

Electrical fault level basics

1. What is fault level?

The maximum short circuit power that could occur in a particular bus is called the fault (3 phase fault) level of that particular bus.

2. What are the types of faults?

Phase to earth.

Phase to Phase.

Three phase fault.

Three phase to earth fault (rare).

Number of faults in the system occur in the same order.

75% of faults are only earth faults.

3. What is the significance of fault level?

To install the breakers with

breaking capacity over and above the fault level.

To design and provide earthing system of the substation.

4. What are type of feeders?

Radial feeder: Feeds with only one source from one end.

Grid feeder / Ring main: Fed by different sources from both ends.

5. What are the protections employed for radial feeders?

Over current protection with time delay & instantaneous features.

Earth fault protection with time delay & inst. feature.

No earth fault relay is employed on the LV side of the transformers in our substations.

6. What are the protection used for grid feeders?

Distance protection.

Directional over current & earth fault protection.

7. What are the protections used for transformer?

Bucholtz protection.

Winding temperature Trip. (90 deg. C)

Pressure relief valve trip (0.41 kg/sq. Cm).

OLTC Surge relay trip.

Differential/Merz price/Circulating current protection.

8. How to calculate the fault level of a 110 kV bus at 230 /110 kV substation?

Example:

230 kV bus fault level say :15000 MVA

Assume Three nos.230/110 kV,100 MVA auto transformers with percentage Impedance of 11.86,12,23,11.57 %

Transformer equivalent % Impedance
 $=1/(1/11.86+1/12.23+1/11.57)=3.96\%$

Tr.eq.Imp p.u.value . =
 $3.96\%/100 =0.0396 \text{ pu.}$

System impedance = Transformer MVA/ System fault MVA =
 $300/15000= 0.0200\text{pu}$

Total impedance for fault = $0.0396 +0.0200=0.0596 \text{ pu}$

110 kV bus Fault MVA =Total Trf Capacity/Net Impedance in p.u.
(Source to fault) = $300 \text{ MVA}/0.0596 \text{ Z (p.u)} =5033 \text{ MVA}$

Isc= $5033 \text{ MVA} /$
 $(1.732 \times 110 \text{ kV})=26.42 \text{ kA.}$

Breaking current selection for all breakers should be more than 26.42kA.

9. What is fault level and its significance?

The maximum short circuit power that could occur in a particular bus is called the fault (3 phase fault) level of that particular bus.

10. What are the effects of short ckt currents?

Thermal effects,
Dynamic forces,

System Stability.

