

Knowledge Domain: Power Supply

Unit: Fuse

Skill: Fuse Substitution

Tools and Parts Required:

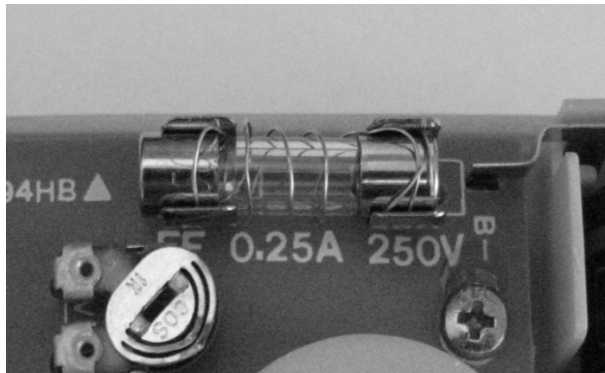
- 1) Assorted fuses
- 2) Assorted stranded wires
- 3) Multimeter
- 4) Power supply or batteries (for generating a current)

Introduction

Fuses are essential to the operation and protection of sensitive electronics. A blown fuse can prevent a device from functioning. Sometimes an exact replacement fuse cannot be found. Using a substitute fuse will help return equipment to service until the correct fuse is found.

Example

Below is a picture of a strand of wire used as a substitute for a blown fuse.



Identification and Diagnosis

A blown fuse is 'open.' An open fuse will not conduct electricity. You learned how to check a fuse in the skill "Power Supply: Identifying a Blown Fuse." It is best to use an exact replacement fuse. Fuses have 4 specifications to consider:

- 1) Amperage: The amperage (amps, A) rating tells how much current flow the fuse can withstand.
- 2) Voltage: The voltage (volts, V) rating tells how much voltage the fuse tolerates.
- 3) Type: The type of fuse may be fast-acting or slow-blow. A fast-acting fuse will blow quickly. A fast acting fuse protects against spikes in electricity. A slow-blow fuse, or time-delay fuse, blows slowly. The slow-blow fuse will not blow immediately with high power. Slow-blow fuses are commonly used in motors, where there is high current for short time periods during startup.

- 4) Physical mating: The physical mating refers to the size and shape of the fuse and the fuse holder.

Procedure

To substitute a fuse, you must know all 4 specifications of the original fuse. First, try to find a fuse that matches all 4 specifications. Replace the fuse in the machine, recalibrate, and return to service. You are finished.

When you cannot find an exact duplicate, use the second-best option. The second-best option matches specifications 1-3. Try to duplicate the amperage, voltage, and type of the fuse. A physical match may be impossible to find.

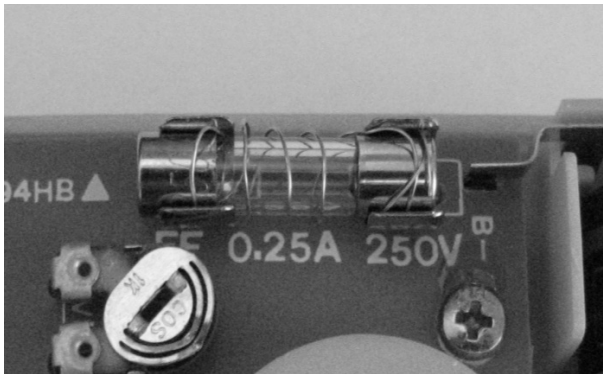
If you cannot physically match your substitute fuse, select a fuse that matches specifications 1-3 even if the size and shape are different. The fuse must be electrically connected to the equipment. Insure that the ends of the fuse make an electrical connection with the contacts of the original fuse holder. You can run wires from the ends of the substitute fuse to the original fuse holder. Use a continuity tester to verify the electrical connections.

Sometimes you cannot match 3 specifications. Try to match as many as possible. Then, follow these rules to protect the equipment:

- Fuse type: A fast-acting fuse may replace a slow-blow fuse. The fast-acting fuse will blow more easily. A fast-acting fuse will need to be replaced more often. **A slow-blow fuse may not replace a fast-acting fuse.** The slow-blow fuse will not protect the electronics against spikes.
- Voltage: Voltage ratings refer to the maximum values. A higher voltage fuse may replace a lower voltage fuse. **A lower voltage fuse may not replace a higher voltage fuse.** A lower voltage fuse replacement may lead to arcing. Arcing will damage or destroy sensitive electronics.
- Amperage: A lower current (lower amperage) fuse may replace a higher amperage fuse. The lower current fuse will blow more easily. A lower current fuse will need to be replaced more often. A higher current fuse will not provide adequate protection.

Temporary Measure: Sometimes you will need to use a piece of equipment before you can find a new fuse. A temporary solution is to use a single strand of wire. Always look for the correct fuse first.

1. Strip a stranded wire and separate one of the strands. Look for a wire that is very thin, such as the wires in a headset.
2. Use an adjustable power supply or battery of known rating to run a current through the wire. Measure the amount of current passing through the filament when it turns red. This measured current is the approximate rating of the filament. If the current rating is lower than the original fuse, place multiple strands side by side, creating a parallel circuit until you reach the rating needed. The total current rating is the sum of the currents of the parallel wires.
3. Connect the ends of the wire with the original fuses' connections. You may need to tape the strands into place. If you still have the blown fuse, wrap the wire around the blown fuse to hold the new strands in place.



Do not run equipment with a temporary measure for an extended period. Temporary measures are generally acceptable only for a few hours. Temporary measures may causes fires or permanent damage to the equipment.

Exercise

Select a fuse from your assorted fuses. In your assorted fuses, determine which fuses would be adequate replacements for the blown fuse. Which fuse would be the best substitute? Which fuse would be the next best substitute?

Next, your instructor will provide you with a selection of stranded wires. Use the wires to obtain a single strand. Determine the current rating of each strand. How would you use the wire as a substitute for the blown fuse?

Your instructor must verify your work before you continue.

Preventative Maintenance and Calibration

Use caution when substituting a fuse. Check for an exact replacement if possible. If you find a replacement, consider buying multiple fuses. You will need to replace fuses more than once.

Fuses often blow because of a defect. Look for and repair the problem to prevent future fuses from blowing. If you do not repair the problem, and you continue replacing the fuse, the equipment may be damaged permanently.

Avoid bridging the fuse. Remember to always replace temporary measures with an actual fuse as soon as possible.

Always calibrate every medical device before returning it to use.