A

Seminar report

On

Earthing

Submitted in partial fulfillment of the requirement for the award of degree
Of ECE

SUBMITTED TO: **SUBMITTED BY:**

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Acknowledgement

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Secondly, I would like to thank my parents who patiently helped me as i went through my work and helped to modify and eliminate some of the irrelevant or un-necessary stuffs.

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Next, I would thank Microsoft for developing such a wonderful tool like MS Word. It helped my work a lot to remain error-free.

Last but clearly not the least, I would thank The Almighty for giving me strength to complete my report on time.

Preface

I have made this report file on the topic **Earthing**; I have tried my best to elucidate all the relevant detail to the topic to be included in the report. While in the beginning I have tried to give a general view about this topic.

My efforts and wholehearted co-corporation of each and everyone has ended on a successful note. I express my sincere gratitude to ……..who assisting me throughout the preparation of this topic. I thank him for providing me the reinforcement, confidence and most importantly the track for the topic whenever I needed it.

What is Earthing?

Earthing can broadly be described as a connection to the greater mass of earth. Earthing can be used in a number of contexts within the electric power industry:

- Low voltage wiring protective earth conductor
- Earth stake installed at LV switchboards
- Earth grids installed at transformers and substations consisting of bare conductors and earth rods
- Overhead earth wires on high voltage lines
- Cable screens on HV cables

Sometimes earthing can be metallic items that are not originally intended as such, for example telecommunications cables, pipelines and fences.

In power systems, earthing exists for a number of reasons:

- Transient energy dissipation (such as lightning strikes)
- Allowing protection to operate during faults
- Minimise equipment damage during faults
- Minimise voltage differences and protect people during faults

Each of these earthing systems may be stand-alone, or they may be connected together to a form a larger, common bonded earthing system.

Mitigating Hazards During Earthing Faults

In order to mitigate hazards during earth fault events, two methods can be employed:

1. Reducing the overall hazard magnitude
2. Addressing local hazards in an effort to reduce the current that may flow through a body

To reduce the overall hazards, commonly would mean reducing fault clearing times, reducing the fault level (often with a neutral earthing resistor), or reducing the system impedance (by making more connections or installing a larger earth grid).

Where the above options are not available, local hazards in specific location may be addressed through engineering controls such increased resistance/insulation, isolation, equipotential bonding, and administrative controls such as procedural changes and PPE.

Important: In order to understand the hazard levels and any necessary controls, appropriate testing and analysis is required to determine the performance of the installed earthing system.

Zero Sequence Earthing are happy to spend some time to discuss your design or testing needs, provide advice, and can also assist by undertaking earthing system design and testing of complex earthing systems, including:

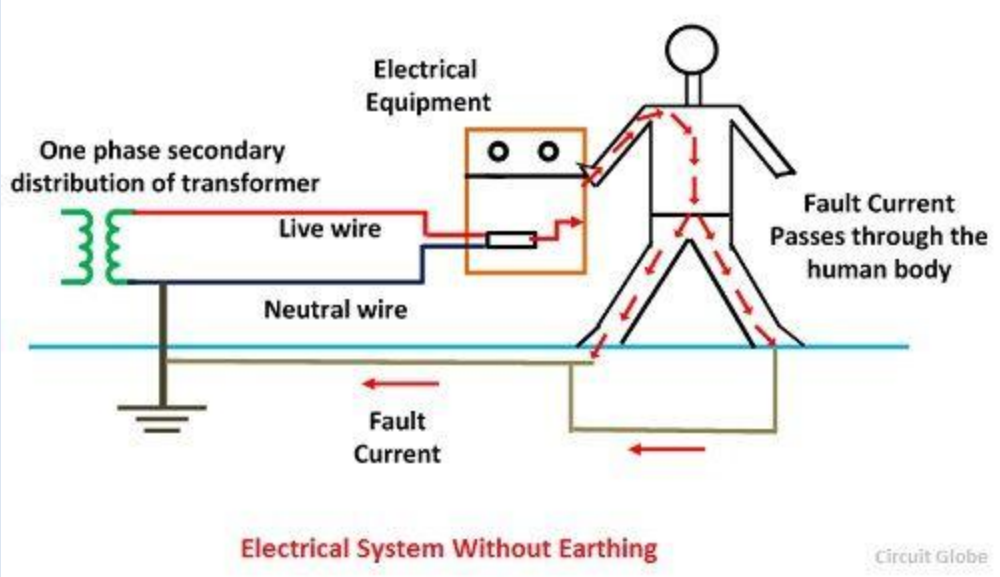
- Distribution and zone substation earthing
- Private HV, mining and industrial earthing
- High voltage transmission lines and cable fed systems
- Electromagnetic induction (Low Frequency Induction) assessments
- Electrostatic induction problems

