NAUTIC
STRENGTH FOR AFRICA

Ship's Handbook For

I.H. PEPPLE

FAST CREW BOAT

Document Number P254-052-000-A3

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Certificate Details:

Vessel:	24 Metre Fast Crew Boat	BV Registry Number:	22131H
Vessel Name:	I.H. Pepple	Yard Number:	P254

Item	Description	Certificate Number or Date of Issue
	Ship	
1.	Nautic Africa After Sales Introduction incl terms, flow and form	Rev D - 20120823
2.	Stability Handbook	P254-034-001-A
3.	Builders certificate	P254-052-002-A
4.	Port letter of good standing	P254-052-005-A
5.	Pest Free Certificate	P254-052-082-A
6.	Electrical Handover Certificate	P254-052-301-A
7.	Compass deviation card issued by Fox & Eastman on 7 November 2012 - No Expiry	P254-052-422-A
8.	Trial Report	P254-070-001-A
9.	Certificate of Classification	LCP0/AOS/20130131125730
10.	Class Conditions	P254-081-023-A
11.	Receiving of BV docs sign off - 20130201	P254-081-023-A
12.	Examination report - Stability - 20130125	P254-081-034-A
13.	Examination report of intact stability	P254-081-034-A
14.	Inclining experiment report - Stability	P254-081-034-A
15.	Limit Operating Conditions	P254-081-034-A
16.	I.H. Pepple Tonnage Certificate	DPO 13/034
17.	Statement of compliance for non-conventional ship	P254-081-082-A
18.	EPIRB certificate of assurance	P254-081-400-A
19.	Attestation of Asbestos free construction (in lieu of hazardous materials certificate)	P254-081-603-A
20.	Periodical radio survey report	P254-081-400-A
21.	Record of radio installation	P254-081-400-A
22.	Safety Equipment Supplied	P254-081-700-A
23.	Safety Plan	P254-730-000-A
24.	Inventory List	I.H. Pepple Inventory for Ship's manual
25.	Lubrication List	963 4218

Notes to Users

1. This handbook contains mainly, the as-built information relating to the ship's equipment and systems that are not included in the individual supplier's handbooks.

2. The information in this handbook is intended to supplement the information in the various system and equipment handbooks provided by equipment suppliers. It **DOES NOT** replace the equipment handbooks supplied. When operating the actual equipment always refer to the equipment supplier's handbook.

3. In the case of conflict between the information in this handbook and the information in the equipment supplier's handbook, the equipment supplier's handbook shall always take precedence.

4. The PIN code for the fire alarm panel is 2222.

5. The PIN code for the MJP Panel is 7121. Note using this code gives access to the MJP configuration settings. DO NOT change these settings without first consulting Nautic Africa.

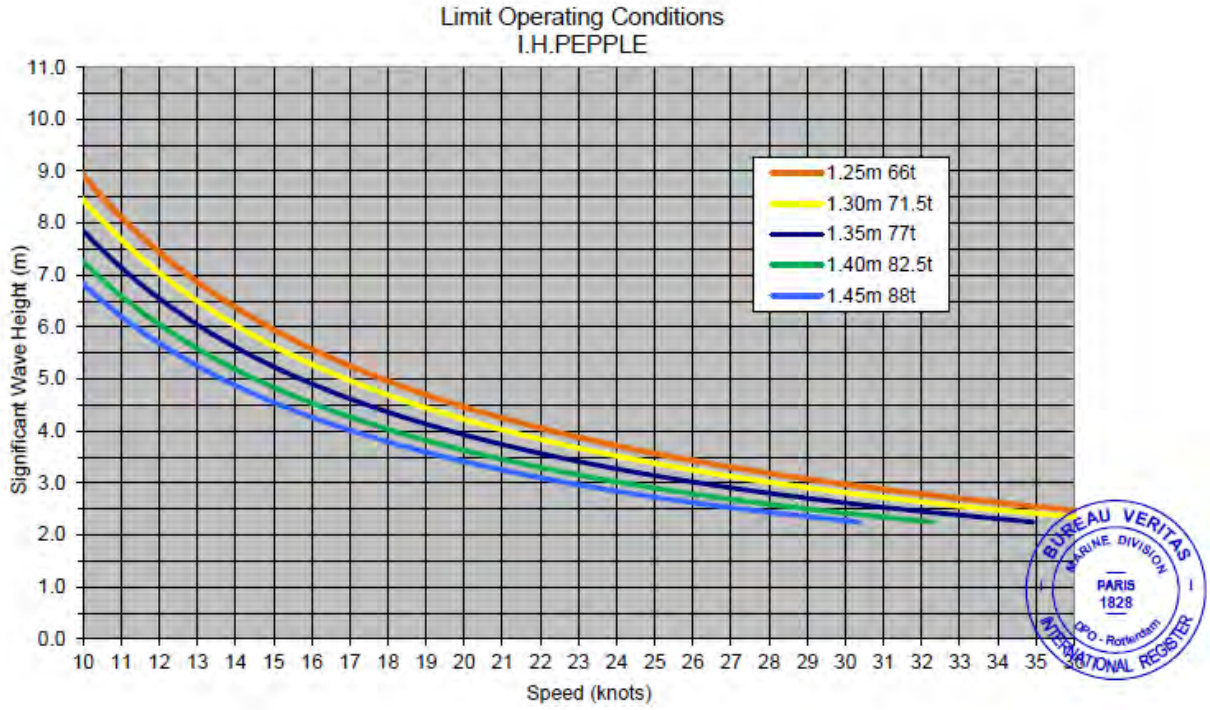
Extracts from the Preliminary Stability Handbook

Operating Restrictions

The structural design of the vessel is in accordance with Bureau Veritas 'Rules for the Classification of Crew Boats', rule NR490 DTM RO1 E. The vessel is therefore accordingly restricted to operating not more than 4 hrs, at operational speed, from a place of refuge.

The 'Arrival Condition' as specified in this booklet is considered to be the minimum sea-going condition for the vessel. That is to say, that the vessel should not be operated with less than the equivalent of 10% fuel and freshwater in the main fuel and freshwater tanks. Great care should always be taken in severe weather, and it is important to note that in such conditions, it would be safer to operate with substantially more than the minimum fuel and water on board, whenever possible.

Further to this, the vessel must at all times be operated within the defined Limit Operating Condition – see graph below, which specifies the maximum speed for any particular characteristic wave height. Exceeding the specified speed will lead to dangerous levels of structural loading on the vessel and will thus compromise the safety of the vessel, crew and passengers. (This graph must be on display in the wheelhouse at all times).



Particular care should be taken with water-jet-driven vessels in quartering and following seas. In 'surfing' conditions it is common for the vessel speed to approach the 'free stream' speed of the jets, and steering control can then be lost, which may result in broaching. It is important therefore to throttle back in such conditions, as steering control can be regained by temporarily increasing thrust. Some Masters have found that in extreme 'surfing' conditions it can even be beneficial to reverse the jet thrust in order to maintain steering control.

The hydrostatics particulars are provided for the vessel at its design trim. When the actual trim of the vessel is far from this design trim, the actual values of the hydrostatics particulars vary from those provided. This may result in the stability being over-estimated. Every effort must therefore be made to keep the vessel close to design trim at all times. The vessel must not at any time be operated at a draught exceeding the maximum draught indicated in this booklet.

Master's Shipboard Procedures

The maintenance of watertight integrity is the responsibility of the Commanding Officer, and is essential to developing the maximum stability and reserve buoyancy following underwater damage. All watertight access hatches and doors should be secured when at sea and closed immediately after use. If significant following seas or inclement weather conditions are anticipated the vessel should seek sheltered waters or turn into seas.

It is important that due notice is taken of the preceding section 'Operating Restrictions' and that the vessel is, at all times, operated safely within the limits imposed by these restrictions.

