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1 GENERAL PROVISIONS

11 PREFACE

It is the intent of this Specification (hereinafter called the Specification) and accompanying plans to describe and set forth the design, material, construction and equipment of a ocean going, single screw diesel driven single deck double hull bulk carrier.

General Arrangement Plan, Midship Section and Makers' List to accompany and form an integral part of the Specification. The Specification and attached plans to be complementary to each other.

The terms of the shipbuilding contract to prevail and govern in the event of disagreement, contradiction or any inconsistency between the shipbuilding contract and the Specification.

In addition, in the event of disagreement, contradiction or any inconsistency between the Specification and the drawings, the Specification to prevail.

The description in Part I General Provision to be applied to all parts of the Specification, where as the descriptions in the other parts to be applied to the respective parts, if not described otherwise.

The Builder to furnish all items required for the completion of the vessel in accordance with the specification except items specifically stated herein as to be furnished and supplied by the Owner.

Anything not mentioned in or covered by the Specification and the attached plans but required for normal operation of this type of vessel to be provided by Builder according to the shipbuilding practice.

Anything twice or more mentioned in the Specifications to be only once supplied or executed.

Any requirement of the Owner, which is in excess of the requirements of the Rules and Regulations listed herein and/or the content of this specification, to be subject to agreement and possible adjustment to the contract price, deadweight, service speed, etc. which may be affected.

Amendments and changes to the Specification, plans or other written documents to be signed by an authorized representative of the Builder and Owner. These documents to be the supplement to the contract.

If any specified article or material cannot be obtained or supplied, the Builder to have the right to select suitable substitutes with Owner's approval.

12 GENERAL DEFINITIONS

121 Materials, workmanship, standards and units

1211 Materials

Materials, machinery and equipment, etc. to be of Chinese maker unless specifically agreed and/or described in the Specifications and the Makers' List.

All structural steel used for the construction of the vessel and machinery including forgings and castings to be of the shipbuilding and marine engineering quality, tested, inspected and certified as and when required by the Classification Society and to be physically and chemically in conformity with such requirements.

All wood to be well seasoned and free from defect.

All using material can be safely recycled. Minimizing the use of materials known to be potentially hazardous to health and the environment, especially asbestos, refrigerants (R12/ R22), HALON. Lead-based paint and Tin-based anti-fouling paint to be not used.

1212 Workmanship

All workmanship entering into the construction of the vessel to be in accordance with the Chinese ship building standards and/or Builder's standard practice, applicable to this kind of vessel, subject to the approval of the Classification Society where necessary. The standards of Builder's practice to be submitted to the Owner for reference.

All work to be carried out according to Specification and plans and to the requirement of Classification Society and also regulatory bodies mentioned hereinafter.

1213 Standards

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

- a) ISO standard
- b) Chinese industrial standards (GB, CSQS, CB, YB, etc.)
- c) Builder's standards, and Builder's standard practice
- d) IEC

1214 Units of measure

SI units to be adopted for design and construction of hull, machinery, equipment, etc. in general.

All measuring units such as power, pressure gauge, thermometer, volume gauge, tank scales, etc. to be in accordance with SI system.

Types, sizes and materials of fittings, equipment and machinery to be in accordance with ISO or equivalent, the standard of REC or equivalent, and/or the Builder's standard and/or Manufacturer's standard.

The SI unit to be applied throughout the vessel. However, some conventional units are also to substitute the corresponding SI units or metric units as common customs in shipbuilding and shipping.

Principal units frequently used in Specifications, drawings and other documents to be shown in the Table 1 "LIST OF UNIT" in page and conversion between SI units and conventional units in the Table 2 "LIST OF UNIT CONVERSION" in page

ISO (International Organization for Standardization) metric threads to be generally applied to the vessel, however, the Builder to inform the Owner of the items to which ISO threads cannot be applied according to the Manufacturer's standard.

122 Plans and documents

The list of approval drawings and final drawings shall be submitted to owner for approval after the contract of the vessel.

The Builder to submit five (5) copies of the plans to the Owner for approval, and two (2) copies to be returned to the Builder with the Owner's signature of approval.

If the Builder does not receive the Owner's reply to the plans within twelve (12) working days excluding mailing time, they to be regarded as approved by the Owner without any comments.

The Builder to give answer for Owner's comments within 14 days from the date of receiving. If the Builder fails to answer, the Owner to deem that the comments have been automatically accepted.

In the event that any of the already approved plans for the first vessel are same as those for the subsequent sister vessels, the Builder may leave out the submission of such plans for the subsequent vessels. In which case the plan to clearly state the name/yard number of vessels.

The Builder to furnish four (4) copies of the final drawings and the instruction books of the major machinery and equipment to the Owner at the delivery of the vessel. One (1) CD-ROM with all available finished plans and documents to be provided to the Owner.

The plans which have to be approved by the Classification Society to be submitted to the Society directly by the Builder or the Subcontractors.

Two (2) copies of each following drawings to be submitted on board for passing through Suez and Panama Canals:

General Arrangement Plan
Capacity plan
Cargo Gear Arrangement
Engine Room Arrangement with Machinery List
Midship Section
Sounding Table for L. O. & F. O. Tanks

The following plans to be provided in frames and placed on board at such locations as designated by the Owner's representative:

General Arrangement	Two (2) copies
Capacity plan with Deadweight Scale	Two (2) copies
Maneuvering characteristics diagram with time and distance	Two (2) copies
Fire control plan with life saving appliance in color-coding	Two (2) copies
Oil transfer procedures as per USCG	Two (2) copies
Pumping plan	Two (2) copies
Safety radio telegraphy certificate	One (1) copy

The drawings and the instruction books to be written in English except those attached with the equipment from abroad.

123 Sub-contractors

Ordering of materials, machinery, equipment and other components to comply with the Specification and Makers' List which to be submitted to Owner for approval before signing the contract.

Selection of manufacturers of machinery and equipment to be done by the Builder, however, the Owner's preference, will be considered provided that there is no price difference from the Builder's proposal.

124 Owner's supply

Following items to be furnished and supplied by the Owner at their own expense, and installed on the vessel by the Builder. The Builder to provide sheltered and secure storage, handling in storage and handling on-board.

- Mooring ropes in excess of the Specification
- All air tools, hoses, steel wires, etc. other than those mentioned in the Specification
- All charts, nautical and radio station books, house flag and national flag
- All consumable stores
- All medicine and medical equipment except those for life boat
- Recreation equipment such as Stereophony, Video tape recorder and TV etc and stationery other than mentioned in the Specification
- Painting and pictures

- Boatswain's and carpenter's tools over and above the Builder's standard
- All bedding and linen (blankets, sheets, covers, etc.) but excluding mattress.
- All napery (serviettes, table clothes, etc.)
- All cook's and steward's utensils (crookery, cutlery, silverware, earthenware, glasses, pots, pans, etc.
- Typewriters, copy machine
- Loose lashing/securing fittings for cargoes
- Suez Canal searchlight, but socket and davit to be supplied by builder
- Navigation equipment in excess of those required by the authorities and/or those specified in this Specification
- Cargo handling equipment such as grabs (including the control devices) etc.
- Personal computer
- All bunkers, lubricants, grease/hydraulic oil, working oil and other consumable liquid except those consumed during construction and test/trials before delivery. The Owner to supply lub. oil for sea trials and the Builder to pay the cost for the quantities of lub. oil consumed during the trials.
- All other spare, store and equipment in excess of Rule and Specification requirements and maker's standard, unless maker agrees to supply additional spares free of charge after agreement with Owner/Builder.
- Gas sampling device and temperature measuring device for cargo hold

125 Spare parts

Spare parts to be furnished in accordance with the recommendation of Rule and maker's standard. Tools to be furnished in accordance with the Builder's standard.

All spare parts, except those fitted on the arranged position, to be stowed at suitable compartment (store) in different boxes, each to be properly identified including list of each box's content inside individual boxes.

Heavy spare be stored within reach of overhead crane in general. Heavy spare parts and tools to be mounted on suitable brackets/seats near the auxiliaries/machinery for which they are intended.

126 Delivery

At the delivery, the vessel to be complete in every respect, ready for service as specified, with the exception of the fuel oil, lubricating oil, water, store, provisions, crew and their effects, and such items of outfit and equipment as are herein exempted in this Specification.

127 Dry docking

Before the sea trial, if the period between launching and delivery is more than 6 months, the vessel to be subjected to the dry docking before sea trail. Hull bottom cleaning and final painting to be carried out.

128 Ship model

One (1) 1:150 scale vessel model for each vessel to be supplied by the Builder upon delivery of the vessel.

13 GENERAL DESCRIPTION OF THE SHIP

The vessel to be designed and built as a single screw motor driven double-skin bulk carrier for normal worldwide service.

The vessel to comply with the requirements for type "B" ships defined by the International Convention of Load Lines, 1966.

The vessel to be constructed and fitted up so as to be capable of carrying:

- 1) Solid bulk cargoes, e.g. ore, grain
- 2) IMSBC Code cargoes (including solid dangerous goods in bulk)
All Appendix A&C cargoes, e.g. cement, distillers dried grains with solubles (DDGS);
Appendix B cargoes, e.g. coal, DRI(A), Fertilizer, seedcake(a), sulphur, wood products.

The design of the vessel to reflect on economical operation, safety and environmental protection. The vessel shall offer the following measures of environmental protection:

NOx emission control;
Oil fuel management for the control of SOX emission;
Oil pollution prevention measures;
Garbage management;
Sewage treatment and discharge control;
Ballast water Management;
Prohibit application of hull anti-fouling system containing TBT.

The vessel to be designed and built with single continuous deck with forecastle, a erect stem, a transom stern, a semi-balanced rudder with rudder horn and a large-diameter, slow-rotating, high efficiency fixed pitch propeller.

All accommodation including navigation bridge and propulsion machinery to be located aft.

The cargo area to have five (5) cargo holds. Cargo holds to be constructed with double bottom and double skin. Hold 2, 3 and 4 are box-shaped with no hopper or top wing tanks. Hold 1 is to be with hopper and top wing tanks. Hold 5 is to be with hopper tanks only. Side hoppers to have a slope of approximately 45° and topside tanks to have a bottom slope of not less than 30° to the horizontal (suitable for grain loading).

Cargo holds to be designed for loading of heavy cargo. No.2 and No.4 holds may be empty.

Ballast Water to be arranged in fore and aft peak tank, double side tanks and double bottom tanks in cargo space. Double bottom tanks except No.3 are to be used as clean ballast water tanks and other tanks as normal ballast water tanks. Normal ballast tanks to be used for normal ballast condition and clean ballast water tanks for heavy ballast condition without any hold flooded.

All oil tanks with capacity larger than 30m³ to be designed not directly contact with shell.

All fuel oil tanks to be arranged in engine room with cofferdams at ship sides.

No Pipe-duct to be arranged in double bottom.

Four (4) sets of 30 t S.W.L. single-type deck cranes to be arranged on ship's centerline as shown on General Arrangement.

The features and arrangement of the vessel is generally shown on the "General Arrangement Plan".

14 PRINCIPAL PARTICULARS

141 Dimensions

1411 Main dimension

Length	(o.a.)	abt.	180.00 m
Length	(b.p.)		177.00 m
Breadth	(mld.)		32.00 m
Depth	(mld.)		15.00 m
Designed draft	(mld.)		9.50 m
Scantling draft	(mld.)		10.50 m

1412 Deck height at center line, moulded

Upper deck to A deck	3.10 m
A deck to B deck	2.80 m
B deck to C deck	2.80 m
C deck to Bridge deck	2.80 m
Bridge deck to compass deck	2.80 m
Upper deck to forecastle deck	~2.50 m

1413 Camber, sheer and frame space

Camber:

Upper deck (knuckle)	0.50 m
Compass deck (knuckle)	0.10 m
Forecastle deck	Nil
Other decks	Nil

Sheer on upper deck:

Aft at centerline	Nil
Fore at centerline	Nil

Sheer on forecastle deck: Nil

Rise of floor: Nil

Frame space as per GA-plan

142 Deadweight

The deadweight in sea water of 1.025 specific gravity to be about 33,400 metric tons at designed draft of 9.5 m, 38,800 metric tons at scantling draft of 10.5 m.

The deadweight to be defined as the difference between the displacement and light ship weight.

The "light ship weight" and the "deadweight" of the vessel to include the following weights respectively.

Light ship weight

- (a) Hull steel.
- (b) Fittings, equipment and inventories ready for sea service.
- (c) Machineries in dry condition.
- (d) Spare gears and tools which are required by the Classification rules.
- (e) Water in the main engine and machineries, and their own piping lines.
- (f) Oil in the steering gear and its piping lines.

Deadweight

- (a) Cargo.
- (b) Fuel oil
- (c) Fresh water and sanitary water.
- (d) Water and oil which are not mentioned in the "light ship weight".
- (e) Ship's crew and their effects.
- (f) Provisions, stores, spares, equipment and inventories over and above the Classification rules' requirements.
- (g) Others not mentioned in the "light ship weight".

143 Tonnage

Gross tonnage (International, 1969)	abt. 25,500
Net tonnage	abt. 13,000

144 Capacities

Cargo hold (grain)	abt.	50,800 m ³
Heavy fuel oil tank (including settling and service tanks) (100% full)	abt.	850 m ³
Diesel oil tank (including service tanks) (100% full)	abt.	50 m ³
Low sulphur M.D.O. tank (0.1% sulphur, including service tanks)	abt.	300 m ³
Fresh water tank	abt.	250 m ³
Ballast water tank (excluding clean ballast water tanks)	abt.	12,000 m ³
Ballast water tank (including clean ballast water tanks)	abt.	16,500 m ³
Cargo hold F.W. wash water tank	abt.	250 m ³
Cargo hold slop water tank	abt.	250 m ³

145 Main propulsion plant

Type and number	WARTSILA 5RT-flex50-D Tier II 1set
CMCR	6100 kW x 99 r/min
CSR (75%CMCR)	4575 kW x 89.9 r/min

146 Speed

The service speed of the vessel to be abt. 14.0 knots at designed draft and at CSR of main engine with 15% sea margin and clean bottom on calm (no wind no wave), deep open sea. Energy-saving methods such as such as PRE-SWIRL DUCT or HVAF to be used to achieve the speed.

147 Fuel oil consumption and endurance

Main engine fuel oil consumption per day at CSR (4575kW) and lower calorific value of 42,707 kJ/kg at ISO 3046-1 ambient reference condition:
abt. 17.6 t/d (+5%)

Endurance based on fuel oil consumption of 42,707 kJ/kg lower calorific value, service speed of 14.0 knots and main engine run at CSR with 15% S.M. to be abt.18,000 n.mile. All tanks excluding service tanks is used for endurance calculation.

148 Complement

Rank		Deck depart.		Engine depart.		Other depart.		Sum	
O F F I C E R	Captain class	Captain	1	C/Engineer	1			2	
	Senior officer class	C/Officer	1	2/Engineer	1	Owner	1	3	
	Junior officer class	2/Officer	1	3/Engineer	1			8	
		3/Officer	1	4/Engineer	1	Pilot	1		
	Ass./Officer	1	E/Engineer	1	Off. Spare	1			
Sum		5		5		3		13	
C R E W	Rating class	Boatswain	1	Motorman	3	Cook	1		
		Seaman	3			Spare	1		
Sum		4		3		Cadit	2		
Total		25 persons							
Suez canal crew									6

15 CLASS, RULES, REGULATIONS AND CERTIFICATES

151 Classification and flag

The vessel, including its machinery and equipment, to be built under the special survey and inspection of the Classification Society and to be classed and registered with the following notations:

DNV +1A1 Bulk Carrier ESP, CSR, BC-A (CH 2&4 empty), GRAB(20), DG-B, BIS, TMON,
BWM-T, CLEAN, E0, COAT-PSPC(B,D), Recyclable

The vessel to fly the flag of convenience.

152 Rules and regulations

The vessel to be registered in Malta or equivalent and to comply with the requirements of the following rules and regulations which are in force at the date of signing the Contract.

- a) Rules and Regulations of Classification Society
- b) Maritime laws and regulations of flag authority
- c) International rules and regulations
 - International Convention on Load Lines (1966) including all and latest amendments
 - International Convention for the Safety of Life at Sea (SOLAS 1974) including all and latest amendments
 - International Convention for the Prevention of Pollution from Ships 1973 (MARPOL 1973) with protocol 1978 and all amendments, including Annexes I, IV, V, VI
 - International Regulations for Preventing Collisions at Sea (London 1972) including latest revision
 - International Tele-communication convention with amendments including watch keeping receiver (Geneva 1976) and radio regulation
 - International Regulation on Tonnage Measurement of ships, 1969
 - MLC Maritime Labour Convention, 2006- Only mandatory Standards to be meet
 - 2008 IS Code – International Code on Intact Stability, 2008
 - IMO Resolution MSC. 23 (59) (International Grain Code)
 - IMO Resolution MSC. 137 (76) “Standards for Ship Maneuverability “
 - IMO Resolution MSC. 215 (82) (PSPC)
 - IMO Resolution A. 868 (20) “Guidelines for the control and management of ships’ ballast water to minimize the transfer of harmful aquatic organisms and pathogens “
 - IMSBC Code – International Maritime Solid Bulk Cargoes Code
 - All IACS Unified Requirements for strength applicable to New Building of Bulk Carrier which has been formal published at the date of signing contract including UR S1A, S21, S24, S25, S26, S27, S28, etc.
 - SOLAS resolution II-1/3-6 regarding PMA.

- International marine pilots association requirements
 - IMO resolution A468 (XII) code of noise level on board ships
 - ISO 6954 guidelines for vibrations on board ships
 - AFS - International Convention on the Control of Harmful Anti-Fouling Systems on Ships, 2001
 - ISPS code
- d) Special rules and regulations
- Rules and Regulations governing navigation of Suez Canal, including tonnage measurement
 - Rules and Regulation governing navigation of the Panama Canal including tonnage measurement
 - U.S. Coast Guard Regulations applying to foreign flag vessel trading in U.S. waters concerning pollution prevention (without certificate)
 - Australian Maritime Safety Authority MARINE ORDERS Part 32 "Cargo Handling Equipment" Issue 2, Compilation No.1 prepared on 27 June 2007 (for ladders in cargo hold/deck)

153 Certificates

Certificates	Issued by
Classification Certificate	Classification Society
International Load Line Certificate	Classification Society
Cargo Ship Safety Equipment Certificate	Classification Society
Cargo Ship Safety Construction Certificate	Classification Society
Cargo Ship Safety Radio Certificate	Classification Society
Certificate of International Convention for Prevention of Pollution from ships	Classification Society
Certificate of Compass Adjustment	Authorize party
Derating Exemption Certificate	Assigned Authority
International Tonnage Certificate	Classification Society
Suez Canal Tonnage Certificate	Classification Society (or other assigned authority)
Panama Canal Tonnage Certificate	Classification Society (or other assigned authority)
Cargo Gear Certificate	Classification Society
Builder's Certificate	Builder
Report on chemical examination for cargo hold paint	Authorize party

Magnetic compass Certificate	Classification Society (or authorized body)
Grain Loading Certificate	Classification Society
Deadweight Certificate	Classification Society
MLC Maritime Labour Convention, 2006	Classification Society
Letter of compliance for MARPOL Annex VI (atmosphere) for M/E, D/Gs and Incinerator (Classification Society)	
USCG Compliance letter for foreign flag vessels	Classification Society
Asbestos absence certificate	Builder
Letter of compliance with AWWF requirements	Authority
Sewage Unit certificate	Classification Society

However if formal certificate(s) cannot be obtained at the ship's delivery, Builder to furnish provisional certificate(s) to the Owner which substitutes the formal certificate(s). In such case, Builder to deliver formal certificate(s) to Owner as soon as practicable after the ship's delivery, but in any case prior to the expiration of the validity of the provisional certificate(s).

Certificates for anchors and chains, issued by the Classification Society, and those for navigation lights, life boats, lifesaving equipment etc., issued by any others assigned authority with approval for required items to be delivered to the Owner by the Builder.

The Owner to supply the following documents approved by the Classification Society with the Builder's assistance:

- SOPEP
- Cargo Securing Manual
- Training Manual
- Garbage Plan
- ISPS Manual
- Fire safety manual

16 HULL FORM AND MODEL TEST

The Builder to design the hull form, propeller, energy saving duct and rudder suitable in view of the vessel's speed and performance.

The model basin test to be carried out for the following items:

- Resistance tests at design and scantling draft, ballast trial draft
- Self propulsion tests at design and scantling draft, ballast trial draft
- Flow test for bilge keel at service speed and design draft
- Wake field measurement at service speed and design draft
- Open-water test of design propeller

The test results shall be submitted to the Owner for reference.

17 TRIM AND STABILITY

The vessel to satisfy the IMO stability requirements under loading condition specified below.

- a) Normal ballast condition (without clean ballast water tanks), departure, halfway and arrival

- b) Heavy ballast condition (with clean ballast water tanks), departure, halfway and arrival
- c) Fully loaded condition with light homogeneous cargo, departure, halfway and arrival
- d) Fully loaded condition with heavy homogeneous cargo (3 t/m³), departure, halfway and arrival
- e) Fully loaded condition with heavy homogeneous cargo (3 t/m³) in alternative holds (No.1, 3 & 5 holds), departure, halfway and arrival
- f) Grain loading condition with stowage factors of 42, 46, 50, 55, 60ft³/Lt, departure, halfway and arrival
- g) Loading with steel coils, departure, halfway and arrival
- h) All other loading conditions required by CSR
- i) Docking condition
- j) Light ship condition

At above calculation:	departure condition:	100% bunker/FW
	halfway condition	50% bunker/FW
	arrival condition:	10% bunker/FW

Specific gravity and filling ratio of liquids to be based on following table.

Diesel oil	: 0.85 t/m ³	: 98 %
Heavy fuel oil	: 0.98 t/m ³	: 98 %
Lubrication oil	: 0.90 t/m ³	: 98 %
Fresh water	: 1.00 t/m ³	: 100 %
Ballast water	: 1.025 t/m ³	: 100 %

The Builder to submit the "Loading manual" on the various loaded conditions based on the results of the inclining test approved by the Classification Society.

Builder also to supply loading sequences manual approved by Classification society

18 INSPECTIONS, TESTS AND TRIALS

180 General

Tests and trials to be carried out in accordance with the requirement of the classification society and according to the Builder's usual standard practice in the presence of the surveyor of the Classification Society and the Owner's and the Builder's representatives. During inspection time the owner have right to invite experts from Maker (M/E, A/E) to attend the tests.

The Builder to submit the schedule of test and trial for the Owner's approval.

181 Tests of construction and installation

All tests for hull structure and installations to be conducted in accordance with the requirements of the Classification Society Rules and Regulatory Bodies concerned and the standard of the Builder and CSQS.

1811 Inspection of hull structure

All steel structures to be inspected and tightness to be tested for tanks, bulkheads, superstructures, decks and other wet spaces as required by the Rules.

Tanks to be tested hydrostatically or by air as required by the Rules.

X-ray photographs or ultrasonic to be taken mainly from cross-points of seams and butts of block assemblies of bottom shell, bilge strake, main deck and sheer strake as required by the Rule. Additional 10% X-ray photographs to be appointed and checked by the Owner's supervisor.

Castings of stern frame and rudder to be tested by magnaflux or equivalent.

1812 Block inspection

The block inspection to be carried out after completion of hull block steel works. Even if fittings are fitted wholly or partially to the hull blocks, the inspection for the hull blocks to be carried out without dismantling such fittings unless the block inspection is obstructed by such fittings.

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 to be completed before the said inspection, in which case, after completion of the outfitting works, final inspection of such parts to be made in accordance with the "Item of inspection and testing" mutually agreed between the Owner and the Builder.

1813 Shop tests

Shop tests for main engine, auxiliary machinery, deck machinery, motors etc. to be performed in accordance with the Rule requirements and/or the standard of the makers. The Owner's representatives will join the shop tests of main equipment.

1814 Installation and equipment

Installation and equipment to be tested on board the vessel in accordance with the requirements of the Classification Society and/or Regulatory Bodies and the standard protocol of the Builder.

Test protocol to be approved by the Owner.

The structure, fittings, machinery and electrical installations to be tested after installation on board to demonstrate satisfactory workmanship, proper working, alignment of moving parts, suitability for the purpose intended and in compliance with rules and regulations.

1815 Piping tests

Working tests to be carried out after completion of the piping system. Pressure tests of piping systems to be conducted as per requirement of the Classification Society and normal shipbuilding practice.

182 Light ship weight measurement and Inclining test

When the vessel is substantially completed except minor items of work, inclining test of the vessel to be carried out by the Builder near the pier. The inclining test scheme to be submitted to the Owner for approval. The inclining test to be conducted in calm water without strong current and strong winds.

The light ship weight measurement to be carried out by reading the draught of the vessel, by measuring specific gravity of water and by an investigation of weights to be added or to be deducted in the presence of the Owner's representatives or the person authorized by the Owner.

The draught of the vessel to be measured at both sides of stem, stern and midship draught marks.

Displacement of the vessel to be measured from the hydrostatic curves. All measurements and correction to be made as per international standard.

If any superfluous weight is on board the vessel or any item belonging to the light ship weight is not on board the vessel at the time of the light ship weight measurement, such a weight to be adjusted later.

The calculation of the light ship weight and deadweight to be made by the Builder and verified by the Owner's and Classification representatives in order to determine "light ship weight" and "deadweight".

The inclining test to be carried out in the presence of the Owner's representatives or the person authorized by the Owner and the Classification Society's surveyor, and then the position of the centre of gravity of the vessel in lightship condition to be determined by the calculation based on the results of the inclining experiment.

The inclining test to be done for first ship of the series only.

183 Mooring trials

Mooring tests to be conducted after vessel is substantially complete and prior to the sea trial. Procedure for mooring test of the vessel to be as per Builder's standard.

After the mooring trial of main engine the crankcase shall be inspected and crankshaft deflection measured. All main bearing top/bottom clearance shall be checked and all records to be submitted to Owner's representative.

184 Trials and tests at sea

When the vessel is substantially completed, i.e. mooring trial finished, defects remedied, all equipment and outfitting in sailing condition and painting work almost completed, sea trial to be performed by the Builder.

Main engine to use heavy fuel oil abt. 180 cSt/50° during sea trial except otherwise specified.

All H.F.O., D.O., L.O. for commissioning and testing and L.O. in system to be paid by yard. Prior to sea trial quay trials to be carried out for all machinery and systems. Detailed scheme for sea trials to be submitted to the Owner for approval prior to sea trials.

Reports of sea trial to be submitted to the Owner.

Sea trial at the ballast condition to be carried out as follows.

a) Endurance trial

Endurance test to be carried out according to the builder's practice and rule's requirement

The endurance test to include measurement of fuel consumption using heavy fuel oil.

The propulsive machineries and necessary auxiliaries to be kept at normal operational conditions at sea.

The demonstration of changing H.F.O. to M.D.O. to be carried out during this period.

Pumps and auxiliary to be changed over during trials.

b) Progressive speed trial

Progressive speed trial to be performed at 50% CMCR, 75% CMCR, 85% CMCR and 100% CMCR or the output corresponding to the allowable shaft revolution of the engine, whichever is reached firstly.

The trial speed to be measured by DGPS. Each speed trial to consist of two consecutive runs, along and against the tide over the same course and the speed to be obtained as the mean speed of the consecutive runs at each condition.

Result of speed trial shall be corrected to the calm water condition (no wind, no wave) and deep sea according to Builder's standard.

Shaft power and RPM to be measured by torsion meter.

- (c) Turning test at full speed - only for first vessel
- (d) Zigzag test - only for first vessel
- (e) Emergency stop, ahead and astern test at full speed
- (f) Williamson turning test - only for first vessel
- (g) Course keeping test - only for first vessel
- (h) Steering gear test
- (i) Anchoring test
- (j) Main engine starting test
- (k) Main engine minimum revolution test
- (l) Engine room fire alarm test
- (m) Torsional vibration measurement of shafting
- (n) Fresh water generator capacity test
- (o) Aux. boiler safety valve setting test
- (p) Other normal tests

185 Vibration and noise measurement

The vibration level in living quarters of the vessel to be measured by local vibration equipment by the Builder when the vessel is running straight ahead steadily at normal output of main engine on calm and deep open sea trial condition.

Limitation values to be in accordance with ISO 6954 requirements.

Noise level in accommodation and working spaces shall be in accordance with the IMO Regulation A468 (XII) – "Code on Noise Levels on Board Ship, 1981". The test of noise level shall be carried out with the normal running of air conditioning and ventilation.

Noise level to be measured by the Builder at the suitable point in the machinery space, engine control room, wheelhouse, private cabin, galley, pantry when the vessel is running ahead steadily at normal output of main engine in the sea trial.

In case of excessive noise and/or vibration, corrective action to be taken prior delivery of vessel.

Vibration and noise measurement to be carried out for the first vessel only.

186 Automation and remote control test

Automation and remote control test to be carried out according to test method for automatic system which to be in accordance with the requirement of Classification Society.

187 Overhauling

After sea trial, working parts of main engine to be opened for the Owner's inspection in accordance with the standard of the Builder and approved by Owner and refitted to working condition.

M/E overhaul to be the same as that made for M/E overhaul after shop tests.

A/E also to be opened for visual overhaul if necessary.

19 **LOADING COMPUTER**

One(1) set of loading computer to be provided in ship's office by the Builder.

Loading computer with printer to have following functions:

- (a) Draught , trim and stability calculation including showing stability curve and figure.
- (b) Strength (shear fore & bending moment) calculation at harbor and sea condition including showing weight, displacement, shear force, bending moment and at about 50 framing in curve and figure.
- (c) Reasonable trim recommendation.
- (d) Loading and unloading procedure recommendation
- (e) Ballast Exchange Procedure recommendation.
- (f) Backup, restore, copy and print.

All results to be displayed together with given, comparable criterion (stability: IMO requirements, strength: % of class permitted tensions). Violation of requirements to be displayed in a bright field and alarmed.

With every step of work, the next possible steps to be offered for choosing on screen, it to be also indicated how these steps may be initiated.

The class approved software to be supplied within three (3) months after vessel's delivery.

TABLE 1: LIST OF UNIT

Quantity	Unit	Remarks	Quantity	Unit	Remarks
Length	km,m,cm,mm		Angle	°,rad	
Nautical distance	nm	Non-SI	Frequency	Hz	
Thickness	mm,µm		Revolution speed	s ⁻¹ ,min ⁻¹	
Area	m ² ,cm ² ,mm ²		Density	t/m ³ ,kg/m ³	
Volume	m ³ ,cm ³ ,mm ³ ,L		Concentration	%,vol%,ppm	Non-SI
Time	h,min,s		Molecular quantity	mol	
Velocity	m/h,m/min,m/s		Temperature	°C, K	
Ship's speed	kt	Non-SI	Heat quantity	kJ,kW,h	
Accelleration, Vibration	cm/s ² ,mm/s ²		Thermal conductivity	W/(m·°C),W/(m·K)	
Mass	t,kg,g		Specific heat	J/(kg·°C),J/(kg·K)	
Deadweight, Displacement	t		Viscosity	Pa·s	
Mass-Moment	t·m		Kinetic viscosity	mm ² /s	
Mass flow rate	kg/h,kg/min,kg/s		Voltage	V	
Volume flow Rate	m ³ /h,m ³ /min,m ³ /s		Electric current	A,mA	
Force	kN,N		Electric resistance impedance	Ω	
Torque	kN·m,N·m		Electric power	MW,kW,W	
Pressure	MPa,kPa,Pa		Apparent power	MVA,kVA,VA	
Stress	kN/m ² ,M/mm ²		Elcectric energy	J,kWh,Wh	
Noise level	dB	Non-SI	Mumination level	lx	
power	MW,kW,W		Sound power	W	

Note: "Non-SI" in the remark column indicates conventional unit.

TABLE 2: LIST OF UNIT CONVERSION

Quantity	SI Unit	Conventional Unit
Vibration	1 cm/s ² =1 Gal	1 Gal =1 cm/s ²
Force	1 N =0.10197 kgf 1 kN =0.10197 tf	1 kgf =9.80665 N 1 tf =9.80665 kN
Power	1 kW =1.3596 PS	1 PS =0.7355 kW
Revolution speed	1 min ⁻¹ =1 rpm	1 rpm =1 min ⁻¹
Pressure	1 kPa =0.010197 kgf/cm ² =0.01 bar =0.10197 mAq =7.5006 mmHg	1 kgf/cm ² =98.0665 kPa 1 bar = 100 kPa 1 mAq =9.80665 kPa 1mmHg =0.1333 kPa
Stress	1 N/mm ² =0.10197 kgf/mm ²	1 kgf/mm ² =9.80665 N/mm ²
Heat quantity	1 kJ=0.23889 kcal 1 kW·h=860.00 kcal	1 kcal=4.1861 kJ 1 kcal=0.0011628 kW·h
Viscosity	1 Pa·s=1,000 cP	1 cP=0.001 Pa·s
Kinetic Viscosity	1 mm ² /s = 1 cSt	1 cSt =1 mm ² /s

2 HULL STRUCTURE AND CORROSION PREVENTION

20 GENERAL

201 Material

Steel of the hull construction to be of mild steel or high-tensile steel approved by the Classification Society, and steel including casting and forging to be of qualities as to comply with the requirements and tests of the Classification Society.

Steel material not specified by the Classification Society to be in compliance with Chinese Industrial Standard or the Builder's practice.

Steels for hull construction to be of normal quality mild steel and high strength steel (yield stress 315 N/mm² {32 kgf/mm²} and 355 N/mm² {36 kgf/mm²}) approved by the Classification Society, and steel including casting and forging to be of qualities as complying with the requirement and test of the Classification Society.

202 Scantling

Scantling of all hull structural members to be calculated based on scantling draft and to be approved by Classification Society.

Scantling of cargo hold structure members to be in compliance with IACS unified requirements for new building bulk carriers.

Scantlings not specified by the Classification Society to be in compliance with Builder's practice.

Special strengthening of the hull structure more than the drawings approved by the Classification Society is generally not to be provided, or to be considered as the extra work on the Owner's account.

If extra thickness or over scantling which are above Rule requirement except specially mentioned in the Specification are required by the Owner, they shall be accepted by the Builder subject to price and deadweight adjustment, so far as the works do not disturb the Builder's working schedule.

203 Workmanship

All works for the hull construction to be carried out in accordance with the Builder's practice and under the survey of the Classification Society.

Temporary access and ventilation openings to be provided as few as possible and to be not open on shear strake and stringer strake, subject to the approval of the Classification Society.

204 Welding

The hull to be of all welded construction.

Welding to be carried out as per Builder's practice which is in accordance with the requirements of the Classification Society.

All welding for the main hull and superstructure exposed to weather or wet space to be of double continuous fillet. Intermittent welding to be used for internal structure in superstructure for ordinary beams, frames and stiffeners in dry space.

Dogs, eye plates and clamps etc. used for the erection to be cut and ground smooth. Any under cut found in way to be built up with welding.

Where exposed to view, the temporary filling used for erection to be neatly removed, damages to the base material to be repaired by welding and grinding.

The X-ray photographs inspection to be carried out for the junctures of seam and butt of bottom shell and the upper deck in the presence of the Classification surveyors.

Extent and location of X-ray photographs inspection to be in accordance with the Classification rules.

205 Slots, scallops and holes

Slots, scallops, air holes and drain holes to be provided where necessary in accordance with the Builder's practice.

In general, non-tight structural members to be provided with adequate access/lightening holes in accordance with the Builder's practice, provided such a hole is necessary or practicable and not detrimental to the structural strength of members.

In ballast and oil tanks particular care to be given to provide good drainage in order to get good efficient pump operation. Suitable drain holes and air holes to be provided on transverse structural members.

Lightening holes at platform (in horizontal position) in peak tanks to be of grating type.

206 Structural and tightness test

Structural and tightness tests to be carried out in accordance with the Builder's practice which is in line with the requirement of the Classification Society.

21 DESIGN LOAD

210 General

In general all construction to be designed according to the standard design load as specified by the classification society.

211 Double bottom in cargo hold

The local load for the tank top in each cargo hold to be $25t/m^2$, discharging by grab with unladen weight of 20 tons.

Steel coil loading of 2 tiers of 20 tons steel coils in 1800mm long to be considered. 3 dunnages will support one steel coil.

22 MAIN HULL

220 General

The scantling, construction and materials of hull within a range of midship part to be as shown on the Midship Section.

The main hull girder to consist of the upper deck, the double hull, the double bottom and the sloping bottom of upper wing tanks(only for no.1 cargo hold) and to be longitudinally framed in general with the exception of the following parts which are transversely framed.

- * Side and double bottom in engine room
- * End parts of the vessel
- * Upper deck between cargo hatchways

221 Shell plating

The thickness of shell plate to be approved by the Classification Society and to be gradually tapered from midship part to ends in accordance with the requirements of the Classification Society.

The plate of bottom forward to be strengthened against slamming according to the requirement of the Classification Society.

Anchor to stow against a "frog eye" construction to ensure that anchor drops clear of bulbous bow.

Semi-round bar to be welded on transom edge adjacent to shell plate.

Tug push marks to be marked on the shell plating. The structure in thrusting position to be strengthened and stiffened. 6 Tug push spots to be provided at bulkhead 3/4 P&S when 1 tug; bulkhead 1/2 and 4/5 P&S when 2 tugs.

Extra thickness to be provided by inserted thicker plates in way of hawse pipe, around sea chest openings. Openings in shell plating to be well rounded and reinforced by inserted thicker plates.

The lifting rings to be provided for propeller and rudder installation.

222 Bottom construction

Cellular double bottom to be constructed under cargo holds and engine room.

The hull bottom constructions including hopper tank to be provided longitudinal framing system for cargo space and transverse framing system for engine room space and fore and aft peak tanks. Attention to be paid to the members for the transition region of the longitudinal and transverse framing.

Double bottom in cargo space to be of flat type for no.2~4 cargo hold and only for no.1&5 cargo hold with hoppers on both sides having inclination of about 45° to the horizontal.

Spacing of double bottom floors in way of the cargo hold area should not exceed three (3) frame spaces.

Double bottom including bilge hopper part to be utilized as water ballast tanks as indicated in the General Arrangement.

Each cargo hold to have two (2) bilge wells at each after corners of hold, and the perforated steel cover plates to be provided for the wells. Bilge well to be divided into two parts, one as settling and one as suction.

Cofferdams to be arranged around M/E L.O. SUMP TK.

