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Classification of Equipment in Marine ERP Systems

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ABSTRACT

Enterprise Resource Planning (ERP) is one of the important aspects in the maritime industry. It is an important part of the ERP system that helps in ensuring the durability of the ship. In this paper, a study is carried out on the ERP systems in the shipping industry. The study discusses the use of SFI grouping method and ERP system for this purpose. For transportation purposes, the study proposes discussing various sizes for its specific purpose and also implements SFI system, which classifies ships for its purpose such as bulk cargo, passenger ferries, and so on. For defence purposes, it discusses developing hawse ships and provides a review of the range of equipment used in the shipbuilding industry and ERP's role within it.

Keywords: ERP, Shipping, Marine engineering, SFI, Machinery, Database, Library

INTRODUCTION

The current report concerns itself with explaining the ERP software and also analysing the methods used in grouping machinery for the ERP system in the shipping industry. The paper is about comparing the database indexing (grouping) in ERP software of shipping companies. Regardless of any EPR software, the data of each machinery of a ship has to be grouped in one way or another, the way the machinery can be grouped and indexed is not yet standardized completely, some use the SFI classification system, some use the ship's maker manuals library index and some use any grouping the user prefers depending on which parameter is selected for the indexing (location, cost, size).

The machinery of the ship is the same, the way it is grouped is different. The goal is to explain the SFI system, explain the library index method, and compare maritime to another industry's method of grouping.

Below cases are analysed as proposed standards for indexing classification:

SFI Coding and Classification System - SFI Coding and Classification System - i.e. Code 73 is always Compressed air systems/ 731 Starting air systems/ 731.001 Starting air compressor/ 731.003 Starting air emergency compressor/ 731.005 Starting air water/oil separator and so on... This means that the database can be easily transferred from one ERP system to another ERP system as the codes are same.

As per ship's drawings and manuals library index, thus grouping machineries as per the index, i.e. Machinery/MA GENERAL/MA-2 30001 Machinery particulars. While the database follows the library index, it cannot be transferred from one ERP system to another ERP system, because each maker (Shipyard) has its own format of grouping.

Classifying by the SFI coding is quite effective and also so is the library index. The shipping industry is to be compared with another industry.

MARINE ERP SYSTEM

Enterprise Resource Planning (ERP) is one of the integrated management present in the main operations that are observed within the maritime industry. In this case, the maritime industry is observed to be effective because it employs maritime software to ensure ERP is implemented with relative ease (Evans, 2021). In addition, with maritime software, the inherent challenges within the shipping industry are mitigated. One of the software used in this case is related to equipment management, which helps schedule business operations and monitor the

related tasks within the industry (Oracle, 2020). This is an effective method to engage with issues in the maritime industry because each aspect and facet of the industry are mitigated and resolved, such as vessel maintenance, logistics management, etc.

Through this endeavour, the shipping industry experiences a surge in productivity as the maritime software streamlines its process and ensures the marine vessels' durability is also increased. The degradation occurring over time is resolved as the maritime software provides a schedule that can easily prolong its maintenance (Marine Digital, 2018). The marine ERP system is quite significant for the shipping industry because it facilitates each stakeholder according to their specific requirements in the industry (Marine Digital, 2018). The transportation services are also streamlined and can employ digital technologies to collect and process data for a streamlined maritime operation.

For this purpose, the concept of digital twin integration is also present in the shipping industry as it helps develop sensor configuration and record and interpret log readings (Assani et al., 2022). Due to the digital twin system, the configuration can stream data through multiple channels.

SFI GROUP SYSTEM

One of the main components present within the maritime industry is that the SFI group system is considered to be varied in communication, cost control, comparison, and quality control. The SFI group system has a strong scope and position within the shipping industry (Pfeifer et al., 2020). Furthermore, the shipping industry requires such varied expertise because such classification addresses the shipping industry's specific concerns and ensures the shipping industry is resilient to adverse conditions (Li et al., 2022). In addition, the shipping industry can capitalise on the SFI group system to command control over its domestic and offshore operations, evident through the amount of control and quality assurance granted to the industry.

The classification obtained through the SFI system also helps conduct various operations for the shipping industry, such as extracting estimates and making specifications for the organisation. This is obtained through proper planning and establishing business routines considering the maritime context. This is important for the maritime industry and the shipping industry in particular because a streamlined operation can enhance its durability. Abd Rahman et al. (2019) also mentioned SFI classification as the study identifies the shipping industry as a complex and complicated project and can be managed through thorough segmentation.

