



038: Grounding and Shock

Why we ground

To remove voltage differences on metal parts of an electrical system to protect against lethal shock (permanent).

To limit or eliminate current flow on de-energized conductors as part of a lock-out/tagout process (temporary).

Grounding has its limits

Connecting metal parts of an electrical system to a ground rod does not remove voltage imposed by a line-to-ground fault.

Connecting metal parts of an electrical system to a ground rod does not cause the overcurrent protection device (OCPD) to open if current attempts to flow through them. Nor does it eliminate the potential for a flashover.

Electrical basics apply

Electricity leaving the power supply is not trying to go to ground. It is trying to return to the source.

Ohm's Law states that resistances add in series, but drop when in parallel.

Kirchoff's Law states that current will divide proportionately among the various paths, or resistances, before it. It does not take the path of least resistance.

Thus, current will not ignore your body in favor of a ground rod.

An example

Let's assume you are working on a 480V circuit.

Let's assume your body is 100 ohms and your feet are at earth potential. Your feet would be at essentially earth potential if you were standing on the ground rod, very near it, or in water.

For purposes of calculation, we can say you are in parallel with that ground rod.

Let's assume your ground rod is four times better than the NEC requirement and so is 10 ohms to earth.

Total resistance is about nine ohms, so total current would be about 53 amps. You would get about 5 amps through your body—far more than it takes to kill you.

If the breaker is 60 amps or larger, it will never trip while you roast.

To protect against lethal shock, you must remove unsafe voltage on metal parts of the electrical system and the building. At 120V, you have less than one second to do this. The required current rise of about 10 times the rating of the OCPD doesn't easily happen.

Bonding

A ground rod that isn't bonded back to the source is not ground.

OCPDs require a low impedance fault path. You create a low-impedance path when you bond together the metal parts of the electrical system and bond them to the power supply system grounded (neutral) conductor.

Discussion leader duties for this session:

Read NEC Article 250 and IEEE-142, if those are available.

What this Safety Talk covers:

The facts about grounding for the purposes of shock prevention.

Discussion notes :

