

Performance Optimization of Cooling Machines to Keep The Quality of Food Materials on The Ship MT. Pujawati

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Abstract: The support that is very vital and related to welfare and health is the Cooling Machine to ensure the quality and quantity of food ingredients. The good quality of meat and fish are meat and fish which are not mushy, not rotten and when stored can be frozen entirely and if necessary crystallize. In order for foodstuffs to remain good, it needs storage temperature ± 20 C. For storage of meat and fish we need storage temperature $\pm 15^{\circ}\text{C}$. The lack of maximum working of the cooling machine is influenced by various factors, both internal factors such as the number of machine working hours. For external factors, this is closely related to the lack of maintenance of the cooling engine. In the research that the authors do there are several factors that are very influential in the smooth operation of the food cooling machine. The presence of ice flower on evaporator pipes is the most common problem in evaporator work. This occurs when the temperature of the pipe surface is lower than 00 (freezing temperature of water). Next is the poor condensation process. Suggestion given in this problem that is: Immediately close the door of cooling chamber at the time of entrance or exit cooling chamber and to do periodic monitoring and maintenance to amount of Freon through glass of suspect and lubrication oil contained in compressor. In order for the condensation process Freon perfect and can meet the needs of cooling, then do condenser treatment well. For normal conditions once a month and if in an emergency, cleaning and checking can be done as soon as possible. Periodically check for leaks in the cooling engine installation. Monitoring the lubricants contained in the compressor and the condition of the oil separator so that lubricating oil does not coexist with the Freon into the system that will be able to cause oil deposits and air bubbles. Checking the thermo-expansion valve, if the temperature in the cooling chamber is still high set the thermo-expansion valve by rotating the bolt to the left or right and replace it with a new one if necessary.

Keywords: Optimization, Cooling Machine, Food Ingredients.

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I. Introduction

The voyage will be able to achieve its objectives successfully, on time, safely and safely if all existing infrastructure and supporting components are adequately covered. One support that is very vital and related to welfare and health is the quality and quantity of food ingredients. The food is undamaged or rotten. In order for the food ingredients to remain quality in storage, we need to have a cooling machine that meets work standards. For meat and fish are still good meat and fish are not mushy, not rotten and when stored can be frozen entirely and if necessary crystallize. In order for food ingredients to remain good, it needs a storage temperature of $\pm 2^{\circ}\text{C}$. For storage of meat and fish we need a storage temperature of $\pm 15^{\circ}\text{C}$.

Literature Review

1. Definition of Optimization.

According to the Big Dictionary of Indonesian Language Optimization is derived from the optimal basic word which means best, highest, most profitable, making the best, making the highest, optimizing the process, ways, optimizing actions (making the best, highest, etc.) so that optimization is an action, process, or methodology to make something (as a design, system, or decision) become more / fully perfect, functional, or more effective

2. Definition of Cooling Machines

A tool used to move heat from the room to the outside of the room or a cooling machine is a series of circuits that are able to work to produce a cold temperature or temperature.

3. Definition of Foodstuffs

According to the big Indonesian dictionary Definition Foodstuffs are ingredients that can be used as food.

II. Methodology

Data analysis method that writer use in this research is descriptive qualitative where data obtained data arranged systematically and regularly, then writer make qualitative analysis in order to get clarity about problem which done in this research. Data analysis conducted in this study is an analysis of the performance of the cooling engine. From this explanation, it is expected to be able to describe the overall subject matter and problem solving of this research.

III. Analysis And Discussion

Data from the cooling engine on the MT.PUJAWATI ship are:

Maker : USHIO REINETSU Co.LTD - Japan

Type : URS-2.2SSSD4

Compressor type : FAD-2SSYM; Semi-hermetic type

Driven and revolution: direct driven 1750 min-1

Power source : AC 440 V; 60Hz; 3 phase

Condenser type: UWC-204 ; shell and finned tube type

Condenser tube material : aluminum brass

Evaporator type : SG-UIS2HL

Cooling coil evaporator material : aluminum cooper tube fin plate

Disturbances experienced by the author during carrying out the practice of the sea aboard MT.PUJAWATI namely:

1. On April 15, 2017, the ship MT.PUJAWATI was docked in the port of Al-Jubail, Saudi Arabia, as usual crew ship to work in accordance with their duties and responsibilities respectively. One morning at 8:00 a.m., the two machinists in this case were responsible for the food cooling machine, checking the temperature in the cooling room. After examination, it was found that there was a steady increase in temperature from the previous day at the temperature of the meat and fish chillers, the temperature of the vegetable cooling chamber, and the temperature in the lobby. Then the results of further examinations were carried out by the two machinists that the pressure on the compressor was normal, the amount of lubricant oil seen in the alleged glass in the compressor was also normal. Next, it was inspected in the cooling room and found many ice flowers on the evaporator pipes.

