diagnostic Load Test (Ground Circuit)



Courtesy of CHRYSLER GROUP, LLC

1. Disconnect the connector from the device(s) to gain access and isolate the terminal for the circuit being tested.
2. Connect the positive lead of the load test tool to the positive side of the battery.
3. Using an approved connector back probe tool, connect the negative lead of the load test tool to the circuit being tested at point (A).

> *CAUTION:*
>
> *Use only approved connector back probe tools when back probing a connector so as not to cause damage to the terminals or insulation of the connector. Damage to the terminals can cause poor terminal contact or retention. Damage to the insulation can introduce corrosion due to water infiltration.*

Does the bulb light bright, when compared to a direct battery connection?

Yes

1. The circuit being tested can carry a load, check other circuits, connectors and terminals for concerns.

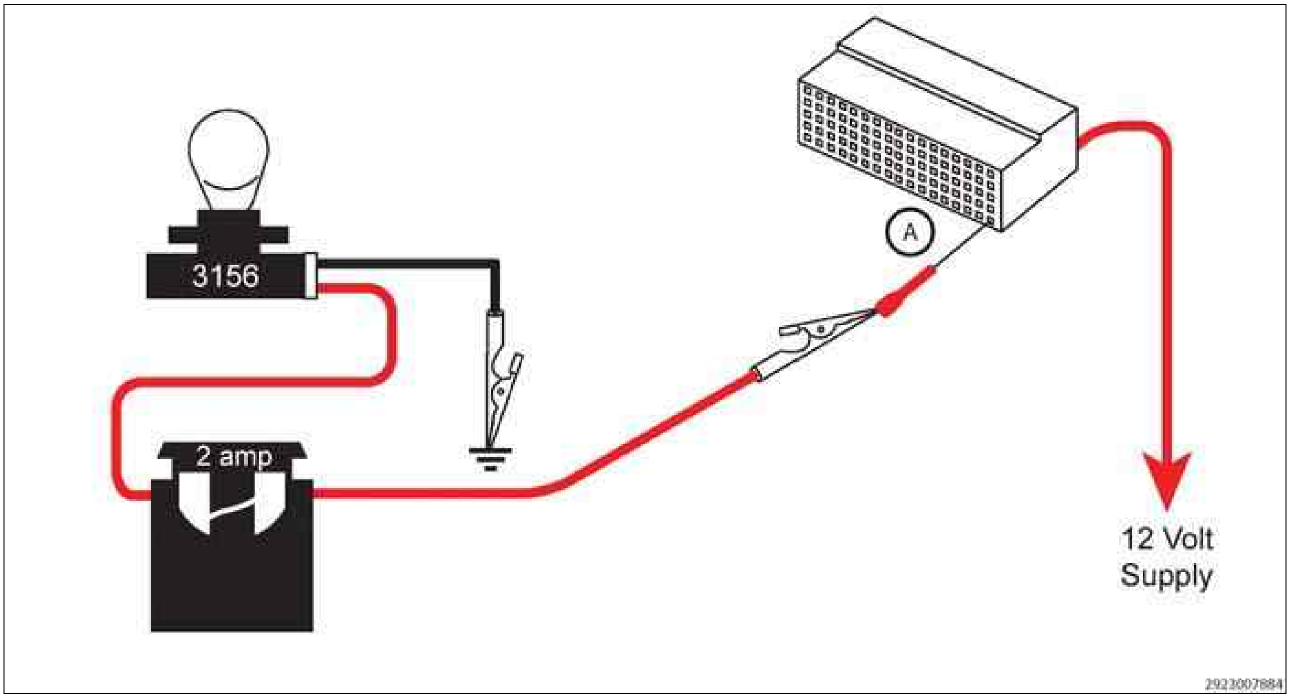
No

1. Repair the circuit, connector or terminal that has an open or excessive resistance.
2. Perform any related Recalls or Technical Service Bulletins (TSBs) that may apply.

STANDARD PROCEDURE > CIRCUIT LOAD TESTING PROCEDURE > LOAD TESTING A BATTERY OR IGNITION FEED CIRCUIT

DIAGNOSTIC LOAD TEST (BATTERY/IGNITION FEED CIRCUIT)

Fig 1: Performing Diagnostic Load Test (Battery/Ignition Feed Circuit)



Courtesy of CHRYSLER GROUP, LLC

1. Disconnect the connector from the device(s) to gain access and isolate the terminal for the circuit being tested.
2. Using an approved connector back probe tool, connect the positive lead of the load test tool to the circuit being tested at point (A).
3. Connect the negative lead of the load test tool to the negative side of the battery or ground.

> ⚠ *CAUTION:*
>
> *Use only approved connector back probe tools when back probing a connector so as not to cause damage to the terminals or insulation of the connector. Damage to the terminals can cause poor terminal contact or retention. Damage to the insulation can introduce corrosion due to water infiltration.*

Does the bulb light bright, when compared to a direct battery connection?

Yes

1. The circuit being tested can carry a load, check other circuits, connectors and terminals

for concerns.

