

BUILDING SPECIFICATION

35,000 DWT

DOUBLE HULL

HANDYSIZE BULK CARRIER

SEAHORSE 35

(Version 2011-1-1)



Published	: 26 th February 2011
Project	:
Document	: 051-02
Version	: 2011-1-1
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000. - 099. GENERAL CHARACTERISTICS AND DESIGN PHILOSOPHY**001. Intent**

It is the intent of this Contract Specification and the related documents to describe the construction of the vessel in question to such extent that will enable the Builders to build, furnish and deliver the vessel as intended.

Documents related to this Building Specification :

051-02	Building Specification SEAHORSE 35 - 35,000 DWT Double Hull Handysize Bulk Carrier
009-01	General Arrangement
102-01	Midship Section
051-03	Maker's List

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

Capacities of equipment such as pumps, etc. as mentioned in this Specification shall be verified or determined as to suit their intended service in the engineering phase.

Any amendments or changes in Rules and Regulations as described in Article 2 "CLASSIFICATION RULE, REGULATION AND CERTIFICATE" issued and coming into effect after signing of the contract is to be treated as a modification to the Contract and to be subject to separate discussions between the Buyer and the Builder. However, Rules and Regulations does not come into force at present but specifically mentioned as "irrespective of the date coming into force" in the Specification to be applicable on this vessel.

Where ever in the Specification the term "or", "if necessary", when considered" and other similar expressions may be used, the final choice in all important matters are to be made by mutual agreement between Builder and Buyer.

Whenever the term "or equal" is used after a brand or a type of machinery equipment or component, the term "or equal" to be understood as any substitute shall be of equivalent standard and quality.

But any change of capacity of equipment is to be mutually agreed.

002. Design Philosophy and General Description

The vessel described to be an ocean going single screw diesel engine driven geared five hold bulk carrier.

The layout and design of the vessel shall reflect the following requirements:

- economical operation
- maintenance friendly
- environmental friendly
- loading flexibility
- robustness
- safety

The vessel to have sufficient robustness and strength to accommodate the latest developments within cargoes normally traded in handy-size bulk carriers and furthermore to meet the latest IMO/IACS regulations for bulk carriers.

The vessel to be suitable for carrying bulk cargoes such as:

- Coal
- Ore
- Grain
- Cement
- Alumina
- Bauxite
- Mineral sand
- Fertilizer
- Steel coils
- Scrap iron
- Direct Reduced Iron (A), (Briquettes, Hot Moulded)
- Ammonium nitrate
- Sulphur
- Saltpetre
- Seed cake (Cont. Vegetable Oil (a), Mechanically Expelled Seeds)
- Packaged timber
- Project cargoes, such as pipes etc.

The vessel to have a vertical stem and a forecastle and a stern bulb and a transom stern.

An accommodation block in five tiers aft with cofferdam below wheelhouse.

Funnel aft of accommodation block.

The hull under the upper deck to be divided by watertight bulkheads as follows:

- Fore peak tank
- Five (5) dry cargo holds
- Engine room
- Aft peak tank

Each cargo hold fitted with one single hatch opening with hydraulically operated end-folding hatch covers.

The vessel is fitted with 4 deck cranes for cargo handling.

Natural ventilation arranged for all cargo holds. No mechanical ventilation for cargo holds.

For cargo hold 2, 3 and 4 flush lashing points to be fitted at the longitudinal bulkheads.

The hull in the cargo hold section to be complete double skinned.

Cargo hold 1 and 5 to be arranged with hopper tanks. Cargo hold 2, 3 and 4 to be arranged with inner shell and tanktop at 90 deg. angle, i.e. no hopper tank. Topside tanks to be arranged in all holds suitably angled to minimise shifting of grain cargo.

Vertical corrugated watertight transverse bulkheads with upper stool to be provided between cargo holds. No bottom stool to be arranged. Plane plate and stiffener type bulkheads to be arranged between cargo hold 5 and engine room and cargo hold 1 and fore peak tank.

Water ballast in the double bottom tanks, the top side tanks, the fore peak and the aft peak tank. Cargo hold no. 3 to be laid out as heavy weather water ballast tank with additional gravity filling and discharge.

Ballast piping and valves are to be arranged in the pipe duct in the double bottom.

Two aftermost upper part of side tanks to serve as hold washing water holding tank (temporary storage).

Cables, hydraulic piping and fire main are to be arranged in a pipe duct in the top wing tank. The top wing tank pipe duct to serve as protected deck passage to deck houses and forward store room.

The vessel is powered by a 2-stroke diesel main engine directly coupled to a fixed pitched propeller.

Three identical medium speed diesel auxiliary engines with generators are generating electrical power.

The main engine and the auxiliary engines are to be IMO NO_x Tier II compliant.

Heavy fuel oil in deep tanks and diesel oil tanks to be arranged in engine room.
Heavy fuel oil and diesel oil tanks to be coffered towards shipside and cargo hold bulkhead.

003. Principal Dimensions

Length overall, max	180.00 m
Length between p.p.	approx. 176.75 m
Breadth moulded at design, max	30.00 m
Depth moulded to upper deck at side	14.70 m
Scantling draught	approx. 10.10 m
Deck heights (at CL):	
From upper deck to 1. acc. deck	0.90 m
From 1. acc. deck to 5. acc deck, each deck	2.80 m
From 5. poop deck to wheel house top	3.00 m
Deck houses	2.20 m
Camber in upper deck from side to 5300 mm from CL	0.60 m
Sheer in upper forecastle deck	0.20 m
No camber, no sheer in other decks.	

004. Deadweight and Draught

The below deadweight all told is to be measured in metric tons in sea water with a specific gravity of 1.025 t/m³.

Scantling draught moulded	approx. 10.10 m
Deadweight corresponding hereto	35,000 tons

005. Capacities

Cargo Spaces: (100%, including hatches)

Cargo hold no. 1	approx. 7,900 m ³
Cargo hold no. 2	approx. 9,800 m ³
Cargo hold no. 3	approx. 9,800 m ³
Cargo hold no. 4	approx. 9,800 m ³
Cargo hold no. 5	approx. 9,400 m ³
Total cargo hold volume	approx. 46.700 m ³

Tank capacities (100%):

Heavy fuel oil	approx. 1,570 m ³
MDO (Marine Diesel Oil)	approx. 150 m ³
MGO (Marine Gas Oil)	approx. 50 m ³
Lub. oils etc	approx. 100 m ³
Fresh water	approx. 250 m ³
Ballast water (incl. peaks and excl. hold no. 3)	approx. 12,800 m ³
Ballast water (incl. peaks and incl. hold no. 3)	approx. 22,600 m ³

006. Speed and Power

Service speed on scantling draught of 10.10 m
on even keel, including 15% sea margin, approx.: 14.0 knots

Corresponding engine output at NCR (approx. 90% of MCR) approx. 5,700 kW

The trial speed on light ballast draught approx. 15.2 knots

The trial speed to include no sea margin and the measured trial speed to be fully corrected according to actual loading condition, sea state, wind and water depth etc.

007. Consumption and Range

Daily consumption of marine diesel oil (MDO)

Main engine at NCR of approx. 5,700 kW (MDO) approx. 21.9 t

Auxiliary engines (MDO) approx. 2.1 t

Total daily consumption of MDO approx. 24.0 t

(Heat value of MDO is specified at 42,700 kJ/kg)

Daily consumption of heavy fuel oil (HFO)

Main engine at NCR of approx. 5,700 kW (HFO) approx. 23.3 t

Auxiliary engines (HFO) approx. 2.2 t

Total daily consumption of HFO approx. 25.5 t

(Heat value of HFO is specified at 40,200 kJ/kg)

The consumption is based on scantling draught (10.1 meter draught) and 15% sea margin. M/E Tolerance of +5% not included

Endurance approx. 18,500 Nm

approx. 55 days steaming (on HFO) - 336 nautical miles per day and 2 days spare.
(Based on NCR, 98% capacity of HFO tanks, scantling draught and 14.0 knots)

008. Complement

Rank		Deck	Engine	Other	Sum
Officers	Captain Class	1 – Captain	1 – C.Engineer		2
	Senior Officers	1 – C.Officer	1 – 1 st Engineer		2
	Junior Officers	1 – 2 nd Officer 1 – 3 rd Officer	1 – 2 nd Engineer 1 – 3 rd Engineer 1 –El. Engineer	1 - Pilot	6
	Sum	4	5	1	10
Subordinates	Petty Officers	1 - Boatswain	1 - Fitter	1 – Cook	3
	Ratings	3 - Seamen 3 - Sailors	3 – Oiler 1 - Wiper	2 – Mess boys	12
	Sum	7	5	3	15
Total on Board					25

010. CLASS, RULES AND REGULATIONS

The vessel to be built under survey of and according to rules of Det norske Veritas.

011. Classification Notation

DnV +1A1 Bulk Carrier ES(D), CSR, BC-A (Holds 2 and 4 maybe empty), GRAB(20), ESP, E0, HA(+), DK(+), TMON, BIS, FUEL (700cSt, 991kg/m³, -15deg), DG-B, BWM(s,f),

or equivalent LR or GL class.

012. Flag of Registry

Flag of convenience

014. International Rules and Regulations

The ship has to comply with International Rules and Regulations in force of date of signing the contract.

1. Rules and Regulations of Registry Government
2. International Convention for Safety of Life at Sea, 1974, and protocol of 1978 with later amendments including global maritime distress and safety system (GMDSS).
3. Intact Stability Rules (IMO Res. A749)
4. IMO Damage Stability Rules, MSC 19(58)
5. Grain Stability Rules (IMO Res. MSC 23 (59))
6. Personal Live-saving Appliances (SOLAS III/32)
7. Code of Safe Practice for Solid Bulk Carriers
8. International Load Line Regulations 1966, including later amendments (B-Freeboard)
9. International Regulations for Preventing Collision at Sea, 1972 with later amendments
10. International Convention for Prevention of Pollution from Ships (MARPOL) 1973 with the 1978 Protocol and later Amendments incl. Annex I, IV, V, VI
11. International Telecommunication convention 1979 (Geneva) and Radio Regulation
12. International Convention on Tonnage Measurements of Ships, 1969
13. Maritime Labour Convention 2006 Regulation 3.1 & 4.3

14. Rules of Navigation of Suez Canal Authority, including the Regulations for the Measurement of Tonnage
15. Rules and Regulations Governing Navigation of the Panama Canal, and adjacent waters, including the Regulations for the Measurement of Tonnage
16. Regulation of the U.S. Coast Guard, regarding Pollution prevention, marine sanitation device and navigation equipment, rules and regulations for Foreign Vessels operating in the navigable waters of the United States (CFR Title 33- Navigation and Navigable Waters, Part 155, 156, 159 & 164, without certificates nor Inspection)
17. Australian Rules (AWWF) regarding cargo gear and holds access, and loading and unloading safety measures
18. IMO reg. A 868 (20) Ballast Exchange Management
19. IMO Requirements of Permanent Means of Access
20. Common Structural Rules for Bulk Carriers (CSR) including Performance Standard for Protective Coating (PSPC)
21. International Convention on the Control of Harmful Anti-Fouling Systems on Ships
22. ISPS Code
23. IEC requirements for electrical installation for ships (in particular publication 92), 1974 with amendments
24. Standard Specification of the International Maritime Satellite Communication System for Ships and INMARSAT Regulation
25. IMO resolution A468 (XII) code of Noise Level on board Ships
26. ISO 6954, guidelines for the overall evaluation of vibrations inversion ships
27. IMO Res. A 574 (XIV), Recommendation on General Requirements for Electronic Navigational Aids
28. IMO NOx Tier II compliance for Main Engine and Auxiliary Engines
29. EU low-sulphur Directive (Directive 2005/33/EC)

017. Certificates

Prior to delivery the Builder to deliver the following certificates in duplicate. One set for the Buyer and one set for the vessel.

Certificate:	Issued by:
1. Certificate for classification (Hull Machinery)	Classification society
2. International load line certificate	Classification society
3. Safety radiotelegraph certificate	Assigned Authority
4. Safety construction certificate	Assigned Authority
5. Safety equipment certificate	Assigned Authority
6. International oil pollution prevention certificate	Classification society
7. SOPEP Manual (prepared by Builder)	approved by class
8. International tonnage certificate	Assigned Authority
9. Suez Canal tonnage certificate	Classification society (or other assigned Authority)
10. Panama Canal tonnage certificate	Classification society (or other assigned Authority)
11. Builder's certificate	Builder
12. Deratting exemption certificate	Assigned Authority
13. Certificate for magnetic compass and	Builder
14. Trim and stability booklet & Loading Manual	Classification society (approval only)
14A Loading Sequence Plan	as above
15. Grain loading booklet	Classification society (approval only)
16. Deadweight certificate	Builder
17. Builder's quality certification	Builder
18. Cargo gear certificate	Class society
19. Gear Certificate for engine room crane and all Lifting Appliances	Class society
20. Exhaust gas emission certificate (EIAPP)	Classification society
21. Certificate for carriage of dangerous goods	Classification society
22. Certificate of fitness for solid bulk cargoes and Coal	Classification society
23. Damage Control Plan	Class approved
24. Cargo securing manual	Class approved

25.	Ballast management plan	Class approved
26.	Fire safety manual	Class
27.	Emergency training manual	Class approved
28.	Loading Computer Certificate	Class
29.	Cert. of Inspection of Crew Accommodation	Assigned authority
30.	USCG Manoeuvring Data	Builder
31.	Exemption Cert. for RDF (if required)	Assigned authority
32.	Asbestos Free Certificate	Builder
33.	Grain Compatibility Cert. for C/Hold Coatings	Paint Supplier

Possible certificates provisionally issued to be replaced by original ones arranged by the Builders as soon as possible.

Prior to delivery all certificates covering machinery items, deck equipment etc (not listed above) and including sub-contractors' certificates to be delivered to the vessel in duplicate.

Equipment certificates for various equipment such as, but not limited to, anchors, chains and main engine, issued by the Classification Society, and those for navigation lights, life boats, life saving equipment, radio, navigation, etc., issued by any other assigned authority approval for required items, to be delivered to the Buyer by the Builder.

The vessels to be delivered with all clear Class papers and no conditions of Class. Certificates to be provided for all lifting equipment, Chain Blocks and wires etc.

18. Building quality standard

The following standard to be applied to the construction of the vessel as far as practicable, except the fittings specially described hereinafter.

- a) Chinese industrial standard (KSQS, GB, CB, CSQS, YB, JB, HB, SY, etc)
- b) Builder's standard, and Builder's standard practice to be submitted to buyer for reference.
- c) DIN or JIS standard.
- d) ISO standard.
- e) Fire and safety equipment to be EEC Wheel marked

020. HULL REQUIREMENTS**021. Hull Form**

The hull form shall under the constraints given by the principal dimensions be suitable for maximum performance and good sea keeping both at full draught and ballast draught and in calm and rough weather in order to minimise fuel consumption. In order to maintain a low vibration level special attention has been paid to the interaction between propeller and hull by incorporating a stern bulb.

022. Tank Testing

The tank tests to be performed with final designed propeller by a reputable ship model testing institution, cost of Builder's account.

The Buyer's representative to witness model test.

One wooden model in suitable scale for still water tests to be manufactured. The model to be complete with one fixed rudder and photo grid markings.

The model to be tested at the following draught conditions:

1. Ballast draught (speed trial condition)
2. Light Cargo draught
3. Scantling draught

The test to include self-propulsion tests for condition 1, 2 & 3, in a 10 to 16 knots speed range.

A full report with predictions, comments, and photographs to be issued and submitted in 3 copies to the Buyer.

023. Steering and Manoeuvring

Good steering and manoeuvring characteristic to be ensured and to comply with the relevant IMO recommendations as far as possible.

026. Trim and Stability Requirements

IMO stability requirements to be complied with in all loading conditions including grain.

The vessel to possess adequate stability in all loaded conditions without the use of water ballast except as applicable and normal grain cargo under part load conditions.

The vessel is to be capable of loading grain cargoes to the designed/scantling draught within the design limits without trimming of filled hold, or bagging or the erection of special fittings.

When leaving port with part load grain cargo, ballast water may be applied in order to meet grain stability criterion during deep-sea navigation. In this case trimming or bagging may be applied.

In homogeneous loading departure conditions (100% consumables, crew etc.) and with full load to scantling draught the vessel shall be at even keel or trim slightly by the stern (max. 1.0% of the ship's length) without any water ballast.

Possible trim adjustment by using ballast water to obtain approximately even keel at full load arrival condition.

A preliminary Trim and Stability Booklet to be submitted to the Buyer covering at least the following conditions.

1. Light ship.
2. Docking condition.
3. Light ballast condition. Departure and Arrival. No WB in hold No.3.
4. Heavy ballast condition. Departure and Arrival. WB in hold No.3.
5. Homogeneous cargo full loading at design and scantling draught. Departure and arrival.
6. Grain loading condition with stowage factors of 45, 55, & 65 ft³/lt. Departure and arrival without hold ends untrimmed.
7. Heavy ore cargo / cement in No.1, 3 and 5 holds equally distributed as far as practicable and the other cargo holds empty. (incl. short voyage with 600 t of supply).
8. Full deadweight steel coil loading

The preliminary Booklet to include bending moment and shear force as well as weight distribution and necessary hydrostatic tables.

Final trim and stability calculation for above loading conditions shall be made on the basis of the centre of gravity and the lightweight of the Vessel obtained from the inclining experiment. The final manual to include loading and discharge sequences for alternate and homogeneous cargo conditions.

For trim and stability calculations the following Specific gravities to be used:

Sea water	1.025 t/m ³
Fresh water	1.000 t/m ³
Heavy fuel oil	0.950 t/m ³
Diesel oil	0.850 t/m ³
Lub. oil	0.900 t/m ³

A ballast exchange plan is to be submitted on the basis of the vessel remaining within all stress limits both while at sea and in ballast and partial ballast/cargo.

027. Noise and Vibration Requirements**1. Vibration**

The Draught International Standard ISO/6954 'Guidelines for the overall evaluation of vibration in merchant ships' shall apply.

Measurements carried out as part of the official sea trials shall demonstrate that the allowed vibration levels are met.

To prevent harmful vibration and damage in the after body, the single amplitude of 1st order blade frequency pressure impulses at the outer shell above the propeller shall not exceed 6KPa in scantling and ballast draught condition. 2nd order blade frequency pressure impulses shall not exceed 4KPa in scantling and ballast draught condition. Pressure pulses to be verified by tank testing.

2. Noise

To prevent the occurrence of potentially hazardous noise levels and provide an acceptable acoustic environment on board, the International Maritime Organisation (IMO) Resolution A.468 (XII) 1981, entitled: 'Code on noise levels on board ships', should be strictly followed.

Local vibration and noise measurements to be carried out and recorded at agreed compartment for first vessel with the attendance of the Builder and Buyer.

If the sea trial result shows the Vibration and the Noise level higher than this specification requirement, the Builder shall correct the vessel construction to fulfil the requirement.

030. SUPPLIERS AND SUPPLIES**033. Buyer's Supplied items**

Following items to be furnished and supplied by the Buyer at their own expense and received, stored and installed on the vessel by the Builder.

- All hoses, etc., other than those required by the Rules, or mentioned in this Specification.
- Steel wires, ropes and hawsers for mooring in excess of the requirements of the Classification Society and/or this Specification.
- Deck, engine and cabin stores in excess of those specified in this Specification.
- All bedding (pillows, blankets, sheets, covers, etc.) but excluding mattresses.
- All napery (serviettes, table cloths, etc.).
- All cook's and steward's utensils (crockery, cutlery, silver-wares, china, glasses, pots, pans, etc.).

- All chandlery (soaps, lamp oil, etc.) toilet papers, food and other consumables.
- All charts and books.
- All consumable stores.
- All medicine and medical equipment.
- Recreational equipment other than mentioned in this Specification.
- Office machines.
- Air tools and hoses in excess of those specified in this Specification.
- Hand tools other than specified in Specification.
- Loose lashing fitting for deck cargo
- Grabs including control devices
- The hazardous gas detection and bilge well detection equipment for carriage of coal.
- The hazardous gas detection equipment and personal protection for carriage of dangerous cargoes.
- Paintings and pictures
- Spare parts, navigation equipment, flags, etc., in excess of the requirements of the Rules and Regulations as specified herein, and/or those specified in this Specification.
- Lub. oil, hydraulic oils, hand consumable stores. Consumed oil during testing and sea trial shall be paid for by Builder.
- The Buyer shall furnish the Builder with necessary specifications, plans, drawings, instruction books, manual, reports, certificates, the manufacturer's service engineers etc. as required by the Builder, which shall form an integral part of the Buyer's supplies.

034. Manufacturers and their Products

The Builder shall have the option to freely choose between the suppliers in the agreed "Makers List" as long as the requirements in the specification are fulfilled.

The Buyer shall have the option to propose his preferred maker(s) other than the Builder's elected maker. If any cost differences occur, these shall be borne by the Buyer after reasonable agreement.

As soon as the Yard has chosen a supplier, they shall notify the Buyer of their choice. The yard should not sign purchasing contract without the final approval from the Buyer.

If the Buyer has his own preferred maker, he shall notify the Builder accordingly within 14 days after receipt of the Builder's information.

If the Builder has not received such preference(s) within 14 days, buyer loses the right to exercise his option.

If the Buyer prefers another maker than the Builder's preferred maker, the Builder at the Buyer's request shall submit by fax or other agreed procedure technical specifications and quotations from both the Builder's and the Buyer's preferred maker.

Final selection of maker to be made by negotiations and agreement between Buyer and Builder as mentioned above.

Selection of makers for equipment not specified in this makers list to be at the Builder's discretion, but for the Buyer's approval.

Please note possible reservations regarding suppliers and supplies in the general part of the specification.

The builder shall have the option to select the makers from the "Makers List" which shall be prepared by the Builder and shall be mutually agreed between the Buyer and the Builder, according to instructions as given in the "Makers List" where names of certain materials, articles and manufacturers thereof are mentioned in the Specification for the purpose of illustrating the general character of the design, quality construction etc., it is to be understood that they may be of a nature similar thereto and of approved design and quality adopted to the intended use. However, the Buyer and the Builder shall mutually agree the Maker's List. The Builder has option to choose the Makers in accordance with the agreed Makers List, but the Builder always endeavour to cooperate and comply with the Buyer's preferred Maker based on same condition, extra expenses will be on the account of Buyer if any.

060. PLANS AND DRAWINGS

Plans for approval

A list of the plans for approval to be prepared by the Builder, and mutually agreed by Buyer and Builder at early time of design stage.

Two (2) copies of each of the plans for approval shall be submitted to the Buyer for approval in accordance with the "List of the Plans for Buyer's approval".

The Buyer shall, within fourteen (14) days after receipt thereof, return to the Builder one (1) copy of such plans with the Buyer's approval or comments, if any, written thereon.

In the event that the Buyer shall fail to return the plans within the time limits as herein above provided, such plans shall be deemed to have been approved or confirmed without any comment. (The Buyer's comments may be made by facsimile).

The Builder may submit the plans to the Buyer's Representative resident in the shipyard for approval, subject to the provisions of the Contract.

Full set of working drawings also to be supplied.

Finished plans and instruction books

At the time of the Vessel's delivery finished plans ("as built" drawings) in blueprint shall be furnished to the Buyer in triplicate, one (1) copy to the Buyer's site office and two (2) copies to the vessel. In addition to paper copies, final drawings as per agreed drawing list and instruction books to be delivered on a CD ROM in PDF format for each vessel.

The scope of supply of the finished plans shall be in accordance with the Builder's standard and the list of the finished plans shall be submitted to the Buyer in due course for approval.

The following plans, one (1) copy each, shall be provided in frames and placed on board the Vessel at such locations as designated by the Buyer's Representative:

- a. General arrangement
- b. Capacity plan with deadweight scale
- c. Manoeuvring characteristics
- d. Separate Fire plan & LSA Plan
- e. Bunkering and Fuel Transfer Plan
- f. Damage Control Plan
- g. Ballast and Hold Bilge Pumping Plan

Three (3) copies of the instruction books of the Vessel's major machinery and equipment shall be furnished, one (1) set of the Buyer's site office and two (2) sets to the Vessel.

One (1) exhibition model scale 1:150 to be delivered for each vessel.

Further models to be delivered at cost.

General Arrangement Plan, Capacity Plan, FFA & LSA Plans, Docking Plan and Pocket Capacity Plan to be supplied as reproducible in addition to copies.

One (1) set of E/R system plans to be delivered in plasticized form.

080. TESTS AND TRIALS**General**

Reference is also made to Shipbuilding contract.

The Builder shall at all time keep the Buyer advised in every respect of the programs of work and upon request, methods which he intends to use. Notices of major events, tests and trials shall be given sufficiently in advance to the Buyer to permit them or the person they designate to make necessary arrangement in order to attend the tests or event.

All necessary drawings and information which are required for the inspector or permit him to carry out his work and keep the Buyer advised of construction details and work progress shall be made available to him upon request.

Inspection by the Buyer's representatives shall be regarded as a verification of the Builder's own quality control measures and shall not be used as a substitute for quality control.

In case the Buyer's Inspector is unable to attend any test, he may designate a person to act on his behalf, otherwise the inspector shall waive the right to have comments for such test, provided notice is given as agreed.

Whenever materials, equipment and machinery etc., have been tested and inspected by the Buyer's supervisor, such material and equipment shall be clearly marked and assigned to the vessel. Such materials and equipment shall not be exchanged with any other without the Buyer's written consent.

At the acceptance inspection each space shall be completely clean and finally painted if/as specified and fitted out in accordance with specification.

All piping shall be proven tight and free of internal obstruction. Electric cabling and equipment shall have a satisfactory megger test and prove operational.

Piping test to be carried out with all rust and paint removed from welding seams. No primer to be applied.

The Buyer agrees to the Yard choosing one out of three sets of diesel generators on board to be used for onboard testing. However, the operation of it shall follow the Maker representative's instruction. Before delivery, normal maintenance such as replace of strainers etc. shall be carried out. If the running hour exceeds 500 hours, overhaul shall be carried out under Maker's instruction.

All test programs as given in the list for inspection shall be submitted to the Buyer's representatives for approval at least one week prior to the test. The subcontractors to supply updated work schedules for their equipment. Application for inspections shall be submitted to the Buyer's representative the day before inspection (24 hours in advance) if such inspection is in the Yard.

In general, all work equipment, machinery, systems etc. whether belonging to hull part or machinery part shall be tested sufficiently onboard to prove specified performance, safe operation and suitability in service compliance with all applicable rules and regulations.

Should there be indications that underwater parts of the vessel have been grounded or unduly strained before delivery, the Builder is to undertake to place her in dry-dock and carry out corrections as necessary at Builder's cost.

The Builder is to deliver the vessel in a clean and freshly painted condition, all valves, wires, machinery oiled and greased, refrigerated stores cooled down to operating temperature, hatches, booms and stores securely stowed and ready for sea.

Builder to ensure that full safety matters are considered during inspections/tests.

Progress

The Builder is to provide the Buyer with a bar chart showing the intended schedule of construction until delivery before keel-laying.

In case the Builder falls behind the intended schedule, then the Builder is to make every possible effort to bring the vessel back on schedule in order to meet delivery date.

Once per month during the building period and at the time of special events, such as keel laying, launching and delivery, the Builder is to make photographs in sufficient number to clearly show the progress of the work and submit same to the Buyer in five (5) copies.

Builder's standard programs for inspection, test and trials to be submitted to Buyer for review/comments asap.

Dry docking

Prior to the sea trial the vessel shall be dry-docked for hull and propeller cleaning, if sea trial is performed more than 4 month after launching.

The Vessel to be dry-docked for hull cleaning, propeller polishing and paint repair, if vessel is not delivered to Buyers within six (6) months after launching.

Tests and inspection

Hull structure tests

All steel structures to be inspected and tightness to be tested for tanks, bulkheads and superstructure deck and other wet space etc. as required by the Class Rules.

Tank to be tested hydrostatically or by air as required by the "Class Rules".

X-ray photographs or ultrasonic inspection to be taken mainly for, but not limited to, cross-points of seams and butts block assemblies of bottom shell, bilge strake, main deck and sheer strake as required by the "Class Rules".

Hull inspection

The block inspection to be carried out after completion of hull block steel works. If fittings are fitted wholly or partially to the hull blocks, the inspection for the hull blocks shall be carried out without dismantling such fittings provided satisfactory access to all hull parts is possible.

The internal inspection for hull construction works of tanks, engine room, etc. to be carried out even if outfitting works in such spaces have not been finished yet but any works in connection with strength and tightness of the hull construction shall be completed before the said inspection, in which case, after completion of the outfitting work, final inspection of such parts to be made in accordance with the mutual agreement between Buyer representatives and Builder. Inspection of the hull construction shall be made before any paintwork is done.

Shop tests shall be carried out for the machinery and equipment by the manufacturers at their shops.

Test results of major machinery and equipment shall be furnished to the Buyer in triplicate.

The Buyer shall be informed of the shop test schedule at least seven (7) days in advance of the expected date of the shop tests and the Buyer's attendance shall be confirmed to the Builder four (4) days in advance of the expected date of the shop test.

Installations and equipment

Installations and equipment to be tested on board in accordance with the "Class rules" and/or Regulatory bodies and the standard of the Builder and approved by the Buyer.

Tests to be carried out according to equipment makers guidelines.

Piping test

As far as hydrostatic test is practicable for a part of piping, such test to be made for such part before completion of the whole system. Working test to be carried out after completion of the piping system.

Final flow quantity measurement to be carried out on major systems by ultrasonic flow measurement (cooling systems etc.).

Mooring trial

Mooring trial for the main engine with associated aux. Machinery and equipment shall be carried out prior to the sea trials while the Vessel is moored at the Builder's quay:

- a. Confirmation of starting position
- b. Turning gear interlock test
- c. Confirmation of control position
- d. Safety device test (automatic trip by simulation)
- e. Minimum revolution test
- f. Test of starting air capacity
- g. Inspection of crankcase

Sea trial

When the vessel is substantially completed, sea trial shall be carried out by the Builder in accordance with the sea trial procedure which shall be prepared by the Builder according to Class requirements, and shall be submitted to the Buyer for approval.

Marine diesel oil and heavy fuel oil with viscosity as available on the domestic market shall be used during the sea trial.

Heavy fuel oil as the fuel system is designed for, if available, to be used for sea trial. Cylinder LO quality for ME to be selected according to the fuel quality and may be changed during the sea trial.

Sea trial shall be carried out at the light ballast condition and with draught and trim equivalent to the condition which is tested in the model tank.

Maximum power to be shown by increasing revolution on the main engine. Engine maker to be consulted what maximum speed or load can be accepted.

Buyer to approve the condition.

Sea trial to ascertain that the vessel conforms with the terms of the contract and specification.

Torque meter to be fitted during sea trial on the intermediate shaft.

Progressive speed trial

Speed trial for the assessment of the guaranteed speed performance shall be conducted in deep water, i.e. about 45 m and above, by means of the radio wave speed measuring system and shaft power to be measured by torsionmeter.

Seatrial Report to include results of speed trials corrected to the calm water (no wind, wave).

Applied method for correction to be based on internationally accepted methods. Corrections to be carried out by Builder and approved by Buyer.

The progressive speed trial shall consist of one (1) double run (alternating in direction) at main engine loads of 50% SMCR, 75% SMCR, 85% SMCR and SMCR or the output corresponding to 105% rated shaft revolution of the engine, whichever is reached first. The maximum engine speed permitted during sea trial to be confirmed by the engine Maker.

Endurance trial

Endurance trial shall be conducted for four (4) hours at NCR, and for thirty (30) minutes at SMCR or the output corresponding to 105% rated shaft revolution of the engine whichever is reached first.

Manoeuvring trials

The following tests shall be carried out to check the manoeuvrability of the Vessel:

- a. Crash stop astern and ahead test
- b. Turning test
- c. Williamson turning test / Z - Manoeuvring Test
- d. Inertia test
- e. Minimum revolution test

Other tests and measurements

The following tests and measurements shall be conducted at proper time during the sea trials according to the requirements of the Classification Society and the Rules and Regulations and the Builder's practice.

- a. Unmanned operation test
- b. Steering gear test
- c. Shaft torsional and axial vibration measurement
- d. Vibration measurement at NCR (during endurance trial)
- e. Noise measurement at NCR load (during endurance trial)
- f. Electrical load measurement (during endurance trial)
- g. Operation test of navigation equipment
- h. Confirmation of gyro compass and adjustment of magnetic compass
- i. Anchoring test
- j. Black-out test/Restart from dead ship (for first ship only)
- k. Alarm sound test (during running of main engine at full load)
- l. F.W. generator capacity test at NCR during endurance trials.
- m. Exhaust gas economizer evaporation test
- n. Fuel Consumption measurement (LCV of HFO to be verified)

Other tests and measurements also to be carried out by Builder as required by Class and regulatory bodies and Makers.

In case of the series vessels following trials and measurements shall be conducted only for the first vessel for Buyer.

- a. Progressive speed trial except for guarantee speed point
- b. Manoeuvring trials
- c. Shaft torsion vibration measurement
- d. Hull vibration measurement
- e. Noise measurement
- f. Electrical load measurement

Overhauling, inspection after sea trial

After sea trial, working parts of main engine to be opened for the Buyer's inspection in accordance with the standard of the Builder approved by Buyer and refitted to working condition. A confirmation dock run after overhauling for ½ hours at low load to be carried out before delivery.

