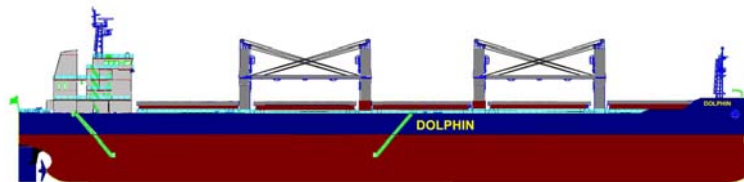


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DOLPHIN HANDYMAX

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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 single-skin 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

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 27 and conversion between SI units and conventional units in the Table 2 "LIST OF UNIT CONVERSION" in page 27.

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 lists of the drawings for the Owner's approval and the final drawings to be submitted to the Owner for approval after the contract of the vessel.

The Builder to submit four (4) 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 two (2) weeks 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 three (3) 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.)
- All napery (serviettes, table clothes, etc.)
- All cook's and steward's utensils (crockery, cutlery, silverware, earthenware, glasses, pots, pans, etc.
- Gas welding equipment
- 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.

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 4 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 bulk carrier for normal worldwide service.

The vessel to comply with the requirements for type "B-60" 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 grain in bulk or sack, coal, iron ore, steel coil, steel pipe and other dry cargoes. No deck cargo to be loaded.

Certain dangerous goods could be carried inside the cargo holds based on the outfitting and equipments mentioned in this specification hereafter.

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;
- Refrigerant management;
- 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.

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

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

The cargo area to have five (5) cargo holds. Cargo holds to be constructed as single skin with topside tanks, hopper tanks and double bottom.

Four (4) set of 30 t S.W.L. single deck cranes to be arranged 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 over all	abt. 189.99 m
Length between perpendiculars	185.00 m
Breadth (moulded)	32.26 m
Depth (designed)	18.00 m
Draft (designed)	11.30 m
Draft (scantling)	12.80 m

1412 Deck height at center line, moulded

Upper deck to A deck	3.10 m
A deck to B deck	2.75 m
B deck to C deck	2.75 m
C deck to Bridge deck	2.75 m
Bridge deck to compass deck	2.80 m
Upper deck to forecastle deck (after end)	2.55 m

1413 Camber, sheer and frame space

Camber:

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

Sheer on upper deck:

Aft at centerline	Nil
Fore at centerline	as per ILLC

Sheer on forecastle deck: abt. 200 mm

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 57,000 metric tons at scantling draft.

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 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. 32,300
Net tonnage	abt. 18,700

144 Capacities

Cargo hold (grain, including hatch coamings)	abt.	71,500 m ³
Heavy fuel oil tanks (including settling and service tanks) (100% full)	abt.	2200 m ³
Diesel oil tanks (including settling and service tanks) (100% full)	abt.	120 m ³
Fresh water tanks (including distilled water tank) (100% full)	abt.	400 m ³
Ballast water tank (excluding No.3 hold) (100% full)	abt.	15,500 m ³
(including No.3 hold) (100%full)	abt.	30,500 m ³

145 Main propulsion plant

Type and number	MAN B&W 6S50MC-C (Mark 7)	1 set
CSR (90%MCR)	Output	8532 kW
	Revolution	122.6 r/min

146 Speed

The service speed of the vessel to be about 14.2 knots at designed draft of 11.3m and at CSR of main engine with 15% sea margin and clean bottom on calm(no wind no wave), deep open sea.

The trial speed at ballast draft to be confirmed after tank test and the measured trial speed to be corrected according to actual sea state.

147 Fuel oil consumption and endurance

The fuel oil consumption of main engine to be abt. 30.0 t/day based on service speed of 14.2 knots at engine power of 7419kW, ISO ambient condition and diesel fuel oil of lower calorific value of 42707kj/kg.

M/E fuel oil consumption to be confirmed as per maker's shop test.

Endurance to be 18000n.mile based on draft 11.30m and CSR of main engine at service speed of 14.2 knots.

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	Radio Officer 1	8
		3/Officer 1	4/Engineer 1	C/Steward 1	
	Sum	4	5	4	13
C R E W	Crew class	Boatswain 1	Oiler 1	Cook 2	14
		Seaman 3	Motorman 3	Spare 2	
	Sum	4	4	6	
Total		27 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 of BV and to be classed and registered as the following:

BV ✕ HULL, ✕ MACH, Bulk carrier BC-A, GRAB(20), CSR, Holds 2, 4 may be empty, ESP, unrestricted navigation, ✕ AUT-UMS, VeriSTAR-HULL, INWATERSURVEY, MON-SHAFT

Or equivalent.

The vessel to fly the flag of convenience.

152 Rules and regulations

The vessel to be registered in Panama 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 all relevant annexes
 - International Regulations for Preventing Collisions at Sea (London 1972) including latest revision
 - International Tele-communication convention with amendments including watch keeping receiver (Geneva 1776) and radio regulation
 - International Regulation on Tonnage Measurement of ships, 1969

- ILO convention concerning Crew Accommodation on Board ship NO.92, NO.133.
 - ILO convention concerning A/C of Crew Accommodation on Board ship NO.140, NO.141
 - IMO Resolution A. 749 (18) (Intact Stability Rules)
 - IMO Resolution MSC. 23 (59) (International Grain Code)
 - IMO Resolution MSC. 137 (76) "Standards for Ship Maneuverability "
 - 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 "
 - Code of Safe Practice for Solid Bulk Carriers
 - 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
 - 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
 - Australian Maritime Safety Authority MARINE ORDERS Part 32" Cargo Handling Equipment" Issue 2, Order NO.9 of 1999 (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 & Governments of India, Pakistan, Canada and Australia (Owner to supply blank book)
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
ILO convention 92 and 133	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
NOx emission	Classification Society & Manufacturer

Builder shall prepare the related information for the Owner.

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, life saving equipment etc., issued by any others assigned authority with approval for required items to be delivered to the Owner by the Builder.

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

SOPEP
Cargo Securing Manual
Training Manual
Garbage Plan
ISPS Manual

16 HULL FORM AND MODEL TEST

The Builder to design the hull form, propeller 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 with stock propeller 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

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

17 TRIM AND STABILITY

The vessel to be so designed as to have sufficient stability and suitable trim on various loaded conditions.

Trim, stability, bending moment and shearing force to be calculated on the following condition and the summary of calculation to be submitted to the Owner at the preliminary design stage:

- a) Normal ballast condition (without No.3 ballast hold), departure, halfway and arrival
- b) Heavy ballast condition (with No.3 ballast hold), 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/m^3), departure, halfway and arrival
- e) Fully loaded condition with cargo with cargo density of 3 t/m^3 in alternative holds (No.1, 3 & 5 holds), departure, halfway and arrival
- f) Grain loading condition with stowage factors of 42, 46, 50, 55, $60\text{ft}^3/\text{Lt}$, departure, halfway and arrival
- g) Loading with steel coils, departure, halfway and arrival
- h) All other loading conditions required by CSR
- i) Ballast exchange sequence
- j) Docking condition
- k) Light ship condition

l) Propeller seal maintenance 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 and ballast exchange 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.

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 also 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. Block joint's edge preparations and back gouging to be inspected by site supervisor.

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.

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 duration to be 0.5 hours at 25% MCR, 0.5 hours at 50% MCR, 0.5 hours at 75% MCR, 1 hour at 90% MCR, 3 hours at MCR and 0.5 hours at 110% MCR, including the UMS trial.

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% MCR, 75% MCR, 90% MCR and 100% MCR 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
- (d) Zigzag test
- (e) Emergency stop, ahead and astern test at full speed
- (f) Williamson turning test
- (g) Course keeping test

- (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 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	
Acceleration, 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		Electric 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.

High strength steel used in the hull construction to be about 35% of steel weight.

Inner bottom plate, lower 3 m of hopper tank sloping plate and transverse lower stool plating to be mild steel and to have adequate thickness against grab operation according to the rules.

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 for Hold No. 1, 3, 5 and 20t/m^2 for Hold No. 2, 4. Tank top strength also to satisfy the requirement for heavy cargoes, discharging by grab with unladen weight of 20 tons.

Steel coil loading of 2 tiers of 25 tons steel coils in 1600m long to be considered. More than 5 dunnages will support one steel coil.

212 Deck load

No deck cargo will be carried.

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 bottom and the sloping bottom of upper wing tanks and to be longitudinally framed in general with the exception of the following parts which are transversely framed.

- * side structure of cargo holds
- * 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; 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 at the center and 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) frames 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 lubricating oil tanks.

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

Duct keel to be provided in double bottom of No.2 to No.5 cargo holds.

Duct keel to have accesses at forward end and engine room. The access in engine room to be fitted with watertight hatch cover. Manholes to be provided from hold. Bottom structure in way of duct keel to be adequate for docking with centerline keel blocks.

223 Side structure

Side shell structure

Main frames to be fitted at every frame space on side shell and to be firmly connected to the structure of topside tank and hopper tank.

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

Topside Tank

The topside tank to be arranged at shoulder part of cargo holds and to be used as water ballast tanks and fuel oil tanks.

The sloped bulkhead of topside tanks to have a slope of about 30° to the horizontal.

The structure in topside tanks to be longitudinal framing system with non-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.

Transverse bulkheads in No.3 cargo hold which are designed for dual purpose as cargo hold and fully loaded ballast tank to be constructed of vertical corrugation with upper and lower end stool.

Suitable eyes for lashing will be positioned on longitudinal or transverse bulkheads in cargo holds.

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 with bulbous bow form 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 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.

Stern tube to be welded-in between shaft boss and aft peak bulkhead.

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 cylindrical 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 e 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.

Foot steps to be provided at suitable position on hatch corners. 4 standing platforms for hatch operator on each hold: for/aft.

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 grating 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 grating to be provided to remove mud & etc.

600 x 1000 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.

Perforated plates 600mm above bottom to be fitted.

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 of flat bar type with one edge stiffened by bulb plate and the other edge welded to a flat pad plate which is attached onto bilge strake by welding.

The bilge keel to be about 450 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 bulwark of 1.05 meter high with top rail of plate to be fitted on forecastle deck to the extent as indicated 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 half-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 or rail for painting stage to be provided outside.

Company's emblem to be of steel plate fully welded construction.

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: ϕ 42mm.

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 Swedish standards SIS.

Painting scheme to be submitted to Owner for approval, colors of finish paint to be as per Owner's color scheme. Each coat of anti-corrosive paint to be of different color for easy identification.

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

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 SIS SA 2.5. Grit or sand blasting to 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 grit or sand blasted to SIS SA 2.5.

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. Different color shop primer to be used for mild and high tensile steel plates and sections.

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	In block stage, In pre-erection, dock & quay stage
------	---

Bottom and boottop	ST 2.5
Topsides	ST 2.5
Weather deck	ST 2.5
Deckhouse exterior	ST 2.0
Deckhouse interior	ST 2.0
E/R interior	ST 2.0
Water ballast tanks	ST 3.0
Cargo holds	ST 2.5
Tanks other than F.O., D.O. tanks	ST 2.0
Others	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. In such a case two additional stripe coatings to be applied, one before and one in between full coatings.

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.

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.

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. Paint in ballast tanks to have five (5) year guarantee.

