UNIVERSITI TEKNIKAL MALAYSIA MELAKA

IMPROVING GAS EMISSION IN 4-STROKE SMALL ENGINE THROUGH SYSTEMATIC OVERHAUL METHODOLOGY

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

by

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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 (Automotive) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Di dalam mengatasi masalah proses membaikpulih yang tidak sistematik dan peningkatan pemanasan global masa kini, satu metodologi membaikpulih yang sistematik di dalam enjin kecil 4 lejang dan menganalisis ujian mampatan dan pelepasan gas yang terhasil sebelum dan selepas proses membaik-pulih telah dijalankan. Proses membaik pulih, pengukuran dan pemeriksaan, ujian mampatan dan pelepasan gas telah digunakan untuk mendapatkan keadaan komponen enjin dan pengeluaran gas sebelum dan selepas proses membaik pulih. Perbandingan keputusan ujian mampatan antara sebelum dan selepas baik pulih menunjukkan peningkatan tekanan meningkat di dalam silinder enjin apabila proses membaik pulih enjin telah siap dijalankan. Pengukuran dan pemeriksaan komponen enjin adalah bertujuan untuk menentukan sama ada ia masih berfungsi dengan baik atau tidak. Ia juga mengenalpasti komponen-komponen yang boleh digunakan sekali lagi dan komponen-komponen yang perlu diganti. Ujian pelepasan gas dijalankan keatas motosikal yang statik di dalam neutral gear. Dalam pelepasan gas yang dikeluarkan dari kebuk pembakaran terhadap keadaan sebelum dan selepas proses baik pulih ditentukan melalui Mesin analisa gas ekzos di pelbagai enjin RPM. Perbandingan data di antara dua keadaan ini mendapati terdapat beberapa gas yang telah berkurang dan terdapat juga beberapa gas yang telah meningkat selepas proses baik pulih enjin selesai sepenuhnya. Semua keputusan yang terhasil akan dipelajari dan dianalisis untuk membuat penjelasan yang lebih lanjut. Setelah kesemua eksperimentasi dan data selesai dijalankan dan dipelajari, peningkatan ujian mampatan adalah sebanyak 4.6% manakala peningkatan CO^2, O^2, HC masing-masing adalah sebanyak 33%, 16.5% dan 30%. Bacaan CO bertambah sebanyak 6.5% disebabkan oleh pelarasan karburetor yang tidak betul.

ABSTRACT

In order to overcome the non-systematic overhaul methodology and global warming nowadays, a systematic overhaul methodology in 4-stroke small engine and study and analyze compression and emission test results before and after overhauling process were performed. Overhaul process, measurement and inspection, compression and emission test were used in order to get the condition of the engine components and the gases produces before and after the overhauling process. The comparison of compression test results between before and after overhaul shows the improvement of pressure increased in the engine cylinder when the engine overhaul was completely done. Measurement and inspection of the engine components was intended to determine whether they work well or not. It also determined which components can be used again and which components need to be replaced. The emission test was run on the static motorcycle in neutral gear. The emission gases that produced from the combustion chamber in the condition of before and after overhaul process were determined by exhaust gas analyzer machine in the various engine RPM. The comparison data between these two conditions found that there have some gases were reduce and some gases were increased after the engine overhaul process was completely done. All the results were studied and analyze for further explanation. After all the experiments and data had been done and studied, the compression test was improved about 4.6% while the CO^2, O^2, HC were improved 33%, 16.5% and 30% respectively. The CO reading was slightly increased by 6.5%. This is because the improper carburetor adjustments.

DEDICATION

I dedicate this project to God Almighty my creator, my strong pillar, my source of inspiration, wisdom, knowledge and understanding. He has been the source of my strength throughout this program and on His wings only have I soared. I also dedicate this work to my beloved parents, Shahurin Bin Hj Shaari and Wan Zuraini Binti Wan Chik who has encouraged me all the way and whose encouragement has made sure that I give it all it takes to finish that which I have started. To my supervisor, Mr. Adnan Bin Katijan who has always gave a motivated and advice in order to complete my Bachelor's Degree Project. To my friends who have been affected in every way possible by this quest. Thank you. My love for you all can never be quantified. God bless you.

