DESIGNING OF DISTRIBUTION SUBSTATION LIGHTNING PROTECTION SYSTEM TO MINIMISE DAMAGE DUE TO LIGHTNING

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Degree of Master of Science

Department of Electrical Engineering

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Sri Lanka

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Dissertation submitted in partial fulfillment of the requirements for the Degree Master of Science in Electrical Engineering

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Declaration

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(Dr. Asanka S. Rodrigo)

Abstract

Lightning interferences in the Distribution lines is a major problem in CEB network. A significant number of substation failures are reported due to lightning. These failures occurred due to over voltages in the distribution line and it is impossible to prevent. These over voltages lead to a failure in the insulation of the transformer. Selecting transformers having high insulating level will increase the costs and volume of it. Therefore to decrease insulation levels and its cost, it is necessary to control over voltages and let them to earth by means of arresters. Performance of the arrester depends on the impulse resistance of the earth electrode, lead wire length and the substation installation. It is not necessary for earthing resistance of earth electrode to be of same value for all locations. It depends on the lightning level of each location. The Ground Flash Density in the area is an important parameter to decide the maximum lightning current experienced during the life time of the equipment and the required failure rate.

This dissertation discusses the over voltages due to lightning and its danger to Distribution Substation. The effect of arrester earthing resistance, Lead wire length, Substation configuration and medium voltage line arrangements at the substation in the CEB distribution Network are also studied for this investigation.

Digital simulation has a very important role on predicting the lightning performance of the distribution substation and distribution lines. PSCAD software is used for transient modeling of a three phase distribution line, substation and arrester for analyzing their performance during lightning. The method used to analyze the increase in voltage due to lightning was analyzed by using this software.

Keywords – Lightning, over voltages, Lightning Arrester, Earth Resistance, Lead wire

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