UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN AND DEVELOPMENT OF PORTABLE SUPERBIKE PADDOCK STAND

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree of Mechanical Engineering Technology (Refrigeration and Air-Conditioning Systems) with Honours.

By

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Refrigeration and Air-Conditioning Systems) with Honours. The member of the supervisory is as follow:

……

(Mohd Faez Bin Zainol)

ABSTRAK

Paddock Stand adalah alat untuk mengangkat superbike yang biasanya tidak datang dengan “double stand” seperti yang biasa dijumpai dalam motosikal berkapasiti enjin rendah (CC) atau motosikal jenis “mope”. “Paddock stand” adalah alat khas untuk mengangkat motosikal untuk menjadikan ia berdiri di kedudukan menegak untuk kebiasanya penyelenggaraan superbike memerlukan roda depan dan roda belakang tergantung dari permukaan untuk memberi lebih banyak ruang kepada proses peyelenggaraan. Oleh itu, reka bentuk dan pembangunan “paddock stand” “superbike” mudah alih adalah untuk mengatasi keadaan yang dihadapi oleh pemilik motosikal untuk membuat proses penyelenggaraan dengan lebih mudah. Objektif projek ini adalah untuk mereka bentuk paddock stand mudah alih menggunakan CAD (SOLIDWORK). Reka bentuk telah dibangunkan dengan menggunakan perisian untuk membuat reka bentuk lebih serasi dan ergonomik. Menganalisis reka bentuk menggunakan Kejuruteraan Bantuan Komputer digunakan untuk menguji struktur utama “paddock” mudah alih untuk membuktikan kekuatan dan fungsi untuk tujuan pelaksanaan sebenar pembuatan “paddock” mudah alih. Reka bentuk telah dipilih menggunakan kaedah “Pugh Method Matrix” untuk memilih reka bentuk yang terbaik untuk dijadikan sebagai prototaip “paddock stand” mudah alih. Pada akhir projek ini prototaip kemudian akan menjalani ujian sebenar pada fungsi pada superbike sebenar untuk menguji kekuatannya mengikut berat yang ditetapkan.

ABSTRACT

Paddock stand is the device to lift the superbike which is usually does not come with the double stand such as commonly found in moped or lower cubic centimeter (CC) motorcycle. Paddock stand is the special tools to lift the bike to make it stand in vertical position for maintaining usually the maintenance of superbike required the fronts wheels and rear wheels off the grounds to give more excess to the bike. Hence, the designing and development of portable superbike paddock stand is to overcome the circumstances faces by the owner of the bike to make the maintaining process more reliable. This project objective is to design the portable paddock stand using the CAD (SOLIDWORK). The designs were developed by utilizing the software to make the design more compatible and ergonomics. Analyzing of the design using Computer Aid Engineering were used to test the main structure of the portable paddock to justify it strength and function for applying to the real implementation. The design were selected using the Pugh Method Matrix approach to select the best design to be fabricate as prototype of portable paddock stand. At the end of this project prototype then will undergo the real testing on the functionality on the real superbike to test its strength according to the weight apply.

DEDICATION

To my beloved parents Jusoh Bin Dollah and my mother Khadijah Binti Awang Hamat. My beloved sibling and all the people who encourage me.

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CC	-	Cubic Centimetres
GP	-	Grand Prix
ECU	-	Electronic Control Unit
CAD	-	Computer Aided Design
CAE	-	Computer Aided Engineering
MDI	-	Multiple Document Interface
GUI	-	Graphical User Interface
3D	-	Three Dimension
CAM	-	Computer Aided Manufacturing
MIT	-	Massachusetts Institute of Technology
MS	-	Mild Steels
BDS	-	Bright Drawn Steel
HTS	-	High Tensile Steels
ALSI	-	Aluminum Silicon
AW	-	Arc Welding
MMAW	-	Manual Metal Arc Welding
SMAW	-	Shielded Metal Arc Welding
GMAW	-	Gas Metal Arc Welding

MIG	-	Metal Inert Gas
FCAW	-	Flux-cored Arc Welding
GTAW	-	Gas Tungsten Arc welding
SAW	-	Submerged Arc Welding
TIG	-	Tungsten inert gas
Psi	-	Pressure per square inch
Mpa	-	Mega pascal
Lb	-	Pound
º	-	Degree
N	-	Newton
Kg	-	Kilogram
kN	-	Kilo newton
mm	-	Millimeter
In	-	Inch
%	-	Percent

CHAPTER 1

INTRODUCTION

1.1 Introduction to Paddock Stand

The paddock stand is the device to lift the superbike more than 100kg. The superbike usually does not come with the double stand such as commonly found in moped or lower cubic centimeter (CC) motorcycle. The paddock stand is a very important device for superbike to make it stand in vertical position for maintaining or other work to be done on the bike. The side stand of the superbike is to place the superbike in slanting position, which is give limited space to do maintenance on the bike (Feyen et al., 2000).