Overhaul inspection might be carried out during sea trial before arriving at the berth.

Above tests to be deleted for further sister vessels for Buyer after mutual agreement after successful sea trial for first ship for Buyer. However, overhaul inspection to be carried out on each vessel of the series.

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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 (see 011) and Buyer's requirements as outlined below.

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

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

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

The vessel shall be designed and constructed to the below listed loads:

- Loads referring to scantling draught
- Tank top, uniform load 22.0 t/m²
- 2 tier of 22.5 t steel coil (length 1750 mm) on 5 wooden dunnages
- 1½ tier of 30 t steel coil (length 1750 mm) on 5 wooden dunnages
- Weather deck hatches, uniform load 2.5 t/m²
- Weather deck, uniform load 4.0 t/m²

102. Midship Section and Other Class Plans

The scantlings of the main hull structure to be determined in accordance with class requirements, the loads listed in 101 and the loading conditions for the vessel.

108. Rudder and Rudder Stock (Class)

Spade rudder on rudder horn.

Rudder area approx. 34 m² including rudder horn

Rudder stock diameter in way of bearings to be 5 mm above class requirement.

110. MATERIALS AND METHODS

All steel to be new mild or high tensile steel to class requirements.

HT36 steel mainly to be located in the upper part of the hull within 60% of length amidship. High-tensile steel to be adapted only to the upper deck, longitudinal members of upper deck, sheer strake, top side tank and longitudinal cargo hatch coaming.

HT32 steel mainly to be located in cargo hold double bottom structure and corrugated cargo bulkheads.

Plating : breadth according to Builder's practice. Thicknesses in steps of 0.5 mm

Profiles : bulb flats and flat bars

Brackets : Bracket flanges to be of welded flatbar. No bended type flanges..

Steel in excess of class requirements:

- boundaries of seachests +5.0 mm
- shell plating below anchor +3.0 mm
- diameter of propeller shaft and rudder stock +5.0 mm in way of bearings

120. MAIN FRAMING

121. Longitudinal Framing

In double bottom and wing tank structure in general and side tanks in way of cargo hold 2, 3 and 4.

Side girders as per rules and necessity.

122. Transverse Framing

Transverse framing to be used at side shell between tanktop and top side tanks in way of cargo hold 1 and 5 and toward the ends of the hull. Double bottom in engine room, forecastle deck, house decks etc.

123. Stem

The stem to be built up of shaped plates with adequate number of internal cross brackets. A rolled steel bar to be used in the lower part for attachment of shell plates. The bow with adequate stiffening including floors on every frame.

Shell plate in way of anchor to be reinforced.

124. Stern Frame

The stern frame to be shaped to fair properly with the hull lines. The stern frame to be made of heavy steel plates and profiles.

125. Pillars

Pillars in engine room to be used only where not obstructing functions. Doublers at top and bottom of pillars but not in tanks. Pillars in aft end and deck house to be in line to minimise vibrations.

Pillars in engine room and tanks to be I-profile.

126. Fore Peak

Fore peak with side stringers with transverse framing. Sloshing loads to be kept within reasonable limits.

127. After Peak

After peak area subdivided longitudinally and transversely, with side girders and deep floors as well as intercostal stiffening thus reducing non-stiffened panels of shell plating to small, nearly square areas in order to minimise vibrations.

130. BOTTOM CONSTRUCTION

131. Double Bottom, General

To be arranged with water ballast tanks.

A pipe-duct to be arranged between forepeak and engine room. Rail transport system to be arranged in double bottom pipe duct. WT hatch covers for easy access.

Square bar steps and handgrips in tanks at manholes in tank top for easy access.

Main engine foundation to be incorporated in double bottom structure and foundation bolts to be placed for easy access.

Arrangement of steps, access openings, ballast and bilge piping etc. to be arranged according to Technical Provisions for Permanent Means of Access.

133. Floors and Bottom Girders

Double bottom to be longitudinally stiffened in cargo hold area with floors on every third frame and girders as per class requirement. In forward end additional floors to be fitted in order to absorb increased acceleration forces from cargo and to avoid slamming damage. Floors to be fitted at every frame in engine room.

134. Bottom Frames/Longitudinal

Bottom to be framed longitudinally in cargo hold area and longitudinals to be of bulbous type. Longitudinal to withstand possible slamming forces.

135. Tank top

Tank top to be plane. Tank top to be flush with flush manhole covers to double bottom placed near bulkheads.

To be reinforced for grab unloading.

136. Bilges/Bilge Wells

To be arranged as per class requirements for easy drainage.

Bilge well to be of two-compartment type in order to separate water and cargo waste. In each cargo hold at least 2 bilge wells to be arranged.

Cargo hold 3 to be arranged with 2 ballast suction wells.

Perforated steel cover plates to be provided for the bilge wells.

140. SHELL PLATING

141. Shell Plating, General

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

The thickness of the shell plating to be reduced gradually from midship to fore and aft ends in accordance with the requirement of the Rules.

143. Local Reinforcements

Heavy inserted plates in way of anchor resting areas, in way of sea chests and otherwise as required by class. Heavier shell plates in areas exposed to damage from anchors and chain cables and in the area above the propeller. Openings in shell plating to be well rounded and where compensation is required it is to be in the form of insert plates.

144. Side Stringers

To be arranged in double side tanks as per rules and to enable easy access to all structure inside tanks. Arrangement of ladders, access openings, airpipes etc. to be arranged according to Technical Provisions for Permanent Means of Access.

145. Bulwarks

To be arranged as per General Arrangement Plan. To consist of plating welded to brackets and/or stays. Top and bottom to be flanged or fitted with flat bar. Bulwark to be reinforced in way of mooring chocks and similar where fitted in bulwark.

Hard wood top rail to be fitted around bridge wing bulkwarks.

Walkways to be made under bridge wings for painting.

Height of bulwarks is in general to be 1100 mm above deck.

146. Bilge Keels

To be fitted in approx. 30% of the length of the ship PS and SB in the water flow direction. The bilge keels to consist of bulb profile welded to flat bar which in turn is to be welded to the shell plating. Bilge keels to terminate on frames and to be tapered at ends. Not to extend outside rectangular midship hull section.

147. Chafing Guards

For the protection of mooring lines chafing moulding strips of half-round bar or pipe to be fitted on shell in way of side fairleads and chocks and at deckhouses and coamings if required and to Buyer's representatives' agreement. No chafing guards on sheer strake except at ends.

Chaffing half round bars to be supplied on hatch coamings and wing tank/top stool side.

148. Drain Plugs, Tank Markings etc

Stainless steel drain plugs for all tanks. Doublings in way of plugs. Plug heads different for oil tanks and water tanks.

All drain plugs to be clear of docking blocks.

Tank markings shall be of welding bead type to be applied for tank boundary and name of the tank to be welded next to the bottom drain plug. Tank markings to meet BIS requirements.

150. HULL BULKHEADS**151. Transverse Bulkheads**

Watertight transverse bulkheads to be arranged as per General Arrangement.

Transverse WT bulkheads in holds to be of corrugated type supported by top stools. Floors to be arranged below both bulkhead platings.

Duct keel webs below transverse bulkheads to be strengthened with no scallops and full penetration welding. In general no scallops in upper part of floors below bulkhead.

Other WT transverse bulkheads of plate and stiffener type.

152. Longitudinal Bulkheads

Watertight longitudinal bulkheads to be arranged as per General Arrangement in cargo hold area.

Manholes to be of flush fitting type with stainless steel bolts.

153. Wash Bulkheads

To be arranged in fore peak if required.

155. Enclosed Emergency Exit

To be arranged from the lower part of the engine room up to the upper deck or otherwise as per regulations, and from the forward part of the double bottom pipe duct to the upper deck.

160. DECKS AND HATCH COAMINGS, GENERAL

Corners of openings in strength deck to be well ground and to be elliptical in shape. Compensation for holes as per class requirements. Adequate strengthening to be provided in way of cranes, masts, deck machinery, bollards, steering engine etc. Doubling or insert plates to be fitted. Decks forming part of tanks according to rules.

All weather decks to be fitted with gutter-ways with adequate drainage. Patent type rubber plugs to be provided on upper deck drains to prevent direct discharge over-board.

Weather decks such as bridge deck etc to be specially faired to avoid water puddles.

165. Cargo Hatchway Coamings

To be arranged as per General Arrangement and of strong construction with chafing bars.

Hatch coaming compression bars to be in stainless steel.

Longitudinal hatch coamings to be of same yield strength as upper deck. Terminations to have local strengthening and adequate soft toe transition.

Stevedore viewing platforms (1 PS and 1 SB) to be provided at each cargo hold.

166. Other Hatchway Coamings

Coamings for hatchways to store rooms etc to be as low as possible, regulatory bodies permitting, and to have chafing bars.

167. Local Reinforcements/Fittings

To be made for storage of the spare anchor and all other large spare parts.

170. FOUNDATIONS

All foundations to be completely finished with coatings and cleaning before machinery is placed on top of these foundations. All these foundations to be provided with adequate drain holes.

Foundations to land on structure, not on unstiffened plates.

171. Main Machinery Foundation

To be arranged as an integral part of engine room bottom structure and to be fabricated of steel plates and rolled sections of scantlings to suit the machinery with due regard to the dynamic forces imposed by motion of the vessel and vibrating forces generated by the machinery. Top plates with surplus material to allow for finishing prior to installation. Provision is to be made for the fitting of chocks or shims under machinery.

Holding-down bolts to be accessible for inspection and service.

Foundations to be designed as per the instructions/guidelines of the machinery manufacturer.

172. Auxiliary Machinery Foundations

To be arranged in rigid steel plate design (or according to maker's recommendation) with due consideration to access for cleaning and drainage. Foundation to arranged to utilise existing steel structure as far as possible.

173. Deck Machinery Foundations

The steering gear foundation to be designed to form a rigid base with under deck inter-costal girders or similar.

Windlass and other deck machinery generally to have foundations of inverted angle bars with sufficient strength to develop full breaking strength of the rope or cable assuming normal load. Distance between deck and machinery to enable easy maintenance.

175. Independent Tank Foundations

To be built with drip tray.

177. Miscellaneous Supports

Suitable supports for cargo crane jibs in stowed position to be fitted to manufacturer's recommendations.

180. MISCELLANEOUS STEEL STRUCTURE

181. Hawse Pipes and Chain Pipes

Flanges and pipes of fabricated welded steel.

The hawse pipes to point in such direction that stem anchors when dropped will always clear vessel's bow in normal trim and heeling conditions. Frog eyes to be installed if necessary. 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.

Hinged steel spray cover plate with effective dogging arrangement or equal to be fitted neatly at the top of each hawse pipe. Portable covers for chain pipes.

The chain pipes to lead as directly (vertically) as possible into the top of the chain lockers. Pipes to be finished with round mouldings.

182. Chain Lockers

Two self-stowing watertight chain lockers to be built forward of the collision bulkhead. The volume of the chain locker shall allow 1.2 m clearance above full stowage of anchor chains. The chains to rest on perforated galvanised steel plates at least 700 mm above the bottom such that a drain sump will be provided below.

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

183. Sea Chests

To be arranged in number and size as necessary for the practical operation of machinery, pumps etc. In engine room in total two seachests to be arranged, one high and one low. One seachest PS and one seachest SB.

One separate sea chest for the emergency fire pump to be arranged.

Grids to be hinged type and locked with stainless steel pins.

Grids to be galvanised after fabrication.

Sea inlets to be designed to effective de-aeration of water.

Circulation holes to be fitted on top and bottom of the inlet on the side plate.

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

Cathodic protection is to be provided for the sea chest.

187. House Visors and Wind Deflectors

House visor on top of wheelhouse.

Top of bulwarks on front of navigation bridge wings to be designed as a steel wind deflector. Height of wind deflectors to be 1350 mm.

190. SUPERSTRUCTURES AND DECK HOUSES**196. Accommodation Deck Houses**

To be arranged as per General Arrangement Plan with internal stiffeners.

Structure should be laid out with due consideration to minimize noise and vibration.

198. Funnel

To be provided with steel roof 1000 mm below top with ample drainage.

Eye plates for cleaning and painting staging to be arranged inside and outside.

Top platform to have manhole with hinged cover. Drain pipes to be fitted.

199. Machinery Casing

Platforms, ladders and eye plates for easy access and maintenance to be provided.

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200. - 299. OUTFIT AND EQUIPMENT (HULL)**200. MARKINGS AND IDENTIFICATION****201. Hull Marks for Tanks**

Tank markings to be made by welding beads near drain plugs. Marking of tank lengths and boundaries to be made by welding beads.

Tug push, bulkhead and pilot ladder marks to be provided (Welded and painted).

Frames also to be marked by cut plate along weather decks and inside wing tanks numbered accordingly.

Cargo compartment (CC) is to be outlined by cut plate and painted on starboard side of each hatch coaming.

Hatch number to be marked at the two central hatch cover panels for each cargo hold.

Depth markings to be marked at the fore and aft bulkhead in each cargo hold.

202. Draught Marks and Waterline Marks

Draught marks fore, aft and mid-ship PS & SB, to be provided with cut plate as per usual practice and as close to the perpendiculars as practicable. To be accurately located to Class and Buyer representatives' satisfaction.

The deep waterline and the lower line of the boot top - if any - to be marked by welding beads over the entire ship's length PS & SB.

203. Loadline Marks

The statutory deck line and assigned load line marks to be accurately located P & SB, with cut plate. The net tonnage and the official number to be marked as usual.

204. Name and Port of Registry

The vessel's name and port of registry to be placed on the transom stern and the name on both sides forward. To consist of letters of ample size to Buyer's approval made in thin plates and welded to exterior of shell plating.

205. Bow Mark, Funnel Mark and Buyer's Name

Buyer's logo to be marked with welded beads on port and starboard sides of hull. Buyer's badge to be made in plating of ample size and welded to stem. Buyer's funnel mark also to be made in plating and bolted with stainless steel bolts to studs on funnel on both sides.

206. Warnings

Warnings, such as NO SMOKING, to be marked (painted) at bunker station as per usual practice.

207. Name Plates for Compartments

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

208. Label Plates

Label plates of metal with enamel filled characters on sounding pipes, filling pipes, and air-pipes on control devices etc in execution to Buyer's approval.

210. CLOSURES, ACCESS, PROTECTION (HULL)

211. Manholes with Covers

Manholes with stainless steel bolted covers and reinforcement rings to be fitted for access to all tanks, void spaces, and cofferdams. Jacking screws to be provided for all manhole covers. All such compartments, except small ones, to have two manholes in diagonal opposite corners, whenever possible. Tank number to be welded next to the manhole and tank name to be marked near manhole opening. Manholes in general to be 600 x 450 mm.

Manholes serving as access to WB tanks, pipe ducts etc. to fulfil IMO requirements regarding permanent means of access.

Furthermore the following additional manholes to be provided :

- one flush manhole cover to be arranged at tanktop giving access to the aft part of each ballast tanks. Man holes to be used for cleaning purposes.
- Two manhole covers to be arranged each side at upper deck to upper deck pipe duct for maintenance
- One man hole to be arranged at watertight division at CL in all top stools.
- One flush manhole (SB and PS) at upper deck in way of washing water holding tank arranged to drain deck washing water into the washing water holding tank.

Easy access through manholes to be arranged for all tanks and void spaces.

Manholes to double bottom tanks in machinery spaces and on steering gear flat to be arranged on minimum 150 mm high coamings.

Manholes in way of cargo holds to be flush. All manhole covers to pack with oil-resistant gaskets. Each cover to have recessed handles. Steps under manholes as required. Studs for manhole covers in all wet areas to be of stainless steel, nuts to be of brass.

All bolts to be stainless steel.

212. Small Hatches

Weather tight hatches to be fitted as per General Arrangement plan.

One hatch in each end of each cargo hold

One access hatch to upper deck pipe duct to be arranged fore and aft.

One access hatch to all top stools to be arranged.

Hinged steel covers on smaller hatches in watertight execution with waterproof rubber gaskets, sufficient number of dogs, hold-back arrangement and lifting handle. To enable opening from both sides. Access hatches for C/H 3 to have stainless steel compression bar.

Stainless steel hinge pins and pad eyes for pad lock. Name of the hatch cover to be marked with welded beads.

Hatch size equal to greater than 1000 mm shall be fitted with counter weight, such as hatch for bosuns store that will handle the Suez searchlight.

A rope hatch to be arranged on aft deck. To have chain securing arrangement from inside rope stowage space.

A bolted hatch for engine spare parts to be arranged aft. (1300 x 2200). A small hatch (800x600) to be arranged on top of bolted hatch for daily use.

213. Exterior Access Doors

Interior doors, see 259.

Weathertight steel entrance doors meeting the Load Line Regulations to Class I closing appliances to be fitted in accordance with Regulations and General Arrangement plan.

Doors to have waterproof rubber gaskets, six dogs and fixed porthole.

Similar doors with four dogs to be fitted elsewhere where permitted.

Access doors on higher tiers of deckhouse to be GRP construction with fixed porthole. Stainless steel (316L) sliding doors from bridge wings to wheelhouse with square window.

All exterior doors to be pirate proof.

Mosquito screen doors to be arranged as required.

Hold-back hooks with rubber bumpers to be fitted on all doors.

Top of doors 2000 mm above finished decks.

Minimum clear door width 700 mm unless otherwise mentioned.

Door to provision room and galley wide enough to allow for passage of freezers/refrigerators – min. 800.

The width of door to hospital to be 800 mm. Wheelhouse doors 900 mm.

215. Port Lights and Windows

Port lights to be used in entrance doors, in wet spaces, and in poop. Windows elsewhere.

Large-size windows providing maximum visibility to be arranged in wheelhouse/chart room including the wheelhouse doors. Two wheelhouse side windows to be of hinged type. The front windows to have electric wipers, solar screens, and heaters. Wipers according to Panama Canal requirements to be arranged. All wheelhouse windows to have hot freshwater sprinkler on the outside and gutterway on the inside.

Anti-glare screen to be provided for the wheelhouse windows.

Two (2) sets of 350mm dia clear view screen with heater to be installed on front window of the wheelhouse.

To be energized through a switch located on the control console near to the coning position.

The wipers to be of horizontal movement type.

Variable speed controller switch to be provided for each window wiper on the wheelhouse front wall.

Cabins and public spaces generally to have minimum one hinged window. To be fitted in accordance with the G.A. plan.

Wheel house front	abt. 7 x (2000 x 1400 fixed) 2 x (1000 x 1000 fixed outside of W/H)
Wheel house side	abt. 2 x (2150 x 1250 fixed) 1 x (1350/1050 x 1250 fixed) 1 x (1350 x 1250 fixed)
Wheel house aft	abt. 4 x (2000 x 1250 fixed)

Large type windows (min.900 x 630) fitted in the following rooms:

Captain's day room and office
Chief Engineer's day room and office
Chief officer's cabin
1st Engineer's cabin
Officer's mess
Crew's mess

All glass frames to be in aluminium with suitable isolation from surrounding steel.
Main frame to be welding type.

Deadlights to be fitted where required.

All windows to be surrounded by window boxes of steel or GRP provided with gutter (on the interior side).

All glass to be tempered safety glass.

For spare window panes see 1047.

216. Gangway and Accommodation Ladders

2 - Accommodation ladder to be fitted SB and PS as pr General Arrangement

2 - Pilot ladder (fixed type) to be provided SB and PS as per General Arrangement. Rope pilot ladder is to be arranged in connection with fixed pilot ladder.

Accommodation ladder and fixed pilot ladder to be of aluminium alloy complete with shaped steps, portable stanchions with wires (solid upper rail), lower landing, upper turntable and handling gear. To be stowed automatically.

Each ladder to be 600 mm in width and to have the length to reach 1 m above the water level with an inclination of 55 deg. to the horizontal when the vessel is at light ballast condition.

Electric motor operated with remote pushbutton. Limit switches to be provided. Electric motors for accommodation and pilot ladder to be protected against heavy weather damage.

Accommodation and pilot ladder stanchions to have sufficient strength to withstand green water loading.

Rope pilot ladder to be stowed and secured safely to withstand green water.

1 - Gangway of aluminium with removable stanchions to be delivered.

217. Stairs and Ladders (Outside Cargo Space)

Stairs and ladders to 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 passages or with non-skid material. Step edges with Ferodo noses or equal. To be inclined 40° if possible, but maximum 45°.

Exterior stairs and/or inclined ladders with side stringers of plate or rolled channels and steps of non-slip chequered plating tread or grating type treads. Steps/treads in hot-dip galvanised execution. To be inclined 50° if possible but maximum 55°.

Vertical access ladders - where fitted - to have flat bar side stringers and square rod rungs. Vertical ladders in excess of 2.0m in height are to be fitted with life-line rail or with safety hoops in accordance with the authorities and Buyers requirements.

Cut-out holes for hand and toe hold in chain locker bulkhead for access to bottom.

Miscellaneous treads, gratings, hand grabs, etc are to be fitted to provide safe access as necessary for operation, observation and maintenance of the vessel and its equipment and fittings.

Ladder supports to be installed on doubling plates.

218. Rails and Stanchions

Hand rails on both sides in interior stairways and on exterior stairs. Grab handrails in passageways where required.

Storm hand rails to be fitted on exterior bulkheads of all deck houses surrounded by free decks and these handrails to be carried around corners of deckhouses.

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

Galvanised steel hand rails with three rails and stanchions to be fitted on decks as per General Arrangement and in accordance with Load Line Regulations. Height 1050 mm. Rail doors where required.

219. Awnings

Awnings of corrugated FRP sheets to be arranged on navigation bridge deck P & S. Awnings acc. Panama rules to be arranged.

220. LIGHT RIGGING AND DECK FITTINGS

221. Signal Mast and Radar Mast

To be arranged as per General Arrangement Plan, with access ladder, navigation light pads, Christmas tree yards, signal yards and halyards suspended from blocks on the signal yards. To be thoroughly checked regarding vibrations.

Fall arresters to be arranged for all masts to enable safe access for repair and maintenance.

222. Foremast

To be arranged as per General Arrangement Plan, 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 at the bow, both in portable pipe construction, with sheave, cleat, halyard and fixing fitting to be installed.

225. Pad Eyes

To 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.

226. Other Davits

- 1 - Suez search light davit of steel construction for lowering and hoisting operation by means of chain block to be provided. Fittings for this davit shall also be provided.
- 2 - Davits for bunkering. SWL approx. 0.9 t, 10 m/min, electric type.

229. Deck Arrangement

Deck arrangement to be submitted for approval at an early stage.

230. MOORING FITTINGS AND EQUIPMENT

Sizes and numbers of below equipment to suit arrangement, rope dimensions, applicable rules and necessity.

A sufficient number of rollers to be arranged at forecastle deck to enable mooring with four self-tension mooring lines.

A sufficient number of rollers to be arranged at aft deck to enable mooring with four self-tension mooring lines.

6 set (3 each side) of bollards and chocks to be arranged at upper deck between frame 40 and 175.

Emergency towing arrangement, including Smith bracket, safe bit or similar to be arranged fore and aft.

Mooring arrangement to comply with Panama Canal requirements.

231. Bollards and Cleats

- Double, in welded construction
- Cleats of steel

232. Fixed Chocks

- Panama type, cast steel
- Closed chocks (hawse holes), cast steel

233. Deck Fairleads

- open type multi roller deck fairleads, cast steel with grease fittings and erected on conical foundation.

- Inclined anchor cable fairleads in way of upper end of hawse pipes. May be combined with chain stoppers.

234. Roller Guides

Roller guides of suitable size according to arrangement.

236. Anchors

- 2 - Bow anchors (approx 7.800 kg each or equivalent high-holding anchors)

Stowage arrangement and possibility of shifting anchor to be approved by buyer.

Patent connecting anchor shackles. (Kenter or similar).

Swivel fitted at anchors.

- 1 - Spare Kenter shackle

237. Anchor Chain Cables

- Material type, grade 3
- Diameter 68 mm, total length approx 632,5 m

To be delivered in units of 27.5 m with shackle

Kenter shackle at normal lengths.

S-swivel and shackle to be attached to end of chains.

Bitter end of cable in suitable position forward with quick release.

238. Hawsers and Warps

To be delivered to class requirements.

- 12 x Mooring lines each 200 m, nylon with spliced eyes at each end to be delivered on board

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.

All equipment to be worldwide serviceable.

241. Lifeboat

- 1 - Free fall lifeboat Capacity 25 persons.

- 1 - Rescue boat of rigid or permanently inflated construction or a combination of both and with prescribed equipment including also diesel inboard engine with accessories.

242. Launching Appliances

- 1 - Davit arrangement for free fall lifeboat
- 1 - Launching appliance, crane type for MOB boat, with winch
- 1 - Launching appliance, for life rafts

Davit for MOB and raft to be supplied as per GA.

243. Life Rafts

- 2 - Inflatable life rafts for 25 persons in GRP containers. Suitable galvanised steel cradles. Launching pads if required.
- 1 - Life raft, with minimum capacity for 6 persons, mounted on the forecastle deck

244. Life-Saving Equipment etc. to be provided for 25 persons

Life jackets, survival suits, and lifebuoys in number, types and stowage acc. regulations.

245. Other Safety Equipment

To be delivered and stowed in accordance with SOLAS

247. Magnetic Compass. Bells

- 1 - Magnetic projector compass and a spare bowl for compass of approved type installed on wheelhouse top with viewing mirror suitably oriented in the wheelhouse for observation by the helmsman to be delivered and installed. To be corrected, compensated and adjusted by an officially qualified adjuster to the satisfaction of the Buyer's representatives prior to delivery. Deviation cards in duplicate to be delivered.
- 1 - 300 mm ship's bell of cast bell metal with vessel's name & year of delivery engraved to be furnished and mounted on the forecastle.

248. Tarpaulins and Covers

Covers of protective fabric to Buyer's approval to be made to suit and provided for search light, wire reels, winches, magnetic compass, ventilator cowls, winch controls etc.

250. DECK COVERING, INSULATION, JOINER WORK**251. Deck Covering. Exterior**

No deck covering on exterior decks. For deck surface preparation and painting see 291-293.

252. Deck Covering. Living Spaces

Deck surfaces in wheelhouse/chart room, office, stairs and passageways to be covered with Buyer-approved vinyl flooring, installed on under layer of Semtex or equal minimum 8 mm thick synthetic rubber type deck composition.

Deck surface in recreation, mess rooms and cabins to be covered with 2 mm thick vinyl flooring.

Deck covering to be curved up at edges for mop cleaning to prevent lifting.

Under flooring in 'dry' accommodation spaces on upper deck and on wheelhouse deck made as 'floating floor' to be arranged for comfort and compliance with noise levels as required.

The periphery of all spaces with above flooring to be furnished with 100 mm high vinyl cove base (skirting board).

The steel decks to be power-cleaned to remove all dirt, rust and mill scale etc prior to the application of the deck covering.

253. Deck Covering. Wet Spaces

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

Owner may choose alternative synthetic anti-skid floor covering wet areas.

The steel decks to be power cleaned.

Deck covering in spaces containing hydraulics to be of non-slip type.

254. Gratings and Safety Treads

Non-slip synthetic rubber mat (runner) or similar on bridge wings.

Rubber mats to be provided in front of electric switch boards.

Ordinary coir mats restrained from movement to be placed inside all exterior access doors to accommodation and in way of machinery casing doors in the accommodation.

255. Insulation. Accommodation/Engine room

Glass wool or whatever material approved by Rules/Regulations. Insulation to be provided for accommodation against extreme high and low temperatures and ceramic fibre to be used against fire and noise.

Thickness of insulation material to comply with regulations for insulation against heat, cold, fire and noise, if any, and shall in any case not be less than:

- 100 mm on exterior walls and ceilings
- 50 mm over beams and stiffeners
- 100 mm below exposed decks
- 100 mm against engine casing if adjacent to accommodation spaces

Insulation in sandwich-element wallboards may form part of the above thicknesses.

Engine control room to have sufficient insulation against heat, fire and noise, and engine room bulkhead towards cargo hold to have A-60 insulation.

256. Insulation. Sundry

Hot pipes passing through accommodation and other spaces to be insulated as per usual practice.

257. Linings and Partition Walls

All steel in accommodation spaces to be lined. Linings and partition walls to comply with IMO recommendations to fire protection in cargo ships or to national regulations if at least to same standard.

Mineral wool sandwich element boards are preferred (bulkheads lined with steel or aluminium and with PVC surface on approved soft core panels). Alternative proposals may be considered.

Wall colours to Buyer's approval.

Partition walls and linings, where floating deck to be connected to steel bulkheads, to be fitted in accordance with system selected.

258. Deck Heads (Ceilings)

To comply with same regulations as mentioned in 257 and to be fitted throughout the accommodation in 'wet' as well as 'dry' spaces. Ceiling in wheelhouse to be of anti-glare type.

Access trap doors in ceiling in way of valves.

259. Doors and Locks

For exterior access doors see 213.

Interior doors to be of fire-proof type in accordance with same regulations as mentioned in 257.

Steel doors to galley and other spaces as per usual practice. Screen doors at exterior entrances with stainless steel wire mesh insert screens.

All doors to be provided with door locks, hinges, handles and hooks of chromium-plated brass with dull finish or hydronalium. Internal alleyway doors are not to have locks fitted for safety purposes.

Self-closing arrangement (overhead heavy-duty hydraulic type or equal) on doors to staircases and other important fire doors as per regulations.

All door sills covered with stainless steel plates.

Top of all doors min. 2000 mm above finished decks. Minimum door width 650 mm. Doors to lockers and wardrobes may be narrower. Hospital door to be larger than standard width (approx. 1000mm).

All doors including wardrobe doors to be provided with locks. Exterior doors to have locks of entirely non-corrosive materials. Exterior storeroom doors and similar to have stainless steel padlocks.

All drawers in cabins to have locks. Interior doors to be provided with escape panel.

Central key system to include all door locks. Master key for captain and department master keys for each of captain (deck department), chief engineer (engine department), cook (catering department). Single-lock keys for all locks. Two keys of each different type to be delivered. One key locker for captain and each of two departments to be installed complete with hooks and identification numbers. All keys to have a number.

Spare set of keys numbered to be arranged in a cabinet in Chief officers office as replica for cutting replacements.

Locks and door closers cupboard catches to be good quality.

260. ACCOMMODATION. LIVING SPACES

261. General

All areas within the accommodation, stores room etc. to be pirate and stowaway safe.

The minimum clear deck heights between top of flooring and deck heads to be:

- | | |
|---|-------------|
| - In wheelhouse, cabins, recreation rooms and mess rooms: | min. 2.10 m |
| - Elsewhere | min. 2.05 m |

Materials, patterns, colours and design to Buyer's approval.

Fixed furniture shall be of good quality wood veneered and in rigid design adequate for marine service.

262. Arrangement

The arrangement generally to be in accordance with the General Arrangement Plan with cabins and associated rooms for the complement listed in 008.

The following spaces shall be arranged in accommodation area:

- | | |
|--------------------|---|
| - Living spaces | Cabins |
| - Public spaces | Officer's mess / recreation room |
| | Crew's mess/ recreation room |
| | Officer's pantry |
| | Duty mess room |
| | Gymnasium |
| | Conference room |
| | Hospital |
| | Tally office |
| | Change room |
| - Control spaces | Wheelhouse with chart/radio space |
| | Engine control room in engine room space |
| | Fire control room |
| | Deck office (ballast control room), engine office |
| - Passage spaces | Stairway, corridors |
| - Catering spaces | Galley |
| - Provision spaces | Dry provision store |
| | Refrigerated provision stores |
| - Sanitary spaces | Private toilet |
| | Hospital toilet |
| | Public toilets |
| | Laundry |
| | Drying rooms |
| - Sundry spaces | Battery room |
| | Paint & lamp store |
| | Other miscellaneous stores & lockers |
| - Machinery spaces | Air-conditioning machine room |
| | Emergency generator room |

CO₂ room

Public toilets to be arranged in vicinity of the following room/areas:

- Wheelhouse
- Offices
- Galley
- Mess room
- Engine room entrance
- Captains deck

Hospital to consist of hospital room and toilet room with bath.

A ventilated and locked storage facility for chemicals and one for drums of lub oil, the latter can be incorporated on shelved units in steering flat, if accessed from ER.

General Note: Number of furniture etc., sizes are given for guidance only. Reference is made to Accommodation Plans.

263. Cabins

Cabins and associated rooms to be laid out as follows:

Personnel	Type of Accommodation	No. of Personnel
Captain/Chief engineer	A	2
Chief officer / 1 st engineer	A	2
Officers/engineers/pilot	B	6
Jr. officers/Petty officers/Ratings	C	15
Type A consists of	Dayroom, bedroom and private bathroom.	
Type B consists of:	Single cabin and private bathroom.	
Type C consists of:	Single/Double cabin, as type B, but with less furniture etc.	

- 1 - Suez crew cabin for six persons.

264. Mess Rooms and Recreation Rooms

Two mess rooms/recreation rooms to be arranged for easy catering from the galley/pantry. One refrigerator to be provided in each mess room and in dayrooms of Captain, Chief Engineer, Chief Officer and 2nd.Engineer.

Pantry to be arranged in captain's deck.

Officers mess room to have hot servery for buffet type meals.

Notice boards to be provided nearby mess rooms.

266. Navigation Spaces

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

Navigation and other equipment to be installed in workstations according to the notation.

