



ULSTEIN®

TURNING VISIONS INTO REALITY

ULSTEIN PX121 H

Platform Supply Vessel



FOR MARINE OPERATIONS

ULSTEIN PX121 H is a compact and reliable PSV for general cargo transport and fire-fighting, designed to fulfill the general demands of the offshore industry as carriage of dry bulk and liquid bulk cargoes in tanks and pipes and other general cargo on open deck.

The vessel surpasses industry standards with regards to cargo capacities and performance, and fully complies with requirements for energy efficiency and conservation.

Main characteristics

Deadweight	4000	tonnes	Length over all	83.4	m
Cargo deck area	850	m ²	Breadth	18.0	m
Speed	14.5	knots	Depth to main deck	8.0	m
Generators power	5250	bkW	Draught, max	6.7	m

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Enterprise number NO 926 738 461



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Page 2 of 21

Rev 0 - 5/7/2013

1. SHIP GENERAL

General description

Together with the enclosed General Arrangement plan U10782_101-100, this specification briefly describes a platform supply vessel, hereafter referred to as the Vessel.

The basic principle for the design of the Vessel is to meet operational demands with cost efficient solutions. The Vessel shall be able to fulfill the general demands of the offshore industry.

The Vessel to be built for international trade, except for service in the arctic or Antarctic Climatic zones, US inland waters and similar areas with special restrictions and requirements.

The hull form, with the ULSTEIN X-BOW®, and the diesel electric propulsion system, ensures exceptional performances with regards to fuel consumption, sea keeping, station keeping, speed, stability and cargo capacity.

The cargo systems ensure safe and efficient loading and discharging of the Vessel.

The propulsion system comprises two azimuth type propellers, each driven by an electrical motor.

Two tunnel thrusters are installed in the fore part of the Vessel.

Mooring room forward shall be closed (not water tight).

The Vessel has accommodations for totally 30 persons and 1 hospital.

Main particulars

Length over all:	Approx. 83.4 m
Length between perpendiculars:	Approx. 76.5 m
Breadth moulded:	Approx. 18.0 m
Depth from Main deck:	Approx. 8.0 m
Max. draught:	Approx. 6.7 m
Freeboard at max. draught:	Approx. 1.3 m
Dead-weight at max. draught:	Approx. 4000 t

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Turning visions into reality

Page 3 of 21

Rev 0 - 5/7/2013

Performance, Trial speed

Trial speed at 100 % load on each of the drive shafts, at 4,5 m draught, clean hull, clean propellers and with Sea state 0-1 to be approx. 14,5 knots..

Load on the main propulsion units drive shafts shall be verified by strain gauges at the sea trials.

The Vessel's systems to be designed for service with the following environmental conditions: Air temperature between -19 to +45 C° and sea temperature from 0 up to +32 C°.

Station keeping capability:

ERN numbers: [99,99,82,63] Preliminary numbers only.

Final ERN calculations to be performed by DP-system supplier.

Capacities

Fuel oil (cargo and domestic):	Approx.	1.475 m3 370 m3 dedicated
Fresh water (cargo and domestic):	Approx.	1.055 m3 705 m3 dedicated
Drill Water/ Water ballast:	Approx.	1.620 m3
Mud:	Approx.	1.295 m ³ Ten combined tanks
Brine:	Approx.	1.295 m ³ Ten combined tanks
Slop:	Approx.	505 m3 Four combined tanks
Base oil:	Approx.	265 m3 Two tanks
Low Flashpoint Liquids:	Approx.	155 m3 Four tanks
Dry bulk :	Approx.	255 m ³ Four tanks
Recovered oil:	Approx.	660 m ³ Slop tk's plus LFL tk's
Lub. oil:	Approx.	40 m3
Sewage:	Approx.	55 m3
Bilge / Sludge / Drop tanks:	Approx.	40 m3
Deck load (VCG 1 m ab. main dk.):	Approx.	1.900 t MSC.235(82)
Deck load (VCG 1 m ab. main dk.):	Approx.	1.575 t MSC.266(84)
Cargo deck area:	Approx.	850 m2 Wood covered
Deadweight at max. draught:	Approx.	4.000 t
Deadweight at design draught:	Approx.	3.100 t
Gross tonnage:	Approx.	3.900 GRT

Maximum deck cargo capacity occurs at a draught less than Vessel maximum draught.

