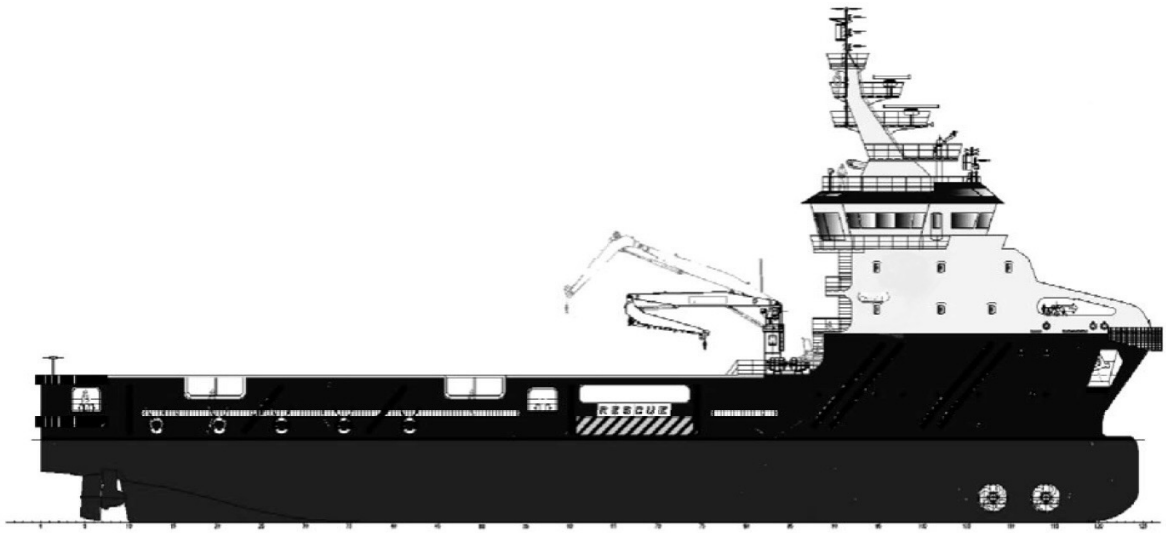
PSV

79m DP2 PLATFORM SUPPLY VESSEL

TECHNICAL SPECIFICATIONS



DESIGNER :

CONAN WU ENTERPRISES

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SECTION 1 – GENERAL

100. INTENT & DEFINITION

This specification together with the GA drawing No: CW7921–PS / G–1 revision L is intended to describe the construction of a DP2 direct diesel engine, twin Azimuth propeller driven vessel completely outfitted for offshore supply, firefighting, oil recovery classed, safety standby capability c/w anti-pollution and other related duties for offshore operation condition. The vessel is to be classed to American Bureau of Shipping for Unrestricted Services and to comply with the regulations of both the Classification and Maritime Laws and Regulations of Vanuatu.

The following terms will be used in the following specifications:

1) Designer : Conan Wu Enterprises Private Limited
2) Classification : American Bureau of Shipping

101. GENERAL DESCRIPTION (REFER GA PLAN)

This is to be all welded steel constructed vessel driven by twin diesel engines direct coupled to twin Azimuth controllable pitch propellers with nozzles. A clutch and brake are to be installed between the propulsion engine and ASD to allow power generation without turning the propeller (in case of fouling etc). The vessel's accommodation is to be located in the deckhouse deck, upper & lower forecastle deck and forward main deck. The main hull is to be divided by number of transverse WT bulkheads into the following compartments (final layout of tanks to be determined). Final sub-division, compartment and cabin layout to meet ABS requirements and relevant rules.

1) Forepeak D.W. / W.B. Tank and Chain Lockers
2) Bow Thruster / Forward Machinery Compartment, D.W. / W.B. and Potable Water Tanks
3) Fuel Oil Tanks P & S with Wing Tanks D.W. / W.B., Foam and Dispersant Tanks
4) Engine Room with D.W. / W.B. Tanks, Fuel Oil Tanks, Dirty Oil Tank, Bilge Holding Tank, Hydraulic Oil Storage Tank, Lubricating Oil Storage, and Engine Control Room etc
5) Cement Tank Compartment cum Cargo Pump Room, D.W. / W.B. Tanks, Potable Water Tank, Common Tanks for Brine / Mud / Recovered Oil Tank. Double bottom and wing tanks are to be fitted throughout in this compartment for D.W. / W. B.
6) Stern Azimuth Thruster Compartment and D.W. / W.B. Tanks

101. GENERAL DESCRIPTION (cont'd)

The 'tween' deck to be fitted within the Engine Room to house the Engine Control Room, Workshop and Engine Store.

The forward main deck accommodation is to consist of :

1) Forepeak Store and Chain Lockers
2) Mess Rooms 1 & 2 (for crew and officers)
3) Recreation Room (can be converted to Survivors Recovery Room, retro – fit to meet Standby Safety Rescue notation)
4) Gymnasium (can be converted to washplace for survivors; with gymnasium relocated to upper decks; to meet Safety Standby Rescue notation)
5) Sick Bay / Rescue Treatment Room c/w attached washplace
6) Changing Room with attached washplace
7) Provision Store / Preparation Room
8) Built – in Chiller and Freezer Rooms
9) Galley
10) HPU room~~Duty Mess and Reception Area~~
11) Common toilets
12) Deck Store (reserved to convert to Morgue)
13) Exhaust Casing

(Final layout to be agreed upon by Owner)

The lower forecastle deck accommodation is to consist of:

1) Forward Bosun Store
2) Three (3) 2 – Man cabins c/w attached washplace
3) Four (4) 4 – Man cabins c/w attached washplace
4) A.H.U. Room
5) Laundry
6) Emergency / Harbour Generator Room
7) CO_2 Room
8) Paint Store
9) Deck Store
10) Exhaust Casing

(Final layout to be agreed upon by Owner)

101. GENERAL DESCRIPTION (cont'd)

The upper forecastle deck accommodation is to consist of:

1) Eight (8) 2 – Man cabins c/w attached washplace
2) One (1) 4 – Man cabin c/w washplace
3) Office 1
4) Prayer Room
5) Deck Stores
6) Exhaust Casing

(Final layout to be agreed upon by Owner)

The deckhouse accommodation is to consist of:

1) Captain cabin c/w attached washplace on starboard side
2) Chief Engineer cabin c/w attached washplace on port side
3) Four (4) 1 – Man cabins c/w attached washplace
4) Two (2) 2 – Man cabins c/w attached washplace
5) Instrument Room
6) Meeting Room
7) Office 2
8) Deck Store
9) Exhaust Casing

(Final layout to be agreed upon by Owner)

102. MAINTAIN STATION CRITERIA

The vessel is to be capable of operating and performing services 24 hours a day at 100% MCR maintaining station at following environment :

Wind Velocity	:	Beaufort Force 7, up to 35 knots
Sea condition	:	Sea State 4, "Rough Sea" (up to 8 ft or 2.5 m significant wave height)
Current Velocity	:	2.0 knots (1.0 m/sec)

(with all elements acting 90° to the fore and aft axis of ship)

102. MAINTAIN STATION CRITERIA (cont'd)

Transverse Thrust Performance

The vessel is to be capable of side-stepping, at the operational even-keel draft in still water, of 2.75 knots average sideways movements with a maximum of ± 3° heading variation. Capability to be determined by model testing.

103. DESIGN ENVIRONMENTAL CONDITIONS

	Max.	Min.
Ambient Air Temperature	45°C	–10°C
Relative Humidity	90%	0%
Sea Water Temperature	36°C	+1°C

104. PRINCIPAL PARTICULARS

Length overall, approx.	:	79.96 m (262.35 ft)
Length W.L.	:	78.84 m (258.67 ft)
Beam moulded	:	21.00 m (68.90 ft)
Depth moulded	:	7.20 m (23.62 ft)
Draft SPS, approx.	:	5.60 m (18.37 ft) – to be confirmed by ABS
Deadweight @ SPS draft	:	3300 tonnes approx.
Draft maximum, approx.	:	6.20m (20.34 ft) – to be confirmed by ABS
Deadweight @ max. Draft	:	4000 tonnes approx.
Shallow water draft	:	3.96 m (13.00 ft) – to be confirmed
Deadweight @ 3.96m draft	:	1050 tonnes approx.
Deck area	:	900 m^2 (9688.46 ft^2) approx.
Deck strength	:	5 t/m^2
Deck cargo, minimum	:	1500 tons @ 0.9m above deck (liquid cargo will be reduced accordingly), to be confirmed

104. PRINCIPAL PARTICULARS (cont'd)

Tween Deck Heights (mean)

Forward Raised Main Deck	:	3.00 m (9.84 ft) approx.
Upper Forecastle Deck	:	2.85 m (9.35 ft) approx
Lower Forecastle Deck	:	2.85 m (9.35 ft) approx.
Deckhouse Deck	:	2.85 m (9.35 ft) approx.
Wheelhouse	:	2.85 m (9.35 ft) approx.

Accommodation

6 x 1-berth cabins	:	6 men
13 x 2-berth cabins	:	26 men
5 x 4-berth cabins	:	20 men (3 cabins for passengers)
Total	:	**52 men**

Tankage, 98% capacity (to be finally determined)

			approx.
1)	Potable Water	:	550 m^3 (145,200 usg)
2)	Fuel Oil	:	1330 m^3 (351,120 usg)
3)	D.W. / W.B.	:	1600 m^3 (422,400 usg)
4)	Liquid Mud / Brine	:	950 m^3 (5,975 bbl) {internal to be smooth with corrugated division bulkheads with external stiffeners}
5)	Recovered Oil	:	620 m^3 (163,680 usg)
6)	Dry Bulk, 4 tanks	:	283 m^3 (10,000 ft^3)
7)	Foam	:	18 m^3 (4,752 usg)
8)	Dispersant	:	20 m^3 (5,280 usg)
9)	Dirty Oil	:	13 m^3 (3,432 usg)
10)	Bilge Holding	:	13 m^3 (3,432 usg)
11)	Main Engine Lube Oil, built-in	:	7.0 m^3 (1,848 usg)
12)	Aux. Engine Lube Oil, built-in	:	3.5 m^3 (924 usg)
13)	Hydraulic Oil, built-in	:	3.5 m^3 (924 usg)
14)	Black Water (Sewage Holding)	:	20 m^3 (5,280 usg)
15)	Grey Water	:	20 m^3 (5,280 usg)

104. PRINCIPAL PARTICULARS (cont'd)

Main Engines	:	two (2) x 2400 kW (3265 bhp) at 750 rpm, each engine front PTO to drive a shaft alternator & a FiFi pump.
Stern Propulsion Thruster, CPP	:	two (2) Azimuth controllable pitch propellers, direct diesel driven via cardan shafts, c/w clutches and brakes
Bow Thrusters, CPP	:	two (2) x 12t transverse tunnel CPP thrusters, electrically driven, min. 950 kW, 440/3/60, IP44 water cooled motor with soft starter
Speed	:	max. speed about 13 knots @ trial condition
	:	service speed 12 knots
	:	economical speed 11 knots (all subject to model test)
Endurance (approx.)	:	50 – 60 days of 24 hrs/day (subject to model test)
Range (approx.)	:	13,200 – 15,840 nautical miles at 11 knots average (subject to model test)

105. PORT OF REGISTRY (POR)

The owners are responsible for the registration of the vessel. The design and construction are suitable for registration in Vanuatu under its Maritime Laws and Regulations.

106. CLASSIFICATION AND REGULATIONS

General

The vessel is to meet the requirement of the following rules and regulations:

- Rules and regulations (including ABS rules) which are valid on the date when the contract is signed.
- Rules and regulations (including ABS rules) which are made public on or before the date when the contract is signed and which are explicitly know to be effective at or before the delivery of the vessel at time of the contract signed.

106. CLASSIFICATION AND REGULATIONS (cont'd)

Class

The vessel is to be built in accordance to the rules for Building and Classing Steel Vessels under American Bureau Shipping, Guide for Building and Classing Offshore Support vessels, Part 1, 3, 4 and 5 effective 1 January 2013.

+A1, Offshore Support Vessel, (E) +AMS, +ACCU, ENVIRO, HAB(WB), MLC–ACCOM, +DPS–2, UWILD, Fire–Fighting Vessel Class 1, OSR–C1, SPS Code 2008

CLASS NOTATION OPTION :

SSR Capability (after retro–fit) – refer to Annex 'B'

NOTE :

The design, arrangement, stability and equipment fitted for this vessel is intended to suit the requirement of SPS Code 2008. In addition to this, a secondary OSV loadline is to be obtained from ABS upon delivery of ship. Two (2) plimsoll marks are to be welded to the ship side. OSV plimsoll mark is to be painted with the same color of top side.

Flag State and National

- Vanuatu Maritime laws, regulations and requirements applicable to this type vessel
- Panama Canal Tonnage Measurement Certificate
- Suez Canal Tonnage Measurement Certificate

IMO (International Maritime Organization)

- IMO Convention 1991 and 1993 Amendments
- SOLAS 1974 – International Convention for the Safety of Life at Sea, 1974, including the Protocol of 1978 and 1988 Amendments
- COLREG 1972 – Convention on the International Regulations for Preventing Collisions at Sea, 1972, as amended
- Load Lines (LL) 1966 and 1988 – International Convention on Load Lines, 1966 and Amendments 1988
- MARPOL 73/78 – International Convention for the Prevention of Pollution from Ships, 1973 and amendments 1978 : Annex I (oil), Annex II (harmful liquid in bulk), Annex IV (sewage), Annex V (garbage), Annex VI (air pollution)
- TONNAGE 1969 – International Convention on Tonnage Measurement of Ships, 1969
- IMO Intact and Damage Stability A469

106. CLASSIFICATION AND REGULATIONS (cont'd)

IMO (International Maritime Organization) (cont'd)

- IMO Radio Requirements (GMDSS) Areas 1+2+3
- IMO Code on Noise and Vibration onboard of Sea-going vessels as per HAB(WB)
- AFS – International Convention on the Control of Harmful Anti-Fouling Systems on Ships
- Ballast Water – International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004
- IMO Code of Safety, 863 (20) Code of Safe Practice for the Carriage of Cargoes and Persons by Offshore Supply Vessels (OSV Code)
- ILO Maritime Labour Convention 2006 (MLC 2006)
- IMO resolution MSC.235(82) – Guidelines for the Design and Construction of Offshore Supply Vessels
- ISPS Code – International Code for the Security of Ships and Port facilities (Alarm, IMO code marking, additional socket outlets, portable lamps, locking of doors and hatches, CCTV system for protection of intrusion). Maximum six (6) TV cameras to arrange to meet ISPS code
- AIS – Automatic Identification System– Type 'A' requirement to meet SOLAS as amended and IMO performance standards for AIS
- BNWAS – Bridge Navigation Watch Alarm System – SOLAS Ch V, Reg 19
- SPS Compliant (2008) – under 60 men accommodation : additional load line from ABS
- IMO IMDG Regulation A673(16) Guidelines for the transport and handling of limited amount of hazardous and noxious liquid substances in bulk in offshore support vessel
- SOLAS Chapter 2–2 Regulation 19.4 Guidelines for the carriage of dangerous deck cargoes

To meet the above two regulation, attached list (Appendix 1) showed what noxious and dangerous cargoes will be carried by this vessel.

Non – Governmental

- ITU – International Telecommunication Convention 1973 and Radio Regulations, 1974 (edition of 1976) and those amendments of 1979 including GMDSS (A1 + A2 + A3 MF / HF)
- IEC Publication No.92 – Electrical Installation In Ship
- Oily water : Shipping Industry guidance on the use of oily water separators
- IACS's Recommendation No.47 Part A – Shipbuilding & Repair Quality Standard for New Construction
- Failure Mode and Effects Analysis (FMEA)

106. CLASSIFICATION AND REGULATIONS (cont'd)

Non – Governmental (cont'd)

- OVID (Offshore Vessel Inspection Database) of OCIMF (Oil Company International Marine Forum) with regards to :
  a. Crew / Passenger Transfer Operations regarding Passenger Transfer Operations and Vessel Access
  b. Supply Operations c. Mooring Operations
  d. Safety Standby, Security and Emergency Response (for optional vessel only)

To be supplied by Owner

- Ship Security Plan
- Shipboard Marine Pollution Emergency Plan (SMPEP) – a furtheron and combined plan including previous Shipboard Oil Pollution Emergency Plan (SOPEP)
- Garbage Disposal Management Plan
- Bilge Management Plan
- Sewage Management Plan
- Oil Recovery Operating Manual
- Refrigerant Management
- Ballast Water Management Plan
- PA Manual
- Cargo Securing Manual
- DP Operation Manual
- Filing Management Plan and Procedure to meet ABS requirements(Fuel Oil Management Plan)
- Fire Fighting Class 1 Operating Manual
- ISM – International Safety Management Manual
- Safety Manning Certificate
- Safety Management Certificate (issued by ABS on behalf of Flag State)
- Certificate of Registry (Vanuatu)

107. CERTIFICATES

The following certificates are to be supplied to the Owner(s) at the time of delivery of the vessel :

Certificates issued by Classification (ABS)

1) Certificate for Hull and Machinery
2) International Tonnage Certificate (1969)
3) International Load Line Certificate with Valid Inspection Endorsement
4) FiFi 1 Certificate (to be issued by ABS)

5) Fire Detection System Certificate (issued by ABS)
6) Crane and davit Certificate (issued by ABS) as required
7) Certificates for anchor and anchor chain

107. CERTIFICATES (cont'd)

Certificates issued by Classification (ABS) – cont'd

8) Certificate for windlass
9) Certificate for mooring ropes
10) Certificate for life rafts (by authorized LSA maintenance agent + ABS)
11) Pressure bottle certificate
12) CO_2 bottles certificate
13) Acetylene / Oxygen bottles certificate
14) Certificate for breathing apparatus
15) Foam Test Certificate or Statement of Fact (by authorized LSA management agent + ABS)
16) Ballast Water Treatment Certificate
17) Enviro Certificate [hull anti – fouling, ballast water treatment, pollution prevention of oil, sewage, garbage and air : Marpol I (oil), II (harmful liquid in bulk), IV (sewage), V (garbage), VI (air) of International Convention Prevention from Ships]
18) HAB(WB) – ABS Guide for Crew Habitability on Workboats regarding Climate (temperature and air changes / ventilation), Lighting, Noise and Vibration (including whole body vibration) and Area for seafarers etc.

Certificates issued by the National Authorities

19) Cargo Ship Safety Construction Certificate
20) Cargo Ship Safety Equipment Certificate
21) Cargo Ship Safety Radio Telephone Certificate
22) Certificate for Compass Adjustment
23) Certificate for navigation lights and special signal lights
24) Certificate for nautical instruments as required by Flag
25) GMDSS (Safety radio certificate)
26) IAPP Certificate (International Air Pollution Prevention)
27) IOPP Certificate (International Oil Pollution Prevention)
28) ISPP Certificate (International Sewage Pollution Prevention)
29) Certificate for the International Convention on the Control of Harmful Anti-Fouling System
30) Suez Canal Tonnage Certificate (with Suez Canal search lights and signal lights provided)
31) Panama Canal Tonnage Measurement Certificate

107. CERTIFICATES (cont'd)

Miscellaneous Certificates etc

32) Builder's certificate, notarized and authenticated, two (2) months prior to the delivery of the vessel
33) National Registry Certificate (to be provided by owner)
34) Ship Sanitation Control Exemption Certificate (issued by relevant authority)
35) Annual Certificate of Inspection of fire-fighting equipment
36) Bi-Annual Certificate of Inspection of Fixed Fire-Fighting Equipment
37) Deratisation Certificate
38) Marpol Certificate for Annex 1, IV & V (sewage, oil & garbage)
39) Certificate for nautical equipment
40) Statement of Fact for Compliance for Asbestos-Free and CFC Free
41) Non – Asbestos Certificate issued by an Accredited Surveyor Company i.e. Coffey (Australia) or equal acceptable to Owner.
42) Public health analysis certificate for potable water
43) Main and Generator engine compliance with MARPOL 73/78 annex VI Reg. 13 Class (NOx) with EIAPP (Engine International Air Pollution Prevention) provisional certificate
44) All other certificate required by the Classification and Flag State for all products, machinery and equipment for the type and class of vessel
45) International Anti – Fouling Guarantee Letter (60 months) – International Paint
46) Potable Water Tank Paint Certificate (Safety)
47) Inventory of hazardous and potentially hazardous material

The cost of all fees and charges incurred for survey, classification and issue of certificates are to be borne by the Builder.

108. MATERIALS & WORKMANSHIP

1) All materials and workmanship are to be good quality of the new and recent manufacture. All steel plates, sections, hull forging and castings are to meet classification's requirements and supplied with test and class certificates where required by classification. All visible steel plates are to be smooth or straight as applicable. Standard to be of J.S.Q.S.
2) All woods used to be suitable for the intended purpose and of good quality. All timber to be free from knots and well seasoned.
3) All smith work or fabricated fittings to be of neat design, strong, smooth & free from defects.

108. MATERIALS & WORKMANSHIP (cont'd)

4) All castings to be of good quality close grained and free from cracks, blow holes and other defects. Steel castings to be manufactured to classification requirements and approval as required.

109. WELDING

Vessel to be of all welded construction, in accordance with contract plans, specifications, classification requirements. Welding procedure is to be in accordance with classification requirements. Automatic welding is to be used as far as possible. All steel used to be of good welding quality, free from laminations or other harmful defects and be Class approved and certified by ABS.

Electrodes to be selected from classification approved lists. High standards of up-to-date welding practice and procedures are to be applied. These are associated with accurate alignment, fairness, edge preparation and gap widths. Where possible, structure should be pre-fabricated in assemblies and sub-assemblies to give the maximum possible amount of down hand welding.
All exposed areas and structural members inside of all tanks and in way of bilges are to have double continuous welding.

Welders to be approved by ABS.

110. INSPECTION / SUPERVISION

Throughout the construction period prior to the delivery, the surveyors, owners' representative and consultants are to be given free access to the builders' yard during normal working hours for supervision and inspection. Shipyard is to provide permanent cleanliness of the vessel during construction period.

Inspection list / programme submitted by the Builder to the Owner's representative to be in English. All comments and defect list given during the inspection and testing are to be rectified as soon as possible with the Surveyor and Owner.

A separate air – conditioned office c/w telephone, fax and internet facility to be provided for the Owner representative.
Daily inspection list must be notified 24 hours in advance.

111. TESTS

Prior to delivery, the hull, all machinery, electrical, piping, ventilating, all navigation/ communication equipment, machinery and deck fittings, domestic equipment, etc. are to be thoroughly tested and accepted in the presence of the classification's attending Surveyor, Owner(s) and / or their representative.

112. INCLINING EXPERIMENT

Before the sea trials with the vessel in near complete condition, an inclining experiment (for the first ship) or a Lightship Survey (for sister vessels) as required by classification in order to ascertain the lightship weight and the center of gravity. Experiment is to be carried out by the builder with the presence of classification surveyor and owner's representative. Based on the results, a stability report is to be prepared by the builder for submission to Classification for approval.

113. DOCK TRIALS (PRIOR TO SEA-TRIALS)

Upon the completion of the vessel, the following trials are to be carried out and accepted by Owner(s) prior to sea-trials:

1) Bow and Stern Thrusters
2) All piping systems are to be fully tested and proven, including the checking of valve name plates to be acceptable by Owner and ABS
3) Electrical power plants, main and auxiliary switchboards together with associated systems
4) Auxiliary machinery
5) Ventilation, refrigeration machinery
6) All deck machinery
7) Air-conditioning machinery
8) All pumps, etc
9) Tests of electrical wiring and piping systems for Ballast Water Treatment System prior to delivery (Treatment System to be OFE)
10) Alarm, fire detection, rescue craft, CO_2, bilge pipe system prior to sea trials
11) Other systems as required i.e. galley

114. SEA TRIALS

Sea trials are to be arranged and carried out in accordance with a program agreed by the Classification Society and Owners. The Builder is to supply a master and crew, all victuals and necessary equipment and arrange the catering. All diesel oil, lubrication oil, hydraulic oil, grease for initial filling of the systems according to the quality to be approved by Owner.

The Builder is to pay for initial fill – up of the machinery and equipment as well as fuel, water oils and all consumables used during the tests and trials. Remaining amounts in the storage tanks and drums (unopened drums only) excluding those are in the systems (machinery and piping) are to be taken over by the Owner upon delivery and paid at current published port prices for fuel, lube, hydraulic fluids etc.

Pilotage, standby vessel and dues for the trials are to be paid for by the Builder. Potable water remaining in the tanks is to be paid for by the Owner upon delivery at current published port prices subject to acceptance by the Owner and Potable Water Certificate supplied by certified authorities.

Prior to the testing of main components at Makers' factories, the Owner is to be advised in sufficient time, to ascertain if he is going to attend the testing in the factories. Torsion vibration calculations (main engine at flywheel and free ends, fire pump outlet and shaft alternators) are to be carried out by the manufacturer at the time of factory testing and to be approved by Classification prior to the trials. Class approved documents to be given to the Owner. The compass is to be adjusted during sea trial.

1) Speed Trials

Speed trials to be conducted over a recognized measured mile or with GPS. Two (2) double runs are to be made with CPP Z – Drives propeller combinator adjusted to represent engine ratings of 100% MCR (maximum continuous revolutions), 85% MCR and 50% MCR. Records of main engine cooling water temperature and pressure, fuel consumption, engine revolution and etc. are to be taken. Records of propeller reading also are to be taken. Record of fuel consumption is to be taken. Fuel consumption to be taken by means of installed FuelTrax equipment. "Best Speed" and "Best Consumption" to be noted. Records of power generated are to be taken and recorded using torque meters or similar during all trials.

2) Endurance Trials

Endurance trial of 4 hours with the engines developing 100% MCR output and 100% propeller pitch is to be carried out in conjunction with speed trials in accordance to Owner approved trials protocol.

114. SEA TRIALS (cont'd)

3) Maneuvering Trials

Maneuvering trials are to be carried out. Z – Drive rotational speed must stay within the safety limits of the hull's stability characteristics to avoid capsizing. The diameter of the turning circle and the time taken to complete a full circle are to be recorded.

The times taken to complete rudder propeller movements to be taken as follows (after consulting with the Owner's representative and Azimuth Drive maker as to a safe rotation speed) :

- amidships to "hardover" 35° port
- amidships to "hardover" 35° starboard
- 35° port to 'hardover" 30° starboard
- 35° starboard "hardover" 30° port
- Williamson turn (man – overboard)

Maneuvering trials are to be carried out as follows:

With the vessel proceeding at full power on a straight course, a rudder angle of 35° port is to be applied and held until the vessel has turned 35° to port of the original course. At this point the helm is to be immediately reversed and held at 35° starboard rudder angle until the vessel has turned 35° to starboard of the original course. At this point the helm is again to be reversed and held at 35° port angle until the ship's head reaches the original straight course.

A total time taken to complete the maneuver : from straight course to 35 degrees port to 35 degrees starboard to straight course, is to be recorded.

The above is to carried using two azimuth thrusters, then each thruster individually with the second thruster remaining straight ahead at full pitch and then in zero pitch.

4) Stopping & Astern Trials

With the vessel proceeding ahead at full power and the controls are to be moved from 'full ahead' to 'full astern'. The following records are to be taken:

a) Time to move controls from 'full ahead' to 'full astern by changing to propeller reverse pitch and rotating of the propeller through 180 degrees and maintaining full pitch
b) Time to bring the vessel to a stop
c) Estimate of distance run between initiation of order and stopping of vessel
d) Time to a steady astern condition
e) Record of vibration to be taken at aft main deck

During the astern trial the vessel is to be inspected for occurrence of superstructure and local vibration and condition must be satisfactory by Classification / Owner.

114. SEA TRIALS (cont'd)

5) Crash Stop Trial

Vessel to be capable of going from full ahead (full speed) to stop dead in the water in 40 seconds or less while fully loaded to summer load line draft – see item 4(a) above.

6) Bow Thruster Tests

Bow thruster tests are to be carried out with one (1) and two (2) bow thrusters individually and together in operation. Tests program is to be agreed by the Builder and Owner.

7) Anchor Trial

Anchor trials are to be carried out in accordance with classification requirements.

8) External Fire Fighting System Tests

Tests are to be conducted according to a program to be agreed with the Owner and Class.

9) Dispersant System Tests

Tests are to be conducted according to a program to be agreed with the Owner.

10) Dynamic Positioning Trials

Dynamic positioning trial is to be conducted to Rules requirements. In addition, special trials to be conducted to ensure meeting the requirement of keeping station. A program of trials is to be presented by the shipyard to the Owner for review and approval prior to commencement of trial.

Wind : up to 35 knots
Sea Condition : 2.5m wave period, 10 secs period
Current : 2 knots (1.0 m/sec)

11) Crabbing Tests

Side stepping of 2.75 knots at operational even – keel draft in STILL WATER and no wind, average sideways movements with a maximum of ± 3° heading variation. Capability to be determined by model testing.

115. DELIVERY

Delivery of the vessel is to be taken afloat of shipyards jetty or in Owner agreed designated export anchorage whichever is required by the country of builder and to meet its national rules and regulations. All tanks, compartments, bilges, accommodations, open spaces and machinery spaces are to be cleaned and free of all dunnage and dirt.

116. DRAWINGS

On completion, four (4) hard disks containing a full set of auto – cad format drawings and calculations. Three (3) sets of the following calculations and as fitted drawings in paper prints are to be supplied by Builder / shipyard. Two (2) sets of drawings and calculations stamped approved by the classification, are to be supplied.

All vendors' detailed instructions / installation drawings are to be given to the Owner for approval prior to construction commencement. Owner to revert the comments or confirmation within fourteen (14) days after his receipt of Builder's drawings.

