



NAOS P364

Caronte & Tourist Isole Minori

RoPax “Classe A” - “LAMPEDUSA/PANTELLERIA”

TECHNICAL SPECIFICATION

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1000 SHIP GENERAL

100 GENERAL

100.1 Intent of Specification

This Technical Specification (TS) describes NAOS P364 Diesel/LNG(DF)/Electric RoPax vessel, and is intended to set forth the requirements, the work to be executed and the materials to be used in the design, construction and outfitting of the vessel.

Basic design will be carried out by NAOS Ship and Boat Design s.r.l., as stipulated in a separate agreement between NAOS and the Yard.

If not otherwise specified in the Contractual Technical Specification and the Ship Contract, the standards, quality of materials, finish and complexity of all equipment, systems, furniture, outfits and for other technical aspects, to be not less than those of the ship "NT Elio" IMO NR. 9819806 as built (Reference Vessel), for what is applicable, however detail of the builder's standards to be submitted for Owner approval.

The shipyard is to be responsible for the design and construction of the ship based on the requirements of this specification. The vessels are to be fully completed and suitably equipped for their intended service in Italy, even if all details are not mentioned in this specification. Necessary information regarding to the service ports of the vessel will be delivered to the yard for design purposes after effectiveness of the contract by the Owner.

The Vessel to be delivered to the Owner ready for operation, clean, fully equipped and tested.

Modifications and/or changes to the Specification shall be agreed on mutually by the Owner and the Builder and are subject to adjustment of price, delivery and technical performance. These shall be confirmed in writing by both parties.

100.2 Contract Documents

This specification, together with the General Arrangement Plan P364_100000_16, shall form the Contract documents. In case of contradictions or inconsistencies, the Technical Specification shall prevail.

Anything not mentioned in the Specification or the General Arrangement but necessary for the operation of this type of Vessel according to SFI 11, shall be provided by the Builder according to normal shipbuilding practice.

None verbal or written communication of acceptance by the Owner or its representatives that has been exchanged during the precontractual design phase, regarding preliminary equipment specifications, subcontractors, materials, tests, etc., shall commit the Owner and shall exempt the yard of the responsibility to fully comply with the prescriptions of the Building Contract and related Ship Technical Specification and Annexes. The above-mentioned approvals and acceptance will be managed during Plan Approval Process.

All documents shall be prepared in English including drawings, manuals and labels etc. except the statutory documents which according to the rules and regulations shall be prepared in Italian language. Equipment Labeling shall be in English language. The shipyard will agree with the Owner the extension of labels in both language (English and Italian).

If there are systems or equipment, indicated in the TS and GA, that need essential components necessary to the correct functioning, not listed in the TS, this components shall be provided and properly installed to assure the correct function.

100.3 Maker List

The List of Makers shall contain the possible manufacturers for each equipment. Within the Makers List the Yard has the right to choose any of the manufacturers, provided that the manufacturer's product fulfils this Specification, irrespective of the fact that various products or makers may have been mentioned in other parts of this Specification.

Items specifically indicated in the maker list shall have at least one technical service point (or recognized one) located preferably in Italy or at least in Europe. Derogation can be accepted by Owner, after a separate dedicated agreement for service and maintenance.

The Owner will be notified of the Yard's choices for approval before the final purchasing decision. The Owner has the right to suggest other makers not included in the Makers List provided, that such other makers meet the delivery times and the technical requirements of the Yard. In such cases, if the costs are different, a cost adjustment is to be agreed upon prior to choosing such other maker.

In particular cases Owner and the Yard has right to propose different maker which is not mentioned in the Maker's List; in that case this proposal is subject to approval of other party.

The Owner shall have the right to examine and approve the Builder's technical specifications before purchase.

100.4 Delivery of the Vessel

Delivery will take place at the Shipyard quays.

The Vessel shall be delivered with all necessary approval by the Owner, the Flag State Authority and the Class, and all necessary certificates.

At the time of delivery shall be ready to operate, and all system fluids shall be filled: Fresh water for cooling system, lube oil, hydraulic oil, water for chillers, etc. Fuel oil for sea trials will be at Yard charge.

All main systems and machineries technical manuals shall be prepared and forwarded to the Owner at least one month before the tests starts.

10 SHIP GENERAL DESCRIPTION

The vessel shall be a modern RoPax vessel intended to be operated, designed and built for Italian Administration "A" class navigation.

The vessel will be constructed for 1000 persons on board including 38 crew.

The vessel will be designed to transport:

- Passengers in accommodation spaces
- Vehicles (cars and Trucks) in cargo spaces
- Dangerous goods (see SFI 10.8) in cargo spaces
- Garbage in closed container in cargo spaces

The vessel will be divided in 5 MVZ (main vertical zones) and 4 will be dedicated to passengers' accommodation.

SRTP safe areas will be located in MVZ1 and MVZ3, Assembly stations are located on deck 4.

Based on the operation profile, SRTP navigation range is as per SFI 10.3 from the nearest safe port.

To fulfill SRTP system redundancy will be applied to SOLAS essential system and the following layout will be used:

- Two (2) separated and independent engine rooms
- Two (2) separated and independent main switchboard rooms connected via bus-tie
- Two (2) separated and independent propulsion thruster room with relative frequency converters
- One (1) SRTP Bridge
- Emergency genset positioned in a different fire zone from the Engine rooms for orderly evacuation requirement.

The main deck will be divided in 2 special category space, one open and one enclosed, for the transportation of dangerous goods.

The vessel shall be designed for future bow door retrofit.

10.1 Main Dimensions

LOA	abt..	138.4 m
B moulded	abt.	22.00 m
B max	abt.	25.2 m
Main Deck Height	abt.	8.00 m
Design Draft	abt.	5.10 m
Corresponding DWT	abt.	2125 t
Air Draught	Less than	20.0 m
Air Draught at top of Radar mast		29.3 m.

All above dimension may slightly change during the basic design stage.

10.2 Design Speed

At design draft and calm sea, the speed/power performances will be:

- 18.0 knots with 80% of the Nominal Propulsion Thruster Power,
- 19.0 knots with 100% of the Nominal Propulsion Thruster Power

Speed trial conditions: with deep water, smooth sea and wind force up to Beaufort 2. Corrections for wind force, water depth and ship draught can be made according the known and established methods if they differ from the trial conditions.

Final amount of weights and water for sea trial tests will be determined after the ship weighing and inclining test.

10.3 Range and Fuel consumption

At the design speed of 18kn, in calm sea, with electrical load of about 600 kW, the total ship's range will be approximately 4200 nm:

- abt. 800 nm at LNG
- abt. 3400 nm at MDO.

The range in SRTP condition is limited to 80 nm and 12 hours with Beaufort 8 sea state, further limitation for the worst-case scenario regarding propulsion and availability of engine rooms will be defined with Class and Flag.

Fuel consumption:

Fuel consumption of the diesel engines, both in diesel and Gas mode, shall be as per Maker's guarantee, and will be ascertained during the engine shop trials. Fuel consumption shall not exceed 5% of the engine type certification.

A fuel consumption monitoring system shall be arranged with read-out function in the ECR and wheelhouse, with accuracy $\pm 2\%$.

Even if the vessel shall not comply with EEDI regulation because of unconventional propulsion, the yard shall provide EEDI calculation and try to stay below of the limit curve in force in the date of vessel delivery.

10.4 Tanks Capacities

Main capacities are:

LNG "C" type tank	abt. 150 m ³
MDO Storage	abt. 3x110 m ³
MDO Service	abt. 3 x 25 m ³
MDO Emergency genset (36h)	abt. 5 m ³
MDO overflow	12.5 m ³
Ballast	abt. 800 m ³
Anti-Heeling	abt. 200 m ³
Anti-roll passive stabilizing "Flume" tanks	abt. 100 m ³
Fresh water	abt. 100 m ³
Distilled Fresh water	abt. 5 m ³
Bilge	at least 2 x 15 m ³
Sludge tanks	abt. 2 x 10 m ³
Black water	abt. 15 m ³
Grey water	at least 3x15 m ³
Clean Lube Oil main engines	abt. 2 x 5.5 m ³
Dirty Lube Oil main engines	abt. 2 x 5.0 m ³
Clean Lube Oil Propulsion Thrusters	abt. 1 x 5.5 m ³
Dirty lube oil for propulsion thruster	abt. 1 x 5.5 m ³
Water mist tank	TBD m ³

Miscellaneous tanks such as sludge, overflow, technical water, bilge, lube oil, urea, black water etc. in addition.

Final number and capacity of tanks to be in accordance with approved tank plan.

10.5 Deadweight

The Deadweight composition will be the following (values for reference only):

ITEM	t
RoRo Cargo (1.9 t /lm)	1159
Cars	106
Pax and Crew (1000x 85 kg)	85
LNG (90%)	63
MDO	254
Heeling Tank	200
Trim fresh water	100
Clean Lube Oil ME	16
Clean Lube Oil Thrusters	9
Fresh Water	100
Technical Water	5
Sludge (10%)	1
Black Water (10%)	1
Grey Water (10%)	2
Bilge (10%)	1
Stores	10
Miscellaneous	13
TOTAL DWT	Abt. 2125

10.6 Gross Tonnage

Preliminary Gross tonnage GT=13500

10.7 Cargo capacity

Deck 3

Trailers abt 610 lane meters (3 m width)
 Cars abt 710 lane meters (2,3 m width)
 Abt 149 cars (4,70 m)

Garage clear (undeflected) height 5.0 m.

Deck 2

Cars abt 255 lane meters (2,3 m width)
 abt 53 cars (4,70 m)

Garage clear (undeflected) height 2.3 m.

10.8 Carriage of Dangerous Goods

The vessel shall be capable to transport dangerous goods on Deck 3.

Aft part of the Main Deck, between stern ramp and the watertight barrier, has large openings on top and at sides. At least the two (2) central lanes, 18 m each in length, can be considered as an open ro-ro cargo space and can be used for "on the deck" stowage". The rest of aft part of the deck as well as cargo space forward of stern door is considered as closed ro-ro cargo space for and used for "under deck stowage" only.

For typical dangerous goods use as Reference ship Caronte & Tourist "Ulisse"

Deck area	Class
Deck 4 – open deck	1, 2, 3, 4, 5, 6, 8 and 9
Deck 4 – enclosed deck	1.4, 2.2, 3, 4, 5.1, 6.1, 8 and 9

IMDG CODE CLASSES		
Class	Description	Stowage
1.1 A 1.6	EXPLOSIVES	03
1.4 S	EXPLOSIVES - SIGNALS	01
2.1	FLAMMABLE GASES LNG – 1972 LPG - 1978	D E
2.2	NON-FLAMMABLE GASES, NON- TOXIC GASES OXIGEN COMPRESSED 1072	A
2.3	TOXIC GASES, FLAMMABLE	D
2.3	TOXIC GASES, NON-FLAMMABLE	
3	FLAMMABLE LIQUIDS (I.P.<23°C GASOLINE)	E
3	FLAMMABLE LIQUIDS (I.P.>23°C DIESEL OIL)	A
4.1	FLAMMABLE SOLIDS	B
4.2	SUBSTANCES LIABLE TO SPONTANEOUS COMBUSTION	D
4.3	LIQUID SUBSTANCES WHICH, IN CONTACT WITH WATER, EMIT FLAMMABLE GASES	D
4.3	SOLID SUBSTANCES WHICH, IN CONTACT WITH WATER, EMIT FLAMMABLE GASES	D
5.1	OXIDIZING SUBSTANCES	A
5.2	ORGANIC PEROXIDES	D
6.1	LIQUID TOXIC SUBSTANCES	A
6.1	LIQUID TOXIC SUBSTANCES (I.P.<23°C)	
6.1	LIQUID TOXIC SUBSTANCES (I.P.>23°C)	B
6.1	SOLID TOXIC SUBSTANCES	A
8	LIQUID CORROSIVE SUBSTANCES	C or B
8	LIQUID CORROSIVE SUBSTANCES (I.P.<23°C)	C
8	LIQUID CORROSIVE SUBSTANCES (I.P.>23°C)	B
8	SOLID CORROSIVE SUBSTANCES	B
9	MISCELLANEOUS DANGEROUS SUBSTANCES	A

STOWAGE CLASS 1		
Stowage	Cargo Ship	Passenger ship
	(No passengers onboard)	
Category 01	YES, any amount, on deck in closed cargo transport unit or under deck	YES, any amount, on deck in closed cargo transport unit or under deck
Category 02	YES, any amount, on deck on closed cargo transport unit or under deck	YES, any amount, on deck in closed cargo transport unit or only if < 10 kg under deck in closed cargo transport unit
Category 03	YES, any amount, on deck on closed cargo transport unit or under deck	only if < 10 kg, on deck or under deck
Category 04	YES, any amount, on deck on closed cargo transport unit or under deck on closed cargo transport unit	only if < 10 kg, on deck or under deck
Category 05	YES, any amount, on deck on closed cargo transport unit or	only if < 10 kg, on deck or under deck
STOWAGE CLASS 2-9		
Stowage	Cargo Ship	Passenger ship
	With less than 43 passengers	
Category A	YES, any amount, on deck or under deck	YES, any amount, on deck or under deck
Category B	YES, any amount, on deck or under deck	YES, any amount, on deck
Category C	YES, any amount, on deck	YES, any amount, on deck
Category D	On Deck Only	PROHIBITED
Category E	YES, any amount, on deck or under deck	PROHIBITED

The vessel will operate as cargo ship with less than 25 passengers (or other value in accordance with regulations) for dangerous goods on board based on the stowage category related to the goods.

For example it will operate as cargo ship for the following goods:

- Class 2.1 (Methane, compressed) -Stowage cat E
- Class 2.1 (LNG) -Stowage cat D - shall be transported on the two central lanes aft
- Class 2.1 (LPG) -Stowage cat E
- Class 3 -Motor spirit, gasoline – Stowage cat E

The transportation of some categories requires that the vessel is operated as a cargo vessel, so with less than 12 or 43 passengers, depending on the Class of dangerous good.

IMO requirement shall apply for ventilation, firefighting system, electrical systems in the RoRo spaces, for dangerous good and vehicles.

10.9 Ambient condition

If not otherwise stated, the ship's systems and equipment to be dimensioned for following conditions:

Sea water	0° to 32°
Air outside	0° to 35°

10.10 Stability and Subdivision

The vessel shall fulfil damaged stability rules in force from 1 January 2020 as amended, plus Italian Flag rules (Stockholm Agreement, 2.7 m significant wave height) "Direttiva 2003/25/CE 20 relative ai requisiti specifici di stabilità per navi ro-ro pax, DL 14 marzo 2005, n.65".

10.11 Noise and vibration Levels

Special attention shall be paid in the design and construction to limit the vibration and noise levels within the ship. Limits for noise levels (dB(A)) are specified for the various spaces as follows:

SPACE	dBA
Standard cabins	55
Crew cabins	55
Look-out posts, incl. navigating bridge wings and windows	70
Public crew spaces	60
Cargo Deck with Ventilation Only (not vehicles)	80
Offices	60
Mess Room / recreation room	60
Engine Control Room	75

Vibration levels in living quarters during normal sea operation in good weather at service speed shall be limited to upper boundary of ISO DIS 6954 "Guidelines for overall evaluation of vibration in merchant ship" as well as the latest SOLAS II-1/3-12 "Code on noise levels on board ship".

Single amplitude of blade frequency pressure pulses shall not exceed 2.2 kPa in the hull above the propeller, at design draft and 100% of nominal power and shall not exceed 1.8 kPa at 80% of the nominal power.

10.12 Energy efficiency – renewable energy

All windows glasses shall be double panes, energy saving type (gas filled) to reduce the heat transfer from outside.

Photovoltaic cells to be installed on top of the open deck as sun protection, on a surface of abt. 600 sqm, for a peak production of abt. 100 kW (See SFI 850).

10.13 Environmental aspects

The ship to fulfill:

- Tier III in Marpol concerning NOx emission
- Minimize CO₂ emissions

Biodegradable oil/grease according to OECD to be used for controllable pitch propeller, thrusters, cargo hydraulics, deck machinery, wire ropes.

11 CLASS, RULES AND FLAG

110 Classification & statutory fees & certificates

The ship shall be enabled to the following type of navigation:

Class "A" (EU directive 2009/45/CE 6/5/2009) as passenger ship carrying vehicles and trailers with fuel in their tanks and dangerous goods according to SFI 10.8

110.1 Class

Ro-Ro Passenger Ship+ SRTP, A CLASS, UNRESTRICTED NAVIGATION, AUT-UMS, AUT-PORT, DYNAPOS-SAM, GAS FUELED, GREEN PLUS, GREEN PASSPORT PLUS – CLEAN SEA, BATTERY POWERED SHIP, IWS, BIOSAFE SHIP (or equivalent), CONF-NOISE, CONF-VIB,

110.2 Flag of registry

ITALIAN-flag

110.3 National Rules and Regulations

1. "Direttiva 2009/45/CE del parlamento europeo e Circ. n. 10/SM All. 2 – 4 Jan. 2007 - Direzione Generale per il trasporto marittimo e per vie d'acqua interne – Italy" for passengers with reduced mobility.
2. "Linee Guida Contenenti Prescrizioni Tecniche Per Agevolare L'accessibilità e La Mobilità a Bordo Delle Navi Impiegate in Viaggi Nazionali Marittimi da Parte Delle Persone a Mobilità Ridotta" Circ.20540 17/12/2012.

3. Attuazione della direttiva (UE) 2016/844 della Commissione, del 27 maggio 2016, che modifica la direttiva 2009/45/CE del Parlamento europeo e del Consiglio, relativa alle disposizioni e norme di sicurezza per le navi da passeggeri"
4. Decreto Legislativo 4 febbraio 2000 n. 45 Attuazione della direttiva 98/18/CE relativa alle disposizioni e alle norme di sicurezza per le navi da passeggeri adibite a viaggi nazionali.
5. DECRETO DEL PRESIDENTE DELLA REPUBBLICA 8 NOVEMBRE 1991 N 435 (Pubblicato nella Gazzetta Ufficiale del 22 gennaio 1992, Suppl. Ord. n. 17) Approvazione del regolamento per la sicurezza della navigazione e della vita umana in mare.
6. Decreto Legislativo 2 febbraio 2001 n. 31 "Attuazione della direttiva 98/83/CE relativa alla qualità delle acque destinate al consumo umano", e successive modifiche ed integrazioni.
7. Decreto Legislativo 2 febbraio 2002, n.27 "Modifiche ed integrazioni al decreto legislativo 2 febbraio 2001, n. 31, recante attuazione della direttiva 98/83/CE relativa alla qualità delle acque destinate al consumo umano.
8. DM 6 aprile 2004 n. 174 "Regolamento concernente i materiali e gli oggetti che possono essere utilizzati negli impianti fissi di captazione, trattamento, adduzione e distribuzione delle acque destinate al consumo umano".
9. Decreto del Presidente della Repubblica 6 giugno 2005, n. 134, "Regolamento recante disciplina per le navi mercantili dei requisiti per l'imbarco, il trasporto e lo sbarco di merci pericolose".

110.4 Statutory fees

International Convention for the Safety of Life at Sea, SOLAS 2020

International Convention of Load Lines of 1966 - as amended

International Convention on tonnage measurement for ships 1969

European directive 2003/25/EC in specific req. for Ro-Ro Pax ships (Stockholm Agreement)

Code on Intact Stability (IS), (2008)

International Telecoms Convention (GMDSS A3)

International Convention for Preventing Collision at Sea 1972, COLREG

Annex I, III, IV, V and VI – 2011

International Convention for the Prevention of Pollution from Ships - MARPOL 73/78 with applicable Annexes and Amendments

International Convention for Control & Management of Ships' Ballast Water and Sediments, BWM

International Convention on the Control of Harmful Anti-fouling Systems on Ships 2008

Maritime Labor Convention, MLC 2006 (parts A & B)

International Electrotechnical Commission (IEC 92 – electrical installation in ships)

IGF Code (2016 Edition)

IMDG Code

EU Directive on Inventory of Hazardous Material

Marine Equipment Directive 2014/90/EU-MED

MSC/Circ 735 (recommendation on the design and operation of passenger ships to respond to elderly and disabled persons' needs)

International maritime Pilot's association regarding Pilot Boarding arrangement

ITU Radio Regulations, 2008 edition

IMO MSC 337(91) Code on noise level on board ships 2012

International Life Saving Appliance (LSA) Code

International Code for Fire Safety Systems (FSS Code)

MED - Marine Equipment Directive 2014/90/EU

Guidelines on maritime cyber risk management - MSC-Fal.1/Circ.3

ILO-resolutions and convention

All mandatory IMO Resolutions and International Rules.

All mandatory Italian Rules.

110.5 Certificates

- Builder Certificate
- Class certificate: Hull, Mach, SRTP AUT-UMS, DYNAPOS-SAM,
- Cargo Gear booklet according to ILO 152
- Fitness for carriage of motor vehicle certificate
- IAFS - International Anti-fouling Certificate
- IAPP – International Air Pollution Prevention Certificate
- IDG – International Dangerous Good certificate
- IEEC certificate
- ILLC certificate
- IOPP and applicable annexes – International Oil Pollution Prevention Certificate
- Inventory of Hazardous Material certificate
- ISPPC – International sewage pollution prevention Certificate
- IWBM certificate
- MED certificate issued on MLC 2006
- MSC-FAL.1/Circ.3 Guidelines on maritime cyber risk management certificate
- PSSC – Passengers ship safety certificate
- SAFPAX DL45 certificate
- Statement of compliance to MARPOL (Ann.V)
- Ship safety radio certificate (GMDSS)
- SOPEP – Ship Oil Pollution Emergency Plan
- International Tonnage Certificate
- Class certificate (MED) for Machineries and Equipment (Machinery, Steering Gear, CAE, Windlasses, Winch, Life Saving Equipment, etc.)
- Passenger ship floatability and stability certificate
- Certificate of compliance with Italian Decree dated 14.3.2005 N.65 implementation of European directive 2003/25/EC in specific req. for Ro-Ro Passenger ships (Stockholm Agreement)

- International Ballast Water Management Certificate Per A Class

and all mandatory IMO certificates applicable related to FAL.2/Circ. 131; MEPC.1/Circ. 873; MSC.1/1586; LEG.2/Circ.3 – and European and Italian rules.

Manuals

- Record for The Carriage of Dangerous Goods In Packaged Form
- Inventory of Hazardous Material
- Record of Approved Safety Equipment
- Trim and Stability Booklet
- Cargo Securing Manual
- LSA maintenance manual
- Ship operational manual

All the documentation of the vessel including also drawings, one-line diagrams, P&ID, workshop drawings have to be provided in readable digital format. (PDF, DWG, Word, XLS)

15 TESTS, INSPECTIONS, TRIALS

The Builder shall prepare a comprehensive an Inspection and Test Program covering all aspect of the construction and testing of the vessels. All tests and trials are to take place at the cost and on the responsibility of the Builder and under his leadership.

The program shall include SRTP systems test schedule during the construction phases, based on the estimated date of completion of the system itself, in accordance to Owner and Class.

For each system, a dedicated test procedure shall be prepared according to the class requirements and submitted for review to the Owner in advance in order to be fully approved at least one month before any of such tests and inspections.

All main systems and machineries technical manuals shall be prepared and forwarded to the Owner at least one month before the tests starts.

15.1 Factory Acceptance Tests (FAT)

Machinery and equipment is to be tested according to the manufacturer's standard procedure to demonstrate the compliance with Rules and contractual documentation.

At the beginning of the design phase, but not later than 6 months after the effectiveness of Ship Contract, the Builder shall propose a list of all the Factory Acceptance Tests of the main equipment to be performed and their relative schedule.

The shop trials for main equipment will be carried out according to the requirements of the Class Society and the manufacturers' specification.

Builder will provide FAT date confirmation 30 days in advance in order to arrange Owner attendance, including test FAT procedure and relative drawings. Additional tests may be required by the Owner. Any extra cost that could occur, due to the Owner's additional test requirements, shall be discussed in advanced and agreed by shipyard and Owner.

Relevant remarks raised by the Class and the Owner must be fixed before the equipment's delivery at Yard.

15.2 Commissioning Procedures

Commissioning and acceptance procedures specific to the vessel, including sea trials test, will be developed to assess and record that the equipment and systems meet all the requirement regarding the safety, functionality, reliability, accessibility and performances.

The test procedures will be developed fulfilling all the Class Society requirements. Additional functionality tests may be required by the Owner.

The Builder shall propose a list of all the test procedures (and relative tentative schedule) of the main systems and plants intended to be carried out on board. The above-mentioned schedule, taking in account the building program, will be detailed in order to allow the Owner to have the necessary resources available in time for the inspections. Furthermore, the procedures are to be submitted for review at least one month prior to the intended procedure taking place to give sufficient time for comments and agreement.

15.3 Supervision & Inspections

The Builder has to foresee a schedule of main categories inspection activities to the Owner information, based on a similar vessel, not later than two (2) months before the first steel cutting. This schedule is to share the shipbuilding activities and the period at which the Owner or his representatives can start to examine the building operations.

The dates and times of the inspections will be formally confirmed to the Owner in reasonable advance in order to organize the attendance.

The Builder is to present a Quality Control System to formally record the result of each inspection with a suitable data base available and shared with the Owner's representative.

A non-destructive inspection plan shall be submitted from the builder to the Owner for approval. The Owner may have the authority to ask to perform extra inspections areas to be mutually agreed with the Yard.

Any non-conformities can be contested in any stage of construction through remark or defect (in the case of significant contractual and/or rules deviations). Remark and defect must be corrected as quickly as possible and in any case before delivery.

15.4 Sea Trials

On completion of the harbor trials, sea trials shall be carried out in order to demonstrate the proper operation and performance of the Vessel.

The Sea Trial is to be carried out in accordance with an agreed schedule. A description of the trials, the time allocated to each trial, the form of the report to be used, the location of the trial area will be submitted by the Builder to the Owner at least 4 weeks prior to the sea-trials.

An inclining test according to the IS code shall be completed satisfactorily prior to any sea trials taking place.

A detailed list of Sea trials will be prepared by the Yard according to the rules and regulations and will be submitted to the owner for review. The Sea Trials shall include indicatively and not limited to, the following principal tests:

- Speed trials
- Progressive speed trial
- Endurance trial
- Course stability test (including Zig-zag test).
- Crash stop test
- Turning circle test
- Thruster tests
- Fin stabilizer test according to Maker indications

Miscellaneous tests

- SRTP Bridge equipment Test
- Anchoring test
- Maneuvering test
- Stop test/Inertia test
- Steering gear test
- AUT-UMS trial
- M/E remote control test at engine control room and wheelhouse
- E/R and Cargo ventilation fan function test
- Dead ship recovering test (to be complete under anchoring condition at dock)
- Measurement of noise and vibrations
- General alarm test
- Auto-steering system test
- Adjustment of compasses.
- Echo-sounder test (can be complete before the sea trial at shipyard)
- Speed log adjustment (can be complete before the sea trial at shipyard)
- Fire pump and emergency fire pump test (can be complete before the sea trial at shipyard)
- Bilge water separator test (can be complete before the sea trial at shipyard)

Within 1 week after sea trials completion, a list of pending remarks and defects shall be addressed to the Builder by Class and Owner. If necessary additional trials shall be carried out after correction of deficiencies.

The Builder shall provide for all the tests: the personnel, the fuel, the food and provisions, the accessories, the equipment and as well as the spare parts necessary for the management and operation of the Vessel.

15.5 SRTP Tests

Also a detailed test program for SRTP required essential systems operation, shall be defined with the Class and Owner and completed at the shipyard before the Sea trials where applicable.

2000 HULL

20 HULL MATERIALS, GENERAL HULL WORK

200 Hull material

The vessel to be built generally with High tensile steel AH36 (approximately 70%), and with "A" grade standard steel where high tensile steel is not effective to reduce weight. The hull structure is to be carefully designed in order that the lightship weight can be minimized. All steel material shall be Class certified.

To keep the hull weight within acceptable limits, the steel plates shall be selected according to the IACS UR W13 and ISO 7452:2013 Class B; deviation from nominal thickness of plates shall within the lower and upper limits indicated in the table below:

Table 2 — Classes of distribution of tolerances on thickness

Dimensions in millimetres

Nominal thickness	Nominal width, w																	
	$w < 2\,000$						$2\,000 \leq w < 4\,000$						$4\,000 \leq w$					
	Class A		Class B		Class C		Class A		Class B		Class C		Class A		Class B		Class C	
	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper
$4.00 \leq t < 5.00$	-0.40	+0.80	-0.30	+0.90	0	+1.20	-0.45	+0.85	-0.30	+1.00	0	+1.30	—	—	—	—	—	—
$5.00 \leq t < 8.00$	-0.40	+0.80	-0.30	+0.90	0	+1.20	-0.50	+1.00	-0.30	+1.20	0	+1.50	—	—	—	—	—	—
$8.00 \leq t < 15.0$	-0.45	+0.85	-0.30	+1.00	0	+1.30	-0.50	+1.10	-0.30	+1.30	0	+1.60	-0.60	+1.20	0.3	+1.50	0	+1.80
$15.0 \leq t < 25.0$	-0.50	+1.00	-0.30	+1.20	0	+1.50	-0.65	+1.25	-0.30	+1.60	0	+1.90	-0.70	+1.50	0.3	+1.90	0	+2.20
$25.0 \leq t < 40.0$	-0.55	+1.05	-0.30	+1.30	0	+1.60	-0.65	+1.35	-0.30	+1.70	0	+2.00	-0.80	+1.60	0.3	+2.10	0	+2.40
$40.0 \leq t < 80.0$	-0.65	+1.35	-0.30	+1.70	0	+2.00	-0.80	+1.60	-0.30	+2.10	0	+2.40	-0.90	+1.90	0.3	+2.50	0	+2.80
$80.0 \leq t < 150$	-0.90	+1.90	-0.30	+2.50	0	+2.80	-1.05	+2.15	-0.30	+2.90	0	+3.20	-1.20	+2.40	0.3	+3.30	0	+3.60
$150 \leq t < 250$	-1.20	+2.40	-0.30	+3.30	0	+3.60	-1.30	+2.60	-0.30	+3.60	0	+3.90	-1.40	+2.80	0.3	+3.90	0	+4.20
$250 \leq t \leq 400$	-1.30	+2.70	-0.30	+3.70	0	+4.00	-1.45	+2.95	-0.30	+4.10	0	+4.40	-1.60	+3.20	0.3	+4.50	0	+4.80

Either plus side (+) or minus side (-) of the thickness tolerances given in this table may be limited on request. Also a minus side of thickness of 0.3 mm is permitted. In all cases the total tolerances shall be equal to those given in Table 1.

