DIOGNOSTIC METHODS TO ASSESS THE ULHEALTHY BATTERY: FOR TELECOMMUNICATION APPLICATION

AMIR HAMZAH BIN ZAILAINI

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To my big family for the undying loves and support

To all lectures and my supervisor Dr. Shahrin Bin Md Ayob for his ideas and guidance

To all my friends thanks for your support

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ABSTRACT

This thesis presents the research and study of the internal impedance of the battery. The battery is an important apparatus for providing backup power supply in case of power outages critical service industry like banking companies, telecommunications companies and others. It is common practice checklist for electrical engineering officers use to measure the voltage in the battery performance. Of referring to the writing of the research and study of the internal impedance of the battery, the author felt that the internal impedance of the battery can be a benchmark for evaluating the performance.

ABSTRAK

Tesis ini membentangkan berkenaan dengan penyelidikan dan kajian nilai galangan dalaman bateri. Bateri merupakan radas yang penting untuk memberikan bekalan tenaga elektrik sandaran jika berlaku gangguan bekalan elektrik kepada industri perkhidmatan yang kritikal seperti syarikat perbankan, syarikat telekominukasi dan lain-lain lagi. Oleh kerana sudah menjadi kebiasaan senarai semak bagi pegawai teknik elektrik menggunakan nilai voltan dalam untuk mengukur prestasi bateri. Daripada merujuk beberapa penulisan tentang penyelidikan dan kajian nilai galangan dalaman bateri, penulis merasakan nilai galangan dalaman bateri boleh menjadikan tanda ukur untuk menilai prestasi.

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LIST OF ABBREVIATION

ATV	All Terrain Vehicle
BMS	Battery Management System
CL	Cycle Life
Cr	Rated Capacity
CF	Capacity factor
Nr	Negative Plate Resistance
Pr	Positive Plate Resistance
RL	Reserve Life
Sp	Positive-Negative Plate Resistance
SOH	State of Health
SOC	State of Charge
VRLA	Valve Regulator Lead Acid

CHAPTER 1

INTRODUCTION

1.1 Background Of Study

Nowadays the use batteries in our daily lives is very widespread as example for hybrid and electric vehicles, secondary vehicles such as electric bicycle, industrial forklifts or all terrain vehicle (ATVs), solar and wind power conversions systems, UPS backup for critical services such as airport operation and online banking and many more.

With increasing competitive pressures and high customer expectations at every service has been subscribed, there needs proper engineering techniques to prevent battery failure to deliver full power when called upon.

The suitable diagnostic method to detect the unhealthy batteries wills result in improved battery life, schedule maintenance & operation activities more organized and improved safety work environment.

1.2 Problem Statement

Lead-acid battery is a secondary battery which is responsible for providing standby power to critical equipment and services. That which is popularly used in a variety of fields, typically used at electrical power system at the data processing by financial institutions, telecommunication company, government offices and military data center. What level of consumer confidence in the ability of the battery to make sure healthy enough to carry the intended load?

Battery is one of the important assets in the operating to achieve high reliability and availability service for the critical services industrial. Batteries are responsible for providing standby power and batteries will be the last line of defence from to avoid user experiences electrical power outage, interrupted and disturbed. Figure 1.1 shows the electric power system block diagram for critical services industrial.

