

Tender specification

3000t Multipurpose platform supply vessel

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CHAPTER – 1

GENERAL PART

1.0 Intent of the Specification:

The Vessel shall be able to fulfill the general demands of the offshore industry for the transport of bulk cargo, liquids and equipment to and from general offshore locations worldwide. The ship to be built and classified for unrestricted service.

The vessel to be propulsion by Two (2) diesel engines engaged to main gear box each driving controllable pitch propeller with two (2) tunnel thrusters at aft end and two (2) tunnel thrusters forward. The engines shall be In-line type, Medium speed not exceeding 900 rpm. Minimum Three (3) Auxiliary DG's and Two (2) Shaft Generators shall be arranged.

One of the Vessels will be Diesel Electric propulsion with minimum Four (4) no DG's and Azimuth propulsion system of equal capacity to be arranged.

Vessel should be designed considering the use of alternate fuels. Fuel oil tanks and systems to arranged for ready use of alternate fuels

The design and construction of the vessel to meet the requirements of the Classification Society and the statutory regulations as applicable to an IMS class VIII vessel

The vessel shall be SPS compliant for 60 persons and accommodation to be arranged accordingly for crew and passengers

The shipyard may submit any one of the following designs.

- Rolls Royce –UT Design (Norway)
- Ulstein Design (Norway)
- Vard (Norway)
- Havyard (Norway)
- Wartsila Ship Design (Norway)
- Moss (Norway)
- Damen, (Netherland)
- Robert Allan (Canada)
- Sea Tech (Singapore)
- Focal Marine & Offshore(Singapore)
- Khiam Chuan Marine(Singapore)
- Conan Wu Enterprises Pte Ltd. (Singapore)

1.1 Arrangement, Description

The ship to be arranged as a single deck vessel. Machinery and accommodation is to be arranged forward.

The vessel is designed and arranged according Clean Design class requirements.

Cargo deck; totally approx. 670 m², arranged for four lengths of pipe (12,2 m each) and with a load of 7.5 t/m². With ERRV module the free area is approx. 555 m² and the area below the ERRV module is approx 115 m² with a height of approx. 3000 mm.

One (1) off passive roll reduction tank to be provided aft of the superstructure.

A.C. accommodation for about 60 persons required.

Vessel to be **SPS 2008 code compliant** for carrying not more than 60 persons as per Indian Flag Administration.

1.2 Operational Requirement

The vessel to be designed and equipped for the following duties:

Carrying and unloading to rigs and production platforms, pipe laying barges etc.:

- Deck cargo;
- Pipes;
- Liquid cargo;
- Dry bulk;
- Special products incl. methanol/PPD
- Emergency Response & Rescue Vessel

The vessel to be arranged in compliance with latest Emergency Response & Rescue Vessel Survey Guidelines Group 'B' (previously known as the UKOOA 'B' ERRV guidelines).

The requirements of the ERRV guidelines are met by adding separate module to the vessel inclusive all functions required for compliance to the ERRV guidelines.

Good maneuverability and station keeping, is to be achieved by using twin controllable pitch propellers, twin rudders and transverse bow and stern thrusters.

Sea worthiness to operate in open waters / adverse weather conditions up to sea state 5. Roll and pitch must not exceed 50 in sea state 5.

Twin maneuvering consoles to be fitted in the wheelhouse stations, forward and aft.

The wheelhouse is designed to ensure excellent all-round view as far as practicable.

Unobstructed view to the, aft deck and aft overhead is to be ensured by fitting lower level and deck head windows.

The accommodation is well-appointed and centrally air-conditioned.

All documents shall be in the English Language.

1.3 Principal Particulars (approx.):

Length (Overall) Approx	:	78.0 m
LBP Approx	:	72.0 m
Breadth (mld) Approx	:	17.0 – 18.5 m
Draught (Design)	:	5.1 m
Max. Draught	:	6.4 m
Deck cargo c.o.g. 1 m above main deck approx.	:	1400t
Total Cargo deck area approx.	:	670m ²
Cargo deck, free area approx.	:	555m ²
Cargo deck, below ERRV module approx.	:	115m ²
Gross Tonnage 1969 international	:	> 2000 GRT
Deadweight	:	3000 T at draft of 5.95 m

1.4 **Capacities (approx.):**

Fuel oil (dedicated tanks)	approx.	600 m ³
Fuel oil (incl. dual tanks)	approx.	900 m ³
Ballast / Drill water	approx.	1400 m ³
Freshwater	approx.	650 m ³
Dry bulk cargo tanks (Cement / Baryte)	approx.	300 m ³
Base oil	approx.	165 m ³
Mud / Brine (sg. 2,8 t/m ³ – 8 off cylindrical tanks)	approx.	800 m ³
Special products/Methanol/PPD (2 off tanks)	approx.	160 m ³

All Mud-, Brine- and Base oil tanks are to be designed for the carriage of liquids with a flashpoint above 60 degrees Celsius.

Special purpose / Methanol tanks are to be laid out for safety and pollution hazard substances with flash point below 43 degrees Celsius, according DnV class LFL* or equivalent.

Electric sockets for 12 Nos reefer containers to be arranged at suitable location on main deck

1.5 **Endurance:**

The endurance of the vessel to be for 40 days.

1.6 **Dead weight-**

Deadweight of vessel at design draft and Maximum draft 6.2 M to be indicated. Dead weight of the vessel at 5.95m draft minimum 3000t

1.7 **Speed:**

Minimum 12 knots at max. Draft @ 85% MCR with 15% Sea margin not exceeding 3 Beaufort condition.

1.8 **Crew Complement:**

The vessel shall be provided with accommodation for following crew complement:

Master	:	1	Chief Engr. Officer	:	1
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Chief Officer	:	1	2nd Engr. Officer	:	1
Junior officers/engineers	:	3	Trainee Officers	:	2
Petty officers	:	2			
Crew	:	8			
Passengers	:	41			
Total		60			

1.9 **Class, Tonnage regulations, certificates :**

The vessel, including hull, machinery, equipment and fittings, to be constructed under the rules and regulations of an international class (ABS/BV/DNV/LRS) to obtain the class notation equivalent to following (DNV) notation:

Det Norske Veritas +1A1, SF, E0, DK(+), HL(2,8), DYNPOS AUTR, CLEAN DESIGN, LFL*, BIS, COMF V(3)C(3), NAUT OSV(A), FIRE FIGHTER 1

The ship is also to have a dual class with Indian Register of Shipping Rules, with equivalent class notations

The ship is to be built according regulations for international trade, and all relevant Indian Merchant Shipping Rules applicable for this type of vessel.

Flag state:

The Vessel shall be registered in a port of India and shall comply with the following Rules and Regulations (edition and amendments officially published and adopted/ratified at the date of signing the Contract and which come into effect and become mandatory by the time the Vessel's keel is laid.)

Rules and Regulations:

- Rules and regulations (including Class rules) which are valid on the date when the contract is signed.
- Rules and regulations (including Class rules) which are made public on or before the date when the contract is signed, but which will be effective at or before the delivery of the vessel.

Owners representative shall during the building period have access to the Builder's Yards and workshops for control and inspection. Builder to assist the Owner's representative so he can inspect and supervise at the Yard's subcontractors.

1.10 **Dynamic Positioning System**

The DPS shall be installed to meet the DP-2 notation of IMO for suitable environmental conditions and favourable current, wind directions.

1.11 **Fuel Oil Consumption:**

Daily fuel oil consumption to be indicated at MCR of Main engine based upon fuel oil of 10,200 Kcal/kg in lower calorific value at shop test under ISO reference condition.

The specific fuel oil consumption of main engine at MCR according to main engine manufacturer without considering the tolerance margin of 5 % to be indicated .

1.12 **Certificates, Approved manuals and Booklets:**

The builder to provide the following original certificates, manuals and drawings:

- (i) Builder Certificate.
- (ii) Classification certificates for Hull & Machinery.
- (iii) Safety construction certificate. (Statutory).
- (iv) Safety equipment certificate (Statutory).
- (v) Safety Radiotelephony certificate (Statutory).
- (vi) Record of safety equipment (Statutory)
- (vii) International load line certificate (Class)
- (viii) Tonnage certificate and computation (Statutory)
- (ix) Deratisation exemption certificate(Port authority)
- (x) Potable water certificate.(Port authority)
- (xi) Compass adjustment certificate(Competent authority)
- (xii) Medical chest certificate.(Statutory authority)
- (xiii) Certificates for LSA, FFA, navigation aids, crane, wire ropes, winches, windlass, anchor, chains, mooring ropes & other mooring equipment, castings and forging etc.(Class/Statutory authority)
- (xiv) Intact stability booklets approved by the Maritime Administration and Classification Society.(Statutory authority)
- (xv) Deadweight calculation sheet from shipyard.
- (xvi) Statement of compliance from for TBT free anti-fouling paint issued by the paint manufacturer and class.
- (xvii) DP-2 certificate.
- (xviii) International oil pollution certificate.
- (xix) International sewage pollution prevention certificate
- (xx) International air pollution prevention certificate
- (xxi) Certificate for light and navigational aids.
- (xxii) Calibrating Certificate for flow meters in cargo system
- (xxiii) NDA Certificate for rig movements
- (xxiv) Statement of fact of MARPOL compliance
- (xxv) Statement of fact of IMO resolution compliance ,applicable under section 0.11
- (xxvi) Maritime labour certificate and a declaration of maritime labour compliance
- (xxvii) Suez canal and Panama canal tonnage certificate.
- (xxviii)Ship Recycling Plan and Green Passport with Listing All Hazardous Materials. Issued by the Builder)
- (xxix) PSPC Compliance Certificate
- (xxx) **Compliance certificates from class for “UKOOA Guidelines for class “B’ vessel (Issue 05, May 2008 or latest edition)**
- (xxxi) Any other certificates or plans as required by MSC circular 1151.

The following manuals stamped by the class or other assigned authority shall be provided.

- Stability booklet in hard copy and on CD ROM.
- Garbage management manual

- Shipboard Marine pollution prevention plan (SMPP)
- Ullage table
- Procedure and Arrangement Manual for carriage of brine
- Cargo Securing Manual
- Letter of compliance for carrying dangerous cargo packed good on deck.

Certificates not listed, but required by class or authorities, to be delivered by the shipyard.

Yard also to work out an Equipment specification with a brief description of all equipment and with a statement of Make, Type, Production No., Supplier with address, telephone No., Fax No., and other relevant information for effective maintenance of the ship. This information to be delivered in paper and on a diskette produced in Word or Excel program.

Builder shall ensure that the ship's crew have the necessary instructions on board for using the equipment fitted.

1.13 Model Test:

The following tests to be conducted in an established model testing tank to arrive at an optimum hull form to achieve the design speed.

- (i) Resistance tests and self propulsion tests (with stock propeller) at design draft.
- (ii) Propellers to be designed with the available data and open water test to be carried out with the design propellers.
- (iii) Self propulsion test using above designed propellers at design draft.
- (iv) Other tests as necessary for this type of vessel.
- (v) Manoeuvring & sea keeping calculation.

1.14 Stability & Inclining Experiment:

The vessel shall have adequate stability under all normal and expected conditions of loading and towage for the intended service in all weather condition. The stability particulars shall also comply with the load line requirements and with IS code 2008

No ballast to be carried in fully loaded condition. No head trim to be allowed in any loading condition. The max. trim allowed in any loading condition not to exceed 1.0% LBP. No permanent ballast shall be allowed.

When the vessel is almost complete and outfitted, the lightship weight measurement and an inclining experiment to be carried out in presence of Statutory Authority Surveyor, Owner's representative. The light-ship distribution to be calculated and given to owners.

The lightship weight shall be defined as follows.

This is the weight of the vessel complete i.e. the weights of hull, machinery, electrical and outfitting parts including all equipment, fittings and shall also include the following:

- a) Water and oil in machinery and pipes directly related to main propulsion engines and power generating systems for the purpose of propulsion.
- b) Oil in Stern tube.
- c) All stores, spares, inventories and tools as required by Classification and other regulatory bodies and as specified in this specification.