NOTE By agreement at the time of enquiry and order, and in addition to the A, B and C tolerances, a maximum thickness difference within any plate may be applied: see annex A.

Global and local loads analysis shall be performed with FEM calculation. Areas where high stress levels are detected, shall be evaluated and eventually corrected after a denser mesh modelling and calculation.

FEM analysis based on the Dry-docking plan shall be performed to verify that global and local stress between the hull and the docking blocks remains within acceptable values.

Steel Preparation

All steel plates and profiles shall be shot blasted to Sa 2.5 before shop priming.

All steel work shall be performed according to Class and Yard standard, which shall be presented to and accepted by Owner.

A Class approved welding booklet collecting all the welding procedures and details shall be submitted from the shipyard to the Owner for review, at least 30 days before the beginning of the construction.

For the areas which cannot be blasted is excluded from this requirement such as inside the structural pillars etc.

Detailed design and construction work, which are not subject to the requirements of the Classification Society shall be carried out in accordance with the Builder's practices and respond to good building practice.

The shell and other visible plating shall be as straight and even as practicable and acceptable for the Classification Society. The maximum deflection of plates has to be in accordance to IACS standard.

Flatness tolerance to be in accordance to IACS requirements on ro-ro decks and accommodation decks and under Classification society survey.

Bumps in accommodation decks shall be kept at the minimum in order to reduce the amount of levelling material.

If construction would involve connection between the ship structure and other non-structural fittings made different metal alloys, that connection shall be insulated to avoid galvanic corrosion.

223 Tank Top, Double Bottom, Voids, Tanks, Cofferdam

Tanks, Voids, cofferdam, bilge wells to be arranged as shown on General Arrangement drawing.

Separation shall be considered between Lube oil/Fuel/sludge tank and ballast/grey/black water and Fresh water, to avoid contamination.

Cofferdams, where foreseen, shall be fully accessible with a minimum height of 700 mm

226 Decks, Platforms, Bulkheads, & Hull Tanks Below Main Deck

The Owner has right to ask for a plate thickness increment up to 2 mm above requirements and deck structure shall be adequately reinforced in the way of:

- mooring areas,
- winches, capstans
- davits' foundation

Decks, on the way of stairs platforms or landings shall be reinforced to avoid vibration or plate instability.

On wet spaces (as galley, pantries, toilets, laundries, etc.), where there are no perimetral welded bulkheads, a watertight coaming of at least 100 mm, with continuous welding on the wet side to be considered.

A proper protection to be arranged on the main deck, where passenger walkway and equipment, as cabinet or other, could be damaged by car/trailer impact. Protection could also be easily removable.

Corrugated bulkheads to be avoided below main deck and as external boundaries.

234 Deck Stiffening

Scantling of all structural members shall be in compliance with the requirements of the Classification Society.

The complete hull girder as well as local parts to have strength enough to allow full flexibility under different load conditions, partly loaded and ballasted conditions likely to occur in service.

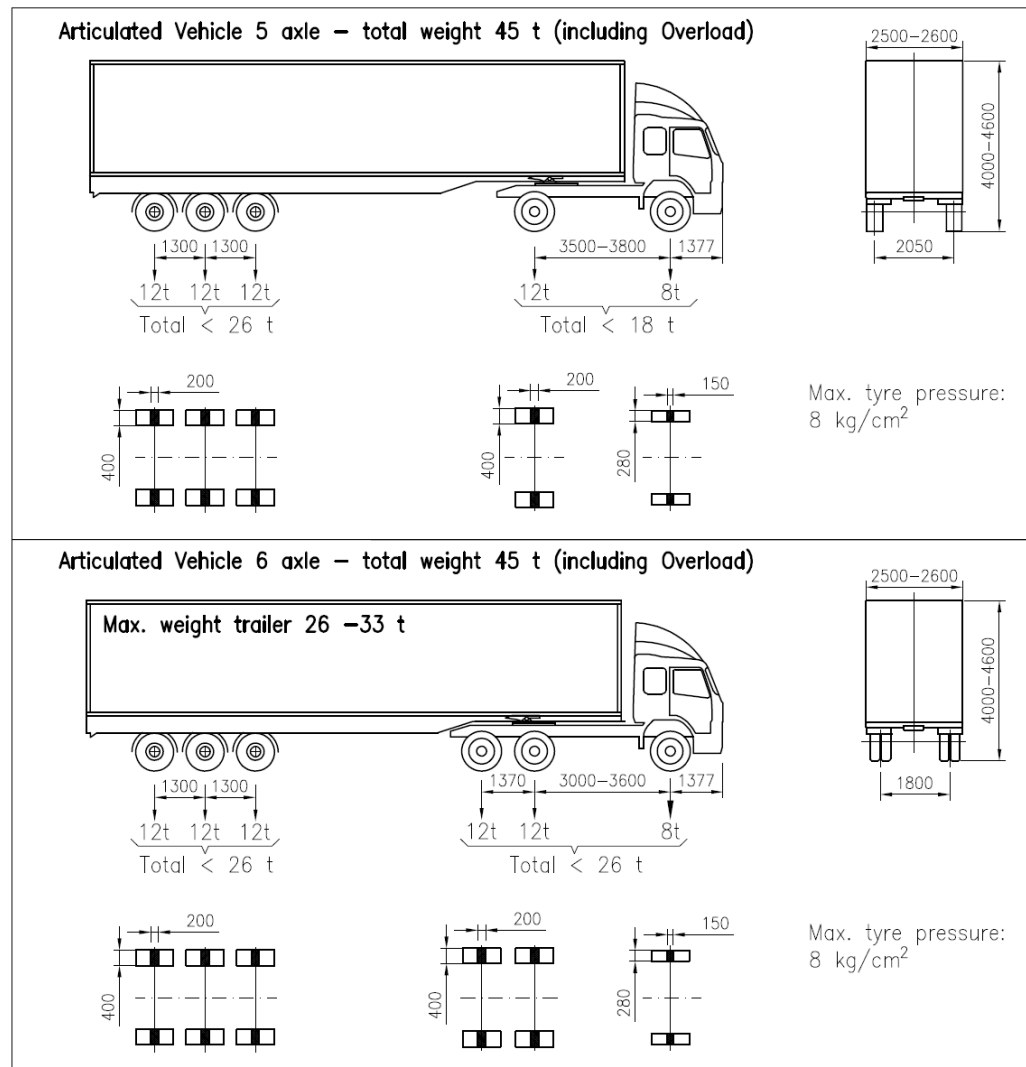
The hull structure is to be carefully designed in order that the lightship weight can be minimized.

Cargo deck scantling shall be dimensioned for the following deck's load:

- Uniform distributed load (UDL) of 1 t/sqm.

Deck	Type of cargo, weight per axle	Clearance [m]	Unit Load [t/sqm]
2	Cars, max weight 2.2 t, max axle load 1.2 t	2.3	0.4
3	Road trailers as indicated in the picture	5.0	1.0

Roro decks shall have 1 mm extra-thickness above Class requirement to reduce local deformation.



24 FOREBODY

241 Shell Panels, Separate Shell Plates

Shell plating to be in accordance with Class.

On the shell plates, where particular narrow edges shall occur (i.e. hull connections, thruster tunnels, etc), proper brackets and junction have to be designed to avoid stress concentration.

Considering the daily high number of anchor deployment and recoveries, particular attention shall be applied on the area of the bulb and around the anchor pockets, with increase of shell thickness of 1-2 mm and/or the application of proper protections to guide the anchors and avoid damages to the hull.

The extension of the increased thickness area will be approved by the Owner.

252 Radar Mast

Due to the height limitation in Lampedusa port (20 m from Sea level) the radar mast and navigation light mast shall be telescopic, hydraulically actuated, with locking system.

The masts shall be capable to fold within the max allowed height and to control position of radar's antennas to avoid damages during folding.

261 Hull marking

Hull mark plan shall be presented to the Owner and approved by.

Ship name and home port shall be marked by 5 mm thick plate. 800 mm height letters welded to the shell plate shall be used for ship's name and 500 mm height letters for the port. Shape to be defined in accordance with Owner.

IMO number shall be marked according to requirements, on 5 mm thick plates welded to the surface.

Freeboard marks shall be marked according to rules, on 5 mm thick plates.

Draft marks shall indicate every 20 cm of draft and made of 5 mm thick plates welded to the hull.

All necessary marks for Main Thruster, Bow Thrusters, fin stabilizers shall be fitted. Drain plugs shall be marked, indicating the code of the served tank.

Manholes serving tanks shall have marked the code of the tank with weld lines.

All necessary marks, required from IWS notation, shall be fitted.

262 Bottom Plugs, Sea Chest and Bilge Wells

Sea chests, bilge wells and bottom valves shall be constructed for 5-year docking intervals.

Bottom plugs

Bottom plugs shall be fitted on the shell plate of any tank/void/cofferdam which is confined by. The bottom plug shall be of stainless steel AISI 316L and its size and detail shall be in accordance with Shipyard standards and approved by the Owner.

Bottom plugs to be positioned outside docking blocks contact areas and such a way to allow complete tanks drainage. Bottom plugs shall be flash mounted.

A spare set of bottom plugs shall be supplied. If special dismantling tools are required, also a set of tools shall be supplied.

Sea Chests

Centralized sea water cooling system is made of a structural or pipe duct connecting two sea chests, one high and one low. On that duct all suctions from pumps are fitted.

Note: based on SRTP a second sea water cooling system could be installed (one each engine room) to guarantee complete independence in case of one ER loss.

A structural cross duct, designed to house box coolers (Hydroniq type), fed by sea water coming from the above sea chests, with forced circulation shall be arranged.

One (1) separate sea chest inlet to be provided in the bow thruster room for emergency fire pump and chilled water system.

Sea Chest openings on the external shell shall be fitted with protecting hinged gratings to allow scuba divers entrance/maintenance from outside.

Sea chest gratings shall be of stainless steel AISI 316L construction, the fastening bolts, nuts and safety pin of the grids shall be of stainless-steel grade A4.

The fixing brackets shall be of stainless steel AISI 316L.

The net area of the external grating shall be at least 2.5 times the section area of the filter connection pipe, to avoid flow pressure losses.

Sea chests shall be connected to compressed air system to purging and cleaning.

Bilge Wells

Spaces below Main Deck shall be fitted with properly positioned and sized bilge wells. Any accumulation of water shall be avoided taking into consideration trim and heel which may occur.

Bilge wells shall be recessed. They shall be covered with a flash mounted removable grid to avoid suction of relevant size object. Grids shall be positioned by gravity and never fixed with bolts, to allow fast removal and cleaning.

263 Foundations

Gensets shall be installed on a common frame resiliently mounted to the hull. Structures below shall be properly integrated into the hull structure.

Leakages around main gensets or couple of genset foundations shall be contained with the installation of coamings, covering also the area where valve and flanges are direct coupled with the equipment. At least one daily bilge suction with its well shall be provided inside the engine foundation coaming to drain accumulated liquids.

Coamings shall be provided around other main equipment where liquid leakage may occur, as pumps, heat exchangers, hydraulic power units, etc. Stainless steel drain plugs to be installed on the side of the coamings to remove the accumulated liquid.

Main Thruster foundation

Main thrusters shall be installed on a canister which is bolted into an appropriate well into the hull, so that it can be dismantled without docking the vessel. This canister to be flanged by the shipyard into well to be designed according to vendor installation drawing.

The canister shall be equipped with lifting eyes and be easily demountable. It shall be possible to lift out the whole propulsion unit and canister through a deck hatch which shall be open first. Gap between propulsion unit canister and hull shall not exceed in general 30 mm.

A dedicated gantry crane shall be installed to perform the dismantling (see SFI 453)

264 Fenders and Bilge Keels

Fender plan, together with fender constructive details, shall be submitted to the Owner for approval, and shall be verified according to relevant quay and pontoon solutions at relevant vessel loading conditions and tide. As an indication, fender list shall be built of 12 mm curved plate welded to the skin. The fender list shall be minimum 300 mm high and 200 mm wide.

Relevant quay and pontoon information will be delivered by the Owner immediately after the contract effectiveness.

Deflectors shall be fitted in way of launching areas for MES units and FR boats and drop zones for life rafts.

Bilge keel to be arranged SB and PS. Length and size to be balanced to vessel size. Location according to the Model Test recommendation or CFD calculations.

Bilge keels will be interrupted in way of stabilizer fins.

Bilge keel welding according to Classification society requirements. Doubling plate (flat bar) to be fitted between bilge keel and shell plate.

Note: if Roll dumping obtained from fin stabilizers and anti-roll passive stabilizing "Flume" tank will be considered sufficient, bilge keels installation could be deleted upon Owner approval.

266 Anchor Pockets, Hawse Pipe And Chain Locker

Hawse pipes / Anchor pockets

Two (2) Bow anchor hawses arranged on the shell plating, with hawse pipes.

Hawse pipes thickness, in accordance with the Owner, shall be increased at least to 2 mm above requirements to cope with the high daily rate of anchors launching.

A dedicated study of hawse pipes and anchor pockets shall be performed and submitted to the owner for approval, to verify that there are no contacts between the hull and the anchors during anchor recovery, considering a heeling angle of $\pm 3^\circ$.

Chain lockers

Two (2) off Chain lockers to be arranged on the way of collision bulkhead. The chain locker to be of sufficient size and constructed so that good self- stowage of anchor chain is achieved.

Manholes and steps for access into and in each chain locker to be arranged.

As far as practical all structural elements to be fitted at the outside of the locker bulkheads.

In bottom of each chain locker a grating of perforated galvanized plates to be arranged approx. 1200 mm above bottom level for drainage and inspection with a minimum thickness of 15 mm. Perforated plate shall be easily removable for replacement.

The Structure below the perforated plates shall be sustained by pillars to have easy access through a hatch.

Inboard end of chain to be attached according to Classification society requirements.

Chain safe release to be take place in a separated space outside of the lockers.

Dedicated chain lockers' suction to be provided via ejector and screw pump to overboard discharge.

Dedicated chains washing system to be provided. Due to expected high usage rate and high mud level retained from the chains, a proper water flow and number of nozzles shall be defined in accordance with Owner.

27 MATERIAL PROTECTION, EXTERNAL

270 Material protection, External

Painting works including surface preparation and painting inspection shall be carried out in accordance with the Builder's practice and standard and the paint manufacturer's recommendation, however the painting works and inspection procedure to be approved by the Classification Society

where necessary and the basic requirements for the application shall comply with PSPC where is applicable.

Constructional steelwork to be free of mill scale and rust by means of machine grit-blasting to a degree of SA 2.5 after grit-blasting treated with a zinc-based shop primer

All defects on primer, weld seems etc. outside and inside shall be shot blasted or mechanically cleaned according to paint manufacturers standard prior to application of new primer.

All cut edges shall in general be grinded according to paint manufacturer's standard.

All surfaces which are to be primed and/or painted shall be cleaned according to paint manufacturer's standard prior to application.

Paint specification according to the following chart as indication:

For corrosion protection of the underwater hull of the vessel will have a paint system consisting of anti-fouling suitable for a docking interval of 5 years.

Keel Block points will be painted with Tin Free Anti Fouling paint instead of Silicone.

Flat bottom, Side Bottom, Thrusters tunnel, Rudder	1st coat of Epoxy tie coat (75 dft) 2nd coat of SPC tin free AF (100 dft) 3rd coats of SPC tin free AF (100 dft)
Bottom, Topsides, External bulwark, Accommodation block & Accommodation block exposed deck, Forecastle deck, Funnel exterior systems	1st coat of Epoxy (150 dft) 2nd coat of Epoxy (150 dft) 3rd coat of Polyurethane or Waterborne (50dft)
Deck 7, Deck 5, Deck 3 & 1, Ramp Driveways	1st coat of Alkyl or Ethyl zinc silicate (75 dft) 2nd coat of Epoxy tie coat (40 dft) 3rd coat of Abrasive resistant Epoxy (200dft)
Deck 1, Deck 3, 5 & 7 walls and overhead, Ramp construction	1st coat of Epoxy (100dft) 2nd coat of Epoxy (100 dft) 3rd coat of Polyurethane or Waterborne (50dft)
Main Ventilations internal included Insulated areas	1st coat of Epoxy (150 dft) 2nd coat of Epoxy (150 dft)
All insulated areas except ventilation areas and deck 7 areas which shall be painted as insulated areas	1st coat of paint as for adjacent area
Walls, overheads and decks for all machine spaces, escape trunks etc	1st coat of Alkyd (80 dft) 2nd coat of Alkyd (80 dft) 3rd coat of Alkyd (40dft)
	1st coat of Epoxy (125 dft)

Voids, tanks top up to first grating level & cofferdams	2nd coat of Epoxy (125 dft)
Water ballast tanks & chain locker	1st coat of Epoxy (160 dft) 2nd coat of Epoxy (160 dft)
Fresh water tanks	1st coat of Solvent free Epoxy (160 dft) 2nd coat of Solvent free Epoxy (160 dft)
Tech water, boiler feed water, and grey water and ureatanks	1st coat of Phenolic Epoxy (160 dft) 2nd coat of Phenolic Epoxy (160 dft)
DO tanks	Oiled

Thickness in the table as to be intended as minimum requirement. Values in the table can be updated accordingly to the paint maker products and specification in agreement with Shipyard and Owner. The paint material and the thicknesses and number of layers can be modified accordingly.

Color table and layout will be defined by the Owner.

Hull Side Company logo/name to be placed in accordance to Owner indication for type, size, position and colors.

Yard may propose alternative painting cycle, subject to Owner approval.

278 External cathodic protection

ICCPS

An Impressed Current Cathodic Protection System will be installed. The capacity of the ICCP- System is based on the wetted surface of the hull and required protection of 35 mA/m² (600 mA/m² for the propellers).

Zinc anodes

Aluminium anodes to be installed on propulsion thruster units, bow thrusters and sea chests, lifetime 5 years. Anodes shall be mounted with screws.

3000 EQUIPMENT FOR CARGO

30 HATCHES, PORTS

General

The vessel shall be designed for efficient cargo loading and unloading. Recessed/flush type lashing points shall be fitted on main deck, according to the stowage plan, in longitudinal rows between and outside the trailer lanes.

Cargo spaces, Free height

Cargo lanes (m) distributed as follows:

Deck 3	Refer to SFI 10.7
Deck 2	Refer to SFI 10.7

300.1 Cargo lashing

Recessed/flush type lashing points shall be fitted on all decks, according to the stowage plan in longitudinal rows between and outside the cargo lanes.

Dedicate space for safe stowage of motorcycles and bicycles shall be defined on deck 3 and 4

304 Hatches, Manhole covers

All manholes and hatches will be produced according to builder's standards and have class approval where necessary.

All tanks shall have flush manholes with bolted cover as shown on the drawings. All manholes have oil-tight gaskets or O-rings. A similar watertight manhole fitting shall be provided on each potable water tank.

At least 2 manholes to be considered for each tank and void space, positioned on opposite location, to allow access to all the area; Limited space or passage through other compartments entrance should be avoided as far as applicable, or submitted to owner approval.

For small tanks, a single manhole can be considered in accordance with Class and Owner.

Manholes shall have maximized net opening, with a minimum size of 600x400mm.

Manholes plan shall be submitted to Owner for approval.

In compartments with risk of contamination such as Engine rooms, thrusters' rooms, etc., horizontal manholes shall be provided with a 50 mm coaming to avoid inlet of contaminated fluid in the tanks.

Vertical manholes shall be provided with handles and lifting eye.

304.1 Thruster hatch

Two (2) bolted flush hatches on the main deck, on top of the main propulsion thruster, sized for the extraction of the propulsion canister. Hatches shall have four lifting eyes. Hatches to be designed and constructed to cope the same loads of the serving deck. The contact shall be steel to steel and the watertightness assured by proper sealing. Coamings to have drains on the four corners.

Hatches to be designed so that the full pod unit can be dismantled for maintenance without dry docking.

304.02 – Services Hatches

One (1) bolted and hinged flush hatch on the main deck, size abt. 2300 x 1900, in Fore engine room with proper laydown area arranged below.

Two (2) bolted and hinged flush hatches on deck 4, below the MES, rotating down, to allow the passage of the MES through the deck to the RoRo deck (for maintenance purpose).

Bolts to be operable from below or with other detail to be Owner approved.

All Hatches to be watertight with suitable and durable seal, their coaming shall have drains.

304.03 – Bow Thruster Hatch

One (1) bolted and hinged flush hatch on the main deck, size abt. 2300 x 1900, to be foreseen for Bow thruster maintenance. It could be deleted if alternative solution will be found.

304.04 – Emergency Escape Hatches

Emergency Escapes Hatches shall be openable from both sides. All Escapes from spaces below Main Deck shall land 2.5 m above the Main Deck and shall be Weathertight (not Watertight).

Note: All Hatches on Main deck shall have cargo lashing pots as per cargo arrangement plan distribution.

305 Stern Ramp and Watertight barrier

All ramp driving surfaces to be surfaced with anti-skid material (epoxy/stones) as well as approach areas to ramps within 6 m distances.

305.1 Stern ramp door

The ship to have a stern ramp/door, not watertight dedicated to vehicles access.

The ramp has a width about of 16.0 m and a length about of 8.5 m.

Flaps to be triangular section shaped and easily removable when ramp is in open position, hinges to be accessible by bolted covers for easy dismantling.

Design inclination from horizontal is +/- 8 degr. with transition of max 4 degr. for the flap. It shall be operated within a heeling angle up to 2 degr. and a trim of +/- 1.5 m.

The plating of the stern ramp will be partially done by steel structural gratings, supporting the wheels loads as per SFI 234, but leaving air circulate as natural extraction on the aft side of the main garage. The shape of the openings to be carefully designed to avoid permanent deformations or high tensile loads.

Opening/closing time shall be less than 3 min, locking/unlocking excluded.

In stowed position, the ramp shall be inclined to stern abt. 5 Deg, so that, in case of failure of the system and after having disengaged the cylinders, it shall open n by gravity.

Ramp shall be designed to allow the simultaneous passage of two trucks of the max weight declared on the Midship Section.

Hydraulic locking cylinders shall be used to secure closed position. Operation shall be possible from wheelhouse and local operation panel.

Stern ramp driving surfaces to be coated with anti-skid material (epoxy/stones) and steel strip (10x10 mm) full penetration welded as well as approach areas to ramp within 6 m distances.

Ramp to be hydraulically operated by means of cylinders, with a control post located in cargo room and on wheelhouse.

Limit switches physically activated by the ramp (not inside cylinders) are to be provided to recognize the effective ramp position.

Signal and alarms shall be present locally and on bridge for both doors according to class (interfaced to Voyage data recorder).

Emergency operation

In case of system failure emergency operations, can be performed using mooring equipment and mooring winches with dedicated fittings

Facility to dismount lifting cylinders shall be provided.

Emergency operation shall allow opening or closing operation in abt. 10 minutes, excluding the preparation time.

Other alternative proposal for emergency operation may be proposed by the Yard and shall be approved by the Owner.

305.2 Passengers Stern ramp door

The ship to have a stern ramp/door, not watertight dedicated to passengers' access. Design inclination from horizontal is +/- 8 degr. with transition of max 4 degr. for the flap. It shall be operated within a heeling angle up to 2 degr. and a trim of +/- 1.5 m.

The ramp has a width about of 2.000 mm and a length about of 8500mm.

Ramp to be hydraulically operated by means of cylinders, with a control post located in cargo room and on wheelhouse.

Hydraulic locking cylinders shall be used to secure closed position. Operation shall be possible from wheelhouse and local operation panel.

Signal and alarms shall be present locally and on bridge for both doors according to class (interfaced to Voyage data recorder).

305.3 Weathertight Barrier on Main Deck

On the basis of stability calculation (intact, damage and Stockholm Agreement), a watertight barrier will be placed approximately 19.0 m FWD from the transom, to impede the passage of water from the open part of the Main Deck to the closed deck area of Main Deck.

That door, with a height of abt. 2500 mm (final dimension according to stability calculations) and abt. 17 m wide, shall be Watertight on its sides and lower perimeter, sliding from a rest position below the upper deck to the working position down. When in its watertight position it shall be locked by adequate number of cleats to assure watertightness. It will be hydraulically manoeuvred from the same position of the stern Ramp/door control post.

Emergency operation of the Watertight door shall be arranged. The system shall be capable to unlock and operate the door in case of unserviceable hydraulic cylinders.

Doors to be certified according to Class Rules.

305.4 Internal Ramps and Covers

Free driving width of the down-going ramp to be minimum 2600 mm. The inclination of the ramp leading to the lower car deck to be 8.2 degrees with 4 degrees in both ends of the ramp for optimal transition when approaching with the vehicle from decks to ramp. The WT cover to the lower hold shall be side or front hinged.

305.5 Bow Door - Predisposition

For the Bow door future installation, the vessel shall be designed with minimize the re-woks. All possible structures, piping and equipment arrangement shall be placed in such a way that in future retrofit limited modification will be necessary.

307 Side doors

Two (2) MDO bunker/pilot doors, one on each side of the vessel.

Two (2) LNG bunker doors, one on each side of the vessel.

309 Hydraulic system

One (1) Hydraulic Power Unit shall be arranged in the Hydraulic room with at least two (2) pumps. In case of failure of a single hydraulic pump, the HPU shall be capable of operating the ramp door and the watertight barrier with reduced performances.

The HPU shall serve the stern Ramp, the passenger ramp and the intermediate Watertight barrier on Main Deck (SFI 305).

An audible and visual alarm shall be provided, to indicate when the ramp doors are in operation.

An interface with Ship Alarm Monitoring System shall be foreseen.

The signals that shall be provided are:

- Ramps/door position (close and blocked, open).
- HPU running
- Alarm for ramps' inclination out of range.

Suitable base resilient mounts and flexible pipes connections shall be provided in order to avoid/minimize possible induced noise/vibrations.

Proper HPU oil cooling system to be installed.

315 Lashing Equipment

Flush type lashing pots to be arranged on Main deck, according to cargo stowage plan prepared by the Yard and to be approved by the Owner. Local strengthening below the deck to be arranged correspondingly according to rules. Fittings to be Class approved if necessary.

Dedicated storage room for lashing equipment shall be located on deck 3.

36 REFRIGERATING SYSTEM FOR CARGO

RoRo deck will be equipped with 30 reefer socket, 400 V, 3ph, 50Hz, with dedicated manually controlled switchboard located in a technical space on deck 3

Sockets to be positioned portside and starboard with a longitudinal spacing of abt. 15 m, in such a way to cover both open deck cargo area and enclosed deck.

Min Vertical position to be at last 450mm above the cargo deck to avoid the usage of Ex-proof sockets as per SOLAS.

Only in open deck where dangerous goods are transported Ex-proof socket to be considered.

Socket shall be arranged so that cables shall not lay on deck.

37 CARGO SPACES VENTILATION SYSTEMS

In the cargo area (deck 2-3), fans will provide 10 air changes per hour at sea and 20 air changes per hour during loading and unloading.

The ventilation system on deck 3 is designed for longitudinal ventilation, with inlet vent fans located forward and outlet through the open space above the watertight barrier located approximately at fr. 15. Those inlet fans don't need to be EX-proof.

For deck 2, 50% of the fans shall be reversible.

Ex proof fans shall be used where required by rule.

Fan's electric motors speed to be controlled by frequency drive for energy saving.

Closing appliances according to requirements. Max air speed in grids 6 m/s.

Noise level to be as per section 10.10 within the holds.

Particular attention has also to be given to external noise in harbor during loading/downloading operations.

Air ducts to be fitted with remote controlled air operated closing dampers according to Rules.

Where the fans are located, a service hatch will be arranged, big enough for removing the fan motor. Lifting eye(s) to be mounted above/nearby each fan for removal of the fan during maintenance or replacement work.

Ventilation fans power supply to fulfill SRTP requirements.

376 Inert Gas System

One (1) inert gas system using nitrogen shall be provided, capable to purge and gas freeing the following systems:

- LNG bunkering lines
- LNG Engines supply lines in case of ESD
- LNG tanks piping and other spaces indicated by the LNG system supplier during maintenance operations.

For tanks gas freeing also an external nitrogen supply line shall be provided, consisting in:

- One (1) nitrogen generator capacity 20Nm³/h.
- One (1) buffer tank of abt. 3000l at 10bar.
- One(1) spare rack of 12 bottles (capacity of each bottle 50l at 200bar) (Owner supply)

All the previous equipment shall be located in "Nitrogen storage Room" on deck 3. The compartment shall have easy access and clear route for forklift. Quick connection for bottles rack with reducing valve to be provided (Connection standard to be defined in accordance with the Owner). The spaces shall be provided with dedicated ventilation and monitored with low Oxygen detectors.

Final volume of the buffer tank and nitrogen generator capacity to be defined on piping lengths and diameter.

4000 MANOUVERING MACHINERY & EQUIPMENT

40 MANOUVERING MACHINERY & EQUIPMENT

400 Azimuth Thrusters for Propulsion

The vessel shall be equipped with Two (2) 360 DEG azimuth thruster units electrically driven for propulsion and steering of the vessel. The units are steerable and equipped with FP or CP propeller. See SFI 63.

