

# EARTH RESISTANCE MEASUREMENT

# WHY DO WE NEED TO HAVE GOOD EARTHING?

**The grounding system is an essential element for the electrical system security and it is required to:**

Allow for protective devices activation when there is an insulation fault.

Equalize the potential of conductive parts that can be accessed simultaneously, with the potential in the surrounding soil in order to prevent people from being exposed to hazardous voltages.

Allow the lightning strike energy to be safely dissipated.

To Reduce electromagnetic interferences.

# WHAT IS RESISTANCE?

- Resistors have two terminals and its resistance is defined as the quotient of the voltage applied on those terminals and the current circulating between them as a consequence of that voltage.
- $R = V/I$  in ohms (Voltage / Current)

# WHAT DOES RESISTANCE DEPEND ON?

- The value of the resistance depends on the type of material (resistivity) and its physical dimensions (area and length of the resistive element).

$$R = \frac{\rho \times L}{A}$$

# HOW TO MEASURE EARTH RESISTANCE?

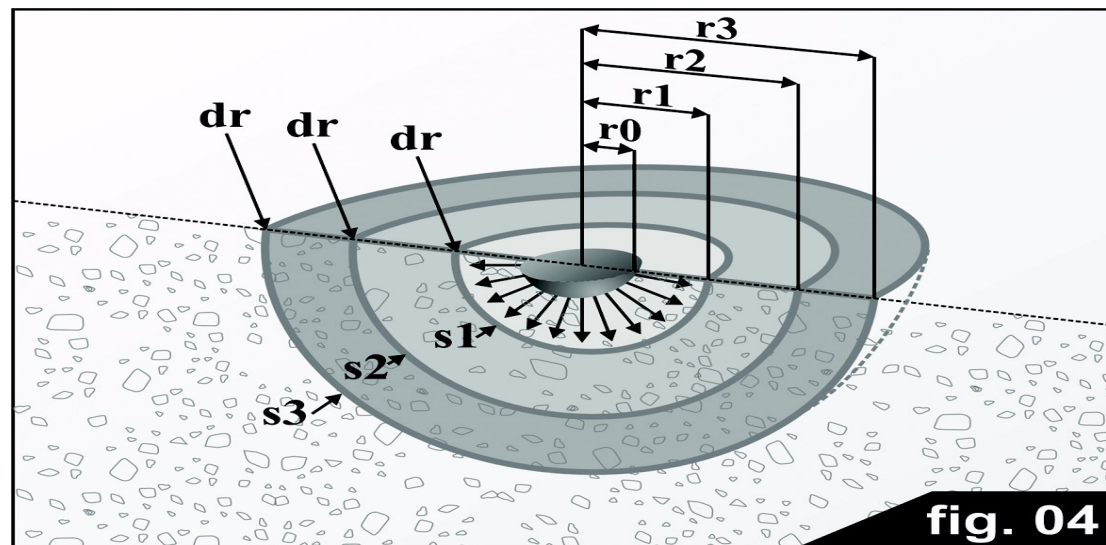
- Only one of the terminals is evident in the earth resistance. In order to find the second terminal we should recourse to its definition: Earth Resistance is the resistance existing between the electrically accessible part of a buried electrode and another point of the earth, which is far away  
(Eg: To measure between the distance)

# HOW TO CALCULATE SOIL RESISTIVITY?

- To obtain a measurement representative of the soil in the vicinity of the rod (of known resistivity) and down to a useful depth, the rod should be driven to a depth of at least 0.2 meters, preferably 0.4 meter minimum. It should be spaced away from any other buried conductors by at least five (62%) times its own depth in the soil.

