e-ISSN: 2829-6192, p-ISSN: 2829-6184
DOI: https://doi.org/10.38035/ijam.v2i2
Received: 29 July 2023, Revised: 29 Agustus 2023, Publish: 14 September 2023

Performance Analysis of Sea Water Cooling Pumps on The Smoothness of The Main Engine Cooling System On The Mt. Fail

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Abstract: The main engine sea water cooling pump is a type of centrifugal pump as one of the pumps that is often found in the ship machinery industry working on the principle of impeller rotation as a fluid transfer element driven by a propulsion engine. The liquid inside will rotate due to the impetus of the blades and cause a centrifugal force which causes the liquid to flow from the middle of the impeller and out through between the blades and leave the impeller at high speed. The sea water cooling pump has a very important role in supporting the cooling system process on the main engine. If the coolant pump does not work properly, it will result in a less than optimal cooling system. Like the problems the author experienced when carrying out sea practice on the MT ship. This causes problems with the lack of maximum performance from the pump impeller and pump vibrations that are too high. which resulted in affecting the performance of the main engine and disrupting the operation of the ship. The purpose of this research is to find out the cause of the less than optimal performance of the impeller on the pump and find a solution. and to find out the cause of too high vibration in the pump and find a solution. While this research method is a qualitative descriptive research method. The results of this study are expected to be useful in science as a contribution to ideas related to the analysis of the performance of seawater cooling pumps to support ship operations.

Keyword: Seawater Cooling Pump, Impeller

INTRODUCTION

In the smooth operation of a cooling system on board it needs to be supported by the perfection of the work processes of each part or component of the cooling system, so that they can work according to their respective functions. One of these components is a seawater cooling pump, a pump is a machine that can flow fluid which is basically to move fluid from one place to another by pressing the fluid. The sea water cooling pump has a very important role in

supporting the cooling system process on the main engine. If the coolant pump does not work properly, it will result in a less than optimal cooling system.

Based on the author's experience while doing sea practice on the MT. Menggala, when the ship was sailing from Merauke to Ambon, an alarm fresh water cooler was found, then after a while the main engine rpm also decreased, the oiler who was on duty at that time immediately checked by checking the expansion tank and it turned out to be in normal condition, then checked the main engine there were no signs of leakage, but when checking the seawater cooling pump there was a pressure drop in the pressure gauge. And it turns out that the pressure of the sea water cooling pump has decreased, which should have a pressure of 2.5 kg/cm² to 1.2 kg/cm². Then a check is carried out by firing a temperature sensor or temperature gun on the shaft that connects the motor to the impeller, it turns out that the temperature shows a very significant increase, which is around 47oC, while the normal temperature is around 28o-33oC. Then the engineer on duty at that time instructed to replace the seawater cooling pump using a GS (general service) pump. After using the GS (general service) pump it turned out that the fresh water cooler had returned to normal and no more alarms occurred. After analyzing and overhauling the cause of the alarm on the fresh water cooler is the lack of impeller performance that is not functioning optimally. Then after 1 month from the occurrence of the problem of lack of performance of the impeller, the main engine sea water cooling pump is again having problems, namely the pump is experiencing too high a vibration. Vibration on the seawater cooling pump is characterized by a fairly loud noise at a distance of approximately 20 meters and when the seawater cooling pump is held by hand there is a vibration that feels strong enough so that the hands vibrate too. The impact of vibration on the seawater cooling pump is that the pressure on the seawater cooling pump decreases and the rotation becomes unstable so that the seawater cooling pump cannot work optimally when the ship is sailing. In addition, other problems often occur in seawater cooling pumps, namely leaks in the gland packing, blockage of seawater flow in the sea chest and damage to the pump electromotor. Vibration on the seawater cooling pump is characterized by a fairly loud noise at a distance of approximately 20 meters and when the seawater cooling pump is held by hand there is a vibration that feels strong enough so that the hands vibrate too. The impact of vibration on the seawater cooling pump is that the pressure on the seawater cooling pump decreases and the rotation becomes unstable so that the seawater cooling pump cannot work optimally when the ship is sailing. In addition, other problems often occur in seawater cooling pumps, namely leaks in the gland packing, blockage of seawater flow in the sea chest and damage to the pump electromotor. Vibration on the seawater cooling pump is characterized by a fairly loud noise at a distance of approximately 20 meters and when the seawater cooling pump is held by hand there is a vibration that feels strong enough so that the hands vibrate too. The impact of vibration on the seawater cooling pump is that the pressure on the seawater cooling pump decreases and the rotation becomes unstable so that the seawater cooling pump cannot work optimally when the ship is sailing. In addition, other problems often occur in seawater cooling pumps, namely leaks in the gland packing, blockage of seawater flow in the sea chest and damage to the pump electromotor.

