

UNIT - 2

Overcurrent Relays

- Protection against excess current was naturally the earliest protection systems to evolve
- From this basic principle has been evolved the graded over current system, a discriminate fault protection.
- “over current” protection is different from “over load protection”.

- Overload protection makes use of relays that operate in a time related in some degree to the thermal capability of the plant to be protected.
- Over current protection, on the other hand, is directed entirely to the clearance of the faults, although with the settings usually adopted some measure of overload protection is obtained.
- In terms of the general torque equation the over current relay has both constants K_2 and K_3 equal to zero. Therefore, the equation becomes

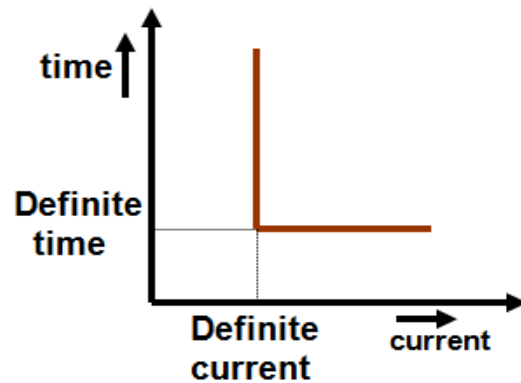
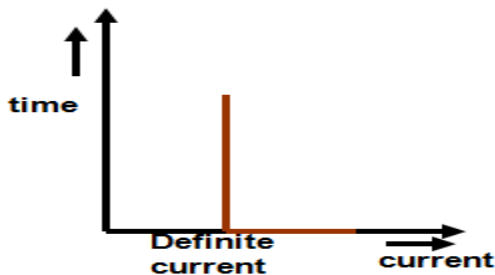
$$T = K_1 I^2 + K_4$$

1.6.1 Types of over current relays

- Based on the relay operating characteristics , overcurrent relays can be classified into three groups
 - Definite current or instantaneous
 - Definite time
 - Inverse time

DEFINITE-CURRENT RELAYS

- This type of relay operates instantaneously when the current reaches a predetermined value.



DEFINITE TIME CURRENT RELAYS

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- This type of relay operates after a definite time when the current reaches a pre-determined value.

INVERSE TIME RELAYS

- The fundamental property of these relays is that they operate in a time that is inversely proportional to the fault current. Inverse time relays are generally classified in accordance with their characteristic curve that indicates the speed of operation.
- Inverse-time relays are also referred as inverse definite minimum time or IDMT over current relays

SETTING THE PARAMETERS OF TIME DELAY OVERCURRENT RELAY

Pick-up setting

The pick-up setting, or plug setting, is used to define the pick-up current of the relay, and fault currents seen by the relay are expressed as multiples of plug setting.

- Plug setting multiplier (PSM) is defined as the ratio of the fault current in secondary Amps to the relay plug setting.
- For phase relays the pick-up setting is determined by allowing a margin for overload above the nominal current, as in the following expression

$$\text{Pick-up setting} = (\text{OLF} \times I_{\text{nom}}) / \text{CTR}$$

Where, OLF = Overload factor that depends on the element being protected.

I_{nom} = Nominal circuit current rating, and CTR = CT Ratio

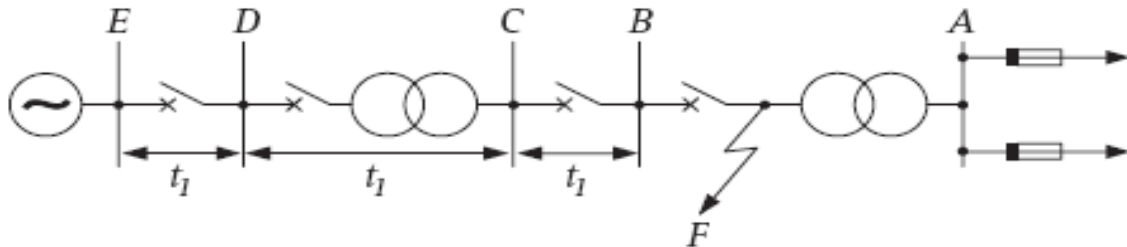
Time dial setting

- The time-dial setting adjusts the time –delay before the relay operates whenever the fault current reaches a value equal to, or greater than the relay setting.
- The time-dial setting is also referred to as time multiplier setting (TMS)

DISCRIMINATION BY TIME

In this method an appropriate time interval is given by each of the relays controlling the CBs in a power system to ensure that the breaker nearest to the fault location opens first.

A simple radial distribution system is considered to illustrate this principle

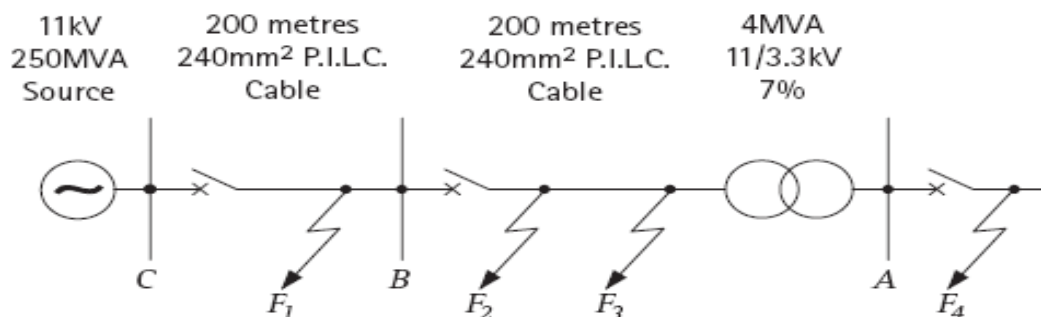


A radial distribution system with time-discrimination

- The main disadvantage of this method of discrimination is that the longest fault clearance time occurs for faults in the section closest to the power source, where the fault level is highest.

DISCRIMINATION BY CURRENT

- Discrimination by current relies on the fact that the fault current varies with the position of the fault, because of the difference in impedance values between the source and the fault.
- The relays controlling CBs are set to operate at suitably tapered values such that only the relay nearest the fault trips its circuit breaker.



Inverse time over current relay characteristic is evolved to overcome the limitations imposed by the independent use of either time or over current coordination.