

The Effect of Using Crankcase Emission Control System Technology on the Performance of a 160 cc Single Cylinder Four Stroke Engine

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Abstract—The research was carried out on a single-cylinder four-stroke petrol engine with a rotation variation of 1000 rpm - 9000 rpm, using crankcase emission control system (CECS) technology. The air that will enter the carburetor is mixed with hot gas that flows and comes from the CECS, causing the air to become warm and then mixed with the fuel in the carburetor, and then the mixture passes through the manifold into the combustion chamber. Investigation in the first stage under standard conditions and in the second stage using CECS technology. The use of CECS technology results in increased machine performance. After testing with and without using CECS technology, optimum performance in the form of power, torque and specific fuel consumption occurred at engine speeds of 8000 rpm, 6000 rpm, and 7000 rpm respectively producing power, torque and specific fuel consumption of 13.11; 1.504 kg.m and 0.152 kg/hp.an hour without CECS, and with the use of CECS technology of 13.20 hp; 1.56 kg.m and 0.151 kg/hp.hour.

Keywords: *performance; blowby; crankcase emission control system; power; torque; specific fuel consumption.*

I. INTRODUCTION

An internal combustion motor is an engine that utilizes a working fluid/hot gas resulting from combustion, where the medium that utilizes the working fluid (gas) and the working fluid are not separated by a dividing wall [14].

A piston combustion engine is a machine that converts heat energy into mechanical work. In a piston combustion engine, heat energy is released through the combustion of a mixture of

fuel and air in the combustion chamber. A homogeneous mixture of fuel and air is needed for the combustion process to be complete [5].

In this research, an experiment was carried out using crankcase emission control system (CECS) technology. The air that will enter the carburetor is warmed first then mixed with the fuel in the carburetor and then the mixture passes through the manifold into the combustion chamber. And how does CECS technology affect machine performance [2].

The automotive world (especially motorbikes) is developing very rapidly. There are more and more technological devices on petrol motorbikes so that petrol motorbikes are more sophisticated and faster in the working process. Modifications that have been made by automotive manufacturers include the emergence of Crankcase Emission Control System (CECS) technology to increase engine performance.

The problem studied is how the Crankcase Emission Control System affects torque, power, and specific fuel consumption. The gas leak referred to here is a gas leak or gust from the combustion chamber due to a leak in the piston and piston ring against the wall leading to the crankcase. This is a leak that occurs in the piston and piston rings and piston rings from the cylinder wall to the crank chamber. The exhaust from this leak contains hydrocarbons (HC) around 20% of the total HC content of the engine and will increase by around 20% if the piston ring is damaged (worn). In this blowing gas, around 85% of the mixture from the carburetor is in the form of raw HC, of which the remaining 15% is burnt gas.

II. EXPERIMENTS

The research object here is intended to clarify the machines used in the research. The engine used is a single-cylinder four-stroke petrol motorbike/Honda. The testing tools and machines used are petrol motorbikes, 4 stroke/Honda - single cylinder, SOHC type, dynamometer, tachometer, fuel cylinder, and CECS.

In this study, the engine was started with the gas throttle fully open, then a braking load was applied to get the engine speed to vary as desired.

Meanwhile, the steps taken by researchers to collect test data are:

1. Start the engine by adjusting the gas throttle several degrees as needed, so that the engine is stationary.
2. Preheat 5 minutes at idle, to ensure engine working condition and reach engine working temperature.
3. To start data collection, first open the gas throttle slowly until it is fully open, then the load is applied until it reaches the desired engine speed.
4. Turn off the machine when the test is complete.

III. RESULTS AND DISCUSSION

The crankcase emission control system model used is standard from the Honda Megapro 160 cc manufacturer as shown in figure 2.

CECS technology utilizes warm air from the engine's respiratory tract by channeling it back into the combustion chamber so that combustion is easier and can improve engine performance. Apart from that, this technology can also reduce exhaust gas emissions in the crank chamber due to leaks in the piston and piston rings against the cylinder walls, mainly in the form of HC which ranges between 20 ÷ 35 % of the total.

The way this technology works is that when the engine is operating, the piston moves up and down in the cylinder and carries out a work cycle, especially when it moves to the top dead center (TDC) which carries out the compression and combustion process/steps, where when If

both valves are in the closed position, then the gas in the cylinder will be pushed and compressed by the piston, so that the pressure will increase and the gas will move in all directions, especially against the push of the piston's movement, so that a small portion of the gas will leak/come out. to the crank chamber (crankcase) due to leaks in the piston and piston rings against the cylinder wall (blowby), where the gas will then be utilized and circulated to the combustion chamber which will previously pass through the air filter and then mix with oxygen (from the outside air) to become air. which is warm and then enters the combustion chamber because there is suction from the piston which previously passed through the carburetor and will be mixed with fuel (gasoline), so that the two gases become gas which is already in the form of mist, then enters the combustion chamber and carries out the further combustion process.