Suitable drain holes to be arranged in double bottom tanks so as to be able to discharge / drain easily.

223 Side structure

Side shell structure

For no.1~5 cargo hold, side shell structure to be consist of longitudinal framing and web frames.

In engine room web frames spaced in general not more than five (5) frame space apart to be fitted.

Topside Tank (only for no.1 cargo hold)

The topside tank in No.1 hold to be arranged at shoulder part of cargo hold and to be used as water ballast tank.

The sloped bulkhead of topside tank in No.1 hold to have a slope of not less than 30° to the horizontal.

The structure in topside tank to be longitudinal framing system with watertight transverses, and longitudinal framing to be continuous through watertight partitions.

224 Deck structure

The upper deck to be connected to shell plating by direct welding.

The design load for upper deck to be in compliance with the requirement of Rule.

Upper deck to be strength deck with longitudinal framing system outside line of openings and transverse framing inside line of openings. Upper deck to be fitted with hatch side girders, longitudinal stiffeners, and transverses spaced not more than six (6) frame space apart. Other part of upper deck to be transverse framing system.

A thicker insert plate to be used at the hatch corner and the form of the hatch corner to be elliptical in accordance with the Class Rules for prevention of stress concentration. Flush up type of main hole covers on main deck to be provided.

Suitable reinforcement to be provided in way of openings and under machineries and fittings if necessary.

225 Main bulkheads and pillars

Bulkheads

Transverse watertight bulkheads to be arranged as shown on the General Arrangement.

All transverse watertight bulkheads to be extended to the upper deck.

Transverse bulkheads in cargo holds to be of water-tight construction and of vertically corrugated with upper and lower stool, with the exception of plane type with stiffeners for fore and aft end transverse bulkheads of cargo space.

All other watertight or oil-tight bulkheads to be generally of plane type with stiffeners.

Pillars

Pillars and girders to be properly arranged in the machinery space.

Adequate number of pillars to be provided under the superstructure decks or deckhouse walls under concentrated loading, if necessary.

226 Stem, stern frame and rudder horn

Stem throughout to be of fabricated welded steel plate construction and to be well rounded forward face.

Stern frame to be fabricated with cast steel and welded heavy steel plate, i.e. the boss part, neck bearing and the part of rudder horn to be of cast steel and the remains to be of welded heavy steel plates.

The casting of stern frame to be inspected by ultra-sonic test or magna flux test.

Pre-heating to be carried out for the part of cast steel where heavy plate to be welded.

227 Peak construction

Fore and aft peak tanks to be reinforced with side transverses, side stringers or non-watertight opening platform and to be used for water ballast.

Horizontal lightening holes on platform in peak tanks to be grating-type.

Fore peak and fore area to be reinforced for panting and slamming according to CSR.

Rudder trunk of steel plates of same thickness as side shell plate of the part to be of square box form in section with its ends welded to the rudder carrier and the neck bearing.

Two (2) self-stowing, watertight chain lockers to be located as indicated in the General arrangement plan

23 CONSTRUCTION OF DECKHOUSE AND CRANE HOUSE

231 Deckhouse

The vessel to have five (5) tiers of deckhouses. The front wall of wheelhouse to be inclined forward. The bridge wings to be extended to the exterior breadth of the vessel.

The deck structure of superstructure and deckhouse to be of longitudinal or transverse framing system.

The boundary walls for the superstructure to be plane type with vertical stiffeners of suitable spacing.

The reasonable arrangement for steel walls in the deck house to be provided so as to reduce the vibrations.

Effective drainage from all decks to be arranged. Drainage pipes to be as straight as possible.

232 Crane house

For crane house, combination framing system to be built and formed a entirety with the crane post as shown on General Arrangement Plan. Crane post to protrude through upper deck and be anchored to upper stool lower plate.

24 HULL MISCELLANEOUS

241 Foundation

(a) Machinery space

Girders under main engine to be extended as far forward and aft as possible.

Foundation for the main engine to be welded structure as a part of the double bottom construction of the engine room. The scantlings of foundation to be in accordance with the recommendation of main engine maker. Foundation for generators and the boiler to have adequate strength and rigidity.

(b) Deck machinery

Suitable reinforcements to be provided for deck machineries if necessary.

242 Hatch coaming

The hatch coamings for cargo hatches to be fitted with horizontal stiffened surface plating and half round wear bar 60x30mm on the top and T type stay and horizontal stiffeners to increase coaming stability on plate of T type stay attached a horizontal flat bar at mid height.

The hatch coaming to be continuous of steel construction except No.1 hatch coaming.

243 Chain Locker

Two (2) round type self-stowing chain lockers to be arranged in the fore peak tank and Bosun's store, and to have ample capacity for stowage of chain cables. Minimum height between lower edge of chain pipe bell mouth and loosely stowed chain to be not less than 1500 mm.

A suitable designed steel perforated plates of partly removable type to be provided about 0.8m from the bottom of the chain locker adequately supported to take the weight of the chain cables. Access to space under Perforated plates to be provided to remove mud & etc.

600 x 800 mm watertight steel cover to be provided on each chain locker wall.

Bitter end of chain cable to be secured to a quick releasing device fixed on the side wall of the chain locker.

244 Bilge keel

A bilge keel of welded construction to be fitted on each side of the vessel, for approximately 1/3 length of the vessel amidship.

The bilge keel to be about 400 mm in depth with ends tapered gradually.

The butt seams on the bilge keel flat bars and shell plates to be staggered each other as per the Rule.

Transverse welds intersecting shell plating to be scalloped.

245 Sea chest

One (1) high sea chest and one (1) low sea chest to be provided. The clear area of sea chest opening to be at least 2.0 times of main pipe suction. Separate sea chest to be provided for emergency fire pump.

The sea chests to be built welded by steel plate. The drain holes and the air holes to be arranged in the shell plates in lower and upper parts of the high sea chests. Chest openings to be shaped so as to avoid stress concentration of shell plating and fitted with thicker insert plates.

The hinged strainer plate welded by the galvanized steel plates to be provided for each sea chest with stainless steel bolts and nuts.

246 Bulwark

Steel bulwarks to be fitted on forecastle deck and bridge winds in the General Arrangement.

The steel bulwark of 1.35meter high forming wind deflectors to be fitted on the front bulwark of the bridge wing.

Opening for fairleader on bulwark to be well-rounded reinforced with round bar.

247 Funnel

The rectangular funnel to be welded construction with vertical stiffeners and horizontal stringers, and with closed top plate, adequate number of eye plate.

Louver to be provided on back of funnel for engine room ventilation.

Funnel structure to be strengthened at supports for exhaust pipes etc. Eyes for painting stage to be provided outside.

Company's emblem to be made by intermittent welding bead..

248 Bottom plug

Material: Boss: Mild steel
Plug: Stainless steel

Location: in the bottom shell of all ballast, fuel, fresh water tanks, sludge tanks and cofferdams etc.

Different key for water and oil tank to be provided.

Scantling: $\phi 42\text{mm}$.

Suitable number of spare bottom plugs to be supplied as follows:

Two (2) pieces for oil tanks

Five (5) pieces for ballast tanks

Bottom plugs to be located clear of the docking block.

25 PAINTING AND CATHODIC PROTECTION

250 General

The surface preparation grades to be as per ISO or Swedish standards SIS.

The detail inspection procedure including surface preparation and coating processes for dedicated seawater ballast tanks according to IACS PSPC shall be agreed upon between the Owner, Builder and paint maker (hereinafter referred to as "the three parties' agreement") at the signing of contract.

Painting scheme to be submitted to Owner for approval, colors of finish paint to be as per Owner's color scheme.

Copper, copper alloy, aluminum alloy, stainless steel and galvanized parts not to be painted in general unless otherwise specified.

The surface in contact with doubling plates and internal surfaces of tightly enclosed spaces shall not be painted unless otherwise specified subject to paint maker's recommendation.

Steel outfitting manufactured by sub-contractors to be coated as per specification or with equivalent type of paint compatible with the adjacent structure's coating system for ease of subsequent maintenance.

Time schedule for painting of each coat to be decided according to the Builders construction schedule but to be governed by re-coating intervals recommended by the paint maker.

Painting for the parts or spaces not specially specified to be similar to the surrounding space or comparable space.

Coating of machinery, electrical equipment, outfitting, valves, navigation equipment, deck machinery, furniture etc. to be done according to makers' standard unless otherwise specified. When paint damage occurs before or after installation on board the damaged parts to be repaired with equivalent paint to original and in case of extensive damage a full coat to be applied after repairs.

All sharp edges, edge of small holes, such as slots, scallops, drain holes etc. and flame cut free edges of structural steel to be grounded smooth.

Galvanized pipes on exposed deck to be painted.

251 Surface Preparation

2511 Primary surface preparation

Generally the hull structural and sections of 6 mm thickness and above to be shot blast cleaned on both sides to ISO or SIS SA 2.5. Grit or sand blasting to ISO or SIS SA 2.5 or pickling may be applied instead of shot blasting when shot blasting is considered impractical. The hull structural steel below 6 mm, if any, to be treated by pickling or power tool cleaning in according to paint maker's recommendation.

2512 Shop priming

Just after primary surface preparation one coat of 15 microns zinc silicate or epoxy zinc type shop primer to be applied. The shop primer to have good compatibility with the succeeding coats. Shop primer shall be provided Chinese Maker.

2513 Secondary surface preparation

Before the first coat is applied, the damages on shop primer by welding, burning, rubbing, etc., and the rusted steel surface to be prepared in accordance with the following table.

Area	ISO or SIS Grade	
	at block	at other stages
Flat bottom and vertical bottom	Sa 2.5	ST 3.0
Topsides	Sa 2.5	ST 3.0
Weather deck	ST 3.0	ST 3.0
Deckhouse exterior	ST 3.0	ST 3.0
Deckhouse interior	ST 2.0	ST 2.0
E/R interior	ST 2.0	ST 2.0
Water ballast tanks	Sa 2.5	ST 3.0
Cargo holds	ST 3.0	ST 3.0
Fresh water tanks	Sa 2.5	ST 3.0
F.O., D.O. and L.O. tanks	No treatment	ST 2.0
Others	ST 2.0	ST 2.0

Before the first coat is applied, wire-brush to be used for non-damages on the shop primed area.

The secondary surface preparation for F.O., D.O. tanks etc. to be cleaned and oil wiped as per the Builder's practice.

After erection, the damaged areas and re-rust welding seams etc will be power tooling to ST3 for epoxy paint and ST2 for other areas.

2514 Surface cleaning before overcoating

The surfaces to be cleaned of oil, moisture, dust, and other foreign materials with thinner, fresh water, wire brush, or compressed air and vacuum cleaners prior to coating.

Whatever the method is used to remove contamination on the steel surface, the surface quality not to be degraded.

252 Painting

2521 Application of Painting

The painting to be carried out by airless spray, in general. Where the spraying is impractical, the brush or roller to be used.

Mixing and thinning of the paint material and interval of painting to be in accordance with the maker's recommendation.

The painting scheme specified hereunder may have alteration in number of coats and the dry film thickness in accordance with standard specification of the selected paint maker.

In the edges of small holes such as slots, scallops, drain holes, etc. and corners of flame burnt free edge of structural members, the dry film thickness may not always be specified. Stripe coats shall be applied according to the maker's recommendation and the Builder's practice.

The painting of the exposed structural steel surface such as outsides of shell, deckhouse, funnel, etc., and of living space and passages in living quarters to be free from sags and runs.

After the specified coating is applied, the damages in paint film to be repaired at proper time. When the damage reaches the steel surface and rust occurs, the surface to be cleaned by the wire brush and/or disc sander and to be coated as originally specified.

When the damage does not reach the steel surface, the surface to be touched up to the specified film thickness.

The steel structure surfaces including all welded beads to be painted before the leak test, in general. However, fillet welding joint and erection butt joint forming tank boundary to be painted after joint has been examined either by compressed air test, vacuum test or tank air test as appropriate, but the shop primer can be applied to the fillet welding joint and erection butt joint before the leak test.

Pre-erection joint of hull block which is erected at any location, to be painted before leak test and not to be considered as block erection joint.

The adhesive tape may be used to protect the fillet joint and erection butt joint waiting for leak test from contamination by surrounding painting.

If the first coat does not have a primer function, a primer to be applied first on bare steel.

2522 Film Thickness

The dry film thickness to be measured after each coat to confirm adequate thickness. Under water hull paint thickness to be checked before and after application of anti-fouling paint and recorded. The number of points of thickness measurement to be adequate to get a fair idea of the paint thickness on covered areas.

The dry film thickness specified in the painting schedule to be attained on at least 90% of the measuring points and may not be achieved on the remaining 10% measuring points, but at least 90% thickness of the specified one to be attained on remaining 10% measuring points.

No measurement of dry film thickness shall be made for machinery, equipment, outfittings, pipes, pipe supports, machinery seats, small fittings, area within 100mm from free edges, slots, scallops, drain holes, air holes and manual welding beads.

2523 Inspection

The inspection of coatings to be done at all stages of coating for outside shell, the checking of paint dry film thickness to be carried out by Builder and maker's representative, and spot check to be conducted in the presence of Owner's representative.

2524 Painting Scheme

Painting scheme to be in accordance with the following specification.

Painting scheme for the parts and spaces not specified herein to be similar to surrounding space or comparable spaces.

Painting scheme to be changeable according to paint maker's recommendation.

Self-polishing paint under waterline to have five (5) year guarantee.

Painting scheme:

No.	Painting space	Type of paint	DFT (μ m)	Remarks
1.0	Outside Shell			
1.1	Flat bottom	Modified epoxy Modified epoxy TBT free anti-fouling paint	200 100	As per maker's standard
1.2	Vertical bottom (Up to normal ballast W.L.)	Modified epoxy Modified epoxy TBT free anti-fouling paint	200 100	As per maker's standard
1.3	Boottop (Up to scantling draft)	Modified epoxy Modified epoxy TBT free anti-fouling paint	150 100	As per maker's standard
1.4	Topside	Modified epoxy primer Modified epoxy finish	150 100 Σ 250	
2.0	External Structure			
2.1	Exposed Deck	Modified epoxy Modified epoxy	150 100 Σ 250	
2.2	Deck House, Funnel, Erection such as Deck Store, Companion etc.	Modified epoxy primer Modified epoxy finish	150 100 Σ 250	
2.3	Hatch Cover & Coaming	Modified epoxy primer Modified epoxy finish	150 100 Σ 250	
3.0	Inside of tanks			
3.1	Water Ballast Tanks	Tar free Modified epoxy Tar free Modified epoxy Tar free Modified epoxy Tar free Modified epoxy	160 Strip coat Strip coat 160 Σ 320	
3.2	Stern Tube Cooling Water Tank	Modified epoxy Modified epoxy Modified epoxy Modified epoxy	125 Strip coat Strip coat 125 Σ 250	
3.3	Bilge Tank	Modified epoxy Modified epoxy	125 125 Σ 250	
3.4	Fresh Water Tanks	Pure epoxy	300 Σ 300	
3.5	Fuel Oil Tank & Diesel Oil Tank	No paint, only wipe with oil		
3.6	Lub. Oil Tank	No paint, only wipe with oil		
4.0	Cargo Holds			
4.1	Tank top of Cargo holds	No paint but shop primer to be applied		
4.2	Cargo holds except above area	Modified epoxy Modified epoxy	100 100 Σ 200	

4.3	Cargo Hatch Cover (Underside)	Same as Cargo hold		
5.0	Inside of Cofferdam / Void Space			
5.1	Lower Stools, Access Trunk to Double Bottom Void Space	Modified epoxy Modified epoxy	100 100 Σ 200	
5.2	Upper Stool	Modified epoxy Modified epoxy	100 100 Σ 200	
5.3	Fore peak Tank (void), Cofferdam, Void space (except Cargo hold part)	Modified epoxy Modified epoxy	100 100 Σ 200	
6.0	Internal Surface of Compartments			
6.1	Engine Room Side and overhead of bare steel	Alkyd primer Alkyd finish	80 40 Σ 120	
	Side and overhead of steel under ceiling, lining or insulation	Alkyd primer	80 Σ 80	
	Lower deck	Alkyd primer Alkyd deck paint	80 40 Σ 120	
	Bottom up to lower floor	Modified epoxy Modified epoxy	100 100 Σ 200	
6.2	Steering gear Room and Bosun store	Alkyd primer Alkyd finish	80 40 Σ 120	
6.3	Inside of Chain locker	Modified epoxy Modified epoxy	160 160 Σ 320	
6.4	Rudder (interior)	Modified epoxy	150	
6.5	Refrigerated provision chamber under insulation	Modified epoxy	150	
6.6	Accommodation space and Stores Bare steel deck	Alkyd primer Alkyd deck paint	80 40 Σ 120	
	Gutter way	Modified epoxy	150 Σ 150	
	Steel deck under deck composition	No painting		
	Side and overhead of bare steel	Alkyd primer Alkyd finish	80 40 Σ 120	
	Side and overhead of steel under ceiling, lining or insulation	Alkyd primer	80 Σ 80	
6.7	Inside of Funnel	Alkyd Primer Alkyd alum. Heat resistant paint Alkyd alum. Heat resistant paint	80 20 20 Σ 120	
6.8	Battery Room	Modified epoxy primer Modified epoxy finish	100 100 Σ 200	
7.0	Outfitting on Deck			
7.1	Cranes, Crane post, Ventilators Outside	Modified epoxy Modified epoxy	100 100 Σ 200	
	Inside	Modified epoxy	100	
7.2	Masts Outside	Modified epoxy Modified epoxy	100 100 Σ 200	
	Inside	Modified epoxy	100	
7.3	Mooring fittings fabricated by steel	Modified epoxy primer	100	

	(Bollards, etc.), Davits, Pipe supports, etc.	Modified epoxy finish	100 Σ 200	
7.4	Anchor	As per maker's standard		
7.5	Ancher chain	As per maker's standard		
7.6	Bare steel outfittings	Modified epoxy primer Modified epoxy finish	100 100 Σ 200	

2525 Painting scheme of wooden surface

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

- 1 coat of wood primer paint
- 2 coats of white tint color paint

Wooden furniture to have:

- 1 coat of wood sealer
- 2 coats of clear resin

253 Galvanizing

Following outfits to be galvanized:

Handrail top rails, Ladders and steps exposed to weather

Boat lashings

Ventilator ducts (2.3 mm and below)

Small chains (12mm dia. and below)

Hinges, small bolts and nuts under 12mm dia. exposed to weather

Blocks, sheaves, cleats, shackles, wire ropes to be also galvanized.

254 Cathodic protection

Cathodic protection to be provided for the sea chests in engine room. The Zinc or Aluminum anodes (bolting type) to have a life of 5 years.

Impressed current cathodic protection system to be installed and the mean current density is 35 mA/sq.m at scantling draught. Propeller, shaft and rudder to be integrated with this system.

3 OUTFITTING

31 ANCHORING AND MOORING EQUIPMENT

310 General

The arrangement of anchoring and mooring to be in accordance with the relevant Rules and Regulation and approved by the Owner.

The windlass and mooring winch to be of electric-hydraulic type.

Maker's standard spare parts and tools to be provided.

The mass of anchor, the diameter & length of anchor chain and the length of mooring rope in the specification only for refer, the data shall be confirmed according to the final calculate.

311 Windlass and mooring winch

3111 Combined windlass / mooring winch

Two (2) sets of combined windlass/mooring winches to be located on forecastle deck.

Each combined windlass/mooring winch of independent type serving both port and starboard side to be composed of one (1) prime mover, one (1) gypsy wheel, two (2) hawser drums and one (1) warping head without auto-tension device.

Gypsy wheel and hawser drum not to be operated simultaneously.

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

Warping head to be mounted directly on the shaft of winch. Warping head to be designed to take about six turns of hawser.

Particulars:

Item	Wheel	Synthetic fiber rope drum	Warping head
No.	1	2	1
Capacity	About 9.0m/min 196kN(20t) x 9.0m/min (at the gypsy wheel)	147kN (15 t) x 15m/min (on the first layer)	118kN (12t)
Standard for chain, rope and capacity	φ 68 Grade 3 chain of welding or cast steel. Joining shackles to be of Kenter type	φ64 x 200m rope wind around drum	Six (6) turns

Each anchor to be connected with chain cables through a swivel.

3112 Mooring winch

Two (2) mooring winches to be located on after part of upper deck.

Each mooring winch to be composed of one (1) prime mover, two (2) mooring drum and one (1) warping head without auto-tension device.

Particulars:

Item	Synthetic fiber rope drum	Warping head
No.	2	1
Capacity	147 kN (15t) x 15 m/min (on the first layer)	118 kN (12t)
Rope capacity and standard	φ64 x 200m	Six (6) turns

The windlasses and mooring winches to be controlled locally.

The construction, material, accessory, spare parts and tools are to be in accordance with the manufacturer's standard.

312 Anchor, chain cable and mooring rope

3121 Anchor and chain cable

- 2 - Bower anchors, no spare
Stockless, AC-14 type anchor (balanceable), 5,850Kg each
- 2 - Stud link chain, dia. 68 mm (welded or casting steel, grade 3)
27.5m x 23 total length

Cable releasers, chain controller and wire anchor stoppers to be fitted.

The fixed end of chain cable to be placed near the chain locker and cable releaser to be placed in bosun's store.

The anchor shall not collide with sheel plate when the vessel have 5 degree heel.

3122 Mooring rope

8 – 200m long polypropylene rope with brake load not less than 480kN, 4 coil around windlass / mooring winch drum and 4 coil around aft mooring winch drum.

3123 Tow line

- 1 – wire line, break load 1470kN

313 Hawse pipe and chain pipe

3131 Hawse pipe

A hawse pipe to be provided at each side of the bow.

Each hawse pipe to be fitted with a cast steel bell mouth at the lower end and a steel deck flange at the top to allow satisfactory housing of the chain cable and easy lead to the gypsy wheel.

"Frog eye" welded construction to be fitted on the shell for proper housing of anchor.

No anchor recess to be provided.

Nozzles branched from the fire & wash deck line to be fitted to the hawse pipes for washing the chain cables.

A removable cover to be provided at the top of each hawse pipe.

3132 Chain pipe

A chain pipes to be fitted at the top of each chain locker under each gypsy wheel.

A chain pipe cover of galvanized steel plate to be provided on the top of each chain pipe.

Chafing ring of fabricated steel bar on deck and bell-mouth at lower edge to be fitted for protection and smooth running of cables.

314 Mooring fittings

The following mooring fittings to be provided:

(a) Bollards

8 - 560 mm diameter on forecastle deck and upper deck

4 - 500 mm diameter on forecastle deck and upper deck

4 - 450 mm diameter on upper deck

(b) Fairleaders

4 - ϕ 350 mm diameter x 3 rollers

6 - ϕ 350 mm diameter x 2 rollers

2 - ϕ 350 mm diameter x 4 rollers

(c) Panama chocks

4- 360 mm x 260 mm (double chock) on forecastle deck and upper deck

8 - 450 mm x 260 mm (double chock) on forecastle deck and upper deck

(d) Stand rollers

8 - ϕ 350 mm diameter on forecastle deck and upper deck

(e) Cross bits

2 - 300mm diameter on upper deck

Note: the data of above table may be changed in accordance with final calculation approved by class.

Anti-slip weld beads to be fitted around

All rollers for mooring fittings to have bronze bushes and grease nipples.

All bollards and fairleads to be stiffened / supported.

32 STEERING SYSTEM

321 Steering gear

Steering gear to be of electro-hydraulic, rotary vane type with two pump unites which can move rudder from rudder angle of 35 deg. at one side to 30 deg. at the other side within 28 seconds with one pump in operation and the other in stand-by, when the vessel is running at maximum speed at scantling draft.

Duty capacity of the steering gear to be abt. 600 kN-m and to be approved by Classification Society. (The capacity of steering gear will be calculated according to rule requirement, and the capacity will be increased 10% above rule requirement.)

Maximum rudder angle to be limited to 37 deg. on either side by means of stopper.

If one power unit fails, the remaining unit to be able to operate by immediate change of the gear. In case of power failure emergency generator to supply power to one pump unit.

Both pumps can be in operation simultaneously.

Suitable relief valves, by-pass valves to be fitted.

Low level oil alarm to be provided in wheelhouse and engine room.

Rudder angle to be indicated in wheelhouse, ECR and bridge wings.

Steering to be controlled by electro-hydraulic and autopilot system in wheelhouse stand and also to be done by manual operation of solenoid control valve at the side of the gear.

Tiller to be of solid boss type and keyless, oil injection type on rudder stock.

Rudder angle stopper to be provided.

322 Rudder arrangement

3221 Rudder and rudder stock

The rudder to be of a double plate with stream-line section and semi balanced type having rudder area of about 1/65 of immersed projected area of the ship at the scantling draft.

The rudder plates and horizontal & vertical rudder frames to be of fabricated steel plate with one(1) pipe of rigid casting for securing the rudder stock and pintle.

Rudder pintle to be forged steel and fitted with stainless steel sleeve (SUS316).

Rudder pintle to be tapered and of oil injection type.

Rudder stock to be constructed of forged steel and to be keyless at the upper and lower ends to take tiller and rudder respectively and to be oil injection type. Lower part of rudder stock to be tapered with screw and connected with rudder by a nut.

Rudder stock to be forged steel and fitted with stainless steel sleeve (SUS316).

Rudder trunk thickness shall be increased to take steering gear forces. Minimum thickness to be same as shell plating.

Rudder trunk to be extended to the steering gear flat and having rectangular water-tight section with a manhole on it.

Lifting holes, lifting eye plate, air and drain plugs of the rudder to be provided.

Rudder pintle bush & rudder stock bush to be Thordon or equivalent material.

Jumping stopper for rudder to be provided

33 CARGO HANDLING SYSTEM

331 Cargo gear

Four (4) electric hydraulic drive, single deck cranes to be provided as shown in the General Arrangement.

The arrangement and capacity of the deck crane to be as follows: (for reference only)

Item		No.1~No.4 Crane
Capacity		294kN (30t)x26m single
Slewing angle		360°
Hoisting speed		abt.30t x 20m/min, 12t x 42m/min
Lowering speed		abt 60m/min (at rated load)
Luffing time		Abt. 70sec
Slewing speed		1.0rpm
Working Raius	Max.	26m
	Min.	4.5m
Hoisting lift height (at minimum radius)		
Electric motor		kW
Operation		One-man operation at operation cab on the crane

Arrangement to be made to rest crane jibs horizontally when navigation and refer to General Arrangement plan.

Crane jib between cargo hold No.4 and No.5 not to be rest on superstructure front wall.

The data of the crane may be slightly different due to the selection the maker.

The cranes to be prepared and fitted with all required fittings for working with motor grabs.

Cargo handling equipment such as grabs (including the control devices) is supplied by owner.

The cranes to be fully rated for continuous operation. Operating cabin to be suitable for all weather conditions (-20°C -+45°C).

The cranes should be designed at 5 degrees heel and 2 degrees trim.

The cranes shall be operated simultaneously at rated load and speed for all three (3) motions.

332 Cargo hatchway and hatch cover

3321 Cargo hatchway

Hatchway size to be as follows:

	<u>Length</u>	<u>Width</u>
No.1 hatchway	9.6m/6.4m	20.8m/16.2m
No.2-5 hatchway	20.0m	27.0m

3322 Hatch coaming

Hatch coaming height to be abt.1400 mm at ship's centerline.

3323 Hatch cover

Cargo hatch covers to be weather-tight double skin folding type with flat top and out-placed hydraulic cylinders.

Double skin to be filled with VPI (Vapor Phased Inhibitor).

Two-panel cover sets for the folding type hatch cover to be stowed at each end of hatchways except one set for No.1 hatchway forward.

Steel hatch covers to be built up by welding, and to be of approved construction by the Classification Society.

The hatch cover to have sufficient strength withstanding the pay load of 29.4 kN/m² {3.0 t/m²}.

Stainless steel compression bar to be fitted on the top of hatch coaming and between the panels of the hatch cover.

Weather tightness of hatch covers including the between panels to be kept by gasket and quick acting cleats.

The opening and closing of the hatch covers to be done by means of external hydraulic cylinder and, in emergency, done by means of portable pump unit.

Two grain and cement loading scuttles to be provided.

Four hold ventilations with square flange to be provided on side of H/C, two on forward panel and two on after panel.

All design and work drawings as well as calculation documents concerned to be approved by Classification Society. After installation, hatch cover to be hose tested to prove its weather tightness. The hose test pressure to be in accordance with Rule requirement.

Helicopter winch mark to be provided on top of No.3 Hatch Cover by means of welding bead and paint.

Hatch covers shall be designed to operate under ship's condition of 5° heel and 2° trim.

Gas sampling points to be provided to cargo hatches if required by Class.

3324 Hydraulic system

One hydraulic station to be installed in crane house.

The hydraulic power unit shall supply sufficient power for operation of one pair of hatch panel within max. 3 minutes for opening or closing of hatch panel excluding cleating times. i.e. operation two pair of hatch panels for one cargo hold to be max. 6 minutes for opening or closing of hatch panel excluding cleating times.

The hydraulic station to consist mainly of two high pressure (25MPa) pumps and two electric motors to be supplied for operation of hatch covers.

Mechanically ventilation to be provided on the hydraulic pump station.

Emergency operation to be arranged by one set of portable electro-hydraulic pump.

333 Provision for cement cargo/grain

Two (2) cement holes 700 mm in diameter with flush type cover on each hatch cover (10 sets in total)

34 LIFE-SAVING APPLIANCE

340 General

Life saving appliances to be arranged for 25 persons and furnished in accordance with the SOLAS and the flag administration.

341 Life boat and launching appliance

One (1) free fall type totally enclosed lifeboats for 25 persons with launching appliance to be fitted on after part of vessel.

The lifeboat to be made of glass-reinforced plastic and provided with a fixed diesel engine.

The lifeboat to be supplied with inventory and spare parts required by the Rules.

The launching appliance to be of one steel cradle for housing the free falling lifeboat at fixed angle, complete with:

- hoisting frame operated by hydraulic cylinders
- guiding rollers on both sides
- power pack hydraulic operated

The release mechanism to be operated from the inside of the boat by acting on a brake capable of lowering by gravity fully equipped boat with persons on board at a velocity automatically regulated and ship trimmed and heeled according to SOLAS.

342 Rescue boat and davit

One (1) G.R.P. rescue boat with gas outboard engine according to the SOLAS rules to be fitted on starboard of A deck.

Elec-hydraulic operated single arm davit to be provided. The davit to be capable of hoisting the rescue boat at a speed of about 0.3 m/s when loaded with 6 persons and equipment. The davit to be combined with liferaft davit.

343 Liferaft

One(1) davit launched type inflatable life for 25 persons rafts to be installed on A deck starboard. The liferafts to be operated by single arm davit (common davit with rescue boat).

One (1) throw-out type inflatable life for 25 persons rafts to be installed on A deck port with hydrostatic unit.

One (1) throw-out type six (6) persons inflatable life raft to be installed on forecastle deck.

344 Other lifesaving appliance

Lifebuoys of required number and lifejackets for each person on board to be provided and stowed in accessible position, and the other six lifejackets to be stowed in engine control room, bosun's store and wheelhouse.

Lifejackets and lifebuoys to be of approved design, construction and material and completely equipped in accordance with requirement of SOLAS.

Immersion suits for all persons onboard.

A line throwing appliance to be provided. Immersion suits to be supplied as per SOLAS.

EEBDs to be supplied as per Flags requirements.

35 NAVIGATION EQUIPMENT**351 Navigation instruments**

The following nautical instruments to be supplied:

Name	Number	Description
Magnetic standard compass	1	liquid reflector type, 165mm card dia.
Spare bowl for compass	1	liquid type, 165mm card dia.
Deep sea lead	1	13 kg weight with 230m line
Hand lead	2	5kg weight with 52m line
Clinometer	6	clock type(wheel house, ship's office, captain day room, engine control room and passage way)
Clinometer	1	Pendulum type (engine room)
Sextant	2	
Binoculars	3	50mm x 7 times
Aneroid barometr	3	hectopascal scale
Themometer	1	wet & dry bulb (double type)
Thermometer	4	for atmosphere
Thermometer	1	for sea water
Triangle	1set	360mm, 45° & 60° each 1
Parallel ruler	2	550mm
Chart weight	8	
Ruler	3	300mm, 500mm, 1000mm
Anemometer	2	portable
Chronometer	1	quartz
Protractor	2	with handle
Station point	1	
Dividers	3	150mm, 200mm, 350mm
Megaphone	2	
Magnifying glass	2	D=90mm
Star globe	1	

Electric nautical instruments, radio equipment and navigation & signal lights are described in the Electric Part, and signal horns are described in the Machinery Part.

352 Flags

International signal flag	2 set
Ship's name code flag (medium)	1 set
Pilot flag (G and H, medium)	1 set
Blue peter (P, medium)	1
Quarantine flag (Q, medium)	1
National flag	(Owner supply)
House flag	(Owner supply)
Hand signal flag	2 set
Numeral pendants	1
Symbols flag	1

353 Signals

Black ball	3
Cylindrical shape	1
Diamond shape	1
Ship's bell	1
Gong	1
Electric whistle	1
Air horn	1
Distress signal (consisting of 12 parachute signals)	1 set

354 Masts and rigging

A foremast, a radar mast, etc. to be arranged as shown in the General Arrangement.

Fore mast

A fore mast of stayless streamlined construction of fabricated steel to be arranged on forecastle deck on the centerline of vessel.

The mast to be fitted with a vertical ladder, navigation and signal lights, two Panama Canal steering lights, necessary fittings and eye plates for steel wire rope stays which to be fitted in case of excessive vibration.

Radar mast

A radar mast of fabricated steel streamlined construction to be arranged on compass deck at the centerline of vessel.

The mast to be fitted with a vertical ladder, a gaff, navigation lights, a Christmas tree for Suez Canal signal lights and radar platforms, etc.

Flag staff and rigging

A jack staff of steel pipe to be fitted on the top of the bow chock.

An ensign staff of steel pipe to be fitted at the stern.

Necessary rigging and tackles for davits, flag yards, signal yard etc. to be furnished completely.

Flag halyard of 8 mm diameter synthetic fiber rope to be provided.

355 Communication device

No voice tube is to be provided.

In regard to telephone, call bell, loud speaking systems, engine telegraph and alarm bell, refer to the Electric Part.

356 Nautical books and charts

Nautical books and charts are to be supplied by the Owner.

36 DECK FITTINGS MISCELLANEOUS

361 Small hatches and manhole

3611 Small hatches

Hatches for access, etc. to be provided to the spaces listed in the following table:

Served Space	Number	Size (mm)	Position
Rope store etc.	1	Φ 600	Upper deck
Cargo holds	each 2	750 x 750	Upper deck
Bosun's store	1	1,000 x 1,000	Forecastle deck
Funnel top	1	630 x 630	
Engine room (B deck)	1	1400 x 2200 with 800 x 600 small hatch on top	Boat deck

The hatch on exposed deck to be of weather-tight construction with steel cover, synthetic rubber gasket and clampings lifting handle and locking in open position to be provided.

Nuts, bolts for hatches on weather deck to be of stainless steel.

The coaming height to comply with Rules requirement and all of weather-tight hatch to be tested by hose water.

All hatches to have eye plates for pad lock except escape hole

Large opening for engine room to have suitable coaming and portable stanchions for rope guard.

Hatch for rope handling to have protector of steel round bar for running of rope where sharp edge exists at coaming or deck beam etc. and to be fitted with rollers.

3612 Manholes

Oil tight or watertight oval manholes etc. to be provided for double bottom tank, side tank, Cofferdam etc.

Manholes on the tank top in way of cargo holds to be of flush type.

Manholes on the tank top in the engine room to be provided with coamings 100 mm high while the others with no coaming.

Manholes located on the exposed decks to have stainless steel stud bolts and stainless nuts.

The manholes to be oval in shape, and the size of them to be 600 mm by 400 mm except that the size of manhole on chain locker wall to be 800x600.

The size of manholes in cargo hold area must meet the PMA requirements.

Space name under manhole to be described with welded bead on each manhole cover.

362 Miscellaneous davits and cranes

3621 Provision crane

One(1) set of electro operated monorail to be provided at the back of deckhouse for hoisting provision and spare parts, etc.

The working load of monorail to be 3 tons with outreach about 3m beyond the maximum beam of the ship.

3622 Suez Canal searchlight davit

One (1) steel jib type 0.5t davit to be place on fore part of forecastle deck for hoisting Suez Canal searchlight and articles.

Hoisting and slewing of steel jib to be done manually.

3623 Hose davit

One (1) set of davit of 0.5 ton S.W.L. to be place on each side of A deck near bunker station for the handling of fuel oil hose.

Hoisting to be done electric and slewing of steel jib to be done by manual.

363 Ladders

3631 Accommodation ladder

One accommodation ladder of aluminum frame with aluminum curved steps to be provided at each side of upper deck out of cargo operating area.

The accommodation ladders to be 600 mm in width and to have the length to reach 0.5m above the water level with an inclination of 55 degrees to the horizontal when the vessel is in light ballast arrival condition.

The ladders to be stowed vertically along the accommodation ladder recesses on upper deck side by self stowing system.

An arm davit and a ladder winch with a fixed electric motor to be provided at each side of the vessel. Lifting and stowing ladder to be done by winch and to be one man remote push button control.

Handrails of vinyl sheathed synthetic fiber ropes to be provided at each side of the ladder. Height of top rail to be about 1000mm.

The upper platforms and lower platforms of the ladders to be of galvanized steel.

The surface of the steps and platforms to be of non-skid type.

3632 Pilot ladder

One(1) set of pilot rope ladder to be provided on each side of the middle upper deck in accordance with the requirement of SOLAS and National Authority and MSC.308(88) and MSC.1/circ.1331 &1375 .

The pilot ladders to be combined with slant ladder to meet international marine pilot association recommendation as shown on GA plan.

The fixed eye plates to be fitted on upper deck.

The length of pilot rope ladder to be sufficient to reach down to about 610mm above water line when the vessel is in light ballast arrival condition.

3633 Access ladders

Deck ladder

Steel inclined ladders 700 mm in width to be provided on exposed decks as shown in the General Arrangement.

Non-skid surface to be provided at the foot of each ladder. The deck ladders to have the steps of checkered steel plate 4.5 mm thickness.

The inclination of the deck ladders to the horizontal to be 55 degrees, in general.

