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A Review Paper on Utility Earthing System

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Abstract— *This paper gives about Earthing. For a brief section of a century, the earth was not used as a conductor for uninterrupted flowing man-made electricity. In hindsight, one could reach the conclusion that the lack of comprehension of man-made electricity allowed that appear to the correct movement at the time. Later would demonstrate to be dangerous to human beings and other living things. Power progression and electrical safety are consequential for all industrial and commercial applications. Some of the calamitous effects created by faults in a system include loss of power, demolition of equipment.*

Keywords— Earthing, earth, high resistance, soil pipe, neutral.

I. INTRODUCTION

Earthing is one of the most common provisions for protection in a power system. In electrical engineering, ground or earth can provide a common return path for electric current. The motive of an earthing system is to protect personnel against electrical shocks, decrease damage to equipment and provides a point of zero reference potential for the phase. In this system, the connection to the earth is made through the earth electrode. An earth electrode is a conductor or group of conductors that provide electrical connections to the earth. Earthing survey its purpose only if it's resistance is within a specific range of values, and this value, in general, made as few as possible. This project is based on a Solidly grounded neutral system that has the source transformer neutral point directly connected to the earth through a sufficient solid, ground condition. The solidly grounded neutral system is effectually controlling overvoltage conditions and the instant opening of the defensive device when the first phase-to-neutral or phase-to-earth fault occurs.

II. LITERATURE REVIEW

The literature review contains a brief discussion of some recent work of the earthing system.

Earthing system and its methods affect human being safety, apparatus safety and operation. The earthing system provides protection against transmission, distribution network, and lighting system. Major accidents are happening due to improper earthing and leakage current through the human body or through hazards material and faulty or losses of power occurs. Person dies after touching the pole due to improper earthing [4]

T Weslley De Lime has reviewed the type of electrical power system arrangements experience on a major offshore platform and in particular, considers the earth fault liberality requirements of drilling operations to ensure suppliers are maintained whilst moving towards the make-well-secure secure condition. The three low voltage earthing methods most commonly applied to oil and gas facilities are manly IT, TT, TN. The goal of this paper is to compare the different low voltage earthing methods. [5]

Tang Zhaosheng.Gain cheng has proposed to reduce the grounding resistance of grounding objects by reducing the resistivity of soil. It depends on the size of the ground, selecting the appropriate shape of the grounding (depth of vertical ground). [6]

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Clayton L.Hallmark describes a horizontal earthing electrode consisting wire of graphite cement encloses a counterpoise wire. Its horizontal length and large cross-section allow the grounded to fast and efficiently separate the lightning current over a wide area around the site. Communication facilities of the electrical protection can be improved by using a horizontal strip electrode.[13]

B. Pungsiri has described the design and establishment of the grounding system in high voltage laboratory at KMUTT. KMUTT was 9 rods connected in a grid connection each rod was 3 meters long. The grid-connected resistance was less than 5 ohm. By implementing aluminum plates on the cement floor, then connected to the grounding of each piece of equipment to them.[14]

III. EARTHING SCHEMES

3.1 TT System (Earthed Neutral)

One point at the supply source is connected straight to earth. All exported exposed- and extraneous-conductive-parts are connected to a separate earth electrode at the installation [8]. This electrode may or may not be electrically individualistic of the source electrode. The two zones of influence may overlap without affecting the operation of the protective device.

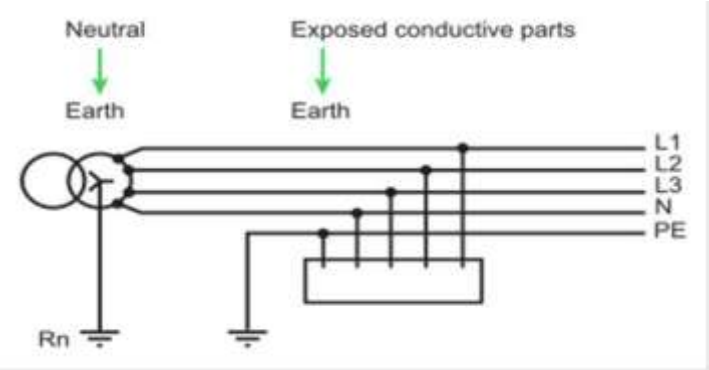

FIGURE 1: TT System

3.2 TN Systems (Exposed Conductive Parts Connected To the Neutral)

The source is earthed as for the TT system (above). In the installation, all exposed- and extraneous-conductive-parts are connected to the neutral conductor. The several type of TN systems are shown below.

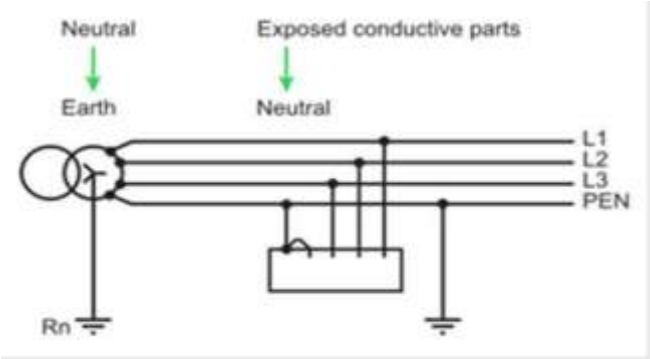

FIGURE 2: TN System

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3.3 IT System (isolated or impedance-earthed neutral)

No intentional connection is build between the neutral point of the supply source and earth Exposed- and extraneous-conductive-parts of the attachment are connected to an earth electrode. In practice, all circuits have leakage impedance to earth since no insulation is perfect. In parallel with this (distributed) resistive leakage path, there is the dispense capacitive current path, the two paths together constituting the normal leakage impedance to earth.