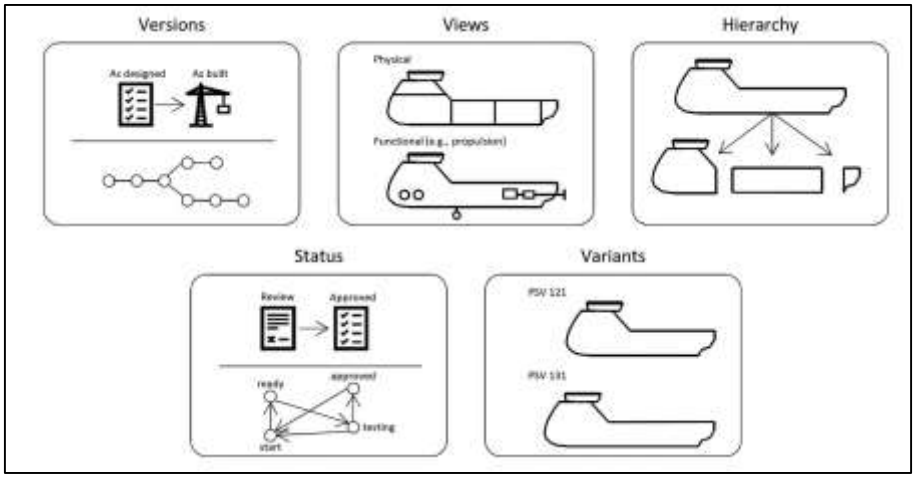

Figure 1. Product data management

For this purpose, Figure 1 demonstrates a hierarchal structure can be obtained and is also compared with project management principles such as the work breakdown structure (WBS).

The study also signifies about the SFI group system and compares its similarities with the WBS stating that the SFI uses a coding system and the user is provided with much ease and convenience. The qualities mentioned can be obtained through coding system initiated within the SFI coding system such as implementing effective cost management.

SFI Group	Description
0	(reserved)
1	Ship General
2	Hull
3	Equipment for Cargo
4	Ship Equipment
5	Equipment for Crew and Passengers
6	Machinery Main Components
7	Systems for Machinery Main Components
8	Ship Common Systems
9	(reserved)

Figure 2. SFI groups

The above figure mentions about the group division and its corresponding coding present within the SFI group and in this manner, the shipping industry can allocate its resources for its objectives as per the requirement. As the work progresses, the shipping industry can widen its SFI grouping and the groups can be extended further as per its discretion (Liu et al., 2019). These groups are effective for cost controlling along with making decisions for shipping-related purposes such as repairs, budgeting, raw materials, equipment, and so on.

Another important aspect determined within the SFI grouping method is the man-hours estimation method where the ERP method is installed and is being managed by the ship manager. Moreover, the man-hours estimation is made through labour and time required to complete the project within an estimated time (Perumana Thomas, 2019). This automated process is essential for the business because the shipping industry can account for the different man-hours and is also dependent on the ships overall shelf-life. The estimation is imperative and necessary for the business as most ships do not prolong for more than 2 years.

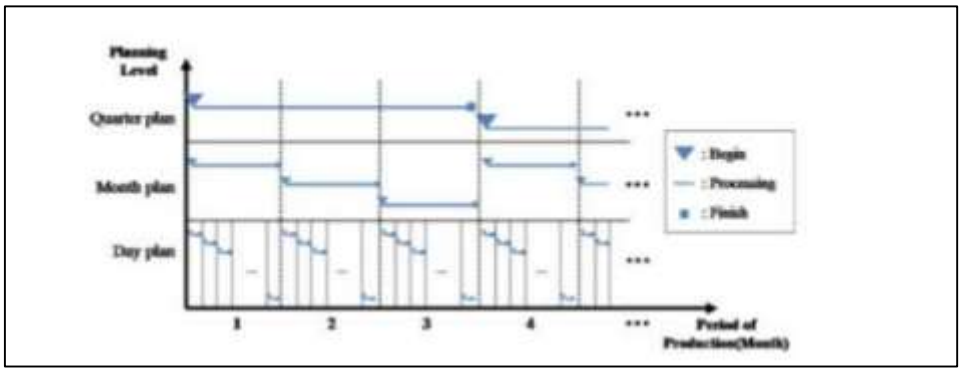

Figure 3. Man-hours estimation

The man-hours estimation (as shown in the above figure) can help in segmenting the time duration in cyclical phases for e.g. 3 months and can be provided with significant information

related to its role. In other words, with proper planning and segmentation, the shipping industry can realize its objective of creating better ships that can be deemed efficient.