1) ARRANGEMENT & LAYOUT

- General Arrangement
- Wheelhouse
- Accommodation Layout (cabins and furniture)
- Galley
- Engine Room
- Engine Control Room
- Main Engines, Cardan Shaft and ASD
- Forward Machinery Compartment
- Azimuth Thruster Compartment
- Mooring Arrangement (forward and aft deck)
- Harbour / Emergency Genset Compartment
- Line of sight
- Height of mast etc (complete ship) to be displayed on bridge
- Manual sounding table (booklet) for all tanks. Fuel and water tanks to include correction tables for trim and heel.

116. DRAWINGS (cont'd)

2) CALCULATIONS

- Speed and Powering
- Hydrostatic Curves
- Cross Curves
- Tank Capacity
- Intact and Damage Stability Calculations (preliminary and final)
- Electrical Load Analysis
- Longitudinal Strength
- Inclining Experiment Agenda
- Freeboard (final freeboard assignment to be given by ABS)
- Tonnage (1969) Measurement (final tonnage to be assigned by ABS)
- Equipment Number (anchor and chains etc)
- CO_2 bottles or Water Mist System
- DP Capability Plot (by DP Vendor)

3) STRUCTURE

- Structural Profile and Deck
- Forward Sections and Bulkheads
- Aft Sections and Bulkheads
- Shell Expansion
- Superstructure
- Bow Thruster Tunnel
- ASD Propeller Well Construction
- Main Engine Seating
- Generators Seating

4) MECHANICAL

- Ventilation Arrangement : Engine room, Bow Thruster Compt. and ASD Compt.
- Shafting Arrangement including plummer block bearings (steel solid chock to be used)

5) PIPINGS SCHEMATICS

- General Service, Bilge and Firemain System
- Drill Water and Ballast System
- Domestic Potable and Cargo Water System

116. DRAWINGS (cont'd)

5) PIPINGS SCHEMATICS (cont'd)

- Ship's Fuel and Cargo Fuel System
- Domestic Sea Water and Sanitary System
- Dry Bulk System
- Liquid Mud, Brine and Recovered Oil Systems
- Position of Tank Vent, Sounding and Filling Pipes
- External Fire Fighting System including water curtain
- Dispersant System
- Engine Cooling System
- Hydraulic Oil System
- Grey Water System
- Sewage System
- Lube Oil System
- Compressed Air System
- Purifier System For Fuel Oil And Lube Oil

6) OUTFITTINGS

- Docking Plan
- UWILD Plan
- Deck Support Fittings with SWL shown

7) SAFETY

- LSA and Fire Fighting Equipment
- Structure Fire Protection Scheme
- Turning Circle Diagram with Results Obtained After Sea Trials

8) ELECTRICAL

- Single Line Diagram
- Schematic Wiring Diagram
- Main Switchboard Wiring and Short Circuit Calculations, etc
- 24V DC Radio Battery Charging Panel and 24V DC Switchboard
- Switchboard Operation Manual (vendor supplied)
- DP Single Line Diagram

117. MANUALS OF MACHINERY & EQUIPMENT

Four (4) sets of manuals of all machinery and equipment in the English language are to be supplied by the builders / vendors both in hard copy and on CD. The manufacturer of all equipment of its maker, model and serial number, type, and capacity is to be supplied and their location listed in CD c/w vendor contact details, names, telephones, emails and addresses to be provided.

118. PRACTICE

Any modifications and changes required by Classification Society or Flag State Administration authority not mentioned in the specification and drawing are be modified and installed at no extra cost to the Owner.

Any items be they of steel / piping for equipment, machinery or outfitting which inadvertently are not expressly called for in these specifications or drawings but which nonetheless are of good marine practice and necessary for the safe and efficient working of the vessel to be furnished and installed as the case may be by the builder without any increase of the cost to the Owner.

119. CHANGE OF EQUIPMENT / MATERIAL

1) If for any reason the Owner or Builder should want to change any make or brand of equipment, components and materials etc then the reasons for the requested change is to be submitted to the Owner for their approval. All changes must be agreed and approved in writing; any differences in prices are to be adjusted accordingly to the contract price. However the acceptance or rejection of alternatives is for the Owner's decision only and such decision will be final.

2) The Builder is to follow strictly contract and maker's list, equipment and materials, rules and regulations as in these specifications. In case, the described equipment or materials have "equals", the builder must submit detailed technical information to the owner for approval prior to purchase.

3) Owner has the final approval authority of the Makers List.

120. SUPERVISION AND INSPECTION BY OWNER'S REPRESENTATIVE

The Builder is to present detailed and accurate S – Curves with support information for Engineering, Production and Commissioning from the time of project commencement until delivery. However, this does not release the Builder from responsibility of building and fitting out a complete vessel meeting the contract, specifications requirements.

Despite Owner / Buyer's approval to subject drawings being obtained it is still incumbent upon the Builder to ensure that the vessel meets all requirements as stated or intended under this specification and notation. The cost and time associated to meet these requirements is to be Builder's account.

121. FRAMED UP PLANS

The following plans properly framed and glazed to be fitted on board:-

- General Arrangement Plan
- Capacity Plan
- Safety Plan
- Fire Plan
- Bilge and Ballast Plan
- Fuel Oil Plan
- Certificates as required by relevant authorities

122. SHIP'S MODEL

Three (3) ship models for each vessel to be built in the scale of 1:75 are to be supplied by Builder to the Owner upon the delivery of each vessel.

SECTION 2 – STRUCTURE

200. GENERAL

The steel hull and superstructure are to be of all welded construction. Transverse framing system is to be used throughout. The following structural scantlings are for guidance only and are subject to Classification Society final requirement and approval. In order to minimize noise and vibration levels, steel structure analysis is to be carried out by an accredit specialist prior to commencement of construction.

201. KEEL

A flat plate keel to be minimum 16mm thick is to be fitted and connected throughout its length to the centre girder. It is to be tapered at the forward end to the stem bar and connected to the aft centerline skeg.

202. STEM

The stem below the waterline is to be formed by stem plate. It is to be well - shaped at the ends to the keel plate and the upper stem plating.

Above the waterline, the stem is to be formed by a raked and radius plate. The stem plate is to be stiffened by webs and breast-hooks.

203. SKEG

A box shape skeg is to be fitted at the centerline and set forward of the propellers as shown on the GA Drawing. Provision is to be made to ensure internal drainage to the docking plugs.

204. BOTTOM CONSTRUCTION

The bottom is to be of double bottom construction, except in stern and forepeak D.W. / W.B. tanks and other area of the below main deck. Cement tank compartment and the engine room to be completely double bottom construction. In order to give a structural continuity in the bottom, two engine girders P&S, together with the center girder are to be extended as far forward as possible and are to be linked with the longitudinal bulkheads of the aft tanks and to meet with Classification / SOLAS requirements.

205. PLATING

All plating and stiffeners are to be in accordance with ABS requirements. The bottom and side plating are to be longitudinally plated, to have welded butts and seams and to have the following thickness:

Aft Deck plate, in general	: 12 mm
Bottom plate in general	: 12 mm
Side shell in general	: 12 mm
Sheer strake	: 16 mm
Shell plating in way of propeller well openings	: 20 mm

206. FRAMES

Frames for main hull to be bulb plate spaced at 600mm throughout and to be welded to the shell plating. Strong longitudinal girders and transverse ring frame (or web) is to be provided.

207. BEAMS

Beams for main deck to be bulb plate and fitted at every frame. They are to incorporate with strong beams of plate fabricated section fitted in way of deck openings and other locations as shown on the drawing.

208. GIRDER & PILLARS

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

209. ENGINE GIRDERS AND SEATING

Main engine girders of vertical plate with horizontal rider plate are to be provided for main engines which are to have Chockfast mounting. Bearings for Cardan shafting are on Chockfast mountings Auxiliary engines and alternators sets are to be mounted with Vibracon mounts to a common skid. The skids are to be resiliently mounted to the hull. Chockfast is not allowed.

210. AZIMUTH PROPELLERS SEATING

ASD units are of rigid mounting by bolts or welding (Azimuth flange mounted from bottom up to the ASD CAN). Refer to Section 1002 for further details.

211. WORKING DECK – DESIGNED FOR 5 t/m^2 UNIFORM LOADING

The aft main deck is to be transversely framed and supported by deck girders and deep transverses. The deck plating aft of the superstructure is to be 12mm thick and designed to take a uniformly distributed load of 5 t/m^2.

Elsewhere the deck plating in way of accommodation is to be to classification requirements. The main deck plating is to be welded directly to the shell plating.

Stowage fittings are to be arranged outside of the cargo rail for the rig discharge hoses as required.
Scupper pipes in forward upper forecastle deck and anchor windlass area to be installed.
Mooring chocks, chain stoppers, roller fairlead, etc. are to be fitted as shown on General Arrangement and to be of cast steel.

212. BULWARKS

Bulwarks at main deck levels are to be 2850mm height as shown on the GA drawing. Bulwark plating is to be 10mm with solid web and longitudinal bulb plate. Opening on bulwark for cargo discharge pipe and mooring bollard are to be provided, the bulwark structure to be integrated to cargo rail structure.

Freeing ports are to be arranged in main deck bulwarks with area to Classification requirements. Freeing ports are to be lined with 14mm round bars.

Forecastle deck bulwark plating to be 8mm thick with 150 x 12mm bulb plate on top with bulwark stays welded to deck with doublers.
Bulwark is to have a number of lugs (half stud link chain U2 – 34mm dia. with double plate) welded to the outside for securing portable used aircraft tyre fenders).
Folding type of double – leaf bulwark gate in way of rescue zone (P & S) to be provided.

213. WATERTIGHT / OILTIGHT BULKHEADS

The W.T. / O.T. bulkheads as shown on the General Arrangement may be plated horizontally with two different thicknesses. Stiffeners are to be spaced to suit deck and bottom structure with bracket at each end. The numbers and types of doors are to be according to rules and regulations.

Manholes on internal WT / OT bulkheads are to be hinged type with raised coaming for the bolted covers, if these manholes are to be positioned at high levels. Rungs or vertical ladders and grab rails to be fitted on both sides of these manhole access. Hinged manholes are to be fitted with a “hold open” device or pin.

214. WHEELHOUSE

The wheelhouse is to have 8mm plate for the front, 8mm for sides and top fitted with vertical / horizontal stiffeners and beams respectively. Aft side windows to be full height with 10mm steel bulkhead. All wheelhouse windows to be fitted from outside with toughed safety glass.
The wheelhouse top deck is to be strengthened to accommodate the mast and various equipment. Wheelhouse wings are to be provided in accordance with the G.A. Small platforms and walkways are to be arranged aft of the wheelhouse and outside the bridge wings for cleaning and maintenance purposes.

At wheelhouse side bulkhead (P&S) outer doors, are to be painted in light colors with glass window.

215. DECKHOUSE

All exposed boundary bulkheads is to be 8mm with L100 x 75 x 7 stiffeners. The top, sides and minor bulkheads are to be 6.5mm. The vertical stiffeners and deck beam are to be L75 x 50 x 6mm.

216. FORECASTLE

Side plate (lower f'cle)	–	8mm and 10mm with 12mm at break of forecastle
Side plate (upper f'cle)	–	8 mm
Deck	–	8mm with 12mm forward in way of anchor windlass
Bulkhead	–	8mm
Beam & stiffeners	–	L125 x 75 x 7mm / L100 x 75 x 7mm / L75 x 50 x 8mm

217. FUNNEL

Single funnel uptake to be arranged as shown on the General Arrangement Plan to accommodate the exhausts. Funnel is to serve as engine room hot air exhausts. Funnel to carry owner's insignias cut from 4mm plate and bolted to position (Owner's approved insignias).
A hinged water tight access door or portable panel is to be fitted on the funnel for maintenance accessibility. A cross piece is to be fitted on top, joining the funnel together and act as platform for mounting and operating the fire monitors. Under the cross piece, a steel constructed compartment for DP equipment / independent air conditioning unit and batteries etc is to be provided.
Safety ladders with hoops to allow safe access to lights and equipment on the mast to be installed.
Internal of funnel to be well lighted and working platform, grab rails to be provided for maintenance.
Spark arresting silencers of 35 dBa to be fitted with exhaust pipes running to the top of funnel and secured with flexible mountings.

Final arrangement to be made to meet Owner requirements.

218. BILGE KEELS

Two (2) bilge keels made of approx. 300 x 12mm bulb plates are to be fitted on doubler plates P & S. Bilge keels are to be aligned with the natural streamline flow but to be not protruding past the vertical sides of the vessel.

219. MATERIAL THICKNESS TOLERANCE

Material thicknesses is to have a tolerance within classification limits.

220. OUTFITTING (EXPOSED AREA)

All the external hatches, door, air-vent, ladders, flanges, lighting and etc. to be fitted with stainless steel bolts and nuts.

221. CARGO RAIL

Two (2) 2850mm height longitudinal cargo rails of 12mm to be installed around the main deck aft. They are to be fitted with a top plate which forms a longitudinal platform between cargo rail and bulwark. A series of transverse webs which will form part of the bulwark webbing will be part of the foundation for bulk tank compartment and stern Azimuth thruster compartment ventilation ducting to be built into the cargo rails. All cargo pipes are to run under cargo rail overhead stiffening and support.

The cargo rails to have openings in way of cargo rollers. Of these, two (2) rollers, 1P & 1S to be positioned at most aft end. Clear head room under the cargo rail to be maintained at 2.10m minimum.

A number of the following items to be fitted within the cargo pen (numbers & details to be finally decided by Owner) :

- 50t SWL pad eyes
- 20t SWL pad eyes
- Raised type deck sockets (elephant foot) for lashings flush mounted with timber deck
- 5t 'D' rings
- 250 dia. cargo rollers
- 4" Sch. 80 portable pipe stanchions for holding of long deck cargoes (pipes) – see Section 7 for details

SWL are to be welded on all pad eyes and 'D' rings.

222. SEWAGE TANK AND GREY WATER TANK

In order to maintain structural integrity, the above compartments are to be protected by heavy steel of 14mm to 16mm thick.

223. SEA CHESTS

The following sea chests are to be fitted with extra steel plates (16mm) :

- 2 x sections of built – in channel in the engine room bottom for engine cooling and ballast water inlet
- 2 x external fire fighting sea chests in engine room
- 1 x emergency fire pump sea chest in bow thruster compartment
- 1 x sea chest c/w Class approved hull gate valve, blank flange for future installation of a hydro-acoustic valve to be provided by Builder (gate valve to be 500mm diameter)
- others as necessary

Air vents, compressed air blow-downs, and anodes, hinged gratings secured by SUS 316 nuts and bolts with split pins are to be fitted to all sea chests.

SECTION 3 – ACCOMMODATION AND COMPARTMENT SPACES

300. GENERAL

The accommodation and mess are to be air-conditioned to meet International Labour Organisation (ILO) MLC 2006 : MLC – ACCOM and HAB(WB). And they are to be arranged and fitted out in accordance with the General Arrangement drawing. Scheme of decoration and colors, samples of all decorative materials, finishes such as furnishing fabrics, plastic laminates, deck covering, paints etc are to be submitted to the Owner(s) for approval prior to commencement of work.

The vessel's air-conditioning system to be capable of maintaining a constant temperature of 21°C (76°F) and 50% relative humidity (RH) under peak ambient conditions of :-

	MAX.	MIN.
Ambient Air Temperature	45°C	–15°C
Relative Humidity	90%	0%
Sea Water Temperature	36°C	+1°C

The mess / recreation room(s) are to have sufficient seating capacity for 50% complement in one seating. Final arrangement is to exceed minimum requirement of one (1) WC and one (1) shower for every 6 crew members. Four (4) washing machines and four (4) electrical dryers are to be supplied and fitted (dryers mounted on top of washing machines with ventilation to outside deck spaces). They are to be sized to external access through the doors for replacement.

All fixed and loose furniture, curtain, 150mm thick spring mattresses, bedding sheet, pillows and pillow cases etc. as described in the following specification are to be supplied and fitted by the builder. All kit lockers in accommodation are to be full height and lockable for crew's personal effects & clothing.

All internal doors are to meet with SOLAS requirement and hung on stainless steel hinges and fitted with stainless steel door fixtures with louvers at the bottom for return air ventilation. All materials used must be of asbestos free (zero asbestos content).

Good quality locks with three sets of keys clearly labeled are to be provided to doors of all cabins, stores and other compartments throughout the accommodation. Stainless steel locks are to be fitted to drawers, cupboards, lockers, refrigerator and stores as necessary. Three (3) master keys are to be provided.

300. GENERAL (cont'd)

Structural fire protection is to be provided for all accommodations and machinery spaces. In addition, machinery spaces to be equipped with a full flooding CO_2 system to meet rule requirements including FiFi – 1 class.

Ample storage space for maximum utilization is to be achieved. The shipyard is to submit to the owner detailed drawings of wheelhouse, cabins, common rooms, galley, all machinery compartments and stores, under the staircases and passageways showing the storage shelving, lockers, bins, cabinets, etc prior to work commencement.

<table>
<tr><td></td><td colspan="2">ILO MLC 2006 & HAB(WB) REQUIREMENT</td><td colspan="2">DESIGN</td></tr>
<tr><td>Cabin type</td><td>Min. Sleeping Room area</td><td>Min. inside dimension of berth</td><td>Sleeping Room Area</td><td>Designed inside dimension of berth</td></tr>
<tr><td>single</td><td>5.5m^2</td><td rowspan="4">1980 x 800mm (78" x 31.5")</td><td rowspan="4">As per GA plan</td><td>2150 x 1200mm (84.7" x 47.3")</td></tr>
<tr><td>2 – man</td><td>7.5m^2</td><td rowspan="3">1980 x 800mm (78" x 31.5")</td></tr>
<tr><td>3 – man</td><td>11.5m^2</td></tr>
<tr><td>4 – man</td><td>14.5m^2</td></tr>
</table>

Special attention is to be paid noise and vibration levels within the limits of HAB(WB) and ILO MLC 2006, Guidelines for Noise Levels and Whole – body Vibration Limits Guidance.

Installation of floating floors, flexible mounting of ceilings and bulkheads are to be provided as necessary.

Minimum headroom in all accommodation is to be 2.05m. All sanitary spaces to have ventilation to the open air, independent of any other part of the accommodation. Each occupant to have minimum 475 litres of lockers space and drawers of 56 litres.

300. GENERAL (cont'd)

NOISE LIMIT GUIDANCE TABLE

	NOISE LIMIT dB(A) MAXIMUM	
SPACE	MLC 2006	HAB(WB)
Accommodation Space :		
Cabins and hospital	60	60
Mess Rooms	65	65
Indoor Recreation Rooms	65	65
Open Recreation Areas	75	75
Gymnasium		65
Sanitary Spaces (separate from cabin)		65
Navigation and Control Spaces :		
Wheelhouse, Pilothouse, Bridge		65
Radio Room		60
Offices	65	65
Cargo Control Rooms		65
Machinery Control Rooms		75
Service Spaces :		
Food Preparation (e.g. Galley, Scullery)	75	75
Pantries and Storerooms	75	75
Laundry Areas		75
Operating and Maintenance Spaces :		
Continuously Manned Machinery Spaces		90
Not Continuously Manned Machinery Spaces		110
Workshops		85
Fan and Generator Rooms		90

300. GENERAL (cont'd)

In order to meet HAB(WB), the following are to be supplied and fitted as necessary :

- Spring mounting for compressors, ~~hydraulic power pack & pipes~~, auxiliary engines and exhaust pipes to be fitted.
- Silencers for ventilation fans i.e. inlet and outlet of engine room, bow thruster compartment and others ~~as necessary~~.
- Low noise propellers for Azimuth and bow thrusters.
- Engine Control Room (ECR) fitted with double door noise trap and window to be double frames / panes.
- All fans in wash places to be independently control – turn off while not in use.
- Machinery vibration to be in accordance with Class recommended limits – all rotating machinery.
- Floating floors / insulating bulkheads to be used in the accommodation as deemed necessary to reduce structure borne noise.
- All machinery spaces adjacent to accommodation spaces, and the casing to be acoustically insulated.
- Portholes and windows to have double frames, with the inner frame insulated from the outer frame.
- Ducts for air conditioning / ventilation passing through or adjacent to accommodation to be acoustically insulated.
- Noise from HVAC defuses outlet in accommodation spaces to be 5 dB less than the limit for that space under HAB(WB) requirement (without machinery running).

WHOLE – BODY VIBRATION CRITERIA TABLE

FREQUENCY RANGE	MAXIMUM RMS LEVEL					
	Transit Conditions			Thruster / DP Conditions		
	MLC 2006	HAB(WB)		MLC 2006	HAB(WB)	
		Acom. Area	Work Space		Acom. Area	Work Space
1.0 – 80 Hz	214 mm/s^2	161 mm/s^2	178 mm/s^2	286 mm/s^2	178 mm/s^2	196 mm/s^2

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 including the built – in.

Deck covering in way of accommodation and wheelhouse are to have floating floors of sandwich construction.

Safety treads of brass with wooden steps are to be fitted on all ladder footings c/w stainless steel or solid wood capped hand rail on the deck inside of accommodation passage way and step ladder area in ECR / wheelhouse control.

Stair tread risers are to be equal from deck to deck after installation of deck insulation and deck coverings. Internal stairs to be not exceed 50 degrees gradient.

Schedule of Deck Coverings

Wheelhouse top & wheelhouse deck exterior & main deck etc.	:	non-skid deck paint
Wheelhouse interior	:	4mm raised dot rubber sheet (butt joint to be welded) on level floor made up by deck composition
Mess, lobby, cabins and others	:	4mm raised dot rubber sheet (butt joint to be welded) on level floor made up by deck composition
Washrooms, galley and laundry	:	non-slip quarry tiles laid on wired cement layer under and curved at the skirting with proper waterproofing seal
Engine room, Azimuth thruster / cement } Tank / bow thruster compartment }		mainly **aluminum** alloy chequer plate except in way of escape routes where 6mm **steel** chequer plate is to be used. All floor plates is supported on top of bearers and secured by SUS 316 countersunk screws
Machinery spaces flooring	:	non-skid paint
Stores	:	wood gratings on painted steel deck
Engine Control Room	:	floating floor under 4mm raised dot rubber sheet
Wheelhouse floor	:	floating floor under 4mm raised dot rubber sheet
Wheelhouse grating	:	wooden gratings in control positions as required
All electrical switchgear	:	4mm raised dot rubber sheet

302. MINOR BULKHEADS & LINING

All steel minor bulkheads are to be lined with fire retardant soft core panel c/w metal strip ceiling and fire rated door in the wheelhouse, engine control room and the entire accommodation cabin / living / public space and area etc.

The divisional bulkhead to be on galvanised metal welded frame works and double skin panel construction for passageways, cabins and other accommodation area and to meet with SOLAS requirement. In way of pipelines and ducts, the deckhead and bulkhead linings are to be made removable where required. Where ceilings and bulkheads form an outside boundary, they are to be suitably insulated and lined with non-combustible plastic laminated material of good marine quality approved by the Owner.

Store(s) in accommodation area is / are to be of calcium silicate asbestos free non-combustible fire retardant marine board material for deck head only and side lining to be painted.
Galley and provision store are to be lined from deck to deck head with satin finish stainless steel laminate with soft core c/w metal strip ceiling, A60 material and sound proof insulation material for Engine Control Room, Bow Thruster Compartment, Emergency Generator Room, AHU Room and funnel casings etc. to achieve limiting noise level condition and to meet with SOLAS requirement. All materials for fire protection are to be good quality and subject to the Classification's and Owner's approval.

Alleyways

Ceilings : fire retardant material, thickness about 9mm with plastic facing on both sides, and flexible mounted.

Bulkheads : steel bulkheads are to be lined with the light colour panels. Different light colours scheme for each deck to be submitted to Owner for approval. Divisional bulkheads between cabins and alleyways are to consist of fire retardant material lined with plastic on both sides. Grab rails are to be of chromed steel pipes.

Floors : suitably insulated for noise and vibration with floating floor as necessary and to be covered with linoleum (6 mm thick) as approved by the Owner.

Cabins, Operational Rooms, Mess Room

Ceilings : non-combustible panel about 9mm thick with plastic lining both sides trimmed with binding strips hung by flexible suspension means.

Bulkheads : divisional bulkheads as well as internal linings of weather-exposed bulkheads are to be of fire retardant materials, about 20mm thick, lined with 9mm thick plastic board on both sides. Flexible connection between steel bulkheads and plastic board.

302. MINOR BULKHEADS & LINING (cont'd)

Sanitary spaces

Ceilings : non-combustible panel about 9mm thick with plastic lining both sides trimmed with binding strips

Bulkheads : steel, painted in a light color

Galley Service spaces

Deckheads : non-combustible panel about 9mm thick with plastic lining both sides trimmed with binding strips

Bulkheads : steel bulkheads are not to be lined but painted in a light colour

303. THERMAL, ACOUSTIC & FIRE PROTECTION INSULATION

Insulation

All exposed steel work is to be insulated on the inside with high density glass wool and retained behind the linings. 100mm thick x 130 kg/m^3 density Rockwool (Class-A60 and sound proof insulation) for exhaust casings and in between wheelhouse, bridge deck, forecastle and raised deck crew cabin / mess bulkhead in way of accommodation / engine room area and bow thruster compartment etc. The insulation is to be considered in conjunction with the capacities of the air-conditioning plant.

Thermal Insulation

The following surfaces are to be insulated :

- Weather-exposed bulkheads of air-conditioned rooms
- Weather-exposed bulkheads of the wheelhouse
- Deckheads of all domestic and catering spaces where such deckheads are located under weather-exposed decks or under store rooms situated on deck
- Deckhead of the wheelhouse

Acoustic and Vibration Insulation

Insulation is to be installed to ensure the compliance to noise and vibration level limits of ILO MLC 2006 and class HAB(WB) criteria.

304. WHEELHOUSE

The wheelhouse is to be located on wheelhouse deck as per GA and to be fitted with all navigation, communication and control equipment as specified below and as required by Class or flag state authorities. The helmsman's position at the center and between the consoles fitted at forward and aft of the wheelhouse. Storm rails of stainless steel pipe to be fitted at strategic locations. Chairs provided at forward and aft control consoles to be approved by Owner but they are to be sliding type i.e. forward console to be transversely sliding and fore and aft direction for aft console.

Wheelhouse front windows are to be arranged to have about 275° visibility. Forward windows to be arranged to enable the helmsman a clear view of the anchor windlass. Aft windows to be large full height type as shown in GA plan. The compass is to be located above the forward steering position. Wheelhouse aft control station is to have unobstructed view of all deck and safety equipment including safety rescue zones and FRC launching areas. The three (3) center forward windows and the four (4) center aft windows are to be fitted with full length window wipers (speed adjustable) and de – icers.

The vessel is to be fitted with conventional controls and joystick controls at the forward and aft control stations and be arranged for smooth changeover from one station to another. The joystick control system to integrate all thrusters and thruster units and / or control surfaces as required. Joystick control system to be incorporate Auto Heading and to be linked to the Doppler log to provide "auto speed" facility. The joystick control heads to be incorporate direction and thrust components and be notched to indicate thrust magnitudes.

The conventional controls system is to be provided independent control of all thrusters and thruster units and / or control surfaces as appropriate. Arrangement of thruster controls is to be approved by Owner.

Both control stations are to be fitted with communication and navigational equipment, engine controls and alarm indicators, rudder angle or thrust angle vector, heading, pitch and RPM indictors. Both stations to have a clear arc of visibility of not less than 240° from each control position.

Primary Fire fighting control is to be located at forward console with a remote joy – stick.

A toilet (module type) complete with washbasin (hot and cold water), water-closet, toilet paper holder, tumbler rack, towel hook and mirror cabinet, suitably ventilated installed adjacent to the exhaust casing in the wheelhouse.

