



Analysis of Damage to Exhaust Valve in Auxiliary Engine Number 3 For Smooth Operation n The Mt. Kurau

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Abstract: The exhaust valve is a component that functions apart from being a way out for combustion residue in the combustion chamber, it also plays a role so that the combustion chamber remains airtight during the compression stroke and the effort stroke. The performance of the exhaust valve greatly affects the power generated by the auxiliary engine. A tight exhaust valve is very important so that the combustion products in the cylinder do not leak into the exhaust manifold so that the performance of the auxiliary engine becomes optimal and the role of the auxiliary engine as the heart of a ship can supply electricity on board properly. The research method used is qualitative with qualitative descriptive data analysis techniques and data collection techniques through observation, interviews, and documentation studies. An indication of damage to the exhaust gas valve is the high temperature of the exhaust gas, as well as abnormal engine sound. After analysis, several causes were found, namely the use of inappropriate spare parts, fatigue in the exhaust gas valve, incomplete combustion in the combustion chamber. Then solve the problem which results in optimal exhaust valve performance so that the performance of the auxiliary engine is good.

Keyword: Analysis, The Exhaust Valve, Valve Head Is Broken, The Surface Of The Valve, Face And Valve Seat Is Uneven

INTRODUCTION

Considering that in this era of globalization, people's needs for sea transportation are increasing, so the prime condition of ships is one of the keys to the smooth running of these activities by always maintaining normal machine performance and ensuring that the supporting systems run optimally. In general, an auxiliary engine or diesel generator is a power plant machine commonly called a "genset" which stands for generator set. The generator set in its meaning is a combination of 2 different devices, namely the engine and alternator which become

a set of machinery. The function of the engine is as a source of energy for the alternator player which is presented in the form of revolutions in units of RPM (rotation per minute), while the alternator is used as a power generating device. As a power source to operate, this machine uses diesel fuel. The exhaust valve is one of the important components in a diesel engine which has a function as a door for the remaining combustion gases in the cylinder to escape. The exhaust valve must be able to close tightly so that the combustion in the combustion chamber becomes airtight so that the combustion in the cylinder is not wasted when the valve closes. On the MT ship. KURAU on September 13 2021 in the Java Sea while sailing from Madura to Surabaya, East Java. During machinist III's duty hours at 00-04 in the morning, Auxiliary engine number 3 experienced a problem because cylinders number 4 and 5 experienced an increase in exhaust gas temperature up to $\pm 380^{\circ}\text{C}$ accompanied by an abnormal engine sound. Upon inspection, it was found that the exhaust valve had burst. which causes the compression in the combustion chamber to not be optimal because the air and fuel mixture goes straight out through the broken exhaust valve before the combustion process occurs, so the auxiliary engine does not work properly. Machinist III, as the person in charge of the auxiliary engine, also overhauled cylinder heads number 1,2,3 and 6 assisted by Foreman and cadets to check the condition of the components in the cylinder head, especially the valves. After overhauling and checking, it was found that many of the valves in each cylinder head were not fit for use because the surface between the Valve Face and Valve Seat was not even. and 6 assisted by Foreman and cadets to check the condition of the components in the cylinder head, especially the valves. After overhauling and checking, it was found that many of the valves in each cylinder head were not fit for use because the surface between the Valve Face and Valve Seat was not even. and 6 assisted by Foreman and cadets to check the condition of the components in the cylinder head, especially the valves. After overhauling and checking, it was found that many of the valves in each cylinder head were not suitable for use because the surface between the Valve Face and Valve Seat was not even.

Based on this experience, the authors conducted research and raised the problem to become material in the author's thesis which was compiled with the title: Damage Analysis of Exhaust Valves on Auxiliary Engine Number 3 for Smooth Operation on the MT Ship. I guess.

METHOD

The method or technique of analysis uses a qualitative approach with qualitative descriptive analysis techniques. The data analysis technique used in this research is descriptive qualitative, descriptive qualitative technique functions, advantages of qualitative descriptive techniques, and stages of making qualitative descriptive analysis techniques.

RESULTS AND DISCUSSION

Rupture of valve heads

September 13, 2021 in the Java Sea while sailing from Madura to Surabaya, East Java. During driver's watch III at 00-04 in the morning, in the middle of the shift the auxiliary engine (diesel generator) number 3 experienced a problem because Cylinder Head numbers 4 and 5 emitted smoke accompanied by an abnormal sound. When the engineer III checked the exhaust gas temperature in each cylinder, it was found that the exhaust gas temperature in cylinders number 4 and 5 had exceeded the normal limit. The standard exhaust gas temperature in the instruction manual book is in the range of 200 to 380, but a significant difference in exhaust gas temperature is found in cylinders number 4 and 5 which almost touches the number 400, while in other cylinders the exhaust gas temperature is still normal at 230°C - 280°C . machinist III also found that the chimney of generator number 3 glowed red because the temperature was too hot. Meanwhile KKM ordered Machinist III assisted by cadets to overhaul Auxiliary Engine number 3 on cylinder head numbers 4 and 5. After inspection, it was found that the

Valve Head (valve leaf) on the exhaust valve had broken, which caused compression in the combustion chamber to not be optimal because the air and fuel mixture went straight out through the broken exhaust valve before the combustion process occurred, so that the exhaust gas temperature would increase from its normal state and the auxiliary engine would not work properly.