The trim & stability booklet, to be prepared based on the inclining experiment, to include the following conditions:

- (i) Lightship condition,
- (ii) Docking condition,
- (iii) Fully loaded departure with cargo distributed below deck and deck cargo specified by position and weight with full stores and fuel, arrival with 50% consumables and arrival with 10% consumables respectively.
- (iv) Ballast arrival condition without cargo but with 10 % stores and fuel.
- (v) Ballast condition departure without cargo but with full stores and fuel.
- (vi) The vessel in the worst anticipated operating condition.
- (vii) The vessel in a typical condition ready for towing.

Monitor heeling moment to be examined in the most unfavourable loading condition. The monitor heeling moment should not exceed 0.5 times Max. GZ in most unfavourable loading condition.

1.15 Plans:

A comprehensive list (consisting of structural, outfit accommodation, machinery & electrical) of drawings to be submitted for Owners approval. Lists of "as fitted plans and manuals", reproducible tracings and display plans also to be submitted for owners approval.

No work to be carried out with out receiving the buyer's approval on drawings

The builder shall provide all the necessary drawings and documents required for the registration of vessel.

In case there is any major modifications necessary to drawings which has been approved by the buyer, the builder would resubmit the drawing once again. The modifications to be clearly marked on the drawing.

Buyer's approval of drawings does not relieve the shipbuilder from his responsibility for proper design/ construction, workmanship and commissioning, trials.

Before trial test of the main engine at the factory, the Owner shall be called upon in due course.

Torsion vibration calculations to be carried out by the engine manufacturer and submitted to the Owner and the Class for approval. The calculations also to include drive for Fi-fi pumps

1.16 Material, Workmanship, Standards:

The vessel, including all its material, equipment, piping, machinery, workmanship etc., shall comply with highest standards of best shipbuilding practice applicable to this kind of vessel. In no case these be less than BIS/DIN/JIS/ISO. All work to be carried out according to specification and plan and to the full satisfaction and approval of

owner and his authorised representatives and to the requirements of the Classification Society and also statutory regulatory bodies.

If defects are found in any material, equipment or workmanship (except owner's supplied items), the builder shall cause such defects to be replaced or repaired in proper and efficient manner at the builder's expense.

When words such as or, and/or, similar, necessary, if any may etc are used, the Builder's option shall be respected in consultation with the buyer

Details which are not described in the specifications shall be in accordance with good shipbuilding standards for this type and kind of vessel in consultation with owners.

1.17 Equipment/Machinery Manufacturer And Sub-Contractors:

All machinery and equipment shall be of renowned make. The selection of maker shall be made with the main objective to get smooth and trouble free service. Easy availability of spares and maintenance/servicing facility in India also should be the criteria for choosing the equipment/ machinery manufacturer. The makers list will be discussed and finalized during the development of the final Technical Specification. Selection of the makers from the Maker's list will be made in consultation and with approval of the Buyer. Equipment manufactured by licensees of the listed makers may also be considered subject solely to Buyer's acceptance and subject to the licensees following the latest design of the principal manufacturer with all modification

1.18 Inspection, Test And Trials:

All hull structure, machinery, electrical equipment and outfit shall be inspected by the owner or his authorised representative according to normal shipbuilding practice during the construction of the vessel and to be approved by him.

The completed vessel with all machinery, outfit and equipment shall be thoroughly tested by the builder to demonstrate their efficient working and to confirm that all requirements of the specifications and plans are fully complied with.

The sea-trials should be conducted in such a manner that the data will be available to conform to the requirements of the following:

Standardisation code for trials and testing of new ships of the ship technical societies, Norway 1971-2nd Edition, or equivalent to be followed for various tests and trials.

1.19 Sea Trial

When the vessel is nearly completed, the shipyard shall carryout sea trials of the tug as described below:

(i) Progressive Speed Test: The progressive speed test to be carried out as follows:

At 50% of max output	: One double run
At 75% of max output	: One double run
At 90 % of max output	: One double run
At max output	: Two double run

(ii) Endurance Test :

The endurance test shall be carried out at full power for six (6) hours. Fuel consumption and all other parameters of Main Engine shall be measured during the endurance test.

(iii) Manoeuvring Tests :

Following tests shall be carried out to check the manoeuvring of the vessel:

- a) Crash stop astern and ahead test.
- b) Astern manoeuvrability test with and without use of bow thrusters.
- c) Turning circle test
- d) Inertia test.
- e) Emergency steering test.
- f) Zig-Zag manoeuvre test
- g) Spiral manoeuvre test.
- h) Dynamic positioning test according to manufacturer's recommendation.
- i) Course keeping test.

(iv) Endurance test which includes 4 hours continuous service with unmanned engine room. All alarms and service data for the main engine to be noted on a special form. The form to be enclosed with technical documentation at delivery.

(v) All equipment and systems function, performance and capacity tests will be carried out during the sea trials

After sea trial, important parts of the main engine shall be opened up in the presence of the owners representatives, and then completely closed up ready for service.

1.20 Dry-docking:

The vessel shall be dry-docked or underwater inspection to be carried out at shipyard's expenses before delivery, if the time between undocking and delivery of the vessel exceeds 60 days.

1.21 Photographs & Model:

During the construction of the Vessel, progress reports in the form of coloured photographs and category-wise bar charts at fortnightly intervals shall be furnished to the Owner, with proper indication of amount of work completed and amount of work to be done etc.

One (1) ship model (scale 1:50) to be supplied to owner's head office in an illuminated glass case .

1.22 As Fitted Specification, Plans and Manuals:

Builder shall supply 3 sets of "as fitted" specification at the time of delivery of the vessel along with the as fitted plans and manuals. One (1) set of as fitted specification along with as fitted plans and manuals to be supplied in electronic form.

Also one set reproducible tracings of these drawings shall be supplied for the first vessel only. 200 nos. pocketsize plans/booklets incorporating details of the vessel also to be supplied.

1.23 Spares & Inventory :

Builder to supply the following spare parts on board the vessel at the time of delivery:

- (i) Spares recommended by Classification Society and other Regulatory Bodies.
- (ii) Essential spares recommended (including standard supply) by the manufacturers of various machinery and equipments.
- (iii) Medicines and medical appliances as required by IMS Rules.

All the spares and inventories mentioned above to be properly listed and stored/stowed on the vessel by the builder.

1.24 Scope of Supply:

The vessel to be delivered by the Shipyard to the Owner, complete in all respect and to include all items mentioned in the final specification. The vessel as delivered to be ready to go into the intended service.

There shall be no items of the Owner's supply except navigation charts, signal codes, sailing books and consumables.

The shipyard to provide fuel oil, lub oil and grease for initial filling of the system. The buyer will pay cost of fuel oil, lub oil and grease remaining on board after sea trial and before delivery of vessel.

Any item(s) which is/are not mentioned in the specification but which is/are required by any applicable rules and regulations at the time of signing of the contract and any item(s) which is/are not mentioned in the specification but which is/are required for smooth operation of the vessel, in general spirit, to be furnished by the Builder.

1.25 Guarantee:

The vessel and all its equipment and outfit shall be covered for a period of 12 months from the date of delivery of the vessel for quality of material, workmanship and performance.

The painting of water ballast tanks, fresh water tanks and underwater hull to be guaranteed for Five(5) years. Extended guarantee of major machineries will be discussed during technical discussions.

Should defects arise that fall under the guarantee clause requiring immediate repairs, whether or not such defects require dry docking, the builder shall pay for any cost incurred by the ship-owner, without limitations. Should the ship-owner wish to keep the vessel at the repair yard for his own repairs and maintenance purposes, such time and expense are for the ship owner's account.

1.26 Cleaning up before delivery :

Before delivery of the vessel the complete hull, accommodation, machinery spaces and all dry compartments to be thoroughly cleaned and touched up with paint where necessary.

All F.W. tanks to be pressed up with water.

All machinery, equipment and outfits to be in efficient working condition.

The vessel to be thoroughly cleaned and ready to sail out for the intended service.

1.27 Environmental conditions.

The vessel, plant, machinery and equipment, their components and related systems shall be entirely suitable for service under the following conditions:-

Ambient air temperature	:	45 deg C (max)
Relative humidity	:	70 % (max)
Sea water temperature	:	32 deg C (max)
Air Pressure	:	1000 m bar
Engine Room Temperature	:	55 deg C

1.28 Delivery:

The vessel to be delivered at Shipyard quay. Notice for delivery to be given to the buyer 4 weeks in advance.

CHAPTER - 2

HULL

2.0 Material of Construction:

Hull structure is to be made of steel approved by Class. All steel plates, sections, castings and forgings for the hull/equipment construction are to be certified by Classification Society. No high tensile steel to be used.

2.1 Construction:

Structural details in general shall be approved by the Classification Society and Owners.

The vessel to be of all welded construction. The vessel to be divided into forepeak space, thrusters compartment, accommodation spaces, engine room, and aft peak space.

The vessel to be designed for transverse framing system. All bulkheads to be of plane type construction with vertical stiffener.

Bulwark of 1100 mm height to be provided all around on the main deck and forecastle deck. The bulwark to have adequate tumble home and to be supported at every alternate frame.

Forward peak space to be divided into forepeak tank, chain lockers, stores.

Ballast to be arranged in forepeak space, aft peak space or other locations as necessary. All fresh water tanks to be separated by cofferdams from other tanks. Oil tanks to be separated from accommodation space by cofferdam.

Bilge keel to be provided for the vessel over approx. 30% length.

No steel plating to be less than 6 mm. Hull superstructure to be at least 1 m in board of the shipside to prevent damage to superstructure by contact with other vessels.

The vessel's bottom shall be suitably reinforced for docking.

The structure to be adequately strengthened by providing inserts/ carlings in way of concentrated loads, discontinuities or any other points where stress concentration may occur. Foundation of towing winch and hook are sufficiently strengthened so as to be capable of withstanding the breaking strength of towline.

Doublers to be provided below all weather deck drain pipes. Striking plates to be provided under all sounding pipes.

One echo sounder compartment with sufficient space to accommodate 2 numbers transducers.

2.2 Sea chests:

Three (3) sea chests shall be arranged in engine room- one (1) in low position, one (1) in high position and one (1) independent sea chest for distilling plant. One (1) sea chest shall be arranged in suitable location for emergency fire pump intake. The boundary plates thickness in way of sea chests and bilge wells to be 2 mm higher than rule requirements. Two(2) Sea chests shall be provided for Fifi pumps

2.3 Bilge keel:

Bilge keel shall be arranged at both sides of the vessel for approx. 30% of length.

2.4 Stern:

Stern shall be welded construction. Stern above the water line shall have transom stern with full breadth extended to the extreme aft. The plate thickness of transom stern to be adequate keeping in mind the anchor laying operation. The plate forming the extension athwart ship from the stern roller shall also be adequately strengthened. All corners shall be well rounded.

Steering gear compartment shall be provided aft with access from engine room. One emergency access hatch shall be provided from the main deck to access the steering gear compartment.

2.5 Engine Casing Opening/hatch for spares:

To be provided on the main deck or any other suitable location to serve the purpose.

2.6 Stabilizing tanks:

To be provided as required.

2.7 Deckhouse and Superstructure:

The minimum plate thickness in exposed area to be not less than 8 mm and in other area to be not less than 6 mm.

2.8 Stem:

The stem shall be built for pushing duty.

2.9 Test:

All tank boundaries to be air tested for tightness before application of paint.

Tanks to be hydraulically tested as required by class and owners. The structural testing to be carried out before application of paint on weld joints.

ND tests and radiographs to be carried out as per Classification rules and owners requirement.

2.10 Painting:

All descaling, shop priming, derusting and painting works to be carried out in accordance with the published manufacturer's recommendation and the Builder's standards approved and accepted by the Owner.

All colours of finish to be in accordance with the Owner's colour scheme and subject to the Owner's approval.

No paint shall be applied on any seam/butt fillets or other weld forming boundaries of tanks before leak test.

Machinery and equipment to be prepared and painted in accordance with manufacturers standard. System pipes to be coloured as per colour code approved by owner.

All epoxy paints other than those applied on underwater hull to be TBT , cybutinefree.

