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Technical Specification for a luxury Cruise Vessel

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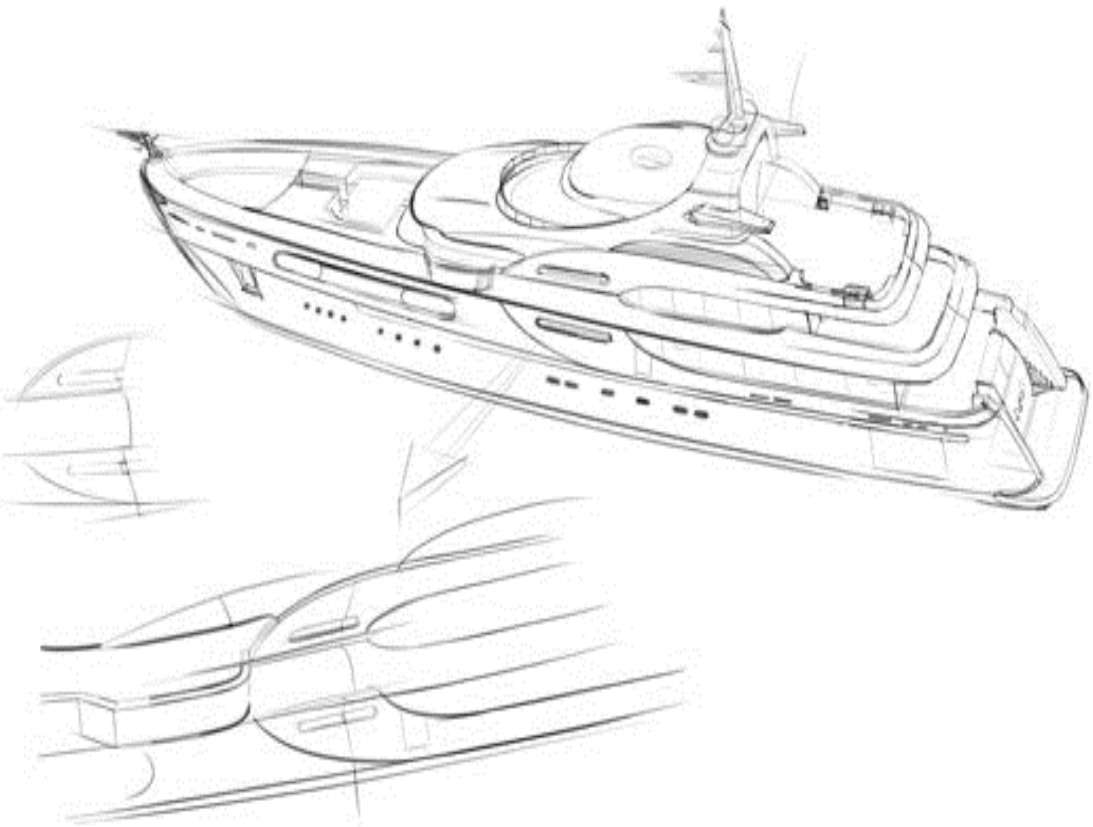

ABSTRACT

The aim of this dissertation was to provide a detailed analysis and presentation of the technical specifications for building a new luxury cruise ship. Technical specifications are important for clarifying what sellers are able and expected to offer, as well as what buyers are expected to receive. International Maritime Organization's (IMO) SOLAS Convention represents the main regulatory framework surrounding the technical specifications of ships, whose determination strongly takes into consideration safety of ships, cargos, the environment and human life. The proposal of the mini technical specification for building a new luxury cruise ship, carrying up to 36 passengers and performing international voyages, was based on SOLAS directives, as well as their amendments during the 90s. It also took into consideration the need to offer comfort and luxury services to its passengers. Building the new ships following the proposed detailed technical specifications will save time and money both to the ship owner(s) and the constructor (shipyard owner), while also making it clear who to blame for violated terms and conditions of the contracting agreement in case of deficiencies At the same time, it will ensure construction accuracy, which is very important for the compliance of the new cruise ship with SOLAS Convention.

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I would like to thank a number of people regarding the completion of this dissertation. First of all, I would like to thank my tutor for his help and guidelines throughout the dissertation conduction process, which were very valuable for me, in order to be able to accomplish this academic target. Moreover, I would like to thank all my lecturers, who provided me with the necessary knowledge to carry out this dissertation. Additionally, I would like to thank my classmates for their help and cooperation they provided me throughout this year, when I found them necessary. Last but not least, I would like to thank my family and friends for their support and motivation, which led me at the point of submitting my dissertation.

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1. INTRODUCTION

1.1. DISSERTATION AIMS AND OBJECTIVES

The aim of this dissertation is to provide a mini technical specification for the building of a new luxury cruise ship. More specifically, the dissertation has the following objectives:

- To analyze the elements and importance of technical specification
- To outline a detailed mini specification for the building of a new cruise ship, which will be a twin screw, luxury passenger vessel, meeting SOLAS ’90 regulations and its amendments issued in 2000, for passenger vessels carrying up to 36 for international voyages.
- To provide implications for shipping companies and other bodies involved in ship building regarding the importance of correct technical specifications in terms of cost, time, and ship-building accuracy

1.2. CONTEXT AND BACKGROUND

Technical specifications refer to all technical standards and requirements that materials, products and services need to meet. They include specifications regarding every single technical aspect of products and services, such as raw materials to be used, manufacturing or design processes to be followed, as well as safety requirements that need to be satisfied. They are developed either between sellers and purchasers as part of contracting agreements, while they may also be developed by official private corporations or public authorities (Langenberg, 2005). Their importance lies in that they act as a means of communication between the parties involved, clarifying what sellers can and shall offer, as well as what purchasers can and shall expect in terms of materials, products, and services (Dickson *et al*., 2008). In the shipping industry, technical specifications are very important not only for ship design

and attributes, but also for safety of ships, cargos, and humans at sea. All ships' specifications are determined by SOLAS. Increased attention during the last two decades has been devoted to human life protection, the result of which was the adoption of IMO's ISM Code. As far as ships carrying over 12 passengers are concerned, technical specifications are further determined by amendments made to SOLAS after 1990, as well as MARPOL, the latter determining fuel consumption specifications for large vessels and passenger ships that cause excessive environmental pollution (IMO, 2014).

1.3. RATIONALE OF TOPIC SELECTION

The rationale behind selecting the particular dissertation topic lies in that technical specification is of vital importance for ship-building, since it gives the necessary guidelines to shipyards regarding how to build a ship. Moreover, the strict regulations regarding how ships shall operate at sea, especially as far as safety of ships, cargos, and human life are concerned, makes the conduction of correct technical specification indispensable. Next to the above, the case of luxury cruise ships is even more interesting, given that, except for safety, passengers shall also enjoy all services and comforts characterizing luxury cruise shipping, thereby making technical specification even more important.

1.4. DISSERTATION STRUCTURE

Chapter 2 provides the theoretical framework regarding technical specification in general, and technical specification of ships in specific, while also paying attention to the legal framework surrounding the determination of technical specifications for all ships in general, and passenger ships in specific. Chapter 3 gives a general description of the new vessel to be built, mainly referring to the tanks and decks the vessel will consist. Chapter 4 provides the specification of hull, while Chapter 5 outlines the life-saving appliances and

equipment that the new cruise ship will have. The fire protection to be installed on the new ship is specified in Chapter 6, while Chapter 7 is occupied with describing the cathodic protection the vessel will be subject to. Chapter 8 provides a thorough outline of the machinery to be installed in the new cruise ship, namely propulsion machinery, machinery for heating services and purposes, engine systems, pollution control systems, as well as further control and instrumentation. Chapter 9 outlines the specification regarding the new piping system of the vessel, while Chapter 10 is occupied with specifying the electric power and the systems and sources of the new vessel. Chapter 11 outlines in detail the specification regarding the air conditioning, ventilation and insulation system of the vessel, while electronic, communication and navigation equipment are presented in Chapter 12. Chapter 13 provides the specifications of the interiors of the ship, while Chapter 14 outlines the paint system of the ship. Chapter 15 is dedicated to describing teak decks and deck fittings, while Chapter 16 provides an analysis of the tests and trials that need to be made, so that all technical specifications are evaluated in practice. Finally, Chapter 17 provides important conclusions regarding the importance of designing correct technical specifications for ship owners, as well as implications for all the parties involved in the process.

2. THEORETICAL FRAMEWORK

2.1. DEFINING TECHNICAL SPECIFICATIONS

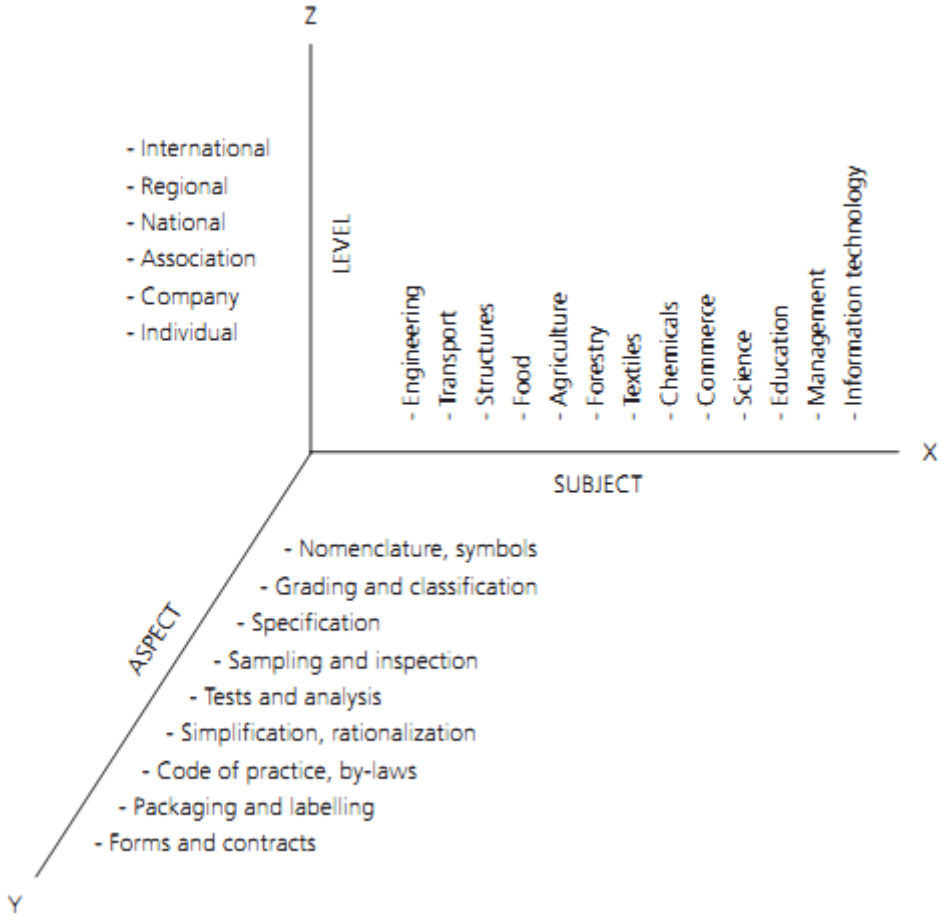
Specification is the term used to define the set of requirements that need to be satisfied by a material, a product, or service, in terms of their design and construction (where applicable). Material, products, or services that do not meet these requirements are said to be out of specification. Due to the fact that specification mainly refers to technical aspects, it is normally also referred to as technical standard. Both public and private organizations may be authorized to develop technical specifications, such as private corporations, professional associations, national governments, international industry associations, or purpose-made standards organizations. Technical specifications are normally accompanied by data sheets, the two concepts often overlapping (Stefanovic *et al*., 2009). Technical specifications involve any single aspect regarding the manufacturing and design of materials, products, and services. Detailed description of products or services, raw materials to be used, how to be used, processes to be followed, the sequence of processes to be followed, safety issues, as well as any other technical aspect that product manufacturing, material supplying, or service design are subject to are embodied in technical specifications (Langenberg, 2005).

As Figure 1 indicates, technical specifications are developed in terms of three functions. The first is the level. More specifically, technical specifications and standards may be applied at an individual level, whereby each individual product manufacturer or service provider develops the technical specifications of the products or services offered by the company, as a means of actually describing them and listing their components. Technical specifications may also be developed by trade associations, which refer to products and services offered by companies operating in certain industrial or service sectors. Next to the above, materials, products, and services may be subject to technical

specifications that are applied within a regional, national, or international context (UNIDO, 2006).

The second function is that of the subject. This function actually defines the industry or sector within which products and services are offered and used. The third function is that of the aspect. This function involves the actual elements of technical specifications, such as the symbols that products need to carry, their grading and classification, their actual technical standards and specifications (actual product or service description, and description of components and how they are used or what they offer), the tests and analyses that products and services need to undergo, in order to be able to be marketed, product packaging and labelling, the forms and contracts that the use of products and services need to be subject to, as well as codes of practice. Despite this general outline, the content of technical specifications may vary in terms of the different levels within which they are developed, as these levels were previously outlined (UNIDO, 2006).

Figure 1: Technical standardization: Level, subject, and aspects



(UNIDO, 2006)

It is necessary for technical specifications to be developed in any type of business that involves purchasing and selling of materials, products, and services. Specifications in most cases are often confirmed by signing contracts between purchasers and sellers. Violation in terms of compliance to specifications normally gives the right to purchasers to withdraw from a purchase (always depending on contracts' terms and conditions) (Ping, 2011). An important issue that needs to be addressed here is that products or services covered produced in line with the pre-defined technical specifications are not necessarily products and services that fit for any use. Rather, product or specification designers may need to alter initial specifications to fit for certain uses, which they can follow during construction, after agreeing with the rest of the parties involved in contractual agreements, and after taking the

necessary confirmation from the relevant governing bodies (Shapiro & Varian, 1999). In other words, products and services rarely meet 100% their initial technical specification; rather, a certain percentage of variation, depending on the importance of each specification, is expected. For this reason, formal specifications normally list alternative options, so that manufacturers fit them with their manufacturing processes and capabilities. In this way, it is ensured that specifications are met to the maximum possible point (Dickson *et al*., 2008).

2.2. THE IMPORTANCE OF TECHNICAL SPECIFICATIONS

There are a number of reasons that make technical specifications important. First of all, technical specifications act as the means of communication between purchasers and sellers, users and manufacturers. In other words, technical specifications make know to sellers what purchasers require from them, and what they expect from the products or services they will receive and use (Ostwald & Muñoz, 1997). At the same time, technical specifications makes known to purchasers what sellers are able to offer, what purchasers should expect from what they will purchase, and how every attribute of the product or service they purchase functions and operates (Shapiro & Varian, 1999). Except for the above parties, when technical specifications are developed by official public authorities or official private corporations, they act as the means of communication between these bodies and purchasers and sellers. Purchasers get to know what exactly they can order and use, in order to comply with official specifications and the legal framework surrounding them, while sellers know exactly what they can design or manufacture, in order to be subject to the same level of compliance as well. The above advantages lead to the additional advantage of reducing uncertainty; by running through technical specifications, purchasers are able to compare products, while also ensuring that they have not selected the wrong product or service (Christensen & Raynor, 2003).

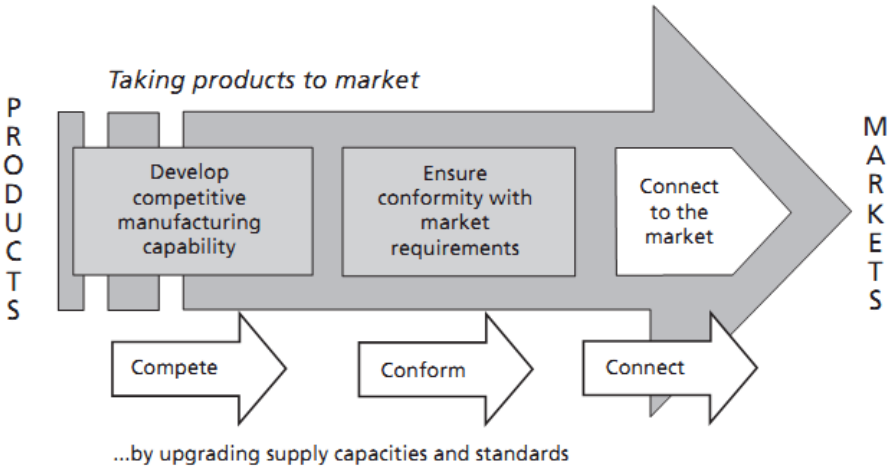
During the bidding process, sellers (or/and manufacturers) have the opportunity to make their quote based exactly on the required specifications by purchasers, having the ability to precisely calculate their material, manufacturing, labour, and other forms of operating costs. At the same time, purchasers also have the ability to make a more precise estimation of the costs they have to bear (Hopp & Spearman, 2011). During the construction, manufacturing, or service development process, technical specifications actually act as the instruction manuals of the manufacturers and designers. Having these specifications gives the ability to manufacturers and designers to know exactly the processes to be followed, while also providing necessary system documentation (Craig & Douglas, 2000).

Since the beginning of the era of globalization, the development of technical specifications has attracted even more increased interest. As World Trade Organization (WTO) states, cited by United Nations Industrial Development Organization (UNIDO) (2006), the main challenge that export-oriented companies have faced for many decades has been to find ways to overcome technical barriers for trading the products and services to foreign countries. This has been more evident in the case of developing countries, whose manufacturing and design capacities had been inferior to those of Western countries, thereby characterizing their products as out of specification and unable to operate within developed national contexts. In order to reach the point of dominating world trade and economic growth, as it happened before with Japan, and today with China and India, to name a few, developing economies had to develop institutional infrastructure determining the technical and quality standards that would allow them to operate within a global context. Towards this end, WTO adopted two agreements, the Agreement on Technical Barriers to Trade and the Agreement on Sanitary and Phytosanitary Measures, as a means to provide manufacturers of developing countries with the necessary technical standards to follow, so that their products are accepted for use in the rest of the world. As UNIDO (2006) supports, the development of official guidelines and technical specifications has indeed

been the main reason for growth and development in developing countries, which gained the opportunity to take advantage of their lower manufacturing costs to offer products and services of identical (or even better) quality to those of their Western counterparts in more competitive prices (ibid, 2006).

Of course, except for general provisions provided by WTO, as well as other official international organizations, each country has its own regulations that determine the use of design and use of products and services. Companies that wish to compete within an international context need to be aware of technical specifications applied in each country, and follow them precisely. Failing to do so will cause their products and services being unaccepted to be used, which means that companies will be subject to failure in entering foreign countries. It follows that technical specifications have also given the opportunity to export-oriented companies to identify what it takes to expand to foreign countries, as well as decide which foreign countries to target, based on their manufacturing and design capacities and capabilities (UNIDO, 2006). Figure 2 illustrates the phases that products pass through, in order to enter a target market.

