TECHNICAL SPECIFICATION

FOR

65M ANCHOR HANDLING TUG

/ OIL RECOVERY

/ SUPPLY VESSEL

(REV 0)

OWNER: TBD

BUILDER: TBD

HULL NO.: TBD

DESIGNER: TBD

(Project No.: P-1672)

SECTION 1 - GENERAL

100. **Intent**

This specification together with the GA drawing is intended to describe the construction of an anchor handling tug / supply vessel completely outfitted and equipped for following duties.

1) Transportation of deck cargo and personnel between offshore platform and shore
2) Transport consumables - fresh water, diesel oil, bulk cement, liquid mud, drill water, brine, general materials and equipment etc. to offshore platform from shore base
3) External Fire-fighting
4) Rescue
5) Offshore platform towing / pushing
6) Anchor handling
7) Spilled oil recovery

The vessel will be registered as unrestricted service.

The Builder shall furnish all items required for the completion of the Vessel excepting items specifically stated herein as to be furnished and supplied by the Owner.

It is to be understood that anything not mentioned in the Specification but required by the Classification Society or Regulatory Bodies listed herein which are valid before and upon contract signing, shall be supplied and/or equipped by the Builder.

Even if any item is repeated twice or more in the Specification, it is to be understood that such item to be supplied and/or equipped once only.

101. **General Description**

The vessel is to be all welded steel construction with twin diesel engines, twin CP propellers. The vessel's accommodation is to be located on the forward decks.

Vessel design shall comply with SPS code 2008 and MLC 2006.

102. **Principal Particulars**

Length overall	:	65.00M
Length BP	:	58.50M
Beam moulded	:	16.00M

Depth moulded	:	6.20M
Draft designed	:	5.00M
Draft scantling	:	5.20M

Deadweight about 1,800 t at scantling draft.

Accommodation

8 x 1- berth cabins	:	8 men
5 x 2- berth cabins	:	10 men
8 x 4-berth cabins	:	32 men
Total	:	50 men

Tank capacity (approx)

Potable water	:	380 m^3
Fuel oil	:	550 m^3
Drill water	:	400 m^3
Fresh water ballast (incl. DW)	:	550 m^3
Dry bulk cargo tanks	:	150 m^3
Mud / Brine	:	400 m^3 (SG 2.5)
Rec. oil	:	400 m^3
Lub oil	:	10 m^3
Dirty oil	:	10 m^3
Foam	:	10 m^3
Dispersant	:	10 m^3

Deck cargo capacity	:	about 600 t
Deck cargo space	:	about. 435 m^2
Cargo deck design load	:	7 t / m^2
Engines	:	2 x 3,300 HP. Medium speed
Performance Speed	:	12.5 knots at trial condition, 100% MCR, design draft
Bollard pull	:	80 ton

Deck height	:	3,000mm between main deck and forecastle deck. 2,800mm between forecastle deck / upper forecastle deck / navigation bridge deck. 4,000mm between navigation bridge deck and compass deck (incl. 1,000mm high cofferdam).

103. **Classification**

Class notation: ABS+A1(E) OFFSHORE SUPPORT VESSEL (AH, SUPPLY-HNLS, TOW) OSR-C1 +AMS + DPS-2 FFV 1, SPS CODE UWILD UNRESTRICTED SERVICE

104. **Flag**

The vessel to fly Malaysia flag.

105. **Regulations**

The vessel is to comply with:-

1) Class Rules for Building and Classing of Steel Vessel, latest version.
2) Class Guide for shipbuilding and repair quality standard for hull structures during construction (latest version).
3) Marine Labor Convention 2006 & UK MERCHANT SHIPPING ACT (CREW ACCOMMODATION) REGULATION 1997
4) International Telecommunication and Radio regulation of 1973/1976 and 1982 including latest GMDSS-rules for radio communication.
5) International Convention for the Prevention of Collision at Sea 1972 including amendments.
6) International Convention for the Prevention of Pollution from Ships (MARPOL) 1973/1978, including latest amendments.
7) IMO Resolution A>468 (XII) Code on noise levels on board ships. (For guidance only)
8) IMO Resolution A719 (XVII) Prevention of Air Pollution on Ships.
9) International Convention on tonnage Measurements.
10) Maritime Laws and Regulation of Flag.
11) International Convention for the Safety of Life at Sea, 1974 including latest

amendments (SOLAS).

12) IMO Res. MSC 266(84) Code of Safety for Special Purpose Ships (SPS 2008), for not more than 60 special personnel.

106. **Certificates / Statements**

The following certificates / statements are to be supplied to the owners at the time of delivery of the vessel.

1) Builder's certificate
2) Classification Certificate (Hull and Machinery)
3) Safety Equipment Certificate
4) Safety Construction Certificate
5) Tonnage Certificate, including Suez Canal Tonnage
6) Loadline Certificate
7) Safety Radio Certificate
8) I.O.P.P. and I.A.P.P
9) Marpol Statement of Fact Certificate (Annex I, IV, V ,VI)
10) Bollard Pull Test Certificate Issued by the Classification Society
11) Class certificate for anchor and chain cable
12) Other usual certificates including those for navigation light and magnetic compass issued by the assigned authority, and magnetic compass adjustment and direction finder calibration issued by recognized Authority.
13) Asbestos free statement
14) Launching certificate
15) Deratization certificate
16) Statement of fact for complying with SPS 2008
17) SMPEP (By Owner)
18) Cargo securing manual (By Owner)
19) International certificate concerning the transport and handling of limited amount of hazondous and Noxious liquid substanes in bulk of offshore vessel (IMO Res A673(16) pt 1.5..3 Marpol Annex 11 with Appondix 1
20) Cert of compliane with special requiements for ships carring dangous goods in package form (Solas 11-2 Marpol Annex 111
21) NLS Certificate

22) International sewage pollution prevention cert

23) SOC TBT-Free anti-fouling system

24) Certificate of Fitness

Sample of the Noxious Liquid Substances

S/N	LIST OF NOXIOUS LIQUID SUBSTANCES	Conditions of Carriage		Pollution Category	Remarks
	Substances	In Bulk (On Deck)			
1	Butylene glycol			Z	
2	Calcium nitrate solutions (50% or less)			Z	
3	Calcium nitrate/Magnesium nitrate/Potassium chloride solution			Z	
4	Diethylene glycol			Z	
5	Drilling brines (containing zinc salts)			X	
6	Drilling brines including: Calcium bromide solution Calcium chloride solution Sodium chloride solution			Z	
7	Ethylene glycol			Y	
8	Noxious liquid, N.F, (7) n.o.s. (trade name…, contains…) S.T.3, Cat. Y			Y	
9	Noxious liquid, N.F, (9) n.o.s. (trade name…, contains…) S.T.3, Cat. Z			Z	
10	Noxious liquid, (11) n.o.s. (trade name…, contains…) Cat. Z			Z	
11	Non-noxious liquid, (12) n.o.s. (trade name…, contains…) Cat. OS			OS	
12	Poly(2-8) alkylene glycol monoalkyl (C1-C6) ether (n)			Z	
13	Potassium formate solutions			Z	
14	Propylene glycol			Z	
15	Sodium silicate solution			Y	

Note:
1) The vessel shall be carrying clean/passive mud of following types:
- Oil based mud containing mixtures of products with flashpoint exceeding 60°
- Water based mud containing mixtures of products with flashpoint exceeding 60°

The pollution category for the above oil & water based mud are not listed in appendix 1 of IMO Resolution A.673(16). i.e. the mud do not contain any chemical/hazardous and noxious liquid substances that are harmful to the marine resources, human health and amenities.

107. **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.

108. **Lightship Weight Measurement**

The lightship weight measurement shall be carried out by reading the draft of the Vessel, measuring the specific gravity of sea water and by investigation of weight to be added or to be deducted, in the presence of the Owner's representative.

The draft of the Vessel shall be measured at both sides of stem, stern and midship draft marks.

Displacement of the Vessel at this lightship weight measurement shall be determined by reading the draft-displacement table on the corresponding draft obtained from the measured draft. The correction for trim, heel and deflection of the Vessel and the specific gravity of seawater at the measurement shall be made also.

If any superfluous weight is on board the Vessel or any item belonging to the lightship weight is not on board the Vessel at the time of the light weight measurement, such a weight shall be corrected by calculation.

The calculation of the lightship weight and deadweight shall be made by the Builder and verified by the Owner and then "lightship weight" and "deadweight" shall be determined.

109. **Inclining Experiment**

The inclining test shall be carried out, after the light weight measurement, in the presence of the Owner or the person authorized by the Owner and the Classification Society's Surveyor, and then the position of the center of gravity of the Vessel in light condition shall be determined by the Builder's calculation based on the test results.

The inclining test shall be conducted by shifting weight and by appropriate means.

The test may be carried out in the Builder's dock, or in sheltered water near the Builder's yard.

110. **Bollard Pull Test**

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

The strain gauge to be used for the test shall be properly calibrated before the test. The pulling from the stern shall be carried out and the steady pull shall be maintained for a minimum of 5 minutes.

Engine output shall be increased in steps of equal increment up to the maximum rating in a total of 3 steps and a steady pull shall be maintained at each step for a minimum of 5 minutes. The gauge reading, engine rpm, shall be recorded. The fuel rack and governor position shall be noted.

111. **Quayside 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) All deck machinery
6) Air-conditioning machinery
7) All pumps etc.
8) Generator load test.

112. **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.

Oil fuel , lubricating oil , hydraulic oil , fresh water , pilotage , tugs and dues for the trials are to be supplied by the builder .

Following as minimum to be carried during sea trial.

1) A full power continuous endurance trial in conjunction with speed trial is to be carried out for the period of four hours. Throughout the period readings of pressures and temperature are to be recorded as per engine manufactures recommendations. In additional to those parameters recorded, peak pressure reading and fuel pump rack setting are to be taken on all cylinders.
2) Speed trials are to be measured by GPS or other relevant equipment at50%,75%,90% and 100 % MCR (100 % Lever at governor setting,temperatures, pressure, wind direction, current reading to be recorded)
3) Speed trials to be carried out:

   50% MCR –one double run

75% MCR –one double run

90% MCR –one double run

100% MCR –three(3) double runs

4) Crash stop from full ahead to astern to be carried out and the distance to be measured.
5) Steering gear trials to be carried out, in accordance with Classification requirement.
6) The bow and stern thruster are to be tested.
7) Fuel oil consumption is to be taken on both engines at 100%, 90% & 75% MCR and recorded/tabulated and included as part of official sea trial report.
8) Crash stop and turning circle diagrams to be produced and posted.
9) Noise level to be measured as full speed and to be witnessed by Class surveyor.
10) External fire fighting system to be tested.
11) DP system trial to be carried out to class / maker requirements.
12) Maneuvering trial

113. **Environmental conditions**

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

Ambient air temperature	:	45 ^{o}C (max), 0^{o}C (min)
Relative humidity	:	95(max), 0% (min)
Sea water temperature	:	32 ^{o}C (max), 10 ^{o}C (min)

114. **Delivery**

Delivery of the vessel is to be taken afloat at Builder's yard.

115. **Spare Parts**

Spare parts for all equipment are to be provided according to Class requirements.

116. **Noise & Vibration**

The Builder is to ensure that objectionable noise and vibration levels do not arise on the Vessel during normal operation, particularly in accommodation and service spaces.

Sound absorbent material to be applied wherever necessary. The Builder is to pay particular attention to avoiding resonance, noise and vibration.

Following table, quoted from the International Maritime Organization (IMO) Regulation A.468 (XII), 1981, entitled: 'Code on noise levels onboard ships", to be as guidance.

(Tolerance margin of 3 dB(A) shall be allowed in addition to the following values.)

Engine Room	-	110	dB(A)	Cabin	-	60	dB(A)
Control Room	-	75	dB(A)	Hospital	-	60	dB(A)
Workshop	-	85	dB(A)	Offices	-	65	dB(A)
Wheelhouse	-	65	dB(A)	Mess/Recreation Rooms	-	65	dB(A)
Bridge Wings	-	70	dB(A)	Galley	-	75	dB(A)
Open Recr. Areas	-	65	dB(A)				

Noise level measurement shall be carried out on the sea trial when running ahead steadily at normal continuous rating of the main engine without side Thrusters in operation.

Measuring method shall be in accordance with the BSRA method or equivalent standard.

