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Analysis of the Increase in Water Content in Oil Lubricating Auxiliary Engine on Ships MT West Poit

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ABSTRACT

This study aims to analyze the factors that cause the increase in water content in auxiliary engine lubrication oil on the MT West Point ship, as well as its impact on engine performance. The methods used in this study include regular sampling of lubricating oil, laboratory analysis to measure moisture content, and observation of the lubrication system and operational environmental conditions. The results of this study show that the increase in moisture content in lubricating oil has a significant impact on viscosity, lubrication power, and corrosion risk in engine components. Therefore, preventive measures are needed such as regular monitoring of lubricating oil quality, stricter maintenance of the cooling system, and the implementation of cleaner and safer lubricating oil filling procedures.
Keywords: Lubricated Oil, Water Content, Auxiliary Engine, Vessel, Engine Performance

ABSTRAK

Penelitian ini bertujuan untuk menganalisis faktor-faktor yang menyebabkan peningkatan kandungan air dalam minyak lumas auxiliary engine di kapal MT West Point, serta dampaknya terhadap performa mesin. Metode yang digunakan dalam penelitian ini meliputi pengambilan sampel minyak lumas secara berkala, analisis laboratorium untuk mengukur kadar air, serta observasi terhadap sistem pelumasan dan kondisi lingkungan operasional. Hasil penelitian ini menunjukkan bahwa peningkatan kadar air dalam minyak lumas berdampak signifikan terhadap viskositas, daya pelumasan, serta risiko korosi pada komponen mesin. Oleh karena itu, diperlukan langkah-langkah preventif seperti pemantauan rutin kualitas minyak lumas, perawatan sistem pendingin yang lebih ketat, serta penerapan prosedur pengisian minyak lumas yang lebih bersih dan aman.
Kata Kunci: Minyak Lumas, Kandungan Air, Auxiliary Engine, Kapal, Performa Mesin

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1. INTRODUCTION

Ships are an important means of transportation that supports various aspects of life, especially in a maritime country like Indonesia. In addition to playing a role in the economy, ships are the main means of distribution in the logistics, fisheries, and maritime industries. For the operation of the ship to run smoothly, the condition of the engine must always be optimal, which depends on the maintenance and maintenance system, including cooling, lubrication, and auxiliary engine operating limits. Auxiliary machines have a crucial role in maintaining temperature stability and preventing overheating that can reduce the viscosity of lubricating oils, so the proper use of lubricating oil is very important.

In a ship's cooling system, water is often used as a cooling medium because of its ability to absorb heat better than air or oil. However, the use of seawater has a risk of corrosion and scale formation in the cooling ducts, which can interfere with heat transfer. Some cases indicate that the cooling water can mix with the lubricating oil on the auxiliary engine, increasing the moisture content in the lubricating oil and lowering the lubrication efficiency, causing corrosion of engine components, as well as interfering with the cooling and lubrication system. This phenomenon, one of which was found on the MT West Point ship, became the background for research on the analysis of increased water content in lubricating oil in auxiliary engines.

This study aims to identify the causes of increased moisture content in lubricating oil and its impact on auxiliary engine performance. The formulation of the problem includes: what causes the increased moisture content in the lubricating oil, and what is the impact on the performance of the auxiliary machine. Research limitations include focusing on identifying the causes and impacts of mixing water with lubricated oil on the performance and condition of auxiliary engines, so that the discussion remains directional and relevant.

The benefits of this research are both theoretical and practical. Theoretically, the research is expected to be a reference for further studies related to auxiliary engine lubrication and cooling systems, as well as to enrich the literature on the effects of mixing water with lubricating oil. Practically, this research can help ship operators improve the efficiency of auxiliary engine maintenance, as well as be a guide for cadets and prospective ship engine experts in understanding the lubrication system and monitoring the quality of lubricating oil to maintain engine performance.

2. METHOD

This study uses a qualitative method with a descriptive approach to analyze the factors that cause the increase in water content in auxiliary engine lubricating oil on the MT West Point ship. The research was conducted over four months, from January to April 2024, with locations on board the MT West Point ship. The study population included the entire auxiliary engine lubrication system, with samples in the form of lubricating oil from three units of Daihatsu AngQing auxiliary engines taken periodically. Independent variables include O-Ring wear and engine cooling temperature, while dependent variables consist of water content and lubricating oil viscosity. Data were collected through field observation, technical documentation, and literature studies, and analyzed using descriptive data reduction and presentation techniques.