Based on the description above, the authors chose the title: "Performance Analysis of Sea Water Cooling Pumps on the Smooth Main Engine Cooling System on the MT Ship.

RESEARCH METHOD

Methods/techniques of analysis using a qualitative approach with qualitative descriptive analysis techniques. Based on the problem that has been selected, the subject of research is the analysis of the performance of the seawater cooling pump on the smooth running of the main engine cooling system on the MT Menggala ship. The analysis technique used is a qualitative descriptive analysis method, namely examining existing data which is the root of the problems

discussed in this study where the data is analyzed and then the appropriate and appropriate conclusions are sought.

RESULTS AND DISCUSSION

Lack of Maximum Impeller Performance in Seawater Cooling Pumps

When the ship sailed from the port of Merauke to the port of Ambon on September 14, 2021, an alarm fresh water cooler was found. then after a while the main engine rpm also decreased.

*Oiler*who was on duty at that time immediately checked by checking the expansion tank and it turned out to be in normal condition, then checked the main engine for no signs of leaks, but when checking the seawater cooling pump there was a pressure drop which was known through the pressure gauge. And it turns out that the pressure of the seawater cooling pump has also decreased, which should have a pressure of 2.5 kg/cm² to 1.2 kg/cm². Then a check is also carried out by firing a temperature sensor or temperature gun on the shaft that connects the motor to the impeller, it turns out that the temperature shows a very significant increase, which is around 47ºC, while the normal temperature ranges from 28º-33ºC. Then the engineer on duty at that time instructed to replace the seawater cooling pump using a GS (general service) pump. After using the GS (general service) pump it turned out that the fresh water cooler had returned to normal and no more alarms occurred. After analyzing and overhauling the cause of the alarm on the fresh water cooler is the lack of impeller performance that is not functioning optimally. The causes of the less than optimal performance of the impeller are various factors, namely blockage of the impeller by sea shells, then corrosion of the impeller and lack of maintenance on the impeller.

The following shows the pressure data for the centrifugal pump of the main engine cooling system seawater which was taken before the impeller replacement and after the impeller replacement. This data collection is done every hour by the oiler and witnessed by the engineer on duty.

Table of seawater pump performance conditions at the time before the impeller replacement

Waktu Pengamatan	Tekanan Masuk Pompa	Temperature air laut	Keterangan
14 September 2021 Pukul 04.00	2,5 kg/cm²	32°C	Kondisi normal
14 September 2021 Pukul 06.00	2,1 kg/cm²	33°C	Kondisi normal
14 September 2021 Pukul 07.00	1,7 kg/cm²	42°C	Kondisi tidak normal
14 September 2021 Pukul 08.00	1,2 kg/cm²	47°C	Kondisi tidak normal

Table of seawater pump performance conditions after impeller replacement

Waktu Pengamatan	Tekanan Masuk Pompa	Temperature air laut	Keterangan
14 September 2021 Pukul 11.00	2,5 kg/cm²	30°C	Kondisi normal
14 September 2021 Pukul 12.00	2,5 kg/cm²	29°C	Kondisi normal
14 September 2021 Pukul 13.00	2,5 kg/cm²	29°C	Kondisi normal
14 September 2021 Pukul 14.00	2,5 kg/cm²	29°C	Kondisi normal

This can be overcome by:

a. Carry out maintenance on the pump according to PMS, because this factor is very important considering that periodic inspection and maintenance of the cooling pump can reduce the risk of sudden damage to the seawater cooling pump.
b. Maintaining pressure and temperature conditions under normal conditions can be done by monitoring or checking the pump impeller every single voyage. If during monitoring or checking the impeller contains debris, the impeller must be cleaned immediately, but if the impeller is damaged due to corrosion or other problems it must be replaced immediately so that the pump pressure is maintained under normal conditions.

