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Efforts to Optimize Injector Performance for The Combustion Process in The Diesel Generator on The Mt. Gas Patra 3

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Abstract: The injector is a component that functions to atomize fuel in the combustion process, the performance of this injector is very influential on whether or not the combustion process is complete in a diesel generator. The combustion process is very important so that the diesel generator gets optimal performance so that it can properly supply the electricity needs on board. The research method used is descriptive qualitative using data analysis techniques using fishbone diagrams and using data collection techniques through interviews, observation and documentation studies. The indications that appear about the not optimal fogging is the high temperature of the exhaust gas, the exhaust gas is black in color and detonation appears. After analysis, several causes were found, one of which was a lack of pressure on the injector.

Keyword: Optimization, Injector, Detonation

INTRODUCTION

The ship is a means of sea transportation that functions to deliver passengers and goods in large quantities. The role of the ship has been known since ancient times, which has been increasingly developed by humans so as to increase the use value of the ship. Diesel generator is machinery on board which functions to supply electricity on board. Diesel generators include internal combustion engines (Internal Combustion Engines), diesel generators are divided into two major components, namely diesel engines and alternators. The diesel engine functions as a driver to generate rotation, the diesel engine converts heat energy into mechanical motion energy as output which is forwarded to the shaft and then to the propeller. The alternator shaft is connected to the shaft of the diesel engine so that it can convert mechanical energy into electrical energy. The injector is one of the diesel engine components that functions to atomize the fuel in the combustion chamber. Injector pressure must reach 240 kg/cm2 in order to achieve a perfect fogging process so that the combustion process occurs in an even ratio between air and fuel. Injector performance that is not optimal will affect the combustion process if the pressure

is too low the quantity of fuel that is atomized is not appropriate and fuel drips occur resulting in detonation. using 2 Diesel Generators in parallel at the Pertamina Pangkalan Susu North Sumatra Jetty on September 16, 2021. When Machinist 4 did a patrol, he found a thumping sound on Diesel Generator no. 2 and it could be seen that the Diesel Generator exhaust funnel was black in color, then on September 18, 2021 when maneuvering towards the berth, it was found that the exhaust gas temperature of Diesel Generator no.2 cylinder no.2 showed a value of 330°C. Based on the facts and data available, Machinist 3 on September 19 2021 tested the Diesel Generator injector no. 2 and found that injector No. 2 had a pressure of only 190 kg/cm2, while in the manual book the pressure of the injector should be 240 ± 10 kg/cm2. After these indications occurred, Driver 3 checked the Running Hours Fuel Injection Valve no. 2, it was time to replace it, but after checking at the store, no new spare parts were found.

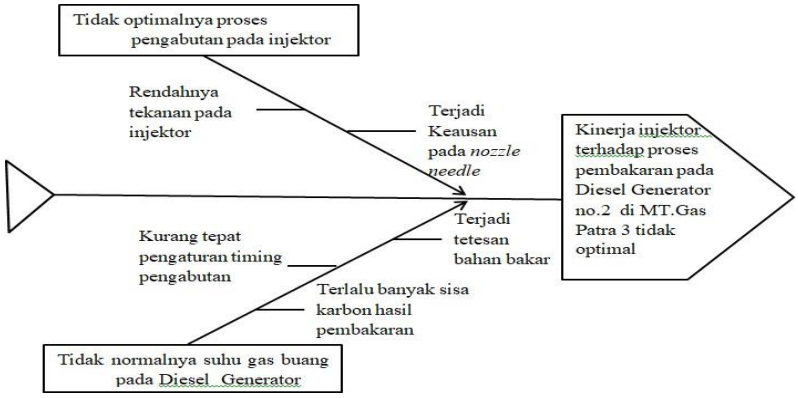
Based on the description above, the authors are interested in raising this issue in the preparation of a thesis with the title: Efforts to Optimize Injector Performance on the Combustion Process in Diesel Generators on LPG/C Gas Patra 3 Ships.

METHOD

Methods/techniques of analysis using a qualitative approach with qualitative descriptive analysis techniques. The subject of this research is Yanmar S165L-DN Diesel Generator Injector. The data analysis method used by the author in addressing the problem is the fishbone method to identify problem factors. The fishbone diagram method is a method for analyzing the causes of a problem or condition. Often this diagram is also called a cause-and-effect diagram or cause effect diagram.

RESULTS AND DISCUSSION

Data Description and Analysis



Data analysis

What causes the diesel generator injector to not optimize the fogging process?

a. Low pressure on the injector

The pressure on the injector is very much needed in the fuel injection process, the injector pressure according to the manual book is 240 ± 10 kg/cm2.

