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Research Paper

# Maintenance of Water Distribution Device and Shaft System at MDO Purifier on MV. Tanto Mitra

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**Abstract**

Purifier is one of the separators used on ships to separate fuel from water and dirt in the ship's fuel system. The purpose of this study is to determine the factors that cause damage and efforts to overcome problems in the Water Distribution Device caused by O-rings damaged seal and Shaft System due to damaged spiral gear and bearing on the M.D.O Purifier at MV.Tanto Mitra. The research method used in this study is a qualitative case study method. Sources of research data were obtained from primary and secondary data, including observation, literature study, ship documentation, and interviews with technical personnel responsible for the maintenance of the M.D.O Purifier. The data obtained were then analyzed to identify problems and factors that influence its performance using Fishbone analysis. The results of this study indicate that the factors that cause damage to the Water Distribution Device and Shaft System in the M.D.O Purifier at Mv. Tanto Mitra lacks routine purifier maintenance, according to PMS. The operation does not comply with S.O.P and the lack of purifier spare parts and crew engine communication for purifier maintenance. Through optimal maintenance, it can increase the operational efficiency of the purifier, reduce the risk of disruption, and extend the life and performance of the purifier to remain optimal on a ship.

**Keywords:** *Purifier; Water Distribution Device; Shaft System; Maintenance*

## INTRODUCTION

A purifier is a separation machine between pure fuel and sediment using the principle of centrifugal force by utilizing differences in specific gravity and viscosity (viscosity) of fuel (Waworuntu.et al; 2022). The ship's fuel system starts from a double-bottom tank, where the fuel is stored before being transferred to a daily tank called a service tank. In the service tank, the fuel is collected and precipitated first so that the fuel can be clean and avoid impurities. Whether or not the clean fuel in the service tank is sufficient depends on the work of the purifier auxiliary aircraft. The number of hours that the purifier works too long without stopping while the ship is sailing can affect the performance, function and effectiveness of the moving parts, namely the components that work in the purifier (Dickens, 2016).

Maintenance and operation of the purifier that is not in accordance with the S.O.P (Standard Operating Procedure) can result in the performance of the purifier is not optimal, resulting in the resulting fuel still containing impurities and water. Damage in the purifier can cause problems with the work of the diesel motor disturbed. Periodic maintenance is needed to maintain good conditions and performance so that the fuel purification process that occurs in the purifier can run so that the operation of the engine on the ship can run smoothly. The creation of smooth operation and sea transportation capital cannot be separated from technological advances in this millennial era. Advances in science, technology and economic growth have significantly affected the shipping sector. The ship's main engine plays an important role in smooth operations, but it is also assisted by complex machinery systems. Along with the times, many companies rely on sea transportation services to meet their transportation needs (Hardianata; 2019).

MV. Tanto Mitra, who was travelling from Jakarta to Pontianak, experienced a problem with


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the purifier, namely the instability of the electric current (amperes), which can be seen on the Purfier's Screen Monitor and the sound of noise on the purifier machine. This research was carried out with the aim of knowing efforts to optimize maintenance purifiers.

## LITERATURE REVIEW

### Maintenance

Maintenance is an action taken to maintain, maintain or repair an item or system so that it functions properly, optimally, and efficiently. Maintenance can be performed on various items or systems, such as machines, vehicles, household appliances, buildings, and others.

Maintenance of machines, namely activities carried out on machines continuously and scheduled carried out by manufacturing companies (Rosyidi et al: 2015).

Some definitions of care according to experts:

1. According to Ansori and Mustajib (2013), maintenance is an understanding of all activities needed to maintain the quality of facilities or machines so that they continue to function optimally efficiently as in their initial conditions.
2. According to Corder (1988), it is a combination of any action taken to maintain an item or to repair it to an acceptable condition.

### Water Distribution Device and Shaft Systems

The Water Distribution Device in the purifier consists of several main parts that play an important role in the process of refining fuel oil, which include the following:

1. *Center drums,* namely the main part of the Water Distribution Device in the purifier, are a place where the separation process occurs, with the aim of producing fuel that is cleaner and free from contaminants such as water and solid particles.
2. Water holes are small holes in the Water Distribution Device that drain water into the central drum.
3. The distributor ring is a ring located under the central drum, which functions to regulate and direct the flow of water into the water holes in the water distribution device.
4. The seal ring is a rubber ring placed between the center drum and the housing, which serves to prevent water leakage.
5. The water outlet is the channel where water separates from the fuel oil.
6. Housing is one of the outer parts of the Water Distribution Device, which functions as a place to place all components in the water distribution device.