All surface preparation and painting works to be inspected by the representative of paint supplier and to be approved by owners representative.

2.11 Surface Preparation:

Rolled hull structural steel to be blasted to SIS SA 2.5, prior to fabrication and primed with one coat of zinc silicate shop primer. Thickness of shop primer to be min 15 microns.

Pipes and fittings to be acid pickled and galvanised and painted.

Damages on the primer on the external hull and deck shall be spot blasted to SA 2.5 and touch up with primer. Damage to primer on the internal area shall be power brushed to ST3 and touch up as recommended by paint manufacturer.

All paints in fresh water tanks to be certified for drinking purpose.

Paint thickness to be measured and recorded which is to be submitted to the Owner.

Intermediate coats to be of different colour for easy identification.

2.12 Painting Scheme :

The vessel to be painted as follows:

Underwater Hull up to load line	:	2 coats of tar free epoxy paint of upto load line total 250 mic. 1 coat of vinyl tar 75 mic. 2 coats of tin-free antifouling paint of DFT recommended by paint maker.
Topsides	:	Recoatable Epoxy – Two coats system DFT total 250 mic.
Water Ballast tanks, cofferdams	:	Modified Epoxy – Three coats total 320

	mic.
Fresh water tanks	: Pure epoxy/Solvent free epoxy- total 300 mic.
Sewage tanks	: Pure epoxy-Three coats total 300 mic.
All weather decks, coaming, bulwarks & crane columns	: Recoatable epoxy HB-two coats, total 250 mic.
Exposed deck houses	: Epoxy/Polyurethane system (as recommended by paint maker)
Inside E.R./Accom./ Steering gear compt.	: Alkyd paints total 150 microns
F.O. & L.O. tanks	: Rust inhibitive oil
Side Thruster tunnel	: Same as underwater hull

Note: Painting scheme shall be discussed in detail at the time of technical discussions and finalized.

2.13 Cathodic Protection:

Zinc anodes of Five (5) years life to be provided on the underwater hull for stern part, around propeller area, rudders, sea chests, bow thruster tunnel and bilge keel. Mean current density :

- Around propellers : 400 mA/sq.m.
- Other areas : 40 mA/sq.m.

2.14 Hydraulic Operated Sliding Doors

Required nos of Water Tight remote operated hydraulic driven Sliding Doors (light opening ~700x1800 mm)to be Provided

Remote operated according to rules and regulations.

Note-

Door to bow thrusters room to have big enough light opening to get remove el. motors on thrusters

CHAPTER - 3

HULL OUTFIT

3.0 Steering Gear

Two independent electro-hydraulic steering gears with two pumps on each rudder motor and complete alarm system to be installed. Remote control for steering gears to be according to class. .

Steering time at 35-0-30 degrees rudder angle : 28 seconds
Maximum rudder angle : 2 x 45 degrees

Control panels and rudder indicator for both rudders to be fitted in forward and aft of wheelhouse.

The system shall independent and simultaneous steering of the rudders.
Interface to auto pilot and Dynpos -system

“overhead” panorama indicator in wheel house to be provided.

3.1 Rudders.

Two no.s rudders to be provided with an approved area. The rudders are to be water tight streamlined,. double plate type , fabricated.

Rudder stock of mild steel with stainless steel liner mounted in stern bearing with bronze liner.

Stainless plugs to be fitted on top and bottom of rudders.

Rudders to be protected internally against corrosion.

Wire Ejector to be fitted between Rudder and Kort nozzle

3.2 Capstans:

Two (2) High pressure hydraulic driven capstans with fixed warping head on both sides of main deck aft. Each having capacity of approx. 6.0 T variable from 0-24 m/min.

3.3 Anchor Windlass Cum Mooring Winch:

One (1) unit anchor windlass winch (High pressure) combined with mooring winch shall be provided with two declutchable cable lifters, one mooring drum and two fixed warping heads. The capacity of cable lifter .mooring drum and warping ends should be as per vessel size.

Two (2) chain stoppers with lashing screw to be provided for stud link chain cable
4 (four) nos heavy eyes for duty anchor lashings are to be provided. .

3.4 Anchor & Chain Cables:

The anchor, chain cables and mooring lines are to be supplied in accordance with classification society requirements.

Two (2) Stockless high holding power anchors and steel link chain to be delivered in length and dimensions as required by class. Half chain length (13.5 m) next to anchor to be hot dip galvanized.

Anchor Chain of K3 quality stud chain according to class requirements.

3.5 Mooring Ropes & Fittings:

The mooring ropes & fittings to meet all rules and regulations. Adequately stiffened mooring ports to be fitted in the bulwarks, forward and aft. Bollards, fairleads, mooring fittings to be provided as required to owners approval.

2 x 220 m of 6" circumference + 2 x 220 m of 8" circumference polypropylene ropes as loose mooring equipment. Tow Line of 190 m length with breaking load of 306 kn to be supplied

3.6 Tugger Winches And Spare Wire Reels:

Two (2) units Tugger winch, each consisting of one fixed drum with band brake of 250 meters of 18 mm dia, wire rope , High pressure Hydraulic with brake bands each having capacity of 10 tonnes variable from 0-18 m/min shall be arranged in front of main deck. manually operated brake control and spooling from underside of drum.

Two (2) hydraulic wire reels for spare rig towing wire (1200 m x 64 mm dia.) with non-declutchable drum.

3.7 Thrusters:

The vessel to have Two (2) tunnel thrusters forward and Two (2) tunnel thruster aft of suitable capacity and for DP-II operation. Electric motors for thrusters shall be Fresh water cooled in order to ensure prolonged life time and reduced ventilation requirements.

Starters for tunnel thrusters to be equipped with soft starter arrangement / frequency converter controlled. Ammeter in space heater circuit to be provided

The thrusters to be controlled from two positions in the wheelhouse

Interface to be arranged for

- DP System
- Alarm and monitoring system

3.8 Service Cranes/davits:

One hydraulic operated crane of approx. 15 T tonnes at 15 M outreach from side shell. The hydraulic oil to the crane to be supplied from Hydraulic power pack unit.

One portable type hand operated davit for bunker hose handling shall be provided with sockets on port and starboard.

3.9 Life Saving Appliances :

Life saving appliances to be provided for 60 persons. All life Saving appliances to comply with IMS rules. One davit to be provided for each rescue boats.

2 Nos life boats of 60 persons capacity with davits to be provided each side of the Ship
1 Nos Work boat to be provided

Fast Rescue Craft and Lifeboats With Equipment.

Two (2) no FRC with outboard motor and single fixed arm davit to be installed according to UKOOA requirements for class “B” vessel. The capacity of both rescue boat to be for 15 persons with FRC launch system and recovery system ,crew life jacket, FRC equipment and crew protective clothing to meet UKOOA requirements. The FRC shall have a speed of approx. 20 knots in calm weather, fully loaded (15 persons respectively).

One (1) off Class and SOLAS approved davit shall be installed on *each* side of the vessel with suitable arrangements for safe and efficient launching and recovery under all foreseeable climatic conditions. The Davits shall have “A”-arm type construction and be fully hydraulically operated, by independent power pack for emergency launching / recovery.

Power supply shall be taken from the emergency generator. Davit to be in accordance with UKOOA guidelines

For more detail Emergency Response & Rescue Vessel Survey guidelines issue 5. May 2008 may be consulted.

Two (2) no Lifeboats sufficient to carry total personnel onboard (P&S) to be provided

3.10 Fire Fighting Appliances:

Fire monitoring/control and fire fighting appliances to be provided in compliance with the IMS rules and regulations.

Fire extinguishing system to be installed as follows :

- | | |
|---------------------|---|
| Exposed areas | : Sea water fire extinguishing system. |
| Engine room | : CO2 total flooding system, sea water fire extinguishing system. Portable fire extinguishers.
Local protection system of water mist as per SOLAS II/3.7 |
| Living quarters | : Sea water fire extinguishing system, Portable fire Extinguishers |
| Paint/chemical room | : Sprinkler nozzle from Fire line. |

Fire fighting system FIFI 1

The External fire fighting system with capacity in compliance with Fi-Fi I notation shall be fitted. The system shall consist of following major components:

- 2 x 1600 m³/h at 16 bar pumps driven by main engine through flexible coupling clutch and gears.
- 2 x sea chests (one for each pump)

- 2 x fire fighting monitors total capacity 2400 M3/hr at 120 M Pressure at monitor inlet shall be about 12 bar. The monitors shall be turnable and with operating range as per rule requirement.
- Deluge system of suitable capacity as per class notation.
Two nos separate sea chest valve with necessary valves and controls
- Remote controlled from bridge
- Necessary loose equipment according to class notation to be supplied by the yard.
- A high pressure compressor with accessories suitable for filling the cylinders of the breathing apparatuses, shall be installed onboard in the safest possible location. The capacity of the compressor shall be at least 75 litres/minute. The air intake for the compressor shall be equipped with a filter.
- External water spray system to be arranged according to DnV Fi-Fi I requirements.
- Approx. 400 m3/h water to be supplied from each of the main pumps

Roll Reduction Tank

Two (2) passive roll reduction tank shall be arranged. Operating medium is to be Ballast water or drill water.

Theoretical calculations to determine the overall efficiency of the system in the vessel to be carried out.

3.11 Ladders:

Following steel ladders to be provided.

Access ladder for tanks	Vertical	1 set for each manhole
On exposed decks	Inclined & vertical	As necessary.

The scantling and size of ladders to be approved by owner.

One set of portable aluminium ladder to be provided and stored on deck.

3.12 Hatches And Manholes:

Rope hatches (ford & aft), hatch for bosun store etc. to be provided. Size of hatches should be about 600x600 mm and to be fitted with bronze butterfly nuts. Escape hatches for steering gear to be provided

2 sets of oval type 600 x 400 mm manhole to be provided for all tanks in the vessel. Manholes to be also provided for chain locker and cofferdam spaces. Manhole covers to be provided stainless steel studs and nuts.

The arrangement of hatches and manholes to be to Owner's approval.

3.13 Masts, Posts, Platforms Etc.:

Vessel to be provided with a radar mast (Unstayed type) on wheel house top and other necessary posts/masts. These are to be equipped with navigation lights, flood lights,

horn, radars etc. The masts and posts to be provided with ladders and platforms as required.

3.14 Doors:

All entrance doors on main deck, store rooms, CO2 room, fan rooms to be of weather tight steel construction.

Other entrance door to the accommodation to be made of good quality teak wood.

3.15 Pilot Ladder:

Two (2) pilot ladders made of manila rope lines and as per rule.

3.16 Lashing Lugs / Pipe stanchions

Twenty (20) nos of 5 tonnes lugs to be arranged on main deck for lashing and securing deck cargoes.

Portable pipe stanchions ten (10) approx. to be arranged on main deck.

3.17 Deck arrangements.

Main cargo deck area shall be fitted with 3” wooden deck sheeting except for anchor berthing area in the centre aft which shall have 25 mm steel insert plate.

On main deck a cargo rail with flush plate towards main deck shall be fitted SB and PS, for the full length of the working deck area as indicated on GA plan, providing a safety zone and safe passage for the deck crew.

The top of cargo rail aft and towards the stern roller shall be designed for smooth running of the towing wire. Lashing eyes and cargo securing stanchions to be fitted

Water tight hatches to be provided for the following compartments.

- Steering gear compartment
- Linen store
- Bosun store
- Rungs or vertical ladders are to be fitted for each hatch.

On each side of the roller ,port and starboard, fixing fairing plates are to be arranged with the same diameter as the outboard sides of the roller.

3.18 Fenders

A substantial fender for the protection of the vessel’s sides is to be fitted at deck level extending the whole length of the vessel. Bow fender, shear and Foc’sle Side Fender and stern fender of suitable sizes to be fitted .Vessel to be fitted with sufficient numbers of D-Type rubber fenders on each side.

CHAPTER 4

EQUIPMENT CARGO

4.0 Dry Cement Tank

Four (4) nos tanks for the carriage of four grades of cement to be provided. Total capacity to be approx 220 Cu.m and working pressure 5.6 bar. Ladders to be mounted inside tanks. Access hatches to be located on top of tanks or on the side near to the top.

