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Effect of Intake Valve Gap Adjustment Variation on Fuel Consumption in Daewoo 4dwy-30 Diesel Motorcycle

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ABSTRACT

The valve mechanism system on a 4 stroke diesel motor functions as an opening or closing mechanism which is used as a way for air to enter the combustion chamber or as an outlet for residual combustion gases from the combustion chamber. To maximize diesel engine performance, valve clearance adjustments need to be carried out periodically. This research aims to determine the effect of variations in intake valve gap adjustment on fuel consumption on the Daewoo 4 DWY-30 diesel motorbike. This research uses experimental methods and is quantitative research, namely presenting the results of experiments in the laboratory on test objects. The research results show that there is an influence of variations in intake valve gap adjustment on fuel consumption. The highest fuel consumption is at the intake valve gap setting of 0.20 mm, and the lowest fuel consumption is at the intake valve gap setting of 0.60 mm

Keyword: Valve mechanism, Valve gap, Fuel Consumption.

ABSTRAK

Sistem mekanisme katup pada motor diesel 4 langkah berfungsi sebagai mekanisme pembukaan atau penutupan yang diganakan sebagai jalan masuk udara keruang bakar atau sebagai jalan keluar gas sisa pembakaran dari ruang bakar. Untuk memaksimalkan kinerja mesin diesel penyetelan celah katup perlu dilakukan secara berkala. Penelitian ini bertujuan untuk mengetahui pengaruh variasi penyetelan celah katup masuk terhadap konsumsi bahan bakar pada motor diesel Daewoo 4 DWY-30. Penelitian ini menggunakan metode eksperimental dan merupakan penelitian kuantitatif, yaitu memaparkan hasil eksperimen di laboratorium kepada benda uji. Hasil penelitian menunjukan bahwa ada pengaruh variasi penyetelan celah katup masuk terhadap konsumsi bahan bakar. Konsumsi bahan bakar tertinggi berada pada setelan celah katup masuk 0,20 mm, dan konsumsi bahan bakar terendah beradas pada setelan celah katup masuk 0,60mm

Keyword: Mesin Diesel, Tekanan Injektor, Konsumsi Bahan Bakar.

1. Introduction

The current technological advancements have a significant impact on those who are highly attracted to the industry. However, this attraction must align with the knowledge of the important components of machinery that play a crucial role in the production process. Cylinder block, cylinder head, crankcase, crankshaft, piston, valve shaft mechanism, and other components must be understood by someone interested in the world of machining. Valves, also known as "valves," are engine components used to modify fluid flow or pressure rates in a process system using power for operation [18] [1].

Environmental pollution as one of the causes of global warming has become an important issue worldwide, including in Indonesia. The increasing population, economic activities, and transportation contribute to environmental pollution.

Exhaust emissions from motor vehicles can have negative effects on human health and the environment [1] [2]. The growth in the number of motorcycles from year to year exacerbates the danger of vehicle exhaust pollution to humans. The increasing number of motor vehicles from year to year will also increase exhaust gas pollution from vehicles [2] [3].

The gas flow system in the engine is greatly influenced by the operation of the valve. In a 4-stroke engine, each cylinder head has two types of valves: intake valve and exhaust valve. Valves have a very important function as regulators of fuel and gas intake and exhaust. The intake valve serves as a passage for new gas from the carburetor to the combustion chamber, while the exhaust valve serves as an outlet for exhaust gases from combustion [4]

Modifying the camshaft profile can change the timing of valve opening and closing. The purpose of camshaft modification is to increase the volumetric efficiency of the fuel and air mixture entering the cylinder and to smooth the exhaust process after combustion. It is hoped that increasing the volumetric efficiency entering the cylinder and burning it completely can produce greater power [5].

Valve adjustment should be done every 10,000 km. This is important to ensure the engine's performance remains optimal. Valve clearance adjustment should be done when the engine is still cold. This is intended to ensure accuracy according to specifications. Improper valve adjustment can cause inefficient engine performance and fuel wastage. Improper valve adjustment will cause the valves to open and close not according to the engine's operational needs [6].