Click here to view Stability Handbook

Abbreviations

Abbreviation	Meaning
A	Amperes
A/C	Air Conditioning
A/H	Ampere Hours
AC	Alternating Current
AIS	Automatic Identification System
AM	Amplitude Modulation
AUX	Auxiliary
BHP	Brake Horse Power
BLKD	Bulkhead
BWM	Bilge Water Module
BWS	Bilge Water System
CB	Circuit Breaker
CCW	Counter Clockwise
CFL	Compact Fluorescent Lamp
CW	Clockwise
DB	Distribution Board
DC	Direct Current
DGPS	Directional GPS
DPU	Digital Processing Unit
DSC	Digital Selective Calling
ECDIS	Electronic Chart Display
EMS	Engine Management System
ENC	Electronic Navigational Chart
EPIRB	Emergency Position-Indicating Radio Beacon
ER	Engine Room
ES	Electrical Supply
FiFi	Fire Fighting
FM	Frequency Modulation
FM200	Trade name for Engine Room Fire Smothering system
FO	Fuel Oil
FR	Frame
FW	Freshwater
GCU	Gearbox Control Unit
GEN	Generator
GENSET	Generator Set
GMDSS	Global Maritime Distress & Safety System
GPS	Global Positioning System
GSP	General Service Pump
HDG	Heading
HF	High Frequency
HHP	High Holding Power
HMI	Human Machine Interface
HPS	High Pressure Sodium
HVAC	Heating, Ventilation and Air Conditioning
Hz	Hertz (frequency)
I/O	Input/Output
ICAF	Impressed Current Anti Fouling
JB	Junction Box
kW	Kilo Watt
LAN	Local Area Network
LCU	Local Control Unit
LDB	Local Distribution Board
LOP	Local Operating Panel
LRIT	Long Range Identification and Tracking System
LUB	Lubricating
MCC	Machinery Control Centre
MCS	Marine Clock System
MDB	Main Distribution Board
MH	Metal Halide
MMS	Machinery Management and Alarm System
MSB	Main Switch Board
NAV	Navigational
NAVNET	Furuno's proprietary navigational network
NAVTEX	Navigational Telex
NiCd	Nickel Cadmium
NC	Normally Closed

Abbreviation	Meaning	Abbreviation	Meaning
NIJ	National Institute of Justice		
NMEA	National Marine Electronics Association (US)		
NO	Normally Open		
OB	Overboard		
O/L	Overload		
OP	Operators Panel		
PA	Public Address		
PC	Personal Computer		
PCU	Power Control Unit		
PIN	Personal Identity Number		
PLC	Programmable Logic Controller		
PMU	Power Management Unit		
POE	Power Over Ethernet		
PSU	Power Supply Unit		
QTY	Quantity		
RCU	Remote Control Unit		
RIB	Rigid Inflatable Boat		
SAMSA	South African Maritime Safety Association		
SART	Search & Rescue Transponder		
S/C	Short Circuit		
SSB	Single Side Band		
STARBOARD	Starboard		
SW	Seawater		
SWBD	Switchboard		
UPS	Universal Power Supply		
UV	Ultra Violet		
V	Volts		
VAC	Volts Alternating Current		
VDC	Volts Direct Current		
VDU	Visual Display Unit		
VHF	Very High Frequency		
WH	Wheelhouse		

Chapter 0: Introduction

Overview

The information in this handbook is applicable I.H. Pepple which is a Fast Crew Boat built for the OCTOPUS CLAN of Nigeria by Nautic Africa.

The I.H. Pepple is a high speed semi-displacement vessel with a V-bottom hull shape with the hull constructed from marine grade aluminium plate and the superstructure from Kevlar Glass composite.

The primary role of this vessel is the transfer of crew and supplies from port to offshore facilities and vessels and vice-versa.

The I.H. Pepple has a length of 24 metres and a beam of 6.3 metres, with a capacity for 24 seated passengers (6 berths are provided for passengers that may need to sleep onboard while the vessel is stationed off a rig). There are four berths for the crew including the captain.

The 24 metre vessel is powered by two CAT C32 ACERT engines of 1300 bhp each, coupled to ZF3050 gearboxes and MJP DRB 500 Jets. It has a roundtrip range of 650 nautical miles at standard speed, but achieving speeds of up to 27 knots when required.

Brief Description

Layout

The hull is of an all welded aluminium construction and is divided into 4 watertight compartments as follows:

- Engine room with main engines, generators, batteries, pumps, etc.
- Passenger cabin accommodation, Captain's cabin and laundry room situated amidships below main deck.
- Galley, mess room, crew cabin accommodation and ablutions forward.
- Forepeak with chain/rope storage.

Fire resistant and watertight doors are fitted in the watertight bulkheads between the engine room and the aft end of the passenger accommodation and between the passenger accommodation and the crew accommodation/ablution area.

The composite superstructure comprises a deckhouse with the wheelhouse being an integrated ballistic protection area. On top of the wheelhouse is the mast carrying the radar and communication sensors. The deckhouse contains passenger seating and saloon.

Two weather-tight doors are fitted in the deckhouse, 1 aft at the entrance to the passenger saloon and the other at the entrance to the wheelhouse on the port side.

Ballistic protection against small arms fire is provided around the wheelhouse and the passage area immediately behind the wheelhouse. Note that the wheelhouse deck head is not protected. The Protection provided meets Euro Ballistic Standard EN1532 Class FB6 and NIJ Standard Class III+.

Fuel, freshwater, waste water and oily water tanks are integrated into hull construction. Flush mounted manholes provide access to all tanks.

Watertight escape hatches are fitted in the engine room and crew's accommodation to provide access to the deck in an emergency. A further escape hatch is fitted in the wheelhouse giving access to the mast deck. Note that there is also access hatch to the fore peak.

200 Propulsion System

210 Engines

The vessel is powered by two water cooled main engines resiliently mounted on longitudinal bottom girders in the engine room. Each engine drives a water jet through a reduction gearbox. The main engines have integrated systems for lubrication oil, cooling water and fuel oil with turbo charging and charge air-cooling.

Normal control of the starting and running of the engines is from the engine room with emergency stop controls available in the wheelhouse. The installation is such that the engine room may be left unattended during normal operation.

When required, each main engine may be removed and replaced through the engine hatch on the aft main deck.

NOTE: Diesel fuel quality is an important factor in satisfactory engine life and performance (see Fuel Oil Quality on page 2-2 for further detail).

220 Gearboxes and Shafting

Each engine is coupled to a reduction gearbox with a flexible coupling. Between the gearboxes and water jets light weight shafting is provided with highly flexible couplings.

The gearboxes have a reduction ration of 1.563:1 which is selected to meet the vessel's performance when used with fitted MJP water jets.

230 Jets

There are two high performance water jets which are steered.

The high performance jets are suitable for medium duty operations (approximately 4000 hours/year) with hydraulic pumps for control of the steering nozzles and thrust buckets. The hydraulic pumps are mounted on the power take off of each gearbox. Note that the jets have a double pump where one pump provides hydraulic function and the other lubrication of the bearing.

240 Instrumentation

241 Engine Control and Instrumentation

An electronic control station situated in the wheelhouse console controls each main engine and gearbox. This unit will continue operation in case of black-out of the AC system. In case of emergency, the engines can be stopped with an emergency switch from the wheelhouse and engine room.

Monitoring is provided for each engine via a CAT Marine Power Display (MPD). This unit is a self contained engine monitoring and display system which monitors the following parameters in its standard configuration.

- Oil pressure
- Water temperature
- Tachometer
- Engine alarms
- Running hours

242 Gearbox Control

The controls for gearboxes are integrated with those of the engines. Note in the case of an emergency, the gearboxes can be manually put into gear in the engine room.

243 Jet Control and Instrumentation

The outer water jets are controlled via units located on the console in the wheelhouse.

244 Autopilot

A Furuno NAVPILOT-700 autopilot is fitted. The system comprises:

a. Processor Unit FAP-7002

b. Control Unit FAP-7001

c. Heading Sensor PG-500

d. Rudder Reference Unit FAP-6112

300 Electrical

310 Electrical Power Supply

311 Generator Set

Two Caterpillar 64 kVA, 400 VAC generator sets are installed in the engine room, one behind the other aft of the engines and on the port side of the centreline. Each is equipped with a built-in auto voltage regulator

and is driven by a Caterpillar C4.4 marine diesel engine. One generator is used at a time. The diesel engine is electrically started and stopped from the generator control panel next to the generator.