In addition, the SFI group system is found to be effective because it is mainly dependent on its own hierarchical system that is mainly managed and functioned from the ship and also attests importance related to its component function (Fonseca & Gaspar, 2021). Due to this, a numeric tag system is preferred and is supported by at least 3 layers or levels that are managed through a specific code. This code is in line with the SFI grouping system as it helps in presenting information about the type of materials and components required in a ship (Arrichiello & Gualeni, 2020). The objectives within the SFI is also found to establish alternative hierarchies to provide additional support to the shipping industry and also mentions about ERP software for this purpose.

In addition, it is also mentioned that the shipping industry is able to perform on operational data and is also provided with an identification tag. This tag is mainly added to be validated through operational data and can be used to develop dashboards and also perform simulations of the shipping industry. Regarding the shipping components, steel with improved fatigue properties are also incorporated within the shipping industry and through the anti-fatigue damage, the steel plates are found to have a fatigue propagation life. This is construed as an improvement over the steel plates as the fatigue strength is improved. This is classified under *Nippon Kaiji Kyokai;* a classification society that has primarily focused on fatigue cracks and also increase the shipment's resistance to such fatigues (Okada et al., 2021). The classification society is able to increase the welded structure's strength and also determine its fatigue strength under various conditions present in the maritime environment.

LIBRARY INDEX

The library index for the shipping industry's grouping machinery is regarded to be effective as it is an adherent of implementing ERP management and has been successful in implementing the Upgrade Decision Model (UDM) (Otieno, 2010). The decision model is significant because it helps in expressing tendencies to influence the ERP systems in the shipping industry and the UDM aids the shipping industry in their upgrade decision. Through the model, the shipping industry is able to take pertinent decisions related to upgrade practices and also identify any possible issues in the shipping industry. Following on, it is also stated that the library index is considered to be one of the major aspects present in the shipping industry because of its guidelines present in creating and designing the ship.

Moreover, shipping industry has been continually been upgraded to improve its mechanism and to ensure it continues to serve its purpose such as transporting goods from one place to another (Suresh Chandra Misra, 2015). For transportation purposes, the study suggests discussing various sizes for its specific purpose and implements SFI grouping system as well, which classifies ships for its purpose such as bulk cargo, passenger ferries, and so on. The SFI coding system is being used to ensure the transportation is done with relative ease and thus is met with its appropriate cargo size (Sasa et al., 2021). The ocean deadweight capacity is discussed and implemented to accommodate the shipping size and also ensure no mishaps take place during its sea movement.

In addition, there are different barriers present in the oil tankers such as exporting crude oil as well. For such crude transportation, it is stated that the shipment is being transported using the ocean deadweight determination such as Panamax vessels such as transportation i.e. ranging 50,000-90,000 tons (Suresh Chandra Misra, 2015). The library index presents a discussion is regarded to be effective, in this case the drawing size is adhered with much importance because it is found to be benefit the shipping design and materials.

Letter Designation	Sheet Width (inches)	Sheet Length (inches)	Margin (inches)
B	11	17	3/8
C	17	22	1/2
D	22	34	1/2
E	34	44	1/2
F	28	40	1/2
J	34	48 to 144(a)	1/2(b)

Figure 4. Drawing size and sheet

The multiple sheet drawing, as shown in Figure 4, is adhered with much importance because the sheet numbering is found to be a series of continuation sheets that are presented with above-noted lengths and the zone size is a prerequisite element present within the shipping industry because its design size needs to be within the appropriate range i.e. 5.5 inches by 8.5 inches (Davidson et al., 2020). The strong emphasis on the design size merits significant importance for the shipping industry because each passenger vehicles are different and requires different shipping materials.