Research [7] indicates that in this observation, changes in the adjustment of the intake valve clearance affect fuel consumption and engine speed. With a tighter intake valve clearance, fuel consumption increases and engine speed increases, while with a looser valve clearance, engine speed decreases and fuel consumption decreases. The optimal valve clearance is 0.40 mm according to specifications.

Research [8] shows that the percentage of fuel consumption for standard valve clearances (ln 0.20/Ex 0.30) at 2000 rpm (12.27 mL), 3000 rpm (12.57 mL), 4000 rpm (16.40 mL). Testing with narrow valve clearances (ln 0.15/Ex 0.25) at 2000 rpm showed an increase of 2.2 mL/ 17.92% from the standard 2000 rpm test, for the 3000 rpm test there was an increase of 2.43ml / 19.33% from the standard 3000 rpm test, and in the 4000 rpm test there was an increase of 0.77 mL /4.69% from the standard 4000 rpm test.

Subsequent research by [9] shows that with loose valve clearances at each load given to the diesel engine, there is an increase in specific fuel consumption and a decrease in thermal efficiency. Compared to the intake valve clearance setting of 0.015 inches (specification), the highest specific fuel consumption occurs with an intake valve clearance setting of 0.024 inches with a percentage of 5.16%, and the lowest decrease in thermal efficiency occurs with an intake valve clearance setting of 0.024 inches with a difference of 1.54%.

Theory

Combustion engine is an energy conversion machine that converts heat energy into mechanical energy. With heat energy as an energy source, the engine requires fuel and a combustion system. In this case, the commonly used fuels in motor vehicles are gasoline and diesel. An engine that uses gasoline as fuel is called a gasoline engine, while a piston engine that uses diesel fuel is called a diesel engine [10].

In a diesel engine, the combustion chamber can consist of one or more chambers depending on its use, and within one cylinder, there can be one or two pistons. Typically, a diesel engine cylinder has only one piston. The pressure of the combustion gases from the fuel and air will drive the piston, which is connected to the crankshaft via a piston rod, allowing the piston to move reciprocally [11]. The reciprocating motion of the piston is converted into rotational motion by the crankshaft. Conversely, the rotational motion of the crankshaft is also converted into reciprocating motion of the piston during the compression stroke [12].

The operation of a 4-stroke diesel engine is through a fixed sequence of intake, compression, power (combustion), and exhaust strokes [13]**,** Based on how to analyze the system work system, diesel motors can be divided into two, namely diesel motors that use airless injection system (solid injection) which is analyzed by dual cycle analyzed with a dual cycle and a diesel motor which uses an air injection system that analyzed with the diesel cycle[14].

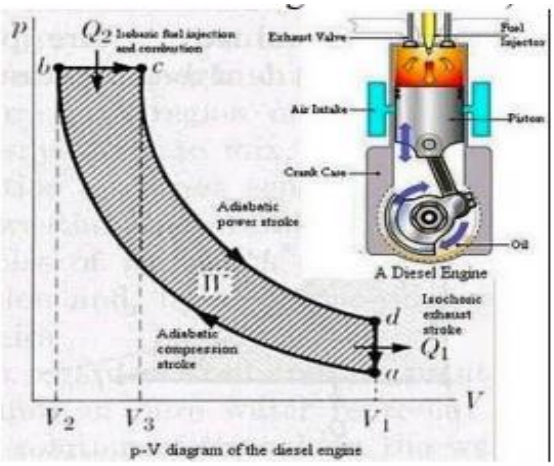


Figure 1.1 P-V diagram of the diesel cycle
[14]