Importance of Earthing

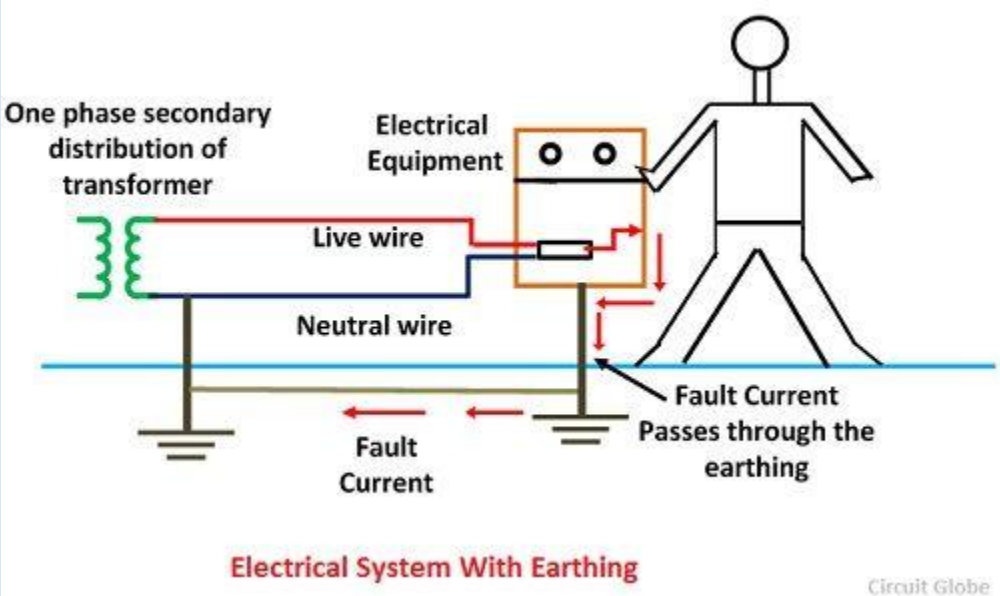
The earthing is essential because of the following reasons

- The earthing protects the personnel from the shortcircuit current.
- The earthing provides the easiest path to the flow of shortcircuit current even after the failure of the insulation.
- The earthing protects the apparatus and personnel from the high voltage surges and lightning discharge.

Earthing can be done by electrically connecting the respective parts in the installation to some system of electrical conductors or electrodes placed near the soil or below the ground level. The earthing mat or electrode under the ground level have flat iron riser through which all the non-current-carrying metallic parts of the equipment are connected.



When the fault occurs the fault current from the equipment flows through the earthing system to the earth and thereby protect the equipment from the fault current. At the time of the fault, the earth mat conductors rise to the voltage which is equal to the resistance of the earth mat multiplied by a ground fault.



The contacting assembly is called earthing. The metallic conductors connecting the parts of the installation with the earthing are called electrical connection. The earthing and the earthing connection together called the earthing system.

Why Earthing is Important?

The primary purpose of earthing is to avoid or minimize the danger of electrocution, fire due to earth leakage of current through undesired path and to ensure that the potential of a current carrying conductor does not rise with respect to the earth than its designed insulation.

When the metallic part of electrical appliances (parts that can conduct or allow passage of electric current) comes in contact with a live wire, maybe due to failure of installations or failure in cable insulation, the metal become charged and static charge accumulates on it. If a person touches such a charged metal, the result is a severe shock.

To avoid such instances, the power supply systems and parts of appliances have to be earthed so as to transfer the charge directly to the earth.

