

Got the Right Fuse?

If you think a fuse is just a fuse, think again.



You probably know that fuses are made to open when a certain level of electric current is exceeded, protecting equipment and facilities from damage or fires started by overloaded circuits. But good fuses are also designed to protect you from the hidden dangers of making current measurements.

Why does a tester need a fuse?

Voltage testers and digital multimeters that only measure voltage don't use fuses, but they do use other forms of protection to protect the equipment and the user. For testers that also measure current, fusing is required.



When you measure current with a meter, the current flows through the internal protection fuse and the meter's current shunt. The fuse's and shunt's resistance is very low. Add the resistance of the test leads and you still have a low resistance measurement circuit of less than 5 ohms. This resistance is adequate if you're measuring current, but it's essentially a short circuit if you try to measure voltage.

If you inadvertently try to make a voltage measurement after making a current measurement, with the test leads in the current input jacks, you'll place that short circuit across the voltage source. Years ago, a mistake like this would have pretty well destroyed the meter – and in some instances injured the user.

To protect against this common occurrence, meter manufacturers started using fuses.

Why you need the right fuse

Manufacturers specify in manuals and often on the meter itself the required amperage, interrupt and voltage ratings for replacement fuses. These fuses are so specific, they're an integral part of the tester's current protection circuitry.

If you select a fuse without these ratings, or even worse, place a wire around the fuse connections, believe it or not, you have compromised the overall safety design of the meter, put yourself in danger and potentially just created a thermal hand grenade – you just need the right conditions to set it off.

If the wrong fuse were installed in the meter, here are the potential impacts, depending on the energy level you're working with:

Low Energy: CAT I or CAT II (less than 300 volts) environments are fairly low energy and often have built-in fuse protection, circuit breakers and over-current protection circuits that should prevent an explosion. However, it's not a safe way to work and violates OSHA standards.

High Energy: When you move to an electrical distribution cabinet (CAT III) or primary feed lines (CAT IV), you face an almost unlimited amount of energy. The metal element in the insufficient fuse (or wire) will most likely heat up very quickly and begin to vaporize, creating a large explosion.

In the case of the wrong fuse, the fuse enclosure may burst open from the force of the explosion, gaining access to enough oxygen to fuel a plasma fireball.

The test leads may also start to melt, quickly spreading fire and hot metal to your hands, arms, face and clothing.

How long the energy remains applied to the tester, how much oxygen is available and the presence of safety equipment – like face shields and heavy gloves – will determine how serious your injuries are.

How to choose the right multimeter and fuses

- First, choose a multimeter rated for the highest category you could be working in.
- Then, look for a multimeter with a voltage rating for that category matching your needs.
- While you're at it, don't forget the test leads – they should be certified to a category and voltage as high or higher than the meter.

Finally, don't forget that Grainger carries the complete line of Fluke test tools.



Tip: Specially designed "high-energy" fuses are designed to keep the energy generated by an electrical short within

the fuse enclosure, protecting the user from electric shock and burns. These high-energy fuses limit the length of time energy is applied and the amount of oxygen available for combustion. They also use a special kind of sand that melts from the high temperature (up to 10,000°F) energy and turns into glass, coating the element and smothering the fireball.

*Information courtesy of Fluke Corporation