Theoretically, if the intake valve is opened precisely when the piston reaches Top Dead Center (TDC) and closed when the piston reaches Bottom Dead Center (BDC), the air sucked into the combustion chamber will be equal to the piston stroke. However, in reality, this does not happen due to significant obstacles in the intake passage, including the height of the valve opening. To overcome this issue, the opening of the intake valve is made earlier in the intake stroke, a few degrees before the piston reaches TDC, and closed a few degrees after the piston passes BDC. As for the exhaust valve, it is opened a few degrees before the piston reaches BDC and closed a few degrees after the piston passes TDC. To determine the degree of valve overlap, the following steps can be taken: First, create a 5° circle on a piece of paper, forming a full circle of 360°. Then, place the paper with these measurements on the flywheel. The second step is to rotate the pulley until the piston is at top dead center (TDC), ensuring it is indeed at TDC. The third step is to find the valve opening and closing angles. This search involves using a dial indicator tool attached to the rocker arm. The fourth step is to position the dial indicator to show zero (0). Mark the engine block as a reference point for reading the angles [15]

2. Method

Research methods are steps taken by researchers to collect data or information to be processed and analyzed scientifically. Research on the effect of variations in intake valve gap adjustment on the Daewoo 4DWY-30 diesel motor is carried out by connecting the engine to a 3 kW electric generator as the main load. The electric power generated by the generator is connected to 5250 watt lamps and can be turned on periodically. The study was conducted by conditioning the engine to achieve a voltage of 220 volts at the generator, and the gas stance will not be changed. The valve settings tested were 0.20 mm, 0.30 mm, 0.40 mm, 0.50 mm, 0.60 mm. The fuel used is Pertamina diesel. The time used for each test is 6 minutes, and repeated three times to minimize errors in data collection.

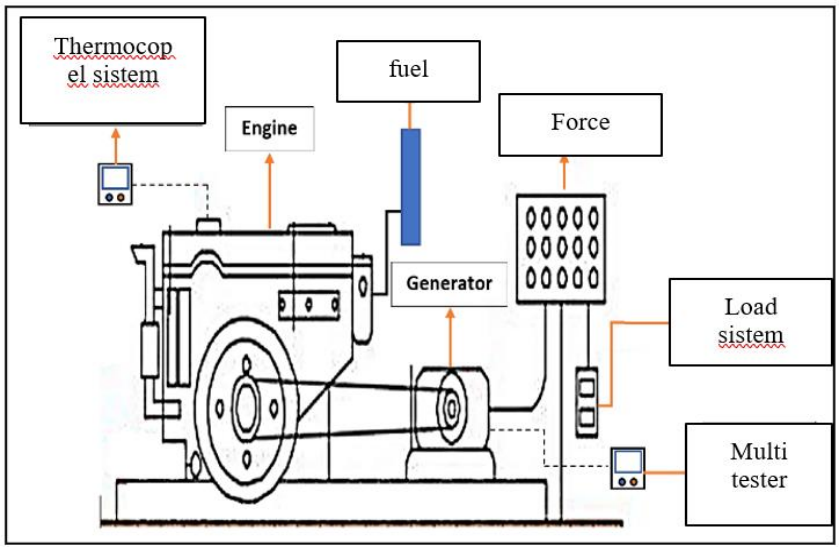


Figure 2.1 The Research Scheme

In Figure 2.1, it can be seen that the research scheme of the effect of variations in intake valve gap adjustment on the Daewoo 4DWY-30 diesel motor is carried out by connecting the engine to a 3 kW electric generator as the main load. The electric power generated by the generator is connected to 250 watt lamps totaling 5 pieces and can be turned on periodically. The study was conducted by conditioning the engine to achieve a voltage of 220 volts at the generator, and the gas stansioner stut will not be changed. The valve settings tested were 0.20 mm, 0.30 mm, 0.40 mm, 0.50 mm, 0.60 mm. The fuel used is Pertamina diesel. The time used for each test is 6 minutes, and repeated three times to minimize errors in data collection.