The furnishing of these spaces shall at least include:

- 1 - Navigation and control workstations
- 1 - Chart table with drawers and felt-lined chronometer box
- 1 - Pigeonhole flag locker with identification labels
- 2 - Pilot armchairs with upholstered seat and back
 - Bookcase as necessary
- 3 - Binocular boxes of wood lined with felt
- 1 - Coffee percolator table with cabinet (sink, hot and cold water)
- 1 - Locker for signals etc
- 1 - Radio table
- 1 - Table for radio and telex equipment
- 1 - Filing cabinet
- 1 - Thermometer box
- 1 - Revolving chair for radio operator
- 1 - Noticeboard

Day cabin to be provided at wheelhouse.

Besides, lockers, racks etc as necessary for the navigation and communication equipment.

270. FURNITURE AND DECORATIONS

271. Berths and Mattresses

Berths for cabins of Type A:	2000 mm x 1400 mm.
Berths for cabins of Type B (and Cadets / Petty officers)	2000 mm x 1250 mm
Berths for Rating/ SC Crew	2000 mm x 1000 mm

All above measurements are inside measurements.

Berths with drawers underneath to have a permanent bottom of plywood above the drawers and the mattress to rest on the permanent bottom. Sufficient ventilation holes to be provided. Mattresses of good quality, hospital type, with springs and separate top mattresses.

272. Wardrobes and Lockers

Each cabin to have wardrobe with rod for coat hangers, shelf above rod and ventilation opening at top and bottom. For locks see 259.

One working clothes locker for each officer and rating, made of steel and fitted in a change room or of panel material and fitted just outside the respective cabin.

273. Writing Desks and Tables

Desks and tables generally with edges of hardwood. Chart table and radio table with linoleum tabletop. All other writing desks and tabletops to be of dull finish, resistant to moisture, alcohol and burns.

Double pedestal writing desks generally with four regular drawers, one file drawer, one shallow centre drawer. Single pedestal writing desks generally with three regular drawers and one shallow drawer. All drawers to have sea catches and at least two drawers in each desk with locks.

Crew cabin writing desks with one shallow drawer only.

Generally, all tables rigidly fastened to permanent pedestals. Mess room and recreation room tables to have sea rails.

274. Racks and Other Furniture

All officer cabins to have a bookcase and a radio shelf.

All crew cabins to have a combined bookcase and radio shelf.

Officers to have a chest of drawers with approx. six drawers or a locker with shelves in addition to the wardrobe.

Cabinet, cupboard or similar in senior officers' dayrooms.

File cabinets to be of steel with drawers on rollers fitted with extension slides, locks, thumb latches and safety catches to prevent accidental withdrawal.

Steel safe with keys to be installed in captain's dayroom/office.

Long mirrors for to be provided in bedroom of Type A cabins.

Long mirrors to be fitted inside wardrobe doors.

Refrigerators (60L) to be also provided for 2nd.Officer, 3rd.Engineer and on Bridge, in ECR and Conference room.

275. Sofas, Settees, Chairs

Sofas in crew recreation rooms, officer cabins and recreation rooms.

Settees in crew cabins with upholstered seats, fronts and backs.

Minimum clear length 2000 mm for officers, and similar for crew wherever possible. Sofas and settees may where necessary extend under end of berths.

All chairs to be made of wood and be of rigid design. Number of chairs in accordance with General Arrangement Plan.

Arm chairs to be provided in public rooms and in Captain, Ch. off., Ch. Engr. and 2nd. Engr. cabins

276. Upholstery, Carpets

All sofas, desk chairs, settees and lounge chairs to be upholstered with synthetic fibre fabric.

Carpet tile to be laid in Captain, Chief Engineer, Chief Officer, 2nd. Engineer cabins and Officers & Crew's recreation space.

277. Curtains, Roller Blinds, Duvets

All windows and portholes in living spaces to have curtains. Curtains to be large enough to cover completely and to be provided with tie-backs. Plastic curtain rods with sliding hooks and tie-back hooks on bulkhead.

Plastic curtains in way of all showers plus 3 spare ones.

All windows and portholes either facing forward or facing exterior free decks and passageways to be provided with roller blinds.

Duvet for all berths. Two feather pillows for all beds.

Materials for curtains, roller blinds and duvets to be of fabric with low flammability.

Bridge windows in front and in Chart Space to be fitted with solar blinds.

278. Hardware. Paper Baskets

Hardware throughout the entire accommodation generally of stainless steel / chromium plated brass or equal. Hardware in bathrooms generally of chromium-plated brass, heavy pattern, suitable for marine use. See 281. Three coat hangers in each bedroom, cabin and office. Also coat hanger in mess room and where required.

- 1 - Paper basket of non-inflammable material to be delivered for each cabin and mess room.

280. MISCELLANEOUS ROOMS

In general rooms are to be arranged as per General Arrangement.

281. Bathrooms and Toilets. Change room

Bathrooms and toilets may be of prefabricated type.

Each private bathroom to be equipped with the following items:

- 1 - Socket for electric shaver
- 1 - Wash-basin of vitreous china approx. 550 mm x 450 mm with faucets indexed or marked for identification of hot and cold
- 1 - Water closet of vitreous china with flushing valve and with plastic seat and cover
- 1 - Shower with thermostatic mixing faucet and fixed, turnable shower head
- 1 - Toilet locker with mirror and light
- 1 - Toilet paper holder
- 1 - Sponge basket
- 2 - Soap holders, one for shower and one above wash-basin
- 2 - Towel rods, which may be combined with the wash-basin supporting brackets
- 1 - Shelf with rail above wash-basin
- 1 - Coat hanger
- 2 - Safety grip bar
- 2 - Towel hooks

Separate toilets to be equipped with the following items:

- 1 - Wash-basin of vitreous china, approx. 450 mm x 300 mm with mixing faucet
- 1 - Water closet of vitreous china with flushing valve and with plastic seat and cover
- 1 - Mirror
- 1 - Toilet paper holder
- 1 - Coat hanger
- 2 - Towel hooks
- 1 - Soap holder above wash-basin

Change room to be equipped with the following items:

- Steel lockers
- Wood bench

- Wash-basin of vitreous china approx. 550 mm x 450 mm with faucets indexed or marked for identification of hot and cold
- Shower with thermostatic mixing faucet and fixed turn able shower head
- Coat hangers
- Mirror
- Soap holders
- Shelf with rail above wash-basin
- Towel hooks

282. Laundry and Separate Drying Room

Drying room to be fitted with suitable ventilation and in particular a coil of piping from the hot water system to heat the room, and to be provided with:

- 2 - Ironing board together with canvas cover. One 1.5 kW capacity electric iron.
- 1 - Heavy duty automatic washing machine, industrial 20kg capacity
- 2 - Domestic washing machine, 5kg capacity
- 2 - Tumble drier, fitted above washing machine industrial 20kg capacity
- 1 - Stainless steel washing tub
- 1 - Clothes line on hooks
- 1 - Table
- 1 - Storage box for washing powder, volume approx. 250L

283. Galley and Pantry

Galley to be arranged on 2nd accommodation deck.

The furnishing to consist of tables, dressers, storage racks, shelves, and cupboards and cabinets of stainless steel, and besides, of the below listed equipment:

- 2 - Cooking range (with oven) abt. 14.4kW/each
- 1 - Microwave oven
- 1 - Rice cooker (for 20 people)
- 2 - Automatic dishwasher (side loading type)
- 1 - Hot plate
- 1 - Garbage disposer, abt. 0,75 kW
- 1 - Food mixer with accessories 30 l
- 1 - Electric refrigerator 500 l
- 1 - Dresser with 1-sink
- 2 - Stainless steel working table
- 1 - Hand washbasin

- 1 - Stainless steel counter
- 2 - Whiteboard
- 1 - Flavouring rack
- 1 - Small stool
- 1 - Towel rack
- 1 - Wall cupboard
- 2 - Plastic wastebasket
- 1 - Crockery and glass rack
- 1 - Potato peeler
- 1 - Chopping block, plastic type.
- 1 - Working table with sink
- 1 - Electric toaster, 4 slices (0.8 kW)
- 1 - Electric kettle (abt. 2 l)
- 1 - Working tables
- 1 - 25kg scale for weighing food
- 2 - Locker
- 1 - Electric meat chopper (abt. 0.7kW)
- 1 - Elec. Baking oven with 3 sections (app. 9kw)
- 1 - Deep fat fryer
- 1 - Drinking water machine

All equipment to be properly mounted with suitable foundations and installed to facilitate easy maintenance and cleanliness.

All doors and drawers of galley equipment to be fitted with push button locks.

All units to be of stainless steel.

Exhaust hood over galley.

Pantry to be arranged on 2nd accommodation deck to serve the officer's mess rooms and the pantry to be furnished as follows:

- 1 - Coffee machine (20 ltr/h)
- 1 - Refrigerator (200 ltr)
- 1 - Hot water boiler (9 ltr) electric type
- 1 - Toaster (4 slices)
- 1 - Sink (2-bowl) with under locker
- 1 - Serving hatch (600 x 600mm) & serving table (300 x 1000mm)
- 1 - Cupboard (1000 x 300 x 600mm)
- 1 - Dish rack (L=800mm)
- 1 - Portable waste bin of stainless steel

- 1 - Microwave oven

Necessary plate racks, cup racks, bottle racks, kettle hooks, cup and jug hooks, etc., to be furnished.

Six (6) cold and hot water fountains of domestic type with sterilizer to be fitted and located as follows:

- 1 - Upper deck passage
- 1 - Acc. deck passage
- 1 - Crew's pantry
- 1 - Galley
- 1 - Engine room
- 1 - Captain's deck

284. Miscellaneous Hull Machinery Rooms

Fan rooms to be arranged as necessary.

Battery box, complying with applicable regulations, to be arranged. Batteries to be secured to prevent movements at sea.

Steering gear compartment to be arranged with shelving in two tiers.

Other deck machinery rooms to be arranged as necessary.

285. 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 are to be substantially constructed and arranged to prevent or restrict movements of items stowed.

The storerooms and lockers shall generally be in accordance with the General Arrangement Plan and shall include, though not necessarily be limited to, those listed in 286-288.

For machinery storerooms see 582.

286. Storerooms and Lockers in Accommodation

- 1 - Clean linen locker, well ventilated and heated
- 1 - Bonded store
- 1 - Medical locker
- 1 - Cleaning gear locker, well ventilated

287. Deck Storerooms

- 1 - Paint room, well equipped with ventilation and fire-fighting equipment
- 1 - Rope store forward
- 1 - Boatswain's store with workbench with screw-vice

288. Provision Store Rooms (Refrigerated and Dry)

For dry provisions as per GA:

Removable shelves of stainless steel except potato box, which may be of wood. stainless steel meat hooks, division bars and fiddles of stainless steel.

Special stowage arrangement for tins to Buyer's approval.

Approx. capacity and temperature for refrigerator stores:

-	Vegetable refrigerator room	21 m ³	5°C
-	Dairy refrigerator room	6 m ³	5°C
-	Meat freezer room	21 m ³	-20°C
-	Fish freezer room	8 m ³	-22°C
-	Handling space	15 m ³	8°C

Remote temperature monitoring in ER control room.

289. Gymnasium and swimming pool

Space to be provided for a gymnasium. The Buyer will supply inventory for the gymnasium.

Swimming pool to be fitted as per general arrangement.

290. CORROSION PREVENTION AND PROTECTION**291. Paint Work****General**

Painting works including surface preparation and painting inspection shall be carried out in accordance with the Builder's practice and standard, paint manufacturer's recommendations and Buyer's approval. The Ballast tanks, including those of the double side skin shall be coated in accordance with and meeting the IMO Performance Standards for Protective Coatings (PSPC).

The instruction and recommendations of paint manufacturers and their coating advisors shall be adhered to, and the work shall be carried out to the satisfaction of these advisors and Buyers' representatives.

All flame cut edges including scallops/lightening holes, stiffener etc. to be smooth ground to a radius for superior paint protection. (This on exposed decks, ballast tanks, ballast hold, FW tanks, coamings, hatch covers).

The finish colour shall be decided in accordance with the Buyer's colour standard. The surface of copper, cooper alloy, aluminium alloy, stainless steel, galvanized steel or other non-corrosive materials, surfaces in contact with doubling plates and internal surfaces of tightly enclosed spaces shall not be painted unless otherwise specified. Painting works for the equipment and machinery shall be carried out in accordance with the manufacturer's standard. However, the part damaged after installation shall be touched up in accordance with the Builder's practice.

Painting works shall not performed in the open air during the periods of rain, snow, fog or mist and also shall not be carried out when the weather conditions may cause condensation i.e., when the relative humidity exceeds 85%, or steel temperature is not higher than the dew point by 3°C.

Painting works for the parts or spaces which are not specified in this specification shall be similar to surrounding or comparable spaces.

Painting schedule shall be prepared by the Builder according to the Builder's standard and manufacturer's recommendation and submitted to the Buyer for approval. In general, different paint coat (1st /2nd coat) shall be different colour shade for undercoat only.

Paint shall be applied as received from the manufacturer's with no addition of oil, thinner, dryers specifically instructed by the manufacturer.

Smooth grinding of sharp edges shall be done for all steelworks. One (1) stripe coat shall be applied as paint manufacturer's recommendation for all welding seams, sharp edges and corners. In the Ballast tanks, in accordance with PSPC, 2 stripe coats are to be applied.

All non-galvanized pipes longer than 6 meters in length and above 450 mm in diameter shall be blasted or acid pickling and primed prior to bring onboard, and/or mounting on block.

When blasting in proximity of galvanized items, the damaged parts of galvanized surface shall be touched up with zinc rich primer.

All windows, name plates and similar, shall be properly protected during blasting and/or painting.

All the galvanized parts to be protected during blasting of surrounding areas. All damaged paint areas to be repaired/touched up with full number of coats.

All small fittings such as pipe supports, steel doors, hatches, foundations etc., treated and painted prior to installation onboard or on block.

2nd coat shall never overlap the 1st coat, 3rd coat shall not overlap the 2nd coat etc. No mixing and stirring of paint by hand. Only power mixer shall be used.

Prior to installation of pipes, equipment, the foundation and pipes/ equipment in way of contact surface shall be painted with complete paint system.

In areas where the film thickness can not be reached with spray gun, such as scallops, edges, corners, hand welding seams, limber holes etc., in W.B. and F.W. tanks, shall be touched up by a stripe coat of the paint system before applying each coat.

The handrails, ladders, gratings except supports, pipe and pipe support of steel construction, except hydraulic lines, whose thickness is equal to or less than 5mm shall be galvanized if these are installed in water tanks and weather deck.

Primary surface protection and shop priming:

Steel plates and sections of 6mm and above in thickness and 3m in length shall be shot-blasted to the Swedish Standard SIS Sa 2.5 which is equivalent to the Builder's standard, and primed with inorganic zinc silicate ship primer to 15 microns of dry film thickness.

Steel plates and sections less than 6mm in thickness or 3m in length, including outfitings shall be cleaned by pickling or power tool in accordance with the Builder's practice.

Secondary surface protection:

Secondary surface protection for welded parts, burnt and damaged parts of shop primer shall be carried out as below table:

LOCATION		SIS Grade	
		At block stage	At erection stage
Shell outside	Below water line	SIS Sa 2.5	SIS St 3
	Above water line	SIS Sa 2.5	SIS St 3
Weather decks		SIS St 3	
Deckhouse, outside			
Void spaces and cofferdam			
Deckhouse, behind the insulation lining or ceiling		SIS St 2	
Deckhouse, bare steel			
Machinery space			
Cargo holds		SIS Sa 2.5	SIS St 3
Water ballast tanks incl. sewage tank			
Fore & after peak tanks			
Fresh water tanks		SIS Sa 2.5	
H.F.O., D.O. and L.O. tanks		SIS St 2	
Miscellaneous			

Application of paints:

Painting works shall be carried out by airless spray and/or air spray. However, hand brush or roller may be used where it is impracticable to use spray. Technical requirements for painting works such as thinning ratio, atmospheric temperature, humidity, recoating interval and drying time shall follow the paint manufacturer's recommendation.

A epoxy primer shall be applied to the outfittings and pipes, and one (1) coat of finish paint shall be applied in accordance with the Builder's standard, unless otherwise specified.

Measurement of dry film thickness:

MICROTESTER, INSPECTOR or other instrument shall be used for measurement of dry film thickness. A full program of measurement and methods must be presented and agreed with Buyer and Coatings supplier for the Ballast tanks and included in appropriate documentation required in accordance with the PSPC.

For ship's hull, water ballast tanks, fresh water tanks and cargo holds the average DFT based on measurements shall always be equal to or larger than specified DFT. Up to 10% of the measured points may have a thickness between 100% and 90% of the specified DFT.

For other areas the average DFT based on measurements shall always be equal to or larger than specified DFT. Up to 10% of the measured points may have a thickness between 100% and 90% of the specified DFT.

Dry film thickness shall not be measured for machinery, equipment, outfitings, pipe supports, seats, welding beads and edge of structural members.

Epoxy Paint Coatings in Ballast and Fresh Water Tanks to be guaranteed for five (5) years.

Epoxy paint in ballast and freshwater tanks to be in light colours. Coat 1 and 2 to have different colour.

Painting Schedule:

PAINTING AREA				SHOP	PAINT & NUMBER OF COAT			REMARKS
Interior Parts				PRIMER	1	2	3	
Tanks	Fuel oil tank			IZ	No coating			
	Lub. oil tank			IZ	Wiped with oil			
	Fresh water tank			IZ	EP**	EP**		Total 400
	Drinking water tank			IZ	EP**	EP**		Total 400
	Fore peak tank			IZ	ME	ME	2 x SC	Total 320
	Aft peak tank			IZ	ME	ME	2 x SC	Total 320
	Bilge well			IZ	ME	ME		Total 300
	Stern tube (Outside)			IZ	ME	ME		Total 300
	Chain locker			IZ	ME			Total 150
	Cofferdam			IZ	ME			150
	Void space			IZ	ME			150
	Double bottom water ballast tank			IZ	ME	ME	2 x SC	Total 320
	Top side water ballast tank			IZ	ME	ME	2 x SC	Total 320
	Side Ballast Tanks			IZ	ME	ME	2 x SC	Total 320
Accommodation Space	Living room, Public room, Offices, Pas-sage	Ceiling wall	Bare steel	IZ	AP	AP	AF	Total 145
			Under insulation		AP			75
		Floor	Bare steel	IZ	AP	AP	AF	Total 145
			Under covering		No coating			
Stores	Dry prov. St. Wet. prov. St.		Ceiling wall	IZ	AP	AF	AF	Total 145
			Floor		AP	AF	AF	Total 145
	Battery room		Ceiling wall	IZ	AP	AF	AF	Total 145
			Floor		ME			125
	Ref. prov. Chamber		Ceiling wall	IZ	ME			125
			Floor		ME			125

PAINTING AREA				SHOP	PAINT & NUMBER OF COAT			REMARKS	
Interior Parts				PRIMER	1	2	3		
Cargo Hold Except No.3	Ceiling			IZ	ME	ARE		Total 300	
	Wall			IZ	ME	ARE		Total 300	
	Tank top			IZ	No paint				
	Bilge well			IZ	ME	ME		Total 300	
No.3 Cargo Hold	Ceiling			IZ	ME	ARE		Total 320	
	Wall			IZ	ME	ARE		Total 320	
	Top of double bottom			IZ	ME	ARE		Total 320	
	Bilge Well			IZ	ME	ARE		Total 320	
Engine room	Eng. Room, Boiler room, Steering gear room	Ceiling		IZ	AP	AF	AF	Total 145	
		Wall	Ceiling-Skirting-Grating	IZ	AP	AP	AF	Total 145	
			Grating top of double bottom	IZ	AP	AP	AF	Total 145	
		Floor	Top of double bottom	IZ	ME	ME		Light colour Total 250	
			Grating	Top	--	AP	AF		Total 110
				Under surface	--	ME	ME		Total 250
			Engine flat		IZ	AP	AP	AF	Total 145
			Under machinery seat, Bilge well		IZ	ME	ME		Total 250
	Outside of pipe	Galvanized		--	No paint				
		Under grating			ME	ME		Total 250	
		Insulated		--	HRP	HRP		Total 50	
		Steel pipe except above		--	AP	AP	AF	Total 145	
Engine Room and Steering gear room	Outside surface of Insulation	Outside surface of galv. plate		--	EP	AF		Total 110	
		Except above		--	AF			Total 35	
	Main engine			Paint by Manufacture					
	Boiler								
	Auxiliary machinery								

PAINTING AREA			SHOP PRIMER	PAINT & NUMBER OF COAT						REMARKS
Exterior Parts				1	2	3	4	5	6	
Deck Fittings	Outside of Pipe	Galv. pipe	--	No paint						
		Insulated steam pipe	--	HRP	HRP					Total 50
	Cargo hatch Cover	Outside	IZ	ME	ME	PT				Total 350
		Inside	IZ	ME	ME					Total 300
	Cargo hatch Coaming	Outside	IZ	ME	ME	PT				Total 350
		Inside	IZ	ME	ME					300
	Anchor		--	BS						175
	Anchor chain		--	BS						175
Shell	Bottom	Before launching	IZ	ME	ME	TC				Total 375
	Bottop (incl searchests) (TBT free)						ANT	ANT		
	Top side		IZ	ME	ME	PT				Total 350
	Rudder	Outside	IZ	Same as bottom						Total 375
		Inside		ME						250
	Inside of stern frame		--	ME						250
	Rudder trunk		IZ	ME						125
Supper-Structure, Deck Fittings	All decks		IZ	ME	ME	PT				Total 350
	Under deck machinery		IZ	ME						Total 125
	Under covering		IZ	No coating						
	Deck house		IZ	ME	ME					Total 350
	Deck store	Outside	IZ	ME	ME	PT				Total 350
	funnel	Outside	IZ	ME	ME	PT				Total 350
		Inside	IZ	AP	HRP	HRP				Total 85
	Mast and post		IZ	ME	ME	PT				Total 350
	Ventilator		--	ME	ME	PT				Total 350
Deck machinery		--	Paint by manufacture							

Note: The thickness specified shall be taken as a reference. Actual thickness may be adjusted subject to specifications recommended by manufacturer. SPC to be of 5 years life.

Abbreviations:

SC	Stripe Coat
IZ	Inorganic zinc silicate shop primer
ANT	TBT free Anti-fouling paint (long life 5 years)
AP	Alkyd Primer
AF	Alkyd Finish
HRP	Heat Resistant Aluminium Alkyd
EP	Epoxy primer
EM	Epoxy Mastic
BS	Bituminous Coating
EP**	Solvent-free Pure Epoxy
PT	Polyurethane
TC	Tie Coat
ME	Modified Epoxy
ARE	Abrasion Resistant Epoxy

Painting Schedule of Wooden Surface:

Walls and ceilings in accommodation spaces not covered with plastic overlay or decorative wood to have:

2 coats of white or tint colour paint

Wooden furniture to have:

1 coat of wood sealer coats of clear resin

Galvanizing

Galvanizing process to be approved by Buyer.

Galvanizing of steel piping to be applied in accordance with Article 12.2 Bolts and nuts for piping shall not be galvanized except in water ballast tank.

Following outfits to be galvanized:

- Handrail top rail
- Boat lashings
- Handles and clips of steel doors
- Hinges, small bolts and nuts under 12mm dia. Exposed to weather
- Ventilator ducts (2.3mm and below)
- Ventilator heads in weather part (3.2mm and below)
- Small chains (8mm dia. And below)
- Wooden block fittings
- Small shackles and thimbles (8mm dia. And below)
- Steel shelves in stores
- Standing rigging for masts

Funnel and bow mark

Stack or bow insignia as designed by the Buyer to be marked by weld bead or steel plate and painted on each side of the funnel and forward part of bow respectively. The Builder to forward drawings showing the location of above marking for Buyer's approval.

Name and port registry

The name of vessel to be made from steel plate and painted on both sides of the bow and on stern. Port of registry to be marked similarly on stern only. Name and port of registry to be made of plate letters.

All life saving equipment to have the ship's name and/or Port of Registry.

Draft mark, freeboard mark and boundary mark

Draft marks to be made from steel plate and painted to the shell at 200mm intervals up to 1.0 meter above the load waterline at stem, midship and stern, on port and starboard sides.

Figures to be 100mm height and Arabic figures to be used. The bottom edge of the numeral will indicate the projected vertical height in meters from the bottom of the keel.

Freeboard marks as required by the International Loadline Regulation to be marked by intermittent weld bead and painted on both sides of the vessel, amidship. Boundary marking to be provided for full load draft line by welding beads.

Tug push marks

Tug push mark to be marked by intermittent welding beads and painting at suitable positions both port and starboard. Structure in way to be reinforced.

Hold division marks

Marks made of intermittent welding bead on side shell for identifying the cargo hold and its boundary.

Miscellaneous

Tank number and code to be marked closed to the bottom plugs.

Manhole covers to tanks to be marked with tank number and code.

Hatch covers to be marked with hatch number, port and starboard sides by means of welded bead.

Manhole covers to tanks, access hatches to holds, rope hatches and other means of entry to be marked with appropriate tank number, code or space identification.

Painting mark at side shell by intermittent welding bead.

Marking scheme for division boundaries, tank identification, bottom plugs, etc to comply with Class requirements for under water survey.

Frame numbers to be marked along the side of the main deck in steel plate and inside wing ballast tanks

298. Corrosion Protection

Impressed current system for hull and propeller protection to be fitted.

Hull protection: 5 years period.

Hull: 35 mA/m²

Propeller: 600 mA/m²

One (1) anti-fouling system for sea chest, sea water strainers and SW Cooling Water circuits to prevent micro fouling of cooling water pipes to provided.

299. Sacrificial Anodes

A suitable number of zinc or aluminium back-up anodes to be fitted in ballast tanks, seachests and forward of propeller.

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300. - 399. HULL ENGINEERING

In general operating temperature of all exposed deck equipment such as, but not limited to, windlasses, hydraulic aggregates, navigating equipment shall be minus 20 degrees Centigrade.

In general all equipment, pipes etc. on exposed decks to be well protected against damage from cargo handling.

300. VENTILATION**301. Ventilation, General**

Ventilation requirements, see 302.

Spaces to be ventilated according to the applicable regulations.

Noise level in accordance with IMO resolution A468 (XII) code of Noise Level on board Ships.

Air-inlets not to face towards cargo handling area and inlets and outlets to be kept well clear of each other.

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

Natural and/or mechanical ventilation in general to be provided as follows:

Compartment	Ventilation system
Accommodation quarter: Living spaces, public spaces, laundry and drying room, dry provision room etc. except sanitary spaces	Air conditioning system (Spot cooling/heating in wheel house**, chart space, pantries, hospital* and galley*)
Sanitary spaces	Natural supply through door louver Mechanical exhaust
Paint store, steering gear room, emergency fire pump room, CO ₂ room, hydraulic pump rooms, emergency generator room, wing & bottom pipe ducts,	Mechanical exhaust, natural supply For steering gear room mechanical supply and natural exhaust
Other stores, lockers, battery room etc.	Natural ventilation
Cargo holds	Natural ventilation for dangerous cargoes (see 970)
Machinery space	Mechanical & natural ventilation (see 541 and 542)

*Separate air condition unit and exhaust fan for galley and hospital to be installed.

** Wheel house to be fully cooled and thermo-hydrimetrical conditions to be guaranteed.

Any space not specifically mentioned is to be governed by Class requirements.

302. List of Ventilation Requirements

Approx. air changes per hour:

Type of Space:	Mechanical		Natural	
	Exhaust:	Supply:	Exhaust:	Supply:
Bathrooms and toilets	15			S
Laundry and drying room	30			S
Change rooms	15			S
Galley	60	40		
Navigation bridge		10		
Mess rooms		12		
Cabins		8		
Machinery control room		10		
Suez Crew Room			E	S
Converter room			E	S
Cellar deck			E	S
Deck store rooms			E	S
Garbage room			E	S
A/C unit room			E	S
Paint store room	15			S
Steering gear compartment		15	E	
Emergency fire pump room	15			S
Emergency generator room	15			S
HPU room	15			S
CO ₂ room	15			S
Battery room	6			S
Refrigeration compressor room	15			S
Upper - / bottom pipe ducts	6			S

Engine room – See 541 and 542

303. Natural Ventilation

Generally, all spaces, which are not air-conditioned, shall have natural ventilation. Spaces such as deck storerooms 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, etc, to have natural supply through door louvers or similar from adjacent rooms, and mechanical exhaust by fan on ducted system.

Natural ventilation to be provided for cargo holds. See also 971.

Mushroom, gooseneck or wall ventilators to be fitted for ventilation of store spaces, paint store, battery room, hospital, etc. wherever necessary.

All ventilators leading to the cargo holds and accommodation spaces to be fitted with stainless steel rat proof nets, and those leading to living quarters to be fitted with stainless steel wire net screen in addition to the rat proof net.

Mushroom ventilators of diameter 450 mm and above and axial fan to be opened/closed with a turning handle. Smaller diameter ventilator to be handled by a turning bonnet cover.

304. Miscellaneous Ventilation

The galley to be provided with mechanical exhaust system incorporating a hood above the galley range and deep fat fryer area with grease filter and additional outlets as necessary.

305. Fan Rooms

The air-conditioning central unit (see 314) to be installed in a separate room. Where practical, other mechanical ventilation systems, serving rooms in way of the accommodation to have their fans installed in the same fan room.

306. Fans

All fans to be delivered by the same approved manufacturer and to be electric-motor driven axial or centrifugal type. Axial fans only on weather decks and in machinery spaces.

Hinged swing out type arrangement for maintenance and cleaning of axial fans is required.

307. Ducts, Inlets, Outlets

Ducting of fabricated hot-dipped galvanised, painted steel sheet, minimum 1.0 mm in thickness with flanged connections and insulated where necessary to prevent sweating and heat rise and minimise noise levels due to air flow in ducts.

Cleaning holes to be provided where necessary.

Ventilation cowls, mushrooms, goosenecks and ventilators of min. 5mm steel, sand-blasted, primed and painted.

All inlets and outlets on exposed decks should be capable of being closed off with a weathertight hinged cover.

In general grids to be of stainless steel.

Ventilation inlets (engine room, A/C and crane) to be arranged with a easy washable dust filter.

308. Fire Dampers

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

Remote closing of fire dampers for engine room ventilation to be enabled from fire station.

310. AIR-CONDITIONING AND HEATING**311. Air-Conditioning Requirements**

The accommodation to 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	
	Temp.	Rel. humidity	Temp.	Rel. humidity
Hot	+35°C	90%	+27°C	50%
Cold	- 20°C		+20°C	

Wind speed 16 m/s

Design cooling water temperatures: +36°C

Number of air changes per hour: See 302.

An amount of max. 50% of the air may be re-circulated.

Air from the hospital, not to be re-circulated.

In mild climates when cooling or heating is not required, the system to serve as mechanical ventilation for accommodations, supplying fresh air only.

312. Refrigeration Machinery for Air-Conditioning

A set of freshwater cooled refrigeration plant (with two (2) compressors/condensers) complete with accessories with sufficient capacity to maintain the specified design conditions at 85% of its maximum capacity. A separate cooling water boost pump to be provided if necessary. Provision shall be included at a suitable location in the system to allow shore cooling water to be admitted.

The plant to be assembled as a unit on a common bedplate. Refrigerant to be of ecological type.

314. Air-Conditioning Central Unit

The unit to 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*. Humidity control for supply air while heating is to be done manually at the humidifier of fan unit. Unit to be built of galvanised steel and to be provided with thermal and acoustic insulation.

Air-condition unit supplier to verify requirements stated in 311. Verification to be based on actual accommodation insulation type and thickness.

The capacity and temperature to be locally controlled and from the Chief Engineer's cabin.

* The cooling section to have two cooling grids, each one connected to one refrigerant condensing unit

315. Air-Conditioning Ducting

A single-pipe duct system consisting of light prefabricated and preinsulated pipes, preferably with two concentric tubes with mineral wool in between.

316. Air-Conditioning Outlets

The air-conditioning room units to be of such design that 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 to be fitted near outlets.

318. Heating of Non-Conditioned Spaces

Calorifiers supplied with steam to be installed in the engine room (2), steering gear compartment (1) and one in each of the store rooms in the aft ship to ensure an inside temperature of 5°C, when the outside temperature is -20°C. The ship store in fwd end of the vessel to be supplied with electric heaters. The spaces which require installation of calorifiers are not restricted to the above, but shall depend on the Builders' final development of arrangement plans and insulation plans and otherwise be in accordance with usual practice.

320. HULL PIPING SYSTEM**321. System Requirements**

Diagrammatic plans based on this specification with complete information on pipe sizes, wall thickness, flanges, couplings, location of valves and instruments in detailed design stage to be submitted for Buyer's approval.

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

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

Pipes inside ballast tanks to be arranged in order not to obstruct escape routes according to the requirements of Technical Provision of Permanent Means of Access.

All pipelines to have section valves to facilitate maintenance.

Copper pipes and PVC pipes are to be seamless.

Removable pipe joints (union or flange) are to be applied to valves, equipment, machinery and location where considered necessary

Expansion joints are to be applied to the lines running fore and aft to relax expansion and contraction stress in pipes due to temperature changes or deformation of hull

Dresser coupling joints are to be applied to the ballast line, fire & wash deck line, fuel oil lines, bilge lines and electric cable pipe

Offset expansion bends are to be applied to the compressor air lines, hydraulic lines, tank heating steam and drain lines, small piping and where required by class

In general, penetration pieces are to be of steel. Penetration pieces for steel pipes through watertight bulkhead or exposed deck are to be extra heavy steel pipe or same thickness as the pipes connected to the pieces, whichever is greater

Steel sliding shoe pieces are to be provided where found necessary, especially for ballast pipe

Pipes are to be bent by cold-bending machines in general. When pipes are to be reduced or enlarged that should be by using reducer pieces or special flanges. Hot bending, elbows and tees are also to be used in accordance with GB.CB, DIN, JIS or ISO standard.

