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**36,000 TONNES DEADWEIGHT
DOUBLE HULL BULK CARRIER**

OUTLINE SPECIFICATION

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1 SHIP GENERAL

1.1 Description

This document is intended to briefly describe, in conjunction with the General Arrangement (Drawing No 100_01) and other drawings provided in Annex A, the main technical requirements appertaining to the procurement and subsequent building of a '36000 Tonnes Deadweight, Double Hull Bulk Carrier'.

The ship is designed for worldwide operation and includes the following primary features :

- A single screw propulsion system, with slow speed engine
- A double skinned, single deck hull structure
- Five main holds for the carriage of grain and other bulk cargoes
- All holds are designed to be suitable for grab discharge of cargoes
- The ship complies with the latest SOLAS, IMO and IACS regulations

The ship's hull is designed with a raked stem above the waterline, a bulbous bow and transom stern, an integral Forecastle is also featured.

The main propulsion machinery is fitted in the aft part of the hull. The ship is also equipped with a bilge keel to provide a dampening effect on the rolling characteristics.

Cargo can be carried in all holds or in alternate holds arrangement, with either Nos 2 & 4 Holds OR No 3 Hold empty.

Water ballast, fuel oil, fresh water etc are arranged to be carried in tanks as arranged on the General Arrangement drawing, No 3 Hold has been designated as a floodable hold for the purpose of carrying Water Ballast.

All necessary arrangement and class drawings, to be approved by Flag Authority and/or Classification Society are to be BMT delivery, according to agreed list of deliverables.

Drawings and documents relating to Owner's supplied equipment are to be Owner's delivery.

All workshop/manufacture drawings are to be shipyard delivery.

1.2 Precedence & Standards

In case of discrepancies between this Specification and any other information provided, the Specification will take precedence unless agreed in writing by the Owner.

All necessary documentation and drawings are to be in the English Language.

Metric units are used throughout all documentation for this proposal, unless specified otherwise within this specification; all dimensions are given in millimetres. Likewise the completed vessel is generally to have all equipments, gauges, dials and instrumentation in metric units, unless agreed in writing by the Owners.

The vessel is to be built to the highest standards of workmanship, with all materials and equipments in compliance with the latest Classification Society Rules and Statutory Regulations.

All machinery, equipments and furnishings are to be suitable for operation in the marine environment, with ambient conditions ranging from Sub-Arctic to Tropical, as given below.

	MAXIMUM	MINIMUM
External Ambient Temperature	+ 40.0 °C	-15.0 °C
Internal Temperature	+ 25.5 °C	+21.0 °C
Sea Water Temperature	+ 35.0 °C	-1 °C

1.3 Owner's Supply Equipment

The shipyard will agree with the owner a complete list of items that are to be supplied by the owner, at a time to be agreed with the shipyard and in satisfactory condition ready for installation. The equipment is to be appropriately stored in a secure location by the shipyard between delivery and installation on the vessel.

1.4 Build Schedule

The shipyard will agree with the owner as soon as possible the building schedule for the vessel. The building schedule is to include provision for regular meetings between Owners and Shipyard representatives, to assess progress and agree appropriate actions to facilitate timely completion and delivery of the vessel.

1.5 Principal Particulars and Classification

1.5.1 Principal Dimensions

Length Overall (LOA)	182.700	Metres
Length B.P.	175.000	Metres
Breadth Moulded (at Upper Deck)	30.000	Metres
Depth Moulded (to Upper Deck)	14.900	Metres
Draught to Summer Load WL (Moulded)	10.500	Metres

Note: Moulded summer load draught is the maximum draught at which the vessel is allowed to operate.

1.5.2 Speed and Endurance

The vessel is to be capable of a service speed of 14.5 knots at the summer load draught, with the main engines developing 85% of maximum continuous rating, in conditions not exceeding sea state 3 and wind speed not exceeding Beaufort scale 3. Consumables (Fuel, Fresh Water, Provisions etc) are to be suitable for an endurance of 15,000Nm at the summer load draught.

1.5.3 Deadweight

The estimated total deadweight of the vessel (including cargo and all consumables), in salt water having a specific gravity of 1.025 t/m³, is about 35870 tonnes at the summer load draught of 10.5m.

1.5.4 Capacities

Estimated fluid and cargo capacities (subject to confirmation) are as follows:

Heavy Oil.....	2350	Cu. Metres
Diesel Oil.....	270	Cu. Metres
Lubricating Oil	110	Cu. Metres
Fresh Water	300	Cu. Metres
Ballast Water.....	8190	Cu. Metres
Ballast Water (in No 3 Hold floodable)	10115	Cu. Metres
Ballast Water (incl No 3 Hold floodable).....	18305	Cu. Metres
Cargo Hold Capacity (Total)	46600	Cu. Metres

1.5.5 Complement

The vessel has accommodation arranged for a total of 29 persons as listed below:

Captain Class.....	2	Suite
Senior Officer Class.....	2	Suite
Junior Officer Class	8	in single cabins
Petty Officer Class	3	in single cabins
Rating Class.....	12	in single cabins
Owner.....	1	Suite
Pilot	1	single cabin

In addition there shall be arranged dayroom, mess, galley, provision stores etc as described elsewhere in this specification and as shown on the General Arrangement drawing.

1.5.6 Flag Authority and Classification

The vessel is to be built to the list of rules and regulations given below (not necessarily exclusive).

The choice of Flag State is of the Owner's preference, to be advised before contract.

The vessel is to be constructed to the latest rules of Det Norske Veritas for steel ships (or other authority if preferred) and (IACS Common Structural Rules 2006) with the following typical class notations: or their equivalent from BV,LR,GL

DnV +1A1, Bulk Carrier, ESP, CSR, GRAB(X), BC-A,EO, ES(D), CLEAN DESIGN, COAT-1, LCS, with additional notations - "Strengthened for Heavy Cargoes", Nos 2 & 4 Holds OR No 3 Hold may be empty.

In addition to the above, each including the latest versions and amendments:

- 1). International convention for the Safety of Life at Sea (SOLAS) 1974, including 1978 and 1988 Protocols and all amendments up to the 2004 Consolidated edition.
- 2). International Load Line Convention 1966, including the 1988 protocol and subsequent amendments 2003.
- 3). International convention for the Prevention of Pollution from Ships (MARPOL) 1973, including the 1978 & 1997 protocols and all amendments up to October 2004.
- 4). International Tonnage Convention 1969 (London).
- 5). International Labour Organisation (Nos 92 and 133) concerning crew accommodation on board Ships, Geneva 1949.
- 6). International Tele-Communication Regulations (1973), Radio Regulations (1982), GMDSS certification for sea area A3.
- 7). International Convention for the Prevention of Collisions at Sea 1972, including all amendments up to 2001.
- 8). IMO Resolution A468 (XII), Code for Noise Levels on board Ships.
- 10) Intact Stability to A749 and Damage Stability to SOLAS 74/78.
- 11) IMO resolution MSC 23(59) International Code for the Carriage of Grain 1991.
- 12) All other IMO resolutions and standards as required for this type of vessel.
- 13) All Flag Rules as appropriate to the ship type and choice of Flag Authority.

1.5.7 Commissioning and Trials

The shipyard is to carry out commissioning and trials of the vessel and its main equipments to prove that the specified performance is achieved. A suitable programme of tests and trials is to be agreed by Shipyard and Owner.

2 HULL

2.1 Hull Materials

All materials to be used in the vessel's construction (including forgings and castings) are to be of marine quality, tested, inspected and certified as and when required by the Classification Society.

The bottom shell, exposed decks and side shell are to be of 'A' quality steel throughout, unless required otherwise by Class or specified on scantlings drawings.

