TECHNICAL SPECIFICATION

FOR

65m ANCHOR HANDLING TUG / MULTI-PURPOSE SUPPLY VESSEL

TABLE OF CONTENTS

1 GENERAL DESCRIPTION

1.1 General intent of Specification

This specification together with the General Arrangement plan describes an anchor handling tug / multi-purpose platform supply vessel, which is designed for satisfying the general demands of the offshore industry.

The vessel is designed for multi-purpose roles and operations in unrestricted waters, which for guidance are as follows:

a) Anchor handling
b) Towing
c) Transport fresh water, drill water, diesel oil, bulk cement, liquid mud, brine, stores, pipes, materials, equipment.
d) Transport men and materials between platforms and shore
e) External fire fighting
f) Oil spill recovery capability

1.2 General Conditions

The vessel is to be delivered to the buyers after having successfully carried out tests and sea trials, showing that she is built entirely to the requirements of this specification, cleaned and painted. Buyers are entitled to have the building and the assembly supervised by their supervisors and representatives who at any time shall have free access to the shipyard and all workshops, for supervisory work and inspection of materials and workmanship.

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 : 50°C (max) in Summer, 0°C (min) in Winter
Relative humidity : 95 % (max)
Sea water temperature : 32°C (max) in Summer, 5°C (min) in Winter

1.3 Arrangement, Description

The ship is arranged as a mono-hull vessel with innovative stern hull in the aftship and raked bow without bulbous in the foreship. The engine room is arranged in the forward ship and all the accommodation is arranged forward.

Accommodation facilities for number of persons described in the spec shall be arranged according to the General Arrangement plan subject to reasonable revisions as necessary to accommodate Owner‟s preference during finalization of plan review.

Further, twin azimuth propellers with nozzle and two side tunnel thrusters forward to be arranged. Main cargo deck to be arranged free from obstructions.

1.4 Main Particulars

Length overall	approx.	65.00	m
Length between p.p.	approx.	57.20	m
Breath moulded	approx.	16.50	m
Depth main deck	approx.	6.80	m
Design draft	approx.	5.00	m
Max. draft	approx.	5.40	m
Deadweight at scantling draft	approx.	2200	MT
Gross tonnage international (1969)	approx.	2400	GT

1.5 Classification & Registry

The Vessel shall be classed under the rules and regulations of **Bureau Veritas** according to the following notations:

BV: I ✠ HULL, ✠ MACH, Unrestricted navigation
Supply vessel, LHNS, oil product / Fire-fighting ship 1, water spraying
Special service, anchor handling, Oil recovery ship,
DYNAPOS AM R

The Port of Registry to be **Singapore** or **Panama**.

1.6 Complement

4 X 1 berth cabin	:	4	men
7 X 2 berth cabin	:	14	men
8 X 4 berth cabin	:	32	men
Total	:	50	men

The complement comprises 16 crew and 34 special personnel.

1.7 Trial Speed, Performances and Bollard Pull

Trial speed	: 13.5 knots @ design draft, 100% MCR.
Economic speed	: 10 - 12 knots.
Endurance	: approx. 7200 nautical miles (on economic speed)
	: 30 days provisions and supplies
Bollard pull	: approx. 90 tons with main engine at 100% MCR

1.8 Tankage – Capacities

Ballast water / Drill water	approx.	531 m^3
Freshwater	approx.	470 m^3
Fuel oil	approx.	578 m^3
Dedicated	approx.	314 m^3
FO cargo	approx.	264 m^3
Mud/Brine/	approx.	800 m^3 (a)
Mud/Brine/	approx.	370 m^3
Mud/Brine//ORO	approx.	440 m^3
Oil recovery capacity	approx.	440 m^3
Mud/Brine//ORO	approx.	440 m^3
Dry bulk tanks – 4 tanks (s.g. 2.5)	approx.	200 m^3
Foam tank	approx.	24 m^3
Dispersant tank	approx.	24 m^3
Cargo deck area	approx.	450 m^2
Deck load		7 t/m^2

Note:

a) The brine tanks and mud tanks to be arranged for carrying of noxious liquids to be according to IMO A 673(16) and IMO MSC 236 (82) for category “P” substances with flame point above 60 °C for Mud and Brine.

1.9 Certificates

The following certificates are to be supplied to the owners at the time of delivery of the vessel:

a) Builder‟s certificate
b) Tonnage Certificate
c) Loadline Certificate
d) Classification Certificates
e) Safety Construction Certificate
f) Safety Equipment Certificate
g) Safety Radio Certificate
h) Deratization Certificate
i) Asbestos Free Certificate issued by the yard
j) Launching Permit (where necessary)
k) MARPOL Certificate
l) Dynamic Position System 2("DPS2") Notation in Class Certificate
m) Bollard Pull Certificate (Certified by CLASS)
n) Other Certificates issued by class necessary

1.10 Rules and regulations

As a base for the contract price, the Vessel as delivered, shall comply with the rules and regulations, including the editions and amendments thereto, being in force at the date of signing the Contract.

The following rules, regulations, standards and guidelines shall be adhered to during the design and construction of the vessel:

1. International Convention on Load Lines, 1966
2. International Convention for the Safety of Life at Sea (SOLAS), 1974 with the Protocol of 1978 and Amendments to date of contract, and latest GMDSS Amendments (herein called “SOLAS”)
3. International Convention for the Prevention of Pollution from Ships, 1973/1978 Consolidated Edition (Annex I, IV and V), 1991, with 1992 Amendments to Annex I (herein called “MARPOL 73/78”)
4. Convention on the International Regulation for Preventing Collisions at Sea, 1972 with the Amendments of 1981, 1987 and 1989
5. International Convention on Tonnage Measurements of ships, 1969
6. IMO resolution A468 (XII) code of noise level on board ships. - for guideline only
7. International Standards Organization (ISO) Draft Proposal No. 6954, “Guide lines for Overall Evaluation of Vibration in Merchant Ships”
8. IEC Publication and Recommendations of the International Electrical Commission. IEC Publication no. 92: Electrical installation in Ship.
9. IMO Resolution A.469(XII) Guidelines for design and construction of Offshore vessels
10. SPS code 2008; Code of Safety for Special Purpose Ships, 2008
11. IMO reg. A673 (16) “Guidelines for the transport and handling of limited amounts of hazardous and noxious liquid substances in bulk in offshore support vessels”.
12. Marine labour convention 2006

1.11 Materials & Workmanship

a) All materials and workmanship are to be of the acceptable quality. All steel plates, sections, hull forging and castings are to meet classification‟s requirements and supplied with test certificates where required by classification.

b) All woods used to be suitable for the intended purpose and of acceptable quality. All timber to be free from nodes and well seasoned.

c) All smith work or fabricated fittings to be of neat design, strong, smooth & free from defects.

d) All castings to be of acceptable quality, close grained and free from all cracks, blow holes and other defects.
Steel castings to be manufactured to classification requirements and approval where required.

e) In case the thickness of steel plates and sections specified in the drawings by the consultant are not available, the Builder is to, with the approval of owner and class, substitute them with thicker plates and sections.

1.12 Welding

Vessel to be of all welded construction, in accordance with contract plans, specifications, classification.

Welding to be in accordance with classification requirements. All steel used to be of good welding quality, free from laminations or other harmful defects and be class approved. Electrodes to be selected from classification approved lists. Welding schedules to meet classification requirement/standard. High standards of up-to-date welding practice and procedures are to be applied, associated with accurate alignment, fairness, edge preparation and gap widths.

Where possible, structure should be pre-fabricated in assemblies and sub-assemblies to give the maximum possible amount of down hand welding.

All welds which are liable to be exposed to sea water including all deck fittings, external ladders and treads, bulwark stays, load line and draft marks etc. are to be of continuous type.

1.13 Inspection / Supervision

Throughout the construction period prior to the delivery, the surveyors, owner‟s representative and consultants are to be given free access to the Builder‟s yard during normal working hours for supervision and inspection. Shipyard to provide permanent cleanliness during construction period.

1.14 Tests

Prior to the delivery, the hull, all machinery, electrical, piping, all equipment installed, machinery and deck fittings, domestic equipment are to be thoroughly tested to class requirement in the presence of the classification‟s attending surveyor, owners and/or their representative. The Builder is to submit a program for dock and sea trials to the Owner and class two weeks before the start of the trials for their approval.

1.15 Inclining Experiment

An inclining experiment which will ascertain the lightship weight and the vertical centre of gravity at lightship condition is to be carried out by the Builder with the presence of classification surveyor. Basing on these results, a final stability report is to be prepared by the consultant.

1.16 Dock Trials

Upon the completion of the vessel, the following trials are to be carried out:

1) All piping systems are to be fully tested, including the checking of valve name plates.
2) Electrical power plants together with all lights
3) Auxiliary machinery
4) Ventilation, refrigeration machinery
5) All deck machinery
6) Air-conditioning machinery
7) All pumps etc.

The sanitary systems are to be in continuous operation during the trials and each tap, water closet, shower, etc. together with all systems for pumping, electrical load, ventilation systems, auxiliary/deck machinery, accommodation system etc shall be tested to full continuous load conditions.

1.17 Sea Trial

Sea trial is to be arranged and carried out in accordance with a program approved by the class/owners. The Builder is to supply a master, crew, all victuals and necessary equipment and arrange the catering. The compass is to be adjusted during sea trial.

a) <u>Speed Trials</u>

Speed trials shall be conducted over a recognised measured mile in deep water. Two (2) double runs are to be made with the engines running at maximum continuous revolutions (100% MCR). Records of main engine operation parameters (temperature and pressure), engine revolutions are to be taken.

b) <u>Endurance Trials</u>

Endurance trials of 4 hours with the engines developing 100% MCR output are to be carried out in conjunction with speed trials according to class requirements.

c) <u>Steering Trials</u>

Steering trials are to be carried out with normal electro-hydraulic with engine at 100% MCR. The diameter of the turning circle and the time taken to complete a full circle are to be recorded.

Manoeuvring trial to be carried out.

d) <u>Stopping & Astern Trials</u>

With the vessel proceeding ahead at full power the main engine, controls are to be moved from `full ahead‟ to `full astern‟ and the following records taken:

1) Time to move controls from 'full ahead' to 'full astern'
2) Time to bring the vessel to stop.
3) Distance run between initiation of order and stopping of vessel.
4) Time to a steady astern condition.

During the astern trial the vessel is to be inspected for occurrence of local vibration.

e) Anchor trials

To be carried out in accordance with Classification Society and Owner‟s requirements.

f) DP trials

DP trials to be carried out in accordance with trial procedures to Classification Society and Owner‟s requirements

g) Bollard Pull Trial

A static bollard pull trial shall be conducted at full power with the vessel securely fastened by a towline to a fixed point ashore according to Class requirements.

The strain gauge to be used for the test shall be properly calibrated to approval before the trial. The trial shall be conducted with the engine output at the service rating. Pulling from the stern shall be carried out and the steady pull shall be maintained according to Class requirements.

Engine output shall be increased in steps of equal increment up to a total of 2 steps of 90%, 100% Maximum output and a steady pull shall be maintained at each step according to Class requirements. The gauge reading and engine rpm, shall be recorded. The fuel rack and governor position shall be noted.

1.18 Delivery

Delivery of the vessel is to be taken afloat adjacent to the builder's yard. All certificates, instructions manuals, approved drawings and any other documents necessary for the operation of the vessel shall be handed over to the Buyer at the time of delivery.

1.19 Drawings, Instruction Manuals etc.

Upon delivery of the vessel, two (2) copies of the following drawings to be provided:

- All main drawings in final revision in files with index (as built drawings to be supplied by the Builder).
- User/Instruction manuals for equipment

In addition, when the main drawings are available as data files, these to be delivered the ship/Owner at CD-ROM in PDF format.

Further to be delivered:

- SOPEP / SMPEP manual (Prepared by Owner, Builder to submit to Class)
- Operation manual (NLS certificate) for carrying of noxious cargo(Prepared by Owner, if necessary)
- Cargo securing manuals (Prepared by Owner Builder to submit to Class)
- Approved stability booklet in hard copy and on CD-ROM

- Procedure & Arrangement manual (Based on copy of owners standard and prepared by Owner)

The Builder to provide the following framed drawings:

- General Arrangement
- Capacity plan
- Tank plan
- Arrangement of manifold in cargo rail
- Safety plan
- Bilge & Ballast plan
- Certificates as required by relevant authorities.

1.20 Ship's Model

One (1) ship model for each vessel to be supplied by builder to the owner upon the delivery of vessel.

1.21 Owner Deliveries

Following to be delivered by the Owner:

1) Galley and Mess utensils
2) Blankets and linen
3) Exercise equipment to the Gymnasium
4) Books and charts
5) Consumables
6) Spare parts and other equipment above Class requirements.
7) Loose welding and cutting equipment for steel with extension welding cables, gas hoses and gas bottles
8) Mooring ropes
9) Hand tools
10) Personal protection equipment.
11) Hardware and software for maintenance system. Yard to fill in relevant info to spreadsheet presented by Owners.

1.22 Trim & Stability

Trim and Stability Data and calibration tables for all tanks are to be provided in a booklet during delivery of the vessel.

Approved trim and stability calculations to be supplied to the Owner in PDF or other suitable format on CD-ROM.

1.23 Noise & Vibration

The Builder is to pay particular attention avoiding undue resonance, and excessive noise and vibration that may arise on the Vessel during normal operation, particularly in accommodation and service spaces. Sound absorbent material to be applied wherever necessary.

Noise level measurements shall be carried out on the sea trials when running ahead steadily at normal continuous rating of the main engine with and without tunnel thrusters in operation for record purpose only.

1.24 Practice

Any modifications or changes by classification or Government Authority after signing of contract will be for the account of the Buyer.