4.1 Pneumatic bulkhandling system

One (1) off Bulk Handling system to be installed for storage and transfer of dry cement/baryte

The system is capable of discharging two grades of cement/baryte simultaneously through two separate discharge lines: - one from the two foremost tanks and one from the three aftermost tanks. Bulk handling system pipes to be arranged for easy dismantling.

Discharge station on port and starboard side, totally 3 stations each system. Discharge pipes shall have 5" dia. bending radius 5xD (625 mm) where possible.

The plant consists of:

2 x Rotary lube screw compressors, excluding sound covering, capacities 2 x 22,7 m³/min approx. The plant to be built on freshwater cooled coolers, each cooler to be arranged with closing valves on inlet/outlet, moisture separator and automatic condensation trap, oil separator with alarm lights, star/delta starters, automation for on/off regulation, giving complete automation for parallel run of both compressors.

Further the plant has instruments for temperature and pressure controls, selection switch, start/stop buttons and hour meter.

- 1 No Mucking ejector for tank cleaning to be arranged. Drive water from WB/DW system
- 2 No Freshwater cooled Refrigerated air dryers to be arranged.

The system to be arranged with emergency stop switch for closing of all discharge valves. This switch shall be mounted on bridge and in deck store.

4.2 LOADING/DISCHARGING SYSTEMS FOR LIQUID CARGO

Cargo/discharge pumps

Following cargo discharge pumps to be arranged: 1 off Fuel oil discharge pump
1 No Fresh water discharge pump

- 2 No Liquid Mud discharge pumps
- 1 No Brine discharge pump
- 1 No Ballast/Drill water discharge pump
- 1 No Base oil discharge pump
- 1 No Methanol/Special Products discharge pumps

Fuel oil, base oil and liquid mud system to have black steel piping. Seawater, Brine and freshwater piping to be of galvanized steel.

Methanol/special Products piping to be of stainless steel AISI316.

Emergency stops to be arranged for all cargo pumps.

Fuel oil discharge pump (1 No)

- Type : Centrifugal type pump w/air ejector
- Capacity : 150 m³/h-90 mlc approx
- Motor : El. driven, 2 speed.

One flowmeter with printer to be arranged for filling and discharge purposes of F.O.

Fresh water discharge pump (1 No)

- Type : Centrifugal type pump w/air ejector
- Capacity : 150 m³/h - 90 mlc approx
- Motor : El. driven, 2 speed

One flow meter with printer to be arranged for filling and discharge purposes of F.W.

Liquid Mud discharge pumps (2 No)

- Type : Eccentric screw pump
- Capacity : 100 m³/h - 18 barMax. spes.gravity : 2,8 t/m³
- Motor : El. driven, 1 speed.

Ballast / Drill water discharge pumps (1 No)

- Type : Centrifugal type pump w/air ejector
- Capacity : 150 m³/h - 90 mlc approx
- Motor : El. driven - 2 speed

Brine discharge pump: (1 No)

- Type : 2-spindle screw pump.
- Capacity : 75 m³/h - 18 bar

Max. spes. gravity : 2,8 t/m³
Motor : : El. driven, 1 speed.

Base oil discharge pump (1 No)

Type : Centrifugal type pump w/air ejector
Capacity : 100 m³/h - 90 mlc
Motor : El. driven, 1 speed

Methanol discharge pump (2 No)

Type : Centrifugal type pump, pumps to be of submerged type.
Capacity : 75 m³/h - 90 mlc
Motor : Hydraulically driven

4.3 Filling/Discharge stations

PS/SB amidship : FO, FW, DW, Dry Bulk, Liquid Mud,
Brine, Base oilSB aft : DW, Dry Bulk, Base oil, Special
Products/Methanol
PS aft : FO, FW, Brine, Liquid mud, Dry Bulk (*) (* = Dry
bulk to be included if space for piping allows.)

4.4 Hose connections:

All discharge-/filling pipes to be arranged with Camlock couplings and reducers as agreed upon with the Owner.

One adaptor suitable for 4" Camlock coupling for each of the cargo systems FW/DW/FO/Cement/Byrite will be provided.

In addition the fuel oil, base oil and methanol connections to be arranged with Avery Hardoll couplings with necessary adapters

All cargo systems to have segregated filling/discharge system from other liquids.

4.5 Tank washing system:

Permanent tank washing system with hot water to be installed in each mud/brine tank (8 off cylindrical tanks) and Slop tank.

The tank washing pipe system from pumps to washing machines to be of stainless steel. Sloppipe system to be hot dip galvanised steel.

The tank dedicated to handle the Slop for tank washing system, are to be provided with two suctions, located at different levels above tank bottom.

4.6 Auxiliary Systems

Suitable system for machinery alarm/ monitoring to be installed. 1 PC with keyboard, pointing device (mouse), 2 monitors and printer on bridge, and 1 PC with keyboard,

pointing device, printer and 2 monitors in engine control room. All cargo tanks to have also manual sounding pipe in addition to tank level gauging system.

One (1) remote pneumatic draft gauge to be installed to measure aft, midship and forward draft. Reading to be displayed at wheelhouse .

4.7 Special system for Cargo :

General

The fuel oil cargo, freshwater cargo, ballast/drill water, liquid mud, brine, base oil, specialproduct, methanol systems to be operated/monitored from cargo control system.

The remote control system will enable the operators to operate the cargo systems fullyautomatic in normal cargo handling operations. Drain valves, change-over valves, Blind flange-valves, service valves and butterfly valves at discharge stations, etc. can be manually operated.

The remote operated valves for cargo systems to be of butterfly type with pneumatic double acting actuator with double solenoid valves where approved by Class, elsewhere spring returnactuator with single solenoid valve to be utilized.

Butterfly valves to be used to the greatest possible extent.

Instrument air, to be utilised as air supply for the actuators. All tanks situated above tank top to be arranged with suction well .

One (1) off non-return valve to be fitted on discharge side of the pumps.
The pumps to be arranged with strainer on suction side, except for submerged pumps. Arrangements for easy access for taking samples on load- and discharge side on all cargotanks to be arranged.

In general welding on galvanized pipes to be avoided.

Emergency stop for cargo pumps to be arranged on main deck and on bridge.

Mud system

Pipe system to be of seamless steel quality with flanges welded on. In weather exposed area the seamless steel pipes to be externally hot dip galvanized after completed welding and treatment, with flanges welded on.

Eight (8) mud/brine combination tanks between tank top and main deck to be arranged for carrying mud with density up to $2,8 \text{ t/m}^3$ and with flashpoint above $60 \text{ }^\circ\text{C}$ and pollution hazardonly, denotation "P" (acc. IBC).

The mud pump in system 1 to be arranged as back-up for the pump in system 2, and viceversa.

Mud system to be designed for 5" fill connection from drop line to each tank. Suction pipesystem in general to be 6"

For agitation of the mud, electric driven agitators with high capacity to be arranged in the mudtanks.

Flushing possibilities of the liquid mud system utilizing compressed air to be arranged. Each mud system to be arranged with loading filter, with bypass possibilities.

All tanks to be fitted with high-level alarm.

The system to be arranged for two types of mud simultaneously through separate pump andseparate pipe system.

Drop/recirculation lines with filter and bypass possibilities to be arranged.

Brine system

Pipe system to be of seamless steel quality with flanges welded on. Pipes to be hot dip galvanized after completed welding and treatment.

The Brine tanks: see mud system.

For discharge of brine, one discharge system with one pump to be arranged. Drop/recirculation lines with filter and bypass possibilities to be arranged.

Flushing possibilities of the brine system utilising fresh water to be arranged.

Cargo Fuel oil systems

Pipe system to be of seamless steel with flanges welded on. In weather exposed area the seamless steel pipes to be externally hot dip galvanized after completed welding and treatment, with flanges welded on.

Valves to be of nodular cast iron with internal and spindles of non-ferrous material.

The FO cargo pump to be arranged for transfer between group of tanks, in addition todischarge to deck.

The fuel oil cargo pump to be arranged as back-up for the base oil pump.

One flow mass flow meter carioles type with connection to AMS and printer to be arranged for monitoring fuel oilfilling and discharge operation.& for ME and AEs

Discharge pipe to act as filling pipe with bypass arranged at the pump.
Each fuel oil cargo discharge stations to include a sampling flange of DNV type.

Fresh water cargo system

Pipe system to be of seamless steel quality with flanges welded on. Pipes to be hot dipgalvanized after completed welding and treatment

The FW cargo system to be arranged for transfer between tanks in foreship and aftship in addition to discharge to deck.

All potable water tanks to be equipped with automatic temperature readings. These readings to be interfaced with the ACON Tank Monitoring System

The FW pump to be arranged as back-up for the WB/DW pump.

Ballast/Drill water system

Pipe system to be of seamless steel quality with flanges welded on. Pipes to be hot dip galvanized after completed welding and treatment

WB/DW pump- to be arranged as back-up for the FW cargo pump and vice versa.

Base oil system

Pipe system to be of seamless steel with flanges welded on. In weather exposed area the seamless steel pipes to be externally hot dip galvanized after completed welding and treatment, with flanges welded on.

2 No Fuel oil tanks also to be arranged for Base oil.

Base oil system to be arranged for bunkering and discharge to deck stations. The Base oil pump to be arranged as back-up pump for the FO pump.

Methanol/Special Products systems

Two (2) Nos tanks to be arranged below main deck to carry methanol with flash point below 43degC. The tanks to be surrounded with cofferdam containing seawater or nitrogen inert gas.

One (1) No bilge ejector, capacity approx. 40 m³/h, to be submerged in the cofferdam. SW filling of cofferdam and drive water to bilge ejector from fire line system. The tanks to have access from open deck. Filling/discharge station to be arranged on main deck SB side.

The discharge pump arrangement to be in accordance with class requirements, and to be arranged as back-up for each other.

Methanol/Special Product and inert gas pipes to be of stainless steel quality
AISI 316L. Vent. pipes to be of hot dip galv. steel quality.

One (1) No nitrogen inert gas bottle bank to be installed, the system to include:

- Nitrogen bottles, capacity according to Class rules
- Reduction valve cabinets
- Double block and bleed system

One (1) No nitrogen inert gas generator plant to be installed, the system to include:

- Nitrogen generator, capacity approx. 11 Nm³/h.
- Surge tank
- Booster compressor
- Feed air compressor

The inert gas system to be arranged for inert gas purging and padding of special product pipes and tanks.

Foam system

Sounding and tank ventilation system

The methanol cargo arrangement to be according to Low flashpoint fuel requirements as per IBC code

4.8 El. Hydr. Power Pack

The power pack to have min. 2 hydraulic pumps and to have capacity to supply power to the methanol discharge pumps running at 100% discharge rate simultaneously.

Local control cabinets to be provided. Power pack to be remote operated from cargo control system.

Hydraulic pipes to be of seamless steel quality, with steel flanges type GS-Hydro or similar for pipes above ND40. Pipes ND 40 and below, compression ring fittings type Ermeto or similar to be used. Oil cooler to FW cooled.

Hydraulic system to be arranged with filter on pressure side, return side and leak oil side. Pipe lines to be connected to the power pack by means of flexible hoses.

4.9 Mud Tank Washing System

The mud tanks to be arranged with fixed installed water washing machines of Butterworth or similar for cleaning with seawater, hot or cold freshwater. It shall also be arranged for adding soap/chemicals to the washing water.

The system to comprise:

- 1 no washing machine in each mud tank
- 1 no tank washing pressure/slop discharge pump, eccentric screw type, capacity

- approx. 10 m³/h - 12 bar
- 1 no slop tank in combination with sludge tank
- Valves and pumps to be manually operated.

4.10 Gas Detection

Vessel to be equipped with Two (2) Nos approved portable hydrocarbon and H₂S detectors.

