UNIVERSITI TEKNOLOGI MARA

THE STUDY OF DISTRIBUTION VOLTAGE DROP AND NEUTRAL-TO-GROUND VOLTAGE OF A HEALTHCARE FACILITY

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ABSTRACT

The proliferation of modern medical devices has raised the issue of power quality related problems in healthcare industries. These devices represent non-linear loads which will inject harmonics into the system. The concern lies on how far the existing power system of a building can tolerate the increasing magnitude of current harmonic. This study presents prediction of how far electrical system cable can operate before violating the permissible voltage drop and neutral-to-ground voltage during harmonic loading condition in the system. It is based on case study at Clinical Training Centre (CTC) building, UiTM Sungai Buloh. The cost of equipment malfunction recorded (March 2013-April 2015) in this building shows a fatal loss of RM 298.389 and the list of equipment is included in this paper. Following the claim, Fluke 1750 power monitor device was logged at several affected feeders. The work is presented in this paper. The analysis of power log data found that there were several voltage dropout occurrences and current harmonic level was considerably high. Based on the facility's single line diagram and measurement data, a selected feeder was simulated using MATLAB-Simulink, where the original recorded harmonic current percentage were increased percentage by percentages to predict the limit before violating the standard voltage drop and neutral-to-ground (NGV) outlined by the utility provider. The results showed that the magnitude of harmonic current that can be borne by each A, B, and C phase cables and neutral cable are different. Phase cable C possesses the highest spare capacity. The finding of this study may help the facility in planning future load installation by phases such as prioritizing the installation of highly potential harmonic source load to phase C followed by B and A. It was also found that the neutral cable was far underrated compared to the phase cables hence, in order to make the neutral cable to perform at equal level, neutral cable needs to be redesigned. This study also served as a preliminary study that is hoped to have influence to the facility in making decision before adopting mitigation equipment following the severity of equipment malfunction reported. Instead, the facility should inspect the grounding bonding of the facility in finding the source of the problem.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Distribution system of electrical power system is one of the most vulnerable systems to power quality problem [21]. Distortions of voltages and currents increase due to the increase in number of sophisticated and sensitive equipment. Furthermore, the three-phase four-wire system (3P4W) possesses the problem of excessive neutral current and current unbalance due to the uneven distribution of single phase loads. This has resulted in unbalance in supply voltages and currents, increased voltage and current harmonics excessive neutral current, poor power factor, increased losses and reduced overall efficiency.

Power quality is unavoidable, only the intensity of the distortion can be controlled through proper study and preventive maintenance. The losses due to power quality