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Comments on the docking of seagoing vessels and the certification of ship repair and maintenance work

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Abstract. Repair and maintenance (R&M) work of a ship involves all activities carried out, on board the ship or in the shipyard, in order to prevent and correct potential failures. In general, the terms of repair and maintenance of the ship are used together and involve the docking action of the ship for carrying out a standard maintenance routine, according to the requirements of the classification societies under whose supervision vessels are operated, at specified periods. Docking refers to the complex process of repair and maintenance of ships (on time and within the limits of the estimated budget based on the technical specifications of works) while stationed in the shipyard. The certification of the works is carried out, through concerted actions, both by the shipyard, as a contractor, as well as the owner / technical manager of the vessel, as beneficiary. The paper aims to emphasize some aspects of this process with a high degree of complexity, by schematizing, originally, the processes carried out.

Keywords: repair & maintenance; docking process; ship & shipyards; technical specification

1. Introduction

Terms referring to the repair and maintenance of the ship have different connotations in the literature. On the one hand, the repair of a ship consists of actions to correct a malfunction in the structure of the hull, machinery, equipment, or systems existing on board [1]. On the other hand, the maintenance of a ship involves all activities carried out on board or in the dock to prevent potential failures [2]. Both tasks require the same infrastructure to be performed, such an infrastructure being a shipyard, so that the terms of repair and maintenance of the ship are used together (R&M) and involve docking the ship to perform a standard maintenance routine [3].

Repair and maintenance work of a ship can be classified as follows [4]:

- scheduled work - being performed maintenance works and verifications according to the requirements of the classification society;
- unscheduled work- repair works being performed to remedy some malfunctions at the installations, equipment, or systems defective on board or the reconditioning of the hull structure following damage in the event of collision or landing of the ship. Unscheduled work can be assimilated to the concept of corrective maintenance in engineering [5]. Basically, there are four important aspects that largely determine the demand for unscheduled work, which are: accidents involving ships; control of government authorities in port; docking the ship to be sold; reactivation of vessels kept in conservation.

The docking of the ship is carried out because of the requirements and standards imposed to complete the maintenance and repair works or because of accidents occurring in operation, the

consequences of which have affected the integrity of the ship's submerged hull and ship structures, systems, installations, and equipment related to the area affected by the accident.

The ship's maintenance systems, generally applied when performing a scheduled docking of the ship in a shipyard, are [6]:

- maintenance system as needed (corrective maintenance) [7]. It is applied for the corrosion protection of the sheets of the outer shell of the hull and on the inside in the structural tanks. It is also applied to the replacement of sheets of the body structures that have the thickness diminished below the acceptable limits or for sheet metal replacements of deformed body structures because of damage due to collisions or grounding.

- preventive maintenance system [8]. Applies to existing systems in the submerged part of the hull as well as those hull structures and systems of the ship which cannot be inspected normally in the course of the operation of the ship.

Regardless of the situation, repair and maintenance work of a ship is required by the owner of the ship. The owner of the ship (defined by the International Maritime Organisation (I.M.O.) in 1993) [9] is the person (or company) who is responsible for the day-to-day operation of the vessel engaged in the trade, which has the highest authority of command, and which has an interest in ownership of the vessel. Consequently, for shipowners, the general objective of the ship's repair and maintenance work is to minimize damage to the ship so that six fundamental considerations can be identified, these being [10]: ensuring the safety and navigability of the ship; extending the economic life of the ship; improving the resale value of the vessel; efficient performance of the transport of the goods; efficiency of the ship's operating costs; environmental impact as a result of the ship's operation.

2. The docking of a ship in the shipyard

The docking of a ship for carrying out the maintenance and repairs works as required by the classification societies, as presented in Figure 1, consists by two sub-processes (pre docking and docking itself) run by the ship owner / technical manager and the shipyard where the ship owner / technical manager is the responsible party of the full process.

The pre-docking process is characterized by the actions carried out by the owner/technical manager of the ship to draw up the technical specification and to select a shipyard from the ship's area of operation for the execution of works, following the analysis of the price and time offers.