304. WHEELHOUSE (cont'd)

FORWARD CONTROL STATION (275° clear visibility) :

1) Stern azimuth thruster controls : ASD pitch (combinator) and propeller turning – maker standard but to be approved by Owner.
2) Bow thruster pitch controls with indicators and alarms. The controls are for individual and combination of both. Complete with DP interface.
3) DP operator terminal consisting of 3-axis joystick control, heading wheel, buttons and status lamps, built – in computer with color display, and wing terminal interface and auto heading. Both DP operator consoles are to be located at the stern bridge consoles.
4) Interdependent joystick controls of all thrusters with auto heading, thruster direction and other components
5) Auto pilot linked to Gyro compass
6) Emergency shut – down control for main engines, auxiliary engines and thrusters
7) Main and auxiliary engines alarm and indication panels
8) Horn button (mounted on console)
9) Gyro repeater (flush mounted table top type)
10) Two (2) searchlights with electric remote control, 2000 W
11) Three (3) marine type horizontal wipers with fresh water washing and heater (demisted, de – icing & sunscreen)
12) One (1) clear view screen
13) Electric engine telegraph
14) Sound power telephone
15) Remote control for anchor windlass
16) One (1) VHF (GMDSS unit) – fixed type with two (2) extensions i.e. one (1) each in Captain's and Chief Engineer's cabin.
17) One (1) auto telephone
18) One (1) lot horn control
19) One (1) joystick control
20) One (1) Doppler log to be fitted at forward control position with repeater in aft control station, capable of measuring forward, aft & athwart ship speed, current speed / direction. Doppler log can be connected to DP system if so required. Interface to be provided with manual switch on/off.
21) Two (2) Helmsman's chairs, swivel type c/w sliding track to allow 1m each side movement
22) Remote fire monitor controls with extension plug-in at the aft control station
23) Two (2) radars
24) One (1) wind speed indicator

305. WHEELHOUSE (cont'd)

FORWARD CONTROL STATION (cont'd) :

25) Alarm panel(s)
26) Echo sounder
27) Dimmer switches
28) FiFi pump with remote joystick control
29) Independent joystick control and wandering lead for wing controls
30) CCTV with two (2) fixed camera (IP56 or greater) for windlass area observation

AFT CONTROL STATION :

1) Stern azimuth thruster controls : ASD pitch (combinatory) and propeller turning
2) Bow thruster remote pitch controls for electrical bow thrusters with indicators and alarms. Controls for individual bow thruster and combination of both. Complete with DP interface.
3) DP operator terminal consisting of 3-axis joystick control, heading wheel, buttons and status lamps, built-in computer with color display, and wing terminal interface and auto heading
4) Interdependent joystick controls of all thrusters with auto heading, thruster direction and components
5) Auto pilot linked to Gyro compass
6) Emergency shut – down control for main engines, auxiliary engines and thrusters
7) Main and auxiliary engines alarm and indication panels
8) Ship's Navigation DGPS (can be displayed on radar screen)
9) Horn button (mounted on console)
10) Gyro repeater (flush mounted table top type)
11) Four (4) marine type horizontal wipers with fresh water washing
12) Two (2) searchlights with remote control, 2000 W
13) Bulk tanks system control panel
14) Stern capstan remote control panels with emergency release
15) VHF Radiotelephone (independent unit) – fixed type with two (2) extensions i.e one (1) each in Captain's and Chief Engineer's cabin
16) Echo Sounder Repeater
17) Emergency stop buttons for P.W., F.O., D.W., B.W., mud, brine and dry bulk system
18) Remote sounding / gauging monitoring for fuel oil and drill water tanks, controls etc
19) Cargo control panel (selective of type of cargo)
20) Microphone for P.A / intercom / telephone system
21) Two (2) swivel Helmsman's chairs on sliding tracks

304. WHEELHOUSE (cont'd)

AFT CONTROL STATION : (cont'd)

22) Remote fire monitor controls with 20m wandering lead for external wheelhouse controls (this is slave station to main station on forward control console)
23) One (1) printer each for the fuel oil and fresh water cargo systems. These printers are to be connected to the flow meters for remote readout and record purposes.
24) Emergency release buttons for capstans
25) Fuel and water cargo system displayed and controls :
    - Emergency shut-down
    - Tank level gauges displaying innages or ullages
    - Manifold pressure gauge display
    - Pump Amperage, pressure and vacuum gauges display

WING CONTROLS (inside wheelhouse) – docking stations :

Control panel to be sling type and carried on Helmsman's neck with portable joystick control connections (plug-in type). Radar repeater (optional).

Other equipment in wheelhouse to be fitted out as follows :

1) Navigation equipment – radars, echo sounder, gyro compass/ gyro repeaters c/w autopilot, GPS, AIS, SSAS, Navtex receiver, Doppler speed log, navigation lights and shapes etc.
2) Communication equipment MF/HF & VHF radio telephones, flags, loudhailer, PA / intercom system, bell and Morse lamp etc.
3) BNWAS to be fitted
4) Mechanical plunger horn
5) Navigation light switches and alarm panel
6) Signaling lamp c/w battery in a box
7) Sufficient spare power points, 220/1/60 and 24 volt DC in addition to those required for equipment specified.
8) Radio and chart table with lockers and drawers under, flexible type table lamp with dimmer and emergency light and curtain all round. DGPS to be installed and interfaced with radars to allow course plotting etc from chart table.
9) Helmsman chair c/w arm & head rest, sliding track, swing seat for aft console as per GA plan.
10) Wooden platform for wheelhouse forward & aft control console as required.
11) Book racks and side board
12) Barometer – 1 off
13) Thermometer – 1 off

304. WHEELHOUSE (cont'd)

WING CONTROLS (inside wheelhouse) – docking stations :

14) Flag locker with complete signaling flags and Port of Registry (POR) flag
15) GMT Radio clock
16) Marine Battery Clock
17) Settee with coffee table
18) Ceiling light with separately on / off switch to be provided
19) Emergency stop button for air conditioner, fuel oil and fans
20) Chronometer
21) LAN sockets
22) Clinometers, etc
23) Refrigerator and space for coffee making to be arranged
24) Toilet with washbasin (module type)

Final wheelhouse layout is to be agreed with Owner.

305. CAPTAIN'S CABIN C/W ATTACHED WASHPLACE

The captain's cabin is to be situated forward of deckhouse deck as shown on the drawing and fitted out as follows:-

- 1 2150 x 1500 mm (84 inches x 59 inches) inside dimensions built-in high berth with drawers under and reading light at bunk
- 1 kneehole desk with drawers and light
- 1 built – in upholstered settees c/w coffee table
- 1 built – in locker c/w drawer, hanger rod and hooks with lifejackets stowage on top
- 1 upholstered chair with hold – back elastic straps with hook for securing to the table
- 4 coat hooks on back of door
- 3 600 x 400 mm windows with deadlight covers as required by rules and curtains
- 1 key box with lockable door
- 3 spare power points 220/1/60
- 1 marine battery clock
- 1 bookcase
- 1 safe
- 1 mirror c/w light
- 1 100 – litres refrigerator with lockable door
- 1 sound power telephone
- 1 sideboard and 2 lockable lockers

305. CAPTAIN'S CABIN C/W ATTACHED WASHPLACE (cont'd)

- 1 TV / radio socket
- 1 waste paper basket
- 1 LAN socket
- 1 steel filing cabinet with 3 – lockable drawers
- 1 Multi – system television (32") and DVD / stereo system

306. CHIEF ENGINEER'S CABIN C/W ATTACHED WASHPLACE

The Chief Engineer's cabin is to be situated forward of deckhouse deck as shown on the drawing and fitted out as follows:

- 1 2150 x 1500 mm (84 inches x 59 inches) inside dimensions built – in high berth with drawers under and reading light at bunk
- 1 kneehole deck with drawers and light
- 1 built – in upholstered settees c/w coffee table
- 1 built – in locker c/w drawer, hanger rod and hooks with lifejackets stowage on top
- 1 upholstered chair with hold – back elastic straps with hook for securing to the table
- 4 coat hooks on back of door
- 3 600 x 400 mm windows with deadlight covers as required by rules and curtains
- 1 key box with lockable door
- 3 spare power points, 220/1/60
- 1 marine battery clock
- 1 bookcase
- 1 safe
- 1 mirror c/w light
- 1 100 – litre refrigerator
- 1 sound power telephone
- 1 sideboard and 2 lockable lockers
- 1 TV / radio socket
- 1 waste paper basket
- 1 LAN socket
- 1 steel filing cabinet with 3 – lockable drawers
- Remote ACCU alarm
- 1 Multi – system television (32") and DVD / stereo system

307. 1 – BERTH CABIN C/W ATTACHED WASHPLACE – 5 OFF

These cabins are situated on the deckhouse deck as shown on the drawing and fitted out as follows:

- 1 2150 x 1200 mm (84 inches x 48 inches) inside dimension built-in berth with drawers under and reading light at bunk with curtain around the bed
- 1 kneehole desk with drawers under and desk light
- 1 upholstered chair with hold – back elastic straps with hook for securing to the table
- 1 built-in lockers c/w shelf, hanger rod and hooks with life-jackets stowage on top
- 1 built-in upholstered settees c/w coffee table
- 4 coat hooks on back of door
- 1 600 x 400 mm windows with deadlight cover and curtain for four (4) cabins on upper forecastle deck
- 1 350 mm diameter port light with deadlight cover and curtain for two (2) cabins on lower forecastle deck
- 3 spare power points, 220/1/60
- 1 book shelf and locker and mirror
- 1 TV / radio socket
- 1 marine battery clock
- 1 waste paper basket
- 1 LAN socket
- 1 intercom and telephone
- Remote ACCU alarms in two (2) of these cabins i.e. 2nd and 3rd Engineer's cabins

308. INSTRUMENT ROOM

This room situated on deckhouse deck as shown on the drawing and fitted with necessary equipment as supplied by Kongsberg.

309. DECK STORES

A number of deck stores situated on deckhouse deck, upper forecastle deck and lower forecastle deck c/w lockable steel doors are to be provided with shelves and natural ventilated.

310. MEETING ROOM

The meeting room situated on the upper deckhouse deck as shown on the drawing and fitted out as follows:

- 1 conference table
- 6 upholstered chairs with hold – back elastic straps with hook for securing to the table
- 1 computer table
- 1 sideboard with cupboards, drawers, tumbler rack and book rack fitted
- 4 spare power points, 220/1/60 on bulkhead
- 2 spare power points 220/1/60 on table
- 1 42 inches flat screen colour television set c/w antenna and DVD player
- 1 LAN cable socket
- 1 whiteboard
- 1 intercom and telephone
- 1 600 x 400 mm window with deadlight cover as required by rules and curtains
- 1 waste paper basket
- 1 100 – litres refrigerator
- 1 marine battery clock
- 2 24V DC sockets
- Remote ACCU alarm

311. 2 – BERTH CABINS C/W WASHPLACE – 13 OFF

These cabins are situated on the lower and upper forecastle deck as shown on the drawing and fitted out as follows:

- 1 2-tier 1980 x 800 mm (78 inches x 31.5 inches) inside dimensions built-in berth with drawers under and reading light at bunk with ladder for upper berth. Curtains fitted for each bunk
- 1 desk with drawers under and desk light
- 1 upholstered chair with hold – back elastic straps with hook for securing to the table
- 2 built – in lockers c/w shelves, hanger rod and hooks with life-jackets stowage on top
- 4 coat hooks on back of door
- 1 350 mm diameter port light with deadlight cover and curtain
- 2 spare power points, 220/1/60
- 1 book shelf and locker
- 1 mirror c/w light
- 1 marine battery clock
- 1 TV / radio socket

311. 2 – BERTH CABINS C/W WASHPLACE – 13 OFF (cont'd)

- 1 waste paper basket
- 2 LAN sockets
- 1 built – in upholstered settee

312. PRAYER ROOM

A central air-conditioning prayer room fitted with stainless steel deep wash basin with hot / cold supply. 4mm raised dot rubber sheet on level floor made up by deck composition with loose carpet, coat hanger and towel rail to be fitted.

313. OFFICES NO. 1 & 2

These compartments are situated on the upper and lower forecastle deck as shown on drawing and fitted out as follow :

- 2 desks with drawers and table lamp
- 2 upholstered chairs with hold – back elastic straps with hook for securing to the table
- 1 computer
- 1 4 – drawer steel filing cabinet
- 2 sideboard with cupboards, drawers, tumbler rack and book rack fitted
- 4 spare power points, 220/1/60
- 1 LAN cable socket
- 1 whiteboard
- 1 TV / radio socket
- 1 LAN socket
- 1 intercom and telephone
- 1 sofa or built – in settee
- 1 100 – litres refrigerator
- 1 waste paper basket
- 1 marine battery clock

314. FORWARD BOSUN STORE

This store situated on lower forecastle deck is to be fitted with steel shelves and rope bin. It is fitted with a vertical ladder and a hatch for passing mooring ropes to be in a bin. Forced ventilation to be provided. Timber and steel storage racks to be fitted as agreed by Owner.

315. 4 – BERTH CABINS C/W ATTACHED WASHPLACE(S) – 5 OFF

These cabins are situated on the lower and upper forecastle deck as shown on the drawing and fitted out as follows:

- 2 2-tier 1980 x 800 mm (78 inches x 31.5 inches) inside dimensions built – in berth with drawers under and reading light at bunk with ladder for upper berth. Curtains fitted for each bunk
- 1 desk with drawers under and desk light
- 1 upholstered chair with hold – back elastic straps with hook for securing to the table
- 4 built – in lockers c/w shelf, hanger rod and hooks with life-jackets stowage on top for 4 – men cabin
- 1 built – in upholstered settees
- 4 coat hooks on back of door
- 1 350 mm diameter port light with deadlight cover and curtain (for external cabins only)
- 2 spare power points, 220/1/60
- 1 bookcase
- 1 mirror c/w light
- 1 marine battery clock
- 1 TV / radio socket
- 1 waste paper basket
- 4 LAN sockets

316. ATTACHED WASHPLACE – APPROX. 30 OFF : MODULES TYPE

One (1) washplace attached to all cabins, wheelhouse and main deck and each to be fitted as follows:

- 1 shower fitted with curtain, soap dish, hot and cold water and grab rail (except for wheelhouse and upper forecastle deck)
- 1 stainless steel washbasin with hot / cold water supplies with lever type handle
- 1 pedestal WC (European type) with seat, lid, toilet roll holder & grab rail
- 1 extractor fan
- 2 towel hooks
- 1 vanity cabinet with mirror and lights
- 2 towel rails
- 1 scupper
- Toothbrush and tumbler holder for each occupant

Wheelhouse and main deck common toilets (internal & external) are fitted similarly except without showers.

317. LAUNDRY ROOM

This compartment to be spot cooled, are situated on lower forecastle deck as shown on the drawing and fitted out as follows:

- 1 extractor fan
- 1 stainless steel deep washtub with taps for hot and cold fresh water supply
- 4 6 kg stainless steel washing machines (heavy duty type)
- 4 6 kg stainless steel tumbler dryers (heavy duty type) with exhaust to outside
- 1 bulkhead mounted ironing board
- 2 spare power points, 220/1/60
- 1 stainless steel storage cabinet for soap and iron storage etc

318. AIR CONDITIONING MACHINERY ROOM

This air conditioning machinery is situated on the lower forecastle deck and fitted with air handling unit (AHU). Cooled air is to be ducted to all accommodation spaces. Spare power point, F.W line, steel shelving and necessary condensate water drainage to be provided (refer to Section 10). This compartment is also to house the freezer and chiller machinery. Necessary drains are to be installed on deck. Heavy rubber matting is to be place in front of electrical switchgear.

319. EMERGENCY / HARBOUR GENERATOR ROOM

This compartment situated on the lower forecastle deck as shown on drawing & fitted out as follows:

- Generator driven by radiator cooled marine diesel engine running on MGO
- Emergency Switchboard
- Ventilation Fan with auto-start c/w emergency stop button
- F.O. Daily Tank (for 36 hours supply)
- Battery charger
- Batteries of gel cell type
- Spare power point, 220/1/60
- Heavy rubber matting is to be place in front of electrical switchgear
- Sound powered Telephone complete with remote headset fitted in sound – proof station

320. PAINT STORE

The paint store located on lower forecastle deck fitted with security gates, shelving and adequate ventilation. Lighting and forced ventilation is to be of explosion proof type and the fan to have a remote emergency stop outside the Paint Store. Water spraying (from S.W pressure set and G.S pump) or CO_2 gas flooding system is to be provided and to meet with SOLAS requirement.

321. CO_2 ROOM

This compartment is to install CO_2 bottles mounted on wooden racks and weighable. Force exhaust and natural ventilation to be arranged. Compartment to be protected by sprinklers or / and CO_2 to meet Rule requirements.

322. FOREPEAK STORE

The store is accessible from the Bosun Store above through a vertical ladder and also from Recreation / Mess Room. Store is to be fitted with steel shelves. Forced ventilation is to be provided.

323. FREEZER & CHILLER

These built – in compartments are to be fitted with insulation and lined with stainless steel sheet for side and ceiling and stainless steel shelves to be provided c/w wooden grating fitted on floor (refer Section 5).

The door is to be stainless steel insulated with door alarm connected to the wheelhouse and able to open from inside. Hold back hooks are to be fitted to both doors.

324. PREPARATION ROOM / PROVISION STORE

This compartment is to be fitted with steel shelves with plywood c/w retaining battens wooden grating is to be fitted on the floor. It is fitted with mechanical ventilation and spot cooling.

325. GALLEY

The galley situated on main deck adjacent to mess room is to be fitted out as follows:

- 2 6 – hotplate marine type electric stove c/w oven & retainer bars with S.S vent hood and 250mm (min.) extractor fan above stove
- 1 deep type twin bowl stainless steel sink with workbench c/w hot and cold FW supplies and hanging cabinets/ plate racks over. Swing handle taps to be fitted
- 6 spare power points, 220/1/60, earthed
- 2 stainless steel side boards c/w drawers and shelves below and hanging cupboards above
- 1 400 – litres minimum stainless steel commercial type freezer / fridge, 2-door type
- 1 waste food grinder c/w table and stand to meet with Marpol Annex V requirement
- 1 electric rice cooker
- 1 microwave oven
- 1 water filter for potable water supply line – Ultraviolet type

325. GALLEY (cont'd)

- 1 marine battery clock
- 1 10 – litres hot water urn
- 2 towel rails
- 2 free – standing freezers of stainless steel constructed commercial type, 4-doors type, each about 1000 litres (if space permits)
- 1 lot plate racks for various sizes of plate (gutter trench all round with perforated SUS cover plates that must be flush fitting with the surrounding floor
- 1 lot cup hooks
- Oil / Grease trap
- Auto Telephone
- CO_2 for extraction fan

326. MESSES 1 & 2

These rooms situated on the forward main deck and each room to be fitted out as follows:

- A number of dining tables c/w formica top and edge fiddles
- A number of upholstered chairs with hold – back elastic straps with hook for securing to the table
- A number of built – in upholstered settees
- 8 spare power points, 220/1/60
- 1 200 litres domestic type fridge in each room with cold water drinking & ice – maker
- 1 marine battery clock in each mess room
- 2 350 mm diameter port lights with deadlight covers and curtain
- 1 42 inches flat screen colour television set c/w antenna and DVD player in each mess room
- 1 side board and white notice board in each mess room
- 1 AO serving hatch (in between galley & mess) in each mess room
- 1 waste paper basket in each mess room
- 2 LAN sockets in each mess room
- 1 intercom and telephone
- 1 3 – litres hot water urn
- A number of Bain Maries (food warmer) in each mess room
- Remote ACCU alarm

327. RECREATION ROOM

This room situated on main deck as shown on the GA drawing. (This room is to be reserved for Survivors Recovery Area with bunks etc at later stage). For this contract the following are to be fitted :

- A number of L – shaped built-in settees c/w back rest with stowage under
- A number of dining tables c/w formica top and edge fiddles
- 2 coffee tables
- A number of upholstered chairs with hold – back elastic straps with hook for securing to the table
- 2 350 mm diameter port lights with deadlight covers and curtains
- 4 spare power points, 220/1/60
- 1 200 – litres domestic-type fridge with cold water drinking & ice – maker
- 1 marine battery clock
- 1 42 inches flat screen colour television set c/w antenna and DVD player
- 1 side board and white notice board
- 1 waste basket
- 2 LAN sockets
- 1 intercom and telephone
- 1 3 – litres hot water urn with filling pipe over or piped in
- Remote ACCU alarm

328. GYMNASIUM

This room is to be provided with gymnasium equipment (Owner supplied) and air – conditioned. Sufficient number of 220V AC power sockets to be provided. And this room reserved and retrofit into a Survivor's washplace with four (4) WC, for (4) shower cubicles and four (4) washbasins and assorted towel rails. For details, refer to Annex 'B'.

A space of 1.85m2 to be reserved for installation of gymnasium equipment as per HAB(WB) rules in this compartment after the conversion of SSR usage or on upper decks in the office or one of the cabins.

329. HPU ROOM

~~This compartment situated aft main deckhouse is to be fitted with one (1) settee or sofa, table with two (2) chairs, cabinet and central air – conditioned. Facilities such as 3 – litres hot water urn, telephone, intercom, 100 – litres refrigerator and sink to be provided. One (1) LAN cable socket and Remote ACCU alarm to be provided. Adjacent to this, is an external W.C. unit.~~

330. WASHING AREA

This area is situated on aft main deckhouse is to be fitted with eye – wash station(s) and necessary drains are to be installed on deck.

331. SICKBAY / TREATMENT AREA – 1 OFF

This cabin situated on the aft of main deck as shown on the drawing and fitted out as follows:

- 2 fire retarding steel constructed hospital beds with steel sheet mattress deck, backrest c/w adjustable by crank handle at foot end, hand & foot panel, SUS collapsible side rails, 100 mm x 100 mm castor with brakes. Bunk size minimum 2020 x 965 mm (80 inches x 38 inches) inside dimensions with suitable mattress size, high density foam. Curtain fitted.
- 1 kneehole desk with drawers under and desk light
- 2 steel free standing lockers c/w shelf, hanger rod and hooks with life-jackets stowage on top
- 1 upholstered chair with hold – back elastic straps with hook for securing to the table
- 4 coat hooks on back of door
- 3 spare power points, 220/1/60
- 1 book shelf and locker with double locking wooden cupboard
- 1 sideboard with one (1) locker and mirror
- 1 marine battery clock
- 1 alarm call to bridge
- 1 100 – litres refrigerator with lockable door
- 1 exhaust ventilation (ducting connection and non-return flap to be installed)
- 2 350 mm diameter port lights with deadlight cover and curtain
- 1 medical locker on top of desk, 1000 x 1200 x 300 (LWH) with padlock
- 1 waste paper basket
- 1 LAN socket
- 1 towel rail
- 2 deck drains
- 1 wet unit comprises of one (1) shower, one (1) WC and hand basins with hot and cold water supplies to be fitted out similar to Section 316
- emergency 24V lightings and power socket
- external and internal doors dimensions to allow stretcher's access, clear minimum 900mm

332. CHANGING ROOM

This compartment to be spot cooled, is situated on main deck as shown on the drawing and fitted out as follows:

- 1 steel construction shower cubicle with hot/cold water supplies, soap dish, hook etc
- 1 steel construction toilet cubicle fitted with WC (European type) with seat, lid, toilet roll holder, grab rail
- 1 stainless steel washbasin with hot / cold water supplies with lever type handle
- 1 stainless steel deep wash tub n with hot / cold water supplies with lever type handle
- 2 6 kg stainless steel commercial washing machines (heavy duty type)
- 2 6 kg stainless steel commercial tumbler dryers (heavy duty type) with exhaust to outside
- 2 6 kg stainless steel commercial electric clothes dryers (heavy duty type)
- 1 extractor fan
- 10 coat hooks
- 2 towel rails
- 2 spare power point, 220/1/60
- 1 wooden bench
- A number of steel slim lockers with keys

333. AFT DECK STORE

This compartment situated on aft main deckhouse is to be fitted out with steel shelving. Door is to be mild steel watertight c/w adequate ventilation to be provided. Padlocks are to be provided.

334. BOW THRUSTER & FORWARD MACHINERY COMPARTMENT

This compartment is to be fitted with two (2) electrical motor driven tunnel CPP thrusters with soft starters. It houses the sewage treatment plant and transducer for echo sounder and Doppler log, emergency fire pump etc. The flooring is to be of aluminum and steel chequer plate with stainless steel SUS 316 countersunk screws to steel bearers and fitted with handrail as necessary.

All hydraulic machinery to have savealls of suitable capacities and drain cock.
All moving parts are to be provided with guards or rails or both. Portable handrails are to be provided in strategic positions for protection of crew safety.

Watertight sound power telephone c/w 10m length cable with headset and siren and yellow beacon is to be fitted. Forced extract fan to be provided.

334. BOW THRUSTER & FORWARD MACHINERY COMPARTMENT (cont'd)

Heavy rubber matting is to be place in front of electrical switchgear. Bow thruster tunnels to have hinged hot-dipped galvanized steel bars grating with stainless steel fittings. These will enable openings by diver's inspection to meet UWILD (Underwater Inspection in lieu of Dry Docking). Locking pins to be located on one horizontal side of grating and hinges on the other horizontal side.

335. ENGINE ROOM

The engine room arranged to have a mezzaine deck to house the main engines, generators, pumps and compressors etc. All machinery and equipment are to be positioned in appropriate locations to facilitate easy access for operation and maintenance.

Machinery with exposed moving parts which constitute a potential danger to personnel to be protected with screens, handrails or both. The portable handrails are to be provided in strategic positions for protection of crew's safety.

Tween deck is to be fitted with machinery not required by regular access such as hydraulic power pack to be protected, workshop fitted with lathe and drill, and storage made of wire-mess enclosure and lockable door.

All wet and / or slippery areas are to be provided with non – skid adhesive mats walking surfaces. Steel chequer plates are to be used in way of escape route and aluminum alloy flooring to be secured with stainless steel SUS 316 countersunk screws to steel bearers and fitted with hand grip as necessary. And the floor plate arrangement is to be of sufficient strength to support machinery components during inspection and maintenance.

Lifting lugs over heavy equipment to be provided. SWL is to be permanently displayed.

Ballast water treatment plant c/w adjacent pipe and electrical supply installation to be fitted prior to delivery.

Two (2) separate manifolds, one (1) for potable water and one (1) for drill water are to be provided with cross-connection. Each manifold is to be fitted with isolating valve and blank, separating each manifold from the other locating on port and starboard side of working deck.

Flow meters with remote print – out to be fitted for fuel oil, potable water, drill water.

336. BULK TANK COMPARTMENT CUM CARGO PUMP ROOM

This compartment to be fitted with four (4) bulk storage tanks and cargo pumps for mud and brine driven by hydraulic motor or intrinsically safe electric motors as shown on the G.A plan. This compartment is considered as hazardous space with cargoes of flash point below 60 degrees, fixed full CO_2 flooding system is to be fitted.

All electrical fittings and equipment inside this compartment are to be intrinsically safe or explosion proof as per Class requirements. Stern thruster cardan shaft passing through gas – tight bulkheads to be fitted with flexible couplings, stuffing boxes or bulkhead gland in way of shaft penetration at the gas tight bulkheads. These stuffing boxes or bulkhead glands are to be designed to prevent any leakage of gas from the pump room into the machinery space and of non – sparking construction.
If a bellow's piece is incorporated in the design, it is to be pressure tested before being fitted. Bulkhead shaft glands to be fitted with temperature sensor alarm to meet ABS requirement.
Shaft bearings to be oil bathed with common reservoir fitted with level alarm and temperature monitoring device (PT100 intrinsically safe).

The compartment fitted with one (1) siren and yellow beacon to be linked to engine room sound power telephone system.

Forced ventilation is to be provided. Built – in vent trunks to be painted internally and provided with manholes for maintenance.
The flooring is to be of aluminum steel chequer plates with stainless steel countersunk screws to steel bearers and fitted with hand rail as necessary. In way of escape route, aluminum chequer plate to be replaced by painted steel chequer plates.

337. ENGINE CONTROL ROOM (ECR)

The air – conditioned engine control room is located at the forward of the engine room as shown on the drawing with double – glazed windows looking aft. A/C unit to be ceiling mounted to save space. The air conditioning system for this room is an independent type and for air – recirculation only with fresh water cooled condenser unit positioned in the engine room.

The following to be provided :

- One (1) sound power telephone c/w 10m length cable with headset
- One (1) telephone
- Two (2) sets siren and yellow beacon with alarms & indicator lights linked to engine room, bulk tank, bow and Azimuth thruster compartments
- One (1) quartz battery clock

337. ENGINE CONTROL ROOM (ECR) – cont'd

- One (1) clinometer
- One (1) 100-litres refrigerator
- One (1) bench
- One upholstery chair with hold – back elastic straps with hook for securing to the table
- One (1) 20 inches flat screen monitor to be hooked to laptop computer
- One (1) desk with drawers
- One (1) cupboard with lockable door
- Assorted bookshelves
- One (1) LAN socket

Main switchboard is to be located forward of engine room on mezzanine floor. Rubber mats to be placed throughout the engine control room. The main console is to be fitted with main engine rpm control, ASD pitch control and propeller turning and other items as required by Class and Owner.

These are to be supplied by ASD maker for both stern thrusters.

338. ENGINE STORE / WORKSHOP

An engine store and an air-conditioned workshop (water cooled self – contained unit for re-circulating only) are to be arranged inside the engine room on mezzanine floor.
Store is to be protected with steel mesh bulkheads, steel shelving and lockable door.
Workshop is to be fitted with:

- 1 work bench
- 1 deck mounted grinder
- 2 6 inches vices
- 1 300 Ampere portable MIG and electrode rod welding set, 440/3/60
- 2 spare / power outlets, 440/3/60
- 2 spare / power outlets, 220/1/60
- Running air supply and steel shelving
- Forced supply/ natural ventilation as necessary
- 1 small lathe about 1m long shaft
- Stainless steel washbasin with hot / cold water taps
- 1 compressed air outlet

339. AZIMUTH PROPULSION THRUSTER COMPARTMENT

This compartment is to be fitted out with Azimuth propellers with all ancillary equipment. The flooring is to be of steel chequer plate with stainless steel – trapping screws to steel bearers and fitted with hand rail as necessary. Heavy rubber matting is to be placed in front of all electrical switchgear. Watertight sound power telephone c/w 10m length cable with headset and siren and yellow beacon is to be fitted to meet SOLAS requirements.

Forced ventilation and hydraulic oil tank is to be provided.
Lifting lugs to be fitted over heavy equipment and machinery. Gyro repeater to be fitted as per ABS rules.

340. AIR LOCKS

A number of pressurized air locks are to be provided to meet class requirements. The air locks are to be formed by two (2) doors, both self – closing and without holding back arrangements, capable of maintaining the over – pressure in each of the spaces. The machinery room and air lock are ventilated by over – pressure in accordance with 8.4, 4.1.5.2(c) of IEC60092 – 502 Fifth Edition.

The air lock locations include the following :

- Accommodation entrances on main deck (2 off)
- Accommodation entrances on lower forecastle deck (2 off)
- Accommodation entrances on upper forecastle deck (2 off)
- Accommodation entrances on upper deckhouse deck (2 off)
- Area between engine room and bulk tank compartment / cargo pump room
- Area between Azimuth propeller room and bulk tank compartment / cargo pump room
- Other locations as required

341. MAIN DECK BUOYANCY COLUMNS

Two (2) enclosed compartments, one (1) port and one (1) starboard, formed by the external bulwarks and cargo pen walls are to be provided as STORE and fitted with steel shelves, naturally ventilated and electrical lightings.

