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Measurement of Earth Value Using Earth Tester Measurement at Efarina University

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ABSTRACT

Grounding *refers* to the connection of an electrical equipment or installation to the ground so that it can protect humans from electric shock , and secure installation components from the danger of abnormal current voltages . This grounding system has low resistance properties, so that the overcurrent in the installation network can be flowed quickly to the ground to minimize damage to equipment in the building and protect the people inside. This study reviews the measurement of grounding around the earth at the efarina university. To find out the condition of the grounding resistance at each grounding, it is necessary to measure each grounding by measuring directly on the grounding installation network using an earth tester using an electrode pin . The calculation of grounding resistance is based on the type of soil, the depth of the electrode rod. The results show that the earth around the campus lobby has met the General Electrical Installation Requirements (PUIL) standard, which is smaller than 5 ohms. However, for earthing around the health faculty, it does not meet the PUIL standard, which is less than 5 ohms.

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1. INTRODUCTION

Grounding is a very important protection system in electrical installations, because it functions to remove excess current into the ground, so as to protect humans and electrical power system equipment. The grounding system is expected to have the smallest possible ground resistance value, because with a small resistance it can drain excess current directly to the ground. According to Puil Thanan the ground must be less than 5 ohms. Factors that affect the size of the grounding resistance in a place are the resistance of the grounding electrode, the resistance of the grounding electrode to the surrounding ground contact and the type of soil resistance. Earthing measurement is one of the important factors in an effort to safeguard and protect against overcurrent and overvoltage disturbances. The security system must be able to protect equipment and people. The grounding system is used as direct security in the event of disturbances along the power line. Therefore, it is necessary to frequently measure the ground resistance on each grounding rod in order to find out how much ground resistance is at the grounding rod point. In (PUIL, 2000), the factors that influence a good Electrical Earthing System include: Soil resistivity. This soil resistivity is related to the type of soil to which the electrical earthing system will be installed. In this study, research will be conducted on measuring the value of grounding using an earth tester at the University of Efarina.

A. Grounding (Grounding)

Grounding *is* a mechanism in which electrical power is connected directly to the ground (earth). As we all know that electric current occurs when there is a potential difference between two points. Electric current always flows from a point with a higher potential energy to a point with a lower potential energy . This happens the other way around with the direction of the flow of electrons flowing from a point with a lower potential energy to a point with a higher potential energy. Electrical energy or commonly referred to as electrical power is the product of the product of the electric voltage and the electric current. Electric current will always flow to a point that has resistance.

B. Measurement

Measurement is an activity to obtain quantitative data information. The results of the measurement can be in the form of information or data expressed in the form of numbers or descriptions that are very useful in decision making. In essence, this activity is to compare something with or something else. In electrical measurements there is also a comparison using tools (measuring instruments). In carrying out measurements, the method of measurement must first be determined. The method and implementation of the measurements are chosen in such a way that the existing measuring instruments can be used and the results obtained with the desired accuracy. The person who takes the measurement and the tools used are important elements that need to be considered in the measurement. In connection with this important matter, it is often necessary to pay attention to the conditions under which measurements are made, such as temperature, humidity, magnetic field, and so on. Important things to consider in electrical measurements are as follows: The measurement method must be correct, the measuring instrument must be in good condition, the operator must be careful, the recording of the measurement results.

C. Soil type resistance

Soil characteristics are one of the factors that absolutely must be known because they are closely related to the planning and grounding system to be used. In accordance with the purpose of earthing that the fault current must be evenly distributed into the soil as soon as possible, the investigation of the characteristics of the soil in relation to the measurement of resistance and soil resistivity is an important factor that greatly affects the magnitude of the earth resistance. In fact, the resistivity of soil varies in price, depending on the composition of the soil and other factors. The resistivity of the soil (Ωm) is the resistance value of the earth that describes the value of the electrical conductivity of the earth and is defined as the resistance, in ohms, between opposite faces of a one cubic meter cube.

The importance of this soil resistivity to be known because soil resistivity has several benefits, namely:

1. Some data obtained from subsurface geophysical surveys can help to identify mining sites, rock depths and other geological phenomena.
2. Soil resistivity has a direct influence on the corrosion of underground pipes. If the soil resistivity increases, the corrosion activity will also increase.
3. The resistivity of the soil layer has a direct influence on the earthing system.

When planning an earthing system, it is advisable to look for a location that has the smallest soil resistivity in order to achieve the most economical earthing installation. The balance factor between the earth resistance and the surrounding capacitance is the soil resistance, which is represented by . The price of soil resistivity in a certain depth depends on several factors, namely:

1. Type of soil: clay, sandy, rocky and others
2. Soil layers: layers with different or uniform resistivity
3. Soil Moisture
4. Temperature
5. Soil density

Soil types, such as sandy, rocky, clay and others affect the resistivity. Based on the General Requirements for Electrical Installation 2000 (PUIL 2000) the resistivity of soil types from various types of soil can be seen in the table below:

Table 1. Soil Type Resistance (PUIL 2000)

Type of soil	Soil Type Resistance (Ω-m)
Marshland	30
Clay	100
Wet Sand	200
Wet Gravel	500
Dry sand and gravel	1000
rocky ground	3000

In contrast to the standard above, the soil resistivity according to SNI 04.0225-2000 is shown in the table below.

