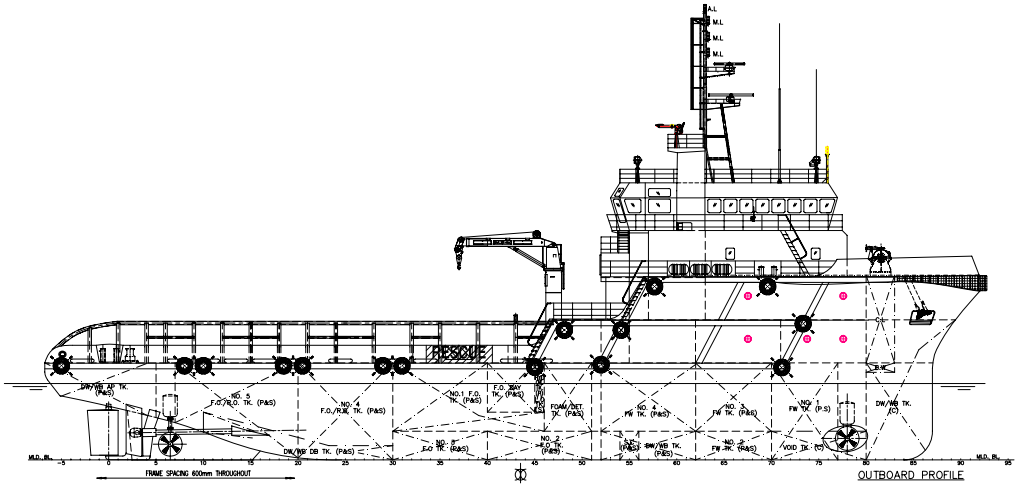
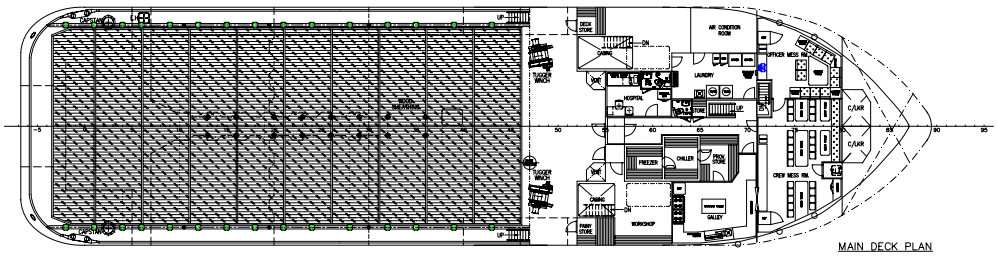
S P E C I F I C A T I O N S

F O R

59 METRE PLATFORM SUPPLY VESSEL





C O N T E N T S

Group No. 00
General

Group No. 00-1
General

00-1.1 General Provision

The Specifications and accompanying plans are intended to describe the details of technical matters in the Contract i.e., the performance, capacities, construction, machinery equipment, material, etc. required for the construction of a Platform Supply Vessel being capable of operating as sea-going in unrestricted waters, hereinafter called "the Vessel"

If any discrepancy is found between the Contract and the Specification, the Contract shall prevail, and if any discrepancy is found between the Specifications and the accompanying plans, the Specifications shall be taken.

Any item, which is not expressly called for in the Specifications, shall not be furnished by the Builder, unless it is required by the specified rules and regulations.

Spare parts are to be supplied by the Builder according to the Specifications, which meet the requirements of the specified Classification Society and/or the normal standards of the Builder and manufacturers.

00-1.2 General Outline

The Vessel shall be equipped with two (2) Controllable Pitch Propellers, one (1) bow thruster & one (1) stern thruster. It shall be built of steel and engine room is to be located in the middle. For further details see the relevant sections of this Specification.

Details, features and design criteria, which are not mentioned herein, but which are necessary or usual by test actual marine practice for this type of Vessel are to be provided by the Builder and included in the Contract price.

00-1.3 Temperature and Humidity

The climatic conditions, which the Vessel shall be operated, are to be at the maximum of

- Sea water temperature 32°C
- Ambient air temperature 45°C
- Relative air humidity 95%

These climatic conditions shall be considered in the design of the Vessel including its equipment.

00-1. 4 Condition

The Builder is to take full responsibility in all respects, without reservation, for design, construction, quality of workmanship and material, commissioning trials and delivery to the Owner.

Anything omitted from this Specification but which is considered to be normal or necessary in order to comply with Rules or to be in keeping with the marine standards for satisfactory service is to be supplied and fitted without extra cost. Anything mentioned twice which is normally only supplied once shall be supplied once only.

Measurements, calculations, etc shall be in accordance with metric or decimal systems and units of S.I. system to be used.

Measuring units shall be in metric system for instance:

- Length m
- Capacities m^3 or liter
- Weights kg or t
- Pressure bar
- Temperature °C

The Vessel is to have the capacity of precise positioning at slow speeds and to have excellent handling and maneuverability at all speeds and under all conditions.

00-1.5 List of Roles

The Vessel is to be designed in such a way that the following roles can be obtained:

a) Transport fuel oil, fresh water & liquid mud
b) Move men and materials between platforms
c) External fire fighting
d) Safety & rescue operations
e) 24 hours/day continuous operation, capable of remaining on station for a minimum of 14 days.
f) Carriage of recovered oil from a spill

The design of the Vessel is to take into consideration the type of operations in which it shall be engaged with particular reference to safety of operation and accessibility to all parts for operation, maintenance and overhaul.

Scantlings are to be in accordance with Classification Society Rules, or greater where noted in this Specification for a vessel of this class, type and intended service.

The Builder is to submit outfitting standard for the Owner's consideration and approval.

Group No. 00-2
Classification, Rules and Regulations

00-2.1 Classification

The Vessel including its hull, machinery and outfitting equipment shall be constructed in accordance with the latest International Rules and Regulations and under the survey of American Bureau of Shipping for Unrestricted Service for Class Notation ABS + A1 (E) OFFSHORE SUPPORT VESSEL , FIRE-FIGHTING CLASS 1, OIL RECOVERY CAPABILITY CLASS 2 + AMS + DPS-1.

00-2.2 Rules and Regulations

The Vessel and its equipment shall be designed and built in accordance with Classification Requirements in respect of general hull, marine engineering and electrical equipment and relevant Rules and Regulations which are in force at signing of Contract and mentioned below.

In order to fulfill these requirements the following international regulations and recommendations shall be applied:

(a) The International Convention on Load Lines, 1966 (Type 'B' Freeboard)
(b) Rules of the Classification Society
(c) The International Regulation for Tonnage Measurement of Ships, 1969
(d) The International Convention for the Safety of Life at Sea (SOLAS) 1974 for cargo Ships, including all amendments
(e) The International Convention for Prevention of Pollution from Ships, 1973 and Protocol 1978, MARPOL 73/78 and Its latest amendment
(f) Radio Communication Regulation to International regulations
(g) The International Convention for Prevention of Collision at Sea 1972 including amendment of 1981
(h) IMO code on noise and vibration onboard of sea-going cargo vessels
(i) Requirements for Accommodating of Crew on Board of Ship ILO 92
(j) Wireless Safety Requirements (GMDSS)
(k) IMO Resolution MSC 235(82) for stability
(l) IEC Regulation relating to vessel electrical equipment system

Original certificates shall be provided from Classification Society, manufacturers, national authorities as per rules, regulations and/or requirements and as usual or necessary accompanied by survey report where relevant.

The Vessel shall be registered under the flag of Marshall Island.

00-2.3 Certificate

The following certificates and documentation shall be obtained by the Builder and furnished to the Owner in 3 sets (one original and two copies) at the time of delivery of the Vessel.

When provisional documents are furnished at the time of delivery, the Builder shall furnish the formal documents as soon as practicable upon the delivery of the Vessel. The appointed class society shall confirm the delivery of all full-term certificates at an appropriate time.

(a) Provisional Classification Certificate issued by the Classification Society
(b) Builder's Certificate issued by the Builder
(c) International Load Line Certificate for the international voyage issued by the Classification Society
(d) Certificate of International Tonnage Measurement 1969 issued by the registered government or the Classification Society
(e) Cargo Ship Safety Equipment Certificate issued by the Classification Society
(f) Cargo Ship Safety Construction Certificate issued by the Classification Society

(g) Safety Certificate as required by SOLAS 1974 and all amendments

(h) Certificate as required by MARPOL 73/78, Annex I, IV and VI

(i) IOPP Certificate issued by the Classification Society

(j) Cargo Ship Safety Radio Certificate issued by the Classification Society

(l) Test certificate for Anchor and Chain Cable issued by the Classification Society

(m) Certificates for navigation light and magnetic compass issued by the assigned authority and magnetic compass adjustment and direction finder calibration issued by recognized Authority.

(n) SOPEP Manual (owner to submit ABS)

(o) Cargo Securing Manual (owner to submit ABS)

(p) P & A Manual (owner to submit ABS)

(q) Oil Recovery Operating Manual(owner to submit ABS)

(r) ILO 92 Accommodation Certificate (owner to submit Flag)

(s) Deratization Certificate (issued by shipyard)

(t) Asbestos-Free Certificate (issued by shipyard)

(u) Spark-Free Certificate for diesel engines exhaust gas silencer

(v) Tin-free Anti-fouling coating issued by Classification Society

(w) Lien free certificate/statement

(x) EIAPP certificate (Nox file Tier II)

00-2.4 Noise and Vibration

The Builder is to ensure that objectionable noise and vibration levels do not arise on the Vessel during normal operation, particularly in accommodation and service spaces in addition to the application of sound absorbent material. The Builder is to pay particular attention to avoiding resonance by choice scantling, alignment of bulkhead, fitting of acoustic barriers, etc.

The noise level will be according to the requirements of IMO resolution no. A 468/XII

Group No. 00-3
Principal Particular

00-3.1 Principal Dimension

Length overall	59.25 m
Length waterline	56.00 m
Length between perpendiculars	52.20 m
Breadth moulded	14.95 m
Depth moulded	6.10 m
Draft moulded	4.95 m

00-3.2 Complement

4 x 1 - man cabins	4 men
4 x 2 - man cabins	8 men
7 x 4 - man cabins	28 men
Total	40 men
Hospital	1 men

00-3.3 Tankage

Fuel oil	590 m^3
Fresh water	480 m^3
Water ballast/Drill water	400 m^3
Mud	530 m^3
Recovery Oil	750 m^3
Foam	13 m^3
Detergent	13 m^3

00-3.4 Performance

Deadweight @ 4.95m draft	1360 Tonnes
Gross tonnage	1690~
Deck loading	7.5 Tonnes/m^2
Clear deck area	370 m^2
Trial speed (100% MCR)	13.0 knots

00-3.5 Machinery

Main engine	2 x 2575 BHP
Propulsion system	Controllable pitch propeller
Generating set	2 x 350KW diesel driven
Shaft generator	2 x 800 KW via PTO
Bow thruster	1 x 8.0T controllable pitch type
Stern thruster	1 x 3.5T controllable pitch type
Fuel oil cargo pump	1 x 150m^3/hr @ 75m head
Fresh water cargo pump	1 x 100m^3/hr @ 75m head
Drill Water pump	1 x 100m^3/hr @ 75m head
Mud pump	2 x 75m^3/hr @ 75m head

00-3.6 Deck Machinery

Tuggers	2 x 10 tonnes @ 15m/min
Capstan	2 x 5 tonnes @ 15m/min
Deck Crane	1 x 3 tonnes @ 9m

Group No. 00-4
Test And Trial

00-4.1General

Tests and trials shall be conducted in accordance with the requirements of the Classification Society and other regulatory bodies and the marine practice.

The Builder shall submit to the Owner and/or regulatory bodies the detailed schedule or memorandum for the test items mentioned hereinafter in due time prior to those tests according to the Contract.

The Owner’s representative shall attend the inspections and tests as necessary if the Owner’s representative is unable to attend, such inspections and tests shall be performed in the presence of the Builder's inspector and/or Classification Society's Surveyor if required. The Builder may consider the inspections and tests completed and the results shall be submitted to and accepted by the Owner’s representative upon satisfaction of the attending party or parties.

In the event of defects or omissions for which the Builder is liable under provisions of the Contract being revealed by such tests or trials, the Builder shall be obliged to remedy same and if necessary, new tests or trials shall be carried out at the Builder's expense to establish that the Vessel or equipment, machinery has been completed in conformity with the contract.

00-4.2 Shop Test

The Vessel's machinery, equipment, fittings, construction and so on shall be tested or checked before installation on board the Vessel at the Builder’s yard or the sub-contractor's shops or the manufacturers' factories, etc., according to the requirements of the Classification Society and/or the Builder's Protocol for testing and commissioning and/or the manufacturer's and/or the sub-contractor’s standard test schedules.

00-4.3 Construction Test and Onboard Test

After the necessary tests are carried out at the Builder's yard, sub-contractor's shops or manufacturers' factories, etc., the Vessel shall be constructed and equipped with machinery, apparatus and fittings on board.

The construction, machinery, apparatus and fitting shall be checked and examined on board the Vessel to ensure that these are satisfactory for the purpose intended.

The items for which construction tests or onboard tests are necessary shall be inspected and/or tested according to the requirements of the regulatory bodies and the Builder's Practice.

The Owner’s representative and the Builder shall determine the scope of tests or inspections to be attended by the Owner’s representative on the basis of the Builder's Protocol for testing and commissioning schedule.

They shall also determine the extent to which the Owner’s representative shall accept tests or inspections on the basis of the Builder's subsequent reports the tests without his attendance on the tests.

After the main engine, auxiliary machinery and electrical equipment are install on board the Vessel and necessary piping and wiring are fitted, these may be operated prior to sea trials to confirm their satisfactory running.

00-4.4 Sea Trial

Upon completion, except for minor items of work, which may be left unfinished until the trials are over, the Vessel shall be subjected to the sea trial described below.

The sea trial shall be carried out by and at the expense of the Builder who is to provide necessary materials and services for the operation of the Vessel, during the sea trial.

00-4.4.1 Preliminary Sea Trial

Prior to official sea trial, a preliminary sea trial shall be carried out to check beforehand that main engine and auxiliaries are capable satisfactory running at the official sea trial.

The preliminary sea trial shall be conducted by the Builder's side only and according to the Builder's usual practice under suitable draft and schedule.

00-4.4.2 Official Sea Trial

The Official sea trial shall be carried out in accordance with the sea trial protocol schedule submitted by the Builder and approved by the Owner.

The Official sea trial shall be carried out at weather conditions not exceeding force 2 Beaufort Scale, in deep water, with clean hull and at ballast condition. The sea trial area to be Three Gorge and to be approved by Classification Society.

The trial to be inclusive of the following:

(a) Progressive Speed Test

The progressive speed test shall be executed under the following machinery load, on the measured course by using electrical instrument.

