Electrical Safety : Earthing Aspect

Innovative methods for measurement of Earthing / Grounding systems.

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The faults in any electrical system are unavoidable. Every electrical equipment's, 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 & 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 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 applied. When contraction due to electricity is more that will power contract and relaxes which brings to death due to electric shocks. The current affect heart muscles and when contract become too powerful, muscles bewildered 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 person can tolerate and still release grip of energize object differs person to person. It depends on body resistance (varies 500 to 1 lack ohms.) at time of accident (Man-9ma, Women-6ma,child 4.5ma)

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 & time consuming methods or handy instruments were not available. Many a times the important aspect of proper earthing is neglected resulting in complex problems associated with poor earthing.

Hazards happening everyday due to improper Earthing

Major Accident are happened due to improper earthing and leakage current passed through human body or through hazards material and fatality or loss occurs.

- Person dies after touching the pole. It was observed that the pole was not earthed & lamp wire inside was with deteriorated insulation & came in contact with inside pole.
- In a sugar factory a person was stacking sugar bags by climbing on steel ladder. He took support of roof truss and got shock. The fitting erected on truss was short & leakage pass to labor.
- A person on the roof is electrocuted as he touches the TV antenna. In TV phase directly goes to internal circuit & neutral connected to chassis. Antenna circuit is also connected through capacitor. As phase position changed & phase comes directly in contact with chassis: circuit is completed but as a capacitor of antenna gets shorted & leakage transfer from chassis to metallic part of antenna.
- A holy cow fell down in the gutter and got shocked. Earth wire was disconnected from earth rod and was in energized condition due to heavy leakage.

Whenever electrical Installation is to be completed its non-conducting parts should be connected firmly to earth electrodes. Every Electrical Installation should be having proper Earthing. Earthing provides protection against dangerous potential under fault conditions.

It is also important to take precautions against leakage of current. Insulation Resistance values should be checked periodically. It is also necessary to maintained Earthing properly of all electrical Installation. As the same time it is also very important at regular interval to check and if required unproper Earthing should be repaired.

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 lightning.
• 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 connected to the system.
• Earthing plays an important role in Generation, Transmission & Distribution for safe and proper operation of electric system.
• Every Earthing should be tested / checked at regular interval so as resistance of Earth connection should be minimum. The records should be maintained if results are poor, action should be taken to be improved.
Old Measurement Methods is called fall of potential method./ In this method 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. The potential difference developed between the auxiliary potential electrode and the electrode.

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 as to be liable to injury from lightening, shall adopt efficient means for diverting to earth any electric surge.
• To measure at earthing wire of Transformer to check proper grounding as most difficulties occur from the contact between the soil & the stack. If this is poor the flow of electricity is resistricated
• To measure earth / ground resistance of Live Electrical installation 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.
The objectives of Maintaining Proper Earthing is very good but the road ahead is very long, rough and tardy but with the cooperation and strong will, nothing is impossible