Importance of Measurement of Earthing / Grounding

Earthing plays an important role in generation, transmission and distribution for safe and proper operation of any electric installation, highlight

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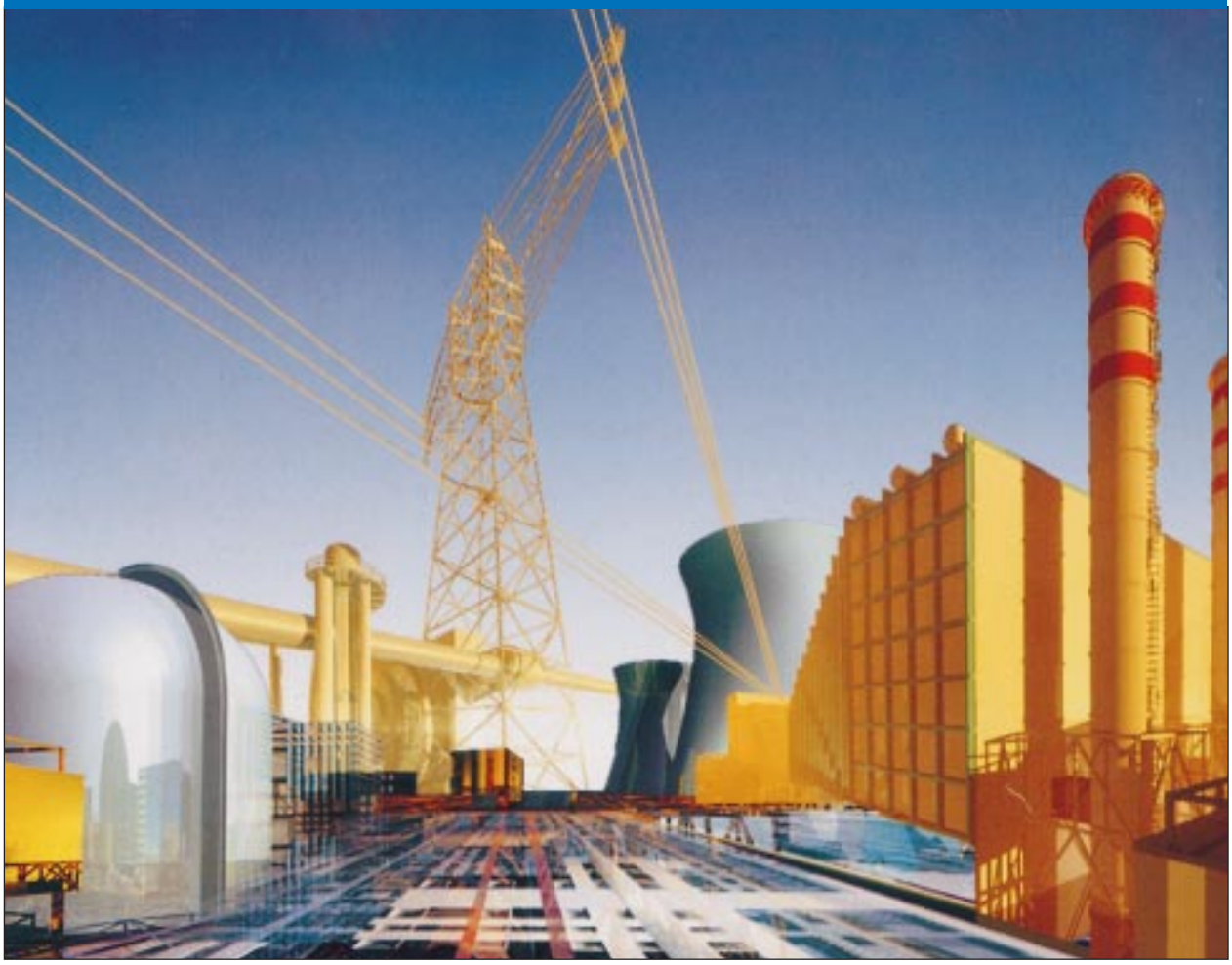
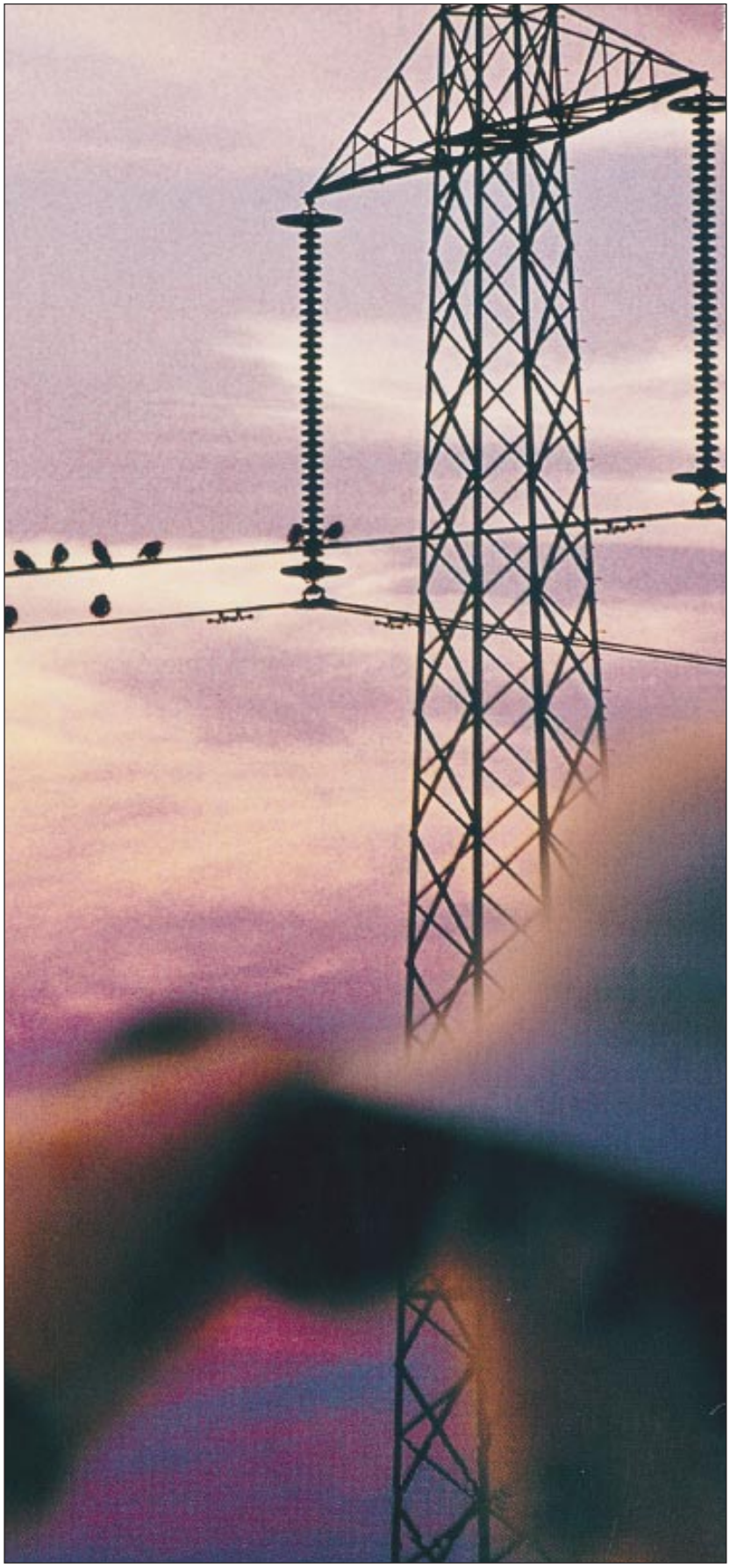
Introduction

