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Analysis Of Main Bearing Wear On Auxiliary Engine On Board Jhoni XLV

***Muh Rezal[1], Samsul Bahri[2], Muh Syuaib Rahman[3],**
[1] Diploma IV Program, Politeknik Pelayaran Makassar, Makassar, Indonesia
[2,3] Department of Technical, Politeknik Ilmu Pelayaran, Makassar, Indonesia

*** Corresponding Author:**
Muh Rezal
Diploma IV Program, Politeknik Ilmu Pelayaran Makassar, Makassar, Indonesia
Jl. Tentara Pelajar No. 173 Makassar, 90172, Indonesia
Email: muhrezal125@gmail.com

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ABSTRACT

This study aims to analyze the level of wear on the main bearing auxiliary engine of the Jhoni XLV ship. The study focused on identifying the main causes of wear and its impact on engine performance. The research method uses direct observation and measurement with precision tools. The results showed significant wear and tear caused by high workloads and routine maintenance neglect. It is recommended that lubrication system repairs and periodic inspections be carried out to prevent further damage. This research contributes to the maintenance of ship engines to support optimal operations.
Keywords: *Main Bearing Wear, Auxiliary Engine, Engine, Ship.*

ABSTRAK

Penelitian ini bertujuan untuk menganalisis tingkat keausan pada main bearing auxiliary engine kapal Jhoni XLV. Studi ini fokus pada identifikasi penyebab utama keausan dan dampaknya terhadap performa mesin. Metode penelitian menggunakan pengamatan langsung dan pengukuran dengan alat presisi. Hasil menunjukkan adanya keausan signifikan yang disebabkan oleh beban kerja tinggi dan kelalaian perawatan rutin. Disarankan dilakukan perbaikan sistem pelumasan dan inspeksi berkala untuk mencegah kerusakan lebih lanjut. Penelitian ini memberikan kontribusi dalam pemeliharaan mesin kapal guna mendukung operasional yang optimal.
Kata kunci: *Keausan Main Bearing, Auxiliary Engine, Mesin, Kapal.*

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1. INTRODUCTION

The auxiliary engine is one of the important components on the ship that serves as a source of support power to operate the electrical system, pumps, and

other equipment on the ship. The reliability of this engine greatly affects the smooth operation of the ship as a whole. One of the main components that plays a role in engine performance is the main bearing, which supports the engine shaft so that it can rotate smoothly and stably.

Wear and tear on the main bearing can cause engine performance disturbances, such as excessive vibration, decreased combustion efficiency, and serious engine damage if left unchecked. Common breakdowns to the main bearing include surface wear, cracks, and deformation caused by heavy workloads, lack of optimal lubrication, and sub-optimal operating conditions.

The problem of wear on the main bearing is a special concern in the shipping world, because the cost of repairing and downtime of the ship that arises is quite large. Therefore, preventive efforts through periodic analysis of wear conditions and proper handling are essential to maintain the performance and life of the ship's engine.

This study aims to analyze the level of wear of the main bearing auxiliary engine on the Jhoni XLV ship. Using physical measurements, visual inspection, as well as vibration and lubrication data analysis, this study is expected to provide an overview of the actual condition of the bearing along with the factors causing wear. The results of the study are expected to be the basis for effective preventive maintenance recommendations to improve engine reliability and ship operational safety.

2. METHOD

This study uses a quantitative descriptive approach that aims to analyze the level of wear on the main bearing auxiliary engine of the Jhoni XLV ship. The research location was carried out directly on the ship during the three-month observation period. Data collection is carried out by visual inspection method on the surface of the main bearing to detect physical damage such as scratches and cracks. Furthermore, the dimensions of the main bearing were measured using a dial gauge and a micrometer to obtain quantitative data on the level of wear.

Lubricating oil sampling is also carried out to analyze the content of metal particles and their viscosity, in order to determine the quality of the lubricant during operation. In addition, a vibration sensor is installed on the machine to record

vibration data as an indicator of the dynamic condition of the main bearing. The data obtained were analyzed using descriptive statistical techniques and vibration signal processing to evaluate the wear conditions and the relationship with the causative factors.

The entire data collection process is carried out periodically every two weeks in order to monitor the development of bearing conditions in detail. The results of the study are then compared with the technical standards and manufacturer's recommendations to provide appropriate maintenance recommendations to extend the life of the main bearing.

