



## DEMONSTRATION MODULE TROUBLESHOOTING AN OPEN CIRCUIT

2 – 1

### OBJECTIVES

Using this module and the horn circuit model, you will

- identify loads and components in a circuit,
- match circuit models to circuit diagrams,
- identify sources of resistance in a circuit,
- describe how voltage works in a circuit, *and*
- troubleshoot a circuit.



### IMPORTANCE

This demonstration lesson will provide a brief, hands-on look at how we integrated technical content and mental-model formation to develop troubleshooting skills. The target audience was service technicians in motorcycle dealership service facilities. This module provided paper and pencil rehearsal and practice—the next step would be hands-on application with a live circuit board with a 12v. power source, followed by practice on a “rigged” motorcycle.

### PROCEDURE

- Read the material and do the exercises in this module. Write the answers in the spaces provided or put a check mark next to the right answers.
- After completing each section of the module, stop and check your work with the Feedback Sheet, then proceed to the next section.

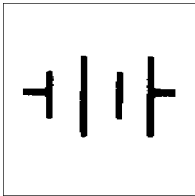
### STUDENT RESOURCES

- Video: Watch Tom troubleshoot a circuit.
- Job Aid: Troubleshooting Open Circuits.
- Horn Circuit Model.



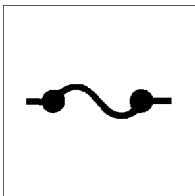
## SYMBOLS AND DEFINITIONS

Some common parts of ELECTRICAL CIRCUITS are:



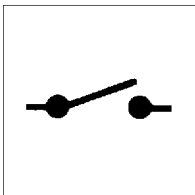
POWER SOURCE

The BATTERY. It *supplies power* to the electrical system and also serves as a reservoir for power produced by the alternator.



FUSE

The FUSE is a *control device*. It protects the circuit from getting an overload of electrical current.

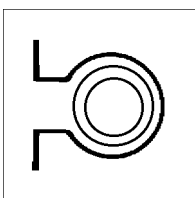


SWITCH

The SWITCH is a *control device* that controls current flow through a circuit.

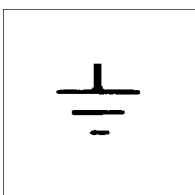
An OPEN SWITCH prevents electric current from flowing through the circuit.

A CLOSED SWITCH allows current to flow through the circuit.



HORN, or LOAD

The HORN is one of the *loads* found in a motorcycle circuit. The symbol can also be used generically to represent any LOAD that uses electricity to perform a task.

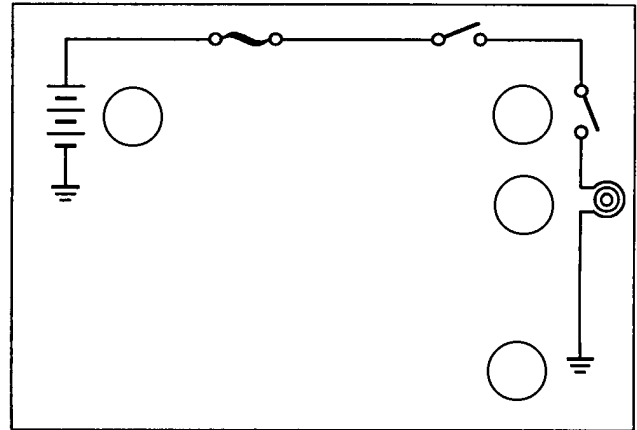


GROUND

The GROUND is the connection from the circuit to the motorcycle frame, which then completes the electrical path back to the battery.

**EXERCISE 1:**

**Circuit Components**



1. Write the letters that you see on the circuit model inside the circles on the circuit diagram, next to the symbol for the circuit component they go with.
  
2. Now match the names below with the letters from the diagram by writing the letters in the blanks.

- \_\_\_\_\_ circuit switch
  
- \_\_\_\_\_ load
  
- \_\_\_\_\_ power source
  
- \_\_\_\_\_ circuit ground

3. In this column write the letter of the circuit part that matches the description.
- \_\_\_\_\_ Supplies power to the circuit.
  
  - \_\_\_\_\_ Uses electricity to perform a task.
  
  - \_\_\_\_\_ Controls power flow through the circuit.
  
  - \_\_\_\_\_ Connection from circuit to ground path.



**VERIFY YOUR WORK WITH THE FEEDBACK SHEET,  
THEN GO ON TO THE NEXT EXERCISE**



## PROPERTIES OF ELECTRICITY

- **CURRENT** is the flow of electricity through a circuit. You might think of it as being like water flowing through a pipe.
- **RESISTANCE** is what current has to overcome to keep flowing.
- **VOLTAGE** is what pushes current through the resistance of a circuit. It is like the pressure that forces the water through the pipe.

