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An Increasing Insulation Resistance of Poly Vinyl Formaldehid (PVF) Wire in Avoiding Voltage Breaking Electrical Installations

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ABSTRACT
The development of industry in Indonesia has experienced a fairly rapid capacity in recent years, in line with that, many problems have arisen. To overcome these problems, it is necessary to test the results of an industrial product in order to determine the properties of the materials produced so that the results of a product can be used in accordance with good standards and quality. Testing is also useful in preventing harm to humans and the surrounding environment caused by breakdown of cable insulation. So that repeated tests are very good in the selection of conductors to be used. Every industrial product material before being used as part of an equipment, for example for transformer coils, must be tested based on predetermined standards. This is so that the dielectric properties of these materials can be known from the test results, so a conclusion will be drawn whether the material is suitable for use or not.

Keywords : ***Vinyl Formaldehid(PVF), Voltage, Electrical Solution***

INTRODUCTION

Industrial development in Indonesia progressed quite rapidly in recent years. in line With that, many problems arise. To solve this problem it is necessary held testing to results industrial products to determine the properties of the nature of the material produced so that the results a product can be used according to with quality standards good.

Beside Thing the results testing also useful for preventing danger to humans and environment surrounding, which due to the breakdown of the cable insulation. For this reason, each material used as part of a industrial production materials before equipment transformer predetermined standards. It is intended that the materials it can be known the properties dielectric from the test results, then a conclusion can be drawn whether the material is suitable for use or no.

LITERATURE REVIEW

Insulation.

Insulation is a material property that can electrically separates two or more adjacent conductors so there is no leakage current. The insulation is designed for could used continuously on voltage 10-15% higher than allowable voltage, this is done to maintain the possibility of voltage changes during operation, and has the strength to ensure the required safety factor.Failure can occur due to deterioration of insulation or due to a breakdown in the parts In general, insulating materials are very difficult to know their dielectric properties.

Electrical Insulation Material ClassificationClassification of Electrical Insulating Materials with respect to temperature can be seen in the table below:

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Table 1. Electrical Insulation Material Classification

Class	Max Temperature (^{O}C)
Y	90
A	105
E	120
B	130
F	155
H	180
C	>180

PVF Wire Insulation

One of polymer material isolation used is insulation material which manifold PVF (polyvinyl formadehid) ingredients this can in can with the formulation process (formaldehyde) of polyvinyl chloride and the methanol produce polyvinyl formaldehyde (PVF). Because This isolation has electrical insulation and adhesion the good one with metal used as layer isolation electricity after mixed with alkyfenal (insulated cable formal) PVF(polyvinyl formadehyd) have good qualities in custody against chemical oil water heat and abrasion degraded with increasing temperature. The insulation properties of this type of PVF (polyvinyl formaldehyde) can be seen in Table 1 as follows:

Table 2. PVF – Type Insulation Properties

Polyvinyl FORMALDEHYD (PVF)	SIMAN
Specific Grafity 1.2 – 1.4	90
Tensile Strength (KGF/M_2)	6.5 – 8.4
Strength Impact (KGF/CM/CM_2)	7 – 11
Extend (%)	2.2 – 4.2
Volume Resistance (Ω - CM)	10 - 15
Strength Break Dielectric (KV/MM)	12 - 14
Dielectric Constant (10Hz)	3.0
Absorbtion Water (24j. 3MM THICK %)	0.8

Copper Wire Conductor

A conductor is a material with low resistance to the passage of electric current in a cable means a wire that is electrically continuous or wires forming a conduction section Metallic copper that has good electrical and thermal conductivity, good mechanical properties, is resistant to connection rust. Conductors made of copper have a special ability to carry high electric currents which are strengthened to maintain flexibility.

Breakthrough Voltage

There is a sudden change in an isolation from a non-conducting state to a conductive state when the insulation is exposed to a sufficiently strong electric field this change can result

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in damage here which we callleak electricitytemporary isolation working as protector tools from isolation this is called insulator. Incident failure something ingredient isolation in doing function called break down and The voltage that causes this breakdown is caused by a breakdown voltage or down voltage.