NOTE: Diesel fuel quality is an important factor in satisfactory engine life and performance (see Fuel Oil Quality on page 2-2 for further detail).

The generator set is provided with a local control panel which includes:

- A cooling water temperature indicator
- A lubrication oil pressure indicator
- Start-stop button

The generator set switches off automatically when the cooling water temperature reaches a maximum level or when the lubrication oil pressure indicates a minimum level. Generator failure alarms are displayed on the combined vessel information system display panels.

312 Shore Power

A shore connection point on the starboard side of the aft deck and a 25 metre shore-to-ship electrical supply cable is supplied.

320 Switchboards

Switchboards provided are:

- 2 x 24 VDC in the wheelhouse and switchboard room
- 1 x 12VDC in the wheelhouse
- 230/400 VAC main switchboard in the switchboard room
- 3 x 230/400 VAC distribution switchboards in the switchboard room, galley and wheelhouse

340 Batteries and Chargers

There are 4 sets of gel type batteries installed, 2 sets for starting the main engines and generators, 2 sets for general service use.

The battery sets are charged via battery chargers adjacent to them.

350 Lighting

Normal 230 VAC and emergency 24 VDC interior and exterior lighting is provided.

360 AC Power Supplies

AC wall sockets are available in the engine room, deckhouse, wheelhouse, passenger and crew cabins, mess room and galley.

370 DC Power Supplies

A DC wall socket for the connection of a signal light is fitted in the wheelhouse.

390 Alarm Systems

Combined Vessel Information System

A combined vessel information system which operates on a PLC platform is installed. Connections to the system include both OEM equipment that have "General" or "Common" alarm circuits available for monitoring and alarm circuits that are controlled by the PLC itself.

Examples of OEM equipment whose alarm circuits are monitored the Fire Detection System, the Intercom System, the Propulsion System and the Generators.

Alarms and information messages that are controlled by the PLC are displayed in the Engine Room, Switchboard Room, Captain's cabin and the main alarm system Operators Panel (OP) located in the wheelhouse.

Alarms that are displayed on the PLC system displays include:

- Electrical (including Generator) alarms
- Fuel system alarms
- Waste water tank level alarm
- Freshwater level alarm
- Bilge high level alarms
- Fire alarms (smoke and heat detection)
- Engine room fire smothering system (FM200) activation alarm
- Door/hatch open alarms

The Engine (with Gearbox) and Water Jet have dedicated displays on which associated alarms are displayed. Note that engine alarms are displayed in the wheelhouse and at the local operator panels in the engine room.

Fire Alarm System

The Fire Detection system comprises a Synchro ASM Single Loop Control panel linked to smoke detectors, heat sensors and manual call points.

The system is divided into zones which monitor the various detectors. The control panel in the wheelhouse is equipped with a large graphic display, indicators and the controls to operate the panel, providing the user with versatile Fire Detection annunciation features.

If the system detects an input from a sensor, the control panel will give a visual and audible alarm. In the event of the alarm not being accepted by a crew member within 2 minutes the system activates the General Alarm system.

400 Electronics

421 Navigational Systems

The I.H. Pepple has a Furuno suite of navigation instruments linked together via NavNet which makes data available to all connected displays on the vessel. Thus with one of the two 12 inch colour LCD display monitors switched off or faulty you still have GPS position, course and speed available on other display monitor.

Systems linked via NavNet are:

a. Radar using a 6 kW 4 foot open antenna

b. AIS FA-50 Automatic Identification System

c. DFF-1 Depth Sounder

d. NavTex Navigational Telex System

e. PG-500 Heading Sensor

f. NavPilot 700 Autopilot

g. Thermal Imaging System

421 Navigational Lights

Navigational lights include port and starboard sidelights, stern light, masthead light and anchor light.

Thermal Imaging System

The vessel is fitted with a Flir Thermal Imaging System which comprises a thermal imaging camera mounted on top of the wheelhouse forward of the mast and a JCL1 Joystick control unit located in the wheelhouse console on the port side.

422 Searchlight

A hand operated 1000 watt 230 VAC searchlight is installed on top of the wheelhouse.

423 Signalling System

The mast mounted Marco pneumatic signalling horn is operated from a pushbutton on the wheelhouse console.

424 Radar

A Furuno DRS-6A 4 foot 4 kW open antenna array with built-in processor is mounted on the main mast. Radar information is distributed via the NAVNET network and displayed on the 12 inch colour LCD display monitors.

425 GPS and Compass

A GP-320B GPS/WAAS receiver antenna is installed which is connected to the NAVNET network enabling accurate GPS position data to be displayed on the 12 inch colour LCD display monitors.

The magnetic steering compass is a Ritchie SP-5B Globemaster.

430 Communication Systems

431 External Communication Systems

2 x ICOM IC-M604 VHF Marine Radio Telephones	:	The IC-M604 is an all-in-one marine VHF radio system consisting of a 25 W VHF radiotelephone, a DSC modem, and a CH 70 watch receiver. It complies with GMDSS carriage requirements for safety and general communications.
VHF (Handheld)	:	A Sailor SP3520 GMDSS VHF handheld transceiver is supplied for onboard and emergency communications. It is a waterproof impact resistant unit fitted with rechargeable NiCd batteries.
HF/MF Transceiver		An Icom M802 HF/MF marine transceiver is installed. Features include wide band receive coverage (0.5 – 29.9999MHz) and a remote control mic allowing direct channel selection. Can be set for email access if required.
AIS		A Foruno FA-500 AIS Class B transponder is fitted and feeds AIS data to the NavNet vx2 for incorporation into the radar display. The system comprises the Class-B AIS transponder connected to a GPA-017S GPS antenna and a CX-4 VHF antenna.
NAVTEX	:	A Furuno NX-700 dual channel NAVTEX receiver is installed. The system comprises a NX-7001 receiver, a NX-700B display unit and a NX-7H antenna.

432 Internal Communications System

Internal Intercom and Loudhailer System	:	A Vingtor ETB10 Internal Intercom and Loudhailer system, comprising: 2 x HE112M Outdoor loudspeakers with call buttons 4 x STB1 Wall mounted indoor loudspeakers with call and answer buttons 2 x STB3 Engine Room Unit equipped with a PMT7 Headset and one with blue signal light 1 Mast mounted Horn/Speaker

440 Nautical Systems

441 Depth Sounder

A Furuno DFF-1 Network Sounder coupled to thru-hull depth transducer is fitted and connected via the NavNet network. Depth information is displayed on one of the 12" LCD colour display monitors.

490 Entertainment System

Mess Room	:	A TV and radio/CD/DVD is located in the mess room for the crew's

entertainment.

Passenger Saloon : An audio-visual system is installed for passenger entertainment with DVD unit on wheelhouse console.

500 Ship's Systems

510 Bilge System

All watertight compartments with exception of the forepeak are connected to a centrally operated bilge manifold in the engine room. The bilge system is combined with general service and internal fire fighting.

All suction points are equipped with a suction filter to prevent blockage.

The system is provided with two electrical pumps and one mobile diesel pump. Manual pumps are provided for the engine room and forepeak.

520 Fuel and Lube Oil System

There are four bunker tanks, located in the bottom of the hull and a header tank in the engine room. The bunker tanks have filling and vent pipes. The vent pipes are fitted with flame traps and a self closing device to prevent the ingress of seawater. A drip tray is fitted around the fuel filling point to prevent any oil spillage on the deck. The header tank filling is via transfer pumps (main and standby) and there is an overflow return to the bottom tanks. Level and contents sensors in the tanks are connected to the PLC system for display in the wheelhouse, Captain's cabin, switchboard room and engine room.

Two bunker tanks have a capacity of 4500 litres each and the other two 3800 litres each. In addition the header tank has a capacity of 1800 litres. Each tank (including the header tank) is fitted with a level sensor which gives contents and low and high level indications to the PLC system.

A duplex coarse fuel filter and water separator is installed in the fuel line between the bunker tanks and the header tank and in addition each engine is equipped with duplex fine oil filter. The water separator's water alarm is connected to the ship's alarm system.

Note that emergency stops in the switchboard room allow the fuel lines to be closed in an emergency.

