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# PERFORMANCE INSULATOR COVER TYPE : YSL-70-AP POST VOLTAGE BREAK DOWN TEST

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***Abstract.*** Electrical energy affect to economic, electrical energy consumption will increase and decrease likely economics. In this globalization era, electricity consumption was increased trend yearly since industrialization era. The reliability Electrical energy is very important for economic growth. The lower SAIDI and SAIFI is the bench mark for reliability of electrical energy supply. The reliable of insulator cover type: YSL-70-AP affect to the reliability electrical distribution energy on over head distribution circuit. Insulator cover protected to over head distribution circuit againt animal, bird, tree ang other temporary disturbance. Insulator cover also to protect half insulated medium voltage cable againt partial discharge and flashover. Over voltage stress more often during operation, to impact to the material insulation performance. This quantitative research founding: insulator cover type: YSL-70-AP still feasible to use after voltage breakdown stress. The fault current is still under the maximum allowable leakage current (11,600 micro ampere) which is 41.61 micro ampere, and breakdown voltage is still higher than minimum that specified (24 kilo volt), which is 49.63 kilo volt. Post breakdown voltage the material insulation performance of insulator cover type: YSL-70-AP is good, and reliable to continuous operation over head distribution circuit.

*Keywords : Cover, breakdown, performance.*

## 1. INTRODUCTION

Energy consumption in globalization can also go up and down and may not always increase yearly, although it tends to increase in period 1992 to 2011 [1]. Energy consumption includes: oil, electricity and others. The world economic activity strongly influenced by electrical energy consumption. There was bidirectional causality between economic growth and electricity consumption [2]. Indonesian Economic growing also need electricity growth. Electricity growth includes: capacity and reliability.

There are several problems to reliability of electricity. The remote power plant impacted the problems. This reliable system is designed to guarantee the electrical energy availability. Systems standard that meet reliability and secure operation, consumer rights protection, the National Electricity Company (PLN) benefit, and economic growth. Electricity System reliability measured by the lower of SAIDI and SAIFI value [3].

The height SAIDI and SAIFI is caused by many disturbances. Disturbance in the electrical distribution can be caused by abnormal equipment and by nature. That disturbance can be supply over voltage condition. Over voltage over than equipment capacity, can damage equipment in the electric power distribution system. Continuity of operation after temporary voltage breakdown stress will only occur if the isolation performance is still in provided to protect in normal voltage. The general principle of insulation co-ordination requires a reasonable margin between the voltage level held by the protective device (the protectable level) and the various basic levels themselves to insure that adequate protection is provided [4].

This research is very important to answer, the insulation cover performance after breakdown voltage stress. In this study the breakdown voltage was simulated in the test of breakdown voltage of the insulation cover. The good electrical insulation for medium voltage performance is more than 100 mega ohm [5]. Based on this, insulator cover post voltage break down stress must also have insulation resistance more than 100 mega ohm. After voltage

break down stress the voids and oxidation cover insulator is not increase, because the performance of electrical insulation is strongly influenced by high oxidation, voids, and a mixture of non-homogeneous [6].

## 2. METHODS

This research is quantitative research trough value measured, calculation and analysis. The formulation of these problems will be discussed by samples testing of post voltage breakdown stress tested to Insulator Cover type : YSL-70-AP at the high voltage laboratory of Malang Brawijaya University. The test results analyzed statistically and mathematically to obtain resistance and voltage breakdown value, comparing to the standard, and than taken conclusions.

This research was conducted by measuring three samples post voltage break down tested. The three samples is the samples were taken from laboratory after voltage break down stress tested. Before first voltage break down stress, the samples randomly taken in PT. Adi Putra warehouse.

In this study, the observed magnitude of voltage test, leakage current and the breakdown voltage post voltage break down tested. Transformer tester is the source of voltage test in this study. Leakage current is the value of current flowed in to the sample test, due to discharged test voltage. The breakdown voltage is the value of voltage at the time of insulation failure.

Electrical test voltage against minimal insulation is tested with a voltage equal to the operating voltage. the minimum voltage for testing 20 KV equipment is 20 KV. The source of voltage test is variable step-up transformers. The value of this study is measured by volt meters and ampere meters. The ampere meter protected from over current with parallel spark gap. All material and equipment are connected to grounding system for securely process. Tested are made between phase and grounding.

For current leakage tested, each test sample (insulator cover post voltage break down stress tested) is placed between the electrodes of the AAAC conductor, the first electrode is given a 50 Hz AC voltage and the second electrode is grounded trough ampere meter. The voltage at the first electrode is increased step by step from 5 KV until 25 KV. Every 5 KV step, current leakage was measured with ampere meter. That current leakage tested process are repeated three time for each sample.

