BUILDING
SPECIFICATION
53,000 DWT DOUBLE HULL
HANDYMAX BULK CARRIER

DIAMOND 53

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Prepared : Michael H. Schmidt / Per M. Jørgensen
Checked : 
Approved : 

Industry, Marine & Environment  Dwinger Marineconsult
Egeskoven 222     Telephone: +45 4348 6178     Telephone Direct: +45 4348 6526
Glostrup 2600     Telefax: +45 4343 6007     53k-specification-
Denmark     CVR- No.: 48233511     vietnam-final07apr2004

ONL@carlbro.dk     ONL/SWU
ONL/SWU
Web: www.carlbro.dk
<table>
<thead>
<tr>
<th>TABLE OF CONTENTS</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>000. - 099. DESIGN AND GENERAL</td>
<td>5</td>
</tr>
<tr>
<td>000. DESIGN CHARACTERISTICS</td>
<td>5</td>
</tr>
<tr>
<td>010. CLASS, RULES AND REGULATIONS</td>
<td>10</td>
</tr>
<tr>
<td>020. HULL REQUIREMENTS</td>
<td>13</td>
</tr>
<tr>
<td>030. SUPPLIERS AND SUPPLIES</td>
<td>15</td>
</tr>
<tr>
<td>060. PLANS AND DRAWINGS</td>
<td>17</td>
</tr>
<tr>
<td>080. TESTS AND TRIALS</td>
<td>18</td>
</tr>
<tr>
<td>100. - 199. HULL STRUCTURE</td>
<td>24</td>
</tr>
<tr>
<td>100. SCANTLINGS AND MAIN CLASS PLANS</td>
<td>24</td>
</tr>
<tr>
<td>110. MATERIALS AND METHODS</td>
<td>25</td>
</tr>
<tr>
<td>120. MAIN FRAMING</td>
<td>25</td>
</tr>
<tr>
<td>130. BOTTOM CONSTRUCTION</td>
<td>26</td>
</tr>
<tr>
<td>140. SHELL PLATING</td>
<td>27</td>
</tr>
<tr>
<td>150. HULL BULKHEADS</td>
<td>28</td>
</tr>
<tr>
<td>160. DECKS AND HATCH COAMINGS, GENERAL</td>
<td>28</td>
</tr>
<tr>
<td>170. FOUNDATIONS</td>
<td>29</td>
</tr>
<tr>
<td>180. MISCELLANEOUS STEEL STRUCTURE</td>
<td>30</td>
</tr>
<tr>
<td>190. SUPERSTRUCTURES AND DECK HOUSES</td>
<td>31</td>
</tr>
<tr>
<td>200. - 299. OUTFIT AND EQUIPMENT (HULL)</td>
<td>32</td>
</tr>
<tr>
<td>200. MARKINGS AND IDENTIFICATION</td>
<td>32</td>
</tr>
<tr>
<td>210. CLOSURES, ACCESS, PROTECTION (HULL)</td>
<td>33</td>
</tr>
<tr>
<td>220. LIGHT RIGGING AND DECK FITTINGS</td>
<td>37</td>
</tr>
<tr>
<td>230. MOORING FITTINGS AND EQUIPMENT</td>
<td>38</td>
</tr>
<tr>
<td>240. SAFETY EQUIPMENT AND DECK EQUIPMENT</td>
<td>39</td>
</tr>
<tr>
<td>250. DECK COVERING, INSULATION, JOINER WORK</td>
<td>40</td>
</tr>
</tbody>
</table>
520. ENGINE ROOM OUTFIT AND EQUIPMENT 91
530. MAINTENANCE AND REPAIR FACILITIES 92
540. VENTILATION AND EXHAUST GAS SYSTEM 93
550. FILTERS AND STRAINERS 96
560. HEAT EXCHANGERS 97
570. ENGINE ROOM TANKS 98
580. TOOLS, SPARES, STORES 99

600. - 699. MACHINERY PIPING SYSTEMS 101
600. MACHINERY PIPING - GENERAL 101
610. COOLING WATER SYSTEMS 110
620. FUEL OIL SYSTEM 112
630. LUBRICATING OIL SYSTEM 113
640. COMPRESSED AIR SYSTEMS 113
650. MISCELLANEOUS PIPING SYSTEMS 115
670. STEAM SYSTEM 116
680. CONDENSATE SYSTEM 117
690. MACHINERY LIST (PRELIMINARY) - all figures to be finally confirmed according to
the design 118

700. - 799. ELECTRICAL PART 131
700. ELECTRICAL PART - GENERAL 131
710. ELECTRIC POWER SUPPLY 134
720. ELECTRIC DISTRIBUTION 140
730. ELECTRIC POWER DEVICES 147
740. LIGHTING 150
750. COMMUNICATION 155
760. ELECTRIC NAVIGATION EQUIPMENT 160
770. MISCELLANEOUS ELECTRIC EQUIPMENT 163
780.  TOOLS, SPARES, STORES (ELECTRIC) (ALSO 1080)  165

800. - 899.  AUTOMATION  167

800.  CENTRALIZED INSTRUMENTATION, GENERAL  167
810.  MANOEUVRING CONSOLES, MAIN CONSOLES  168
840.  SYSTEMS FOR OPERATION OF DIESEL GENERATOR SETS  169
890.  AUTOMATION EQUIPMENT FOR OTHER MACHINERY COMPONENTS  169

900. - 999.  CARGO SPACES AND CARGO HANDLING  171

910.  ACCESS TO CARGO COMPARTMENTS  171
920.  OUTFIT OF CARGO SPACES  171
930.  RIGGING AND CARGO GEAR  172
970.  CARGO SPACE VENTILATION  174
980.  CARGO HOLD WASHING  174

1000. - 1099.  SHIP’S TOOLS, SPARES AND STORES  175

1000.  GENERAL  175
1010.  NAUTICAL INSTRUMENTS (Builder's supply)  175
1020.  FLAGS, SIGNALS, LAMPS - Builder’s Supply  175
1030.  GALLEY, MESS AND CABIN INVENTORIES (Owner Supply)  176
1040.  DECK TOOLS, SPARES AND STORES  176
1050.  MACHINERY TOOLS  177
1070.  ELECTRIC TOOLS  179
1080.  ELECTRIC SPARES AND STORES - Builder's Supply  179

APPENDIX 1:  MAKERS’ LIST  183
000. - 099. DESIGN AND GENERAL

000. DESIGN CHARACTERISTICS

001. Intent

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

Documents included in this outline:

40.3067.90.002/ 051_01A Building Specification 53,000 DWT Double Hull Bulk Carrier
40.3575.00/ 009_01D General Arrangement Plan
40.3575.00/ 102_01 Midship Section

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

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

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

Wherever in the Specification the term “or”, “if necessary”, when considered” and other similar expressions may be used, the final choice in all important matters are to be made by mutual agreement between Builder and Owner.

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

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

002. Principal Dimensions

Length overall, max 190.00 m
Length between p.p. approx. 183.25 m
Breadth moulded at design 32.26 m
Depth moulded to upper deck at side approx. 17.50 m
Light cargo draught, moulded 11.10 m
Scantling draught 12.60 m

Deck heights: (at CL):
From upper deck to 1. poop deck 3.00 m
From 1. poop deck to 5. poop deck, each deck 2.80 m
From 5. poop deck to wheel house top 3.00 m
Deck houses 2.60 m

Camber in upper deck from side to 5,600 mm from CL 0.60 m
No camber, no sheer in other decks.

003. Deadweight and Draught

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

Scantling draught moulded 12.60 m
Deadweight corresponding hereto approx. 53,000 tons

Light cargo draught 11.10 m
Deadweight corresponding hereto approx. 44,500 tons

The deadweight on scantling and light cargo draught to be finally confirmed after appropriate calculations.

005. Capacities

Cargo Spaces: (including hatches)

<table>
<thead>
<tr>
<th>Cargo hold no.</th>
<th>Capacity (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>approx. 12,450</td>
</tr>
<tr>
<td>2</td>
<td>approx. 13,330</td>
</tr>
<tr>
<td>3</td>
<td>approx. 13,330</td>
</tr>
<tr>
<td>4</td>
<td>approx. 13,330</td>
</tr>
<tr>
<td>5</td>
<td>approx. 13,260</td>
</tr>
<tr>
<td><strong>Total volume</strong></td>
<td><strong>approx. 65,700 m³</strong></td>
</tr>
</tbody>
</table>

Tank capacities:

<table>
<thead>
<tr>
<th>Type</th>
<th>Capacity (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy fuel oil</td>
<td>approx. 2,000</td>
</tr>
<tr>
<td>DO</td>
<td>approx. 200</td>
</tr>
<tr>
<td>Lub. oils etc</td>
<td>approx. 50</td>
</tr>
<tr>
<td>Fresh water</td>
<td>approx. 250</td>
</tr>
<tr>
<td>Ballast water</td>
<td>approx. 17,000</td>
</tr>
</tbody>
</table>

The stated capacities are preliminary, to be verified during basic design of the vessel.
At an early design stage a preliminary capacity plan to be delivered to the Owner.

006. Speed and Power

Service speed on scantling draught of 12.60 m on even keel, including 15% service allowance (sea margin), approx.: 14.0 knots

Service speed on light cargo draught of 11.10 m on even keel, including 15% service allowance (sea margin), approx.: 14.2 knots

Corresponding engine output at max. 82% of MCR (CSR) with approx. 119 RPM on propeller approx. 7,780 kW

The trial speed on ballast draught approx. 15.2 knots

The trial speed to include no sea margin and the measured trial speed to be corrected according to actual sea state.

007. Consumption and Range

Daily consumption of heavy fuel oil on main engine at 82 % of MCR approx. 7,780 kW and approx. 119 RPM approx. 33,1 t

The consumption of heavy fuel oil is based on ISO conditions, see 411.

Daily consumption of auxiliary engines approx. 2,5 t

The total daily consumption of HFO approx. 35,6 t

The consumption is based upon HFO of 380 cSt at 50°C and heat value of 42,700 kJ/kg, scantling draught and 15% sea margin.

The above to be confirmed after model tank test.

Endurance approx. 18,000 N miles

Based on 82 % of MCR, 100% capacity of HFO tanks, scantling draught and 14.0 knots, and 2 days spare.

Equal to approx. 55 days steaming (on heavy fuel oil) each 336 nautical miles.
008. Complement

<table>
<thead>
<tr>
<th>Rank</th>
<th>Deck</th>
<th>Engine</th>
<th>Other</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Officers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Captain Class</td>
<td>1 - Captain</td>
<td>1 – C.engineer</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Senior Officers</td>
<td>1 – C.officer</td>
<td>1 – 1.engineer</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Junior Officers</td>
<td>1 – 2.officer</td>
<td>1 – 2.engineer</td>
<td>1 – Pilot</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>1 – 3.officer</td>
<td>1 – 3.engineer</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 – E.engineer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subordinates</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petty Officers</td>
<td>1 - Boat-swain</td>
<td>1 - Fitter</td>
<td>1 – cook</td>
<td>3</td>
</tr>
<tr>
<td>Ratings</td>
<td>3 - Seamen</td>
<td>3 – Oiler</td>
<td>2 - Messboys</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>3 - Sailors</td>
<td>1 - Wiper</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Total on Board</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td></td>
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</tr>
</tbody>
</table>

009. Design Philosophy and General Description

The vessel described to be an ocean going single screw diesel engine driven vessel suitable for carrying ordinary bulk cargoes such as coal, ore, grain, cement, alumina, bauxite, mineral sand and steel coils and packaged timber.

The vessel to be constructed and equipped for carrying certain dangerous cargoes within the IMDG Class 4.1, 4.2, 4.3 and 5.1, and BC code MHB cargoes. With regards to IMDG Class 4.3, this matter present under evaluation and if required by Buyer would constitute additional cost.

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

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

The vessel to have a bulbous bow and a forecastle and a stern bulb.

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

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

An accommodation block in six tiers aft with cofferdam above main deck & below wheelhouse.

Funnel aft of accommodation block.

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

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

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

Cargo holds with hopper tanks at bottom and top side tanks. Tanks to be suitably angled to minimise shifting of grain cargo.

Vertical corrugated watertight transverse bulkheads with lower and upper stool to be provided between cargo holds. Plate and stiffener type at ends of cargo section.

Water ballast in the double bottom tanks, the top side tanks, lower stools, the fore peak, the aft peak tank and cargo hold no.3.

Two aftermost upper wing tanks to serve as combined water ballast tank and hold washing water holding tank (temporary storage).

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

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

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

Diesel oil tank to be arranged in engine room.

Lubricating oil tanks to be arranged in engine room.

The vessel to be capable of loading cargo:

• Dry homogeneous cargo in all cargo holds.
• Heavy ore cargo in No.1, 3 and 5 holds equally distributed as far as practicable and the other cargo holds empty.
• Light ore cargo and other dry bulk cargoes with equivalent density in hold no. 1, 2, 4 and 5, equally distributed as far as practicable and hold no. 3 empty.
• Grain cargo in all holds with one slack hold. Sufficient grain stability to be verified.
• Packaged timber cargo in all holds, hatch covers and partial upper deck.
• Steel coils in all cargo holds.
• Coal, cement, alumina, bauxite, mineral sand
010. **CLASS, RULES AND REGULATIONS**

The vessel to be built under survey of and according to the rules of Class.

The ship to fulfil the below listed Rules and Regulations being in force or being foreseen at the date of signing of contract.

011. **Classification Notation**

**DNV** +1A1 Bulk Carrier ESP, NAUTICUS (New Building), Holds No. 2,4 or 3 empty, BC-A, GRAIN, GRAIN-U, HA(+), DK (+), IB(+), EO, TMON

Or equivalent

**BV I+HULL, +MACH, Bulk Carrier ESP, Unrestricted navigation nonhomload** (Hold, No.2, 4 or 3 may be empty) Grabloading, BC-A, +AUT-UMS, STAR-HULL,

Underwater survey requirements to be fulfilled.

012. **Flag of Registry**

Liberia, Bahamas, Hong Kong or Greece

013. **National Rules and Regulations**

To comply with laws, rules and regulations of the Maritime Administration of the flag state.

014. **International Rules and Regulations**

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

1. International Convention for Safety of Life at Sea, 1974, and protocol of 1978 with later amendments including global maritime distress and safety system (GMDSS A1, A2, A3).

2. Intact Stability Rules (IMO Res. A749)
   
   IMO Damage Stability Rules, MSC 19(58)
   
   Grain Stability Rules (IMO Res. MSC 23 (59))
   
   Live-saving appliances code
   
   Code of safe practice for ships carrying timber deck cargoes (IMO Res. A715 (17))
   
   Dispensation for trimming of hold ends (IMO MSC CIRC. 323)
   
   Display of manoeuvring data (IMO Res. A601 (15))

3. Code of Safe Practice for Solid Bulk Carriers
1. Certificate for classification (Hull Machinery)  
2. International load line certificate  
3. Safety radiotelegraph certificate

Prior to delivery the Builder to deliver the following original certificates in duplicate: one set for the Owner and one set for the vessel.

<table>
<thead>
<tr>
<th>Certificate</th>
<th>Issued by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Certificate for classification (Hull Machinery)</td>
<td>Classification society</td>
</tr>
<tr>
<td>2. International load line certificate</td>
<td>Classification society</td>
</tr>
<tr>
<td>3. Safety radiotelegraph certificate</td>
<td>Classification society (or other assigned Authority)</td>
</tr>
</tbody>
</table>
4. Safety construction certificate  
   Classification society (or other assigned Authority)
5. Safety equipment certificate  
   Classification society (or other assigned Authority)
6. International oil pollution prevention certificate  
   Classification society
7. International tonnage certificate  
   Classification society (or other assigned Authority)
8. Suez Canal tonnage certificate  
   Classification society (or other assigned Authority)
9. Panama Canal tonnage certificate  
   Classification society (or other assigned Authority)
10. Builder’s certificate  
    Builder
11. Deratting exemption certificate  
    Vietnamese Government
12. Certificate for magnetic compass and  
    Builder
13. Trim and stability booklet  
    Classification society (approval only)
14. Grain loading booklet  
    Classification society (approval only)
15. Deadweight certificate  
    Builder
16. Builder’s quality certification  
    Builder
17. Cargo gear certificate  
    Classification society
18. Gear Certificate for engine room crane  
    Classification society
19. IMO Certificate for exhaust gas emission  
    Classification society
20. Certificate for carriage of certain dangerous goods IMDG Class 4.1, 4.2, 4.3 and 5.1, BC code MHB cargoes.  
    Classification society
21. Certificate of fitness for solid bulk cargoes  
    Classification society
22. Cargo securing manual  
    Class approved
23. Ballast management plan  
    Class approved
24. Fire safety manual  
    Class approved
25. Emergency training manual  
    Class approved

Possible certificates provisionally issued to be replaced by original ones arranged by the Builders as soon as possible.
Prior to delivery all certificates covering machinery items, deck equipment etc (not listed above) and including sub-contractors’ certificates to be delivered to the vessel in duplicate.
Equipment certificates for various equipment such as but not limited to anchors, chains and main engine, issued by the Classification Society, and those for navigation lights, life boats, life saving equipment, radio, navigation, etc., issued by any other assigned authority approval for required items, to be delivered to the Owner by the Builder.

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

18. Building quality standard

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

a) Chinese industrial standard (KSQS, GB, CB, CSQS, YB, JB, HB, SY, etc)
b) Builder’s standard, and builder’s standard practice to be submitted to buyer for reference.
c) DIN or JIS standard.
d) ISO standard.

020. HULL REQUIREMENTS

021. Hull Form

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

023. Steering and Manoeuvring

To comply with the relevant IMO recommendations as far as possible.

026. Trim and Stability Requirements

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

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

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

When leaving port with part load grain cargo, ballast water may be applied in order to meet grain stability criterion during deep-sea navigation. In this case trimming or bagging may be applied.
In homogeneous loading departure conditions (100% consumables, crew etc.) and with full load to scantling draught the vessel shall be at even keel or trim slightly by the stern (max. 1.0% of the ship’s length) without any water ballast.

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

At an early design stage a preliminary Trim and Stability Booklet to be submitted to the Owner covering at least the following conditions.

1. Light ship.
2. Docking condition.
3. Light ballast condition. Departure and Arrival. No WB in hold No.3.
4. Heavy ballast condition. Departure and Arrival. WB in hold No.3.
5. Homogeneous cargo full loading at design and scantling draught. Departure and arrival.
6. Grain loading condition with stowage factors of 45, 55, & 65 ft³/lt. Departure and arrival with and without hold ends untrimmed.
7. Heavy ore cargo in No.1, 3 and 5 holds equally distributed as far as practicable and the other cargo holds empty.
8. Light ore cargo and other dry bulk cargoes with equivalent density in hold no. 1, 2, 4 and 5, equally distributed as far as practicable and hold no. 3 empty.
9. Packaged timber loading. Departure and arrival (2.5 t/m² on weather deck hatch covers).

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

Final trim and stability calculation for above loading conditions shall be made on the basis of the centre of gravity and the lightweight of the Vessel obtained from the inclining experiment.

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

- Sea water: 1.025 t/m³
- Fresh water: 1.000 t/m³
- Heavy fuel oil: 0.950 t/m³
- Diesel oil: 0.950 t/m³
- Lub. oil: 0.900 t/m³

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

1. Vibration


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

To prevent harmful vibration and damage in the after body, the single amplitude of blade frequency pressure impulses at the outer shell above the propeller shall not exceed 7KPa in scantling and ballast draught condition when tank testing. Propeller designer to verify the max. outer shell pressure impulses.

2. Noise

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

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

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

030. SUPPLIERS AND SUPPLIES

033. Buyer’s Supplied items

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

- All hoses, etc., other than those required by the Rules, or mentioned in this Specification.
- Steel wires, ropes and hawsers for mooring in excess of the requirements of the Classification Society and/or this Specification.
- Deck, engine and cabin stores in excess of those specified in this Specification.
- All bedding (pillows, blankets, sheets, covers, etc.) but excluding mattresses.
- All napery (serviettes, table cloths, etc.)
- All cook’s and steward’s utensils (crockery, cutlery, silver-wares, china, glasses, pots, pans, etc.)
- All chandlery (soaps, lamp oil, etc.) toilet papers, food and other consumables.
- All charts and books.
- All consumable stores
- All medicine and medical equipment
- Recreational equipment other than mentioned in this Specifications.
- Typewriter and other office machines
- Air tools and hoses in excess of those specified in this Specification
- Hand tools other than specified in Specification.
- Loose lashing fitting for lumber and logs.
- Lumber spreader suitable for use with the deck cranes.
- **Grabs for bulk cargoes (Bulk grabs) including the control devices.**
- The hazardous gas detection and bilge well detection equipment for carriage of coal.
- Paintings and pictures
- Suez searchlight, but socket and cable to be provided by yard.
- Spare parts, navigation equipment, flags, etc., in excess of the requirements of the Rules and Regulations as specified herein, and/or those specified in this Specification.
- Bunker, lub. oil, hydraulic oils, hand consumable stores, consumed oil during testing and sea trial shall be paid for by Builder.
- The Owner shall furnish the Builder with necessary specifications, plans, drawings, instruction books, manual, reports, certificates, the manufacturer’s service engineers etc. as required by the Builder, which shall form an integral part of the Owner’s supplies.

034. Manufacturers and their Products

The Builder shall have the option to freely choose between the suppliers in the "Makers List" as long as the requirements in the specification are fulfilled. See appendix 1.

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

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

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

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

If the Owner prefers another maker than the Builder’s preferred maker, the Builder at the Owner’s request shall submit by fax or other agreed procedure technical specifications and quotations from both the Builder’s and the Owner’s preferred maker.
Final selection of maker to be made by negotiations and agreement between Owner and Builder as mentioned above.

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

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

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

060. PLANS AND DRAWINGS

Plans for approval

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

Three (3) copies of each of the plans for approval shall be submitted to the Owner for approval in accordance with the “List of the Plans for Owner’s approval”.

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

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

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

Full set of working drawings also to be supplied.

Finished plans and instruction books

At the time of the Vessel's delivery finished plans (as it is built drawings) in blueprint shall be furnished to the Owner in triplicate, one (1) copy to the Owner's site office and two (2) copies to the vessel.
The scope of supply of the finished plans shall be in accordance with the Builder’s standard and the list of the finished plans shall be submitted to the Owner in due course for approval.

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

a. General arrangement  
b. Capacity plan with deadweight scale  
c. Manoeuvring characteristics  
d. Fire plan

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

One (1) exhibition model scale 1:200 to be delivered for each vessel.

Further models to be delivered at cost.

General Arrangement Plan, Capacity Plan and Pocket Capacity Plan to be supplied as reproducible in addition to copies.

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

080. TESTS AND TRIALS

General

Reference is also made to Shipbuilding contract.

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

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

Inspection by the Owners’ representatives shall be regarded as a verification of the Builders own quality control measures and shall not be used as a substitute for quality control.

In case the Owners Inspector is unable to attend any test, he may designate a person to act on his behalf, otherwise the inspector shall waive the right to have comments for such test, provided notice is given as agreed.
Whenever materials, equipment and machinery etc., have been tested and inspected by the Owners’ supervisor, such material and equipment shall be clearly marked and assigned to the vessel. Such materials and equipment shall not be exchanged with any other without the Owners’ written consent.

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

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

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

The Owner agree the Yard to chose one out of three sets of diesel generators on board to be used for onboard testing. However, the operation of it shall follow the Maker representative’s instruction. Before delivery, normal maintenance such as re-place of strainers etc. shall be carried out. If the running hour exceeds 500 hours, overhaul shall be carried out under Maker’s instruction.

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

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

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

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

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

Progress

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

In case the Builder falls behind the intended schedule, then the Builder is to do every possible efforts to bring the vessel back on schedule in order to meet delivery date.
Once per month during the building period and at the time of special events, such as keel laying, launching and delivery, the Builder is to make photographs in sufficient number to clearly show the progress of the work and submit same to the Owners in five (5) copies.

Builders standard programs for inspection, test and trials to be submitted to Owners for review/comments a.s.a.p.

**Dry docking**

Prior to the sea trial the vessel may be dry-docked for final inspection and bottom painting if necessary. The Vessel to be dry-docked for hull cleaning, propeller polishing and paint repair if vessel is not delivered to Buyers within seven (7) months after launching.

**Tests and inspection**

**Hull structure tests**

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

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

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

Castings to be inspected also by owners.

**Hull inspection**

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

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

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

Test results of major machinery and equipment shall be furnished to the Owner in triplicate.
Castings to be also inspected by Owner’s representatives.

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

Installations and equipment

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

Tests to be carried out according equipment makers guidelines.

Piping test

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

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

Mooring trial

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

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

Sea trial

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

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

Heavy fuel oil as the fuel system is designed for, if available, to be used for sea trial. Cylinder LO quality for ME to be selected according the fuel quality and maybe changed during the sea trial.
Sea trial shall be carried out at the ballast condition and with draught and trim equivalent to the condition which is tested in the model tank.

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

Owner to approve the condition.

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

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

**Progressive speed trial**

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

Results of speed trials shall be corrected to the calm water (no wind, wave).

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

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

**Endurance trial**

Endurance trial shall be conducted for four (4) hours at 75 % of MCR load, and for one (1) hours at MCR or the output corresponding to the 105% rated shaft revolution of the engine whichever is reached first. The maximum engine speed during sea trial to obtain maximum available power to be confirmed by the engine Maker.

**Manoeuvring trials**

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

a. Crash stop astern and ahead test  
b. Turning test  
c. Williamson turning test  
d. Inertia test  
e. Minimum revolution test

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

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

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

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

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

Overhauling, inspection after sea trial

After sea trial, working parts of main engine to be opened for the Owner’s inspection in accordance with the standard of the Builder approved by Owner and refitted to working condition. A confirmation dock run after overhauling for 1½ hours at low load to be carried out before delivery.

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

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

100. SCANTLINGS AND MAIN CLASS PLANS

101. Structural Requirements

The hull with superstructures and deck house shall be in fully welded construction in accordance with class requirements (see 011) and Buyer’s requirements as outlined below.

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

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

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

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

- Loads referring to scantling draught
  - Tank top, uniform load 25.0 t/m² and 2 tier of 25 t steel coil (length 1200, diameter 2000) on 3 wooden dunnage
  - Deck, uniform load 4.50 t/m²
  - Weather deck hatches, uniform load 2.50 t/m²

Tanktop to be strengthened for cargoes discharged by grab as per class requirements.

102. Midship Section and Other Class Plans

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

108. Rudder and Rudder Stock (Class)

Spade rudder on rudder horn.

Rudder stock to have diameter 6 mm above class requirements.
110. MATERIALS AND METHODS

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

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

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

120. MAIN FRAMING

121. Longitudinal Framing

In double bottom and upper deck. On topsides and in Hopper tanks.

Side girders as per rules and necessity.

122. Transverse Framing

Transverse framing to be used at side shell between hopper and top side tanks and in the ends of the hull. Double bottom in engine room, forecastle deck, house decks etc.

123. Stem

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

Shell plate in way of anchor to be reinforced.

124. Stem Frame

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

125. Pillars

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

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

126. Fore Peak

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

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

130. BOTTOM CONSTRUCTION

131. Double Bottom, General

To be arranged with water ballast tanks.

A pipe-duct to be arranged between forepeak and engine room. WT hatch covers for easy access.

Square bar steps and handgrips in tanks at manholes in tank top for easy access. For longitudinal passage in tanks in way of cargo hold, at least one manhole in every floor to be 600 x 450 mm (larger when possible) and to be in-line provided no extra stiffening required.

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

133. Floors and Bottom Girders

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

134. Bottom Frames/Longitudinal

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

135. Tank top

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

To be reinforced for grab unloading.

136. Bilges/Bilge Wells

To be arranged as per class requirements for easy drainage.

