UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FAST CHARGING 48V CHARGER

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Power) with Honours.

by

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I hereby, declared this report entitled FAST CHARGING 48V CHARGER is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Industrial Power) with Honours. The member of the supervisory is as follow:

Signature: …….

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ABSTRACT

In this era the need for a better rechargeable battery is needed to encourage the people to use more electrical vehicle to help with the growing climate change. The existence charger that will take about 10 hours in charging the lead-acid battery. The charger that is designed to charge a 48V acid lead battery that takes shorter time and help to keep the battery in good condition and not degenerate faster. The methods of producing the charger is by evaluating the existing charger and create a new one than later perform data logging to the product hopping it will achieve maximum efficiency. By doing so will gain more understanding and improving the charger for the lead-acid battery.

ABSTRAK

Pada era ini, keperluan untuk penggunaan bateri yang boleh dicas semula diperlukan dalam menggalakkan masyarakat dalam menggunakan kenderaan elektrikal. Pengecas bateri plumbum asid yang sedia wujud akan mengambil masa kira-kira 10 jam. Produk pengecas yang direka untuk mengecas bateri plumbum asid 48V yang mengambil akan masa yang lebih singkat dan membantu untuk memastikan bateri dalam keadaan yang baik dan tidak merosot dengan lebih cepat. Kaedah menghasilkan pengecas adalah dengan menilai pengecas sedia ada dan membuat yang baru lalu kemudian melakukan pengumpulan data keatas produk untuk mencapai kecekapan maksimum. Dengan harapan dapat menabah pemahaman dan menambah baik pengecas bateri plumbum asid.

DEDICATION

I would like to utilise this opportunity to thank the people who have been the pillars of my success that is my beloved parents, Mr. Anuar bin Tamsir and Mrs. Fardah Binti Ja'afar who always support me and give me strength when I need them the most and are the only people who have worked day in and day out to prepare me for the challenges in life. This achievement that I have obtain today is thanks you to my beloved parents.

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LIST OF SYMBOLS

D, d	-	Diameter
F	-	Force
g	-	Gravity = 9.81 m/s
I	-	Moment of inertia
1	-	Length
m	-	Mass
N	-	Rotational velocity
P	-	Pressure
Q	-	Volumetric flowrate
r	-	Radius
T	-	Torque
Re	-	Reynold number
V	-	Velocity
w	-	Angular velocity
x	-	Displacement
z	-	Height
q	-	Angle

LIST OF ABBREVIATIONS

PCA	Principal Component Analysis

LIST OF PUBLICATIONS

CHAPTER 1

INTRODUCTION

1.1 Background

The lead-acid cell has existed for over a hundred years from it conception, it was normally use with unrestricted access between surface of the electrolyte and the external atmosphere and so when overcharge occur the following hydrogen and oxygen were lost from the cell via electrolysis. The result is a periodic addition of distilled water were necessary. Since 1970, the alternative to the traditional 'flooded' cell has been available that advance in the term of the need for water maintenance. Furthermore, the acid is use in new design and this endow the cell with additional benefit of being 'spill-proof' and able to work in any orientation.

The improvement into the so-called 'valve-regulated lead–acid' (VRLA) technology has not been achieve without difficulty. The experience has demonstrated forcibly the fundamental differences between the two systems, and the lead– acid battery manufacturing industry has faced hard trials in advancing the VRLA version with a performance to match that of its flooded predecessor. Still, the research into understanding the electrochemistry, producing improved cell components and optimizing charge strategies has developed in VRLA batteries becoming well-recognized and a reliable device. The operators now take benefit of the properties of the batterie in the used of storing electrical energy in a broad variety of stationary applications.