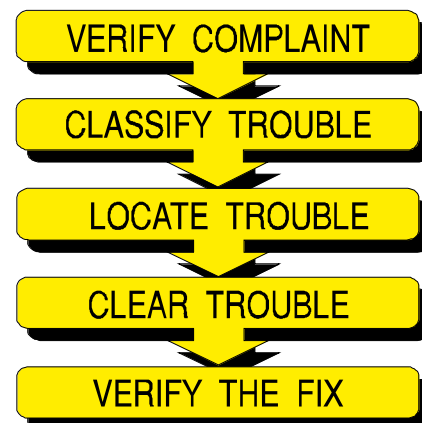
## HOW VOLTAGE WORKS

- **VOLTAGE** is supplied by the power source, or **BATTERY**.
- **VOLTAGE is used up, or DROPPED, by the RESISTANCE in a circuit.**
- There can be **VOLTAGE** in a circuit, even if **NO CURRENT** is flowing.

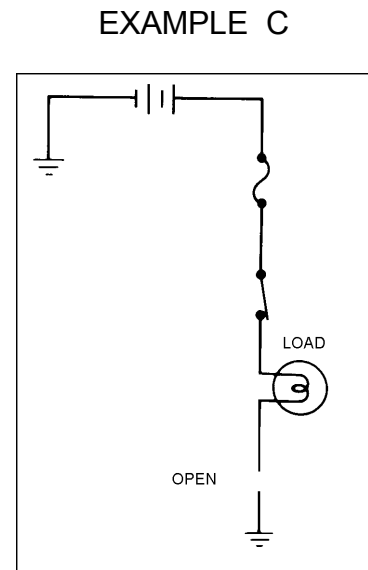
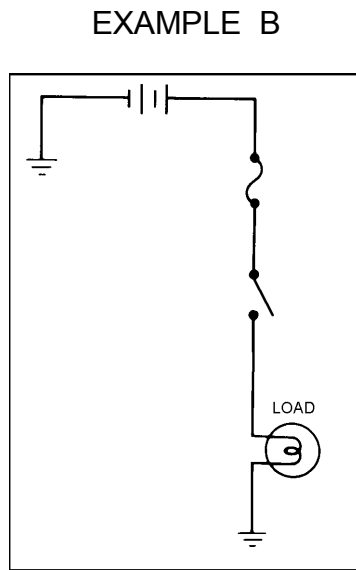
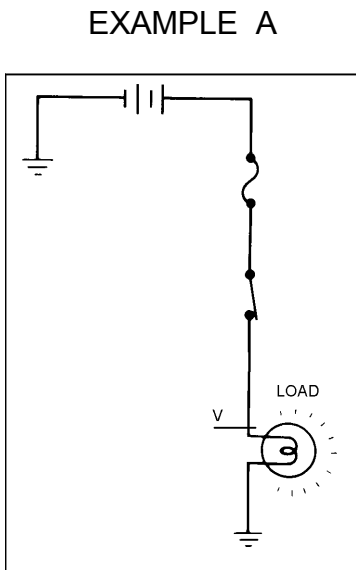
## INCOMPLETE CIRCUITS

- There will be **VOLTAGE up to the break in the circuit**, whether the load is operating or not.

"Always use Tom's  
Troubleshooting Procedures"



EXERCISE 2:    Answer the questions below about these circuits.



1. In a normally operating circuit, you would find battery voltage in the circuit path until:
  - the load causes the voltage to *drop* substantially \_\_\_\_\_
  - the alternator *increases* the voltage \_\_\_\_\_
  - voltage *stops* at an open in the circuit \_\_\_\_\_
  
2. Draw a line labeled "V" **across** each of the circuit paths to show how far you would find battery voltage of about 12 volts. (*Example A is done for you.*)
 

TIP:    Where does voltage either STOP or DROP in a circuit?
  
3. If you suspected an open in a circuit, as in Example C above, where would you check circuit voltage to see whether the open might be on the battery side or the ground side of the load?
  - at the battery \_\_\_\_\_
  - at the load \_\_\_\_\_
  - at the circuit ground connection \_\_\_\_\_

