ANALYSIS OF SURFACE FLASH OVER OF 33 kV INSULATOR DUE TO SALINE POLLUTION

A Dissertation submitted to the
Department of Electrical Engineering, University of Moratuwa
in partial fulfillment of the requirements for the
Degree of Master of Science

by
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Abstract

Ceylon Electricity Board (CEB) has the responsibility of Transmission, most of the Generation and Distribution of electric power in Sri Lanka. Contamination-driven insulator failure is a problem that incessantly plagues distribution systems. It erodes power quality and diminishes system reliability. Contamination levels can continue to grow unless abated by natural cleaning or if not taken measures to wash insulators at the distribution level in a preventative maintenance mode. When contamination is combined with moisture, a pollution layer forms and provides a path for leakage current to flow. Increases in contamination severity result in heightened levels of leakage current activity.

As a result of rapid development and growth of populated areas, several high voltage power transmission systems operating at various voltages up to 132 kV have been put into service and flashover difficulties with insulators of these systems caused by pollution of different types have been experienced. Not only the transmission network but also the distribution network of 33kV, running in coastal belt, has experienced frequent insulator flashover making a burden to the maintenance Engineers.

In order to assess the pollution behavior of insulators in the distribution network, 33kV pin type insulator was selected as a sample insulator and been subjected to natural pollution at three selected localities for considerable period. The naturally polluted , insulators have been subjected for conductivity test and by which the equivalent salt deposit density (ESDD) which points out the pollution severity is calculated. Subsequently, artificially contaminated insulators of different pollution severities were tested for power frequency and impulse test in the High Voltage Laboratory of University of Moratuwa.

To better understand the progression of insulators from a healthy state to failure, the flashover voltage (FOV) of insulator must be studied. This study was focused on the following key areas.

- Experiment of 33kV Pin Insulator contamination severity based on Zone categorization (Zone-I, 2 and 3)

• Prediction of surface flashover voltage of Insulators over ESDD and tabulate the figures for reasonable ESDD values.

• Streamline the process of Insulators treatment under preventive maintenance.

• Review the levels of insulator's specific creepage distances placed at different pollution severity in Sri Lanka co-relating with IEC regulation.

Experimented results state that insulator contamination level improves over the duration in ad hoc basis and could be utilized to build up a trend curve to predict a relationship against the insulator exposure duration. It is recommended that insulators in Zone 1 have to be treated after 8 months from the date of last treatment and those in Zone 2 & 3 to be treated after 18 months under preventive maintenance to get away from flashover.

It is also recommended to review the required specific creepage distance of insulator installed in non-polluted areas due to the fact that the current practice of insulators placement in all over is with specific creepage distance of 25mm/kV which is recommended for high polluted zones as per IEC regulation.

DECLARATION

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated.

It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

UOM Verified Signature

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Date: 25th January 2010

We endorse the declaration by the candidate.

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