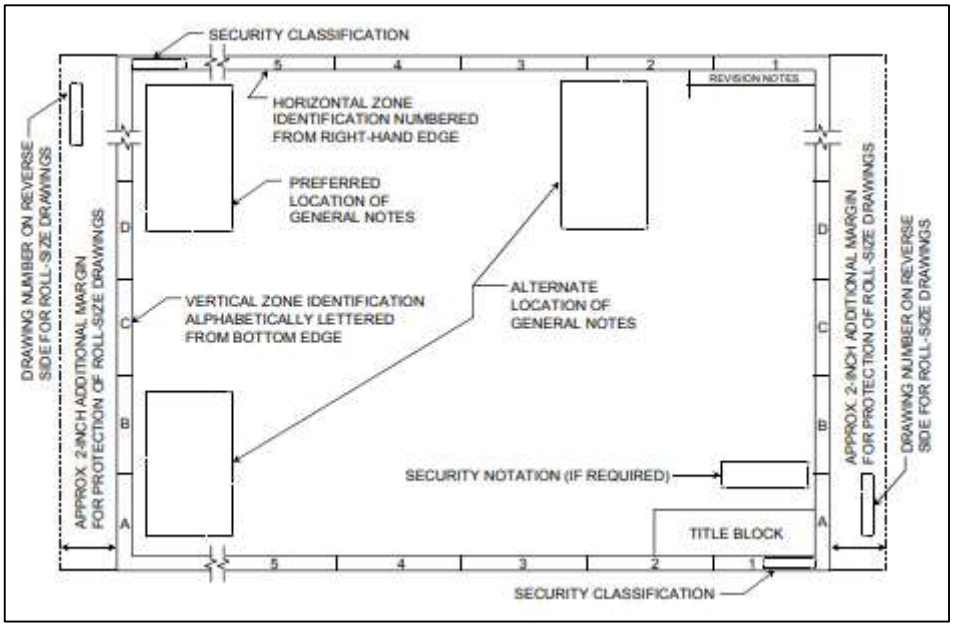

Figure 5. Ship format and size drawings

Figure 5 denotes multiple sheets drawing for the shipping industry with each layer indicated with specifications along vertical and horizontal lines to strike a balance within the ship and can ensure a smooth operation is realized. Moreover, it is further elaborated that the maritime transport does require digitalization because of its potency to implement an accurate design (Plomaritou & Jeropoulos, 2022). In addition, the use of an innovative design is also ensured through digitalization because keeping track of the specific design in the shipping industry is quite difficult through conventional means and methods. However, through digitalization, the shipping industry can examine the shipping operation and process through innovation techniques and also improving its ERP mechanism.

The ERP mechanism is also implemented through its software specifically for maritime operations and its environment. This facilitation is considered to be effective and necessary for the shipping industry so that the end result i.e. ship in this context, can be customized and can be changed as per the given requirements (Tanaka et al., 2022). Moreover, the ERP system is also effective in customized so that the deployment time is also managed. At this point, the ERP software is found to benefit the maritime environment and the shipping industry as it is

now able to reduce its capital expenditure and also simultaneously improve its efficiency (Czermański et al., 2022). The main reason for acquiring this dual benefit is because ERP software aids in providing accurate details about the maritime environment.

In other words, the shipping industry requires to implement a process-driven transition and also ensure better technologies are present in the maritime industry and can also design and implement management strategies. The data process can be obtained through such strategies and can also employ the use of a big data and also implement algorithms for implementing digital innovations.