For breakdown voltage tested, one by one sample (insulator cover) is placed between two electrodes. The electrode made from the AAAC conductor. The first electrode charged by a 50 Hz AC voltage and the second electrode is grounded directly. The voltage at the first electrode is increased step by step, until the beginning of the corona, until a breakdown and this voltage is recorded as a breakdown voltage.

Data from the measurement are processed quantitatively. The resistance value result by the value of the test voltage divided by the leakage current. The average value is all resistance results are summed, then divided by the amount of data.

The value of the breakdown voltage obtained by summing the value of breakdown voltage measurement, divided by the amount of data. In this way, the insulator cover breakdown voltage rate obtained.

## 3. RESULTS AND DISCUSSION

### 3.1 Result

Unlimited resistance is a perfect insulating material. In the reality no once material is a perfect isolator. So many problem infected to the insolation, that are: material, production process, saving behaviour, shipping, installing process, operating dan disturbance [6]. One of the disturbance is breakdown voltage discharge. Breakdown voltage discharge results in excessive heat stress on to insulation materials. Age and heat stress will be decrease the insulator performance [7]. All electrical insulating materials flowed by current. That is leakage current trough insulation material. This problem justify that the resistance of insulating material is not unlimited. The value of insulation material resistance according to Ohm's Law is voltage divided by leakage current equation below.

$$R=V/I \quad (1)$$

Remark:
R = Insulating Resistance (M Ω)
V = Voltage charge due the sample (K V)
I = Leakage Current (μ A)

The result of this research described by figure and table. The data post voltage break down stress test collected by measured voltage between conductor and electrode test, and current leakage trough conductor-sample post voltage break down -electrode test-ampere meter, like describe at Figure 1. Voltage breakdown test just measured voltage between conductor and electrode test insulated by sample post voltage break down, and without ampere meter to measure the current, like describe at Figure 2.

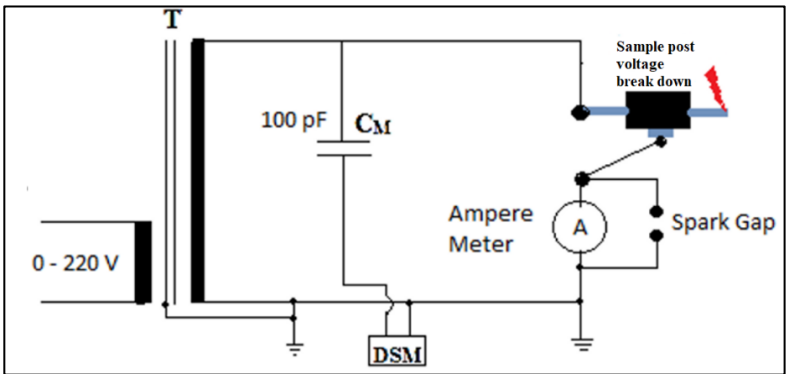


Figure 1. Post Voltage Break Down Current Leakage Test

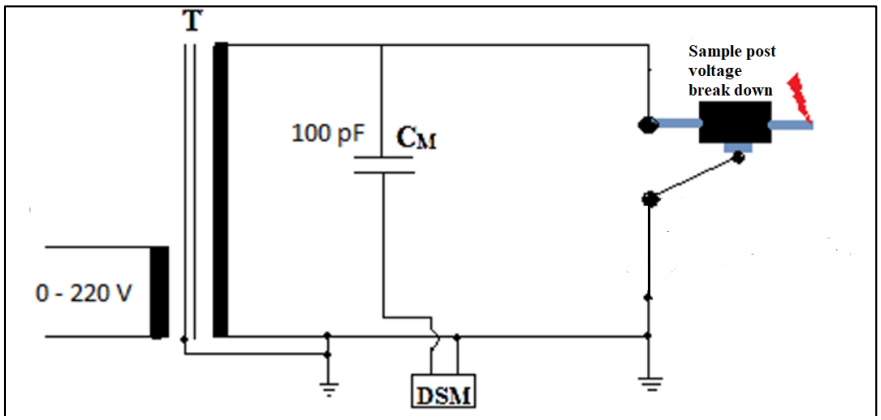


Figure 2. Post Voltage Break Down Voltage Break Down Test

The voltage value to charge at flash over discharge is noted voltage breakdown. Data noted from value displayed at measuring equipment like volt meter and ampere meter. The data analyzed by formula :

$R=V/I = 5.28/16.82 = 316.18$ M Ω

The other data analyzed with the same role. The data and output analysis is describe at the table 1.
Table 1. Data And Analysis Insulation Resistance Of Insulator Cover Type : YSL-70 AP Post Voltage Breakdown Stress.

| Voltage (k V) | Leakage Current (μ A) | Resistance (M Ω) |
|---|---|---|
| 5.18 | 16.12 | 322.48 |
| 10.37 | 33.30 | 313.06 |
| 15.43 | 50.47 | 308.20 |
| 20.03 | 70.70 | 285.93 |
| 24.11 | 108.89 | 225.27 |
| Temperature (°C) | | 24.56 |
| Humidity | | 74% |
| Pressure (m BAR) | | 954.67 |
| Voltage corona (k V) | | 23.93 |
| Voltage Breakdown (k V) | | 49.53 |
| Average resistance (Ω) | | 290.99 |

Like describe on the tabel 1, if voltage test are increase, he leakage current also increase. Figure 3 was display that increase.