The test procedure of noise level measurement shall be submitted to the Owner.

If the measured noise level exceeds the above values, the Builder shall take measures to reduce the noise in the areas where it is higher than acceptable levels to acceptable levels. Method of rectification shall be mutually agreed between the Builder and Owner.

117. **Supervision**

The Vessel shall be constructed and equipped in accordance to this specification and under the supervision of the Classification Society's Surveyor and the Owner’s representative in compliance with the Builder's construction schedule.

Throughout the construction period and prior to delivery, the Owner’s representative

shall have free access to all premises of the yard or its subcontractor's where the Vessel or parts of it are being manufactured during normal working hours.

Shipyard shall always ensure and maintain permanent cleanliness and safety on board throughout the construction period. Spill oil shall be removed promptly. Garbage shall be removed daily. Smoking shall not be permitted on board. Lighted access shall be provided throughout.

118. **Finished Plan (As-built Drawing)**

All classification approved drawing to be stamped by class. All the drawing to be updated and stamped "As-built" by designer. Builder shall be provided one (1) CD of electronic copies of design documents. Builder to provide the list of the as-built drawing and the minimum drawings should be as follows

1) GA
2) Accommodation, paneling, ceiling and insulation and deck covering layout
3) Safety plan
4) Fire control plan
5) Fire protection plan
6) Air-conditioning & mechanical ventilation layout
7) Refrigeration system
8) CO2 bottles room arrangement
9) Tank capacity plan
10) Navigation light arrangement
11) Mast detail
12) W/T Door & Hatches layout
13) Deck machinery foundation
14) Stern roller details
15) Cargo rail detail
16) FIFI pump foundation
17) Bow fender detail
18) Nozzles & shaft bracket detail
19) Sea chest construction
20) Hull Cathodic protection
21) Ladder detail

22) Portable panel details
23) Wheel house Console Arrangement
24) Draft marks & ship Name detail
25) Docking plan
26) Painting specification
27) Lines plan
28) Principal structural sections
29) Profile and deck plans
30) Bulkhead and frames sections
31) shell expansion
32) Welding schedule
33) Superstructure construction
34) Funnel construction
35) Hawse pipe detail
36) Skeg detail
37) Engine room machinery arrangement
38) Bow thruster room machinery arrangement
39) Steering gear room machinery arrangement
40) Shafting arrangement
41) Schematic tank vent and sounding system
42) Schematic bilges piping system
43) Schematic ballast piping system
44) Schematic firemain & deck wash system
45) Schematic fuel oil system
46) Schematic main engine cooling system
47) Schematic Aux engine cooling system
48) Schematic fresh water / drill water system
49) Schematic Domestic F.W & S.W supply system
50) Schematic Drain system
51) Schematic liquid mud system
52) Schematic oily water system
53) Schematic engine exhaust system
54) Schematic Quick closing valves system

55) Schematic lub oil system

56) Electrical single line

57) Schematic watertight door indication

Following plans, one (1) copy each, mounted in the frames with glass shall be installed onboard the Vessel in location designated by the Owner's representative:

- General Arrangement
- Capacity Plan
- Fire Control Plan
- Diagram of Pipeline System for ballast, bilge & fire extinguishing etc.
- Safety Plan

120. **Manual**

Three (3) sets of all manufacturer's instruction manuals and maintenance books, service manuals, spare parts lists and lists of agents are to be supplied to the Owner by the time of delivery of the Vessel.

All such documents are to be in English Language, indexed and placed in box files.

121. **Standard, Material and Workmanship**

Materials, machinery and equipment to be generally in accordance with ISO standards, JIS standards, IEC Standards and DIN Standards, unless specifically agreed or stated herein.

All material, machinery and equipment used in the construction of the Vessel are to be new and unused, of acceptable shipbuilding quality, suitable for the intended service, and approved by the Owner and the Classification Society.

All workmanship is to be of acceptable shipbuilding standard, and is to be to the satisfaction of the Owner. Welding to comply with class requirements.

All equipment and major components are to carry permanent identification integrally cast-in, hard-stamped or engraved on a permanently secured non-corrodible plate. The identification is to show, at minimum, the manufacturer's name or trade name, model type, size and rating.

Associated instruments, gauges or metering devices must be of acceptable quality, fit for the intended purpose, non-corrodible and delineated in metric or S.I. units.

All temporary construction equipment such as mounting lugs etc. is to be carefully

removed by flame-cutting, re-welding and grinding flush and coated in accordance with paint manufacturer's recommendations.

Any equipment place in the Vessel, either permanently or temporarily, is to be protected from damage from all causes during the construction phase.

Any item accidentally and physically damaged is to be removed and renewed in its entirety.

The Builder is to ensure that all material, equipment and components delivered to his premises for use in construction or outfitting of the Vessel, and forming part of his Contract with the Owner, are to be officially logged into his premises and clearly identified. The material and components are to be stored under cover and properly protected from direct sunlight, rain, dust, insects or rodent attack, All material and equipment are to be always accessible for inspection by Owner and, if considered necessary, to be moved to more secure or a better-protected environment shall any deterioration be apparent or considered likely to occur.

122. **Tests & Trials For Subsequent Vessels**

Above-mentioned tests and trials to be conducted for each subsequent vessel, except inclining test is for first vessel only, provided there is no substantial change in subsequent vessels.

SECTION 2 – HULL STRUCTURE

200. **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. Transverse framing system is to be used throughout except deck may be longitudinal framing upon builder's choice.

201. **Keel**

A flat plate keel is to be fitted, connected throughout the length to the centre girder. It is to be tapered at the forward end to the stem and connected to the aft centreline skeg.

202. **Bow Section**

The fore body shall have bulbous bow / stem and be built of steel plates with thick steel bar stem in way of waterline. The fore body including stem shall be well stiffened.

Wash bulkhead with lightening holes shall be provided in part of the fore peak if needed. Chain locker in fore body is to be divided into two compartments by a thick non-watertight bulkhead on the centre line and stiffened with solid half-round stiffeners with cut-in-steps.

Perforated steel plates of 20mm thick shall be arranged inside of the chain lockers and to have a minimum height of 600 mm above the bottom of the chain locker for good drainage. The Chain lockers shall be arranged with bilge piping. Bitter ends to be fitted for securing cable ends.

203. **Engine Room Foundations**

Foundation of main engines shall have ample strengthening and good connection to

the Vessel's hull. Foundations of main engines are forming a part of the bottom construction in way of the engine room. Foundations for main diesel generator units, pumps, separators, deck machinery etc. shall be provided with sufficient strength in order to suppress vibrations.

204. **Aft Section**

The aft body shall have a well-stiffened transom stern. Floor plates shall be arranged at every frame with lightening holes for sufficient access to all spaces. Non-tight wash bulkheads with lightening and access shall be provided as necessary.

205. **Skeg**

A box shape skeg is to be fitted at the centreline, also as housing for stern thrusters. The skeg may be partially below base line.

206. **Bottom Construction**

The bottom is to be of double bottom except in forepeak and aft hull where single bottom construction is to be adopted. 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 as possible and are to be linked with the longitudinal bulkheads of the aft tanks.

207. **Shell Plating**

Bottom-and side shell plating, including bilge radius and frames, are to be in accordance with Classification Society regulations. In way of hawse pipes, propeller area, shafts, thruster units and sea chest plating and openings, the plate thickness is to be increased as necessary.

208. **Frames**

Frames for main hull are to be angle bar spaced at 600mm throughout and to be toe welded to the shell plating. Strong transverse ring frame (or web) is to be fitted where necessary.

Frames in deckhouse are to be angle bar.

209. **Beams / Longitudinales**

Beams or longitudinales for main deck are to be angle bar. They are to incorporate with strong beams of fabricated section fitted in way of deck openings and other locations.
Beams for superstructure decks are to be angle bar.

210. **Girder & Pillars**

Girders of fabricated sections together with pipe pillars are to be fitted in engine room.

211. **Decks**

Deck plate thickness is to class requirement. Insert plate is to be fitted in way of heavy equipment foundation.
Doubling plates are to be fitted under bollards and forward bulwark stays.
An engine room flush panel shall be fitted as per shown on GA.

212. **Watertight / Oiltight Bulkheads & Steel Walls**

The W.T. / O.T. bulkheads are to be plated horizontally.
All bulkheads shall be fitted according to Classification Society rules and stiffened with profiles.
Steel walls, being well stiffened by profiles, shall be arranged for subdivision of cabins, stores and workshops as well as stair casings in lower compartments of hull.

213. **Bulwarks**

Bulwarks are to be in 1100mm height. Bulwark is to be fitted with 3" Sch 80 top rail and flanged plate stays. All bulwarks are to be fitted with lugs welded to the outside for securing portable tyre fenders.
Freeing ports to be arranged in main deck bulwarks with area to Classification requirements. All transitions in the bulwark top are to be made as smooth as possible to avoid snagging the tow line. Freeing ports to be lined with 14mm round bars.
Hinged Rescue Zone gate are to be fitted on bulwark port and starboard, in way of the Rescue Zone as shown on GA.

214. **Wheelhouse**

The wheelhouse is to have 8mm plate for the front, 8mm for sides and top with angle bar for vertical stiffeners and beams.

215. **Deckhouse**

The deckhouse's front plate is to be 8mm. The top, sides and aft end bulkhead are to be 8mm. The front vertical stiffeners, side and aft bulkhead vertical stiffeners are to be to class requirement.

216. **Funnel**

Funnel to be made of 8mm plate with stiffeners.

217. **Bilge Keels**

Two (2) bilge keels made of 340 x 12 plate Bulb plate are to be fitted about one-third ship length.

218. **Steel Fenders**

15mm thick x 12" doubler plates are to be welded in side shell as shown on the G.A.

Rubber fender see section 6.

219. **Cargo rails**

Cargo rails made of 10" N.B., Sch. 80 pipes are to be fitted longitudinally along the main deck, height 2800m, stanchions of I beam at 2400mm apart. Top of rail at outboard side shall be fitted with pipe support.

Rail to be covered with steel plates from inboard side with safe-heaven access openings at short intervals. Outboard surface of the cover plates to be used for storage of cargo hoses and tools.

220. **Rudder / Rudder trunk**

Two (2) high lift type flap rudders with bottom pintle are to be fitted. The rudders are to be watertight streamlined, double plate type, fabricated of mild steel, with internal horizontal plate frames.

Suitable lifting arrangements are to be incorporated and filling / drain plugs fitted.

The plate frames to have limber holes to ensure internal drainage.

A lifting eye and a jumping ring to be fitted to each rudder stock.

The rudder stock is to be of forged steel.

The rudder trunk is to be tubular steel, with a heavy top plate to take the steering gear and watertight gland. A heavy steel boss to be incorporated at the lower end of the trunk and fitted with approved type bearing. The bearing and stock to be designed to take the full side load of the rudder.

The rudder bearing lubricated. According to maker

221. **Steering Gear**

Two (2) electro-hydraulic independent type steering gears of 2 x 60 KNm torque capacity (subject to vendor verification and class approval) at 2 x 35 deg. rudder angle. Bedplates, actuator, locking valve, solenoid valve, filter, motor, starter, steering column, steering switch and other necessary fittings are to be provided. One (1) rudder indicator of panorama type to be fitted. Structural stoppers to be provided at the side of each tiller. Rudder turning speed 10 sec/35deg with two pumps, 20 sec/35 deg with one pump.

Steering gear control to be from forward and aft consoles in wheelhouse. Rudder angle indicators to be mounted at both forward and aft steering positions.

222. **Nozzles & Shaft Brackets**

Two (2) fixed mild steel nozzles, with diameter suitable for Controllable Pitch Propellers, are to be fitted. Each nozzle is to be supported by streamlined side brackets. The bottom structure of the hull in way of the nozzles will be stiffened by additional transverse and longitudinal members. Wear rings to be sheathed with 316L stainless steel. Width of the wear ring to be 25% in excess of propeller sweep width (welding to be away from sweep area).

Propeller shaft brackets are to be the “Y” type, of fabricated mild steel construction, upper part to support shaft aft bossing and lower part to prevent wires entering nozzle thus protecting propellers.

223. **Sea Chests**

Four (4) sea chests shall be arranged in engine room- one (1) in low position, one (1) in high position and two (2) independent sea chest for Fi-Fi pumps.

