FLUKE®

Don't forget the grounding system

Prevent equipment failure and stay safe

Application Note

Poor grounding not only increases the risk of equipment failure; it is dangerous. Facilities need to have adequately grounded electrical systems so in the event of a lightning strike, or utility overvoltage, current will find a safe path to earth.

Simple grounding systems consist of a single ground electrode driven into the ground. The use of a single ground electrode is the most common form of grounding and can be found outside your home or place of business.

Complex grounding systems consist of multiple ground rods; connected, mesh or grid networks; ground plates; and ground loops. These systems are typically installed at power generating substations, central offices, and cell tower sites.

Why test?

Over time, corrosive soils with high moisture content, high salt content, and high temperatures can degrade ground rods and their connections. So although the ground system when initially installed had low earth ground resistance values, the resistance of the grounding system can increase if the ground rods are eaten away.

It is recommended that all grounds and ground connections be checked annually as a part of your normal predictive maintenance plan. If the technician finds an increase in resistance of more than 20 percent, investigate the source of the problem and make the correction to the grounding system to lower the resistance.

What is a good ground resistance value?

Confusion exists about what constitutes a good ground and what the ground resistance value needs to be. Ideally a ground should be of zero ohms resistance.

There is no one standard ground resistance threshold recognized by all agencies. However, the NFPA and IEEE have recommended a ground resistance value of 5.0 ohms or less.

The NEC has stated, "Make sure that system impedance to ground is less than 25 ohms specified in NEC 250.56. In facilities with sensitive equipment it should be 5.0 ohms or less."

The telecommunications industry has often used 5.0 ohms or less as their value for grounding and bonding.

The goal in ground resistance is to achieve the lowest ground resistance value that makes sense economically and physically.

What are the testing methods?

Several methods of earth ground testing are available.

Soil resistivity testing, which uses stakes, is most necessary when determining the design of the grounding system for new installations (green field applications) to meet your ground resistance requirements.

The **Fall-of-Potential** test method is used to measure the ability of an earth ground system or an individual electrode to dissipate energy from a site.

For the 3-pole Fall-of-Potential test, two earth stakes are placed in the soil in a direct line—away from the earth electrode.

Selective testing is very similar to the Fall-of-Potential method, providing all the same measurements, but in a much safer and easier way. With selective testing, the earth electrode of interest does not need to be disconnected from its connection to the site.

Stakeless measurement is possible by measuring earth ground loop resistances for multi-grounded systems using only current clamps. This test technique eliminates the dangerous and time-consuming activity of disconnecting parallel grounds, as well as finding suitable locations for auxiliary ground stakes. You can also perform earth ground tests in places you might not have considered before: inside buildings, on power pylons, or anywhere you don't have access to soil.

In situations where driving ground stakes is neither practical nor possible, you can do **two-pole ground resistance/ continuity** measurements. To perform this test the technician must have access to a good, known ground such as an all-metal water pipe.

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