Figure 2: Phases followed by products entering a market



(UNIDO, 2006)

Companies that are more compliant with technical specifications that are effected within industrial, national, or international contexts are more likely to

be more competitive than non-compliant ones. For manufacturers, the existence of technical specifications in the industries or countries within which they operate gives them the opportunity to follow the strategy of product standardization, thereby also giving them the ability to pursue mass production, which helps manufacturers in saving from research and development (R&D) costs, improve their productivity, while at the same time enjoying economies of scale through higher productivity and better utilization of resources (Keegan & Schlegelmilch, 2001). Standardization also offers the ability to manufacturers to further reduce their operating and production costs, since it reduces the variety of products and services that can be manufactured and designed, thereby reducing R&D, inventory, and overall production costs. What is more, companies become more competitive, given that, instead of competing in terms of integrated systems, they competitive in terms of product or service components (Theodosiou-Leonidou & Leonidou, 2002). This also gives the ability to sell parts and components to other companies in the form of outsourcing, while they may also decide to outsource part(s) of their production processes themselves (Murphy & Yates, 2008).

In general terms, and in consistency with the previous argument, the development of detailed technical specifications contributes to the reduction in time and costs involved in manufacturing products or designing services. In the absence of certain technical specifications, it normally takes much more time for manufacturers (or designers, in the case of services) to take decision regarding what materials and equipment to use, how to proceed and with how many people, as well as other technical issues related to each project (Buzacott & Shanthikumar, 1993). The time and costs become even higher, when mistakes or omissions are identified at a late stage of the manufacturing process, and manufacturers need to have part of the job redone, so as to correct the identified defects. It also takes more time for users of products or services to identify how what they have purchased operates, and what it eventually consists of (Theodosiou-Leonidou & Leonidou, 2002).

Under no doubt, environmental protection is another issue that is safeguarded through the existence of and compliance with technical standards and specifications. Specifically, and as it was also mentioned before, official industrial, national, and international technical specifications determine production process to be followed, as well as materials to be used, also taking into consideration their impact on their environment (McWilliams & Siegel, 2001). Environmental pollution, excessive use of scarce resources, and animal abuse are the main functions to be prevented when developing technical specifications within the context of environmental protection (Chase, *et al*., 2011).

The results of technical specifications on technology are ambiguous. On the one hand, the stricter technical specifications are, the less the room for developing innovative technologies is, since technologists need to conform to certain standards, thereby limiting their innovativeness. On the other hand, though, technical specifications are also likely to foster technological and overall business innovativeness (Hill, 2000). Given that all companies in a sector or region have to compete in terms of identical technological standards, they need to find new ways to be more competitive within the context of the standards they have to comply with. Developing and using innovative technologies is certainly one of the ways to achieve this aim (Buzacott & Shanthikumar, 1993).

Last but not least, the existence of technical specifications is also important for legal reasons. In case purchasers and sellers are engaged in conflict regarding product or service specifications that purchasers are unsatisfied with, technical specifications indicate whether purchasers made a wrong initial decision, or sellers violated technical specifications that were agreed and signed. In fact, technical specifications lead to elimination of conflicts between the two parties involved, since they make it clear which side has violated them. The most important part, though, is that technical specifications safeguard product manufacturers and service designers from not being liable

for cases regarding human health and safety. In other words, when manufacturers fully comply with technical specifications, there is no one to blame them in case of negative effects of product or service use on human health and safety. Rather, such cases will be attributed to product or service misuse by users themselves (Malakooti, 2013).

2.3. SHIPS' TECHNICAL SPECIFICATIONS

2.3.1. GENERAL FRAMEWORK

Talking about the specific case of the shipping sector that this dissertation is occupied with, as it happens in all other sectors, technical specifications describe the requirements of ship owners regarding the new ships and vessels to be built in shipyards worldwide (Stopford, 2009). Given that the shipping industry is one of the most globalized ones, technical specifications mainly apply within an international context (the next sections outline the international regulatory framework surrounding ship and vessel specifications). Of course, Flag States have also developed their own ship specifications, which are, though, mostly concentrated on operating specifications, rather than technical ones (Soyer & Tettenborn, 2013).

Ships' technical specifications normally include the type of the ship (containership, bulk carrier, tanker, cruise ships, ferry or any other type), her design and dimensions, the materials from which to be constructed, her machinery, equipment, engine, and other systems, her loading capacity, as well as any other design feature that ship owners may wish to include in their ships. Except for the above, technical specifications also involve any systems, devices, and areas of the ship that contribute to safety at sea (Alexopoulos & Fournarakis, 2003).

There are a number of reasons for which ships' technical specifications are important. As it happens with other industrial sectors as well, ships technical

specifications also define what constructors need to do and are allowed to do, while also defining what ship owners shall expect from their newbuildings. Moreover, ship owners and shipyards use technical specifications in order to construct ships and vessels that conform with international shipping standards, as these have been developed by IMO. The development of unified technical standards for ships and vessels has also contributed to the homogenization of the shipping industry, and, thus, the development of its international nature (United Nations, 2013).

2.4.2. REGULATORY FRAMEWORK-ALL TYPES OF SHIPS

Ships' technical specifications are mainly determined by the "International Convention for the Safety of Life at Sea" (SOLAS). This convention was adopted in 1974 and up-to-date it has been into force as amended in 1978, 1990, 1991-1992, and 1994. The aim of SOLAS is to determine the minimum construction, operating, equipment, design, and machinery standards that ships and vessels across the world need to have, so as to ensure safety of ships, cargos, and human lives at sea. According to SOLAS, it is the responsibility of flag states to ensure that ships are seaworthy and compliant with the technical and safety specifications provided by SOLAS, mainly through informed or uninformed inspections. It also gives the right to flag states to monitor ships of other Contracting States, if there is the suspicion that they do not comply with SOLAS provisions.

2.4.3. REGULATORY FRAMEWORK – PASSENGER SHIPS

The regulatory framework regarding the technical specifications of passenger ships mainly involves the SOLAS Convention and its amendments after 1990. It also involves the implementation of the ISM Code, which emphasizes on the safety of the human elements, and, among others, states that ship masters

and inspectors need to ensure the seaworthiness of ships in terms of crew training, safety management procedures, and correct use and maintenance of safety management equipment (IMO, 2014).

SOLAS' regulations regarding technical specifications of ships are embodied in an Annex that consists of 12 chapters. The scope of the most important chapters of this convention, which are applicable to the case of passenger ships, like the one that this dissertation is occupied with, is briefly outlined in what follows:

Chapter II-1: This chapter determines the degree of subdivision for all ships, the higher of which are applied to passenger ships. In general, passengers need to be watertight compartments, and when damage is identified at their hull, they need to remain steady and stable at sea. Great emphasis is given on the construction materials. The same chapter also states that ships need to be equipped with the necessary electronic installations and materials to ensure safety of ships, passengers, and crews. Strength, integrity and stability of ships are necessary to prevent loss of human life, ships, and cargos, as well as environmental pollution (IMO, 2014).

Chapter II-2: This chapter suggests that ships need to take all preventive measures to prevent or fight fire incidents. As such, ships need to be divided into zones by thermal and structural boundaries, such as fire doors. At the same time, fire exhaustion and detection systems need to be installed to all ships, depending on their size and the areas that need to be protected. Last but not least, fire and emergency exits also need to be evident on ships (IMO, 2014)

Chapter III: This chapter is occupied with life-saving appliances and arrangements that ships must develop. Such appliances and arrangements include the existence and number of life boats and life jackets, which also vary according to the type of ships. More specific technical requirements

regarding life-saving appliances are provided by the International Life-Saving Appliance (LSA) Code. Regulation 34 of this chapter of SOLAS states that all life-saving appliances of ships need to be in accordance with the aforementioned in terms of type, size, amount, and material. Arrangements like escape routes also need to have been taken into consideration in the initial design of ship, especially passenger ones (IMO, 2014).

Chapter IV: This chapter provides technical specifications regarding ships' radio communication systems. Specifically, passenger ships with a gross tonnage of 300 or above, performing international voyages, need to be equipped with Emergency Position-Indicating Radio Beacons (EPIRBs), as well as Search And Rescue Transponders (SARTs) (IMO, 2014).

Numerous amendments to SOLAS have been adopted by The Maritime Safety Committee (MSC) since 2006, aiming at further ensuring passenger safety at sea. One of these amendments referred to Chapters I and II, setting criteria for ship design to determine the amount of damage that passenger ships can bear, so that they are able to return passengers safely back to port. Moreover, the aim of the amendments was to offer greater flexibility in ship design, so that ship designers are able to anticipate changing safety requirements that may prevail in the years following the amendments (IMO, 2014).

3. DESCRIPTION

3.1. GENERAL DESCRIPTION

The new vessel will be a twin screw, luxury passenger vessel, meeting SOLAS '90 regulations and its amendments issued in 2000, for passenger

vessels carrying up to 36 for international voyages. It is to have an exterior finish, interior joinery works, furnishings and fittings of first class standards as a luxury Mega Yacht. The vessel consists of a steel hull and superstructure, except for the top deck deckhouses, which will be of aluminum. It is designed to meet SOLAS one- compartment standards of subdivision, and is intended to carry passengers on "international voyages". The vessel is to have DNV Classification +1A1 Passenger Ship. It is intended to carry up to 36 passengers. The vessel has a bulbous bow, Mediterranean - transom and is fitted with a double bottom with the tank top at 1.7 meters above the baseline. There are two (2) decks below the bulkhead deck, and three (3) decks above the bulkhead deck for a total of five (5) decks.

The vessel is transversely framed, with the transverse frame spacing from frame 21 aft @ 500mm between frames 21-92 @ 700 mm and from frame 92 forward @ 500mm. (Frame 0 is at the rudder stock). Modified frame spacing may be agreed during the final stages of the project development always in agreement with the Classification Society requirements.

Below the bulkhead deck the vessel is divided into seven (7) watertight compartments, by six (6) watertight bulkheads. The watertight bulkheads are located at frame 108, 101, 83, 52, 47, 21. (Note: the aft bulkhead of the Bow Thruster room is a watertight bulkhead from the baseline to the underside of the Lower Deck, however it does not contain a watertight door).

The General Arrangement (dwg. # 172-02a & b) and Tank Capacity Plan (#172-25) should be utilized at this time to follow along with the description of the vessel as listed below.

3.2. SPECIFIC DESCRIPTION

3.2.1. Double Bottom &Tanks

Frame 108 is the collision bulkhead, forward of this bulkhead are two (2) Forepeak Ballast Tanks with the tank top at the Lower Deck Level. Frame 101 to 108 is the Bow Thruster Room, with the top of the compartment at the Lower Deck Level. There is a 1400mm wide by 700mm deep pipe tunnel that runs from the forward engine room bulkhead, frame 39 to frame 101.

Frame 101-108 & 93-100 are the Technical Fresh Water Tank integral with the hull and the tank top 1700mm above the baseline.

Frame 91-92 is the Grey Water Collecting Tank.

Frame 83-91 are the Diesel Oil Tanks No. 1 Port, Center and Starboard.

Frame 70-82 are the Diesel Oil Tanks No. 2 Port-Center, Center and Starboard-Center with outer tank boundaries 3500 mm & 2100 mm off centerline.

Frame 70-82 of Diesel Oil Tanks No. 2 Port-Center and Starboard-Center are the Sea Water Ballast Tanks No. 1 Wing-Port and Wing-Starboard.

Frame 58-70 are the Diesel Oil Tanks No. 3 Port-Center, Center and Starboard-Center with outer tank boundaries 3500 mm & 2100 mm off centerline.

Frame 58-70 outboard of Diesel Oil Tanks No. 3 Port-Center and Starboard-Center are the Sea Water Ballast Tanks No. 2 Wing-Port and Wing-Starboard.

Frame 48-57 are the Diesel Oil Tanks No. 4 Port-Center and Starboard-Center with outer tank boundaries 3500 mm & 2100 mm off centerline.

Frame 48-57 is the Grey Water collecting tank Center with outer tank boundaries at 2100 mm off centerline.

Frame 48-57 outboard of Diesel Oil Tanks No. 4 Port-Center and Starboard-Center are the Sea Water Ballast Tanks No. 3 Wing-Port and Wing-Starboard.

Frame 41-47 is the Diesel Oil Overflow Tank Center with outer tank boundaries at 2100 mm off CL.

Frame 39-41 are the Dirty Lub Oil Collecting Tank Center Port-Center and the Diesel Oil Drain Tank Starboard-Center with outer tank boundaries at 2100 mm off Centerline.

Frame 39-47 outboard of Center Tanks are the Sludge Tank Port-Center and the Bilge Collecting Tank Starboard Center with outer boundaries at 3500 mm off Centerline.

Frame 39-47 outboard of Bilge Collecting Tank and Sludge Tank are the Sea Water Ballast Tanks No. 4 Wing-Port and Wing-Starboard.

Frame 32-38 are the Sea Water Ballast Tanks No. 5 Port, Center and Starboard.

Frame 21-24 is the Sea Water Ballast Tank No. 6 Center with Tank boundaries at 2100 mm off Centerline and Tank Top at 2100 mm above Baseline.

Frame 17-21 are the Technical Water Tanks Port-Center and Starboard-Center with Tank boundaries at 3500 mm off centerline and Tank Top at 3500 mm above Baseline.

Frame 14-17 are the Sea Water Ballast Tanks No. 7 Port-Center and Starboard-Center with tank boundaries at 2100 mm off Centerline and Tank Top at 3500 mm above Baseline.

Frame 05-21 with Tank Top at Lower Deck, Frames 47-48, 57-58, 82-83, 92-93 and 100-101 with Tank Top at 1700 mm above Baseline are void spaces.

3.2.2. Tanktop Deck

Frame 108 forward are the Forepeak Ballast Tanks. The bulbous bow is incorporated as part of the Forepeak Tanks.

Frame 101-108 is the Bowthruster Room with access from the Lower Deck.

Frame 93-101 Port is an "A class" emergency escape trunk with a normally closed "A class" fire door, extending up to the Main Deck, with access from Lower Deck.

Frame 83-101 are the Laundry and Ironing rooms.

Frame 83-88 ½ Port is a 2-person crew cabin, with bathroom, bunk beds, and locker.

Frame 88½ -91 Port is a storage locker for china, cutlery & miscellaneous domestic stores.

Frame 79-83 P&S contains two (2) crew cabins, each for 2 persons, with bathrooms, bunk beds, desk, chair and lockers.

Frame 75-79 Port is an "A class" emergency escape trunk with a normally closed "A class" fire door, extending up to the Main Deck, with access from Lower Deck.

Outboard of the staircase is the Wine Cellar. It shall be equipped with shelves, as well as temperature and humidity controls ensuring proper treatment of vintage wines

Frame 75-79 Starboard is a 2-person crew cabin, with bathroom, bunk beds, desk, chair, and locker.

Frame 71-75 Port & Starboard are two (2) three-bed crew cabins with bathroom, bunk beds, desk, chair, and locker.

Frame 67-71 Port & Starboard are two (2) four-bed crew cabins with bathroom, bunk beds, desk, chair, and locker.

Frame 59½-67 Port & Starboard are two (2) four-bed crew cabins with bathroom, bunk beds, desk, chair, and locker.

Frame 57-67 Port and Starboard are the Stabilizer Equipment compartments.

Frame 47-57 Starboard is the crew mess area with access to main service staircase (Fr. 52-57 Port), crew accommodation & Engine Room.

Frame 47-52 Port is the Fire Fighting Equipment room containing Hi-Fog Plant and a day head serving the engine room.

Frame 52-57 Port is the main crew staircase. Within this space is the main elevator (lift), and a food service lift at Frames 50½-52, sized to take warming ovens from the Tank-top Deck up to the Sun Deck, with access to the pantries on Main, Upper & Bridge Decks.
Frame 48½-50½ Port is a day head for the crew public areas.

Frame 21-39 is the Main Engine Room Lower Level. There is an 'A class' emergency escape trunk with a normally closed "A class" fire door, extending up to the Main Deck, with access from the Lower Deck at Frame 21-22½ Stbd.

The space aft of the aft engine room bulkhead at frame 05 will contain the steering gear, and some engine parts stores, with access through hatches on the Lower Deck.

3.2.3. Lower Deck

The Port & Starboard chain lockers are situated forward of frame 112.

Frame 95-108 contains storerooms as well as an "A class" staircase to the Main Deck above, and an "A class" trunk for access to the Bow Thruster Room below. There will be a hinged watertight hatch with coaming in this area for access to the Bow Thruster Room below. Frame 95-108 is the emergency escape trunk leading from Tank-top Deck to Main Deck.

Frame 91-102 Starboard is the Air Conditioning Plant Room.

Frame 91-100 Port is a single berth cabin for an officer with bathroom, bunk desk, chair, bed, and locker.

Frame 87-91 are two (2) cabins for one (1) officer each, complete with private head, double size bed, desk and clothing locker.

Frame 83-87 is the Passengers Gym area.

Frame 75-80 Port is an "A class" emergency escape trunk with a normally closed "A class" fire door, extending up to the Main Deck, with access from the Lower Deck.

The Spa is a major focal point of the vessel. The functions and decor are meant to rival that of any world class Spa. Frame 57-83 of the Lower Deck is dedicated to the Spa facilities. Watertight bulkheads bound the Roman Bath, which is to serve as the central focal point of the Spa. The area is to have marble floors. Port and Starboard of the Roman Bath are mirror image Men's & Women's changing facilities, including a sauna, steam room, Jacuzzi, lavatory, clothes lockers and showers. The area will have a beauty salon to starboard and a wet treatment and mud treatment area to port.

The reception area from Frame 57-60 will be bound to the main staircase. Frame 52-57 Port contains the main crew staircase, the main elevator, food lift and a hydraulic watertight shell door.

Frame 53-57 Starboard is the Main Passengers Staircase with direct access to Main Deck above.

Frame 47-57 Port is a refrigerated garbage space, which is to be constructed to meet VSPHS regulations.

Frame 47-57 Starboard is the refrigerated food storage area. The space is to be divided into separate storage areas.

Frame 39-47 is the Main Galley area. It is separated from adjacent spaces with "A" Class bulkheads and appropriate fire doors. The Galley shall have a tiled floor. Bulkheads and ceilings will be provided with stainless steel lining.

Frame 45½-47 Starboard is an "A class" emergency escape trunk with a normally closed fire door and direct access from the Main Deck.