Painting scheme:

No.	Painting space	Type of paint	DFT (μm)	Remarks
1.0	Shell plating			
1.1	Flat bottom, Boottop	ME SPC	Total 300 Total 240	As per maker's standard
1.2	Bottom (including bilge keel, sea chest & rudder outside)	ME SPC	Total 300 Total 300125X3	As per maker's standard
1.3	Topside (including bulwark outside)	2-ME 1-PU	150+100 50	
2.0	Rudder inside	1-B	Filling	
3.0	Weather deck	2-ME 1-PU	150+100 50	
4.0	Superstructure			

4.1	Deck house exterior & under surface of overhang deck	2-ME 1-PU	150+100 50	
4.2	Steel surface covered with lining & insulation	2-ALP	40+40	
4.3	Ceiling & wall steel surface	1-ALP 2-ALF	40+40 40+40	
4.4	Floor steel surface	2-ALP 2-ALD	40+40 40+40	
4.5	Floor covered with deck covering			No painting
4.6	Ceiling, wall & floor of battery room	2-ALP 2-ALF 2-ME (floor only)	40+40 40+40 125+75	
4.7	Ref. Provision chamber steel surface under insulation	2-ME	125+ 75	
5.0	Engine room			
5.1	Ceiling & wall steel surface, under surface of partial deck & floor plate	2-ALP 2-ALF	40+40 40+40	
5.2	Upper surface of partial deck & floor plate	2-ALP 2-ALD	40+40 40+40	
5.3	Steel surface behind insulation	2-ALP	40+40	
5.4	Tank top	2-ME	150+100	
5.5	Exhaust pipe			No painting
6.0	Funnel			
6.1	Outside	2-ME 1-PU	150+100 50	
6.2	Inside	2-ALP 2-HP	40+40 25+25	
7.0	Cargo hold			
7.1	Ceiling & wall	2-ME	150+ 100	
7.2	Tank top of cargo hold	2-ME	100x2	
8.0	Outside surface of hatch coaming & hatch cover, outside surface of bulwark	2-ME 1-PU	150+100 50	
9.0	Inside surface of hatch coaming	2-ME	150+100	
10.0	Water ballast tank, void spaces, boiler water tank, bilge water tank & pipe tunnel	2-NTE	150+150	
11.0	Fresh water tank	3-PE	75 +75+75	
12.0	F.O. tank, D.O. tank, L.O. tank	CKO rust inhibitive oil	25	
13.0	L.O. sump tank			No painting
14.0	Chain locker	1-ME	200	As per maker's standard
15.0	Echo sounder compartment, cofferdam & void space	2-NTE	125+125	
16.0	Emer. Fire pump room & electro-magnetic log	2-ALP 2-ALF	40+40 40+40	
17.0	Anchor & mooring system			
17.1	Anchor, chain cable, chain pipe etc.	1-B	Filling	Chain cable is the dip. painting
17.2	Bits, cleats, fair leaders etc.	2-ME 1-PU	125+75 50	
18.0	Post & radar mast etc.			
18.1	Post outside & radar mast outside etc.	2-ME	125+75	

		1-PU	50	
18.2	Post inside & radar mast inside etc.			No painting
19.0	Machinery beds			
19.1	Main machinery beds (deck machinery, main engine, G/E, F.W. generator)	2-ME	125+75	
19.2	Electrical equipment bed	2-ALP 1-ALD	40+40 40	
19.3	Bed supplied by the maker			Maker's standard
19.4	Other beds	2-ALP 1-ALD	40+40 40	
20.0	Pipes on exposed deck & in accommodation & passage way			
20.1	Invisible part & pipes in tanks	Same as paint in tank		
20.2	Visible part (galvanized)	1- WP 2- ALF	20 40+40	
20.3	Visible part (non galvanized)			Same as surrounding
21.0	Other interior fittings exclude pipes			
21.1	Galvanized fitting for visible part	1- WP 2- ALF	20 40+40	
21.2	Invisible part			No painting
21.3	Non galvanized fittings	2-ALP 2-ALF	40+40 40+40	
22.0	Other exterior fittings exclude pipes			
22.1	Galvanized fittings for visible part	1- WP 2- ALF	20 40+40	
22.2	Invisible part			No painting
22.3	Non galvanized fittings	2-ALP 2-ALF	40+40 40+40	
23.0	Outfitting for example deck machinery, main engine, generator, electric equipment, life boat etc.			Maker's standard

Remarks: Double skin hatch covers to be filled with vapor inhibitor protection.
All epoxy used for external hull and cargo holds to be abrasion resistant.

Type of paint:

- VT – Vinyl tar paint
- SPC – Self-polishing anti-fouling paint
- ME – Modified epoxy paint
- B – Bituminous paint
- ALP – Alkyd resin primer paint
- ALF – Alkyd resin finish paint
- ALD – Alkyd resin deck paint
- HP – Aluminum heat resisting
- NTE – Tar free modified epoxy paint
- PE – Pure epoxy paint
- WP – Wash primer
- PU – Polyurethane finish

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

Vent heads for tanks and hold (only No.3), blocks, sheaves, cleats, shackles, flag post, wire ropes to be also galvanized.

254 Cathodic protection

Impressed current cathodic protection system to be installed for the hull under scantling draught and the mean current density is 35 mA/m².

Cathodic protection to be provided for ballast tanks. The Zinc anodes to have a life of five (5) years.

The Zinc anodes to be provided also for sea chest, rudder and stern part.

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 electro-hydraulic type with medium or high pressure.

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

311 Windlass and mooring winch

3111 Combined windlass / mooring winch

Two (2) 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) mooring drum and one (1) warping head.

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.

Auto-tension system to be fitted.

Particulars:

Item	Wheel	Synthetic fiber rope drum	Warping head
No.	1	2	1
Capacity	About 9m/min 253kN(25.8t) x 9m/min (at the gypsy wheel)	147kN (15 t) x 15m/min (on the first layer)	118kN (12t)
Standard for chain, rope and capacity	U3 chain of welding or cast steel. Joining shackles to be of Kenter type	φ64 x 220m 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.

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 220m	Six (6) turns

Auto-tension system to be fitted.

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.

3113 Hydraulic power unit for deck machinery

Two (2) sets of hydraulic pump unit for windlasses / mooring winches are to be provided in boatswain store and two (2) sets of hydraulic pump unit for mooring winches are to be provided in steering gear room.

The hydraulic apparatus such as oil pumps, oil motors, oil flow control valves, relief valves, etc., to be in accordance with the manufacturer's standard construction and materials.

Spare parts and tools to be supplied in accordance with the manufacturer's standard.

312 Anchor, chain cable and mooring rope

3121 Anchor and chain cable

- 2 - Bower anchors
Stockless, speck type anchor, 8,700Kg each
- 2 - Stud link chain, dia. 73 mm (welded or casting steel, grade U3)
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.

3122 Mooring rope

8 – 220m long polypropylene rope with brake load not less than 500kN, 4 coil around windlass / mooring winch drum and 4 coil around aft mooring winch drum.

3123 Tow line

1 – wire line, break load 1471 kN

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 galvanized 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

- 2 - 400 mm diameter x 3 rollers
- 8 - 400 mm diameter x 2 rollers

(c) Panama chocks

- 10 - 360 mm x 260 mm (double chock) on forecastle deck and upper deck
- 6 - 450 mm x 260 mm (double chock) on forecastle deck and upper deck

(d) Stand rollers

- 12 - 400 mm diameter on forecastle deck and upper deck

(e) Cross bitts

- 2 - 300mm diameter on upper deck

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 units 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. 750 kN-m and to be approved by Classification Society

Maximum rudder angle to be limited to 36 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.

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 fitted with stainless sleeve in way of the rudder carrier.

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) electro-hydraulic 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)
Slewing angle		360°
Hoisting speed		abt.30t x 22m/min, 12t x 44m/min
Lowering speed		
Luffing time		Abt. 60sec
Slewing speed		0.6rpm
Working Raius	Max.	28m
	Min.	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.

Working pressure of hydraulic system to be as per manufacturer standard.

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

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.

332 Cargo hatchway and hatch cover

3321 Cargo hatchway

Hatchway size to be as follows:

	<u>Length</u>	<u>Width</u>
No.1 hatchway	18.86m	18.26m
No.2-5 hatchway	21.32m	18.26m

3322 Hatch coaming**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.

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

The hatch cover to be design for loads as required by the Classification Rules, and no cargo loading on hatch covers to be considered.

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.

Hold ventilation with square flange to be provided on side of H/C, one on forward panel and one on after panel diagonally.

No.3 cargo hatch cover to be specially reinforced against full ballast water in hold.

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 winching 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 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.

335 Provision for cement cargo

The following provisions to be provided for cement loading.

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

- One (1) water blasting machine (for hold cleaning)

- One (1) water hose ,compressed air hoses and accessories.(for hold cleaning)

Five (5) hose connections (15A) on compressed air line for each cargo hold.

Driving source for cleaning to be compressed air (0.69 KPa) from main air compressor.

34 LIFE-SAVING APPLIANCE

340 General

Life saving appliances to be arranged for 27 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 27 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 electric 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 according to the SOLAS rules to be fitted on starboard of A deck.

Electrically 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.

343 Liferaft

Two (2) davit launched type fifteen (15) persons inflatable life rafts to be installed on A deck starboard. The liferafts to be operated by single arm davit (common davit with rescue boat).

Two (2) throw-out type fifteen (15) persons inflatable life 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

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

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	1	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
Fog 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	600 x 600	Upper deck
Refrigerated store	1	1,200 x 1400	A deck
Bosun's store	1	1,200 x 1,200	Forecastle deck
Cargo holds	each 2	750 x 750	Upper deck
Pipe tunnel	2	600 x 600	1 – in engine room 1 – nearby No.1 crane on upper deck
Engine room	1	2000 x 2000 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, top side tank, tunnel, 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 450 mm except that the size of manhole on chain locker wall to be 1000x600.

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

Space name under manhole to be described with steel plate welded 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 4 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) 0.5t fuel oil supply davit to be placed on port and starboard in front of deckhouse.

Hoisting and slewing of davit 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.

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 and one(1) set of pilot slant ladder to be provided on each side of the middle upper deck in accordance with the requirement of SOLAS and National Authority.

The slant ladder to be of aluminum alloy construction with 600mm width.

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 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, Order No.9 of 1999 (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, chain lockers, aft peak tank, fore peak tank, fresh water tanks, distilled water tank, access way to the chain lockers, etc.
One aluminum wharf ladder to be provided.

Two (2) embarkation ladder with wooden steps and Manila side ropes for life raft to be provided. One knobbed rope for fore raft 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 32 mm in nominal diameter for handrails on the f'cle deck aft and about 25 mm in nominal diameter for others.

The intermediate rails to be steel round bars about 19 mm in diameter.

Steel flat bars of 65mm breadth x 16 mm thickness to be used as stanchions for handrails with the top rail of 32 mm in nominal diameter, and 50mm breadth x 12 mm thickness as those with the top rail of 25 mm.

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, cut out plates of 8 mm.
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, cut out plates of 8 mm and well illuminated
Draft mark in metric system	Welded steel plate
Freeboard mark	Cut out plates of 8 mm
Pilot embarkation	Welded bead
Bulkhead mark, and lines of boot top paint	Welded bead or cut out plates of 8 mm
Builder's name board	Brass plate with carved letters.
"NO SMOKING" sign	To be painted red on welded plates of 8 mm in each hold, engine and generator room
Cargo hold mark	Welded bead on hatches coaming
Depth marks in holds	Welded bead
Caution marks in hold	Welded bead on bulkheads indicating existence of platforms etc. under cargo.
Tonnage & official number	Welded bead
Tank contents to be marked on	Welded bead
Tug push mark	Cut out plate of 8mm, to be fitted on shell plate at

suitable position both port and starboard. Structure in way to be reinforced.

Bulbous Bow Mark

Cut out plate of 8mm, 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 shell.

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 of valves to be in accordance with ISO 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.

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.

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.

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 and 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.

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

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.

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.

3715 Suction bell mouth

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

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

3716 Other piping fittingsGasket

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.

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.

3718 Pipe protection

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.

Surface treatment and cleaning

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 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) Welded sleeve joints fabricated on-board
- 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 lubricating oil and hydraulic oil pipes to be pickled before installation. After installation onboard, the pipes to be flushed and cleaned and checked by Owner'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.

Pressure Test

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

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 and other working spaces.
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Water mist system	Partial fire hazard area in engine room.
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CO2 fixed system	Cargo holds, Engine room and paint store, etc.
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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 room to be provided with controls for quick closing valves, fans, CO2, oil pumps and oil purifiers, etc.

3721 Sea water system**Fire main line**

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

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 of 18m in length with coupling.

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, E.C.R. and pump side.

Emergency fire pump

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.

The remote control system to be interlock with audible alarm.