One (1) sea chest shall be arranged in bow thrusters compartment for emergency fire pump intake.

One (1) sea chest to be fabricated for installing of the HIPAP valve for future

expansion, valve size 500mm. The flange opening is to be bolted with suitable flange. Flange PCD Builder to liaise with Kongsberg.

Plate thickness in way of sea chests to be 2mm above class requirement.

224. **Drain Plugs**

Drain plugs of 42mm(1-1/2") diameter stainless steel screw fittings are to be fitted in all tank compartments adjacent to hull bottom plate.

Two (2) sets of drain plug spanners to be supplied.

225. **Mud Tanks**

The mud tanks to be square shape. They are also to be used for brine and recovered oil with stiffeners located outside the tanks.

Over-pressure caused by burst disc / PV valve to be considered when size the scantling of the tank structure.

Each mud tank to be provided with two suction wells.

SECTION 3 – ACCOMMODATION & COMPARTMENTATION

300. **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.

Modular toilet unit is to be provided for each cabin.

Separate mess room is to be provided for crew and officer.

Fire rating of partition and insulation to SOLAS requirement. Method IC to be adopted for bulkhead construction.

Cabin and wheelhouse clear height to be as much as practical, with 2050mm as min.

301. **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.

Steel ladders to have chequered plate, flanged treads.

Schedule of Deck Coverings

Wheelhouse top, wheelhouse deck exterior & main deck : non skid deck paint.

Wheelhouse interior	:	2mm thick vinyl sheet on latex
Mess & passageways	:	2mm thick vinyl sheet on latex
Crew's cabins	:	2mm thick vinyl sheet on latex
Washrooms and galley	:	ceramic tiles on cement with curves at skirting
Engine room	:	steel chequer plate on top of floor bearers.
Bow thruster & Steering gear compartment	:	4.5mm steel chequer plate on top of floor bearers (if headroom permits)
Deck Stores	:	non skid deck paint
Provision stores	:	wood gratings on painted steel

302. **Minor Bulkheads & Lining**

All steel minor bulkheads are to be lined with non-combustible material. Free Standing bulkheads are to be non-combustible material. 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, AHU, CO2, machinery and steering compartments.

303. **Insulation**

Wherever applicable, exposed steel work is to be insulated on the inside with 50mm thick glasswool density 30 kg/m3 or mineral wool of correct density and retained behind the linings. 40mm thick density 170 kg/m3 for funnel bulkhead adjacent to accommodation areas.

1) Wheelhouse & deckhouse : deckhead and sides
2) Main deck cabins : exposed deckhead, bulkheads and sides
3) Air conditioning room : exposed deckhead, bulkheads and sides

In way of living spaces on main deck, such as mess rooms, hospital, galley etc, deck insulation with high noise reduction to be laid.

Fire insulation arrangement to comply with class requirements. Deckhouse aft bulkhead and side bulkhead within 3m from aft end are to be A60 insulation or protected by fixed water spray system.

304. **Windows & Scuttles**

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 finishing work to be of fibre glass or wood material.

305. **Steel Doors**

All external doors, except wheelhouse doors, to be of steel with coaming heights according to the loadline requirement.

Six 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.

A60 water-tight / weather-tight doors to be installed as per class requirement.

Wheelhouse doors to be steel type with fixed window.

Eye brow to be fitted over weather doors where there is no deck over hang.

306. **Carpenter's Work**

All external doors are to be in steel complimented with wooden doors except the wheelhouse doors. All internal doors to be self closing type or hold-back hooks, self closing type provided with rubber stoppers to prevent rattling, device hold- back hooks to retain the doors in open position. Hardware to be of brass or chrome. Hinged doors with large windows in wheelhouse. Store rooms to be provided with steel shelves with retaining bars.

Arrangement of shelves, etc. to be sufficient for the intent of each store room. Ceiling in accommodation and navigation spaces are to be of non-combustible type.

307. **Wheelhouse**

The wheelhouse is to be located on wheelhouse 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 of the wheelhouse. Wheelhouse windows are to be arranged to give maximum visibility all round and provided with window wipers and clear view screen for front and after windows . Freshwater washing to be provided for windscreen wipers. The compass is to be located above the forward steering position.

308. **Master's Cabin**

The Master's accommodation arranged at forward upper forecastle deck on the starboard side. To comprise cabin with attached modular toilet compartment, fitted with the following:-

- 1 built in berth, with drawers under
- 1 built in settee
- 1 kneehole desk with drawers
- 1 desk chair
- 1 wardrobe
- 1 coffee table
- 1 small refrigerator
- 1 book rack on deck

- 1 clock
- 3 hat and coat hooks
- 2 rectangular windows with curtain
- 4 spare power sockets
- 1 waste bin

Attached Toilet (Module Type)

- 1 washbasin (hot and cold water)
- 1 toilet paper holder
- 1 towel hook
- 1 tumbler rack
- 1 water closet and grab rail
- 1 shower with plastic curtains on rail, hot and cold water
- 1 mirror cabinet
- 1 extractor fan
- flushing spray

309. **Chief Engineer's Cabin**

The Chief Engineer's accommodation is to be fitted out generally as per Master's cabin

310. **Attached Washroom for Cabins**

Module type washrooms attached to each cabin are to be fitted out identically as same as Master's cabin.

311. **One Berth Cabin**

The cabins are to be arranged on upper forecastle deck, for Officers, and to be fitted with the following:-

- 1 built in berth, with drawers under
- 1 wardrobe
- 1 kneehole desk with drawers
- 1 desk chair
- 1 book rack on desk
- 2 hat and coat hooks
- 4 spare power sockets

- 1 rectangular window with curtain
- 1 settee
- 1 waste bin

312. **Two Berth Cabin**

Cabins to be arranged as shown on the General Arrangement Drawing, each with the following:-

- 1 built-in two-tier or 2 built-in single wooden berths with plywood bases and drawers under lower tier
- 2 lockers
- 1 book rack on desk
- 2 sets berth curtain rails
- 1 waste bin
- 1 desk
- 1 chair
- 4 spare power sockets

313. **Four Berth Cabin**

Cabins to be arranged as shown on the General Arrangement Drawing, each with the following:-

- built-in two-tier wooden berths with plywood bases and drawers under lower tier
- 4 lockers
- 1 book rack on desk
- 4 sets berth curtain rails
- 1 waste bin
- 1 desk
- 1 chair
- 4 spare power sockets

All single room bed internal dimension 1000 width X 2050 length（in mm）

All two and four berth bed internal dimension 800width X 2050 length（in mm）

All cabins to come with wall mounted table light and bed light

314. **Crew Mess / Recreation Room**

The mess room situated on the main deck is to be fitted out as shown on the GA :-

- Dining tables c/w formica top and edge fiddles
- 4 spare power point
- 24 upholstered chairs
- 1 sideboard
- 1 clock, battery quartz type
- 1 commercial four-slot toaster
- 1 900 watt microwave oven
- 1 270 litres refrigerator
- 1 drinking fountain
- 1 40" LCD TV

315. **Officer Mess**

The mess room situated on the main deck is to be fitted out as shown on the GA :-

- 2 dining tables c/w formica top and edge fiddles
- 3 spare power point
- 8 upholstered chairs
- 1 sideboard
- 1 32" LCD TV
- 1 commercial coffee machine
- 1 commercial four-slot toaster
- 1 900 watt microwave oven
- 1 250 litres refrigerator
- 1 drinking fountain
- 1 clock, battery quartz type

316. **Hospital / Treatment Area**

The hospital / treatment area shall have medical supplies in accordance with Class requirements for the number of personnel on board. The hospital/medic to be situated on main deck and are to be fitted out as follows:

- 1 hospital type bed and en-suite facilities fitted with emergency call facilities to wheelhouse

- Medical Chest in accordance to Class (Owner supply)
- Desks and chairs
- 1 4-drawer steel cabinet
- 1 attached wash room
- mechanical exhaust / supplying as per regulation

317. **Store room**

steel shelves are to be fitted.

318. **Laundry / Changing Room**

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

- 2 domestic washing machine (approx. 10 kg)
- 2 domestic spin dryer (approx.10 kg).
- 2 250mm diameter portlight with deadlight
- 4 spare power points
- 1 foldable ironing board
- 1 deep bowl sink
- 20 1m height lockers, stacked in two tiers
- 1 wood bench
- 1 shower cubic

319. **CO_2 Room**

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

320. **Galley**

The galley situated on main deck 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 stainless steel exhaust canopy over electric range.
- 1 stainless steel twin bowl deep sink with shelves, lockers under and plate racks over.
- Assorted cupboards, workbenches, plates rack, etc – in stainless steel.
- 6 power sockets

- 1 commercial refrigerator of min. 500 L
- 1 food waste disposal to be fitted below sink
- 1 Rice cooker
- 1 microwave oven
- 1 dishwasher 500 plates/hour
- 1 Steam Oven
- 1 mixer
- 1 hot water urn
- 1 garbage compactor
- UV sterilizer & filter
- DEEP FAT FRYER (COMPLY TO SOLAS)
- Bain marine food warmer

321. **Ship Office / Meeting Room**

To be fitted as shown on General Arrangement drawing, each to be fitted with:

- 1 steel filing cabinets (4 drawers)
- 1 desk and 1 upholstered chairs
- 24V telephone system to be fitted.
- Meeting table with chairs
- Emergency light connected to the ships main emergency system
- 1 quartz wall clock
- 2 spare power points
- 1 wall-mounted white board

322. **Common Toilet**

Common toilet on main deck to be fitted with following.

- 1 W.C. Pedestal c/w seat and lid, toilet roll holder and grab rail and water spray taps for general use.
- 1 washbasin with hot and cold FW supplies
- 1 mirror with tray and light
- 1 spare power point
- 1 Extractor fan.
- Flashing spray

323. **Provision Store**

This compartment is to be fitted with stainless steel shelves c/w retaining battens. Wooden grating is to be fitted on floors. Exhaust ventilator fan to be arranged. Lock for the door. Provision room bulkhead and deckhead shall be painted or decorated

324. **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 aft & fwd scupper pipes to be provided.

325. **Bosun Store**

The bosun store incorporated with the chain lockers is to be situated forward of the collision bulkhead on forecastle deck and fitted out with steel shelves.

326. **Engine Room Fittings**

The engine room is to house all machinery and equipment at convenient locations described elsewhere. Steel chequer plates 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.

One common battery operated telephone to be fitted.

327. **Engine Control Room**

Engine control room is to be equipped with:-

- Main switchboard
- Machinery control console (MCC)
- Office desk
- Office chair
- Sufficient power points
- One (1) packaged air-conditioner, sea water cooled.

328. **Steering Gear Compartment**

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

Shark haw / towing pin HPU and cabinets will be installed in this compartment.

329. **Chiller / Freezer Room (walk in type)**

Refrigeration plant of R404a system direct expansion type, water cooled, electrically driven, to be installed complete with all necessary accessories.

Two (2) compressors to be fitted, one acting as 100% standby.

The plant is to maintain temperatures of -18 degrees C in freezer room and +4 degrees C in chiller room.

Man-in-fridge alarm bell to be fitted for each compartment.

330. **Bow Thruster Compartment**

This compartment is to be fitted with bow thruster machinery with suitable forced ventilation. Flooring to be 4.5mm thick aluminum plates.

331. **Cement Tank Compartment**

Two (2) compartments are to be provided for the housing of four (4) units of cement tanks. Forced ventilation and aluminum plates passage are to be fitted.

332. **Fan Rooms**

Fan rooms to be provided for housing of vent fans.

333. **Towing Winch Casing**

Non-tight casing to be provided for towing winch as shown in GA.

334. **Paint Store**

To be fitted with steel shelves. Natural ventilation and ex-proof electrical fittings / lighting and CO2 fire-extinguishing system to be provided.

SECTION 4 - CORROSION PROTECTION

400. General

All de-scaling, shop-priming, de-rusting and painting work shall be carried out as outlined below.

The paint scheme for shell plate under waterline and ballast tank is to be based on design life of three (3) years.

A detailed painting scheme based on the standards specified below shall be prepared by the builder to owner's approval. The chosen colours are based on the available standard colour shade of the supplier of coating material, but all exterior paints according to Owners standard colour shades.

Paint application should be in accordance with paint supplier's recommendations.

