TEST RIG DEVELOPMENT FOR HIGH PRESSURE SPRAY

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A project report submitted in partial fulfillment of the requirements
for the award of Diploma of Mechanical Engineering

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SUPERVISOR'S DECLARATION

'I hereby declare that I have read this project report and in my opinion this project report is sufficient in terms of scope and quality for the award of the Diploma of Mechanical Engineering'

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Date	:	……

STUDENT'S DECLARATION

I declare that this thesis entitled "Test Rig Development for High Pressure Spray". This result of my own research except as stated in the references. This thesis/report has not been accepted for any degree and is not concurrently submitted in candidate of any other diploma or degree.

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DEDICATION

Bismillahi Rahmanirahim, in the name of Allah S.W.T, I start my dedication to thankful to God that give me an opportunity to finish my final year project based on the schedule. Besides that, I am grateful to become a student that can teach me how to be a good person and a good leader in organization on the future. To my parents especially my mother Hasma Binti Ismail and my father Mohd Yusuff Bin Maliki that guide me and give a lot of motivation to me in order to become a worthy person for the religion, race and state. They are also my inspirations of what I get succeed until now. Thanks also to my group members in their support and encouragement to me towards this project

Also to the grateful my supervisor, Tuan Haji Amirruddin Bin Abdul Kadir and all mechanical staff that give me a lot of helpful and guide me until I had finished my final year project. Without all of them, there could be difficult to me to complete this task. Thanks a lot to my university and other lecturers for their supportive advices towards this project.

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ABSTRACT

Automotive technology is very important to peoples nowadays. It can help us to move freely wherever we want to in a very short time. Automotive technology is very fast growing at the moment because of the importance in human life. So an experiment of improvement needs to be carrying on consecutively to the system especially in fuel system in order to make sure the effectiveness of the system. On behalf of this the place to conduct an experiment is needed to ease the researching process. In this report, the models of the test rig that are already in the market is discussed. Besides that, it is also explain about the materials that will be used in making and build the test rig which is suitable to the equipment and apparatus on it. A briefly explanation about the problems faced while completing this project is also state in this report. Also to the good ideas that are generated to an improvement of the test rig for high pressure spray given in this report to future improvement.

ABSTRAK

Teknologi Automotif begitu penting dalam kehidupan seharian kita. Ia menolong manusia bergerak dari satu tempat ke satu tempat yang lain dalam masa yang singkat. Teknologi Automotif mudah berkembang kerana kepentingannya dalam kehidupan manusia. Oleh itu, kajian yang berterusan terhadap pengunaan sistem khususnya system bahan api perlu dilakukan bagi mengenal pasti kelangsungan sistem yg cekap. Oleh yang demikian, untuk memudahkan kajian, tempat ujikaji perlu disediakan. Dalam laporan ini juga menerangkan tentang model-model tempat ujikaji yang telah ada pada masa kini. Selain itu, ia juga menerangkan tentang pengunaan bahan yang sesuai untuk digunakan untuk membina sebuah tempat ujikaji yang sesuai dengan sistem diatasnya. Penerangan masalah- masalah yang dihadapi semasa menyiapkan projek ini juga turut dinyatakan dalam laporan ini. Begitu juga idea-idea penambahbaikan untuk rangka ujian yang dilengkapi dengan sistem pancutan minyak bertekanan tinggi juga disediakan bagi masa yang akan datang

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LIST OF ABBREVIATIONS

Kg	Kilogram
Kgf.m	kilogram-force meter
Km/h	Kilometer per Hour
kW	kilo Watt
L	Liters
mm	millimeters
N.m	Newton meters
PS	Pound per Second
rpm	Revolution per minutes
SOCH	Single overhead camshaft

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CHAPTER 1

INTRODUCTION

1.1 Background

This project title is test rig development for high pressure spray. First of all, the test rig is the place where the setup of certain experiments will take over in order to run the experiment process. It is practically used to run the specific experiment with using the specific apparatus. The test rig is designed based on the experiment's procedure which precisely made only for the apparatus on it. This test rig is used to investigate the spray flow of the high pressure fuel injection system when the different quantities of ethanol blended with gasoline (gasohol) that will be sparking into the high pressure combustion chamber. It is equipped with the fuel tank, fuel filter, fuel pump, fuel regulator, and an injector with the high pressure combustion chamber.