Hold access ladder

The hold ladders provided in each cargo hold to comply with Australian Maritime Safety Authority MARINE ORDERS Part 32 "Cargo Handling Equipment" Issue 2, Compilation No.1 prepared on 27 June 2007 (for ladder in cargo hold / deck crane access) and to be well protected from possible mechanical damage.

3634 Miscellaneous ladders

Suitable vertical steel ladders or steps to be provided for radar mast, foremast, deck crane posts, water ballast tanks, fuel oil tanks, aft peak tank, fore peak tank, fresh water tanks, distilled water tank, access way to the chain lockers, etc.

One jacob ladder to be supplied for chain locker.

One aluminum wharf ladder to be provided.

Three (3) embarkation ladder with wooden steps to be provided.

364 Rails, lifeline and awning**3641 Handrail on exposed deck**

Handrails to be fitted as shown in the General Arrangement.

Handrails to consist of a top rail, two intermediate rails and stanchions except where noted otherwise.

The height of the top rail above deck to be 1050mm.

The top rails to be steel pipes about 42 mm in nominal diameter for handrails.

The intermediate rails to be steel round bars about 20 mm in diameter.

Steel flat bars of 65mm breadth x 16 mm thickness to be used as stanchions for handrails.

Storm rails to be fitted on the side walls and aft wall of deck houses, and at longitudinal engine casing walls in corridors of accommodation quarters. Storm rail to be of galvanized steel pipe for weather part and stainless steel pipe for interior accommodation.

Monkey rails or guard rails of steel round bar to be fitted on masts and posts for handling blocks, lamps, etc. starting from 2m above the deck.

3642 Lifeline

One (1) lifeline separated to several sections, made of galvanized steel wire rope covered by vinyl tube to be provided at port and starboard sides of the upper deck and to be fitted with suitable galvanized shackles and turnbuckles for adjusting tension and portable stanchions at suitable interval.

3643 Awning

Pilot shelter platform required by Panama Canal Authority to be provided on each side of bridge wings.

366 Canvas cover

Canvas cover of vinylon to be provided one for each magnetic compass, electric compass, chain pipe, horn, sound pipe, searchlight, focus light, accommodation ladder winch, wire winch, rope ladder etc.

Cloth cover to be provided for radar screen, control table etc, in wheelhouse.

The detail list to be provided by Builder and agreed by Owner.

367 Name plate and marks

Name plate and marks to be provided as follows and to be distinguished by color paint and lacquer.

Ship's name and port of registry on transom In English, welded bead.

Ship's name board at compass deck	Hard wood with carved name. Name board at both Side of compass deck to be painted with vinyl resin paint and well illuminated.
Funnel mark and bow mark	According to the Owner's standard, welded bead. and well illuminated
Draft mark in metric system	Welded steel plate
Freeboard mark	Cut out plates of 6 mm
Pilot embarkation	Welded bead
Bulkhead mark, and lines of boot top paint	Welded bead
Builder's name board	Brass plate with carved letters.
"NO SMOKING" sign	To be painted red on welded bead.in each hold, engine and generator room
Cargo hold mark	Cut out plates of 6 mm
Depth marks in holds	Cut out plates of 6 mm
Tonnage & official number	Welded bead
Tug push mark	Welded bead, to be fitted on shell plate at suitable position both port and starboard. Structure in way to be reinforced.
Bulbous Bow Mark	Welded bead, at forward part both port and starboard
Miscellaneous marks	
Tank number and code to be marked closed to the bottom plugs.	
Manhole covers of tanks to be marked with tank number and code.	
Mark for tank division to be provided on side shell and bottom shell.	
Mark for frame to be place on bulwark or deck.	
Mark for pilot to be of stainless steel and fitted on both side of wheelhouse.	
Plastic plaques engraved with ship's call letters to be fitted in suitable location in the wheelhouse.	
All filling lines and tanks air vent on deck plus sounding pipes to be labeled with engraved stainless steel plate.	
IMO number, official Number and GRT in cargo Hold No.5 after hatch end beam to be also provided.	

37 HULL PIPING SYSTEM

370 General

The general requirements for piping systems contained herein to be particularly applicable to piping systems outside the engine room, unless otherwise especially stated. For detailed and/or specific requirements of a particular system, refer to that section which describes the system and to the applicable Rules and Regulations.

Materials and dimensions of pipes, joints, valves including bolts, nuts ect. to be manufactured in accordance with the Chinese industrial standard, and/or the Builder's standard except otherwise specified hereinafter. The diameter of connecting flange and distance between flanges of valves to be in accordance with ISO standard.

Valves, pipes and fittings mounted on its equipment to be in accordance with the manufacturer's standard.

371 Piping materials and work

3711 Pipe

The materials and wall thickness of pipes to be in accordance with Paragraph 3791 "SCHEDULE OF HULL PIPING" and Paragraph 3792 "SCHEDULE OF VALVES" and to meet the requirements of the Classification Society.

The specification of pipes forming a part of machinery or equipment supplied by the maker to be of the maker's standard.

Pipe bore to be decided so as to accommodate given flow quantity and corresponding pumping pressure.

As far as practicable, the pipe lines to be led directly with a minimum number of bend and the arrangements to avoid well part where drains likely to stay.

Suitable draining arrangement of DN 15 mm bronze valve or drain plug to be provided for well parts of water pipes in exposed locations where those may be frozen.

Pipe lines to be kept away from switchboard and the electrical appliances, where the piping is unavoidably led above the electrical appliances, the welded joint and steel trays to be provided.

Where the piping pierces girders or any structural element, the compensation, if necessary, to be provided in accordance with the requirements of the Classification Society and the Builder's standard.

The arrangement of piping to be designed in consideration of convenience in painting hull, cargo handling and traffic as far as practicable.

Piping to be designed to release the excessive stress due to thermal expansion and deflection of the ship's structure.

Pipe bend radius to be not less than 2.5 times outside diameter except elbow.

3712 Valve

In general, the valve size to be of the same nominal bore as that of the pipes connected except automatic control valves.

Cast steel and ductile cast iron valves to be fitted to such locations as required by the Classification Society.

In general, for DN100mm and above, butterfly valves to be used as far as possible, except high pressure and high temperature system.

Use of gate valves to be limited where require by Classification Society for the purpose of fire protecting closure.

Gate valves to be of non-rising stem type and to have solid wedge disc.

Installation of the ship side valve to be in accordance with the Classification Society's requirements and to be fitted rigidly to the shell with short stub piece of heavy wall as far as practicable.

In general, the actuators of remote butterfly valves to be of enclosed double acting type, and to be directly coupled to the valves except those required by Rules.

Remote controlled valves to be provided with manual operation device required by Classification Society.

Valve name plates of brass to be fitted to the valves or floor next to the valves.

3713 Pipe joint

Unless otherwise specified, the welding joints of outside sleeve type, butt welding and flange connections generally to be applied to pipe connections with valves, fittings, machinery and where necessary for the work according to the Builder's practice.

The material of pipe connection to be similar to that of the pipes connected.

In general, flanges to be of steel fillet weld-on type for steel piping and brass-on type for non-ferrous piping of small diameter.

Preformed welding socket to be used for high pressure steel pipe such as hydraulic oil lines, etc.

Butt welding joint to be applied for reducer, elbow, tee, and others except otherwise specified.

Steel hexagonal head bolts and nuts electroplated with zinc to be used for piping in water tank, weather deck, etc.

Metric threaded and/or welded type unions may be used at dismantling point of small bore steel pipe or non-ferrous tubes

For copper or aluminum brass piping, bite type union or brazing type or sleeve joints to be applied for small bore pipes and tight welding joints for large bore pipes of fire-fighting system.

Sliding type coupling joints to be generally used for ballast, bilge, fire main, cable protection lines, etc., where necessary to compensate the pipes from expansion and contraction.

Sleeve type coupling joints to be applied to high temperature pipe lines such as steam and the system required by the Classification Society.

Offset expansion bends (loop) may be applied to compressed air line, steam line in fuel oil tanks, high pressure hydraulic oil lines and wherever practicable.

Scheduled angle pipes to be used for all bents. No welded pipe sections to be used for turn of pipes.

3714 Bulkhead and deck penetration

Where the piping pass through the watertight or oil tight bulkheads and decks, the bulkhead or deck to be sufficiently compensated, where necessary, in accordance with the requirements of the Classification Society.

The penetration pieces to be as per Builder's standard thickness.

The connections through the insulated bulkheads to be of suitable length to permit access to flange connections without disturbing the insulations.

3715 Suction bell mouth

Inverted hopper shape suction bell mouth fabricated of mild steel to be used in general.

Double Plate to be installed below ballast water bell mouth.

The clearance between suction bell mouth and tank bottom to be Builder's standard.

3716 Other piping fittings

Branches, bends, and other fittings etc.

Branch pipes for low pressure piping up to 5MPa to be welded directly to the main pipe.

For high pressure pipes of DN 40mm and below, socket welding type tee to be used.

Standard elbow pieces and reducers to be of fabricated steel made by electric arc welding.

Fittings forming a part of pipe to be of the equivalent material as jointing pipes in general.

If cold bending is not applicable or small bending radius is necessary to facilitate the piping arrangement, high frequency induction bending or butt-welding elbow to be used.

The loose fittings (Filters, Strainers, Traps, Rose Box, Mud Box, Rose Plates, Plugs, Nozzles, Orifice, expansion couplings, separators, air pipe heads, etc.) to be selected by pipe size, line pressure and pipe line material according to Builder's practice.

Gasket and packing

Gasket used for all pipe lines, in general, to be of multi-purpose type or reinforced rubber sheet type, suitable for the pressure, temperature and the medium inside the pipe.

Asbestos gasket not to be used.

Material of packing for valve stem to be of valve Maker's standard.

3717 Pipe support

The piping to be securely supported and braced as per the Builder's practice to avoid damage, vibrations and movement due to thermal and/or ship's deflection.

Support for non-ferrous pipe to be inserted with similar non-ferrous sheet metals so as steel not to be directly contacted with the pipes.

Fixing supports to be provided for preventing floated pipe from excessive free moving, where required.

For clamping, "U" shape steel round bar bolt clips to be used for steel pipes (DN \geq 15mm) and flat bar band clips for the others.

U-bolts to be secured to the supports by means of double nuts (each one on both sides of the support) for all hydraulic pipes, ballast pipes and fuel oil pipes.

Steam heating pipes to be supported by means of U bolts-fixing of nuts. 'Fixed' and 'sliding' type arrangement to be applied.

However, all size of vent pipes, and the other pipes not mentioned above to be supported without sliding pad.

3718 Pipe protection surface treatment and cleaning

The piping works to be protected from mechanical damage, where necessary and the protection to be constructed with steel angels, plates or channels as per Builder's practice.

The surface treatment and coating of the machinery, loose fittings and valves to be carried out in accordance with maker's standard for the intended purpose, and no special surface treatment to be made exceeding maker's standard unless otherwise specified.

The pipe fittings whose function is to join branches of the system (such as tees, Y-pieces, elbows, flanges, unions, bushing, etc.) to be painted same as connected pieces.

The loose fittings other than above pipe fittings supplied by makers (such as expansion coupling, filters, strainers, traps, separator, rose boxes, nozzles, plug, orifice etc.) to be painted in accordance with Maker's standard unless otherwise specified.

The galvanizing to be carried out after fabrication of pipes in principle, but in such case that welding after galvanizing is unavoidable as under mentioned, the external of the damaged parts to be touched up with two (2) coat of zinc solution paint, and internal parts to be touched up with the same paint as far as practicable.

- a) Fabrication of sleeve joints and adjustment of pipes on board to be avoided as far as practicable, fire-fighting pipe joint instead of sleeve joints to be used as far as practicable.
- b) Flanges of pipes adjusted on-board
- c) Middle flanges of penetrating pieces adjusted on-board
- d) Anchoring pieces welded on galvanized pipes after adjusting on-board
- e) Butt weld joint adjusted on-board

The service fuel & lubricating oil and hydraulic oil pipes to be pickled before installation. After installation onboard, the pipes to be flushed and cleaned and checked by Buyer's site supervisors prior to being connected to machinery.

Where the acid pickling is necessary for pipes, the acid pickling to be done and inside to be treated with oil to prevent rust before installation on board.

3719 Inspection and test

All the tests and inspections of pipe lines to be carried out in accordance with the requirements specified in the Specification and/or the Rules and Regulations and the Builder's standard.

Visual Test

Dimensions, scantlings, locations, surfaces finishing, welding, fastenings, joints, etc. to be visually inspected where necessary.

Leakage Test (Flow Test)

The pipes which to be occasionally filled up by gravity or pipes through which liquid flow without pressure during the actual service shall be tested by free flow of water to confirm tightness of pipe lines.

Pressure Test

The statically hydraulic pressure test to be carried out in accordance with the requirements of the Classification Society and Builder's standard.

During the pressure test, a blank flange to be provided at the open ends with the valves and/or any other means of closing on the piping fully open.

372 Fire fighting system

3720 General

The following fixed fire fighting systems to be provided for the spaces as listed below.

Sea water system	Exposed decks, engine room, steering gear room, cargo holds, Accommodation space, paint store and other working spaces.
Fixed water mist system	Localized fire suppression in engine room.
CO2 fixed system	Cargo holds, Engine room, etc.

All fire fighting system and equipment to comply with the requirements of SOLAS.

Fire control and protection plan to be provided on either side of the ship by Builder.

Fire control station to be provided with controls for quick closing valves, fans, CO2, oil pumps and oil purifiers, etc.

Five (5) sets of hydrant and branch pipe without fire hose shall be provided for hold cleaning.

Hold cleaning machine with hose and quick coupling matched with ANSI type hydrant shall be provided by Buyer.

3721 Sea water system

Fire main line

Fire main line water to be supplied from two fire, bilge & G.S. pumps and the emergency fire pump.

The fire main line and branch line to be led along the upper deck and connected with fire hydrant.

Through essential branch line and stop valve the system to be used for wash decks and for other purpose as follows:

- 1) For washing chain, four (4) nozzles to be provided in each hawse pipe.
- 2) Driving water for bilge eductors.
- 3) Driving water for ballast stripping eductors.
- 4) cooler for deck machinery, if necessary

Sufficient number of drain cock to be provided for deck wash system exposed to weather.

Fire hydrant and hose rack/box

Fire hydrant to be arranged that at least two jets of water not emanating from the same hydrant, one of which to be from a single length of hose, may reach any part of the ship normally accessible to the crew while the ship is navigating.

Fire hydrants to be DN65mm in exposed deck and DN40mm in living quarter and engine room respectively.

One (1) international shore connection to be provided in accordance with the Rule requirement.

The fire hydrant to be manually operated valve with hose coupling of bronze.

Hose boxes to be of glass-reinforced plastic construction on exposed deck and in accommodation to be provided and each to contain following equipment:

One (1) – rubber lined synthetic hose with coupling, the length to be 25m in exposed deck, 20m in accommodation and 15m in engine room

One (1) - approved dual purpose type (spray/jet) nozzle incorporating a shut-off.

One (1) - spanner

Fire hydrants line and the hose racks/boxes to be painted in red.

The fire pumps to be remotely started and stopped from the wheelhouse, the fire control room, and pump side for local start/stop.

Emergency fire pump

An emergency fire pump room to be located behind the collision bulkhead as the GA shown. The arrangement should meet the FSS Code (Ch.12.2.2.1.3).

An electric motor driven emergency fire pump to be installed in emergency fire pump room. The pump to be able to draw water and build up design pressure at ship ballast condition.

The pump to have self-priming device and there is an emergency independent sea chest besides.

The emergency fire pump to be discharged to fire main line through non-return stop valve.

3722 Water mist system

The system refer paragraph 5672.

3723 CO₂ fire extinguishing system

CO₂ fire extinguishing system to be arranged for engine room to comply with the requirements of the Rule and SOLAS.

CO₂ fire extinguishing system for engine room can be released by operating manual valve in CO₂ room and by operating of remote-control system in fire control room. CO₂ fire extinguishing system for cargo holds can be released by operating manual valve in CO₂ room.

The remote control system to be interlock with audible alarm.

Independent CO₂ fire extinguishing system for galley exh. duct to be provided according to Rules' requirement and released by manually at local. A portable CO₂ extinguisher to be provided for emergency generator room.

Suitable arrangement to be provided for weighing of CO₂ bottles and safety devices to be provided in accordance with the requirements of Regulations and manufacturer's standards.

Brass plate engraved with operation and distribution instruction for CO₂ system to be provided in CO₂ room, wheelhouse and fire control room.

3725 Portable fire extinguisher

Portable fire extinguishers to be furnished and properly secured in accordance with the requirement of the SOLAS.

Dry powder or CO₂ type portable fire extinguisher should not be less than 5 kg and to be arranged near the entrance of living quarters and store. For machinery space the portable fire extinguisher to be provided according to detail engine arrangement. Each one set of dry power portable fire extinguisher to be furnished in radio room, wheel house and galley and each one set of spare charge unit to be provided.

3726 Fire detection and alarm system

Indication of fire to be provided on fire alarm panel in the wheelhouse in accordance with SOLAS.

Suitable numbers of fire/smoke detectors to be provided in the machinery spaces and indication of fire to be provided on fire alarm panel in the wheelhouse and alarm in engine control room.

Smoke tube type fire detecting system shall be provided for cargo holds.

Combined CO₂ gas discharge & smoke suction line shall be led in each cargo hold, smoke detection with 3-way valve and suction fan shall be arranged in the CO₂ bottle room, a repeater panel shall be in the wheel house.

Suitable numbers of manual break-on alarm boxes to be provided in access of every deck and passage ways and suitable spaces.

The details of the system refer to Electric Part.

3727 Fire control station

A fire station for fire fighting system shall be arranged in accommodation area.

Followings shall be controlled or stowed in:

- Emergency stop of the ventilation fans for E/R
- Emergency stop of fuel oil pumps and lubricating pumps in E/R
- Emergency stop of fuel oil purifier in E/R
- Emergency quick-closing of valves on oil tanks in E/R
- Start/stop push button of the bilge, fire & G.S. pumps and emergency fire pump
- Fire alarm push button
- Fire alarm repeater panel
- Fire alarm manual call point
- Portable international shore connector
- Portable fire extinguisher as required by the Rule
- CO₂ releasing box for engine room
- Auto telephone
- Others as per the Rule and Regulation

Fire plans shall be provided in accordance with Rule and Regulation and to be stored in galvanized steel case on both sides of accommodation on upper deck.

3728 Fireman's outfit

Two (2) sets of fireman's outfits to be provided and stored in fireman's outfit store in separated space.

3729 Escape trunk for engine room

One (1) set of escape trunk to be provided from lower floor plan of engine room to a safe position outside engine room.

373 Bilge system and ballast system**3731 Bilge system**

One (1) bilge mainline to be led in double bottom.

Two (2) hold bilge suction with strum boxes of galvanized steel plate, one (1) on each side, to be arranged at the bilge well of each hold and to be independently led to the mainline. The bilge mainline to be connected to the bilge pumps in engine room.

Remote electrical hydraulic butterfly valve of hold bilges to be fitted on each branch line.

Non-return valves to be fitted in all hold bilge wells accessible from the holds.

Bilge water in the chain locker to be discharged overboard by a water eductor and driving water for the water eductor to be supplied from the hydrant and wash deck line.

Bilge water in the bosun store to be discharged overboard by a water eductor and driving water for the water eductor to be supplied from the hydrant and wash deck line.

Bilge water in the steering gear room to be led to the bilge well in the engine room through self-closing valve.

One discharge connection with stop valve and blank flange to be arranged on upper deck for the oil sludge via a non-return valve and a shut-off valve and oily bilge via a non-return valve and a shut-off valve in engine room in accordance with USCG requirement.

Equipment for emergency stop of sludge pump to be fitted near the connection of oil sludge discharge system.

High level alarm to be provided for bilge well in cargo holds.

The water ingress level alarm system for cargo holds, water ballast tank and dry space to be provided in compliance with SOLAS – CH. -reg.12.

The bilge line arrangement for dry space and water ballast tank forward of the collision bulkhead to be in compliance with SOLAS – CH. -reg.13.

Fire, bilge & G.S. pump shall supply washing sea water through the deck fire main by hose connection to washing machine for cargo holds, then the fire, bilge & G.S. pump shall suck out fresh water from the washing fresh water tank located in side cofferdam tank to washing machinery for re-washing of cargo holds.

Water after washing shall be shifted by the bilge & G.S. pump to slop tank located in side cofferdam tank for settling, then discharge to overboard by gravity or a ballast stripping eductor.

Cargo hold washing system

A portable air/water-driven cargo hold washing system to be provided. The system to be consist of:

- 2 Combi-guns (Air 7 MPa, SW 0.7 MPa, 20 m³/h)
- 1 Mini-gun (FW flushing, FW 0.7 MPa, 100 l/min)
- 1 Spray foam equipment
- 2 portable air driven bilge water pump (35 m³/h)

Quick coupling standard valves for connecting short-length flexible hose for the cleaning equipment (air, SW, FW and washing water discharge line) to be arranged close to the tanktop. Valves to be arranged in a recess. Recess to be closed by an easy dismountable hinged bolted cover.

Two tanks aft in way of ballast wing tanks to be arranged as F.W. washing tank and slop tank.

One common hold washing water line branched down in each cargo hold leading to the slop tank. A direct overboard discharge of washing water to be possible.

3732 Ballast system

Two (2) main ballast lines to be arranged in double bottom, each main ballast line to be respectively connected to No.1~5 water ballast tanks (P&S) through a branch ballast line and a branch ballast line to be connected to fore peak water ballast tank.

A suction of the bell mouth to be provided in each ballast tank.

Suction mouth of ballast to be connected with flange in tanks and easily dismantled. Enough drain hole to be provided at structure member surrounding mouth pieces.

The ballast main to be connected to two ballast pumps in engine room.

The ballast pipe for A.P. water ballast tank to be connected to ballast pump

No shifting of ballast between ballast tanks to be considered.

Two (2) sets of ballast water treatment plant to be provided in the engine room. The ballast water treatment plant shall be IMO approved type with certificate.

The hydraulic operated butterfly valve to be fitted on each branch ballast line in dry chamber of the double bottom located in adjacent ballast tank and easily assessable from the main deck. These valves to be remote operated from ship's office.

All remote operation valves can be open/shut manually in case of failure of remote operation.

A hydraulic screw-down valve to be fitted in F.P. W.B. tank and operated remotely from the deck office on the upper deck.

Remote level for ballast tanks and draft reading to be indicated on ballast control panel in ship's office.

Stripping line for No.1~5 W.B. tanks to be provided with remotely operated valves in the double bottom and ballast stripping eductors in engine room.

One (1) hydraulic power unit to be provided in common for bilge piping and ballast piping.

374 Air and sounding pipe system

3741 Air escape/overflow pipe

The air pipes to be arranged in compliance with the Load Line Regulation.

Air pipes to be provided to all cofferdams and tanks, and to be terminated in the place in accordance with the requirements of the Classification Society with suitable heads. The air pipe head for fuel oil tank to be fitted with float type closer and fire proof screen of stainless steel and the head for fresh water tank to be fitted with closer. Air pipes to be of steel for oil tanks and to be of steel with hot galvanized for water tanks.

Coaming and oil spill tanks to be arranged around air escape pipe for oil tank to contain spilled oil according to U.S.C.G. requirement and drain valve to be provided.

Size of air pipes to be not less than 125% of sectional area of suction pipe in accordance with Rule requirements.

All air pipes to be arranged clear of bollard, chocks and deck fittings.

All H.F.O. bunkers, M.D.O. and L.S.M.D.O.(sulphur 0.1%) bunkers should have overflow pipes connected to the F.O. overflow tank located in the engine room.

3742 Sounding pipe

One (1) sounding pipe of deck flush type to be fitted to each water tanks, void spaces and chain lockers, and the sounding pipes for oil tanks to be extended to suitable height above upper deck and terminated with brass plugs, the pipes for engine room double bottom tanks to be terminated at about 800 mm above floor plate with self-closing cocks and screw caps.

The sounding pipe to be of steel pipe DN 65 mm for F.O. tanks and DN 40 mm for water tanks and chain locker. Application of galvanization for sounding pipes to be the same as air pipes.

Sounding pipe of DN 65mm for cargo hold bilge well to be utilized.

Sounding pipes to be as straight as practicable and fitted with brass cap. The lower end to be extended to a height of about 50 mm above the tank bottom and striking pad of 10 mm thick to be fitted to protect the tank bottom.

Lowest part of sounding pipes to be detachable for removing broken sounding tape.

375 Fresh water service system

3751 Cold fresh water system

The fresh water filling pipe shall be not less than DN 65mm.

Pressure tank system shall be adopted to supply cold fresh water.

Cold fresh water system consist of one (1) F.W. hydrophore, two (2) fresh water pump, one (1) F.W. mineralizing unit and one (1) F.W. sterilizer.

The cold fresh water shall be supplied to ship's domestic consumers including washing and sanitary water.

The pumps shall take suction from F.W. tanks or F.W. washing tank (distilling water) and discharge to F.W. hydrophore to supply ship's domestic consumers including drinking, washing and sanitary water. A separate branch line for drinking system trough F.W. sterilizer to galley,pantry and drinking trough. The cold water shall be led to consumers by means of branches with shut-off valves at the main for each deck.

The F.W. hydrophore shall be constructed of mild. steel or conten steel and finished completely with level gauge, pressure gauge, relief valve, drain connection and connections from the compressed air system for charging purpose.

The automatic pressure controls shall be fitted to start and stop the pump to maintain the necessary pressure in the hydrophore.

One F.W. valve with connection shall be provided also on both sides of the bridge wings.

Fresh water line shall be provided on upper deck with ten (10) ball valves and quick coupling connections, one in way of each hold. The connecting pipe shall be of DN 25 mm.

3752 Hot fresh water system

The closed loop system to be adopted to supply hot fresh water to same as cold water consumers except handling room of refrigerated provision.

Hot water system to consist of one (1) calorifier with electric & steam heating, One (1) circulating pump, main circulating pipe and branch pipes.

The hot water to be circulated by hot water circulating pump discharging water through calorifier which to be filled from cold water main. The hot water on each deck to be distributed by means of pipeline formed as a loop with shut-off valves at the main and with short branches led to consumers.

Hot water to be also supplied to wheelhouse for front window washing.

3753 Distilled water system

The distilled water from the fresh water generator passes through water meter and salinity indicator to the F.W. washing tank / F.W. (P&S) tanks through mineralizer.

Distilled water system consist of one (1) tech. F.W. hydrophore, two (2) tech. fresh water pump,

The tech. F.W. hydrophore shall be constructed of mild. steel or conten steel and finished completely with level gauge, pressure gauge, relief valve, drain connection and connections from the compressed air system for charging purpose.

The automatic pressure controls shall be fitted to start and stop the tech. fresh water pump to maintain the necessary pressure in the hydrophore.

Distilled water system supply water to the F.W. expansion tank, oily water separator etc.

376 Scupper and drainage system

Sufficient scuppers to be provided for all decks, top of deck houses, galley, pantries, lavatories, wheelhouse, refrigerated provision stores, passages in accommodation space and other enclosed spaces, wherever necessary.

Drainage to be arranged away from accommodation ladder, pilot ladder and lifeboat position.

Upper deck scuppers for overboard to have grids with plug can be inserted. Scuppers for refrigerated space to be with plugs.

Scupper pipes to be led to the weather decks or overboard directly according to the situation.

Storm valves to be fitted for necessary pipes as required by the Classification Society.

Soil scupper pipes from the water closets to be collected to the sewage treatment plant installed in engine room in harbor or directly overboard through one (1) gate valve and one (1) non-return valve near the ballast line during at sea.

After the treatment plant, the sewage also can be discharged to overboard at sea or to sewage holding tank installed in engine room in harbor duration, then using the sewage transfer pump to discharge overboard at sea.

Sewage pipe line from hospital shall be led independently to the sewage treatment plant.

Air vent pipes to be provided for soil scupper pipe, where necessary, and led to open deck.

Waste water lines to be connected with wash basins, sinks, laundry equipment, deck scuppers in accommodation space, etc. and to be discharged to sewage holding tank or overboard by storm valves near the ballast water line level.

Water sealed traps to be fitted to the refrigerated provision stores.

Scuppers to be arranged accessibly and hard bending for galley scuppers and soil pipes to be avoided as far as possible.

Fat trap to be provided for galley scuppers.

Flat bar coaming to be fitted around steering gear etc.

Drain pipe from funnel top shall also be led to the deck.

Scuppers and drainage pipe to be as straight as possible. Soil pipes and internal pipes to be provided with connection points for compressed air line to utilize incase of blockage.

Platform decks in engine room to be provided with scuppers. Drain pipes to be guided to the bilge well from deck to deck.

377 Compressed air system for deck service

One (1) compressed air line for using disk sander and paint spray guns and chipping hammers to be led along upper deck, forecastle deck and accommodation decks.

The compressed air with 0.7MPa to be supplied from deck service air reservoir in engine room.

Water/oil separator with drain valve shall also be positioned at lowest point for compressed pair service line on main deck.

Main line to be DN 40 mm and connection piece with DN 15 mm hose connection valve to be equipped as follows:

Upper deck:	Twelve (12) connections
Forecastle deck:	Two (2) connections
Accommodation deck:	Two (2) connections (each P & S)
CO ₂ room:	One (1) connection
Emergency generator room:	One (1) connection
Paint store	one(1) connection

378 F.O. and L.O. filling system and F.O. tank heating system

3781 Fuel oil filling system

All fuel oil tanks to be arranged in engine room as shown on GA plan.

Two (2) bunker stations for the H.F.O., M.D.O. & L.S.M.D.O. to be provided in the front of the deckhouse, one (1) on each side of the ship.

The H.F.O. shore connection to be of DN200mm, and the M.D.O. & L.S.M.D.O. shore connection to be of DN100mm.

Each shore connection to be fitted with blank flange, butterfly valve, sampling device and pressure gauge, etc. and one (1) thermometer also to be fitted at H.F.O. shore connection. There is a filter in the HFO and M.D.O. (L.S.M.D.O.) bunkering manifold in engine room.

HFO tanks (P&S), M.D.O. tank and L.S.M.D.O. tank to be bunkered by filling pipes with remote operated hydraulic butterfly valves.

The F.O. shore filling lines to act as discharging lines by the F.O. transfer pumps in engine room respectively.

The remote operated hydraulic butterfly valves to be fitted on each F.O. branch line and to be remote operated from E.C.R.

Oil spill spaces with drain plug to be provided at F.O. bunker stations.

Remote level for oil tanks to be indicated in E.C.R. Caution plate required by USCG to be provided near the bunker station where necessary.

3782 L.O. Filling system

One (1) filling connection of DN80 mm with a blank flange to be provided for the main engine system oil and auxiliary engine system oil on each side of the ship.

One (1) filling connection of DN50mm with a blank flange to be provided for the main engine cylinder oil on each side of the ship.

3783 Fuel oil tank heating system

Steam tank heating system to be adopted for H.F.O.tanks.

Heating coils to be of steel pipe.

The steam to be led from the engine room to each tank, and led back to cascade tank in the engine room.

Steam tracing to be adopted for suction pipe of H.F.O. line and to be insulated together with H.F.O. suction pipe.

379 Schedule of hull piping and valves

3791 Schedule of hull piping

System		Pipes			Pipe Joint	Pressure Standard for flange (MPa)
		Size	Material	thickness		
Tank heating coil in fuel oil tank		All	Seamless steel	C	sleeve or butt welded or flange	1.0
Compressed air pipe for deck service		All	Seamless* steel galv.	B	Sleeve or flange	1.0
Fuel oil	On deck	All	Seamless steel	B	Sleeve or flange	0.6
Ballast	Out of engine room	All	GRP .	-	Sleeve or flange	0.6
	In engine room	All	Seamless* steel galv.	Refer to Para.5612	Sleeve or flange	
Bilge	Out of engine room	All	GRP ..	-	Sleeve or flange	0.6
	In engine room	All	Seamless* steel galv.	Refer to Para.5612	Sleeve or flange	0.6
Domestic steam & drain		10	Seamless copper		Socket	0.6
		15 & above	Seamless steel	B	Sleeve or flange	0.6
Cold fresh water		All	Seamless copper		Flange	0.6
Hot fresh water		All	Seamless copper		Flange	0.6
Soil pipe		All	Seamless steel galv.	B	Flange	0.6
Scupper	Above upper deck	All	Seamless steel galv.	B	Sleeve or flange	0.6
	Under upper deck	All	Seamless steel galv.	B as per rule	Sleeve or flange	0.6
Air	For oil tanks	All	Seamless steel	B as per rule	Sleeve or flange	0.6
	For other tanks	All	Seamless steel galv.	B as per rule	Sleeve or flange	
Sounding	In oil tanks	65	Seamless steel	B as per rule	Sleeve or flange	0.6
	In other tanks	40	Seamless steel galv.	B as per rule	Sleeve or flange	0.6
Hydrant and wash deck		All	Seamless steel galv.	B	Sleeve or flange	1.0
Hydraulic pipe for deck machinery	Pressure line	All	Seamless steel	Manufacturers standard	Flange	
	Return line	All	Seamless steel	Manufacturers standard		
Refrigerant	Connecting pipe	As per maker's standard				
CO2	From CO ₂ cylinder to selection valve	All	Seamless steel galv.	B	Sleeve or flange	11.8
	From selection valve to discharge nozzle	All	Seamless steel galv.	B	Sleeve	1.0

Notes: (1) Thickness of pipe shown in the table refers to Paragraph 5612 of Machinery Part.

A ordinary B Medium C Heavy

(2) * Compressed air horn pipe exposed to weather to be of copper.

(3) All gal. pipe to be of hot dip type.

(4) Hold temperature pipes to be provided in each hold.

(5) The penetration pieces for GRP to be of mild steel type.

3792 Schedule of valves

Piping system	Size (nominal)	Material			Pressure Standard of valve (MPa)
		Body	Seat	Stem	
Steam and drain line for tank heating	50 mm & above	Cast steel	Steel	Stainless steel	Steam 1.0 Drain 0.6
	40 mm & under	Bronze	Bronze	Brass	Steam 1.0 Drain 0.6
Fuel oil line	All	Cast steel	Steel	Stainless steel	In accordance with the Rule
Scupper line (storm valve)	All	Cast steel	Steel	Stainless	0.6
Ballast and bilge line	All	Cast iron	Steel or bronze	Stainless steel or bronze	0.6
Cold fresh water	All	Bronze	Bronze	Brass	0.6
Hot fresh water	All	Bronze	Bronze	Brass	0.6
Domestic steam and drain	40 mm & under	Bronze	Bronze	Brass	0.6
Fire and wash deck line	50 mm & above	Cast iron	Bronze	Brass	1.0
	40 mm & under	Bronze	Bronze	Brass	1.0
Hydraulic pipe	Pressure side	32 mm & above	As per maker's standard		
		25 mm & below	As per maker's standard		
	Return side	All	As per maker's standard		
Refrigerant	All	As per the maker's standard			
CO ₂	All	As per the maker's standard			

3793 Schedule of pipe insulation

Piping system	Range of Insulation	Material		Cover	
		Pipe	Flange & Valve	Pipe	Flange & valve
Exhaust gas pipe for emergency generator engine	in accommodation	Alum. Silicate or mineral wool	Alum. silicate or mineral wool	Wire net + glass cloth + galv. steel sheet 0.8 mm thick.	
Domestic steam and drain	in accommodation	mineral wool	Mineral wool	Binding wire net(stainless steel) + Glass cloth	Binding wire net(stainless steel) + Glass cloth
Cold fresh water, fire water and drain	Pipes in accommodation excluding vertical pipes inside linings	Canvas	—	—	—
Hot fresh water	Pipes in accommodation excluding vertical pipes inside linings	Canvas	—	—	—
Refrigerant	Suction line from ref. rige chamber to compressor	As per maker's standard		As per maker's standard	
	Line from expansion valve to refrig chamber	As per maker's standard		As per maker's standard	

38 HULL PART INVENTORY

Inventory and spare parts for out fittings to be supplied by Builder as per the rules and maker's standard, and to be properly tagged and boxed, the heavy or big one to be adequately secured.

In accordance with Rules and "Ship's Store Catalogue" prepared by the builder except those not suitable for this vessel which to be discussed mutually.

4 ACCOMMODATION

41 CLASSIFICATION OF ACCOMMODATION

Accommodation quarter to be divided into living, service, storage and machinery space, which are ranked as follows:

Cabin

Class	Name	Room	Lavatory
2	Captain class cabin	Day room, bed room	Private lavatory with bath tub
3	Senior officer cabin	Day room, bed room	Private lavatory with shower
8	Junior officer cabin	Single cabin	Private lavatory with shower
12	Crew cabin	Single cabin except the two cadets	Private lavatory with shower
	Hospital	Single – berthed	Private lavatory with bath tub
6	Suez canal crew	6 persons	Public lavatory

Public Spaces

Officer's mess room
 Officer's saloon (Meeting room)
 Crew's mess room
 Crew's saloon
 Gymnasium (to be also used as Suez crew room)
 Citadel

Control Spaces

Wheelhouse with chart and radio space
 Engine control room
 Fire control room

Offices

Deck office (with ballast control)
 Engine office
 Tally office

Medical Spaces

Hospital

Commissary room

Galley
 Pantry

Sanitary spaces

Private lavatories
 Public toilets
 Officer's laundry and dry room
 Crew's laundry and dryroom
 Deck change room
 Engine change room

Storage spaces

Refrigerated stores

Provision store
Linen store
Bonded store
Bosun store
Paint store
O₂/C₂H₂ store
Navigation equipment store
Deck store
Other stores or lockers (see General Arrangement Plan)

Machinery spaces

Air condition unit room
Emergency generator room
Engine workshop
Electric room
Battery room
CO₂ room
Hydraulic pump room
Windlass control room
Carpenter room

42 JOINER WORK

Clear height in living space, service spaces and passages to be not less than 2,100 mm.

421 Divisional bulkhead, lining and ceiling

4211 Steel wall

The following spaces to be enclosed with steel walls.
Wheel house with chart and radio space

Electric equipment room
Battery room
Air conditioning unit room
Sanitary spaces except private bath room and private toilet
Galley
Provisions stores
Refrigerated provisions chamber
Paint store
Deck stores
Stairway enclosure
Emergency generator room
CO₂ room
Escape trunk
Cable and duct trunk
Engine casing

4212 Joiner bulkhead

Partition walls forming passages to be of B class 50 mm thick modular panel.

Division walls between rooms to be of 50 mm thick modular panel.

Modular panel to be made of a core of rock wool board covered with steel sheet (sandwich panel).