2. On July 26, 2017 at around 9:30 a.m., when the MT.PUJAWATI ship was carrying out a move to the port of Budge-budge in India, the ship passed a long river and for a long time. After the motion is complete the activities in the engine room run as usual, not long after the alarm on the engine cools off and the compressor turns off by itself. Then the engineer two resets the cooling engine by pressing the reset button on the control panel. After waiting a while the engine coolant alarm goes back and the compressor dies. The second machinist finds the temperature of the cooling room abnormal and does not reach the desired cooling temperature. Then the engineer did two checks on the installation of food refrigeration machines, it was known that the surface of the cooling material in the glass was assumed to be normal as well as the oil level of the lubricant under normal conditions. The two engineers checked the coolant pressure of the sea water and found that sea water pressure was not normal, then the engineer had two initiatives to immediately turn off the cooling engine and open the condenser. Once opened, the tubes on the condenser are dirty and contain a lot of mud which causes the condensation process to be bad.

IV. Discussion

The cooling machine is one of the auxiliary aircraft that works based on the principle of heat transfer. For the process of heat absorption, there is a condensation process on the condenser and the evaporation process in the evaporator. By integrating several processes in one system, it can be used as a cooling device. From the process above, the evaporation process in the evaporator that is used for cooling a room. When Freon in the evaporator evaporates, it absorbs heat around the evaporator capillary tube, so that the area around the evaporator becomes cooler. Because the evaporator process in the evaporator occurs continuously and very quickly then the circumstances surrounding the evaporator become colder. In the presence of a blower mounted near the evaporator, the cold air is exhaled throughout the cooling room so that the cooler becomes cooler.

The lack of maximum cooling engine work is influenced by many factors, both internal factors such as the number of hours the machine works. For external factors, this is closely related to the lack of maintenance of the cooling engine. In the research that the authors do there are several factors that are very influential in the smooth operation of the food cooling machine.

1. The presence of ice flowers on the evaporator pipes is the most common problem in the work of the evaporator. This occurs when the temperature of the pipe surface is lower than 00 (freezing temperature of water). This happens because of several factors, namely:

a. Doors in refrigerated foodstuffs often open for a long time. Because every time you open the door of the food cooler, the cold air from inside the cooling chamber will come out because of its greater specific gravity. The place is empty and the vacuum will be filled by the outside air which is hotter than the air in the cooling chamber and if the outside air enters the cooling room it will cause the incoming water vapor to freeze on the evaporator pipes which can cause the cooling room temperature to rise or abnormal. Often the opening of doors in the cooling room can be caused by the arrival of materials from the ground to the ship that is inserted into the food stuffing chillers.

b. Wearing the piston ring on the compressor also causes ice flowers to appear on the evaporator. With damage to the piston ring or piston on the compressor causes the compressor to circulate or circulate the Freon to be not good so that heat absorption becomes less than optimal.

c. The onset of ice flowers is caused by the dryer or dryer not functioning. This is because the silica gel in the dryer is saturated so it cannot dry or absorb water vapor and impurities that circulate with Freon. The vapors will freeze on the evaporator pipes so that they will form ice flowers and inhibit the process of absorbing heat from the food cooler which causes the temperature to rise.

d. Lack of Freon circulating in the system due to a leak that causes the outside air to enter the system and circulate with Freon, if the air containing moisture and direct contact with Freon will freeze water vapor on the surface of the evaporator pipes. There was found a layer of ice flower which would cause a blockage in the evaporator pipes and result in the flow of Freon inhibited. In MT. PUJAWATI the food cooler consists of a cooling room for meat and fish, a cooling room for fruits and vegetables and lobby. Freon in the evaporator changes form from liquid to gas by taking heat from the surroundings so that in the cooling room of foodstuffs is equipped with a fan motor so that there is circulation of cold air evenly to all parts of the room. Hot air in the cooling chamber is sucked by the motor fan driven back into the room where the food is stored. Inside the outside air conditioning room that enters the inside should not be excessive or must be limited to entry. If the air enters too much, the moisture contained in the outside air will condense and make layers of ice flowers on the evaporator pipes. This layer of ice flower is a barrier of heat absorption so that the heat in the cooling chamber cannot be absorbed by the Freon perfectly. The air entering the cooling chamber causes the temperature in the cooling chamber to rise. Signs of the evaporator in the cooling chamber have occurred the ice flower layer is the compressor continues but the desired temperature in the cooling chamber is not achieved and can be checked directly on the evaporator.

2. In order for the Freon to be expensed and evaporated well in the evaporator is the Freon must be in liquid form. To obtain Freon in liquid form, the Freon which in the form of gas results from the compressor work must be transformed into a liquid having high pressure. The process of changing the form from gas to liquid is called the condensation process. In the cooling system the condensation process takes place on the condenser. In order for the condensation process to be maximal, the thing that must be fulfilled is the capacity of the cooling water. To remove heat contained in refrigerant in the tube in the condenser. For that condenser also need care as well as on the evaporator for condensation process on the condenser to be good. The lack of condensation process can be caused by several factors, such as:

- [a] Interrupted by the condensation process on the condenser can be caused by a lot of dirt or mud which causes the condenser pipes to end so that the cooling process of Freon by the cooling water is not optimal. Condenser pipe bundles result in poorly maintained condensers or because ships enter shallow water such as entering rivers that contain dirt or mud.
- [b] Normally the condensation process can also be caused by the pressure of the sea water entering the condenser to be low. This is due to a leak in the cooling system of the sea water leading to the condenser so that the cooling of Freon on the condenser becomes abnormal because Freon is still hot so that the temperature to be achieved in the cooling chamber cannot be achieved.