Main engine load	:	75% load of maximum output – one (1) double run
	:	90% load of maximum output – one (1) double run
	:	Maximum output – three (3) double run

The main engine load shall be determined by fuel rack and scavenging air pressure based on the figures recorded at shop test or as recommended by manufacturer. Record on fuel oil consumption at designated loads to be submitted to Owner.

(b) Endurance Test

The endurance test shall be carried out under the following conditions:

Main engine load	:	Maximum output (uninterrupted)
Duration	:	4 hours

Fuel consumption of main engine shall be measured for reference during the endurance test.

The time required for progressive speed test at maximum output shall be included in the above mentioned time for endurance test.

(c) Maneuvering Test

Following tests shall be carried out to check the maneuvering of the Vessel:

(1) Crash stop astern and ahead test
(2) Turning test with helm angle of not less than 35 degrees port and starboard (diameter of turning circle to be measured)

Main engine load:	
Crash stop astern test	From ahead, maximum output
Crash stop ahead test	From astern, about 80% of maximum output
Turning test	At ahead, Maximum Continuous Rating

Time and distance are to be recorded.

(d) Remote Control Test

The performance of remote control for propulsion plant shall be tested.

(e) Other Tests at Sea

The following tests shall be conducted according to the agreed testing and commissioning protocol at a proper time during the sea trial or in port, on a suitable trim and displacement:

(1) Steering test

To be performed at maximum output of main engine by steering control from the wheelhouse. Maneuvering time to bring the rudder from:

Midship to 35 degree starboard
35 degree starboard to 30 degree port
35 degree port to 30 degree starboard
35 degree starboard to midship

Time taken for the above trials shall meet Classification Society requirement for the supply vessel notation.

(2) Anchor test

Each anchor is lowered up to five shackles of chain cable under control of hand brake and hoisted by windlass.

Hoisting speed, electric current shall be measured.

(3) Gyro / Autopilot test

(4) Adjustment of gyro and magnetic compasses

(5) Tests or adjustment of other electrical navigation equipment and instruments

(6) Functioning test of bow/stern thrusters

(7) Functioning test of fire fighting equipment

00-4. 5 Light Weight Measurement and Inclining Test

Upon completion except for minor items of work, light weight measurement and inclining test of the Vessel shall be carried out by the Builder.

00-4.5.1 Light Weight Measurement

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

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

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

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

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

00-4.5.2 Inclining Test (for first ship only)

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

The inclining test shall be conducted by shifting weight and by appropriate means.
The test may be carried out in the Builder's dock, or in sheltered water near the Builder's yard.

Group No. 00-5
Standard, Material and Workmanship

All material, hull, machinery and equipment used in the construction of the Vessel are to be new and unused, of good commercial shipbuilding quality, suitable for the intended service, and approved by the Owner and the Classification Society if required. All major items of equipment, including items omitted from plans or Specifications, but which nevertheless are necessary for efficient operation of the Vessel in its proposed service, are to be from suppliers acceptable to the Owner.

All workmanship is to be of China Shipbuilding Standards and Classification Acceptable Standard or other agreed equivalent. Welding to comply with Classification Society.

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

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

All temporary construction equipment such as mounting lugs etc. is to be carefully removed by flame-cutting, re-welding and grinding flush and coated in accordance with paint manufacturer's recommendations.

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

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

All electric motors are to be of S.I. standard and according to IEC requirements.

The Builder is to ensure that all material, equipment and components delivered to his premises for use in construction or outfitting of the Vessel, and forming part of his Contract with the Owner, is to be officially logged into his premises and clearly identify.

All material and equipment are to be always accessible for inspection by Owner and, if considered necessary, to be moved to more secure or a better-protected environment shall any deterioration be apparent or considered likely to occur.

The Builder is to hold regular meetings with the Owner in order to report the building program progress relative to the Builder's outline program, Builder is responsible for ensuring that the Vessel is completed on time and according to the schedule.

Should slippage be apparent, the Builder is to increase his labor force or the number of hours worked, at his expense, until the lost time has been recovered and the program is back on schedule. The Builder is responsible for the performance of his sub-Builder, and shall be held responsible for all delays, deficiency or incompetence by them, to the Owner.

As regards to warranty of quality, the Contract document shall be referred to.

Group No. 00-6
Building Procedure

00-6. 1 Working Procedure

The Builder shall submit the principal design schedule and construction schedule to the Owner prior to commencement of construction and these schedules shall be kept with the cooperation of the Owner and the Builder.

00-6. 2 Plan

00-6.2.1 Working Unit, etc. Used in the Plan Working Procedure

"The plans" stated hereunder in the Specification shall mean those which shall be submitted to the Owner, such as the Contract plans, plans for approval, finished plans, instruction books, etc. All plans and other documents which shall be submitted to the Owner shall be written in English language.

The unit used in the plans shall be of metric units including finished plans for the Vessel's operation, such as hydrostatic table, capacity plan, deadweight scale, sounding tables. etc.

The graduation on gauge or meters on board the Vessel shall be in metric systems.

The instruction books shall be prepared in metric systems.

The plans including the finished plans shall be made in suitable scale and to be consistent according to the Builder's usual practice, and shall be in black line copy as a rule.

00-6.2.2 Plan for Approval

Prior to starting work, the Builder shall submit the specified working plans to the Owner and/or the regulatory bodies for approval in due time of design and construction schedules.

The list of the plans for approval shall be mutually agreed between the Owner and the Builder.

The list shall contain the following drawings, as minimum proposal:

1) General construction drawing (transverse frame sections)
2) Construction of the oiltight and watertight bulkheads and tanks
3) Construction of the main deck and above with girders and pillars
4) Construction of the forecastle deck with girders and pillars
5) Construction of ship ends with stem, stern and appendices
6) Construction of the deckhouse, wheelhouse, casings and funnels
7) Construction of the foundations of the diesel propulsion engine and auxiliaries generator in the machinery space
8) Construction of hawse pipes and chain lockers
9) Construction of the foundation of winches, gantries and deck auxiliaries
10) Construction of hatches, trunks, etc.
11) Construction of bulwark, railings, stairs, ladders, etc.
12) General arrangement plan of the engine room and bow thruster room, layout of engine room and bow thruster room floor and gratings
13) Diagrams of all piping systems (ballast, cargo, engine, etc.)
14) Diagrams and construction details of the propulsion, installations, remote control, etc.
15) Diagrams and building details of the pneumatic and hydraulic installations
16) The contraction drawings of the controllable pitch propeller unit
17) Arrangement of deck auxiliaries, hoisting gear
18) Arrangement and construction of masts
19) Plans with details of the paneling, linings, ceilings, floor converting and arrangements of the accommodations, stores, wheelhouse, etc.
20) Plans with details of natural ventilation
21) Drawings with details of the air conditioning and the mechanical ventilation systems
22) Arrangement of rescue boats and davits
23) Arrangement of gangway and platforms and accommodation ladder

24) Body plan with appendices
25) Hydrostatic and cross curve diagrams and calculations
26) Tank capacities with centers of gravity
27) Strength calculation
28) Tank testing plan
29) Docking Plan
30) Safety and fire-fighting plan
31) Single wiring electric diagram
32) Electrical load analysis (24 Volts DC, 415 Volts AC, 220 Volts AC)
33) Yard's standard (welding frames, manholes, portholes)
34) Emergency generator and electrical switchboard
35) Main switchboard
36) Short-circuit calculations
37) Piping insulation
38) Vent pipes filling and sounding pipe
39) Fire detection cabinet, location of heads and CO_2 piping schematic diagram of alarm devices, safety circuits, remote-control
40) Circuit breaker (justification of choice)
41) Navigation instruments (radar, radio positioning system, Echo Sounder, etc.)
42) Cathodic protection (zinc anode location)
43) Paint specification, etc.

When any other plans or technical information such as detailed working plans are requested by the Owner's representative in addition to the list of plans, the Builder shall show or submit them for reference.

The Builder's standard plans and the subcontractor's or the manufacturer's plans may be used as working plans or plans for approval.

00-6.2.3 Finished Plan (As Fitted Drawing)

At the time of delivery of the Vessel, the Builder shall furnish to the Owner with three (3) copies of each finished plan and three (3) copies of each instruction book.

The lists of finished plans shall be mutually agreed upon between the Owner and the Builder.

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

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

00-6.2.4 Manual

Three (3) sets of all manufacturer's instruction manuals and maintenance books, service manuals, spare parts lists and lists of agents are to be supplied to the Owner by the time of Provisional Acceptance with provision to stow one set onboard the Vessel.

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

00-6.3 Supervision

The Vessel shall be constructed and equipped in accordance to this specification and under the supervision of the Classification Society's Surveyor and the Owner's representative in compliance with the Builder's construction schedule.
Throughout the construction period and prior to delivery, the Owner's representative shall have free access to all premises of the yard or its subcontractor's where the Vessel or parts of it are being manufactured during normal working hours.

On the construction of the Vessel, the Owner’s representative shall negotiate the detailed matters directly with the relevant persons of the Builder, but shall discuss any important matter with the Builder's Surveyor about the matter as necessary.

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

Any request from the crew of the Vessel shall be submitted to the Builder after summarized by the Owner’s representative.

In case that opinion about the results of supervisions cannot come to an agreement between the Owner’s representative and the Builder's Inspector, they shall confer together with the Classification Society's Surveyor and the designer.

00-6.4 Delivery

When the Vessel has been completed ready for service, has passed the tests and had been certified as prescribed in the Specification, the Vessel shall be delivered to the Owner as per Contract.

00-6.5 Warranty

The Builder is to warrant the Vessel in accordance with Conditions of Contract. Builder shall submit to the owner detailed listing of the manufacturer (address, e-mail, fax no., telephone no. and mobile) and their worldwide agencies contact. Builder shall provide information on terms, coverage and the validity as well as expiry dates for all the equipment fitted on board.

00-6.6 Builder's/Contractor's Responsibility

(1) Builder to be responsible for the liaison between sub-contractors of equipment requiring interlinking to ensure proper Interfacing and compatibility of equipment.

(2) Builder alone to be responsible for the construction and quality of work for the ship. The fact that drawings and data have been shown to the Owners or approved by the Owners or their representative, does not relieve the Builder In any way from the above mentioned responsibility.

(3) During the building and outfitting of the vessel, Builder to exercise due care and diligence In the protection and the cleanliness at all times of equipment and pipework being Installed In the vessel. Particular care to be taken to protect equipment from dampness, dust Ingression, weld spatter, paint and general mechanical damage to owner's approval. Any damage to be made good to owner's satisfaction, at Builder's expense.

Group No. 10
Hull

Group No. 10-1
General

The hull including the deckhouse shall be built of mild steel, of good commercial shipbuilding quality. The steel shall be according to Specification and furnished with test certificate as required by Classification Society. The scantlings shall be designed in accordance with a draft of 5.10 m.

The hull is to be built with combination of transverse and longitudinal frame system. The superstructure shall be made of steel construction.

10-1.1 Transom Section

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

10-1.2 Engine Room

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

10-1.3 Floor and Bottom Construction

The Vessel shall be designed to have double bottom except aft/forepeak tank & steering gear compartment. Tanks for fuel oil, fresh water, dirty oil, sludge, oil, sewage, water ballast etc. are to be arranged as appropriate.
Inner floors and longitudinal girders of bottom construction with sufficient lightening holes (also for good access), limber and air holes are to be provided except where watertight or oil tight construction is required.

Shell plating, Frame, Bulwark, etc.

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

Deck Plating

Plating of decks is to be according to Classification Society's regulations and strengthened where necessary in way of windlass, winches, mooring bitts, etc. Stanchions of steel pipe shall be arranged for supporting decks only where necessary.

Bulkhead

Watertight transverse and longitudinal bulkheads are to be arranged. All bulkheads shall be fitted according to Classification Society rules and stiffened with profiles.

Bulkhead in Liquid Mud Tanks

Transverse and longitudinal bulkheads in liquid mud tanks shall be corrugated or plane type with stiffeners placed on the reverse side of bulkheads forming tank boundaries.

Steel Wall and Tank Below Main Deck

Steel walls, being well stiffened by profiles, shall be arranged for subdivision of stores and workshops as well as stair casings in lower compartments of hull.

10-1.4 Bow Section

The fore body shall have vertical stem and be built of steel plates, the fore body including stem shall be well stiffened.

Chain locker in fore body is to be provided into two compartments by a thick (15mm minimum) non-watertight bulkhead on the centre line with cut-in-steps.

Loose gratings of galvanized perforated steel plates of 25mm thick shall be arranged inside of the chain lockers and to have a minimum height of 600 mm above the bottom of the chain locker for good drainage.
The Chain lockers shall be arranged with bilge pipe and piping arrangement.

10-1.5 Superstructure And Deckhouse

Superstructure and deckhouse shall be of fully welded steel construction with transverse and/ or longitudinal framing. Pillars and girders are to be provided where necessary according to Classification Society regulations. Interior and exterior walls are to be well stiffened by profiles. For the inside structure, intermittent welding shall be applied.

10-1.6 Bulwark

Bulwarks, reinforced in way of mooring fittings, are to be fitted extending from corners of transom to aft of forecastle and to be made of 9mm thick steel plates with 140 x 35 x 9mm bulb plate welded on top of bulwark. Vertical stiffening of bulwark is to be provided by profiles welded on deck with doublers.

Height of bulwark is to be not less than 1000 mm.

Cargo-rails aft to be carefully faired down to main deck.

Stowage fittings are to be arranged for the rig discharge hoses as required.

Freeing ports to be arranged in main deck bulwarks with area to Classification requirements. All transitions in the bulwark top are to be made as smooth as possible to avoid snagging the tow line. Freeing ports to be lined with 14mm round bars.

10-1.7 Keel

A flat plate keel 14mm thick is to be fitted, connected throughout the length to the centre girder. It is to be tapered at the forward end to the stem and connected to the aft centreline skeg

10-1.8 Bilge Keel

Bilge keel made of 450mm x 16mm plate with 30mm dia. round bar and doublers shall be provided at amidships for not less than 1/3 the length of the Vessel on both sides at bilge shell.

10-1.9 Rudders & Rudder Trunks

Rudders to be conventional type.

10-1.10 Nozzles & Shaft Brackets

Two (2) fixed mild steel nozzles, with diameter suitable for Controllable Pitch Propeller, are to be fitted. Each nozzle is to be supported by two streamlined side brackets. The bottom structure of the hull in way of the nozzles will be stiffened by additional transverse and longitudinal members. Width of the wear ring to be 25% in excess of propeller sweep width at full pitch (weldment to be away from sweep area).

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

10-1.11 Fenders

Doubler plate to be welded to the forecastle plating between the deckline fenders as shown on the General Arrangement Plan.

'W' shaped vertical hollow rubber fender of 500mm x 350mm to be fitted at the bow as per the General Arrangement drawing.

Thirty-two (30) numbers and size of tyres (Dia. 1050mm x 450mm wide) are to be installed on shipsides. Lugs for installing the fenders to be fitted.