A 1000 litre dirty lube oil tank is provided.

530 Cooling System

531 Main Engine and Generator Engine Cooling

Each engine and generator has an independent water cooling system comprising a heat exchanger and a closed loop freshwater system. Seawater is fed to the heat exchangers and discharged partly via the engine exhaust system and partly via a bypass in the hull.

The seawater cooling system has two sea inlets each with a stainless steel inlet strainer box. A shutoff valve is fitted between the strainer and the sea inlet to allow cleaning of the strainer.

541 Sanitary System

541 Freshwater System

Freshwater is stored in 2 x 1800 litre painted aluminium tanks built located one on the port side and one on the starboard side between frames 16 and 18 above the waterline. Freshwater is supplied throughout the ship via a duplex water pressure set.

The freshwater tank is fitted with a level sensor which gives contents and low high-level indications to the PLC system.

In addition, a reverse osmosis type water maker producing 155L/h is installed. The water maker receives seawater from the generator cooling water strainer and feeds freshwater into the freshwater system.

542 Wastewater System

A 2200 litre combined grey/black wastewater tank is built into the hull.

Water from sinks, washbasins, showers and toilets is fed to the waste water tank. Shower and sink drains collect in three 20 litre sumps separate from the toilet drain, before being pumped into the wastewater tank. The wastewater tank can be either discharged overboard or ashore via a dedicated connection on the main deck.

The wastewater tank is fitted with a level sensor which gives contents and high-level indications to the PLC system.

560 Ventilation and Air Conditioning

The wheelhouse and all accommodation areas are supplied with fresh air and are air conditioned.

The forced ventilation for the engine room is from air ducts at the aft main deck, using two 230VAC axial flow fans. Supply is sufficient to provide combustion air of all engines and dissipation of heat. Engine room ventilation ducts can be fully closed in the event of a fire.

580 Exhaust System

581 Propulsion Exhaust

The main engine exhaust system runs through the sides of the vessel above the waterline and is fitted with goosenecks and non-return flaps. Water from the engine cooling water system is injected into the exhaust system for heat and noise reduction.

The exhaust lines have flexible bellows ether side of the silencers and are thermally insulated. The engine monitoring system monitors back pressure and exhaust gas temperature.

582 Generator Exhaust

Each generator engine has a dry thermally insulated exhaust system running through the side of the vessel, above the waterline. Each line is fitted with a gooseneck and non-return flap.

600 Outfitting

611 Anchor Equipment

The ship carries one 100 kg Hall type anchor. The anchor is fitted with 110 metres of 13 mm common link Q2 chain and is operated by a capstan type windlass on the ship's foredeck.

700 Safety

710 Fire Fighting System

The fire fighting system forms an integral part of the bilge and general service system. Seawater is delivered to two hydrants on the main deck and one on the bilge module for fire fighting purposes. The volume of water supplied is sufficient to operate all hydrants simultaneously.

Fire hoses and nozzles are stored near each hydrant, the hoses are long enough to reach every space in the vessel. Nozzles have jet and spray functions and can be shut off.

A fixed fire extinguishing systems is installed to protect the engine room. The system uses a FM200 extinguishing gas from a pressurized cylinder fitted inside the engine room. Actuation is manual from outside the engine room.

Seven 4.5 kg dry powder extinguishers, two 5 kg CO2 extinguishers and two foam extinguishers are supplied. Their locations are shown on the ship's safety and evacuation plan.

Specifications

Dimensions

Length Overall	:	24.0 m (excluding fenders)
Beam Overall	:	6.3 m (excluding fenders)
Depth at sides (at half length)	:	3.56 m
Draught (approximate)	:	1.16 m
Displacement (Light Ship)	:	45 t
Displacement (fully loaded)	:	65 t
Gross Tonnage	:	125.25 t

Tank Capacities

Fuel Oil	:	18400 l (includes 1800 l in header tank)

Freshwater	:	3600 l
Wastewater	:	2200 l
Grey Water Sumps	:	3 x 20 l
Dirty Lub Oil	:	1000

Performance

Cruise Speed	:	21 Knots
Maximum Speed	:	27 Knots
Range at Cruise Speed	:	650 nm (Total round trip distance)
Range at Maximum Speed	:	500 nm (Total round trip distance)

Propulsion System

Main Engines	:	2 x Caterpillar C32 ACERT
Total Power	:	1300 bhp at 2100 rpm
Water Jets	:	2 x Steered
Gearboxes	:	2 x ZF 3050

Electrical Equipment

Generator Sets	:	2 x CATERPILLAR C4.4 Diesel generator sets 64 kVA
Networks	:	400 V, 50 Hz
		230 V, 50 Hz
Switchboards	:	230/400 VAC Main Switchboard (Switchboard Room)
		230/400 VAC Switchboards (Galley, Switchboard Room and Wheelhouse)
		24 VDC (Wheelhouse and Switchboard Room)
		12 VDC (Wheelhouse)

Deck Lay-out

Anchors	:	100 kg Hall Type
Anchor Chain	:	110 m (12.0 mm diameter, common link Q2)
Mooring Ropes	:	4 x 40m lengths, 40 mm diameter

Life Saving Equipment

Life Buoys	:	2 (with lights and smoke)
		2 (with buoyant line)
Life Jackets	:	40 (with light)
Life Rafts	:	2 x 25 persons
		1 x 6 persons
Flares	:	12 x Parachute
		6 x Red handheld
Fire Blanket	:	1
First Aid Kit	:	Type A
SART	:	1

Accommodation

Crew	:	3 cabins comprising Captain's cabin, Engineer's cabin and 1 x three berth crew cabin. Note that Cabins, mess room, etc all air conditioned
Passengers	:	1 x 4 berth cabins
		24 seat day passenger accommodation in deckhouse.
Ablutions	:	1 x toilet (with basin and hot and cold water) aft of the wheelhouse on the port side 2 x Bathrooms (with shower, toilet, basin and hot and cold water) one aft of the forward crew accommodation on the port side and the other forward of the passenger accommodation on the port side.

Ballistic Protection

Wheelhouse	:	Meets: Euro Ballistic Standard EN1532 Class FB6 NIJ Standard Class III+ (see Figure 7-2 on page 7-12 to identify area which has ballistic protection)
Windows (Wheelhouse)	:	52 mm ballistic glass

Length Overall	:	24.0 m (excluding fenders)
Beam Overall	:	6.3 m (excluding fenders)
Depth at sides (at half length)	:	3.56 m
Draught (approximate)	:	1.16 m
Displacement (Light Ship)	:	45 t
Displacement (fully loaded)	:	65 t
Gross Tonnage	:	125.25 t

