

TECHNICAL SPECIFICATION

OF

2500TEU CONTAINER SHIP

M2004M-4034-01

June 21, 2004

MARINE DESIGN AND RESEARCH INSTITUTE OF CHINA

CHAPTER 0

GENERAL

0.1 PREFACEGeneral Description

The intent of this Specification is to describe particulars of the vessel considering that Builder will deliver the vessel fully in compliance with Rules listed under 0.11.

It is understood that:

- any part of the ship's equipment, machinery or spares mentioned several times in this Specification shall be delivered only once,
- the equipment listed in this Specification may be substituted with equivalent one, provided that it is agreed by the Owners.
- all dimensions given in this Specifications are subject to Shipyard/Makers standard tolerances.
- all the equipment will be made and tested as per the basic maker standard.
- equipment not mentioned in this Specification will be not delivered with the vessel unless required by any Rules and Regulations listed under para 0.11 (with exception of Owner's delivery).
- Vessel and equipment parameters given herein as „about” may be adjusted by the Builder as reasonably necessary.

In the event of conflict or inconsistency between the terms of the parts of this Specification, the Hull part will prevail in respect of hull items, the Deck Equipment part will prevail in respect of deck equipment items, the Accommodation part in respect of accommodation equipment and arrangement and paint specification items, the Engine Room and Piping part in respect of machinery and hull piping items, the Electric Installation part in respect of electrical, navigation and auto and remote control items, and the Refrigerating Plant part in respect of refrigerating machinery items.

It is regarded that Chapter 0 “General” prevail all other chapters of this Specification.

0.2 TYPE AND GENERAL CHARACTERISTICS

The ship is container vessel intended for carriage:

- 20 and 40 ft ISO standard containers in holds and on deck,
- 45 ft containers on main deck (above engine room),
- 400 units of reefer containers sockets to be provided, in which about 200 reefer sockets on deck and hatch covers (two tiers) and about 200 reefer sockets in Hold No.3/4/5.

The ship is a single screw motorship with B type freeboard, fitted with one fixed pitch propeller driven by one two stroke low speed marine main engine. The ship has five cargo holds, engine room and accommodation aft, transom stern, symmetric stern, bulbous bow, raked stem, one semi-balanced rudder, bow thruster and enclosed wheelhouse wings

The ship is prepared for the carriage of IMO dangerous cargo in containers:

Hold No. 1 prepared for IMO cargoes of 1, 2, 3, 4, 5.1, 6.1, 8 & 9 classes as per SOLAS, Chapter II-2, Reg.19;

Holds No. 2,3,4,5 prepared for IMO cargoes 1.4S, 2, 3, 4, 5.1, 6.1, 8 & 9 classes. In Hold No.5, the dangerous cargo should be loaded 3m far away the bulkhead between engine room and Hold No.5

Three (3) single deck cranes and one (1) bow thrusters to be installed.

The air draft should be less than 150 ft from top of radar mast to waterline at ballast condition.

For ship's layout please refer to General Arrangement Plan

Ship's systems designed for following conditions:

– sea water temperature [°C]	WINTER	0	/	SUMMER	32
– ambient air temperature [°C]	WINTER	-20	/	SUMMER	35
– air relative humidity [%]	WINTER	85	/	SUMMER	70

0.3 PRINCIPAL DIMENSIONS

Length overall	abt.	208.90 m
Length b.p.	abt.	196.90 m
Breadth moulded		29.80 m
Depth to main deck		16.40 m
Design Draught		10.10 m
Scantling Draught	abt.	11.40 m

0.4 CLASS

The ship will be designed and built to the Rules requirements and under survey of the Germanischer Lloyd and eligible for the class notation:



**100 A5 E Container Ship, IW, NAV-O, SOLAS II-2, Reg. 19, RSD, BWI-F
+MC E AUT**

0.5 DEADWEIGHT

The deadweight of the ship when completely outfitted and ready for service and floating on the even keel in sea water 1.025 t/m³, at design draught will be about 26,800 t and at scantling draught will be about 33400 t.

The a/m figure includes cargo, diesel oil, fuel, lubricating oil, fresh water, ballast water, provisions, stores, crew with their luggage and effects, dismantling type fixtures for containers securing/positioning, inventories and spare parts in excess of those require/recommended by the Classification Society.

Draft reading for ascertaining the lightship weight of the vessel shall be taken at three (3) stations, i.e. at the stem, stern and midship (both sides) draft markings, if any deductible weights are aboard the vessel at the time of determining the lightship weight, their actual weight is to be ascertained by the Builder.

The deadweight calculation shall be made by the Builder and submitted to the Owner for approval.

0.6 CONTAINER CAPACITY

The ship suitable for carriage of 20ft ISO containers, (20' × 8' × 8' 6") fulfilling IMO visibility requirements:

- in holds: abt. 984 TEU
- on decks: abt. 1528 TEU

TOTAL abt. 2512 TEU

Notes:

1. For Panama Canal visibility requirements total number of a/m containers will be decided later.
2. Containers in top layer in holds could be 9'6" high except Hatch No.1 where containers 8'6" are carried.
3. Assumed height of containers on deck: 8'6".
4. Following numbers of containers may be carried:
 - 45 ft - 50 pcs on main deck above engine room

0.7 REGISTER TONNAGE

The tonnage figure:

- abt 25300 GT
- abt 12700 NT

The tonnage calculations based on the International Convention for a Uniform System of Tonnage Measurement, London 1969.

0.8 STORAGE / BALLAST TANK CAPACITIES

Tanks will be approximately as follows:

Heavy fuel	abt	2750 m ³
Diesel oil	abt	220 m ³
Fresh water	abt	200 m ³
Ballast water	abt	9600 m ³
Sludge	abt	100 m ³
ER bilge water	abt	60 m ³

0.9. CRUISING RANGE

Cruising range of the vessel is abt 13,000 Nm world wide trading based on fuel tank capacity:

- service speed 22.0 knots
- 90% MCR
- one day margin

0.10 SPEED

Service speed of the vessel will be 22.0 knots under following conditions:

- draught 10.10 m.
- zero trim
- 90 pct MCR
- wind not exceeding Beaufort 2
- sea state not exceeding 2
- water depth more than 7 times ship's draft
- unfouled hull

Trial speed will be measured during sea trials at a ballast draught corresponding to the conditions used during tank tests. Compliance of the ballast trial results with the tank test results in said ballast condition will be considered as compliance of the ship with the contract conditions concerning the speed.

For a given speed, where the power measured at the ballast trial varies from the tank test results, the loaded power at the speed shall be evaluated as follows.

The power, for a given speed, at load draught shall be the loaded tank test result multiplied in the ratio of the measured ballast power divided by the tank test result of ballast power, for the speed under consideration.

If the actual weather conditions or water depth or ship displacement (draught) are different as above during speed trials, the measured results to be corrected in compliance according to Builder practice.

Speed will be confirmed by the average out of 2 trial runs. Speed measurements carried out by means of differential GPS.

During speed trials the exact output of the ME will be measured by torsionmeter and recorded as well as fuel consumption (with fuel counter).

All other parameters such as pressure and temperatures for the Main Engine performance evaluations will be recorded.

The propeller will enable the Main Engine to be loaded to 100% load in service and overloaded according to Classification Rules.

0.11 RULES AND REGULATIONS

The ship shall comply with requirements of the following international rules and regulations:

1. Classification Society Rules (Germanischer Lloyd).
2. International Convention for the Safety of Life at Sea, 1974 with Protocol of 1978 and Amendments, including GMDSS. Issue 2001/2003 amendments
3. International Convention on Load Line, 1966 as amended by 1988 Protocol to the Load Line Convention and June 2003 Amendment (Res.MSC 143/77) in the extent agreed upon with GL.
4. International Convention for an Uniform System of Tonnage Measurement of Ships, 1969.
5. International Convention for the Prevention of Pollution from Ships, 1973 with Protocol of 1978 and Amendments of 1984,1985,1987,1989,1990,1991 and 1992 (MARPOL 73/78) with Annexes I, IV and V including revised Annex IV becoming effective in July 2005, subject of availability of equipment if equipment not available on time, the original Annex IV shall apply.
6. International Regulations for Preventing Collisions at Sea, 1972 and amendments 1981 (IMO Resolution A.464(XII), 1981.
7. Flag - Liberia
8. International Telecommunication union radio regulations, 1994 edition.
9. Radiocommunication Code, Geneva 1976.
10. Suez Canal Regulations, 2003, edition 1995 and amendment 2003.
11. Panama Canal Regulations, 1984. Notice to Shipping N-01-2003

12. US. Coast Guard Rules and Regulations for Foreign Vessels Operating in the Navigable Waters of the United States, 1986 edition, Title 33, Chapter 1, Part 155.310, 155.320, 159 and 164.
13. ILO Convention 92 and 133 (crew accommodation).
14. ISO Vibration Levels Guidelines 6954 - 2000
15. IMO resolution A468(XII) „Code on Noise Levels Onboard Ship”.
16. SOLAS II-2, Reg 19 (dangerous cargo), according Contract Specification.
17. ILO Codes of practice, safety and health in dockwork.
18. ISPS Code.
19. IMO resolution A.708(17), recommendation of guidelines on navigation bridge visibility.
20. Australia and New Zealand Waterside Workers Federation Rules as applicable to hold entrances and ladders, including Australian Marine Safety Authority, Marine Orders, Part 32, Issue 2, Order No.14 of 1997, (appendix 16, para 1.2. concerning spacing of freight containers)
21. Resolution MSC.137(76) adopted on 4 Dec.2002, Standards for ship Manoeuvrability and MSC/Circ.1053 with explanatory notes.
22. Occupational Safety & Health Administration, U.S. Department of Labor – OSHA regulations (standards – 29 CFR)-Containerised cargo operations (without inspection, certificate or letter of compliance)

All above Rules and Regulations including their amendments as valid on the contract signing date.

0.12 CERTIFICATES

The ship delivered with the following class certificates issued by Classification Society:

1. Class certificate for hull and equipment.
2. Class certificate for machinery.

Besides, the following delivered:

1. Cargo ship construction safety certificate (GL).
2. Cargo ship equipment safety certificate (GL).
3. International load line certificate (GL).
4. International tonnage certificate (GL)
5. Suez Canal tonnage certificate (GL).
6. Panama Canal tonnage certificate (GL).
7. Potable Water Certificate (Authorities).
8. Bilge Water Separator (GL) including USCG approval number

9. Certificate of Sewage Pollution Prevention (GL) including USCG approval number.
10. Builder's Certificate (Builder).
11. De-ratting Exemption Certificate (Authorities).
12. Radio Safety Certificate (GL).
13. IOPP Certificate (GL). Annex I, IV, V.
14. Magnetic Compass Calibration (Authorities).
15. Certificates for Navigation equipment (GL).
ISO 8468 (1990) SOLAS V/15 + MSC / Circ.982
16. Cargo Securing Manual, Stability + Longitudinal Stress Manual (corporation owner/yard).
17. Certificate of compliance of carriage of dangerous goods (GL).
18. Certificate of compliance of ILO Convention 92 and 133.
19. Certificate of compliance of Suez, Panama, USCG regulation for foreign flag (GL).
20. Certificate concerning pollution prevention garbage MARPOL, Annex 5 (GL)
21. Cargo Gear certificates, cargo gear book (GL).

The documents listed issued by Authorities as noted in brackets.

0.13 MODEL TESTS

The hull form for the ship will be tested in model test tank, with the following tests:

- resistance test on design & scantling draught and ballast draught,
- wake measurement for 10.10 m draught 22.0 knots speed,
- propeller design and open water test of final propeller,
- cavitation testing for design draught,
- self-propulsion test on ballast draught and design & scantling draught even keel, with designed propeller, including speed predictions for trial and service conditions.

results of a/m tests will be used in speed trials.

0.14 STABILITY AND LONGITUDINAL STRENGTH

The ship's stability will comply with IMO requirements(IMO resolution A.749(18) as amended by resolution MSC.75(69)) for vessels of unrestricted cruising area.

The stability calculations will be done according to IMO requirements with VCG of containers assumed 45 pct high.

The vessel will be able to carry about 1880 TEU of 14 t homogeneous containers at below given conditions:

- stores 10% or 100%,
- necessary water ballast,
- VCG of container assumed at 45% of height,

- container height 8'6",

An inclining experiment to be carried out upon completion of the vessel and a stability information booklet to be worked out for the conditions agreed upon with the owners, besides the conditions required by rules (14t/TEU), the stability information shall include also conditions with homogeneous containers with varying loads per TEU (8,10,12,16,18 t/TEU) for design and scantling draft. The additional conditions shall also include a partly loaded docking condition with about 5000t of cargo in the middle holds. In all operating conditions the trim shall not exceed 0.2m by bow and 1.5m by stern.

If, before departure of the vessel, the final trim and stability booklet is not available due to approval process, the builder shall provide the vessel with the provisional trim and stability booklet for temporary use until the approved booklet is obtained.

0.15 NOISE/VIBRATION LEVEL

Vibration levels in accommodation and working spaces normally occupied shall satisfy recommendations of ISO 6954 – 2000 (E) – below upper curve.

Noise level in accommodation and working spaces normally occupied shall not be higher than that admitted by Rules specified in para 0.11 – IMO Resolution A468(XII).

Vibration and noise measurements will be carried out on sea trials performed at sea state not exceeding 3 and sea depth over 8 ship draughts with ship sailing with service rpm (max load of main engine – 90% MCR).

When the vibration and/or noise level is found to be exceeding the specified level, reasonable countermeasure shall be taken to improve the vibration response and/or noise characteristics – by mutual agreement between the Owner and the Builder.

0.16 MATERIALS AND WORKMANSHIP

Structural steel materials of main hull structure will be of the quality as required by the Classification Society.

Certified machinery and equipment will be of quality acceptable to the Regulatory bodies and suitable for the purpose intended.

Other materials and equipment will be applied according to ISO.

Quality control – as per Builder practice plus Owner's supervision.

Workmanship – according to CSQS(China Shipbuilding Quality Standard) and Builder practice.

Asbestos containing materials are specifically excluded from the construction.

0.17 INVENTORIES AND SPARE PARTS

Inventories will be delivered as per Inventory List and stored as per agreed distribution.

Inventories not mentioned in above list, neither requested by the Rules mentioned under item 0.11 or necessary for normal ship service will be Owners delivery.

Spare parts for the equipment certified by the Classification Society will be delivered as required and/or recommended by Classification Society, and for the equipment beyond the Classification scope as recommended by the Makers, and stored as per agreed distribution

0.18 TEST AND TRIALS

Test and trials to be carried out in agreement with Owners and maker's acceptance to the requirements of the Classification Society and to Builders standard.

The program of dock and sea trials will be arranged upon with the Owner and Classification Society.

The Builder shall prepare and submit the detailed schedule or memorandum for the test items for approval of the Owner and/or Regulatory Bodies in due time prior to those tests. Minimum seven (7) days notice for test outside China and four (4) days notice for test and inspection inside China, and 24 hours notice for Supervisor (owners) in yard for normal surveys / approval supervisor in general.

0.19 DOCUMENTATION

Contract documentation:

- Technical specifications
- General Arrangement Plan
- Maker's List

0.20 PLANS FOR APPROVAL

The builder shall submit to the Owner three (3) copies of plans and drawings for approval. Two copies for head office and one copy to site office.

The Owners shall consider the plans and return one copy to the yard within 21 days after receiving as approved or commented.

The Builder's standard plans and subcontractors' or manufacturers' plans may be used as plans of classification project with or without modifications.

The builder shall submit to the Owner for approval modifications or alterations required by the Class Society and other regulatory bodies or mutually agreed by the Owner and builder

0.21 FINISHED PLAN

Three (3) copies of the Yards delivery documentation scope as per yards standard and three (3) copies of the instruction manuals in scope as per Maker's standard will be delivered to the ship.

One (1) copy in English non fading each of the following plans to be also framed and mounted on board the ship.

General arrangement, Capacity Plan, Container Stowage Plan.

Fuel Pumping plan

Fire control plan

Life saving plan

Oil transfer process in accordance with U.S.C.G. Rule (3 copies)

Muster Plan

Safety Radio Telegraphy Licence

Bridge Poster acc. To IMO MSC res. A.601(15)

Pilot, Manoeuvres value & curves, Emergency steering instructions (SOLAS Ch V,Reg26)

Live saving signals, acc.to SOLAS Ch V, Reg.29

Drawings and Documentation in electronic type stored in CD-ROM.

By the way, two ship model (scale 1:100 and 1:200 each) for each ship shall be provided by Builder.

0.22 LANGUAGE, UNITS, ETC

In the Specifications and plans, instruments, etc., metric units (MKS) to be used all over including draft mark and table, if not stated otherwise, and language will be English.

Name plates, placards, notices, etc., throughout the vessel will be in English language.

Instruction books, manuals, drawings, parts lists, etc., will be in English. Correspondence will be in English.

0.23 OWNER'S FURNISHED EQUIPMENT

Following equipment including its accessories and spares to be furnished and supplied by the Owner's at their own expense, and installed on board the vessel by the Builder or directly by the Owner's, unless otherwise mentioned in other parts of the Specification:

1. Hobby equipment in excess of those specified in the specification.
2. Nautical instrument not mentioned in Inventory List.
3. Medicine, medical outfit and sterilizer, medicines, ship's medicine box.
4. Galley inventory, pantry inventory.
5. Silverware, crockery, and glassware.
6. Linen, blankets and sheets.
7. Bedding.
8. Mooring ropes other than those required by the Classification Society.
9. Charts, books (nautical almanacs, ITU books, international signal books, register book, tide table, etc.).
10. Paintings and pictures.
11. Hand tools and inventory other than those specified in the specifications.
12. Lub. oil, greases and operating oils of all machinery and equipment.
13. Consumable stores.
14. Spare part and tools above the Classification recommendations and maker's standard.
15. Copy machine, typewriter, personal computers, printers and stationery.
16. Suez searchlight.
17. Gymnastic apparatus.
18. Boiler water test kit.
19. Potable water sampling/test device.
20. Fuel oil sampling/test device.
21. Loading computer with software required by GL.
22. Audio – video equipment (radio, TV, video, etc.).
23. Loose lashing equipment
24. Oxygen and acetylene cylinders.
25. Other in excess of those specified in the specifications.
26. Garbage press
27. SOPEP
28. Training Manual
29. Safety operational & maintenance plan for the fire fighting equipment
30. Garbage management manual
31. Ballast exchange / management manual
32. ISPS manual

33. SMC Safety Management Certificate**34. DOC Document of Compliance**

Water, fuel, oil, lubricants and grease, working oil for all machinery on board will be for the Owner's account except those which have been consumed during trials and tests, which to be borne by the Builder.

All Owner's supplies to be sent to the Builder's shipyard at the time designated by the Builder in a condition ready for installation and at Buyer's expense.

The Builder to be responsible for storing these articles at their shipyard, and to install on board the vessel at the Builder's expense.

Final adjustment into good working order or testing of this equipment on board the vessel to be made by the manufacturer's personnel of its agency, designated by the Owners and/or the manufacturer at the Owner's expense.

If any of the Owner's supplies are subject to approval, inspection and/or certification by the Classification Society and/or other Regulatory bodies concerned, the Owner will arrange with the manufacturers of the equipment, that the equipment is in full compliance with the requirements of the said authorities, and/or certified, before delivery to the Builders. All approval and/or certification fees to be for the Owner's account.

The Owner or the manufacturer designated by the Owner will furnish plans, instruction books, test reports, test certificates, etc. required by the Rules or regulations, to the Builder for preparation of installation.

The Owner will compensate for any expense incurred by the Builder for repair of Owner's supplies due to defective design, defective materials, poor workmanship, poor performances and/or any damage during transportation to the Builder's shipyard.

CHAPTER 1

HULL

1.0. GENERAL

The hull structure will be of all-welded construction.

The quality of weld will be checked by non-destructive testing according to the Yard's standard and classification requirements. Excessive distortions of the hull structure after fabrication will be cured according to the Yard's standard and to class satisfaction. Yard's standard will be submitted to Owners for information.

Materials and scantlings are in accordance with the Classification Rules. The high tensile steel will be applied for main deck, sheer strake, upper strakes of longitudinal bulkheads in holds and continuous longitudinal hatch coamings, less than 50% high tensile steel to be applied. Other structural members will be made of normal strength structural steel.

The hull construction will be reinforced to E ice class requirements.

The scantling draught for hull design is 11.50 m.

Transverse and longitudinal framing system is adopted with following frame spacing:

- 720 mm within after peaks,
- 800 mm within Engine Room,
- 790/620/600 mm elsewhere.

1.1. DOUBLE BOTTOM

Double bottom extends from afterpeak bulkhead to forepeak bulkhead. It is horizontal all over the ship's beam. The double bottom height measured in ship's centre line in holds and Engine Room area is about 1500/2200 mm respectively.

Longitudinal bottom framing extends fore and aft as far as practicable, i.e. both inner and outer bottoms are strengthened in this way.

Plate floors adopted generally at every fourth frame in the area of holds (according to the container distribution) and on every frame in the Engine Room.