Rupture of the valve head on the auxiliary engine can be caused by the use of inappropriate spare parts, one of which is reconditioned spare parts. Reconditioned spare parts are used spare parts that are renewed in such a way as to become ready-to-use spare parts. These spare parts are not guaranteed to be durable so there is a risk of causing the valve head to rupture, plus material fatigue in the exhaust gas valve can cause the exhaust valve to fail fatigue which causes the valve to experience micro cracks which are continued by crack propagation until the component breaks.

Incorrect quality of injector pressure can also affect valve head rupture, because it results in a buildup of carbon left over from incomplete combustion. The carbon will stick to the exhaust valve and exhaust gas channel in the cylinder head so that it will cause overheating which triggers damage to the exhaust valve. From these causes, a solution to the problem is found:

- a. Rearrange the maintenance schedule and communicate the availability of spare parts with the company. This is done so that the machining maintenance schedule on the ship does not have a maintenance schedule collision, so that each machine gets the maximum maintenance ration. And having good communication with the company aims to make the company know the actual condition of the machining on board so that it can supply spare parts in a timely manner and in sufficient quantities according to demand.
- b. Reconditioning the exhaust gas valve. Reconditioning can be done if the availability of spare parts on board is not available, reconditioning must be made according to the specifications according to the instruction manual book so that the spare parts can be reused optimally.
- c. Resetting the fuel injector pressure is done every 500-800 hours of engine operation. So that the fuel ignition will always be optimal and the combustion in the cylinder will be perfect.

Uneven Surface Of Valve Face And Valve Seat

Considering that maintenance on the auxiliary engine is not carried out properly, it will cause an indication of damage to the exhaust valves of other cylinders. Knowing that this would happen, KKM ordered Machinist III to simultaneously check the exhaust valve on the other cylinder in the troubled auxiliary engine number 3.

Machinist III as the person in charge of the auxiliary engine, overhauled cylinder heads number 1,2,3 and 6 assisted by Foreman and cadets to check the condition of the components in the cylinder head, especially the valves. After overhauling and checking, it was found that many of the valves in each cylinder head were not suitable for use because the surface between the Valve Face and Valve Seat was not even. This can be caused by incomplete combustion in the combustion chamber due to clogged injector nozzle and improper fuel injector pressure resulting in accumulation of carbon-carbon deposits from the rest of the combustion products which are trapped in the exhaust ducts in the cylinder head and attached to the surface of the valve face and valve seat on the valve.

Likewise, if the valve clearance is not set correctly, if the valve gap is too narrow, it can allow the exhaust gas valve to not close tightly, resulting in a combustion leak from inside the cylinder through the valve gap that does not close completely. This can cause overheating of the valve and can change the surface structure of the valve face and valve seat.

From these problems can be done problem solving as follows:

- a. Perform maintenance on fuel injectors. This maintenance is carried out every 1000 hours of fuel injector operation including overhauling the injectors by checking the condition of the

- components inside and cleaning them especially at the injector nozzle to prevent clogging. Replacement of the injector nozzle can be done every 2000 operating hours, so that the performance of the fuel injectors can be maintained.
- b. Routine maintenance of valve clearance adjustments every 1000 working hours of the valve with a gap of 0.3 mm, this is so that the valve starts to open 50° (before TMB) and closes 60° (after TMA). So that the valve can close perfectly.
 - c. Renewal of the valve by lapping which aims to make the surface (valve face and valve seat) flat so that it can close tightly and the angle meets predetermined conditions so that no gas leaks from inside the cylinder occur. In the instruction manual book, lapping maintenance is carried out every 4000-5000 valve working hours or every year. Of course this can be done if the valve has not reached the size limit for certain parts.

CONCLUSION

Based on the discussion and analysis, damage to the exhaust valve on the auxiliary engine number 3 on the MT ship. KURAU can cause a decrease in the performance of the auxiliary engine. The cause of the damage to the exhaust valve is found as follows:

1. Rupture of valve heads.

The use of non-conforming parts (non-genuine parts and reconditioned parts) can result in unpredictable exhaust valve damage, in addition to material fatigue in the exhaust valve due to stress and strain cycles and continuous temperature changes over a long period of time. Then the quality of the fuel injector pressure that is not right can also cause the exhaust gas valve to break because it can produce a buildup of carbon from incomplete combustion residues resulting in overheating.

2. Uneven surface between valve face and valve seat.

Incomplete combustion in the combustion chamber which results in fouling of the exhaust gas valves, especially the valve faces and valve seats which touch each other. Change structure the material and carbon deposits from the rest of the combustion will stick together so that they are susceptible to corrosion. Incorrect valve clearance adjustment can also cause changes in the surface of the valve face and valve seat due to overheating.

To overcome damage to the broken exhaust valve is to do a reconditioning with reference to the specifications according to the instruction manual book if spare parts are not available on board.

Meanwhile, to overcome the uneven surface damage between the valve face and valve seat, renewal can be done by doing lapping work. In addition, the exhaust valve also needs to be maintained regularly, such as adjusting the valve free gap and improving the maintenance of other components that affect the performance of the exhaust valve, such as fuel injectors so that the exhaust valve is always in good condition according to working hours.

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