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ULSTEIN PX121 H

Turning visions into reality

Page 4 of 21

Rev 0 - 5/7/2013

Class, Certificates and Regulations

The vessel is designed to comply with rules, regulations and requirements laid down by the Flag State, IMO and the Classification Society (hereafter referred to as the Class) as applicable.

Flag: NIS.

Main Class shall be DNV ✕ 1A1 with the following Class notations:

Offshore Service Vessel, SF, E0, DYNPOS-AUTR, CLEAN DESIGN, NAUT-OSV(A), COMF-V(3), LFL*, Fire Fighter I, OILREC, BIS

IMO: Conventions, Codes and Resolutions that are in force and adopted by the Flag State.

Resolution MSC.235(82) - Adoption of Guidelines for the design and construction of offshore supply vessels, 2006. Supersedes Resolution A.469(XII)

Resolution MSC.266(84) Code of safety for special purpose ships

Maritime Labour Convention 2006.

Drawings, Instruction Manuals etc.

In general all drawings to be delivered by the Yard unless else is particularly agreed. Approval of drawings at the relevant Class and control authorities to be obtained by the Yard. Arrangement and Class drawings to be submitted to the Owner for approval.

All numerical units refer to the metric, SI system of measurement.

Building methods

The Yard's normal standards and production methods shall be applied.

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ULSTEIN PX121 H

Turning visions into reality

Page 5 of 21

Rev 0 - 5/7/2013

2. HULL AND STRUCTURE

Hull materials

All materials to be new and of marine quality according to Class regulations, and where required, with certificates. Materials are to be suitable for the service intended with the Vessel.

Blasting, shop priming, cleaning of materials

Steel building materials to be grit-blasted, and primer of approved type to be applied. Paint work to be performed on clean surfaces, according to manufacturer's recommendations.

Steel construction in general

All dimensioning to be according to Class requirements.
Frame spacing to be 700 mm.

Cargo rail with escape gates to be arranged according to General Arrangement.

Cargo rail to be reinforced for possible future mezzanine deck as shown on General Arrangement. Approx. frame 44-53

Reinforcements for possible future offshore crane to be made below main deck on SB side approx. frame 22 to 26. Max. lifting capacity of future crane to be 60 t at 9 m outreach and 1000m wire.

Material protection

All painting and material protection work shall be carried out in accordance with good workmanship, common good practice and specification from paint manufacturer.

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ULSTEIN PX121 H

Turning visions into reality

Page 6 of 21

Rev 0 - 5/7/2013

3. CARGO/SERVICE HANDLING

Dry bulk system

- 4 off Tanks for dry bulk to be installed. Working pressure minimum 5.6 bar.
Dry bulk tanks to be free-standing and of circular type with domed bottom.
 - 1 off Duplex BHS compressor unit with freshwater cooling.
Capacity approx. 2 x 30 m³/min and approx. 5.6 bar.
 - 1 off Mucking ejector with flexible hose for tank cleaning.
 - 2 off Water separators with automatic drain trap.
 - 2 off Vent. filter system, one PS and one SB.
- The two segregated loading / discharging systems to be installed with monitoring from cargo control system.
- Vent line midship to be arranged with hose connection at deck and 2 off outlets at different heights below waterline at both sides.

Deck cranes for cargo / rescue

- 1 off Electrohydraulic provision crane.
Crane to have a capacity of approx. SWL 3 t at 18 m outreach.

Tugger winches

- 2 off Hydraulic tugger winch.
Pull capacities: Approx. 10 t pull at first layer 35 m/min.
Drum capacities: Approx. 110 m of 20 mm wire.
Driving unit: Hydraulic motor.