Bottom structure forward adequately reinforced against slamming.

Tank distribution in D.B. refers to General Arrangement Plan.

Tank top point load: 156 t/TEU, 180 t/FEU.

1.2. BULKHEADS

Distribution of bulkheads as shown on General Arrangement Plan. All transverse watertight bulkheads extend up to main deck. The bulkheads are of plain construction with vertical stiffeners of rolled steel sections.

Between hatch No.1 and 2, 3 and 4, 5 and 6, 7 and 8, 9 and 10 cross-ties of box construction are arranged extending from side platform to the top of transverse hatch coamings.

1.3. SIDE FRAMING, SHELL PLATING AND LONGITUDINAL BULKHEADS IN HOLDS

For double sides in way of holds a combined transverse longitudinal framing system adopted (transverse below and longitudinal above tweendeck). Other parts of ship's sides framed transversely.

In way of ice belt transverse intermediate frames will be provided and shell thickness increased accordingly to rule requirements.

1.4. DECKS

For main deck in way of holds and engine room a longitudinal framing system adopted. Remaining parts of main deck and all other decks framed transversely.

Hatch dimensions are as below:

- hatch N°1 12.64 m × 15.36 m
- hatch N°2 12.64 m × 20.36 m
- hatch N°3-10 12.64 m × 25.35 m

Continuous longitudinal hatch coamings (height of abt 1.5 m on deck) supporting steel pontoon hatch covers arranged on main deck and forecastle deck.

An assembly hatch to the engine room is foreseen in the main deck forward of front superstructure bulkhead in way of trunked engine casing.

Exposed main deck has camber 100mm , but no sheer.

Continuous gutterway flat bar provided.

Forecastle deck has camber 100 mm but no sheer.

All enclosed decks have neither sheer nor camber.

Main deck in front of superstructure stack load strength:

80 t/TEU, 100 t/FEU.

1.5. STERN STRUCTURE

The ship has transom type, single-screw stern structure. The framing system of transverse type. The transom has vertical stiffeners. Rudder horn, sternframe of symmetrical form together with propeller boss made as a compact cast steel. Chafing bars for ropes provided on sides of transom stern and in way of fairleads.

1.6. BOW STRUCTURE

The foreship and bulbous bow are transversely framed. Stem of welded construction. One bow thruster with anti-suction tunnel installed aft of the collision bulkhead. Chain lockers arranged under forecastle deck of self-trimming design. The anchor pocket to be provided as possible.

Bulkhead plating of chain locker will be 12 mm.

1.7. SUPERSTRUCTURE

Outer and inner steel walls of superstructure will be plain plate with stiffeners..

In the proximity of magnetic compass a non-magnetic steel will be used, and according to recommendation of maker.

The deckhouse decks have camber 100mm outside cabin area, but no sheer; other decks flat.

Bridge wings will be of closed design

1.8. BULWARK

Bulwark of steel plate welded construction are provided as shown on G.A. Plan.

1.9. HULL STRUCTURE MISCELLANEOUS ELEMENTS

1.9.1. Foundations

Main engine foundations is integral with the inner bottom and will create (together with floors and longitudinals) a strong supporting structure.

Suitable and strong foundations for auxiliary engines, pumps, etc., arranged..

Anchor and mooring winches placed on strong foundations welded to the strengthened deck. For all bitts and cleats necessary deck strengthenings are arranged.

All cofferdams and void spaces will be protected against stowaways.

1.9.2. Draught Marks, Freeboard Marks

Draught marks will be provided on the bow, stern transom and midship and will be made of steel plates and welded PS and SB. All in decimals. Freeboard marks, PS and SB executed in the same way.

1.9.3. Bilge Keels

The continuous Bilge keels with 0.3 L long made of bulb plate, fitted on shell plate will be provided.

Positioning will follow streamline model test results.

1.9.4. Fenders, Guard Rails, Break water, F-cle Shelter

The shelter deck will be provided on the f'cle deck.

Guard rails made of half round bar profile arranged in the stern and bow of the vessel below fairleads, chocks.

Round bar as wear protection for mooring ropes will be provided at transom sides.

Rope protection in a way of rudder blade welded to the hull above blade bar.

Rail for ship's name forward will be provided. Ship's name will not be welded in block letter, and to be paint only with basic lines below paint letter.

SOLAS chapter XI, IMO number on transom stern 300mm length.

Regulation 3 IMO number in engine room bulkhead.

CHAPTER 2

DECK EQUIPMENT

2.1. RUDDER ASSEMBLY

The rudder assembly comprises:

- one rudder,
- one steering gear,
- telemotor c/w gyropilot,
- magnetic compass.

2.1.1. Steering Gear

One electrohydraulic, rotary van type steering gear of appropriate power complete. The steering gear has two independent power units (one as stand-by). The steering gear one power unit in operation is capable of putting the rudder from +35 deg to -30 deg with in 28 seconds at ship's maximum service speed. The steering gear has two limit switches to switch off the supply when the angle of the rudder is 35 deg, as well as two overload valves.

Working rudder angle is 60 deg port and starboard if the ship speed is less than 6 knots ,

mechanical stopper provided at 61.5 deg. If the speed exceeds 6 knots, the rudder angle is limited automatically (in electric way), mode switch low angle 35°, high angle 60°, should be arranged on bridge panel in rudder gear control panel.

Hydraulic pumps to be switched-on from the wheelhouse. The gear is bolted to steel welded foundation..

Flat bar 80 × 6 framing around the steering gear counteracts the spill of oil.

2.1.2. Rudder

One streamlined, partially balanced rudder installed behind the propeller. The blade is a welded construction of steel plates.

Steel casting is welded to the upper part of the blade where rudder stock is installed.

The blade is to undergo a tightness test following painting inside. Water drain screws are to be provided in the lower and upper parts of the blade.

Pipe sections welded to the upper parts and near the centres of gravity of the blade for its lifting.

Rudder stock is connected to the blade by means of conical rudder coupling (hydraulically mounted).

The rudder stock has eye bolt in the upper part to enable its lifting and lowering.

The blade is underhand in the upper thrust bearing via rudder stock. The upper bearing is mounted in the steering engine compartment..

Rudder stock and pintle are made of cast steel, liners of stainless steel.

Lower rudder stock bearing bush and pintle bearing bush is made of Thordon.

Pintle and lower rudder stock bearings are water lubricated.

2.1.3. Telemotor c/w Gyropilot

The telemotor electrical transmitter with incorporated gyropilot of adaptive type for automatic steering is mounted in the wheelhouse, and the receivers on the steering gear housing.

Such arrangement enables the following modes of steering from the wheelhouse:

- automatic, by means of the steering column complete with gyropilot combined with signal transmission to telemotor receivers,
- electrical, by means of the a/m column via the steering level with simultaneous signalling to telemotor receivers via two systems (follow-up and switches).
- Override steering tiller (non follow) arranged in the center of navigation panel closed to master / pilot station.

Additionally, steering from both bridge wings is provided.

Mechanical emergency steering of the pumps is also possible from the steering gear compartment.

Rudder position is shown by indicators in:

- the wheelhouse (three dimensional type), conning pos.1 (panama)
- the wheelhouse console, navigation panel.
- the steering gear compartment,
- the ECR,
- on both bridge wings. Conning pos.2 and 3.
- Main steering position (if the separate column).

2.1.4. Magnetic Compass

One periscopic magnetic compass, rose dia 180 mm, with reflection tube in wheelhouse is provided with flexgate sensor, combined to Navdata distribution.

.

2.3. ANCHOR/MOORING GEAR

This gear comprises:

- two windlasses (coupled to electrically driven mooring winches) foreship, with capstan.
- two bow stockless anchors,
- two sections of anchor chain,
- two anchor chain stoppers,
- two anchor chain releases,
- two hawse pipes,
- two anchor chain pipes.

2.3.1. Anchor/Mooring Windlasses Coupled with Mooring Winches.

Two electrically driven anchor/mooring winches are mounted on the deck fore. The winches are capable of lifting anchor from 80 m below sea level with the speed as per GL Rules (taking anchor off the ground excluded).

The winches bolted to steel welded foundation on deck plating.

The deck has appropriate strengthening.

2.3.2. Anchor Chains

Sections of anchor chain are of U3 category steel acc. to GL Rules.

Complete bow anchor cable comprise two cable shots, shot consisting of 27.5 m long sections.

Total anchor chain length is about 687.5 m. Kenter shackles are used to join the section together. The forerunner section of each of two shots is fitted with the swivel shackle and attached to the anchor. A chain locker section is on the other end of the chain. Both bow anchor should be stowed in rest position in anchor pockets incorporated in ships shell and bow construction.

2.3.3. Anchor Chain Stoppers

Roller Type chain stoppers are fitted between the anchor attachments and hawse pipes.

2.3.4. Hawse Pipes

The hawse pipes are made of flanged, steel pipes. They are equipped with an arrangement for flushing anchors with water from the fire installation. Steel covers protect the hawse pipe openings on deck.

2.3.5. Anchor Chain Pipes and Releases

The bow anchor chain is led to the anchor chain locker via steel pipe. Quick chain release is installed above the chain locker. The chain is released by hammering the wedge out. Anchor chain pipe opening is covered with split steel covers.

The chain lockers are arranged on either side of the ship. Abt. 800 mm from the chain locker bottom a grating of steel sheet is arranged as well as a mud hole opening. Drainage by ejector driven by water fire system. The locker is designed for self-stowing of the chain. Min. clearance above the stowed chain is abt 1.5 m. Manhole with hinged cover to provide access to space above chain to be fitted.

2.3.6. Mooring/Towing Gear

all electric driven anchor/mooring winches shall be frequency controlled type.

Foreship:

- two electrically driven anchor/mooring self-tensioning winches of abt. 125 KN mooring pull, mooring speed 18 m/min, c/w separated drum designed for synthetic line and one lateral head capable at least five turns of mooring rope dia.72mm.
- one electrically driven mooring self-tensioning winch of abt 125 KN mooring pull, with double drum, mooring speed 18 m/min, c/w separated drum designed for synthetic line (capable for dia. 72mm, length 200m),
- one towing hawse hole in ship's CL,
- two mooring pipes,
- six multi roller chocks,
- seven bollards,
- four Panama type hawse holes,
- four guide rollers.

Aftship:

- three electrically driven mooring self-tensioning winches of abt 125 KN mooring pull, mooring speed 18 m/min, c/w separated drum designed for synthetic line(capable for dia. 72mm, length 200m) and one lateral head, two winches with single drum and another one with double drum.
- two mooring pipes,
- four Panama type hawse holes,
- six bollards
- six multi roller chocks,
- two guide rollers.

Main deck:

- six bollards and fairleads.

2.4. LIFE-SAVING APPLIANCES

2.4.1. General

They comprise:

- one covered, plastic "Free-Fall" lifeboat, cap. 30 persons, with diesel motor and charging battery by solar collector,
- one crane to pickup the free-fall lifeboat (see also point 2.8.8.),
- one inflatable life-raft, cap. 6 persons,
- 4 inflatable life-rafts, cap. 16 persons each,
- 37 lifejackets for adults,
- 3 lifejackets for children,
- one set of lifebuoys (12 pcs),
- one pyrotechnic signalling set,
- one set of line throwing gun,
- 4 lifelines, 30 m long,
- three lifesuits,
- one rescue boat (6P), rigid GRP boat with keel.
- one davit for rescue boat and life raft.

2.4.2. Life-Boat Launching Arrangement

Lifeboat is mounted on launching way with rolls, lock and interlock. Crane for the hoisting of the free-fall lifeboat on the aftship. The same hoisting arrangement used for provisions. Crane must be capable for Suez Canal mooring boats, refer to Suez Canal Reg.20, 1995.

2.5. OUTER COMMUNICATIONS

2.5.1. Gangplank

One aluminium gangplank will be provided with round steps 9.0 m long, with dismountable stanchions and two horizontal ropes..

2.5.2. Outer Stairs

All outer stairs are of fully hot galvanised welded construction with steps of checkered plates and hand rails of galvanised steel piping.

Their arrangement is according to the General Arrangement Plan.

2.5.3. Ladders

Light steel ladders of flat stringers and square rung bars edge up are provided where necessary. Ladders in ballast tanks are welded or fitted with corrosion resistant bolts.

2.5.4. Railings and Hand-Rails

Open decks with no permanent bulwark have hot galvanized, steel railing with flat bar stanchions. Their height is 1200 mm. On main deck stanchions fitted on steel pads. On accessible superstructure outer walls, at 1000 mm height, steel hot galvanized pipe storm rail is provided.

In aft part ,on superstructure deck, doors in railings have been provided on PS,SB for fixing of gangplank at harbour with platforms (2 pics), incorporated in rail..

Securing ropes on open deck will be made of stainless steel wire rope.

2.5.5. Accommodation Ladders

Two aluminium accommodation ladders with fixed arch steps and swivel type top platform are provided port and starboard. One man controlled lifting and lowering of the accommodation ladder is operated by electric winch. The top platform swings automatically by lifting and lowering of the accommodation ladder. Manual lashing device provided for sea going condition.

2.6. HATCH COVER

Eight hatches are provided on the main/forecastle decks, opening size:

- hatch N°1: 12.64 × 15.36 m,
- hatch N° 2: 12.64 × 20.36 m.
- hatch N° 3-10: 12.64 × 25.35 m.

The hatches covered by weathertight, three panel steel pontoon covers with longitudinal running cover joint except for hatch N°1 and 2, where two pontoon cover is provided.

Non-sequence of opening/closing of hatch covers is provided. Opening of one panel will enable loading/unloading of all containers stowed directly underneath that cover.

Hatch cover seals, are generally of surface type. Longitudinal joint between pontoon will be of double rubber lip joint type.

the flexible and exchangeable selflubricating pads are provided as vertical stoppers.

Covers fitted with container foundation sockets, locking devices and spreader inserts for 20 and 40 ft.

Spreaders are Owner's delivery.

Marking of hatch covers made as per Owners request made of successive welds, painted.

Weight of panels including fixed lashing equipment and twistlock will not exceed abt. 33 t.

Loading:

- uniform load: 2.5 t/m²
- container stack load: 60 t/TEU - 90 T/FEU on hatch 1 & 2
80 t/TEU - 100 t/FEU on hatch 3-10

2.7. DECK CRANE

Three (3) sets of 45 tonnes deck crane with level luffing to be provided between hatch No. 2/3, 6/7, after 10.

The cranes are to be electro-hydraulic single jib. Each crane is to consist of a jib, hoisting winch, wire luffing, slewing gear, hydraulic pump unit, control cab, etc. and to be placed on a crane post with a turn table. The cranes are to have the following particulars.

Item	Deck Crane Specification
Hoisting load	45 tonnes x 25 m 40 tonnes x 28 m 36 tonnes x 31 m
Luffing time	Manufacturer's standard
Slewing speed	Manufacturer's standard
Working radius	About min. 3.5 m - max. 31 m
Slewing angle	360 degrees

2.8. MANHOLES AND BOTTOM PLUGS

Tank in the double bottom, wings and fore peak and aft peak equipped with two oval, watertight manholes. Smaller tanks have one manhole each. Bolts and nuts of manholes will be of stainless steel.

Each manhole and each manhole cover is to be marked by welding. E.g. Tank No.

Bulkheads marked acc.to IW notation with frame No. in height of bilge keel and deep load line on both sides. Frame numbers on main deck, every fifth frame marked by welding 50mm from frame zero.

Permanent tank numbering is provided on hull plating and tanks extremities. Marks are made by welding. There are provided 50 mm. dia. stainless steel drain plugs fitted to a steel flange welded to hull plating in each water, F.O., duct keel and cofferdams. Square head for water and hexagonal for rest.

Vent heads on open deck also marked permanently with kind of tank and number by welding.

Watertight hatches are provided: on the forecastle to the store room, for engine room emergency exit and for steering gear room exit.

One watertight, bolted cover 3.8 × 1.9 m is arranged on the main deck in the forward area of the engine room.

Hinged hold access hatches are provided. Hinge bolts will be of corrosion resistant material.

2.9. OTHER DECK EQUIPMENT

2.9.1. Container Fittings

The necessary amount of fixed and loose container fittings will be in compliance with GL-unreduced GM and acceleration forces-for stowage and securing of containers on board.

- Container cell guides construction.

For guiding containers in holds, welded container cell guides are provided only for 40' ISO units, angle bars from hatch coaming to tank top. Min. size 160x160x14mm.

- Container deck supports.

At ship's sides of main deck, fixed container stanchions are arranged to support and secure wind stacks of hatch cover containers.

- Fixed container fittings.

in holds: besides cell guides fixed fittings are arranged as follows,

- fixed cones on doubler plates in 40' cell guider corners and doubler plates with foundation plates for loose stacking cones in 20' ISO gap on tank top and side tank steps.
- The side pressure bar to be based on standard of maker.

On main deck, hatch covers and side stanchions,

- arrangement of fixed foundation will ensure shipment of 20', 40', 45' units possible for lashing / securing containers from both ends with GL required lashing material, short/long rods, turnbuckles, semi-automatic TWL, midlocks acc. To OSHA rules.
- Stowage of 40' ISO boxes on top of 20' ISO boxes on deck and hatch covers must be secured.
- Lashing plates and eyes for lashing rods (lashing eyes should be avoided wherever possible).
- Loose container fittings.

On deck: short lashing rods, where necessary due to achieving full stack load long lashing rods, turnbuckles, twislocks, bridge fittings for the top layers, linkage plates and pressure adaptors. Loose fittings for deck loaded containers will be supplied for deck containers according to lashing plan.

In holds: stow pieces for 20' containers. Loose fittings for holds loaded containers will be supplied for TEU containers according to lashing plan.

All loose fittings, except frames, galvanized.

Stowage arrangements arranged in holds and on decks for loose container fittings and also for means for access for lashing.

Semi-automatic container lashing equipment acc.to OSHA regulations will be used on the ship.

2.9.2. Radar Mast, Signal Mast

Installed on the wheelhouse top, the mast has the platform with guard rails of steel tubes and Xmas lights in its upper part. An access ladder to the platform is of flat and square bars edge up.

Provided also is signal mast with respective arrangements including lights as required by the Rules listed under para. 0.11.

Necessary arrangement for flag yard should be made, both side with 3 position each.

2.9.3. Acoustic Signalling

In area of the anchor windlasses fore, a bell with ship's name engraved, dia 300 mm, and in the aft part a gong with a hammer attached is installed. The fore mast has installed on it an enclosed-type, heated electro typhoon, operated by means of electric push/buttons combined with signalling light aft.

2.9.4. Store Rooms

Store rooms are equipped with racks, lockers, tanks, hooks, etc., as required by purpose. Bosun's store will be equipped in addition with one double wheel grinder.

2.9.5. Flag Pole

One flag pole made of steel pipe hot galvanised is provided aft. The pole has a block and a line attached to hoist the flag.

2.9.6. Attachments for Hull Painting

Attachments for hull painting are not provided.

2.9.7. Propellers/Rudders Dismantling Lugs

To assist in dismantling and re-fitting the propeller and rudder, lugs of suitable strength are provided, welded to shell plating.

2.9.8. Auxiliary Crane

- 1 provision store / life boat crane, abt. 72 kN / 10 m and abt 52 kN / 18.5 m situated in CL aft. (refer to Suez Canal Regulation 1995, reg.20)
- 2 portable davits 2.5 kN for F.O. hoses handling will be provided.

2.9.9. Anti-skid Deck Protection

Anti-skid paint will be applied on decks in area of the manoeuvring station fore and aft, and area of outer stairway.

CHAPTER 3

ACCOMMODATION

3.0. General

Accommodation, duty, public, domestic, sanitary, etc., spaces are located on eight accommodation decks. Clear height to be 2100mm.

Compartment layout as shown in General Arrangement Plan

3.0.1. Ship's spaces**3.0.1.1. Duty spaces:**

Wheelhouse with Chart room & Radio space,
Engine Control Room,
Engine Office,
Cargo Office & Conference Room
Tally Office

3.0.1.2. Accommodation

	cabins - persons		

Master's class suite	2	-	2
Senior Officer's suite	2	-	2
Officer's single cabin	5	-	5
Crew single cabin	13	-	13
Two seaman cabin	1	-	2
Suez cabin	1	-	6

Total	24	-	30

3.0.1.3. Public Spaces for Crew

Crew's mess/day room,
Hobby room,
Officer's mess/day room,
Duty Messroom

3.0.1.4. Domestic Spaces and Stores

Reefer chambers and provision rooms
Galley,
Pantry,
Laundry,
Drying room,
Dirty linen store,
Clean linen store,
Luggage store,
Bonded store,
Two independent safety store

3.0.1.5. Hospital Spaces

Dispensary,
Hospital with sanitary block (with bath tub).

3.0.1.6. Sanitary Spaces

Individual sanitary block with bath (in hospital)	-	1,
Individual sanitary block with shower	-	24,
Public WC	-	2,
Deck WC	-	1,
Changing room	-	1,

3.1. INSULATION OF COMPARTMENTS

Outside walls and ceilings under weather decks are heat insulated with 50 mm and 75mm thick mineral wool respectively. Insulation is secured with pins to steel walls and deck. Density of wool to be 24-45 kg/m³.