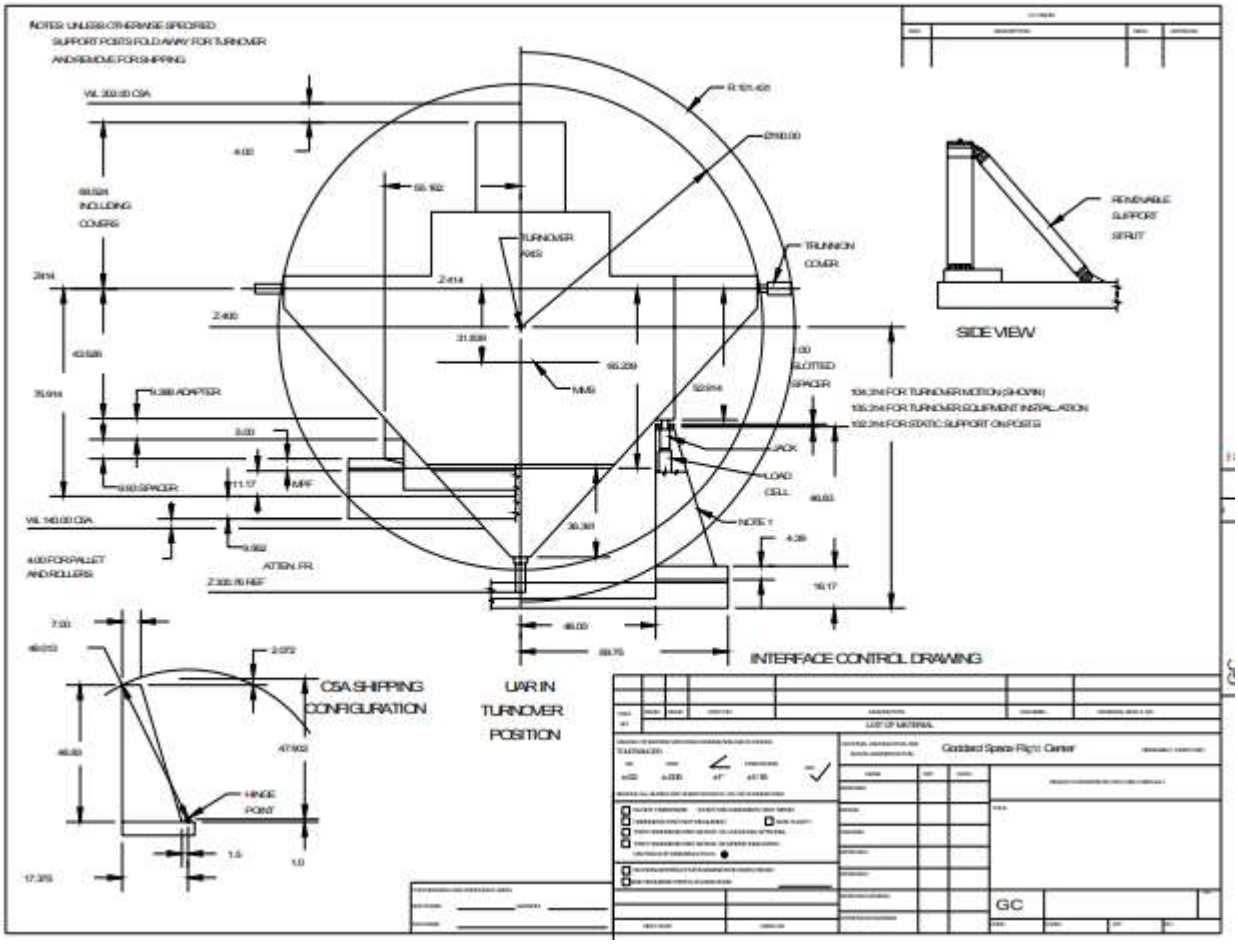

Figure 6. Ship control drawing

Figure 6 indicates the importance establishing compatibility between physical and functions and is considered to be an important element for the shipping industry. With the designing activities, the shipping design can ensure integrate information related to specific features related to the ship. These include dimensions, bolt sizes, holes, hardware, and so on. The interface control drawing is an integral element for the shipping building process because at this point, any suggested changes in design can be done (Wang et al., 2022). In addition, the control drawing interface also holds a checklist that helps in keeping in check regarding the shipping materials and design. The interface design along with the material can also be changed as per the requirement.