The material protection system internal and external (including sacrificial anodes) is to be designed suitable to the vessels role and the environmental conditions stated in section 1.3, for a minimum life of 5 years. Surface preparation and application is to be in accordance with paint manufacturers recommendations and as approved by the Owner.

2.2 Welding

Welding is to be in accordance with Classification Society requirements, wherever applicable and to best shipyard practice elsewhere, all electrodes to be of Classification Society approved manufacture and type. The welding sequence is to be carefully planned in order to minimise shrinkage and distortion, any distortion or unfairness to be corrected during the assembly process.

Intermittent welding is not to be applied in water tanks (Fresh Water and Water Ballast), in wet spaces or on external decks.

2.3 Testing

X-ray and Ultrasonic testing of welding to be carried out as required by Classification Society.

All tanks are to be water tested or air pressure tested by the Classification Society.

2.4 Construction

Hull and Superstructure are to be generally of all welded construction, scantlings as required by the Classification Society, unless exceeded specifically by this specification or at Owner's request.

The vessel is generally to be transversely framed at the side shell with the Upper deck longitudinally stiffened and a double bottom of cellular type construction, see structural drawings for details.

Insert plates of increased thickness (and/or higher grade) are to be arranged in way of major shell openings and in any areas expecting higher than normal loadings.

During fabrication and assembly utmost care should be taken to ensure good alignment and fairness, keel sightings, block alignment and shell measurements to be recorded at intervals as agreed with the Classification Society and the Owner.

Sources of corrosion are to be eliminated wherever possible and all plating corners to be rounded. Butts and seams are to be kept well clear of corners and plating is to be carefully erected to minimise hollows (especially in exposed areas).

The hull is to be properly earthed throughout the entire building period.

2.5 Tanks

The capacities for storage tanks, as shown on the Tank Plan, are to be suitable for the carriage of liquids with the following specific gravities:

Fresh/Potable Water	SG	1.000
Salt Water Ballast	SG	1.025
Heavy Oil	SG	0.985
Diesel Oil	SG	0.900
Lub Oil	SG	0.900

2.6 Material Protection

The vessel will be painted and coated according to the procedures and requirements of Paint Manufacturer

External Painting

External painting is to be completed as far as practicable, prior to launch, and according to the paint manufacturer's recommendations.

All external welds and damaged primer to be sandblasted and touched up. Preferably, all welding is to be finalised prior to start-up of sand blasting.

Edges and welding seams in exposed areas to be stripe coated before coating is applied.

Before coating is applied, all fat, oil, grease salt and other contamination's are to be completely removed.

All painting and material protection work to be carried out in accordance with good workmanship, common good practice and specification from manufacturer by rolling or spraying according to recommendation for the different types of coating.

The paint to be applied as received from the manufacturer. Oils, thinner and other drying liquids shall not be added except when specified from the manufacturer.

Parts of steel that are riveted or bolted together are to have adequate protection on the joint areas.

Colours to be in accordance to the Owners preferred colour scheme.

Specified paint thickness is to be considered as minimum thickness in dry condition.

Painting supervision and inspection during the building period is to be carried out in accordance with the Owners and the paint manufacturers recommendations.

Paint specification

All paints to be certified as being TBT free.

Pre-treatment of steel surface

According to paint supplier recommendations

2.7 Material Protection Internal

Grinding

All sharp edges are to be ground to a minimum radius of 3mm on structure exposed to ballast or weather and to a minimum radius of 2mm elsewhere. Grinding to be completed before application of first coat of primer.

Internal Painting

Internal painting is to be completed as far as practicable, prior to launch, and according to the paint manufacturer's recommendations.

All internal welds and damaged primer in dry rooms to be steel brushed and touched up with zinc primer before coating.

Specification of paintwork internal shall be similar to external specification.

All edges and welding seams in tanks to be stripe coated before and between coating layers.

Pre-treatment of steel surface

According to paint supplier recommendations and IMO MSC.215(82).

2.8 External Cathodic Protection

Galvanic anode protection

Anodes for cathodic protection against corrosion are to be arranged in sea chests.

Impressed current protection

An impressed current cathodic protection system is to be fitted.

The system to consist of following equipment:

A controller with power supply and ammeter.

Instrumentation for reference cell voltage and anode current.

Current density is to be approx. 35 mA/m².

2.9 Internal Cathodic Protection

Galvanic anode protection

Anodes for cathodic protection against corrosion are to be arranged in all dedicated ballast tanks.

3 HULL OUTFIT

3.1 Cargo Hatches

Each of the five main holds is to be equipped with flat topped, hydraulically operated, watertight, folding steel hatch covers. Covers for each hatch are to comprise one pair folding forwards and one aft, with each pair being capable of separate operation, central hydraulic power-pack is to be arranged at a suitable location.

Cargo hatch covers are to be equipped with cement/grain loading ports and hatch coamings should be provided with sampling and temperature monitoring apertures.

The hatch covers are all to be designed for a uniform loading of 2.5 tonnes/m² and all hatches are to be constructed with elliptical corners.

The dimensions of cargo hatches are to be as follows :

No. 1 Cargo Hatch	15.20m	x	15.75m
No. 2 Cargo Hatch	19.20m	x	20.50m
No. 3 Cargo Hatch	19.20m	x	20.50m
No. 4 Cargo Hatch	19.20m	x	20.50m
No. 5 Cargo Hatch	19.20m	x	20.50m

3.2 Deck Cranes

The ship is to be equipped with electro-hydraulic deck cranes as shown on the General Arrangement drawing and as listed below :

Between Nos. 1 & 2 Cargo Hatches	30 tonnes SWL
Between Nos. 2 & 3 Cargo Hatches	30 tonnes SWL
Between Nos. 3 & 4 Cargo Hatches	30 tonnes SWL
Between Nos. 4 & 5 Cargo Hatches	30 tonnes SWL

The maximum working radius of the cranes is to be 24 metres, with the jib horizontal.

Grab to be furnished and supplied by the owners at their own expense.

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

3.3 Deck Loadings

The Upper deck is to be designed for the carriage of deck cargoes equivalent to a height, level across the ship, of 3.5 metres above the deck, at a stowage rate of 1.4 cubic metres/tonne and suitable for a maximum uniform loading of 2.5 tonnes/sq metre.

The Tank Top in each hold is to be designed for a maximum uniform loading of 20.0 tonnes / sq metre and also to be specifically strengthened to allow grab discharging of cargo.

3.4 Crane Houses

Steel houses are to be arranged between each pair of hatches, as shown on the General Arrangement drawing, to support the cargo deck cranes. The houses are to be sub-divided to contain hold accesses, hydraulic equipment for hatches & cranes, paint stores etc.

3.5 Stores Crane

One (1) stores crane is to be positioned aft (port side), close to storeroom locations, to be suitable for operation at 2 tonnes SWL at 10 metres working radius.

3.6 Accommodation Ladders

Two light alloy, self-stowing accommodation ladders are to be fitted each approximately 11 metres long, complete with portable electric winch and davit fittings. The ladders to be arranged one each side of the ship adjacent to No 4 crane house.

3.7 Mooring Equipment

The anchors and mooring equipment are to be installed according to equipment number from DNV Classification Rules. Mooring and towing lines sufficient for intended service requirements are also to be supplied.

Subject to confirmation of final equipment numeral the following to be supplied - three (3) stockless Bower anchors (including the spare), each of 7350 kg mass, complete with a minimum length of 605 metres of stud link chain cable of 3010 kN breaking strength.

A minimum length of 240 metres of mooring wire of breaking strength 1453 kN is required and at least 5 mooring lines of minimum length 200 metres with breaking strength 480 kN.

