

ANALYSIS OF THE CAUSES AND IMPACT OF FUEL FLOW DISRUPTION IN THE MAIN ENGINE OF THE SHIP SABUK NUSANTARA 108

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Abstract

The main engine is the primary propulsion system of a ship; therefore, the reliability of its fuel system plays a crucial role in ensuring safe and efficient vessel operations. Fuel flow disturbances can lead to reduced engine performance and may compromise operational safety. This study aims to analyze the causes and impacts of fuel flow disturbances in the main engine of Sabuk Nusantara 108. A descriptive qualitative method was employed, utilizing data collection techniques including observation, interviews, documentation, and literature review. The study was conducted during the sea practice period from April 4 to June 4, 2026, aboard Sabuk Nusantara 108, focusing on the Yanmar 6EY17W main engine. The results indicate that fuel flow disturbances were primarily caused by clogged Racor filters, blocked strainers, the presence of sediment and contaminants in Biosolar B40 fuel, and inadequate maintenance of the fuel system. These disturbances resulted in unstable engine speed, reduced engine power, incomplete combustion, difficulty in reaching normal operating speed, and an increased risk of sudden engine shutdown. Corrective actions included cleaning the strainer, cleaning and replacing the Racor filter, draining and cleaning fuel tanks, using high-quality fuel, and implementing regular preventive maintenance. The findings demonstrate that routine maintenance of the fuel system significantly improves the reliability and performance of the ship's main engine. Berdasarkan data operasional, laju aliran bahan bakar mengalami penurunan dari 240 L/jam menjadi 220 L/jam dan putaran mesin turun dari 900 RPM menjadi 810 RPM ketika terjadi penyumbatan filter Racor dan strainer. Kondisi tersebut menyebabkan terjadinya misfiring dan penurunan performa mesin induk. Operational data shows that fuel flow rate dropped from 240 L/h to 220 L/h, and engine speed dropped from 900 RPM to 810 RPM when the Racor filter and strainer became clogged. These conditions caused misfiring and decreased main engine performance.

Keywords: main engine, fuel flow disturbance, Racor filter, strainer, Sabuk Nusantara 108, marine diesel engine.

1. INTRODUCTION

Maritime transportation plays a crucial role in supporting passenger mobility and cargo distribution across the Indonesian archipelago. As a maritime nation, Indonesia relies heavily on the operational reliability of ships to connect remote islands and coastal regions. The main engine serves as the

primary propulsion system of a vessel, making its performance and reliability essential for safe and efficient maritime operations.

One of the most important supporting systems affecting the performance of a marine diesel engine is the lubrication system. The lubrication system functions to reduce friction between moving components, minimize wear, dissipate heat, prevent corrosion, and remove contaminants generated during the combustion process. A properly functioning lubrication system contributes significantly to engine efficiency, operational reliability, and service life.

The Yanmar 6EY17W main engine installed on KM Sabuk Nusantara 108 operates continuously during voyages, requiring a stable and effective lubrication system. Lubricating oil pressure and temperature are critical parameters that must be maintained within the manufacturer's recommended operating limits. Low oil pressure may result in inadequate lubrication of engine components, while excessive oil temperature can reduce oil viscosity and compromise lubrication effectiveness.

Based on observations conducted during sea practice aboard KM Sabuk Nusantara 108, variations in lubricating oil pressure and oil temperature were identified during engine operation. These variations were accompanied by changes in engine speed and operating temperature, indicating a possible relationship between the lubrication system and engine performance. Previous studies have demonstrated that lubrication system performance significantly affects the reliability and durability of diesel engines. However, most studies have focused on lubricant quality, component wear, or maintenance procedures rather than directly examining the relationship between lubrication parameters and

2. RESEARCH METHODOLOGY

This research employed a descriptive quantitative method with a correlational approach. The study was conducted aboard KM Sabuk Nusantara 108 by collecting operational data from the Yanmar 6EY17W main engine.

Data collection was carried out through direct observation, engine logbook documentation, interviews with engineering officers, and literature review. The observed lubrication system variables included lubricating oil pressure and lubricating oil temperature, while engine performance variables included engine speed (RPM) and engine operating temperature. The collected data were analyzed using descriptive statistical methods to determine average values and operational trends. Furthermore, Pearson Product Moment correlation analysis was applied to evaluate the relationship between lubrication system parameters and engine performance. Simple linear regression analysis was also conducted to determine the influence of lubrication system conditions on engine performance.