1.2 Problem Statement

Mostly the design of test rig is not suitable with the workplace and not stable to support the apparatus on the rig. This project is to produce the test rig with suitable size to make it easier for the researcher or user to undergoes the experiment that they will be conduct

1.3 Project Objective

To design and fabricate a test rig for high pressure spray based on mechanical engineering method.

1.4 Scopes of the project

There are four scopes in this project:

i) Applying every related topic that learned during the course of Diploma of Mechanical Engineering such as Automotive Technology, Industrial Design, Fluid Mechanics etc.

ii) Fabricate a test rig for high pressure spray that have fuel tank, fuel filter, fuel pump, fuel regulator, and fuel injector through the combustion chamber for experimental usage.

iii) Must be in 130 cm height and 80 x 120 cm width. The fuel tank must be on top, while the injector and high pressure combustion chamber will be place lower than the fuel tank.

iv) The injector must be precisely inserted into the combustion chamber as the high speed camera will capture the drop of the spray in injection process through the combustion chamber.

1.5 Flow Chart.

Organization of the project is guided from the project flow chart, A flow chart, or flow diagram, is a graphical representation of a process or system that details the sequencing of steps required to create output. This flow chart was present steps or process of final year project that I will present in this semester. Figure 1.0 shows that process to complete my final year project.