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Page 7 of 21

Rev 0 - 5/7/2013

Loading / discharging pumps

Qty	List of cargo pump	Capacity approx.	Pump driven by:
1 off	FW cargo pump	200 m ³ /h – 9 bar	Centrifugal type. El. motor, Frequency controlled.
1 off	Base oil pump.	150 m ³ /h – 9 bar	Centrifugal type. El. motor, Frequency controlled.
1 off	Drill / Ballast water pump.	200 m ³ /h – 9 bar	Centrifugal type. El. motor, Frequency controlled.
1 off	Fuel oil cargo pump.	200 m ³ /h – 9 bar	Centrifugal type. El. motor, Frequency controlled.
1 off	Brine / Slop pump.	75 m ³ /h – 18 bar	Eccentric screw type. El. Motor, Frequency controlled.
2 off	Mud pump / OILREC.	75 m ³ /h – 24 bar	Eccentric screw type. El. motor, ex. type. Frequency controlled.
2 off	LFL* pump / OILREC.	75 m ³ /h – 9 bar	Centrifugal type. Hydraulic driven.

Loading / discharging systems on deck

System	Dim	Location port side	Location star. side	Remark
BHS no.1	5"	Midship. Aft.	Midship.	Female Weco type coupling
BHS no.2	5"	Midship.	Midship. Aft.	Female Weco type coupling
BHS ventilation line no. 1 and 2	4"	Midship.	Midship.	Female Weco type coupling
Fresh water cargo	5"	Midship. Aft.	Midship.	Female Weco type coupling
Base oil.	5"	Midship. Aft.	Midship.	Female Weco type coupling
Drill / Ballast water	5"	Midship. Aft.	Midship.	Female Weco type coupling
Fuel oil cargo	5"	Midship.	Midship. Aft.	Female Weco type coupling
Brine / Slop	5"	Midship. Aft.	Midship.	Female Weco type coupling
Mud / Brine	5"	Midship.	Midship. Aft.	Female Weco type coupling
LFL*	4"	Midship	Midship. Aft.	Female Weco type coupling

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ULSTEIN PX121 H

Turning visions into reality

Page 8 of 21

Rev 0 - 5/7/2013

Loading / discharging systems in pump room

Discharge pipes for cargo systems to be used as filling lines with bypass line at pumps.

Non Return valves to be installed at pressure side of all cargo pumps.

Blind flanges between combined system to be of suitable type.

Electrical equipment installed in area with gas dangerous zones to be ex proof type or disconnected in OILREC operation.

Arrangements for taking samples on load- and discharge side on all cargo tanks to be arranged.

In general remote operated valves for cargo systems to be with bus operated electric actuators.

Pressure transmitter with local and remote readout to be installed at each cargo pump.

FW cargo system

All FW cargo tanks to be divided into two groups, forward and aft group.

Pipe system to be designed with transfer possibility between these groups and discharge to main deck.

Pipe with valve and hose connection for stripping in each FW cargo tanks to be installed.

Fresh water pump to be back up for water ballast pump.

Flow meter with remote read out to be arranged for loading, discharging and transfer.

Brine / Slop system

High level alarm sensor inside brine tanks to indicate 95% and 98% of tank volume.

Sensor to be mounted below main deck and connected to cargo control system.

Brine / slop tanks to be designed for specific gravity 2,5 t/m³.

Loading/discharge filter with bypass possibilities and discharge to deck.

Filter on suction lines to be arranged.

Blowing of pipes by compressed air from BHS compressor. Fixed pipe connection for air blowing to be arranged.

Recirculation lines to be arranged.

Safety valve to be arranged.

Base oil system

Loading/discharge filter with bypass possibilities and discharge to main deck.

Base oil pump to be back up for fuel oil pump.

Drill-/Ballast water system

All ballast tanks to be divided into four groups.

Ballast group 1, tanks in foreship at port side.

Ballast group 2, tanks in foreship at starboard.

Ballast group 3, tanks in after body at port side.

Ballast group 4, tanks in after body at starboard.

Pipe system to be designed with transfer possibility between these groups, ballast water

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Page 9 of 21

Rev 0 - 5/7/2013

overboard and drillwater discharge to main deck.

Drill-/ Ballast water pump to be back up for fresh water pump.

FO cargo system

Flowmeter for FO cargo in filling/discharge line and possibility for monitoring and printing from cargo control system to be included.

