SAN-EARTH®

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SANKOSHA

Product Description

SAN-EARTH M5C is a fine powder packaged in 25 kg (55 lb) bags which provides an environmentally safe long term solution to many grounding problems. SAN-EARTH M5C grounding electrodes are easily installed by spreading the dry powder in a strip over and around a conductor in a horizontal trench. When the trench is refilled SAN-EARTH M5C absorbs moisture from the surrounding soil and hardens to become part of the grounding electrode. The surface area of the electrode is thus dramatically increased and resistance to ground is substantially reduced. In addition, surge impedance is also lowered significantly. This feature of SAN-EARTH electrodes has a positive impact on both equipment performance and personnel safety.

SAN-EARTH M5C was developed in the 1970's to aid in the grounding of electric power transmission lines in mountainous areas where construction is difficult and soil resistivities tend to be high. Since then, it has proven effective in a wide variety of other applications including power

station grids, telecommunication switches, radio transmission towers, computers and cathodic protection systems. The list continues to grow. The consistent performance of SAN-EARTH M5C grounding systems has been confirmed through long term monitoring of installed electrodes. Independent testing has shown that SAN-EARTH is environmentally safe and has proven that SAN-EARTH covered copper electrodes last ten times longer than bare copper ground wires.

SAN-EARTH Benefits

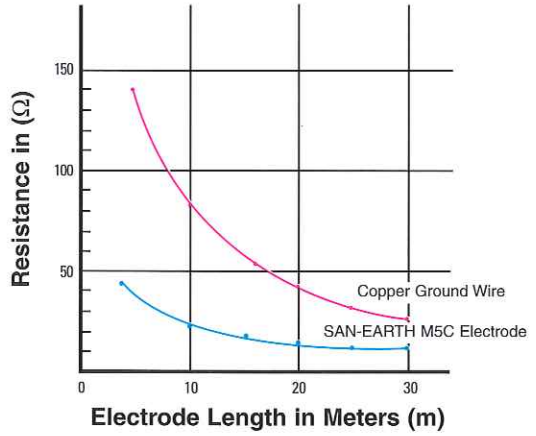
- Reduces resistance to ground by up to 50%.
- Lowers surge impedance significantly.
- Environmentally safe.
- Provides ideal contact with the surrounding soil.
- Improves personnel safety conditions.
- Reduces corrosion in grounding conductors.
- Easy to install anywhere.
- Improves surge protection device performance.
- Cost efficient and maintenance free.
- Prevents conductor theft.

Applications

- Electric transmission and distribution towers
- Power plant grounding grids
- Microwave towers
- Substation ground systems
- Surge protection systems
- Cathodic protection systems
- Central office switches
- Cellular systems
- Remote digital switches
- Computer systems
- Fiber optics
- Radio transmission towers
- Central office DC power
- Satellite ground stations

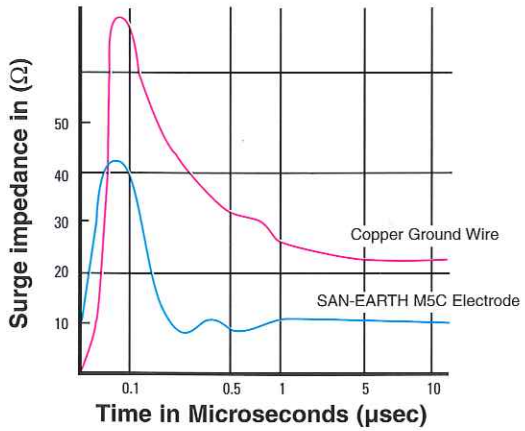
SAN-EARTH vs Bare Copper Wire

Resistance to Ground



Electrode Depth: 0.5 meters
SAN-EARTH Electrode Width: 0.5 meters

Surge Impedance



Surge Waveform: 1/100 µsec
Electrode Length: 40 meters
SAN-EARTH Electrode Width: 0.5 meters

Measured Soil Resistivities for Both Tests

Depth	0.2 meters	1.72 meters	4.3 meters	6.88 meters	20.0 meters
Resistivity at Indicated Depth	305.91 Ω-m	382.40 Ω-m	185.80 Ω-m	161.20 Ω-m	47.40 Ω-m
Ave. Resistivity to Indicated Depth	305.91 Ω-m	371.58 Ω-m	232.24 Ω-m	331.77 Ω-m	236.98 Ω-m

Results:

1. Resistance measured with the SAN-EARTH electrode was 60-70% lower than the resistance measured with the bare copper counterpoise wire.