2 HULL PART

2.1 General

The hull including the deckhouse, shall be built from mild steel of shipbuilding quality. The steel shall be according to Specification and furnished with test certificate as required by Classification Society. The scantlings shall be designed to draft and deck load as specified in previous section.

The steel hull and deckhouse are to be of all welded construction. Longitudinal framing system is to be used throughout except certain area may be transverse framing upon builder‟s choice.

2.2 Shell Plating

The shell plate in connection with the propellers to have thickness in excess of the Classification Society requirements, with special attention to the following:

- Vibration
- Deflections
- Stresses

Shell plating in way of propeller area to be increased locally with insert plates.

The shell-plate in way of sea inlets to have locally increased thickness in excess of the Classification Society requirements as follows:

- Rule minimum thickness as required for sea chests plus 2 mm.

2.3 Bottom construction and keel

➢ Double bottom:

Double bottom to be arranged. In order to give a structural continuity in the bottom, two engine girders P&S, together with the centre girder are to be extended as far forward as possible and are to be linked with the longitudinal bulkheads of the tanks.

➢ Keel:

The keel to be formed from a flat steel plate with extension and thickness not less than the Rules of the Classification Society, being properly shaped at ends of the Vessel.

➢ Centre girder:

A centreline girder not less than the Classification Society requirements for height and thickness shall be continuously welded throughout the full length of the Vessel except in way of the thruster units.

2.4 Main deck

Main deck to be made of steel with no sheer or no camber, with strengthening according to Class. Insert plate is to be fitted in way of heavy equipment foundation.

The deck load in cargo area to be 7t/m^2.

Deck plates in Main Deck from transom to approx. frame #12 and abt. 3.6 m from centerline starboard and port to have suitable increased thickness, the deck load to be 10t/m^2.

2.5 Superstructure

All decks to have no sheer and no camber.

The deck heights in the accommodation, measured between steel deck moulded levels shall be as follows:

Main deck to lower forecastle-deck	Approx. 4100 mm
Lower forecastle-deck to upper forecastle-deck	Approx. 2900 mm
Upper forecastle-deck to bridge-deck	Approx. 2900 mm
Bridge-deck to top of Wheelhouse	Approx. 3550 mm

2.6 Wheelhouse

Wheelhouse to be arranged as shown on General Arrangement plan.

Flat bars forming gutters to be welded on inside of the stiffeners all around the wheelhouse' perimeter.

A platform giving easy access for washing of windows etc. to be arranged aft of the wheelhouse. Outside platforms an anti-skid fibre glass grating to be used throughout where allowed by class.

On top of wheelhouse shall be arranged for funnel up-take and with platform for mounting of FI-FI monitors.

The platform shall be arranged with ladder from top of wheelhouse and railing around the whole circumference.

Vertical ladder from wheelhouse to top of wheelhouse to be arranged outside wheelhouse.

2.7 Stern sections

The aft stern to be have smooth lines and to be specially strengthened for considering anchor handling and towing operations.

A cylindrical stern roller is to be fitted in the stern.

2.8 Skeg

Skeg to be integrated with hull.

2.9 Mud / Brine tank

Mud / Brine tanks to be arranged for liquids with density up to 2.5 ton/m^3 and flashpoint above 60ºC. The tanks to have smooth bulkheads and sloped bottom with discharge pot at lowest point. Direct access from open deck to be arranged.

2.10 Rig chain on Deck

The rig chain to be arranged to store on deck via gypsies of anchor handling winch.

Chutes for carriage of rig chain from gypsies to main deck to be arranged on site in cooperation with owners representatives. Chutes to have well rounded ends.

2.11 Chain Lockers for ship anchor chain and Pipes

Two (2) chain lockers are to be constructed forward of the collision bulkhead. The capacity of each locker is to be sufficient to stow specified length of chain cables.

The cables are to be self-stowing. The floor of the locker is to be galvanised perforated steel plate made removable.

Foot holes are to be cut in bulkhead adjacent to the access opening which is to be fitted with a watertight hatch cover.

Chain pipes and hawse pipes to be of welded steel construction designed to give easy stowage of the anchors and cables. A permanent flushing arrangement to be provided in the hawse pipes for cleaning the anchor cables.

2.12 Casings and funnel

Casing and funnel to be arranged as shown on General Arrangement plan.

Casing to extend from main deck to top wheelhouse and with adequate strength to carry the funnel uptake structures. Exhaust pipes shall be extended as high away as practical above top of funnel.

Open gratings to be arranged within casing and funnel at deck levels. In the upper section of funnel, ventilation louvers to be fitted.

2.13 Bottom plugs

Drain plugs of 38mm diameter stainless steel screw fittings are to be fitted in all tank compartments.

2.14 Sea Chests

The following sea chests are to be fitted with extra plates thickness of 2mm above class requirement.

- 2 x cooling / ballast systems etc., one arranged as low suction and the other high suction
- 2 x external fire fighting
- 1 x emergency fire pump
- 1 x Marine Growth Protection System (MGPS) for above sea chests.

Air vents, compressed air blow-downs, and anodes are to be fitted to all sea chests.

2.15 Steel Fenders and bilge keels etc.

- Steel fenders:

Steel fenders to be arranged as a half steel pipe with double plate as shown on General Arrangement plan. Plate thickness and extension to be according to rules.

- Bilge keel:

Bilge keel made of 300 x 12 mm bulb profiles to be fitted on each side. The location and extension to be according to the model test results.

The bilge keels to be welded on doubling plate against the shell plating.

2.16 Bulwark and cargo rail

- Bulwarks:

Bulwarks of 1200mm height to be arranged according to the General Arrangement plan.

Access doors/gates to be arranged in outer railing at each side on Main Deck. Stainless steel hinges, bolts, nuts and bronze bushes to be provided. Stainless steel locking device to be arranged. Greasing possibility to be arranged.

The bulwark on Main Deck to have flanged supports on every second frame and a horizontal flat bar stiffener in between. Freeing ports in bulwark plate shall be carried out in accordance with the "International Load Line Convention".

The bulwark is to be adequate tumble home and formed as an integral part of the protected walkway between the cargo rail and the ship side.

- Cargo Rail (Securing of deck cargo):

On Main Deck a cargo rail to be fitted on each side approx. 6850 mm from ship centerline.

The cargo rail shall have flush plate towards main deck.

The cargo rail shall have strong profile supports, with portal reinforcement between cargo rail and ship side bulwark. Length between supports max. 5.6 m. Height of cargo rail to be approx. 2600 mm above deck.

Cargo rail shall be both side removable type (about 5m width) within rescue zone.

Lashing eyes to be arranged in Main Deck, each side, for securing of cargo etc. The eyes shall be adapted both to hook and shackles. In addition lashing eyes to be arranged on working deck, each side, along the deck. All lashing points to be marked on drawing with SWL.

Clamping of pipes accommodated in the cargo rail and protective means for pipes, valves etc. to be performed to the satisfaction of the site inspection team.

2.17 Painting General

All descaling, shop priming, derusting and painting works to be carried out in accordance with the published manufacture‟s recommendation and the Builder‟s standard approved and accepted by the owner.

All colors of finish to be in accordance with the Owner‟s color 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 colored as per color code approved by owner.

All epoxy paints other than those applied on underwater hull to be tar free type.
All surface preparation and painting works to be inspected by the representative of paint supplier and to be approved by Owner representative.

2.18 Surface Preparation

Rolled hull structural steel to be blasted to SIS SA2.5, 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 galvanized 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 color for easy identification.

2.19 Painting Scheme

The painting scheme is based on Hempel or equivalent as per paint manufacturer‟s recommendation for five (5) years life-span.

2.20 Pipework Colouring

All exposed piping systems are to be identified with colour bands in accordance with the following colour schemes (for guidance only):

1) Bilge & ballast		:	black
2) Fire main		:	bright red
3) FW Systems	Cold	:	blue
	Hot	:	blue with red bends
4) Fuel oil		:	brown
5) Lube oil		:	yellow
6) Hydraulic oil		:	purple
7) Sea suctions		:	green
8) Seawater cooling		:	light green
9) Compressed air		:	white
10) Liquid mud		:	grey
11) Bulk cement		:	grey
12) Drill water		:	signal blue

2.21 Cathodic Protection

Under water hull and ballast tanks to have cathodic protection against corrosion.

Five (5) years life-span system to be provided. Anodes of zinc to be used where applicable. Size, number and location of anodes to be decided according to calculations.

Anodes to be bolted type.

3 ACCOMMODATION & WHEELHOUSE

3.1 General

The accommodation is to be arranged and fitted out in accordance with the General Arrangement drawing. Scheme of decoration together with colour scheme and samples of all decorative materials and finishes such as furnishing fabrics, plastic laminates, deck covering, paints etc. are to be submitted to the owners for approval prior to purchase.

The accommodation for crew to meet Marine labour convention 2006.

Air conditioning system is to be serviced all living spaces & public spaces within the accommodation area.

Private lavatory is to be provided for each crew and special persons living cabin.

Separate mess room is to be provided for crew and officer, with partition in between.

Fire rating of partition and insulation to SOLAS requirement.

Cabin clear height to be as far as practical 2,100mm and the wheelhouse to be as far as practical 2,250mm.

3.2 Deck Coverings

Steel decks are to be thoroughly cleaned and mastic coated before the installation of deck coverings which are to be laid under all furniture.

Outdoor steel ladders to have chequered plate, flanged treads.

Schedule of Deck Coverings

Wheelhouse top & wheelhouse	: non skid deck paint
Deck exterior & main deck	: non skid deck paint
Wheelhouse interior	: vinyl sheet
Captain & Chief Eng. cabin	: vinyl sheet
Crew‟s cabins	: vinyl sheet
Mess & passageways	: vinyl sheet
Washrooms and galley	: suitable ceramic tiles on cement
Engine room	: Alum. chequer plate on top of floor bearers Steel chequer plate for CAT.A areas in way of escape route as required by Class
Aft thruster compartment	: Alum. chequer plate on top of floor bearers (if headroom permits)
Deck Stores	: non skid deck paint
Provision stores	: wood gratings on painted steel

3.3 Minor Bulkheads & Lining

All steel minor bulkheads are to be lined with non-combustible material. Free Standing bulkheads are to be non-combustible material.

Internals of wash place, store, and provision store are to be of non-combustible material for deck head only and side lining to be painted.

Division walls where not steel bulkheads shall be of approved type and have a thickness of 50 mm or 70 mm with plastic laminate on both sides.

Galley is to be lined from deck to deck head with non-combustible material and stainless steel finishing. No lining for engine room, store rooms and steering compartments.

The lining panel to be complex rock wool panel type.

3.4 Insulation

- Heat insulation

All exposed steel work is to be insulated on the inside with 50mm thick rock wool and retained behind the linings. 100mm thick for funnel bulkhead adjacent to accommodation areas.

1) Wheelhouse & deckhouse : deckhead and sides
2) Deck house cabins : exposed deckhead, bulkheads and sides
3) Underdeck cabins : exposed deckhead, bulkheads and ship sides.
4) Air conditioning room : bulkheads and sides

- Fire insulation

Fire insulation arrangement to comply with class requirements.

- Sound isolation

Sound isolation to be provided in engine control room and cabins where necessary for noise control.

1) Engine control room bulkhead : 100mm thick sound isolation
2) Deck between accom. and engine room : 100mm thick sound isolation
3) Exhaust trunk adjacent to accom. : 100mm thick sound isolation
4) Air conditioning room adjacent to accom. : 100mm thick sound isolation
5) Eninge room vent duct adjacent to accom. : 100mm thick sound isolation

3.5 Windows & Scuttles with Equipment

All windows are to be steel framed type with tempered glass to suit the classification‟s requirements. Side scuttles are to be steel frame type with deadlight. All windows and scuttle frame work to be of fibre glass or wood material.

Wheelhouse:
In wheelhouse windows to be arranged to give maximum visibility all round.

Overhead windows to be arranged as indicated in G.A. plan.

Defroster system on all bridge windows shall be provided.

Water supply for window washing for all windows.

Four (4) sets of horizontal type window wipers and two (2) sets of clear view screen to be provided.

3.6 Steel Doors

All external doors, to be of steel with sill heights according to the loadline requirement.

Suitable dogs workable from both sides are to be fitted with clips and grease fittings. The doors to be channel-framed tightened to gaskets of soft neoprene or similar.

Doors to be fitted with sturdy padlocks and hold-back hooks to retain them in open positions.

The doors used for corridor to be fitted with fixed portholes of approx. 250 mm dia. and with central closing appliances.

Hinged doors with large windows in wheelhouse.

3.7 Doors (not steel) In Accommodation

Interior doors to be adapted to the chosen panelling system (if practical) and with ventilation grid with noise trap at lower part. Cabin doors to have rubber seal around coaming and no gap below for noise reduction.

All frames to be of steel. Doors to be fitted with stainless steel thresholds.

Refrigerated provision room doors with stainless steel fittings to be installed in provision and refrigerating room. The doors are to be according to Builder‟s standard and regulations.

Interior door sill heights to be 150 mm for galley, washroom and other damp room. Normal height elsewhere.

Fire door(s) in galley and staircase to be equipped with self close device.

Master key locking system to be provided for external and internal doors in accordance with common practice. Locking system to be approved by Owners representative.

Clear width of door opening

Clear width (mm)	Location
800	Provision room, hospital

Clear width (mm)	Location
600	Private lavatory, store, locker
750	Wheelhouse (weather part), passage way
700	All other doors

3.8 Hydraulic Watertight Sliding Door

Adequate sets of hydraulic operated watertight sliding doors to be provided as shown on the General Arrangement Plan. They are to be capable of local manual control, from each side of the bulkhead and also remote controlled.

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

3.9 Carpenter's Work

Store rooms to be provided with steel shelves with retaining bars. Wooden grating in store rooms for hawsers and warps. Arrangement of shelves is to be sufficient for the intent of each store room.