The faults in any electrical system are unavoidable. Every electrical equipment, appliance, system must be earthed or grounded to obtain a low resistance path for dissipation of current into the earth. Earthing plays an important role in generation, transmission and distribution for safe and proper operation of any electric installation.

Electricity most often kills a man

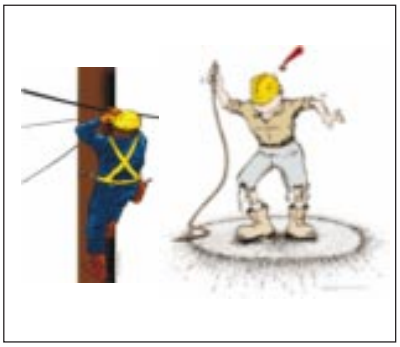




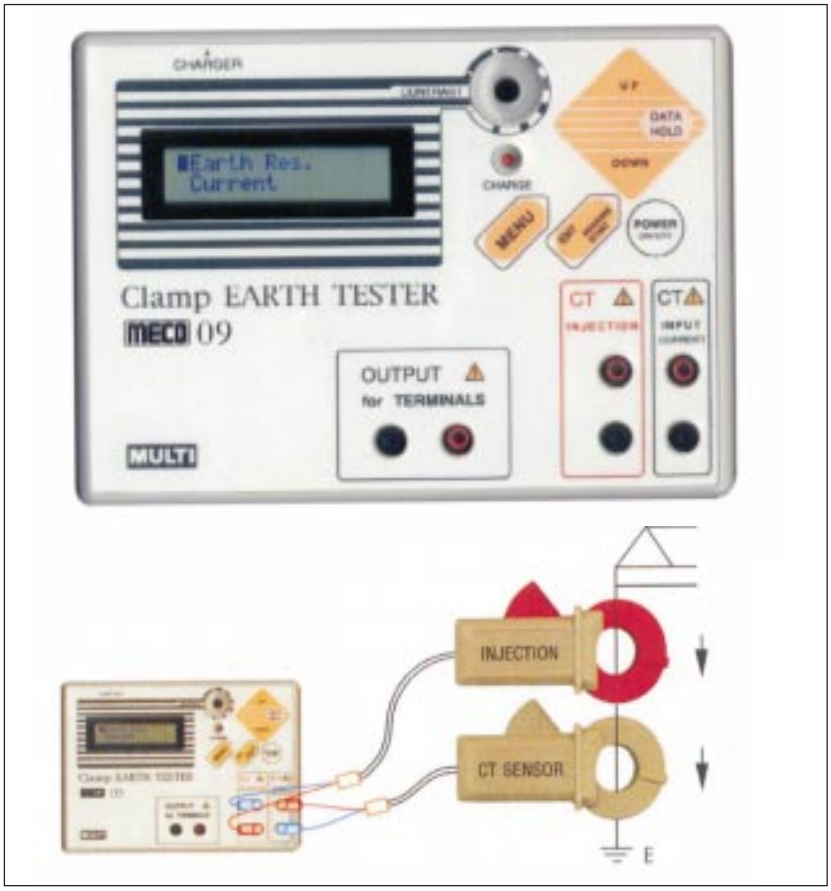
- not causing extreme physical injuries - but by merely shocking the life out of the body suddenly. This is due to life and electricity in minute form being closely inter-related so that a small current can prove fatal. When body is alive it is found to maintain a potential difference between its inside and outside. This potential difference exists as long as there is life and disappears when life goes. This potential difference is very small, 10 to 100 millivolts.

Galvany, in 1780 proved that all live muscles contract when electricity is applied. When contraction due to electricity is more that will power contract and relaxes which brings to death due to electric shocks. The current affects heart muscles and when contract become too powerful, muscles bewilder and fall in state of flutter, called ventricular fibrillation, the heart stops functioning. It will be proper to know what current and potentials are safe to handle.

The maximum safe current a person can tolerate and still release grip of energize object differs from person to person. It depends on body resistance (varies 500 to 1 lakh ohms.) at the time of accident (Man-9ma, Women-6ma, Child 4.5ma) Under



Every earthing should be tested / checked at regular intervals so as to ensure that the resistance of the earth connection should be minimum.



Ground Resistance and Earthing Measurement System.

the provisions of Indian Electrical Rules 1956, electrical installation of the licensees, consumers are inspected every year by the Electrical Inspectorate wing of Government of Maharashtra under the guidance of Chief Engineer (Electrical) P.W.D. Mumbai for observance and for enforcement of safety measures for working on electrical equipment, installation. During inspection of installations, overhead lines, transformers etc., if any defects are observed then the recommendations are given to the concerned for compliance of the same. Also, all the electrical accidents are investigated by the electrical inspectorate wing to check the observance of electrical measures and recommendations are given for compliance.

In the field, the condition of earthing is so poor and normally earth resistance or leakage current is not measured either because of prevailing tedious and time consuming methods or due to the lack of availability of handy instruments. Many-a-times, the important aspect of proper earthing is neglected resulting in complex problems. The distribution transformers fail because of earthing not being proper and lightening arrestors do not carry out their work. In case of HT consumers, the meter behaves erratically as unbalance voltages are recorded due to poor earthing or no earthing. To ensure proper monitoring of earthing, it is necessary to have a handy and easy-to-use equipment.