Pipe system to be designed with transfer between groups of tanks and loading/discharge to deck. Blowing of pipes by compressed air from BHS compressor. Fixed pipe connection for air blowing to be arranged.

FO cargo system to be connected to fuel oil transfer system.

Fuel oil pump to be back up for base oil pump.

LFL* system

Pipe system to be designed with pumps submerged in cofferdam with transfer to deck.

Special requirements for material of valves: Press./ Vac. Valve to be stainless steel.

Special requirements for material of pipes: Pipes to be of stainless steel AISI 316L.

Inert gas system to be arranged for purging and padding of LFL* pipes and tanks, and for supply to C/D surrounding LFL* tanks.

OILREC system

An OILREC system to be installed by utilizing the LFL* and mud systems.

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Page 10 of 21

Rev 0 - 5/7/2013

4. SHIP EQUIPMENT

Manoeuvring machinery and equipment

Side thrusters:

Bow thrusters

- 2 off Tunnel thrusters.
 - Fixed speed, controllable pitch type.
 - Propeller diameter approx.: 2.000 mm.
 - Motor rating approx.: 880 kW at 1.200 rpm.
 - Electric motor to be fresh water cooled.
 - Electric motor to be fitted with soft start.

Passive Roll Reduction System:

- 2 off Roll reduction tanks
 - Tanks will be arranged as shown on the General Arrangement plan. Medium shall be ballast water or fresh water.

Dynamic Positioning:

Dynamic positioning system comprising the following main components and software modes, reference systems and interfaces:

- 2 off Operator stations with joystick on aft bridge.
- 1 off Redundant controller.
- 2 off UPS power supplies.
- 1 off Printer.
- 2 off Mode selector switches according to class requirements.
- 2 off Wind sensors with heating and four off "NMEA 0183" output.
- 3 off Motion reference units (x-y direction).
- 2 off DGPS, DPS 110 including the following appurtenant systems:
 - 2 off IALA Beacon receiver.
 - 2 off Spotbeam demodulator.
- 1 off Laser reference system.
- 1 off Gyro compass system comprising 3 off gyros (combined with navigation).
- 1 off Independent joystick.

Radar plants

- 1 off S-band ARPA radar, 26" colour display and 14' scanner.
- 1 off X-band ARPA radar, 26" colour display and 8' scanner.

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ULSTEIN PX121 H

Turning visions into reality

Page 11 of 21

Rev 0 - 5/7/2013

- 1 off Performance monitor for both radars.
 - 1 off 22" Radar slave monitor.
- Both radars shall have gyro interface and shall be provided with inter switch.

Navigation and communication equipment

Navigation and communication equipment to be according to regulations.

- 1 off Complete GMDSS A3 radio installation.
- 2 off DGPS for Navigation Bridge.
- 3 off Gyrocompass.
- 1 off Control panel in forward bridge console.
- 1 off Electronic unit with interface to gyro, magnetic compass and steering gear.
- 1 off Conning system with two displays.
- 1 off ECDIS charting system with two independent stations and 26" monitors.
- 1 off MF/HF SSB simplex radio station 150 W with transmitter and DSC, according to Class requirements.
- 1 off Navtex receiver. 1 off Ship Security Alert System (SSAS).
- 2 off Fixed UHF bridge.
- 1 off Fixed UHF in engine control room
- 1 off Modern PABX system with 2 wire communication and interface to the PA system and alarm signal plant (audible / flashlights)

Anchoring and mooring equipment

The deck machinery includes:

- 1 off Double hydraulic windlass / mooring winch according to Class requirements.
- 2 off Electric capstans aft, approx. 10 t pull at min. 30 m/min.

- 2 off Bollard aft ship,
- 4 off Bollard fore ship
- 4 off Bollard amidships
- 1 off Bollard on bridge deck

Chocks according to Regulations and General arrangement plan.

Repair / Maint. / Clean. Equip. Workshop Arr.

Equipment for workshop in engine room

- 1 off Drilling machine with gear box and rotating table, stand-alone type.
- 1 off 8" Grinding machine.
- 1 off Vice.

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Page 12 of 21

Rev 0 - 5/7/2013

- 1 off Sink with hot and cold water.
- 1 off Work bench with drawers/locker, and steel top.
- 6 off Lockers, lockable.
- 1 off Portable welding inverter, 140 A.

