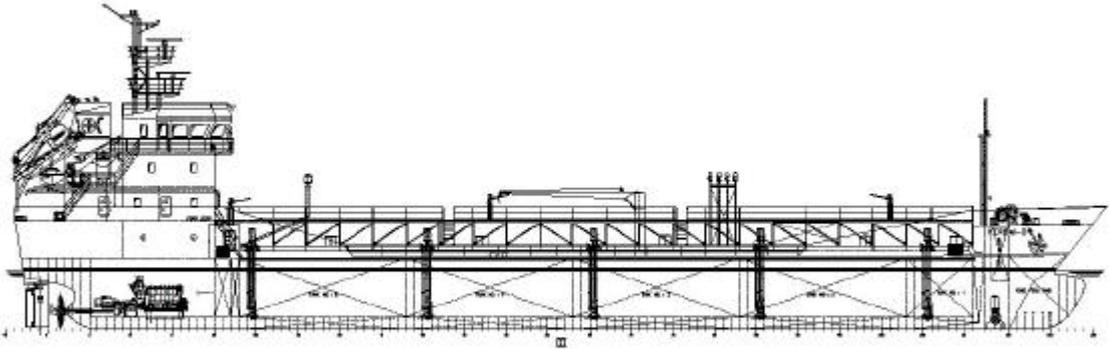


# M/T KEREM D



## PRODUCT/CHEMICAL TANKER TYPE II

### OUTLINE SPECIFICATION

-CT24-

TABLE OF CONTENTS:

---

- 000. - 099 DESIGN AND GENERAL
- 000. DESIGN CHARACTERISTICS
- 010. CLASS, RULES AND REGULATIONS
- 020. HULL REQUIREMENTS
- 025. SUPPLIERS AND SUPPLIES
- 040. GENERAL CONDITIONS
- 050. DOCUMENTATION
- 060. PLANS AND DRAWINGS
- 070. WORKING PROCEDURES
- 080. TESTS AND TRIALS
  
- 100. - 199. HULL STRUCTURE
- 100. SCANTLING AND MAIN CLASS PLAN
- 110. MATERIALS AND METHODS
- 120. FRAMING
- 130. BOTTOM CONSTRUCTION
- 140. SHELL PLATING
- 160. DECKS AND HATCH COAMINGS, IN GENERAL
- 180. MISCELLANEOUS STEEL STRUCTURE
- 190. SUPERSTRUCTURES AND DECK HOUSES
  
- 200. - 299. OUTFIT AND EQUIPMENT (HULL)
- 200. MARKINGS AND IDENTIFICATION
- 210. CLOSURES, ACCESS, PROTECTION (HULL)
- 220. RIGGING AND DECK FITTINGS
- 230. MOORING FITTINGS AND EQUIPMENT
- 240. SAFETY EQUIPMENT AND DECK EQUIPMENT
- 250. DECK COVERING, INSULATION, JOINER WORK
- 260. ACCOMMODATION FURNISHING
- 270. FURNITURE AND DECORATIONS
- 280. MISCELLANEOUS ROOMS
- 290. CORROSIONS PREVENTION AND PROTECTION
  
- 300. - 399. HULL ENGINEERING
- 300. VENTILATION
- 310. AIR-CONDITIONING AND HEATING
- 320. HULL PIPING SYSTEM
- 330. BALLAST, BILGE, DRAINING PIPING
- 340. FILLING, SOUNDING AND VENTING
- 350. SERVICE PIPING SYSTEMS
- 360. FIRE-EXTINGUISHING
- 370. DECK MACHINERY
- 380. STEERING GEAR AND MANOEUVRING MACHINERY

- 400. - 499. MAIN AND AUXILIARY MACHINERY COMPONENTS
- 400. MACHINERY GENERAL
- 410. MAIN PROPULSION MACHINERY
- 420. POWER TRANSMISSION SYSTEM
- 430. GENERATOR PRIME MOVERS
- 440. PUMPS - GENERAL
- 450. LIST OF PUMPS
- 460. COMPRESSORS AND AIR VESSELS
- 470. TREATMENT UNITS FOR LIQUIDS
- 480. BOILERS
  
- 500. - 599. OUTFIT AND EQUIPMENT (MACHINERY)
- 500. MARKINGS AND IDENTIFICATION
- 510. CLOSURES, ACCESS AND PROTECTION OF MACHINE
- 520. ENGINE ROOM OUTFIT AND EQUIPMENT
- 530. MAINTENANCE AND REPAIR FACILITIES
- 540. VENTILATION AND EXHAUST GAS SYSTEM
- 550. FILTERS AND STRAINERS
- 560. HEAT EXCHANGERS
- 570. ENGINE ROOM TANKS
- 580. TOOLS, SPARES, STORES
  
- 600. - 699. MACHINERY PIPING SYSTEMS
- 600. MACHINERY PIPING - GENERAL
- 610. COOLING WATER SYSTEMS
- 620. FUEL OIL SYSTEM
- 630. LUBRICATING OIL SYSTEM
- 640. COMPRESSED AIR SYSTEMS
- 650. MISCELLANEOUS PIPING SYSTEMS
  
- 700. - 799. ELECTRICAL PART
- 700. ELECTRICAL PART - GENERAL
- 710. ELECTRICAL POWER SUPPLY
- 720. ELECTRICAL DISTRIBUTION
- 730. ELECTRICAL POWER DEVICES
- 740. LIGHTING
- 750. COMMUNICATION
- 760. NAVIGATION
- 770. MISCELLANEOUS ELECTRIC EQUIPMENT
  
- 800. - 899. AUTOMATION
- 800. CENTRALIZED INSTRUMENTATION, GENERAL
- 810. MANOEUVRING CONSOLES, MAIN CONSOLES
- 840. SYSTEMS FOR OPERATION OF DIESEL

- 870. GENERATOR SETS  
AUTOMATION EQUIPMENT FOR OTHER MACHINERY  
COMPONENTS
- 900. - 999. CARGO SPACES AND CARGO HANDLING
- 950. CARGO TANKS AND ACCESSORIES

**000.-099. DESIGN AND GENERAL**

**000. DESIGN CHARACTERISTICS**

**001. Intent**

It is the intent of this Specification and associated reference to describe the construction of the vessel in question to such an extent that it will enable the builders to construct, furnish and deliver the vessel as intended.

Design, material, construction and equipment will be such as to provide for dependable, safe and economic operation of the vessel and expedient handling at minimum construction costs.

**002. Principal Dimensions**

Length overall	78.56 m
Length between perpendiculars	72.78 m
Breadth, moulded	10.45 m
Depth moulded	5.10 m
Draft scantling	4.27

m

**003. Deadweight and Drafts**

Deadweight measured in sea water, density 1.025 t/m<sup>3</sup>:

Deadweight all told on scantling draft approx. 1850 t

**004. Lightweight**

The lightweight includes:

- The empty ship completed and equipped, but without articles of consumption.
- Inventories, spare parts and reserve equipment that belong to the Yard's delivery and are intended to be carried aboard, except spare parts other that required by the specified rules and regulations.
- System liquids in machinery and pipes directly related to the machinery systems.

The lightweight of the ship is to be kept low by avoiding too heavy constructions and materials and overdimensioning.

**005. Capacities:**

Consumables and Water Ballast:

Marine diesel oil	91.8 m <sup>3</sup>
Lub. oil etc.	3.4 m <sup>3</sup>
Fresh water	55 m <sup>3</sup>
Water ballast	948.86 m <sup>3</sup>
Total capacity in Cargo Tanks (100%)	2204 m <sup>3</sup>
Deck cargo tanks (100%)	29.16 m <sup>3</sup>

**006. Speed and power:**

Speed on design draft (4.27 m) 11.5 knots

Conditions for trial speed calculations:

Unlimited water, no current, clean bottom, wind velocity and sea forces not exceeding Beaufort 2, sea water temperature of 15°C and specific gravity of water equal to 1.025 t/m<sup>3</sup>.

**007. Consumption and range:**

Corresponding main engine  
Consumption per 24 hours at 1140 KW approx. 4.5 t

Cruising range will be approx. 4,000 nautical miles without cargo heating.

**008. Accommodation**

Accommodation arranged and furnished as follows:

1. Captain, Chief Engineer.  
Each to have day room, bedroom and attached toilet/bathroom.
2. 2<sup>nd</sup> Engineer, 2<sup>nd</sup> Officer and Shipowner  
Each to have single cabin with own toilet/bathroom.
3. Four (4) Crew cabins  
Each to have single bed with own toilet/bathroom
4. One (1) Repair man cabin  
In one cabin with two beds with own toilet/bathroom.
5. Two (2) Mess rooms;  
One (1) for crew, one (1) for officers
6. Stores, galley, laundry

**009. General Description**

The vessel is designed as a single-screw motor vessel for world-wide services and is provided with medium speed main engine driving a controllable pitch propeller through a reduction gear.

The vessel is specially designed as a chemical/product carrier for world wide operation, able to carry;

Clean products:

- kerosene
- naphtha
- automotive gasolines (MTBE & ETBE lower than 15%)

Aviation gasolines:

- jet propulsion (J.P.) (all classes)
- gas-oil

Dirty products:

- Fuel-oil
- Vegetable oils

The vessel is fitted with a forecandle deck and a poop deck carrying two tier deckhouse with bridge at top.

Transverse bulkheads subdivide the vessel into afterpeak, engine room, total 4+ one pair of cargo tanks, bow thruster room trim tank and forepeak.

Water ballast tanks to be arranged in double bottom tanks, double side tanks and peak tanks.

One service crane for hose handling mounted in midship manifold area. Outreach 10 m on

SWL 2 t.

Cargo area is divided with transverse bulkheads to five (5) sections and bulkheads to a total of nine (9) cargo tanks, ballast tanks.

The ship's systems are dimensioned for the following ambient conditions:

	Air temp.	Seawater temp.
Summer conditions:	+ 35°C	+ 32°C
Winter conditions:	- 18°C	0°C

## **010. CLASS, RULES AND REGULATIONS**

### **011. Classification**

Built to and under the special survey of:

BV, MS AUT , Unrestricted Navigation Tanker for Oil products and Tanker for Chemicals, Ice 1D

### **012. National Rules and Regulations**

This ship will comply with all existing and/or pre-issued international rules and regulations at the time of the contract.

### **014. International Conventions, Regulations or Special Requirements.**

The design and construction of the vessel and selection of equipment for installation on board shall be based upon the relevant requirements of the following regulations in force at the date of contract.

- Classification Society rules and requirements
- National Maritime Requirements of Country of Registry
- International Convention on Load Lines, 1966, with amendments 1971/75/79
- International Convention for the safety Of Life At Sea, 1974, protocol 1978, amendments 1981 and 1983, including GMDSS, (SOLAS).
- International Convention for Pollution from ships, MARPOL 1973, with Protocol of 1978, and including annexes I, II, IV, V and VI
- International Convention of Preventing Collisions at sea, 1972, and amendments, 1981 (COLREG).
- International Convention for Tonnage Measurements (London 1969).
- International Telecommunications and Radio Regulations, 1976/79/83 with GMDSS rules.
- IBC –Code International code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk. Type II.
- Panama Canal Regulations, including tonnage measurement.
- OCIMF-Rules for Mooring Equipment etc. 2.nd edition 1997, as far as practical.
- OCIMF Standards for Tanker Manifolds, 4th Edition 1991, as far as practical.
- IMO Resolution A468. (XII), “Code on Noise Levels on board ships”.
- I.A.C.S. Shipbuilding and Repair Quality Standards.
- Exxon minimum safety criteria.

### **017. Certificates (other than those mentioned in the foregoing)**

Certificates are to be issued for unrestricted, world- wide trade.

The following original certificates, with two copies shall be handed over to Owner together with the ship.

- Classification certificate for Hull and Machinery
- Load Line certificate
- Safety radio certificate, including GMDSS requirements
- Cargo Ship Safety equipment certificate, incl., record of survey
- Cargo Ship Safety and Construction certificate
- Classification certificate for anchor, chain and hawsers, machinery and equipment
- Certificate for Life boats and life saving equipment
- Certificate for navigation light and special signal lights
- International oil pollution prevention certificate (IOPP-certificate)
- Certificate of fitness for the carriage of dangerous chemicals in bulk
- P & A manual and SMPEP manual certificate
- International Tonnage certificate 1969
- Builder's certificate, including Dead weight certificate and – calculation
- Equipment supplier certificate
- Certificate of compass adjustment
- Wireless Telephony Ship Licence
- Typhoon certificate
- Sewage treatment plant certificate
- Certificate for unattended engine room
- Certificates for fire fighting appliances as required by authorities
- Certificates of test results of casing, forging, etc., issued by class
- Certificates of mooring ropes and wires
- Cargo gear certificates
- Certificates for lifting and hoisting equipment
- Certificate for Medical equipment
- De ratting certificate
- Certificates of major machinery and equipment
- All other usual certificates not listed above and relevant certificates and approvals from Class and Authorities required for ocean-going, worldwide trading, for compliance with the rules and regulations specified above.

## **020. HULL REQUIREMENTS**

### **021. Hull Form**

The slender hull form including the bulbous bow has been designed especially for efficient operation in loading conditions as well as in ballast conditions with a view to rough weather performance and low fuel oil consumption.