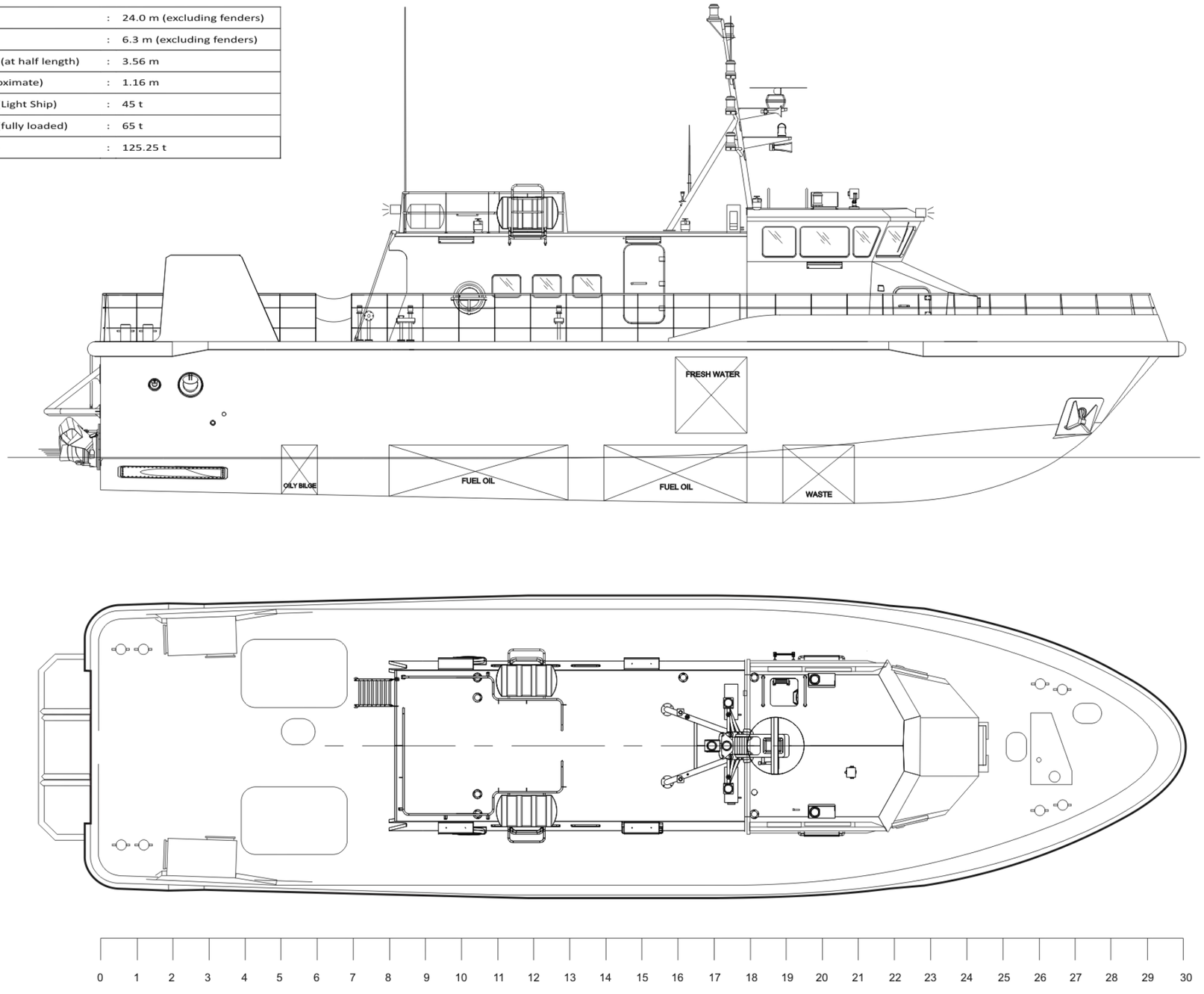


Figure 0-1: General Arrangement I.H. Pepple Fast Crew Boat Side View and Top Deck

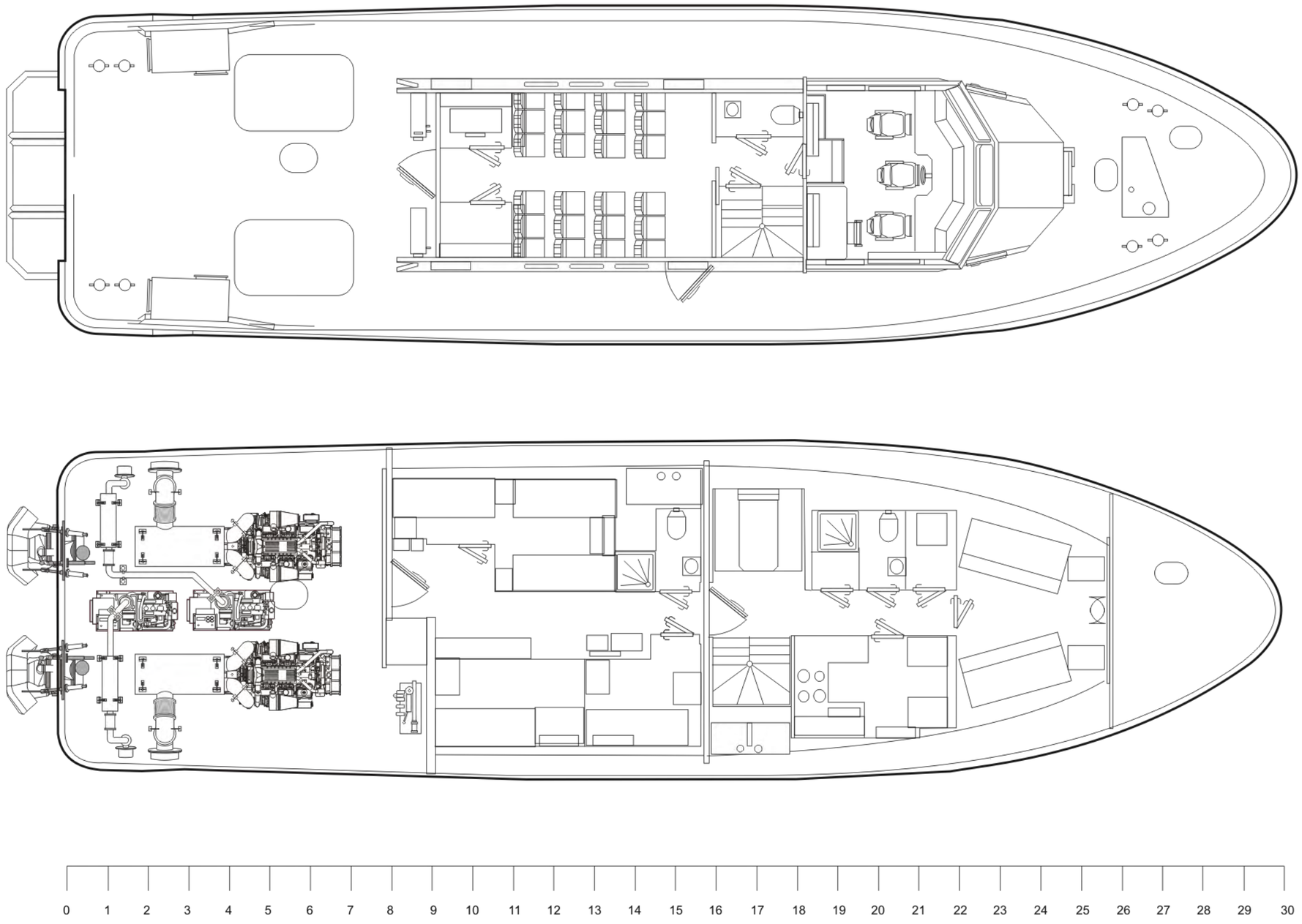


Figure 0-2: General Arrangement I.H. Pepple Fast Crew Boat Main and First Decks

Chapter 1: 100 Structure

110 Hull

Machinery Space/Engine Room

- The vessel's machinery space is located on the lower deck between frame 0 and frame 9.
- A water tight bulkhead is located at frame 8 on the port side doglegging to frame 9 on the starboard side to accommodate the FO header tank. Access to the machinery space is via the lower deck central corridor, through the electrical switch gear space and a water tight door.
- An escape hatch and ladder are installed on the vessel centre line between frames 6 and 7 for access onto the aft main deck.
- Two soft patches are set into the main deck and are located over each main propulsion unit to provide for engine extraction and replacement.
- Three seawater inlets/ strainers are provided. Two for port and starboard main engine cooling are located under the centre walkway between port and starboard main engines (frames 5 and 6) and one for No 1 and No 2 Generator cooling between frames 4 and 5 to the starboard on generator No 1.
- Engine room ventilation supply and extraction shafts are positioned on each side of the vessel between frames 2 and 4.
- The fuel Header tank is located on the port side at lower deck level between frames 8 and 9. Note that the bunker fuel tanks are described under Tanks on page 1-2.
- A dirty oily bilge tank, integral with the lower hull structure, is located between frames 5 and 7.
- The engine room is unmanned under normal operation of the vessel.

WARNING: ACCESS SPACE IN THE ENGINE ROOM IS LIMITED AND THE WEARING OF HARD HATS AND EAR PROTECTION MUFFS IS RECOMMENDED.

Engine Room Equipment

The engine room houses the following major equipment (see Figure 1-1 on page 1-4).