25mm diameter (min.) galvanized chain to be used to hold the tyres in position. Cut opening in the tyres to be reinforced with pipe of approximate size which to be held in to position by collar welded on both sides.

10-1.12 Kort Nozzle and Skeg

After testing, the Nozzle and skeg are to be filled with corrosion protection "Falchen" solution and drained.

Group No. 10-2
Deck Equipment and Outfit

10-2.1 General

All deck machinery and equipment are to be supplied and installed to meet Classification and Owner requirements as applicable.

All fastening materials, bolts and nuts which are exposed on the open deck shall be of stainless steel 316 materials, but excluding deck machinery.

10-2.2 Anchor and Mooring Equipment

Anchoring and mooring equipment shall be provided as per Classification Society Requirement.

The anchor chain shackles shall be marked.

10-2.2.1 Windlass

One (1) electro-hydraulic anchor windlass with two (2) cable lifter and two (2) warping drum is to be provided. Brake and coupling allowing independent operation of cable lifter and warping drum shall be arranged to suit the anchoring equipment to be installed at the upper forecastle deck.

Capacity : 9 tonnes at 12 m/min for 36mm dia. chain

10-2.2.2 Capstan

Two (2) electro-hydraulic capstans shall be installed at main deck aft (P & S), with pulling force of 5 tonnes @ 15m/min. and variable speed control to be located at main deck aft

10-2.2.3 Anchor and Chain

Two (2) bow anchors with high holding force together with shackle and stud link chain cable are to be installed in accordance with the rules.

For guidance, they are as follows:-

- Two (2) high-hold-type anchors, stowed in anchor-pockets, each of 1305 kg.
- Total length of 440M x 36mm / grade 2 stud-link-chain cables, divided to port and starboard side with swivel and shackle.
- Two (2) chain-stoppers, spindle compressor type

10-2.2.4 Bollard, Fairlead, Loose Mooring Equipment

Sufficient number of bollards and fairleads shall be provided.

- Mooring lines (polypropene) : 4 x 160M long mooring ropes of min. 132 KN breaking strength
- Tow line (polypropene) : 1 x 190M long towline of min. 338 KN breaking strength

10-2.3 Tugger Winches

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

10-2.4 Rescue Zones

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

- Each rescue zone shall not be less than 5 metres in length
- Each rescue zone shall be illuminated both on deck
- Bulwarks shall be either of the opening or removable type to allow open working area
- Scrambling nets shall 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 area will be no more than 1.8 metres, based on an operating draft of not less than 3.5 metres.
- Suitable securing points for scrambling nets, safety lines and rescue boat
- A clear access will be provided to the survivor holding area
- Rescue zone shall be cleared of any overboard discharge

10-2.5 Watertight Doors & Hatches

Hand operated watertight doors with clear opening of 700mm wide (Hospital door should be with clear opening of 800mm wide) if applicable are to be fitted as shown on the General Arrangement Plan. They are to be able to control from either side.

Watertight hatches are to be fitted on the main deck between bulwarks and cargo rail and one on fore deck, as shown on the General Arrangement Plan. All coamings are to be as per Loadline Regulations. Lids to be capable of being opened and closed from inside and outside.

Hatch covers to be counter-balanced if applicable for ease of opening from inside. Watertight door and hatches to be fabricated to ISO Standard.

10-2.6 Funnels

Two (2) funnels are to be arranged as shown on the General Arrangement drawing. A hinged weathertight 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 funnels together and act as platform for mounting and operating the fire monitors. Vertical ladder is to be arranged from wheelhouse top to this platform.

10-2.7 Masts

The main mast is to be fitted with brackets for the navigation lights.

Small portable tubular pole mast to be arranged at stern to carry the anchor stern lights, if required.

Masts to have rungs carried on top, arranged for access to light trays and necessary fittings. Safety cage of galvanized steel material to be fitted for high above 2.5M.

Blocks for aerials, yard arms and ensign staff to be fitted and sheaves for signal flags and shape hoists to be arranged on masts, as required.

Cable fastener, bolt, nuts, fittings, bar and steps to be of SS316 material.

10-2.8 Rails & Stanchions

To be fitted around wheelhouse top, bridge deck, forecastle deck and elsewhere, as indicated on General Arrangement Plan.

Storm rails of suitable design are to be fitted along passageway inside accommodation spaces.

Hand grips to be fitted in way of W.C.'s and showers and where required in way of manholes and vertical ladders.

Top rails to be 32mm galvanized pipe, middle and bottom rails to be 19mm diameter solid rod. Stanchions to be of 65mm x 12mm mild steel flat bar, spaced approx. 1800mm and welded to deck with doublers.

10-2.9 Towing Bollard

Bow towing bollard of SWL 40 tonnes shall be installed on the upper forecastle deck forward as shown on the General Arrangement Drawing.

10-2.10 Bollards & Mooring Posts

Double mooring bollards of heavy pipes are to be fitted on main and upper forecastle deck as shown in the General Arrangement. Rope eye on upper deck to be provided.

10-2.11 Manholes

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

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

Covers to bead-welded for identification and mark to indicate the fitted position.

Manholes for liquid mud tank shall be of 600mm dia. rounded and flushed type, located on the main deck.

10-2.12 Crash/Cargo Rail

Crash/Cargo rail of 250mm N.B. heavy pipes with I beam stanchion shall be provided on main deck (P&S) as shown on drawing.

Height of the cargo rail to be approx. 2500mm to top of pipe.

Six (6) off grinding rollers (3 on each side) to be arranged. Location of grinding rollers to be agreed upon by builder and owner.

10-2.13 Wooden Sheathing

Wooden sheathing of 75mm thick is to be fitted on aft main deck.

10-2.14 Deck Crane

One (1) unit marine crane to be installed on forecastle deck aft.

Load S.W.L.	: 3.0 tonnes
Minimum outreach	: 9.0 meter
Horsepower required	: 50 hp (approx)

Group No. 10-3
ACCOMMODATION

10-3.1 General

Accommodation spaces for crew and duty rooms shall be arranged to provide the comfort and space utilization. Special attention shall be paid to the rules and regulations concerning the noise level. Scheme of decoration together with colour for furnishing fabrics, plastic laminates, deck coverings, paints etc, shall be chosen by the Builder and submit to Owner for approval. Asbestos is never allowed to be used for accommodation materials. Builder shall provide information to all material used for the construction.

All fixed and loose furniture including mattresses, as described in the following specification are to be supplied and fitted by the builders.

All doors are to meet with SOLAS requirements and with baked enamel finished, hung on stainless steel hinges and fitted with stainless steel door fittings. Good quality deadlocks with three (3) labeled keys each are to be fitted to doors of all cabins, stores and other compartments throughout the accommodation. Chrome plated brass locks are to be fitted to all drawers, cupboards, lockers, stores and cold/freezer rooms.

All internal space to have a minimum clear height of 2.1 meters from floor to ceiling.

All door frames to have stainless steel wear plate at the lower station. All emergency exit door frame shall be colour coded.

10-3.2 Flooring Inside

10-3.2.1 Underlay

A minimum of 8 mm underlay shall be installed for area as mentioned in Clause 10-3.2.2. Insulation floor (fire-, noise-) shall be arranged according to rules and regulations.

10-3.2.2 Top Covering

Accommodation capt./chief engineer	Carpet
Accommodation officers	Carpet
Accommodation crew	Carpet
Public spaces	vinyl/PVC tiles
Alleyways, staircase	vinyl/PVC tiles
Mess rooms	vinyl/PVC tiles
Bridge	Knobbed PVC tiles
Galley	ceramic tiles
Laundry & changing room	ceramic tiles

All top layers are of type approval and to yard's standard; colours shall be approved by Owner.

10-3.3 Window, Door

10-3.3.1 Window

Steel framed type side scuttles and windows are to be arranged as per the drawing with appropriate thickness to meet the rules and regulation requirement. Curtains to be provided.

Rectangular windows to be fitted in wheelhouse. One (1) window with clear view screen is to be provided at wheelhouse forward. Three (3) windows with windscreen wipers, two (2) at wheelhouse aft and one (1) forward are to be provided together with fresh water washing nozzles.

10-3.3.2 Non-Ferro Door

One (1) door is to be provided at each side, port and starboard, of wheelhouse, with window, and to be made of marine aluminum alloy.

10-3.3.3 Fire Protection Door

Fire protection doors are to be supplied according to rules and regulations.

10-3.3.4 Interior Door

Interior doors of sandwich type according to rules and regulations shall be of steel sheet covered rockwool with plastic laminated finish on both sides. Fitting shall be out of chromium plated brass.

10-3.3.5 Master Key System

Master key system shall be installed according to international standard.

10-3.4 Partition Wall, Wall Lining, Ceiling

10-3.4.1 Partition Wall, Wall Lining

Partition walls, panels and wall linings in all crew's, public and duty rooms as well as on the navigation bridge shall be of sandwich type standard panels and all to rules and regulation requirements.

10-3.4.2 Ceiling

Acoustic type standard ceilings for deck heads shall be installed and colour shall be approved by Owner to meet the rules and regulation requirements. Panels finishing and choice of colours to be as per Owner's request and requirement.

10-3.4.3 Window Box

Window boxes are to be fabricated from GRP and painted. Drainage for condensation to be provided.

10-3.4.4 Insulation

Insulation (fire-, noise-, vibration protection) shall be applied to rules and regulations and international standard.

10-3.5 Furniture and Equipment for Wheelhouse

Wheelhouse to be equipped with all navigational instruments and electronics as specified elsewhere. Wheelhouse windows to be arranged to give maximum visibility all round. Wheelhouse arrangement drawing to be submitted to the Owner for approval. Two (2) combined steering and engine maneuvering consoles to be fitted, forward and aft.

In addition to navigational and electrical equipment, the following items shall be supplied and fitted in the wheelhouse :-

- Flag lockers c/w one (1) set of International Code Flags and National Ensign.
- Two (2) binocular boxes
- Stainless steel storm rails on consoles
- Chart table with drawers under and with save-all end slit on table top edge for the charts
- Chart table lamp with dimmer
- Radio operator's clock
- Two (2) Helmsman chairs with arm rest, upholstered, adjustable in height and with foot rest
- Book shelf and racks of sufficient size
- Upholstered settee, hat pegs, coffee table and coat hooks
- One (1) anemometer
- One (1) electronic horn

- One (1) 300mm diameter brass ship bell, engraved with the vessel's name, year of built and yard number, mounted at the starboard side bridge wing.
- Two (2) deck head mounted rudder indicators fitted above the aft and forward control consoles
- One (1) Quartz type battery clock
- Three (3) 2000W searchlight c/w remote controls
- One (1) Aneroid barometer
- One (1) inclinometer, bulkhead mounted type
- One (1) chronometer
- One (1) set Aidis signal lamp
- Two (2) sets hand leads
- One (1) attached toilet module
- Five (5) numbers of 220V power points
- One (1) set Engine telegraph

10-3.6 Furniture and Equipment for Living Quarter

10-3.6.1 Furniture and Fixture

Arrangement, design and size of the furniture shall be in accordance with the Builder's or manufacturer's practice and approved by the Owner.

In general, material for furniture shall be of chipboard, plywood or solid hardwood depending on piece of furniture.

Surfaces of chipboard and plywood furniture shall be covered with hard plastic laminates of wood colours (Reposal, Perstorp, Formica or equivalent).

Top of all desks, tables, and other exposed top surfaces shall be covered with hard plastic laminates of a cigarette and alcohol-proof type.

Fixed furniture shall be secured to deck or bulkhead. Provision is made to secure all portable furniture in rough sea.

For easy cleaning, sufficient space around the furniture shall be provided.

Fixed furniture shall be closely connected to bulkhead, floor and/or ceiling, in order to avoid small gaps and inaccessible areas.

Legs of furniture pieces shall be of metal, chromium-plated, plastic-covered, or painted and will be fitted with plastic caps.

10-3.6.2 Upholstery

Upholstery shall be supplied.
Mattresses shall be of foam plastics with spring.
Mattresses cover shall be of cotton.
Pillow shall be of foam plastics and covered with cotton.
Cloth for sofa and chair shall be of vinyl leather.
Stuff of seat for sofa and chair shall be of foam plastics.
Curtain shall be of fabrics with fire retarding properties and shower curtain shall be of plastics.
Curtain for windows facing bridge front shall be lined with light proof lining and all to have fire retarding property.

10-3.6.3 Hardware

Hardware shall be of chrome-plated brass in general.
Cylinder type locks shall be fitted for door of cabins, wardrobes and some of drawers in public space, living space, office space, etc.
Stick mortice type locks shall be fitted to the doors exposed to weather in commissary space, sanitary space, sundry space, etc.
Door lock for water closet shall be fitted with indicator.
Door stopper with hook shall be provided.
Coat and hat hook shall be fitted in each cabin and lavatory.
Each door lock shall be supplied with three (3) keys.