404 Bow Tunnel Thrusters

Two (2) bow thrusters to be fitted, each about 1000 kW, started by auto transformer soft start device. CP propeller, fixed RPM motors powered by the main gensets.

The two bow thrusters, in conjunction with the stern azimuthal thrusters, shall be suitable for DYNAPOS-SAM dynamic positioning and maneuvering assistance in maximum side wind speed 45kn and narrow harbors.

Hydraulic system for pitch control to be arranged with independent hydraulic power pack and system according with manufacturer's standard.

Cathodic protection ref. 278, Anodes to be placed in the tunnel as recommended by the propeller maker.

3 phase AC asynchronous motor with squirrel cage shall be provided as prime mover.

Remote control

An remote-control system to be arranged for control of thruster pitch. Main units for the system:

One (1) set of control modules to be installed in the main bridge console, consisting of: Thruster control lever, thruster controls, motor drive controls, indicators

Two (2) set of indoor control modules to be installed in the wing bridge console, consisting of: Thruster control lever, thruster controls, indicators

One (1) set of control modules to be installed in the SRTP bridge console, consisting of: Thruster control lever, thruster controls, motor drive controls, indicators

405.1 Anti-roll passive stabilizing "Flume" tanks

One anti-roll passive stabilizing "Flume" tank will be arranged, to achieve approx. 50% roll reduction at every speed condition (including zero speed) with dedicated equipment and control.

The tank shall be filled with fresh water.

405.2 Fin Stabilizers

One pair fin stabilizers shall be installed. Fins shall not protrude out from moulded beam of the ship and not below base line.

Design criteria: approx. 60 % roll reduction from fin stabilizer and total roll reduction approx. 80% combined with anti-roll passive stabilizing "Flume" tanks on the following conditions:

- Speed 18.0 knots
- Wave slope 3.5 degrees.
- GM of abt. 2.0 m (without considering anti-roll passive stabilizing "Flume" tank)
- Sea condition: Hs 2.5 m, PM spectrum

The plant shall be structurally sized for the maximum vessel speed on trials.

Rotary vane actuator preferred.

Approximate preliminary area of fins shall be at least 4.5 sqm.

The Bridge control panel to include all the necessary switches and indications for the full operation of stabilizers, motor start / stop switches, giving warning below threshold speed.

405.3 Anti-Heeling system

The heeling pump will be positioned near to the cross duct of the heeling tanks.

Heeling tanks shall have the possibility to be filled with fresh water. Pumping capacity abt. 700 m³/h.

The pump shall be reversible motor driven propeller pump, with remote/local operated section valves for flow control and easy dismantling.

Filling and drain line to shall be installed in both tanks Port and starboard.

The system shall be remote controlled (automatic mode, manual mode) in Wheelhouse and ECR.

41 NAVIGATION & SEARCHING EQUIPMENT (OWNER CHOICE)

410 Navigation Equipment

All navigational and radio equipment to be provided according to unrestricted world-wide service.

410.1 Navigation systems

The wheelhouse to be of fully integrated and shall be designed in cooperation with the Owner.

SOLAS guidelines on ergonomic criteria for bridge equipment and layout shall be followed.

NOTE: Alternative position for essential systems in case of loss of the Wheelhouse is the SRTP bridge located below the fore deckhouse on deck 7. Essential equipment for navigation and communications will be fitted according to MSC.1369 rule requirement.

Wheelhouse with bridge wings (enclosed type), control and manoeuvring console with steering stand in centre, chart table, radio console, safety console and overhead panels.

Layout shall comply with ergonomic and visibility IMO rules and class requirements.

The system is to integrate information and controls in an organized way from the various sensors and feedback. In detail system includes radar, conning and ECDIS workstations, AIS, autopilot, echo sounder and the central alarm system.

Bridge wing consoles shall have reinforced glass on the floor to have a clear view of the ship side when berthing.

All navigation and radio equipment to be provided according to National "A" class navigation.

One (1) Central control and monitoring system shall incorporate the following equipment, but in any case, according to classification and relevant rules:

- Throttle and steering control
- Side thruster control
- Emergency stop of main engines
- RPM and steering angle indicator for Main Thrusters
- Speed log
- Autopilot
- Radar X-Band display, ARPA function
- Radar S-Band display, ARPA function
- NAVTEX receiver
- Chart Plotter with radar overlay display
- ECDIS display
- Magnetic Compass periscope reader
- General Automation and monitoring control workstation
- Fin stabilizers control panel
- Anti Rolling Tank control panel
- Anti-heeling system control panel
- Emergency lights control
- Searchlight control
- Flood Light control
- Window wipers and washing system control
- Anchor release and breaking
- Wind indicator
- Operation and monitoring of Stern Ramp and Weathertight Door

Main console will use 27" monitors as standard, where not differently indicated.

Two (2) Bridge Wing control stations will incorporate

- Throttle and steering control
- Side thruster control
- ECDIS remote control display (15"), one each wing
- VHF repeater
- Wind indicator

One (1) GMDSS console

One (1) Safety console

The layout of the wheelhouse, central and wing stations, chart and radio room with their consoles shall be approved by the Owner.

410.2 DYNAPOS-SAM equipment

Vessel is equipped with a Semi-Automatic Dynamic Positioning System.

The operator's manual intervention is necessary for position keeping, the control system has to achieve synthetic control of all the thrusters, Propulsion and side, thanks to a simple single device (for instance a joystick)

The control system has to indicate the position and heading of the unit to the operator. Control settings are to be displayed and show propulsion and maneuvering data.

The control device handle is to have a well-defined neutral position (no thrust)

The system consists of the following main components:

Four (1) off Control panel for joystick.

- One (1) on central console
- One (1) Port wing console
- One (1) Stbd wing console
- One (1) SRTP Bridge console

One (1) off Main processor in separate cabinet.

The system to be interfaced to the vessel's Gyro compass, DGPS navigator, speed log and wind sensor.

The whole propulsion system composed by propulsion thruster and bow thruster has to keep the position in the case of side wind speed of 45kn.

411 Radar Equipment

One (1) Radar X-Band

One (1) Radar S-Band

413 Gyro, Autopilot and Compass

two (2) Gyro compass, one service, one backup, Fibre-optic maintenance free type.

Gyrocompass repeaters shall be positioned as follow

- One (1) in the wheelhouse
- One (1) in SRTP Bridge
- One (1) PORT Propulsion room
- One (1) STBD Propulsion room

Other position may be defined based on Class and SRTP requirements.

One (1) magnetic compass

416 CCTV-system

CCTV system according to ISPS and SOLAS Cap.II-1 requirements shall be installed on open decks, Ro-Ro spaces, hull doors, stern ramp, passengers' areas, machinery spaces and mooring stations.

A control station shall be installed in Wheelhouse, SRTP Bridge and ECR with recording system to be installed in the wheelhouse console.

Roro space shall be accurately monitored to detect and prevent flooding, fire and unauthorized access.

For SOLAS requirement:

- Stern Ramp/entrance,
- Stern WT barrier
- LNG bunkering stations
- Pilot/Bunker station doors
- Predisposition for future bow door

For ship operation:

- Cargo deck,
- Engine rooms,
- Public spaces,
- open decks,
- LSA embarkation

Final camera positions and number to be defined by rules and agreed with Owner.

Monitors located on Wheelhouse, and Engine control room and SRPT bridge.

Recording capability for 10 days playback shall be included.

419 Integrated Navigation System

One (1) Voyage Data Recorder system according to IMO performance standard A.861 (20) standard shall be provided.

42 COMMUNICATION EQUIPMENT (OWNER CHOICE)

The equipment for the Radio/communication on board shall be in compliance to GMDSS A1+A2+A3 and Class and Flag requirements.

421 Radio Plant, GMDSS

Two (2) Inmarsat-C terminal Satellite communication station Inmarsat-C, with EGC receiver according to GMDSS requirements, one of the GMDSS station to be conform to Italian D.M. 130/2003.

One (1) MF/HF radiotelephone in central console with DSC and DSC Watch receiver and Telex terminal, to be approved for Aeronautical Frequencies and Italian flag.

One (1) GMDSS distress panel at the conning position

One (1) International Navtex receiver with printer

410.4 GMDSS Radio equipment (addition to GMDSS)

One (1) VHF Radiotelephone simplex/semi duplex in the Bridge with remote control units at both Bridge wings shall be provided.

One (1) fixed GSM/Satellite telephone at bridge and one (1) portable aeronautical VHF radiotelephone shall be provided.

422 Lifeboat Radio Transmitters, EPIRBs

One (1) Free-float emergency beacon (EPIRB), mounted at a suitable location on wheelhouse top.
(Can be combined with VDR Free float capsule)

One (1) Emergency beacon (EPIRB), mounted inside wheelhouse.

Two (2) Radar transponder (SART) (9 GHZ)

423 Data Transmission Plants, Communication

A 4G mobile system for data transmission with an ethernet distribution system to the following spaces to be supplied.

Final position for socket a spare connection to be defined in accordance with the owner and equipment layout.

420.1 Telephone system and Data network

Communication cable system:

a common category 6 cables system shall be installed for telephone and data communication.

- Two (2) Cat 6 cables each crew cabin

Telephone exchange/Data communication system shall be present with sufficient number of cables and racks shall be installed in

- All crew cabins,
- work/office stations and
- necessary technical spaces
- Public spaces, decks and open deck for passengers.

The system shall be connected to telephone/data exchange system.

Telephones exchange system to be provided and to be located at the broadcast rooms and interfaced with Satellite connection to telephone and data communication.

The rooms shall be provided with air conditioning and local UPS.

The system shall comply to the minimum IT security requirements of MSC-Fal.1/Circ.3 .

424 VHF/UHF Telephone

The vessel shall be equipped with a VHF communication set for external communication.

Two (2) VHF radiotelephone with DSC and DSC Watch receiver according to GMDSS requirements.

Three (3) VHF two-way watertight portable radiotelephone apparatus with charging station and spare battery According to SOLAS Chapter II-2, Reg. 10.10.4

One (1) UHF repeater system SRTP compliant, with minimum 4 channels, to cover the ship while the watertight doors are closed. UPS power for UHF repeater system.

UHF system will be used in place of talkback system. The system shall be designed in with duplicated control units and duplicated normal/emergency power supply in such a way to survive any casualty. Charging stations to located in proper number and quantity included in wheelhouse, SRTP bridge, ECR and Steering gear

Six (6) Fixed UHF stations, one in each following location

- ECR,
- Wheelhouse
- SRTP Bridge
- Reception desk
- Master cabins

Ten (10) Ex proof UHF radiotelephone with Headsets for internal communication with charging station and spare battery

Four (4) Ex-proof UHF radiotelephone with Headsets for firemen with charging station and spare battery, to be positioned in 2 in each main fire zone where fireman outfits are located

The portable UHF radio system shall be used for emergency communication between crew and for emergency announcements over the PA system.

424.1 Central Antenna system

A central antenna system with coaxial cable for satellite broadcasts to be installed.

12 satellite channels to be provided. Signal to be distributed on the vessel as per Owner requirements.

425 Internal Communication System

Public Address & General Alarm System (PAGA)

The PAGA system shall operate throughout the loudspeaker networks with dedicated amplifiers. The PAGA system, complying SOLAS Ch. III Reg. 6.5, has to provide the following:

- Normal announcements
- Emergency announcements
- General alarm signal
- Fire alarm signal
- Background music diffusion.
- Music/entertainment system

Amplifiers shall be divided in 2 separated broadcast room, one each Accommodation MVZ to fulfil SRTP requirement.

Call station to be in wheelhouse, Reception and SRTP bridge to fulfil SRTP requirements and Flag Rules. Call stations shall be capable to recall and replay prerecorded messages.

Loudspeakers shall be grouped in sub networks based on Owner requirements. Cabling and positioning shall be performed as per rules to guarantee redundancy and acoustic coverage.

Muting to be assured during alarm or emergency announcements to background music and local entertainment systems (LES)

External loudspeaker shall be Watertight.

Talk-back system

UHF system (see 424) to be used as Talkback

Sound powered telephones (SPT)

Sound Power Telephones to be installed as per National Authority Requirements.
Number, type and position as follow:

- Two (2) SPT with noise cancelling headsets and audible/optical signal in one each Propulsion Thrusters Room
- One (1) SPT in ECR/ Fore Main SWBD room
- One (1) SPT in Aft Main SWBD room
- One (1) SPT with noise cancelling headsets and audible/optical signal in aft Main Engine room
- One (1) SPT with noise cancelling headsets and audible/optical signal in fore Main Engine room
- One (1) SPT in Wheelhouse main console
- One (1) SPT in Wheelhouse safety console
- One (1) STP SRTP Bridge
- One (1) SPT in Emergency generator room
- One (1) STP in each Fire Control Station
- One (1) STP each Master Cabin
- One (1) SPT Aft mooring/ ramps control
- One (1) SPT FWD mooring

The system shall be divided in 4 subgroups:

- Machinery
- Hull
- Maneuvering
- Emergency – Key positions

Extra devices may be required by Class.

Automatic telephones

Automatic telephones system shall be supplied covering all public and service spaces, crew & pax cabin. technical rooms ECR, Thrusters Room and Wheelhouse. Final position to be defined in accordance with owner requirements.

Calling system

Calling/alarm system to be provided for refrigerated provisions store.

420.4 SRTP Bridge

A secondary space, with front view or port and starboard open deck access, to be equipped with required equipment to conduct the vessel in case of loss of wheelhouse.

NOTE: All systems present in SRTP bridge shall be designed to survive and operate after the loss of the wheelhouse and Vice versa through duplication or segregation.

Below all the items requested for navigation and communication are recapped:

Navigation Equipment:

- One (1) Radar monitoring stations for X band radar with ECDIS
- One (1) Magnetic compass or a gyro compass interfaced with radar and ECDIS with bearing repeater
- One (1) Electronic chart system of approved type (ECDIS) interfaced with AIS
- One (1) Global Navigation Satellite System receiver interfaced with radar and ECDIS
- Echo-sounder interfaced with ECDIS
- Doppler speed log w/three axis. interfaced ECDIS

Internal communications:

- One (1) PAGA call station
- One(1)Sound-powered telephone (connected with ECR and Steering gear room)
- One(1)UHF system fixed station

External Communications

- Portable aeronautical VHF
- Portable VHF station
- Light and Signal equipment
- One(1) Whistle control or duplicated system
- One(1) Ship's Navigation Lights control panel

Essential equipment for navigation will be fitted inside.

By the fact that SRTP Bridge is located in the same MVZ of the Wheelhouse a further position located in the Reception will be provided with:

- Internal Communications: Public address & General Alarm Call station
- External Communication: Portable VHF with charging station

43 ANCHORING, MOORING & TOWING EQUIPMENT

General

Anchor arrangement and equipment and mooring arrangement and equipment shall be sized accordingly EN and high operational cycles (at least 10 cycles/day – 300 days/year).

Power Supply: 690V / 50 Hz

Preliminarily Equipment Number (EN) is abt.1400.

431 Anchors with Chain and Equipment

Two (2) flush stowed Bow anchors, stockless high-holding power balanced type, sized according to EN shall be fitted.

Suitable swivel connected to the anchor shanks; stud link anchor chain cables, grade Q3, with Kenter shackle connection.

The anchors to be linked to anchor chain and fitted in hawse pipes.

A spare anchor shall be arranged on board on the mooring deck forward or in any other location mutually agreed with the Owner.

Anyway, to be provided a suitable arrangement on board to accommodate the spare anchor.

Quick release arrangement for anchor chain cable in the chain lockers.

The anchor recesses to have water nozzles for cleaning the chain and the anchor. Jets to be arranged around each hawse pipe and connected to the fire main line with local closing valves.

Local and automatic remote release from wheelhouse.

All anchors and chains to be certified from the Classification Society.

433 Fore Mooring arrangement

Two (2) combined windlasses-winch electrical and frequency controlled with one mooring drum and one warping end, shall be sized according to the EN.

Based to the expected high operational cycles (at least 10 cycles/day – 300 days/year), the anchoring shall be appropriately dimensioned.

Two (2) Chain stopper, Roller type to be fitted. Chain holding force (80% chain MBL).

One (1) winch electric driven, locally (deck) controlled by means of frequency converter and electric motor, two at side SB and PS and one central, each with one cable lifter, one mooring drums and one warping end, shall be sized according to the EN.

Control: Combined consoles on each side with remote operation, which also handles clutch and brake. The control shall be such that both winches can be operated from each position.

Wheelhouse control station shall be capable to anchor launch and recovery, controlling windlass clutch and brake.

Equipment shall be heavy duty type due to the high daily number operations.

Electric Control cabinet insulated class IP54 for each winch, intended to be placed under deck, containing all necessary electric features to control the winch motor, brake and anti-condense heating, power supply 690V/50Hz, each with the following main functions:

- Soft starting and continuous adjustment of rotation speed in both directions of electric motor
- Overcharge protection of the electric motor
- Limitation of torque developed by electric motors request for anchor mode
- System to be able to work at 1.5x nominal torque of the motor for 2 minutes

Local control IP56 for each winch with remote operation, containing following features:

- 1 x "CONTROL ON" button / lamp
- 1 x Joystick for control of electric motor in both directions (veer – 0 – haul), proportional, type spring return in neutral position
- 1 x Emergency stop button
- 1 x System alarm

Different position each side to plug in the remote control.

Light line speed: 40 m/minute.

Control: Combined consoles on each side with remote operation, which also handles clutch and brake.

One (1) wireless mobile control box shall be provided for each mooring station (interchangeable).

430.2 Aft Mooring arrangement

Three (3) winches Electric driven, locally (deck) controlled by means of frequency converter and electric motor, two at side SB and PS and one central, each with one cable lifter, one mooring drums and one warping end, shall be sized according to the EN.

Based to the expected high operational cycles (at least 10 cycles/day – 300 days/year), the anchoring shall be appropriately dimensioned.

Control: combined consoles on each side with remote operation, which also handles clutch and brake.

Different position each side to plug in the remote control as indicated on the GA.

Aft mooring arrangement shall be capable to perform Vehicles Stern ramp emergency operation (see SFI 305.1).

435 Fixed Mooring Equipment

Two (2) recessed bollards on each side, for bunker barges.

Bollards, Panama Chocks, fairleads, stand rollers and cable chests as needed to be in compliance with regulations and guarantee feasible ship operation.

436 Loose Mooring Equipment

Synthetic ropes as per regulation (min. 10) with a minimum breaking strength according to Equipment Number, shall be provided

Emergency towing rope to be fitted on the drums.

Fittings, pulleys and dedicated rope for stern ramp emergency operations to be properly stored in dedicated storage box.

44 REP./MAINT./CLEAN. EQUIP. WORKSHOP/STORE OUTFIT, NAME PLATES

440 Workshop

A combined engine room and electrical workshop will be provided, properly ventilated and air-conditioned as per Rules and regulations and arranged with the necessary portable electrical and hand tools for normal maintenance and repair up to 5.000 Euro value and to include the following:

- Vertical drilling machine
- Grinding machines
- One Metal workbench with two vices
- High pressure washing machine
- One small work bench with a vice
- Tool board

All electrical above tools shall be CE certified.

Welding equipment to be Owner supply.

The shelves, lockers and work bench will be of the Builders standard design in general, proper storage arrangements will be made aboard the Vessel.

Storage facilities including bins, tanks, hooks, clips etc. will be substantially constructed of painted steel and arranged to prevent or restrict movement of items stowed. Lockers and shelves will be made of steel.

Workshop to be lockable.

A cleaning station for machinery parts will be arranged near the workshops:

The following arrangements will be made at the fuel cleaning station:

- Stainless steel sink
- hot and cold water
- working air supply
- shelves for chemicals
- floor gratings
- drainage with mud box connected to the oily bilge system

444 Cleaning Equipment, Garbage Chutes

Deck Cleaning Equipment

A fixed high pressure, electrical driven, cleaner shall be installed. Pressure of abt. 150 bar and water capacity of 50l/min. The high-pressure cleaner shall be connected to hot and cold freshwater system.

High-pressure stainless-steel pipe shall be led to all deck levels, engine rooms and thruster rooms, and shall be equipped with quick release coupling outlets and closing valves for hose connection.

Abt. 30 wall mounted quick connections shall be provided covering all cargo spaces, Machinery space and open decks. Final number and position to be agreed in accordance to Owner and to be verified based on GA.

Necessary drain points to avoid freezing of the system for external decks.

3x20 meters hose with nozzle and soap ejector shall be provided.

Garbage Shute

Garbage chute will convey selected garbage material to the garbage room on deck 4 from the provision unpacking area on deck 3.

The garbage room will be located on the main deck, to collect

- Cardboard and paper
- Plastic
- Metallic cans
- Glass

and shall be easily accessible for the removal of garbage containers by means of specific vehicles.

One (1) cardboard/plastic compactor to be installed in the unpacking area.

Food waste system

A vacuum food pulper waste handling and processing system to be installed.

The system has to transport and process automatically all food waste on board and to be aligned to the relevant rules prescription for food waste discharge.

To collect the wet waste generated are installed vacuum feeding stations as follow:

- one (1) in the main galley on deck 4,
- one (1) in Bar pantry deck 6.
- one (1) in crew pantry deck 6.

The feeding stations are provided to process and macerate the food waste (below the admissible particles size) at that point in food preparation areas and has to be integrated with catering equipment. Each feeding station has to be provided with relevant valves (ball/gate type), fittings, water cleaning and ancillaries.

In addition, the system has to include at least

- One (1) Vacuum unit with two (2) vacuum pumps, one in service one stand-by
- One (1) food waste tank of abt. 3m³ capacity with cleaning point
- One (1) homogenizing pump or mixer
- Two (2) Discharge pumps (one in service, one in standby) with cleaning connection to automatically wash the pump and the pump and the outboard pipe

The overboard has to be located light load water line and arranged with a remote-control valve leaded by IAS. Only Y connection and 45° bends are to be used for piping connecting the equipment. All parts that are in contact with the food waste (acid) to be made of Stainless steel AISI 316L.

One (1) Food waste collecting tank, size to be according manufacturer's recommendation

The collected food waste to be discharged to dedicated overboard pipe, or to dewatering system for composting (Option).

448 Name Plates/Marking on Machinery, Equipment, Pipes, Cables

Sign in Vehicles Cargo Spaces

At the entrance of the vehicles deck maximum allowable dimensions and weight of roro cargo shall be indicated, with Road Type Signals for Axle weight and clear height, plus uniform distributed load.

All sign shall be according to Italian standard.

Cargo deck shall be painted in Green color, 2.5 m wide cars lanes shall be marked with yellow paint, 3m wide truck lanes shall be marked by Lashing Pots colored in Yellow.

Obstacle shall be marked with Black and Yellow stripes.

Sign related to Drencher sections shall be in compliance with IMO Circ. 1615, 26 June 2019, and to corresponds with sign in the Drencher valves control room.

Other sign shall be placed according to rules

Tanks marking

Tanks will be marked adjacent to manholes and drain plugs by welding beads.

Air caps, filling and sounding pipes will be marked with tank identification and content to Buyer's approval.

Label plates of metal to be fitted on sounding pipes, filling pipes and air-pipes.

Sign in Engine rooms

All system pipes shall be marked with flow code ISO 14726 coloring system according to ISO14726 at least every 3 meters or on each point where the pipe passes through a deck or bulkhead. The marks consisting of labels showing direction of flow and system served.

All machineries, equipment, valves and others piping ancillaries shall have plate labelling made on engraved signs.

The labelling is to be foreseen also for pipes, equipment and valves also under gratings floor, lining and ceilings.

The labels shall be written both in English and Italian text.

Electrical installations

The electric installation shall be systematically labelled with English and Italian text.

White name plates with black letters shall be used and mounted by screws for all electrical cabinets, instruments, switches, handles, lamps, alarm systems and main navigational console.

Manufacturer's standard labelling can be used with the Owner's approval.

Labelling shall be robust and preferably made on engraved signs. Cables shall be labelled with robust "plastic strips". On distribution panels the distribution diagram shall be placed in a solid frame.

Labelling shall have direct reference to drawings and documentation.

45 LIFTING & TRANSPORT EQUIPMENT FOR MACHINERY COMPONENTS

452 Travelling Cranes & Lifting Gear in Machinery

Lifting beams, cranes and trolleys to be arranged for overhauling engines parts and alternators. The relevant path shall be according to GA.

For each one of the main engine room

For overhauling purposes, one manually operated chain blocks (hoist winch - both for lifting and traveling motion) to be installed above of each one of the main engines and to be supported by one (if possible to operate above both engine banks and turbochargers) "U-shaped" or two longitudinal fixed I-beam(s), fitted in accordance to main engine manufacturer instructions as regard to "lifting and service space requirements for L-engine", laid across fore and aft of the main engines, with a suitable capacity according to main engines manufacturer but not less than 1,5 ton.

Additional suitable I-beam(s) shall be arranged for the transportation of main engine parts up to the workshop entrance and in way of the engine skylight/deck opening.

Proper "SWL" shall be permanently marked on each beam.

For purifiers

For convenience of overhauling, in each purifier room an overhead lifting beam rail shall be fitted on the vertical of each purifier up to cleaning sink.

For other equipment

For convenience of overhauling the shafting and important machines, suitable number of eye plates to be welded on the construction near the shafting and machines to look a chain block in the eye plate ; proper "SWL" value shall be permanent marked in way of each lifting eye plate.

Pad eyes

Pad eyes shall be fitted on the hull in way of inclined parts for handling paintings scaffoldings, Pad eyes shall be fitted for reaching the highest parts of frontal bulkhead, funnel

453 External Lifting Gear for Machinery Components

Propulsion thruster lifting device

A gantry structure above deck 4 as indicated in the GA plan, shall be suitable for lifting the propulsion thruster units so that can be loaded on a roll trailer to be disembarked from the ship.

One (1) dedicated trolley, positioned on the top of the gantry, capable to support the weight of the thruster, shall be supplied in accordance to GA plan.

The gantry-trolley design shall guarantee a safe side to side travelling, with dedicated lock and storage positions.

The necessary equipment to move and fasten the trolley during the thruster dismantling operation and during navigation shall be Yard supply.

The Trolley shall be provided with proper cover.

Electrical chain hoist necessary for lifting of the propulsion thrusters will be supplied by the owner. The dismounting test will be done with the above.

LNG Bunker stations

A hydraulic foldable crane located inside each LNG bunker station shall be installed to allow easy lift of the bunkering piping.

The crane shall be equipped with electrical or compressed air actuated self-locking winch

After side door opening the crane shall extend the lifting point out from the ship side of about 2 m.

Lifting capacity in fully extended position to be at least 1 ton and sized on bunkering piping weight during bunkering.

Crane control panel shall be located proper position in the bunker station.

All equipment shall be ex-prof.

5000 EQUIPMENT FOR CREW AND PASSENGERS

50 LIFESAVING, PROTECTION AND OTHER EQUIPMENT

General

For short international Voyages for 1000 persons on board (ship compliant with special standards of subdivision prescribed by SOLAS regulation II-1/6.5), Lifeboats shall be provided for 30% of the persons on board. 70% in liferafts, and an additional capacity of 25% of the number of persons on board as spare.

500 Lifeboats

- One (1) davit launched fully enclosed lifeboats of approved type on one side, with a capacity of 150 seating will be installed, complete of davit.
- One (1) davit launched fully enclosed lifeboats/rescue-boat of approved type on the opposite side, with a capacity of 150 seating, complete of davit.

Power supply to be 690V 50Hz

Fast Rescue Boat

One (1) Fast rescue boat shall be fitted. The speed, power and capacity shall meet the requirements of SOLAS and of the LSA Code –Life Saving Appliances Code.

One (1) SOLAS type launching and recovery davit, suitable for FRB and MOR operations.

Means of Rescue

One (1) Means of Rescue Liferaft, as per LSA code shall be stowed next to the FRB on deck 6.

Embarkation Ladder

Two embarkation Ladders shall be stowed, one on each side, at Deck 4, in the way of lifeboat davits. Ladder length to be suitable to reach water at heeling angle from 10° to 20°.

501 Liferafts

Enclosed self-righting liferafts are arranged on board on deck 4 close to lifeboats and MES.

As per SOLAS requirements:

- Standard liferafts capacity 700 persons
- Additional liferafts capacity 250

Enclosed self-righting liferafts are arranged on board on deck 4 deployed through a MES system.

Following equipment to be arranged and symmetrically distributed PS and SB:

- Two (2) MES (Marine Evacuation System), with enclosed one liferaft for 100 persons.

- Six (6) enclosed self- righting liferafts with a capacity of 100 persons each.
- Two (2) enclosed self-righting liferaft with a capacity of 50 persons.
- Two (2) enclosed self-righting liferaft with a capacity of 25 persons.

503 Lifesaving, Safety & Emergency Equipment

A towing point, for the launch and recovery operation of the fast rescue boats, will be fitted in a suitable location on ship side for the attachment of the painter line.

Immersion Suits

A total of fifteen (15) approved rescue suits shall be delivered and located in dedicated locker in the crew quarters dedicated to lifeboats, Rescue boat and MES crew. All suits shall be marked with "Crew". Final number to be confirmed based on Muster list.

Lifejackets

Lifejackets with self-igniting light according to rules shall be stored on accommodation decks into easily accessible lockers or storage boxes (yard supply).

Life Jackets for Crew shall be stored on in Crew Accommodation, in Wheelhouse and in Engine Control Room.

Preliminary quantities are listed below:

- 1100 pcs for adults
- 100 pcs for children
- 25 pcs infants

Lifebuoys

Total number of Lifebuoys shall be 18 according to SOLAS.

Lifebuoys to be stowed in appropriate supports.

Two (2) pcs Lifebuoy with self-activating light and smoke, capable of quick release from navigation bridge.