Independent CO₂ fire extinguishing system for paint store, emergency generator room and galley exh. duct to be provided and released by manually at local.

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.

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.

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 pipe tunnel 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 in pipe tunnel. The bilge mainline to be connected to the bilge pumps in engine room.

Remote 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 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 and oily bilge 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.

3732 Ballast system

Two (2) main ballast lines to be arranged in pipe tunnel in double bottom, each main ballast line to be respectively connected to D.B. water ballast tanks through a branch ballast line and a branch ballast line to be connected to fore peak water ballast tank. T.S. water ballast tanks (P&S) to be ballasted and emptied through two (2) main ballast lines arranged in T.S. water ballast tanks (P&S) with submerged type remote operated valves.

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 fire & G.S. pump.

The No.3 cargo hold to be used as a water ballast tank for heavy weather ballast condition.

Two (2) suction wells to be provided for No.3 C/H floodable hold at port and starboard side of No.3 C/H. One (1) portable steel grid to be fitted at the entrance of the suction well.

When carrying the dry cargo, a blank cover to be fitted at each end of the floodable hold to prevent the leakage of ballast water into the hold.

The safe ballast exchange at sea to be considered. The flow through method to be used for F.P. water ballast tank and the sequential method to be used for other W.B. tanks.

No shifting of ballast between ballast tanks to be considered.

The hydraulic butterfly valve to be fitted on each branch ballast line in pipe tunnel and to be remote operated from ship's office including ballast exchange at sea.

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

A hydraulic butterfly 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 D.B.W.B. tanks to be provided with remotely operated valves in the pipe tunnel 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 and stainless steel wire gauge insect guard. 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.

Air pipes for top side tanks to be laid at hatch coaming side.

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.

Generally the sounding pipe to be as straight as practicable.

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 cold fresh water system will be divided into two (2) independent system, i.e. domestic fresh water system and technical water system.

Fresh water to be led to wash basins, showers, sinks, laundry, galley, pantry, toilets and drinking fountain, etc.

Technical water to be led to consumer in engine room, for example, cascade tank, purifiers, expansion tanks and so on.

Pressure tank system to be adopted to above-mentioned system.

a) Domestic fresh water

The fresh water filling pipes to be provided on weather deck of which the diameter to be not less than DN 65mm.

Domestic cold fresh water system to have two (2) lines, i.e. a potable water service line and general fresh water service line, and one (1) hydrophore and two (2) fresh water pump driven by electric motor to be installed.

One (1) pump to serve as standby.

The pumps to take suction from the fresh water tanks, and discharge through the stop check valve to the hydrophore.

Potable water to be led to the galley, pantry and cold water fountains through a sterilizer.

General fresh water to be supplied from the fresh water hydrophore in the engine room and led to the galley, pantry, wash basins, showers, bath tubs, laundries, toilets, lobby of refrigerated provision chamber, hospital, front windows of wheel house, washing machine, hose connections in super structure.

The pressure tank to be constructed of carbon steel and furnished completely with gauge glass, pressure gauge, relief valve, drain connections and connection of compressed air line to hydrophore by short flexible.

The automatic pressure control to be fitted to start and stop the pumps to maintain the necessary pressure in the tank.

Fresh water line to be provided on deck with five (5) ball valves, one in way of each hold. Diameter of pipe to be 25 mm.

b) Technical water system

The fresh water for engine room consumers to be provided by technical water system.

The system consists of one distilled water tank, one (1) hydrophore and two (2) technical water pumps.

The pumps to take suction from the distilled water tank and discharge to T.W. hydrophore and then to technical water main. The technical water to be led to consumers by means of branches with shut-off valves at the main.

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 pass through water meter and salinity indicator to the fresh water tanks through mineralizer and distilled water tank.

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 to have grids. 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 the engine room. Interior drain and soil pipe from hospital to be separately led to the sewage tank.

The soil piping system to be arranged so that the soil can be discharged overboard by-passing the sewage treatment plant through one (1) storm valve near the ballast water line level when necessary.

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 waste water 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 to engine casing to be provided.

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.

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

The H.F.O. tank and M.D.O. tank to be located as follows:

NO.1 H.F.O. tanks (P&S)	In topside tank with cofferdam
NO.2 H.F.O. tanks (P&S)	In topside tank with cofferdam
NO.3 H.F.O. tanks (P&S)	Deep tank in engine room
M.D.O. tank	In engine room

Two (2) bunker stations for the H.F.O. & 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. 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 bunkering manifold.

No.1 HFO tanks (P&S) to be bunkered by filling pipes arranged in side cofferdams with remote operated electric-hydraulic butterfly valves. The compensators to be fitted at filling lines. No.2 & 3 HFO tanks (P&S) to be bunkered by filling pipes arranged in engine room with manual operated butterfly valves.

Separate M.D.O. filling system to be led directly to M.D.O. tank with manual operated butterfly valve in engine room.

The F.O. to act as discharging filling lines deck shore filling 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	1.0
Compressed air pipe for deck service		All	Seamless* steel galv.	B	Sleeve or flange	1.0
Fuel oil		All	Seamless steel	A	Sleeve or flange	0.6
Ballast	In pipe tunnel water ballast tanks and void spaces	All	GRP		Sleeve or flange	0.6
Bilge	In double bottom tanks	All	GRP		Sleeve or flange	0.6
	In other spaces	All	Seamless steel galv. Or GRP	B -	Sleeve or flange	0.6
Domestic steam & drain		10	Seamless copper		Socket	0.6
		15 & above	Seamless steel galv.	A	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	50	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			
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	Stainless 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	Bronze	Brass	In accordance with the Rule
Scupper line (storm valve)	All	Cast steel	Bronze	Stainless	0.6
Ballast and bilge line	All	Cast iron	Bronze	Brass	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	Cast steel	Bronze	Stainless
		25 mm & below	Cast steel	Bronze	Stainless
	Return side	All	Cast iron	Bronze	Brass
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	Glass cloth	Glass cloth
Hot water	in accommodation	mineral wool	mineral wool	Glass cloth	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
14 – Crew cabin		Single cabin except double-berth cabin for Cadet and Spare	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/Lounge
- Crew's mess room/Lounge
- Conference room
- Gymnasium & Suez Crew

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
- Officer's Pantry
- Crew's Pantry

Sanitary spaces

- Private lavatories
- Public toilets
- Officer's laundry and drying room
- Crew's laundry and drying room
- Deck change room
- Engine change room

Storage spaces

Refrigerated stores
Provision store
Linen store
Bond 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
Radio locker
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).

The surface of the joiner bulkheads to be treated as described in the 2.5.

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 on the passages, sanitary spaces, galley, 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.

Bulkhead 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).

The surface of linings to be treated as described in the paragraph 2.5.

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.

The surface of the overhead ceilings to be treated as described in paragraph 2.5.

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 glass wool of 25 mm in thickness.

Heat insulation for exposed part to be extended to about 500mm 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 110kg/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.

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.

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 on the skirting

Grooved tile to be applied to the galley.

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 steel of the standard design.

Wooden furniture to be generally finished with polyester plastics overlay.

The top of tables and chest of drawers to be covered with melamine plastic laminate.

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	2,000 x 1,500	1,200 x 600	2,000 x 800	2500 x 1500 x 650	-
Senior officer	2,000 x 1,300	1,000 x 600	1,600 x 700	-	2000 x 650
Junior/Petty officer	2,000 x 1,000	800 x 600	1,200 x 600	-	2000 x 650
Crew	2,000 x 1,000	800 x 600	1,000 x 500	-	2000 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.

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	-
Book shelf	1	-	1	-	1	-
Book rack	-	-	-	-	-	1
File cabinet	2	-	1	-	-	-
Safe	1 (captain only)	-	-	-	-	-
Sofa	1 (L-type)	-	1 (L-type)	-	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 (50 liter)	-	1 (50 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 (in Gymnasium)

Folding double bed	3
Table	1
Easy chair	1

Mess room and meeting room

Furniture	Officer's Mess room	Crew's Mess room	Meeting Room
Mess table	2	3	-
Meeting table	-	-	1
Side board	1	1	1
Arm chair	2	-	8
Common chair	16	16	-
Dresser with sink	-	-	-
Bottle cabinet	1	-	1
Notice board	1	1	-
Coat hook	16	12	8
TV rack	1	1	-
Sofa (L type)	1	1	2
Tea table	1	1	2

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	1	-
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	4	4	-
Book case	1 (case)	1 (case)	1 (rack)
Desk	1	1	1
Copy table	1	1	-
Common chair	-	-	2
Arm chair (Rev.)	7	6	-
Notice board	1	1	1
Sofa	1	1	1
Key box	1	1	-
Waste basket	1	1	1
Table (rectangular)	1	-	-
Coat hook	6	6	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 oriental type cooking range (abt 24 kW) with one oven, four hot plates
- 1 - Baking and roasting oven
- 1 - Refrigerator (abt. 400 liter)
- 1 - Multipurpose peeling machine (abt. 6 kg)
- 1 - Water basin
- 1 - Table with two sink
- 1 - Bowl and dish rack
- 1 - Bottle rack
- 1 - Titling frying pan
- 1 - Wooden block
- 1 - Glass rack
- 1 - Water boiler (abt. 15 liter)
- 1 - Service table
- 1 - Garbage disposer
- 1 - Universal kitchen machine
- 1 - Clock
- 1 - Meat slicer
- 1 - Soup boiler
- 1 - White board

4413 Pantry equipment

- 1 - Refrigerator (abt. 180 liters)
- 1 - Service table
- 1 - Auto-water boiler (15 liter)
- 1 - Table with two sink
- 1 - Glass rack
- 1 - Hot plate (1 kW)
- 1 - Toaster
- 1 - Auto-coffee machine
- 1 - Garbage can (plastic)

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

Officer's laundry and crew's laundry to be provided with following equipment.

2 - Electrical washing machine with hydro-extractor (5 kg, domestic type)

1 - Electric iron (0.6 kW)

1 - Washing sink

1 - Wood shelf

1 - Shelf for iron

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 and mirror, eight(8) steel jumper locker and one (1) bench.

443 Cold drinking water fountain

Seven (7) cold water fountains of marine type with sterilizer to be fitted on all decks, E/R 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. 30	+ 4
Meat room	abt. 20	-18
Fish room	abt. 15	-18
Lobby	abt. 15	
Dry provision	abt. 35	+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 control panel and dial type remote reading thermometer to be fitted near the chamber.

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.

Wooden grating to be fitted.

4514 Refrigerating plant

The refrigerating plant 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 provision store 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.

One (1) gas dryer, two (2) oil separators 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	2-tier galvanized steel shelves with fiddles and wooden grating
Linen store	2-tier wooden shelves with galvanized steel frame
Paint store	2-oil tank, tin hooks, fire extinguishing system 2-tier steel shelves
Boatswain store	2-tier steel shelves with wood plate, and wooden grating
Rope store	2-tier steel shelves.
Battery room	Steel galvanized shelves and FRP box for storage of batteries and shelves for distilled water bottle etc.
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
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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 1950 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, a door hook 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 weather door of aluminum flush type with a 250 mm diameter fixed bull's eye and the self-closing device.

Sliding doors in the wheel house to be of aluminum hollow type each with a clear glass and slided on a top guide rail by hanging rollers.

463 Size of door opening

The height from the floor to the door's top to be not less than 2000mm, 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 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 1100 mm high fixed window, and 950 mm wide x 1100 mm high fixed windows of aluminum alloy framed to be fitted to the front of the wheel house.

800 mm wide x 710 mm high windows of fixed type to be fitted for other parts of the wheel house.

Five (5) window wiper of swing type to be fitted to the fixed windows of the wheel house front.

1200 mm wide x 800 mm high windows of fixed type to be fitted for the engine control room.

(c) Skylight

No skylight for the engine room and galley to be provided.

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 45 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, offices and mess room to be fully air conditioned by a medium 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 50%RH
Fresh air ratio	50%	50%
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%, two (2) sets of air handling unit and diffusers etc.