Hasil pengetesan tekanan injektor Diesel generator no.2

Date	*Fuel Injection Valve Pressure Test* (Normal : 240 ±10 kg/cm²)					
19 Sept 2021	1	2	3	4	5	6
	235 kg/cm²	190 kg/cm²	245 kg/cm²	245 kg/cm²	240 kg/cm²	245 kg/cm²

After getting these results then the author with machinist 3 analyzed looking for the cause of the lack of pressure on the injector no.2 and found several causes including:

1. Implementation of PMS (Planned Maintenance System) has not been maximized.

PMS *Running Hour* Diesel generator no.2

Date	Total RH	Fuel Injection Valve					
		1	2	3	4	5	6
		2000					
Last R/H		2106,5	2106,5	1584,0	1584,0	1423,0	1423,0
16/9/21	270,5	2377,0	2377,0	1854,5	1854,5	1693,5	1693,5

2. Damage to the high pressure pipe (high pressure pipe)

This damage is in the form of a leak caused by too tight binding on the holder so that it can cause cracks which can lead to leaks.

b. There is wear and tear on the injector needle nozzle

This wear occurs due to excessive friction on the nozzle needle injector so that it can increase the clearance between the nozzle needle and the atomizer. This wear and tear on the nozzle needle is caused by:

1. Use of non-original or reconditioned parts
2. Lack of maintenance on the fuel filter

What causes abnormal exhaust gas temperatures in diesel generators?

The exhaust gas temperature is an indicator of the combustion process, optimal or not can also be seen from the temperature displayed on the thermometer.

Data gas buang Diesel generator no.1 & no.2

D/G	Hari/Tanggal Jam Jaga	Temperatur Gas Buang (°C)						Ket.
		Cylinder						
		1	2	3	4	5	6	
1	Sabtu, 18 September 2021 (12.00-16.00)	250	260	255	250	265	260	Normal
2	Sabtu, 18 September 2021 (12.00-16.00)	280	330	250	255	270	260	Cyl no.2 Abnormal

The exhaust gas temperature is between 250-300 °C, while the Diesel generator no.2 in cylinder no.2 reaches 330 °C. therefore the researcher looks for the cause of the problem, namely:

a. Too much residual carbon from combustion in the cylinder head. The remaining carbon attached to the cylinder head is the result of an incomplete combustion process, causing soot or carbon residue in the cylinder head and combustion chamber.
b. Fuel dripping occurs after the fogging process on the injector

Identification of the occurrence of these drops is when testing the injector on the pressure gauge reading the resulting pressure is 195 kgf/cm2 and there are fuel droplets.

c. Inaccurate fog timing settings

Setting the timing of the ignition can also be one of the factors causing abnormally high exhaust gas temperatures, because if the process of spraying fuel earlier will cause a high P max and the combustion process is too fast, when the process of spraying fuel is too slow it will also result in the ignition of the fuel being late and even entering the business step, so that the impact is that the degree of the combustion process is not optimal and the power produced will decrease.

Not optimal fogging process on the injector

Efforts to solve the problem of the non-optimal fogging process on the injector are:

a. Replacing the high pressure pipe because spare parts are readily available and is an easy action to do.
b. Carry out cleaning of the fuel filter according to the working hours specified by the maker through the manual book as an effort to prevent damage to other components.

Abnormal exhaust gas temperature on a diesel generator

Efforts to solve the problem of abnormal exhaust gas temperatures in diesel generators are:

a. Cleaning residual carbon in the cylinder head as an effective effort to reduce the high temperature of the exhaust gas in the diesel generator cylinder no.2.
b. Perform maintenance on the injector, namely cleaning the atomizer needle, cleaning the components and testing the injector pressure.

CONCLUSION

The conclusions of this study are as follows:

The non-optimal fogging process on diesel generator injectors is caused by:

a. Low pressure on the injector The pressure determined by the manual is 240 ± 10 kg/cm2 while after testing it only reached 190 kg/cm2 after analysis it was found several causes for the non-optimal fogging process, namely due to:
   1. The implementation of the PMS (Planned Maintenance System) has not been maximized so that the performance of the injector components has become less than optimal.
   2. High pressure pipe damage (high pressure pipe) caused by too tight binding on the holder, which can cause cracks which can lead to leaks.
b. There is wear and tear on the injector needle nozzle.

   The wear in question is erosion due to excessive friction between components caused by combustion heat, this heat causes expansion or changes in the structure of the nozzle needle, then the causes are analyzed:

   1. Use of non-original or reconditioned parts
   2. Lack of maintenance on the fuel filter

Abnormal exhaust gas temperatures in diesel generators are caused by:

a. Too much carbon residue adhering to the cylinder head.
b. Fuel drips occur after the fogging process on the injector.
c. Less precise fog timing

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