Side lining and ceiling in wheelhouse, accommodation, engine control room and living spaces fitted with fire-retardant type material.

All furniture except mess tables is to be made of solid wood material with good quality standard. Final arrangements of furniture are to be in accordance with accommodation plan and approved by Owner.

3.10 Wheelhouse

The wheelhouse is to be located on navigation bridge deck as per GA and to be fitted with all navigation, communication and control equipment. The helmsman‟s position at the centre and directly behind the console fitted at forward and aft of the wheelhouse.

Wheelhouse windows are to be arranged to give maximum visibility all round. The compass is to be located above the forward steering position.

The vessel is to be fitted with conventional controls and joystick controls at the forward and aft control stations. The forward control station to be consisted of one (1) console and the aft control station to be consisted of two (2) consoles.

Forward control station is to be fitted with:

1) Main engine controls complete with meter and gauges according to makers‟ standard
2) Azimuth thruster Control Panel and lever
3) Bow thruster control panels with meter and gauges according to maker‟s standard
4) One (1) autopilot
5) One (1) Electric engine telegraph
6) Telephone & Sound powered telephone handsets

7) One (1) main VHF set
8) Electric and air horn buttons (mounted on console)
9) Two (2) Radars
10) One (1) Gyro Compass with two (2) repeaters to be installed on bridge wings
11) One (1) Echo Sounder
12) One (1) Anemometer
13) One (1) Speed log
14) Two (2) searchlight which remote control in the wheelhouse
15) Two (2) horizontal type window wipers with F.W. spray
16) One (1) clear view screen, 300mm dia.
17) One (1) helmsman chair swivel type, sliding unit with armrest, upholstered, adjustable in height and with footrest and keep lanyard

The controls and alarms fitted are to comply with requirement of CLASS.

Aft control station is to be fitted with:
1) Main engine controls
2) Azimuth thruster Control Panel and lever
3) Dynamic Positioning Systems
4) Dynamic positioning system main control.
5) Dynamic positioning system Secondary control
6) Bow thrusters control / indication panel
7) One (1) VHF set.
8) Gyro repeater (flush mounted type)
9) LCD Radar Repeater
10) One (1) Anemometer
11) Rudder indicators
12) Towing pins and shark jaw control pins
13) Anchor handling towing control panel
14) Bulk cement control panel
15) Liquid cargo control panel
16) Fire fighting control console
17) Two (2) horizontal type window wipers with F.W. spray
18) One (1) clear view screen, 300mm dia.
19) One (1) Sliding chairs of swivel type, with armrest, upholstered, adjustable in height and with footrest and keep lanyard
20) One (1) searchlight which remote control in the wheelhouse

Other equipment in wheelhouse to be fitted out in the wheelhouse as follows:
1) Navigation equipment - reflector compass, weather facsimile, Automatic Identification System, Navtex etc
2) Communication equipment –SSB, signal flags, loudhailer, intercom/PA system and morse lamp, EPIRB, SART
3) Navigation light switches and alarm panel
4) Aldis signalling lamp
5) Four (4) spare power prints, 220/1/60, four (4) 24V DC and addition to those required for equipment specified
6) Rudder indicators Ceiling mounted Port & Starboard
7) One (1) Twin gyro compass and one (1) gyro compass meeting DPS2 requirement
8) Battery clock - 1 off, Quartz type
9) Radio and Chart table with lockers and drawers under and curtain all round

10) Book racks
11) Barometer - 1 off
12) Thermometer ~ 1 off
13) Flag locker with complete signalling flags
14) Ship‟s bell
15) Two (2) independent air-con units, air-cooled and stand mounted

3.11 Captain's Cabin

The Captain‟s cabin to be fitted with the following:

Bed room
- 1 built in berth 2,100x1,200, with drawers under
- 1 wardrobe
- 1 module toilet
- 1 side scuttle with dead light and curtain
- 1 combination safe
- 2 spare power sockets

Day room
- 1 3-person sofa
- 1 desk with drawers
- 1 desk chair
- 1 sideboard
- 1 coffee table
- 1 small refrigerator
- 1 book case
- 1 clock
- 3 hat and coat hooks
- 1 side scuttle with dead light and curtain
- 4 spare power sockets
- 1 TV / radio socket and LAN cable socket
- 1 marine battery clock
- 1 waste bin
-

3.12 Chief Engineer's Cabin

The Chief Engineer‟s accommodation is to be fitted out generally as per Captain‟s cabin but without safe.

3.13 Private lavatory for cabins (Module type)

Module type washrooms attached to each cabin are to be fitted out identically as follow:
- 1 shower fitted with curtain, soap dish and grabrail
- 1 stainless steel washbasin with hot/cold water supplies
- 1 extractor fan
- 1 spare power point
- 4 coat hooks

- 1 pedestal WC (European type) with seat, lid & toilet roll holder & grabrail.

3.14 One Berth Cabin (2 units)

These cabins to be fitted with the following:

- 1 built in berth 2,100x900, with drawers under
- 1 locker
- 1 book rack
- 1 waste bin
- 1 table
- 1 chair
- 4 spare power sockets
- 1 LAN socket
- 1 side scuttle with dead light and curtain

3.15 Two Berth Cabin (7 units)

These cabins to be fitted with the following:

- 1 built-in two-tier double or 2 built-in single wooden berths with size about 2,100x900 with plywood bases and drawers under
- 2 lockers
- 1 book rack
- 2 sets berth curtain rails
- 1 waste bin
- 1 table
- 1 chair
- 4 spare power sockets
- 1 LAN socket
- 1 side scuttle with dead light and curtain

3.16 Four Berth Cabin (8 units)

These cabins to be fitted with the following:

- 2 built-in two-tier double berths with size about 2,100x900 with plywood bases and drawers under
- 4 lockers
- 1 book rack
- 2 sets berth curtain rails
- 1 waste bin
- 1 table
- 1 chair
- 4 spare power sockets
- 1 LAN socket

3.17 Mess / Recreation Room

<u>For crew</u>

The crew mess / recreation room is to be fitted out as shown on the GA:

- Dining tables c/w formica top and edge fiddles

- 6 spare power points
- upholstered chairs
- 1 sideboard
- 1 clock, battery quartz type
- 2 hot & cold water dispenser, 2.5l/hr
- 1 'White' notice board
- 1 42” LCD TV

For Officer

The mess room is to be fitted out as shown on the GA:

- Dining table c/w formica top and edge fiddles
- 3 spare power points
- upholstered chairs
- 1 sideboard
- 1 clock, battery quartz type
- 1 commercial four-slot toaster
- 1 900 watt microwave oven
- 1 130 litres refrigerator
- 1 32” LCD TV

3.18 Galley

The galley is to be fitted out as follows:

- 2 stainless steel 4 hot plate marine electric range c/w large ovens fitted with batten arrangements to prevent movement of pans, and with exhaust canopy over.
- 1 stainless steel twin bowl deep sink with shelves, lockers under and plate racks over.
- 1 Assorted cupboards, workbenches, plates rack, etc – in stainless steel
- 6 power sockets
- 1 food waste disposal to be fitted below sink
- 1 Commercial food mixer
- 2 Rice cooker
- 1 dishwasher (12 plate settings)
- 1 Commercial deep fryer
- 1 hot water urn, 19l
- 1 garbage compactor

The room shall be fitted with draining board, drawers, lockers, shelves, etc. suitable for cooking and food handling. All furniture is to be delivered in stainless steel.

Scuppers and taps to be arranged for easy cleaning.

3.19 Provision Store(spot cooling)

This compartment is to be fitted with stainless steel shelves c/w retaining battens.

Composite grating is to be fitted on floors.

Ventilator to be arranged.

Lock for the door.

Provision room bulkhead and deckhead shall be painted.

3.20 Chiller / Freezer Room (walk in type)

The capacity of refrigerated provision store to be as follows:

Compartment	Capacity (m^3)	Temperature (°C)
Chiller	~30	+4
Freezer	~26	-18

These built-in compartments are to be fitted with insulation and lined with stainless sheet, stainless steel shelves to be provided c/w wooden grating fitted on floor (refer to Section **4 Refrigeration System - Freezer & Chiller Room**).

3.21 Entertaining Equipment

On wheelhouse top to be fitted antennas for TV and radio system. Television Antenna (Terrestial) system to be equipped.

Two (2) TV sets (wall mounted LED type) one each in captain and chief engineer‟s cabins to be provided.

3.22 Hospital

The hospital shall have medical supplies in accordance with Class requirements for the number of personnel on board. The hospital to be fitted out as follows:

- 1 treatment table
- 2 hospital type beds and en-suite facilities fitted with emergency call facilities to wheelhouse
- 1 Medical locker in accordance to Class
- 1 Desk and chair
- 1 4-drawer steel cabinet
- 1 attached wash room with bathtub

3.23 Laundry / Changing Room

The laundry / changing room situated on the main deck is to be fitted out as follows:

- 2 washbasins with cold and hot freshwater taps and soap dishes
- 2 domestic washing machine (approx. 7 kg)
- 1 domestic spin dryer (approx. 7 kg).
- 2 spare power points
- 1 foldable ironing board
- lockers arranged in two tiers
- 1 toilet cubic
- 1 shower cubic

3.24 CO_2 Room

This compartment is to store the CO_2 bottles. Force exhaust to be arranged. CO_2 room is to comply with class requirements.

3.25 Deck & Paint Store

These compartments to be fitted out with steel shelves on steel framing c/w retaining bars. Deck to be painted with non-skid deck paint. Natural ventilation to be arranged.

CO_2 gas flooding system is to be provided in paint store and to meet with SOLAS requirement.

3.26 Linen Store

The linen store is to be fitted with wooden shelves.

3.27 Ship Office

One (1) to be provided as shown on General Arrangement drawing, and to be fitted with:
- 2 steel filing cabinet with double door
- 2 desks and 2 upholstered chairs
- 1 Telephone/fax/e-mail/data link
- 1 white writing board
- 1 Emergency light connected to the ships main emergency system
- 1 quartz wall clock
- 4 spare power points.

3.28 Conference Room

One (1) conference room to seat 12 persons, situated on the main deck is to be fitted out as follows:
- 1 conference table
- 12 upholstered chairs
- 1 sideboard
- 1 'White' notice board
- 1 quartz wall clock
- 4 spare power points.

3.29 Air Conditioning Room

One (1) Air Handling Unit (AHU) Room to be provided to house the air conditioning unit, located as per the General Arrangement Plan. Lightings, ventilation ducts and scupper pipe to be provided.

3.30 Emergency generator room

This compartment is to be fitted with an emergency generator set.

3.31 Bow Thruster Compartment

This compartment is to be fitted with bow thruster machinery with suitable forced ventilation. Flooring to be alum. chequer plates.

3.32 Engine Room

The engine room is to house all machinery and equipment at convenient locations described elsewhere. Steel chequer plates of 6mm are to be used for flooring secured with galvanised steel self trapping screws to steel bearers and fitted with hand grib as necessary.

All moving parts to be provided with guards or rails or both. Portable handrails to be provided in strategic positions for protection of crew‟s safety. Rubber mats to be placed in front the switchboard. Workbench to be fitted at suitable location.

One common battery operated telephone to be fitted. Marine clock and clinometer to be suitably positioned.

3.33 Engine Control Room

The engine control room is located as shown on the General Arrangement plan, and is an air conditioned room to house the main switchboard and engine alarms.

Rubber mats to be placed in front the switchboard.

Engine control room is to be equipped with:
- Main switchboard
- Machinery alarm console
- Office desk
- Office chair
- One (1) sound power telephone c/w 10m length cable with headset
- Three (3) power points
- One (1) LAN socket
- One (1) packaged air-conditioner, sea water cooled.
- One (1) quartz battery clock
- One (1) clinometer

3.34 Aft Thruster Compartment

This compartment is to be fitted out with azimuth thrusters. Common battery operated telephone to meet classification requirement to be fitted.

3.35 Fire Control Station

No fire control station to be provided.

3.36 Mortuary / Store

Facilities for shelving and securement are to be provided in this compartment to store the number of bodies that Class required.
This compartment to be cool ventilated.

4 MACHINERY & PIPING

4.1 Machinery General

All main and auxiliary engines, pumps etc., are to be approved type and supplied with certificates as required by the classification. They are to be supplied and fitted by the Builder.

propulsion system
The vessel shall be driven by two (2) diesel engines and two (2) fixed pitch azimuth thrusters with shafts.

4.2 Main Engines

Two (2) off Main diesel engines to be installed in engine room, each with the following details:

Engine output, approx.	: abt. 2573 kW (3500HP)
Engine speed at 100% MCR	: 800 RPM
Fuel	: Marine Diesel Oil
Specific fuel oil consumption at Max. output power	:
Cooling	: Sea water

Engine exhaust to meet Marpol NO_X Tier 2 standard.

Standby or spare pumps are to be provided in accordance with classification requirements. Necessary sensors and connections for DPS-2.

Engine control with main propulsion system
a) Wheelhouse Fwd/ Aft control stations
b) Engine control room (ECR)
c) Engine and Azimuth local panels
d) Local controls directly on equipment
e) DPS-2

Flexible couplings:
High elastic coupling to be provided between main engines and clutch.

High elastic coupling to be provided between main engines and gear box for Fi-Fi pump and shaft generator at forward PTO.

High elastic coupling to be provided between gear box and shaft generator.

4.3 Generating Sets

- Main generator set

Three (3) off diesel engine driven el. generator sets to be provided, each with the following details:
Generator engine type : marine cylinder piston with tub-charge and intercooled

high speed diesel engine

Capacity	: abt. 380kW x 1800rpm
Engine fuel	: Marine Diesel Oil
Generator output (ekW)	: approx. 350 ekW each at 1800 rpm
Voltage (V)	: 3 X 440
Frequency (Hz)	60
Enclosure	: IP 23
Generator coolant	: Acc. To maker‟s standard
Start device	: Acc. To maker‟s standard

- Shaft Generator

Two (2) off shaft generators, each approx. 1000 kW (440V/3/60Hz).