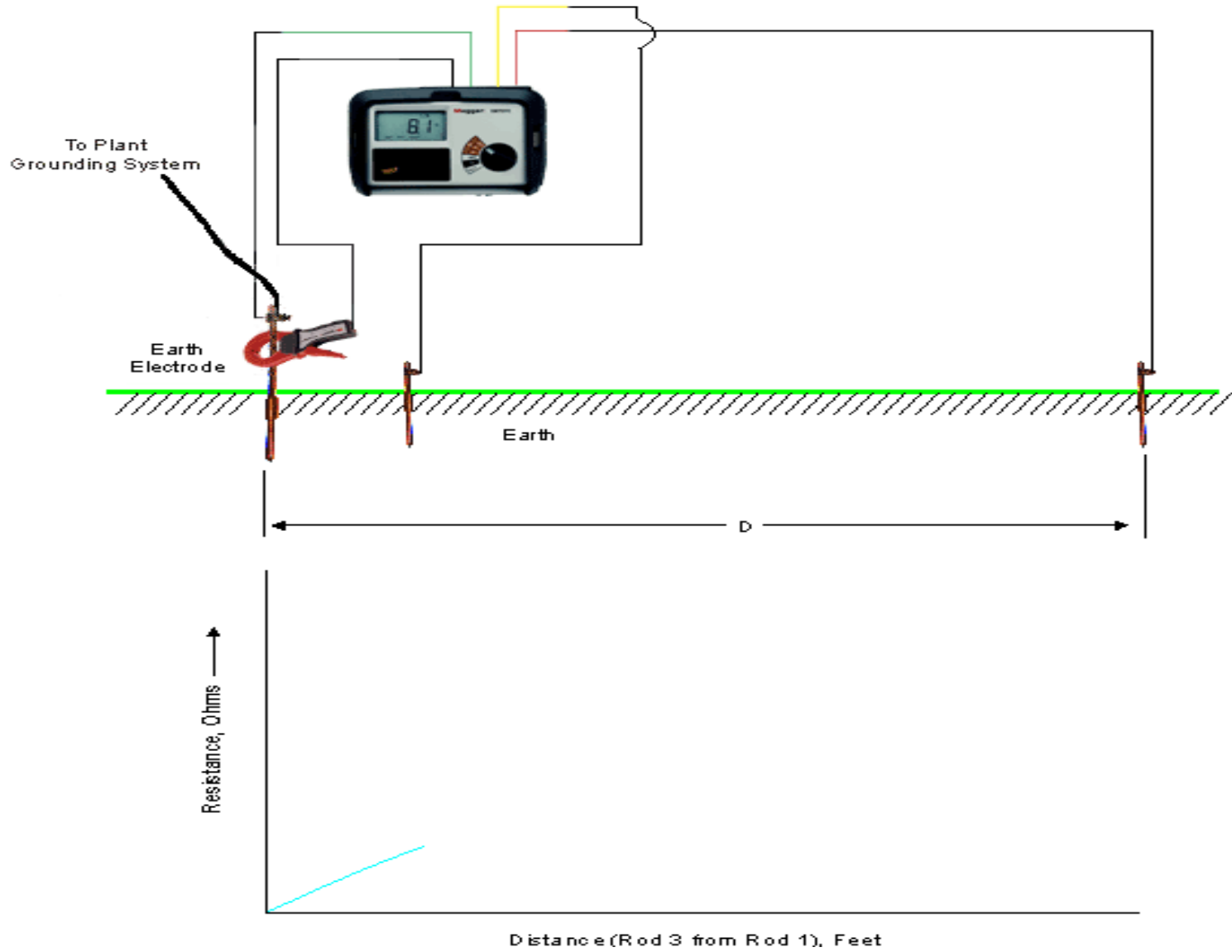
# HOW DOES THE RESISTANCE GEOMETRY SURROUNDING A BURIED ELECTRODE LOOK LIKE?

Eg: Length Depends up On the depth of the Rod Buried



# METHODS OF REDUCING EARTH RESISTANCE


- By adding mixture of salt and water to the earth pit.
- By adding salt, charcoal and sand mixture to the pit.
- By using a bigger grounding plate
- By burying the ground plate as deep as possible
- By having parallel ground plates with a distance of 10m between grounds
- By using salt, charcoal etc., to reduce resistivity



# How do I hook up my leads?

- The tester is a four-terminal model, the operator has some discretion. The E1 and P1 terminals has to be jumpered i.e., short. The lead should be taken from the E1, not the P1 to the ground to be tested. The longest lead is connected to the E2 terminal, and normally, Stretched out to its full length. The P2 receives the lead of intermediate length.