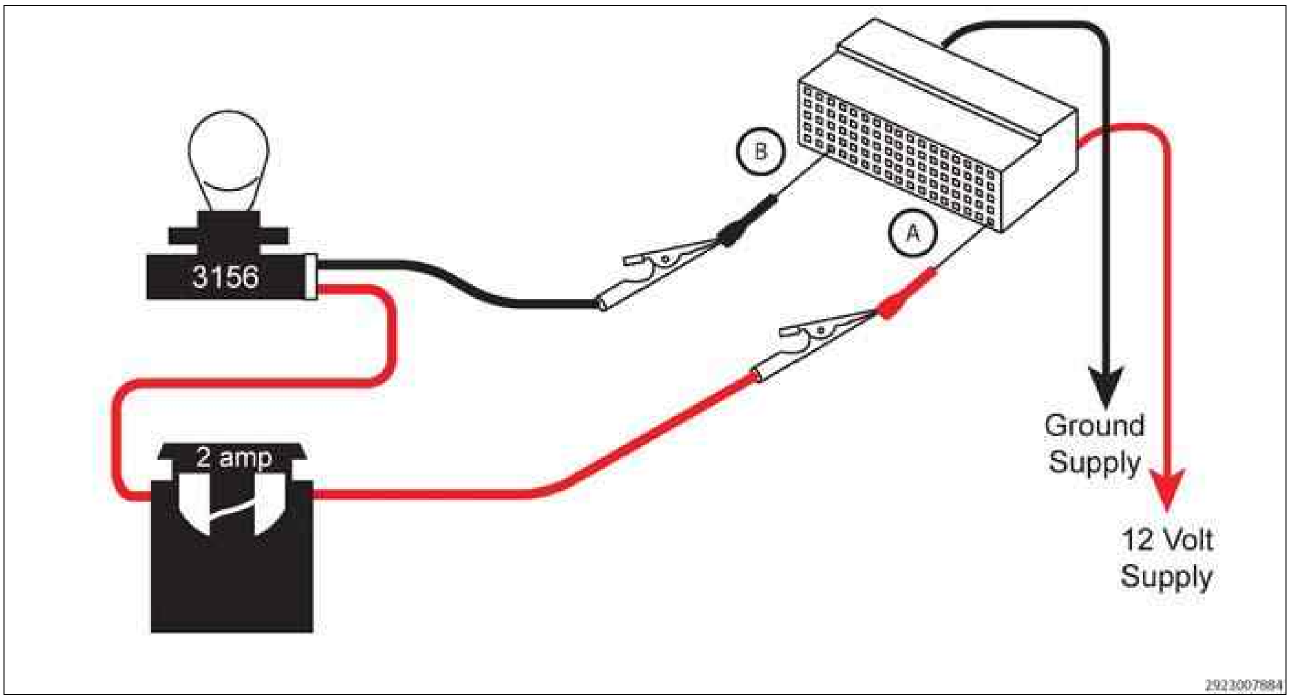
No

1. Repair the circuit, connector or terminal that has an open or excessive resistance.
2. Perform any related Recalls or Technical Service Bulletins (TSBs) that may apply.

STANDARD PROCEDURE > CIRCUIT LOAD TESTING PROCEDURE > LOAD TESTING A BATTERY OR IGNITION FEED CIRCUIT AND GROUND CIRCUIT

DIAGNOSTIC LOAD TEST (BATTERY FEED & GROUND CIRCUIT)

Fig 1: Performing Diagnostic Load Test (Battery Feed & Ground Circuit)



Courtesy of CHRYSLER GROUP, LLC

1. Disconnect the connector from the device(s) to gain access and isolate the terminal for the circuit being tested.
2. Using an approved connector back probe tool, connect the positive lead of the load test tool to the circuit being tested at point (A).
3. Using an approved connector back probe tool, connect the negative lead of the load test tool to the circuit being tested at point (B).

> ⚠ *CAUTION:*
>
> *Use only approved connector back probe tools when back probing a connector so as not to cause damage to the terminals or insulation of the connector. Damage to the terminals can cause poor terminal contact or retention. Damage to the insulation*

can introduce corrosion due to water infiltration.

Does the bulb light bright, when compared to a direct battery connection?

Yes

1. The circuit being tested can carry a load, check other circuits, connectors and terminals for concerns.

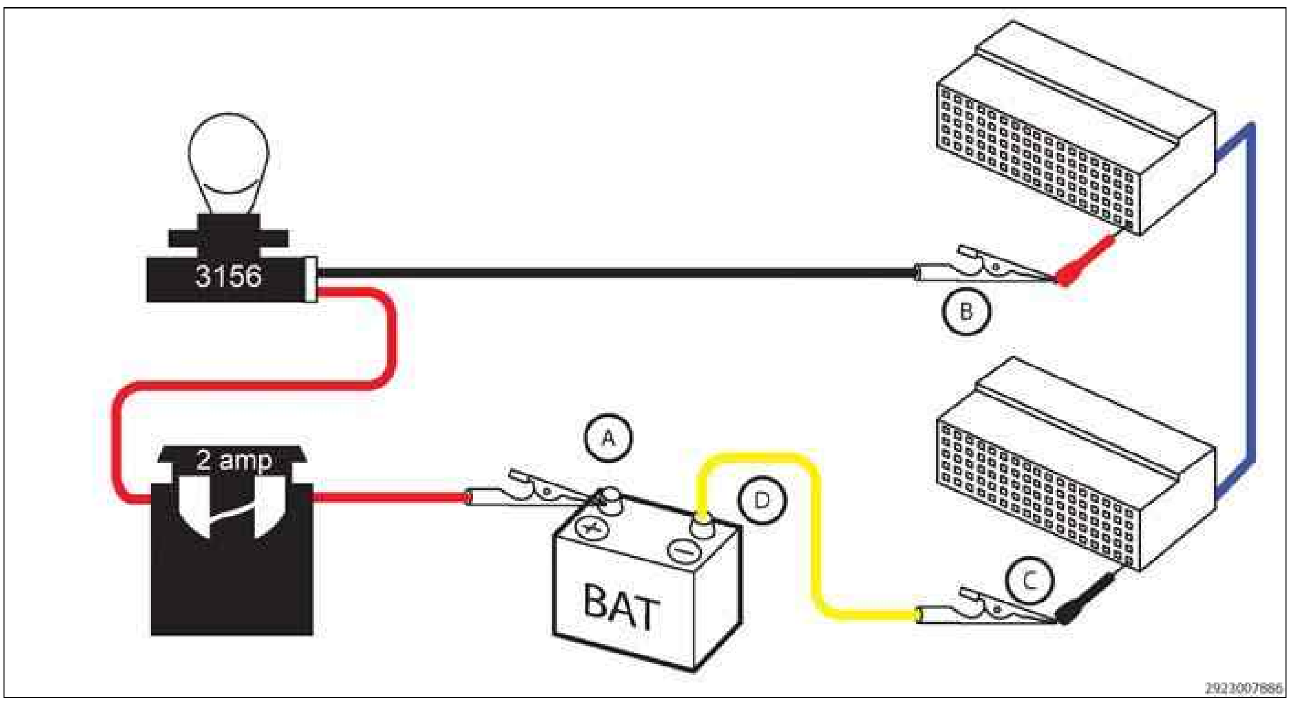
No

1. Test the circuits individually to determine which circuit is the cause of the test failure.
2. Repair the circuit, connector or terminal that has an open or excessive resistance.
3. Perform any related Recalls or Technical Service Bulletins (TSBs) that may apply.

