Earthing ...what is it?

As it is stated in the ANSI/IEEE Standard "IEEE Guide for Safety in AC Substation Grounding," a **safe grounding design has two objectives:**

1. To provide means to carry electric currents into the earth under normal and fault conditions without exceeding any operating and equipment limits or adversely affecting continuity of service.
2. To assure that a person in the vicinity of grounded facilities is not exposed to the danger of critical electric shock.

How do you earth something?

The term 'earthing' means trying to achieve a connection" to earth itself… the lower the resistance between your earth system and earth (the planel), the better the 'earth'.

So, the materials required naturally need to be highly conductive and because they are being buried in the ground, they also need to be resistant to corrosion. That is why copper is the preferred material.

The earth connection itself relies on the 'soil resistivity', which in turn is affected by several factors, namely:

- Moisture content
- Mineral content
- Granularity
- Temperature

Equipment Earthing (Grounding)

The non current carrying metallic parts in every electrical installation are connected to the underground earthing mesh at earth potential for safety of personnel and for discharging fault current, The connection of non-current carrying metallic parts to underground earthing system is called *Equipment Earthing (grounding)*.

The equipment grounding also helps in the earth fault protection. The earth fault current from the equipment flows through the earthing system to the earth and is sensed by protection system and circuit breakers are opened. The faulty equipment is then repaired and re-commissioned. The earthed parts remain at approximately earth potential even during flow of fault current. The equipment earthing ensures safety to personnel.
The *Station Earthing System* should have *low earth* resistance; *low touch potential and low step potential.*
Modern Station Earthing System has buried borizontal mesh of steel rods and vertical electrodes (spikes) welded to the mesh. Further, the vertical risers and the galvanized steel and the points to be earthed.
The Earthing is of two principal types :

1. Neutral Earthing.
2. Equipment Body Earthing.

Earth-Resistance of Earthing System

"Earth Resistance ER" is the resistance of the earthing electrode / earthing mat to the real earth and is expressed in ohms. ER is the ratio of *V/I*, where V is measured voltage between the electrode and the voltage spike and *I* is injected current during the earth resistance measurement through the electrode. The desirable values of earth resistance measurement (average of 12 monthly readings) are:

Table 18C.3.

* EHV AC Installations	< 0.01 ohm
High Voltage Installations above. 33 KV	< 0.5 ohm
Medium Voltage Installations 1 KV to 33 kV	< 0.5 ohms
Low Voltage Installations up to 1 KV	< 1 to 2 ohm
Residential buildings	< 2 ohm

* Measured by High Current Method.

- For installations rated below 1000 V and earth fault current (Is) less than 500A, the earth resistance shall be less than 125/Is.

-For installations rated less than 2000 KVA and 1000V, (Residential Loads), the earth resistance should not exceed 2 ohms.

Earth resistance value obtained would depend on :

- Weather the soil is dry or wet. During the rainy season lower values are obtained and during summers, higher values are obtained. It is a good practice to irrigate the earth electrodes regularly during summers and winters.
- The resistivity of soil varies widely between 1 ohm m to 10000 ohm m (Table-1) depending on the type of soil.

Table-1.

Type of Soil	Resistivity ohm m
Marshy	1 5
Clay	3 150
Clay & Gravel Mixture	10 1250
Chalk	60 500
Sand	90 1000
Sand & Gravel Mixture	500 5000
Slate	100 500
Crystaline Rock	500 10,000

Let *ER* be earth resistance for one electrode in ohm.

$$\text{Resistivity of Soil (ohm m)} = \frac{\text{Earth-resistance ER in ohm}}{0.003}$$

e.g. With *ER* = 0.3 ohm, soil resistivity $= \frac{0.3}{0.003} = 100$ ohm metre

Wi.th *ER* = 12 ohm, soil resistity $= \frac{12}{0.003} = 4000$ ohm metre

Earthing System for Installations Within a Building :

The Earthing System is planned as a part of civil design and construction. The earthing rods are placed in mesh formation in the floor and in the area surrounding the building Risers are placed in walls. Earth connections are by galvanized iron strips or copper strips/ stranded wires provided between the individual body/neutral point and the Risers. Earthing strips are placed in the floor and walls and are connected to several places with the Eanhing Mesh. Sensitive measuring Instruments, Communication Equipment, Computer Facility etc. need proper low resistance earthing system spread in the various rooms of the buildings. *Electro-Magnetic Disturbances are eliminated* by *proper Earthing.*

Earthing Systems are basically advantageous. They ensure safety of persons. Earthing system has its own advantage and the user must therefore be guided according to his needs with the exceptions, however, of prescription or of standards or legislative bans.

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