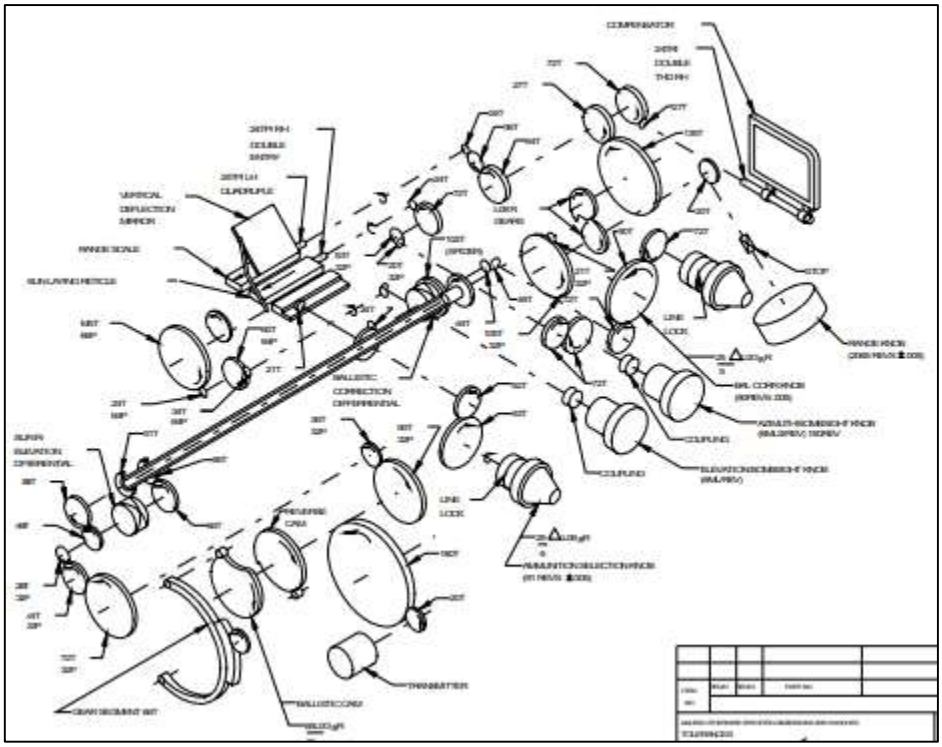

Figure 7. Modified drawing

Modified drawing as indicated in Figure 7 is found to be in line with interface control drawing as it is considered for making delineate changes and also classifying the stock items. This includes panel blanks, installations, and assemblies. The parts are assembled and designed at this stage to ensure the shipping materials can be assessed with relative ease and whether it requires any addition of rework items.

Reiterating on the shipping materials and equipment, shipping radars are also merited with significant importance as it helps in marine navigation and also reduce any mishaps. This is an important aspect present in the shipping industry and is one of the prerequisite equipment used on board (Mukherjee, 2021).

Figure 8. Shipping radar

The above figure displays a shipping radar and it is used to accurately navigate and circumvent the marine conditions present. Within the ERP software context, the marine radar is also used to position and monitor the shipping vessels to ensure the ship is not met with any adverse conditions. This radar system is also important to track ships and more importantly avoid any collision at the sea. This maritime precaution is only possible through shipping radars

and is a necessary component to ensure ships over 3000 tons have installed this mechanism on their ships (Mukherjee, 2021).

Moreover, another important component within a ship is the Lake hawse pipes that helps in preventing the ship's hull from colluding with either the anchor line or chains.