Solution

1. The occurrence of ice flowers in the evaporator pipe is the result of the large amount of moisture in the air entering the cooling chamber because the door in the cooling chamber is too often opened. Actions that can be taken to overcome the occurrence of thickening of ice flowers on the evaporator pipes are:

a. Check the number of Freon's contained in the receiver. The receiver is a collection of Freon liquids as a result of condensation that occurs in the condenser. If there is a shortage of Freon in the cooling engine installation, this will cause the absorption of heat to be less than optimal and the blast of cold air exhaled by the evaporator will also be reduced so that this can also cause ice flowers on the evaporator pipes. Freon requirements in the receiver must not be too low and should not be too excessive. Must be in accordance with the instructions in the Instruction Manual Book of food refrigeration machines. The Freon level in the refrigeration engine installation can be seen in the guess cup found on the receiver inside the condenser. Normal or not the Freon level in the glass can be seen as shown. (Fig. 4.1)

2. To remove the flower on the evaporator can by means of defrosting. Defrosting is the melting of ice flower on evaporator pipes. Defrosting can be done in several ways:

1) By spraying hot water or low pressure water. In this case the compressor must be turned off first by turning off the blower from the evaporator and closing the Freon output valve from the condenser. Then hot or low-pressure water is sprayed on evaporator pipes containing ice flowers until the flowers of the ice on the evaporator are completely gone. When it's finished, the blower is turned on again and open the Freon output valve from the condenser.

2) Use electric heater with timer. This timer with defrost has been designed so that within 24 hours that happens 3 or 4 times to make defrost.

Figure 4.1
The Freon level in the guess glass

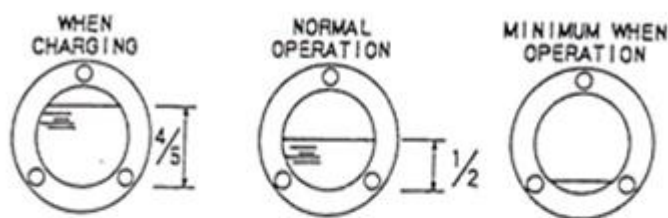
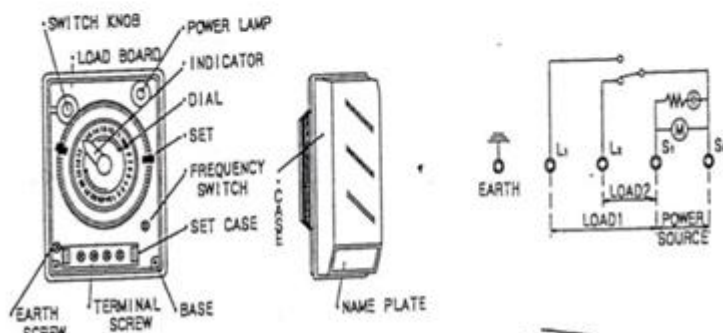


Figure 4.2
Defrost timer



V. Conclusions And Suggestions

A. Conclusion

1. The occurrence of thickening of ice flowers is due to the lack of Freon in the system and the damage to the components of the compressor so that the absorption of heat in the cooling chamber is less than optimal. This results in the emergence of ice flower on the evaporator pipes and causes the temperature in the cooling room to be not optimal.

2. The condensation process on the condenser is less than maximum can be caused because the condenser is in a dirty state so that it will disrupt the condensation process of the Freon gas to become liquid. The condensed Freon cannot provide for cooling in the cooling chamber so that the ideal cooling chamber temperature cannot be achieved.

B. Suggestions

- [1]. Immediately close the door of the cooling chamber upon entry or exit of the refrigeration chamber as well as periodically monitoring and maintaining the amount of Freon through the suspected glass and the lubricating oil contained in the compressor in order to avoid wear of the components on the compressor and the temperature in the fixed chamber awake.
- [2]. So that the Freon condensation process is perfect and can meet the cooling needs, then conduct condenser maintenance properly. For normal conditions once a month and if in an emergency, cleaning and checking can be done as soon as possible.
- [3]. Perform regular checks of leakage on the installation of cooling machines for Freon gas circulation to run properly.
- [4]. Monitor the lubrication oil contained in the compressor and the condition of the oil separator so that the lubricating oil does not flow with the Freon into the system which will cause oil deposits and air bubbles to occur.
- [5]. Check the thermo-expansion valve, if the temperature in the cooling room is still high set the thermo-expansion valve by rotating the bolt to the left or right and replace it with the new one if necessary.

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