Air filter to be provided. gas dryer, automatic temperature controller to be fitted. Compressor to be fitted with unloading device.

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

In summer the inside temperature in air conditioning spaces to be automatically controlled by the thermostat and the solenoid valves.

In winter the supply air temperature to be automatically controlled by steam regulating valve, the steam humidifying to be controlled manually.

Double wall insulated spiral ducts to be used.

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 50% 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 not more than 50% of that 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 independent air conditioner to be provided for galley with full fresh air.

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	-	10
Drying room	-	-	15
Linen locker	6 spot	-	-
Galley	10 spot	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
Pipe tunnel	-	-	6
Hydraulic oil pump room	-	-	10

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 to be provided.

The natural venting trunks with closing cover and safety mesh to 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, 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 and accessories of equipment 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.

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, cy1. 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	1	1/2

b) Governor test

c) Fuel oil consumption test at 50% 75%, CSR and 100% of MCR to be mentioned in report

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. 5 min)

h) 1 cylinder cut off test (test load according to maker's standard, only for proto engine)

I) Crank shaft deflection measurement (at both hot and cold state)

J) Turbo-Charger cut off test (test load according to maker's standard, only for proto engine)

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.

M/E overhaul inspection including one whole unit of engine components to open up for inspection such as cylinder cover, piston, cylinder liner, crosshead bearings and guide shoe, crankpin bearings, main bearings. Besides, gear wheel inspection doors to open up for inspection. Fuel valves for one cylinder unit to be tested. Exhaust valve seat condition to check.

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 and speed 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 380 cSt/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.

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%.

5030 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 MCR.

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) emergency air reservoir to be charged by the emergency air compressor for starting of aux. engine in case of "dead ship".

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 MCR.

b) Heaters

The water heaters to be of shell-tube type.

The type of oil heaters to be recommended by maker.

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, the capacity to be at least 120% of fuel oil consumption of main engine at MCR and one (1) G/E at normal sea.

One (1) for working and the other's 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.

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	1000
Fuel oil circulating pump	25.8	1000
Fuel oil transfer pump	25.8	1000
M.D.O. transfer pump	25.8	1000
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	: MAN B&W 6S50MC-C
Type	: Two stroke, single acting, crosshead, direct reversible, High efficient turbocharged type marine diesel engine
MCR	: 9480 kW x 127 r/min
CSR (0.9 MCR)	: 8532 kW x 122.6 r/min
No. of cylinder	: 6

Cylinder bore : 500 mm
Stroke : 2000 mm
S.F.O.C. : abt.171 g/kW.h+5% at MCR based on the use of a fuel calorific value of 42700kj/kg at ISO conditions and fulfilling the IMO NOx 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 steel pedestal, upper and lower part lined with white metal

One (1) - Stern tube fabricated steel

One (1) - Stern tube after bearing. Cast iron bearing bush lined with white metal.

One (1) set - Stern tube seal to be of Simplex type with rope guard and net cutters
Fwd. seal -2 viton seals, aft seal -4 viton seals

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.

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
Output & Revolution : As per maker's recommendation (not more than 900 r/min)
Alternator : abt.600 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 : 99 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 : 1500 kg/h
Exh. gas section : 1000 kg/h (at CSR of M/E under ISO reference condition)
Feed water temp. : 60°C
Steam state : 0.7MPa (working) saturated

515 Engine room systems

(a) Compressed air system

Main air compressor

No. of set : Two (2)
Type : M.D. two stage, fresh water cooled
Capacity : 180 m³/h (F.A.)
Delivery pressure : 3 MPa
Revolution : not more than 1200 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 air compressor

No. of set : One (1)
Type : Motor driven, air cooled, screw type
Capacity : 160 m³/h (F.A.)
Delivery pressure : 0.7 MPa

Main air reservoir

No. of set : Two (2)
Type : Cylindrical all welded
Capacity : 5.0 m³ x 3 MPa

Emerg. air reservoir

No. of set : One (1)
Type : Cylindrical all welded
Capacity : 0.25 m³ x 3 MPa

Control air reservoir

No. of set : One (1)
Type : Cylindrical all welded
Capacity : 0.25 m³ x 0.7 MPa

Control air dehydrator

No. of set : Two (2)

Type	: Refrigerated type
Capacity	: abt.80 m ³ /h (F.A.)
(b) Cooling water system	
Cooling S.W. pump	
No. of set	: Three (3)
Type	: M.D. vert. centrifugal
Capacity	: abt.320 m ³ /h
Total head	: 0.25 MPa
M/E jacket cooling F.W. pump	
No. of set	: Two (2)
Type	: M.D. vert. centrifugal
Capacity	: 85 m ³ /h
Total head	: 0.30 MPa
L.T. cooling F.W. pump	
No. of set	: Two (2)
Type	: M.D. vert. centrifugal
Capacity	: abt.570 m ³ /h
Total head	: 0.35 MPa
Harbor L.T. cooling F.W. pump	
No. of set	: One (1)
Type	: M.D. vert. centrifugal
Capacity	: abt.270 m ³ /h
Total head	: 0.35 MPa
M/E Jacket cooling F.W. Cooler	
No. of set	: One (1)
Type	: plate type (stainless steel)
Heat dissipation	: abt. 1440 kW
Jacket F.W. flow	: 85 m ³ /h
Jacket F.W. inlet temp.	: 80 °C
L.T. cooling F.W. flow	: abt.125 m ³ /h
Cooling surface	:
Central F.W. cooler	
No. of set	: Two (2)
Type	: plate type (titanium)
Heat dissipation	: abt. 4496 kW (60% total capacity each)
L.T. cooling F.W. flow	: abt.285 m ³ /h
L.T. cooling outlet temp.	: 36 °C
Cooling S.W. flow	: abt.320 m ³ /h
Cooling surface	:
Air cooler chemical cleaning pump	
No. of set	: One (1)
Type	: M.D. horiz. centrifugal
Capacity	: 2 m ³ /h
Total head	: 0.3 MPa
Main engine jacket F.W. pre-heater	
No. of set	: One (1)
Type	: Shell-tube, steam heating
Capacity	: 3 m ²

M/E jacket F.W. pre-pump

No. of set	: One (1)
Type	: M.D. horiz. centrifugal
Capacity	: 9 m ³ /h
Total head	: 0.3 MPa

G/E cooling F.W. preheating unit

No. of set	: One (1)
Type	: Electric heating
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.
Total head	: According to boiler maker's recommendation

Atmospheric condenser

No. of set	: One (1)
Type	: shell tube type
Condensate temp	: 60 °C
Cooling surface	: abt. 25m ²

(d) Fuel oil system

M/E & G/E fuel oil supply module unit

No. of set	: One (1)
Capacity	: According to maker's recommendation

Heavy fuel oil transfer pump

No. of set	: One (1)
Type	: M.D. vert. screw
Capacity	: 40 m ³ /h
Total press.	: 0.4 MPa

Marine diesel oil transfer pump

No. of set	: One (1)
Type	: M.D. vert. screw
Capacity	: 40 m ³ /h
Total press.	: 0.4 MPa

Heavy fuel oil purifier with heater

No. of set	: Two (2)
Type	: Automatic, self-cleaning and steam heating
Capacity	: abt.2350 l/h (380 cSt/50°C)
Supply pump	: Acc. to maker's std.

F.O. flow meter

M/E & G/E F.O. service system	: One (1)
Boiler F.O. system	: One (1)

(e) Lubricating oil system

Lubricating oil pump

No. of set	: Two (2)
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Type	: M.D. centrifugal deepwell type
Capacity	: 230 m ³ /h
Total head	: 0.45 MPa
Lub. oil transfer pump	
No. of set	: One (1)
Type	: M.D. horiz. gear
Capacity	: 5 m ³ /h
Total press.	: 0.35 MPa
Lubricating oil purifier with heater	
No. of set	: Two (2)
Type	: Automatic, self-cleaning and steam heating
Capacity	: abt. 1800 l/h (SAE30)
Supply pump	: Acc. to maker's std.
M/E lubricating oil cooler	
No. of set	: One (1)
Type	: Plate type (stainless steel)
Heat dissipation	: abt. 660 kW
Lub. O. Flow	: 230 m ³ /h
L.T. cooling F.W. flow	: abt. 125 m ³ /h
L.T. outlet temp	: 45°C
Cooling surface	:
Cylinder L.O. pump	
No. of set	: One (1)
Type	: M.D. horiz. gear
Capacity	: 1 m ³ /h
Total pressure	: 0.3 MPa
Lub. oil fine filter	
No. of set	: One (1)
Type	: Auto. back wash and manual open when alarm
Absolute fineness	: 40 micron
Capacity	: 230 m ³ /h
Working pressure	: 0.45 MPa
L.O. by-pass filter	
No. of set	: One (1)
Type	: Simplex
Fineness	: 40 micron
Capacity	: 230 m ³ /h
Working pressure	: 0.45
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	
Fire, & G.S. pump	
No. of set	: One (1)

Type	: M.D. vert. centrifugal with self- priming device
Capacity	: 110/200 m ³ /h
Total head	: 0.75/0.25 MPa
Bilge & G.S. pump	
No. of set	: One (1)
Type	: M.D. vert. centrifugal with self-priming device
Capacity	: 110/200 m ³ /h
Total 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
Total press.	: 0.35 MPa
Ballast pump	
No. of set	: Two (2)
Type	: M.D. vert. centrifugal with self-priming device
Capacity	: 800 m ³ /h
Total head	: 0.25 MPa
Oily bilge separator	
No. of set	: One (1)
Type	: IMO approved type, auto. discharge type with pump, oil discharge content monitor and high ppm alarm.
Capacity	: 5 m ³ /h, 15 ppm
Sludge pump	
No. of set	: One (1)
Type	: M.D. horizontal mono.
Capacity	: 5 m ³ /h
Total pressure	: 0.4 MPa
Emergency fire pump	
No. of set	: One (1)
Type	: M.D vert. centrifugal with self priming device
Capacity	: 72 m ³ /h
Total head	: 0.75 MPa
Ballast stripping eductors, C/H bilge eductor	
No. of set	: Two (2) + One(1)
Capacity	: 50 m ³ /h
Suction lift	: 5m WG
Discharge pressure	: 0.12 MPa
Pressure of drive water	: 0.7MPa
Driven water flow	: abt. 103 m ³ /h
Material	: Bronze
Eductors for C.L. and bosun store	
No. of set	: Two (2)
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. 75 m ³ /h
Material	: Bronze

(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	: 18 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
Total head	: 0.5 MPa
Hot water circulating pump	
No. of set	: One (1)
Type	: M.D. horiz. centrifugal
Capacity	: 2 m ³ /h
Total head	: 0.2 MPa
Technical water pump	
No. of set	: Two (2)
Type	: M.D. centrifugal
Capacity	: 2 m ³ /h
Total head	: 0.5 MPa
Technical water hydrophore	
No. of set	: One (1)
Type	: Vert. cylinder type, stainless steel
Capacity	: 300 l
Working pressure	: 0.5 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	: 2000 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

Calorifier

No. of set : One (1)
Type : Shell tube type with electric & steam heating, mild steel with paint for drinking inside, anti-heat paint outside.
Capacity : 500 l
Working pressure : 0.5 MPa
Inlet temp. : 10°C
Outlet temp. : 70°C

516 Fan**Engine room ventilating fan**

No. of set : Four (4)
Two (2) of them to be reversible
Type : M.D. axial flow
Capacity : 850 m³/min.
Total pressure : 600 Pa

Purifier room exhaust fan

No. of set : One (1)
Type : M.D. axial flow
Capacity : 150 m³/min
Total pressure : 500 Pa

E/R welding space exhaust fan

No. of set : One (1)
Type : Centrifugal flow
Capacity : 35 m³/min
Total head : 400 Pa

517 Workshop equipment**Lathe**

No. of set : One (1)
Type : M.D. conventional
Center span : 1000 mm
Swing over bed : 450mm

