

Analysis of The Use And Maintenance of Lifeboats To Support Safety On Board The Mv. Tanto Subur II

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Abstract.

This study analyzes the use and maintenance of enclosed lifeboats to support safety on board the MV. Tanto Subur II. The background of this study is based on the importance of lifeboat readiness as the main safety tool according to SOLAS and Planned Maintenance System (PMS) provisions, however, problems are still found in the implementation of maintenance in the field. The purpose of this study is to analyze the implementation of enclosed lifeboat maintenance and assess its suitability with the PMS in supporting operational readiness during emergencies. This study uses a descriptive qualitative method. The study population is all crew members involved in the operation and maintenance of lifeboats, with samples consisting of the Chief Officer, Third Officer, Third Engineer, and Electrician through a purposive sampling technique. The research instruments include interview guidelines, observation sheets, and documentation. The data analysis technique uses the Miles and Huberman model consisting of data reduction, data presentation, and conclusion drawing. The results of the study indicate that although maintenance and procedures have been implemented according to the PMS, obstacles are still found such as gear brake damage, limited equipment, old engine age, and low frequency of lifeboat drills. The conclusion of the study shows that the readiness of enclosed lifeboats is not optimal so that continuous improvement of maintenance, supervision, and training is needed.

Keywords: *Emergency Preparedness, Lifeboat Maintenance, Maritime Safety, Planned Maintenance System and Ship Operation.*

I. INTRODUCTION

A lifeboat is one of the primary safety devices on a ship, used as a means of evacuation in emergencies at sea. According to Chapter III of the International Convention for the Safety of Life at Sea (SOLAS) 1974 Consolidated Edition 2021, every ship is required to ensure that the lifeboat is always ready for use through regular inspection, maintenance, and testing. Furthermore, the International Maritime Organization emphasizes the importance of a Planned Maintenance System (PMS) to ensure the operational readiness of the lifeboat and its launching equipment. Lifeboats are designed to have good stability and are equipped with various safety equipment such as emergency food, fresh water, communication devices, a magnetic compass, and a propulsion engine to support the safety of the crew in an abandon ship situation [1], [2]. In the context of modern shipping safety, the existence of a lifeboat is not only seen as mandatory equipment, but also as an important element in the ship accident risk mitigation system and the protection of human life at sea [3], [4].

Problems related to lifeboats are still frequently encountered on various merchant vessels, particularly in the maintenance and operational readiness aspects. Many cases show that the lack of routine inspections, inadequate component lubrication, and the crew's poor understanding of maintenance procedures result in the lifeboat being unable to be used optimally when an emergency occurs. On August 16, 2024, the starboard enclosed lifeboat on the MV. Tanto Subur II experienced a jammed gear brake due to a lack of lubrication. After repairs and a launch test, the lifeboat slid into the sea, causing leaks and damage to the propeller because the gear brake was not functioning properly. This incident shows that non-compliance with PMS procedures can pose a serious safety risk to the crew [5], [6]. Previous research also stated that lifeboat maintenance failures are generally influenced by human factors, limited supervision, and suboptimal implementation of SOLAS procedures on board [7], [8].

Another issue related to the importance of lifeboat readiness was seen in the KM. Musthika Kencana II accident on July 4, 2011, which caught fire while sailing around Masalembo waters. Based on the final report of the National Transportation Safety Committee (KNKT), all passengers and crew were successfully evacuated using lifeboats and liferafts after the captain decided to abandon ship. The success of the

evacuation shows that lifeboats have a vital role in saving human lives at sea if they are in a ready-to-use condition and can be operated properly [2], [9]. Therefore, the implementation of routine lifeboat maintenance and in accordance with international standards is a primary need in supporting shipping safety. In addition to technical aspects, training in the use of lifeboats and safety drills are also needed to improve the readiness of the crew in facing emergency conditions [10], [11].

In reality, the implementation of lifeboat maintenance on ships still faces various obstacles, such as limited maintenance time, lack of coordination between crew members, and weak supervision of the implementation of PMS. These conditions cause several lifeboat components such as davits, wires, gear brakes, and launching systems to not function optimally. Previous research shows that low maintenance discipline and lack of understanding of lifeboat operational procedures are the dominant factors causing the failure of safety equipment on ships [6], [12]. In addition, human error in the implementation of inspections and lifeboat operations is also a factor that has the potential to increase the risk of accidents during drills or actual emergencies [13], [14]. Thus, evaluation of the implementation of lifeboat maintenance based on PMS is very necessary to ensure the readiness of these safety equipment to support the safety of the ship's crew.

