METAL OXIDE SURGE ARRESTER TRENDING AND ANALYSIS

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To my beloved mother Umbi Kalthom Kasim,

My father Lotepi Mohd Zin,

And my siblings

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ABSTRACT

Surge arrester is very important and is required for the insulation coordination of to power system equipment. It will regulate the rising voltage in power system in order not to exceed the withstand voltage levels of equipment. A good arrester should return to its original condition after its voltage-limiting operation. A reliable condition monitoring of surge arrester is important to ascertain the continuity and reliability of power supply. The effect or behaviour of the different surge arrester used, environmental effects on the surge arrester and trending analysis on surge arrester need to be considered in order to record and establish database. The database of the surge arresters were recorded in order to analyse the trending of the arrester. The recorded data was analysed using the MATLAB. Based on the third harmonics current measurements, the arrester types are ranked from the best third harmonic current to the worse third harmonic current. Arrester type Siemens is found to be the best arrester based on its very low leakage current increment with number of years in service.

ABSTRAK

Penangkap kilat sangat penting dan diperlukan sebagai penebat dalam sistem kuasa. Ini akan mengehadkan voltan yang semakin meningkat dalam sistem agar tidak melebihi had voltan peralatan. Penangkap kilat yang baik akan kembali kepada keadaan asal selepas proses pengehadan voltan. Pemantauan penangkap kilat ini adalah penting bagi memastikan bekalan kuasa sentiasa baik dan berterusan. Prestasi atau kesan berlainan jenis penangkap kilat yang digunakan, kesan alam sekitar terhadap penangkap kilat dan trend harus dipertimbangkan bagi merekod dan mewujudkan pangkalan data. Data yang di rekod dianalisis menggunakan MATLAB. Berdasarkan arus harmonik ketiga, jenis-jenis penangkap kilat di ranking daripada arus harmonik ketiga paling baik kepada arus harmonik yang lebih buruk. Siemens adalah penangkap kilat yang baik berdasarkan arus harmonik ketiga yang sangat rendah dalam beberapa tahun perkhidmatan.

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LIST OF ABBREVIATIONS

ZnO	-	Zinc Oxide
LCM	-	Leakage Current Measurement
TNB	-	Tenaga Nasional Berhad
KTGI	-	Kota Tinggi
PNAS	-	Pekan Nanas
PONT	-	Pontian
PGPS	-	Pasir Gudang Power Station
PGIE	-	Pasir Gudang Industrial Estate
PSAK	-	Pasak
TKPG	-	Tanjung Kupang
SNAI	-	Senai
TBRU	-	Tebrau
TPOI	-	Tampoi
A	-	Ampere
μA	-	Micro-Ampere
>	-	Greater than
<	-	Less than
3rd	-	Third
rms	-	Root Mean Square

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CHAPTER 1

INTRODUCTION

1.1 Introduction

A substation provides services for distribution of energy sources to the surrounding area. The main function of the substation is receiving energy transmitted at high voltage from power stations and lower back to a particular value for local distribution and this require appropriate switchgears. Some substations only serve as easy switching station where a different connection between various transmission lines. Apart from that, it is used to convert the ac supply to dc or otherwise convert it to low-frequency high voltage and vice versa. Substations have additional functions such as providing part of the installation of security equipment and this allows it to be separated by equipment or online when damage occurs. Busbar output voltage of the distribution can also distributed at the substation system.

In power stations, surge arrester are used as protection devices to the transmission and distribution system. Surge arrester is a device used in order to protect the electrical equipment from over voltages occurs from lightning or switching. Surge arrester installed between the phase and the earth in order to improve the lightning performance and reduce the failure rates. High energy stresses

and housing deterioration are the main factors of degradation and damage of surge arrester. Thus, there are need for the testing and monitoring the surge arrester in order to determine the ability of the surge arrester and the condition will be effective to protect the transmission and distribution system.