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

Cargo hold 3 to be arranged with ballast suction wells.

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

141. Shell Plating, General

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

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

Plate sizes to be 2.2 - 3.5 m width in general on shell plating.

143. Local Reinforcements

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

144. Side Stringers

To be arranged in double side tanks as per rules and to enable easy access to all structure inside tanks.

145. Bulwarks

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

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

Walkways to be made under bridge wings for painting.

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

146. Bilge Keels

To be fitted in approx. 50% of the length of the ship P and SB in the water flow direction. The bilge keels to consist of bulb profile welded to flat bar which in turn is to be welded to the shell plating. Bilge keels to terminate on frames and to be tapered at ends. Not to extend outside rectangular midship hull section.

147. Chafing Guards

For the protection of mooring lines chafing moulding strips of half-round bar or pipe to be fitted on shell in way of side fairleads and chocks and at deckhouses and coamings if required and to Buyer’s representatives’ agreement. No chafing guards on sheer strake except at ends.
Chaffing half round bars to be supplied on hatch coaming corners, according to class requirement.

148. Drain Plugs, Tank Markings etc

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

All drain plugs to be clear of docking blocks.

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

150. HULL BULKHEADS

151. Transverse Bulkheads

Watertight transverse bulkheads to be arranged as per General Arrangement.

Transverse WT bulkheads in holds to be of corrugated type supported by stools top and bottom.

Other WT transverse bulkheads of plate and stiffener type.

152. Longitudinal Bulkheads

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

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

153. Wash Bulkheads

To be arranged in fore peak if required.

155. Enclosed Emergency Exit

To be arranged from the lower part of the engine room up to the upper deck or otherwise as per regulations.

160. DECKS AND HATCH COAMINGS, GENERAL

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

All weather decks to be fitted with gutter-ways with adequate drainage. Patent type rubber plugs to be provided on upper deck drains to prevent direct discharge overboard.
Weather decks such as bridge deck etc to be specially faired to avoid water puddles.

165. Cargo Hatchway Coamings

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

Hatch coaming compression bars to be in stainless steel.

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

166. Other Hatchway Coamings

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

167. Local Reinforcements/Fittings

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

170. FOUNDATIONS

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

Foundations to land on structure, not on unstiffened plates.

171. Main Machinery Foundation

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

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

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

172. Auxiliary Machinery Foundations

To be arranged in rigid steel plate design (or according to maker’s recommendation) with due consideration to access for cleaning and drainage.

173. Deck Machinery Foundations

The steering gear foundation to be designed to form a rigid base with under deck inter-costal girders or similar.
Windlass and other deck machinery generally to have foundations of inverted angle bars with sufficient strength to develop full breaking strength of the rope or cable assuming normal load. Distance between deck and machinery to enable easy maintenance.

175. Independent Tank Foundations

To be built with drip tray.

177. Miscellaneous Supports

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

180. MISCELLANEOUS STEEL STRUCTURE

181. Hawse Pipes and Chain Pipes

Flanges and pipes of fabricated welded steel.

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

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

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

182. Chain Lockers

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

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

183. Sea Chests

To be arranged in number and size as necessary for the practical operation of machinery, pumps etc. In engine room one high and one low sea chest to be arranged at PS and SB.

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

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

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

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

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

Cathodic protection is to be provided for the sea chest.

184. Wave breaker

A low approx. 1.8 m wave breaker to be arranged on the aft end of forecastle deck.

The wave breaker shall serve as green water protection for the forward store room hatch, natural vent heads and air vents.

187. House Visors and Wind Deflectors

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

190. SUPERSTRUCTURES AND DECK HOUSES

196. Accommodation Deck Houses

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

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

198. Funnel

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

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

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

199. Machinery Casing

Platforms, ladders and eye plates for easy access and maintenance to be provided.
200. - 299. OUTFIT AND EQUIPMENT (HULL)

200. MARKINGS AND IDENTIFICATION

201. Hull Marks for Tanks

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

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

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

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

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

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

202. Draught Marks and Waterline Marks

Draught marks fore and aft, P & SB, to be fitted as per usual practice and as close to the perpendiculars as practicable. Location to be accurately located to Buyer's representatives' satisfaction.

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

203. Loadline Marks

The statutory deck line and assigned load line marks to be accurately located P & SB, outlined with chipped groove or equal. The net tonnage and the official number to be marked as usual.

204. Name and Port of Registry

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

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

206. Warnings

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

207. Name Plates for Compartments

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

208. Label Plates

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

210. CLOSURES, ACCESS, PROTECTION (HULL)

211. Manholes with Covers

Manholes with stainless steel bolted covers and reinforcement rings to be fitted for access to all tanks, void spaces, and cofferdams. Jacking screws to be provided for all manhole covers. All such compartments, except small ones, to have two manholes in diagonal opposite corners, whenever possible. Tank number to be welded next to the manhole and tank name to be marked near manhole opening. Manholes in general to be 600 x 450 mm. On upper deck and lower hopper 800x600 mm.

One manhole cover from each side ballast tank to double bottom ballast tank to be arranged. One manhole cover from upper wing pipe duct to each side ballast tank to be arranged.

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

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

Manholes in way of cargo holds to be flush. All manhole covers to pack with oil-resistant gaskets. Each cover to have a handle, except the flush ones, which are to have a slot for convenient removal. Steps under manholes as required. Studs for manhole covers in all wet areas to be of stainless steel, nuts to be of brass.

All bolts to be stainless steel.
212. Small Hatches

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

One hatch in each end of each cargo hold.

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

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

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

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

A hatch for engine spare parts to be arranged aft.

213. Exterior Access Doors

Interior doors, see 259.

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

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

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

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

All exterior doors to be pirate proof.

Mosquito screen doors to be arranged as required.

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

Top of doors 1950 mm above finished decks.

Minimum clear door width 700 mm unless else mentioned.

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

The width of door to hospital to be 800 mm. Wheelhouse doors 900 mm.
Port Lights and Windows

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

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

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

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

<table>
<thead>
<tr>
<th>Location</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheel house front</td>
<td>abt. 1 (1400 x 850 fixed)</td>
</tr>
<tr>
<td></td>
<td>10 (1400 x 1385 fixed)</td>
</tr>
<tr>
<td></td>
<td>2 (500 x 710 fixed outside of W/H)</td>
</tr>
<tr>
<td>Wheel house side</td>
<td>abt. 4 (1250 x .... fixed)</td>
</tr>
<tr>
<td>Wheel house aft</td>
<td>2 (1250 x 1350 fixed)</td>
</tr>
</tbody>
</table>

7 windows wipers fitted to bridge windows.

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

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

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

Deadlights to be fitted where required.

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

All glass to be tempered safety glass.

For spare window panes see 1047.
216. Gangway and Accommodation Ladders

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

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

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

Electric motor operated with remote pushbutton. Limit switches to be provided.

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

2 - Pilot ladder to be provided SB and PS as per General Arrangement.

The pilot ladder to be 0.6m width of aluminium alloy with approved type rope ladder.

Davit and electric motor driven hoisting winch are to be fitted for each slant ladder

Electric motors for accommodation and pilot ladder to be protected against heavy weather damage.

217. Stairs and Ladders (Outside Cargo Space)

Stairs and ladders to be arranged for convenient access to all decks, flats etc.

Interior stairs in accommodation with steps of steel, and closed with steel between steps. Steps sheeted with same material as top layer of deck covering in passageways or with non-skid material. Step edges with Ferodo noses or equal. To be inclined 40º if possible, but maximum 45º.

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

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

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

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

Ladder supports to be installed on doubling plates.
218. Rails and Stanchions

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

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

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

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

219. Awnings

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

220. LIGHT RIGGING AND DECK FITTINGS

221. Signal Mast and Radar Mast

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

222. Foremast

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

224. Flag Staffs

An ensign staff at the stern and a flag staff at the bow, both in portable pipe construction, with sheave, cleat, halyard and fixing fitting to be installed.

225. Pad Eyes

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

226. Other Davits

1  - Suez search light davit of steel construction for lowering and hoisting operation by means of chain block to be provided. Fittings for this davit shall also be provided.

2  - Davits for bunkering. SWL approx. 0.9 t, 10 m/min, electric type.
1 - Davit for forward rope hatch.

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

230. MOORING FITTINGS AND EQUIPMENT

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

231. Bollards and Cleats
- Double, in welded construction
- Cleats of steel

232. Fixed Chocks
- Panama type, cast steel
- Closed chocks (hawse holes), cast steel

233. Deck Fairleads
- open type multi roller deck fairleads, cast steel with grease fittings and erected on conical foundation.
- Inclined anchor cable fairleads in way of upper end of hawse pipes. May be combined with chain stoppers.

234. Roller Guides
Roller guides of suitable size according to arrangement.

236. Anchors
2 - Bow anchors
Stowage of spare anchor and possibility of shifting to spare anchor to be approved by the Buyer.
Patent connecting anchor shackles. (Kenter or similar).
Swivel fitted at anchors.
1 - Spare Kenter shackle

237. Anchor Chain Cables
- Material type, grade 3
To be delivered in units of 27.5 m with shackle
Kenter shackle at normal lengths.
S-swivel and shackle to be attached to end of chains.

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

238. Hawsers and Warps

To be delivered to class requirements.

10 x Mooring lines each 220 m, nylon with spliced eyes at each end to be delivered on board

240. SAFETY EQUIPMENT AND DECK EQUIPMENT

The safety equipment to comply with SOLAS 1974/1978 with later Amendments as well as the national regulations of flag of registry.

All equipment to be worldwide serviceable.

241. Lifeboat

1 - Free fall lifeboat Capacity 25 persons.
1 - Rescue boat of rigid or permanently inflated construction or a combination of both and with prescribed equipment including also diesel inboard engine with accessories.

242. Launching Appliances

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

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

243. Life Rafts

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

244. Life-Saving Equipment etc.

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

245. Other Safety Equipment

To be delivered and stowed in accordance with SOLAS Regulations.
247. Magnetic Compass. Bells

1 - Magnetic projector compass and a spare bowl for compass of approved type installed on wheelhouse top with viewing mirror suitably oriented in the wheelhouse for observation by the helmsman to be delivered and installed. To be corrected, compensated and adjusted by an officially qualified adjuster to the satisfaction of the Buyer’s representatives prior to delivery. Deviation cards in duplicate to be delivered.

1 - 300 mm ship’s bell of cast bell metal with vessel’s name & year of delivery engraved to be furnished and mounted on the forecastle.

248. Tarpaulins and Covers

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

250. DECK COVERING, INSULATION, JOINER WORK

251. Deck Covering. Exterior

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

252. Deck Covering. Living Spaces

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

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

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

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

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

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

253. Deck Covering. Wet Spaces

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

The steel decks to be power cleaned.

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

254. Gratings and Safety Treads

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

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

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

255. Insulation. Accommodation/Engine room

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

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

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

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

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

256. Insulation. Sundry

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

257. Linings and Partition Walls

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

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

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

258. Deck Heads (Ceilings)

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

Access trap doors in ceiling in way of valves.

259. Doors and Locks

For exterior access doors see 213.

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

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

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

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

All door sills covered with stainless steel plates.

Top of all doors min. 1950 mm above finished decks. Minimum door width 650 mm. Doors to lockers and wardrobes may be narrower.

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

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

Central key system to include all door locks. Master key for captain and department master keys for each of captain (deck department), chief engineer (engine department), cook (catering department). Single-lock keys for all locks. Two keys of each different type to be delivered. One key locker for captain and each of two departments to be installed complete with hooks and identification numbers. All keys to have a number. Spare set of keys numbered to be arranged in a cabinet in Chief officers office as replica for cutting replacements.

Locks and door closers cupboard catches to be good quality.
260.  ACCOMMODATION. LIVING SPACES

261.  General

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

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

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

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

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

262.  Arrangement

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

The following spaces shall be arranged in accommodation area:

- Living spaces  Cabins
- Public spaces  Officer’s mess / recreation room
  Crew’s mess/ recreation room
  Officer’s pantry
  Duty mess room
  Gymnasium
  Conference room
  Hospital
  Tally office
  Combined office
  Change room
- Control spaces  Wheelhouse with chart/radio space
  Engine control room in engine room space
  Fire control room
  Deck office (ballast control room)
- Passage spaces  Stairway, corridors
- Catering spaces  Galley
- Provision spaces  Dry provision store
Refrigerated provision stores
- Sanitary spaces
  Private toilet
  Hospital toilet
  Public toilets
  Laundry
  Drying rooms
- Sundry spaces
  Battery room
  Paint & lamp store
  Other miscellaneous stores & lockers
- Machinery spaces
  Air-conditioning machine room
  Emergency generator room
  CO₂ room

Public toilets to be arranged in vicinity of the following room/areas:
- Wheelhouse
- Offices
- Galley
- Mess room
- Engine room entrance
- Captains deck

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

Suez crew room to be arranged.

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

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

263. Cabins

Cabins and associated rooms to be laid out as follows:

<table>
<thead>
<tr>
<th>Personnel</th>
<th>Type of Accommodation</th>
<th>No. of Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Captain/Chief engineer</td>
<td>A</td>
<td>2</td>
</tr>
<tr>
<td>Chief officer/1st engineer</td>
<td>A</td>
<td>2</td>
</tr>
<tr>
<td>Officer/engineers/pilot</td>
<td>B</td>
<td>6</td>
</tr>
</tbody>
</table>
Petty officers/Ratings

C

15

Type A consists of: Dayroom, bedroom and private bathroom.
Type B consists of: Single cabin and private bathroom.
Type C consists of: As type B, but with less furniture etc.

1 - Suez crew cabin for six persons.

264. Mess Rooms and Recreation Rooms

Two mess rooms/recreation rooms to be arranged for easy catering from the galley/pantry. One refrigerator in each mess room and in captain’s dayroom, chief engineer’s and chief officer’s dayroom.

Pantry to be arranged in captain’s deck.

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

Notice boards and cold-water fountains to be provided nearby mess rooms. Cold water fountain also provided in engine room.

266. Navigation Spaces

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

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

The furnishing of these spaces shall at least include:

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

Day cabin to be provided at wheelhouse.

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

270. FURNITURE AND DECORATIONS

271. Berths and Mattresses

Berths for officers and engineers: Type A: min. 2000 mm x 1250 mm.

Fixed type berths for cook, ratings and spare cabins, Type B: 2000 mm x 800 mm.

All above measurements are inside measurements.

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

272. Wardrobes and Lockers

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

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

273. Writing Desks and Tables

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

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

Crew cabin writing desks with one shallow drawer only.

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

274. Racks and Other Furniture

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

All crew cabins to have a combined bookcase and radio shelf.
Officers to have a chest of drawers with approx. six drawers or a locker with shelves in addition to the wardrobe.

Cabinet, cupboard or similar in senior officers’ dayrooms.

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

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

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

Long mirrors to be fitted inside wardrobe doors.

Refrigerators (60L) also provided for C/E, Captain, 2/O, 1/E, 2/E, C/O, Bridge, Control room and Conference room.

275. Sofas, Settees, Chairs

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

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

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

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

Easy chairs provided in public rooms and in captains, chief off., chief eng., 1st eng. room.

276. Upholstery, Carpets

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

Carpet tile to be laid in Captain, Chief Engineer, Chief Officer, 1st Engineer, and owner, officer & crew’s recreation space.

277. Curtains, Roller Blinds, Duvets

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

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

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

Duvet for all berths. Two feather pillows for all beds.
Materials for curtains, roller blinds and duvets to be of fabric with low flammability.

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


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

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

280. MISCELLANEOUS ROOMS

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

281. Bathrooms and Toilets. Change room

Bathrooms and toilets may be of prefabricated type.

Each private bathroom to be equipped with the following items:

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

Separate toilets to be equipped with the following items:
1 - Wash-basin of vitreous china, approx. 450 mm x 300 mm with mixing faucet
1 - Water closet of vitreous china with flushing valve and with plastic seat and cover
1 - Mirror
1 - Toilet paper holder
1 - Ashtray
1 - Coat hanger
2 - Towel hooks
1 - Soap holder above wash-basin

Change room to be equipped with the following items:
- Steel lockers
- Wood bench
- Wash-basin of vitreous china approx. 550 mm x 450 mm with faucets indexed or marked for identification of hot and cold
- Shower with thermostatic mixing faucet and fixed turnable shower head
- Coat hangers
- Mirror
- Ashtray
- Soap holders
- Shelf with rail above wash-basin
- Towel hooks

282. Laundry and Separate Drying Room

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

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

283. Galley and Pantry

The furnishing to consist of tables, dressers, storage racks, shelves, and cupboards and cabinets of stainless steel, and besides, of the below listed equipment:
<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Cooking range (with oven) abt. 14.4kW/each</td>
</tr>
<tr>
<td>1</td>
<td>Microwave oven</td>
</tr>
<tr>
<td>1</td>
<td>Rice cooker (for 20 people)</td>
</tr>
<tr>
<td>2</td>
<td>Automatic dishwasher (under counter type)</td>
</tr>
<tr>
<td>1</td>
<td>Hot plate</td>
</tr>
<tr>
<td>1</td>
<td>Garbage disposer, abt. 0.75 kW</td>
</tr>
<tr>
<td>1</td>
<td>Food mixer with accessories 30 l</td>
</tr>
<tr>
<td>1</td>
<td>Electric refrigerator 500 l</td>
</tr>
<tr>
<td>2</td>
<td>Dresser with 1-sink</td>
</tr>
<tr>
<td>2</td>
<td>Stainless steel working table</td>
</tr>
<tr>
<td>1</td>
<td>Hand washbasin</td>
</tr>
<tr>
<td>1</td>
<td>Stainless steel counter</td>
</tr>
<tr>
<td>2</td>
<td>Whiteboard</td>
</tr>
<tr>
<td>1</td>
<td>Flavouring rack</td>
</tr>
<tr>
<td>1</td>
<td>Small stool</td>
</tr>
<tr>
<td>1</td>
<td>Towel rack</td>
</tr>
<tr>
<td>1</td>
<td>Wall cupboard</td>
</tr>
<tr>
<td>2</td>
<td>Plastic wastebasket</td>
</tr>
<tr>
<td>1</td>
<td>Crockery and glass rack</td>
</tr>
<tr>
<td>1</td>
<td>Potato peeler</td>
</tr>
<tr>
<td>1</td>
<td>Chopping block, plastic type.</td>
</tr>
<tr>
<td>1</td>
<td>Working table with sink</td>
</tr>
<tr>
<td>1</td>
<td>Electric toaster, 4 slices (0.8 kW)</td>
</tr>
<tr>
<td>1</td>
<td>Electric kettle (abt. 2 l)</td>
</tr>
<tr>
<td>1</td>
<td>Working tables</td>
</tr>
<tr>
<td>1</td>
<td>25kg scale for weighing food</td>
</tr>
<tr>
<td>2</td>
<td>Locker</td>
</tr>
<tr>
<td>1</td>
<td>Electric meat chopper (abt. 0.7kW)</td>
</tr>
<tr>
<td>1</td>
<td>Elec. Baking oven with 3 sections (app. 9kw)</td>
</tr>
<tr>
<td>1</td>
<td>Deep fat fryer</td>
</tr>
<tr>
<td>1</td>
<td>Drinking water machine</td>
</tr>
</tbody>
</table>

All equipment to be properly mounted with suitable foundations and installed to facilitate easy maintenance and cleanliness.
All doors and drawers of galley equipment to be fitted with push button locks.

All units to be of stainless steel.

Exhaust hood over galley.

Pantry to be arranged on main deck to serve the officer’s mess rooms and the pantry to be furnished as follows:

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

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

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

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

284. Miscellaneous Hull Machinery Rooms

Fan rooms to be arranged as necessary.

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

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

Other deck machinery rooms to be arranged as necessary.

285. Store Rooms and Lockers. General

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

Stowage facilities shall include shelves, lockers, bins, tanks, hooks, clips, racks etc, and are to be substantially constructed and arranged to prevent or restrict movements of items stowed.
The storerooms and lockers shall generally be in accordance with the General Arrangement Plan and shall include, though not necessarily be limited to, those listed in 286-288.

For machinery storerooms see 582.

286. Storerooms and Lockers in Accommodation

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

287. Deck Storerooms

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

288. Provision Store Rooms (Refrigerated and Dry)

For dry provisions as per GA:

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

Special stowage arrangement for tins to Buyer’s approval.

Approx. capacity and temperature for refrigerator stores:

- Vegetable refrigerator room 21 m³ 5°C
- Dairy refrigerator room 6 m³ 5°C
- Meat freezer room 21 m³ -20°C
- Fish freezer room 8 m³ -20°C
- Handling space 15 m³ 8°C

Remote temperature control in ER control room.

289. Gymnasium and Swimming pool

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

Swimming pool to be fitted as per general arrangement.
Painting works including surface preparation and painting inspection shall be carried out in accordance with the Builder’s practice and standard, paint manufacturer’s recommendations and Owner’s approval.

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

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

The finish colour shall be decided in accordance with the Owner’s colour standard. The surface of copper, cooper alloy, aluminium alloy, stainless steel, galvanized steel or other non-corrosive materials, surfaces in contact with doubling plates and internal surfaces of tightly enclosed spaces shall not be painted unless otherwise specified.

Painting works for the equipment and machinery shall be carried out in accordance with the manufacturer’s standard. However, the part damaged after installation shall be touched up in accordance with the Builder’s practice.

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

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

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

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

Smooth grinding of sharp edges shall be done for all steelworks. One (1) stripe coat shall be applied as paint manufacturer’s recommendation for all welding seams, sharp edges and corners.

All non-galvanized pipes longer than 6 meters in length and above 450 mm in diameter shall be blasted or acid pickling and primed prior to bring onboard, and/or mounting on block.
When blasting in proximity of galvanized items, the damaged parts of galvanized surface shall be touched up with zinc rich primer.

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

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

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

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

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

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

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

Primary surface protection and shop priming:

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

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

Secondary surface protection:

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

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>SIS Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At block</td>
</tr>
<tr>
<td>Shell outside</td>
<td></td>
</tr>
<tr>
<td>Below water line</td>
<td>SIS Sa 2.5</td>
</tr>
<tr>
<td>Above water line</td>
<td></td>
</tr>
<tr>
<td>Weather decks</td>
<td>SIS St 3</td>
</tr>
<tr>
<td>Deckhouse, outside</td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td>Surface Preparation</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Deckhouse, behind the insulation lining or ceiling</td>
<td></td>
</tr>
<tr>
<td>Deckhouse, bare steel</td>
<td></td>
</tr>
<tr>
<td>Machinery space</td>
<td></td>
</tr>
<tr>
<td>Void spaces and cofferdam</td>
<td></td>
</tr>
<tr>
<td>Cargo holds</td>
<td>SIS Sa 2.5</td>
</tr>
<tr>
<td>Water ballast tanks incl. sewage tank</td>
<td></td>
</tr>
<tr>
<td>Fore &amp; after peak tanks</td>
<td></td>
</tr>
<tr>
<td>Fresh water tanks</td>
<td>SIS Sa 2.5</td>
</tr>
<tr>
<td>H.F.O., D.O. and L.O. tanks</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
</tr>
</tbody>
</table>

Application of paints:

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

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

Measurement of dry film thickness:

MICROTESTER, INSPECTOR or other instrument shall be used for measurement of dry film thickness.

For ship’s hull, water ballast tanks, fresh water tanks and cargo holds the average DFT based on measurements shall always be equal to or larger than specified DFT. Up to 15% of the measured points may have a thickness between 100% and 85% of the specified DFT.

For other areas the average DFT based on measurements shall always be equal to or larger than specified DFT. Up to 15% of the measured points may have a thickness between 100% and 85% of the specified DFT.

Dry film thickness shall not be measured for machinery, equipment, outfittings, pipe supports, seats, welding beads and edge of structural members.
## Painting Schedule:

<table>
<thead>
<tr>
<th>PAINTING AREA</th>
<th>SHOP PRIMER</th>
<th>PAINT &amp; NUMBER OF COAT</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interior Parts</strong></td>
<td></td>
<td><strong>1</strong></td>
<td><strong>2</strong></td>
</tr>
<tr>
<td><strong>Tanks</strong></td>
<td></td>
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</tr>
<tr>
<td>Fuel oil tank</td>
<td>IZ</td>
<td></td>
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<tr>
<td>Lub. oil tank</td>
<td>IZ</td>
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<tr>
<td>Fresh water tank</td>
<td>IZ</td>
<td>EP**</td>
<td>EP**</td>
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<tr>
<td>Fore peak tank</td>
<td>IZ</td>
<td>PE</td>
<td>PE</td>
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<tr>
<td>Aft peak tank</td>
<td>IZ</td>
<td>PE</td>
<td>PE</td>
</tr>
<tr>
<td>Bilge well</td>
<td>IZ</td>
<td>PE</td>
<td>PE</td>
</tr>
<tr>
<td>Stern tube (Outside)</td>
<td>IZ</td>
<td>PE</td>
<td>PE</td>
</tr>
<tr>
<td>Chain locker</td>
<td>IZ</td>
<td>BS</td>
<td>BS</td>
</tr>
<tr>
<td>Cofferdam</td>
<td>IZ</td>
<td>EM</td>
<td></td>
</tr>
<tr>
<td>Void space</td>
<td>IZ</td>
<td>EM</td>
<td></td>
</tr>
<tr>
<td>Double bottom water ballast tank</td>
<td>IZ</td>
<td>PE</td>
<td>PE</td>
</tr>
<tr>
<td>Top side water ballast tank</td>
<td>IZ</td>
<td>PE</td>
<td>PE</td>
</tr>
<tr>
<td><strong>Accommodation Space</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Living room, Public room, Offices, Passage</td>
<td>Ceiling wall</td>
<td>Bare steel</td>
<td>IZ</td>
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<tr>
<td></td>
<td></td>
<td>Under insulation</td>
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<td></td>
<td></td>
<td>Floor</td>
<td>Bare steel</td>
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<td></td>
<td>Under covering</td>
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<tr>
<td>Stores</td>
<td></td>
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<tr>
<td>Dry prov. St.</td>
<td>Ceiling wall</td>
<td>IZ</td>
<td>AP</td>
</tr>
<tr>
<td>Wet. prov. St.</td>
<td>Floor</td>
<td>IZ</td>
<td>AP</td>
</tr>
<tr>
<td>Battery room</td>
<td>Ceiling wall</td>
<td>IZ</td>
<td>AP</td>
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<tr>
<td></td>
<td>Floor</td>
<td>IZ</td>
<td>EM</td>
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<tr>
<td>Ref. prov.</td>
<td>Ceiling wall</td>
<td>IZ</td>
<td>EM</td>
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<tr>
<td>Chamber</td>
<td>Floor</td>
<td>IZ</td>
<td>EM</td>
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<tr>
<td>PAINTING AREA</td>
<td>SHOP</td>
<td>PAINT &amp; NUMBER OF COAT</td>
<td>REMARKS</td>
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<td>PRIMER</td>
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<td>2</td>
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<tr>
<td><strong>Interior Parts</strong></td>
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<tr>
<td>Cargo Hold</td>
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<td>Except No.3</td>
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<tr>
<td>Cargo Hold</td>
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<td>No.3</td>
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<tr>
<td>Engine room</td>
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<tr>
<td>Eng. Room, Boiler room,</td>
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<tr>
<td>Steering gear room</td>
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<tr>
<td>Ceiling</td>
<td>IZ</td>
<td>EM</td>
<td>EM</td>
</tr>
<tr>
<td>Wall</td>
<td>IZ</td>
<td>EM</td>
<td>EM</td>
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<tr>
<td>Hold bottom &amp; lower part of</td>
<td>IZ</td>
<td>EM</td>
<td>EM</td>
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<tr>
<td>lower hopper</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bilge well</td>
<td>IZ</td>
<td>EM</td>
<td>EM</td>
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<tr>
<td>Cargo Hold</td>
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<td>Except No.3</td>
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<td>No.3</td>
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<tr>
<td>Engine room</td>
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<tr>
<td>Eng. Room, Boiler room,</td>
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<tr>
<td>Steering gear room</td>
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<tr>
<td>Ceiling</td>
<td>IZ</td>
<td>AP</td>
<td>AF</td>
</tr>
<tr>
<td>Wall</td>
<td>IZ</td>
<td>AP</td>
<td>AF</td>
</tr>
<tr>
<td>Grating top of double bottom</td>
<td>IZ</td>
<td>AP</td>
<td>AF</td>
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<tr>
<td>Floor</td>
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<tr>
<td>Top of double bottom</td>
<td>IZ</td>
<td>EM</td>
<td>EM</td>
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<tr>
<td>Grating</td>
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<tr>
<td>Top</td>
<td>--</td>
<td>AP</td>
<td>AF</td>
</tr>
<tr>
<td>Under surface</td>
<td>--</td>
<td>EM</td>
<td>EM</td>
</tr>
<tr>
<td>Engine flat</td>
<td>IZ</td>
<td>AP</td>
<td>AF</td>
</tr>
<tr>
<td>Under machinery seat, Bilge</td>
<td>IZ</td>
<td>EM</td>
<td>EM</td>
</tr>
<tr>
<td>pipe</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Galvanized</td>
<td>--</td>
<td>No paint</td>
<td></td>
</tr>
<tr>
<td>Under grating</td>
<td></td>
<td>EM</td>
<td>EM</td>
</tr>
<tr>
<td>Insulated</td>
<td>--</td>
<td>HRP</td>
<td>HRP</td>
</tr>
<tr>
<td>Steel pipe except above</td>
<td>--</td>
<td>AP</td>
<td>AF</td>
</tr>
<tr>
<td>Engine Room and Steering</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>gear room</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outside surface of Insulation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outside surface of galv. plate</td>
<td>--</td>
<td>EP</td>
<td>AF</td>
</tr>
<tr>
<td>Except above</td>
<td>--</td>
<td>AF</td>
<td></td>
</tr>
<tr>
<td>Main engine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boiler</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Auxiliary machinery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAINTING AREA</td>
<td>SHOP PRIMER</td>
<td>PAINT &amp; NUMBER OF COAT</td>
<td>REMARKS</td>
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<td>---------------</td>
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<td>---------</td>
</tr>
<tr>
<td><strong>Exterior Parts</strong></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Outside of Pipe</td>
<td>Galv. pipe</td>
<td>--</td>
<td>No paint</td>
</tr>
<tr>
<td>Insulated steam pipe</td>
<td>--</td>
<td>HRP</td>
<td>HRP</td>
</tr>
<tr>
<td>Cargo hatch Cover</td>
<td>Outside</td>
<td>IZ</td>
<td>EM</td>
</tr>
<tr>
<td>Inside</td>
<td>IZ</td>
<td>EM</td>
<td>EM</td>
</tr>
<tr>
<td>Cargo hatch Coaming</td>
<td>Outside</td>
<td>IZ</td>
<td>EM</td>
</tr>
<tr>
<td>Inside</td>
<td>IZ</td>
<td>EM</td>
<td>EM</td>
</tr>
<tr>
<td>Anchor</td>
<td>--</td>
<td>BS</td>
<td></td>
</tr>
<tr>
<td>Anchor chain</td>
<td>--</td>
<td>BS</td>
<td></td>
</tr>
<tr>
<td><strong>Deck Fittings</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bottom</td>
<td>Before launching</td>
<td>IZ</td>
<td>CTE</td>
</tr>
<tr>
<td>Bottop (TBT free)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top side</td>
<td>IZ</td>
<td>EM</td>
<td>PT</td>
</tr>
<tr>
<td>Rudder Outside</td>
<td>IZ</td>
<td>Same as bottom</td>
<td></td>
</tr>
<tr>
<td>Inside</td>
<td>BS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inside of stern frame</td>
<td>--</td>
<td>BS</td>
<td></td>
</tr>
<tr>
<td>Rudder trunk</td>
<td>IZ</td>
<td>EM</td>
<td></td>
</tr>
<tr>
<td><strong>Shell</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All decks</td>
<td>IZ</td>
<td>EM</td>
<td>EM</td>
</tr>
<tr>
<td>Under deck machinery</td>
<td>IZ</td>
<td>EM</td>
<td></td>
</tr>
<tr>
<td>Under covering</td>
<td>IZ</td>
<td>No coating</td>
<td></td>
</tr>
<tr>
<td>Deck house</td>
<td>IZ</td>
<td>EM</td>
<td>EM</td>
</tr>
<tr>
<td>Deck store Outside</td>
<td>IZ</td>
<td>EM</td>
<td>EM</td>
</tr>
<tr>
<td>Inside</td>
<td>IZ</td>
<td>EM</td>
<td>EM</td>
</tr>
<tr>
<td>funnel</td>
<td>Outside</td>
<td>IZ</td>
<td>EM</td>
</tr>
<tr>
<td>Inside</td>
<td>IZ</td>
<td>AP</td>
<td>HRP</td>
</tr>
<tr>
<td>Mast and post</td>
<td>IZ</td>
<td>EM</td>
<td>EM</td>
</tr>
<tr>
<td>Ventilator</td>
<td>--</td>
<td>EM</td>
<td>EM</td>
</tr>
<tr>
<td>Deck machinery</td>
<td>--</td>
<td>Paint by manufacture</td>
<td></td>
</tr>
</tbody>
</table>

Note: The thickness specified shall be taken as a reference. Actual thickness may be adjusted subject to specifications recommended by manufacturer. SPC to be of 3 years life.

Abbreviations:

- **IZ** Inorganic zinc silicate shop primer
- **ANT** TBT free Anti-fouling paint (long life 3 years)
- **AP** Alkyd Primer
- **AF** Alkyd Finish
- **HRP** Heat Resistant Aluminium Alkyd
- **EP** Epoxy primer
- **EM** Epoxy Mastic
- **BS** Bituminous Coating
- **PE** Pure Epoxy
- **CTE** Coal Tar Epoxy
- **EP** Solvent-free Pure Epoxy
Painting Schedule of Wooden Surface:

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

2 coats of white or tint colour paint

Wooden furniture to have:

1 coat of wood sealer coats of clear resin

Galvanizing

Galvanizing process to be approved by Owner.

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

Following outfits to be galvanized:

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

Funnel and bow mark

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

Name and port registry

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

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

Draft mark, freeboard mark and boundary mark
Draft marks to be made from steel plate and painted to the shell at 200mm intervals up to 1.0 meter above the load waterline at stem, midship and stern, on port and starboard sides. Figures to be 100mm height and Arabic figures to be used. The bottom edge of the numeral will indicate the projected vertical height in meters from the bottom of the keel.

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

**Tug push marks**

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

**Bulbous bow mark**

Bulbous bow mark to be marked by intermittent welding beads and painted at the forward part both port and starboard sides.

**Hold division marks**

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

**Miscellaneous**

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

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

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

Manhole covers to tanks, access hatches to holds, rope hatches and other means of entry to be marked with appropriate tank number, code or space identification. Painting mark at side shell by intermittent welding bead.

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

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

**298. Impressed Current Protection**

Impressed current system for hull and propeller protection to be fitted.
300. - 399. HULL ENGINEERING

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

300. VENTILATION

301. Ventilation, General

For machinery ventilation see 541-542. For ventilation of cargo spaces see 970. A list of requirements appears in 302.

Spaces to be ventilated according to the applicable regulations. Noise level in accordance with ISO 6954-1984.

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

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

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

<table>
<thead>
<tr>
<th>Compartment</th>
<th>Ventilation system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accommodation quarter:</td>
<td></td>
</tr>
<tr>
<td>Living spaces, public spaces, laundry and drying room, dry provision room etc. except sanitary spaces</td>
<td>Air conditioning system (Spot cooling/heating in wheel house, chart space, pantries and galley*)</td>
</tr>
<tr>
<td>Sanitary spaces</td>
<td>Natural supply through door louver Mechanical exhaust</td>
</tr>
<tr>
<td>Steering gear room, emergency fire pump room, CO₂ room, hydraulic pump room, emergency generator room, wing &amp; bottom pipe ducts,</td>
<td>Mechanical exhaust, natural supply</td>
</tr>
<tr>
<td>Other stores, lockers, battery room etc.</td>
<td>Natural ventilation</td>
</tr>
<tr>
<td>Cargo holds</td>
<td>Natural ventilation Mechanical ventilation for dangerous cargoes, if applicable</td>
</tr>
<tr>
<td>Machinery space</td>
<td>Mechanical &amp; natural ventilation (see Machinery Specification)</td>
</tr>
</tbody>
</table>

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

Any space not specifically mentioned is to be governed by Class requirements.
302. List of Ventilation Requirements

Approx. air changes per hour:

<table>
<thead>
<tr>
<th>Type of Space</th>
<th>Mechanical Exhaust</th>
<th>Mechanical Supply</th>
<th>Natural Exhaust</th>
<th>Natural Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deck store rooms</td>
<td></td>
<td></td>
<td>E</td>
<td>S</td>
</tr>
<tr>
<td>Bathrooms and toilets</td>
<td>15</td>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laundry and drying room</td>
<td>30</td>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change rooms</td>
<td>15</td>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steering gear compartment</td>
<td>15</td>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Em. fire pump room</td>
<td>15</td>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galley</td>
<td>60</td>
<td>40</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Supply

<table>
<thead>
<tr>
<th>Space</th>
<th>Exhaust</th>
<th>Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Navigation bridge</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Mess rooms</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Cabins</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Machinery control room</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

303. Natural Ventilation

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

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

Natural ventilation to be provided for cargo holds.

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

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

Mushroom ventilators of 450mm dia. and above and axial fan to be opened / closed with a turning handle, and smaller dia vent, to be handled by a turning bonnet cover.

304. Miscellaneous Ventilation

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

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

306. Fans

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

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

307. Ducts, Inlets, Outlets

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

Cleaning holes to be provided where necessary.

Ventilation cowls, mushrooms, goosenecks and ventilators of min. 5mm steel, sandblasted, primed and painted.

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

308. Fire Dampers

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

310. AIR-CONDITIONING AND HEATING

311. Air-Conditioning Requirements

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

<table>
<thead>
<tr>
<th>Climate</th>
<th>Outside</th>
<th>Inside</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Temp.</td>
<td>Rel. humidity</td>
</tr>
<tr>
<td>Hot</td>
<td>+35°C</td>
<td>90%</td>
</tr>
<tr>
<td>Cold</td>
<td>- 20°C</td>
<td></td>
</tr>
</tbody>
</table>
Wind speed: 16 m/s
Design cooling water temperatures: +36°C

Number of air changes per hour: See 302.
An amount of max. 50% of the air may be re-circulated.

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

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

312. Refrigeration Machinery for Air-Conditioning

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

The plant to be assembled as a unit on a common bedplate and to be installed in a separate room accessed from outside deck. Refrigerant to be of ecological type.

313. Heat Producer

The necessary heating to be provided by the central heating system. The system is dimensioned for the air-conditioning heating requirements and for the ship’s other heating requirements in rooms and for service water etc. The system is heated by the steam from the oil fired boiler via heat exchanger.

314. Air-Conditioning Central Unit

The unit to comprise a mixing and filtering section with control dampers and dry-type air filter, a heating section, a fan section with a centrifugal fan, a cooling section with air cooler, and a discharge section as well as the necessary accessories. Humidity control for supply air while heating is to be done manually at the humidifier of fan unit. Unit to be built of galvanised steel and to be provided with thermal and acoustic insulation.

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

315. Air-Conditioning Ducting

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

316. Air-Conditioning Outlets

The air-conditioning room units to be of such design that will ensure low velocity, low noise level and individual control. The outlets (supply units) may be as grilles or as ceiling diffusers and noise-absorbing boxes to be fitted near outlets.
318. Heating of Non-Conditioned Spaces

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

320. HULL PIPING SYSTEM

321. System Requirements

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

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

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

All pipelines to have section valves to facilitate maintenance.

Copper pipes and PVC pipes are to be seamless.

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

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

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

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

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

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

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

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

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

No lobsterbacks as bends.

322. General Demarcation

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

For machinery piping systems: See under 600.

323. Materials, Pipes. Types

See under section 600.

325. Assembly and Supports

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

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

Pipe supports should land on structure, not unsupported plating.

326. Insulation of Pipes

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

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

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

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

For insulation of machinery, see 516, 546.

For insulation of pipes in engine room, see 606.
327. Protection of Pipes

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

330. BALLAST, BILGE, DRAINAGE PIPING

331. Ballast Piping (Outside Engine Room)

Ballasting and deballasting system for BW tanks, in side tanks and DB tanks.

The ballast system is to be according to Class requirement and Owner’s approval.

Ballast pipes in tanks to be of Sch.80 steel Galvanised pipes.

Lightning and drainage holes in tank structure to ensure full flow to tank suctions.

Special attention shall be paid to effective drainage of all ballast tanks. For ballast system in engine room see 651.

Special attention shall be paid to effective ballast exchange.

The following to be installed:

2 - Ballast pumps. 1000 m$^3$/H x 4.0 Bar each
1 - Ballast eductor (for stripping). 160 m$^3$/H x 2.0 Bar

The Cargo Hold no 3 to be connected to the main ballast pipe system. In addition the Cargo hold no 3 to be arranged with a separate gravity filling connection and a separate ballast overboard for ballast flow through for water ballast exchange.

332. Bilge Piping (Outside Engine Room)

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

Bilge pipes in tanks to be of Sch.80 steel Galvanised pipes.

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

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

Bilge wells to be of 2 chamber segregation type.

Total two portable eductors shall be arranged for cargo hold bilge wells to take suction of hold washing water (incl. particle debris from former cargo). The hold washing water to be transferred via a common hold washing water collecting line to the hold washing water holding tanks or if permitted discharged directly over board.
333. Scuppers and Drains, General

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

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

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

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

334. Exterior Deck Scuppers

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

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

335. Interior Gutter-ways and Scuppers

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

336. Floor Drains

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

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

337. Sanitary Drains and Galley Drains

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

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

Discharge outlets of the wastewater and soil drainage mains are to be located below the light ballast water line level
An independent line for waste and soil drains from hospital is to be led to the sewage treatment plant and overboard discharge outlet

338. Pipes
Ordinary sewage piping to sewage treatment unit and to sewage collecting tank in engine room.
For toilet flushing system, see 352.

339. Hydraulic Pipes
Hydraulic pipes on open deck to be of heavy duty seamless carbon steel with denso tape.
All hydraulic control piping to stainless steel (316L).
Independent hydraulic pipe systems for:
- mooring and anchor
- cranes
- hatch covers
- steering gear

340. FILLING, SOUNDING AND VENTING

341. Filling Pipe Systems
Filling pipe connections P & SB with valves on deck and sampling flanges (of dripping type) for filling of fuel oils. To be fitted with coarse filter and sampling point. Filling pipes to tanks common with suction after by-passing transfer pumps.
Filling pipes on deck for lub. oil, diesel oil, sampling flanges (of dripping type) and for fresh water to respective tanks.
Separate filling pipes to be arranged for different type of lub. oils.
Arrangement for drawing samples of oil for the purpose of analysis to be provided. No equipment for this purpose will be provided by the Builder.
Piping size to be calculated so as to base a normal bunkering capacity of 300 m$^3$/h (45 Deg. Celcius)
Dimensions of the filling pipes:

<table>
<thead>
<tr>
<th>Oil Type</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFO</td>
<td>2 x ND 200 mm</td>
</tr>
<tr>
<td>DO</td>
<td>2 x ND 100 mm</td>
</tr>
<tr>
<td>LO</td>
<td>6 x ND 50 mm</td>
</tr>
<tr>
<td>FW</td>
<td>2 x ND 50 mm</td>
</tr>
</tbody>
</table>

One adapter (4 inch x 6 inch steel reducer) is to be supplied for the fuel oil filling at Panama Canal.
A high level alarm is to be provided for each of fuel oil tanks and alarm lamps are to be fitted at each side of the vessel in front of the access on upper deck. One additional high-level alarm to be provided in engine control room.

Each HFO tank to be provided with remote temperature indicators.

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

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

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

342. Overflow Pipes

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

Cargo hold no. 3 to be fitted with automatic air vents, refer to 974.

343. Sounding Pipes

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

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

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

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

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

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

Sounding pipes to be marked with tank name.
344. **Tank Vent Pipes**

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

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

All pipes to be marked with tank name.

350. **SERVICE PIPING SYSTEMS**

351. **Cold and Hot Freshwater Supply**

Freshwater supply from freshwater hydrophore system with pumps and pressurised storage tank in engine room. Connection to all cold water taps and via a water heater to all hot water taps fitted on all wash basins, showers, slop basins and sinks. Also connections to washing machines. Besides, one outside cold water tap for hose connection at aft side of each accommodation deck house level. Isolating valve to be fitted inside accommodation area.

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

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

Stop valves before each tap.

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

352. **Toilet Flushing System**

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

Freshwater toilet flushing system.

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

354. **Sanitary Fixtures**

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

357. **Working Air Connections**

Compressed-air outlets (0,8 MPa) to be provided on open decks for repair and cleaning tools.
Compressed air to be provided for the following spaces or rooms:

- Steering gear room
- Emergency generator room
- CO\textsubscript{2} bottle room
- Bosuns store
- Cargo holds (to serve hold washing system)

360. FIRE-EXTINGUISHING

361. Fire-Fighting Requirements

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

The engine room and cargo holds to be installed with smoke detection system and CO\textsubscript{2} fire extinguishing system.

In addition to the CO\textsubscript{2} system the engine room to be protected in accordance with latest IMO rules i.e. water spray system for selected machinery component.

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

CO\textsubscript{2} system fitted to galley exhaust trunking.

CO\textsubscript{2} system fitted to emergency generator room.

CO\textsubscript{2} system fitted to the paint store.

Fire control station.

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

- Emergency stop of ventilation fans for engine room
- Emergency stop of fuel oil pumps in engine room
- Emergency quick-closing of the valves on oil tanks in engine room
- Start/stop of the bilge, fire & general service pump and emergency firepump
- Manual call point for fire alarm
- International shore connection
- CO\textsubscript{2} releasing box for engine room
- One (1) CO\textsubscript{2} portable fire extinguisher
- Remote closing of fire shutters for engine room fans and louvers from the fire station.

362. Fire and Safety Plan

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

Additional watertight provisions for safety plan stowage in way of gangways.
363. Fire Detection System

A fire detection system to be fitted in the accommodation and engine room. Detector box to be placed in wheelhouse.

364. Portable Fire-Extinguishing Equipment

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

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

365. Fire and Deck Wash Main

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

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

To serve the hold washing system a branch line from the fire and deck wash main to be arranged in each cargo hold.

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

Driving water for bilge- and hold eductor to be supplied from the fire main line. Hydrant to be arranged in suitable intervals so that two (2) hydrant jets can reach any part of the vessel.

Size of hose couplings to be of ND 50 mm for all spaces. The hydrant to be of cast iron with bronze coupling of NOR or STORZ type.

The synthetic fire hoses of 15m length and 50mm diameter in size with the instantaneous couplings and jet/spray nozzles shall be provided for the accommodation decks, weather deck and engine room, etc.

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

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

The fire and wash deck line shall have a drain cock at the lowest point to prevent freezing in cold weather. Nozzles will be supplied equal to the number of hoses. Nozzle to be of jet and water
spray type approved by the Classification Society.

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

The fire pumps to be arranged for remote starting.

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

366. CO₂ System

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

The CO₂ releasing panel for engine room shall be located at the fire control station. CO₂ gas shall be released through master control valve/3-way valve manifold and shall be distributed to engine room.

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

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

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

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

370. DECK MACHINERY

Deck machinery for cargo handling: See section 900.

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

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

371. Windlass Forward

2 - Windlasses to be installed forward

Type: Electro hydraulic

Each windlass to have:

1 - Declutchable cable lifter with hand-operated band brake
2 - Mooring rope drums of split type with auto self tension
1 - Warping head of cast iron
Mean cable lifter hoisting speed: 9 m/min.

Hawser speed 15 m per min.

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

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

Gypsy wheel and hawser drum not to be operated simultaneously.

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

All bearing to be lubricated with grease.

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

372. Cable Lifter Brakes

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

373. Mooring Winch on Deck Aft

2 - Mooring winches to be installed on deck aft.

Type: Electro hydraulic

Each mooring winch to have:

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

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

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

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

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

To be supplied according to requirements from deck machinery etc. Position and lay-out according to General Arrangement.

Pipes to be run under deck when applicable.

Hydraulic power packs

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

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

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

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

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

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

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

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

Hydraulic piping

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

The hydraulic pipes shall be of steel, and shall run under deck as far as practicable.

STEERING GEAR AND MANOEUVRING MACHINERY

Steering Gear

Electric hydraulic steering gear of rotary vane type complete with two sets of independent electric motor driven hydraulic pumps, and two independent hydraulic motors.

See also section 108.
Each set to be capable of operating the rudder on one (1) power unit from 35° on one side to 30° on opposite side in not more than 28 seconds with vessel running full speed ahead and operating at maximum continuous horsepower rating and loaded to deepest load line. (scantling draught)

The electric motors and power units to be provided with remote starting from the bridge and local with green running light and red light for alarm.

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

Gyro repeater and helm indicator in steering gear room.

Oil drip coaming with suitable handrail shall be provided around the steering gear.
400. - 499. MAIN AND AUXILIARY MACHINERY COMPONENTS

400. MACHINERY GENERAL

401. Machinery Requirements

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

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

The following auxiliary systems for the main engine to be laid out for the main engine nominal rating, i.e. 9480 kW at 127 RPM:

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

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

Considerations are to be given so that the entire rotating masses are free of all major stresses due to the torsional vibration in the normal operating range between 85% and 110% of the main engine nominal speed (related to the MCR).

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

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

For design conditions see 402.

HFO operation: Main engine
Boiler
Diesel generator sets

HFO specification: ISO 8217:1987 (E), ISO-F-RMH 55 (700 cSt at 50°C)

DO operation: Main engine
Boiler
Diesel generator sets
Incinerator
Emergency diesel generator
DO specification: BS MA 100 Class M2, equivalent to ISO 8217 (F), DMB

402. Design Conditions

The design conditions for all machinery components and systems:

- Sea water temperature +32°C
- Ambient engine room temperature and +45°C
- and relative humidity 70%

403. Machinery Tests and Trials

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

404. Instruments and Gauges

The necessary gauges, equipped with special connection and cocks for fitting pressure gauges for calibration, thermometers, indicators, counters, etc. shall be furnished for main and auxiliary machinery and piping systems, as required for proper operation and control.

For centralized control requirements see 800.

409. Machinery Arrangement

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

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

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

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

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

Lifting arrangement and transport ways in engine room to be sufficient in number and capacity to ensure easy transport of heavy elements such as large spare parts for M/E, and arrangement in engine room also is to make possible easy and safe taking over the weights by harbour cranes as well as the provision crane.

In principle, all pumps in E/R shall be fitted above floor plates.

No valves to be in walkways or below floor plates with cover or coaming around.
Handrails with standard connection pieces have to be fitted, easy demountable for transfer of equipment.

Heat exchangers, condensers to have bypass valves if necessary

All main engine related items to have a capacity based on Nominal 100% MCR (9480 kW) of the main engine with additional safety/cleanliness margin according to manufacturer’s standard for scavenge air coolers.

**410. MAIN PROPULSION MACHINERY**

**411. Main Diesel Engine**

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

   MAN B&W 6S50 MC-C

Ratings: MCR 9480 kW / 127 RPM  
CSR (82 % of MCR) 7780 kW / 119 RPM

The optimising point and the CSR to be approved by the Owner.

The M/E to be complete with necessary fittings and accessories acc. to M/E maker’s standard and in consideration of owner’s supplied list.

One high efficiency turbo charger to be installed.

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

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

Specific fuel oil consumption: 171 g/kWh at MCR based on the ISO 3046-1

The M/E to be fitted with VIT (Variable Injection Timing) fuel pumps.

**418. Main Machinery Control**

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

**420. POWER TRANSMISSION SYSTEM**

**423. Shaft and Bearings**

The propeller shafting to consist of:

1 - Propeller shaft  
1 - Intermediate shaft

The shafts to be of carbon steel.
The diameter of the shafting to be determined by Rule’s requirement and to have a margin as follows:

About 5 mm excess in diameter for the intermediate shaft
About 5 mm excess in diameter for the propeller shaft

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

The dimensions of the shafts to be designed based on the MCR (9480 kW, 127 rpm).

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

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

One shaft torsion meter to be provided.

424. Stern Tube with Bearings

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

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

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

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

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

425. Shaft Seals

1 - Set of outer and inner shaft seals of ‘Simplex’ type (split sea – double security)
4 rings for aft and 2 rings for forward.
Aft shaft seal protected by rope guard (plate screen). Net knives fitted at propeller boss

426. Propeller

1 - Fixed type keyless right-handed propeller with skew back blades to be provided. Optimisation draught and M/E power to be agreed after tank test, (see 006).
Diameter: approx. 5.9 m
RPM approx. 119 rpm
Service power: 7780 kW
Number of blades: 4
Materials: Fixed propeller: Ni-Al-Bronze

The propeller to be able to absorb ME MCR (9480 kW and 127 RPM).

The propeller is to be designed for 5~6% light running under normal sea conditions.

The propeller may be redesigned as per Owners request to suit different power point for the sister vessels at no extra costs.

430. GENERATOR PRIME MOVERS

431. Auxiliary Diesel Engine Sets

3 - Identical diesel generator sets

Continuous rating: about 700 kW (or 770 kW) at 1200 RPM (720 rpm)

Final rating to be decided after el-load balance calculations.

Fuel: See 401

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

Starting system: Air starting

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

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

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

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

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

433. Emergency Diesel Generator Set

1 - Emergency diesel alternator set

Continuous Rating: Approx. 125 kW at 1800 RPM
Fuel: See 401

Cooling system: Fan cooled radiator

Diesel engine directly coupled, or via a flexible coupling according to manufacturers recommendations, to an AC-generator.

Rating: Approx. 150 KVA, 3 x 440 V, 60 Hz, 1800 RPM

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

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

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

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

440. **PUMPS - GENERAL**

The pumps shall have a high peak efficiency.

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

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

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

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

441. **Pump Materials**

Pump materials in accordance with the below table:

441.1 **Water Pumps**

<table>
<thead>
<tr>
<th>Pump fluid</th>
<th>Casing</th>
<th>Impeller</th>
<th>Shafting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea water (cooling water bal-</td>
<td>Gun metal or bronze</td>
<td>Al. bronze</td>
<td>Stainless</td>
</tr>
<tr>
<td>last W.)</td>
<td></td>
<td></td>
<td>steel</td>
</tr>
<tr>
<td>Fresh cooling water</td>
<td>S.G. or cast iron</td>
<td>Al. bronze</td>
<td>Stainless</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>steel</td>
</tr>
<tr>
<td>Bilge water</td>
<td>Gun metal or bronze</td>
<td>Al. bronze</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------</td>
<td>------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Bilge water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(mono pump)</td>
<td>Cast iron</td>
<td></td>
<td>Stainless steel</td>
</tr>
<tr>
<td></td>
<td>Rubber liner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washing water</td>
<td>Cast iron</td>
<td>Bronze</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>Drinking water</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
</tr>
</tbody>
</table>

### 441.2 Fuel and Lub. Oil Pumps

<table>
<thead>
<tr>
<th>Pump type</th>
<th>Casing</th>
<th>Gear</th>
<th>Idler</th>
<th>Rotor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gear</td>
<td>Cast iron</td>
<td>Carbon steel</td>
<td></td>
<td>Carbon steel</td>
</tr>
<tr>
<td>Screw</td>
<td>Cast iron</td>
<td>Carbon steel</td>
<td>S.G. steel</td>
<td>Carbon steel</td>
</tr>
</tbody>
</table>

### 442. Centrifugal Pumps

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

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

### 444. Rotary Positive Displacement Pumps

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

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

### 446. Hand Pumps

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

### 447. Electric Motors for Pump Driving

As far as possible, pump motors to be of the same maker and to have 5% margin in their rated capacity.