CHAPTER -5
ACCOMMODATION

5.0 Accommodation Arrangement for Officers & Crew:

Accommodation to be provided for about 60 personnel for SPS compliance on the vessel as per the following details:

Captain class	:	2 (Suites with attached toilet and bath.)
Senior Officers	:	2 (2 x single berth cabins with attached toilet/shower)
Junior Officers	:	3 (3 x single berth cabins with attached toilet/shower.)
Trainee Officers	:	4 (2 x 2-berth cabin)
Petty Officers	:	2 (2 x single berth cabins with attached toilet/shower.)
Crew	:	8 (4 x 2-berth cabins with attached toilet/shower.)
SPS personnel	:	about 39

Cabin distribution for accommodating about 39 representatives of Charterers:

Single room (01 person) – 4 Nos.

Double room (02 persons)- 3 Nos.

Two tier (04 persons) – 7 nos.

5.1 Clear Height :

All accommodation spaces to be designed for clear height of 2100mm from top of floor covering to bottom of overhead ceiling.

5.2 Insulation :

The decks and bulkheads which are exposed to outside weather or to the machinery/working spaces to be insulated against fire, heat and noise. The insulation to be attached to the steel surface by means of anchoring pins, washer and G.I. wire

net. Thereafter the surface to be lined/panelled with 'B' class panels within accommodation spaces and with galvanised sheets or glass cloth in other spaces.

Insulation for fire protection to be in accordance with the requirements of Classification Society and Regulatory Body.

5.3 Panelling, Lining, Ceiling etc.:

The material its grade and installation to be in compliance with rules and regulations specified in GENERAL PART. It is to be of solid core type of approved material other than asbestos.

The full accommodation space including corridors to be panelled/lined and provided with ceiling except for the common sanitary spaces, dry provision store, and small stores / lockers. The galley to be provided, with stainless steel lining and ceiling.

5.4 Floorings And Deck Coverings:

The decks in cabins, public spaces, corridors, stairways etc. to be covered with suitable deck composition and laid with vinyl tiles. All deck composition to be approved type. 100 mm skirting of Stainless steel/Aluminium to be provided.

All sanitary spaces and galley to be laid with mosaic tiles over cement having total thickness of 40mm. Skirting up to 150 mm above floor level in all these spaces also to be tiled.

The floors of Captain Class and Senior officers cabins are to be provided with wall to wall carpets. All other cabins to be provided with bed-side runners.

Rubber mats of 20 mm thickness to be provided in Navigation. Bridge around console and in ECR in front of switch board.

5.5 Furniture And Fittings:

The design and sizes of furniture and fittings in accommodation spaces should be as per IMS crew accommodation rules and meeting Owner's approval. The list of furniture for various cabins shall be finalized during technical discussions at Mumbai.

The design, decor and finish to be to Owners approval.

The materials to be of marine quality.

5.6 Windows and Scuttles:

The windows & scuttles to have brass frames and to comply with BSMA standards.

The wheelhouse shall be so designed as to provide unobstructed all round view. The wheelhouse shall be fitted with as large windows as possible and the upper windows are to be inclined outwards to provide better visibility. Funnels shall be designed in such a way that it doesn't obstruct the aft view.

4 Nos. horizontal type window wipers and 2 Nos. CVS of de-fogging type to be provided No. and size of windows/scuttles to be as per owners approval.

5.7 Upholstery & Furnishings:

All furniture and fittings to be well upholstered to Owner's choice. All doors, windows, 2-tier beds, chart room, showers etc. to be provided with curtains.

150 mm foam mattresses and foam pillows to be supplied for each bed.

5.8 Provision Store :

A dry provision store of sufficient capacity to be provided in a suitable location and to be furnished with racks and other necessary outfitting. Provision store to be air-conditioned.

5.9 Air Conditioning & Refrigeration plant.

Air Conditioning

The vessel to be provided with central single duct type air conditioning system. The system shall consist of one (1) set of air handling units having 100% of total required air load capacity. Two complete automatic sets of compressors/condensing units to be provided (one working and one standby). Refrigerating units to be cross connected. A/C system to be based on following conditions:

OUTSIDE

35° C at 85% RH

INSIDE

27° C at 50% RH

Sea water temperature 36 deg C

Re-circulation to be not more than 50%.

Water temp. for cooling condenser to be 37° C.

Cooling water to condensers to be provided from central fresh water cooling system.

After the completion of air conditioning system following tests to be performed in accordance with builder's practice.

- 1- Vacuum and pressure test of the refrigerant (R 404 A) line
- 2- Air volume test
- 3- Cooling test.

ISO 7547, Shipbuilding – Air-conditioning and ventilation of accommodation spaces on board ships – Design conditions and basis of calculations

Refrigeration plant

Refrigerating plants to be designed to run on environment friendly refrigerant (R404a) or equivalent. The refrigerating plant for provision rooms shall have two (2) air cooled compressors and shall operate fully automatic. The compressors are “back-up” for each other. The plant to be direct expansion type, the cooling elements are equipped with electric de-icing with drip tray underneath.

Remote temperature reading of the provision rooms to be arranged in galley.

Locked in alarms to be arranged as per regulations.

5.10 Cabin Fans

350 mm dia. wall mounted cabin fans to be provided in cabins and in public spaces as per Owners approval.

5.11 Mechanical ventilation

Mechanical ventilation to be provided for steering gear compartment, CO2 room, thruster rooms, battery room, bosun store, A/C Unit room, sanitary space and in stores below main deck.

Other spaces to be provided with natural ventilation.

Engine Room

Mechanical ventilation system to be provided for the engine room with amount of air supply corresponding to approx. 150% of air consumption of main engines, auxiliary engines, and air compressors.

2 Nos. Mechanical supply (one no. reversible fan) and natural exhaust. The engine room supply fan capacity to be sufficient to ensure positive pressure inside engine room at all working conditions. One of the fan to be connected with emergency switch board.

5.11 Laundry:

One laundry with automatic washing machine of 10 kg capacity to be provided. Drying room also to be provided. One ironing board with iron to be provided. Adequate capacity steel lockers and shelves to be provided. One (1) sink and two (2) tumble dryer to be also provided.

In addition, two fully automatic washing machines (5 Kg each, one for Officers and one for Crew) to be provided suitably in the passage ways.

5.12 Galley:

For the equipment and furniture, metal part directly in contact with food to be of stainless steel and the remainder to be of steel baked enamel or steel to owners approval.

One galley for officer and crew to be provided with the following equipment.

- 1 - Electric cooking range with six (6) hot plates total 16 KW and one(1) oven of auto-thermal control type with built in switch, necessary accessories and fittings each.
- 1 - Electric mixer with the necessary attachments.
- 1 - Wet grinder (1KW).
- 1 - Electric water boiler (22.5 ltrs.) of stainless steel (1.3KW).
- 1 - Microwave oven (30 ltr.) convection type.
- 2 – Toasters (4 slice).
- 1- One garbage compactor of 0.1 cu.m capacity
- 2 – Garbage boxes.
- 1 – Dough mixing trough of stainless steel with hard wood top.
- 1 – Hard wood meat block
- 2 – Refrigerator ,300ltrs, (Galley and mess room)

- 1 – potato peeling machine with 4 kg new filling
- 2 – dresser units
- 1 – dishwasher

Water cooler at suitable locations (3 to 5 Ltrs capacity)

Steel dressers with stainless steel top and one (1) stainless sink with drinking water and hot water supply with drain board.

Shelves, pan racks, condiment drawers to be provided for storage of utensils etc.

All the equipment to be mounted 300 mm clear of the floor for easy cleaning under.

Galley fixed fire fighting system to be installed

5.13 Refrigerators:

Four nos. refrigerator each 165 ltrs. Capacity to be provided in Master, CEO, CO & 2 EO’s cabins.

5.14 TV Sets :

Six (6) TV sets (LED type) one each in Master, CEO, CO & 2 EO’s cabins and officers and crew recreation rooms to be provided.

5.15 Photocopy Machine:

One (1) latest make to be installed at suitable location. (A3 size)

5.16 Reefer Provision Stores:

Room	Volume	Temp.
Freezer room	15 cu. m.	-18 deg c.
Chiller room	15 cu. m.	+2 deg C

Refrigeration plant to maintain above temp. to be provided consisting of two condensing units (each 100% capacity). Plant to be designed to run on environment friendly refrigerant. However, same to be capable of running on R-404A refrigerant .

The refrigerating plant for provision rooms shall have two (2) air cooled compressors and shall operate fully automatic. The compressors are “back-up” for each other.

The plant to be direct expansion type, the cooling elements are equipped with electric de-icing with drip tray underneath.

Remote temperature reading of the provision rooms to be arranged in galley. Locked – in alarms to be arranged as per regulations.

CHAPTER 6 SHIPS SYSTEMS

6.0 General

All pipe lines to be according to system drawings approved by the Owners, Classification Society and as required by the National Authorities.

Where necessary the pipe lines shall be equipped with expansion joints or to be laid in expansion bends.

Systems to be provided with possibilities for drain or airing as required.

Pipes to be delivered with certificates to the extent that is required by the Classification Societies.

All pipes ND 50 and above to be flanged, except for tank vent pipes and drain pipes where welded connections may be applied.

Use of flexible couplings to be kept to a minimum.

Overboard valves to be of nodular cast iron.

Butterfly valves to be used wherever practical

6.1 Bilge System/Ballast System

All bilge and ballast pipes to be laid of galvanised steel pipes. Pipes to be flanged or connected with Viking Johnsen couplings or similar approved by the Classification Society.

Bilge from engine room, chain lockers, bow thrusters room, to have connection to the valve chests.

Bilge wells to have level alarms according to Class requirements.

1 no Bilge/fire pump suitable capacity to be provided,

1 no Bilge pump of suitable capacity to be provided

Emergency bilging of engine room to be arranged by means of one of the sea cooling water pumps for main engine.

Bilge level alarms to be provided in the engine room and other suitable locations with Alarm repeater in the wheel house.

6.2 Fire / Deck washing system

A necessary number of fire posts to be arranged in engine room, accommodation and on deck. One of the fire pumps are combined bilge/fire pump

One no general service pump to be provided, serving both fire/deck washing system and foam system

One emergency fire pump of reciprocating type, electric driven of suitable capacity meeting SOLAS requirements to be installed.

6.3 Air and sounding system

Manual tank sounding arrangement to be provided as per rule requirements in addition to remote indication of tank levels with a continual indication from 0-100 % tank levels.

6.4 Environmental Protection Equipment

(a) Anti pollution Dispersant System

One no Hull integrated dispersant tank of capacity . 10 m³ , one no common pump and one spray boom on each side of the vessel to be arranged. Storage racks to arranged for booms when not in use. System to allow for use of neat and dilute dispersant (Two sets of nozzles)

(b) Save Alls / Deck Drainage system:

Vessel to be provided with save alls / coamings from deck areas which are exposed to oil spill.

Following areas to be covered as a minimum:

- Cargo loading / discharge stations
- Ventilation heads for oil tanks
- Dedicated areas for washing operations on deck

Save-all / coamings are to be provided with a draining system leading to a below decks drainage tank of adequate capacity.

Transfer from tank via bilge pump to bilge tank then via Oily Water Separator

One dedicated SOPEP lockers to be provided with items as per SOPEP plan

CHAPTER-7

MACHINERY

7.0 GENERAL

All machinery to be first class marine type with all normal outfitting and accessories.

Machinery in this group to fulfill Class rules and ISO 3046/1 for capacity or effect under the following ambient reference conditions:

- ◆ Total barometric pressure 1 bar
- ◆ Ambient outside air temperature -15 to 45 °C
- ◆ Relative humidity of air 60 %
- ◆ Sea water temperature 32 °C

Components and systems in this group covered by the Classification to be designed to operate under the following environmental conditions according to Class rules but with reduced power in conditions with air temperature over 45 °C:

- ◆ Air temperature in the machinery space between 0°C and 55 °C.
- ◆ Relative humidity of air in the machinery space up to 96%.
- ◆ Sea water temperature up to 32 °C.
- ◆ List rolling, trim and pitch according to limits for the Classification notes.

Main Engines and deck machinery, epoxy resin chocks to be used for chocking. Medium components such as pumps etc. to be mounted directly to foundation.

Diesel generator sets, air compressors to be resiliently mounted.