# My testing is all on concrete, how can I drive probes?

-  You may only need to lay the test probes flat on the surface and establish contact by wetting the area and adding mud. Concrete conducts current fairly well and chances are good that you'll have an acceptable test.

# Does it matter how deep I drive the probes?

- Yes.

- Try to insert the given probe as deep as possible.

# If I water the test probes to improve contact, won't this influence my result?

- No. Remember, it is the resistance of the ground electrode that is being measured, not that of the test probe. The probe is merely a tool. Once a minimum amount of contact is made with the soil, the setup is ready to go on with the test. In order to achieve sufficient contact, it is perfectly legitimate to water the area around the probes. This is like sanding an alligator clip with emery paper before connecting to a circuit; just a specialized means of improving contact.
- Watering the area around the ground electrode lowers its resistance too, and this, of course, does influence the test result.

Eg: Pour water in to the electorde, Not into the Pit

# How often should I test my grounds?

- Odd intervals of 5, 7, or 9 months are recommended so that the various seasons will all be encountered in succession. This is because the quality and effectiveness of a ground are profoundly affected by weather and seasons. If quarterly or semiannual testing schedules were used, certain months would consistently be missed, and these could be the ones in which the grounding is most stressed by the weather. Adopting irregular intervals, on the other hand, ensures that worst case seasons will be revealed. Since a ground fault, potential fire or accident, can happen at any time, your protection is only as good as the ground condition in the worst time of year.

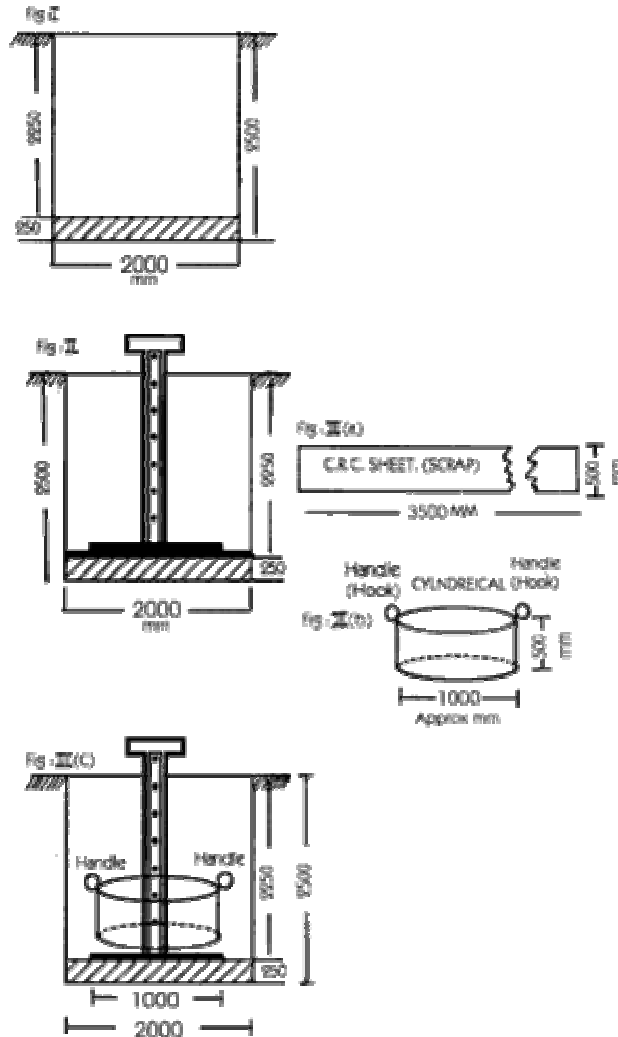
# EARTH PIT PROCEDURE FOR INSTALLING A GOOD EARTH PIT

## Step A :

Excavate the earthing pit size 1000 X 1000 X 2300 mm depth. Sprinkle sufficient quantity of water in the bottom and surrounding walls to become wetty only.