Fire insulation is provided on all A-type bulkheads and made of mineral wool of thickness as required by the Rules. Secured with pins.

Structural fire protection as per SOLAS IC method.

Acoustic insulation is fitted on accommodation ceilings (i.e. below deck) where necessary.

Asbestos free insulation to be used throughout the ship.

3.2. WALL AND CEILING LINING

Location		Wall or Division wall		Overhead ceiling	
		Lining	Finish	Lining	Finish
Inside Passage	Adjacent to engine room	Rockwool panel	PVC	Rockwool panel	PVC
	Adjacent to living space	Rockwool panel	PVC	Rockwool panel	PVC
Navigation space Living space, public space, office space		Rockwool panel	PVC	Rockwool panel	PVC
Sanitary space		Rockwool panel	PVC	Rockwool panel	PVC
Provision store, Bonded store		Rockwool panel	PVC	Rockwool panel	PVC
Galley, pantry		Rockwool panel	Stainless	Rockwool panel	Stainless
Laundry room, Drying room		Rockwool panel	PVC	Rockwool panel	PVC
CO ₂ room, ref. machine room, paint store, battery	Non Insulation	Bare steel	painted	Bare steel	Painted
Engine room,	Non Insulation	Bare steel	painted	Bare steel	Painted
Control room (in engine room)		Acoustic board		Acoustic board	
Store, locker		Bare steel	painted	Bare steel	Painted

The rockwool panels to be of 25mm in thickness, except for that as division wall of 50mm in thickness.

CO₂ room to be insulated with glass fiber cloth if necessary.

3.3. FLOOR LINING

In cabin area including navigation rooms abt 10 mm thick underlayer compound is applied on steel deck, covered with 2 mm PCV welded layer.

All sanitary spaces, laundries, galley, pantry, drying room and reefer chambers have floors covered with ceramic tiles laid on cement ground.

Where fire insulation is required, flag authorities accepted construction will be provided.

Noppengummi (chequed rubber): main staircase and corridors, alley ways, hobby room, duty mess room, wheelhouse with radio corner, cargo office and conference room, engine office and engine control room, tally office.

PVC title in office and crew mess and dayroom.

Crew cabins and hospital and discrepancy with PVC welded layer.

Carpets: capt./officers cabin(Capt, C/E, 1/O, 2/E).

3.4. DOORS AND WINDOWS

3.4.1. Doors

Inner doors with stove enamelled frames; doors made of non-asbestos plates lined with decorative laminate

Fire class as per Rules. Door lock with fixed cylinder, with possibility of opening from inside the cabin by means of a fixed knob. Door fittings made of chrome plated brass, stainless steel hinge bolts. Door hooks or clamps provided. Ventilation louver (where provided) made of seawater resistance aluminium or equivalent material.

Locks provided for all inner doors except for WC doors. Master key system with 3 sets of keys including 6 pcs of master keys and necessary key lockers. Doors leading to E. Room fitted with self closing device.

Outer doors leading to accommodations made of steel, up to deck N°1; on higher decks (ISPS code). Each door with 400 × 600 mm window, box lock and possibility to secure door from the inside.

Wheelhouse outside doors to be of hinged type.

Outside door hinge bolts made of corrosion resistant material.

Entrance doors to deckhouse will be protected as required by ISPS rules

3.4.2. Windows

All windows with metal frames, welded into walls. Window frame made of steel, inner frame of aluminium. All windows have night shield for darkening.

If several windows fitted in one cabin, then one of them will be of opened type. In officers and crew messrooms and galley two windows of opened type are provided.

Wheelhouse front windows (10 pcs) will be of electric heated type, 8 of them will be equipped with window wipers. Washing warm water system with air pressure blow out and sun blinds

guided and self stopping device. Wipe arms of pantographic system. All wheel house fore and side window to be inclined type. The aft window of wheelhouse to be vertical type.

Cabin and messrooms windows are 400 × 560 mm; opened windows open sideways.

Front accommodation windows have night shields (curtains), for darkening.

Washing device for wheelhouse front windows with air blow pipe will be provided.

Windows will be protected as required by ISPS rules, all glass sheets of approved security glass, thickness acc to GL rules (ISPS code).

3.5. ACCOMMODATION EQUIPMENT

3.5.0. General

Depending on the service and applied standard compartments are provided with set of furniture for sitting, lying, work and storage. Furniture according to catalogues of standard furniture approved by owner

Basic materials are:

1. Carpenter's board and chipboard for constructions, enclosures and tops.
2. Steel profiles for construction.
3. Steel plates or non-asbestos plates for walls and doors.
4. Decorative laminates for top finish.
5. Veneer for carpenter's/chipboard finish.
6. 100% Acrylic upholstery for chair/armchair/settee back - rests and seats, except for Master class rooms, Officers' Day Room and Officers' Mess Room, where wool will be used.
7. Seat upholstery for chair/armchair back - rests for duty and hospital spaces.
8. PVC decorative foil and painting coats for plate/profile finish.
9. Stainless steel for galley and pantry furniture.
10. Painted steel plate and profiles for domestic furniture and stores.
11. the cabins' window equipped with net curtain and blind curtain.

3.5.1. Furniture

3.5.1.1. Duty spaces

Central clock system in duty spaces, messrooms, wheelhouse and engine control room.

3.5.1.1.1. Wheelhouse with Chart Room & Radio Space

- 1 chart table,
- 1 corner table with side lockers/drawers,
- 1 settee (with two drawers for lifebelt),
- 2 locker for documents,
- 1 flag and banners locker,
- 2 division walls with curtains,
- 2 swivel armchairs (in front of radar set) on rails with stopping device,
- 1 pilot armchair with lashing device in flooring,
- 1 pilot armchair,
- 1 book shelf,
- 2 shelves,
- 2 lockers for binoculars,
- refrigerator housing with sink, top plate made from stainless steel
- 1 radio clock
- 4 coat hooks

3.5.1.1.2. Engine Control Room

- 2 writing desks with locker,
- 2 swivel armchairs,
- 1 medicine locker,
- 2 key lockers,
- 1 filing cabinet,
- 2 whiteboards,
- 1 sounding board.
- 1 clock

3.5.1.1.3. Engine Office

- 1 writing desk with side lockers/drawers,
- 1 filing cabinet,
- 3 swivel armchairs,
- 2 open cabinets,
- 1 key cabinet,
- 1 whiteboard
- 1 table,
- 2 chairs.

3.5.1.1.4. Cargo Office & Conference RM

- 2 writing desks with side lockers/drawers,
- 3 filing cabinets,
- 2 open cabinets,
- 1 key cabinet,
- 2 swivel armchairs,
- 1 whiteboard,
- 6 coat hooks.
- 1 conference table,
- 6 chairs,
- 1 refrigerator housing,
- 1 hanging cupboard,

3.5.1.1.5. Tally Office

- 1 writing table
- 1 filing cabinet
- 1 desk side table
- 1 chair
- 4 coat hooks
- 1 open cabinet

3.5.1.2. Accommodation

3.5.1.2.1. Master's Class Suite

Dayroom

- 1 writing desk with side locker/drawers,
- 1 desk side table,
- 1 filing cabinet, 3 drawers
- 1 shelf,
- 1 corner settee,

- 1 table,
- 1 armchairs,
- 1 swivel armchair,
- 1 cupboards set,
- 1 refrigerator in housing,
- 1 hanging (3 shelves) cupboard
- 2 coat hooks.
- 5 sockets on desk

Bedroom

- 1 berth (1400 × 2000),
- 1 wardrobe (with lifebelt locker),
- 1 linen locker,
- 1 bed side locker with safe,
- 1 safe,
- 1 mirror,
- 2 coat hooks.

Sanitary block as per p. 3.5.6.1.

3.5.1.2.2. Senior Officer's Suite

Dayroom

- 1 writing desk with side locker/drawers,
- 1 table,
- 1 shelf,
- 1 corner settee,
- 1 armchair,
- 1 swivel armchair,
- 1 cupboards set,
- 1 refrigerator in housing,
- 1 hanging (3 shelves) cupboard,
- 1 filling cabinet,
- 2 coat hooks.

Bedroom

- 1 berth (1400 × 2000),
- 1 wardrobe (with lifebelt locker),
- 1 linen locker,
- 1 bed side locker,
- 1 shelf.
- 2 coat hooks.

Sanitary block as per p. 3.5.1.6.1.

3.5.1.2.3. Officer's Single Cabin

- 1 berth (1200 × 2000),
- 1 settee
- 1 writing desk with side locker,
- 1 table,
- 1 swivel armchair,
- 1 wardrobe (with lifebelt locker),
- 1 refrigerator in housing,
- 1 hanging (3 shelves) cupboard.
- 1 linen locker,
- 1 shelf,
- 2 coat hooks.

Sanitary block as per p. 3.5.1.6.1.

3.5.1.2.4. Crew Single Cabin

- 1 berth (1000 × 2000),
- 1 settee or corner settee,
- 1 wardrobe (with lifebelt locker),
- 1 table, topplate size abt. 600x800mm
- 1 chair,
- 1 linen locker,
- 1 shelf,

Sanitary block as per p. 3.5.1.6.1.

3.5.1.2.5. Two Seaman Cabin

- 1 double bunk (1000 × 2000),
- 1 settee,
- 2 wardrobes (with lifebelt lockers),
- 1 table, topplate size abt. 600x800mm
- 2 chairs,
- 2 linen lockers,
- 2 shelves

Sanitary block as per p. 3.5.1.6.1.

3.5.1.3. Public Spaces for Crew

3.5.1.3.1. Crew's Mess/Day Room

- 3 tables,
- 10 chairs,
- 1 cupboards set,
- 1 refrigerator in housing,
- 1 hanging cupboard,

- 1 settee,
- 2 armchairs,
- 2 settee side tables,
- 2 coat hooks.

3.5.1.3.2. Officer's Mess Room (105) and Officer's Day RM (105A)

- 2 round tables,
- 14 armchairs,
- 2 cupboards set,
- 1 flower bed,
- 3 setties,
- 1 table,
- 6 coat hooks.

3.5.1.3.3. Hobby Room

- 1 tennis table,
- 1 locker.

3.5.1.4. Domestic Spaces

3.5.1.4.1. Galley

- 1 table with sink,
- 4 galley tables,
- 1 pot board,
- 1 electric stove with 4 hotplates: one oven ,
- 1 frying pan,
- 1 universal galley machine with mixing and dough kneading/meat mincing/vegetable slicing facilities and coffee grinder,
- 1 deep fat fryer,
- 1 mixer,
- 1 refrigerator of 300L capacity,
- 3 lockers,
- 2 shelves,
- 4 racks for plates,
- 1 garbage container,
- 1 swivel stool,
- 1 electric water boiler,
- 1 waste disposal unit.

3.5.1.4.2. Pantry

- 1 coffee/tea machine,
- 1 table with double sink,
- 1 plate board,
- 1 refrigerator of 200L capacity,
- 1 dish washing machine,
- 1 locker,
- 1 wash basin,
- 2 el. toaster.

3.5.1.4.3. Ship's Laundry

1 washing machine of 7.0 kg capacity,
1 washing machine of 10.0 kg capacity,
1 tumble drier,
1 table with wash tub.

3.5.1.4.4. Drying Room

1 table for ironing,
1 folding ironer,
1 shelf,
hooks for ropes for hanging linen.

3.5.1.4.5. Linen Stores (clean, dirty)

1 rack.
1 locker.

3.5.1.4.6. Bonded Store

3 racks.

3.5.1.4.7. Luggage Store

1 rack.

3.5.1.5. Hospital Spaces

3.5.1.5.1. Dispensary

1 couch, with security devices to fix patient.
1 medicine locker,
1 instrumental table,
1 chair,
1 swivel stool
1 toilet cabinet,
1 wash basin,
1 refrigerator of 100 l capacity.

3.5.1.5.2. Hospital

1 swing bed as per Rules,
1 swivel stool,
1 double door wardrobe,
1 bedside locker.

Sanitary block - as per p. 3.5.1.6.1.

3.5.1.6. Sanitary Spaces

3.5.1.6.1. Individual Sanitary Block with Shower (or bath tub) of abt. 1500 × 1500 mm.

- 1 WC bowl,
- 1 pool c/w shower fittings (bath tub in hospital),
- 1 washbasin c/w fittings,
- 1 locker c/w mirror and socket for electric razor,
- 1 dustbin,
- 1 hanging ashtray,
- 1 toilet paper holder,
- 1 sponge/soap tray,
- 1 soap tray,
- 1 brush c/w handle,
- 1 storm grip handrail,
- 1 pool curtain c/w rail and lead tape in lower end,
- 1 pool grating,
- 4 hooks.
- 1 electric heater

3.5.1.6.2. Public WC

- 1 WC bowl,
- 1 washbasin c/w fittings,
- 1 toilet paper holder,
- 1 soap tray.
- 1 brush c/w handle,
- 1 storm grip/handrail,
- 2 hooks,
- 1 mirror,
- 1 dustbin,
- 1 hanging ashtray.

3.5.1.6.3. Deck WC

- 1 WC stainless bowl,
- 1 stainless washbasin.

3.5.1.6.4. Changing Room (007)

- 5 double clothes lockers,
- 2 seating benches,
- 8 coat hooks.
- 1 washbasin, 1 soap tray, 1 mirror.
- 1 shower.

3.6 PROVISION CHAMBERS

3.6.1 Provision Chambers Outfit

Freezing and refrigerated chambers are fitted with stainless steel racks.
In dry provision chamber wooden racks provided.

3.6.2 Provision Chamber Insulation and Lining

Walls and ceilings panels are of sandwich design, built up by a core of CFC-free polyurethane foam with a cladding of steel sheet on both sides. Visible wall and ceiling insulation is lined with aluminium alloy sheets of 1.5 and 1.0 mm thickness respectively. Invisible wall and ceiling insulation is lined with galvanised steel sheets 0,6 mm thickness .

Insulated walls/ ceiling in Chambers: Dry provision and Drinks are lined with galvanised steel sheets 0,7 mm thick. Outside walls and ceilings under weather decks are heat insulated with 50 mm thick mineral wool (on stiffeners 30 mm). Insulation is secured with pins to steel walls and deck.

Floor in provision chambers is covered with ceramic, non-slip tiles. Dry provision chamber deck top and above - painted.

3.6.3 Doors to Provision Chambers

Type - Stainless steel, filled with insulation

Width - 700 mm

Sealing - Rubber packing, electric (24 V) heating element for freezing chamber doors.

In dry provision chamber steel type – painted.

3.7 MISCELLANEOUS

3.7.1 Accommodation Staircases, Stairs and Rails

Staircases construction made of steel. Stairs covered with anti-slip rubber.

Accommodation rails made of wooden profile.

3.7.2 Information Plates

Each door have information plates with number and description of compartment. Plates made of plastic for inner doors and of brass for outer doors. In main staircase on each deck one summary information plate with cabin numbers and rating. In Poop deck general information plate with all decks.

3.8 MARKING

Funnel mark, ship's name, home port, bulkhead marks, tug boat pushing marks, deep load line marked with successive welding and painted. Bulbous bow mark stern and bow thruster mark made of steel plate, welded. S.

IMO number to be welded on transom stern 300mm, IMO number 100mm on engine bulkhead acc to SOLAS. IW markings acc to Class approval, tanks No. and bulkheads with frame No.

3.9 PAINTING

3.9.1 Primary Surface Preparation

The steel plates from 6 mm thick and profiles are shotblasted to class Sa 2,5 as per Standard ISO 8501-1:1988 and coated with Zinc Silicate Shop Primer (about 15-20 μm). Shop primer is compatible with the succeeding coats and approved by Paint Supplier.

3.9.2 Secondary Surface Preparation

After fabrication and prior to application of the first coat of paint system, damages of shop primer by welding, burning, rubbing and rusted surfaces are prepared to ISO class specified in table below.

Area	In block stage(**)	In pre-erection, slipway or quay stage
Underwater	----	St 3
Topside	----	St 3
Main deck*, forecastle deck and hatch coamings	----	St 3
*poop deck, main deck between superstructure and hold no4		St 3
Hatch covers	Sa 2,5	----
Superstructure (exterior) including funnel and superstructure decks	St 3	----
Superstructure (interior)	----	St 2
Engine Room, machinery spaces, technical rooms	St 2	-----
Cargo holds	St 3	St 3
Cofferdams and void spaces	St 2	----
Ballast water tanks	Sa 2,5	St 3
Fresh water tanks	Sa 2,5	St 3
Fuel oil tanks	----	St 2
Lubrication oil tanks	----	-----

(**) – the process may be moved to next stages of building, depends on Builder's production power capabilities.

3.9.3 Paint Application

Generally application of anticorrosive paints is carried out on section fabrication stage, however number of coats depends on the production technology.

Application of the finishing paints is carried out on the slipway or on the fitting out quay. In a case of paint application during winter season the Builder may use the winter type paint as recommended by paint maker.

The painting to be carried out by airless spray, in general. Where the spraying is impracticable, the brush or rollers can be use for stripe coats or minor touch up.

Surface preparation and following coatings i.e. compatibility to be agreed with Paint Manufacturers.

The surface of materials other than steel and inside of permanently enclosed water-air-tight spaces are unpainted except otherwise specified.

Machinery, electrical equipment, valves, deck machinery, navigational equipment, furniture which the Builder will purchase are painted in accordance with each Maker's standard.

3.9.4 Painting Specification

Main painting area	Surface Preparation	Painting Description	No. of coating	D.F.T. (micro.)
Bottom Keel	Sa 2.5	Epoxy Mastic Vinyl mod.epoxy SPC (tin-free)	2 1 <u>3</u>	100 150 <u>315</u>
Rudder, sea chest and bow thruster tunnel shall be same above + 1 coat Inside of rudder to be painted with 100 micr. DFT bituminons before the latest plate covered.				
Boottop (From D.L.W.L to 5m below D.L.W.L		Reinforced epoxy Vinyl mod.epoxy SPC (tin-free)	2 1 4	150 80 500
Topside Bulwarks outer, superstructure, deckhouses, funnel, masts, interior of vent trunks, fan room	<u>Sa2.5</u>	Epoxy mastic Polyurethane I	2 1	300 50
hatch covers(top and side)	Sa 2.5	Zinc ethyl silicate coating epoxy Polyurethane	1 1 1	75 40 50
Weather deck Hatch coaming, bulwark inner,	st3	Epoxy epoxy Polyurethane	1 1 1	125 125 50
Underside of hatch covers	Sa 2.5	Epoxy Tar-free epoxy paint	1 2	100 200
Cargo hold, side only	St3	epoxy mastic	2	300
Tank top in hold	St3	Epoxy	2	300
Exposed wall in engine room and other accommodation	St 3	Alkyd rust preventive primer Alkyd finishing paint	1 1	80 80
Exposed deck in engine room and other accommodation	St 3	Alkyd rust preventive primer Alkyd finishing paint	1	80 80
Engine room below floor	St 3	epoxy epoxy	1 1	100 100
Steel surface behind insulation and lining or ceiling	St 3	Alkyd rust preventive primer	1	80
Bilge well, chain lock	St 2	Bituminous paint		250

Main painting area	Surface Preparation	Painting Description	No. of coating	D.F.T. (micro.)
Fresh water tank	Sa 2.5	Pure epoxy coating	2	300
Ballast water tank	Sa 2.5	Epoxy Mastic	2	300

The final paint scheme is in accordance with the recommendation of maker and approved by owners, the thickness of A/F of ballast tanks and shell according to five years lifetime.

CHAPTER 4

ENGINE ROOM

4.0 GENERAL

All components with direct relation to propulsion are designed for MCR (Maximum Continuous Rating unless otherwise specified).

ER specific systems as indicated hereafter will be suitable also for 90% ME cont. Service.

All machinery and equipment will be designed and installed according to the Classification requirements and manufacturer's practice.

The color of all machinery to RAL6019, except main engine, main diesel generators and separators.

Pipes, flanges, valves, bolts, nuts, gauges etc. will be in accordance with an internationally recognized standard and/or Builder's standard practice.

Except manufacturer's standard, screw threads to be metric screw thread of ISO.

Pressure gauges in bars, thermometers in degree of Centigrade, and tank level in m³ or liter to be applied.

Materials except specified in this Specification to be in accordance with the Subcontractor's standard.

The machinery spaces to incorporate an air conditioned and sound insulated Engine Control Room.

Propulsion system consists of single Main Engine driving directly fixed pitch propeller.

The propeller turns clockwise.

All machinery and equipment suitable for tropical conditions as in para 0.2. Air temperature in Engine Room of 45°C.

Fuel oil for ME, and auxiliary boiler - HFO with viscosity up to 600 cSt at 50°C and density max.

1010 kg/m³ from pier to pier, Fuel oil for machinery system – HFO with viscosity up to 380 cSt at 50°C, Fuel oil for main generators –HFO with viscosity up to 380 cSt at 50°C.

Gas oil for emergency diesel generator MDO class CIMAC-DB.