- 2 x Caterpillar C32 ACERT marine propulsion engine and integral gearboxes
- 2 x Caterpillar C4 Generating Sets
- Fuel Transfer Module
- Bilge/Fire fighting module
- 2 x Steering hydraulic tanks and valves
- 2 Water Jet lubrication tanks
- 2 x Hydraulic/ Lubrication Pumps mounted on the port and Starboard gearboxes servicing the water jets.
- 2 x Battery banks each comprising battery chargers and starter batteries.
- Duel fuel water separator

- Steering and braking hydraulic cylinders mounted on frame 0 (transom)
- Drive unit shafts and couplings
- FM200 fire fighting system cylinder
- Watermaker

Tanks

The vessel's bunker fuel tanks, wastewater and Bilge/dirty oil tanks are integrated into the double bottom construction. These tanks are fitted with both filling and breather pipes. Note that the fuel header tank also has a breather pipe. Bunker fuel tank location is as follows:

a. Forward fuel oil tank: Between frames 16 and 18 (capacity 3800 l)

b. Aft fuel oil tank: Between frames 14 and 16 (capacity 3800 l)

c. Port and starboard fuel oil tanks: Between frames 8 and 13 (capacity 4500 l each)

The two freshwater tanks are mounted above the waterline on the port and starboard sides with the port tank between frames 14 and 16 and the starboard tank between frames 16 and 18.

All breather pipes terminate at main deck level and are fitted with self closing devices to prevent the ingress of seawater. In addition, the main fuel tanks are fitted with flame traps.

The various tanks and the access to them are shown on Figure 1-2 on page 1-5.

The breather and filler pipes on the main deck are identified in Figure 1-3 on page 1-6.

Pre-Operation Checks

The list below details the major items that should be checked before proceeding to sea. Please note that the list is not exhaustive and operators should add to it as necessary.

1. Has stabilized power been established?
2. Has the shore supply cable been disconnected and stowed?
3. Have all navigational lights been checked and confirmed operational?
4. Has all navigational equipment been checked and confirmed operational?
    a. SSB Radio
    b. Navtex
    c. 2x VHF radios
    d. 2x plotter/radar
    e. Talk back system
5. Have all fuel tanks been filled as per operational requirements?
6. Have all freshwater tanks been filled as per requirements?

7. Are both port and starboard main engines operational ready?
8. Are both forward and aft gensets operational ready?
9. Have all bilges been cleared and pumped dry?
10. Has all safety equipment been checked?

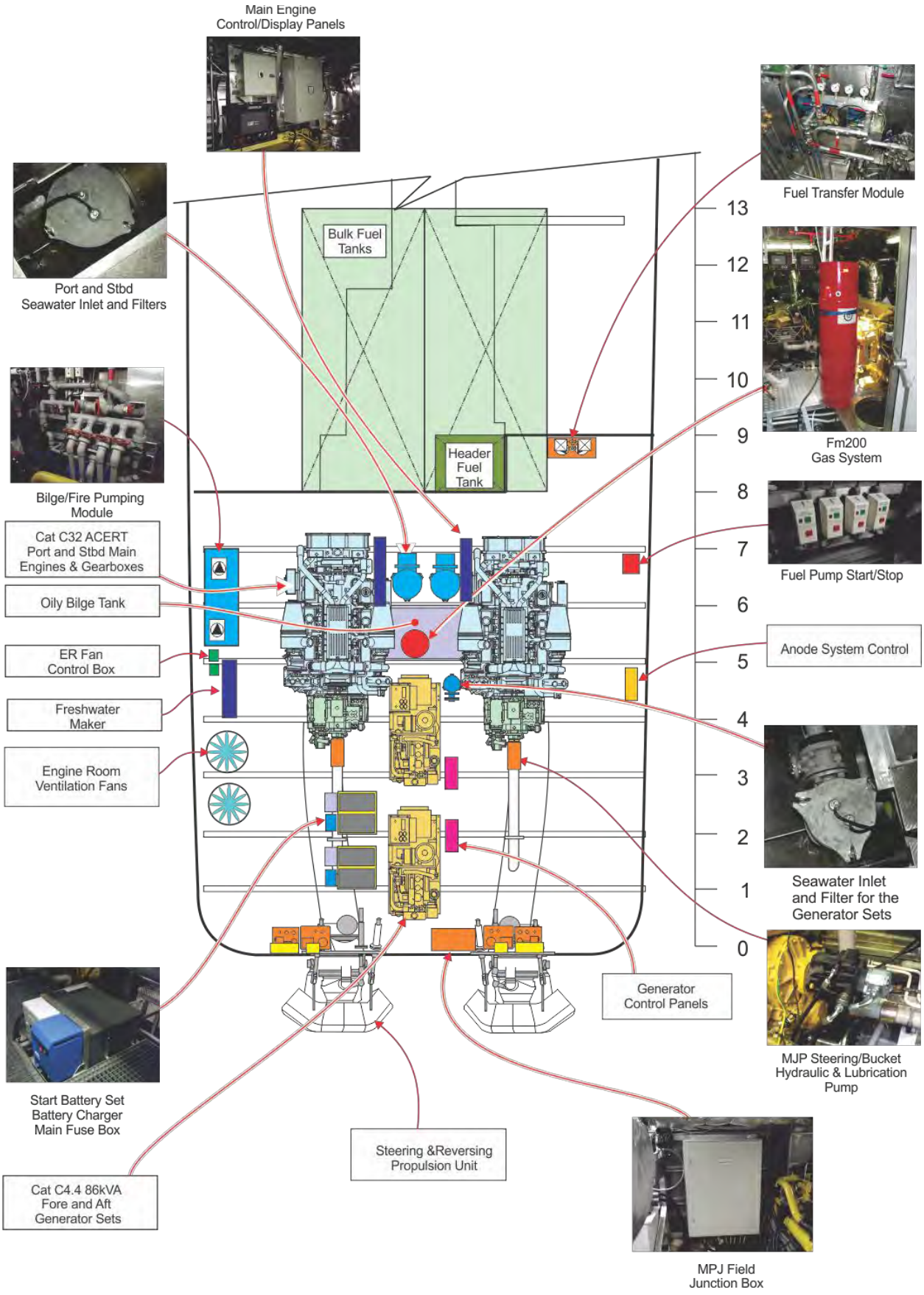


Figure 1-1: Identification of Equipment in the Engine Room

TANK	VOL TOTAL (L)	VOL NOMINAL (L)
FRESH WATER - PORT	1850	1800
FRESH WATER - STBD	1850	1800
BULK FUEL - FWD	3916	3800
BULK FUEL - AFT	3916	3800
FUEL OIL - PORT	4659	4500
FUEL OIL - STBD	4659	4500
FUEL OIL - HEADER	1850	1800
OILY BILGE	1050	1000
BLACK/GREY WATER	2358	2200

