

GROUND FAULT PROTECTION

Ground faults in any power distribution system require special consideration. A ground fault occurs whenever a phase conductor develops an electrically conductive path to ground. This path may be caused by deteriorated insulation, mechanical damage, surges, heat, aging, the presence of rodents and the intrusion of foreign objects such as tools into bare bus compartments.

A ground fault may develop as a "bolted fault" and or "arcing fault." Ground fault protection will protect against either type if properly set.

A "bolted fault" occurs when a phase conductor is solidly connected to ground. This produces a high fault current which dissipates energy throughout the distribution system.

An "arcing fault" occurs when a phase conductor develops an electrically conductive path to ground, but is not solidly connected to ground. This path develops an arcing fault which, if self-sustaining, is capable of releasing tremendous energy at the point of fault. This tremendous energy, released at low current levels over a period of time, creates devastating results sufficient to ignite fires.

The I.E.E.E. studies indicate that the typical arcing fault current is only 38% of the bolted fault current. It is this low current level that renders normal over current protection useless. The only recourse is to add supplemental relaying to secure adequate protection.

The National Electric Code requires in Article 230-95: "Ground fault protection of equipment shall be provided for solidly grounded Wye electrical services of more than 150 volts to ground, but not exceeding 600 volts phase to phase for each service disconnecting means rated 1,000 amperes or more".

The voltage range for ground fault protection is specified since arcing faults in circuits less than 150 VAC to ground are usually self-extinguishing and arcing faults in circuits over 600 VAC line to line approach bolted fault levels which may be detected by ordinary phase over current devices if the system is solidly grounded.

When a ground fault is detected, the Normal and/or the Emergency source will be opened, isolating the ground fault from the external voltage source. To insure that the alternate source will not be closed to a known fault. The Automatic Transfer Switch will be inhibited from transferring to the alternate source until:

- 1) the fault is cleared
- 2) Automatic Transfer Switch is manually reset and
- 3) Ground Fault Relay is reset by pushing the Reset Pushbutton

The maximum setting of the ground fault protection shall be 1200 amperes, and the maximum time delay shall be one second for ground fault currents equal to or greater than 3000 amperes.

For Delta connected systems, please consult the factory. Ground Fault Protection is not required for a continuous industrial process where a non-orderly shutdown will introduce additional or increased hazards.



GROUND FAULT INDICATION

Article 700-26 of the National Electric Code states "The alternate source for emergency systems shall not be required to have ground fault protection of equipment with automatic disconnecting means". Although this is an exception to Article 230-95, it provides the designer of a system the ability to exercise judgment in the balance between risking damage to equipment verses loss of the emergency power source. This article does, however, require Ground Fault Indication be provided for the emergency source.

Article 700-6 of the National Electric Code states "Audible and visual signal devices shall be provided, where practicable, for Ground Fault. To indicate a ground fault in solidly grounded Wye emergency systems of 150 volts to ground and circuit protective devices rated 1,000 amperes or more. The sensor for the ground fault signal devices shall be located at, or ahead of the main system disconnecting means for the emergency source, and the maximum setting of the signal devices shall be for a ground fault current of 1200 amperes. Instruction on the course of action to be taken in event of indicated ground fault shall be located at or near the sensor location". Therefore the detection of a ground fault on an emergency service is desirable. However, Automatic Disconnect in the event of such a fault may not be appropriate.

Article 517 requires that any Ground Fault sensing for on site generating units shall be indication only.

Article 517.17 (A) states, "where ground fault protection is provided for operation of the service disconnecting means or feeder disconnecting means as specified by 230.95 or 215.10, an additional step of ground fault protection shall be provided in the next level of feeder disconnecting means downstream toward the load. Such protection shall consist of overcurrent devices and current transformers or other equivalent protective equipment that shall cause the feeder disconnecting means to open. The additional levels of ground fault protection shall not be installed as follows:

- 1) On the load side of an essential electrical system transfer switch
- 2) Between the on-site generating unit(s) described in 517.35(B) and the essential electrical system transfer switch(es)
- 3) On electrical systems that are not solidly grounded Wye systems with greater than 150 volts to ground but not exceeding 600 volts phase-to-phase."

When Ground Fault Indication is specified on a Lake Shore Electric Corporation Transfer Switch the fault will be annunciated, however the ATS will remain in the automatic mode and will allow the closing of either source to the known fault.

For Delta connected systems, please consult the factory.