The technical specification is drawn up by the ship manager within the technical department of the navigation company or the management company, based on the information contained in the following documents [11]:

- observations and recommendations included in the reports, as a result of periodic inspections of the classification society on the ship, with the deadline for carrying out corrective actions, consisting in carrying out the necessary maintenance/repair works, at the docking of the ship;

- inspection reports carried out by the ship's crew, which mentions the unsatisfactory state of the body and its structures or malfunctions in the operation of machines, equipment, installations and systems;

- list of maintenance work required to be carried out on the docked vessel;

- a list of maintenance work, other than those of the docked vessel, which may be carried out only in a shipyard;

- the list of modernization works necessary to be carried out in order to comply with the requirements of the I.M.O. conventions.

The technical specification is sent to be quoted in terms of prices and time at the selected shipyards in the area where the ship will be available for carrying out the necessary maintenance work and, based on the evaluation analyses of the quotations, followed by possible negotiations, the owner/technical manager of the ship chooses and nominates the shipyard in which the maintenance works mentioned in the technical specification will be executed which, together with the price and time offer of the shipyard, become annexes to the contract for the execution of the maintenance works

on the ship, signed by the owner / technical manager of the ship as "beneficiary" and by the shipyard as "Contractor".

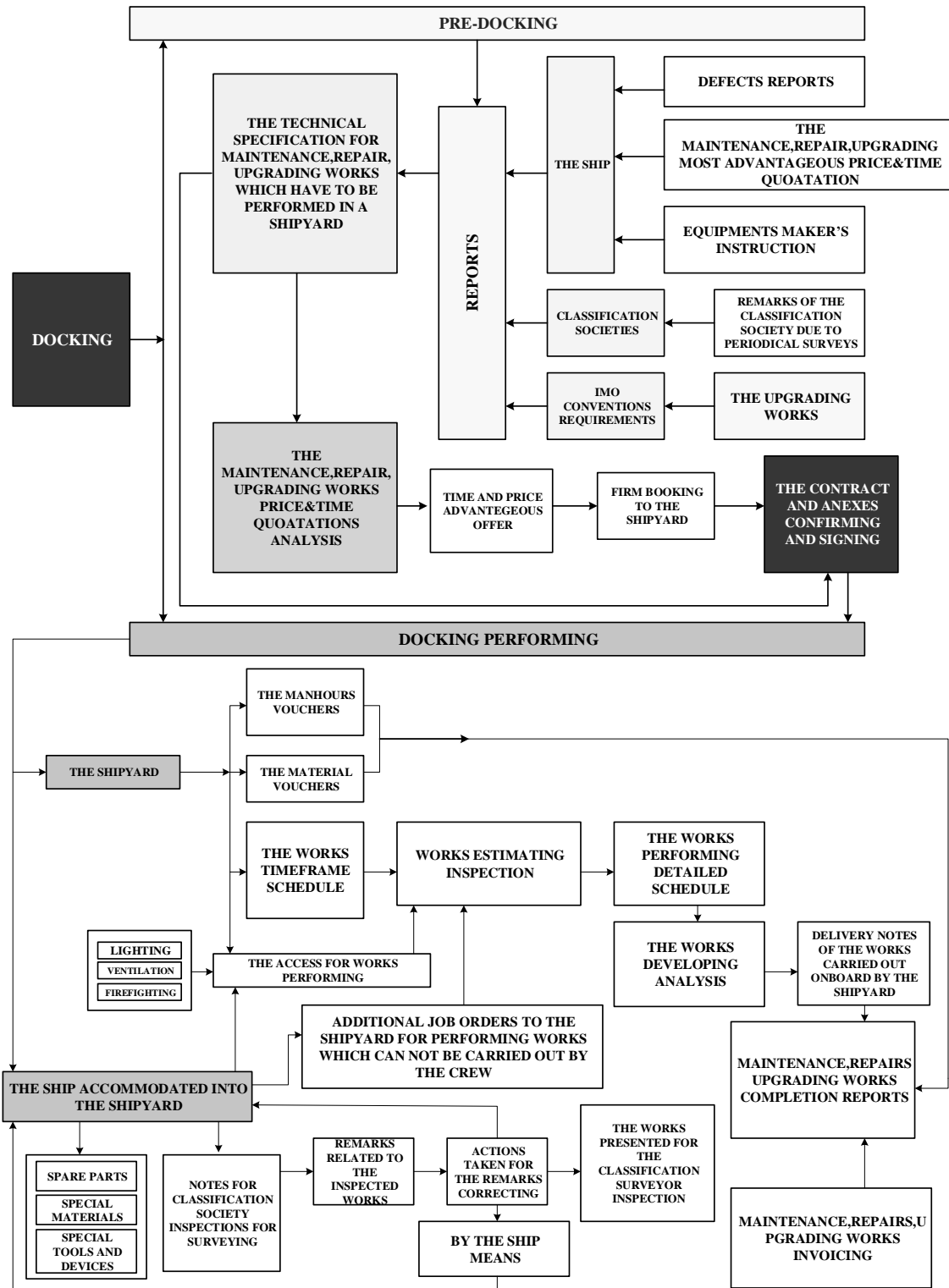


Figure 1. The docking of a ship process for carrying out the maintenance and repairs works as required by the classification society

By signing the contract for the execution of the maintenance works on the nav, the pre-docking process is completed, moving on to the process of carrying out the execution of maintenance works during the ship's stay in the shipyard.

The docking process itself refers to the execution of maintenance works during the ship's stay in the shipyard and is characterized by the concerted actions of the owner/technical manager of the ship and of the shipyard, carried out both together and separately, for the performance of the maintenance works on time and the compliance with the budget initially estimated.

From the positions of "beneficiary" and "contractor", the owner/technical manager of the ship respectively the shipyard carries out the following joint activities [12].

- access to the ship, during the ship's stay on the construction site, safe for the ship's crew and for the shipyard's workers working on board the ship, as well as the application of environmental protection measures according to the integrated management systems existing within the two organizations, for carrying out maintenance work in accordance with the technical specification, such as: access permits for inspections of enclosed spaces; open-fire work permits for the various areas where it is necessary to perform this type of work on board the vessel;