- Emergency generator set

One (1) off emergency diesel generator set, air cooled, rated approx. 99 kW (440V/3/60Hz).

4.4 Gear box & Clutch

Two (2) off gear boxes, each gear box is single input and two output reduction gears with built-in hydraulic friction clutches, its output end to be connected shaft generator and Fi-Fi pump.

Gearbox reduction ratio	: TBD
Cooling water	: Sea water

Two (2) off clutches is as per Manufacturer's recommendation. Each clutch is hydraulically actuated mulitiple-disc, wet type with dual modulation slipping clutch.

Lube oil cooler	: Sea water

4.5 Azimuth Propeller & Shaft

Model	: Fixed pitch Azimuth Z-Peller
Number of propellers	2
Engine input	: abt.2573 kW (3500HP) per engine
Bollard Pull	: min. 90 t
Number of blades	: 4 each propeller
Propeller diameter, approx.	: abt. 2700 mm with Kort-nozzle
Propeller hub	: Ni-Al-Bronze
Propeller speed, approx.	:

The shafts to be forged steel.

4.6 Bow Thruster

Two (2) transverse tunnel CPP bow thrusters each giving thrust of approx.9T, to be driven by air cooling electrical motor of abt.600 kW.

All necessary controls and interlocks to be provided.

4.7 Pump for Engine

1) Sea water pump

No.	Name	Type	Capacity x Total head or Dis. Press
2	main engine sea water cooling pump	Attached with engine	acc. to maker standard
1	main engine sea water cooling spare pump	maker standard	acc. to maker standard
2	Deck machinery HPU sea water cooling pump	E.V.C.	Abt. 30 m^3/h x 30 m (finally as per vendor recommend)
2	HAVC sea water cooling pump	E.V.C.	Abt. 60 m^3/h x 30 m (finally as per vendor recommend)
2	dry bulk compressor sea water cooling pump	E.V.C.	Abt. 10m^3/h x 30 m (finally as per vendor recommend)
2	Ballast /bilge/fire water pump	E.V.C. with self priming	Abt. 100 m^3/h x90 m
2	Fire/bilge/GS pump	E.V.C. with self priming	~50m^3/h x 60 m
1	Eductor for fore bilge		~5m^3/hx0.12MPa Suction lift:7m
1	Sea water pressure pump(Fitted with SW hydrophore)	E.V.C.	10 m^3/h x 50m
1	Spare pump for SW & FW hydrophore with by-pass pipe	E.V.C.	10 m^3/h x 50m

No.	Name	Type	Capacity x Total head or Dis. Press
2	main engine fresh water cooling pump	Attached with engine	acc. to maker standard
1	main engine fresh water cooling spare pump	maker standard	acc. to maker standard
1	Fresh water pressure pump(Fitted with FW hydrophore)	E.V.C.	10 m^3/h x 50m
1	Hot water circulating pump(Fitted with hot water hydrophore)	E.V.C.	2 m^3/h x 20m

3) L.O. and Fuel oil pump

No.	Name	Type	Capacity x Total head or Dis. Press
2	FO feed pump for main engine	Attached with engine	acc. to maker standard
1	FO feed spare pump for main engine	maker standard	acc. to maker standard
2	LO for main engine	Attached with engine	acc. to maker standard
2	LO priming pump for main engine	E.V.Sc. or E.H.G	$30m^3$/hx5.0bar (finally as per vendor recommend)
2	LO pump for clutch if required	Attached with clutch	acc. to maker standard
2	FO transfer pump	E.H.G.	10 m^3/h x 30m
1	LO transfer pump	E.H.G.	5 m^3/h x 30m

4) Other"s

No.	Name	Type	Capacity x Total head or Dis. Press
1	dirty oil pump	E.H. G	5 m^3/h x 30 m
1	Sewage transfer pump	E.H.C. with self priming & cutting device or open impeller	5 m^3/h x 30 m

Abbreviation :
E : Electric motor driven
V : Vertical
H : Horizontal
C : Centrifugal
Sc : Screw
G : Gear

4.8 Air Compressor, Fan and Air Reservoir

1) Air compressor and Fan

No.	Name	Type	Particular (Abt.)
2	Starting air compressor	air cooled, motor driven	25 m^3/h (Free air) x 30 bar
2	Engine room supply fan	Motor driven, vertical axial flow, one set reversible	as per maker calculation

2) Air Reservoir and accessories

No.	Name	Particular (Abt.)
2	start air reservoir	0.5 m^3 x 30 bar, (finally as per vendor recommend)
1	service air reservoir	0.3 m^3 x 7 bar
1	Air reservoir for whistle	0.1m^3 x 7 bar
1	Air reservoir for quick closing valve	0.05m^3 x 7 bar
2	Control air dryer	Refrigerated type, 50m^3/h

4.9 Purifier

No.	Name	Type	Particular (Abt.)
1	F.O. purifier	Centrifugal, automatic operating, self-cleaning, with built-in feed pump	~1000 l/h
2	L.O. purifier	Centrifugal, automatic operating, self-cleaning, with built-in feed pump	~800 l/h

4.10 Environment protect equipments

No.	Name	Type	Particular (Abt.)
1	Sewage treatment plant	Biological IMO type	50 persons
1	Oily water separator	IMO approved type	1m^3/h , ≤15ppm

4.11 Water Hydrophore

No.	Name	Particular (Abt.)
1	Fresh water hydrophore	capacity of each tank to be approx. 1,000 liter
1	Sea water hydrophore	capacity of each tank to be approx. 1,000 liter
1	Hot water calorifier	One (1) Heat water Calorifier with electric heating element, capacity app. 40 kW with safety cut outs, capacity of tank to be approx. 1,000 liter
1	Fresh water maker	One (1) Reverse Osmosis type,cap. 10t/d
1	Drinking water sterilizer	Ultraviolet type, 1000 l/h

4.12 Lifting Beams

Lifting beams or Lifting lugs are to be fitted over each main engine, diesel alternator and major items of auxiliary machinery.

4.13 Lifting Lug in Engine Room

Lifting lugs (of JIS or equal with SWL marking) suitable for use of chain blocks are to be fitted at the following positions:

- Two (2) points above each main engine, trolley beam c/w pulley and chain block

- Two (2) points above each generator engine
- Two (2) points above each generating alternator
- Allow for further 20 points as nominated by Owner‟s representative

4.14 Maintenance Tools

Following to be provided:
- 1 ton chain blocks x 2
- Workbench with adjustable light and drawers under in the engine room
- 125mm vice mounted to the workbench
- one set of assorted hand tools for general maintenance
- steel sounding tape x 2, bronze sounding tape x 2
- electrical hand inspection lamp with wandering leads x 2
- steel locker with padlock for spares

4.15 Piping General

All pipes are to be arranged according to good marine practice with sufficient bore and thickness for the purpose intended. They are to be well clamped to the ship‟s structure and to have minimum number of bends. Approved type of bulkhead fitting is to be used where piping penetrates a watertight or oiltight bulkhead, deck or tank top. Expansion bends are to be fitted where necessary to avoid damage due to expansion or movement of the structure. Mud boxes, strainers, filters and valves are to be arranged according to classification‟s requirements.

All valves will be marked with appropriately named plates. Bunker station will be arranged on deck with common filling and discharge of diesel oil. Pipes of 1-1/2” (DN40) and over to be butt welded with flanged connections, below 1-1/2” (DN40) are to be screwed with unions except for the air piping where butt welded with flanged is to be adopted.

All bare steel pipelines to be painted with primer prior to final finish coat as per paint specification.

4.16 Pipe & Valve Materials

Pipes:
Hull pipes to ISO / CBM or equivalent. For pipes passing through tanks, pipe scantlings may be increased to be to Classification requirement.

System	Material	Remarks
Bilge + Ballast	Hot-dip galvanised steel under main deck	Seamless Sch 80
Fire + Deck wash	Hot-dip galvanised steel	Seamless Sch 80
S.W. Cooling	Hot-dip galvanised steel	Seamless Sch 80
F.W. Cooling	Hot-dip galvanised steel	Seamless Sch 40
Fuel Oil	Black Mild Steel	Seamless Sch 40
Lube Oil	Black Mild Steel	Seamless Sch 40
Sanitary, Fresh Water	Hot-dip galvanised steel PE (accom)	Seamless Sch 80 Acc. to maker‟s standard
Soil Pipe	Hot-dip galvanised steel PE (accom)	Seamless Sch 80 Acc. to maker‟s standard
Air + Sounding	Steel Except for oil tank	Seamless Sch 80
Cement	Black Mild Steel	Seamless Sch 80
Mud/brine	Hot-dip galvanised steel	Seamless Sch 80
Control air	Copper	Acc. to class requirement
Compressed Air	Black Mild Steel	Seamless Sch 40
Exhaust	Black Mild Steel With heat resistance paint	min. 6mm
Hydraulic oil	Vendor standard	Vendor standard

Where hot-dip galvanising is specified, this is to be carried out after fabrication as far as practical. Piping is not to be led through tanks as far as practical.

Valves:
Shipside valves and sea valves to have cast steel or bronze body with class certificates.

Valves on bilge, ballast, cooling water (S.W. and F.W.), fire and washdeck may be cast iron body with bronze trim.

Valves on compressed air system to be steel or bronze.

Valves on fuel oil and lube oil systems to be steel or bronze.

4.17 Bilge & Ballast System

Bilge and ballast pipes are to be arranged with valves, strainers, mud boxes, manifolds and pumps in accordance with the piping drawing to meet the classification‟s requirements.

Suctions are to be fitted to the following compartments:

- Engine room
- F.W./S.W.B. tanks
- Cargo pump space

Mud boxes are to be galvanized.

Two (2) bilge / ballast / fire / G.S pumps and two (2) bilge/GS pumps to serve above space.

Chain lockers to be drained by bilge ejector driven by G.S pumps.

4.18 Fuel Oil System

Fuel oil pipes are to be arranged with valves, filters, manifolds, pumps and tanks in accordance with the piping drawing and to meet classification‟s requirements.

The fuel oil bunkers and daily service tanks are to be arranged as shown on the drawing.

FO day tanks to be positioned at convenient locations.

Air pipes and sounding pipes (or level gauge) are to be fitted to each tank.

A bunkering line is to be led to the main deck, P&S for filling and discharge for all bunkers.

The fuel transfer pumps together with the pipes and valves etc is to be arranged to transfer fuel oil from FO overflow tank and discharge to either of the FO day tanks.

Each FO day tank is to be provided with supply, filling and overflow pipe, drain valve, sight glass or content gauge to meet classification requirement.

4.19 Lube Oil System

Lube oil pipes shall be arranged in accordance with engine manufacturer‟s recommendation and to meet Class requirements.

A lube oil storage tank with tank gauging means shall be provided in engine room with filling pipe fitted in main deck. All diesel engines shall be supplied with built-in lube oil pumps.

4.20 Engine Cooling System

Tube / shell or plate cooler to be provided. Capacity to maker‟s requirements.

4.21 Compressed Air System

Compressed air for engine starting and general service is to consist of:

- 2 air compressors, air-cooled type, with oil/water separator, electrically driven
- 2 start air receivers, each 500L at 30 bar
- 1 service air receivers, 300L at 7 bar
- Assorted pressure gauges, pressure reducing valves, relief valve etc.
- General service to tap off from this system
- Sea chest blow-down to be 4 bar
- Main engine and other equipment controls

4.22 Hydraulic Systems

The hydraulic piping of solid drawn steel (internals to be acid cleaned) for the anchor handling /towing winch, shark jaw, towing pin, anchor windlass, capstan, etc. to be arranged in accordance with the manufacturer‟s recommendations and to meet classification requirements. Adequate strainers to be provided.

4.23 General & Deck wash Service

Seawater for the general and wash deck service is to be supplied from the GS and fire pump to hydrants fitted on the weather decks and engine room.

4.24 Freshwater System

Potable water tanks are to be arranged as shown on the G.A. Water is to be supplied to the accommodation and engine room through self-contained, automatic pressure tank fitted in the engine room.

A bunkering line is to be led to the main deck, P&S for filling and discharge for all freshwater tanks.

4.25 Hot Freshwater System

Hot freshwater system is to be drawn from cold freshwater into electric calorifier and piped to wash places and galley. Hot water pipes to be suitably lagged.
Hot water circulation pump to circulate hot water in the system.

4.26 S.W. Sanitary System

Sea water sanitary pipes are to be arranged with valves, S-trap, scuppers and pressure set in accordance with marine practice and meeting classification requirements.

4.27 Scuppers & Discharges

Discharges from washbasins, showers, sinks and internal scuppers are to be grouped into a common cross main to sewage treatment plant or the sewage holding tank or discharge overboard through storm valve. Air pipe to be arranged from the cross main and sewage treatment plant. Discharge from W.C. to be led

to sewage treatment plant or the sewage holding tank or discharge overboard through storm valve.

Scuppers from the refrigeration spaces are to be led overboard via a storm valve. A scupper from the air conditioning compartment is to be led overboard via a storm valve. 50mm scuppers to be fitted in toilets. Laundry and galley scuppers to be 65mm, each corner of galley to be fitted with a scupper. All internal scuppers to be trapped, and fitted with portable gratings.

Discharges and trips generally to be as follows:

Showers	: 50mm with P-trap
Washbasins	: 32mm with deep seal bottle trap
Galley sink	: 65mm with water and grease trap, strainer to be fitted
W.C.s	: 100mm

Cleaning plugs to be fitted as may be required.
Open superstructure/deckhouse decks to be drained by 50mm scuppers.
Moisture condensate drainage to be provided from behind accommodation panelling.