Based on the description, this study aims to analyze the implementation of enclosed lifeboat maintenance on board the MV. Tanto Subur II and assess its suitability with the Planned Maintenance System in supporting operational readiness during emergencies. This study has urgency because the lifeboat is the main safety tool that must always be ready to be used to minimize the risk of loss of life in ship accidents. The novelty of this study lies in the focus of the analysis of the incident of enclosed lifeboat gear brake damage on the MV. Tanto Subur II which is studied based on the implementation of PMS and operational readiness of the lifeboat directly in the field. This study is expected to provide practical contributions for shipping companies and ship crews in improving the effectiveness of lifeboat maintenance and strengthening the safety culture on board [5], [7].

II. METHODS

This study uses a descriptive qualitative research method to analyze the use and maintenance of enclosed lifeboats to support safety on board the MV. Tanto Subur II. This method is used because the study focuses on real conditions in the field related to the implementation of lifeboat maintenance, operational readiness, and the suitability of maintenance implementation with the Planned Maintenance System (PMS). The descriptive qualitative approach allows researchers to obtain in-depth information through direct observation and interaction with the crew involved in lifeboat maintenance activities [15], [16]. The study was conducted during sea practice on board the MV. Tanto Subur II in the period July 12, 2024 to July 13, 2025 with the focus of the research on the maintenance of enclosed lifeboats as the main safety tool on board the ship [17], [18].

The population in this study was all crew members involved in the operation and maintenance of enclosed lifeboats on board the MV. Tanto Subur II. The sampling technique used purposive sampling, namely the selection of informants based on certain considerations according to research needs [16], [19]. The research sample consisted of the Chief Officer, Third Officer, Electrician, and several deck crew who had direct involvement in inspection, maintenance, and implementation of lifeboat drills. The selection of informants was carried out because they were considered to understand the maintenance procedures and operational conditions of lifeboats on board the ship [18], [20].

The research instruments used were interview guidelines, observation sheets, and documentation. Data collection techniques were carried out through unstructured interviews, active participant observation, and documentation. Interviews were conducted to obtain data regarding the implementation of lifeboat maintenance, obstacles encountered, and lifeboat readiness in emergencies [15], [19]. Observations were conducted directly during sea practice by observing the physical condition of the lifeboat, launch system, wire, davit, engine, and completeness of inventory according to the PMS. Documentation in the form of photos, videos, and field notes were used as supporting data to strengthen the research results [17], [21].

The data analysis technique uses the Miles and Huberman model which consists of data reduction, data presentation, and drawing conclusions [22]. Data reduction is carried out by selecting and simplifying

data from interviews, observations, and documentation that are relevant to the research focus. Furthermore, the data is presented in the form of descriptive narratives to make it easier to understand and analyze. The final stage is carried out by drawing conclusions based on the relationship between data obtained during the research [15], [16]. Data analysis is carried out continuously to obtain a comprehensive picture of the implementation of enclosed lifeboat maintenance and its impact on the safety of the crew on the MV. Tanto Subur II [18], [20].

The research procedure began with a literature study on lifeboats, SOLAS 1974 Consolidated Edition 2021, Planned Maintenance System, and previous research related to shipping safety and lifeboat maintenance [17], [18]. The next stage was data collection through observation, interviews, and documentation during sea practice on board the MV. Tanto Subur II. After the data was collected, the researcher conducted a systematic data analysis to identify the implementation of lifeboat maintenance, compliance with the PMS, and factors that influence the operational readiness of the lifeboat. The final stage was carried out by compiling conclusions as a form of evaluation of the implementation of enclosed lifeboat maintenance in supporting safety on board the ship [20], [21].