SECTION 4 – PAINTING & CATHODIC PROTECTION

400. PAINTING GENERAL (AS PER INTERNATIONAL PAINT SPECIFICATIONS)

All plates and sections are to be new and grit blasted to Sa 2.5 Swedish Standard and primed with zinc silicate shop primer as per International Paint specifications shown below. All weld splatters, smoothened weld seams and sharp edges are to be removed. Fresh water is to be used to wash down all dirt and contamination as necessary. Degrease if necessary is to be in accordance to SSPC – SP1 solvent cleaning. Where the surface shows signs of beading, the surface to be degreased IAW AS1627.1 – 2003.

All welds, burnt, damaged and corroded areas are to be blasting to Sa2½ ISO 8501 – 1 or near white metal SSPC SP10. Grit sweep intact shop primer to AS 2 – 3 International Paint Sweep Blast Standards. Where lugs or brackets are used during construction, they are to be removed and the area ground smooth and flush with the surrounding steel plate. The external finish must be smooth and flush when coated and the repaired area must not be visible when over coated.

Power tool clean all welds, damages and corroded areas to SSPC – SP3 or Pt3 of JSRA SPSS – 1984 or St3 of ISO 8501 – 1.
Internal areas where blasting is not feasible, power tool cleaning to SSPC – SP3 or zinc silicate shop primer, disc intact shop primer to Pt2 JSRA SPSS 1984 to be carried out.

401. PAINTING SCHEMES (AS PER INTERNATIONAL PAINT SPECIFICATIONS)

Painting schemes to be strictly in accordance to Owner / International Paint specification. The following is for guidance. Final specification is to be approved by Owner.

All steel – Shop Primer	Microns
Interspeed 640 Red	100
Keel to 150 mm (6”) above Load Waterline	
Intershield 300HS Bronze	150
Intergard 263 Light Grey	100
Intersmooth 7465HS SPC Red	100
Intersmooth 7465HS SPC Brown	100
Intersmooth 7465HS SPC Red	100

401. PAINTING SCHEME (cont'd)

Loaded Waterline to Caprail, Internal Bulkwarks, Chocks, Wheelhouse Visor	Microns
Intershield 300HS Bronze	125
Intershield 300HS Aluminum	125
Intergard 263 Light Grey	100
Interthane 990 Dark Blue	50
Interthane 990 Dark Blue	50

Fashion Name Plate	
Intershield 300HS Bronze	125
Intershield 300HS Aluminum	125
Intergard 263 Light Grey	100
Interthane 990 Light Blue	50
Interthane 990 Light Blue	50

Logo "T"	
Intershield 300HS Bronze	125
Intershield 300HS Aluminum	125
Intergard 263 Light Grey	100
Interthane 990 International Orange	50
Interthane 990 International Orange	50

External Superstructure	
Intershield 300HS Bronze	125
Intershield 300HS Aluminum	125
Intergard 263 Light Grey	100
Interthane 990 Blued White	50
Interthane 990 Blued White	50

External Decks under boards	
Intershield 300HS Bronze	100
Intershield 300HS Aluminum	100
Intershield 300HS Bronze	100

401. PAINTING SCHEME (cont'd)

External Deck and Platforms (outside of Boards, Pilot House & F'cle)	Microns
Intershield 300HS Bronze	125
Intershield 300HS Aluminum	125
Intershield 6GV Dark Grey	865
Interthane 990 Storm Grey	50

External steel decks are to have epoxy non – skid deck coating supplied by International Paint and not grits and sands. The top of the pilot house is the only deck to be coated with blue white in lieu of storm grey.

Safety Markings	
Intershield 300HS Bronze	125
Intershield 300HS Aluminum	125
Intergard 263 Light Grey	100
Interthane 990 Yellow	50
Interthane 990 Yellow	50

Exposed Bulkheads & Overhead, State Rooms, Galley and Living Areas	
Interturf 262 Grey	100
Interthane 990 Blued White	50

Bulkheads & Overhead, Machinery Spaces, Passageways and Work Areas	
Intertuf 262 Grey	100
Interthane 990 Blued White	50

Interior Spaces behind Sheathing	
Intertuf 262 Grey	100
Intertuf 262 Red	0

All Internal Decks	
Intertuf 262 Red	125
Intertuf 262 Grey	125
Interthane 990 Storm Grey	50

401. PAINTING SCHEME (cont'd)

Bilges Areas under walking flats	Microns
Intertuf 262 Red	125
Intertuf 262 Grey	0
Intertuf 262 Grey	125

Fuel Oil Tanks	
Interplate 317 Grey	0

No coatings – rust inhibitive oil to be applied.

Liquid Mud / Brine / Base Oil / ORO Tanks	
Intershield 300HS Bronze	150
Intershield 300HS Aluminum	0
Intershield 300HS Bronze	0
Intershield 300HS Aluminum	150

Dirty Oil / Sludge / Slop Tanks	
Intershield 300HS Bronze	150
Intershield 300HS Aluminum	0
Intershield 300HS Bronze	0
Intershield 300HS Aluminum	150

Dry Bulk Tanks (Internal Surfaces)	
Intershield 300HS Bronze	125
Intershield 300HS Aluminum	125

Dry Bulk Tanks (External Surfaces)	
Interzinc 75 Low Lead Grey	75
Intertuf 262 Grey	125
Interthane 990 Blued White	50

Ventilation Duct Interiors	
Intertuf 262 Red	125
Intertuf 262 Grey	125

401. PAINTING SCHEME (cont'd)

Sewage and Galley Discharge Tank	Microns
Interline 994 Pink	100
Interline 994 Buff	0
Interline 994 Buff	100
Interline 994 Grey	0
Interline 994 Grey	100
Potable, Cargo, Ballast Water Tanks	
Intershield 300HS Bronze	150
Intershield 300HS Aluminum	0
Intershield 300HS Bronze	0
Intershield 300HS Aluminum	150
Chain Lockers	
Intershield 300HS Bronze	150
Intershield 300HS Aluminum	0
Intershield 300HS Aluminum	150
Accessible Voids and Cofferdams	
Intershield 300HS Bronze	150
Intershield 300HS Aluminum	0
Intershield 300HS Bronze	0
Intershield 300HS Aluminum	150
Inaccessible Voids surrounding Thrusters	
Interbond 808 Aluminum	160
Interbond 808 Buff	0
Interbond 808 Aluminum	0
Interbond 808 Buff	160
Intergard 263 Light Grey	125
Intersmooth 7465HS SPC Red	100
Intersmooth 7465HS SPC Brown	100
Intersmooth 7465HS SPC Red	100

401. PAINTING SCHEME (cont'd)

Inaccessible Voids and Inaccessible Skegs	Microns
Interbond 808 Aluminum	160
Interbond 808 Cream	0
Interbond 808 Aluminum	0
Interbond 808 Buff	160
Piping (as per striping guide for product designations)	
Intershield 300HS Bronze	125
Intershield 300HS Aluminum	125
Intergard 263 Light Grey	100
Interthane 990 Blued White	50
Interthane 990 Blued White	50

The shipyard and paint manufacturer is to give guarantee on antifouling, Potable Water / Drill Water / Ballast / Mud / Brine and other tanks, all machinery space, bilges, stores, and all areas / locations for sixty (60) months, excluding the areas caused by wear and tear. The guarantee to cover only areas coated by the shipyard.

402. PIPEWORK COLOURING

All exposed piping systems are to be painted in white and identified with colour bands in accordance with the following colour schemes: (as per International Paint Specifications)

1) Fire Fighting (hose brackets, axes, monitors, extinguisher cylinders) : C287 Signal Red
2) Fire Extinguisher Service Stripes –
   - o Water / Sand : C287 Signal Red
   - o Carbon Dioxide : C287 Signal Red / D260 Orange
   - o Dry Powder : C287 Signal Red / B134 Signal Yellow
   - o Foam : C287 Signal Red / C000 White
3) Electrical (all electric motors, switches, panel boxes etc) : K724 Storm Grey
4) Safety Equipment (first aid kits,stretchers, gas mask containers, oxygen kits etc) : E323 Spray Green / B134 Signal Yellow / Y999 Black

402. PIPEWORK COLOURING (cont'd)

5) Danger Areas –

o Rescue Zone	:	B134 Signal Yellow / Y999 Black
o Stairways	:	B134 Signal Yellow / Y999 Black
o Belt Guards	:	B134 Signal Yellow
o Protruding or Hanging Objects	:	B134 Signal Yellow / Y999 Black

6) Piping System (DO NOT PAINT VALVE STEMS OR NAME TAGS) –

o Air	:	K724 Storm Grey / C287 Signal Red
o Ballast Water	:	L549 Signal Green / G920 Violet
o Bilge Water	:	Y999 Black / L549 Signal Green
o Brine	:	R244 Brown / L549 Signal Green
o Bulk Mud	:	R244 Brown / B134 Signal Yellow
o Chilled Water	:	D899 Light Blue / C000 White
o Cooling Water (fresh)	:	D899 Light Blue / L549 Signal Green
o Cooling Water (sea)	:	L549 Signal Green / B134 Signal Yellow
o Dirty Oil	:	D260 Orange / M231 Teak
o Fire Main System	:	C287 Signal Red
o Foam	:	C287 Signal Red / C000 White
o Fuel Oil (diesel)	:	M231 Teak / B134 Signal Yellow
o Grey Water	:	Y999 Black / D899 Light Blue
o Halon	:	C287 Signal Red / G920 Violet
o Hydraulic Fluid	:	D260 Orange / K724 Storm Grey
o Liquid Mud	:	R244 Brown / D260 Orange
o Lube Oil	:	D260 Orange / L549 Signal Green
o Methanol	:	G920 Violet / M231 Teak
o Potable Water	:	D899 Light Blue / G920 Violet
o Sanitary (fresh water)	:	D899 Light Blue / M231 Teak
o Sanitary (sea water)	:	L549 Signal Green / M231 Teak
o Sewage	:	Y999 Black / B134 Signal Yellow
o Sludge	:	Y999 Black / M231 Teak

NOTE : Do not paint gauges or equipment name plates.

403. CATHODIC PROTECTION

Cathelco Impressed Current System (ICCP) corrosion protection system for hull and sea water piping is to be provided. The protection is to cover the entire hull including shadow areas, sea chest piping and sea water piping system.

Note : Further details of full painting specifications are to be attached to the contract as a separate document.

SECTION 5 – PLUMBING & PIPING

500. 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 to be used where piping penetrates a watertight or oil-tight bulkhead, deck or tank top. Expansion elbow or bends only are to be fitted where necessary to avoid damage due to expansion or movement of the structure. Mudboxes, stainless steel strainers, filters and valves are to be arranged according to Classification's and Owner's requirements. All seawater pipes are to be of hot dipped galvanized steel and all valves to be of approved type and suitable for sustained sea water use.

All valves will be marked with appropriate name plates. Bunker station will be arranged aft main deck and amidships with common filling and discharge lines of F.W., D.W., Fuel oil, Mud & Brine water, etc located in the same area. Pipes of 12mm welded with flanged connections, below 10mm are to be screwed with unions except for the air piping where butt welded with flanged is to be adopted. Threaded pipes are to be avoided wherever possible except in freshwater supplies system for domestic use.

All bare steel pipelines to be painted with primer prior to final finish coat as per paint specification. All steel pipelines to be painted with coats of primer prior to final finish coat and valve to be classification approved marine type and all the marine valve for size below 50mm dia. to be material of Bronze except for high pressure system.

All underwater openings such as sea chests, bow thrusters and Azimuth thrusters with hinged gratings are to open – able by diver to meet UWILD (Underwater Inspection in lieu of Dry Docking) – sea valves, sea suctions, bearings. High and low sea chests with strainers and isolation valves for cleaning and air vent.

Overboard discharge above waterline is to be fitted with deflecting plates.

501. BILGE & BALLAST SYSTEM

Bilge and ballast pipes of Sch. 80 hot dipped galvanized steel with suitable fittings are to be arranged with valves, strainers, mudboxes, manifolds, pumps and ballast water treatment plant in accordance with the piping drawing to meet the classification requirements. Two (2) pumps to be fitted sharing the duty with GS and fire pump.

501. BILGE & BALLAST SYSTEM (cont'd)

Ballast and cooling salt water systems to be protected by Cathelco Marine Growth Prevention Systems (MGPS) to be installed.

Suctions are to be fitted to the following compartments:

- All D.W. / W.B. Tanks
- Ship's Chain Lockers
- Bow Thruster Compartments
- Cofferdam in way of forward Fuel Oil / Potable Water Tanks
- Engine Room
- Air Lockers
- Bulk Tank cum Cargo Pump Room
- Azimuth Propulsion Thruster Compartment

Filling, suction and sounding are to be fitted to all tanks. Docking plugs of 38mm diameter stainless steel screw fittings are to be fitted in F.W. / S.W.B. Tank and Sewage / Bilge Holding Tank.
High level bilge alarm is to be provided in engine room, aft bulk tank compartment, Azimuth thruster, forward bulk tank compartment and bow thruster compartment and indicator to be installed in wheelhouse.

502. GENERAL SERVICE, FIRE & WASHDECK SERVICE

Seawater piping of Sch. 80 hot dipped galvanized steel with suitable fittings i.e. valves, strainers, mud boxes, manifolds and pumps for general and wash deck as well as internal fire fighting service are to be supplied from the GS and fire pumps to hydrants fitted on the various deck levels and engine room. Two (2) pumps to be fitted sharing the duty with bilge and ballast pump.

503. FUEL OIL SYSTEM (SHIP'S FUEL AND CARGO FUEL)

Fuel oil pipes of seamless black mild steel of Sch. 80 are to be arranged with valves, filters, manifolds, pumps and tanks in accordance with piping drawing and to meet classification's requirements.
Sounding and air pipes are to be fitted to each tank. Those positioned on main deck are to be located as near as possible to the cargo rail.

The fuel oil bunkers and daily service tanks are to be arranged as shown on the drawing. Daily service and settling tanks to be positioned at convenient locations and to be fitted with water drain cocks.

503. FUEL OIL SYSTEM (SHIP'S FUEL AND CARGO FUEL) – cont'd

A bunkering line is to be led to / from the main deck, P& S with 125mm (5 inches) Hammerlock type quick connecting coupling for quick filling / discharge for all bunkers c/w two (2) approved type flow meter units for each tank which are to be 'piped-in'. One is for standby. Reading to be in litres c/w filter to be fitted in between storage / day tank and transfer pump for filling / discharge line.

The fuel transfer and cargo pumps together with the manifold and valves etc. are to be arranged to transfer fuel oil from any tank to any tank. It is to draw from any bunker and discharge to either of the daily service tanks and settling tank.

A FuelTrax system as specified by the Owner covering the cargo and ship's fuel systems are to be installed.

Each daily service tank is to be provided with supply, filling and overflow pipes, drain valves, level alarm, content gauge to meet classification requirement. Transfer of fuel oil from bunker tanks to settling tanks by F.O. transfer pump and centrifuge with emergency stop button to be installed in the emergency / harbor generator room. In addition, a hand pump is to be provided to transfer fuel from bunker tanks to the day tanks in case of emergency.

Approved type fuel flow meters c/w filter are to be provided for monitoring fuel consumption for main engines, generator engines, fuel oil cargo pumps and bunker lines.
Fuel oil overflow tank to be provided and fitted with high level alarm.

Shipyard is to install Owner supplied FuelTrax system which caters for cargo fuel and ship's fuel systems.

Remote monitoring from aft wheelhouse control console to be fitted with :

- Emergency shut-down control
- Tank level gauges displaying innages or ullages
- Manifold pressure gauge display
- Pump amperage, pressure and vacuum gauge display
- Remote stop

504. LUBE OIL SYSTEM

Lubricating oil pipes of seamless black mild steel of Sch. 80 (internals to be acid cleaned) are to be arranged in accordance with engine manufacturer's recommendation and to meet classification's requirements. Lubricating oil storage tank is to be provided in engine room with filling pipe fitted on main deck and fitted with level gauge.

Lubricating oil circulating wet sump and engine driven lubricating oil pump(s) will be fitted to suit main engines chosen. Standby electrical pumps to be installed. These pumps can be used for priming purposes when the engine is on standby.

505. DIRTY OIL, SLUDGE & SLOP SYSTEM

Oily bilge, dirty oil and sludge piping system is to consist of Sch. 80 galvanised black mild steel pipes with filter, valves, separator and pumps. Oils are to be stored in the two (2) tanks as shown. Discharge of these oils to be performed by the one (1) horizontal gear pump of $8m^3$/hr @ 45m head. Drip tray to be suitably located on main deck discharge station.

506. MACHINERIES COOLING SYSTEM

The main engines, auxiliary engines, dry bulk compressor, air-conditioning, refrigeration machinery and thruster units including thruster motors are to be cooled by central F.W. cooled titanium plate coolers. The raw water cooling piping is to be 90 – 10 CuNi with suitable fittings and is to be arranged in accordance with the engine manufacturer's recommendations and to meet classification requirements. 20% margin to be added to heat calculation. Rust inhibitor to be added.

Three (3) F.W. cooling pumps of 50% capacity each are to be provided.

100% redundancy of plate coolers are to be connected in the central cooling system.
Further, Cathelco Impressed Current System to counter extreme corrosion of the pipes is to be installed to the S.W. supply.

The central plate coolers are to have easy access for cleaning the plates. Back flushing is to be provided on the S.W. sides of the coolers.

Four (4) S.W. cooling pumps (each of 50% capacity) with double isolated piping system of adequate capacity for the central coolers are to be provided. Strainers are to be provided at the sea main and are capable of cleaning while all S.W. pumps are in operation.

507. COMPRESSED AIR SYSTEM (refer to Section 10)

The main engines are to be air started. Auxiliary engines are to be electric started. The compressed air pipes of Sch. 80 solid drawn black mild steel are to be arranged with air bottles, valves, pressure gauges in accordance with engine manufacturer's recommendations and to meet classification requirements.

Three (3) general service / starting air compressors are to be provided. One (1) of which is a standby unit completely piped–in but which can be used as a service unit on a rotational basis.

Air pressure reduction from 10 to 7 bar is to be arranged to cater for general service and from 10 to 2 bar for sea chest blow down.

508. HYDRAULIC SYSTEMS

The hydraulic piping of Sch. 80 solid drawn steel (internals to be acid cleaned) and high pressure flexible hose of approved type for anchor windlass and capstan, crane, tugger winches (optional) etc and systems to be arranged in accordance with the manufacturer's recommendations and to meet classification requirements. Adequate strainers are to be provided.

509. SHIP'S POTABLE WATER SYSTEM

A cold potable water piping system of hot-dipped galvanized pipe Sch. 80 for domestic and potable water cargo systems with stainless steel supply branches lines connected to the equipment for galley, drinking and washing purposes. UV sterilizer is to be fitted.

Water supply to accommodation and machinery compartment, engine room and etc. through self-contained, automatic pressure tank fitted in the engine room or bow thruster compartment.
100mm (4 inches) Camlock or equal deck fitting to be installed for common filling and discharge on main deck at port and starboard.

The potable water cargo pump with suction and filling manifold, etc is to be arranged to transfer potable water from one tank to the other tank, one (1) Owner approved type flow meter reading in litres for the potable water pump outlet line.
One (1) additional pressure pump is also to be fitted to act as standby for both potable water and sanitary water pressure sets.

A potable water maker of Reverse Osmosis type of 10t/day with salt content below 500 ppm capacity is to be installed.

509. SHIP'S POTABLE WATER SYSTEM (cont'd)

Remote monitoring from aft wheelhouse control console to be fitted with :

- Emergency shut-down control
- Tank level gauges displaying innages or ullages
- Manifold pressure gauge display
- Pump Amperage, pressure and vacuum gauge display

Alternative : approved type of PVC pipes to be adopted for domestic and sanitary services.

510. HOT POTABLE WATER SYSTEM

Hot potable water of closed loop system is to be drawn from cold freshwater into an electric calorifier and piped to washplaces and galley. Hot water pipe of hot dipped Sch. 80 galvanized seamless steel are to be suitably insulated with lagging.

511. SANITARY SYSTEM

Sanitary piping system of Sch. 80 hot dipped galvanized steel with suitable fittings are to be arranged with valves, S-trap, scuppers and pressure set in accordance with good marine practice and meeting classification requirements. Freshwater flushing is to be adopted with salt water backup.

512. SANITARY FITTINGS

1)	Washbasins	:	500mm x 400mm with 12mm cold / hot water supply. White vitreous China type for all cabins and bathrooms except sickbay and changing room whereas stainless steel to be used
2)	Showers	:	12mm cold and hot water screw down taps and mixing valves
3)	WC	:	white vitreous China with plastic seats and lids. 25mm SW supply with flush valve and potable water supply c/w valve for cleaning
4)	Galley sink unit	:	Deep type stainless steel twin bowl unit 12mm hot & cold potable water supplies c/w filter.
5)	Taps	:	all taps to be handles type and not screw downs

513. REFRIGERATION SYSTEM – FREEZER & CHILLER ROOM

The built–in walk–in chiller and freezer are to be furnished and installed as shown on the drawings. The two (2) complete sets compressors and condensers units (100% standby) to be fitted in the AHU compartment or other suitable location. Condensers to be central plate cooled.
Performance criteria to be based on 45° C ambient temperature, 90% RH. It is to maintain cold room (meat & fish) temperature at –18° C and cool room (vegetable) temperature + 4° C. The adjacent preparation room is to be spot cooled to +20°C.

Each compartment is to be accessible through a proper stainless steel insulated door with 150mm minimum polyurethane to preserve temperature. Each compartment to be thermostatically controlled; in addition each compartment to be fitted with a heated drain and U – trap for excess water and condensation.

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

The condensers to be water cooled with copper nickel condensers and central plate cooled with F.W. The compressor sets to be identical, with one serving as a standby unit, fitted with proper sealed refrigeration valves so either unit can be isolated for service. The operating unit to service both the chiller and freezer fan / evaporator units, with pressure / temperature controlled expansion valves, tied to each thermostat, controlling the compressor operation.

The system is to be designed to operate R407c gas or equal. Proper dryers, with valve bypass, and moisture indicating sight glasses will be fitted. All compressor motors will be TEFC enclosures, belt driven.

A remote temperature gauge is to be installed outside the chiller / freezer room and door alarm / bell with indication light to be installed in the bridge / galley. Doors fitted with hold back hooks. Suction & pressure gauges (permanent) to be provided for each compressor. The bottom of the walk-in compartments is to be finished in red ceramic tile, with wood grating over. The sides and overhead to be stainless steel sheet metal over non-flammable, oil resistant type of insulation. Shelves are to be stainless steel frames with stainless steel bottoms and raise three and four tiers high of approx. of 200mm above floor level.

514. EXHAUST PIPES & SILENCERS

Exhaust pipes of Sch. 20 for main and auxiliary engines are to be led to top of funnels. Exhaust pipes and silencers to be well insulated with heat resisting insulating material (Non asbestos type) and covered with galvanized steel sheeting. Minimum two (2) in number of expansion pieces for main and auxiliary engines' exhaust pipes are to be arranged.

Silencers and exhaust pipes are to be thermo-metrically insulated from steel work and supported by spring mounting to minimize noise and vibration. All exhaust silencers to be fitted with certified spark arrestors and fitted with water drains to the lowest parts of exhaust pipes. Silencers for main and auxiliary engines are to have 35 dBA noise reduction.

Exhaust pipes to be extended beyond the top of funnels and with 45° angled towards outboard to minimize soot accumulation around top of funnels and surrounding areas. All exhaust pipes to be resilient mounted.

Minimum flanges to be used to avoid possible leakage of exhaust gas. Expansion bellows to be used for expansion and contraction.

515. BULK TANKS FOR DRY BULK MATERIAL

1) Bulk Tanks and System

The system is designed for transporting cargo of cement, barite and bentonite for cargo of S.G. up to 2.5. It has two (2) segregations and able to handle two (2) cargoes simultaneously. Discharge to be able to delivered cargo at minimum 50 t/hr at 60m head, minimum 125m distance with a 6.5 bar system.

Filling / discharge line for the outlet station (4 stations, 2 amidships, 2 aft) arranged on the main deck at port & starboard side amidships. 125mm diameter discharge pipe line c/w female Camlock or equal coupling to be along the port & starboard side cargo rails and discharge point at the stern. Discharge and purge air system c/w compressor emergency stop button to be operated / controlled from central control panel and located in the wheelhouse.

Vents fitted with discharges overboard if positioned below the waterline to be designed without causing contamination.

The bulk system to be remote operated with the exception of the butterfly valves (manual operated) located on the main deck. Deck connection for filling / discharge / vent line to be of 125mm (5 inches) diameter quick-disconnect type female Camlock or equal coupling.

515. BULK TANK FOR DRY BULK MATERIAL (cont'd)

1) Bulk Tank and System (cont'd)

External and internal surface of bulk tanks to be blasted to according to specifications stated in Section 4.

Capacity of bulk tanks	:	3 x 76m^3 (2684 ft^3) + 1 x 67m^3 (2366 ft^3), total 295 m^3 / 10,418 ft^3 double dome type
Class	:	ABS
Working / operation pressure	:	95 psi (6.5 bar)
Test pressure	:	9 bar

All bulk tanks to be complete with aeration system, quick release, sounding point, lifting lugs, legs and pipe connection for discharge, filling and vent links c/w air inlet, level indicators / alarm (0 – 100% level indicator for each tank at site and in aft wheelhouse control station), safety valves and pressure gauge with transmitter.

Safety valves to be lead to the main deck and not into the bulk tank compartment. A pressure equalization system is to be provided to assure minimum pressure differential between the upper and lower spaces within the tank.
The four (4) nos. bulk tanks to be individual remote operated system for filling, discharge and vent line.

Air filter equipment

- 2 Loading filters used to remove any non-powder pollution from the cargo that flows into the pressure tanks.
- 2 Mucking ejectors (one for each type of cargo) used to completely remove all cargo dust from the pressure tanks, in the event that the tank(s) used for Bentonite / Barite instead of Cement or vice versa.
- 2 Dust collectors (one for each type of cargo), filter tank type used to retrieve product from the dust that would otherwise be emitted. Maximum dust emission 5 mg dust per m^3 vent air.

515. BULK TANK FOR DRY BULK MATERIAL (cont'd)

2) Bulk Tank Compressors

Two (2) 25m^3/min (approx.) @ 6.5 bar (95 psi) rotary screw marine type compressors to serve two types of cargoes i.e. cement and barite / bentonite. Compressors come with rubber mounting and compensators for low vibration, and capable of 45°C air intake. They are to be electrically driven, F.W. plate cooled. Soft starting motor to be IP55 and Class F insulation. These two compressors are cross - connected for emergency change – over.

The system consisting of two (2) refrigerated air-dryers, capacity to suit each compressor.
Air piping systems from compressor to bulk tanks are to be as straight as possible with maximum 45° bends in order to eliminate condensation collection points. There are to be seamless black mild steel with Sch. 80, 125mm (5 inches) diameter for filling, discharge and vent pipe-lines. Flange connection no longer than 3 metres. For filling, vent and discharge lines, Victaulic type of mechanical bolted couplings and gasket seal to be fitted before and after the bends.

516. OIL BASED LIQUID MUD / BRINE / RECOVERED OIL SYSTEMS **(MUD S.G 2.8, BRINE S.G. 1.23)**

A total of six (6) cargo tanks to be arranged aft of the engine room :

- Four (4) of them are triple purpose cargo tanks (Brine, Mud & Recovered Oil)
- Two (2) of them are dual purpose cargo tanks (Brine & Mud)
- each tank can be individually filled or discharge

Liquid mud / brine / recovered oil and Oil Recovery System (ABS Class 1) pipes of black seamless mild steel Sch. 80 are to be arranged with valve, pumps and epoxy coated with stiffeners on the external of tanks or corrugated bulkhead construction tanks in accordance with piping system drawing. Four (4) completely separate piping systems, inter – connected with double segregation valves to be arranged.

Three (3) horizontal screw pumps driven by intrinsically safe motors to be fitted. ~~A dedicated centrifugal pump of 100 m^3/hr @ 30m to be fitted for recovered oil usage.~~

PV valves are to be provided to suit maximum loading / unloading rate of recovered oil for each tank in Oil Recovery operation.

100mm dia. female Welco deck quick coupling fittings to be installed for common filling and discharge along the port and starboard cargo rails at the stern and amidships (4 discharge points).

516. OIL BASED LIQUID MUD / BRINE / RECOVERED OIL SYSTEMS (cont'd)

Three (3) transfer pumps and two (2) circulating pumps are to be fitted (refer to section 10).
The ampere meter on the starter panel and low / high level alarm indicators are to be provided in the local and wheelhouse.

A dedicated re-circulating system consisting of suitable numbers of nozzles per tank is to be provided and installed in all mud tanks for 24 hours continuous operation. Pumps of 2 x 35m^3/hr @ 25m to be provided to discharge brine from each of the tanks. Details as per vendor system designer's recommendation. In addition, all mud tanks are to be fitted with electrical or hydraulic agitators of paddle type mechanical mixers. Rate of flow must be sufficient to keep the tank bottoms swept clean of sediment.

Cleaning of six (6) mud tanks with portable tank cleaning machine to be mounted on main deck Butterworth fittings. Machine driven by S.W. from fire main system. Flushing of liquid mud and brine with drill water by – pass line also to be arranged.

Mud tanks are to be fitted with air vents of twice the cross sectional area of the filling pipe and provided with a disc of burst pressure 0.2 bar.

Relief valve to be fitted in the discharge of each recovered oil pump and piped back to the suction if system is not served by centrifugal pump. All pump flanges, connections to be fitted with oil spill coamings of minimum 150mm (6") height. Pressure gauge to be fitted at pump discharge.