7.1 MAIN PROPULSION

Two(2) nos. unidirectional medium speed four stroke marine diesels Engines each developing sufficient power to be provided to meet specification requirement of speed.

Standby pumps are to be provided in accordance with Rules and Regulations.

The output of the engine shall refer to the following conditions

Total barometric pressure	:1000 mbar
Engine air temperature	: 45 deg c
Relative humidity	: 60 %
Sea water temperature	: 32 deg c

The power and fuel consumption of engine shall be determined in accordance with standard reference condition specified in ISO 3046/1-1995(E)

The engines shall have standard equipment and accessories as per maker's standard and class requirements.

The engine to be equipped with electronic remote control from bridge, and instruments according to engine manufacturers standard and class requirements.

All attached pumps should have electric motor driven standby units having same capacity.

7.2 GEARBOX

Each main engines to drive each propeller through a marine reduction gear. Gear ratio is to match the engines for appropriate propeller rpm. Reduction gear type single input and single output.

Power take -off for shaft generator to be arranged on each of the reduction gear so that shaft generator can be operated while running any one engine .The reduction gears to be equipped with built-in hydraulic clutch and thrust bearing and PTO for shaft generator.

Flexible couplings shall be provided between main engine-reduction gear, Reduction gearbox-shaft generator and main engine and Fi-Fi gear box.

7.3 SHAFTING

Each of the hollow -bored propeller shaft made of forged steel to be sized to as per Classification Society requirements. Rotation of propellers will be arranged with due consideration of specified performance of the vessel. Propeller shaft withdrawal arrangement shall be submitted. Necessary lifting pad eyes shall be fitted. Supply by Maker's propulsion package complete with all necessary interfacing. The shaft to be equipped with simple locking device to avoid wind-milling during repairs.

7.4 REMOTE CONTROL

The vessel to have a electronic-hydraulic remote system for main engines and C.P propellers. The system shall be arranged as two (2) electrically independent plants, one port and one starboard.

7.5 GENERATORS – MAIN

Two (2) nos. Shaft Generator and Three (3) nos. Diesel engine driven Generators, heat exchanger cooled, 440 V, 3 Phase, 50/60 Hz, 0.8 p.f.

Basic Design Characteristics:-

- Heat exchanger cooled
- Air start
- 4 stroke
- Engine mounted L.O, fresh water, fuel oil and
- Engine mounted L.O. and fresh water coolers

- Remote start for Engine Control Room
- Resilient mounting
- Brushless type
- Insulation Class F with temperature rise “B”

The capacity of the generators is to be determined by a detailed Electric Load Analysis approved by Buyer.

Shaft generators to be fresh water cooled in from main engines FW LT circuit with double tube coolers.

The shaft generator to be equipped with:

- Anti condensation heaters
- Excitation equipment (AVR), complete with over voltage protection according to class requirements.
- Winding temperature sensors
- Bearings temperature sensors
- Cooler leakage detector
- Transformers for differential protection, both for switchboard and generator.

Sleeve bearings to be arranged with complete built on lub oil system for each of the shaft generators. Shaft generator to be supplied with hatch for emergency cooling.

7.6 EMERGENCY GENERATOR

One (1) emergency diesel generator sets, radiator or air cooled, 440 V, 3 Phase, 50/60 Hz, 0.8 p.f . Two means of starting the engine to be provided. The engine to be radiator-cooled. The diesel engine shall have built-on still stand heater, the generator shall have built-on anti condensation heater..

7.7 TUNNEL THRUSTER UNITS

Two (2) astern tunnel thruster and two (2) bow thrusters each of suitable capacity, electric motor driven CPP units of approved make and type with all necessary controls and interlocks. Control of thrusters shall be from two positions in wheelhouse.

7.8 ENGINE COOLING SYSTEM

Each engine shall have built in fresh water pump and independent fresh water system. One no standby fresh water pump for each engine shall be provided. Fresh water pipes shall be galvanized steel.

7.9 STERN TUBES

Two (2) fabricated mild steel stern tubes are to be supplied and fitted, secured at the bulkhead and at the "A" frame boss. Each is to be fitted with a cast iron white metal lined bushes, and arranged for oil lubrication. The stern tubes are to be fitted with seals, all in accordance with Propeller manufacturer's standards.

Two (2) stern tube oil tanks are to be fitted and arranged, one to feed each tube by gravity. The tanks are to have air release arrangements, an oil level gauge, and low level alarm to be provided.

7.10 PROPELLERS

Two (2) four bladed controllable pitch propellers of suitable diameter to be supplied, one RH and one LH. Propeller material to be of approved nickel aluminum bronze and are to be manufactured to ISO/TC 8 Class I standard and statically balanced. Each propeller plant to be mounted in a fixed nozzle of mild steel material.

7.11 ENGINE EXHAUSTS

Exhaust pipes from Main engines and Auxiliary engine shall be arranged with spark arresters and silencers giving minimum 35 Db (A) attenuation. Exhaust pipes and silencers shall be resiliently suspended.

7.12 STAND BY PUMPS

Stand-by pumps for Main engines and Auxiliary diesel engines to be provided in accordance with Classification Society requirements.

7.13 COOLING WATER PREHEATER

One (1) electric cooling water FW pre-heater to be provided for the Main engines in accordance with Maker's recommendations.

7.14 HOT WATER BOILER

One (1) no electric powered water heater to be provided. The heater will supply water for the accommodation and other domestic use.

Boiler to be equipped with el. heating element ,capacity 20 kW With all safety cut outs. Capacity of tank to be approx 650 litre

7.15 FRESH WATER GENERATOR

The vessel to have a fresh water generator capable to making 15 tons per day on reverse osmosis principle. Control and regulators shall be arranged according to main engine manufacturer's recommendations. The fresh water generators shall be arranged for delivery to the fresh water tanks, via dolomite filter / water softener etc. The product shall be potable water. One (1) U.V Sterilizer of suitable capacity to be installed.

7.16 BALLAST WATER TREATMENT PLANT

A ballast water treatment system of IMO/USCG approved type in compliance to statutory requirement shall be installed in the vessel.

7.17 Engine Room Piping.

Sea Water Cooling System:

Pipes to be of SCH 80 , ND40 and above flanged or fitted with "Straub Grip" couplings. Pipes below ND40 to be fitted with bronze compression ring fittings. Valves to be cast iron with non ferrous internal and spindles. Butterfly valves to be

used to the greatest possible extent. Valves below ND40 to be of gun metal. Valves fitted on ship side to be of nodular cast iron. Chemical dosing system for sea water system to be arranged. Pumps for seawater to have housing and impeller of NiAl Bronze and shaft of stainless steel. The electric driven pumps to be equipped with frequency converter for variable speed, max. 1800 rpm, where nothing else is specified. Backflush arrangement to be included.

Fresh Water Cooling System

Pipes general to be seamless steel with mild steel flanges welded on, or coupling type. Piping below ND40 to be fitted with compression ring fittings. Valves general to be cast iron with non ferrous internal and spindles. Valves below ND40 to be of gun metal. The cooling fresh water temperature at cooler outlet side shall be automatically controlled by temperature control valve

Butterfly valves to be used to the greatest possible extent.

Lub. Oil System

Pipes general to be seamless steel with mild flanges welded on. Pipes below ND40 to be precision steel tubes with compression ring fittings. Valves general of cast iron with internal and spindles of non ferrous material. Valves below ND40 to be of gun metal

Fuel oil system:

Main engines fuel oil system to be divided into two independent systems and to have fuel supply from either of the service tanks.

Velocity in FO pipes shall generally not exceed 1.5 m/s.

A complete FO overflow system with dedicated overflow tank to be provided.

Two (2) Day Tank and Two (2) Settling Tank in Engine Room (Automatic Start/Stop for filling of settling tank)

One (1) Fuel oil drain tank

One (1) no FO separator, self cleaning type, Automatic with capacity according to engine make.

Two (2) nos fuel oil transfer pump of adequate capacity.

One (1) no FO service tank for emergency generator

One (1) FO Transfer Pump, remote operated, w/ filling line to Day Tank for Emergency generator and for filling of rescue boats.

Remote quick closing arrangements for fuel valves, emergency shut down for fuel pumps, etc. shall be provided as required by SOLAS regulations.

Mass Flow meters to be provided at inlet and outlet for ME and MEs & MDGs

Lub. Oil System:

One (1) nos Lub oil transfer pump to be installed.

Cap.: approx. 3 m³/h - 2 bar, el. motor.

One (1) hydraulic oil transfer pump to be provided

One (1) no lub. oil separator, self cleaning automatic to be installed.

The separator to be of automatic self cleaning type with electric heater and separate electric driven supply pump.

Capacity to be according to main engine manufacturer's recommendations.
Automatic change over between engines to be arranged.
Separators also to be arranged for separation of stern tubes oil systems and hydraulic oil systems.

Stern tube and stern tube tank

For the stern tube a pressurized level tank to be arranged to provide a static pressure for the Stern tube.

The tanks to be located above the deep loading waterline and to be prepared for an air pressure of 0,2-0,3 bar.

Drain from the stern tubes to be arranged.

One no 400 lt storage tank for stern tubes to be arranged in cement tank room.

Cooling system

2 nos sea inlets (one low suction and one high sea suction)

2 no Sea chests to be provided for F-Fi system

1 no sea inlet in aft ship

SW cooling system with common SW backup pumps

Independent FW cooling system for main engines and propeller plant at each side.

Centralized fresh water cooling system to be applied on board for various equipments.

Heat exchangers for Freshwater to Seawater to be of plate type, with plates of titanium
25 % fouling factor to be included in calculations. The coolers to be arranged with in-line filters and with back flushing arrangements..

FW cooling system for miscellaneous equipment (Aux engines, Aux air conditioning plant, Refrigeration compressors, Hydraulic power pack for spooling device, Bow thrusters electric motors, shaft generators, BHS compressors oil coolers)

Bilge Water Separator

One (1) no bilge water separator to be provided. Capacity : 1.0 m³/h.

The installation shall meet the MEPC resolution 107 (49) requirements.

Sludge System

One (1) no sludge pump with capacity max. 2.5 m³/h - 1-speed to be provided. Sludge pump to have discharge to IMO standard flange on deck. One no sludge tank to be arranged in double bottom in engine room.

The sludge pump also to serve as stripping pump for fuel oil tanks. The pipe system to be arranged for fuel oil sample and chemical dosing.

Ballast water treatment Plant

Air Pressure System:

Starting air system and maneuvering system

Pipe lines to be of steel precision tubing.

Two (2) nos air cooled starting air compressors each with a suitable capacity at 30 bar to be installed.

Two (2) nos air bottles for air pressure of 30 bar and a capacity as per Class requirements to be installed.

Air pressure of 30 bar to be applied as starting air for the main engines and the aux engines.

Working air system in engine room etc.

One no Working air / instrument air compressor, screw type, to be installed.
Suitable Capacity: 7 bar.

One no Working air bottle. of suitable Capacity:
Working air to be back-up supplied from starting air system by means of reduction valve 30 - 7 bar.

Three (3) outlets for working air to be arranged in the engine room. In addition 1 outlet in workshop and 1 in cement room.

Working air system for deck etc.

A total number of Five (5) outlets for working air to be arranged.

Instrument / Control air

One (1) no air dryer of suitable capacity (cooling medium Freon R-404 A) for sounding system and for instrument air (control air) system .

7.18 Exhaust pipe and silencers

Exhaust pipes to be made of welded steel pipes and bends, and to be equipped with expansion compensators where necessary.

In exhaust pipe from main engines and auxiliary engine to be arranged spark arrestors and silencers with minimum 35 Db (A) attenuation. The exhaust pipes and the silencers to be resiliently suspended. The exhaust pipes to be insulated with mineral wool. Drain from exhaust pipes to be arranged.

7.19 Lifting Facilities In Engine Room

Trolley beams with SWL of 2 tons, for removal of pistons/liners to be arranged above Main engines, fitted with trolley and chain hoist of adequate size. Sufficient trolley beams for spare parts transport to be arranged.

Lifting lugs suitable for use of chain blocks are to be fitted above main equipment and pumps

7.19 Sewage Discharge System

Discharge system to be gravity type, shall be installed for sewage and washing water.