Deviations or changes that prove to be required during execution of the work will be agreed jointly between the supplier, builder and Owner regarding necessary measures for the performance of work. On the event that the temperature conditions necessary during application are impossible to achieve, alternative coating system as recommended by supplier of coating material will be applied, subject to Owner's approval.

Steel structure surfaces, except manual welded beads, erection seams and butts, may be painted before leak test.

Final layer of coating is to be applied in one run.

Coating of machineries and electric equipment to be done in accordance with manufacturer's standard coating systems.

Colour scheme to be agreed between owner and builder.

Not listed members of items to be prepared and coated as per their surroundings. Representatives of painting suppliers have to present during paint application at the yard for technical service and supervision.

Inaccessible spaces like tubular pillars are to be separated airtight from adjacent structure and will have no internal surface protection.

Gas cut sharp edges to be grounded smooth before application of paint.

The surface of copper, copper alloy, aluminium alloy, stainless steel, and non-corrosive material shall not be painted unless otherwise specified.

401. **De-scaling and Priming**

Plates and Profiles

All steel material to be pre-blasted to SA 2.5 and immediately coated with one (1) coat of shop primer.

Fittings and Equipment

The steel surface of fittings and equipments such as pipe seats, grating supports, auxiliary machinery seats, etc., to be generally power-cleaned with wire brush or disc-sander to remove the weather rust and loose mill-scale.

402. **Preparation and Application**

Surface Preparation before Painting

Surface preparation to be inspected and accepted by paint supplier and Owner before application of paint.

Prior to the application of the coating system, secondary surface re-preparation is to be carried out where the shop primer has been damaged or weathered or missing, according to the following schedule as guideline and subject to paint maker's recommendation :

Area	**Preparation Grade**
Underwater hull, flat bottom to deep load line	SA2 1/2 (St3 for repair)
Topsides, above deep load line incl. external bulwark	A2 1/2 (St3 for repair)
Weather deck	P St. 3
Exterior superstructure and decks	P St. 3
Interior superstructure	P St. 2
engine room, stores etc.	P St 2
W.B. tanks, mud tank, brine tanks	SA2 1/2 (St3 for repair)
Oil Tanks, Sludge tanks	P St 2
Potable water tanks	SA 2 ½
Void spaces & cofferdams	P St 3
Generally	P St 2

Definition of Grades

The Swedish Standard SIS 055900-1967 and/or German Standard DIN 55928, part 4, applies to all cleanness grades mentioned.

Application

The coating materials will generally be applied by means of airless spraying. Paint brushes or rollers will be used for marking the different coloured areas or for painting small structural members and for lettering, as well as for setting-off edges.

The paint not to be applied during periods of rain, snow, fog or mist in the open air, and also not to be applied when weather conditions may cause condensation (when relative humidity is above 85% and the steel temperature is lower as 3 ° C above dewpoint), except when paint maker has confirmed a particular paint can be applied during such weather conditions.

Film Thickness

All stated film thicknesses are dry film thicknesses. The actual total film thickness may deviate from the specified film thickness as follows:

- Shell external, water ballast tanks. Mud tanks, brine tanks: 85 % of the points measured are to correspond to the specified film thickness or more. Remaining points measured are allowed to be 15 % less of that stated film thickness.
- All other Areas: 85 % of the points measured are to correspond to the specified film thickness or more. Remaining points measured are allowed to be 15 % less of that film thickness.

Film thickness shall not to be measured on irregular surfaces, such as welding seams and corners or edges of structural members. For repair coats in overlaps, higher film thickness to be tolerated.

The shop primer is included in the total film thickness.

Appearance of Finish

Painting of the exposed structural steel surfaces such as outside of shell, deckhouse, etc. and of living spaces and passages in accommodation to be free from sags and runs. In other areas except the above, paint sags and runs which are not considered harmful to the performance, need not to be removed.

Damaged Coatings

The surface preparation of damaged or destroyed, partly finished or finished surfaces will be carried out by disc or wire brushed according to specification but max. to P St 3.

Covering

All parts and fittings (e.g. glass, label plates, rubber gaskets, spindles etc.) to be protected or covered before application of coatings is commenced.

403. **Painting Schemes**

Following specification for coating system are for guidance. IP or Jotun specifications of equal standard would be acceptable agreed by the Owner.

	Code	Colour	Code	DFT(Microns)
Flat Bottom				
1 coat HEMPADUR	17630	20320	Cream	150
1 coat HEMPADUR	17630	12170	L Grey	150
1 coat HEMPADUR	45182	25150	Yellowish Grey	75

1 coat HEMPEL'S A/F OLYMPIC	86950	60700	Brown	150
1 coat HEMPEL'S A/F OLYMPIC	86950	51110	Red	150

Waterline To Main Deck Including Bow & Bulwark External

1 coat HEMPADUR MASTIC	45881	50630	Redbrown	125
1 coat HEMPADUR MASTIC	45881	53246	Orange	125
1 coat HEMPATHANE TOP COAT	55210	53246	Orange	50

Superstructure, Deckhouse External & Railings

1 coat HEMPATEX HI-BUILD	46410	50630	Redbrown	100
1 coat HEMPATEX HI-BUILD	46410	12170	Grey	100
1 coat HEMPATEX ENAMEL	56360	10000	White	50

Exposed Deck & Under wood Sheathing Including Stern Roller & Bulwark Interior

1 coat HEMPADUR MASTIC	45881	50630	Redbrown	125
1 coat HEMPADUR MASTIC	45881	53246	Orange	125

Interior Exposed Accommodation Spaces, Machinery Rooms, Cement Tank Compartment, etc

1 coat HEMPALIN PRIMER	12050	50410	Red	40
1 coat HEMPALIN UNDERCOAT	42460	10000	White	40
1 coat HEMPALIN ENAMEL	52140	10000	White	35

Steel Behind Lining

1 coat HEMPADUR MASTIC	45881	11480	Grey	100

Ballast Tanks, Chain Lockers, Void Space, Fore & Aft Peak

1 coat HEMPADUR MASTIC	45881	50630	Redbrown	150
1 coat HEMPADUR MASTIC	45881	11480	Grey	150

Potable Water, Cement , Foam & Dispersant Tanks

1 coat HEMPADUR	15400	50900	Light Red	100
1 coat HEMPADUR	15400	10000	White	100

Liquid Mud Tanks

1 coat Hempadur	17630	12170	Grey	150

Bilges – Engine Room, Bow Thruster Room & Steering Gear Room

1 coat HEMPADUR MASTIC	45881	50630	Redbrown	125
1 coat HEMPADUR MASTIC	45881	10000	White	125

Funnel Internal

1 coat HEMPALIN PRIMER	12050	50410	Red	40
1 coat HEMPEL'S SILVIUM	51570	19000	Light Alu	25

Deck Equipment, Cranes, Davits, Hatches, etc

1 coat HEMPADUR MASTIC	45881	11480	Grey	50
1 coat HEMPATHANE TOPCOAT	55210	10270	Grey	50

404. **Pipe Work Colouring**

All exposed piping system are to be identified with color bands at 2m intervals in accordance with the following colour schemes. Base color to be white.

1) Bilge & ballast		:	black
2) Fire main		:	bright red
3) F.W. System	cold	:	blue
	hot	:	blue with red band
4) Fuel oil		:	brown
5) Lub. oil		:	yellow
6) Liquid Mud		:	pink
7) Dry bulk		:	green
8) Hydraulic oil		:	purple
9) Sea suction		:	green
10) Sea water cooling		:	light green
11) Compressed air		:	grey

Galvanised pipes are to be etched-primed and then top-coated with colour code.

Colour code for pipes and ahackles to be engaved on a 10mm thick while plastic sheet boltes and displace on the main deck

405. **Cathodic Protection**

Appropriate numbers and sizes of zinc anodes are to be bolted(nuts cemented) to the immersed loaded hull, thruster nozzle and inside of the sea chest for three (3) years lifespan.

SECTION 5 - MACHINERY & PIPING

500. Machinery General

Two (2) independent propulsion plants, each unit shall consist of:

- One (1) Main Engine
- One (1) Gear Box
- One (1) shafting set
- One (1) Controllable Pitch Propeller with nozzle

The entire propulsion plant is to be designed, constructed and installed according to the rules and requirements of Classification Society, IMO and Flag State.

Exhaust gas emission limitations, according to IMO, shall be noted as well as structural measures for sea-going vessels for the prevention of marine pollution by oil, sewage and garbage in conformity with MARPOL 73/78.

The installations of main and auxiliary machineries including their accessories are to be easily accessible in order to allow maintenance and repairs to be carried out with minimum expenditure for effort and time.

Before installation on board, the important machinery shall be inspected and proved by Classification Society and the Owner at manufacturers test bed. The designed output shall be demonstrated during trial for required duration.

The ambient data as described in section 1 shall be used for machinery design and material selection purpose.

501. Main Engines

Two (2) units of Medium speed, turbo-charged, non-reversible marine diesel engine 3,300 PS each, run on MDO. With front PTO for fire pumps. Port engines in counter rotation,Starboard engine in anti-counter rotation (Seen from aft)

Air starting for main engines. Fresh water cooling with sea water coolers.

502. **Gear Box**

Each main engine to drive the propeller through a marine gear box, vertical offset type. Gear ratio is to match the engine for appropriate propeller. With PTO for shaft generator. For alarms, safeguards and instrumentation, see separate clauses. All in accordance with standard shipbuilding practice.

503. **Shaft**

Each of the forged steel tail shaft to be sized to classification requirements. Shaft coupling between intermediate shaft and propeller shaft to be of the oil mounted coupling type.

The Builder shall install the complete twin screw controllable pitch propeller system.

Supply by Maker's propulsion package complete with all necessary interfacing.

A torsional vibration analysis of shafting system shall be prepared by the engine manufacturer and to be submitted to the Owner after approval by the Classification Society.

Shaft line is to be installed with 1.0 degree inclination.

504. **Stern Tube & Propeller**

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

Two (2) stern tube oil tanks, are to be fitted and arranged, one to feed each tube by gravity. And two(2) header tanks for the cpp hub.

The tanks are to have air release arrangements, an oil level gauge, and low level alarm provided.

Two (2) four or five bladed controllable pitch propellers to be supplied, one RH and one LH, and are to be operated in fixed nozzles. Propeller diameter about 3.05m-3.1m

Propeller blades and hubs will be in Ni-Al bronze or equal with all stainless steel bolts, to be manufactured to ISO/TC 8 Class I standard and statically balanced. The blades will be designed for operation in propulsion nozzles. The entire CP propeller system is to be designed, built and installed to meet Classification standards.

Propellers to be designed to give speed and bollard performances as specified in section

1.

505. **Generating Sets**

The electrical power is to be supplied by

- Three (3) 450 KW diesel driven alternators (415V/3/50Hz).
- Two (2) 1000 KW shaft generator driven by gear box

Each diesel generator in the engine room shall be driven by a water-cooled marine diesel engine. Starting of engines is to be by compressed air. All accessories shall be in accordance with the Classification Society.

The diesel engine and generator are to be fitted to a common foundation, which is to be resiliently mounted.

One (1) diesel-driven emergency generator, rated approx 95 KW (415V/3/50Hz), with air-cooled radiator system and to be of electric-start type shall be provided in the Emergency Generator Room located on the forecastle deck and to be readily accessible from the open deck.

The emergency genset room is to be well insulated and the generator is to be mounted on resilient foundations to minimize noise and vibration.

Diesel oil service tank for the emergency generator set shall be fitted with low level and cut off alarm. The tank is to be served by an electrical power pump. Starting and stopping switch for the electric pump shall be located at the vicinity of the diesel oil tank in the emergency diesel generator compartment.

506. **Bilge / Ballast / GS / Fire Pumps**

Two (2) vertical self-priming centrifugal SW pump of 100M^3/hr at 70M total head. Suction and discharge pressure gauges to be provided.

- Casing : Bronze
- Shaft : Stainless steel
- Impeller: Bronze
- Seal : mechanical

Location of the pumps to be in different compartment as much as possible.

507. **Bilge Pumps**

Two (2) set. capacity 45M^3/hr at 30M total head.

One (1) daily bilge pump, capacity 2M^3/hr at 25M total head.

508. **Fuel Transfer Pump**

Two (2) 15 M^3/hr at 20M head horizontal gear. To have a cast iron body with carbon steel impeller and shaft. To have one (1) remote stop switch outside engine room.