Electric motor overload safety protection should be fitted and the motors screened where liable to water damage.

For other details, see 731.
449. Ejectors

The following ejectors to be provided.

One ejector for bilge well suctions in chain lockers, stores in forecastle and forward section of upper pipe ducts.

One ejector for main bilge system.

Two portable ejectors for cargo hold washing, driving water for these ejectors from fire & deck washing system.

One ejector for stripping ballast water tank, driving water for this ejector from main ballast pump.

450. LIST OF PUMPS

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

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

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

453. Emergency Fire Pumps

1 - Emergency fire pump

To be located in compartment below steering gear room.

460. COMPRESSORS AND AIR VESSELS

461. Starting Air Compressors

2 - Starting air compressors to be installed. Working pressure 3.0 MPa. Three Stage type, air cooled and driven by an electric motor

   Capacity each: 180 m$^3$/h

1 - Service air compressor (120 m$^3$/hr rotary package type) at 0.8 MPa pressure.

1 - Emergency air compressor to be installed. The capacity to meet rules' requirements for restoring propulsion power from dead ship condition.

465. Air Receivers

2 - Starting air receivers to be installed.

   Working pressure: 3.0 MPa
   Capacity: each 4.5 m$^3$
1 - Service air receiver to be installed.
   Working pressure: 0.8 MPa
   Capacity: 1 m³

1 - Control air receiver: 0.25 m³

1 - Aux. air receiver. Capacity: 0.45 m³

Automatic drain trap for each main air receiver to be provided.

470. TREATMENT UNITS FOR LIQUIDS

471. HFO Separators

2 - Fuel oil separators for fully automatic operation and with alarm and control panel for operation including selection for operation in series, respectively in parallel. The separators to be belt driven, self cleaning and of the partial discharging type.

   Capacity each: According to engine builder’s and separator maker’s recommendation.

   As guidance approx. 3000 l/h.

   The separators to be suitable for continuous cleaning of HFO with a density greater than 1.

   Each of the separators to be delivered with one supply pump and one preheater.

472. Diesel Oil Separator

One of the HFO separators could be used as diesel oil separator.

The separator to be delivered with supply pump.

473. Lubricating Oil Separator for M/E and AUX. Engines.

2 - Lubricating oil separators for fully automatic operation and with alarm and control panel for operation. Self-cleaning and partial discharge type.

   Capacity: According to engine builder’s and separator maker’s recommendation.

   As guidance approx. 1800 l/h.

   The separator to be delivered with supply pump and preheater.
474. Bilge Water Separator

1 - Bilge water separator unit to be installed.

Capacity: 5 m³/h

The oil content of water after treatment does not exceed 15 parts per million (PPM).

The bilge water separator is to be capable of passing mixtures ranging from clean water to water-free oil.

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

A SW flushing line to be arranged.

The bilge water separator and the measuring equipment to fulfil:

- MARPOL 73/78
- IMO Resolution A393 (x)

475. Freshwater Generator

1 - Freshwater generator with salinometer.

Capacity: 20 m³/24 h

1 - Sea water supply pump for freshwater generator

1 - Electric salinity alarm and solenoid valve so that fresh water with high salt content is to be automatically discharged to the bilge

476. Sewage Treatment Unit

1 - Sewage treatment unit, IMO approved type, to be installed.

Capacity: 30 persons/day

The unit to consist of:

1 - Bed frame
2 - Air compressors
1 - Discharge pump
1 - Control panel

Further the following connections to be provided:

1 - Inlet for black water
1 - Inlet for grey water
1 - Shore connection
1 - Air pipe
1 - Flushing connection
1 - Holding tank, capacity for 10 days black and grey water to be installed.
1 - Independent discharging pump or alternative arrangement for emptying the sewage/holding tank to be provided.

480. **BOILER**

483. Steam Boiler

1 - Composite boiler with capacity approx. 2000 kg/h (oil) and 1100 kg/h (exhaust gas), but in any event shall be at least 120% max. thermal consumption.

The boiler to be made of welded steel plates. The boiler to be insulated with mineral wool and covered with galvanised steel sheet plates.

The exhaust gas side of the boiler to be dimensioned to MCR (9480kW) and the final calculation to be carried out by ME maker.

The oil fired section to use plain smoke tubes.

485. Incinerator

1 - Incinerator for burning solid waste and sludge simultaneously to be installed.

The capacity of the unit to match a vessel of this size and arrangement. Approx. 50L per hour for sludge/400L per hour for solid waste.

Garbage storage facilities near the incinerator and on upper deck to be supplied.
500. - 599. OUTFIT AND EQUIPMENT (MACHINERY)

500. MARKINGS AND IDENTIFICATION

501. Tank Identification

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

502. Sounding Board

A white board with all the tanks of the vessel indicated in white letters to be made and mounted as directed by the Buyer.

503. Exit Signs and Warning Signs

To be in accordance with Buyers standard as listed, see section 206.

505. Pipe Colour Schedule

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

506. Name Plates for Machinery Components

All engines, pumps, compressors, boilers, pressure vessels etc to have a nameplate with the following information:

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

as well as year of fabrication and fabrication number.

A booklet containing the above mentioned information to be provided.

These should be screwed to purpose made backing plate appropriate mounted.

507. Label Plates on Valves and Fittings

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

Name plates, instructions books, valve plates etc. to be in English.

These should be screwed to purpose made backing plate appropriate mounted.

508. Label Plates on Operation Panels

Sufficient labels shall be mounted to secure information to operator.

To be provided to Buyer’s approval.
509. **Piping Diagrams Mounted on Board**

As-built main piping diagrams to be plastic covered and placed in engine room.

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

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

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

Floor plates are to be a non-slip type. (Tear plates or similar).

Floor plates are to be fastened by screws and readily removable for access to bilges, pipework and machinery and fitted with small portable or hinged sections above valves, filters or similar.

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

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

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

Gratings are to be made of steel and to be of a non-slip type.

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

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

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

All outside stairways to be made of hot deep galvanised steel.

Galvanized steel dust guard to be fitted at underside of main ladders in engine room.

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

Fully enclosed emergency exit to be provided from floor level in engine room to open deck.

Emergency exit to be provided with self-closing door.
514. Rails and Stanchions

Handrails and stanchions are to be of steel.

Handrails and stanchions are to be securely fixed by screws or bolts.

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

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

515. Guard Rails and Guards

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

516. Insulation of Machinery

All heated zones at machinery to be insulated for the safeguard of personnel. Where exposed to mechanical damage such as in traffic areas galvanised steel sheet covering to be provided.

520. ENGINE ROOM OUTFIT AND EQUIPMENT

521. Fixed Mounting of Machinery

When mounting machinery components great care to be taken to ensure proper alignment.

Shims, chocks etc to be used as required. Epoxy chocks or resilient mountings may be fitted according to manufacturers recommendations.

The main engine to be fixed mounted on resin chocks.

522. Flexible Mounting of Machinery

Where found practicable and pending noise abatement rules flexible mounting of machinery components to be arranged on suitable shock-absorbing material/fittings.

524. Fire-Extinguishing

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

525. Waste Containers, Drip Trays

Steel containers for cotton waste etc with hinged covers of suitable, portable size to be provided in the following compartments:

2 - Engine room
Drip trays are to be fitted under all appliances which are required to be opened up frequently for cleaning or adjustment.

530. MAINTENANCE AND REPAIR FACILITIES

531. Lifting Gear

An overhead crane, suitably sized and of sufficient capacity according to the main engine maker’s recommendations, shall be located above the main engine for the function of all normal maintenance duties according to engine manufacturers recommendations.

One monorail to be arranged above each generator set and purifiers.

Strong lifting pads for tackles to be arranged above large or heavy components according to requirements from Buyer’s representatives.

532. Transfer Arrangement

The design and arrangement of the machinery space shall be such that components, as a dismantled diesel generating set, pumps, electric motors etc, can be removed from their position and either transferred to workshop or fairly easily be unshipped through hatch each by means of suitable positioned transport rail system. One flush hatch in upper deck above main engine room.

533. Workshop with Outfit

A mechanical engineering workshop is to be provided.

In the workshop a welding table with accessories to be arranged. Provision of a heavy fire retardant fibreglass drape.

The machinery and equipment are to include:

1 - Drilling machine
1 - Grinding machine
1 - Vice bench
2 - Parallel vices
1 - Electric welding transformer
1 - Welding table
1 - Lathe
1 - Fuel value test facility for main and aux. engines

1 - Cleaning bath for M.E. air coolers

Emergency stops to be fitted to all moving machine tools.

The workshop is to be provided with all necessary tools for normal maintenance and repairs.
The workshop is also to be provided with shelves and lockers for small engine components as appropriate.

Lathe machine to accommodate ME exhaust valves.

534. Cleaning Outfit

1 - Cleaning slop basin with sealed cover for cleaning of engine parts to be provided.

1 - Sink with hot/cold water for waste facility.

536. Autogenous Welding Equipment

1 - Set of oxygen and acetylene welding equipment comprising:

2 - Oxygen bottles
1 - Acetylene bottle
1 - Set of standard cutting and welding equipment including 30 metres of hoses
1 - Set of various welding rods etc

The acetylene and oxygen bottles to be located in a separate room accessible to open deck space.

The facility to store additional bottles (4 oxygen and 2 acetylene) shall be provided in accordance to regulations as close as possible to the working station.

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

537. Electric Welding Equipment

1 - 200 A welding rectifier with necessary equipment including a standard box with electric welding tools, rods, 30 m power cable and 2 x 30 m welding cable.

Plug sockets to be arranged as per 723.

540. VENTILATION AND EXHAUST GAS SYSTEM

541. Natural Ventilation

The machinery space to have natural exhaust ventilation through a rainproof grid on the aft side of the funnel. The air escape to be sufficient to allow escape of 75% of the capacity of the electric engine room fans at a reasonable speed. A fire damper operable from outside the funnel to be fitted.

542. Mechanical Ventilation

3 - Engine room supply fans to be installed. To be of vertical, axial flow, electric motor driven type. One fan to be reversible.
The ventilators to be placed in the ventilation trunk accessible from open deck. The air inlets to be as large as to ensure a low inlet speed and low noise level. Provision to be made for filter gauze to be fitted in the event of dusty cargo operations.

For noise requirements, see 027.

Integrated steel trunkings and galvanised steel sheet ducts with fire dampers from fans to machinery spaces with branches for effective air distribution. Adjustment arrangement to be provided.

The separator room to have separate exhaust fan.

The separator room exhaust to be led separately from the machinery space.

The ECR to be particularly well ventilated.

Control room with air conditioning unit, refrigerant of ecological type (not R22).

The louvers of the funnel to be provided with arrangements for easy fitting and removal.

543. Exhaust Gas System for Main Engine

The main engine to be provided with an independent exhaust gas system. The max. back pressure not to exceed 300 mm water column. The exhaust gas velocity not to exceed 40 m/s. Engine builder to approve.

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

The dimension of the ME exhaust gas piping to be based on MCR (9480kW)

Stainless steel compensators to be fitted to allow for expansion and to reduce vibrations.

The silencer should have a minimum 25 dB(A) attenuation.

A drain cock to be installed at the lowest point to prevent ingress of water into the engine.

The system to be fabricated in mild steel.

The composite boiler to be included in the main engine exhaust system.

The silencer can alternatively be an integrated part of the composite gas boiler.

544. Exhaust Gas System for Diesel Generating Sets

Each diesel generating set is to be provided with an independent exhaust pipe system.
The uptakes and silencers of the diesel generating sets to be suitably insulated up to the funnel top. Insulating pads to be placed between uptake and silencer supports and the ship structure, see also 546.

Due allowance to be made for vibration damping and thermal expansion by fitting stainless steel compensators in the exhaust system where appropriate. The expansion compensators connected to the engine to be supplied by the diesel generating set supplier.

One spare compensator to be provided for each size of compensator used.

The exhaust silencers of the diesel generating sets to be supplied by the diesel generating set supplier and to be designed for a nominal 35 dB(A) attenuation.

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

The systems to be fabricated in mild steel.

545. Boiler Uptake

The composite boiler to be furnished with two uptakes.

The boiler uptake to be based on MCR (9480 kW).

When operating at full output, the uptake system pressure loss not to exceed 280mmwc. The system to be designed to withstand exhaust gas temperatures and pressures corresponding to the boiler supplier’s specified duty.

The uptake to be insulated as per 546.

Due allowance to be made for vibration damping and thermal expansion by fitting of a compensator.

A drain cock to be installed in the lowest point of the uptake to prevent the ingress of water into the unit.

The uptake system to be fabricated in mild steel.

546. Insulation of Engine Exhaust Gas Systems and Boiler Uptake

Exhaust pipes, silencers, and boiler uptakes to be insulated with Rockwool or other approved material, suitably lagged with alu-coated glass fibre cloth neatly sewed with wire and covered galvanised steel sheeting.

The silencers might be uninsulated based on the type of silencer.

547. Incinerator Uptake

A separate uptake for the incinerator to be arranged.
549. Crankcase Venting

The main engine crankcase to be vented through a pipe led directly and unbroken from the engine to the funnel top deck, terminating with a flame screen. The pipe to be provided with a drain arrangement of S-shape and siphon type with a gas trap for drainage of oil condensation to a drain tank.

550. FILTERS AND STRAINERS

551. Filters and Strainers - General

All filters and strainers to satisfy machinery builders’ requirements and recommendations with respect to:

- Filter mesh size
- Filter type
- Number of filters

Manometers to be fitted before and behind the filters. All manometers to be visible above floor plates. Most of the filters and strainers to be provided with vent and drain cocks or plugs.

552. Seawater Strainers

Strainers for seawater inlet to be installed as close to the sea chest as possible. Strainers to be fitted with vent cocks. Straining plates to be of stainless steel.

554. Fuel Filters

1. Automatic HFO supply filter.

Duplex filters to be installed for the main engine aux. engine and boiler fuel supply system.

555. Lubricating Oil Filters

1. Automatic backflush filter for the main engine lub. oil system
1. Bypass filter to be installed for the automatic backflush filter.

557. Bilgewater Filters

Suitable mud boxes of the single element type according to recognized builder standard to be installed in the suction line for the following equipment:

- Oily bilge pump
- Sludge pump

558. Air Filters

Air filters to be installed in the compressed air system in accordance with normal practice.
All reduction valves to have filters at the inlet side.

560. HEAT EXCHANGERS

561. Heat Exchangers - General

The following heat exchangers to be of the plate type:

- M/E LO coolers (1)
- Jacket water cooler (1)
- Central coolers (2)

Heat exchangers shall be mounted in such a way as to allow easy access and over-haul.
Capacities according to the requirements of the suppliers of the various machinery in question.

The two (2) central coolers to be dimensioned each to 100% of total required capacity plus 25% fouling margin and provision for back flushing.

The design to be based on MCR (9480 kW).

Every heat exchanger installed to be equipped with thermometers at inlets and outlets on primary and secondary side.

Materials for plate coolers/preheaters:
Cooler plates : Titanium (seawater), stainless steel (316L) (fresh water)
Frame plates : Steel plate
Gaskets : Suitable rubber material

Heat exchangers of the tube type to be arranged for easy pull-out of pipe stack for cleaning.

566. Fuel Oil Heaters

2 - Preheaters for the main engine (steam/electrical heated)
2 - Preheaters for the HFO separators (steam/electrical heated)
1 - Preheater for HFO boiler (electrical heated)

567. Lubricating Oil Heater

1 - Lubricating oil preheater for the lub. oil separator (steam heated)

568. Freshwater Heaters

1 - Hot water tank capacity approx. 500 l. The tank to be galvanised.

The tank to be furnished with:
- Manhole or handhole
- Inlet/outlet connections
- Heating coil from central heating system
  (Coil capacity according to plant manufacturers recommendations for size of system).
- In addition one electric heating coil
- Drain
- Safety valve
- Thermometer

The tank to be well insulated.

570. ENGINE ROOM TANKS

571. Tank Outfit - General

All tanks to be in rigid steel construction. Tanks may be part of ship’s structure (integral) or independent, constructed in workshop and welded to suitable foundations and suitable securing points. Easy access to internal of all tanks for inspection and cleaning to be provided, and all tanks to be furnished with necessary manholes, hand holes, drain connections, high/low level alarms, and level indicators and thermometers if required. At least the below listed tanks to be provided.

Alarms at all times must meet the class requirements.

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

572. Heavy Fuel Oil Tanks

4 - HFO storage tanks to be arranged in engine room
2 - Settling tanks
2 - Service tanks

573. Diesel Oil Tanks

To be arranged in engine room

1 - Settling tank
2 - Service tank (12 hours operation for aux. engines)
1 - Service tank for emergency diesel

574. Lubricating Oil Tanks

1 - Circulation tank for main engine lub. oil (below the M/E)
2 - Storage tanks for main engine lub. oil
1 - Storage tank for generator diesel lub. oil
1 - Gravity tank for stern tube lub. oil
1 - Lub. oil cleaning tank with connections to sludge pump and to/from lub. oil purifier
2 - Storage tanks for cylinder oil for M/E
1 - Service tank for cylinder oil for M/E

575. Sewage Treatment Tank

1 - Sewage treatment tank according to USCG with the required capacity

577. Miscellaneous Small Tanks

1 - Expansion tank for fresh cooling water
1 - Expansion tanks for fresh cooling water system aux. engine
1 - Expansion tank for central heating system

578. Freshwater Hydrophore Tank

1 - Freshwater hydrophore tank

Capacity: approx. 1000 l

The tank to be galvanised / painted same as fresh water tank.

579. Overflow, Sludge, Drain and Holding Tanks

1 - Fuel overflow tank
1 - Fuel drain tank
1 - Separator sludge tank

Separator sludge tank shall also be capable of being pumped to the incinerator plant

1 - Bilge water holding tank
1 - Drain tank for main engine fresh cooling water (high)
2 - FW tank
1 - Sludge oil tank
1 - Sewage holding tank
1 - Feed water tank
1 - Stuffing box drain tank
1 - Scavenge drain tank

580. TOOLS, SPARES, STORES

581. Storage of Tools, Spares, and Stores

All items to be delivered according to the contract and to be inspected, checked as to agreement with bills of lading, stored, transported in the yard, protected and placed on board the vessel as directed.

Large spare parts of main engine (piston, liners, cylinder head) to be stowed and secured in appropriate position with reach of overhead crane.

Separate stowage to be arranged for chemicals according to Class/flag requirements.
Spare to be stored in marked and numbered wooden/metal boxes.

582. Store Room with Outfit

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

Lockers to have locks.

Locker provided with ventilation for chemicals and lub. oil to be arranged in way of casing on upper deck.

583. Standard Engine Tools

Tools normally supplied with equipment to be delivered in accordance with the main engine makers' recommendations.

Larger tools to be secured to bulkheads in appropriate places as indicated by Buyer's representative.

585. Manufacturers Standard Spares

Standard spares, normally offered and delivered with machinery and equipment, to be supplied to the vessel by the builder, but at least covering the Class recommended spares and maker's standard.
600. - 699. MACHINERY PIPING SYSTEMS

600. MACHINERY PIPING - GENERAL

601. System Requirements - General

All piping systems to be installed in accordance with the designers’ drawings as approved by the Buyer and to the Buyer’s satisfaction.

All piping to be led as directly and practically as possible, with appropriate fall where required according to medium. Pipelines to be kept away from switchboards and electrical control equipment, where the piping is avoidably led above the electrical equipment the sleeve to be provided. Oil piping to be fitted at a safe distance from hot surfaces.

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

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

Save alls to be arranged under all filters, components containing oils etc. Drainage with adequate pipe diameter and inclination to the drain tanks.

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

Acid pickling or phosphate treatment to be carried out for the piping of lub. oil system except lub. oil drain and lub. oil transfer and piping. Pipes acid pickled to be thoroughly neutralised afterwards.

All piping, whenever practical, to be kept clear of the weather deck, see also 165.
Pipes, Selection of Material, and Design of Components

The material of pipes to be in accordance with the following standards. If these standards differ from the ISO, GB and CB Shipbuilding standards, the latter should prevail.

The minimum wall thickness of piping to be in accordance with Class requirements, unless specified otherwise.

The Builders’ standard for pipe materials, valves and dimensions to be integrated in the design of the different pipe systems.

<table>
<thead>
<tr>
<th>System</th>
<th>Nominal Size (mm)</th>
<th>Pipe Material</th>
<th>Pipe Thick</th>
<th>Valve Disc &amp; seat</th>
<th>Fitting</th>
<th>Press. ST. (Mpa)</th>
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<tbody>
<tr>
<td>Steam (0.7Mpa)</td>
<td>32 &amp; above</td>
<td>Seamless steel</td>
<td>B</td>
<td>Cast steel flanged</td>
<td>Cast steel or welded steel flanged or branches</td>
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<td>Steam (0.3Mpa) steam drain</td>
<td>32 &amp; above</td>
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<td>B</td>
<td>Cast steel flanged</td>
<td>Cast steel or welded steel flanged or branches</td>
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<td>Butt welded</td>
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<td>Aux. boiler feed pump delivery</td>
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<td>Seamless steel</td>
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Note: Material of automatic control valves for all systems to be of manufacturer’s standard.

Heating coil to be butt welded in the workshop and use sleeve on board.
<table>
<thead>
<tr>
<th>System</th>
<th>Nominal Size (mm)</th>
<th>Pipe Material</th>
<th>Pipe Thick</th>
<th>Joint</th>
<th>Valve Body Material</th>
<th>Valve Disc &amp; Seat</th>
<th>Valve Stem Material</th>
<th>Fitting</th>
<th>Press. ST. (Mpa)</th>
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<tbody>
<tr>
<td>Boiler feed Pump delivery</td>
<td>40-20</td>
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<td>Steel welded flange</td>
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<td>Cast iron or welded steel flanged. Or welded branches</td>
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<td>Main and auxiliary cooling sea water</td>
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<td>C</td>
<td>Steel welded flange</td>
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<td>Water ballast, Bilge system</td>
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<td>Fire main &amp; deck wash</td>
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<td>Steel welded flange</td>
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<td>Fresh water service*</td>
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* Drinking water piping to be of stainless steel or plastic of approved type.
<table>
<thead>
<tr>
<th>System</th>
<th>Nominal Size (mm)</th>
<th>Pipe Material</th>
<th>Pipe Thickness</th>
<th>Pipe joint</th>
<th>Valve Body</th>
<th>Disc &amp; seat</th>
<th>Stem material</th>
<th>Fitting</th>
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<tbody>
<tr>
<td>Fuel oil circulating pump delivery</td>
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<tr>
<td></td>
<td>10 &amp; below</td>
<td>Seamless copper</td>
<td>Brass union</td>
<td>Forged</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>steel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Fuel oil pump delivery pipes to be schedule 80 (C)
* 1 Stern tube lube oil piping in cooling water tanks to be “C” thickness and fitted with sleeve joints.

Fresh water cooling and Starting air pipes not to be galvanized.
<table>
<thead>
<tr>
<th>System</th>
<th>Nominal Size (mm)</th>
<th>Pipe</th>
<th>Pipe</th>
<th>Valve</th>
<th>Fitting</th>
<th>Press. ST. (Mpa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressed air (0.7 Mpa)</td>
<td>40 &amp; above</td>
<td>Seamless steel Galv.</td>
<td>B *(4)</td>
<td>Steel welded flange</td>
<td>Cast steel flanged</td>
<td>Cast iron or welded steel flanged or welded branches</td>
</tr>
<tr>
<td>32-15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 &amp; below</td>
<td>Seamless copper</td>
<td>Brass union</td>
<td>Forged steel screwed</td>
<td>Bronze</td>
<td>Bronze</td>
<td>Brass screwed</td>
</tr>
<tr>
<td>Air vent &amp; overflow</td>
<td>40 &amp; above</td>
<td>Seamless steel*</td>
<td>B</td>
<td>Steel welded flange</td>
<td>Cast iron flanged</td>
<td>Cast iron or welded steel flanged or welded</td>
</tr>
<tr>
<td>Except mentioned Above. Open Drain scupper</td>
<td>32-20</td>
<td></td>
<td></td>
<td></td>
<td>Bronze flanged</td>
<td>Brass screwed</td>
</tr>
<tr>
<td></td>
<td>15 &amp; below</td>
<td>Seamless copper</td>
<td>Brass union</td>
<td>Bronze screwed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sounding for double bottom. Deep tank &amp; void space</td>
<td>125 &amp; below</td>
<td>Welded steel*</td>
<td>C</td>
<td>Steel welded flanged</td>
<td>--</td>
<td>Cast iron or welded steel flanged or welded branches</td>
</tr>
<tr>
<td>Sounding for other tanks</td>
<td>40</td>
<td>Welded steel</td>
<td>B *(2)</td>
<td>Steel welded flange</td>
<td>--</td>
<td>Cast iron or welded steel flanged or welded branches</td>
</tr>
</tbody>
</table>

Note:
*(1) Both sides galvanized except in F.O. Tanks.
*(2) Pipe thickness to be complied with the Classification Requirement
*(3) For symbols kinder thickness or pipe in the table:
  A - Ordinary corresponding to Sch. 10
  B - Medium corresponding to Sch. 40
  C - Heavy corresponding to Sch. 80, but not more than 12mm except T.S.T. discharge to be 18mm
*(4) General service compressed air system on weather deck to be of class “C”
604. Valves, Fittings, Materials, Types

Where possible, the same make and type of valve is to be used for all similar valves in the vessel.

The straight-through type of valve is preferred.

The materials for the valves to be in accordance with the standard in section 601: VALVES AND FITTINGS, MATERIALS AND TYPES.

The Builder’s standards to be integrated as far as possible in the design.

Remote Controlled Valves:

Ballast and hold bilge valves to be remote controlled from the ballast control room.

The valves to be hydraulically controlled via a hydraulic power pack complete with control panel.

This system to consist of:
- Hydraulic power unit complete with two pumps
- Solenoid valve cabinet
- Portable hand pump unit
- Actuator for valves or EHS (Electric Hydraulic System) valves.

The control pipes to be of stainless steel, multi-core pipe.

System to be integrated into alarm and monitoring system with mimic display on PC.

605. Assembly and Supports

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

Generally, pipes above ND 50 mm to be assembled with flange connections, however sleeves may be used for the following systems:

- Ballast and bilge outside engine room
- Air and sounding pipes
- Fire deck wash pipes (outside engine room)
- Scuppers (outside engine room)
- Sewage system (outside engine room)

Hydraulic pipes to be assembled with socket weld flange connection or approved compression fittings. No cutting ring fittings to be used.

All pipes to be suitably supported. Supports selected to prevent excessive thermal loads, gravity loads, and vibrational forces from being transmitted to connected components and vice versa.
Pipes are not to be supported by each other or any other equipment or machinery. Pipe supports should land on structure, not unsupported plating.
Insulation of Pipes

General

All surfaces of machinery, piping and tanks having normal operating fluid temperature above 60°C, except cooling water system and where otherwise described hereinafter, to be insulated in accordance with following specifications.

In all cases, where pipe insulation abuts flanges and fittings, the end of insulation to be suitably terminated to permit free removal of bolts and/or to allow movement of pipes at hangers.

All insulating materials to be properly secured to prevent settling and to permit ready removal.

Thickness of insulation to be determined on a basis that insulation surface temperature will be 60°C when the ambient temperature is 32°C.

Pipings in the funnel to be insulated up to the height of 2m from the deck floor.

All mounded insulation to be secured with steel bands.

All flanges and valves for all piping above 60°C to be insulated.