ME mounted on epoxy chocks, diesel generators and starting air compressors on flexible pads, auxiliary equipment (where applicable) on steel chocks.

Auxiliaries are electric motor driven of 3 x 440V; 60 Hz.

Parameters of auxiliaries and systems influenced by M.Engine will be selected to fulfil M.E. Maker's recommendation.

Compartments inside ER:

- Engine Control Room
- Engineer's workshop
- El. Workshop

- Engineer's store
- El. store

4.1 SHAFTING

4.1.1 Propeller

Propeller of Ni-Al-Bronze, five blades, fixed pitch clockwise rotation type.

Keyless type with hydraulic nut.

4.1.2 Shafts

The shaft line consists of propeller shaft and one intermediate shaft. Propeller shaft will be oversized to make possible to machine possible cracks at propeller seat - min. 5 mm in diameter. Shafts will be of forged steel. Propeller and intermediate shaft connected using flange. Propeller shaft withdrawn outboard after dismantled rudder's blade. Intermediate shaft flange and ME flywheel connected with fitted cylindrical bolts.

4.1.3 Stern Tube and Intermediate Shaft Bearing.

Stern tube installed in hull structure by epoxy resin.

Oil lubricated stern tube bearing, lined with white metal. Oil lubricated and FW cooled intermediate shaft bearings, lined with white metal. The aft bearing of stern tube with exchangeable type temperature sensor.

4.1.4 Stern Tube Seals

Stern tube seals of simplex, non-split type.

Seal fitted with net cutter and net protection ring.

Number of rubber seals:

- Aft seal (4) four (with ceramic liner)
- Fwd seal (2) two

4.2 Main Engine

Two stroke, single acting, low-speed, direct-reversible, fully electronically controlled diesel engine. The M/E provided with second order moment balancer if necessary.

- | | | |
|------------------|---|------------------|
| – Type | : | MAN B&W 6K80ME-C |
| – Output / CMCR/ | : | 21,660 kW |
| – Speed | : | 104 rpm |

- Number of cylinders : 6
- Cylinder bore : 800 mm
- Stroke : 2300 mm
- Specific fuel consumption : 171 g/kWh + 5%

The specific fuel consumption is related to test on Maker's station at ambient conditions as per ISO 3046/1, low calorific value equal to 42707 kJ/kg and 100% CMCR of ME.

The ME built to consider IMO Regulation for NOx emission.

Grinding machine for outlet valves seats will be provided. Turbocharger to be ABB TPL or MAN TCA type.

4.3 Steam Boilers

One composite boilers are installed in Engine Room.

oil fired side, designed to burn HFO with viscosity up to 600 cSt at 50°C.

Capacity - 2000 kg/h. Capacity control – by pressure control

Steam pressure - 0.7 MPa. Equipped with soot blower.

exhaust gas side,

Capacity –abt. 2000 kg/h at 90% MCR of ME and maker's standard. Steam pressure - 0.7 Mpa. Capacity control by dumping surplus steam into atmospheric condenser.

Equipped with soot blower.

4.3.1 Exhaust Gas Pipes.

Exhaust gas pipelines built of welded steel pipes, 5 mm thick; for EDG of 5 mm seamless steel pipe. Exhaust gas pipelines to be of welded steel, except the parts going through the top plate of funnel(above and below plate with 300mm) to be of stainless steel.

Water drain of exhaust pipes will be carried into cascade tank (visible / cleanable).

Pipelines insulated with mineral wool and covered with galvanized steel plates.

Exhaust pipes are provided with sufficient number of expansion joints.

ME/DG piping below Superstructure Deck resiliently mounted to hull Diesel generator exhaust gas pipe lines will be led individually from each engine to atmosphere through the silencer.

Main engine exhaust gas pipe will be led to atmosphere through exhaust gas economizer. Aux. boiler and waste incinerator uptake to be led to the funnel top, expansion joints will be provided as necessary.

4.4 GENERATING SETS

For electric power generation are installed:

- Main Diesel Generator (MDG) 4 pcs,
- Emergency Diesel Generator (EDG) 1 pc,

Electric power - see Chapter 6.

4.4.1 Main Diesel Generators - Engines.

Four (4) sets of Main Diesel Generators provided, each driven by four stroke, medium speed, turbo charged diesel engine:

- Rated output : about 1995 kW x 3 sets + about 665 kW x 1 set
- Rated speed : about 720/900 rpm
- Specific fuel consumption
at 100% of power : 195 g/kWh + 5%
(reference - ISO conditions, LCV = 42707 kJ/kg without engine driven pumps).

Engine outfitting according to maker's standard.

Engines built to consider IMO Regulation for NOx emission.

Engine start by compressed air acc. to maker's standard and GL Rules.

4.4.2 Emergency Diesel Generator

Emergency Diesel Generator is installed in separate compartment above bulkhead deck.

Diesel engine of radiator cooled type, 4 stroke, about 190 kW x1800 rpm, battery starting.

4.5 AUXILIARY EQUIPMENT

4.5.1 Centrifugal Pumps.

Vertical pumps and horizontal pumps fitted with mechanical seals.

Vertical pumps casing (except small size pumps) are split so that the impeller removal is possible without disturbing the pipe connections.

Materials:	Sea water pumps:	
	Casing	: Bronze,
	Shaft	: Stainless steel,
	Impeller	: Bronze
	Fresh water and bilge water pumps:	
	Casing	: Cast iron
	Impeller	: Bronze

Shaft : Stainless steel

Ballast pumps:

Casing : Bronze

Impeller : Bronze

Shaft : Stainless steel.

4.5.2 Screw Pumps.

Pumps are provided with built-in-safety valve. Pumps fitted with mechanical seals.

Materials: Casing : Cast iron

Power rotor : Steel

Idle rotor : Steel or cast iron.

4.5.3 Piston Pumps / Screw Pump

For bilge transfer in Engine Room

Materials:

Body cylinder and covers of cast iron, crankshaft and piston rod of steel, piston and cylinder liner made of brass or stainless steel.

4.5.4 Coolers and Condensers

Two LT- central coolers and one ME LO cooler are of plate type, condensate coolers are of tube type. Coolers will be designed with the fouling margin of abt. 10% for ME LO, condensate coolers. Central coolers provided for 60% load each and with 10% margin each. Back flushing function to be installed.

Materials : Plate coolers:

– LT central coolers:

Plates : titanium

Frame : mild steel.

– ME LO, and condensate coolers:

Plates : stainless steel

Frame : mild steel

– Shell-and-tube condenser:

Shell : steel
Cover and water box : cast iron – coated inside
Tube : Al-brass
Tube plate : brass.

4.5.5 Steam Heaters

FO and LO heaters are of plate type or tube type. For booster units to be tube type, the others to be according to recommendation of makers.

Materials:	Frame plate:	mild steel epoxy painted
	Heating element :	stainless steel

4.5.6 Incinerator

One solid / oil waste incinerator of abt. 550.000 kcal/hr. Solid waste abt. 400 l/h and sludge oil 50 l/h with all equipment for automatic operation to be provided.

Garbage press - Owner's Delivery

Box for solid waste (300 kg) will be provided.

4.6 REPAIR AND MAINTENANCE EQUIPMENT

4.6.1 Workshops

Engineer's and electrical workshops provided in Engine Room.

Following machinery and equipment fitted:

- one universal lathe of max. 500 mm turning diameter and length between centres of 1000 mm,
- one drilling machine, max. drilling dia of 25 mm, rested on the floor.
- one welding bench
- one double wheel grinder, wheel dia 200 mm,
- one workshop bench (abt. 2,5 m) with two vices and drawers
- one container for dirty rugs
- tool boards
- tool lockers with locks/drawers
- one welding rectifier AC/DC type, approx. 400 A
- gas welding and gas cutting equipment
- one electric test panel

Three (3) oxygen and three (3) acetylene cylinders fitted in cabinet on open deck - Owners delivery. Fixed solid lines to the welding place in the E. Room workshop provided, stainless steel on exposed deck.

4.6.2 Fuel Injection Test Stand

For fuel injection test separate stand will be provided in ER.

4.6.3 Engineer's Store

Store equipped with steel racks and steel cabinets, properly marked and with sufficient lighting to be provided.

4.8 FLOORS AND GRATINGS

Platforms, floors, gratings and ladders provided for convenient access and maintenance of machinery and other apparatus and for entrance to and scape from machinery space.

Main communication routes min. 600 mm wide with a headroom min. 2000 mm.

Engine Room floors and Main Engine platforms built of chequered plates of 4 mm thickness, fixed to the frame by means of brass screws. Floor permissible load 400 kg/m², enough to service heavy parts and components.

Engine Room stairs 600 mm wide and inclined at 60 deg to horizontal.

Stairs provided with galvanized steel shields on the underside. Vertical ladders provided above main deck (engine casing and funnel).

4.9 OTHERS

4.9.1. Hoisting Arrangements

- ME overhead travelling crane : capacity about 6.3 t provided
Special attachment for servicing ME turbocharger are provided.
- Trolley and chain hoists :
 - Main Diesel Generators : Beam with travelling chain hoist, 500 kg capacity, over MDG engine,
 - To Engineer's workshop : Beam with travelling chain hoist, 2000 kg capacity.
 - Purifiers : Beam with travelling chain hoist, 500 kg capacity.
 - For machinery transportation: Beam with travelling chain hoist, 2000 kg capacity from M/E area to MDG area.

To facilitate dismantling of other arrangements eye pads provided where necessary.

Eye pads besides the ME to be provided.

CHAPTER 5

PIPING

5.0 GENERAL**5.0.1 Materials**

Basic materials used in specified installation - see installation description.

5.0.2 Tests

- acc. to the requirements of Classification Society, or in case of lack of such requirements in operation, after assembly on board.

5.0.3 Clamping of Pipelines Clamps on Steel Brackets.

Bolts and nuts - steel, galvanized.

Nuts will be locked to not become loose.

Clamps, except in fuel and oil tanks - galvanized.

Clamps nuts will be locked to not become loose.

5.0.4 Name Plates and Pipelines Marking

1. Name plates - location:
 - at all valves and other hand controlled fittings,
 - valves in E.Room: at valves and on the floor,
2. Name plates - materials:
 - brass.

Pipes marked by colour stripes, painted or glued. Colours to be as follows:

SYSTEM	COLOUR	Remarks:
Fresh water	Blue	1. Fire extinguishing valve bodies, handles
Feed water	Blue	and spokes to be painted with red.
Potable water	Blue	2. Division to be marked by vinyl tape.
Sea water	Green	
Ballast	Green	
Heavy fuel oil	Brown	
Diesel oil	Brown	
Lubricating oil	Yellow	
Cylinder oil	Yellow	
Steam	Red	
Exhaust & drain	Red	
Bilge	Black	
Compressed air	Pink	

5.0.5 Bulkhead Passages

Bulkhead passages of sleeve type made of thickwall pipes, non-galvanized. After mounting the sleeves coated with suitable paint.

5.0.6 Welded Joints of Galvanized Pipelines

Welded Joints of galvanized pipelines, which are made on board, shall be painted outside only.

In case of weld connection not treated thickness of pipe will be oversized.

5.1 ENGINE ROOM PIPING

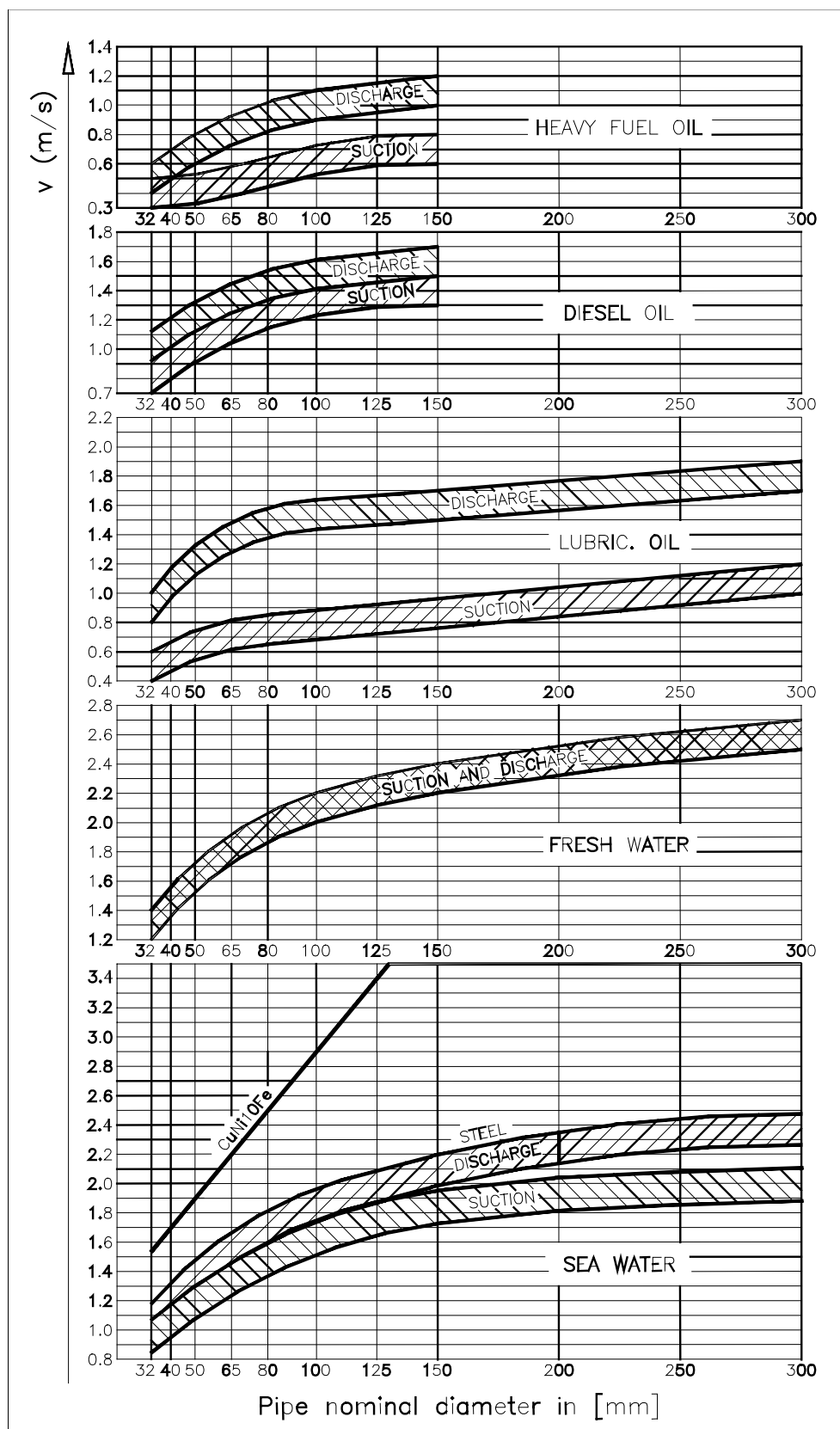
1. Pipe to be designed to allow the stress due to thermal expansion and deflection of the ship's structure.
3. All pipes for steam and oil line to be arranged with sufficient distance from electrical instruments.
4. Pipes to be suitably supported to avoid the piping vibration.
5. Pockets in piping to be as few as possible.
6. The pipes which to be specified as galvanized, to be galvanized after fabrication of flange. When galvanizing falls off, zinc paint to be painted on board twice. When damaged parts are not accessible from inside and outside, pipe to be regalvanized, except thick wall pipes led via el. comp. and above el. equipment which are welded on board. Welds are painted outside only.
7. Where pipes pass through water tight decks or bulkheads, 3 - flanged spools or sleeve joint to be used.
8. Gasket packing for the flanged joint to be of flat packing type, asbestos free.
9. Main engine lubricating oil system to be flushed with system oil as per agreed procedure with Owner and Engine Maker.
10. All pipe, valves, fittings, and components to be of an internationally recognized standard, such as DIN.
11. As far as practical, pipes bent in cold bending machine. For diameters 200 mm and above the elbows to be prefabricated (welded segments).
12. Bending radius, supports, connections, bulkhead fittings, clamps are according to Builder's practice.
13. Name plates are fitted at all valves and other hand controlled fittings. For valves located under a floor/lining additional name plates are fitted on the floor/lining cover.
Material: - brass,
 - plastic (for nameplates on lining).
15. Cooling water systems will be flushed.

Note:

- Pipes wall thickness satisfy GL regulations, according to the following table.
- Flow velocities in pipes according to enclosed diagram

FLOW VELOCITIES $V = f(D_{nom})$ IN ER INSTALLATIONS

/ FOR CONTINUOUS FLOW /



MINIMUM PIPES WALL THICKNESS

/ SATISFIES CLASSIFICATION SOCIETY RULES REQUIREMENTS /

PIPE WALL THICKNESS IN [mm]									TABLE 1
Nom. Dia. ND	Outer Dia. OD	STEEL							COPPER ALLOY
		A General	B Venting overflow and sounding pipes for structural tanks	C Bilge ballast and general sea water pipes	D Bilge, air ,overflow and sounding pipes through ballast and fuel tanks, ballast lines through fuel tanks and fuel lines through balast tanks	E Heating coils	F CO ₂		G Sea water
							To valves	After valves	
	6.0								
	8.0								0.8
	10.0								0.8
8	12.0	1.6							1.0
10	13.5	1.8							1.0
	14.0								
	16.0	1.8							1.0
15	20.0	2.0							1.0
	21.3	2.0		3.2		4.0	3.2	2.6	
20	25.0	2.0		3.2		2.0 SS	3.2	2.6	1.2
	26.9	2.0		3.2		4.0			
25	30.0	2.0		3.2			4.0	3.2	1.2
	33.7	2.0		3.2		4.5			
32	38.0	2.0	4.5	3.6	6.3	4.5	4.0	3.2	1.2
	42.4	2.0	4.5	3.6	6.3				
40	44.5	2.0	4.5	3.6	6.3	4.5	4.0	3.2	1.2
50	57.0	2.3	4.5	4.0	6.3	5.0	4.5	3.6	1.5
	60.3	2.3	4.5	4.0	6.3	5.0	4.5	3.6	
65	76.0								1.5
	76.1	2.6	4.5	4.5	6.3		5.0	3.6	
80	88.9	2.9	4.5	4.5	7.1		5.6	4.0	
	89.0								2.0
100	108.0	2.9	4.5	4.5	7.1		7.1	4.5	2.0
	114.3	2.9	4.5	4.5	7.1		7.1	4.5	
125	133.0	3.6	4.5	4.5	8.0				2.5
	139.7	3.6	4.5	4.5	8.0				
150	159.0	4.0	4.5	4.5	8.8				2.5
	168.3	4.0	4.5	4.5	8.8				
200	219.0								3.0
	219.1	4.5	5.9	5.9	8.8				
250	267.0								3.0
	273.0	5.0	6.3	6.3	8.8				
300	323.9	5.6	6.3	6.3	8.8				
	324.0								3.5
350	355.6	5.6	6.3	6.3	8.8				
	368.0								3.5
400	406.4	6.3	6.3	6.3	8.8				
	419.0								3.5
450	457.0	6.3	6.3	6.3	8.8				3.5

Notes: the final thickness according to China standard GB/CB and ISO.

