MEASURES TO REDUCE TRANSFORMER FAILURES IN THE DISTRIBUTION NETWORK OF CEB

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by

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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.

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Abstract

Ceylon Electricity Board (CEB) has many transformer installations in its distribution network, with their capacities ranging from 100 kVA to 1000 kVA. The latest transformer designs are very much simplified and optimized. Due to the vast spread in the distribution network and practical constraints in employing high end protective devices, these transformers more frequently undergo adverse impacts imposed by the condition of the network and by the nature. These transformers are nowadays manufactured to operate almost without supervision. A high failure rate of nearly 3% per year (out of approximately 20,000 installed transformers) could be observed. When added up the cost due to loss of transformers, the overall loss becomes nearly one billion rupees per year. Although most of the causes contributing for these failures are thought beyond our control, it is investigated and found that this failure rate can be drastically reduced by merely following better erection practices.

This report discusses many causes for distribution transformer failures and elaborates on measures that can be adopted for reducing transformer failures, mainly through proper erection practices.

Existing transformer installations are studied and analyzed to see whether the present auxiliary gear used, lead connecting methods followed and earthing done are acceptable for proper functioning of transformers. It is analyzed and shown that the earthing method practiced presently on MV transformer installations is not effective. A research which has been initiated to determine an improved earthing system is introduced and discussed in this report. Conclusions of this research would be arrived after a careful study.

Studies are carried out to determine the most probable lightning pattern in Sri Lanka and their effects on the distribution network, especially on transformers. A transient waveform simulation is done to observe the voltage stresses exerted on transformers for few selected installation arrangements. This is further expanded to carry out a sensitivity analysis to observe the behavior of voltage stresses under different types of lightning surges. A better installation practice is thereby proposed.

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