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Analysis Of Results Of Voltage Transformer Insulation Resistance Test On Bay Banda Aceh 1 And Bay Banda Aceh 2 Conductors At Ulee Kareng Substation

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ABSTRACT
Voltage transformers are one of the important components in an electric power system that functions to reduce the voltage from the transmission network to a lower level for measurement and protection purposes. The quality of the insulation of the voltage transformer greatly affects the reliability of the operation of the electric power system. Therefore, periodic insulation resistance testing is needed to ensure optimal insulation performance and avoid electrical interference. This study aims to analyze the results of the insulation resistance test on the voltage transformer used in the Bay Banda Aceh 1 and Bay Banda Aceh 2 conductors at the Ulee Kareng Substation. The test was carried out using a megger test tool with a method of measuring the insulation resistance between the primary winding and the ground and between the primary winding and the secondary. The measurement data were compared with applicable standards to determine the insulation condition of the voltage transformer. The results of the study showed that the insulation resistance values obtained from both conductors had variations that were influenced by environmental factors such as temperature and humidity. Based on the analysis carried out, most of the test results were still within safe limits according to IEEE and SPLN standards. However, there were several test values that were close to the minimum limit, which indicated insulation degradation that needed further attention. With this research, it is expected to provide information on the condition of voltage transformer insulation and recommendations for preventive actions needed to maintain the reliability of the electric power system at the Ulee Kareng Substation.

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INTRODUCTION

In human life, electricity is one of the basic needs that must be met, where in line with the growth of the era that continues to advance such as technological growth, industry to population growth, the need for electricity continues to increase every year. In this case, in order to always provide satisfaction to its consumers, the electricity industry such as PT PLN (Persero) in Indonesia is required to be able to protect the reliability of its electricity well so that it can always supply electricity according to consumer expectations. In

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electricity generation, the energy that has been generated will be distributed through transmission lines to the main substation and will be distributed to consumers through its feeders.

PLN as an asset sensitive company, where asset management makes a major contribution to the success of its business, needs to carry out asset management properly and in accordance with asset management standards. In asset management, strategic policies, regulations, guidelines, rules, supporting factors and competent implementers are needed in an integrated manner. PLN has set several provisions related to asset management. (PT.PLN, 2014). To maintain the lifetime of assets, equipment maintenance is needed, one of which is by testing the insulation resistance of voltage transformers. Voltage transformer is a device that transforms a higher system voltage to a lower system voltage for the needs of indicator equipment, measuring instruments and relays. (PT.PLN, 2014) voltage transformers have the same working principle as power transformers but the design of voltage transformers is different, namely, their capacity is small (10-150 VA) because they are used only on measuring instruments, relays and indication equipment that consume small data, and have a high capacity level and one end of the high voltage terminal is always grounded. Based on the background that has been described, it can be assumed that an analysis study or research is needed to see how the insulation resistance test parameters can overcome the breakdown of voltage transformer equipment in the Substation. So the researcher is interested in conducting the test in a writing entitled "Analysis of the Results of the Voltage Transformer Insulation Resistance Test on the Bay Banda Aceh 1 and Bay Banda Aceh 2 Conductors at the Ulee Kareng Substation"

METHOD

The research approach is a quantitative approach. The author will describe the feasibility of the insulation resistance, after analyzing the data information from the results of the insulation resistance test. The quantitative approach as a study that produces analytical information through calculation results, while this type of research is a descriptive type, namely in the form of written or oral words from people and attitudes that can be observed. The author is not required to form certain theories in advance regarding the aspects being studied, but the author can focus his attention on natural events as contained in the information produced. This study uses analysis, to obtain conclusions from the results of the research that has been carried out by the author. Because in this study, an analysis of the insulation resistance was carried out in accordance with the title of the research, namely "Analysis of the Results of the Voltage Transformer Insulation Resistance Test on the Bay Banda Aceh 1 and Bay Banda Aceh 2 Conductors at the Ulee Kareng Main Substation". This research was conducted at the Ulee Kareng Main Substation, Lamgapang Village, Krueng Barona Jaya District, Aceh Besar Regency. The research period is planned to last for approximately 2 (two) months, starting from data collection, insulation resistance testing, and data collection from the results of the insulation resistance testing. The initial stage carried out is the collection of insulation resistance test data. This data collection contains the results of CVT insulation resistance tests from several references related to the title of