509. **Water cargo pumps**

One (1) vertical centrifugal self priming pump to be provided for FW. Capacity 100 m^3/hr, at 70m head.

One (1) vertical centrifugal self priming pump to be provided for DW. Capacity 100 m^3/hr, at 70m head. The pump to be connected to ballast system.

Both pumps material to be as follows.

- Casing : Bronze
- Shaft : Stainless steel
- Impeller: Bronze
- Seal : mechanical

510. **Cargo fuel oil pump**

One (1) vertical self priming screw pump to be provided, capacity 150 m^3/hr at 70 m head. To handle discharging of cargo fuel oil. Pump casing insert is to be of cast iron and main screw in nitrurated carbon steel. The pump is to be directly connected to electric motor and completed with relief valve.

511. **Mud Agitator**

Agitators are to be installed as advised by the manufacturer to allow maximum agitation. Nos of agitator for each mud tank are to comply with maker's recommendation.

512. **Liquid Mud / Brine / Recovered Oil Pumps**

Two (2) horizontal pump to be provided for mud / brine / rec. oil system, capacity 100 m^3/hr when discharging against pressure of 70 MLC at mud density of 2.5. Centrifugal type, Motor driven with VFD.

To be installed in pump room with motor in engine room. Gastight seal to be provided at

bulkhead penetration. Flexible couplings are to be provided in shafts between pumps and motor, and stuffing boxes which can be lubricated from outside the pump room are to be fitted at the bulkheads. The seal parts of the glands are to be of non-sparking construction.

513. **Dirty Oil / Sludge Pump**

One (1) electric driven horizontal positive displacement type screw pump installed in the engine room and shall deliver 5m3/hr at 45m head.

514. **SW. cooling pump for air conditioning / refrigeration plant & others**

Two (2) horizontal self-priming centrifugal S.W. circulating pumps, electrically driven, to be fitted to serve air conditioning system. Capacity to be about 60 m3/hr at 25m head. One as 100% standby set.

Two (2) horizontal self-priming centrifugal S.W. circulating pumps, electrically driven, to be fitted to serve refrigeration system. Capacity to be about 8 m3/hr at 25m head. One as 100% standby set.

Two (2) horizontal self-priming centrifugal S.W. circulating pumps, electrically driven, to be fitted to serve cement compressors. Capacity to be about 8 m3/hr at 25m head.

For cooling of other equipment, pumps to be provided as required.

515. **FW Pressure Set**

One (1) fresh water pressure set complete with about 3.5m3/hr at 40m head and one (1) pressure tank of about 500 litres with working pressure 40-60 PSI with pressure relief valve.

516. **SW Pressure Set**

Additional set. Specs Identical to FW pressure set except for sea water. One additional pump to be provided as standby for both FW and SW sets.

517. **Emergency Fire Pump**

One (1) horizontal self-priming centrifugal fixed emergency fire pump of $45M^3$/hr at 60M head to be electric motor driven and installed in bow thrusters compartment.

518. **Exhaust Pipes & Silencers**

Exhaust pipes from main and auxiliary engines to be led to top of funnels. Exhaust pipes and silencers to be well insulated and covered with galvanized steel sheeting. Exhaust silencers to be able to suppress noise not less than 35 dBA and to be fitted with spark arrestor.

Drain for exhaust pipes to be provided.

Flexible hangers to be provided for exhaust pipes.

519. **Engine Cooling System**

To maker's requirements, by plate or shell-tube cooler.

520. **Lub Oil System for Main / Auxiliary Engines**

To maker's requirement.

521. **Compressed Air System**

Compressed air system for engine starting is to consist of

- 2 air compressors, air- cooled type, at 30Kg/cm^2, two (2) electrically driven, to be able to charge air receivers within one (1) hour.
- 2 air receivers, 2 x 500 L at 30Kg/cm^2
- 1 oil/water separator

Compressed air system for working / general service is to tap off from starting air and to consist of

- 1 working air receiver, 300L at 7Kg/cm^2
- 1 oil/water separator

Assorted pressure gauges, pressure reducing valves, relief valve etc to be supplied for both systems.

Two (2) working air connections each to be provided on main deck at port and starboard.

One (1) connection each on aft forecastle deck at port & starboard.

One (1) connection on forward upper forecastle deck mooring area.

Sea chest blow- down to be 3/4" NB STP steel pipe, 7Kg/cm^2

Main engine controls if any to be by working air system.

522. **Oily Bilge Water Separator**

One (1) MARPOL standard oily water separator complete with pump and oily water discharge alarm to be fitted. Capacity 1 m^3/hr with oil content monitor less than 15 ppm.

523. **Bow / Stern Thrusters**

Two (2) transverse tunnel CPP bow thrusters, each giving a thrust of approx. 10T, to be driven by continue electrical motor.

One (1) transverse tunnel CPP stern thruster, giving a thrust of approx. 8T, to be driven by continue electrical motor.

All necessary controls, interface to DPS and interlocks to be provided.

524. **Sewage Treatment Plant**

One (1) sewage treatment plant for 50 men. One sewage pump of 5m3 capacity, 3 bar pressure to be provided with the plant.

525. **Fresh water maker**

One (1) set of R.O. water maker (cap: 10 tons per day) c/w sand filters and back flushing to be provided with UV sterilizer.

526 **Purifier**

One (1) self cleaning Fuel oil purifier and One (1) self cleaning lub oil purifier shall be supplied and installed by the Builder. Capacity to be confirmed by engine maker.

527. **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. Mudboxes, strainers, filters and valves are to be arranged according to classification's requirements. All seawater pipes are to be of galvanised steel.

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 1/2" (22mm) and over to be butt welded with flanged connections, below 1/2" (22mm) are to be screwed with unions.

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

"Y" strainer for the sanitary and domestic FW pumps.

528. **Pipe and valve materials**

Pipes:-

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

System	Material	Remarks
Bilge + Ballast	Galvanised steel	Seamless Sch 80
Fire + Washdeck	Galvanised steel	Seamless Sch 80
S.W. Cooling	Galvanised steel	Seamless Sch 80
F.W. Cooling	Maker recommendation	Seamless Sch 40
Fuel Oil / Base oil	Black	Seamless Sch 40
Lub Oil	Black	Seamless Sch 40
Sanitary, Fresh Water	Galvanised steel	Seamless Sch 40
	PE(accom)	to maker's standard
Soil Pipe	Galvanised steel	Seamless Sch 80
	PE(accom)	to maker's standard
Air + Sounding	To suit tank	Seamless Sch 80
Cement	Black steel	Seamless Sch 80
Mud / brine / rec. oil	Galvanised steel	Seamless Sch 80
Control air	Copper	2mm
Compressed Air(30kg/cm2)	Black steel	Seamless Sch 80
Compressed Air(others)	Black steel	Seamless Sch 40
Exhaust	Black steel	ERW, 8mm

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

Utility pipes in accommodation to be of PE material as much as practical.

Valves: see tables below.

System	Nom Dia (mm)	Type	Material				Pressure Standard Kgf/cm^2
			Body	Disc	Seat	Stem	
30 kgf/cm^2 compressed air	6 to 10	Screwed globe or cock	Forged steel or brass	-	-	Brass	30
	15 to 25	Flanged globe or angle	Forged steel	Brass	-	Brass	
	32 & above		Cast Steel	Brass	Brass	Stain-less steel	
10kgf/cm^2 compressed air Feed water pump outlet	6 to 10	Screwed globe or cock	Bronze	-	-	Brass or bronze	20
	15 to 40	Flanged globe or cock	Bronze	Bronze	-	Brass	16
	50 & above		Cast Iron	Bronze	Bronze	Brass	10
Fuel Oil supply pump outlet	6 to 10	Screwed globe or cock	Bronze	-	-	Brass or bronze	20
	15 to 40	Flanged globe or angle	Bronze	Bronze	-	Brass	16
	50 and above		Cast Steel	Bronze	Bronze	Brass	10
Fuel Oil (Exceed 60^{o}C)	6 to 10	Screwed globe or cock	Bronze	-	-	Brass or bronze	20
	15 to 40	Flanged globe or angle	Bronze	Bronze	-	Brass	5
	80 & above		Cast Steel	Bronze	Bronze	Brass	

System	Nom Dia (mm)	Type	Material				Pressure Standard Kgf/cm2
			Body	Disc	Seat	Stem	
Exhaust & Drain	6 to 10	Screwed globe or cock	Bronze	-	-	Brass or Bronze	20
Feed water (low pressure)	15 to 40	Flanged globe or angle	Bronze	Bronze	-	Brass	5
Potable Water	50 & above	Flanged globe or angle	Cast Iron	Bronze	Bronze	Brass	5
Cooling fresh water	50 & above	Flanged Gate	Cast Iron	Cast Iron	Bronze	Brass	5
Fuel Oil (below 60°C)	50 & above	Butterfly	Cast Iron	Cast Iron	Rubber	Stain-less Steel	5
Diesel Oil	50 & above	Butterfly	Cast Iron	Cast Iron	Rubber	Stain-less Steel	5
Lubricating Oil	50 & above	Butterfly	Cast Iron	Cast Iron	Rubber	Stain-less Steel	5
Cylinder Oil	50 & above	Butterfly	Cast Iron	Cast Iron	Rubber	Stain-less Steel	5
Cooling Sea Water	6 to 10	Screwed globe or cock	Bronze	-	-	Brass or Bronze	20
Bilge & Ballast	15 to 40	Flanged globe or angle	Bronze	Bronze	-	Brass	5
Sewage	50 and above	Flanged globe or angle	Cast Iron	Bronze	Bronze	Brass	5
Fire	50 and above	Butterfly	Cast Iron	Alumi-nium bronze	Rubber	Stain-less Steel	10
Deck Wash	50 and above	Butterfly	Cast Iron	Alumi-nium bronze	Rubber	Stain-less Steel	10
Ship side	40 and below	Flanged globe or angle	Bronze	Bronze	-	Brass	10
	50 and above	Flanged globe or angle	Cast Steel	Stainless steel	Stainless steel	Stainless steel	10
F.O. & L.O. tank emergency shut down valve	40 & below	Flanged globe or angle	Bronze	Bronze	-	Brass	5
	50 & above	Flanged globe or angle	Cast Steel	Bronze	Bronze	Brass	5

529 **Bilge & Ballast System**

Bilge 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. Mud boxes and strainers to be galvanized.

Bilge suctions are to be fitted to the following compartments:

- Bosun Store bilge well
- Bow thruster room
- Engine room bilge wells
- Cement tank compartments
- Steering gear compartment

Bilge pumps are to be arranged in different compartment as much as practical.

Bilge system valves to be remote controlled by pneumatic or electric actuators from location above main deck.

Ballast suctions are to be fitted to all ballast water tanks. Transfer of ballast water between port and starboard tanks is available from the system. Striking plate to be installed under each bell mouth.

530. **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. Daily service tanks to be positioned at convenient locations.

Sounding and air pipes are to be fitted to each tank.

A bunkering line is to be led to the main deck, P&S with 4" Kamlock fittings for quick filling and discharge for all bunkers.

The fuel transfer pump together with the manifold and valves etc is to be arranged to transfer fuel oil from one pair of tanks to others for forward and aft direction only. It is to draw from another bunker and discharge to either of the daily service tanks.

Each daily service tank is to be provided with supply, filling and overflow pipes, drain valves, sight glass or content gauge to meet classification requirement.

Drip trays of 150mm coaming height to be fitted in way of pumps. Drain from drip trays to be drained to dirty oil tank.

531. **Dry bulk handling system**

The system is designed for cement and dry bulk with a maximum specific gravity of 2.8.

Loading/discharge stations are arranged at main deck, midship and aft locations, port and starboard sides. The piping plant to be arranged as two systems. The plant to be capable of discharging two types of dry bulk simultaneously through two separate discharge lines. Air dryer to be provided for the discharge line.

Fill/discharge piping to be 5". Fill/discharge stations to be equipped with 5" female unions.

Loading/discharge operation to be from Central Control Panel to be located in wheelhouse.

5" diameter quick couplings are to be provided complete with dust caps and linked chain.

Ventilation through two common lines to be arranged with Kamlock coupling for connection of the vent hose.

Four (4) off vertical cement tanks. Working pressure 5.6 bar.

Test pressure 1.3 times working pressure.

