

**MINIMIZATION OF TRANSFORMER FAILURES DUE
TO LIGHTNING SURGES BY INTRODUCING AN
ELECTROSTATIC SHIELD IN THE HT WINDING**

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University of Moratuwa, Sri Lanka.
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Department of Electrical Engineering

University of Moratuwa
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Supervised by: Eng. W.D.A.S. Wijayapala

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April 2014

DECLARATION

“I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other university or institute of higher learning and to the best of my knowledge and belief. It does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The above candidate has carried out research for the Masters Dissertation under my supervision.

.....

Signature of the supervisor

Date:

(Eng. W.D.A.S. Wijayapala)

ABSTRACT

The MV Distribution Network of CEB is frequently exposed to lightning and it is the main suspected reason for transformer failures. Appreciable number of transformer failures occurs due to insulation failures notably at points near line ends. The short rise time of a surge prompted by a lightning impulse can cause deterioration in the insulation and ultimately lead to a dielectric breakdown. The voltage distribution along transformer HV winding becomes non-linear under surge conditions due to the capacitive currents. This research focuses on the possibility of neutralizing this effect with the aid of an electrostatic shield inserted in to the HV winding.

The comparison of the behavior of the winding under surge conditions with and without electrostatic shield requires appropriate transient models suitable for simulations. The necessary calculations required for this purpose were carried out and the proposed models are presented. The simulations were carried out with PSCAD software and the results are included in this report. The oscillatory nature due to the combined effect of capacitors and inductors is observed in the wavetail region and some of the peaks created have potentials exceeding the peak potential of the surge waveform as well. The simulations revealed the reduction of stresses when a shield was used.

The proposed transformer model have a definite positive effect compared with the available model as the results obtained by simulations clearly reveal the reduction of the stresses on the transformer HV windings when a shield is used.

Key words : Electrostatic Shield, Surge, Winding, Capacitance, Transformer



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LIST OF ABBREVIATIONS

CEB	Ceylon Electricity Board
LTL	Lanka Transformers Pvt Ltd
HV	High Voltage
MV	Medium Voltage
LV	Low Voltage



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