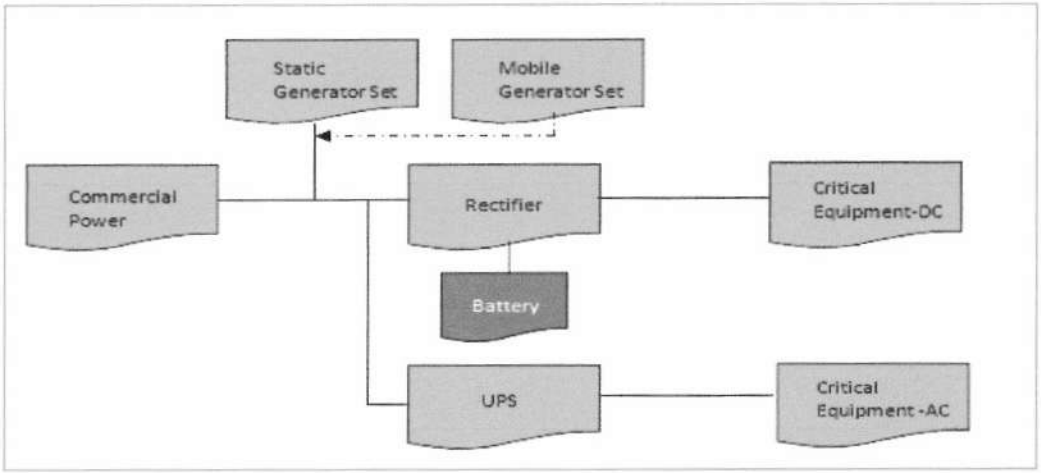

Figure 1.1: Block diagram electric power system

There is a lot of attention and interest in the various areas of the capacity of the battery to store electrical power for critical applications. From figure 1.2 clearly show the highest contribution problem category caused of major breakdown to electric power system is because of battery failure. There are good opportunities for electrical engineers to study more about the battery to counter problem because of battery faulty.

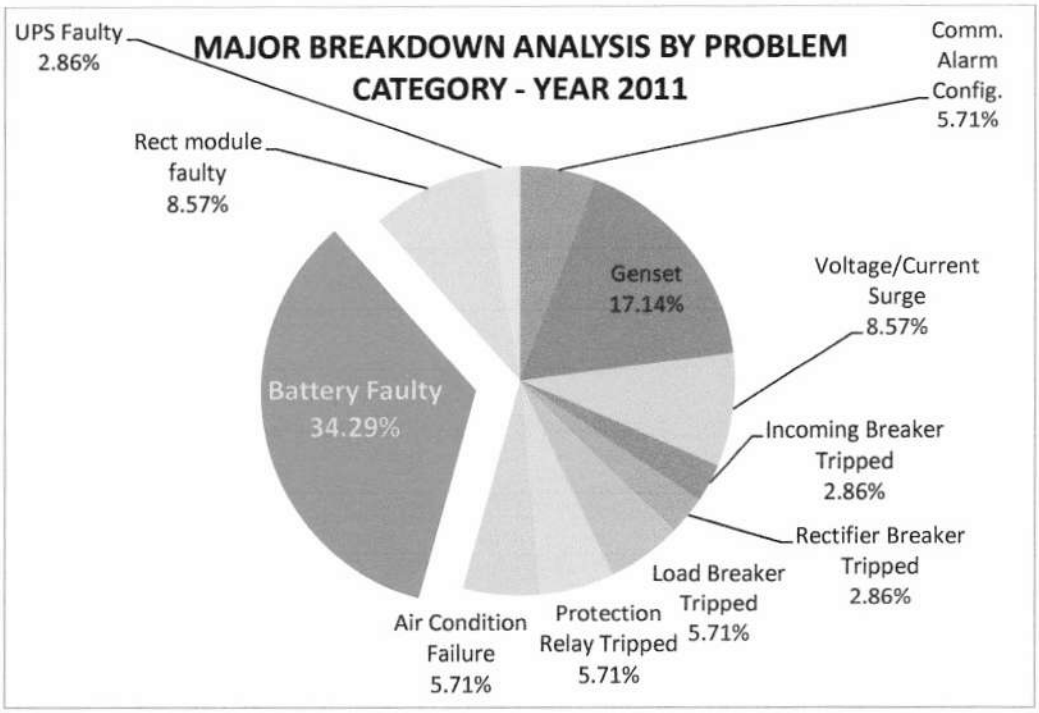

Figure 2.2: Percentage major breakdown by problem category.