Gas welding central

- 4 off Oxygen bottles
- 2 off Acetylene bottles

Location of gas welding outlets:

- 1 off Outlet in engine room workshop.
- 1 off Outlet in Workshop on main deck.

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Page 13 of 21

Rev 0 - 5/7/2013

5. EQUIPMENT FOR CREW AND PASSENGERS

Safety equipment

The Vessel to be fitted with safety equipment according to SOLAS-regulations.

4 off Life rafts, 30 persons each, two on each side.

1 off MOB-boat with rigid hull, inboard diesel engine and water jet propulsion. The boat shall be equipped according to Class and Authorities requirements.

1 off Davit of approved type for launching the MOB-boat.

Accommodation and inventory

The Vessel accommodates a total number of 30 persons according to current regulations, divided into:

16 single cabins: for officers,

7 double cabins for crew

All officer and crew cabins with separate WC / Shower. Officer cabins to be arranged on B-deck.

Public areas to include mess, dayroom and public toilet. In addition an officer mess to be arranged according to the General Arrangement plan.

Wardrobe room, laundry, galley and provision stores will be arranged according to the General Arrangement plan.

Deck covering in general to be vinyl, using leveling mass where needed. The decks in galley, wardrobe room and provision stores to be covered with casting and tiles.

All wall paneling shall be insulated and ceiling built in sound absorbing material. All walls and ceiling shall be mounted with resilient suspensions towards the steel structure, "floating" accommodations system.

All outer bulkheads, staircases and steel ducts will be insulated with air-gap to the wall paneling.

Division between cabins shall contain of sound damping paneling. Further shall ceiling in the cabins have extra insulation to suppress noise to spread above the ceiling.

Windows to be arranged according to the General Arrangement plan. Blind covers to be delivered according to Load Line requirements.

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Page 14 of 21

Rev 0 - 5/7/2013

All front windows in wheelhouse to be equipped with one wiper each, and two of the large windows aft, each with two off wipers of approved type. All windows, except overhead windows, shall be arranged with hot air nozzles.

Water tight doors

Doors in transverse watertight bulkheads to be hydraulic operated sliding doors of approved type.

Number and location of watertight sliding doors according to General Arrangement.

Freezing / refrigeration systems for provisions

Dry provision room to be connected to the air condition plant.

The refrigeration plant to consist of two fully automatic FW cooled compressors. Each compressor to be dimensioned for an air temperature of 45 °C and be able to serve as backup for each other. Cooling medium according to Class requirement.

Ventilation, AC and heating

Areas in general to be fitted with satisfactory ventilation, heating and cooling according to ISO 7547, 8861, 8862, 8864 and 9099 for 'Design conditions and basis of calculation'.

Summer: Outdoor air temperature +35°C and 80 % relative humidity
Indoor air temperature +25°C and 50 % relative humidity

Winter: Outdoor air temperature -20 C°
Indoor air temperature winter +22°C and min. 30 % relative humidity

The Vessel to be equipped with a single spiro air duct distribution system. Insulated supply ducts and uninsulated exhaust/return air ducts. HVAC plant for accommodation with hot water secondary system from boiler as heating medium and cooling from the chilled water plant.

The HVAC system is based on use of enthalpy recovery system with 100% fresh air to AC-1. The enthalpy recovery system to be made of aluminium foil.

- 2 off Separate chilled water plant to be installed. Each plant consist of a min. 80% direct drive screw type drive compressor, condenser, valves/control system and chiller.
- 2 off Chilled water pumps, capacity according to suppliers requirement and frequency controlled.

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Page 15 of 21

Rev 0 - 5/7/2013

1 off Water expansion tank for chilled water plant.

Refrigeration compressor to be provided with automatic capacity control system.

2 off Supply fans for engine room, frequency controlled axial fans with sound trap and remote operated closing dampers. Capacity for each fan according to ISO 8861.
Fans to be control by air pressure sensor in engine room.

Sanitary systems

Sanitary supply systems:

- 2 off FW hydrophore pumps.
- 1 off UV-steriliser.
- 1 off Hot water calorifier to be installed.
- 2 off Hot water circulation pump.

