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Ship Building Construction Systems

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Abstract

The need for sea transportation, which includes ships, is increasing – driven by the growing competition in the economic, social, political, and defense and security sectors. This, in turn, is driving advances in ship construction techniques in Indonesia. In building a ship, several factors must be considered. In addition to planning the shape and characteristics of the hull, as well as planning the strength and arrangement of the ship itself. Ship construction in general consists of two main parts, namely the hull and the building on the ship or deck house.

Keywords: Transportation; Construction System; Ship.

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1. Introduction

Since time immemorial sea transportation services have been known and utilized by humans. It is proven by the success of our ancestors in the past who managed to explore the world by using a Pinisi boat whose facilities were very limited. Likewise for developments in the trade sector, the use of ships is also very important because apart from being cheaper, the cargo capacity is also bigger and there are many other advantages.

The need for sea transportation, which includes ships, is getting bigger in line with the increasing competition in the economic, social, political, and defense and security sectors. For this reason, we are motivated to design and manufacture ships that are technically feasible, economical in operation and capable of competing with ships produced in other countries. So that in planning a ship, we have to plan its construction too. The definition of construction in relation to the discipline of shipping is how a ship is built according to the sequence, as well as how the parts of the ship are connected and how they are connected. In building a ship, several factors must be considered. In addition to planning the shape and characteristics of the hull, also planning the strength and composition of the ship itself. Ship construction in general consists of two main parts, namely the hull and the building on the ship or deck house. Basically, this construction

depiction process can be done in three ways, namely the transverse construction system, the longitudinal construction system and the combination construction system. The depiction that will be done here is the depiction of the midship, details, cuts, skin openings, and profile.

In general, the construction of the hull consists of starboard hull, base and/or several decks. Meanwhile, the building on the boat or deck house is an additional building located at the top of the hull. The superstructure that is located in front of the ship, starting from the level of the face is called a forecastle, while the superstructure located in the middle is a bridge and the one behind is called a poop. The function of this construction depiction is, among other things, to facilitate the construction process of a type of ship because it provides instructions on the sequence of construction and how to connect by showing the cross-section of the plates and the size of each plate line, and describing the location of all holes or openings in the hull of the ship. (Santoso, I.G.M & J.J. Sudjono. (1983). Teori Bangunan Kapal. Direktorat Pendidikan Menengah Kejuruan. Jakarta: Depdikbud. p. 207).

Construction in general means the components of a building that support a building that supports a design (S Zuhriatina, S. Z. (2020). Penerapan Value Engineering Pada Konstruksi Gedung (Studi Kasus: Proyek Pembangunan Gedung Pascasarjana Stahn Gde Pudja Mataram) (Doctoral dissertation, Universitas Muhammadiyah Mataram)). In the field of shipping, ship construction is an arrangement of components in a ship building which consists of the hull and the superstructure (super structure) (Yunianto, M. Y. (2019). Kekuatan Sruktur Bracket Yang Dilubangi Pada Konstruksi Kapal. Prosiding Seminakel, 1(1)). The superstructure is the building above the deck which covers the entire width of the ship, its length is part of the length of the deck, and some along the deck. (Sulthoni, M. H. F., Amiruddin, W., & Yudo, H. (2020). Rekayasa Desain Bangunan Atas Kapal Katamaran Bermaterial Plastik HDPE dan Pengaruhnya Terhadap Performance Kapal. Jurnal Teknik Perkapalan, 8 (2)). The upper structure at the stern is the poopdeck, and the bow is the fore castle deck which is located above the main deck building. The construction plane which divides the hull of the room in the direction of its height is called the deck. The deck extending the entire direction of the ship and from the left and starboard hulls is called the full deck. The construction plane that divides the hull in the transverse and longitudinal direction is called the transverse and longitudinal bulkhead. The space located between the two decks is called the space between the decks (tweendeck). The space below the lowest deck is called the hatch room. For loading goods in the hold and tweendeck, a hole is made on the deck called the hatchway. The holes are lined with vertical walls called hatccoaming. On the edge of

the deck, fortifications were installed which served to protect people from falling out of the ship and to prevent the overflow of sea water on the deck when the sea water was choppy. To channel abundant seawater to the deck, holes were made at the bottom of the walls, called freeing ports. On the higher decks, the strongholds were replaced by fences in the form of pipes and slats.