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 hose length 20m x 1
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	: 27 P
Main engine overhead crane	
No. of set	: One (1)
Type	: Hoisting (two speed), traveling and transversing by motor driven.
Capacity	: 3 t
Engine control room unit cooler	
No. of set	: One (1)
Type	: Packaged type for marine use, cooling only
Capacity	: abt.17 kW
Marine growth preventing system	
No. of set	: One (1)
Type	: Anode type
Capacity	: abt.1200m ³ /h
Life	: Five (5) years
Hydraulic power unit for remote control valves	
No. of set	: One (1)
Type	: Hydraulic type
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 *	6	2120	HC, HL, RL, SD, HT
H.F.O. settling tank **	2	20 each	I, HC, ML, HL, LL, AT, HT, S, RL
H.F.O. service tank **	2	20 each	I, HC, ML, LL, AT, HT, S, RL
M.D.O. tank	1	80	HL, RL, SD
M.D.O. service tank	1	20	PL, RL, LL
M.D.O. settling tank	1	20	PL, HL,LL, RL

Tank	Set	Capacity (m ³)	Remarks
Emergency generator M.G.O. service tank	1	0.8	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	5	S, HC, HL, SD
F.O. overflow tank	1	10	S, HC, HL, SD, RL
M/E scavenge air box drain tank	1	0.4	S
M/E lub. oil storage tank	1	17	PL
M/E lub. oil settling tank	1	17	HC, PL
M/E lub. oil sump tank	1	15	HC, FL, LL
G/E lub. oil storage tank	1	5	PL
G/E lub. oil settling tank	1	5	HC, PL
Cyl. oil storage tank	2	20 each	PL
Cyl. oil measuring tank	1	0.6	PL, LL
Waste oil tank	1	10	S, HC, HL, SD
Stern tube L.O. sump tank	1	1.5	SD, HL
Stern tube L.O. gravity tank	1	0.2	PL, LL
Sludge tank	1	15	S, HC, HL, SD
Stern tube seal oil tank	1	Acc. to maker's std.	PL, LL
M/E jacket F.W. expansion tank	1	1.0	GL, LL, MU
L.T. F.W. expansion tank	1	1.0	GL, LL, MU
Air cooler chemical cleaning tank	1	0.4	HC,SD
Bilge holding tank	1	15, as large as possible	HC, HL, SD
Cascade and inspection tank	1	1.5	MU, LL

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

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.

- d) The H.F.O. tank with mark “**” include six (6) tanks, the No.1 & No.2 H.F.O. tanks (P & S) to be arranged within cargo hold area and the NO.3 H.F.O. tanks (P & S) to be arranged in engine room as deep tank.
- e) The H.F.O. tank with mark “***” to have inclined bottom.
- f) 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) The M/E L.O. sump tank to be fitted with heating coil only around the suction bell mouth.
- h) All of the oil tanks to be provided with drip tray, as practicable.
- i) The miscellaneous oil tanks to be provided according to the Builder’s practice.

52 MAIN DIESEL ENGINE AND SHAFTING

521 Main engine

5210 General

The main engine to be manufactured by Chinese engine builder under the license from MAN B&W.

The particulars of main engine to be as specified in Paragraph 511

The direction of engine revolution to be clockwise viewed from aftward 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.

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 380cSt/50°C

The main engine to comply with MARPOL 73/78 Annex VI Regulation 13 (Mandatory code on NOx emission).

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.

- High efficiency exhaust gas turbocharger. 1 set
- Air cooler (shell and tube type) 1
- Thrust shaft (incorporation type) and thrust block 1

- Turning gear (remote control box with cable of 15m length, one plug and two receptacles)	1
- Flywheel	1
- Interlocking apparatus for turning gear	1
- Exhaust gas receiver	1
- Standard gallery with handrail and steps	1
- Mechanical cylinder L.O. lubricator	2
- Governor (Electronic type)	1
- Manoeuvring and reversing device.	1
- Main starting valve with non-return valve	1
- Control position indicator	1
- Aux. blower (including electric motor and starter)	2
- Electric engine tachometer.	1
- Steam tracing on fuel oil inlet pipe and return pipe	1
- Fire extinguishing CO2 pipe connection for scavenging chamber.	1
- Axial vibration damper according to the manufacturer's standard	1
- Engine protection device	1
- Emergency control apparatus incl. instrument panel for local manoeuvring system	1
- Indicator valve assembly	1
- Crankcase oil mist detector	1

Others to be supplied in accordance with the manufacturer's standard.

Friction type top bracing to be made by Builder in accordance with M/E maker 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 white metal bearing. Simplex type seal to be fitted at forward end and aft end of stern tube.

The shaft diameter, propeller diameter and the number of blades and other details to be determined and designed in consideration of the main engine 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.

At the non-essential speed range, the barred speed range with quick by-pass arrangement to be provided.

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.

One (1) set each of spare coupling bolts to be provided for between crankshaft & intermediate shaft and between intermediate shaft & propeller shaft.

5234 Intermediate shaft bearing

The intermediate shaft bearing to be of the single oil disc type and of cast steel 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.

The stern tube to be connected for oil supply, air vent and return line.

A steel plate rope guard to be provided at the after end of the stern frame hub.

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.

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.

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	forged steel

(b) Stern tube

Stern tube	Cast steel and steel plate
Bush	Cast iron with white metal

(c) Intermediate shaft bearing

Upper and lower shells	Cast steel
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
- L.O. filter (manual duplex type)		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/water tube boiler which consists of oil fired section and exhaust gas section.

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.

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.

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 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 requirements 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 have a thrust bearing installed in the pump and 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 coolerGeneral

The heat exchanging surface to consist of number of corrugated plates clamped together in a frame and sealed at edges by rubber gaskets.

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 coolerGeneral

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	Aluminum brass
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Tube plate	Naval brass
Shell	Steel plate or steel pipe
Water box and cover	Cast iron or steel plate

5423 Shell tube type heaterGeneral

Each heater should fitted temperature gauge and safety valve.

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	0.7	90	130~150
Fuel oil heater for purifier	0.7	50	98
Lub. oil heater for purifier	0.7	40	90
Fuel oil heater for boiler	elect.	50	
Calorifier	steam & elect.	10	70
M/E jacket F.W. pre-heater	0.7		
A/E cooling F.W. preheater	elect.		

Material

Tube	Steel pipe
Shell	Steel plate or steel pipe

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.

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 stages, fresh water 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, air cooler, auto. drain traps and other necessary fittings.

Each main compressor to be provided with automatic and remote 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.

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.

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.

Each fuel oil purifier to run continuously and sludge discharge to be carried out automatically by means of a timer. Start and stop of the purifiers to 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.

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.

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.

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. 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 & U.S.C.G.

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.

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.

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 6 t 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.

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
Lub. oil drain 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	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

where a duct is welded directly to the ship's structure, the thickness to be of 4.5mm.

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 in take to be provided with pneumatics type emergency shut-off device 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 each generator engine and emergency generator engine.

The composite boiler to be used as silencer of M/E.

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.

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.

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 two (2) bottles of A.C. and four (4) 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 and led to working table from the engineer's workshop entrance.

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 55 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.

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 make auxiliary machinery, but these instruments can be interchanged with Chinese product.

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
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(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.	< 50	30	Mineral wool	Glass cloth Glass cloth
	> 50	40		
	< 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 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 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 without removal of pipes.

Short pieces to be provided for each inlet/outlet pipe lines of coolers/heaters for easy maintenance (cleaning).

The gasket for all 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. & seal	Stem		
Steam 0.7MPa	50 & above	Seamless steel	B	Steel slip on welded flange or butt welded or sleeve	Cast steel flgd.	Stainless 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	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.	Stainless steel	Stainless steel	Cast steel or welded steel flgd. or welded branches	0.6
	40				Bronze or brass				
	25-15	Seamless copper	Brass union or bite joint or sleeve	Bronze or brass screwed	Brass screwed	0.6			
10 & below									
Heating coils in oil tank	All size	Seamless steel	C	Butt welded	--	--	--	-	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				
Aux. boiler feed pump delivery and boiler blow aff.	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				
Cooling sea water	50 & above	Seamless steel galv.	B	Steel slip on welded flange or butt welded or sleeve	Cast iron flgd.	Bronze or brass	Bronze or brass	Cast iron or welded steel flgd. or welded branches	0.6
	40-15	Seamless steel galv.	B		Bronze or brass flgd				
	10 & below	Seamless copper	B	Brass union or bite joint or sleeve	Bronze or brass screwed			Brass screwed	

System	Nominal size (mm)	Pipe		Pipe joint	Valve			Fitting	Press ST. (MPa)
		Material	Thick		Body	Disc. & seal	Stem		
Cooling fresh water	50 & above	Seamless steel	A	Steel slip on welded flange or butt welded or sleeve	Cast iron flgd. Bronze or brass flanged	Bronze or brass	Bronze or brass	Cast iron or welded steel flgd. or welded branches Brass screwed	0.6
	10 & below	Seamless copper		Brass union or bite joint or sleeve	Bronze or brass screwed				
Water ballast, bilge	50 & above	Seamless steel	B	Steel slip on welded flange or butt welded or sleeve	Cast iron flgd. Bronze or cast steel	bronze	Brass or bronze	Cast iron or welded steel flgd. or welded branches Brass screwed	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. bronze or brass flgd.	Bronze or brass	Brass or bronze	Cast iron or welded steel flgd. or welded branches Brass screwed	1
	40-15								
	10 & below	Seamless copper		Brass union or bite joint or sleeve	Bronze or 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.			Cast iron or welded steel flanged or welded branches Bronze bracing flanged	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. & seal	Stem		
Fuel oil booster pump delivery	25 & above	Seamless steel	B	Steel slip on welded flange or butt welded or sleeve	Cast steel flgd.	Bronze	Brass or bronze	Welded steel flgd. or welded branches	1.6
	15				Bronze flgd.			Brass screwed	
	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 flgd.	Bronze	Brass or bronze	Cast iron or welded steel flgd. or welded branches	1
	15				Bronze or Brass flgd.				
	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	Bronze or brass	Brass or bronze	Cast iron or flgd. or welded branches	0.6
	15				Bronze or brass flgd.				
	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 flgd.	Bronze	Brass or bronze	Cast iron or welded steel flgd. or welded branches	0.6
	40-15				Bronze or brass flgd.				
	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 flgd.	Stainless steel	Stainless steel	Cast steel or welded steel flgd. or welded branches	3.0
	25-15				Forged steel flgd.				
	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. & seal	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.	Bronze	Stainless steel	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						
		Seamless steel	A						
Air vent & overflow attached to double bottom & deep tank	100 & above	Seamless steel*	B	Steel slip on welded flange, sleeve, butt welds	--	--	--	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.	Bronze	Brass	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	0.6

Notes:

- All gal. pipe to be of hot dip type.
- * 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	Simplex	50 micron	Cast iron or fabricated steel plate	Brass wire
	Generator engine	Inlet		Duplex	10 micron		
	F.O. purifier	Suction	1 each	Duplex	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	Duplex	60		
	L.O. trans. pump	Suction	1	Simplex	62		
	Cylinder L.O. transfer pump	Suction	1	Simplex	62		
	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				φ6 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

5614 Flow velocities in pipe lines

The max. fluid velocities in pipe lines to be as following, as far as possible:

HFO transfer pipes: 0.6 m/s
HFO Bunker pipes: ~1.5 m/s
LO pipes: 1.8 m/s
MDO pipes: 1.0 m/s
FW pipes: 3.0 m/s
Seawater pipes: 2.5 m/s

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 or recirculation.

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 two (2) sets of low temperature cooling fresh water pump, one (1) set of harbor cooling fresh water pump, L.T. fresh water expansion tank, valves, fittings and pipes etc., one (1) set to be used at sea and other set to be as stand-by. One (1) set of harbor cooling fresh water pump can 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 one (1) set of M/E. jacket cooling F.W. cooler 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 cooling F.W. cooler
- G/E air coolers and L.O. coolers
- Intermediate shaft bearing
- Air conditioning plant
- Packaged air cooler for E.R.C. in E/R and galley
- Main air compressors
- Ref. compressors
- Atmospheric condenser

The outlet temperature from central F.W. coolers to be designed of 36°C.