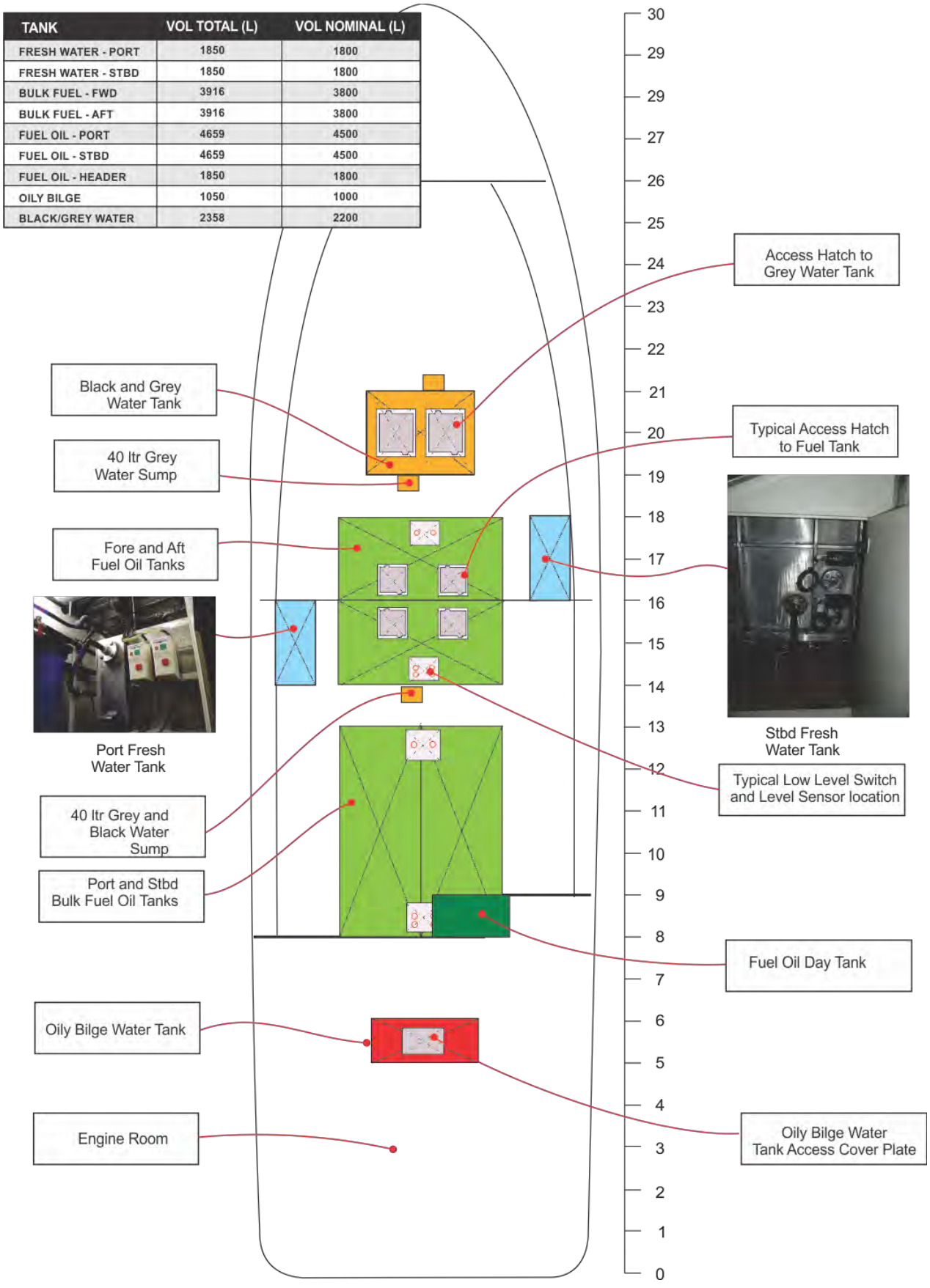


Figure 1-2: Location and Access of Tanks

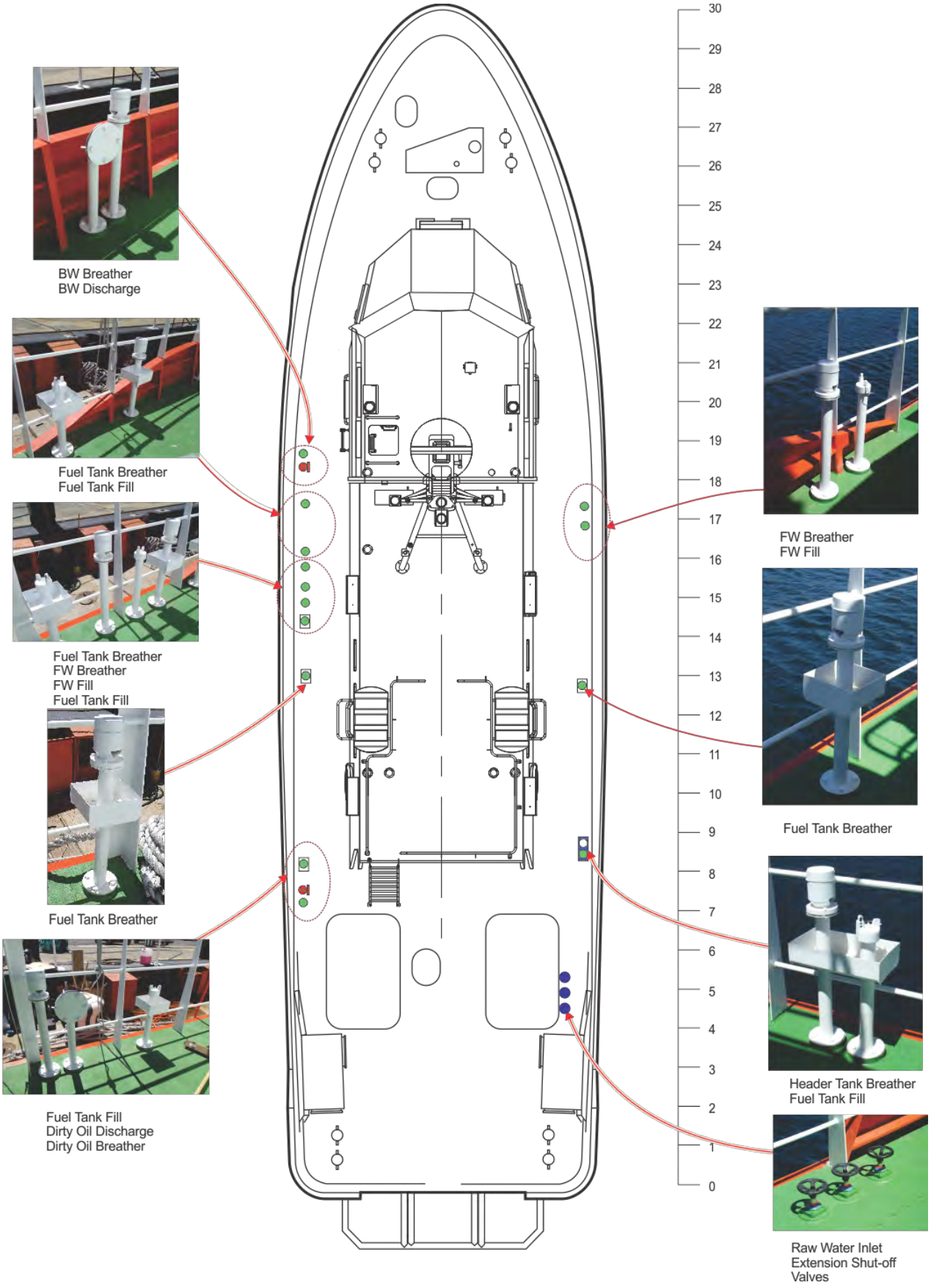


Figure 1-3: Filling Points and Breather Pipes on the Main Deck

Chapter 2: 200 Propulsion

210/220 Engines and Gearboxes

Brief Description

The ship's propulsion system comprises two Caterpillar C32 ACERT turbo-charged marine diesel engines developing 1300bhp (970kW) @ 2100 rpm. The engines are direct coupled to ZF 3050 single ratio reversing gearboxes with a reduction ratio of 1.563:1. The engines are located between frames 4 and 7.

The engines are shaft connected to MJP500DD double reverse bucket (DRB) water jets providing normal propulsion, steering and reversing functions. Although the gearboxes have a reversing capability this is only used for back-flushing of the jets to clear debris which may have fouled the water intakes and is not used for vessel reversing. As an alternative to back-flush, the vessel can be reversed with one jet in back up mode to clear the other jet.

The engines are arranged for seawater cooling via integrated engine mounted heat exchangers (see Seawater System on page 530 Cooling System on page 5-25 for further information). Fuel and lubricating oil supply to the engines is also described in Chapter 6 (see page 5-13).

The engines are started from their Local Operation Panels (LOPs) in the engine room. As the engine room is normally unmanned engine functions such as stop, monitor, etc can be carried out from the wheelhouse.

Figure 2-1: Engine Local Operator Panels & Electrical Control Panels

The engines are started electrically from 24V batteries located in the engine room aft on the port side aft of the port engine between frames 1 and 3. Battery Bank 3 starts the port engine and No 1 generator (forward) via DC-DC-004 and Battery Bank 4 the starboard engine and No 2 generator (aft) via DB-DC-005. In the event of a battery bank failure, the other battery bank can be used via a removable cable link between DB-DC-004 and DB-DC-005. Each battery bank has a dedicated battery charger, identified by the

same numbering as the battery bank, i.e. Battery Charger 3 and Battery Charger 4. Electrical supply to the battery chargers and engine start panels is from Q12 on MDB-001 (Battery Charger 3) and Q3 on MDB-002 (Battery Charger 4) located in the electrical control room.

