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Submission date: 20-Feb-2023 08:12AM (UTC-0500)

Submission ID: 2018805360

File name: 5.0113782.pdf (412.38K)

Word count: 2690

Character count: 13674

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Cite as: AIP Conference Proceedings **2675**, 020005 (2023); <https://doi.org/10.1063/5.0113782>
Published Online: 14 February 2023

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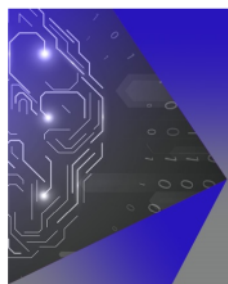
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The Analysis of Corrosion Prevention on the Main Deck and Head Coming of Sultan Hasanuddin Training Ship

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Abstract. The handling of corrosion on Sultan Hasanuddin Training Ship becomes a very crucial part of sustainable maintenance. To have the optimal maintenance of the main deck and the head coming, it is required the maximum implementation of procedure by all crews. This descriptive qualitative research collects the data from the observation and unstructured interviews, with the involvement of the entire crew which becomes the population of this study. The aim was to obtain a solution on the constraints faced related to the handling and prevention as well as the treatment of corrosion on the main deck and head coming. In the prevention of corrosion on the main deck and the head coming, sustained treatment must be performed according to plan. The Identification of the corrosion causes, and the use of anti-corrosion paint are an effective system that works. Based on the observation results, there are some mistakes in terms of inappropriate paint used, unsustainable maintenance system, and the less optimal maintenance activities due to the Officer's lack of knowledge about it. Similarly, when conducting interviews, some of the Officers had no knowledge of the specifications or components of the paint substances that are able to prevent the occurrence of corrosion, resulting in the submission of the request to the Politeknik Ilmu Pelayaran Makassar still using the old request. Moreover, during the treatment process, the unstructured systematic treatment was performed. For example, after the rust is chipped, the surface should be brushed first to remove the rust dust and the use of paint thinner as the first layer and the second layer still use paint with thinner and the last layer will be the paint according to the pre-designed color. As a conclusion, the crews of Sultan Hasanuddin Training Ship require the initial knowledge and maintenance procedures in accordance with applicable regulations, and there has been no document related to the maintenance plan and there has been no document that records in detail the maintenance that has been running.

INTRODUCTION

Ships become the means of water transport that have modern technology in the control and operation, so it requires human resources that are reliable and have adequate competencies. In the ship's body, all the equipment has been equipped with a system that is authorized in its operation, so it requires effective and regular maintenance. For ship's body, it is true that the material consists entirely of iron or steel, so the corrosion cannot be avoided. Thus, the prevention measure should be performed by the crews. The ASM Materials Engineering Dictionary describes corrosion because of a chemical or electrochemical reaction between the anode and cathode steel with the electrolyte environment resulting in a decrease in the quality of the material and its chemical properties [1]. Corrosion is also described as the condition where the metal material's ability to hold the load is decreased because of the oxidation with the environment causing the thinning of the construction material [2]. The National Association of Corrosion Engineers (NACE International), according to a book written by Fontana and Greene in 1967, Corrosion and how to tackle it on ships that you can do by Uniform Attack (Uniform Corrosion), usually characterized by a chemical or electrochemical reaction taking place uniformly over the entire surface of the open or in a large area [3]. A chemical reaction occurs because the pH of the water is low and the air is humid, so by the time the steel plate getting thinner and this type of corrosion can be prevented by the selection of steel plate material that is appropriate and its coating,

given a protective layer containing inhibitor and cathodic protection [4]. The objective of this research is the action in the prevention of the occurrence of corrosion on Sultan Hasanuddin Training Ship, in the main deck and the head coming area which are easily experiencing corrosion since they are in the open area where the air is humid and water PH change fast resulting in the chemical reaction of the anode and cathode. Where the main deck or deck is a floor on the ship, which is used to hold the payload, usually found almost on the entire ship which is distinguished by its function.