2. Research Methods

This type of research is a qualitative method. According to stating that qualitative research methods are the most appropriate type of research method in capturing human perceptions only with direct contact and an open mind and through inductive processes and symbolic interactions, humans can recognize and understand something. (Semiawan, C. R. (2010). Metode Penelitian Kualitatif: Jenis, Karakteristik dan Keunggulannya (Arita L (ed.)). Grasindo). The data collection technique used in this research is participatory observation with an exploratory step, namely doing one of the qualitative data collection techniques that is recommended to obtain descriptive data (Gunawan, I. (2017). Metode Penelitian Kualitatif. Bumi Aksara (5th ed.)). Sources of data used are primary data in the form of observations and secondary data in the form of data collected, processed and presented by other parties in the form of books and previous research results.

3. Result and Discussion

3.1. Types of Construction Systems

At the base of the ship hull consists of construction components which are located in the transverse and longitudinal directions. In arranging the above components into the overall hull construction, there are several ways that are commonly used in practice, among others (Juliansyah, J. (2019). Konstruksi Dan Stabilitas Kapal Di Kamar Mesin Untuk Menjaga Ketahanan Badan Kapal Di Pt. Indonesia Marina Shipyard. Karya Tulis):

3.1.1. Transverse Construction Frame Systems

(2) Transverse frame construction system is a construction where the load that works on the construction is received by the skin plate and the longitudinal beams of the ship with the help of beams that are located across the ship. In this system the ivory

(frame) is installed vertically or following the body plan). On the deck, both the strength deck and other decks, deck beams are installed with the same distance as the distance between the tusks. The ends of each deck beam supported by tusks located in the same vertical (Rachman, A., Yulianto, T., & Setyawan, D. (2018). Perancangan Aplikasi Perhitungan dan Optimisasi Konstruksi Profil pada Midship Kapal Berdasar Rule Biro Klasifikasi Indonesia. Jurnal Teknik ITS, 7(1), G12-G18).

On the plinth mounted wrangs with a distance equal to the distance between the tusks in such a way that each wrang, tusks and deck beams form a series that are interconnected and are located in one vertical plane according to the cross-section of the ship at the location concerned. Thus, along the length of the ship, these framering lines are standing with tight intervals. This circuit is only eliminated if transverse bulkheads or other series of large ivory have been installed at the same place (Rizal, S. A. S. Estimasi Kebutuhan Material Dan Jam Orang Pada Pemasangan Lambung Kapal TB. Harmony VII Blok I Di PT. Kukar Mandiri Shipyard).

Big ivory (web frame) is ivory that has a blade (web) that is very large compared to the main ivory. This large ivory is also connected at the ends of the deck beam which has a large blade (web beam). These large tusks are generally only placed in certain rooms, for example in the engine room, but can also be in the loading room if necessary as additional transverse bracing. The transverse bulkheads in the tusks are elements of the transverse strengthening of the hull (Sihombing, P., & Adi, F. T. (2020). Menentukan Design Konstruksi Landing Ponton Yang Tepat Di Pelabuhan Sri Tanjung Gelam Karimun. Jurnal Jalasena, 1(2). p. 108-118).

The elements which are installed longitudinally in the transverse system are (Mairuhu, T. (2011). Kekuatan Struktur Konstruksi Kapal Akibat Penambahan Panjang. Jurnal Teknologi. p. 835-843):

1. On the base: center girder and side girder. The center support is a plate that is installed vertically extending the ship right in the plane of the beak (center line). In a double base this center support height is the height of the double base. In this single base the pedestal cuts the wranges right at the plane of the beak. The side girders (side girder/side keelson) are also vertical plates that are installed next to the center hump. A ship can have one or more side supports.