The temperature regulating valves to be provided for H.T. and L.T. cooling F.W. circuits.

Make-up water to be automatically supplied to M/E jacket F.W. expansion tank and L.T.F.W. expansion tank from fresh water hydrophore system with float valve.

Each one (1) set of M/E jacket pre-heater 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.

The lub. oil transfer pump to be also used for transfer and drain of stern tube L.O. sump tank.

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 to be supplied by main lubricating oil pump.

The lubricating oil pump to draw from the lub. oil sump tank and through, L.O. cooler, a thermostatic valve and a auto. back wash filter or a by pass filter then enter to the main engine. Lubricating oil to flow out directly from engine crankcase into the lub. oil sump tank after lubrication and piston cooling.

The lub. oil sump tank to be arranged in double bottom.

Cylinder oil from cylinder oil store tank to be transferred to cylinder oil measuring tank by a pump.

Cylinder lubricating oil to be fed to the main engine lubricators through filter by gravity from the cylinder oil measuring tank.

Each generator engine will have its own internal lubrication oil system with components built on the engine.

Lub. oil coolers to have a by-pass valve on the lub. oil side for temperature control.

The stern tube bearing lubrication system to be of a gravity system.

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

Drain oil from the main engine stuffing boxes to be led to the waste oil tank.

Save-all drip pans to be provided for the pumps, purifiers and tanks of the L.O. systems and to be led to the waste oil tank, and emptied to waste oil tank for incinerator by sludge pump.

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. respectively.

The filling line to be led to the H.F.O. tanks and M.D.O. tank located in cargo hold area and in engine room.

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 systemMain engine and generator engines system

One (1) 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.,

Fuel oil supply pump to draw from the HFO service tank or 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.

A M.D.O. pump to be fitted in supply module unit for emergency use, the power source of the MDO pump to be from emergency switchboard.

The manual operated H.F.O./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

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.

The H.F.O. purifiers shall also take suction from F.O. drain tank and the purified F.O. to be discharged into H.F.O. settling tank.

The M.D.O. purifying system to be installed the same as the H.F.O. purifying system.

One set of H.F.O. purifier can be also used as M.D.O. purifying.

Overflow pipe from the bottom of the service tanks back to settling tank to be provided.

Re-purifying system for H.F.O. service tank and M.D.O. service tank to be arranged.

H.F.O. purifiers can be run in parallel.

Sludge and water from purifiers to be discharged into the sludge tank and bilge holding tank respectively and to be shifted to waste oil tank for incinerator or to shore by the sludge pump.

5644 Fuel oil system besides the above

Dirty oil from main engine scavenge air box to be led to a small drain tank then shifted to F.O. drain tank.

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 Sea chests Engine room miscellaneous service

Main air reservoirs to be charged by main air compressors.

Emergency air reservoir to be charged by emergency air compressor or main air compressors.

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 emergency 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.

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:

0.7 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

Drain from fuel oil and lub. oil tank heating coil and oil heaters to be led to the cascade tank through atmos. condenser and the inspection tank.

Other drains to be led to cascade tank through atmos. 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.

Flange type steam hose connections to be provided for cleaning oil tanks in the engine room.

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 atmos. condenser.

5662 Feed water system

Condensate from atmos. 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 a fresh 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 M.C.R. 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 the bilge & fire pump, the fire & G.S. pump, daily bilge pump and the oily bilge separator 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 recirculate to bilge 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.

5672 Fire fighting systemSea water fire fighting system

The fire main to be served by the fire & G.S. pump, the bilge & fire pump 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, F.W. tank, water nozzles, pipes, alarm system and release station etc.

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.

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.

Each suction sea chest to be equipped with a hinged type stainless 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) marine growth preventing system to be installed.

568 Exhaust gas system

Exhaust gas piping from the turbocharger of the main engine 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 each 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.

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	Air line after reducing valve	1 each	≤ 100	
	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 stern tube bearing, 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 emergency control stand to be provided at the engine side.

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

5701 Engine control room and other control rooms

Engine 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 CRT. Local station shall still work in the case the computers are out of order.

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)

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 (17 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), mess room

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 signalling faults which require the main engine to be shut down immediately.

Automatic slow down group alarm

The alarm signalling faults which require the main engine to be slow down automatically.

Serious faults group alarmGeneral faults group alarmIndependent alarm

The fault alarm should be extended to wheelhouse independently, including the bilge level in engine room and cargo holds, 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.

(c) 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 systemEngine 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:

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 em'cy control station.

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, 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 mechanical control system 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 electric governor 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 emergency control

The following controls to be performed manually by operating lever and handle at main engine local emergency control stand.

Starting and stopping

Reversing

Fuel pump rack setting

d) Change - over of control position

Local - engine control room

Change - over of control position between main engine local em'cy control stand and engine control room to be carried out by change - over handle at the engine side.

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 set

Remote 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 preselection 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 LCD and a printer in ship's office.

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
- Alarm in each cargo hold, F.P.W.B. tank and bosun store when water ingress
- 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 pipe tunnel and emergency fire pump room

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 valves
- Indication of opening and closing of F.O. filling and transfer system 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 (refer to Paragraph-519)
- Fresh water tanks and distilled water tank
- Water ballast tanks
- Ships draft (four points)

The electronic level measuring system to be provided.

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:

- M/E jacket cooling F.W. cooler inlet
 - 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 system, single phase AC two-wire 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 against hull throughout the vessel except for ground detecting circuits, secondary circuits of potential and current transformers to be grounded at switchboard or control panel.

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 50V 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 fire-retardant and non-corrosive material, such as acrylic resin or brass or stainless steel etc.

The letter on the name plates and caution plates to be in English.

605 Color scheme of electric equipment

Metal surfaces of enclosure of the electrical equipment to be painted with the following colors or according to the owner's specified.

Generators, motors and transformers	Munsell code 7.5 BG 7/2
Switchboards, distribution boards and starter panels, control console etc.	Do
Interior communication, navigation and radio equipment	Manufacturer's standard
General alarm and other emergency operating equipment	Munsell code 5R4/13
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.

61 CABLE

611 Cable application

In general, cables to be of flame retardant and complied with IEC 332-3/A. In addition, fire resistant cables to be used according to the requirement of rules.

Cables to be of ethylene propylene rubber insulated polyvinyl-chloride or polychloroprene sheathed, with/without steel wire braided (or copper wire braided) type marine cable.

The other insulating material cables may also be adopted, but permissive operating temperatures of cable conductor should be 85°C.

The cables with polyvinyl-chloride outer sheath to be used where exposed to weather and in the ref. chamber, galley and dangerous space.

For portable appliances, polyvinyl-chloride or polychloroprene sheathed flexible cables or cords to be used.

Special cables such as coaxial cables, compensating 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 to be fixed in accessible position, as far as practicable.

In general, cables running in groups to be fixed on steel hangers or trays.

The cable to be secured with steel hoops or nylon binding tapes, except that cable to be secured with stainless steel hoops on part exposed to the weather.

Where the cables are exposed to mechanical damage, they to 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.

The cables passing between superstructure and fore part of the vessel to be laid through galvanized steel pipe with sleeve couplings and expansion joints.

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.

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.

62 ELECTRIC SOURCE

620 General

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 and supply electric power to necessary loads throughout the vessel; such as motors, electric heaters, lighting, nautical instruments and radio equipment.

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, nautical instruments, emergency lights, one set steering gear and emergency fire pump etc, when the main power supply fails.

621 Main generator

6211 Diesel generator

Type:	Drip-proof, self-ventilated type with washable type air filter
Output:	abt 600 kW
Voltage:	AC 450 V
Phase:	3 PH
Frequency:	60 Hz
Power factor:	0.8
Rating:	Continuous at full load.
Insulation:	Class "F"
Exciting system:	Brushless, self-excitation.
Protection:	IP 23.

Other particulars and construction of the main generators to be in accordance with makers' standard.

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 to be fitted in the stator winding of each phase of generator for alarm,

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 (maximum of 85% output)
Normal sea going with displace ballast water	Two (2) sets
Arrival or departure	Two (2) sets
In port	One (1) set

622 Emergency generator

Type:	Drip-proof, self-ventilated type
Output:	Abt.99 kW
Voltage:	AC 450 V
Phase:	3 PH
Frequency:	60 Hz
Power factor:	0.8
Rating:	Continuous at full load
Insulation:	Class "F"
Exciting system:	Brushless, self-excitation
Protection class:	IP23.

Other construction and characteristics of the emergency generator to be in accordance with the maker's standard.

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.

The generator to be started automatically in case of occurrence of the power failure of the main power supply and supply electric power to the loads automatically. After restoration of electric power from the main generator, the power supply system to be automatically disconnected from the emergency generator and connect to the main generator. The emergency generator engine to be stopped manually.

622 Transformer

(a) For general service

Two (2) transformers to be installed in the engine room for general lighting system, domestic service, interior communication, nautical instruments and radio device etc.

Principal particulars to be as follows:

Type:	Drip-proof, dry type
Output:	120 kVA
Number:	2 (one as spare)
Voltage:	AC 450/230V
Phase:	3 PH
Frequency:	60 Hz
Insulation:	Class F
Rating:	Continuous
Cooling system:	Self-cooling

(b) For emergency service

Two (2) transformers to be installed in the emergency generator room for emergency service.

Principal particulars to be as follows:

Type:	Drip-proof, dry type
Output:	35 kVA
Number:	2 (one as spare)
Voltage:	AC 450/230 V
Phase:	3 PH
Frequency:	60 Hz
Insulation:	Class B
Rating:	Continuous
Cooling system:	Self-cooling

624 Storage battery

For general use

Storage Battery-

No. of set:	2
Type:	Lead-acid type, maintenance-free
Voltage:	DC 24V

Capacity: abt. 200Ah

Charging & Discharging Board-

One (1) set of charging and discharging board of dead front type for charging the general use batteries and distributing the power of DC24 volts to be installed, complete with silicon rectifier, ammeter, voltmeter, change-over switch, fuses, necessary numbers of mould case circuit breaker for DC 24V feeder circuits and other necessary fittings. Battery charging to be float charging type with AVR. Normal charging facility to be also provided by change over switch

Others

Batteries for emergency generator engine starting and for radio emergency source to be provided according to the Rules and maker's standard.

One (1) set charger for emergency generator starting battery to be provided. Battery charging to be of normal type with AVR.

Radio battery to be charged by a charger incorporated in the radio console.

The power socket and cable with plug etc. for boat battery charging to be equipped (if necessary).

625 Shore connection box

One (1) set of shore connection box for receiving AC 440V volts, 400 amperes, 3 PH, 60Hz shore source to be provided and wired to the main switchboard.

The box to be of drip-proof type with a 400 amperes three (3) pole moulded case type circuit breaker, connecting terminals and phase sequence indicator.

The shore connection box to be of wall mounted type and to be installed in the emergency generator room or near.

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 440V 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 exhaust fan etc.

Non-essential services and other small motors to be connected to each distribution board or group starter board fed from AC440V 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 distribution board and AC 220V system of radio equipment and nautical instruments to be fed from AC 220V feeder panel of the emergency switchboard.

DC 24 system of alarm, some interior communication equipment and nautical instruments to be fed from the battery charging & discharging board.

631 Main switchboard

One (1) main switchboard for receiving power from the main generators, and feeding to general loads to be installed in the engine control room.

The main switchboard to be multi cubicle, metal enclosed, self-supporting, dead front type and complete with necessary fittings and instruments.

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 main switchboard to have hinged front doors and removable rear side covers.

The main switchboard to consist of main generator panels, synchronizing panel, AC 440V feeder panels, group starter panels and AC 220V feeder 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 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 generator panel : (or according to maker's standard)

- 1 - Air circuit breaker
- 1 - AC ammeter
- 1 - Change-over switch for AC. ammeter
- 1 - AC voltmeter
- 1 - Change-over switch for AC voltmeter
- 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 with a select switch for each generator and main bus bar
- 1 - Dual indication oscillation type frequency meters and select switch for each generator and bus-bar
- 3 - kW meters
- 3 - ACB control switches.
- 3 - Governor control switches.
- 1 - Synchroscope with control switch
- 1 - Set of 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 - Select switch for stand by generator
- 3 - Diesel generator stand-by indication lamp
- 1 - Emergency generator running pilot lamp

And other necessary equipment.