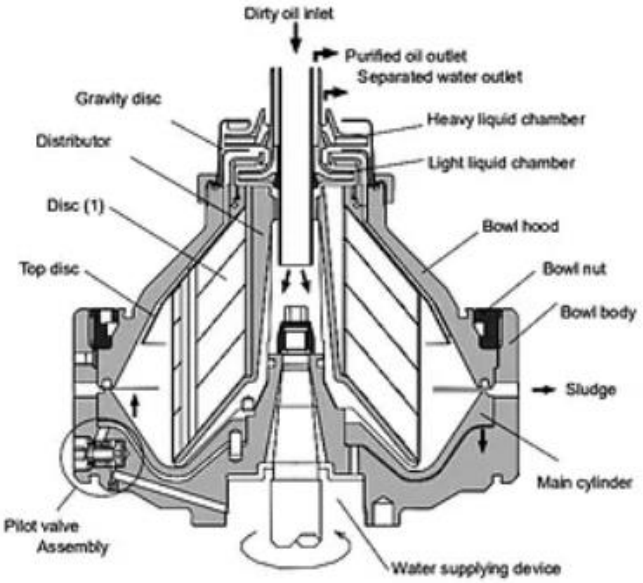


**Figure 1.** Water Distribution Device

*Shaft System* in the purifier is a shaft and gear system that drives the separator bowl in a fuel purifying machine (Tjahjono; 2108). Here are some explanations about the components of the shaft system.

1. Mainshaft

This shaft serves to connect various machine parts such as separator bowls, gears, and drive motors. The main shaft is designed with high resistance to heavy rotational loads and must be resistant to corrosion.

2. Gear wheels

This part is connected to the main shaft and rotates with the main shaft. This gear serves to rotate the bowl that separates dirt and other particles in the fuel that enters the purifier.

3. Pinion Shafts

It is a small shaft that is connected to the gears and rotates with the gears. This pinion shaft serves to transmit rotational motion from the drive motor to the gears. The pinion shaft is designed with high resistance to heavy rotational loads and corrosion resistance.

*4. Bearings*

Machine parts that function to reduce friction between the shaft and gears have high resistance to heavy rotational loads and must be resistant to heat and corrosion. Worn bearings can cause damage to the purifier.

5. Seals

Is the part of the machine that functions to prevent the fuel and oil in the engine from escaping from the fuel purifying machine. Damaged or worn seals can cause fuel or oil to leak from the engine.

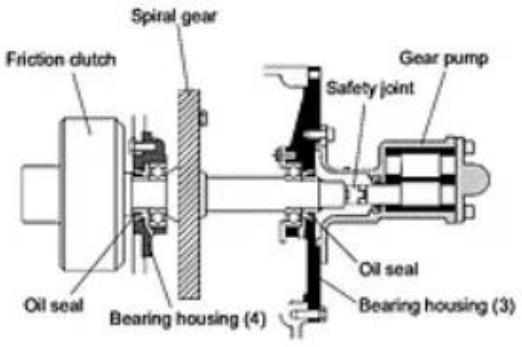


**Figure 2.** Shaft Horizontal Purifier

1. *Marine Diesel Oil (MDO)*

*Marine Diesel Oil (MDO)* is a heavy fuel oil specifically designed for use in ships, including boats, boats and other ship machinery. MDO generally consists of a mixture of distillate fuel oil and residual fuel oil from the crude oil refining process.

One of the important characteristics of MDO is its stability at low temperatures. This fuel is more resistant to thickening and freezing compared to other fuel oils. In terms of composition, MDO has a high Cetane Number (CN) content. Marine Diesel Oil (MDO) is a reliable and efficient fuel choice for marine vessels, with stable performance and meets the special requirements of ship diesel engines (Kass; 2022).

2. *Purifiers*

A purifier is a tool to separate two liquids with different specific gravity. On ships, the purifier functions to clean fuel from liquid and solid impurities, such as mud, which are mixed in it .According to the Manual Book Purifier Type KYDH204SD-23, describes several important components in the purifier, including:

a. Disc

Disc is the part that has an important role in holding back the flow of oil, which will be cleaned slowly until finally the oil comes out and enters the service tank. The disc has holes as the entrance for the fuel to be filtered in the purifier. Through this process, oil and dirt will be separated from each other.

b. Distributo

The distributor functions as a channel for the entry of dirty fuel to be cleaned in the purifier. The distributor is also in charge of dividing the oil into the bowl disc parts through the holes in the distributor. After the fuel enters through the distributor, the disc will rotate following the movement of the bowl hood underneath. Through the distributor, the dirty fuel that enters the purifier can be directed and distributed evenly into the Disc bowl. This allows for effective and efficient separation of oil and particulate matter in the purifier.

c. Electro Motor

Electromotor is a component whose job is to convert electric power into motion or rotational energy, which is used as the main driving force in the purifier. Its main function is to drive the bowl and gear pump in the purifier. The electromotor is connected to the purifier through two types of shafts, namely horizontal shafts and vertical shafts.

d. Horizontal Shafts

Horizontal shafts serve as a direct link between the electromotor and the bowl purifier.