PIPES MATERIAL AND WALL THICKNESS

/ ER & HULL INSTALLATION /

TABLE 2					
It.	Piping system	Pipe wall thickness group	Pipe material	Pipe treatment	Valve body
1	SW cooling	G C	Cu alloy seamless CuNi10Fe (<250mm) Steel	--- Galvanized	Bottom valves: galvanized steel or butterfly valves rubber lined nodular cast iron Discharge butterfly valves: rubber lined nodular cast iron Elsewhere: bronze or rubber lined cast iron in case of butterfly valves Emergency bilge valves -steel
2	FW cooling	A	steel	Black	Grey cast iron
3	Fuel oil	A	Seamless steel	Black	For I & II class: steel Elsewhere: grey cast iron HFO pipes heated and insulated
4	Luboil	A	Seamless steel	Black	Grey cast iron
5	Compressed air	A B (starting air)	Seamless steel	Galvanized Starting air and pipes of d≤20mm: black	For I & II class: steel Elsewhere: grey cast iron
6	Ballast	C	steel	Galvanized	Sea side valves: cast steel or nodular cast iron - see Note 1 Elsewhere: grey cast iron
7	ER Bilge	C	steel	Galvanized	Sea side valves: cast steel or nodular cast iron - see Note 1 Elsewhere: grey cast iron

8	S t e a m S y s t e m	Boiler feed water and blowdown pipes	C	Seamless steel	Galvanized	Steel, cast steel or nodular cast iron
		Exhaust gas boiler, circul. water and steam pipes			Black	Pipes insulated
		Condensate pipes				Grey cast iron Pipes insulated
9		Filling, sounding and venting pipes	B	steel	Galvanized FO & LO pipes: black	Grey cast iron, brass
10		Scuppers and drains	B	steel	Galvanized	Grey cast iron
11		Tank heating coils	E	Seamless steel	Black	Cast steel
12		Water fire fighting system	C	Seamless steel	Galvanized	Grey cast iron, brass
13		CO ₂ fire fighting system	F	Seamless steel	Galvanized	Steel, bronze
14		Air conditioning system	0.5 mm	Steel, spirally wounded (Spiro type)	Galvanized	II-nd stage insulated
15		Sanitary FW	A	Seamless steel	Galvanized	Brass, Grey cast iron
16		Sanitary discharge system	A C (Lines below freeboard deck directed to overbaod)	steel	Galvanized	Cast steel, grey cast iron For ship's side: Nodular cast iron
17		Compressed air outside ER	A	Seamless steel	Galvanized	Grey cast iron, brass

18	Refrigerating system (Freon R404A)	1.0÷1.2 mm (Lines of d≤19 mm)	Seamless copper – see Note 2	---	Steel, bronze, brass
		A (Lines of d>19 mm)	Seamless steel	Black	
19	Hold Bilge System	Passing via ballast tks: D Others: C	steel	Galvanized	Sea side valves: cast steel or nodular cast iron - see Note 1 Elsewhere: grey cast iron
20	Fuel transfer	A	Seamless steel	Black	Grey cast iron Fittings under tank hydrostatic pressure: steel, cast steel or nodular cast iron
21	Bow thruster hydraulic oil	A	Seamless steel	Black	Steel, cast steel

Notes:

1. If it is permitted by Classification Society Rules butterfly valves can be used as side valves.
2. In provision chambers – nickel plated in visible places.
3. Valve seats:
 - butterfly valves of “wafer” type: synthetic rubber,
 - elsewhere: stainless steel or bronze,
 - pneumatically controlled valves: synthetic rubber.
4. Flange joints for pipes of DN>32 mm; cone unions for pipes of DN≤32 mm.
5. Where permitted by GL Rules bilge, ballast, fuel transfer piping outside ER to be connected by means of muff joints.
6. Valve type to be appropriate for their service and may include globe, butterfly or ball type.
Gate or sluice valves and cocks except for pressure gauge valve, not to be used, except on fuel oil filling stations and sanitary discharge system.

5.1.0 Sea Connection

One high and one bottom sea chest provided, inlet grates of galvanized steel.

Bolted zinc anodes fitted inside the sea chests filter with capacity for 5 years

Air/steam connection for blowing each sea chest provided.

Sea chest main valves to be cast steel / iron valve.

Sea main strainers have welded steel body, galvanized and stainless steel strainer plate with 5 mm mesh.

Air vent valve and line to be provided.

Anti-fouling plant: the electric anodes in main strainers with capacity for 2 years, by the way, the bolted zinc anodes inside sea chest with capacity for 5 years will be provided.

5.1.1 Water Cooling Systems

5.1.1.1. Sea Water Cooling System

Mechanisms and arrangements:

- Two main SW pumps, vertical of centrifugal type approx. 1140 m³/h, 0.25 MPa
- One standby SW / ballast pump, vertical of centrifugal and self-priming type approx. 325 m³/h, 0.27 MPa.

5.1.1.2 Central FW Cooling System

System will be executed acc. to ME maker's standard recommendations and it will be suitable for ME continuous operation at 85% load.

(LT-system with by-pass at charge air cooler for automatic temperature of scavenging air.

Charge air temperature will be controlled at 40⁰ for ME continuous service 85% load (as recommended by ME maker)).

Mechanisms and arrangements:

- two vertical, abt 950 m³/h centrifugal main pumps (one stand-by),
- two LT central coolers, capacity of one cooler = 60% loading,
- one expansion tank, capacity 1 m³.
- two ME cylinder cooling FW pumps, vertical, centrifugal type (one stand-by), approx. 179 m³/h, 0.30 MPa,
- one FW generator, capacity 25 t/24 h,
- one steam preheater for ME/HT circulating water,
- cylinder cooling water drain tk,

FW temperature automatically controlled.

Separate system for each MDG provided.

Each system comprises:

- one HT FW pump fitted on engine,
- thermostat fitted on engine.

System complies with maker's requirements.

For heating of all MDGs is provided system comprising:

- one heater circulating pump centrifugal, horizontal, selfpriming type, 1.5 m³/h; 0.2 MPa,
- one steam heater for MDG circulating water.

5.1.2 Fuel oil Systems

5.1.2.1 Fuel Oil Transfer System

System comprises:

- two HFO transfer pumps, screw type, 31 m³/h, 0.4 MPa,
- one diesel oil transfer pump, screw type 10 m³/h, 0.3 MPa,

HFO transfer pump serves as stand-by for DO.

Structural tanks:

- HFO storage tanks,
- two HFO settling tanks,
- DO storage tanks,
- one DO storage / service tank.
- One FO overflow tank

5.1.2.2 Fuel Oil Purification System

System comprises:

- two separation units, belt driving (two HFO separators, self-cleaning, abt.6700 l/h) (one separation unit with connection for ME LO separating - dismounting connection),
- two feed pumps for HFO separators, gear type, (filter duplex type on suction pump)
- continuous flow regulating system FC
- two steam heaters for HFO separators,
- shut of valve – sludge outlet.
- one MDO separator,

5.1.2.3 M/E and MDG Fuel Oil Supply System

One set of fuel oil supply system for main engine and main diesel generators.

Consists of:

- two supply pumps (one stand-by) gear type, $\sim 4.5 \text{ m}^3/\text{h}$, 0.5 MPa,
- one pressure regulating valve,
- one automatic fuel oil filter, mesh 0.34 mm, with by-pass pipeline, automatic back flushing filter with back flushing by means of compressed clean air, back flushing initialled either by time interval and/or differential pressure. Filter design of multi-chamber type, filter elements / filter candles of maker standard with plain surface.
- one electric preheater (50-60% ME load) in case of boiler failure
- two flow meter,
- one buffer unit,
- two circulating pumps (one stand-by) screw type/gear type $\sim 7.8 \text{ m}^3/\text{h}$; $\Delta p=6.5 \text{ MPa}$, 1.15 MPa
- two steam heaters, for MCR each, (for 140% each),
- one viscosimeter,
- one indicator filter, change-over, duplex type, mesh 0,05 mm.
- One emergency DO supply pump for MDGs.

Structural tanks:

- one HFO service tanks,
- one DO service tks

5.1.2.4 Boiler Fuel Supply System

System comprises:

- two HFO circulating pumps,
- two fuel flow meter,
- burner fuel equipment c/w pressure pump, heater, etc.

5.1.2.5 Emergency Diesel Generator Fuel System

System consists of:

- one fuel service tank,
- one engine driven booster pump,
- fuel filter, mounted on the engine.

The pump is gravity fed with fuel from the tank. Excess of fuel is returned to the service tank.

5.1.3 Luboil Systems

5.1.3.1 Lube Oil Transfer System

System comprises:

- one lube oil transfer pump, gear type, 10 m³/h, 0.4 MPa,
- one cylinder oil transfer pump, gear type, 1.0 m³/h, 0.4 MPa,
- one hand pump for cylinder oil emergency transfer,
- one filling line to ME sump tank.

Lube oil taken through the bunker stations on each side of the vessel into the corresponding tank.

Separate takeover connections provided for:

- ME circulating oil,
- ME cylinder oil, two tanks
- DG circulating oil.

Structure tanks for lube oil:

- ME lube oil storage tank,
- ME lube oil sump tank,
- ME dirty oil tank,
- two cylinder oil storage tanks,
- Diesel Generator lube oil storage tank.

5.1.3.2 ME Lubricating and Cooling Oil System

Consists of:

- two LO circulating pumps (one stand-by) screw type or centrifugal type, aprox. 550 m³/h, 0.45MPa,
- one cooler, abt. 2172 kW
- one automatic LO filter, mesh 0.05 mm, with by-pass pipeline, automatic back flushing filter with back flushing by means of compressed clean air, back flushing initialled either by time interval and/or differential pressure. Filter design of multi-chamber type, filter elements / filter candles of maker standard with plain surface. Sludge check with paper cabridge mounted on automatic filter.
- one indicator filter, mesh 0.06 mm, duplex type.

LO temperature in the system automatically controlled.

Schematic diagram enclosed at the end of chapter.

5.1.3.3 ME Cylinder Lubricating System

System comprises:

- one cylinder oil service tank, 1.0 m³

Schematic diagram enclosed at the end o chapter.

5.1.3.4 ME Lube oil Separating System

System comprises:

- one L.O. selfcleaning separator with controlled partial discharge, belt driving
abt. $Q=3000$ l/h,
- one feed pump for ME lube oil purifier, gear type,
- one steam heater for ME lube oil purifier.

Schematic diagram enclosed at the end of chapter.

5.1.3.5 DG Lubricating & Lub-oil separating System

Separate system for each MDG provided. Belt driving.

Each system comprises:

- engine driven lube oil circulating pump,
- one prelubricating pump, electr. driven on base frame engine,
- one cooler on engine,
- one LO automatic filter on engine.

LO temperature in systems automatically controlled.

Common for all DG:

- One separator supply pump,
- one LO to separator steam heater, belt driving.
- one LO selfcleaning separator with controlled partial discharge,
, abt. $Q = 550$ l/h,

For each MDG provided: glacier centrifuge (with driving pump) for cont. Crankcase purifying.

Schematic diagram enclosed at the end of chapter .

5.1.3.6 Stern Tube Lube Oil System

The system comprises:

- one gravity tank,
- one fwd seal tank,
- one aft seal tank.(capacity based on maker's standard)

Tail shaft bearing lubricating oil can be drained into hull tank provided for all oil drainage from ER.

To this system LO transfer pump is connected.

5.1.4 Compressed Air System

For starting of ME and Diesel Generator compressed air of 3 MPa is used. Compressor with air cooled type.

For general purpose compressed air 0.7 MPa from service air compressor with back-up through reducers from main receivers, and for automation purpose air of 1.0 MPa used, from main air receivers through reducer and via filter dryer.

System comprises:

- two starting air compressors, piston type, electric motor driven, abt. 255 m³/h , 3.0 MPa, air cooled.
- one topping up compressor piston type, electric motor driven, abt.100 m³/h, 3.0 MPa air cooled,
- two ME starting air receivers, abt. 8.5 m³ each, with automatic drain.
- one Diesel Generator starting air receiver, abt. 0.25 m³.

5.1.5 Steam, Condensate and Feed Water System

System comprises:

- auxiliary and exhaust gas boiler described in para 4.3,
- two (one stand-by) boiler feed pumps, centrifugal, horizontal, self-priming type, about 3.5 m³/h, 0.8 MPa,
- one hotwell with oil contamination alarm, total capacity 1.0 m³.
- one hotwell replenish pump, centrifugal, horizontal, self-priming type, 2.5 m³/h, 0.25 MPa,
- one dumping condenser, shell & tube type,
- one condensate observation tk,
- one chemical water conditioner.
- one salinometer in boiler feed water system,
- Shore connection for steam supply.

Boiler supply saturated steam of nom. 0.7 MPa to steam main. Steam pressure are:

- 0.7 MPa - for ME HFO heaters,
- 0.5 MPa - for Engine Room service (others),
- 0.5 MPa - for A.C. units and central heating,
- 0.2 MPa - for sea chest blowing.

Surplus steam produced by exhaust gas boiler can be dumped to atmospheric condenser. Thermodynamic steam traps with isolating valves (and by-pas arrangement to blowthrough where necessary) at every steam outlet connection will be provided. Test cocks provided at outlets of heating coils.

5.1.6 ME Air Cooler Cleaning System

System will comply with maker's requirements.

5.2 Bilge and Ballast Systems

5.2.1 Bilge System

System consist of:

- two bilge pump, centrifugal, self-priming type, 160 m³/h, 0.25 MPa,
- one bilge pump, piston type, 10 m³/h, 0.3 MPa,
- one sludge transfer pump, rotary type, abt. 50 m³/h, 0.4 MPa,
- one bilge water separator 5 m³/h, with 15 ppm alarm, and recorder,
- one de-watering plant for reducing water content in sludge (sludge de-watering unit , max 65 l/h or similar),
- one bilge water settling tank, ship's structural,
- one bilge water - sludge tank, ship's structure, capacity abt 100 m³,
- one FO/LO separator waste tank,
- one drainage and dewatering tank.

Centrifugal type pumps discharge bilge water directly overboard. Piston type pump discharge bilge water to the bilge water settling tank. After sediment period this water is deoiled by means of bilge water separator and discharged overboard. Continuous measurement of oil content in water pumped from deoiler overboard provided. In case of exceeding oil content in discharge water above 15 ppm value deoiler is automatically stopped. All suctions from bilge wells are fitted with mud box and non-return valves. Bilge suctions to be provided at the aft end bilge well, fwd port and fwd stbd bilge wells.

Valves are pneumatically remotely controlled. Suction lines from cofferdams, piping tunnel, oil drain tanks, etc. are provided with manually operated valves.

Schematic diagram enclosed at the end of chapter.

Separate bilge system provided for No 1 to 5 Holds. The system consists of 1 (one) bilge pump for dangerous cargo 25 m³/h, 0.25 Mpa,.

Pump and valves situated in separate compartment.

Discharge onto deck with international connection provided.

Bilge well (the one where scavenging drains) will be automatic emptying.

5.2.2 Ballast System

System Comprises:

- two ballast, centrifugal, self-priming type pump, 500 m³/h, 0.2 MPa.
- one ballast ejector (end emptying), abt. 80 m³/h, 0.7 Mpa (the supply water come from fire fighting system and connected to fire fighting pump in Engine Room)

Simultaneous operation of both pumps is provided excluding transfer of the ballast from one side to another side ballast tanks. Pneumatically controlled valves.

Remotely controlled pneumatic valves in the ballast system will be of butterfly wafer type with cast iron body, bronze disc and stainless steel shaft, NBR seal.

For compensating ship's heel during container loading/unloading heel compensation system is provided. System use two ballast tanks.

System comp.:

- one antiheeling, centrifugal, pump, 600 m³/h, 0.13 MPa.

Pump and two automatic controlled valves are fitted in separate antiheeling pump room.

Antiheeling system will be of one supplier (electronic / pump / sensors).

Automatic control – see item 6.7.16.

For compensating ship's heel in case of damage of side shell of tank ,in the emergency case, the valve of anti-heeling system can be controlled from bridge.

5.3 HULL PIPELINES.

5.3.1 Filling, Sounding and Air Vent Pipelines

5.3.1.1 Sounding Pipelines

Generally all ballast hull tanks, closed spaces, cofferdams, bilge wells and chain lockers are fitted with 1 1/2" sounding pipelines.

Heavy oil tanks are fitted with 2 1/2" sounding pipelines; potable water tanks with level gauges.

Generally all pipelines which run to open decks to be led in areas free of passageways and terminated abt. 500 mm above deck.

Sounding lines for the double bottom tanks which are situated in engine room are abt. 0.8 m above the floor and terminated with self - closing cocks c/w test cocks. Striking plates fitted at the ends of sounding pipes.

Sounding pipes lower end terminated 30mm above bottom.

Materials:

- steel pipes - double sided hot galvanized (for oil and fuel tanks non-galvanized),
- deck plugs - steel seats, brass plugs,
- self closing and test cocks - malleable heads and brass cones.

Connections:

- muff joints or welded flanged.

5.3.1.2 Filling Pipelines

The ship is fitted with central heavy fuel, diesel oil and luboil filling intakes system. Fuel oil consisting of:

- one coarse filter
- one pressure gauge
- one sampling connection (details to be submitted by the Owner).

Filling terminals are situated in boxes of capacity acc. to the USCG requirements. Heavy fuel oil filling pipe dia. to be 200 mm.

Bunkering stations are situated PS and SB and are equipped with lugs.

Potable water intakes are led from main deck directly to each tank.

Removable thermometer (1) to be provided. Rails to be modified to allow straight hose connection.

Water inlet fitted with connecting flange as per DIN ISO 5620.

Sampling device for fuel to be delivered by the Owner and mounted by the Shipyard.

Materials:

- steel pipes double-sided hot galvanized for water,
- non-galvanized, painted outside for fuel and oil.

Connections:

- flanged or welded or with muff joints.

5.3.1.3 Air Vent Pipelines

All hull tanks, closed spaces, cofferdams and sea chests are fitted with air vent pipes. Positioning and diameter of the pipes are to Classification Society requirements.

Potable water and ballast water air vent pipes are led to weather deck and terminated with air vent heads of approved type. Air vent heads of potable water tanks are fitted with antiinsect protection.

Air vent pipes of fuel tanks are connected to overflow pipelines led to overflow tanks, separately for HF and DO.

HF tanks in E.Room area are included into separate overflow system. Overflows from daily tanks led to settling tanks. The highest point of overflow piping fitted with air vent pipe terminated on weather deck with air vent head with spark arrester net.

Common air vent pipe of E.Room tanks and of M. Engine lube oil circulating tank, and sewage treatment unit led to funnel platform. Fuel overflow tanks air vent pipes led to open deck; the tanks have 20% and 90% of filling signalization. HF and DO tanks will have additional 90% floating switch alarm (beside of tank remote system).

Air vent head of luboil tanks have spark arrester nets.

Sea chests vent pipelines terminated on open deck with pipe end bent down.

Small E. Room luboil tanks air vent pipes terminate in E. Room.

All vents terminated above weather deck will be arranged in safe distance from air-condition system inlets.

Materials:

- steel pipes - double sided hot galvanized for water,
- non-galvanized, painted outside for fuel and oil,
- vent heads - cast iron, or steel welded painted body

Connection:

- flanged or welded or muff joints.

5.3.2 Scuppers

The weather superstructure decks are drained in cascade system from upper to lower decks. Deck scuppers arranged to keep decks water free at all trims and lists. Scupper pipes from main deck to be led to just above deep load line with protection plates on deck.

Pipelines from main deck and 1st deck are made of thick wall pipes (114.3 x 10), welded to deck and shell plating. Funnel platform drains are led onto weather deck. All stores (except paint store and deck store), workshop, etc. situated on weather decks are drained by drain plugs mounted in the walls. Paint store and deck store are drained by drain plug. Chain lockers are emptying by ejector and storm valve overboard.

Materials:

- steel pipes - double side hot galvanized (for scuppers from decks above freeboard line),
- drain grates - hot galvanized steel.

Connections:

- flanged, welded or muff joints.

numbers of discharge pipe for plug on weather decks to be provided. The numbers to be decided by final arrangement.

5.3.3 Tank Heating and Steaming - out

Heating medium : steam 0,5 MPa.

Heavy fuel viscosity : 380 cSt.

The system ensures obtaining of temperatures in tanks as listed in table below:

It	Tank	Tm [°C]	Tp [°C]	t [h]
1	Heavy fuel settling tank	60	60	---
2	Heavy fuel daily service tank	80	80	---
3	Heavy fuel storage tank	38	55	48
4	Heavy fuel overflow tank	38	55	48
5	Separator wastes tank	35	60	24
6	Bilge water settling tank (1)		50	24
7	Bilge water separator wastes tank	35	60	12
8	ME luboil circ. Tank	30	30	-----

where:

Tm	-	temperature maintained in tank
Tp	-	pumping temperature
t	-	heating-up time from Tm to Tp
(1)	-	temperature is maintained in tank only in time of separator operation.

Pipelines supplying steam to tanks and heating coils in tanks are made of steel pipes. Heating coils with welded connections. Except tank heating, the system is prepared for heating of overflow main outside E. Room.

Heating coils in HFO storage tanks subdivided into about 50/50 percent with separate steam inlet and outlet c/w steam traps. All dirty oil tanks, sludge tanks provided with heating coils.

Fuel and oil tanks will have steaming out possibility.

Materials:

- steel pipes - non-galvanized.
- fittings - suitable for heating medium.

Connections:

- flanged or welded.
- heating coils in tanks sleeve welded.

5.4 BOW THRUSTERS

One controllable pitch or fixed pitch with step starter type bow thruster driven by electric motor about 1100 kW installed.

Bow thruster arranged fore in transverse-tunnel.

5.5 FIRE-EXTINGUISHING INSTALLATIONS

5.5.0 General

These incorporate:

- water fire installation
- water spraying system for Holds No 1
- CO2 fire system
- portable fire fighting equipment
- fire detecting and signalling system
- local application water mist system

5.5.1 Water Fire Installation

The water fire installation is designed and installed as per SOLAS and Classification Society requirements.

The installation is fed by two fire pumps. One of them, is situated in ER, the second one in bow thruster compartment supplied from ESWBD - and remotely operated from bridge.

One (1) pump has got capacity 90 m³/h at delivery pressure abt 0.8 Mpa, located in Bow thrusters room. Another one (1) pump has got capacity about 140 m³/h at delivery pressure abt 0.8 Mpa, located in ER.

Quantity and positioning of hydrant valves are per IMO requirements.

Fire system water is also used for hawses wash-down and for sewage treatment unit washing and for chain locker drainage - through dismountable connection and for swimming pool filling with sea water.

Shore connections provided on PS and SB, terminated with international flange.

Materials:

- seamless steel both side hot galvanized pipelines.

Pipe joints:

- flanges or welded or muff joints.