The vessel will be fitted with a stern bulb and a spade rudder. In order to maintain a low vibration level, special attention has to be paid to the interaction between propeller and hull.

### **024. Noise and Vibration Requirements**

Necessary precautions observed in detail design stage to reduce vibrations and noise in accommodation. When mounting accommodation bulkheads, ceilings, pipes, cables etc. necessary precautions shall be taken to avoid noise and vibrations; in comply with the code of Noise Levels on board ships A 468 (XII) and ISO draft proposal No 6954 "guidelines for the overall evaluation of Vibration in merchant ships" of september 1979.

**025. SUPPLIERS AND SUPPLIES**

**026. General**

A list of approved makes in Builder's choice with normally at least two choices. If not otherwise stated, items in this specification will be supplied and installed by the Builder. Items listed more than once will be delivered once.

Spare parts to class requirements.

Spare parts and stores including Owner-supplied items will be stowed on board.

**027. Owner's Supplies**

Owner is to supply cooking utensils, kitchen ware, china, cutlery, glass ware, napery, pillows, blankets and linen.

**028. Bunker Oils and Lub. Oils**

The builder is to supply bunker oil, lub. oil, hyd. oil etc. and fill all systems on board before tests and sea trials.

The remaining quantities of bunker oil after tests and trials will be invoiced the Builder.

**037. Delivery**

Delivery is to be effected in accordance with the terms of the Contract.

**040. GENERAL CONDITIONS**

**041. Contract Documents**

Shipyard with whom the contract will be signed is in this specification referred to as the BUILDER or the BUILDERS, whilst the purchaser (as well as his authorized representatives) is referred to as the OWNER or the OWNERS.

The contract documents comprise:

- The CONTRACT
- Appendix 1 including
  - This SPECIFICATION with possible amendments, if any, agreed at the time of contract
  - GENERAL ARRANGEMENT PLAN
  - CARGO AND BALLAST SYSTEM

In this specification the above plans are referred to as the Guidance Plans.

**044. Omissions and Conflicts**

It will be the Builders' responsibility to deliver the vessel complete in every respect (except for such items and services explicitly listed in the Specification as being Owner's furnishing) ready to put to sea, constructed in accordance with recognized marine practice and complying with all applicable requirements of the regulatory bodies as described in the technical documentation.

If anything in the Specification is found in error or in conflict with any applicable regulation, the part who observes this shall notify the other part in due course.

## **050. DOCUMENTATION**

### **055. Hydrostatics and Stability Booklet**

The hydrostatic data, the residuary stability data and the loading conditions specified and/or required by the authorities to be compiled in a suitable booklet which is to be delivered in triplicate.

The following loading conditions will be submitted:

- 1) Light ship(positive stability only )
- 2) Docking condition
- 3) Ballast condition (Dep / Arr.)
- 4) Homogeneous full loaded condition
- 5) Full cargo capacity at 2 densities below homogeneous density, and full dead weight at 2 densities above homogeneous density including maximum density.
- 6) Full cargo loaded to scantling draft (homogeneous), and two densities (maximum density) above homogeneous at scantling draft.

The use of water ballast in operation and arrival condition will be permitted.

The vessel also to fulfil MARPOL Annex I, reg. 25A, regarding intact stability in port.

Preliminary trim and stability calculation will be submitted to Owner for approval at an early stage, with loading conditions as above.

The preliminary stability calculations also to contain:

- Hull and compartment definition
- Tabulated hydrostatics and righting levers
- Preliminary light weight calculations, incl. Max. allowable bending moments and shear forces
- Tank volume tables

Final loading manual with trim, stability and longitudinal strength calculations, for loading conditions as in preliminary calculations and based on the ship's lightship weight and centre of gravity determined from the inclining test, and corresponding lightship weight distribution, shall be worked out and be approved by authorities.

### **056. Tests and Trials, Plans and Reports**

The Builders are to advise the Owner's representatives two weeks before start of main testing period and 24 hours before each single test and trials at the shipyard, and all delivery tests and trials detailed plans will be presented for approval.

Besides, the Builders shall notify the Owner min. two weeks in advance regarding shop tests of main engine, generator sets, main switchboard and cranes.

Full reports on all important and extensive tests and trials will be delivered to the Owner in triplicate and upon by the owner.

**057. Instruction Books**

All instruction books to be delivered in three (3) copies, one of those will be given one month before the test.

**060. PLANS AND DRAWINGS**

**065. Builder's Working Drawings**

The builders will, before construction commence, submit four copies of all main drawings, for the owners approval and orientation. One copy of the drawings is to be returned marked with owners approval/reservations. If owner does not react by forwarding comments within two weeks after reception by the owners, unless otherwise mutually agreed, the drawings will be considered approved without any reservations.

If the shipyard sends lots of information at the same time, then a priority shall be included in case of two weeks limitation exceeds.

**066. Delivery - 'As Built' - Drawings**

All necessary certificates will be delivered with the ship.

Certificates and costs for approval of plans by the Authorities concerned shall be paid for by the Builder.

All necessary piping diagrams, safety plan etc. will be fitted in engine room, alleyways etc. as per builder's normal practice.

**070. WORKING PROCEDURES**

**071. Standards**

IACS's standards, constructions, materials, equipment and machineries will be used in all solutions whenever possible, but standards shall, however, meet authorities' and Owners' approval

**072. Measuring Systems**

All dimensions will be in SI-Units if not otherwise stated.

**073. Languages**

The text on all principal drawings will be in English. The text on name plates, label plates and in instruction books will be in English.

**074. Materials**

Only first class quality materials in accordance with the requirements of the regulatory bodies and/or this Specification and otherwise in accordance with recognized marine practice and to the entire satisfaction of the Owner will be used.

**075. Workmanship**

Workmanship shall be of first class quality throughout and shall be to the satisfaction of the Owner's representatives, classification society and authorities.  
During the building period the Builders shall show due diligence in order to avoid damage to the ship, its machinery and equipment by exposure to weather, pilferage, fire hazards, etc.  
The Builders will be fully responsible for the satisfactory launching and docking of the ship. Any damage caused during the launching or floating up is to be repaired to the Owner's and class' approval at the Builders' expense.

**080. TESTS AND TRIALS**

**081. Tests of Materials, Components, Systems on board**

Tests of materials, components and systems shall be in accordance with the rules and the regulations, the specifications with approved modifications and to the satisfaction of the representatives of the regulatory bodies and owner.

When any workmanship, material or equipment fails to pass any inspections or tests it shall be subject to full retest after all known faults have been eliminated there from, or at the Builders' option and subject to the shipowner's approval any such material or equipment shall be completely removed from the work and replaced by new. After such replacement the regulatory bodies, or shipowner may require a repeat of the test.

On completion of satisfactory tests and trials miscellaneous machinery will be opened for inspection as per usual shipbuilding practice and, as pointed out by class and/or Owner's representatives in case of suspected malfunctions or detected faults. Inspected parts shall be in first class condition. If not replacements, and if required, corrections to take place.

The entire hull, rudder and rudder stock shall be specially surveyed by classification society. All tanks shall be tightness tested to class requirements.

All work involved in the above shall be carried out/supplied without any additional costs being charged to the Owner.

**083. Dock Trials**

Dock trials shall be conducted before sea trials as required to ensure proper alignment, smooth running and proper functioning of all main and auxiliary machinery and all other parts and systems. Dock trials will be performed on the basis of the programme made by Builder and approved by the owner.

**084. Sea Trials**

Sea trials shall be conducted in open water with adequate water depth under fair conditions of sea and current for sufficient length of time to satisfactorily accomplish the trials. The trials will take place in both load and ballast conditions.

A detailed trial program shall be prepared by the Builders and be accepted by the Owner's representatives before commencement of the trials.

All costs in connection with the sea trials will be covered by the Builders.

The sea trials shall include at least:

- 90% MCR with shaft generator running on design load and ballast draught, trials over double runs according to GPS differential control or similar, totally one double run.
- 100% MCR without shaft generator running on design draft and ballast draft, trials over double runs according to GPS differential control or similar, totally one double run.
- 80% MCR with shaft generator running at normal ship service power, on design draft and ballast draft, trials over double runs according to GPS differential control or similar, totally one double run.
- 4 - 6 UMS test hours with main engine running according to manufacturers' instructions and classification Society's requirement.

The endurance test may take place during UMS test, if possible.

- Reversing test
- Crash stop test
- Emergency go-home test
- Manoeuvring trials
- Turning circle test
- Steering gear test
- Anchor tests
- Noise and vibration measurements
- Test with combination(pitch-rpm) and fixed pitch of the propeller

During the sea trials other power consuming machinery and equipment which is normally in operation shall be running.

The navigation equipment shall be adjusted and calibrated during the sea trials.

A trial trip report will be handed over to the Owner's representatives as soon as possible after completion of the trials.

#### **085. Equipment Test**

Equipment items which have been tested in workshops only shall be service tested again after mounting, either during the dock trials or during the sea trials as per a mutually agreed test program and as practicable as possible.

#### **086. Inclining Test**

Immediately before delivery the vessel shall be subject to an inclining test, which will be carried out with the greatest possible accuracy. The test may take place before the sea trials, provided the vessel is completed with weights and cleared of all items not belonging to the ship.

The proposed procedure, the conditions of wind, tide etc. under which the experiment is to be performed must be acceptable to the Owner and the appointed representative of the authorities and be carried out in their presence.

The lightweight and its centre of gravity thus determined to be used for the final stability booklet with loading conditions.

The deadweight scale on the capacity plan will be worked out according to the lightweight found.

#### **087. Noise and Vibration Measurement**

During the sea trials noise measurements at contractual 80% MCR are to take place throughout the accommodation areas, work spaces etc. to check compliance with specified regulations and vibration test ISO 6954 and Noise test A468(XII). The measurement at 90% MCR will be measured only for information.

## **100. - 199. HULL STRUCTURE**

### **100. SCANTLINGS AND MAIN CLASS PLANS**

#### **101. Structural Requirements**

The hull with superstructures and deck house shall be in fully welded construction in accordance with class requirements and Owner's requests as outlined below.

Effective continuity of entire structure shall be ensured in all directions in the design as well as in the actual work.

Insert plates will be used for local reinforcement and compensation in lieu of doublers except where otherwise stated.

Non-tight structural members will be provided with adequate numbers of lightning/access holes as well as sufficient numbers of air and drainage holes.

Scantlings according to the Rules and Regulations of the Classification Society.

Cargo tanks to be dimensioned for no filling limits in sea going conditions.

Cargo tanks in hull will be dimensioned for specific cargo gravities of 1.35 t/m<sup>3</sup> at 80° C.

During construction of the hull IACS tolerance rates and recommendations on construction details will be followed. All stages of construction will be documented and controlled as per shipyard's quality control system which is detailed in shipyards

#### **102. Midship Section and Other Class Plans**

The scantlings of the main hull structure will be determined in accordance with class requirements

#### **108. Rudder and Rudder Stock**

Double plate full spade flap rudder with stainless steel air and drain plugs in top and bottom.

Conical coupling with hydraulic nut for connection of rudder-stock to rudder and steering gear. Rudder will be "Becker type" or similar.

**110. MATERIALS AND METHODS**

All steel to be new steel to class requirements, no high tensile steel to be used.

Only closed welding in all tanks and wet spaces. Intermittent welding may be employed without scalloping in enclosed spaces other than tanks and cofferdams where acceptable to class. When scalloping is used welds will be closed at ends.

The finish welding is to follow an approved welding sequence to reduce residual stresses to a minimum.

Distortions in plates due to electric welding will be kept to a minimum.

Welding will be carried out carefully to avoid heating stresses.

Temporary weldings will be carefully removed and made smooth by chipping and/or grinding where necessary.

Only welding rods of approved make to be used.

**117. Structural Removals**

Lugs and other tools used for assembling the structure which are fully welded will be cut 10mm from plate edge and rounded.

Temporary lugs and other tools used for assembling on shell, outside house and gangways or lugs and tools which are not fully welded will be removed carefully.

**120. FRAMING**

**121. Framing**

Longitudinal or transverse framing after builders choice

**124. Stern Frame**

Stern bulb, with internal structure as per builders practice.

**130. BOTTOM CONSTRUCTION**

Double bottom will be arranged for water ballast as per GA plan. Steps and handgrips in tanks at manholes in tanktop for easy access. Double bottom will be longitudinally stiffened with floors and girders as per class requirement.

**136. Bilges/Bilge Wells**

Bilge wells will be arranged as per class requirements for easy drainage.

**140. SHELL PLATING**

**141. Shell Plating, General**

Flat keel plate will be integrated in the bottom shell. Special consideration is to be given to block pressures when dry-docking to avoid indentation in plates.

**143. Local Reinforcements**

Heavy inserted plates in way of anchor resting and vertical areas, in way of sea chests and otherwise as required by class. Openings in shell plating will be well rounded and where compensation is required it will be in the form of insert plates.

**145. Bulwarks**

Will be arranged as per GA-Plan. To consist of plating welded to brackets and/or stays. Top and bottom are to fit with flat bar. Bulwark will be reinforced in way of mooring chocks and similar where fitted in bulwark.

