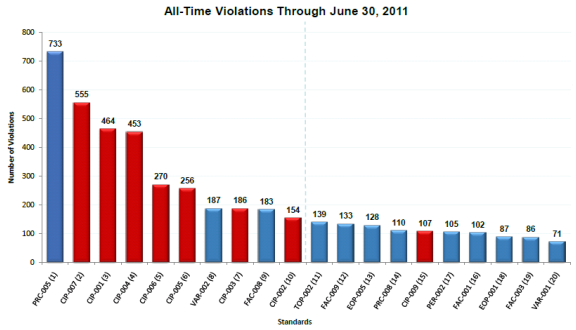
APPLICATION NOTE

Locating Ground Faults

Avoid safety hazards, fines and faulty equipment by locating and eliminating ground faults.

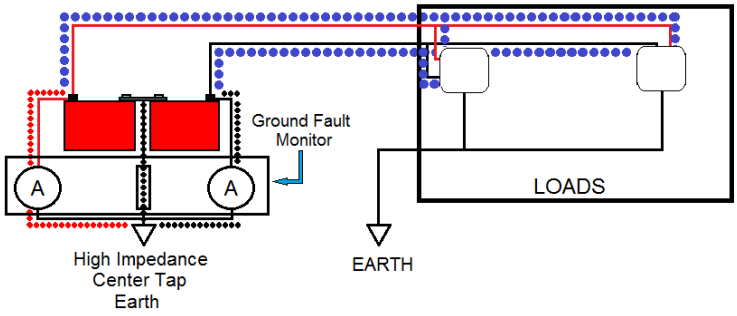
The North American Electric Reliability Corporation (NERC) now has mandatory minimum requirements that apply to all substation battery strings, VLA, VRLA or NiCD.
NERC PRC-005-6 requires that these dc systems are free of battery ground faults.

Maximum Maintenance Interval	Maintenance Activities
4 Calendar Months	Verify: • Station dc supply voltage Inspect: • Electrolyte level • For unintentional grounds



Battery strings in substations are isolated (floating systems). This keeps critical systems from going off line in the presence of a ground fault. If they were not isolated, a breaker could trip in the presence of a ground fault. Since they *are* isolated, they require ground fault monitors.

A ground fault is a fault to earth. These can be either a low resistance or high resistance fault and can be caused by insulation failures or worn insulation that allows water ingress. This is why the number of ground faults will increase after a rainstorm. Other causes of ground faults can include pinched wires and electrolyte leakage. Ground faults can cause nuisance trips, safety hazards, and damaged equipment.



When there is no ground fault, the current through the positive and negative paths of the ground fault monitor are equal. In the presence of a ground fault, the currents become unbalanced in the ground fault monitor and a ground fault will be detected. This will also create an unbalance in the voltages between positive the terminal to earth and negative terminal to earth.

Megger USA - Valley Forge Corporate Center
2621 Van Buren Avenue, Norristown, Pennsylvania, 19403, USA
T. 1-610 676 8500 F. 1-610-676-8610

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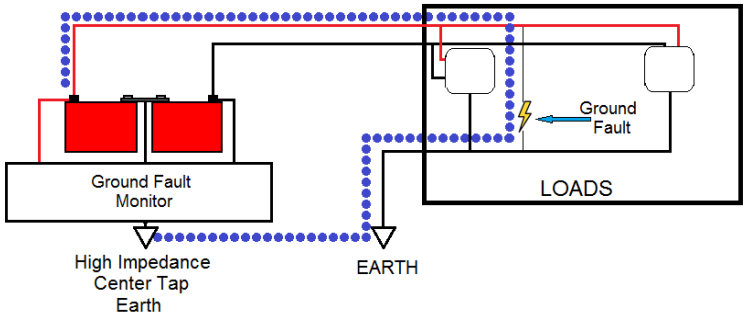
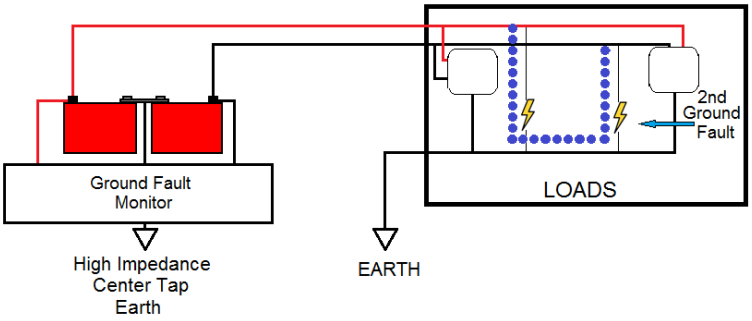
A current path through earth is created when a ground fault occurs. On an isolated system, a single ground fault will not draw significant current due to the high impedance center tap.



If a second ground fault occurs, this creates another path for current. Depending on the location and impedance of this ground fault, significant current can be drawn. This can cause a relay to trip taking a critical system off line, damaging equipment or injuring personnel.



However, knowing a ground fault exists and locating it are two different issues.
To locate a ground fault, a pulsed or AC current is injected between the side of the battery string and earth that will follow the path of the ground fault. By tracing the path of this current the ground fault can be located. However, there are several risks that need to be avoided when tracing a ground fault. These include the following:

Inadvertently tripping a breaker: A transmitter being connected incorrectly and too much current being injected into the system can trip a breaker. This can cause critical systems to go off line.

Inability to locate the fault due to stray capacitance: Long cable runs increase the capacitance on the system. This creates a path to earth for pulsed and ac signals. These long cable runs can appear as false ground paths. Without being able to distinguish these capacitive paths, a fault could be traced all day and never be found.

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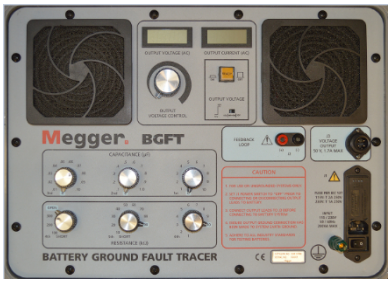
Intermittent & high impedance faults: A high impedance fault can be difficult to trace due to low signal strength. Water ingress faults can be intermittent and may already be dried out when attempting to locate.

The Megger Battery Ground Fault Tracer (BGFT) addresses all of these issues.

The BGFT has two output ranges. The low voltage range is specifically designed not to trip breakers even under conditions of misuse. In addition the BGFT injects a low frequency, low current AC signal between the side of the battery that is faulted and earthed.



The BGFT has a built in Wheatstone bridge which allows the user to determine the actual capacitance and resistance on the circuits. This ensures that no time is wasted tracing a false path. The BGFT allows the circuit to be identified with the fault.

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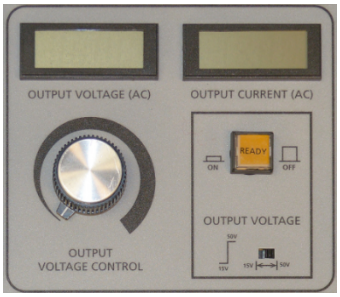
The BGFT can locate faults up to 399KΩ. The high gain receiver can pick up very small, low frequency signals from the transmitter.

The BGFT has an adjustable output. This allows you to use as little or as much current as desired. For example, on intermittent water ingress faults, minimal current from the transmitter can be used so as not to dry out the fault before you locate it.



The Megger BGFT allows easy location of the toughest ground faults and avoids down time, safety hazards and fines.

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