Frame 21-39 is the upper main engine room. It will have a complete steel deck with an open platform deck in way of the Main Engines. The Starboard aft section is to be used as a workshop with access into the "A class" escape trunk that extends from Tank-top Deck to Main Deck. The aft port section of this space is the Engine Control area. The Control area will have air conditioning, sound insulation and windows for viewing the engine room and also a watertight door on Frame 19.

Frame 11-19 Port & Starboard will be the independent Potable Water Tanks.

Except for the potable water tanks, Frame 2-9 also includes at starboard side a guest changing room with W.C. and shower, diving equipment storage area

and at port side it includes an area for the central Hi-Fog system units, an area for storage of the engine room spare parts and a bunker station.

Between these and at Frame 2-11, there is a small bar, which will serve the guests in this area in combination with the watertight hydraulic door on the transom of the vessel (width: 2.5 m and height: 1.8 m approx.) and the swimming platform.

3.2.4. Main Deck

Main Deck is the Bulkhead Deck and Embarkation Deck. Frame 57 is a Main Vertical Zone bulkhead and divides the vessel into MVZ #1 forward and MVZ #2 aft.

Frame 112 - forward will serve as the anchor and line handling station. The deck will be covered with teak, fitted with stainless steel bits and hawse holes, and complete with two (2) anchor windlasses and mooring line winches.

Frame 105-112 Starboard is the boatswain locker. The aft bulkhead will have a manually closed fire door that will allow for emergency escape from the accommodation area to the open deck forward by way of the hatch on the Centerline of the vessel. There will be a hatch in this area for access to the bow thruster compartment.

A Fire Equipment Locker will be located in this area, as well as the "A class" enclosed staircase leading from the Lower Deck.

Frame 57-105 is the guest accommodation area with ten (10) guest staterooms for two (2) persons each. This section of the vessel will encompass the full beam. Each stateroom will have a king size bed, a flat screen television, desk & chair, sofa, built in cabinetry, walk in closet, head with shower, toilet bidet, tub, Jacuzzi tub and double sink. The decor will be

specified by the interior designer, however it is to be of first class standard and is to meet SOLAS fire regulations. Bathroom floors, counters tubs & shower bulkheads will be marble or equivalent stone. Stateroom carpets shall be delivered with SOLAS Certificates.

Frame 73-80 Starboard will be space utilized for air conditioning components, and the "A class" enclosed staircase from the Spa area terminates at frame 75-80 Port.

Frame 47-57 contains the main entrance foyer. The foyer is part of the main guest staircase that leads from the Lower Deck Spa area all the way up to the Bridge. There is a public head in the forward starboard section of the foyer. The port side of this area includes the guest lift, and the crew staircase. Also on the port side is a pantry, which will give access to the outside deck for the crew during normal operating conditions.

Frame 35-45½ Port & Starboard is the formal dining room, which will accommodate 36 guests.

Frame 45½ -47 Port & Starboard will house the engine room supply ventilation fans.

These fans will require a fire damper and the intake louvers will be fitted with weather-tight closing appliances to meet Load Line Regulations.

There is an exit from the emergency escape trunk at frame 45½-47 starboard.

The Main Salon is located from frame 17½-35 and will have a bar in the forward port section.

Frames 13-22½ outboard Port & Starboard will contain the staircase to the upper deck, the emergency escape trunk from the engine room and the engine room's ventilation exhaust ducts.

Frames 13-22½ outboard Port & Starboard will have deck lockers. The starboard locker will be a Fire Equipment Locker and have an International Shore Connection to the fire main.

The aft deck will have mooring equipment, including polished stainless steel bits and hawse holes, and capstans port and starboard.

The aft deck will serve as the embarkation deck and therefore the house side bulkheads from frame 57 aft. Note that the glass in these bulkheads can be "A-O" class with a dedicated hi-fog head for each window.

There are exterior stairs P&S leading down to the transom swim platform and also two exterior staircases P&S at frames 52-58 leading to the upper deck.

A built in seating arrangement on the centerline from Frame 2-3 shall be provided.

A boarding ladder is incorporated into the bulwarks at Frame 23-33, there is a boarding gate at the forward end of the ladder.

There is one (1) passerelle located in the transom, with boarding gate located in the Main Deck transom bulwark.

All exterior decks are to be covered with teak.

3.2.5. Upper Deck

Frame 100-111 Centerline is built-in exterior seating.

The Master Suite extends from frame 80-100. It includes a sitting room to port with desks, computers, furniture and a flat screen plasma television. The master bathroom is to Port and is finished in marble with elevated Jacuzzi tub, two vanity style sinks, a large shower, toilet and bidet. There are his & hers walk in closets at the entrance to the bathroom. The Master stateroom has panoramic windows encompassing the rounded house front. There is one (1) weather-tight door located at Frame 94 P. The master bed is a raised platform California King size. At the foot of the bed is a cabinet that contains a stereo, DVD and a flat screen plasma television. A remote controlled mechanism raises the TV set out of the top cabinet for viewing. Various seating and cabinetry will be as per interior designers details.

There is an emergency exit corridor at frame 75-76½ port side, to eliminate the dead end corridor as required by SOLAS regulations and a staircase exit on the Starboard side.

Frame 75½-84 Starboard and 57-75 contains five (5) guest staterooms for two (2) persons each. They are to be finished identical to the Main Deck guest staterooms, as per interior designer.

Frame 52-57 contains the Main Passenger staircase, the lift and the crew stairs, all bounded by "A class" bulkheads. Frame 48-52 Port is a service pantry and the food service lift. Opposite this space on the starboard side is a storage locker for cabin steward stores.

Frame 39-53 has lockers P&S for air conditioning equipment, engine room ventilation fans and deck lockers with manual watertight doors outboard.

Frame 27-39 contains a VIP guest stateroom for two persons with seating areas, desk, computer, furniture and a flat plasma screen TV. The bathroom is to Port side finished with marble with Jacuzzi tub, two vanity style sinks, a

large shower, toilet and bidet. There are walk-in closets at the entrance to the bathroom. The bed is a raised platform, king size. Various seating and cabinetry will be as per interiors designer's details.

There are two SOLAS approved Life Boats located Port and Starboard on frames 30-47. They will be launched by SOLAS approved double arm davits.

Also fitted on the aft deck P&S (frame 20-30) are the two open speedboats of the vessel. These will be launched by means of 2 pairs of telescopic type davits fitted on the lower side of the bridge deck.

There will be four (4) personal watercrafts with storage chocks located at frames 6 - 9.

Four (4) twelve-person SOLAS approved inflatable Life rafts are located at Frames 24-27 port and starboard. Life rafts will be equipped with hydrostatic release mechanisms and bulwarks in way will be hinged to fall down to facilitate launching.

There is a port centerline exterior stair at frame 20-25 leading to the Bridge Deck.

All exterior decks will be sheathed with teak.

3.2.6. Bridge Deck

Frame 75-84 is the Navigation Bridge. Combined with the port side Radio Room, the enclosed space is a SOLAS Control Station and will require the aft bulkhead to have appropriate "A class" insulation. In addition to navigation equipment, it will have the fire alarm, fire door, watertight door and sprinkler system panels, and controls for ventilation fans shut-off and the Public Address system. The console is to be situated forward for easy walk around access. There is an interior centerline fire door and two wing doors leading to the open deck. The wings are to be equipped with steering, throttle and bow thruster controls.

Frame 68-72 Port is the Chief Engineer's cabin with a queen size bed, head, shower, sink, locker desk and chair, finished as per interior designer.

Frame 68-72 Starboard is the Captain's cabin and office. The cabin is to be finished in a style similar to the Chief Engineer's cabin.

Frame 72-75 Starboard is the vessel's office and on the Port side a daily head for the bridge watch.

Frame 57-67 is the guest library with furniture, including also a separate business center, seating and cabinetry as per interior designer specifications.

Frame 52-57 is the Main passenger staircase, the crew staircase, (this is the upper termination of the crew staircase), and the lift.

Frame 46-52 Port is the main pantry used for serving full meals on the aft deck, by way of the port side deck. Alongside, there is a day head for guests' use.

Frame 32-52 is the Sky Lounge, with a bar in the aft starboard section, and it is to be finished as per interior designer specifications.

There is one (1) longitudinal exterior stair at the aft end of this area, connecting to the Sun Deck.

There are to be two (2) tables that are fitted with removable leaves accommodating eighteen (18) guests each. The tables can be broken down to have four (4) circular tables seating six (6) guests each.

All exterior decks will be sheathed with teak, except for the helicopter landing area.

3.2.7. Sun Deck

Frame 33-37 is a sunbathing area with a raised platform forward, accommodating two (2) Jacuzzis. Fixed seating is to be built in port and starboard.

Frame 52-57 is the upper termination of the Main guest staircase as well as the guest lift.

Frame 47-52 is the bar and the barbecue. The space is to be finished as per interior designer. There is a day head located at frame 52-55 Starboard.

The emergency diesel is located at frame 57-66 Port, with access from the open deck by way of a weather-tight door. The emergency switchboard is also located in this compartment.

There are two (2) lockers containing air-conditioning equipment on the starboard side at frame 49-66, with access from the open deck through a manual watertight door.

The aft deck has one (1) longitudinal exterior staircase leading down to the Bridge Deck.

All exterior decks will be sheathed with teak.

A circular raised deck located on the Centerline from frame 12½-25½ will serve as a helicopter landing area.

4. HULL

4.1. HULL DESIGN

4.1.1. Drawings Accompanying this Specification

The layout of the vessel is to be in accordance with the following drawings, which accompany this specification:

DRG NO.	TITLE
172-02a/02b	General Arrangement Plan
172-25	Capacity Plan

4.1.2. Principal Dimensions

The vessel is to have the following principal dimensions:

Length overall (L_{OA})	85.30m
Length between perpendiculars (L_{BP})	72.06m
Breadth (mld)	14.00m
Breadth (extreme)	14.44m
Depth (mld) to main Deck (amidships)	8.00m
Design draught	3.70m
Scantling draught (mld)	4.00m

The tween deck heights of the vessel are to be as shown in the accompanying General Arrangement Plan (dwg. # 172-02a & b). The minimum clear height in accommodation spaces below all obstructions is to be 2200mm and the max 2750mm.

4.1.3. Tank Capacities

The following tank capacities are to be provided:

Diesel Oil	280.28 m^3
Potable Fresh water	55.00 m^3
Technical Fresh Water	55.55 m^3
Grey Water	39.07 m^3
Lub Oil	2.34 m^3
Sludge	9.92 m^3
Seawater Ballast	224.87 m^3

4.1.4. Lines Design

The hull form is to be designed in line with the following parameters:

- The flare forward is not to be continuous. A knuckle is to be incorporated at Main deck level.
- No fo'c'sle is to be fitted.
- A transom stern and centreline skeg are to be fitted.
- The propeller clearance from the hull is to be approx. 500mm but in any event not less than 0.1 x propeller diameter.
- In view of the required position of the LCB, particular attention is to be paid to the flow at the aft end.
- Optimisation of resistance within the speed range, based on owner's requirements (15-19 knots) and of the alteration of the trim during sailing (10 – 20 knots).

4.1.4. Trim & Stability, Damage Stability

The following Trim & Stability conditions are to be forwarded for approval as preliminary conditions in the early stages of the design, and as final conditions following the inclining experiment.

- Full load departure and arrival
- Arrival and departure with liquid cargo only
- Arrival and departure – according to regulations
- Ballast departure and arrival
- Docking

Wind heeling calculations, in accordance with the latest IMO method are to be submitted.

Subdivision calculations and floodable length curves are to be submitted.

The vessel is to be constructed to a one-compartment standard of damage stability. Calculations covering the anticipated range of drafts and trims using the maximum permissible KG method are to be submitted.

Equivalent flooding calculations using IMO Regulations.

4.1.5. Model Tests

Model tests, which will take place in an established test tank, will be performed and their results will be delivered.

The tests to be performed are the following:

- Naked hull resistance.
- Resistance with appendages and openings.
- Propulsion with agreed model and stock propellers. Three-dimensional wake distribution.

- Wake field measurements.
- Aft part stream lines definition.
- Optimisation of V-brackets position.

4.1.6. Hull Machinery and Equipment

a. Watertight Doors & Controls

Hydraulically operated sliding watertight doors are to be fitted in the locations shown on the General Arrangement Plan (dwg. # 172-02a & b).

Locally, operation from both sides and remotely from the wheelhouse with open-close indication in a mimic diagram.

b. Steering Gear

For details of the design criteria for the steering gear see below.
The steering gear is to be of the rotary vane type having two hydraulic steering motors mounted one on each rudderstock with electrical synchronization. The motors are to be powered by electrically driven pumps. The main steering gear is to be arranged so as to obviate the requirement for an auxiliary system. Closing off selective hydraulic circuitry in the event of failure is to be automatic.

All instrumentation, alarms and control buttons are to be provided locally and in the wheelhouse. In the machinery control area only instrumentation and alarms are to be provided.
Provision is to be made for isolation, centring and locking amidships of each rudder independently. Stops are to be provided to limit rudder angles to 35 degrees each way.

Control of the steering gear is to be from:
- the auto pilot (2 channels)
- hand follow up control in wheelhouse console
- semi-manual control at the steering gear flat

- helm angle indicators are to be provided in the wheelhouse, bridge wings, machinery control area and steering gear flat.

c. Anchors, Cables and Stoppers

Two high holding power anchors are to be provided. They are to be stowed in shell anchor recesses covered by stainless steel 316.

Two stud link chain anchor cables of U2 grade steel, each of eight shackles in length are to be provided.

Each chain cable is to be led from the windlass through a chain stopper to the hawse pipe.

d. Deck Machinery

Deck machinery is to be electro-hydraulically operated with analogue power control.

The following items of equipment are to be fitted:

- Forward
  Two vertical spindle windlasses with declutching warping heads (bronze-stainless steel).

- Aft:
  Two mooring capstans (Bronze-stainless steel).

- Bow thrust unit
  The thrust unit is to be electrically driven with four-bladed controllable pitch propeller.

The power is 300 KW and control is to be effected from the wheelhouse and wing control consoles (P&S).

- Stabilizers

  Retractable fin type stabilizers are to be fitted. They are to be designed with the following parameters:

Ship Speed:	16 knots
Wave Slope Capacity:	1.3 – 5.0 degrees
EWS:	88%
GM:	1.5 m
Design Draught:	3.70 m

- Ship's Tender Davits

  On each side of the vessel, at the position of the tenders (upper deck), there will be installed 2 double pairs of tender davits (1 pair on each side). These will have electric motion and lifting capacity 2.5 tons at an opening of 2.0 m (from the side of the vessel).

  All the equipment specified here is to meet the operational criteria of the DNV Code for sea state 2 or 3, wind state 4 Beaufort.

- Inflatable Tender Crane

  One electro-hydraulic crane of compact design is to be installed on the bow deck.

  It is to have a lifting capacity of 0.6 tonnes SWL at 3.6m derrick opening.

  It will be telescopic (2.5 m closed position, 3.6 m open position), it will have rotation capacity 180º, lifting angle 60º and hoisting speed approx. 10m/min. at full load

- Lifts

  The accommodation lifts are to meet the operational criteria of DNV for sea state 2 – 3, wind Beaufort 4.

  The following lifts are to be fitted within the accommodation:

  - Guest lift suitable also for handicapped individuals
  - 1 Galley to pantries food lift

- Side Accommodation Ladder, Passarelle Ladder

  One hydraulic side accommodation ladder is to be supplied and fitted, installed so as to be stowed in a recess in the hull under the main deck.

  The ladder is to be of sufficient length to reach a position 900mm above the ballast arrival waterline at an angle of 55 degrees to the horizontal with an ability to rotate by 90 degrees.

  The net ladder width is to be minimum 750mm.

  One hydraulic passarelle ladder is to be supplied and fitted, installed so as to be stowed in the aft compartment. It will have a watertight door on the vessel's transom.

  Its net width will be minimum 750 mm and it will have an ability to rotate 90 degrees port or starboard with respect to the centreline.

  Its length will be such that it will allow access in case of berthing alongside by means of rotating.

  It will also have the ability of being lowered up to 20 degrees with respect to the horizontal.

Both ladders will be manufactured of stainless steel and teak.

4.1.7. Windows, Sidelights and Doors

Window sizes are to be in accordance with the General Arrangement Plan.

Sidelights below the main deck are to be fitted with deadlights.

Windows and sidelights are to have steel frames welded to the ship's structure and the deadlights are to be made of stainless steel or chrome-covered bronze.

Window shutters and deadlights are to be provided in accordance with regulatory requirements.

External weather-tight doors will be of steel with safety mechanisms and stainless steel hinges.

All guest exits will have a porthole or a window.

The external door of the upper saloon will be sliding with stainless steel frame, "Securit" glass and automatic operation.

5. LIFE SAVING APPLIANCES

5.1. GENERAL

Life saving appliances will be provided for a certified complement of 72 persons.

5.2. LIFEBOATS & DAVITS

Two SEL-R 7,4 FASSMER Life Boats, semi-enclosed type, 27 persons each will be installed together with davit system type D-NP 50.

According to regulations, the lifeboats can also be used as rescue boats and as vessel's service boats.

The will be equipped with diesel engines, with a maximum speed of 30 knots.

5.3. LIFERAFTS

2 x 12-person life rafts are to be provided on each side of the vessel.

5.4. PERSONAL LIFE SAVING APPLIANCES, BUOYANT APPARATUS

Lifebuoys are to be of the rigid polyurethane type. Two of the lifebuoys on the bridge wings are to be fitted with a quick release mechanism.

Personal lifejackets are to be stowed under the beds in the cabins. Excess lifejackets are to be stowed loose or in GRP boxes (according to their

location) to regulatory approval. Boxes are to have hinged lids with quick release catches.

5.5. VISUAL SIGNALS, LINE THROWING APPARATUS

Signal pyrotechnics and a line throwing appliance to rule requirements are to be supplied and stowed in ventilated and weather tight lockers.

5.6. TENDERS

Two approx. 7.00 LOA GRP – Diesel engine driven tenders will be supplied (Owner's supply).

6. FIRE PROTECTION

6.1. GENERAL

The vessel is to be protected in accordance with the SOLAS regulations. No material used for fire protection purposes is to contain asbestos. Additionally, all loose furnishings, floor coverings, draperies, curtains and other suspended textile materials are to have qualities of resistance to the propagation of flame to the satisfaction of the Flag Authority. The vessel accommodation is to be subdivided into two fire zones divided at Frame 57 from tank-top to sun deck.

6.2. FIRE DOORS

A system of fire doors is to be provided throughout the vessel located as shown on the General Arrangement plan (dwg. # 172-02a & b). Principal fire doors in alleyways and stairways are normally to be held open on a magnetic catch electrically operated.