STANDARD PROCEDURE > CIRCUIT LOAD TESTING PROCEDURE > LOAD TESTING A CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

DIAGNOSTIC LOAD TEST (OPEN/HIGH RESISTANCE CIRCUIT)

Fig 1: Performing Diagnostic Load Test (Open/High Resistance Circuit)



Courtesy of CHRYSLER GROUP, LLC

1. Disconnect all components from the circuit being tested.
2. Connect the positive lead of the load test tool to the positive side of the battery (A).
3. Using an approved connector back probe tool, connect the negative lead of the load test tool

to the circuit being tested at point (B).

4. Using an approved connector back probe tool, connect a jumper wire to the circuit being tested at point (C).
5. Then connect the other end of the jumper wire to the negative side of the battery or ground (D).

> *CAUTION:*
>
> *Use only approved connector back probe tools when back probing a connector so as not to cause damage to the terminals or insulation of the connector. Damage to the terminals can cause poor terminal contact or retention. Damage to the insulation can introduce corrosion due to water infiltration.*

Does the bulb light bright, when compared to a direct battery connection?

Yes

1. The circuit being tested can carry a load, check other circuits, connectors and terminals for concerns.

No

1. Repair the circuit, connector or terminal that has an open or excessive resistance.
2. Perform any related Recalls or Technical Service Bulletins (TSBs) that may apply.

STANDARD PROCEDURE > VOLTAGE DROP TEST PROCEDURE > THEORY OF OPERATION

Voltage drop is the reduction in voltage in an electrical circuit between the voltage source and load components. The wires and connectors of a circuit should contain almost no resistance and **all** the voltage should be consumed through the load. The "load" is the component using the power, such as a light, starter, or blower motor. If a circuit has excessive resistance, it prevents the wire from carrying sufficient current under high load conditions. A voltage drop test is an effective way to locate excessive resistance in connections and circuits.

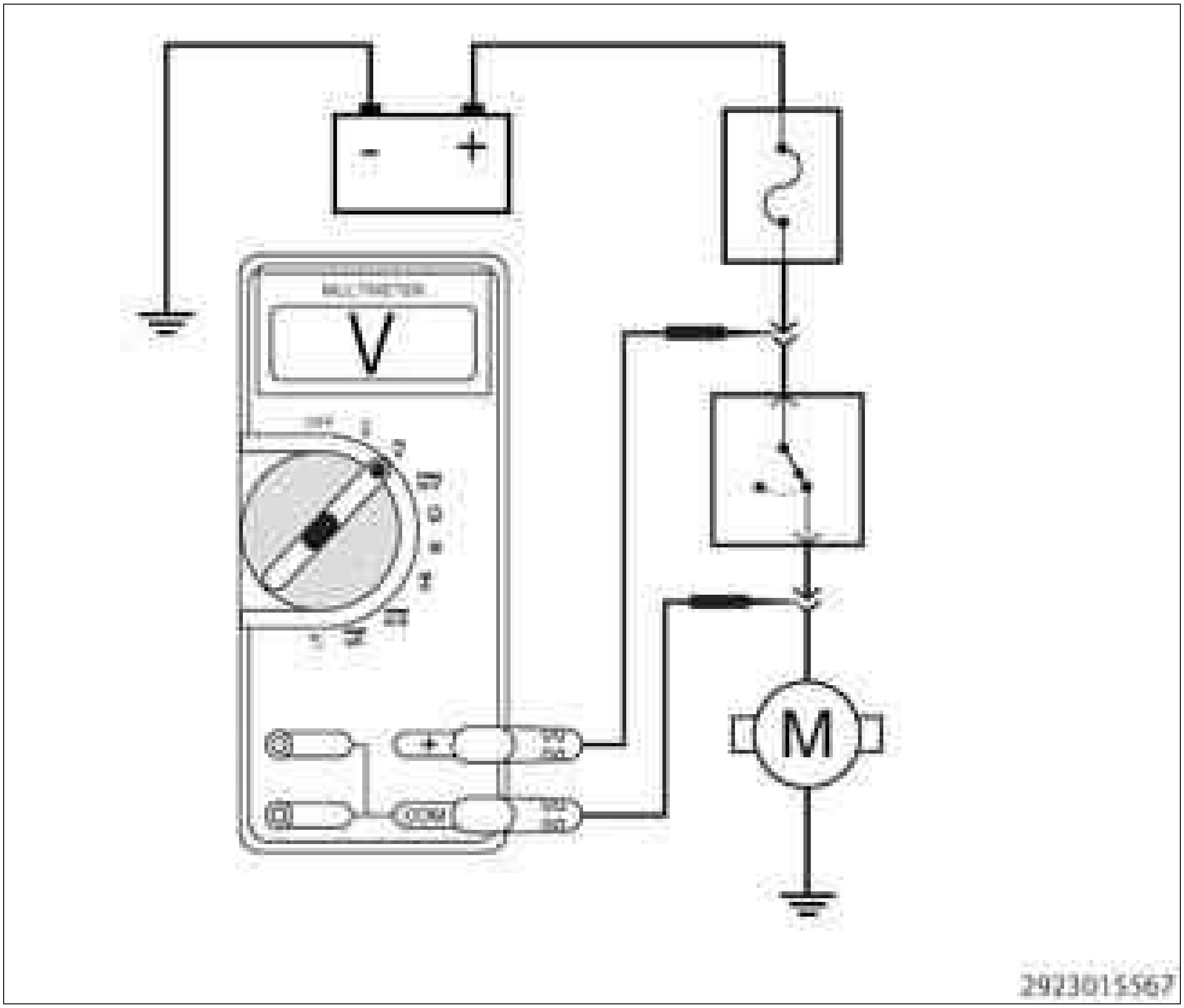
To perform a voltage drop test, a Digital Volt Ohm Meter (DVOM) is used to measure the voltage drop across a live circuit or connection while it is under the load. If the circuit or connection being tested has excessive resistance, the DVOM will measure the voltage that the resistance is using. **Little or no voltage drop should be read, ideally less than 0.2 of a volt** , anything greater indicates excessive resistance and the circuit or connection should be inspected for cleaning or repair.