2. On the side: side stringer. It is generally only installed in certain places (especially in recesses and engine rooms), it can also be in the loading room, depending on local requirements.

3. On the deck: deck girders (deck girder or carling) for cargo ships with one hatch in each cargo space on the deck concerned, 1-3 deck racks can be installed, depending on the width of the ship. The deck supports are installed directly in the plane of the beak or continuously with the longitudinal hatchside girder, namely the supports that are directly below the longitudinal hatch threshold. It is thus seen that in the transverse system, the elements of the construction which are mounted longitudinally are much less in number than the elements of the frame which are part of the transverse bracing (Wijaya, A. T. A. (2017). Analisa Kekuatan KOsntruksi Geladak Corrugated dengan Strong Beam Pada Longitudinal Framing System Kapal Tanker 17.500 DWT (Doctoral dissertation, Institut Teknologi Sepuluh November)).

The functions of the longitudinal blocks are:

1. Ensuring the stability of the arch shape of the main cross beam
2. For the division of forces concentrated on several adjacent main transverse beams
3. The merits of the transverse construction frame:
4. Produces a simple construction
5. Easy to build
6. The transverse strength of the ship is excellent in the presence of the main tusks
7. The number of transverse bulkhead walls is minimized
8. Reducing the hold space
9. Make good use of the hold space

The disadvantages of transverse frame construction systems:

1. The cross-sectional modulus of the ship is small in that the longitudinal beams are only the deck plate, double bottom and bottom shell as well as the uncut centered support and deck support.
2. The stability of the skin plate is smaller.
3. This construction system is only used on short ships where the longitudinal strength of the ship as a result of the bending moment of the ship is not large and is not so dangerous.

3.2. Longitudinal Construction Frame System

In this system the main tusks are not installed vertically, but are installed longitudinally on the side of the ship with a distance between, measured in a vertical direction of about 600 mm - 1000 mm. these tusks (on the sides) are called side longitudinal. At every certain distance (about 3-5 m) large tusks are installed, as large tusks in the transverse system as well as in the transverse system. The so-called side transverse (Ramadhan, F. (2018). Pembuatan detail Desain unmanned surface vehicle (USV) untuk monitoring wilayah perairan indonesia (Doctoral dissertation, Institut Teknologi Sepuluh November)).

On the base and the inner base are also attached longitudinals such as the side longitudinals mentioned above with a distance between the same as the distance between the side longitudinals. They are called the bottom longitudinal and, at the inner base, the inner bottom longitudinal. The plinths were also attached to the wrang, and connected to the side transversals. But generally not on each side transverse; that is, every two, or more, side transversals. The marks on a longitudinal system are also called bottom transverse. The center and side supports are the same as in the transverse system.

On the deck also fitted longitudiners like the other longitudiners mentioned above. These longitudinal lines are called the longitudinal deck. Deck beams with large slats are attached to each side crossbar; and is called the deck transverse. Other constructions (deck supports, bulkheads, etc.) are the same as for transverse systems. It is thus seen that in the longitudinal system the elements of the frame mounted longitudinally are much more numerous than those which constitute transverse reinforcement.

1. The advantages of the longitudinal construction truss system are:
    - With the unbroken longitudinal blocks enlarge the cross-sectional modulus of the ship.
    - Attaching the longitudinal beams to the double baseplate means will stiffer the constructions and increase their stability.
2. The ugliness of the longitudinal construction frame system is:
    - Required to make multiple transverse bulkhead walls on the ship.
    - Increase the number of hatches.
    - Unifying the operation of loading and unloading goods.
    - Difficult to lift large items.

This construction system is often found on passenger ships which require a lot of transverse bulkheads and are useful for durability and leakage and do not prioritize loading and unloading operations.