Fire doors are to be grouped in the vertical fire zones and are to be capable of operation locally from both sides of the door and remote closure from the wheelhouse. The remote closing operation is to result in all doors in a particular zone operating together. Doors closed from a remote position are to be capable of being opened locally. All fire doors are to be fitted with self/closers.

Open/closed indicators for fire doors are to be provided in the wheelhouse.

6.3. FIRE DAMPERS AND SMOKE OUTLETS

Fire dampers are to be fitted to all ventilation systems as required by the regulations. These dampers are to be arranged on fusible links. The dampers are to be operable (i.e. opening and closing) from both sides of the fire division in every case and indication as to whether a damper is open or closed is to be fitted at each operating position.

Where dampers are hidden behind linings or ceilings an easily removable, identified hinged cover is to be provided in way of each damper manual operating position.

Where practicable all dampers are to be within reach from the deck. Operating positions are not to be obstructed by furniture, shelves, etc.

Covers within the accommodation are to be identified by IMO nameplates.

Manual dampers to main inlets and outlets are to have their operating position well identified and easily accessible. If flaps have wire, pneumatic or other forms of remote operation the mechanism is to be as simple as possible with a minimum number of pulleys, bends etc and are to be designed for easy maintenance. Remote positions are to be provided with damper position indicators and means of opening the damper.

6.4. EMERGENCY SHUTDOWN SYSTEMS

Emergency shutdown of fans providing ventilation to the machinery spaces and accommodation is to be provided. Control of the shutdown is to be from two separate locations, namely the wheelhouse and the emergency headquarters.

The necessary emergency stops and fuel shut-off valve controls for the machinery systems are also to be arranged outside the E/R.

6.5. FIRE AND WASH DECK SYSTEM

A pressurised fire and wash line main with a suitable number of valves and hydrants is to be provided throughout the vessel. Screw-down valves and cross over lines are to be fitted in suitable positions to allow sections to be closed down for maintenance and to ensure that failure of one part of the main does not render the system inoperative. Hydrants in accommodation spaces are to be recessed into the bulkhead boxes capable of carrying the hose and other local fire-fighting equipment.
Steel boxes are to be fitted adjacent to hydrants on the open deck for stowage of hoses and nozzles. All boxes are to have drainage holes and all doors are to be fitted with quick release catches
An international shore connection, port and starboard, is to be fitted in the fire and wash deck main.
Hawse pipe chain and anchor wash facilities with screw down isolating valves are to be arranged off this system. The chain lockers are to be drained by an ejector system driven by the fire and wash deck system.

Dual purposes nozzles, jet/spray, are to be provided throughout the vessel. Brass nozzles are to be provided in accommodation, machinery spaces and decks. All couplings are to be instantaneous.
Hoses are to be according to the Classification requirements.

6.6. FIRE ALARM & DETECTOR SYSTEM

An addressable type system to rule requirements is to be fitted. The system is to be zoned with detector panels located in the wheelhouse.

6.7. HI-FOG SYSTEM

A complete hi-fog system according to regulations will be installed.

The system will also fully cover the engine room.

6.8. PORTABLE EXTINGUISHERS, MISCELLANEOUS FIRE FIGHTING EQUIPMENT

A comprehensive outfit of fire fighting equipment is to be provided according to rule requirement and of a standard and quality consistent with the duties of the vessel. The equipment is to be stored on fitted racks and shelves in the emergency headquarters and other safety centres.
In accommodation spaces portable fire extinguishers are to be stored in recesses. In other areas extinguishers are to be placed in conspicuous positions and protected from the weather as far as possible.

6.9. MUSTERING

The mustering arrangement is to be approved by the regulatory authorities. Information concerning mustering is to be provided by notices fitted in each cabin, public area, corridor and in other locations, previous agreement with the competent authorities.

Framed plans providing full mustering information are to be provided in the wheelhouse, and the emergency headquarters in addition to those required by the regulatory authorities.

6.10. FIRE & SAFETY PLAN, DAMAGE CONTROL PLAN

A fire & safety plan showing the position of all fire extinguishers, fire safety centres, emergency shut down valves, fire alarms etc, suitably colour coded and showing fire bulkheads and emergency escape routes is to be submitted.
In addition a separate damage control plan is to be provided in accordance with rules and regulations.

7. CATHODIC PROTECTION

7.1. GENERAL

The cathodic protection of the vessel is going to be by zinc anodes. Special care must be taken in protecting efficiently propellers / rudders / bow thruster tunnel / stabilizer recesses-fins / sea chests.

Zinc anodes shall be attached with 316 St. Steel studs to the hull.

8. MACHINERY

8.1. INSTALLATION DESIGN

8.1.1. General

The machinery installation and that of the outfitting is to be in keeping with the overall standard of this luxury vessel. Machinery spaces are to be in accordance with the best modern practice. The main engine room in particular is to be regarded as a showpiece of the vessel.

The geared diesel propulsion machinery is to consist of two main engines burning diesel oil and connected through single-input, single-output gearboxes to controllable pitch propellers.

8.1.2 Machinery and Equipment Installation Requirements

The Builder is to ensure that the design and installation of the systems associated with all equipment and machinery throughout the vessel fully meet the requirements of the machinery and equipment designers.

8.1.3. Special Operational Requirements

Attention is to be given to the selection and design of equipment and systems to ensure that the machinery installation is well suited to the particular requirements of the intended service.

8.1.4. Economic Maintenance

To avoid unnecessary maintenance work, high quality standards are to be applied when selecting machinery, equipment and materials throughout the vessel.

Special attention is to be given to the arrangement of machinery, piping, ducting, cabling, light fittings, ladders, handrails, floor plates, gratings, alarms, fire detectors, control panels, starters and other such fittings so that all routine In-service inspection, maintenance and the majority of survey requirements can be carried out by the ship's staff with the minimum expenditure of manpower and minimum requirements for external assistance within practical limits. In particular materials handling systems are to be designed and provided so that heavy machinery parts can be readily moved around the machinery spaces, Including workshops and storage areas, and to and from the quayside using the ships own gear.

8.1.5. Machinery Installation

The machinery installation is to be designed, constructed, installed and commissioned to satisfy the requirements of DNV.

8.1.6. Pollution

All arrangements will be provided for achieving compliance with the specified pollution regulations for oily bilge water, oil sludge, sewage, gray water and garbage.

Special attention is to be given to the reduction of smoke emission from the main and auxiliary engines and from the hot water boiler under all operating conditions. Proposals from the manufacturers of these Items of equipment for reducing or eliminating smoke and particle emissions are to be obtained and

discussed with the Owner before ordering equipment. The requirements of Annex VI of MARPOL 73/78 shall apply to all gaseous emissions.

8.1.7. Machinery and Tank list

The list below summarizes the main machinery items and tanks. Similar equipment attached to items of machinery, e.g. pumps, filters, coolers are not included separately in this list. Additional items of equipment, systems and tanks may be required as a result of design development.

Principal Machinery:

- Main engines
- Gearboxes
- Diesel alternators
- Propellers
- Emergency alternator

Pumps, Compressors and Fans:

- 1 Bilge and ballast pump
- 1 Bilge/ballast and fire pump
- 1 Bilge and fire pump
- 1 Emergency bilge pump
- 1 Emergency fire pump
- 2 F.O. transfer pumps
- 1 Main sludge pump
- Oil/Water separator
- 2 Chilled FW pumps
- 2 SW A/C pumps
- 1 Aux. SW M/E/GS pump
- 1 SW cooling pump for provisions plant
- 2 SW cooling pumps for gear cooling
- 2 Sludge pumps for sewage system

- 1 Grey water transfer pump
- 2 Hydrophore pressure unit pumps (for potable water)
- 2 Hydrophore pressure unit pumps (for technical water)
- 3 Hot water circulating pumps for potable and technical water
- 2 Diesel oil separator pumps
- 1 Pressure keeping pump for fire line
- 2 Pre-Lub pumps
- 2 Stand-by Lub oil pumps
- 2 Stand-by Jacket water cooling pumps
- 2 Stand-by A/C cooler pumps
- 1 Oil-water separator
- 2 Reverse osmosis plants
- 1 Hydrophore pressure tank for potable water
- 1 Hydrophore pressure tank for technical water
- 1 Boiler for FW
- 2 FO separators
- 2 Air compressors
- 4 Air receivers
- 1 Vacuum collecting tank
- 1 Pressure vessel for fire system
- 2 F.W. heat exchangers
- 2 Jacket water heater modules
- 2 Expansion tanks
- 1 High fog system pump
- 2 F.W. pumps for SPA

Miscellaneous:

- 2 Main engine exhaust silencers
- 3 Auxiliary engine exhaust silencers
- 1 Emergency alternator silencer

- 1 Sewage treatment plant
- 1 Vacuum sewage transport system
- 1 Twin wheel grinder
- 1 Bench drilling machine
- 1 Electrical test panel
- 1 Arc welding set
- 1 Oxy-acetylene welding set
- 1 Heavy duty vice
- 1 Compactor
- 1 Shredder
- 1 Bottle crusher
- 3 Hand operated hoists and trolleys

Tanks:

- AC plant chilled water header tank
- FW cooling systems header tanks
- Diesel oil service tank
- Diesel oil overflow tank
- Waste oil tank
- Oil fuel sludge tank
- Lubricating oil storage tank
- Stern tube oil header tanks
- Galley waste tank

8.2. MAIN PROPULSION MACHINERY

8.2.1. Main Engines and Gearing

2 x CATERPILLAR 3606 diesel engines with power 2030 KW at 1000 RPM.

- On 3.50 m Draft estimated for full loaded condition without ballast:
  RPM 900 Power 2 x 1850 KW speed 16 Knots
  RPM 1000 Power 2 x 2030 KW speed 17 Knots

- On 3.77 m Draft estimated for full loaded condition with full ballast:
  RPM 900 Power 2 x 1850 KW speed 15.5 Knots
  RPM 1000 Power 2 x 2030 KW speed 16.3 Knots

The main engines will be installed with flexible couplings. Between the main engines and the gearboxes there will also be flexible couplings.

The engine and gearbox isolation systems are to include suitable flexible elements in all connecting pipe work.

8.2.2. Gearing

The gearing is to be single input, single output configuration. Each gearbox mounting system is to be designed to isolate gear frequencies but meet thrust transmission requirements.

Gear elements are to be single helical, hardened and ground and all output shaft bearings are to be plain bush type.

The gearing is to incorporate the following, per set:

- Thrust bearing to absorb the propeller thrust
- Integral oil sump
- Directly driven oil pump
- Oil cooler
- Duplex oil filters with magnetic inserts
- Friction clutch: The clutch is to be provided with local and remote control. The clutch engagement time is to be adjustable. Suitable Interlocks are to be provided to prevent inadvertent

operation of the clutch. The clutch is to disengage automatically on low pressure of the operating fluid.

Special attention is to be given to the provision of quiet gearing including high quality gear cutting and finishing, provision of cast iron, rather than fabricated casings and the selection of oil pumps with low noise characteristics.

8.2.3. Shafting System

It will be a controllable pitch propeller system (KAMEWA).

Its length will be approx. 12 m and the diameter of the propeller approx. 2600 mm.

Details of shaft alignment calculations and procedure, torsional, axial and lateral vibration calculations are to be carried out and submitted. The extent of vibration calculations is to be verified by measurements taken during sea-trials.

- **Shafting**

Each shaft system is to consist of a forged steel propeller shaft in accordance with the Classification Society requirements with an oil sleeve type hydraulic coupling at its forward end.

- **Stern tubes**

The propeller shafts are to run in oil filled fabricated steel stern tubes.

A white metal bearing is to be fitted in each V bracket. A steel cover is to be fitted between each V bracket and bossing. The aft end of the steel cover tube is to be bolted direct to the V bracket and the forward end is to be located at the aft end of the bossing by a detachable retaining ring.

Bearing bushes are to be white metal lined cast iron and are to be fitted with anti-rotation dowels.

- **Stern Seals and Lubrication System**

Inner and outer stern tube seals are to be fitted. They are to be of a split type IHCSIMPLEX which eliminate the possibility of pollution of the sea by oil from the stern tube. The lubricating oil system for the stern tubes is to be pressurised by means of header tanks, one for each shaft system, in accordance with the seal manufacturers recommendations.

8.2.4. Propeller – Propeller Blades

The system incorporates quantity 4 propeller blades in each shaft system complete with a set of blade bolts with sealing rings to give a propeller diameter of approximately 2,700mm.

The blades will be of a high skew profile tailor made for the ship in accordance with modern hydrodynamic theory for optimum efficiency, minimum cavitation and low noise level. Blade design is optimised for the vessel's operating service profile, which is required from the shipyard or owner within three weeks of order confirmation.

The propeller is designed for operation in open water i.e. without a nozzle.

8.3. HEATING SERVICES

All water and air heating will be effected by hot water.

Preheating heat exchangers will be installed that will use the generator cooling water, as well as electric boiler and water heating.

8.4. GENERATORS

8.4.1. Alternator Sizing

The diesel alternator sets and all associated equipment are to be designed such that they can fulfil the following duties:

NO. OF SETS IN USE	DUTY
2	All loads
1	Stand-by
1	Emergency generator

An automatic load bank is to be provided of about 500 Kw capacity to maintain the load.

8.4.2. Diesel Alternator Sets

The diesel alternator sets are CATERPILLAR type 3412 TA.

The diesel alternator sets are to be driven by turbocharged, in line, marine diesel engines having a maximum speed of 1,500 rpm.

The engines are to be provided with electronic governors and the engine manufacturers recommendations for minimising engine fouling problems due to low load running are to be incorporated. Engines are to be selected with special regard to minimising smoke and particle emissions when required to run at low loads for protracted periods.

Engines are to be provided with hand pumps to discharge oil from the engine sumps to the waste oil tank.

8.4.3. Emergency Diesel Alternator Set

The engine driving the emergency alternator set is to be a four stroke turbo charged diesel, radiator cooled, running at 1500 rpm maximum.

The alternator set is to be installed on flexible mounts. All piping connections to the set are to be provided with flexible sections.

The alternator set is to be provided with means for automatic starting in the event of mains power failure. Two approved methods of starting to be provided.

8.5. EQUIPMENT AND MATERIALS

These general requirements are to be applied as relevant to all equipment and materials throughout the vessel recognizing their limited application to standard components of package units.

All pumps; compressors, filters, heat exchangers, auxiliary machinery and other equipment are to be fitted with engraved brass name plates giving principal data such as manufacturer, capacity, head, pressure, temperature, volume, surface area, rpm, type number and serial number as appropriate. These name plates are not to be obscured by paint, Insulation, structure or other equipment.

It is the responsibility of the Builder to ensure that the suppliers of any equipment which may affect the noise and vibration characteristics of the vessel are aware of and can comply with the relevant section of the specification concerning Noise and Vibration before an order is placed.

The above sector includes:

- Pumps
- Compressors
- Purifiers, filters, strainers
- Water makers (R.O. plant)
- Heat exchangers
- Fuel Oil Tanks Equipment
- Fans

8.6. ENGINE SERVICE SYSTEMS

8.6.1. General

This section describes the systems associated directly with the main and auxiliary engines. The Builder is required to ensure that the design and installation of these systems fully meets the requirements of the equipment designers.

- **Diesel**

The main engines are to be suitable for and arranged to operate on distillate diesel oil.

The auxiliary engines and the incinerator are also to be arranged to run on distillate diesel oil.

The emergency alternator engine is to be arranged to run on diesel oil.

Connections are to be provided throughout the fuel systems to facilitate the taking of representative samples of oil.

- **Storage and Transfer**

Diesel oil is to be taken on board through one oil fuel filling stations located at the aft part of the vessel, provided with deep drip-trays of a minimum capacity 25 lts.

- **Treatment**

Two diesel oil purifier and are to be arranged in a well lit and well ventilated area of the engine room.

- **Fuel Supply Systems**

Separate supplies of diesel oil are to be provided from the diesel oil service tank for the main engines, auxiliary engines.

8.6.2. Cooling Systems – General

Two fresh water cooling systems are to be provided. A main engine fresh water cooling system is to provide cooling to each main engine. An auxiliary cooling system is to provide cooling for the auxiliary engines and other auxiliary machinery, e.g. Gearboxes, shaft bearings, hydraulic power packs. The main engine system is to comprise two sea water/fresh water coolers, each sized to meet the cooling requirements of one main engine. The fresh water cooling pumps are to be engine driven.

8.6.3. Sea Water Cooling System

Two main sea water cooling pumps and two air conditioning chiller sea water pumps are to be fitted.

The main sea water pumps are to circulate both main engine and the auxiliary IT coolers. In port the auxiliary LT coolers are to be normally circulated by a bilge and OS pump with the other bilge and GS pump acting as standby.

Sea suctions are to be provided on each side of the vessel. Each inlet is to be sized to pass 100% of the maximum flow through the suction main. The size of the main is to be capable of meeting the demand with the relative pumps in use simultaneously.

The number of shell penetrations for sea chests and overboard discharges is to be kept to a minimum

8.6.4. Fresh Water Cooling Systems

- **Main Engine Cooling System**

Each main engine is to have its own independent cooling system. Each system is to include one engine driven circulating pump and one seawater cooler mounted off the engine.

- **Auxiliary Cooling System**

Each auxiliary engine is to have Its own independent cooling system connected to two sea water/fresh water coolers which are common with the auxiliary cooling system. Each system is to comprise one engine driven circulating pump, one lubricating oil cooler and one charge air cooler.

8.6.5. Lubricating Oil Systems

Each main engine is to be provided with its own engine driven main lubricating oil pump and a hand pump to transfer the contents of the sump to the waste oil tank.

8.6.6. Compressed Air System

See adjoining compressed air system schematic.

The compressed air system is to provide a supply at 120 PSI for engine starting, ship services and control air. The two air compressors are to be screw type and resiliently mounted in acoustic enclosures.

The systems are to be supplied from two air receivers, connected on the discharge side and either compressor is to be capable of filling either receiver. Each air receiver is to be sized to provide a minimum of twelve main engine starts.

8.6.7. Exhaust Systems

- **Main Engine Exhaust System**

The main engines are to be provided with underwater exhaust systems, which are to be water cooled via sea water cooling spray rings fed from the main sea water pumps.

- **Auxiliary Exhaust Systems**

Exhaust gas lines for the three auxiliary diesel engines are to be provided with exhaust system on waterline level.

For the two out of the three auxiliary diesel engines, there will be given an alternative solution for exhaust system on the main mast on the flying bridge deck and at the highest possible position.