Possible Causes
EXCESSIVE CIRCUIT RESISTANCE (CHAFED, PIERCED OR CORRODED WIRES)
HIGH RESISTANCE WITH IN-LINE CONNECTOR (BENT, PUSHED OUT OR CORRODED TERMINALS)

STANDARD PROCEDURE > VOLTAGE DROP TEST PROCEDURE > DIAGNOSTIC TEST

TESTING FOR VOLTAGE DROP

Fig 1: Testing For Voltage Drop



Courtesy of CHRYSLER GROUP, LLC

1. Turn the ignition off.
2. Use the wiring diagram as a guide, trace the circuit being tested and locate the components related to the circuit.
3. Set the multimeter to measure DC voltage.
4. Carefully back probe the two component harness connectors of the circuit being tested.

WARNING:

When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing. Failure to follow these instructions may result in possible serious or fatal injury.

NOTE:

If you are testing the starting circuit, disable the engine so the engine does not start.

5. Crank the engine for five seconds if you are testing the starting circuit and monitor the multimeter voltage reading.
6. For circuits that don't require the engine running, turn the ignition on.
7. For circuits that require the engine running, start the engine.

NOTE:

If the circuit you are checking needs to be operating, such as the Blower Motor or a Lamp, do so now.

8. Monitor the voltage reading.
9. The voltmeter will show the difference in voltage between the two points.

Is the voltage less than 0.2 of a Volt?

Yes

1. At this time the circuit is functioning properly. Continue to measure the voltage between the components and wiggle the wire harness and connectors while checking for an intermittent condition.
2. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors where the excessive resistance could occur intermittently.
3. Look for any chafed, pierced, pinched, or partially broken wires.
4. Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related wire harness connectors.
5. Perform any Technical Service Bulletins (TSBs) that may apply.

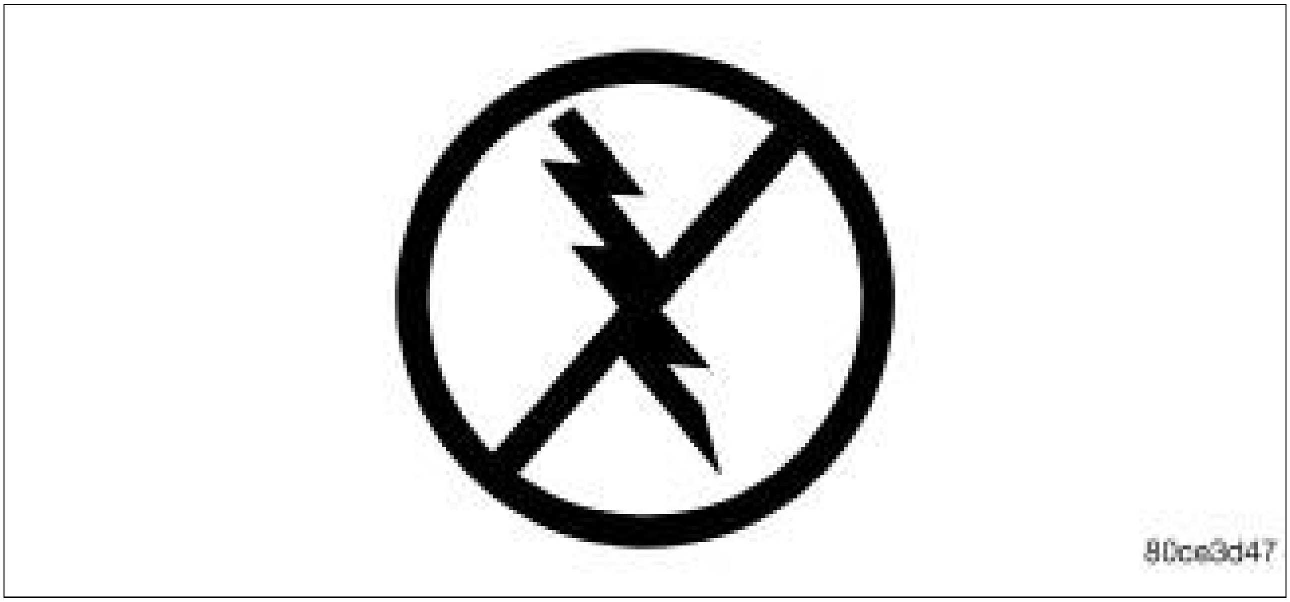
No

1. Repair the excessive resistance in the circuit.
2. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors where the excessive resistance may occur.
3. Look for any chafed, pierced, pinched, or partially broken wires.

4. Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related wire harness connectors.
5. Perform any Technical Service Bulletins (TSBs) that may apply.

STANDARD PROCEDURE > ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES

Fig 1: Electrostatic Discharge Symbol



Courtesy of CHRYSLER GROUP, LLC

All ESD sensitive components are solid state and a symbol is used to indicate this. When handling any component with this symbol, comply with the following procedures to reduce the possibility of electrostatic charge build up on the body and inadvertent discharge into the component. If it is not known whether the component is ESD sensitive, assume that it is.

Perform the following procedure when handling ESD sensitive components:

1. Always touch a known good ground before handling the component. This should be repeated while handling the component and more frequently after sliding across a seat, sitting down from a standing position, or walking a distance.
2. Avoid touching electrical terminals of the component, unless instructed to do so by a written procedure.
3. When using a voltmeter, be sure to connect the ground lead first.
4. Do not remove the component from its protective packing until it is time to install the component.
5. Before removing the component from its package, ground the package to a known good ground on the vehicle.