**146. Bilge Keels**

To be fitted in appr. 30% of the length of the ship P and SB in the water flow direction. The bilge keels to consist of bulb profile welded to flat bar which in its turn is to be welded to shell plating. Bilge keels to terminate on frames and to be tapered at ends.

**148. Drain Plugs, Tank Markings etc.**

Stainless steel drain plugs for all tanks. Insert plates in way of plugs.

**160. DECKS AND HATCH COAMINGS, IN GENERAL**

Corners of openings in strength deck will be well rounded at corners, circular or elliptical in shape. Compensation for holes as per class requirements. Adequate strengthening will be provided in way of masts, deck machinery, bollards steering gear.

**166. Other Hatchway Coamings**

Coamings for hatchways to store rooms etc. will be as low as possible, regulatory bodies permitting.

**172. Auxiliary Machinery Foundations**

Will be arranged in rigid steel plate design with due consideration to access for cleaning and drainage.

**173. Deck Machinery Foundations**

Windlass and other deck machinery generally will have foundations of sufficient height enabling easy maintenance.

Foundations will be of steel plates and rolled sections.

Increase in scantlings when necessary.

**180. MISCELLANEOUS STEEL STRUCTURE**

**181. Hawse Pipes and Chain Pipes**

The hawse pipes to point in such direction that stem anchors when dropped will always clear vessel's bulbous bow. Anchors to stow securely so as not to rattle or shift due to motion of the vessel or force of the seas. Pipes to be finished with round mouldings. Spray nozzles for washing chains on branch pipes connected to fire main pipe.

The chain pipes to be finished with round mouldings.

**182. Chain Lockers**

Two self-stowing watertight chain lockers of ample size will be built forward of the collision bulkhead. The chains is to rest on perforated steel plates well over the bottom such that a drain sump will be provided below.

Quick release arrangement for operation outside the chain lockers will be arranged at the bitter end of each chain.

**183. Sea Chests**

Will be arranged in number and size as necessary for the practical operation of machinery, pumps etc. In engine room two sea chests. In pump room one sea chest. Grids will be bolted with stainless steel screws. Grids will be galvanized after fabrication.

Sea chest will be built up of plate in accordance with class requirements.

**190. SUPERSTRUCTURES AND DECK HOUSES**

**198. Funnel**

Will be provided with steel roof below top with ample drainage.

Exhaust pipes to protrude above top profile.

**199. Machinery Casing**

Platforms, ladders and eyeplates for easy access and maintenance will be provided according to builders standard.

**200. - 299. OUTFIT AND EQUIPMENT (HULL)**

**200. MARKINGS AND IDENTIFICATION**

Waterline, drain plugs etc. will be marked with spotwelding. Draft, warning signals, free-board marks and position of WT bulkheads, name and homeport to cut in plate and welded to shell. Draft marks aft and forward.

Tanks will be marked adjacent to manholes.

Air caps, filling and sounding pipes will be marked with tank identification and content.

Owners' mark and name will be welded on the stem of the fore bulwark.

**207. Name Plates for Compartments**

Engraved plastic or non-corrosive metal name plates will be made and fitted on or over doors to each compartment throughout. If metal plates, characters will be enamel filled. Outside only non-corrosive metal plates will be used.

**208. Label Plates**

Label plates of metal on sounding pipes, filling pipes, and air-pipes.

**210. CLOSURES, ACCESS, PROTECTION (HULL)**

**211. Manholes with Covers**

Manholes according to builders standard will be fitted for access to all tanks, void spaces, and cofferdams. Tank number will be welded close to manhole cover.

Manholes to double bottom tanks in machinery spaces and on main deck to ballast tanks to be arranged.

All manhole covers will be packed with oil-resistant gaskets. Steps under manholes as required. Bolts in stainless steel.

**212. Covers for Smaller Hatches**

Hinged steel covers on smaller hatches in watertight execution with waterproof rubber gaskets, sufficient number of dogs, hold-back arrangement and lifting handle.

If required for access to spaces not normally being accessible, particularly for larger parts, bolted plates with gaskets should be arranged.

On all hatch covers acting as emergency exits, handles will be operated from inside and outside.

**213. Exterior Access Doors**

Watertight entrance doors meeting the Load Line Regulations to be fitted.

Hold-back hooks on all doors.

'Eyebrows' over all exterior access doors unless protected by overhanging decks.

Top of doors 2000 mm above finished decks. Minimum clear door width 650 mm. Door to provision room and galley wide enough to allow for passage of freezers/refrigerators.

**215. Port lights and Windows**

Fixed windows 400 mm x 600 mm of steel alloy throughout accommodation. Special larger windows in wheel house

**216. Gangway and accommodation ladder**

One gangway of aluminium alloy, with storage fittings on deck, on platform, with turnable SB and PS on upper deck to fit the gangway. Gangway to be handled with the hose crane.

**217. Stairs and Ladders (Outside Cargo tanks)**

Stairs and ladders will be arranged for convenient access to all decks, flats etc. Interior stairs in accommodation with steps of steel, and closed with steel between steps. Steps sheeted with same material as top layer of deck covering in passageways or with non-skid material. Step edges with Ferodo noses or equal. Exterior stairs and/or inclined ladders with side stringers of plate or rolled channels and steps of non-slip checkered plating tread or grating type treads. Steps/treads in hot-dip galvanized execution. Vertical access ladders - where fitted - will have flat bar side stringers and square rod rungs. Cut-out holes for hand and toe hold in chain locker centre line bulkhead for access to bottom. Miscellaneous treads, gratings, hand grips, etc. will be fitted to provide safe access as necessary for operation, observation and maintenance of the vessel and its equipment and fittings.

**218. Rails and Stanchions**

Hand rails on both sides in interior stairways and on exterior stairs. Grip hand rails in passageways where required. Storm hand rails will be fitted on exterior bulkheads of all deck houses surrounded by free decks. Protective rails, screens or guards as appropriate will be fitted as directed to safeguard personnel from moving deck machinery, deck openings or other hazards. Galvanized steel hand rails with three rails and stanchions will be fitted on decks as per Guidance Plan and in accordance with Load Line Regulations. Height 1050 mm.

**220. RIGGING AND DECK FITTINGS**

**221. Signal Mast and Radar Mast**

Will be arranged as per Guidance Plan with access ladder, navigation light pads, signal yards and halyards suspended from blocks on the signal yards.

**222. Foremast**

Will be arranged as per Guidance Plan, self-staying, with access ladder, with navigation light pad, block with halyard and other fittings as per usual practice.

**224. Flag Staffs**

An ensign staff at the stern and a flag staff in portable stainless steel pipe construction, with sheave, cleat, halyard and fixing fitting will be installed.

**225. Pad Eyes**

Will be fitted for lifting of rudder and propeller and elsewhere as directed for access for paintings etc. Those for rudder and propeller to fit on the shell plating and to be exactly in line with frames.

**230. MOORING FITTINGS AND EQUIPMENT**

According to the general arrangement and it's comments, sizes and numbers will suit arrangement, rope dimensions and necessity. The deck machinery will be hydraulically driven with two different systems one aft, one forward.

**231. Bollards**

According to the general arrangement plan.

**232. Fixed Chocks**

According to the general arrangement plan.

**233. Deck Fairleads**

According to the general arrangement plan.

**235. Wire Reels**

2 Wire reels with stop hook

**236. Anchor Equipment**

2 Bow anchors (HHP) 967.5 kg.

Fully balanced bow anchors 2 pcs weight according to class requirements. Anchor chain cables material U3 with a diameter of 32 mm, length and diameter according to class requirements.

**238. Hawsers and Warps**

Will be delivered according to class requirements.

- 4 Mooring lines,
- Baskets for hawsers to be fitted aft and forward.

**240. SAFETY EQUIPMENT AND DECK EQUIPMENT**

The safety equipment to comply with SOLAS 1974/1978 with later Amendments as well as the national regulations of flag of registry. In the following the word 'regulations' cover both.

**241. Rescue Boat**

- 1 - Rescue boat of rigid construction with prescribed equipment including also outboard engine with accessories.

Petrol tank stowage in an approved location.

- 1 - Launching and retrieval appliance, crane type for MOB boat, with winch.

**242. Free fall life boat**

- 1 Free fall lifeboat for 12 persons. Retrieval of life boat to take place with crane for stores.

**243. Life Rafts**

- 2 - Inflatable life rafts 12 persons in GRP containers. One on each side of accommodation.

**244. Life-Saving Equipment etc.**

Life jackets, survival suits, and lifebuoys in number and stowed as to comply with - and of types approved by - the regulations. However, number of life jackets and survival suits to be at least equal to the capacity of one life raft.

**245. Other Safety Equipment**

Will be delivered and stowed in accordance with SOLAS - 74 Regulations and Amendments.

**250. DECK COVERING, INSULATION, JOINER WORK**

**251. Deck Covering. Exterior**

No deck covering on exterior decks.

**252. Deck Covering. Living Spaces**

Vinyl or carpet in cabins and mess rooms, recreation rooms, offices, navigating spaces and interior passageways.

Deck surface in recreation, messrooms and cabins will be covered with 3 mm thick vinyl asbestos-free flooring or vinyl.

Floating floor in accommodation on main deck.

**253. Deck Covering. Wet Spaces**

Deck surfaces in toilets and showers, galley and laundry will be covered with 10 mm thick non-skid ceramic tiles laid on 40 mm thick Portland cement. Tiles will be flushed 120 mm up the periphery bulkheads. Shower areas will be countersunk. Floors will have inclination against scuppers at all normal trim.

**255. Insulation**

Mineral wool insulation will be provided for accommodation against extreme high and low temperatures and mineral wool will be used against fire and noise. Thicknesses of insulation material is to comply with regulations for insulation against heat, cold, fire, noise and noisy levels.

**256. Insulation. Sundry**

Hot pipes passing through accommodation and other spaces will be insulated as per usual practice. In engine room for cold sanitary piping system will be insulated.

**257. Linings and Partition Walls**

All steel in accommodation spaces will be lined. Linings and partition walls are to comply with IMO recommendations to fire protection in cargo ships or to national regulations if at least to same standard. Wall colours to Owner's approval. Partition walls and linings, where floating deck is placed on floating floor .

**259. Interior doors and locks**

All doors will be provided with door locks, hinges, handles and hooks of chromium plated brass. Where necessary safety scuttles will be provided.

Selfclosing arrangement on doors to staircases and other important fire doors as per Regulations. Doors to cabins and toilets are fire proof B-type in accordance with Regulations: Doors to cabins, galley, store rooms, mess rooms and wheel house will be provided with central key system, each lock with 2 keys. 3 master keys.

Cabinet for spare keys is delivered.

**260. ACCOMMODATION FURNISHING**

**261. Arrangement**

The Accommodation is arranged in accordance with requirements of National Regulations and will be laid out and furnished in accordance with the international standards widely used for commercial ships.

See also General Arrangement

All furniture is made in beech wood, fastened to decks and bulkheads. Furniture is treated with acid hardened lacquer.

Large scale accommodation plans, including equipments&furnitures, will be worked out together with owners to the satisfaction and acceptance of the owner.

**270. FURNITURE AND DECORATIONS**

**271. Wardrobes and Lockers**

Each cabin has at least one wardrobe for each person with rod for coat hangers, shelf above rod. Ventilation opening at top and bottom.

**272. Berths and Mattresses**

Sizes of berths 2000 x 900 mm with the exception of Captain and Chief Engineer which will be 2000 x 1000 with extension facilities. These dimensions are interior dimensions. Drawers under berth, at least two drawers per person. Drawers will have sea catches. Mattresses of approved normal type, good spring quality and separate top mattresses.

**273. Writing Desks and Tables**

Desks and tables with edges of hard wood. Tables tops will be laminated.

**277. Hardware in Accommodation**

One refrigerator 60 litres is fitted in the following rooms:

- Captain's cabin
- Chief Engineers cabin
- Officer's mess room
- Crew's mess room.

**278. Navigation Spaces:**

Combined wheelhouse and chart room laid out and furnished in accordance with modern principles.

The furnishing of these spaces shall at least include:

- 1 - Navigation and control desks
- 1 - Chart table with drawers
- 1 - Pigeonhole flag locker with identification labels
- 2 - Pilot arm chairs with upholstered seat and back
- 1 - Bookcase
  
- 1 - Coffee percolator table with cabinet
- 1 - Locker for signals etc.
- 1 - Radio table
- 1 - Table for radio and telex equipment

**280. MISCELLANEOUS ROOMS**

**281. Bathrooms and Toilets. Change room**

Bathrooms and toilets will be of conventional type.

Each private bathroom will be equipped according to the international standards widely used for commercial ships.

Every bathroom will be equipped with toilet, wash basin, shower basin, non-skid tiles.

**282. Laundry and Drying Room**

Laundry will be provided with:

- 2 - Washing machine
- 1 - Washing sink
- 1 - Tumble dryer

**284. Galley**

Galley will be equipped with:

- Two refrigerator each 850 ltd.
- One universal kitchen machine
- One electric range with griddle top and electrical grill.
- One baking oven.
- One marine type heavy duty Dish washing machine
- Necessary tables, racks, lockers
- One double sink
- One coffee machine.
- One coffee grinder.