- agreeing to a fault program for the joint inspection of the hull and structures of the ship as well as of the ship's machinery, equipment, installations and systems, included in the technical specification, with a view to the final evaluation and approval, on the spot, of the volume of maintenance work required to be carried out during the shipyard's stay in the shipyard;
- the development of joint analyses with reference to: the stage of execution of the maintenance works necessary to be carried out during the ship's stay in the shipyard, according to the deadlines presented by the shipyard in the detailed execution schedule and the mutual agreement of the possible corrective actions necessary to be taken; solving the possible inconsistencies reported in the reception report of the maintenance works executed at the freight rate or in the final invoice presented by the shipyard.

3. Certification of ship repair and maintenance work

Classification is mandatory for all seagoing vessels engaged in international trade throughout the world. Most national regulations, especially those applicable in Europe, concern the fact that the strength of the hull construction must be confirmed. The classification of a vessel also covers superstructures, annexes and fittings, machinery, and electrical installations. The requirements shall be based on coherent principles, with reference to the type, dimensions and characteristics of the materials used in the construction of the ship, including with tests and trials on the safety and reliability of all existing installations, systems, and equipment on the ship.

The naval classification societies are organized for the purpose of verification during the construction of the ship, in the shipyard, of the processes of design and execution of construction works for the purpose of certification, upon delivery of the ship in operation, and the degree of satisfaction of the condition to safely load and carry cargo for the crew, freight and the environment, by carrying out the initial inspection following which the ship's certificates are issued.

Also, the classification societies have established requirements, rules and procedures for the verification (by maintenance and repair works) of the ships in operation, in order to confirm that they are operated and maintained in good technical condition by qualified personnel. At the completion of the construction of the ship, respectively the execution of the maintenance and repair works in the shipyard, the classification society certifies that the ship has been constructed or verified in accordance with the requirements of the international conventions and rules in force;

The certificates issued are valid for specific periods of time and the extension of their validity is obtained after periodic inspections of the vessel are carried out by the classification society.