These walls to be fixed on the decks with suitable steel bases.

4213 Lining

A lining of modular panel 25 mm in thickness to be applied to the steel walls forming the living rooms and public rooms, however 50 mm thick one to be applied to non insulated exposed steel walls of these rooms.

No lining to be fitted in sanitary spaces, stores and lockers except specially specified in the Specifications.

About 0.6mm galvanized steel sheet painted to be used for sanitary space where heat insulation or sound isolation or fire insulation is used.

Lining in galley and pantry to be covered with stainless steel sheet of about 0.5mm thickness.

Ceiling in galley and pantry to be covered with stainless steel sheet of about 0.5 mm thickness.

Modular panel to be made of a core of rock wool board covered with steel sheet (sandwich panel).

4214 Ceiling

A ceiling of modular panel 25 mm in thickness to be provided for the living rooms, public rooms, passageway, service space etc.

About 0.6mm galvanized steel sheet painted to be used for sanitary space where heat insulation is used.

The overheads under the exposed deck in way of galley to be insulated and covered with Stainless steel sheet of 0.5mm thickness.

Modular panel to be made of a core of rock wool board covered with stainless or galvanized steel sheet.

4215 Finishing of surface

The joiner bulkheads, linings and ceilings of modular panel to be finished with PVC foil.

The ceiling of asbestos free type calcium silicate board to be finished with polyester plastic overlay.

422 Heat, fire and sound insulation**4221 Heat insulation****a) Exposed deck**

Undersides of exposed decks in way of the living rooms, public rooms, passages and overhead of galley, drying room and wheelhouse to be insulated with rock wool of 50 mm in thickness and covered with the before-mentioned ceilings except battery room, electric equipment room and radio locker covered with the aluminum glass cloth.

Deck beams and girders under the weathered part in way of the living rooms, public rooms and wheelhouse etc. to be insulated with rock wool of 25 mm in thickness.

Heat insulation for exposed part to be extended to about 450mm beyond end of exposed part.

Mineral rock wool to be secured to wall with fastener clips suitably spaced.

Mineral rock wool density to be not less than 100kg/m³ for heat insulation.

b) Exposed steel walls

Exposed steel walls in way of living room, CO2 bottle rooms, paint room, electric equipment room and radio locker to be insulated with rock wool of 50 mm in thickness and covered with the aluminum glass cloth.

c) Engine casing/room

Fire insulation serving also as thermal insulation to be provided to the bulkhead and deck forming boundaries of the engine room fire insulation and to be secured with galvanized wire net and fastening pins / clips suitably placed.

d) Floor

All floor areas just above engine room to be provided with fire insulation.

4222 Fire insulation

Structural fire protection to comply with the 1981, 1983 and 1989 Amendments to the SOLAS 1974 Convention.

Fire insulations of A-60/30/15 on bulkheads or decks between various spaces to be provided in accordance with Chapter II-2, Part C, Method IC, and places of fire insulation to be as follows;

A – 60 : Bulkhead and deck separating control station, accommodation spaces etc. from the engine room. Bulkhead and deck separating the accommodation spaces and service spaces of high risk from the control station.

Escape trunk in engine room.

Bulkhead between E/R and Cargo Hold No.5

A – 30 : Nil

A – 15 : Bulkhead and deck separating the control stations from the service spaces of low risk and machinery spaces other than category A.

Fire insulation material to be of rock wool having sufficient thickness for the required insulation value.

Air spaces enclosed behind ceiling or lining to be divided by close fitting draught stops spaced not more than 14 meters apart.

4223 Sound insulation

The division wall between the living room and a noisy space such as the public room to be a high noise reduction type.

Suitable sound insulation for attenuating the transmission of noise to be provided to the steel wall and deck plate in way of the living and public room which are directly adjacent to the engine room, air-conditioning unit room and fan.

Insulation with 50mm rock wool covered with glass cloth to be provided in air conditioning unit room deck head.

423 Deck covering

4231 Deck composition

Floor of the living rooms for all living space and passageway to be covered with 2 mm thick vinyl tiles on 10 mm thick latex deck composition except A-60 class deck.

Navigation bridge wings to be covered with perforated rubber mat.

No deck composition to be applied to the weather deck.

Floating floor deck cover to be placed on deck of engine control room and in superstructure main deck except working and store place...

Grating to be provided in steering gear room as per Class Rules.

4232 Cement and tile

The floors in the sanitary spaces, galley, pantry, change room and laundry to be laid with 30 mm cement and ceramic with one tier of 150 mm height tile on the skirting

Non-slip tile to be applied to the galley.

Gutter way in galley to be made with ceramic profile or stainless steel flat bars, stainless grating to be provided.

43 FURNITURE

430 General

a) The general features and size of furniture to be as listed up in the following. Color scheme book to be submitted for Owner's approval.

b) Writing desks and chairs are to be of wooden of the standard design.

Wooden furniture to be generally finished with low flame spread material overlay.

The size and particulars of the furniture to be as per the attached table.

c) Chairs and movable sofas to be provided with fastening device.

Other furniture to be fixed.

431 Dimension of large furniture

CLASS	Bed	Wardrobe	Desk	L – type sofa	Sofa
Highest officer	2,050 x 1,500	1,200 x 600	2,000 x 800	2500 x 1500 x 650	-
Senior officer	2,050 x 1,200	1,000 x 600	1,600 x 700	-	2000 x 650
Junior/Petty officer	2,050 x 1,000	800 x 600	1,200 x 600	-	2000 x 650
Crew	2,050 x 1,000	800 x 600	1,000 x 500	-	1400 x 650

Note:

a) Wardrobe size to be designed according to demarcation of cabins. Life jacket locker to be fitted above wardrobe.

b) In general beds to be positioned longitudinally with drawers under (excluding Suez crew room).

c) In general sofas to be positioned transversely as far as possible and the sofa size may be adjusted upon the final cabin's arrangement.

432 Furniture

Cabins

Furniture	Highest Officer		Senior Officer		Junior	Petty Officer /Crew
	Day room	Bed room	Day room	Bed room		
Bed	-	1	-	1	1	1
Wardrobe	-	1	-	1	1	1
Desk	1	-	1	-	1	1
Dressing table with Stool	-	1	-	1	-	-
Tea table	1	-	1	-	1	-
Night table	-	1	-	1	1	-
Bookcase	1	-	1	-	-	-
Book rack	-	-	-	-	1	1
File cabinet	2	-	1	-	-	-
Safe	1 (captain only)	-	-	-	-	-
Sofa	1 (L-type)	-	1	-	1	1
Rev. arm chair	1	-	1	-	-	-
Easy chair	-	1	-	1	-	-
Arm chair	2	-	2	-	1	1
Waste basket	1	-	1	-	1	1
Coat hook	4	2	4	2	2	2
Refrigerator	1 (120 liter)	-	1 (120 liter)	-	-	-

Note:

- a) Key box suitable for about 150 keys to be provided for chief officer, about 50 keys for captain, chief engineer, 2nd engineer and electric engineer.
- b) All cabins to have a mirror of suitable size.
- c) TV table to be arranged in the following cabins:
captain, owner, chief officer, chief engineer, 2nd engineer
- d) Suez crew room

Double bed	3
Table	1
- e) Furniture may be changed according to final cabin's arrangement.

Mess room and meeting room

Furniture	Officer's Mess room	Crew's Mess room	Officer's saloon (Meeting room)	Crew's saloon
Mess table	3	3	-	-
Side board	1	1	-	-
Arm chair	-	-	8	4
Common chair	12	16	-	-
Play table	-	-	1	1
Bottle cabinet	1	-	1	1
Notice board	1	1	-	-
Coat hook	12	16	8	4
TV rack	1	1	-	-
TV table	-	-	1	1
Sofa (L type)	-	-	1	1
Tea table	-	-	1	1

Above table may be changed according to final cabin's arrangement.

Gymnasium

Gymnastic device	2
Locker	1
Bench	1
Coat hook	6
Notice board	1

Control spaces

Furniture	Wheelhouse/Chart space	Radio space
Chart table (with chronometer chart locker)	1	-
Binocular box	2	-
Log book and ballast note board	1 (each)	-
Flag locker	1	-
Book rack and book case	1 (each)	1 (book case)
File cabinet (4 drawers)	-	1
Radio stand	-	1
Working table	1	1
Pilot chair	2	-
Rev. arm chair	-	1
Sofa	1	-
Sounding board	1	-
Notice board	1	-
Pigeon hole for flag	2	-
Kettle rack	1	1
Direction indicator	1	-
Folding board	2	-
Coat hook	2	2
Wooden locker	1	1

Offices

Furniture	Deck office	Engine office	Tally office
File cabinet with 4 drawers	3	3	-
Book case	1 (case)	1 (case)	1 (rack)
Desk	1	1	1
Copy table	1	1	-
Common chair	-	-	1
Arm chair (Rev.)	6	4	-
Notice board	1	1	1
Sofa	1	1	1
Key box	1	1	-
Waste basket	1	1	1
Table (rectangular)	1	-	-
Coat hook	6	4	2
Computer table	1	1	-
Ballast water control table	1	-	-

Hospital

Furniture	Hospital
Steel single bed (2000 x 1000)	1
Wardrobe	1
Night table	1
Arm chair	1
Desk	1
Steel stool	1
Medicine locker	1

433 Upholstery

4331 Material

Item		Material	
Settee	Upholstery	Textil for officer class and vinyl for other room	
	Stuffing	Seat	Polyurethane foam
		Back	Polyurethane foam
Chair	Upholstery	Vinyl leather	
	Stuffing	Seat	Polyurethane foam
		Back	Polyurethane foam
Mattress	Upholstery	Mattress cloth	
	Stuffing	Spring & Polyurethane foam	
Curtain	Bed	Drapery	
	Window	Drapery	
	Shower	Vinyl film	

4332 Curtain

A window curtain to be provided for each rectangular window and side scuttle in the living rooms and public rooms.

The curtain for the windows on the front of deck house to be a blackout type. A shower curtain to be provided for each shower compartment.

Bed curtain to be provided for hospital.

A black curtain to be provided around the chart and radio space in the wheel house.

44 COMMISSARY AND SANITARY OUTFIT

441 Commissary equipment

4411 Material

Material of equipment for commissary spaces to be generally as follows:

Equipment	Material
Sinks, Top of dressers, Top of cooking tables	Stainless steel
Frames of dressers, Frames of cooking tables and shelves	Galvanized steel
Cooking machinery	Maker's standard

Note: All surfaces coming in contact with food to be stainless steel.

4412 Galley equipment

- 1 Electric cooking range with 4 hot plates and 1 oven
- 1 Electric baking and roasting oven
- 1 Electric soup boiler
- 1 Flying pan
- 1 Electric slicing M/C
- 1 Electric potato peeler
- 1 Refrigerator (abt. 400 L)
- 1 Electric universal kitchen M/C
- 1 Electric multipurpose peeling machine
- 1 Electric garbage disposer
- 1 Electric toaster
- 1 Electric water boiler (abt. 15 L)

4413 Pantry equipment

- 1 Electric hot plate
- 1 Coffee machine
- 1 Refrigerator (abt. 180 L)
- 1 Electric water boiler
- 1 Electric dish washer

442 Sanitary outfit

4421 Material

Wash basin, urinal and water closet in sanitary spaces to be of vitreous china.

Material of laundry equipment to be of maker's standard.

Equipment to be suitable for marine use.

4422 Fittings in lavatories

Private and hospital lavatory Shower set, water closet, wash basin and toilet cabinet with mirror.

Public lavatory Water closet, wash basins and toilet rack with mirror.

Toilet paper holder, storm rails, towel rails and soap dishes to be provided for each individual use as necessary.

Private lavatory and hospital lavatory to be prefabricated type.

All wash basins to be provided with hot and cold independent adjustable valves with one (1) outlet.

Water closets to be of European type and fitted with cistern type, seat and cover to be of plastic material.

Showers to be chrome plated fixed type with mixing valve.

Stop valves to be provided for each hot and cold water pipe below washbasins.

4423 Laundry equipment

Each laundry to be provided with following equipment.

- 1 Electric washing machine (abt.10 kg marine type)
- 2 - Electrical washing machine with hydro-extractor (5 kg, domestic type)
- 1 - Electric iron (0.6 kW)
- 1 - Ironing board (folding type)

One (1) drying room shall be provided with steam radiator (or electric heater) and hanging rope.

4424 Fittings in changing room

Deck and engine changing room to be provided as shown on general arrangement plan.

Each changing room to be fitted with one (1) stainless wash basin with toilet rack, soap basin and mirror, eight (8) steel jumper locker and one (1) bench.

443 Cold drinking water fountain

Six (6) cold water fountains of marine type with sterilizer to be fitted on all decks, ECR and bridge and to be supplied by cold water line running through lobby of refrigerated store.

444 Galley lift

No galley lift to be provided.

45 STOWAGE SPACES

451 Refrigerated chamber

4510 General

The refrigerated provisions chambers are to be of prefabricated type.

The approximate net capacities of individual compartments to be as follows:

	Capacity (cu.m)	Temperature (deg.C)
Vegetable room	abt.20	+ 4
Meat room	abt. 20	-18
Fish room	abt. 8	-18
Dairy room	abt. 10	+2
Lobby	abt. 12	Uncooled
Dry provision	abt. 23	+12

4511 Insulation

The boundary walls to be of steel and insulated as follows:

Insulation	polyurethane foam thickness about 120 mm
Surface furnishing	0.5 mm stainless steel sheet

4512 Door

Door frames in fish and meat room to be fitted with strip heater with thermostat control.

4513 Furnishing

Meat room and fish room to be furnished with 2 tiers wooden shelves with stainless steel frames at one side of the wall.

Stainless steel meat rails to be suspended from the deck head spaced about 600mm apart. Stainless steel hooks to be fitted at suitable intervals.

Vegetable room to have 2-tiers wooden shelves with stainless steel frames arranged at one side of the wall.

Thermal expansion valve for each unit cooler and dial thermometer for each cold chamber with name plate min stainless steel shall also be mounted on common panel.

Alarm bell to be fitted in galley with signal light outside the compartment and push button arranged in each chamber and lobby. Other details refer to "Electric Part".

Meat chopping block, one (1) meat hook and one weighing scale to be furnished near the refrigerated chamber and a sink, hot and cold fresh water supply to be provided.

PVC/GRP grating to be fitted.

The dial thermometer shall be installed for each cold chamber. Remote temperature indication of cold chambers shall also be equipped on control console in engine room respectively.

One set of ozone generator shall also be equipped inside of vegetable room for hygienic consideration.

4514 Refrigerating plant

The refrigerating plant to be of PLC control type and to consist of following units.

Two (2) - Refrigerating compressors, R-404A or equivalent, direct expansion, reciprocating, automatic start-stop, electric motor driven.

Two (2) - Condensers, shell and tube type, horizontal, multipass tubes.

Cooling water to be supplied by L.T. cooling F.W. pump in engine room.

The refrigerating plant to be capable of maintaining the specified temperatures with one (1) compressor working at full load not more than 16 hours per day. The other compressor to serve as standby. Cooling down to specified temperatures to be worked by two compressors. Ambient temperature to be based on 35 °C and cooling F.W. temperature of 36 °C. Compressors to be automatically started and stopped to maintain the specified temperatures.

Each compartment to be cooled by one (1) ceiling suspension type diffuser. Diffuser to consist of an aluminum fin cooling coil and an electric fan contained in an enameled metal case. Drain pan to be fitted and drain pipe to be led to the scupper in the chamber. An electric defrost device with timer to be provided for meat and fish rooms.

Gas dryer, oil separator and automatic temperature control device to be fitted.

Compressor to be fitted with unloading device.

Drain pipe to the scupper to be fitted with heating elements.

Return line of refrigerants to be led through steel pipe grids in the lobby, and temperature regulation for lobby will not be provided.

Thermostat, pressure gauges, remote reading thermometers, necessary valves and safety valves, level gauges, gas charging device, etc., to be fitted completely.

Expansion valves to be provided and strainer to be fitted.

Shore connection to be provided for condenser cooling water line of refrigerating plant.

Materials for compressors, condensers etc. to be per manufacturer's standard.

452 Provision store

Dry provision store to be furnished with 3 tiers wooden shelves with galvanized steel frames at one side of the wall.

The boundary to be insulated according to the requirement of temperature.

453 Miscellaneous Stowage Facility

Name of Store & Locker	Fittings
Bonded locker	3-tier galvanized steel shelves with fiddles and wooden grating
Linen store	3-tier wooden shelves with galvanized steel frame
Paint store	2- tin hooks, fire extinguishing system 2-tier steel shelves
Boatswain store	2-tier steel shelves with wood plate
Rope store	2-tier steel shelves.
O ₂ /C ₂ H ₂ room	Steel shelves with mounting for bottles
Carpenter's workshop	Working table, locker, bench
Other stores & lockers	Steel shelves, wooden plate

454 Equipment for welding shop

locker (1)
black smith vice (1)
welding table 2 sections with two drawers
gas welding tools
rack
electric grinder
reel for hot and electric cables
garbage box

46 DOOR

461 Weather tight steel door

Weather-tight steel door to be used in accordance with the requirement of Regulation.

Clear width of weather-tight steel doors to be generally 700 mm and top of doors to be about 1980 mm above the surface of deck.

Weather-tight steel doors to be of hinged, single steel plate type having seal channels with synthetic rubber gasket, and pad lock eye plate and fixing hook and door stopper.

Sill height of weather-tight steel door to be in accordance with regulation.

Foot step to be installed only to sills with height equal and above 450 mm.

Stainless steel sliding door with fixed square window to be provided on each side of the wheelhouse.

462 Cabin door

Steel hollow type hinged joiner doors with steel frame to be fitted to the living rooms, public rooms, sanitary spaces (except private bath room and private toilet), galley, laundry and lockers in the living quarters facing passageway.

The doors to be equivalent to the class of fire integrity of the division in which they are fitted.

Finishing for surface of the steel hollow type door to be of baked paint or PVC covered steel plates.

Each door to be fitted with a lock, a handle, a sill plate, hinges and a door cushion.

Each door in the living rooms, public rooms, sanitary spaces to be fitted with vent hole with shutter.

Each bed rooms to be fitted with a crash panel for emergency escape.

The entrance to the passage on each deck to have a steel door with a 250 mm diameter fixed bull's eye.

463 Size of door opening

The height from the floor to the door's top to be not less than 1980mm, clear width to be as follows:

Clear width (mm)	Location
800	Entrance to corridor from weather deck, hospital (weather part), galley, provision store, CO2 room
600	Private lavatory
900	Wheelhouse (weather part)
700	Mess room, passage way and stairway
650	All other doors.

All hardware of cabin's door to be marine type of chrome plated brass. Door handles to be lever type.

Door self-closing devices to be applied in accordance with requirements of Rules.

464 Lock and key system

Doors inside living space to be fitted with mortise locks or latches with following characters:

Location	Lock
Living room, changing room, cabin's inside door	Using key to open from outside with locking knob Inside
Small locker, store room etc.	Using key to open from outside
Private lavatory	Locking knob inside lavatory Emergency square key can open from inside of cabin
Stairway door	No lock, lever handle only for opening from either side
Common lavatory (Inside door)	Lock showing "Occupied or Vacant"

All locks mentioned above except lavatory locks can be opened by master keys and a grand master key.

Three grand master keys for captain and each three submaster key for three Departments to be supplied.

47 SIDE SCUTTLE , WINDOW, STAIRWAY AND RAIL IN ACCOMMODATION SPACE

471 Side scuttle and window

(a) Side scuttle

Side scuttle of 400 mm diameter to be fitted for living rooms and public rooms on the upper deck

Side scuttles to be of aluminum alloy framed and to be of side hinged or fixed type. (The welding frame of window to structure is steel)

The numbers and positions to be as shown in the General Arrangement.

A fixed bull's eye on the entrance doors to be 250 mm in diameter and aluminum alloy frame.

(b) Rectangular window

400 mm wide x 560 mm high windows of side hinged or fixed type to be fitted for the living rooms, public rooms and galley.

1,500 mm wide x 1300 mm high fixed window, and 1800 mm wide x 1300 mm high fixed windows of aluminum alloy framed to be fitted to the front of the wheel house. (The welding frame of window to structure is steel)

1200 mm wide x 800 mm high windows of fixed type to be fitted for other parts of the wheel house.

3 wipers and heater: centre, and conning positions as per or Panama Canal regulations.

1200 mm wide x 800 mm high windows of fixed type to be fitted for the engine control room.

472 Stairway and storm rail

(a) Stairway in living quarter

Stairways in the living quarters to be enclosed with steel walls.

Item		Living Space	Service Space
Dimension	Breadth (clear of hand rails)	abt.800 mm	abt.700 mm
	Inclination	Not more than 50 deg.	Not more than 50 deg.
Material	Step	Steel plate covered with PVC tile and nose grip to be fitted.	Checkered steel plate (galvanized)
	Hand rail	Stainless steel	Steel pipe (galvanized)

(b) Storm rail in living quarter

Storm rails to be fitted on one side of the corridor in the living quarters at 1.0m height above decks.

Storm rails to be fitted on the front wall of wheelhouse, handrail material to be of stainless steel pipe and seat of chrome plated brass.

Storm rails to be fitted in toilets / showers as per normal practice.

Outdoor rail refer to paragraph "3641 – Handrail on exposed deck"

48 AIR CONDITIONING AND VENTILATION

481 Air conditioning system

All cabins, public rooms, mess room and hospital to be fully air conditioned by a high velocity, single duct system having a central heating and cooling plant.

Wheelhouse, pantry, gymnasium, bonded locker, mess room and laundry to be provided spot cooling or heating, but not to be counted as air conditioned spaces with regard to temperature and relative humidity.

Design Criteria	Cooling	Heating
Outside	35°C 70%RH	-20°C

Inside	28°C 50%RH	20°C
Fresh air ratio	40%	40%
Cooling F.W. temperature	36°C	

Air-conditioning system to consist of two (2) sets of R404A or equivalent, direct expansion compressor unit, each having a capacity of 60%, one (1) set of air handling unit and diffusers etc.

Air filter to be provided. gas dryer, automatic temperature controller to be fitted. Compressor to be of PLC control and fitted with unloading device.

Cooling F.W. to be provided by L.T. cooling F.W. pump in engine room.

No control for humidity in case of cooling condition.

Double wall insulated spiral ducts to be used.

In summer the inside temperature in air conditioning spaces shall be automatically controlled by the thermostat and the solenoid valves.

In winter the supply air temperature shall be automatically controlled by steam regulating valve, the humidity of the supply air shall be controlled manually.

The air ducts for each deck to be connected to the air distribution box of air handling unit individually in order to obtain even air flow for each cabin.

Necessary dampers to be fitted to main branches at easy accessible locations.

Non-return damper to be provided for hospital.

The ducting to be designed such that the fresh air in the total supply air to be not less than 40% and the other part of the supply air to be re-circulated from those spaces.

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

Proportion of fresh air, re-circulation air and exhaust air is to be controlled manually by means of dampers.

The doors to each cabin or wall where necessary to be fitted with ventilation shutter to allow to exhaust air supplied into passageways, and to be re-circulated to air handling unit via passageways, stairways and return air ducts.

No re-circulation to be from hospital, galley, pantry and mess rooms.

Fire dampers to be installed where required by the Rules.

One (1) set of air conditioner to be provided for galley with full fresh air.

Each one (1) set of air conditioner to be provided for E.C.R. and engineer's workshop in engine room.

483 Ventilation system

4831 Mechanical ventilation and air change rate

The air conditioning and mechanical ventilation system to be provided with following minimum air change times per hour based on the volume of each compartment.

Compartment	Air conditioning	Mechanical
-------------	------------------	------------

		Supply	Exhaust
Living room	8	-	-
Office	10	-	-
Mess room	12 spot	-	15
Meeting room	10	-	-
Wheelhouse & chart space	10 spot	-	-
Lavatory	-	-	10
Hospital	10	-	15
Changing room	8	-	10
Public toilet	-	-	15
Laundry	6 spot	-	15
Drying room	-	-	15
Linen locker	6 spot	-	-
Galley		20	40
Pantry	10 spot	-	15
CO2 room	-	-	10
Steering gear room	-	6	
Emergency generator room	-	10	-
Gymnasium	12 spot	-	-
Bonded locker	6 spot	-	-
Paint store	-	-	20
Hydraulic oil pump room	-	-	10
Emergency fire pump room	-	-	15
A/C room	-	-	15

Materials of the fan to be as maker's standard.

Stainless steel canopy to be provided over electric cooking range and tilting frying pan in galley for exhaust. Canopy to have stainless steel filters and arrangement of collecting and drain of fat.

Exhaust ducts to have stainless grids at suction side.

Hospital lavatory to have independent exhaust.

Insect screens of stainless steel to be provided at weather openings of supply and vent ducts for living quarters.

Engine room ventilation to be described in Machinery Part.

4832 Natural ventilation

The other compartments without mechanical ventilation to be arranged with natural ventilation if not otherwise required by the authorities.

Suitable mushroom ventilators, wall ventilators, small gooseneck ventilator or door louvers to be provided where necessary.

Coming height of ventilators to be as Rules requirements for upper deck and to be as the Builder's practice for the other decks.

4833 Ventilation for cargo holds

The natural ventilation shall be provided for all cargo holds.

The natural venting trunks with closing cover and safety mesh shall be arranged on the hatch covers.

5 MACHINERY PART

50 GENERAL

500 General description

The vessel to be designed and constructed as a single screw driven by a diesel engine located aft and in compliance with the requirements of Classification Society.

The propelling plant consists of a slow speed, electronically controlled common rail fuel injection system, crosshead, reversible diesel engine driving a fixed pitch propeller through a forged steel shafting.

The propeller shaft to be turned clockwise viewed from after ward of M/E when running ahead.

The main electric generating plant consists of three (3) diesel generator sets and one (1) emergency diesel generator set.

The steam generating plant consists of one (1) composite boiler.

The main engine to be remotely controlled from engine control room, wheelhouse and emergency control stand at the engine side to be provided.

An air-conditioned engine control room to be provided in engine room and to be equipped with engine controls device, main switchboard and other necessary monitoring equipment.

SI units to be adopted for design, construction of machineries and measuring units, such as power, pressure, temperature and volume etc..

Pipes/valves flanges to conform to ISO standard. Pipe dimension and material to be of Chinese standard except those pipes/valves attached on imported equipments which to be maker's standard.

Material of machinery and equipment to be in accordance with maker's standard for marine use.

In this Specification, if the description of the materials, capacity and accessories of equipment, concerning with main engine especially, is in-coordinate with the maker's standard, then maker's standard to be taken.

501 Inspection and tests

All inspection and tests for machinery to be carried out in accordance with the requirements of Classification Society and maker's inspection standard.

During inspection time the owner have right to invite experts from Maker (M/E, A/E) to attend the tests. The following inspection and test, the application for which will be submitted to the Buyer's representative in advance, to be carried out by the manufacturer in the presence of surveyor of the Classification Society and the Buyer's representative.

However, if the Buyer's representative cannot attend due to his own cause, these inspection and tests to be entrusted to surveyor of the Classification Society and/or shipbuilder's inspector, results of which to be regarded as acceptance by the Buyer.

Running test and trial of machinery to be carried out at manufacturer's shop after completion, and necessary data to be recorded during the trial and submitted to the Buyer.

Especially for main engine and diesel generator engine, the shop test schedule to be informed to the Buyer.

5011 Main engine shop test

The following tests to be performed by using equipment, lubricating oil, cyl. oil and marine diesel oil etc. supplied by maker.

The brand of lubricating oil and cyl. oil used during shop test to be chosen in accordance with the maker's standard.

a) Load Test

Load	25%	50%	75%(CSR)	100%	110%
Hours	1/2	1/2	1	2	1/2

b) Governor test (not for MAN ME type engine)

c) Fuel oil consumption test at 50% 75%, CSR and 100% of CMCR to be mentioned in report (but only CSR to be of guarantee point.)

d) Starting test and reversing test at no load

e) Safety test with emergency trip device

f) Minimum revolution test at no load (min. 10 min)

g) Astern test at no load (min. 15 min)

h) Turbocharger cut-off test, only for the first vessel

i) One FO pump cut-off test

j) Engine side maneuvering

k) Crank shaft deflection measurement (at both hot and cold state)

Overhaul inspections for necessary portions after shop test to be carried out in accordance with maker's standard and in compliance with requirement of Classification Society.

5012 Generator engine shop test

The following tests to be performed by using equipment, lubricating oil and marine diesel oil supplied by maker with AC alternator coupled together.

- Load Test

Load	25%	50%	75%	100%	110%
Hours	1/2	1/2	1/2	1	1/2

- Starting test

- Governor test

- Parallel running test
- Torsional vibration test (only for first ship)
- Voltage regulation test
- Fuel oil consumption test at 100% load
- Emergency trip test including all protective device
- Crank shaft deflection measurement (at both hot and cold state)

Overhaul inspection to be carried out in accordance with the requirement of the Classification Society and manufacturer's standard.

5013 Other auxiliary machinery tests

Performance and continuous running tests to be carried out in accordance with maker's standard and in compliance with requirement of Classification Society.

502 Fuel oil employed

Heavy fuel oil having a viscosity of up to 380 cSt/50°C to be used for main engine at normal sea going, starting and stopping, but can be exchanged over to MDO when the engine is expected to be inactive for a prolonged period with cold engine.

The generator engine to be designed to use HFO of 380cSt/50°C same as for main engine and can be exchanged over to M.D.O. if necessary.

The emergency generator engine to be designed to burn DMA or DMX.

Heavy fuel oil same as for main engine to be used for the boiler and cold starting to be done by MDO.

When the ship is navigating to enter into a SOx emission control area, the burning F.O. for engines and boiler shall be changed over to low sulphur marine diesel oil (sulphur content less than 0.1% m/m, viscosity more than 3 cst at 40°C).

L.S.M.D.O.(sulphur content less than 0.1% m/m, viscosity more than 3 cst at 40°C) to be used as per the requirement of EU port (EU directive 2005/33/EC and New Section of California Code of Regulation title 13/17)

503 Design condition

The main engine, generator engines and the aux. equipment in engine room including the shafting to be so designed that the main engine is satisfactorily operated at the contract maximum continuous rating at sea water temperature of 32°C, L.T. cooling F.W. temperature of 36°C, engine room ambient air temperature of 45°C, barometric pressure of 0.1 MPa and relative humidity of 60% subject to maker's limitation.

5031 Machinery installation aspect

The supporting chocks of main engine to be made of epoxy chocks.

The resilient mounting to be used for diesel generator sets and air compressor sets.

The steel liner to be used for pumps and other aux. equipment.

5032 Shafting and propeller

The diameter of the shafts to be determined by the Rule's requirements and to have margin in diameter as follows:

Abt. 3 mm for intermediate shaft

Abt. 5 mm for propeller shaft

The propeller to be designed to absorb output of CSR of the main engine at 3.5% higher revolution of CSR under design draught, clean bottom, calm and deep sea condition.

Propeller strength and shafting to be designed for M/E CMCR.

5033 Electric power

Refer to Electric Part.

5034 Steam generating plant

Necessary steam for ship's service to be as follows.

Normal sea service:	Exhaust gas section Oil fired section (if necessary)
Port in/out service:	Exhaust gas section & oil fired section
Port service:	Oil fire section

5035 Compressed air plant

Two (2) main air reservoirs to be able to start main engine consecutively at least twelve (12) times without replenishment, and total intake capacity of main air compressors to be capable of refilling two (2) main air reservoirs within one (1) hour.

One (1) aux. air reservoir to be charged by the emergency air compressor for starting of aux. engine in case of "dead ship", and charged through the main air line from main air reservoir normally.

5036 Heat exchanger

a) Coolers

The central F.W. coolers, M/E jacket cooling F.W. cooler and M/E L.O. cooler to be of plate type.

The type of L.O. cooler served for gen. engines to be recommended by maker.

The atmospheric condenser to be of shell-tube type.

The coolers for main engine to be designed on the basis of heat dissipation of CMCR.

b) Heaters

The heaters to be of shell-tube type or plate type.

c) Cleanliness factor

The cleanliness factor to be 90% for plate type cooler, 85% for shell-tube type cooler and 85% for oil & water heaters.

5037 Purifier

a) For heavy fuel oil

Two (2) automatic, self-cleaning type F.O. purifiers to be provided for the heavy fuel oil purifying with density 1.01 at 15 °C , the capacity to be at least 120% of fuel oil consumption of main engine at CMCR and one (1) G/E at normal sea.

One (1) for working and the other are as stand-by.

The H.F.O. purifiers to be able to operated in parallel when required.

b) For MDO

One H.F.O. purifier to be also used for purifying M.D.O..

c) For lubricating oil

Two (2) automatic, self-cleaning type L.O. purifiers to be provided for purifying L.O. of main engine and generator engines.

The lub oil purifier shall be capable of circulating the oil in the main engine sump tank at least every 12 hour.

5038 Pump

Where two (2) pumps for M/E service are provided in one (1) systems, one (1) pump to be sufficient to handle the system and the other service as stand-by.

The specified capacity and motor output of oil pumps to be designed as following viscosities.

	Capacity cSt/50°C	Motor output cSt/50°C
Fuel oil supply pump	25.8	380
Fuel oil circulating pump	25.8	380
Fuel oil transfer pump	25.8	1000
M.D.O. transfer pump	25.8	1000
L.S.M.D.O. transfer pump	3 cSt/40°C	100
L.O. pump	25.8	400
L.O. transfer pump	25.8	1000
Sludge pump	25.8	1000

51 PRINCIPAL PARTICULARS OF MACHINERY

511 Main engine

No. of set	: One (1)
Model	: Wartsila 5RT-flex50-D-TII (delta tuning)
Type	: Two stroke, electronically controlled common rail fuel injection system, single acting, crosshead,

	direct reversible, high efficient turbocharged type marine diesel engine
MCR	: 8725 kW x 124 r/min
CMCR	: 6100 kW x 99 r/min
CSR (0.75 CMCR)	: 4575 kW x 89.9 r/min
No. of cylinder	: 5
Cylinder bore	: 500 mm
Stroke	: 2050 mm
S.F.O.C.	: abt.160.7 g/kW.h+5% at CSR based on the use of a F.O. with lower calorific value of 42,707 kJ/kg at ISO conditions and fulfilling the IMO NOx TII emission limitations)

512 Shafting and propeller

- One (1) - Intermediate shaft
 - Material : Forged steel
 - Diameter : At least 3mm above the Classification Society Rules, subject to torsional vibration calculation, and bearing part to be of 5mm over size with at least 15 mm beyond the ends of bearing
- One (1) - Propeller shaft
 - Type : Forged steel with integral flange at fore end
 - Diameter : At least 5 mm above the Classification Society Rules, subject to torsional vibration calculation
- One (1) - Intermediate shaft bearing. Cast iron pedestal, upper and lower part lined with white Metal
- One (1) - Stern tube fabricated steel
- One (1) - Stern tube aft bearing. Cast iron bearing bush lined with white metal
- One (1) - Stern tube fore bearing. Cast iron bearing bush lined with white metal
- One (1) - seal to be Simplex type with rope guard and net cutters
- One (1) - Propeller
 - Type : Solid, aero dynamic section key less right handed.
 - Material : Nickel aluminum bronze of suitable diameter and pitch.
- One (1) - Fair water cap
 - Material : Nickel aluminum bronze
- One (1) - Propeller Nut
 - Conventional type made of forged steel with hydraulic mounting.

Withdrawal of propeller to be carried out without the propeller shaft shift to inboard side.

Remote temperature reading of intermediate shaft bearing shall also be fitted on control console in engine control room.

Spare propeller and spare propeller shaft not to be provided.

513 Electric generating plant

- Generator engine
- No. of set : Three (3)

Type : 4-stroke, single acting trunk piston engine each rigidly coupled to a one bearing air cooled alternator, Nox emission approved type according to MARPAL Annex VI regulation 13.