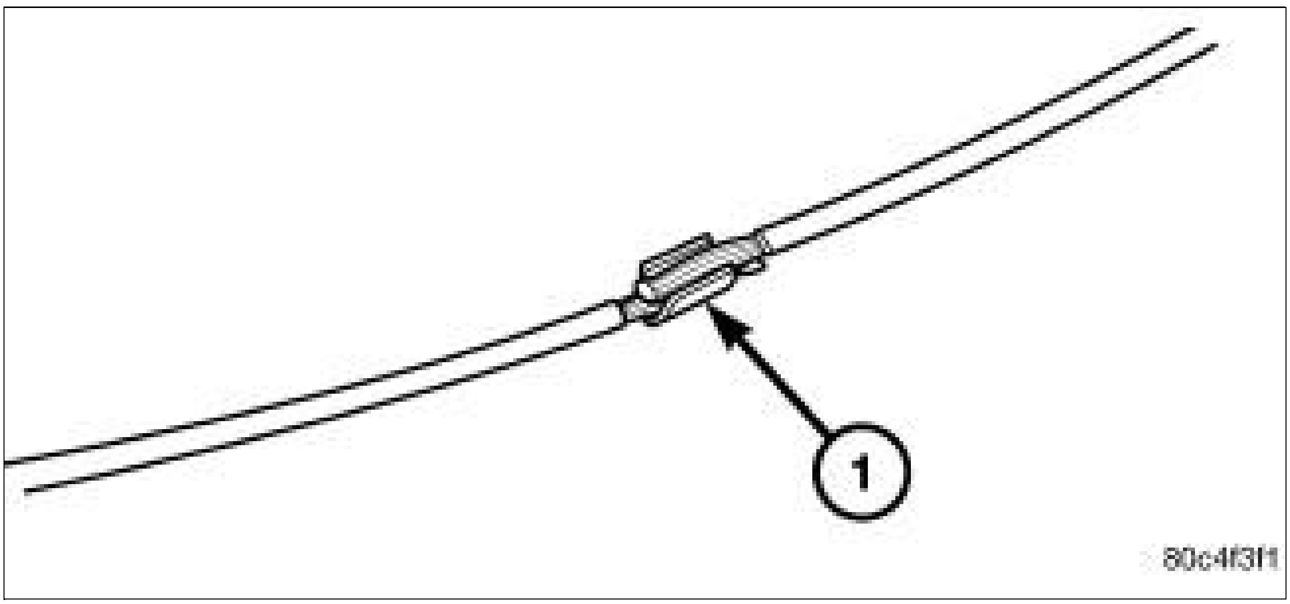
STANDARD PROCEDURE > WIRE SPLICING

A multimedia supplement to the instructions contained in this article is available.
To view the multimedia example of the condition described go to;
http://www.youtube.com/user/Mitchell1Tips then type "A00619692.vid1" into the "Search Channel" box.

CAUTION:

If additional wire is needed when making a splice repair to any wire, it is important that the same or next larger size wire gauge be used. Refer to the appropriate wiring diagram for the original wire gauge size.

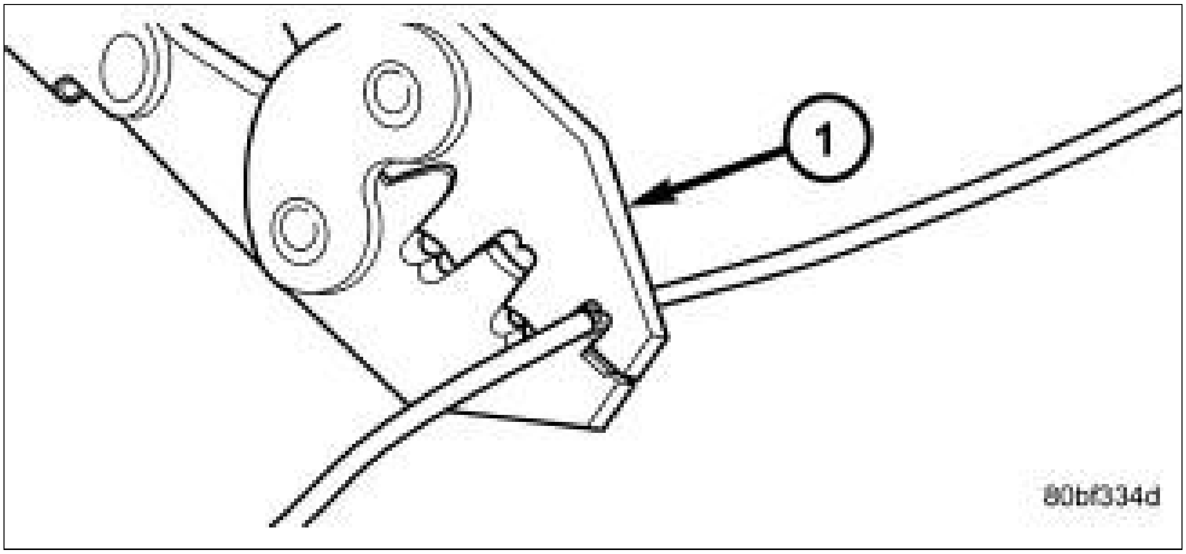
Fig 1: Splice Band



Courtesy of CHRYSLER GROUP, LLC

1. Remove 13 millimeters (0.50 inch) of insulation from each wire that needs to be spliced.
2. Place a piece of adhesive sealant-lined heat shrink tubing (Part Number 04778570 or equivalent) over the wire on one side of the splice. Be certain the length of tubing will be sufficient to cover and seal the entire repair area.
3. Place the strands of the wires being spliced so that they are overlapping each other within the splice band (1).

