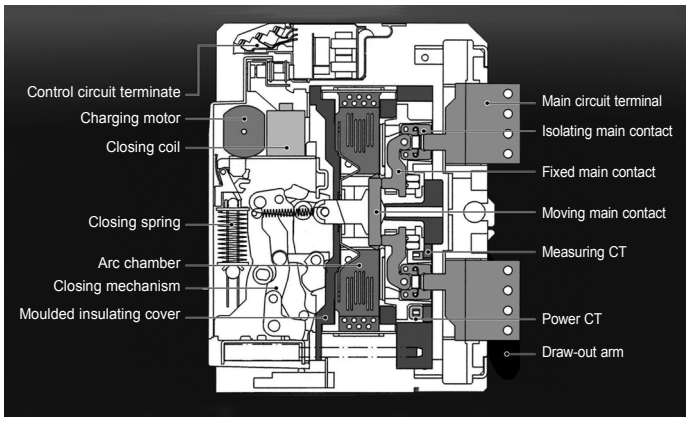
96 - How to Choose a Circuit Breaker

The construction and operation of air circuit breakers (ACBs) and moulded case circuit breakers (MCCBs) have common features.
A contact system with arc-quenching, a mechanism to operate the breaker, a system to provide a means of protection, control and indication. However, there are some fundamental differences in application that should be considered.



Load

Current-carrying capacity of the breaker should be higher than the *design rating* of the circuit. MCCBs are available up to 4000A from Terasaki, but become less cost-effective for very large ratings (2000A and above). The advantage of MCCBs for very large ratings is their compact size. An ACB is physically larger, but more cost-effective for higher ratings.

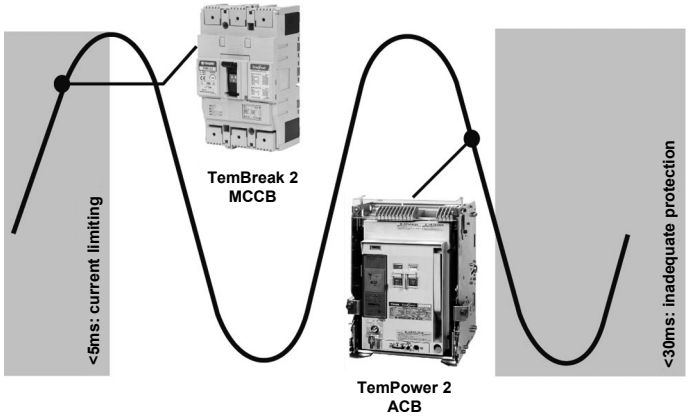
Current-carrying capacity: In (A) according to BS EN 60947-2

Design Rating: Ib (A) according to BS7671

Fault Limitation

In a short circuit the contacts of Terasaki MCCBs open before the first peak of the current waveform (faster than five milliseconds in a 50 Hz system). The fault current flowing through the MCCB never reaches its peak, and fault energy passed downsteam is limited. This fault limitation protects sensitive equipment which is not rated to withstand faults.

ACBs are selected for their ability to withstand fault current rather than limit it (see Discrimination). A typical ACB will open a short- circuit in between twenty-five and thirty milliseconds, allowing between one and two cycles of fault current through before opening. The load protected by an ACB (transformer windings, busbars for example) should be rated to withstand fault current for a short duration.



Fault Interruption Times

Historical Note

Terasaki developed the world's first current limiting circuit breaker in 1965. Previous to this, fuses were always installed in series with circuit breakers to provide the current limitation. Hence the first name of Terasaki in the UK "The No-Fuse Circuit Breaker Company"

Fault Level

Circuit breakers must be capable of safely interrupting the maximum potential short-circuit current in the section of circuit they protect. The circuit breaker must have a breaking capacity higher than the potential short-circuit current. Note that the cost of circuit breakers becomes lower with lower breaking capacity. Potential short-circuit current is determined by:

1. The available power from the transmission network
2. Transformer characteristics
3. Impedance of conductors in the distribution system.

A fault level study which accounts for transformer characteristics and conductor impedance at all circuit breaker installation points will allow selection of breakers with optimum breaking capacity, saving money. Terasaki's Application Team provide this service.

Ultimate Breaking Capacity (two short-circuit interruptions): Icu (kA) according to BS EN 60947-2

Service Breaking Capacity (three short-circuit interruptions): Ics (kA) according to BS EN 60947-2

Terasaki's Application Team:

- Fault level studies
- Discrimination studies
- Breaker selection

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