‘Saya / Kami akui bahawa telah membaca

karya ini dan pada pandangan saya / kami karya ini

adalah memandai dari segi skop dan kualiti untuk tujuan penganugerahan

Ijazah Sarjana Muda Kejuruteraan Mekanikal (Struktur dan Bahan)’

Tandatangan :

Nama Penyelia I :

Tarikh :

Tandatangan :

Nama Penyelia II :

Tarikh :

ANALISIS MINYAK PELINCIR BARU UNTUK KERETA DENGAN MENGGUNAKAN FOUR-BALL TESTER

MUHAMMAD AZUAN FAUZAN BIN PUNIJAN

Laporan ini dikemukakan sebagai
memenuhi sebahagian daripada syarat penganugerahan
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APRIL 2010

"Saya akui laporan ini adalah hasil kerja saya sendiri kecuali ringkasan dan Petikan yang tiap-tiap satunya saya telah jelaskan sumbernya"

Tandatangan :

Nama Penulis : MUHAMMAD AZUAN FAUZAN BIN PUNIJAN

Tarikh : 5 April 2010

DEDICATION

I would like to dedicate this project to my beloved family:

Punijan Bin Munijo (Father)

Arfiah Bt. Ab. Hamid (Mother)

And also to my brother and sisters:

Muhammad Azrul Hafiz

Nur Aqilah Najihah

Intan Marhaini

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ABSTRACT

Tribology is a study focusing on friction, wear and lubrication of interacting surface in relative motion. In this case we are study on lubricant. The function of lubricant is to control friction and wear in a given system. Based on the study we can relate to the performance of the lubricant. Rather that that we also can predict the quality of the lubricant that can be reflects to its resistance to degradation on service.

Four Ball Tester machine was used to examine the properties of the lubricant. This machine is used to study the effect of the temperature and applied load on the performance of the lubricant. Therefore, we can get the relationship between the temperature and the applied loads with the performance of the lubricant.

As for this project, we will study the relationship between the applied load and the performance of the lubricant. The performance can be representing on how the lubricant work in order to prevent the steel ball from weld. As a consumer, we would like to know which one could give a better protection to the engine. Therefore, we make a comparison between the X and Y lubricant in order to choose which one could give a better protection to the engine which their price are mostly alike.

ABSTRAK

Tribologi adalah kajian mengenai geseran, kehausan dan pelinciran terhadap dua permukaan yang bersentuhan pada gerakan relatif. Untuk masalah ini, kita mengkaji mengenai minyak pelincir. Kegunaan minyak pelincir adalah utntuk mengawal geseran dan kehausan pada sesuatu sistem. Berdasarkan daripada kajian tersebut kita dapat kaitkan dengan prestasi minyak pelincir tersebut. Selain itu, kita akan dapat mengkaji kualiti minyak pelincir yang bertindak balas dengan pengurangan gred semasa operasi.

Mesin 'Four-Ball Tester' digunakan untuk melakukan eksperimen terhadap cirri-ciri minyak pelincir. Mesin ini digunakan untuk mengkaji hubung kait antara suhu, dan pemberat terhadap prestasi minyak pelincir. Oleh yang demikian, satu hubung kait antara suhu dan pemberat terhadap prestasi minyak pelincir dapat dihasilkan.

Untuk projek ini, kita akan mengkaji hubung kait antara pemberat dan prestasi minyak pelincir. Prestasi minyak pelincir boleh digambarkan dengan bagaimana minyak pelincir ini mampu menahan bola besi daripada melekat. Sebagai pelanggan juga, kita ingin tahu minyak pelincir mana akan memberikan perlindungan yang terbaik pada enjin kereta. Oleh yang demikian, kita akan melakukan perbandingan antara minyak pelincir X dan Y dalam usaha untuk memilih minyak pelincir yang akan memberikan perlindungan yang lebih baik kepada enjin kereta dimana harga minyak pelincir X dan Y hampir sama.

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F	=	Force (N)
A	=	Area (m^2)
u	=	Velocity (ms^{-1})
h	=	Height (m)
η	=	Dynamic Viscosity (Pas)
τ	=	Shear stress (Pa)
υ	=	Kinematic viscosity (m^2/s)
ρ	=	Fluid density (kg/m^3)
α	=	Pressure-viscosity coefficient (m^2/N)

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

In this project, the properties and the behavior of the lubricant are been studied. Furthermore, the relationship of the lubricant performance with load are been gather from the experiment. Rather than that, the performance of the lubricant before done a maintenance are also been study. To observe the relationship of the lubricant between load and diameter scar we will used the Four Ball Tester machine.

From the study, as the viscosity is higher, it will affect the performance of the lubricant. There are 3 type of lubricant for car engine:

i. Regular oil

ii. Semi synthetic oil

iii. Fully synthetic oil

These are the lubricant that will be used in the experiment and make a differentiation based the performance. From the observation the fully synthetic lubricant should have the better performance, and also want to know how long it can be operating

before maintenance. Same goes to other lubricant oils; we will observe how the lubricant will react with the high temperature and extreme load.

We will know how far the lubricant performance by seeing the wear and scar on the ball from the Four Ball Tester machine. The maximum load and maximum temperature can be determined as the steel ball is weld together.

1.2 IMPORTANT OF PROJECT

This experiment and analysis is important in order to understand the behavior of the lubricants. It also helps to determine the maximum load that the lubricant can endure during operating.