From the "beneficiary" and "contractor" positions the ship owner/technical manager and respectively the shipyard, runs specific activities, as presented in Figure 2.

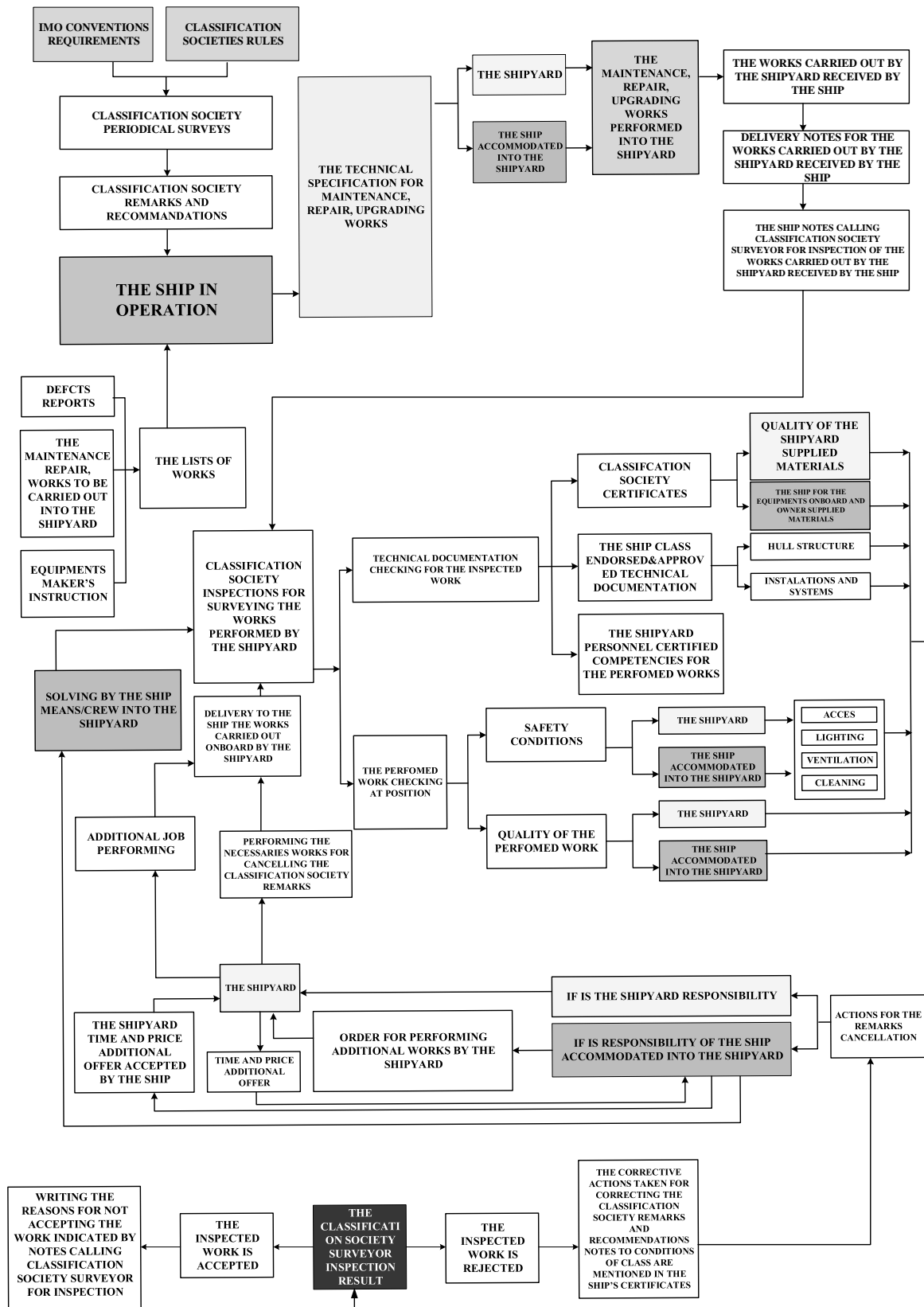


Figure 2. The ship maintenance works certification process in a shiprepairs shipyard