All keys shall be tagged.
Pad lock shall be fitted to all steel weather tight door.
A master key shall be supplied with three (3) spare keys.
Spare keys cabinet shall be located in the Captain's cabin

10-3.6.4 Accommodation

The accommodations shall be arranged for forty (40) ship's crew plus one (1) extra berths In the hospital and all to be arranged and fitted out as follows :-

All cabins shall be provided with T.V. and radio antenna socket

10-3.6.4.1 Captain's & Chief Engineer's Cabins

These two (2) cabins situated on upper forecastle deck as shown on the G.A. are to be fitted out identically as follows:-

- 1 built-in berth of 2000mm x 900mm x 150mm spring mattress with drawers and bunklight
- 1 desk with drawers and light
- 1 built-in upholstered sofa
- 1 built-in wardrobe c/w shelf, hanger rod and hooks with lifejackets stowage on top
- 1 upholstered chair
- 2 coat hooks on back of door
- 1 keyboard (Captain only)
- 1 quartz battery clock
- 1 intercom telephone
- 1 x 4 drawer steel filing cabinet with locks
- 2 x 300mm dia. scuttles with deadlight covers
- 2 power points 220/1/50
- 1 attached toilet module

10-3.6.4.2 One-Man Cabins

Two (2) one-man cabins situated on upper forecastle deck to be fitted as follows:-

- 1 built-in berth of 2000mm x 900mm x 150mm spring mattress with drawers and bunklight
- 1 desk with drawers and light
- 1 built-in upholstered sofa
- 1 built-in wardrobe c/w shelf, hanger rod and hooks with lifejackets stowage on top
- 1 upholstered chair
- 2 coat hooks on back of door
- 2 power points 220/1/50
- 1 attached toilet module

10.3.6.4.3 Hospital

One (1) hospital situated on the main deck and to be fitted as follows:-

- 1 built-in berths of 2000mm x 800mm x 150mm spring mattress with drawers and bunklight
- 1 desk with drawers and light
- 1 built-in wardrobes c/w shelves, hanger rods and hooks with lifejackets stowage on top
- 2 upholstered chairs
- 1 medical locker
- 2 coat hooks on back of door
- 1 quartz battery clock
- 1 x 300mm dia. scuttles with deadlight covers
- 2 power points 220/1/50
- 1 attached toilet module

10-3.6.4.4 Two-Man Cabins

Four (4) two-man cabins, situated on the upper forecastle deck and forecastle deck respectively are to be fitted identically as follows:-

- 1 x 2-tier berth of 2000mm x 800mm x 150mm spring mattress c/w bunklight, curtains, drawers under and ladder for the upper bunk
- 1 desk with drawers and light
- 1 built-in upholstered sofa
- 2 built-in wardrobes c/w shelves, hanger rods and hooks with lifejackets stowage on top
- 1 upholstered chair
- 2 coat hooks on back of door
- 2 power points 220/1/50
- 1 attached toilet module

10-3.6.4.5 Four-Man Cabins

Seven (7) 4-man cabins, situated on the forecastle are to be fitted identically as follows:-

- 2 x 2-tier berth of 2000mm x 800mm x 150mm spring mattress c/w bunklight, curtains, drawers under and ladder for the upper bunk
- Four (4) built-in wardrobes c/w shelves, hanger rods and hooks with lifejackets stowage on top
- 4 coat hooks
- 1 table/desk c/w drawers and light
- 1 upholstered chair
- 1 300mm dia. scuttles with deadlight covers
- 2 power points 220/1/50
- 1 attached toilet module

10-3.6.4.6 Attached Toilet Module for Cabins

Each toilet module is to be fitted identically as follows:-

- One (1) WC pedestal c/w seat and lid, toilet roll holder and grab rail
- One (1) shower cubicle with hot and cold F.W. supplies, grab rail, curtain, soap dish and separate scupper drains
- One (1) washbasin with hot and cold F.W. supplies
- One (1) mirror with tray and light
- One (1) tumbler and toothbrush holder
- One (1) towel rail
- Two (2) coat hooks
- One (1) extractor grille

10-3.6.4.7 Mess Room

One (1) mess room situated on the main deck as shown on the General Arrangement drawing is to be fitted out generally as follows:-

- Built-in upholstered settee(s) with stowage under
- Dining table(s) with formica top and edge fiddles
- Upholstered chairs or settees
- Wall and ceiling light with on/off switch
- One (1) clock, battery quartz type
- Four (4) 220/1/50 power sockets
- One (1) sideboard with drawers
- One (1) cold water fountain
- One (1) 10-litre hot water urn
- One (1) coffee maker
- One (1) colour T.V. 29” c/w CD player

- One (1) side board and cabinet

10-3.6.4.8 Engine Control Room

Engine control room is to be equipped with:-

- Main switchboard
- Machinery control console (MCC)
- Office desk
- Office chair
- 2 power points 220/1/50
- One (1) packaged air-conditioner

10-3.7 Service and Sanitary Area

In general, metal part directly contact with prepared food shall be of stainless steel and remainder of steel baked enamel.
Shelf and rack of hardwood or galvanized steel shall be provided suitably.

10-3.7.1 Galley

Galley is situated on the main deck and is to be fitted out as follows: -

- One (1) electric cooking range with 6 hot plates 415 V. AC. 3 phase and 1 oven (western type)
- One (1) electric water boiler (10 litres)
- One (1) refrigerator, not less than 290 liters
- One (1) freezer, not less than 250 litres
- One (1) dresser, stainless steel top and 2 deep sink
- One (1) cooking table, stainless steel top
- One (1) dish shelf
- Two (2) serving tables, stainless steel top
- One (1) set knives, forks and spoons for 26 persons (stainless steel)
- Two (2) kitchen knives
- Six (6) soup ladles (stainless steel)
- Two (2) choppers with handles
- Fifty two (52) tumblers
- Twenty six (26) dinner plates
- Twenty six (26) soup plates
- Twenty six (26) coffee mugs
- Six (6) coffee pots
- Six (6) tea pots
- Two (2) coffee boxes 2 liter capacity
- Two (2) sugar boxes 4 liter capacity
- Two (2) tea boxes 4 liter capacity
- Two (2) coffee mills
- Twenty six (26) coffee spoons
- One (1) 10 gal domestic electric hot water heater

10-3.7.2 Provision Room

Cool & Freezer Room

The cool and freezer room are to be situated as shown on the General Arrangement. They are to be cooled by a fully automatic refrigerating plant with seawater cooling pump. Deck, sides and deck head are to be insulated with foam plastic respectively. The internal finish will be covered by plywood with stainless steel for side and ceiling. Thickness and type of insulation are to be in accordance with the recommendation of the manufacturer for the refrigeration machinery and to the Owner's approval.

The door is to be stainless steel insulated door with door alarm connected to the wheelhouse and able to open from inside.

Freezer room to have self-defroster.

Temperature range - 18^{o}C for freezer room
+ 4^{o}C for cool room

Provision Store

Provision store shall be provided and equipped with shelves. The room capacity shall be sufficient for the period of fifteen (15) days.

10-3.7.3 Laundry

This compartment situated on the main deck and to be fitted out as follows:-

- Two (2) automatic10-kg. washing machines
- Two (2) dryers with extraction connected to outside of the compartment.
- One (1) stainless steel tub
- Two (2) ironing boards
- Two (2) irons
- Four (4) 2-tier steel cabinet
- One (1) attached toilet module
- Two (2) power points, 220/1/50Hz

Necessary shelve lockers for storage of laundry shall be provided.

10-3.7.4 Air Conditioning Room

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

10-3.7.5 Deck Store

The deck stores situated on various deck levels are to be fitted out with timber shelves on steel frames. Lightings and natural ventilation to be provided.

10-3.7.6 Bow Thruster Compartment

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

10-3.7.7 Engine Room

The engine room is to house the main engines, generators, pumps and compressors facilitate easy access for operation and maintenance. Machinery with exposed moving parts which constitute a potential danger to personnel shall be protected with screens, handrails or both. All wet and / or slippery areas shall be provided with non-skid walking surfaces.

Engine store shall be provided with bins or shelves, or other storage means.

4.5mm thick steel chequer floor plates fastened by stainless steel countersunk screws are to be laid.

10-3.7.8 Steering Gear Compartment

Steering gear compartment is to be fitted with necessary steering machinery. Sound powered telephone and gyro repeater to be fitted.

Mushroom head forced ventilator and communication are to be provided in this room and to meet rules and regulation requirement.

Rudder angle is to be shown by indicator plate on rudderstock.

10-3.7.9 Emergency Genset Room

The emergency genset is to be installed as per SOLAS.

10-3.7.10 CO_2 Room

Situated on the forecastle deck as per General Arrangement Drawing to store the CO_2 bottles and to be outfitted to meet the rules and regulation requirement.

10-3.8 Yard Supply Articles

10-3.8.1 General

The following items shall be supplied and installed on board the Vessel and shall be of suitable size and capacity:

- Clocks (for cabins, public rooms, wheelhouse, engine room, etc.)
- Hi fi Stereo, Video, VCD and TV set (for public rooms, captain room, chief engineer room)
- Refrigerators (for public rooms, captain room, chief engineer room)

10-3.8.2 Flag, Signal, Signal Light

Flag, signals and signal lights shall be in accordance with international rules and regulations, at least the following items shall be supplied:

- One (1) set ship's call flag
- One (1) blue peter
- One (1) quarantine flag
- One (1) pilot flag
- One (1) danger flag
- One (1) hand signal flag, red and white
- Six (6) national flags
- Two (2) sets of international flags
- One (1) daylight signaling light (portable type)
- One (1) ship's bell, 300 mm dia. (with ship's name and date engraved thereon)
- One (1) mechanical fog-horn (hand type)

10-3.8.3 Canvas Cover

All open deck equipment such as winches, signal lamp controller and etc. shall be covered with high quality water repellence canvas.

10-3.8.4 Carpenter's Utensil

Dimensions denote approximate size:

- Two (2) carpenter's chisel bevel edged 19 mm, hollow 13 mm
- One (1) gimlet
- One (1) sledge hammer 6 kg.
- Two (2) hand hammers 0.5 kg, 0.9 kg
- One (1) claw hammer
- One (1) large wood hammer
- One (1) axe
- One (1) hatchet
- Three (3) fids, 45mm dia. x 300 mm, 55 mm dia. x 380 mm, 60mm dia. x 460 mm
- Three (3) marine spikes, 20mm dia. x 200 mm, 25 mm dia. x 350 mm, 30mm dia. x 500 mm
- Two (2) serving mallets
- Two (2) serving boards
- Two (2) palms
- Four (4) rust hammers
- One (1) big scraper
- One (1) triangular scraper
- Six (6) scraper
- Two (2) hand steel brushes
- Two (2) squeegees

- Two (2) mops (linen type)
- Two (2) mops (sponge type)
- Two (2) coir brooms
- Five (5) paint pots, two (2) for 3 litres, three (3) for 2 litres
- Two (2) paint brushes with long handle
- Six (6) paint brushes, flat type
- Two (2) long tar brushes
- Two (2) crow bars, 25 mm dia. x 1200 mm long, 30 mm dia. x 1500 mm long
- One (1) shifting spanner
- Five (5) common spanners double head
- One (1) pliers
- Two (2) hand tin snips, straight pattern, circular pattern
- Four (4) screw drivers
- Five (5) scoops
- One (1) spade
- Three (3) sharpening stones, coarse, medium, fine
- Two (2) cork fenders, 600 mm dia.
- Six (6) rat guards for mooring ropes
- Two (2) oilers
- One (1) water funnel
- Two (2) hand saws
- One (1) lamp scissors
- Two (2) oil funnels
- One (1) oil measure, 3 litres
- One (1) bench vice
- One (1) hand grinder
- One (1) breast drill
- Two (2) spanners for sounding cap
- Four (4) spanners for bottom plug
- Four (4) spanners for side scuttle glass
- Two (2) sounding rods, four (4) folding type with wire rope
- Two (2) steel measuring tapes for sounding pipe
- One (1) can hook
- Two (2) bosun's chairs with block and halyard
- Two (2) paint stages for hull painting
- One (1) buoy strop
- Two (2) heaving lines for mooring
- Two (2) chain stoppers with turnbuckle
- Two (2) spare bottom plugs
- Three (3) spanners for man hole cover
- Five (5) spare glasses for side scuttle
- Five (5) spare glasses for square windows
- Four (4) steel blocks
- One (1) single sheave tackle
- One (1) double sheave tackle
- Two (2) wooden blocks (Single sheave)
- One (1) cargo hook (3 tons)
- One (1) shackle
- One (1) snatch block for mooring

10-3.8.5 Hose

Length of the following hoses shall be of suitable size:

- Four (4) rubber hoses for deck cleaning and washing
- Two (2) air hoses for miscellaneous use, with nozzle

10-3.8.6 Boxes and Sundry

The following items shall be supplied and/or installed at suitable locations with appropriate size:

- One (1) sand box

- Two (2) gear boxes
- Two (2) broom boxes
- Two (2) thermometer boxes
- Two (2) binocular boxes
- One (1) sounding board
- One (1) carpenter' chest
- One (1) scrap paper holder
- One (1) ink stand
- Four (4) black boards
- Two (2) notice boards
- One (1) ruler holder
- One (1) foot stool
- One (1) grating for steering wheel
- One (1) engine box
- Two (2) frame for general arrangement
- One (1) frame for capacity plan
- One (1) frame for bilge and ballast system
- Three (3) frame for fire control plan
- Three (3) frame for fire & boat station
- One (1) frame for safety certificate wireless telegraph
- One (1) frame for ship's certificate
- One (1) frame for radio certificate
- One (1) frame for safety construction certificate
- One (1) frame for safety equipment certificate
- Five (5) frame for life jacket instruction
- One (1) tonnage board
- Two (2) ship's name boards
- Two (2) notice boards for propeller
- Two (2) "navigators only" boards
- One (1) "no admittance" board
- One (1) notice board for radio station
- One (1) sailing notice board
- Three (3) log book holders
- One (1) paper holder
- Two (2) divider & pencil stands
- One (1) test tube stand
- One (1) canvas bucket for sea water
- In/out status board

SOPEP locker and equipment as per class requirements shall be furnished and installed.

Group No. 10-4
Material Protection, Labeling

10-4.1Cleaning, Derusting

10-4.1.1 Sand Blasting, Prime Coating

All steel surfaces shall be gritblasted to SA 2.5 and painted with a shop primer of an approved manufacturer. Before application of the first coating the area shall be cleaned, sharp edges shall be ground and damaged areas, welding seams, etc. shall be prepared as follow:

- Non automatic welding seams and worst heating tracks in underwater area are to be mechanically cleaned to SA 2 or SA 2.5 by gritsweep/wire brush or grinding disc
- All other outside areas shall be prepared by gritsweep/rotary wire brush to ST3
- All inner areas generally shall be prepared to ST 2

10-4.1.2 Conservation of Materials

A full strip coat of all welds, edges, drain holes, lighting holes and hard-to-reach areas shall be carried out prior to the application of the first coat. Any damaged areas shall be recoated with the full coating system.

All pipes, fitting and equipment contact areas shall be coated with the full coating system and to be inspected to the satisfaction of owner representative before commencement for installation of equipment, fitting and pipings. Dry film thickness (DFT), as specified, shall be interpreted, as the minimum required.

All coatings shall be applied in accordance with maker's standard requirements and approval. Before the commencement of application, the area/systems must be accepted by the Owner's representative.

Painting system shall allow vessel to operate for 3 years without docking.

The Builder is to prepare painting procedures and Specifications for the Owner's approval for guidance.

They are as follows:-

10-4.2 Paint Specification, External

Area	Dry Film Thickness
Bottom and boot top	
Epoxy	1x150 microns
Vinyl Tar	1x100 microns
Anti Fouling	2x 90 microns
Total	430 microns
Hull, topside	
Epoxy	2x125 microns
Polyurethane	2x50 microns
Total	350 microns

Hull, deck	
Epoxy	1x150 microns
Epoxy Topcoat	1x100 microns
Anti-skid	100kg
Total	250 microns
Superstructure etc.	
Epoxy	2x100 microns
Polyurethane	1x50 microns
Total	250 microns

10-4.3 Paint Specification, Internal

Area	Dry Film Thickness
Funnel Ext	
Epoxy	1x100 microns
Pionner Topcoat	2x40 microns
Total	180 microns
Funnel Internal	
Alkyd Primer	1x80 microns
Aluminium pain	2x25 microns
Total	130 microns
Internal Accommodation Space, Engine Room Bow Thruster Room, Steering Gear Compartment etc.	
Alkyd Primer	1x80 microns
Alkyd Topcoat	2x50 microns
Total	180 microns
Exhause pipe(steel)	
Alkyd Primer	1x80 microns
Alkyd Topcoat	2x50 microns
Total	180 microns
Exhause pipe(galvanized steel)	
Pure Primer	1x100 microns
Alkyd Topcoat	2x50 microns
Total	200 microns
Crash railing(steel)	
Alkyd Primer	1x80 microns

Alkyd Topcoat	2x50 microns
Total	180 microns
Fresh Water Tanks	
Solvent-free Epoxy	2x125 microns
Total	250 microns
Water Ballast/Drill Water Tanks, Liquid Mud/RO Tanks, Chain Lockers etc.	
Pure Epoxy	2x125 microns
Total	250 microns
Liquid Mud/RO Tanks	
High-build Epoxy	3x100 microns
Total	300 microns

10-4.4 Protection

Anode Protection

Sacrificial anodes according to a recognized system shall be fitted for external protection of hull, rudders, seachests, thrusters and propellers against galvanic corrosion.