III. RESULTS AND DISCUSSION

1. Data Presentation

A. Primary Data

a. Observation

Observations in this study were conducted through direct observation of the research object, namely the enclosed lifeboat located on the MV. Tanto Subur II. This ship is equipped with two enclosed lifeboat units located on the right and left sides of the ship. Based on the results of the observations carried out, it is known that in July 2024 routine maintenance and checking activities were carried out on the enclosed lifeboat by the Third Officer. From the results of the check, it was found that the equipment contained in the enclosed lifeboat was in accordance with the provisions stipulated in SOLAS 1974. The implementation of the planning and maintenance of the enclosed lifeboat on the MV. Tanto Subur II has been running well and according to the schedule listed in the planned maintenance system (Planned Maintenance System / PMS). However, a problem was found in the right enclosed lifeboat gear brake which was jammed so that it could not function properly, which caused the right enclosed lifeboat to fall during gear brake repairs, resulting in damage to the enclosed lifeboat body and propeller, then carried out temporary repairs to the lifeboat body with fiber and resin, as well as the addition of safety lashing. Because the right enclosed lifeboat was not optimal, maintenance was then focused on the left enclosed lifeboat which was still in good condition. On October 26, 2024, MV. Tanto Luas experienced engine failure around the Madura Sea and required a hydraulic jet, MV. Tanto Subur II which was also passing immediately helped, with sea conditions that did not allow for STS, the Captain decided to send using the left enclosed lifeboat, the hydraulic jet was successfully sent and the enclosed lifeboat was able to function properly.

Observations show that the enclosed lifeboat engine is regularly tested by the Third Engineer and the battery condition is checked by the Electrician. The engine is still operable, and these checks are carried out to maintain the operational readiness of the enclosed lifeboat. Checks of the enclosed lifeboat engine, fuel, lubricating oil, cooling system, as well as periodic engine start-up tests, and inspections of the dewi-dewi, wire rope, brake system, hook release gear to ensure the enclosed lifeboat can be lowered and operated safely and smoothly. The physical condition of the left lifeboat body is still in good condition and no major damage was found to the enclosed lifeboat body, canopy, or davit. Meanwhile, the leak in the right lifeboat body has been temporarily handled by patching using fiber and resin. Maintenance is carried out on the davit, wire, and brake gear. In general, the launching system is still usable, but it is starting to be seen that more attention is needed to ensure safe operation of the mechanical components. The crew carries out routine maintenance in the form of cleaning the exterior of the enclosed lifeboat, visual inspections, and lubrication of the wire davit. These activities aim to keep the enclosed lifeboat in a ready-to-use condition. The condition of the goddesses that are starting to rust requires immediate maintenance, the Third Officer carries out chipping, brushing and painting on the right and left goddesses, in addition the color condition of the enclosed lifeboat

body on the left has begun to fade, the Third Officer carries out maintenance by repainting the enclosed lifeboat body with orange color and continued with marking up the identity of the enclosed lifeboat. The condition of the wire that is no longer suitable is immediately replaced by the Third Officer with a new wire. Checking the enclosed lifeboat engine, fuel, lubricating oil, cooling system, as well as periodic engine start-up tests, and checking the goddasses, wire rope, brake system, hook release gear to ensure the enclosed lifeboat can be lowered and operated safely and smoothly.

At the end of the observation period, maintenance activities were continued through physical inspections, inventory, engine, and battery checks, and especially the implementation of lifeboat drills. The implementation of lifeboat drills aims to train the readiness, skills, and coordination of all crew members in facing emergencies. The lifeboat drill was carried out by launching the lifeboat on the water to ensure the readiness of the enclosed lifeboat and ensure that each personnel understands their roles and responsibilities well. It also serves as a real effort to improve shipping safety and minimize the risks and impacts that may occur during an actual emergency. The observation results showed that the readiness of the enclosed lifeboat is greatly influenced by the consistency of maintenance and the adequacy of its launching system.

b. Interview

Researchers also obtained data through interviews with several crew members who have direct responsibility for the operation and maintenance of the enclosed lifeboat on board the MV. Tanto Subur II. The interviews were conducted with the aim of obtaining more in-depth information regarding the condition of the lifeboat, its operating procedures, and the maintenance activities carried out to ensure the enclosed lifeboat is always ready for use. The sources interviewed in this study included the Chief Officer, Third Officer, Third Engineer, and Electrician, each of whom has different but interrelated responsibilities in maintaining the safety equipment on board.

Based on the results of the interview with the Chief Officer, it was found that the Chief Officer has the primary responsibility for overseeing the implementation of safety equipment maintenance on board the ship, including the enclosed lifeboat. The Chief Officer explained that all safety equipment on board the ship must always be in a ready-to-use condition in accordance with applicable provisions, especially those regulated in the International Convention for the Safety of Life at Sea (SOLAS). Therefore, checks on the enclosed lifeboat are carried out periodically to ensure the condition of the enclosed lifeboat body, safety equipment inside the enclosed lifeboat, and the lifeboat launching system are functioning properly. The Chief Officer also emphasized the importance of coordination between the deck department and the engine department in carrying out enclosed lifeboat maintenance, especially if damage is found to the mechanical components or the enclosed lifeboat's propulsion system.