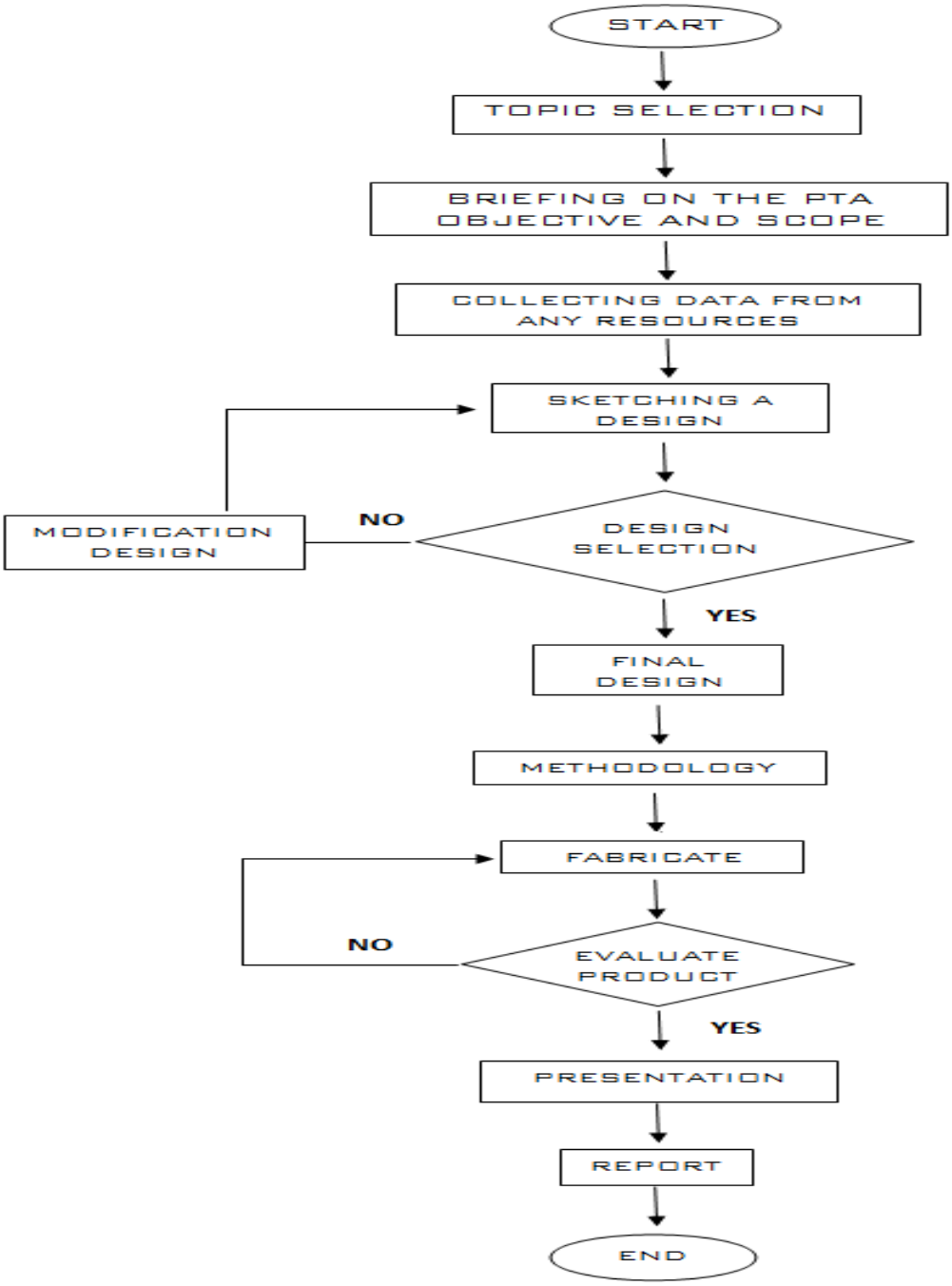

Figure 1.0 The flow chart of the project

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter concludes about general test rig, current designs of the other test rigs, and briefly explanation about the apparatus that will be equipped on this high pressure test rig.

2.2 Current Product Designs

2.2.1 First Current Design

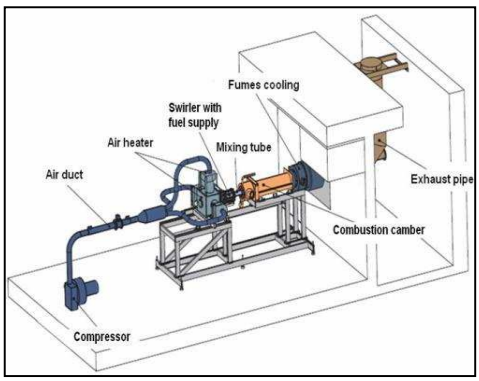

Figure 2.0 First Design Concepts

This is the first current model of test rig that is already exist in the market. The base of this test rig is fully located on the floor. This characteristic is important in order to make sure the test rig is stable to support the heavy apparatus on the rig. The apparatus on the rig also assembled in the suitable coordinates.

2.2.2 Second Current Design

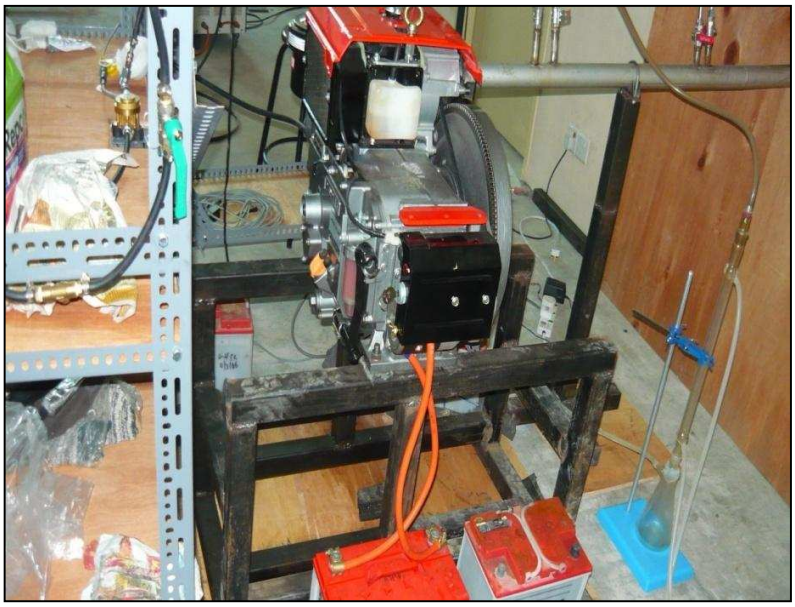

Figure 2.1 Second Design Concept

This is an engine test rig that located in the UMP automotive lab. Some research are made on this rig. The material used to fabricate this rig is as square hollow mild steel bar. It is also joined by welding method. The design was fixed and there are no adjustments.

2.2.3 Third Current Design

Figure 2.2 Third Design Concept

This product was design and fabricate by engineer in figure 2.2, this product had been test at Universiti Malaysia Pahang (UMP) for eddy current dynamometer test and it is located in automotive laboratory, UMP. This design was completely with the height adjustable to locate the drive shaft of dyno engine. There are so many materials used in fabricating this design but it is an effective design and stable.

2.3 Materials used

Materials are needed to make a test rig structure. A good characteristic of materials are need to make the high quality of test rig structure. Regarding to the test rig structure that had review, most of the test rig structure are made by mild steel.