Design lifetime: three years (minimum)

10-4.5Lettering, Labeling, Marking

10-4.5.1 Vessel's Name

Vessel's name and port of registration shall be made of steel plate continuous welding to the Hull and painted.

10-4.5.2 Draft Mark

According to the rules of the Classification Society, the mark shall be welded to hull and painted white.

Draft marks are to be in Arabic numerals at both sides with a distance of 10 cm and to be provided at midship, forward and aft. The draft marks are to be accurately located and to be marked by continuous welding.

10-4.5.3 Identification

Name Plates

Identification labels of brass with black engraved lettering, shall be arranged at all valves, sounding pipes, access hatches, outside doors, machinery, pumps, etc.

Identification labels of white plastic with black engraved lettering shall be provided beyond all inside doors as well as at control devices and electrical equipment. Name plates and signboards are to be in English Language.

Indication instruments and warning lamps shall be provided as per general practice.

Coloured Identification

All piping shall be painted white and marked with the following colour codes in compliance with international practice and as follows:-

1)	Bilge & Ballast		:	black
2)	Firemain		:	bright red
3)	F.W. System	Cold	:	blue
		Hot	:	blue with red band
4)	Fuel Oil		:	brown
5)	Lube Oil		:	yellow
6)	Hydraulic Oil		:	purple
7)	Sea Suction		:	green
8)	Sea Water Cooling		:	light green
9)	Compressed Air		:	grey
10)	Drill Water		:	Blue / black
11)	Cargo Fuel		:	Black/ brown/ black
12)	Liquid Mud		:	Black/ orange/ black

Galvanized pipes are to be etched-primed and then top-coated with colour codes.

Labeling of Piping Systems

Identification labels at all valves, pipes, machinery, pumps, etc. shall be according to necessary with English Language.

On deck and in engine room labels shall be secured with stainless steel 316 screws.

Group No. 20
Machinery

Group No. 20-1
Propulsion Plant

20-1.1 General Requirement

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

- One (1) Main Engine
- One (1) Controllable Pitch Propeller with nozzle

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

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

Acceptance, installation and calculation

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

The minimum life expectation of all machinery components according to part of this specification shall be observed.

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

The following ambient data shall be used for design and material selection purpose, otherwise the required ambient data is to be mentioned:

Air temperature 45 °C
Sea water 32 °C
For re-cooling of machinery, the system shall be done only by fresh cooling water, providing that the temperature complies with manufacturer's requirements
Air pressure 1000 mm bar

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

20-1.2 Main Engine

Two(2) Caterpillar 3516C, single-acting, four stroke, non-reversible, trunk piston type, marine diesel engines with exhaust turbo charging and charge air-cooled are to be provided. Complete engine cooling shall be provided by freshwater. Each engine is to be of electric-starting system.

Each engine to have 2575 BHP@1600rpm and is to be coupled to one (1) Controllable Pitch Propeller Unit via a reduction gear.

The engine shall comply with the latest IMO requirement for NO_x emission and shall be supplied with EIAPP certificate.

20-1.2.1 Cooling System

The cooling of engines is to be by fresh water cooling system and shall be done via heat exchangers as per manufacturer's recommendation.

20-1.2.2 Exhaust Gas System

The system is to consist of the following elements:

- Two (2) exhaust gas silencers, being able to suppress noise not less than 35 dBA and equipped with spark arrestor and suitable for oil field operation
- Exhaust gas supports to be provided by flexible suspensions

- Two (2) exhaust gas compensators, stainless steel construction, after turbo charger or where necessary
- Insulations to be equipped with galvanized steel sheet covering
- Drains

20-1.2.3 Power Take Off (P.T.O)

Each engine is to be provided with one (1) P.T.O at front end of about 650 KW to drive a fire pump via a step-up gearbox to match the RPM of the fire pump complete with Isolating clutch.

20-1.3 Reduction Gear

Two (2) Twindisc reduction gearboxes with built in hydraulics clutches shall be supplied. Gear ratio(7.59:1) is to match the engine speed for appropriate propeller rpm. Rotation configuration shall be made to ensure correct propeller's rotation direction.

20-1.4 Propeller and Shafting

20-1.4.1 Propeller

Two (2) sets of controllable pitch propeller.

Material : nickel aluminum bronze or equivalent
No. of Blade : Four (4)

20-1.4.2 Shafting and Sterntubes

Sterntubes shall be fitted with inboard and outboard Deep Sea Seal and to be oil lubricated. Two (2) sterntube oil tanks are to be fitted and arranged to feed each sterntube by gravity.

Forged steel tailshaft and intermediate shaft to be sized in accordance to rules requirements.

Forward and aft bearing to be of white metal make and intermediate shaft bearing to be of roller type. Bearing should have temperature alarm.

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

20-1.4.3 Maneuver and Control Equipment

- Engine control console in engine control room
  One (1) separate engine-maneuvering stand is to be provided and shall incorporated in control console which is to be fitted with instrument panels with all necessary temperature and pressure gauges, tachometer and etc. Emergency handling of main engines shall be provided according to Classification Society.

- Control consoles in bridge
  Forward and aft engine-maneuvering control console to be installed at the bridge and fitted with all required instruments. Main engines shall be controlled remotely by electrical power from the wheelhouse including all safety features for safe operation of the vessel from the wheelhouse.

- Manual joystick to be fitted.

20-1.5 Bow/Stern Thrusters

One(1) transverse bow thruster of approved make and type to be fitted with a thrust of approximately 8.0 tonnes.

One(1) transverse stern thruster of approved make and type to be fitted with a thrust of approximately 3.5 tonnes.

All thrusters are to be driven by an electric motor (B/T about 515 KW, S/T about 220kw) and complete with controllable pitch propeller, powered by electric power from shaft generators. Motor to be provided with temperature sensors.

Control of the thruster shall be from all control positions in wheelhouse combined with DP system.

20-1.6 Steering Gear

An electro-hydraulic steering gear of twin screw arrangement of sufficient torque operational is to be fitted in the steering gear room. System to be completely independent c/w 2 pumps.

The total turning time for 70^{o} helm angle is to comply to Class requirement for supply vessel.

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

Group No. 20-2
Auxiliary

20-2.1 Main Generators

The electrical power is to be supplied by two (2) Caterpillar C18 diesel-driven generators and two shaft generators. Each diesel generator in the engine room shall be driven by a water-cooled marine diesel engine. Starting of engines is to be electrical system. All accessories shall be in accordance with the Classification Society.

Shaft generators to be driven by gearbox integrated PTO.

Generator is to be designed for parallel operation. The cooling of engines shall be done by heat exchangers.

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

Diesel Generators	:	2
Voltage	:	415 V, 3 phases
Frequency	:	50 Hz
Output of each set	:	350 KW

Shaft Generators	:	2
Voltage	:	415 V, 3 phases
Frequency	:	50 Hz
Output of each set	:	800 KW

20-2.2 Emergency Diesel Generator

One (1) diesel-driven emergency generator with air-cooled radiator system and to be of electric-start type shall be provided in the Emergency Generator Room located on the main deck and to be readily accessible from the open deck.

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

The capacity of generator is to be sufficient to supply all emergency and harbour loads as required.

Output: 65 KW

Diesel oil service tank for the emergency generator set shall be fitted with high, low lead and cut off alarm is to be served by a electrical power pump. Should have drain pan and drain line.

Starting and stopping switch for the electric pump shall be located at the vicinity of the diesel oil tank in the emergency diesel generator compartment. Start/stop should near to the pump.

20-2.3 Fuel Oil and Lubricating Oil Pump

20-2.3.1 Fuel Oil Transfer Pump

Two (2) horizontal gear pump to be installed. Pump to have a cast iron body with carbon steel rotor and shaft. Pump to have a capacity of 10 M^3/hr against a discharge head of 20 M.

Pump is to be directly coupled to a 3 phase, 50 Hz, 415 volts motor and mounted on a common base plate.

Pump to have one (1) remote stop switch outside engine room. Should have local pressure gauge.

20-2.3.2 Dirty Oil Pump

One (1) dirty oil pump of 2 M3/hr at 29M head shall be installed. Waste oil pump is to be connected to shore line manifold at both starboard and port sides

20-2.3.3 Fuel Oil Purifier

One (1) set of fuel oil purifier of self-cleaning and self-discharging type to be provided.

Capacity: to meet engine marker's requirement. Should have localized exhaust.

20-2.4 Water Pump

20-2.4.1 Bilge and Ballast Pump

The following ballast pump shall be provided:

- One (1) self-priming ballast pump of electric motor-driven type
- Capacity: 75 m^3/h at 40M head
- Suction and discharge pressure gauges to be provided.
- Casing : Cast Iron
- Shaft : Stainless steel
- Impeller: Bronze
- Provided with strainer.

The following bilge pumps shall be provided:

- One (1) self-priming pump of electric motor-driven type.
- Capacity: 75 m^3/h at 40M head
- Suction and discharge pressure gauges to be provided.
- Casing : Cast Iron
- Shaft : Stainless steel
- Impeller: Bronze

The following ejector shall be fitted onboard:

- One (1) bilge ejector for chain locker
- Capacity: 5 m^3/hr

20-2.4.2 General Service & Fire Extinguishing Pump/Emergency Fire Pump

- A general service and fire main system to be provided with one (1) self-priming pump with connections to the following services:
- Fire hydrants
- Bilge ejectors
- Standby for : main engines, air-conditioning and refrigerating plant cooling.
- Capacity : 75 M^3/hr at 40M head
- One (1) electric driven emergency fire pump is to be arranged and located outside the engine room in accordance with the regulations
- Capacity 25 m^3/hr at 4.5 bar.
- Provided with strainer.

20-2.5 Supply and Drainage Plant

20-2.5.1 Freshwater/Seawater Hydrophore Plant

Freshwater Hydrophore Plant

One (1) freshwater hydrophore plant of 2 M^3/hr at 35M head complete with 1 KW motor, 2800 RPM, 415/3/50 and one (1) pressure tank of about 300 litres with maximum working pressure and pressure relief valve.

Seawater Hydrophore Plant

One (1) salt water hydrophore plant of 2 M^3/hr at 35M head complete with 1 KW motor, 2800 RPM, 415/3/50 and one (1) pressure tank of about 300 litres with maximum working pressure and pressure relief valve.

Hydrophore Plant Standby Pump

One (1) hydrophore plant standby pump complete with 1 KW motor, 2800 RPM, 415/3/50 with maximum working pressure 35M head with pressure relief valve and connect to freshwater and seawater systems as standby.

All Pumps are to have :
- Casing : cast iron
- Shaft - stainless steel
- Impeller - bronze

20-2.5.2 Freshwater Maker

One (1) set reverse osmosis type freshwater maker to be provided.

- Capacity : 5 tonnes/day

20-2.5.3 Sewage Holding and Treatment System

Sewage shall be treated in a self-contained compact sewage treatment plant in order to render it biologically harmless. The plant is to be suitable for 42 persons. Grease trap shall be provided in waste water pipe from galley, chloride discharge must below recommended limits acceptance to MARPOL requirement.

20-2.5.4 Oily Bilge Water Separator

One (1) oily bilge water separator, having capacity of 1.0 m^3/hr with oil content less than 15 ppm, is to be provided with matching capacity pump. Using gravity technique to separate fuel through plate pack able to dissemble for cleaning with oil content and bilge alarm to monitor the unit, according to MARPOL Standard.

20-2.5.5 Central Water Heating System

One (1) set of central water heating system c/w 300 liter tank and circulating pump to be provided.

20-2.6 Machinery for Cargo System

20-2.6.1 Mud Pump for Liquid Mud (S.G. 2.5)

Two (2) mud (liquid mud) discharge pumps of 70 M^3/hr @ minimum 75M head pressure. Either pumps can be used as circulation pump. Pump to be centrifugal type or equivalent. RPM shall be less than 1500 rpm. Two (2) remote control emergency stop switches shall be provided, one in the wheelhouse and the other on main deck.

20-2.6.2 Fuel Oil Cargo Pump

One (1) gear pump or equal to be provided, having a capacity of 150 M^3/hr at 75M head. Two (2) remote control emergency stop switch to be provided, one (1) in the wheelhouse and the other on main deck.

20-2.6.3 Drill Water Pump

One (1) self-priming centrifugal pump to be provided, having a capacity of 100 M^3/hr at 75M head. Two (2) remote control emergency stop switch to be provided, one (1) in the wheelhouse and the other on main deck.

20-2.6.4 Fresh Water Cargo Pump

One (1) self-priming centrifugal pump to be provided, having a capacity of 100 M^3/hr at 75M head. Two (2) remote control emergency stop switch to be provided, one (1) in the wheelhouse and the other on main deck.

20-2.6.5 Flow meter

Cargo F.O. F.W. and drill water flow meters with local read-out and to include remote indicator and printer on bridge.

20-2.7 Engine Room Construction and Inventory

20-2.7.1 Flooring in Engine Room

Floor plates are to be of steel chequer plates with minimum thickness of 4.5 mm, and shall be laid on a welded steel angle bar substructure.

20-2.7.2 Stair, Ladder, Railing in Engine Room

All designs and constructions of the above mentioned items are to be made according to rules and regulations as well as Classification requirements.

20-2.7.3 Funnel Arrangement Inside

Exhaust gas pipes shall be fastened by elastic holders and insulated with calcium silicate or equivalent and finished with galvanized sheet according to regulations.

20-2.7.4 Lifting Lugs in Engine Room

Lifting lugs suitable for use of chain blocks are to be fitted at the following positions:

- One (1) trolley beam above each main engine c/w sliding chain block
- One (1) point above each gearbox
- Two (2) point above each intermediate shaft
- Two (2) point above each generating sets
- One (1) point above each Fi-Fi pump
- Two (2) point on the outside of the hull and adjacent to each propeller
- Two (2) point on the outside of the hull and adjacent to each rudder
- One (1) point above each rudderstock on the underside of main deck

Group No. 20-3
Piping System

20-3.1 General

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

Bilge, scupper, fresh water, cargo lines and fire lines to be hot-dipped galvanized.

Fluid pipes are not allowed to be laid above switchboard or distribution board. Screens to be arranged where fuel oil and lube oil pipes are laid on hot area if required.