Two hydraulically operated automatic tensioning mooring winches, combined with windlass units suitable for 76mm diameter grade NV K2 steel chain cable, are to be fitted on the Forecastle deck (one port and one starboard).

Two hydraulically operated automatic tensioning mooring winches are to be fitted on the Upper deck aft (one port and one starboard).

In addition all necessary equipment to provide a completely effective mooring system are to be installed including – chain stoppers, mooring pipes, bollards, fairleads, smit brackets, chocks etc. Mooring pipes and Panama fairleads are also to be suitably positioned along the Upper deck for Panama Canal transit.

3.8 Steering Gear

The ship is to be equipped with a rotary vane or ram type steering gear, located above the aft peak tank, as shown on the General Arrangement drawing.

3.9 Rudder

A semi balanced rudder of double plate construction and streamlined section is to be fitted, the rudder to be of such area as to provide optimum steering characteristics for the ship.

3.10 Lifesaving Equipment & Rescue Boat

The ship is to be equipped with a totally enclosed lifeboat suitable for the total complement, arranged on the Upper deck to free-fall over the stern (as shown on the General Arrangement).

A davit launched rescue boat (a 4.5 metre semi-rigid inflatable powered by a 40hp outboard motor) is to be fitted at Upper deck level, adjacent to the superstructure on the starboard side of the ship.

Other lifesaving equipment (including life rafts, lifejackets and lifebuoys etc) in accordance with SOLAS requirements is to be supplied, located generally as shown on the General Arrangement.

3.11 Hatches

Watertight hatches, of approved type and construction, approximately 800mm x 800mm are to be provided in way of emergency escapes and for general access, as shown on the General Arrangement and in the table below.

LOCATION (Approx)	CLEAR OPENING (mm)	TYPE	TYPE OF OPENING DEVICE
1 off Upper Dk (Aft) Rope Stores Hatch	800 x 800 Approx	Hinged Flush Watertight	Manual Dogged
1 off Upper Dk (P) Engine Stores Hatch	1400 x 1400 Approx	Hinged Flush Watertight	Manual Dogged
1 off Upper Dk (Fwd) Fore Peak Stores Hatch	800 x 800 Approx	Hinged Flush Watertight	Manual Dogged
1off Forecastle Dk Rope Stores Hatch	800 x 800 Approx	Hinged Flush Watertight	Manual Dogged

4 CREW EQUIPMENT

4.1 Outfitting General

Detailed design and construction of the accommodation and its various systems is the responsibility of the Shipyard, based on the contents of this specification and the General Arrangement.

Materials to be used in the accommodation are to be of best marine quality throughout and suitable for the climatic conditions given in section 1.3. Non-combustible and /or fire retardant materials and doors are to be used where necessary and as required by the Class and/or Flag authorities. All joinery work is to be in accordance with best shipbuilding practice.

Throughout all living and working spaces, the clear height between floor and ceiling is not to be less than 2100mm.

Windows and doors of approved type and manufacture are to be provided throughout the accommodation.

All main stairways within the accommodation are to be enclosed by A60 insulated steel bulkheads, fitted with self-closing A60 rated access doors at each deck level.

All soft furnishings, upholstery, curtains, napery, linen etc are to be supplied by the shipyard.

4.2 Crew Accommodation

The crew accommodation, arranged as shown on the General Arrangement, is to be fitted out with furnishings and equipment to good marine standard, as follows:

Captain & Chief Engineer	Suite with dayroom, bedroom and bathroom
Senior Officers	Suite with dayroom, bedroom and wc/shower
Junior Officers	single berth cabins with wc/shower
Petty Officers	single berth cabins with wc/shower
Junior Crew	single berth cabins with wc/shower

4.3 Owner and Pilot Cabins

The Owner is to be provided with a suite on the Upper Bridge deck comprising dayroom, bedroom and separate wc/shower.

A Pilot's cabin with separate wc/shower is to be arranged at Navigating Bridge deck level adjacent to the Wheelhouse.

4.4 Public Spaces

The vessel is to be provided with the following spaces, suitable for intended purpose and fitted out with furnishings and equipment to best shipyard standard, appropriate to the stated complement.

Galley	Duty Mess
Officers Saloon	Crews Mess Room
Officers Lounge	Crew Recreation Room
Engineers Changing Room	Laundry / Drying Room
Hospital	Ship's Office
Engineer's Office	Tally Clerks Office

4.5 Storerooms and Offices

Various offices, stores and lockers are arranged throughout the vessel, as listed below, they are to be furnished and equipped suitable for their intended use.

Battery Locker	Navigating Bridge Deck
Fore Peak Store	Upper Deck
Forecastle Store	Upper Deck
Refrigerated Stores	Upper Deck Stbd
Dry Provisions Store	Upper Deck Stbd
Paint Store	No 1 Crane House
Deck Stores	Nos 1, 2 & 3 Crane House
Engineers Store	Upper ER Flat Port
Electricians Store	Upper ER Flat Port

NB: The above compartment list is not necessarily exclusive.

4.6 Sewage Treatment and Garbage Disposal

A marine vacuum type sewage system, complete with holding tank and treatment plant, is to be arranged as shown on the General Arrangement (see section 7.7.4 for full details). The system is to be suitably sized for the complement, it is required to comply with all rules & regulations for worldwide operation.

One incinerator of about 180,000kCal/hr capacity (210kW) is to be arranged adjacent to the funnel (port side) on the Upper Deck, to be capable of handling oil sludge as well as ship's usual garbage.

4.7 Ventilation / air-conditioning systems for accommodation

The vessel is to be equipped with an air conditioning plant for accommodation with hot water from heat recovery/boiler as heating medium and single spiro-duct air distribution system. Air conditioning fans to be pressure controlled. Air terminal units to be installed in cabins, common areas, offices, dry provision rooms, laundries, wardrobes, instrument room and wheelhouse. In addition, dampers for ventilation of air-conditions room to be installed at air condition central.

Separate air-conditioning plant (AC-2) for wheelhouse and instrument room based on 100% return air and fresh air from AC-1 heating battery in ducts to defroster nozzles to be installed.

Cooling medium based on direct expansion, of approved type.

Design conditions

Outdoor air at winter	-15°C
Indoor air at winter	+20°C
Fresh water cooling temperature	+38°C
Sea water temperature	+35°C
Outdoor air in summer	+40°C and 80 % relative humidity
Indoor air in summer	+25°C and 50 % relative humidity

Return air from accommodation

Return air from cabins and common areas partly through sanitary spaces and partly through grilles at lower part of entrance doors. Return air from corridors separately to air condition central. Air condition unit to be dimensioned for maximum 50 % return air

4.8 Ventilation / air-conditioning systems for boiler / engine rooms

Three (3) off supply fans and 1 off exhaust fan for the engine room, frequency controlled axial fans with sound trap and automatic CO₂ dampers. Supply fans to be pressure/temperature controlled.

Capacity for each fan is approx. 36 000 m³/h.

One (1) of the fans to be reversible and is to have power from emergency switchboard.

Inlets to be protected from sea and fitted with drain.

Manual dampers to be installed in end of duct system in engine room.

Separate exhaust duct is to be arranged from the main engine room to Upper Deck.

Additional fans and heating/cooling are to be provided to control rooms and auxiliary spaces as required.

4.9 Ventilation / air-conditioning systems for Cargo Holds

Cargo holds are to be naturally ventilated, with supply and exhaust ducting to be arranged through the crane houses and designed to classification society requirements.

5 MACHINERY

5.1 General

The main machinery and equipment are to be constructed and installed under survey in compliance with Classification rules as appropriate to its Class notations and are to be complete with all normal spares, outfitting and accessories.