4.28 Refrigeration System - Freezer & Chiller Room

The built-in walk-in chiller and freezer are to be furnished and installed as shown on the General Arrangement plan. The two (2) complete sets compressors units (100% standby) to be fitted in the AHU compartment or other suitable location. Compressors to be central plate cooled.

Refrigeration plant of R404A system direct expansion type, water cooled, electrically driven, to be installed complete with all necessary accessories.

Performance criteria to be based on 50°C ambient temperature, 95% RH. It is to achieve cold room (meat & fish) temperature at - 18°C and cool room (vegetable) temperature + 4°C.

Each compartment is to be accessible through a proper stainless steel insulated door with 150mm minimum polyurethane to preserve temperature. The door opening size to be W800 X H1700. Each compartment to be thermostatically controlled; in addition each compartment to be fitted with a drain for excess water and condensation.

Provision for unlatching access door from inside is to be provided. Extra precaution is to be taken to insure that a vapor seal be maintained. The chiller and freezer are to be fitted with deep shelves all around for storing food, retaining with sea rails.

The compressors to be water cooled with copper nickel condensers and S.W. cooling pump of bronze casing, bronze installer and SUS shaft. The compressor sets to be identical, with one serving as a standby unit, fitted with proper sealed refrigeration valves so either unit can be isolated for service. The operating unit to service both the chiller and freezer fan / evaporator units, with pressure / temperature controlled expansion valves, tied to each thermostat, controlling the

compressor operation. Proper valued dryers, with bypass, and moisture indicating sight glasses will be fitted.

A remote temperature gauge will be provided outside the chiller/freezer with high temperature warning buzzer. Suction & pressure gauges (permanent) will be provided for each compressor.

The bottom of the walk in boxes will be finished in ceramic tile, with wood grating over, the sides and overhead will be stainless steel sheet metal over non-flammable, oil resistant type of insulation.

Shelves will be stainless steel frames with stainless steel bottoms and rails three tiers high.

4.29 Ventilation & Air Conditioning

- Air Conditioning

Accommodation spaces to be central air-conditioned with both cooling and heating, and maintained with overpressure.

Designing Conditions

Outside Temperature : summer 50 °C, 95% R.H, winter -5 °C.
Inside Temperature : summer 25 °C, winter 20 °C. 65% R.H.
Fresh Air Intake about 30%

Living spaces, wheelhouse shall be fully air-conditioned and spot cooling for the galley by water-cooled marine type machinery.

In addition to central air-conditioning, **independent air- conditioners** to be provided as following:

- Wheelhouse to be provided with two (2) independent air-con units with R404A direct expansion, air-cooled and ceiling mounted, and one(1) standalone air-con unit to be provided.
- The engine control room shall be installed one (1) packaged air conditioner with R404A direct expansion, sea water cooled, electric heating. Temperature in engine control room to be nearly 27°C with engine room temperature 45 °C.

Galley is to have an independent exhaust system with stainless steel hood over range. Blower units are to be designed and installed to give minimum noise level.

All vent outlets are to be fitted with adjustable dampers capable of closing completely. Cooling / heating of air through mechanical ventilation system is to be thermostatically controlled from one central location, on the air-conditioning unit.

One air-conditioning plant, with two compressors of Freon R404A and two blowers, each of 100% of total required capacity, to be installed to serve all living spaces & public spaces within the accommodation deck. The plant to maintain the inside climate conditions as described under this section.

Galv"d rectangular ducting to be provided for the equal air distribution to the air-conditioned space. Duct to be insulated with mineral wool wrapped with double sided aluminum foil externally acting as vapour seal.

The air-conditioning plant compressor and condenser shall be fitted with Cu-Ni tubings.

- Ventilation

a) Engine room : forced supply
b) Pump space : forced exhaust and natural supply
c) Washplaces & Galley : forced supply and natural exhaust
d) Emer. Gen. room : forced supply and natural exhaust
e) Bow thruster room : forced supply and natural exhaust
f) Aft thruster room : forced supply and natural exhaust
g) Hospital & washroom : forced exhaust

4.30 Exhaust pipe and silencers

Provide all engine exhaust piping including flexible connections, vibration isolators, silencers. Engine exhausts shall be of the dry type, and shall be routed up through an exhaust trunk, from the engine room to the top of the wheelhouse.

Silencers shall provide at least 25dB noise reduction and shall be fitted with spark arresters. Provide insulation from engine turbocharger outlets through the exhaust trunk. Proper accesses shall be arranged with appropriate grating floors and ladders.

The exhaust piping shall be a minimum of 6mm wall. The exhaust piping shall be seamless steel. Fittings, flanges and bolts shall be appropriate for the required pipe material. Pipe supports for the exhaust system, except those used as anchor supports, shall have standoffs that will accommodate thermal expansion and isolate vibration and heat from ship structure. Expansion joints shall be provided at each engine outlet by the engine manufacturer. Additional expansion joints shall be installed in each exhaust pipe as required for thermal expansion. Ends of exhaust piping outside funnel will be made of stainless steel and directed 45°outwards and aft. Penetration in funnel top plate to have water tight collar. The pipes to be clamped in such a way that they can freely expand.

Insulation thickness to be min. 50mm for the main engine and min. 50mm for the auxiliary engines. The insulation to be covered with galvanized steel lining.

4.31 Fire detector system

One (1) off addressable fire alarm central shall be mounted in the wheelhouse with slave panel in engine control room.

The fire detection central panel shall have built-in monitoring circuits which are intended to control that the equipment at any time is in satisfactory order and indicate faults which could prevent fire alarm.

Faults in the system shall be indicated on the central panel by means of visual and audible signals.

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

Accommodation vent. fans to be stopped automatically when fire alarm and by emerg. stop push button in bridge.

Fire door to close automatically when fire alarm, if normally open. In addition manual release on bridge and locally release button at doors.

4.32 Fire / Deck washing system

The pipes to be of galvanized steel. A necessary number of fire posts according to rules to be arranged in engine room, accommodation and on deck.

2 off	Ballast / bilge / fire water pump, centrifugal type, to be provided
2 off	Bilge/ fire / GS pump, centrifugal type, to be provided

Washing of anchor chain to be arranged.

4.33 Fire fighting system with CO_2

Provide separate systems to protect the Engine Room, with carbon dioxide bottle to be located in the CO_2 room.

Provide ventilation dampers for closure upon carbon dioxide release for the spaces protected.

Provide automatic shutdown for ventilation equipment upon release of CO_2.

Fixed carbon dioxide systems shall be in accordance with SOLAS II-2, Regulation5.

Provide a system for the Galley exhaust hood and duct as required by SOLAS and stored in the Galley.

Marking of Fire Equipment shall comply with the Flag Administration, CLASS & SOLAS requirements.

4.34 Fire fighting system with water mist

Full and local fire fighting in designated areas in engine room shall be possible with the means of water mist system. The system to be arranged according to Class and SOLAS

4.35 Fire fighting system with hand extinguishers

Hand extinguishers to be installed according to the authorities requirements.

4.36 External Fire-fighting System

External fire-fighting equipment for Fi-Fi Class 1 shall be installed.

The following equipment are to be fitted for the vessel:

a) Fire Pumps
Two (2) units seawater pumps 1,600 m^3/hr at 125mlc.
The pumps to be driven from main engine PTO via flexible coupling with clutch and step-up gear.

b) Fire Monitors
Two (2) units monitors at 1,200 m^3/hr each (one of them is dual barre water/foam)
The monitors are to be remotely controlled from wheelhouse.

c) Fixed Water Spraying System
The vessel is to be protected by a permanently installed water-spraying system consisting of a number of nozzles fitted on all deck levels. The fixed water spraying system is to provide protection for all outside vertical areas of hull, superstructures deckhouses and other equipment.
The arrangement of the water spraying system is to be such that necessary visibility from the wheelhouse and the control station for remote control of the fire fighting water monitors can be maintained during water spraying.

d) Foam System.
Foam system to install as per fire pump maker recommendation, one (1) set of foam mixer consisting of eductor and metering valve with mixing ratio 1-5% to be fitted.

4.37 Dispersant System

An anti-pollution oil dispersant system shall be provided, complete with the following:

a) The dispersant system is to make use of GS/Fire pump or the Bilge pump for the delivery of dispersant seawater mixture.
b) Mixing unit - line proportion eductor to mix dispersant with sea water at the ratio of 0-3-6 per cent.
c) Two (2) adjustable spray nozzles each mounted on port and starboard forward bulwark for the system.

4.38 Discharge-/Fill stations

Fuel oil :Midship SB&PS
Drilling water :Midship SB&PS
Fresh water :Midship SB&PS
Brine water :Midship SB&PS
Liquid mud :Midship SB&PS
Dry bulk :Midship SB&PS, aftship SB&PS
ORO :Aftship SB

Connections:
Adapter fittings to be provided as follows:
All discharge-/fill pipes to be arranged with quick couplings as required.
-F.O : 4" (DN100) KAMLOCK
-D.W : 4" (DN100) KAMLOCK
-F.W : 4" (DN100) KAMLOCK
-Mud/Brine : 4" (DN100) KAMLOCK
-Dry Bulk : 5" (DN125) KAMLOCk
All deck discharges to be provided with 1" test cocks.

For Sewage and dirty oil, deck discharge connection to meet MARPOL 73/78, location at main deck aft of deckhouse.

4.39 Cargo/discharge pumps for liquid & bulk cargo

Product	No.	Capacity		Type of pump	Type of drive
		(m^3/h)	(bar)		
Fuel oil pump	2 off	100	9	One speed, vertical, Centrifugal pump	Electric driven, vertical, self-priming
Fresh water pump	1 off	100	9	One speed, vertical, Centrifugal pump	Electric driven, vertical, self-priming
Ballast / bilge / fire / Drilling water pump	2 off	100	9	One speed, vertical, Centrifugal pump	Electric driven, vertical, self-priming
Liquid mud / Brine	2 off	100	15/7.5 (sg 1.0/2.5)	One speed, horizontal, Centrifugal pump	Electric driven, with space heater
Bulk air compressor	2 off	20	5.6	Screw type	Electric driven, sea water cooled

4.40 Mud Agitator

One (1) set of agitator, electric driven, to be installed on the bottom of each mud tank.

4.41 Flow Meter

"All flow meter with calibration certificates
One F.O. flow meter with local read-out for cargo F.O. is to be installed.

One F.W. flow meter with local read-out for cargo Fresh Water is to be installed.
One D.W flow meter with calibration certificates to be provided.
One F.O. flow meter is to be fitted in the discharge line from the transfer pumps. This meter should be fitted with in line filter at the inlet and have a by-pass line and valve fitted. Appropriate by-pass and strainers shall be provided at all flow-meters for maintenance of flow meter.

Fuel oil cargo flow meter should be of positive displacement type, provided with air eliminator tank of min. flow rate 2.5 m3/min.
-All flow meter will have additional remote read out to be installed inside ECR with ticket print out.

4.42 FW Cargo System:

Fresh water pipe system to be of seamless steel with flanges welded on.

Valves to be of cast iron or cast steel with internal and spindles of nonferrous material, operated by manual.

The FW cargo system to have transfer possibilities between tanks in foreship and tanks in aftship in addition to discharge to deck.

Flow meter for measuring filling and discharge with certificate of calibration to be arranged.

4.43 Ballast/Drill water System:

Ballast/drill water pipe system to be of seamless steel with flanges welded on.

Valves to be of cast iron or cast steel body with internal and spindles of nonferrous material, operated by manual. Valves on ship side to be of nodular cast iron or cast steel.

The ballast system to be arranged to obtain satisfactory trimming of the vessel. Pipe system to be designed with transfer possibility between the groups of tank, ballast water overboard, and the drill water system to have discharge to deck.

Flow meter for measuring filling and discharge with certificate of calibration to be arranged.

One of the W.B/D.W. cargo pump to be utilized as back-up FW cargo pump with spectacle blind flange.

4.44 Fuel oil Cargo System

FO pipes to be of seamless steel below main deck, on open deck and in cargo rail area the seamless steel pipes with flanges welded on.

Valves to be of ductile iron or cast steel with internal and spindles of nonferrous material, operated by manual.

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

Flow meter for measuring filling and discharge with certificate of calibration to be arranged.

The fuel oil cargo system to have connection to domestic fuel system.

Fuel oil cargo pump to be arranged with coaming around foundation with an arrangement suitable for efficient drain.

4.45 Liquid Mud / Brine water / System

The l Mud/Brine system is to be designed for cargo of s.g. up to 2.5 and pollution hazard only, non-flammable.

The liquid mud pump is to be located as close as possible to the mud tanks as practical.

The liquid mud pumps to be provided pressure/vacuum gauge.

Electric driven agitator to be installed in all mud tanks.

Liquid mud tanks to be fitted with high level.

Re-circulation in piping for liquid mud agitation to be provided.

The Mud/Brine system to be arranged with blind flange and spool piece.

4.46 Pneumatic Bulk Cargo Handling System

The dry bulk system shall be suitable to transport two grades of cargoes cement/barite/bentonite having a specification of 2.5t/m^3. The system to be designed into 2 segregated systems. Two loading / discharge station to be provided for each system each side. (One in midship, one in stern part)

Pneumatic handling system to be provided for unloading cement tanks. The plant to consist of two (2) compressors of suitable capacity to be delivered as one unit and flexible mounted.

The system & actual equipment to be installed will be based on the manufacturer‟s recommendations but shall include all necessary fittings, controls, safety cutouts, valves, dryers and alarms etc suitable for the application.

Four (4) Dry bulk tanks to be free standing and circular cylinder type, operation pressure 5.6 bar.