3.3. Combined construction truss system.

This combination system means that the transverse system and longitudinal system are used together in the hull. In this system the deck and base are made according to the longitudinal system while the sides according to the transverse system. Thus, the sides are reinforced by transverse girders with tight intervals as is the case in the transverse system, while the base and deck are reinforced with longitudinals. Thus, in following the rules of classification (rules) the sides of the ship are subject to the provisions that apply to the transverse system, while the base and deck follow the provisions that apply to the longitudinal system, for things that are required separately.

Given the shortcomings of the transverse construction system, the use of a combination frame construction system has arisen. Combined construction frame system is a combination of a transverse construction frame system and a longitudinal construction frame system.

1). Profile Construction Elements

The elements of ship construction in profile construction are:

a). Materials and Profiles

The type of material commonly used to build a ship. are these materials, among others: steel, aluminum, copper, fiberglass, wood. Of the several types of steel materials that are currently the most widely used for shipbuilding. Steel is known as a carbon-iron alloy with several additional elements. The permitted carbon content for steelmaking must not exceed 2%. The use of steel can be comprehensive or only certain parts. The parts made of steel include the hull, the frame of the ship and many other parts. There are also some steel ships that use aluminum to make certain parts of the ship. for example, superstructures, deck houses, window hatch covers, and doors. There are also ships made of aluminum alloy, so that most of the materials for shipbuilding are taken from aluminum alloys. Compared to steel, aluminum alloys have a weight of 1/3 of the weight of steel for the same size. Therefore there is a ship whose top is made of aluminum. Such a building will reduce the overall weight of the ship. Besides, the weight from the bottom of the ship becomes smaller or in other words, the stability of the ship will be relatively better.

In terms of strength, corrosion resistance, workability, and weldability, aluminum has almost the same properties as steel, only aluminum is relatively more expensive than steel. Another common material to complement the building of steel ships is institutions. Copper is widely used for the installation of pipes on ships.

Other materials such as fiberglass and wood are widely used as staples for making relatively smaller ships, as well as for making the interiors of steel or aluminum ships. Shipbuilding steel can only be produced by steel factories that have been approved by the Indonesian Classification Bureau. The steel also has to be made through a certain process. The process includes steel making with open hearth, electric kitchen, blowing process with oxygen (acidic substances) from above, or other approved special processes. Through these processes, it is hoped that high-quality steel will be produced with chemical composition and mechanical properties, as required. as far as possible free of non-metallic material content and internal or external defects which may affect its subsequent use or workmanship, and the steel material which has been heat treated. Steel for building a ship is generally divided into two major parts, namely

- Steel shipbuilding ordinary ship building with high tension.
- Ship steel is commonly used in ship construction which is recommended to have chemical properties, heat management deoxidation, or mechanical properties that have received BKI approval,. The classification is based on the method of deoxidizing the chemical composition of the elements contained, compressive testing, tensile testing, and heat treatment. The mechanical properties that ordinary steel must have are a minimum melt limit of 24 kg/mm2 tensile strength from 41 kg mm2 to 50 kg/mm2, and a fracture strain of at least 22%.

Steel ships that have high stress used for ship building must comply with the Bureau regulations regarding chemical composition, mechanical properties, deoxidation methods, and heat treatment. High-tension ship steel for the hull, is classified into two parts, namely steel with a melt stress of at least 32 Kg/mm2 and has a tensile strength from 48 Kg/mm2 - 60 kg/mm2 and steel with a minimum melt stress of 36 Kg/mm2 and has a strength tensile from 50 kg/mm2. The quality classification is based on the deoxidation method, manufacturing process, chemical composition, tensile testing, notch testing, hit testing, and heat treatment. High tension steel is also used for ship construction parts that are subject to great stress on the structure of the ship's frame.

