

Effect of the fault impedance on the performance of directional over current relays in medium voltage power cables- a case study

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The most common type of cable faults is the contact asymmetrical faults. The contact fault is described as a partial or total short circuit between cable cores or between cores and cable sheath. The value of fault impedance varies from zero Ohms to many mega Ohms. These faults are caused by the internal discharge in the cables that results from gradual deterioration of the insulation materials between cores and sheath. Asymmetrical faults are single phase to ground, line to line and double line to ground through impedance faults. One of the most effective techniques for protection of medium voltage cables is the Directional Over Current relays (DOC). However, the fault impedance may lead to mal-operation of these relays if it is improperly set. In this paper, different medium voltage network's configurations in Saudi Arabia are analyzed.

All faults types are simulated using ETAP software which is an efficient user friendly tool in power system analysis studies. The directional over current relay settings are calculated for each network configuration and the effect of the value and nature of fault impedance (resistive or inductive) is illustrated. After that ETAP software is used for validation of these results on a real case study in Saudi Arabia.

The directional over current relay settings of 13.8kV incomer feeders with the possibility of parallel operation of two 115/13.8kV transformers are calculated for Royal Commissioning JUBAIL substation.