Below are the basic needs of Earthing.

- To protect human lives as well as provide safety to electrical devices and appliances from leakage current.
- To keep voltage as constant in the healthy phase (If fault occurs on any one phase).
- To Protect Electric system and buildings form lighting.
- To serve as a return conductor in electric traction system and communication.
- To avoid the risk of fire in electrical installation systems.

Types of Earthing

Earthing can be done in many ways. The various methods employed in earthing (in house wiring or factory and other connected electrical equipment and machines) are discussed as follows:

1). Plate Earthing:

In plate earthing system, a plate made up of either copper with dimensions 60cm x 60cm x 3.18mm (i.e. 2ft x 2ft x 1/8 in) or galvanized iron (GI) of dimensions 60cm x 60cm x 6.35 mm (2ft x 2ft x ¼ in) is buried vertical in the earth (earth pit) which should not be less than 3m (10ft) from the ground level.

For proper earthing system, follow the above mentioned steps in the (Earth Plate introduction) to maintain the moisture condition around the earth electrode or earth plate.

2). Pipe Earthing:

A galvanized steel and a perforated pipe of approved length and diameter is placed vertically in a wet soil in this kind of system of earthing. It is the most common system of earthing.

The size of pipe to use depends on the magnitude of current and the type of soil. The dimension of the pipe is usually 40mm (1.5in) in diameter and 2.75m (9ft) in length for ordinary soil or greater for dry and rocky soil. The moisture of the soil will determine the length of the pipe to be buried but usually it should be 4.75m (15.5ft).

3). Rod Earthing

it is the same method as pipe earthing. A copper rod of 12.5mm (1/2 inch) diameter or 16mm (0.6in) diameter of galvanized steel or hollow section 25mm (1inch) of GI pipe of length above 2.5m (8.2 ft) are buried upright in the earth manually or with the help of a pneumatic hammer. The length of embedded electrodes in the soil reduces earth resistance to a desired value.

4). Earthing through the Waterman

In this method of earthing, the waterman (Galvanized GI) pipes are used for earthing purpose. Make sure to check the resistance of GI pipes and use earthing clamps to minimize the resistance for proper earthing connection.

If stranded conductor is used as earth wire, then clean the end of the strands of the wire and make sure it is in the straight and parallel position which is possible then to connect tightly to the waterman pipe.

5). Strip or Wire Earthing:

In this method of earthing, strip electrodes of cross-section not less than 25mm x 1.6mm (1in x 0.06in) is buried in a horizontal trenches of a minimum depth of 0.5m. If copper with a cross-section of 25mm x 4mm (1in x 0.15in) is used and a dimension of 3.0mm^2 if it's a galvanized iron or steel.

If at all round conductors are used, their cross-section area should not be too small, say less than 6.0mm^2 if it's a galvanized iron or steel. The length of the conductor buried in the ground would give a sufficient earth resistance and this length should not be less than 15m.

The advantages of earthing

The practice of earthing is widespread, but not all countries in the world use it.

There is certainly a high cost involved, so there must be some advantages. In fact there are two. They are:

1. - The whole electrical system is tied to the potential of the general mass of earth and cannot 'float' at another potential. For example, we can be fairly certain that the neutral of our supply is at, or near, zero volts (earth potential) and that the phase conductors of our standard supply differ from earth by 240 volts.

2. - By connecting earth to metalwork not intended to carry current (an extraneous conductive part or a an exposed conductive part) by using a protective conductor, a path is provided for fault current which can be detected and, if necessary, broken. The path for this fault current is shown in .

The disadvantages of earthing

1. - Cost: the provision of a complete system of protective conductors, earth electrodes, etc. is very expensive.

2. - Possible safety hazard: It has been argued that complete isolation from earth will prevent shock due to indirect contact because there is no path for the shock current to return to the circuit if the supply earth connection is not made. This approach, however, ignores the presence of earth leakage resistance (due to imperfect insulation) and phase-to-earth capacitance (the insulation behaves as a dielectric). In many situations the combined impedance due to insulation resistance and earth capacitive reactance is low enough to allow a significant shock current.

References

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