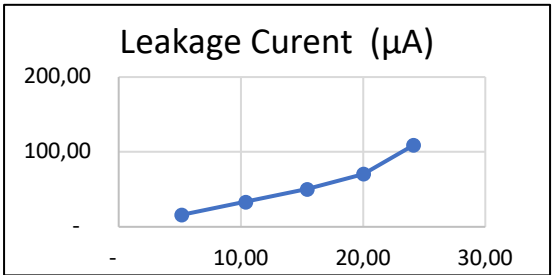


Figure 3. The Current Leakage Vs Voltage Test Post Voltage Break Down Stress

### 3.2 Discussion

Based on Table 1, the value of insulation resistance of the insulator cover post voltage break down stress is obtained as follows: 322.48; 313.06; 308.20; 285.93; 225.27; M Ω. The average results are 290.99 M Ω. If Cover Insulator Type YSL-70 AP post voltage stress continuous operated on 20 KV system, the voltage phase to ground is : $20/\sqrt{3} = 11.6$ KV. When there is a ground fault disturbance by temporary interference, the ground fault current post voltage break down stress are : 11,600/290.990,000 = 39.86µA. The interference current is 39.86µA, only 0.34% from the allowable maximum leakage current its mean 1,000µA/KV x 11.6 KV =11,600 µ A.
Based on Table 1, the breakdown voltage of 49.53 KV is obtained. Resistance to breakdown of 49.63 KV is equal to 206,38% higher than that specified in SPLN 1: 1995. This study found that after breakdown voltage stress, isolators cover are still feasible to use continuously in over head distribution system with AAAC or AAAS-S conductors.

## 4. CONCLUSION

Based on the results of the research and discussion, conclusions of performance insulator cover post voltage breakdown stress disturbance, can be drawn as described. The insulation resistance of insulator cover type : YSL-70AP post voltage breakdown stress disturbance is increase from 278.80 M Ω to 290,99 M Ω. The breakdown voltage of insulator cover type : YSL-70AP more decrease from 49.63 KV to 49.53 KV. Insulator cover type : YSL-70AP is still reliable to cover the pin post insulator on 20KV over head distribution system after voltage breakdown stress disturbance, because: (a) The fault current is still under the maximum allowable leakage current (11,600 µ A) which is 41.61µA; and (b) Breakdown voltage is still higher than minimum that specified (24 KV), which is 49.63 KV.

Based on the results of this study, there are many suggestions as describe: (a) PLN must utilize Insulator cover type : YSL-70 AP optimally, because the results of this study indicate the performance after voltage breakdown stress disturbance still feasible to use continuously. (b) For further researchers, further research needs to be done, how many times the voltage breakdown can be held by insulator cover type : YSL-70-AP, but still reliable to use continuously.

## 5. ACKNOWLEDGEMENT

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## 6. REFERENCES

[1] Bayar. Limas and Hasan Alp Ozel, “Electricity consumption and economic growth, in emerging economic,” Scientific Paper, Vol. IV, Issue 2, April 2014.
[2] Bayar. Limas and Hasan Alp Ozel, “Electricity consumption and economic growth, in emerging economic,” Scientific Paper, Vol. IV, Issue 2, April 2014.
[3] Math H. Bollen, “Understanding power quality problems:voltage sags and interruptions,” Wiley-IEEE Press, ISBN:9780470546840, 2000.
[3] McCarley S., T&D Protecting Wildlife and Minimizing World Magazine, Outages, Sep 05, 2013.
[4] IEEE, Standard basic impulse insulation levels, Electrical Engineering, Vol: 60 Issue 3, March 1941.
[5] Sanjay Gothwal, Kaustubh Dwivedi, and Priyanka Maheshwari, “Partial Discharge Characteristics and Insulation Life with Voltage Waveform,” International Research Journal of Engineering and Technology (IRJET), Volume: 05 Issue: 07 July 2018.
[6] Alan Melo, Manuel Martinez, dan Alvaro Antonio Alencar De Queiroz, Analysis of the XLPE Insulation of Distribution Covered Conductors in Brazil, Journal of Materials Engineering and Performance, February 2014.
[7] Catalin Rusu-Zagar, Petru V. Notingher, and Cristina Stancu, 2014, Ageing and degradation of electrical machines insulation, Journal of International Scientific Publications: Materials, Methods and Technologies, Volume 8, ISSN 1314-7269 (Online).