Two (2) unit of electrically driven bulk air compressor to be provided, sea water cooled with a capacity of app. 20m^3/min @ 5.6 bar for each unit.

After coolers complete with moisture separator and auto drain trap, all to manufacturer"s recommendation. Electric motors and air compressor units mounted on common skid.

Two (2) off air dryer each of approved capacity.

Discharge and loading pipe bend radius to be minimum 5 times the diameter.

Vent pipe bend radius to be minimum 3 times the diameter.

The system to be arranged with emergency stop switch mounted on the central control panel located in the wheelhouse.

4.47 Tank Vent System

Vents shall be provided for all tanks, voids, cofferdams, and sea chests. No vents shall be located in way of the removable bulwark and cargo rail sections, if impossible, removable vents to be provided.

Mud tank air vent pipe to be fitted a burst disc with rupture pressure of 0.2 Bar.

4.48 Tank Level Gauging System

Sounding pipes shall be of welded type with closure devices for tanks except fresh water tanks.

Each FO storage tank to be provided with 90% floater type high level alarm. Visual and buzzer alarm to be fitted in ECR.

Each fresh water tanks provided floater type level gauge.

4.49 Recovered Oil System.

Recovered oil pipes to be seamless steel below main deck; on open deck and in cargo rail area the seamless pipes to be hot dip galvanized outside pipe after completed welding and treatment with flanges welded on.

The vessel to have BV “Special service, Oil recovery ship” notation. There is no requirement of dedicated recovered oil tank. The suitable Mud tank can be designated as recovered oil storage tank subject to the approval from class.

One line of compress air for oil boom to be pre-installed.
One electric outlet cabinet for ORO to be provided at the cargo deck each side.

All oil recovery tanks to have approx. 800 mm dia flush manhole opening directly to main deck. Provided filling connection and Pressure / Vacuum valve

Two portable instruments of an approved type are to be provided onboard the vessel for hydrocarbon gas detection/measurements.

Two portable hydrogen sulfide gas monitoring devices are to be provided onboard the vessel.

Two portable foam applicator units are to be provided. A portable foam applicator unit is to consist of an air-foam nozzle of an inductor type capable of being connected to the fire main by a fire hose together with a portable tank containing at least 20 liters of foam-making liquid. The nozzle is to be capable of producing effective foam suitable for extinguishing an oil fire, at the rate of at least 90 m^3/hr. A total of at least eight portable tanks of foam-making liquid are to be supplied on board.

Oil recovery equipment (Owner-provided)

One set of containerized oil recovery equipment, be composed of hydraulic power pack unit, weir skimmer head, floating umbilical, storage and handling unit, instrumentation, hose for external connections, etc, be Owner provided.

5 DECK MACHINERY & HULL FITTINGS

5.1 General

All deck machinery and equipment are to be supplied and installed to meet classification requirement.

Following information is for guidance only and subject to class acceptance & equipment number calculation for this class of vessel.

Protective guard is to be provided in way of deck machinery equipment at local control panel area.

5.2 Anchors, Chain Cables & Mooring Lines

The anchors, chain cables and mooring lines are to be supplied in accordance with the classification"s requirements. For guidance, they are as follows:

Anchor	: Two (2) AC-14 HHP stockless anchors, stowed in anchor-pockets, each of 1,710 kg.
Chain cable	: Total length of 660m x Ø 36mm / Grade U3 stud-link-chain cables, divided to port and starboard side with swivel and shackle.
Chain stoppers	: Two (2)
Mooring lines	: 4 x 170m long, Ø36 mm dia. mooring ropes of min. 172kN breaking strength.
Towline	: Nill

5.3 Anchor Windlass

Two (2) off electro-hydraulic combined anchor windlass to be fitted on Upper forecastle deck. Local control as well as remotely from wheelhouse.

Combined windlass to be provided with following equipment:

1 off Declutchable cable lifter, suitable for the chain cable required by Class.
Chain dia./grade: Ø36 mm grade 3.
The cable lifters to be fitted with hand operated brake and coupling.
1 off warping ends
1 off Declutchable mooring drums, split type.
Stowing capacity: 170 m of 36 mm dia. rope.

Duty on cable lifters	: 62kN x 9 m/min.
Duty on mooring drums	: 38kN x 15 m/min.

5.4 Capstans

Two (2) capstans, electro-hydraulic with warping head shall be arranged at the stern of the ship.

Each capstan shall be capable of 5 tonnes @ 15m/min, local control.

5.5 Tugger winches:

No.	: 2 sets
Type	: electro-hydraulic, one drum and without warping head
Drum Capacity	: 250 m Ø22 mm wire
Rated Pull (1st layer)	: 10 tonnes @ 15m/min.
Control	: local

5.6 Towing and anchor handling winch:

No.	: 1 set
Type	: Double Drums in Waterfall Arrangement
Towing	: upper fwd drum
Anchor Handling	: lower aft drum
Drum Capacity	: 1200m x 60mm dia. SWR Steel Wire Rope
Rated Pull (1st layer)	: 150 tonnes @ 5m/min.
Brake	: Spring acting, hydraulic cylinder release
Brake Holding	: 250 tonnes (1st layer)
Clutch	: Hydraulic cylinder operated.
Control	:

- Electro-Hydraulic Power Pack unit:

The unit to be high pressure system and would comprise of approximately two electric motors, but should be based on manufacturer‟s recommendations.

The unit shall be supply hydraulic oil to towing/anchor handling winch, capstan and tugger winches.

Hydraulic power pack to be seawater cooled.
Oil system is to be provided with appropriate filters.

5.7 Storage Reel

One (1) electro-hydraulic powered storage reel winch to be provided. Drum capacity of 1,200m x 60mm dia. steel wire rope, rated pull at 1st layer is 10 tonnes @ 0 - 15m/min. One small crucifix with fairlead roller to be installed.

5.8 Shark Jaw and towing pins:

One (1) unit of hydraulically operated shark jaw, SWL 300t, retractable type of approved maker to be installed on main deck aft.

One (1) pair of vertical hydraulic towing pins, SWL 300t, retractable type of approved maker, closed top to be installed in the center line of the main deck.

- Hydraulic power pack unit:

The hydraulic power pack for shark jaw and towing pins to be supplied and installed in accordance to manufacturer's recommendation.

The control of towing pins and shark jaws shall be locally and remote from bridge Aft console.

5.9 Stern roller:

A stern roller min. 5m lengths by 2m diameter (SWL 300 mt) with weld-able steel shaft running on two bearings, one on each end of the roller, to be installed in center line of the transom stern.

5.10 GOB EYE

One (1) set of recess type pad eyes for anchor handling securing to be provided. SWL 150t to be permanently marked with bead welded.

The deck in way of the pad-eyes is to be adequately reinforced.

5.11 Provision Crane

One (1) off electro-hydraulic operated single arm crane to be provided aft accommodation starboard side.

Capacity to be 3t SWL at 14m radius.

The crane to serve for shore gangway, access hatches on main deck and working deck.

5.12 Mast

The navigation mast is to be completely fitted out with necessary brackets and stays for navigation lights and shapes. Climbing rungs to be provided.

Buyer is to apply for exemption of forward mast, position of stern light and separate of mast light distance from statutory authority.

5.13 Manholes

All manholes are to be standard elongated shape with stainless steel studs and nuts (316L). In way of accommodation, they are to be of recessed type with flush wooden covers to match deck level.

Manholes according to Yard standard and with light opening 400 x 600 mm in general. For Liquid mud/Brine tanks, the manholes on Main deck shall have a light opening of approx. 850 diameter to ensure that mechanical installations inside tanks (agitators, etc.) shall be accessible through manhole.

5.14 Hatches

Watertight hatches to be provided for the following compartments:

- engine room 1 off
- aft thruster compartment 1 off
- bosun store 1 off
- bow thruster room 1 off

Rungs or vertical ladder to be fitted for each hatch.

5.15 Draft Marks

Draft marks are to be in metric P&S forward, amidship and aft as per the relevant regulations.

5.16 Logos

Logos are to be steel plate and welded on the outboard side of funnels.

5.17 Nameplates and Notice Boards

All cabins and rooms, work spaces etc. to be identified by plastic name plates over doors. All such name plates to indicate name of compartment.

Notice boards and name plates as requested by Classification and Authority regulations are to be provided.

Shipbuilder‟s names plates to be fitted on deckhouse front.

Labels are to be supplied for all keys. All tags to be marked for space and numbered.

Valve name plates are to be bolted to valve wheels. Air sounding pipe filling and discharge pipes to have name plate.

5.18 Storm Rails (Grab Rails)

Storm rails to be fitted all round wheelhouse and on exterior bulkheads. Storm rails also to be fitted in convenient positions in toilets and engine room.

5.19 Drainage for Decks

Suitable scupper pipes to be positioned in funnels, along the main deck, forecastle deck and wheelhouse top to facilitate deck drainage.

5.20 Gangway / Bulwark Gates

One (1) 5 m x 0.6 m portable aluminium gangway complete with handrail and net is to be provided.

Two (2) hinges steel gates to be fitted, one on each side.

5.21 Fixed Mooring Equipment

Bollard, chocks and rollers, etc. to be provided where necessary for mooring arrangement.

The arrangement, quantity and the size of fixed mooring equipment shall be submitted to the owner for approval on the detail design stage.

5.22 Handrails & Stanchions

Stanchions are to be 65 x 16 F.B. x 1000mm high with short backstays and spaced not more than 1.5m apart. Top rails of Ø42 mm pipe and the lower rails of Ø19 mm steel bar. At access points (if fitted) short link galvanised chain with hook and eyes to be installed.

5.23 Covers for Deck Equipment

Strong canvas covers for compass, searchlights and anchor windlass, etc. are to be provided.

5.24 Ladders

All ladders to be steel construction. External ladders to be non-slip, made of chequer plate or similar construction. Vertical ladder to be constructed with 19mm square bar rungs welded to steel flat bar and to be 250mm clear of steel bulkheads. Hand grips to be fitted as necessary.

5.25 Rubber Fenders

"W" type rubber fender to be fitted at stern and bow as shown on GA.

Vessel to be fitted with tyre fenders each side. Final position according to agreement with owner. Tyre fenders to be bolted in accordance with suppliers recommendations. Fender plan to be approved by Owner.

5.26 Deck Sheathing

75mm thick marine type hardwood deck sheathing over T-section is to be fitted to the cargo deck as shown on General Arrangement plan.

Proper drainage is to be provided.

5.27 Cargo Rollers

Ten (10) sets of cargo rollers, five (5) at each side, to be installed inside cargo rail.

5.28 Cargo Lashings / Separation Stanchions

6 SAFETY SYSTEM

6.1 Life Saving / Rescue Equipment

Life saving equipment is to be in accordance with the requirements of the Class and Government authority for total complement of fifty (50). Quantity below are provided as guidance.

1.	Rescue boat with davit	Refer to **6.2**
2.	Life rafts	Six (6) off 25 men inflatable life rafts with full emergency pack in rigid fibreglass container conforming to SOLAS 74 convention.
3.	Lifebuoys	Acc. to Class and Government authority
4.	Lifejackets	Fifty (50) approved type lifejackets to be supplied and stowed adjacent to each berth plus ten (10) additional spare jacket.
5.	Immersion suit	To follow and comply with SOLAS requirement.
6.	Pyrotechnics	- One (1) line throwing apparatus (4 projectiles & 4 lines) - Twelve (12) parachute distress rockets. - Two (2) orange smoke signals. - Six (6) hand flares -
7.	Rope Ladders	Two (2) embarkation rope ladders to be provided
8.	Emergency escape breathing devices	To follow and comply with SOLAS requirement.
9.	Eyes washing / shower device	Two (2) sets
10.	Safety Plans and Personnel Muster List	There are to be displayed in glass protected frame work on each deck level.
11.	Scrambling nets	Two (2) sets
12.	Rescue basket	One (1) set
13.	First Aid Kits	As per rule
14.	Ships‟ Medical Stores	To meet minimum requirements of Class
15.	Paraguard Stretcher	One (1) set

6.2 Rescue boat with Davit

One (1) off rescue boat of approved type with water jet inboard engine to be delivered and installed. The capacity of the rescue boat to be 15 persons. The rescue boat to be capable of maneuvering, for at least 4 hours, at a speed of at least 20 kn with 15 persons, 25kn with 6 persons.

The rescue boat to be delivered with protection canvas.

One (1) SOLAS approved single point A-frame shall be installed to handle the rescue boat.

Electric socket (24 V DC or 42V DC or 220 V AC depending on rescue boat maker requirement) to be provided on the davit leg for the purpose of supplying the rescue boat battery charging current.

Power supply shall be taken from the emergency generator.

6.3 Rescue Zones

Rescue zones shall be established on both sides of the vessel and will meet with the following requirements:

a) Each side of the vessel marked with 6mm steel plate rescue zone which is painted in bright yellow with diagonal black stripes
b) Each rescue zone to be not less than 5 metres in length
c) Each rescue zone to be illuminated both on deck and over side with no shadow areas
d) Bulwarks to be both side open type to allow an open working area and to be abt. 5.0 metres in width
e) Cargo rail shall be starboard side removable type (about 5m width)
f) Two (2) scrambling nets to be supplied to the vessel that can be fitted in the area of the rescue zone such that the maximum height from sea to the main deck to be no more than 1.75 m, with a minimum clearance of 0.20 m off the vessel‟s side
g) Suitable securing points for scrambling nets, safety lines and rescue craft
h) Each rescue zone shall be illuminated both on deck
i) A clear access will be provided to the survivor holding area.

6.4 Fire-fighting Equipment

Fire-fighting equipment is to be provided to meet classification and government regulations and generally in accordance with the following:

1) Firemain
Refer to section: MACHINERY.

2) Fixed CO_2 System
Refer to section: MACHINERY.