Exhaust pipes to be insulated up to the top.

Piping

Piping insulation cover material to be high quality and be painted after installation.

Steam piping

Pipes, flanges, valves and fittings of all steam piping to be insulated as follows:
Temperature

<table>
<thead>
<tr>
<th>Temperature</th>
<th>205°C &amp; above</th>
<th>155°C &amp; above</th>
<th>101°C &amp; above</th>
<th>60°C &amp; above</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulating material</td>
<td>Glass wool or rockwool</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cover material</td>
<td>Glass cloth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal pipe Dia. (mm)</td>
<td>Thickness (mm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>350</td>
<td>65</td>
<td>50</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>300</td>
<td>65</td>
<td>50</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>250</td>
<td>65</td>
<td>50</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>200</td>
<td>60</td>
<td>50</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>150</td>
<td>60</td>
<td>50</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>125</td>
<td>55</td>
<td>50</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>100</td>
<td>55</td>
<td>50</td>
<td>25</td>
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</tr>
<tr>
<td>80</td>
<td>55</td>
<td>40</td>
<td>25</td>
<td>20</td>
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<tr>
<td>65</td>
<td>50</td>
<td>40</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>50</td>
<td>50</td>
<td>40</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

Below 50

Moulded insulation to be secured to the pipe with steel bands.
Insulation of flanged joints and valves to be provided.
Solid pipe halves of foamed material to be used on steam pipes if possible.

**Steam drain piping**

Drain piping to be insulated in the same manner as for steam piping.
All small steam drain piping to be wrapped (spiral wrapped) with glass fibre tape.

**Water piping**

Cooling fresh water piping will not be insulated.
Following piping to be insulated in the same manner as for steam piping.
Composite boiler blow-off piping in from of the boiler and where subject to handling.
High temperature cooling water to be insulated at designated point. Sludge transfer line to be heat traced and insulated also up to the shore connection.
Oil piping

Heated oil piping having temperature above 60° to be insulated in the same manner as for steam piping excepting that no insulation will be applied over flanged joints, and valves will have their bodies only insulated with glass wool or other equivalent.

The following H.F.O. pipes in engine room shall be provided with steam tracing. And shall be insulated:

- Transfer
- Purifiers suction from settling tank to heater
- Main engine, auxiliary engines and auxiliary boiler service

The following pipes part exposed to the crew shall be insulated with glass cloth regardless of pipe diameter and internal fluid temperature:

- Auxiliary boiler blow-down pipe
- Exhaust steam pipe after the relief or safety valves
- Steam drain pipe after the drain valves and drain traps

Exhaust gas piping

Insulation to be applied as follows:

<table>
<thead>
<tr>
<th>Kind of Engine</th>
<th>Insulation</th>
<th>Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thickness (mm)</td>
<td>Material</td>
</tr>
<tr>
<td>Main Engine</td>
<td>Pipe 100</td>
<td>Glass cloth +</td>
</tr>
<tr>
<td></td>
<td>Flange 100</td>
<td></td>
</tr>
<tr>
<td>Generator</td>
<td>Pipe &amp; 80</td>
<td>Rockwool or glass wool +</td>
</tr>
<tr>
<td>Diesel engine</td>
<td>Flange 60</td>
<td>Glass cloth</td>
</tr>
<tr>
<td>Incinerator</td>
<td>Flange</td>
<td></td>
</tr>
</tbody>
</table>

The exhaust gas piping in funnel to be insulated with rock wool of 50mm thick and approx. 2m above casing top in funnel to be insulated with rock wool of 25mm thick.

Main engine exhaust manifold and silencers for generator diesel engine to be insulated in accordance with the manufacturer’s standard.

Exhaust pipes to have insulation, wire, wire mesh and galvanized steel plates. To be insulated up to full length.

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

Cold water pipes passing through heated rooms to be insulated.
607. Protection of Pipes

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

The pressure losses across major components, such as heat exchangers to be checked to establish the actual volume flow from the aggregate characteristic. Unacceptable differences from the desired hydraulic balance to be corrected. Noise from vibration of pipes to be eliminated by additional supports.

608. Valves for Quick Closing Systems

Quick closing valves of approved type to be mounted on oil tanks according to regulations. Necessary valves and operating instructions, to be placed near emergency stops in the fire control position.

610. COOLING WATER SYSTEMS

611. Seawater Cooling Systems

The following seawater cooling systems to be provided:

- A central cooling water system

The engine room to be provided with 2 sea chests, 1 low inlet and 1 high inlet. The 2 inlets to be connected with a common suction main.

611.1 Central Cooling Water System

The central fresh cooling water system to remove the heat dissipation from the following equipment:

- Main engine HT freshwater circuit
- Main engine LT freshwater circuit
- Diesel generating sets freshwater systems LT and HT
- Condenser for boiler
- Starting air compressors
- AC system
- Air condition and refrigerant condensers.

Two seawater-cooling pumps and one harbour sea water cooling pump to be provided with capacity in accordance with engine maker’s recommendations and service profile.

The seawater pumps to draw from the cross-over and to deliver to the central coolers.
612. Sea Inlet Valves

Isolating valves to be fitted at each connection on the sea inlet chests and to have a combined local and remote control capability. Remote controls to be located at approved positions above the main deck. Sufficient isolation valves to ensure failure of a branch line does not affect vessel operation.

613. Overboard Discharges

All seawater cooling system overboard discharge valves to be of the butterfly/non-return type, with a combined local and remote control as per class requirement, if found necessary for easy operation.

Any overboard valves inaccessible to have access.

615. Freshwater Cooling System

The freshwater cooling systems to be arranged as a separated central cooling system.

The freshwater cooling system to divided into a

High Temperature Circuit (HT) and a

Low Temperature Circuit (LT)

615.1 High Temperature FW Circuit

The following equipment to be arranged for HT freshwater cooling:

- Main engine cylinder liners, covers, exhaust valves

The diesel alternator engines to be provided with built-on freshwater coolers and pumps.

A heat exchanger to be installed for preheating of engine cooling water.

615.2 Low Temperature FW Circuit

The following equipment to be arranged for LT freshwater cooling:

- Main engine air cooler
- Main engine lub. oil cooler
- Diesel alternator engines
- Starting air compressors
- Condenser for boiler
- AC units
- Refrigeration plant

The diesel alternator engines are provided with built-on freshwater cooling pumps and HT/LT coolers.
FUEL OIL SYSTEM

Heavy Fuel Oil System

A combined fuel transfer, supply system and a fuel oil purification system to be arranged.

The fuel oil transfer pump draws from the bunker tanks and delivers to the settling tank or service tanks.

The separator pumps draw from the settling tanks and deliver to the service tanks.

Transfer between F.O. tanks to be possible.

Overflow to be arranged from settling to a fuel overflow tank.

Overflow to be arranged internally from service to settling tanks as far as possible.

Filling/overflow system to be arranged according to U.S. Coast Guard Pollution Prevention.

Emergency supply connection for the service system to be arranged from one of the settling tanks.

For the heavy fuel oil system a fuel oil flow meter with m³ counter and a viscosity controller to be provided.

Diesel Oil System

A combined diesel transfer, supply system and a diesel oil purification system to be arranged. The diesel oil transfer pump draws from the bunker tanks and delivers to the settling tank or to the service tanks.

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

Overflow to the fuel overflow tank.

Overflow from service to settling tank as far as possible.

Filling/overflow system as for the HFO system.

Supply system to be arranged for:

- Main engine
- Diesel alternator engines
- Boiler
- Incinerator

A separate fuel oil filling and service oil system to be arranged for the emergency diesel generator.
623. **Boiler Oil System**

The fuel oil supply for the boiler burner to be as follows:

2 - Fuel oil supply pumps
1 - Preheater (electric heated)

630. **LUBRICATING OIL SYSTEM**

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

The main engine to operate on the dry-sump principle with the lub. oil circulating tank situated below main engine.

The lub. oil system to consist of the following:

2 - Lub. oil pumps (deep well type)
1 - Lub. oil cooler (FW-cooled)
1 - Automatic backflush filter and manual filter
1 - Thermostatic valve

A lubricating oil purification system to be integrated.

634. **Lubricating Oil System for Stern tube and Shaft Seals**

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

The system to consist of:

1 - Gravity tank
2 - Gravity tanks for the forward and aft stern tube seal

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

Each diesel generating set to be equipped with own separate lubricating oil system.

Means for draining the sump to be arranged with hand pump.

Connection to be arranged from each sump to lub. oil purifier.

640. **COMPRESSED AIR SYSTEMS**

The following compressed air systems to be provided:

- Starting air system, 3.0 MPa
- Service air system, 0.8 MPa
- Control air system, 0.8 MPa
For compressors and starting air vessels, see 461-465.

641. Starting Air System

The 3.0 MPa starting air system to be capable of performing the following functions:

- Providing 12 starts for the main engine
- Providing 3 starts on each diesel generating set
- Control air
- Service air

642. Service Air System

The service air system to be arranged from 3.0 MPa system and service air compressor.

The 0.8 MPa service air system to be capable of delivering air for air-operated tools and other portable equipment.

The service system to be a dedicated system from only one (1) reservoir. A service air receiver of 1000 ltr. to be installed.

Filters to be fitted before each reduction valve.

Service air outlets to be located in the engine room and in addition outlets shall be provided at the following locations:

1 - Steering gear room
1 - CO₂ room
1 - Emergency generator room
1 - Bosuns store
2 - Forecastle deck
2 - Front of house
2 - Midship PS + SB
2 - Aft deck
1 - Each cargo hold
3 - To be placed in accordance with Owner's approval.

643. Control Air System

Control air for machinery and equipment is to be arranged from 3.0 MPa system.

Control air to be supplied for:

- Main engine
- Fuel oil separators
- Lubricating oil separator
- Bilge water separator
- Main engine control system

Reduction valves are to be fitted where required.
A relief valve to be fitted on the reduced pressure side for all reducing valves.
Filters to be fitted before each reduction valve.

645. Air Dryers

Air dryers to be fitted in the control and service air lines.

650. MISCELLANEOUS PIPING SYSTEMS

651. Ballast System

The ballast system to facilitate:

- Drawing and delivering ballast water from/to all ballast tanks.
- Trimming/listing vessel (see section 331)

The ballast pump discharge time should be fast and pumps should be able to pump out without throttling the discharge valve and to leave min. of dead water.

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

The ballast line to have sufficient size to have two ballast pumps running at the same time.

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

Stripping of tanks by means of stripping eductors.

The ballast water valve and ballast pumps to be remotely operated from engine control room and ballast control room.

Ammeters to be provided at both positions.

652.1 Bilge System

The system to be arranged as per class requirements with suctions in sufficient number and size to ensure efficient drainage of all watertight compartments. Provision for holding bilge water from holds shall be provided in the upper part of No.5 wing tank P&S.

652.2 Oily Bilge System

The oily bilge system to be capable of performing the following functions:

- Pumping sludge from wells and recesses in engine room
- Separating oil and water
- Discharging oil to the sludge oil tank and incinerator, clean sea-water or fresh water overboard to specified standard
- Discharging sludge oil to barge or shore connections

The system to consist of:
1 - Bilge water separator with built-on supply pump
1 - Sludge pump
1 - Oily bilge water pump

654. Hydrophore System

The system consists of the following components:

1 - Hydrophore tank
1 - Hot water tank
2 - Hydrophore pumps (one as spare)
1 - Hot freshwater circulation pumps
1 - F.W. generator with pump
1 - UV steriliser (flag state approved)

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

The hot water discharge temperature to be controlled by means of by-pass and a 3-way thermostatic controlled valve.

Tanks to have separate suctions.

670. STEAM SYSTEM

In general tank heating shall follow ISO or CB Shipbuilding Standard and normal practice.

The system to deliver steam to the following heat consumers:

- HFO bunker tanks
- HFO service and settling tanks
- Bilge holding tank
- Misc. oil tanks
- Preheaters for HFO, lubricating oil
- Heat tracing HFO pipes
- Heat tracing filters
- Heat exchangers for central heating
- Heating section in air condition center unit

The system to consist of the following equipment:

1 - Oil composite boiler (item 483)
1 - Drain/filling pump
2 - Feed pumps
1 - Condenser
1 - Filter tank / hot well
680. CONDENSATE SYSTEM

683. Auxiliary Condenser

The auxiliary condenser to be of atmospheric, shell and straight tube multipass type. The condenser to be capable of condensing the full steam production from the M/E exhaust gas at MCR (9480 kW).

Materials to be as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shell</td>
<td>steel plate</td>
</tr>
<tr>
<td>Water head</td>
<td>cast iron</td>
</tr>
<tr>
<td>Tube</td>
<td>aluminium brass</td>
</tr>
<tr>
<td>Tube plate</td>
<td>naval brass</td>
</tr>
</tbody>
</table>
### MACHINERY LIST (PRELIMINARY) - all figures to be finally confirmed according to the design

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>No.</th>
<th>Maker/type</th>
<th>Capacity</th>
<th>Weight item (kg)</th>
<th>Specification of electric motor voltage</th>
<th>freq</th>
<th>rat. Power</th>
<th>rpm</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>306.09</td>
<td>Fan, engine room</td>
<td>1</td>
<td></td>
<td>17 M3/s x 700 Pa</td>
<td></td>
<td>3x440</td>
<td>60</td>
<td>30</td>
<td>1750</td>
<td></td>
</tr>
<tr>
<td>306.10</td>
<td>Fan, engine room</td>
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<td></td>
<td>17 M3/s x 700 Pa</td>
<td></td>
<td>3x440</td>
<td>60</td>
<td>30</td>
<td>1750</td>
<td></td>
</tr>
<tr>
<td>306.11</td>
<td>Fan, engine room</td>
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<td></td>
<td>17 M3/s x 700 Pa</td>
<td></td>
<td>3x440</td>
<td>60</td>
<td>30</td>
<td>1750</td>
<td>Reversible electric motor</td>
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<tr>
<td>306.12</td>
<td>Fan exhaust, Purifier room</td>
<td>1</td>
<td></td>
<td>1,25 M3/s x 600 Pa</td>
<td></td>
<td>3x440</td>
<td>60</td>
<td>1.5</td>
<td>3600</td>
<td></td>
</tr>
<tr>
<td>306.14</td>
<td>Flue gas fan for incinerator</td>
<td>1</td>
<td></td>
<td>7000M3/H</td>
<td></td>
<td>3x440</td>
<td>60</td>
<td>8.7</td>
<td>1740</td>
<td></td>
</tr>
<tr>
<td>306.16</td>
<td>Fan for steering gear room</td>
<td>1</td>
<td></td>
<td>0,25 M3/s x 250 Pa</td>
<td></td>
<td>3x440</td>
<td>60</td>
<td>0.55</td>
<td>1800</td>
<td></td>
</tr>
<tr>
<td>306.17</td>
<td>Fan for Galley exhaust</td>
<td>1</td>
<td></td>
<td>0,3M3/s x 420 Pa</td>
<td></td>
<td>3x440</td>
<td>60</td>
<td>0.55</td>
<td>3600</td>
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</tr>
<tr>
<td>306.18</td>
<td>Fan for galley supply</td>
<td>1</td>
<td></td>
<td>0,35 M3/s x 350 Pa</td>
<td></td>
<td>3x440</td>
<td>60</td>
<td>0.75</td>
<td>3600</td>
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</tr>
<tr>
<td>306.19</td>
<td>Fan for Laundry exhaust</td>
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<td></td>
<td>0,3 M3/s x 420 Pa</td>
<td></td>
<td>3x440</td>
<td>60</td>
<td>0.75</td>
<td>3600</td>
<td></td>
</tr>
<tr>
<td>306.20</td>
<td>Fan for Hospital exhaust</td>
<td>1</td>
<td></td>
<td>0,1 M3/s x 250 Pa</td>
<td></td>
<td>3x440</td>
<td>60</td>
<td>0.55</td>
<td>1800</td>
<td></td>
</tr>
<tr>
<td>306.21</td>
<td>Fan exhaust, sanitary rooms</td>
<td>1</td>
<td></td>
<td>0,5 M3/s x 900 Pa</td>
<td></td>
<td>3x440</td>
<td>60</td>
<td>1.5</td>
<td>3600</td>
<td></td>
</tr>
<tr>
<td>306.22</td>
<td>Fan for A/C unit no 314.01</td>
<td>1</td>
<td></td>
<td>5.01 m3/s at 2650Pa</td>
<td></td>
<td>3x440</td>
<td>60</td>
<td>13.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>306.23</td>
<td>Fan exhaust, dry provision room</td>
<td>1</td>
<td></td>
<td>0,1 M3/s x 250 Pa</td>
<td></td>
<td>3x440</td>
<td>60</td>
<td>0.1</td>
<td>3400</td>
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| Earthing device, complet                        | 1        | mounted on inter-
<p>| Aux engine no 1                                  | 1        |mediate shaft     |
| Aux engine no 2                                  | 1        | 700 kW/1200 rpm or 770kW/720rpm |
| Aux engine no 3                                  | 1        | 700 kW/1200 rpm or 770kW/720rpm |
| Diesel engine for emergency generator           | 1        | 125 kW x 1800 rpm|
| SW cooling pump                                 | 1        | 450 m³/h, 0.3 Mpa|
| SW cooling pump harbour                         | 1        | 120 m³/h, 0.3 Mpa|
| LT FW cooling pump                              | 1        | 430 m³/h, 0.35 MPa|
| LT FW cooling pump harbour                      | 1        | 110 m³/h, 0.35 MPa|</p>
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<th>Code</th>
<th>Description</th>
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<th>Max Flow rate</th>
<th>Pressure</th>
<th>Motor Type</th>
<th>Power</th>
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<td>85 m³/h</td>
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700. - 799. ELECTRICAL PART

700. ELECTRICAL PART - GENERAL

The electric equipment and installation to comply with the Rules and Regulations specified in section 010-016 of the Specifications and Builder's standard.

Yard to submit to owner for approval “Electrical installation standard”.

All electrical machines and apparatus delivered to the shipyard and awaiting installation are to be kept in a clean, dry and well ventilation store. When installed on board all equipment is to be protected from dirt, mechanical damage and moisture at all times.

Suitable lifting eyes should be fitted above all electric motors, generators and large electrical components.

All final circuits and subcircuits complete with components where possible, are to be Megger tested and a complete list of insulation readings submitted to the owner prior to delivery.

**Voltage, frequency and distribution system**

In general, voltage, frequency and distribution for electric equipment to be as follows:

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<tr>
<th>Item</th>
<th>Voltage</th>
<th>Frequency</th>
<th>Phase</th>
<th>Conductor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generator</td>
<td>450V A.C.</td>
<td>60HZ</td>
<td>3</td>
<td>3 wire</td>
</tr>
<tr>
<td>Power motor</td>
<td>440V A.C.</td>
<td>60HZ</td>
<td>3</td>
<td>3 wire</td>
</tr>
<tr>
<td>Do. (fractional horse power and special service)</td>
<td>220V A.C.</td>
<td>60HZ</td>
<td>3</td>
<td>3 wire</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>or 1</td>
<td>or 2 wire</td>
</tr>
<tr>
<td>Electric range and oven</td>
<td>440V A.C.</td>
<td>60HZ</td>
<td>3</td>
<td>3 wire</td>
</tr>
<tr>
<td>Heating</td>
<td>220V A.C.</td>
<td>60HZ</td>
<td>3</td>
<td>3 wire</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>or 1</td>
<td>or 2 wire</td>
</tr>
<tr>
<td>Lighting</td>
<td>220V A.C.</td>
<td>60HZ</td>
<td>1</td>
<td>2 wire</td>
</tr>
<tr>
<td>Nautical equipment</td>
<td>440V A. C. or 220V A. C. or 24V D.C.</td>
<td>60HZ</td>
<td>3</td>
<td>3 wire</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------------------</td>
<td>------</td>
<td>---</td>
<td>-------</td>
</tr>
<tr>
<td>Interior communication, general alarm, etc.</td>
<td>220V A. C. or 24V D.C.</td>
<td>60HZ</td>
<td>1</td>
<td>2 wire</td>
</tr>
<tr>
<td>Radio equipment</td>
<td>440V A.C. or 220V A.C. or 24V D.C.</td>
<td>60HZ</td>
<td>3 or 1</td>
<td>3 wire</td>
</tr>
<tr>
<td>Entertainment equipment</td>
<td>220V A.C.</td>
<td>60HZ</td>
<td>1</td>
<td>2 wire</td>
</tr>
<tr>
<td>Emergency generator</td>
<td>450V A.C.</td>
<td>60HZ</td>
<td>3</td>
<td>3 wire</td>
</tr>
</tbody>
</table>

**Sockets**

In general, type and size of socket for lamps to be as follows, but the socket for fluorescent lamps to be of bi-pin type (spring type)

<table>
<thead>
<tr>
<th>Lighting fixture (250W and over)</th>
<th>Edison</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>(200W and below)</td>
<td>Edison</td>
<td>27</td>
</tr>
<tr>
<td>Mercury lamp (250 W and over)</td>
<td>Edison</td>
<td>40</td>
</tr>
<tr>
<td>(200W and below)</td>
<td>Edison</td>
<td>27</td>
</tr>
<tr>
<td>Pilot lamp provided in the equipment</td>
<td>Manufacturer's standard</td>
<td></td>
</tr>
</tbody>
</table>

**Fuses**

In general, tubular fuses to be used except special type fuses for electronic equipment.
Colours

(1) Electric equipment

Final painted colours of metal surface for electric equipment to be as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generator and motor</td>
<td>7.5 BG 7/2 (light blue)</td>
</tr>
<tr>
<td>Switchboard, control panel and control stand</td>
<td>7.5 BG 7/2 (light blue)</td>
</tr>
<tr>
<td>Transformer, section and distribution board</td>
<td></td>
</tr>
<tr>
<td>for accommodation space</td>
<td>N-8 (light grey)</td>
</tr>
<tr>
<td>for other spaces</td>
<td>7.5 BG7/2 (light blue)</td>
</tr>
<tr>
<td>Lighting fixture for accommodation spaces</td>
<td></td>
</tr>
<tr>
<td>Water-proof type</td>
<td>N-7 (grey)</td>
</tr>
<tr>
<td>other</td>
<td>N-8 (light grey)</td>
</tr>
<tr>
<td>Lighting fixture for other spaces</td>
<td>7.5 BG7/2 (light blue)</td>
</tr>
<tr>
<td>Bell, buzzer, siren and speaker</td>
<td></td>
</tr>
<tr>
<td>waterproof type</td>
<td>N-7 (grey)</td>
</tr>
<tr>
<td>other</td>
<td>N-8 (light grey)</td>
</tr>
<tr>
<td>General alarm and other emergency equipment</td>
<td>R5 4/13 (red)</td>
</tr>
<tr>
<td>Nautical equipment</td>
<td>7.5 BG7/2</td>
</tr>
<tr>
<td>Radio equipment</td>
<td>7.5 BG7/2</td>
</tr>
<tr>
<td>Electric equipment except above mentioned</td>
<td>manufacturer's standard and foreign make</td>
</tr>
</tbody>
</table>

Inside metal surface of electric equipment to be painted by manufacturer's standard colour.

(2) Busbar

<table>
<thead>
<tr>
<th>A.C. system</th>
<th>D.C. system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase R or U</td>
<td>Positive (+) ... Red</td>
</tr>
<tr>
<td>Phase S or V</td>
<td>Negative (-) ... Blue</td>
</tr>
<tr>
<td>Phase T or W</td>
<td>Brown</td>
</tr>
</tbody>
</table>

703. Electrical Tests and Trials

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

One (1) set of testing panel with switches, sockets, lamp holder for incandescent and fluorescent lamp, fuse check contact and pilot lamps to be fitted in engine room electric store.

Electric source of testing panel to be fed as follows:

- 440 volts A.C. 3 phase, 60HZ 10A
- 220 volts A.C. 1 phase, 60HZ 10A
- 24 volts D.C. 3A

706. Name and Label Plates

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

709. Electrical Arrangement

All electric equipment shall be located such as to be easily accessible for repairs and removal, and as to reduce to a minimum any likelihood that the equipment may be exposed to damage caused by leaking oil, water, etc from pipes or tanks, or by excessive heat, or to mechanical damage.

A 'one-line electrical diagram' to be draughted, and a framed copy hereof to be mounted near the main switchboard.

Ampmeters to be provided for main Ballast pumps at Ballast control console

710. ELECTRIC POWER SUPPLY

711. Main Generators

The final rating of the generators to be decided after the Estimated Power Loading of the vessel has been calculated. The generators to conform to the Service Conditions showed below with a maximum estimated loading of 90%.

Main diesel generators to be installed in engine room as follows:
(1) **Particulars**

<table>
<thead>
<tr>
<th>Type</th>
<th>Synchronous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure</td>
<td>Drip-proof IP23</td>
</tr>
<tr>
<td>Cooling system</td>
<td>Self-ventilated with air filter</td>
</tr>
<tr>
<td>Output</td>
<td>Abt. 700 kW or 770kW</td>
</tr>
<tr>
<td>Voltage</td>
<td>450 V A.C.</td>
</tr>
<tr>
<td>Frequency</td>
<td>60 HZ</td>
</tr>
<tr>
<td>Phase</td>
<td>3 phase</td>
</tr>
<tr>
<td>Power factor</td>
<td>0.8 (lagging)</td>
</tr>
<tr>
<td>Revolution</td>
<td>1200 r/min or 720 r/min</td>
</tr>
<tr>
<td>Rating</td>
<td>Continuous at full load</td>
</tr>
<tr>
<td>Exciting system</td>
<td>Brushless rotary exciter</td>
</tr>
<tr>
<td>Insulation</td>
<td>Class F</td>
</tr>
<tr>
<td>No. of Bearing</td>
<td>2, sleeve bearings.</td>
</tr>
<tr>
<td>No. of set</td>
<td>3</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>45 Deg.</td>
</tr>
</tbody>
</table>

(2) **Construction**

Bearing, lubricating system and thermometer to be according to manufacturer's standard.

(3) **Space Heater**

Space heaters with thermostat, to be installed in the frame of each generator to prevent the condensation of moisture when the generator is idle, and fed from 220 volts A.C. and interlocked with generator air circuit breaker.

(4) **Self Exciting Equipment**

The exciting equipment to be of brushless rotating silicon rectifier type and provided with current forcing transformers for short circuit current and voltage transient excitation. The manual voltage regulator to be built in M.S.B.
(5) Characteristics

Generator sets to be able to run in parallel. The voltage regulation of the generator to be maintained in the range of $\pm 2.5\%$ of rated voltage between zero and full load under steady condition of rated power factor. Maximum voltage change not to exceed 15% when a current equal to 80% of the full load current at power factor between zero and 0.4 lagging is suddenly drawn. The voltage to be restored to within 3% of the rated voltage in not more than 1 second.

It's accordance with the classification's requirements.

(6) Service

The generators to serve as follows:

<table>
<thead>
<tr>
<th>Service condition</th>
<th>No. of set in service</th>
</tr>
</thead>
<tbody>
<tr>
<td>At normal sea going</td>
<td>One</td>
</tr>
<tr>
<td>At leaving &amp; arriving</td>
<td>Two</td>
</tr>
<tr>
<td>At cargo handling</td>
<td>Two</td>
</tr>
<tr>
<td>At port</td>
<td>One</td>
</tr>
</tbody>
</table>

(7) Prime Mover

See Machinery Specification (Section 1 - "Machinery Particulars")

(8) Governor Motor

The governor motor to be electrically operated and controlled from the main switchboard.

(9) Electric Temperature Detector

Each generator to be provided with two (2) temperature detectors in each phase of stator coils for detecting the temperature of stator coil and giving alarm.

(10) Automatic Synchronizing and Load Sharing Device

One (1) set of automatic synchronizing and load sharing device is to be provided and assembled in a cubicle in main switchboard.