Great deal of the latest innovation of the VRLA technology has been accomplished through a co-operative research effort under the auspices of the Advanced Lead-Acid Battery Consortium (ALABC). The main effort has been directed towards the development of VRLA battery systems for new-generation road transportation that is the electric and hybrid electric vehicles that will reduce fuel consumption and lower the carbon dioxide emissions. Additionally, development achieved in this endeavour will eventually also benefit the massively important markets in telecommunications and remote-area power supplies. (P.T. Moseley, J. Garche ,C.D. Parker, D.A.J. Rand, 2004)

1.2 Problem Statement

The creation of lead acid battery had been applied to many fields of study such as in motorcycle, car, robotic, scooter and many more. The more vehicle car that is used the more carbon dioxide emission. The increment of investment of technology in of Electric Vehicle (EV) had also increase the demand of lead acid battery production. The usage of lead acid battery had become a great important because of the benefit it had to a lot of industry but because of the time required to charge a lead acid battery required about 5-8 hours it had become an issue so the need to produce a fast charging is a need. The durability of lead acid battery will also decrease faster base on the charging method apply to it.

1.3 Objectives

The road to achieve and complete the following project of creating a fast charging charger for Lead Acid Battery, a few selected required objectives had been made. The objective is made as a guideline to ensure the project will produce is in optimal functionality and quality.

1. To evaluate the required characteristic in assembling a fast charging 48v charger.
2. To perform data logging on the 1.6 Amp and 3.0Amp and the assemble fast charging 48V charger.

1.4 Project Scope

The limitation of this project in creating a fast charging for a lead acid battery prototype:

1. Using 4X12-volt lead acid battery set.
2. This project uses AC supply to charge the lead acid battery.
3. A cycle of charging and discharging about 4 times to get the data to make comparison.
4. The Arduino is used to control and monitor the system.

1.5 Result Expectation

The General idea of this project is to encourage more people to use electrical base vehicle or scooter to help reduce the increment of global warming from the emission of carbon dioxide. By creating a more faster charging charger and doing so it will help with slowing down the increment of global warming that is currently direly affecting the live of the population.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A battery charger is a device that is designed to force an electric current into a rechargeable battery. The charging arrangement that indicate how many voltages and current can be charged to complete the charging of the following rechargeable battery or cell will totally depends on the type and size of the battery. All existing battery has different ability example there are battery that can endure overcharge above their charging limit even if the battery is fully charge and some can maintain the battery full status through a constant voltage source or constant current source.

Some basic battery charger required the user to manually turn of or else it will to force the current into the battery and gassing will occurred. Some charging method or type is designed to take longer time to complete a charging a battery because it is made of non-safety feature that cannot withstand continuous charging. To enable the use of this type of charger the required precaution highly need to be made for example the need to have a voltage sensor, current sensor, temperature sensor and a microcontroller so that it can make changes to the flow of voltage and current and possible to enable it to cut off the supply.

Next, the present of another type of charger is a trickle charger is use by supplying a small value of current but just enough to counteract the self-discharge of the battery that is not been use in a long period of time. The following charger can only be use for a few types of battery and lithium ion battery cannot use this charger because the system that it is used for the battery is chemistry system that can lead to damage to the battery. (Weicker, 2014)

Besides that, a slow type battery charger is design to charge the battery that has low tolerates toward high rate charging that can damage it, but the downside is it takes a very long time to complete a charging process. (Battery University, 2019)

Furthermore, a fast charger is a device that use the application of a control unit circuitry that control the high rate charge into the battery without damaging it. The control unit circuitry can be built directly into the battery or to the charger part of the system and most of the fast charger has a cooling system that help maintain the required temperate that can be refer in the table 1. (Battery University, 2019).

Table 1: Charger characteristics

Type	Chemistry	C-rate	Time	Temperatures	Charge termination
Slow charger	NiCd Lead acid	0.1C	14h	0°C to 45°C (32°F to 113°F)	Continuous low charge or fixed timer. Subject to overcharge. Remove battery when charged.
Rapid charger	NiCd, NiMH, Li-on.	0.3-0.5C	3-6h	10°C to 45°C (32°F to 113°F)	Senses battery by voltage, current, temperature and time-out timer.
Fast charger	NiCd, NiMH, Li-on.	1C	1h+	10°C to 45°C (32°F to 113°F)	Same as a rapid charger with faster service.
Ultra-fast charger	NiMH, Li-on, NiMH.	1-10C	10-60 minutes	10°C to 45°C (32°F to 113°F)	Applies ultra-fast charge to 70% SoC (limited to specialty).