Unless specifically required otherwise by the rules, all machinery, equipment and heat exchangers are to be capable of continuous 24-hour operation, at maximum rated output with water and ambient air conditions as follows:

Sea Water	-1 to +35° C
Fresh Water	+38° C Constant
Air	+45° C at 60% relative humidity

All equipment is to be capable of operating (if unavoidable - at reduced output) in an air temperature range of -15° C + 40° C.

Machinery foundations are to be specifically designed to keep noise and vibration levels in the engine room within acceptable levels, throughout all loading conditions.

5.2 Main Propulsion Machinery

The main engine is a low-speed, direct-reversible, single-acting, two-stroke engine, comprising crosshead-guided running gear, hydraulically operated poppet-type exhaust valves, turbocharged uniflow scavenging system and oil-cooled pistons.

The engine is designed for running on a wide range of fuels from marine diesel oil (MDO) to heavy fuel oils (HFO) of different qualities, with a viscosity of 380 centistokes at 50° C.

The main engine (MAN B&W 5S50MC-C7 or Wartsila 6RTA48T-B) will be capable of generating a maximum continuous power of about 7900 kW at 127rpm and will be direct coupled to a right-handed propeller.

The main engine should also feature a constant-pressure turbo-charging system comprising exhaust gas turbochargers and auxiliary blowers for low-load operation. All reasonable precautions are to be taken to prevent the possibility of scavenge or turbo-charger system fires.

5.3 Main Generators

The ship is to be fitted with three marine diesel generator sets. Each of the sets are to be supplied as complete units and are to consist of a medium-speed engine directly coupled to a generator and are to be resiliently mounted with flexible service connections.

The generator sets are to be designed such that start up can be achieved from 'black ship'.

The generator engines are to be, 4 stroke, turbocharged, medium speed, marine diesels, developing about 600kW MCR at 900-rpm max (owner supply) OR Hyundai 5H17/28 developing 520kW MCR at 900-rpm.

The generators are to be 3 phase, synchronous brush-less, self-excited and self-regulated at 440V and 60 Hz and are to be suitable for continuous parallel operation.

5.4 Emergency Generator

The emergency generator is to be located on the Lower Bridge Deck (Port side) between frames 10-18, rated at about 150kW, 440V, 3 phase, 60Hz and is to be of the brush-less type with not less than class 'F' insulation and class 'B' temperature rise. The generator shall be able to momentarily synchronise with the main generators during harbour mode, for load transfer purposes, subject to Class approval.

The engine is to be a 4 stroke, turbocharged, radiator cooled marine diesel, with local control panel

5.5 Boilers

Necessary steam for ship's service to be as follows.

Normal sea service: Exhaust gas section

Oil fired section (if necessary)

Port in/out service: Exhaust gas section & oil fired section

Port service: Oil fire section

5.6 Composite boiler

No. of set : One (1)

Type : Cylindrical vertical type boiler with burner and feed water regulator
(on/off control)

Evaporation

Oil fired section : 1200 kg/h

Exh. gas section : 1200 kg/h (at CSR of M/E under ISO reference condition)

Feed water temp. : 60? C

Steam state : 0.7MPa (working) saturated

6 MACHINERY SYSTEMS

6.1 General

All piping systems are to be designed for ease of maintenance and with the minimum variation in types and sizes, securing arrangements are to include suitable allowance for expansion. Extended spindles are to be provided for valves located in inaccessible positions.

All pumps to be from one major supplier, if practicable, they should be installed with non-return valves in the discharge line and arranged with isolating valves for maintenance purposes.

6.2 Fuel Oil

The ship's fuel oil system is to be marine fuel oil having a viscosity of 380cSt at 50°C and is to be used for operating the main engine, boiler, all main generators and incinerator. Filling connections are to be arranged on the Upper Deck (P & S), for bunkering of fuel storage tanks, via remote operated tank valves and bypass of the transfer pumps. The remote tank valves to be operated from the machinery control room.

Fuel Oil bunker tanks are to be arranged at the forward bulkhead of the machinery space and protected by cofferdams from the outer hull (port & stbd).

Service and settling tanks are to be arranged with cofferdam separation from outer hull, appropriately sized for the system, fully fitted to Class requirements with drip trays, drains, level alarms, etc. Pumps are to be arranged for local control and remote control from the machinery control room, fire stations and bunkering stations.

The system is to be complete with two automatic self-cleaning purifiers sized according to engine manufacturers recommendations, the purifiers drawing from the un-purified settling tanks and discharging to the service tanks.

Fuel oil drain tank, leakage tank and overflow tank to be suitably sized and arranged in the double bottom in way of engine room.

The emergency generator is to be located in a separate room with a separate service tank and is to operate on marine gas oil according to ISO 8217.

6.3 Lub Oil

Lubricating oil systems are to be provided for filling and emptying engines, gearboxes, etc. Systems are to be segregated to prevent mixing of different oils and to include suitable purifying capacity.

Various tanks are to be provided for storage of lub / hydraulic oils for major equipment with each tank having a separate filling line from the Upper Deck and fully fitted to class requirements with drip trays, drains, level alarms, etc. and segregated from ship's outer hull.

Each main generator set is to have a separate lub oil system with all necessary accessories and fittings to engine builder's recommendations.

One (1) main engine lube oil drain tank to be arranged in the engine room double bottom.

6.4 Cooling Water

The vessel is to have a central cooling systems installed to cater for all cooling requirements, the system is to be located in the main machinery space.

All overboard connections to be below the light ballast water line.

System design parameters are to be as follows:

FW low outlet from central coolers	37°C
Seawater inlet temperature	35°C / -1°C
Freshwater velocity in pipes not generally to exceed	4.0 m/sec
Fouling factor for FW/SW heat exchangers	+15%
Design margin in calculation of FW/SW heat exchangers	+10%

6.4.1 Sea water cooling system

Sea chests

2 off Sea inlets (1 off Port and 1 off Starboard) to be arranged in engine room.

2 off salt water cooling pumps of capacity about 170m³/hr

1 off Sea inlet in fore ship for emergency fire pump etc.

Arrangement of sea chests to be according to class requirement.

Anti-fouling system with copper and cast iron anodes to be installed.

6.4.2 Fresh Water Cooling system

A central cooling system is to be arranged in the engine room comprising of 2 low temperature (LT) pumps of capacity 250m³/hr each and 2 high temperature (HT) pumps of capacity 80m³/hr each. Cooling of the high temperature circuit is to be by means of a thermostatic valve connected into the low temperature circuit. The system is to be equipped with a pre-heater.

Low temperature freshwater cooling for air conditioning condenser units, self contained air conditioning units, water cooled air compressors, refrigerator condenser units and all other equipment/machinery as applicable are to be provided from the central cooling systems in the machinery spaces. The necessary circulation is to be provided by motor driven centrifugal pumps with 100% standby capacity available.

Central freshwater coolers are to be provided with an automatic temperature control valve for regulation of coolant temperature.

Air is to be vented from the system by means of expansion tanks.

6.5 Compressed Air

6.5.1 Starting Air

Two (2) 30 bar starting air compressors are to be installed, each with a capacity of 50m³/hr. Two starting air receivers of 1800 litres capacity and rated at 30 bar are also to be arranged according to Class requirements.

One 30 bar topping-up/emergency air compressor, capacity 10m³/hr is to be provided.

6.5.2 Service Air

Service air is to be provided by a rotary-type air compressor supplying at least 160 m³/hr of free air at a pressure of 7 bar

6.5.3 Control Air

A control air compressor is to be installed, capable of delivering 25 m³/hr of free air at a pressure of 7 bar. The compressor to be complete with air receiver and air drier.

6.6 Automation

6.6.1 General

Consoles are to be rigid freestanding units constructed of steel plate not less than 3mm thick on a steel angle bar framework. Consoles are to be etched, primed and stove-enamelled in semi-gloss with final colour to Owner's approval.

