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The Design of E-Maintenance Applied on Vessels' 2000 Horse Power Diesel Engine

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Abstract

Sumber Rezeki Bahari Permai, is a Company running its shipping business, which has a set of 20 fleets where all of the vessels are still manually maintained. There are maintenances with running hours schedule which haven't been applied correctly by engineers and ship's crews. Problems occurred frequently on the response of reparation and spare parts request due to the running hours computation that is not yet continue and the manual report system. For taking care of that issue, then our option is to apply the E-Maintenance system, which is designed to minimalize more fatal damages to engine components. With this system applied, we hopefully gain a good engine performance. This kind of system covers the maintenance of running hours for important engine components, engine performance and also spare part list. Preventive maintenance using the E-Maintenance is purposed to reduce the breakdown of engine components and also to keep them running well and more efficient.

Key Words: Diesel Engine Components, Preventive Maintenance, Maintenance Scheduling, E-Maintenance

INTRODUCTION

Sumber Rezeki Bahari Permai, is a Company running its shipping business, which has a set of 20 fleets. In the last 2013, the company had a very big claim value that didn't match to targeted income of the vessels in which after certain inspections and analyses held, the result went to an over budget on engine maintenance. The maintenance for the diesel engine was still manually applied and there were some slow responds to reparation process so the repairing process itself took a long time and the issues came along with the slow spare parts delivery. As a result, the downtime of repairing vessel engine became longer[1]. A manually operated preventive maintenance system for a large number of fleet can't be held effectively either by Vessel's crews or office management. For the components of diesel engine which using preventive maintenance system, it is very significant to make a schedule for periodical inspection, where in this case we can use running hours of the engine. To Bring improvement to the manual type maintenance system of vessels, we give a solution to apply the preventive maintenance using the *E-Maintenance,* based on database which is purposed to reduce more fatal damages when it runs, so it results to an easier maintenance control for both vessels' crews and the head office.

LITERATURE REVIEW

Mean Time between Failures

Mean Time between Failures is the basic measurement of a system's reliability. It is the average time a system needs to work without having failures in a certain period[2]. The approximation of Mean Time between Failures value can also give us information about a device's reliability where in this case it can also be a analysed about human error probability as a factor contributes in a device failure. The value is calculated / measured by dividing between optimal period time total with the number of damages occurred.

Here is the equation to find the MTBF value[3]:

$$\textbf{MTBF} = \frac{\sum^{\textbf{tUptime}}}{\textbf{n}}$$

$$\textbf{MTBF} = \frac{\textbf{t1 + t2 + t3 + t4…}}{\text{n}}$$

Where:

MTBF = Mean Time between Failures

t.Uptime = Optimal Time

n = number of damages occurred

6 EL 32 Diesel Engine [4]

This kind of diesel engine is an internal combustion engine type where fuel is sprayed directly by nozzle into the combustion chamber at the end of compression stroke. This kind of engine was produced by Yakohma engineer in 1992, armed with 2000 horse power and completed with 6

cylinders. The fuel used to operate this engine is MFO or HSD type fuel with gearbox driver system to pass on the thrust to propeller axle. In the starting process to drive the piston, this engine uses about 25 kg of air pressure. It has maximum 250 Rpm with 0.8 kg of air intake pressure. The pressure and the temperature hold important role when the engine runs. The pressure in this case covers air intake pressure, lubricant pressure, cooler pressure and also compression pressure. Temperature as an engine control when it works has a very vital role for monitoring each media, either cooler media such as fresh water and salt water or lubricant media.

RESEARCH METHODS

Research Time and Location

The location of the research was at Sumber Rezeki Bahari Permai Shipping Company, located in Jakarta and at one of the company's vessel, MT. Berkat Anugerah 03. The Research was held on August 2010 until May 2013.

