

Circuit breaker ratings

- 1) Rated short circuit breaking current
- 2) Rated short circuit making current.
- 3) Rated operating sequence of circuit breaker.
- 4) Rated short time current.

Short Circuit Breaking Current of Circuit Breaker

This is the maximum short circuit current which a circuit breaker can withstand before it is finally cleared by opening its contacts. When a short circuit flows through a circuit breaker, there would be thermal and mechanical stresses in the current carrying parts of the breaker. If the contact area and cross-section of the conducting parts of the circuit breaker are not sufficiently large, there may be a chance of permanent damage in insulation as well as conducting parts of the CB.

As per Joule's law of heating, the rising temperature is directly proportional to square of short circuit current, contact resistance and duration of short circuit current. The short circuit current continuous to flow through circuit breaker until the short circuit is cleared by opening operation of the circuit breaker. As the thermal stress in the circuit breaker is proportional to the period of short circuit, the breaking capacity of electrical circuit breaker, depends upon the operating time.

Rated Short Circuit Making Capacity

The short circuit making capacity of circuit breaker is expressed in peak value not in rms value like breaking capacity. Theoretically at the instant of fault occurrence in a system, the fault current can rise to twice of its symmetrical fault level. At the instant of switching on a circuit breaker in faulty condition, of system, the short circuit portion of the system connected to the source. The first cycle of the current during a

circuit is closed by circuit breaker, has maximum amplitude. This is about twice of the amplitude of symmetrical fault current waveform. The breaker's contacts have to withstand this highest value of current during the first cycle of waveform when breaker is closed under fault.

As the rated **short circuit making current of circuit breaker** is expressed in maximum peak value, it is always more than rated short circuit breaking current of circuit breaker. Normally value of short circuit making current is 2.5 times more than short circuit breaking current.

Rated Operating Sequence or Duty Cycle of Circuit Breaker

This is mechanical duty requirement of circuit breaker operating mechanism. The sequence of rated operating duty of a circuit breaker has been specified as

$$O - t - CO - t' - CO$$

where O indicates opening operation of CB. CO represents closing operation immediately followed by an opening operation without any intentional time delay.

t' is time between two operations which is necessary to restore the initial conditions and / or to prevent undue heating of conducting parts of circuit breaker. $t = 0.3$ sec for circuit breaker intended for first auto re closing duty, if not otherwise specified. Suppose rated duty cycle of a circuit breaker is 0 – 0.3 sec – CO – 3 min – CO.

Rated Short Time Current

This is the current limit which a circuit breaker can carry safely for certain specific time without any damage in it. The circuit breakers do not clear the short circuit current as soon as any fault occurs in the system. There always some intentional and an intentional time delays present between the instant of occurrence of fault and instant of clearing the fault by CB.

This delays are because of time of operation of protection relays, time of operation of circuit breaker and also there may be some intentional time delay imposed in relay for proper coordination of power system protection. Even a circuit breaker fails to trip, the fault will be cleared by next higher positioned circuit breaker. In this case the fault clearing time is longer. Hence, after fault, a circuit breaker has to carry the short circuit for certain time.