Monitoring the state of health of batteries for critical services industrial batteries is very important for providing uninterrupted service. The common use and conventional testing for evaluated the condition battery called the battery capacity testing. The test is to be done according to the specification from datasheet of battery manufacturing and following the recommendation procedure by the professional institute.

The conventional testing is the most reliable method to assess the state of health of a battery. However, the conventional testing is a time consuming and expensive method because it must be done in off-line from power system, which could potentially result in down time problems. This method is also affected the performance of the batteries, in logical and theoretical the routine discharges activities could reduce the life span and the performance battery due to increasing the internal resistance of the battery.

1.3 Objective

Until recently, the methods commonly used to determine the condition of the battery is to do a test capacity / load. Although reliable, this method has proven to be cumbersome, time consuming, expensive, and risky [1]. An alternative to load testing is the impedance comparison method.

The main objective of the proposal project is determining the early detection premature failure battery using the ohmic measurement to protecting the battery from the premature failure and resulting to prediction of remaining useful life of battery. The more specific objectives of this study are as follows:

a) To make some experiment on various condition of the batteries to discuss the most significant values between voltage or ohmic.
b) To study the effectiveness ohmic measurement to estimate the condition the cell and bank of battery.
c) To make the statistical and hypothesis analysis on the data that has been taken to assess the performance the group of batteries.

1.4 Project Scope

The methodology approach on this proposal project will be based on the analyzing the actual related parameter at battery to determine the health of batteries. From here, the main battery parameter to be investigated and analyzed to assess the condition and health of VRLA batteries is the internal resistance (impedance) of battery.

Theoretically, conspicuous effects of the change in impedance of the battery is due to several factors such as the decay of the positive and negative battery plates, chemical deterioration in the purity of the electrolyte of the battery, charge/discharge cycles, harmonics, and load levels.

All the assumptions and ideas for this proposal project will be proved through research, simulation and experiment. In this project, simulation of the ohmis influence to the battery is unavailable due to several technical constraints.

Experiment and research can be made from measuring actual internal resistance at the real field with a variety of battery conditions. The conditions of battery will measure for this experiment is:-

a) New battery (1-3 years service)
b) Moderate battery (4-6 years service)
c) Old battery (7-9 years service)
d) Unhealthy battery (faulty)

To realize the objectives of this project were categorized the project scopes as below:

i. Identify the measurement parameter and related data for assess the condition battery
ii. Study Influence factor to prolong the life time of battery
iii. Chose several VRLA capacities for as sample and study case.
iv. Make measurement, record and analyze the related parameter and data are obtained from actual field.
v. Record and analyze the actual performance of the battery from failure report records from the suitable analysis tool
vi. Lastly choose the best prediction & measurement method to evaluate the health of battery.

1.5 Significance of Project

Expected from this research has been conducted to provide a simple and effective way to evaluate the performance of the battery by means of reading the battery impedance and specific method of analysis.

Although the proposed method does not have accurate results in evaluating the performance of the battery compared with the old method, but the proposed method can at least be used as a screening test for the battery in the battery health test.

There is great interest from stakeholder and related party to find the best method to assess the health of the battery. Useful in terms:-

i. Easy to operate.
ii. Economical of operation.
iii. Accurate and reliable data.
iv. Build customer confident.

1.6 Organization of Report

This report will consist of five main chapters; Introduction, Literature review, Methodology, Result and Discussion, Conclusion and Future Recommendation.

In *Chapter 1: Introduction*, at 1st chapter author will discuss the crucial aspect of the research work such as background of study, objectives and scope of the project.

Chapter 2: Literature Review will completely dedicate in explaining about the related VRLA batteries. The author will explain more on the measurement ohmic relation with the battery performance and several analytical methods to be implemented in this project.

Chapter 2: Methodology will explain how the author will complete the project. The timeline will be show in order to briefly view the project implementation towards the completion.

Chapter 3: Result and Discussion is section for covered the explained and some discuss base on the experimental result has been made in this project. Finally, the conclusion and some future works will be covered at *chapter 4: Conclusion and Recommendation.*

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