Furthermore, the results of the interview with the Third Officer showed that the Third Officer has an important role in carrying out routine inspections of enclosed lifeboats and managing safety equipment inventory. The Third Officer explained that the enclosed lifeboat inspection activity is carried out using an enclosed lifeboat inspection checklist that includes the physical condition of the enclosed lifeboat, the completeness of safety equipment, and the condition of the davit system and gear brake. The Third Officer is also responsible for ensuring that all equipment contained in the enclosed lifeboat, such as oars, ropes, emergency navigation equipment, and other safety equipment is in complete condition and ready for use. If during the inspection process damage or discrepancies are found, then this will be immediately reported to the Chief Officer and the Captain for further repairs to be submitted to the company.

The interview with the Third Engineer revealed that the engine department also plays a crucial role in supporting the readiness of enclosed lifeboats, particularly in the engine section. The Third Engineer explained that periodic inspections of enclosed lifeboat engines are carried out to ensure that they can operate properly in an emergency. These inspections include checking the condition of the engine, fuel system, cooling system, and testing the operation of the enclosed lifeboat engine. Furthermore, the Third Engineer also checks the condition of the propeller and other mechanical components to ensure that the enclosed lifeboat can operate optimally when used.

In addition, based on the results of interviews with the Electrician, it was discovered that the enclosed lifeboat's electrical system is also an important aspect that needs to be considered in enclosed lifeboat

maintenance activities. The Electrician explained that routine checks are carried out on the condition of the battery used to start the enclosed lifeboat engine and other electrical systems in the enclosed lifeboat. These checks include checking the battery voltage, cable condition, and other supporting electrical systems to ensure that the enclosed lifeboat can be operated properly in the event of an emergency.

Based on the results of interviews with the four sources, it can be seen that the maintenance of the enclosed lifeboat on board the MV. Tanto Subur II is carried out through collaboration between several crew members who each have their own responsibilities. The crew works together to ensure safe sailing on the MV. Tanto Subur II. This shows that the readiness of the enclosed lifeboat as one of the safety equipment on board is highly dependent on the implementation of routine and coordinated maintenance by the crew.

B. Secondary Data

In this study, secondary data was obtained from various ship documents relating to the operation and maintenance of enclosed lifeboats on board the MV. Tanto Subur II. This secondary data was used to support the results of previous observations and interviews. These documents provide information on enclosed lifeboat usage procedures, maintenance activities carried out by the ship's crew, and safety training related to enclosed lifeboat use.

One of the documents used as secondary data in this study is the Standard Operating Procedure (SOP) for launching an enclosed lifeboat. This SOP outlines the steps that must be taken by the crew during the process of lowering an enclosed lifeboat into the sea during an emergency. The procedure covers crew preparation, opening the enclosed lifeboat's lashing and stopper, operating the davit system, and lowering the enclosed lifeboat to the sea surface. This SOP aims to ensure that the enclosed lifeboat lowering process is carried out safely, in a coordinated manner, and in accordance with applicable safety regulations.

A good understanding of SOPs helps each crew member understand their duties, responsibilities, and the steps they must take correctly and orderly during the enclosed lifeboat launch process. Good coordination and communication will ensure a safe, orderly process that meets safety standards.



Fig. 1. Lifeboat Launching Procedure

Source: Other Ship Document, MV. Tanto Abadi (2025)

Furthermore, the operation of an enclosed lifeboat is a crucial aspect of a ship's safety system that must be understood and mastered by all crew members. Proper operating procedures ensure that an enclosed lifeboat can be used optimally and safely in emergency situations. Therefore, systematic and structured steps are required, from preparation and engine operation to engine shutdown, to minimize the risk of errors in using an enclosed lifeboat.

One of the documents used as secondary data in this study is the enclosed Standard Operating Procedure (SOP) for lifeboat launching. This SOP contains the steps that must be taken by usage can be minimized and crew safety is maintained.

1. Preparation

a) Check the condition of the lubricant (lubricating oil) in the sump tank to ensure the amount is sufficient and there are no leaks.