Lifebuoys shall be marked with Ship's name and port of registry.

Other rescue equipment shall be in compliance with regulations. All equipment shall be of high quality, by recognized suppliers, and located in Owner's approved positions.

505 Loose Firefighting Apparatuses & Equip., Firemen's Outfit

Loose fire-fighting equipment for accommodation, service, machinery and cargo spaces shall be provided in compliance with SOLAS requirement.

A total of fourteen (14) firemen's outfits and relative equipment as per FSS code requirement to be provided, to be positioned at least two in two for each main vertical zone in dedicated spaces as per SOLAS requirement.

For each firemen outfit one set of spare cylinders shall be provided.

In addition, four (4) sets of personal equipment shall be provided.

One (1) breathing air compressors to be provided, for firemen air bottles recharging; power supply to be from main and emergency switchboards, or independently driven, with a minimum capacity of 60 L/min as per SOLAS requirement.

506 Chemical Protection Equipment for Dangerous Goods

Four (4) sets of full protective clothing, resistant to chemical attack, shall be provided.

51 INSULATION, PANELS, BULKEHEAD, DOORS, SIDESCUTTLES, SKYLIGHT

Accommodation General

The interior appearance to be of modern West European RoPax standard.

Reference vessel with regards to interior standard CARTOUR GAMMA, IMO number 9349758.

Unobstructed free height (in way of lamps, signs fire detectors etc.) shall not be less than:

- Accommodation decks 2100mm.
- Galley and provision stores 2200 mm
- Public spaces 2300 mm.

Crew and passenger areas details will be as per GA plan, and approximately according the following table.

DESCRIPTION	NUMBER OF CABIN	PERSONS/ CABIN	SPACE AREA
Master / Chief Eng.	2	1	abt. 15
Single bed Crew Cabins.	14	1	abt. 10
Twin bed Crew cabins	11	2	abt. 10
Crew day	1		abt. 25
Crew mess	1		abt. 55
Office mess	1		abt. 30
Crew Office	1		abt. 27
Laundry /clean/dirty linen	1		abt. 30
Linen stores	5		abt. 10
Provision/refrig.	1		abt. 20
Galley	1		abt. 100
Dry Store	1		abt. 20
Infirmary	1		abt. 46
2 bed Pax Cabin	48	2	abt. 9
4 bed Pax Cabin	55	4	abt. 10
Suites	4	2	abt. 16
RMP cabins	6	2	abt. 12
Public space / Reception	1		abt. 400
Open Deck area on Deck 6	1		abt. 700
Children playroom	1		abt. 30
Pax Self-service on deck 4	1		abt. 600
TOTAL CREW BEDS		38	
TOTAL PAX BEDS		336	

Passenger access and areas

Passengers without vehicles shall normally enter the vessel by SB dedicated ramp on deck 3. The access to passenger decks is provided at SB by escalator.

On deck 3 SB side, a luggage deposit shall be present.

Passengers embarking with vehicles on Deck 3, shall reach reception area on deck 5 via stairs and lift on SB side and fore PS stairs.

Passengers embarking with vehicles on Deck 2, shall reach reception area on deck 4 via Aft SB stairs and fore PS stair.

Main public/services spaces are located on deck 4, divided into two zones, separated by a common stair trunk provided with 2 Pax lifts and on aft deck 6.

The Muster stations shall be located:

- MVZ3 Dk. 4 - "Reception Area"
- MVZ1 Dk.4 - "Main lounge"

The SRTP Safe areas shall be located:

- MVZ3 Dk. 4 - "Reception Area" and "Pullman seats" + Dk. 5 Pax cabins.
- MVZ1 Dk.4 - "Main lounge" and "Self-service Restaurant" + Dk. 5 Pax cabins.

Deck 4 "Reception Area" & "Pullman seats" - Muster/safe area station MVZ3/4

This is main passenger hall/reception; it is arranged on deck 4 in the aft zone (MVZ3/4), where the escalator and main lift and stairs coming from the Deck 3 RoRo spaces lands.

Reception, shop, "Pullman seats area" and a shall also be arranged in this area.

About 175 seats shall be available in that area.

About 250 Pullman seats shall be available in that area.

Sanitary block shall be arranged in the abaft this zone (in MVZ4), included RMP toilets.

Deck 4 "Main Lounge"

A galley with distribution counter equipped to serve hot, cold beverage and meals will be fitted in the forward Main Zone (MVZ 1). A variety of hot meals shall be served on board.

The preparation area will be equipped for that purpose, with proper space and equipment.

About 370 seats shall be dedicated to the Main lounge and "Self-service Restaurant"

Sanitary block shall be arranged in the aft portside part of the zone included RMP toilets.

Aft open deck will guest Dogs cages.

Deck 5 id dedicated to Pax cabins.

Deck 6 "Upper Bar" and Crew cabins

On Deck 6 aft, there is a large open area furnished with tables and seats for about 300 passengers, partially shadowed by a Solar Cell roof.

Upper bar with distribution desk is present, with dedicated pantry.

Children room is also positioned in the area.

About 300 seats shall be available in that area.

PASSENGERS AVAILABLE SEATS	
Reception/Hall	Abt. 175
Pullman Seats	Abt. 250
Self-service Restaurant and Main Lounge	Abt. 370
Open Deck 6	Abt. 300
TOTAL	Abt. 1095

PRM - Passengers with Reduced Mobility

All accommodation spaces, public spaces and escape routes shall fulfill the local regulations see SFI110.3 and international rules as for passengers with reduced mobility (PRM), as per tactile maps and paving, minimum alleyway and door clearance, PRM lift emergency supply, etc.

Crew areas

Crew accommodation is located at the fore part of Deck 6.

Crew cabins are arranged as single and double.

Officer cabins are single cabin.

Crew areas are in general separated from passenger areas with separated accommodation areas and dedicated stairway. Crew stairways may be used also as passenger emergency escape

Crew cabins shall fulfil MLC 2006 requirements.

510 Furnishing of cabins

Crew and passenger areas details will be as per GA plan.

Builder shall present one cabin mock-up module including wet unit to Owner satisfaction.

Laminate for furniture can be used for wood appearance. All material shall in general be of non-flammable type meant for maritime use.

511 Insulation, Panels, Bulkheads, Doors, Side-scuttles, Skylights

Fire Insulation

Steel hull passive fire protection shall be provided as per Structural Fire Protection Plan according to SOLAS requirements. Where fire insulation is placed, no additional thermal or sound insulation will be installed unless deemed necessary for noise reduction.

Thermal Insulation

On external boundaries (deck, bulkheads and shell) of air-conditioned accommodation and service spaces Mineral wool thermal insulation shall be fitted, not less than:

All above area to be insulated not less than:

- 100 mm thick, 35 kg/m³ on plating
- 25 mm thickness, 35 kg/m³, over structural elements (stiffeners)

Thickness of insulation material to comply in anyway with requirements for insulation against heat, cold, fire and noise.

Insulation to follow the contour of the structure without creating any voids and is to be over-lapped with a ribbon (thermal bridge) which extends at least 300mm from the protected surface on web frames, girders and decks.

Thermal/comfort insulation shall be combined with fire insulation.

Sound/Acoustic Insulation

All insulation to be defined by the Builder in order to comply with the noise levels defined in section 10.10

Insulation in sandwich-element wallboards may form part of above thickness.

Insulation Finishing

Insulation under linings to be covered with aluminum sheet. All free edges to be securely pinned to the structure.

Insulation under the deck above the RoRo space shall be covered by Fiberglass tissue ready to be painted and lined with thin aluminum or corrugated galvanized-painted steel plates.

Insulation which is exposed to be covered with a heavy fiber glass tissue cloth which is pre-treated for receiving the painting system. Pin ends and securing washers to be covered with pads of cloth material glued in place and painted. A profile between deck and insulation to be mounted according Builder's standard to prevent water from soaking the insulation fibers.

For service spaces and machinery spaces insulation which is particularly exposed to physical damage will be protected by a galvanized or painted steel sheeting 0,8mm thick or with a light alloy sheeting 1mm thick fitted on adequate support structure. The metal lining to be extended from deck to a height of 2 meters without any exposed sharp edges.

Panel, Bulkheads and Ceiling

Accommodation partitioning shall be done according to approved Structural Fire protection Plan, building material certified accordingly

Bulkhead, lining and ceiling panels shall be mounted on metallic support structure.

Ceilings will be based on panel paint protected system mounting and shall be of fire-retardant material.

Surface finishing shall comply with SOLAS requirements.

Installation shall be carried out taking care to prevent any resonance or noise generated by movement of the panels.

All Accommodation construction shall be made of noncombustible material, constructed with panel system.

Panels shall have in general following thickness:

- Covering Bulkheads 25 mm
- Partition 50 mm

512 Doors in Accommodation

All fire rated doors to be certified as per Marine Equipment Directive (MED), fire rating as per approved Structural Fire protection Plan. All fire rated doors shall comply with SOLAS requirements, regarding closing, opening, signaling, etc.

All fittings of doors (Hinges, handles, locking devices) shall be stainless steel.

The doors will be PVC coated and have painted steel frame.

512.1 Door locks and cylinders

Cabins doors locking shall be metallic key (not electronic).

All doors, except non-lockable doors, to be equipped with locks organized into master key systems, including passenger cabins, crew cabins, public rooms, lockers, fan rooms, pantries and public toilets, etc. Final rooms and details of exact master and sub-master key divisions and distribution to be finalized in cooperation with Buyer to suit the operational conditions. A system of key-tags to be provided for all keys and key system on board, subject for Buyer's approval.

Keyboard/lockers suitably labelled to be supplied and located in a sufficient number to Buyer's requirement. Locking plan to be approved by Buyer.

Doors locks (ISPS) to be of heavy-duty electronic type. In general, all doors giving access to the vessel from the outside, should be lockable.

513 Other Internal Doors

513.1 Watertight Internal Doors

Hydraulically or Electrically operated remote-controlled watertight sliding doors shall be fitted, where required by applicable rules and regulations, in bulkhead below the Deck 3, as per General arrangement plan. Doors to have position (open/closed) indication on bridge. Doors shall comply relevant SOLAS requirements regarding operation, position indication, alarms etc. Sliding doors coamings shall be flush with floor grating.

Clear door opening not less than 1200mm.

513.2 Fire Doors

All fire rated doors to be certified as per Marine Equipment Directive (MED), fire rating as approved Structural Fire protection Plan. All fire rated doors shall comply with SOLAS requirements, regarding closing, opening, signaling etc.

Fire doors in general shall be hinged. Door leaves in public area to be lined with a finishing laminate or foil matching the adjacent wall finish on both sides.

514 External doors

External doors to be certified as per Marine Equipment Directive (MED) where applicable.

For shell side doors see SFI 307.

All external doors shall have coamings according to ILLC and relevant stability rules, shall be suitable for the specific location and fire rated according to the relevant rules.

Doors on upper decks shall have coamings to the Owners' satisfaction.

If external door is Fire door it shall comply with requirements for fire doors

Sloped ramps for accessibility of wheelchair shall be located where necessary.

Door can be hinged or sliding, according to the GA and a door plan to be submitted to the Owner for approval.

Passenger and Crew doors leading shall open deck have windows. Doors leading to wheelhouse shall have large windows.

515 Side Scuttles & Windows

Sizes, number and location of cabin side scuttles and windows to be in accordance with General Arrangement drawing and a Side scuttles & windows plan to be approved by the Owner.

Windows in accommodation shall be of fixed type, with steel frame to be welded to the ship structure. All windows glasses shall be flat, double panes, energy saving type (dry gas filled) with:

- thermal conductivity less than $2.5 \text{ W/m}^2 \text{ }^\circ\text{C}$.
- Sun Factor: 0.40 (40% of sun heat will go through)
- Daylight transparency: 68%

Strength and thickness of windows frame and glass shall be designed according to rules and based on vertical and longitudinal position.

Windows in public spaces shall have the dimensions of 1400 x 1800 (b x h) and installed about 250 mm from the deck. Large size windows may be reinforced by intermediate frame bar.

Cabins windows to be approximately 530 x 680 mm.

All side scuttles and windows to be internally finished with window boxes of GRP or metal according Builder's standard. Lower part of window boxes to be strengthened to allow for seated and standing passengers.

Windows in way of descent of LSA shall be properly fire rated, as per regulations.

Wheelhouse windows

Wheelhouse windows shall give the best view outside, with narrow mullions (as much as practicable). Preliminary number of windows as per GA plan to consider:

- Twenty (20) standard size Windows abt. 1200x1200
- Ten (11) Full height Size Windows abt. 1200X1800
- Two (2) floor windows for wing consoles abt. 1200x650

Electrical windows wipers and washing nozzles shall be fitted. Sun screening roll-down curtains of polarized type shall be fitted to wheelhouse.

Number of wipers to be installed approx. 12,4 in front, 3 each side, 1 aft each side

516 Skylights

Four (4) skylights, size 6800x2000 mm to be installed on deck 7, to provide natural light to crew spaces on deck 6.

The skylights shall be provided with light filtering shades. Filtering grade to be defined in accordance with the Owner.

Design shall consider Helicopter pick up point requirements.

52 INTERNAL DECK COVERING, LADDERS, STEPS, Railing

521 Internal Decks Flooring

Lightweight Levelling compound ($\leq 900 \text{ kg/m}^3$) shall be used under flooring.

In any case, deck steel works shall be performed to avoid levelling underlay to exceed 13 kg/sqm .

Internal decks in accommodation shall be floored mainly with PVC marine use laminate, colour to the Owner choice in all spaces and for sanitary rooms.

Galley and Pantries with antislip ceramic tiles.

In wet spaces PVC covering shall extend vertically on the wall panels for abt. 200 mm, watertight joints.

Service rooms not used by passengers may be painted.

Details of flooring shall be presented to the Owner for approval.

524 Stairways, Ladders and Handrails in accommodation

In all passenger and crew corridors, along escape routes, handrails shall be fitted, complying with SOLAS requirements

Width and slope of internal and external stairs on escape routes shall comply with SOLAS and FSS Code requirements for escape routes.

Stairs to be made according to Yard standard approved by Owner, and in compliance with Flag Authority rules. Main Passengers stairs and external stairs to have slope not exceed 35 degr. Other passengers' stairs to have slope not exceeding 40 degr.

Crew stair to have an inclination not greater than 50 degr. And with to be not less than 700 mm.

Stairs trunk leading to RoRo space shall be in overpressure to the main garage pressure.

All steps shall be fitted with antislip aluminium bars at the extremities. Appropriate finishing to avoid discontinuities on step and deck flooring.

525 Flooring in Machinery Spaces

Flooring in machinery spaces shall be made of steel droplet plates, screwed on the angular profile frame system. Single plate shall weight less than 25 kg. Flooring shall cover all area necessary to have access, do service and dismount parts. Hatches in way of equipment below shall be arranged.

Machineries spaces stairs shall have stairs made by hard antislip surfaces or grating.

53 EXTERNAL DECK COVERING, LADDERS

531 External deck covering

External decks will be painted in anti-slip paint as per Paint Specification.

533 Handrails, Railing, Rail Gates

Railing on passenger deck and stairs shall be 1100 mm high and made of vertical round bars with 180 mm spacing. Handrail to be round pipe, 50 mm dia.

Vertical Spacing could be modified related to National regulation.

Handrails shall be fitted on external bulkheads where necessary.

Handrails with gates shall be placed around FRB, Liferafts and external stairs to helideck.

Stern Ramp shall be provided with railings on both side of the path.

All Handrails to comply to SOLAS and related regulation requirements

534 External Platforms, Steps, Ladders & Grating W/Equipment

External platforms and stairs according to GA plan. External stairs shall have steps made of grating and shall be built of painted or galvanized steel.

All external stairs should be provided with handrails on both sides.

54 FURNITURE, INVENTORY, ENTERTAINMENT EQUIPMENT

The material used for the furniture shall use as core Poplar Plywood MED certified, no chipboard type has to be considered.

541 Furniture for Crew, Standard Furniture

The general layout will be according to the GA plan. Final layout shall be presented to Owner for approval.

542 Wheelhouse

A preliminary layout of the wheelhouse is represented on the GA plan. Final Layout shall be presented by the Yard for Owner approval.

Floor in wheelhouse shall be raised abt. 500 mm to allow cable passage below.

The navigation consoles shall have ergonomic angled top plates/panels, and large, easy dismountable hatches for easy access on rear.

Pilot Chairs will be standard type with footrest.

546 Entertainment System

A common antenna installation for TV and radio with an antenna amplifier shall be fitted.

Connections for TV and radio antennas shall be arranged with connections in all Crew and Passenger cabins and in passenger lounges.

One 24" color TV set per cabin, two 50" color TV set shall be fitted in each main passenger lounge to be used for broadcasting of safety videos.

Cabling and mounting shall be done by Yard. TV set will be Owner supply.

The distribution system shall have standard architecture or connected via data cables and IPTV; the type shall be defined in accordance with the Owner. The system shall be interfaced with PAGA and muting.

548 Furniture for Passengers

The general layout will be according to the GA plan and the interior final design.

All public spaces to be easily accessible by passengers, including persons on wheelchairs, which shall have also dedicated spaces for stay and locking devices on the floor.

Lockers for lifejackets shall be easily accessible and located in the right proportions around the ship.

An adequate number of public toilets shall be fitted with

- WC
- washbasins
- Urinals
- Reduced Mobility Persons WC + washbasin and
- changing table for infants located generally in RMP toilets

55 GALLEY/PANTRY EQUIPMENT

551 "Self- service Restaurant" Main galley

A main galley of abt. 140 sqm (included stores), directly connected with the self-service counter of about 20m with 2 cashes. Serving the Main lounge.

Equipment to be Owner selection.

Galley equipment shall include necessary furniture, equipment and kitchen machinery to prepare and serve food (hot & cold) and beverages, cleaning and storage of dishes and kitchen tools and equipment for disposal of food waste. The capacity shall be sufficient to provide the above services for the abt. 160 persons in two shift, plus the crew.

The main galley and other food preparation areas shall be of "easy to clean" type including:

- Efficient deck drain system
- Floor tiles.
- Stainless steel furniture.
- Stainless steel walls.

The counter of the Distribution area shall be equipped with shutters which can be closed when not in service.

A dry and cold store to be arranged in the back, as per GA plan, with easy access through manual pallet truck or carriages from the service lift starboard.

An unpacking area shall be provided close to dry store, it will be directly connected with a garbage chute to the garbage room on deck 3.

552 Galley/Pantry Equipment For Preparation & Serving

Food preparation equipment to be arranged as per Owner selection in

- Main galley on deck 4 for food preparation and scullery service.
- One (1) Pantry shall be arranged on deck 6 MVZ 1, for crew food preparation and scullery service.
- One (1) Minor pantry shall be arranged on "Upper Bar" pantry on deck 6 with direct access to the relative bars.

553 Cafeteria

One (1) bar/cafeteria shall be fitted, to serve coffee and cold drink On Deck 4, MVZ3.

One (1) bar cafeteria shall be fitted, to serve coffee and Hot & cold drink and snacks on Deck 6, MVZ1.

The equipment shall be Owner selection.

554 Freezing/Refrigerating Systems For Provisions

One Cold store of abt. 20 sqm to be arranged in direct connection of Main galley.

A dedicated refrigerated equipment shall consist of two (2) water cooled compressors, each of 100 % of total capacity, each supplying for both freezer rooms and fridge rooms.

Provision shall be stored in following compartments:

- Freeze room -18/-20°C
- Cure meats, milk products/ Vegetables +2/+4°C
- Cold store access area 0°C ÷ +8°C

56 TRANSPORT EQUIPMENT FOR CREW, PASSENGERS & PROVISIONS

561 Elevators and escalators

The ship is equipped with an efficient system for vertical access for passengers, crew and provision. The elevators and escalators must be certified by licensed company and in compliance with regulation listed in 110.3 and ISO 8383 - Regulation for use on board ships - Lift and elevators.

Passengers

- one (1) passenger escalator, from deck 3 to the reception area on deck 4.
Minimum step net width 1000 mm
- one (1) elevator, abt. 2100x1400mm, capacity 12 persons, min clear opening 2000x1000mm, from deck 3 to deck 6, sized for wheelchair and stretcher in horizontal position with 4 stops.
- one (1) elevator, abt. 1400x1100mm, capacity 6 persons, min clear opening 2000x1000mm, from deck 3 to deck 6, sized for wheelchair position with 3 stops.
- Two (2) elevator, abt. 1400x1100mm, capacity 6 persons, min clear opening 2000x1000mm, from deck 4 to deck 6, sized for wheelchair, with 2 stops.

All elevators shall have no sills for wheelchairs easy passage, Braille writing on the panels and voice information. Door clear opening shall be greater than 900 mm.

The elevators must be in compliance with regulations for use on board ships and be certified by licensed company and Classification society.

Service

- one (1) service elevator abt. 1300x2000mm, capacity 12 persons or 900 kg, min clear opening 2000x900mm, with 3 stops and 2 internal doors according to GA, and is used to carry the provision from deck 3 to the unpacking storage on deck 4, to hotel store on deck 5 and to the Crew deck (Deck 6). The minimum door free width is 900mm. 4 stops and 1 internal doors according to GA.

Food lift

- One (1) food lift is used to carry the food for the crew and the officials from the galley on deck 4 to the mess on deck 6. The food lift would have minimum internal dimension of about 600x1000mm. 3 stops and 1 internal door according to GA.

566 Helicopter Platforms W/Equipment

The unit is provided of a Helicopter Landing area suitable for helicopters in emergency operations. The Helicopter type considered for structural calculation is:

- Builder and Model: Agusta Westland 139 (or similar)

- Max weight: 7000 kg

Note: Max weight could be modified based on average weight of rescue helicopter available on the operation areas of the vessel.

Deck structure related to Chapter 2

All Requirements to be fulfilled based on Regulation

Thermal insulation to be foreseen inside helideck cofferdam.

57 VENTILATION, AIR-CONDITIONING & HEATING SYSTEMS

General

Ventilation and air conditioning system shall be arranged for each main fire zone and no duct shall penetrate through a fire zone division according to relevant Rules, SOLAS and fulfil SRTP redundancy.

The ventilation to be designed in accordance with flag authority, Classification society and international standards:

- ISO-7547 "Air-conditioning and ventilation of accommodation spaces – Design conditions and basis of calculations".
- ISO-8861 "Engine room ventilation in diesel-engine ships - Design requirements and basis of calculations (15.05.1998)".
- ISO-8863 "Ship's wheelhouse windows – Heating by hot air of glass panes".
- ISO-8864 "Air-conditioning and ventilation of wheelhouse on board Ships - Design conditions and basis of calculations".
- ISO-9943 "Ventilation and air-treatment of galleys and pantries with cooking appliances".

HVAC system study and thermal balance shall be performed by a professional specialized company.

The identified system shall be approved by the Owner and shall met Flag Authority Rules and environmental conditions stated in the table below:

Summer		
Sea water	32°C	
Air outside	+35°C	70%RH
Air inside	+23°C	50-60%RH
Winter		
Sea water	0°C	
Air outside	0°C	90%RH

Air inside	+22°C
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The system is designed to maintain contractual conditions with all the external doors closed and is to be fully balanced and tested also in operating summer conditions during guarantee period.

Minimum air changes shall be as follows:

Compartments	Supply Air (fresh)	Supply Air Changes [Vol/h]	Exhaust Air Change [Vol/h]	Energy Recovery
<i>Pax Cabin</i>	100%	6		Rotating enthalpy exchanger
<i>Crew Cabin</i>	100%	6		Rotating enthalpy exchanger
<i>Cabin Pax/crew Toilets</i>			15	Rotating enthalpy exchanger
<i>Public Toilets</i>		10	15	Separate exhaust system
<i>Public Area</i>	100%	10		Rotating enthalpy exchanger
<i>Galley</i>	100%	*	*	Separate exhaust system. No recovery.
<i>Wheelhouse</i>	100%	10 (**)	10 (**)	Rotating enthalpy exchanger
<i>Pantry/Bar (without cooking appliance)</i>	100%	10-12	12-15	Separate exhaust system. No recovery.
<i>Laundry</i>	100%	10	15	Separate exhaust system. No recovery.
<i>Stairways</i>	50%	5-10		Separate exhaust system. No recovery.

Irrespective of the above, in all operating conditions, at least the minimum fresh air supply quantity per person to be in accordance with the requirement of ISO 7547:2002.

Heat load calculations are based on loads of persons, lighting, equipment, solar gain and heat transmissions and to be in accordance to ISO 7547:2002.

* Galley quantity of the exhaust and supply airflow shall be greater than the supply airflow calculated according ISO 9943-2009.

** Wheelhouse quantity of the exhaust and supply airflow shall however be greater than the supply airflow calculated according ISO 8864-1987.

In principle, separate AC systems to be provided for the following areas:

- Pax Passenger cabins and public spaces dk 6;
- Public spaces on deck 5;
- Wheelhouse
- Crew cabins and crew area
- Stairways
- Galley (To be verified if necessary)
- Technical rooms
- Laundry

Special attention shall also be given to maintain effective air conditioning of the passenger lounges when taken into account doors being constantly opened by passengers. Fan curtains, air locks or other equivalent solutions are to be considered in order to avoid unnecessary "leakages".

Separate exhaust systems to be arranged for the following areas:

- Infirmary
- Galley
- Pantry
- Laundry
- Public Toilets

Back up air conditioning system based on Self Contained Units (SCU))

- Battery Room
- PA system room
- Navigation/Tech. room
- Electrical equipment room (Deck3 and 6)
- ECR/Fore Main SWBD room
- Aft Main SWBD room

Optional unit to be considered on maker request for ESS system

All stores and bunker station to have mechanical ventilation

Natural ventilation only:

- Voids
- Trunks
- Escapes

571 Ventilation/air conditioning and heating system for accommodations

General

All ventilation and AC ducts shall comply with SOLAS requirements (insulation, flaps, dampers etc)

The Air conditioning cooling plant to consist of three (3) chilled water units, each with 50 % of total capacity located in the in different MVZ to fulfil SRTP requirements.

HVAC system to be a 100% fresh air, heat recovery, single duct type.

Heat recovery for AC systems to be arranged with an enthalpy wheel.

Minimum fresh air requirements in accordance to ISO 7547:202 and Flag Authority.

Control of accommodation and technical spaces to be in in charge of HVAC automation system.

All ventilation inlets to be provided with demisters.

AHU chilled water to be supplied by chilled water system.

AHU hot water system to be supplied by waste heat recovery system during normal working condition. Only for emergency or occasional usage as back up of waste heat recovery system an electrical water calorifier shall be installed:

- One (1) electrical calorifier of 2m³ capacity, stainless steel made, with proper capacity to sustain HVAC heat load request.

Capacity of pumps to be according to final heat balance.

AHU to be located as indicated in GA. AHU power supply to be designed in accordance to SRTP.

Air velocity according to class notation

For guidance the distribution will be divided into two systems:

- high velocity max 15 m/s for cabin areas
- low-medium velocity approx. 6 - 8 m/s for public and technical spaces
- low-medium velocity about 8 m/s for structural inlet/outlet trunks

The above air velocity values are given only as guidance and they are not to be intended as maximum values.

Noise levels according to class notation.

No thermal insulation material inside the duct, only external.

Passenger and Crew Cabins /Crew Spaces

Fresh air supply 100% from AHU, distribution via thermally insulated spiro duct and supplied to the individual spaces through cabin units.

The primary air system provides the cabins with fixed air volume of fresh air based on the contractual number of occupants and to compensate for the airflow exhausted through the cabins' toilets and the corridors.

Each cabin shall be provided with wall mounted thermostat controlling cabin temperature setpoint through the cabin unit and AC louvers in way to close/adjust the airflow.

The Cabins AHU consists of:

- Filter section
- Rotating enthalpy exchanger
- Heating section (hot water)
- Cooling coil
- Fan section with Frequency converter for RPM control
- End section with spiro duct connection
- Exhaust part with inlet section with spiro duct connection, filter and fan

Passengers Public Spaces

Public space ventilation is 100% fresh air with energy recovery and individual temperature and air volume control in each zone in each Public Area. Fresh air and pre-cooling/heating is provided from AHU and distributed through thermally insulated spiro duct or square ducts system and supplied to the rooms through perforated ceiling or slots.

The public spaces are divided as indicated below:

MVZ3

- Reception area - Deck 4
- Pullman seats - Deck 4

MVZ1

- Main Lounge - Deck 4
- Self service - Deck 4

are divided into zones and each zone can have different supply temperature controlled by the public fan coils.

The public fan coils control the temperature by mean of chilled water and electrical heater.

Rain fall air supply system optimizes the individual climate control in zone of the public area.

Lounges shall be isolated by exterior areas by means of double door lobbies and Upper Bar with air curtains to reduce the thermal losses.

The public spaces AHU consists of:

- Filter section
- Rotating enthalpy exchanger
- Heating section (hot water)
- Cooling coil
- Fan section with Frequency converter for RPM control
- End section with spiro duct connection
- Exhaust part with inlet section with spiro duct connection, filter and fan

Public Toilets

Special attention shall be paid to avoid spread of odours from toilettes to other spaces.

Public toilet shall have a rate of 15 air changes/h in extraction.

Staircase

Staircase ventilated with return air units. Fresh air supply 50% from AHU and 50% of recirculation
The primary air system provides the staircase with a variable air volume of fresh air based local sensor indications.

AHU shall be connected to Emergency power source for over pressure during shutdown

The Cabins AHU consists of:

- Inlet optional return air section
- Filter section
- Heating section (hot water)
- Cooling coil
- Fan section with Frequency converter for RPM control

Wheelhouse

Wheelhouse ventilation is 100% fresh air with energy recovery and temperature control with fan coils

Rainfall air supply

Included a defrosting system:

- One centrifugal fan
- One duct mounted heater
- window nozzles
- desk mounted control panel

The Wheelhouse AHU consists of:

- Filter section
- Rotating enthalpy exchanger
- Heating section (hot water)
- Cooling coil
- Fan section with Frequency converter for RPM control
- End section with spiro duct connection
- Exhaust part with inlet section with spiro duct connection, filter and fan

Main Galley/Pantries

Air supply from Public space AHU or dedicated AHU based on supplier recommendation

Mechanical extraction fan (Frequency controlled) 100 - 50% air volume

Special precautions to be taken to avoid condensation resulting from the introduction of cold air into the rooms.