RESEARCH METHOD

Corrosion (rust) is the red (yellowish) layer attached to the iron and so on because of a chemical process [5]. Rust is a degradation process (*deterioration*) or destruction of the material caused by the influence of the environment around and oxidation process between the acid and iron [6]. The locations where the researcher obtained the data directly are as follows:

- The main deck, to find out the last painting record and other documents
- The head coming, to find out the last painting record and other documents
- Paint material used
- Equipment available
- Officers who do the job
- Ship's crew involved in the maintenance
- The duration and progress of the work
- The using technique of maintenance equipment
- Identify the result of the finished work
- The constraints related to technical and non-technical

Thus, this study uses a descriptive qualitative with emphasis on the validity of the data obtained in the field at the time of retrieval from the sources and informants. The questions which are given to participants are as follows:

- Do you have the documents related to the progress of the long-term/short-term maintenance?
- What is your basis in deciding the location of the treatment?
- Why the broken equipment is still being used?
- Has the use of paint thinner already been appropriate (Painting with the paint thinner, should be 2 times to make it thicker and more resistant to the weather)?
- Why do you use the local/national brand that its material is not design for preventing corrosion?

RESULTS AND ANALYSIS

This study used a descriptive qualitative study where the researcher collects the data based on the results of observation with the design used to obtain and process as well as describe the data in a more meaningful display and easier to understand by other people. The data obtained from the direct observation and unstructured interviews on board, then compiled on a systematic and regular basis to obtain clarity on the issue of corrosion prevention in the main deck and the head coming of Sultan Hasanuddin Training Ship.

Data Collection through Observation in Sultan Hasanuddin Training Ship

Based on the observation on June 17, 2021, at 09.00 GMT-8, the researchers identified the equipment used by the crew in performing maintenance in the main deck and the head coming of Sultan Hasanuddin Training Ship

TABLE 1. Maintenance Equipment

No	Equipment used	Condition of Maintenance Equipment		Total
		Good	Damaged	
1	Hammer	3	2	4
2	Chipping Hammer	4	4	5
3	Burrs	2	2	4
4	Sandpaper	12	12	12
5	Scraper	2	1	3
6	Wire Brush	2	2	2

The Processed Data, 2021

From the results of observations onboard ship, it can be identified the incompatibility in the quality and quantity of the equipment used in the maintenance of in the main deck and the head coming that the crew only rely on improvised equipment with a limited number in case of any damage on it.

TABLE 2. Paint Material for Maintenance

NO	Material	Brand	Total
1	Primary Paint (Meni)	National	
2	Top Coating Paint	National	26
3	Anti-Fouling Paint	National	-
4	Thinner	National	6

The Data, Processed 2021

Based on observation, the cause of the occurrence of corrosion is the presence of natural chemical processes, with the presence of humidity, acid, salt, oxidation, and temperature. Furthermore, there are chemical electrical processes in the steel material with the potential to make positive current molecules (anode) and negative ones (cathode), with the presence of transferring substances of the electrolyte (seawater), then it will make the flow of electricity (galvanized electric) in the electrolyte from cathode (+) to anode (-) while in the air from the anode to cathode. The presence of such flows will cause erosion in the (+) pole pool and hoarding in the (-) pole pool. Thus, on the main deck and the head coming, there is an expansion or corrosion in yellow. The most efficient and effective use of paint should consider many factors.

- Specify the location and area of the painting to determine the amount of paint used.
- Clean the surface that will be painted from rust and dirt, if there is water or oil then dry it immediately.
- The paint that will be used for the painting should be match to the location or place of painting, exterior or interior.
- Pay full attention to the usage instructions in order to get maximum results.
- Pay attention to rust *grade*, to determine whether to do the painting twice or only once.
- Adjust the tools that are used for painting with the location to be painted.
- Pay attention to the weather and also the shipping area (especially for a ship that sailed past the area that has four seasons).
- The additional painting should be adjusted to the color and type of paint that has been used previously to avoid any color difference.