1 no USCG type II Sewage treatment plant Aeration type for 60 persons to be provided. The Sewage plant should meet the requirement of MARPOL 73/78 Annex IV, Regulation of pollution by sewage and shall be fitted with standard discharge Connection. The Sewage plant to be as per MEPC resolution 227(64)

1 no sewage tank as hull tank

1 no Sewage transfer pump

Sewage discharge pump to be arranged for discharge to deck PS and SB with IMO flange and overboard below water line.

Grey water from washstands and scuppers to discharge to sewage tank or directly overboard.

CHAPTER -8
AUTOMATION SYSTEM

8.0 General:

The automation to be as per the Class notation (equivalent to DNV-E0). The following automation is for guidance only and specifies minimum requirements.

8.1 Maneuver Desks, Main Console, Instruments

All consoles to be made of steel plates. The equipment shall generally be mounted on the top of the console. The consoles to have detachable covers in the front or where practicable according to arrangement.

- a) Engine room console to be installed in engine control room. The following equipment to be installed in the console:

- 1 Remote control panel for C.P. propellers and main engines.
- 1 Pitch indicator for each C.P. propeller
- 1 RPM meter for each C.P. propeller
- 1 RPM meter for each main engine
- 1 Hour counter for each main engine
- Push buttons for start of main engines
- Push buttons for stop of main engines

A necessary number of indicating lamps for main engines.

All other necessary equipment for controlling the main engines, according to the main engine manufacturer's specification.

Push buttons for starting and stopping of main engine's aux.- and stand by pumps.

Switch for selecting man./auto for stand by pumps.

Indicating lamps for main engine's aux.- and stand by pumps running.

Push buttons for starting and stopping engine room ventilation fans.

Indicating lamps for ventilation fans running.

Push buttons for remote start/stop of pumps for capstans and tugger winches.

Push buttons for remote start/stop of fire pumps.

1 amplified telephone

1 alarm plant (E0) for main engines, propeller plant and other equipment.

1 synchronizing panel with mimic for MSB.

b) Bridge consoles.

Two consoles forward bridge and three consoles aft bridge to be installed.

- i) Bridge console forward port shall include the following equipment:
An adequate number of switches for external lights, searchlights, compass light etc.

2 Engine room telegraphs
1 Morse light switch
1 Fire alarm central including life boat (general) alarm
1 Push button for fire alarm
1 Push button for life boat alarm
1 Remote control panel for bow thrusters
1 Remote control panel for stern thruster
1 Push button for maneuver light
Window wiper control panel(s)
Emergency stop push buttons with cover, for emergency stop as described under group 88.
1 Group alarm panel connected to eng. alarm (E0) plant
1 Push button for remote start/stop of hydr. pump for windlass and winches and capstans on the forecastle deck

- ii) Bridge console forward starboard shall include the following equipment:

1 Auto pilot with gyro repeater and off-course alarm
1 Steering gear control panel w/rudder indicators
1 Steering gear alarm panel
1 Intercom. telephone
1 Amplified telephone

Remote control panel for main engines and C.P. propellers.

1 Emergency stop for each main engine
1 Ind. lamp overload for each main engine
1 Pitch indicator for each C.P. propeller
1 RPM meter for each main engine
1 RPM meter for each main C.P. propeller
1 VHF radio set
Window wiper control panel(s)
1 Typhoon controller
1 Digital log repeater

- (iii) Bridge console stern port shall include the following equipment:

An adequate number of switches for external lights.
Remote control panel for main engines and C.P. propellers

- 1 Pitch indicator for each C.P. propeller
- 1 RPM-meter for each main engine
- 1 RPM-meter for each main C.P. propeller
- 1 Emergency stop for each main engine
- Steering gear control panel, rudder indicators in separate cabinet.
- Remote start/stop with indication light for all cargo pumps
- Push-button for emergency closing of cement discharge valves.

iv) Bridge console stern centre:

- 1 Push button for typhoon
- 1 Intercom. telephone
- 1 Amplified telephone
- Remote control panel for bow thrusters
- Remote control panel for stern thruster
- 1 VHF radio set
- Window wiper control panels

v) Bridge console stern starboard.

- 1 Remote control panel for anchor handling/towing winch
- 1 Remote control panel for towing pins
- 1 Remote control panel for anchor handling tongs

In the bridge consoles shall all maneuvering handles, revolution counters, rudder indicators and pitch indicators and all instruments be illuminated.

All lights in the maneuvering desk exclusive the warning lights to be provided with step less dimming.

8.2 Alarm/monitoring system

The alarm and monitoring plant shall be equivalent to DNV-E0 Class.

The system shall include a Color TFT Monitors (23"), a printers at bridge and engine control room and a watch/responsibility panel as well as alarm panels for cabins and mess.

One (1) no monitoring unit at bridge and Two(2) Monitoring units at engine control room to be installed.

Each unit includes - one (1) off 23" LCD colour monitors, one (1) off PC with keyboard, one (1) off pointing device, one (1) off alarm buzzer and one Suitable (1) UPS

Common for the two ECR workstations; One (1) off alarm printer and one (1) off graphic colour printer. All installed in a separate console .

Datalogger to be provided with provision for remote access.

The system shall have reset for alarm and acoustical and visual signal for each alarm which comes into function simultaneously with the alarm. There shall be common rotating/flash lights and sirens in the engine rooms. The acoustic signal shall have a loudness that can be heard in the engine room when the machinery is in service.

The alarms will be divided into several groups based on their importance and which machinery they come from. When alarm is given the group will be indicated on the alarm panel in the bridge console.

The monitor in the engine control room can display the alarms individually.

For display on the monitor, the different alarm items shall be arranged in picture(s) for the different machinery systems.

The alarm plant shall include both analogous and binary (on/off) alarms. Relevant items on the main machinery shall have analogous sensors.

Main Engine Safety System

A safety system for protection and control of each of the main engines shall be provided. The safety system shall control and protect the main engines in order to prevent faulty operation and/or major failure. The system shall automatic stop the engine upon critical failure which may lead to breakdown of the engines, such as too low lube oil pressure, over speed, in addition to any further requirements according to the Class.

The safety panel cabinet shall be located in the engine room.

Aux. Engine Safety System

A safety system for protection and control of the aux. engine shall be provided. The safety system shall be similar to the safety system for the main engine.

The safety system for the aux. engine may include alarm and monitoring of the engine as well. If so, the alarm shall be clearly indicated on the safety system panel / cabinet. In addition a common alarm for the aux. engine shall be given to the central alarm plant.

Alarm repeaters to be also provided in the wheel house.

The safety panel / cabinet shall be located in the engine control room.

Steering Gear Alarm System

A separate alarm system for each steering gear to be provided according to requirements. Common alarm to be given to the central alarm plant.

8.3 Remote control of main engines and C.P. propellers

The vessel shall have electronic hydraulic remote control system for main engines and C.P. propellers.

There will be 2 electrically totally independent plants, one port and one starboard. A failure in the port plant will not put the starboard plant out of operation and vice versa.

Each plant to have two galvanic isolated power supplies.

The alarms will be divided into several groups based on their importance and which machinery they come from. When alarm is given the group will be indicated on the alarm panel in the bridge console.

The monitor in the engine control room can display the alarms individually.

For display on the monitor, the different alarm items shall be arranged in picture(s) for the different machinery systems.

The alarm plant shall include both analogous and binary (on/off) alarms. Relevant items on the main machinery shall have analogous sensors.

The alarms will be divided into several groups based on their importance and which machinery they come from. When alarm is given the group will be indicated on the alarm panel in the bridge console.

The monitor in the engine control room can display the alarms individually.

For display on the monitor, the different alarm items shall be arranged in picture(s) for the different machinery systems.

The alarm plant shall include both analogous and binary (on/off) alarms. Relevant items on the main machinery shall have analogous sensors.

Each plant - port and starboard - consists of the following main components:

- 1 Main bridge panel, mounted in aft bridge console
- 1 Slave bridge panel, mounted in forward bridge console
- 1 Engine room panel, mounted in engine control room console
- 1 Electronic rack, containing all electronic components. Mounted in engine control room console.
- 1 Hydraulic (servo) unit, mounted on each gear, including servo valves of analogous/pulse type, feed-back pot. Meters, alarm sensors for the machinery alarm plant etc., also including charge air pressure.

OPERATION:

Combinator:

When combinator operation is used, the main engines RPM and the pitch will be increased/decreased accordingly - depending on the given order.

By using the lever on the wheelhouse panel, or any other panel in command, an electronic signal will be given to the main engines governors and the analogous/pulse servo valve for pitch control.

Constant (fixed) RPM:

In modes of operation using shaft generator(s), fixed RPM on the corresponding main engines are required. By using the push-button for fixed RPM on the engine room panel, the main engines will automatically be running at the pre-set RPM.

In this condition, the control lever on the maneuver panel in command will control only the pitch. The pitch control will be as for combinator operation. The only difference will be that the RPM are now fixed.

Failure:

If the electronics discover a system failure, the plant will automatically be switched over to emergency control. The system failure ind. lamp on the wheelhouse panels will be lighted together with the ind. lamp for emergency control. In addition, a signal will be given to the vessel's engine alarm plant. Now, the pitch can be controlled by using the emergency control push buttons on the wheelhouse panel in command.

Apart from the servo valve, the emergency control is independent of the normal control, and have 24V DC power supply.

Emergency Machinery Telegraph:

If a serious emergency situation should set even the emergency control out of operation, the pitch can be manually controlled. The order from the wheelhouse will then be given by using the emergency machinery telegraph, and the pitch will be manually controlled by operating a lever on the gear box.

The emergency machinery telegraphs - one port and one starboard - are independent of the vessel's ordinary remote control system. They shall be connected to 24V DC battery. There shall be one unit for each side in the forward bridge console, (the transmitter), one unit at each gear, (the receiver) and one slave (indication) unit at each main engine.

The receiver shall have acknowledgement push-button. The orders, given by operating a switch or push-buttons in the wheelhouse transmitter, shall be visually shown on the receiver by means of clearly marked indication lamps. An audible signal shall be given when a new command is transmitted.

The orders shall be:

- Ahead full
- Ahead half
- Ahead slow
- Stop
- Astern slow
- Astern half
- Astern full

Automatic Overload Protection Of Main Engines:

To prevent overload, the main engines are protected by means of signal from a fuel filling feed back transmitter and RPM signal. The propeller's electronic control system compares the 2 values, and if the fuel filling exceeds the corresponding value of the RPM signal, the pitch will be reduced accordingly.

The size of the reduction, and the speed of it, will depend on the difference between the 2 measured values. A heavy overload will lead to a fast and large pitch reduction. Then the pitch will be stabilized on a value where the engines are not overloaded.

When using shaft generator, the corresponding main propeller's pitch will be reduced analogous to the shaft generator's load on the main engine, by means of the automatic overload protection system.

When supplying side thrusters etc. from the shaft generators which prime mover is also driving the main propeller, a fixed pitch reduction will be introduced on the corresponding main propeller. This pitch reduction will be in steps (adj.) according to corresponding shaft generator's load. If higher load, the automatic overload system will come into function for a further pitch reduction.

8.4 Remote control system.

One (1) wheel house control panel for control of the following:

- a) Speed control- hoist /lowering for the towing / anchor handling winch
- b) Brake control- On / off for the two drums on towing /anchor handling winch
- c) Tension control for towing /anchor handling winch
- d) Indication lamps for brakes on /off
- e) Clutch control for towing and anchor handling winch
- f) Indication lights for clutch on/off
- g) Emergency release
- h) Instrument reading for system oil pressure, oil temperature
- i) Start /stop of main pumps with running lights
- j) Start /stop of servo pumps with running lights
- k) Grease lubrication system
- l) Long time towing indication
- m) Alarm for high oil temperature in main system, high speed of hyd motor, low pressure and level of expansion system, low pressure in brake cylinders, and low level/temperature alarm on servo units.
- n) Towcon unit for read out of wire length, dynamic and static tension and rpm on both drums.

