SOIL RESISTIVITY INVESTIGATION AND DESIGN FOR EXTERNAL GROUNDING SYSTEM FOR ITM'S PULSED POWER LABORATORY

Thesis Presented in Partial Fulfilment for the Award of the Bachelor of Electrical Engineering (Hons) of MARA INSTITUTE OF TECHNOLOGY

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JULY 1997

ACKNOWLEDGEMENT

In the name of ALLAH S.W.T , The Merciful , The Beneficent, The Almighty One. Praised to HIM alone for HIS endowment that renders the completion of this project.

Firstly, I would like to express my deepest appreciation to En. Ngah Ramzi Bin Hamzah project Supervisor for his encouragement , invaluable suggestions and also their guidance throughout the preparation of this project.

I also would like to express sincere appreciation to En. Zaki for his willingness and sharing knowledge and sources of information and other Lecturers towards accomplishment of this project. Also thanks to all the Laboratory Assistants especially to Encik Nordin for their helpful.

ABAM 1997

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Preface

The fundamental purpose of this report is to design a grounding system to be employed by the ITM's Pulsed Power Laboratory . As this laboratory deals with high voltage, current and power, an extremely safe working condition is vital. Any abnormal condition during testing will cause hazardous to operators and equipment inside and outside the laboratory . As such, a well arrangement must be considered in the design ,planning and construction of the Pulsed Power Laboratory grounding system. IEEE Standard 80 can be made as reference and guideline during the planning, design, implementation and construction .

Chapter 1 and 2 are dealing with the fundamentals of grounding system , providing detailed definition of grounding terminology discusses also the meaning of earth resistance of single electrode in the soil . The equation of earth resistance with different types of electrodes embedded in the soil and also the performance of single rod and grids grounding system are discussed in Chapter 2 . Chapter 3 discusses the design grounding system procedures based on IEEE Standard 80 . The hazardous effects caused by abnormal condition of Pulsed Power Laboratory and normal arrangement practice of grounding system for High Voltage Laboratory are discussed in Chapter 4.

Chapter 5 discusses about this project, that is to verify the soil resistivity in the vicinity of Pulsed Power Laboratory (Block A) by using three normally employed methods that is, Wenner Method, Driven Rod Method and by using Earth Tester . Several data were recorded and from the comparison made between them , it is obvious that Wenner Method is not suitable for this purpose .

1.1 Introduction

Whether or not to ground a system is question that must be faced by most engineers in charged of the electrical distribution planning. The use of electricity brings with it an electric hazard for human and animal , particularly in the case of defective electrical apparatus . The objective of the grounding is to ensure correct operations of electrical devices, stabilise the voltage during transient condition and therefore to minimise the probability of flash-over during transient , dissipates lightning strokes and to provide safety to human and animal during normal and fault conditions . The dangerous potential difference must not exist , either between metal parts , or between metal and earth. Thus, in the event fault , sufficient currents will flow through and operates the protective device system, rapidly to isolate the faulty circuit .[1]

A grounding will ensure protective device operation and noise control including the transient of all sources . Power quality problem also can occur due to lack of grounding system within the facilities. [2] The need of the connection to the ground to be sufficiently at low resistance essentially an important consideration in designing a grounding system. A low resistance per-area is needed to provide a path for current leaving any supply voltage line to return to its sources and to minimise the potential differences at various point on the earth during abnormal operation .

But the pattern current in the huge conductor (Earth) will be determine by the soil resistivity contact area and the operation frequency . Since the earth is complex conductor , the soil resistance varies as a function of moisture , solvent content and