The air supplied to and exhausted from the rooms to be sized to ensure an air flow balance and hence minimize draughts to the adjacent spaces.

All galley exhausts over hot ranges, grills, fryers, and similar equipment producing grease to be fitted with hoods, and grease filter, grease trap and fixed fire extinguishing system as per SOLAS requirements.

Stainless steel hoods to be installed complete with automatic fire dampers and fail to safe actuator.

Crew Laundry (part of the Crew area ventilation):

Air supply from Crew cabin AHU

Mechanical extract fan (Frequency controlled) 100 - 50% air volume

The air supplied to and exhausted from the rooms to be sized to ensure an air flow balance and hence minimize draughts to the adjacent spaces.

Exhaust duct to be arranged from driers and ironer with stainless steel filter for easy cleaning

Ducts to be arranged with inspection hatches and firefighting means.

Fire dampers according to class requirements

Infirmary (Part of crew area ventilation)

Fixed air volume from Crew cabin AHU

100% fresh air to be filtered

Separate exhaust fan Air to be filtered

Pax/Service lifts/Escalator

Fixed air volume from Staircase AHU

Surplus air to open deck

To be according to lift supplier recommendations

Technical Rooms

Balanced supply and exhaust systems.

Air supplied and air exhausted from the rooms to be sized to ensure an air flow balance and hence minimize draughts to the adjacent spaces.

If necessary, separate fan coils to be installed in Electrical equipment room, lift machinery etc.

Complete list to be according to final GA)

HVAC Control System

The hardware for electrical components (starters, etc.) and automation equipment will be mounted on/near each Air Handling Unit (decentralized installation).

The HVAC plant automation system of the stand-alone type is intended for the control and monitoring of accommodation central AHU's and optional interfaced to the IAS system

All HVAC fans and controllers shall have automatic re-start after black-out.

572 Chilled Water system

A chilled water system to be arranged for serving following areas / compartments:

- AHU for Passenger cabins
- AHU for Crew Spaces/cabins
- AHU and FC for Public spaces
- AHU and FC for Wheelhouse
- AHU for Stairways
- UPS/server rooms/ESS room
- Main technical rooms with Self-contained units (SCU)

The system consists in two (2) chilled water units with 2 compressors each with a rated capacity of compressor skid 66 % located in separated rooms located in different MVZ.

All compressor to be used in dry dock with sea water dry dock connection
All compressors are interconnected by crossover piping with manual closing devices.
All chilled water pipes to be thermal insulated. Steel pipes to be properly cleaned and coated before thermal insulated. No coating needed for copper piping before insulation.

Two (2) Chilled water circuits to be arranged, one each MVZ.

Each circuit to consist of:

- 1 off chilled water unit with 2 off compressors
- Number of circulation pumps: 2 Frequency controlled
- Buffer tanks 1 (If necessary)
- Expansion tanks 2
- Water treatment station

The Chilled water system to be equipped and arranged according to HVAC system supplier's recommendation and classification society requirements.

Ring distribution to be designed according to SRTP requirement.

573 Ventilation/Air-conditioning for Control Rooms

Wheelhouse

The Wheelhouse is served by the main HVAC system or a dedicated AHU. Extra independent fan coil units served by chilled and warm water system, shall be fitted to cope with temperature peaks.

ECR/Fore Main Switchboard Room and Aft Main SWBD Room

The Engine control room (ECR/main switchboard room) and Aft Main SWBD Room shall be arranged with a cooling system consisting of an independent air conditioning system (SCU). The system shall be dimensioned to keep 24°C air temperature when the external temperature is as per SFI 10.8.

Fresh Air Supply demand 30m³/h per person from Engine Rooms air supply ventilation.

574 Ventilation/Air-conditioning for engine and machinery rooms

Engine room ventilation shall be regulated by engine load and temperature. Pressure shall be kept as constant as possible.

Ventilation to be in accordance with ISO 8861 standard and relative amendments.

For machinery areas including propulsion thruster rooms, engine rooms, equipment room, bow thruster room and emergency genset room and all the other technical spaces conventional overpressure ventilation with axial type electric driven fans is arranged.

Min air Changes per rule requirement

Supply fans to be installed in one common air duct on the ship side for each engine room and exhaust in relative funnel. Air inlet will be arranged with water trap, manually and automatic operated shutters.

Distribution ducts to be arranged in engine room for an efficient ventilation of the engine spaces.

Aft and Fore Main Engine Room

Ventilation configuration to be as follows:

Air Supply system

- Inlet louvers, Mist eliminator, water trap connected with external scuppers
- Two (2) Axial supply flow fans each 50%.
- Two (2) Closing dampers w/actuators
- Two (2) Sound attenuators
- Two (2) Flexible connections
- Two (2) Frequency controllers
- Two (2) Control cabinet

Air Exhaust system

- One (1) Exhaust louvers (in the funnel)
- One (1) Axial exhaust flow fan 100%
- One (1) Closing dampers w/actuators
- One (1) Sound attenuators
- One (1) Flexible connections
- One (1) Frequency controllers
- One (1) Control cabinet Common with supply fans
- Fresh air inlet

Variable Air Volume system for comfort air and combustion air.

Max temperature admissible in Machinery space temperature +45°C.

Min temperature admissible in Machinery space temperature +10°C.

575 LNG Tank Connection Space and Tank Room Ventilation

The whole hazardous part of the LNG system, which include:

- LNG tank connection space
- GVU (Gas Valve Unit)
- Double wall ventilated piping
- DF engines

is a Gas tight system with ventilation and extraction made by a redundant set of EX fans. The system shall be designed as per Maker instructions.

Air inlet will be arranged with water trap, mist eliminator connected with external scuppers and particle filter. Additionally, manually operated air shutter will be arranged. Air outlet shall be arranged with water trap.

LNG tank room shall have 10 air changes per hour.

Air change can be increased to avoid condensation, possible dehumidifier installation on maker indication.

576 Ventilation of Propulsion & Bow Thruster Rooms

Propulsion Thruster Room

- Air supply fan
 - Air exhaust fan
 - Fan coil unit connected to ship's Chilled water system with electrical heater*
- (*) To be installed only on thruster maker request and HVAC supplier recommendation

Bow Thruster Room

- Air supply fan
 - Air exhaust fan
 - Fan coil unit connected to ship's Chilled water system with electrical heater*
- (*) To be installed only on thruster maker request and HVAC supplier recommendation

576.1 Auxiliaries Rooms or other technical spaces below bulkhead deck

Anyway for other spaces where technical equipment can be placed proper ventilation shall be considered as below indicated.

- Air supply fan
 - Air exhaust fan
 - Fan coil unit connected to ship's Chilled water system with electrical heater*
- (*) To be installed only on thruster maker request and HVAC supplier recommendation

577 Central Heating System

Central heating system to be supplied in principle by heat wasted by Engines Cooling

When the heat recovery system is not operating, a dedicated electrical boiler has to be provided as back up.

The system to be designed with dedicated pumps and equipment for each MVZ and relative Engine room.

It has to be provided with:

Four (2+2) Circulation Pumps, frequency controlled (50 % of total capacity each)

Two (2) Expansion tanks

All hot water pipes to be thermal insulated. Steel pipes to be properly cleaned and coated before thermal insulated.

579 Ventilation in deck store

All Air inlet will be arranged with water trap, mist eliminator connected with external scuppers and particle filter shall be supplied for any space.

Hydraulic Room

- Air exhaust fan
- Air supply fan

Emergency Gen. Set Room

- Air supply fan
- Supply louvers
- Exhaust louvers

Garbage Compacting/Sorting Room

- Air exhaust fan
- Air supply fan

Nitrogen Rack room

- Air exhaust fan
- Air supply fan

Paint Store

- Air exhaust EX-Proof fan
- Air supply fan

Lashing Store

- Air exhaust EX-Proof fan
- Air supply fan

Ex-Proof listed rooms (To be checked with final GA)

- Paint store
- Fuel treatment room
- Battery room (Depending on battery type)
- LNG Bunker station PS/SB
- Bunker Station PS/SB
- Gas venting Fans room

Note: For louvres and vent grids that may present water inlet or condensation, differing from what listed before, dedicated solution shall be defined in accordance with Yard and approved by the Owner.

58 POTABLE WATER SYST. W/DISCHARGES, ACCOMMODATION DRAIN SYSTEMS

581 Potable water supply system

The whole potable water system must satisfy the requirements of all applicable rules in all the aspect concerning the health of passengers and crew, but at least the following rules listed in 11.3 points 2 to 5 shall be followed.

Redundancy of systems to be assured with dedicated storage tanks and supply pumps during SRTP conditions.

Each potable water components shall be properly sized in accordance to potable water balance to be submitted for Owner approval. For the distribution of fresh and warm potable, system to be arranged at least as follow:

Storage and Bunkering

The potable water storage system consists of two structural tanks properly coated with capacity as per 10,4. Every potable water storage tank should be provided with a vent located and constructed so as to prevent the entrance of any contaminating substances. The vent or combined vent and overflow should terminate with the open end pointing downward and should be suitably protected.

The coating materials of storage tanks should not be toxic or allow any contamination of potable water by toxic substances. Coatings should be applied correctly including the surface pre-treatment, prewashing, coating method, film thickness, etc. and all procedures should be documented.

The filling line to the storage tanks is to be connected by one filling crossovers for the fresh water supply from shore with one port and one starboard multiple hose connections.

Each shore connection for each potable water bunker station will have a capacity of 40 t/h.

Treatment

The bunkered water will be processed before to transfer to the potable water storage tanks, by passing through an automatic halogenation unit during bunkering. The process consists in a PID control system composed by:

- Panel and sensors for chlorine and pH
- Chlorine distribution pump and tank
- Acid distribution pump and tank

The system will automatically detect and correct the chlorine and pH values and will be led by IAS.

Water delivered to the service system is to be dechlorinated and then disinfected through One (1) UV sterilizing units and filtered through two (2) filters.

Any waste sampling water used in the analysis process is to drain to the grey water system.

Distribution

Cold potable water distribution system shall be provided with

- Four (2+2) electrically driven vertical centrifugal self-priming pumps each having a capacity of abt. 20m³/h against a total head of 50 m (one continuously running, the second starting on low pressure, one as stand-by).
- two (2) hydrophore vessel made of stainless steel, capacity of 1.5m³ each, design pressure 6 bar. One each MVZ.
- one (1) freshwater transfer pump of 25 m³/h against a total head of 50m (can be arranged also as emergency distribution pump)

and all the necessary connections, branches and ancillaries to ensure maximum availability of system.

The pump in service shall start automatically when the pressure drops under the pre-set value and shall stop automatically when the set system pressure is attained.

The service pumps will have suction from each potable water storage tank and discharge to the potable water tank filling line, to the hot potable water system and to the cold-water rising mains. Ring system served by the rising mains will be arranged separately for cold and hot freshwater system; the feed line to each ring will be provided of one pressure reducing valve, by-pass valve and strainer. Each ring is to be provided with isolating valves to allow maintenance of any part of the system with no more than 15 freshwater outlets of any type out of operation.

The hot and cold potable water system are to be self-venting through automatic vent valves at highest points.

Potable water piping should not pass under or through sewage or tanks holding non-potable liquids.

Appropriate backflow prevention arrangements should be installed where contamination from backflow can occur. The system should be protected against backflow by either backflow preventers (e.g. reduced pressure, vacuum breakers) or air gaps. All pipes and storage tanks should be insulated, when necessary, to help ensure that water is maintained, as far as practicable, outside the temperature range of 25-50 °C to minimize the risk of Legionella growth.

Hot potable water system shall be heated mainly with heat recovered from engine cooling system (see SFI 640), through two, stainless steel, heat exchangers with capacity of 100% of hot water potable demand. For the hot water potable system will be provided:

- one calorifier of 2m³ capacity, stainless steel made, equipped with electrical heaters of 300kW capacity, design pressure 6 bar.

in order to cover the hot water demand when the heat recovery system is out of service or the heat recovered from engines is not sufficient.

Hot potable water distribution system and will also be designed as a ring system with return lines for recirculation and shall be provided with:

- Two electrically driven glandless centrifugal hot water recirculating pumps each having a capacity of abt. 20m³/h against a total head of 50 mt (one as stand-by)

Maximum energy recovery to be made to avoid electric heaters to work in normal condition.

The preheated domestic water temperature never exceeds 60°C and the regulating system shall avoid also sub-cooling of HT cooling water below the engine manufacturer recommendations.

Throughout the hot water distribution systems, water temperatures should be ≥ 50 °C

The plate heat exchangers to be double walled and provided with coaming to detect any fluid loss.

The hot and cold water supply systems are to be fitted with self-activated pilot operated pressure reducing valve located in engine room. Each valve will service a riser can serve rings on two decks. The hot and cold potable water system are to be self venting through automatic vent valves at highest points.

Distribution systems for cold and warm potable water pipes shall be made of hot galvanized steel or plastic and detailed inside piping specification.

To have maximum water savings, where applicable, automatic self-closing tap shall be installed and for urinals an automatic flushing system with dedicated sensor shall be installed for each unit.

582 Sanitary Discharge System

Grey Water System

The grey waters from washbasins, showers, galley, bar, pantries and laundry are to be drained via collecting pipes into two suitable reinforced fiberglass collecting tanks, one for each MVZ, and then will be discharged:

- directly over-board (located below the light load water line);
- to grey water holding tank;
- to bunker stations shore connection;
- to the wastewater treatment plant.

Structural tanks to be suitable coated for purpose and sizing to accommodate at least two days of grey water stream.

Two (2) GRP collecting tank forward located in MZ1 and MVZ3, having a capacity of abt. 2,5 m3 and provided each with two (2) electrically driven, open impeller type centrifugal pumps with capacity of abt. 10m3/h and head sufficient to discharge overboard. The stand-by pump to be ready to start at

lead pump failure. Collecting tanks to be provided also with internal water trap to avoid vapours spread inside the ship.

The galley, bar and crew pantry water drains are to be routed separately and processed through a manually grease trap.

One(1) Galley/pantries GRP(or other material suitable for galley water) collecting tank, having a capacity of abt. 2,5 m3 and provided with two (2) electrically driven, open impeller centrifugal pumps with capacity of abt 10m3/h and head sufficient to discharge overboard.

The nominal diameter of grey water collecting systems and discharges shall never decrease in the direction of flow and therefore full-bore valves to be used in order to avoid blockages.

Grey water pipes routed above pantry, galley, bar, electrical room to be avoided. Where is recognized this is not possible, the pipes will be continuous with no mechanical couplings.

All grey water lines are to be installed with suitable slop to ensure that in all expected conditions of heel and trim the grey water will not return back to users.

Water traps or other means are to be provided to prevent unpleasant odors returning through the system.

Only "Y" connections will be used for connecting the collecting manifold together. Suitable means are to be made for cleaning the manifolds Cleaning connections are to be easily accessible.

The system will be designed to minimize the need for valves to protect the integrity of watertight bulkheads in the event of side damage and flooding of the vessel compartments.

Internal Scupper

Scuppers are to be provided in the galley, pantry, bar, galley, lockers, storerooms, launderette, public toilet or private ones, and all other space where water may accumulate or a drain needed. All of these scuppers are to be routed and connected to the grey water system in a way to avoid backflow. All scuppers are to be provided with water trap or syphon to prevent bad odor spreads.

Only "Y" connections will be used for connecting the collecting manifold together. Suitable means are to be made for cleaning the manifolds Cleaning connections are to be easily accessible.

Black Water Vacuum Collecting System

The toilets and urinals are served by a vacuum discharge system, composed by

- two (2) vacuum units one each MVZ for SRTP requirements, arranged with Two (2) pumps, one in service and one in stand by (ready to start at lead pump failure).

The capacity of each pump will be designed for the peak requirement of the total lifesaving capacity of the vessel.

Sizing calculations to determinate the peak load to be submitted for Owner approval.

Vacuum collecting manifolds and down-comers to be developed in accordance with the equipment Manufacturer's requirements and in order to maximize the availability of the system.

Each horizontal manifold will be isolated after the last user and each down comer will be provided with a stop valve and a manometer at the manifold connection.

To avoid blockages below prescriptions to be followed:

- only Y type connections are to be used for connecting systems together and 45° elbows to be used.
- the internal diameter of the collecting systems and discharges never decrease in the direction of flow.
- the valves to have no restriction in the open position (full bore)
- removable end covers, fitted with section valve, to be provided to allow manifolds cleaning and inspection

Sewage pipes in way of pantry, galley, bar, electrical room to be avoided. Where is recognized this is not possible, the pipes will be continuous with no mechanical couplings.

Black Water Treatment System

A Waste-Water Treatment System to be supplied and installed. Plant to be capable, with respect to the capacity of total number of persons on board, considering the voyage profiles (SFI 100.5), to treat and discharge waters such as Sewage Water, Accommodation Grey Water, Laundry Grey Water and Galley Water and to produce an effluent suitable to comply with the requirements of MEPC 227(64).

Based on the Operative profile of the vessel, the Sewage Treatment Plant has no requirement to fulfil MPEC.227(64) sec.4.2 Notation for Special Areas.

The whole treatment system, including relevant ancillaries or additional tanks, to be developed in accordance to the supplier's requirements.

Sizing calculations to determinate the hydraulic and organic load to be submitted for Owner approval on the basis of the following input table.

	Hydraulic load	BOD5
	Specific (l/pd)	Specific (mg/l)
Black Water	15 l/pd	3000
Grey Water Accommodations	100* l/pd	200
Grey Water Galley	10 l/meal	1250

*: for pax and crew cabins

Structural tanks, properly coated, are to be provided to collect waste waters with capacity in accordance with the above balance and sized to accommodate at the following days of sewage streams:

- Two (2) Untreated Grey Water holding tank (each abt. 1 day storage of streams)
- Two (2) Treated Grey Water holding tank (each abt. 1 day storage of streams)
- One (1) Black Water Holding tank (abt. 2 days storage of streams) located on Deck 1

Additional Mixing tank to be provided only if required by the treatment supplier.

A bio-sludge double bottom tank to be provided to accumulate the sludge stream of the treatment process for at least two months. The builder will arrange means to avoid sedimentation for the sewage and sludge tank.

Transfer pumps for grey/galley/black and sludge tanks to be provided to discharge overboard (located below the light load water line), to the bunker station shore connection to the waste treatment or to transfer grey water streams.

59 OUTFITTING OF PASSENGER/CREW CABIN AREAS AND PUBLIC AREAS

590 General

The Yard shall appoint an interior designer, which could be the interior subcontractor company designer, to prepare sample rendered view of the public spaces of the ship. Those images shall be presented and discussed with the Owner with the intent to fulfill Owner expectation in terms of colors, materials, shapes and details. Presentation of physical samples is also required. Once details are agreed between parties, the interior architect shall guide the detailed design of interiors.

Preliminary approvals can be done by the Owner from 2D sketches or arrangements. After color schemes and furniture type definition, 3D renderings will be presented to the Owner for final approval. The process will be decided between parties.

The appearance shall be in compliance with the reference vessel or better.

Accommodation quarters will be arranged in accordance with the General Arrangement Plan.

Arrangement and extent of furniture and fittings in the Passenger and Crew cabins shall be at least as "Cartour Delta" vessel IMO 9539042.

Due care to be taken in the fairing of all linings, bulkheads and ceilings. All electric cables to be concealed within the accommodation bulkhead system.

Throughout accommodation area flush access flaps or removable panels to be arranged where required for access to valves, dampers, fire door control systems etc. and to be in compliance with surrounding materials/colors. Coamings to be provided for such openings in way of wet areas.

Visible profiles to suit the decorations scheme of the area concerned.

All decorated surfaces in accommodation area are to be protected against damage throughout construction period. Protection to be removed at the latest.

A proper number of suitable locations to install two Owner's supply vending machines (abt L 2,5m, W 1 m, H 2,2m) according to GA are to be provided with electrical connections (25A breaker, differential switch and interlocked socket) and potable water connection.

591.1 Passenger Cabins

According to General Arrangement drawing there will be four (4) types of Passenger Cabins

- 4 people cabin (2 low beds + 2 foldable beds).
- 2 people cabin (1 low bed, 1 top bed).
- Suites Cabin, 2 lower bed
- Reduced mobility Persons Cabin, 2 lower bed

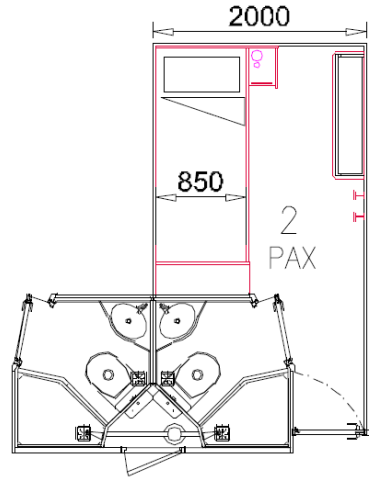
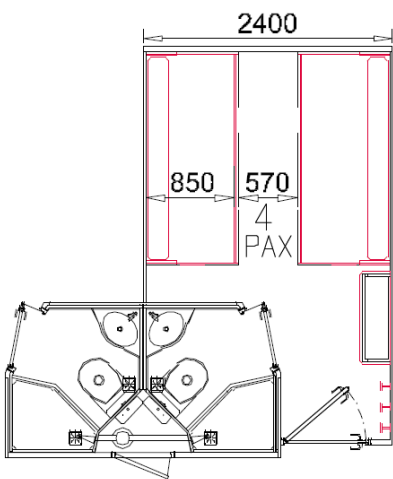
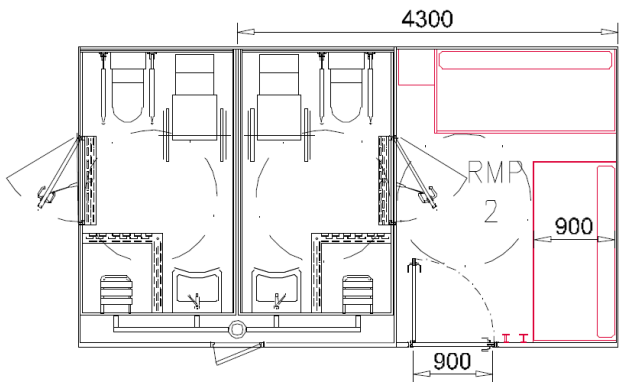
For quantities, Ref. SFI 510.

Builder shall present one cabin mock-up module including wet unit to owner's approval. Laminate for furniture can be used for wood appearance. All material shall in general be of non-flammable type meant for maritime use. Electrical sockets with USB port are to be provided.

Basic dimension and layout of the cabins as per following drawings;

591.1 Pax cabins principle layout

Note dimensions are merely indicative:

2 bed cabins	 2000 850 2 PAX The diagram shows a rectangular cabin layout with a total width of 2000mm and a depth of 850mm. It includes two berths, a small table, and a door. The text '2 PAX' indicates the capacity for two passengers.
4 bed cabins	 2400 850 570 4 PAX The diagram shows a rectangular cabin layout with a total width of 2400mm. The depth is divided into two sections: 850mm and 570mm. It includes four berths, a small table, and a door. The text '4 PAX' indicates the capacity for four passengers.
PMR cabins	 4300 900 900 RMP 2 The diagram shows a larger rectangular cabin layout with a total width of 4300mm. It includes two berths, a small table, and a door. The text 'RMP 2' indicates the capacity for two passengers. The dimensions 900mm are shown for the berths.

591.1.2 Pieces of furniture

All furniture in the passenger cabins to be as per reference ship and to be of the pre-manufactured type, fitted on board after the erection of joiner's ceiling/bulkheads.

Furniture to have no locks. Curtains / Blinds are manually operated.

All lower beds to have a sufficient clearance below for storage of a standard suitcase.

591.1.3 Walls and linings

Walls in cabin and corridor areas shall consist of modular panels insulated rockwool. On the exposed side, as bulkhead finishing, shall be as per architectural design or reference ship.

In cabin areas all divisional bulkheads required to be B-O/B-15 by Regulation, are to be connected to ceilings in "B-15 continuous ceiling" integral system.

Wall in wet areas shall stand on perimeter steel coaming.

591.1.4 Ceilings

In accommodation spaces, ceilings shall generally be of the B-15 rated type and as per reference vessel.

In corridors ceiling panels throughout are to be removable. In way of valves etc. above, access is to be arranged. Such panels to be identified as to their purpose as per reference vessel.

591.1.5 Cabin door

Cabin door clear width will be 700 mm. RMP cabins to be fitted with doors wide 850 mm.

Door frames of polished stainless-steel hollow profiles and with extruded anodized aluminum list.

Self-closing device to be provided. Hinges to be of stainless steel.

Cabin door sills to be nearly flush with the finished deck coverings and covered with stainless steel profiles.

For key system, see 512.1

591.1.6 Passenger cabin corridors

Corridor width and shape to be as per General Arrangement drawing. Min corridor clear width to be 1100 mm.

Cabin signage to be as per architect design.

Handrails shall be installed in longitudinal corridors and where requested by the Rules. In longitudinal corridors, handrail to be fitted on one side only except where width is 2m or more. Handrails in passenger's corridors to be as per reference ship.

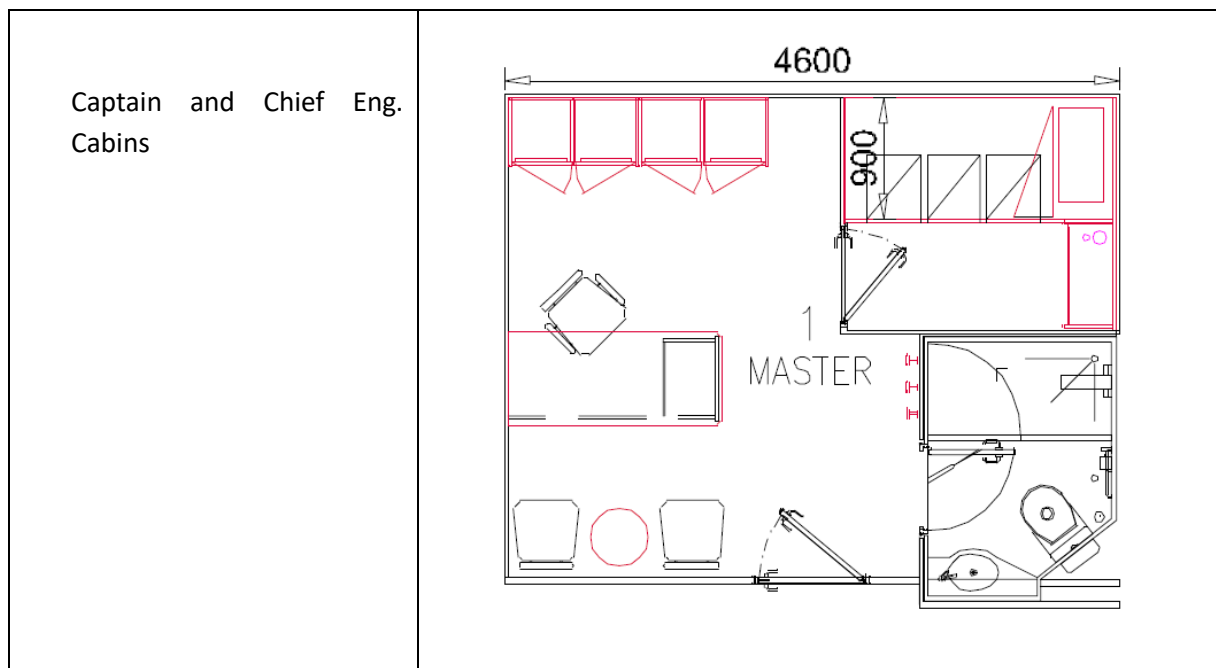
Handrails will be produced with Stainless Steel supports and round wood or stainless-steel top.

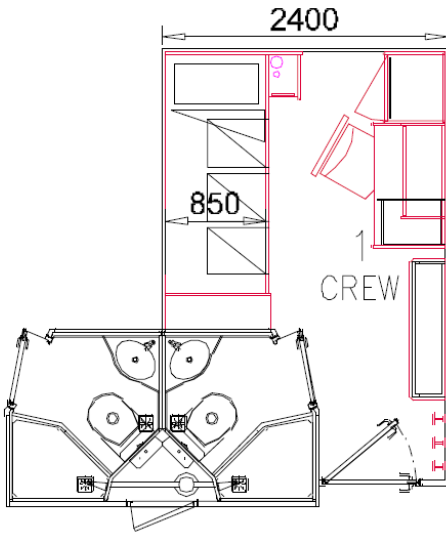
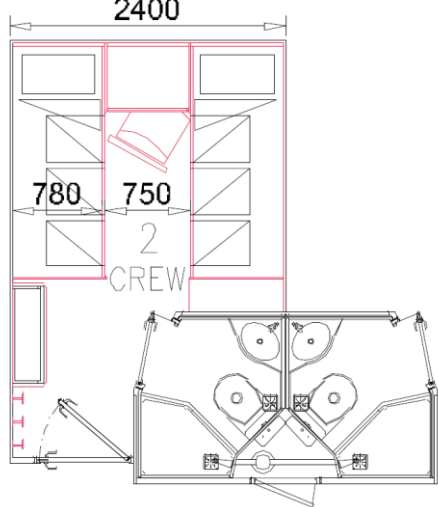
Flush hinged doors shall be fitted in way of supply/waste-water pipes niches of toilets units and of fan-coil cabinet. Electrical sockets for vacuum.