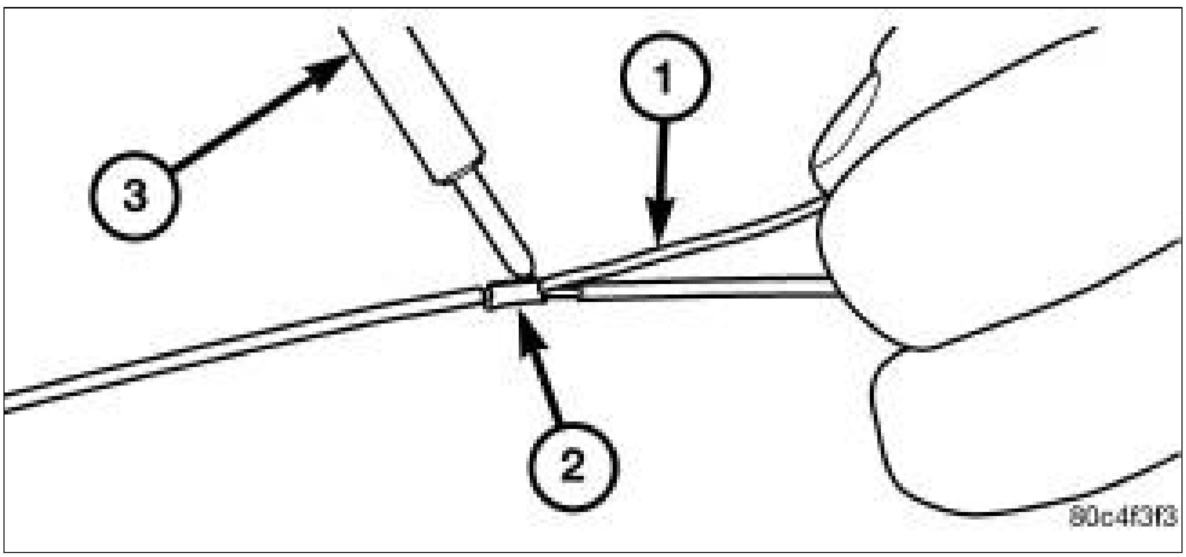
Fig 2: Crimping Tool



Courtesy of CHRYSLER GROUP, LLC

4. Using a crimping tool (1) (Mopar® Part Number 05019912AA, Miller Special Tool Number (special tool #10042, Crimper, Wire/Terminal) or equivalent) crimp the splice band and wires together securely.

Fig 3: Solder Splice

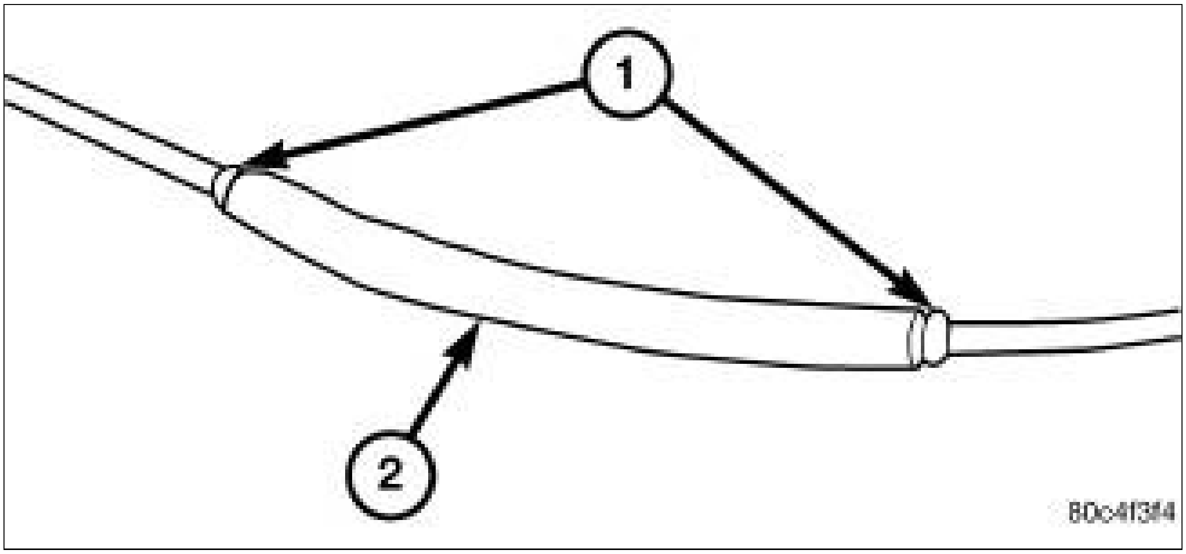


Courtesy of CHRYSLER GROUP, LLC

> ⚠ *CAUTION:*
>
> *Never use acid core solder for electrical wiring repairs.*

5. Using Rosin Core type solder (1) only and a suitable soldering iron (3), solder the wire and splice band connection (2) together.