8.7. POLLUTION CONTROL

8.7.1. General

The Shipbuilder is to be aware and is to make allowance in the design that, in addition to IMO [Marpol] and USCG requirements regarding liquid effluent discharge, various local authorities in the Vessel's planned trading areas, particularly the Caribbean and USA Eastern Seaboard, operate "Zero Discharge" policies, which include black water, grey water, laundry discharge, galley discharge and oily bilge discharge. Adequate storage capacity for both treated and untreated effluent is to be provided so that the Vessel may exist for several days without discharging.

8.7.2. Oily Water Treatment

Oily bilge water is to be treated by an IMO and USCG approved separator system designed to treat 5.0 m^3 of oily bilge water per hour.

8.7.3. Waste Oil and Sludge Disposal

Waste oil and sludge is to be discharged by the waste oil pump to deck connections at the bunkering station for disposal ashore.

8.7.4.Sewage Treatment

A sewage system is to be provided to serve Owner's, Guest and Crew accommodation comprising approximately 43 toilets of the super silent type and 18 bidets.

8.7.5. Galley Waste

- **Organic Waste**

Organic waste is to be macerated in the galley prior to gravitating to a galley waste holding tank. The tank is to be provided with a macerating type discharge pump and water jetting connections. The tank is to be independent of the ship's structure, manufactured in stainless steel or GRP. Discharge is to be arranged on the port side aft of the main sea water inlet.

- **Inorganic Waste**

Combustible waste is to be collected in plastic bags in the galley and delivered to the garbage handling room.

Garbage to be compacted and held in a suitable storage area in the garbage room, which is to be chilled to a temperature of about 5^{o}C.

Bulky garbage from the stores area is to be shredded in the garbage handling room then bagged and if necessary stored before transfer ashore.

A compactor, shredder and bottle crusher are to be provided in the garbage handling room.

8.7.6. Garbage Treatment

A special area with garbage compactors (for wood, cardboard, fresh garbage) and refrigeration chamber for the fresh garbage on lower deck.

8.8. CONTROLS AND INSTRUMENTATION

8.8.1. General

All machinery spaces and services are to be operated as per Classification rule requirements.

Control and instrumentation equipment is to meet the relevant requirements of the current DNV Environmental Test Specifications. Wherever possible equipment having a DNV Type Approval Certificate is to be used.

All alarms, instrumentation and control systems are to be supplied by a voltage stabilised power source. The power supply units are to be duplicated to give an uninterrupted supply and an alarm on failure of an individual unit. Electrical supply to these units is to be duplicated with two separate dedicated supplies from the emergency switchboard. An emergency battery for these systems with an automatic charger is to provide an uninterrupted power supply.

All signals brought to the console in the MCR for data presentation and alarm purposes are to be transmitted by electrical or pneumatic means only.

8.8.2. Control Consoles

They will be installed in:

- Machinery control room
- Wheelhouse

8.8.3. Remote Control Systems

They will include:

Propulsion System Controls
Bow thrusters Control
Alternator Control
Emergency Alternator Control

Pumps Controls
Valves Controls
Steering Gear Control
Bow Thruster Control
Stabilizers Control
Process Controls
Steering Gear Controls

8.8.4. Machinery Alarm and Monitoring System

A comprehensive alarm, monitoring and control system is to be provided incorporating digital, analogue and switched sensors. The system will have approx. 1200 control and monitoring points, with central stations on the ERC and on the bridge of the vessel.

- **Alarm System Printer**

An alarm system printer is to be provided for event recording and data logging purposes.

An alarm channel tally plate is to be located next to the printer.

- **Engineers Extension Alarm System**

An extension of the machinery alarm system is to be provided for periods when the machinery spaces are unmanned.

- **Engineers Emergency Call System**

A switch with protective hinged cover is to be provided on the MCR console, to enable the watch keeper to summon assistance in an emergency by sounding a distinctive audible alarm in the wheelhouse, crew accommodation and throughout the machinery spaces.

9. PIPING

9.1. GENERAL

The present specification concerns the construction and fitting of the Piping systems mentioned here bellow:

1. BILGE & S.W. BALLAST PIPING SYSTEMS
2. FUEL OIL FILLING & TRANSFER PIPING SYSTEMS
3. AIR VENT, SOUNDING AND OVERFLOW PIPING SYSTEMS
4. FRESH WATER FILLING AND TRANSFER PIPING SYSTEMS
   FRESH WATER PIPING SYSTEMS
5. FIRE LINE PIPING SYSTEM
6. GREY WATER PIPING SYSTEM
7. SEA WATER COOLING PIPING SYSTEM FOR MAIN ENGINES
8. FRESH WATER COOLING PIPING SYSTEM FOR MAIN ENGINES
9. FUEL OIL CONSUMPTION PIPING SYSTEM
10. LUBRICATION OIL PIPING SYSTEM
11. FUEL OIL PURIFICATION PIPING SYSTEM
12. BILGE OILY WATER SEPARATOR PIPING SYSTEM
13. STARTING & COMPRESSED AIR PIPING SYSTEMS

The works for the construction of the above mentioned piping systems will be executed in accordance with the relevant diagrammatic plans, the requirements of DNV, the standing SOLAS ‘74 requirements together with the recommendations of the engineers in charge based upon common shipyard practice.

The pipes, the type of the fittings and the kind of material to be used will comply with the European standards according to DIN and they will be of

marine type as described in detail in the system specifications and the relevant diagrammatic plans.

The system pipes, which are specified to be galvanized, will be hot deep galvanized after being formed and welded (on the spot welding on galvanized pipes will not be accepted).

The butt welds of the pipes will be realized on shaped ends, which will be 2.0 mm apart with a 30-degree shaping machine.

The penetration of the watertight bulkheads and decks by the pipes will be realized by means of welded pipe pieces with doubling and welded flanges or, where applicable, by means of rubber plug system.

The arrangement of the piping through the PIPE TUNNEL in the double bottom should be so as to take into consideration all the piping passing through it.

The piping systems will be installed in such a way as to facilitate their dismantling, their proper operation and the easy maintenance of the vessel.

All piping systems will be pressure tested at a pressure equivalent to 1,5 times the system operating pressure.

9.2. BILGE & SEAWATER BALLAST PIPING SYSTEMS

The BILGE & BALLAST system will be constructed in accordance with the Diagrammatic Drawings.

The pipes will be black seamless (According to DIN standards) 2448/1629/3 st.37 with the thickness as mentioned on the drawing.

All pipes will be deep hot galvanized after their shaping and welding (welding of galvanized pumps are not allowed).

All stop valves gate valves, swing check valves, filters, mud box, will be of European type, made of recognized manufacturers and in accordance with DIN standards.

The butterfly valves will be pneumatically remote operated and the ones fitted in the engine room will be equipped with a mechanism for on the spot operation.

The arrangement of the pipes will be realized in such a way as to make all areas accessible and their dismantling possible.

All piping systems will undergo a hydraulic test equivalent to 1,5 times the system operating pressure.

9.3. FUEL OIL FILLING &TRANSFER PIPING SYSTEMS

The FUEL OIL FILLING & TRANSFER piping system will be constructed according to the drawings.

The pipes will be seamless black steel (According to DIN standards) 2448/1629/3 st.37 with the thickness as mentioned on the drawing.

The valves, filters etc. will be European type made of cast or forged iron with stainless steel internal parts (cast iron / stainless steel or Nodular cast iron / stainless steel) except for the Quick closing valves which must be made of steel (Cast steel / stainless steel).

9.4. AIR VENT, SOUNDING AND OVERFLOW PIPING

SYSTEMS

The tanks AIR VENT, SOUNDING AND OVERFLOW PIPING SYSTEMS will be constructed according to drawings.

The fuel oil tank overflow and sounding system line pipes will be seamless black steel pipes (seamless steel tubes acc. To DIN standards) 2448/1629/3 st.37 with thickness as mentioned on the drawing.

The fuel oil tanks are ventilated through the overflow system.

The air vent and sounding system line pipes from the ballast, potable fresh water tanks, the cofferdams and void spaces will be seamless black steel (according to DIN standards) 2448/1629/3 st.37 with the thickness reported on the drawings.

These pipes will be hot galvanized after forming and bending (welding of galvanized pipes is not allowed).

9.5. FRESH WATER FILLING AND TRANSFER PIPING SYSTEMS - FRESH WATER PIPING SYSTEMS

The FRESH WATER FILLING AND TRANSFER piping systems and the FRESH WATER piping systems will be constructed according to drawings.

The pipes in way of the Engine Room and the pipe tunnel will be stainless steel and in accommodation spaces they will be polypropylene random copolymer pipes and fittings.

All other pipes will be hot galvanized after their forming and welding (welding of galvanized pipes is not allowed).

The butterfly valves will be remotely operated (pneumatic operated) and those which are fitted in the engine room will have a mechanism for local operation.

9.6. FIRE LINE PIPING SYSTEM

The Fire main line piping system will be constructed according to the drawings.

The pipes will be seamless black steel (acc. to DIN standards 2448/1629/3 st.37), with the thickness mentioned on the drawing.

All pipes will be hot galvanized after their forming and welding (welding of galvanized pipes is not allowed).

The butterfly valves will be remotely operated (pneumatically) and those which will fitted in the engine room will bear a mechanism for local operation.

9.7. GRAY WATER PIPING SYSTEM

The Gray and Black water systems will be constructed according to the drawings.

The pipes are to be hot galvanized seamless black steel.

The butterfly valves will be remotely operated.

9.8. SEA WATER COOLING PIPING SYSTEM FOR MAIN ENGINES

The SEA WATER COOLING piping system will be constructed according to the drawings.

The pipes will be made of CuNi10Fe1Mn according to DIN 86087, except for the pipes which will be connected to the sea chests and the cross-over tunnel, for the suction necks from the cross-over tunnel and for the overboard discharges, which will be of heavy type black steel pipes according to DIN 2448/ St 37.0 with thickness as reported on the drawings.

All steel pipes will be deep hot galvanized after their shaping and welding (welding of pipes after their galvanization is not allowed).

The connection of the steel pipes will be realized by means of welded flanges according to DIN 2576, PN 10 Atm. For the CuNiFe1Mn pipes, the connection will be by means of CuNiFe1Mn necks and roll steel flanges according to DIN 86037 PN10.

On the CuNiFe1Mn pipelines, except for the cases where valves, filters etc. are to be fitted by means of flanges, the connections of lines may also be carried out by means of “STRAUB GRIP METAL couplings”.

The welding of the CuNiFe1Mn pipes will be carried out by applying the TIG welding procedure and with the use of inert gas for the filling of the pipe during the welding.

All valves will be of European type, in accordance to DIN standards, produced by recognized manufacturers. Globe valves and gate valves will be of bronze, ball valves will be AISI 316 and the overboard discharge valves will be of steel with stainless steel interiors (Cast steel/stainless steel). The butterfly valves will be cast iron or nodular cast iron, interior lining (NBR) and Al.-Bronze flap.

The arrangement of the pipes will be done in order to make their dismantling possible and all areas accessible.

The piping system will undergo a hydraulic test equivalent to 1,5 times the system operating pressure.

All flange connections including screws and nuts, between steel and copper-nickel iron pipes should be bridged with conventional isolating joints in order to avoid wear due to electrolysis.

The pipes supports will be fabricated with double shell type supports, double galvanized clamps and 2 mm thick flexible gaskets. The distance between the supports is determined in relation with the diameter of the pipe.

7.9. FRESH WATER COOLING PIPING SYSTEM FOR MAIN ENGINES

The FRESH WATER COOLING piping system will be constructed according to the drawings.

The pipes will be made of CuNi10Fe1Mn, according to DIN 86087.

The pipes will be connected by means of CuNiFe1Mn necks and roll steel flanges DIN 86037, PN10.

On the CuNiFe1Mn pipelines, except for the cases that valves, filters etc. are to be fitted connected by means of flanges, the connections of lines may also be realized by “STRAUB GRIP METAL couplings”.

The welding of the CuNiFe1Mn pipes will be carried out using the TIG welding procedure with the use of inert gas for the filling of the pipe during the welding.

All valves will be of European type, in accordance with the DIN standards, produced by recognized manufacturers. Globe valves will be made of Bronze and gate valves as well as ball valves will be of AISI 316. Butterfly valves will be made of cast iron or nodular cast iron with interior lining (NBR lining) and Al.-Bronze flap.

The arrangement of the pipes will be carried out in such a way as to make all areas accessible and their dismantling possible.

The piping system will undergo a hydraulic test equivalent to 1,5 times the system operating pressure.

All flange connections including screws and nuts, between steel and copper nickel iron pipes should be bridged with conventional isolating joints in order to avoid wear due to electrolysis.

The pipes supports will be realized with double shell type supports, double galvanized clamps and 2 mm thick flexible gaskets. The distance between the supports will be in accordance to the diameter of the pipe.

9.10. FUEL OIL CONSUMPTION PIPING SYSTEM

The FUEL OIL CONSUMPTION piping system will be constructed according to the drawings.

The pipes will be seamless black steel pipes according to DIN standards 2448/1629/3 St.37, with thickness mentioned on the drawings.

Flanges according to DIN 2576 will be used for the connection of pipes in the engine room.

Care must be taken so that pipe connections will not be fitted above electric boards, electric motors and in general near sources of heat.

9.11. LUBRICATION OIL PIPING SYSTEM

The LUBRICATION OIL piping system will be constructed according to the drawings.

The pipes, which are bigger than DN 40, will be seamless black steel pipes according to DIN2448/1629/3 st.37. Those that are smaller than DN 32 will be precision pipes according to DIN 2391. All will have thickness as specified on the drawings.

For the pipes connections there will be used:

- For the simple steel pipes: flanges according to DIN 2576
- For the precision pipes: “ERMETO” type connections

Care must be taken so that pipe connections will not be fitted above electric boards, electric motors and in general near sources of heat.

The valves, filters etc. will be of European type. Those smaller than DN 40 will be bronze and those bigger than DN 50 will be of cast or forged iron with stainless steel internal parts (cast iron / stainless steel or Nodular cast iron / stainless Steel), except for the quick closing valves on the storage tanks, which must be steel (cast steel / stainless steel).

The length of the pipes should be as small and with as few curves as possible and continuous upward direction in front of the pumps, so as to avoid cavitation of the pumps and to keep the pressure drop low in the suction.

After their construction and welding, the pipes will undergo internal cleaning with acid, they will be flushed, oiled and then plugged with protective plugs until the time that they will be fitted onboard at which time they are unplugged.

After completion of its installation and before the commencement of its operation, the lubrication oil system will undergo internal flushing with separate re-circulation pump and filter for thorough cleansing of the system.

Care must be taken so that pipes will not be fitted above electric boards, electric motors and in general near sources of heat.

9.12. FUEL OIL PURIFICATION PIPING SYSTEM

The FUEL OIL PURIFICATION piping system will be constructed according to drawings

The pipes will be black seamless pipes according to DIN standards 2448/1629/3 st.37 with the thickness mentioned on the drawings.

The valves, filters etc. will be European type, made of cast or forged iron with stainless steel internal parts (cast iron / stainless steel or Nodular cast iron / stainless steel).

Flanges according to DIN 2576 will be used for the connection of pipes inside the engine room.

Care must be taken so that pipe connections will not be fitted above electric boards, electric motors and in general near sources of heat.

9.13. BILGE OILY WATER SEPARATOR PIPING SYSTEM

The BILGE OILY WATER SEPARATOR piping system will be constructed according to the drawings.

The pipes will be black seamless pipes according to DIN standards 2448/1629/3 st.37 with the thickness mentioned in the drawing.

The valves, filters etc. will be of European type, made of cast or forged iron with stainless steel internal parts (cast iron / stainless steel or Nodular cast iron / stainless Steel).

Flanges according to DIN 2576 will be used for the connection of pipes inside the engine room.

Care must be taken so that pipe connections will not be fitted above electric boards, electric motors and in general near sources of heat.

9.14. STARTING & COMPRESSED AIR PIPING SYSTEMS

The STARTING & COMPRESSED AIR piping systems will be constructed according to the drawings.

The pipes which are larger than DN 32 will be seamless black steel (according to DIN standard 2448/1629/3 st.37). Those that are smaller than DN 25 will be precision pipes and will have thickness as mentioned in the drawings.

The valves, filters etc. will be European type, made of cast or forged iron with stainless steel internal parts (cast iron / stainless steel or Nodular cast iron / stainless Steel).

For the connection of the pipes there will be used:

- For the simple steel pipes: flanges according to DIN 2576 PN 40 ATM.
- For the precision pipes: “ERMETO” type connections

10. ELECTRICAL

10.1. GENERAL

The Electrical Installation complies with the DET NORSKE VERITAS rules, the SOLAS 74 in force and the Statutory Requirements.
The Electrical System will be insulated from the ship's hull.
Continuous Earth Monitoring System shall be installed in the 380V and 220V Main and Emergency systems, giving audible and visual alarm through the Engine Room Monitoring and Alarm System.
The installation of all the electrical equipment shall be designed for unrestricted parallel operation of all the vessel's Main Generators and rated to withstand the thermal and mechanical stresses of the maximum short circuit fault currents at the Main and Emergency Switchboards.
The system protection devices shall be coordinated to give adequate discrimination for all essential circuits.
All electrical equipment shall be constructed in such way as to prevent accidental touching of live parts.

10.2. POWER SYSTEMS

The electrical power systems used, are as follows:

Main power	380 V ac 3 phase 50 Hz
Emergency Power	380 V ac 3 phase 50 Hz
Main & Emergency Lighting	220 V ac 3 phase 50Hz
Main & Emergency Lighting Final sub-circuits	220 V ac 2 phase 50Hz

Heaters	
i. Large capacity	380 V ac 3 phases
ii. Low capacity	380 V ac 2 phases
Automation and Alarms	220 V ac 3 or 2 phases, or 24 V dc
Internal Communication	220 V ac 2 phases or 24 V dc
Navigation Equipment	380 V ac 3 phases, 220 V ac 3 or 2 Phases or 24 V dc

Radio Equipment	380 V ac 3 phases, 220 V ac 2 Phases, 24 V dc
Small passenger appliances	110 V ac 60 Hz through converter

Distribution. The distribution shall be as follows:

i. For 380 V 3 phase: three or four wire. The fourth being used for earth.
ii. For 220 V 3 phase: three or four wire. The fourth being used for earth
iii. For 220 V 2 phase: three wires. The third being used for earth.
iv. For 110 V ac 60 Hz: three wires. The third being used for earth.
v. For 24 V dc: two wire.

All cables for power and lighting purposes, unless otherwise specified shall be with stranded conductors Ethylene Propylene Rubber insulated and Halogen free sheathing (Ethylene copolymers), temperature class 85°C. In spaces where mechanical protection is required the cables shall be with wire braiding and overall sheathing.