3) Fireman‟s Outfit

Four (4) complete fireman‟s outfit are to be provided, each consists of:

a) Two (2) aluminium asbestos protective clothing
b) One (1) breathing apparatus & safety line (c/w spare cylinder)
c) One (1) 12” fireman‟s axe
d) One (1) safety lamp of portable battery type (3 hours)
e) Two (2) sets of gloves & boots & helmet with visor
f) Two (2) spare cylinders for each SCBA to be added
g) One (1) charging compressor 200 bar for refill of the air bottles for EEBD / SCBA.

7 ELECTRICAL

7.1 General Installation

Electrical apparatus and wiring system are to comply generally with the respective classification society‟s requirements.

All electrical fittings used to be of good quality and suitable for tropical and marine environment.

All the electrical equipment installed in hazardous area to be explosion proof type.

7.2 System of Supply

a)	440 volts, 3 phase, 60 Hz	- for power (motor)
b)	220 volts, 1 phase, 60 Hz	- for lightings and power less than 3 kW
c)	24V D.C.	- for alarms, emergency lights in selected areas, radio, navigational aids, navigation lights and other emergency loads
d)	440 volts, 3 phase, 60 Hz	- for emergency lighting, communications, alarms, steering gear system, etc

7.3 Power Supply

➢ Normal Supply

The A.C main power supply system is to be obtained from:

- Three (3) 350 ekW diesel driven alternators (440V/3/60Hz).
- Two (2) 1000 ekW shaft generators (440V/3/60Hz).

➢ Emergency Supply

For emergency duties the power supply shall be obtained from a 99 kW capacity, 440V/3/60Hz diesel generator arranged for independent battery starting in the event the main power supply fails. The emergency generator shall be started and supply power to consumer loads within 45 seconds.

➢ Shore Supply

A 400 Amp T.P 440V/3/60Hz, 3 wire watertight shore supply complete with connection box, sequence indicator, circuit breaker and connected to the main switchboard.

➢ 24V D.C Supply

a) The 24V D.C main supply is to be obtained from two (2) banks of 24V 200AH main batteries via the main battery charger. Batteries to be sized for ship‟s power supply for emergency duties. Batteries to be float charged by two (2) 40 amp battery chargers.
   In the event of failure of the main (or emergency) source of power, the emergency batteries shall automatically supply power to the emergency communications and navigation aids, etc.

b) A 24V D.C supply for the radio equipment is to be obtained from one (1) bank of 200 AH main batteries via the radio battery charging panel, powered by one (1) 40 amp battery charger, automatically regulated.

7.4 Switchboard - Main

The main switchboard shall be of opened hinged front and opened back screw type and arranged in the engine control room. A fixed louver complete with fine insect netting shall be installed in the back plate.

It shall be fitted with split busbars, circuit breakers, voltmeters, ammeters, frequency meter and earthing for controlling the entire A.C. system. For generator protection the generator circuit breakers shall have under voltage trip inverse time over current and instantaneous trip devices. Synchronising equipment for manual parallel operation of diesel driven generators shall be installed with synchronising lamps, synchronous scope, selector switch for generators, frequency meter, governor motor switch etc. In addition to under voltage and over current relays, a reverse power relay shall be provided.

Interlocking between shore power connection and generators shall be fitted. An ground indication light and testing switch shall be fitted and also a selector switch for ammeter and voltmeter.

The internal wiring of the switchboard shall be carried out in EPR insulated wire to Classification and specification with a maximum operating temperature and having the following insulation grades:
- Power Cables : 440 volts
- Control Cables : 220 volts

On completion of manufacturing and before despatched to the vessel the switchboard shall be subject to an electrical voltage test of 2000 volts at a frequency between 25 to 100 cycles in accordance with Classification requirements.

A rubber insulating mat shall be laid full length in front of and behind the switchboard. It shall have a minimum width of 600mm.

All components throughout the switchboard shall be provided with white-black-white traffolite nameplates clearly indicating the components service and normal full load current ratings. The plates shall be secured with brass pins or screws.

An insulated handrail shall be fitted to the front of the switchboard; it shall be at a convenient height and run the full length of the switchboard.

AC Switchboard

The AC switchboard is to be provided with controls and instruments for each generator as required by the Classification Society. Following items are for guidance only:

- air circuit breaker c/w long time over-current protection, short-time delay trip and reverse power relays
- voltmeter c/w selector switch
- ammeter c/w selector switch
- kilowatt meter
- frequency meter
- voltage regulator
- emergency push switch
- indicator lights
- Automatic paralleling / synchronization / load shedding manual operation is to be possible.
- governor switch
- ground detection system (lamp type) and low lever insulation monitoring device with alarm

The following outgoing circuits are to be fed from the 440V and 220V bus-bar via plug-in moulded cased circuit breaker:

- air conditioning plant
- ventilation fans
- galley range
- anchor windlass
- anchor handling /towing winch
- tugger winch
- shark jaw and towing pin
- capstan
- bilge and ballast pump
- freshwater pressure set
- FW transfer pump
- cold and cool room refrigeration plant
- fuel oil transfer pumps
- starting air compressors
- transformers
- bilge oily water separator
- fuel oil purifier
- G.S. & fire pump
- Lub oil transfer pump
- main engine standby pumps
- air compressors
- f w cargo pumps
- fuel oil cargo pump
- general lighting & power
- dirty oil pump
- engine cooling pumps
- battery charger
- thruster motors

- spare circuit breakers, 15% of total

7.5 Switchboard - Emergency

One (1) emergency switchboard similar in construction to main AC switchboard shall be provided for the control of diesel engine driven emergency alternator set. During normal operation the emergency switchboard shall receive power from the main switchboard.

Distribution of electrical power shall be made available both at 440V and at 220V levels.

The 220V distribution shall be derived from 440/220V transformers.

7.6 24V DC Switchboard (Emergency)

The instrumentations and controls are to consist of the following:
- battery charging switch
- moulded-case circuit breaker
- ammeter c/w shunt
- voltmeter
- indication lights
- battery change-over switch
- earth leakage monitoring with test system, etc.

The following outgoing circuits to be fed from the bus-bar via moulded-cased circuit breakers:
- navigational aids
- alarms (general, fire, engines and low levels)
- emergency lights, etc.

7.7 24V DC Radio Charging Panel

The instrumentations and controls are to consist of the following:
- battery charging switch
- battery change-over switch
- ammeter c/w shunt
- voltmeter
- indication lights
- outgoing miniature circuit breakers (MCB)
- earth leakage monitoring with test system

7.8 Cable Installation

All cables shall meet with Classification rules. Where exposed to damage, and in machinery spaces, cables to have galvanised steel wire braid armour and PVC outer sheathed.

Care shall be exercised in the run of all cables to avoid areas of excessive temperature, action from condensed moisture or drip and protected from risk of mechanical damage.

Power cable and signal cable should be laid in separate cable trays with distance of class requirements.

When required, the water tightness of the cable ends situated below the bulkhead deck shall be ensured by appropriate means at the time of installation.

Normally cable runs shall not include joints. If a joint is absolutely necessary or desirable, it shall be carried out in a suitable box of such design that the conductors remain properly insulated and protected from atmosphere action, and fitted with terminals .
In toilet and washroom areas as far as practicable only cables absolutely necessary for the supply of equipment used in these spaces shall be permitted.

All cables to be regularly colour coded or labelled.

Penetration of watertight decks and bulkhead shall be effected in watertight manner.

Lighter individual stuffed glands or boxes containing several cables and filled with fire retarding packing shall be used for this purpose.

7.9 Busbar Colours

Busbar of different polarity shall be clearly marked with distinguishing colours as follows (final acc. to vendor‟s standard) :

Red : Phase one
Yellow : Phase two
Blue : Phase three

7.10 Cable Tray / Supports

Cables within machinery spaces shall be secured by approved type ties onto perforated galvanised steel tray/galvanised cable ladder.

In accommodation spaces, cables shall be run behind panelling in horizontal or vertical run in an orderly manner and clipped to straps welded to frames. Where it is not practical to run cable behind panelling the cable shall be covered with battens.

Cables subject to weather or mechanical damage shall be run suitably supported in pipe with welded unions. Pipe shall be smooth on the interior and not subject to deterioration from the effects of moisture. The pipes shall have their ends shaped or bushed in such a way as not to damage the cable covering. The pipes shall be mechanically and electrically connected to terminating boxes.

7.11 Distribution

Distribution shall be by the three wires with neutral earthed system.
Distribution of power throughout the vessel shall be generally as described.

AC and DC distribution boards are to be TP and double pole respectively and provided c/w miniature circuit breakers.

1) DC Distribution Boards
- 24V DC distribution board
- Emergency lights distribution board

2) AC Distribution Boards
- Below main deck distribution board
- Main/ raised deck distribution board
- Forecastle deck distribution board
- Bridge deck distribution boards
- Wheelhouse distribution boards

7.12 Switch Panels

Switch panels shall be sited at the wheelhouse and all outgoing circuits fitted with nameplates indicating the circuits.

Radio Switch Panel (24V D.C.)
The radio switch panel shall be powered from the radio battery via the radio charging panel. It shall be fitted with indication lights, ampere and voltage meters, fuses, circuit breakers and alarm indicator.

Navigation Light Switch Panel
This panel shall be fitted with a built-in indicators, switches, buzzers, fuses, failure alarm indicator and change-over switch. Main supply is obtained from emergency and 220/1/60 Hz A.C supply.

7.13 Motors

All motors shall be suitable for working in climatic conditions and in accordance with the requirements of Classification.

Generators and motors in excess of 50 kW shall have built in space heaters.

7.14 Motor Starters

All motor starters shall be tested in accordance with Classification.
All motor starters shall be enclosed in steel cases. The applied paint shall be treated in accordance with Classification Regulation.

All cut outs and door edges shall be suitably sealed with gaskets, ensuring that the case is IP22.

Every starter shall have the load break insulator mechanically interlocked with the case door; ensuring power is off when door is opened.

All outgoing cable terminations shall be located above in removable 6.5mm gland plate located in the base of the case thus providing ready access to terminals and glands.

A starter shall be provided for all electric motor 0.5kW and above.

Motors up to 28kW rating shall be started by means of a „DIRECT ON LINE" type starter. Motors between 28kW and 86kW shall be started by means of a "STAR/DELTA" type starter. Motors above 86kW shall be started by means of an "AUTOTRANSFORMER" type starter or soft starter.

All the motor starters for oil related pumps and fans to engine room shall be fitted with remote stop stations located one in the passageway outside the machinery space and one in the wheelhouse.

7.15 Transformers

- For main lighting system

Rating capacity	about 75kVA, 2 sets, Phase 3
Type	dry, insulation F or B class
V1/V2	440V/220V, Connection D/D

- For emergency lighting system

Rating capacity	about 30kVA, 2 sets, Phase 3
Type	dry, insulation F or B class
V1/V2	440V/220V, Connection D/D

7.16 Storage Batteries

All batteries shall be of the lead acid type.
All batteries shall be installed in battery room on the compass deck. The batteries shall be set on non-absorbent insulating supports with similar spacer blocks at the sides to secure air circulation space round the battery.

The battery space shall be painted with a corrosion resistant paint.

7.17 Shore connection equipment

Provision shall be made to connect a 400A, 440 Volt, 3 Phase, 60 Hz, supply from shore to the main switchboard.

The system shall be arranged so that it is not possible to parallel ship"s alternators with shore supply.

The connection box shall be complete with circuit breaker, phase sequence indicator, pilot lamps and socket.

7.18 Fuses & Circuit Breakers

Fuses circuit breakers used throughout the installation shall be of the Classification approved type and shall be suitably sized to circuit requirements.

7.19 Switches

All switches in the accommodation are to be flushed mounted and switches in the engine room and other machinery and watertight compartments are to be watertight and metal mould (marine type) Control switches shall be suitably sized to circuit requirements.

7.20 Sockets & Terminals

Cable sockets and connecting terminals shall be of such dimensions that the maximum current likely to flow through them shall not produce heat which would be injurious to the installation.

Where soldering is adopted for securing cable sockets and connecting terminals, corrosive solid or liquid shall not be used.

Accommodation:
Non-watertight 220/1/60, switch sockets, flush or surface mounted shall be fitted throughout the accommodation spaces.

Engine Room/Galley/Stores:
Watertight 220/1/60, switch sockets, marine moulded type surface mounted shall be fitted throughout the engine room, galley and store space

7.21 Lighting

All rooms shall be provided with electric lighting. In general, fluorescent light are to be fitted unless the incandescent lamp shall be provided where impractical.

Main lighting shall be laid out for 220 V. Light fittings are to be fitted with vibrating dampers where necessary.

Emergency lights are to be installed according to the rules and regulations.

- Lighting for Accommodation

All cabins are to have ceiling light fitting, bed lamps, desk lamps, socket outlets. Mirror light with socket shall be mounted in cabins‟ bathroom/washstand. Fluorescent light fittings are to be provided in all alleyways and stairs.

Bridge and chart room is to have ceiling lighting and working light over chart-table and radio table.

Plug sockets with suitable number shall be provided including dimming device for chart-table lamp, compass lights, tachometers and rudder angle indicator.

Plug socket for daylight signaling lamp shall be provided.

- Lighting for Engine Room & Other Technical Room below Main Deck

Engine rooms and other machinery room below main deck are to be fitted with watertight fluorescent light fittings and watertight plug sockets. Engine room lighting shall be supplied from different distribution board and shall be arranged alternatively to minimize blackout of entire engine room should failure occur to any one source.

- Lighting for Deck

Floodlights, 6 off, 2 forward 500W, 4 aft 1000W, to be provided on navigation bridge deck.

All lighting on deck shall be provided with on/off switches to be installed in the bridge. Watertight plug sockets are to be fitted in alleyways at outside doors in each side. Watertight light fittings are to be installed for outside lighting.