Table 2. Soil Type Resistance (SNI 04.0225-2000)

Type of soil	Soil Type Resistance (Ω-m)
Marshland	10 - 40
Farmland	20 - 100
Wet Sand	50 - 200
Wet Gravel	200 - 3000
Dry sand and gravel	< 1000
rocky ground	2000 - 3000

D. Grounding electrode

The grounding electrode is a conductor that is embedded in the earth and makes direct contact with the earth. A non-insulated earth conductor embedded in the earth is considered as part of the earth electrode. A single-rod grounding system requires a grounding rod electrode embedded in the soil so that it will make direct contact with the ground. Non-insulated connecting conductors (such as copper wire) that are also embedded in the ground include grounding rod electrodes. The electrode used for grounding must meet several requirements, including:

1. Has a large enough conductivity so that it will not increase the dangerous local potential difference.
2. Has a mechanical hardness (strength) at a high level, especially when used in areas that are not protected against physical damage.
3. Resistant to melting from poor electrical connections, although the conductor will be exposed to a large fault current for a long time.
4. Resistant to corrosion.

The material used for the grounding rod electrode is a metal that has a fairly high conductivity, namely copper, in addition to getting a more economical value, galvanized steel or copper-coated steel can be used. The electrode rods are made of round metal rods or steel profiles that are driven into the ground and one end is tapered with a taper (45° ± 5°). The electrodes used in this study used rod type electrodes as shown in the figure below.

Figure 1. *Grounding rod*

E. Earth Tester

Earth Tester is a measuring instrument used to determine the resistance value or ground resistance, where the resistance on the ground needs to be known as a basis before grounding or grounding the electrical circuit system. In an electrical circuit, an earthing or grounding installation is needed which functions as a safety guard or protection against shock voltages, electric current leakage which can cause short circuits, and endanger humans. However, in an installation of grounding or holding an electrical circuit, data on the amount of ground resistance is required where the ground resistance / earthing is in accordance with the PUIL standard. Basically, Earth Tester measuring instruments are divided into 2 types, namely Analog Earth Tester and Digital Earth Tester. The digital earth tester is as shown in the image below.

Figure 2. *Earth Tester*

2. RESEARCH METHOD

Based on the study to be researched, namely the measurement of grounding values using an earth tester measuring instrument at the efarina university. *The flowchart* of this research is as shown in the following figure.

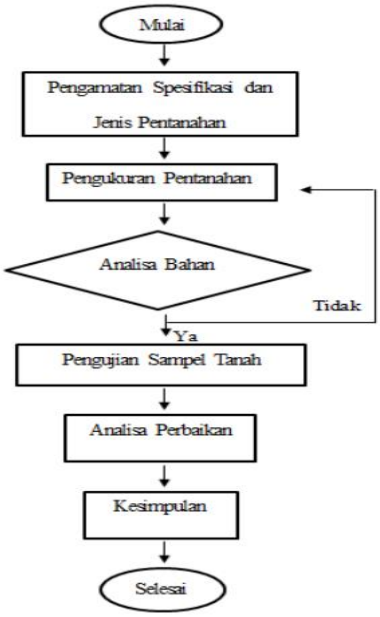

Figure 3. Research *flowchart* .

Measurement of grounding resistance using an earth tester as shown in the image below:

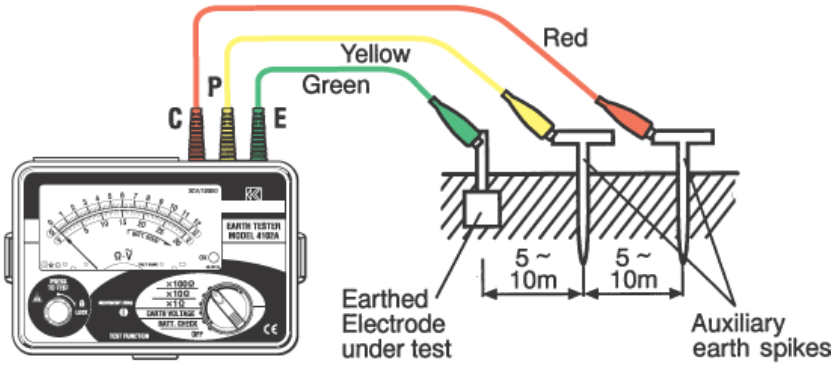

Figure 4. Measurement with *Earth Tester*

The steps for measuring grounding resistance using an earth tester are:

1. Provide a grounding earth tester
2. Plug in 2 T-shaped electrodes with a distance of 5 meters each
3. Connect the green test lead to the grounding wire with the earth tester clamp.
4. Connect the yellow test lead to iron T1 which is 5 meters from the green test lead
5. Connect the red test lead wire to the T2 iron which is 5 meters from the T1 iron or about 10 meters from the green test lead
6. Turn on the earth tester switch and select the range selector position in the 20 ohm position.
7. Record measurement results

3. RESULTS AND DISCUSSIONS

The results of grounding measurements carried out in the Efarina university complex include the campus lobby and around the health faculty as shown in the table below.

Table 3. Research Results

The place	Type of soil	Depth (m)	Resistance value (Ω)
Campus Lobby	Pebbled sand	0.5	10.5
		1	5
		1.5	3.4
health faculty	Clay	0.5	20
		1	14.8
		1.5	11.4

The results show that the earth around the campus lobby has met the General Electrical Installation Requirements (PUIL) standard, which is smaller than 5 ohms for an electrode depth of 1 - 1.5 m. However, for earthing around the health faculty, it does not meet the PUIL standard, which is less than 5 ohms.

4. CONCLUSION

This study discusses the measurement of the grounding value using an earth tester at the efarina university. The results of this study can be concluded as follows:

1. Grounding prisoners in the campus lobby are in accordance with PUIL regulations.
2. Grounding prisoners at the health faculties have not complied with PUIL regulations.

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