Consoles are to be arranged with all-round access and panels with neoprene gaskets, ventilation grilles and substantial grab-rails where appropriate. Where necessary, doors and access panels are to be arranged with lockable quick-release catches similar to those on switchboards and with supporting stays.

Console wiring is to be multi-strand type, of adequate cross-section and in general not less than 1mm² except for miniature components or internal wiring of electronic components. Console wiring connections are to be brought out to external connection chambers with coded terminal strips.

Console wiring is to be run in securely cleated looms or conduits with crimped terminals and coded ferrules at each end.

Control circuits and power circuits are to be segregated.

Consoles are to be arranged with internal illumination.

Cable-connections to door/panel-mounted equipment are to be flexible, loomed or taped together, positioned to ensure they do not impede access and arranged to prevent chafing due to vibration or to physical contact when doors/panels are open. Wiring is to be arranged to avoid stress on terminal connections.

Consoles are to be arranged to ensure easy access for inspection and maintenance of all internal equipment and connections on switches, meters, lamps, etc.

Each console is to be arranged with an internal earth bar with flexible bonding connection to the vessel's structure. Console structure and all necessary individual components including casings of items having a working voltage of more than 55 volts are to be connected to console earth bar via earth cables having a distinctive coloured sheath.

Each console is to be arranged with all necessary power supply units, fuses, isolators, anti-condensation heaters and plug-in relays with retaining clips and indication of coil energisation.

Isolating switches and fuses are to be fitted in console. One independently powered alarm is to be fitted to indicate total power failure to each console.

Controls, instruments, indicators, communications equipment and alarm displays are to be arranged in logical groupings according to function, sequence of usage and frequency of use.

Controls and their associated instruments are to be arranged to give a clear indication of their relationship with equipment being operated, i.e. where possible, movement of control instrument and equipment being controlled is to be in same direction.

Console displays are to be arranged, so that the operator's hands and arms will not obscure them during control movements. Controls are to be arranged so that they cannot be subject to accidental operation when other controls are being operated.

Console-mounted instruments are, generally, to have rectangular or square dials with black figures, black pointers, white face and non-reflective glass.

Each control, indicator and instrument is to be clearly identified by an engraved metal or Traffolite tally.

Console instrumentation, indicators, controls and surveillance equipment are, wherever practicable, to be calibrated prior to installation of console aboard the vessel and certificates supplied to the Owner.

Manufacturer's Standard, if different from above, can also be considered.

6.6.2 Machinery Control Room Console

The Machinery Control Room console is to be arranged with a sloping desk and sloping rear display. The console is to incorporate a kneehole writing desk with suitable writing surface, two drawers and a locker with shelf.

Console is to be designed and arranged in accordance with requirements of this specification and submitted to Owners for approval prior to construction.

One swivel chair with height-adjustment, armrests and anchorage screw is to be supplied.

Chair anchorage points are to be arranged in the deck at the writing desk.

The console is to be arranged for centralized control and monitoring of the propulsion and associated auxiliary systems.

All analogue/digital data is to be processed by the surveillance system outstations and displayed on the console by means of a VDU terminal. A further terminal is also located on the Bridge.

6.6.3 Bridge Consoles

Controls and instrumentation in the navigating bridge are generally to be arranged in functional groupings in freestanding consoles and panels for ease of operation/maintenance and safe navigation of the vessel. Final arrangements are to be approved by the Owner.

All bridge consoles are to include all manoeuvring handles, revolution counters, rotation-indicators and all illuminated instruments. All lights in the manoeuvring desk,

excluding the warning lights, are to be provided with stepless dimming (bright to completely dark).

One console forward bridge and one console at each bridge wing are to be installed. (Final arrangement is to be agreed upon during detail designing).

i) Bridge console forward is to include the following equipment:

- 1 intercom telephone
- 1 amplified telephone
- Echo sounder
- Radar x-band plus 1 ARPA tracking
- 1 Morse light switch
- 1 push button for fire alarm
- 1 indication panel for watertight doors and hatches as require by Class.
- 1 autopilot with gyro repeater and off-course alarm
- Whistle controller
- Remote start/stop fire pumps
- Adequate number of switches for external lights

In addition to console, other equipment is to be mounted overhead forward. This is equipment like:

- Echo sounder repeater (digital)
- Ship speed indicator (digital)
- Main engine RPM
- Anemometer and anemoscope
- Clock
- Rudder angle indicator
- Rate of turn indicator
- Window wiper panels
- Window flushing (air/water)
- VHF station
- Light switches
- Gyro repeaters
- Wind measuring indicators (Anemometers)

ii) Bridge consoles port/starboard wing:

- Search light controller
- Window wiper panel
- Window flushing (air/water)
- Slave VHF station
- 1 push button for whistle

6.7 Alarm/Monitoring System

6.7.1 General

All control and surveillance systems are to comply with Classification Society and the regulatory body requirements. A dedicated specialist named group from the Builder

is to be responsible for the coordination, supply, installation, testing, commissioning of all remote controls, instrumentation and automation.

All control equipment, surveillance equipment and components are to meet the requirements of the Classification Society Environmental Test Specification, and preference is to be given to equipment having a type approval certificate.

Control, instrumentation, automation and surveillance systems are to be arranged with all necessary features and equipment for safe unmanned operation of propulsion plant from two locations, i.e. the Bridge and Machinery Control Room. Main control, instrumentation, automation and surveillance system is to be coordinated with all necessary ancillary plant and sub-systems to achieve a fully integrated overall system.

Wherever possible/practical, control equipment, components and transducers are to be selected to ensure that a single make, style and type of device is employed for each function throughout the vessel.

Control and surveillance equipment is to be of modular construction, with automatic self-checking and identification of faulty modules. Provision is to be made for regular in-service test-procedures for transducers and other necessary equipment without undue dismantling. All control systems using PCB cards are to be supplied with at least one spare card of each type.

Components/circuits of control, protection and surveillance systems are to be segregated from each other to prevent inter-system fault propagation.

Where appropriate, surveillance and protection systems are to be arranged with two-level alarm and trip set-points sufficiently divorced to allow timely manual corrective action before automatic shutdown occurs.

Wherever practical, control and surveillance functions are to be performed electrically, employing solid-state equipment for control equipment, logic functions, etc. Electric-pneumatic systems will be considered for on/off valve control. Hydraulic transmission of data or signals, whether by oil or water, is not to be employed.

Propulsion machinery is to be fitted with local instrumentation as follows: power (kW), rpm, cabinet temperature, cooling water temperature and cooling water pressure and cooling water flow indication.

Switchboards, control consoles, control stations, etc. are to be arranged to ensure uniformity of operational procedures, layout, construction, finish and colour.

Switchboards, control consoles, control stations, etc. are to comply with Health and Safety IEC standard and any associated regulations.

Mimic diagrams are to be provided where a number of interconnected displays are required, such as fire-alarm points, navigation lights, machinery status indication, etc.

Local thermometers are to be red spirit in glass, brass clad, anti-vibration pencil-type calibrated in degrees Celsius except where specified otherwise.

Local pressure gauges are to be generally brass-cased damped Bourdon-tube gauges with white face, black figures and pointer, calibrated in Bars. Pressure gauges are, in general, to be not less than 75mm diameter.

Tank contents gauges are to be calibrated in tonnes or litres (tonnes for tanks 5 tonnes and above and litres for tanks under 5 tonnes).

All indicating instruments, gauges and thermometers are to be arranged with red lines indicating normal maximum allowable working parameters.

Electrical indicating instruments as far as practicable are to be at least 90mm square, with white face, black figures and pointer.