Fittings:

- cut-off valves: cast iron bodies,
- hydrant valves with Storz nozzle 52: brass,
- sea valves: cast steel or steel,
- drainage valves: cast iron,
- drain cocks: brass.

5.5.2 Water Spraying System

For holds No1 destined for carriage of dangerous goods of class 1 acc. to SOLAS, Ch. II-2, Table 19.3, water spraying system is provided. System consists of one elect. driven pump (or without this pump based on Rules of Class), pipelines and set of spraying nozzles.

Nozzles quantity and layout ensure intensity of water delivery min $5 \text{ dm}^3/\text{min.} \times \text{m}^2$. There is also possibility to connect the water spraying installation to the fire main.

Materials:

- | | | |
|---------------|---|--|
| – Pipelines | - | seamless steel, both sides hot galvanized, |
| – Pipe joints | - | flanges, muff joints and threaded unions, |
| – Fittings | - | bodies of cast iron. |
| – Nozzles | - | corrosion resistant material, acc. to Maker's recommendation |

5.5.3 CO2 Fire System

The systems are designed to protect the following spaces:

- ER with adjacent compartments
- holds
- emergency generator compt

galley exhaust duct – protected by 5 kg portable type extinguisher.

For E. Room fire protection CO2 quick release system is provided. Remote cylinder and E. Room valve opening is actuated with CO2 operated release in releasing cabinet, on main deck, SB in corridor close to the ER exit. Actuating of the system is also possible from the CO2 compartment. In the CO2 compartment the manifold with valves for gas releasing into holds and independently into EG compt.

Galley exhaust duct is protected by means of one 5 kg CO2 portable type extinguisher connected to duct.

The CO2 is stored in steel 67.5 1 cylinders with filling ratio 0.675 Kg/1.

Opening of doors of remote actuating of E. Room extinguishing system or opening of E. Room main valve in CO2 compartment actuates CO2 alarm singnallization and E. Room fans shut off. 0.5 - 0.7 MPa compressed air is provided for installation blowthrough.

Level indicator of ultrasonic type is provided for cylinder filling ratio measurement.

CO2 compartment is fitted with exhaust ventilation; the fan switches on with compartment door opening.

Connection with shore CO2 system is provided.

For extinguishing of fires in ME scavenging box local CO2 station, consisting of four cylinders, one-way valves bank is provided.

A/m extinguishing set is situated in ER.

Materials:

- Seamless steel hot galvanized pipelines able to withstand imposed proof pressure, with. Classification Society Certificates.

Fittings:

- CO2 cylinder and other valves : bronze.
- Main ER valve : steel.
- Nozzle : bronze.
- Air supply valves : steel.

Cylinders:

- Steel, V = 67.5 dm³, with Classification Society certificates.

Pipe Joints:

- welded flanges or welded,
- cone threaded unions or muff connection.

5.5.4 Hand Operated Fire Fighting Equipment

The ship is provided with adequate quantities of fire extinguishers, protective clothing, breathing apparatus and other-according to the rules of Classification Society and IMO.

5.5.5 Fire Detecting System

Machinery space covered by fire detecting installation of approved type. For the details - see: Electrical Part.

Smoke detection, of approved type, provided for holds. Smoke detection unit situated in CO2 compartment, smoke detection cabinet in CO2 room, and slave panel to be provided in wheelhouse.

5.5.6 Local Application Water Mist System

The system is designed to protect the following zones:

- main engine,
- auxiliary engines,
- boiler burner,
- fuel oil separators,
- incinerator.

The system is supplied with fresh water from fresh water tank. The system have connection to working air system.

Each zone is monitored by one flame and one smoke independent detectors.

The installation is activated automatically (by signal of fire from detectors) or manually.

Materials:

- stainless steel pipelines or copper pipeline.

Pipe joints:

- cutting ring couplings.

Fittings and nozzles:

- corrosion resistant material, acc. to Maker's recommendation.

5.6 VENTILATION AND AIR-CONDITIONING SYSTEMS.

All ventilation ducts to be equipped with pad eyes for ventilators removing.

5.6.1 Low Pressure Ventilation

The installation is divided into two basic systems:

- Ventilation of compartments outside engine room,
- Ventilation of engine room (see Chapter 4.).

5.6.2 Ventilation of Compartments Outside Engine Room.

Ventilation ducts are made of non-galvanized 4 mm steel plates, connected by welding or of galvanized 0.7-1.0 mm steel plates with flanged connections or with tightening inlets. Radial and axial fans, with electric motors, of marine type are provided.

Electric motors of fans to be provided with attached connection box.

Ventilation flaps hinge bolts made of corrosion resistant material.

Air changes and type of ventilation as follows: Air changes/h

Compartment	Supply	Exhaust	Notes
CO2 compt	Nat.	10	Started automatically by door opening.
Paint Store	Nat.	15	Expl. proof fan.
Laundry	15	20	
Galley	20	40	Supply from AC.
Bosun Store	nat.	6	
Hospital	Air-Cond.	12	
Steering Engine	**)	nat.	
Bow Thruster	nat.	**)	
Holds	3	3	Expl. proof fan, No 1-5 Holds
Air cond. unit compt.	10*)	10	
Pump room	nat.	5	
Deck Stores	Nat.	nat.	
Garbage store	Nat.	2	
Chemical store	Nat.	3	Expl. proof fan.
Oil store	Nat.	3	Expl. proof fan.

*) - air supply from accommodation exhaust system.

**) - depending on heat dissipation.

The ventilation for the holds with reefer containers to be also in accordance with Rules, the ventilation for reefer containers in hold to be mechanical air supply and natural exhaust system.

Supply and exhaust ducts in holds situated diagonally to each other.

5.6.3 Ventilation of E. Room

Ventilation ducts are built of galvanized steel-plates or steel painted on both sides with regulating flaps and wire net. Air is supplied to ER using axial-flow fans. Air is discharged from ER via funnel louvres.

Total air supply capacity of ventilation fans shall be determined basing on double amount of air consumed by the M. Engine and three MDG running at nominal rating, and supplied by four (4) fans.

Vent ducts branches will be built of steel plates 4 mm and coated inside with epoxy

Main vent. ducts will have filters and water traps.

5.6.4 Air-Conditioning System

Air-conditioning system is designed for the ambient conditions as per Chapter 0, para 0.2.

At the a/m parameters, the following conditions are provided in accommodation and public spaces:

	Inside	outside
– summer :	temperature +27 °C; humidity 40-60%,	temperature +35 °C; humidity 70%
– winter :	temperature +22 °C; humidity 40-60%.	temperature -20 °C;

In sanitary spaces with showers temp +24°C obtained by electr. heaters is provided

Single-duct air-conditioning system with individual cabin temperature control; cooling with freon R404A direct evaporation.

The air from air-conditioning installation is also supplied to:

- wheelhouse : 6 air changes / h
- bonded store

Air conditioning installation is supplemented with exhaust installations: public and sanitary.

Engine and electric workshops in ER will be supplied by packaged air conditioner and without temperature guarantee.

ECR air-conditioning with autonomous air-conditioner.

Materials: Galvanized "Spiro" type pipes.

A steam generator providing odourless steam by use of tap water from the ship's fresh water system shall be installed in order to control the humidity of the inside air at cold outdoor condition. The steam production shall be adjustable from 100% to 20%.

5.7 FRESH WATER INSTALLATION.

One common installation of fresh water, for drinking and sanitary purposes, is provided.

The installation is served by automatically operated hydrophore system comprising:

- 1 m³ pressure tank; working pressure 0.40 - 0.55 MPa,
- 2 selfpriming centrifugal pump; Q = 70 ÷ 150 l/min, H = 0.27-1.2 MPa,
- 1 UV sterilizer

fresh water generator to be plate type, and salinity to be less than 2 ppm.

Water counter is fitted on hydrophore tank outlet.

Hot water is prepared by steam heater of 1000 l capacity and by electr. heater in case of steam heater damage. Capacity of those emg. heater to be based on calculation.

Thermostat keeps the water temperature not higher than 60°C.

Centrifugal pump Q = 5 - 35 l/min, H = 0.06 - 0.04 MPa ensures hot water circulation.

The fresh water is stored in two hull tanks PS and SB. The water is replenished from 25 t/day vacuum evaporator.

From the evaporator water can be directed to boiler feed water tank or via dolomite mineralizer to fresh water tanks.

The water is hardened by mineralizer to 1.2-1.5°N (German deg.).

All above described equipment is situated in E. Room. Cold and hot water is supplied to sinks, washing basins and showers; cold water is supplied to drinking water coolers - one set in pantry and one near ECR, to WC bowl and draw - off points.

For wheelhouse window washing cold water is provided.

Fresh water connection point on board as following,

Main deck near accommodation, aft part of bridge deck, main deck near midship.

Materials:

- | | | |
|-------------|---|--|
| Piping | - | copper. |
| Connections | - | threaded unions, flange welded or soldering, |
| Fittings | - | cut off and distribution valves – brass and cast iron, |
| | - | wash basins, showers, sinks, bath tube - chrom plated brass. |
| | - | wash basins, sinks, self closing non concussive type. |
| | - | shower, mixing valve bath tub valve mixing type – chrom plated brass |
| Pumps | - | cast iron body, bronze impeller, stainless steel shaft. |

Hot water pipelines are heat insulated; cold water pipelines have only anticondensation insulation where arranged behind linings.

All sanitary piping to be of copper, and the other working water piping to be of gal. Steel.

5.8 SANITARY DISCHARGE SYSTEM

There are provided sanitary discharge systems as follows:

- a) discharges from toilet bowls,
- b) discharges from medical block spaces,
- c) discharges from washbasins, showers, sinks and floor drains in WC rooms,
- d) discharges from laundry,

Discharges under a) (sewage) are passed by gravity to a biological sewage treatment plant or directly via storm flap overboard.

Discharges under b) are passed to sewage treatment plant.

Remaining discharges are directed via storm flap overboard.

Only discharges from galley sinks and floor galley scuppers are led to defatter, then overboard.

The highest points of discharge verticals are fitted with air vents terminated with "goose necks" on open deck above wheelhouse.

Materials	:	-	, hot galvanized steel pipes,
		-	sinks - stainless steel,
		-	WC bowls, wash basins - china (porsanit),
Fittings	:	-	wash basin and sink sewer traps - PVC.
		-	cut-off valves - cast steel or cast iron bodies,
		-	storm flaps - cast steel bodies.
Connections	:	-	flanged, welded, muff joints, PVC pipes joined with adhesive.

5.9 Compartment Heating

Electric systems is provided.

Ensures heating of compartments as listed in following table.

List of heated compartments:

Compartment	Heating System	Capacity in kW	Notes
Wheelhouse	el.	3 x 2 kW	see Note
Sanit. Spaces	el.	1 x 300 W	see Note
WC's	el.	1 x 300 W	
Steering Gear	el.	2 x 2 kW	
CO2 cyl. comp.	el.	2 x 2 kW	
Emerg. Generator	el.	1 x 2 kW	
Fire equipment store	el.	1 x 2 kW	
Bow thruster room	el.	3 x 2 kW	
Bosun store	el.	1 x 2 kW	

Note:

1. Sanitary spaces are heated with air from adjacent compartments and only additionally heated by electric heaters.
2. Deck stores are provided with electric heaters – in order to avoid moisture collecting in compartment only.

5.10 COMPRESSED AIR SYSTEM

5.10.1 Compressed Air Outside Engine Room

The installation of 0.5-0.7 MPa is carried to:

- CO2 blow-through in CO2 cylinders compartments,
- supply points on weather decks PS and SB, 6 points each side and one in CL plus forecastle (1), poop (1), bow thruster room and bosun store,
- supply points in ER,
- emergency generator compt
- wheelhouse window washing line blow-through
- sea chest blow-through with air reduced to 0.2 MPa.
- supply points on 2,4,6 superstructure decks (one per deck)

All valves of supply points are fitted to connection of threaded end of flexible hoses or threaded blinds. Dewaterers are fitted before reduction unit.

The compressed air 0.7 MPa is supplied by working air compressor with capacity abt. 120 m³/h.

Materials : steel seamless pipes, double sided hot galvanized.

Fittings :

- supply valves - brass,
- dewaterers - galvanized steel body.

Connections :

- flanged or threaded cone unions welded to pipes.

CHAPTER 6

ELECTRIC INSTALLATION

6.0. GENERAL

Installation of electric equipment and wiring necessary by structural, joiner, or machinery works mentioned in Hull and Machinery part of the Specifications will be provided.

A. Stipulation**1.) Temperature**

In general, electric equipment will be designed considering the ambient temperature and the value of temperature rise specified by the rule.

Where the ambient temperature is in excess of the above value, the maximum temperature rise not to exceed the value specified by the rule.

2.) Installation

The whole electrical works on the vessel will be carried out in accordance with the Specifications and Builder's usual practice.

Electric equipment will be placed in ventilated space, where they are not exposed to the risk of mechanical injury and the damage from water, steam, oil, and where inflammable gases can be accumulated and by excessive heat.

Where necessarily exposed to such risk, the equipment will be protected from the damage, including total enclosing if necessary.

Insulation resistance for feeder circuits will be measured and recorded. Minimum $5M\Omega$.

All heavy hinged doors in switch boards, distr. panel and consoles will have door stopper in open position.

3.) Phase Identification

Busbars in generators, motors, switchboards, starter panels and distribution boards will be marked with following colours.

Those in other branch circuits will be marked with manufacturer's standard colours.

a) Alternating current circuit**Phase symbol**

<u>Source side</u>	<u>Load Side</u>	<u>Colour</u>
L1	U	Light blue
L2	V	Black
L3	W	Brown

b) Direct current circuit

<u>Pole</u>	<u>Colour</u>
Plus (+)	Red
Minus (-)	Blue

4.) Colour of electric equipmentFinal paint colourEquipmentColour Number

Generator, motor	:	Blue
Switchboard, starter, transformer, distribution board, battery charging board	:	RAL7032
Lighting fixture	:	Manufacturer's standard
Interior communication equipment	:	"
Nautical equipment	:	"
Radio equipment	:	"
Emergency bell and switch	:	(red)

Owner will provide the above relevant color code to yard.

The paint colour of the inner surface of metal casing will be in accordance with the manufacturer's standard.

The paint colour of foreign make electric equipment and electric equipment on the market such as refrigerators, washing machines, etc. will be in accordance with the manufacturer's standard.

Synthetic resin

Manufacturer's standard.

5.) Colour of indication lamps, pilot lamps, etc., of switchboards, starter panels, distribution boards and battery charging / discharging boards

Running	:	green
Ready to start, heating	:	orange
Power source	:	white
Alarm / shut down	:	red
Heating	:	blue

Those colour of small electric equipments, navigation, communication and radio equipments will be in accordance with manufacturer's standards.

B Fuse

The fuses which are used for protection of control circuits, alarm circuits, indicating circuits, etc., will be of cartridge type, except that the fuses fitted on the special equipment such as electronic equipment, foreign make equipment will be of the manufacturer's standard type and rating.

6.0.1. Power Distribution

Based upon 60 Hz, three-phase, three-wire system with isolated neutral. The voltages used:

- 3 x 450 V generators,
- 3 x 440 V power consumers,
- 3 x 220 V domestic appliances,
- 220 V lights, emergency lights, radio equipment, nav aids, indications, domestic appliances, heaters in cabins and public rooms 440 V heaters (others),
- 24 VDC ER control system, emergency D.G. starting apparatus, fire fighting central unit, radio station.

6.0.2. Cables**Cables and Cable Installation**

Cable installation will be done according to Rules and Makers Regulations and Builder's standard method. About the details of cable installation, Drawing of Builder's Standard of Cable Installation will be submitted to the Owner.

All cables will be so installed that they are not subjected to tension or chafing due to the working of the ship's structure.

Cable penetration of watertight bulkhead or deck will be carried out with watertight gland, stuffing tube.

Cable penetration of ordinary deck to be carried out by steel pipe in height of 20cm from deck except for cable inlet to deck mounting type electric equipment.

Cables installed in group will be supported by steel hangers which are so arranged as to permit painting of the surrounding structure without undue disturbance.

Cables will be fixed to the hanger by the binding tapes of galvanized steel or polyamid 6.6 for the cables in the machinery space, accommodation space, and store space, and by the binding tapes of polyamid 6.6 for cables exposed to weather.

All cables will be bound together without relation to kinds of circuit such as power, control, lighting, radio, navigation and communication circuits. Cables will be supported on flat iron strips, round bar or conduit tube.

Cables runs may include the joints or connections. Where the joints or connection are necessary, the junction boxes or branch boxes will be fitted, and to have easy access. Multiple core cables and multiple terminal connection boxes will be used to some communication, nautical, lighting, measuring and control circuits. These cables and connection boxes will be common use for all kinds of circuit.

Cables laid under the engine room lower floor and under the checkered plate grating will be protected by flexible metal conduit tube and/or steel galvanized pipes and laid in accessible position not to be exposed to accumulation of water, oil, oily vapour, steam and excessive high temperature.

Cables in cabins, public rooms and passage, where ceiling or walls are lined, will be installed behind lining.

In cabins, if not possible to fit cables behind lining, cables will be covered with plastic cover.

Cables laid on the upper deck if necessary will be arranged in galvanized steel pipes (S.G.P.) with suitable expansion joints and pull boxes.

Cables along foremast will be protected with galvanized steel pipe and/or steel plate up to 2 m height on the deck.

Special cables, such as radio cables, compensating cables, shielded cables, etc., will be used where necessary.

Cables are provided with copper multi-wire cores, in crosslinked polyethylene insulation and sheathing suitable for working temperature 85°C.

Cables will be accepted by GL class.

6.0.3. Power Supply to Consumers

3 x 440V, 60 Hz consumers are fed ex generators via main switchboard, group distr. boxes and end distr. boxes using three-wire system. Some consumers are fed ex main switchboard via emergency switchboard - please see 6.1.7. 3 x 220 V, 60 Hz consumers are fed ex 3 x 440V, 60 Hz main switchboard busbars via three-phase 450/231 V, 60Hz transformers, 3 x 220 V, 60 Hz main switchboard busbars, group distr. boxes and distr. boxes.

Some 3 x 220 V, 60 Hz consumers as prescribed are fed ex 3 x 220 V emergency switchboard busbars.

6.0.4. Motors

Shipboard machinery is operated by asynchronous motors for direct-on-line start, or in case of considerable starting currents, via star / delta system. Motors over 0.5 kW are started by means of contactor c/w thermal relay in distribution box or in contactor box, or by means of individual starters the versions being used to suit the controls and alarms of the machinery. Protection degrees for el. motors according to classification requirements.

Starters for motors of 0,5 kW and above include:

- fuse and breaker (see item 6.1.9),
- magnetic contactor,
- thermal overcurrent relay for two phases,
- orange lamp for stand – by (if provided),
- start/stop push button (if starter box is “in situ”)

installed in steel contactor box or group contactor box

For motors up to 0,5 kW following should be provided:

- magnetic contactor,
- thermal overcurrent relay,

– start/stop push button (if starter box is “in situ”)

installed in contactor box or group contactor box.

Essential consumers fed directly from main switchboard are fitted with running hour meters.

Motors of bow thruster, pumps placed in pumproom, steering gear, mooring winches, cargo cranes, auxiliary cranes with anticondensation heaters.

Motors above 10kW installed on open deck or in compartment where air temperature is below 10⁰ C is possible to be fitted with anticondesating heating.

6.1. POWER SOURCES AND DISTRIBUTION GEAR

6.1.0. General

All diesel driven generators have anticondensation heater controlled by thermostat and interlocked.

A complete automatic start / stop system with load sharing and stand-by selection provided for main generators.

6.1.1. Main Generators

Three (3) sets 3 x 450 V, 60 Hz diesel operated generators abt. 2494 kVA each, power factor - 0.8 and One (1) set 3 x 450 V, 60 Hz diesel operated generators abt. 831 kVA each, power factor - 0.8. They are synchronous, self-excited brushless generators c/w voltage auto control, arranged for parallel and single operation. Synchronising of generators is either manual or automatic by means or relays responding to difference of frequencies of busbars and of generator.

During leaving and arriving port, the part group of reefer containers must be tripped due to electric power of above listed capacity of main generators is not enough for all loads. The load factor of main generator to be about 85% in general.

.

6.1.2. Emergency Generator

One (1) set 3 x 450 V, 60 Hz generator abt. 238 kVA, power factor 0.8, arranged for auto start, in case of voltage decay in 3 x 440 V main switchboard busbars. The generator supplies the consumers via emergency switchboard.

6.1.3. Shore Connection

The ship's installation can be connected to dockside system via special box c/w auto breaker, incorporating pilot lamps, kWh counter to be provided, phase order indicator and voltmeter incorporating switch. The shore connection box is designed for 3 x 440 V, 60 Hz, abt. 400 amps. and is interlocked with generators breakers to prevent parallel running.

6.1.4. Batteries

- one 24 V alkaline battery, abt 108 Ah for ER control system,
- one 24 V alkaline battery, abt 50 Ah for ER alarm system,
- one 24 V alkaline battery for fire detecting plant,
- one 24 V lead battery for radiostation,
- one 24 V lead battery for emergency set start.