The bulk system shall be remote operated from the wheelhouse with the exception of butterfly valves (manual operated) located on the main deck.

One (1) remote control stand for four (4) tanks operation, having two purge valves and two (2) compressor stop buttons incorporated. It shall be located in wheelhouse.

Compressors:

2 off electrically driven compressor, sea water cooled.

Capacity : 13 m3/min. 75 KW.

After coolers completed with moisture separator and auto drain trap, all to manufacturer's recommendation.

Electric motors and compressor units mounted on common skid.

Receiver:

2 off vertical air receiver each of approved capacity complete with safety valve, gauge and drain ‘trap, butterfly valves and fittings.

Dryer:

2 off moisture removal and dryers.

Air piping from compressor to tanks to be as straight as practicable to eliminate condensation collection points.

One(1) remote control emergency stop switch to be provided in the wheelhouse

532. **Mud System**

Mud pumps can be used for discharge or for circulation.

Piping with openings to be fitted at bottom part of mud tank for mud circulation.

Piping if any through other tanks to be all welded pipe without valves, flanges, fittings or take-down joints.

Loading is by shore pumps. All pipe work to be designed and installed accordingly.

533. **Brine System**

Mud / brine pump can be used for discharge and transfer of brine between port and starboard tanks. Loading is by shore pumps. All pipe work to be designed and installed accordingly.

534. **Hydraulic Oil Systems**

The hydraulic piping of solid drawn steel (internals to be acid cleaned) for the steering gear and other deck machinery to be arranged in accordance with the manufacturer's recommendations and to meet classification requirements. Adequate strainers to be provided.

535. **Fire & Deckwash Service**

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

536. **Air & Sounding Pipe**

Ventilation head for fresh water to be provided with heavy duty stainless steel insect screen and for fuel oil with stainless steel spark-arresting gauge. Sounding pipes shall be of welded type with closure devices.

537. **Freshwater System**

A cold F.W. piping system is to be fitted complete with one UV sterilizer or equivalent

filtering system for drinking and washing purposes. Potable water tanks are to be arranged as shown on the drawing. Water is to be supplied to the accommodation and engine room through self-contained, automatic pressure tank.

538. **Hot Freshwater System**

Hot freshwater system is to be drawn from cold freshwater into an electric calorifier, capacity 500 litre, and piped to wash places and galley. A hot water circulation pump is to be provided. Hot water pipes to be suitably lagged.

539. **S.W. Sanitary System**

Saltwater sanitary pipes of PE material (Galvd. Steel under main deck) are to be arranged with valves, S- trap, scuppers and pressure set in accordance with good marine practice and meeting classification requirements.

540. **Sanitary Fittings**

1) Washbasins : white vitreous China, or stainless steel 20" x 16" with 3/8" cold hot water supply. Taps to be chromed plated.

2) Showers : light coloured 6” or 12” ceramic tiles with 3/8" cold and hot water screw down taps and mixing valves.

3) W.C. : white vitreous China with plastic seats and lids. 1" S.W. supply with flush valve.

4) Galley sink unit : 16" S.W.G. stainless steel twin bowl unit 1/2" hot & cold F.W. supplies. Chrome plated taps.

541. **Scuppers and discharges**

Discharges from washbasins, showers, sinks and internal scuppers are to be grouped into a common cross main to discharge overboard through storm valve. Air pipe to be

arranged from the cross main. Discharge from W.C. to be led to a sewage treatment plant.

Scuppers from the refrigeration spaces are to be led to the bilges. 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 80mm. 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 min 50mm scuppers.

Moisture condensate drainage to be consider from behind accommodation panelling.

No take down flanges to be fitted in way of accommodation/galley/mess room/provision store.

542. **Filling / discharge systems**

The cargo discharge lines are to be led to the rig discharge stations on deck.

The combined filling and discharge deck fittings are to be color coded. Color code to be advised by owner.

The systems to cater for:-

a) Cargo fresh water: Female 100 mm, one each at port midship and starboard midship.

b) Cargo fuel oil: Female 100 mm, one each at port aft and starboard aft.

c) Recovered oil: Female 100 mm, one each at port aft and starboard aft.

d) Drill water: Female 100 mm, one each at port midship and starboard midship.

e) Dry bulk: see section 531.

f) Mud: Female 125 mm, one each at port aft and starboard aft.

g) Brine: Female 125 mm, one each at port aft and starboard aft.

Deck terminations to be fitted with approved type of quick couplings. Butterfly valves to be fitted adjacent to quick couplings.

Except for fresh water, drill water and dry bulk, the rest of cargo connections to be provided with drip trays with sufficient capacity.

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

543. **Ventilation & Air Conditioning**

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

Designing Conditions

Outside Temperature: summer 45 °C, 75% R.H, winter 0 °C.

Inside Temperature: summer 25 °C, 50~60% R.H, winter 20 °C.

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, wheelhouse to be provided with two (2) independent air-con units, air-cooled and ceiling mounted. 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 open type compressors of Freon R404a and one blower, 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. Spiral duct to be insulated with mineral wool wrapped with double sided aluminium foil externally acting as vapour seal

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

<u>Engine Room Ventilation</u>

Main and auxiliary diesel engines are to draw combustion and cooling air from engine room. The engine room is to have two (2) separate electrically driven main fans of low-noise type, each to have 50% required capacity. One of them is to be reversible. The fans to have sufficient capacity according to ISO8861 requirement and to be

capable to maintain overpressure in engine room. The fans to be installed in fan compartments. Air ducts to be made of galvanized sheet. Natural exhaust shall be provided via funnel. Air inlets and outlets shall be installed at least 6 m above water level.

Steering Gear Room Ventilation

One (1) axial flow supply fan is to be provided above main deck for steering gear room ventilation. Exhaust by natural.

Forward Cement Tank Compartment Ventilation

One (1) axial flow exhaust fan to be provided for forward cement tank compartment for ventilation. Supply by natural. Air inlet and outlet are located at main deck.

Bow Thruster Compartment Ventilation

Two (2) axial flow supply fan is to be provided for bow thruster compartment for ventilation. Exhaust by natural. Air inlet and outlet are located at forward of upper forecastle deck accommodation. The air supply is to cater for the cooling of bow thruster motors, emergency fire pump motor etc.

Emergency Generator Room Ventilation

One (1) supply fan is to be provided for the room ventilation. Exhaust by natural.

Towing Winch HPU Room Ventilation

One (1) supply fan is to be provided for the room ventilation. Exhaust by natural.

Wash Places & Galley Ventilation

Wash places and galley to be provided with exhaust fans base on the nos of air change per hour.

Pump Room / aft cement tank compartment ventilation

One (1) axial flow explosion proof exhaust fan to be provided for pump room / aft cement tank compartment ventilation, with minimum twenty air changes per hour. Fan motors to be located outside the pump room and vent duct. Supply by natural. Air inlet and outlet are located at main deck. The motor to be immediately shutdown upon release of CO2.

544. **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 1,650 M3/hr at 140m head. To be confirmed by vendor to class requirements.

The pumps to be driven by main engine front PTO.

Independent sea suction and piping system for the pumps to be provided. Sea suction valve of class approved material and remote controlled from wheelhouse and manual control at valve. Pump outlet valve is electric actuated and remote controlled in wheelhouse. The pump casing to be cast iron with internal coating, shaft and impeller to be duplex stainless steel

b) Fire Monitors

Two (2) units monitors at 1,200 m^3/hr each (one dual barrel water/foam)

The monitors are to be remotely controlled from wheelhouse, control system consisting of the following:

- One (1) main control panel – logic for operation of monitors.
- One (1) portable joystick panel for installation in wheelhouse with control of elevation and rotation of monitors.

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. Remote operated solenoid valve [IP56] with control at the aft wheelhouse control console for controlling the water spray at the wheelhouse level during the fire fighting operations.

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.

545. **Lifting beams**

Lifting beams are to be fitted over each main engine, with SWL clearly marked

546. **Lifting Lug in Engine Room**

Lifting lugs (SWL as per GB7029-86 stand chart) 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
- One (1) point above each gearbox
- Two (2) points above each intermediate shaft
- Two (2) points above each generating alternator
- Two (2) points on outside of Hull and adjacent to each rudder
- One (1) point above each rudder stock on the under side of the main deck
- Six (6) points above and offset from each tail shaft line on the underside of the main deck, fwd & aft of the nozzle if applicable
- Allow for further 20 points as nominated by Owner's representative

547. **Flow meter**

Flow meters with printer to be provided for FO & Portable water liquid cargoes. Local reading for main engine flowmeter permanently installed.

548. **Maintenance & Technician Tools**

Following to be provided.

- 0.5-ton chain blocks x 2, 1-ton chain blocks x 2, , 1.5-ton chain blocks x 2, , 2-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
- electrical hand inspection lamp with wandering leads x 2
- steel sounding rods and lines
- steel locker with padlock for spares
- Tool board
- Electric test panel 415V, 230V &DC;

549. **Mud / Rec Oil Tank Vent System**

For ventilation of mud tanks which may also be used as recovered oil tanks, suitably sized vent pipe to be led from each tank into a common header fitted with pressure-vacuum valve at the outlet to atmosphere, height min. 2m above main deck, and the valve to open at: +0.14 bar(Gauge), -0.035 bar(Gauge).

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

550. **Mud / Rec Oil Tank Level Gauging System**

Mud / recovered oil tanks to be fitted with pressure sensor type level gauging system with display at pump control location and wheelhouse aft control station. The pressure sensor to be installed in a short spool at tank bottom level outside the tank, with compressed air connection for blowing of the spool. High level alarm to be set at 85% and 95% level.

Screw flushed sounding plug made of brass size 200m to be installed on the manhole cover.

551. **Recovered Oil System**

Recovered oil loading is through deck connection by gravity drop-in. Discharging is by recovered oil pump.

Pressure gauge is to be fitted at the pump discharge, with additional display at pump control station.

Header and branch line to each tank to be common with mud system.

552. **Oil Recovery Equipment**

Oil skimmer or similar oil recovery equipment will not be installed.

SECTION 6 - DECK MACHINERY & FITTINGS

600. **General**

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

All fastening materials, bolts and nuts which are exposed to weather on the open deck shall be of stainless steel materials except strength requirement.

601. **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:

- Two (2) AC-14 HHP stockless anchors, stowed in anchor-pockets, each of 1,845 kg..
- Total length of 495M x 38rnrn / Grade U3 stud-link-chain cables, divided to port and starboard side with swivel and shackle.
- Two (2) chain-stoppers
- Mooring lines: 4 x 180M long mooring ropes of min. 23.5 tonne breaking strength.

602. **Anchor Windlass**

Two (2) sets of electric-hydraulic anchor windlass suitable for specified diameter cable, each completed with one hawser drum and one warping head to be provided. The cable lifter, hawser drum and warping head are to be independently clutched. They are to be securely mounted on fabricated steel seating on forward of upper forecastle deck above the chain lockers. Chain pipes, cable stoppers and hawse pipes are to be arranged to suit. Local control to be provided.

Capacities - 10 tonnes at 9m/min for chain cables.

6 tonnes at 15m/min and at light loads 30m/min for mooring lines.

603. **Capstans**

Two (2) electro-hydraulic capstans shall be installed at main deck aft (P & S), with pulling force of 10 tonnes at 15m/min. Variable speed control to be located at main deck aft.

604. **Towing & Anchor Handling Winch**

One (1) set, high pressure electro-hydraulic driven, double drum, waterfall type.

Towing drum and anchor handling drum rated pull at first layer: 150 ton at low speed.

Braking capacity : 250 ton

Stowing capacity : 60 mm dia. x 1,200M wire rope – Upper drum; (Towing)
60 mm dia. x 1,200M wire rope – Lower drum; (Anchor Handling)

Wire rope : 60 mm dia.

Rig chain size : 76 mm dia.

Control : Remote control from aft control station in wheelhouse

The winch is to be delivered with empty drums. Wire rope is to be supplied by Owner.

605. **Towing Pin & Shark Jaw**

Two (2) hydraulic towing pins of approved make, retractable type, closed top to be installed in the centerline of the main deck. The anchor handling pins to be able to take a SWL of about 250 tonnes and to extend about 600mm above main deck level in the fully extended position. The pins are to be operable from wheelhouse and aft local control station on the main deck aft at the vicinity of shark jaws.