591.2 Crew Cabins

Crew cabin shall be compliant with MLC2006

The following crew cabin categories will be arranged:



Single bed Crew Cabin	
Double bed Crew Cabin	

6000 MACHINERY MAIN COMPONENTS

60 GENERAL

The propulsion shall be Electric, therefore internal combustion engines will serve to produce Electric Power. The system will be designed in accordance with SRTP regulation.

The Machinery space is divided into two main compartments where power generators are installed, as indicated on the GA plan and listed below:

- Fore Main Engine room shall accommodate two medium-high speed MDO/LNG (DF), gensets.
- Aft Engine room shall accommodate two medium-high speed MDO/LNG (DF), gensets.

WT bulkhead will separate the two Engine rooms.

ECR/Main Switchboard will be located in the fore compartments, watertight protected from main engine rooms.

A second Main switchboard room will be located in aft compartment.

The main switchboard rooms will be interconnected via Bus-Tie.

Propulsion thruster units and relative electrical drive will be located in 2 dedicated compartments.

The total installed generation power for propulsion shall be abt. 7-8.5 MW to fulfil DYNAPOS-SAM requirements as indicated in 410.2 and shall be suitable to manoeuvre in strong side wind conditions (45 kn) and small harbours not provided of tug boat.

63 PROPELLER, TRANSMISSION

630 Propulsion

The vessel will be equipped with two Azimuthal Pod Unit, equipped with four bladed propeller, diameter approximately 3500 mm.

Propeller could be either FP or CP, it could be reversed at the full power and speed and that DYNAPOS-SAM requirements are fulfilled.

Electric permanent magnet motors, power according to speed performances, driven through Frequency Converters.

Each propulsion unit shall be capable to work independently from the other. Any fault in one of the plants shall not influence the functionality of the other.

Pods Units are electrically driven.

Pods and relative Drive cabinets to be positioned in dedicated watertight compartment to fulfill SRTP requirements.

Propulsion units shall be welded on a canister which is bolted on his hull foundation and adapted to the hull shape (See 263).

All connections of electric and oil lubrication shall be possibly made with "quick-connectors", in order to reduce at the maximum the time for dismounting the Pod unit with its canister. Oil lubrication piping shall have flexible piping connection and quick-connectors.

64 HEAT RECOVERY FROM ENGINES

640 Hot water Production Plant

The system is to be dimensioned on a thermal load balance, to be approved by the Owner, with the following operating condition:

- Service speed with 2 FORE ME
- Service speed with 1 FORE ME and 2 AFT ME

Starting from the above indication and making reference to the electric load balance, the heat rejected by engine HT cooling system can be calculated. The final heat users, considered at 100% of load are the following:

- Distilled water generator
- Hot Potable water preheater
- HVAC system preheater
- LNG heating media system

Each engine is to have dedicated plate exchanger sized to maintain minimum 3°C temperature pitch between the inlet of hot side and outlet of cold side, maximum pressure drop on hot side 0,2-0,3 bar

AC preheater is to be sized to maintain maximum 10°C temperature pitch between the inlet of hot side and the outlet of cold side.

Circulation pumps with adequate capacity will be provided for the heating recovery system with all the necessary fittings

When the heat recovery system is not operating, three (3) dedicated electrical boilers have to be provided as "back up", one for each of the following users:

- One (1) for Hot Potable water system (See SFI 581)
- Two (2) for HVAC system, one for each chiller (See SFI 571)
- One(1) LNG heating media (vaporizer and Pressure build up unit heater to be Engine maker supply)

Each boiler has to fulfil following indication:

- To be installed on users' circuit
- To be sized to fulfil 100% user demand

- To be capable to adjust to the user heat loads demand, controlling the number of its active heating coils.

NOTE: The Class could require two independent systems, one each engine room for SRTP requirement.

65 MOTOR AGGREGATES FOR MAIN & EMERGENCY EL. POWER PRODUCTION

650 Motor aggregates

650.1 Diesel generators

The Electric power plant shall be of 2 pairs of MDO/LNG DF Generators for one pair each main engine room, with almost equivalent power abt. 7-8.5 MW.

The gensets shall be dual fuel generators 50 Hz and 690 V.

Final power to be verified and adjusted by electrical load balance at later stage.

The engine installation to fulfil MARPOL TIER III with SCR installation for MDO usage.

Main generators and Aux. generators to be positioned in dedicated watertight compartment to fulfill SRTP requirements.

650.2 Emergency Diesel Generator

A traditional emergency genset according to rule requirements shall be installed in dedicated compartment with day tank and emergency switchboard on deck 6.

One (1) radiator cooled emergency diesel generator set to be installed, comprising a diesel engine, driving an air-cooled AC alternator with brush-less excitation of preliminary rated power of 350kW.

One (1) feeding tank to be located at the EDG platform level, with a capacity equivalent to 36 hours of EDG running, according to SOLAS.

One (1) feeding pump of a capacity of 1 m³/h. This pump shall run only with EDG running.

7000 SYSTEMS FOR MACHINERY MAIN COMPONENTS

7 General piping design criteria

Prior the beginning of engineering detail phase a detailed piping specification will be developed and submitted to Owner approval.

SRTP requirement to be clearly stated and

Pipes shall generally be routed as shortest path as possible with a minimum number of bends and large bending radius. Long straight lengths, for instance between bulkheads, shall be provided with suitable expansions.

All pipes must be assembled in their position without forcing and stressing them.

Water pockets shall be avoided by design in all pipes, to avoid corrosion. Where not possible, drain valves to be fitted. For the high points in under pressure systems are to be provided venting devices. Special attention to be made to suction pumping pipe system that have no pipe loops/pockets/syphons in which air can be trapped.

A sufficient number of joints and flanges shall be provided, so that all systems can be easily dismantled.

In general, all main components and equipment (i.e. regulating valves, heat exchangers, filters, etc) shall have section valves on all sides and thermometers and manometers shall be foreseen at each connections.

Any auxiliary devices as thermometers (and their bulb pockets), pressure gauges, transmitters, thermostats and other instruments are to be installed in order to avoid the necessity to stop the system.

All pressure gauges are to be fitted with three ways testing cocks and with proper pressure scale for the their intendent service (i.e. no pressure gauge with 16 bar scale on systems with max pressure 6 bar).

Fuel and Lube Oil pipes are to have fuel pipe clamps over flanges, as per SOLAS prescription.

Where joints are to be necessary in pipe work carrying flammable fluids, the connections are to be far away from all hot surfaces that could ignite the possible leaking fluid.

Clamps to be compatible with the material of the pipe served and provided with gaskets to avoid galvanic corrosion phenomena. Pipes shall have proper distance from structure and proper insulations taking in consideration the operating temperature.

High points heat exchangers to be equipped with vent valves. Lower points of the systems to have drains to allow drainage.

Installation of pipes containing pressurized fluids or drainages are not be routed in the Engine Control Room or any other designated electrical room fitted with Switchboards. Where demonstrated not

avoidable, the pipes conveying fluids will be metallic and fully welded and subject to Owner approval case by case.

All valves to be installed in a way that they are accessible for maintenance operations.

All automatic control valves are to be sized for the required operating range and permit local adjustment with a hand wheel for emergency manual operation and maintenance without removal from the line. Control and regulating valves shall not be used as section valves.

The flow through systems shall be adjusted, if necessary, by means of stainless-steel orifices (with pressure gauges upstream and downstream) or by balancing valve. The manual balancing/regulating valves are to be of the type with a flow measurement capability. A complete portable differential pressure measuring device is to be provided.

Hand operated butterfly valves $\geq$ DN 150 and above are to be provided with gearboxes.

Shut off and by pass valves, cross connections and other means are to be foreseen to guarantee the flexibility and maximize availability of the system, permitting cleaning/maintenance and emergency operations without interfering with the service requirements and to guarantee safe operations.

Piping Materials

The below in principle list of material Vs system service can be followed:

Sea Water systems	Glass Reinforced Epoxy to be used where allowed by Class, where not allowed seamless steel pipes, hot galvanized shall be used
Fresh Water-cooling system	Seamless steel pipes with welded flanges, hot galvanized
Bilge / FW Trimming system	Seamless steel pipes, hot galvanized, with welded flanges
Fire and Deck wash system	Seamless steel pipes, hot galvanized, with welded flanges
Diesel Oil	Black seamless steel pipes
Lube Oil	Black seamless steel pipes
Drencher system	Seamless steel pipes, hot galvanized, with welded flanges
Water Mist System	Stainless steel (as per maker recommendation)
Potable Water (hot and cold)	RPVC or multilayer in accommodation, steel pipe hot galvanized in machinery spaces.

Drains of open deck	black seamless steel pipes, hot galvanized
Hydraulic systems	Stainless Steel (metallic + soft seal joints without rubber element)
LNG	Vacuum insulated stainless steel
Gas pipes	Stainless steel (as per vendor recommendation)
Gas Vent pipes	Stainless steel (as per vendor recommendation)
Nitrogen Piping	Stainless steel (as per vendor recommendation)
Food Waste	Stainless Steel AISI 316L
Vacuum/Grey Sewage System	Stainless steel, AISI 316L Blucher type stainless steel push-fit drainage pipework in accommodation, stainless steel in machinery spaces

Wall thickness of pipes according at least to Class rules.

Yard standard may be applied when equivalent or superior and can be proposed for Owner approval.

External pipes less than ND50 shall be made of stainless steel AISI 316L.

All the pipe works made in stainless steel are to be treated with pickling and passivation to remove contaminants and assist the formation of a continuous chromium-oxide passive film. At this regard special attention to be paid to the welded joints.

Steel cold galvanizing to be absolutely avoided.

Where applicable in accordance with Class, rules and technical requirements, press-fitting system shall be permitted. The choice of the piping coupling and type shall be done in early design stage and approved by the Owner.

Remote Controlled Valves

A Valve Remote Control System for the control of the electro actuated valves installed on board and interfaced with IAS is to be provided.

In particular at least the following items are to be controlled centrally via IAS and other connected control systems:

- sea water suction valves (crossovers, etc.);
- ballast main branch valves
- bilge main branch valves
- isolating valves at each bilge main pump suction and discharge

- ballast main overboard valves
- bilge main overboard valves
- fire main pump suction valves (if dedicated suctions are provided)
- drencher sea water suction valves (if dedicated suctions are provided)
- drencher zone section valves (if not included in drencher maker scope of supply)
- any valves on watertight compartment boundaries necessary for damage control purposes
- all valves requiring remote operation for the belonging system

The valves must be located always in easily accessible position and have the local status indication and an emergency local manual control via suitable handwheel.

The valve controlled in emergency from above the freeboard deck shall have status indication also on the controller Unit.

The cabinets of the valves not requested by the Rules to be operated above the freeboard deck, will be installed close to the controlled valves on the first deck.

Bilge remote control valves shall be supplied by Normal/Emergency power source as per SOLAS requirement.

For the type and material of valves reference to be made to Piping Specification.

Note: Systems Remote controlled valves shall be defined according to SRTP philosophy requirements.

Heat Exchangers Material

The materials of the heat exchangers to be minimum as follows:

Plate type heat exchangers for sea water:

- Frame: Mild steel
- Plate: Titanium

Plate type heat exchangers for fresh water:

- Frame: Mild steel
- Plate: Stainless steel 316L

Plate type heat exchangers for potable water (no chlorine):

- Frame: Mild steel
- Plate: Stainless steel 316L double wall

Suitable alternative can be proposed from Builder.

Pumps Materials

Materials for centrifugal water pumps to be minimum as follows:

Fluid SEA WATER:

- Pump casing: Al Bronze
- Impeller: Al Bronze
- Shaft: Stainless steel AISI 316L

Fluid FRESH WATER COOLING

- Pump casing: Cast iron
- Impeller: Al Bronze
- Shaft: Stainless steel AISI 316L

Fluid POTABLE WATER

- Pump casing: AISI 316L
- Impeller: AISI 316L
- Shaft: Stainless steel: AISI 316L

Materials for the oil pumps to be min as follows:

SCREW TYPE PUMPS

- Casing: Cast iron
- Screw: Steel
- Shaft: Steel

HELICAL GEAR TYPE PUMPS

- Casing: Cast iron
- Helical gear: Ni-Al Bronze
- Shaft: Stainless steel

Materials for the sludge pumps to be min as follows:

MONO-SCREW TYPE PUMPS

Casing: Cast iron

- Rotor: Stainless steel
- Stator: Synthetic rubber suitable for fluid pumped

Materials for the Piston Pump to be min as follows:

RECIPROCATING TYPE PUMPS

- Casing: Cast Iron
- Piston: Bronze
- Piston rod: Stainless Steel
- Air vessel: Cast iron

Alternative suitable materials subject to Owners' approval may be offered.

Bunker Stations

Two (2) bunker stations. One each side shall be arranged on deck 3. Bunkering station equipped to:

- MDO filling/emptying (approx. 30 m³/hr), Manifolds to accept 100 mm hoses from shore
- Lube oil filling
- Sludge emptying (approx 5m³/hr)
- Sewage emptying
- FW filling
- Dirty oil discharge

Two (2) LNG bunkering station will be fitted on the SB & PS side, with all relevant equipment (airlock, nitrogen for purging, fire station)

Final position of LNG bunker stations and related ventilations, may change based on the final LNG tank positioning.

70 FUEL SYSTEMS

700 General

Fuel, other than LNG, is based on MDO, and a separate system shall be provided for that. All internal combustion engines to start, stop and operate on MDO ISO 8217-2017, but can operate with LNG (DF).

Emergency genset to start, stop and operate on MDO.

Hull integrated structural tanks, with capacities according to 10.4, to be fitted as follows:

- Four (4) MDO service tank - Capacity in accordance with SRTP range
Low level alarm to be installed to save SRTP reserve.
- Two (2) MDO storage tanks

In addition, following tanks to be provided:

- Two (2) fuel oil clean drain tank
- One (1) fuel oil overflow tank
- Two (2) Sludge tank.

Fuel oil purifier

Two (2) MDO double purifiers one for each Engine Room, centrifugal type, each one capable of 100% total engines capacity at 85% MCR, with cross connection. Each purifier is to be foreseen with its own feeding pump (capable to have suction from DB), flow control device and water detector. Integrated purifier sludge tank with pneumatic pump to be provided if gravity discharge to sludge system may be difficult.

The arrangements are to be such to ensure easy handling and cleaning of the purifier bowls. A save-all is to be fitted below each machine.

In any their case capacity to be in accordance with engine maker recommendation.

Each separator will be assembled together with his own auxiliaries in package execution.

These purifiers will be capable of operating both in parallel as purifiers or in series as purifier and clarifier: the piping will therefore allow this double function. Discharge of sludge will be automatic.

The pipeline will be arranged for running the purifiers in closed circuits with the service tanks and for transferring from the storage to the day tanks.

Over any purifier a dedicated vent hood to be considered, with its own dedicated fan.

Fuel oil Feeding system

The feeding system shall be designed according to Maker instruction, included filters, pumps and coolers and approved by the Owner.

Two (2) mass fuel meters interfaced with IAS are to be provide at the suction and delivery side of each engine feeding pump.

Engine pilot fuel pumps to be electrical type (not engine driven). Pilot fuel oil return shall be separated from main fuel oil return. Viscosity sensors are to be provided and interfaced with IAS to monitor the fuel viscosity operative range and detect alarms. Special provisions to be taken in order to maintain constant the viscosity, through temperature regulation

Emergency feeding of engines after blackout has to be guaranteed.

Fuel oil Transfer system

MDO is to be led from the bunkering connections to all MGO tanks by a common filling and transfer main system.

Two (2) MGO transfer pumps are to be provided suitable for 2.0 cSt at 40°C fuel. The transfer pumps have larger capacity than engine consumption such that service tanks are normally full.

MGO Transfer Pumps normally are to be used to transfer MGO from the MGO storage tanks to the MGO service tanks, but the system can be empty the storage and service tank to bunker and have suction also from the fuel clean drain tanks.

One dedicated pump shall be arranged to fill the emergency diesel generator service tanks via a flow meter and 10 micron filter on the vicinity of the tanks

Quick Closing Valves System

A pneumatic operated quick closing valves system is to be provided for the fuel oil tanks and lubricating oil tanks according to rule requirement.

Sludge

All items in the machinery spaces and bunker stations associated with LO or MDO have to be provided with drip trays for collecting split or surplus liquid from drains, vent, seals or glands.

All these not pressurized leakages/drains are to be collected and drained by gravity to the sludge tanks, one for each engine room compartment.

Pressurized leakages/drains to be led to the sludge double bottom tanks through separated lines.

The coordination of this equipment is to be arranged at a sufficient height to allow gravity drainage of the drip trays where technically feasible.

Capability to discharge to shore the sludge water is to be provided through

- two (2) screw type oil sludge pumps with approximately 10 m³/h.

Discharge station to be arranged with IMO flange, according to the rules.

704 LNG Fuel System

LNG system and relevant equipment to comply with all the prescriptions of IGF code and relevant rules.

LNG will be contained in One (1) type C (Vacuum insulated) independent LNG tank: The capacity as defined at paragraph 10.4.

Design Criteria of the LNG Tank;

- Minimum LNG Holding Time inside the tank will be calculated according to IGF 6.9.1.1 (.3 pressure accumulation).
- Worst Loading Limit of the LNG tanks shall be according to IGF 6.8.1
- Best Loading Limit of the LNG tanks shall be according to IGF 6.8.2

The cryogenic tank will be located above the double bottom and below the main deck, with appropriate ventilation and connection to LNG bunkering station.

Alternative tank positioning (i.e. open decks or other) can be suggested by the Yard, in accordance with IGF code and stability requirements.

The responsibility of correct functioning and interaction of gas storage, supply system and combustion engines remain of the Yard. It will be preferable that the Engine maker will undertake responsibility of the whole chain, irrespective of the LNG tank supplier, in order to avoid any conflict.

LNG Piping

Piping shall be suitable for temperature indicated by the system supplier, and thermal stress analysis shall be carried out by the system integrator/supplier. LNG pipes to be sloped to the tank, at least 1.5 deg. when moving longitudinally and 2.5 deg. when moving transversally.

Bunkering pipes shall be double wall vacuum insulated, stainless steel.

It should be possible to emptying the LNG tank in case of tank servicing. The system shall be connected to the inert gas system to purge lines after bunker operation.

GAS Piping - "Inherently Safe Machinery Space"

All gas pipes running into enclosed spaces shall be double walled, full penetration continuously welded.

The A dedicated, fully redundant ventilation system shall produce at least 30 air-changes per hour in;

- Double wall gas pipes
- GVU
- Tank connection spaces
- Internal combustion engines gas circuit

There be one set of ventilation fans, taking clean air from outside, and one set of extraction fans, exhausting at the end through the Gas Vent Mast.

All places where Gas may be contained shall have pressure relief valves discharging in pipes route on top of the Gas Vent Mast.

LNG Bunkering station

LNG bunkering stations are located both sides on deck 5, in a space which is separated from the open deck by means of an Air Lock chamber.

LNG Bunkering station to have his own ventilation system. Stainless steel drip tray to protect hull structure to LNG leakage shall be fitted, with discharge overboard.

A foldable crane according to SFI 453 shall be supplied to move the bunkering pipes.

A Water curtain, with feeding line from fire main and cleaning line with potable water shall be provided.

Ship to shore link to be provided for emergency shut down process.

LNG Storage Tank and supply system

One (1) IMO Type C double shell LNG tank, with a capacity as indicated in 10.4, vacuum and perlite insulation inside the two shells. LNG tank to cope with the pressure of max 9 bar, according to system integrator.

If the LNG storage tank is not fitted on open deck, the TCS shall have his own integrated air lock so that the LNG tank room is gas safe not only in normal operation but also during servicing of the TCS.

Tank Connection Space (Cold Box)

All pipe connections to/from the LNG storage tank shall be within the TCS which is mounted to one end of the tank and integrating an Air Lock.

The TCS is a gas hazardous area where cryogenic valves and equipment are located.

Gas detectors to be arranged according to Class Rules and maker guidance. The gas detectors shall be linked to a common Emergency Shut Down System.

The tank connection space is a stainless-steel compartment that is welded to the outer vessel of the storage tank. The equipment in the tank connection space is accessed for maintenance and inspection through an integrated air lock.

TCS shall be fitted with temperature and liquid level indicators. Triggering of high-level alarm may indicate glycol-water leaks, while a combined triggering of temperature and level alarm may indicate LNG leaks.

The cold box shall be delivered with A60 insulation.

For possible service or repair of an evaporator the cold box roof shall be arranged with a suitable sized cutting area. The corresponding area on the main deck over the TCS, shall be free from any system piping and arrangements to be cut and removed if necessary.

All evaporators shall be located in the cold box.

LNG Supply to Engines

All gas carrying pipes shall double walled, continuous welding and X-ray checked as per Class request.

Pipes shall be routed to avoid gas pockets and minimize leakages. Piping shall be provided with gas/fracture (pressure drop) detection.

The supply system shall be designed considering two (2) independent double walled pipelines, each with dedicated shutdown valves. Double walled pipelines shall be routed from TCS respectively to each main engine room and relative GVUs.

Shutdown valves shall be remotely operated and connected with ESD.

Four (4) GUV (Gas Valve Unit) shall be installed to manage the flow demand to each DF engine and they will be part of Engines supplier scope.

71 LUBE OIL SYSTEM

Lubricating Oil system shall be designed according to engine maker guidance. Each Genset shall have his own electrical driven external stand by pump and strainers, according to the maker instructions.

711 Lube Oil System – Drain and Transfer System

Lubrication oil storage, clean and dirty tanks, to be arranged according to General Arrangement drawing. Final number and capacity of lube oil tanks to be in accordance with approved tank plan.

Bunkering stations will fill by pipe each store tank through a common filling/transfer system. Tanks to be equipped with air pipes, sounding device, tapping cocks, remote level and waste tray. The waste tray in engine room were practical to be drained to sludge oil tank. A drainpipe from spill-tray at the emergency generator to be arranged to sludge oil tank.

- Two (2) Clean LO transfer pumps for main engines to be arranged. Capacity: abt. 5 m³/h – 3 bar.

Emptying of main engines and other main equipment to dirty oil tanks facilities is to be provided and a suitable dirty oil system with

- two (2) dirty LO transfer pumps (abt. 5 m³/h – 3 bar) is to be arranged in order to discharge the dirty oil in bunker station.

A suitable system to empty the main two azimuthal thrusters' dirty oil to the adjacent dirty thruster oil tank to be provided and connected to the main dirty oil manifold. One (1) dedicated LO thruster clean pump (abt. 5 m³/h – 3 bar) is to be provided to fill the azimuthal thrusters with all relevant ancillaries.

Not structural lube oil daily tanks (abt. 300-500 liters) are to be provided for daily topping up. Those tanks are to be provided with deep trays and visual level.

The number and the locations are to be defined considering the different oil typology used on board for main equipment and their relative arrangement on-board.

712 Lube Oil Purification Plant

Each main engine will have a dedicated lube oil separator, according to engine maker prescriptions.

The system and capacity of separators shall be dimensioned for continuous separating as indicated by the engine maker.

Each purifier is to be foreseen with its own feeding pump (capable to have suction from DB), flow control device, electrical heater, and water detector. Dedicated purifier sludge tank to be provided if gravity discharge to sludge system may be difficult.

Each separator will be assembled together with his own auxiliaries in package execution.

The circuits shall be arranged with closed circuit between one separator and one engine with possible interchange for this cross-connection philosophy between separators for each engine room shall be provided.

72 COOLING SYSTEM

The ship is to be arranged with a centralized cooling system for main combustion engines and an auxiliary low temperature system.

A dedicated flow and cooling balance to be provided for Owner approval.

System to be based on heat exchangers with forced sea water flow (A) , or, if convenient and technically consistent, by using box coolers in structural duct where sea water is circulated by pumps (B).

Two (2) sea chests to be provided one high, one low sea chest, see also SFI 262

One cooling system for the chilled water units, with his own sea chest.

Sea-chests and sea water piping shall be protected with electro-chemical anti-fouling system.

No chemical addition has to be considered.

721 Sea Water Cooling System

An adequate number of sea water pumps (at least two (2) each engine room) will be installed according to cooling calculation, engine maker project guide and Class requirements.

Box-cooler (Hydroniq type) mounted in a dedicated structural crossover, with forced SW circulation, shall be fitted and sized with 15% of fouling factor. Alternatively plate cooler or conventional box coolers can be installed upon owner approval.

Plate type heat exchangers to be made of cooling plates of titanium, frame plate and frames of painted steel and sized with 15% of fouling factor.

Sea water cooling system to be arranged with Epoxy glass fiber reinforced pipes (GRE) and suitable protections are to be foreseen to avoid galvanic corrosion of steel piping systems.

All Sea Water coolers to be galvanic isolated from piping system by use of rubber gaskets at flanges and bolts.

Chilled water unit 1 and 2 to be direct Sea Water cooled. One (1) sea water pump for each unit with cross connection.

All sea inlets to be arranged with strainers, one spare basket strainer for maintenance purpose.

Three ways regulating valve to be of the electrical type with indication of opening percentage and external handwheels.

In addition to the remote operated sea inlet valve, two manual butterfly valves to be added, one at each side of strainer.

Connection for water supply at docking to be foreseen. The system should include required cooling for any gen. set, two chilled water unit (necessary flow for one), one refrigeration compressor and the transformers required. Distribution of cooling water from dock to be arranged through pipe connection at one of the bunker stations to be agreed with Owner.

722 Fresh Water-Cooling System

The freshwater cooling system, consisting in a FW-LT system and FW - HT system, shall be supplied for each engine room.

LT and HT freshwater cooling pumps capacity and head pressure in accordance with Engine Maker Project Guide.

One (1) Drain/filling connection from lowest point to be arranged with valve and snap-coupling of claw type on all FW cooling systems.

Fresh water expansion tanks to be installed according to engine supplier's recommendation.

FW expansion tanks to have fixed filling possibility from Distilled Fresh Water system.

Each genset to be equipped with external electric driven stand by pumps ready to automatically start, both for LT and HT.

Two auxiliary low temperature systems are to be provided for cooling the Stbd and port propulsion electrical devices and other eventual equipment that needs to be cool down. Two circulating pumps are to be provided for each system.

Fresh water treatment station

All the closed circuits circulating fresh water, as HT/LT/Chilled (SFI572), shall be provided with dedicated water chemical treatment stations, with dosing pumps, local storage tanks for chemicals, sensors and ancillaries, in such a way to keep the water inside the circuit within its optimal operative conditions and avoid corrosion or fouling in the relative systems.

73 COMPRESSED AIR

731 Starting Air Compressor System

Pressure of 3000 kPa for main engines starting air, according to Engine Maker.

Three (3) starting air compressors, piston types, 2 stages, air cooled, with automatic condense drain. Size according to the recommendation of the engines manufacturer and classification rules.

For each engine room, two (2) air bottles of r air pressure of 3000 kPa to be provided and installed. With capacity according to Class requirements and engines maker.

Air compressors shall be driven by electric motors, and the speed of electric motor for reciprocating type air compressors shall be maximum 1,800 rpm. Each air compressor and driving motor shall be mounted on a common bed, as per manufacturer's standards.

Main air compressors shall be furnished with automatic starting and stopping arrangement in order to maintain the sufficient and safe pressure in main air reservoirs.

Automatic drain of high pressure upon stopping, and automatic unloading at starting of main air compressors shall be implemented.

Compressed air from the main air compressors shall be led to the main air reservoirs through an oil-water separator.

Final number of compressors may change based on SRTP requirements.

Typhoons and whistles to be connected with high pressure compressed air system, though a dedicated piping provided with filter and drainage and electro actuated control. The system shall be in compliance with Class requirements.

732 Working Air System in Engine Room Etc.

Two (2) services/working air compressors, screw type capacity 80-90cbm/h FAD (Free Air Delivery), Working pressure 8 bar, with dryer, oil filter/separator

Two (2) air bottles for the above with capacity of 1.5 m³.

Instrument air to engines and other automation systems to be supplied from working air system.

Safe back- up instrument air supply to be arranged from starting air system by means of reduction valve 30 - 7 bar.

Aft and forward engine rooms air compressed systems shall be cross connected with proper piping and section valves.

The outlets to consist of closing valve and a quick coupling of the claw type at following locations (or as agreed with Buyer):

- One (1) in each Thrusters room, totally two (2)
- Two (2) in each engine room, one each deck, totally four (4)
- One (1) in Aft Aux. room, totally one (1)
- One (1) in fore Aux. room, totally one (1)
- One (1) in purifier room, totally one (1)
- One (1) in heat exchanger room, totally one (1)
- One (1) in engine workshop, totally one (1)
- One (1) at each side of mooring deck aft, totally two (2)
- One (1) at mooring deck forward, totally one (1)
- One (1) in bow thruster room, totally one (1)

One (1) in Bunker station, totally four (4)

Total number and positioning of outlets can be modified based on the space definition and shall be approved by the Owner.

74 EXHAUST SYSTEMS

Engine exhaust system shall be arranged from engine rooms into exhaust casing and to exhaust funnel.

Exhaust pipe diameters shall be selected according to pressure head calculations and engine manufacturer's recommendations.

Piping through the funnel top plate shall be provided with suitable provision for expansion, and top plate penetrations shall be of rain-proof type and equipped with a small weathertight hinged hatch cover.

The drain piping from the top plate shall be led inside of the funnel and directed overboard (poop deck level).

Exhaust pipes system to be provided with expansion compensators as required. The pipes to be suspended in such a way that they can expand freely through the top plate. Resilient mounts and dampers to be installed at the suspension/link points.

Exhaust pipes built in Corten steel with constant rise are routed through exhaust casing, arranged with flexible bellows and flexible supported to hull structures.

Exhaust pipe top section, i.e. system above funnel top, incl. necessary collar system, to be stainless steel.

