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| Station | | Task | |
| 26 | | 4 | |
| ELECTRIC TESTS | | | |
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# Short circuit detection

## TASK OBJECTIVE

At the completion of this task the technician will be able to properly perform various short detection methods on electrical circuits.

**INTRODUCTION**

A short circuit is one where resistance through the circuit is less than adequate in relation to the amount of voltage being applied to the circuit. Stated another way, a ‘short circuit’ is one that is lacking, or ‘short of’, resistance, hence the term ‘short’ circuit. It is extremely important to always keep in mind that electricity is fundamentally lazy; it will always seek out and take the easiest path to ground. Or it can be said that electricity takes the path of least resistance.

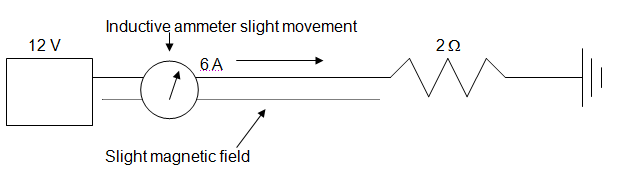
The lower the resistance is in a circuit, the higher the current flow. So, anything that reduces the resistance through a circuit will increase current flow. Excessive current flow generates heat in the conductor (the wire), which can result in blown fuses and sometimes melted wires.

There are a few possibilities to have with types of shorts. One is a “dead short”. That is when it is always directly shorted and immediately will blow the fuse or circuit breaker. This can be detected with a short finder kit or by using a logical approach to diagnose the problem. The second is an “intermittent short”. That is when the fuse blows occasionally. This type is the most difficult to find. An intermittent short usually occurs when the chassis or engine flexes or moves in such a way as to cause a wire to rub directly through on a piece of frame or harness. They are usually found “visually” in areas such as where harnesses may get pinched or wrapped around different areas in their routing. Other examples of shorts include, incorrectly connected wires or faulty components. The third type of short is an “overloaded circuit”. This is when the circuits normally protected amperage rating is exceeded, such as too many accessories on a circuit or an electrical motor that is drawing to many amps.

**SHORT FINDER**

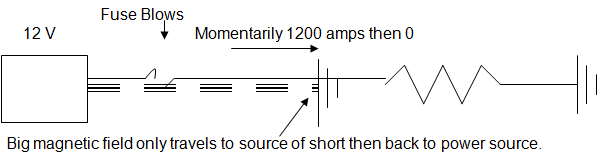
**Consider a normal circuit at 12 volts / 2 ohms = 6 amps**

The electron field causes a slight magnetic field and slight amount of heat through-out the entire circuit.

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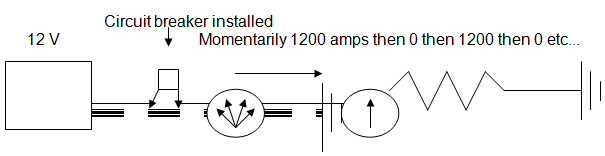
**A short circuit 12 volts / .01 ohms = 1200 amps**

The electron field causes a large magnetic field and large amount of heat to the point of the short and then returns to the power source

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**Short finder usage:**

**A short circuit 12 volts / .01 ohms = 1200 amps**

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Install a circuit breaker and then slowly move a short finder (inductive amp meter) along the suspected circuit until the needle stops reacting or slows in reaction. When the Ammeter needle reacts violently it is detecting the shorted harness or more specifically an individual shorted wire.

When it reaches a point just past the shorted area it stops reacting or slows in reaction. It will also stop reacting or slow in reaction when it is moved towards a path of the harness that is not shorted, such as at the good side of a junction. This is how to use the Ammeter as a direction finder.



**PROCEDURES**

**The switches 14, 15, 16 and 17 create shortcuts on the circuits 18, 19, 20 and 21**

**The fuse for the circuit 18 is already blown**

**Switch ON 19, 20 and 21 to confirm the circuits are operatives**

**Switch them OFF**

Follow the steps and answer the questions below:

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| --- |
| 1. Measure the resistance of the circuit 18 between the blown fuse and ground:\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| 1. Place the switch #14 to the right |
| 1. Measure again the resistance of the circuit 18:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| 1. Is there any difference?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| 1. What does it means?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| 1. Replace the blown fuse of the circuit 18 by the circuit breaker leads CB |
| 1. Place the switch #14 to the right |
| 1. Is the circuit breaker clicking? |
| 1. Switch OFF #18 |
| 1. Does the circuit breaker stop clicking? |
| 1. What does it means? 2. The short is in the harness 3. The short is in the bulb |
| 1. Follow the circuit with the inductive amp meter |
| 1. Where is the circuit 18 shorted? |
|  |
| 1. In order to save fuses, remove the fuse #2 and install the circuit breaker. |
| 1. Place the switch #15 to the right |
| 1. Is the circuit breaker clicking? |
| 1. Switch OFF #19 |
| 1. Does the circuit breaker stop clicking? |
| 1. Where is the short? 2. The short is in the harness   b. The short is in the bulb |
| 1. Follow the circuit with the inductive amp meter |
| 1. Where is the circuit 19 shorted? |
|  |
| 1. Remove the fuse #3 |
| 1. Note the resistance of the circuit 20 between the fuse 3 terminal and ground |
| 1. Place the switch #16 to the right |
| 1. Check the resistance of the circuit again |
| 1. Is the circuit shorted? YES NO |
| 1. Switch OFF #20 |
| 1. Check the resistance of the circuit again |
| 1. Is the circuit still shorted? YES NO |
| 1. Where is the short? |
|  |
| 1. Remove the fuse #4 and install the circuit breaker on it |
| 1. Place the switch #17 to the right |
| 1. Is the circuit breaker clicking? |
| 1. Switch OFF #21 |
| 1. Does the circuit breaker stop clicking? |
| 1. Where is the short on the circuit 21? |
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| 1. Ensure all switches are to the left and install 10 amp fuses on every circuit |
| 1. Switch OFF all circuits. |

**Note: The circuit # 20 is shorted on \_\_\_\_\_\_\_\_\_\_\_\_. That’s why we didn’t use the circuit breaker on this case. The high current of the short crossing the switch #20 will damage it after some test.**

Questions

1. What have you learned from this task? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Instructor sign off-- Go \_\_\_\_\_\_\_\_\_\_**