Before starting up of any system if required, should be inspected and cleaned prior to sea trials and be satisfactorily inspected by the Owner representative.

20-3.2 Material

The material for different systems are specified as below:-

A) Pipe Material List

System	Size (mm)	Pipes	Flange
Exhaust gas	400 & above 400 below	Steel built-up 6mm thick Welded steel, slip-on	Steel plate JIS 5K
Compressed air 25 kg/cm^2 & above	All sizes	Seamless steel Sch 40 galvanized	JIS 30K welded type
Compressed air 10 kg/cm^2 below	All sizes	Seamless steel	JIS 10K
Lubricating oil	All sizes	Seamless steel	JIS 5K
Air vent & sounding	All sizes	Seamless steel Sch 80 galvanized Seamless steel Sch 40 for air vent of fuel tank in double bottom	JIS 5K
Fuel oil suction, filling, transfer & purifying & other low press piping	All sizes	Black pipe	JIS 5K
Cooling sea water	All sizes	Seamless steel Sch 80 galvanized	JIS 5K
Sea water services fire & wash deck	All sizes	Seamless steel Sch 80 galvanized	JIS 5K or 10K
Cooling fresh water	All sizes	Seamless steel Sch 40	JIS 5K
Sea main, bilge & ballast	All sizes	Seamless steel Sch 80 galvanized	JIS 5K
Quick closing system	All sizes	Stainless steel 316	

System	Size (mm)	Pipes	Flange
Fresh drinking and sanitary water	All sizes	Seamless steel Sch 40 galvanized	JIS 5K
	All sizes	Copper in accommodation	JIS 5K Copper flange or union coupling or sleeve joint
Fire-fighting pipe	All sizes	Seamless steel Sch 80 galv'd	JIS 16K
Hot water line	All sizes	Copper in accommodation	Copper flange or union coupling or sleeve joint
	20 & below All size in accommodation	Copper	JIS 5K Copper-flange or union coupling or sleeve joint
Soil and waste water drain pipes	All sizes	Seamless steel Sch 80 galvanized	JIS 5K sleeve joint
Gauge pipes	All size	Copper	Union joint
Sludge and other drain pipes	All size	Seamless steel SPP galvanized	JIS 5K
Hydraulic pipe	12mm & below	Stainless steel 316L	Square flange

B) Valve Material List

System	Size (mm)	Nominal Press (kg/cm^2)	Bodies	Mounting
Compressed air 25 kg/cm^2 & above	32 & over	30 30	Cast steel flanged	Stainless steel
	25 & below	30	Forged steel flanged	Stainless steel
Compressed air kg/cm^2 below	50 & over	10	Cast iron flanged	Bronze
	40 & below	16	Bronze flanged	Bronze
Lubricating oil	50 & over 40 & below	5 5	Cast iron flanged Bronze flanged	Bronze Bronze
Fuel oil suction, filling transfer purifying other low press piping	50 & over	5	Cast iron flanged	Bronze
	40 & below	5	Bronze flanged	Bronze
Fuel oil line press pipings	40 & below	16	Bronze flanged	Bronze
Cooling sea water and cooling fresh water	50 & over	5	Cast iron flanged	Bronze
	40 & below	5	Bronze flanged	Bronze
Bilge, sludge, fire main and ballast	50 & over 40 & below	5 or 10 5 or 16	Cast iron flanged Bronze flanged	Bronze Bronze
Sea suction over-board discharge attached on shell	50 & over	5	Cast steel flanged	Bronze
	40 & below	5	Bronze flanged	Bronze

and sea chest

Gauges, instruments and other small pipe of 12mm & below:

Compressed air ($30\ kg/cm^2$)	30 for pipeline	Screwed or union ended bronze cock	
All other system	16	Bronze screwed or union	Bronze

20-3.3 Vessel Service Piping System

20-3.3.1 Bilge and Ballast Piping System

Bilge and ballast pipes are to be of steel pipes and galvanized after welding. The ballast system is to be provided for filling and discharging of tanks as well as trimming.

The bilge system is to be arranged with valves, strainers, mudboxes, manifolds and pumps in accordance with the piping drawing to meet the classification requirements. Suctions are to be fitted to the following compartment.

Bow thruster room
Engine room
Steering gear room
Tunnels
Void tanks

Filling, suction and sounding are to be fitted to tanks as indicated in piping drawings.

Docking plugs to be flushed with external shell plating and marked on the bottom plate outside with weld beads. Two (2) docking plug spanners to be supplied.

The chain locker bilges are arranged to be pumped out using eductor system.

20-3.3.2 Fuel Oil System

The ship's fuel oil bunkers are to be arranged as shown on the General Arrangement Plan, with one bunker arranged as an overflow tank.

Fuel oil filling connections to be arranged port and starboard on the main deck.

The oil fuel piping to be arranged so that the transfer pump may draw from any of the bunker and discharge to the daily service tanks.

Fuel lines to be led to just above tank top.

A spring loaded draw-off cock to be fitted to daily service tank. Drip tray with drain line to dirty oil tank to be fitted underneath.

Daily service tank to be fitted with sightglass as per class requirement and air/overflow pipe led into a common main, as far as practicable, which is to discharge into the overflow tank. Each tank shall be fitted with high and low suction and drainage at the lowest point of the tank.

A single air pipe is to be arranged to the overflow tank and is to be terminated under the forecastle deck bulwark with gooseneck with float ball vent and stainless steel flame arrestor screen.

Drip trays of sufficient coaming height to be fitted in way of pumps and strainers, and drained to dirty oil tank.

All drain from drip trays to be drained to save-all tank. Emergency shut-off fuel oil valves with remote pneumatic or hydraulic operated closing devices for all oil valves are to be provided as per Rules and Regulation.

Primary F.O. filters/water separators acceptable to Class are to be Installed for the main and auxiliary engines.

20-3.3.3 Air, Filling and Sounding Pipe

Air pipes for drill water, fuel and lubricating oil tank(no need galvanized) etc. shall be galvanized.

Ventilation head for fresh water to be provided with S.S. insect screen and for fuel oil with S.S. spark-arresting gauge (heavy and fire type).

Filling connection is to be with flange closures. Sounding pipes shall be of welded type with closure devices. Filling connection for fresh water and fuel oil shall be equipped at port and starboard sides.

20-3.3.4 Sanitary/Fresh Water System

The domestic fresh water system is to be supplied from a hydrophore unit and equipped in accordance with general practice.

The system shall supply fresh water to galley, all attached toilet modules, washbasins and showers and consists of the following:-

One (1) sanitary fresh water pressure tank.

One (1) 10-litre electric hot water heater to be provided for the galley. Fresh water supply to the galley and mess room shall be filtered and sterilised (U.V.) before consumption.

Fresh water pipes are to be of copper or galvanized steel.

The toilet flushing system for all toilet modules shall be supplied by the S.W. sanitary system.

20-3.3.5 Drainage and Scupper (Sanitary)

All scuppers and drainage pipes shall be galvanized steel pipes.

Inside scuppers shall be provided with water seals and shut off device.

Overboard-discharge shell penetrations are to be of galvanized steel with gate valves and non-return flaps.

20-3.3.6 Chain Washing

Chain washing system with wash nozzle for each hawse pipe to be provided, stop valves shall be provided on each chain wash line and operated on the exposed deck.

20-3.3.7 Hydraulic System

Pipes are to be of seamless black steel pipes with cutting ring connections. High pressure flexible hose of approved type to be provided where necessary and according to pipe schedule or as per 20-3.2.

20-3.3.8 Service Air System

The service air piping to be arranged with air compressor, air bottles, valves, and pressure gauges to meet classification requirements.

20-3.4 Cargo Handling System

The filling and discharge lines for vessel's cargo system shall have two (2) positions on main deck P&S midship.

The combined filling and discharge points on deck shall be colour coded and with the following sizes for various cargo:-

- Cargo fresh water - 100mm N.B.
- Cargo fuel oil - 100mm N.B.
- Cargo drill water - 100mm N.B.
- Liquid mud - 100mm N.B.

Deck termination shall be fitted with appropriately sized “Evertite” type quick coupling or equivalent. Butterfly valve (S.S.) to be fitted adjacent to the quick coupling.

20.3.4.1 Liquid Mud System

Two (2) tanks between tank top and main deck to be arranged for carrying liquid mud and brine with density up to 2,5 and with flashpoint above 60^{o}C. The tanks to be arranged with 600mm dia. flush-type manholes on main deck, air pipes etc. according to the rules.

For discharge of mud and brine, 2 off discharge systems to be arranged with one pump per system. The systems also to be cross-connected. The mud tanks also to be arranged for recirculation, using the discharge pumps.

Mud pipe system to be arranged with compressed air blowing from general service receiver. Mud systems to be arranged with loading filter, with bypass possibilities.

20.3.4.2 Fuel Oil Cargo System

The fuel oil system to be arranged with manifold for transfer between group of tanks in addition to discharge to deck.

20.3.4.3 Freshwater Cargo System

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

20.3.4.4 Ballast/Drill water System

BW/DW pump to be arranged with manifold as back-up for the FW cargo pump.

Group No. 20-4
Air Conditioning and Ventilation

20-4.1 Ventilation and Air Conditioning for Accommodation

Ventilation and air conditioning systems

Ventilation duct thickness and arrangements are to comply with Classification Society's requirements.

Ventilation and air conditioning systems in accommodation

The accommodation throughout the Vessel including the wheelhouse and hospital are to be served by a sea water cooled single duct air-conditioning system with central cooling.

The system shall be arranged for automatic operation and manual adjustment and to have 0-50% recirculation capacity, providing that the cooling unit shall be designed for 20% fresh air and 80% recirculation and to comply with the following conditions:

- For the seawater cooling water temperature not more than 36°C
- Recooled by shell cooler
- The air-conditioning system is to be designed for the following conditions:

Peak load
Outdoor: +45 deg C, 95% RH
Indoor: +28 deg C, 50% RH

High load
Outdoor: +35 deg C, 70% RH
Indoor: +22 deg C, 50% RH

One (1) central air handling unit shall be provided. Two (2) compressors, capable of handling Refrigerant R404A, each sized for 100% capacity and two (2) shell condenser (Bitzer or equal), each sized for 100% capacity to be provided. Independent SW cooling pump of adequate size and capacity to be provided for cooling of condenser. Toilet/shower, changing room, store rooms and other spaces shall not be served by the air-conditioning system but to be ventilated by forced ventilation and exhaust blower (with minimum 50Pa static pressure head).

The galley is to be provided with spot air-nozzle and separate ventilation. The hospital exhaust air shall not be re-circulated to the system.

Fire dampers to be fitted where necessary and to rules requirements.

One (1) additional split unit air conditioner having sufficient capacity to maintain the wheelhouse temperature below 25^{o}C when the main air-con unit not in operation, shall be provided.

20-4.2 Engine Room Ventilation

Air inlets and outlets shall be installed as per Classification requirements.

20-4.2.1 Engine Room Ventilation

Main and auxiliary diesel engines are to draw combustion and cooling air from engine room. The engine room is to have two (2) separate electrically driven main fans, each to have 50% required capacity. One of them is to be reversible. The fans to have sufficient capacity of 40 air charge per hour as per Rules and to maintain a minimum 50Pa static pressure head in the engine room.

Natural exhaust shall be provided via funnel.

20-4.2.2 Ventilation of Technical Room

Bow thruster room, CO_2 room stores each shall be equipped with one (1) exhaust ventilator of ample capacity.

20-4.2.3 Ventilation and Air-conditioning for Engine Control Room

The engine control room is to have independent air condition unit with sufficient capacity.

20-4.2.4 Refrigeration

Two (2) refrigeration compressor capable of handling R404A, each sized for 100% capacity and two (2) shell condensers (Bitzer or equal) each size for 100% capacity to be provided.

Independent SW cooling pump of adequate size and capacity to be provided for cooling of the condenser.

Group No. 20-5
Fire Fighting System

20-5.1 EXTERNAL FIRE FIGHTING

External fire fighting system is to be as generally stated below and is required to meet FFV Class 1.

20-5.1.1 Fire pumps

Two (2) seawater pumps each 1500 m^3/hr at 14 Bar. Each pump to be driven by main engine front PTO.

Independent sea suction and piping system for each pump. The pump casing to be cast iron, shaft acid proof steel & impeller of Al-Bronze.

Capacity	:	1650 m^3/hr
Head	:	12 Bar
Pump speed	:	1800 Rpm
Power absorbed	:	about 743kw
Driver power	:	Maker requirement

20-5.1.2 Fire Monitors (water/foam)

Two (2) units water monitors (one with double barrel for foam discharge). Remote control from the wheelhouse.

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

Capacity water/foam	:	1200 /300m^3/hr
Inlet pressure	:	10 bar
Throw length	:	120m
Reaction thrust	:	15 KN about
Swivels and swivel	:	Bronze
Barrel	:	Acid proof steel, according to requirement for FFV Class I vessel.
Throw height	:	50m measured vertically from sea level assuming a mean impact area located at a horizontal distance not less than 70 m from nearest part of vessel.Horizontal and vertical movement with limit stops restricting monitor discharge on any part of the vessel.

Foam shall be introduced to the monitor from branch pipe directly and expansion in the foam barrel for application.

20-5.1.3 Monitor control

The monitor remote control system consisting of the following:

- One (1) main control panel – logic for operation of monitors.
- One (1) joystick panel for installation in wheelhouse with the following remote functions

i) elevation and rotation of monitors.
ii) clutch in/out operation of fire pumps.

20-5.1.4 Deck Delivery Heads

Two (2) sets of 4-way 50mm delivery heads with instantaneious hose connections are to be fitted on main deck.

20-5.2 Fixed Water-Spraying System

The vessel is to be protected by a permanently installed water-spraying system consisting of a number nozzles fitted on all deck levels. The fixed water spraying system is to provide protection for all outside vertical areas of hull, superstructures and deck houses including foundations for water monitors and other equipment. The arrangement for the water-spraying system is to be such that necessary visibility from wheel house 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 sparying system is to have a capacity not less than 10 litres/min/m^2 of the area to be protected.

Drenching branch line for the main spraying system shall be provided with remote operated solenoid valve with control at the aft wheelhouse control console for controlling the supply to the wheelhouse during fire fighting operation.

20-5.3 Sea Chest

Two (2) independent sea chest for external fire fighting is to be fitted with suitable strainers in suction pipes.

20-5.3.1 Foam/Dispersant System (comply to FFV Class 1 Requirement)

Foam system to come with tank of 13m^3 capacity and foam monitor. Dispersant system to come with tank of 13m^3 capacity with two (2) Clustern nozzles at bow (P & S). Dispersant system to have proportional and metering devices.

20-5.4 Search Lights

Four (4) searchlights with remote under deck control are to be provided to comply with Classification requirements for operations at night. Add with localized control(electirc) on the wheel house console.

