



## PERFORMANCE ANALYSIS OF WASTE GATE VALVE IN REGULATING EXHAUST GAS FLOW TOWARDS THE TURBOCHARGER FOR THE FLEXIBLE COMBUSTION PROCESS ON THE TANGGUH JAYA LNG/C SHIP

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**Abstract:** A turbocharger is an auxiliary engine that functions to supply air into the cylinder and in general every turbocharger has two sides, namely, the compressor side and the turbine side, the rotation of the turbocharger is generated from the remaining exhaust gases from combustion in the cylinder which goes to the turbine side of the turbocharger and produces rotation. on that side and also rotates at the same speed on the compressor side of the turbocharger. The amount of air that will enter the cylinder depends on the rotation of the turbocharger itself, if the rotation of the turbocharger is too fast it will produce too much air in the cylinder which results in knocking or knocking on the main drive engine, whereas if the turbocharger rotates too slowly it will result in too little quantity of air resulting in a misfire or failure of combustion in the cylinder. To determine the rotational speed of the turbocharger, we need a tool that can regulate the quantity of the remaining exhaust gases from combustion in the cylinder, namely the waste gate valve. When the writer carried out the sea practice, the writer experienced various interesting things about the waste gate valve, such as the opening that did not match the degree of the waste gate valve to the difference in the indicator readings on the waste gate valve. In this case the author will analyze the cause of the imperfect supply of air entering the cylinder caused by the non-optimal performance of the waste gate valve.

**Keywords:** Turbocharger, Round, Air quantity, Knocking, Misfire, Waste gate valve, cylinder

### INTRODUCTION

Reliable and safe engine performance requires the correct and appropriate ratio of fuel and air content in all situations and conditions so that complete combustion occurs in the cylinder, handling in maintaining perfect combustion results must require special attention from various aspects such as the only quantity of air entering the cylinder. A turbocharger is an auxiliary

engine that functions to supply air into the cylinder and in general every turbocharger has two sides, namely, the compressor side and the turbine side, the rotation of the turbocharger is generated from the remaining exhaust gases from combustion in the cylinder which goes to the turbine side of the turbocharger and produces rotation. on that side and also rotates at the same speed on the compressor side of the turbocharger. The amount of air that will enter the cylinder depends on the rotation of the turbocharger itself, if the rotation of the turbocharger is too fast it will produce too much air in the cylinder which results in knocking or knocking on the main drive engine, whereas if the turbocharger rotates too slowly it will result in too little quantity of air resulting in a misfire or failure of combustion in the cylinder.

To determine the rotational speed of the turbocharger, we need a tool that can regulate the quantity of the remaining exhaust gases from combustion in the cylinder, namely the waste gate valve. The waste gate valve is a valve that can open and close according to the air requirements needed by the main propulsion engine on board the ship by holding some of the remaining exhaust gas and flowing it directly to the exhaust manifold. When the author carried out the sea practice, the author experienced various interesting things about the waste gate valve, such as the opening that did not match the degree of the waste gate valve to the difference in indicator readings on the waste gate valve. These events can be said to almost often occur with the same problem but have a variety of different ways and handling.

In this case the author will analyze the cause of the imperfect supply of air entering the cylinder caused by the non-optimal performance of the waste gate valve. One of the causes of delays in the loading and unloading process on tankers is that there is damage to important components such as manifolds, bellmouths, cargo pump faucets and cargo pipes used for loading and unloading. The causes above can be overcome by handling, maintaining, and repairing these components on a regular basis so as not to cause harm to the ship, company, or the surrounding environment. In addition to these problems, depreciation (losses) can also cause delays in the loading and unloading process on ships.

Depreciation (losses) is a common problem and continues to occur when the ship finishes loading or unloading at the port. This problem occurs because of differences in calculations between the ship and the land where the calculation results exceed the tolerance limit given by the company. This shrinkage can occur if the temperature between the two tanks is much different. In reducing the risk of such depreciation, it is necessary to control depreciation (losses) while on board the ship. Control can be done by checking the temperature on the land tank or ship tank. The different temperatures between land tanks and ship tanks are caused by different weather and climatic factors. Depreciation control can also be done by monitoring the volume of oil on each movement of oil from land or to ships. This control aims to control oil shrinkage from the specified tolerable loss, by reducing, maintaining and tackling, thereby increasing profits for the company.