Usually the maintenance of superbike required the fronts wheels and rear wheels off the grounds to do the work (Vanvalkenburgh, 2006; Siivonen, 2005). This required the special tools to lift the bike which is called paddock stand. Paddock stands usually and commonly can be seen in the superbike races. For example in grand prix (GP) which is the greatest superbike races in the world. This first world championship was run in 1949 officially at Isle of Man which is a self-governing crown dependency in the Irish Sea between the islands of Great Britain and Ireland. The paddock stands at this moment have been use for standing the bike in the race. The paddock stand is a very important device that use in the world of motoring without this device the superbike cannot be stands in vertical position. In moto GP, paddock stand is very necessary and important things must have to fulfill the needed on the superbike.

The paddock stand usually consists of three type of stand. First is the rear paddock stand which is the rear wheels of superbike is lifting up from the ground, but the front wheels are still on the grounds. The rear paddock stands usually install at the rear swing arm with the help of bobbin as the pivot point to lift the swings arm. When the rear swing arm was lift the rear wheels of superbike were lift to. Usually the rear paddock stand allows the owner of superbike to do maintenance on the drive chain and sprocket for cleaning it.

Second's type of paddock stand is front paddock which is the fronts wheels of superbike were lift above the grounds. The front paddock usually smaller in size than the rear paddock stand because the front wheels or fork is smaller in size compared to rear swing arm. Fronts paddock were install whether at the fork shaft or using the front wheels as a pivot point. If the paddock install at the fork the front wheels can be rotate and if the paddock install at the wheels the front wheels cannot be rotate. This type of paddock is less stable compared to the rear paddock stands because the handle of the front wheels still can move and have the tendency the superbike fall down.

The last one is the body paddock stand which is the stands is install at the main frame of the superbike. This type of stands usually use for overall maintenance because this stand can lift the whole superbike which mean the rear and front wheels of superbike is lift up from the ground. This paddock stands usually use for big maintenance purpose such as for engine overhauls and the other major maintenance to be done on the superbike. This stands usually have a big size, heavy weight and very strong in shape to support the entire weight of the superbike. The main advantages of this paddock stands is the owner or mechanic can do entire maintenance on the superbike which is 100% can be excess.

The most important things in the manufacturers of the paddock stand is the material. The main material commonly use to fabricate the products is metal. Commons metals that have been use in the making of the frame of the paddock stand are carbon steel.

(a) (b)

Figure 1.1(a) Body paddock (b) Rear and Front Paddock

Figure 1.1(a) and (b) shows how the ways of different type of paddock stand use on superbike.

1.2 Problem Statement

Nowadays the production of the superbike in the market very rapidly was manufactured. The world famous brand such as Honda, Yamaha, Kawasaki, Suzuki and many more were fight among them to produce the various superbikes with various cc. The implementation of the modern technology in the bike production is the main concern to make the high quality of the products, starting from the engine performance and all over the superbike component that implement the new technology such as Engine Control Unit (ECU) for engine management system for controlling the engine performance. The most important things are the petrol consumptions and maximum power output for the superbike. For example the fuel injection technology is word wide use for saving the petrol consumption and cost for the fuels. The mechanical products also have been concerned for the use in the superbike word which is stands for the

superbike are the necessary accessories to stand the bike in the vertical position for testing and work to be done on the bike.

In this project, the main problem paddock stand at the market is not suitable with the needed of the user. Paddock stands at the market nowadays are heavy in weight. Secondly, the paddock stand is not portable. The frame of the paddock is not detachable which is cannot be disassemble. The frame is rigid and big in size. This can made the superbike owner cannot stand their bike everywhere they want. Most importantly the paddock stand is not easy to carry because of the rigid frame of the paddock stands. This project is to find the best solution to the problem facing by designing new paddock stand by utilization of CAD (SOLIDWORK) to develop the design of portable paddock stand. A few analyses are using computer aided engineering (CAE) to study the structure, stress and compression of the design.

1.3 Objective

Based on the problem statement the main objective of this study is;

- To design the portable paddock stand using CAD (SOLIDWORK)
- To make an analysis on the design using Computer Aided Engineering (CAE)
- To fabricate portable paddock prototype and test it strength acording to weight apply.

1.4 Scope

In order to fulfill the objective of the project, a few scopes have been drawn. The scope of this project is to design the portable paddock stand using the utilization of SOLIDWORK and make a few analyses on the selected sub part from the selected design using CAE in the SOLIDWORK. The compression testing on the sub part that have been selected will be done to study the structural strength of the part which is the force is applied to find out the maximum weight that the stand can received. The selected weight for the superbike is between 150kg to 250 kg which is only for medium