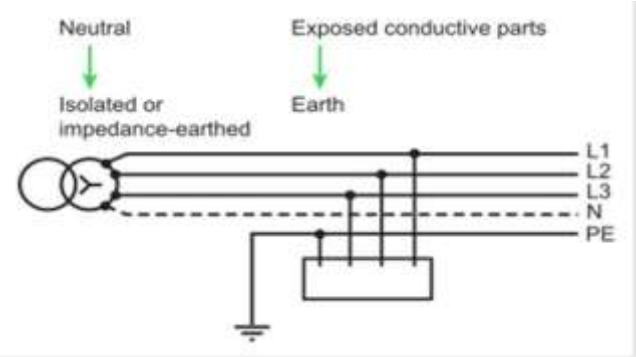

FIGURE 3: IT System

IV. EARTHING: ONE OF THE BEST PROTECTION SCHEME

4.1 Earth Resistance

The earth resistance should be minimum. If the earth resistance is high, the human body would be the lower resistance path for circulation of current and the motive of earthing is lost. The major donate factor to earthing resistance is the soil resistance whereas the other two factors are small fractions of an ohm and can be neglected for all practical purposes. Soil resistivity depends on the ground layers of soil and on the underlying geological formation

4.2 The moisture content of the soil

It has been noticed that resistivity is only moderately affected when the moisture content is above 20% .when the moisture content is below 20%, therefore an increase in resistivity and a decrease in moisture content.

4.3 Soil temperature

Soil resistivity increases with a decrease in temperature soil resistivity near a ground electrode depend on the amount of current that flows into the ground. This may affect the moisture and temperature levels of soil which then affect the resistivity of soil.

4.4 Earth pit location

Dry sand, gravel chalk, limestone, granite, and very stony ground should be avoided while selecting the constructing an earth pit. A site should be that it is not naturally well-drained. A waterlogged area is not essential unless the soil is sand or gravel. Charcoal, soft coke, sodium chloride (NaCl), sodium carbonate, calcium chloride, and copper sulfate salt are some of the most commonly used substances for this purpose.

4.5 Electrode material

Electrode material does not affect main earth resistance significantly. Appropriate precautions need to be taken while selecting the material so that it is resistant to corrosion in the type of soil in which it will be used.

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4.6 The Dimension of the Electrode

When pipes are used as electrodes, the resistance to the earth reduces drastically with the length for up to 2 or 3m (electrode length) [1]. When the diameter of the earth electrode is increased, there is an improvement in the mechanical strength of the electrode.

V. GROUND PENETRATING RADAR

One of in the main limits concerning the study of the singular process is a characterization of the pipe network (defining number, location, dimension, and connectivity of pipes. In this context, non-invasive sub-surface imaging using ground-penetrating radar (GPR) seems a promising technology. According to Jones [3], these natural pipes can be considered as the largest classification of macrospores and may develop subterranean networks with the greatest hydrological connectivity. In this, the ability of ground-penetrating radar's (GPR) to detect heterogeneous in soil interfaces has sharp variations in electromagnetic properties. When there is a sharp variation electromagnetic properties, as should be the case with pipes (air-cooled or water-soluble interface have strong electromagnetic contrast).

5.1 Field Equipment and Methodology

We used a time-domain GPR system (model SIR-20, Geophysical survey system,) as an on-ground GPR which was equipped with a transmitting (TX) and receiver (Rx) 400 MHz center-frequency bow-tie antenna system. The GPR transmitter antenna produces a Ricker type pulse with a frequency bandwidth of the 100-800 MHz. soil pipes act as discrete objects if crossed transversally, and hence they appear on radar grams as reflection hyperbolas. In this study, the latter was considered as the first sub-surface indicator of soil pipes[7], The second type of subsurface pipe indicator corresponded to singular reflection which was not hyperbolas.

VI. EARTHING-GROUNDING METHOD: A PRIMER

6.1 Connecting to Earth

Connection to earth minimizes the voltage difference between conductive metallic object and ground. Various methods are used to connect to the earth. The connection to earth is called the grounding or earthing electrodes. These connections can be divided into two groups. One group comprised man-made electrodes specifically designed for and used on used only for electrical connection to the earth. the connect of earth, and the electrode can be made using many different forms such as a rod, a loop of copper conductor, a plate, or a reinforcing bar or a length of copper conductor immersed in the concrete foundation. The resistance of the electrode to earth is made up of many components.

- The Resistance of the electrode.
- The condition of the soil
- The Moisture of the soil.
- The Temperature of the soil.
- Material content
- Types of soluble chemicals in the soil.
- The Concentration of soluble chemicals in the soil

To explore the connection to the earth and common 3m (9.8ft) long by 1.6mm (5.2ft). Diameter rod will be compulsive into virgin soil in a remote area unimpeded with underground metallic piping or other conducting materials.

6.2 Resistivity of Soil

The symbol for resistivity of the soil is, and it is measured in ohm-centimeter. Each type of soil will have an average resistivity. Moisture will have a temperature. Moisture and temperature of the soil become more stable at greater depths below the earth's surface. The soil resistivity will vary directly will the moisture content and inversely with temperature

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VII. CONCLUSION

Earthing is very important for the electrical system. We explained various types of earthing and major factor contributing to earthing resistance is the resistivity of soil. All earthing system will ensure equal protection to personnel against electrical shock as long as the system is properly designed, implemented by following the international and national standards. Sub-surface imaging using GPR seems a promising technique for soil pipe network characterization. It needs specific improvement in single processing, object detection, and system configuration GPR system must be used. This should be enhanced quality, quantity, and diversity of sub-surface information and this facility pipe network characterization.

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