Recovered oil pipe runs, flanges, joints and other vapour leakage services are not to be located within machinery spaces. Mechanical ventilation to be provided for the bulk tank compartment of minimum 20 air changes per hour with automatic shut down of the fan motor open release of fire extinguishing medium. Fixed fire fighting system to be provided for the bulk tank compartment.

517. DRILL WATER SYSTEM

Drill water pipe of Sch. 80 hot dipped galvanized steel with suitable fittings is to be arranged with valve, pumps and tank in accordance with piping system drawing.
The drill water cargo pump together with suction and filling manifold, etc. is to be arranged to transfer D.W from one tank to the other tank, one (1) approved type flow meter unit reading to be in litres for the D.W pump outlet line. D.W flushing arrangement for mud and brine piping system.
Owner approved flow meter with remote printer to be fitted.

517. DRILL WATER SYSTEM (cont'd)

100mm dia. female Camlock or equal deck fitting to be installed for common filling and discharge on main deck port and starboard side at the amidships.

Remote monitoring from aft wheelhouse control console to be fitted with :

- Emergency shut-down control
- Tank level gauges displaying innages or ullages
- Manifold pressure gauge display
- Pump amperage, pressure and vacuum gauge display

518. HOSES

Independent hoses and connections (quick coupling) are to be provided for fuel oil, potable water, drill water, mud and dry bulks with quick release fittings on both ends.

F.O. : 3 x 15m (50ft) of 100mm (4") and 125mm (5") and each length to be –
- Electrically continuous between the flanges or couplings
- Made of an "anti-static" material
- Fitted with 4" dia. quick release Hammerlock fittings, male and female at opposite ends of each hose length
- valves on ends

Potable water : 3 x 10m of 100mm (4") and 125mm (5")
- each length with quick release Camlock fitting at each end

D.W. : 3 x 12m (40ft) of 100mm (4")

Mud : 2 x 12m (40ft) of 100mm (4")

Brine : 2 x 12m (40ft) of 100mm (4")

Dry Bulk : 2 x 12m (40ft) of 125mm (5")

Dirty Oil : connection to meet Marpol 73/78 (1.5" or 40mm)

Sewage : connection to meet Marpol 73/78 (1.5" or 40mm)

Grey Water : connection to meet Marpol 73/78 (1.5" or 40mm)

Camlock fittings for potable water, drill water, dry bulks and mud at both ends. Hammerlock type for fuel oil.

519. TANK VENTS

In principle, air vent pipes of all tanks are to be individual. Fuel oil system only have cascading overflow / vent system. Common vent / overflow pipe is only allowed subject to the satisfaction of final damage stability approved by ABS.

Vent pipes to be 760mm above the freeboard (main) deck or 450mm above the superstructure deck. Sounding and vent pipes for gas – safe thanks are not to be terminated in hazardous area in way of the recovered oil tanks. Areas of open deck within 3m radius of recovered oil tanks openings are to be considered as hazardous zone.

Vents are to be arranged from the highest part of the tank.

520. PIPING ARRANGEMENT TO MEET 'ENVIRO NOTATION'

The following are to be provided :

- Fuel oil management for control of Sox emission, fueling management plan and procedure to be submitted for ABS approval by Owner
- All fuel oil tanks to be fitted with high level alarm
- Collecting trays with $0.12m^3$ to be fitted under all oil tank vents (fuel, lube oil, hydraulic oil, overflow tank, filling manifolds) c/w means for disposal of drainage without discharging it into the sea

SECTION 6 – DECK MACHINERY & EQUIPMENT

600. GENERAL

All deck machinery and equipment are to be supplied and installed to meet classification approval for circle E. Following information is for guidance only and subject to ABS acceptance & equipment number calculation for this class of vessel.

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

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:-

Anchors	:	two (2) fully balance stockless AC-14 high holding power anchors, each 2850kg
Chain cables	:	two (2) x 12 shots each of 1080 ft (330 m) long (total of 660 m), 50 mm diameter & Grade 3 stud link chains
Hawsers	:	four (4) x 180m long of minimum 270 kN breaking strength
Towline	:	200 m, 691 kN B.S.

(Anchor winch and chain size are allowed to be reduced to Rules requirements except chain cable length).

602. ANCHOR WINDLASS / MOORING WINCH

Two (2) electro hydraulic anchor windlasses / mooring winches, each with one (1) gypsy, one (1) warping drum and one (1) mooring rope drum. The cable lifters, rope drum and warping drums are to be independently clutched and brake with variable speed local hydraulic local control and remote control on the forward wheelhouse console.

Chain pipes, roller type chain stoppers and hawse pipes with S.W. washing are to be arranged. Hydraulic brake and manual over-riding to be fitted. Emergency quick release to be fitted.

Anchor Windlass:-

Capacity	:	about 15t @ 0 to 14m/min (to be confirmed)
Gypsy size	:	suitable for 50mm dia. Grade 3 stud line chain
Chain stopper	:	suitable for 50mm dia. stud line chain

602. ANCHOR WINDLASS / MOORING WINCH (cont'd)

Mooring Rope Drum

150 m x 60 mm dia. Polypropylene rope (Owner's supply)

Rated drum pull of 15t @ 15 m/min. Hydraulic operated bend brake holding about 20t SWL.

CCTV with two (2) fixed camera (IP56 or greater) for forward forecastle deck observation of windlass operation to be fitted on wheelhouse forward control.

603. CAPSTANS

Two (2) variable speed electro hydraulic capstans c/w remote control in the wheelhouse aft console and local hydraulic control unit.

Capacity	:	8 t
Winding speed	:	15 m/min
Drum diameter	:	400 mm

604. TUGGER WINCHES

Two (2) variable speed electro hydraulic tugger winches c/w warping head of 400 mm diameter & local control. Control position to have heavy personnel protection bars facing aft and from top to bottom.

Capacity	:	10 tonnes
Winding speed	:	15 m/min
Wire drum	:	100 m x 25 mm dia. hardcore FSWR (galvanized) - Owner's supply
Brake /clutch	:	manual operated brand brake

605. CRANE

One (1) electro-hydraulic knuckle arm marine crane, capacity 3.5 – 4t @ 19m working radius, 440/3/60, local control. Crane support is to be provided as necessary for storage on starboard outside the deckhouse.

Crane capacity limitation in operation is to be considered in the stability calculation and duly approved by Classification (with maximum inclination 3°).

606. DISPERSANT SPRAY BOOMS

Refer to Section 10

SECTION 7 – OUTFITTINGS

700. GENERAL

All outfitting are to be supplied and installed to meet intended design and operation requirements. Structure analysis and reinforcement for deck machinery as required by rules and regulations are to be submitted for classification approval.

701. DRAFT MARKS

Draft marks in metric measurement are to be at the forward, amidships and aft, port and starboard sides as per the relevant regulations to reflect the class selection by the Owner (OSV or SPS). Datum line for either OSV or SPS (non – selected) is to be marked by raised welded steel plate and painted in yellow and black around hull.

702. NATIONAL COLOURS

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

703. LOGOS

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

704. MAST

The main navigation mast is to be completely fitted out with necessary brackets and stays for navigation lights and shapes mounted on top of a bridge structure straddled between the funnel and the battery / wheelhouse air–con room. Internal and external ladders are to be arranged for easy access.

On the mast, safety cage and climbing rungs are to be provided. Fire monitors are to be fitted.

Fore – mast exemption is subject to approval of Maritime Laws and Regulations of Vanuatu prior to finalization of design.

705. ESCAPE HATCH

Watertight mild steel hatch cover c/w counter balance weight and two (2) steps stopper to be provided for engine room, accommodation, bow & Azimuth thruster compartments and stores. All hatch coaming height to be to Load Line Regulations. Internal locking arrangement as per ISPS code.

706. MANHOLES

All manholes are to be of elongated shape with stainless steel studs, washer and nuts. In way of exposed main deck, they are to be of raised type with flush steel covers to wooden deck level.
In accommodation manholes are to be flushed type. Minimum opening 600 x 400.

Raised welded bead tank markings painted in white for tank designation. On the upper side of bulkheads, manhole covers to be hinged and hooked back for stowage with the adjacent rungs for easy access.
No rubber and neoprene to be used in any oil, mud or any kind of tank.

707. STORM RAILS (GRAB RAILS)

Storm rails are to be fitted at strategic positions for maximum safety and to meet rule requirements. It is fitted at all round deckhouse and on exterior bulkheads. Storm rails also to be fitted in convenient positions in toilets, bulk tank compartment, stern propulsion thruster & bow compartments and engine room.

Grab rails to be fitted on both sides whenever possible in particular for all stairways.

708. HANDRAILS & STANCHIONS

Handrails are to be fitted at strategic positions for maximum safety and to meet rule requirements. Stanchions are to be 75 x 12 FB x 1000mm high with short backstays and spaced not more than 1200mm spaces apart. Top rails of 38mm diameter and lower rails of 25mm diameter. All galvanized pipes. At access points, pipes substituted by 12mm short link SUS chain with hook and eyes.

709. MOORING BOLLARDS

1) Bollards

A number of 300mm NB Sch. 80 heavy pipe double bollards are to be fitted on aft main deck, on lower forecastle deck and on upper forecastle deck and one (1) double crucifix bollards with fairleader to be fitted on forward forecastle deck as shown on the drawing.

Design SWL Loads are to be welded to bollards.

709. MOORING BOLLARDS (cont'd)

2) Mooring Pipes / Closed Chocks

Mooring pipes or closed chocks, size: 300mm and 400mm are to accompany each bollard. They are to be welded to the bulwarks, on deck as shown on the GA drawing. Final mooring arrangement is to be prepared and approved by the Owner.

3) Vertical Rollers

A number of 200mm dia. fair lead-open type vertical rollers are to be fitted to the upper forecastle deck.

710. TOWING BOLLARD / SMIT BRACKET

One (1) 300mm NB Sch. 80 pipe 'H' bollard fitted on forward bow of deckhouse on upper forecastle deck. One (1) set of smit towing bracket to be provided on forward most forecastle deck.

711. FENDERS

1) Rubber fenders : Heavy duty oil and abrasion resistant synthetic rubber fenders diagonally and vertically lay on ship sides, cross – sections of 400mm x 150mm thick rectangle rubber blocks fastened by SUS bolts and nuts.
300mm thick rubber blocks at bow (one row) and stern corners [two (2) rows] secured by galvanized M.S. rods or heavy gauge pipes.

2) Steel fenders : 20mm steel doubler or equivalent insert plates to be welded at ship sides

3) Tyre fenders : A number (approximately 20) of used aeroplane tyres and secured by 20mm diameter galvanized chains and shackles tightened to the shipside are to be provided for each side.
Tyre fenders to be fitted using a flat plate located internally in the tyre which is welded to a pipe collar and protruded through a drilled hole in the tyre tread. The pipe collar is to be welded to a pad eye which is shackled to the securing chain.

712. COVERS FOR DECK EQUIPMENT

Strong PVC covers or waterproof canvas for deck equipment such as compass, anchor windlass, capstan, tugger winch and control panel etc.

713. FLOODLIGHTS

Refer to Electrical Section 9.

714. SEARCHLIGHTS

Refer to Electrical Section 9.

715. HAWSE PIPES & ANCHOR RECESSES

Two (2) Sch. 80 hawse pipes welded to 12mm anchor recesses. Chain washing to be provided.

716. DRAINAGE FOR DECKS

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

717. GANGWAY / BULWARK GATES

One (1) 6 m x 0.6 m portable aluminum gangway (with ABS certificate) complete with handrail and net is to be provided. Two (2) hinges steel gates to be fitted, 1 P & 1S c/w overhead support 75 mm diameter pipe and manila swing ropes.

718. DECK POWER ELECTRICAL SUPPLY SOCKETS (ALL W.T.)

Refer to Section 919.

719. SOUNDING PIPES

Deck sounding pipes for aft tanks in way of the cargo area are to be positioned as close to the cargo rails as possible to facilitate sounding operation when cargo deck is in full used.

720. DECK SHEATHING

75mm thick hardwood planks are to be laid on aft main deck with non-drying bitumastic compound on top of painted steel deck according to approved International Paint scheme. Gaps of wood are also to be filled with same bitumastic solutions and retained with T-steel boundary bars at edges and plank ends. Proper drainage is to be provided.

721. DECK LASHING AND HOLD DOWN

To be provided are bottle screws, chain tensions and cargo pins (portable cargo stanchion, 125mm pipes).

722. DECK CONTAINERS MOUNTING SOCKETS

Elephant – feet ISO container sockets for minimum eight (8) containers i.e. 4 x FEU, 4 x TEU to be welded on aft deck flush with the wood sheathing.

723. CARGO STANCHIONS

A numbers of portable stanchions 4" diameter heavy Sch. 80 pipe, to be socket mounted standing 1 metre height above deck for holding the cargoes in positions.

724. PAD EYES, 'D' RINGS AND CARGO ROLLERS

Refer to Section 221.

725. INTERNAL AND EXTERNAL LADDERS

All ladders are to be steel construction. Tread to be non-slip, made of galvanized grating or similar construction. Vertical ladder to be constructed with 19mm square bar rungs welded to steel flat bar and 200mm to be clear of steel bulkheads. Hand grips to be fitted as necessary.

All internal and external ladders are to meet ILO MLC 2006 and HAB(WB) requirements with inclination angle less than 50 degrees and vertical step space less than 230mm. Actual distance of vertical spacing must be equal taken into consideration of thickness of deck compound, insulation and floor covering material.

726. DOORS

Doors are to be fitted as shown on the General Arrangement drawing. All external accommodation watertight doors (to outside) to be of mild steel construction and in addition with complementary windowed fire rated internal doors open inwardly for accommodation area c/w self-closer with coaming heights according to the load line requirement.

Sickbay to have 900mm wide doors for the external bulkhead and double – leaf door from the main deck air lock lobby.

726. DOORS (cont'd)

In general, door openings are to be min. 600mm wide except main entrance to each deck level, Galley, Sickbay and Emergency / Harbour Generator Room are to be minimum 750mm wide.

All doors in common rooms are to be open outwards.

All hinged type steel doors are to have four (4) or six (6) dogs. Each dog is operating individually.
All W.T. doors under the main deck are to be sliding type operated by hydraulic motors and fitted with remote monitoring in wheelhouse to meet rule requirements.

These doors are to be channel-framed construction and tightened to gaskets of soft neoprene or similar. Doors are to be fitted with sturdy padlocks and hold-back arrangement to retain them in open positions.

Wheelhouse side doors is to have mild steel W.T. external doors and BO type internal joiner doors with windows complete with self- closing device.

All external doors in way of accommodation are to be accompanied by fire rated, flush fitted internal joiner doors c/w self-closing device and manual hook-back. In principle, all doors are to be lockable.

All below main deck, doors are to be made with steel and water-tight. The numbers and types (hinged or sliding) are to be according to rules and regulations requirements. Alarms and indicators for the remote monitoring of these doors (open or close) are to be fitted in wheelhouse forward control console.

727. WINDOWS & SCUTTLES (PORT-LIGHTS)

All windows are to be mild steel welded type with tempered glass to suit the classification's requirements as a standby rescue vessel as well as FiFi Class 1. Side scuttles are to be mild steel welded type with deadlight cover. All the scuttles below forecastle deck accommodation area are to be of insert type. FiFi Class 1 requirements are to be met. Minimum port – lights diameter 350mm.

Wheelhouse windows to be fitted from outside with toughened safety glass.

728. NAMEPLATES AND NOTICE BOARDS

All cabins and rooms, work spaces etc. to be identified by plastic name plates over doors. All such name plates to indicate name of compartment.
Notice boards and name plates as requested by Classification and Authority regulations are to be provided.
Shipbuilder's names plates to be fitted on deckhouse front.

Labels are to be supplied for all keys. Three (3) sets of keys for each cabin plus six (6) master keys. All tags to be marked for space and numbered.
Valve name plates are to be bolted to valve wheels. Air sounding pipe filling and discharge pipes to have name plate.

729. CARPENTER'S WORK

All external doors are to be in mild steel complemented with fire-retardant doors open inwardly except in wheelhouse. All internal doors to be self closing type provided with rubber stoppers and hold-back hooks to retain the doors in open position. Hardware is to be of brass or chrome. Hinged steel doors with bolted mild steel type large windows fitted in wheelhouse.

Store rooms to be provided with steel shelves with retaining bars. Wooden grating in store rooms for hawsers and warps. Arrangement of shelves is to be sufficient for the intent of each store room.
Side lining and ceiling in wheelhouse, accommodation, engine control room and living spaces fitted with fire-retardant type material.

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

SECTION 8 – SAFETY & NAVIGATION EQUIPMENT

800. LIFE SAVING EQUIPMENT (for Ship's crew)

Life saving equipment is to be in accordance with the requirements of the Classification and Government Authority for Ocean Going vessel with a total complement of fifty – two (52). All equipment is to be approved by Owner(s).

1) Life Rafts

A total of two (2) 25 – man and two (2) 15 – man inflatable life rafts on each side with full emergency pack in rigid fiberglass container conforming to SOLAS 74 latest amend convention. The life rafts are to be stowed on the forecastle deck in hinged type cradles c/w automatic hydrostatic release for quick sideway launching.

Maker and quality must be of approved type by Owner prior to purchase.

2) Lifebuoys

Total nine (9) lifebuoys of SOLAS approved type. Maker and quality must be of approved type by Owner prior to purchase.

- Five (5) 90ft buoyancy lines
- Four (4) 90ft buoyancy line and c/w two (2) each self-igniting electric lights and smoke signals electric lights
- Life buoys to be fitted with retro-reflective tape

3) Life-jackets

Fifty – two (52) approved type lifejackets to be supplied and stowed adjacent to each berth plus additional spare jacket of ten (10) in nos. and to meet with SOLAS requirement.

Maker and quality must be of approved type by Owner prior to purchase.

4) Work Vests

Eight (8) Driclad type 1 or equal work vests of self-uprighting type and approved by U.S. Coast Guard Offshore Work Vest Type V PFD.

Maker and quality must be of approved type by Owner prior to purchase.

800. LIFE SAVING EQUIPMENT (cont'd)

5) Immersion Suit & Thermal Protective Aid

To follow and comply with SOLAS requirement.

Maker and quality must be of approved type by Owner prior to purchase.

6) Fast Rescue Craft (FRC)

Refer to Section 801, item 3.

7) Boat Hooks

2-boat hooks c/w 5m aluminum handle with blunt hook at the end.

8) Pyrotechnics

- One (1) line throwing apparatus (4 projectiles & 4 lines)
- Six (6) hand flares
- Twelve (12) parachute distress rockets
- Two (2) orange smoke signals each to have 120 seconds discharge time and be waterproof type.

Maker and quality must be of approved type by Owner prior to purchase.

9) Retro Reflective Tapes

To be fitted to all life saving appliances.

10) Man Overboard Smoke / Light fittings

Two (2) pieces.

11) Self-Igniting lights

Two (2) pieces.

12) Splints

Six (6) sets air splint.

13) Paraguard Stretcher & 4-points lifting sling

One (1) rescue stretcher c/w carrying case.

Maker and quality must be of approved type by Owner prior to purchase.

800. LIFE SAVING EQUIPMENT (cont'd)

14) Oxygen Resuscitator

One (1) set of oxygen resuscitator c/w oxygen cylinders and two (2) spare cylinders.

15) First Aid Kits

To rules requirements, minimum three (3) boxes.

16) Skin Cleaner Anti-Septic Lotion

10 litres of Aqua Centrimide (Savalon) 1 % for cleaning. Skin / antiseptic lotion to be in a sealed locker.

17) Signboards

Emergency procedures, signboards, etc to be placed at various locations and to be written in English Language.

18) Emergency Escape Breathing / Devices set

To follow and comply with SOLAS requirement.

19) Safety Plans and Personnel Muster List

There are to be displayed in glass protected frame work on each deck level.

20) Abandon Ship, Man-Overboard

Fire and gas drills to be held in accordance with the Saudi Charterer Loss Prevention Program.

21) VHF Survival Craft Radios

Three (3) hand-held numbers to meet IMO specified requirements for Marine Department Basic Marine Vessel Specifications and Requirements. This is in addition to the rules requirements.

22) Abandon Ship, Man-Overboard, Fire & Gas Drill / Fire Alarm

To be held in accordance with the Charterers Loss Prevention Program.

23) Damage Control Equipment

Suitable for the size of the vessel in accordance with Marine Department Basic Marine Vessel Specifications & Requirements.

800. LIFE SAVING EQUIPMENT (cont'd)

24) Fire Blanklets

Suitable numbers stowed in engine room and galley.

25) Ships' Medical Stores

To meet minimum requirements of UK Merchant Shipping Notice, MSN 1768 (M + F) in conjunction with MSN 1776 (M) and MGN 257 (M) for this type of vessel. For details, obtain from internet Google sources, MCA MSN 1768 (M + F).

Initial ship's medical items apply to all vessels to be provided by Builder.

801. SAFETY RESCUE EQUIPMENT FOR EXTERNAL OPERATION

The vessel is to be equipped with the following :

1) Rescue Zones

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

a) Each side of the vessel marked with 6mm steel plate rescue zone which is painted in bright yellow with diagonal black stripes
b) Each rescue zone to be not less than 5 metres in length
c) Each rescue zone to be illuminated both on deck and over side with no shadow areas
d) Bulwarks to be either of the opening or removable type to allow an open working area and to be not less than 5 metres in width – two (2) steel doors of double leaf
e) Two (2) scrambling nets to be supplied to the vessel that can be fitted in the area of the rescue zone such that the maximum height from sea to the main deck to be no more than 1.8 m, with a minimum clearance of 0.20 m off the vessel's side
f) Suitable securing points for scrambling nets, safety lines and rescue craft
g) One (1) portable over – side ladder providing a foothold clear of the bulwarks and hull and extending one (1) metre into the water
h) Additional eight (8) lifebuoys with buoyant heavy lines to be provided for safety rescue operation. This is in addition to the numbers required in standard classification requirements
i) A clear access to be provided to the survivors holding area

801. SAFETY RESCUE EQUIPMENT FOR EXTERNAL OPERATION (cont'd)

2) Helicopter Hoisting Area

The vessel is to be equipped with a helicopter hoisting area which to be suitably marked in a highly visible color and to be clear of all obstructions when not covered by drilling supplies on aft deck.

The following Aviation approved and certified equipment to be provided for helicopter high-line operations :

a) Aviation Radio with frequencies 121.5 MHZ, 135.900 MHZ and 135.950 MHZ as a minimum
b) Two (2) pairs of heavy duty insulated rubber gloves
c) One (1) suitable earth bonding pole (to catch winch wire)
d) One (1) set of heavy duty wire cutters (one metre long)
e) Wind sock (illuminated at night)
f) Paraguard stretcher (refer to Section 800, item 13)
g) Day and night helicopter batons
h) High visibility over vests

3) Fast Rescue Boat (FRC)

One (1) FRC of minimum nine (9) persons with a speed of minimum of 20 knots in calm water with a crew of three (3) persons and at least 8 knots when loaded with its full complement of persons & equipment) is to be fitted. This is to be powered by an inboard diesel engine operating a water jet propulsion system. All necessary equipment to be provided in accordance with IMO Resolution A656 (16).

The FRC to be self – righting or capable of being readily righted by not more than two of the crew, and self–bailing or be capable of being rapidly cleared of water.

A launching device in accordance with SOLAS Regulation 48 is to be fitted to the vessel for launch and recovery of the FRC. This device is to be easy to operate and avoid the requirement for slewing the FRC during launching and recovery.

It is constructed in such a way that when suspended by its lifting point, it is of sufficient strength to withstand a load of four (4) times the mass of its full complement of persons and equipment without residual deflection upon removal of the load.

801. SAFETY RESCUE EQUIPMENT FOR EXTERNAL OPERATION (cont'd)

3) Fast Rescue Boat (FRC) – cont'd

Personal protective equipment for the FRC crew to include at least :

- Inflatable life jacket
- Hard hat
- Eye goggles
- Leather gloves

A permanent waterproof VHF radio with external speaker to be provided.
In addition, three (3) hand-held VHF sets with aero mobile VHF emergency frequencies and two (2) loud hailers are provided for this FRC.
Owner is to approve the design of FRC and the associated equipment.

4) Survivor Recovery Area

Vessel is to have suitable area as designated for recovery with seating for a minimum of twelve (12) survivors on the lower forecastle deck. This area is normally served as the lounge / recreation room when not otherwise required for survivors.

Three (3) 4–pax cabins are available for twelve (12) survivors. Each cabin to be fitted with shower cubicle with a portable shower head with extending hose, grab rail, wash hand basin with lever-type taps, soap dish, pedestal WC, toilet roll holder, grab rail, vanity cabinet with mirror, extractor fan, coat hooks and towel rails. Hot and cold water supplies to the shower and wash basin.

5) Hospital / Sickbay / Survivor Treatment Area

The vessel is to have an air – conditioned designated sickbay or survivor treatment area. It is to be equipped with a treatment table, suitable lighting powered by mains and emergency sources, instrument table, medical cabinet (locked) for medicines and equipment, with communications to the wheelhouse.

This room is to be fitted two (2) hospital beds and furnished to meet Rules requirement. Medicines supply is only the minimum requirement of a Standard Supply Vessel without safety standby vessel requirements.

801. SAFETY RESCUE EQUIPMENT FOR EXTERNAL OPERATION (cont'd)

5) Hospital / Sickbay / Survivor Treatment Area (cont'd)

One (1) shower and one (1) WC cubicle is to be provided. These are to be made by steel partition and suitable tiled and forced ventilated.

- Shower cubicle is to be fitted with portable hot / cold water shower head with extending hose, grab rail, wash hand basin with lever-type elbow taps, soap dish, extractor fan, coat hooks and towel rails.
- WC cubicle is to be fitted with WC pedestal with lid, toilet roll, grab rail, extractor fan, coat hooks and towel rails.
- Wash basin with hot and cold water supplies to be provided.

6) General Alarm and System

Refer to Section 9.

7) Portable H_2S Gas Sniffer and Oxygen Meter

One (1) portable H_2S Gas sniffer and one (1) portable oxygen meter is to be provided and kept well maintained, weekly tested and logged and calibrated every three (3) months.

OPTIONAL :

H_2S and Hydrocarbon vapor sensors covering the entire vessel's exterior structure with automatic alarms and control panel on the wheelhouse, calibrated as per manufacturer guidelines or at six (6) monthly intervals, whichever is lesser.

8) Morgue (optional extra)

Refrigerated morgue is to be retro–fit utilizing the whole or part of the deck store on main deck.

802. FIREFIGHTING EQUIPMENT

Firefighting equipment is to be provided to meet classification and government regulations and generally in accordance with the following: (Fire – fighting is not required for DP operation).

1) Firemain

A firemain and suitable numbers of 38 – 42 mm bronze hydrants are to be installed, these are to be provided on various deck levels and minimum 4 nos. in Engine Room / Azimuth Thruster Compartment. 15–20 metres fire hose c/w brass coupling and jet / spray type nozzle is to be supplied and stowed alongside each hydrant in a protective box.

- All hose fitting, nozzles and hydrants to be gunmetal
- All hoses to be approved marine standard
- All hoses nozzle to be approved marine standard
- Two (2) international shore connections

All above are subject to Owner's approval.

2) Fixed CO_2 System (alternative a total Hi – Fog Water Mist System to be offered)

A fixed CO_2 flooding system to be installed in paint store (or water spraying system), emergency generator room, engine room and cement tank compartment with CO_2 bottles stored in compartment on the main deck and system to meet with classification / SOLAS requirement.

3) Water Mist Fire Fighting System

Water mist fire extinguishing system to be provided to meet relevant rules. Vessel to have automatic and manual release. Distribution tubings to be stainless steel.

4) Emergency Fire Plan

These plans are to be placed in a weather-proof, highly visible, fire resistant easy to open container stored in a locked fire storage locker outside the accommodation.

5) Fireman's Outfits

Six (6) complete fireman's outfit is to be provided to comply with SOLAS requirement (4 sets for class FiFi One) :

a) One (1) fire protective clothing
b) One (1) complete set breathing apparatus with two (2) spare bottles & safety line
c) Two (2) fireman's axes
d) One (1) safety lamp of portable battery type
e) One (1) set of gloves & boots & helmet

802. FIREFIGHTING EQUIPMENT (cont'd)

5) Fireman's Outfits (cont'd)

Remarks: One (1) set air compressor capable of recharging the air bottle used in breathing apparatus to be provided to meet with classification requirement. Spare air cylinders in accordance with the Rules to be provided.

All items above are subject to Owner's approval.

6) Portable Fire Extinguishers

Fire extinguishers as required by the classification with SOLAS latest requirement and government authority are to be supplied and installed. For guidance, they are as follows (subject to final approval) :

Position	No.	Type
Wheelhouse	2	5 kg dry chemical
Upper deckhouse deck accommodation	2	5 kg dry chemical
	2	9 litres liquid chemical
Upper forecastle deck accommodation	2	5 kg dry chemical
	2	9 litres liquid chemical
Lower forecastle deck accommodation	2	5 kg dry chemical
	2	9 litres liquid chemical
	2	9 litres foam
Main deck service areas i.e. galley etc	2	5 kg dry chemical
	2	9 litres liquid chemical
	4	9 litres foam
Engine room entrance	1	9 litres foam
BT / Azimuth thruster	2	5 kg dry chemical
	2	9 litres foam
Bulk Tank cum Cargo Pump Room	2	5 kg dry chemical
	2	9 litres foam
Engine Room / Machinery Space	1	45 litres foam – mechanical
	5	5 kg dry chemical
	4	9 litres foam
Engine Control Room	1	5 kg dry chemical
Main deck clear area	2	50 kg dry chemical - mechanical

802. FIREFIGHTING EQUIPMENT (cont'd)

6) Portable Fire Extinguishers (cont'd)

Fire extinguishers must be of good quality and made in Japan to Unitor / Wilhelmsen Specification.