The system can be a decentralised system where each system has its own CPU. It can consist of the following sub systems: Alarm and monitoring plant, pump and valve control, tank sounding. Electrical Load control system, these systems can be connected to a redundant network with independent operating stations. If one operating station develops a fault the others are to function as normal.

Alarms related to the propulsion and main machinery are to be of the switched/analogue type, as applicable. Instruments, sensors and control equipment are to be of simple, robust and standardised design. Transmitters are to be used in order to avoid sensing lines carrying fuel, oil, steam or water being lead into the control room.

Local instrumentation, such as thermometers, pressure gauges, etc. are to be provided as necessary for manual start-up, control, and monitoring of equipment in the machinery spaces. Scale engravings are to be in metric units.

Pressure and temperature sensors are to be installed in places where there is minimal risk for damage during normal overhaul and maintenance. Temperature sensors are to be installed in wells and be capable of being withdrawn for replacement or calibration.

All components and wires are to be marked with numbers in accordance with the instrumentation list and installation drawings.

6.7.2 Alarm Monitoring and Control System

The system is to be a microprocessor based multi-user system for remote control of various ship / cargo systems. The system is to provide complete alarm and monitoring of the vessel's propulsion and auxiliary machinery, using mimic diagrams giving constant condition status. In addition a comprehensive trend analysis function is to provide information on all monitored variables.

Alarms are to be initiated if abnormalities are detected. The system is to be flexible and easy configurable, both during installation and for later alterations.

Quantities of points provided to be adequate and are to have at least 10% spare of each type of points for future use.

One electronic, solid-state microprocessor-based surveillance system of sufficient channels is to be installed in machinery control room.

Surveillance system is to include all necessary sensors, scanning units, central processing unit, visual display units with keyboards, colour ink jet/graphics printer, alarm event recorder and inhibit control unit. Watch-keeping extension alarm system, audible alarm, visual alarm and any optional features that are described in this specification.

The surveillance system is to incorporate self-checking/diagnostic features.

An automatic earth-fault detection alarm is to be connected to the Surveillance System. A circuit is to be incorporated in the binary and analogue input section to provide detection ideally down to one channel level. All subject to Owner's approval.

Console Alarm Indication is to consist of a small audible and two flashing lights (1 red, 1 amber) to be fitted on top of the console or in a suitably prominent position in MCR.

A minimum number of alarm indicators consisting of flashing xenon beacons and Banshee type audibles (or equivalent) are to be installed in the following locations, as per Class requirements.

- 4 - Machinery Space
- 1 - Workshop
- 1 - Store

The final approval of alarms is to be made by the Owners.

7 SHIPS SYSTEMS

7.1 General

All systems are to be protected by adequate climate control systems, by way of heating, trace heating, cooling and air conditioning as necessary, to ensure their correct operation in all temperature ranges indicated within this document. All pipes, valves and cocks are to conform to GB, CBM, CB, JB and YB standard or equivalent standard. The flanges shall conform to ISO standard. Bolts and nuts shall conform to CIS standard.

7.1.1 Pipeline Systems - General

All pipelines are to be according to system drawings approved by the Owner, Classification Society and to the satisfaction of the selected sub-contractors. National Authority's approvals to be obtained on systems where required. Working practices and materials of pipes and fittings are to be in accordance with the Builder's standard practice and the requirements of the Classification Society.

7.1.2 Materials

The materials to be used in piping systems are to be suitable for the medium and service for which the system is intended.

The pipelines to be constructed in the following materials according to the Yard's approved pipe schedule:

- Ballast / Salt Water : GRP outside engine room
- Ballast / Salt Water : hot-dip galvanised steel, Sch.80
- Primary Sea Water Cooling : CuNiFe10
- Other Sea Water Piping : hot-dip galvanised steel, Sch.80
- Bilge. : Galvanised Steel
- Drain/scuppers. : Galvanised Steel
- Fire. : Galvanised Steel
- Air pipes for Ballast tanks etc : Galvanised Steel
- Air pipes for Oil tanks. : Galvanised Steel
- Remote sounding pipes. : Stainless steel 304 inside tanks, copper elsewhere
- Manual sounding. : Mild Steel
- Hydraulic high pressure System. : Seamless Steel

Couplings of approved type may be fitted over all where Classification requirement permits. Elsewhere, flanges are to be provided for nominal diameters of 40 mm and above except for air pipes where welded connections may be used. Sounding pipes with self-closing sounding valves to have 1 1/2" screwed connection. Unless otherwise specified, valves are generally to be of nonferrous metal up to ND 32 and of cast iron with non-ferrous fittings above ND 32.

Shipside valves are to be of Classification approved type.

Butterfly valves may be fitted where this is considered to be practical.

All weather exposed remote control tubes to be of stainless steel SS316 and all weather-exposed pipefittings are to be lined with Denso tape or equivalent.

7.1.3 Workmanship

For copper and CuNi pipes, flat steel clamps are to be provided and fitted with neoprene lining.

For steel pipes galvanized flat, steel clamps or Utype steel bolts are to be used. Where galvanizing is required, hot dipped galvanizing is to be used on completely finished pipes and after all welding and treatment, where possible.

Pipe clamps are generally to be bolted.

Where necessary, the pipelines are to be fitted with expansion joints or designed with expansion bends.

Drain arrangements and compressed air connections are to be provided where necessary.

7.2 Bilge and Ballast

Two (2) Ballast pumps, each 1000 m³lh - 3 bar, are to be arranged. Pumps to be of the electric motor driven centrifugal self-priming type. The pump casing and impeller are to be NiAlBronze with shaft of stainless steel and mechanical shaft seal.

The pumps are to be arranged as backup for each other. The ballast system pump and associated tank valves are to be remotely operated and monitored from the machinery control room and remote monitoring in the cargo office. Monitored parameters are to include the ballast pump suction and discharge pressures, open and closed status of the valves and tank levels.

The ship's ballast tanks are to be connected to a remote controlled ballast ring main system which is to be provided to facilitate loading, discharge and transfer of seawater ballast to all ballast tanks.

Ballast overboard discharge is to be arranged at approximately 500mm above the water line at maximum ballast water draft. Ballast discharge piping is to be arranged with two (2) overboard outlets of equal size, one (1) port side and one (1) starboard side.

Butterfly valves are to be of the wafer type with body of cast iron, al.bronze disc, stem of stainless steel material and seals of buna-nitrile material.

Valve actuators are to be of the double acting type where approved by the Classification Society and are to be pneumatically or hydraulically operated.

The bulkhead valve for the forepeak tank is to be remotely operated. Provisions for operation from the Upper Deck according to Class requirement is to be arranged.

7.2.1 Bilge System

The bilge system to have valve chests casing of cast iron and garniture of metal. Bilges in the engine room, etc. are to be connected to valve chests. All bilge pipes to have mud boxes with easy access for cleaning.

Direct bilge lines are to be arranged in engine room according to rules.

Bilge wells are to have level alarms according to Classification requirements. The bilge system is to be arranged for discharge to the bilge water tank.

Two (2) bilge pumps of sufficient quantity and capacity according to Class requirements are to be installed.

The pumps are to be the motor driven eccentric screw type with cast iron casing, stainless steel rotor and perbunan stator.

In addition one (1) motor driven bilge pump of the reciprocating type is to be installed, suitable for a capacity of approx. 5 m³/h at 3 bar.

7.2.2 Bilge Water Separator

One (1) bilge water separator having a capacity of 1.5 m³/h is to be provided. The separator is to be fitted with a bilge monitor capable of detecting 15-ppm oil in water content.

The bilge water separator is to be arranged to draw from bilge water holding tank.

One (1) off bilge water tank is to be arranged in the engine room area. The installation is to meet the IMO requirements and USCG marine pollution regulation.