**285. Miscellaneous Hull Machinery Rooms**

Fan rooms will be arranged as necessary.

Battery boxes, complying with applicable regulations, will be arranged.

Batteries will be secured to prevent movements at sea.

Deck machinery rooms will be arranged as necessary.

**286. Store Rooms and Lockers. General**

Proper stowage arrangements shall be made on board the vessel for all items and equipment necessary for the operation and maintenance of the vessel.

Stowage facilities shall include shelves, lockers, bins, tanks, hooks, clips, racks etc., and will be substantially constructed and arranged to prevent or restrict movements of items stowed.

**290. CORROSION PREVENTION AND PROTECTION**

Generally, the instructions and recommendations of the paint manufacturers and their coating inspectors shall be adhered to, and the work shall be carried out to the entire satisfaction of these inspectors.

Special care will be taken of steel preparation, especially inside sea water compartments.

Finishing colours to Owner's instructions. The detailed painting specification to be worked out in co-operation with the paint manufacturer.

Paints and coatings may be applied by sprayer, brushes or roller according to maker's recommendations.

Second and later applications to be compatible with shopprimer and subsequent applications.

The finishing coat for the hull sides above light waterline to be applied reasonably close to the delivery date.

**292. Preparation of Surfaces. Galvanizing**

All steel materials equal to or above 6 mm thickness are to be abrasive blasted to SA 2½ and shopprimed with abt. The surface preparation that will be recommended by the paint firm, will be accepted.

Underwater external areas, ballast spaces, weather decks, portable water, fresh water, misc. Water tanks that are to be coated internally, welds to be finished as per equal to NACE replica standard RP0178 D grade and edges ground to a minimum of 2 millimeters.

**297. Cementing**

Cement apart from underlayer for tiling, should be used as little as possible, if at all, and only in places like bottom of peak tanks where poor accessibility, and where drainage can be improved.

**298. Cathodic Protection**

Cathodic protection of the hull will be done by zinc anodes which is in accordance with the docking periods of the ship. Life periods of the anodes is minimum 3 (three) years

**300. - 399. HULL ENGINEERING**

**300. VENTILATION**

**301. Ventilation, General**

Natural ventilation to stores, rooms ect. as usual.

Mechanical Ventilation:

All supply and exhaust ventilators serving accommodation will be fitted with non-corrosive mosquito nets.

**302. List of Ventilation Requirements**

Approx. air changes per hour:

Type of Space	Mechanical		Natural	
	Exhaust	Supply	Exhaust	Supply
Deck store rooms			E	
Bathrooms and toilets	15			
Laundry and drying room	10			
Changerooms	15		E	
Steering gear compartment		E/R vent		S
Bow thruster room	15			S
Galley	50/20			
Ballast pump room	20/20			
Navigation bridge	8			
Mess rooms	8			
Cabins	6			

**303. Natural Ventilation**

Generally, all spaces which are not air-conditioned shall have natural ventilation. Spaces such as deck store rooms shall only have natural ventilation and thus be provided with one inlet and one outlet.

Spaces such as bathrooms, toilets, laundry, drying room, linen rooms, oil skin locker etc., will have natural supply through door louvres or similar from adjacent rooms, and mechanical exhaust by fan on ducted system.

**304. Miscellaneous Ventilation**

Spaces in the cargo area will have mechanical ventilation with air changes according to the IBC code.

**307. Ducts, Inlets, Outlets**

Ducting of fabricated hot-dipped galvanized, minimum 0.5 - 0.6 mm in thickness with flanged connections and insulated where necessary will prevent sweating and heat rise and minimize noise levels due to air flow in ducts.

Ventilation cowls, mushrooms, goosenecks and ventilators of steel, sandblasted, primed and painted.

**308. Fire Dampers**

Fire dampers will be fitted in ducts in accordance with regulations. They will be located readily accessible, and will be adjustable and clearly marked. Fire damper shafts of stainless steel with brass bushings and standard grease fittings.

**310. AIR-CONDITIONING AND HEATING**

**311. Air-Conditioning Requirements**

The accommodation will be ventilated, heated and cooled by a medium pressure single-pipe air-conditioning system, which shall meet the national regulations applicable and at least the following design conditions and requirements:

Climate	Outside		Inside	
	Temperature	Relative humidity	Temperature	Relative humidity
PRIMARY:				
Summer				
(primary)	+ 35°C	70%	+ 27°C	50%
(secondary)	+ 28°C	80%	+ 22°C	50%
Winter	-20°C		+ 20°C	
Wind speed:	16 m/s			
Design seawater temperatures	Hot climate : + 32°C Cold climate : + 0°C			

Number of air changes per hour: See 302

An amount of max. 50% of the air may be recirculated.

**312. Refrigeration Machinery for Air-Conditioning**

Fresh water low temperature refrigeration plant complete with accessories with sufficient capacity to maintain the specified design conditions at 85% of its maximum capacity and 75% clean tube efficiency will be installed. A separate cooling water pump will be provided. The plant will be assembled as a unit on a common bed plate and will be installed in the engine room.

Two open type compressors on the refrigerating plant, working on R22 each rated at 70% of power needed for the above performances.

**314. Air-Conditioning Central Unit**

The unit will comprise a mixing and filtering section with control dampers and dry-type air filter, a heating section, a fan section with a centrifugal fan, a cooling section with air cooler, and a discharge section as well as the necessary accessories. Unit will be built of galvanized steel and will be provided with thermal and acoustic insulation.

**316. Air-Conditioning Outlets**

The air-conditioning room units will be of such design that it will ensure low velocity, low noise level and individual control. The outlets (supply units) may be as grilles or as ceiling diffusers and noise-absorbing boxes will be fitted near outlets. Opening to external air will be fitted with remote control closing device.

**320. HULL PIPING SYSTEM**

**321. System Requirements (S)**

Velocities in water pipes: As per rules, regulations, makers' recommendations or Builders' standard.

All piping will be led as directly as possible with a minimum of bends. Drain plugs will be provided where necessary so that pipes may be completely drained when desired.

**322. General Demarcation**

The piping systems specified under section heads 330-350 are outside cargo tanks and machinery spaces. The specifications in 321 and 323-327 cover systems under section heads 330 to 390.

**323. Types and Materials of Pipes**

According to the minimum class society requirements and as per appendix I, II, III.

**325. Assembly and Supports**

Generally, steel pipes of 40 mm diameter and beyond will be assembled with flanged connections. Hydraulic pipes will be assembled with special couplings of maker's standard or builder's standard. All pipes will be suitably supported. All threads of bolts will be metric.

**326. Insulation of Pipes**

Hot pipes in accommodation (temperature exceeding approx. 40°C) will be insulated with mineral wool or equal.

Cold pipes (for refrigeration) will be insulated with mineral wool or equal.

The insulation shall normally not cover flanges, valves and fittings.

For insulation of machinery, see 516, 546.

For insulation of pipes in engine room, see 606.

**327. Protection of Pipes**

All pipes will be properly fastened to the ship's structure with clamps and similar. Where exposed to mechanical damage or shipping of green seas, pipes will be as suitably protected as practicable. Expansion bends and/or flexible couplings will be used where pipes are exposed to stresses due to temperature variations and due to hull deflections.

**330. BALLAST, BILGE, DRAINAGE PIPING**

**331. Ballast Piping (Outside Engine Room)**

The ballast system will be designed for a ballast discharge time of less than 6 hours.

Two (2) self-priming (double housing) centrifugal pumps will be installed, each with a capacity of about 100 m<sup>3</sup> /h at 3 bar.

All ballast valves in ballast tanks will be controlled from the cargo control room.

**332. Bilge Piping (Outside Engine Room)**

Bilge piping according to class requirements and suitable for the pump capacities of the pumps connected to the system, see 452.

Bilge ejectors for ballast pump room and foreship see 449. For bilge system in engine room see 652.

Drainage from steering gear room to engine room bilge by hand pump.

**333. Scuppers and Drains, General**

Scuppers and drains in sufficient numbers and of adequate sizes will be installed in lowest positions for effective drainage of decks, gutterways, floors, sanitary installations etc.

Pipes will run vertically or sloping as far as possible, and with as few bends as possible. No bends will be sharp and cleaning out plugs will be arranged conveniently in accessible positions as necessary.

All overboard discharges are to comply with applicable regulations and will be clear of lifeboat embarkation stations.

**334. Exterior Deck Scuppers**

Deck scuppers P & SB from all decks above superstructure decks to next deck below

arranged well clear of entrances to accommodation.

**335. Interior Gutterways and Scuppers**

Gutterways behind the lining of the accommodation deck house sides will have scuppers with brass plugs in house sides at deck level.

**336. Floor Drains**

Drain will be arranged in bathrooms, toilets, laundry, galley .

**337. Sanitary Drains and Galley Drains**

Drains from wash basins, showers, floor drains, slop basins, galley sinks, dishwashing machines and washing machines will be provided with water sealed traps and connected to mains for sewage system.

System will be of gravity type and a sewage tank will be arranged for waste water.

**338. Sewage Pipes**

Galvanized steel sewage piping to sewage collecting tank in engine room.

For toilet flushing system, see 352.

**340. FILLING, SOUNDING AND VENTING**

**341. Filling Pipe Systems**

The vessel will be arranged with MDO system:

Bunker system will be arranged MDO.

Filling line for MDO will be arranged on both sides of the vessel.

Tanks for manual lubricating will be arranged into the engine room for different types of lubricating oils.

Filling pipes on deck for lub. oil and for fresh water to respective tanks.

**342. Overflow Pipes**

Overflow pipe arrangement and spill containers on deck for oil fuel bunkering in accordance with U.S. Coast Guard Regulations. See also 344.

**343. Sounding Pipes**

All tanks, void spaces etc will have sounding pipes as per class requirements located in easily accessible positions.

Striking plates under all sounding pipes.

Sounding pipes from double bottom tanks in machinery spaces to terminate well over floor with self-closing taps.

**344. Tank Vent Pipes**

Air pipes will be arranged as per class requirements and Load Line Regulations. Those for fuel oil tanks will be combined with overflow arrangement.

**350. SERVICE PIPING SYSTEMS**

**351. Cold and Hot Freshwater Supply**

Freshwater supply from freshwater hydrophore system with pumps and membrane tank in engine room. Connection to all cold water taps and via water heater to all hot water taps fitted on all wash basins, showers, slop basins and sinks. Also connections to washing machines. Besides, one outside ½" cold water tap for hose connection on boat deck. Hot and cold water connection to sprinkler on wheelhouse front windows. Stop valves before each tap of ash basins.

**352. Toilet Flushing System**

Discharge pipes from toilet flushing system will be combined with other discharge pipes from wash-basins, showers, galley etc.

**354. Sanitary Fixtures**

Metal fixtures in bathrooms and toilets (see 281) are generally to be in chromium plated brass or hydronalium.

**355. Provision Stores Ref. Machinery**

Two freezer (each 600lt) will be placed in provision room.

**357. Working Air Connections**

17 pcs of compressed-air outlets (7 bar) will be provided on open deck.  
3 pcs of compressed-air outlets (7 bar) will be provided in engine room.  
1 pc of compressed-air outlets (7 bar) will be provided in paint store.

**360. FIRE-EXTINGUISHING**

**361. Fire-Fighting Requirements**

The whole fire protection, including fire extinguishing equipment and fire alarm, is to fulfil rules and requirements of Solas and National Rules.

**362. Fire and Safety Plan**

Plan showing location, number and sort of all items intended for use in case of fire and/or other emergencies will be made and mounted on board.

**363. Fire Detection System**

A fire detection system will be fitted in accommodation, engine room and stores. Detector box will be placed in wheelhouse.

#### **364. Portable Fire-Extinguishing Equipment**

Portable fire-extinguishers will be supplied and mounted, including one spare cartridge for each at approved locations.

Fire-hoses with fog nozzles will be placed in hose stations (boxes of GRP).

#### **365. Fire and Deck Wash Main**

Will be arranged conveniently with hydrants in easy accessible positions. Besides, the fire and deck wash main will be connected to:

##### Deck wash and Fire main line

The combined deck wash and fire main pipeline is arranged on main deck.

The deck wash line is provided with shut-off valves and fire hydrants as required by Authorities.

Also branch with fixed nozzle led to each hawse pipe is arranged.

Water fire extinguishing systems for accommodation, engine room and deck are served by the fire pumps and the emergency fire pump via distribution valves.

Fire pumps will have suction from sea and discharge to the fire main line. Pumps according to rules.

International shore connection is installed on poop deck. Also two portable international shore connections are installed on board.

Fire hydrants will be of a uniform type.

##### Accommodation

The system consists of inside branch lines from main deck to bridge deck with hydrants on each deck.

##### Engine room

The system consists of branch lines on platforms and tank top level. Fire hydrants are fitted on each level.

##### Anchor chain washing

- Two non-corrosive jets with common control valve will be installed for each hawse pipe for washing the anchor chain cables
  - The chain locker will be sucked by foreship ejector.
- Drain cocks will be provided in lowest points for emptying pipe system in case of frost.