One (1) set of hydraulically operated anchor handling fork (hydraulic retractable shark jaws) of approved make to be installed in centerline on main deck aft. The stopper SWL to be 250 tonnes.

Stopper and towing pins with common power unit and to be remotely controlled from the wheelhouse aft console and local control station.

The insert to be provided for 50mm to 75mm dia. wire and 28mm to 75mm dia. chain.

606. **Tugger Winches**

Two (2) electro-hydraulic tugger winches of 10 tonnes at 15 m/min to be installed as shown on the General Arrangement. Each winch is to be complete with one (1) wire drum and one (1) warping head with its capacity 250m x 22mm dia. wire.

Material of warping head to be cast steel, shaft to be high intensity steel.

607. **Spare Wire Reel**

One (1) hydraulic-operated spare towing wire reel to be installed, drum capacity 1,200 m x 60mm (SWR) dia. wire rope and to be locally controlled. The pull rating shall be 6 tonnes at 20m/min.

Wire provided by buyer or owner

608. **Stern Roller**

A 250 t SWL stern roller, about 4.4M long by 1.7 M diameter with SUS316 stainless steel shaft (In way of bearing only) and SW lubricated external bearings. Roller to have four (4) pipe sockets fitted on each end in order to use turning bar to keep the roller free to rotate.

609. **Deck Crane**

One (1) electro-hydraulic telescopic crane to be installed. SWL 2t at outreach 15m.

Independent hydraulic power pack to be provided for the crane.

610. **Mast**

The navigation mast is to be completely fitted out with necessary brackets and stays for navigation lights and shapes. Mast to have rungs to top, arranged for access to light trays and necessary fittings. Blocks for aerials, yard arms and ensign staff to be fitted and sheaves for signal flags and shape hoists to be arranged on masts, as required.

Cable fastener, bolt, nuts, fittings to be of sus material, bar and steps to be of galvanised steel.

611. **Manholes**

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

In engine room and main deck, they are to be “raised” type, if necessary.

Covers to welded with steel alphabet for identification and mark to indicate the fitted position.

Manholes for liquid mud tank shall be of 800mm dia. rounded and flushed type, located on the main deck.

612. **Draft Marks**

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

613. **National Colours**

"Staff" to be installed at mast for national colours.

614. **Hatches**

Watertight hatches to be provided for the following compartments:

- engine room (1 off Bobby hatch with WTD)
- steering gear compartment (1 off)
- forward store (1 off)

Rungs or vertical ladder to be fitted for each hatch.

615 **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. Storm rails inside accommodation spaces to be 32mm diameter polished stainless steel.

616. **Drainage for Decks**

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

617. **Doors**

Steel doors to be fitted as shown on the General Arrangement drawing. All exterior doors and internal W.T./G.T. doors to be in steel. All watertight / weathertight doors to outside are complemented with composite material doors with deadlights, with automatic door close on inner doors.

Internal wooden doors in accommodation spaces to be of flush type.

618. **Mooring Chock**

To be provided for mooring arrangement.

619. **Handrails & Stanchions**

Stanchions are to be 65 x 20 F.B. x 1000mm high with short backstays and spaced not more than 3 frames spaces apart. Top rails of 1-1/2" galvanised pipe and the lower rails of 1" round bar. At access points, pipes substituted by 1/4" short link galvanised chain with hook and eyes.

620. **Bollard, Fairlead, Loose Mooring Equipment**

Sufficient number of bollards and fairleads shall be provided as required by vessel mooring.

621. **Covers for Deck Equipment**

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

622. **Handrails & Grabrails**

Handrails and grabrails are to be fitted at strategic positions for maximum safety and to meet rule requirements.

623. **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 150m clear of steel bulkheads.
Hand grips to be fitted as necessary.

624. **Floodlights**

6 x 1000W, 2 forward, 4 aft. Halogen type.

625. **Searchlights**

3 x 2,000 W, c/w underdeck controls within reach of helmsman. Suitable for FIFI-1

626. **Hawse Pipes & Anchor Recesses**

Two (2) 12"NB, Sch. 80 hawse pipes welded to 19mm anchor recesses. Chain pipes to

be 8" NB, Sch 80.

627. **Rubber Fenders**

Appropriate number of aeroplane tyres c/w 25mm galvanized shackle and chain to be provided at shipside as shown in GA.

Bow & stern 300mm "M" type rubber fender to be fitted.

628. **Deck Sheathing**

75mm thick good quality marine type hardwood deck sheathing over T-section is to be fitted to the aft deck as shown on drawing.

629. **Gob Eye**

One gob eye to be installed on main deck centre line.

630. **Watertight Doors Below Main Deck**

All watertight doors below main deck are to be sliding type.

They should be able to be remotely operable locally from each side of the bulkhead. Indicators to be provided at the wheelhouse control station showing whether the door is closed or open, and an audible alarm is to be provided at the door closure. The door's power, control and indicators should be provided with emergency electrical power in case of main power failure. Individual hand–operated mechanism to be provided so that the door can be opened and closed by hand at both side if control system failed.

631. **Dispersant Nozzles**

An oil dispersant system consisting of 2 spray booms, complete with dispersant eductor and proportioning metering valve 0-10%.

The sea water shall be supplied by the General Service Pump.

632. **Cargo Rollers**

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

633. **Cargo Lashings / Separation Stanchions**

Ten (10) sets of cargo lashing / separation stanchions shall be provided.

SECTION 7 - SAFETY SYSTEM

700. **Life Saving 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) Liferafts : six (6) twenty five (25) men inflatable liferafts with full emergency pack in rigid fibreglass container conforming to SOLAS 74 convention.

2) Lifebuoys : total eight (8) lifebuoys to be supplied:
- four (4) 90ft buoyancy lines
- four (4) 90ft buoyancy line and self-igniting electric lights (Two [2] with smoke signals).

3) Lifejackets : fifty (50) approved type lifejackets to be supplied and stowed adjacent to each berth plus additional spare jacket as per flag state requirment.

4) Pyrotechnics :
- One (1) line throwing apparatus (4 projectiles & 4 lines)
- Twelve (12) parachute distress rockets.
- Two (2) orange smoke signals.
- Six (6) hand flares

5) Rope Ladders : Two (2) embarkation rope ladders to be provided

6) Rescue Boat & Davit: One(1) rescue boat (according to SOLAS) with diesel in board engine capable of carrying 6 persons with davit for launching over one side. To be provided with SOLAS certificate

7) Immersion suit : one for each crew, plus ten (10) spare sets to be provided. Or three (3) sets in total if exemption could be obtained from Flag for tropical water operation.

8) Rescue basket: one to be provided.

9) First Aid Kit : 1 set conform to SOLAS standard

10) Emergency Escape Breathing Device : 8 sets conform to SOLAS standard

701. **Fire-fighting Equipment**

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

1) Firemain

A firemain and 1- 1/2" bronze hydrants are to be installed.

International shore connection is to be fitted.

2) Fireman's Outfit

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

a) One aluminium asbestos-free 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) One sets of gloves & boots & helmet with visor

3) Portable Fire Extinguishers

Fire extinguishers as required by the classification/government authority are to be supplied and installed.

Replacement charges are to be supplied.

4) Fire Blanket

Two (2) off to be provided in engine room and galley.

Fire Axes

Two (2) off. 36” long fire axe with wooden handle.

5) Fixed CO_2 System

A full flooding CO_2 system consisting gas bottles c/w quick operated valves and auto alarms is to be provided for engine room and pump room fire fighting. The CO_2 bottles to be stowed inside a separate compartment. Operation is to be manual arranged both on the bottle(s) and in a "break glass" pull box at the engine room access.

6) Engine room fixed water-based local fire-fighting system

The system should comply with IMO requirement and protect following areas.

- main engines and gensets

702. Rescue Zones

Rescue zones, length at least 5 m, shall be established at both sides of the vessel and shall meet the class requirements, in way of which bulwark gates with 2m width to be provided. When not in use, normal bulwark height is obtained. The area shall be clearly marked from outboard. It shall be serviced by means of scrambling nets. Rescue zone shall be cleared of any overboard discharge.

SECTION 8 - ELECTRICAL

800. **General Installation**

The electrical installation is to be made in accordance with the requirements of the Classification Society and IEC latest regulation.

All electrical and electronic equipment shall be accordance with modern technology for easy maintenance and simple operation. This shall include all control systems and electronic equipment as well as electrical components in engine room, engine control room, accommodation, and bridge including on deck.

All electrical fittings on exposed decks to be at least IP55 protection.

Before sea trials commence, a thorough testing of all equipment shall be carried out.

Care is to be taken for prevention of Electro Magnetic Interference to ensure that only interference-eliminated equipment shall be allowed to install onboard.

All electric fittings inside hazardous area are to be explosion proof type.

801. **System of Supply**

a) 415 volts, 3 phase, 50 Hz - for power (motor)

b) 220 volts, 1 phase, 50 Hz - for general lightings and power less than 3 kW.

c) 24V D.C. - for alarms, emergency lights, radio, navigational aids, navigation lights and other emergency loads.

802. **Power Supply**

-Normal Supply :-

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

- Three (3) 450 KW, 415/3/50, 0.8 P.F. and 3 wire diesel engine driven generators.
- Two (2) 1000 KW shaft generators

The diesel driven generators shall be capable of parallel operation.

Diesel generator and shaft generator shall be capable of parallel operation for short period for load transfer.

-Emergency Supply :-

For emergency duties the power supply shall be obtained from a 95 KW capacity,

415/3/50 generator arranged for independent battery starting in the event the main power supply fails.

-Shore Supply :-

A 200 Amp T.P 415/3/50, 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 2 x 24V 200 AH main batteries via the main battery charger. Batteries to be sized for ship's transitional power supply for emergency duties without re-charging. Batteries to be float charged by two (2) 60 amp battery chargers.

In the event of failure of the main (or emergency) source of power, the emergency batteries (transitional power supply) shall automatically supply power to the emergency lighting communications and navigation aids, etc.

b) A 24V D.C supply for the radio equipment is to be obtained from one (1) bank of 2 x 200 AH main batteries via the radio battery charging panel, powered by one (1) 40 amp battery charger, automatically regulated.

803. **Switchboard - main**

The main switchboard shall be of opened hinged front and opened back screw type and arranged in the engine control room.

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 semi-automatic parallel operation of diesel driven generators shall be installed with synchronising lamps, synchroscope, 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 earthing 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 or XLPE insulated wire to Classification and specification with a maximum operating temperature and having the following insulation grades :-

- Power Cables : 660 volts
- Control Cables : 250 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 trifoliate 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.

804. **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 415V and at 220V levels. The 220V distribution shall be derived from a 415/220V transformer.

805. **Distribution board - 24v D.C**.

The 24 volt D.C. switchboard shall be provided for battery charging and distribution of DC sources. It shall be equipped with all necessary voltmeters, ammeters, isolation, changeover and selector switches for battery charging and circuit breakers, as required.

A dummy push button switch to simulate power failure shall be incorporated.

806. **Cable installation**

All cables shall meet with Classification rules. Where exposed to damage, external weather and in machinery spaces, cables to have galvanised steel wire braid armour and PVC or SHF1 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.

When required, the watertightness 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 and busbar of 4 dimensions proportionate to the current rating.

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.

807. **Cable colours**

Cable colours according to maker standard.

808. **Cable tray/supports**

Cables within machinery spaces shall be secured by approved type saddles 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 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

809. **Electric distribution**

Distribution shall be by the three wires with neutral earthed system.

Distribution of power throughout the vessel shall be generally as described.

810. **Distribution boards**

Distribution boards situated in Accommodation spaces shall be installed in an easy accessible manner.

Outgoing circuits, shall be fitted with traffolite nameplates indicating the circuits, maximum amps, and rating of fuse fitted.

A.C. and D.C. distribution boards are to be double pole type.

Power and lighting distribution boards in number and size as necessary.

811. **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 (24V D.C.)

This panel shall be fitted with a built-in transformer rectifier 220V AC/24V DC indicators, switches, buzzers, fuses, failure alarm indicator and change-over switch. Main supply is obtained from 220/1/50 A.C supply and emergency from the main batteries.

812. **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.

813. **Motor starters**

All motor starters shall be tested in accordance with Classification.

All motor starters shall be enclosed in 16 SWG quality bright mild 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 hose-proof to IP22.

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 0.5HP and above.

