

Analysis of Influential Exhaust Valve Damage on the Exhaust Gas Temperature of the Main Engine on the MT Ship. Bintang Mas Hsb 2

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Article Info: Received march 11, 2026. Revised march 12, 2026. Accepted april 07, 2026

ABSTRACT

This study aims to analyze exhaust valve damage that affects the exhaust gas temperature of the main engine, focusing on the cause of the damage, its impact on the main engine, and preventive measures. Data were obtained through observation methods during marine practice for 12 months and literature studies related to the literature on ship engine engineering. The results show that wear on the spindle and seat rings is the main cause of damage, which can temporarily stop engine operation and reduce the efficiency of the vessel. Qualitative descriptive analysis was used to understand the relationship between exhaust valve failure and change in exhaust gas temperature. This research provides theoretical contributions in the management of ship engines as well as practical recommendations in the form of exhaust valve maintenance and repair procedures, including the implementation of planned maintenance systems. With the right implementation, these results are expected to improve the reliability and operational efficiency of ships, minimize downtime, and ensure smooth shipping activities.

Keywords: Breakdown, Exhaust Valve, Ship Engine Maintenance.

ABSTRAK

Penelitian ini bertujuan menganalisis kerusakan exhaust valve yang memengaruhi temperatur gas buang mesin induk, dengan fokus pada penyebab kerusakan, dampaknya terhadap mesin induk, dan upaya pencegahan. Data diperoleh melalui metode observasi selama praktik laut selama 12 bulan dan studi pustaka terkait literatur teknik mesin kapal. Hasil penelitian menunjukkan bahwa keausan pada spindle dan seat ring menjadi penyebab utama kerusakan, yang dapat menghentikan operasi mesin sementara dan menurunkan efisiensi kapal. Analisis deskriptif kualitatif digunakan untuk memahami hubungan antara kerusakan exhaust valve dan perubahan temperatur gas buang. Penelitian ini memberikan kontribusi teoritis dalam pengelolaan mesin kapal serta rekomendasi praktis berupa prosedur perawatan dan perbaikan exhaust valve, termasuk penerapan sistem perawatan terencana. Dengan implementasi yang tepat, hasil ini diharapkan dapat meningkatkan keandalan dan efisiensi operasional kapal, meminimalkan downtime, serta memastikan kelancaran kegiatan pelayaran.

Kata Kunci: Kerusakan, Katup Buang, Perawatan Mesin Kapal

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Citation: Fadli, Bahri, S., Macrizandi, M.S. 2026. Analysis of Influential Exhaust Valve Damage on the Exhaust Gas Temperature of the Main Engine on the MT Ship. *Bintang Mas Hsb 2. Jurnal Andromeda*, 10(1), 20-27. DOI: <https://dx.doi.org/10.48192/ard.v10i1.868>

1. INTRODUCTION

Sea transportation is the backbone of international trade. The optimal performance of the ship's engine, which is the heart of the ship's propulsion, is highly dependent on its supporting components, one of which is the exhaust valve. The exhaust valve plays a crucial role in the process of exhausting combustion gases. Damage to the exhaust valve, such as wear on the spindle and seat ring, can have a significant impact on engine performance, even leading to a shutdown of operations. This research was inspired by the phenomenon of an increase in exhaust gas temperature in the main engine of the ship that is not in accordance with normal conditions, indicating a potential problem with the exhaust valve.

Given the importance of exhaust valves to the performance of ship engines, this study aims to: (1) identify the cause of malfunction of the main engine exhaust valve; (2) analyze the impact of exhaust valve damage on the performance of the main engine, especially related to the increase in exhaust gas temperature; and (3) formulate recommendations for the prevention of exhaust valve damage to maintain the optimal performance of the ship's engine. Theoretically, this research is expected to enrich understanding of the mechanism of exhaust valve failure and its effect on engine performance. Practically, this research is expected to contribute to improving the maintenance and repair procedures of exhaust valves, so as to minimize the risk of damage and maintain the smooth operation of ships.