7.2.3 Sludge System

One (1) sludge pump with capacity of approx. 2.5 m³/h is to be arranged.

The sludge pump is to draw from the bilge water tank, lube oil drain tank and sludge tank and discharge to the incinerator sludge tank and IMO standard flanges on deck, port and starboard.

One (1) sludge tank located inboard on the lower engine room flat.

7.2.4 Drain System Outside the Accommodation

Scuppers or drains are to be provided on all decks in accordance with good shipbuilding practice.

The scupper pipes on open or semi-enclosed continuous decks are to be fitted on both port and starboard sides at intervals of approximately 15 m and led to the side shell.

Each exposed weather deck of the accommodation is to be drained subsequently to the next lower deck in general, and with drainpipes ended approximately 100mm above the lower deck.

Locations of weather deck drains are to ensure that there will be no standing water on the deck at normally anticipated conditions of list and trim.

The scupper pipes from the weather deck of the accommodation are to be of the outside mounting type.

Drain pipes from wheelhouse top to be fitted outside down to the Bridge deck.

Drain pipes from the top of funnel to be led overboard.

Deck drains to be of sufficient size and number to efficiently drain the areas or spaces served. Areas and spaces, and especially enclosed spaces, are to be fitted with at least one drain to be located as close as practicable to the after end or aftermost boundary bulkhead of the area or space served.

Drainpipe lines to be of galvanised steel pipes.

Facilities to incorporate the collection of all contaminated fluids via save-alls and drains connected to holding tanks within the ship's structure are to be provided.

7.3 Fire Detection and Alarm System

One (1) automatic addressable fire detection system is to be installed in accordance with regulatory body requirements.

A central fire detection control panel is to be mounted in the wheelhouse with slave in machinery control room.

Fire detectors are automatically led to fire alarm when:

- A heat detector reaches a pre-set maximum temperature limit.
- A combustion gas has reached a smoke detector.
- A fire alarm push button (manual call point) is activated.

The installation to be according to requirements and with:

- Heat detectors in accommodation, Engine Room and similar machinery spaces, Cargo Holds
- Smoke detector in accommodation, Wheelhouse, Engine Room and similar machinery spaces, Cargo Holds, Paint Stores, Chemical Stores, Bunker Sample Store
- Manual call point (push button) detector in accommodation, corridors and in engine room exits
- Smoke detectors to be installed in each cabin and all corridors
- Alarm bell in accommodation corridors
- Alarm bell in converter room, etc
- Alarm siren in Engine Room
- Red flash lights in noisy area where fire alarm bell(s)/siren(s) are installed
- Printer

Fire detectors to be easily accessible for testing. Detectors mounted below working deck are to be mounted with rubber suspension. All detectors and man call posts are to be marked / labelled according to circuit diagram.

A push button lifeboat alarm (General alarm) is to be mounted in the forward bridge console. Alarms are to sound continuously for a fire alarm and intermittently for a general alarm with signal generator.

The fire detection central panel is to have built-in monitoring circuits, which are

intended to control that the equipment at any time is in satisfactory order and indicate faults, which could prevent fire alarm.

Faults in the system are to be indicated on the central panel by means of visual and audible signals.

The fire alarm plant is to be equipped with a separate battery and battery charger or alternatively built-in to the central.

Power supply is to be from emergency switchboard.

Accommodation vent fans are to be stopped automatically when a fire alarm is initiated or a stop push button in the bridge area is activated.

Fire doors are to close automatically when a fire alarm is initiated. In addition, fire doors are to be capable of being closed manually from the bridge and locally. An indication panel is to be mounted in the bridge.

A watch clock system comprising portable master recording clock and 20 key stations sited throughout the vessel is to be provided to Owner's requirements.

7.4 Fire/wash down syst., emergency fire pumps sprinkler systems

2 off Fire pumps are to be installed according to class requirement.

1 off Emergency fire pump is to be installed according to class requirement.

Necessary fire hydrants are to be installed according to class requirements.

7.5 Fixed CO₂ Fire Fighting System

The vessel to be equipped with a fixed CO₂ centralised fire-extinguishing system according to Classification and Authority's requirements. The CO₂ containers are to be arranged in a separate mechanically ventilated room between frames 10-18 Upper Deck (Stbd side).

Spaces to be protected are as follows:

- Engine room included casing
- Engine control room
- Incinerator room
- Galley exhaust hood by means of a local mounted fire extinguisher
- Paint store
- Emergency generator room

Cargo Holds

Release mechanisms are to be located in a locker situated above the Upper Deck and are to be arranged to automatically stop the ventilation fans serving the affected space. An alarm is to be activated prior to the release of the CO₂.

A blind-ring flange is to be provided in the main line for securing the system to prevent accidental release of the CO₂ when the vessel is in the hands of a ship repairer.

The fixed CO₂ fire extinguishing may be extended to protect the cargo holds, exemption from SOLAS II-2 (Reg 53 1.3) is allowed depending on the intended cargoes to be carried.

7.6 Air and Soundings

7.6.1 Sounding system

A remote sounding system with electronic indication is to be installed. The system is to be interfaced to the alarm/control/monitoring system.

Remote sounding with one (1) air bell or equivalent is to be arranged in each of the following tanks:

- Water ballast tanks
- Freshwater tanks.

Remote sounding with two (2) air bells or equivalent is to be arranged in each of the following tanks:

- Fuel oil bunker tanks

Manual sounding pipes are to be arranged in all tanks, in compliance with Flag rules and regulations. The manual sounding pipes to be as straight as possible led directly to the lowest point in tank and to be equipped with striking plate at bottom.

The Yard is to ensure that all manual sounding pipe locations are easily accessible.

The maximum volume of each tank is to be sounded by taking into consideration the tank's shape and size, the ship's normal trim and the location of the air bell(s).

Where rules permit, tank gauges may replace sounding pipes.

Density measures read out for fuel oil bunker tanks is to be arranged.

Fuel oil service and settling tanks are to be fitted with a Classification approved local contents gauge in addition to two (2) remote sounding air bells.

Local content gauges are to be provided for the oily water tank, sludge tank, bilge water tank and sewage tank.

Lub oil storage tanks and hydraulic oil storage tanks to be fitted with Classification approved local content gauge or sight glass.

The sounding system is to be interfaced with the VMS.

Four (4) draft sensors are to be arranged for remote reading of the vessel's draft at the forward, aft and amidships position both port and starboard. The draft sensors are to be interfaced with the sounding system.

7.6.2 Air pipes

Air pipes for built-in tanks are generally to be led to the open deck.

Air pipes for oil tanks are to be of ordinary steel and for water tanks are to be of galvanised steel.

The air pipes' height above the deck to the opening where sea can penetrate is to be a minimum of 760mm on Upper Deck.

Tank ventilation valves are to be fitted with fireproof screens (stainless steel) for the fuel oil tanks and insect proof stainless steel wire net for the freshwater tanks.

An oil-spill catch basin around filling and vent pipes for oil tanks and sludge discharge connections on the open deck are to be provided. These basins to comply in all respect with Classification Society, Flag state and USCG requirements and, in particular, the requirements for volume and height of coamings. Catch basins to be fitted with threaded drain plugs.

All fluids are to be handled in accordance with a zero discharge policy.

7.7 Sanitary

The sanitary arrangements are to have Marpol Annex IV certification.

7.7.1 Sanitary Supply System

Freshwater tanks filled from filling stations on Upper Deck port and starboard.

Deck connection filling through hypo-chlorinator to fresh water storage tanks.

The line from the Fresh Water plants is to be connected to the filling line before the hypo-chlorinator.

The fresh water is to be stored and handled on board in accordance with Classification Society regulatory body requirements, with particular regard to 'M' Notice 1214 and later amendments where applicable.