Bus bar should have possibility of isolation feeder 1 & feeder 2

Cabling of Gen should run from two different path separately port & stbd

440V Feeder panel

Necessary quantity - Moulded case type circuit breakers (with abt. 10% spare)

- 1 - Moulded case type circuit breaker for shore supply
- 1 - Shore supply indicating lamp (white lamp)
- 1 - Insulation monitor with alarm lamp for checking AC 440V system.

AC 220V feeder panel

Necessary quantity - Moulded case type circuit breakers (with abt. 10% spare)

- 1 - Insulation monitor with alarm lamp for checking AC 220V system
- 1 - AC ammeter
 - 1 - Change-over switch for AC ammeter (for each phase of power transformer secondary circuit)
- 1 - AC voltmeter
 - 1 - Change-over switch for AC voltmeter (between each phase of power transformer secondary circuit).
- 1 - Megg-ohm meter with change-over switch

Group Starter Panels

The starters for the important pumps and ventilation of the engine room to be assembled into group starter panels, each unit to have circuit breaker, 440/220V transformer, contactor, thermal relay, indicating, push buttons etc., which are fixed type.

632 Emergency switchboard

In principle, the construction of the emergency switchboard to be similar to the main switchboard.

The emergency generator to be protected by a three-pole air circuit breaker, which is non draw-out type.

The isolation link between the bus-bar and the ACB to be provided.

Interlock circuit to be provided between emergency generator A.C.B and the space heater circuit.

The switchboard to be consisted of the following: (or according to maker's standard)

Generator panel

- 1 - Air circuit breaker
- 1 - AC ammeter
- 1 - Change-over switch for AC ammeter
- 1 - AC voltmeter
- 1 - Change-over switch for AC voltmeter
- 1 - Frequency meter.
- 1 - Change-over switch for frequency meter (for emergency generator and main source)
- 1 - kW meter
- 1 - Automatic bus transfer switch (bus tie breaker)
- 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 - Manual voltage adjuster
- 1 - Red lamp for ACB abnormal trip
- And other necessary equipment

AC 440V/220V Feeder panel

Necessary quantity - Moulded case type circuit breakers (with abt. 10% spare)

- 1 - Insulation monitor with alarm lamp (for AC 440V & 220V).
- 1 - AC ammeter
- 1 - Change-over switch for AC Ammeter (for each phase of emergency power transformer secondary circuit)
- 1 - AC voltmeter
- 1 - Change-over switch for AC voltmeter (between each phase of emergency power transformer secondary circuit)
- 1 - Megg-ohm meter with change-over switch for AC 440V & 220V line

634 Section board and distribution board

All section boards and distribution boards to be enclosed with steel sheet case.

Distribution boards and section boards fitted in the living quarters and those fitted in the engine room, steering gear room, stores and other similar places to be of drip-proof type.

In general, distribution boards and section boards to be equipped with two or three pole molded case type circuit breaker with over-load and short circuit protected. At least one (1) spare breaker to be provided in each board.

The circuit label showing the service of each outgoing circuit to be fitted at the inside of the door.

635 Connection box

All boxes to be drip-proof or waterproof construction depending on their locations.

The waterproof type connection box exposed to weather to be of brass-made.

637 Test panel

One (1) set of wall mounted type test panel to be installed in the electric workshop.

The panel to be provided with following devices:

Each one (1)	Set of test terminals of AC 440V 3PH and AC 220V 1 PH both up to 10A
One (1)	Set of test terminals of DC 24V up to 5A
One (1)	Fuse checker
Each one (1)	Lamp holder for various fluorescent lights and incandescent lamps.
Each one (1)	Receptacle of non-water-tight and watertight for AC 220V, 15A.

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) Governor motors
- (3) Instrumentation and automation equipment
- (4) Motors and their control equipment supplied as a complete set with auxiliary machinery such as, aux. blower, turning gear, small and household appliances etc.

641 Motor

General

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 or three phase type according to maker's standard.

Enclosure of motors to be generally provided as follows:

Waterproof type (IP56) of motors for exposed to weather.

Totally enclosed type (IP44) of motors for steering gear, axial flow fans, emergency fire pump and motors in engine room, provision refrigerating room, purifier room, galley and laundry and similar space.

Drip-proof type (IP22) for motors in accommodation and other dry spaces.

Space heater to be provided for motors of deck machinery, steering gear, emergency fire pump, M/E turning gear etc.

High current motors should be star-Delta connection.

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.

Insulation

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

In general, starters to be of magnetic control type except that small motors(0.5kW or less) may be manually operated by line switch with protective fuse on each pole.

In general, motors to be arranged to start across the line, but for 60kW and above large capacity motors (MSB feeder), reduced voltage starting means (Star-Delta or auto-transformer starting method) to be adopted.

In general, the control circuits to be isolated from main power source through transformer.

The wiring diagram of starter to be fitted on the back of each starter door.

Ammeters and running hour counters to be equipped on the starters for important motors and motor of 10kW and above.

Starters located out of sight of motors to have local start/stop push button switches near respective motors, except the E/R fan.

(a) Group Starter Boards

In general, starters for non-essential motors to be assembled in group starter boards as far as practicable. The group starter boards to be in combination with starters according to their location and/or purpose.

These group starter boards to be of bulkhead or floor mounting type and to be mounted near the respective motors as far as practicable.

The starters to be built into one enclosed metal box of drip-proof construction with hinged door.

(b) Individual Starter Cabinets

Starters which are not contained in the group starter panels to be mounted in the drip-proof metal cabinet.

The cabinet to be arranged for bulkhead mounting type near the respective motor.

643 Special control

6431 Emergency stop device

Emergency stop push button for engine room ventilating fans, fuel oil pumps, L.O. pump, and other similar oil pumps to be located at the entrance outside the engine room & fire control station.

Emergency stop push button for accommodation ventilating fans to be located in wheelhouse and fire control station.

Emergency stop button for engine room bilge pump to be provided on upper deck (port and starboard), according to the requirement of USCG Regulation.

If sea water discharge pumps having a water discharge outlet beneath the lifeboat place shall be stopped in case of boat launching.

6432 Preferential tripping arrangement

Preferential tripping 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

Total three (3) sets of connection box for secondary circuit of electric welder to be equipped at fore, middle and after part of the ship.

645 Electric warmer for rooms

Electric warmers (AC220V, 2kW) for room to be installed as follows:

- 2 - S/G room
- 1 - Em'cy fire pump room
- 1 - Em'cy generator room
- 1 - Hospital
- 2 - W/H
- 1 - Each common lavatory
- 1 - Bosun store

65 LIGHTING SYSTEM AND SIGNAL LIGHT**650 General**

The vessel to be adequately illuminated throughout with fluorescent lights and supplemented by incandescent lights. Lighting fixtures for flood lighting shall be of halogen type or H.P. mercury type.

The lighting system to 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 and fittings to be of the following type dependent on their location:

- | | |
|----------------------------------|---|
| Waterproof type:
(IP55, IP56) | Spaces exposed to the weather, pipe funnel, refrigerated chamber, E/R below floor, oil separator room, galley, laundry and common lavatory etc. |
|----------------------------------|---|

Drip-proof type: (IP22)	Machinery spaces, store room, pantry etc. wet spaces.
Non-waterproof type: (IP20)	All cabin, mess room, wheelhouse, engine control room and office etc. dry spaces.
Explosion proof type:	Battery room, paint store, acetylene store and other dangerous spaces.

651 Illumination level

None.

652 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, office, recreation room etc.
Fluorescent ceiling light (20W x 2, surface type)	Galley, laundry, common lavatory
Fluorescent corner light (20W x 1)	Inner passage, staircase
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 room, recreation room, senior officer day room
Incandescent pendant/wall light(60W)	Outer passageway

Machinery space

Lighting fixture	Space/location
Fluorescent pendant light (40W x 2, 20W x 2)	Engine room, steering gear room, emergency generator room and other machinery space.
Fluorescent ceiling light (20W x 2, flush type)	Engine control room
Incandescent pendant light (40W)	Pipe tunnel, funnel inside, escape trunk, under the E/R lower floor
Incandescent spot light (100W, with adjustable arm)	On work face of machine tool and worktable in workshop
Halogen type flood light (500W, 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 ceiling light (20W x 2, red)	Above the wheelhouse console for night navigation

Store

Lighting fixture	Space
Fluorescent pendant light (20W x 2) or incandescent pendant light (60W)	General storage spaces
Incandescent pendant light (60W)	Ref. chambers

Incandescent pendant light (60W, explosion-proof type)	Battery room, paint store, acetylene store etc. dangerous spaces
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Outdoor light

Lighting fixture	Qty	Location	Illuminated area
1000W halogen lamp	2	Compass deck front	Main deck cargo space
	2	Foremast-behind	
500W halogen lamp	2	Navigation deck after	Funnel mark
500W halogen lamp	2	Navigation deck side	Ship' name
200W halogen lamp	2	Foremast-forward	Fore mooring space
200W halogen lamp	2	Superstructure after	Stern mooring space
500W halogen lamp	2	Main deck side	Accommodation ladder
200W halogen lamp	2	Main deck side	Pilot ladder
500W halogen lamp	2	Boat deck	Lifeboat embarkation and outboard

Portable lamps

Each four (4) portable type 220V, 300W incandescent cargo lamps to be supplied for each cargo hold. All of these portable lamp to have 20m 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 with four (4) sets switch.

Total ten (10) sets of 24V,60W portable work lamp with ten (10) meters flexible cord and plug to be provided.

653 Emergency lighting

None.

654 Control of lighting

The ceiling lights in the engine room to be generally controlled by moulded case circuit breakers 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.

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 mould case circuit breakers of the distribution boards.

The lights for the outside passages to be controlled from the wheelhouse.

The outside flood lights to be controlled by respective switches on the group switch panel in the wheelhouse.

The lights in the staircase, nav. equipment room and lavatory associated the wheelhouse to be controlled by a door limit switch (if necessary).

The ceiling lights of the explosion-proof type to be controlled by respective switches located in the safety place.

655 Switch and receptacle

6551 switch

Switches in living quarters to be of non water-proof type, and switches in the machinery spaces, galley, laundry, toilets etc. to be of water-proof type in general.

Switches to be constructed for surface mounting in general, and flush type switches to be provided for the spaces where steel wall and linings are fitted, such as the wheelhouse, crew space, mess room engine control room etc..

The switch for cold provision stores and lobby lighting to be with a red indicating lamp to indicate when the inside lights are on.

6552 Receptacle

(a) Non-water-proof type receptacles

Receptacles for small electric appliances to be of non-waterproof, two (2) poles with earthling contact type, AC 220V 10A capacity and to be fitted as follows:

At least two (2) free receptacles to be provided in the wheelhouse, chart space, radio space, hospital, engine control room, all crew's cabins, corridors, office, mess room and other common rooms.

Moreover, each one (1) receptacles of two (2) poles, DC 24V 5A capacity to be provided in the rear of the main switchboard and the emergency switchboard.

(b) Water-proof Type Receptacles

Suitable number of AC 220V/24V water-proof, two (2) poles with earthling contact type with switch receptacle boxes to be fitted in steering gear room, engine room, air conditioning room, bos'n store, galley, outside of ref. provision chamber, engine's work shop, em'cy generator room, laundry etc. to be used for portable lamps or tools.

Receptacles fitted in weather space to be of brass-made.

656 Special light

None.

657 Navigation light and signal light

6571 Navigation light

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.

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

6572 Signal light

(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.

(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)

One (1) 25W 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 the Kiel Canal stern signal light (green) or Suez Canal stern signal light (red). The colour filter of the light will replaceable.