This research will focus on exhaust valve damage that has a direct impact on increasing the exhaust gas temperature of the main engine. Other factors that might affect engine performance, such as fuel quality or operating environmental conditions, would not be the main focus of the study Ini.

The results of this research are expected to provide benefits both theoretically and practically. Theoretically, this research can 1 contribute to the development of a model for predicting exhaust valve failure and its relationship to

engine performance. Practically, the results of this study can be used as a basis for developing guidelines for the maintenance and repair of exhaust valves that are more effective. Thus, this research is expected to improve the reliability and operational efficiency of ships, as well as support the smooth running of export and import activities.

2. METHOD

This research was carried out directly on board the ship during the author's Marine Practice (PRALA) period. The method used is a combination of direct observation of the research object and literature study. Observation is carried out by observing and recording phenomena related to the main engine exhaust valve. In addition, literature studies are carried out by reviewing various literature, reference books, and machine manuals to obtain a strong theoretical foundation.

The data used in this study consisted of qualitative and quantitative data. Qualitative data was obtained through interviews with engineers on board, while quantitative data was obtained from engine operational records. Data analysis was carried out in a qualitative descriptive manner. This means that the data obtained will be described and interpreted in depth to find the patterns, relationships, and meanings contained in it. The results of the analysis will then be compared with the theory that has been studied previously.

3. RESULTS AND DISCUSSION

3.1 Research Results

The results of the study showed that the exhaust gas temperature anomaly in the fifth cylinder of the main engine of the YANMAR MF 33-STD on the MT ship. Bintang Mas Hsb 2 is caused by several factors, including inappropriate valve clearance, valve fire due to inadequate lubrication and cooling, and exhaust gas leakage into the combustion chamber. In the repair effort, the damaged exhaust valve is replaced according to the manufacturer's manual standards, the scale on the valve surface is cleaned to ensure tight closure, and the valve clearance is adjusted correctly. This process is carried out by prioritizing work safety and strict protocols. Proper adjustments ensure that the valve does not over-expand or close

at the wrong time, so that exhaust gas temperatures remain under control, emissions are reduced, and fuel efficiency is maintained.

The research data obtained during the study are as follows:

Table 1 Normal exhaust gas temperature data

GUARD HOURS	EXHAUST GAS (°C)						LO (°C)		FW(°C)		SW (bar)
	1	2	3	4	5	6	IN	OUT	IN	OUT	
24:00 - 04:00	340	336	333	336	337	331	60	64	69	79	3,0
04:00 - 08:00	330	333	325	335	335	332	61	65	68	78	3,0
08:00 - 12:00	332	340	325	340	340	335	60	63	70	79	3,0
12:00 - 16:00	331	335	330	325	330	336	59	62	71	77	3,0
16:00 - 20:00	333	330	325	325	325	334	58	65	69	78	3,0
20:00 - 24:00	335	333	330	330	330	332	60	63	68	79	3,0

Table 2 Normal exhaust gas temperature data according to manual book

EXHAUST GAS (°C)						LO (°C)		FW(°C)		SW (bar)
1	2	3	4	5	6	IN	OUT	IN	OUT	
330	330	330	330	330	330	60	65	70	80	3,0

Investigations found that the exhaust gas temperature of cylinder 5 rose significantly. Overhaul is performed, replacing damaged valves. Temperatures are returning to normal, confirming the importance of regular inspections and maintenance.

b. Discussion

1) Factors Causing Exhaust Valve Damage

Problems with the exhaust valve of the main engine can be caused by various factors, whether they come from material quality, operating conditions, or negligence in the maintenance process. Here is a detailed explanation of each factor that contributes to exhaust valve damage:

a) Material Quality and Valve Construction:

Exhaust valves that are made of low-quality materials or have a construction that does not meet specifications tend to wear out faster. Material quality greatly affects the valve's ability to deal with the high pressures, extreme temperatures, and friction that occurs during the combustion process.