Observations are made directly on the condition of engine components and routine maintenance, while documentation includes maintenance reports, engine logbooks, and laboratory test results (Karl Fischer Titration and viscosity). Literature studies are also used to reinforce theories and examine previous studies. The data analysis process includes the classification and simplification of information (data reduction), as well as the presentation of results in the form of narratives, tables, and diagrams to illustrate the relationships between variables. The research schedule covers all stages from the collection of references to the closing seminar, which runs from 2023 to 2025.

3. RESULTS AND DISCUSSION

a. Auxiliary Engine Specifications

Table 1Auxiliary Engine Specifications

Parameters	No. 1	No. 2	No. 3
Type / Model	5DK-20	5DK-20	5DK-20
Serial Number	AQ 5K 20129	AQ 5K 20514	AQ 5K 20512
Manufacture Date	Sep 2006	15th FEB 2007	15th FEB 2007
Unit Number	5 CYLINDERS	5 CYLINDERS	5 CYLINDERS
Bore (mm)	200mm	200mm	200mm
Stroke (mm)	300mm	300mm	300mm
Output	660 KW MCR	897PS / 660KW	897PS / 660KW
RPM	900	900	900
Maker	Marine Diesel Wind	Marine Diesel Wind	Marine Diesel Wind
Address	No. 18 Dujiang street, Anqing, Anhui Province, P.R.C	No. 18 Dujiang street, Anqing, Anhui Province, P.R.C	No. 18 Dujiang street, Anqing, Anhui Province, P.R.C
Tel / Fax / Tlx Number	Tel: 55-5209477, Fax: 86054	Tel: 55-5209477, Fax: 86054	Tel: 55-5209477, Fax: 86054

b. Observation Data

Based on the results of observations that the author has made on board the MT West Point, the problems that occur in the auxiliary engine related to the increase in the water content in the lubricating oil are indeed occurring and are quite disruptive to the operational process of the engine. Under normal conditions, the engine should be able to run at a stable temperature, maximum lubrication, and free from water contamination problems.

However, when a problem occurs, the engine begins to show abnormal symptoms, namely an increase in engine temperature above normal. The temperature increase then becomes an indication that the lubrication and cooling process of the engine is being disrupted. The first step taken by the maintenance team is to check the condition of the lubricating oil in the sumptank. After checking, it appeared that there was a change in the color of the lubricating oil that was previously clear and clear to become more cloudy and brownish, so it is suspected that there was water mixed in it.

Before the problem occurs, the condition of the engine and lubricating oil can run normally according to the operating standards, as can be seen in Table 2 below:

Table 2 Auxiliary Engine (AE) Cooling System – Normal Condition (Before Fault)

No.	Parameters	Normal Standard	Remarks
1	Temperature Jacket Cooling Machine	≤ 80°C	Normal
2	Cooling Water Pressure	2 – 3 bar	Normal
3	Lubricating Oil Pressure	4 – 5 bar	Normal
4	Lubricating Oil Temperature	≤ 55°C	Normal
5	Lubricating Oil Color	Clear Black	Normal

Auxiliary Engine (AE) Cooling System Observation Data - Abnormal Conditions (April 20, 2024)

No.	Parameters	Conditions During Disruption	Incompatibility
1	Temperature Jacket Cooling Machine	95°C	Exceeding standards
2	Cooling Water Pressure	1.5 bar	Below standard
3	Lubricating Oil Pressure	3 bar	Experiencing a decline
4	Lubricating Oil Temperature	75°C	Exceeding standards
5	Lubricating Oil Color	Cloudy browning	Contaminated

A summary of the condition of the engine and lubricating oil after repair can be seen in Table 4.3 below:

Table 3 Auxiliary Engine (AE) Cooling System Observation Data - After Repair (April 21, 2024)

No.	Parameters	Measurement Results	Conditions
1	Temperature Jacket Cooling Machine	78°C	Normal
2	Cooling Water Pressure	2.5 bar	Normal
3	Lubricating Oil Pressure	4.5 bar	Normal
4	Lubricating Oil Temperature	50°C	Normal
5	Lubricating Oil Color	Clear	Normal

Source : MT West Point

From the table above, it can be concluded that the cooling and lubrication system has returned to normal operation. There are no fluctuations that lead to damage or interference. The stable temperature indicates that no more water enters the lubrication line, indicating that the contamination has been successfully addressed.