3. Result and Discussion

3.1 Inlet Valve Gap 0.20 mm

At a load of 0 W the resulting voltage is 240 V and decreases to a voltage of 142 V when the load is increased to 1250 W, and there is an increase in current when the load is added, at a load of 0 W the resulting current is 0 A and increases to 4.8 A when the baban is added to 1250 W, while the rpm on the engine and generator decreases The meisn rotation is at 1. 086 rpm when the load is 0 W, and will drop gradually to 1021 rpm when the load reaches 1250 W, while the rotation of the generator is at 1.679 rpm when the load is 0 W and will drop gradually to 1304 rpm when the load reaches 1250 W, while the fuel consumption increases along with the increase in load, at a load of 0 W the fuel consumption is 120 ml and will increase gradually to 150 mL when the load reaches 1250 W.

Table 3.1 Inlet Valve Gap Testing Results 0.20 mm

Load (W)	Volt (V)	Current (A)	Rotation (RPM)		Fuel Consumsion (ml)
			Engine	Generator	
0	240	0	1.086	1.679	120
250	230	2,2	1.068	1.613	126
500	218	3,4	1.043	1.555	132
750	187	3,7	1.031	1.467	138
1.000	163	4,3	1.026	1.392	144
1.250	142	4,8	1.021	1.304	150

