

What Is the Difference Between a Fuse and a Circuit Breaker?

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Submitted by mhowe on Tue, 02/25/2014 - 12:32

Large power overloads may potentially destroy electrical equipment, or in more serious cases, cause a fire. A fuse and circuit breaker both serve to protect an overloaded electrical circuit by interrupting the continuity, or the flow of electricity. How they interrupt the flow of electricity is very different, however. A fuse is made up of a piece of metal that melts when overheated; a circuit breaker has an internal switch mechanism that is tripped by an unsafe surge of electricity. Fuses tend to be quicker to interrupt the flow of power, but must be replaced after they melt, while circuit breakers can usually simply be reset.

How Fuses Work



There are many different types of fuses for residential and commercial use, but the most common type is made up of a metal wire or filament that is enclosed in a glass or ceramic and metal casing. In a home, the fuse is typically plugged into a central fuse box where all the building's wiring passes through. When the electricity is flowing normally, the fuse permits the power to pass unobstructed across its filament, between circuits. If an overload occurs, the filament melts, stopping the flow of electricity.

It generally takes very little time for the filament in the type of fuse used in a home to melt, so any power surge is quickly stopped. Once a fuse is blown, however, it must be discarded and replaced with a new one. There are many different voltage and ratings available that handle different capacities of electricity, and the best fuse for a circuit is typically one that is rated for slightly higher than the normal operating current.

How Circuit Breakers Work



A circuit breaker works in one of two ways, with an electromagnet (or solenoid) or a bi-metal strip. In either case, the basic design is the same: when turned on, the breaker allows electrical current to pass from a bottom to an upper terminal across the solenoid or strip. When the current reaches unsafe levels, the magnetic force of the solenoid becomes so strong that a metal lever within the switch mechanism is thrown, and the current is broken. Alternately, the metal strip bends, throwing the switch and breaking the connection.

To reset the flow of electricity after the problem is resolved, the switch can simply be turned back on, reconnecting the circuit. Circuit breakers are often found in a cabinet of individual switches, called a breaker box. The simple switch action of a circuit breaker also makes it easy to turn off an individual circuit in a house if it's necessary to work on the wiring in that location.

Another use of the circuit breaker is a ground fault circuit interrupter (GFCI) outlet, which functions to prevent electric shock instead of overheating. It works by breaking the circuit in an outlet if the current becomes unbalanced, and can be reset by the push of a button. This technology is particularly useful in bathrooms or kitchens where electrocution is a risk due to the frequent use of electric appliances near a source of water.

Advantages and Disadvantages

The fuse and circuit breaker both have advantages and disadvantages, each of which can depend on the situation in which they are used. Fuses are inexpensive and can be purchased from any hardware store. They also tend to react very quickly to overloading, which means that they can offer more protection to sensitive electronic devices. This quick reaction can be a disadvantage, however, if the circuit is prone to surges that regularly cause fuses to blow.

Fuses must always be replaced once they are blown, which can be challenging in a darkened room or if the appropriate replacement is not immediately available. Another issue is that a do-it-yourselfer can mistakenly select a fuse that has a voltage or current rating that is too high for his needs, which can result in an overheated circuit. In addition, there may be exposed electrical connections in a fuse box, which can pose a danger to someone who does not follow the proper safety precautions.

Circuit breakers have many advantages, not the least of which is how quickly they can be reset. It is usually clear which switch has tripped, and it can be easily reset in most cases. For the average homeowner, it is also safer because there is no question about choosing the right fuse rating and all of the electrical connections are hidden in a breaker box.

A drawback to using a circuit breaker is that it is usually more expensive to install and repair. A circuit breaker also typically does not react as quickly as a fuse to surges in power, meaning that it is possible that electronics connected to the circuit could be damaged by "let-through" energy. It also is more sensitive to vibration and movement, which can cause a switch to trip for reasons unrelated to an electricity overload.

A fuse and circuit breaker are not interchangeable for all power applications. For example, a fuse cannot be used in situations that require a GFCI. Electricians are best qualified to determine whether a fuse or circuit breaker system is better for a particular electrical installation or upgrade.