Replacement charges are to be supplied by the Builder(s).

7) External Firefighting

External fire fighting system is to be as generally stated below and is required to meet Class FiFi 1 requirement (refer to Section 10).

a) Fire Pumps

Two (2) seawater pumps each about 1820 m^3/hr at 125m. Fire monitors requirement each 1200 m^3/hr at 10 bar inlet pressure. Water curtain requirement about 1000 m^3/hr at 7 bar. The pumps requiring about 814 kW (equal 1092 hp), to be driven from the front clutched PTO of the main engines via one in, two out gearbox (increaser) with built – in clutch on the pump side and local manual / remote control (clutch in / clutch out) panel in the wheelhouse. FiFi–1 pumps and clutches must be of the close coupled hydraulically actuated type.

Independent sea suction and piping system for each pump. The pump casing is to be NiAl bronze, shaft and impeller duplex to be stainless steel. Mechanical seal to be provided.

b) Fire Monitors (Water / Foam)

Two (2) units of dual flow monitors of stainless and bronze construction suitable for foam and water. Electric remote control monitor c/w spray deflector for straight jet stream / spray remote joystick control in the wheelhouse.

Two (2) hand wheels for emergency manual control also built on the monitors.

802. FIREFIGHTING EQUIPMENT (cont'd)

7) External Firefighting (cont'd)

b) Fire Monitors (Water / Foam) – cont'd

Capacity – water	:	1200 m^3/hr
– foam	:	300 m^3/hr
Inlet pressure	:	10 bar
Throw length	:	120 m (throw length reduce for foam operation)
Reaction force – water	:	14,250 N
– foam	:	3,563 N
Swivels and swivel	:	Bronze
Body, gear & Barrel	:	AI-Bronze housing
Throw height	:	50m measured vertically from sea level assuming a mean impact are located at a horizontal distance not less than 120m from monitor outlet.

Horizontal and vertical movement with limit stops restricting monitor discharge on any part of the vessel.

c) Control Panels

The main control panel fitted at forward wheelhouse control console with plug-in arrangement at forward station with a portable neck-slung control panel. The following functions with 20m wandering lead are to be provided : both fixed and portable panels.

Main fixed panel

i) Two (2) clutch in / out with green / red light indication
ii) Two (2) alarms for low lube oil pressure
iii) Two (2) alarms for oil high temperature
iv) Two (2) valves (suction) open / close with position indication
v) Two (2) valves (discharge) open / close with position indication
vi) Two (2) joysticks for monitor elevation and azimuth move
vii) Two (2) switches for deflector up / down (jet / fog)
viii) One (1) monitor reduce capacity adjustment for foam operation
ix) One (1) dimmer
x) One (1) buzzer
xi) One (1) alarm reset / lamp test
xii) Two (2) emergency clutch out
xiii) One (1) portable joystick with 15m cable and two (2) sockets

802. FIREFIGHTING EQUIPMENT (cont'd)

7) External Firefighting (cont'd)

c) Control Panels (cont'd)

Portable Panel

i) Two (2) joysticks for monitor elevation and azimuth move

ii) Two (2) switches for deflector up / down (jet / fog)

iii) One (1) monitor reduce capacity adjustment for foam operation

d) Deluge System, Deck Delivery Head, Hoses and Sea Chests

Two (2) 4 – way 65mm delivery heads c/w brass flanged 90 degrees valve for coupling with cap with instantaneous hose connections are to be fitted on main deck. Inlet pipe 80A (3") N.B. and eight (8) hoses each 65mm dia. x 30ml complete with variable nozzles (jet / fog) for capacity each 350 litres/min @ 4 kg/cm^2 c/w shut–off & 65mm diameter.

The vessel is to be protected by permanently installed water – spraying (deluge) system with fixed nozzles and pipes. However for main deck protection, water monitors are to be used. The fixed water – spraying system is to provide protection not only all the decks and deck machinery but including all outside vertical areas of hull, deckhouses, superstructures and masts.

The arrangement for the water–spraying system is to be such that necessary visibility from wheelhouse and the control station for remote control of the fire fighting water monitors can be maintained during the water – spraying. The pipelines and nozzles are to be so arranged and protected that they will not be exposed to damage during the operations. The fixed water – spraying system is to have a capacity not less than 10 litres/min/m^2 of the area to be protected.

Two (2) independent sea chest for external fire fighting is to be fitted.

e) Foam System

The foam system consisting of the following is to be installed :

- Supply of foam via any one of the external fire pumps with cross connection
- Two (2) in-line inductors with mixing ratio of 3% to 6%
- Two (2) metering valves
- Two (2) pressure gauges
- One (1) foam tank c/w valves
- One (1) compound gauge with cock and copper pipe

803. NAVIGATION EQUIPMENT

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

1) DGPS Navigator Equipment (Independent of DP)

One (1) unit IMO type approved DGPS navigator equipment for indication of vessel's position, planning of routes via waypoints plotting, mob position, anchor watch alarm, waypoint arrival alarm, cross-track error alarm, at 4 NMEA outputs for interface to radar, gyro compass, autopilot, GMDSS equipment comprising of display unit, DGPS antenna, standard accessories and connection cable and one (1) repeater for the aft console. One (1) repeater fitted on chart table.

2) DGPS Equipment (item supplied by DP System supplier and included in DP)

Two (2) units of Kongsberg (1 x DPS–232 + 1 x DPS–110) DGPS equipment are to be installed. System including sub-meter accuracy, 12 channel GPS receiver, L-Band satellite differential correction receiver, dual channel digital MF beacon receiver (IALA), WAAS & EGNOS capable and c/w combined L1 GPS, satellite differential beacon antenna and system for interfacing to DP system.

3) Radars for Navigation (outside Kongsberg DP equipment)

Two (2) radars, both 24 NM range. One (1) X-band (high definition), one (1) S-band (for heavy rain and sand storm) with daylight viewable in colours PPI and table mounted capable of displaying data on a chart plotter. They are of gyro stabilized type (IMO approved type, GRT $\geq$ 1000) and 220V AC and suitable for 24DC operation and system to interface to Gyro-compass, GPS, time and speed, etc. Both radars are of ATA / ARPA radar with transceiver performance monitor, antenna, radar display, electronic cabinet, keyboard, RPU with control panel. Both radars fitted at forward wheelhouse control position.

The 10 kW X-band pedestal with up-mounted modulator-receiver-transmitter, 6 feet X-band antenna array, one (1) set of spare parts, user and technical manual. A 'slave' radar monitor to be mounted at aft wheelhouse control station.

4) Emergency Position Indicating Radio Beacon (EPIRB)

One (1) EPIRB with 406 MHz primary and 121.5 MHz as secondary. Ship's particulars programmed internally with automatic float-free hydrostatic release and operation manual.

803. NAVIGATION EQUIPMENT (cont'd)

5) Echo Sounder

One (1) unit IMO type approved navigation echo sounder with remote read out in both metres and feet. Depth range from 0 to 800m, bottom alarm, depth alarm, interface with GPS and NMEA and other navigation data equipment comprising of 1 (one) unit depth graphic LCD displace with integral keyboard, transducer of 200 KHz, junction box and one repeater for the aft control station. Main display unit to be at the forward console.

6) Magnetic Compass

One (1) reflector type compass fitted on wheelhouse top c/w Azimuth circle, spare compass cord and bowl. It is capable of obtaining compass errors and positioned to obtain errors. Deviation card is to be made during the sea trials.

7) Automatic Identification System (AIS)

One (1) unit Automatic Identification System (AIS), type 'A' with GPS antenna and mounting cassette. Gyro compass and GPS signals are to be interfaced to the AIS system to conform to SOLAS as amended and IMO's Performance Standard for AIS.

8) Doppler Speed Log

One (1) unit of IMO type approved Doppler speed log fitted in wheelhouse forward console with dimmer repeater in wheelhouse aft console, capable of measuring fore, aft and athwart ship speed, 0.1kt in any direction, current speed and directions. System is to have interface to DP system radar, GPS, gyro-compass or autopilot. It comprises of one (1) electronics cabinet with compensation adjustment unit. One (1) transducer, 24V DC is to be fitted. Doppler Log to be of the 2–axis type.

9) Anemometer and Anemoscope Equipment

A. For Navigation :

One (1) of analogue uninterrupted true readings of both Wind Speed & Direction in knots indication. Equipment comprising of one (1) cup unit for wind speed, one (1) vane unit for direction, one (1) wind speed indicator in knots and Beaufort scale, one (1) wind direction indicator in cardinal scale, 24 VDC operation. They are to be fitted free of any obstruction.

B. For DP Operation :

Three (3) designated wind sensors to be supplied by Kongsberg. Wind sensors to be of the Gill Ultrasonic type

803. NAVIGATION EQUIPMENT (cont'd)

10) Laser & Radar Reference System (item supplied by DP System supplier)

One (1) unit of Cyscan, high precision laser positioning and tacking system and system interface to DP system.

One (1) unit radar reference system using Dual RADius 1000 with 700x Transponder to be installed. Unit to be intrinsically safe mode.

11) Gyro Compass c/w Auto-pilot (preferred Kongsberg to supply : Navigat X Mk 1, Mod 10)

Three (3) IMO approved type Gyro-compasses to be provided for DPS–2 operation. One of which is linked with independent auto-pilot navigation by the controls of Azimuth stern thrusters.

Gyro-compasses are to be fitted in the following positions :

a) Wheelhouse forward station : one (1) analogue gyro – repeater & one (1) digital gyro - repeater for steering
b) Wheelhouse aft station : one (1) master gyro & two (2) digital gyro – repeaters
c) Wheelhouse wing stations : two (2) analogue gyro-repeaters, 1P & 1S for sighting c/w Azimuth circle for obtaining gyro errors
d) Wheelhouse top external station : one (1) analogue gyro - repeater
e) Stern propulsion thruster compt. : one (1) analogue gyro – repeater

In addition, in order to meet IMO requirements, the following Gyro interfaces are to be provided in aft wheelhouse console :

Two (2) - Radars
One (1) - DGPS Navigator for navigation
One (1) - DP control unit
One (1) - DP joystick system
One (1) - autopilot preferably be supplied by DP system supplier

12) Independent Joystick Control System (part of DP System)

Two (2) fixed integrated joystick control panels with interface between :

a) Two (2) stern propulsion Azimuth propellers : propeller pitch & steering
b) Two (2) bow thrusters units : propeller pitch

The two (2) fixed operation terminals to be fitted in both forward and aft wheelhouse control stations with portable connection to docking stations outside the wheelhouse, 1P & 1S.

803. NAVIGATION EQUIPMENT (cont'd)

12) Independent Joystick Control System (cont'd)

The duplex dynamic positioning system to be interface with the vessel stern Azimuth propulsion systems, bow thrusters, bus tie breaker and main switchboard system allowing to maintain position or to maintain a desired heading.

Joystick system to be as per Kongsberg cJoy Independent Joystick System.
The joystick control system is a manual backup to be provided and arranged to operate independently, so that failure of the main DP does not render the total DP system inoperative.
The numbers of sensors and environmental references are to be according to the requirements of DPS–2.

The system in between manual / joystick / DPS control change-over switch For Joystick Mode or Auto Heading Mode. It is to be installed on wheelhouse aft console.

Basic system hardware :

a) 2 x cJoy Operation Terminal
   - Operator panel consisting of :
     - Joystick (3-axis) control
     - Heading wheel
     - Buttons and status lamps
     - Built-in computer with colour display (6.5" TFT flat screen)
   - Junction box
   - Single net interface (LAN)
   - cWing wing terminal interface (CAN)

b) 1 x cJoy Controller unit
   - Wall mount cabinet
   - Single Real Time Processor, RCU510
   - Single net interface (LAN)
   - 7 each Serial interfaces RS232/422 (galvanic isolated)
   - 32 each multifunctional input/output embedded
   - Input power 115/230VAC from external UPS
   - Galvanic isolation Analogue Outputs

803. NAVIGATION EQUIPMENT (cont'd)

12) Independent Joystick Control System (cont'd)

c) cJoy OT Junction Box

- Power connection
- CAN interface

13) Different Receiver / Demodulator (optional – item supplied by Kongsberg DP System supplier)

One (1) unit Fugro Seastar 3610 spot beam receivers to be supplied.

14) Horns

One (1) mechanical plunger fog horn.

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

15) Ship's Bell

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

16) Clinometers

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

17) Flags

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

18) Chart Table

Chart table to be fitted with chart drawers & table light with dimmer. Dividers, triangles, parallel rulers, pencils and pencils sharpeners to be provided.

19) Electronic Chart Display and Information System (ECDIS)

An ECDIS to plot the vessel's position in real time and compatible with Hydrographic Survey Unit (HSU) Charts Data such as Garmin GPSmap 4012, GPSmap 5012 or GPSmap 3010C. Software of map is to be provided by the owner to cover the delivery voyage and operational areas. Three (3) display units, wall mounted with two (2) in wheelhouse and one (1) in engine control room.

803. NAVIGATION EQUIPMENT (cont'd)

20) Electrical Navigation Lights & Shapes

A complete set of dual lens, 24V DC / 220 AC supply navigation lights are to be supplied and fitted as specified in electrical section.

In addition to this, the following is to be supplied:

- Two (2) black circular shapes of 600 mm diameter
- One (1) black diamond shape of 600 mm
- Others as required by Rules and Regulations

21) Chart & Reference Materials (Owner supplied)

One (1) set of relevant charts for International Water Area and publications and tide table including the following :

- Deck Log Book
- Oil Record Book
- Compass Error Book
- British Admiralty Charts for Middle East Waters Corrected up-to-date (exact area to be define)
- Operation Field Charts
- Operation Tide Tables
- Admiralty Pilot Book For Middle East
- Operation Port Authority Regulation in operating areas
- Nautical Almanac
- Browns or similar with Rules of the Road

22) Searchlights (4 off)

Four (4) 2000w halogen searchlights with electric remote joystick and focus controls. Two (2) in forward and two (2) in aft wheelhouse stations.

23) Clocks

Thirty – four (34) marine battery clocks and one (1) radio clock.

24) Signal Lamp

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

803. NAVIGATION EQUIPMENT (CONT'D)

25) Wipers / CVS

Minimum seven (7) horizontal screen wipers are to be installed : three (3) off forward and four (4) off aft of wheelhouse. Final number of window wipers to be determined to suit window sizes.

One (1) 350mm CVS : forward of wheelhouse.

26) Barometer

One (1) barometer

27) Thermometer

Three (3) thermometers (wet & dry type)

28) Binoculars

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

29) Chronometer

One (1) chronometer

30) Manuals

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

31) Engine Telegraphs

Two (2) sets electric push button telegraphs operating on 24 volt DC for twin screw propulsion in the wheelhouse and engine control room.

32) Morse Signal Lamp

One (1) Morse signal lamp system and two (2) Morse key switch to be provided.

33) VSAT – System (Owner supplied)

One (1) set of satellite communication system to be provided for internet, external telephone, data transfer etc. Builder is to provide mounting, cable routing and sockets.

34) Sunscreen

SOLAS approved removable sunscreen to be fitted for all windows in the wheelhouse. Sunscreens are to be capable to be manually retractable at night.

803. NAVIGATION EQUIPMENT (CONT'D)

35) Voltage Data Recorder (VDR)

VDR is to be fitted as required by Rules fro vessel over 3000 GRT.

804. COMMUNICATION EQUIPMENT

1) GMDSS A3 Radio Communication Equipment

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

One (1) unit of compact radio console for operation in area A3 is completely assembled and pre-wired. Equipped with all necessary equipment and components e.g. emergency light, voltage alarm system, AC / DC distribution and also includes GPS position data with data distribution.

It comprising of :

- One (1) unit MF / HF radio with DSC / watch receiver, transmitter 250 W (PEP) 1.6 – 27.5 MHz, main receiver 0.03 – 30 MHz, distress / safety DSC receiver operation terminal with display unit and keyboard and handset printer for 24 V, power supply 220 V and 24 V, (auto switch-over). It is to be fitted with digital selective calling (DSC) and receiving capability on 2187.5 MHz and capable of generating distress alert on 2182 KHz with minimum special frequencies 3825 and 4753 KHz.

  Furuno model : FS 2570

- Two (2) independent fixed VHF Radio–telephones with built-in DSC. Both to be multichannel 25 watt RF output power and 1 watt reduced RF output switch fitted with digital selective calling (DSC) and capable of receiving and transmitting on 156.525 MHZ (Channel 70) – refer to Section 2, same items.

  Remote handsets to be located at the forward and aft control stations and fitted with Charterer Rig Move frequencies 153.080, 153.320 and 153.56 MHZ. Failure to provide radios with rig move frequencies will render the vessel not suitable for rig move duties. For restricted areas, these frequencies are prohibited : 156.150, 157.200 and 157.425 MHz.

  Emergency frequencies for aero mobile VHF to be lighted for communication with helicopter aero mobile radio beacon.

  Furuno model : FM 8900 S

804. COMMUNICATION EQUIPMENT (cont'd)

1) GMDSS A3 Radio Communication Equipment (cont'd)

- Two (2) Inmarsat-C Satellite Communication with operation terminal / transceiver unit with EGC / GPS and display unit, keyboard printer for 24 V, power supply 220 V and 24 V, (auto switch-over). Receiving capability on 2187.5 MHZ and sending distress signals on 2182 MHZ with minimum special frequencies of 3825 and 4753 MHZ.

  Furuno model : FELCOM 15

2) Navtex Receiver Equipment

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

3) SART

Two (2) units IMO type approved SART (9GHZ) with 96 standby time and at least 8 hours of continuous operation, constantly interrogated by radar signals.

4) Portable Transistorised Loud Hailer

One unit battery type

5) GMDSS type-approved VHF radios

Four (4) units GMDSS type approved handheld VHF radios with all the International Marine VHF channels. A minimum of one (1) spare battery pack for each radio and two (2) in number of battery re – charging units. The handheld radios to be intrinsically safe type. The output power preferably be changeable between both 1 watt and 5 watts.

6) Ship Security Alert System (SSAS)

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

7) Weather fax

One (1) unit weather fax to be provided.

804. COMMUNICATION EQUIPMENT (cont'd)

8) PA / intercom / telephone System

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

- Forward and Aft Wheelhouse Station
- All cabins
- Recreation room
- Gymnasium
- Messes
- Offices
- Meeting Room
- Treatment Area / Sickbay
- Engine Control Room
- Engine Acoustic booth (half booth)
- Bow thruster compartment
- Azimuth thruster compartment
- Forward windlass station
- Portable lead with 20m cable on aft deck
- Portable station at aft capstans
- Loudspeakers on wheelhouse top

Emergency telephone communication between two (2) wheelhouse control stations, captain's cabin, engine room, engine control room, ~~duty mess / reception~~, treatment room / sickbay and emergency steering position in Azimuth thruster compartment are to be clearly audible when main engines, bow & stern thrusters and external fire pumps are running.

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

External telephone via satellite system is to be provided for wheelhouse, Captain and C/Engineer's cabins, meeting room, all single-man cabins, Owner's office, treatment room / sickbay, recreation room and mess.

Exact locations, numbers of telephone, intercom and loudspeakers are to be advised by Owner.

804. COMMUNICATION EQUIPMENT (cont'd)

9) System Entertainment

One (1) Omni-directional and one (1) worldwide receiving wideband satellite television and internet system for output to multi stations T.V units in the wheelhouse, accommodation areas. Maximum sixteen (16) points.

All items above are subject to Owner's approval.

10) Sound Powered Phones

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

* Wheelhouse (fwd and aft)
* Captain and Chief Engineer Cabins
* Engine Room c/w headset, siren and rotating light
* Engine Control Room
* Dry Bulk Compartment
* Azimuth Thruster Compartment c/w headset, siren and rotating light
* Bow Thruster Compartment c/w headset, siren and rotating light
* others

Final arrangement to be given by Owner.

11) Reference Materials (Owner supplied)

Refer to Section 803

805. BNWAS (BRIDGE NAVIGATIONAL WATCH ALARM SYSTEM)

Bridge Alarm system to be provided according to rules and regulations. The system includes functions for monitoring the watch officer's presence for maritime casualty avoidance, transfers an alarm to the backup officer, in the event that the watch officer fails to respond to the active alarm or emergency call.

- Main alarm panel
- Processor unit
- Officer / Public cabin panels
- Timer Reset Panels
- Installation materials and spare parts
- Watertight timer reset panels (optional)
- Motion sensor (optional)

SECTION 9 – ELECTRICAL

900. GENERAL INSTALLATION

Electrical apparatus and wiring system are to comply with the respective classification society and relevant Authority requirements.

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

Prior to the commence of work, Builder is to provide Owner with Electrical One Line Diagram and Electrical Load analysis.

901. SYSTEM OF SUPPLY

a) 440 volts, 3 phase, 60 Hz – for power (motor).

b) 220 volts, 1 phase, 60 Hz – for general / emergency lightings, socket, etc. and power less than 3 kW communication and navigation equipment.

c) 24V DC – for emergency lights, navigational lights, communication/ navigation equipment, alarm, radio and other emergency loads.

d) 440/220 volts, 3 phase, 60 Hz dry type transformer for general and emergency operation system.

e) 220 volts, 3 phrase, 60 Hz – for Charterer's freezer / chiller containers to be installed on deck

902. POWER SUPPLY

1) AC Supply

a) The AC main power supply system is to be obtained from three (3) 550 kW, IP 44 water-cooled, 440/3/60, 0.8 PF 3-wire generators sets. The main generators sets are to run synchronized in parallel and load sharing operation and continuously whenever required, but any one of the generator set is to be capable of supplying the vessel's electrical requirements under normal sea-load condition with the other generator sets on standby as selected and coming into operation in case of blackout automatically as required by ACCU notation.

b) Two (2) 2100 kW, 440/3/60, 440/3/60, 08 PF, 3 wire, IP 44 water – cooled shaft alternator (PTO from M/E). The primary function is for each shaft alternator to provide power to the electric motor driven bow thruster units. However, they can be used to provide power to the vessel's main switchboard for ship's service at any time when in use – load permitting.

902. POWER SUPPLY (CONT'D)

1) AC Supply (cont'd)

b) These shaft alternators are each sized to be able to provide power to either or both bow thruster motors at the same time (but not to be run in parallel except for the purpose of changing loads from one to the other).

The shaft alternators are not to be designed or intended for continuous parallel operation between each other or the diesel generators sets however they must be capable of being paralleled to each other or to the diesel generators for the purpose of changing power sources without blacking out the vessel. Synchronization for the foregoing can be automatically provided via the vessel's PMS or manually if necessary.

When in DP–2 mode, it is intended that each shaft alternator will provide power to each side of the switchboard when operating with an open bus tie – breaker. In this mode power can be supplied for each bow thruster and split ship's essential services at the same time as required when operating in DP–2 mode. Alternatively power can also be supplied to either bow thruster motor without supplying ship's services at the same time if so preferred. The same power can be provided by any combination of diesel generators up to their maximum capacity in single or parallel operation with each other (but not in parallel with the shaft alternators).

c) The harbour / emergency generator has to be capable of limited parallel operation with the diesel main generators in order to prevent black out when changing over supply for port or anchor use.

d) A 500A, 440/3/60, 3-wire watertight shore supply connection box to be provided c/w circuit breaker, phase sequence protection relay/indications, pilot lamp, overload protection and socket with plug, etc. and fitted on main deck, emergency generator room.
The shore power system is to be inter-locked to prevent parallel operation with the main / shaft generator sets. The shore power connecting box is to be permanently wired to the main switchboard.
Shore supply connection box capacity is to be confirmed after Electrical Load Analysis duly approved by the Owner.

902. POWER SUPPLY (cont'd)

2) DC Supply (24 V DC)

a) The 24 V DC supply for emergency lights and navigation aids is to be obtained from two (2) banks of 24 V, 200 AH batteries.

b) A 24 V DC supply for radio is to be obtained from 2 banks of 24V, 200 AH batteries.

c) Two (2) static battery chargers, 60 amperes, 24V DC output is to be provided for charging the above batteries and located in the wheelhouse.

d) Gel cell type batteries to be stored in two (2) fiberglass storage box c/w glands and ventilation for D.C. wiring outlets and located on wheelhouse top.

e) One (1) emergency static battery charger of 60A, 24V DC output is to be provided for charging the above batteries and located in the Emergency Generator Room.

f) Dead battery alarms to be fitted.

903. CABLES

All cables (power, lighting and control 600 / 1000 volts) installed in the vessel are to meet IEC standard for marine cables construction / manufacturing as well as installation on ship. They are of :

- Flame retardant (IEC 60332 – 3A)
- fire resistant (IEC 60331)
- halogen free (IEC 60754)
- low smoke emission density (IEC 61034)

They are made of annealed stranded copper, class 2, insulated by cross-linked polyethylene (XLPE) with bedding / inner sheath of thermoplastic compound (halogen free) and protected by armouring / screen of bare or plain copper wire braid. Cables' outer sheath is to be thermoplastic compound (halogen free). All sheathing materials are to be in accordance with IEC 60092-359 type SHF1.

For instrument cables (250 volts), they are to be twisted pair with individually and / or overall screened with aluminum foil in order to minimize electro-magnetic inference (EMI) effect as per equipment maker recommendation.

904. INSTALLATION OF CABLES

Cables are generally supported by a perforated galvanized steel cable tray / ladder and secured by stainless steel cable clips or similar. Where cables pass through WT / OT bulkheads, decks or tanks, an approved WT cable sealing glands is to be fitted.

Cables run on exposed deck are to be run through conduits.

905. SWITCHBOARD – GENERAL (DPS-2 & ACCU)

The switchboard is to be dust and drip-proof and dead-front type with sheet steel construction and self-supporting framework c/w handrail and ventilation louvers suitable for marine duty operation to be installed in the engine control room (ECR). It is constructed for 440/220V, 60 cycles with all indicators, knobs and handles clearly marked by name plates and the switchboard of the Bus-Bar system to be divided into two (2) division (split bus – bars) which to be connected by a Circuit Breaker or other approved means and the connection of generator sets, shaft alternators and other duplicating equipment(s) to be equally divided between the two (2) divisions as far as practical. Interlocking safety devices system in between shore power and shaft/ main generator is to be fitted.

The facilities for control and paralleling of the three (3) main diesel generators, one (1) emergency / harbour generator and separately two (2) shaft generators are to be provided and system must comply with classification of ACCU, DPS–2 / SOLAS latest requirement. All switchgear and circuit breaker used throughout the installation to be of the classification approved type and to be suitably sized to circuit requirements.

1) AC Switchboard

The AC switchboard is to consist of the following controls and instrumentations for each generator :

- Air circuit breaker (ACB) with motor mechanism c/w over-current and reverse-power relays and ACB to be draw-out type with generator protection trip unit
- voltmeter c/w selector switch
- ammeter c/w selector switch and frequency meter
- kilowatt meter (unbalance loaded type)
- power factor meter (unbalance loaded type)
- voltage trimmer and AV12 (supplied by generator maker)
- emergency push button
- indicator lights
- semi-auto synchronizing and load shedding system
- governor switch
- earth detection system c/w indicating light & alarm system of continuous monitoring type
- manual synchronizing
- space heater (alternator) etc

Remarks : If equipment motor above 400 kW @ Air circuit breaker (ACB) type is to be used.

905. SWITCHBOARD – GENERAL (cont'd)

1) AC Switchboard (cont'd)

Switchboard is to be designed to suit DPS and ACCU requirements in terms of redundancy of power supply. The following outgoing circuits are to be fed from the 440/220V bus-bar via plug-in moulded cased circuit breaker :

* fuel oil transfer pump
* fuel oil purifier pump
* air compressors (one of these must come from emergency switchboard)
* general service and fire fighting / dispersant pump
* air-conditioning plant / cooling pump
* cold / cool room refrigeration plant / cooling pump
* engine room, bow and Azimuth thruster rooms ventilation fans
* galley range
* hydraulic power pack – forward anchor windlass / mooring winch, tugger winch, and capstans
* bilge and ballast pump
* freshwater pressure set
* saltwater pressure set
* battery charger (220 V)
* general / emergency lightings and power
* navigational aids (220 V)
* dirty oil pump
* oily water separator pump
* calorifier
* bow thruster servo Hydraulic oil pump
* bulk tank compressor
* bulk tank/ deck machinery S.W cooling pump
* liquid mud cargo pump
* drill water cargo pump
* fuel oil cargo pump
* lube oil purifier c/w heater
* fuel oil purifier
* Azimuth thruster / CPP servo standby pump (ASD maker standard)
* main engine lubricating oil priming / standby pumps
* fresh water cargo pump
* sewage submersible pump

905. SWITCHBOARD – GENERAL (cont'd)

1) AC Switchboard (cont'd)

* sewage treatment plant
* reefer sockets – refer to Section 920
* welding set etc
* others

2) Harbour / Emergency Switchboard

The harbour / emergency generator is to be rated 238 kW, 440 volt, 3–phase, 60 Hz, 3–wire, battery started, IP44 air cooled with radiator cooled Caterpillar engine, or to be as required by Class for service operation. The emergency generation capacity is to be sufficient to supply the essential load for safety in emergency with due regard given to services that may have to be operated simultaneously.

The harbour electrical supply for the hotel service is to be taken from the harbour / emergency generator or from the main switchboard (diesel generator) if selected.

The general construction and design of the switchboard to be similar to the main switchboard except that the switchboard under normal operating condition will receive power from the main switchboard and supply to the entire essential & emergency load connected to it.

On the loss of the normal power from the main switchboard, the emergency switching to open the main incoming circuit-breaker, automatically start the generator and connect it to the harbour / emergency switchboard. The incoming main feeder breaker and emergency generator circuit breaker is to be interlocked to prevent parallel operation.