### **366. FOAM FIRE EXTINGUISHING SYSTEM**

A foam fire extinguishing system shall be provided for deck surface over cargo tanks. Also one foam gun will be installed on boat deck for stern line.

The capacity and amount of hydrants must satisfy the applicable rules and regulations.

The system will consist of foam making water supply pumps, foam liquid storage tank.

The fire pumps and emergency fire pump will be used as foam making water supply.

Foam monitors combined with foam water nozzles. Foam liquid proportioners will be provided in engine room.

Foam tank will be integrated tank and will be suitably coated, in order not to react with foam liquid.

### **367. CO<sub>2</sub> System**

A CO<sub>2</sub> system will be installed for the engine room, emergency generator room and ballast pump room according to class, SOLAS and the national regulations.

CO<sub>2</sub> bottles will be installed in CO<sub>2</sub> room where placed on poop deck.

**400. - 499. MAIN AND AUXILIARY MACHINERY COMPONENTS**

**400. MACHINERY GENERAL**

All machinery will comply with the rules, regulations and specifications etc, listed in sections 010.

Where the specification exceeds the requirements of the above rules and regulations (- or where they do not apply -) the Specification shall prevail.

Torsional vibration calculations of the main propulsion machinery will be made by the main engine manufacturer including total shaft line.

Vibration and noise levels will meet the requirements of the national authority and specifications.

For design conditions see 024.

The following items will be arranged for continuous operation on diesel fuel according to Distillate Fuel Specification - British standard BSMA 100:

- Main engine	MDO
- Aux. engine	MDO
- Emergency generator set	MDO
- Boilers	MDO

**402. Design Conditions**

The design conditions for all machinery components and systems:

- Sea water temperature + 32°C
- Ambient engine room temperature + 45°C  
and relative humidity 70%
- Special hot areas such as inside the funnel and around the boilers etc., will be specially considered.

**403. Machinery Tests and Trials**

Tests and trials will be carried out in accordance with the requirements set forth in sections 081-085 and 087.

**404. Instruments and Gauges**

The necessary gauges, thermometers, indicators, counters, etc. shall be furnished for main and auxiliary machinery and piping systems, as required for proper operation and control.

For centralized control requirements see 800.

**409. Machinery Arrangement**

The lay-out of the engine room, the components and systems will be designed and arranged with emphasis on good accessibility, easy maintenance, effective operation, control and high reliability and as far as applicable to the experience and satisfaction of the owners.

**410. MAIN PROPULSION MACHINERY**

The propulsion of the vessel is achieved by means of a non-reversible main engine, driving a controllable pitch propeller via a reduction gear box.

The reduction gear box will be fitted with two speed PTO.

**411. Main Diesel Engine**

One four stroke medium speed engine, non-reversible, turbo-charged, main engine made by MAK, type 6M20.

Ratings: MCR = 1140 KW  
Engine speed: 1000 RPM

The above ratings are based on the following conditions:

- |                           |           |
|---------------------------|-----------|
| - sea water temperature   | 32 °C     |
| - suction air temperature | 45 °C     |
| - ambient air pressure    | 1000 mbar |
| - relative humidity       | 60%       |

Specific fuel oil consumption based on a lower calorific value of 42,700 kJ/kg and ISO 3046/1 reference conditions:

%100	190g/Kwh
% 85	189g/Kwh
% 75	189g/Kwh
% 50	191g/Kwh

Blower inlet temp. As per supplier's information

Blower inlet press. As per supplier's information

Charge air coolant temp. As per supplier's information

The engine manufacturer's delivery comprises:

- Spare parts and tools as per class requirements
- Tools for maintenance according to manufactures standard.

**418. Main Machinery Control**

The propulsion plant will be supplied with control equipment for remote control from the engine control room and bridge and wings as well as a local control direct on the engine.

**420. POWER TRANSMISSION SYSTEM**

**421. Gearbox**

One (1) reduction gearbox, single input (M/E)	
Input from main engine:	1140 kW/1000 RPM
Output for shaft generator:	308kW/1800 RPM
Output for gear oil pump	
Input for shaft motor	308kW/1800 RPM

**423. Shaft and Bearings**

The propeller shafting will consist of:

- 1 - Propeller shaft
- 1 - O.D. box for propeller

The shafts will be of forged steel and the thickness of the shafting will be 2 mm above the regulations.

The shafting system is to contain the necessary internal equipment and hydraulic oil tubes for operating the controllable pitch propeller.

The shafting will be earthed to the hull.

**424. Stern Tube with Bearings**

The stern tube will be an integrated part of the vessel.

A stern tube bearing will be provided at each end of the stern tube. The stern tube bearings to be oil-lubricated.

The bearing bush material will be of steel and the bearing liner will be of white metal with bearing length in accordance with the rules.

**425. Shaft Seals**

- 1 - Set of outer and inner shaft seals of rubber lip ring type..  
Outer shaft seal will be of split type and protected by rope guard (plate screen).

**427. CP-Propeller**

1 - CP-Propeller will be provided.

Diameter	: approx. 2.25 m
Propeller RPM	: approx 288
Number of blades	: 4
Materials:	
Blades	: NiAl-bronze

Preliminary calculations are made according to standart series, the dimensions mentioned above will be optimised according to proppeller and main engine data.

**430. GENERATOR PRIME MOVERS**

**431. Auxiliary Diesel Engine Sets**

For the main electric power production two (2) diesel engine alternator sets, will be installed. Two (2) sets each with a capacity of 225kW, 3 × 440V, 60 Hz, 1800 RPM.

The engine and the generator will be fitted on common bed plate of fabricated steel.

The diesel generator sets will be designed for continuous parallel run between them. Short time parallel run between shaft generator and diesel generators will be arranged.

The driving diesel will be a single acting, non reversible, four stroke, turbocharged, fresh water cooled marine diesel engine with forced lubrication and direct fuel injection.  
Engine fuel: MDO.

**432. Shaft Alternator**

A shaft alternator of 308 kW to be fitted through PTO system.

**433. Emergency Diesel Generator Set**

As emergency source of power, one diesel engine will be installed.

In the generator room, a fuel oil tank, the starting equipment and the emergency switchboard will be installed. The engine will run on MDO.

The diesel engine will be air cooled, single acting, four stroke, non-reversible engine having the output of approx. 90 kW, 3 x 440 V, 650 HZ, 1800 RMP.

The engine will be provided with flywheel, speed governor, cooling system, lub.oil system, fuel oil system and silencer with spark arrester.

The emergency diesel generator will not operate in parallel with main generators.

#### 440. PUMPS - GENERAL

All pumps when practical will be located above the floor plates.

#### 441. Pump Materials

Pump materials in accordance with the below table:

##### 441.1 Water Pumps

Pump fluid	Casing	Impeller	Shafting
Ballast pumps	Bronze	Bronze	Stainless steel
Fire pumps	Bronze	Bronze	Stainless steel
Tank cleaning	Ni Resist Cast iron	Stainless Steel	Stainless steel
Fresh cooling water	Cast iron or cast steel	Al. bronze	Stainless steel
Bilge water	Cast Iron	Bronze	Stainless steel
Bilge water (mono pump)	Cast iron Rubber liner	Stainless steel	
Foam Sea Water Pump	Bronze	Bronze	Stainless Steel
Fresh-water Pumps-domestic	Stainless Steel		
Emergency Fire	Bronze	Bronze	Stainless Steel

##### 441.2 Fuel and Lub. Oil Pumps

Pump type	Casing	Gear	Idler	Rotor
Gear	Cast iron	Carbon steel		Carbon steel
Screw	Cast iron	Steel Nitrated	S.G. steel	Carbon steel

#### 442. Centrifugal Pumps

Will be used for water pumps unless otherwise specified. Self-priming types where required. Normally, pumps will have mechanical shaft seals and ball bearings. Each pump with driver on common bedplate or structure.

**444. Rotary Positive Displacement Pumps**

Will be used for fuel and lub.oil. Pumps of self-priming type. Pumps will be internally lubricated by fluid pumped.  
Pumps will have relief valve of suitable size.

**446. Hand Pumps**

Hand pumps of adequate design will be installed for various minor services as required.

**447. Electric Motors for Pump Driving**

As far as possible, pump motors will be of the same make and to have a rated power equal to at least %10 more than the maximum power required for the pump. For other details, see 731.

**449. Ejectors**

One ejector will be used for bilge well suction in pump room, foreship .  
Driving water from fire and deckwash system.

**450. LIST OF PUMPS**

Pumps in number, capacity, and execution to recommendations for class, engine makers and makers of other relevant equipment for the service intended.

All pumps will be delivered, mounted, and connected in accordance with the system's design.

All figures are tentative and subject to final calculations by Builders.

Key to abbreviations:

C - centrifugal pump

H - horizontal

RP - reciprocating pump

S - screw pump

G - gear wheel pump

BE - built-on engine

HD - hydraulic motor

R - rotary pump

V - vertical

E - electric motor

SP - self priming

HT - high temperature

LT - low temperature

**451. Cooling Water Pumps**

2	- FW pump for main eng. (one of pump built on engine)	E/C
1	- SW pumps for air-condition machinery	E/C

The systems will be subject to the makers approval.

**452. Other Water Pumps**

1	Ejector pump for FW-generator	E/C
2	FW hydrophore pump 4,5 m <sup>3</sup> /h at 5.5 bar	E/C
1	FW hot water circulation pump	E/C
2	Ballast pumps	E/C/SP
1	Sewage discharge pump	E/C
2	Fire & deck wash pumps	E/C/SP
1	Tank cleaning pump	E/C

**453. Emergency Fire Pump**

1	Emergency fire pump	E/C/SP
---	---------------------	--------

**454. Fuel Oil Pumps**

1	MDO transfer pump 10m <sup>3</sup> /h at 4 bar	E/S or G
2	Booster pumps (one of pump built on M/E)	E/S or G
2	Supply pumps boiler	E/S or G

**455. Lub. Oil Pumps**

2	Main eng. lub. oil pumps	E/S
2	Gear lub. oil pumps (Built on gearbox)	E/S + BE

**456. Cargo Pumps**

9	Cargo pumps 100m <sup>3</sup> /h	E/S
9	Ex-proof electric motor for frequency converter drive	
1	Portable pump 70m <sup>3</sup> /h with hydraulic power	HD
1	Screw pump for deck tanks	S- HD

**459. Other Pumps**

1	Sludge pump	E/R
1	Oily bilge water sep. pump	E/R

**460. COMPRESSORS AND AIR VESSELS**

**461. Starting Air Compressors**

- 2 - (Two) starting air compressors will be installed. Working pressure 30 bar. Two cylinder type, air cooled and driven by an electric motor  
Capacity approx. 38 m<sup>3</sup>/h at 30 bar. (Supplier recommendation to be followed)

**465. Air Receivers**

- 2 - (Two) vertical starting air receivers will be installed.  
Working pressure: 30 bar  
Capacity: 250 l each (Supplier recommendation to be followed)

**470. TREATMENT UNITS FOR LIQUIDS**

**471. MDO separator**

- 1 - One MDO separator will be installed.

**474. Bilge Water Separator**

- 1 - Bilge water separator unit will be installed  
Capacity: 0,5 m<sup>3</sup>/h

The separator is capable of separating all kinds of mineral, vegetable and synthetic oils with a density up to 0.96, so that the oil content of water after treatment does not exceed 15 parts per million (PPM).

Separator unit will be arranged for fully automatic operation with an oil content alarm device.

The bilge water separator and the measuring equipment is to fulfil:

- MARPOL 73/78
- IMO Resolution A393 (x) and MEPC 60, (33)
- and latest recommendations

**475. Freshwater Generator**

- 1 - Fresh water generator in copper-nickel design with copper – nickel tubes, utilizing waste heat from engine jacket cooling water, skid mounted with all necessary accessories , e.g. valves, thermometers, manometers, salinometer unit , solenoid valves, distillate pump and salinometer/ control switch board.

Capacity :5-6 m<sup>3</sup>/24 h of fresh water with residual salt content of less than 4 ppm Nacl.

The freshwater generator will be heated from the HT-cooling water system.

**480. BOILERS IN GENERAL**

For general heating purposes two vertical steam generators will be installed.

**481. Steam Generator**

One steam generator capacity 900kg/h  
One steam generator capacity 600kg/h

Design pressure of steam generators	10 bar
Max working pressure of steam generators	9 bar
Working pressure at full load	8 bar

Fuel: MDO

The boiler will be made of welded steel plates, insulated with mineral wool and covered with galvanized steel sheet plates.

The unit is equipped with:

- Fuel pump
- Complete fuel oil piping
- Complete burner
- Necessary contactors, gauges, alarm and safety devices.
- Duplex softener
- Chemical pump
- Chemical tank
- Hotwell tank

**482. Exhaust gas**

Spark arrester and silencer will be installed in way of exhaust gas ducts.

**486. Sewage plant**

1- Biological sewage treatment plant with capacity adequate for 11 persons.

**500. - 599. OUTFIT AND EQUIPMENT (MACHINERY)**

**500. MARKINGS AND IDENTIFICATION**

**501. Tank Identification**

All tanks in machinery spaces will be clearly marked with their content and capacity.

**503. Exit Signs and Warning Signs**

Will be in accordance with standard.