6.1.5. Transformers

Two three-phase 115 KVA 450 / 231 V transformers connected on DY5 or maker's standard system, for feeding 3 x 220V, 60 Hz main line.

One transformer is sufficient to feed 3 x 220V, 60 Hz lights and indications, the other being the standby. The 3 x 220V, 60 Hz emergency line is fed acc to Class requirements, when the emergency generator is running, ex 3 x 440 V emergency switchboard busbars via 40 KVA 450 / 231 V transformer.

6.1.6. Main Switchboard

Free-standing switchboard of steel construction, operated from the front, arranged in Engine Control Room. Instruments accessible from the front and from the rear upon opening doors.

Mounted on foundation plate and shock - absorber pads. Provided at least four busbar sections:

- one to which diesel generators are connected and shore supply. This section feeds 3 x 440 V, 60 Hz section of emergency switchboard and other single consumers. Consists of hand, and automatic synchronization system and also failure system.
- two for power distribution of double consumers e.g. associated with main engine, transformers and refrigerated containers.

Two-stage trip-off of non-essential services is operative in case generators are overloaded. It is effected in main switchboard by means of auto breakers or contactors. Consumer panel are fitted with fuses and switches or breakers c/w protections. Large-size are fed via short - circuit breakers. Each generator has separate panel in main switchboard, incorporating:

- voltmeter and ammeter c/w switches,
- active / reactive power meter c/w switch.
- engine governor,
- switchgear,
- switch c/w lamp for anti-condensation heater,
- breaker and voltage controls,
- generator protections against overload, reverse power and voltage decay,
- frequency meter

Lock prevents operation of shore connection while any generator is running. The lock also trips off shore supply as soon as some selected is cutting in.

3 x 220 V, 60 Hz are fed ex two transformers incl. standby, to supply lights, indications, radionavids. The busbars are provided with voltage / current readout in three phases insulate readout, insulation indicating and transformer overload alarm.

Main generators circuit breakers of pull-out type with test position.

Four 100A frame size for 440V and two 100A frame size for 220V spare feeders are provided.

The type of ACB and MCCB as follows,

ACB----draw-out, MCCB----plug in

6.1.7. Emergency Switchboard

Wall-adjacent switchboard of steel construction arranged in emergency generator compartment. Instruments accessible from the front upon opening doors.

Provided with two busbars sections: 3 x 440V, 60 Hz and 3 x 220 V, 60 Hz.

Emergency generator is coupled to separate panel incorporating:

- main breaker,
- voltmeter and ammeter c/w switches,
- kW meter,
- frequency meter,
- generator protections.

The switchboard is fitted with:

- voltage / current readout for 3 x 220 V, 60 Hz busbars,
- readout / indication for insulation of busbars.

Locking facility prevents simultaneous switch on of supply from:

- 3 x 440 V main switchboard busbars,
- emergency generator,

The type of ACB and MCCB as follows,

Emergency generator circuit breaker----plug in, MCCB----plug in

6.1.8. Emergency Supply System

This covers the services supplied from emergency switchboards:

- emergency fire pump,
- start air topping up compressor,
- bilge pump,
- auxiliary engine prelub. pump panel,
- DG fuel booster pump,
- steering gear c/w gyropilot (1 set only),
- main / auxiliary radars,
- gyrocompass,
- emergency lights consumers,
- radio equipment,
- nav aids,
- alarms / indications,

- fire fighting central,
- one engine room exhaust fan.
- messroom

The emergency light consumers are fed ex end distr. boxes via group distr. boxes. The emergency supply system permits to supply the services as prescribed, in emergencies.

6.1.9. Distribution Boxes

Power group and end distr. boxes are fitted with cartridge type fuses and pacco switches or, in addition, with contactors and thermal relays. End distr. boxes for light are fitted with two-polebreakers, 10 amps. The distribution boxes are of wall-mounted or wall-adjacent type, made of steel elements, arranged in recesses or separate electrical compartments.

The distr. boxes for engine room machinery are installed in ECR or "in situ".

Most distr. boxes are typical power and contactor boxes or IP44 protection. Some group distr. boxes are specially designed boxes of IP 22 protection.

Spare circuit are provided in each distribution box, approx. 10% .

MCCB to be fixed type.

6.1.10. Power System

6.1.10.1. Auxiliaries

Main engine and engine room auxiliaries are fed ex main switchboard and ex distribution boxes. Other machinery are fed ex contactor boxes. workshop machinery and shaft turning gears are fed ex distribution boxes. Individual motor starters are provided "in situ" close to equipment.

6.1.10.2. Deck Machinery

Cranes, bow thruster and mooring winches are fed directly from main switchboard. Steering gear c/w gyropilot is fed via two lines, from main switchboard busbars and from emergency switchboard, one system on PS, one on SB.

Other machinery such as boat crane are fed ex distribution boxes.

Contactor gear for deck machinery is arranged in special electrical compartments. Controls for rudder engine and bow thruster with respective indicators are provided also from the bridge wings.

6.1.10.3. Ventilation

Engine room fans are fed from main switchboard.

Controlled by means of START / STOP buttons c/w lamps in Engine Control Room, also connected to ALARM AND MONITORING SYSTEM.

Accommodation fans are fed ex contactor boxes, controlled by means of START/STOP buttons c/w lamps, arranged either within space ventilated or in way to it. Hold fans are fed ex contactor boxes, controlled from wheelhouse and Deck Office by means of START/STOP buttons c/w lamps.

6.1.10.4. Provision Store and Air-Conditioning Plant

Provision store plant is supplied in separate line from main switchboard via distribution box in reefer machinery space. Compressor and air conditioning unit in accommodation air-conditioning plant are fed from main switchboard via distribution box "in situ". The a/m pumps have START/STOP buttons c/w lamps. The compressors have START/STOP buttons c/w lamps and ammeter for "in situ" control. Air-conditioning units are fed ex main switchboard via group contactor boxes.

6.1.10.5. Domestic Appliances and Heaters

Domestic appliances and heaters are fed from group and end distr. boxes.

6.1.10.6. Refrigerated Container Sockets

Places for 400 plug sockets for refrigerated containers 3 x 440 V, 60 Hz, 11.0 kW are provided, in which about 200 plug sockets on deck and about 200 plug sockets in holds.

Distribution of refrigerated container sockets according to plan later.

Reefer monitoring system – is supplied by Owner, but the cables and necessary installation for applying PCT in future to be installed on board by builder.

6.1.10.7. General receptacles

Receptacles shall be provided on the inside of passage ways for the use of vacuum cleaners and small electrical appliances.

Each cabin to be provided with one 220V AC receptacles for general use, one automatic telephone outlet and one multi coupler antenna.

Two receptacles of 3 pole earthed type 16 A, with switch to be positioned at each hold (1 each side).

One receptacle of 3 pole earthed type 16 A, with switch will be positioned at each superstructure deck.

Adequate number of same characteristic receptacles to be fitted in E.R., including tunnel, provision stores, forecastle deck, and steering gear space . each single cabin with 2 sockets, 220v for general use, for senior officer cabins with 2 plus 3 same sockets.

6.1.11. **Machinery Emergency Shutdown**

Centralizer safety station provided in fire control station.

The installation covers:

- lube oil / fuel pumps, separators and engine room fans operable from control boxes at engine casing exit,
- engine room fans operable prior to CO2 discharge into machinery space.
- accommodation fans, accommodation air-conditioner and hold fans operable from wheelhouse and Ships Office.

another safety station provided on corridor outside engine room will cover the emergency stop for equipment in engine room.

The shutdown effected by use of pacco switches, one switch per a number or even group machinery.

One central station outside the engine room with all emergency shut-offs and releases provided.

6.2. LIGHTING SYSTEM

6.2.1. Engine Room

Lighting in engine room is of mixed type using fluorescent tubes and four halogen floodlights, 500W. Fed ex main/emergency switchboards via separate lines.

Distribution of lighting points and division of lines ensure uniform illumination of the engine room in case of voltage decay in main switchboards. Level gauges, indicators and sight-glasses illuminated with incandescent lamps. Lighting is switching off-on by circuit switches of end distr. boxes.

Tank top and bilge wells to be illuminated with incandescent lamps.

Double bottom tunnel will be sufficiently illuminated.

Sufficient bilge lighting will be provided.

6.2.2. Accommodation

Fluorescent tubes for main ceiling lights in accommodation spaces and in corridors. In small-size sanitary spaces, are provided incandescent lamps. In addition each cabin is fitted with incandescent reading lamp and general – use two double SHUKO plug socket 220 V and three double sockets above desk.

Shaver sockets provided in fluorescent mirror lamps, and fed via transformers. General-use SHUKO plug sockets in public rooms – two double sockets, one double socket in bedroom and one double socket in each corridor. Local lights and basic general lights fed from dissimilar lines. Accommodation lights except cabins, WCs, and stores fed from main and emergency switchboards.

Wall lamps in messrooms, off. living rooms and conference room are provided. the red light during night navigation and the light of instruments are with dimmer.

6.2.3. Outside Lights

Decks, manoeuvring stations and boat stations illuminated with mast type floodlights mounted at mast and guard rails. Weather-tight fluorescent lamps used for deck illumination under hatch coamings in sufficient number. Floodlights fitted PS and SB in way of lashing fittings between 40 ft containers.

The floodlights will be of sodium or halogen type to suit requirements. Superstructure outside illuminated with fluorescent lamps and halogen floodlights, controlled from distribution box in navigating desk. Two searchlights mounted on bridge wings acc to Suez Canal regulation.

Cargo holds illuminated with sufficient number of fluorescent and halogen floodlights, accessible for maintenance, explosion proofed type with key switch in bridge control panel.

Lights endangered for mechanical damage will be protected against.

Provided one connection box outlet for the Suez Canal searchlight, in bosun's store. Cable through-led pipe provided. Suez Canal searchlight - Owner's delivery.

Switch box / control unit Lightning passage ways, outside of accommodation are controlled from wheelhouse and cargo office.

4 floodlights should be fitted above bridge deck, 1000W each.

Funnel is illuminated by flood lights

Ship's name on bridge sides will be illuminated by fluorescent lights

Lighting acc ISPS for ships hull outside will be installed.

6.2.4. Navigation Lanterns

These are as required by the Classification Rules and International Convention for Safety of Life at Sea. Fed with 220 V, 60 Hz from main switchboard or emergency switchboard.

6.2.5. Signalling Lights

Aldis lamp and Morse lamps are fed from main or emergency switchboard via distribution box in navigating desk or from battery.

6.2.6. Wheelhouse Console

This incorporates: (radars+electronic seachart+navigation control panel)

- ME control system and indication panel,
- ALARM AND MONITORING SYSTEM workstation for ballast control,
- navigation lights mimic control panel,
- x-mass three lights mimic control panel,
- distribution box for outer lights,
- accommodation ventilation, air conditioning and hold fans emergency shutdown,
- general alarm,
- steering engine indications,
- fire pump indications / controls,
- "man in reefer" alarm,
- hold fans indications / controls,
- "hospital" alarm
- bow anchors, anchor chain remote release control with length indicator showing length of chain in/out,
- off course alarm in steering column,
- hold lighting control,
- electrotyphon control,
- Watch up system (6 reset push bottoms) sufficient dimmed lamp.

Bridge wing console incorporates:

- ME: control, emergency stop, override, starting air indicator
- Thrusters: controller, emergency stop, A-meters
- NFU tiller with rudder angle indicator
- VHF handset, loudspeaker connected to one VHF set bridge
- Talk back loudspeaker and microphone

- Typhone push botton
- Deadman reset button

Additional panama canal requirements:

- indication of main engine RPM and direction
- rudder angle indication with sufficient size.

6.3. ALARMS

6.3.1. General Emergency Alarm

The alarm is fed under 220 V, 60 Hz from main switchboard and emergency switchboard with change over.

The alarm system is activated by push-button located in wheelhouse console, or by a push button at lifeboat station. General emergency alarm signalling is effected by electronical sirens distributed all over the ship. Silent/mute alarm to be installed acc to ISPS and SOLAS.

Electronical sirens and flashing lamps are provided in machinery spaces.

Alarm signals:

Function		Audiable		Visual
		Code No	Device	
1.	General Emergency alarm	1	Sirens in accommodation corridors. High tone of dual tone electric siren in ER, High tone el. siren on open deck.	Green/white flash light in ER wherever electric sirens are likely to be inaudible + pictogram
2.	CO2 alarm	2	High tone of dual ton electric siren in ER.	Red flash light in ER wherever electric sirens are likely to be inaudible + pictogram
3.	Fire alarm	3	High tone of dual tone electric siren in ER. Sirens in accommodation corridors (after 2 minutes if fire alarm is not acknowledged in fire central unit or repeater).	Red flash light in ER wherever electric sirens are likely to be inaudible + pictogram
4.	Machinery alarm	4	Second tone of dual tone electric siren in ER.	Amber flash light in ER wherever electric sirens are likely to be inaudible + pictogram
5.	Telephone call	5	Second tone of dual tone electric siren in ER	pictogram
6.	Telegraph sign.	6	Second tone of dual tone electric siren in ER	pictpgram

6.3.2. Carbon Dioxide Warning

Fed under 220 V, 60 Hz from the system feeding general emergency alarm. Actuated by limit switches at gas discharge valves. A warning alarm shall be given before the carbon dioxide is released.

6.3.3. Fire Alarm

Fed under 220 V, 60 Hz from emergency switchboard via power unit and under 24 V from independent battery, consists of:

Conventional type fire central unit c/w smoke (ion or optical) and thermal sensors as well as pushbuttons. Manual push-buttons on each deck of superstructure in alleyways.

Sensors provided in engine room, corridors and stairways within accommodation.

The system does not cover the holds.

The central unit is arranged in wheelhouse, alarm repeater with acknowledge reset button in deck office.

If a fire signal is not acknowledged within two minutes an audible alarm is automatically actuated by means of general emergency alarm signalling appliances.

The smoke detection cabinet for hold will be arranged in wheelhouse, and smoke detection unit will be arranged in CO2 compartment.

6.3.4. MAN-in-REEFER Alarm

Operable by means of illuminated pushbuttons, at door inside each refrigerated hold provision chamber. Audio alarm is carried to galley and wheelhouse. Fed under 220 V, 60 Hz from wheelhouse console.

6.3.5. Hospital Alarm System

Hospital bed is provided with alarm push-button whereas visual and acoustic signalling system is located in wheelhouse console. Hospital alarm is supplied at 24 V, 60 Hz.

6.3.6. Dead man Alarm System

The dead man alarm system to be installed on board as follows,

In Engine Room entrance (on-off switch)

In Engine Room (reset push-buttons and warning lights)

In Wheelhouse with extension alarm to alarm light panel.

6.3.7. Alarm light column system

For visual and audible alarm indication in machinery space. The alarm light column responds to the following signals:

General alarm / Fire alarm / Machinery alarm / Telephone call / Telegraph call / Dead man alarm / CO2 alarm.

Suitable number light column with 7 alarm windows including necessary rotating light, siren or alarm horn etc, should be installed in Engine Room.

1 – control box to be installed in ECR.

1 – minic panel and bell on Engine Control Console.

Power supply: AC 220V.

6.4. COMMUNICATION SYSTEMS

6.4.0. General

Equipment will be in compliance with GMDSS, vessel will sail without radio operator. Area A3.

6.4.1. Radio -communication System

6.4.1.1. Complex Radio Station-1 set including:

- complex MF/HF 250 W PEB radiotelephone(150W-Owner option)
- main control unit with head set
- MF/HF DSC controller
- 2 set of Inmarsat C with EGC receiver
- battery charger
- set of antennas
- set of radio battery
 - set of special cables

The radio station is provided in the radio space (wheelhouse).

Supply voltage: 220 V, 60 Hz directly from Emy SWBD and 24 V - from own radio emy battery.

6.4.1.2. Satellite Communication System

Inmarsat-Fleet 77 with fax and phone, suitable for data transfer. Placed in radio space (wheelhouse). ADU on special mast on wheelhouse top deck. Supply 220V/60 Hz from ESWBD via distribution box, and back up 30min by UPS. The second satellite telephone in Captain room.

Connection between Inmarsat-Fleet 77 and telephone exchange is provided.

6.4.1.3. Radiotelephone DSC-VHF - 2 sets

Each set:

- 55 international channels
- dual watch facility
- full duplex operation
- 220 V, 60 Hz supply and 24 V DC

– maker's antenna.

One set in radio space (wheelhouse); one sets in wheelhouse console. On both bridge wings sockets for VHF connection are installed on bridge wings. Two handset provided.

One handset with remote control to be connected to cargo office.

6.4.1.4. Portable VHF Radiotelephone

3 sets portable radiotelephones in compliance with GMDSS and SOLAS are provided, with three battery chargers. They are located in the wheelhouse.

Additional 5 sets portable VHF radiotelephones (2 off Ex proof execution). 3 fixed battery chargers in Ship's Office (two for ex-proof radiotelephone) and 2 portable battery chargers.

6.4.1.5. Emergency Radio Beacon

One (1) GMDSS, float-free satellite operating EPIRB is provided.

Frequency 460 and 121,5 MHz. Location on navigation deck. Remote activation of sound alarm.

6.4.1.6. Antennas of Radiocommunication Systems

All antennas are delivered by the makers together with the equipment .

6.4.2. **Internal Communication System**

6.4.2.1. Public Address System

One (1) set of PA-System is provided as follows:

- a). Main Station including microphone and talk-back devices installed in wheelhouse console.
- b). PA talk-back substation located in following places:

Talk-back from both wing consoles

- Bow (PS+SB)
- Stern (PS+SB)
- steering gear, with headset+socket
- boat station / meeting point (socket+portable micro)
- top of wheelhouse
- ECR + Em. Control stand with handset
- loudspeakers in corridors and accommodation spaces

Supply voltage: 220 V, 60 Hz and 24 V DC.

Public addressor to be divided into four groups:

Officers

Crew cabins, public spaces, offices

Open decks and engine rooms

All group

One shifter to be installed:

Cargo office, Captain and chief/engineer's telephone

6.4.2.2. Aerial Amplifier AM/FM/TV

One set of aerial amplifier is provided. The aerial sockets are installed in the officers mess, the crew's mess, radio space (wheelhouse) and all officer's / crew cabins.

Supply voltage: 220 V, 60 Hz.

6.4.2.3. Sound Signal Reception System

One (1) set of sound signal reception system will be installed

Power supply 220V, 60Hz

6.4.3. Communications

6.4.3.1. Automatic Telephones

Automatic telephone exchange to be connected to Inmarsat F77 and public address system, 60 subscribers and 5 official lines in.

Supply voltage: 220 V, 60 Hz and 24 V DC.

Telephone sets are provided in accommodation each crew cabinet and public spaces.

With priority relay, extension facilities, telephone sets bulkhead, wall or desk type acc to agreement, 2 telephone sets in wheelhouse with console type. Telephone sets in captain, chief/Eng cabin and cargo office free speaking.

Telephone exchange performs also the crew's call system function, from wheelhouse, ship office, ECR, Master and Chief Engineer cabins.

Minimum five (5) simultaneous calls to be possible.

Telephone exchange to PA System is provided.

Two telephones connections in engine room.

One telephone connection at ME emergency emergency control stand.

6.4.3.2. Sound powered Telephones

The sound powered telephone system to be installed on board as following,

- a) Wheelhouse, Engine Control Room, Steering Gear Room, Engine Side*, Emergency Generator Room*, CO2 Room, Emergency Fire Pump.
- b) Engine Room – Fuel oil filling station (one (1) portable telephone and two (2) jack boxes)

Telephone with * mark shall be installed with anti-noise headphone.

Electric power is 24 volts D.C.

6.5. NAVAIDS

6.5.1. **Electro-navaids**

6.5.1.1. Gyro Compass

Dual gyro compass system (two master units) is provided. Master gyros are located in the ECR, course printer in the chartroom, repeaters: in the steering gear compartment, on the bridge wings above windows. Outputs for radars. Dual gyro compass system 8 repeaters, and NMEA signal outlet to navigation distribution interface for radar, VDR, AIS, Echo sounder, Electronic seachart, SAT F, autopilot.

Supply: 220 V, 60 Hz directly from EMY SWBD and 24 V DC.

6.5.1.2. Sat-Speed Log + EM transceiver(Owner option, change to normal speed log)

One set of Sat-Speed Log + EM transceiver (exchangeable) as per SOLAS requirements for cooperation with ARPA is provided. The speed indicators are located in the wheelhouse, chart table, bridge navigation consoles, wing consoles, pilot conning position, connection to navigation distribution interface, NMEA signal to supply radar, VDR,AIS, electronic seachart, autopilot.

The log sensor is fitted in bottom of the ship acc. maker's requirements.

Supply voltage: 220 V, 60 Hz.

Sensor exchangeable by diver.

6.5.1.3. Echo sounder of Navigation Type

The echo sounder transducer is fitted in the ship's bottom, near engine room, acc. maker's requirement, two transducers to be fitted in ship bottom (1 bow, 1 near engine room), the graphic indicator with depth alarm in the chartroom and the digital visual indicator in the wheelhouse conning position. Individual echosounder printer is provided.