Thermal insulation shall be arranged to protect exhaust pipes within engine rooms and exhaust casings.

Covering of the insulation of the exhaust ducts, with galvanized steel or alloy plates, of the engines sets shall be carried out, accordance with the Builder's standards.

Drains from exhaust gas pipes of main diesel generators, large and small shall be led to the bilge.

Oil mist chamber with drip trays, connected to sludge system, shall be provided at the funnel, and the following vent pipes shall be led to the oil mist, chamber;

- Main engines oil sump / crankcase venting
- Sewage tank air vent
- Purifier tank air vent

Each DF engine exhaust system shall be arranged with explosion relief valves with flame arrestor according to engine supplier's recommendations. Safety ventilation system shall be arranged

according to engine maker recommendation. unburned natural gas shall not be trapped in any part of the exhaust gas system.

Exhaust pipes from each main engine and emergency generator engine shall be fitted with combined spark arrester and silencer.

Silencers with minimum 35 dB (A) noise reduction to be installed.

The exhaust pipe system and silencers to be resilient mounted.

Special care to be taken for silencer and exhaust system due to reduce impact of sound pressure level during harbour operation.

Engine exhaust system shall be arranged from engine rooms into exhaust casing and to exhaust funnel.

Exhaust pipe diameters shall be selected with basis in pressure head calculations and engine manufacturer's recommendations.

Thermal insulation shall be arranged to protect exhaust pipes within engine rooms and exhaust casings.

741 SCR System for Main Engines.

A complete SCR system to be installed for any engine designed for NOx reduction during MDO operation. Reduction rate in ideal condition to comply with IMO Tier III.

Four (4) off SCR reactors / catalysts.

Four (4) off Dosing units.

Four (4) off Mixing devices

Four (4) off NOx sensors for real time measurement.

Four (4) off Diff pressure for SCR reactors.

One (1) off Control unit / automatic control system.

One (1) off Pump station.

Exhaust pipe between Mixing device and SCR reactors to be of AISI 316L.

Urea tank, capacity to be defined in accordance with system supplier.

Exhaust gas bypass from the SCR to protect the catalytic reactor from high temperature damage, during LNG operation to be considered, based on SCR maker request.

SCR system to be interfaced with IAS/PMS/Main Switchboard for generator load, alarms, flowmeter for urea consumption and run signals etc.

74 DISTILLED WATER SYSTEM

One (1) fresh water generators, capacity abt. 20t/24h each are installed.

- ALFALAVAL AQUA Blue C80
- Other equivalent

Final capacity according to boiler manufacturer. The fresh water generators use the heat from engine's fresh water HT cooling system.

A salinity control unit will monitor salinity of the distillate not to exceed 10 PPM and it. On sensing an excessive salt content, the fresh water outflow to be automatically diverted to the bilge or returned to the evaporating chamber by a dump valve.

Feed water treatment of chemical injection shall be provided in order to prevent scale formation. The capacity and installation of the chemical injection tank shall be according to the manufacturer's standards.

The distilled water tank, fed by the above described evaporator, shall be a structural tank.

One a hydrophore system (pipes and reservoir in stainless steel AISI 316) complete with two electric driven suitable centrifugal pumps (one as standby) for distilled water system shall be provided. The system shall supply water to purifiers, main engines and to sterilizer/mineralized system.

Pumps with bronze body, stainless steel shaft and impeller, mechanical seals.

79 AUTOMATION SYSTEMS FOR MACHINERY

General

Main control of machinery shall be located in a well-lighted, air conditioned and sound insulated engine control room to be arranged adjacent to the engine room according to General Arrangement drawing.

Wheelhouse Control desk

791 Manoeuvre consoles, main consoles

The control consoles in wheelhouse to be made of steel and painted in colors approved by Buyer.

Engine Control Desk

An engine control desk for machineries and other relevant ship systems shall be installed in the engine control room.

792 Automation and alarm system

The Integrated Automation System (IAS) is an integrated alarm, monitoring and control system, to be designed for reliable operation of main propulsion machinery and ship systems from Wheelhouse and Engine Control Room.

The IAS and relevant instrumentation to be designed and installed for fulfilment of the rules of Classification Societies and notation Unattended Machinery Space.

Alarm and monitoring according to AUT-UMS class:

The following to be included:

- Propulsion Thruster
- Bow Thruster
- Fin stabilizers
- Mooring winches
- Main gensets
- Emergency genset
- Main switchboards
- Emergency switchboards
- Navigation equipment
- Compressed air
- ICCP cathodic protection System
- Lifts
- Lifeboats batteries
- UPS
- Sea water system
- Lubricating oil
- Fuel oil system
- LNG supply system
- Fresh Water
- Trim & heeling system
- Technical water
- Black/Grey Water
- Bilge
- Ventilation ER and Auxiliary Spaces, Cargo Spaces fans and dampers
- Common alarms from safety systems page, as per reference vessel

Remote Control of Pumps and valves

As per reference vessel and:

- All tanks suction and filling valves to be remote controlled.
- All side valves to be remote controlled.

Other System to be interfaced

- Power management system (PMS)
- Emergency Shut Down System (ESD)
- LNG Systems (ESD, Gas detection, Gas ventilation system).
- Fire Fighting and Detection Systems
- Interface for monitoring of fire alarm plant
- External light management
- Others

Note: HVAC shall provide with a dedicated and independent controllers/CPU for control and monitoring. Only remote monitoring/operation from IAS.

Alarm and monitoring system

IAS to be designed according relevant rules and following recommendations:

The number of IO's to be kept within a total of up to approx. 3 000 IO's (1500 Hardware | 1500 Software)

The alarm Items to be divided in groups dependent on type of machinery and importance in order to limit the number of IO accordingly.

The system will include view of machinery system diagrams as relevant for this application. The number of mimic pages will be up to 90.

IAS system to be based on a distributed processor system connected in a ring architecture or by redundant buses.

Signals from the field to be collected by I/O local cabinets or with dedicated interfaces and sent via a bus to microprocessor controllers.

Necessary test cocks and other additions to enable easy testing of monitoring equipment, alarms and shutdowns, to be provided. The builder shall uniquely identify and mark all alarm test points in accordance with the completed installation.

Test equipment to be provided according to requirement.

The operator to interact with the process via "operator stations" that allow monitoring and control of interested machineries.

Remote access for service and troubleshooting to be provided via LTE connection.

IAS to include Management of:

- Trend monitoring,
- alarms (critical-non critical),
- running hours.

Alarm panels

Group alarm/watch responsibility panels to be installed according to Classification Societies and notation Unattended Machinery Space.

The following UMS Alarm Panel equipment are located in:

- One (1) ECR
- One (1) Wheelhouse
- Two (2) Masters' cabins
- One (1) Officers' Mess room

The system to be delivered with a dead man alarm system acc. to classification society requirements

Operation stations

One (1) Operator station wheelhouse.

The unit to include one (1) 27" color monitors, one (1) PC with keyboard and pointing device.

Two (2) Operator stations engine control room, each unit to include two (2) 27" color monitor one (1) PC with keyboard and pointing device. One (1) common alarm printer matrix, one (1) printer matrix for critical alarms and one (1) color printer to be provided in ECR.

IAS operator stations shall be fitted with SSD hard drive and UPS power supply.

Hard drive storage capacity to be at least 6 months (1 year preferable).

All data have to be easily downloadable on external USB storage.

Data recording procedure and storage to allow easy data trend analysis.

If required, SSD encryption to be considered.

Interfaces

The IAS will include serial links to following systems such as:

- Voyage Data Recorder
- Trim/Heeling System
- Maintenance computer (if present)
- Serial lines to Main Engines, Drives and Thrusters controllers.
- Fire alarm plant

Light Column/Traffic Light System

A light column/traffic light system to be installed, in engine room and auxiliary machinery spaces.

Light column/traffic light system is to be a separate alarm indicating system, which consists of machine alarm, fire alarm and telephone calling alarm (automatic & sound powered telephone) of control room.

The system is to be with light panels divided into different colored light fields, each color corresponding to a certain alarm.

The panels are also provided with a sounder and flashing light.

Final design and extent of monitoring, control and automation system shall be in accordance with the requirement of class notation for periodically unmanned machinery spaces and submitted to Owner for approval.

Power Management System

PMS shall be part of the Automation System plant.

The PMS plant shall be able to start/stop generators, synchronize, open/close bus, loads control, start/stop major consumers, and control short time parallel operation with shore connection.

The PMS shall be able to properly manage any unexpected shut down of one single genset, by reduce the electric load during the transient time to start another genset. In such case, preferential switching of non-essential consumers shall happen prior to automatic limitation of the propulsion system power, according to the available power from the network.

The principles in the following table shall be applied:

	Navigation Service Speed with two FME	Navigation Service Speed with one FME and two AME	Navigation with one FME and one AME	Maneuvering with two FME	Maneuvering with one FME and two AME	Maneuvering with one FME and one AME
	In the meantime, the system connects to the network the other genset/s:					
Shut down of one FME	One FME in service	Two AME in service	One AME in service	One FME in service	Two AME in service	One AME in service
	Switch off not essential users	Switch off not essential users	Switch off not essential users	Switch off not essential users	Switch off not essential users	Switch off not essential users
	Reduce available propulsion power equally on two azimuthal propellers	Reduce available propulsion power equally on two azimuthal propellers	Switch off one azimuthal propeller and reduce available propulsion power	Reduce available propulsion power equally on two azimuthal propellers	Shut down one azimuthal propeller and reduce available propulsion power	Switch off one bow thruster and reduce the available power up to 30% (within 10 sec) for the remaining one
				Switch off one thruster and reduce available power for the remaining one	Switch off one bow thruster and reduce available propulsion power	Shut down one azimuthal propeller and reduce available propulsion power
Shut down of one AME	One FME in service	One FME - One AME in service	One FME in service	One FME in service	One FME - One AME in service	One FME in service
		Switch off not essential users	Switch off not essential users		Switch off not essential users	Switch off not essential users
		Reduce available propulsion power equally on two azimuthal propellers	Reduce available propulsion power equally on two azimuthal propellers		Shut down one azimuthal propeller and reduce available propulsion power	Switch off one bow thruster and reduce the available power up to 65% (within 10 sec) for the remaining one
					Switch off one bow thruster and reduce available propulsion power	Reduce available propulsion power equally on two azimuthal propellers

FME: Fore Main Engine

AME: Aft Main Engine

The above situation shall be simulated during sea trials.

The PMS functionalities and mimics shall be approved by the Owner.

8000 SHIP COMMON SYSTEMS

80 BALLAST & BILGE SYSTEMS, GUTTER PIPES OUTSIDE ACCOMODATION

801 Ballast system

Two (2) main ballast pumps each of approximately 150 m³/h each.

Ejector for ballast stripping to be provided.

Ballast pumps in common with bilge.

One (1) off Ballast water treatment system to be installed based on Authority requirement.

IMO approved ballast water treatment system based on filtration and UV treatment. The system to cover the capacity of one (1) ballast pump. The system shall not be based on chemical treatment.

Letter of compliance to IMO A868 Ballast water treatment required.

Main Bilge system

The rule bilge system pumps shall have suction from bilge wells in all watertight compartments and cofferdams. Strum boxes shall be provided for all bilge wells/suctions. Mud box in the machinery spaces suctions.

All bilge wells, voids and cofferdams will be provided with flooding/level alarms according to the rules.

Discharge overboard or to the bilge water settling tank.

The system will be remote controlled from the ECR and the wheelhouse. This shall include the remote control of all pumps and valves necessary to operate the system. Dry pump running (bilge well empty) protection to be provided.

The Main Bilge system will be provided with pumps as follows:

Four (4) centrifugal rule bilge pumps, self-priming, located in accordance to SOLAS.
Capacity according to SOLAS and Class requirements.

One (1) Bilge water ejector to be installed for chain lockers

According to the rules, the required bilge pumps will have direct bilge suction and will be also connected to the main bilge line with overboard discharge or with discharge to the bilge water tank. Direct emergency bilge suction will be provided from one main freshwater cooling pump in the Engine rooms.

All bilge wells to have a capacity of at least 0.5 m³

Oily Water Bilge System

A separate daily service and oily bilge system with two bilge piston pumps with remote control of the valves and pumps from the IAS will be provided to take suction from machinery space bilges, and oily water settling tank and to discharge into oily water settling tank and ashore. The Machinery/oily bilge system will be provided with:

- two (2) daily bilge piston type pump, with capacity of abt. 5 m³/h.

The machinery/oily bilge system to have suction from bilges in all machinery and auxiliary spaces. Mud box shall be provided for all bilge suctions in the machinery spaces.

Discharge to the bilge water tanks to sludge collecting tanks or to ashore via bunkering station is to be guaranteed. Direct discharge at sea shall be not possible by design.

Bilge valves to be remote operated from the ECR and the wheelhouse.
All bilge wells, to be equipped with level alarm.

The Bilge Water System is to be equipped with the following tanks according to the tank plan:

- One Oily Bilge Water Holding/Settling Tank for the storage of unprocessed bilge water and oil separation via gravity before processing/treatment;
- One Clean Bilge Water Tanks for the temporarily storage of bilge water already processed;

Bilge holding/settling tank, as tall as feasible, is to be divided in two. Each stage to be fitted with:

- Three oil level test cocks in different heights with a "funnel like" arrangement inside in the tank. The picked-up oil will be drained to sludge tank;
- Inspection hole or side glasses; Remote and local level sensor and high-level alarms. The third compartment level sensor must also automatically activate the separator;

The bilge water intake in the first compartment must be designed in such a way to prevent turbulence.

Bilge water separator of centrifugal type to be installed with capacity of 2,5 m³/h and oil content in discharged/cleaned water max 15 ppm.

The bilge water separator is to be foreseen with its own feeding pump (capable to have suction from DB), filter and chemical dosing units. Integrated sludge tank with pneumatic pump to be provided if gravity discharge to sludge system may be difficult.

Bilge water separator of approved type by the national authorities under IMO resolutions A.393 (X) and MEPC.107(49), rated for a discharge quality of 15 PPM, with alarm and automatic stopping device on discharge, to be installed.

804 Gutter Pipes Outside Accommodation

Scuppers shall be located on all external decks avoiding accumulating of water in any part of exposed decks and with any possible trim and heel condition during normal operation.

The number of scuppers is to be designed for the most severe rainfall (cm/hour) expected in the operational area.

Each drainage to be realized with a proper scupper welded at its bottom end to the collecting pipe. Pipes directly welded on deck to be avoided. Each scupper is to have an its own removable grid to permit the cleaning and water trap. Yard to submit its own standard design of scupper for Owner approval.

Only "Y" type branches are to be used for connecting the collecting systems together.

Special provisions are to be made for clearing and rodding all the pipe work, without the need to dismantle them. Rodding connections will be easily accessible.

Drainage outlet shall be located in the nearness of the waterline.

Scuppers from the vehicle decks will be led overboard and in accordance with the Load Line Convention. The scuppers shall have the possibility through stop-check valve, hydraulic remote controlled, to discharge in two common lines and discharge on double bottom bilge tank.

Aggregate capacity of discharge for each side shall be 125% of the max flow rate of the fixed firefighting system plus the flow of four fire hoses according to MSC 1320 Par. 3.1.4.1.

Overboard drain gates will have two automatic non-return valves.

Grids to prevent obstruction of drainage on RoRo deck shall be fitted.

The nominal diameter of all pipe works have to remain the same or increases at the connections between pipes.

81 FIRE & LIFEBOAT ALARM, FIRE FIGHTING & WASH DOWN SYSTEMS

810 Fire detection, fire & lifeboat alarm systems

811 General and Fire Alarm systems

A fixed fire detection and alarm system, with individually addressable detectors according to the rules and regulations (SFI 110.4 ,110.3 Pt.3.) shall be installed

Generally every accommodation and service space including corridors, stairways and escape routes within accommodation), except private bathrooms, shall be fitted with smoke detector. In galley heat detectors may be installed instead smoke detectors.

EX proof detectors shall be located in gas hazardous compartment area.

The fire alarm central shall be located in the wheelhouse and duplicated in the engine control room. The system shall be integrated or interfaced with the IAS.

The fire alarm as well as the general alarm shall be given through the loudspeakers network of the public address system.

Fixed fire and detection system shall cover the following area:

- Accommodation
- Service spaces
- Machinery spaces
- Cargo spaces

The fire alarm central shall be located in the wheelhouse and duplicated in the engine control room for SRTP. The system shall be integrated or interfaced with the IAS.

The fire alarm as well as the general alarm shall be given through the loudspeakers network of the public address system.

Manual Operated Call Points

Manually operated call points complying with the FSS Code shall be installed throughout the accommodation spaces, service spaces and control stations, special category space (Deck 3) and machinery spaces, as per SOLAS requirements.

811.1 Gas Detection System

Gas detectors shall be installed according to the LNG package supplier and Class requirements, but in general:

- Aft and Fwd Engine rooms
- Gas pipes ventilation ducts

- Ventilation Outlets of Gas Ventilation system
- Tank connection spaces
- Outlet of TCS ventilation ducts
- LNG tank room

The gas alarm central shall be located in the wheelhouse and duplicated in the engine control room. The system shall be integrated or interfaced with the IAS.

The gas alarm shall be operating performing ESD of the LNG system as required by rule.

The selected gas detectors shall be suitable and certified for the locations they are installed.

Gas alarm limits shall be adapted to each detector's location and shall be selected with basis in the defined ESD philosophy. It shall be defined both low and high level alarm limits. Gas detectors shall be calibrated and adjusted before Trials

At least one spare gas detector shall be delivered and stored on-board.

812 Emergency Shut Down System

A emergency shut-down system will be installed.

Emergency Shut-down system (ESD) according to Class requirements to be installed. The Emergency Shut-down system to cover accommodation, engine room and cargo holds fans/fire dampers, fuel oil pumps, LNG supply system and Controlled Fire doors.

The ESD system shall be interfaced to the fire & gas alarm systems (ref. SFI 811 & 811.1) and shall secure safe actions in the event of gas leaks.

The safety (emergency shutdown) system and control system shall be completely separated. The vessel will then be arranged with an ESD system that will be dedicated to safety (emergency shutdown) and a gas control system that will be dedicated to control only.

The valves that are controlled by both the safety and the control system are required to be independently operated from the two systems.

The ESD to be with system architecture of two (2) redundant CPUs, one for each Main Vertical Zone.

ESD to be based on a distributed processor system connected by redundant main network between CPU's and Operator stations.

Signals to/from the field to be collected by I/O local cabinets or with dedicated interfaces and sent via a bus to microprocessor controllers.

The control units and each local cabinet will be supplied with normal and UPS supplies.

ESD Operation stations

One (1) Operator stations in wheelhouse safety console. The unit to include 27" color monitor, one (1) PC with keyboard and pointing device. One (1) printer and manual shut-down device/function to be delivered for wheelhouse safety console.

One (1) Operator stations engine control room. The unit to include 27" color monitor, one (1) PC with keyboard and pointing device. One (1) printer and manual shut-down device/function to be delivered for ECR.

Emergency stops functions are to be allowed from ESD Safety panels (HW switch) and from AIS operator stations.

The system is developed for safety stops and status monitoring of:

- LNG/Fuel oil and Lube oil pumps
- Controlled Hinged and sliding Fire Doors
- Fire Dampers and Fans
- Overboard discharge (if necessary)
- Safety controls of Watertight Doors/Splash Doors/Bulkhead Valves

Safety systems to be interfaced with ESD system for monitoring purpose:

- Fuel oil/LNG pumps and controlled machineries
- Fire/GAS detector plant (serial line with fire detector system) for monitoring purpose
- Watertight doors/splash doors/Bulkhead valves plants
- Water Mist alarm plant
- Ramp/Side doors monitoring
- LLL system

Following safety systems to be interfaced with ESD system for monitoring and control purpose:

- Fire dampers (HVAC and ventilation) Electrically operated Local/Automatic/manual controlled Feedback with alarm on Visual display unit and printer if discrepancy in status.
- Fire doors plant Control of the fire door individually and group Automatic alarms on ESD Visual display/printer.
- Relevant Consumers for HVAC/ventilation

The ESD system shall have reserve capacity able to suit for future requirements regarding number of user interfaces, equipment to be monitored and controlled, and the level of redundancy needed.

The ESD plant shall be able to execute automatic safe actions such as gas engine shutdown in case of detected gas leaks.

The ESD plant shall also include an operation panel in which manual shutdowns can be carried out.

812.1 Emergency Stop

Emergency stop switches shall be provided as follows:

ECR Fire station

- E.R. Ventilation (Fans and Fire dampers)
- Cargo rooms Ventilation (Fans and Fire dampers)
- LNG system Ventilation (Fans and Fire dampers),
- fuel oil and lube oil pumps,

as per Classification Societies requirements

Wheelhouse

- Accommodation air conditioning for each MVZ
- E.R. Ventilation (Fans and Fire dampers),
- Cargo room Ventilation (Fans and Fire dampers),
- LNG system Ventilation (Fans and Fire dampers)
- Controlled Fire doors Closing (one each MVZ)
- Watertight door closing

Lifeboat area (one PS, one SB)

- any pump whose discharge outlet is located in way of lifeboat launching area.

ESD switches shall be adequately protected to prevent an improper use.

813 Fire Main

Fire pumps number and location as Requirements SOLAS and 2009/45/EC

Three (3) main fire pumps will be installed on board as described below:

- One electrically driven fire pump shall be installed in aft engine room.
- One electrically driven fire pump shall be installed in fore engine room.
- one electrically driven fire pump shall be arranged in Fore thruster room.

Standby pump to be considered optional and to agree on Class requirement.

The fire pumps shall be used for the following purposes:

- Fire main (hydrants).
- Seawater supply to water mist system
- Drive water for main bilge system.
- Car deck fresh water flushing system

Pump capacity for fire main shall not be less than 100 m³/h at 9 bar g pressure head. Pump capacity for seawater supply shall be according to Rules and Suppliers' calculations. Total fire pump capacity (flow and pressure) shall be based on the most unfavorable combination of the above identified consumers.

The fire pumps shall be installed below waterline level and generally as recommended by the maker.

Special care shall be given to the suction side of fire pumps, where pipe dimensions must be adequate to avoid cavitation at peak water consumption.

Fire pump start button shall be placed on the Wheelhouse, ECR and Fire control station and in 2 positions on Deck 3 and 4. Start buttons may be placed in fire hose cabinets.

Fire Pumps number and location according to rules. Fire main system to be used for:

- Fire Hoses
- Bilge Ejector drive water
- Deck washing system

813.1 Water Mist System

All the enclosed spaces where required by rule, except deck 3 cargo hold, shall be protected by low pressure water mist system.

In accommodation it shall operate as sprinkler system wet pipe with automatic activation.

In machinery it shall operate with controlled activation and dry pipes.

The system shall be kept under pressure using a FW dedicated tank (capacity defined by the maker). It will automatically switch to Sea Water once FW is terminated.

The system shall be prepared to work properly with potable water present on board.

The nozzles for accommodation are made in nickel plated brass, while the nozzles for machinery spaces are made in stainless steel or plated brass.

The system shall be divided in 2 independent compressor/pumps units located in different MVZ to fulfill SRTP requirement.

813.2 Drencher System

RoRo deck will be protected by Sea Water Drencher system, capacity according to rules (MSC.1/Circ1430/rev.1). The system shall cover the whole surface of Main deck forward of the WT barrier located approximately at Fr.15. Minimum section length to be 20 m. Approx. pumps capacity to be 2 x 500 cm/h.

The system shall be remotely operated from the wheelhouse and manually activated from the fire control station on deck 3.

A dedicated branch shall be to be placed above the aft open deck for dangerous goods to protect the 3 central cargo lanes during LNG transport. Nozzles and piping shall be designed to do not interfere with gantry crane main thrusters' removal operation.

If LNG tank will be located on open deck, proper water spray system shall be supplied as required from IGF code.

816 - Fire Fighting Systems w/Foam

A complete Foam fire fighting equipment with mixing unit, water tank and monitor shall be provided on the Helideck to protect the landing space in case of fire. Proper space shall be dedicated for fire fighting equipment for personnel near the foam mixing station complying with IMO MSC.1/Circ1312.

Helideck foam fire pump capacity shall not be less than 25 m³/h at 12 bar g pressure head.

818 Fire protection of the LNG Bunker station

One permanently mounted powder fire extinguishing system in compliance with IGF code requirements shall be fitted in each LNG bunkering station.

82 AIR & SOUNDING SYSTEMS

821 Air system for tanks

All compartments and tanks below main deck not provided with mechanical ventilation, shall have air pipes leading above Main Deck. The upper part of the air vent pipes shall be taken into consideration for hull scantling and damaged stability.

822 Sounding system

All trimming water tanks, anti-roll passive stabilizing "Flume" tanks, fresh water tanks, heeling water tanks, all fuel tanks (included overflow and Emergency genset), grey and black water tanks, sludge tanks, excluding voids, shall be equipped with remote sounding system. Reading of remotod tank level shall be possible on bridge/engine control room.

Preferred solution are:

- pressure transmitters for water tanks and for fuel oil.

Fuel service tanks shall have sight glass and level alarm as per rules.

Manual sounding pipes will be provided to all the above-mentioned tanks additional to the above system.

Lube oil tank will be equipped with manual soundings pipes only and optical level indicators

85 COMMON ELECTRIC & ELECTRONIC SYSTEM

General

The whole electric system shall be supplied to the vessel according to the rules and regulations and SFI 110.3 Pt.3 and the transportation of dangerous goods as per SFI 10.7

Main voltage on board will be 690 V, 50 Hz

Power will be generated by Diesel Generator set as described in para.650.1

The plant, the machinery and the electrical equipment shall be designed and installed in accordance with the RULES and REGULATIONS as specified in SFI 11 of this specification, with relevant IEC standards and in accordance with the Builder's standard.

The electric installation shall be in accordance with IEC requirements.

Requirements in IEC 533 regarding EMC ("Electromagnetic Compatibility of Electrical and Electronic installations in Ships" are regarded as minimum.

All electrical systems or equipment, indicated in the TS and GA, shall be installed and delivered fully operative.

850 Renewable Energy - Solar Panels

High efficiency photovoltaic cells (at least 200W/sqm peak) to be installed on top of the open deck as sun protection, on a surface of abt. 600 sqm, for a peak production of abt. 100 kW. The power will be transferred through a String Inverter into the Main Switchboard and managed from the vessel PMS.

851 Energy Storage System (Hybrid Electric)

(Option) Energy Storage system (ESS) located in Deck 1 as per GA, can store genset electric production in a battery pack with a capacity of abt. 1000 kWh with C- rate at least equal to 3C, for the use of the hotel load during port stops, with all Gensets switched off, the so called "Zero Emission in Port".

Battery can be also used to optimize energy consumption by load levelling during manoeuvring and peak shaving at sea.

- 800 – 1100 V Min/Max
- Liquid Coolant temperature supplied to battery: 20°C ± 3°C
- 10 Year Life
- Night Mode: 2 Cycles per Day. (Charging at night)
- Night Mode operating SOC Range (BOL): 29% - 86% at beginning of life.
- Night Mode operating SOC Range (EOL): 10% - 86% at EOL.
- Load Levelling: 1500 kW for 30 seconds discharge – 1500 kW for 30 seconds charge, 1 minute cycle for 15 minutes. Considering 20 minutes idle time between each load levelling event.
- Peak Shaving: 1500 kW for 10 seconds discharge – 1500 kW for 10 seconds charge, 20 seconds cycle for 40 minutes. Considering 20 minutes idle time between each peak shaving event.

- To avoid hitting overvoltage thresholds (max voltage 1100 VDC) we assumed an 85%SOC when charging under the Peak Shaving mode or Load Levelling.

Night Mode: In each night batteries will feed the hotel load with 2 cycles and Diesel generator will charge the batteries after the 1st cycle finished.

- 4 hours 15 minutes batteries will be in discharging mode with average 130kW ≈ 553kWh
- 1 hour batteries will be in charging mode until the full capacity with approx. 553 kW
- 4 hours 15 minutes batteries will be in discharging mode with average 130kW ≈ 553kWh

Full Predisposition for future installation for both Photovoltaic cells and Electric energy storage system to be properly installed on board (cabling, breakers, control system, ventilation, cooling if requested, etc.)

852 Electrical Installation

General

The distribution system is to be 3-phase with insulated neutral.

Voltages and Frequency

In general the voltages, frequency and distribution system will be as follows:

Item	Voltage	Frequency	Phases
Alternators	690 V	50 Hz	3
Motors	690 V	50 Hz	3
Fractional motors	400/230V	50 Hz	3/1
Small galley ,bar , etc	400/230V	50 Hz	3/1
Special services	230V	50 Hz	1
Navigation aids	400/230V	50 Hz	3/1
Lighting	230V	50Hz	1
Reefer sockets	400V	50 Hz	3

Terminal blocks and lugs

The cables connected to switchboards, generators, motors, transformers, starters and other power cables are connected using compression solderless lugs. All other cables are directly connected to equipment terminals. Where suitable terminals are not fitted on the equipment cables are to be terminated with compression solderless lugs.

Termination in conductors of high voltage cables are, as far as practicable, to be effectively covered with suitable insulating material.

Precautions are to be taken to relieve the electrical stresses where cable insulation is terminated.

Furthermore termination and splices are to be of a type compatible with the insulation and jacket material of the cable and are to be provided with means to ground all metallic shielding components (i.e. tapes, wire, etc.).

All terminal boards shall be suitably marked.

Fuses

Fuses in general, shall be of not renewable cartridge type, with ceramic or equivalent body and breaking capacity adequate to the perspective short-circuit current at their points of applications.

Terminal blocks with fuses shall be also provided.

Fuses installed in particular or special equipment, including those of circuit breakers, will be in accordance with the Manufacturer's standard.