Fig 4: Heat Shrink Tube

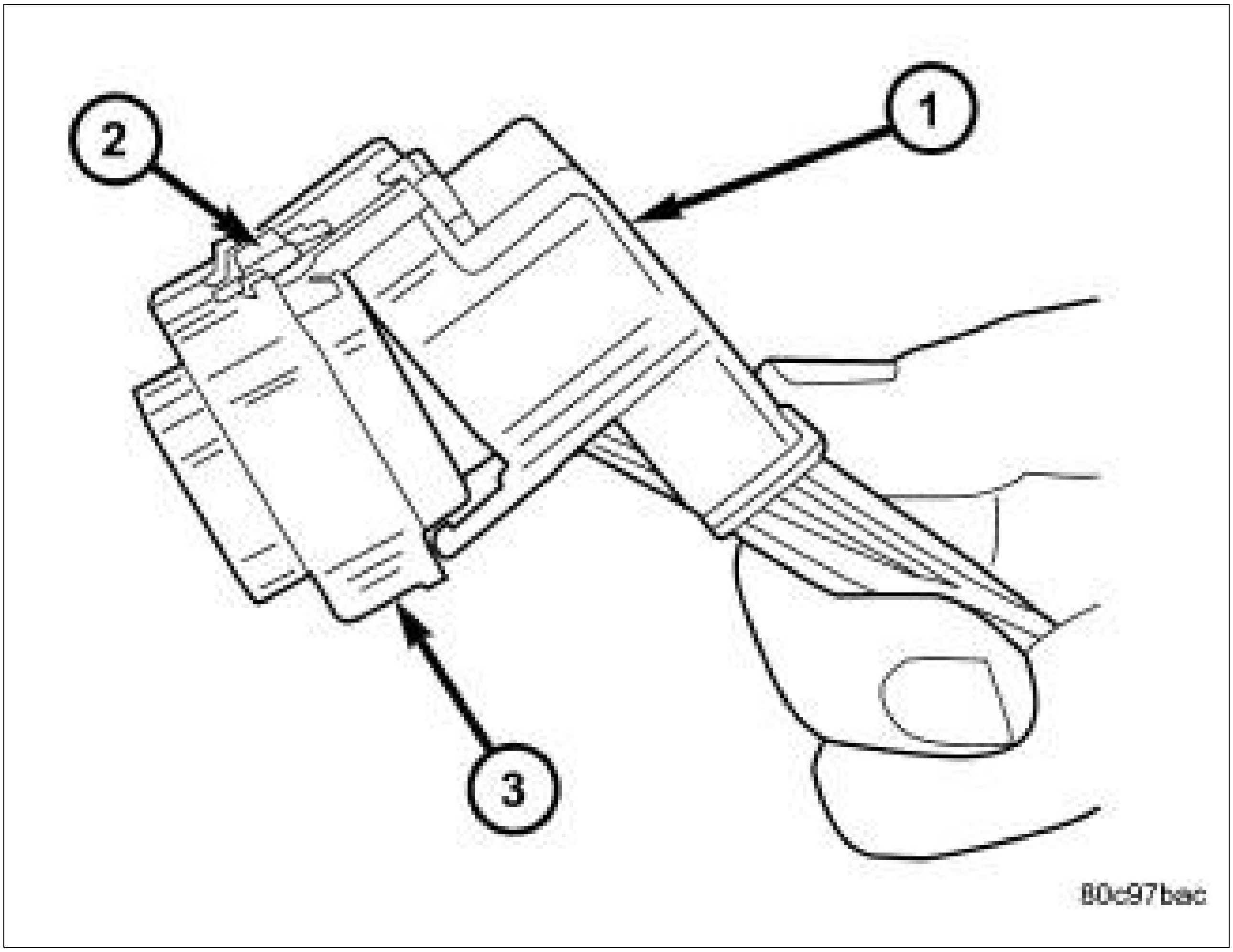


Courtesy of CHRYSLER GROUP, LLC

6. Center the heat shrink tubing (2) over the splice joint repair and heat using a suitable heat gun. Heat the joint until the tubing is tightly sealed and sealant (1) begins to ooze out of both ends of the tubing.

REMOVAL > CONNECTOR TERMINAL REMOVAL

Fig 1: Removal Of Dress Cover

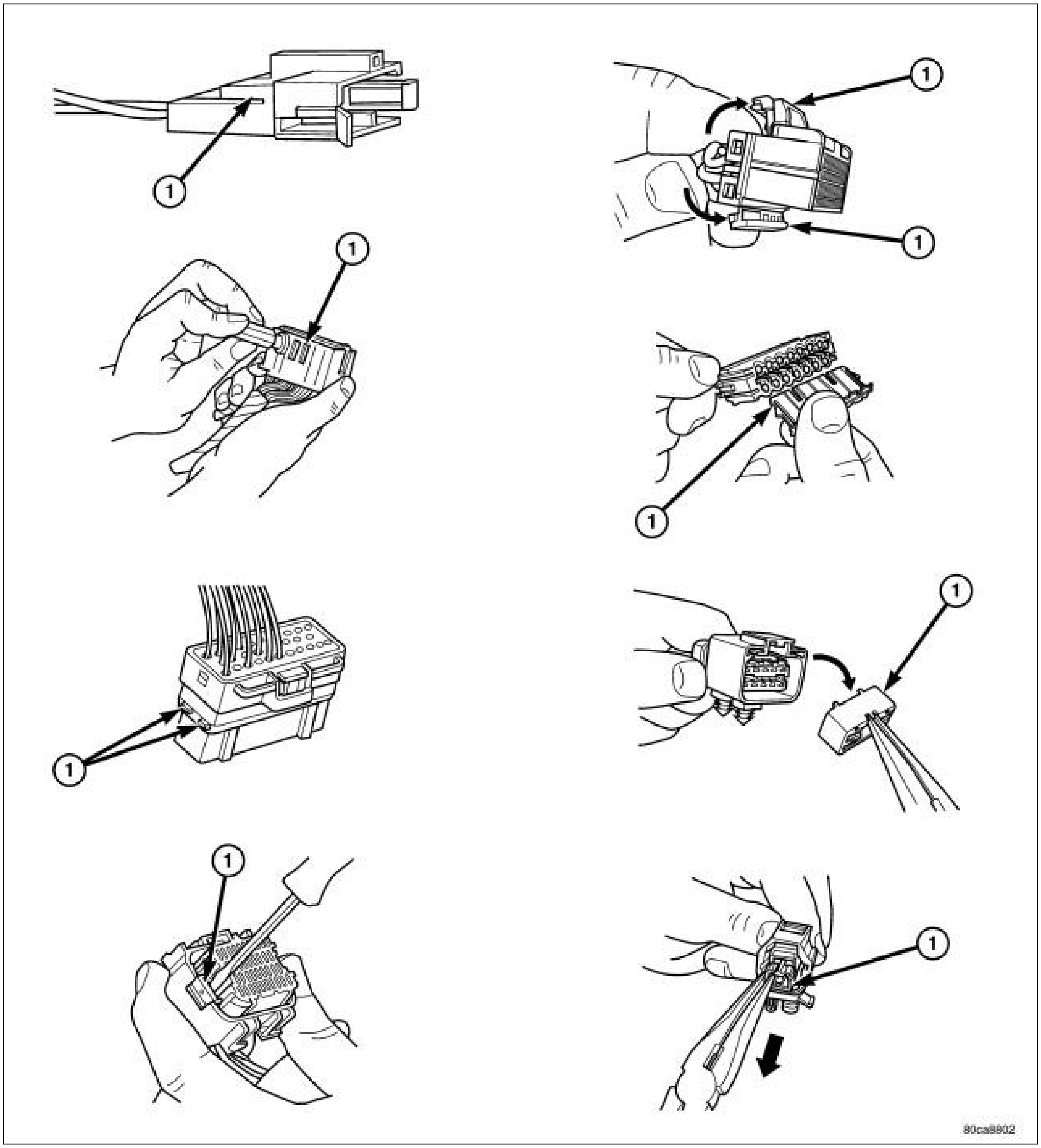


Courtesy of CHRYSLER GROUP, LLC

1 - DRESS COVER	
2 - CONNECTOR LOCK	
3 - CONNECTOR	

1. Disconnect battery.
2. Release Connector Lock (2).
3. Disconnect the connector (3) being repaired from its mating half/component.
4. Remove the dress cover (if applicable) (1).