The device to have the function of automatic synchronizing one diesel generator to the main bus bar source, closing the diesel generator's air circuit breaker after synchronizing, automatic sharing effective power loads between diesel generators running in parallel, and/or shifting load from one diesel generator to another by automatic controlling of the governor for generator engine. In addition, unloaded generator should disconnect from MSB and shut down after 10 minutes.

713. Emergency Generator

(1) General

The emergency generator is to be installed in the emergency generator room.
The emergency generator is not to be capable of running parallel with the diesel generator.

The emergency generator is to be operated locally and manually and to be automatically started at no-voltage of emergency switchboard.

The running light for EG to be fitted in the MSB.

(2) Particulars

<table>
<thead>
<tr>
<th>No. of set</th>
<th>One (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure</td>
<td>Drip-proof IP23</td>
</tr>
<tr>
<td>Ventilation</td>
<td>Self ventilated with air filter</td>
</tr>
<tr>
<td>Excitation</td>
<td>Brushless rotary exciter type</td>
</tr>
<tr>
<td>Output</td>
<td>abt. 150 KVA (125KW)</td>
</tr>
<tr>
<td>Voltage</td>
<td>AC 450V</td>
</tr>
<tr>
<td>Phase</td>
<td>3 phase</td>
</tr>
<tr>
<td>Frequency</td>
<td>60Hz</td>
</tr>
<tr>
<td>Revolution</td>
<td>1800 rpm (4 poles)</td>
</tr>
<tr>
<td>Power factor</td>
<td>0.8 (lag)</td>
</tr>
<tr>
<td>Insulation class</td>
<td>B or F for rotor and stator (depending on manufacturer's standard)</td>
</tr>
<tr>
<td>Rating</td>
<td>Continuous at full load</td>
</tr>
<tr>
<td>Bearing</td>
<td>Manufacturer's standard</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>45 Deg.</td>
</tr>
</tbody>
</table>

(3) Exciting Device

Exciting device of generator is to be rotary exciter of brushless type and to be connected to the generator shaft end directly.

The automatic voltage regulator (AVR) with voltage adjuster is to be provided.

(4) Prime Mover

Refer to Machinery specification.

The prime mover is not to be provided with any governor motor.
(5) Space Heater

Generators to have 230V AC space heater controlled by gen. circuit breaker.

Manual switch and indicating lamp to be fitted in ESB.

714 Operation of Generator

The diesel generators and emergency generator are to be operated as follows:

(1) Stand-By Operation of Diesel Generator

(a) In case of one diesel generator in operation (at sea)

(i) When one of the following troubles happens on the main bus bar of the main switchboard, the stand-by generator which is preliminarily selected is to be automatically started and it is to be alarmed on the main switchboard.

- High voltage
- Low voltage
- Low frequency
- High frequency

When the voltage of the stand-by generator comes up the rated voltage, the air circuit breaker (ACB) of the originally running generator is to be opened automatically and that of stand-by generator is to be closed automatically.

After that, motors for propulsion auxiliaries are to be automatically and sequentially started.

However, if the trouble is cleared off by the time of the building-up of the stand-by generator, the originally running generator is to continue to supply the power to the main switchboard, and stand-by generator is to run with no-load until stopped manually.

And if the stand-by generator engine fails to start or the ACB fails to close, the second stand-by generator is to be automatically started and perform the stand-by operation in the same manner as the former stand by generator.

(ii) When the following trouble happens the running diesel generator, preferential trip is to be executed and alarmed on the main switchboard.

Over current

(iii) When current of running generator comes up to abt. 85% rated current the standby generator to be automatically started and two generators to be led to running in parallel.

(b) In case of two diesel generators in operation

(i) When one of ACB of the running diesel generators is tripped by some trouble, preferential trip is to be executed and alarmed on the switchboard and at the same time the stand-by generator is to be automatically started.
When the voltage of the stand-by generator builds up to the rated voltage ACB of the stand-by generator is to be automatically closed and two generators are to be led to running in parallel completely by functioning the automatic synchronizing and load sharing device.

And non-essential consumers preferentially tripped are to be manually restarted, if necessary.

(ii) When the following trouble happens on any running diesel generators, preferential trip is to be executed and alarmed on the main switchboard.

Over current

(2) Automatic Start of Emergency Generator

The emergency generator is to be started automatically by detecting no-voltage of the emergency switchboard bus bar and the ACB of it is to be connected automatically after confirming the continuation of no-voltage.

Switchboard should have low load shedding facility and unloaded generator should auto disconnect from the board and auto shut down after 10 minutes.

715. Shore Connection

One (1) set of 440 volts, 60HZ, three phase, 400 amperes, drip-proof type shore connection box with a moulded case circuit breaker and phase sequence indicating lamps to be installed inside of engine casing or upper deck passage and permanently connected to main switchboard.

716. Batteries

(1) Storage Battery

The lead-acid type batteries to be installed as follows:

<table>
<thead>
<tr>
<th>No. of set</th>
<th>Capacity (Ah)</th>
<th>Voltage (V)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>For general service</td>
<td>2</td>
<td>195</td>
<td>24</td>
</tr>
<tr>
<td>For radio equipment</td>
<td>Manufacturer's standard</td>
<td>Battery room</td>
<td></td>
</tr>
</tbody>
</table>

The battery for general service to supply the power for interior communication equipment and alarm device etc.

(2) Charging Device

One (1) set of charging and discharging board for general service battery to be of parallel floating charging type with AVR to operate by means of voltage dropper, in addition to the above charging method manual charging type to be available by change over switch and located near the battery room.
All necessary charging apparatus i.e. source switch, transformer, voltage adjuster, silicon rectifier, voltmeter, ammeter, indicating lamps, molded case circuit breaker, fuses, etc., to be provided.

Receptacle to be provided on boat deck for charging boat batteries.

The silicon rectifier to be as follows:

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>Max. output current (A)</th>
<th>Max. output Voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>For general service</td>
<td>1</td>
<td>60</td>
<td>35</td>
</tr>
</tbody>
</table>

One (1) set of battery charging panel for radio equipment of manufacturer's standard type to be located in radio control station.

720. ELECTRIC DISTRIBUTION

General

(1) Construction and installation

The switchboard to be of dead front and self standing type and to be made of steel frame work.

The switchboard shall have hinged doors in front and rear.

The switchboard to be provided with handrails in both front and rear of the switchboard.

Movable type drip-proof covers to be provided on the rear face of the switchboard.

(2) Meter

All meters mounted on the front panel of the switchboard to be of the semi-flush and 100mm (or maker's standard) rectangular type with circular scale. The accuracy of meter to be within 1.5 percent of full scale deflection.

(3) Generator Air Circuit Breaker

The circuit breakers for generators to be motor or magnetically operated free trip, air circuit breakers having long time over current trip, instantaneous trip, short time delay trip, under voltage trip and reverse power trip features.

Each air circuit breaker to be provided with interrupting capacity against short circuit current.

Generator ACB to be interlocked with shore supply connection.

Generator ACB to be of draw-out type.

(4) Feeder Circuit Breaker
Moulded case circuit breakers with inverse time thermal trip and instantaneous magnetic trip features to be provided for 440 volts.

For 220 V and 24 DC miniature circuit breakers to be used.

Moulded case circuit breakers to be of plug-in type.

Steering gear motor feeders to be protected against short circuit only.

Moulded case circuit breakers to have interrupting capacity for short circuit current at parallel operation of main generators.

721. Main Switchboard

The main switchboard to be installed in the engine control room and consist of following panels.

No. 1 440 volt feeder panel
No. 1 diesel generator panel
Synchronizing panel
No. 2 diesel generator panel
No. 3 diesel generator panel
No. 2 440 volt feeder panel
220 volt feeder panel

The following instruments to be installed on the switchboard.

(1) Generator Panel

One each generator panel:

1 - ACB
1 - ACB close indicating lamp
1 - ACB open indicating lamp
1 - Generator space heater switch (inside of panel)
1 - Generator space heater close indicating lamp
1 - Manual voltage adjuster (inside of panel)

Each 1 - A.C. voltmeter and selector switch
Each 1 - A.C. ammeter and selector switch
Each 1 Frequency meter and selector switch
Each 1 - kilo wattmeter
1 - Reverse current relay for preferential trip
1 - Over current relay for preferential trip

(2) Synchronizing Panel

For total main generator sets:
3 - ACB close-open switches
3 - Governor motor control switches
2 - A.C. voltmeter and selector switch
2 - Frequency meter and selector switch
1 - Synchroscope and switch
1 set - Synchronizing indicating lamp
1 - Automatic synchronizing device for generators
1 - Diesel generator starting selector switch (remote-manual/auto)
3 - Diesel generator start-stop switches
3 - Generator ACB abnormal trip alarm lamps
3 - Diesel generator remote-start possibility indicating lamps
3 - Diesel generator stand-by indicating lamps
3 - Diesel generator starting-failure alarm lamps
3 - Generator ACB non-close alarm lamps
3 - Automatic synchronizing start push button switches
1 - Preferential trip alarm lamp
1 - 24V D.C. source indicating lamp
1 - Test switch for buzzer and lamp

(3) 440 Volt Feeder Panels

Necessary quantity moulded case circuit breakers for all feeder circuits as required.
1 set - Insulation detection device

No1 440V feeder panel to also include follows:
1 - Pilot lamp for shore connection
1 kWh meter for shore line

1 - NO fuse breaker for shore supply. Shore supply voltage and current are to be measured commonly by one of the voltmeter and ammeter on the generator panel.

3 - Amp. meters for cranes, windlasses and mooring winches with selector switch.

(4) 220 Volt Feeder Panel

Necessary quantity of miniature circuit breakers for all feeder circuit as required.

Each 1 - A.C. voltmeter and selector switch

Each 1 - A.C. ammeter and selector switch

1 set - Insulation detection device

Rubber mat of approved type to be fitted in front and rear of MSB.

Preferential trip should also operate on 100% KW load.

722. Emergency Switchboard

One (1) emergency switchboard to be installed in the emergency generator room.

The emergency switchboard to be energized from the M.S.B. while diesel generator is in normal operation and once the emergency switchboard bus bar becomes no-voltage. The emergency switchboard to supply electric source by the emergency generator.

In general, description and construction are to be as same as the main switchboard.

723. Distribution Panels, Power

Electric distribution

In general, for large power and/or essential motors, group control panel, radar, auto pilot and radio equipment to be supplied from main switchboard or emergency switchboard directly and other small power consuming devices to be supplied through distribution boards from the main switchboard.

Each steering gear motor to be fed from independent circuit, one to be connected to the main switchboard, the other to be connected to the emergency switchboard.

Power for 220 volts lighting and heating system to be supplied from transformers and circuits from distribution boards to lighting fittings or heating equipment to be single-phase two wire system.

The feeder circuits of electric range and baking oven to be three-phase three-wire system.
Power for 24 volts interior communication and alarm to be supplied from the battery and feeder circuit to be two-wire system.

Distribution panels

Every distribution panel to be protected by steel case. The front door to have an efficient latch of substantial type.

Pilot lamp indicating live voltage of panel to be provided.

Distribution panel to have necessary components as follows

(1) 440 volts circuits to be equipped with 3-pole moulded case circuit breakers with over current tripping devices.

(2) 220 volts circuits to be equipped with 2-pole or 3-pole miniature circuit breakers with over current tripping devices in general.

(3) 24 volts circuits to be equipped with 2-pole miniature circuit breakers with over current tripping devices.

(4) General alarm and emergency lighting circuits to be equipped with miniature circuit breakers.

Distribution apparatus

(1) Junction box to be made of sheet steel, drip-proof type for accommodation. In machinery, store spaces, and cargo hold, to be of waterproof type.

(2) Branch box to be made of plastic non-waterproof type to be installed in accommodations.

(3) Switch to be made of plastic, non-waterproof and surface type or flush type in accommodation to be waterproof, surface type in machinery, store and weather spaces.

(4) Generally, socket outlet to be made of plastic, non-waterproof and surface type or flush mounted type according to the respective location in accommodation spaces, and socket outlet to be made of plastic, water-proof surface type in machinery, store and weather spaces.

Waterproof socket outlet to be used on upper deck.

Each socket outlet to have an extra grounded contact. Except the socket outlet for electric razors.

Transformers

The transformers to be installed as follows:

Each transformer to be of 60 Hz, dry type, air cool by natural circulation, drip-proof and to have class B insulation.
<table>
<thead>
<tr>
<th>No.</th>
<th>Capacity (KVA)</th>
<th>Voltage Pri./Sec.</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) For general service</td>
<td>2</td>
<td>Abt. 100</td>
<td>450/230</td>
</tr>
<tr>
<td>(2) For Suez Canal searchlight, forward lighting, cargo hold light,</td>
<td>1</td>
<td>16</td>
<td>450/230</td>
</tr>
<tr>
<td>(3) For emergency use</td>
<td>2</td>
<td>50</td>
<td>450/230</td>
</tr>
<tr>
<td>(4)</td>
<td>1</td>
<td>20</td>
<td>450/230</td>
</tr>
<tr>
<td>(5)</td>
<td>2</td>
<td>16</td>
<td>450/230</td>
</tr>
</tbody>
</table>

Main and emergency transformers shall be such arranged that the full working load can be carried by one transformer in each case. Feeder breakers to transformers to be interlocked to prevent inadvertent dual operation.

All transformers to be fitted with nameplates indicating the duty of the unit.

726. Cables and Cable Installations

All cables to be approved by the classification society and the cable application to be as follows:

Rated voltage of all cables to be 660V and 250V for rated voltage 440V and 220V consumer respectively and current of all cables not to be lower than the rating of individual consumer or motor.

Fire resistant cable to be used according to the rules. All cables to be Halogen free.

XLPE (Cross Linked Polyethylene) insulated, PO (Polyolefin) sheathed Cable be also used.

Cables in accommodation spaces to be of EP rubber insulated, polyvinyl chloride sheathed and steel wire braided.

Cables in machinery spaces and other similar spaces to be of EP rubber insulated, polyvinyl chloride sheathed.

Cables installed on weather deck either protected by steel pipe, or of EP rubber insulated, polyvinyl chloride sheathed and steel wire braided with PVC covering.
For portable appliances such as portable hand lamps and portable cargo lamps, cables to be of flexible rubber insulated and poly-chloroprene sheathed, and for table lamps to be of flexible vinyl cord.

Special cables such as coaxial cables, compensating cables etc. to be used where necessary. All cables have to clearly marked and single wires to be numbered.

**Cable installation**

Cables are not to be painted (oversprayed) at any building stage of the vessel.

In general, cables run in groups to be supported with metal hangers as far as practicable.

Where the cables are exposed to any mechanical damage, they are to be protected by steel plate, steel conduit or flexible tube.

Cables between bridge house and upper deck fore part to be wired through galvanized steel pipe with bolted flanged expansion joint and cable expansion box, which pipe to be led on the side of hatch coaming on upper deck.

Cables installed on mast or post on upper deck to be wired in galvanized steel pipe up to about 1m height from the deck and to be run on galvanized steel saddle or hanger.

All cables passing through weather decks or watertight bulkheads to be provided with watertight glands, deck tubes, or equivalent means such as multi-cable transit and the cables passing through other decks to be provided with deck tubes or coamings.

For cables passing through beams, and non-watertight bulkheads etc. the hole bushed with vinyl or steel coaming to be provided on such beams and bulkheads when they are less than 6mm in thickness.

In principle, in living quarters, i.e., all cabins, alleyway, etc., the cables to be fitted inside the woodworks and or walls.

Outer armour braiding to be bonded to earth on all cables at the point of distribution. All equipment to be bonded to earth with the correct sized cable, insulated with PVC green/yellow colour, and the shortest length possible between component and hull. Where cable sheathing is removed for the purpose of making connections, the exposed rubber insulation is to be sleeved with flame retardant material and the cable sealed at the termination of the sheath.

Correct size of cable gland to be used for cables where necessary.

Motors above 5 KW shall equipped with ammeters.

Hour meters to be fitted on major equipment, which will be specified in the mutually agreed list after signing of the contract.
730. ELECTRIC POWER DEVICES

731. Electric Motors

(1) *The motors*, in general, to be designed of squirrel cage induction type and to operate on 440 volts, 3-phase, 60HZ, A.C. and the motors less than 0.4kW and domestic service motors to be designed to operated on 440 volts or 220 volts single or three phase a.c. in accordance with manufacturer's standard.

The domestic service motors and special motors such as galley equipment laundry machines and elevator etc. to be as per manufacturer's standard, regarding insulation and construction of enclosure etc.

(2) **Rating**

The motors to have continuous rating except those specified hereunder.

Steering gear
Hyd. oil pump for deck machinery

(3) **Insulation** 40% E.D.

All motors to have class B or F insulation in general.

(4) **Enclosure**

The motors to have minimum IP 22 enclosure and to comply with Class requirements.

(5) **Bearing**

According to manufacturer's standard.
(6) Speed Changing

All motors to be of single speed.

(7) Space Heater

The each motor for steering gear, hydraulic pump of deck machinery and boat winch motors etc. to be provided with space heater.

(8) Particular of Motor

As for particular of motors, see Hull (Deck Machinery" and "Refrigerated Provision Chamber" etc.) and Machinery Specification (Section 1- "Machinery Particulars").

732. Starters and Controllers

(1) General

In general, the control gears in engine room to be installed in MSB, not to be withdrawable.

The controller cabinets to have interlocking devices with the opening door for convenience to check inside when the motor are running.

The controller to be of marine type drip-proof construction. The control gears for all motors to be of magnetic across-the-line starting type except those for above 60 KW to be of the reduced voltage starting type.

The control for reversible type motor to be operated by push button switch on the control gear.

All above 5 kW motor control boxes to have ammeters.

Hour meters to be fitted on all control boxes for important equipment.

The control gears to have low voltage protection, except for steering gear motors and vital motors used as propulsion auxiliaries which to have low voltage release and which to be automatically started in sequential order in case of emergency starting.

Generally, each control gear to contain the following devices:

Disconnect switch
Control fuses or automatic fuse-breakers
Pilot lamp for source
Sequence start equipment (if necessary)
Magnetic contactor
Overload relay of thermal trip type
Space heater indication lamp (if necessary)

Start and stop push button switch

Running indicating lamp for all motors in general.

However, control gears for motors less than 0.4KW to contain rotary switch only, larger than 0.4 KW may use rotary switch with approval of owner.

Steering gear motors to be operated both by push buttons on control gears in steering gear room and by push buttons separately installed in wheelhouse.

The control gears for domestic service motors and special motors such as galley equipment, laundry machines etc. to be as per manufacturer's standard, regarding insulation and construction.

(2) Auto Start and/or Stop

Automatic start and/or stop control gears to be provided with automatic-manual selector switch.

Automatic changeover control gears to be provided with a stand-by unit selector switch for two (2) control gears.

Motors with their starters located in MSB to have local (remote) start/stop push-button control station with run lamp and stop interlock.

As for detail, see Machinery Specifications (remote control, automatic and instrumentation).

Starters on open deck to be IP56, in wet location IP44, yet of fully enclosure marine type.

(3) Emergency Stop Switch

Emergency stop-push button for forced draft fan, engine room ventilating fan, fuel oil and lub, oil transfer pump, fuel oil booster pumps, purifiers, and other similar fuel and lub. oil pumps to be located near engine room entrance.

Emergency stop-push button for accommodation ventilating fans to be located in wheelhouse.

Emergency stop-push button for bilge pump and sludge pump to be located near each accommodation ladder.

Emergency stop switch button to be fitted with plastic covers.

735 Heating Equipment and Welder

Electric power 220 volts A.C. to be supplied for laundry, galley and domestic service motors and heaters.
Electric range and electric welder with electric shock protection to be fed from 440 volts A.C. Welding cable connection box will be arranged on the upper deck, one (1) at the aft and one (1) forward.

AS for details of above-mentioned equipment see Hull and Machinery Specification.

One (1) set of electric heater 1kW to be installed in drying room.

Electric heating of freezing room's doors to be installed.

**740. LIGHTING**

741. Lighting Fixtures

In general, unless otherwise noted, lighting fixtures and accessories to be as follows:

<table>
<thead>
<tr>
<th>Type</th>
<th>Accommodation spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-waterproof type</td>
<td>Bosun's store, outside spaces exposed to swet and weather, galley, lavatories, bathroom engine room, steering gear room, air condition room, ref. machine space.</td>
</tr>
<tr>
<td>Waterproof type</td>
<td>Battery room, paint store</td>
</tr>
<tr>
<td>Explosion-proof type</td>
<td></td>
</tr>
</tbody>
</table>

In general, unless otherwise noted, the ship to be lighted by incandescent and fluorescent type lighting fixtures as follows:

<table>
<thead>
<tr>
<th>Type</th>
<th>Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluorescent type</td>
<td>Cabins, officer's mess room and smoking space, wheelhouse, chart space, Ship's /Eeg's office, tally office, engine control room, inside passage, engine room, steering gear room, store rooms, outside on decks, fore ship.</td>
</tr>
<tr>
<td>Incandescent type</td>
<td>Other outer spaces and engine room (partially)</td>
</tr>
</tbody>
</table>

All switches to be of double-pole type and all plugs and receptacles to be of three-pole type except special service.

The captain class cabin, officer's galley, and engine control room to be controlled by two-way switch from the both entrances.

Lighting levels shall not be less than those recommended by DOT and not less than 10 Lux on deck working areas.

The fixtures and outlets to be fed from 220 volts A.C. except otherwise noted, and those material which are installed on exposed weather deck to be of brass.

The fixtures and outlets to light the vessel to be installed as follows:

(1) Decorative fluorescent type ceiling fixture (flush type) with globe in captain classroom, senior officer class room, engine control room, officer's mess room and smoking space. In addition 2 bulkhead incandescent lights to be
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>fitted in each officer’s cabin.</td>
<td></td>
</tr>
<tr>
<td>(2)</td>
<td>Fluorescent type ceiling fixture (surface type) with globe in each room, rating’s cabin, tally office, ship office, wheelhouse, crew’s mess room and crew’s smoking room.</td>
</tr>
<tr>
<td>(3)</td>
<td>A 40 watts fluorescent type desk light at each desk in cabins.</td>
</tr>
<tr>
<td>(4)</td>
<td>An 8 watts fluorescent type berth light with globe at the head of each berth.</td>
</tr>
<tr>
<td>(5)</td>
<td>A 15 or 8 watts fluorescent type mirror light with globe and a two-pole type receptacle for razor at the mirror over each washbasin.</td>
</tr>
<tr>
<td>(6)</td>
<td>Incandescent type lights for outer passageways.</td>
</tr>
<tr>
<td>(7)</td>
<td>Fluorescent type light with guard partially incandescent type light with guard in engine room.</td>
</tr>
<tr>
<td>(8)</td>
<td>Suitable number of 400 watts reflector type mercury light for illumination of the main engine and main generator engines cylinder head in engine room.</td>
</tr>
<tr>
<td>(9)</td>
<td>Incandescent type ceiling fixture of suitable type in each compartment elsewhere mentioned above.</td>
</tr>
<tr>
<td>(10)</td>
<td>Explosion-proof fixtures in battery room, paint store, cargo holds, access ways.</td>
</tr>
<tr>
<td>(11)</td>
<td>The high pressure sodium flood lights to be installed as follows:</td>
</tr>
<tr>
<td>1000 watts (total 8)</td>
<td>Four (4) on the fore mast aft illumination, four (4) on the Nav. Bridge front, each wing 2 for fore illumination.</td>
</tr>
<tr>
<td>500 Watts (total 2)</td>
<td>Two (2) for pilot gangways</td>
</tr>
<tr>
<td>500 Watts (total 2)</td>
<td>Two (2) on fore mast fore illumination.</td>
</tr>
<tr>
<td>500 watts (total 2)</td>
<td>Two (2) for upper deck aft illumination</td>
</tr>
<tr>
<td>500 watts (total 1)</td>
<td>On stern for anti-pirate</td>
</tr>
</tbody>
</table>

The above lights to be controlled from wheelhouse.
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Four (4) fixed floods lights to be fitted in each hold except No. 3 cargo hold, access to be made from port/starboard walkway</td>
</tr>
<tr>
<td>13</td>
<td>Two (2) 400 watts mercury type projectors for accommodation ladder and controlled from wheelhouse.</td>
</tr>
<tr>
<td>14</td>
<td>Two (2) 400 watts halogen type projectors for the funnel mark to be provided and controlled from wheelhouse.</td>
</tr>
</tbody>
</table>
| 15 | Boat lights and life raft light to be provided as follows:  

  - Two (2) 500 watts halogen type boat deck lights near each lifeboat.  
  - Above lights to be provided with switches in wheelhouse.  
  - Two (2) 60 watts (D.C. 24V) incandescent type boat preparation lights to be provided for each boat and fitted on the boat davit.  
  - One (1) each 60 watts (D.C. 24V) incandescent type life raft light near each life raft. |
| 16 | Two (2) incandescent type chart table lamps with dimmer switch for chart table. |
| 17 | A red pilot lamp which indicates (ON) or (OFF) of the light in refrigerating provision chamber to be installed in inner passageway near the chamber. |
| 18 | Emergency light to be a part of general light in the following room and spaces to be fed from emergency switchboard and used for emergency lights in case of trouble of main diesel generators. |
|   | Wheelhouse  
|   | Inner and outer passages  
|   | Stairs in accommodation  
|   | Electric equipment room  
|   | Work shop  
|   | Emergency generator room  
|   | Engine control room  
|   | Hospital  
|   | Engine room  
|   | Offices  
|   | Steering gear room  
|   | Public rooms  
|   | Emergency fire pump room  
|   | Common toilets  
|   | The launching lighting  
|   | Chart space  
| 19 | Two (2) 40 watts magnetic compass lights to be provided in magnetic compass and feed from 24 volts duplicate source. (24V A.C. & D.C.) |
Control switches

The passageway lights, lights in engine room and other similar spaces to be controlled at distribution board. Lights in outer passageway to be lighted from wheelhouse.

Receptacles to be installed as follows:

<table>
<thead>
<tr>
<th>Service</th>
<th>No.</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>for Portable light</td>
<td></td>
<td>Engine room, workshop, refrigerating provision chamber, steering gear room, bosuns store, deck stores, wheelhouse, engine control room, air cond. room, electric store hyd. oil pump room.</td>
</tr>
<tr>
<td>for Cargo light</td>
<td>12</td>
<td>Inside of crane columns and in sheltered space fore and aft.</td>
</tr>
<tr>
<td>for General use</td>
<td>Each 3</td>
<td>Each senior officer class room</td>
</tr>
<tr>
<td></td>
<td>Each 2</td>
<td>Each public room, each office and all other cabins</td>
</tr>
<tr>
<td></td>
<td>(10 amp)</td>
<td></td>
</tr>
</tbody>
</table>

Receptacles for domestic equipment such as electric refr. toaster, cold water fountain, TV and stereo sets to be provided.

Each three (3) receptacles to be provided for cleaners in inner passage of each deck.

Receptacles for other equipment such as galley equipment and laundry equipment, to be provided as occasion demands.

Socket on exposed decks to be mounted inside waterproof protection boxes.

2 wall incandescent lights fitted in each officer's cabin.

Lights provided on bridge close to tea table.

Extra floodlight fitted to illuminate main deck

Lights to be provided at Gangway and Pilot area to be switchable from bridge.

Navigation Lights and Anchor Lights

A complete set of electric turning lights and signal lights required by the Rules and Regulation to be installed as follows:-
(1) Navigation Light

2 - Masthead light (2-60 watts lamp bulbs)
1 - Stbd. side light (2-60 watts lamp bulbs)
1 - Portside light (2-60 watts lamp bulbs)
1 - Stern light (2-60 watts lamp bulbs)

The navigation light indicator-panel (graphic panel) in wheelhouse to be supplied through two (2) separate feeder circuits, one to be fed directly from main switchboard, the other from emergency switchboard.