Output & Revolution : As per maker's recommendation (not more than 900 r/min)
 Alternator : abt.500 kW, AC, 450V, 3 ϕ / 60 Hz (drip-proof brushless type)

Emergency generator engine

No. of set : One (1)
 Type : Four cycle, vertical, single acting, radiator cooled type diesel engine.
 Output : As per maker's recommendation
 Revolution : 1800 r/min
 Alternator : 120 kW, AC 450V 3 ϕ / 60 Hz
 Start system : To comply with the Rules

514 Steam generating plant

Composite boiler

No. of set : One (1)
 Type : Cylindrical vertical type boiler with burner and feed water regulator (on/off control)

Evaporation

Oil fired section : about 1500 kg/h
 Exh. gas section : about 550 kg/h (at CSR of M/E, burning with HFO under ISO reference condition) or maximum possible according to boiler maker
 : about 130 kg/h for one A/E (the No.1 and No.2 A/E to be connected to the composite boiler, running at 85% load, burning with MDO under ISO reference condition)

Feed water temp. : 80°C
 Steam state : 0.6 MPa (working) saturated

515 Engine room systems

(a) Compressed air system

Main air compressor

No. of set : Two (2)
 Type : M.D. two or three stage, air cooled
 Capacity : 105 m³/h (F.A.)
 Delivery pressure : 3 MPa
 Revolution : not more than 1800 r/min

Emergency air compressor

No. of set : One (1)
 Type : M.D. air cooled
 Capacity : 15 m³/h (F.A.)
 Delivery pressure : 3 MPa

Deck service compressor

No. of set : One (1)
 Type : Motor driven, air cooled, screw type
 Capacity : 100 m³/h (F.A.)
 Delivery pressure : 0.7 MPa

Main air reservoir

No. of set : Two (2)

Type	: Cylindrical all welded
Capacity	: 3.5 m ³ x 3 MPa
Aux. air reservoir	
No. of set	: One (1)
Type	: Cylindrical all welded
Capacity	: 0.25 m ³ x 3 MPa
Control air reservoir	
No. of set	: One (1)
Type	: Cylindrical all welded
Capacity	: 0.25 m ³ x 0.7 MPa
Deck air reservoir	
No. of set	: One (1)
Type	: Cylindrical all welded
Capacity	: 1.0 m ³ x 0.7 MPa
Control air dehydrator	
No. of set	: One (1)
Type	: Refrigerated type (with auto drain device)
Capacity	: abt.50 m ³ /h (F.A.)
(b) Cooling water system	
Cooling S.W. pump	
No. of set	: Three (3) (two working, one for standby)
Type	: M.D. vert. centrifugal
Capacity	: abt.280 m ³ /h (depending on final heat balance)
Delivery head	: 0.25 MPa
M/E jacket cooling F.W. pump	
No. of set	: Two (2)
Type	: M.D. vert. centrifugal
Capacity	: 56 m ³ /h
Delivery head	: 0.25 MPa
L.T. cooling F.W. pump	
No. of set	: Three (3) (two working, one for standby)
Type	: M.D. vert. centrifugal
Capacity	: abt.225 m ³ /h (depending on final heat balance)
Delivery head	: 0.25 MPa
Central F.W. cooler	
No. of set	: Two (2)
Type	: plate type (titanium, equipped with in-line filters in sea side)
Heat dissipation	: Depending on heat balance (60% total capacity each)
L.T. cooling F.W. flow	: abt.225 m ³ /h
L.T. cooling outlet temp.	: 36 °C
Cooling S.W. flow	: abt.280 m ³ /h
Cooling S.W. temp	: 32 °C
M/E Jacket cooling F.W. Cooler	
No. of set	: One (1)
Type	: plate type (stainless steel)
Capacity	: 954kW
H.T.F.W. flow	: 56 m ³ /h

H.T.F.W. inlet temp.	: 85°C
Main engine jacket F.W. pre-heater	
No. of set	: One (1)
Type	: Shell-tube, steam heating
Capacity	: 2 m ²
M/E jacket pre-heater pump	
No. of set	: One (1)
Type	: M.D. horizontal centrifugal
Capacity	: 6m ³ /h
Delivery head	: 0.25 MPa
G/E cooling F.W. preheating unit	
No. of set	: One (1)
Type	: Electric heating(auto type with high temperature alarm)
Capacity	: According to maker's recommendation
(c) Feed and drain system	
Feed water pump for comp. boiler	
No. of set	: Two (2)
Type	: M.D. centrifugal
Capacity	: According to boiler maker's standard.
Delivery head	: According to boiler maker's recommendation
Atmospheric condenser	
No. of set	: One (1)
Type	: shell tube type
Condensate temp	: 80 °C
Cooling surface	:abt.15m ² (to be capable of condensing the excess steam from the exh. Gas section of the composite boiler at M/E MCR under ISO reference condition)
(d) Fuel oil system	
M/E & G/E fuel oil supply module unit	
No. of set	: One (1)
Type	: Design for 380 cSt, auto. clean filter booster modular
Capacity	:According to maker's recommendation including F.O, supply pumps, circ. Pumps, steam heaters, viscosity controller, auto. Filter back-flushing type and flow meter after supply pumps, etc. One (1) L.S.M.D.O. pump to be fitted for A/E emergency use or in EU port.
Heavy fuel oil transfer pump	
No. of set	: One (1)
Type	: M.D. vert. screw
Capacity	: 25 m ³ /h
Delivery press.	: 0.35 MPa
M.D.O. transfer pump	
No. of set	: One (1)
Type	: M.D. vert. screw
Capacity	: 25 m ³ /h
Delivery press.	: 0.35 MPa

L.S.M.D.O. transfer pump

No. of set	: One (1)
Type	: M.D. vert. screw
Capacity	: 15m ³ /h
Delivery press.	: 0.35 MPa

Heavy fuel oil purifier with steam heater & electric motor driven supply pump

No. of set	: Two (2)
Type	: Automatic, self-cleaning and steam heating
Capacity	: abt.1600 l/h (380 cSt/50°C)

L.S.M.D.O. cooler

No. of set	: One (1)
Type	: plate type (stainless steel)
Capacity	: depending on final calculation

F.O. flow meter

Boiler F.O. system	: One (1)
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(e) Lubricating oil system

M/E lubricating oil pump

No. of set	: Two (2)
Type	: maker's standard
Capacity	: 130 m ³ /h
Delivery head	: 0.75 MPa

Lub. oil transfer pump

No. of set	: One (1)
Type	: M.D. horiz. gear
Capacity	: 5 m ³ /h
Delivery press.	: 0.35 MPa

Lubricating oil purifier with steam heater & electric motor driven supply pump

No. of set	: Two (2)
Type	: Automatic, self-cleaning and steam heating
Capacity	: abt.1250 l/h (SAE30)

M/E lubricating oil cooler

No. of set	: One (1)
Type	: Plate type (stainless steel)
Heat dissipation	: abt. 567 kW
Lub. O. Flow	: 130 m ³ /h
L.T. cooling F.W. flow	: abt. 49 m ³ /h
Lub. O. outlet temp	: 46°C

Cylinder L.O. pump

No. of set	: One (1)
Type	: M.D. horiz. gear
Capacity	: 1 m ³ /h
Delivery pressure	: 0.35 MPa

Lub. oil fine filter

No. of set	: One (1)
Type	: Auto. back wash and manual open when alarm
Absolute fineness	: 40 micron
Capacity	: 130 m ³ /h
Working pressure	: 0.75 MPa

L.O. by-pass filter	
No. of set	: One (1)
Type	: Simplex
Fineness	: 40 micron
Capacity	: 130 m ³ /h
Working pressure	: 0.75
Gen. engine L.O. cooler	
No. of set	: Three (3)
Type	: Acc. to G/E maker's recommendation
Gen. engine L.O. filter	
No. of set	: Three (3)
Type	: Acc. to G/E maker's recommendation
(f) Fire, bilge, ballast and general service system	
Bilge, Fire, & G.S. pump	
No. of set	: Two (2)
Type	: M.D. vert. centrifugal with self- priming device
Capacity	: 100/185 m ³ /h
Delivery head	: 0.75/0.25 MPa
Daily bilge pump	
No. of set	: One (1)
Type	: M.D. horizontal mono type
Capacity	: 5 m ³ /h
Delivery press.	: 0.3 MPa
Condensate water pump	
No. of set	: One (1)
Type	: M.D. horizontal mono type
Capacity	: 5 m ³ /h
Delivery press.	: 0.3 MPa
Ballast pump	
No. of set	: Two (2)
Type	: M.D. vert. centrifugal with self-priming device
Capacity	: 700 m ³ /h
Delivery head	: 0.35 MPa
Oily bilge separator	
No. of set	: One (1)
Type	: IMO approved type, to meet the requirement of IMO MEPC 107 (49), auto. discharge type with pump, oil discharge content monitor and high ppm alarm.
Capacity	: 3 m ³ /h, 15 ppm
Sludge pump	
No. of set	: One (1)
Type	: M.D. horizontal mono.
Capacity	: 10 m ³ /h
Delivery pressure	: 0.35 MPa
Emergency fire pump	
No. of set	: One (1)
Type	: M.D vert. centrifugal with electrical self priming device

Capacity	: 72 m ³ /h
Delivery head	: 0.75 MPa
Ballast stripping eductor	
No. of set	: Two (2)
Capacity	: 50 m ³ /h
Suction lift	: 4m WG
Discharge pressure	: 0.17 MPa
Pressure of drive water	: 0.7MPa
Driven water flow	: abt. 90m ³ /h
Material	: Bronze
Eductor for C.L. store	
No. of set	: One (1)
Capacity	: 15m ³ /h
Suction lift	: 7 m WG
Discharge pressure	: 0.08 MPa
Pressure of drive water	: 0.5 MPa
Driven water flow	: abt. 30m ³ /h
Material	: Bronze
Eductor for bosun store	
No. of set	: One (1)
Capacity	: abt. 25 m ³ /h (as per rule requirement)
Suction lift	: 7 m WG
Discharge pressure	: 0.08 MPa
Pressure of drive water	: 0.5 MPa
Driven water flow	: abt. 60 m ³ /h
Material	: Bronze
Eductor for emergency fire pump room	
No. of set	: One (1)
Capacity	: abt. 15 m ³ /h
Suction lift	: 7 m WG
Discharge pressure	: 0.15 MPa
Pressure of drive water	: 0.5 MPa
Driven water flow	: abt. 60 m ³ /h
Material	: Bronze
Ballast water treatment	
No. of set	: Two (2)
Type	: IMO approved type
Capacity	: 700 m ³ /h
(g) Fresh water service system:	
F.W generator	
No. of set	: One (1)
Type	: Vacuum distilling, plate type using M/E jacket cooling fresh water as heating medium
Capacity	: 10 t/d (at CSR of M/E)
Salinity	: Max. 10 ppm
F.W generator ejector pump	
No. of set	: One (1)
Type	: M.D. cent.
Capacity	: Acc. to F.W generator maker's recommendation

Distiling water pump	
No. of set	: One (1)
Type	: M.D. cent.
Capacity	: Acc. to F.W generator maker's recommendation
Fresh water pump	
No. of set	: Two (2)
Type	: M.D. centrifugal
Capacity	: 10 m ³ /h
Delivery head	: 0.5 MPa
Hot water circulating pump	
No. of set	: One (1)
Type	: M.D. horiz. centrifugal
Capacity	: 2 m ³ /h
Delivery head	: 0.2 MPa
F.W. mineralizing unit	
No. of set	: One (1)
Type	: Dolomite filter
Capacity	: 1.25 m ³ /h
Sterilizer	
No. of set	: One (1)
Type	: Ultra violet type
Capacity	: 1000 l/h
Fresh water hydrophore	
No. of set	: One (1)
Type	: Vert. cylinder type mild steel with pure epoxy coating inside, color paint outside
Capacity	: 1500 l
Working pressure	: 0.5 MPa
Tech. water pump	
No. of set	: Two (2)
Type	: M.D. centrifugal
Capacity	: 2 m ³ /h
Delivery head	: 0.5 Mpa
Tech. water hydrophore	
No. of set	: One (1)
Type	: Vert. cylinder type mild. steel
Capacity	: 400 l
Working pressure	: 0.5 MPa
Calorifier	
No. of set	: One (1)
Type	: Vert. cylinder type with electric & steam heating, mild steel with pure epoxy coating inside, anti-heat paint outside.
Capacity	: 500 l
Working pressure	: 0.5 MPa
Inlet temp.	: 10°C
Outlet temp.	: 70°C

Engine room ventilating fan

No. of set	: Four (4) Two (2) of them to be reversible
Type	: M.D. axial flow
Capacity	: 600 m ³ /min.
Static pressure	: 500 Pa

Purifier room exhaust fan

No. of set	: One (1)
Type	: M.D. centrifugal flow
Capacity	: 150 m ³ /min
Static pressure	: 500 Pa

E/R welding space exhaust fan

No. of set	: One (1)
Type	: M.D. centrifugal flow
Capacity	: 35 m ³ /min
Static head	: 400 Pa

517 Workshop equipment

Lathe

No. of set	: One (1)
Type	: M.D. conventional
Center span	: 1000 mm
Swing over bed	: 420mm

Driller

No. of set	: One (1)
Type	: M.D, floor mounted
Max. drilling dia.	: 32 mm

Grinder

No. of set	: One (1)
Type	: M.D. double wheel
Wheel dia.	: 250 mm

Electric welder

No. of set	: One (1)
Type	: A.C. arc welding drip-proof type, machine side control
Capacity	: 300 A
Cable	: 2x50m

Gas welder compatible unit

No. of set	: One (1)
Type	: 2 x 40 l Oxygen bottles. 1 x 40 l Acetylene bottle
Rubber hose	: Each 2x50m for oxygen & acetylene

518 Miscellaneous equipment

Incinerator

No. of set	: One (1)
Type	: Solid waste and sludge oil burning, IMO approved type
Capacity	: 210 kW

Sewage treatment plant

No. of set	: One (1)
Type	: Biological IMO approved type
Capacity	: 25 P
Sewage transfer pump	
No. of set	: One (1)
Type	: M.D. horiz. centrifugal
Capacity	: 8 m ³ /h
Delivery pressure	: 0.2 MPa
Main engine overhead crane	
No. of set	: One (1)
Type	: Hoisting (two speed), traveling and transversing by motor driven.
Capacity	: 2.5 t
Engine control room unit cooler	
No. of set	: One (1)
Type	: Packaged type for marine use, cooling only
Capacity	: according to final calculation
Engineer workshop unit cooler	
No. of set	: One (1)
Type	: Packaged type for marine use, cooling only
Capacity	: abt. 22,000 Kcal/h
Marine growth preventing system	
No. of set	: One (1)
Type	: box type
Capacity	: abt.600m ³ /h
Life	: Five (5) years
Remote control valves system	
No. of set	: One (1)
Type	: One common hydraulic power unit, hydraulic actuators for valves
Capacity	: Acc. to maker's recommendation

Cold water fountain in engine room see Hull part.

519 Tanks in engine room

Tank	Set	Capacity (m ³)	Remarks
H.F.O. tank *	3	~850 (total)	HC, HL, RL, SD, HT
H.F.O. settling tank **	2	~16 (each)	I, HC, ML, HL, LL, AT, HT, S, RL, HSP, LST
H.F.O. service tank **	2	~16 (each)	I, HC, ML, LL, AT, HT, S, RL
M.D.O. tank *	1	~40	HL, RL, SD,
M.D.O. service tank**	1	~16	RL, LL, SD, ML,
L.S.M.D.O. tank *	1	~300	I,HL, RL, SD,LL,ML
L.S.M.D.O. service tank	2	~16 (each)	I,RL, LL, SD, ML,
Emergency generator M.G.O. service tank	1	1.0	PL, LL
M.D.O. tank for incinerator	1	0.2	PL, LL
Waste oil tank for incinerator	1	Acc. to maker's std.	HC, I, HL, LL, SD
F.O. drain tank	1	3	HC, HL, SD,
F.O. overflow tank	1	18	HC, HL, SD,

Tank	Set	Capacity (m ³)	Remarks
M/E lub. oil storage tank	1	15	PL
M/E lub. oil settling tank	1	15	HC, PL
M/E lub. oil sump tank	1	12	HC around suction, FL, LL, RL,
G/E lub. oil storage tank	1	5	PL
G/E lub. oil settling tank	1	2	HC, PL
Cyl. oil storage tank	2	18 (each)	PL
Cyl. oil measuring tank	2	0.6 (each)	PL, LL
L.O. drain tank	1	3	HL, SD
Sludge tank	1	15	S, HC, HL, SD
M/E F.W. expansion tank	1	1.0	GL, LL, MU
Condensate drain tank	1	3	HL, SD
Bilge primary tank	1	3	HC, HL, GL
Bilge holding tank	1	15, as large as possible	HC, HL, SD
Waste oil tank	1	5	SD, HC, HL,
Sewage holding tank	1	20	HL, GL
Distilling water tank	1	15.0	GL, HL,
Cascade and inspection tank	1	2.0	LL, MU,
Sludge oil trap (for Wartsila engine)	1	Acc. to maker's std.	Acc. to maker's std.

Abbreviations:

HC	: steam heating coil
S	: steam blow
I	: insulated
ML	: magnetic float level gauge
GL	: glass level gauge
FL	: float level gauge
PL	: plain glass level gauge
SD	: sounding pipe
RL	: level remote measuring
HL	: high level alarm
LL	: low level alarm
HT	: high temperature alarm
AT	: auto. temperature regulating
MU	: make-up water auto. control
HSP	: High level stop
LST	: Low level start

Notes:

- The final capacity for some pumps and aux. equipment such as cooling S.W. pump and L.T. cooling F.W. pump, etc. may be readjusted after detail analysis for heat balance.
- The final capacity for the tanks may be readjusted after determination of hull line and position of the tank.
- The positive displacement pumps should be with 0.05 MPa suction head.
- The H.F.O. tank with mark “*” to be arranged within E/R.
- The H.F.O. tank with mark “***” to have inclined bottom.
- All tanks to be made of welded steel plate and well secured to the hull. Each tank to be provided with necessary fittings such as inlet and outlet connections, drain, air vent, manhole or hand-hole,

overflow, thermometer socket, steam blow-out connection, etc. all depending on the purposes for which they are intended.

- g) In generally all the tanks above floor to be provided with drip pans & surrounded by coaming.
- h) All insulated tanks to have gal. sheet cover.
- i) The miscellaneous oil tanks to be provided according to the Builder's practice.
- j) Flow meter with remote non flow alarm and filter shall also fitted on outlet line of cylinder oil measuring tank.

52 MAIN DIESEL ENGINE AND SHAFTING

521 Main engine

5210 General

The main engine to be manufactured by engine builder under the license from Wartsila.

The particulars of main engine to be as specified in Paragraph 511

The direction of engine revolution to be clockwise viewed from afterward when running ahead.

The main engine to be remotely controlled either from engine control room in the engine room or from wheelhouse.

The main engine to be temporarily controlled at engine local side when the remote control system is in failure.

Heavy fuel oil having a viscosity of up to 380 cSt/50°C to be used for main engine at normal sea going as per para. 502. The construction and materials of M/E to be in accordance with maker's standard and to be complied with the requirements of Classification Society for burning H.F.O. of 700 cSt/50°C

The main engine to comply with MARPOL 73/78 Annex VI Regulation 13 (Mandatory code on NOx emission Tier II).

5211 Installation

The main engine to be fastened to the tank top by hydraulic holding down bolts and resin chock to be used for leveling the engine foundation,

5212 Accessories and fittings

The following accessories mounted on main engine, and material and dimension of accessories, and the associated fittings including pipe, valve and cock, etc. to be designed and constructed according to the manufacturer's standard to meet the requirement of the Classification Society.

- 1 - Set of ABB high efficiency exhaust gas turbo - charger
- 2 - Sets of auxiliary blowers complete with electric motor and starter
- 1 - Set of air cooler with cooling water, cleaning and drain connections
- 1 - Set of exhaust gas manifold
- 1 - Fly - wheel
- 1 - Set of turning gear with electric motor, starter and portable switch box with capture cable of 20m
- 1 - Set of control lever for emergency operation (direction selection, starting and fuel control without governor)
- 1 - Supply unit for high pressure fuel oil supply to fuel common rail

- 1 - Common rail for distribution for high pressure fuel oil along the engine
 - 1 - Injection control units with rail valves and control position for volumetric control of fuel injection and individual injection valves
 - 1 - Automatic back - flushing filter for servo and control oil
 - 1 - Sets of connections and for vertical lubricating oil drain from dry sump in bed plate
 - 1 - set of electrically driven, load dependent cylinder lubricating system
 - 1 - Starting air main valve.
 - 1 - Electronically controlled starting air valve in each cylinder head
 - 1 - Blocking valve for turning gear engaged
 - 1 - Crankcase explosion relief valve for each cylinder
 - 1 - Indicator valve and driven gear for each cylinder
 - 1 - Safety valve on scavenging air receiver
 - 1 - Electronically controlled exhaust valve actuation
 - 1 - Pressure regulating valve for fuel oil return
 - 1 - Set of steam tracer piping on engine for operation with heavy fuel oil
 - 1 - Set of cleaning device for turbo - charger on gas inlet side and blower side by water washing
 - 1 - Set of brackets for the engine platforms with gratings, hand railing and steps
 - 1 - Set of steam connections for piston underside fire extinguish
 - 1 - pump index transmitter
 - 1 - Electric governor
 - 1 - Tachometer to be of electronic type
 - 1 - Set of safety cut - out device on the fuel pump and solenoid valve
 - 1 - Engine speed transmitter for the over speed shut - down system
 - 1 - Starting air control valve
 - 1 - Emergency stop button at emergency control station
 - 1 - Emergency overriding button at emergency control station
 - 1 - Oil mist detecting device
 - 1 - Integrated axial damper mounted at the forward end of the crankshaft
 - 1 - Slow turning device
 - 1 - Torque measurement device
 - 1 - Hydraulic top bracing system
 - 1 - 2nd order moment compensator (according to manufacturer's standard)
- The lubricator, fuel pump and hydraulic actuator, indicator valve shall be in accordance with manufacturer's standard.

Others to be supplied in accordance with the manufacturer's standard.

522 Reduction gear and coupling

None.

523 Shafting and propeller

5230 General

The shafting to consist of one intermediate shaft and one propeller shaft made of integral forged high quality carbon steel. The intermediate shaft to be fitted with oil- lubricated plain bearing and propeller shaft to be of oil-lubricated bearing aft and forward of stern tube.
Rope guard and net cutters will be fitted.

The shaft diameter, propeller diameter and the number of blades and other details to be determined and designed in consideration of the shafting torsional vibration as well as hull vibration.

The shafting system to be so designed and manufactured that the system is free from harmful torsional vibration at normal speed range in accordance with the Rule requirement. The detail of barred speed zone to be according to the calculation of shafting torsional vibration.

At the non-essential speed range, the barred speed range with quick by-pass arrangement to be provided. The detail of barred speed zone to be according to the calculation of shafting torsional vibration.

Propeller shaft to be withdrawn from inboard, the side shell opening part to be marked by welding bead in red color paint on the inside of the engine room.

5231 Hydraulic system

None.

5232 Shaft

(a) Intermediate shaft

The intermediate shaft to be made of forged steel with solid flange coupling on both ends and coupled together with each shaft with parallel reamer bolts.

The shaft to be machined all over and finished brightly in way of bearing where the diameter is increased abt.5mm.

The shafting to be electrically earthed to the hull and a shaft earthing device to be installed to the intermediate shaft.

(b) Propeller shaft

The propeller shaft to be made of forged steel with a solid flange coupling on fwd end. The propeller shaft to be smoothly machined all over and finished brightly in way of bearings where the diameter is increased abt.5mm.

The after portion of the shaft to be machined to 1/20 tap to fit the propeller hub and the end of the shaft to be left-hand threaded to suit a propeller shaft nut.

5233 Coupling

All flange coupling to be fitted with straight shank forged steel reamer bolts and nuts.

The diameter of the coupling bolts and the thickness of the coupling flanges of intermediate shaft and propeller shaft to comply with the requirements of the Classification Society.

The fillet radius at the base of flanges to comply with the requirements of the Classification Society.

5234 Intermediate shaft bearing

The intermediate shaft bearing to be of the single oil disc type and of cast iron pedestal and upper and lower part lined with white metal.

The bearing to be provided with ample oil reservoir and cooling water jacket inside the pedestal, with end baffle to prevent loss of oil at end of bearing.

An oil level checking device and oil drain plug to be provided on the bearing.

5235 Stern tube, stern tube bearing and stern tube seal

a) Stern tube

The stern tube to be of steel plate fabricated type, constructed a shell.

The fwd end to be secured to the aft peak bulkhead, and the after end to the stern frame hub by epoxy resin.

A steel plate rope guard to be provided at the after end of the stern frame hub.

Distance ring to be provided.

b) Stern tube bearing

One (1) bearing to be fitted at the stern frame hub.

The bearing sleeve to be of cast iron lined with white metal and of oil retaining type.

The stern tube bearing to be complied with the requirement of Classification Society.

Two (2) sets of temperature sensor to be installed at the after bearing for monitoring the bush temperature, one (1) set as working and the other as spare.

c) Stern tube seal

The oil seal assembly to be fitted at forward and after ends of the stern tube to prevent ingress of sea water or loss of lub. oil.

The stern tube seal to be of compact, simplex type (4 rings for AFT and 2 rings for FWD) with net cutters.

The material of seal rings to be of Viton or equiv..

The material of the seal casing to be cast iron for forward and bronze for aft.

The forward and aft sealing gland to be of non split type.

The forward seal liner and aft seal liner to be of chrome steel.

A separate lubrication system to be provided for the forward seal with a small head tank.

The wear down measuring apparatus to be provided to measure the clearance at the aft side bushing of the stern tube.

5236 Propeller, fair water cap and propeller nut

The propeller to be of fixed pitch, aerofoil section, right handed, solid, nickel aluminum bronze, keyless type. The manufacturing tolerance shall be in accordance with class I of ISO 484/1, net cutter also should be supplied.

Propeller to be designed through analysis concerning propulsion efficiency, cavitation, and the lowest possibility of the existence of vibration to hull superstructure and machinery. The propeller to be so designed that the continuous service rate may be developed at the shaft revolution of about 3.5% higher than that corresponding to the rating in condition at design draft, clean hull and fair weather.

The propeller hub to be bored to taper so that it may be accurately fitted to the taper end of the propeller shaft.

The propeller to be force fitted to the propeller shaft and secured by hydraulic mounting tool and nut with locking device.

A fair water cap of nickel aluminum bronze to be fitted over the propeller nut.

The fair water cap to be drilled and to have connections with brass plugs for filling the void spaces with rust preventive grease.

After the propeller has been finished and inspected the static balance of the propeller to be checked.

5237 Earthing device

An earthing device installed at intermediate shaft to be provided which is capable of keeping the electrostatic voltage between crankshaft and hull below 100 mV.

5238 Material

(a) Shafting

Intermediate shaft	forged steel
Propeller shaft	forged steel
Nut of propeller shaft	forged steel
Coupling bolts	alloy steel

(b) Stern tube

Stern tube	Cast steel and steel plate
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(c) Intermediate shaft bearing

Upper and lower shells	Cast iron
Bearing metal	Mild steel lined with white metal

53 ELECTRIC GENERATING ENGINE AND STEAM GENERATING PLANT

531 Electric generating engine

(a) General

The electric generating plant consists of three (3) sets of diesel generator and one (1) set of emergency diesel generator. Relevant data refer to Paragraph 513.

Concerning electric alternator, refer to Electric Part.

(b) Construction for generating engine

For generator engine

The design, construction, materials, and accessories to be of maker's standard in accordance with the requirements of unmanned machinery space.

The engine to be suitable for burning HFO of 380 cSt/50°C.

Each diesel generator set to be capable of parallel running.

Cooling medium to be fresh water for cylinder jacket and cylinder cover, lubricating oil cooler and air cooler.

Governor with governor motor to be accordance with maker's standard.

Each engine coupled with an alternator to be installed on a common bed and resiliently mounted on the hull foundation.

For emergency generator engine

The design, construction, materials, and accessories to be of maker's standard in accordance with the requirements of unmanned machinery space.

The engine to be a vertical, four cycle, single acting, trunk piston, radiator-cooled marine diesel engine.

The engine to be completed with self-contained cooling system and forced feed lubricating system.

The engine coupled with an alternator to be installed on a common bed and resiliently mounted on the hull foundation.

The engine to burn DMA or DMX.

(c) Accessories

For each main generator engine

- Exhaust gas turbocharger	1
- Air cooler	1
- Governor with governor motor	1
- Fuel injection pump	each 1/cyl.
- F.W. pump (engine driven)	1
- L.O. pump (engine driven)	1
- F.O. filter	1
- L.O. cooler (with a thermostat valve)	1
- F.W. cooler (with a thermostat valve)	1
(subject to maker's standard)	
- L.O. filter	1
- Pre-lubricating oil pump (Ele. Motor driven)	1
- Turning device (hand operated type with starting interlock)	1
- Gauge board	1
- Emergency stopping device	1
(Including over speed, L.O. pressure low and F.W. excessively high temp.)	
- Exhaust gas expansion connection	1
- Exhaust gas silencer	1

The other's accessories except for above mention of the engine to be provided in accordance with maker's standard.

For emergency generator engine.

- L.O. pump (engine driven)	
- F.O. pump (engine driven)	1
- Cooling water pump (engine driven)	1
- Cooling water radiator	1
- Governor	1
- Gauge board	1
- Starting device	2
- Emergency stopping device	1
- Exhaust gas expansion connection	1
- Exhaust gas silencer	1

The other's accessories except for above mentioned of the engine to be provided in accordance with the maker's standard.

532 Steam generating plant

General

The steam generating plant consists of one (1) composite boiler.

The composite boiler to be vertical cylinder welded construction smoke boiler which consists of oil fired section and exhaust gas section (to be connected with M/E and two A/Es exhaust gas pipes).

Relevant data refer to Paragraph 514.

The boiler to be designed to burn heavy fuel oil same as main engine at normal service, and M.D.O. to be used for cold starting. Low sulphur M.D.O. to be used to comply with EU directive.

The boiler to permit a simultaneous operation of the oil-fired section and the exhaust gas section when necessary.

The normal necessary steam at sea to be generated by the exhaust gas section of composite boiler utilizing the exhaust gas heat of the main engine, No.1 and No.2 auxiliary engine, oil fired section to be used in cold condition.

The exhaust gas section may be dry boiled in case of emergency.

In cold area, or when ship runs at low load of the main engine or similar condition, assisting oil fired section of composite boiler to be taken into consideration.

Excess steam should be led to a atmospheric condenser via a dump valve.

The exhaust gas section can act as main engine, No.1 & No.2 auxiliary engine exhaust silencer and the noise attenuation to be as per maker's standard. No exhaust by-pass to be provided.

Accessories

The boiler is supplied with burner, control box, feed water regulator, water level gauge, safety valves, other valves and pressure gauges etc.

Main material to be as follows:

Header:	Boiler steel plate
Element:	Boiler steel plate
Casing:	Boiler steel plate

All accessories and fittings to be in accordance with maker's standard and requirements of Classification Society.

Chemical dosing equipment and boiler water testing device, oil detecting device and salinity alarm equipment to be provided.

The feed water pumps and F.O. supply pumps to be provided in accordance with the maker's recommendation.

54 AUXILIARY MACHINERY

541 Pump

The relevant data of the pumps refer to Paragraph 515.

Pump construction, material, accessories, spares and tools to be in accordance with maker's standard and in compliance with equipments of Classification Society. In general the following accessories to be provided such as air vent plug, drain valve/plug, pressure gauge and compound gauge with root valves and fitting on or near the pump, coupling cover for horizontal pump etc., all depending on the purposes for which they are intended.

The construction, materials and accessories for pumps being attached to other machinery such as generator engine, fresh water generator, oily bilge separator etc. to be in accordance with maker's standard practice.

Positive displacement pumps to have relief valves.

In generally, the pump motors to be located above the lower floor plate. Pumps to be accessible for easy maintenance.

Horizontal pumps to be mounted on common bed plates of fabricated steel or cast iron with the driving motor.

5411 Centrifugal pump

General

Electric motor of centrifugal pump not to be overloaded at the service condition on board.

The pump casing to be designed that the rotating member may be exposed for inspection or replacement without disturbing the pipe connections except the small pump capacity less than 100 m³/h.

The shaft seal to be of mechanical type except small pump, capacity less than 50 m³/h.

The priming device for pump, where fitted to not be run continuously.

All vertical pumps to be driven through flexible coupling between impeller and motor shaft, or may have the thrust bearing in the driving motor and be driven through rigid coupling, subject to maker's standard.

Material

	S.W. Handling	F.W. Handling	Boiler feed W. handling	L.O. handling
Casing	Bronze	Cast iron	Cast steel or Ductile cast iron	Cast iron
Impeller	Phosphor bronze or Ni-Al- bronze	Phosphor bronze or Ni-Al- bronze	Stainless steel	Bronze
Shaft	Stainless steel	Stainless steel	Stainless steel	Cr-Mo steel or carbon steel

Others to be in accordance with the manufacturer's standard.

5412 Gear and screw pump

General

Each pump to be directly coupled to a power end of driver via flexible or rigid coupling according to the maker's standard design.

Gear and screw pumps to develop rated capacity against rated discharge pressure without over loading of driving motors when handling with viscosity for which the pump is intended.

The mechanical seal to be applied for gear and screw pumps.

The safety valve to be fitted on the pump casing.

In general, pumps to be internally lubricated by the pumping fluid.

Material

Part	Gear pump	Screw pump
Casing	Cast iron	Cast iron or steel plate
Gear	Carbon steel	-
Shaft	Carbon steel	-
Power rotor	-	Carbon steel
Idle rotor	-	Carbon steel or ductile cast iron

Other's to be in accordance with the manufacturer's standard.

5413 Piston pump and mono. pump

Construction and material to be in accordance with maker's standard.

542 Heat exchanger

The relevant data refer to paragraph 5036 and 515.

5421 Plate type cooler

General

The heat exchanging surface to consist of number of corrugated plates clamped together in a frame and sealed at edges by rubber gaskets. Back washing piping with valves shall be installed for cooling sea water line of plate type coolers.

The plates form a closed system of parallel two media between which heat is exchanged flow through alternate interplate spaces.

The accessories to be in accordance with maker's standard.

Material

Frame	Mild steel
Plate	Titanium plate for sea water handling Stainless plate for fresh water and L.O. handling
Gasket	Nitrile rubber

5422 Shell tube type cooler

General

The tubes to be expanded into the plates at both ends of the tubes.

An expansion joint to be provided on the shell for relieving the thermal expansion between the tubes and shell on the straight tube type heat exchanger.

The cooling fluid to pass through the tubes and the cooled fluid to flow outside of the tubes.

The accessories to be included with air vent valve, drain valve, chemical cleaning flanges, thermometers, short pipe for inlet/outlet and steam boiling connection etc. if the cooler to be cooled by S.W. the cooler covers to have tar epoxy coating and zinc anode fitting.

Material

Tube	Naval brass
Tube plate	Naval brass
Shell	Steel plate or steel pipe
Water box and cover	Cast iron or steel plate

5423 Shell tube type heater

General

Each heater should fitted temperature gauge and safety valve.

Material

Tube	Steel pipe
Shell	Steel plate or steel pipe

5424 Heat exchanger operating condition

The operating conditions for various oil and water heaters to be as follows:

Item	Heating steam Pressure (MPa)	Fluid temp (°C)	
		Inlet	Outlet
Fuel oil heater for M/E & G/E	0.6	90	130~150
Fuel oil heater for purifier	0.6	50	98
Lub. oil heater for purifier	0.6	40	90
Fuel oil heater for boiler	elect.	50	
Calorifier	steam & elect.	10	70
M/E jacket F.W. pre-heater	0.6		
A/E cooling F.W. preheater	elect.		

The operating conditions for various oil and water coolers to be as follows:

Central cooler	36 °C at the cooler outlet of L.T. cooling F.W.
M/E H.T. F.W. cooler	85 °C at the cooler inlet of H.T. cooling F.W.
M/E L.O. cooler	46 °C at the cooler outlet of L.O.
Atmosphere condenser	80 °C at the cooler outlet of condensate water

543 Air compressor and air reservoir

The air compressors and air reservoirs to be of sufficient capacity to meet the requirement of the Classification Society. Mode change over switch for main air compressors shall also be fitted on control console in engine control room.

The construction, materials, accessories, spares and tools to be in accordance with maker's standard.

5431 Main air compressor

The main air compressors to be of single acting, two or three stages, air cooled, piston type and to be driven by electric motors.

Each main air compressor to be fitted with unloader, safety valve, air strainer, pressure gauge, auto. drain traps and other necessary fittings.

Each main compressor to be provided with automatic starting and stopping control as well as local manual controllers.

The main air compressors to be resiliently mounted on the platform in engine room.

5432 Emergency air compressor

Emergency air compressor to be motor driven air cooled type and power source to be from emergency switchboard for starting when dead ship.

5433 Deck service air compressor

The air compressor to be of screw type, electric motor with v belt driven, air cooled, self-contained L.O. system, oil filter and oil separator.

The material, spares and tools to be in accordance with the manufacturer's standard.

5434 Air reservoir

The air reservoirs to be of cylindrical type of welded steel plate, and complete with pressure gauge, safety valve, drain connection and manhole for main air reservoirs. Remote pressure indicator of main air reservoirs shall also be provided on control console on engine control room.

The air reservoirs drain connection to be with double shut down valves.

The compressed air escape pipe from relief valve led to terminated outside of engine room but acc.to the type of relief valve.

The air reservoirs to be painted inside with tar epoxy.

The air reservoirs to have ample construction and to be hydraulically tested in compliance with the Classification Society requirements.

544 Oil purifier**5441 Fuel oil purifier**

Two (2) sets of centrifugal purifier to be provided in the purifier room for H.F.O. purifying. One (1) HFO purifier is for normal running and the other is as standby. One set of purifiers can be also used for MDO purifying.

The independent supply pump with driving motor shall be provided for each F.O. purifier.

Each purifier shall be provided with necessary fittings such as a pressure gauge, a thermometer, abnormal flow detector, oil feed shut off valve, water transducer and etc.

Each fuel oil purifier shall run continuously and sludge discharge shall be carried out automatically by means of a timer and water transducer. Start and stop of the purifiers shall be manually and locally effected.

One (1) automatic control board with timer and abnormal alarm to be arranged near the purifiers.

Materials, accessories, spars and tools to be provided according to maker's standard.

All purifier tools shall be mounted on tool board.

One (1) "I" beam to be fitted above the purifiers for maintenance.

One (1) cleaning table to be provided with comp. air, cold water, hot water, M.D.O. pipes and valves and drain valve.

5442 Lubricating oil purifier

Two (2) sets of centrifugal purifiers to be provided.

One for main engine continuous running and the other for G/E L.O. purification or as standby for M/E.

Two (2) independent suction pumps with motor driven to be provided.

The purifier to be run continuously and sludge discharge to be carried out automatically by means of a timer. Start and stop of the purifier to be manually and locally effected.

One (1) automatic control board with timer and an abnormal alarm to be arranged near the purifier for each purifier.

Materials, accessories, spars and tools to be provided according to maker's standard.

545 Engine room ventilating fan

The relevant data refer to Paragraph 516

Four (4) ventilating fans to be provided, the airflow to be used for combustion for main engine, generator engines, composite boiler and for evacuation of heat mission from aux. equipment in engine room. The ventilating fan to be vertical totally enclosed motor driven axial flow type. Casing of driven motor of engine room ventilation fans shall also be split type for handy maintenance.

Two (2) sets of them to be reversible and the capacity and head is reduced when the fan to be run at reverse rotation.

The material to be as follows:

Casing : steel plate

Impeller: aluminum alloy casting or maker's standard

In addition to above, each one (1) exhaust fan for purifier room and welding space in engineer's workshop to be installed.

546 Oily bilge separator

Oily bilge separator to be provided with oily bilge pump for handling of the oily bilge in engine room.

The performance is to meet the requirements of MARPOL & IMO MEPC 107 (49). The oil content of treated water to be less than 15 ppm and oil content bilge alarm to be provided.

The construction, materials, accessories, spares and tools to be in accordance with maker's standard.

The inside of separator body to be coated with tar epoxy or equivalent.

547 Sewage treatment plant

One (1) sewage treatment plant of biological chemistry type to be provided in engine room to collect sewage from living compartments by gravity.

The construction, materials, accessories, spares and tools to be in accordance with maker's standard.

Soil pipe from hospital to be separately led to the sewage treatment plant.

Sewage treatment plant to be furnished with certificate complying IMO.

548 Incinerator

The incinerator to be in compliance with the requirements of MARPOL 73/78/97 and MEPC 76 (40) and alarms for furnace high temperature, flue high temperature, initiation failure, blanking failure and low fuel oil pressure etc.

The incinerator to be capable of burning solid waste and waste oil.