Apart from the steel mentioned above, there are other types of steel used for ship building. The steel is spot steel. The properties that must be possessed by this forged steel are that the steel must have a minimum tensile strength of 41 Kg/mm2. This type of

steel is used in certain parts of the ship, namely for the propeller shaft, steering clutch, height, shaft, crank, gears, and so on. All materials that meet BKI requirements will be stamped. If a part that has received a stamp from BKI does not meet the requirements after another test, the stamp must be canceled by deleting or deleting the stamp. The materials used to make the hull are usually plates and profiles. The plates are stamped on both sides, front and back at opposite corners of the plate so that the stamp can always be seen without flipping the plate or profile. Based on the thickness, the plates can be divided into three groups, namely:

- thin plates with a thickness of 3 mm to 5 mm to 25 mm
- thick plates with a thickness of 25 mm to 60 mm.
- The most widely sold plate sizes are 1,500 mm x 6,000 mm and 1,200 x 2,400 mm.
- Most profiles for building ships come in a variety of shapes and sizes. The uses of the plates and profiles are as follows.
- Plates, as the main material for building ships
- Beams with square section are usually used for tall beams, keels and others.
- Round section profiles are generally used for small supports, beams for handrails.
- A semi-round profile is generally used on the edges of the plates so that they are not sharp at the edges, for example at the edge of the hatch.
- Isosceles elbow profiles are used for plate fixers or braces.
- Isosceles elbow profiles are used for plate bracing or reinforcement.
- Bulb elbow profile is an elbow profile which one side is reinforced by enlarging the edge until it is inflated
- U profile is a profile that has greater strength than a bulba elbow profile. This profile is used for greater construction strength than is required.
- The Z-shaped profile is the same as the U profile in terms of shape, but one side is reversed.
- H and I profiles are very strong profiles, but they are not used in general, they are installed in constructions that require special strength.
- T profiles are those that are used for special purposes. For example, for deck occupants.
- The inflated T profile is a profile that has greater strength than the T profile.

- A puffed profile is a profile where one end is puffed and is used for plate reinforcement.

b). Functions of Main Ship Elements

The strength deck, base and sides of the ship act as a box girder, so it is often referred to as a hull girder or ship girder, which accepts longitudinal bending and other loads working on hull construction. The weather deck, base and sides of the ship also serve as impermeable walls that hold water from outside and receive buoyancy so that the ship can float. Other elements directly assist these functions and some only act as a support or support so that the main elements always remain in their position so that they can function effectively.

Construction Elements in the Midship Section:

1. Wrang

It is a part of ship construction that uses a double bottom construction in the form of a plate that runs along the width of the ship. There are three types of wrang, namely plate wrang (solid floor), open floor (open floor), and waterproof wrang (water tight floor). Wrang is very useful in increasing the transverse strength of the ship

2. Human Hole (man hole)

Is a construction element that is often found on the type of plate wrang (solid floor). Installation of man holes or human holes on a double base is useful for the passage of workers during welding and inspection of the ship bed. The shape of a man hole is round or oval and made sufficiently so that people can enter and exit the man hole (Harsono Wiryo Sumarto, To shie Okumura. (1991). Teknologi Pengelasan Logam. Jakarta: Pradnya Paramita, p. 98).

3.Lightening Hole

It is a construction element that is often found on ships with double-bottom construction and open wrang type. The circular relief hole serves as a lightening for the double base construction.

4. Main support (center girder)

It is a support plate which is located vertically in the middle of the base construction. It functions so that in the double bottom space work can be carried out on the manufacture and repair of the ship, when the ship runs aground on the water bed and occurs on the skin plate, the bottom is as far as possible protected from damage.

5. Side support (side girder)

Its vertical shape is the support plate that is located to the left and right of the center girder, where together the center girder adds to the longitudinal strength of the ship and takes part in the curvature of the ship.

6. Big Ivory (web frame)

Forming a T profile, it is a fixer as a hull plate reinforcement. The web frame functions as a successor to the forces or loads received by the side plates to be transferred to the basic construction, especially in the transverse construction frame system.

7. Main Ivory (main frame)

L-shaped profile, as a reinforcement for the hull plate in the transverse direction.

8. Ivory Alas (bottom frame)

Is a continuation of the main ivory, then the profile is the L profile, mounted on the base plate. So the base ivory serves to support the load the base plate received.

