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SEE 4722

**FAKULTI KEJURUTERAAN ELEKTRIK
UNIVERSITI TEKNOLOGI MALAYSIA
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**INSTITUT VOLTAN DAN ARUS TINGGI (IVAT)
PROBLEM (Experiment 01)**

**Effect of Contamination to the Dissipation Factor Properties
for Measuring Breakdown Voltage of Glass Insulators**

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Introduction:

Insulation is a main subject in high voltage engineering. It plays an important role in maintaining the performance and the safety of the electrical power apparatus. Electric power supply should ensure reliability and continuity to the utility concerned, hence the power lines and sub-stations are to be operated and protected against overvoltages such that the numbers of failures are as few as possible. At the same time, the cost involved in the design, installation and operation of the protective devices should not be too high.

Insulators not only must have sufficient mechanical strength to support the physical loads, but must be so designed to withstand severe electrical and environmental stresses without mechanically failing. It has been reported that most of the electrical power supply breakdowns are due to the insulation failure. For proper design and safe and reliable operation of the insulation system, knowledge of the physical and chemical phenomena which determine the dielectric properties of the insulating material is very important.

Most of high voltage insulators are being used in outdoor applications. Environmental pollution can cause the insulators to become progressively coated with dirt and chemicals in the long run. The contamination level of the insulator is determined from the Equivalent Salt Deposit Density (ESDD). Under high electric field stress, the level of leakage current (LC) varies with the contamination level of the insulator. These LC and ESDD will influence the insulation performance as well as the dielectric properties of the insulator.

Problem Statement

You are working as an engineer in the Transmission and Distribution Unit of an electrical power supply company. Your tasks are to monitor the insulators performance as well as to identify the caused of insulator failure of the systems. One day, a major flashover had occurred at one of the 275 kV overhead transmission line insulators that installed in the area where the higher contaminated environment is observed. This unexpected breakdown was causing surprise to the company because there is no thunderstorm during the incident and also the insulators was used just three years in service. You have asked the technicians to take out the faulty insulators to study the caused of flashover. You are given four weeks by the head of maintenance and safety group to explain the caused of failure and submit a report to the top management of the company. Based on your findings, they will take an appropriate action in order to avoid this phenomenon to be occurred again.

Trigger

The level of insulation performance can be obtained by measuring several dielectric properties and physical parameters values such as;

- Breakdown voltage
- Leakage current
- Dissipation factor ($\tan \delta$) or Power factor
- Capacitance or permittivity
- Resistivity
- ESDD (shows the level of contamination)

- 1) What is the definition of such dielectric properties and how do you relate with the performance of the insulator?
- 2) How do you measure the dielectric properties and the level of contamination of the insulator?
- 3) How the process of degradation occurs which leads to the surface flashover of contaminated insulators?
- 4) What should you do so that the insulation performance can be maintained in good condition for the long run?