Potential Hazards

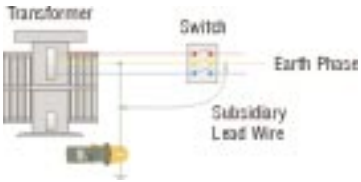
Major accidents happen due to improper earthing and leakage.

- A person dies after touching the pole. It was observed that the pole was not earthed & live wire inside had a deteriorated insulation which came in contact with the pole.
- In a sugar factory a person was stacking sugar bags by climbing on a steel ladder. He took support of roof truss and got shock. The fitting erected on truss was short and leakage passed to the labourer.

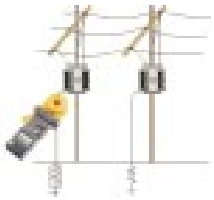
Major Application of Measuring Earth Resistance and Leakage Current

- Earthing cable of transmission pole (tower) to get ground resistance of soil resistivities. Soil resistivity is a crucial factor in obtaining a "Good Earth". Every overhead line, which is exposed has to be liable to injury from lightening, shall adopt efficient means for diverting to earth any electric surge

- To measure at the earthing wire of the transformer to check proper grounding, as most difficulties occur from the contact between the soil and the stack. If this is poor the flow of electricity is redirected.

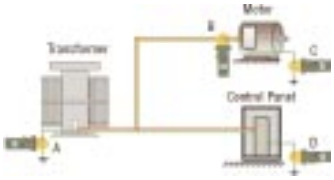


- To measure earth / ground resistance of live electrical in-

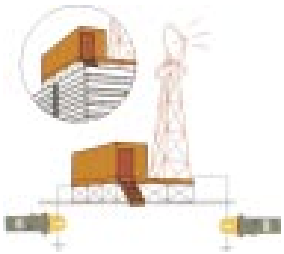


stallation earthing wire of any transformer/motor/control panel without shutdown. In a Delta connected system, a neutral point shall be obtained by insertion of grounding transformer & current limiting resistance or impedance.

- Neutral point to measure proper grounding of Passive lines. An effective grounding system is one in which the potential rise of the surrounding earth is minimized.



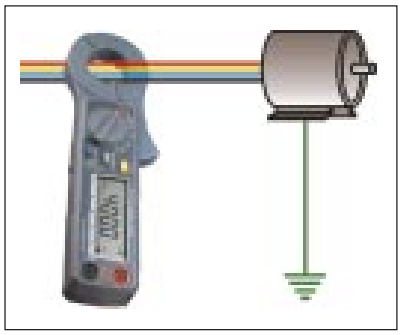
- Earthing wire of telecommunication shelter cabin or signal relay antenna at ground near earth bit. As it is important to reduce the Electrodynamics stress on material to limit the induced voltage on telecommunication line & over voltage on LV component.



- Other areas:
  - Lightning Arrestor, Earthing Lines, Streetlight Poles
  - Telephone Shelter Cabin and Ground Pits
  - Secondary of Transformers, Substation, Receiving Station
  - High Tension and High Voltage Appliances.
  - Electronic Switch Boards
  - Multiple Grounding Points, Equipotential Bonding
  - Petrochemicals Pipelines & Storage Tanks
  - Static Electricity Prevention Equipment & Appliance
  - Sugar, Cement, Iron & Steel Plants / Factory

- A person on the roof is electrocuted as he touches the TV antenna. In a TV, phase directly goes to internal circuit and the neutral connected to chassis. The antenna circuit is also connected through a capacitor. As phase position is changed and phase comes directly in contact with chassis, the circuit is completed but as a capacitor of antenna gets short, and leakage transfers from chassis to metallic part of the antenna.
- A cow fell down in the gutter and died of a shock. The earth wire was disconnected from the earth rod and was in an energized condition due to heavy leakage.