**505. Pipe Colour Schedule**

All piping will be marked with coloured identification tape. Direction of flow will be indicated with arrows.

**506. Name Plates for Machinery Components**

All engines, pumps, compressors, boilers, pressure vessels etc. will have a name plate with the following information:

- Name of manufacturer
- Type
- Size, capacity, RPM, voltage etc.

**507. Label Plates on Valves and automation sensors**

Nameplates with text will be placed on or by all valves to ensure proper identification.

**508. Label Plates on Operation Panels**

Sufficient labels shall be mounted to secure information to operator.

**510. CLOSURES, ACCESS AND PROTECTION OF MACHINERY**

**512. Floor Plates. Landings and Gratings**

Floor plates will be provided to form platforms and passageways as are required for access to the machinery in order to permit inspection, local operation, maintenance and repair.

Floor plates will be removable for access to bilges, machinery, valves, filters or similar.

Floor plates and boundary bars will be of steel. Vertical supports attached to the hull structure will be of steel. Machinery is not to be used to support floor plates. Plates will be divided into sections small enough for easy handling.

Landing area below the removal route is to be kept free from all kinds of machinery and equipment.

Platforms above floor level may be fitted as gratings, where lighting and ventilation conditions do not permit floor plates to be fitted.

**513. Stairs, Ladders and Emergency Exits**

Adequate number and size of stairs and ladders will be arranged for convenient access to all decks, platforms, casings and funnel.

Stairs and ladders will be made of steel. The treads of sloping ladders will be of approved pattern and designed to provide a durable non-slip surface.

All sloping ladders will be fitted with a screen plate.

Vertical access ladders will have flat bar side stringers and square rod rungs.

Fully enclosed emergency exit will be provided from upper platform in engine room to open deck.

Emergency exit to be provided with self-closing door.

**514. Rails and Stanchions**

Handrails and stanchions will be of steel.

Handrails and stanchions will be securely fixed by screws or bolts.

Protective rails, screens or guards as appropriate will be fitted as directed to safeguard personnel from rotating machinery, openings or other hazards.

Portable stanchions will be made where necessary for access to equipment and machinery.

**515. Guard Rails and Guards**

Guards, splash plates, casings, fenders, hand and foot holes, screens, handrails, etc. required for the safety of the personnel and machinery will be provided and fitted as required. Moving parts of machinery in which floating objects may become lodged under flooded condition will be adequately guarded.

**516. Insulation of Machinery**

All heated zones at machinery will be insulated for the safeguard of personnel and for saving energy purposes.

**520. ENGINE ROOM OUTFIT AND EQUIPMENT**

**521. Fixed Mounting of Machinery**

When mounting machinery components great care will be taken to ensure proper alignment. Shims, chocks etc. will be used as required.

**524. Fire-Extinguishing**

For fire-extinguishing in machinery spaces, see section 366.

**530. MAINTENANCE AND REPAIR FACILITIES**

**531. Lifting Gear**

Crane rails (2 tonnes) will be arranged above main engine. Mono rail will be provided above auxillary engines and purifiers.  
Strong lifting pads (0.5 tonnes) for tackles will be arranged above large or heavy components.

**532. Transfer Arrangement**

The design and arrangement of the machinery space shall be such that components, as a , electric motors etc., can be removed from their position and fairly easily be unshipped through emergency hatch. Size must be proportional to the size of the shaft generator, turbo-charger or diesel engine for the generator.

One lifting beam from engine room to the machinery workshop will be arr. with a runner for 2 tonnes.

**533. Working Area with Outfit**

A mechanical engineering working area will be provided.

The machinery and equipment will include:

2 - Parallel vices

The workshop is also to be provided with shelves and lockers for small engine components as appropriate.

**535. Working Area Machines**

The following workshop machines will be installed:

- 1 - Drilling machine, bench type. Drill capacity up to 20 mm diameter in steel.
- 1 - Double wheel grinding machine, wheel size 175 mm diameter.

**536. Autogenous Welding Equipment**

- 1 - Set of oxygen and acetylene welding equipment comprising:
- 2 - Oxygen bottle
- 1 - Acetylene bottle
- 1 - Set of standard cutting and welding equipment including 2 x 25 metres of hoses
- 1 - Set of various welding rods etc.

The acetylene and oxygen bottles will be located in a separate room outside machinery space (on boat deck with protective cabin).

Outlet station with manometer and reduction valves for bottles will be arranged at welding table.

**540. VENTILATION AND EXHAUST GAS SYSTEM**

**541. Ventilation**

The machinery space is to have natural exhaust ventilation through a rainproof grid on the forward side of the funnel. A fire damper operable from outside the funnel will be fitted.

**542. Mechanical Ventilation**

2 Engine room supply fans will be installed. The amount of fresh air supply will be calculated as follows: two and a half times the air consumption, which includes main engine at MCR and two boilers running at maximum power.

Integrated steel trunkings in plating or galvanized steel sheet ducts with fire dampers from fans to machinery spaces with branches for effective air distribution. Adjustment arrangement will be provided.

**543. Exhaust Gas System for Main Engine**

The main engine will be provided with an independent exhaust gas system.

The main engine exhaust system including the silencer with spark arrestor will be suitably insulated up to the funnel top deck, see 546.

Steel compensators, will be fitted to allow for expansion and to reduce vibrations.

The silencer will be delivered and will have a 25 dB(A) attenuation.

A water trap, complete with drain cock, will be installed in the lowest point of the uptake to prevent the ingress of water into the engine.

The system will be fabricated in mild steel, and fitted with elastic support.

**544. Exhaust Gas System for Diesel Generating Sets**

Each diesel generating set will be provided with an independent exhaust pipe system. The uptakes and silencers with spark arrestor of the diesel generating sets will be suitably insulated up to the funnel top deck, see 546. The exhaust silencers of the diesel generator sets will be designed for a nominal 25 dB(A) attenuation.

Steel compensators, will be fitted to allow for expansion and to reduce vibrations.

A water trap, complete with drain cock, will be installed in the lowest point of each uptake to prevent the ingress of water into the engine.

The systems will be fabricated in mild steel, and fitted with elastic support..

The steam generators will be provided with an independent exhaust pipe system.

When operating at full output, the uptake system pressure loss not to exceed suppliers' recommendations. The system will be designed to withstand exhaust gas temperatures and pressures corresponding to the boiler supplier's specified duty.

The uptake system will be fabricated in mild steel.

#### **546. Insulation of Engine Exhaust Gas Systems and Boiler Uptake**

Exhaust pipes, silencers, and boiler uptakes will be insulated with Rockwool or other approved material, suitably lagged with alu-coated glass fibre cloth neatly sewed with wire. Where exposed to mechanical damage, such as in trafficated areas, galvanized steel sheet covering to be provided.

#### **549. Crankcase Venting**

The main engine crankcase will be vented through a pipe led directly and unbroken from the engine to the funnel, terminating with a flame screen. The pipe will be provided with a drain arrangement for drainage of oil condensation.

#### **560. HEAT EXCHANGERS**

##### **561. Heat Exchangers - General**

The heat exchangers for the main engine and generator to be of box cooler type.

Box coolers shall be mounted in sea chests.

The capacities will be according to the requirements of the supplier.

Heat exchanger will be equipped with thermometers at inlets and outlets.

The maximum efficiency will be satisfied at 85% capacity of the heat exchangers.

The heating reates and surface area to be adjusted in accordance with the fluid and maker's recommendations.

##### **568. Freshwater Heaters**

2 - Hot water tank capacity approx. 0.1 m<sup>3</sup>.

The fresh water heater will be heated by electric.

**570. ENGINE ROOM TANKS**

**571. Tank Outfit - General**

All tanks will be in rigid steel construction. Tanks may be part of ship's structure (integral) or independent, constructed in workshop and welded to suitable foundations. Easy access to internal of all tanks for inspection and cleaning will be provided, and all tanks will be furnished with necessary manholes, handholes, drain connections, and level indicators.

Leakage fuel oil from engines, fuel oil units etc. will be collected to leak tank. Leakage oil from engine, lub. Oil units etc. will be collected to dirty oil tank. Sludge may be pumped ashore by sludge pump.

The below listed tanks will be provided as a minimum..

The capacities of tanks in the engine systems is to meet the engine manufacturer's recommendations. The capacities for the remaining tanks - where not specified - are to suit the services and circumstances.

The capacities will be determined taking into account the margin of 4% expansion, and 6% unpumpables.

**580. TOOLS, SPARES, STORES**

**581. Storage of Tools, Spares, and Stores**

All items will be delivered to the Builders will be stored and transported on board the vessel.

**582. Store Room with Outfit**

The store room to be furnished with steel lockers, drawers, and shelves of steel in sufficient number.

Lockers will have locks.

**583. Standard Engine Tools**

Tools normally supplied with equipment will be delivered

**584. Class Spare Parts**

Spare parts will be delivered in accordance with class requirements or according to shipyard's standard delivery extent.

## **600. - 699. MACHINERY PIPING SYSTEM**

### **600. MACHINERY PIPING - GENERAL**

#### **601. System Requirements - General**

All piping systems will be installed in accordance with the Builders' drawings as approved by the Owner. All piping system will be designed following maker's recommendations.

All piping will be led as directly and practically as possible. No pipes will be fitted close to switchboards, wiring, and electrical control equipment, and oil piping will be fitted at a safe distance from hot surfaces.

Pockets in pipelines will be avoided wherever practicable, and all pipelines will be provided with fittings and valves facilitating complete drainage, when desired.

All steel piping is to be roughly cleaned before installation. All lubricating and hydraulic oil piping will be cleaned and to be protected against corrosion until use. After installation, all piping systems will be thoroughly cleaned by flushing with the medium they are intended for and/or in accordance with the equipment manufacturers' requirements.

In general, the necessary number of isolating valves will be provided in the cooling water systems, freshwater systems, hydrophore and heating systems, so that various parts of the systems may be closed, when necessary, to make repairs without closing the entire system.

All piping, whenever practical, will be kept clear of the weather deck.

#### **604. Valves, Fittings, Materials, Types**

Relief valves will be installed on the discharge side of the following pumps and heat exchangers:

- all positive displacement pumps
- all heat exchangers.

Gauges to be fitted:

- pressure gauges on pressure and suction sides of pumps.
- temperature gauges as necessary.

#### **605. Assembly and Supports**

Large pipe lines will be made in sections at adequate lengths in order to minimize access work in case of dismantling and refitting.

Generally, pipes above nominal diameter of 50 mm will be assembled with flanged connections. Hydraulic pipes will be assembled with special couplings.

All pipes will be suitably supported. Supports are selected to prevent excessive thermal loads, gravity loads, and vibrational forces from being transmitted to connected components and vice versa.

#### **606. Insulation of Pipes**

Cold pipes for refrigeration will be insulated with mineral wool or equal.

Hot water pipes will be insulated when the normal operating temperature exceeds 50°C, excluding freshwater cooling pipes.

Pipes will be insulated with mineral wool or other approved material, suitably lagged with coated glasfibre cloth.

Where exposed to mechanical damage, galvanized steel sheet covering will be provided. The insulation will normally not cover flanges and valves.

**607. Protection of Pipes**

All pipes will be properly fastened to the structure of the ship with clips or similar. Where exposed to mechanical damage, pipes will be practically protected. Expansion bends and/or flexible couplings will be used where pipes are exposed to stresses due to temperature variations and to hull deflections.

**608. Valves for Quick Closing Systems**

Quick closing valves of approved type will be mounted on fuel and oil tanks according to regulations. Operation panel will be operated by hydraulic valves, and operating instruction will be placed near emergency stops in the fire control position.

**610. COOLING WATER SYSTEMS IN GENERAL**

Two sea chests will be provided.

Air blowing system will be arranged to each sea chest.

**611. Sea-water Cooling Systems**

The sea-water cooling systems will comprise:

- M/E and Generators cooling system with box cooler.
- Sea water supply for FW-generator plant.

**612. Sea Inlet Valves**

A strainer provided with stainless steel basket will be installed between sea chest and sea water main line. A closing valve will be installed on both sides of the strainer. Sea valve will be of gate valve type.

**615. Freshwater Cooling System**

The freshwater cooling systems will comprise two F.W cooling pump (one st-by). Fresh Water cooling circuit will be arranged for chemical corrosion inhibition.

**620. FUEL OIL SYSTEM**

**622. Marine Diesel Oil System**

A combined diesel oil transfer and supply system will be arranged. The diesel oil transfer pumps draws from the bunker tank and delivers to the sett. tank.

The separator pump draws from the settling tank and delivers to the service tank.

Overflow to the fuel overflow tank.

Filling/overflow system as for the HFO system.

Supply system will be arranged for:

- Main engine
- Diesel alternator engines
- Emergency diesel engine
- Steam Generators

Two (2) electric-motor driven screw pump for MDO transfer.

For MDO purification.

**623. MDO System for boilers**

Two (2) fuel oil booster pumps will be installed for the steam generators according to the recommendations of the supplier of the plant.