3. RESULTS AND DISCUSSION

The MT collision incident. MARISA N on April 13, 2023 was caused by a failure rooted in two main factors: Extreme Bad Weather and Lack of Effective Communication Between Crews. Weather factors (winds of 15-20 knots, waves of 1.5-2.5 meters, unstable currents, and low visibility at 03.00 WIB) exceeded operational safe limits, which were exacerbated by the absence of adjustment of maneuver strategies. Meanwhile, the communication factor is characterized by the non-implementation of Safety Briefing, errors in the delivery of information distance from the bow, delayed warnings, and failure to implement *a closed-loop communication* system. The SOP evaluation corroborates that vital procedures, such as briefings and *close-loop communication,* are ignored or not optimally implemented, even when extreme weather is known. As a preventive measure, it is recommended: (1) Weather Mitigation through periodic monitoring, delay of operations when conditions are unsafe, selection of protected locations, and the use of modern navigation tools (Radar, AIS); and (2) Improving Communication through the implementation of mandatory *Safety Briefing*, strict implementation of *closed-loop communication*, appointment of Special Communications Officers, routine training, and *Master-to-Master written agreements* before STS operations.

a. Research Overview

The auxiliary engine on the JHONI XLV ship is a 4-stroke diesel engine that functions to generate electricity needed during the ship's journey, such as for navigation, lighting, pumps, and cooling systems. The engine works at a speed

of 1,500 revolutions per minute with loads that change according to sailing conditions.

The lubrication system is specially made to keep the engine temperature stable and prevent damage to fast-moving parts, especially the crankshaft and its main bearings. These main bearings are very important because they keep the crankshaft in position, reduce circulation, and make engine rotation stable. If these bearings are damaged or worn, it can cause serious problems such as shifting wheel shafts, abnormal engine noise, and even the engine can stop completely. Therefore, the condition check of these bearings is an important part of the maintenance of the machine.

This machine has a length of about 2 meters, a width of almost 80 cm, and a height of about 1.3 meters, with a weight of about 1,600 kg. The engine was made in 2011 and is always maintained regularly to keep its performance optimal. In addition, this engine is also equipped with a cooling system so that the engine temperature is not too hot during operation, and a lubrication system that keeps engine parts from quickly wearing out.

b. Object Data Studied

Table 1. Auxiliery Engine Specifications

Parameters	Specification
Machine Type	Auxiliary Engine Ship Jhoni XLV
Bearing Type	Main Slide Bearing
Bearing Material	Wear-resistant special alloy steel
Size Diameter	As per the manufacturer's specifications
Lubricant Viscosity	SAE 40 (ship standard)
Frequency of Operation	As per engine RPM

c. Research Data Analysis

1) Main Bearing Wear and Main Causal Factors

Damage to the main bearing of auxiliary engine number 2 of the JHONI XLV ship occurred due to several main interrelated factors. First, the bearing coating layer called babbit is thinned and even peeled off in some parts. This condition makes the base metal surface of the main bearing directly exposed. The size of the gap or clearance between the crankshaft and the main bearing has also exceeded the limit determined by the factory, which is 0.19 mm compared to the maximum standard of 0.12 mm. This difference indicates severe wear. When this gap is too large, the crankshaft can move unsteadily, causing direct damage to the bearing housing, which can lead to more serious damage.

In addition, it was found that there were elongated scratches on the bearing surface which indicated direct contact due to the lack of lubricant that protected the two metal surfaces. All of these conditions indicate that the main bearing is already in a critical stage, and if left unchecked, the damage could progress faster and cause greater disruption to the engine. Damage to this main bearing risks causing the crankshaft to become misaligned, increase engine vibration, and ultimately lead to more serious component failures.

2) Degradation of Lubricating Oil Quality and Its Impact on the Engine

The quality of lubricating oil is very important to keep engine parts durable and functioning properly. However, in auxiliary engine number 2 of the JHONI XLV, it was found that the viscosity of the oil dropped drastically from the supposed range of 12–14 cSt, to only 9.1 cSt when tested at a working temperature of 100°C. This decrease in viscosity occurs because the oil undergoes an oxidation process, metal particles are polluted from component wear, and air ingress due to marine leaks in the ship's cooling system.