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the research in the field, this source is obtained in the form of scientific papers, journals, books, or from the internet as support and to facilitate the author in completing this research. This research was conducted at the Ulee Kareng Banda Aceh Main Substation.

Figure 1 Ulee Kareng Main Substation Banda Aceh

Research methods are ways of techniques / descriptions of an analysis / calculation carried out in order to achieve a goal in research. The steps of this research method are:

1. Literature Study
   Literature study is the activity of collecting, reading, recording, and processing research materials related to a particular topic. Literature study is carried out by reading various books, journals, and other publications that are relevant to the problem and objectives of the research.
   The purpose of literature study is to reveal theories that are relevant to the problem being studied. These theories will then be used as reference material in discussing the results of the research. With several steps that can be taken, namely, determining the research topic and problem formulation, selecting library sources, tracing library sources, reading library sources, taking notes, and presenting literature reviews.
2. Data Collection
   Data collection is the process of finding and collecting information from various sources to answer research questions, test hypotheses, and evaluate results. The data collected can be in the form of numbers, symbols, codes, images, sounds, languages, and conditions.
3. Data Processing and Analysis
   Data processing and data analysis are processes carried out to change raw data into useful information that can be used to make decisions. The process of changing raw data into useful and easily accepted information is carried out after data collection. A systematic process for describing, interpreting, and processing data so that valuable conclusions can be drawn.

RESULTS AND DISCUSSION

This test is carried out starting from a series of insulation resistance testing tools, using a megger.

1. Primary-Ground CVT Insulation Resistance Test

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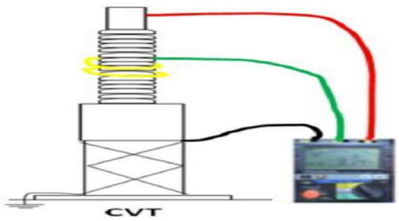

Figure 2. Primary-Ground CVT Insulation Resistance Test

On this Kyoritsu insulation resistance tester there are supporting equipment such as: red cable to CVT primary, black cable to CVT ground, green cable to wire wrapped around CVT insulator. By using the following tools and materials:

1. PPE: Helmet, Wearpack
2. Work Tools: Kyoritsu 3125

Table 1. CVT Phase R Insulation Resistance Test Results

Jenis Pengujian	Pengujian I	Pengujian II	Hasil Uji
Primer - Ground	91,4 GΩ	31,1 GΩ	Baik
Primer - Sekunder 1	62,3 GΩ	67,7 GΩ	Baik
Primer - Sekunder 2	53,6 GΩ	77,3 GΩ	Baik
Sekunder 1 - Sekunder 2	14,6 GΩ	13,7 GΩ	Baik
Sekunder 1 - Ground	14,4 GΩ	14,1 GΩ	Baik
Sekunder 2 - Ground	14,2 GΩ	15,1 GΩ	Baik

Figure 3. R Phase Test Results (Primary – Ground)

2. Primary-Secondary CVT Insulation Resistance Test

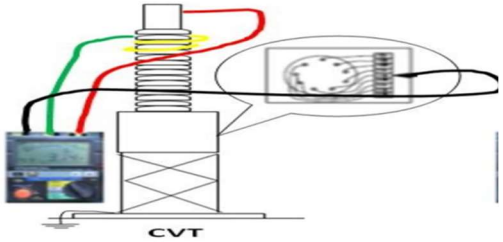

Figure 4. Primary- Secondary CVT Insulation Resistance Test

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On this Kyoritsu insulation resistance tester there are supporting equipment such as: red cable to primary CVT, black cable to secondary CVT, green cable to wire wrapped around CVT insulator. By using the following tools:

1. PPE: Helmet, Wearpack
2. Work Tools: Kyoritsu 3125

Table 2. CVT Phase S Insulation Resistance Test Results

Jenis Pengujian	Pengujian I	Pengujian II	Hasil Uji
Primer - Ground	660 GΩ	190 GΩ	Baik
Primer - Sekunder 1	31,1 GΩ	45,8 GΩ	Baik
Primer - Sekunder 2	26,3 GΩ	27,0 GΩ	Baik
Sekunder 1 - Sekunder 2	7,48 GΩ	7,32 GΩ	Baik
Sekunder 1 - Ground	0,0 GΩ	0,0 GΩ	Buruk
Sekunder 2 - Ground	0,0 GΩ	0,0 GΩ	Buruk

Figure 5. Results of S Phase Testing (Primary – Ground)

3. Secondary-Ground CVT Insulation Resistance Test

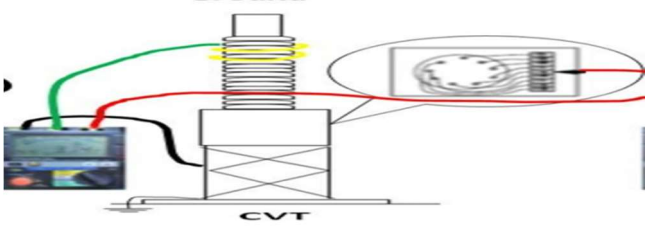

Figure 6. Secondary-Ground CVT Insulation Resistance Test

On this Kyoritsu insulation resistance tester there are supporting equipment such as: red cable to secondary CVT, black cable to secondary CVT, green cable is not used (conditional). By using the following tools:

1. PPE: Helmet, Wearpack
2. Work Tools: Kyoritsu 3125

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Table 3. CVT Phase T Insulation Resistance Test Results

Jenis Pengujian	Pengujian I	Pengujian II	Hasil Uji
Primer - Ground	310 GΩ	420 GΩ	Baik
Primer - Sekunder 1	26 GΩ	39,5 GΩ	Baik
Primer - Sekunder 2	91,4 GΩ	81,5 GΩ	Baik
Sekunder 1 - Sekunder 2	12 GΩ	13,1 GΩ	Baik
Sekunder 1 - Ground	12,8 GΩ	13,4 GΩ	Baik
Sekunder 2 - Ground	12,9 GΩ	13,3 GΩ	Baik

Figure 7. T Phase Test Results (Primary – Ground)

4. Secondary-Secondary CVT Insulation Resistance Test

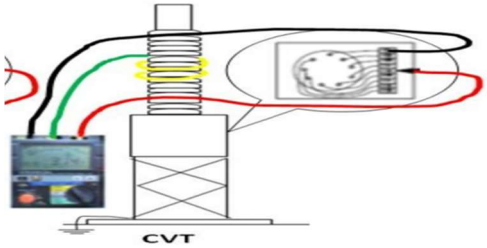

Figure 8. Secondary- Secondary CVT Insulation Resistance Test

On this Kyoritsu insulation resistance tester there are supporting equipment such as: red cable to secondary CVT, black cable to ground CVT, green cable is not used (conditional). By using the following tools:

1. PPE: Helmet, Wearpack
2. Work Tools: Kyoritsu 3125

CONCLUSION

The conclusion of the insulation resistance analysis in this study is: Based on the tests that have been carried out, the test results obtained are the average Gohm based on the provisions of the PLN SKDIR standard test of 1kv = 1 Mohm. With good equipment, the test can operate normally and produce good test data, so that it can avoid breakdown (bad test results). The suggestions from the insulation resistance analysis in this study are: From the results of the research that has been done, if the test results are below 1 Mohm, it is

recommended to clean it. However, if it has been cleaned but still experiences the same thing (bad test results), then a new tool will be replaced.

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