RESISTANCE GROUNDING SYSTEMS & TECHNIQUES

Neutral grounding systems are similar to fuses in that they do nothing until something in the system goes wrong. Then, like fuses, they protect personnel and equipment from damage. Damage comes from two factors, how long the fault lasts and how large the fault is. Ground relays trip breakers and limit how long a fault lasts. Neutral grounding resistors limit how large the fault is.

Neutral grounding systems take one of two forms, low resistance or high resistance. Low resistance systems have a fault current value of higher than 25 amps. High resistance systems have a fault current value of less than or equal to 25 amps. Let's look at low resistance first.

NEUTRAL GROUNDING RESISTORS – LOW RESISTANCE GROUNDING

Low resistance grounding systems limit the fault current when a phase of a power system unintentionally goes to ground. The majority of systems limit the fault current to 200-400 amps in the USA, based on the guidelines contained in IEEE-142. When a fault occurs, the neutral grounding resistor (NGR) limits the current that can flow from ground back to the transformer. This limits the fault current on grounds throughout the entire system. Although limited, the current is still high enough to require protective relays to trip a breaker and remove power from the faulted system.

Typically, NGRs are available from 480 volts to 72kv (line-line voltage). The standard NGR comes complete with an outdoor enclosure (galvanized or painted) for mounting on top of or next to a power transformer or generator. Numerous options are available ranging from CT’s, disconnect switches, elevating stands, stainless steel or aluminum enclosures, and grounding transformers just to mention a few. Certified test reports and Installation & Maintenance accompany each NGR.

HIGH RESISTANCE GROUNDING SYSTEMS

High Resistance Grounding (HRG) systems limit the fault current to such a low value that the breaker does not have to trip and the loads continue to function without interruption. Why have HRG systems not been used in the past? Solid state protective relays have allowed a sensitivity not previously available with mechanical relays. HRG systems are not effective on systems above 15kV and the NEC does not allow HRG systems on systems with phase to neutral (single-phase) loads.

When a fault occurs, the current is limited to an allowable value and a relay (if provided) senses the excessive voltage across the neutral grounding resistor. The relay signal is time delayed to prevent false alarms and after timing out activates a horn. Auxiliary contacts are provided to trigger a remote alarm panel. With this alarm the system loads continue to function without interruption and the fault may be corrected during a planned maintenance outage. If ignored, another fault may occur on a different phase causing equipment damage and a breaker trip.

When an alarm occurs, a pulser circuit (if provided) may be used to track a slowly fluctuating rhythmic current signal with a portable hand-held detector to the point of fault. This system has proven to be very effective and time saving at locating the point of fault. Some HRG systems have an adjustable fault current setting to allow the resistance value and therefor the fault current value to be recalibrated if the power system is modified or equipment added.

HRG systems are available in free-standing floor-mounted enclosures so they can be easily integrated into a switchgear lineup or they are available with a wall-mounted control panel and a remotely mounted resistor section. Retrofit kits are also available as an add-on for substation upgrades.