- b) Check the availability of coolant in the radiator to maintain stable engine temperature during operation.
 - c) Check the condition and volume of fuel in the tank to ensure the enclosed lifeboat can operate optimally.
 - d) Ensure that battery 1 and battery 2 are in good condition and have sufficient power for the engine starting process.
2. Lifeboat Starting Procedure
- a) Set the battery position to battery 1, battery 2, or both as needed during the engine start-up process.
 - b) Turn the ignition key to the preheat position for approximately 5 seconds to prepare the engine combustion system.
 - c) Turn the ignition key to the start engine position until the engine starts.
 - d) After the engine starts, return the ignition key to the normal or middle position.
 - e) Ensure the engine is running normally and stably before the enclosed lifeboat is operated further.

3. Procedure for Shutting Down a Lifeboat (Stopping Engine)

- a) Pull the stop lever up until the machine stops completely.
- b) Return the battery switch to the off position to cut off the power supply and ensure system safety.

In addition, maintenance activities on the enclosed lifeboat body are also part of the secondary data supporting this research. *lifeboat* Periodic maintenance is carried out to maintain the physical condition of the enclosed lifeboat so that it remains in good condition. These maintenance activities include cleaning the enclosed lifeboat body, repainting certain parts that are damaged or corroded, and visually inspecting the enclosed lifeboat's structural condition. Maintenance is also carried out on the enclosed lifeboat wire by periodically applying grease (lubrication). Greasing the wire aims to prevent corrosion, reduce friction, and maintain the strength and flexibility of the wire so that it remains in optimal condition during use. If the wire is found to be worn or damaged, it is replaced according to the procedures in force on board the ship.



Fig. 2. Body Enclosed Lifeboat Maintenance and Wire Replacement

Source: Document of MV. Tanto Subur II (2025)

Other secondary data obtained from the enclosed lifeboat engine testing checklist (Main Engine test) indicates that enclosed lifeboat engines are routinely tested to ensure their operational readiness. Enclosed lifeboat engine testing is typically performed by starting the lifeboat engine to check the condition of the fuel system, cooling system, and overall engine performance. The results of the inspection indicated that the enclosed lifeboat engine is prone to overheating due to an aging engine system, which causes poor coolant flow.

| PEMERIKSAAN TES MESIN SEKOCI | | | | |
|-------------------------------------|---------------|------------------------------|----------|--------------|
| MV. TANTO SUBUR II / JZKS / JAKARTA | | | | |
| TANTO | LOKASI : | JUMLAH : | MODEL : | NEXT SERV. : |
| 2023 | LIFEBOAT DECK | 3 PORT SIDE 3 STARBOARD SIDE | | |
| BULAN | MINGGU 1 | MINGGU 2 | MINGGU 3 | MINGGU 4 |
| JANUARI | 01 | 04 | 21 | 28 |
| FEBRUARI | 01 | 02 | 20 | 27 |
| MARET | 01 | 12 | 19 | 26 |
| APRIL | 01 | 04 | 21 | 28 |
| MAY | 01 | 08 | 15 | 22 |
| JUNI | 01 | 12 | 19 | 26 |
| JULI | 01 | 05 | 12 | 19 |
| AUGUSTUS | 01 | 05 | 12 | 19 |
| SEPT | 01 | 05 | 12 | 19 |

Fig. 3. Enclosed lifeboat engine testing checklist (ME test)

Source: Document of MV. Tanto Subur II (2025)

In addition to engine maintenance and testing, the MV. Tanto Subur II also conducted a lifeboat drill as part of safety training for the entire crew. This lifeboat drill aimed to improve the crew's preparedness in dealing with emergencies, particularly in the evacuation process using an enclosed lifeboat. During the lifeboat drill, the crew simulated the preparation for lowering the enclosed lifeboat and re-understood their respective duties and responsibilities according to the assigned division of tasks.



Fig. 4. Implementation of Lifeboat Drill

Source: Document of MV. Tanto Subur II (2025)

2. Data analysis

Data analysis in this study was conducted systematically on primary and secondary data obtained from observations, interviews, and documentation related to the operation and maintenance of the enclosed lifeboat on the MV. Tanto Subur II. The analysis aimed to understand the actual condition of the enclosed lifeboat and evaluate its maintenance implementation to ensure its readiness as the primary safety device on the ship.

The data analyzed included the condition of the enclosed lifeboat, crew maintenance activities, and the implementation of safety drills. This process was also used to assess the alignment of field conditions with operational and maintenance procedures that should be implemented according to maritime safety standards.