Sufficient lighting to be provided along the cargo rails, main deck aft working area, and forward mooring area which is covered.

The helicopter winching deck area to be well-lighted.

7.22 Navigation Lights

Double tier lens, 220V navigation lights shall be fitted. The navigation lights shall be according to International Regulations. At least to consist of the following:-

- Three (3) Masthead lights
- Two (2) Towing lights
- One (1) Port light
- One (1) Starboard light
- One (1) Stern light
- Two (2) Anchor lights
- One (1) set of Immigration lights
- One (1) set NUC lights (three in number)

All navigation lights shall be controlled by indicator panel fitted in the Wheelhouse. The supply shall be taken normally from the main and emergency 220/1/60 A.C. supply.

Each navigation light shall be controlled and protected by a double pole switch and fused on each conductor. A visual and audio indicator shall be fitted.

7.23 Emergency Lights (220V A.C.)

Emergency light is to be provided and fitted at strategic points in the wheelhouse, lobby, aft thruster, bow thruster and cement tank compartments, engine room, at entrances, galley, mess and radio area. All to Classification and relevant Authority requirements.

Emergency lights shall be automatically energised on failure of main A.C. supply and shall form part of the normal lighting system.

Following emergency lights to be fed from 24V D.C. before taken over by 220V A.C.:

- one in wheelhouse
- one each at corridor of each tier of deckhouse
- one in steering gear room
- one in engine room
- one in engine room forward part

7.24 Fire & General Alarm

Fire and general alarm supply system is to be taken from 220V A.C. and the 24V D.C. supplies. Alarm push buttons are to be fitted in wheelhouse, forecastle deck, main deck, bow thruster compartment and engine room. Alarm bells are to be sited in wheelhouse, forecastle, and main deck lobby. An alarm horn is to be installed in the bow thruster compartment. In the engine room, an alarm horn complete with a red rotating beacon is also to be fitted. The installation shall meet SOLAS, Classification and relevant Authority requirements.

7.25 Main & Auxiliary Engine Alarm

All alarm shall be operated on 24V D.C.
All the engines and low level alarms shall be provided with a panel in the Engine Control Room and in the wheelhouse with visual and audio indicators.

A steering gear visual and audio alarm indicated shall be provided.

7.26 Extension Alarm System

The alarms to the bridge and accommodation, including on duty engineer selection and engineer call system shall be provided according to the rules.

Group alarm panels and selection panels are to be included as following:

Engine control room	1 pc
Bridge	1 pc
Engineers cabins	3 pcs
Mess room	1 pc

The system is to have a “Call all engineer and call duty engineer” function.

In addition, Vessel shall be fitted with a minimum of five (5) H2S and hydrocarbon sensors with automatic alarms. These sensors shall be located in the bow, stern, port, starboard, and wheelhouse top, the sensors are to be suitable for working in a marine environment and be capable of being immersed in salt water for short periods.

7.27 Engine Room Alarm Device

In the engine room, the separate alarm indicating panels shall be provided, which consist of:

- General alarm
- Machinery alarm
- Fire alarm
- CO_2

7.28 LAN

Cabling for LAN to be installed, with sockets in wheelhouse, ECR, ship office, and cabins.

7.29 Safety & Emergency Operation

All necessary safety and emergency operation are to be located in separate control panels.

Separate safety control system shall be situated in the control places in engine control room and on the bridge if required by rules and regulations.

The main engines are to be provided with separate safety system for each engine according to the rules. Indication and controlling of the vessel at the aft control station shall be reflection of actual movement of the vessel. Indication shall be properly colored and named.

<u>Cargo pump remote shutdown</u>
Mud pumps, brine pumps to have remote shutdown at wheelhouse aft control station.

7.30 MOB Alarm

Bridge operated “Man Overboard” alarm to be installed which is clearly audible throughout the vessel and is separated and distinct from all other alarms.

7.31 CCTV

- Two cameras at anchor handling/towing winch position with display after console.

8 Navigation Equipment

The following navigation equipments are to be fitted and to comply with latest IMO / SOLAS requirement for GMDSS sea area: “A3” c/w console table and all the equipments are to be submitted to the owner for approval prior to purchase.

8.1 DGPS Navigator Equipment

One (1) unit IMO type approved DGPS navigator equipment for indication of vessel‟s position,

8.2 DGPS Equipment (item supplied by DP System supplier)

Two (2) units of DGPS equipment are to be installed as per DP manufacturer‟s recommendation.

8.3 Radars

Two (2) radars. One (1) X-band, one (1) S-band with daylight and table mounted. They are of gyro stabilized type (IMO approved type) and system to interface to Gyro-compass, GPS, time and speed, etc. They are of ARPA radar with transceiver performance monitor, antenna, radar display, electronic cabinet, keyboard. Both radars fitted at forward wheelhouse control position.

Remote radar LCD display monitor.

8.4 Echo Sounder

One (1) unit IMO type approved navigation echo sounder with remote read out in both metres and feet. Depth range from 0 to 600m, bottom alarm, depth alarm, interface with GPS and NMEA and other navigation data equipment comprising of one (1) unit depth graphic LCD with integral keyboard, transducer of 200 kHz, junction box and one repeater for the aft control station.

8.5 Magnetic Compasses

One (1) reflector type compass c/w Azimuth circle, spare compass cord and bowl. It is capable of obtaining compass errors and positioned to obtain errors.

8.6 Automatic Identification System (AIS)

One (1) unit Automatic Identification System (AIS), Gyro compass and GPS signals are to be interfaced to the AIS system to conform to SOLAS as amended and IMO‟s Performance Standard for AIS.

8.7 Doppler Speed Log

One (1) unit of IMO type approved Doppler speed log fitted in wheelhouse forward console with repeater in wheelhouse aft console.

8.8 Anemometer and Anemoscope Equipment

Two (2) units of Wind Speed & Direction in knots indication. Each comprising of one (1) wind sensor and one (1) wind display on AC220V operation.

8.9 Gyro Compass c/w Auto-pilot

Three (3) IMO approved type Gyro-compasses to be provided for DPS-2 operation.

Five (5) repeater to be provided:
- Two single scale bearing repeater (bridgewing port & stbd)
- Two analogue dial repeater, flush mount (fwd & aft bridge console)
- One digital repeater with bracket in aft thruster room

8.10 Horns

One (1) electrically activated marine air horn (to be operable at fwd and aft control).

8.11 Ship's Bell

One (1) 300mm brass bell, engraved with the name and year of completion of the vessel.

8.12 Clinometers

Three (3) units, wall mounted with one (1) in wheelhouse and two (2) in engine room.

8.13 Flags (Owner Supply)

One (1) complete set of International signaling flags
Two (2) National Ensign
Two (2) International signal code manual (one for visual, one for radio)
One (1) set of Flag of country of Builder (~30 country)
One (1) Charterer courtesy ensigns – Owner supplied

8.14 Chart Table

Chart table to be fitted with chart drawers & table light with dimmer.

8.15 Electrical Navigation Lights & Shapes

A complete set of dual lens, navigation lights are to be supplied and fitted as specified in electrical section.

In addition to this, the following is to be supplied:
- Two (2) black circular shapes of 600 mm diameter
- One (1) black diamond shape of 600 mm

Others as required by Rules and Regulations

8.16 Chart & Reference Materials (Owner supplied)

One (1) set of relevant charts for International Water Area and publications and tide table including the following:
- Deck Log Book
- Oil Record Book
- Compass Error Book
- British Admiralty Charts for Middle East Waters Corrected up-to-date (exact area to be define)
- Operation Field Charts
- Operation Tide Tables
- Admiralty Pilot Book For Middle East
- Operation Port Authority Regulation in operating areas
- Nautical Almanac
- Browns or similar with Rules of the Road

8.17 Searchlights

Three (3) 2000W halogen searchlights with remote controls in wheelhouse.
Two (2) in forward and one (1) in aft wheelhouse stations.

8.18 Clocks

Marine battery clocks and radio clock to be provided.

8.19 Signal Lamp

One (1) unit portable signal lamp c/w battery in a box, 24V DC.

8.20 Wipers / CVS

Refer to section: **ACCOMMODATION & WHEELHOUSE**

8.21 Barometer

One (1) barometer.

8.22 Thermometer

Three (3) thermometers (wet & dry type).

8.23 Binoculars

Two (2) binoculars with wooden stowage box forward and aft, Marine type.

8.24 Chronometer

One (1) chronometer

8.25 Manuals

All navigational equipment is to be provided with operation manual in English.

8.26 English Telegraphs

Three (3) sets electric push button telegraphs operating on 24 volt DC for twin screw propulsion in the wheelhouse and engine control room.

8.27 Bridge Navigation Watch Alarm System (BNWAS)

To be fitted to meet rules and regulations of International Performance Standards.

9 Communication Equipment

9.1 GMDSS A3 Radio Communication Equipment

The communication equipment to be supplied in accordance with Charterer Maritime Safety Authority requirements, Classification requirements to meet GMDSS A3 requirements and to consist of at least the following:

One (1) unit of compact radio console for operation in area A3 containing the following systems : MF / HF radio station 250 W for telephony, DSC, VHF radio telephone semi-duplex with DSC and inmarsat-C satellite communication.

The console is completely assembled and pre-wired. Equipped with all necessary equipment and components e.g. emergency light, voltage alarm system, AC / DC distribution and also includes GPS position data with data distribution.

It comprising of:

- Current / Direction Indicator
  Maker: Furuno C1-88 or equal

- One (1) unit MF / HF radio with transmitter 250 W (PEP) 1.6 – 27.5 MHz, main receiver 0.03 – 30 MHz, distress / safety DSC receiver operation terminal with display unit and keyboard and handset printer for 24 V, power supply 220 V and 24 V, (auto switch-over).

- Two (2) independent VHF Radio–telephones. Both to be multichannel 25 watt RF output power and 1 watt reduced RF output switch fitted with digital selective calling (DSC) and capable of receiving on 156.525 MHz (Channel 70).

- Two (2) Inmarsat-C Satellite Communication with operation terminal / transceiver unit with EGC / GPS and display unit, keyboard printer for 24 V, power supply 220 V and 24 V, (auto switch-over).

- FBB T&T SAILOR 250(Owner supply, and Builder to install)

9.2 Navtex Receiver Equipment

One (1) unit IMO type approved Navtex receiver, receiving SAR messages on dedicated 518 KHz, navigational and meteorological warnings, operates on 24 VDC.

9.3 SART

Two (2) units IMO type approved SART (9GHZ).

9.4 Emergency Position Indicating Radio Beacon (EPIRB)

One (1) EPIRB with 406 MHz primary. Ship‟s particulars programmed internally with automatic float-free hydrostatic release and operation manual.

9.5 Portable Transistorised Loud Hailer

One unit battery operated loud hailer.

9.6 GMDSS type-approved Walkie-Talkie

Three (3) units GMDSS type approved walkie-talkie, lithium battery pack, rechargeable battery pack, charger and antenna.

9.7 Ship Security Alert System (SSAS)

One (1) set Ship Security Alert System to be installed on-board and alert to consist of basic alert functions via e-mail to CSO and security agencies at least two alert button is to be situated at wheelhouse and captain‟s cabin and the system must be follow / comply with IMO / SOLAS requirement.

9.8 PA / intercom System

One (1) intercom/ public address system (PA) consisting of built-in facility for talk-back and paging c/w amplifier, microphone, etc. to be provided and system must comply with SOLAS requirement.

Fixed PA system covering the whole accommodation and deck area is to be clearly audible over the whole vessel with main engine and fire pump in operation.

9.9 Television Antenna (Terrestial)

One (1) Omni-directional receiving wideband television antenna system for output total 4 stations T.V unit in the accommodation area.

9.10 Sound Powered Phones

Sound powered phones to be fitted and system must comply with SOLAS requirement.

- Wheelhouse (fwd and aft)
- Captain and Chief Engineer Cabins
- Engine Room c/w headset, siren and rotating light
- Aft thruster room and Bow thruster Compartment c/w headset, siren and rotating light

9.11 Chart Plotter

One (1) set of chart plotter to be provided.
Maker: Garmin 5012 or equal.

9.12 Course Recorder

One (1) set of course recorder to be provided.

9.13 Aviation Radio

One (1) aviation radio, 25 watt, multi-channel, capable of digital selective calling (DSC), cover 121.5MNz, 135.90MNz and135.95MNz as minimum.

Maker: I-COM or equal.

9.14 Rig Move Radio

One (1) rig move radio, with remote hand set with permanently fitted with charge in place the control station. Cover 153.080MNz, 153.32MNz and153.560MNz as minimum.

Maker: I-COM or equal.

10 DYNAMIC POSITIONING SYSTEM

The vessel shall be equipped with dynamic positioning system to class requirement for DPS-2 notation, as per DP manufacturer's recommendation.

The control of the DP shall be at the aft wheelhouse console together with the independent joystick system in accordance with class requirements, fitted at the aft wheel house console.

- DP Environmental Condition with All thrusters at 100%

Significant wave height : 2.44m
Wave period : 10 sec
Wind speed : 33 knots
Current : 2 knots

The DP system shall consist of the following.
- One (1) independent Joystick
- Duplex DP workstations with two control and field cabinet
- VRU or MRU to DP-2 requirement
- Two (2) UPS
- One (1) printer
- One (1) laptop PC
- One changeover switch (DP/IJS/manual control)
- Three (3) reference system:
  - 1 X DGPS
  - 1 X DGPS
  - 1 X Cyscan system

The system shall have interface with DGPS, gyrocompass, wind tracker, VRU, UPS, printer, etc.

The electrical system on vessel including the switchboard shall be designed and installed according to the class requirement to meet DP Class 2.

FMEA study and analysis to be approved by class. FMEA trial is to be attended by third party.