9. Ivory Reverse (reverse frame)

Is a continuation of the main tusks. The shape of the profile is L profile, back ivory is placed on the inner bottom plate. Ivory back serves to support the load working on the basein.

10. Deck Beams

Deck beams are installed at each ivory distance. There are two ways deck beam installation:

a. Transverse direction

The installation of the deck beam in the transverse direction functions to:

- The ivory can function more as a transverse reinforcement of the ivory so that it does not curve inward or outward due to water pressure or other forces acting on the sides of the ship.
- Hold the deck as much as possible along with the loads on it, in this case the deck beam must be firm enough so as not to flex downward.

b. Longitudinal direction

Laying the deck beam lengthwise serves to:

- The reinforcement is longitudinal, resulting in rigidity of the entire vessel structure increase.
- Supports as much deck as possible and loads above it, so that the deck beam has sufficient rigidity.

11. Deck Supporters

T-shaped profile, located on the deck plate and serves to support the deck.

12. Bracket

It is an elbow plate that serves as a connection reinforcement between two construction elements, for example used in the connection between the deck beams with large ivory (web frame) or with the main frame (main frame).

13. Leather Plates

Located on the outer part of the ship which covers the ivory which functions as:

a. Protecting ship compartments from sea water.

b. Withstand sea water pressure perpendicular to the hull

c. Withstand the bending and twisting forces arising on the way

d. Withstand loads as precisely as possible, among others: at ship launching, collisions with other ships, and waves in the bow of the ship.

14. Paid off

The keel is a beam extending at the bottom of the ship which is located in the longitudinal plane of the ship, between the bow and stern height along the length of the ship. The keel is the most important construction part of a ship, together with the keel in the inter-keel plate.

15. Paid Bilga

The bilga keel is a part of the construction in the form of a fin that is attached to the bilga of the ship which is mounted longitudinally in the bilga area of the ship, along one half to two thirds of the length of the ship. Serves as an “anti rolling device” (a tool to reduce ship prankiness).

16. The strongholds (bulkwark)

The strongholds are fences on the edge of the ship which function to maintain the safety of passengers and crew and protect goods on the deck from falling into the sea when the ship is tipped.

17. The deck

Besides functioning as the tightness of the ship, the deck also protects cargo and the room where the crew and passengers live. Furthermore, the deck also functions to increase the lengthening strength of the boat.

18. Hatch threshold

The hatch is a hole in the deck of a ship that functions as a place for the entry and exit of cargo into the cargo space and also serves to ensure smooth loading and unloading.

19. Hatchway beam

The hatch cover is wood or light metal or steel which closes the hatch which serves to protect the load.

2). Single Base Construction and Double Base Construction

a) Single bottom construction

The basic frame of the single base construction consists of the transverse beam of the ship and the longitudinal beams, namely: The keel in the middle which is located in the longitudinal plane of the ship and the keel in the side which is located between the left hull and the keel in the middle.

b) Double bottom construction

In the operation of ships with a single bottom construction system, it turns out that it is having difficulties. To fulfill the ship's maneuverability on a voyage without cargo, the ship must be filled with solid ballsts (Rizal, Op.Cit).

In the 19th century the solid ballast was replaced with a liquid ballast, to store the liquid ballast in the space made tanks which are connected to each other by pipes - papa. To reduce the above ugliness, the tank construction was changed in which longitudinal beams were placed on top of the frame. On top of the beams were placed plates which were later called double baseplate. In a dual base system this first form where the beams extend usually 1.5 times the distance between the wrang.

The second form of the dual base system consists of vertical plates extending to the height of the double basement, cut across the sides and connected to the top by double basement plates. This dual base system gives the possibility of reducing the height to an efficient size and at the same time eliminating the excessive loss of useful volume in the pallet space in the presence of a double bottom. The third form is a checkered basic frame system. The base beam of this system is a plate frame in which a light hole is placed on each tusk and is continuous from the keel in the middle to the inner keel plate of the sides consisting of cut plates that are placed between the frames which also eliminates the bracket system.

a. With a continuous color on each ivory

b. With a continuous frame alternating with the given frame the so-called lightening is also open wrang.