Data Collection Method

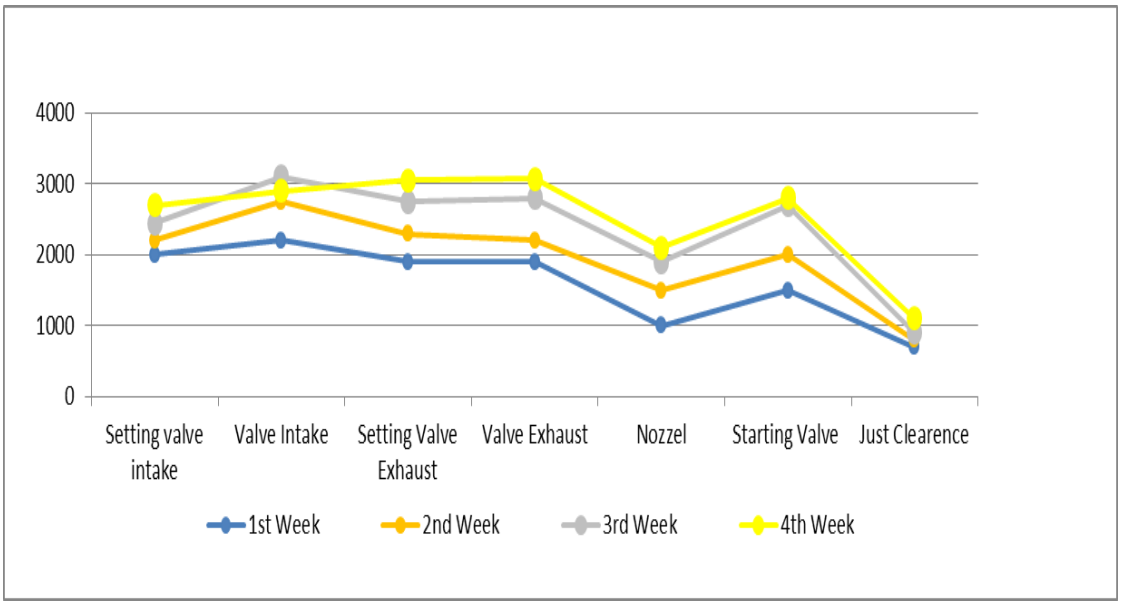
In doing the research, it was needed several data for analysing the problems faced. The data withdrawal is as described: MTBF data was obtained from several damage issues on engine components. Temperature data was obtained from temperature and pressure sensors attached on actual engine. Spare part data was taken from stock list on vessel.

RESULTS AND DISCUSSION

Damage Time Data and MTBF Value Calculation

The Data of each part's working hour is really needed to calculate TBF and TTR value. Therefor we need to make notes for every engine's movement from it starts until it stops, 24 hours a day[5]. We book the operating time in hour unit. The Time between Failures and Time to Repair calculation are done for all damage categories on every component. MTBF is the average time between the occurring damages on an engine component, counted from the first repairing until the next damage occurs, on the same component. MTBF shows us how reliable a component is, seen from the average time when a component starts to have problem to the next damage appears. On below is displayed the maintenance schedule data for each component:

Table1: Damage Chart



Data Chart of Engine Components Maintenance Period February 2013

E-Maintenance

In this phase, we do the making process of maintenance using the maintenance data base in which we use the Mean Time between Failures and Mean Time To Repair formula. The outcome is used as a basis for making maximum limit for each component. Whenever the maximum limit of running hours has been reached, and there is no maintenance given then the system will automatically deliver a warning or a notification to the e-mail which has been registered in the system. The E-Maintenance consists of several things as

described below:

a. Running hours

For engine components maintenance with running hours calculation in every time the engine works.