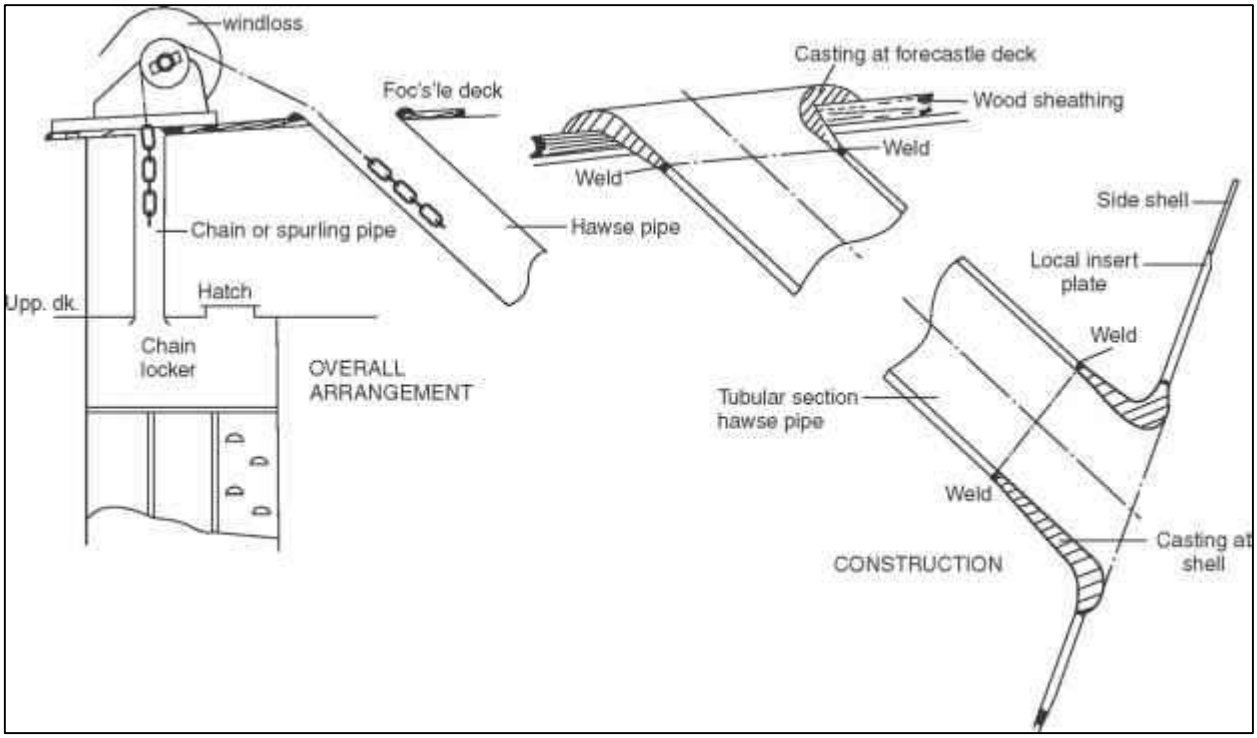

Figure 9. Hawse pipes

Developing hawse ships is considered to be one of the elements functioning on the automated system because it is frequently used to avoid any mishaps and helps in increasing the ship's durability. However, there are some criticisms attested with where the concept of autonomous ships are also being invoked. One of the proponents of this ship is Christos Flokkou's (2021) study that signifies an autonomous ship can provide possible solutions to the modern environment. The automation aspect is interpreted through the maritime progress where to accommodate the shipping industry, it is important to align it with the current maritime standards.

MACHINERY GROUPING METHOD/CODING IN THE DEFENCE INDUSTRY

The SFI grouping method also finds its application within the defence industry and has been a major part of the naval structure. The naval fleet design is also facilitated through the SFI grouping method as these naval vessels require significant changes to accommodate changes as per its operation (Alharbe et al., 2022). It is important to note that naval vessels operate on a different mechanism owing to its purpose as compared to other shipping vessels because the former is expected to carry arms and ammunitions and related stockpile between destinations. Thus its requirement differs with other ships for example, the naval vessel technologies operate on an array of engines along with maintains alternative system that includes number of gas and steam turbines in addition to diesel engines (Demir & Çıtakoğlu, 2022).

Operating on different metrics help the defence industry and is thoroughly facilitated through SFI grouping method. Moreover, the shipping industries in the defence industry are designed with pertinent care and understanding because the maritime platform designs so that

its modular capabilities (Manuel, 2023). As a result of this specification, it is stated that the defence industry is facilitated as it is provided with enhanced defensive approaches and are able to mitigate emerging threats. Following on, it is also mentioned that the defensive industry is more likely to adopt innovation solutions to ensure its defence strategies are also adhered to with relative ease and convenience.

Following on, it is also stated that the accuracy control is also determined within the defence industry through the SFI method because it uses a range of statistical methods to monitor control over its operations (McManus & Breen, 2023). This is also effective in establishing both assembly and welding sequence that helps in managing the control over its shipment. Furthermore, with such controls, the fabrication standards are also implemented using the SFI method to ensure weld shrinkage and other allowances can be enabled through technologies (Liu et al., 2019). In this case, the defence industry can establish its operations through better allocation of services and also incorporating information related to accuracy control methods. These methods allow in making a ship reference system that helps in determining measurements and also establishes a series of control documents.

This is effective for the defence industry in particular because it can establish suitable vital points and also determine about the shipbuilding structural processes, which helps in establishing accuracy control so that the defence mechanisms can be catered and also incorporated with structural drawings.