All special cables required for various equipment shall be in accordance with the relevant equipment manufacturer's requirements.

Earthing

All electrical equipment enclosures shall be earthed in accordance with the Rules and Regulations.

10. 3. ELECTRIC POWER SOURCES

The main power shall be generated from three Diesel Alternators each 500 kW continuous rating, 380 V, 0.8pf ac., 50 Hz, 3 phase, insulated neutral and with static type Automatic Voltage Regulators (AVR). The three main Diesel Alternators shall be suitable for continuous parallel operation. They shall be of the brush-less type, Class "F" insulated.

The Alternators shall be fitted with anti-condensation heaters, and winding temperature sensors connected to the machinery monitoring and alarm system.

Two of the Main Diesel Alternators working in parallel at 85% load shall be capable of taking the load in “Normal at Sea”, Maneuvering without Bow thruster” and “At Anchor” conditions.

The third Diesel alternator shall be a spare one.

For the condition “Maneuvering with Bow Thruster”, the third Main Diesel Alternator (spare) shall be required to be paralleled with the other two.

Main Lighting Transformer

The Main Lighting Transformers 180 KVA, 380V/220V are of the dry type and consist of four 3-phase transformers.

Emergency Lighting Transformer

The Emergency Lighting Transformer 45 KVA, 380V/220V are of the dry type and consist of four 3-phase transformers.

Shore supply

One Shore power connection box shall be installed on the Aft part of the vessel, for 265kW 3 phase 380V, 50Hz shore supply.

24V dc supplied from batteries

Systems requiring 24V dc for operation under Emergency conditions, shall incorporate their own battery/charger systems (unless otherwise mentioned) with sufficient power to maintain their operation for the time required by the Rules and Regulations.

380V ac 50Hz to 110V ac 60Hz through power converter

The converter shall supply sockets in the passenger cabins for small passenger appliances.

10.4. POWER DISTRIBUTION

10.4.1. Main Power 380V ac 3 phase

The Main 380V ac 3 phase electric power is distributed through the Main Switchboard's power distribution section, the motor group starter section, the local motor starters and the distribution boards.

10.4.2. The Emergency Power

The Emergency power is distributed through the Emergency Switchboard located in the emergency Diesel–generator compartment and the Emergency distribution boards situated in various compartments. The Emergency Switchboard shall be interconnected to the Main Switchboard. The interconnection is so arranged through interlock that during Main Power failure, the Emergency Diesel Generator cannot supply the Main Switchboard. All equipment requiring emergency power are permanently connected to the Emergency Switchboard and shall be supplied with power during normal operation from the Main Switchboard through the interconnection.

10.5. LIGHTING

10.5.1. General

The lighting (lighting levels, type of fittings, types of control and positioning) in the guest accommodation areas and public spaces shall be in accordance to the Interior Designer's requirements, however the Rules and Regulations requirements will be in any case exceeded.
The GA of the Interior Designer will be the guiding plan.

- **Main lighting**

The main lighting shall be installed in all areas and shall cover 70% of the required total lighting. The main lighting shall be supplied from the main switchboard's 220V section through the main lighting distribution boards. The Main Lighting in public areas shall be supplied from at least two separate circuits.

- **Emergency lighting**

The emergency lighting shall be installed in all areas and it shall form part of the overall general lighting scheme covering approximately 30% of the required total lighting. During normal operation the emergency lighting shall be supplied from the main alternators through the emergency switchboard's 220V section and through the emergency lighting distribution boards. The Emergency Lighting in public areas shall be supplied from at least two separate circuits.
In all the guest staterooms and the crew cabins at least one lighting fitting shall be supplied from the emergency lighting system.

- **Transitional Lighting System**

The transitional lighting system shall be installed in all areas required by the Rules and Regulations. The Transitional Lighting Fittings are of the electronic type and they are equipped with one 18W fluorescent lamp supplied during Emergency situations by a rechargeable nickel/cadmium battery incorporated in the fitting.

- **Iluminated Sign system**

Emergency illuminated exit signs shall be installed at all emergency routes, stairways and muster stations throughout the accommodation areas, public areas, working areas, lift, etc.

- **Low location lights**

The Low Location Lights shall be supplied from the Emergency Distribution Boards. During emergency conditions the LLL shall be supplied from the rechargeable Gel type batteries, contained in the local power units.

11. AIR CONDITIONING, VENTILATION, INSULATION

11.1. AIR CONDITIONING

A complete Air Conditioning Plant will be installed onboard the vessel in order to guarantee the indoor climate in the accommodation areas as per the requirements of the design.
The Air Conditioning Plant will comprise different types of Air Conditioning systems as follows:

11.1.1. Air Conditioning Systems – Description

Category A: Guest Staterooms
(AC-EC.1.01, AC-EC.2.03 & AC-EC.2.04)
Single pipe A/C System with Enthalpy Exchanger, VAV & Electric re-heat in the cabin units will be installed.

During the summer period the fresh outside air is centrally treated in the AHU (Air Handling Unit), the outside air is filtered, pre-cooled and pre-dehumidified in the enthalpy recovery unit and then further cooled and de-humidified by the common cooling/heating coil.

During the winter period the fresh outside air is centrally treated in the AHU, The outside air is filtered, pre-heated and pre-humidified in the enthalpy recovery unit and then further pre-heated and humidified by the common cooling/heating coil.

The enthalpy recovery unit recovers part of the energy in the exhaust air.
To maintain constant static pressure in the pipe system, the supply and exhaust fans are provided with frequency converters controlled via a static pressure sensor in the discharge box of the air-handling unit.

All main supply and exhaust ducts will be fitted with silencers.
Fresh air intake and outlet ducts will be connected to corresponding grids and fitted with shut-off dampers.

Category B: Crew Cabins

(AC.2.01 & single fan EC.2.01)

Single pipe A/C System with air re-circulation (max. 50%) and manual airflow regulation in the cabin units will be installed.

During the summer period the fresh outside air is centrally treated in the AHU. The outside air is filtered, pre-cooled by mixing with re-circulated air and then further cooled and de-humidified by the common cooling/heating coil.

During the winter period the fresh outside air is centrally treated in the AHU. The outside air is filtered, pre-heated and pre-humidified by mixing it with re-circulated air and then fully heated and humidified by the common cooling/heating coil.

To maintain constant static pressure in the pipe system, the supply and exhaust fans are provided with frequency converters controlled via a static pressure sensor in the discharge box of the air-handling unit.
All main supply and exhaust ducts will be fitted with silencers.
Fresh air intake and outlet ducts will be connected to corresponding grids and fitted with shut-off dampers.

Category C: Public Areas

(AC-EC.1.02 & AC-EC.2.02)

A single duct, low/medium pressure A/C System with Enthalpy Exchanger and zone re-heaters will be installed for all public rooms and public spaces.

During the summer period the fresh outside air is centrally treated in the AHU, that is filtered, pre-cooled and pre-dehumidified in the enthalpy recovery unit

and then further cooled and de-humidified by the common cooling/heating coil and then, if necessary, reheated in the reheating zone.

During the winter period the fresh outside air is centrally treated in the AHU, that is filtered, pre-heated and pre-humidified in the enthalpy recovery unit and then further pre-heated up to the base temperature by the common cooling/heating coil and then reheated in the reheating zone.

The enthalpy recovery unit recovers part of the energy in the exhaust air.
AHU's supply and exhaust fan will be provided with two speed motors.
All main supply and exhaust ducts will be fitted with silencers.
Fresh air intake and outlet ducts will be connected to corresponding grids and fitted with shut-off dampers.

Category D: Staircases

(AC.1.03 & single fan EC.1.03)

A single duct, low/medium pressure A/C System with air re-circulation (max. 50%) will be installed in the Main Staircase.

During the summer period the fresh outside air is centrally treated in the AHU. The outside air is filtered, pre-cooled by mixing it with re-circulated air and then further cooled and de-humidified by the common cooling/heating coil.

During the winter period the fresh outside air is centrally treated in the AHU. The outside air is filtered, pre-heated and pre-humidified by mixing it with re-circulated air and then fully heated by the common cooling/heating coil.

All main supply and exhaust ducts will be fitted with silencers.
Fresh air intake and outlet ducts will be connected to corresponding grids and fitted with shut-off dampers.

Category E: Galley

(AC.1.04 & single fan EC.1.04)

A single duct, low/medium pressure A/C System with 100% fresh air is installed for the Galley.

The system will provide conditioned air to working areas. For comfort reasons, the supply air temperature is selected 10°C below outdoor temperature, minimum 20°C.

During the summer period the fresh outside air is centrally treated in the AHU. The outside air is filtered and then cooled and de-humidified by the common cooling/heating coil.

During the winter period the fresh outside air is centrally treated in the AHU, where is filtered and then fully heated.

Supply & exhaust fans will be provided with two speed motors.

11.1.2. Description of the Air Conditioning Plant

For the location of AHUs and single fans, the serviced areas and the proposed distribution and duct routing and sizing please refer to the One Line Diagrams of the Air Conditioning Plant (1st issue).

11.1.3. Air Handling Units (AHUs)

The Air Handling Units will be of marine type with frame and panels of stainless steel. Panels will be manufactured of double skin steel sheet with interposed mineral wool. The AHU will have soft rounded edges. The casing will be smooth on the inside, which will make it easy to clean.

Sections that require maintenance will have wide access doors for inspection and maintenance.

11.1.4. Single Fans

EC.1.03, EC.1.05, EC.2.05 & EC-2.06:
Centrifugal fan, single inlet, V-belt, electric motor – single speed,

EC.1.04:
Centrifugal fan, single inlet, V-belt, cleaning hatch, drain plug, electric motor – 2 speed,

EC.2.01:
Centrifugal fan, single inlet, V-belt, electric motor – single speed (to be controlled by frequency inverter).

11.1.5. Fan Coil Units (FCUs)

In areas where high and varying heat gradients appear (due to solar radiation, crowding of people, lights, installed equipment) the supply from the A/C Systems will be supplemented by FCUs (one or two in each case).

11.1.6. Fire & Shut-Off Dampers

Fire & Shut-off dampers will be installed in accordance with the Rule requirements.
Fire dampers will be made of galvanised steel, with Shut-off dampers of Stainless steel (AISI 316).

11.1.7. Electric Heaters

Electric Heaters will be installed.

11.2. WATER SYSTEMS

11.2.1. Cooling/Heating Water System

Chilled water

Two (2), R134A water chiller units (of 500kW cooling capacity each) will be installed in the Main Engine Room in order to supply with chilled water the cooling coils (air coolers) of the AHUs (8 pieces) and FCUs (6 pieces) via a two pipe Hydronic system.

- At outside conditions 38^0C/95%RH, the total cooling capacity of the cooling coils has been calculated to approx. 960kW.
- At outside conditions 35^0C/75%RH, the total cooling capacity of the cooling coils has been calculated to approx. 460kW.

Operation

The water is cooled down by the chiller units and supplied to the cooling coils, controlled by three-way valves.

The cooling coils are working with chilled water of approx. 6-12 ^{0}C.

Hot water

For heating, three (3) hot water heaters (with heating capacity of approx. 410 kW) equipped with oil burner will be installed in order to heat the water.

The hot water utilises the same piping and pumps by-passing the chillers units.

Heating water temperature approx. 40-35°C.

Operation

During winter mode when there is no demand for cooling the chiller units shut down and the water circulating through the Heater warms up.

The hot water (approx. 40°C) utilises the same piping system and serves the common cooling/heating coils of the AHUs and FCUs.

The switch over between summer/winter modes can be performed manually via corresponding butterfly valves.

11.2.2. Re-Heating Water System

Reheating water system has a separate circulating system.

11.2.3. Steam Humidification System

Steam suitable for humidification will be provided for the AHUs serving cabins.

11.2.4. Condensed Water Drainage Piping

Each cooling coil (AHU and FCU) will produce condensed water through the de-humidification of treated air.

11.3. CONTROL PHILOSOPHY

Each AC system is provided with a dedicated PLC (Programmable Logic Controller) built into the Starter Panel for the system.
Each controller locally controls and monitors the air handling process including the separate fans and dampers related to the system.
The controller can work autonomously in case of failure in the bus-system.

11.3.1. Guest Staterooms
(AC-EC.1.01, AC-EC.2.03 & AC-EC.2.04)

a) Cooling operation

The fresh outside air is centrally cooled and de-humidified in the enthalpy exchanger and the cooling coil of the AHU.

b) Heating operation

The fresh outside air is centrally pre-heated and humidified in the enthalpy exchanger, the preheating coil and the humidification sector of the AHU (common coil for cooling and preheating).

c) Pressure regulation

In order to keep constant static pressure in the pipe system, the speed of supply and exhaust fans is controlled via frequency converters.

d) Flow adjustment

During commissioning the basic settings of the design flow for each cabin unit will be adjusted by a hand-held terminal via a plug-in connection at the UP.

11.3.2. Crew Cabins

(AC.2.01 & single fan EC.2.01)

a) Cooling operation

The fresh outside air is centrally pre-treated by mixing it with re-circulated air and then cooled and the de-humidified in the cooling coil of the AHU.

b) Heating operation

The fresh outside air is centrally pre-treated by mixing it with re-circulated air and then fully heated and humidified in the heating coil and the humidification section of the AHU (common coil for cooling and heating).

c) Pressure regulation

In order to keep constant static pressure in the pipe system, the speed of supply and exhaust fans is controlled via frequency converters.

d) Flow adjustment

During commissioning the basic settings of the design flow for each cabin unit will be performed by the manual regulation damper built in the unit.

11.3.3. Public Areas
(AC-EC.1.02 & AC-EC.2.02)

a) Cooling Operation

The fresh outside air is centrally cooled and de-humidified in the enthalpy exchanger and the cooling coil of the AHU.

b) Heating Operation

The fresh outside air is centrally heated and humidified in the enthalpy exchanger and the heating coil of the AHU.

11.3.4 Stairs
(AC.1.03 & single fan EC.1.03)

a) Cooling operation

The fresh outside air is centrally pre-treated by mixing with re-circulated air and then cooled and de-humidified in the cooling coil of the AHU.

b) Heating operation

The fresh outside air is centrally pre-treated by mixing with re-circulated air and then fully heated in the heating coil of the AHU.

11.3.5. Galley
(AC.1.04 & single fan EC.1.04)

a) Cooling operation

100% fresh air is cooled by the cooling coil, provided with a 3-way automatic control valve to approx. 10°C below outdoor temperature, min. 20°C.

b) Heating operation

The air will be fully heated by the common cooling/heating coil up to the necessary supplied air temperature.

c) Air flow control

The fans can be switched on 1/1 – 2/3 speed, manually, directly from the room served.

11.3.6. Enthalpy Exchanger

a) Cooling operation

The exchanger will start pre-cooling the air when the outdoor air is 2°C warmer than the exhaust air.

b) Heating operation

The exchanger will start up at a pre-set temperature between approx. –5°C and +12°C in order to recover the grow of heat from persons, sun, and lighting before the preheating exchanger is switched on.

c) Speed guard relay

The exchanger has a time delay function of 20s in order to obviate alarm activation during start-up.

d) Purging

During periods when the exchanger is turned off, a time relay will start it up for 3 minutes each 6 hours.

11.3.7. Shut-Off Dampers

Shut-off Dampers controls and position indicators are to be installed throughout.

11.3.8. Fire Dampers

Fire Dampers controls and position indicators are to be installed throughout.

Local control, LED's, Remote control, Hardwired control and Interlocks from Fire Dampers are to be installed throughout.

11.3.9. Smoke Dampers

Each main duct (for supply or exhaust air) leaving the AC Station is provided with a manually regulating damper.

11.3.10. Freeze Guard

The pre-treatment coil is equipped with a temperature gauge signalling the low temperature of the water in the coil.

11.4. CLIMATIC CONDITIONS

Summer conditions:

Outside temperature	38.0 ^{o}C
Relative humidity	95.0 %
Inside temperature	24.0 ^{o}C
Relative humidity	50.0 %

In the galley the supply air temperature will be 10°C lower than the outside temperature. Minimum supply temperature will be 20°C.

Winter conditions:

Outside temperature	-10.0 ^{o}C
Inside temperature	24.0 ^{o}C

In the galley the supply air temperature will be 22°C.

Ref. 101325 Pa, 20^{o}C, 50%R.H., RHO = 1.2 kg/m3

Solar heat gain

Temperature difference due to solar radiation				
Time	Deckhead	Bulkhead Light	Bulkhead Dark	Glass
	^{o}C	^{o}C	^{o}C	W/m^{2}
8.00	12	16	29	240
10.00	12	16	29	240
12.00	12	16	29	240

11.5. DESIGN CRITERIA

Air Volume Ratio	**Outdoor Air**	**Recirculated Air**
Guest Staterooms	100%	0%
Crew cabins	50%	50%
Public spaces	100%	0%
Main stairs	50%	50%
Galley	100%	0%

Cooling Media : Chilled water 6/12 ^{o}C

(Pre)-Heating media: Hot water 40/35 ^{o}C

Re-Heating media : Hot water 80/60 ^{o}C

Fresh air per person: 30 m^3/h

11.6. MINIMUM AIR CHANGE RATES *(in times per hour)*

	Supply	Exhaust
Public spaces	15	15
Passenger cabins	8	15
Officers and crew cabins	8	15
Stairways	8	8
Public toilets	-	20
Lockers	-	5
Lounges, saloons, bars, cafes	15	15
Pantries	15	15
Galley	50	50
Laundry	20	22
Stores	10	10

11.7. VENTILATION GENERAL

11.7.1. Calculation of Air Flow Rates

The capacity of the ventilation plant has been designed in order to provide comfortable working conditions, to supply the necessary combustion air (where applicable) and to prevent heat sensitive apparatus overheating in the Main Engine room and the other Machinery spaces.

The calculation of Ventilation airflow rates has been performed according to ISO 8861 standard, based on manufacturer data for Main and Auxiliary engines and dissipated heat of other installed machinery.

11.7.2. Air Intake/Outlet Grids, Ducts and Air Distribution.

Air intake and outlet chambers to be equipped with sufficient drainage.

The thickness of air ducts to be abt. 2mm for main ducts depending on actual duct size.

Generally the air distribution inside machinery spaces will be arranged in way that acceptable air changes per hour can be reached in all areas and local hot / gas pockets be avoided.
The air shall be distributed in the engine room by ducts and rat proof meshes with manual regulating dampers (wherever necessary).

11.8. VENTILATION DESCRIPTION

Adequate ventilation will apply to all spaces stated below:

Main Engine Room

Engine Control

Stabilizer Compartments (PS & SB)

Bow Thruster Room

Motorboat Garage

Garbage Treatment Plant

Lockers

Boatswain's Stores

Hydraulic Unit Room

Emergency Generator

Stairs

Elevators

11.9. CONTROLS

The fans will be controlled in engine spaces locally.

