

### 5.10 Rating and selection of Circuit breakers:

The rating of circuit breaker is given according to the duties that are performed by it. For complete specifications, standard rating and various tests of switches and circuit breakers is 375/1951 may be consulted. A circuit breaker is required to perform the following three major duties.

1. It must be capable of opening the faulty circuit and breaking the fault current. This is described as breaking capacity of a circuit breaker
2. It must be capable of being closed on to a fault. This refers to making capacity of a circuit breaker
3. It must be capable of carrying fault current for a short time while another circuit breaker is clearing the fault. This refers to short time capacity of the circuit breaker.

In addition to the above ratings, a circuit breaker should be specified in terms of:

***Rated voltage:*** the rated maximum voltage of a circuit breaker is the highest rms voltage, above nominal system voltage, for which circuit breaker is designed and is the upper limit for operation. The rated voltage is expressed in kVrms and refers phase to phase voltage for three phase circuit.

***Rated current:*** the rated normal current of a circuit breaker is the rms value of the current which the circuit breaker shall be able to carry at rated frequency and at the rated voltage continuously, under specified condition.

***Rated frequency:*** the rated frequency of a circuit breaker is the frequency at which it is designed to operate.

***Operating Duty:*** the operating duty of a circuit breaker consist of the Prescribed number of unit operations at stated intervals.

#### **Breaking capacity:**

- Breaking current is the RMS value of current that a circuit breaker is required to break at the instant of contact separation. The symmetrical breaking current is the RMS value of its symmetrical component.
- If however, at the instant of contact separation, the wave is still asymmetrical it is known as the asymmetrical breaking current.

- Breaking capacity (MVA) = Rated symmetrical breaking current (kA) ×  
Rated service voltage (kV) ×  $\sqrt{3}$

**Making capacity:**

A circuit breaker may complete a full short circuit on being closed. This is known as making capacity.

Making capacity =  $1.8 \times \sqrt{2} \times$  Symmetrical breaking capacity.

**Short time rating:**

- Circuit breaker should be capable of carrying high currents safely and without showing undue stress for a specified short period in a closed position. This is known as short time rating.
- This happens in case of momentary fault like bird age on the transmission lines and the fault is automatically cleared and persists only for 1 or 2 seconds.
- For this reason the circuit breakers are short time rated and they trip only when the fault persists for duration longer than the specified time limit.