Fill up the bottom layer of the pit up to 150 mm height from the bottom by mixture.

Black soft soil + 1 MT. salt + 1 MT. wooden charcoal pieces. (Fig. I)



## Step B :

Prepare the electrode assembly as per Sr. No. - 3 of the drawing and rest the entire Assembly in the pit as shown in (Fig. II)

## ● Step C :

- Collect thin C.R.C. sheet from the scrap approx 18 to 20 SWG having size 500 mm width 2.3 meter length approx. (Please make joints of three to four pieces to achieve requirement of 2.3 meter length (Fig. III-a))
- Prepare the Cylindrical Ring from the above sheet by bending both ends & joining each other. The diameter "D" of the cylindrical ring shall arrive approx. 1000 mm and height shall be 500 mm. Collect two pieces of scrap G.I. wire of approx. 8-SWG and prepare two lifting round handles (Hooks) on upper side of the cylindrical ring to facilitate the lifting of the Cylindrical Ring. (Fig. III-b)
- Now wear this cylindrical ring to the electrode pipe of the electrode assembly such a way that the electrode pipe remains in the centre of the cylindrical ring. (Fig III-c)

- **Step D :**

Fill up the inner part of the Cylindrical Ring with Mixture

- The remaining part i.e. the Gap between walls of the pit and outer periphery of the Cylindrical Ring by Mixture - II. After completing filling work of both the mixtures up to 500 mm height, proper ramming and watering is to be done. (Fig. IV)

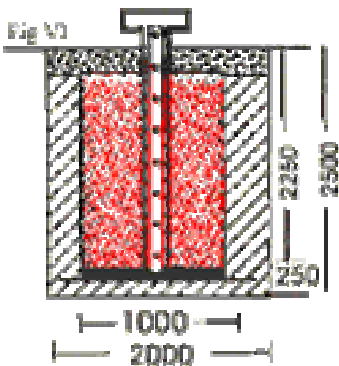
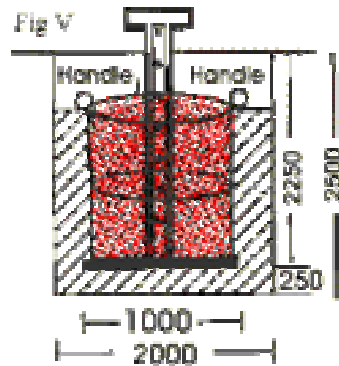
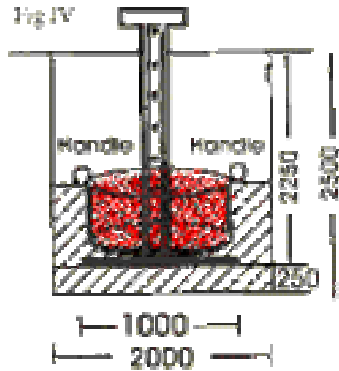
## Step E :

There after lift the Cylindrical ring by help of two lifting handles (hooks) and again rest it on the layer for carrying out filling of 2nd layer cycle. Again fill up the inner cylindrical part of the ring by Mixture - I and outer gap between walls of the pit & outer Cylindrical periphery by Mixture - II up to height of the Cylinder (i.e. 500 mm) (Fig. V)