All flanges to be in accordance to ISO-standard.

Plastic pipes of approved type in general to be used for accommodation piping system.

The pipes in fuel oil and diesel oil tanks are not to be galvanised.

No lobsterbacks as bends, except for exhaust gas pipes.

322. General Demarcation

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

For machinery piping systems: See under 600.

323. Materials, Pipes. Types

See under section 600.

325. Assembly and Supports

Generally, steel pipes of 20 mm diameter and beyond to be assembled with flanged connections.

Hydraulic pipes to be assembled with special couplings of maker's standard or Builder standard subject to approval. All pipes to be suitably supported. All threads of bolts to be metric.

Pipe supports should land on structure, not unsupported plating.

326. Insulation of Pipes

Hot pipes such as drain and hot water pipes in accommodation (temperature exceeding approx. 60°C) to be insulated with mineral wool in sections or as mats, covered with aluminium sheet plate or galvanized sheet plate where exposed to mechanical damage.

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

Cold water pipes passing through heated rooms in accommodation to be insulated.

Canvas cover or equivalent is to be applied to the water service and drain pipes which are led behind the ceiling of the accommodation.

For insulation of machinery, see 516, 546.

For insulation of pipes in engine room, see 606.

327. Protection of Pipes

All pipes to be properly fastened to the ship's structure with clamps and similar. Where exposed to mechanical damage or shipping of green seas, pipes to be suitably protected as practicable. Expansion bends and/or flexible couplings to be used where pipes 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 to facilitate:

- Drawing and delivering ballast water from/to all ballast tanks.
- Trimming/listing vessel

Two (2) ballast main lines to be arranged in DB pipe duct. Each line to be respectively connected to double bottom and side tanks at PS or SB through branch lines. A ring

connection to be provided forward with valve separation to enable each pump to serve PS and SB tanks. Two separation valves to be provided at midlength of each main line.

The ballast pump discharge time should be fast and pumps should be able to leave min. of dead water. Stripping of tanks by means of a separate stripping main line by means of a stripping ejector.

Ballast piping, including stripping line, to be arranged to let ballast water be discharged from both SB and PS into the sea.

The ballast pumps to draw from common SW-cross-over.

The two ballast pumps to operate simultaneously on SB and PS water ballast tanks, i.e. max. one ballast pump serving one ballast tank (except for Fore Peak Tank).

For cargo hold 3 and Fore Peak tank both ballast pumps to operate simultaneously.

Ballast valves with electric hydraulic or hydraulic type actuators and pumps to be remotely operated from engine control room and deck office. Manual operation of valves to be possible in case of failure of remote system.

The cargo hold 3 to be connected to each main ballast line and in addition the cargo hold 3 to be arranged with a separate gravity filling / discharge connection.

Cargo hold 3 to be arranged with one vacuum valve located at uppermost forward part of tank in hatch cover.

Sequential water ballast exchange to be possible for all water ballast tanks. For cargo hold 3 flow through water ballast exchange to be possible. The overflow water from cargo hold 3 to be discharged through 2 permanent pipes (one SB and PS). The discharge pipes to be arranged with valves from top of the longitudinal coaming down through the wing tank and through the shipside approx. 1.5 m below deck.

Ballast and stripping pipes to be of GRE (Glassfiber Reinforced Exopy type).

The following to be installed:

- 2 - Ballast pumps, 800 m³/h x approx. 0.20 MPa each frequently controlled.
- 1 - Ballast ejector (for stripping), 50 m³/h

Ballast water treatment to be considered and necessary space must be kept free of equipment and installations for future installation of Ballast Water Treatment System.

12 mm doubling plates to be arranged below the bell mouth of all ballast tank pipes.

332. Bilge Piping (Outside Engine Room)

A main line bilge system to be installed. Remote electro-hydraulic or hydraulic butterfly valves to be fitted at each branch line. Valves to be remotely controlled from deck office and engine control room. Non-return check valves to be fitted in all bilge wells (access from holds to be possible).

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

Bilge pipes to be of GRE (Glassfiber Reinforced Exopy type).

Bilge ejectors for holds and chain lockers, see 449. For bilge system in engine room see 652. Size of ejectors to class approval.

Drainage from steering gear room to engine room bilge with self-closing valve.

Bilge wells to be of 2 chamber segregation type.

Drainage of forward compartment to be arranged according to SOLAS XII / 13.

Each cargo hold to be arranged to accommodate a portable pneum. pump to take suction of hold washing water. See also 980.

333. Scuppers and Drains, General

Scuppers and drains in sufficient numbers and of adequate sizes to be installed in lowest positions for effective drainage of decks, gutter-ways, floors, sanitary installations etc.

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

All overboard discharges to comply with applicable regulations and to be clear of life-boat embarkation stations.

Hinged guards are to be fitted on top of the scupper pipes on upper deck. Scupper plugs of rubber seal type are to be supplied for openings on the upper deck as a deck scupper-closing device.

334. Exterior Deck Scuppers

Sheer strake towards accommodation to be raised over main deck forward of the breakwater aft to collect and guide deck washing water into scupper leading to the washing water holding tank.

Deck scuppers PS & SB from all decks above superstructure decks to next deck below arranged well clear of entrances to accommodation. Deck scuppers from superstructure decks and upper deck of extra heavy gauge pipes carried inboard and terminating on shell plating close to the load water line.

Rose plates are to be fitted on the top of the scupper pipes on superstructure deck and above.

335. Interior Gutter-ways and Scuppers

Gutter-ways behind the lining of the accommodation deck house sides to have scuppers with pipes led to decks below and with brass plugs in house sides at deck level.

336. Floor Drains

Drain to be arranged in bathrooms, change rooms, toilets, laundry, galley, provision room.

2 drains to be arranged in bathrooms, one inside shower stool and one outside.

337. Sanitary Drains and Galley Drains

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

338. Sewage Pipe System

Ordinary sewage piping to sewage treatment unit and to sewage collecting tank in engine room to include the following:

- 1 - Black water holding tank, capacity for 10 days, to be installed.
- 1 - Grey water holding tank, capacity for 10 days, to be installed.
- 1 - Independent discharge pump or alternative arrangement for emptying the sewage/holding tank to be provided.

Separate fixed installed pipes for down washing to be arranged inside in black water tank. Temporary connection to general service pumps to be possible via fire hose.

An international discharge connection is to be provided at each side of accommodation house to discharge the sewage.

Discharge outlets of the wastewater and soil drainage mains are to be located below the light ballast water line level

An independent line for waste and soil drains from hospital is to be led to the sewage treatment plant and overboard discharge outlet.

For toilet flushing system, see 352.

339. Hydraulic Pipes

Hydraulic pipes on open deck to be heavy duty seamless carbon steel. Pipes on deck to be well protected.

All hydraulic control piping to stainless steel (316L).

Independent hydraulic pipe systems for:

- mooring and anchor
- cranes
- hatch covers
- steering gear

340. FILLING, SOUNDING AND VENTING

341. Filling Pipe Systems

Filling pipe connections P & SB with valves on deck and sampling flanges (of dripping type) for filling of fuel oils. To be fitted with sampling point. Filling pipes to tanks common with suctions after by-passing transfer pumps.

Filling pipes on deck for lub. oil, diesel oil, sampling flanges (of dripping type) and for fresh water to respective tanks.

Separate filling pipes to be arranged for different type of lub. oils.

Arrangement for drawing samples of oil for the purpose of analysis to be provided. No equipment for this purpose will be provided by the Builder.

Piping size to be calculated so as to base a normal HFO bunkering capacity of 300 m³/h (45 Deg. Celcius)

Dimensions of the filling pipes (approx.):

HFO	2 x ND 200 mm
DO	2 x ND 100 mm
LO	6 x ND 50 mm
FW	2 x ND 50 mm

Steel reducers/spool piece to be supplied for fuel oil filling at Panama Canal.

- 1 x 200 mm x 6 inch
- 1 x 200 mm x 4 inch
- 2 x 200 mm x 8 inch

Included blind flanges type ANSI #150

A high level alarm is to be provided for each of fuel oil tanks and alarm lamps are to be fitted at each side of the vessel in front of the access on upper deck. One additional high-level alarm to be provided in engine control room.

Each HFO tank to be provided with remote temperature indicators.

A thermo well with plug at its open end is to be provided for each of port and star-board fuel oil filling connection for local-reading temperature gauge. One local-reading temperature gauge is to be provided.

A stop valve with plug at its open is to be provided for port and starboard fuel oil fitting connections for local reading pressure gauge. One local reading pressure gauge is to be provided.

Bunker station to have stop switches for FO transfer, bilge, sludge pumps and bunker telephone connection.

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.

Cargo hold no. 3 overflow pipes, see 331.

343. Sounding Pipes

All double bottom tanks, top side tanks, deep tanks, fuel oil tanks, peak tanks, cofferdams, void spaces, chain lockers and cargo hold bilge wells to have sounding pipes as per class requirements located in easily accessible positions. Sounding pipes are to run as straight as practicable with no restrictions.

Sounding pipes for HFO tanks to be arranged with flanged connections.

Tank ullage readings for heavy fuel tank to be provided in addition to sounding tables.

Striking plates under all sounding pipes, or equivalent arrangement approved by ship Buyer.

Each sounding pipe except those from double bottom tanks in machinery spaces to terminate 150 mm above deck with a sleeve and to be closed off with a screwed-on bronze cup (burglar-proof type) with external threads.

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

Sounding pipes to be marked with tank name.

344. Tank Vent Pipes

Air pipes to be arranged as per class requirements, Load Line Regulations and USCG. Those for fuel oil tanks to be combined with overflow arrangement. No. 3 hold to be suitably vented. See also 331.

All airpipes to be arranged clear of bollards, chocks and deck fittings and well protected to avoid damage during deck cargo operation and from green water.

Air pipes for HFO tanks to be arranged with flanged connections.

All pipes to be marked with tank name.

Air pipes from water ballast tanks through other water ballast tanks to be of the material GRE

350. SERVICE PIPING SYSTEMS**351. Cold and Hot Freshwater Supply**

Freshwater supply from freshwater hydrophore system with pumps and pressurised storage tank in engine room. Automatic pressure control to start and stop pumps to be provided. Connection to all cold water taps and via a water heater to all hot water taps fitted on all wash basins, showers, slop basins and sinks. Also connections to washing machines. Isolating valve to be fitted inside accommodation area.

Hot water system to be arranged with ring main and circulating pumps.

Hot and cold water connection to sprinkler on wheelhouse front windows.

Stop valves before each tap.

The normal fresh water piping system shall consist of two lines, one for drinking water service with a flag state approved steriliser and the other for cold washing water and sanitary water service.

The cold washing water and sanitary water line the following outlet shall be arranged:

- 3 outlets in engine room
- 1 outlet at monkey island*
- 1 outlet at each accommodation deck level (aft side)*

Furthermore a separate high pressure (app. 20 m³/h, 0,9 MPa) fresh water line to be arranged in upper deck pipe duct, Outlets to be arranged with ball valves and quick couplings. Outlets to be arranged as follows:

- 1 outlet located near the tanktop in each cargo hold
- 2 outlets on deck at each cargo hold. One SB and one PS
- 2 outlet at aft deck. One SB and one PS
- 2 outlets at forecastle deck. One SB and one PS

Isolation valves for drainage to be arranged for branch lines at main line.

The high pressure line should be able to draw water from the after peak tank and the FW tanks.

352. Toilet Flushing System

Each toilet to be of the individual cistern type with freshwater flushing system.

Discharge pipes from toilet flushing system are to be separated from discharge pipes from wash-basins, showers, galley etc.

354. Sanitary Fixtures

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

357. Working Air Connections

Compressed-air outlets (0.7 MPa) effective at each outlet) to be provided on open decks for repair and cleaning tools.

Compressed air to be provided for the following spaces or rooms:

- Steering gear room
- emergency generator room
- CO₂ bottle room
- Bosuns store
- Upper deck SB and PS at each hold
- Cargo holds (branched down to tanktop to serve hold washing system)

360. FIRE-EXTINGUISHING**361. Fire-Fighting Requirements**

Fire fighting system to be installed in accordance with the requirement of SOLAS Regulation.

The engine room and cargo holds to be installed with smoke detection system and CO₂ fire extinguishing system.

In addition to the CO₂ system the engine room to be protected in accordance with latest IMO rules i.e. water spray system for selected machinery component.

Water hydrant system to be provided for fire extinguishing of accommodation quarters and open deck and engine room.

CO₂ system fitted to galley exhaust trunking.

CO₂ system fitted to emergency generator room.

CO₂ system fitted to the paint store.

Fire control station.

A fire control station shall be arranged in accommodation space or casing and shall be controlled or stowed in:

- Emergency stop of ventilation fans for engine room
- Emergency stop of fuel oil pumps in engine room
- Emergency quick-closing of the valves on oil tanks in engine room
- Start/stop of the bilge, fire & general service pump and emergency firepump

- Manual call point for fire alarm
- International shore connection
- CO₂ releasing box for engine room
- One (1) CO₂ portable fire extinguisher
- Remote closing of fire shutters for engine room fans and louvers from the fire station.

362. Separate Fire and Safety Plan

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

Additional watertight provisions for safety plan stowage in way of gangways.

363. Fire Detection System

A fire detection system to be fitted in the accommodation and engine room.

Detector master panel to be placed in wheelhouse and repeater panel in ECR and fire control room

364. Portable Fire-Extinguishing Equipment

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

Fire-hoses with fog nozzles to be placed in hose stations (lockers with hydrants in accommodation and boxes of GRP elsewhere).

365. Fire and Deck Wash Main

Fire hydrant system combined with the wash deck hold service to be installed for extinguishing accommodation quarters, open decks, cargo hold and engine room. Sea water to be supplied from the Fire & G.S. Pump. Bilge & G.S. pump and/or the Emergency Fire pump.

Fire and deck wash main to be arranged in upper deck pipe duct.

Three non-corrosive jets with common control valve to be installed for each hawse pipe for washing the anchor chain cables.

Size of hose couplings to be of ND 65 mm for all spaces. The hydrant to be of cast iron with bronze coupling of NOR or STORZ type approved by class.

The synthetic fire hoses of 15m length and 65mm diameter in size with the instantaneous couplings and jet/spray nozzles shall be provided for the accommodation decks, weather deck and engine room, etc.

The fire hoses with instantaneous couplings and jet/spray nozzles shall be stowed in FRP boxes with necessary fittings on accommodation decks and weather deck, but the flush type steel boxes shall be used instead of FRP boxes when the fire hydrants are placed inside the accommodation.

The hose cradle made of 2.3mm thick mild steel shall be fitted for the stowage of hoses and nozzles in enclosed spaces such as engine room, steering gear room, bosun's store etc.

The fire and wash deck line shall have a drain cock at the lowest point to prevent freezing in cold weather.

Nozzles will be supplied equal to the number of hoses. Nozzle to be of jet and water spray type approved by the Classification Society.

Two (2) international shore connection piece to be supplied.

The fire pumps to be arranged for remote starting.

Extra FW cooling connection to be arranged to A/C and provision cooling units.

366. CO₂ System

A combined CO₂ system to be installed for engine rooms and cargo holds according to class, SOLAS and the national regulations.

The CO₂ releasing panel for engine room shall be located at the fire control station. CO₂ gas shall be released through master control valve and shall be distributed to engine room.

Smoke detection and CO₂ distribution piping for cargo holds to be arranged through a 3- way valve manifold. The smoke detection unit to be located in the CO₂ room, with repeater panel in wheel house.

Instructions for operation of the system shall be displayed at the control position. Alarm shall be given before release of CO₂ gas to engine room, and means of automatic shut down of ventilation fan, etc. shall be provided.

Provision shall be made for checking contents of CO₂ bottles by weighting device. The CO₂ nozzles shall be positioned clear of ladder ways, walkways and doorways. CO₂ pipe shall be blown with air to verify that there are no obstructions inside pipe after installation onboard.

CO₂ piping shall be of galvanized steel and shall be tested according to the Rules concerned.

CO₂ bottles to be installed outside machinery space according to regulations.

370. DECK MACHINERY

Deck machinery for cargo handling: See section 900.

Deck machinery to be controlled locally and from positions, port and starboard close to bulwarks on fore and aft deck.

To be comply with relevant rules and regulations and Buyer's requirements.

371. Windlass Forward

- 2 - Windlasses to be installed forward

Type: Electro hydraulic

Each windlass to have:

- 1 - Declutchable cable lifter with hand-operated band brake
- 2 - Mooring rope drums of split type with auto self tension
- 1 - Warping head of cast iron

Mean cable lifter hoisting speed: 9 m/min.

Hawser speed 15 m per min.

Warping head to be designed to take six turns of hawser and to have no taper nor whelp.

Each windlass to be operated by one (1) set of hydraulic power unit to obtain the specified capacity either on the gypsy wheel or on the first layer of the hawser drum.

Gypsy wheel and hawser drum not to be operated simultaneously.

Brake load for the gypsy wheel and hawser drum to be about 1.5 times of the nominal capacity of the hawser drum.

All bearing to be split-type and lubricated with grease.

Roller type cable guide to be provided with counter balanced tongue type cable controller to hold the anchor securely in the hawse pipe.

372. Cable Lifter Brakes

- 2 - Chain stopper of tongue-type to be provided.
- 2 - Sets of devil's claws with stainless steel screw spindle to be fitted for each bower anchor.

373. Mooring Winch on Deck Aft

- 2 - Mooring winches to be installed on deck aft.

Type: Electro hydraulic

Each mooring winch to have:

- 2 - Mooring rope drums of split type with auto self tension
- 1 - Warping head of cast iron

The hawser drums to be de-clutch able to the shaft and to be operated through clutch and fitted with friction brake.

Brake load to be about 1.5 times of the nominal capacity of the hawser drum.

Warping head to be mounted directly on the shaft of each winch on upper deck.

Warping head to be designed to take about six turns of hawser and to have no taper nor whelp.

378. Hydraulic Systems

To be supplied according to requirements from deck machinery etc. Position and layout according to General Arrangement.

Pipes to be run under deck where applicable.

Hydraulic power packs

Two (2) sets of electro-hydraulic power unit shall be provided, one in the steering gear room and the other in the bosun's store.

Each power unit shall consist of two (2) electric motors and pumps (i.e. 2 pump units).

The forward power unit shall supply the hydraulic power to all deck machinery on forecastle deck while the aft power unit shall supply the hydraulic power to all deck machinery on upper aft.

The forward power unit shall have a capacity for operating two (2) mooring drums simultaneously, one (1) cable lifter at rated capacity, whichever is greater, while the aft power unit shall have a capacity for operating two (2) mooring drums simultaneously at rated capacity.

The start and stop of the power units shall be made at power pack side, and at outside the spaces where hydraulic power units are situated.

Each power unit shall consist of hydraulic oil pumps, electric motors, starters and other necessary accessories including filling connection in accordance with the manufacturer's standards.

No interconnection between forward power unit and aft power unit shall be provided.

The hydraulic system shall be designed to ensure the heat-up of the system against the freezing weather.

Hydraulic piping

Two (2) groups of hydraulic pipings shall be arranged together with necessary valves, fittings etc., in accordance with the manufacturer's recommendations and the Builder's practices.

The hydraulic pipes shall be run under deck as far as practicable. Material of pipes to be seamless steel underdeck and stainless steel (316L) on weather deck

379. Mooring Equipment

See 230.

380. STEERING GEAR AND MANOEUVRING MACHINERY

381. Steering Gear

Electric hydraulic steering gear of Rotary Vane type, alternatively 2 ram 4 cylinder type complete with two sets of independent electric motor driven hydraulic pumps, and two independent hydraulic motors.

Torque approx. 500 kNm.

See also section 108.

Each set to be capable of operating the rudder on one (1) power unit from 35° on one side to 30° on opposite side in not more than 28 seconds with vessel running full speed ahead and operating at maximum continuous horsepower rating and loaded to deepest load line. (scantling draught)

The electric motors and power units to be provided with remote starting from the bridge and local with green running light and red light for alarm. Low level oil alarm to be provided in wheelhouse and engine room.

Arrangement for connection to autopilot to be provided. (Follow-up and non-follow-up).

Gyro repeater and helm indicator in steering gear room and bridgewings.

Manual emergency steering with all necessary communication equipment to wheelhouse to be provided.

Oil drip coaming with suitable handrail shall be provided around the steering gear.

400. - 499. MAIN AND AUXILIARY MACHINERY COMPONENTS**400. MACHINERY GENERAL****401. Machinery Requirements**

All machinery to comply with the rules and regulations etc listed in sections 011-017.

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

The following auxiliary systems for the main engine to be laid out for the main engine SMCR:

- pumps (cooling water, fuel, lub. oil)
- exhaust boiler and condenser
- exhaust pipe system
- cooling water system
- fuel oil system
- lub. oil system
- starting air system
- engine room ventilation
- shafting and bearings
- propeller

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

Considerations are to be given so that the entire rotating masses are free of all major stresses due to the torsional vibration in the normal operating range between 75% and 110% of the main engine nominal speed (related to the SMCR).

The speed of the main engine should be so arranged that the ship manoeuvring can override any barred range, even if this appears below 75% SMCR.

Vibration and noise levels to meet the requirements set forth in 027.

For design conditions see 402.

HFO operation:	Main engine Boiler Diesel generator sets
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HFO specification:	ISO 8217:2005 (E), RMK 700 (700 cSt at 50°C)
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MDO operation:	Main engine Boiler Diesel generator sets Emergency diesel generator
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MDO specification:	ISO 8217-2005 (E), DMB
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MGO operation:	Boiler Diesel generator sets
MGO specification:	ISO 8217-2005 (E), MGO
GO operation:	Emergency diesel generator
GO specification:	ISO 8217-2005 (E), DMX

402. Design Conditions

The design conditions for all machinery components and systems:

- Sea water temperature +32°C
- Ambient engine room temperature and +45 °C
and relative humidity 85%

403. Machinery Tests and Trials

Tests and trials to be carried out in accordance with the requirements set forth in this specification.

404. Instruments and Gauges

The necessary gauges, equipped with special connection and cocks for fitting pressure gauges for calibration, 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

Unless stated otherwise all machinery and equipment to be of marine execution and in accordance with good worldwide shipbuilding standard.

During design and construction of the engine room, particular attention to be paid to ensure that adequate space is provided for operation and maintenance with the minimum dismantling of the piping systems, mechanisms or other arrangements.

As far as possible, machinery and equipment pertaining to each system to be localized in order to reduce the amount of piping and to permit easier operation.

Machinery and equipment such as pumps, heat exchangers, etc., shall be provided with isolating valves to facilitate repairs.

All machinery, tanks etc. to have save-all and drain led to appropriate drain tanks.

Lifting arrangement and transport ways in engine room to be sufficient in number and capacity to ensure easy transport of heavy elements such as large spare parts for

M/E, and arrangement in engine room also is to make possible easy and safe taking over the weights by harbour cranes as well as the provision crane.

All valves to be easy operational and accessible.

Handrails with standard connection pieces have to be fitted, easy demountable for transfer of equipment.

Heat exchangers, condensers to have bypass valves if necessary

410. MAIN PROPULSION MACHINERY

411. Main Diesel Engine

1 - Two stroke, single acting, cross head, direct reversible, turbocharged type:

MAN B&W 5S50ME-B9.2 TII (or equivalent Wärtsilä engine)

Ratings:	SMCR	6,350 kW / approx 102 RPM (excl. 5% light running)
	NCR	5,700 kW

The M/E to be complete with necessary fittings and accessories acc. to M/E maker's standard and in consideration of Buyer's supplied list, except that Alpha Lubricator System to be provided for cylinder lubrication.

The M/E to be prepared for installation of 2nd order moment compensator, if required.

The engine must incorporate all latest modifications introduced by the engine designer, covering improvement in materials and design, that are effective at the time of signing the contract with the engine builder

Make and manufacturer of major components like crankshaft, turbocharger, scavenge air cooler, crankcase oil mist detector and governor to be submitted for Buyers approval

The 'Extent of Delivery' document and 'Technical Specification' for the engine must be submitted by the Shipyard for Buyers approval as part of the 'Technical Agreement', before signing the contract for the engine.

The following should be included in the scope of supply :

- (i) A PMI off-line system in addition to the indicator cam gear
- (ii) Alpha lubrication system
- (iii) Hydraulic top bracings
- (iv) Nimonic Exh. valves
- (v) A worktable (Swivel type) for dismantling of exh.valves

One high efficiency turbo charger to be installed at aft end of M/E.

The main engine to be designed for pier to pier running on HFO.

The engine to be designed to burn heavy fuel oil up to 700 cSt at 50°C.

Specific fuel oil consumption: 162.6 g/kWh at SMCR based on the ISO condition and LCF 42,700 kJ/kg. M/E SFOC tolerance +5%.

418. Main Machinery Control

Main engine (M/E) to be operated from engine control room, wheelhouse, and emergency control station at the engine side. Instrumentation to be centralized and designed to facilitate easy watching from the engine control room.

420. POWER TRANSMISSION SYSTEM

423. Shaft and Bearings

The propeller shafting to consist of:

- 1 - Propeller shaft
- 1 - Intermediate shaft

The shafts to be of carbon steel.

The diameter of the shafting to be determined by Rule's requirement and to have a margin as follows:

The shafts shall in way of the bearings to be 5 mm larger in diameter than the nominal shaft size.

The dimensions of the shafts to be designed based on the SMCR.

The number of shaft bearings (self lubricating oil bath type with FW cooling) to be the minimum required to support the weight of the propeller and shafting system without the occurrence of shaft whirling within the operation speed range.

A shaft earthing device to be installed to instructions of maker of hull cathodic protection and main engine Builder.

One shaft torsion meter to be provided. Power and RPM to be displayed in ECR and Wheelhouse.

424. Stern Tube with Bearings

The stern tube to be installed in the aft stern and forward stern bosses by chockfast orange or similar approved resin. Alternatively the bosses to be finish-bored by machining.

A stern tube bearing to be provided at each end of the stern tube. The stern tube bearings to be oil-lubricated. A drain/ sample cock to be provided.

The bearing bush to be of an approved material and the bearing liner to be of white metal with bearing length in accordance with the rules.

Tail shaft monitoring for min. 10-year Class survey intervals to be provided.

Temperature sensors to be installed in the aft bearing (one connected and one as standby).

425. Shaft Seals

- 1 - Set of outer and inner shaft seals of 'Simplex ' type (split sea – double security), 4 rings for aft and 2 rings for forward.

Aft shaft seal protected by rope guard (plate screen). Net knives fitted at propeller boss.

426. Propeller

- 1 - High efficient NPT - New Profile Type (or equivalent type with similar or better performance), fixed type, high skew, non constant pitch propeller to be provided.

Diameter:	approx. 5.9 m
Number of blades:	4
Materials:	Ni-Al-Bronze
Manufacturing tolerance (ISO484/1-1981(CE)):	Class I
Light Running:	5%

Cavitation performance and hull pressure pulses to be verified by tanktest and propeller designer to approve tanktest results.

The propeller may be redesigned as per Buyers request to suit different power point for the sister vessels.

430. GENERATOR PRIME MOVERS

431. Auxiliary Diesel Engine Sets

- 3 - Identical diesel generator sets

Continuous engine rating: about 600 kW at max. 900 rpm

Fuel: See 401

Cooling system: Engines to be cooled from a central cooling system

Starting system: Air starting

Each diesel engine coupled, either directly or through an elastic coupling as recommended by manufacturer, to an AC generator.

Each engine with generator mounted as a set on common bedplate.

Each alternator set to be resiliently mounted on a ship foundation with all piping connections etc to engine manufacturer's requirements. To be arranged for parallel operation.

The generator diesel engines are capable of starting and stopping from the engines, from the main switchboard and from the power management system.

One set of complete piston, rod, cylinder head to be provided as spare per vessel.

433. Emergency Diesel Generator Set

1 - Emergency diesel alternator set

Continuous Rating: Approx. 110 kW at 1800 RPM

Fuel: See 401

Cooling system: Fan cooled radiator

Diesel engine directly coupled according to manufacturers recommendations, to an AC-generator.

Engine with generator mounted as a set on common bedplate. The whole set resiliently mounted on a ship foundation with all piping connections etc to engine manufacturer's requirements.

Set arranged for 24 V DC automatic starting after black-out.

Set to be arranged in a heated fire-insulated room outside engine room according to National Regulations of the Country of Registry.

Second starting system to be in accordance with the Class Rules.

440. PUMPS - GENERAL

The pumps shall have high peak efficiency (min 75% efficiency at operating point for centrifugal pumps, unless otherwise is agreed). As far as possible, pump motors to be of the same maker, and all electric pump motors shall have a rated power of at least 5% above the maximum power required for the pump.

The selection of pumps to be based on pressure loss calculation of the total system, and the peak pump efficiency to be close to the actual operating point.

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

Pumps to be of a recognised maker to Buyer's approval. If possible, all pumps - and at least all centrifugal pumps - to be from the same manufacturer.

All pumps to be delivered, mounted, and connected in accordance with the systems' design.

Pumps should be standardised as far as possible for supply and stock of spares.

All pumps and electric motors, when technical and practical to be located above the floor plates.

Greasing fittings are to be unified and to be of 'pin' type of brass make, having same nominal size throughout the vessel as far as possible.

441. Pump Materials

Pump materials in accordance with the below table:

441.1 Water Pumps

Pump fluid	Casing	Impeller	Shafting
Sea water (cooling water and ballast water)	Bronze	NiAl-Bronze	Stainless steel
Fresh water (cooling and washing water)	Spheroidal graphite cast iron or cast iron	NiAl-Bronze	Stainless steel
Bilge water (General service)	Bronze	NiAl-Bronze	Stainless steel
Bilge water	Cast iron	Stainless steel	
Fire & washing water	Bronze	NiAl-Bronze	Stainless steel
Drinking water	Stainless steel	Stainless steel	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	Carbon steel	

442. Centrifugal Pumps

To be used for water pumps unless otherwise specified. Self-priming types where required.

Normally, pumps to have mechanical shaft seals and ball bearings. Each pump with driver on common bedplate or structure. Pump to be provided with flexible spacer coupling.

444. Rotary Positive Displacement Pumps

To be used for fuel and lub.oil. Pumps of self-priming type with replaceable liner. Pumps to be internally lubricated by fluid pumped.

Pumps to have relief valve of suitable size built into the pump casing and piped back to the pump suction.

446. Hand Pumps

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

447. Electric Motors for Pump Driving

As far as possible, pump motors to be of the same maker and to have 5% margin in their rated capacity.

Electric motor overload safety protection should be fitted and the motors screened where liable to water damage.

For other details, see 731.

449. Ejectors

1 - Ejector for bilge well suctions in chain lockers, stores in forecastle and forward section of upper pipe ducts.

1 - Ejector for main bilge system.

1 - Ejector for stripping ballast water tank

450. LIST OF PUMPS

Reference is made to 690.

460. COMPRESSORS AND AIR VESSELS**461. Starting Air Compressors**

- 2 - Starting air compressors to be installed. Working pressure 3.0 MPa. Three stage air-cooled type and driven by an electric motor. Two stage water cooled type can also be considered.

Capacity each: 150 Nm³/h

- 1 - Service air compressor (450 Nm³/h rotary package type) at 0.7 MPa pressure effective at all outlets.
- 1 - Emergency air compressor of air cooled type to be installed. The capacity to meet rules' requirements for restoring propulsion power from dead ship condition.

465. Air Receivers

- 2 - Starting air receivers to be installed.

Working pressure: 3.0 MPa
Capacity: each 5.0 m³

- 1 - Service air receiver to be installed.

Working pressure: 0,8 MPa
Capacity: 2 m³

- 1 - Control air receiver: 0.5 m³

- 1 - Aux. air receiver 0.2 m³ (Capacity sufficient for 3 starts of one auxiliary engine)

Automatic drain trap for each air receiver to be provided.

470. TREATMENT UNITS FOR LIQUIDS**471. HFO Separators**

- 2 - Fuel oil separators for fully automatic operation and with alarm and control panel for operation including selection for operation in series, respectively in parallel. The separators to be belt driven, self cleaning and of the partial discharging type. The separators to continuously monitor water content in clean oil outlet by transducer. Drain valves to be fitted.

Capacity each: According to engine Builder's and separator maker's recommendation for meeting Separation Performance Standard at rated capacity, as required by Class Notation.

As guidance approx. 2,800 l/h each.

The separators to be suitable for continuous cleaning of HFO with a density greater than 1.0.

Each of the separators to be delivered with one supply pump and one preheater.

472. Diesel Oil Separator

One of the HFO separators could be used as diesel oil separator.

The separator to be delivered with supply pump.

473. Lubricating Oil Separator for M/E.

- 2 - Lubricating oil separators for fully automatic operation and with alarm and control panel for operation. Self-cleaning and partial discharge type.

Capacity: According to engine Builder's and separator maker's recommendation.

As guidance approx. 1,200 l/h each.

Each of the separators to be delivered with supply pump and preheater.

474. Bilge Water Separator

- 1 - Bilge water separator unit to be installed.