Group No. 20-6
Fire Extinguishing System

The fire-fighting and extinguishing equipment to be provided to meet Classification requirements.

20-6.1 CO_2-Fire Extinguishing System and Smoke Alarm System

Main engine room shall be protected by means of a "total flooding" fixed CO_2 central bank fire extinguishing system.

The required CO_2 amount shall be stored in CO_2 bottles. The CO_2 cylinders are to be stored in well-ventilated CO_2 room situated on the main deck.

The release of the system is to be made pneumatically from the release box, placed outside the protected space and in the CO_2 room.

The release box is to be provided with door switches for start of alarm and stop of ventilation and fuel oil system.

Automatic audible and visual warning is to be provided in the room and the alarm is to sound prior to any release of CO_2.

20-6.2 Firemain

A firemain and twelve (12) hydrants are to be installed, eight (8) on various deck levels, two (2) in engine room and one (1) in bow thruster compartment and one(1) in steering gear compartment..

15M class approved type fire hose c/w brass coupling and nozzle is to be supplied and stowed alongside each hydrant in a protective box.

All nozzles to be dual jet/spray type and incorporating shut-off type.

International shore connection is to be fitted.

All quick couplings to comply with BS304 requirements.

20-6.3 Fireman's Outfit

Six (6) complete sets (each contained in its own separate storage unit) of fireman's outfit are to be provided, comprising the following:-

- One (1) aluminum asbestos protective clothing
- One (1) breathing apparatus – oxygen tank and mask
- One (1) fireman's axe
- One (1) safety lamp of portable battery type
- One (1) set of gloves and boots
- One (1) length of lifeline

20-6.4 Portable Fire Extinguishers

Fire extinguishers as required by the classification requirements to be supplied and installed. For guidance, they are as follows:-

Position	Type
Wheelhouse	5 kg. CO_2 /dry powder
Forecastle deck accommodation	5 kg. dry powder
Main deck accommodation	5 kg. dry powder
Galley	5 kg. CO_2 / 9L foam
Steering gear compartment	5 kg. dry powder
Engine room	45 litres foam
	5 kg. dry powder

Bow thruster compartment	5 kg. dry powder
Mess room	5 kg. dry powder
Engine control room	5 kg CO_2 /dry powder
Store	5 kg. dry powder
Hospital	5 kg. dry powder
Laundry	5 kg. dry powder
Work shop	5 kg. dry powder

A complete set of replacement charges are to be supplied by builder.

20-6.5 Fire Blankets

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

20-6.6 Fire Axe

One (1) off

20-6.7 B.A. Recharging Compressor

One (1) electric driven Breathing Apparatus Recharging Compressor of capacity 75 ltr/min @ 200 bar to be installed to meet Classification requirement of FFV Class 1.

Group No. 30
Electrical

Group No. 30-1
General

30-1.1 General Installation

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

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

30-1.2 Power Supply

30-1.2.1 AC System

i) The electrical generation plant on board this vessel comprises:
2 x 350KW, 415V, 3 phase, 50 Hz alternator driven by auxiliary diesel engine
2 x 800KW, 415V, 3 phase, 50 Hz alternator, driven by gearbox connected PTO.

The auxiliary diesel engine driven alternator sets are able to run in parallel and continuously when required. The generator sets must therefore be suitable for parallel operation and must be completed with necessary control kits for parallel operation and load sharing in proportion to their capacity.

One (1) 65KW output diesel driven emergency generator to be provided c/w an independent day tank for at last 18 hours continuous running. Emergency generator to have sufficient capacity to cater for emergency lights, emergency fire pump, navigation lights, intercom system, navigation aids, fire detection and alarm system and aldis light for 18 hours.

ii) A 200A T.P. 415/3/50, 3 wire, W.T. shore supply box to be provided c/w circuit breaker, phase sequence indications, pilot lamp and connection terminals.

30-1.2.2 DC Supply (24V DC)

i) The 24V DC supply is to be obtained from 1 bank of 200AH, 24V DC regulated output transformer/rectifier with the input coming from the main switchboard.

ii) Two (2) bank 200AH 24V DC battery mounted on wheelhouse top to be provided and operated during the transition period of half an hour and to be connected automatically to the emergency switchboard on failure of main AC supply.

iii) 24V DC supply for the radio is to be obtained from 1 banks of 24V, 200AH batteries via the radio battery charging panel.

iv) Two (2) 40A, 24V DC output static battery charger to be provided.

30-1.3 Vessel's Wiring

Standard voltages are as follows:

- 415 V AC, 3 phases 3 wires : power machines
- 220 V AC : main lighting
  : small consumers
  : navigation equipment
  : emergency lighting
- 24 V DC : automation
  : command and indicator plant
- Frequency : 50 Hz

30-1.3.1 Cable Installation

Cables are generally to be supported by perforated galvanized steel cable tray and secured by a S.S. cable clips or similar. Where cables pass through weather tight bulkheads or deck, a W.T. type of cable sealing gland or compound is to be fitted.

All metal sheaths and armour of cable shall be electrically continuous and shall be earthed (grounded). Cables and wiring serving essential or emergency power, lighting, internal communications or signals shall, so far as practicable, be routed clear of galley, laundry, machinery spaces of category A and those of high fire risk area.

30-1.3.2 Cabling

All cables installed in the vessel are to be tinned copper conductors ethylene propylene rubber (EPR) insulated PVC sheathed, galvanized steel wire braided. Screened cable to be fitted where interference with navigation aids or radios are likely to occur. Compliance to IEC 3/3.

30-1.4 Electric Motor

In general, the electric motors for 415V are to be of squirrel cage type with totally enclosed fan cooled construction.

Group No. 30-2
Distribution

30-2.1 General

Mounted case circuit breakers are to be used in general for protection of feeder circuits. Circuit breakers shall be lockable in open position.

30-2.2 Shore Supply

Shore connection panel of 200A, and phase meter shall be included in the main switchboard via permanent cables, running from the shore connection box, placed on the main deck within the superstructure and connected to shore supply through watertight bulkhead opening.

The shore connection box is to include:

- Power Indicator Light
- Phase Indicator
- Circuit breaker
- kWH meter

30-2.3 Main Switchboard

The main switchboard is to be of free-standing type, steel framed and arranged for parallel running of generator sets.

Care is to taken to ensure that there shall be enough space between switchboard and any structure as per Classification Society's requirements for the easy maintenance of the switchboard.

Generator circuit breakers shall be operated electrically. A mechanical device shall be installed in each breaker and equipped with protections as per Classification Society's requirements.

The switchboard shall be provided with insulated handrails at the front as well as back. Care is to be taken for appropriate arrangement of switches, fuses, protections and control equipment to ensure ease of maintenance and operation.

One (1) rubberized sheet with 600mm width, 12mm thick and length equal to the length of the switchboard shall be provided.

30-2.3.1 Internal Cabling of Switchboard

Copper bars are to be used and arranged at the upper, rear part of the switchboard and also selected for the connection to the generators and power switches.

30-2.3.2 Operation

During the cruising, the electrical equipment shall be fed by the generator. In case of deficiency in using one generator, the stand-by generator is to be started automatically and take over that exceeded load.

The necessary arrangement shall be made to guarantee an uninterrupted operation of all essential consumers in case that the loads have to be taken over by stand-by generator.

Emergency diesel generator or shore connection box with 415 V, 3 phases, 50 Hz, shall feed the electrical equipment instead.

A circuit breaker shall be provided with interlock to prevent the parallel operation between generator and shore supply connection box at main switchboard.

The AC switchboard is to consist of the following controls and instrumentation for each alternator.

1) Air circuit breaker c/w current, reverse-power and short circuit relays.
2) Voltmeter c/w selector switch
3) Ammeter c/w selector switch
4) Kilowatt meter
5) Frequency meter
6) Voltage trimmer
7) Emergency push switch
8) Indicator lights
9) Governor switch
10) Synchronizing system
11) Earth test system
12) Load shedding system
13) Power factor meter

The following outgoing circuits are to be fed from the 415V & 220V bus-bars via plug-in moulded case circuit breaker.

1) Fuel oil cargo pump
2) Ballast & drill water pump
3) F.W. cargo pump
4) Air-conditioning plant
5) Ventilation fans
6) Thruster compartments ventilation fan
7) Steering gears
8) Marine electric range
9) Fuel oil transfer pump
10) Cold/Cool room plants
11) Bilge & ballast pump
12) Standby pumps
13) Dirty oil transfer pump
14) Hydraulic power packs
15) Sewage treatment plant
16) Pressure sets
17) Navigational aids (220V)
18) General lightings and power (220V)
19) Oily bilge water separator
20) Six (6) Nos. spare circuit breakers (415V & 220V)
21) Laundry equipment
22) Workshop - welding transformer
23) Reefer point for deck cargo, required six(6) points c/w sockets, three points at each port and starboard.
24) Spare breakers

30-2.4 Emergency Switchboard

The emergency switchboard shall be arranged in a similar manner as the main switchboard and shall be fed via a bus tie cable from main switchboard in normal operating conditions.

In the event of voltage failure to the emergency bus bars, the bus tie breaker on the emergency switchboard shall open on no volts. The emergency diesel generator is to start automatically and close its breaker onto the emergency switchboard.

The instrumentation and controls are to be provided as follows:

a) Battery charging switch
b) Moulded-case circuit breaker
c) Ammeter c/w shunts
d) Voltmeter
e) Indication light
f) Battery change-over contactor with stabilizer circuits
g) Testing facilities
h) Change-over switches x 2

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

a) Navigational aids
b) Emergency lights
c) Alarm (general, fire, CO_2, engines and low levels)
d) Navigational lights
e) Main engine & thruster instrumentation

An indicator to be provided in the AC main switchboard to indicate the transition battery on a discharge condition.

30-2.5 Distribution Panel

30-2.5.1 Distribution Board

All necessary distribution panels (DP) for power consumers and lighting to be according to regulations are to be installed.

Panels are to be of steel sheet construction, having proper mechanical protection as per Classification Society's requirements and shall be identified by an engraved plastic name plate.

Distribution boards are to be located base on their purpose.

The following distribution boards shall be provided:

- 415 V consumers
- 220 V consumers
- 220 V lighting
- 220 V emergency lighting
- 24 V DC consumers
- 24 V DC radio battery charging panel

All distribution panels shall be thoroughly cleaned by vacuum cleaner and inspected by owner's representative before installation, testing and commissioning.

30-2.6 Motor starter

All motor starters to be suitable for marine use and provided with single phasing, overload protection and running indication. The starters are to be of magnetically operated type.

In principal, all motors 15KW and under to be protected by direct-on-line starter. Motors between 15KW and 30KW to have Star-Delta starters, and motors over 30KW to be protected by auto-transformer starters unless otherwise specified by equipment manufacturers.

Group No. 30-3
Transformer and Battery

30-3.1 Transformer

Two (2) set of transformers are to be provided for lighting and etc. Any one of the transformers is to be able to supply all consumers.

Two (2) set of transformers are to be provided for emergency lighting and etc. Either set of the transformers is to be able to supply all emergency consumers.

30-3.2 Battery and Charger

Batteries are to be of valve regulated, lead-acid type for all services. Capacity of batteries is to be according to the rules.

Chargers are to be located as close as possible to the batteries.

Chargers shall be fitted with stabilizer at output to prevent power surges during changing over for charging and discharging.

Group No. 30-4
Lighting

30-4.1 General

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

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

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

30-4.2 Lighting for Accommodation

All cabins are to have ceiling light fitting, bed lamps, desk lamps, socket outlets. Mirror light with socket for shaving machine shall be mounted in cabins' bathroom/washstand.

Fluorescent light fittings are to be provided in all alleyways and stairs.

30-4.2.1 Bridge

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

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

Plug socket for daylight signaling lamp shall be provided.

Light at entrance to wheelhouse shall be automatically switched-off when door to wheelhouse is opened.

30-4.3 Lighting for Engine Room & Other Technical Room Below Main Deck

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

30-4.4 Lighting for Deck

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

30-4.5 Light and Signal Equipment

The Vessel shall be provided with equipment as follows:

- One (1) air horn
- Five (5) 500W floodlights (sodium halogen type)
- Three (3) searchlight 2000W on top of wheelhouse with remote under deck control
- One (1) daylight signaling light

- Navigation and signal lights consist of the following:-

  1) Three (1) masthead lights, dual len type

2) One (1) port light, dual len type
3) One (1) starboard light, dual len type
4) One (1) stern light, dual len type
5) One (1) anchor light, dual len type
6) Three (3) NUC light, single len type
7) One (1) complete set of immigration lights, single len type

All navigation lights are to be controlled by indicator panel fitted in the wheelhouse. Each navigation light is to be controlled and protected by double pole switch and fused on each conductor. Visual and audible alarm indicator is to be fitted,

30-4.6 Switches, Sockets & Switch Sockets

All switches, sockets and switch-sockets in accommodation are to be plastic cased and in the engine room and other machinery space are to be watertight and metal moulded. An adequate number of switch sockets to be provided in accommodation, galley, mess room, workshop and other machinery spaces for portable equipment.

Total two (2) numbers welding sockets of 415v for electric arc welding are to be provided one each at the following areas:

- Engine room
- Main deck

30-4.7 Reefer Sockets

2 x 220V, 1-ph and 4 x 415V, 3-ph reefer sockets are to be provided for the aft deck.

Group No. 30-5
Alarm and Control System

30-5.1 Monitoring Alarm and Control System for Machinery

The purpose of the alarm system is to provide warning and monitoring of important parameters on the main engine and propulsion as well as on the auxiliary equipment.

Proper method shall be provided to allow the operator to monitor the functioning of automatic control procedures and to resume manual control (overriding principle) at any time.

The control, alarm and monitoring system to be of modern design based on the Classification Society's requirements and including alarms as required by the engine manufacturer.

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

30-5.1.1 Extension Alarm System

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

The ECR panel is to be divided into 20 points including system failure.

Group alarm panels and extension alarm panels are to be including as following:

Engine control room	1 pc
Bridge	1 pc
Engineers cabins	1 pc
Messroom/dayroom	1 pc

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

30-5.1.2 Alarm Device

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

- General alarm
- Machinery alarm
- Fire alarm
- CO_2
- level
- Engine telegraph alarm

30-5.1.3 Engine Performance Monitoring

Performance monitoring consists of the following measurements :-

- Engines speed
- Fuel rate and temperature of engines
- Main engines, auxiliary engines

30-5.1.4 Remote Control System for Main Engines

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

The control from bridge wings shall be both forward and aft console.

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

30-5.1.5 Safety and Emergency Operation

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

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

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

30-5.1.6 Remote Indication

In the control room, remote indication are supplied as follows:

- Propeller speed 1 item
- Main engine speed 1 item
- Miscellaneous remote reading instruments as necessary

30-5.2 Fire Detection and General Alarm System

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

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

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

30.5.3 Main & Auxiliary Engine Instrumentation & Alarm

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

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

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

Group No. 30-6
Navigation Equipment

The equipment installed on board the Vessel shall be the latest design with an efficient layout of minimum manning.