The picture below shows the parts of the CECS, namely 1. air filter, 2. carburetor, and 3. breathing duct from the crankcase.

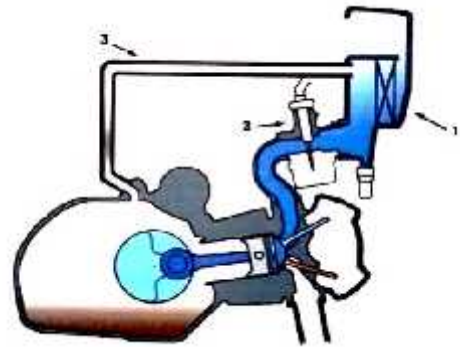


Figure 1. Crankcase emission control system

Table 1. Engine rotation, power, torque, and specific fuel consumption

Engine rotation	Without CECS (standard)			Remarks		
	Power	Torque	Sfc	Power	Torque	Sfc
[rpm]	[hp]	[kg.m]	[kg/hp.h]	[hp]	[kg.m]	[kg/hp.h]
1000	0,158	0,11	2,01	0,137	0,026	2,259
2000	0,981	0,29	0,468	1,125	0,371	0,43
3000	3,23	1,049	0,205	3,316	1,327	0,197
4000	5,117	1,292	0,184	5,379	1,395	0,174
5000	7,45	1,429	0,154	7,467	1,481	0,152
6000	10,03	1,504	0,152	10,06	1,56	0,151
7000	12,14	1,34	0,156	12,21	1,42	0,151
8000	13,11	1,19	0,153	13,2	1,191	0,152
9000	12,24	0,99	0,188	12,65	1,052	0,178

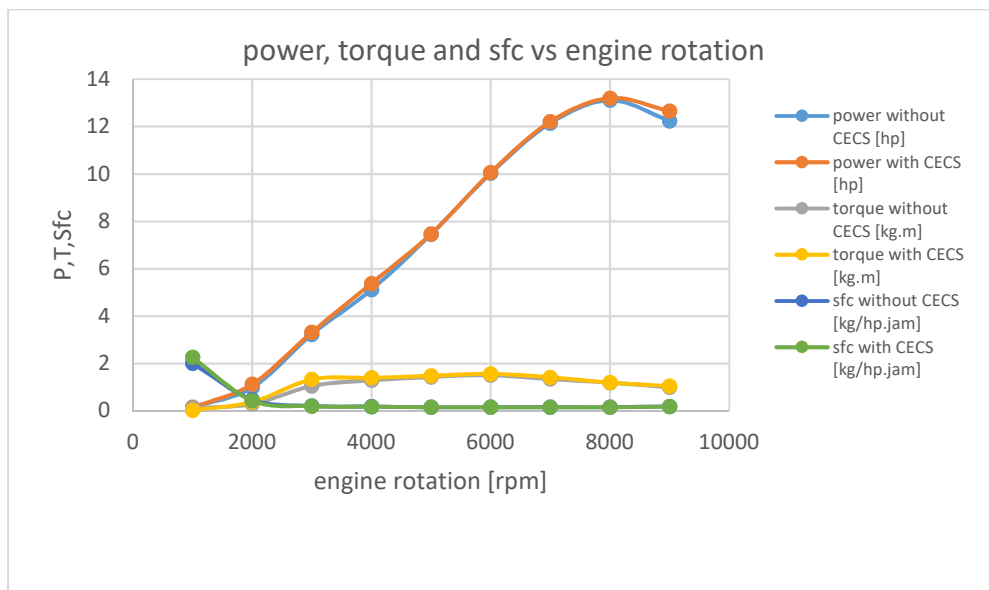


Figure 2. Relationship of power, torque, and specific fuel consumption to engine speed

Figure 2 shows the relationship between power, torque, and specific fuel consumption with the engine speed of a single-cylinder four-stroke vehicle with a range of engine speed variations at 1000 to 9000 rpm with 1000 rpm intervals. This experiment was carried out under conditions without using CECS (standard) and was carried out using CECS so that a mixture occurred between the air entering the air filter and hot gas coming from the crankcase due to leaks in the piston and piston rings against the cylinder wall (blowby).

From the test results, the optimum power, torque, and specific fuel consumption values are 13.2 hp; 1.56 kg.m, and 0.150 kg/hp. hour respectively were produced at 8000 rpm, 6000 rpm, and 7000 rpm compared to other conditions. Optimum results were obtained in testing using CECS technology.

IV. CONCLUSION

From the test results, it can be seen that using CECS technology on the carburetor of a four-stroke, single-cylinder motorbike engine can improve performance compared to without using CECS technology (standard conditions). This is proven by the increase in power value at 8000 rpm engine speed, although less than 1%, the torque value at 6000 rpm engine speed reaches 3.72% and can minimize the specific fuel consumption value at 7000 rpm engine speed up to 3.22%.

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