Supply voltage: 220 V, 60 Hz.

Sensor exchangeable by diver.

6.5.1.4 Voyage Data Recorder

One set of Voyage Data Recorder is provided. The capsule is mounted on Compass Deck.

Power supply: 220 V, 60Hz

6.5.2. **Radio-navigation system**

6.5.2.1. Radars

The ship is provided with two radars of daylight display type operating in switching system within the bands X and S.

16" (or effective diameter 340mm) indicators (both with ARPA) are fitted in the wheelhouse, transceiver blocks in the radar compartment, aerials on the radar mast.

Supply voltage:

- Radar X – 3x220V, 60 Hz,
- Radar S – 3x220V, 60 Hz.

6.5.2.2. DGPS Receivers

The ship is provided with 2 sets of DGPS receivers (12 channels). One of DGPS indicator in navigation console, second on chart table.

Mode selection switch provided on chart table. Exchange of way-points voyage track between GPS, radar and electronic seachart provided. NMEA signal to navigation distribution interface for supply radars, VDR, AIS, electronic seachart, autopilot, gyro, DSC MF/HF and DSC VHF.

Supply voltage: 220 V, 60 Hz.

DGPS wheelmark approved.

6.5.2.3. Weather Facsimile Receiver and NAVTEX Receiver

The ship is provided with a facsimile chart receiver, 1 set and NAVTEX receiver - 1 set. both sets installed in chartroom.

Supply voltage : 220 V, 60 Hz.

6.5.2.4. Radar Transponders

Two sets of 9 GHz radar transponders provided on board.

6.5.2.5 Automatic Identification System

One set of AIS is provided. AIS presentation on radar's display.

Power supply 220V, 60Hz.

6.5.2.6 Electronic Chart System (Owner's delivery)

One set ECDIS(master and slave) with interface to radar,AIS. Power supply supported by 2 UPS. Cable from ECDIS to bridge wing console to be installed by yard.

6.5.2.7 Anemometer

One set wind speed / direction meter system to be provided as follows:

- 1 sensor on top signal mast
- 1 main indicator / control unit in wheelhouse console
- 2 repeaters in bridge wing panels
- outgoing signal NMEA to radar and navigation distribution interface

remarks:

most of radio navigation units have power supply of 24 V DC, to avoid installation of individual power converter, it is recommended to have central transformer in line ESWB to consumer 220V AC / 24V DC and central back up battery set instead of individual UPS.

6.5.2.8 Quartz crystal clock

one master – chart space

three hands slave clock – ECR / the front bulkhead of wheel house / radio space

two hands slave clock – officer's cabin / mess room / gallery

6.6. CATHODIC PROTECTION SYSTEM

One ICCP system is provided with life time for 10 years for immersed part of the hull together with tailshaft earthing.

Mean current density is appr. 35 mA/m^2 for hull underwater and 600 mA/m^2 for propeller provided.

Zinc anodes for 5 years are fitted for stern part, ballast tanks, bow thruster tunnel.

6.7. AUTO AND REMOTE CONTROLS

6.7.1. Autocontrol and Control Range

E.R. is provided with arrangement of control and monitoring system complying with GL classification requirements for 24 h unmanned E.R. Irrespective of remote or automatic control and monitoring systems, indispensable means for monitoring and control are provided, permitting monitoring and control in way of installation location of a given arrangement. E.R. has to be prepared for starting and for unmanned operation by E.R. crew.

Every ME alarm (temperature/pressure) sensor will be analog sensor for process leading system, and with consideration of owner's requirement.

6.7.2. Engine Control Room (ECR)

ECR is arranged in E.R. on platform SB. It is soundproof and air-conditioned.

ECR equipped with following arrangements:

- a) - main switchboard 3 x 440V ; 3 x 220V
- b) - 2 VDU of ALARM AND MONITORING SYSTEM
- c) - auto-control system power supply unit.
- d) - communication installations.
- e) - log repeater
- f) - rudder angle indicator
- g) - clock
- h) - swivel chairs (2 pcs)
- i) - key cabinet
- j) - filing cabinet
- k) - medicine locker
- l) - whiteboard
- m) - sounding board
- n) - small working table / office desk

The following systems are mounted in ECR console:

- a) Integrated Computer Monitoring System comprising the following equipments:

- 2 VDU
- 2 Keyboard
- log-book printer / alarm condition printer
- manoeuvre printer (see note)
- individual pressure gauges for main ship's propulsion system circulation systems.
- b) - ME start and parameter control system
- c) - Aux. Eng. parameter monitoring system
- d) - ME viscometers
- e) - control system for pumps operating in automatic stand-by function
- f) - starting air compressors control and signalling system
- g) - exhaust and supply fan control and signalling system
- h) - cable communication installations
- i) - boiler indications
- j) - spare cable between ECR and Cargo Operation Center and spare cable between ECR and Wheelhouse

Note: Manoeuvre printer and dead man switches are installed in wheelhouse.

6.7.3. Electric Power Supply System

Auto-control systems are supplied from power supply unit 24 V DC fed with two circuits 3 x 440 V, 60 Hz - one from main switchboard and the other from Emergency Switchboard. The supply unit works in joined operation with storage battery; it has buffer connection.

At total supply voltage decay, consumers are automatically fed from battery. Battery capacity is sufficient for complete supplying of all consumers for 30 minutes.

Monitoring system is fitted with own supply unit.

6.7.4. Pneumatic Supply System

Auto-control system is provided with two air-treatment and drying station. The station is fed from starting-air receivers. After air purification and pressure reduction it is supplied to collecting pipes at 1 MPa/0.8 MPa pressures.

Oil removal filter before dryer is provided.

6.7.5. Main Propulsion Control System

The following control types are provided:

- a) from wheelhouse: M.E start, stop, reverse and r.p.m. control (manoeuvre console)
- b) from bridge wings: ME *start, stop, reverse and* r.p.m. control
- b) from ECR: ME start, stop, reverse and r.p.m. control (control - manoeuvre console)

- c) from ME emergency control stand: ME start, stop reverse and r.p.m. control.

At ECR and emergency control, commands are transferred with E.R. telegraph. Telegraph transmitter located in wheelhouse and receivers in ECR and at ME emergency control stand.

M.E. r.p.m. indicators are provided:

- a) in wheelhouse: in manoeuvre console and on bridge wings
- b) in chief engineer's cabin (living room)
- c) in ECR: in control-manoevre console
- d) at ME emergency control stand.

ME r.p.m.revolution counter in ECR will be provided.

Auxiliary blower control:

- blower start/stop automatically in response to engine load (ME maker's)
- both e-mot. shall be designed for continuous running (ME maker's)

Telephone set (with headset) at ME emergency control stand is provided.

Additional two telephones in ER are provided.

6.7.5.1. Bow Thruster Control System

Bow thruster stop, pitch control will be provided in wheelhouse and bridge wing columns. See *item 6.2.6*.

6.7.6. **Generating Set Auto-control System**

The auto-control system ensures:

- standby set selection
- periodical lubrication of set selected as standby unit
- remote start / stop of any set from ECR
- automatic start of standby generating set in case of:
 - high load,
 - high/low voltage,
 - high/low frequency,
 - no voltage
- generating set parameters monitoring.

Generating sets are equipped with safety system operating in case of exceeding the following parameters:

- r.p.m
- lube-oil pressure dissipation
- cooling water flow loss
- cooling water outlet temp. high

Re-starting after emergency shut-down is possible only after unlocking the system. Each time after stopping the generating set, engine is lubricated.

6.7.7. Autocontrols for ME/AE Circulation System Pumps

The following pump pairs are operating in automatic starting of standby units:

- ME lube-oil circulation pumps
- ME fuel circulation pumps
- AE fuel circulation pumps
- ME fuel supply pumps
- ME fresh cooling water (low-temperature circulation) pumps
- ME fresh cooling water (high-temperature circulation) pumps
- S.W. pumps
- DG emergency supply pumps

The a / m pumps will additionally perform the following functions:

- a) sequential switching on pumps, operating in case of ME busbar voltage decay and recovery
- b) emergency manual control at pump local stand.

ECR console is provided with the following signal - control means:

- standby pump selection - switch selector
- start / stop push - buttons
- pump operation signalling
- pump standby mode selection signalling
- failure signalling.

Pump selected for "standby" mode is started in case of :

- pressure drop below permissible value on pressure control mounted at pump delivery side.

6.7.8. Starting - Air Compressor Autocontrol System

Compressed air system includes the following compressors:

- starting air topping up compressor
- two main starting air compressors

1. Topping up compressor is main unit for replenishing air losses in starting air tanks.

Topping up compressor can be operated automatically from two positions:

- local control panel
- ECR console.

Automatic start will occur at 2.5 MPa pressure and stop at 3.0. MPa pressure.

Alarm conditions are signalled individually in control panel and group signal "Compressor-Failure" occurs in ER monitoring-measurement system.

2. Main starting air compressor

Compressors can be operated from two positions:

- local control panel
- ECR console

Console permits remote manual or automatic control of selected compressor.

Selection of control type is performed using switch located in panel of ECR console.

Automatic start occurs at 2.0 MPa and stop at 3.0 MPa.

Such setting permits reserve operation of main compressor in case of too high air loss in starting air receivers.

Group signal "Compressor failure" is transmitted to ER monitoring-measurement system.

6.7.9. Oil and Fuel Separators

1. HFO separators.

Separators and pumps are controlled from distribution boxes mounted in the vicinity of separators.

Control includes:

- a) - manual start / stop of separators and fuel feed pumps,
- b) - water seal / bowl monitoring,
- c) - fuel temperature monitoring,
- d) - self - cleaning during separator operation,
- e) - information and alarm signalling in distribution box.
- f) - group alarm signalling in ECR.

2. Lube-oil separators

Separators is controlled from distribution boxes which covers.

- a) - manual start / stop of separators,
- b) - water seal / bowl closing monitoring,
- c) - oil high temperature monitoring,
- d) - information signalling in distribution box,
- e) - self-cleaning during separator operation,
- f) - group alarm signalling in ECR.

6.7.10. Boiler Block

1. Boiler burner.

Fully automated burner operation from boiler plant control panel located near boiler is provided.

In control panel there is provided signal - control system according to burner suppliers' recommendations.

Interlock system operation is signalled individually in control panel and as group alarm "Burner failure" in alarm system. After emergency shut down the burner can be operated after previous unlocking of the system.

2. Hotwell.

Water level in hotwell is made up using feed pump controlled with float-type sensors. Oil content signalling and automatic oil drain systems are provided.

3. Pressure control in steam main.

Steam pressure in steam main is controlled using pressure relief valve, carrying off excessive steam to condenser.

4. boiler and hotwell is provided with level signalling devices mounted on them:

- boiler : min/max
- hotwell: min

Signalling connected to alarm system.

5. Boiler feed pumps are operated from boiler plant control panel. Automatic stand-by for the pumps is provided.

6.7.11. ME Fuel Viscosity Control

Fuel viscosity control system ensures automatic maintaining of required fuel viscosity at engine inlet.

Allowances are signalled in alarm system.

Indicator for HFO in ER to be provided as well as fuel temperature indicator.

6.7.12. ME Lube-oil and Fuel Filters

Automatic control systems for the a / m filters are provided from control panels located in ER and as far as self-cleaning is concerned. Manual operation is possible from control panel. Exceeding of permissible pressure difference value on filter is signalled in alarm system.

6.7.13. Temperature Control System

Thermocontrol, indirect-acting valves (*with electric actuator*) are installed in the following circulation systems :

- ME fresh water (high temperature circulation),
- ME fresh water (low temperature circulation),
- HFO separator fuel,

Local temperature control in a/m circulating systems is possible by means of manual drive built on control valves .

Controllers mounted in ECR console.

Controllers for HFO separators mounted near separators.

6.7.14. Load Calculator (Owner's delivery)

Ship's office is provided with load calculator and alarm and monitoring system workstation.

On-line connection between alarm and monitoring system - remote tank level measurement system and load calculator is provided.

Remote draft reading will be provided in alarm and monitoring system and loading computer.

6.7.15. Engine room alarm, monitoring and control system

The engine room alarm, monitoring and control system to be as follows:

1. Two colour 19" TFT monitor with keyboard in ECR
2. One colour 19" TFT monitor with keyboard in ship's office
(installed on desk) for ballast and cargo bilge systems. Other systems to be displayed only without control possibility.
3. One colour 19" CRT TFT monitor with keyboard in wheelhouse for ballast and cargo bilge systems. Other systems to be displayed only without control possibility.
4. one alarm printer in ECR
5. main computer(s) according to maker's standard
6. The integrated monitoring and control installation of electronic – microprocessor modules suited for analogue and binary sensors. All input channels to be made with self-monitoring properties. The modules to be installed on site and /or in ECR, dependent on maker's standard.
7. All parameters measured by analogue sensors to be indicated and displayed on TFT screen.
8. Alarm conditions to be signaled by common sound signal in ship's office, ECR and flashing light sign on TFT screen. After acknowledgement of the failure condition, flashing light signal will be turned to steady one and sound signal be silenced. Steady light will be automatically cancelled after normal condition is restored.
9. Each alarm condition to be transmitted to the signalling and warning system in ECR and in engine room as well as in engineer's alarm unit installed in:
chief engineer's dayroom (with additional buzzer in bedroom)

- three (3) engineer's cabins (including electrician)
 - officer's dayroom
 - officer's messroom
 - Also to group alarm panel in bridge.
10. The colour graphic systems in main computer will include the following mimic displays:
- ME monitoring
 - Bargraph or exhaust gas temperature
 - ME and AE fuel installation
 - ME and AE lub.oil installation
 - ME and AE fresh water cooling installation
 - Sea water cooling installation
 - Compressed air installation
 - Fuel transfer system
 - Ballast system installation
 - Bilge system installation
 - Generators control and PMS system
 - Stand-by system
- Any computer controlled machinery or valve to be selected on the mimics, then can be START /STOP or OPEN /CLOSE controlled by means of keyboard.
11. Other functions realised in the computer:
- running hour counter
 - remote temperature measuring in fuel tanks
 - dead man alarm with 2 activating and 5 reset panels
 - alarm signalling and display of level, volume and weight in fuel tanks
 - alarm signalling and display of level, volume and weight in ballast tanks
 - ship's draught display
- All level sensors in tanks and also draught sensors to be connected directly to ER monitoring and control system. Tanks level, volume and weight measurements to be corrected depending on trim calculated from draught measurements. Tanks level measurement necessary data (tank level, volume and weight, draught data) to be sent via serial lines to loading computer.
12. Sensors, transmitters and switches to be arranged for easy testing.
13. The system to be provided for about 900 hardwired I/O (input /output) channels, including parts with necessary spares and necessary number of I/O's provided as serial. Number of I/O channels (hardwired):
- Each 10 pieces of I/O spares to be considered for pressure, temperature, level and others alarms (total 40 pieces).
14. In addition to the individual hardwired monitoring and controls channels the following installations to be provided with serial interface (to /from IAS) for control and monitoring or just display of operational status:

power management system, control and monitoring (range of control and monitoring signals acc. to manufacturer standard)

ME control system, only monitoring and status display (rang of control and monitoring signals acc. to manufacturer standard)

ME torque meter

6.7.16. Control of fuel transfer system

The fuel transfer installtion to be remote controlled by means of graphic diagram on TFT screen and keyboard, as follows:

remote control of fuel oil transfer pumps

remote valves control in fuel transfer installation

remote level measurement in fuel tanks

START/STOP push-buttons to be installed near each fuel transfer pump and STOP push-button in bunker station. FO transfer pump to be stopped automatically on high level in FO settling tanks.

Independent high level alarm in all fuel oil bunker tanks to be provided.

6.7.17. Emergency remote quick closing values

On the main deck, in the fire station, quick closing facilities for pneumatic remote closing of fuel and lubricating oil valves to be provided.

6.7.18. Control of ballast system

Ballast system and cargo holds bilge system to remotely controlled by equipment installed in the ship's office or wheelhouse

1. Control equipment

The following control and indication facilities to be installed:

- TFT screen display with keyboard enabling remote control of bilge and ballast pumps and valves as well as read-out of tanks level and measuring of draught and also signalling high level in ER and holds bilge wells;
- other necessary equipment.

2. Remote control of butterfly valves

Butterfly valves –for ballast operation and also for ballast water management to be electropneumatically remote conteolled by means of dynamic mimic diagrams on the screen via solenoid valves fitted in separate cabinet outside ship's office and pneumatic actuators fitted directly on valves.

Limit positions of the valves to be signalled by means of colour changing of the valves symbols on screen.

The actuators to be provided with emergency drive.

3. Control of ballast pumps

The ballast pumps to be remotely controlled from ship's office or wheelhouse (via mimic diagram) and machineside.

Suction and delivery pressure display on the screen.

Stop of ballast pumps from high level in ballast tanks alarm to be provided.

4. Remote level indications in ballast tanks

Each ballast tank to be arranged with remote level measuring system of pressure transducers type.

Level readout will be presented on the TFT screen display

6.7.19. Measuring of draught

Remote draught measuring system to be provided, with readout on the TFT screen display

Ship's draught to be measured:

- foreward
- aft
- midship

input signals to be transmitted from separate pressure transducers to specislized level measurement computer system

6.7.20. Automatic heel control installation

Heel levelling installation to be provide, utilizing a heel levelling ballast pump.

Control cabinet with START/STOP facilities and pilot lamps indicating status of pump and valves to be fitted in the ship's office.

Heeling installation to be operate manually via control panel or automatically via separate computer control system independent of ship monitoring and control system. An inclinometer with a range of -5° , 0° , $+5^{\circ}$, to be provided for heel angle indication instrument and also for automatic heeling control.

A common failure alarm and excessive heel angle alarm to be provided in ship monitoring and control system.

CHAPTER 7

REFRIGERATING PLANT

7.0. GENERAL

The ship is provided with two refrigerating plants for:

1. provision store
2. accommodation air-conditioning

Both systems are arranged for direct evaporation of R404A freon.

7.1. PROVISION CHAMBERS

The ship is fitted with chambers as follows:

Item	Chamber	Floor (m ²)(abt.)	Temperature
1	Fish	7	-20
2	Meat	7	-20
3	Vegetables & Dairy	15	+ 4
4	Thawing	4	+ 5
5	Drinks	8	attached to air-condition
6	Dry provision/drinks	12	attached to air-condition
Total		53 m ²	

Above listed temperature are ensured with one compressor set operating, the second one is stand-by.

The chamber air is cooled in air-coolers arranged for direct evaporation of R404A freon.

The air-coolers installed in chambers, are fitted with electric heater for defrosting. The heaters are semi-automatically controlled: switching on by hand, switching off automatically after time specified individually for a/m chamber on time-relay expires.

Scuppers from meat, vegetables and thawing chambers are provided.

Drains from evaporators drip trays are led to bilge well in steering compartment. Drip pipe to be fitted with tape electr. heater, (in meat and fish chambers only) and water loop below main deck.

One portable ozone generator is provided for chambers disinfecting. Generator connecting sockets are provided in each refrigerated chamber, thawing room and in dry provision chamber.

7.1.1. Provision Store Refrigerating Plant

This incorporates:

- two refrigerating reciprocating compressor units (one stand-by) directly driven by AC electric motor (3 x 440V , 60 Hz), built for 20 hours operation per 24 hours under tropical conditions.
- two shell-and-tube condenser, cooled with fresh water from FW cooling line,
- one drier,
- air-coolers sets installed in provision chambers,
- valves, pipes, fittings and autocontrols.

R404A freon pipings up to dia 19 mm are made of copper pipes.

Over 19 mm pipes are of steel. The copper pipes installed in chambers are nickel plated. Copper pipes are connected with hard solder or with flare connections. Steel piping connections are welded.

Freon suction pipes led outside of chambers are insulated with synthetic rubber “Armaflex” type.

Fresh water piping made of materials as specified in Chapter 4.

Pipes connected by flanges or by threaded joints.

Provision store refrigerating plants are situated in Air conditioning unit compartment. - main deck, PS.

7.2. AIR - CONDITIONING REFRIGERATING PLANT

This incorporates:

- two refrigerating reciprocating compressor units (60% total cooling capacity each) directly driven by AC el. motor (3 x 440 V, 60 Hz)
- two shell and tube condenser cooled with fresh water from FW cooling line
- two freon receiver
- two freon drier
- air coolers set installed in air conditioning units
- valves, pipes, fittings and autocontrols.

Plant to be worked in automatic parallel service.

Accommodation air conditioning refrigerating plant is situated in Air conditioning unit compartment - main deck, PS.

7.3. AIR - CONDITIONING REFRIGERATING SYSTEM PIPINGS

Air-conditioning freon pipings of dia up to 19 mm are made of copper; of dia above 19 mm of steel pipes. Copper pipes are connected with hard solder or with sleeve connections.

Steel piping connections are welded.

Freon suction pipes are insulated with synthetic rubber "Armaflex" type.

Fresh water piping are made of materials as specified in Chapter 4, connected by flanges or by threaded joints.