No onshore tank capacity can also hamper the loading and unloading process at the port. The loading and unloading process activities at the port, especially the land side, are the full responsibility of the Loading Master, if there is no ullage in the land tank, it must confirm or contact the ship, in this case the officer in charge and the officer in charge of the cargo, because

otherwise it will cause overflowed in the land tank and became a new incident. The Loading Master must also stop the loading and unloading process at the port because there is no capacity in the land tank, therefore the loading and unloading process is hampered and cannot be completed on time. Because the operation of the port is not only owned by ships, in order to streamline time, the port party coordinates with the pilot and the Loading Master regarding this kind of incident, they must remove the ship and ask the ship or the captain to dock temporarily to wait until the cargo on the land tank is sold. This is because the land side cannot predict when the cargo will be moved or distributed via tank trucks, it takes 1 hour or more, sometimes days to move the cargo.

## **METHOD**

The approach method used by the author in this study is a qualitative descriptive research method. This qualitative descriptive research method has the aim of revealing facts, phenomena, variables and circumstances that occur when the research is running and providing actual data so that in this study we get the actual research results. The qualitative approach in this study is expected to reveal the problems faced in handling the loading and unloading process on the MT ship. Pagerungan.

### **Approach Method**

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### **Data collection technique**

Data collection techniques are intended to obtain relevant and accurate data. The data collection method used in this study consists of a combination of several methods, so that they can complement each other's methods in order to achieve the perfection of research results. The author will use several data collection techniques, namely as follows:

a. Observation

Prof. Dr. S. Eko Putro Widoyoko, M.Pd. (2012: 46), explains that observation is the process of systematically observing and recording the elements that appear in a symptom in the object of research. The visible elements are called data or information that must be observed and recorded correctly and completely. The author becomes a participant and acts as a participatory observer in MT. Pagerungan while carrying out marine practice which lasted 1 year. This observation is carried out by observing directly the object of research, namely by observing the events that occur during the loading and unloading process, and the author can determine the sources who will provide information about the description of the problem.

b. Interview Method

The interview method is a meeting of two people to exchange information and ideas through question and answer, so that meaning can be constructed in a certain topic (Prof. Dr. Sugiyono, 2015). The targets of this interview method include:

- 1) Obtain or confirm a fact by asking directly to people who know the fact.
- 2) Strengthening trust by asking questions about matters relating to the respondent's belief or opinion about a fact.
- 3) Knowing a person's reasons for his assumptions, feelings, behavior, and policies in dealing with a problem.

In this study the authors conducted interviews with several crew members to obtain information, some of the respondents who had been interviewed were as follows:

- 1) The captain is the party responsible for all events that occur on the ship.
- 2) Mualim I as the operational person in charge of loading and unloading activities from the ship.
- 3) Loading Master Plaju as the operational person in charge of loading and unloading activities from the land side.
- 4) Pumpman as the party who assists Mualim I in the preparation and closing process when loading and unloading activities take place on the ship.

The author conducted interviews informally, but asked spontaneously without using a list of questions while on guard together in the cargo control room during loading and unloading activities.

c. Literature review

Literature Study is a data collection technique by conducting a review study of books, literature, notes, and reports that have a relationship with the problem to be solved (M. Nazir, 2003). This library study is used as a guide for analysis by reading books including applicable regulations and other documents related to the issues discussed.

d. Documentation

According to Prof. Dr. Sugiyono (2015: 240) documents are records of events that have passed. Documents can be in the form of writing, pictures or monumental works of someone. Documents in the form of writing such as diaries, life histories, biographies, regulations, policies. Documents obtained from the ship MT. Pagerungan in the form of data on Naptha load, hourly loading and discharge rate, and pressure pump.

### **Data analysis technique**

According to Prof. Dr. Sugiyono (2015: 334), data analysis is the process of systematically searching and compiling data obtained from interviews, field notes and documentation, by organizing data into categories, breaking down into units, synthesizing, compiling into patterns. , choose what is important and what will be studied, and make conclusions so that they are easily understood by themselves and others.

