PROTECTIVE GROUND SETS

Educational Series: Why Test?

Why Are Personal Protective Ground Sets So Important?

Protective or safety grounds help protect those working on de-energized electrical circuits from electric shock. By providing a secure and highly conductive path to ground, they are designed to prevent unintended or accidental energization of equipment. Safety grounds provide personal protection in the event of induced voltages from adjacent circuits, switching errors causing inadvertent circuit re-energization, stored charges from capacitors and other unusual conditions that might bring an energized conductor in contact with a de-energized circuit. Protective grounds must be capable of withstanding (without melting or coming apart due to magnetic forces) the maximum available phase-to-ground and/or phase-to-phase fault current for the period of time beginning at fault initiation and continuing until the overcurrent protective device clears the circuit.

OSHA regulations [Title 29 of the Code of Federal Regulations, Part 1910.269(n)(4)(i)] state: "Protective grounding equipment shall be capable of conducting the maximum fault current that could flow at the point of grounding for the time necessary to clear the fault."

Part 1910.269(n)(4)(ii) states: "Protective grounds shall have an impedance low enough to cause immediate operation of protective devices in case of accidental energizing of the lines or equipment."

What Are the Components of a Protective Ground Set?

Protective grounding sets should be constructed from components designed for the application and with ASTM grade designations only. The components and requirements of a properly constructed grounding set are as follows:

Clamp

- Must be designed for the type of conductor to which it is being clamped.
- Must have an ASTM grade rating appropriate for the application.

Cluster or Four-Way Connector

- Must have an ASTM grade rating appropriate for the application.

Ferrule

- Must have an ASTM grade rating appropriate for the application.
- Must be installed on the cable using an industrial grade compression-type crimp device.

Cable

- Must be of adequate conductor size and have an adequate protective covering for the application.

What Are the Maintenance Procedures for a Protective Ground Set?

Proper care and maintenance of protective grounds is vital for reliable and safe operation. They should be visually inspected for damage to the conductor and cuts in the protective covering. The clamp and cable connector fittings should be checked for tightness. The clamp jaws should be checked for both tightness of friction plates and assurance that friction surfaces are clean. The final step is an electrical withstand test to ensure the assembly complies with the ASTM F855 standard.

How Are Protective Grounds Tested?

Protective grounds should be tested with the use of a high current source and a multi-range voltmeter. All test equipment leads should be clean and tight. Voltmeter connection leads must be attached correctly to minimize reading errors due to the lead and connection resistances as well as induced voltages.

The test method involves loading the grounding set to a specific amperage proportional to the withstand current rating of the grounding set. The voltage drop across the set is recorded and then multiplied by the ratio of the withstand current rating to the applied loading current. If this calculated voltage drop is less than the maximum allowable value for the grounding set rating, the assembly can be considered satisfactory.

How Often Should They be Tested?

The generally accepted practice in the industry recommends that protective grounds be tested annually. Relevant industry standards and other references include:

- OSHA 29 CFR 1910.269
- Standard for Electrical Safety in the Workplace, NFPA Standard 70E
- Personal Protective Grounding for Electric Power Facilities and Power Lines, Volume 5-1, US Bureau of Reclamation
- Standard Specifications for Temporary Protective Grounds to be Used on De-Energized Electric Power Lines and Equipment, ASTM Standard F-855
- Guide for Protective Grounding of Power Lines, IEEE Standard 1048
- Maintenance, Operation, and Safety of Industrial and Commercial Power Systems, IEEE Stantard 902