Through the horizontal shaft, the rotational power from the electromotor is supplied to the bowl purifier. The bowl purifier will rotate and start the process of separating liquids and particles contained in fuel or oil.

e. Vertical Shafts
Vertical shafts connected to the gear pump, whose job is to move the liquid that has been separated by the purifier. With the help of rotational power from the electromotor via a vertical shaft, the gear pump can rotate and pump the cleaned liquid into the appropriate storage tank.

f. Spiral Gears
Spiral gears on the purifier consists of two spiral-shaped gears that interact with each other to transmit power or rotary motion. The spiral gear is connected to the shaft or shaft, which is rotated by the driving motor, which functions to convert the rotational motion received from the driving motor into rotational motion in the bowl and gear pump. This rotational movement is very important in the process of separating and refining fuel in the purifier. The spiral gear allows the bowl and gear pump to rotate at the appropriate speed and in sync to achieve optimal separation efficiency.

g. Gear Pumps
Gearpump consists of a series of housings with two covers covering the inner chamber. This pump uses the principle of gear movement to circulate liquid through a pipe or channel system. In a gear pump, there are two interacting gears, namely, the driver gear and the driven gear.

h. Brakes
Brakes in the purifier has an important role as a braking device that is used to stop or slow down the rotation of the bowl quickly in certain situations

## RESEARCH METHOD

According to Sugiyono (2018) primary data is the main source of information or the main witness of events that have occurred. This primary source is original data from historical information. Information derived from primary sources is considered superior to data from secondary sources. In this study, the data was obtained through survey methods and observations of the research object studied while on the ship. Primary data was obtained from interviews with machinists, namely the factors that influence the operation of the purifier maintenance system on a regular basis. In obtaining primary data, the researcher obtained data directly from the ship by observing and interviewing machinists and crew at MV. Tanto Mitra.

### Data collection technique

*Interview Method*

The interview technique is a systematic way of obtaining information in the form of oral statements about an object or event in the past, present and future. Interview according to Sugiyono (2018: 194), "Interviews are used as a data collection technique if the researcher wants to conduct a preliminary study to find problems that must be studied, as well as if the researcher wants to know things from respondents that are more in-depth". This technique is carried out by holding discussions with machinist 4, where engineer 4 is the officer responsible for the purifier machinery and also the Head of the Engine Room who has full responsibility for the engine room and the machinery in it and does not forget to also interview the engine crew on board who are more experienced in solving problems that occur in the machinery on board, especially in the purifier engine system.

*Observation Method*

According to Sugiyono (2018: 229), observation is a data collection technique that has specific characteristics when compared to other techniques. Collecting data by direct observation is a way of collecting data by going directly to the scene for the purpose of collecting research data.

*Documentation*

According to Sugiyono (2018: 476) documentation is a method used to obtain data and information in the form of books, archives, documents, written numbers and pictures in the form of reports and information that can support research. Documentation is a data collection technique used by recording and taking pictures of machine parts when working on repairs and maintenance of a machine and everything related to the purifier and its system. In this technique, archives and ship documents are used to complement the data obtained so that the data can be more accurate and can be accounted for.

*Literature review*

Literature study, according to Sugiyono (2018), namely literature study is a link with theoretical studies and other references related to values, culture, and norms that develop in the social situation under study. Research or literature study is research conducted by collecting data from books and literature that can be used as a reference source to compile a scientific report.

*Data analysis technique*

The fishbone diagram is one of the methods used in improving quality. Fishbone diagram or Ishikawa diagram, also known as cause-and-effect diagram or fishbone diagram (Coccia, 2018). It is a method used to analyze and identify the root causes of problems. This diagram is called the Ishikawa diagram because it was discovered and developed by Dr. Kaoru Ishikawa, a quality management expert from the University of Japan, in the 1960s. The fishbone diagram is so called because of its shape, which resembles a skeleton of fish bones (Fauziah, 2014).

## FINDINGS AND DISCUSSION

### Problem analysis

In conducting research on purifiers at MV.Tanto Mitra, using the fishbone method to identify the causative factors that affect non-optimal performance in purifiers, especially in Water Distribution Devices and shaft systems. The fishbone approach is used to describe the steps needed to improve purifier performance.

### Problem Discussion

In conducting research on the purifier at MV. Tanto Mitra, the fishbone method was used to identify problems in the purifier, especially in the Water Distribution Device and shaft system. The fishbone approach was used to describe the optimization steps needed to improve purifier performance. The fishbone approach provides a better understanding of the factors affecting purifier performance and provides guidance to optimize the use of purifiers in the fuel quality of MV. Tanto Mitra.