Sanitary discharge systems:

- 1 off Vacuum sewage plant, consisting of 2 pumps.
- 1 off Sewage treatment plant.
- 1 off Sewage tank as hull tank.
- 1 off Sewage discharge pump.

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Page 16 of 21

Rev 0 - 5/7/2013

6. MACHINERY MAIN COMPONENTS

Diesel engine for propulsion

2 off Main engine generator sets, capacity approx. 1.630 bkW each at 1.800 rpm.

2 off Main engine generator sets, capacity approx. 990 bkW each at 1.800 rpm.

Total output approx. 5.250 bkW

Engines to be of four-stroke turbo charged type.

One of the large engines (port side) to have front end PTO for Fi-Fi pump drive.

Each main engine and main generator to be mounted on common frame with flexible coupling between. Main generator sets resiliently mounted.

FW LT and HT pumps to be mechanical driven and built on engines. FW LT pump may alternative be electric driven.

2 off Main generators, capacity approx. 1.550 ekW each at 1.800 rpm.

2 off Main generators, capacity approx. 910 ekW each at 1.800 rpm.

Electrical motors drives for propulsion

2 off AC asynchronous el. Motors shall be installed in propulsion room, each connected to its propeller, with below parameters:

- Speed: 0-1800rpm for continuous operation

- Voltage: 690V

- Cooling: by fresh water

- Power: 1600 ekW

- Enclose: IP44

Frequency converter for propulsion motors

Each of the propulsion motor shall supply from frequency converter, the propeller drives shall be controllable pitch azimuth propeller type.

The frequency converters are fresh water cooled type with pre-charge circuits to avoid inrush current during startup, also have load shedding function to prevent blackout in case of unexpected stop of online generator.

Azimuth Propellers for propulsion

2 off Main azimuth thrusters with controllable pitch propellers to be installed..

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Turning visions into reality

Page 17 of 21

Rev 0 - 5/7/2013

Power to be approx. 1.600 kW on each unit.

Motor speed to be 0 - 1.800 rpm.

Propeller diameter of approx. 2.200 mm..

The drive shaft to be equipped with simple locking device to avoid wind-milling during repairs.

Propeller diameter and blade area to be optimized in co-operation with propeller manufacturer and / or model test results.

Boilers, steam and gas generators

Central heating and thermal oil boilers

Hot water boiler

1 off Hot water boiler with automatic oil burner, electrical heating elements and expansion tank.

Capacity of boiler 300.000 kcal/h plus 4 x 10 kW from heating elements.

Emergency diesel Generator sets

1 off Emergency generator sets, output approx. 99 ekW
Speed at 1800 rpm. The engine to be air cooled

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U10782

ULSTEIN PX121 H

Turning visions into reality

Page 18 of 21

Rev 0 - 5/7/2013

7. SYSTEMS FOR MACHINERY MAIN COMPONENTS

Fuel oil system

Engines to use marine gas oil according to ISO 8217, ISO-F-DMA.

- 2 off FO service tanks as hull tank.
- 2 off FO setting tanks as hull tank.
- 1 off FO separator, self-cleaning type with capacity according to engine maker.
- 2 off FO transfer pumps, capacity approx. 15 m³/h and 3 bar.
- 1 off FO sampling pump, portable and air driven.

Lubricating oil system

- 2 off LO stores tank for main engines.
- 1 off LO stores tank for bow thrusters.
- 1 off LO stores tank for main azimuth thrusters.
- 1 off Hydraulic oil stores tank.
- 1 off LO drain tank.
- 1 off FO drain tank.
- 1 off LO separator, self-cleaning type with capacity according to engine maker.
- 1 off LO transfer pump for main generator sets, capacity approx. 2,9 m³/h and 2 bar.
- 1 off LO transfer pump for main azimuth thrusters, capacity approx. 2,9 m³/h and 2 bar.
- 1 off LO transfer pump, portable and air driven. Capacity approx. 2,4 m³/h.