Exhaust pipe for incinerator to be provided with suitable expansion joints.

The following accessories to be included:

Burner unit	1 set
Waste burner	1 set
Pilot burner	1 set
Waste oil supply pump	1 set
Diesel oil pump	1 set
Force draft fan	1 set
Waste oil tank	1 set

Other necessary accessories, fittings, spares and tools to be according to maker's standard.

549 Others**5491 Fresh water generator**

The vacuum type fresh water generator, utilizing the waste heat of M/E jacket cooling F.W. to be installed in engine room and to be cooled by sea water.

The fresh water generator to produce rated capacity of distilled water not exceeding 10 p.p.m. of salinity, and if the salinity high in distilled water happen, the distilled water to be automatically re-circulated to the F.W. generator to prevent contamination of fresh water service system or to bilge.

The fresh water generator to consist of a evaporator and a condenser and complete with water ejector, ejector pump, distillate pump, salinity indicator, automatic alarm, water meter and other accessories for operation.

A chemical injection system included dosage tank to be provided.

The materials to comply with the requirements of the Classification Society and maker's standard.

5494 Elevator

None.

55 MISCELLANEOUS EQUIPMENT AND OUTFITTING OF MACHINERY SPACE

Miscellaneous equipment and outfitting such as tanks, ventilating duct, ladders, floor plates, etc. to be constructed and furnished in accordance with Builder's standard practice and to be comply with the requirements of the Classification Society.

551 Overhauling and removal of machinery

Overhauling equipment for main engine and auxiliary machinery to be provided as mentioned below.

During designing and construction of the engine room, particular attention to be paid to ensure sufficient space for operation and dismantling of machinery and equipment.

M/E T/C main parts, D/G alternator casing to be taken out from engine room through engine room hatch.

5511 Overhauling crane of main engine

For overhauling cylinder piston and liner etc. of main engine, there to be a crane on the overhead lifting beam. Overhauling Crane of Main Engine to be load tested and certificate must be provided.

Lifting beam with chain block/roller for T/C to be provided, capacity according makers recommendation

The crane to be of trolley type with electric motor driven hoisting, traveling and traversing. The construction and materials to be in accordance with maker's standard.

I-beams to be securely supported to ship's structure and to extend the full length of the main engine.

5512 Propeller shaft removal

Suitable number of lifting eyes using chain blocks to be provided so that the relocation of the intermediate shaft and the withdrawal of the propeller shaft in board for inspection may be facilitated. Two (2) sets of 10 t chain blocks to be supplied.

Removal of propeller shaft from the vessel may be carried out via a temporary opening out in the shell plating which to be marked by welding bead in red color paint. No equipment and pipe to be arranged at that place.

5513 Overhauling of auxiliaries

Generator engines to have adequately strength lifting beam to facilitate overhaul.

Lifting beam	:	3 sets
Chain block with roller	:	3 sets
Capacity	:	0.5 t

Oil purifiers to have lifting beam using chain blocks to facilitate overhaul.

Lifting beam	:	1 set
Chain block with roller	:	1 set
Capacity	:	0.5 t

A lifting beam to be provided for transport of the heavy parts from engine room to work shop.

Lifting beam	:	1 set
Chain block with roller	:	1 set
Capacity	:	1 t

Other larger pumps and heat exchangers above to have eye plates to facilitate overhaul.

5514 Heavy element in/out engine room

Spare gears, tools and other machine parts and big strainers to be carried in/out of engine room through the hatch on deck.

Lifting arrangements and transport ways from exposed deck to bottom floor in engine room to ensure easy transport of heavy elements by machinery jib crane on deck or harbor crane.

552 Tanks in engine room

Tanks in engine room to be of welded steel plate, and provided with necessary fittings such as heating coil, thermal insulation, level measuring apparatus, thermometer socket, air escape pipe, overflow pipe, drain plug, hole for cleaning, valves, etc., to be according to tank purpose. Coaming in height of 150mm with drain scupper line shall also be equipped for F.O., D.O. & L.O. tanks in engine room.

All of the oil tanks to be provided with drip pans.

Heating coils to be provided for the following tanks:

Tank name	Heating coil surface ratio
H.F.O. tank	0.04 m ² /m ³
H.F.O. deep tank	0.04 m ² /m ³
H.F.O. settling tank	0.12 m ² /m ³
H.F.O. service tank	0.12 m ² /m ³
Fuel oil overflow tank & drain tank	0.15 m ² /m ³
Lub. oil settling tank	0.10 m ² /m ³
Waste oil tank	0.10 m ² /m ³
Bilge holding tank	0.08 m ² /m ³
Sludge tank	0.15 m ² /m ³
Air cooler chemical cleaning tank (for MAN engine)	0.10 m ² /m ³

553 Ventilation of machinery space

The ventilating ducts to be so arranged that necessary air for main engine, generator engines, composite boiler, workshop store and working space etc. is available.

Fresh air to be supplied through ducts to machinery space having sufficient outlets.

The ventilating ducts to be of rectangular cross section and made with flange connection to allow replacement for repair, the duct to be painted with anti-rust paint on the steel plate.

Spiral duct of galv. steel sheet may be used for branch duct.

The least height at passage beneath the air ducts to be 2.0 m.

The steel plate thickness ventilating duct to be as follows:

5 mm for main duct

3 mm for branch duct

1.5mm for small duct

where a duct is welded directly to the ship's structure, the thickness to be of 5 mm.

The air ducts to be provided with necessary adjustable dampers where necessary for proper ventilation keeping healthy conditions and even temperature distribution within the machinery space. All adjustable dampers can be easily reached for open/shut.

All dampers in engine room to be fitted with stainless steel wire at the end of ducts.

The independent exhaust air duct to be arranged for purifier room and workshop welding space. and the ventilating duct for purifier room should be fitted with a fire damper.

Ducts to be securely supported or braced from ship's structure and to be designed to avoid irregular bends or branches as far as practicable.

The pin, hinge, bolts and nuts in the fan casing and duct connecting flange exposed to weather to be stainless steel.

The exh. air opening and fresh air intake to be provided with pneumatics type emergency shut-off device according to rule requirements and the main control panel to be arranged in fire control room.

The working ladder or step to be provided for maintenance if necessary.

554 Silencer

The silencer to be provided for one generator engine and emergency generator engine.

The composite boiler to be used as silencer of M/E and two generator engines.

555 Equipment and fittings for engine control room, engine room workshop and store

5551 Engine control room

The engine control room to be heat and sound insulated and to be provided with engine control, monitoring console and main switchboard etc. a unit cooler for air conditioning to be provided.

One (1) computer desk with chair to be provided.

5552 Engineer's workshop and engine room store

The engineer's workshop and engine room store to be arranged in the engine room.

The engineer's workshop to be enclosed by steel wall.

Following machineries to be arranged in the engineer's workshop.

1- Lathe

1- Driller

1- Grinder

1- Electric welder

1- Gas welder

(Oxygen and acetylene bottle to be stored in separated room outside the engine room and to be provided with steel piping to engineer's workshop)

1- Working table with a vice

1- Welding table

1- Exh. valve grinding device for M/E (M/E standard type)

1- Fuel valve test device with valve holder for M/E.

1- Package air conditioner

Adequate space for table and locker to be provided for boiler water testing in engineer's workshop or near E.C.R. or near boiler.

The racks in A.C. and O.X. bottle room to be capable to stow at least One (1) bottles of A.C. and Two (2) bottles of O.X..

Two (2) sets of steel cabinet with locking device & drawer to be provided in engine room store.

Steel shelves in engine room store to be provided in accordance with the Builder's practice.

A lifting beam and chain block to be provided in the engineer's workshop.

5553 Electrician's workshop and store

The separated electrician's workshop for test panel, working table with a vice and racks for elect. spare to be provided in elec. store.

556 Ladder, handrail, grating and floor plate

The ladders, handrails, gratings and floor plates to be provided in accordance with shipbuilder practice.

5561 Ladder

Main access ladders to be led fore and aft wherever possible and to slope of 60 degrees from the horizontal, and width of main ladder to be of 600 mm.

Ladders to be inclined type, except where it is unavoidable, vertical ladder to be used for unimportant access provision. The width of vertical ladder to be of 400mm. Galvanized steel dust guard to be fitted at underside of main ladders.

Treads to be a non-slip type.

All ladders to be attached at top and bottom by bolts to provided ready portability for overhaul of machinery when necessary.

One portable aluminum ladder (folding type) to be provided for maintenance.

5562 Handrail

Handrail to be fitted at gratings, ladders and floors where necessary for the safety and convenience of operating personnel. Handrails to be of steel pipe carried in steel pipe stanchions and to be fitted with portable section where required for overhauling machinery.

Handrails to have a clear hand space of at least 50mm from adjacent equipment and bulkhead.

5563 Floor plate

In general, the flooring to be checkered steel plate of about 4.5 mm in thickness, supported and fastened to suitable bars of angle frame by not less four (4) brass screws. Removable sections to be provided as required for proper access for handling and inspection of the equipment located under floor and for manholes. Floor plates sections not to be larger than what can be handled by one man as far as practicable.

Coaming of height 50mm to be provided around permanent openings.

5564 Grating

Adequate gratings of steel to be provided for machinery space walkways, platforms, and floors only where specifically required for ventilation and continuous visibility purposes.

Suitable fastening pieces to be provided for firmly holding the gratings to the supporting structure.

5565 Protection device

All moving parts such as flywheel, coupling to be protected by safety cover.

557 Distinguishing and measuring instrument

In case of two or more sets of identical machinery units are installed, those machineries to be distinguished by numbering. In general, the numbering to be carried out in this way:

From up to down,
Fore to aft,
Port to starboard

The measuring instruments used for machinery and equipment in engine room to be of Chinese make according to international standard except those attached to the foreign auxiliary machinery.

Name plates to be made of brass plate and to be marked by etching and painted black for illustration plate, red for warning plate respectively.

Items	Language	Measuring unit	
		Chinese make	Foreign make
Instruments	English	Metric or SI	Metric or SI
Thermometer Temperature indicator Pressure gauge Compound gauge Vacuum gauge Level indicator Electric indicator Salinity indicator Flow meter Indication of tank volume			
Name plates & drawings	English or English & Chinese		
Name plate (fitted to machinery) Plan for approval Finished plan Instruction book Inspection record Test record Sea trial record Name plate (fitted to valve)			

558 Insulation

5580 General

The surfaces of the equipment, tanks and piping which shall treat or contain the fluid with temperature over 60°C except for cooling F.W. piping and L.O. piping should be insulated.

Main engine, generator engines, composite boiler, incinerator and calorifier shall be insulated according to the maker's standard. Atmosphere condenser and cascade tank shall not be insulated.

Where it is necessary to fit removable and replaceable insulation on flanges, fittings and covers, etc., the tailor-made pads or blankets shall be used.

The outer face temperature after insulation should be not exceeded by 60°C. When the engine room temperature is 45°C.

5581 Insulation for thermal equipment

(a) Boiler and heater

The composite boiler will be insulated according to maker's standard.

The minimum thickness of insulation material for surfaces of large extent such as heaters, etc. shall meet the following requirements or according to the maker's standard, and insulation material to be covered with 0.5mm galvanized steel sheet.

Temperature range of internal fluid	Aluminum silicate or mineral wool
60 to 155 °C	25 mm
156 to 260 °C	50 mm

(b) F.O. tanks

H.F.O. setting and service tanks should be insulated.

The external surface of the above tanks exposed to the engine room except for the tank bottom to be insulated with 25 mm thickness of mineral wool or aluminum or equivalent and covered with 0.5mm galvanized steel sheet.

(c) Silencers

The exhaust gas silencers for generator engine and emergency generator engine should be insulated with 50mm thickness of mineral wool or aluminum silicate or equivalent and covered with 0.5mm galvanized steel sheet.

5582 Insulation for exhaust gas piping and uptake

The exhaust gas piping and uptake should be insulated up to 2m height above C deck in funnel and the requirements are as follows:

Name of equipment	Insulation		cover
	Thickness mm	material	
Main engine	Pipe 80 Flange 80	Mineral wool or aluminum silicate	Wire net + glass cloth + galv steel sheet 0.5mm thick
Generator engine	Pipe & flange 60	Do	Do
Incinerator & composite boiler	Pipe & flange 60	Do	Do

Where the pipe insulation contacts on the flanges and fittings the insulation to be suitably terminated to permit free removal of bolts and to allow for movement of the pipe at supports.

5583 Insulation for thermal fluid piping

The following piping system should be insulated.

Name of piping	DN mm	Insulation		cover
		Thickness mm	Material	
H.F.O., L.S.M.D.O.	< 50	30	Mineral wool	Glass cloth
	> 50	40		Glass cloth
	< 10		Two layers of glass cloth	
Steam, condensate & feed water	< 50	30	Mineral wool	Glass cloth
	> 50	40		
Hot water		20	Mineral wool	Glass cloth

The following pipes in engine room to have steam tracing and to be insulated together.

- H.F.O. transfer line
- H.F.O. purifier suction from settling tank to H.F.O. purifier heater
- M/E, G/E and boiler H.F.O. service line
- H.F.O. return line
- Sludge pump suction and discharge line
- HFO drain & overflow line

The following pipes to be insulated with glass cloth.

- Boiler blow line
- Exhaust steam line after relief valves and safety valves.
- Drain line after steam drain valves and drain traps.

559 Others

5591 Painting and color scheme in engine room

Machinery and piping in engine room to be painted except following parts.

- a) Working surface of machinery, brass surface, and other parts which are finished bright.
- b) Surfaces of insulation which are not covered with steel sheet or equivalent.

External surface of pipes (not galvanized) and valves fitted below floor level to be painted with two (2) coats anti-corrosion paint only.

Other machinery and equipment to be in accordance with maker's standard.

The color of finished coat for external surface to be in accordance with the following table.

Name of machinery or equipment	Color
Diesel engine Air compressor Centrifugal pump Screw, and gear pumps Oil purifier Fan F.W. generator Overhead crane Workshop machine Intermediate shaft bearing Steel box for spare parts L.O. and F.W. coolers	Light blue green (Munsell notation: 7.5 BG 7/2)
Turbocharger for main engine Turbocharger for generator diesel engine Boiler Incinerator Oil heater	Silver
Atmospheric condenser Air reservoir Tanks not to be insulated Pipes not to be insulated air trunk Hydrophore Valves not to be insulated Strainer Top rail of hand rail Lagging of glass cloth	White
ER. tank top Sewage treatment plant Bilges	Grey
Ladder except step Hand rail	White
Floor plates (outside / inside)	Green

The piping to be marked with the Owner's standard color vinyl tapes or color paints to indicate the various medium.

The medium flow direction to be indicated by arrow shown at outside the pipe.

56 PIPING SCHEDULE AND PIPING SYSTEM IN ENGINE ROOM

561 Piping schedule in engine room

5610 General

All pipes, valves and cocks are to conform to GB, CBM, CB, JB and YB standard or equivalent standard. The flanges to conform to ISO standard. Bolts and nuts to be conformed to CIS standard.

Piping to be fitted as straight and simple as possible, and so arranged as to have easy removing. Piping to have no sharp angle bend in general.

Each piping system to be so designed to allow stress due to deflection of ship's structure and thermal expansion etc.,

Electric cables to be so installed as to have an enough distance from oil and steam pipes as far as possible.

All pipes to be adequately supported by suitable number of bands to prevent harmful vibration.

In general, steel support and U-type bolts to be applied to pipe lines at suitable intervals. Pipe support for copper pipes to be lined with lead. Double nuts to be used for U-type bolts in tanks and spaces which are not usually accessible.

No pipe of non-ferrous metal to be fixed to the hull directly.

Attentions to be taken as there is no air pocket in each piping system as far as possible, and drain pipes to be fitted where necessary positions of each piping system.

Where galvanized piping is specified, galvanizing to be done after welding of flanges and plug seats as possible, but short section such as drain pipe to be allowed to weld on board. Where welding has destroyed galvanization, the surface shall be touched up with two coats of Zinc solution paint.

In consideration of repair, each piping connections to be of flange type or union joints, but union joint not to be used as far as possible.

Piping to be marked with owner's standard color vinyl tape for easy recognition, and also on either side of bulkhead at all bulkhead penetrations.

Pipes to be tested according to the Classification Society's rules.

Piping workmanship to satisfy the requirement of the Classification Society and the followings:

Piping to be led as direct as practicable, with a minimum number of bends and with suitable number of joints for removal.

Sleeve joints not to be applied for galvanized steel pipes in E/R unless specially approved by the Buyer. Flange to be used in general.

Sleeve welded joints to be generally used to prevent leakage from all steel pipe joints in the spaces such as cargo holds, tanks, cofferdam, void spaces, ducts, store spaces, accommodation spaces, etc. where it is not accessible usually or difficult to remove the pipes. But welded joints may be applied instead of sleeve welded joints where the inside cleaning of the pipes can be carried out.

For connecting different diameter pipes, the commercial reducing piece to be used.

Pipes to have suitable thickness for each service, according to the Regulations of the Classification Society and Specification as mentioned below.

Expansion to be compensated for by means of bend except otherwise described.

Pipes generally to be bent in cold process. In case that cold bending machine is not applicable, high frequency induction bender or hot bending process to be used.

The radius of bends of steel pipes, in general, not to be less than 2.5 times the outside diameter except narrow space of structure or crowding of pipes, where commercial elbow to be used. Bends of copper pipes except coils not to be less than twice the outside diameter as far as practicable.

Commercial length of pipes to be used as far as practicable.

For the following cases, butt welding connection or fabrication to be carried out.

- a) When the cold bending machine is not applicable.
- b) Where welding piece such as tube turn or bend piece is used.
- c) To make fabricated steel pipe of large diameter such as main engine exhaust pipe.

The oil piping and electric cables should be kept away from steam lines and other hot surface.

Piping in way of the machinery and equipment to be arranged to permit overhaul of the unit with minimum dismantling of piping as far as practicable.

Where possible, piping at tank top level to be arranged so that any length may be removed without disturbing adjacent pipelines.

Air pockets in pipe lines to be avoided as far as practicable. Where pockets do occur, bosses with a cock or screwed plug for drainage to be provided.

Pipes on weather deck to be fitted with drain plugs where necessary.

All piping to be cleaned and free of welding slag before installation, and after installation, the principle piping system to be flushed.

All lube oil piping, fuel oil piping, hydraulic oil piping to be acid pickled and oil flushed before installation.

L.O. piping for the main engine and generator engines to be flushed with system oil after installation.
F.O. piping for the main engine and generator engines to be flushed with M.D.O. after installation.
Hydraulic oil piping to be flushed with flushing oil after installation.

Where pipes pass through the water tight bulkhead and deck, penetration pieces of three flange type or sleeve joints to be used.

The pipe shall as far as possible not be arranged directly above or in front of or behind the switchboard. If unavoidable, suitable protection shall be provided.

Free zone (piping) around main engine to be arranged.

Overhaul of pumps/machinery to be possible for maintenance.

Short pieces to be provided for each inlet/outlet pipe lines of coolers/heaters for easy maintenance (cleaning).

The gasket for pipe lines, in general, to be reinforced rubber sheet type which suitable for the pressure, temperature and the medium in side the pipe. The asbestos products not to be used.

5611 Valve and fitting

Butterfly valves may be used for nominal diameter of 80 mm and above in fresh water, ballast, bilge, sea water system, lubricating oil system and fuel oil system excluding hull fitted valves.

Each pressure reducing valve on inlet side with a simplex strainer to be provided and on its discharge side with a pressure gauge and a safety valve having sufficient

Valves to be fitted as extensively as possible instead of cocks, and cocks may be used for low pressure lines and drain lines.

Pneumatic type quick closing valves for oil tank to be fitted in accordance with the requirements of the Classification Society, these valves to be capable of being operated locally.

Expansion joints to be provided on piping lines to prevent damage from vibration and thermal stresses where necessary.

All valves essential for system understanding to have name plated clearly stating their purposes. These nameplates to be properly fastened to the valve body or on the hand-wheel. Valves below engine room floor to be arranged for easy access.

5612 Material and size of piping

Materials and size of pipes, valves and fittings to be in accordance with following tables.

System	Nominal size (mm)	Pipe		Pipe joint	Valve			Fitting	Press ST. (MPa)
		Material	Thick		Body	Disc. & seat	Stem		
Steam 0.6MPa	50 & above	Seamless steel	B	Steel slip on welded flange or butt welded or sleeve	Cast steel flgd.	Steel	Stainless steel	Cast steel or welded steel flgd. or welded branches	1
	40-15				Bronze of brass flgd.				
	10 & below	Seamless copper		Brass union or bite joint or sleeve	Bronze or brass screwed	Bronze or brass	Bronze or brass	Brass screwed	
Steam 0.4MPa steam drain	50 & above	Seamless steel	B	Steel slip on welded flange or butt welded or sleeve	Cast steel flgd.	Steel	Stainless steel	Cast steel or welded steel flgd. or welded branches	0.6
	40				Bronze or brass				
	25-15								
	10 & below	Seamless copper		Brass union or bite joint or sleeve	Bronze or brass screwed	Bronze or brass	Bronze or brass	Brass screwed	0.6
Heating coils in oil tank	All size	Seamless steel	C	Sleeve	--	--	--	-	1
Aux. boiler feed pump suction	15 & above	Seamless steel	A	Steel slip-on welded flange or butt welded or sleeve	Bronze flgd.	Bronze	Bronze	Cast iron or welded steel flgd. or welded branches	0.6
	10 & below	Seamless copper		Brass union or bite joint or sleeve	Bronze screwed				
								Brass screwed	
Aux. boiler feed pump delivery and boiler blow off.	40-15	Seamless steel	B	Steel slip-on welded flange or butt welded or sleeve	Bronze flgd.	Bronze	Bronze	Cast iron or welded steel flgd. Or welded branches	1.6
	10 & below	Seamless copper		Brass union or bite joint or sleeve	Bronze screwed				
								Brass screwed	
Cooling sea water	50 & above	Seamless steel galv.	C	Steel slip on welded flange or butt welded or sleeve	Cast iron flgd.	Steel or bronze	Stainless steel or bronze	Cast iron or welded steel flgd. or welded branches	0.6
	40-15	Seamless steel galv.	C		Bronze or brass flgd				
	10 & below	Seamless copper		Brass union or bite joint or sleeve	Bronze or brass screwed				

System	Nominal size (mm)	Pipe		Pipe joint	Valve			Fitting	Press ST. (MPa)
		Material	Thick		Body	Disc. & seat	Stem		
Cooling fresh water	50 & above	Seamless steel	A	Steel slip on welded flange or butt welded or sleeve	Cast iron flgd.	Steel or bronze	Stainless steel or bronze	Cast iron or welded steel flgd. or welded branches	0.6
	10 & below	Seamless copper			Bronze or brass flanged				
Water ballast, bilge	50 & above	Seamless steel	C	Steel slip on welded flange or butt welded or sleeve	Cast iron flgd.	Steel or bronze	Stainless steel or bronze	Cast iron or welded steel flgd. or welded branches	0.6
	40-15	galv.							
	10 & below	Seamless copper		Brass union or bite joint or sleeve	Bronze or brass screwed				
Fire main	50 & above	Seamless steel galv.	B	Steel slip on welded flange or butt welded or sleeve	Cast iron flgd.	Steel or bronze	Stainless steel or bronze	Cast iron or welded steel flgd. or welded branches	1
	40-15								
	10 & below	Seamless copper		Brass union or bite joint or sleeve	Bronze or brass screwed		Brass screwed		
Fresh water service in engine room	50 & above	Seamless steel galv.	A	Steel slip on welded flange or butt welded or sleeve	Cast iron flgd.	Steel	Stainless steel	Cast iron or welded steel flanged or welded branches	0.6
	40-15	Seamless copper							
	10 & below	Seamless copper		Brass union or bite joint or sleeve	Bronze screwed			Brass screwed	

System	Nominal size (mm)	Pipe		Pipe joint	Valve			Fitting	Press ST. (MPa)
		Material	Thick		Body	Disc. & seat	Stem		
Fuel oil booster pump delivery	25 & above	Seamless steel	B	Steel slip on welded flange or butt welded or sleeve	Cast steel fgd.	Steel or bronze	Stainless steel or bronze	Welded steel fgd. or welded branches	1.6
	15				Bronze fgd.				
	10 & below	Seamless copper		Brass union or bite joint or sleeve	Bronze screwed			Brass screwed	
Fuel oil transfer pump & F.O. purifiers delivery, engine F.O. return	25 & above	Seamless steel	B	Steel slip on welded flange or butt welded or sleeve	Cast steel fgd.	Steel or bronze	Stainless steel or bronze	Cast iron or welded steel fgd. or welded branches	1
	15				Bronze or Brass fgd.				
	10 & below	Seamless copper		Brass union or bite joint or sleeve	Bronze or brass screwed			Brass screwed	
Fuel oil transfer pumps suction & F.O. purifiers suction	25 & above	Seamless steel	A	Steel slip on flange or butt welded or sleeve	Cast steel	Steel or bronze	Stainless steel or bronze	Cast iron or fgd. or welded branches	0.6
	15				Bronze or brass fgd.				
	10 & below	Seamless copper		Brass union or bite joint or sleeve	Bronze or brass screwed			Brass screwed	
Lub. oil	50 & above	Seamless steel	A	Steel socket welded flange or butt welded or sleeve	Cast iron fgd.	Steel or bronze	Stainless steel or bronze	Cast iron or welded steel fgd. or welded branches	0.6
	40-15				Bronze or brass fgd.				
	10 & below	Seamless copper		Brass union or bite joint or sleeve	Bronze screwed			Brass screwed	
Compressed air (3 MPa)	40 & above	Seamless steel galv.	B	Forged steel socket welded flange	Cast steel fgd.	Steel or bronze	Stainless steel or bronze	Cast steel or welded steel fgd. or welded branches	3.0
	25-15				Forged steel fgd.				
	10 & below	Seamless copper		Brass union or bite or sleeve	Forged steel screwed			Brass screwed	

System	Nominal size (mm)	Pipe		Pipe joint	Valve			Fitting	Press ST. (MPa)
		Material	Thick		Body	Disc. & seat	Stem		
Compressed air (0.7 MPa)	50 & above	Seamless steel galv.	B	Steel slip on welded flange or butt welded or sleeve	Cast steel flgd.	Steel or bronze	Stainless steel or bronze	Cast steel or welded steel flgd. or welded branches	1.0
	40-15				Bronze or brass flgd.				
	10 & below	Seamless copper	Brass union or bite joint or sleeve		Forged steel screwed			Brass screwed	
Main & Aux. Engine exhaust gas, Aux. boiler exhaust gas	500 & above	Welded steel plate	8mm	Steel welded flange or butt welded or sleeve	--	--	--	Welded steel flgd. or welded branches	--
	500-300		6mm						
	250 & below	Welded steel plate	6mm						
Air vent & overflow attached to double bottom & deep tank	100 & above	Seamless steel*	B	Steel slip on welded flange, sleeve, butt weld	--	--	--	Nodular cast iron or welded steel flgd. or welded branches	0.6
	80-50	Seamless steel*	B						
Air vent & overflow except mentioned above open drain scupper	50 & above	Seamless steel*	B	Steel slip on welded flange or butt welded or sleeve	Cast iron flgd.	Steel or bronze	Stainless steel or bronze	Nodular cast iron or welded steel flgd. or welded branches	0.6
	40-15				Bronze flgd.				
	10 & below	Seamless copper		Brass union or bite joint or sleeve	Bronze screwed	Brass screwed			
	Sounding for double bottom, deep tank & void space		Seamless steel*	B	Steel slip on welded flange or butt welded or sleeve	--	--	--	Cast iron or welded steel flgd. or welded branches

Notes:

- a) All gal. pipe to be of hot dip type.
- b) * All air vent, overflow & sounding pipes to be galvanized except for oil system.

Remarks:

A Ordinary

B Medium

C Heavy

Table of steel pipes thickness

Nominal diameter (mm)	External diameter (mm)	Thickness (mm)		
		A	B	C
10	17	3.0	3.0	-
15	22	3.0	3.5	4.0
20	27	3.0	3.5	4.0
25	34	3.0	3.5	4.5
32	42	3.5	3.5	5.0
40	48	3.5	4.0	5.0
50	60	4.0	4.0	5.5
65	76	4.0	5.0	7.0
80	89	4.0	5.5	7.5
100	114	4.5	6.0	8.5
125	140	4.5	6.5	9.5
150	168	5.0	7.0	11.0
200	219	6.0	8.0	13.0
250	273	6.5	9.5	13.0
300	325	10.0	10.0	13.0
350	377	10.0	10.0	13.0
400	426	10.0	10.0	13.0
450	480	10.0	10.0	13.0
500	530	10.0	10.0	13.0

Table of copper pipes thickness

External diameter (mm)	Thickness (mm)
	Copper pipe
8-10	1.0
12-20	1.5
22-48	2.0
50-76	2.5

5613 Strainer

Strainers to be provided for various systems according to the following table.

Strainers not listed below and supplied together with equipment to be according to maker's recommendation.

System	Place of installation		No. of set	Type	Mesh of element	Material	
						Body	Elem.
Fuel oil	Main engine	Inlet	1	Auto-back flushing with manual by pass filter	34 micron	Cast iron or fabricated steel plate	Brass wire
	Generator engine	Inlet		Duplex	10 micron		
	F.O. purifier	Suction	1 each	Simplex	60		
	H.F.O. trans. pump	Suction	1	Simplex	32		
	M.D.O. trans. pump	Suction	1	Simplex	60		
	F.O. fill	Inlet	1 each	Simplex	φ 4 mm		
Lub. oil	Lub. oil pumps (for main engine)	Delivery	1	Aut. back wash with manual by-pass filter	40 micron		
	L.O. purifier	Suction	1 each	Simplex	60		
	L.O. trans. pump	Suction	1	Simplex	60		
	S/T L.O. trans. pump	Suction	1	Simplex	60		
	Cylinder L.O. transfer pump	Suction	1	Simplex	60		
	Cylinder L.O. inlet of M/E		1	Simplex	60		
	Sludge pump	Suction	1	Simplex	φ 4 mm		
Water	Sea chests	Suction	1 each	Simplex	φ 6 mm	Galv. steel	Stainless steel plate
	Emerg. fire pump				φ 6 mm		
	Daily bilge pump	Suction	1	Simplex	φ 4 mm	Galv. steel	
	Fresh water pumps	Suction	1 each	Simplex	24	Galv. steel	Stainless steel wire

562 Cooling water system

5621 Cooling sea water system

The system to consist of three (3) of cooling S.W. pumps, two (2) sets of sea chest, two (2) sets of central F.W. cooler and valves, fittings and pipes etc..

Three (3) pumps to be of same model. two (2) sets to be used at sea and other set to be as stand-by. Any one (1) set of them to be used for harbor service.

Cooling S.W. pumps to take suction from sea main through sea chests stop valves and strainers and discharge to central F.W. coolers, then overboard.

The back washing piping for central F.W. coolers S.W. side to be arranged.

F.W. generator to be directly cooled by sea water.

5622 Cooling fresh water system

The system to be consist of L.T. cooling F.W. circuit and H.T. cooling F.W. circuit. The L.T. cooling F.W. circuit include three (3) sets of low temperature cooling fresh water pump, L.T. fresh water expansion tank, valves, fittings and pipes etc., two (2) sets of L.T. cooling F.W. pump to be used at sea and other set to be as stand-by, one (1) set of them to be used for harbor service. The H.T. cooling F.W. circuit include two (2) sets of M/E jacket cooling fresh water pump and accessories etc.

The essential various consumers for L.T. circuit to be listed as follows:

- M/E air cooler
- M/E L.O. cooler
- M/E jacket F.W. cooler
- G/E air coolers, L.O. coolers and generators
- Intermediate shaft bearing
- Air conditioning plant
- Packaged air coolers for E.C.R and engineer workshop in E/R and galley
- Main air compressors
- Ref. compressors
- Atmospheric condenser

The outlet L.T. cooling F.W. temperature from central F.W. coolers to be designed of 36°C.

The temperature regulating valves to be provided for L.T. cooling F.W. circuits.

Make-up water to be automatically supplied to M/E F.W. expansion tank from fresh water hydrophore system with float valve.

Each one (1) set of M/E jacket pre-heater and pump, and A/E cooling F.W. preheating unit to be provided.

563 Lubricating oil system

5631 Lub. oil Filling and transfer systems

One (1) each separate deck filling line with blank flanges to be arranged on upper deck port & stb. for main engine and generator engine system oil.

The main engine cylinder oil filling line to be arranged on upper deck port & stb. side.

The lub. oil transfer pump to be arranged to transfer L.O. between the lub. oil tanks in engine room or to discharge overboard via "on deck" filling connections.

A simplex filter to be provided at suction side of lub. oil transfer pump.

5632 Lub. oil service system

The main engine system oil and piston cooling oil shall be supplied by main lubricating oil pump. The lubricating oil pump shall draw from the lub. oil sump tank and through L.O. cooler, thermostatic valve and auto. back wash filter or a by-pass filter then enter to the main engine. Lubricating oil shall flow out directly from engine crankcase into the lub. oil sump tank after lubrication or piston cooling.

Auto back Wash filter to be of disc type instead of wire type.

M/E turbocharger shall be lubricated from the main engine system.

The lub. oil sump tank shall be arranged in double bottom and having sufficient capacity to hold lube oil in this system after main engine stopped. .

The main lubricating oil pump suction in L.O. sump tank shall be arranged away from the T/C L.O. drain, auto filter drain and L.O. purifier suction.

Cylinder oil from cylinder oil store tanks shall be transferred to cylinder oil service tank by a pump.

Cylinder lubricating oil shall be fed to the main engine by means of a pump station mounted on the engine from the cylinder oil service tank (according to maker's standard).

Each generator engine shall have its own internal lubrication oil system with components built on the engine.

Lub. oil coolers shall have a electric PI type valve by-pass on the lub. oil side for temperature control.

5633 Lub. oil purifying system

The lub. oil purifying system will consist of two (2) lub. oil purifiers, one (1) for main engine and one (1) for generator engines. The L.O. purifiers will have same capacity and to be standby for each other.

Purified oil to be led to the lub. oil sump tank or lub. oil settling tank.

Sludge and water from the purifiers to be led to the sludge tank and the bilge holding tank respectively and to be shifted to waste oil tank for incinerator or to shore by the sludge pump.

5634 Lub. oil drain system

Leakage oil from the main engine stuffing boxes shall be led to Waste oil tank and shifted to the sludge storage tank or the waste oil tank for incinerator..

Dirty oil from the main engine scavenging air chamber shall be led to its drain tank and tank shall be emptied to the sludge storage tank during service.

Save-all drip pans shall be provided for pumps, purifiers and tanks, and shall be led to the L.O. drain tank.

564 Fuel oil system

5641 Fuel oil filling and transfer system

The bunker stations will be arranged on upper deck (P & S) with filling lines DN200 mm for H.F.O. and DN 100 mm for M.D.O. & L.S.M.D.O. respectively.

Each F.O. filling connection to be provided with simplex strainer, butterfly valve, blank flange, pressure gauge and sample taking device. One (1) thermometer also to be fitted at each H.F.O. shore connection.

The fuel oil transfer pumps in the engine room to be arranged to transfer F.O. from bunker tanks to the engine room tanks and to be standby for each other.

Automatic pumping up of H.F.O. setting tank to be provided by H.F.O. transfer pump and controlled by level switches.

The F.O. transfer pumps to have suction also from F.O. service tanks.

A simplex filter to be provided at the suction side of each F.O. transfer pump.

5642 Fuel oil service system

Main engine and generator engines system

The M/E & G/E F.O. supply module unit to be provided for main engine and generator engines. The unit consists of fuel oil supply pumps, fuel oil circulating pumps, fuel oil heaters, filters, viscosity control equipment, venting tank and flow meter etc, and a L.S.M.D.O. pump for emergency use and EU port use that the power source to be from emergency switchboard.

Fuel oil supply pump to draw from the HFO service tank, MDO service tank, or L.S.MDO service tank through a strainer and then to discharge to main engine or generator engines through a flow-meter, F.O. circulating pumps, the heaters and an automatic back flush filter. The heaters to be fitted with temperature automatic regulating valve, governed by a viscometer. Excessive fuel oil from main engine and generating engines to be led to the fuel oil circulating pump suction side through a venting tank.

The manual operated H.F.O./ L.S.M.D.O. change-over 3-way valves for each G/E to be provided.

The back flush F.O. from the aut. back flush filter to be drained into F.O. drain tank directly.

Composite boiler (to be compatible with 0.1% low sulphur M.D.O.)

Two (2) sets of boiler F.O. supply pump to be arranged near the H.F.O. service tank and drawn from the H.F.O. service tank to discharge to the burner.

M.D.O. to be used for ignition of composite boiler and to be drawn from the M.D.O. service tank.

One (1) set of F.O. flowmeter to be provided.

5643 Fuel oil purifying system

Heavy fuel oil after settled in the settling tank to be drawn by the suction pump of heavy fuel oil purifier and to be delivered to the purifier through the fuel oil heater.

After purification, the clean oil to be discharged into the heavy fuel oil service tank by the discharge disc or pump attached to the purifier.

One set of H.F.O. purifier can be also used as M.D.O. / L.S.M.D.O purifying from M.D.O. / L.S.M.D.O service tank circulation purifies.

Overflow pipe from the bottom of the service tanks back to setting tank to be provided.

H.F.O. purifiers can be run in parallel.

Sludge from purifiers to be discharged into the sludge tank and to be shifted to the waste oil tank for incinerator or to shore by the sludge pump.

5644 Fuel oil system besides the above

Oily water from main engine scavenge air box to be led to the bilge holding tank directly. (For MAN engine)

A sludge trap to be provided. (For Wartsila engine)

Save-all drip pans to be provided for pumps, purifiers and the tanks of the F.O. systems and to be led to the F.O. drain tank.

For the waste oil incinerator, D.O. supply line from the incinerator M.D.O. tank to be provided.

565 Compressed air system

Compressed air to be provided for various services with following pressure:

3 MPa	: Main engine starting Generator engine starting
1 MPa	: Air horn
0.7 MPa	: Deck service M/E manoeuvring system and safety system Control air service
0.4 MPa	: F.W. hydrophore Engine room miscellaneous service Sea chests

Main air reservoirs to be charged by main air compressors.

Aux. air reservoir to be charged by emergency air compressor and from main air reservoirs.

Deck service air reservoir to be charged by deck service air compressor.

Compressed air for starting the main engine and generator engines to be supplied from the main air reservoirs.