CHAPTER-9

ELECTRICALS / NAVIGATION / COMMUNICATION

9.0 GENERAL

The electrical installation is to be in accordance with latest IEC standards, the Classification and relevant Authority requirements for unmanned machinery spaces and shall be suitable for tropical conditions.

All electrical equipment shall be constructed of durable flame retarding, non-hygroscopic materials which shall not be subject to deterioration in the atmosphere and at the temperature to which it is likely to be exposed.

All conductors, switchgear and accessories shall be of such size as to be capable of carrying the maximum current which can normally flow through them without their respective ratings being exceeded.

Insulating materials and insulated windings shall be resistant to moisture, sea air and oil vapor in tropical conditions. The design of all equipment shall provide for accessibility to parts requiring inspection.

Enclosing cases for electrical equipment, junction boxes etc. to be of adequate mechanical strength and rigidity to protect the contents and to prevent distortion under all likely conditions of service.

Electrical power will in general be supplied from shaft generators driven from PTO located at the main reduction gearboxes, and the switchboard main bus shall have split breaker between Port/ Starboard side, providing redundancy in power supply and distribution.

SYSTEM OF SUPPLY

- 440/415 Volts, 3 Phase, 60/50 Hz for power.
- 220 Volts, 1 Phase, 60/50 Hz - for general lighting and power less than 3 KW.
- 24V D.C - for alarms, controls, radio and navigation aids and navigation lights.
- 440/220V, 3 Phase, 60/50 Hz emergency generator for emergency lighting, communication, alarms and steering gear system.

9.1 POWER SUPPLY

Normal Supply:-

The A.C main power supply system is to be obtained from 2 nos. suitable capacity Shaft Generators and 3 nos. suitable capacity diesel engine driven generators and three wire alternators. Alternator to be brushless type with Class F insulation.

The following operation of the generators is envisaged:

Normal Steaming	:	One (1) shaft alternator
Maneuvering	:	Two (2) shaft alternators

Two (2) diesel generators can be run in parallel with shaft alternator depending on the electrical load requirement. One Diesel generator to be standby
Electrical load analysis is to be submitted for revision and approval by owners.
Short circuit calculation will be provided.

A power management system suitable for DPS-class 2 is to be provided

Two feeders 750 KW each (P&S) extending to upper deck from MSB shaft generator section

Emergency Supply:-

For emergency duties the power supply shall be obtained from suitable capacity, 440/415 V/ 3 Ph / 60/50 Hz alternator arranged for independent battery starting in **the event** the main power supply fails. Two starting battery systems with their own chargers for emergency generator to be placed close to the engine. Alternate starting methods to be also provided.

Shore Supply:-

440v/415v/ T.P 415/3/50hz/60hz wire watertight shore supply complete with connection box, phase sequence indicator, circuit breaker and connected to the main switchboard. The shore breaker shall be interlocked with generator breakers.

24V D.C Supply:-

The 24V D.C main supply is to be obtained from two (2) banks suitable capacity main batteries via the main battery charger. Batteries are to be of suitable capacity to cater for 24V DC load and transient light for 30 minutes.

A 24V D.C supply for the radio equipment is to be obtained from Two (2) banks of suitable capacity batteries via the radio battery charging panel, powered by one (1) suitable capacity battery charger, automatically regulated to be provided. Standby charges are to be provided for radio battery.

To provide one set of step down transformer to have 24 V D.C supply from 220 V A.C as an alternate source of supply

9.2 MAIN AND AUXILIARY ENGINE INSTRUMENTATION AND ALARM

To be in accordance with Classification Society requirements.

All the engines and low level alarm should be provided with a panel in the Engine Room and in the Engine Control Room with visual and audio indicator.

9.3 NAVIGATION AND SEARCH EQUIPMENT

The following equipment to be installed.

- 1 no S-band (10 cm) 12' LCD display of suitable power output, antenna according to manufacturers standard
- 1 no X-band (3 cm) ARPA radar with LCD display, 10 kW transmitter, antenna according to manufacturers' standard. Radar inter-switch to be provided.
- 2 nos DGPS navigator to be installed.
- 1 no Helicopter frequency Homer
- 1 no Aero VHF
- 1 no Gyro compass system with repeaters and Recorder
- 1 no Autopilot system complete consisting of:
 - 2 no Magnetic compass (transmitting type)with 8-10" compass card and spare one will be as a spare
 - 1 no Echo sounder recorder with depth indicator and alarm.
 - 1 no Doppler speed log.
 - 1 no Weather fax Receiver
 - 1 No AIS
 - 1 No LRIT System
 - 2 nos ECDIS

Miscellaneous Nautical Equipment

The following equipment to be delivered according to regulations in force:

- 1 no Aneroid barometer
- 1 no Drum sextant
- 2 nos Binoculars 7 x 50 with case and binocular box
- 1 no Night vision binoculars, type ITT
- 6 nos 6" chromed 6 days ship clocks
- 1 no Chronometer
- 1 no Radio clock
- 1 no Parallel ruler
- 2 nos Thermometers
- 2 nos Torches with spare battery and bulb
- 1 no Black signal beacon
- 1 nos Electric wind indicator (anemometer), force and direction
- 2 nos Anchor signal balls

Approved certificates to be delivered.

9.4 Radar, signal observation and antenna masts

Fore mast

The mast to be constructed from mild steel tube, and have necessary brackets for light signals.

Main signal mast

Main signal mast to be located on wheelhouse top.

Wheelhouse top to be sufficient reinforced with extra girders below the mast.

The mast to be equipped with foundation for radars, VHF-antennas, flag staff etc.

The mast also to be equipped with brackets for light and sound signals.

Ladder and steps to be provided for access to all equipment fitted on mast.

Stern mast

A short portable pole mast to be arranged at stern to carry the anchor lights.

9.5 COMMUNICATION EQUIPMENT

Radio installation according to GMDSS-A1, A2 & A3 to be provided.
One back up communication terminal to be provided
Spare parts and tools according to National requirements.

Radio Plant

- 2 nos DSC VHF sets 25 Watts.
- 1 no. DSC watch receiver with printer
- 1 no MF/HF DSC transceiver 250W with NBDP facility and DSC watch receiver
- 1 no dual frequency type Navtex receiver
- 1 no Additional VHF set without DSC

Life Boat Equipment.

- 2 nos EPIRB float free type to be fitted at an adequate place.
- 2 nos Radar transponder for life raft/boat (9 GHZ)
- 3 nos Portable waterproof VHF radios.

9.6 Telephone System

Intercom. Telephone System (Auto Telephone System)

Auto telephone system shall be provide with 28 telephones. The locations shall be decided during drawing approval stage.

The power supply shall be from 220 V / 24 V DC. The intercom telephone system shall be combined loud and low speaking and have the following features:

- 4 Simultaneous calls.
- Priority for essential station (s).
- Override for essential station (s).
- PA functions divided in several groups.

Telephones in Engine rooms, pump room and steering gear room shall be equipped with earphones and optical call signals.

One (1) PA / talkback system with 6 microphones shall be provided. The system shall be as per relevant rules & regulations.

Sound Powered Telephone System 12 lines to be provided at required locations

24V DC power supply.

Intercom, telephone and sound powered amplified telephone in engine control room shall have common visual and audible signal in the engine room. Rotating or electronic siren shall have different sound from the other sirens. Visual signal shall be common with the engine alarm plants visual signal in the engine room.

9.7 Light and Signal Equipment

Typhoon

One air driven typhoon with electrical operated valves for main and emergency to be installed in radar mast. Automatic signaling device with selector switch (fog signal) to be installed in wheelhouse console forward.

Manual control from wheelhouse console forward and aft.

Air pipes, of stainless steel seamless precision tubing with normal fittings, to be laid easy accessible without risk of water pockets and protected to frost.

The whistle to have built-in heating element and air pipes to be insulated where necessary.

Ships Bell

One 10" ship bell of chromed brass with the ships name and building year engraved, to be suspended in a gallow according to agreement with the Owners.

Flags

Flag rack/locker to be installed in the wheelhouse.

Ship's Navigation Lights

Main and spare electrical lights shall be provided for the masthead, side, stern and anchor lights. Lights shall have dioptric lenses and shall be type approved.

Position of lights to meet the COLREG 1972 requirements.

Screening to prevent light reflecting into the wheelhouse top, bridge wings and fore part of the upper deck shall be provided.

Day signaling lamp

Daylight signaling equipment comprising a portable hand signaling lamp, 220/12 volts transformer, two socket outlets, a portable battery and a portable battery charger. The supply for the transformer shall be taken from the 220 volts emergency system.

9.8 INMARSAT

Two sets of standard C satellite communication terminal with EGC function and integrated with GPS function to be provided and comprises:

Telex with CRT, key board and printer in wheel house.

1 Antenna in RADAR mast

1-Spare paper rolls for printer.

One set of Fleet Broadband satellite communication equipment complete with all accessories to be provided.

The equipment to have Email, Telefax, Telephones (3 mini M quality, 1 ISDN video) & High speed data transmission facility and it is to be interfaced with shipboard computer for ship/shore data communication etc.

8.9 Ship Security Alert System

One (1) set of independent ship security alert system with web based map viewing feature shall be provided .

Two (2) sets of alert button shall be provided, each one under the radio table and other in the locations which will be decided later.

8.10 Integrated electronic control system JOYSTICK/DP system

Joystick system:

The vessel will be equipped with a Joystick system. This system integrates all the maneuvering controls in one lever - the joystick lever, and controls the C.P. propellers, the side thrusters and the rudders.

The system consists of the following main components:

- * Portable control panel
- * Microcomputer in separate cabinet
- * Two plug boxes for connection (forward and aft).

Brackets for support of portable control panel to be arranged in the following locations in the Wheelhouse:

- * Aft between consoles
- * Forward console
- * In each built-in bridge wing

The system is self diagnosing and activates alarms if faults occur.

In case of a system failure, the control is automatic switched over to normal bridge control. The control will be switched over to the panel in command from where it was switched over to Joystick system.

Control panel(s) to contain following functions:

- * Joystick for vessel positioning and heading control.
- * Course indicator showing actual heading and heading order.
- * Pushbuttons for selection of centre of rotation.
- * Selection between bow, centre or stern.
- * Pushbuttons for "Auto Pilot" mode
- * Alarm indication w/reset for:
 - * Computer failure
 - * Panel (console) failure
 - * Off-course

Dynamic Positioning System:

A DP-System, making the vessel comply with the DNV notation DYNPOS AUTR or equivalent.

The system to consists of
Two (2) DP operating stations
Two (2) no DGPS
Three (3) Gyro compass
One (1) no Laser reference system
Two (2) nos wind sensors
Three (3) no vertical reference unit
2-no UPS for DP system 30 Minutes
2-no Printer

8.12 Fire detector system- Fire & general alarm.

One (1) fire alarm plant of approved type shall be mounted in the wheel house with slave in engine control room.

Alarm shall be given by alarm bells, and in engine room by air sirens.

The installation of heat, smoke detectors and manual call points shall be provided according to requirements.

The fire alarm plant shall be equipped with separate battery and battery charger, alternatively built-in to central.

Lifeboat alarm (General alarm) push button shall be mounted in forward bridge console, and shall make all alarm sounders to operate continuously when pressed.

Accommodation vent. fans to be stopped automatically when fire alarm actuates

8.13 Hospital, Refrigerated Room Alarm System

(a) An alarm system shall be provided for the cold room and refrigerated room with alarm bell and indicating lamp in galley and ECR. One (1) each illuminated alarm push button to be installed in cold room and refrigerated room.

(b) One (1) hospital alarm system shall be provided with one alarm push button for each bed and one alarm bell and indicating lamp in wheel house and the passage of forecastle deck.

8.14 Shipboard Computer System

Local area network should be installed for server and Personal computers on board the vessel. Lan cabling should be enhanced Cat 5/ 6 (latest) type. High speed 24 port Switch, Jack panel and Rack to be installed as applicable . Total connection for 24 ports and each port speed 100 /1000 mb.

System to be interfaced with Fleet broadband for transfer of data from Ship to shore and vice versa .

One spark Arrester to be fitted at exhaust pipes