c. Data Analysis

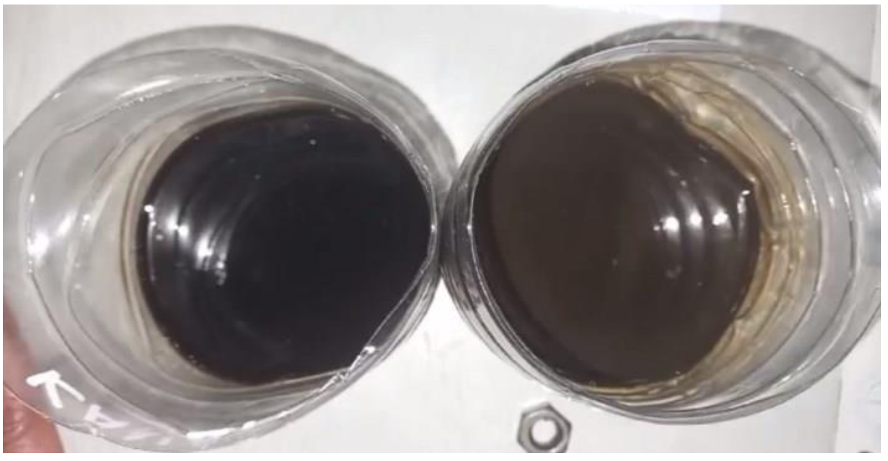
Based on the results of direct observations made by the author on board the MT West Point, it was found that there had been a disturbance in the lubrication system of the Auxiliary Engine (AE) 2 which was characterized by an increase in the moisture content in the lubricating oil. This is an important finding because these conditions can significantly affect engine performance, considering that the lubrication and cooling system plays a vital role in maintaining the operational stability of auxiliary machines.

1) Visual Inspection of Lubricating Oil

The results of physical checks on the lubricating oil showed that the color and clarity of the oil changed drastically, from initially clear and black to cloudy, brighter, and appeared to contain water emulsion particles. This check is also supported by a moisture content test in the lubricant which shows results exceeding the permissible threshold. In a ship's engine lubrication system, water content above 0.2% is already considered an early indication of contamination, and the findings in AE 2 suggest that this figure has been exceeded.

Symptoms of this contamination are also reflected in unstable engine performance, such as excessive friction noises, increased cylinder temperature, and unconstant oil pressure. All of these symptoms are very likely to arise due to the loss of the optimal function of lubricating oil, both as a lubricant, cleaner, and coolant.

Figure 1 Comparison of lubricating oils mixed with water with normal ones



Source : MT West Point

From the image it can be seen that the normal lubricating oil (on the left) appears clearer, darker, and uniform, according to the required specifications. Meanwhile, water-contaminated lubricating oil (on the right) appears cloudier, brighter, and emulsion occurs, so the quality drops and can cause problems with engine performance. Water contamination can also increase the risk of corrosion, wear, and damage to a wider extent if not addressed immediately. By carrying out proper maintenance and thorough repairs, the quality of lubricating oil can return to normal and the service life of the machine can be better maintained.

Figure 2 Lubricating oil mixed with water

Source : MT West Point

Based on the visual documentation obtained, it can be seen that the auxiliary engine lubrication oil has changed color to brown with indications of water contamination, marked by emulsion in the oil. This phenomenon indicates that the lubricating oil has mixed with water,

2) Crack in the Cylinder Liner

The first hypothesis states that cracks in the cylinder liner could be the cause of coolant entering the lubrication chamber. A cracked cylinder liner will create a leaking path between the cooling chamber and the crankcase chamber, allowing water to mix with the lubricating oil. In some cases, these cracks are difficult to detect from the outside, as they are often on the inside of the liner or are micro.

Figure 3 Cylinder Liner Wall Condition

However, after an in-depth inspection of AE 2, no indication of cracks or fine cracks was found on the surface of the cylinder liner. The inspection is carried out using visual inspection and dye penetrant test methods to ensure that there are no internal leaks caused by the liner structure itself. Therefore, this hypothesis is not proven in the case on the MT West Point ship, although technically it remains valid for similar cases on other ships.

3) Damage to the Seal O-ring Joint Cylinder Head

The second hypothesis leads to damage to the O-ring joint on the cylinder head, which functions to prevent the mixing of coolant with lubricating oil in the cylinder area. If these O-rings are subjected to wear, brittleness, or imperfect installation, then cooling water can seep into the lubrication system.

Figure 3 Suspected Damage to O ring Cylinder Join in Cylinder Head

Source : MT West Point

At the time of repairs, it was found that the O-ring seal on the cylinder head was in suboptimal condition, but did not show a level of damage severe enough to be the main cause of water contamination in the oil. The seal function is still able to withstand pressure, even though it has undergone slight deformation due to age of use. Therefore, this hypothesis cannot be stated as the main cause, but may contribute in a minor way to the problem that occurs.