Sea Water Pump Vibration Too High

Then on October 20, 2021 when the ship sailed from Ambon to Ternate, when the Oiler who was on duty at that time checked the condition of the machinery, the seawater cooling pump again experienced a problem, namely excessive vibration in the seawater cooling pump. Which resulted in the main engine experiencing a decrease in RPM (revolutions per minute) because the jacket cooling temperature became hot, namely 88ºC, which at normal temperature is 75ºC. Then a temperature check was carried out at the seawater cooling pump by firing a temperature gun at the shaft that connects the impeller to the bearing and it turned out that the temperature had increased significantly, besides that the vibration also caused the seawater cooling pump pressure to decrease again. then KKM ordered Oiler to replace the seawater cooling pump using a GS (general service) pump. After replacing the pump, the jacket cooling temperature for the main engine returns to normal and the RPM (revolution per minute) returns to its initial state. then the co-author of the Foreman and Engineer IV was ordered by KKM to overhaul the pump. Overhaul and cleaning is carried out on the components of the main engine seawater cooling pump and checking the condition of the impeller, shaft, ball bearing, mechanical seal and pump housing. then the co-author of the Foreman and Engineer IV was ordered by KKM to overhaul the pump. Overhaul and cleaning is carried out on the components of the main engine seawater cooling pump and checking the condition of the impeller, shaft, ball bearing, mechanical seal and pump housing. then the co-author of the Foreman and Engineer IV was ordered by KKM to overhaul the pump. Overhaul and cleaning is carried out on the components of the main engine seawater cooling pump and checking the condition of the impeller, shaft, ball bearing, mechanical seal and pump housing.

At the time of overhauling and analyzing it turned out that the cause of pump vibration that was too high was damage to the mechanical seal and ball bearings in the pump which not only caused vibration but also leaks in the pump. This causes the pump performance to decrease.

Then in this second problem the result of the pump vibration being too high also affects the decrease in sea water cooling pump pressure. The following shows the pressure data for the centrifugal pump of the main engine seawater cooling system which was taken before the vibration repair and after the vibration repair. This data collection is done every hour by the oiler and witnessed by the engineer on duty.

Table of seawater cooling pump performance conditions before repair *ball bearings*and mechanichal seal

Waktu Pengamatan	Tekanan Masuk Pompa	Temperature air laut	Keterangan
20 Oktober 2021 Pukul 08.00	2,4 kg/cm²	31°C	Kondisi normal
20 Oktober 2021 Pukul 09.00	2,1 kg/cm²	33°C	Kondisi normal
20 Oktober 2021 Pukul 10.00	1,7 kg/cm²	42°C	Kondisi tidak normal
20 Oktober 2021 Pukul 11.00	1,1 kg/cm²	48°C	Kondisi tidak normal

Table of seawater cooling pump performance condition after repair *ball bearings*and mechanical seals

Waktu Pengamatan	Tekanan Masuk Pompa	Temperature air laut	Keterangan
20 Oktober 2021 Pukul 13.00	2,5 kg/cm²	30°C	Kondisi normal
20 Oktober 2021 Pukul 14.00	2,5 kg/cm²	30°C	Kondisi normal
20 Oktober 2021 Pukul 15.00	2,5 kg/cm²	29°C	Kondisi normal
20 Oktober 2021 Pukul 16.00	2,5 kg/cm²	29°C	Kondisi normal

This problem can be overcome by:

a. Perform replacement of mechanical seals and ball bearings according to the time limit of use. Efforts are made to minimize damage to other pump components by making a schedule for when to replace the mechanical seal or ball bearing in accordance with the provisions in the manual, with this schedule it can be seen from the age of the mechanical seal or ball bearing itself.
b. Monitoring the pump operation every half hour or once an hour starting from the engine start time and continuing in the next hour until the pump operating time ends. Monitoring the condition of the bearings can be done by checking the temperature of the bearings, and the lubrication of the bearings.

CONCLUSION

In connection with these problems that cause a lack of seawater cooling pump performance, a conclusion can be drawn, namely:

1. The less than optimal performance of the seawater cooling pump impeller is caused by the blockage of the impeller blades by garbage and sea shells, and corrosion of the impeller. Based on the selected problem solving, this can be overcome by carrying out routine maintenance of the pump according to what is in the Plan Maintenance System on board.
2. The author experienced too high pump vibration caused by the use of mechanical seals and ball bearings past the specified time limit, then the lack of lubrication on the pump bearings. Based on the selected problem solving, this can be overcome by replacing pump parts that have been damaged and their use has exceeded the specified maximum time limit.

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