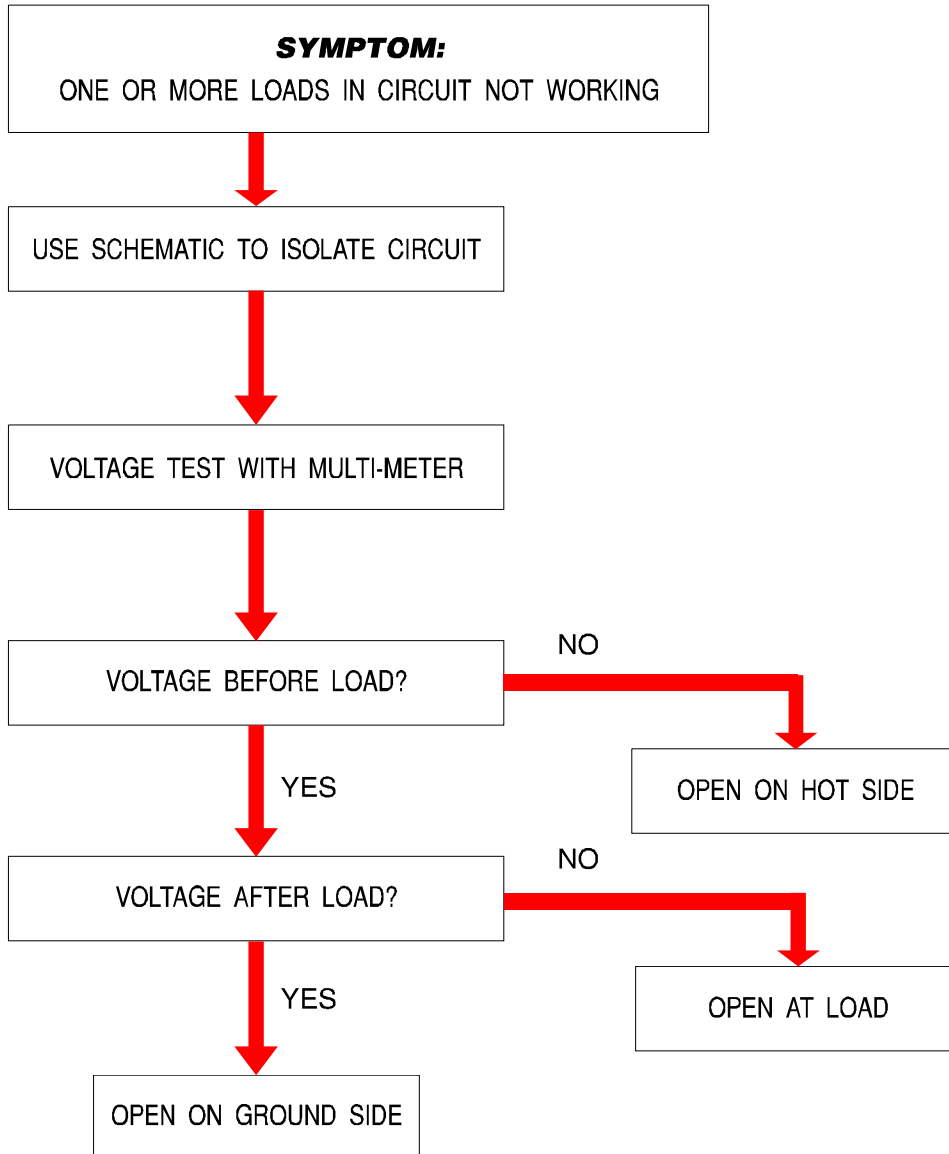


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JOB AID:

*TROUBLESHOOTING OPEN CIRCUITS*

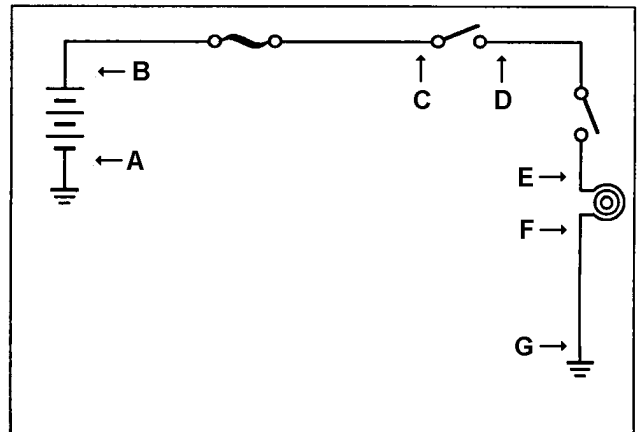


**EXERCISE 3:**

*Troubleshoot this circuit.*

In this exercise assume you are at work and your first assignment today is to troubleshoot a motorcycle. The customer reports that the horn is not working. Your job is to locate the trouble, clear it and make a repair.

Quickly you scan the wiring diagram in the service manual to isolate the horn circuit and you note that it looks like this:



You learned in your *Motorcycle Electrical Troubleshooting Course* that a non-functioning circuit load is a classic symptom of an open circuit. You decide to follow good troubleshooting procedure in locating the circuit trouble.

1. What would you do *first*?

- install a new horn \_\_\_\_\_
- check the VIN for warranty recalls \_\_\_\_\_
- verify* the complaint \_\_\_\_\_

2. Can you *classify* the trouble?

- must be a voltage drop \_\_\_\_\_
- yes, the symptoms sound like an open circuit \_\_\_\_\_
- the horn may be damaged \_\_\_\_\_

3. You determine the battery is fully charged.  
What *quick fix* might you try first?

- check the charging output \_\_\_\_\_
- check to see if the fuse is blown \_\_\_\_\_
- install a known good part \_\_\_\_\_

4. Using the Open Circuits Job Aid, you decide to make a voltage test. Where would you make the first voltage test?

A \_\_\_ B \_\_\_ C \_\_\_ D \_\_\_ E \_\_\_ F \_\_\_ G \_\_\_

5. That test is positive. Where would you make the next voltage test?

A \_\_\_ B \_\_\_ C \_\_\_ D \_\_\_ E \_\_\_ F \_\_\_ G \_\_\_

6. That test is also positive. Where is the open circuit?

- Between A and C \_\_\_\_\_
- next to the power source \_\_\_\_\_
- on the ground side \_\_\_\_\_



**VERIFY YOUR WORK WITH THE FEEDBACK SHEET,  
THEN GO ON TO THE NEXT EXERCISE**