4) Damage and Wear on the O-ring Cylinder Liner

The third hypothesis states that damage and wear on the O-ring cylinder liner can cause water to enter the lubrication system. Based on the results of the inspection during the AE 2 repair, it was found that the O-rings on cylinder liners number 4 and 5 were severely worn. The O-ring has experienced brittleness, small cracks, and loss of elasticity due to long-term wear and continuous exposure to high temperatures.

Figure 4 Oring Cylinder liner replacement

Source : MT West Point

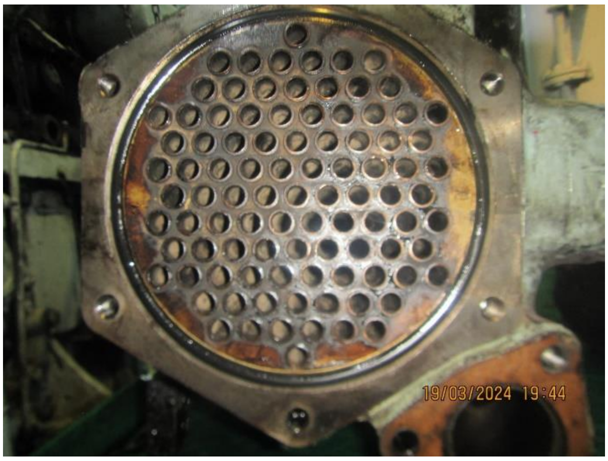
This condition opens a leakage path from the cooling system to the crankcase chamber, allowing the cooling water to enter the sump tank and mix with lubricating oil. The symptoms that appear are in line with the analysis of previous data, namely the engine temperature rises, the lubricating oil pressure decreases, and there is a change in the color and clarity of the lubricating oil. Once the worn O-ring is replaced with a new one, and the lubricant is replaced, the system returns to normal function.

With these evidences, the third hypothesis is declared proven and is the main cause of the increase in moisture content in lubricating oil in AE 2. This suggests that preventive maintenance of small components such as O-rings is essential to prevent damage to the system thoroughly.

5) Leakage in the L.O Cooler Tubes

The fourth hypothesis states that a leak in the cooler's L.O (lube oil) tube can cause cooling water to enter the lubrication system. L.O coolers work on the principle of heat exchange between lubricating oil and cooling water, so that leaks in the walls of the tubes will allow water to seep into the oil stream.

Figure 5 Alleged Leak *on LO Cooler tubes*



Source: MT. West Point

During the inspection of the L.O cooler AE 2, it was found that there were indications of a minor leak in the weld joints between the tubes, but the volume was very small and not significant enough to cause severe contamination. In addition, water does not flow freely into the lubrication system, and after rewelding is performed, there are no more symptoms of leakage. Therefore, this hypothesis is considered to be a minor but not the main cause.

The conclusion of this discussion of causes is that damage and wear on the O-ring cylinder liner cylinder no. 4 and 5 are the main causes of the increase in water content in lubricating oil in AE 2. The other three hypotheses are still relevant to be used as a preventive reference in the engine maintenance program, but they are not proven in actual in this case.

The impact can be described as follows:

1) Decreased Lubrication Effectiveness

Water-contaminated lubricating oil will lose its optimal viscosity properties. The water dilutes the oil and causes a change in consistency so that the formed lubricating film becomes too thin. As a result, lubrication between moving components such as crankshafts, pistons, and camshafts does not run optimally. This triggers increased friction, generates overheat, and accelerates wear on metal surfaces.

In the case of AE 2, this decrease in lubrication effectiveness is reflected in a decrease in oil pressure of up to 3 bar, as well as an increase in the temperature of the lubricating oil that exceeds the normal limit. In addition, the discoloration of the oil to a cloudy milky brown indicates the formation of an emulsion between water and oil, which further worsens the ability of the lubricant.

2) Internal Corrosion in Machine Components

The water that enters the lubricating oil accelerates the oxidation process of the metal, especially in vital parts such as the main bearing, crank pin, camshaft bushing, and the inner area of the cylinder. This corrosion erodes the metal surface and causes misalignment between components.

The long-term impact is decreased compression efficiency, damage to the bearings, and even the potential for premature wear on the crankshaft. Inside the AE 2 crankcase chamber, during a post-oil drain inspection, light rust sparks were found on the crankcase wall and sump tank cap, which is early evidence of corrosion due to the presence of water.