The owner/technical manager of the vessel, as "beneficiary":

- supplies the ship in a timely manner with spare parts, materials, tools and special devices, so as not to condition the normal performance of the maintenance works by the shipyard in accordance with the technical specification;
- provides the shipyard with the ethnic ocumentation (plans, technical instructions of the manufacturers of the equipment on board the ship) necessary for the execution of the maintenance works according to the technical quality standards;
- carries out the periodical inspection, in accordance with the requirements of the classification society, based on a program approved with its representative;
- takes corrective action of the possible observations of the representative of the classification company found on the ship in the shipyard following the checks carried out at the calls for thorough inspections of the technical condition of the hull and structure of the vessel, of the main systems of equipment and installations; corrective actions can be ensured by their own means or by launching additional orders of works necessary to be carried out by the shipyard;
- carries out the necessary surveillance and approval to confirm the retrieval of the maintenance operations carried out by the shipyard on the basis of the technical specification and any orders for additional works;
- makes calls to the classification society for the certification of maintenance works performed by the shipyard on the basis of technical specification and possible orders for additional and accepted works at the nav through delivery notes;
- verifies and confirms the quantitative volume of the maintenance works carried out at the nav mentioned in the report of reception of the maintenance works executed at the ship, drawn up by the shipyard;
- verifies and confirms the value of the final invoice according to the prices of the initial offer and additional offers for maintenance works performed on the vessel specified in the report of reception of works.

The shipyard, as "contractor" draws up, according to its own management quality system:

- the execution frame schedule of the maintenance works required to be performed at the freight rate, according to the technical specification;
- the fault program for the joint inspection of the hull and structures of the ship as well as of the ship's machinery, equipment, installations and systems included in the technical specification with a view to the final evaluation and approval, on the spot, of the volume of maintenance work required to be carried out during the shipyard's stay in the shipyard;
- draws up and launches at the production department labor and material receipts necessary for the execution of the volume of maintenance works found as a result of common defects;
- performs maintenance works according to technical standards, the requirements of the classification society rules and the technical instructions of the manufacturers of equipment in the ship's equipment;
- draws up and presents, in order to obtain the confirmation of the vessel, additional price and possibly time offers for the orders of additional works launched in the execution of the maintenance works at the freight rate;
- draws up and presents, in order to obtain the confirmation of the ship, the report of reception with reference to the quantitative volume of the maintenance works performed on the vessel and confirmed by the delivery notes;
- draws up and presents, in order to obtain the confirmation of the vessel, the final invoice for the value of the maintenance works performed on the vessel and confirmed by the reception report.

4. Conclusions

The estimation of the capacity and labour load of a shipyard for the execution of maintenance and repair works on ships is based on three important aspects:

- dynamics of the maritime cormert respectively of the goods traffic in the geographical area where the construction site is positioned;
- the constructive-functional diversity and the number of vessels in the world's commercial fleet in operation, and which must carry out docking, in accordance with the requirements imposed by classification societies on dock inspections, for the purpose of recertification;
- assessment of competing shipyards in a geographical area, from the point of view of the maintenance and repair works that can be performed and of the working capacities.

In order to make the decision to launch the order for the execution of the repair works, it is taken into account:

- estimation of diversion costs afferent to the distance required to be traveled by the freight from the port of unloading to the repairing shipyard for the start of the maintenance works on the vessel;
- estimating the budget for maintenance works on the ship based on the offer of repair and maintenance works related to the maintenance of the ship drawn up by the shipyard based on the assessment as prices and time from the technical specification drawn up by the owner/technical manager of the ship;
- estimation of the ship's daily fixed expenditure during the period of carrying out the maintenance works on the vessel, the period of time being considered according to the offer of repair and maintenance works related to the maintenance of the ship drawn up by the shipyard;
- estimation of the diversion costs related to the distance to be traveled by the shipyard from the shipyard, after the completion of the maintenance works on the nav, to the port of loading;
- technical evaluation of the shipyard regarding the technical capabilities and capabilities to carry out the maintenance works according to the offer of the ship's repair works.

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