Cooling system

- 2 off Sea inlets (1 off low suction port and 1 off high suction SB) to be arranged for the engine room. Sea inlets to be connected with tank duct below tanktop.
- 1 off Sea chest in aft ship for emergency fire pump, BW/DW cargo pumps and cooling systems in aft ship.

Arrangement of sea chests to be according to class requirement

Marine growth prevention system to be installed in sea chests

SW / FW cooling system for main generator sets.

SW / FW cooling system for propulsion plant aft, one at each side.

SW / FW cooling system for miscellaneous equipment (thrusters, compressors etc.).

Compressed air system

- 2 off Starting air compressors, capacity according to class.

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Switchboard + 47 7000 8000. Telefax + 47 7000 8559.
Enterprise number NO 926 738 461



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Page 19 of 21

Rev 0 - 5/7/2013

- 2 off Starting air bottles, capacity approx. 500 litres.
- 1 off Working air compressor, capacity approx. 70 m³/h at 7 bar.
- 1 off Working air tank, capacity approx. 500 litres at 7 bar.

Exhaust system

Exhaust Silencers with 35 dB(A) noise reduction.

Silencer for emergency generator engine with 25 dB(A).

Exhaust pipe from hot water boiler to have water protected collar through the top of funnel and to be directed aft and outward. Exhaust pipe to have spark arrestor.

Automation systems for machinery

- 3 off Workstations with steel consoles.
- 2 off Integrated manoeuvring chairs including steering gear, propulsion, thrusters, joystick, VHF and loudhailer. Electrical driven position adjustment and rotation.
- 1 off Alarm / monitoring system according to Class requirement.

Integrated Automation System (IAS)

The automation system consists of the following functionality and sub systems;

Integrated Alarm and Monitoring System with Cargo handling and Control (IAS).

These sub system shall be separately operational and be integrated for remote control system.

The operator stations will be connected by a redundant bus network to the two main controllers.

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Page 20 of 21

Rev 0 - 5/7/2013

8. SHIP COMMON SYSTEMS

Ballast system

See chapter 3, Ballast / Drill water system.

Bilge system

- 3 off Bilge pumps of eccentric screw type, capacity according to Class requirements.
- 1 off Bilge water tank in engine room.
- 1 off Clean bilge water holding tank.
- 2 off Bilge water settling tank in engine room, vertical design.
- 1 off Bilge water separator, capacity approx. 1,0 m³/h – 5 ppm & OCD alarm.
- 1 off Sludge pump, 2-speed. Capacity approx. 10 / 5 m³/h and 3 / 2 bar.
- 1 off Bilge ejector for room forward above main deck.

Gutter pipes, outside accommodation

Sufficient number of drain pipes to be laid from respective decks.

Fire Fighting system

- 2 off Fire pumps according to Class requirement.
 - 1 off Emergency fire pump according to Class requirement.
- Fire and alarm for pump room shall satisfied rules of classification..
Paint/Chemical store to have sprinkler connected to hydrophore system

External Fire fighting system

- 1 off Fi-Fi pump, capacity according to Class requirement.
Pump casing nodular cast iron and impeller in ni-al-bronze.
- 1 off Hydr. Clutch for mounting between main engine PTO and Fi-Fi pump.
- 2 off Fi-Fi monitors with el. remote control & manual backup.
Fi-Fi monitors to be installed at wheelhouse top.

Fire fighting systems with foam

Foam system for LFL* cargo tank system, deck protected area according to Class requirements.

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Page 21 of 21

Rev 0 - 5/7/2013

- 1 off Fire general service pump, capacity according to foam calculation.
- 1 off Foam tank.
- 1 off Foam pump.
- 1 off Foam mixer.
- 1 off Foam monitor.

Fire fighting systems with water

- 1 off Protection system of water mist type for engine room to be installed according to Class and Authorities requirements.
- The fire fighting system with water to have interface to ventilation system in the protected areas.

Air and sounding system

- Air pipe size according to Class requirement.
- Workmanship for air and sounding pipes according to Yard's standard.

Common electric system

- Alternating current system, 3 phase, 60 Hz according to DIN and / or IEC norms.
- System voltages: 690VAC, 440VAC, 230VAC and 24VDC.
- Voltage drops shall not exceed 15% at any time during normal operation.

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