Table 3. Wire Diameter Size

Size Factory Diameter Wire (mm)	Heavy (Grams) (p=50cm)	Measurement Result	
		With Isolation	Without Isolation
0.80	2.215	0.89	0.80
1.00	3.500	1.11	1.00
1.10	4.146	1.21	1.10
1.20	5.900	1.32	1.21
1.30	6.850	1.41	1.29
1.40	8.850	1.50	1.39
1.50	8.150	1.62	1.50
1.60	8.975	1.72	1.60
1.70	10.100	1.79	1.70
1.80	11.445	1.92	1.81

Data of Breakdown Voltage Test Results for Copper Conductors is shown in Table 4 as follows:

Table 4. Rated Breakthrough Voltage

DIAMETER WIRE (mm)	VOLTAGE Translucent (KV)
0.8	12
1.0	20
1.10	18
1.20	15
1.30	11
1.40	20
1.50	12
1.60	14
1.70	18
1.80	14

RESULTS AND DISCUSSION

The data processing of the test results is intended to be in accordance with the purpose of the test, namely examining the thickness insulation, conductor diameter conductivity pinhole breakdown voltage and can determine the nature of the voltage condition with a description of the processing from the test results of the calculation of wire resistance (Rx) Calculation of

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conductor resistance based on temperature experiments where the magnitude of the conductor resistance at a temperature of 20^{0}C can be formulated as follows:

$$R_{20} = Rx \left[\frac{234,5 + 20}{234,5 + Tk}\right]$$

$$R_{20} = Rx \left[\frac{Rx + \alpha}{1}\right] \text{x } 1000$$

Where :
Rx = conductor resistance
Tk = room temperature
I = length of test wire
A = resistance temperature coef

From the magnitude of the conductor resistance at a temperature of 750C can be formulated as follows:

$$R_{75} = \left[\frac{234,5 + 75}{234,5 + 20}\right] + R_{20}$$

Based on the test data, we can get the resistance at a temperature of 200C and 750C, where for the test wire the length of 50 cm is taken as follows:

For Rx = 0.0174765 , at t = 240C, where = 0.981

Then the resistance at 20^{0}C and 75^{0}C, Resistance at 20^{0}C is:

$$R_{75} = \left[\frac{234,5 + 75}{234,5 + 20}\right] \text{x } R_{20}$$

$$R_{75} = \left[\frac{234,5 + 75}{234,5 + 20}\right] \text{x } 34,289\ \Omega / Km$$

$$R_{75} = 41,699\ \Omega / Km$$

$$R_{20} = \frac{Rx.\ \alpha}{1} \text{x } 1000$$

$$R_{20} = \frac{0,0174765\Omega\ x\ 0,981}{0,5\ m} \text{x } 1000$$

$$R_{20} = 34,289\ \Omega / Km$$

For Rx = 0.01114 , at t = 28.50C, where = 0.966

From the results of the calculation of temperature conditions 750C above it can be concluded that the resistance of the copper conductor for a diameter of 0.8 mm is still below the standard, that is, it does not exceed the resistance of 42,081 Ohm/Km.

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From the results of the above calculation that the resistance at a temperature of 200C and 750C is still below the standard as shown in the table below:

Table 6. Data of Contuctor Resistance Calculation Result

Diameter Conductor (mm)	Temperature 20^oC		Temperature 75^0C	
	Prisoner Conductor Max Standard	Prisoner Conductor Result Measurement	Prisoner Conductor Max Standard	Prisoner Conductor Result Measurement
0.80	36.08	34,289	42,081	41, 699
1.00	23.33	21, 522	26,931	26,173
1.10	19.17	18,154	22,277	22,077
1.20	16.04	14.738	18,709	17,923
1.30	13.61	12,935	15,943	15,730
1.40	11.70	11,086	13.746	13,481
1.50	10,16	9,372	11,971	11,397
1.60	8,906	8,470	10.523	10,300
1.70	7,871	7,538	9,321	9,167
1, 80	7,007	6,588	8,313	8,011

The calculation results for a wire length of 0.5 m, the conductivity of the wire is as follows:

Table 7 Large Conductivity for 0.5 Meters of Wire Length

Diameter Wire (mm)	□ Rx	Heavy (grams)	temperature (0C)	□ (%)
0.80	0.0174765	2,215	24.8	100.8
1.00	0.1114	3,500	28.5	101.5
1.10	0.0093579	4.146	27.6	101.7
1.20	0.0076841	5.115	30.3	101.5
1.30	0.0066472	5,900	27	101.4
1.40	0.00576245	6,850	30	100.9
1.50	0.00490715	8,150	32	100.3
1.60	0.00441615	8,975	30.5	100.6
1.70	0.003874	10,100	27	100.6
1.80	0.0034353	11,445	30.5	101

CONCLUSIONS

From the test results it can be concluded,

1. Based on the isolation function, it is absolutely necessary and very important for its function in the field of high voltage engineering and the use of electric power.
2. A balanced quality of insulation is obtained from repeated tests. Many insulating materials are made with limited thickness, in fact there is a lot of truth showing that the

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dielectric force of an insulating material rarely increases, even always decreases with an increase in the thickness of the insulation. When tested in a non-uniform field.

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