The aux. air reservoir to be used for starting the generator engine when dead ship.

The electric power for emergency air compressor to be supplied from emergency switchboard.

The deck service compressed air to be supplied from deck service air reservoir and main air reservoirs via pressure reducing valve.

The control air for M/E and the measuring equipment to be supplied from the control air reservoir which to be filled from main air reservoirs via pressure reducing valve and air dehydrators or deck service compressor through air dehydrators..

The pressure reducing valve to be provided with a pressure relief valve and a pressure gauge at its outlet and the by-pass valve to be provided.

Air hose connections to be arranged at each deck in the engine room.

566 Steam, drain and feed water system

5661 Steam and drain system

Following system to be provided

a) Steam supply system

b) Condensate system

Steam to be supplied for various services as follows:

0.6 MPa : F.O. tanks heating
F.O. heaters of F.O. supply module unit
F.O. & L.O. heater of purifiers
Other tank heating and heaters (in engine room)

0.4 MPa : Calorifier
Air conditioning plant
Sea chests in E/R

Drain from fuel oil and lub. oil tank heating coil and oil heaters to be led to the cascade tank through atmospheric condenser and the inspection tank.

Other drains to be led to cascade tank through atmospheric condenser.

Drain traps with by-pass to be provided on condensate pipe.

Escape lines for steam safety/relief valves to be led to the funnel.

The cascade tank to be equipped with inspection glass.

Excess. steam of the boiler to be led to cascade tank through auto. steam dump to atmospheric condenser.

5662 Feed water system

Condensate from atmospheric condenser to be discharged to cascade tank by gravity.

Feed water pump of boiler to draw from the cascade tank and to discharge to the boiler. The feed water pumps to have an emergency suction from the boiler water tank also.

Make-up water to cascade tank to be from fresh water hydrophore automatically.

The bottom and surface blow down lines of the boiler to be led to overboard via double valves.

Each pump to have a capacity for max. evaporation when the main engine operating at CMCR and one (1) pump of them to serve as stand-by.

567 Ship's service system in engine room

5671 Bilge system

the engine room bilge system to be served by two (2) fire, bilge & G.S. pumps, and daily bilge pump.

These pumps to have the connection from the bilge main in the engine room which have the bilge suction each with a mud box, and to discharge overboard. Daily bilge pump to take suction from the bilge main and discharge to bilge tank or MARPOL shore connections.

Direct bilge suction line to be provided in accordance with the requirement of the Classification Society.

The oily bilge pump attached to bilge separator shall take suction from bilge tank and bilge main, and to discharge overboard through the oily bilge separator or recirculation to the bilge holding tank.

Bilge suction to be provided for cofferdams in engine room and main engine recess on tank top.

The emergency suction line with stop-check valve to be connected to a ballast pump.

All bilge wells with galvanized grating cover removable and stainless steel bolts (include cargo hold) to be provided.

Bilge high level alarm for each bilge well in engine room to be provided.

In general, the valves in engine room bilge system to be with manual operation.

The bilge system in engine room shall comply with MEPC.1/Circular.642 (IBTS). Additional bilge primary tank, clean water tank, oily bilge tank and clean bilge pump to be arranged in engine room.

5672 Fire fighting system

Sea water fire fighting system

The fire main to be served by two (2) fire, bilge & G.S. pumps, and the emergency fire pump.

The fire hydrants with manual operation and hose boxes to be arranged on platforms.

Water mist fire fighting system

The fixed water mist local application system to be provided in engine room to protect following fire hazard space such as main engine, diesel generator sets, boiler, oil purifiers and incinerator etc.

The system consists of water pump unit, water nozzles, pipes, alarm system and release station etc as per maker's standard.

The system shall have both automatic release and local manual release.

The fresh water to be supplied from domestic F.W. system.

CO2 fire fighting system

The system refer to paragraph 3723

5673 Ballast system

Two (2) sets of ballast pump to be used for ballasting and deballasting.

Two (2) pumps can be used simultaneously.

Ballast stripping to be carried out by two (2) sets of ballast stripping eductor.

Two (2) sets of ballast water treatment plant to be provided in the engine room. The ballast water treatment plant shall be IMO approved type with certificate

5676 Sea chest

There to be one (1) high suction sea chest and one (1) low suction sea chest in engine room and one (1) suction sea chest in emergency fire pump room. Each suction sea chest to be fitted with a sea valve of butterfly or angle type.

Each suction sea chest to be of welded steel construction. A steam and compressed air blow out connection and an air vent to be arranged for sea chest in engine room, and a compressed air blow out connection and an air vent for emergency sea chest.

Recirculation of cooling sea water to be led to the low sea chest. (Canadian regulation)

Each suction sea chest to be equipped with a hinged type galvanized steel grid.

The bolt and nuts for securing grating to be of stainless steel and locked by stainless steel wire.

The clear area to be at least two (2) times the area of the sea suction valve.

The grill to be secured to the chest so that no part extend beyond the shell surface.

Overboard discharge connection to be of spigot type of extra heavy steel pipe or fabricated steel plate and welded to the shell plate as per Rules.

Overboard discharge valves to be located near the ballast water line.

One (1) anode type marine growth preventing system to be installed.

568 Exhaust gas system

Exhaust gas piping from the turbocharger of the main engine and two generator engines to be led to the composite boiler then discharged directly to open air via funnel top and from boiler oil fired section and incinerator to be led up independently to open air via funnel top also.

Exhaust gas piping from one generator engine and emergency generator engine to be led up independently to open air through a silencer.

Stainless steel expansion elements for exhaust gas pipes of main and gen. engines to be fitted immediately after turbocharger and other's pipe sections as necessary.

Adequate supports to be fitted so that the weight of the piping shall not rest on the turbocharger, boiler, incinerator, silencers and expansion elements, etc.

Necessary drains from the exhaust gas pipes and silencers to be arranged with drain traps of adequate size and led to bilge well.

A soot drain tank of appc. 0.5m³ shall be provided in engine room. The exhaust pipe shall be so arranged as to allow free expansion.

569 Instrumentation

Following instrument to be provided for each machinery or at the piping side exclusive of the instruments used for automatic control in E.C.R.

5691 Pressure, compound and vacuum gauges

Pressure, compound and vacuum gauges to be manufactured in accordance with the Chinese Industrial Standard or equivalent for marine use.

All gauges to have black figures (red figures for vacuum), white faces, letter in English and units in metric or SI system.

The following gauges to be furnished:

	Place of installation	No. of set	Diameter of Gauge (mm)	Remarks
Water	Pumps suction & delivery	1 each	≤ 100	
Oil	Pumps suction & delivery	1 each	≤ 100	
	Lub. oil strainer inlet & outlet	1 each	≤ 100	
	Fuel oil strainer inlet & outlet	1 each	≤ 100	
Steam & Exhaust	Boiler drum	1	≤ 150	
	Heaters (steam side)	1 each	≤ 100	
	Steam line after reducing valve	1 each	≤ 100	
Compressed	Air line after reducing valve	1 each	≤ 100	

air	Air reservoir	1 each	≤ 100	
Others	Various pressure gauge fitted at main engine, generator engine, main air compressors and boiler burning set etc..	Assorted	Manufacturer's standard	
	Main engine exhaust piping after turbocharger	1	-	U tube type manometer

5692 Thermometer

Thermometers to be indicated in Centigrade and to be manufactured in accordance with the International Standard or equivalent. Thermometers of liquid in glass type with separable sockets to be provided as follows.

	Place of Installation		No. of set	Remarks
Water	Fresh water cooler	F.W. side & S.W. side inlet & outlet	1 each	Fresh water side: after temp. cont. valve
	Atmospheric condenser	Cooling water side inlet & outlet	1 each	
	Lub. oil cooler	Cooling water side inlet & outlet	1 each	Lub. oil side: after temp cont. valve
Oil	Heaters	Oil side outlet	1 each	
	Oil tanks with heating	Oil side tank wall or outlet	1 each	
Others	Various thermometers fitted at main engine, generator engine, air compressors, boiler and incinerator		Assorted	
	Oil purifiers	acc. to maker's standard		

57 AUTOMATION, MONITORING AND REMOTE CONTROL

570 General

5700 General description

The machinery installation to be designed and arranged to operate in an unmanned machinery space in accordance with the requirement of Classification Society.

The remote control stand for main engine to be provided in the engine control room and the wheelhouse. An local control panel to be provided on the engine as per maker's standard.

The necessary gauges, thermometers, etc. to be furnished for the main engine, generator engines and composite boiler etc. as specified in the various sections of this specification and as required for proper operation. Local gauges, thermometers, etc. for the main engine and auxiliaries to be furnished in compliance with each Subcontractor's standard, where as those on piping to be of builder's standard.

Automation system consist of the following separate sub-systems:

D/G stand-by start and power management system (PMS).

Auxiliary pump stand-by start system

Controller for temperature and viscosity.

Ballast / bilge / fuel transfer pumps and valves / remote control system.

E/R monitoring and alarm system including sensors, transmitters and switches.

The main propulsion remote control system

Oil and water tank liquid level monitoring system

5701 Engine control room and other control roomsEngine control room

An engine control room with soundproof, heat-insulated to be arranged in the engine room.

One set of main switchboard, one set of central control console fitted with necessary instruments, group starter panels and one set of unit cooler etc. to be installed in the engine control room.

The control room to have suitably sized double-glazed windows, self-closing entrance doors with glass window on the upper part, giving easy access to and from engine room. The control room to be illuminated by the fluorescent light.

One (1) set of water basin and one (1) set of cold water fountain to be installed outside the engine control room near the entrance.

Fire control room

Fire control for engine room:

The following safety devices to be grouped together in the fire control room outside engine room.

- Cut-off switches for all engine room ventilating fans include the unit cooler in E.C.R.
- Cut-off switches for incinerator, composite boiler, F.O. pumps, and purifiers.
- Means for closing the:
 - quick - closing F.O. valves.
 - remote controlled exhaust louvres at the funnel of the engine room.
- Actuation of the engine room fire extinguishing system.

5702 Control console**571 Alarm and monitoring system**

The machinery alarm system (including alarm- and recording points) to be provided in accordance with the requirement of Classification Society and maker's recommendation.

The mimic diagrams of main system to be displayed on TFT.

The alarm systems to be designed on the closed circuit or the monitored open-circuit principle.

Equivalent monitoring principles may be adopted, if necessary.

The machinery alarm system shall provide an optical and an audible signal of unacceptable deviations from operation figures.

The failure of the machinery alarm system to be signaled to the wheelhouse and to the accommodation and mess room of the engineer officers or the responsible crew members.

The alarm system to be supplied from the main power source with battery backup for at least 15 minutes.

Failure of the supply from the main power source shall be alarmed.

System configuration to be as follows

- a) The alarm and monitoring system shall consist of the following:
- Computer based alarm and monitoring system
 - Engineer's call system (refer to Electric Part)
 - E/R extension alarm system

- E/R alarm columns and horns/sirens warning system (refer to Electric Part)
- E/R dead man alarm system

Engineer's call system and E/R extension alarm system may be incorporated into a system, if possible.

b) The system shall include the following arrangement:

Engine room

An alarm point signal measure device and signal acquisition unit
Alarm columns acc. to the Rules (optical & audible signal)

Engine control room

Main station
VDU (21 inches, two sets)
Date logger and alarm printer
Keyboard
Main panel of engineer's call system and section of duty officer
Instrument necessary etc.

Wheelhouse

Extension alarm panel

Accommodation cabin (engine department officers), officer's mess room, ER office

Extension alarm panel (with engineer's call and acknowledgment)

c) The alarm points in the alarm system shall be about 300 points (binary and analogues).

d) The alarms on the wheelhouse to be divided in following five groups according to their urgency:

Shut down group alarm

The alarm signaling faults which require the main engine to be shut down immediately.

Automatic slow down group alarm

The alarm signaling faults which require the main engine to be slow down automatically.

Serious faults group alarm

General faults group alarm

Independent alarm

The fault alarm should be extended to wheelhouse independently, including the water ingress of each cargo hold and F.P.W.B. tank, fire detection system, release of automatic fire extinguishing system and steering gear, etc, in accordance with the requirements of the Classification society.

Fire detection alarm

The same fire detection and fire alarm system to be provided for engine room and accommodation. The main control panel to be located on the wheelhouse and one indicating unit is located in engine control room or fire control station.

The facilities of the system refer to Electric Part

572 Main propulsion control

5721 Engine telegraph system

Engine telegraph

The engine telegraph system to be provided and to consist of:

One (1) - transmitter of stand or table type, sector form, double faces, single lever, with illuminating lamp and dimmer located in the wheelhouse.

Telegraph division to be as follows or according to maker's standard:

ASTERN				STOP	AHEAD			
FULL	HALF	SLOW	D/SLOW		D/SLOW	SLOW	HALF	FULL

One (1) - Receiver of table type with reply facility, located in the engine control console.

One (1) - Order indicator with reply facility located at engine side.

One (1) - Power failure alarm, located in the wheelhouse.

Audible device of engine telegraph to be one (1) buzzer in W/H, each one (1) small gong in engine control room and M/E local control panel.

Sub-telegraph

One (1) set of sub-telegraph of push-button with lamp type to be provided to indicate as follows: finished with engine, stand-by and at sea. They are located in wheelhouse and engine control room and engine side.

Telegraph order recorder

One telegraph order recorder is located on main engine remote control stand in wheelhouse. It records telegraph order time, (day, and hour, minute) main engine revolution of ahead or astern.

The power source is AC 220V or DC 24V.

5722 Remote control system of main engine (subject to the Rule & maker standard)

The main engine to be controlled remotely from engine control room or from wheelhouse.

The local electronic control panel is provided in the engine side.

a) Remote program control from wheelhouse

The following controls to be performed automatically according to preset program by operating engine control lever in wheelhouse.

Starting & stopping
Speed increasing & decreasing
Reversing

Speed control to be carried out through the hydraulic pump for electrical fuel injection on the main engine.

Interlock to be provided according to maker's standard.

In case of the first starting failure, two more starting attempts to be automatically carried out (total three attempts).

An alarm to be given after three attempts without firing.

Re-starting to be carried out after setting the telegraph lever at the "STOP" position.

b) Remote control from engine control room

The following controls to be performed in engine control room.

- Starting and stopping
- Speed increasing & decreasing
- Reversing to be performed by operating engine telegraph lever in ECR.

c) Local control panel

The following controls to be performed manually by local control panel on the main engine:

Starting and stopping

Reversing

Speed setting

d) Change - over of control position

Local - engine control room

Change - over of control position between main engine local control panel and engine control room to be carried out by change - over switch at the local control panel.

Engine control room - wheelhouse

Change - over of control position from engine control room to wheelhouse to be carried out by change - over switch in engine control room and with confirmation in wheelhouse.

Change - over from wheelhouse to engine control room to be done by operating change - over switch in engine control room.

5723 Avoiding of critical speed

A function for automatic avoiding the continuous operation of the main engine in the range for critical speed to be adopted.

Even if the main telegraph transmitter lever is set within the range of critical speed and the signal of avoiding critical speed will be given to the governor. In this case, the engine speed is kept at the lower limit or the upper limit of the critical speed range.

573 Control of electric generating plant

5731 Main diesel generator setRemote control and automatic starting

Each G/S to be started and stopped remotely from the E.C.R. and manually at engine side.

In the following conditions, the pre-selection stand-by G/S to be started automatically.

Voltage high or low

Frequency high or low

Over current

Automatically control system for elec. power system

The automatic control system to have the following functions:

- Generator automatic synchronizing
- Generator load automatic sharing & shift
- Standby generator automatic back-up
- Bus monitoring and power management
- Heavy load start request and permission

Essential service sequential start

Essential service motors shall automatic start sequentially in case of recover of the main bus voltage after the power source failure.

5732 Emergency diesel generator set

The safety device for emergency generator engine to be in accordance with the maker's standard and requirements of Rules.

In case of no-voltage of the bus on the emergency switchboard, the emergency generator to be started automatically and to be stopped manually in engine side.

574 Control of boiler

5741 Composite boiler

The installation, control and signaling for the composite boiler should be in compliance with the Classification Society and maker's standard.

The alarm signals to be connected to the alarm and monitoring system.

575 Control of engine room system and auxiliary equipment

5751 Oil purifier

The F.O. and L.O. purifiers to be automatic in operation, but the start/stop for purifiers to be done by hand.

Purifiers and its pumps to be control from the local controller in the vicinity of the purifiers.

5753 Main air compressor

The main air compressors to be provided for automatic starting and stopping and remote operation from the E.C.R.

Each main air compressor to be auto. stopped while lubricating oil pressure is very low, compressed air temp. very high.

When the compressor auto. stopping, the air to be drain automatically and the compressor can be restarted under unloading.

5754 Incinerator

The installation, control and signaling for the incinerator to be in compliance with the Classification Society and maker's standard.

The alarm signals to be connected to the alarm and monitoring system.

576 Control of ship's system

The following ship's systems control to be provided:

- Ballast system
- Bilge system
- H.F.O. filling system
- Tanks capacity and level remote measuring system

The control for above mentioned systems to be effected by a computer with a 17 inches TFT and a printer in ship's office and another one computer with a 17 inches TFT to be on engine room control console.

5761 Ballast system

The ballast remote control system shall include:

- Opening and closing of ballast system valves
- Start and stop of ballast pumps
- Indication of opening and closing of ballast system valves
- Hydraulic power unit

5762 Bilge system

The bilge remote control system shall include:

- Opening and closing of bilge system remote control valves in cargo hold's area
- Alarm in the bilge wells of cargo hold when filled up
- Alarm in the bilge wells of engine room when filled up
- Alarm in the bilge holding tank when filled up
- Oil-in-bilge water alarm
- Alarms in emergency fire pump room
- Alarm in each cargo hold, F.P.W.B. tank and bosun store when water ingress, to be included in cargo hold water ingress.

5763 Fuel oil filling system

The fuel oil filling and transfer remote control system shall include:

- Opening and closing of F.O. filling and transfer system remote control valves
- Indication of opening and closing of F.O. filling and transfer system remote control valves
- F.O. overflow tank high level alarm

Remote control of F.O. system to be effected by computer E.C.R. and indicated in both E.C.R. and ship's office.

The computer system shall incorporate a mimic diagram together with remote controller, valve controllers, pump controller and alarm lamps etc..

5764 Tank capacity and level remote measuring system

The following fluid tanks shall provide with tank capacity and level remote measuring system:

- H.F.O. tanks and M.D.O. tank, L.S.M.D.O. tank (refer to Paragraph-519)
- Fresh water tanks and distilled water tank
- Water ballast tanks
- Ships draft (four points)

The -pressure electronic type transmitter level measuring system to be provided, and the system will be combined with valve remote control system see item 576.

All necessary high and low level alarms of fluid tank to be refer to Paragraph-519 and to be connected to the alarm and monitoring system.

577 Automation system

5771 Automatic regulation of temperature

The following auxiliary equipment and systems shall provide automatic temperature regulating:

- H.F.O. settl./service tanks (refer to Paragraph - 519)
- Oil apparatus (supplied by maker)
- Generator engines (supplied by maker)
- Carlorifier (supplied by maker)
- Auxillary system for main engine:

One (1) piece each of remote temperature indicator with temperature high/low alarms is to be installed for No.1/2/3/4 H.F.O. storage tanks.

Central F.W. coolers outlet
M/E L.O. cooler outlet

5772 Automatic change-over of stand-by pumps:

The following pumps to be automatically changed-over by low pressure or equivalent:

- Cooling S.W. pumps
- M/E jacket cooling F.W. pumps
- L.T. cooling F.W. pumps
- Boiler feed water pumps
- F.O. pumps attached to the F.O. supply module unit
- Boiler F.O. supply pumps
- L.O. pumps

5773 Automatic starting and stopping of pumps

- Fresh water pumps
- Technical water pumps
- Boiler feed water pumps
- H.F.O. transfer pumps

58 SPARE PARTS AND TOOLS

581 Supply principle for spare parts and tool

Spare parts and tools for all machinery equipment to be furnished in accordance with the requirements of the Classification Society and manufacturer's standard.

All spare parts except ones which are fitted on the arranged position to be suitably stowed in steel box.

Heavy spare parts and tools to be mounted on suitable brackets or straps and fastened near the auxiliaries served wherever practicable.

582 Engine room inventories

One (1) set of engine room inventories to be supplied by Builder in conventional practice.

6 ELECTRIC PART

60 GENERAL

600 General

It is the intent of these specifications to set forth the electric equipment to be installed and the work to be executed for the construction of the vessel.

The whole electric installation to comply with the Rules of the Classification Society and provisions in these specifications.

Electric works on the vessel to be carried out in accordance with these Specifications and Builder's practice.

The type and construction of electric equipment incorporated or packed with the appliances, to be in accordance with the makers' standard.

If any items in the machinery or hull specification necessitate the installation of electric equipment not mentioned in this specification, such equipment to be provided by builder.

601 Electric system

The distribution system to consist of 3 PH AC three-wire insulated system, single phase AC two-wire insulated system and DC two-wire system.

602 Applicable voltage, frequency and phase for equipment

General power system:

AC 440V, 3PH, 60Hz, 3-wire.

Galley and domestic equipment (large capacity):

AC 440/220V, 3PH, 60Hz, 3-wire.

Lighting apparatus, small capacity household equipment:

AC 220V, 1PH, 60Hz, 2-wire.

Nautical instruments and radio equipment:

AC 220V, 3/1PH, 60Hz. 3/2 wire, or DC 24V 2-wire.

Interior communication and alarm system and automation:

AC 220V, 1PH, 60Hz, 2-wire or DC 24V, 2-wire.

All systems to be insulated from the ship's hull except for such as the insulation monitoring circuits, hull return of ICCP system, earthing circuit of emergency generator engine starting device, secondary circuits of potential and current transformers etc. exceptions.

In general, the voltage for portable equipment such as portable lamp, portable control box for turning gear motor and travelling crane and so on to be lower than AC 50 V by the two (2) windings type transformer which the secondary winding not to be earthed.

The metal frame or body for portable equipment to be earthed by the earth connection, if the voltage for portable equipment is AC 220V.

603 Arrangement of equipment

The arrangement of the electric equipment throughout the vessel to be such as to provide ready and safe access to all parts for inspection, maintenance and repair as far as practicable.

All electric equipment to be so located that as far as practicable they are not exposed to risk of mechanical injury or damage from water, steam, oil or excessive heat. Where necessarily exposed to such risks, the equipment to be suitably constructed or enclosed.

604 Name plate

The name plate to be made of corrosive-resisting material, such as acrylic resin, brass or stainless steel etc.

The letter on the name plates (and caution plates) to be engraved in English.

605 Color scheme of electric equipment

Metal surfaces of enclosure of the electrical equipment shall be painted with the following colors or according to the owner's specified.

Generators, motors:	Same as machinery
Transformers, switchboards, starters, distribution boxes, control console etc.:	Munsell code 7.5 BG 7/2
Interior communication, navigation and radio equipment:	Manufacturer's standard
General alarm and other emergency operating equipment:	Munsell code 5R 4/13
Others:	Manufacturer's standard

Interior metal surfaces of electrical equipment to be painted with maker's standard colors.

Resin made surface of electrical equipment to be of maker's standard colors.

606 Trial

The trials for all electrical equipment in manufacturer's shop or on board shall be carried out according to the requirements of Classification Society and the Builder's standard.

After installation on board have been finished, all electrical equipment shall be tested to demonstrate their condition for satisfactory operation in accordance with the requirement of Rules and the detail design document of "Trials program for electrical equipment".

61 CABLE

611 Cable application

All cables throughout the vessel shall be approved by the Classification Society except for special purposes require the use of particular type cables such as coaxial cables, compensating cables, network cables etc. which shall comply with recognized industry standard.

In general, cables to be of flame retardant and complied with IEC 60332-3/A. In addition, fire resistant cables to be used according to the requirement of rules.

Cables to be of cross linked polyethylene (XLPE) insulated with steel wire or copper wire braided armour and polyolefin (PO) sheath or equivalent type marine cables.

Cables without metal wire braiding armour may be used in accommodation area for final supply circuits of lighting system.

For portable appliances, flexible cables or cords with sheath to be used.

Special cables such as coaxial cables, compensating cables, network cables etc. to be used where necessary.

612 Cable installation

All cables to be installed according to Builder's practice and in compliance with the requirement of the Classification Society.

Cables shall be fixed in accessible position, as far as practicable.

In general, cables running in groups to be fixed on steel hangers or trays. The cables to be secured with steel hoops or nylon binding tapes, except that cable to be laid in pipes or cable ducts. Stainless steel hoops to be used on part exposed to the weather.

Cables which are exposed to risk of mechanical damage shall be protected with steel pipe or steel cover.

The cables installed under the engine room lower floor to be protected with flexible conduit or steel pipe.

Where cables passing through watertight decks or bulkheads, watertight cable glands or deck tube or other appropriate methods to be employed.

Where cables passing through non-water-tight decks and bulkheads or beams etc., to be chosen on such position where the hull strength not to be damaged. Suitable bushing or coaming with round edge to be used for their protection.

Penetration of fire protection bulkheads or decks of steel structures to be protected by pipes, cable glands or coaming stuffed with fire retardant compound according to the fire protection class and number of cables.

The cables passing between superstructure (or engine room area) and fore part to be laid on upper deck along the hatch coaming left side through galvanized steel pipe with sleeve couplings and expansion joints.

In rooms and inner passages, where lining walls over steel walls and ceiling over overheads are provided, cables to be concealed behind the lining walls as far as practicable.

Where, for safety reasons, a system shall have duplicated power supply and/or control cables, the cable routes are to be placed as far as possible.

613 Spare cables

Spare cables to be installed as follows:

From -- To	Qty	Type
Wheelhouse – Fore store	1	10×1.5 ²
Wheelhouse – ECR	1	10×1.5 ²

62 ELECTRIC SOURCE

621 Main generators

Three (3) sets of main generator each driven by diesel engine to be installed in the engine room with the shaft parallel to ship's centerline.

Type:	Synchronous, brushless, self-excitation.
Output:	About 500kW
Voltage:	AC 450 V
Phase:	3 PH
Frequency:	60 Hz
Power factor:	0.8
Rating:	Continuous at full load.
Insulation:	Class "F"
Cooling:	Self-ventilated with washable air filter
Protection:	IP 23

Note: Protection grade IP 23 of main generators to be suitable in respect of water based fire fighting system and to be certified by the Classification Society.

Each main generator to have a space heater within the generator frame to prevent the condensation of moisture while the generator is stopped.

An automatic voltage regulator for each main generator to be provided.

Two sets of temperature sensor (one set for working, other set for spare) to be fitted in the stator winding of each phase of generator for alarm,

Other particulars and construction of the main generators to be in accordance with makers' standard.

Each main generator to be arranged for parallel operation, however, not to be run in parallel with emergency generator nor the shore source.

Each main generator to be used as follows:

Normal sea going	One (1) set
Normal sea going with BWM-T	Two (2) sets
Arrival or departure	Two (2) sets
Cargo handling	Two (2) sets (with deck crane & BWM-T)
In port	One (1) set

622 Emergency generator

One (1) emergency diesel generator set to be installed in the emergency generator engine room. The emergency generator to be used for supplying the loads such as radio equipment, interior communication equipment, emergency lights, one of steering gear motor and emergency fire pump etc, when the main power supply fails.

Type:	Synchronous, brushless, self-excitation
Output:	About 120 kW
Voltage:	AC 450 V
Phase:	3 PH
Frequency:	60 Hz
Power factor:	0.8
Rating:	Continuous at full load
Insulation:	Class "F"
Cooling:	Self-ventilated
Protection class:	IP23

The emergency generator to have a space heater within the generator frame to prevent the condensation of moisture while the generator is stopped.

An automatic voltage regulator for emergency generator to be provided.

Other construction and characteristics to be in accordance with the maker's standard.

The generator to be started automatically in case of the main power failure and supply electric power to the loads automatically. After restoration of electric power from the main electric source, the power supply system shall be disconnected automatically from the emergency generator, and connected to the main electric source. The emergency generator engine to be stopped automatically with time delay.

623 Power transformer

(A) Main transformers

Two (2) main transformers (one as spare) to be installed in engine room for general service. Principal particulars to be as follows:

Type:	Drip-proof, dry type
Output:	120 kVA each
Voltage:	AC 450/230 V
Phase:	3 PH
Frequency:	60 Hz
Insulation:	Class F
Rating:	Continuous
Cooling system:	Natural cooling

(B) Emergency transformers

Two (2) emergency transformers (one as spare) to be installed in the emergency generator room for emergency service. Principal particulars to be as follows:

Type:	Drip-proof, dry type
Output:	50 kVA each
Voltage:	AC 450/230 V
Phase:	3 PH
Frequency:	60 Hz
Insulation:	Class F
Rating:	Continuous
Cooling system:	Natural cooling

(C) Galley transformer

One (1) galley transformer to be installed in engine room for galley AC440V/AC220V service. Principal particulars to be as follows:

Type:	Drip-proof, dry type
Output:	80 kVA
Voltage:	AC 450/AC450 V (55kVA); AC 450/AC220 V (25kVA);
Phase:	3 PH
Frequency:	60 Hz
Insulation:	Class F
Rating:	Continuous
Cooling system:	Natural cooling

624 Storage batteries and charging unit

(A) For general use and E/R use

The following unit to be included:

- 24 V lead acid type maintenance-free batteries 2 sets, about 200 Ah each
- Charging module 2 sets (Input: AC440V or AC 220 V; output: DC 24~35 V)
- Charging & discharging panel (CHP) 2 sets, each with meters, control switches, feeding miniature circuit breakers, insulation monitor and other necessary fittings

Rated silicon rectifier for charging & discharging panel shall also be of maximum output current of 60A and maximum voltage of 35V.

The charging module to have sufficient capacity to supplying all the connected consumers and maintaining the batteries in float charging condition.

(B) Others

Batteries and charger for emergency generator engine starting and for radio emergency source to be provided according to the Rules and maker's standard.

Various UPS for engine room automation system and other electronic device to be provided together with relative device according to the Rules and maker's standard.

The power socket and cable with plug etc. for boat battery charging to be equipped as maker's standard.

625 Shore connection box

One (1) set of shore connection box for receiving AC 440 V, 400 A, 3PH, 60 Hz shore source to be provided and wired to the main switchboard.

The shore connection box is drip-proof wall mounted type and fitted in emergency generator room or near.

The box to be equipped with molded case circuit breaker, connecting terminals and phase sequence indicator.

On the bulkhead of laid room, a hole with watertight cover to be provided for passing through the shore connection cables.

63 *DISTRIBUTION SYSTEM*

630 General

In general, separate main feeders to be fed from the main switchboard to essential pump motors, one (1) of steering gear motor and other large capacity services.

Motors, of which starters are assembled into the group starter panels, however, to be connected to the AC 440 V feeder bus of the main switchboard.

Separate feeders to be also fed from the emergency switchboard to one (1) of the steering gear motors, emergency fire pump motor, one (1) of the E/R reverse fan etc.

Non-essential services and other small motors to be connected to each distribution board or group starter board fed from AC 440 V feeder panels of MSB.

The normal lighting system and small domestic services to be distributed adequately through distribution boards fed from AC 220V feeder panel of MSB.

Emergency lighting system and AC 220 V system of radio equipment and nautical instruments to be distributed adequately through distribution boards fed from AC 220 V feeder panel of the emergency switchboard.

DC 24 V system of alarm, some interior communication equipment and nautical instruments to be fed from the battery charging & discharging board (CHP).

631 Main switchboard (MSB)

One (1) main switchboard for receiving power from the main generators, and feeding to general loads shall be installed in the engine control room.

The main switchboard should be multi cubicle, metal enclosed, self-supporting, dead front type and complete with necessary fittings and instruments. Insulating mats to be fitted before/ behind the MSB over full length.

The top and each side of the switchboard to be covered with steel plate, and suitable hand rail to be provided at front and rear. The MSB to have hinged front doors and removable rear side covers.

The main switchboard to consist of main generator panels, synchronizing panel, AC 440 V feeder panels, group starter panels and AC 220 V feeder panel.

An isolating switch (or easily to open isolating links) shall be fitted at main busbar between No.1 and No.2 generator panel .

The preferential tripping system to be provided and so arranged that in the event of the main generators becoming overload, the non-essential loads to be disconnected automatically before the generators' circuit breaker is opened.

Voltmeters, ammeters, wattmeters etc. to be of class 1.5. The meters to have a red mark or indicating needle on the rate value.

Each main generator circuit to be protected by a three-pole air circuit breaker with under-voltage tripping device, overload inverse time trip, short time delay trip and instantaneous tripping device. These air circuit breakers are draw-out type.

All out-going feeder circuits and shore source circuit to be protected by a three pole molded case type circuit breaker with over-load trip and instantaneous trip on each pole except for steering gear motor circuit which to be only equipped with an instantaneous trip. All MCCB to be of plug-in type.

Each feeder circuit on the main switchboard to be distinctly marked by engraved label giving service name of each circuit and frame/set current of the circuit breaker.

The following instruments and apparatus to be provided for each panel : (or according to maker's standard)

Generator panels

- 1 - Air circuit breaker
- 1 - AC ammeter and change-over switch
- 1 - AC voltmeter and change-over switch
- 1 - KW meter
- 1 - Manual voltage regulator
- 1 - Switch for space heater
- 1 - Generator running indicating lamp (white)
- 1 - ACB close indicating lamp (green)
- 1 - ACB open indicating lamp (red)
- 1 - Space heater indicating lamp (orange)
- 1 - Reverse power relay
- 1 - Running hour meter
- 1 - Power management unit
- 1 - Diesel generator remote control ready indicating lamp

1 set - diesel generator start/ stop push buttons
And other necessary equipment.

Synchronizing panel

1 - Dual indication type AC voltmeter and selection switch for each generator and main bus bar
1 - Dual indication frequency meters and selection switch for each generator and bus-bar
3 - kW meters
3 sets - ACB open/ close push buttons
3 - Governor control switches.
1 - Synchroscope with control switch
1 set - Synchronizing lamp
1 - Buzzer for alarm
1 - Switch for buzzer and lamp test
1 - Switch for buzzer stop
1 - 24V DC source indicating lamp
3 - Selection switch for stand by generator
3 - Diesel generator stand-by indication lamp
1 - Emergency generator running pilot lamp
1 - Shore power on lamp(AC440V)
And other necessary equipment.

AC 440 V feeder panel

Necessary quantity - Moulded case circuit breakers (with abt. 10% spare)
1 - Moulded case type circuit breaker for shore supply
1 - Shore supply indicating lamp (white lamp)

AC 220V feeder panel

Necessary quantity - Moulded case circuit breakers (with abt. 10% spare)
1 - AC ammeter and change-over switch (for main transformer secondary circuit)
1 - AC voltmeter and change-over switch (for main transformer secondary circuit)
1 - Insulation monitor with selection switch (for AC 440 V & AC 220 V mains)
1 - Megg-ohm meter with change-over switch

Group Starter Panels

Starter units for the important engine room auxiliaries to be assembled into group starter panels, each unit to have circuit breaker, 440/220 V transformer, contactor, thermal relay, indicating lamp, push buttons etc., which are fixed type.

632 Emergency switchboard

In principle, the construction of emergency switchboard will similar to the main switchboard.

The following instruments and apparatus to be provided for each panel: (or according to maker's standard)

Generator panel

1 - Moulded case circuit breaker (E/G)
1 - AC ammeter and change-over switch
1 - AC voltmeter and change-over switch
1 - Frequency meter. and change-over switch (for emergency generator and main source)
1 - kW meter
1 - Switch for space heater
1 - Generator running indicating lamp (white)
1 - MCCB close indicating lamp (green)
1 - MCCB open indicating lamp (red)

- 1 - Space heater work indicating lamp (orange)
- 1 - Manual voltage adjuster
- And other necessary equipment

AC 440V/ AC 220V feeder panel

- Necessary quantity - Moulded case type circuit breakers (with abt. 10% spare)
- 1 - AC ammeter and change-over switch (for emergency transformer secondary circuit)
 - 1 - AC voltmeter and change-over switch (for emergency transformer secondary circuit)
 - 1 - Insulation monitor with alarm lamp (for AC 440 V & AC 220 V mains)
 - 1 - Megg-ohm meter with change-over switch (for AC 440 V & AC 220 V mains)

633 Distribution Box

All distribution boxes to be enclosed with the steel sheet case.

Distribution boxes fitted in living quarters and other similar places are non-waterproof type, those fitted in engine room, steering gear room, stores and other similar places are drip-proof type.

In general, distribution boxes to be equipped with 2 or 3 poles molded case circuit breakers or miniature circuit breakers with overload and short circuit protection. At least one spare breaker to be provided in each distribution box.

The circuit label showing service name of each outgoing circuit to be fitted on back of the door.

634 Test panel

One (1) set of wall mounting type test panel shall be installed in electrician's workshop. The panel shall be equipped with following devices: (or according to maker's standard)

- Switches, indicating lamps, voltmeter and ammeter
- Each one set – Test terminals of AC 440 V 3-ph & AC 220 V 1-ph both up to 10 A, DC 24 V up to 5 A
- One set – Fuse checker
- Each one set – Lamp hold for various fluorescent light and incandescent lights
- Each one set – Receptacle of non-waterproof/ waterproof type of AC 220 V, 10 A

635 Connection Box

All connection boxes are drip-proof or water-proof type construction depending on their locations.

The water-proof type connection boxes exposed to weather are brass (or stainless steel) - made.

64 POWER EQUIPMENT

640 General

The specification described in this section to be applied to the power motors and their control equipment except the following electrical equipment, which are constructed according to the maker's standards:

- (1) Galley and laundry equipment
- (2) Instrumentation and automation equipment
- (3) Motors and their control equipment supplied as a complete set with auxiliary machinery such as deck machinery, aux. blower, turning gear, small and household appliances etc.

641 Motor

All motors, unless otherwise specified, to be marine type squirrel cage induction motors.

Motors to be designed for AC 440V 3 PH 60Hz except that the motors of 0.5 kW rating and less may be of 220 V single/ three phase type according to maker's standard.

In general, minimum protection degrees of motor enclosure are as follows:

Waterproof type (IP 56) :	Motors exposed to weather
Totally enclosed type(IP 44) :	Motors in engine room, steering gear room, galley, laundry, refrigerating chambers and other similar spaces
Drip-proof type (IP 22) :	Motors in accommodation area and other dry spaces

Motors located within the hazardous area shall be explosion-proof type.