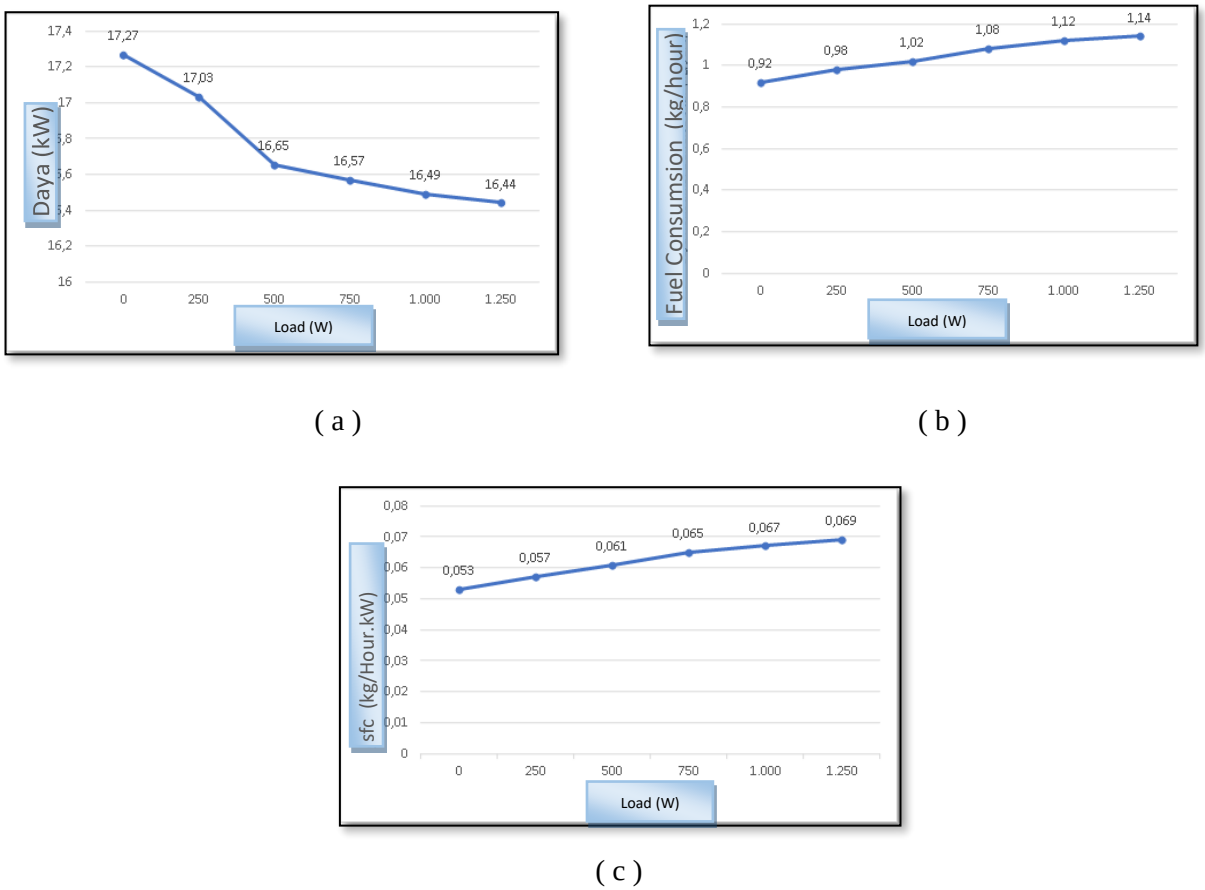


Figure 3.1 Fuel Consumption Rate Chart, Inlet Valve Gap Power, Specific fuel consumption (sfc) at 0.20 mm intake valve gap

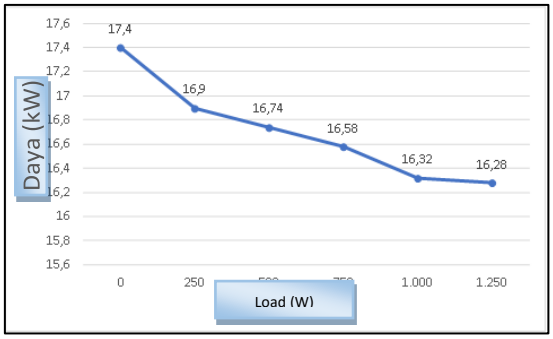
Figure 3.1 (a) shows that there is a decrease in power as the load increases, at a load of 0 W the power obtained is 17.45 kW, and will further decrease to 16.4 kW. (b) shows that there is an increase in the rate of fuel consumption in the engine as the load increases, at a load of 0 W the rate of fuel consumption is 0.97 kg/ hour and increases with increasing load up to 1.22 kg / hour (c) shows that there is an increase in specific fuel consumption (sfc) along with the increase in load, at a load of 0 W the specific fuel consumption is 0.055 kg/h·kW, and will increase to 0.074 kg/h·kW at a load of 1250 W.

3.2 Inlet Valve Gap 0.60 mm

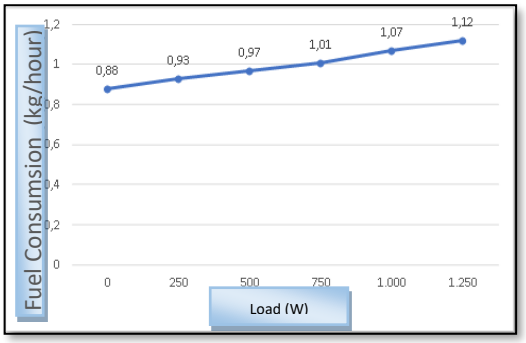
Load of 0 W the resulting voltage is 240 V and decreases to a voltage of 106 V when the load is increased to 1.250 W, and there is an increase in current when the load is added, at a load of 0 W the resulting current is 0 A and increases to 4.6 A when the baban is added to 1.250 W, while the rpm on the engine and generator decreases The meisn rotation is at 1. 083 rpm when the load is 0 W, and will drop gradually to 1.013 rpm when the load reaches 1.250 W, while the rotation of the generator is at 1.690 rpm when the load is 0 W and will drop gradually to 879 rpm when the load reaches 1.250 W, while the fuel consumption increases along with the increase in load, at a load of 0 W the fuel consumption is 108 ml and will increase gradually to 138 ml when the load reaches 1.250 W.