**624. Main engine MDO-system.**

The fuel oil supply to the main engine will be as follows:

Main components:

- Diesel Oil Feed Pump (built on engine)
- Diesel Oil Feed Pump (st-by)
- Fuel primary filter
- 1 pc MDO Separator
  - 1 pc Sep. transfer pump
  - 1 pc Fuel fine filter
  - 1 pc water separator filter

**630. LUBRICATING OIL SYSTEM**

**631. Lubricating Oil System for the Main Engine**

The main engine to operate on the wet sump.

The lub. oil system will consist of the following:

- 2 pcs Lub. oil pumps (one built on engine)
- 1 pc Lub. oil cooler (FW-cooled)
- 1 pc Duplex fine filter (on M/E)
- 1 pc Lub. oil centrifugal filter
  - 1 pc M/E Lub. Oil Filling Pump

**633. Lubricating Oil System for Gear**

The system will supply filtered and cooled lubricating oil to the gearbox and will include:

- Gearbox-driven lubricating oil pump (built on gear box)
- Standby lubricating oil pump (built on gear box)
- Lubricating oil cooler (FW-cooled) (built on gear box)

**634. Lubricating Oil System for Shaft Seals**

The system will be in accordance with shaft seal makers' recommendations.

The system will consist of:

- 1 Gravity tank

**635. Lubricating Oil System for Diesel Alternator Engines**

One Generator Lub. Oil storage tank will be provided.

**640. COMPRESSED AIR SYSTEMS**

The following compressed air systems will be provided:

- Starting air system, 30 bar
- Service air system, 7 bar
- Control air system

**641. Starting Air System**

The 30 bar starting air system will be capable of performing the following functions:

- Providing 6 starts for the main engine
- Providing 3 starts on each diesel generating set

**642. Working Air System**

One air bottle will be provided for working air system.

Working connections will be arranged for the following spaces:

- machinery working area
- on the decks
- machinery spaces

- paint store

### **643. Control Air System and Other Controls**

Control air for equipments will be arranged from 7 bar system. Air balance for the system will be provided.

Control air to be supplied for:

- Main engine
- Bilgewater separator
- Odme
- Self Priming Units

Reduction valves will be fitted where required.

A relief valve will be fitted on the reduced pressure side for all reducing valves.

### **650. MISCELLANEOUS PIPING SYSTEMS**

#### **651. Ballast System**

The ballast system will facilitate:

- Drawing and delivering ballast water from/to all ballast tanks

The ballast system will be arranged with two ballast pumps both electrically driven. The pumps will be fitted with approved type of self-priming device.

The ballast pumps will draw from common SW-cross-over. Filling of ballast tanks by means of gravity will be arranged where possible.

The ballast valves will be remote controlled.

Emergency unloading ballast water pipe DN 200 leading to the manifold area will be mounted.

#### **652.1 Bilge System**

The machinery compartments will be drained by means of the bilge pumps through bilge suction lines and discharged overboard.

#### **652.2 Oil Bilge System**

The oil bilge system will be capable of performing the following functions:

- Pumping sullage (fuel oil, diesel oil, sea water or fresh water, lub. oil and mixtures thereof) from wells and recesses in engine room
- Separating oil and water
- Discharging oil to the sludge oil tank and clean sea-water overboard to specified standard
- Discharging sludge oil to barge or ashore.

The system consists of:

- 1 pcs Bilgewater separator with built-on supply pump
- 1 pcs Sludge pump

**654. Hydrophore System**

The system consists of the following components:

- 2 pcs F.W. Hydrophore pumps
- 1 pcs F.W. membrane tank
- 1 pc Industrial water Hydrophore pump
- 1 pc Industrial water membrane tank
- 2 pcs Hot water tank
- 2 pcs Hot freshwater circulation pump
- 1 pc F.W. generator with pump

Freshwater hydrophore pumps draw from freshwater tanks and deliver freshwater to the system via the hydrophore tank.

**658. Electrical Heating System**

The heating system will cover the heat demand for the following equipment:

- Hot water tank (a tank to store hot water for domestic water system)

**670. Steam Generator System**

The steam system is to provide heating services to the following:

- Heating of all cargo system tanks .

The system will include;

- Two steam generators
- Two water feed pumps (to boiler)
- Two fuel booster pumps
- One duplex softener
- One chemical pump
- One chemical tank
- Two water feed pumps (to hotwell)

## **700. -799. ELECTRICAL PART**

### **700. ELECTRICAL PART - GENERAL**

#### **701. Electrical Requirements**

All electric installations and equipment to comply with the rules and regulations etc. listed in sections 010.

Generally, all equipment to be of types suitable for shipboard use.

#### **702. Design Conditions**

Ambient air temperature +45°C (in hot locations, however, over +80°C) and air of extremely high humidity, containing salt and oil vapour.

#### **703. Electrical Tests and Trials**

Tests and trials will be carried out in accordance with the requirements set forth in sections 081-083 and 084-085.

#### **704. Instruments (Electric)**

The necessary instruments for all systems to be furnished and installed.

#### **706. Name and Label Plates**

Name plates on equipment similar to those on machinery components, see 506. Label plates will be fitted on switchboards, panels, circuit breakers etc. for clear identification of all equipment.

#### **707. Electric Power Systems**

2 x 440 volt, 60 cycles A.C. -	for power consumers
3 x 220 volt, 60 cycles A.C. -	for lighting and small power consumers
24 volt D.C. -	Radio equipment, supplied via batteries, battery chargers, and stabilizer arrangement

All systems of the insulated type, 2 or 3 wires, as appropriate.

#### **709. Electrical Arrangement**

All electric equipment will be located with easy access in mind for repairs and removal, and as to reduce to a minimum any likelihood that the equipment may be exposed to damage caused by leaking oil, water etc. from pipes or tanks, or by excessive heat, or to mechanical damage.

A "one-line electrical diagram" will be drafted, and a framed copy hereof will be mounted near the main switchboard.

**710. ELECTRIC POWER SUPPLY**

**711. Main Generators**

- 2 diesel driven 3 phase AC generators designed for continuous service. The generators will be of enclosed type, class H insulated, brushless with stand still heating  
225 KW, 1800 RPM, 3 x 440 volt, 60 hz.  
The generators will be designed for manual and automatic synchronizing for parallel operation. The kW load is to be shared proportionally.  
Each generator will be mounted on common bedplate with their driving diesel engines.

**713. Emergency Generator**

1 Approx. 90 KW, 3 x 440 V, 60 hz  
Similar execution as the main generators.

**714. Shaft Generator**

1 Shaft generator & emergency go home motor driven by gearbox with filter for air intake.  
Rating: approx. 308 KW, 3 x 440 V, 60 hz

**715. Shore Connection**

The rating will be sufficient to maintain the following services:  
Galley, domestic water services, workshop, and all lighting, accommodation vent fans, air conditioning, and No. 1 engine room fan. Shore connection panel with voltmeter, amperemeter, phase indicator, fuses and triple-pole insulation switch. Information signboard will be mounted.  
Pipe with watertight screw cover will be located in suitable position for leading shore cable through house side or other structural element.  
3 x 440 V, 60 Hz, 250 A.

**716. Batteries**

Batteries of exide gel(dry) type, for the D.C. system. Battery groups for all battery-served consumers placed in boxes easily accessible and on insulated battens. Two automatic battery charging according to rules with charging panels in adequate locations.

**720. ELECTRIC DISTRIBUTION**

**721. Main Switchboard**

The main switchboard will be of dead front totally enclosed, IP 22, built of steel angle bar framework with sheet steel panels forming wholly separated cubicles for circuit breakers, instruments and - where applicable - motor starters.  
The main switchboard is to contain panels for all generators, shore connection and essential power consumers, other consumers and lighting.  
It is possible to separate the main switchboard.  
The necessary circuit breakers and fuse switch units etc. will be installed.  
The necessary amperemeters, hour counter, voltmeters and kilowattmeters all of flush

mounted type, and indicator lamps to be provided. Otherwise as per Rules and Regulations. For generator protection, the generator circuit breakers shall have over-current release, short circuit release, reverse current tripping, voltage regulations and minimum voltage relays. A preference circuit-breaker for tripping of non-essential services will be installed. Spare connections for possible future installations will be provided. Central synchronizing equipment for parallel operation of main generators will be installed with synchroscope, synchronizing lamps selector switch for generators, frequency meter, etc. 10% spare circuits will be installed. The consumers will be arranged as symmetrical as possible. Bow thruster will be feeded by shaft generators or diesel generators. Sequential disconnection will be provided.

**722. Emergency Switchboard**

Protection Level IP 22. The emergency switchboard will be constructed in a similar manner as the main switchboard and shall also incorporate the shore-connection box. Emergency and main switchboard will be connected via an automatic change-over device. The switchboard is to contain an isolating switch, and besides, the necessary equipment and instruments will be provided.

**723. Distribution Panels, Power**

Protection Level IP 54. Power distribution panels of the circuit breaker type will be provided where appropriate for grouping of power loads. All panels will be enclosed in steel drip proof cabinets with hinged doors. Necessary equipment will be fitted for the shore connection. One spare circuit will be installed near bridge.

**724. Distribution Panels, Lighting**

Protection Level IP 54. Lighting distribution panels in number and sizes, as necessary. All panels will be in similar execution as power distribution panels. Each panel is to have a circuit breaker for each single phase branch circuit so arranged that approx. balanced load is obtained between the three phases. 10% spare circuits will be installed.

**725. Transformers**

Protection Level IP 55. 2 Transformers will be of air-cooled (natural draft) marine, drip-proof construction. Voltage: 3 x 440/220 V at full load. Capacity according to electric balance plus 10%. 1 emergency transformer.

**726. Cables and Cable Installations**

All ordinary cables will be standard marine cables of the EPR (Ethylene, Propylene, Rubber) type or equal. Ratings to class requirements. In hot locations, where ambient temperature exceeds + 60°C, fire-resistant type cables will be used and to be placed as far as possible away from heat-sources.

Special cables or conductor types, such as coaxial cables or copper tubing etc., will be used for certain electronic circuits and antenna connections.

Portable cords shall be of oil proof heavy duty rubberjacketed type.

Generally, all cables shall be mounted and/or supported on non-corrosive suitable hangers and/or cable trays of galvanized type. Where subject to mechanical damage, including all open decks, suitable protection is to be arranged or armoured cables to be used.

Number of layers of cables to meet class requirements. Cables passing through decks will be protected by deck tubes. Cables passing through watertight bulkheads will have watertight penetrating sleeves.

Cables for power circuits and the signals will have different colours and will not be mixed.

Cables bends will be according to rules and makers recommendations.

#### **727. Circuit Breakers**

Marine-type circuit breakers will be used throughout. Different types for different applications, as necessary, but number of different types will be kept at a minimum. All circuit breakers shall be capable of opening circuits, carrying the maximum fault currents obtainable at their points of application.

#### **728. Fuses**

Where required, fuses will be installed. The fuses and fuse blocks will be clearly marked to indicate ratings.

#### **730. ELECTRIC POWER DEVICES**

##### **731. Electric Motors**

Protection Level IP 56. Standard electric motors will be used. Motor will be single- or three-phase motors, where appropriate

##### **732. Starters and Controllers**

Starters generally of IP 54 marine type. In wet locations of IP 54, however, of fully enclosed marine type.

Coils, contacts, etc. will be easily replaceable.

Controls for all motors with low-voltage release or low-voltage protection as required, and furthermore, with over-current protection.

Emergency stopping will be provided for all ventilation and forced draft fans, diesel oil pumps and diesel oil separator.

**740. LIGHTING**

**741. Lighting Fixtures**

Sufficient and suitable lighting installations will be provided throughout. All items in the lighting system to be of good marine or heavy duty industrial quality. The system will conform to the refinery rules.

In engine room, steering gear compartment, in exterior and interior passageways, bathrooms, galley, laundry, miscellaneous work rooms, cabins, messrooms, recreation rooms, offices, and wheelhouse store rooms, etc., fluorescent lighting fixtures will be installed. In all wet spaces and on open deck fixtures will be of spray-proof types. Where subject to damage, such as in work areas, fixtures to have guards.

Reading lamp over head of each berth. Suitable working lamps over each writing desk. Working lamps at chart table.

Two separate lighting systems each %50, will be installed, consisting of:

1. Normal lighting
2. Emergency lighting, suitably marked

**742. Plug Sockets**

All sockets will be multi-standard

- 2 Plug sockets with two pole switch shall be installed in all cabins, messrooms and recreation rooms.
- 2 Plug sockets in offices, and wheelhouse and one extra on card table.
- 8 two pole waterproof marine type sockets shall be installed in galley
- 2 two pole waterproof sockets and 1 two pole socket shall be installed in laundry.
- 1 Shaving socket with integral isolating transformer to be installed in each bathroom
- 1 two pole socket for welding transformer will be provided in the following locations: in engine room workshop, on after deck and in the fore end of the ship.

**743. Navigation Lights and Anchor Lights**

Complete set of navigation lights, signal lights and anchor lights in accordance with the regulations will be installed. Each light has a 220 V A.C. bulb with two power sources, main and emergency. Separate control panel with indicator lamps in wheelhouse.

The top lights, side lights, anchor lights and stern lights each will be duplicated.

**744. Signal Lights**

Signal light NUC, will be installed according to rules. Separate control panel with indicator lamps for navigation and signal lights in wheelhouse.