Capacity: 48 m³/24 h.

The oil content of water after treatment does not exceed 15 parts per million (PPM). The system to be prepared for 0 PPM operation.

The bilge water separator is to be capable of passing mixtures ranging from clean water to water-free oil.

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

The bilge water separator and the measuring equipment to fulfil:

- MARPOL Annex I – MEPC 107(49) incl. emulsions
- IMO Resolution A393 (x)

Bilge system to consist of an oily bilge system and a clean bilge system (serving the condensed water from main engine charge air cooler).

475. Freshwater Generator

- 1 - Freshwater generator with salinometer.

Capacity: 20 m³/24 h

- 1 - Sea water supply pump for freshwater generator
- 1 - Electric salinity alarm and solenoid valve so that fresh water with high salt content is to be automatically discharged to the bilge

476. Sewage Treatment Unit

- 1 - Sewage treatment unit, IMO approved type, to be installed.

Capacity: 30 persons/day

The unit to consist of:

- 1 - Bed frame
- 2 - Air compressors
- 1 - Discharge pump
- 1 - Control panel

Further the following connections to be provided:

- 1 - Inlet for black water
- 1 - Overflow
- 1 - Shore connection
- 1 - Air pipe
- 1 - Flushing connection

480. BOILER

483. Steam Boiler

- 1 - Composite exhaust gas/oil-fired boiler to be installed. Vertical, cylindrical type made with welded steel plates, insulated with mineral wool and covered with galvanised steel sheet plates.

Capacity of oil-fired part approx. 1500 kg/h.

Capacity of exhaust gas part approx. 700 kg/h at 90% SMCR on M/E or maximum possible according to the boiler maker and the main engine maker.

Working pressure 0.7 MPa saturated.

Fuel oil specification: see 401

485. Incinerator

- 1 - Incinerator for burning solid waste and sludge simultaneously to be installed. MARPOL Annex VI compliant.

The capacity of the unit to match a vessel of this size and arrangement. Approx. 50 L per hour for sludge / 400 L per hour for solid waste.

A waste oil mixing tank with heating and agitator to be provided.

Garbage storage facilities near the incinerator to be supplied.

- 1 - Garbage compactor to be installed in garbage room.

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500. - 599. OUTFIT AND EQUIPMENT (MACHINERY)**500. MARKINGS AND IDENTIFICATION****501. Tank Identification**

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

502. Sounding Board

A white board with all the tanks of the vessel indicated in white letters to be made and mounted as directed by the Buyer.

503. Exit Signs and Warning Signs

To be in accordance with Buyers standard as listed, see section 206.

505. Pipe Colour Schedule

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

Colour identification scheme according to ISO 508.

506. Name Plates for Machinery Components

All engines, pumps, compressors, boilers, pressure vessels etc to have a nameplate with the following information:

- Name of manufacturer
- Type
- Size, capacity, RPM, voltage etc
as well as year of fabrication and fabrication number.

A booklet containing the above mentioned information together with full style and address of manufacturer to be provided.

These should be screwed to purpose made backing plate appropriate mounted.

507. Label Plates on Valves and Fittings

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

Name plates, instructions books, valve plates etc. to be in English.

These should be screwed to purpose made backing plate appropriate mounted.

508. Label Plates on Operation Panels

Sufficient labels shall be mounted to secure information to operator.

To be provided to Buyer's approval.

509. Piping Diagrams Mounted on Board

As-built main piping diagrams to be plastic covered and placed in engine room.

510. CLOSURES, ACCESS AND PROTECTION OF MACHINERY

512. Floor Plates. Landings and Gratings

Floor plates are to 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 are to be a non-slip type. (Tear plates or similar).

Floor plates are to be fastened by screws and readily removable for access to bilges, pipework and machinery and fitted with small portable or hinged sections above valves, filters or similar.

Floor plates and boundary bars are to be of steel or other approved material. Vertical supports attached to the hull structure are to be of steel. Machinery is not to be used to support floor plates. Plates to 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.

Gratings are to be made of steel and to be of a non-slip type.

513. Stairs, Ladders and Emergency Exits

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

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

All outside stairways to be made of mild steel.

Galvanized steel dust guard to be fitted at underside of main ladders in engine room.

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

Fully enclosed emergency exit to be provided from floor level in engine room to open deck.

Emergency exit to be provided with self-closing door.

514. Rails and Stanchions

Handrails and stanchions are to be of steel.

Handrails and stanchions are to be securely fixed by screws or bolts.

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

Portable stanchions to 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 are to be provided and fitted as required. Moving parts of machinery in which floating objects may become lodged under flooded condition are to be adequately guarded.

516. Insulation of Machinery

All heated zones at machinery to be insulated for the safeguard of personnel. Where exposed to mechanical damage such as in traffic areas galvanised steel sheet covering to be provided.

520. ENGINE ROOM OUTFIT AND EQUIPMENT

521. Fixed Mounting of Machinery

When mounting machinery components great care to be taken to ensure proper alignment.

Shims, chocks etc to be used as required. Shims not to be used to correct undersized chocks. Epoxy chocks or resilient mountings may be fitted according to manufacturers recommendations.

The main engine to be fixed mounted on epoxy chocks.

522. Flexible Mounting of Machinery

Where found practicable and pending noise abatement rules flexible mounting of machinery components to be arranged on suitable shock-absorbing material/fittings.

524. Fire-Extinguishing

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

525. Waste Containers, Drip Trays

Steel containers for cotton waste etc with hinged covers of suitable, portable size to be provided in the following compartments:

- 2 - Engine room
- 1 - Engine workshop

Drip trays are to be fitted under all appliances which are required to be opened up frequently for cleaning or adjustment.

530. MAINTENANCE AND REPAIR FACILITIES**531. Lifting Gear**

An overhead electric travelling crane, suitably sized and of sufficient capacity according to the main engine maker's recommendations, shall be located above the main engine for the function of all normal maintenance duties according to engine manufacturers recommendations.

One monorail to be arranged above each generator set and purifiers. Rail to lead to workshop as far as practical.

Strong lifting pads for tackles to be arranged above large or heavy components according to requirements from Buyer's representatives.

532. Transfer Arrangement

The design and arrangement of the machinery space shall be such that components, e.g. spare parts for main and auxiliary engines, pumps, electric motors etc, can be removed from their position and either transferred to workshop or fairly easily be unshipped through hatch each by means of suitable positioned transport rail system. One hatch in upper deck above main engine room.

533. Workshop with Outfit

A mechanical engineering workshop is to be provided.

In the workshop a welding table with accessories to be arranged. Provision of a heavy fire retardant fibreglass drape.

The machinery and equipment are to include:

- 1 - Drilling machine
- 1 - Grinding machine
- 1 - Vice bench
- 2 - Parallel vices
- 1 - Electric welding transformer
- 1 - Welding table
- 1 - Lathe
- 1 - Fuel valve test facility for main and aux. engines

- 1 – M/E exhaust valve grinder
- 1 - Cleaning bath for M.E. air coolers

Emergency stops to be fitted to all moving machine tools.

The workshop is to be provided with all necessary tools for normal maintenance and repairs.

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

Lathe machine to accommodate auxiliary engine exhaust valves.

534. Cleaning Outfit

- 1 - Cleaning slop basin with sealed cover for cleaning of engine parts to be provided.
- 1 - Sink with hot/cold water for waste facility.

536. Autogenous Welding Equipment

- 1 - Set of oxygen and acetylene welding equipment comprising:
 - 2 - Oxygen bottles
 - 1 - Acetylene bottle
 - 1 - Set of standard cutting and welding equipment including 30 metres of hoses
 - 1 - Set of various welding rods etc

The acetylene and oxygen bottles to be located in a separate room accessible to open deck space.

The facility to store additional bottles (4 oxygen and 2 acetylene) shall be provided in accordance to regulations as close as possible to the working station.

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

537. Electric Welding Equipment

- 1 - 200 A welding rectifier with necessary equipment including a standard box with electric welding tools, rods, 30 m power cable and 2 x 30 m welding cable.

Plug sockets outside E/R to be provided one in Fwd. Deck House and one on Aft Deck (Also refer Art. 735)

540. VENTILATION AND EXHAUST GAS SYSTEM**541. Natural Ventilation**

The machinery space to have natural exhaust ventilation through a rainproof grid on the aft side of the funnel. The air escape to be sufficient to allow escape of 75% of the capacity of the electric engine room fans at a reasonable speed.

A fire damper, remote operable from fire station, has to be fitted.

542. Mechanical Ventilation

- 3 - Engine room supply fans to be installed. To be of vertical, axial flow type, driven by a 2-speed electric motor. One fan to be reversible.

The ventilators to be placed in the ventilation trunk accessible from open deck. The air inlets to be as large as to ensure a low inlet speed and low noise level. For noise requirements, see 027.

Integrated steel trunkings and galvanised steel sheet ducts with fire dampers from fans to machinery spaces with branches for effective air distribution. Adjustment arrangement to be provided.

The separator room to have separate exhaust fan.

The separator room exhaust to be led separately from the machinery space.

The ECR to be particularly well ventilated.

Control room with air conditioning unit, refrigerant of ecological type (not R22).

The louvers of the funnel to be provided with arrangements for easy fitting and removal.

543. Exhaust Gas System for Main Engine

The main engine to be provided with an independent exhaust gas system. The max. back pressure not to exceed M/E suppliers requirement. The exhaust gas velocity not to exceed 40 m/s. Engine supplier to approve.

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

The dimension of the ME exhaust gas piping to be based on SMCR.

Stainless steel compensators to be fitted to allow for expansion and to reduce vibrations. The turbo charger expansion joint should be included in the main engine scope of supply.

The silencer should have a minimum attenuation to fulfil IMO Noise Requirements.

The silencer to be of absorptive type.

Drain arrangement has to be provided to prevent ingress of water into the engine. The arrangement must contain: Drain reservoir in the exhaust gas pipe, drain pipe from exhaust gas system to collection tank and a common (for M/E and A/E's) exhaust gas drain water collecting tank.

The composite boiler to be included in the main engine exhaust system.

The silencer can alternatively be an integrated part of the composite gas boiler.

544. Exhaust Gas System for Diesel Generating Sets

Each diesel generating set is to be provided with an independent exhaust pipe system.

The uptakes and silencers of the diesel generating sets to be suitably insulated up to the funnel top. Insulating pads to be placed between uptake and silencer supports and the ship structure, see also 546.

Due allowance to be made for vibration damping and thermal expansion by fitting stainless steel compensators in the exhaust system where appropriate. The expansion compensators connected to the engine to be supplied by the diesel generating set supplier.

One spare compensator to be provided for each size of compensator used.

The silencers should have a minimum attenuation to fulfil IMO Noise Requirements.

Drain arrangement has to be provided to prevent ingress of water into the engine. The arrangement must contain: Drain reservoir in the exhaust gas pipe, drain pipe from exhaust gas system to collection tank and a common (for M/E and A/E's) exhaust gas drain water collecting tank.

545. Boiler Uptake

The composite boiler to be furnished with two uptakes.

The exhaust boiler uptake to be based on SMCR.

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

The uptake to be insulated as per 546.

Due allowance to be made for vibration damping and thermal expansion by fitting of a compensator.

A drain cock to be installed in the lowest point of the uptake to prevent the ingress of water into the unit.

The uptake system to be fabricated in mild steel.

546. Insulation of Engine Exhaust Gas Systems and Boiler Uptake

Exhaust pipes, silencers, and boiler uptakes to be insulated with Rockwool or other approved material, suitably lagged with alu-coated glass fibre cloth neatly sewed with wire and covered galvanised steel sheeting.

The silencers might be uninsulated based on the type of silencer.

547. Incinerator Uptake

A separate uptake for the incinerator to be arranged.

Stainless steel compensators to be fitted to allow pipe expansion.

549. Crankcase Venting

The main engine crankcase to be vented through a pipe led directly and unbroken from the engine to the funnel top deck, terminating with a flame screen. The pipe to be provided with a drain arrangement of S-shape and siphon type with a gas trap for drainage of oil condensation to a drain tank.

550. FILTERS AND STRAINERS

551. Filters and Strainers - General

All filters and strainers to satisfy machinery Builders' requirements and recommendations with respect to:

- Filter mesh size
- Filter type
- Number of filters

Manometers to be fitted at filter inlet and outlet

All manometers to be visible above floor plates.

Most of the filters and strainers to be provided with vent and drain cocks or plugs.

552. Seawater Strainers

Strainers for seawater inlet to be installed as close to the sea chest as possible.

Strainers to be fitted with vent cocks. Straining plates to be of stainless steel.

554. Fuel Filters

- 1 - Automatic HFO supply filter.

Duplex filters to be installed for the main engine aux. engine and boiler fuel supply system.

555. Lubricating Oil Filters

- 1 - Automatic backflush filter for the main engine lub. oil system
- 1 - Bypass filter to be installed for the automatic backflush filter.

557. Bilgewater Filters

Suitable mud boxes of the single element type according to recognized Builder standard to be installed in the suction line for the following equipment:

- Oily bilge pump
- Sludge pump

558. Air Filters

Air filters to be installed in the compressed air system in accordance with normal practice.

All reduction valves to have filters at the inlet side.

560. HEAT EXCHANGERS**561. Heat Exchangers - General**

The following heat exchangers to be of the plate type:

- 1 - M/E LO coolers
- 1 - Jacket water cooler
- 2 - Central coolers
- 1 - MGO cooler

Heat exchangers shall be mounted in such a way as to allow easy access and overhaul.

Capacities according to the requirements of the suppliers of the various machinery in question.

The two (2) central coolers to be dimensioned each to 50% of total required capacity plus 15% fouling margin and provision for back flushing.

The design to be based on SMCR.

The MGO cooler to be located before the MDO circulation pumps. The cooler capacity has to be sufficient to keep the MGO at approx. 40 deg. (maximum 2 deg. C / minute). In normal MDO operation the cooler has to be bypassed.

Every heat exchanger installed to be equipped with thermometers at inlets and outlets on primary and secondary side.

Materials for plate coolers/preheaters:

Cooler plates : Titanium (seawater), stainless steel (316L) (fresh water)

Frame plates : Steel plate

Gaskets : Suitable rubber material

Heat exchangers of the tube type to be arranged for easy pull-out of pipe stack for cleaning.

566. Fuel Oil Heaters

- 2 - Preheaters for the main engine (steam heated)
- 2 - Preheaters for the HFO separators (1 steam heated)
- 1 - Preheater for HFO boiler (electrical heated)

567. Lubricating Oil Heater

- 1 - Lubricating oil preheater for each lub. oil separator (steam heated)

568. Freshwater Heaters

- 1 - Hot water tank capacity approx. 500 l. The tank to be galvanised.

The tank to be furnished with:

- Manhole or handhole
- Inlet/outlet connections
- Steam heating coil - capacity according to plant manufacturer's recommendations for size of system.
- In addition one electric heating coil
- Drain
- Safety valve
- Thermometer

The tank to be well insulated.

570. ENGINE ROOM TANKS

571. Tank Outfit - General

All tanks to be in rigid steel construction. Tanks may be part of ship's structure (integral) or independent, constructed in workshop and welded to suitable foundations and suitable securing points. Easy access to internal of all tanks for inspection and cleaning to be provided, and all tanks to be furnished with necessary manholes, hand holes, drain connections, high/low level alarms, and level indicators and thermometers if required. At least the below listed tanks to be provided.

Alarms at all times must meet the class requirements.

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

572. Heavy Fuel Oil Tanks

- 5 - HFO storage tanks to be arranged in engine room
- 2 - Settling tanks (each with 24 hours operation of M/E)
- 2 - Service tanks (each 12 hours operation of M/E)

Fuel storage to be arranged for the carriage and consumption of low sulphur fuel in designated areas.

573. Diesel Oil Tanks

To be arranged in engine room

- 1 - MDO storage tank
- 1 - MGO (Max. 0.1% S) storage tank
- 2 - Settling tank
- 2 - Service tank (12 hours operation for aux. engines)
- 1 - Service tank for emergency diesel

574. Lubricating Oil Tanks

- 1 - Circulation tank for main engine lub. oil (below the M/E)
- 1 - Storage tank for main engine lub. oil
- 1 - Lub. oil cleaning/storage tank for main engine with connections to sludge pump and to/from lub. oil purifier.
- 1 - Storage tank for generator diesel lub. oil
- 1 - Lub. oil cleaning/storage tank for generator diesel with connections to sludge pump and to/from lub. oil purifier.
- 1 - Gravity tank for stern tube lub. oil
- 2 - Storage tanks for cylinder oil for M/E
- 2 - Service tanks for cylinder oil for M/E

575. Sewage Treatment Tank

- 1 - Sewage treatment tank according to USCG with the required capacity

577. Miscellaneous Small Tanks

- 2 - Expansion tank for fresh cooling water
- 1 - Expansion tanks for fresh cooling water system aux. engine
- 1 - Expansion tank for central heating system

578. Freshwater Hydrophore Tank

- 1 - Freshwater hydrophore tank

Capacity: approx. 1000 l

The tank to be galvanised / painted same as fresh water tank.

579. Overflow, Sludge, Drain and Holding Tanks

- 2 - Fuel overflow tanks
- 1 - Fuel drain tank
- 1 - Separator sludge tank. Separator sludge tank shall also be capable of being pumped to the incinerator plant
- 2 - Bilge water holding tank (oily and clean)
- 1 - Drain tank for main engine fresh cooling water (high)
- 2 - FW tank
- 1 - Sludge oil tank
- 1 - Sewage holding tank (capacity for 10 days) for black water
- 1 - Sewage holding tank (capacity for 10 days) for grey water
- 1 - Feed water tank
- 1 - Stuffing box drain tank
- 1 - Scavenge drain tank
- 1 - Exhaust gas system drain collection tank

580. TOOLS, SPARES, STORES**581. Storage of Tools, Spares, and Stores**

All items to be delivered according to the contract and to be inspected, checked as to agreement with bills of lading, stored, transported in the yard, protected and placed on board the vessel as directed.

Large spare parts of main engine (piston, liners, cylinder head) to be stowed and secured in appropriate position with reach of overhead crane.

Separate stowage to be arranged for chemicals according to Class/flag requirements.

Spare to be stored in marked and numbered wooden/metal boxes.

582. Store Room with Outfit

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

Lockers to have locks.

Locker provided with ventilation for chemicals and lub. oil to be arranged in way of casing on upper deck.

583. Standard Engine Tools

Tools normally supplied with equipment to be delivered in accordance with the main engine makers' recommendations.

Larger tools to be secured to bulkheads in appropriate places as indicated by Buyer's representative.

585. Manufacturers Standard Spares

Standard spares, normally offered and delivered with machinery and equipment, to be supplied to the vessel by the Builder, but at least covering the Class recommended spares and maker's standard.

600. - 699. MACHINERY PIPING SYSTEMS**600. MACHINERY PIPING - GENERAL****601. System Requirements - General**

All piping systems to be installed in accordance with the designers' drawings as approved by the Buyer and to the Buyer's satisfaction.

All piping to be led as directly and practically as possible, with appropriate fall where required according to medium. Pipelines to be kept away from switchboards and electrical control equipment, where the piping is avoidably led above the electrical equipment the sleeve to be provided. Oil piping to be fitted at a safe distance from hot surfaces.

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

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

Save alls to be arranged under all filters, components containing oils etc. Drainage with adequate pipe diameter and inclination to the drain tanks.

In general, the necessary number of isolating valves to 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.

Acid pickling or phosphate treatment to be carried out for the piping of lub. oil system except lub. oil drain and lub. oil transfer and piping. Pipes acid pickled to be thoroughly neutralised afterwards.

All piping, whenever practical, to be kept clear of the weather deck, see also 165.

Pipes, Selection of Material, and Design of Components

The material of pipes to be in accordance with the following standards. If these standards differ from the ISO, GB and CB Shipbuilding standards, below standards should prevail.

The minimum wall thickness of piping to be in accordance with Class requirements, unless specified otherwise.

The Builders' standard for pipe materials, valves and dimensions to be integrated in the design of the different pipe systems.

Notes for all tables below:

Pipe thicknesses:

"Ordinary" corresponding to Sch. 10

"Medium" corresponding to Sch. 40

"Heavy" corresponding to Sch. 80, but not more than 12 mm.

Pipe thickness to be complied with the Classification Requirement.

Steam, condensate and drain systems:

System	Nominal Size (mm)	Pipe		Pipe	Valve *(1)			Fitting	Press. (Mpa)
		Material	Thick	joint	Body	Disc & seat	Stem		
Steam 0.7 (Mpa)	32 & above	Seamless steel	Medium	Steel welded flange	Cast steel flanged.	Stainless steel	Stainless steel	Cast steel or welded steel. flanged or branches	1.0
	25-15								
	10 & below	Seamless copper		Brass union	Bronze screwed	Bronze	Bronze	Brass screwed	
Steam 0.3 (Mpa) steam drain	32 & above	Seamless steel	Medium	Steel welded flange	Cast steel flanged.	Stainless steel	Stainless steel	Cast steel or welded steel flanged or welded branches	0.5
	25-15								
	10 & above	Seamless copper		Brass union	Bronze screwed	Bronze	Bronze	Brass screwed	1.0
Heating coils in tank	All size	Seamless steel	Heavy	Butt welded *(2)				Butt welded	1.0
Feed pump delivery and Blow off.	40-20	Seamless steel	Medium	Steel welded flange	Bronze flanged	Bronze	Bronze	Cast iron or welded steel flanged or welded branches	1.0
	15 & below	Seamless steel		Brass union	Bronze screwed			Brass screwed	
Feed pump suction	40-20	Seamless steel	Medium	Steel welded flange	Bronze flanged	Bronze	Bronze	Cast iron or welded steel flanged or welded branches	0.5
	15 & below	Seamless steel		Brass union	Bronze screwed			Brass screwed	

Note: *(1) Material of automatic control valves for all systems to be of manufacturer's standard.

*(2) Heating coil to be butt welded in the workshop and use sleeve on board.

Water systems:

System	Nominal Size (mm)	Pipe		Pipe	Valve			Fitting	Press. (Mpa)
		Material	Thick	joint	Body	Disc & seat	Stem		
SW Cool- ing Water	32 & above	GRE	Maker's standard	Maker's standard	Cast iron flanged	Bronze	Bronze	Maker's stan- dard	0.5
	25-15			Brass union	Bronze screwed			Brass screwed	
	10 & below	Seamless copper							
FW Cool- ing Water	32 & above	Seamless steel	Medium	Steel welded flange	Cast iron flanged	Bronze	Bronze	Cast iron or welded steel flanged or welded branches	0.5
	25-15	Seamless copper		Brass union	Bronze screwed			Brass screwed	
	10 & below								
Water Ballast and Bilge System *(3)	32 & above	GRE/ Seamless steel galv	Maker's stan- dard/ Heavy	Maker's standard /Steel welded Flange	Cast iron flanged	Bronze	Bronze	Cast iron or welded steel flanged or welded branches/ Maker's stan- dard	0.5
	25-15	Seamless copper		Brass union	Bronze screwed			Brass screwed	
	10 & below								
Fire Main & Deck Wash	32 & above	Seamless steel galv.	Heavy	Steel welded flange	Cast iron flanged	Bronze	Bronze	Cast iron or welded steel flanged branches	1.0
	25-15	Seamless copper		Brass union	Bronze screwed Bronze screwed			Brass screwed	
	10& below								
Fresh Water service *(4)	20-100	Seamless steel galv.	Medium	Steel welded flange	Cast iron flanged	Bronze	Bronze	Cast iron or welded steel flanged or welded branches	0.5
	15 & below	Seamless copper		Brass union	Bronze screwed			Brass screwed	
Hot Water service	40-20	Seamless copper		Brass brazed	Bronze flange	Bronze	Bronze	Cast iron or welded steel flanged or welded branches	0.5
	15 & below			Brass union	Bronze screwed			Brass screwed	

Note: *(3) GRE (Glassfiber Reinforced Exopy) pipe outside engine room. Galvanised welded steel pipe inside engine room.

*(4) Drinking water piping to be of stainless steel or plastic of approved type.

Fuel and Lub. Oil Systems:

System	Nominal Size (mm)	Pipe		Pipe	Valve			Fitting	Press. (Mpa)
		Material	Thick	joint	Body	Disc & seat	Stem		
FO circ. pump delivery	32 & above	Seamless steel	Heavy	Steel welded flange	Cast steel flanged	Stainless steel	Stainless steel	Cast iron or welded steel flanged or welded branches	1.0
	20				Bronze flanged				
	15 & below	Seamless copper		Brass union	Bronze screwed	Bronze	Bronze	Brass screwed	
FO Suppl. Pump suction & delivery. FO Circ. Pump Suction. FO Puri-fier deliv-ery.	50 & above	Seamless steel	Medium	Steel welded flange	Cast iron flanged	Bronze	Bronze	Cast iron or welded steel flanged or welded branches	0.5
	40-20			Bronze flanged				Brass screwed	
	15 & above	Seamless copper		Brass union	Bronze screwed				
FO filling, suction & FO puri-fier suction FO drain	50 & above	Seamless steel	Medium	Steel welded flange	Cast iron flanged	Bronze	Bronze	Cast iron or welded steel flanged or welded branches	0.5
	40-20				Bronze flanged			Brass screwed	
	15 & below	Seamless copper		Brass union	Bronze screwed				
Lub. oil *(5)	50 & above	Seamless steel	Medium	Steel socket welded flange	Cast iron flanged	Bronze	Bronze	Cast iron or welded steel flanged or welded branches	0.5 (2.0 for Cross-head L.O. Pump deliv-ery side)
	40-20				Cast iron flanged			Brass screwed	
	15 & below	Seamless copper		Brass union	Bronze screwed				

Note: *(5) Stern tube lube oil piping in cooling water tanks to be “heavy” thickness and fitted with sleeve joints.

Compressed air, Vent, Drain and Sounding pipe Systems:

System	Nominal Size (mm)	Pipe		Pipe	Valve			Fitting	Press. (Mpa)
		Material	Thick	joint	Body	Disc & seat	Stem		
Compressed air 3.0 (Mpa)	40 & above	Seamless steel	Medium	Forged steel socket welded flange	Cast steel flanged	Disc. 13% Cr steel seat stellite Faced	13% Cr steel	Cast iron or welded steel flanged or welded branches	3.0
	32-15								
	10 & below	Seamless copper		Brass union	Forged steel screwed			Brass screwed	
Compressed air 0.8 (Mpa)	40 & above	Seamless steel	Medium *(6)	Steel welded flange	Cast steel flanged	Stainless steel	Stainless steel	Cast iron or welded steel flanged or welded branches	1.0
	32-15								
	10 & below	Seamless copper		Brass union	Forged steel screwed			Brass screwed	
Air vent & overflow, except mentioned above. Open drain, sewage, and scupper	40 & above	Seamless steel galv. *(7), *(8)	Medium	Steel welded flange	Cast iron flanged	Bronze	Bronze	Cast iron or welded steel flanged or welded Brass screwed	0.5
	32-20				Bronze flanged				
	15 & below	Seamless copper		Brass union	Bronze screwed			Brass screwed	
Sounding for double bottom Deep tank & void space	125 & below	Seamless steel galv. *(7)	Heavy	Steel welded flanged				Cast iron or welded steel flanged or welded branches	0.5
Sounding for other tanks	40	Seamless steel galv. *(7)	Medium	Steel welded flange				Cast iron or welded steel flanged or welded branches	0.5
Exhaust gas system	250 & above	Welded steel	Acc. to DIN 86044	Steel welded flange, steel socket		Bronze	Bronze	Welded steel flanged or welded Brass screwed	
	200 - 20	Seamless steel	Ordinary	Steel welded flange, steel socket	Bronze flanged				
	15 & below	Seamless copper		Brass union	Bronze screwed			Brass screwed	

Note: *(6) General service compressed air system on weather deck to be "heavy" thickness and pipes to be galvanized.

*(7) Except in F.O. Tanks.

*(8) Air vent pipes through water ballast tanks to be of GRE

604. Valves, Fittings, Materials, Types

Where possible, the same make and type of valve is to be used for all similar valves in the vessel.

The straight-through type of valve is preferred.

The materials for the valves to be in accordance with the standard in section 601: VALVES AND FITTINGS, MATERIALS AND TYPES'.

The Builder's standards to be integrated as far as possible in the design.

Remote Controlled Valves:

Ballast and hold bilge valves to be remote controlled from the ballast control room.

The valves to be electro hydraulic or hydraulically controlled via the ICMS system.

The hydraulic control pipes to be of stainless steel.

605. Assembly and Supports

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

Generally, pipes above ND 20 mm to be assembled with flange connections, however sleeves may be used for the following systems:

- Ballast and bilge outside engine room
- Air and sounding pipes
- Fire deck wash pipes (outside engine room)
- Scuppers (outside engine room)
- Sewage system (outside engine room)

Hydraulic pipes to be assembled with socket weld flange connection or approved compression fittings. No cutting ring fittings to be used.

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

Pipes are not to be supported by each other or any other equipment or machinery. Pipe supports should land on structure, not unsupported plating.

606. Insulation of Pipes

General

All surfaces of machinery, piping and tanks having normal operating fluid temperature above 60°, except cooling water system and where otherwise described hereinafter, to be insulated in accordance with following specifications.

In all cases, where pipe insulation abuts flanges and fittings, the end of insulation to be suitably terminated to permit free removal of bolts and/or to allow movement of pipes at hangers.

All insulating materials to be properly secured to prevent settling and to permit ready removal.

Thickness of insulation to be determined on a basis that insulation surface temperature will be 60°C when the ambient temperature is 32°C.

Piping in the funnel to be insulated up to the height of 2m from the deck floor.

All mounded insulation to be secured with steel bands.

All flanges and valves for all piping above 60°C to be insulated.

Exhaust pipes to be insulated up to the top.

Piping

Piping insulation cover material to be high quality and be painted after installation.

Steam piping

Pipes, flanges, valves and fittings of all steam piping to be insulated as follows:

Temperature	205°C & above	155°C & above	101°C & above	60°C & above
Insulating material	Glass wool or rockwool			
Cover material	Glass cloth			
Nominal pipe Dia. (mm)	Thickness (mm)			
350	65	50	30	25
300	65	50	30	25
250	65	50	25	25
200	60	50	25	25
150	60	50	25	25
125	55	50	25	25
100	55	50	25	20
80	55	40	25	20
65	50	40	25	20
50	50	40	20	20
Below 50	20			

Moulded insulation to be secured to the pipe with steel bands.

Insulation of flanged joints and valves to be provided.

Solid pipe halves of foamed material to be used on steam pipes if possible.

Steam drain piping

Drain piping to be insulated in the same manner as for steam piping.

All small steam drain piping to be wrapped (spiral wrapped) with glass fibre tape.

Water piping

Cooling fresh water piping will not be insulated.

Following piping to be insulated in the same manner as for steam piping.

Composite boiler blow-off piping in from of the boiler and where subject to handling.

High temperature cooling water to be insulated at designated point. Sludge transfer line to be heat traced and insulated also up to the shore connection.

Oil piping

Heated oil piping having temperature above 60° to be insulated in the same manner as for steam piping excepting that no insulation will be applied over flanged joints, and valves will have their bodies only insulated with glass wool or other equivalent.

The following HFO pipes in engine room shall be provided with steam tracing. And shall be insulated:

- Transfer
- Purifiers suction from settling tank to heater
- Main engine, auxiliary engines and auxiliary boiler service

The following pipes part exposed to the crew shall be insulated with glass cloth regardless of pipe diameter and internal fluid temperature:

- Auxiliary boiler blow-down pipe
- Exhaust steam pipe after the relief or safety valves
- Steam drain pipe after the drain valves and drain traps

Exhaust gas piping

Insulation to be applied as follows:

Kind of Engine	Insulation		Cover
	Thickness (mm)	Material	
Main Engine	Pipe 100	Glass cloth	Galvanized steel plate 0.8mm thick
	Flange 100	+	
Generator	Pipe &	Rockwool or glass wool	Galvanized steel plate 0.4mm thick
Diesel engine	Flange 80	+	
Incinerator	Flange 60	Glass cloth	DO

The exhaust gas piping in funnel to be insulated with rock wool of 50mm thick and approx. 2m above casing top in funnel to be insulated with rock wool of 25mm thick.

Main engine exhaust manifold and silencers for generator diesel engine to be insulated in accordance with the manufacturer's standard.

Exhaust pipes to have insulation, wire, wire mesh and galvanized steel plates. To be insulated up to full length.

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

Cold water pipes passing through heated rooms to be insulated.

607. Protection of Pipes

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

The pressure losses across major components, such as heat exchangers to be checked to establish the actual volume flow from the aggregate characteristic. Unacceptable differences from the desired hydraulic balance to be corrected. Noise from vibration of pipes to be eliminated by additional supports.

608. Valves for Quick Closing Systems

Quick closing valves of approved type to be mounted on oil tanks according to regulations. Necessary valves and operating instructions, to be placed near emergency stops in the fire control position.

610. COOLING WATER SYSTEMS

611. Seawater Cooling Systems

The following seawater cooling systems to be provided:

- A central cooling water system

The engine room to be provided with 2 sea chests, 1 low inlet and 1 high inlet.

The 2 inlets to be connected with a common suction main, which to be rubber lined.

611.1 Central Cooling Water System

The central fresh cooling water system to remove the heat dissipation from the following equipment:

- Main engine HT freshwater circuit
- Main engine LT freshwater circuit
- Diesel generating sets freshwater systems LT and HT
- Condenser for boiler
- Starting air compressors (if water cooled)
- AC system
- Air condition and refrigerant condensers.