11.10. INSULATION

11.10.1. Fire Insulation

Fire insulation for all accommodation, machinery, service and special category spaces as indicated in the G.A. plan (dwg. # 172-02a & b) will be according to SOLAS requirements for passenger vessels carrying not more than 36 passengers. All materials used will be type approved by class.

In conjunction with the construction method which will apply to all the above reported spaces.

11.10.2. Heat Insulation

All areas facing outwards will be insulated against heat transfer according to the standards required by the A/C installation. All materials to be used will be of approved type.

Special attention to be given for all enclosed spaces directly exposed to heat , taking into account extreme weather conditions (tropical zones, etc.).

11.10.3. Vibration and Noise Insulation

All spaces will be insulated according to the results of the noise and vibration analysis as well as DNV requirements for Passenger Noise and Comfort level V3.
Materials to be of approved type.

12. ELECTRONIC – COMMUNICATION – NAVIGATION EQUIPMENT

12.1. ELECTRONIC ENTERTAINMENT EQUIPMENT

The builder is to supply and install electronic entertainment equipment such as receivers, tuners, flat screen plasma televisions, computers and stereo equipment up to the value of EURO 460.000. Any excess amount shall be paid by the Owner.

12.1.2. Public address and Entertainment systems (PA)

The system shall be used for:

- Public address / general alarm distribution system
- Transmission of alarm and mute signals (SOLAS)
- Self surveillance of the broadcast system and failure indication
- Transmission of public address announcements
- Broadcast of ship's program and background music.

On the bridge there is an alarm unit connected to General Alarm and Fire Alarm, which has priority over all other units to give signals to PA loudspeakers and also to fire alarm bells. The override priorities of the system shall be as follows:

- Fire alarm
- General alarm
- Wheelhouse microphone broadcast

Loudspeakers shall be installed throughout the ship and shall be grouped according to the owner's specification and arranged to cover all guests and crew public and living areas (including alleyways and WCs), to broadcast announcements and alarms and background music, as well as technical and service areas where only announcements and alarms shall be broadcast.

Loudspeakers shall be installed in boxes integrated to ceiling panels (not above from panels), the positioning shall be such as to supply adequate levels

of sound. PA/GA sound levels shall meet regulations. The loudspeakers shall be of high quality.

The system shall be safeguarded against loss of any parts through provision of at least two separate loops in all areas covered and by incorporating two separate and independent amplifiers.

Local music systems shall be muted while GA signals and announcements are broadcasted.

The public address system shall be connected to the emergency source of power.

Broadcast equipment:

Equipment shall be arranged in racks and/or on consoles and shall include all necessary equipment such as:

- audio sources (autoreverse cassette players, multiple CD players, radio world receiver.)
- audio and audio / video matrix(xes) and/or patch panels
- public address distribution center
- power amplifiers with surveillance units,
- monitor units giving visual and audible failure alarms in the Wheelhouse, Reception desk and the ECR.

About 3 public address call stations shall be provided (wheelhouse, reception desk, ECR,) for announcements.

The system shall be so arranged that announcements can be made only to the following zones:

- All areas
- Ship’s staff
- Owner and Guest areas (protected against accidental operation)
- Muster stations
- Exterior Deck Areas

12.1.2. Central Antenna system

A central TV- and radio antenna system for distribution of antenna signals to the crew and officers cabins, messes, wheelhouse, ECR, and public areas.
The distribution network to be of the branch type so that a defect in one outlet does not effect the others.
Signal levels at antenna outlets to be between 66dBu and 80 dBu,
The antenna system consists of AM and FM antennas, one omnidirectional TV antenna, amplifiers and distribution network.
TV-sets

- 20” color sets for officers cabins
- 26” PAL color sets for the guests public areas
- 20” flat screen color sets for the guests rooms.

12.1.3. Electronic Entertainment Equipment

The receivers, tuners, and stereo equipment is to be of high quality

12.1.4. Internal Data systems

(a)

An Internal Data System shall be installed. The computer and peripheral devices shall be connected through a Local Area Network (LAN).
The Internal Data System shall include Computer with UPS, terminals and printers. The system shall provide various administrative functions, including inventory control.

(b)

A number of portable computers are to be supplied for the guests. The Portable computers should be capable of being connected to the LAN system.

12.2. COMMUNICATION EQUIPMENT

The builder is to supply (in accordance to SOLAS regulations) the equipment (Communication and Navigation Equipment) up to the value of EURO 290.000.

12.2.1. Sound powered telephones

12.2.2. Command talk-back telephones

12.2.3. Automatic telephone system

A digital PBX telephone system shall be installed. The system shall be equipped with the latest release of software, ISDN compatible, and shall be interfaced with the ship computer system. The capacity of the exchange shall be:

- seventy (70) extension lines for digital telephones
- five (5) extension lines for analogue telephones, telex, telefax and data connection
- two (2) shore connection lines
- five (5) satellite connection lines
- one (1) paging connection line
- one (1) operator console with printers
- one (1) line to public address system

Offices, Service areas, etc.:

Telephones will vary depending on the role of the person utilizing the set. The telephone system shall have the capability to tailor the Features and Service to the user's requirements.

System Features:

The telephone exchange shall be equipped with the hardware and software for the following functions:

- Recorded announcement
- Call Transfer
- Emergency Override capability

- Battery back- up (1 hours)
- Station hunting/forwarding

Recorded announcements:
Recorded announcements will be given to guests and public areas.
Telephones in the wheelhouse shall be suitable for console mounting and equipped with illuminated dial buttons.
A telephone shore connection box shall be installed at the aft part of the Lower Deck and shall be connected through permanent cable to the telephone exchange.

12.2.4. Paging system

A paging system (consisting of 12 pagers) shall be installed. The system shall be arranged for display paging.
The paging systems shall be supported by a UHF repeater system.
The radio paging system shall have 100 % coverage of the vessel with watertight door closed.
Hardwired paging phone for programming and direct paging calls shall be provided for the Bridge and the Engine control room.
The system shall be powered from the emergency switchboard.

12.2.5. UHF-telephones

A UHF Base station with antenna network shall be installed
All officers, (approx. 10) to be supplied with multi-channel UHF walkie-talkies, with charging facilities.
Two (2) Smoke masks equipped with microphone and “push to talk” shall be supplied.

12.2.6. GMDSS for A3 Area with one Inmarsat – C and one Telex unit comprising:

- 250W MH/HF GMDSS Transceiver with DSC Controller, including telex-teletype 24VDC
- Antenna for MH/HF Transmitting Whip
- Antenna for MH/MF Receiving Whip.
- Inmarsat C system with integrated GPS card, Antenna, Telex terminal 24VDC
- Two (2) simplex/semiduplex VHF with DSC
- Remote Distress Alarm Unit

12.2.7. VHF Radios

- Three (3) GMDSS Portable Maritime VHF waterproof Transceivers, complying with IMO / SOLAS / GMDSS regulations
- Eleven (11) Channels including emergency channel 16.
- One (1) portable VHF air band waterproof Transceiver, complying with IMO / SOLAS / GMDSS regulations
- Two (2) Channels 121,5 and 123,1 Mhz

12.2.8. Other equipment (in order to fulfill the requirements of SOLAS and GMDSS functions)

- One (1) NAVTEX receiver
- One (1) GMDSS alarm distress panel at the main navigation position
- Two (2) 1,6 Ghz EPIRB (one with hydrostatic release)
- Two (2) Radar Transponders
- One (1) Battery Power Supply
- Emergency light
- Radio room clock
- One (1) set of special cables, connectors and installation material,
- One (1) set of service tools and spares according to the rules.

- One (1) set of Instruction Manuals
- One (1) set of Radio Station Publications.

12.2.9. Antennas

The transmitter antennas shall be located to obtain optimum transmission and to avoid electromagnetic interface (EMI) distribution in the bridge superstructure. To reduce the impact of in - band or cross - band interface, all receiver antennas shall be installed according to the manufacturer's specifications, with optimum clearance from each other, preferably in the same vertical axle. Antenna cables shall be of the double screened and low-loss coaxial type.

12.2.10. Satellite Communication System

Inmarsat Stb-B SES

One (1) Complete Inmarsat Standard B Ship to Earth Station.
One (1) mufti-channel (4) or four (4) separate lines for telephone communication.
One (1) Laser type Group 3 telefax using normal sheet paper shall be provided.

With dual ID:

- First ID interfaced with PAX
- Second ID connected to FAX
- The local Data Network shall be possible to integrate the Inmarsat B SES arrangement, previous approval of Yard, Owner and competent Authorities.

12.2.11. Radio Console

The Radio Console shall have all necessary equipment, control units, displays, printers and VDUs ready installed.
The console shall be equipped with necessary power distribution panels, battery chargers, lights and instruments needed in GMDSS radio station.

12.3. NAVIGATION EQUIPMENT

12.3.1. One Magnetic steering compass with periscope and fluxgate transmitter off course alarm.

12.3.2. One Gyro Compass

- One (1) Master compass which may be integrated into the steering stand
- One (1) Power unit
- One (1) Repeater transmission amplifier
- One (1) Alarm unit
- One (1) Pelorus stand c/w bearing repeater and azimuth ring at conning position at centerline in Wheelhouse.
- Two (2) Pedestals or bulwark mounted brackets incorporating bearing repeater and azimuth bearing sights for port and starboard wing.
- One (1) Heading / rate of turn indicator at wheelhouse front
- One (1)Repeater at
  - Steering flat
  - Chartroom (digital)
  - Captain's Cabin (digital)
  - Staff Cabin (digital)
  - ECR (digital)
- The system shall feed data to the
  - Auto pilot
  - Radar (2)
  - Satellite navigator
  - Satellite communications terminal

Satellite tv terminal
Radio console
VDR
Three spares

12.3.3. Auto Pilot

One combined electric steering control and auto pilot incorporating automatic follow-up and non-follow-up controls for steering equipment.

12.3.4. Rudder Angle Indicators

Rudder angle indicator equipment is to be installed in accordance with the Hull section of the Specification. This system is to include:

1. Selsyn type transmitter located in the steering gear room
2. Watertight bulkhead mounting analogue indicators for the bridgewings (port and starboard) with internal illumination and integral dimming facilities
3. Deckhead mounted three-faced analogue indicator for the wheelhouse with internal illumination and remote dimming facility.
4. Flush mounting indicator mounted on the wheelhouse console with internal illumination and dimming facility (incorporated in the auto pilot console)
5. Flush mounting analogue Indicator in the machinery control console
6. Watertight bulkhead mounting analogue indicator with internal illumination in the steering gear compartment.

The system is to be supplied from the emergency switchboard. Indicators are to show clearly the angular position of the rudder in single degrees up to the maximum rudder angle, port and starboard.

12.3.5. Electromagnetic speed log:

- One (1) flush – fitting transducer
- One (1) sea valve/gate valve assembly
- One (1) main display unit mounted in the chart room
- One (1) output unit, capable of supplying all necessary navigation equipment
- One (1) digital repeater at
  - Wheelhouse console
  - Captain's cabin
  - Port & Stbd bridge wings
  - ECR
  - VDR
  - Three spares

12.3.6. Echo Sounder:

- One (1) main graphics display unit in the chart room
- Two (2) electronic units
- Two (2) transducers with sea chests (1 forward & 1 aft)
- One (1) digital repeater located at the wheelhouse console

12.3.7. Radar:

- "X" band scanner to be mounted incorporating "X" band transceiver
- One (1) radar with 12" display unit
- One (1) radar with 16" ARPA color display unit

12.3.8. Satellite Navigator:

- One (1) global positioning satellite navigator receiver.
- One (1) active antenna for inconspicuous mounting.

- The system shall be capable of connection to various navigation aids, through interfaces.

12.3.9. Weather Facsimile

- One (1) weather facsimile machine complete with internal fully synthesized solid state receiver and pre-programmable frequency memory
- One (1) receiver protection unit
- One (1) antenna

12.3.10. Wind Speed and Direction Indicator (Walker type)

- One (1) wind speed sensor on mast
- One (1) wind speed indicator in wheelhouse

12.3.11. Voyage Data Recorder (VDR)

- The VDR shall be connected (through interfaces) to the equipment foreseen by the Rules and Regulations.

12.3.12. Automatic Identification System

Comprising 8/12 channel D-GPS receiver
VHF data link transceiver

12.4. SECURITY EQUIPMENT

The builder is to supply the security equipment up to the value of EURO 115.000.

The above mentioned equipment includes:

12.4.1. Cameras and Monitoring Stations

Modern technology cameras will be installed at the stern of the vessel and also at the bow, on the main mast, in the side passageways of the main deck (P & S), in the engine room and in the lazaret area in order to monitor the aft door leading to the swimming platform.

Three (3) monitoring stations will be installed. One at the bridge, one in the crew mess room and the last at a position to be designated by the Owner.

12.4.2. Security Alarm Systems

An underwater surveillance system with indication of size-shape of the approaching object and alarm on the bridge will be installed for the monitoring of objects which approach the vessel underwater when she is not in motion.

Alarms and communication system at the entrances of the vessel (passarelle and side ladder) will also be installed.

13. INTERIORS

13.1. GENERAL

The layout of the vessel's interiors is to follow the drawings of the interior designer, which are attached. The drawings will include flooring, ceiling, paneling, furniture, loose furniture etc.

- All bulkheads shall meet the structural fire protection regulations as specified in SOLAS.

- All joiner bulkheads shall be of non-combustible material and delivered with SOLAS certificates.

- The quality of the interior of the entire vessel shall be of top quality.

- No space shall be left unused. Where reasonably possible the Contractor shall make all "dead" space suitable to be used for bookshelves, storage lockers, etc.

- The minimum headroom shall be 2200 mm for all spaces.

- The shipyard will ensure that the accommodation joinery shall be in no way stressed by flexing of the hull structure.

- All locker doors and drawers will have push-pull catches.

- Where glass is used in the joinery it will be tempered.

- Care will be taken that the joinery does not obstruct any equipment or

systems that require access.

- All upholstery and fabrics throughout shall comply with SOLAS regulations.

Owner and Guests Accommodation

- Rooms shall be decorated according to the selections of the interior designer and as per the general arrangement plan (dwg. # 172-02a & b).

Crew Quarters

- Rooms shall be decorated according to the selections of the interior designer and as per the general arrangement (dwg. # 172-02a & b).

13.2. FABRICS AND MATERIALS

13.2.1. Guest Suites

I. Bulkhead Surfaces:

A. Extrusions or sculptural forms are to be placed on each corner or the bulkheads. These are to be made of:

1. ROYAL
2. ROSSO PORTOGALLO
3. ISRAELI
4. CORIAN etc.

B. The bulkhead surfaces are to be made of:

i. Brushed Oak

ii. Painted Surfaces

C. Sandblasted panels with silver leaf patterns and Corian details.

II. Floor:

A. Carpet with exclusive patterns

B. Marble with borders

C. Corian with borders

III. Ceiling:

A. The ceiling will consist of painted surfaces, recessed ceilings covered with Alcandara, leather and wooden surfaces.

IV. Furniture:

A. Combination of classical and modern furniture will enhance the interior of the cabins.

* Furniture: These are to be made of brushed oak.
Some consoles will be decorated with corian.

V. Fabrics:

A. A great selection of fabrics will be used to enhance the interior. These will have to comply with the regulations.

13.2.2. Guest Suits - Bathrooms

I. Bulkheads:

- Marble with borders corian
- Mirror
- Glass Doors

II. Floor:

Marble with borders

- Royal
- Rosso Portogallo
- Israeli
- Corian

etc.

III. Ceiling:

- Painted Panels
- Mirrored Surfaces

IV. Vanities:

- Covered with marble and corian

* Lighting: All types of lighting will be used for the interior of the Guest Cabins such as:

- Floor lighting

- Spots
- P.L.
- Fiber Optics
- Fluorescent

13.2.3. Owner's Suite/Guest State Room

I. Bulkhead Surfaces:

A. Extrusions or sculptural forms are to be placed on each corner or the bulkheads. These are to be made of:

1. MAGAUBA
2. SILVER LEAF
3. CORIAN

The doors are to be covered with wood.

B. The bulkhead surfaces are to be made of:

i. Brushed Oak
ii. Fabrics
iii. Mirrors
iv. Sandblasted panels with silver leaf motives

II. Floor:

Britons fine carpets with exclusive patterns
Areas covered with marble and marble borders

III. Ceiling:

The ceiling will be enriched with alcandara surfaces, recessed lacquered panels and wooden elements.

IV. Furniture:

Classical and modern furniture will decorate the interior of the suite. These are to be made of brushed oak, corian and marble.

V. Fabrics:

A great selection of fabrics will be used to enhance the interior of the suite. These will have to comply with the regulations.

13.2.4. Owner's Suite - Guest Bathrooms

I. Bulkheads:

- The bulkheads will be faced with marble, corian and mirrors.

II. Floor:

Marble with borders

- Magauba
- Rosso Portogallo

or

- Corian with borders

III. Ceiling:

- Painted Panels
- Mirrored Surfaces
- Skylight

* Owner's Suite - Guest Stateroom Bathrooms

IV. Vanities:

- Faced with marble and corian

13.2.5. Lighting

All types of lighting will be used for the interior of these cabins such as:

- Floor lighting
- Spots
- P.L.
- Fiber Optics

- Fluorescent

13.2.6. Guest Saloons & Dining Areas

I. Bulkhead Surfaces:

Extrusions or sculptural forms are to be placed on each corner or the bulkheads. These will be made of:

- Marble
- Corian
- Silver leaf
- Perspex

Sliding glass panels with rich motives.

Bulkheads made of brushed oak.

Sand blasted doors.

II. Floor:

Britons fine carpets with exclusive patterns
Parquet flooring - Amtico etc.

III. Ceiling:

The ceiling will be enriched with alcandara surfaces, recessed lacquered, wooded, mirrored and glass elements.

IV. Furniture:

Classical and modern furniture will decorate the interior of the suite. These are to be made of brushed oak and decorate the interior plexiglas and corian will also be used.

V. Fabrics:

A selection of exclusive fabrics will enhance the guest and dining saloons.

VI. Lighting:

- Recessed fluorescent
- Lighting
- Spots
- P.I.
- Fiber optics
- Floor lighting

13.2.7. Wheelhouse

I. Bulkhead Surfaces:

1. Brushed oak veneers
2. Wooden extrusions
3. Stainless steel panel / column and accessories

Doors with brushed oak veneers

External glass doors.