The data analysis technique used in this study is a descriptive analysis technique with a case study approach. In analyzing research data, the authors explain the problems that cause the loading and unloading process to run not smoothly, such as shrinkage during the loading

and unloading process due to not calibrating the sounding equipment and can also be caused by temporary stops in the loading and unloading process, causing the loading and unloading process to be slow. In addition, the author also explains the problem solving for each inhibiting factor and provides suggestions based on theories. Based on the problems raised by the authors, the authors provide solutions such as calibrating measuring instruments, monitoring during loading and unloading,

## **RESULTS AND DISCUSSION**

### **Damage to Cargo Pump**

As it is known that damage to the cargo pump can cause delays in loading and unloading, this is because the role of the pump is very vital and includes an important component in the loading and unloading process. After the author analyzes the problems that occur due to pump damage, then there are several causes related to pump damage above MT. Pagerungan at the time of loading and unloading are as follows:

a) **Pump Usage at High Power Rate**

Cargo pumps have two types of suction power options, namely low rate and high rate. The low rate has a suction power of 400 kl/hr while the high rate has a suction power of 600 kl/hr. In the event that MT. The natural performance of the cargo pump uses a high suction rate, causing the cargo pump to overheat. This causes the pump to not work optimally.

b) **Lack of Ballast Setting to Generate Trim**

Ballast arrangement is very important to make the ship position trim by ahead or trim by stern. When the remaining cargo in the tank is almost exhausted, what is needed is to change the position of the ship to trim by stern so that the remaining cargo is collected at the back of the tank. In this case, when the ship is positioned trim by stern, the pump that does not suck optimally will make a roaring sound or suck in the wind, it can also cause damage to the ship's pump if it is left too long.

### **Load shrinkage**

#### **Evaporation During the Unloading Process**

Evaporation of temperature during the loading and unloading process may occur. The cause of temperature evaporation is the far position of the tank on land from the port. Due to long distances it can cause temperature evaporation so that the temperature results to be received on the ship will be different from the tank temperature on land. In addition to the distance between the port and land tanks, another factor is the extreme heat during the day, which makes the temperature in the cargo hold tank hotter and affects the temperature of the cargo. These factors can affect the calculation when the first officer and Loading Master do the calculations.

### **Uncalibrated Measuring Instrument**

Mualim I as the officer responsible for carrying out checks on his duties, such as checking the measuring instruments used to measure the height of the cargo tank. Because if the equipment used for sounding the load has reached the expiration limit. Calibration is an activity to determine the conventional truth of the value of the designation of measuring instruments

and measuring materials by comparing them to traceable measuring standards against national and international standards for national or international measuring units to certified reference materials.

Calibration itself aims to achieve measuring instruments that comply with certified standards in order to achieve accurate measurement results. Measurement results can be linked to more precise standards, through an unbroken series of comparisons. Calibration also has several benefits, namely maintaining the condition of measuring instruments and measuring materials in accordance with their specifications, to support quality systems applied in various industries on laboratory and production equipment owned, and being able to know the difference between the correct price and the price indicated by the measuring instrument that. Calibration is usually carried out by a third party within the company, in this case a service provider appointed by the company after the ship's party sends an official report before the calibration period is due.

The process of calculating the amount of oil volume on board to take samples and the volume of cargo for each ship's tank must use tools based on standards for checking. The reality that occurs on board the ship is that the measuring instrument used should be calibrated periodically by the land side. The effect when calculating the load on the ship. Measuring the volume of the cargo tank on the ship must use tools according to standards. The purpose of the use of tools according to standards is so that load measurements are carried out properly, efficiently and accurately.

## **CONCLUSION**

Damage to the cargo pump caused delays in the loading and unloading process at MT. Pagerungan is caused by the use of High rate power which causes the pump to overheat. The solution to this problem is to perform more optimal preventive maintenance.

The occurrence of shrinkage in the loading and unloading process at MT. Pagerungan is caused by the presence of several non-standard measuring instruments on board, causing a significant difference when the land side and the ship perform sounding of the cargo on board. The solution to this problem is to perform regular checks on measuring instruments.

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