66 INTERIOR COMMUNICATION, ALARM AND MEASURING SYSTEM

661 Interior communication

6611 Automatic telephone (AC220V & DC24V)

One (1) set of forty (48) line 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 to 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

Two (2) sets of direct calling type sound powered telephone to be installed as follows:

Wheelhouse-Engine control room/main engine side.

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(with dimmer – If possible)

Emergency generator room(anti-noise type)

Captain room

C/Eng. room

CO₂ room

Fire control station

Steering gear room(anti-noise type)

Engine room (M/E side) (anti-noise type)

6613 Hospital calling system (DC 24V.)

2 – Buzzer or bell located in wheelhouse and officer mess room

1 – Call push button 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, electrical engineer's room, passage of engineer's accommodation, meeting room and mess room.

One set of three (3) position switch (call/off/patrol) to be provided on the engine control console.

6615 Duty navigator calling system (DC 24V.)

One (1) main unit to be installed in navigation watch console and each one (1) set of signal box with acknowledge push button to be provided in captain's, chief officer's, 2nd officer's, 3rd officer's, boson's room and mess room.

6616 Public addressor (AC220V & DC24V)

One set of public addressor with talk back system to be provided as follows:

One (1) - 100 watts amplifier with control panel, in the wheelhouse.

Six (6) - Portable microphone, each one (1) on the both bridge wings, life boat embarkation station, ECR, forecastle deck and main deck after.

One (1) - 50 watts of water-proof type speaker on the compass deck forward.

Four(4) - 10 watts of water-proof type speaker, each one (1) on the forecastle deck and main deck after, two (2) in the engine room.

Four (4) - 5 watts of water-proof type speaker, each one (1) on both bridge wings and two (2) near the life boat.

Two (2) - 5 watts speaker in steering gear room and E/R workshop.

Necessary quantity - 2 watts of indoor type speaker with volume controller, in the engine control room, pantry, officer's mess room, crew's mess room, meeting room, gymnasium and inner passage of each deck and other cabin if necessary. (The speakers for inner passages to be of double face type).

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 and fire station.

6622 Engine room signalling and warning alarm (AC220V emergency)

Signalling and warning alarm system to 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 amount of signal boxes to be installed, with the following illuminated signal/alarm identification signs:

- fire alarm – red globe with FIRE sign
- general alarm – red globe with "ALARM" sign
- CO₂ alarm – red globe with CO₂ sign
- Engine room failure alarm – amber globe with FAILURE sign
- Telegraph communication call – milky white globe with TELEGRAPH sign

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.

Power supply – 220V from emergency mains.

6623 Ref. chamber alarm (DC24V)

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 (AC220V emergency)

One (1) set of engine room CO₂ alarm system to be provided for warning before CO₂ extinguishing gas flooding into the engine room, and to consist of a limit switch in the CO₂ release box, electric horn with rotating lamp in engine room and bells with lamp in engine control room, electric horn and bells to be activated by a door switch inside the starter box in the CO₂ room.

6625 Fire detecting and alarm (AC220V)

One (1) set of fire detecting and alarm system in passage, stair of accommodation area and engine room to be provided as follows:

One (1) - Fire alarm panel in the wheelhouse

One (1) - Fire alarm repeater in engine control room or fire station

Heat detector in galley, smoking room and engine room.

Smoke detector in passage, stair of accommodation, engine room, steering gear room and other machinery space.

Flame detector above the main engine and aux. engine.

Explosion proof type heat detector to be fitted in battery room if necessary.

Manual alarm push button - In passage near the exit, engine control room, entrance to the E/R, steering gear room etc..

Emergency batteries to be built in fire alarm panel, when main net failure, the emergency batteries to support the system working normally.

6627 "Dead man" alarm

Dead man alarm system to be provided.

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/Engr'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 (3) face type indicator in the wheelhouse
- One (1) - Indicator in the engine control room
- Each one (1) - Indicator on both bridge wings.
- One (1) - Indicator in the steering gear room.

lamination 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 slave clock control panel in chart space.

Two (2) hand slave clock:

Decorative type: Each day room of senior officer Class
Mess room, conference room etc. public space

Ordinary type: Each crew room

- Each office
- Hospital
- Pantry

Three (3) hand slave clock: Wheelhouse, engine control room, radio space.

6634 Rate of turn indicator

None.

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 server, PC work station and personal computers to be supplied by the Owner.

The LAN shall include one (1) server unit and six (6) personal computers with printer, they to be installed in 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

The PC work station in captain office to be linked up with INMARSAT-F for data and E-mail transmission.

Three (3) power outlets (AC220V) for each work station to be provided and fed from separate circuit of special distribution board.

665 Others

6651 Detection system of water ingress into cargo hold

One (1) set of water ingress into cargo holds detection system consist of one (1) detector in each cargo hold, one (1) controller box in wheelhouse and extension annunciator in ECR & ship's office to be installed.

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.

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
- 1 – Repeater with pedestal on each bridge wing
- 1 – Repeater in the steering gear room
- 1 – Digital repeater in the steering stand of W/H
- 1 – Course recorder on the wheelhouse chart space

Repeater circuits for the radar's, standard B type satellite communication system, 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 (1) - Steering unit incorporated into the navigation watch console.

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.

Hydraulic power unit with control box and feed back unit to be arranged in steering gear room.

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:

- One (1) - Recorded unit in the chart space
- One (1) - Transducer located in bottom of the vessel fore.
- One (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:

One (1) - main unit with speed and distance indicator in the chart space.
Three (3) - speed indicator at the wheelhouse front wall, captain day room and engine control room.
One (1) - Transducer unit in bottom of vessel.

The speed signal to be connected with radars, AIS and VDR.

6723 Radar (AC220V)

Two (2) sets of marine rasterscan radar to be provided.

	NO.1	NO.2
Frequency band:	X-band	S-band
Peak output power:	25kW	30kW
CRT 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.

Gyro, speed log, DGPS signals to be sent to radars.

6724 DGPS navigator (AC220V & DV24V)

One (1) set of DGPS navigator with necessary accessories to be provided 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 (1) set of voyage data recorder system to be provided as follows:

One (1) main electronics unit for data acquisition and recording to be installed in the suitable space of bridge deck.

One (1) 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 (DC 24V)

One (1) set of AIS with necessary accessories to be provided according to IMO rules.

One (1) transponder to be installed on radar mast and one (1) controller to be installed in the wheelhouse.

Gyro and DGPS signal and other information requirement by rules to be sent to AIS.

674 Electronic chart display & information system

None.

675 Other instruments

6751 Window wiper (AC220V)

Window wipers with heater to be provided on each front windows of the wheelhouse.

The wipers to be of horizontal movement type.

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

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 on (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

Each one (1) set of air horn and electric motor horn complete with automatic fog signal control to be provided. The above-mentioned air horn and electric motor horn to meet IMO recommendation.

Electric motor horn and air horn to be mounted on the fore mast and on the radar mast respectively,

both wings of the bridge deck and in each side of wheelhouse, and to be capable of automatic blowing for fog signal by means of time controller.

including one (1) time controller in the wheelhouse. They to be operated by push button switches at The time controller and push button switches to be used in common for the air horn and electric motor horn. In addition, the air horn on the radar mast to be operated by mechanical pull from the wheelhouse.

Electric heater for the air horn and electric motor horn to be provided.

6755 Sound reception device

None.

676 Bridge console

6761 Navigation watch console

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 limit 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 switch for the accommodation fans
Remote start and stop button for fire pump
Dimmer switches

Main engine remote control unit
Steering stand unit
Steering gear alarm and motor remote control unit
Radar displays
Main compass and repeater
VHF radiotelephone
Etc.

The navigation watch console to be supplied from the AC 220V normal supply system, the AC220V emergency supply system and the DC 24V-supply system.

68 RADIO COMMUNICATION EQUIPMENT

Radio 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 400W MF/HF radio station to be provided and consist of the following equipment:

- 1 - Main transmitter and self-supporting antenna
- 1 - Main receiver and whip antenna
- 1 - DSC watch receiver and whip antenna
- 1 - DSC terminal
- 1 - NBDP terminal
- 1 - Controller
- 1 - Antenna tuner
- 1 - Set of 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/IW. VHF radiotelephone to be provided as follows:

- 1 - Transmitter and receiver including DSC terminal with printer
- 1 - DSC watch receiver on CH70
- 1 - Whip antenna
- 1 - Remote controller unit for captains day room.
- 2 - Socket boxes fitted at both bridge wings (one handset to be provided)

Power source to be AC 220V and DC 24V

DGPS signal to be sent to No.1 VHF radio telephone.

(b) NO. 2 VHF Radiotelephone

One (1) set of international 25W/IW VHF radio telephone used as the duplication of No. 1 VHF to be provided as follows:

- 1 – Transceiver unit with DSC terminal with printer in the wheelhouse
- 1 – DSC watch receiver on CH70
- 1 – Whip antenna on compass deck.

Power source to be AC 220V and DC 24V.

DGPS signal to be sent to No.2 VHF radio telephone.

Both of them to supply signal to VDR

683 Satellite communication system

Inmarsat ship earth station – F

One (1) set INMARSAT SES – F standard to be installed, consisting of:

- 1 - Main unit (radio space)
- 1 – Display and keyboard
- 1 - Printer
- 2 – Telephone (one in captain day room, another in navigation watch console)
- 1 – Facsimile with telephone in radio space
- 1 – Antenna on compass deck

The power supply to be AC 220V.

DGPS signal to be sent to INMARSAT-F system.

Inmarsat Ship Earth Station-C

One (1) set of INMARSAT SES-C standard to be provided as follows:

- 1 - main unit with EGC receiver (radio space)
- 1 - printer
- 1 – antenna on radar mast

Power source to be AC 220V/DC 24V

684 Portable radio device

6841 Two-way VHF radiophone

Two way VHF radiotelephone with battery charger to be provided for lifeboat use.

6842 Radar transponder

9 GHz radar transponder to be provided in the wheelhouse

6843 Satellite emergency position indicating radio beacon

406 MHz and 121.5 MHz self float type sat. EPIRB to be provided on compass deck.

6844 Walkie talkie

Six (6) sets of walkie talkie (400MHz) with battery and charger to be provided.

685 Navtex Receiver

One (1) set of Navtex receiver to be provided as follows:

- 1 - receiver, 518 kHz (chart space)
- 1 - Whip antenna (compass deck)

Power source to be AC 220V and DC 24V

686 Broadcast & television receiving antenna system and recreation equipment

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

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.

69 SUPPLEMENTARY OUTFITS AND SPARE PARTS

691 Supplementary outfits

To be supplied as follows:

6911 For general use

- One (1) – universal meter
- One (1) - 500 volts portable megger
- One (1) - portable clamp - on ammeter
- One (1) - diagonal cutting plier

Two (2) - cutting pliers
One (1) - set of- screw driver
One (1) - Jack knife
Each one (1) - soldering iron (AC 220V 25W, 75W, 150W and 1kg soldering wire)
One (1) - pistol drill
One (1) - set of steel file
Each one (1) - monkey wrenches (6", 8", 10")
One (1) - set of open end wrench
One (1) - set of socket wrench
One (1) - hand bow saw
One (1) - hammer
One (1) - wire stripper
One (1) - convolution rule (3m)
One (1) - tool box.

6912 For storage battery

Two (2) - rod thermometers (alcohol)
Two (2) - suction type hydrometers
Two (2) - funnels
Two (2) - measuring cup (500 CC)
One (1) - bottle of diluted sulfuric acid (5 liters)
One (1) - bottle of distilled water (10 liters)
Two (2) - acid resistant gloves

6913 Cable

Ethylene propylene rubber insulated, polyvinyl-chloride or PCP sheathed cable
(2 x 1.5) 30m
(3 x 1.5) 30m

EP rubber insulated flexible cable - (2 x 1) 30m
PVC insulated flexible wire - (1 x 2.5) 100m

692 Spare parts

The necessary number of spare parts to be supplied according to requirements of the Classification Society and maker's standard.

All spares to be placed in steel boxes duly labeled/marked and boxes to be placed in shelves in spares store room.