Overall, the data analysis provides an overview of the enclosed lifeboat's emergency preparedness and underscores the importance of planned and ongoing maintenance on the MV. Tanto Subur II.

3. Data Reduction

Data reduction in this study was carried out by selecting data from observations, interviews, and documentation related to the condition, use, and maintenance of the enclosed lifeboat on the MV Tanto Subur II. Only data relevant to the research focus, namely the readiness of the enclosed lifeboat and its maintenance, was retained.

From the observations, the data retained includes the condition of the two enclosed lifeboats (right and left), damage to the gear brake on the right lifeboat, and the incident of a lifeboat falling during the test, along with the necessary measures, such as temporary repairs, water pumping, and leak management. This data reflects the actual conditions and problems encountered in the field.

From the interviews, selected information covers the roles and responsibilities of the Chief Officer, Third Officer, Third Engineer, and Electrician in the maintenance and readiness of the lifeboat, such as checking inventory, engines, and electrical systems. This illustrates the coordination between the deck and engine departments in the maintenance of the enclosed lifeboat.

Meanwhile, the retained documentation includes the lifeboat launching SOP, ME test checklist, body and wire maintenance documentation, and lifeboat drill activities. These documents support observations and interviews regarding routine maintenance and testing activities on the ship.

Overall, the results of data reduction focused on the condition of the enclosed lifeboat, maintenance implementation, operational readiness, and problems found during the research on the MV. Tanto Subur II so that the data became more focused and relevant to the research objectives.

4. Data Presentation

The data presentation in this study was carried out by compiling the reduced data into a systematic description based on the research focus, namely the condition of the enclosed lifeboat, maintenance activities, and operational readiness on the MV. Tanto Subur II.

Observational data was used to describe the actual condition of the enclosed lifeboat and operational events in the field, while interview results explained the roles and responsibilities of ship officers in

maintenance. Supporting documents such as launching SOPs, engine checklists, body and wire maintenance documentation, and lifeboat drills were used to corroborate the research findings.

Overall, the presentation of this data facilitates the understanding and analysis of the relationship between the condition of the enclosed lifeboat and the maintenance efforts carried out by the crew in maintaining its readiness as a safety device on the MV. Tanto Subur II.

5. Conclusion Drawing

The conclusions drawn in this study were based on the reduction and presentation of data from observations, interviews, and documentation. During the reduction stage, data relevant to the use and maintenance of enclosed lifeboats was selected, simplified, and grouped, while irrelevant data was removed to focus the analysis.

In the data presentation stage, the reduced information is organized descriptively and grouped by source, such as interviews with the Chief Officer, Third Officer, Third Engineer, and Electrician, as well as observations of the enclosed lifeboat's condition. This presentation makes it easier for researchers to see patterns and relationships among the data.

Based on the analysis, it can be concluded that the condition of the enclosed lifeboat on the MV. Tanto Subur II is significantly affected by the implementation of regular maintenance and checks by the crew. Several problems were found, such as damage to the right lifeboat's gear brake, an expired battery, a jammed cooling system pump, and corrosion of the davit. These findings demonstrate the importance of routine and thorough maintenance. On the other hand, activities such as engine checks, body and wire maintenance, and lifeboat drills are still carried out to maintain the operational readiness of the enclosed lifeboat on board.

IV. DISCUSSION

This research discussion is based on observations, interviews, and documentation related to the condition and maintenance of the enclosed lifeboat on the MV. Tanto Subur II. The aim is to answer the problem formulation regarding the implementation, usefulness of maintenance, and compliance with the PMS (Planned Maintenance System) in maintaining operational readiness as a safety tool for the ship's crew.

The research results show that enclosed lifeboats play a crucial role as lifesaving appliances, survival systems, and safety training tools. Although SOPs, periodic drills, and routine maintenance have been implemented, their implementation has not been optimal. Various technical issues were found, such as a damaged gear brake on the right lifeboat that caused an accident during a test, overheating of the left lifeboat engine, and limited equipment that hampered repairs. Interviews also revealed a low frequency of lifeboat drills, the unsuitable condition of the right lifeboat, an aging engine, and problems with batteries that were difficult to replace.

Overall, the enclosed lifeboat on the MV Tanto Subur II is less than optimal due to limited equipment, aging components, and ineffective maintenance and training. This situation requires evaluation by the ship and the company, as it directly impacts the safety of the crew.