To protect a unit of equipment from transients occurring on an attached conductor, a surge arrester is connected to the conductor just before it enters the equipment. The surge arrester is also connected to ground and functions by routing energy from an over-voltage transient to ground if one occurs, while isolating the conductor from ground at normal operating voltages. This is usually achieved through use of a varistor, which has substantially different resistances at different voltages.

Surge arresters are not generally designed to protect against a direct lightning strike to a conductor, but rather against electrical transients resulting from lightning strikes occurring in the vicinity of the conductor. Lightning which strikes the earth results in ground currents which can pass over buried conductors and induce a transient that propagates outward towards the ends of the conductor. The same kind of induction happens in overhead and above ground conductors which experience the passing energy of an atmospheric EMP caused by the lightening flash. Surge arresters only protect against induced transients characteristic of a lightning discharge's rapid rise-time and will not protect against electrification caused by a direct strike to the conductor. Transients similar to lightning-induced, such as from a high voltage system's fault switching, may also be safely diverted to ground; however, continuous overcurrents are not protected against by these devices. The energy in a handled transient is substantially less than that of a lightning discharge; however it is still of sufficient quantity to cause equipment damage and often requires protection.

Without very thick insulation, which is generally cost prohibitive, most conductors running more than a minimal distance, say greater than about 50 feet, will experience lightning-induced transients at some time during use. Because the

transient is usually initiated at some point between the two ends of the conductor, most applications install a surge arrester just before the conductor lands in each piece of equipment to be protected. Each conductor must be protected, as each will have its own transient induced, and each SPD must provide a pathway to earth to safely divert the transient away from the protected component. The one notable exception where they are not installed at both ends is in high voltage distribution systems. In general, the induced voltage is not sufficient to do damage at the electric generation end of the lines; however, installation at the service entrance to a building is key to protecting downstream products that are not as robust.

1.2 Problem statement

Surge arrester will be degraded due to many factors which are repeated discharging impulse current, high temperature, high moisture operating environment and continuous operating voltage. Many studies were done in order to monitor the surge arrester ageing or degradation. A reliable condition monitoring of surge arrester is important to ascertain the continuity and reliability of power supply. The surge arrester must be able to withstand the effect of the over voltages in order to operate normally. It is essentials to correctly asses the zinc oxide (ZnO) surge arrester condition based on its made and historical data. The effect or behaviour of the different surge arrester made or brand, environmental effects on surge arrester and trending analysis on surge arrester need to be considered in order to record and establish the database for each arrester. In this project, it is desired to know or predict the remaining life /condition of an arrester based on the pattern or the of various surge arresters.

1.3 Objectives

In this project there are several objectives to be achieved. These are:

I. To determine the trending of each type of surge arrester used in the main intake substation (Pencawang Masuk Utama PMU).
II. To do analysis regarding the lifetime/condition of each type of surge arrester.
III. To determine/predict the remaining life of the surge arrester used.

1.4 Scope Of Project

The scope of the project are listed below:

I. Only surge arrester used in 132kV stations will be considered.
II. Both polymeric and porcelain housing will be considered.
III. Only stations in Johor Baru and surrounding area will be considered.

1.5 Report Outline

This thesis basically is divided into five chapters;

Chapter 1- Introduction

This chapter will introduce the readers at the basic aspects of the research undertaken, such as overview of surge arrester, problem statement, objectives, and scopes of this report.

Chapter 2- Literatur Reviews

This chapter reviews the previous work on surge arrester monitoring and other reviews related to this project are presented.

Chapter 3- Methodology

This chapter presents the overall system methodology and steps that must be taken into consideration for this project. In this chapter the author discusses on how the process of the project to be completed.

Chapter 4- Results

This chapter shows the final results. All the result obtained from this project were shown and discussed here.

Chapter 5- Conclusion & Recommendation

This chapter consists of conclusion and recommended work for future improvement.

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