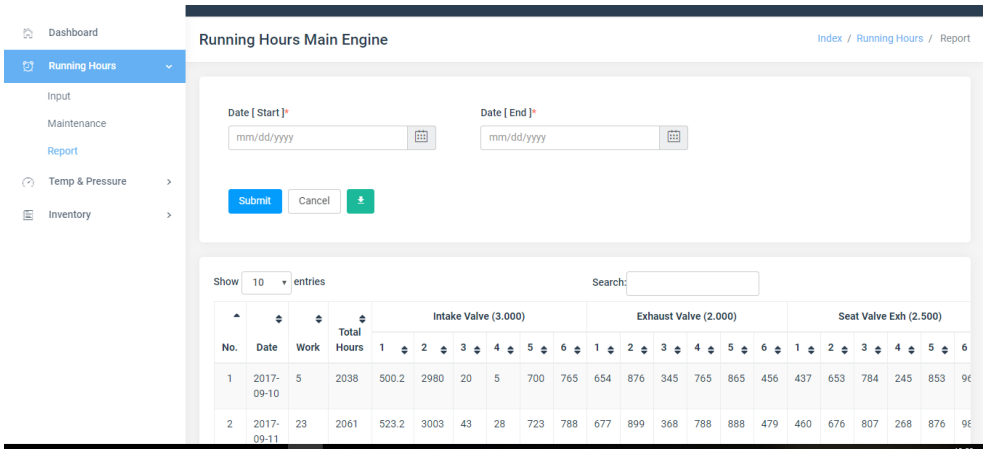
b. Engine Performance

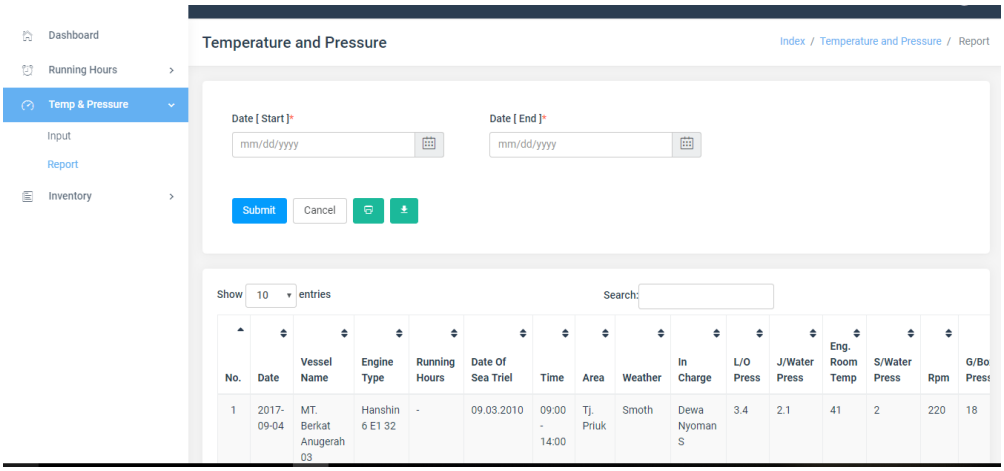
To analyze every parameter works in an engine, the E-Maintenance data base is purposed for monitoring the engine condition.

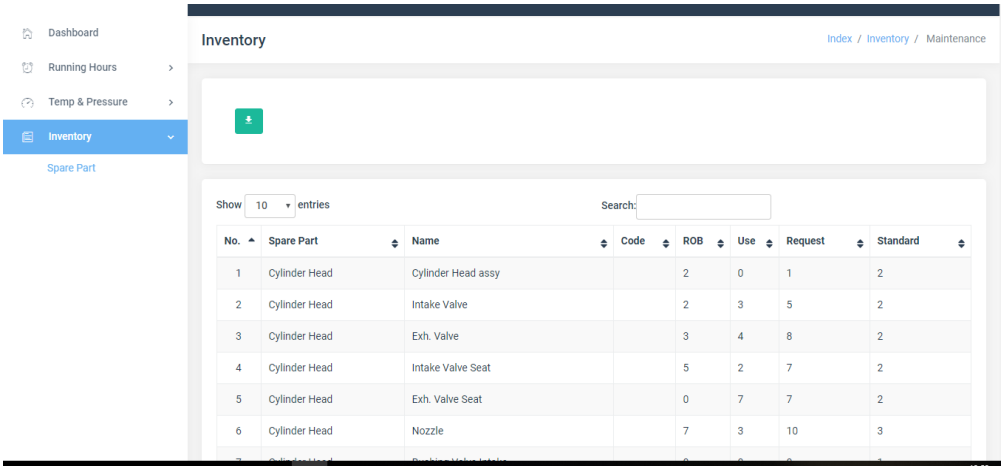
c. Spare Part List

Spare part is important for diesel engine. The Data is to make sure about the spare part availability on board.

E-Maintenace View







CONCLUSIONS

1. E- Maintenance preventive action is a lot more than just important to be immediately applied in Sumber Rejeki Bahari Permai Shipping company related to many Vessels it has where manual maintenance is no longer productive.
2. The preventive maintenance design with E-Maintenance consists of only running hours maintenance,
3. engine parameter and spare part list where those items are really required for vessels operational maintenance runs smoothly.
4. This Preventive maintenance will make maintenance coordination between both vessel side and office side runs easier, thanks to the maintenance which will be operated online, results in reducing fatal damages and also can do cost saving for maintenance optimally

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