Motors up to 15 KW rating shall be started by means of a 'DIRECT ON LINE' type starter. Motors between 15 KW and 55KW shall be started by means of a "STARDELTA" type starter. Motors above 50KW shall be started by means of an "AUTO-TRANSFORMER" type starter unless otherwise specified by equipment makers of standard supply.

All the motor starters for oil related pumps, heaters 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.

814. **Transformers**

Two (2) step-down transformers one as standby, shall be installed in Engine Room to provide for general lightings and power supply for the vessel, approximately 2 x 100 Kva capacity.

Two (2) step down transformers for 220V emergency supply, approx. 2 x 40 Kva capacity.

One (1) step down transformer rectifier shall be installed in the Navigation light switch panel. It shall be of the open type rated for an input of 220V, 1 phase, 50 Hz, with an output of 24V D.C. This transformer rectifier shall be in the normal supply to the navigation lights.

815. **Storage batteries**

All batteries shall be of the lead acid type.

All batteries shall be installed in steel or GRP watertight ventilated boxes on compass deck. The batteries shall be sat on non-absorbent insulating supports with similar spacer blocks at the sides to secure air circulation space all round the battery.

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

816. **Shore connection equipment**

Provision shall be made to connect a 200A, 415 Volt, 3 Phase, 50 Hz, supply from shore to the main switchboard.

A drip proof supply switch fuse box with male type plug receptacle shall be fitted on the main deck in a convenient position and be permanently wired via a changeover switch.

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, pilot lamps and socket.

817. **Fuses and circuit breakers**

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

818. **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.

819. **Sockets and 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 flukes shall not be used.

- Accommodation :-

Non-watertight 220/1/50, switch sockets, flush or surface mounted shall be fitted throughout the accommodation spaces.

- Engine Room/Galley/Stores

Watertight 220/1/50, switch sockets, marine moulded type surface mounted shall be fitted throughout the engine room, galley and store space

820. **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 IEC 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 in hazardous area, such as aft cement tank compartment and shaft tunnels adjacent to rec. oil tanks including air locks, are to be explosion proof type.

Lighting for 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 crash rails, rescue zones and main deck aft working area.

Lightings if any installed in hazardous area are to be explosion proof type.

821. **Navigation lights**

Double tier lens, 24V D.C x 40 watt navigation lights shall be fitted. The navigation lights shall be according to International Regulations. At least to consist of the following :-

- Four (4) Masthead lights (3 on forward mast & 1 on aft mast)
- Two (2) Towing lights dual
- One (1) Port light dual
- One (1) Starboard light dual
- One (1) Stern light dual
- Two (2) Anchor lights
- One (1) set of Immigration lights
- One (1) set NUC lights (three in number)
- One (1) set TSS lightings

All navigation lights shall be controlled by a 6-way indicator panel fitted in the Wheelhouse. The supply shall be taken normally from the 220/1/50 A.C. supply via a 24V D.C output, transformer/rectifier and during emergency from the main batteries.
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.

822. **Emergency lights (240V A.C. / 24V D.C)**

Emergency light is to be provided and fitted at strategic points in

- the wheelhouse, lobby / corridor, steering gear, bow thruster and cement tank compartments, engine room at entrances, galley, mess and radio area: 220V A.C.
- the wheelhouse, lobby / corridor, steering gear, bow thruster and cement tank compartments, engine room at entrances, and radio area: 24V D.C.
- Emergency generator compartment

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.

823. **Monitoring Alarm and Control System for Machinery**

The purpose of the alarm system is to provide warning and monitoring of important parameters on the main engine and propulsion as well as on the auxiliary equipment.
The control, alarm and monitoring system to be of modern design based on the Classification Society's requirements and including alarms as required by the engine

manufacturer.

The system shall be protected against strong signal from the vessel earth grounds.

824. **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
Messroom	1 pc

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

825. **Engine Room Alarm Device**

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

- General alarm Tank Level
- Machinery alarm Telephone
- Fire alarm Telegraph
- CO_2

826. **Engine Performance Monitoring**

Performance monitoring consists of the following measurements:

- Engine speed

827. **Remote Control System for Main Engines**

The remote control system for the main engine shall provide all functions facilities for controlling the engines speed and to class requirements.

Control and monitoring of engine speed shall be available on the bridge forward and aft control console.

828. **Safety and 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.

829. **Remote Indication**

In the engine control room and wheelhouse forward / aft control station, remote indication are provided as follows:

- Propeller speed
- Main engine speed
- Miscellaneous remote reading instruments as necessary

830. **Fire Detection and General Alarm System**

The accommodation, engine room and service spaces are to be provided with a fire / smoke detection and alarm system as per Classification Society rules.

Alarm bells are to be sited within accommodation in accordance to Class requirements. Break glass alarm points are to be fitted in wheelhouse, main deck, thruster compartments, forecastle deck and engine room. An alarm horn and revolving red light are to be installed in the engine room and an alarm horn only fitted in the steering gear compartment. An engineer alarm system to be provided in Chief Engineer's cabin.

A fire detection system based on the self-monitoring principle including periodic testing facilities shall be installed in the machinery spaces and accommodation. It shall be fed automatically from an emergency source of power by or separate feeder if the main source of power fails.

831. **Main & Auxiliary Engine Instrumentation & Alarm**

The main engine and auxiliary engine instrumentation are to be operated on 24V DC supply. Main engines are to be provided with an emergency stop in the wheelhouse. Clutch control indication panel to be provided in engine room and forward and aft wheelhouse control.

Main engine level alarms should be provided with a panel in the engine room, wheelhouse and engineer's cabin (common fault alarm only) with visual and audible indicators as required by regulations such as low oil pressure, high water temperature, low starting air pressure, low tank level, high bilge level etc. It shall be indicated at the same time more than one fault and the acceptance of any alarm shall not hinder another alarm. Alarms shall be maintained until they are accepted and the vessel indicators shall remain until the fault has been corrected.

The 24V DC supply to automatically changeover to a standby power supply in case of loss of normal power supply and failure of the normal power supply shall be indicated by alarm.

832. **Reefer plugs**

Two (2) 415V with 63 AMP and two (2) 220v with 32 AMP reefer plugs to be installed at forward of cargo deck for connection of reefer containers.

833. **CCTV**

For monitoring of towing wire spooling, a CCTV system to be provided. It shall consist of two cameras in towing winch casing and one monitor in wheelhouse aft station.

834. **Gas detector**

One portable gas detector for H_2S, CO_2, CO and O_2 to be provided.

Fixed H2S with cables to ready for future expansion -5 locations

835. **LAN**

Cabling for LAN to be installed, with sockets in wheelhouse, ECR, ship office, single cabins and twin cabins and hospital, officer mess. The hub to be installed in instrument room.

836. **Oil Recovery Equipment Power Supply**

Power supply to non-permanent oil recovery equipment is to be provided. Power outlets to be arranged from connection box provided with a means to prevent disconnection of the portable cable unless power has been removed from the cable. The connection box to be located in starboard cargo rail forward area.

The supply from main switchboard to the connection box to be permanently installed and provided with a separate switchgear with short-circuit and over-current protection.

837. Welding sockets are to be provided at the main deck [AHW compartment] and in the engine room.

SECTION 9 – NAVIGATION & COMMUNICATION SYSTEM

The following navigation and communication equipment for GMDSS A3 are to be supplied and fitted.

900. **Navigation**

1) Daylight signaling lamp, 24V DC
2) Standard magnetic reflector compass
3) Autopilot.
4) 3 x Gyrocompass, with repeaters forward and aft
5) Radars: Two (2) daylight display color radars. One (1) of which shall be gyro stabilized and fitted with an automatic electronic plotting facility (IMO type approved).
6) Echo sounder: 200 KHz c/w transducer etc.
7) Speed log: Doppler type, range –10 to 45 knts
8) Searchlights: 3 x 2,000W, 220/1/50.
9) 3 x DGPS and appropriate display for precise position fixing at operational sites
10) CVS and window wipers: 1 x 300mm CVS & 4 horizontal window wipers (2 forward and 2 aft)
11) Navigation lights: to rule requirements
12) Ship's whistles: 1 x compressed air operated, 250-700 Hz, remote controlled in W/H consoles.
13) Horn: 1 x mechanical fog horn
14) Bell: 1 x 300mm dia. brass bell with ship's name
15) Barometer: 2 x 150mm dials in brass case
16) Clinometers: 4 off
17) Wind Anemometer 3 sets.
18) International Code of Signals: 1 set plus national
19) Nautical publication: 1 lot, (owner supply)
20) Engine telegraphs: 3 locations (2 in W/H, 1 in ECR)
21) Navigation shapes: to rule requirement
22) Binoculars: 2 pairs, 7 x 50 adjustable with eye piece

23) Bar parallel rules: 1 off, 300mm (owner supply)

24) Thermometers: 2 off, 100mm diameter - 20° to 50 ° C

25) Chronometer: 1 off

26) Automatic identification system (IMO approval)

27) Weather fax receiver.

28) LRIT

29) BNWAS

901. **Communication**

Internal

1) PA / talkback System: throughout the ship, main control station in wheelhouse.

2) A 24volt internal automatic telephone system providing service to all command and control centres, offices, public rooms, main alleyways & accommodation.

No.	Location	P.A.	Auto. Tel.
1.	Wheelhouse Aft Console	Main control station, speaker with talkback	Built in console
2.	Wheelhouse Forward Console	Speaker with talkback	Built in console
3.	Wheelhouse Radio Table		Desk mounted
4.	Captain's Cabin	Speaker only	Desk mounted
5.	Chief Engineer's Cabin	Speaker only	Desk mounted
6.	Mess Room/Galley	Speaker with talkback	Wall mounted
7.	Passage Way (Accommodation) Upper Forecastle	speaker	
8.	Passage Way (Accommodation) Forecastle Deck	speaker	
9.	Passage Way (Accommodation) Main Deck	speaker	
10.	Engine Room outside ECR	speaker	Wall mounted
11.	ECR	Speaker with talkback	Desk mounted
12.	Steering gear Room	Speaker with talkback	Wall mounted
13.	Cancelled		
14.	2-Berth Cabins	Speaker only	Desk mounted
15.	Single Cabins	Speaker only	Desk mounted
16.	Bow Thruster Compartment	Speaker only	Wall mounted
17.	Office (1 unit)	Speaker with talkback	Desk mounted
18.	Hospital	Speaker only	Desk mounted
19.	Upper Forecastle Deck Aft	Speaker with talkback	
20.	Upper Forecastle Deck Forward	Speaker with talkback	
21.	Changing room / laundry	Speaker only	

External

1) GMDSS Communication (Sea Area `A3')

- 1 x MF/HF, 250W, voice, DSC & NBDP, ship and shore distress alerts etc.
- 1 x MF/HF DSC watch keeping receiver
- 2 x 25W VHF, 220/1/50 & 24V DC with converter fully synthesized with DSC, all ITU channels, dual and multiple watch, 2 remote handsets
- 2 x VHF watch receiver with DSC decoder
- 3 x 2-way VHF handheld transceivers, waterproof type.
- 1 x Navtex receiver
- SSAS

2) Inmarsat System

1 x Inmarsat ‘C’ is to be fitted.

3) EPRIB, GMDSS satellite 408 MHz EPRIB

4) SART: 2 sets, GMDSS 9GHz

5) TV antenna: 14 outlets

SECTION 10 – DYNAMIC POSITIONING SYSTEM

The vessel shall be equipped with dynamic positioning system to class requirement for DPS-2 notation.

The control of the DP shall be at the aft wheelhouse console together with the independent joystick (c-joy c/w portable 6m cable) system in accordance with class requirements.

One [1] portable c-Wing with 4 junction boxes installed inside the wheelhouse wing c/w 6m removable cable.

The DP system shall consist of the following.

- Duplex DP workstations with maker's two control and field cabinet
- One (1) Radius computer connect with 2 integrators
- VRU or MRU to DP-2 requirement
- Two (2) UPS
- One (1) printer on line sequence and capability analysis connection in DP software
- 3 x wind anemometer
- 3 DGPS [One GPS with plotter and 2 x DPS 110 and 112 by Kongsberg]
-
- One changeover switch (DP/IJS/manual control)

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

The FMEA report shall be completed and submitted to classification for approval and to the satisfaction of the owner.

Software to interface to the following for future expansion

HIPAP

Taut wire

One[1] extra DGPS