Colors

In general, the colors of finishing paint for metal surfaces of electrical equipment (MSWB, ESWB, Bridge console, ECR console, generators, motors, starters) will be defined based on Owner standard except for the followings:

Electric equipment of foreign make as Manufacturer's standard.

Internal metal surfaces of electric equipment shall be painted according to Manufacturer's standard colors.

Busbars marking

A.C. SYSTEM	-	D.C. SYSTEM
-------------	---	-------------

Phase R or U marked L1	Positive (+) L+
---	------------------------

Phase S or V marked L2	Negative (-) L-
---	------------------------

Phase T or W marked L3	
---	--

Push buttons and indicating lights

Indicating lights colors are:

- | | |
|----------------------------|--------|
| • running | green |
| • alive | orange |
| • indication (discrepancy) | white |
| • alarm/stopped | red |

Push buttons colors are.

- | | |
|---------------|-------|
| • start | green |
| • stop | red |
| • reset | black |
| • acknowledge | blue |

855 COMMON COMPUTER SYSTEMS

Safety Management System (SMS)

Safety Management System (SMS) according to Class requirements to be installed. The system is supplied in order to provide a common platform for handling safety related activities.

SMS Operation stations

One (1) Operator station wheelhouse safety console with 24" color monitor, one (1) PC with keyboard and pointing device.

One (1) Operator stations engine control room. The unit to include 24" color monitor one (1) PC with keyboard and pointing device.

The SMS system allows following functions:

- Monitoring and control of fire/gas detectors
- Monitoring and control of fire detection manual call points
- Monitoring and control of fire doors
- Monitoring of side doors & splash-tight doors
- Monitoring of water-mist
- Monitoring and control drencher valves/pumps
- Monitoring and control of Low Location Lighting chargers/units
- Monitoring and control of ESD (emergency shut down system).
- Monitoring and control of watertight doors and hatches
- Monitoring and control of partition valves.
- Monitoring of fire dampers and fans
- Monitoring CCTV cameras
- Monitoring of flooding detectors

In addition to the SMS display facility, two (2) hard mimic panels to be provided for side doors monitoring and tire doors centralized control per main fire zone.

86 GENERATING AND DISTRIBUTION SYSTEM

The whole electric system shall be supplied to the vessel according to the rules and regulations and SFI 110.3 Pt.3 and the transportation of dangerous goods as per SFI 10.7

861 Generators

The ship's electric generating plant (EGP) is to consist of:

- Two(2) FWD main alternators MDO/LNG(DF)
- Two(2) AFT main alternators MDO/LNG(DF)
- 1 em.cy diesel alternator about 350 KW

Main and aux. alternators shall be arranged for steady parallel operation.

Emergency shall be arranged for transitory parallel operation with one aux. alternator.

The main switchboard (MSWB) bus-bars system is divided in two sections connected by means of bus-tie circuit breaker.

861 Generators Alternators

Alternators

Type	: synchronous
Construction form	: B3
Enclosure	: IP 44
Cooling system	: fresh water cooled
Rated voltage	: 690 V a.c.
Frequency	: 50 Hz
No. of phases	: three
Power factor	: 0,8
Service rating	: continuous
Exciting system	: brushless type
Insulation	: class F
Prime mover	: diesel engine

All alternators to be equipped with:

- Automatic voltage regulator with LP filter
- Sensor for cooling water temperature

- Sensors for temperature in windings (PT100, 2x3 off)
- Sensors for bearing temperature
- Sensors for cooling water leakage
- Transformers for differential protection
- Heating element for stand still

Emergency- Harbor Alternator

Type : synchronous
Construction form : B3
Enclosure : IP 23
Rated output : 350 KW (abt)
Rated voltage : 690 V a.c.
Frequency : 50 Hz
No. of phases : three
Power factor : 0,8
Revolutions : 1500 rpm
Service rating : continuous
Exciting system : brushless type
Insulation : class F
Prime mover : diesel engine
The alternator to be equipped with:

- Automatic voltage regulator with LP filter
- Heating element for stand still

ALTERNATORS on DUTY

In general, the generators shall supply the necessary electric power to the network as follows:

OPERATION	GENSET ON DUTY
NORMAL SEA GOING	TWO MAIN DD/AA
MANOEUVERING	TWO MAIN DD/AA
MANOEUVERING (DYNAPOS SAM)	TWO MAIN DD/AA
HARBOUR (LOAD/UNLOADING)	ONE AUX. D/A
HARBOUR (NIGHT REST)	ENERGY STORAGE

865 Transformers

General: insulation class F, IP23 protection, air cooled, connection delta/delta, three phase

The following transformer shall be installed, sizing is preliminary to be confirmed with final load balance :

- 1+1 units 690/230 V for General services
- 1+1 units 690/230 V for Emergency services
- 1 unit 690/400 V - for dry dock Shore connection
- 1 unit 690/400 V - 550 kVA rated power for Reefer 30 sockets (SFI 36)
- 1 unit 690/400 V for galley/laundry/pantry
- 1 unit 690/230 V for heating system cabin dk5 (MFZ3)
- 1 unit 690/230 V for heating system cabin dk5-6 (MFZ1)
- 1 unit for renewable energy electric system
- transformers for control systems /dc-dc converters for galvanic separation

The a.m. rated power may be changed in order to meet the necessity of the plant, taking in to account a suitable service factor.

866 Batteries and Chargers

General

Each set of batteries shall have separate charger with voltage and power control and autonomy like required from Regulation.

Battery chargers

Battery chargers have facilities for automatic boost and trickle charging and are sized to supply the total user load while charging the discharged battery. In case of failure of the automatic circuit, manual charging is possible.

Battery chargers shall have alarm for "fault" connected to Automation plant.

Batteries

Maintenance free lead acid batteries of marine type are to be installed.

SERVICE	N°	Volt	Type	Location
Ship services	1	24V	Lead acid	Battery room
GMDSS		Manufacturer's standard		Radio station
Fire alarm system		Manufacturer's standard		
PA/GA system		Manufacturer's standard		
MONITORING system		Manufacturer's standard		

Em.cy alternator starting	2	24VLead acid		Em.cy D/A room
Transitional light and ship services	2	230 V	Lead acid	Battery room

866.1 Uninterrupted Power Supplies (UPS)

The UPS, in general are built in accordance with makers standard as far as materials, internal wiring diagram, operation and working sequences are concerned.

Each UPS is capable to supply the load of the connected equipment simultaneously in operation, for a duration of 30 minutes aft black-out: of ship's net.

The UPS is provided with local monitoring facilities.

The following free contacts for alarms extended to Monitoring plant will be provided:

- Common fault
- Battery operation
- Earth fault on 230 V AC
- Earth fault on 24 V DC

The following UPS are provided:

- N° 2 set transitional light and ship services UPS with 3-phase input from EMSWBD 690 V, 230 V AC 3-phase output.
- N° 1 set navigation equipment UPS with 3-phase input from EMSWBD and MSWB 690 V, 230 V AC 3- phase output.
- N° 1 set 24 V DC (output) ship services
- N° 2 set 230V ac (output) dd/aa-mm.ee-e.r. services
- N° 2 set 24 V DC (output) dd/aa-mm.e-e.r. services

Final position and number of UPS for essential systems, to be in accordance to SRPT redundancy and segregation.

867 Variable Speed Drive/Converters

The drives/converters in general are built in accordance with makers standard as far as materials, internal wiring diagram, operation and working sequences are concerned.

The following VFD are provided:

- N° 2(two) type active front end converters /AFE), fresh water cooled for El. Propulsion motors
N.B.: Calculation of over harmonic voltage (TDH) shall be worked out by the converter supplier for all operation modes
- N° 1 set VFD for el. motor of Fans of main machinery and auxiliary rooms, thruster room,
N.B.: Fans motor speed must be regulated manually (local) and automatically from Automation plant for all operation modes
- N° 1 set VFD for el. motor of Sea water pumps centralized cooling
- N° 1 set VFD for el. motor of Cargo hold fans

Final Position of drives for essential systems, to be in accordance to SRPT redundancy and segregation.

871 Main Switchboards (MSWB)

General

Two (2) main switchboards shall be provided for SRTP requirement. They shall be located in separate rooms with watertight and fire separation between them, preferably in different MVZ. The switchboards shall be supplied by the relative gensets and cross connected via bus tie link.

The switchboard shall be of dead front type, consisting of units mounted on a common strong base. Units shall have side and top cover plates, hinged front doors, removable rear covers, the bottom shall be open. Handrails shall be provided on the front and on the rear.

The MSWB shall have a drip-proof enclosure (IP 22 protection) and natural ventilation through louvers with rat-proof grid.

The bus bar system, adequately designed on the required current capacity, shall be supported to withstand electrodynamic stress.

The MSWBs shall be located in E.C.R/Fore MSBD Room and . Aft Main SWBD Room.

Connection cables shall enter from the bottom or if necessary from the top through modular multicable transit penetrations arranged respectively floor and on top cover plates.

Instruments

All instruments fitted on MSWBs front shall be of flush type with 96x96 mm square flange for generator and parallel panels and 96x96 mm square flange for other panels.

Automatic circuit breakers (ACB)

In general, the ACB shall be three-pole air circuit breakers with characteristics adequate to the installation and of breaking and making capacity adequate to the perspective short-circuit currents at

the point of installation. Where the ACB have not performances suitable to meet the short - circuit values at the point of installation, manual starters and fuses to be used.

Alternator ACBs shall be of withdrawable type with electric control and manual emergency control as well, complete with overload, short time, instantaneous, reverse power and low voltage protection.

The ACB's fitted on MSWBs for connection with ESWB, shall be of withdrawable type with electric control and manual emergency control as well, it will be also provided with short-circuit and overload protections.

Main and Aux. alternators and emergency alternator ACBs shall be electrically interlocked with the shore connection ACB as indicated in the distribution diagram in order to prevent the shore supply being inadvertently connected in parallel with any ship's generator.

Spare automatic circuit breakers will be also installed (690V and 230V panels).

Protection against short-circuits shall be of selective type, but only for circuit breakers of alternators, vital services panel boards, connection with ESWB and normal light transformer feeder.

In general ACBs up to 630A rated shall be of molded case type, while the others shall be of open type.

Main features

The MSWBs will consists of:

- one panel for each generator (main and aux,)
- one panel for parallel operation
- one panel for energy storage (available)
- panels for el. propulsion motors and 690V users
- one panel for 230V users.
- panels (eventual) for starter main auxiliaries

If necessary, the 230V panel can be fitted separately.

A watt-metric preferential tripping system shall be also provided for the automatic cut-off of the non-vital users in case of generator overload.

The main switchboard can be divided in two separate main parts with bus-tie breaker and both parts can supply consumers needed for 100% propulsion machinery running.

One shore connection to be installed, connected to one section of MSWB.

On the front panels the following instruments will be fitted:

Generator panels

- 1 ACB
- 1 ammeter with change-over switch (COS)

- 1 voltmeter with COS
- 1 frequency meter
- 1 hour counter
- 1 illuminated push button for alternator deexcitation
- 1 illuminated push button for reset deexcitation
- 1 selector "manual-PMS"
- 1 pilot lamp "heater on"
- 1 space heater switch
- 1 alarm panel

Synchronizing and parallel operation panel

- illuminated push-buttons for alternator ACB electric control
- illuminated push-buttons for em.cy alternator ACB electric control
- illuminated push-buttons for ACB connection MSWB-EMSWB at EMSWB electric control
- change-over switch for governor remote control (alternators and em.cy alternator)
- 1 double voltmeter
- 1 double frequency meter (pointer type)
- 1 synchronoscope, pointer type
- 1 synchronoscope, lamp type
- 1 change-over switch for parallel operation
- alternator watt-meters (alternators and em.cy alternator)
- 1 alarm panel with visual and audible alarms
- 1 insulation meter with COS and alarm

For MSWB - EMSWB connection

- 2 three-pole ACB
- 1 ammeter

For shore connection:

- 1 three-pole ACB
- 1 pilot lamp for "shore power on" indication
- 1 ammeter with COS
- 1 voltmeter with COS
- 2 pilot lamps for ACB "on-off" indication
- 1 kWh meter

Panels for power users

Three-pole ACBs as necessary.

Ammeter for the important user.

Panel for 220V users

ACBs and automatic change-over for incoming supply from transformers

ACBs as necessary for all lighting and small power users.

- 1 voltmeter with a change-over switch
- 1 ammeter with COS
- 1 insulation meter with COS and alarm.

Internal illumination of MSWB

The MSWB will be provided with internal illumination by means of led watertight lights.

872 Emergency Switchboard (EMSWB)/Harbor Switchboard

Emergency Switchboard (EMSWB)

The EMSWB shall be similar in construction to the MSWB. It will be located near the EMDG set and will have 690V and 230V bus-bar systems for power distribution to the users.

The EMSWB will be normally fed from the MSWB. In case of black out, an automatic sequence will perform the opening of MSWB/EMSWB connection ACB, the starting of EMDG and the closing of its ACB.

EMDG and emergency lighting transformer ACBs will be arranged for selective protection against short-circuit.

The EMSWB will consists of:

- one panel for em.cy alternator and EMSWB-MSWB connection
- one panel for 690V users
- one panel for 230V users.

Generator panel

- 1 ACB for alternator
- 1 ACB for EMSWB-MSWB connection
- 1 ammeter with change-over switch (COS)
- 1 voltmeter with COS
- 1 frequency meter
- 1 hour counter
- 1 pilot lamp "heater on"

690V panel

- 1 insulation meter with COS and alarm.
- -ACBs as necessary for users.

230V panel

ACBs and automatic change-over for incoming supply from transformers

ACBs as necessary for all lighting and small power users.

- 1 voltmeter with a change-over switch
- 1 ammeter with COS
- 1 insulation meter with COS and alarm.

Harbor Switchboard - Dry Dock Shore Connection Box

One shore connection box 500A 400V 50Hz shall be provided with drip-proof enclosure (IP 23 protection) for installation with isolating transformer 690/400V at aft deck 3.

Electrician's Test Panel

One electrician's test panel shall be supplied and installed in the electrician's workshop. The panel will be arranged for testing various lamps, fuses, pilot lamps and small power equipment.

875 Distribution Panelboards

The power and light distribution panelboards shall consist of a steel cabinet with a waterproof enclosure of IP 44 protection, and with hinged doors, the alive parts shall be adequately protected.

Position and number of panels to be in accordance to SRTP requirements.

The bus-bar system, adequately designed on the expected load, shall be supported to withstand electrodynamic stresses.

The ABCs will have characteristics adequate to the installation and shall have breaking and making capacity adequate to the perspective short-circuit current at their point of application.

- 690V and 400V circuits shall be equipped with three-pole molded automatic circuit breaker of fixed type, with overload and short-circuit protections and signal lamp "voltage on"
- 230V circuits shall be equipped with 2-pole or 3-pole molded case circuit breakers of fixed type, with overload and short-circuit protections and signal lamp "voltage on".
- 24V circuits shall be equipped with 2-pole molded case circuit breakers of fixed type, with overload and short circuit protections.

Some of the lighting panelboards will be provided with contactors - for the cut out of external lighting circuits - remotely controlled by switches installed on the wheelhouse console.

873/4 Local and Group Starters

General

Starters are to be of the magnetic contactor type for direct on-line starting. Starters for motors with starting current which may cause a voltage drop higher than 15% are to be of the same type but are to be equipped with autotransformers or star/delta for reduced voltage starting.

Group starter panels are to be arranged for pumps auxiliaries, cargo area fans, etc.

The starter power circuits are supplied with 690V or 230V AC, three-phase or single-phase, 50 Hz. The auxiliary circuits are supplied with 220V AC, 50 Hz. auxiliary transformer.

Every motor of 1 kW and over is to be controlled by a starter.

Motors of less than 1 kW and without any automatic control are to be operated by a circuit breaker with overload/short circuit protection, according to the Manufacturer's recommendation and/or Builder's standard.

Start and stop push buttons and pilot lamps are to be provided near each motor, if the starter is fitted far from the motor.

For machinery running at two different speeds, the starters are to be provided with interlocks, so that it will be only possible to start the motor at low speed before passing to high speed.

Front access for maintenance and inspection of all cable connection of all starters is to be guaranteed.

As far as possible, the starters are to be of the same Manufacturer.

Starters for particular users, i.e. windlasses, mooring winches, cranes and similar equipment, are to be supplied by the Manufacturer.

Starters for galley, pantry, laundry machinery, etc., shall have functional diagram as per Manufacturer standard

Service rating

In general, all components are to be rated for continuous operation, Contactors are to be suitable for the maximum current rating of the specific service and coordinated with the characteristics.

Construction of individual starters

Starters are to be mounted in painted cabinets with IP 44 protection.

The cabinets are to be made of steel plates with hinged front doors and arranged for bulkhead and/or floor mounting.

Cable entries are to be in the lower part, as far as practicable.

Doors are to be interlocked with the isolating switch for safety reasons, so that they cannot be opened when circuits are alive.

Individual starters are to be fitted near the auxiliary equipment.

Construction of group starter panel (GSP)

The group starter panel to consist of a number of IP 22 cubicles containing 3, 4, 5 or more modular cabinets according to the size required.

All components of each starter to be fitted inside the modular cabinet.

Incoming and outgoing cables will be routed in trunks, arranged on the right hand side of each cubicle, with hinged front access door and handrail.

Bus bars are to be fitted on rear side but accessible from the front for maintenance. Terminal blocks for auxiliary circuits are to be provided in way of each starter drawer.

Cables are to enter from the bottom; where necessary cables may enter also from the top via multiple cable transits.

Each starter drawer is to be of the plug-in withdrawable type i.e. can be withdrawn without disconnecting any power or auxiliary cables. The drawer panel is to include start/stop push buttons and lamps, "heater on" lamp, ammeter and other devices as required including interlock with isolating switch.

Inside the drawer are to be fitted the components i.e. isolator and fuses, terminal boards, current transformer if provided and other components and accessories

Outfit of starter

- Starters shall be equipped with:
- Ammeter (72x72) for user with power > 15Kw
- Hour counter (72x72) for user with power > 15Kw
- Necessary contactors and relays
- Aux. circuit transformer
- Current transformer (eventual)
- Fuses for auxiliary circuit
- Thermal overload relay with manual reset
- Illuminated start/stop pushbutton
- Indication "heat on" for standstill heating (eventual)
- local/remote control switch (eventual)

Control from AUTOMATION system

Function:

- Start/stop, hour counter
- Automatic running st.by pump
- Automatic restart after black-out

Auxiliaries:

- Sea water centralized cooling system pumps
- Fresh water cooling HT-LT systems pumps
- E.R. and machinery rooms fans
- Cargo area fans
- LNG system fans

Following signals to be arranged:

- Local/remote control
- trip
- running
- command start/stop
- set speed (frequency converter drive)
- speed indication (frequency converter drive)

88 ELECTRIC CABLES INSTALLATION

General

The power, instrumentation, communication cables are to be in accordance with:

- IEC publication 60092-350 for General construction and test requirement.
- IEC 60331 for fire resisting characteristic:
- IEC 60332-1 and 60332-3 for flame retardant characteristics.
- IEC 60754 and IEC 61034 for low emission of smoke, toxic and corrosive gases.

Electric cables have:

- Stranded tinned copper conductors.
- Extruded Ethylene Propylene Rubber type, or cross-linked polyethylene, insulation of conductors HF-XLPE.
- Galvanized steel or red copper wire braid armor where necessary or required by the regulatory bodies. In general, not armored cable will be used;
- Extruded external thermoplastic, EVA SHF1 type according IEC 60092-359, sheath stamped with Marker's name, cross section, type of cable, Rules in compliance with.

Where required by the Rules or where the ambient temperature exceeds 70°C, the cables are of "Fire Resistant" type.

Cables sensitive to interference are provided with additional screen made of aluminum polyester tape, ensuring 100% screening capacity.

For portable appliances such as hand lamps, cables are flexible, oil resistant, rubber insulated and polychloroprene sheathed.

Cables for internal connection of electric equipment are in accordance with the Manufacturer standard and accepted by the Classification Societies.

The minimum conductor cross sections are as follows:

- Power and lighting cables (2 or 3 cores) 1,5 mm²
- Control cables 1,0 mm²
- Comm. and instrumentation multicore cables 0,75 mm²
- Special cables i.e. CAT5 will be according Manufacturer cable standard

The voltage drop is to meet the Classification Societies requirement.

Cable type, routing, segregation and redundancy to be designed in accordance to SRTP requirements.

Cables Installation

The cable installation is in accordance with the IEC publication 60092-401, and IEC 60533.

The following groups of cables are routed separately, as far as practicable, with the distance shown hereunder:

Group J: VFD power cables	EMI generating; Not EMI susceptible
Group K: Power cables and lighting feeders Panelboards (230VAC) Low voltage feeders (230V, 24V AC & DC)	EMI generating; NOT EMI susceptible
Group N: Remote controls and signal (relays, mechanical contacts and coils) Low voltage/current signals (sensors, communication equipment etc.)	EMI generating (transient volt./currents); slightly EMI susceptible slightly EMI generating; EMI susceptible
Group S: frequency signals (antennas, radar scanners, log, echosounder, etc.)	Highly EMI generating or highly EMI susceptible

Distance between runs in mm (straight run)

-	J	K	N	S
J	0	500 (250)	500 (250)	500 (250)
K	500 (250)	0	250 (150)	250 (150)
N	500 (250)	250 (150)	0	500 (250)
S	500 (250)	250 (150)	500 (250)	0

NOTE: Figures in brackets refer to crossing points

Where these distances cannot be met, a galvanized steel duct with a cover and without holes is installed particularly for signals and control cables; alternatively galvanized steel conduit is used. In general, cable supports are to consist of metal trays, conduits and individual supports according to Builder's standard; the types are to be rationalized as far as possible. Installation in spaces exposed to drip or accumulation of water or oil vapor is to be avoided. Cables are to be secured to the trays and supports by means of stainless steel straps with buckles and/or plastic strap according to the Builder's standard, and at intervals required by Classification Societies.

The minimum distance from the bulkhead to cable supports in unlined spaces are to be adequate for painting the bulkhead.

Where cables are exposed to any mechanical damage, they shall be protected by steel plate or steel conduit or galvanized steel flexible hose in accordance with Builder's practice.

Where necessary to supply sensors, lighting fixtures of other devices, the cables are to be routed in conduit fitted under the floor plates and secured to the bearers.

All cables passing through watertight bulkheads and/or decks and fitted below the bulkhead deck are to be provided with multiple-cable transit penetrations, approved by classification Societies and in accordance with Builder's practice.

Cables passing through weather decks and/or external bulkheads watertight bulkhead above bulkhead deck are to be provided with penetrations in accordance with the Builders practice, compound or ROXTEC.

Penetration for single or bunched cables of same service passing through not exposed decks and/or bulkheads are to be non-watertight but filled with compound according to the Builder's practice.

All junction boxes are to be properly marked; all terminals inside junction boxes are to be fitted with suitable marking.

All cable ends and conductors are to be adequately marked at each connection point.

The marking is to be in accordance with drawings.

Where cables enter motors, starters and other power and lighting electrical appliances, glands or shrinkable sleeves are to be installed.

On external decks, only cable glands are to be fitted.

Cable penetrations for generators, MSWB, are to be of modular multiple cable transit type.

As far as practicable cables are not to be painted.

Signal cable screens are to be earthed at one end only or in accordance with the requirements of the manufacturer of the equipment.

Power cable armor and screens are to be earthed at both ends of the cable, unless required at one end only for operational reasons.

Earthing

All starters, distribution boards and any other metal enclosed equipment are to be bonded to vessel's hull by copper straps connected by brass screws, from a terminal to which the cubicle earthing and metal bonding conductor are connected.

All resilient or flexible mounted electrical equipment to be earthed by means of flexible strap or by single core conductor with yellow-green insulation.

No electrical system to be earthed to/or via piping system.

Earthing to meet I.E.C. requirements.

89 ELECTRIC CONSUMER SYSTEMS

891- 892 Electric Lighting

General

The ship lighting system shall include the following:

- normal lighting, 230V - 50Hz
- emergency/transitory lighting, 230V - 50Hz
- supplementary lighting with battery storage (SOLAS reg. 42-1)

Under normal conditions, the transitional lighting will be fed from the A.C. network.

Should the 230V - 50 Hz fail, the transitional lighting will be fed from 230V D.C. battery.

Emergency lights will be a part of the ship's general lighting according to the Rules and supplied from the emergency switchboard.

Number of luminaires will be calculated in order to ensure an efficient illumination. The illumination level, measured on a height of 800 mm above the floor will be as follows:

SPACE DEFINITION	MIN. ILLUMINATION
Cabins (General Illumination)	100 lux
Messes and Lounges	150 lux
Accommodation Alleyways	100 lux
Engine Room, Thruster Room	100 lux
ECR and workshops	250 lux
Wheelhouse	150 lux
Passenger Lounge	200 lux
RO/RO deck	50 lux
Weather Decks (working areas)	50 lux

Luminaires and equipment shall have characteristics suitable for the environment and service and shall be manufactured as per the Builder's standard.

In general, luminaires LED type, will be selected as follows according:

- drip-proof protection (IP 23): in cabins, messes, alleyways and public rooms and generally in all lined spaces
- watertight protection (IP 56): on weather decks, in galley and provision room, lockers, engine and auxiliary rooms, steering gear compartment, RO/RO decks and non-lined spaces in general
- explosion proof (AD-PE): paint locker, battery room and hazardous zones in general.

Circuits serving alleyways, stairways, engine room and external lighting will be controlled directly from their panelboard, while circuit in each room shall be controlled by a switch fitted adjacent to the door.

Red light shall be fitted on the bridge and dimmer switch at wheelhouse console

RO/RO deck general illumination will be fitted on the deckhead in suitably protected position to avoid mechanical damages.

Circuits shall be controlled from the distribution panelboards fitted at the entrance of the RO/RO decks.

Switches in cabins shall be of two-pole type. In general, deckhead light will be controlled by means of a two-way switch fitted at the door while those fitted in officers' cabins will be controlled by means of two-way switches, one located at the door and the other at the bed, also in the passengers cabins, close to the beds.

Sockets

At least the following sockets shall be provided; except if otherwise described:

drip-proof two-pole + earth 10A, 230V of flush type:

- one pc. in each crew cabin, messroom, lounge and hospital, fitted near the broadcasting antenna outlet
- one pc. in each lounge, fitted near the TV antenna outlet
- two pcs. in each office, radio station and chart room
- three pcs. in wheelhouse and ECR
- drip-proof two-pole + earth 16A 230V of flush type:
- four pcs. in the alleyways of deck 6 and public spaces of deck 5, for cleaning
- watertight two-pole + earth 10A 230/24V, surface mounted for portable lamp:
- twelve pcs. in Technical rooms

watertight two-pole + earth 10A 220V, surface mounted:

- one pcs in each technical spaces:
- thirty (30) pcs. watertight three pole + earth 32A 400V 50Hz, type CEE, IP66 protection for refrigerated trailers. As far as the electrical load analysis is concerned, a power of 14 kVA, for each socket with 0,6 steady state factor.
- six pcs. watertight three pole + earth 16A 400V 50Hz with interlock switch for welding machine fitted one in Thruster room., one in each dd/aa room, one in e.r. workshop, one in chiller room and one in forecastle space.

893 Electric Lighting Systems for Deck & Cargo Holds

External Lighting

Watertight floodlights LED type will be used for the illumination of the weather deck. Normal and emergency external illumination of superstructure shall be ensured by watertight LED type luminaire suitably located on the boundary bulkhead of each deck.

Shall be fitted the following floodlights with control in the wheelhouse:

- -Two (2) for stern ramp lighting
- -Two (2) for aft mooring space lighting
- -Two (2) for fwd mooring space lighting
- -Two (2) for funnel mark lighting
- -Two (2) for overboard portside lifeboat lighting
- -Two (2) for overboard starboard lifeboat lighting
- -Two (2) for overboard fast rescue boat and starboard liferafts lighting
- -Two (2) for overboard portside liferafts lighting

Appropriate number of the LED flood lights shall be installed in the vicinity of lifeboat and crew door. These lamps are installed in the rotatable bracket so that they can be used for outboard lighting.

Lifeboat stations, as well as places for lowering the lifeboats and rafts on to the sea, will be lit with floodlights supplied from the emergency switchboard, according to the Rules. Pilot door areas will be well illuminated.

Navigation lights, as per COLREG requirements, shall have a dedicated switchboard with Norm/Em. supply. Navigation Lights control shall be located in Wheelhouse and SRTP Bridge.

The Builder is to propose locations for approval by the Buyer.

All lights, except those in engine rooms, will be controlled from the wheelhouse.

898 ELECTRIC MOTORS

General

Motors, in general, shall be of squirrel-cage asynchronous type and will comply with IEC standard. As far as possible, electric motors shall be of the same maker.

Motors for galley, pantry, laundry machinery, etc. shall be built according to the Manufacturer's standard, as regards service rating, insulation, construction, enclosure, etc.

Service rating

In general, the motors shall be rated for continuous service except those for steering gear, turning gear, boat winches, and, if driven by electric motor, windlasses, mooring winches, cranes and similar equipment (thrusters motors excluded).

Those motors will be rated according to the rules and/or the Manufacturer's standard.

Motors for galley, pantries, laundries and other hotel users to be as per manufacturer standard.

Insulation

All motors shall have class F insulation.

The manufacturing, the frame, the stator and the rotor shall be in accordance with the Manufacturer's standard.

Enclosure and installation

All motors shall be totally enclosed external fan cooled, with IP 44 protection.

Very large motors for special services, I.E. bow thruster, ballast pumps, shall be drip-proof IP 23 or IP44 protection considering the location

Motors installed on weather decks, shall be completely enclosed (IP 56 protection).

Space heaters

Space heaters shall be provided only for motors situated in wet spaces with IP 23 and 56 protection, for steering gear motors and motors for particular equipment according to the Manufacturer's standard.