This construction is the development of a dual base system that functions as a liquid ballast tank, in addition to that the double bottom space is used to store fresh water, as a fresh water reserve and a place to store lubricating oil which is limited by two watertight wraps with one ivory distance. This room is called "cofferdam".

3). Shell Expansion Plan

The skin opening is a construction design element for counting the number of plates and the placement of these plates on the ship.

a. *Leather plate function:*

- Protect the ship's room from sea water
- Withstand sea water pressure perpendicular to the hull of the ship
- Withstand local loads, among others at the time of launch and collision by ship.

As for the use of images of skin openings as follows:

- For workers showing the layout of the plates and the size of each row of plates.
- Shows the location of all holes in the hull of the ship.

b. *How to describe skin openings*

As for how to describe skin openings:

- First of all the ivory lines perpendicular to the keel line are drawn.
- On each ivory line, the length of the line obtained from the center is measured
- line to the top edge of the various.
- From the connection of these points, a drawing of the skin opening is obtained.
- In this skin opening drawing will be drawn plate joints
- transverse and longitudinal, deck edge radius, inner base and bulkhead
- transverse.

c. *Construction elements in profile construction*

Elements of ship construction in profile construction:

1. Center girder
2. Side mounts (side girder)
3. Wrang (floor) consists of:
    - Wrang plate/Solid floor
    - Watertight floor
    - Open floor

4. Stiffenner
5. Transverse deck transvers
6. Longitudinal deck
7. Ivory - main and large ivory
8. Hold
9. Main pillar (mast)

d. Single base construction and double bed construction

1) Single bottom construction

It is single which consists of a single base construction is the basic frame of the transverse basic truss system of the wrang and the longitudinal beams, namely the inner keel which is located in the longitudinal plane of the ship and the keel in the middle.

2) Double bottom construction

Double bottom construction is a construction where the tank is changed. On top of the wrang, the longitudinal beams are placed a plate called the Inner bottom plae (Nur, I., Suranto, P. J., & Marasabessy, A. (2019). Rancangan Konstruksi Kapal Penangkap Ikan 60 GT Untuk Nelayan Pelabuhan Perikanan Nusantara Karangantu Kota Serang. Jurnal Ilmiah Giga, 22(2), p.85-92).

e. How to describe the profile construction

Profile construction is a depiction of ship construction in length, where the construction made is a construction that is in the mid ship section which is redrawn only in an extended position. And the depiction of this profile construction is more complex than that of the mid ship section, because of the many depictions added and it will be clearer about the location and parts of the construction. The profile construction consists of a longitudinal picture of the ship's layout viewed from the side and cut vertically at the center of the ship. Then the picture will be clearer with the addition of a picture of; Upper building consisting of a poop deck, boat deck, navigation deck, top deck and fore castle. The second is the main deck and the third is the double bottom. And from the appearance of the picture it will be more clear about the placement of the stiffener, large ivory, main ivory, wrang center girder side girder and other parts. The way of describing the layout or measurement frame is taken from the measurement results of the body plan work assignment.

4. Conclusion

Ship construction consists of two main parts, namely the hull and the building on the ship or deck house. Basically, the process of drawing this construction can be done in three ways, namely the transverse construction system, the longitudinal construction system and the combination construction system. In this case there is a midship section, details, cuts, skin openings, and profiles. Meanwhile, the construction of the hull consists of a starboard hull, base and/or several decks. The building on the boat or deck house is an additional building located at the top of the hull. The superstructure which is located in front of the ship, starting from the level of the face is called the forecastle, while the superstructure located in the middle is the bridge and the one behind it is called the poop. (3) The function of this construction depiction is, among other things, to facilitate the construction process of a type of ship because it provides instructions for the sequence of construction and how to connect by showing the cross-section of the plates and the size of each plate line, and describing the location of all holes or openings in the hull of the ship.

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