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Power Frequency Characteristics and Over Voltage Disturbances (impulses) in 230 VAG Electric Power Distribution System in Sri Lanka

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Delicate electric and electronic equipment in the modern world demand a considerably stabilized power supply system with minimum disturbance. The normal voltage fluctuations (slow variations) in a power network are mainly caused by unbalanced supply and demand of power. However, disturbances of electric power transmission and distribution system are frequently caused by two kinds of transient voltages whose amplitudes may greatly exceed the peak value of the normal a.c. operating voltage. The first kind is lightning over voltages and the second kind is caused by switching phenomena.

This paper describes the variation of power frequency voltages, and over voltage disturbances due to switching and lighting impulses observed in a low voltage power installation network in Colombo-07.

Measurements were made at 15A/230 VAC service outlet to a AC power mains at the Department of Physics, University of Colombo. A bridge rectifier coupled to a step-down transformer was used for voltage measurements with an accuracy of ±0.5 V.A frequency to voltage converter was used to monitor the frequency variations with an accuracy of ±0.4 Hz. Recordings were made using a dual channel flatbed pen recorder. In order to distinguish lighting and switching impulses, surge voltages in the low voltage line were measured simultaneously with the lightning electromagnetic signal picked-up by an out-door broad band plate antenna set-up coupled to a 4 channel 300 MHz LeCroy transient recorder.

Measurements made during the period May-June, 1994 indicated an average line voltage of 235 V with a maximum peak value 245 V and a bear minimum 214 V. The diurnal variation of ac voltage averaged for 30 days during the test period was found be triple period oscillatory type. The three maximum were observed around mid-night, 1230 hours with half hour average voltages 238.5 V, 234.7 V, and 236.7 V, respectively. Those maxima are tallyed with domestic/industrial non-working hours. The three voltage minima obseved were at around 1030 hours, 1500 hours. and 1845 hours with half hour average voltages 231.5 V, 232.5 V, respectively. The first two minima are corresponding to the maximum power consumption at industries/offices during day-time, while the last is due to after-dark lighting. The average frequency during this period was 49.8 ±0.4Hz and it indicated no significant variation during the test period. The total number of surge occurrence measured in 30 days during the test period was 228. It was found that 71 of them were due to lighting induced overvoltages and 157 due to switching impulses.