Three seawater-cooling pumps (each of 50% of max capacity) to be provided with max capacity in accordance with engine maker's recommendations and service profile.

The seawater pumps to draw from the cross-over and to deliver to the central coolers.

612. Sea Inlet Valves

Isolating valves to be fitted at each connection on the sea inlet chests and to have a combined local and remote control capability. Remote controls to be located at approved positions above the main deck.

Sufficient isolation valves to ensure failure of a branch line does not affect vessel operation.

613. Overboard Discharges

All seawater cooling system overboard discharge valves to be of the butterfly/non-return type, with a combined local and remote control as per class requirement, if found necessary for easy operation.

SW cooling water discharge to be arranged both PS and SB, approx. 7 m above the baseline. SW cooling water to be lead through high seachest.

All overboard valves to be accessible.

615. Freshwater Cooling System

The freshwater cooling systems to be arranged as a separated central cooling system.

The freshwater cooling system to be divided into a

High Temperature Circuit (HT) and a

Low Temperature Circuit (LT)

615.1 High Temperature FW Circuit

The following equipment to be arranged for HT freshwater cooling:

- Main engine cylinder liners, covers, exhaust valves

The diesel alternator engines to be provided with built-on freshwater coolers and pumps.

A heat exchanger to be installed for preheating of engine cooling water.

615.2 Low Temperature FW Circuit

The following equipment to be arranged for LT freshwater cooling:

- Main engine air cooler
- Main engine lub. oil cooler
- Diesel alternator engines
- Starting air compressors
- Condenser for boiler
- AC units
- Refrigeration plant
- MGO cooler

The diesel alternator engines are provided with built-on freshwater cooling pumps and HT/LT coolers.

620. FUEL OIL SYSTEM

621. Heavy Fuel Oil System

A combined fuel transfer, supply system and a fuel oil purification system to be arranged.

The fuel oil transfer pump draws from the bunker tanks and delivers to the settling tank or service tanks.

The separator pumps draw from the settling tanks and deliver to the service tanks.

Transfer between F.O. tanks to be possible.

Overflow to be arranged from settling to a fuel overflow tank.

Overflow to be arranged from service to settling tanks.

Filling/overflow system to be arranged according to U.S. Coast Guard Pollution Prevention.

Supply system to be arranged for:

- Main engine
- Diesel alternator engines
- Boiler

Emergency supply connection for the service system to be arranged from one of the settling tanks.

For the fuel oil supply system for the M/E and auxiliary engines a common fuel oil flow meter with m³ counter and a viscosity controller to be provided.

One separate flow meter to be provided for the boiler fuel oil supply system.

The heavy fuel oil system has to be prepared for separate low sulphur fuel oil operation which includes the possibility of using either HFO with a low sulphur contents or using MDO.

622. Diesel Oil System

A combined diesel transfer, supply system and a diesel oil purification system to be arranged. The diesel oil transfer pump draws from the bunker tanks and delivers to the settling tank or to the service tanks.

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

Diesel oil return lines from the A/E's and Boiler to be also adopted accordingly in respect of two separate diesel tanks.

Overflow to the fuel overflow tank.

Overflow from service to settling tank as far as possible.

Filling/overflow system as for the HFO system.

Supply system to be arranged for:

- Main engine
- Diesel alternator engines (MDO & MGO)
- Boiler (MDO & MGO)
- Incinerator

A separate fuel oil filling and service oil system to be arranged for the emergency diesel generator.

623. Boiler Oil System

The fuel oil supply for the boiler burner to be as follows:

- 2 - Fuel oil supply pumps
- 1 - Preheater (electric heated)

The boiler supply system to be suitable for handling MGO with low viscosity.

630. LUBRICATING OIL SYSTEM

631. Lubricating Oil System for the Main Engine

The main engine to operate on the dry-sump principle with the lub. oil circulating tank situated below main engine.

The lub. oil system to consist of the following:

- 2 - Lub. oil pumps
- 1 - Lub. oil cooler (FW-cooled)
- 1 - Automatic back-flush filter and manual filter
- 1 - Thermostatic valve

A lubricating oil purification system to be integrated, see 473.

The system to be prepared for operating with two separate lubrication oils.

634. Lubricating Oil System for Stern tube and Shaft Seals

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

The system to consist of:

- 1 - Gravity tank
- 2 - Gravity tanks for the forward and aft stern tube seal

635. Lubricating Oil System for Diesel Alternator Engines

Each diesel generating set to be equipped with own separate lubricating oil system.

Means for draining the sump to be arranged with hand pump.

Connection to be arranged from each sump to lub. oil purifier.

640. COMPRESSED AIR SYSTEMS

The following compressed air systems to be provided:

- Starting air system, 3.0 MPa
- Service air system, 0.8 MPa
- Control air system, 0.8 MPa

For compressors and starting air vessels, see 461-465.

641. Starting Air System

The 3.0 MPa starting air system to be capable of performing the following functions:

- Providing 12 starts for the main engine
- Providing 3 starts on each diesel generating set
- Control air
- Service air

642. Service Air System

The service air system to be arranged from 3.0 MPa system with two reduction valves and service air compressor.

The 0,7 MPa (effective at outlets) service air system to be capable of delivering air for air-operated tools and other portable equipment, such as maxi-gun and combi-gun cleaners.

Filters to be fitted before each reduction valve.

The service system to be a dedicated system from only one (1) reservoir. A service air receiver of 2000 ltr. to be installed.

Filters to be fitted before each reduction valve.

Service air outlets to be located in the engine room (5 pcs.) and in addition outlets shall be provided at the following locations:

- 1 - Steering gear room
- 1 - CO₂ room
- 1 - Emergency generator room
- 1 - Bosuns store
- 2 - Forecastle deck
- 2 - Upper deck at each cargo hold
- 2 - Front of house
- 2 - Aft deck
- 1 - Each cargo hold
- 3 - To be placed in accordance with Buyer's approval.

643. Control Air System

Control air for machinery and equipment is to be arranged from 3.0 MPa system.

Control air to be supplied for:

- Main engine
- Fuel oil separators
- Lubricating oil separator
- Bilge water separator
- Main engine control system

Reduction valves are to be fitted where required.

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

Filters to be fitted before each reduction valve.

645. Air Dryers

Air dryers of chemical absorption type to be fitted in the control air system and in the service air system.

Service air supply for cargo hold cleaning equipment to bypass the dryer.

Capacity of control air dryer to be approx 200 Nm³/h and service air dryer approx 100 Nm³/h.

650. MISCELLANEOUS PIPING SYSTEMS

651. Ballast System

The ballast system to facilitate:

- Drawing and delivering ballast water from/to all ballast tanks.
- Trimming/listing vessel

See also sect. 331

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

The SW crossover to have sufficient size to have two ballast pumps running at the same time.

Ballast water discharge to be arranged both PS and SB, approx. 7 m above the baseline. Connecting pipe to shell to be of heavy schedule.

Ballast pumps discharge valves should be able to throttle by remote control.

Stripping of tanks by means of a separate stripping line and stripping ejector.

Ballast pumps to be frequency controlled and ammeters to be provided at engine control room and deck office.

652.1 Bilge System

The system to be arranged as per class requirements with suctions in sufficient number and size to ensure efficient drainage of all watertight compartments. Provision for holding bilge/washing water from holds shall be provided in the upper part of No.5 wing tank P&S. Direct overboard discharge to be arranged from bilge/washing water holding tank.

652.2 Oily and Clean Bilge System

The oily bilge system to be capable of performing the following functions:

- Pumping sludge from wells and recesses in engine room
- Separating oil and water
- Discharging oil to the sludge oil tank and incinerator, clean sea-water or freshwater overboard to specified standard
- Discharging sludge oil to barge or shore connections

The system to consist of:

- 1 - Bilge water separator with built-on supply pump
- 1 - Sludge pump
- 1 - Oily bilge water pump

654. Hydrophore System

The system consists of the following components:

- 1 - Hydrophore tank
- 1 - Hot water tank
- 2 - Hydrophore pumps (one as spare)
- 2 - Hot freshwater circulation pumps
- 1 - F.W. generator with pump
- 1 - UV steriliser (flag state approved)
- 1 - Re-hardening filter

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

The hot water discharge temperature to be controlled by means of by-pass and a 3-way thermostatic controlled valve.

Tanks to have separate suctions.

670. STEAM SYSTEM

In general tank heating shall follow ISO or CB Shipbuilding Standard and normal practice.

The system to deliver steam to the following heat consumers:

- HFO bunker tanks
- HFO service and settling tanks

- Bilge holding tank
- Misc. oil tanks
- Pre-heaters for HFO, lubricating oil
- Heat tracing HFO pipes
- Heat tracing filters
- Heat exchangers for central heating
- Heating section in air condition centre unit
- Sludge tank
- M/E LO circulating tank

The system to consist of the following equipment:

- 1 - Composite boiler (item 483)
- 1 - Drain/filling pump
- 2 - Feed pumps
- 1 - Condenser
- 1 - Filter tank / hot well

680. CONDENSATE SYSTEM

683. Auxiliary Condenser

The auxiliary condenser to be of atmospheric, shell and straight tube multipass type. The condenser to be capable of condensing the full steam production from the M/E exhaust gas at SMCR.

Materials to be as follows :

- | | | |
|------------|---|-----------------|
| Shell | - | steel plate |
| Water head | - | cast iron |
| Tube | - | aluminium brass |
| Tube plate | - | naval brass |

690. MACHINERY LIST (PRELIMINARY)

All figures to be finally confirmed according to the design

Item No.	Description	No. off	Maker/type	Capacity	Weight Item (kg)	Specification of electric motor voltage	Rated Power	rpm	Remarks
306.01	Fan, engine room (supply)	1		Approx. 17/8 m ³ /s		440			2-speed electric motor
306.02	Fan, engine room (supply)	1		Approx. 17/8 m ³ /s		440			2-speed electric motor
306.03	Fan, engine room (supply)	1		Approx. 17/8 m ³ /s		440			2-speed reversible electric motor
306.04	Fan, purifier room (exhaust)	1		Approx. 1,25 m ³ /s		440			
306.06	Fan for steering gear room (supply)	1		Approx. 1.0 m ³ /s		440			
306.07	Fan for galley (exhaust)	1		Approx. 2,00 m ³ /s		440			
306.08	Fan for galley (supply)	1		Approx. 1,40 m ³ /s		440			
306.09	Fan for laundry (exhaust)	1		Approx. 0,45 m ³ /s		220			
306.10	Fan for hospital (exhaust)	1		Approx. 0,30 m ³ /s		220			
306.11	Fan, sanitary rooms (exhaust)	1		Approx. 0,50 m ³ /s		220			
306.12	Fan for A/C Compressor room (exhaust)	1		Approx. 0.23 m ³ /s		440			
306.15	Fan for CO ₂ room (exhaust)	1		Approx. 0,80 m ³ /s		440			
306.16	Fan for paint store (exhaust)	1		Approx. 0,70 m ³ /s		440			Spark proof EXD
306.17	Fan for bottom pipe duct (exhaust)	1		Approx. 1,5 m ³ /s		440			

306.18	Fan for wing pipe duct (exhaust)	2		Approx. 1,8 m ³ /s		440			
306.19	Fan for HPU room amidship (exhaust)	1		Approx. 0,20 m ³ /s		440			
306.20	Fan for HPU WINCH room (exhaust)	1		Approx. 0,50 m ³ /s		440			
306.24	Fan for emerg. generator room (exhaust)	1		Approx. 0,8 m ³ /s		440			
312.01	Refr. Compressor unit for A/C plant	1				440			FW cooled condenser
312.02	Refr. Compressor unit for A/C plant	1				440			FW cooled condenser
314.01	AC central unit	1							
314.02	AC unit, engine control room	1				440			FW cooled condenser
314.03	Refr. compressor for A/C unit Galley	1				440			FW cooled condenser
318.01	Steam heated calorifier E/R forward	1							
318.02	Steam heated calorifier E/R aft	1							
318.03	Steam heated calorifier steer. gear room	1							
318.04	Steam heated calorifier stores room	1							
318.05-09	Electric heaters	5				440			
355.01	Provision cooling compressor	1				440			FW cooled condenser
355.02	Provision cooling compressor	1				440			FW cooled condenser
368.01	Pump unit for local protection system	1				440			
378.01	Hydraulic Power Pack For Winch Aft	1				440			including 2 pumps

378.02	Hydraulic Power pack for windlass/mooring arr. forward	1				440			including 2 pumps
378.03	Oil cooler mooring aft	1							Built on power pack
378.04	Hydraulic oil storage tank mooring aft	1							
381.01	Steering gear	1		Torque approx.: 500 kNm					
381.02	Pump unit f. steering gear	1				3x440			
381.03	Pump unit f. steering gear	1				3x440			
381.04	Hydr. oil storage tank for steering gear	1		500L					
381.05	Oil reservoir for steering gear	1							
386.01	Rudder and rudder stock	1							
411.01	Main engine	1	5S50ME-B9.2 TII	SMCR 6.350 kW					
423.01	Propeller shaft	1							
423.02	Intermediate shaft	1							
423.03	Intermediate shaft bearing	1							FW-cooled
424.01	Sterntube	1							
424.02	Sterntube bearing, fore	1							
424.03	Sterntube bearing, aft	1							
424.04	Shaft power meter	1							
425.01	Shaft seal, inner	1							

425.02	Shaft seal, outer	1							
426.01	Propeller	1		approx. 5.90 m					Fixed pitch
427.01	Shafting earting device, complete	1							Mounted on intermediate shaft
431.01	Aux engine no 1	1		600 kW				900	
431.02	Aux engine no 2	1		600 kW				900	
431.03	Aux engine no 3	1		600 kW				900	
433.01	Diesel engine for emergency generator	1		110 kW				1800	Radiator cooled
451.01	SW cooling pump	1		Approx. 200 m ³ /h		440			50% of total cool. capacity, freq control
451.02	SW cooling pump	1		Approx. 200 m ³ /h		440			50% of total cool. capacity, freq control
451.03	SW cooling pump	1		Approx. 200 m ³ /h		440			50% of total cool. capacity, freq control
451.04	LT FW cooling pump	1		Approx. 180 m ³ /h		440			50% of total cool. capacity, freq control
451.05	LT FW cooling pump	1		Approx. 180 m ³ /h		440			50% of total cool. capacity, freq control
451.06	LT FW cooling pump - harbour	1		Approx. 180 m ³ /h		440			50% of total cool. capacity, freq control
451.07	HT FW cooling pump	1		Approx. 70 m ³ /h		440			
451.08	HT FW cooling pump	1		Approx. 70 m ³ /h		440			
451.09	Preheating pump Aux. eng	1		Approx. 3.2 m ³ /h		440			Built-in preheater unit
451.10	Preheating pump Aux. eng	1		Approx. 3.2 m ³ /h		440			Built-in preheater unit
451.11	Preheating pump M/E	1		Approx. 8 m ³ /h		440			

451.12	FW cooling w. make up pump	1		2 m ³ /h		440			
452.01	SW supply pump, FW generator	1		62 m ³ /h		440			
452.02	FW pump, FW generator	1				440			Built-on FW generator
452.03	Hydrophore pump	1		Approx. 5 m ³ /h		440			
452.04	Hydrophore pump	1		Approx. 5 m ³ /h		440			
452.05	Hot water circ. pump	2		Approx. 2.5 m ³ /h		440			
452.06	M/E chemical cleaning water pump	1		1.0 m ³ /h		440			
452.07	Ballast pump	1		800 m ³ /h		440			Frequently controlled
452.08	Ballast pump	1		800 m ³ /h		440			Frequently controlled
452.09	Bilge, fire and general serv. pump	1		Approx. 180 m ³ /h / 120 m ³ /h		440			
452.10	Bilge, fire and general serv. pump	1		Approx. 180 m ³ /h / 120 m ³ /h		440			
452.11	Sewage disch. pump (treatment unit)	1		10 m ³ /h, 0.18 MPa		440			
452.12	Sewage pump (from holding tk)	1		5 m ³ /h, 0.15 MPa		440			
452.13	Ballast ejector	1		50 m ³ /h					Driven by fire pumps
452.15	Bilge ejector for chain lockers and stores	1		15 m ³ /h					Driven by fire pumps
452.16	Bilge ejector for main bilge line	1		100 m ³ /h					Driven by fire pumps
452.20	Portable bilge pump for cargo cleaning	2		35 m ³ /h					Air driven
452.21	High pressure water pump for C/H wash	1		20 m ³ /h		440			

453.01	Emergency fire pump	1		Approx. 100 m ³ /h		440			
454.01	HFO transfer pump	1		20 m ³ /h		440			
454.02	DO transfer pump	1		10 m ³ /h		440			
454.03	HFO sep. supply pump	1		Approx. 2.6 m ³ /h		440			Built on sep. unit
454.04	HFO sep. supply pump	1		Approx. 2.6 m ³ /h		440			Built on sep. unit
454.05	Fuel oil supply pump	1		2,8 m ³ /h, 0.4 MPa		440			Built on fuel oil supply module
454.06	Fuel oil supply pump	1		2,8 m ³ /h, 0.4 MPa		440			Built on fuel oil supply module
454.07	Fuel oil circulating pump	1		7,0 m ³ /h, 0.6/1.0 MPa		440			Built on fuel oil supply module
454.08	Fuel oil circulating pump	1		7,0 m ³ /h, 0.6/1.0 MPa		440			Built on fuel oil supply module
454.09	Fuel oil supply pump, boiler	1		Approx. 730 l/h		440			
454.10	Fuel oil supply pump, boiler	1		Approx. 730 l/h		440			
454.11	DO supply pump for AE	1		2,0 m ³ /h		440			Built on fuel oil supply module
454.12	DO supply pump for AE	1		2,0 m ³ /h		440			Built on fuel oil supply module
454.13	Fuel oil supply unit	1							Located in the separator room
454.14	DO ignition pump for Boiler	1		Approx. 60 l/h		440			
455.01	M/E LO sep. supply pump	1		Approx. 1.85 m ³ /h		440			Located on tanktop
455.02	Aux Eng. LO sep. supply pump	1		Approx. 1.85 m ³ /h		440			Located on tanktop
455.03	Main engine lub. oil pump	1		180 m ³ /h, 0.4 MPa		440			

455.04	Main engine lub. oil pump	1		180 m ³ /h, 0.4 MPa		440			
455.05	Lub. oil transfer pump	1		5.0 m ³ /h		440			
455.08	M/E cylinder oil transfer pump	1		2.0 m ³ /h		440			
455.09	LO priming pump for Aux. eng no 1	1				440			Built on engine
455.10	LO priming pump for Aux. eng no 2	1				440			Built on engine
455.11	LO priming pump for Aux. eng no 3	1				440			Built on engine
455.14	LO transfer pump f.sterntube	1							Hand pump
455.15	LO drain pump f.sterntube	1							Hand pump
457.01	Boiler feed water pump	1		Approx. 3,8 m ³ /h		440			Supplied together with boiler
457.02	Boiler feed water pump	1		Approx. 3,8 m ³ /h		440			Supplied together with boiler
457.03	Feed water make-up pump	1		2.5 m ³ /h		440			
459.01	Sludge oil pump	1		10 m ³ /h		440			
459.02	Sludge dosing pump incinerator	1				440			Built on waste oil tank
459.03	Engine room bilge pump	1		5.0 m ³ /h		440			
461.01	Main air compressor No. 1	1		150 Nm ³ /h, 3.0 MPa		440			
461.02	Main air compressor No. 2	1		150 Nm ³ /h, 3.0 MPa		440			
462.01	Service air compressor	1		450 Nm ³ /h, 0.8 MPa		440			Air cooled, rotary vane type
462.02	Emergency air compressor	1		Approx. 30 Nm ³ /h, 3 MPa		440			Air cooled, piston type

465.01	Main air reservoir No. 1	1		4,5 m ³ x 3.0 MPa					
465.02	Main air reservoir No. 2	1		4,5 m ³ x 3.0 MPa					
465.03	Control air reservoir	1		0.5 m ³ x 0.8 MPa					
465.04	Aux. air reservoir	1		0,2 m ³ x 3.0 MPa					
465.05	Service air reservoir	1		2.0 m ³ x 0.8 MPa					
466.01	Air dryer service air	1		100 Nm ³ /h					
466.02	Air dryer control air	1		200 Nm ³ /h					
471.01	HFO separator	1		2800 l/h		440			Automatic operation
471.02	HFO separator	1		2800 l/h		440			Automatic operation
473.01	M/E lub. oil separator	1		1200 l/h		440			Automatic operation
473.02	A/E lub. oil separator	1		1200 l/h		440			Automatic operation
474.01	Bilge water separator	1		2.0 m ³ /h		440			To IMO resolution MEPC 107(49)
475.01	Fresh water generator	1		20 m ³ /24 hours		440			Production at 85 % SMCR & SW 32 deg. C
476.01	Sewage treatment unit	1		5.5 m ³ /24 hours (30 pers)					
478.01	UV- filter/ sterilizer	1		2.5 m ³ /h					
478.02	Hardening unit	1		2.5 m ³ /h					
479.01	Air cooler cleaning module	1							Chemical dosing unit
479.02	Chemical dosing unit	1							Supplied together with boiler

483.01	Composite boiler	1		Oil:1500 kg/h Exh.: app.:700kg/h		440			Rotary cup burner
483.02	Control panel for boiler	1							
485.01	Incinerator	1		Sludge: Approx. 50 l/h Solid: Approx. 400 l/h		440			
531.01	Crane for main engine	1		SWL 2000 kg		440			
531.02-04	Hoist + trolley, aux. engines	3		Approx. SWL 500 kg					
531.05	Hoist, separator room	1		SWL 500 kg					
531.06	Hoist, engine workshop	1		SWL 1000 kg					
533.01	Work bench (mach. workshop)	1		2400x800x800					
533.02	Work bench (el. workshop)	1		1200x600x800					
533.03-05	Parallel vices	3							
533.06	Anvil	1							
533.07	Lockers	x		200x800x500					
535.01	Lathe	1		Centre dist. 1000 mm		440			
535.02	Drilling machine (27 mm)	1				440			
535.03	Drilling machine (12 mm)	1							
535.04	Double wheel grinding machine	1		200 mm		440			
535.05	M/E exhaust valve grinder	1				440			
536.01	Autogenous welding equipment	1							

537.01	Electric welding rectifier	1		200 A					
538.01	M/E fuel valve test bench	1							Engine builder supply
538.02	D/G fuel valve test bench	1							
538.03	Electric test panel	1							
541.01	Fire damper, air inlet engine room	1							
541.02	Fire damper, air inlet engine room	1							
541.03	Fire damper, air inlet engine room	1							
541.04	Fire damper, air outlet engine room	1							Remote controlled
541.05	Damper for E/R fan no 306.01	1							Remote controlled
541.06	Damper for E/R fan no 306.02	1							Remote controlled
541.07	Damper for E/R fan no 306.03	1							Remote controlled
541.08	Damper for purifier room exhaust	1							Remote controlled
543.01	ME silencer	1							
544.01	Aux. engine silencer	1							
544.02	Aux. engine silencer	1							
544.03	Aux. engine silencer	1							
544.04	Emergency engine silencer	1							Emerg, engine maker's supply
548.01	Aux blower for ME	1				440			Built on ME

548.02	Aux blower for ME	1				440			Built on ME
553.01	Aut. HFO back-flush filter for M/E	1		25 micron absolute					Built on fuel oil supply module
555.01	Aut. lub. oil back-flush filter for M/E	1		40 micron absolute					Built-in by-pass filter
555.02	Stuffing box drain tank	1		0,3 m ³					
562.01	LT FW Central cooler	1							sized to 50% of max. load
562.02	LT FW Central cooler	1							sized to 50% of max. load
562.03	M/E jacket water cooler	1		1120 kW					
562.07	Sample cooler, boiler	1							FW cooled
563.01	M/E lub. oil cooler	1		660 kW					FW cooled
563.02	MDO cooler	1		Approx. 40 kW					
566.01	Preheater, HFO separator	1		Approx. 100 kW					Built on Sep. unit
566.02	Preheater, HFO separator	1		Approx. 100 kW					Built on Sep. unit
566.03	Preheater, fuel oil supply	1		Approx. 150 kW					Built on fuel oil supply module
566.04	Preheater, fuel oil supply	1		Approx. 150 kW					Built on fuel oil supply module
566.05	Preheater, HFO to boiler	1				440			Electric
567.01	Preheater, M/E lub. oil separator	1		44 kW					Built on Sep. unit
567.02	Preheater, D/G lub. oil separator	1		44 kW					Built on Sep. unit
568.01	Hot water tank	1		500 ltr		440	18		Steam and electric heated

568.02	M/E jacket water preheater	1		Approx. 90 kW					Steam
568.03	Preheater for aux engines	1		Approx. 27 kW		440	24		Electric/ built in pre-heater unit
572.01	FO venting box	1		100 ltr					Built on fuel oil supply module
573.01	DO serv. tank, emerg. generator	1		1000 ltr					
574.01	M/E cylinder oil service tank	2		1300 ltr					
574.02	Gravity tank , sterntube lub. oil	1		400Ltr					
574.03	Aft seal tank, sterntube oil	1							
574.04	Fwd seal tank, sterntube oil	1							
576.01	Feed water cascade & obs. tank	1		Approx. 1250 ltr					Supplied together with boiler
577.01	Expansion tank, LT FW cooling system	1		1000 ltr					
577.02	Expansion tank, HT FW cooling system	1		1000 ltr					
577.03	Deaerating tank, FW cooling system	1		50 ltr					
577.04	Alarm device, FW cooling system	1							
577.05	Expansion tank, mooring arr. aft	1							
577.06	Expansion tank, windl/mooring arr. fore	1							
578.01	FW pressure tank	1		1000ltr					
579.01	Scav. air cooler drain tank	1		400 ltr					
579.02	Fuel alarm tank	2							

579.03	Incinerator waste oil tank	1		Approx. 1500ltr					Steam heated
608.01	Quick closing valve opr. panel	1							
682.01	Steam dump condenser, exh. gas boiler	1							FW-cooled Supplied together with boiler
711.01	Main generator	1		570 kWe		3x450		900	
711.02	Main generator	1		570 kWe		3x450		900	
711.03	Main generator	1		570 kWe		3x450		900	
713.01	Emergency generator	1		100 kWe					
716.01	Emergency batteries	x							
716.02	Battery charger	1							
721.01	Main switchboard	1							
722.01	Emergency switchboard	1							
725.01	Transformer	1		Approx. 100 kVA 3x440/220					
725.02	Transformer	1		Approx. 100 kVA 3x440/220					
725.03	Transformer emergency	1		Approx. 50 kVA 3x440/220					
725.04	Transformer for emergency generator	1		Approx. 50 kVA 3x440/220					
725.05	Transformer	1		Approx. 20 kVA 3x440/220					
725.06	Transformer	3		Approx. 16 kVA 3x440/220					
732.01	Motor starters for pumps	x							

732.02	Motor starters for steering gear	2							
935.01	Cargo crane	1		30 t / 26.2 m		440			
935.02	Cargo crane	1		30 t / 26.2 m		440			
935.03	Cargo crane	1		30 t / 26.2 m		440			
935.04	Cargo crane	1		30 t / 26.2 m		440			
939.01	Prov./rescue boat crane	1		1,5 t / 5,5 m		440			
939.02	Provision crane	1		3 t / 10 m		440			

700. - 799. ELECTRICAL PART**700. ELECTRICAL PART - GENERAL**

The electric equipment and installation to comply with the Rules and Regulations specified in section 010-016 of the Specifications and Builder's standard.

Yard to submit to Buyer for approval "Electrical installation standard".

All electrical machines and apparatus delivered to the shipyard and awaiting installation are to be kept in a clean, dry and well ventilation store. When installed on board all equipment is to be protected from dirt, mechanical damage and moisture at all times.

Suitable lifting eyes should be fitted above all electric motors, generators and large electrical components.

All final circuits and subcircuits complete with components where possible, are to be Megger tested and a complete list of insulation readings submitted to the Buyer prior to delivery.

Voltage, frequency and distribution system

In general, voltage, frequency and distribution for electric equipment to be as follows:

<i>Item</i>	<i>Voltage</i>	<i>Frequency</i>	<i>Phase</i>	<i>Conductor</i>
Generator	450V A.C.	60HZ	3	3 wire
Power motor	440V A.C.	60HZ	3	3 wire
Do. (fractional horse power and special service)	220V A.C.	60HZ	3 or 1	3 wire or 2 wire
Electric range and oven	440V A.C.	60HZ	3	3 wire
Heating	220V A.C.	60HZ	3 or 1	3 wire 2 wire
Lighting	220V A.C.	60HZ	1	2 wire

Nautical equipment	440V A. C.	60HZ	3	3 wire
	or 220V A.C.	60HZ	1	2 wire
	or 24V D.C.		-	2 wire
Interior communication, general alarm, etc.	220V A.C.	60HZ	1	2 wire
	or 24V D.C.	-		2 wire
Radio equipment	440V A.C	60HZ	3	3 wire
	or		or 1	2 wire
	220V A.C.		3	3 wire
	or		or 1	2 wire
	24V D.C.		-	2 wire
Entertainment equip- ment	220V A.C.	60HZ	1	2 wire
Emergency generator	450V A.C.	60HZ	3	3 wire

Sockets

In general, type and size of socket for lamps to be as follows, but the socket for fluorescent lamps to be of bi-pin type (spring type)

	Type	Size
Lighting fixture (250W and over)	Edison	40
(200W and below)	Edison	27
Mercury lamp (250 W and over)	Edison	40
(200W and below)	Edison	27
Pilot lamp provided in the equipment	Manufacturer's standard	

Fuses

In general, tubular fuses to be used except special type fuses for electronic equipment.

Colours

(1) Electric equipment

Final painted colours of metal surface for electric equipment to be as follows:

	Munsell
Generator and motor	7.5 BG 7/2 (light blue)
Switchboard, control panel and control stand	7.5 BG 7/2 (light blue)
Transformer, section and distribution board for accommodation space	N-8 (light grey)
for other spaces	7.5 BG7/2 (light blue)
Lighting fixture for accommodation spaces	
Water-proof type	N-7 (grey)
other	N-8 (light grey)
Lighting fixture for other spaces	7.5 BG7/2 (light blue)
Bell, buzzer, siren and speaker	
waterproof type	N-7 (grey)
other	N-8 (light grey)
General alarm and other emergency equipment	R5 4/13 (red)
Nautical equipment	7.5 BG7/2
Radio equipment	7.5 BG7/2
Electric equipment except above mentioned	manufacturer's standard and foreign make
Inside metal surface of electric equipment to be painted by manufacturer's standard colour.	

(2) Busbar

A.C. system

Phase R or U Green
Phase S or V Yellow
Phase T or W Brown

D.C. system

Positive (+) ... Red
Negative (-) ... Blue

703. Electrical Tests and Trials

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

704. Testing Panel

One (1) set of testing panel with switches, sockets, lamp holder for incandescent and fluorescent lamp, fuse check contact and pilot lamps to be fitted in engine room electric store.

Electric source of testing panel to be fed as follows:

440 volts A.C. 3 phase, 60HZ 10A
220 volts A.C. 1 phase, 60HZ 10A
24 volts D.C. 3A

706. Name and Label Plates

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

709. Electrical Arrangement

All electric equipment shall be located such as to be easily accessible 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' to be draughted, and a framed copy hereof to be mounted near the main switchboard.

Amp meters to be provided for main Ballast pumps at Ballast control console.

710. ELECTRIC POWER SUPPLY**711. Main Generators**

The final rating of the generators to be decided after the Estimated Power Loading of the vessel has been calculated. The generators to conform to the Service Conditions showed below with a maximum estimated loading of 90%.

Main diesel generators to be installed in engine room as follows:

(1) Particulars

Type	Synchronous
Enclosure	Drip-proof IP23
Cooling system	Self-ventilated with air filter
Output	Abt. 570 kWe
Voltage	450 V A.C.
Frequency	60 HZ
Phase	3 phase
Power factor	0.8 (lagging)
Revolution	Max. 900 r/min
Rating	Continuous at full load
Exciting system	Brushless rotary exciter
Insulation	Class F
No. of Bearing	To manufacturer standard
No. of set	3
Ambient temperature	45 Deg.

(2) Construction

Bearing, lubricating system and thermometer to be according to manufacturer's standard.

(3) Space Heater

Space heaters with thermostat, to be installed in the frame of each generator to prevent the condensation of moisture when the generator is idle, and fed from 220 volts A.C. and interlocked with generator air circuit breaker.

(4) Self Exciting Equipment

The exciting equipment to be of brushless rotating silicon rectifier type and provided with current forcing transformers for short circuit current and voltage transient excitation. The manual voltage regulator to be built in M.S.B.

(5) Characteristics

Generator sets to be able to run in parallel. The voltage regulation of the generator to be maintained in the range of $\pm 2.5\%$ of rated voltage between zero and full load under steady condition of rated power factor. Maximum voltage change not to exceed 15% when a current equal to 80% of the full load current at power factor between zero and 0.4 lagging is suddenly drawn. The voltage to be restored to within 3% of the rated voltage in not more than 1 second.

It's accordance with the classification's requirements.

(6) Service

The generators to serve as follows:

<i>Service condition</i>	<i>No. of set in service</i>
At normal sea going	One
At leaving & arriving	Two
At cargo handling	Two or three
At port	One

(7) Prime Mover

See Machinery Specification (Section 1 - "Machinery Particulars")

(8) Governor Motor

The governor motor to be electrically operated and controlled from the main switchboard.