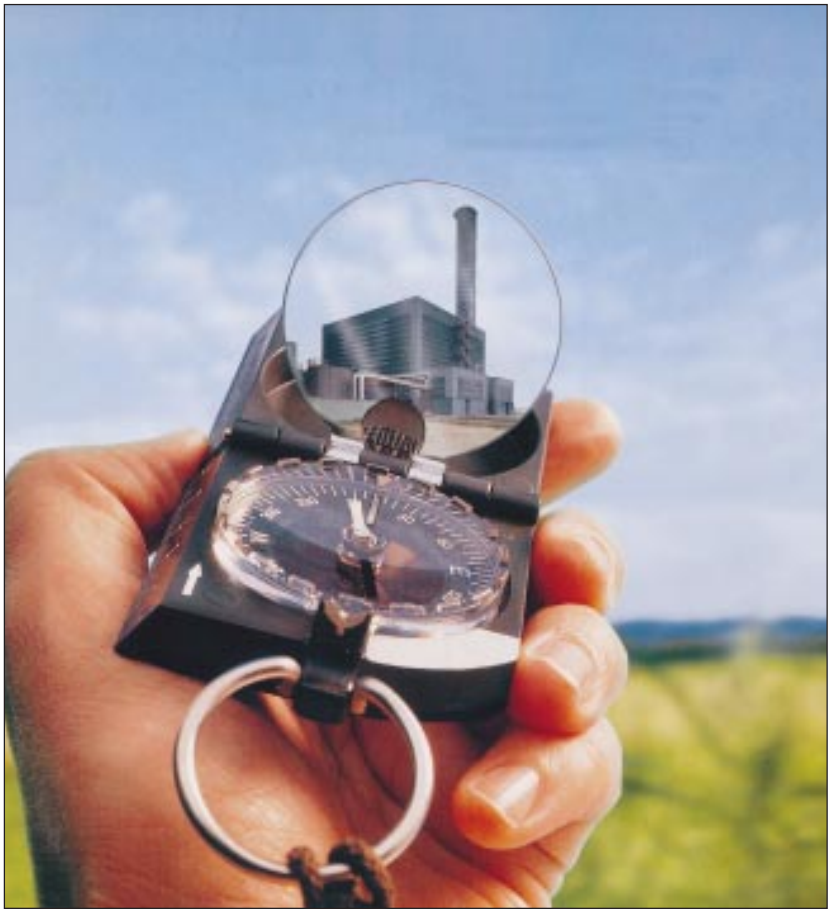
Whenever an electrical installation is to be completed, its non-conducting parts should be connected firmly to earth electrodes. Every electrical installation should have proper earthing. Earthing provides protection against dangerous potential under fault conditions.



Earthing Measurement of an Electrical Installation

Importance of Proper Earthing / Grounding Systems

- Every electrical equipment or appliance must be 'Earthed' or 'Grounded' for the safety of equipment, network as a whole and operating personnel.
- Ground fault current directly has an impact on human safety. Major accidents happen due to improper earthing. Leakage current passes through human body and fatality occurs.
- Every overhead line / sub station / generator station which is exposed are liable to injury from lightening.
- Purpose of earthing in an electric power system is to limit, with respect to the general mass of earth, the potential of current carrying conductors, which are part of the equipment, non-current carrying metal works, associated with the equipment, apparatus and appliances con-



nected to the system.

- Earthing plays an important role in ensuring safe generation, transmission & distribution of an electric system.
- Every earthing should be tested / checked at regular intervals so as to ensure that the resistance of the earth connection should be minimum. Records should be maintained if results are poor, action should be taken to be improved.

Old Measurement Methods are called fall of potential method. In this method, the earth grid is to be isolated from the earth electrode. Two auxiliary electrodes – one current electrode and another potential electrode are placed besides the electrode to be tested at equal distance in a straight line. A measured current is passed through the auxiliary current electrode. A potential difference is developed between the auxiliary potential electrode and the current electrode.

Old measurement methods are:

- Crude
- Time Consuming
- Require Shut – Downs
- In-Accurate
- Strainful

Handy instruments are now available to measure Ground / Earth Resistance and Leakage Current by just clamping to the grounding lines without disconnecting the circuit or driving auxiliary electrodes. The Clamp-On Earth / Ground Resistance Tester can measure ground resistance and AC current (load/leakage) by just clamping to the grounding lines without disconnecting the circuit or driving Auxiliary Electrodes. It is based on an unique principle in which a pre-defined current is injected in the ground circuit under test and then the induced magnetic current there by generated in the circuit is measured at a high frequency by use of special clamp -on current transformer in the instrument.

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