Table 3.1 Inlet Valve Gap Testing Results 0.60 mm

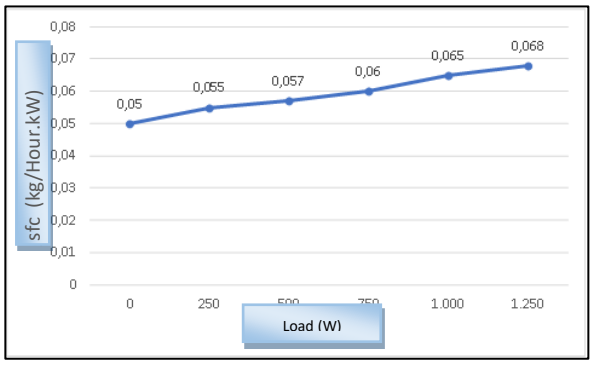
Load (W)	Volt (V)	Current (A)	Rotation (RPM)		Fuel Consumsion (ml)
			Engine	Generator	
0	240	0	1.083	1.690	108
250	232	2,1	1.052	1.618	115
500	197	3,1	1.042	1.394	120
750	143	3,6	1.032	1.096	125
1.000	119	4,2	1.016	964	132
1.250	106	4,6	1.013	879	138



(a)



(b)



(c)

Figure 3.2 Inlet Valve Gap Power Chart, Fuel Consumption Rate at Inlet Valve Gap, Specific Fuel Consumption (sfc) at 0.60 mm Inlet Valve Gap

Figure 3.2 (a). shows that there is a decrease in power along with the increase in load, at a load of 0 W the power obtained is 17.4 kW, and will further decrease to 16.28 kW when the load is at 1250 W and (b) shows that there is an increase in the rate of fuel consumption in the engine along with the increase in load, at a load of 0 W the rate of fuel consumption is 0.88 kg / hour and increases along with the increase in load up to 1.12 kg / hour when the load is 1250 W and (c) there is an increase in specific fuel consumption (sfc) along with the increase in load, at a load of 0 W the specific fuel consumption is 0.05 kg/h·kW, and will increase to 0.068 kg/h·kW at a load of 1250 W.

4. Conclusion

Based on the test results of adjusting the intake valve gap on a diesel engine Daewoo 4 DWY-30 diesel engine can be concluded that:

The highest fuel consumption is at the inlet valve gap setting of 0.20 mm, fuel consumption is 120 mL and will gradually increase to 150 mL when the load reaches 1250 W. at a load of 0 W the fuel consumption rate is 0.97 kg / h and increases with increasing load up to 1.22 kg / h when the load is 1250 W. and the lowest

fuel consumption is at the inlet valve gap setting of 0.60 mm at a load of 0 W the fuel consumption is 108 ml and will increase to 138 ml when the power (P) reaches 1250 W.

The highest engine rpm is at 0.20 mm inlet valve gap setting, at a load of 0 W the specific fuel consumption is 0.055 kg/h·kW, and will increase to 0.074 kg/h·kW at a load of 1250 W. and the lowest engine rpm is at 0. 60 mm inlet valve gap setting, at a load of 0 W the fuel consumption rate is 0.88 kg/hour and increases with increasing load to 1.12 kg/hour at a load of 1250 W (sfc) along with increasing load, at a load of 0 W the specific fuel consumption is 0.05 kg/hour·kW, and will increase to 0.068 kg/hour·kW at a load of 1250 W. The highest engine power is obtained at 0.20mm inlet valve gap setting. At a load of 0 W, the highest engine power was obtained at 17.45 kW, and will further decrease to 16.4 kW when the load is at 1250 W. while the lowest engine power was obtained at an inlet valve gap setting of 0.60mm at a load of 0 W, the highest engine power was obtained at 17.4 kW, and will further decrease to 16.28 kW when the load is at 1250 W.

We recommend adding variations of fuel used in the research such as dexlite or pertinent For further research it is better to do testing on exhaust gas. regarding exhaust gas, The use of various types of fuels can make research more variable where there is a comparison of other fuels such as bio diesel and other environmentally friendly materials, also provide additional air in the fuel system so that the fuel works more perfectly when combustion occurs in other diesel cycles.

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