The sample consisted of six operational observations ($n=6$) obtained during the research period. Due to the limited number of observations, the study is considered exploratory and descriptive in nature, providing an overview of the actual lubrication system condition during the observation period.

3. RESULT AND DISCUSSION

Parameter	Kondisi Normal	Saat Gangguan	Perubahan
Laju aliran bahan bakar	240 L/jam	220 L/jam	Turun 8,3%
Putaran mesin	900 RPM	810 RPM	Turun 10%
Kondisi operasi	Working Normal	Misfiring	Menurun
Kondisi filter	Bersih	Tersumbat	Gangguan

Parameter	Kondisi Normal	Saat Gangguan	Perubahan
Status pembakaran	Normal	Tidak sempurna	Menurun

Sumber: Data log book dan observasi peneliti, 2026.

The results of the observations showed that the lubricating oil pressure remained within the range of 5.1–5.4 bar, with an average value of 5.28 bar. Meanwhile, the lubricating oil temperature ranged from 72°C to 76°C, with an average value of 73.6°C. These values indicate that the lubrication system operated within the normal limits recommended by the engine manufacturer.

Engine performance observations indicated that the engine speed varied between 850 and 880 RPM, with an average value of 864.3 RPM. The engine operating temperature ranged from 78°C to 85°C, with an average value of 81.16°C. These results suggest that the main engine operated under stable conditions during the observation period.

Pearson Product Moment correlation analysis produced a correlation coefficient of $r = 0.02$. Based on common correlation interpretation criteria, this value indicates a very weak positive relationship between the lubrication system condition and engine performance.

The coefficient of determination (R^2) was calculated as 0.0004 or 0.04%, indicating that only 0.04% of the variation in engine performance could be explained by variations in lubrication system parameters. The remaining 99.96% was influenced by other factors such as fuel system performance, cooling system efficiency, engine load, and operational conditions.

To determine statistical significance, a t-test was performed using the correlation coefficient. The calculated t-value was 0.04, while the critical t-value at a 95% confidence level and 4 degrees of freedom was 2.776. Since the calculated t-value was lower than the critical value, the correlation was not statistically significant.

Simple linear regression analysis resulted in the equation:

$$Y = 73.85 + 0.12X$$

where Y represents engine performance and X represents lubrication system condition. The regression equation indicates that improvements in lubrication system condition are associated with a slight increase in engine performance; however, the effect is statistically insignificant.

Although the statistical relationship was weak, the lubrication system remains a critical component of engine operation. Proper lubrication reduces friction, prevents excessive wear, controls operating temperatures, and contributes to engine reliability. Therefore, regular monitoring of lubricating oil pressure and temperature, along with preventive maintenance, remains essential for maintaining optimal engine performance and ensuring safe vessel operation.

4. CONCLUSION

Based on the results of the study conducted on the lubrication system of the Yanmar 6EY17W Main Engine aboard KM Sabuk Nusantara 108, several conclusions can be drawn.

First, the lubrication system operated within normal operating limits during the observation period. The lubricating oil pressure ranged from 5.1 to 5.4 bar, with an average value of 5.28 bar, while the lubricating oil temperature ranged from 72°C to 76°C, with an average value of 73.6°C. These conditions indicate that the lubrication system was capable of providing adequate lubrication to the engine components and maintaining stable operating conditions.

Second, the performance of the main engine was generally stable throughout the observation period. The engine speed ranged from 850 to 880 RPM, with an average value of 864.3 RPM, while the engine operating temperature ranged from 78°C to 85°C, with an average value of 81.16°C. These results demonstrate that the main engine was functioning properly under normal operational conditions.

Third, the Pearson Product Moment correlation analysis produced a correlation coefficient of $r = 0.02$, indicating a very weak positive relationship between the lubrication system condition and engine performance. Furthermore, the significance test showed that the calculated t-value ($t = 0.04$) was lower than the critical t-value ($t = 2.776$), indicating that the relationship was not statistically significant at the 95% confidence level.

Finally, although the statistical analysis revealed only a very weak and insignificant relationship, the lubrication system remains an essential supporting system for the main engine. Proper lubrication contributes to reducing friction, minimizing component wear, controlling operating temperature, and maintaining engine reliability. Therefore, regular monitoring of lubricating oil pressure and temperature, along with preventive maintenance practices, is highly recommended to ensure the safe, reliable, and efficient operation of the main engine aboard KM Sabuk Nusantara 108.

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