(2) Signal Light

2 - 40 watts warning light for propeller (hanging lamp)
2 - 2x60 watts anchor lights (fixed type) to be fed through navigation light indicator panel.
2 - 2x60 watts not under command lights on radar mast (fixed type) to be fed through navigator light indicator panel.
3 - 60 watts deep draught signal light (fixed type, red)
1 - 100 watts manoeuvring signal light on radar mast.
1 - 60 watts portable daylight signalling light (ALDIS type) with three (3) receptacles (24V. A.C.) through transformer fed from 220V main switchboard and emergency switchboard.
1 - 100 watts huge vessel light on radar mast top (flash green lamp)
1 set - 40 watts Suez Canal signal lights on radar mast (Fixed type, Red-6, White-5, green-2) and controlled by switch box with visual indicator in W/H.
1 - 40 watts Suez Canal stern red signal light (fixed type)
1 - Suez Canal searchlight (3kW, 220V A.C.) (Davit to be provided on the forecastle deck forward and with approved electric connection in the Bosuns store.)
2 - 25 watts blue Panama Canal steering lights on the behind of foremast.
2 - 1000 watts Suez Canal search light to be fitted on bridge wings
1 set - 3 x 25 watts morse-code signal light on radar mast with three (3) keys. These lights to be commonly used as air horn signal light and to be controlled by the controller.(combined with manoeuvring signal light)
A control switch box for Suez Canal signal light and Suez Canal stern red signal light to be fitted in wheelhouse.
1 - Daylight signalling and search light (1000W with shutter) on compass bridge deck controlled at local.
Above signal lights to be fed from 220 volts A.C. both emergency and main supply with change-over arrangement except otherwise noted, and to be controlled from W/H except that Suez Canal search light and propeller warning lights to be controlled locally.

750. COMMUNICATION

751. Communication Equipment

Telephone equipment

Telephone equipment to be installed as follows:

(1) Sounder Power Telephone

Common battery telephone to be located as follows:

<table>
<thead>
<tr>
<th>Wheelhouse (with dimmer)</th>
<th>Engine local control station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master cabin</td>
<td>Engine control room (with headset)</td>
</tr>
<tr>
<td>C/Eng. Cabin</td>
<td>Steering gear room (with headset)</td>
</tr>
<tr>
<td></td>
<td>Fire fighting room</td>
</tr>
<tr>
<td></td>
<td>Emergency gen. room (with headset)</td>
</tr>
</tbody>
</table>

| Engine room               | Fuel oil filling station |
|                          | One (1) portable telephones and two (2) jack boxes |

(2) Automatic Telephone

One (1) set of abt. thirty (30) circuits with four (4) simultaneous talking automatic telephone system to be located in accordance with detailed design.

To be fed from 220 volts A.C. and 24 volts battery.

Automatic telephone distribution to be according to accommodation plan.

Output of automatic telephone system to be connected as input of public addresser.

Telephones in engine room and steering gear room to be of anti-noise type with headset.

MF/HF radio equipment and VHF radio telephone

Radio equipment are in accordance with requirement of GMDSS A1, A2, A3

One (1) set of console type radio station to be installed in radio space as follows (or manufacturer's standard):

(A) MF/HF radio equipment

1. Main transmitter abt. 250W
1 - Receiver
1 - DSC watch receiver
1 - DCS terminal
1 - Printer
1 - Battery charger
1 - Transmitter antenna
1 - Receiver antenna
1 - Emergency light (DC24)

(B) VHF Radio telephone

2 - VHF radio telephone with DSC
One of them to supply signal to VDR, and should put one remote handle in
masters office.

(C) INMARSAT C

1 - INMARSAT standard C ship earth station with EGC receiver

(D) INMARSAT F77

1 - INMARSAT F77 ship earth station, including telefax, telephone and printer
to be located in the radio space.
1 - Telephone in masters office

Both INMARSAT C and F77 to be equipped with emergency alarm push button.

To be fed from AC 60HZ, 220V and DC 24V.

Two-way VHF radio telephone

Three (3) sets of two-way VHF radio telephone and (1) set battery charger for three
telephones to be provided.

Walkie talkies

Three (3) sets of walkie talkies to be provided.

Broadcast Equipment

Stereophony

Each one (1) set of stereophony including a stereo radio receiver and cassette deck
to be supplied by Owner and installed by the Builder in officer's smoking space and
crew's smoking space respectively.

Antenna multicoupler system for b.c. radio and TV receiver

One (1) set of B.C. radio and TV receiver antenna multicoupler to be installed as fol-
loows:

1 - Distributor Radio space
each 1 - Receiving outlet (with source receptacle) Public rooms and each private cabin, offices, officer's smoking room etc.

To be fed from 220 volts A.C.

**TV receiver**

Each one (1) set 29 inches, colour type TV receiver to be supplied by owner and installed by builder in each officer's smoking room and crew's smoking room.

755. **Intercommunication and Command Systems**

One (1) set of public address with talk back system to be installed as follows:

| 1 - 100 watts or suitable amplifier | Radio space |
| 2 - Remote control units | W/H and fire control room |
| 1 - 50 watts weatherproof loud speaker | Compass bridge deck |
| 8 - 10 watts drip-proof loud speaker | 6 - Engine room, Bow upper deck aft one each |
| 4 - 5 watts speaker | 2 - Bridge wings |
| | 1 - Galley |
| | 1 - Steering gear room |
| Each 1-2 watts speaker (total abt. 20) | Suitable position of innerpassageway (double face), engine control room, officer's mess room and crew's mess rooms |
| 6 - Microphone | 2 - Wheelhouse, both wings, bow, upper deck aft |

To be fed from 220 volts A.C. and 24 volts D.C.

The system to be interconnected with the automatic telephone system for operation from selected telephones.

756. **Internal Telephones**

Call signal system to be installed as follows:

| Engine control room (push button) | Engineer's and engine crew's quarter passageway, officer's mess and smoking room, crew's mess and smoking room (buzzer) |
| Each refrigerated provision chamber (switch) | Galley (bell with red lamp) |
| Hospital at each head of bed | Wheelhouse and doctor's room (buzzer) |
To be fed from 24 volts battery.

In addition to the above two (2) audible signals and four (4) rotating lights to be provided in engine room and to be sounded by telephone's calling signal and engineer's alarm signal in engine control room, in order to announce to engineers in engine room.

This system to be fed from 24 volts D.C.

757. General Alarm and Alarm Bells

20 cm bell:
- Navigation bridge deck inner passageway 1
- D deck inner passageway 2
- C deck inner passageway 2
- B deck inner passageway 2
- A deck inner passageway 2
- Upper deck inner passageway 3
- Steering gear room 1
- Mess room each 1
- Forecastle 1

12 cm bell with flash lamp:
- Engine control room, working shop 2

Electronic horns with rotating lamp:
- Engine room 2

One set of engine room group alarm device with alarm light columns fed from emergency AC 220V shall be provided.

Manually operated push button switch:
- Wheelhouse 1

To be fed from 24 volts battery.

Engineer's alarms

One (1) set of engineer's alarm system consists of motor, pressure, temperature, and level alarm to be installed at engine control room.

As for detail see Machinery Specifications.

In addition to the above, a steering motor alarm panel to be provided in wheelhouse and engine control room consisting of running indicating lamp and stop alarm with visual and audible signals for each motor.
Fire detection and alarm system

One (1) set of fire detection and alarm system to be installed as follows:

| Fire alarm control and indication equipment: | Wheelhouse |
| Fire alarm repeater: | Fire control station |
| Heat detector: | Galley, smoking room, workshop, above main engine and generator engines, mess room, pantry |
| Heat detector of explosion-proof: | Battery room |
| Smoke detector: | passage, stair, engine room, steering gear room, machinery space |
| Push button: | Passage near the exit, engine control room, entrance to the E/R, steering gear room etc. |

The fire alarm is used as common with general alarm system, as specified in subsection 10.4.

Heat detectors required in mess rooms/pantries.

CO₂ releasing alarm system

One (1) set of CO₂ releasing alarm system to be installed as follows:

| Valve switch and indication lamp: | CO₂ room |
| Control box door switch: | Fire control room |
| Rotating lamp and motor siren: | Engine room |
| Rotating lamp and electric alarm sounder: | Engine control room |

The system to be fed from DC 24V.

The ventilating fans, F.O. pumps and L.O. pumps in engine room shall be stopped automatically when this alarm is operated.

Horn control system

One (1) set of air horn and electric motor horn with auto fog signal control system to be installed as follows:

1 - Electric horn with heater | Fore mast |
1 - Air horn with heater | Radar mast |
1 - Horn controller: | W/H control console |
1 - Push button (N.W.T.) | W/H |
2 - Push button (W.T.) | W/H wings |
1 - Signal light: Radar mast

Horns on the fore and radar mast to be mounted on resilient mounts to prevent the transmission of vibration.

Auto bell and gong system provided for a vessel at anchor.

758. Engine Order Telegraph

One (1) set of engine order telegraph system of electric type to be installed as follows:

1 - Engine telegraph bridge unit (console mounted type) Wheelhouse

1 - Engine telegraph control room unit (console mounted type with bell) Engine control room

1 - Engine telegraph local unit with gong

1 - Logger in wheelhouse

To be fed from 220 volts A.C.

One (1) set of sub-telegraph to be provided.

As for interlock with main engine handle, see Machinery Specifications.

759. Navtex Receiver

One (1) set of NAVTEX receiver to be installed as follows:

1 - Receiver Chart space

1 - Antenna Compass deck

To be fed from AC 60HZ, 220V or 24V D.C.

760. ELECTRIC NAVIGATION EQUIPMENT

The equipment under this heading to be delivered and installed by the Builders. All necessary components for trouble free operation as well as standard spare parts and installation materials to be included in the supply.

Preparation for installation of ECDIS. Cables, sockets and connections to DGPS, radar, gyro, log, echo sounder, wind speed / direction and VDR to be provided for later installation of ECDIS.

761. Gyro Compass and Autopilot

One (1) set of gyro compass to be installed and fed from 220 volts A.C. and 24 volts D.C.

(1) Gyro Compass
The gyrocompass to consist of following parts:

1 - Master compass Wheelhouse
1 set - Accessories (with power fail alarm) Wheelhouse
1 - Course recorder Chart space

6 - Repeater compasses:

- One (1) steering stand
- One (1) wheelhouse front
- One (1) for each navigating bridge wing
- One (1) in captain’s day room
- One (1) in steering gear room
- Gyro signal to be also provided for two (2) radars.

One magnetic compass complete with signal outlet to autopilot.

(2) Auto Pilot

Auto pilot to be of micro processor controlled digital type.

The steering system to have following mode:

1 - Automatic steering
1 - Follow-up steering
1 - Non follow-up steering
1 - Rudder order indicator
1 - Override unit

The equipment shall include 1 rate of turn indicator, 1 magnetic compass compensator unit and 1 off course alarm and fed from starter of steering gear.

762. Depth Sounder

One (1) set of echo depth sounder to be installed as follows:

1 - Recorder Chart space
1 - Sub-indicator with shallow water alarm Wheelhouse
2 - Transducer (1 active & 1 spare) Bottom of vessel

The operation frequency to be of 200 kHz. Sounding range is 0-500 m.

To be fed from 220 volts AC and 24 volts DC.

Signal to be sent to VDR

763. Rudder Angle Indicator

One (1) set of electric rudder angle indicator system of self-synchronous type to be installed as follows:
1 - Transmitter                      Steering gear room
3 - Indicators (200mm dial with dimmer switch) Wheelhouse, Navigation bridge each wing
1 - Indicator (120mm dial)       Engine control room
1 - Indicator (200mm dial)       Steering control room
1 - Indicator (200mm dial)       Captains room

The centre rudder indicator to be of three-face type.

To be fed from DC 24V.

764. Speed/Log Indicator

One (1) set of single axis doppler speed log system (incl. sea valve) to be installed as follows:

1 - Transducer unit                       Bottom of vessel
1 - Main electronics unit                 Chart space
1 - Speed indicator                      Wheelhouse
1 - Speed indicator                      Engine control room

To be fed from 220 volts A.C.

765. Revolution Indicator

(1) Electric Propeller Shaft Tachometer

One (1) set of propeller shaft tachometer system to be installed as follows:

1 - Transmitter                           Engine room
2 - Indicators (200mm dial with dimmer switch) Wheelhouse, Navigation bridge each wing
3 - Indicators (120mm dial)                Engine control room, C/E day room, steering gear room
1 - Revolution counter                   Engine control room

The transmitter to be connected to intermediate shaft of main engine.

(2) Electric Turbo-Charger Tachometer

See Machinery Specifications.

766. Radar Equipment

Two (2) sets of true motion colour type marine radar, one (1) with ARPA system and to be installed as follows:

2 - Display unit 16 inch         Wheelhouse
Peak power min. 25 kW
Max. range 96 miles
Wave length 3 cm, 10 cm each one

2 - Transceiver Chart space
2 - Scanner Radar mast

Interswitch possibility
Interface with DGPS, Doppler log and gyrocompass.
To be fed from 220 volts A.C. or 440 volts A.C.

767. Electric Whistle / fog signalling
See 757.

768. Satellite Navigation
Two (2) sets of DGPS navigator to be provided as follows and fed from A.C. 220V and 24V D.C.
Each set complete with gyro and log interface and connection to autopilot.

2 - Receiver Chart space
2 - Antenna Radar mast

769. Facsimile Receiver
One (1) set of 10” weather facsimile to be installed as follows:

1 - Receiver Chart space
1 - Antenna Compass deck

To be fed from 220 volts A.C.

770. MISCELLANEOUS ELECTRIC EQUIPMENT

771. Radio Screening
One (1) set of ICCP system to be provided as follows:

1 - Electronic automatic transistorised controller power unit
2 - Recessed elliptical mixed metal oxide anodes
2 - Recessed high purity zinc reference electrodes
1 - Propeller shaft grounding assembly
1 - Rudder stock bonding cable

To be fed from 220 volts, 1 phase, 60HZ

772. Data Recorder

A Voyage data recorder is to be installed as per IMO Solas Chapter V reg 20.

773. Master Clock System

One (1) set of crystal controlled electric clock system to be installed as follows:

1 - Master clock
    Chart space

Slave clocks

1 - Three (3) hands (with silent time) Near radio console
2 - Three (3) hands
    1 - Wheelhouse
    1 - Central control room
24 - Two (2) hands (single face)
    1 - Captain's day room (decorative)
    1 - Bedroom
    1 - Chief engineer's day room (decorative)
    1 - Bedroom
    1 - Chief officer's room
    1 - 1st engineer's room
    1 - 2nd officer's room
    1 - 2nd engineer's room
    1 - 3rd officer's room
    1 - 3rd engineer's room
    1 - Electrician's room
    1 - Bosuns room
    1 - Chief steward's room
    1 - Officer's mess room (decorative)
    1 - Officer's smoking room (decorative)
    1 - Crew's mess room
    1 - Galley
    1 - Hospital
    1 - Ship's office
    1 - Engine office
    1 - Owner room
    1 - No.1 oiler
    1 - Gymnasium
    1 - Pilot room

To be fed from 220 volts A.C. and 24 volts battery.

Time signals to be given to the telegraph logger from the master clock.
774. 406 MHZ EPIRB

One (1) set of 406MHZ emergency position indicating radio beacon (EPIRB) to be provided on bridge deck.

775. Radar Transponder

Two (2) sets of radar transponder (9GHZ) to be provided.

776. Automatic Identification System (AIS)

An automatic identification system (AIS) according to IMO regulations to be installed.

Two (2) cameras CCTV system with VCR multi-player on monitor (LCD) in cargo office, the position to be at gangway connection port/starboard. The system to be cabled with a composite cable for power/signal. The camera casing should be of 316L stainless steel.

777. Anemometer

One (1) set of vane type anemometer to be installed as follows:

1 - Transmitter  
   1 - Indicator  
   Radar mast  
   Chart space

To be fed from 220 volts A.C.

778. Clear View Screen

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

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

779. Window Wipers

Six (6) sets of window wipers (electric) to be fitted on bridge windows, to be fitted with solar sun screen.

The wipers to be of horizontal movement type.

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

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

Spare parts

Spare parts to be furnished in accordance with the requirements of the Rules and Builder's standard.

Outfits
The following outfits to be furnished:

1 - Megger, in megohm scale with 500 volts
1 - Circuit tester
1 - Portable clamp-on type combination volt ammeter for A.C. measurement
1 - Electric soldering iron 220 volts 150 watts
1 - Resin cored solder (3kg)
2 - Knives
3 - Plus screw drivers (large, middle & small)
3 - Minus screw drivers (large, middle & small)
2 - Pincers
2 - Nippers
2 - Universal screw-wrenches
2 - Test lamps
2 - Flash lamps with two (2) cells
1 - Pair of electrician's rubber gloves
12 - Vinyl tape (red, blue, black, yellow, green, brown)

781. Storage of Tools, Spares and Stores

All parts to be properly stored in boxes with clear identification of all items. For checking see 581.

782. Storeroom with Outfit

Suitable lockers with shelves and drawers to be provided for storage of electric tools, spares, chemicals and stores.

783. Standard Tools

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

784. Class Spare Parts

To be delivered as recommended by Class and checked by class surveyor.

785. Manufacturers’ Standard Spares (not Class Spares)

Standard spares normally offered and delivered with equipment to be supplied.
800. CENTRALIZED INSTRUMENTATION, GENERAL

The alarm-, control- and monitoring system to be designed as an integrated system (ICMS)

The extent of alarm, monitoring and control systems to be in accordance with the rules and regulations as well as with the owners’ and manufacturers’ recommendations for all equipment and systems.

Centralized controls, instrumentation and monitoring equipment, suitably arranged in consoles, for one-man operation/watch.

Necessary redundancy to be built into the various systems.

Aim of optimum reliability and simplicity of any control circuits.

All electronic equipment to be properly protected against sustained and transient overvoltages and electric noise.

Where possible, safety systems to be designed as NO-circuits and alarm systems as NC-circuits.

The automation and instrumentation plant to be built with separate sensors for alarm circuits and safety circuits according to Class requirement.

All instrumentation and control systems to be of electronic solid state design on a fully modular concept incorporating the minimum number of different types of standard modules.

Instrumentation components such as instruments, transducers, pressure and temperature switches, limit and level switches, signal lamps, relays etc. to be standardised to the same make, type and size as far as practical.

Consideration to be given to the design of all equipment to the environmental conditions of shipboard tropical service and proven marine components to be employed. Particular emphasis to be placed on corrosion, temperature, vibrations, power supply, and electrical interference effects.

System arrangement to be such that no single fault, failure of power supply of system, malfunction will prevent effective plant control being retained.

Standard modules of one manufacturer shall be employed to the greatest possible extent.

All instruments and displays to be of SI-units.

The total automation system to be split up in independent systems:

1. Alarm-, control- and monitoring system
2. Main engine safety system
3. Main engine safety- and slowdown system
4. Main engine remote control system
5. Auxiliary engines start, stop and control system

In addition the following equipment to be integrated in the ICMS system:

- Power management system for DG sets
- Remote valve control
- Tank level gauging system
- Mimic pictures of min. 25 pictures.

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

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

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

As far as possible all instrumentation and calibration equipment to be delivered from the same supplier and the same manufacturer.

A detailed specification with associated drawings to be submitted for Buyer’s approval.

The bridge control desk to be carefully designed with a view to safe operations and ergonomic considerations according to operation.

An engine control room to be arranged adjacent to the engine room. The control room to be well ventilated and to contain all necessary equipment for obtaining unmanned classification.

810. MANOEUVRING CONSOLES, MAIN CONSOLES

Manoeuvring consoles for control of main engine are to be provided.

811. Consoles. Lay-Out

The central control console in the wheelhouse to be built-up from standardized modules of a common base welded to the ship’s platform and painted with store hardened Hammertone finish or similar.

Internal wiring to be well marked.

813. Alarm System

An automatic continuous alarm monitoring system for all essential equipment to be arranged. Wherever possible the system should be fully integrated with the (ICMS) system.
The alarm system shall indicate incoming alarms on the central visual display unit, located in the engine control room.

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

The bridge alarm panel and the cabin watch calling to be connected to the ICMS system.

The alarms monitored in the wheelhouse to be in accordance with class requirements and Buyer's requirements.

Alarm to be fitted from hospital to bridge.

The engine monitoring cabinet to be equipped with:
- Engine room alarm unit
- Alarm fault printer
- Exhaust gas alarm unit
- Engineer call central unit
- M/E safety unit

840. SYSTEMS FOR OPERATION OF DIESEL GENERATOR SETS

841. Remote Start/Stop and Manoeuvring

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

Automatic start of the diesel generator sets will occur under the following conditions:
- Standby start request from a faulty running set
- Low surplus power
- Start request of large electrical consumers
- Low line voltage or low line frequency
- Black-out

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

The control system for the diesel generator sets to achieve the following function:
- Automatic synchronizing to be arranged before connection of a generator to the bus bars
- Maintaining the line frequency at rated value
- Dividing the total load between the running generators in proportion to their rated load

890. AUTOMATION EQUIPMENT FOR OTHER MACHINERY COMPONENTS

A load computer to be installed including software. The load computer to be interfaced to the ICMS system.

892. Remote Tank Gauging System

The remote tank gauging system to be integrated in the ICMS system.
Remote sounding to be arranged for the following tanks:

- Bunker tanks
- Service and settling tanks
- Ballast tanks
- FW tanks

The sounding of the tanks to be displayed on the VDU in engine control room and also in the Cargo Control Room.

Remote draft gauging system fitted. System to be integrated to alarm and monitoring system and co-ordinated by the system supplier.

One set of water ingress alarm system to comply with SOLAS Chapter XII Reg. 12 & 13 and one alarm panel in wheelhouse to be installed. Remote pumping facilities to be supplied for forward part as per Rule’s requirement.
900. - 999. CARGO SPACES AND CARGO HANDLING

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

910. ACCESS TO CARGO COMPARTMENTS

911. Weather Deck Cargo Hatch Covers

Cargo hatch covers to be of mild steel or high tensile steel folding type (4 panels to each cover).

Hatch No. 1 (L x B) 19.2 x 20.8 m
Hatch No. 2-5 (L x B) 21.6 x 22.4 m

Hydraulically operated. 4 panels to be able to operate simultaneously. One operating stand for each hold.

Floating bearing to be fitted on panels ends and mid hinges.
Floating bearing to be used for the hatch ram pivot points.
Twin compression sealing on cross joints and inter-medium joints.

Hatch covers to be double skin construction and fitted with 2 grain/cement loading scuttles.

Manual Cleating and formed profile rubber packing. Compression bars to be of stainless steel.

920. OUTFIT OF CARGO SPACES

924. Stairs and Ladders

2 - steel ladders for each cargo hold to be fitted on each bulkhead. To comply with AMSA rules. (One vertical ladder and one inclined or spiral stair for each hold.) AMSA ladders to be of enclosed type.

Platform to be fitted in middle of each ladder.

927. Cargo Securing System

A suitable number of fixed eye plates to secure packaged timber shall be provided at max. 1.5 m longitudinal intervals on upper deck both sides.

A suitable number of fixed eye plates to secure cargo on hatch covers shall be provided at the longitudinal hatch coamings.

Eye plates for installation of protector net on accommodation from wall shall be provided (wire and net shall be supplied by the Owner).

The design of cargo securing system shall be in accordance with the Builder’s practices, Rules and Regulations, unless otherwise specified.
All loose lashing fittings for timber such as wire, chains, rigging screw etc., shall be supplied by the Owner. Ten (10) galvanized steel boxes of 1 m (B) x 1m (H) x 2m(L) in size shall be provided between the hatches on upper deck and supplied by Buyer.

The bottom of boxes shall be made of steel expanded metal or steel open gratings for drainage, and the top shall be covered with canvas cover.

Personnel protection and safety devices shall not be provided for cargo securing and discharging operations.

All lashing fittings for coil loading in cargo holds, including the reinforcement shall be provided by the Owner, if needed.

930. RIGGING AND CARGO GEAR

934. Store Crane

2 - Store cranes to be installed and arranged SB and PS for provisions and spare parts as per General Arrangement. (Cranes can be combined MOB-boat/ life-raft/provisions). Only one crane to be of luffing type for spare parts and provisions.

SWL 1.5 t at 5.0m outreach for MOB

One SWL 3.0 t at approx. 10.0 m outreach to suit arrangement of hatch for spares and provisions.

935. Fixed Deck Cranes with Foundations

The four (4) sets of electro-hydraulically driven deck cranes of two wires type shall be provided on upper deck for handling the bulk cargoes and logs, mooring boat etc., as shown on the General Arrangement.

The deck cranes shall be designed, constructed and equipped according to the manufacturer’s standards, unless otherwise specified, in compliance with the Rules and Regulations.

(a) Particulars

The particulars of the cranes shall be as follows in accordance with the manufacturer’s standards:

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>36 tons (SWL) at hook</td>
</tr>
<tr>
<td>Type</td>
<td>Single jib, wire luffing</td>
</tr>
<tr>
<td>Speeds (full load)</td>
<td></td>
</tr>
<tr>
<td>- Hoisting</td>
<td>Min. 22 m/min.</td>
</tr>
<tr>
<td>- Slewing</td>
<td>Min. 0.8RPM</td>
</tr>
<tr>
<td>- Lowering</td>
<td>Min. 40 m/min.</td>
</tr>
<tr>
<td>- Luffing time</td>
<td>Max. 65 sec. (from max to min. working radius)</td>
</tr>
<tr>
<td>Working radius</td>
<td></td>
</tr>
<tr>
<td>- Maximum</td>
<td>28.0 m</td>
</tr>
<tr>
<td>- Minimum</td>
<td>Less than 4.5 m</td>
</tr>
</tbody>
</table>
Slewing angle: 360°, endless

The cranes shall be so designed that three (3) motions (hoisting, luffing and slewing) shall be made possible under the full load simultaneously. The cranes shall be operable at 5° heel and 2° trim.

(b) Control and safety devices

The deck cranes shall be operated by two (2) control handles in the operator’s cabin, i.e. one (1) handle shall be used for hoisting and another for luffing and slewing. The following safety devices shall be provided according to the manufacturer’s Standards:

- Deadman switch
- Limit switch for hoisting (upper & lower)
- Limit switch for jib (upper & lower)
- Adjustable limit switch for slewing
- Audible alarms for drivers
- Interlock for prevention of starting the cranes at low power availability

(c) Crane body and crane jib

The crane body shall be constructed with welded steel plate and hoisting, luffing and slewing devices shall be mounted inside the crane body.

Each operator’s cabin shall be equipped with control handle, control panel, one (1) electric window wiper, one (1) air conditioning unit, ceiling light, openable window etc, in accordance with the manufacturer’s standards.

The hoisting winch, luffing winch and two (2) slewing motors, including necessary electric and hydraulic motors shall be installed inside the crane body.

Necessary oil cooler by air and heating device shall be provided for hydraulic system in the crane body.

The heating device shall be provided to warm up the hydraulic system against the freezing weather according to the manufacturer’s standard.

Two (2) cargo flood lights of 500 W halogen type shall be fitted outside of the cabin.

The crane jib shall be of box type construction with welded steel plate and mounted with an inclinometer, the hoisting and luffing sheaves on the end of it.

Crane pedestal and jib rest

Four (4) crane pedestals of fabricated steel plate shall be installed on upper deck as shown on the General Arrangement.

The vertical ladder shall be provided in compliance with the AWWF requirement, and the access to the crane shall be made internally.

The jib of deck crane shall rest on the hardwood lined jib rest on the other crane.
The pad eyes shall be fitted on deck for securing the hook.

The design and equipment of crane pedestal shall be in accordance with the manufacturer’s recommendation.

(d) Others

The grab control devices shall not be provided for the cranes, but the deck cranes shall be equipped with necessary brackets and seats of steel for the future installation of grab control devices by the Owner.

