Circuit Breaker and Fuse Encyclopedia Article

Circuit Breaker and Fuse

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Circuit Breaker and Fuse

A circuit breaker does exactly what its name implies—it is designed to automatically break, or cut off, an electric circuit if the current in that circuit gets dangerously high.

The resistance electricity encounters as it flows through a circuit creates heat. If the electric current is great enough, the resulting heat can generate a fire. While circuits are designed very carefully, a circuit breaker or fuse provides a fail-safe condition and eliminates risk.

The first circuit breaker was based on the electric relay, which was invented by American physicist Joseph Henry in 1829. Turning electricity on and off activated a relay which controlled another circuit. In the late 1890s circuit breakers using springs and electromagnets came into use. If the current in a circuit became too high it would "trip" a relay, thus breaking the connection. When a circuit breaker trips, the fault in the circuit must be corrected before turning the breaker back on, otherwise the breaker will simply trip again.

A fuse performs the same task as a circuit breaker, but in a different manner. It is composed of a metal that melts at a low temperature, and in doing so breaking the overheated circuit. It is based on a discovery made by English physicist James Joule (1818-1889). In 1840 he devised a formula relating the development of heat due to an electric current. He found that the heat generated was proportional to the square of the intensity of the current multiplied by the resistance of the circuit. It was thus possible to determine how thick, or thin, a fuse could be before melting, because the resistance of a certain piece of metal could be measured beforehand.

Fuses are located in older homes and buildings. As in the case of a circuit breaker, when a fuse "blows" the fault in the circuit must be determined before replacing the fuse. Unfortunately, unlike a circuit breaker, it is easy to bypass a fuse by inserting another piece of a conducting metal, like a copper penny, in its place. This is a very dangerous practice and can lead to disaster; the penny allows current to flow but does not have any mechanism for limiting the amount of current. Overloaded circuits can cause fires leading to property damage and loss of life.