3) 24V DC Switchboard (Emergency)

The instrumentations and controls are to consist of the following:

* battery charging switch
* moulded – case circuit breaker
* ammeter c/w shunt
* voltmeter
* indication lights
* battery change-over switch
* earth leakage monitoring with test system, etc.

905. SWITCHBOARD – GENERAL (cont'd)

3) 24V DC Switchboard (Emergency) – cont'd

The following outgoing circuits to be fed from the bus-bar via moulded – cased circuit breakers:

* navigational aids
* alarms (general, fire, engines and low levels)
* navigation lights
* main engine instrumentations
* radio
* emergency lights, etc.

4) 24V DC Radio Charging Panel

The instrumentations and controls are to consist of the following:

* battery charging switch
* battery change-over switch
* ammeter c/w shunt
* voltmeter
* indication lights
* outgoing miniature circuit breakers (MCB)
* earth leakage monitoring with test system

906. DISTRIBUTION

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

1) DC Distribution Boards

* 24V DC distribution board
* Emergency lights distribution board

2) AC Distribution Boards

* Below main deck distribution board
* Main deck distribution board
* Forecastle deck distribution board
* Wheelhouse deck distribution boards
* Wheelhouse distribution boards

907. MOTORS & STARTERS

Motors are generally to be of squirrel cage type with totally enclosed fan cooled construction.
All starters panel for electric motors to be suitable for marine use and provided with single phasing, overload protection and running indication. All fuel pumps including mud / fuel oil cargo, circulating pumps and all supply or exhaust ventilation fans are to have remote push-stop controls mounted in the wheel house and main deck level clearly marked. Direction line starters for motors below 15 HP, and star-delta starters for motors 15 HP to 50 HP, and for motor above 50 HP auto–transformer type starters are to be used except whereas specially described.

Soft starter motors to be used where it is necessary especially for bow thruster which must be protected by water-cooled IP44 standard.
Alternators for shaft generators and diesel generators are to be IP44 water-cooled construction.

Anti – condensation automatic heaters to be provided for all motors over 15 kW.

908. SWITCHES, SOCKETS & SWITCHED-SOCKETS

All switches, sockets and switched-sockets in the accommodation are to be flush mounted moulded cased type and in the engine room and other machinery and WT compartments are to be watertight marine metal moulded type surface mounted. An adequate number of switched-sockets are to be provided in accommodation, wheelhouse, galley, mess room, store and other machinery spaces for portable equipment.

909. LIGHTINGS

Accommodation	:	All lightings are to be fluorescent type and built-in type for accommodation area and c/w emergency lights. All cabins to be provided with desk and reading lights.
Engine Room and Machinery compt.	:	All lights fittings in engine room, stern and bow thruster / bulk tank compartments, emergency generator room, other machinery spaces and stores are to be watertight.
Liferaft areas	:	24V DC floodlight fittings to be mounted in way of liferafts areas. Compass light and chart table light to be provided with dimmer switch.
Aft working deck	:	4 x 400W HP Sodium floodlights or the equivalent of Lux 150 measured 1.5m above the deck with no shadow areas

909. LIGHTINGS (cont'd)

Upper Forecastle Deck : 2 x 400W HP Sodium floodlights or the equivalent of Lux 150 measured 1.5m above the deck with no shadow areas

Wheelhouse Top : four (4) search lights of 50 lux at 250m with 360° rotation controlled inside the wheelhouse.

All light fittings to be approved by Owner prior to installation.

910. EMERGENCY LIGHTS (24V DC AND 220V AC)

A 220V AC and 24V DC emergency light is to be fitted at strategic points in the wheelhouse, lobby, winch / bow and Azimuth thruster / bulk tank compartments, engine room, emergency generator room, machine space, galley, mess, radio area and entrance / common space, escape routes in the accommodation, etc. All escape routes in the accommodation and engine room are to be marked with luminescent tape.

In way of life rafts, FRC launching area and aft deck in way of rescue zones, 24V DC floodlights to be provided. It must also be able to shine over the ship sides.
Emergency lights are to be automatically energized on failure of AC supply and emergency generator will be activated to provide continuing power supply to the battery banks.

Central Test Switch which activates all emergency lighting for test purposes to be fitted.

911. NAVIGATION LIGHTS

Dual lens, unless stated otherwise, 24V DC and 220/1/60 supply navigation lights are to be fitted. The navigation lights are to consist of the following :

* 3 masthead lights (main mast)
* 1 portside light
* 1 stern light
* 2 anchor lights
* 1 starboard light
* 6 NUC lights (single lens)
* 1 complete set immigration / quarantine lights (single lens)

911. NAVIGATION LIGHTS (cont'd)

All navigation lights are to be controlled by indicator panel fitted in the wheelhouse. Each navigation light is to be controlled and protections by double pole switch and fused on each conductor c/w dimmer switch. Visual indicators are to be fitted.

912. NAVIGATIONAL AIDS

1) The following navigation aids equipment require 220/1/60 AC supply :
   * 4 2000 watts halogen searchlights, two (2) in forward wheelhouse station, two (2) aft control stations. All remote under deck controlled.
   * 7 horizontal wind screen wipers
   * 1 clear view screen wipers, 350 mm dia.
   * 2 radars
   * 3 gyro – compasses
   * 1 autopilot
   * 1 navigation light indicator board
   * 1 Morse lamp c/w key switch
   * 1 chart table light c/w dimmer switch
   * 1 GMDSS radio set
   * 1 PA / intercom system
   * 1 DP – 2 system
   * 1 fixed independent joystick system with two (2) control panels

2) The following equipment require 24V DC supply :
   * 1 Doppler speed log
   * 1 echo sounder
   * 1 wheelhouse instrument illuminations
   * 1 standard reflector compass c/w illumination
   * 2 engine telegraphs
   * 3 Gyro – compasses
   * 1 autopilot
   * 1 daylight signaling lamp
   * 1 fire and general alarm
   * 2 independent VHF radios
   * 1 intercom / public address system

912. NAVIGATIONAL AIDS (cont'd)

2) The following equipment require 24V DC supply : (cont'd)

* 1 electric air horn
* 7 sound power telephone
* 1 ship security alert system (SSAS) and automatic identification system (AIS)
* 1 Navigation Light
* 1 GPS navigator
* 1 Navtex receiver and others

913. DOMESTIC EQUIPMENT

The following domestic equipment is to be fitted:

- 2 galley range c/w 6 – hotplate and oven
- 1 10 – litres hot water urn
- 3 3 – litres hot water urn
- 1 water heater (calorifier)
- 3 42 inches flat screen colour television set
- 2 32 inches flat screen colour television set
- 5 DVD players
- 6 6 kg washing machines
- 6 6 kg clothes dryers (electrical)
- 1 electric rice cooker
- 1 washer food grinder
- 1 400 – litres, 2 – door freezer – refrigerator
- 2 200 – litres refrigerators
- 9 100 – litres refrigerators
- 2 free – standing freezers
- 1 built – in freezer
- 1 built – in chiller
- 1 Galley waste disposal unit

914. VENTILATION & AIR – CONDITIONING (all exhausts to the external of ship except otherwise stated)

- Two (2) nos. engine room supply fans (both reversible)
- One (1) no. propulsion Azimuth thruster compartment supply fan (reversible)
- One (1) no. bow thruster compartment supply fan (reversible)
- Two (2) nos. for bulk compartment exhaust fan (reversible with explosion proof motor)
- One (1) no. emergency / harbour generator room exhaust fan
- One (1) no. for galley exhaust fan
- One (1) no. CO_2 room exhaust fan
- One (1) no. each for washplace, changing and laundry room exhaust fans
- One (1) no. each for store exhaust fan
- Central air – conditioning plant for accommodation and wheelhouse
- Remote emergency stop switches mounted on the main deck and wheelhouse (for engine room, Azimuth propulsion compt. and bow thruster compt.)
- Independent wheelhouse ceiling mounted air cooled air – conditioner(s) with branch ducting for electrical store in wheelhouse
- Two (2) additional self – contained air cooled, air conditioning units to be mounted to the wheelhouse deckhead. All refrigerant to be common for all systems onboard and to be of environmentally friendly type.
- Independent water cooled air – conditioners for engine control room (ECR), wheelhouse and workshop
- Spot cooling for provision store, changing room and galley
- Paint locker (with explosion proof motor)

915. FIRE & GENERAL ALARM

Vessel is to be equipped with fire and general alarm capable of being activated from one point on each deck and in each major below decks space aboard the vessel.

These sensors to be located in the bow, stern, port, starboard and wheelhouse top, the sensors are to be suitable for working in a marine environment and be capable of being immersed in salt water for short periods.

The system is to be serviced and calibrated by an approved agent on a bi-annual basis.

915. FIRE & GENERAL ALARM (cont'd)

These alarm electrical supply systems are to be taken from 220V AC and 24V DC supplies. Alarm pushes and alarm bells are to be fitted in wheelhouse, all accommodation decks, engine room, stern and bow thruster / bulk tank compartments.

An alarm horn c/w alarm pushes are to be installed in the engine room, stern and bow thruster / bulk tank compartment with rotating red light. Heat / smoke fire detectors to be provided in accommodation / living / public space / machinery spaces and engine room c/w alarm indicators and sirens.

The installation is to meet with classification, SOLAS and relevant Authority requirement. System arrangement and location is to be submitted to the Owner for approval.

916. MAIN & AUXILIARY ENGINE INSTRUMENTATION & ALARM

All alarms to be operated on 24V DC supply and to be in compliance with applicable rules. The main engine and auxiliary engine instrumentation panels are to be supplied from DC main switchboard.

Main engines, all thrusters and level alarms, etc are to be provided with a panel in the engine control room and group visual and audio indicator in the wheelhouse. Detail system is to be as per maker's recommendation and to meet / comply with classification requirement.

917. REMOTE ACCU ALARM

Alarm system is to be taken from 24V DC distribution boards. Alarm panels to be fitted in the engine control room and alarm c/w indication light to be installed in the Wheelhouse, Chief Engineer cabin, 2nd & 3rd Engineer cabins and in Mess, Recreation Room and Meeting Room to meet Classification / SOLAS requirement. For further details, refer to "Automation System for Machinery Plant".

918. LOCAL AREA NETWORK (LAN)

Network cables are to be provided between wheelhouse, all cabins and common rooms with direct access to worldwide TV network and internet.

919. BATTERY BOX (FOR NAVIGATION, COMMUNICATION AND CONTROLS ETC)

The battery box is to be situated inside in a mechanically ventilated compartment on top of wheelhouse.

920. DECK POWER ELECTRICAL SUPPLY SOCKETS (ALL W.T.)

Watertight socket c/w plug to be provided and fitted on aft forecastle bulkhead as follow :

- 4 x 50 Amp, 440/3/60
- 4 x 50 Amp, 220/1/60
- 4 x 30 Amp, 220/3/60

These are for Charterer supplied freezer and chiller boxes to be placed (lashed down) on deck with 30m electrical extension cables supplied by Builder.
These sockets to be Appleton model AOR1044 (female receptacles) type : 4 wire / 4 poles.

921. CLOSED CIRCUIT TV MONITORING

Video surveillance camera is to be installed for the following areas to meet ISPS requirements.

- Forward anchor windlass area
- Aft deck
- Others
- VSAT unit to be provided by Owner including commissioning and testing. All installation and cabling to be Shipyard responsibility

SECTION 10 – MACHINERY

1000. GENERAL

All main and auxiliary engines are to be IMO approved type (NOX technical code mandatory guidelines TIER 2 relating to Regulation 13 of Annex VI to MARPOL ≥ 130 kW) and supplied with certificates as required by the classification. They are to be supplied and fitted by the Builder.

1001. MAIN ENGINES

Two (2) units of 2400 kW (3265 hp) each at 750 rpm marine diesel engines (wet sump type), direct coupled to two (2) CPP Azimuth propellers via flexible couplings and cardan shafting supported by bearings mounted on strong seating with solid steel chock welded to the ship structure. Bulkheads glands to have gas / water – tight seals with port side engine room access provided with the air lock. Engines to be air – started and plate type exchanger cooled with coolers designed with min. 20% margin above rated capacity. Engine exhaust to meet Marpol NOX Tier 2 standard.
Standby or spare pumps are to be provided for fresh water cooling and lubricating oil. Necessary sensors and connections for DPS – 2 and ACCU to be installed.

Maker : MAK 8M25J, 3265 bhp (2400 kW) @ 750 rpm, 8 cylinders in-line, 255mm bore, 400mm stroke, SFOC 185 g/kWh or 130.5 usg/hr, dry weight (engine only) 30t

Engines to be mounted with Chockfast mounts and to have maintenance rails installed overhead.

Power Take-off

Each engine is to be provided with KUMERA or equal compound gear from its PTO capable of delivering 100% main engine power to drive with step-up gearbox for an external fire fighting pump and a shaft alternator of 2100 kW, 440/3/60, 3 wire. Power / pitch shedding devices between the systems are fitted in order to prevent overloading of engines. Alarm and instrument panel are to be installed in the wheelhouse main control stations (forward & aft), engine control room (ECR) and local.

FiFi Pumps, shaft alternators and main propulsion are to be capable of operating at the same time with overload protection by means of pitch control of main stern thrusters.

1001. MAIN ENGINES (cont'd)

Engine control with main propulsion system

a) Wheelhouse forward, aft control stations & joystick controls at wheelhouse wings
b) Engine control room (ECR)
c) Engine and ASD local panels
d) Local controls directly on equipment
e) DPS–2
f) ACCU
g) In addition to DPS–2, two (2) independent joystick control units to be fitted in wheelhouse : one (1) forward and one (1) aft

1002. AZIMUTH STERN DRIVE THRUSTERS (ASD)

Two (2) controllable pitch Azimuth propellers (ASD with CPP). Each to consist of the following and classed to suit DP operations :

- 4-bladded NiAl-Bronze propeller controllable pitch propeller of high skew low cavitation design
- One (1) input shaft mounted multi disc hydraulic wet clutch in modular design
- Propeller nozzle in mild steel with stainless steel ring in way of propeller.
- Electrical turning system with electric motors which are to be horizontally mounted to suit limited space in aft thruster compartment (one of the motors is to be power from emergency switchboard to meet ABS requirements)
- Brake devices to be installed for both ASD units to allow arresting of propeller movement
- Hydraulic pitch control system with electric motor driven hydraulic pumps
- Individual and combination of both Azimuth thrusters remote controls on wheelhouse forward & aft control stations, two (2) wheelhouse wing docking stations and plus ECR control panel and local controls in Azimuth thruster compartment.
- Thruster direction and pitch indication sensors are to be provided.
- Shafting between Azimuth thrusters and main engines connected with solid cardan shafts, support by spilt type roller bearing and joined by couplings. These are to be protected with steel mesh / steel plate's covers in sections to allow for the maintenance. All fasteners for the covers are to be stainless steel. Shafts to be effective grounded by earth ring.
- Shaft bearings lubricated by grease and are of intrinsically safe, supplied by ASD vendor.
- Spares, special tools and instruction books.
- Necessary sensors and connections for DPS–2 and ACCU.
- Design and installation to meet UWILD class notation (Underwater Inspection in lieu of Dry Docking – on seals of oil-lubricated bearing with gauge wells outboard of the seals etc.

1002. AZIMUTH STERN DRIVE THRUSTERS (ASD) – cont'd

Propeller data

Input power	:	2240 kW (3003 bhp) @ MCR
Input speed	:	1800 rpm
Design speed	:	14.5 knots

Sealing arrangements for ASD units to be of an IHC T4 standard with tungsten carbide liners and viton seals. ASD units are to be installed by fabricating an all – welded steel CAN designed to be mounted vertically from the deck in order to allow for a single lift removal through the deck without the need for docking the vessel. The whole assembly is to be mounted on the hull attachments flange by fitted bolts or welding (Owner to confirm) with final agreement with Builder and Vendor.

1003. BOW THRUSTERS

Two (2) transverse tunnel type bow thrusters of CPP system, minimum static side thrust of each 12t continuously rated and to be classed to suit DP operation.

Each set consisting of the following :

- Two (2) tunnel thrusters to be driven by electric motor
- Tunnels in mild steel with stainless steel ring inside tunnel in way of propeller tips
- Four (4) bladed controllable pitch propeller in Ni–Al–bronze of high skew low cavitation design
- Electric remote control system including two (2) fixed control panels in wheelhouse, one (1) forward, one (1) aft and two (2) portable external wing joystick docking stations
- DP system interface
- Independent joystick system interfaces
- Input coupling between electric motor and thruster supplied by thruster maker
- Necessary sensors and connection for DPS–2 and ACCU

NOTE : Each bow thruster is normally to be driven and started by one (1) shaft alternator. In case of failure of one (1) of the main engines / shaft alternators, manual change–over for power supply is to be arranged so that diesel generators are to be able to take over.

1003. BOW THRUSTERS (cont'd)

Tunnel type electric bow thruster with motor of squirrel cage type rated for continuous operation

Power	:	about 950 kW to be confirmed by thruster maker
Motor speed	:	1200 rpm
Voltage / frequency	:	440/3/60
Protection	:	IP44 water cooled
Starting equipment	:	soft starter type with maximum starting current of 1.7 times full load current
Cooler	:	to be provided
Calculated thrust in deep water	:	13.8 tonnes
Expected continuous static thrust	:	12 tonnes

Sealing arrangements for tunnel thrusters to be of an IHC T4 standard with tungsten carbide liners and viton seals.

1004. GENERATING SETS

Main diesel generators

Three (3) 550 kW (688 kVA), diesel engine driven generators, 440/3/60, 3 wire, IP44 water cooled. All engines and alternators to be mounted with Vibracon mounts to a skid which is resiliently mounted to the hull.

Engine Maker : Caterpillar C18 Acert, 145mm bore, 183mm / electronic control marine diesel engine, 733 BHP @ 1800 rpm, FOC 133 litres/hr, Marpol Tier 2 marine diesel engine. Direct compressed air started and cooled by standard plate type heat-exchangers.

Alternator Maker : 550 kW at 1800 rpm, IP44 water-cooled protection.

Shaft Generators

Two (2) 2100 kW, 440/3/60, 08 PF, 3 wire, IP44 water-cooled shaft alternators driven via front PTO of main engines (refer Section 902).

1005. HARBOUR / EMERGENCY GENERATOR SET

One (1) CAT C9 radiator cooled diesel engine driven alternator of 238 kW (298 kVA) @ 1800 rpm, IP23, FOC 68.1 litres/hr, IMO Tier 2, 440/3/60, 3 wire. Electronic control. Engine to be auto electric-started c/w with radiator cooled and system to be arranged to start the engine / alternator automatically when the main power supply system fails to meet owner's requirement for 36 hours supply.

Emergency circuit is to provide power to lighting at MOB station, on deck and over sides, in passageways, emergency and other exits, public rooms, hospital, telecommunications station i.e fire detection alarm, radar and gyro navigation equipment etc, accommodations, machinery spaces, fireman outfit location, muster station, all essential machinery operating positions and / or control rooms / areas to permit continued operation and safe movements of personnel. All bunk / berth lights to be fed from these circuits.

Emergency battery lighting is to be provided for all principal escape routes, as well as in the emergency generator room.

For harbour use, this generator is to be designed to supply non-emergency loads and fitted with an automatic disconnection cutting off non – emergency circuit in the switchboard.
All engine and alternators are to be mounted with Vibracon mounts to a skid which is resiliently mounted to the hull.

Spark arrestor silencer with 35 dBA reduction muffler to be fitted.

1006. LUBRICATING OIL SYSTEM FOR MAIN ENGINES

The following is to be supplied and fitted per ship (for guidance) :

- 1 Main engine driven lubricating oil pump, gear type c/w built-in relief valve. Capacity, type and drive as per engine manufacturer's recommendation.
- 1 Duplex lubricating oil filter
- 1 Duplex lubricating oil filter, mesh 150 (as per engine maker recommendation)
- 2 M/E lubricating oil purifier, 800 L/hr
- 2 M/E lubricating oil plate cooler
- 1 Lubricating oil transfer pump : 8 m^3/hr @ 35m

Alarm device with audible and visual signals is to be fitted for failure of lubricating oil system of the main engine, auxiliary engines and propulsion units. Exact arrangement and supply to suit engine and class requirements. Lubricating oil system for auxiliary engines is to be enclosed built-in type with engine driven lubricating pumps. Spare lubricating oil pumps to be carried onboard.

1007. MAIN ENGINE STANDBY LUBRICATING OIL PUMPS

Two (2) nos. main engine standby lubricating oil gear pumps final capacity according to engine maker's requirement c/w gauges & 440/3/60 motors.

1008. ENGINE COOLING SYSTEM

The central plate cooler system comprises of two (2) central titanium main plate coolers are to supply fresh water to cool the following :

- Each main engine with its own plate coolers for all cooling systems i.e. lube oil cooling, charge air cooling and jacket water cooling, gearbox and fire pump cooling with its own attached fresh water header tank
- Each auxiliary engine for generator with its own built – in plate coolers for all cooling system of the auxiliary engines
- Azimuth propeller coolers
- Refrigeration condensers
- Wheelhouse condenser (if necessary)
- Air-conditioning AHU condensers
- BHS after – cooler
- BHS compressors
- Refrigerated air coolers
- Engine front PTO compound gear for shaft alternator and fire pump
- Shaft alternators
- ECR air conditioning condenser
- Air dryers
- Bow thruster system
- Stern Azimuth system

The logic of the main central FW cooling system is to supply fresh water cooling water to all systems in place of salt water. It is intended that the system will have sufficient pumps and isolation valves to enable the system(s) to be divided into two independent systems should one machinery item or cooler fail when in use, particularly when in DP mode, without compromising the station keeping or operation of the vessel.

There will be two FW expansion tanks independent of the main engine header tanks each with enough capacity to meet the expansion of the whole system when running combined. Each system must be capable of being isolated from each other if required.

1008. ENGINE COOLING SYSTEM (cont'd)

Capacity of each central plate cooler to be 120% of the requirements with the second plate coolers of similar capacity for the total system. The following pumps are to be supplied :

- 4 S.W. cooling pumps, centrifugal self-priming, bronze casing / impeller with SUS 316L shaft and mechanical seals, capacity to suit
- 3 F.W. cooling pumps, centrifugal self-priming, bronze casing / impeller with SUS 316L shaft and mechanical seals, capacity to suit
- Final capacity of central plate coolers is to be determined after final cooling capacity has been verified

The following equipment are required (per ship) for MAIN ENGINE ONLY.

- 2 HT cooling pumps (engine driven)
- 2 LT cooling pumps (engine driven)
- 2 HT standby pumps
- 2 LT standby pumps
- 2 M/E jacket water pre-heating sets
- 2 M/E FW expansion tanks
- 2 M/E central FW cool oil plate coolers for all cooling systems of main engines i.e. lube oil cooling, charge air cooling and jacket water cooling

1009. ENGINE EXHAUST SILENCERS

All diesel engines are to be fitted with spark arresting silencers of 35 dBA reduction. Silencers to have spark arresting certificate from ABS or approved Class society.

1010. GENERAL SERVICE AND STARTING AIR COMPRESSORS

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

* 3 Air compressors of min. 30 m^3/hr @ 30 kg/cm^2 to be electrically driven [one (1) of which can be acted as standby]. Emergency power is to be taken from emergency switchboard.
* 2 Air receivers of 30 kg/cm^2, volume of receiver as per engine maker recommendation
* 2 Oil / water separator (refrigerated type)
* Assorted pressure gauges, pressure reducing valves, relief valve, etc
* Sharp bend of pipes to be avoided
* General Service to tap off from this system
* Sea chest blow-down to be 20 mm NB STP steel pipe, 10 kg/cm^2

1011. BILGE PUMP **(OUTSIDE ENGINE ROOM)**

One (1) vertical self-priming centrifugal SW pump c/w gauges of 60 m^3/hr at 60m (calculated 57.5 m^3/hr) total head,
440/3/60. Bronze casing, bronze impeller, stainless steel 316 L shaft and mechanical seal.

1012. BILGE, BALLAST & FIRE PUMPS

Two (2) vertical self-priming centrifugal S.W. pumps c/w gauges of 100 m^3/hr at 60m total head, 440/3/60. Bronze casing, bronze impeller, stainless steel 316 L shaft and mechanical seal.

1013. BULK TANK COMPARTMENT BILGE PUMP

An air operated diaphragm pump of capacity 10m^3/hr @ 20m head to be provided for bilge suction in Oil Recovery operation.

1014. DISPERSANT PUMP

One (1) vertical self-priming centrifugal SW pump c/w gauges of 50 m^3/hr at 60m total head, 440/3/60. Bronze casing, bronze impeller, stainless steel 316 L shaft and mechanical seal.

1015. DIRTY OIL PUMP

One (1) horizontal gear pump of about 8 m^3/hr @ 45m total head c/w gauge, 440/3/60 with emergency stop on main deck. Cast iron casing, SUS or MS gear and mechanical seal.

1016. POTABLE WATER MAKER

One (1) reverse osmosis type fresh water maker c/w sand filter and capacity of 10t a day is to be provided.

1017. POTABLE WATER PRESSURE SET

One (1) 15 m³/hr at 4 bar total head horizontal self-priming centrifugal or ejector pump c/w motor, 440/3/60 and Diaphragm type pressure tank of 750 litres.
Working pressure of 2.5 – 3.7 bar with pressure relief valve c/w one (1) 2 m^3/hr circulating pump and 2x454 litres tank of calorifiers, 440/3/60. Pump to have SUS casing, SUS impeller and SUS shaft.

In addition : one (1) identical standby pump of 15 m^3/hr @ 4 bar to be fitted for domestic potable water or S.W. usage.

1018. SANITARY WATER PRESSURE SET

Identical to potable water pressure set

1019. OILY BILGE WATER SEPARATOR

One (1) oily bilge water separator of 1.0 m^3/hr @ 2 kg/cm^2 and single stage 15 ppm monitor and alarm c/w bilge pump as per latest MARPOL requirement.

1020. LUBRICATING OIL PURIFIER C/W ELECTRIC HEATER TANK

Two (2) sets of electrical automatic self-cleaning control partial discharge type lubricating oil purifier (for each main engine) c/w 800 litres/hr electric heater tank to be provided for purifying lubricating oil. Principal materials to be as per manufacturer's standard.

1021. FUEL OIL PURIFIER

One (1) set of electrical automatic self-cleaning centrifugal fuel oil purifier with minimum capacity of 3000 litres/hr but capable of supply maximum consumption of both main engines and two (2) main diesel generators combined. Approved type of flow meter unit and reading is to be in litres. Pump to have cast iron casing, bronze casing and SUS shaft.

Suctions to be taken from the F.O. settling tank or the daily service tanks for recirculation purposes.

1022. FUEL OIL TRANSFER PUMP

Two (2) 20 m^3/hr at 20m total head horizontal gear type F.O. pump c/w gauge 440/3/60. Pump to have one remote stop outside engine room. Main engine F.O. feed pump to be carried onboard as standby. Pump to have cast iron casing, SUS or MS gear and mechanical seal.

1023. FUEL OIL CARGO PUMP

One (1) 150 m^3/hr at 8 bar total head vertical screw F.O. pump c/w gauge 440/3/60 with emergency stop in wheelhouse aft console. Pump to have cast iron casing, SUS impeller and mechanical seal.

1024. POTABLE WATER CARGO PUMP

One (1) 150 m^3/hr at 8 bar total head vertical self-priming centrifugal potable water pump c/w gauge 440/3/60 with emergency stop in wheelhouse aft console. Pump to have bronze casing, SUS impeller and mechanical seal.

1025. DRILL WATER CARGO PUMP

One (1) 150 m^3/hr at 8 bar total head vertical self-priming centrifugal drill water pumps c/w gauge 440/3/60 with emergency stop in wheelhouse aft console. Pumps to have bronze casing, SUS impeller and mechanical seal.

1026. LUBE OIL TRANSFER PUMP

One (1) horizontal gear pump c/w gauge of about 8m^3/ hr @ 35m total head, 440/3/60. Pump to have cast iron casing, SUS or MS gear and mechanical seal.

1027. LIQUID MUD / BRINE / RECOVERED OIL CARGO PUMPS

Three (3) explosion proof (intrinsically safe) electrical driven single stage horizontal screw pumps of capacity 100 m^3/hr at 20 bar total head of S.G. 2.5 to be installed in the bulk tank cum cargo pump room and each pump to be operating at 490 rpm. For Oil Recovery Operation at 490 rpm, the pump can deliver approx. 110 m^3/hr @ 10 bar. Lower pressure head can be achieved by regulating the discharge valve fitted just after the discharge pipe of the pump.

One (1) intrinsically safe motor driven horizontal centrifugal dedicated ORO pump of 100 m3/hr @ 30m head to be fitted for recovered oil usage.

Pump to have emergency stop in wheelhouse aft console. Pump to have cast iron casing, cast iron impeller and SUS shafting.

1028. LIQUID MUD MECHANICAL AGITATOR AND RECIRCULATING PUMP **(FOR 24 HOURS CONTINUOUS OPERATION)**

All mud tanks are to be fitted with intrinsically safe electrical agitators of paddle mixers(#number of agitators will be suitable increased due to new layout of mud tanks). Rate of flow must be sufficient to keep the tank bottoms swept clean of sediment.

IN ADDITION TO THIS :

Two (2) intrinsically safe motor driven horizontal centrifugal pumps of hard Iron casing, hard iron impeller, SUS shaft. Capacity of 35 m^3/hr @ 25m head of S.G. 2.5, 440/3/60. Pumps to be installed in the aft bulk tanks compartment as the flash point of mud and recovered are below 60°C. The electric motors, if not intrinsically safe type, they must be installed inside the engine room. The pumps fitted inside the aft bulk compartment are to be driven by the motor through gas – tight stuffing boxes.