Fig 2: Connector Secondary Terminal Lock

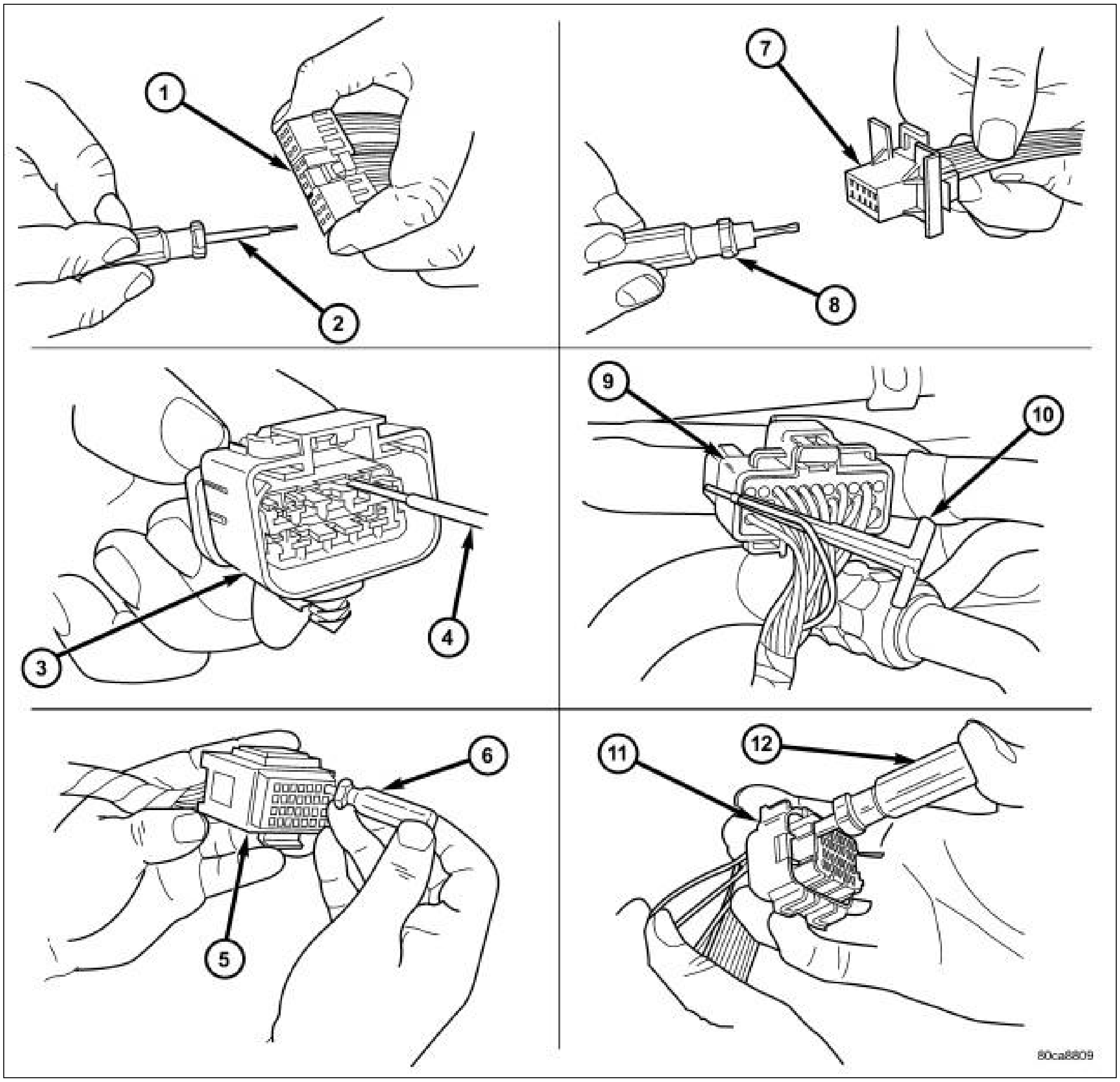


Courtesy of CHRYSLER GROUP, LLC

1 - Secondary Terminal Lock

5. Release the Secondary Terminal Lock, if required (1).

Fig 3: Terminal Removal



Courtesy of CHRYSLER GROUP, LLC

1 - TYPICAL CONNECTOR
2 - PICK FROM TERMINAL REMOVER KIT 10300
3 - APEX CONNECTOR
4 - PICK FROM TERMINAL REMOVER KIT 10300
5 - AUGAT CONNECTOR
6 - ELECTRICAL TERMINAL REMOVAL TOOL
7 - MOLEX CONNECTOR
8 - PICK FROM TERMINAL REMOVER KIT 10300
9 - THOMAS AND BETTS CONNECTOR
10 - TERMINAL REMOVER

11 - CONNECTOR
12 - ELECTRICAL TERMINAL REMOVER

6. Position the connector locking finger away from the terminal using the proper special tool. Pull on the wire to remove the terminal from the connector.

INSTALLATION > CONNECTOR TERMINAL INSTALLATION

1. Select a wire from the terminal repair kit that best matches the color and gauge of the wire being repaired.
2. Cut the repair wire to the proper length and remove one-half (1/2) inch of insulation.
3. Splice the repair wire to the wire harness (see Wire Splicing procedure). Refer to STANDARD PROCEDURE .
4. Insert the repaired wire into the connector.
5. Install the connector locking wedge, if required, and reconnect the connector to its mating half/component.
6. Re-tape the wire harness starting at 1-1/2 inches behind the connector and 2 inches past the repair.
7. Connect battery and test all affected systems.