

**STUDY OF OPTIMAL LOCATION FOR
CAPACITOR INSTALLATION
IN A 220/132/33 kV
GRID SUBSTATION**

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

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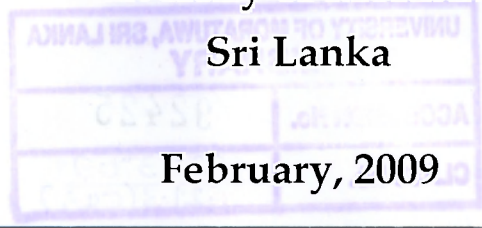
by

W.M.S. DEEPIKA WIJESINGHE

Supervised by: Dr. J P Karunadasa



Department of Electrical Engineering
University of Moratuwa,
Sri Lanka



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UOM Verified Signature

Name of the candidate: W.M.S. Deepika Wijesinghe

Date: February 12, 2009

I endorse the declaration by the candidate.

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10/07/09
Name of the Supervisor: Dr. J P Karunadasa

Date:

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Abstract

In the island wide transmission network of Ceylon Electricity Board, there are 33kV Breaker Switch Capacitor Banks at twelve locations for improving the efficiency and quality of power.

The capacitor bank installed at Pannipitiya Grid Substation, which is the highest capacity installed in a grid substation of the CEB network was failed immediately after connecting to the system. Several studies were conducted to identify reasons of the failure. However the final recommendation is still pending.

Placement of capacitor banks in a grid substation is a major factor, influencing the reliability and efficient operation of capacitor banks. Therefore, this study was focused on to determine the preferred location of installing capacitor banks in a 220/132/33 kV grid substation. The two of possible locations are at 33kV tertiary of the power transformers and at the 33 kV load bus.

Influences on capacitor banks under different fault conditions were analyzed in this study, while simulating the grid model built using Simulink in MATLAB program.

Positive and negative impacts were found in respect of the two identified locations.

- Switching stresses on capacitors of the bank is less when capacitors are installed at tertiary of the power transformers compared to the case when capacitors are at the 33 kV load busbar.
- For balance or unbalanced feeder faults, preferred location is the 33 kV load busbar, since voltage and current fluctuations are less compared to the other location.

- In case of lightning strikes at high voltage side, capacitors have less stresses when located at 33 kV load busbar.

As such, it is recommended to connect capacitor banks at tertiary of 220/132/33 kV transformers of grid substations in industrial areas such as Export processing Zones, because the capacitor banks are subjected to frequent switching due to high load variations of the industrial load.

Installation of capacitor banks at 33 kV load busbars is recommended to the grid substations where there are long power transmission lines with frequent feeder faults because such feeder faults have less influence on capacitor banks when they are located at the 33 kV load busbars.



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