1029. SEWAGE TREATMENT PLANT

One (1) unit sewage treatment plant of approved type suitable for 52 men capacity, to meet with latest MARPOL requirement and bypass for direct emergency overboard discharge system is to be arranged.

1030. SEWAGE SUBMERSIBLE PUMP FOR SEWAGE HOLDING TANK

One (1) 15 m^3/hr at 3 bar total head, 440/3/60 motor, vertical automatic / manual operation. Pump to be macerator screw type and installed in bow thruster compartment. Pump to have cast iron casing, SUS screw and mechanical seal. The sewage submersible pump can be removed for maintenance without the need to pump the sewage holding tank dry.

1031. GREY WATER SYSTEM

Grey water taken from galley, washplaces and laundry is to be gravity fed into the grease trap and then into the grey water tank in the bow thruster compartment. Discharge is to be by an electrical centrifugal pump of 15 m^3/hr at 3 bar c/w auto-start and auto-stop. Bronze pump casing, bronze impeller and SUS shafting.

1032. BALLAST WATER TREATMENT SYSTEM – OWNER'S SUPPLIED TREATMENT PLANT ONLY

It is intention to have sea water ballast and drill water tanks fitted with ballast treatment system based on combination of two (2) basic principles :

- filtration of sediment and particles by disc and screen filters
- UV radiation disinfecting by inactivation of organisms and pathogens by breaking the cell membrane

Ballast water is transferred by ballast pump through filtration plant and UV disinfection plant into ballast water tanks. Piping arrangement is as Vendor design.

Due to limited space in engine room, an integrated or equal system most suited for the installation in function is to be installed. Integrated system combines both ultra-violet (UV) disinfection and filtration all in one compact unit.

Builder to install Owner supplied ballast water treatment plant. Owner is to cover expenses of commissioning and testing by vendor representative(s).

1033. EMERGENCY FIRE FIGHTING PUMP

One (1) electric motor driven emergency vertical centrifugal fire pump c/w gauge installed in bow thruster compartment. Capacity of 45 m^3/hr at 60m total head, 440/3/60. Remote start / stop in the wheelhouse c/w local starter panel, system to meet with SOLAS requirement. Pump to have bronze casing, bronze impeller and mechanical seal.

1034. HVAC (HEATING VENTIALTION & AIR – CONDITIONING)

1) Heating

Heating system is to be according based on –15°C ambient temperature with electrical heating in reverse cycle central air conditioning plant.

2) Ventilation

a)	Engine Room (reversible)	:	forced supply and natural exhaust
b)	Azimuth Thruster Compartment (reversible)	:	forced supply and natural exhaust
c)	Bow Thruster / Fwd. Machinery Compartment (reversible)	:	forced supply and natural exhaust
d)	Bulk Tank Compartment (intrinsically safe motor)	:	natural supply and forced exhaust
e)	Emer. / Harbour Generator Room	:	natural supply and forced exhaust
f)	Workshop & ECR (re – circulation)	:	natural supply and natural exhaust (independent air conditioned)
g)	Washplaces, Changing Room	:	natural supply and forced exhaust direct outside
h)	Paint Store	:	natural supply and forced exhaust
i)	CO_2 Room	:	natural ventilation and forced exhaust
j)	Forepeak, Bosun & Deck Stores	:	natural supply and forced exhaust
k)	Provision Store	:	forced exhaust in addition to chilled by central unit
l)	Drying Room	:	natural supply and forced exhaust
m)	Galley	:	natural supply (in addition to vent hood over the cooker) and forced exhaust
n)	Sickbay & Laundry	:	natural supply in addition to central air-conditioning and forced exhaust direct outside
o)	All tanks and cofferdams	:	to Rule requirement
p)	Air Lock	:	pressurized as per Rule requirement

1034. HVAC (HEATING VENTIALTION & AIR – CONDITIONING) – cont'd

2) Ventilation (cont'd)

In general, ventilation fans are to be built into ship structure with W.T. enclosure to meet rules requirements. Mushroom head ventilators to be avoided and only fitted unless necessary.
Engine room natural exhaust is to be via funnel. Funnel top opening are to be fitted with hydraulic operated remote control closing device.

3) Air – conditioning System

Living spaces, wheelhouse and all the public spaces in the accommodation area, etc. to be fully central air-conditioned (heating and cooling) and spot cooling for the sickbay, store, galley, linen store, provision store, laundry and wash place, etc.

Engine control room is to have self-contained re-circulation A.C. unit (ceiling mounted). Galley is to have independent extraction fan for the compartment as well as cooker hood.
The wheelhouse is to be fitted with an independent wheelhouse top mounted air cooled air conditioning plant for 100% backup.

AHU blower units and return ventilation are to be designed and installed with low noise design with insulation material and minimum noise level with silencers fitted at inlet and outlet of fan as necessary. The plant is designed in accordance with marine type standard system and good marine practice. The system is to be approved and meeting IMO and SOLAS requirements.
All vent outlets are to be fitted with adjustable dampers capable of closing completely or as necessary for balancing. Cooling of air through mechanical ventilation system is to be thermostatically controlled from one central location, near the air handling unit return. Fusible fire dampers and fire dampers with indicators are to be provided as necessary. Dampers are to close automatically in the event of fan failure, fire or shut down. Dampers are to be fitted with manual over – ride facilities.

Air-conditioning plant is a single duct, low velocity reverse cycle (heating and cooling) air conditioning system, comprising a central air handling unit. The plant is design for low pressure system to be installed to serve all cabins / living & public spaces and store in the accommodation area etc. The branch for the sickbay exhaust / air conditioning ducting is equipped with non-return flap. The plant to maintain the inside climate conditions as described under this section.

1034. HVAC (HEATING VENTIALTION & AIR – CONDITIONING) – cont'd

3) Air – conditioning System (cont'd)

Central air handling unit for air-conditioning is to be provided. The central unit consists of :

* Filtering section with dry-type filter
* Fan section with V-belt driven fan
* Cooling section with air coolers for direct expansion of Freon R407c or equal
* Oil / Gas Separator

Aluminum ceiling air-grills are to be provided as necessary for supplying of the conditioned air. Grills to be equipped with air volume control dampers.

A low pressure rectangular ducting system constructed out of galvanized steel sheet with insulation material to be provided for the air distribution to the air-conditioned spaces and double-sided aluminum foil externally acting as vapour seal of the system.

Exhaust return air is drawn from mess rooms and passageway through the exhaust units with low noise insulation material and travel through the ducting to the mixing chamber on the central air handling unit. Air duct / return duct to be insulated and system must be follow the manufacturer's standard and to meet with SOLAS requirement.

The cooling plant is to consist of one (1) air handling unit with two (2) Bitzer compressors and two (2) condensers with F.W. central plate cooling. Either one complete set of compressor c/w condenser unit for 100% standby, in the event of failure of the other unit.

The system to be designed to operate Freon R407c or equal and compressor motor.

Designing Conditions	Max.		Min.	
Ambient Temperature	45°C (113°F)	90% RH	–10°C	0% RH
Internal Temperature	21°C	50% RH	21°C	50% RH
Fresh Air Intake	30%			
Sea Temperature	36°C (96.8°F)		+1°C (33.8°F)	

ENGINE CONTROL ROOM & WHEELHOUSE :

One (1) split type air-condition unit c/w water cooled compressor for Engine Control Room and two (2) sets 5 HP ceiling type split air-condition units c/w air cooled compressor for wheelhouse. Special attention to be made for drainage arrangement for the ceiling mounted condensers.

1034. HVAC (HEATING VENTIALTION & AIR – CONDITIONING) – cont'd

3) Air – conditioning System (cont'd)

Safety device for condenser unit to be fitted (shutdown and protection device) :

- High pressure switch (manual reset)
- Low pressure switch (auto reset)
- Oil protection switch (manual reset)
- Safety valve (factory setting)
- Water pressure switch (auto reset)

NOTE : All the Freon gas system for refrigerating and air conditioning to be CFC free and only environment friendly materials to be used.

1035. OIL POLLUTION CONTROL SYSTEM

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

a) One (1) detergent proportioned of between 3% to 6%.

b) Two (2) spray booms, one each at P & S, 6m long aluminum, each fitted with 3 nozzles of 125 litres/min at 5 kg/cm^2. Booms to be hinged such that these can be swiveled in for storage and secured perpendicularly out when in use.

c) One (1) detergent pump at 50 m^3/hr at 60M head. Pump to have bronze casing, bronze mpeller and SUS shaft.

1036. GARBAGE DISPOSAL

One (1) Unit of Garbage disposal (Macerator) is to be provided and to meet with MARPOL requirement.

Garbage bins (as stated in Garbage Management manual) are to be provided by Builder.

SECTION 11 – SPARES & TOOLS & INSTRUCTION MANUAL

1100. SPARES

The following items are to be provided by the builder and other spare parts to be carried on board as per standard tools supplied by machinery/ equipment supplier.

1101. MAINTENANCE AND WORKSHOP TOOLS

Lifting lugs suitable for use of chain blocks are to be fitted in the following positions:

a. one monorail with rollers above center of each main engine
b. one point above each gearbox
c. two points above each shaft
d. two points above each generating set
e. one point above each pump

An engine room workshop with access door and sufficient storage racks to be arranged.

The following equipment are to be provided :

- Two (2) 2t chain blocks
- One (1) steel workbench with adjustable light and drawers and lockers with padlocks in the engine room
- One (1) 150mm vice mounted on the workbench
- One (1) bench grinder
- One (1) electrical bench drill
- One (1) set of assorted hand tools for general maintenance
- Three (3) steel sounding tapes for F.O. & POTABLE WATER
- One (1) electrical hand inspection lamp with 10m wandering leads
- Two (2) keys for sounding pipes screws plugs
- One (1) set main engine standard tools
- One (1) set generator standards tools
- One (1) set Azimuth propeller standard tools
- One (1) set bow thruster standard tools
- One (1) set general standard tools
- Two (2) sets of burning equipment, one for oxygen and one for acetylene, complete with bottles, regulators with flashback arrestor, gauges, hoses, torch and nozzles (storage for bottles to be arranged on main deck)

SECTION 12 – DYNAMIC POSITIONING SYSTEM

1200. GENERAL

The vessel is to be equipped with dynamic positioning system to class requirement for DPS-2 notation. The control of the DP is to be in the wheelhouse with master station adjacent to the aft wheelhouse console.

The DP system is to consist of the following :

- Duplex DP workstations with two (2) control and field cabinet
- Three (3) gyro-compasses, one of which for navigation
- Three (3) wind sensors without moving parts
- One (1) GPS (Global Positioning System) based on DP – 232 DGPS system
- One (1) GPS (Global Positioning System) based on DP – 110 DGPS system
- One (1) Cyscan high precision laser positioning and tacking system and system interface to DP system
- One (1) radar reference system using dual RADius 1000 with 700X Transponder or Owner approved equal to be installed
- Three (3) MRU (Motion Relative Units) :
  - 3 x MRU D
- Two (2) printers Two (2) printers (one for event black & white, one for hard copy in colors)
- Two (2) UPS (Uninterrupted Power Supply)
- One (1) changeover switch (DP / IJS / manual control)
- One independent joystick system with two (2) joy stick control panels, one at forward station, one (1) at aft station (refer to section 803)

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

A Failure Mode and Effect Analysis (FMEA) report is to be prepared by Owner and Class approved 3rd party specialist. The cost of the FMEA Report is to be Builder responsibility. This report will determine, by the analysis for the effect of single failure of the DP system and the consequential effect, on the ability of the vessel to maintain in position and heading. This report is to be kept onboard of vessel forming an integral part of DP assessment. The DP operation manual is to be completed by FMEA author and submitted to classification for approval.

ANNEX 'A' : AUTOMATION SYSTEM FOR MACHINERY PLANT

A1. GENERAL

Remote and automatic control and instrumentation to be provided in compliance with the requirements of the Classification Society for periodically unattended machinery space.

The main propulsion to be remotely controlled from the wheelhouse and the engine control room and also capable of local manual operation.

Instrument gauges and alarms to be arranged in good order for safe operation and easy maintenance.

Automatic controllers and control valves to be provided on principal systems for safe operation and easy maintenance.

All components and wires to be marked with numbers in accordance with the instrumentation list and installation drawings.

When the measuring value of the system is high or low from the predetermined value, an audible and visual alarm to be activated for the operator's attention.

Audible and visual alarms to be released throughout the engine room as well as the engine control room.

A2. INSTRUMENT AND SENSOR

Instruments to be of suitable construction for maximum operating value, thermometers, pressure gauges etc., to be provided as necessary for manual start-up, control and monitoring of equipment in machinery spaces, and scale engraving to be in metric unit.

Pressure and temperature sensors to be installed in places where there is minimal risk for damage during normal overhaul and maintenance. Temperature sensors to be installed in wells and be capable of being withdrawn for replacement or calibration.

Instruments, sensors and control equipment to be of robust and standardized design.

A3. CONTROL CONSOLE

3.1 Engine Control Room Console

One (1) engine control room console to be provided in the engine control room.

The following instruments and equipment to be installed on the console.

- necessary control, monitoring and alarm for main engine, propulsion and auxiliary generators etc.
- remote start /stop push button and running indicator for auxiliary equipment.
- telephone
- engine telegraph
- fire alarm slave panel
- manual general & fire alarm release
- other equipment intended for mounting in ECR console.

3.2 Bridge Consoles

Console and panels incorporating electric equipment to be provided and installed on the wheelhouse forward and aft. Arrangement to be approved by Owner.

As to the detail list of equipment on each console, section 304 of the specifications to be referred to.

A4. CONTROL, ALARM AND MONITORING SYSTEM

4.1 General

The machinery alarm and monitoring system and installation to comply with the applicable rules for the Class notation.

4.2 Alarm and Monitoring System

A microprocessor based multi-user system for complete alarm and monitoring of main engine, propulsion and auxiliary machinery etc., using mimic diagrams giving constant condition status. In addition a comprehensive trend analysis function can provided information on all monitored variables.

Alarms are initiated if abnormalities are detected, the system is flexible and easy configurable, both during installation and for later alterations.

A4. CONTROL, ALARM AND MONITORING SYSTEM (cont'd)

4.2 Alarm and Monitoring System (cont'd)

Functions of the system to be as follows:

- multi-user system
- provide users with a simple and correct overview of various systems using system pictures/diagrams
- is self-monitoring, i.e. it is equipped with alarms which monitor its own faults
- divides machinery equipment into one system failure group for internal watch and different display groups: i.e. :
  - main engines
  - main generator sets
  - thruster system
  - bilge system
  - cooling system
  - fuel oil system
  - lube oil system
  - compressed air system
  - others
- straight forward parameter adjustments: i.e. limit values, time delays and sensor calibration etc
- possibilities for inhibit and off scanning of individual signals and listing of inhibited and all off-scanned signals
- alarm interlock function
- group status : alarm summary and event lists
- bar graphs for status presentation
- printer(s) for different types of reports and listing
- action group function: i.e. input point status combinations give output action (open / close contacts)
- trends of analogue signals, inhibited and off – scanned signals, past events etc

4.3 Data Processing Unit and I/O Unit Cabinet(S)

The data processing unit to be provided as per the maker's standard and the requirements of the Classification Society.

The unit includes electronics controlling the various functions as well as electronics for digital and analogue inputs / outputs.

A4. CONTROL, ALARM AND MONITORING SYSTEM (cont'd)

4.4 Alarm Extension / Watch Panels and Signal Devices

Alarm extension/watch panels and signal devices etc. to be installed according to the maker's recommendation and to meet rules and regulations.

4.5 Operator Stations

a) Operator stations in engine control room

Two (2) operator stations shall be installed, this included:

- PC with keyboard
- pointing device
- 19" LCD colour monitor
- UPS fed from AC 230 system
- data logging colour printer
- alarm printer
- other necessary equipment

b) Operator station in wheelhouse

One (1) operator station shall be installed, this includes:

- PC with keyboard
- pointing device
- 19" LCD colour monitor
- UPS fed from AC 230 system
- data logging colour printer
- other necessary equipment

4.6 Engineer Calling System

One (1) set of engineer calling system to be provided according to rules.

4.7 Dead Man Alarm System

One (1) set of dead-man alarm system to be provided in engine room.

The system to be switched on the ECR console and each E/R main entrance when the engineer goes to the engine room, and has to reset in intervals by re-set push button on the light signal column.

The system to be arranged to operate the E/R alarm at pre-set intervals (Approx. 30min.) and extended to wheelhouse and engineer's cabins, if not re-set within 5min.

A5. E/R SIGNAL LIGHT COLUMN AND AUDIBLE ALARM SYSTEM

One (1) centralized engine room alarm indicator system to be provided and each light signal column to consist of:

- Fire alarm
- Machinery alarm
- Telephone call for auto and sound powered telephone
- Dead man alarm
- General emergency alarm
- CO_2 alarm
- Fixed local fire fighting alarm
- Engine telegraph

Seven (7) signal columns to be provided as follows :

- 2 x Engine room
- 1 x E/R tween deck
- 1 x bow thruster compartment
- 2 x bulk tank compartments
- 1 x Azimuth thruster compartment

Each unit to be consisting of one siren, one electric horn, two flashing lights and indicating plates. The units to have different sound signal for the extension alarm.

A6. MAIN PROPULSION PLANT CONTROL SYSTEM

6.1 Main Engine and Propulsion Control System

Main engine and propulsion control system to be complying with ABS requirement and the maker's recommendation.

The vessel to have electronic-hydraulic remote control system for main propulsions.

There are two (2) off electrically totally independent plants, one port and one starboard. A failure in the port plant does not put the starboard plant out of operation and vice versa.
Each plant to have two galvanic isolated power supplies.

Propellers to be controlled :

- Port and starboard main azimuth thrusters (one to come from emergency switchboard as per ABS requirements)
- 2 off bow thrusters

A6. MAIN PROPULSION PLANT CONTROL SYSTEM (cont'd)

6.1 Main Engine and Propulsion Control System (cont'd)

Two (2) bridge control stations, one (1) at fore bridge consoles and one (1) at aft bridge consoles, each control station includes remote control panels for main propulsion, main engines, bow thrusters, emergency stop and instrument panels etc.

One (1) ECR station to be mounted in engine control console, it includes remote control panels for main propulsions, main engines and display units etc.

Necessary interface to be arranged for DP system, joystick and alarm/monitoring system etc.

6.2 Main Engine Safety System

A safety system for protection and control of each of the main engines to be provided.

The system to control and protect the main engines in order to prevent faulty operation and/or major failure. The system to automatically stop the engine upon critical failure which may lead to breakdown of the engines, such as low-low lube oil pressure high-high coolant temperature and over speed etc., in addition to any further requirements according to ABS rules.

The safety alarm system to be a separate system, but this information is also be available for alarm & monitoring system.

6.3 Engine Telegraph System

Two (2) set of engine order telegraph system to be provided according to rules and regulations, one port and one starboard.

The engine telegraphs to have the following divisions.

Ahead ……. Full
Half
Slow
Stop

Astern ……. Slow
Half
Full

A6. MAIN PROPULSION PLANT CONTROL SYSTEM (cont'd)

6.4 Automatic Overload Protection of Main Engine

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

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

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

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

A7. GENERATING PLANT CONTROL SYSTEM

7.1 Control and Operation for Diesel Generators

a) General

The main generator engine to be provided with remote start/stop device and automatic starting device.

The speed of main generator engine to be remotely controlled from the engine control room by the governor control switch on the main switchboard and also to be controlled at the engine side.

Each lube oil and fresh water temperature control system to be provided for generator engines according to the maker's standard.

Automatic shut-down at over speed, critical levels of a lube oil pressure and a cooling water outlet temperature to be provided for diesel generator engines as per rule requirements.

A7. GENERATING PLANT CONTROL SYSTEM (cont'd)

7.1 Control and Operation for Diesel Generators (cont'd)

b) Automatic Operation of Generator

- General Mode of Control

  Generator engines to be automatically started by compressed air.

- Mode of Automatic Generator Control

  The stand-by generator to be started automatically on the following conditions :

  a) Blackout on main bus-bar
  b) Low voltage on main bus-bar
  c) High voltage on main bus-bar
  d) Low frequency on main bus-bar
  e) ACB abnormal trip on generator in service
  f) Over-current of generator in service

Condition (a) or (e) :

The stand-by generator to be started and connected to the main bus bar.

Condition (b), (c) or (d) :

The stand-by generator to be started and connected to the main bus bar after opening the ACB of running generator by the signal that normal voltage of stand-by generator is established.

Condition (f) :

The preferential trip system to be initiated and trip the non-essential loads with starting signal of stand-by generator.

The stand-by generator to be started, synchronized, connected automatically to the main bus-bar and run in parallel by automatic proportional load sharing.

- Synchronizing and Load Sharing Mode

  a) Manual synchronizing and manual load sharing :

     When "Manual" position is selected for the stand-by generator, the generator to be started remotely from the engine control room and connected manually to the main bus bar.

A7. GENERATING PLANT CONTROL SYSTEM (cont'd)

7.1 Control and Operation for Diesel Generators (cont'd)

a) Automatic Operation of Generator

- Synchronizing and Load Sharing Mode (cont'd)

  Manual synchronizing to be available by a synchroscope, synchronizing lamps, relevant control and governor control switches of the prime movers.

  Manual load sharing to be available by governor control switches. Stopping of generator to be available by a stop button.

  b) Automatic synchronizing and automatic load sharing:
  When "Auto" position is selected for the stand-by generator, the generator shall be automatically synchronized and connected to the main bus-bar, and automatic proportional load sharing shall be performed.

- Power management system

  Power management system shall be installed according to the requirement of classification society. It is a separate system with stand-alone units, one for each generator suitable for operation with three (3) diesel generators and two (2) shaft generators.

  The control system is to be distributed and provided with stand-alone design, having one control unit for each generator; each control unit shall have an operator panel capable of running its own generator of failure in another generator control unit or bus communication. Commissioning parameters are to be easily accessible.

  All necessary functions and interfaces shall be provided in accordance with manufacturer's recommendation and to meet the requirement of ACCU notation and DP system.

A7. GENERATING PLANT CONTROL SYSTEM (cont'd)

7.2 Automation for Emergency Generator

When the voltage of the main bus fails, the emergency generator shall be automatically started with time delay and the emergency switchboard shall be energized by the emergency generator after closing the circuit breaker.

Abnormal alarms for the following shall be provided at the engine control panel in the emergency generator room.

- Over speed
- L.O. inlet, low pressure
- Cooling F.W. outlet, high temperature
- Leakage from F.O. pressure pipes

The engine to be tripped on the over speed condition.

A8. OTHER CONTROL AND MONITORING SYSTEM

8.1 Air compressor control system

The main and working air compressor shall be automatically started and stopped by the pressure switch on each air reservoir, and shall be stopped automatically in case of lube oil low pressure and discharge air high temperature.

The main air compressor shall be arranged remote start/stop and running indicator on the engine control room console.

8.2 Automatic Start and Change over Vital Auxiliary Pumps

The following auxiliaries shall be automatic start and changed over to the stand-by one in the event of low pressure and/or no voltage of the running pump and stand-by starting alarm shall be indicated on engine room alarm and monitoring system.

However, the initial starting shall be performed at the machinery side in connection with operation of the associated valves.

- Low temp. F.W. cooling stand-by pumps
- High temp. F.W. cooling stand-by pumps
- Main S.W. cooling stand-by pumps
- Main engine lubricating oil stand-by pumps
- etc.

A manual/automatic selector switch for operation to be provided in each starter panel.

A8. OTHER CONTROL AND MONITORING SYSTEM (cont'd)

8.3 Other system

The F.W. and S.W. pressure pumps to be automatically started and stopped by the pressure switch arranged in the pressure tanks.

The oily bilge pump to be automatically started and stopped by the level switch arranged in the bilge well and bilge holding tank.

The fuel oil transfer pump to be automatically started and stopped by the level switch on the fuel oil service / day tanks.

ANNEX 'B': VESSEL FOR SAFETY STANDBY & RESCUE SERVICE (SSR – GROUP B)

GENERAL

It is the intention for this design to be used for the construction of optional vessel(s) to able to classed for Safety Standby Service. Builder to offer costs of the following as "optional extra items" :

1. FOR SAFETY STANDBY SERVICE

- **Wheelhouse windows** to be fitted from outside with toughed safety glass – already provided
- **Decontamination area** fitted with eye wash and shower on main deck.
- **Reception area** fitted with reception counter, chairs, filing cabinets etc. This is to be converted from main deck entrance lobby.
- **Treatment area** of 15m^2 area excluding wet unit already provided in the sickbay. Deck scupper, access and exits for easy transportation of stretchers already provided. One (1) each module shower and toilet – already provided
- **Recovery area** to be converted from Recreation Room on main deck with total berths suitable for twenty (20) survivors inclusive of two (2) single berth as per requirement of Category Group B.
- **Sanitary area** : Gym on main deck to be converted to house four (4) washbasins, four (4) showers and four (4) WC as per requirement of Category Group B.
- **Morgue** : the store room on main deck to be converted with shelving and securement to store ten (10) bodies in a cool ventilated space (or by air cooled independent air conditioning unit) as per requirement of Category Group B.
- Replace one (1) x 9 man **FRC** c/w davit to two (2) x 12 man FRC. All inclusive of davits.
- **Rescue bulwark opening** minimum 5m each side – already provided.
- **Safety nets** minimum 5m wide with weighs, length enough to extend 1m below the light load waterline – already provided
- **Jason cradle** – already provided
- **Search lights** : four (4) x 50 lux at 250m with 360° rotation controlled inside the wheelhouse – already provided. (Minimum two (2) lights as required by Rules)
- **Water spray system** as per FiFi 1 requirement, minimum 5 litres/min/m^2 for exposed deck and control station (wheelhouse aft and accommodation area) – already provided
- **Gas detection equipment** i.e. portable H_2S detector – already provided
- **MOB alarm** – already provided
- **Deck lighting** to be provided for areas such as rescue boat location, launching appliances, reception area and rescue areas – already provided

1. FOR SAFETY STANDBY SERVICE (cont'd)

- **Medical store** : blankets, bandages & dressings, splints etc to be provided. Additional items over and above standard vessel minimum requirement on medical item to be OFE.
- **Towing** : utilized ship's bollards – already provided
- **Helicopter winch area** to be arranged included the following :
  - Winching marking on aft deck
  - Aviation Radio with frequencies 121.5 MHZ, 135.900 MHZ and 135.950 MHZ as a minimum – additional
  - Two (2) pairs of heavy duty insulated rubber gloves – additional
  - One (1) suitable earth bonding pole (to catch winch wire) – additional
  - One (1) set of heavy duty wire cutters (one metre long) – additional
  - Wind sock (illuminated at night) – already provided
  - Paraguard stretcher – already provided
  - Day and night helicopter batons – additional
  - High visibility over vests – additional
  - Helicopter beacon – additional
  - Daylight signaling lamp – already provided
  - Transistor portable loud hailer – already provided
  - Two (2) portable waterproof VHF – already provided
  - Deck lighting illuminate the helicopter winching deck area – already provided
  - VHF radio telephone with helicopter communication frequencies – additional

- **Miscellaneous items :**
  - 8 x lifebuoys with 30m (99 ft) buoyant lines and buoy light – additional quantity
  - 2 x lifebuoys with self – igniting lights and smoke signals – already provided
  - 2 x lifebuoys with self – igniting lights – already provided
  - 3 sets of safety harness and line with safety hook – additional
  - 1 x line thrower with accessories for at least 12 projectiles – already provided
  - 4 x lines suitable for use with line thrower – already provided
  - 2 x diver's ladders – additional
  - Six (6) extra lifejackets to be carried in addition to the quantity required by the relevant regulations – additional

APPENDIX 1
TABLE OF PERMITTED PRODUCTS
(This is from GL Rule)

	Flammability
Oil-based mud containing mixtures of products listed in chapters 17 and 18 of the IBC Code and the MEPC.2/Circular and permitted to be carried under paragraph 1.2 of these Guidelines	No
Water-based mud containing mixtures of products listed in chapters 17 and 18 of the IBC Code and the MEPC.2/Circular and permitted to be carried under paragraph 1.2 of these Guidelines	No
Drilling Brines,including:	No
Sodium Chloride Solution	No
Calcium Bromide Solution	No
Calcium Chloride Solution	No
Calcium nitrate/Magnesium nitrate/Potassium chloride solution	No
Calcium Nitrate Solution (50% or less)	No
Drilling brines(containing zinc salts)	No
Potassium Formate Solution	No
Potassium Chloride Solution	No
Ethyl Alcohol	Yes
Ethylene Glycol	No
Ethylene Glycol monoalky ether	Yes
Methyl Alcohol	Yes
Acetic acid	Yes
Formic acid	Yes
Hydrochloric Acid	No
Hydrochloric-hydrofluoric mixtures containing 3% or less Hydrofluoric acid	No
Sodium Silicate Solution	No
Sulphuric Acid	No
Triethylene Glycol	Yes
Toluene	Yes
Xylene	Yes
Liquid carbon dioxide	No
Liquid nitrogen	No
Noxious liquid,NF,(7) n.o.s.(trade name …,contains …) ST3,Cat. Y	No
Noxious liquid, F,(8) n.o.s.(trade name …,contains …) ST3,Cat. Y	Yes
Noxious liquid, NF,(9) n.o.s.(trade name …,contains …) ST3,Cat. Z	No
Noxious liquid, F,(10) n.o.s.(trade name …,contains …) ST3,Cat. Z	Yes
Noxious liquid, (11) n.o.s.(trade name …,contains …) Cat. Z	No
Non-noxious liquid, (12) n.o.s.(trade name …,contains …) Cat. OS	No