Manoeuvring light on top of signal mast, fog horn installed to forward mast.

One high intensity long range daylight signalling light of marine type will be provided.

Christmastmas tree will be provided.

**745. Search Light**

1 - search light, 1000 W, operable from wheel house will be fitted on top of wheel house.

**747. Flood Lights**

Flood lights of watertight halogen or high press sodium type will be installed in sufficient number to adequately illuminate cargo deck, upper deck, after deck, trunk on deck and lifeboat stations. To be controlled from wheelhouse and will conform to the refinery rules.

Also flood lights at gangways.

**748. Emergency Lighting**

Emergency lighting will be arranged in engine spaces, and in stairs and passageways in accommodation areas and at boat embarkation stations as per regulations.

**750. COMMUNICATION AND NAVIGATION EQUIPMENTS**

The equipment under this heading will be delivered according to the GMDSS rules.

**751. Radio Equipment (GMDSS)**

One radio station to be arranged in accordance with GMDSS, including the following equipment:

- (2) SAILOR VHF DSC
- (1) SAILOR MINI-M (fax, data, telephone communication with satellite)
- MF/HF Radio station
- ICS NAV V NAVTEX
- (2) SAILOR VHF DSC radiotelephones
- SAILOR AIS.

**752. Lifeboat Radio and Survival equipment**

- (1) Float free – SAILOR EPIRB
- (2) SAILOR SART
- (3) Emergency portable VHF with charger - portable water and explosion proof.

**753. Communal Aerial Systems**

- (1) AM, FM, and TV broadcast receiving antenna plant with amplifier and with outlet sockets.

**754. Broadcast Equipment**

- (1) Broadcast receivers and stereo music sets will be installed in the recreation rooms
- (4) Television set will be installed in the recreation rooms.
- (1) Broadcast receivers will be installed, in each cabin.

**755. Intercommunication and Command Systems**

- (1) Public address system.
- (1) 20 station internal telephone system in cabins and sub-stations
- (5) powered system with sound
- (1) loud speaking and talk-back system with 6 stations
- (3) intrinsically safe VHF Portable System with automatic charging device
- (1) intrinsically safe type telephone with 3 stations

**756. Weather Fax**

Fax receiver

**757. General Alarm and Alarm Bells**

Bells and sirens as appropriate will have distinctive sound qualities enabling the crew members clearly to identify the alarm source or system by the hearing sense only. In engine room, flickering lights may be required as additional means of calling attention.  
General alarm system as per regulations

**760. NAVIGATION**

**761. Gyro Compass, Autopilot and Radar**

- (2) X-band radar (Kelvin Hughes NUC 5000 radar)
- (1) Gyro
- (1) Autopilot
- (4) Gyro repeaters (2 bearing repeater, 2 digital repeater)

**762. Depth Sounder**

- (1) Skipper navigation echosounder with recorder in wheelhouse.

**764. Speed/Log Indicator**

- (1) Dobbler type with transducer and sea valve.  
Display unit providing speed in knots on digital indicators on bridge deck console.

**765. Revolution Indicator and C.P. Propeller Indicator**

Propeller revolution indicator mounted overhead in wheelhouse centre, and in side consoles.  
To be easily read from all normal conning positions.

**767. Electric Whistle**

- (1) Electric whistle complete with both manual control and automatic foghorn control
- (1) Push button will be installed in wheelhouse console.

**768. Hyperbola and Satellite Navigation etc**

- (1) GPS navigator differential.
  - (1) GPS navigator.
  - (1) Navtex Receiver
- Necessary antennas, cable connections and all necessary accessories to be provided.

**769 Conning Station**

Conning station for integrated automation/ecdis system to be provided.

**770. MISCELLANEOUS ELECTRIC EQUIPMENT**

**771. Radio Screening**

All motors and generators to be radio screened. In way of navigating bridge only screened wiring to be used.

**773. Load Computer**

- 1 - Load computer with software on-line with cargo tanks' remote readings and stability calculation.
- 1 - 2 axis inclinometers.

**780. TOOLS, SPARES, STORES (ELECTRIC) (ALSO 1080)**

**781. Storage of Tools, Spares and Stores**

All parts will be properly stored in boxes with clear identification of all items.

**783. Standard Tools**

Will be delivered to the extent normally supplied by the manufacturers of the equipment.

**784. Class Spare Parts**

Will be delivered and checked by class surveyor.

**785. Manufacturers' Standard Spares (not Class Spares)**

Standard spares normally offered and delivered with equipment to be supplied.

## **800. - 899. AUTOMATION**

The ship is fitted with automated installations enabling machinery spaces to remain periodically unattended in all sailing conditions including manoeuvring, with class notation AUT-UMS.

The automation details will be provided after negotiating with the suppliers and approval by the owner.

### **800. CENTRALIZED INSTRUMENTATION, GENERAL**

Remote and automatic controls and instrumentation will be provided to the extent required by the relevant rules and regulations, see section 010, for operation with unmanned engine room and one man at bridge.

Sufficient local controls and instruments will be provided to enable the crew to bring the ship safely to port under manual control in the event of a break-down of any of the remotely or automatically controlled systems.

Instruments, sensors and controls will be of highest quality for maximum reliability and accuracy, and besides of simple, robust and standardized design for easy replacement - and if practicable repair - by the ship's staff.

As far as possible all instrumentation will be delivered from the same supplier and the same manufacturer.

The bridge control desk and cargo control desk will be carefully designed with a view to safe operations and ergonomic considerations, see also 811.

The engine control room will be arranged adjacent to the engine room. The control room will be well ventilated with two air conditioned units each 75% capacity and containing all necessary equipment for obtaining unmanned classification.

**810. MANOEUVRING CONSOLES, MAIN CONSOLES**

**811. Consoles. Lay-Out**

Central control console and wing control consoles in the wheelhouse will be built-up from separate modules of a common base welded to the ship's platform and painted with store hardened Hammertone finish or similar.

Internal wiring will be well marked.

**813. Alarm System**

An automatic continuous alarm monitoring system for all essential equipment will be arranged.

The alarm system, both for engine room and bridge (One Man Bridge Operation-rules) shall indicate incoming alarms on the central visual display unit, located in the engine control room and the bridge.

An audible and visual alarm indication will be arranged both in the engine room and on the bridge.

The bridge alarm panel and the cabin watch calling will be connected to the central alarm unit located in the engine control room.

The alarms monitored in the wheelhouse will be in accordance with class requirements.

The engine monitoring cabinet will be equipped with:

- Engine room alarm unit.
- Alarm fault printer.
- Exhaust gas alarm unit.
- Engineer call central unit.
- M/E safety unit.

**840. SYSTEMS FOR OPERATION OF DIESEL GENERATOR SETS**

**841. Remote Start/Stop and Manoeuvring**

The control system for the diesel generator sets will be part of the control system in the control room.

Automatic start of the diesel generator sets will occur under the following conditions:

- Standby start request from a faulty running set
- Low surplus power
- Start request of large electrical consumers
- Low line voltage or low line frequency
- Black-out

**842. Automatic Synchronizing, Phasing In, Magnetizing, Load Sharing**

The control system for the diesel generator sets to achieve the following function:

- Automatic synchronizing to be arranged before connection of a generator to the bus bars.
- Maintaining the line frequency at rated value.

- Dividing the total load between the running generators in proportion to their rated load

**870. AUTOMATION EQUIPMENT FOR OTHER MACHINERY COMPONENTS**

All equipment to be provided with the necessary automation.

**878. Remote tank gauging System**

Remote sounding to be arranged for ballast, diesel oil bunker tanks.

**900. - 999. CARGO SPACES AND CARGO HANDLING**

**916. Cargo tank hatch covers**

Cargo tank access hatch covers will be of circular swing away type abt. 760 mm diameter.. Additionally closing sounding devices with sounding pipe for each cargo tank will be provided.

**917. Walkway on weather deck**

A walkway from aft to fore of the main deck will be installed and outfitted according to rules and regulations.

**924. Stairs and ladders**

Ladders in cargo tanks sub-vertical.

**950. CARGO TANKS ARRANGEMENT AND ACCESSORIES**

In general

The ship will be arranged for the loading and unloading of products via a group of midship manifold. Additionally a stern line will be provided on poop deck.

The cargo discharging system consist of one electrically-driven submerged deepwell pump in each tank.

Each cargo tank will be provided with an individual discharge and filling line, each cargo line cross-connected to one common crossover.

The unloading through the midship manifold will be arranged to total cargo discharge in 6 hours.

Pipes shall be supported to prevent damage from vibration and other causes. Teflon or fiber strips will be installed under pipe support to avoid direct contact between stainless steel pipe and supporting steel.

Heating capacity will be dimensioned for specified cargo heating.

Each cargo tank will be fitted with a fixed nozzle tank cleaning machine..

Each cargo tank will be provided with a controlled cargo venting system with one high velocity not hammering P/V-valve. The system will be cross-connected to common line.

Flame arrester will be installed on vapour return line.

**951. Service crane**

One service crane for hose handling will be provided. It will be located in midship manifold area with an outreach of 10 m and SWL 2t.

**953. Cargo pumps**

Each cargo and slop tank will be fitted with an individual electrically driven submerged pump. Pumps will be constructed of AISI 316 stainless steel.

9 pcs cargo pumps with a capacity of 100 m<sup>3</sup>/h 100 m.c.l.  
1 pc transportable hydraulically driven pump.

**954. Cargo piping and valves**

Piping system to fulfil applicable recommendations of IMO and Class Society. The diameters, reducers and Y will be fixed after the class approval of the system drawings.

Pipes: AISI 316L SCH. 10S  
Butterfly valves: AISI 316  
Ball valve: AISI 316  
Nuts and bolts: Stainless steel  
Design temp.: 80°C

In general, piping will run as directly as practical with a minimum number of bends. Cargo lines are to be arranged to drain to the crossovers at the pumps. Low points, and if found necessary from a drainage point of view, bends, shall have a drain valve.

The vessel cargo manifold system in midship shall be designed and arranged in accordance with O.C.I.M.F. "Recommendations for Oil Tanker Manifold and Associated Equipment" where applicable.

Pipe diam.:  
Individual cargo pipe:  
Common crossover: 150 mm  
Stripping line 25 mm

Ball valve on manifold, drop line and stripping line.  
Ball valve on manifold and drop line to have drain valve.

Valve for dropline, delivery valve (cargo pump) will be electro-hydraulically remote-controlled from cargo control room.  
Hydraulic pipe for remote controlled valve will be of stainless steel 1 mm wall.

Vapour return:  
Cargo vapour return line for connection to shore based Vapour Emission Control System (V.E.C.S.), and location acc. to O.C.I.M.F.

Pipe diameter:

Individual venting pipe to be DN 80. (according to pressure drop calculation)  
Two (2) Common vapour return crossover: 125 mm

**957. Cargo and ballast control**

The cargo control system will incorporate a mimic diagram for remote operation and monitoring of the cargo handling operation.

Following functions to be provided at least:

Cargo and ballast transfer

- Cargo and ballast valve control.
- Cargo and ballast valve position indication.
- Start / stop and speed regulation of cargo pumps.
- Start / stop of ballast pumps.
- Cargo / ballast pump suction/discharge pressure
- Pressure of cargo lines (manifold)
- Cargo oil temperature on 2 levels in each cargo and slop tank.
- Temperature indicators will be provided at manifold, pressure indicators will be provided at pump discharge.

Tank level control

- Cargo, slop, ballast and bunker tank levels.
- Radar type in cargo tanks

System to include alarm set points.

- Independent high level alarm system for each cargo tank acc. to rules (95%, 98%).
- The control and alarm of inert gas system will be provided as per rules and regulations.  
The control and alarm of inert gas system will be located in the bridge at the cargo control area  
and the inert gas pressure of each tank will be indicated at the computer assisted cargo control.

**958. Inert gas system**

Necessary ball valves and quick connections will be fitted in the cargo system, in order to make it possible to inert the cargo hold, ballast tanks and CD from a shore installation or from the app.

**959. Overboard discharges (ODME)**

The cargo system will be provided with an overboard connection meeting the requirements of Marpol Annex 1. This connection will be provided with oil discharge monitoring equipment

(ODME).

**977. Cargo heating**

Each cargo tank is arranged with single loop of heating coils (50% capacity each).

Heating medium:

Enough to maintain 80°C, automatic temperature control will be provided.

Cargo heating will be steam.

Materials:

Pipe on deck: Seamless carbon steel

Pipe in tanks: AISI 316L sch. 10s

Pipes for heating system will be insulated with rock wool with galvanized steel shield.

**981. Tank cleaning system**

Each cargo tank will be fitted with one tank cleaning machine. Also two cleaning hatch for portable cleaning machine for each tank. Two portable cleaning machine will be provided on board.

Tank cleaning machine: Stainless steel AISI 316

Pipe on deck: carbon steel (galvanized)

One washing pump for industrial water will be installed. (75 m<sup>3</sup>/h 11 bar)

One tank cleaning heater will be installed in pump room.

**986. Mechanical ventilation of Cargo- and slop tanks**

2 ventilators 5800 m<sup>3</sup>/h at 6 bar for fresh air to be mounted on tank cleaning hatch.