1. Lifeboat as a life-saving appliance

Enclosed lifeboat It functions to protect the crew in emergencies with safety equipment such as fresh water, food, first aid kits, and emergency signals. However, physical damage can reduce its effectiveness, requiring regular maintenance to maintain optimal performance.

2. Lifeboat as a means of survival at sea (survival system)

Lifeboats serve as temporary survival shelters until help arrives. They are equipped with basic necessities such as water, food, and emergency signaling devices. However, the damage to the MV Tanto Subur II demonstrates that this function is highly dependent on the availability of these equipment, making regular maintenance essential.

3. Lifeboat as a training facility (drill) to increase the crew's preparedness

Drill lifeboat This training serves to train crew members' readiness for evacuation procedures. On the MV. Tanto Subur II, this training has not been routinely implemented, resulting in less than optimal understanding among crew members, especially cadets. This training is crucial for improving coordination and reducing the risk of errors during emergencies.

Lifeboats ready for use require planned maintenance in accordance with the PMS. Maintenance on the MV. Tanto Subur II covers the physical condition, equipment completeness, and operational functions, which are carried out by the crew according to the division of duties between the deck and engine departments.

Thus, enclosed lifeboat maintenance procedures not only focus on equipment maintenance but also include coordination between crew members and regular checks to ensure the enclosed lifeboat is always ready for use. The following is the enclosed lifeboat maintenance performed on the MV. Tanto Subur II:

1. **Inspection of the physical condition of the enclosed lifeboat**

Inspections are conducted to ensure the lifeboat's hull, canopy, and enclosed structure remain serviceable and free from cracks, leaks, and corrosion. Routine visual inspections are conducted by the crew to detect damage early. However, on the MV Tanto Subur II, damage was discovered due to a fall overboard incident that caused a leak in the hull, demonstrating the importance of inspections to maintain safety functions.

2. **Checking the completeness of the enclosed lifeboat inventory**

The inspections ensure all safety equipment, such as fresh water, emergency food, first aid kits, and emergency signaling devices, are available and functioning properly. The inspections are conducted periodically using a checklist by the Third Officer. The inspections indicate that the inventory meets standards, ensuring the enclosed lifeboat's readiness in an emergency.

3. **Launch system maintenance (davit, wire, and gear brake)**

includes wire greasing, davit inspections, and brake gear checks to ensure the launch system functions properly during evacuations. Damage to the right brake gear was discovered on the MV Tanto Subur II, which caused the enclosed lifeboat to fall overboard during a test, resulting in serious damage. This demonstrates the importance of thorough maintenance to prevent system failure.

4. **Inspection and testing of the engine and electrical system of the enclosed lifeboat**

The inspection included testing the engine, fuel, and battery and electrical system. This was carried out by the Third Engineer and Electrician. Regular inspections were conducted to maintain engine readiness, although several issues with electrical components were identified that required repair.

5. **Preventive maintenance of enclosed lifeboats**

This maintenance includes cleaning, painting, body repairs with fiber and resin, and routine wire lubrication. On the MV Tanto Subur II, these activities have been carried out as scheduled to maintain the enclosed lifeboat's serviceable condition and prevent further damage.

V. CONCLUSION

This study shows that the readiness of the enclosed lifeboat on the MV. Tanto Subur II is still not optimal even though maintenance procedures and a PMS system have been implemented. The main findings revealed various problems such as damaged gear brakes, old engine conditions, limited repair equipment, and low frequency of lifeboat drills. In addition, coordination between crew members in carrying out maintenance has been carried out, but it has not been fully effective in maintaining the optimal condition of all lifeboat components. This condition indicates that technical aspects, resources, and training are still the main factors affecting the operational readiness of enclosed lifeboats as a safety device on ships.

The limitations of this study lie in the data coverage obtained from only one vessel, so the results cannot be broadly generalized to all merchant vessels. Furthermore, the limited observation time also affected the depth of observation of the entire PMS maintenance cycle. Therefore, further research is recommended to expand the research object to several different vessels and add a quantitative approach to measure the level of PMS effectiveness more accurately. Practically, the results of this study are expected to provide evaluation material for shipping companies and crews in improving periodic maintenance, strengthening PMS supervision, and increasing the frequency of safety training to ensure enclosed lifeboats are always ready for use in emergencies.

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