When all the behavior of the lubricant under certain condition can be determined, it will help:

i. Prevent the engine from wear

ii. Prolong the life time of engine

iii. Give a better performance and protection for the engine.

1.3 OBJECTIVE

i. Determine the relationship between the lubricant performance and the applied load

ii. Determine the performance of the lubricant before maintenance by identify the maximum load that the lubricant can sustained.

iii. Make a comparison between X and Y Lubricant and analyze the performance of the lubricant

1.4 SCOPE OF THE PROJECT

i. Doing the literature review for the properties of the lubricant and types of wear.

ii. To perform the experiment of Four Ball Tester to get the relationship between the performances of the lubricant and applied load.

iii. To analyze on the behavior and performance of the lubricant.

1.5 PROJECT SUMMARY

This project is about doing the experiment using the Four-Ball Tester machine and doing analysis the data from the experiment. From the data, a graph for diameter scar versus applied load is plot. Based from the graph plot, the performance of the lubricant can be determined by comparing the diameter of the scar.

Besides that, the maximum load for the lubricant can be sustained before failure can be calculated. Therefore, the relationship between the applied load and the size of the scar can be determined. Different lubricant will give a different maximum load that the lubricant can be sustained. It is due to the additives added in the lubricants.

CHAPTER 2

LITERATURE REVIEW

2.1 FUNCTION OF ENGINE LUBRICANT

The lubrication of the engine appears frequently to have been afterthought in the engine design process. Therefore, several experiments are done to develop a better performance of lubricant. The lubricants are needed to fulfill several important functions rather than controlling friction and wear.

Furthermore, they are used to protect the engine against rusting and other types of corrosion. For long term use, it keeps the internal surfaces of the engine clean and in shape by minimizing the deleterious effects of combustion product and other contaminant that can enter the engine. According to J.C Bell, the lubricant also is a primary medium for cooling the piston, where it also plays a part in completing the seal between the piston, piston-ring and cylinder surfaces against leakage of the combustion gases.

The lubricant must perform these functions for long period of hours between oils changes, under extreme and operating conditions. Such as in a high speed driving, under heavily loaded condition that can cause thermal stressing and oxidation of the oil. Even in temperate climates it may occasionally be necessary to start the engine at sub-zero temperatures. The lubricant oil must remain fluid under all these conditions in order to perform its functions efficiently.

2.2 LUBRICANT COMPOSITION

There is some question that still has to answer, what is the chemical composition of the lubricant? How to differentiate several of lubricant? What are the different between mineral and synthetic oils? What are the additives used in oils? Will the composition of the lubricant differ depending to application?

Oils can be divided into two different origins, the biological and non biological and it provide a vast array of hydrocarbon compounds. These substances are usually present as complex mixture and used for many purpose such as to control of wear and friction. Lubricants made from mineral oils are partly refined and partly impure. The balance between impurity and purity is critical to oxidation stability of the oil and it varies depending on the applications.

Chemicals which are deliberately added to oil in order to improve its properties are called additives. Additives can radically change the properties of a lubricant and are essential to the overall performance of the lubricant. They also dictate specific characteristics of the lubricant such as:

i. Corrosion tendency

ii. Foaming

iii. Oxidation

iv. Wear and friction

There are two fundamental aspect of lubricant performance:

i. Achieving the required level of friction and wear rates

ii. Maintaining the standards in spite of continuous degradation of the lubricant.

Additives present in the oil also deteriorate during operation since they react with the metallic parts if the machinery and with the environment. The degradation of the lubricant is inevitable and must be postponed until the required lifetime is achieved. In fact, a large part of lubricant technology is devoted to the preservation of lubricating oils when in use.

2.3 MINERAL OILS

Mineral oils are the most commonly used lubricants. They are manufactured from crude oil which is mined in various part of the world. There are certain advantage and disadvantage of applying mineral oil to lubricate specific machinery. These must be carefully consideration when selecting a lubricant and designing a lubrication system. The cost of mineral oils is low and even with the rapid development of synthetic oils, solid lubricants and wear resistant polymers.

2.3.1 Sources of Mineral Oils

The theory states that the mineral oils are the result of decomposition of animal and plant matter in salt water. Over time they were buried and compressed. Under these conditions the organic matter transformed into tar-like molecules called kerogen. As the temperature and pressure increased the kerogen gradually transformed into the complex hydrocarbon molecules which are the basic constituents of crude oil. When the temperature and pressure became sufficiently high methane was produced from the kerogen or crude oil and hence natural gas is often found together with crude oil.

2.3.2 Manufacture of Mineral Oils

According to the G.W.Stachowiak and A.W. Batchelor, crude oil has a very complex structure which is separated into a number of fractions by a distillation process which is called fractional distillation. The process of fractional distillation involves heating the crude oil to turn into a vapor which is then passed through a tall vertical column (fractional tower), containing a number of trays at various levels. The vapor passes through the column and at each successive tray the temperature gradually drops. The fraction whose boiling point corresponds to the temperature at a particular tray will condense. In this manner the most volatile compounds will condense at the highest trays in the column while those with the highest boiling points condense at the lower trays. The condensed fractions are then tapped.

There are certain temperatures limits to which crude oil can be pre heated. If the temperature is too high then some of the crude may decompose into coke and tarry matter. This problem is overcome by employing another distillation tower which operates at a lower pressure. By lowering the pressure the heavy fractions of crude can be vaporized at much lower temperatures. Thus in the manufacture of mineral oils and petroleum fuels distillation takes place at atmospheric pressure and also at significantly reduced pressures. At atmospheric pressures the following