(9) Electric Temperature Detector

Each generator to be provided with two (2) temperature detectors in each phase of stator coils for detecting the temperature of stator coil and giving alarm.

(10) Automatic Synchronizing and Load Sharing Device

One (1) set of automatic synchronizing and load sharing device is to be provided and assembled in a cubicle in main switchboard.

The device to have the function of automatic synchronizing one diesel generator to the main bus bar source, closing the diesel generator's air circuit breaker after synchronizing, automatic sharing effective power loads between diesel generators running in parallel, and/or shifting load from one diesel generator to another by automatic controlling of the governor for generator engine. In addition, unloaded generator should disconnect from MSB and shut down after 10 minutes.

713. Emergency Generator

(1) General

The emergency generator is to be installed in the emergency generator room.

The emergency generator is not to be capable of running parallel with the diesel generator.

The emergency generator is to be operated locally and manually and to be automatically started at no-voltage of emergency switchboard.

The running light for EG to be fitted in the MSB.

(2) Particulars

No. of set	One (1)
Enclosure	Drip-proof IP23
Ventilation	Self ventilated with air filter
Excitation	Brushless rotary exciter type
Output	abt. 125 kVA (100 kWe)
Voltage	AC 450V
Phase	3 phase
Frequency	60Hz
Revolution	1800 rpm (4 poles)
Power factor	0.8 (lag)
Insulation class	B or F for rotor and stator (depending on manufacturer's standard)
Rating	Continuous at full load
Bearing	Manufacturer's standard
Ambient temperature	45 Deg.

(3) Exciting Device

Exciting device of generator is to be rotary exciter of brushless type and to be connected to the generator shaft end directly.

The automatic voltage regulator (AVR) with voltage adjuster is to be provided.

(4) Prime Mover

Refer to Machinery specification.

The prime mover is not to be provided with any governor motor.

(5) Space Heater

Generators to have 230V AC space heater controlled by gen. circuit breaker.

Manual switch and indicating lamp to be fitted in ESB.

714 Operation of Generator

The diesel generators and emergency generator are to be operated as follows:

(1) Stand-By Operation of Diesel Generator

(a) In case of one diesel generator in operation (at sea)

(i) When one of the following troubles happens on the main bus bar of the main switchboard, the stand-by generator which is preliminarily selected is to be automatically started and it is to be alarmed on the main switchboard.

High voltage
Low voltage
Low frequency
High frequency

When the voltage of the stand-by generator comes up the rated voltage, the air circuit breaker (ACB) of the originally running generator is to be opened automatically and that of stand-by generator is to be closed automatically.

After that, motors for propulsion auxiliaries are to be automatically and sequentially started.

However, if the trouble is cleared off by the time of the building-up of the stand-by generator, the originally running generator is to continue to supply the power to the main switchboard, and stand-by generator is to run with no-load until stopped manually.

And if the stand-by generator engine fails to start or the ACB fails to close, the second stand-by generator is to be automatically started and perform the stand-by operation in the same manner as the former stand by generator.

(ii) When the following trouble happens the running diesel generator, preferential trip is to be executed and alarmed on the main switchboard.

Over current

(iii) When current of running generator comes up to abt. 85% rated current the standby generator to be automatically started and two generators to be led to running in parallel.

(b) In case of two diesel generators in operation

(i) When one of ACB of the running diesel generators is tripped by some trouble, preferential trip is to be executed and alarmed on the switchboard and at the same time the stand-by generator is to be automatically started.

When the voltage of the stand-by generator builds up to the rated voltage ACB of the stand-by generator is to be automatically closed and two generators are to be led to running in parallel completely by functioning the automatic synchronizing and load sharing device.

And non-essential consumers preferentially tripped are to be manually restarted, if necessary.

(ii) When the following trouble happens on any running diesel generators, preferential trip is to be executed and alarmed on the main switchboard.

Over current

(2) Automatic Start of Emergency Generator

The emergency generator is to be started automatically by detecting no-voltage of the emergency switchboard bus bar and the ACB of it is to be connected automatically after confirming the continuation of no-voltage.

Switchboard should have low load shedding facility and unloaded generator should auto disconnect from the board and auto shut down after 10 minutes.

715. Shore Connection

One (1) set of 440 volts, 60HZ, three phase, 400 amperes, drip-proof type shore connection box with a moulded case circuit breaker and phase sequence indicating lamps to be installed inside of engine casing or upper deck passage and permanently connected to main switchboard.

716. Batteries

(1) Storage Battery

The lead-acid maintenance free type batteries to be installed as follows:

	No. of set	Capacity (Ah)	Voltage (V)	Location
For general service	2	195	24	Battery room
For radio equipment	Manufacturer's standard			Battery room

The battery for general service to supply the power for interior communication equipment and alarm device etc.

(2) Charging Device

One (1) set of charging and discharging board for general service battery to be of parallel floating charging type with AVR to operate by means of voltage dropper. in addition to the above charging method manual charging type to be available by change over switch and located near the battery room.

All necessary charging apparatus i.e. source switch, transformer, voltage adjuster, silicon rectifier, voltmeter, ammeter, indicating lamps, molded case circuit breaker, fuses, etc., to be provided.

Receptacle to be provided on boat deck for charging boat batteries.

The silicon rectifier to be as follows:

	No.	Max. output current (A)	Max. output Voltage (V)
For general service	1	60	35

One (1) set of battery charging panel for radio equipment of manufacturer's standard type to be located in radio control station.

720. ELECTRIC DISTRIBUTION

General

(1) Construction and installation

The switchboard to be of dead front and self standing type and to be made of steel frame work.

The switchboard shall have hinged doors in front and rear.

The switchboard to be provided with handrails in both front and rear of the switchboard.

Movable type drip-proof covers to be provided on the rear face of the switchboard.

(2) Meter

All meters mounted on the front panel of the switchboard to be of the semi-flush and 100mm (or maker's standard) rectangular type with circular scale. The accuracy of meter to be within 1.5 percent of full scale deflection.

(3) Generator Air Circuit Breaker

The circuit breakers for generators to be motor or magnetically operated free trip, air circuit breakers having long time over current trip, instantaneous trip, short time delay trip, under voltage trip and reverse power trip features.

Each air circuit breaker to be provided with interrupting capacity against short circuit current.

Generator ACB to be interlocked with shore supply connection.

Generator ACB to be of draw-out type.

(4) Feeder Circuit Breaker

Moulded case circuit breakers with inverse time thermal trip and instantaneous magnetic trip features to be provided for 440 volts.

For 220 V and 24 DC miniature circuit breakers to be used.

Moulded case circuit breakers to be of plug-in type.

Steering gear motor feeders to be protected against short circuit only.

Moulded case circuit breakers to have interrupting capacity for short circuit current at parallel operation of main generators.

721. Main Switchboard

The main switchboard to be installed in the engine control room and consist of following panels.

No. 1 440 volt feeder panel
No. 1 diesel generator panel
Synchronizing panel
No. 2 diesel generator panel
No. 3 diesel generator panel
No. 2 440 volt feeder panel
220 volt feeder panel

The following instruments to be installed on the switchboard.

(1) Generator Panel

One each generator panel:

- 1 - ACB
- 1 - ACB close indicating lamp
- 1 - ACB open indicating lamp

1 - Generator space heater switch (inside of panel)

1 - Generator space heater close indicating lamp

1 - Manual voltage adjuster (inside of panel)

Each 1 - A.C. voltmeter and selector switch

Each 1 - A.C. ammeter and selector switch

Each 1 Frequency meter and selector switch

Each 1 - kilo wattmeter

1 - Reverse current relay for preferential trip

1 - Over current relay for preferential trip

(2) Synchronizing Panel

For total main generator sets:

3 - ACB close-open switches

3 - Governor motor control switches

2 - A.C. voltmeter and selector switch

2 - Frequency meter and selector switch

1 - Synchroscope and switch

1 set - Synchronizing indicating lamp

1 - Automatic synchronizing device for generators

1 - Diesel generator starting selector switch (remote-manual/auto)

3 - Diesel generator start-stop switches

3 - Generator ACB abnormal trip alarm lamps

3 - Diesel generator remote-start possibility indicating lamps

3 - Diesel generator stand-by indicating lamps

3 - Diesel generator starting-failure alarm lamps

3 - Generator ACB non-close alarm lamps

3 - Automatic synchronizing start push button switches

- 1 - Preferential trip alarm lamp
- 1 - 24V D.C. source indicating lamp
- 1 - Test switch for buzzer and lamp

(3) 440 Volt Feeder Panels

Necessary quantity moulded case circuit breakers for all feeder circuits as required.

- 1 set - Insulation detection device

No1 440V feeder panel to also include follows:

- 1 - Pilot lamp for shore connection
- 1 kWh meter for shore line
- 1 - NO fuse breaker for shore supply. Shore supply voltage and current are to be measured commonly by one of the voltmeter and ammeter on the generator panel.
- 3 - Amp. meters for cranes, windlasses and mooring winches with selector switch.

(4) 220 Volt Feeder Panel

Necessary quantity of miniature circuit breakers for all feeder circuit as required.

Each 1 - A.C. voltmeter and selector switch

Each 1 - A.C. ammeter and selector switch

- 1 set - Insulation detection device

Rubber mat of approved type to be fitted in front and rear of MSB.

Preferential trip should also operate on 100% KW load.

722. Emergency Switchboard

One (1) emergency switchboard to be installed in the emergency generator room.

The emergency switchboard to be energized from the M.S.B. while diesel generator is in normal operation and once the emergency switchboard bus bar becomes no-voltage. The emergency switchboard to supply electric source by the emergency generator.

In general, description and construction are to be as same as the main switchboard.

723. Distribution Panels, Power

Electric distribution

In general, for large power and/or essential motors, group control panel, radar, auto pilot and radio equipment to be supplied from main switchboard or emergency switchboard directly and other small power consuming devices to be supplied through distribution boards from the main switchboard.

Each steering gear motor to be fed from independent circuit, one to be connected to the main switchboard, the other to be connected to the emergency switchboard.

Power for 220 volts lighting and heating system to be supplied from transformers and circuits from distribution boards to lighting fittings or heating equipment to be single-phase two wire system.

The feeder circuits of electric range and baking oven to be three-phase three-wire system.

Power for 24 volts interior communication and alarm to be supplied from the battery and feeder circuit to be two-wire system.

Distribution panels

Every distribution panel to be protected by steel case. The front door to have an efficient latch of substantial type.

Pilot lamp indicating live voltage of panel to be provided.

Distribution panel to have necessary components as follows

(1) 440 volts circuits to be equipped with 3-pole moulded case circuit breakers with over current tripping devices.

(2) 220 volts circuits to be equipped with 2-pole or 3-pole miniature circuit breakers with over current tripping devices in general.

(3) 24 volts circuits to be equipped with 2-pole miniature circuit breakers with over current tripping devices.

(4) General alarm and emergency lighting circuits to be equipped with miniature circuit breakers.

Distribution apparatus

(1) Junction box to be made of sheet steel, drip-proof type for accommodation. In machinery, store spaces, and cargo hold, to be of waterproof type.

(2) Branch box to be made of plastic non-waterproof type to be installed in accommodations.

(3) Switch to be made of plastic, non-waterproof and surface type or flush type in accommodation to be waterproof, surface type in machinery, store and weather spaces.

(4) Generally, socket outlet to be made of plastic, non-waterproof and surface type or flush mounted type according to the respective location in accommodation spaces, and socket outlet to be made of plastic, water-proof surface type in machinery, store and weather spaces.

Waterproof socket outlet to be used on upper deck.

Each socket outlet to have an extra grounded contact. Except the socket outlet for electric razors.

725. Transformers

The transformers to be installed as follows:

Each transformer to be of 60 Hz, dry type, air cool by natural circulation, drip-proof and to have class B insulation.

	No.	Capacity (KVA)	Voltage Pri./Sec.	Location
(1) For general service	2	Abt. 100	450/230 3PH	Near the main Switchboard (outside control room)
(2) For Suez Canal searchlight, forward lighting	1	16	450/230 3PH	Forward bosun's
(3) For emergency use	2	50	450/230 3PH	Emergency generator room
(4) For cooking Ranges	2	20	450/230 3PH	
(5) For Galley equipment	1	25	450/230 3PH	

Main and emergency transformers shall be such arranged that the full working load can be carried by one transformer in each case. Feeder breakers to transformers to be interlocked to prevent inadvertent dual operation.

All transformers to be fitted with nameplates indicating the duty of the unit.

726. Cables and Cable Installations

All cables to be approved by the classification society and the cable application to be as follows:

Rated voltage of all cables to be 660V and 250V for rated voltage 440V and 220V consumer respectively and current of all cables not to be lower than the rating of individual consumer or motor.

Fire resistant cable to be used according to the rules. All cables to be Halogen free.'

Cross linked polyethylene insulated, polyolefin sheathed cables may also be used.

For portable appliances such as portable hand lamps and portable cargo lamps, cables to be of flexible rubber insulated and poly-chloroprene sheathed, and for table lamps to be of flexible vinyl cord.

Special cables such as coaxial cables, compensating cables etc. to be used where necessary.

All cables have to clearly marked and single wires to be numbered.

Cable installation

Cables are not to be painted (oversprayed) at any building stage of the vessel.

In general, cables run in groups to be supported with metal hangers as far as practicable.

Where the cables are exposed to any mechanical damage, they are to be protected by steel plate, steel conduit or flexible tube.

Cables between bridge house and upper deck fore part to run in upper deck pipe duct.

Cables installed on mast or post on upper deck to be wired in galvanized steel pipe up to about 1m height from the deck and to be run on galvanized steel saddle or hanger.

All cables passing through weather decks or watertight bulkheads to be provided with watertight glands, deck tubes, or equivalent means such as multi-cable transit and the cables passing through other decks to be provided with deck tubes or coamings.

For cables passing through beams, and non-watertight bulkheads etc. the hole bushed with vinyl or steel coaming to be provided on such beams and bulkheads when they are less than 6mm in thickness.

In principle, in living quarters, i.e., all cabins, alleyway, etc., the cables to be fitted inside the woodworks and / or walls.

Outer armour braiding to be bonded to earth on all cables at the point of distribution. All equipment to be bonded to earth with the correct sized cable, insulated with PVC green/yellow colour, and the shortest length possible between component and hull. Where cable sheathing is removed for the purpose of making connections, the exposed rubber insulation is to be sleeved with flame retardant material and the cable sealed at the termination of the sheath.

Correct size of cable gland to be used for cables where necessary.

Motors above 5 KW shall equipped with ammeters.

Hour meters to be fitted on major equipment, which will be specified in the mutually agreed list after signing of the contract.

730. ELECTRIC POWER DEVICES

731. Electric Motors

(1) *The motors*, in general, to be designed of squirrel cage induction type and to operate on 440 volts, 3-phase, 60HZ, A.C. and the motors less than 0.4kW and domestic service motors to be designed to operated on 440 volts or 220 volts single or three phase a.c. in accordance with manufacturer's standard.

The domestic service motors and special motors such as galley equipment laundry machines and elevator etc. to be as per manufacturer's standard, regarding insulation and construction of enclosure etc.

(2) Rating

The motors to have continuous rating except those specified hereunder. As far as possible, pump motors to be of the same maker, and all electric pump motors shall have a rated power of at least 5% above the maximum power required for the pump.

Steering gear
Hyd. oil pump for deck machinery

(3) *Insulation* 40% E.D.

All motors to have class B or F insulation in general.

(4) Enclosure

The motors to have minimum IP 22 enclosure and to comply with Class requirements.

(5) Bearing

According to manufacturer's standard.

(6) Speed Changing

All motors to be of single speed, except for motors for E/R ventilation, which are to be two speed..

(7) Space Heater

The each motor for steering gear, hydraulic pump of deck machinery, cargo gear and boat winch motors etc. to be provided with space heater.

(8) Particular of Motor

As for particular of motors, see Hull (Deck Machinery" and "Refrigerated Provision Chamber" etc.) and Machinery Specification (Section 1- "Machinery Particulars").

732. Starters and Controllers

(1) General

In general, the control gears in engine room to be installed in MSB, not to be withdrawable.

The controller cabinets to have interlocking devices with the opening door for convenience to check inside when the motor are running.

The controller to be of marine type drip-proof construction. The control gears for all motors to be of magnetic across-the -line starting type except those for above 60 KW to be of the reduced voltage starting type.

The control for reversible type motor to be operated by push button switch on the control gear.

All above 5 kW motor control boxes to have ammeters.

Hour meters to be fitted on all control boxes for important equipment.

The control gears to have low voltage protection, except for steering gear motors and vital motors used as propulsion auxiliaries which to have low voltage release and which to be automatically started in sequential order in case of emergency starting.

Generally, each control gear to contain the following devices:

Disconnect switch

Control fuses or automatic fuse-breakers

Pilot lamp for source

Sequence start equipment (if necessary)

Magnetic contactor

Overload relay of thermal trip type

Space heater indication lamp (if necessary)

Start and stop push button switch

Running indicating lamp for all motors in general.

However, control gears for motors less than 0.4KW to contain rotary switch only, larger than 0.4 KW may use rotary switch with approval of Buyer.

Steering gear motors to be operated both by push buttons on control gears in steering gear room and by push buttons separately installed in wheelhouse.

The control gears for domestic service motors and special motors such as galley equipment, laundry machines etc. to be as per manufacturer's standard, regarding insulation and construction.

(2) Auto Start and/or Stop

Automatic start and/or stop control gears to be provided with automatic-manual selector switch.

Automatic changeover control gears to be provided with a stand-by unit selector switch for two (2) control gears.

Motors with their starters located in MSB to have local (remote) start/stop push-button control station with run lamp and stop interlock.

As for detail, see Machinery Specifications (remote control, automatic and instrumentation).

Starters on open deck to be IP56, in wet location IP44, yet of fully enclosure marine type.

(3) Emergency Stop Switch

Emergency stop-push button for forced draft fan, engine room ventilating fan, fuel oil and lub, oil transfer pump, fuel oil booster pumps, purifiers, and other similar fuel and lub. oil pumps to be located near engine room entrance.

Emergency stop-push button for accommodation ventilating fans to be located in wheelhouse.

Emergency stop-push button for bilge pump and sludge pump to be located near each accommodation ladder.

Emergency stop switch button to be fitted with plastic covers.

735 Heating Equipment and Welder

Electric power 220 volts A.C. to be supplied for laundry, galley and domestic service motors and heaters.

Electric range and electric welder with electric shock protection to be fed from 440 volts A.C. Welding cable connection box will be arranged on the upper deck, one (1) at the aft and one (1) forward.

AS for details of above-mentioned equipment see Hull and Machinery Specification.

One (1) set of electric heater 1kW to be installed in drying room.

Electric heating of freezing room's doors to be installed.

740. LIGHTING

741. Lighting Fixtures

In general, unless otherwise noted, lighting fixtures and accessories to be as follows:

Non-waterproof type	Accommodation spaces
Waterproof type	Bosun's store, outside spaces exposed to wet and weather, galley, lavatories, bathroom engine room, steering gear room, air condition room, ref. machine space.
Explosion-proof type	Battery room, paint store

In general, unless otherwise noted, the ship to be lighted by incandescent and fluorescent type lighting fixtures as follows:

Fluorescent type	Cabins, officer's mess room, galley and smoking space, wheelhouse, chart space, Ship's /Eng's office, tally office, engine control room, inside passage, engine room, steering gear room, store rooms, outside on decks, fore ship, double bottom and upper deck pipe ducts.
Incandescent type	Other outer spaces and engine room (partially)

All switches to be of double-pole type and all plugs and receptacles to be of three-pole type except special service.

The captain class cabin, officer's galley, and engine control room to be controlled by two-way switch from the both entrances.

Lighting levels shall not be less than those recommended by class and not less than 10 Lux on deck working areas.

The fixtures and outlets to be fed from 220 volts A.C. except otherwise noted, and those material which are installed on exposed weather deck to be of brass.

The fixtures and outlets to light the vessel to be installed as follows:

(1)	Decorative fluorescent type ceiling fixture (flush type) with globe in captain classroom, senior officer class room, engine control room, officer's mess room and smoking space. In addition 2 bulkhead incandescent lights to be fitted in each officer's cabin.
(2)	Fluorescent type ceiling fixture (surface type) with globe in each room, rating's cabin, tally office, ship office, wheelhouse, crew's mess room and crew's smoking room.
(3)	A 40 watts fluorescent type desk light at each desk in cabins.
(4)	An 8 watts fluorescent type berth light with globe at the head of each berth.
(5)	A 15 or 8 watts fluorescent type mirror light with globe and a two-pole type receptacle for razor at the mirror over each washbasin.
(6)	Incandescent type lights for outer passageways.
(7)	Fluorescent type light with guard partially incandescent type light with guard in engine room.
(8)	Suitable number of 400 watts reflector type mercury light for illumination of the main engine and main generator engines cylinder head in engine room.
(9)	Incandescent type ceiling fixture of suitable type in each compartment elsewhere mentioned above.
(10)	Explosion-proof fixtures in battery room, paint store
(11)	The high pressure sodium flood lights to be installed as follows:
	1000 watts (total 8) Four (4) on the fore mast aft illumination, four (4) on the Nav. Bridge front, each wing 2 for fore illumination.
	500 Watts (total 2) Two (2) for pilot ladder areas
	500 Watts (total 2) Two (2) on fore mast fore illumination.
	500 watts (total 2) Two (2) for upper deck aft illumination
	500 watts (total 1) On stern for anti-pirate

The above lights to be controlled from wheelhouse.

(12)	Four (4) portable floods lights for each cargo hold.
(13)	Two (2) 400 watts mercury type projectors for accommodation ladder and controlled from wheelhouse.
(14)	Two (2) 400 watts halogen type projectors for the funnel mark to be pro-

	vided and controlled from wheelhouse.	
(15)	<p>Boat lights and life raft light to be provided as follows:</p> <p>Two (2) 500 watts halogen type boat deck lights near each lifeboat.</p> <p>Above lights to be provided with switches in wheelhouse.</p> <p>Two (2) 60 watts (D.C. 24V) incandescent type boat preparation lights to be provided for each boat and fitted on the boat davit.</p> <p>One (1) each 60 watts (D.C.24V) incandescent type life raft light near each life raft.</p>	
(16)	Two (2) incandescent type chart table lamps with dimmer switch for chart table.	
(17)	A red pilot lamp which indicates (ON) or (OFF) of the light in refrigerating provision chamber to be installed in inner passageway near the chamber.	
(18)	Emergency light to be a part of general light in the following room and spaces to be fed from emergency switchboard and used for emergency lights in case of trouble of main diesel generators.	
	Wheelhouse	Inner and outer passages Stairs in accommodation
	Electric equipment room	Work shop
	Emergency generator room	Engine control room
	Hospital	Engine room
	Offices	Steering gear room
	Public rooms	Emergency fire pump room
	Common toilets	The launching lighting
		Chart space
(19)	Two (2) 40 watts magnetic compass lights to be provided in magnetic compass and feed from 24 volts duplicate source. (24V A.C. & D.C.)	
(20)	<p>Control switches</p> <p>The passageway lights, lights in engine room and other similar spaces to be controlled at distribution board. Lights in outer passageway to be lighted from wheelhouse.</p>	
(21)	Receptacles to be installed as follows:	

	Service	No.	Location
	for Portable light		Engine room, workshop, refrigerating provision chamber, steering gear room, bosuns store, deck stores, wheelhouse, engine control room, air cond. room, electric store hyd. oil pump room.
	for Cargo light	12	Inside of crane columns and in sheltered space fore and aft.
	for General use	Each 3 Each 2 (10 amp)	Each senior officer class room Each public room, each office and all other cabins
	<p>Receptacles for domestic equipment such as electric refr. toaster, cold water fountain, TV and stereo sets to be provided.</p> <p>Each three (3) receptacles to be provided for cleaners in inner passage of each deck.</p> <p>Receptacles for other equipment such as galley equipment and laundry equipment, to be provided as occasion demands.</p>		

Socket on exposed decks to be mounted inside waterproof protection boxes.

2 wall incandescent lights fitted in each officer's cabin.

Lights provided on bridge close to tea table.

Extra floodlight fitted to illuminate main deck

Lights to be provided at Gangway and Pilot area to be switchable from bridge.

743. Navigation Lights and Anchor Lights

A complete set of electric turning lights and signal lights required by the Rules and Regulation to be installed as follows:-

(1) Navigation Light

- 2 - Masthead light (2-60 watts lamp bulbs)
- 1 - Stbd. side light (2-60 watts lamp bulbs)
- 1 - Portside light (2-60 watts lamp bulbs)
- 1 - Stern light (2-60 watts lamp bulbs)

The navigation light indicator-panel (graphic panel) in wheelhouse to be supplied through two (2) separate feeder circuits, one to be led directly from main switchboard, the other from emergency switchboard.

(2) Signal Light

- 2 - 40 watts warning light for propeller (hanging lamp)
- 2 - 2x60 watts anchor lights (fixed type) to be fed through navigation light indicator panel.
- 3 - 2x60 watts not under command lights and deep draught signal lights on separate masts (fixed type) to be fed through navigator light indicator panel.
- 1 - 2x100 watts manoeuvring signal light on radar mast.
- 1 - 60 watts portable daylight signalling light (ALDIS type) with three (3) receptacles (24V. A.C.) through transformer fed from 220V main switchboard and emergency switchboard.
- 1 - 2x40 watts Suez Canal signal lights on radar mast (Fixed type, Red-6, White-5, green-2) and controlled by switch box with visual indicator in W/H.
- 1 - 2x40 watts Suez Canal stern red signal light (fixed type)
- 1 - Suez Canal searchlight (3kW, 220V A.C.) (Davit to be provided on the forecastle deck forward and with approved electric connection in the Bosuns store.)
- 2 - 25 watts blue Panama Canal steering lights on the behind of foremast.
- 2 - 1000 watts Suez Canal search light to be fitted on bridge wings
- 1 set - 3 x 25 watts morse-code signal light on radar mast with three (3) keys. These lights to be commonly used as air horn signal light and to be controlled by the controller.(combined with manoeuvring signal light)

A control switch box for Suez Canal signal light and Suez Canal stern red signal light to be fitted in wheelhouse.

- 1 - Daylight signalling and search light (1000W with shutter) on compass bridge deck controlled at local.

Above signal lights to be fed from 220 volts A.C. both emergency and main supply with change-over arrangement except otherwise noted, and to be controlled from W/H except that Suez Canal search light and propeller warning lights to be controlled locally.

Masthead, side, stern, anchor and NUC/CBD lights to be arranged with spare lights.

750. COMMUNICATION

751. Communication Equipment

Telephone equipment

Telephone equipment to be installed as follows:

(1) Sounder Power Telephone

Common battery telephone to be located as follows:

Wheelhouse (with dimmer)	Engine local control station (with headset)
Master cabin	Engine control room
C/Eng. Cabin	Steering gear room (with headset)
	Fire fighting room
	Emergency gen. room (with headset)
Engine room	Fuel oil filling station
	One (1) portable telephones and two (2) jack boxes

(2) Automatic Telephone

One (1) set of abt. thirty (30) circuits with four (4) simultaneous talking automatic telephone system to be located in accordance with detailed design.

To be fed from 220 volts A.C. and 24 volts battery.

Automatic telephone distribution (approx. 30 circuits/4 simult. systems) to be according to accommodation plan.

Output of automatic telephone system to be connected as input of public addresser.

Telephones in engine room and steering gear room to be of anti-noise type with headset.

MF/HF radio equipment and VHF radio telephone

Radio equipment are in accordance with requirement of GMDSS A1, A2, A3

One (1) set of console type radio station to be installed in radio space as follows (or manufacturer's standard):

(A) MF/HF radio equipment

- 1 - Main transmitter abt. 250W
- 1 - Receiver
- 1 - DSC watch receiver
- 1 - DCS terminal
- 1 - Printer
- 1 - Battery charger
- 1 - Transmitter antenna
- 1 - Receiver antenna
- 1 - Emergency light (DC24)

(B) VHF Radio telephone

- 2 - VHF radio telephone with DSC

One of them to supply signal to VDR, and should put one remote handle in masters office.

(C) INMARSAT C

- 2 - INMARSAT standard C ship earth station with EGC receiver

(D) INMARSAT Fleet broadband

- 1 - INMARSAT Fleet broadband ship earth station, including telefax, telephone and printer to be located in the radio space.
- 1 - Telephone in masters office
- 2 - Message receiving buzzers to be provided in Master cabin and alleyway outside Officers Mess

Both INMARSAT C and Fleet broadband to be equipped with emergency alarm push button.

To be fed from AC 60HZ, 220V and DC 24V.

Two-way VHF radio telephone

Three (3) sets of two-way VHF radio telephone and (1) set battery charger for three telephones to be provided.

Walkie talkies

Six (6) sets of Walkie Talkies to be provided. A non-boostered Assist Antenna system to be provided with these Walkie Talkies for E/Room and on Deck.

752. CCTV

VSAT system to be fitted, outlets in captain's cabin, chief engineer's cabin, officers lounge & Crew's lounge.

Two (2) cameras CCTV system with VCR multi-player on monitor (LCD) in cargo office, the position to be at gangway connection port/starboard. The system to be cabled with a composite cable for power/signal.

The camera casing should be of 316L stainless steel.

753. Local Area Network

LAN network to be established and connection to be arranged in the following rooms: Wheelhouse, Radio station, Cargo control room, Engine control room, Conference Room, Captains cabin, Chief Engineer, Chief officer, 1st Engineer, 2nd Engineer, 2nd Officer.

Cables to be routed to Server cabinet in Converter room. LAN cables to be shielded types of category 6E.

Server and network equipment to be Buyers Supply.

754. Broadcast Equipment

Stereophony

Each one (1) set of stereophony including a stereo radio receiver and CD deck to be supplied by Buyer and installed by the Builder in officer's smoking space and crew's smoking space respectively.

Antenna multicoupler system for b.c. radio and TV receiver

One (1) set of B.C. radio and TV receiver antenna multicoupler to be installed as follows:

1 - Distributor	Radio space
each 1 - Receiving outlet (with source receptacle)	Public rooms and each private cabin, offices, officer's smoking room etc.

To be fed from 220 volts A.C.

TV receiver

Each one (1) set 32 inches, LCD type TV receiver to be supplied by Buyer and installed by Builder in each officer's smoking room and crew's smoking room.

755. Intercommunication and Command Systems

One (1) set of public address with talk back system to be installed as follows:

1 - 100 watts or suitable amplifier	Radio space
-------------------------------------	-------------

- 2 - Remote control units W/H and fire control room
- 1 - 50 watts weatherproof loud speaker Compass bridge deck
- 8 - 10 watts drip-proof loud speaker 6 - Engine room, Bow upper deck aft one each
- 4 - 5 watts speaker 2 - Bridge wings
1 - Galley
1 - Steering gear room
- Each 1-2 watts speaker (total abt. 20) Suitable position of innerpassageway (double face), engine control room, officer's mess room and crew's mess rooms
- 6 - Microphone 2 - Wheelhouse, both wings, bow, upper deck aft

To be fed from 220 volts A.C. and 24 volts D.C.

The system to be interconnected with the automatic telephone system for operation from selected telephones.

756. Internal Telephones

Call signal system to be installed as follows:

Engine control room (push button)	Engineer's and engine crew's quarter passageway, officer's mess and smoking room, crew's mess and smoking room (buzzer)
Each refrigerated provision chamber (switch)	Galley (bell with red lamp)
Hospital at each head of bed (push button)	Wheelhouse and doctor's room (buzzer)

To be fed from 24 volts battery.

In addition to the above two (2) audible signals and four (4) rotating lights to be provided in engine room and to be sounded by telephone's calling signal and engineer's alarm signal in engine control room, in order to announce to engineers in engine room.

This system to be fed from 24 volts D.C.

757. General Alarm and Alarm Bells

20 cm bell:

- Navigation bridge deck inner passageway 1
- D deck inner passageway 2
- C deck inner passageway 2
- B deck inner passageway 2
- A deck inner passageway 2
- Upper deck inner passageway 3
- Steering gear room 1
- Mess room each 1
- Forecastle 1

12 cm bell with flash lamp :

- Engine control room, working shop 2

Electronic horns with rotating lamp :

- Engine room 2

One set of engine room group alarm device with alarm light columns fed from emergency AC 220V shall be provided.

Manually operated push button switch (deadman alarm system) :

- Wheelhouse 1

To be fed from 24 volts battery.

Engineer's alarms

One (1) set of engineer's alarm system consists of motor, pressure, temperature, and level alarm to be installed at engine control room.

As for detail see Machinery Specifications.

In addition to the above, a steering motor alarm panel to be provided in wheelhouse and engine control room consisting of running indicating lamp and stop alarm with visual and audible signals for each motor.

Fire detection and alarm system

One (1) set of fire detection and alarm system to be installed as follows:

Fire alarm control and indication equipment:	Wheelhouse
Fire alarm repeater:	Fire control station
Heat detector:	Galley, smoking room, workshop, above main engine and generator engines, mess room, pantry

Heat detector of explosion-proof:	Battery room
Smoke detector:	passage, stair, engine room, steering gear room, machinery space, cargo holds
Push button:	Passage near the exit, engine control room, entrance to the E/R, steering gear room etc.

The fire alarm is used as common with general alarm system, as specified in subsection 10.4.