Separate systems for potable water and fresh water supply are to be arranged as follows.

7.7.2 Potable Water System

A potable water system of hydrophore type is to be installed, providing cold water to following consumers:

- Potable water taps in galley
- Galley machinery, as required
- Drinking water coolers
- Ice cube machines

The system to have suction from the potable water tank and to consist of:

two (2) off pumps, with sufficient capacity to serve listed consumers at 3.2 to 4.6 bar working pressure.

two (2) off tanks with capacity of approx. 50m³ each, located port & starboard between frames 10 and 13.

The plant is to operate fully automatically with one of the pumps in stand-by mode.

Pipelines for potable water are to be manufactured from stainless steel material and are to be insulated.

The system is also to include one (1) off silver ion-steriliser and a micro-filter of ample capacity.

Dechlorinating filters are to be fitted locally to all drinking water fountains and ice making machines.

7.7.3 Domestic Fresh Water Supply System

A marine fresh water hydrophore automatic pressure set is to be installed.

Pumps are to have cast-iron casings, stainless-steel shafts and mechanical shaft seals.

Unit is to be arranged to take suction from Vessel's fresh water storage tank and discharge to systems via one water-meter calibrated in litres.

Non-return/vacuum breakers are to be fitted in all fresh water connections to toilet spaces and any system, which is to draw on the fresh water system.

The pressure set is to comprise:

- Two (2) off pumps with a capacity of approx. 7,5 m³/h, each, and 3.2 - 4.6 bar working pressure.
- One (1) off accumulator tank with capacity 1500 litres.

The plant is to operate fully automatically with one of the pumps in stand-by mode. Discharge lines are to be laid to all taps for cold water on board, and to the hot water calorifier.

Hot water Calorifier water magazine is to be heated by a hot water loop from the oil fired hot water boiler.

The calorifier shall also have 4 x 10 kW electrical heating elements as backup.

A hot water ring main line with branches to all hot water taps onboard is to be installed.

Two (2) off circulating pumps are to be installed, with capacity and head sufficient for providing circulation through the calorifier and the hot water ring main. Pumps are to be arranged for local starting/stopping.

Pipelines for hot and cold fresh water are to be of copper or approved PVC material. Hot fresh water pipes are to be insulated.

All washbasins throughout the accommodation are to be of vitreous china/stainless steel. Visible fittings in accommodation are to be chrome-plated metal.

7.7.4 Sanitary Discharge System

A marine vacuum sewage system is to be arranged for toilets, the sewage discharge to be collected and treated in a dedicated treatment plant. The vacuum system is to include two (2) vacuum pumps and necessary control equipment.

The sewage treatment plant to be of bio-chemical type, sized for a complement of 30 persons and is to fully satisfy the requirements of IMO and the US Coast Guard. Two (2) sewage discharge pumps are to be built on the sewage treatment plant discharging to the Grey Water Holding tank aft

Sanitary discharge pipe work throughout the accommodation is to be of push-fit, stainless steel type manufacture in accordance with Regulatory requirements. Elsewhere, galvanized steel piping is to be used.

Discharge piping from washstands and scuppers are to be led directly to the sewage treatment plant, discharge pipes from washstand and scupper in the hospital are to be lead separately to the treatment plant.

7.7.5 Showers and Toilets

Showers and toilets are to be provided throughout the vessel as shown on the General Arrangement drawing and to be out fitted as described in the following sections.

7.7.6 Suites & Cabins

Toilets in suites and cabins are to be provided with bulkhead-mounted vacuum type vitreous china wc, paper holder, towel hook and hand grabs, toilet cabinet with mirror and shaving socket, mixer taps of normal type.

Each shower is to be provided with towel rack, clothes hooks, soap dish, shower mat, shower curtain, mixing valve of thermostatic type and with anti scald protection.

All doors to WC rooms are to be fitted with locks.

7.7.7 Public Toilets

Toilets in public spaces will be provided with bulkhead-mounted vacuum type vitreous china wc, paper holder, towel hook and hand grabs, mirror over wash basin, mixer taps of normal type.

7.7.8 Showers

Showers, where provided in public spaces, are to be equipped with towel rack, clothes hooks, soap dish, shower mat and shower curtain, mixing valve of thermostatic type and with anti scald protection.

All shower room doors are to be fitted with locks.

7.7.9 Drinking Water Cooler

Four (4) off drinking water coolers complete with mineral filters are to be fitted.

7.7.10 Fresh Water Generator

A fresh water generation plant, fed by the main engine heat transfer system, capable of supplying 15 tonnes of water per day is to be provided.

8 ELECTRICAL

8.1 System Voltages

440v 3ph 60Hz (Insulated)

220v 3ph 60Hz (Insulated)

24v DC (Insulated, battery backed)

For basic distribution see Annex C.

8.2 Generators

See section 5.3 of this specification.

8.3 Transformers

Two (2) Lighting / Power Transformers : 440/220V 3ph 60Hz 150KVA

One (1) Emergency Lighting / Power Transformer : 440/220V 3ph 60Hz 60KVA

8.4 Switchgear & Starters

8.4.1 440V Main Switchboard

Supplied by:

- 3 x Diesel Driven Generator Sets

Feeding:

- 440V Auxiliary Switchboard

8.4.2 440V Auxiliary Switchboard

Supplied by:

- 440V Main Switchboard
- Shore Supply

Feeding:

- 220V Switchboard via Lighting / Power Transformers
- 440V Emergency Switchboard
- 2 x Group Starter Boards for Machinery Spaces
- 440V Distribution
- Battery charger / discharger panel

8.4.3 440V Emergency Switchboard

Supplied by:

- 440V Main Switchboard
- Emergency Diesel Generator

Feeding:

- 220V Emergency Switchboard via Emergency Lighting / Power Transformer
- 440V Emergency Distribution

8.4.4 220V Switchboard

Supplied by:

- 440V Main Switchboard via Lighting / Power Transformers

Feeding:

- 220V Lighting and Power Distribution

8.4.5 220V Emergency Switchboard

Supplied by:

- 440V Emergency Switchboard via Emergency Lighting / Power Transformers

Feeding:

- 200V Emergency Distribution

8.5 Vessel Power Management System

The vessel to be equipped with a power management system (PMS) to control all main generator sets. Control to include; engine speed, load sharing, load at start/stop of engines, automatic synchronisation of generators & bus tiebreaker and control of breakers for other heavy consumers.

8.6 Fire Detection System

- Fire Detection
- Door Holdback

8.7 Internal Communications

- Automatic Telephone System
- Main Broadcast System
- Sound Powered Telephones
- Portable Radios
- 8 point PC network

8.8 External Communications

- Main Radio Equipment (GMDSS)
- Satellite Communications
- VHF & UHF Telephones
- NAVTEX
- Communal Aerial System
- TV Receiver System (including satellite receiver)
- Signalling Lamps
- 1 x Aeronautical VHF/DF Unit
- 2 x Whistle (Typhon)

8.9 Navigation Aids

- Radars (2) 1 S-band, 1 X-band - both with ARPA tracking
- Satellite Navigation
- Gyro Compass (1)
- Auto Pilot
- Magnetic Compass
- Echo Sounders
- Speed Log
- Navigational System integrated with steering system
- Weather Receivers
- AIS
- Voyage Data Recorder

8.10 Ship's Positional System

- Steering Control System (joystick)

8.11 Lighting / Miscellaneous Power Distribution

- Accommodation
- Machinery Space
- Navigational & Signalling Lights
- Deck Lighting
- Emergency Lighting

8.12 Remote Electronic Sounding and Draft Sensors**8.13 Machinery Space Visual / Audible Alarms**

ANNEX A – GENERAL ARRANGEMENT