is necessary to keep objects at the same potential as the earth (zero).

The two main objectives of a grounding system are to provide:

1. Personnel safety and equipment protection by providing a low resistance path to safely dissipate any unwanted charges and potentials.

2. A reference point approximately equal to the potential of the earth for sensitive equipment.

To be effective, a grounding system must be stable and reliable in all adverse environmental conditions, be maintenance-free and have a long life expectancy with no recurring costs.

SYSTEM CONFIGURATION

Lightning protection systems have six primary components: air terminals, catenaries, down conductors, bonding connections, surge suppression devices and grounding. The National Fire Protection Association (NFPA) Lightning Protection Code 780 explains the design and application of most of these components using mathematical models.[1] The same depth and detail is not specified for grounding and, therefore, is not addressed as thoroughly by lightning protection design professionals.

The grounding system is the most important component, however, as it is the end point of the lightning protection system, making it crucial for the entire system to function and protect as designed. Given that the earth grounding system is essentially buried under the ground, it is unavailable for routine inspection and maintenance. Since it is the only part of the lightning protection system that cannot be regularly inspected, it is essential to design the grounding system safely and properly.

The grounding system is responsible for dissipating or transferring a high-energy event, such as a lightning strike, from structures into the natural earth. The grounding system must be conductive, durable, heat-resistant and resilient. It should be low enough in electrical impedance to minimize the rise of ground potential in the soil surrounding the grounding system and minimize the voltage potentials on all interconnected components.

Soil characteristics determine the design and physical construction of a grounding system necessary to achieve the desired ohmic resistance. This includes grounding electrodes, electrode spacing and placement.

TESTING & DESIGN

The single most important characteristic that we are concerned with is the soil's conductivity or ability to conduct electricity, inversely called soil resistivity. Soil resistivity testing will determine how resistive the soil is to the flow of electric current, and ultimately the grounding system layout necessary to achieve a specific earth ground resistance. Factors that affect soil resistivity are its moisture content, electrolyte and metal content, and environmental changes in temperature. Soil resistivity testing must be done to obtain this data.

Two methods are available to determine the soil resistivity of a particular location. The most common and accurate is the four-pin Wenner method. The four-pin method places four probes in the earth. A current flow is established through the outer probes and the resulting voltage drop is measured across the inner probes (see figure).

For an accurate reading, several locations should be tested. Remember that the data is being used to design the grounding system and predict its performance after installation. The more data available, the more confidence you can have in that prediction.

One common point of confusion is the ohm resistance target. The National Electric Code (NEC) requires a minimum of 25 ohms to earth, or else multiple rods should be installed.[2] Manufacturers typically have more stringent requirements for their equipment. Motorola's R56 standard for surge protection is 10 ohms,[3] Harris is 5 ohms.[4] The NEC is concerned with structure and personnel safety, and a 25 ohm target achieves that. Sensitive electronics require a higher performance ground (lower resistance to earth). The target resistance needed for the site must be established before the design begins.

It is important to remember that your grounding system is a fundamental part in keeping your personnel safe, your equipment running smoothly and your facility protected. You must test the soil, design the grounding system, install the system per industry standards and continue to test the system to maintain high performance at all times. ||PSC||

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