b) Overuse:

Long period of operation of the machine with heavy loads can accelerate wear on the valve. If this use is not balanced with good maintenance, the valve components will lose their efficiency faster.

c) Fuel and Lubricant Quality:

The use of low-quality fuels or unsuitable lubricants may lead to the formation of carbon deposits, scale, and fouling on the valve surface. This interferes with valve movement, causes incomplete closure, and increases the risk of leakage.

d) Cooling System Failure or Leakage:

A malfunctioning cooling system can lead to operating temperatures that are too high, thus accelerating damage to the valve. Overheating can also cause deformation of valve material.

e) Inadequate Maintenance or Incorrect Installation:

Unscheduled maintenance or improper valve installation can cause mechanical damage to the valve. An example is an error in the clearance of the valve which can result in a pressure imbalance.

f) Poor Inlet Air Quality:

Air entering the combustion chamber with a high content of dirt or dust can accumulate on the surface of the valve and impede its movement.

g) Corrosion and Rust:

Marine environments that have high levels of humidity and exposure to salt water can cause corrosion and rust of the valves. This will reduce the durability and effectiveness of the valve in the long run.

h) Vibration and Mechanical Stress:

Excessive vibration during machine operation, caused by imbalance or improper installation, may cause mechanical damage to the valve.

i) Uncontrolled Temperature Changes:

Sudden temperature changes, such as when the engine stops abruptly after full operation, can affect the ability of the valve's material to expand and contract, thereby increasing the risk of cracking or deformation.

j) Inappropriate Use of Supporting Components:

Valve accessories or supporting components that do not conform to engine specifications may affect valve performance and increase the risk of failure.

k) Fuel Contamination and Impurity:

Contaminated fuel can cause scale formation in the combustion chamber, which indirectly affects the condition of the exhaust valve.

l) Flue Line Blockage and Contamination:

Blockages in the exhaust gas line due to carbon accumulation can impede gas flow, increase return pressure, and accelerate valve failure.

2) Damage Prevention Efforts Bmoney

To maintain the performance and efficiency of the mother's engine, it is necessary to take the following preventive measures:

a) Regular Inspection and Maintenance:

Perform regular checks and lubrication of exhaust valves to identify signs of wear early.

b) Temperature and Pressure Monitoring:

Monitor the temperature and pressure of the machine during operation. Abnormal conditions can be an early indication of damage to valves or other components.

c) Use of High Quality Fuel:

Use fuels with low impurities to reduce the risk of scaling and deposits on the valves.

d) Valve Overhaul on a Scheduled basis:

Clean, replace seals, and perform a thorough check on the condition of the valve according to the predetermined schedule.

e) Carbon Cleansing:

Clean carbon deposits regularly to ensure smooth flow of exhaust gases and prevent blockages.

f) Precise Lubrication:

Use a lubricant that is of high quality and in accordance with the manufacturer's recommendations to reduce friction and wear.

g) Regular Oil Changes:

Check the quality of the engine oil periodically and replace it according to the recommended schedule.

h) Proper Machine Operation:

Run the machine according to preset temperature, pressure, and load limits to prevent damage from overuse.

i) Efficient Cooling System:

Make sure the cooling system is working properly to keep the machine's operating temperature stable.

j) Advanced Monitoring Technology:

Use monitoring technology to detect potential problems early and prevent further damage.

4. CONCLUSION

Based on the data obtained during the sea training and the discussions that have been presented, it can be concluded as follows:

1. Regular maintenance of the exhaust valve according to the operating hours is essential to prevent fatal damage.
2. Continuous delivery of information related to care is necessary so that new officers assigned can understand their responsibilities.

The following are the recommendations proposed:

1. It is important to read the manual to avoid critical errors when performing equipment repairs on board.
2. Always pay attention to the operating hours of the main engine exhaust valve and understand the planned maintenance system. This system must be implemented according to a predetermined schedule.

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