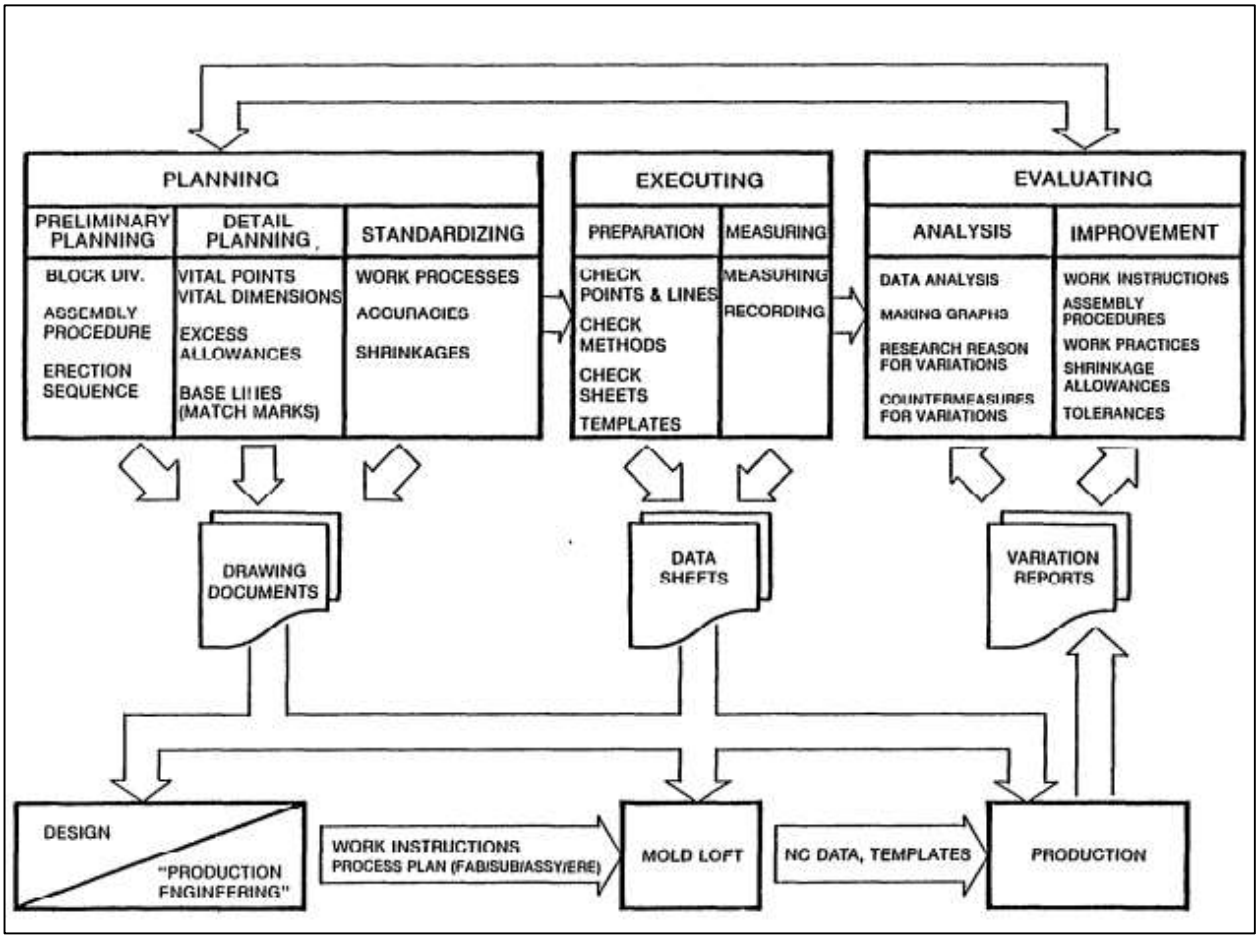

Figure 10. Steps to take accuracy control

Figure 10 discusses in detail the planning, executing, and evaluation that is to be used for the accuracy control so that data sheets along with variation reports so that mold loft and also provides complete work instruction. For this purpose, the ink-marking method that is used as

a tool for distancing itself from torch plates and also discusses the concern related to assembly fitting lines. Through the ink-marking method, the welding sequence and condition of the ship is determined along with its position.

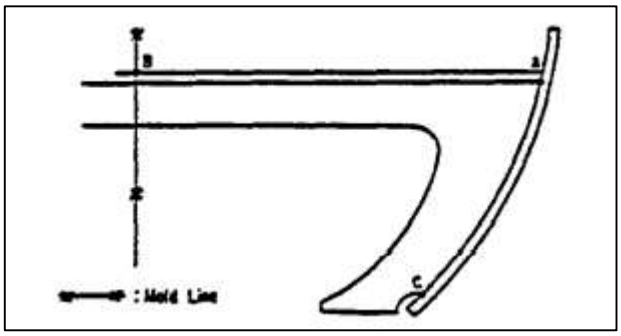

Figure 91. Curved zones

Figure 11 provides information about the vital points present in a ship and also the block erection sequence is evident. In addition, the curved zone and the block point are also determined within the naval vessels so that its width and straightness is determined as per its use. Along similar lines, the port fabrication stage is also determined based upon bottom girders, side floors, and the hold frames.

CONCLUSION

In conclusion, it can be stated that the report consist of a discussion related to prevailing SFI grouping method and ERP's role in the shipping industry. The report discussed considering the maritime context and also provided a discussion on the range of equipment used in the shipping industry and ERP's role within it. Moreover, the report also included a discussion about innovation and the maritime software that can be used to facilitate the shipping industry. Discussion also entailed about the defence industry in comparison and the specifications required in its industry i.e. naval vessels.

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