## Step F :

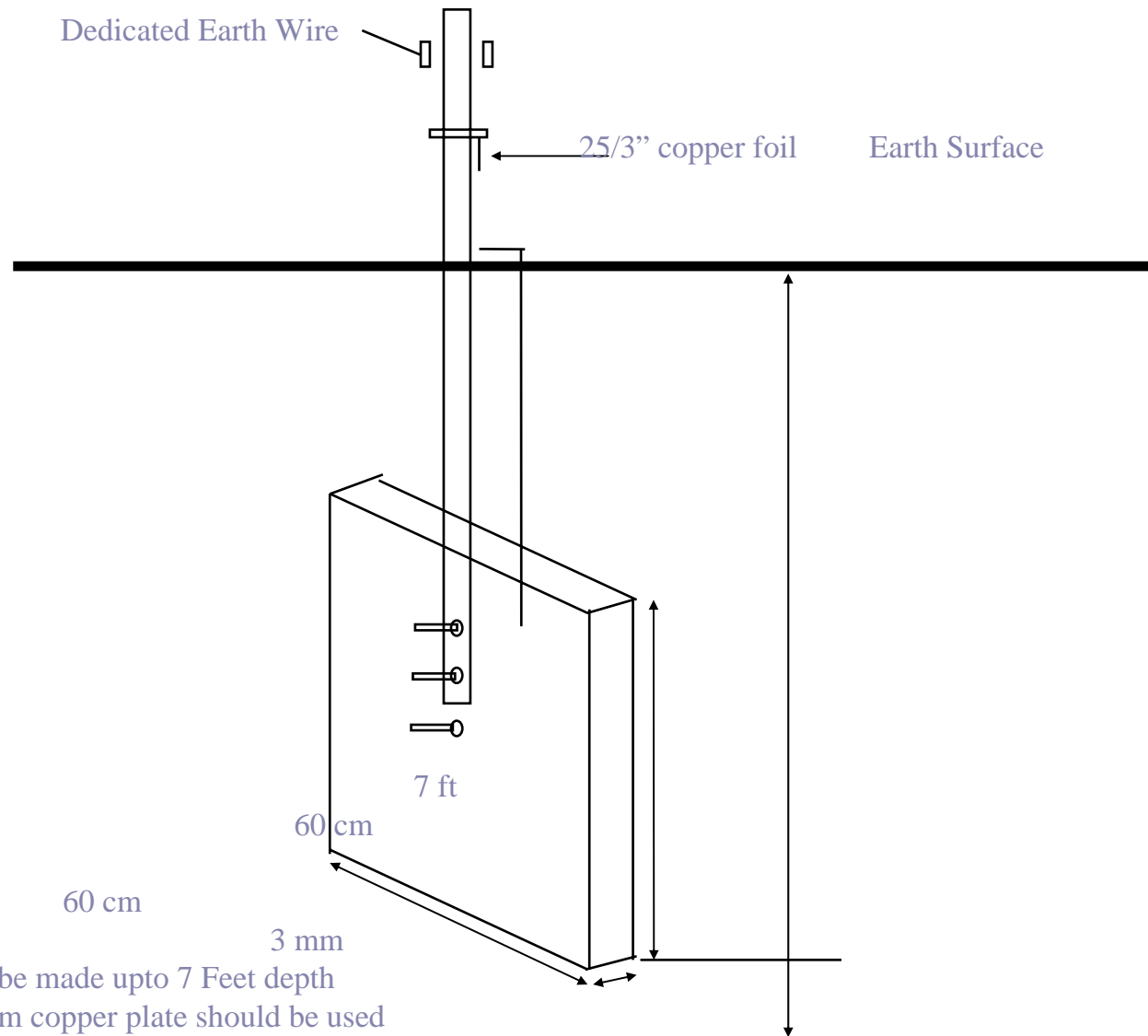
Lift the cylindrical ring by lifting handles (hooks) after proper ramming and watering. Now again place the cylindrical ring on upper layer and arrange 3rd cycle, subsequently complete the filling of entire pit. Please see that water content is minimum 20 %

Fill up upper layer of the pit by crushed rock pieces (Gravel) size 50 X 35 mm. 1 CMT. approx. to provide insulting layer to person moving side by the pit, and to prevent reptile movements subsequently causing hazards. (Fig. VI)



Dedicated Earthing Specifications

Pipe diameter 40 mm



1. 3 x 3 Feet pit should be made upto 7 Feet depth
2. 60 cm x 60 cm x 3 mm copper plate should be used
3. Pit should be filled by salt (25 kgs), coal (25 kgs) and sand
4. Earthing resistance must be less than 3 ohms