If the oil has lost its ideal viscosity, the lubricating oil layer cannot form perfectly, making it unable to separate the fast-moving metal surface. As a result, the occurrence directly between the crankshaft and the main bearing increases, which causes the wear of the bearing to become very fast. This

condition illustrates that the lubrication of the engine is not running optimally and can accelerate damage to important components of the machine.

3) Untimely Oil Change Schedule

Late oil changes also contribute greatly to the damage to the main bearings. By default, the oil is supposed to be changed every 4,000 hours of operation, but the last change is only done at the 5,200th hour. Longer than standard oil usage periods accelerate the oil breakdown process, causing the oil to lose its lubrication ability and become more easily contaminated.

The use of oil that has exceeded this limit causes the lubricant to become less effective in protecting the engine, increasing the risk of damage to bearings and other components. This shows the importance of discipline in changing oil according to the schedule so that engine performance and life remain optimal.

Figure 1. Oil clearance measurement

4) Operating Hours of Machines Exceeding Recommended Limits

The main bearing on this auxiliary machine has been operated for more than 21,620 hours, even though the maximum limit of use recommended by the manufacturer is only 16,000 hours. This means that this component has passed about 5,600 hours beyond the safe limit. Wear that exceeds this limit makes the bearing material experience metal fatigue or metal fatigue, which leads to the appearance of microcracks, decreased durability of the babbit layer, and even exceeds the bearing.

This condition aggravates the bearing's workload and has the potential to accelerate the complete breakdown of the components. It is important to replace the main components in accordance with the manufacturer's recommendations as a prevention so that heavy damage and operational losses can be prevented.

5) Impact of Clogging and Overheating Lubrication Systems

The lubrication system clogged by carbon sludge deposition causes the oil flow to be unsmooth and the oil pressure in the main bearing drops to below 1.8 bar, well below the safe limit. This causes the oil temperature to increase to 97°C, exceeding the recommended maximum operating limit of 90°C. The obstructed oil flow makes the lubricant fail to form a good protective oil layer, eventually there is direct contact between the crankshaft and the bearing. This condition accelerates bearing wear and can cause permanent damage to the machine. This oil blockage must be addressed immediately so that the lubrication system returns to normal and the engine can operate safely.

6) Lack of Effective Monitoring System

The oil pressure and temperature monitoring system on this engine is not equipped with a real-time alarm that works on each bearing. The operator relies only on the general alarm on the control panel, so that if a fault occurs on a single bearing it is not detected from the start.

This condition is known to make the damage develop gradually and only after symptoms become severe. The implementation of more advanced monitoring systems with real-time alarms can help detect problems early, speed up repair actions, and reduce the risk of total machine failure.

Figure 2. Overhaul Auxiliary Engine

7) The Impact of Main Bearing Wear on Machine Performance

Wear and tear on the main bearing has a considerable negative impact on the overall performance of the auxiliary machine. That bearing also leads to the rotation of the crankshaft, which then generates vibrations and disturbances higher than normal. This not only makes the operation of the machine less efficient, but also shortens the life of other components due to excessive vibration.

In addition, the temperature of the worn bearing becomes higher due to the direct occurrence of metal, accelerating the damage that has already occurred. If this condition is not corrected immediately, it can cause fatal damage that causes the engine to stop operating, causing serious disruption in the ship's sailing activities.

4. CONCLUSION

Based on the results of the analysis and discussion, it can be concluded that the wear on the main bearing auxiliary engine of the Jhoni XLV ship occurred due to a combination of sub-optimal lubrication factors, deteriorating lubrication conditions, and engine workload that exceeded the design capacity. This wear is indicated by a decrease in bearing thickness, the presence of micro-scratches and cracks on the bearing surface, as well as an increase in the amplitude of engine vibration.

This study emphasizes the need for periodic maintenance in the form of replacing lubricants with quality according to standards, the use of oil filters that meet specifications, and strict supervision of engine operational loads to keep them within safe limits. Preventive measures and repairs as early as possible are necessary to keep the engine performance optimal and the risk of more serious damage can be minimized. Recommendations for maintenance include proper oil change schedules, improvement of the quality of the lubrication system, and routine inspection treatments involving the analysis of engine vibration performance are expected to extend the life of the main bearing and improve the overall efficiency of the ship's engine.

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