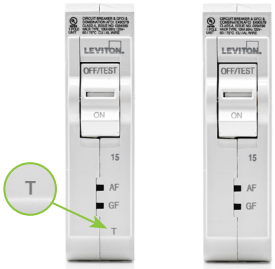
Thermal Magnetic Circuit Breakers vs Hydraulic Magnetic Circuit Breakers



- Leviton circuit breakers offer flexibility for any application. Due to first responder and various utility requirements, outdoor load center installations are becoming increasingly more common. These installations are often performed in harsh environments, where temperature extremes are common.
- Accurate tripping is a key component of any circuit breaker's performance, and different types of circuit breakers can behave differently in harsh environments.
- Leviton offers Thermal Magnetic and Hydraulic Magnetic breakers; the key difference between these technologies is how they react to overloads.

Thermal Magnetic Breaker Technology

Thermal Magnetic circuit breakers typically use a bimetallic strip consisting of two dissimilar metals (with different thermal expansion properties) bonded together. The bimetallic strip is tuned to trip the breaker based on a predetermined temperature. This temperature is calculated based on the heat generated in the system due to current flow and the ability to transfer that heat to the bimetal to trip. UL calibration testing is done at 25°C (77°F) and 40°C (104°F) for circuit breakers, meaning that in theory a 15-amp circuit breaker should trip at 16 amps at 25°C. In environments where the ambient temperature is much colder or hotter, circuit breaker manufacturers publish re-rating curves that the user must reference before installation. For example, one manufacturer publishes that their 20-amp circuit breaker will trip at 25 amps in a freezing environment 0°C (32°F). Additionally, according to the same manufacturer, in very hot locations, a 20-amp circuit breaker may trip at 15 amps if the temperature inside the panel reaches 60°C (140°F).

SUMMARY

Thermal magnetic breakers are affected by ambient temperature and are best used in applications where temperatures do not fluctuate far from the reference ambient temperatures for circuit breakers, 25°C (77°F) and 40°C (104°F).

Hydraulic Magnetic Breaker Technology

Hydraulic Magnetic circuit breakers use a specialized solenoid to trip the breaker on overload. The specialized solenoid consists of a coil assembly which surrounds a nonmagnetic delay tube. The delay tube contains a mobile iron core, a spring, and a silicone fluid that controls the speed of the core. Together, this assembly forms an electromagnet. Once current starts to flow through the coil assembly, a magnetic field is created, and the iron core starts to move. If the current flowing through the coil reaches the breaker's trip current, movement of the iron core will influence the mechanism needed to trip the breaker. Since electromagnetic force is not affected by ambient temperatures, the only component affecting operation of the specialized solenoid is the silicone fluid used to manage the trip time delay. This fluid's useful application temperature ranges from -40°C (-40°F) to 85°C (185°F).

SUMMARY

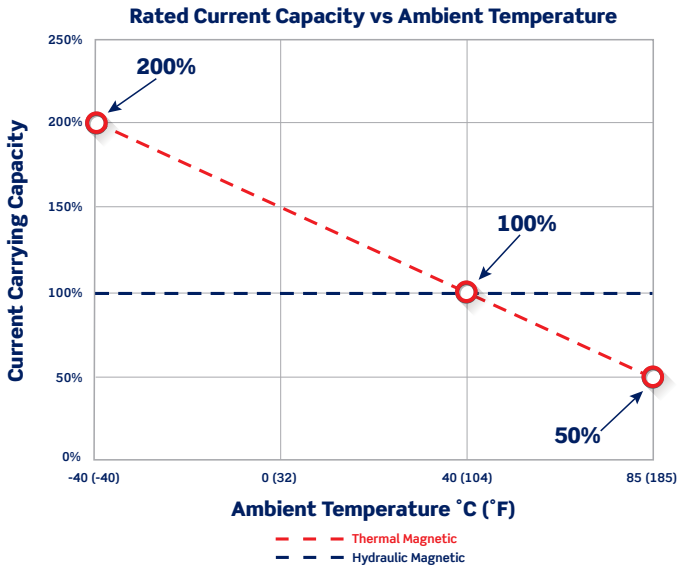
Hydraulic magnetic circuit breakers are best used in harsh environments where temperatures can vary widely.

The chart illustrates the current carrying capacity vs ambient temperature for typical Thermal Magnetic and Hydraulic Magnetic circuit breakers.

In the example, Thermal Magnetic circuit breakers will trip as follows:

- **At a temperature of 185°F**, the breaker will trip at 50% of its current carrying capacity
- **At a temperature of 104°F**, the breaker will trip at 100% of its current carrying capacity
- **At a temperature of -40°F**, the breaker will not trip until it has reached 200% of its current carrying capacity

Conversely, a Hydraulic Magnetic circuit breaker's trip point is not affected by ambient temperature, thus it performs consistently in temperatures ranging from -40°C (-40°F) to 85°C (185°F).



THE LEVITON LOAD CENTER

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