2. Performance of a 10 meter long SAN-EARTH grounding electrode was superior to a 30 meter long counterpoise wire.

Analysis:

1. Ideal and complete contact with the surrounding soil is achieved because the SAN-EARTH is installed as a fine powder that conforms to the shape of the trench.

2. The available surface area of the electrode is many times larger than that of the counterpoise wire making it very effective in lowering grounding resistance.

Benefits:

Reduced resistance to ground results in fewer equipment failures, less down time and improved safety conditions for personnel. Lower resistance values are achievable in less space. The minimal resistance values required by today's sensitive digital equipment can be achieved. Cost efficient long term grounding electrodes are possible.

Results:

1. The SAN-EARTH electrode outperformed the bare copper wire significantly throughout the first 10 µsec of the applied surge.

2. The surge impedance of the SAN-EARTH electrode was particularly low during the critical 0-0.1 µsec of the surge.

Analysis:

1. The capacitance "C" of the SAN-EARTH electrode in relation to the earth is much larger than the capacitance of the standard counterpoise wire electrode.

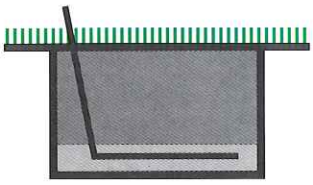
2. As demonstrated above, this results in a much faster response time when subjected to surges.

Benefits:

Higher equipment reliability results through reduced impedance during power surges. SAN-EARTH outperforms other grounding electrodes when subjected to lightning or power fault related surges. SAN-EARTH provides a low impedance path for surge currents to flow to earth thus enhancing surge protection system performance.

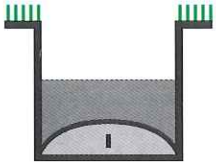
Typical Installations

Horizontal Electrodes

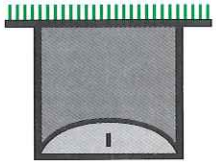


SAN-EARTH M5C is usually installed as a dry powder surrounding the grounding conductor in a trench. It may also be mixed with water and applied as a mortar if desired. After the trench is refilled with soil, SAN-EARTH M5C absorbs moisture from the and hardens to become a conductive electrode whose surface area is many times that of the original ground wire.

The length of the trench is determined by the soil resistivity at the site and the resistance value requirements for the project. The depth of the trench should be at least 0.5 meters (20 inches). It is desirable though not required to have the SAN-EARTH electrode installed below the frost line. The bottom of the trench should be as flat as possible.



Once the trench has been dug, the grounding conductor is placed in the center of the trench. SAN-EARTH M5C is then spread over and around the conductor. The depth of the powder should be about two inches around the conductor so that it can be completely encased and taper off to a depth of about one-half inch at the edges of the trench.



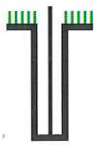
One 25 kilogram (55 pound) bag of SAN-EARTH M5C will cover four or five lateral meters (13-16 feet) of conductor in this typical design. After the SAN-EARTH M5C has been installed, it is carefully covered with about 10 cm (4 inches) of soil and then tamped until firmly packed. At this point the trench is refilled to complete the installation.






Vertical Electrodes

SAN-EARTH M5C may also be installed vertically if space is limited and soil resistivities allow reaching the required resistance to ground. In this type of installation a vertical hole 3 inches (75mm) in diameter is bored into the soil (or rock). The depth of the hole is determined through calculations using the soil resistivity measured at the site.



Water that may have accumulated in the bottom of the hole is pumped out and a copper conductor is placed in the center. Either 3/4 inch (19 mm) copper clad ground rods or 4/0 stranded copper wire can be used.

A slurry or mortar is prepared by mixing SAN-EARTH M5C with water and this mixture is poured into the hole to surround the grounding conductor. This process results in an electrode which not only is three inches in diameter but also makes ideal contact with the surrounding soil.

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