Heat detectors required in mess rooms/pantries.

Fire detection system to be addressable.

CO₂ releasing alarm system

One (1) set of CO₂ releasing alarm system to be installed as follows:

Valve switch and indication lamp:	CO ₂ room
Control box door switch:	Fire control room
Rotating lamp and motor siren:	Engine room
Rotating lamp and electric alarm sounder:	Engine control room

The system to be fed from DC 24V.

The ventilating fans, F.O. pumps and L.O. pumps in engine room shall be stopped automatically when this alarm is operated.

Horn control system

One (1) set of air horn and electric motor horn with auto fog signal control system to be installed as follows:

1 - Electric horn with heater	Fore mast
1 - Air horn with heater	Radar mast
1 - Horn controller:	W/H control console
1 - Push button (N.W.T.)	W/H
2 - Push button (W.T.)	W/H wings
1 - Signal light:	Radar mast

Horns on the fore and radar mast to be mounted on resilient mounts to prevent the transmission of vibration.

Auto bell and gong system provided for a vessel at anchor.

758. Engine Order Telegraph

One (1) set of engine order telegraph system of electric type to be installed as follows:

- | | |
|--|---------------------|
| 1 - Engine telegraph bridge unit
(console mounted type) | Wheelhouse |
| 1 - Engine telegraph control room unit
(console mounted type with bell) | Engine control room |
| 1 - Engine telegraph local unit with gong | |
| 1 - Logger in wheelhouse | |

To be fed from 220 volts A.C.

One (1) set of sub-telegraph to be provided.

As for interlock with main engine handle, see Machinery Specifications.

759. Navtex Receiver

One (1) set of NAVTEX receiver to comply with MSC 148(77) to be installed as follows:

- | | |
|--------------|--------------|
| 1 - Receiver | Chart space |
| 1 - Antenna | Compass deck |

To be fed from AC 60HZ, 220V or 24V D.C.

760. ELECTRIC NAVIGATION EQUIPMENT

The equipment under this heading to be delivered and installed by the Builders. All necessary components for trouble free operation as well as standard spare parts and installation materials to be included in the supply.

761. Gyro Compass and Autopilot

One (1) set of gyro compass to be installed and fed from 220 volts A.C. and 24 volts D.C.

(1) Gyro Compass

The gyrocompass to consist of following parts:

- | | |
|---|-------------|
| 1 - Master compass | Wheelhouse |
| 1 set - Accessories (with power fail alarm) | Wheelhouse |
| 1 - Course recorder | Chart space |

6 - Repeater compasses :

- One (1) steering stand
- One (1) wheelhouse front
- One (1) for each navigating bridge wing
- One (1) in captain's day room
- One (1) in steering gear room
- Gyro signal to be also provided for two (2) radars.

One magnetic compass complete with signal outlet to autopilot.

(2) Auto Pilot

Auto pilot to be of micro processor controlled digital type.

The steering system to have following mode:

- 1 - Automatic steering
- 1 - Follow-up steering
- 1 - Non follow-up steering
- 1 - Rudder order indicator
- 1 - Override unit

The equipment shall include 1 rate of turn indicator, 1 magnetic compass compensator unit and 1 off course alarm and fed from starter of steering gear.

762. Depth Sounder

One (1) set of echo depth sounder to be installed as follows:

- | | |
|--|------------------|
| 1 - Recorder | Chart space |
| 1 - Sub-indicator with shallow water alarm | Wheelhouse |
| 2 - Transducer (1 active & 1 spare) | Bottom of vessel |

The operation frequency to be of 200 kHz. Sounding range is 0-500 m.

To be fed from 220 volts AC and 24 volts DC.

Signal to be sent to VDR

763. Rudder Angle Indicator

One (1) set of electric rudder angle indicator system of self-synchronous type to be installed as follows:

- | | |
|--|---|
| 1 - Transmitter | Steering gear room |
| 3 - Indicators (200mm dial with dimmer switch) | Wheelhouse, Navigation bridge each wing |
| 1 - Indicator (120mm dial) | Engine control room |
| 1 - Indicator (200mm dial) | Steering gear room |
| 1 - Indicator (200mm dial) | Captains room |

The centre rudder indicator to be of three-face type.

To be fed from DC 24V.

764. Speed/Log Indicator

One (1) set of single axis doppler speed log system (incl. sea valve) to be installed as follows:

1 - Transducer unit	Bottom of vessel
1 - Main electronics unit	Chart space
3 - Speed indicator	Wheelhouse and each bridge wing
1 - Speed indicator	Engine control room

To be fed from 220 volts A.C.

765. Revolution Indicator

(1) Electric Propeller Shaft Tachometer

One (1) set of propeller shaft tachometer system to be installed as follows:

1 - Transmitter	Engine room
3 - Indicators (200mm dial with dimmer switch)	Wheelhouse and each bridge wing
3 - Indicators (120mm dial)	Engine control room, C/E day room, steering gear room
1 - Revolution counter	Engine control room

The transmitter to be connected to intermediate shaft of main engine.

(2) Electric Turbo-Charger Tachometer

See Machinery Specifications.

766. Radar Equipment

Two (2) sets of true motion colour type marine radar with ARPA system and to be installed as follows:

2 - Display unit 16 inch (of TFT type)	Wheelhouse
Peak power	min. 25 kW
Max. range	96 miles
Wave length	3 cm, 10 cm each one

- | | |
|-----------------|-------------|
| 2 - Transceiver | Chart space |
| 2 - Scanner | Radar mast |

Interswitch possibility

Interface with DGPS, Doppler log and gyrocompass.

To be fed from 220 volts A.C. or 440 volts A.C.

767. Electric Whistle / fog signalling

See 757.

- ## 768. Satellite Navigation

Two (2) sets of DGPS navigator to be provided as follows and fed from A.C. 220V and 24V D.C.

Each set complete with gyro and log interface and connection to autopilot.

- | | |
|--------------|-------------|
| 2 - Receiver | Chart space |
| 2 - Antenna | Radar mast |

769. Facsimile Receiver

One (1) set of 10" weather facsimile to be installed as follows:

- | | |
|--------------|--------------|
| 1 - Receiver | Chart space |
| 1 - Antenna | Compass deck |

To be fed from 220 volts A.C.

770. MISCELLANEOUS ELECTRIC EQUIPMENT

- ## 771. ICCP System

One (1) set of ICCP system to be provided as follows:

- 1 - Electronic automatic transistorised controller power unit
- 2 - Recessed elliptical mixed metal oxide anodes
- 2 - Recessed high purity zinc reference electrodes
- 1 - Propeller shaft grounding assembly
- 1 - Rudder stock bonding cable

To be fed from 220 volts, 1 phase, 60HZ

772. Voyage Data Recorder (VDR)

A Voyage data recorder is to be installed as per IMO Solas Chapter V reg 20.

773. Master Clock System

One (1) set of crystal controlled electric clock system to be installed as follows:

1 - Master clock	Chart space
1 - Slave clocks	
1 - Three (3) hands (with silent time)	Near radio console
2 - Three (3) hands	1 - Wheelhouse 1 - Central control room
24 - Two (2) hands (single face)	1 - Captain's day room (decorative) 1 - Bed room 1 - Chief engineer's day room (decorative) 1 - Bedroom 1 - Chief officer's room 1 - 2nd engineer's room 1 - 2nd officer's room 1 - 3rd engineer's room 1 - 3rd officer's room 1 - 4th engineer's room 1 - Electrician's room 1 - Bosun's room 1 - Trainee Engineer's room 1 - Officer's mess room (decorative) 1 - Officer's smoking room (decorative) 1 - Crew's mess room 1 - Galley 1 - Hospital 1 - Combined Deck / Engine office 1 - Cook's room 1 - Cadets Room 1 - Fitter's room 1 - Gymnasium 1 - Pilot room

To be fed from 220 volts A.C. and 24 volts battery.

Time signals to be given to the telegraph logger from the master clock.

774. Emergency Position Indicating Radio Beacon (EPIRB)

One (1) sets of 406 MHz emergency position indicating radio beacon (EPIRB) to be provided on Bridge Deck

775. Radar Transponder

Two (2) sets of radar transponder (9GHZ) to be provided.

776. Identification Systems

An automatic identification system (AIS) according to IMO regulations to be installed.

Long range identification and tracking system (LRIT) according to IMO regulations to be installed.

777. Anemometer

One (1) set of vane type anemometer to be installed as follows:

- | | |
|-----------------|-------------|
| 1 - Transmitter | Radar mast |
| 1 - Indicator | Chart space |

To be fed from 220 volts A.C.

778. ECDIS

ECDIS system with official ENC charts to be installed. Hardware and software to be of class approved type. The monitor to be 23".

C-MAP's CM-93/3 Cartography, CM-ENC, or equivalent should be provided for the specified ECDIS/ECS system. In order to facilitate the start-up, sea trial and initial voyage, C-MAP will provide appropriate (CM-93/3) cartographic coverage for 3 months, free of charge.

779. SS Alert System

A ship's security alert system to be installed.

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

Spare parts

Spare parts to be furnished in accordance with the requirements of the Rules and Builder's standard for two year service

Outfits

The following outfits to be furnished:

- 1 - Megger, in megohm scale with 500 volts
- 1 - Circuit tester
- 1 - Portable clamp-on type combination volt ammeter for A.C. measurement
- 1 - Electric soldering iron 220 volts 150 watts
- 1 - Resin cored solder (3kg)
- 2 - Knives

- 3 - Plus screw drivers (large, middle & small)
- 3 - Minus screw drivers (large, middle & small)
- 2 - Pincers
- 2 - Nippers
- 2 - Universal screw-wrenches
- 2 - Test lamps
- 2 - Flash lamps with two (2) cells
- 1 - Pair of electrician's rubber gloves
- 12 - Vinyl tape (red, blue, black, yellow, green, brown)

781. Storage of Tools, Spares and Stores

All parts to be properly stored in boxes with clear identification of all items. For checking see 581.

782. Storeroom with Outfit

Suitable lockers with shelves and drawers to be provided for storage of electric tools, spares, chemicals and stores.

783. Standard Tools

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

784. Class Spare Parts

To be delivered as recommended by Class 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**800. CENTRALIZED INSTRUMENTATION, GENERAL**

The alarm-, control- and monitoring system to be designed as an integrated system (ICMS)

The extent of alarm, monitoring and control systems to be in accordance with the rules and regulations as well as with the Buyers' and manufacturers' recommendations for all equipment and systems.

Centralized controls, instrumentation and monitoring equipment, suitably arranged in consoles, for one-man operation/watch.

Necessary redundancy to be built into the various systems.

Aim of optimum reliability and simplicity of any control circuits.

All electronic equipment to be properly protected against sustained and transient overvoltages and electric noise.

Where possible, safety systems to be designed as NO-circuits and alarm systems as NC-circuits.

The automation and instrumentation plant to be built with separate sensors for alarm circuits and safety circuits according to Class requirement.

All instrumentation and control systems to be of electronic solid state design on a fully modular concept incorporating the minimum number of different types of standard modules.

Instrumentation components such as instruments, transducers, pressure and temperature switches, limit and level switches, signal lamps, relays etc. to be standardised to the same make, type and size as far as practical.

Consideration to be given to the design of all equipment to the environmental conditions of shipboard tropical service and proven marine components to be employed. Particular emphasis to be placed on corrosion, temperature, vibrations, power supply, and electrical interference effects.

System arrangement to be such that no single fault, failure of power supply of system, malfunction will prevent effective plant control being retained.

Standard modules of one manufacturer shall be employed to the greatest possible extent.

All instruments and displays to be of SI-units.

The total automation system to be split up in independent systems:

1. Alarm-, control- and monitoring system
2. Main engine safety system
3. Main engine safety- and slowdown system
4. Main engine remote control system
5. Auxiliary engines start, stop and control system

In addition the following equipment to be integrated in the ICMS system:

Power management system for DG sets
Remote valve control
Tank level gauging system
Mimic pictures of min. 25 pictures.

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

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

Instruments, sensors and controls to 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 and calibration equipment to be delivered from the same supplier and the same manufacturer.

A detailed specification with associated drawings to be submitted for Buyer's approval.

The bridge control desk to be carefully designed with a view to safe operations and ergonomic considerations according to operation.

An engine control room to be arranged adjacent to the engine room. The control room to be well ventilated and to contain all necessary equipment for obtaining unmanned classification.

810. MANOEUVRING CONSOLES, MAIN CONSOLES

Manoeuvring consoles for control of main engine are to be provided.

811. Consoles. Lay-Out

The central control console in the wheelhouse to be built-up from standardized modules of a common base welded to the ship's platform and painted with store hardened Hammertone finish or similar.

Internal wiring to be well marked.

813. Alarm System

An automatic continuous alarm monitoring system for all essential equipment to be arranged. Wherever possible the system should be fully integrated with the (ICMS) system.

The alarm system shall indicate incoming alarms on the central visual display unit, located in the engine control room.

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

The bridge alarm panel and the cabin watch calling to be connected to the ICMS system.

The alarms monitored in the wheelhouse to be in accordance with class requirements and Buyer's requirements.

Alarm to be fitted from hospital to bridge.

The engine monitoring cabinet to 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 to be part of the control system in 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

890. AUTOMATION EQUIPMENT FOR OTHER MACHINERY COMPONENTS

A load computer to be installed including software. The load computer to be interfaced to the ICMS system.

The loading computer to be able to handle:

- Intact, damage and grain stability
- Longitudinal strength, intact and flooded
- Mass/draft restrictions
- Loading sequence for planning of loading and discharge

892. Remote Tank and Draft Gauging System

An electro-pneumatic remote tank and draft gauging system to be fitted. System to be integrated to alarm and monitoring system and co-ordinated by the system supplier.

Remote tank gauging to be arranged for the following tanks:

- Bunker tanks
- Service and settling tanks
- Ballast tanks *)
- FW tanks

The sounding of the tanks to be displayed on the VDU in engine control room and also in the Cargo Control Room.

One set of water ingress alarm system to comply with SOLAS Chapter XII Reg. 12 & 13 and one alarm panel in wheelhouse to be installed. Remote pumping facilities to be supplied for forward part as per Rule's requirement.

*) = If possible level indicator to be a part of the water ingress alarm system for cargo hold no. 3.

900. - 999. CARGO SPACES AND CARGO HANDLING

In general operating temperature of all exposed deck equipment such as, but not limited to, cranes, hydraulic aggregates, hatch covers shall be from minus 20 deg. C. to plus 45 deg. C.

In general protection should be arranged for all deck equipment exposed to deck cargo damage.

910. ACCESS TO CARGO COMPARTMENTS**911. Weather Deck Cargo Hatch Covers**

Hatch No. 1 (L x B)	:	16.0 x 18.7/15.0 m
Hatch No. 2-5 (L x B)	:	19.2 x 20.3 m

Type: End folding steel hatch cover (4 panels to each cover, except hatch no. 1 with 2 folding panels and 1 hinged).

Hatch covers to be hydraulically operated, manually cleated and supported on low friction sliding or flexible pads or equivalent.

The hatch covers to be double-skin construction fitted with 4 integrated grain feeder openings and 1 cement feeder opening (centre of hatch) per cargo hold.

Gas sampling and temperature measuring points to be arranged in hatch covers (alternative hatch coamings) for each cargo hold.

920. OUTFIT OF CARGO SPACES**924. Stairs and Ladders**

For access to each cargo hold, one spiral ladder and one vertical staggered ladder to be provided.

Suitable cargo and grab protection to be arranged for all ladders.

Ladder arrangement to comply with AMSA rules.

927. Cargo Securing System

Recessed lashing rings to be arranged in cargo holds 2, 3 and 4 on longitudinal bulkheads. Horizontal distance 1.6 m staggered 0.3 m and 1.5 m above tanktop.

Lashing points to be arranged along the longitudinal hatch coaming with a distance of max. 1.5m

930. CARGO GEAR**934. Store Cranes**

- 2 - Store cranes to be installed and arranged SB and PS for provisions and spare parts as per General Arrangement. (Cranes can be combined MOB-boat/ life-raft/provisions). Only one crane to be of luffing type for spare parts and provisions.

SWL 1,5 t at 5.0m outreach for MOB

One SWL 3.0 t at approx. 10.0 m outreach to suit arrangement of hatch for spares and provisions.

935. Cargo Cranes

The four (4) sets of electro-hydraulically driven deck cranes of two wires type shall be provided on upper deck for harbour operation of cargo, as shown on the General Arrangement.

The deck cranes shall be designed, constructed and equipped according to the manufacturer's standards, unless otherwise specified, in compliance with the Rules and Regulations.

Cranes to be prepared for operation with electro-hydraulic grabs.

Max. SWL applicable for continuous grab operation in harbour and offshore mode to be stipulated by the supplier.

(a) Particulars

The particulars of the cranes shall be as follows in accordance with the manufacturer's standards;

Capacity	:	30 tons (SWL) at hook
Type	:	Single jib, wire luffing
Speeds (full load)	:	
- Hoisting	:	Min. 22 m/min.
- Slewing	:	Min. 0.8RPM
- Lowering	:	Min. 40 m/min.
- Luffing time	:	Max. 65 sec. (from max to min. working radius)
Working radius	:	
- Maximum	:	26.2 m
- Minimum	:	Less than 4.0 m
Slewing angle	:	360°, endless

The cranes shall be so designed that three (3) motions (hoisting, luffing and slewing) shall be made possible under the full load simultaneously.

The cranes shall be operable at 5° heel and 2° trim.

(b) Control and safety devices

The deck cranes shall be operated by two (2) control handles in the operator's cabin, i.e. one (1) handle shall be used for hoisting and another for luffing and slewing. The following safety devices shall be provided according to the manufacturer's Standards:

- Deadman switch
- Limit switch for hoisting (upper & lower)
- Limit switch for jib (upper & lower)
- Adjustable limit switch for slewing
- Audible alarms for drivers
- Interlock for prevention of starting the cranes at low power availability

(c) Crane body and crane jib

The crane body shall be constructed with welded steel plate and hoisting, luffing and slewing devices shall be mounted inside the crane body.

Each operator's cabin shall be equipped with control handle, control panel, one (1) electric window wiper, one (1) air conditioning unit (dust filter on inlet), ceiling light, openable window etc, in accordance with the manufacturer's standards.

The hoisting winch, luffing winch and slewing motor(s), including necessary electric and hydraulic motors shall be installed inside the crane body.

Necessary oil cooler by air and heating device shall be provided for hydraulic system in the crane body. Oil coolers to be sized for continuous grab operation in tropical conditions.

The heating device shall be provided to warm up the hydraulic system against the freezing weather according to the manufacturer's standard.

Two (2) cargo flood lights of 500 W halogen type shall be fitted outside of the cabin.

The crane jib shall be of box type construction with welded steel plate and mounted with an inclinometer, the hoisting and luffing sheaves on the end of it.

Crane pedestal and jib rest

Four (4) crane pedestals of fabricated steel plate shall be installed on upper deck as shown on the General Arrangement.

The vertical ladder shall be provided in compliance with the AWWF requirement, and the access to the crane shall be made internally.

The jib of deck crane shall rest on the hardwood lined jib rest on the other crane.

The pad eyes shall be fitted on deck for securing the hook.

The design and equipment of crane pedestal shall be in accordance with the manufacturer's recommendation.

The height of jibs in stowed position to be sufficient to allow 6 m stowage of timber on hatch covers and unrestricted operation of hatch covers with jibs in resting position.

(d) Grab Seats

Four (4) grab seats according to Buyers choice of grabs, to be provided on upper deck as per General Arrangement.

(e) Others

Other specifications including spare parts, tools and accessories of the deck cranes shall be in accordance with the manufacturer's standards, unless otherwise specified.

936. Mucking Winches

2 - Portable air driven mucking winches with movable davit to be provided.

Lifting capacity to be sufficient for unloading cleaning equipment and basket with cargo residues.

970. CARGO SPACE VENTILATION

971. Ventilation Requirements

Four natural (coal ventilators) ventilator openings for each cargo hold to be provided, two fore and two aft of each hatch.

Spark arresting screens to be provided for all natural ventilation openings.

975. Trunking and Dampers

Fire dampers and water traps above upper deck in all ventilation trunks.

Ventilators are to be installed with stainless steel rat proof wire nets.

980. CARGO HOLD WASHING

A portable air/water-driven cargo hold washing to be provided. The system to consist of :

- 2 Combi-guns (Air 0.7 MPa, SW 0.7 MPa, 20 m³/h)
- 1 Mini-gun (FW flushing, FW 0.7 MPa, 100 litre/min.)
- 1 Spray foam equipment
- 2 portable air-driven bilge water pumps (35 m³/h)

Compressed air and sea and fresh water to be available in each cargo hold at tanktop level.

Quick coupling standard valves for connecting short-length flexible hose for combi-gun to be arranged recessed in the transverse bulkhead close to the tanktop. Recess to be closed by a easy dismountable hinged bolted cover.

To avoid unintentional water ingress from hold washing water line, when not in use, blind flange or spool piece to be provided. (see also 332. and 365).

Two tanks aft in way of ballast wing tanks to be arranged as washing water holding tank.

One common washing water line to be arranged from cargo holds to the washing water holding tank. A direct overboard discharge of washing water to be possible.

A separate bilge well aligned with mucking davit on upper deck to be arranged in each cargo hold. Each bilge well to be arranged with stainless steel strainer.

1000. - 1099. SHIP'S TOOLS, SPARES AND STORES**1000. GENERAL**

Storage of machinery and electric items in accordance with 581 and 781. Storage or deck items to follow similar guide lines as applicable.

With reference to spares of Builders supply, lists to be submitted and agreed.

1010. NAUTICAL INSTRUMENTS (Builder's supply)

- 2 - Prism binoculars (7 times magn.)
- 1 - Aneroid barometer (in chart room)
- 1 - Thermometers (for atmosphere)
- 1 - Thermometer (wet and dry bulb-double type)
- 1 - Thermometer (for sea water)
- 1 - Sextants
- 1 - Chronometer (quartz)
- 1 - Clinometers, clock type (wheelhouse)
- 5 - Clinometers, pendulum type (engine room, chief officer's cabin, captain's day room, ship's office, control room)
- 2 - Chart dividers (200mm)
- 1 - Chart compass (200m)
- 1 - sets - Parallel ruler (1-60 cm, 1-30 cm)

As for electric nautical instruments, such as gyro compass, radar, echo sounder, ship's log, etc., refer to Electric Specification.

1020. FLAGS, SIGNALS, LAMPS - Builder's Supply

Signal equipment to be furnished as follows:

- 1 - Fog horn
- 3 - Black balls, 610mm dia., to be made up canvas folding type
- 1 - Diamond shape
- 1 - Black cylinder shape

For electrical signal lights, refer to Electric Specification".

Flags to be equipped as follows:

- 2 - National flags (one large and one medium)
- 1 - set - International signal flags

- 1 - set - Pilot flag (GH)
- 1 - Blue Peter (P)
- 1 - Quarantine flag (Q)
- 1 - Set of national flags for 10 nations to Buyer's choice, medium size

Others:

- 1 - Aldis lamp
- 4 - Cargo clusters

1030. GALLEY, MESS AND CABIN INVENTORIES (Buyer Supply)

- 1031. Cooking Utensils and Kitchen Ware
- 1032. China, Cutlery, Glass Ware
- 1033. Napery
- 1034. Pillows, Cushions, Blankets, Bed Linen
- 1035. Towels
- 1036. Mattresses (**Builder's Supply**)
- 1038. Medicine Chest, as per rules
- 1039. Lifeboat Rations, as per rules

1040. DECK TOOLS, SPARES AND STORES

- 1042. Other Cleaning Tools (Builder's supply)
- 1043. Paint Tools
 - 4 - Chipping hammers
 - 6 - Paint scraper with handles
 - 5 - Paint brushes
 - 3 - Long handle paint brushes
 - 5 - Paint pots
 - 2 - Tar brushes
 - 2 - Wire brushes

Builders supply

1044. Hand Tools

- 2 - Common hammers
- 1 - Claw hammer
- 2 - Chisels
- 2 - Planes

- 1 - Carpenter toolbox
- 2 - Hand saws
- 2 - Common spanners

Builders supply

1045. Staging (for Painters), one set

Builders supply

1047. Standard - Spares - Builders Supply

- 2 - Spare windowpanes for each size and type of windows and portlights
- 1 - Spare joining shackle for anchor cable
- 2 - Chain hooks
- 1 - Spare taper pin for kenter joining shackles
- 1 - Spare taper pin for anchor shackles
- 2 - Anchor hammers
- 1 - Disengaging tools for kenter joining shackle

1048. Standard Stores Builders Supply

- 2 - Orange anchor buoys with wire ropes
- 1 - Shackle punch
- 1 - Pin punch
- 4 - Fenders
- 2 - Sounding rods with line
- 4 - Keys for sounding rod caps
- 2 - Grease guns adaptable to standard grease fittings used
- 3 - Canvas covers for compass (and repeaters, if any outside)
- 1 - Workbench with screw-vice mounted in forecastle
- 4 - Rubber door mats for each exterior door to accommodation
- 2 - Extension ladders of light alloy
- 2 - Boatswain chairs
- 10 - Rat guards

1050. MACHINERY TOOLS

The following tools are in excess of those in 583.

1051. General Hand Tools (Builder's Supply)

The vessel is to be furnished on board with general tools and outfitings of the following list in according to Builder's standard.

- | | |
|----------------------------|---------------------------------------|
| 1 - Dial gauge with holder | scale range 10 mm (min scale 0.01 mm) |
| 1 - Micrometer (outside) | scale range 0-25 mm |
| 1 - Vernier calliper | 300 mm |
| 2 - Marking scribes | length - 220 mm |
| 1 - Hand tachometer | 18000 r/min |
| 1 - Surface gauge | 290 mm height, 250 mm spindle length |
| 1 - Square | 300 mm |

1 -	Feeler gauge	16 leaves (length 100 mm)
2 -	Inside callipers	300 mm & 200 mm (each one)
2 -	Outside callipers	300 mm & 200 mm (each one)
2 -	Steel scales	1000 mm & 300 mm (each one)
2 -	Steel tape measure for tank sounding with weight	20 m
2 -	Thermometers with holder	100 deg. c
1 -	Bare thermometer (mercury)	500 dec. c
22 -	Straight shank drills 3 mm, 4mm, 5 mm, 6 mm, 7 mm, 8 mm, 9 mm, 10 mm, 11 mm, 12 mm and 13 mm (each two)	
16 -	Spanners 17, 19, 22, 30, 32, 36, 46 and 55 mm (single and open ended)(each two)	
10 -	Spanners (double and open) 17x19, 24x27, 30x32, 36x41, 46x50 mm (each two)	
5 -	Ring spanner	17x19, 24x27, 30x32, 36x41, 46x50 mm (each one)
2 -	Monkey wrenches	300 mm & 200 mm each one
2 -	Pipe wrenches	600 & 300 each one
2 -	Screw drivers	100 & 150 mm
4 -	Cross drivers	100, 150, 200, 250 each one
1 -	Punch	125 mm
9 -	Files (large) (each rough, medium & fine)	300 mm flat, round & half round
8 -	Files(small) 140 mm flat, round, half round & triangular (each medium & fine)	
1 -	Wooden hammer	
4 -	Scrapers	flat & bamboo leaf (each 450 mm & 350 mm)
2 -	Centre punches	
4 -	Cutting punches	12.5, 16, 19 mm & 24 mm
6 -	Chisels	flat type 160 mm & cross cut type 200 mm (each three)
2 -	Chisels	oil groove cut
2 -	Scissors for metal	flat edge type 300 mm, round edge type 250 mm
1 -	Set of hacksaw frame hacksaw 12 pieces & hacksaws	
1 -	Bench vice	with mouth protector
1 -	Oil stone with wooden bed	
1 -	Torch lamp (kerosene)	
6 -	Oil feeders (polyethylene)	
1 -	Grease pump	
2 -	Wire brushes	
6 -	Wedges	150x25 & 250x50 (each three)
12 -	Eye bolts	M10, 12, 16, 20 (each three)
120 -	Sets of bolts & nuts	M10, 12, 16, 20 (each 30 sets)
120 -	Steel washers	M10, 12, 16, 20 (each 30)
120 -	Split pins 2 mm x 12 mm, 3 mm x 15 mm, 4 mm x 25 mm & 5 mm x 55 mm (each 30)	
1 -	Set of tap & dies with case	
1 -	Sounding scale for tank	2000 mm with 17,000 mm rope
1 -	Lead hammer	
1 -	Sledge hammer	
2 -	Waste boxes	
1 -	Crow bar	25 mm dia., 1000 mm length
2 -	Rubber air hoses with 15 mm dia. 10 m length coupling	
8 -	Valve turning wrenches	

- 5 - Chain blocks
- 3 - Sheets of steel plates t x w x l: 1.6 x 950 x 2000 mm, 2.2 x 950 x 2000 mm, 3.2 x 950 x 2000 mm

The spares to be supplied in compliance with the requirements of classification society and maker's standard.

1053. Lubrication and Grease Tools

Buyer's supply according to contract

1070. ELECTRIC TOOLS

Buyer's supply - lists to be agreed

1071. General Tools

Buyer's supply - lists to be agreed

1072. Mechanical Tools

Buyer's supply - lists to be agreed

1073. Measuring Devices

Buyer's supply

1080. ELECTRIC SPARES AND STORES - Builder's Supply

Electrical spares and stores to be as per Builder's standard supply according to the following list:

- 1 - Digital multimeter, DT-830
- 1 - Clamp-on ammeter, F-302
- 1 - Plier universal, 203 mm (8")
- 1 - Plier needle nose, 162 mm (6")
- 1 - Cutting plier, 162 mm (6")
- 1 - Peeling plier, 203 mm (8")
- 1 - Adjustable spanner, 102 mm (4")
- 1 - Adjustable spanner, 203 mm
- 1 - Knife
- 1 - Set screw driver crossheads (8 units)
- 1 - Screw driver, short handle, 2.6 mm
- 1 - Screw driver, short handle, 4 mm
- 1 - Screw driver, short handle, 6 mm
- 1 - Screw driver, long handle, 2.6 mm

- 1 - Screw driver, long handle, 4 mm
- 1 - Screw driver, long handle, 6 mm
- 2 - Watch marker screw drivers, 1.6 mm
- 1 - Soldering iron, 60 W, 220 V, bend head
- 1 - Soldering iron, 160 W, 220 V, rod type
- 1 - Snips
- 1 - Hammer, 1 kg
- 1 - Hammer, 0,5 kg
- 1 - Pair of rubber gloves
- 2 - Soldering iron
- 2 - Hydrometers
- 2 - Rolls of insulation tape of each following colours: red, yellow, brown, blue, black (to be marked in polyvinyl fluoride)
- 10 - Sheets of sand paper, no. 1
- 2 - Flash lights, w/battery
- 2 - Bottles distilled water, 20 l
- 1 - Bottle sulphuric acid, 10 l
- 1 - Megger, 500 V

1081. Additional Generator Spares

Buyer's supply according to contract.

1082. Switchboard Spares

Builder's supply to be as per manufacturer's standard.

For main switchboard in general:

- No fuse breaker (1 for each 10)

For main switchboard and emergency switchboard:

- Fuse element (1 for each 10)
- Spring (ACB & relay) (1 for each 10)
- Contact-segment for ACB (1 for each 10)
- Contact-segment for relay (1 for each 10)
- Magnetic coil (1 for each 10)
- Resistor (1 for each 10)
- Pilot lamp (1 for each 10)

- Globe of pilot lamp (1 for each 10)
- Rectifier (1 for each 10)
- Condenser (1 for each 10)
- Control switch and change over switch (1 for each 10)
- Relay
- Timer (1 for each 10)

For control gear magnetic contactor:

- For motors of 30 kW and below, 1-complete set for each 10 or less

For motors of more than 30 kW:

- Contact segment (1 for each 2)
- Spring (1 for each 4)
- Magnetic coil (1 for each 6)
- Aux. relay (1 for each 10)
- Over current thermal relay (1 for each 10)
- Pilot lamp (1 for each 10)
- Globe of pilot lamp (1 for each 10)
- Potential transformer for control circuit (1 for each kind)
- Potential transformer for pilot lamp (1 for each 10)
- Push button (1 for each 10)
- Control switch and change over switch (1 for each 10)
- Resistor (1 for each 10)
- Rectifier (1 for each 10)
- Condenser (1 for each 10)
- Printboard (1 for each kind)

For section and distribution boards and group panel:

- Pilot lamp (1 for each 10)
- Globe of pilot lamp (1 for each 10)
- Relay (1 for each kind)
- Timer (1 for each 10)
- Rectifier (1 for each 10)
- Condenser (1 for each 10)
- Annunciator (1 for each 10)

- Resistor (1 for each 10)
- Resistor for dimmer switch (1)
- Switch (1 for each 10)
- Cover for emergency stop switch (1 for each 10)

For electric welder:

- Glass for hand shield and helmet (1 for each 1)
- Connecting metal (2)

1083. Additional Spares for Electric Power Devices

Buyer's supply according to contract.

1085. Spares for Communication Equipment

Manufacturer's standard supplies.

1086. Spares for Navigation Equipment

Manufacturer's standard supplies.

1087. Spares for Centralised Instrumentation

Manufacturer's standard supplies.

APPENDIX 1: GENERAL ARRANGEMENT (009-01)

APPENDIX 2: MIDSHIP SECTION (102-01)

APPENDIX 3: MAKER'S LIST (051-03)