All navigation equipment shall comply with the manufacturers' standard and meet the international rules and regulations

30-6.1 X-Band Radar (2 sets)

Two (2) X-Band Radar, with high resolution daylight display, unit scanner and interconnecting cable and accessories.One Range 96NM.One Range 72NM.

- Operation : DC 24 volts
- Make : Furuno / JRC

30-6.2 Echo Sounder (1 set)

One (1) navigational echo-sounding device to IMO requirement operating on a transmitting frequency of 50 KHZ c/w transducer, interconnecting cable, accessories, and recording paper. Depth readout to be in metres or feet.

- Operations : DC24 volts. Maker: Furuno / JRC

30-6.3 GPS Plotter (1 set)

One (1) global positioning system consisting of antenna and display unit.

- Operation : DC 24 volts. Make: Furuno / JRC

30-6.4 Gyro Compass (1 set)

Two (2) master gyro compasses clearly readable by the helmsman at the main steering position.
To be completed with three (3) gyro repeaters and an azimuth ring capable of obtaining compass errors.

- Operation : 220V AC, 1-phase, 50Hz and DC 24 volts.
- Maker : Anschuetz or equivalent

30-6.5 Magnetic Compass (1 set)

One (1) standard magnetic compass with reflector in front manoeuvring stand shall be installed on the wheelhouse top. Compatible azimuth mirror and deviation card not more than one year old to be provided.

- Maker : Saura or equivalent

30-6.6 Autopilot and Steering Gear (1 set)

One (1) auto-pilot compatible with gyro steering compass and synchronized to it. DC 24 volt operation.

- Maker : Anschuetz or equivalent

30-6.7 Weather Facsimile Receiver (1 set)

- 15 inch display and the built-in synthesized receiver is capable of setting up to 100 Spot memory frequency
- Picture can be recording in 16 level half-tone.
- Make : Furuno / JRC

30-6.8 Doppler Speed Log (1 set)

One (1) Doppler Log unit for indicating speed and distance through the water c/w transducer Unit, display unit, interconnecting cable and accessories.

- Operations : 220V AC, 1-phase, 50 Hz, Maker: Furuno / JRC

30-6.9 Auto Identification System (AIS)

One (1) AIS for providing information about ship (identify, type, position, course, speed, navigation status) to other ships.

30-6.10 Ship Security Alert System

One set SSAS to be provided.

30-6.10 Anemometer & Anemoscope Equipment

Two (2) units of wind speed & direction indication equipment c/w display unit. Each comprising of
one (1) solid state ultrasonic wind speed (with heating) and direction sensor
one (1) wind speed indicator in knot and beaufort scale
one (1) wind direction indicator in cardinal scale, 24V DC operation
one (1) wind sock on monkey island

30-6.11 Bridge Navigation Watch Alarm system (BNWAS)

One (1) set of BNWAS to be installed on board as per class requirements.

Group No. 30-7
GMDSS System

The GMDSS system installed on board the Vessel shall be the latest design with an efficient layout.

All communication equipment for GMDSS system for sea area A1+A2+A3 shall comply with the manufacturers' standard and meet the international rules and regulations.

30-7.1 MF/HF Transceiver (GMDSS)

One set Furuno Model RC-1500-1T 400W Rack Console System for A1-2-3 Areas, Operating 24VDC & AC110/220V. Comprising:-

A) Rack console for the following unit: 1unit
(Printer Selector/Distributor Box for L/L Data Blt-In)
1) Model FS-2570 250W – 1 set
400 CHS, 1.6-30MHZ Full Duplex/Semi-Duplex Synthesized SSB
Radio telephone with ATU and OPO5-57 Dynamic Microphone Kit.
2) Model DSC-6 MF/HF – 1 set
DSC (Distress Selective Calling) Terminal
3) Model AA-50 MF/HF – 1 set
4) DSC Watch Keeping Receiver
5) Model Felcom – 15 – 2 set
Inmarset-C Mobile Earth Station c/w VDU IC-115
Keyboard & 2 pcs IC-300 Distress Message Button
6) PP-510 printer – 2 sets
7) Std Spares for (1) to (6) above – 1 set
8) Std Installation – 1 set

Materials for (1) to (6) above including 30M ANT CBL for (5) 10m ATU/Control CBL for (1)

9) Operator Manual – 1 copy
10) Installation Manual – 1 copy

B) Furuno / JRC – 2 sets

Semi-Duplex GMDSS marine VHF Trans-ceiver with built-in DSC-8V for 24VDC operation comprising:
1) Transceiver unit – 1 unit
2) Handset w/hanger – 1 pce
3) Std Installation – 1 set
Materials (Antenna not included)
4) Std spare parts – 1 set
5) Operator Manual – 1 copy
6) VHF-DSC watchkeeping receiver – 1

C) AC Power Supply – 1 unit
Unit PR-850A with AC-DC Change-over facility.

D) AC Power Supply
Unit PR-300 with AC-DC Change-over facility.

E) BC-6151A-220 – 1pc
Battery charger

F) Antenna System – 1 set comprising:
   1) Marine Whip – 4pc Antenna f/VHF
   2) 2.6m RX Antenna – 1 set for AA-50
   3) Pre-Amp for DSC-60 – 1 pc
   4) Marine Whip – 2 pc Antenna f/SSB
   5) YA-212 Lead-in Insulator – 1 pc

Note: Item B & C shall be installed separately from console

30-7.2 Satellite EPIRB (GMDSS)

1 unit McMurdo Model E5
EPIRB with operator's manual and standard accessories.

30-7.3 2-way Portable VHF Radios (GDMSS)

3 units McMurdo / JRC
14CH (MAX.) GMDSS VHF Handheld Transceiver, each unit comprising:
   1) Main unit – 1 unit
   2) BP-1207 Battery – 1pc Pack
   3) Helical Whip – 1 pc Antenna
   4) Shoulder Belt – 1 pc
   5) Operator's Manual – 1 copy
   6) BP-1208 Lithium – 1 pc Battery for FM-8

30-7.4 SART

Two (2) search and rescue radar transponder (SART), 9 Ghz.
Maker: MCMURDO, Joltron or equal

30-7.5 Navtex Receiver (GMDSS)

1 unit Furuno / JRC 518khz Navtex Receiver for DC 10.8-40V operation comprising:
   1) Navtex Receiver – 1 unit
   2) Active antenna – 1 pc NX-5
   3) 2.6m Whip Antenna – 1 pc
   4) Std Installation – 1 set Materials
   5) Std spare parts
   6) Operator Manual – I copy

Group No. 30-8
External and Internal Communication

The following communication equipment shall be provided and/or Installed on board the Vessel and shall be of the latest design and meet with the International rules and regulations.

30-8.1 Public Address System (1 set)

- Public address system, self-supporting rack modules
- Not less than 50 W power output
- 2 stations speaker with talk-back microphone
- pedal control at aft console
- 1 master speaker with talk-back
- 2 speakers for corridor in accommodation
- 3 stations rain-proof and Intrinsically safe speaker with talk-back micorphone

30-8.2 Intercommunication System (1 set) – Auto Telephone

- Marine Intercom system, integrated automatic exchange and internal communication system
- 20 stations to be located as per the communication Table as 30-8.6

30-8.3 Self-Powered Telephone (1 set)

- Self-powered telephone, self energized or power supply
- Watertight unit for engine room and steering gear compartment . The engine room unit to be provided together with sound and light signals.
- 8 stations

30-8.4 Summary

The following communication table indicates various types of communication system, equipment and fittings to be provided In each compartment.

Communication Equipment

COMMUNICATION TABLE

Line No.	Location	P.A.	S.P.T.	Auto. Tel.
1.	Wheelhouse Aft Console Forward Console	* (#1) *	* (#2) -	* (#2) * (#2)
2.	EM'CY generator room	* (#8)	* (#4 #5)	* (#3)
3.	Captain's Cabin	* (#7)	* (#4)	* (#3)
4.	Chief Engineer's Cabin	* (#7)	* (#4)	* (#3)
5.	Mess Room/Galley	* (#7)	* (#4)	* (#4)
6.	Passage Way (Accommodation) Upper Forecastle	* (#7)		
7.	Passage Way (Accommodation) Lower Forecastle Detail	* (#7)		
8.	Engine Room	*	(#4, #5)	
9.	Steering Gear Room	*	* (#4,#5)	* (#4)

10.	4-Berth Cabins (7 units)	*		* (#3)
11.	2-Berth Cabins (4 units)	*		* (#3)
12.	Bow Thruster Compartment (1)	*		* (#4)
13.	1-Berth Cabin (4 units)	*		* (#3)
14.	Hospital	*		* (#3)
15.	Upper Forecastle Deck Aft	* (#8)		
16.	Upper Forecastle Deck Forward	* (#8)		

KEY:

#1 - Master Control Station – speaker

#2 - Console Mounted (Flush)

#3 - Desk Mounted

#4 - Bulkhead Mounted

#5 - To be supplemented with sound and light signals

#6 - To be supplied with acoustic booth

#7 - Speaker with talk-back microphone

#8 - Speaker with microphone or talk-back

* - Means to be provided

Group No. 30-9
Miscellaneous

The following items shall be provided and/or installed (where necessary) on board the Vessel.

- Dividers (brass) 2 pcs
- Parallel rulers (large size) 2 pcs
- Binoculars (7x50, field 7.3 degree or better) 6 sets
- Night-vision binoculars (4.5x, field 12 degree or better) 2 sets
- Magnifying glasses 2 pcs
- Station pointers 2 pcs
- Sextants 1 pc
- Stopwatches 5 pcs
- Chronometer 1 set
- Hygrometer 1 set
- Barometer 1 set
- Thermometer 1 set
- Writing utensils 1 set
- Navigation books (as necessary) 1 set
- Megaphones 2 sets
- Chart-weights 8 pcs

Group No. 40
Life Saving

Group No. 40-1
Life Saving Equipment

The following life saving equipment shall be provided on board the Vessel and shall be of the latest designed which comply with the manufacturers' standard and meet Classification rules and regulations.

40-1.1 Life Raft (to meet Class requirements)

- Inflatable life raft for 6x25 persons
- Double skinned canopy, inflatable floor and weathertight seal
- Provided with hydrostatic release, and in accordance with SOLAS standard

40-1.2 Life Buoy-Ring (8 sets)

- According with SOLAS standard
- Made from plastic or fiber
- Comply with grabline and reflective panels
- Launching device from wheelhouse quick release

40-1.3 MOB-Light Smoke Signal (4 sets)

- Light and smoke signal
- Automatic/manual emergency lifebuoy marker
- Orange smoke and two lithium battery
- The unit is to be constructed of corrosion-resistant materials and is to be fully weather protected until operated

40-1.4 Light Buoy Light (8 sets)

- Conform to SOLAS standard

40-1.5 Self-Contained Line Throwing Apparatus (4 sets)

- Conform to SOLAS standard

40-1.6 Parachute Distress Signal (12 units)

- Conform to SOLAS standard

40-1.7 Red Handflare Distress Signal (12 units)

- Conform to SOLAS standard

40-1.8 Smoke Signal (12 units)

- Conform to SOLAS standard

40-1.9 Lifejacket (44 sets)

- Synthetic type lifejackets with reflective tape, whistle and light, floatation foam (44 sets) and conform to SOLAS standard

40-1.10 First Aid Kit (1 set)

- Conform to SOLAS standard

Group No. 40-2
Rescue Equipment

The following rescue equipment shall be provided on board the Vessel and shall be of the latest designed which comply with the manufacturers' standard and meet the international rules and regulations.

40-2.1 Rescue Boat (1 set)

- Rigid fire-resistant FRP rescue boat
- Capacity to carry passenger, 6persons
- Power by outboard engines
- SOLAS approved rescue boat davit to be provided for launching of the rescue boat.

40-2.2 Air Breathing Apparatus (4 sets)

- Self Contained Air Breathing (SCAB) apparatus, lightweight pack and adjustable harness system
- Silicone full-face mask not less than 200-degree field of vision and a double revert seals
- A reducer-mounted connection is to be provided
- Provided one unit spare cylinder per each set

40-2.3 Immersion Suits

- Conform to SOLAS standard

40-2.4 Signage

- All safety signage and IMO symbols to be provided statutory and requirements.

Group No. 50
Spare Parts

Group No. 50-1
Spare Parts and Tools

Only spare parts and tools supplied as standard from makers of machinery and equipment are to be provided.

Appendix A DYNAMIC POSITIONING SYSTEM

1 General

The vessel shall be fitted with Dynamic Positioning System (DPS) in order to operate the vessel with improved weather tolerance for a minimum of 300 days in a year.

Fully operational DP system shall keep the vessel in position and working, such that the maximum excursion from vessel motions and position control system accuracy, shall be equal to, or less than, half the critical excursion for the work.

The DPS shall be installed to meet the DPS-1 class notation of ABS.

2 Basic System Hardware

It consists of a controller unit (K-Pos DPC-1) and an operator station (K-Pos OS). The controller unit contains a powerful control computer and I/O units to provide an interface to position-reference systems, sensors and various types of propellers, thrusters and rudders. The operator station contains a high-performance computer running Windows XP. A high-resolution colour flat-screen, approved for maritime operations, provides the main graphic display for presentation of data.

The Basic System hardware consist of
One (1) in no. K-Pos OS Operator Station – Built-in
One (1) in no. K-Pos DPC-1 Controller Unit..
One (1) in no. cWing Terminal Location: Portable between Bridge Wings (Owner's option)
Two (2) in no. cWing Connection Box Location: Both Bridge Wings (Owner's Option).

3 System Interfaces

Two (2) in no. Gyro Compass serial no. (NMEA-0183)
One (1) in no. MRU Analogue Input / Serial line (Kongsberg Maritime Standard)
Two (2) in no. Wind Serial line (NMEA-0183)
Two (2) in no. DGPS Serial line (NMEA-0183)
One (1) in no. Power system interfaces. Consisting off
Bus-tie breaker signals – Digital Input
Generator ready signals – Digital Input
Generator power signals – Analogue Input
Thruster breaker signals - Digital Input
One (1) in no. Bow Thruster Hardwired analogue and digital input signals.
Two (2) in no. Main Propellers & Rudders

4 Peripheral equipment

One (1) in no. Printer with Cable.
One (1) in no. UPS POWEC 3kVA
One (1) in no. Network Cable. totally 30m included, to be confirmed in approval drawing by yard.
Mode Selector Switch (3 positions)

DP Sensors
One (1) Motion Reference Unit MRU-D.

Optional DP Sensors
Two (2) Gill Ultrasonic Wind Sensor
Two (2) Gyro compasses

5 C-Joy Independent joystick system

One (1) in no. cJoy Operator Terminal .
One (1) in no. cJoy Controller Unit.