# CIRCUIT BREAKERS


**DEFINITION**

A circuit breaker is an electrical safety device designed to automatically interrupt the flow of electric current in a circuit when it detects an overcurrent or short circuit. It serves to protect electrical systems and devices from damage caused by overloads, faults, or other anomalies.

**Key Features of a Circuit Breaker:**

1. **Protective Functionality**:
    - Automatically disconnects power when the current exceeds a safe limit.
    - Prevents potential hazards such as electrical fires or equipment damage.

2. **Reusability**:
    - Unlike a fuse, a circuit breaker can be reset (manually or automatically) after tripping, making it more convenient for repeated use.

3. **Versatility**:
    - Available in various sizes and configurations to handle different voltage and current levels, from small residential units to large industrial systems, such as Molded Case Circuit Breakres (MCCB)

4. **Components**:
    - **Frame/Body**: Encases and protects the internal mechanisms.
    - **Contacts**: Open or close to allow or stop the flow of current.
    - **Trip Mechanism**: Detects abnormal conditions and initiates the breaking of the circuit.
    - **Arc Extinguishing Chamber**: Safely dissipates the arc created when the circuit is broken.

5. **Types**:
    - **Miniature Circuit Breakers (MCBs)**: For low-current applications, such as homes or offices.
    - **Molded Case Circuit Breakers (MCCBs)**: For higher currents in commercial or industrial settings.
    - **Air Circuit Breakers (ACBs)**: Used in high-voltage applications, often in power plants or substations.
    - **Residual Current Circuit Breakers (RCCBs)**: Protect against leakage currents that could lead to electric shocks. ( Earth Leakages )

6. **Operation**:
    - Works either **thermally**, by detecting heat from excessive current, or **electromagnetically**, by sensing sudden surges, or both.

    - Circuit breakers are also available in different trip curves, depending on the type of load. For example, motors require a circuit breaker with a slower trip curve, so as to not trip unnecessarily during startup.

    - A circuit breaker should not be used as a typical overload protection relay. For this, a specific overload relay must be used, so as to protect the specific equipment or motor.

7. **False or nonsensical tripping**
    - Circuit breakers may sometimes trip when the current is within normal limits. This maybe caused by excessive external temperatures, such as for example, when placed next to another device that generates excessive heat.

    - Circuit breakers may also trip during power up of certain installations that have very high startup currents. Such as banks of switch mode power supplies, motors, etc.

    - Circuit breakers are generally not very accurate devices... For example, a 10A circuit breaker might never trip, even when exposed to 10.5 or 11A or even more.
      Typically, a C-CURVE circuit breaker, rated 10A, will only trip after a few minutes, when loaded with 20A !!! See curve below.