*Through the Fishbone Diagram, the problem of maintaining MV purifiers. Tanto Partners, namely:*

1. Man

Humans have the most important role in the factors that cause less than optimal purifier performance and maintenance. This is because humans are the main party responsible for the operation and maintenance of the purifier (Kuswardana; 2017).

2. Machine

There are two factors that affect the condition of this machine, namely the age of the machine and the number of hours of operation of the machine. The longer the machine is used and the more hours of operation, the greater the potential for damage that may occur to several parts of the machine, such as the bowl disc, main seal ring, and nozzle. Damage to the bowl disc can be caused by several factors. One of them is the lack of a sludging process, namely the removal of dirt deposits in the bowl. If this process is not carried out sufficiently, dirt will accumulate in the bowl, causing the motor rotation to become heavy and unstable. In addition, scratches on the bowl can also cause damage, as they can exacerbate dirt build-up and affect motor performance.

Damage to the main seal ring can be caused by two factors, namely the installation factor and the engine age factor. If the main seal ring is installed incorrectly, its ability to retain oil will be impaired, causing oil to leak out. In addition, over time, the main seal ring can also experience a decrease in quality and strength, thereby also increasing the risk of oil leakage. The dead end of the screw with nozzle is caused by the accumulation of lime in the water used in the machine for a long time. This buildup can cause the nozzle and sliding bowl to become clogged so that they cannot rise to the top. As a result, oil can leak and the engine cannot hold it properly.

3. Material

In this case, the material factor is greatly influenced by the availability of new spare parts or reconditioned spare parts. Reconditioned spare parts are components that were previously damaged and have been repaired so they can be used again. The quality of the reconditioned spare parts is significantly different from the new spare parts. As with spare parts in purifiers, their availability must always be maintained so that they can support the performance of the purifier.

4. Procedure

Maintenance carried out on purifier components must be in accordance with procedures according to the Manual Book and PMS to anticipate damage that can interfere with purifier performance. Damage to the purifier can affect the process of the material system on board because the quality of the fuel does not meet standards.

*Efforts made to improve the maintenance of the Water distribution system and Shaft System MDO Purifier*

1. Provide adequate training to machinists on the operation, maintenance, and troubleshooting of purifiers. Training should include in-depth technical knowledge of purifier systems, proper maintenance procedures and recognition of signs of damage or failure. By increasing the knowledge and skills of machinists, machinists will be better prepared to carry out their duties and responsibilities effectively.
2. Provides the latest information on technology, procedures, and best practices in purifier maintenance and repair. This can be done through ongoing training, access to online resources, and collaboration with purifier manufacturers or industry experts.
3. Establish and implement a clear Standard Operational Procedure (SOP) and ensure machinists adhere to it. This can involve regular oversight, audits, or inspections to ensure that established procedures are properly followed. It is also important to provide the engineer with a good understanding of the importance of following procedures and the consequences of ignoring them.

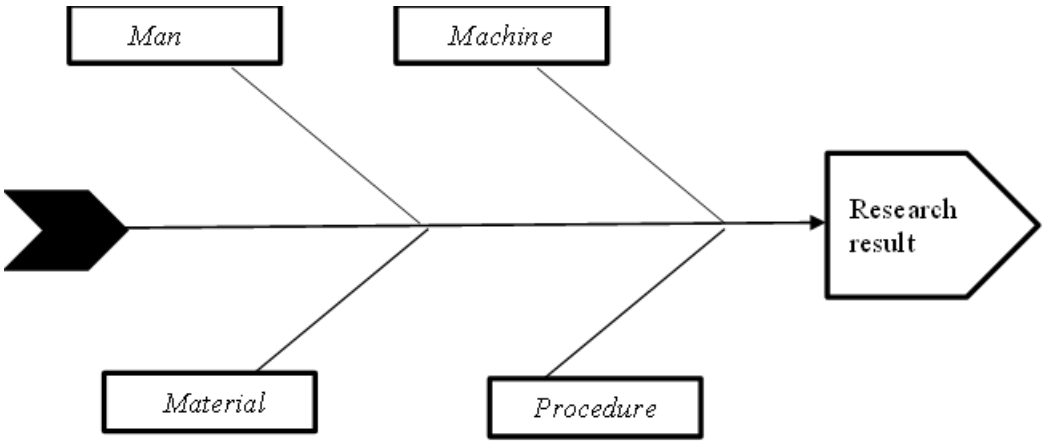


**Figure 3.** Fishbone Diagram

## CONCLUSIONS

To optimize the maintenance and performance of the Water Distribution Device and Shaft System on the M.D.O Purifier, several things are done, including providing adequate training to machinists, providing the latest information on technology and best practices regarding purifiers, implementing clear standard operating procedures, ensuring the availability of new spare parts needed, carrying out planned and intensive maintenance, monitoring machine conditions regularly, and developing a good maintenance schedule for the Water Distribution Device and Shaft System in accordance with the maintenance system plan.

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