Space heater shall also be installed for the driven motor of essential equipment and which are positioned at wet spaces. For instance, motors above 10KW for located under the engine room lower floor and on exposed deck area: M.E turning gear, cooling sea water pumps, emergency fire pump, essential pumps and fire G.S. pump, ballast pumps main L.O. pumps, steering gear, air compressor , crane motors, windlass and mooring winch, air condition compressor, refrigerating compressors and E/R fans etc.

All motors associated with propulsion support functions shall be duplicated according to class rule's requirement and equally divided between the main switchboard sections. Additionally, all other duplicated equipment shall be equally divided between the main switchboard sections.

In general, class B" or "F" insulation to be adopted, except special service motors for which insulation to be in accordance with the maker's standard.

642 Starter

(A) General

The starters are electro-magnetic control type with thermal protection device except starters for non-essential motors of 0.5 kW rating and less which may be manual operated by breaker or line switch only.

In general, motors to be arranged to start direct on-line (DOL), but for 50 kW and above large capacity motors (MSB feeding), reduced voltage starting means (star-delta, auto-transformer or soft starting) to be adopted.

In general, control circuit to be isolated from main circuit through the transformer.

In case the starter located out of sight the motor, local start/ stop button box (with stop position lock) to be provided near the relative motor except engine room fans.

(B) Arrangement and construction

As far as possible, starters for essential engine room auxiliaries to be assembled into two group starter panels which are located at both ends of the MSB.

Other starters to be assembled into several group starter boards according to their location and/or use as far as possible.

Individual starters which are not contained in group starter board shall be mounted in drip-proof metal cabinet next to respective motors.

Ammeter and running hour counter to be equipped on the starters for important motors and motors of 10 kW above.

The wiring diagram of each starter shall be fitted on the back of starter door.

643 Special control

6431 Emergency stop device

(A) For fire use

All ventilating fans and oil pumps shall be capable of being in group stopped in fire.

- a) Fuel oil pumps, lubricating oil pumps, oil purifiers and oil-burning boiler in E/R:
Emergency stop buttons shall be located at two main entrances outside the engine room and fire station.
- b) Ventilating fans and aux. blower in E/R:
Emergency stop buttons shall be located at two main entrances outside the engine room and fire station.
- c) Ventilating fans in accommodation area:
Emergency stop push buttons shall be located in the wheelhouse and fire station.

(B) Others

Each emergency stop push button for engine room bilge pump and sludge pump shall be fitted on upper deck both sides.

If the outlet of any water pump are located in lifeboat launching area above the light waterline, emergency stop push button for the water pump shall be provided near the lifeboat launching station.

Special control function:

Turn gear shall be controlled remotely by the portable push button and with 15 meter flexible cable and receptacles shall be fitted, each one at upper floor and lower floor in engine room.

6432 Preferential tripping arrangement

Preferential tripping (automatic unload) arrangement to be as follows:

Galley and laundry equipment, air conditioner compressor, ventilation fan for accommodation, lathe, drilling machine, tool grinder and air conditioner for engine control room.

6433 Steering gear motor

The steering gear motors to be fed by separate feeders, one (1) from main switchboard and one (1) from emergency switchboard. The feeder cables to be run so as to minimize the probability of simultaneous failure of both feeders.

Two steering gear motor starters to be located at the steering gear room. The motors to be controlled locally or from the bridge.

The steering gear alarm units to be installed at the bridge and the ECR.

644 Connection box of electric welder

Three (3) sets of waterproof type source socket with switch (AC 440 V, 3 ph, 16 A) for removable welder shall be installed at fore, middle and after part of upper deck.

645 Electric warmer for rooms

Electric warmers (AC220V) for room to be installed as follows:

2 – Steering room (2 kW)

- 1 - Emergency fire pump room (2 kW)
- 1 - Emergency generator room (2 kW)
- 1 - Hospital (1 kW)
- 2 - Wheelhouse (2 kW)
- 1 - Each common lavatory (0.5 kW)
- 1 - Bosun store (2 kW)

65 LIGHTING SYSTEM AND SIGNAL LIGHT

650 General

The vessel shall be adequately illuminated throughout with fluorescent lights and supplemented by incandescent lights. Lighting fixtures for flood lighting shall be of halogen lights or H.P. sodium lights.

The lighting system shall be divided into normal lighting and emergency lighting.

Emergency lighting to be installed in all spaces required by rules and to be normally used as part of the overall lighting system.

In general the enclosure of the lighting fixtures to be of the following type dependent on their location:

Waterproof type (IP 55, IP 56):	Spaces exposed to weather
Totally enclosed type (IP34, IP 44):	Machinery spaces, public lavatory, galley, laundry, refrigerating chambers etc. wet spaces
Non-waterproof type (IP 20, IP 22):	All cabins, wheelhouse, offices, mess rooms, control room, saloon etc. dry spaces
Explosion proof type:	Battery room, Paint room, acetylene store and other hazardous areas

651 Lighting fixture

Accommodation area and passage

Lighting fixture	Space/ location
Fluorescent ceiling light (20W x 2, flush type)	Crew's room, mess room, pantry, hospital, ship office, office, saloon etc.
Fluorescent ceiling light (20W x 2 surface type)	Galley, laundry, common lavatory
Fluorescent corner light (20W x 1)	Inner passages, staircases
Fluorescent desk light	On the writing table in each cabin and office
Incandescent berth light	Over the head of each berth (fed by emergency power supply)
Fluorescent mirror light (with shaver socket)	On each private bath room
Decorative type wall light	Mess rooms, saloons, captain class day rooms
Incandescent pendant/ wall light (60W)	Outer passageway

Machinery space

Lighting fixture	Space/ location
Fluorescent pendant light (30 W x 2, 20 W x 2)	Engine room, steering gear room, emergency generator room and other machinery space.
Fluorescent ceiling light (20 W x 2, flush type)	Engine control room
Incandescent pendant light (40 W)	Funnel inside, escape trunk, under the E/R lower floor

Incandescent spot light (100 W, with adjustable arm)	On work face of machine tool and worktable in workshop
Floodlight (500 W, 4 sets)	E/R upper flat top of M.E.

Wheelhouse

Lighting fixture	Location
Fluorescent ceiling light (20W x 2, flush type)	Top of wheelhouse
Incandescent chart lamp (60W, with dimmer switch)	On the chart desk
Fluorescent down light (15W, red)	Above the wheelhouse console for night navigation

Cargo holds

Lighting fixture	Location
Incandescent explosion-proof lamp (60 W)	Entrance space; side of stairway

Stores

Lighting fixture	Space
Fluorescent pendant light (20W x 2) or incandescent pendant light (60W)	General storage spaces; CO2 room; ref. chambers
Incandescent pendant light (60W, explosion-proof type)	Battery room, paint store, acetylene store etc. dangerous spaces

Outdoor flood lighting

Lighting fixture	Qty	Location	Illuminated area
1000W floodlight	3	Compass deck front	Upper deck cargo space
	2	Foremast-behind	
500W floodlight	2	Bridge deck after	Funnel mark
500W floodlight	2	Bridge deck both sides	Ship' name (if require)
500W floodlight	2	Foremast-forward	Fore mooring space
500W floodlight	2	Superstructure after	Stern mooring space
500W floodlight	2	Upper deck both sides	Accommodation ladder
500W floodlight	2	Upper deck both sides	Pilot ladder
500W floodlight	2	Each crane frame	Upper deck and cargo holds
500W floodlight (fed by emergency mains)	2	Boat deck	Lifeboat embarkation and outboard
1000W floodlight	2	Fore part both sides	Ship surrounding area
1000W floodlight	2	Stern part both sides	Ship surrounding area

Portable lamps

Each four (4) portable type 220 V, 300 W incandescent cargo lamps to be supplied for each cargo hold. All of these portable lamp to have 20 m flexible cable with plug.

Two (2) of stainless steel socket boxes, at front and after of each hold hatch coaming to be provided for the above lamps. Each socket box shall be contained water-proof type socket (AC220V, 10A) with switch four (4) sets.

Total ten (10) sets of AC 220V, 60 W portable work lamp with ten (10) meters flexible cord and plug to be provided.

652 Emergency lighting

Emergency lighting system (AC220V) to be a part of the vessel's normal lighting.

- corridors, passages, staircases, escape ways etc.
- engine room abt. 30% of normal lighting.
- wheelhouse
- mess rooms, saloons, offices, galley and laundry at least one light in the said compartments.
- officers and engineers cabins (day room only) and berth light in bed room.
- hospital
- exit from refrigerated chambers,
- boat stations and evacuation ways to the boat, raft area.
- engine control room, emergency generator compartment, steering gear room.
- safety store room

In engine control room and wheelhouse at least one socket outlet 220 V to be supplied from emergency mains. All emergency lighting fixtures to be indicated with a red mark.

653 Control of lighting

The ceiling lights in the engine room to be generally controlled by miniature circuit breakers (MCB) of the distribution boards in the engine room.

The ceiling lights in the machinery compartments such as steering gear room, emergency generator room, etc. to be controlled by a switch located near respective entrances.

In mess rooms, wheelhouse and engine control room etc. spaces, in case multiple access are arranged, the two-pole two-way switches shall be installed in each entrance for control the ceiling lights in common.

The ceiling lights in the living quarters, public spaces, stores, etc. to be controlled by respective switches located near the entrances in general.

The ceiling lights in the inner passages to be controlled by the miniature circuit breakers (MCB) of the distribution boards.

The lights for the outside passages to be controlled from the wheelhouse.

The outside floodlights to be controlled by respective switches on the group switch panel in the wheelhouse.

The lights in the staircase, navigation equipment room and lavatory associated the wheelhouse to be controlled by a door limit switch.

The ceiling lights of the explosion-proof type to be controlled by respective switches located in the safety place.

654 Switch and receptacle

6541 switches

Switches in living quarters to be of non-waterproof type, and switches in the machinery spaces, galley, laundry, toilets etc. to be of water-proof type in general.

Switches shall be constructed for surface mounting in general. Flush type switches to be provided for the spaces where linings are fitted, such as the wheelhouse, crew space, mess room, engine control room etc..

The switch for cold provision stores lighting to be with a red indicating lamp to indicate when the inside lights are on.

In general, all switches for lighting branch circuits shall be of two-pole type.

6542 Receptacles

(a) Non-water-proof type receptacles

Suitable amounts of AC 220V, 10 A two-pole with earthing contact non-waterproof type receptacle to be installed in each room (except small locker) where lining wall are fitted for various small electric appliances.

At least four (4) free receptacles to be fitted in wheelhouse, chart space, radio space, hospital, engine control room, offices, mess rooms and other common rooms.

Suitable amounts of receptacle to be fitted at each inner passage of accommodation area for electric cleaner.

Receptacles fed by emergency power supply to be installed after the main switchboard (2 sets) and emergency switchboard (1 set).

(b) Water-proof Type Receptacles

Other receptacles, except above-mentioned, shall be of AC 220 V, 10 A two-pole with earthing contact waterproof type. Waterproof type receptacles in weather space are brass-made.

Suitable amounts of AC 220 V, 10 A two-pole with switch with with earthing contact type waterproof receptacles shall be installed in steering gear room, engine room, engine workshop, emergency generator room, air conditioner room, boatswain's store, galley, laundry, lobby of refrigerating chamber, upper deck both sides near the pilot ladder etc. spaces for portable work lamps or movable tools.

655 Navigation light and signal light

6551 Navigation lights

The following navigation lights to be of double lamp type and connected to a panel with control switches and indicating lamps graphically arranged, audible and visible signal alarm, and this panel to be installed in navigation watch console in the wheelhouse. Navigation lamps shall be installed according to the requirement of Rules. Navigation lights and its controller should meet the performance standard requirement MSC.253(83).

Two separate feeder circuits to be provided for the panel, one (1) from the AC 220V feeder panel of main switchboard directly and one (1) from the AC 220V feeder panel of emergency switchboard directly.

Two (2) - Mast head lights	220V 60-65W
Two (2) - Side lights	220V 60-65W
One (1) - Stern light	220V 60-65W

Duplicate lamp type electric navigation and signal lighting according to the regulation, mimic navigation light indicator with alarm bell or buzzer and lamp showing accident on navigation lights shall be equipped in NWC.

6552 Signal lights

(a) Anchor light (220V)

Each one (1) 60W anchor light (double lamp type) to be fitted at the forward and aft end the vessel. The source of anchor lights will from navigation light control panel.

(b) "Not-Under-Command" Light (220V)

Two (2) red lamps to be fitted on the radar mast.
The source of NUC lights will from navigation light indicator panel.

(c) Morse signal lamp (220V)

A Morse signal lamp to be mounted on the top of radar mast and four (4) keys to be located at both bridge wings and front wall of wheelhouse.

Morse signal light to be also used as maneuvering light linked to the ship's horn control unit.

The control method of the morse & maneuvering signal lamp should also meet the performance standard requirement MSC.253(83) and as per rules.

(d) Daylight signal lamp (24V)

One (1) set of portable type daylight signal lamp (60W) with battery and charger to be supplied.
Two (2) source receptacles to be installed at both bridge wings.

(e) Suez canal signal light & searchlight (220V)

One (1) set of 40-60W fixed type Suez Canal signal light to be provided, that is, five (5) red, five (5) white and two (2) green. These signal lights to be controlled by respective switches graphically arranged on the signal light indicator panel in the navigation watch console.

One (1) set of receptacle with switch for Suez Canal searchlight to be provided on the f'cle deck.

Two (2) AC 220V 1000W searchlights with rotatable bracket to be installed on both bridge wings or compass deck ,also used as signaling flashing lights.

(f) Panama canal steering light (220V)

Two (2) 25 W blue steering lights to be fitted on the behind of fore mast and controlled with a dimmer switch from wheelhouse.

(g) Other signal light (220V)

Two sets of 40W bulbous bow warning light (hanging type, red).

One set of 40W fixed type stern light for Suez Canal stern signal light (red) /Kiel Canal stern signal light. The colour filter of the light will replaceable.

One (1) set of Singapore strait light for vessel passing traffic separation scheme TSS (three all-round green lights 60W) ;

66 INTERIOR COMMUNICATION, ALARM AND MEASURING SYSTEM

661 Interior communication

6611 Automatic telephone (AC220V & DC24V)

One (1) set of forty-eight (48) lines automatic telephone system with 4 simultaneous calls extension to be provided.

The telephone sets to be arranged in all cabins, offices, public spaces, all control station, hospital, galley, steering gear room and other spaces if required.

The telephone sets to be adopted desk type, wall type or flush type according to their installed location.

The telephone number list to be supplied by the Owner later.

The automatic telephone system shall be connected to the public addresser system to enable paging announcement spoken from wheelhouse and captain room telephone.

The priority function for the following sets to be provided:

- Wheelhouse
- Captain room
- Engine control room

Two sets of terminal box to be installed at both side of main deck to permit integration of the shore side telephone system into the shipboard automatic exchange telephone system.

6612 Sound powered telephone

One (1) set of direct calling type sound powered telephone to be installed as follows:

- Wheelhouse - Engine control room/ main engine side (anti-noise type).
- Engine room - fuel oil filling station (one portable telephone and two jack boxes).

One (1) set of selective calling type sound powered telephone to be installed at following space:

- Wheelhouse
- Emergency generator room (anti-noise type)
- Captain room
- C/Eng. room
- CO₂ room
- Fire control station
- Steering gear room (anti-noise type)

6613 Hospital calling system (DC 24V.)

- 2 – Buzzer or bell located in wheelhouse and officer mess room
- 1 – Call push button (with portable pole) on berth side of hospital

6614 Engineer calling system (DC 24V.)

One (1) main call unit to be installed in engine control console and each one (1) set of signal box with acknowledge push button to be provided in chief engineer's, second's engineer's, third engineer's, fourth engineer's electrical engineer's room and mess room. The system may be combined with E/R extension alarm system.

6615 Bridge navigational watch alarm System- BNWAS (DC 24V.)

The BNWAS system should meet MSC.128(75) requirements and consist of following devices:

One (1) main unit to be installed in navigation watch console, each one (1) acknowledge push button to be provided in navigation watch console (P/S), chart space, radio space and wings(P/S), and each one (1) set of signal box with alarm buzzer to be provided in captain's, chief officer's, 2nd officer's, 3rd officer's, boson's room, deck office and mess room, the detail as per rules.

6616 Public addressor (AC220V & DC24V)

One (1) set of public address with talk back system to be provided as follows:

- 1 - Main unit with 200 W x 2 amplifier in electric equipment room of bridge deck
- 2 - Remote control panel with microphone and build-in speaker in NWC (flush type)

- and fire control station (wall type)
- 5 - Waterproof type microphone stations, each one on both bridge wings, lifeboat embarkation, forecastle deck and stern mooring space
 - 1 - Flush type microphone receptacle & flexible microphone on ECC
 - 1 - Waterproof type 30 W speaker, on compass deck forward
 - 5 - Waterproof type 10 W speakers, each one on both bridge wings, lifeboat embarkation, fore and stern mooring spaces
- Necessary amounts – Drip-proof type 10 W/ 5 W/ 2 W speakers, in engine room area, steering gear room, emergency generator room and other machinery spaces; galley, boatswain store and other crew normal working spaces
- Necessary amounts - Indoor type 2 W/ 1 W speakers with volume control, in all crew rooms, mess rooms, offices, gymnasium and other public spaces; ECR, inner passages, staircases and other spaces if necessary (speakers for inner passages are double face type).

The sound level of loudspeaker system in all areas to comply with the required of Rules.

662 Electric alarm system

6621 General alarm (AC220V emergency)

An electrically operated alarm sounder system consisting of bells, horns and sirens, as appropriate, to be provided, the signals from which shall be clearly audible in all conditions throughout the entire accommodation, navigating bridge, machinery space, and normal crew working spaces of the vessel.

The system to be used for sounding fire and general emergency alarm signal.

The system to be power supplied from AC 220V emergency supply.

The system may be manually operated, spring loaded call points installed at the following locations: W/H navigation watch console, embarkation and fire station.

6622 Engine room signaling and warning alarm (AC220V emergency)

Signaling and warning alarm system (i.e. alarm lighting column) shall be provided in engine room, alarming engine room staff if any alarm condition happen or telephone is calling in engine room or in ECR.

In engine room, suitable amounts of signal lamp columns (including one miniature lamp column in ECR) to be installed, with alarm identification signs and following illuminated signal:

- fire alarm – red globe with FIRE sign
- General alarm – red globe with “ALARM” sign
- CO₂ alarm – red globe with CO₂ sign
- Engine failure alarm – amber globe with FAILURE sign
- Telegraph communication call – milky white globe with TELEGRAPH sign
- Dead man alarm – The signal from E/R automation system
- Telephone – The signal from automatic telephone and sound powered telephone

Simultaneously with alarm display in signal boxes, rotating lights (with red or amber globe) and electric sirens to be actuated.

Telephone calling signal to be stopped automatically if no acknowledgement follows in abt. 2min.

6623 Refrigerating chamber alarm (DC 24V)

One (1) set of ref. provision chamber alarm device to be provided. One (1) switch to be fitted in the each ref. chamber provision room and bell with a red lamp to be fitted in the galley and mess room so as to signal when a person is locked in.

6624 Engine room CO₂ alarm (AC 220V emergency)

One (1) set of engine room CO₂ releasing pre-alarm system to be provided.

The actuating switch to be fitted at CO₂ release box in CO₂ room/ fire control station, Alarm signal in engine room to be happened via the "E/R signaling and warning alarm system"

6625 Fire detecting and alarm (AC 220V)

(A) One set of fire detection and alarm system (as per SOLAS IC standard) for the passage and stairway of accommodation area, engine room and other machinery spaces to be provided as follows:

Fire alarm central panel :	In wheelhouse
Fire alarm repeater :	In engine control room or fire control station
Smoke detectors :	In passages and staircases of accommodation area, paint store, engine room area and other machinery spaces (detector in E/R workshop with temporarily blocking control)
Heat detectors :	In galley, smoking room and suitable places of E/R
Manual alarm buttons :	In passages of accommodation area, service areas, control stations, E/R and other machinery spaces

AC 220 V source to be fed from the MSB & ESB.

(B) One set of suction type smoke detection system for cargo hold shall be installed as follows:

Monitoring & and control panel:	In CO ₂ room
Fire alarm repeater:	In wheelhouse
Extraction fans box:	At suitable location near the CO ₂ room
Smoke sampling intakes:	In each cargo hold

Two feeder circuits of AC 220 V to be fed from the MSB & ESB.

6626 Engine room "dead man" alarm (DC 24V)

One (1) set of engine room "dead man" alarm system to be provided as follows:

- Each 1 – Activating boxes at two main entrances of E/R
- About 8 – Reset buttons at engine control room and suitable location of E/R area

If pre-warning signal that cause by operating the activating box has not been acknowledged within a preset time, an alarm to be released in all engineer's cabins, deck office and mess rooms.

6627 Cargo hold water ingress detection and alarm (AC 220V emergency)

One(1) set of water ingress into cargo hold alarm system to be provided as follows:

- 1 - Alarm box in wheelhouse
- Each 1 - Level sensor at after part of each cargo hold and other spaces required by Rule.

Extension alarm to be installed in ECR & ship's office. Alarm signal also to be sent to VDR system.

6628 E/R local water mist alarm system (AC 220V)

One (1) set fire alarm control panel in fire control station.

One (1) set local pump unit and starter in E/R.

One set repeater panel in wheel house control console and alarms connected to the AMS. Other flame detectors, release push buttons, flash lamp & sirens etc. will be provided in each local mist area (i.e. M/E, A/E, F.O. purifier, boiler, incinerator area etc.) as per rule.

663 Electric measuring instrument**6631 Electric tachometer for main engine**

One (1) set of electric tachometer system to be provided, measuring and indicating the speed in revolutions per minute and the direction of rotation.

One (1) transmitter to be attached to the main engine and each one (1) receiver to be installed as follows:

- Wheelhouse front wall
- Both bridge wings
- C/Eng's day room
- Engine control console

One (1) revolution counter to be installed in the engine control console.

Illumination with dimmer switch to be provided for the tachometer receivers in wheelhouse front wall and bridge wings.

6632 Rudder angle indicator

One (1) set of electrical rudder angle indicator to be provided as follows:

- One (1) - Transmitter in the steering gear room
- One (1) - Three face type indicator in the wheelhouse
- One (1) - Indicator in the engine control room
- One (1) - Indicator on wheelhouse front wall ceiling console
- Each one (1) - Indicator on both bridge wings (panama type).
- One (1) - Indicator in the steering gear room.

Illumination with dimmer switch to be provided for the rudder angle indicators in the wheelhouse, and bridge wings.

6633 Electric crystal clock (AC220V & DC24V)

One (1) set of electric crystal clock system to be provided as follows:

1 - Master clock with control panel in chart space.

Two hand slave clock:

Decorative type: Each day room of captain Class
Mess room, conference room etc.

Ordinary type: Public space
Each crew room
Each office
Hospital
Pantry
Galley

Three hand slave clock: Wheelhouse, engine control room, radio space.

664 Ship's local area network (AC220V)

A PC-LAN, capable of transmitting information between server and connected PC work stations to be installed.

The LAN shall include one (1) server unit and seven (7) personal computers with printer. All personal computers, printers, server and software to be supplied by the Owner and fitted by the shipyard.

The LAN to have connection points on the following locations:

Ship's office (plus server unit)
Captain day room
Chief engineer day room
Chief officer day room
Second engineer room
Electric engineer room
Engine control room
Owner room

The PC work station in captain office to be linked up with INMARSAT-F for data and E-mail transmission.

Three (3) power outlets (AC 220V) for each workstation to be provided and fed from separate circuit of special distribution board.

67 NAUTICAL EQUIPMENT

671 Compass and auto pilot

6711 Magnetic compass (AC220V & DC24V)

One set of transmitting magnetic compass (TMC) with reflector binnacle to be installed.

Heading signal of TMC to be sent to the steering unit for auto steering and off course alarm and other navigation equipment in the event of a gyrocompass failure.

Dimmer for magnetic compass lamps to be provided.

One set of spare magnetic bowl in wooded box to be provided.

6712 Gyro Compass (AC220V & DC24V)

Gyro compass to be fitted as follows:

- 1 – Master compass in NWC
- 1 – Digital repeater on W/H front wall
- 2 – Repeater with pedestal on both bridge wings
- 1 – Repeater in the steering gear room
- 1 – Repeater with pedestal on W/H front wall
- 1 – Digital repeater in the steering stand of W/H
- 1 – Course recorder on the wheelhouse chart space
- 1 – Set of azimuth mirror and azimuth circle

Repeater circuits for the radar's, VDR, AIS and auto-pilot to be provided.

6713 Auto pilot (AC440V & DC24V)

One (1) complete set adaptive auto-pilot to be installed, consisting of one steering unit incorporated into the navigation watch console, feed back unit to be arranged in steering gear room.

The steering unit to be equipped with the facilities of automatic steering with gyro compass and electric hand steering with follow-up and non follow-up control.

The steering stand to be provided with power failure alarm and off course alarm.

672 Searching equipment

6721 Echo sounder (AC220V)

One (1) set of echo sounder with necessary accessories to be installed as follows:

- 1 - Recorded unit in the chart space
- 1 - Transducer located in bottom of the vessel fore.
- 1 - Digital type indicator with shallow water alarm in W/H.

The measurable range to be from 0 to abt. 400 meters.

6722 Speed Log (AC220V)

One set of Doppler log to be provided as follows:

- 1 - Main unit with speed and distance indicator in the chart space.
- 1 - Electronic unit to be installed in fore area of the vessel
- 3 - Speed indicator at the wheelhouse front wall, captain day room and engine control room.
- 1 - Transducer unit (liftable) with gate valve in bottom of vessel.

The speed signal to be connected with radars, AIS and VDR.

6723 Radar (AC220V)

Two (2) sets of marine raster scan radar to be provided.

	NO.1	NO.2
Frequency band:	X-band	S-band
Peak output power:	25 kW	30 kW
TFT effective dia:	340mm	340mm
Display mode:	relative / true motion	relative / true motion
Scanner size:	7~9 feet	12 feet
Performance monitor:	fitted	fitted
ARPA	with	with

The inter-switching unit between S-band and X-band radar to be provided.

One (1) set of marine X band radar equipment (only antenna with transceiver) shall be provided and be installed on fore mast.

Above radars performance standard should be to meet IMO resolution MSC. 192(79). Gyro, speed log, AIS, VDR, DGPS signals to be sent or connect to radar.

6724 DGPS navigator (AC220V & DV24V)

Two (2) set of DGPS navigator with necessary accessories to be provided each as follows:

- 1 - Receiver with printer in the chart space
- 1 - Antenna on the radar mast.

DGPS signal to be linked with log, VDR and GMDSS equipment.

DGPS shall have the capability to operate on at least 8 channels simultaneously, updating the position at least every second. DGPS output to be connected to all required equipment through a distribution box.

673 Voyage data recorder and automatic identify system

(A) Voyage data recorder (AC 220V, DC 24V)

One set of voyage data recorder system according to IMO MSC.333(90) to be provided as follows:

One main electronics unit for data acquisition and recording to be installed in suitable space of bridge deck.

One capsule (black box) to be fixed on compass deck.

Interface box and power supply unit to be provided.

One set of sound reception system to be installed, consists of two (2) outdoor type microphones on both bridge wings and four (4) indoor type microphones in the wheelhouse.

Gyro compass, speed log, echo sounder, radars, DGPS, rudder order, engine order, wind speed and direction, bridge alarm, VHF communication audio, bridge audio and other information requirement by rules to be sent to the VDR.

(B) Automatic identify system (AIS) (DC 24V)

One (1) set of AIS with necessary accessories to be provided according to IMO rules.

- 1 - Transponder on radar mast
- 1 - Controller in the wheelhouse
- 1 - AIS pilot plug
- 1 - USA standard socket (110VAC)
- 1 - Power supply unit
- Etc.

Gyro and DGPS signal and other information requirement by rules to be sent to AIS.

675 Other instruments

6751 Window wiper and clear view screen (AC 220V)

Window wipers with heater to be provided on each front windows of the wheelhouse between windows fitted with clear view screen.

The wipers to be of horizontal movement type. Variable speed controller to be provided for each window wiper on the wheelhouse front wall.

Two sets clear view screen with heater to be provided on front windows of the wheelhouse.

6752 Anemometer and anemoscope (AC220V)

One (1) set of anemometer and anemoscope of vane type to be provided.

One (1) transmitter to be installed on radar mast and one (1) indicator of combined type with wind speed and wind direction to be installed on the wheelhouse front wall or chart space.

6753 Weather Facsimile Receiver

One (1) set of weather facsimile receiver to be provided as follows:

- 1 - receiver (chart space)
- 1 - antenna (compass deck)

Power source to be AC 220V.

6754 Ship's horn

The ship's horn system to be provided as follows:

- 1 - Air horn on after mast
- 1 - Electric motor horn on foremast
- 1 - Time controller in NWC
- 4 - Push buttons at both bridge wings and wheelhouse front wall

The air horn and motor horn to be operated by the push buttons and capable of automatic blow for fog signal by means of time controller.

Electric heater for the air horn and motor horn to be provided.

Power source to be fed of AC 440 V, 3 ph and AC 220 V, 1 ph.

675 Navigation watch console (NWC)

One (1) centralized navigation watch console of dead front and steel frame construction type to be installed in the wheelhouse. The following equipment specified in other sections to be included, but not limited to:

- Navigation light board
- Signal light board
- Control switches for floodlights
- Control switch for general alarm.
- Ship's horn controller
- Sound power telephone set
- Automatic telephone set.
- Public address control unit.
- Distribution boards for lighting, interior communication and nautical equipment
- Emergency stop button for the accommodation fans
- Remote start/ stop buttons for fire pump
- Dimmer switches

- Main engine remote control unit
- Steering stand unit
- Steering gear alarm and motor remote control unit
- Radar displays
- Gyro compass component
- DGPS display (1 set)
- AIS display
- VHF radiotelephone (No.1)
- ECDIS
- Etc.

The navigation watch console to be supplied from the AC 220V normal supply system, the AC 220V emergency supply system and the DC 24V supply system.

676 Electronic chart display & information system (ECDIS)

One (1) set of ECDIS including of the display unit, processor, interface unit, printer and UPS unit etc. to be incorporated into the navigation watch console.

ECDIS shall have the following main function:

- Electronic chart display
- Route planning and route monitoring
- Voyage data recording and playback
- Radar image superimposition etc.

The ECDIS to be linked with the auto pilot. External signals from the gyro compass, speed log, GPS, AIS and radars etc. to be received.

ECDIS shall comply with latest IMO requirements and all charts (electric & paper type) to be supplied by Owner.

68 RADIO COMMUNICATION EQUIPMENT

Radio communication equipment to comply with the GMDSS requirement for sea areas A1, A2 and A3 and adopted shore-based maintenance.

681 MF/ HF radio equipment

One (1) set of 250W MF/ HF radio station to be provided as follows:

- 1 - Main transmitter and self-supporting antenna
- 1 - Main receiver and whip antenna
- 1 - DSC watch receiver and whip antenna
- 1 - DSC terminal
- 1 - Controller
- 1 - Antenna tuner
- 1 set - Necessary accessories according to the maker's standard.

Power source to be AC 220V and DC 24V.

682 VHF radio telephone

(A) No. 1 VHF radiotelephone

One (1) set of international 25W/ 1W. VHF radiotelephone to be provided as follows:

- 1 - Transmitter and receiver including DSC terminal in NWC
- 1 - DSC watch receiver on CH70
- 1 - Whip antenna on compass deck
- 1 - Remote controller unit for captain's day room.
- 2 - Socket boxes fitted at both bridge wings (provide one handset)

DGPS signal to be sent to No.1 VHF radio telephone. Power source to be AC 220V and DC 24V

(B) No. 2 VHF radiotelephone

One (1) set of international 25W/1W VHF radiotelephone used as the duplication of No. 1 VHF to be provided as follows:

- 1 – Transceiver unit with DSC terminal with printer in radio space
- 1 – DSC watch receiver on CH70
- 1 – Whip antenna on compass deck

DGPS signal to be sent to No.2 VHF radio telephone. Power source to be AC 220V and DC 24V.

Both of them to supply signal to VDR

683 Satellite communication system

(A) Inmarsat ship earth station – Fleet broadband (FBB)

One (1) set Inmarsat SES – Fleet broadband standard to be installed, consisting of:

- 1 - Main unit (radio space)
- 1 – Display and keyboard and printer in radio space
- 3 – Telephones (in captain day room and navigation watch console and citadel)
- 1 – Facsimile with telephone in radio space
- 1 – High speed data interface
- 1 – Antenna on compass deck

DGPS signal to be sent to Navtex, Echo sounder, Inmarsat-Fleet broadband system. The power supply to be AC 220V.

(B) Inmarsat ship earth station-C

Two (2) set of Inmarsat SES-C standard to be provided, each including as follows:

- 1 - main unit with EGC receiver and with LRIT function (radio space)
- 1 - printer
- 1 – antenna on radar mast

One set Inmarsat SES-C of them to be used for SSAS & LRIT.

Power source to be AC 220V/DC 24V

684 Portable radio device

6841 Two-way VHF radiophone

Three (3) sets of two way VHF radiophone with 3 pieces of spare lithium battery and charger to be provided for lifeboat use.

6842 Radar transponder and AIS transponder

One (1) 9 GHz radar transponder with brackets and one (1) AIS-transponder to be provided as per rules in the wheelhouse and life boats position.

6843 Satellite emergency position indicating radio beacon

406 MHz/ 121.5 MHz self float type satellite EPIRB with mounting bracket to be provided on compass deck.

6844 Walkie talkie

Six (6) sets of walkie talkie (400 MHz) with battery and charger to be provided.

685 Navtex Receiver

One (1) set of Navtex receiver to be provided as follows:

- 1 – receiver on chart space
- 1 – Whip antenna on compass deck

Power source to be AC 220V and DC 24V

686 Broadcast & television receiving antenna system

One (1) set of broadcast & TV receiving antenna system to be provided as follows:

- 1 - Omni-direction type antenna for TV/FM/AM

Each 1 - Antenna outlet for radio and TV receiver in private rooms, hospital, office, mess room, meeting room and gymnasium room.

Power source to be AC 220V.

TV set, Hi-Fi stereo sets and DVD etc. recreation equipment not to be supplied by the builder.

687 Ship's security alert system (SSAS)

The ship security alert system shall be initiated and transmitted a ship-to-shore security alert compliance with ISPS code., the system shall be capable of being activated from wheelhouse and captain day room.

SSAS to be combined with Inmarsat C system.

69 SUPPLEMENTARY OUTFITS AND SPARE PARTS

691 Supplementary outfits

(A) General tools:

- One(1) - Universal meter
- One(1) - 500 V portable megger
- One(1) - Portable clamp-on ammeter
- One(1) - Pistol drill
- One(1) - Diagonal cutting pliers
- One(1) - Cable shoe cold-rolled pliers
- One(1) set - Steel file
- One(1) set - Socket wrench
- One(1) set - Open end wrench
- Two(2) - Scissors
- Two(2) - Forceps
- Two(2) - Hammers
- Two(2) - Jack knives
- Two(2) - Fuse pullers
- Two(2) - Cutting pliers
- Two(2) - Wire strippers
- Two(2) - Convolution rules (3 m)
- Two(2) - Hacksaws (with 10 pieces of saw blade)
- Two(2) sets - Screw drivers (flat end and cross end)
- Three(3) - Monkey wrenches (6", 8", 10")
- Three(3) - Soldering irons (25 W, 75 W, 150 W)
- One(1) - Tool box

(B) Material:

- | | |
|------------------------------------|--|
| Marine power cables -- | (2×1.5 ²) 30 m; (3×2.5 ²) 30 m |
| Marine flexible cables -- | (3×1.0 ²) 30 m |
| PVC insulated flexible wires -- | (1×2.5 ²) 100 m |
| PVC insulated gum tapes -- | 10 rolls |
| Soldering wire -- | 1 kg |
| Soldering paste -- | 2 tin |
| Compression type cable terminals - | Each 20 of 1, 1.5, 2.5, 4, 6 mm ² |
| - | |

692 Spare Parts

The necessary number of spare parts shall be supplied according to requirements of the Classification Society and maker's standard.

As possible, spares shall be stowed in steel/ wood boxes duly labeled / marked and placed on shelves in spares store room.

ANNEX-1 Bulk Cargo List

Bulk cargo shipping name
ALUMINIUM NITRATE UN 1438
AMMONIUM NITRATE UN 1942
AMMONIUM NITRATE BASED FERTILIZER UN 2067
AMMONIUM NITRATE BASED FERTILIZER UN 2071
BARIUM NITRATE UN 1446
BROWN COAL BRIQUETTES
CALCIUM NITRATE UN 1454
CASTOR BEANS UN 2969
CASTOR FLAKE UN 2969
CASTOR MEAL UN 2969
CASTOR POMACE UN 2969
CHARCOAL
COAL
COPRA (dry) UN 1363
DIRECT REDUCED IRON (A) Briquettes, hot-moulded
DIRECT REDUCED IRON (B)Lumps, pellets, cold-moulded briquettes
DIRECT REDUCED IRON (C) By-product fines
FERROUS METAL BORINGS UN 2793
FERROUS METAL CUTTINGS UN 2793
FERROUS METAL SHAVINGS UN 2793
FERROUS METAL TURNINGS UN 2793
FISHMEAL, STABILIZED UN 2216
FISHSCRAP, STABILIZED UN 2216
FLUORSPAR
IRON ORE PELLETS
IRON OXIDE, SPENT UN 1376
IRON SPONGE, SPENT UN 1376
LEAD NITRATE UN 1469
LIME (UNSLAKED)
LINTED COTTON SEED
MAGNESIA (UNSLAKED)
MAGNESIUM NITRATE UN 1474
METAL SULPHIDE CONCENTRATES
PEAT MOSS
PETROLEUM COKE (calcined)
PETROLEUM COKE (uncalcined)
PITCH PRILL
POTASSIUM NITRATE UN 1486
PYRITES, CALCINED

Bulk cargo shipping name
RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-1) UN 2912
RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-1) UN 2913
SAWDUST
SEED CAKE, containing vegetable oil UN 1386 (a)
SODIUM NITRATE UN 1498
SODIUM NITRATE AND POTASSIUM NITRATE MIXTURE UN 1499
SULPHUR UN 1350 (crushed lump and coarse grained)
TANKAGE
VANADIUM ORE
WOODCHIPS
WOOD PELLETS
Wood Products – General