3) Overheating Due to Indirect Cooling System Disruption

The lubricating system also acts as an indirect coolant in fast-moving engine components. When lubricating oil is mixed with water, its ability to absorb and transfer heat decreases drastically. This causes engine components to not be able to cool optimally and is at risk of overheating.

Observation data showed that in AE 2, the jacket cooling temperature increased to 95°C and the lubricating oil temperature rose to 87°C, exceeding the threshold set in the manufacturer's manual. This temperature spike has the potential to cause disruption to the piston system, liner, and even cylinder head, especially when the engine is running under full load.

4) Damage to the Lubricating Pump and Filter

Water-oil emulsions have a viscous and unstable consistency. If this emulsion is sucked by the lubricating pump, it will cause the pump load to increase and decrease the flow capacity. In addition, the oil filter will quickly clog, causing the back pressure to increase and shorten its service life.

In AE 2, a decrease in oil flow rate, as well as a dirty and saturated oil filter, was found, although it had not passed the standard service life. This indicates that the filter system works harder to filter the emulsion, so there is a high risk of damage if this condition is not treated immediately.

5) Risk of Machine Failure and Operational Disruption

The final impact of the increased water content in the lubricant is the total failure of the auxiliary machine if left for a long time. Component wear, overheating, and damage to the lubricating pump can cause the AE to shut down suddenly or suffer a drastic decrease in performance, ultimately disrupting the entire ship's operating system—especially the main electrical and engine control systems that rely heavily on AE.

In the operational context of the MT West Point ship, AE 2 was used as the primary source during the voyage. If AE 2 fails to function, then the electrical distribution system to the compressor, ballast pump, and navigation device will be disrupted. Therefore, this problem is considered very crucial and needs to be handled quickly and appropriately.

4. CONCLUSION

Based on the results of the research on the auxiliary engine of the MT West Point ship, it can be concluded that the analysis of the increase in water content in lubricating oil is:

a. The main cause of the increased moisture content in the auxiliary engine lubrication oil on the MT West Point ship is damage and wear on the O-ring cylinder liner, particularly on cylinders number 4 and 5. This leak causes cooling water to enter the lubrication system.

b. The impact of the increased moisture content causes a decrease in lubrication quality, an increase in engine working temperature, and the risk of damage to engine components due to corrosion and excessive friction, which directly affects the performance and reliability of the auxiliary engine.

Suggestions for addressing and preventing increased water content in lubricating oil on the auxiliary engine of the MT West Point ship:

a. Regular inspections and replacements of prone components such as O-ring cylinder liners are required, especially when showing signs of wear, to prevent water leakage into the lubrication system.
b. It is necessary to carry out periodic monitoring of engine pressure and temperature parameters as well as the visual condition of the oil, so that the initial indication of contamination can be immediately detected and treated before it has a serious impact on the system and performance of the auxiliary machine.

5. REFERENCES

API (American Petroleum Institute). (2021). *Lubricants and their applications: Guidelines for quality control*. API Publications.

Bires, R., Johnson, T., & Edwards, P. (2020). *Oil lubrication and contaminants: Impacts on engine performance*. SAE International.

Gonzalez, A., & Ruiz, F. (2023). Impact of contaminated lubricants on emission levels in diesel engines. *Journal of Mechanical Engineering*, 45(3), 201–215.

Jones, M., Brown, L., & Smith, R. (2023). *Modern lubrication systems for diesel engines: A comprehensive guide*. CRC Press.

Kumar, P., & Singh, A. (2021). Types and applications of lubrication systems in automotive engineering. *SAE Technical Paper 2021-01-0987*.

Lloyd's Register. (2020). *Marine auxiliary engine lubrication systems: Design and maintenance guidelines*. Lloyd's Register Publications.

Patel, R., Gupta, S., & Wong, M. (2023). High-efficiency filtration systems for lubricant contamination control. *Industrial Lubrication Journal*, 61(2), 87–102.

Smith, J., Carter, W., & Anderson, L. (2021). Oxidation and corrosion in engine lubricants: Effects of water contamination. *SAE Technical Paper 2021-01-1098*.

Tanaka, M., Hoshino, T., & Sato, K. (2023). IoT-based lubricant monitoring systems: Enhancing engine performance through smart sensors. *IEEE Transactions on Industrial Applications*, 59(5), 321–338.

Rahman, A. (2021). Analysis of the Prevention of Mixing of Lubricating Oil and Water on the Auxiliary Engine on the XXI Viktora Ship. *(Makassar Shipping Science Polytechnic)*