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mm	-	Milimeter
psi	-	Per square inch
kPa	-	Kilo pascal

LIST OF ABBREVIATIONS

ICE	Internal Combustion Engine
TDC	Top Dead Center
BDC	Bottom Dead Center
CMM	Coordinate Measurement Machine
SOHC	Single Overhead Camshaft
DOHC	Dual Overhead Camshaft
HC	Hydrocarbon
CO	Carbon Monoxide
NO_x	Oxide of Nitrogen
RON	Research Octane Number
THC	Total Hydrocarbon
ECU	Engine Control Unit
FTK	Fakulti Teknologi Kejuruteraan
PSM	Projek Sarjana Muda
RPM	Revolution Per Minute

CHAPTER 1

INTRODUCTION

1.1 Background

The emission is one of the most important criteria that must be considered in the automotive industry because a dirty engine can lead to the increase in fuel consumption and wear on the engine parts. This emission test has also been skipped before and after the engine overhauling process because of the costing of the emission test equipment is too expensive. In this work, by using the compression test, it can give information about the mechanical situation of the internal motorcycle's engine such as pistons, rings, valves, and head gaskets. It also can give information accurately in case the motorcycle engine's performance decreases due to the cylinder leakage at piston ring, torn head gasket or valves and seats faulty. This method can tell us early either to proceed the engine overhaul or not. An appropriate tool and torque will be used in order to maintain the engine life. However, by using the picture in overhauling process will guide and make them clearly understand the actual picture. Emission gas analyzer will be used before and after the engine overhauling process.

Usually, the procedure of checking the engine's performance at the beginning of engine overhaul is always been skipped. It can affect the motorcycle performance because the initial setting for the motorcycles engine performance is always the best where is manufacturer always follow the standard operation procedure(SOP) and tools. Due to the sensitivity of mechanical parts, inappropriate tools and procedure in overhauling motorcycles engine will damage the engine parts and lack of engine

performance will occur. Hence, appropriate torque and tools must be followed thoroughly.

By overhauling the motorcycle engine, all the parts will be checked and cleaned thoroughly. At the end of this project, it will improve the emission that produces by the motorcycle engine and also will have better performance. For the future, this project can be continued by testing the emission of the engine on the road testing which it can perform on every single gear with respect to the velocity. The different weather also can give different emission result, so this project can be carried out on day and night.

1.2 Problem Statement

Initially, this project made a detailed description of repair and overhaul methodology for four-stroke motorcycle engines. Currently, almost all motorcycle overhauling process does not follow the appropriate methodology for overhauling motorcycle engine. This is because of the limit of time and certain machine or instrument are too demanding at a high price, so the easiest way is uses of the existing tools (not proper tools) to perform the overhaul process. During the reassembly, improper bolts and nuts tightening with the wrong torque needed will result in breakage, leaks, premature bearing and seal failure, cylinder head warpage and suspension failure from loose or missing bolts and nuts. Due to the global warming nowadays, emission issues from the vehicle is one of the highest factors that contribute to it. The abnormal emission is come from the sources of the combustion in the combustion chamber either from the mixture itself or from the poor engine parts.

1.3 Objectives

1. To design the systematic overhaul methodology.
2. To study and analyze compression and emission test results before and after overhauling process.

1.4 Scope

1. Perform overhaul method on four stroke motorcycle engine.
2. Inspect and make sure that all the damaged components will be replaced.
3. Emission test conducted on static motorcycle in neutral gear.
4. Measurement and inspection of engine components by using FTK lab tools only.

1.5 Significant of study

In this project, it will provide an appropriate methodology or also known as SOP on performing engine overhaul for four-stroke motorcycle engine. These SOP will guide from the initial process until finishing process by the using of appropriate torque needed in tightened bolts and nuts, proper hand tools and the easy steps in doing these process. By referring to the SOP, it will save time, cost and the most important is it can reduce damage failure on the parts. This methodology can be used as a learning process in laboratory session in order to make fully understanding about overhauling four-stroke motorcycle engine concept. Last but not least, this project also will be as a references and guidelines to the community for getting more information about engine overhauling process.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

To complete this literature review, research needs to be made first to ensure the limit of the problem area and how to define the problem. By reading the previous history about what they have done in their previous projects, it can help to upgrade what has not been renewed as well as being a guideline to complete the project that wants to be carried out. It also can tell about the chronology of project and be as a perimeter in the project so that it does not go too far beyond what to look for. These will help in identifying the relevance of the research. To make a versatile project, all aspects that involve in this project should take into consideration to ensure the uses criteria can be applied in order to solve the problems that have been identified.

In producing a quality project, this chapter is the main aspect that must be considered because from this literature study, it can lead to the successful production of the project. Various methods that have been done before can be used to specify what are the best and suitable methodologies to overhaul four-stroke motorcycle engine. The choice of the suitable methodology is much focused because this aspect will determine the project's quality. Therefore, this literature review must be done before the project is operated, it is because to ensure that the appropriate methodology can apply to the project. The structure of this chapter is shown in Figure 2.1.