Floor:

II. Teak flooring: It must comply with the regulation

III. Ceiling: Painted or alcandara panels

IV. Furniture: The consoles are to be made of wood and Stainless steel

V. Fabrics: The sofas are to be made of leather

VII. Lighting:

- Spots,
- Floor lighting
- Fiber optics
- P.L.

13.2.8. Guest Recreation Facilities

I. Bulkheads:

The bulkhead will faced with marble corian, mirrors, brushed oak Veneer, sandblasted class and smoked glass.

II. Floor:

- Marble flooring
- Parquet flooring - Amtico etc.

III. Ceiling:

Painted panels, recessed mirrored skylights are to be applied on the ceiling.

IV. Furniture:

Marble vanities, marble benches, wooden benches, gym. equipment, lazy chairs.

V. Lighting:

- Under water lighting.
- Floor lighting
- Fluorescent lighting
- Fiber optics
- Spots

- P.I.

13.2.9. Crew cabins

I. Bulkheads:

- Painted panels.
- Veneer panels.
- Mirrors.

II. Floor:

- Carpet

III. Ceiling:

- Painted panels

IV. Furniture:

- Modern furniture faced with veneer.

V. Fabrics:

- Selection of fabrics to enrich the interior.

11.2.10. Crew Bathrooms

I. Bulkheads:

- Formica- corian
- Sandblasted glass

II. Ceiling:

- Painted ceiling

III. Floor:

- Tiled floor

IV. Vanities:

- Lacquered with corian tops

13.2.11. Lighting

- Spots
- P.L.

13.2.12. Library

I. Bulkheads:

The bulkheads are to be faced with brushed oak veneers

The doors will be solid wood and their frames lacing marble.

II. Floor:

Parquet flooring with exclusive hand made carpets.

III. Ceiling:

Painted ceiling with wooded beams.

IV. Furniture:

Classical furniture made of solid wood & brushed oak veneers.

The fireplace will be faced with marble & wood

V. Fabrics:

Exclusive fabrics will enrich the interior, leather will also be used.

VI. Lighting:

- Wall lighting.
- Floor lighting spots.

13.2.13. Lobby

I. Bulkheads:

Extrusions or sculptural forms are to be placed on each corner of the bulkheads.

The bulkheads will be faced with marble and brushed oak veneers.

II. Floor:

Marble with borders

Types: Royal

Dionisos

Israeli

III. Ceiling:

Painted panels with recessed areas and wooden details.

IV. Furniture:

Consoles made of marble and wood.

V. Lighting:

- Floor lighting
- Fluorescent
- Spots

13.3. GALLEY - LAUNDRY - PANTRIES - REFRIGERATION

13.3.1. General

Vessel should be outfitted with 220V and 380V 50 Hz appliances. Electricity will be used for cooking. All equipment installed shall be easily accessible and removable for cleaning, maintenance and servicing. All equipment and installation should be USCG approved. Care shall be taken that sufficient ventilation is provided for all equipment.

13.3.2. Galley - Equipment List

i. Meat Preparation Area

- Sink
- Work table
- Refrigerator
- Chopping block
- Band saw
- Meat mincing machine
- Hand wash basin
- Cleaning locker

ii. Vegetable preparation

- Sink
- Work table
- Refrigerator
- Potato peeler
- Vegetable cutter
- Hand wash basin

- Cleaning locker

iii. Fish preparation

- Sink
- Work table
- Refrigerator
- Hand wash basin
- Cleaning locker

iv. Hot Galley

- Electric ranges
- Griddle plate
- Electric fryer
- Boiling pan
- Cupboards
- Combi oven
- Refrigerators
- Mixing machine
- Blast cheeler
- Bain Marie on heated cupboard
- Salamander
- Microwave oven
- Plate dispenser on castors
- Canopies
- Hand wash basin
- Cleaning locker

v. Cold Galley

- Refrigerators
- Sink
- Work table

- Cupboards
- Slicing machine
- Hand wash basin
- Cleaning locker

vi. Bakery

- Dough mixing machine
- Sink
- Work table
- Mixing machine
- Refrigerators
- Pastry oven
- Proover
- Ice cream machine
- Hand wash basin
- Cleaning locker

vii. Steward's Area

- Counter
- Coffee machine
- Toaster
- Ice cube machines
- Hand wash basin
- Cleaning locker

viii. Pot washing area

- Sink with 3 bowls (one with heating element)
- Tubular pot racks with 3 levels
- Waste disposer
- Work table
- Hand wash basin
- Cleaning locker

ix. Scullery

- Dish receiving table
- Waste disposer
- Sink
- Dish washing machines
- Glass washing machines
- Rack stand
- Plate storage racks
- Storage locker
- Hand wash basin
- Cleaning locker

13.3.3. Laundry - Equipment List

- Washers/Extractors (6) six
- Washers/Dryers (4) four
- Electric ironers (2) two
- Self contained utility press (1) one
- Basket scale (2) two
- Laundry truck (2) two

13.3.4. Pantries - Equipment List

i. Main Deck Pantry

- Mobile heated cart
- Wall cabinet
- Work counter
- Refrigerator
- Hand sink
- Coffee machine
- Toasters
- Milk heaters
- Juice dispensers
- Bain Maries
- Cold wells
- Ice making machine
- Dish washing machine

ii. Upper Deck Pantry

- Mobile heated cart
- Wall cabinet
- Work counter
- Refrigerator

- Hand sink
- Coffee machine
- Toasters
- Milk heaters
- Juice dispensers
- Bain Maries
- Cold wells
- Ice making machine
- Dish washing machine

iii. Top Deck Pantry

- Work counter
- Refrigerator
- Hand sink
- Coffee machine
- Toasters
- Milk heaters
- Juice dispensers
- Cold wells
- Ice making machine
- BBQ
- Glass washing machine

iv. Officer & Crew Mess Pantry

- Mobile heated cart
- Wall cabinet
- Work counter
- Refrigerator
- Hand sink
- Coffee machine
- Toasters

- Milk heaters
- Juice dispensers
- Bain Maries
- Cold wells
- Ice making machine
- Dish washing machine

13.3.5. Refrigeration - Equipment List

The refrigeration system will comply with the General Arrangement plan (dwg. # 172-02a & b) with regard to space and internal construction. Sanitary and draining system will be USCG approved and electrically powered by 220 or 380 V - 50 Hz.

- Meat refrigerator (walk-in space). Temp.: -20ºC (approx.)
- Fish refrigerator (walk-in space). Temp.: -20ºC (approx.)
- Vegetable refrigerator (walk-in space). Temp.: +2ºC up to +6ºC (approx.)
- Cheese-Milk refrigerator. Temp.: +2ºC up to +6ºC (approx.)
- Wine Cellar area.
- Garbage freezer (as described previously).

14. PAINT SYSTEM

14.1. GENERAL

The Contractor shall utilize a complete system to ensure that the products used are totally compatible. The Contractor shall be wholly responsible for the painting and fairing. All color schemes, styling lines and special features shall be detailed by the Naval Architect. The manufacturer's instructions will be strictly followed with regard to the stowage of all the material, the preparation of the surfaces and the application of the system. Particular consideration will be paid to climatic conditions, mixing ratios, dry-film thickness and overcoating times. Fairing is to be of the highest possible accuracy and quality finishing prior to paint application. The Contractor shall consult closely with the manufacturer and arrange inspections by a representative of the manufacturer. The paint will be applied by spray, and during the application and drying of the final finishes there shall be no other activity taking place in the vicinity which may cause undue dust. Burnishing of the paint is required to achieve the high standard of the final finish. All due care shall be exercised in eliminating unevenness in the superstructure sides, with suitable fairing compounds. The hull from waterline to sheer line shall be faired to remove any major unevenness. Exterior finish will be of good marine practice with finish coat to have a smooth, high gloss surface.

14.2. DESCRIPTION OF THE SYSTEM

14.2.1. General All Steel (External)

i. Blast to SA 2,5
ii. Shopprimer (Epoxy)
iii. Epoxy Anticorrosive to 150 m DFT

14.2.2. Hull Underwater

i. Epoxy Anticorrosive to 150 m DFT
ii. Epoxy Tie Coat to 100 m
iii. Antifouling SPC type to 250 m

14.2.3. Hull (Waterline and Over)

i. Epoxy Anticorrosive to 150 m DFT
ii. LW Epoxy Fairing Compound (as needed)
iii. Refinish Epoxy Filler
iv. Epoxy Primer
v. Sprayable Fairing Compound
vi. Epoxy Primer
vii. P/U Undercoat
viii. P/U Topcoat

Remark: All above mentioned stages are considering that the above system will be applied 80 cm below waterline excluding steps 7,8 and applied steps 2, 3 of underwater area.

14.2.4. Superstructure

i. LW Epoxy Fairing Compound (as needed)
ii. Refinish Epoxy Filler
iii. Epoxy Primer
iv. Sprayable Fairing Compound
v. Epoxy Primer
vi. P/U Undercoat
vii. P/U Topcoat

14.2.5. Aluminum Structures

i. Primer for Light Alloys
ii. Epoxy Primer
iii. LW Epoxy Fairing Compound (as needed)
iv. Refinish Epoxy Filler
v. Epoxy Primer
vi. Sprayable Fairing Compound
vii. Epoxy Primer
viii. P/U Undercoat
ix. P/U Topcoat

14.2.6. Internals (All except Tanks Bilges and Engine Room)

For the internals as already described sandblasting of SA 2 ½ is required prior using the following paints.

i. Water based Acrylic Primer 2 x 60 m DFT
ii. Water based Topcoat 50 m DFT

14.2.7. Oil Tanks

i. Epoxy Base Tank Coating 3 x 100 m DFT

14.2.8. Fresh Water Tanks

i. Epoxy Primer 100 m DFT
ii. Epoxy Base Potable Water Primer 100 m DFT
iii. Epoxy Base Potable Water Topcoat 50 m DFT

14.2.9. Engine Room

As per external topside excluding the fairing.

14.2.10. Bilges, Gray and Black Tanks and Ballast tanks

i. Epoxy Primer 2 x 150 m DFT

15. TEAK DECKS, DECK FITTINGS

15.1. TEAK DECKS

15.1.1. Teak Quality

The teak to be used will be:

- “Decking” quality for all margins and bulwarks
- “Super decking” quality for the rest of the teak decks and the steps.
- Wood humidity before fitting to be not more than 10%.

15.1.2. Mode of Fitting

The plates will be totally cleaned to SA 2.5 sandblasting level in all areas to be welded and cut and in all other areas that are corroded.

If it is a large-scale corrosion (more than 50%) the decks will be totally sandblasted (SA 2.5) and painted with epoxy primer.

Afterwards, the decks will be leveled with special epoxy materials and then the teak will be fitted completely glued with special rubber glue.

The length of the boards will not be less than 4m and their width will not exceed 65 mm with joints 5mm wide and 6 mm deep.

The thickness of the boards will be:

- Main deck and fore deck: 20 mm net
- On all the rest of the decks: 16 mm net

Special foundations of teak will be fitted on all deck fittings such as bollards/bitts, capstans and wherever else necessary.

The teak deck will circle all the above with margins according to the drawings and the recommendations of the Naval Architect.

The special drawings of the Naval Architect will be followed precisely.

The vertical floor side rails will be glued and all curved parts will be laminated with moulds.

The rubber of the joints will be fitted according to the instructions of the manufacturer, whereas the final sanding of the decks will be effected after sufficient time has elapsed and always according to supplier's instructions.

The bulwarks will be constructed and fitted according to the plans of the Naval Architect, special attention will be given to joint areas.

Wherever wood bulwarks are fitted on top of metal bulwarks, there will be suitable slots made on the bulwarks.

Stainless steel screws will be glued on the metal bulwarks. Then special rubber glue will be applied, the bulwarks will be joined with stainless steel nuts, so that the surplus rubber glue can be removed. Wooden cups will be fitted in the holes.

Immediately after fitting and after they are thoroughly sanded, the bulwarks will be coated with protective varnish and painted according to supplier's instructions.

15.2. DECK FITTINGS

The following items which will be made of Stainless Steel 316, will be either constructed or purchased: bollards - hawse pipes, special foundation accessories, anchor hawse pipe jackets, external anchor plates, windlass and capstan foundations, gutter scuppers, non-fixed staircase frames, rails, handrails, flying bridge deck windscreen frame, foundations for antennas and mast instruments, foundations of navigation lighting, clamps and accessories of exterior metal furniture, frames of deck hatch openings, foundations for storm covers, etc. All elements that are visible will be perfectly polished.

The screws/nuts will also be of stainless steel where required.

The Contractor will follow strictly the special drawings and the recommendations of the Naval Architect.

16. TESTS & TRIALS

16.1. GENERAL

The Contractor shall develop a complete schedule of all test and trials and shall be responsible for scheduling the involvement of any of the equipment supplier and vendors.

16.2. DOCK TRIALS

The Contractor shall conduct dock trials of all the vessel's systems prior to sea trials. The Contractor shall ensure the involvement of any equipment suppliers. The Contractor shall make detailed reports of the status of the various systems and keep complete records of all trials.

16.2.1. Stability Test/Inclining Experiment

ALPHA MARINE Ltd. shall conduct an inclining experiment on the vessel upon completion of the building works. The determination of the suitability of the conditions (weather or otherwise) for the test remain with ALPHA MARINE Ltd. and Classification Society surveyor. The Contractor shall be required to re-schedule the test if the conditions are deemed unsuitable. The Contractor shall supply all equipment including but not limited to certified test weights, and equipment for their handling. The test shall be conducted in accordance with the Class standards, the United States Coast Guard Navigation standards where applicable and the requirements of the Flag State. The results shall be used to develop the required stability information booklet for the vessel's master.

16.3. SEA TRIALS

Sea trials shall be conducted on the vessel to insure that the vessel is operating correctly.

The trials shall be conducted in general accordance with the Sea Trial Code C-2 (SNAME, 1973) and shall include the following tests:

- Compass calibration
- Turning circles
- Ahead steering test
- Crash ahead from astern
- Astern run
- Anchor handling test
- Bow thruster test
- Speed trials
- Z-maneuver
- Emergency steering test
- Crash astern from ahead
- Astern steering test
- Fin stabilizer test

There will be also performed any additional tests required by the regulatory bodies or the equipment manufacturers.

The trials shall not be conducted if the true wind exceeds 2 B or the significant wave height exceeds 0,5 m. The main engine manufacturer's guide for sea trials shall also be consulted. Speed trials shall be conducted for at least three well-documented loading conditions of the vessel one of which shall be full load. The documentation of the loading conditions shall include:

- Draft at the forward perpendicular
- Draft at the after perpendicular
- Trim angle
- Number and weight of persons aboard
- Summary of test equipment abroad
- Summary of any missing equipment
- Summary of the tank loading conditions

The Contractor shall bear the cost of the trials including the cost of any instrumentation required to conduct the tests.

17. CONCLUSION

The aim of this dissertation was to provide a mini technical specification for the building of a new luxury cruise ship. More specifically, the dissertation has the following objectives:

- To analyze the elements and importance of technical specification
- To outline a detailed mini specification for the building of a new cruise ship, which will be a twin screw, luxury passenger vessel, meeting SOLAS ’90 regulations and its amendments issued in 2000, for passenger vessels carrying up to 36 for international voyages.
- To provide implications for shipping companies and other bodies involved in ship building regarding the importance of correct technical specifications in terms of cost, time, and ship-building accuracy

As the analysis indicated, technical specifications include all the materials, elements, and processes that are embodied in the production or design of products and services. Depending on the nature of products and services, different specifications apply within company, national, regional, or international contexts. The existence of technical specifications is very important for manufacturers, designers, sellers, and purchasers-users, since they define how products and services shall be produced and designed, as well as what purchasers shall expect from them. The case of the shipping industry is a special one, due to its international nature and the obligation of ship owners to fully company with international shipping standards, in order to enhance and maintain safety of ships, crews, cargos, and passengers, while also safeguarding environmental protection (Stopford, 2009).

The detailed mini-specification that was outlined in this dissertation regarding the construction of a new luxury cruise ship, carrying up to 36 passengers and performing international voyage, was designed in a way that it complies with SOLAS Convention and its amendments, while at the same ensuring that the new ship will have all comforts and facilities to reflect that it is a luxury cruise ship. Indeed, every chapter outlined the specifications of every single element, part, and function of the new cruise ship, being compliant with the chapters and provisions of the SOLAS Convention at the maximum possible point.

The proposed technical specification that was outlined in the main body of this dissertation provides several implications for the bodies involved. First of all, by following the detailed technical specifications that were outlined the shipyard that will be occupied with the construction of the vessel will have the opportunity to control its production and operating costs. It will know in advance what the costs of its part and component of the new vessel will be, how many resources need to be allocated and how, as well as what it takes to construct a vessel that will fully comply with the obligations implied by SOLAS and other IMO conventions. The construction company will also ensure that it will not face any liabilities in case of a maritime accident, or in case the ship owners argue that components or facilities of the vessels were not constructed based on their needs and requests, a point that is closely linked to the opinion of Buzacott & Shanthikumar (1993), who also support that technical specifications safeguard constructors from liabilities.

At the same time, the ship owners of the new vessel will also ensure that they fully comply with international shipping standards, thereby being able to acquire the necessary certifications for the vessel to operate in international seas. They will also maintain the high quality and luxury attributes of the vessel to be built, so as to be consistent with the luxury cruise services that will be meant to provide. Most importantly, ship owners will ensure that they will have taken all necessary measures to ensure safety at sea for the ship itself, her crew, and her passengers, while at the same time not polluting and damaging the environment beyond what is accepted by IMO regulations.

Another advantage for the ship owner will be that the company that will be assigned to construct the vessel will examine the applicability of the proposed technical specifications, and will probably make the necessary changes, so that both parties know in advance what they will have to expect, avoiding the emergence of technical conditions that will request more time and effort to be dealt with, as this is also suggested by Langenberg (2005). In this way, the ship owners will also have the opportunity to identify what each component is likely to cost, and probably omit or upgrade some of them, in order to fit the final construction cost to the initially decided budget. New budget arrangements may also emerge instead, in case of upgrades in the quality of one or more of the components of the new cruise ship. By developing and following the proposed technical specification for the new cruise ship that was outlined in this dissertation, it will also be easier for the flag state (Greece in this case) to monitor the new vessel and check whether it complies with IMO and flag-state regulations as well.

As a whole, the importance of developing a correct and detailed technical specification, as this has also been supported Murphy & Yates (2008) is indicated through the analysis of this dissertation. Indeed, following the outlined technical specification will benefit all the parties involved in the new vessel's construction process. Ideally, the technical specification proposed will lead to the operation of a new cruise ship, which will be operationally efficient and safe for crews, passengers, and the environment, while at the same time serving its commercial aim of offering luxury cruise services to its passengers.

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