The crane grabs shall not be provided, but the fixed securing device for stowage of four (4) electro-hydraulic grabs shall be provided on deck store top according to the Builder’s practice. Plans of grabs to be supplied by Owner.

Other specifications including spare parts, tools and accessories of the deck cranes shall be in accordance with the manufacturer’s standards, unless otherwise specified.

936. 2 - Portable mocking winch with davit to be provided for garbage unloading.

970. CARGO SPACE VENTILATION

971. Ventilation Requirements

Natural ventilation of the cargo holds to be provided.

To comply with regulations for transport of coal cargoes.

974. Ventilation. Inlets and Outlets

Natural ventilation openings to be positioned in the end of the hatch covers.

Two P/V valves to be arranged on cargo hold 3 hatch cover.

975. Trunking. Dampers

Fire dampers and water traps above upper deck in all ventilation trunks. Ventilators are to be installed with stainless steel rat proof wire nets.

980. CARGO HOLD WASHING

A portable air/water driven combi-gun system to be provided for cargo hold washing.

Compressed air and water to be available close to tank top level in each cargo hold.

Quick coupling standard valves for connecting short-length flexible hose for combi-gun to be arranged.

To avoid unintentional water ingress from hold washing water line, when not in use, blind flange or spool piece to be provided. (see also 332. and 365).

Fresh water connection to be available at each cargo hold for hold washing.
1000. - 1099. SHIP’S TOOLS, SPARES AND STORES

1000. GENERAL

Storage of machinery and electric items in accordance with 581 and 781. Storage or deck items to follow similar guidelines as applicable.

With reference to spares of builders supply, lists to be submitted and agreed.

1010. NAUTICAL INSTRUMENTS (Builder’s supply)

2 - Prism binoculars (7 times magn.)
1 - Aneroid barometer (in chart room)
1 - Thermometers (for atmosphere)
1 - Thermometer (wet and dry bulb-double type)
1 - Thermometer (for sea water)
1 - Sextants
1 - Chronometer (quartz)
1 - Clinometer, clock type (wheelhouse)
5 - Clinometers, pendulum type (engine room, chief officer’s cabin, captain’s day room, ship’s office, control room)
2 - Chart dividers (200mm)
1 - Chart compass (200mm)
1 - sets - Parallel ruler (1-60 cm, 1-30 cm)

As for electric nautical instruments, such as gyro compass, radar, echo sounder, ship’s log, etc., refer to Electric Specification.

1020. FLAGS, SIGNALS, LAMPS - Builder’s Supply

Signal equipment to be furnished as follows:

1 - Fog horn
3 - Black balls, 610mm dia., to be made up canvas folding type
1 - Diamond shape
1 - Black cylinder shape

For electrical signal lights, refer to Electric Specification”.

Flags to be equipped as follows:

2 - National flags (one large and one medium)
1 - set - International signal flags
1 - set - Pilot flag (GH)
1 - Blue Peter (P)
1 - Quarantine flag (Q)
1 - Set of national flags for 10 nations to Buyer’s choice, medium size

Others:
1 - Aldis lamp
4 - Cargo clusters

1030. GALLEY, MESS AND CABIN INVENTORIES (Owner Supply)

1031. Cooking Utensils and Kitchen Ware
1032. China, Cutlery, Glass Ware
1033. Napery
1034. Pillows, Cushions, Blankets, Bed Linen
1035. Towels
1036. Mattresses (Builder’s Supply)
1038. Medicine Chest, as per rules
1039. Lifeboat Rations, as per rules

1040. DECK TOOLS, SPARES AND STORES

1042. Other Cleaning Tools (Builder’s supply)

1043. Paint Tools

4 - Chipping hammers
6 - Paint scraper with handles
5 - Paint brushes
3 - Long handle paint brushes
5 - Paint pots
2 - Tar brushes
2 - Wire brushes

Builders supply

1044. Hand Tools

2 - Common hammers
1 - Claw hammer
2 - Chisels
2 - Planes
1 - Carpenter toolbox
2 - Hand saws
2 - Common spanners

Builders supply

1045. Staging (for Painters), one set

Builders supply

1047. Standard - Spares - Builders Supply

2 - Spare windowpanes for each size and type of windows and portlights
1 - Spare joining shackle for anchor cable
2 - Chain hooks
1 - Spare taper pin for kenter joining shackles
1 - Spare taper pin for anchor shackles
2 - Anchor hammers
1 - Disengaging tools for kenter joining shackle

1048. Standard Stores Builders Supply

2 - Orange anchor buoys with wire ropes
1 - Shackle punch
1 - Pin punch
4 - Fenders
2 - Sounding rods with line
4 - Keys for sounding rod caps
2 - Grease guns adaptable to standard grease fittings used
3 - Canvas covers for compass (and repeaters, if any outside)
1 - Workbench with screw-vice mounted in forecastle
4 - Rubber door mats for each exterior door to accommodation
2 - Extension ladders of light alloy
2 - Boatswain chairs
10 - Rat guards

1050. MACHINERY TOOLS

The following tools are in excess of those in 583.

1051. General Hand Tools (Builder’s Supply)

The vessel is to be furnished on board with general tools and out fittings of the following list in accordance with Builder’s standard.

1 - Dial gauge with holder scale range 10 mm (min scale 0.01 m)
1 - Micrometer (outside) scale range 0-25 mm
1 - Vernier calliper 300 mm
2 - Marking scribers length - 220 mm
1 - Hand tachometer 18000 r/min
1 - Surface gauge 290 mm height, 250 mm spindle length
1 - Square 300 mm
1 - Feeler gauge 16 leaves (length 100 mm)
2 - Inside callipers 300 mm & 200 mm (each one)
2 - Outside callipers 300 mm & 200 mm (each one)
2 - Steel scales 1000 mm & 300 mm (each one)
2 - Steel tape measure for tank sounding with weight 20 m
2 - Thermometers with holder 100 deg. c
1 - Bare thermometer (mercury) 500 dec. c
22 - Straight shank drills 3 mm, 4mm, 5 mm, 6 mm, 7 mm, 8 mm, 9 mm, 10 mm, 11 mm, 12 mm and 13 mm (each two)
16 - Spanners 17, 19, 22, 30, 32, 36, 46 and 55 mm (single and open ended) (each two)
10 - Spanners (double and open) 17x19, 24x27, 30x32, 36x41, 46x50 mm (each two)
5 - Ring spanner 17x19, 24x27, 30x32, 36x41, 46x50 mm (each one)
2 - Screw wrenches 300 mm & 200 mm each one
2 - Screw drivers 100 & 150 mm
4 - Cross drivers 100, 150, 200, 250 each one
1 - Punch 125 mm
9 - Files (large) 300 mm flat, round & half round (each rough, medium & fine)
8 - Files (small) 140 mm flat, round, half round & triangular (each medium & fine)
1 - Wooden hammer
4 - Scrapers flat & bamboo leaf (each 450 mm & 350 mm)
2 - Centre punches
4 - Cutting punches 12.5, 16, 19 mm & 24 mm
6 - Chisels flat type 160 mm & cross cut type 200 mm (each three)
2 - Chisels oil groove cut
2 - Scissors for metal flat edge type 300 mm, round edge type 250 mm
1 - Set of hacksaw frame hacksaw 12 pieces & hacksaws with mouth protector
1 - Bench vice
1 - Oil stone with wooden bed
1 - Torch lamp (kerosene)
6 - Oil feeders (polyethylene)
1 - Grease pump
2 - Wire brushes
6 - Wedges 150x25 & 250x50 (each three)
12 - Eye bolts M10, 12, 16, 20 (each three)
120 - Sets of bolts & nuts M10, 12, 16, 20 (each 30 sets)
120 - Steel washers M10, 12, 16, 20 (each 30)
120 - Split pins 2 mm x 12 mm, 3 mm x 15 mm, 4 mmx 25 mm & 5 mm x 55 mm (each 30)
1 - Set of tap & dies with case
1 - Sounding scale for tank 2000 mm with 17,000 mm rope
1 - Lead hammer
1 - Sledge hammer
2 - Waste boxes
1 - Crow bar 25 mm dia., 1000 mm length
2 - Rubber air hoses with15 mm dia.10 m length coupling
8 - Valve turning wrenches
5 - Chain blocks
3 - Sheets of steel plates t x w x l:1.6 x 950 x 2000 mm, 2.2 x 950 x 2000 mm, 3.2 x 950 x 2000 mm
The spares to be supplied in compliance with the requirements of classification society and maker's standard.

1053. Lubrication and Grease Tools

Buyer's supply according to contract

1070. ELECTRIC TOOLS

Buyer's supply - lists to be agreed

1071. General Tools

Buyer's supply - lists to be agreed

1072. Mechanical Tools

Buyer's supply - lists to be agreed

1073. Measuring Devices

Buyer's supply

1080. ELECTRIC SPARES AND STORES - Builder's Supply

Electrical spares and stores to be as per Builder's standard supply according to the following list:

1 - Digital multimeter, DT-830
1 - Clamp-on ammeter, F-302
1 - Plier universal, 203 mm (8")
1 - Plier needle nose, 162 mm (6")
1 - Cutting plier, 162 mm (6")
1 - Peeling plier, 203 mm (8")
1 - Adjustable spanner, 102 mm (4")
1 - Adjustable spanner, 203 mm
1 - Knife
1 - Set screw driver crossheads (8 units)
1 - Screw driver, short handle, 2.6 mm
1 - Screw driver, short handle, 4 mm
1 - Screw driver, short handle, 6 mm
1 - Screw driver, long handle, 2.6 mm
1 - Screw driver, long handle, 4 mm
1 - Screw driver, long handle, 6 mm
2 - Watch marker screw drivers, 1.6 mm
1 - Soldering iron, 60 W, 220 V, bend head
1 - Soldering iron, 160 W, 220 V, rod type
1 - Snips
1 - Hammer, 1 kg
1 - Hammer, 0.5 kg
1 - Pair of rubber gloves
2 - Soldering iron
2 - Hydrometers
2 - Rolls of insulation tape of each following colours: red, yellow, brown, blue, black (to be marked in polyvinyl fluoride)
10 - Sheets of sand paper, no. 1
2 - Flash lights, w/battery
2 - Bottles distilled water, 20 l
1 - Bottle sulphuric acid, 10 l
1 - Megger, 500 V

1081. Additional Generator Spares

Buyer’s supply according to contract.

1082. Switchboard Spares

Builder’s supply to be as per manufacturer’s standard.

For main switchboard in general:

- No fuse breaker (1 for each 10)

For main switchboard and emergency switchboard:

- Fuse element (1 for each 10)
- Spring (ACB & relay) (1 for each 10)
- Contact-segment for ACB (1 for each 10)
- Contact-segment for relay (1 for each 10)
- Magnetic coil (1 for each 10)
- Resistor (1 for each 10)
- Pilot lamp (1 for each 10)
- Globe of pilot lamp (1 for each 10)
- Rectifier (1 for each 10)
- Condenser (1 for each 10)
- Control switch and change over switch (1 for each 10)
- Relay
- Timer (1 for each 10)

For control gear magnetic contactor:

- For motors of 30 kW and below, 1-complete set for each 10 or less

For motors of more than 30 kW:

- Contact segment (1 for each 2)
- Spring (1 for each 4)
- Magnetic coil (1 for each 6)
- Aux. relay (1 for each 10)
- Over current thermal relay (1 for each 10)
- Pilot lamp (1 for each 10)
- Globe of pilot lamp (1 for each 10)
- Potential transformer for control circuit (1 for each kind)
- Potential transformer for pilot lamp (1 for each 10)
- Push button (1 for each 10)
- Control switch and change over switch (1 for each 10)
- Resistor (1 for each 10)
- Rectifier (1 for each 10)
- Condenser (1 for each 10)
- Printboard (1 for each kind)

For section and distribution boards and group panel:

- Pilot lamp (1 for each 10)
- Globe of pilot lamp (1 for each 10)
- Relay (1 for each kind)
- Timer (1 for each 10)
- Rectifier (1 for each 10)
- Condenser (1 for each 10)
- Annunciator (1 for each 10)
- Resistor (1 for each 10)
- Resistor for dimmer switch (1)
- Switch (1 for each 10)
- Cover for emergency stop switch (1 for each 10)

For electric welder:
- Glass for hand shield and helmet (1 for each 1)
- Connecting metal (2)

1083. Additional Spares for Electric Power Devices
Buyer’s supply according to contract.

1085. Spares for Communication Equipment
Manufacturer’s standard supplies.

1086. Spares for Navigation Equipment
Manufacturer’s standard supplies.

1087. Spares for Centralised Instrumentation
Manufacturer’s standard supplies.
### APPENDIX 1: MAKERS’ LIST

(See also item 034)

<table>
<thead>
<tr>
<th>NO.</th>
<th>NAME</th>
<th>COUNTRY</th>
<th>MAKER/AGENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Main Engine</td>
<td>China/Korea</td>
<td>- MAN B&amp;W License</td>
</tr>
<tr>
<td>2</td>
<td>Shafting</td>
<td>China</td>
<td>- Chinese (WARTSILA)/Shanghai</td>
</tr>
<tr>
<td>3</td>
<td>Fore and Aft Stern</td>
<td>Japan</td>
<td>- JMT (WARTSILA)/Shanghai</td>
</tr>
<tr>
<td>4</td>
<td>Fore and Aft Bush</td>
<td>Japan</td>
<td>- JMT (WARTSILA)/Shanghai</td>
</tr>
<tr>
<td>5</td>
<td>Main Diesel Generator Sets</td>
<td>China</td>
<td>- Holeby/Shanghai - Daihastu/Shanghai</td>
</tr>
<tr>
<td>6</td>
<td>Emergency Diesel Generator Set</td>
<td>KOREA</td>
<td>- Cummins/Donghyun</td>
</tr>
<tr>
<td>7</td>
<td>Composite Boiler</td>
<td>Germany/China</td>
<td>- Saack/Shanghai</td>
</tr>
<tr>
<td>8</td>
<td>Gear Pump Driven by Motor</td>
<td>UK</td>
<td>- HamworthyKSE/Shanghai</td>
</tr>
<tr>
<td>9</td>
<td>Centrifugal Pumps Driven by Motor</td>
<td>UK</td>
<td>- HamworthyKSE/Shanghai</td>
</tr>
<tr>
<td>10</td>
<td>Screw Pump Driven by Motor</td>
<td>UK</td>
<td>- HamworthyKSE/Shanghai</td>
</tr>
<tr>
<td>11</td>
<td>Snake Pump Driven by Motor</td>
<td>UK</td>
<td>- HamworthyKSE/Shanghai</td>
</tr>
<tr>
<td>12</td>
<td>Air Compressor</td>
<td>Germany</td>
<td>- J.P.SAUER/HOITUNG</td>
</tr>
<tr>
<td>13</td>
<td>Oil Purifier for Fuel Oil</td>
<td>Germany</td>
<td>- Westfalia/Shanghai</td>
</tr>
<tr>
<td>14</td>
<td>Oil Purifier for Lub. Oil</td>
<td>Germany</td>
<td>- Westfalia/Shanghai</td>
</tr>
<tr>
<td>15</td>
<td>Fresh Water Generator</td>
<td>Sweden</td>
<td>- Alfa-Laval/Shanghai</td>
</tr>
<tr>
<td>16</td>
<td>Sewage Treatment Plant</td>
<td>UK/China</td>
<td>- HamworthyKSE/Shanghai</td>
</tr>
<tr>
<td>17</td>
<td>Incinerator</td>
<td>China</td>
<td>- Teamtec licence/HAICHEUNG</td>
</tr>
<tr>
<td>18</td>
<td>Oil Water Separator</td>
<td>Germany</td>
<td>- HamworthyKSE/Shanghai</td>
</tr>
<tr>
<td>19</td>
<td>Control Air dryer</td>
<td>Germany</td>
<td>- Ultrafilter/EVERBRIGHT</td>
</tr>
<tr>
<td>20</td>
<td>Drinking Water Sterilizers</td>
<td>Sweden</td>
<td>- Alfa-Laval/Shanghai</td>
</tr>
<tr>
<td>21</td>
<td>Eductor</td>
<td>Norway</td>
<td>- Teamtec licence/HAICHEUNG</td>
</tr>
<tr>
<td>22</td>
<td>Ventilating Fan</td>
<td>China</td>
<td>- Hengyuan/New Long March (NLM)</td>
</tr>
<tr>
<td>23</td>
<td>Plate Cooler</td>
<td>Denmark</td>
<td>- APV/Shanghai</td>
</tr>
<tr>
<td>25</td>
<td>Fuel Oil Supply Unit</td>
<td>China</td>
<td>- Aura Marine/Shanghai</td>
</tr>
<tr>
<td>NO.</td>
<td>NAME</td>
<td>COUNTRY</td>
<td>MAKER/AGENT</td>
</tr>
<tr>
<td>-----</td>
<td>----------------------------------------------------</td>
<td>---------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>26</td>
<td>Work Equipment</td>
<td>Norway</td>
<td>- Unitor (Gas Welding)/Shanghai</td>
</tr>
<tr>
<td></td>
<td></td>
<td>China</td>
<td>- Chinese maker/NLM</td>
</tr>
<tr>
<td>28</td>
<td>Remote Control Valve System</td>
<td>Germany/China</td>
<td>- Pleiger/Shanghai</td>
</tr>
<tr>
<td>29</td>
<td>Air Receiver (manhole cover to be big enough)</td>
<td>China</td>
<td>- SAACK/Shanghai</td>
</tr>
<tr>
<td>30</td>
<td>Pressure Tanks</td>
<td>China</td>
<td>- Chinese maker/NLM</td>
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<tr>
<td>31</td>
<td>CO2 Fire Extinguishing Equipment</td>
<td>Norway</td>
<td>- Unitor/Shanghai</td>
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<tr>
<td></td>
<td>Local water spray fire-fighting system</td>
<td>Denmark</td>
<td>- Novenco/Shanghai</td>
</tr>
<tr>
<td>32</td>
<td>Fire Alarm &amp; Detecting System</td>
<td>UK</td>
<td>- TYCO/Shanghai</td>
</tr>
<tr>
<td>33</td>
<td>M/E Remote Control Sys.</td>
<td>Denmark/China</td>
<td>- Lyngso Marine/Shanghai</td>
</tr>
<tr>
<td>34</td>
<td>Level Switches</td>
<td>Germany/China</td>
<td>- Pleiger/Shanghai</td>
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<tr>
<td>35</td>
<td>Air Condition Plant</td>
<td>Denmark</td>
<td>- York/Shanghai</td>
</tr>
<tr>
<td></td>
<td>Packaged Air Conditioner</td>
<td>Denmark</td>
<td>- York/Shanghai</td>
</tr>
<tr>
<td></td>
<td>Ref. Provision Plant</td>
<td>Denmark</td>
<td>- York/shanghai</td>
</tr>
<tr>
<td>36</td>
<td>Windlass of split type with Mooring Winch and Mooring Winch</td>
<td>Korea/China/Norway</td>
<td>- Rolls-Royce (Licence)/Shanghai</td>
</tr>
<tr>
<td>37</td>
<td>Crane</td>
<td>Japan/China</td>
<td>- IHI/Shanghai</td>
</tr>
<tr>
<td>38</td>
<td>Steering Gear</td>
<td>China/Korea</td>
<td>- Ulstein/Shanghai</td>
</tr>
<tr>
<td>39</td>
<td>Anchors</td>
<td>China</td>
<td>- Chinese Maker/Marinehub</td>
</tr>
<tr>
<td>40</td>
<td>Anchor Chain</td>
<td>China</td>
<td>- Chinese Maker/Marinehub</td>
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<td>41</td>
<td>Accommodation Ladders</td>
<td>China</td>
<td>- Chinese Maker/NLM</td>
</tr>
<tr>
<td>42</td>
<td>Lifeboats &amp; Rescue Boats</td>
<td>China</td>
<td>- Jiangyin NPT/Shanghai</td>
</tr>
<tr>
<td>43</td>
<td>Liferafts</td>
<td>France</td>
<td>- Zodiac/Trans-sea</td>
</tr>
<tr>
<td>44</td>
<td>Lifeboats Davits</td>
<td>Netherlands/China</td>
<td>- Ned Deck Marine/Trans-sea</td>
</tr>
<tr>
<td>45</td>
<td>Rescue Boats Davits</td>
<td>Netherlands/China</td>
<td>- Ned Deck Marine/Trans-sea</td>
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<tr>
<td>46</td>
<td>Paint</td>
<td>China</td>
<td>- Sigma/Shanghai</td>
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<tr>
<td>47</td>
<td>Provision Crane also for life raft, Rescue boat</td>
<td>Netherlands/China</td>
<td>- Ned Deck Marine/Trans-sea</td>
</tr>
<tr>
<td>48</td>
<td>Cargo Hatchcover</td>
<td>China-Norway</td>
<td>- TTS/Shanghai</td>
</tr>
<tr>
<td>49</td>
<td>Galley Equipment</td>
<td>Singapore</td>
<td>- Kangli/Singapore</td>
</tr>
<tr>
<td>50</td>
<td>Laundry Equipment</td>
<td>Singapore</td>
<td>- Kangli/Singapore</td>
</tr>
<tr>
<td>NO.</td>
<td>NAME</td>
<td>COUNTRY</td>
<td>MAKER/AGENT</td>
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<tr>
<td>-----</td>
<td>---------------------------------------------------</td>
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<td>-------------------------------</td>
</tr>
<tr>
<td>51</td>
<td>Joiner Work (Partition bulkhead, Lining and ceiling)</td>
<td>China</td>
<td>- Chinese Maker/NLM</td>
</tr>
<tr>
<td></td>
<td>Modular toilets/ bathrooms</td>
<td>China</td>
<td>- Chinese Maker/NLM</td>
</tr>
<tr>
<td></td>
<td>Accommodation materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Main Switchboard</td>
<td>Singapore/China</td>
<td>- Schneider NSE/Shanghai</td>
</tr>
<tr>
<td>54</td>
<td>Emergency Switchboard</td>
<td>Singapore/China</td>
<td>- Schneider NSE/Shanghai</td>
</tr>
<tr>
<td>55</td>
<td>E/R Control Console</td>
<td>Denmark/China</td>
<td>- Lyngso Marine/Shanghai</td>
</tr>
<tr>
<td>56</td>
<td>W/H Control Console</td>
<td>China</td>
<td>- Everpine/shanghai</td>
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<tr>
<td>57</td>
<td>Battery Charging &amp; Discharging Panel</td>
<td>Singapore/China</td>
<td>- Schneider NSE/Shanghai</td>
</tr>
<tr>
<td>58</td>
<td>Shore Connection Box</td>
<td>Singapore/China</td>
<td>- Schneider NSE/Shanghai</td>
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<tr>
<td>59</td>
<td>Test Panel</td>
<td>Singapore/China</td>
<td>- Schneider NSE/Shanghai</td>
</tr>
<tr>
<td>60</td>
<td>Power Distribution &amp; Light Distribution Box Group Starter</td>
<td>Singapore/China</td>
<td>- Schneider NSE/Shanghai</td>
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<tr>
<td>61</td>
<td>Power Management</td>
<td>Denmark/China</td>
<td>- Lyngso Marine/Shanghai</td>
</tr>
<tr>
<td>62</td>
<td>Machinery Alarm and Monitoring System</td>
<td>Denmark/China</td>
<td>- Lyngso Marine/Shanghai</td>
</tr>
<tr>
<td>63</td>
<td>Switch Plug Socket</td>
<td>China</td>
<td>- Chinese Maker/NLM</td>
</tr>
<tr>
<td>64</td>
<td>Battery Telephone System</td>
<td>Norway</td>
<td>- Vingtor/Everpine</td>
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<tr>
<td></td>
<td>Automatic Telephone, PA &amp; Talk Back system</td>
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<td></td>
</tr>
<tr>
<td>65</td>
<td>Rudder Angle Indicator</td>
<td>China/Korea</td>
<td>- Ulstein/Shanghai</td>
</tr>
<tr>
<td>66</td>
<td>Air Horn &amp; Fog Horn</td>
<td>Germany</td>
<td>- Zonller/Marinequip</td>
</tr>
<tr>
<td>67</td>
<td>Gyro Compass &amp; Auto. Pilot</td>
<td>U.K.</td>
<td>- Kevin Hughes/Marinequip</td>
</tr>
<tr>
<td>68</td>
<td>External Signal Lights</td>
<td>Taiwan-China</td>
<td>- Shengan Marine/Marinequip</td>
</tr>
<tr>
<td>69</td>
<td>Marine Radio (GMDSS)</td>
<td>U.K.</td>
<td>- Kevin Hughes/Everpine</td>
</tr>
<tr>
<td>70</td>
<td>Echo Sounder</td>
<td>U.K.</td>
<td>- Kevin Hughes/Everpine</td>
</tr>
<tr>
<td>71</td>
<td>Doppler Log</td>
<td>U.K.</td>
<td>- Kevin Hughes/Everpine</td>
</tr>
<tr>
<td>72</td>
<td>Radar</td>
<td>U.K.</td>
<td>- Kevin Hughes/Everpine</td>
</tr>
<tr>
<td>73</td>
<td>Engine room crane</td>
<td>China</td>
<td>- Chinese maker/NLM</td>
</tr>
<tr>
<td>74</td>
<td>Propeller</td>
<td>China</td>
<td>- LIPS (WARTSILA)/Shanghai</td>
</tr>
<tr>
<td>75</td>
<td>Remote sounding system</td>
<td>Germany/China</td>
<td>- Pleiger/Shanghai</td>
</tr>
<tr>
<td>76</td>
<td>Automatic temperature control valves</td>
<td>UK</td>
<td>- AMOT/Ninghai</td>
</tr>
<tr>
<td>77</td>
<td>Automatic temperature control valves</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO.</td>
<td>NAME</td>
<td>COUNTRY</td>
<td>MAKER/AGENT</td>
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<tr>
<td>-----</td>
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<tr>
<td>78</td>
<td>Calorifier</td>
<td>China</td>
<td>- Chinese maker/NLM</td>
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<tr>
<td>79</td>
<td>Marine outittings (ladders, manhole covers, valves, main engine silencer, mooring equipments, life saving fire fighting equipments, rudder, hose cranes, marine transformer, etc.)</td>
<td>China</td>
<td>- Chinese maker/NLM</td>
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<tr>
<td>80</td>
<td>Steel plate and profiles, steel pipes. etc.</td>
<td>China</td>
<td>- Chinese maker/as per the Buyer’ suggestion</td>
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<tr>
<td>81</td>
<td>ICCP</td>
<td>Italy</td>
<td>- ACG/Shanghai</td>
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<tr>
<td>82</td>
<td>CCTV</td>
<td>Norway</td>
<td>- Oceanor/Trans-sea</td>
</tr>
<tr>
<td>83</td>
<td>Automatic FO and LO filters</td>
<td>Sweden</td>
<td>- Alfalava/Shanghai</td>
</tr>
<tr>
<td>84</td>
<td>Shaft torque meter</td>
<td>UK</td>
<td>- SEATECHNIC/Shanghai</td>
</tr>
<tr>
<td>85</td>
<td>Electric Cable</td>
<td>Europe/Korea</td>
<td>- European/Korea Maker/ZMEEC</td>
</tr>
<tr>
<td>86</td>
<td>Load computer/ software</td>
<td>KOREA</td>
<td>- TECHMarine/Donghyun</td>
</tr>
<tr>
<td>87</td>
<td>Master Clock</td>
<td>Japan</td>
<td>- SEIKO/Marinequip</td>
</tr>
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<td>88</td>
<td>VDR</td>
<td>UK</td>
<td>- Kelvin Hughes/Shanghai</td>
</tr>
<tr>
<td>89</td>
<td>AIS</td>
<td>UK</td>
<td>- Kelvin Hughes/Shanghai</td>
</tr>
</tbody>
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