Why mild steel is use for test rig structure? The American Iron and Steel Institute defines a carbon steel or mild steel as having no more than 2 % carbon and no other appreciable alloying element. Carbon steel makes up the largest part of steel production and is used in a vast range of applications.

Typically carbon steels are stiff and strong. They also exhibit ferromagnetism (i.e. they are magnetic). This means they are extensively used in motors and electrical appliances. Welding carbon steels with carbon content greater than 0.3 % requires that special precautions be taken. However, welding carbon steel presents far fewer problems than welding stainless steels. The corrosion resistance of carbon steels is poor (i.e. they rust) and so they should not be used in a corrosive environment unless some form of protective coating is used (Paul Hudson, 2006).

ADVANTAGES	DISADVANTAGES
• Cheap	• Poor corrosion resistance
• Wide variety available with different properties	
• High stiffness	
• Magnetic	
• Most carbon steels are easy machine and weld	

Table 2.0: Advantage and Disadvantage of Mild Steel

2.4 Schematic Flow of the Rig

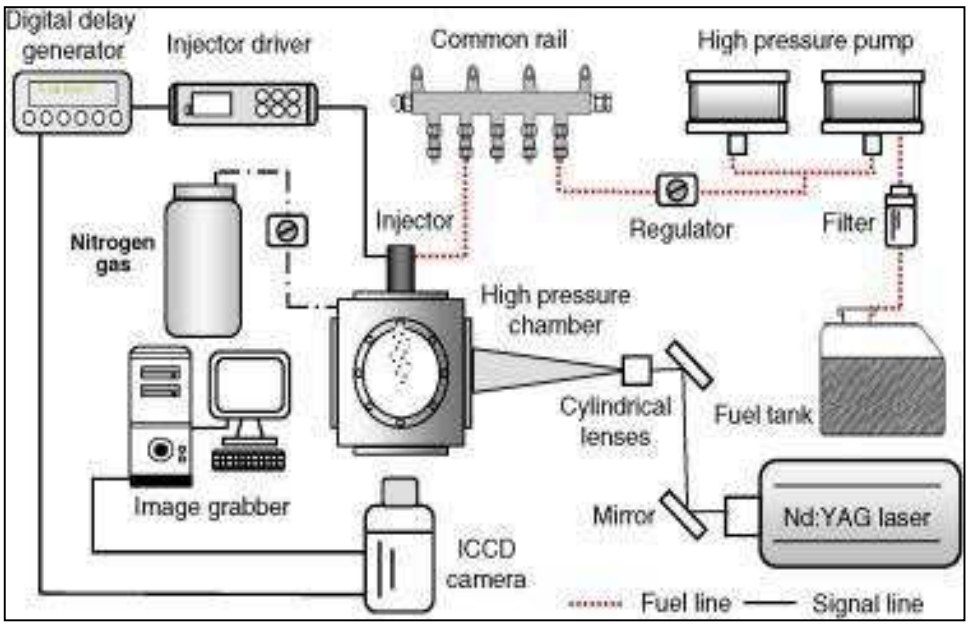

Figure 2.3 Shown the schematic diagram of the process that will be taken on the test rig

The first and very important step before designing the test rig is to study the flow of the schematic diagram of the process that will be taken on the test rig. Figure (above) shown that the test rig must be equipped with all of the required apparatus in order to make sure the experiment will flow smoothly. Firstly, the fuel tank must be placed on the top as it can gain the smoothness of the fuel flow before it went through the fuel filter and fuel pump. While the fuel pump is attached to the direct current, the fuel regulator will measure the pressure of the fuel in the hose. After that, the fuel will flow through the injector that attached into the combustion chamber. Lastly, when all of these steps are taken, the experiment can be conduct on this test rig.

2.5 The Test Rig Equipments

It is important to know the dimension of each equipment that will be install on the test rig. This is because the dimensions of each equipment will affect your test rig design especially on the dimensions. Recognizing the flow of the system on the rig is also one important thing before the rig is design.

2.5.1 Fuel Tank

Figure 2.4 The Fuel Tank that will be used on the test rig

Figure 2.4.1 Two hoses are connected to the fuel tank

A fuel tank is safe container for flammable fluids. On this test rig, the fuel tank is located at the top of the rig.

2.5.2 Fuel Filter

Figure 2.5 Shown a fuel filter that being used on the rig

In this project, the fuel filter is attached from the petrol tank before the petrol is going through the fuel pump. The function of fuel filter is to remove dust particle of dirt or any other unwanted particles that may be present in the petrol.