It becomes the cause of the unpreparedness of the paint material to meet the usage standards on the onset of rust. Then, the sustainable treatment was not implemented according to the plan which has not been well documented. Therefore, it needed a report that will be used as an evaluation material as a follow up of the constraints at the time of maintenance activities on Sultan Hasanuddin Training Ship.

TABLE 3. Types of Maintenance

NO	Type of Work Done	Stadium			
		1 Yellow	2 Dark yellow	3 Brown	4 Dark brown
1	Knocking/absorption	1	1	1	1
2	Clean with the fresh water	1	1	1	1
3	The base paint application	1	2	2	2
4	Final Painting	2	2	2	2

The Data, Processed 2021

The maintenance is still using the semi-manual system because it cannot be planned through a computerized system. In maintenance, it can be done continuously, so does the related equipment, and submission of the requested paint, etc., on the management of Politeknik Ilmu Pelayaran Makassar.

The results of interviews conducted on Sultan Hasanuddin Training Ship by taking 19 of the respondents and conducting unstructured interviews with a duration of 10-15 minutes related to the prevention and maintenance that will be planned and processes, as well as the constraints faced at the time of handling corrosion in the main deck and the head coming.

The Recapitulation of Respondents' Answers to The Questions:

TABLE 4. Summary of Respondents' Answers

No	Respondents	Questions	Answer
1	A	Do you have any documents related to the progress of long/short term maintenance?	No, we don't have it
2	B	On what basis do you decide the area of maintenance??	The officer command/by seeing the area with higher corrosion rate
3	C	Why do you still use the broken equipment?	The other equipment is severely damage, and we have no others
4	D	The painting with paint thinner should be done 2 times to make it thicker and resistant to weather	No need, this is good enough because the quality of the paint is adequate and has been used for many years.
5	E	Why do you use the local/national brand that its material is not design for preventing corrosion?	This is the only one that is easily available in stores and the standardized ones should be ordered from Jakarta. So, it takes a long time, and it is expensive.

The Data, Processed 2021

Thus, it can be concluded from the results of interviews with some respondents, A,B,C, D and E that the maintenance is still faced many constrains, related to the ability of the company to supply the demand with the standardized qualification that can extend the protection of iron or steel from corrosion.

From the results of interviews with respondents, it is found that the analysis of the working plan in maintenance has not yet referred fully to the maintenance norms studied in a variety of supporting theories. Actions in Optimizing the Handling of the Corrosion Against the Onset of Rust.

Remove the rust

- Removing the rust work should be adjusted by the location of the work. The parts of the payload pipes above the deck are frequently attacked by rust, especially on the pipe connection part. For removing rust on that part, the jet chisel is used, so the rust on the narrow part can be lifted. The rust that occurs in payloads pipes above the deck can result in leaking pipes. To lift the rust, engine knock can be used.
- Clean the debris and remnants of rust
- To obtain good results, on the parts that have been applied the knocking, it must be cleaned by brushing it up. It is done to make sure all the remained rust can be lifted. If it is not brushed well, it will accelerate the process of new corrosion on the plates.
- Painting
- If the process of cleaning the plate is completed, it can be continued with the painting on the parts that have been cleaned. The equipment and materials used are primary paints for the base of painting (red load primary), the first base paint (semi-gloss undercoat), the final paint (gloss finish), brush, and roller brush.

CONCLUSION

Based on the results of field observation and interviews with respondents on Sultan Hasanuddin Training Ship, can be concluded:

- The ship maintenance progress is still using the manual input make it not well coordinated for the crews to identify the locations that will be planned next.
- The knowledge on the prevention action and mitigation of corrosion still needs to be disseminated to the crews by having easy-to-understand guidance.
- The crew must create a map related to the periodical maintenance plan to assist the further progress in the maintenance that will be done continuously.

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PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6