Maintenance should be carried out at the time periods specified in the maintenance schedule supplied by the engine manufacturer. If this requirement is not complied with the performance of the engine may be effected. A copy of the maintenance schedule is included in this document for information purposes to indicate what maintenance is required when. For the latest information always refer to the documentation supplied by the engine manufacturer.

Fuel Oil Quality

Diesel fuel quality is an important factor in satisfactory engine life and performance. Fuels used must provide adequate combustion without producing excess contaminates that can harm the engine.

The fuels recommended for use in Caterpillar diesel engines are normally No. 2-D diesel fuel and No. 2 fuel oil, although No. 1 grades are also acceptable.

Table 2-1 lists the worldwide fuel standards which meet Caterpillar requirements.

Table 2-1: Fuel Standards which meet Caterpillar Requirements

Standard	Name	Description
American	ASTM D975	No. 1-D & No. 2-D Diesel Fuel Oils
	ASTM D396	No. 1 & No. 2 Fuel Oils
	ASTM D2880	No. 1-GT & No. 2-GT Gas Turbine Fuels
British	BS 2869	Classes A1, A2 & B2 Engine Fuels
	BS 2869	Classes C2 & D Burner Fuels
West German	DIN 51601	Diesel Fuel
	DIN 51603	Heating Oil El
Australian	AS 3570	Automotive Diesel Fuel
Japanese	JIS K2204	Types 1 (spl), 1, 2, 3, & 3 (spl) Gas Oil
U.S. Government	W-F-800C	DF-1, DF-2 Conus & DF-20 Conus Diesel Fuel
	W-F-815C	FS-1 & FS-2 Burner Fuel Oil
U.S. Military	MIL-L-16884G	Marine Oil

Caterpillar engines can work with a variety of fuels. Any fuel well filtered within the limits indicated is valid for maximum engine performance. The fuel used must meet the following requirements

Table 2-2: Fuel Specification for Caterpillar Engines

Requirements	ASTM Norm:	Limit:
Index of aromatics	D1319	< 35 %
Ash content	D482	< 0,02 % weight
Carbon residue (Above 10% final distillation)	D524	< 1,05 % weight
Cetane Number	D613	> 40
Cloud point	D97	< T amb min.
Copper strip corrosion	D130	< Number 3
Distillation	D86	< 10 % 282°C & < 90 % 360°C
Flashpoint	D93	According legal requirements
API gravity	D287	> 30 & < 45
Pour point	D97	Less than 6oC from ambient temperature
Sulphur content	D3605, D1552	< 3 %
Viscosity at 40°C	D445	> 1,4 cSt y < de 20 cSt
Water content and sediment	D1796	< 0,1 %
Water content	D1744	< 0,1 %
Sediment content	D473	< 0,05 % weight
Rubber and resin content	D381	< 10 mg each 100ml

Maintenance Interval Schedule

Ensure that all safety information, warnings, and instructions are read and understood before any operation or any maintenance procedures are performed. The user is responsible for the performance of maintenance, including all adjustments, the use of proper lubricants, fluids, filters, and the installation of new components due to normal wear and aging. The performance of this product may be diminished if proper maintenance intervals and procedures are not followed. Components may experience accelerated wear if proper maintenance intervals and procedures are not followed.

NOTE: Use whichever of the following that occurs first in order to determine the maintenance intervals: fuel consumption, service hours, and calendar time. Before each consecutive interval is performed, all maintenance from the previous intervals must be performed.

Products that operate in severe operating conditions may require more frequent maintenance.

When Required

- Battery - Replace
- Battery or Battery Cable - Disconnect
- Engine - Clean
- Engine Oil Level Gauge - Calibrate
- Engine Storage Procedure - Check
- Fuel System - Prime
- Heat Exchanger - Inspect

Maintenance Recommendations

- Sea Water Strainer - Clean/Inspect
- Zinc Rods - Inspect/Replace

Daily

- Cooling System Coolant Level - Check
- Engine Air Cleaner Service Indicator - Inspect
- Engine Oil Level - Check
- Fuel System Primary Filter/Water Separator - Drain
- Walk-Around Inspection

Initial 10 Service Hours

- Belts - Inspect/Adjust/Replace

Every 50 Service Hours or Weekly

- Zinc Rods - Inspect/Replace

Every 250 Service Hours or 1 Year

- Aftercooler Condensate Drain Valve - Inspect/Clean
- Auxiliary Water Pump (Rubber Impeller) -
- Inspect/Replace
- Battery Electrolyte Level - Check
- Belts - Inspect/Adjust/Replace
- Cooling System Coolant Sample (Level 1) - Obtain
- Cooling System Supplemental Coolant Additive (SCA) - Test/Add
- Engine - Clean
- Engine Air Cleaner Element - Clean/Replace
- Engine Crankcase Breather - Clean
- Engine Oil Sample - Obtain

- Engine Oil and Filter - Change
- Fuel System Primary Filter (Water Separator) Element - Replace
- Fuel System Secondary Filter - Replace
- Fuel Tank Water and Sediment - Drain
- Hoses and Clamps - Inspect/Replace

Initial 500 Hours (for New Systems, Refilled Systems, and Converted Systems)

- Cooling System Coolant Sample (Level 2) - Obtain
- Engine Valve Lash - Inspect/Adjust
- Fuel Injector - Inspect/Adjust

Every 1000 Service Hours

- Aftercooler Core - Clean/Test
- Closed Crankcase Ventilation (CCV) Fumes Disposal
- Filter - Replace
- Turbocharger - Inspect

Every Year

- Cooling System Coolant Sample (Level 2) - Obtain

Every 3000 Service Hours

- Auxiliary Water Pump (Bronze Impeller) - Inspect/Replace
- Cooling System Water Temperature Regulator - Replace
- Crankshaft Vibration Damper - Inspect
- Engine Mounts - Inspect
- Engine Speed/Timing Sensors - Check/Clean/Calibrate
- Engine Valve Lash - Inspect/Adjust
- Engine Valve Rotators - Inspect
- Fuel Injector - Inspect/Adjust
- Heat Exchanger - Inspect
- Starting Motor - Inspect
- Every 3000 Service Hours or 3 Years
- Cooling System Coolant (DEAC) - Change

Every 5000 Service Hours

- Alternator - Inspect
- Water Pump - Inspect

Every 6000 Service Hours or 3 Years

- Cooling System Coolant Extender (ELC) - Add

Every 12 000 Service Hours or 6 Years

- Cooling System Coolant (ELC) - Change

Overhaul

- Maintenance Recommendations
- Oil Cooler Core - Check/Clean/Test
- Overhaul (Major)
- Overhaul (Top End)

Engine and Gearbox Lubrication

Table 2-3: Engine & Gearbox Lubrication Chart

System Code	Equipment	Make / Type	Application	Type Of Oil/ Grease
210	Main Engine	Caterpillar C32	Oil Lubricated System	DEO 15W-40
220	Reduction Gearbox	ZF 3050	Oil Lubricated System	SHELL RIMULA R2 SAE40

Engine and Gearbox Documentation

The mechanical documentation for the C32 Marine Engine is listed below in Table 2-4. For the electrical documentation refer to Table 2-8 on page 2-23.

Table 2-4: Engine and Gearbox Documentation

Item	Description	Part Number	Remarks
Engine System Manuals			
1.	Operating and Maintenance Manual for C32 Marine Engine	SEBU7782-05	
2.	Operator's Guide for Marine Power Display	LEBM0189-04	
3.	Parts Manual for C32 Marine Engine	SEB 4767-08	
4.	Index of Mechanical Documentation		
5.	Mechanical Installation Guide Propulsion Engine C32	No Number	
6.	General TT-Mounts	Rubber Design BV, Rev. A, 07-02-2007	
7.	Mechanical Drawing Right Side View	10028550MEC2-00-01	
8.	Mechanical Drawing Front View	10028550MEC2-00-02	
9.	Mechanical Drawing Right Side View	10028550MEC2-00-03	

Item	Description	Part Number	Remarks
10.	Mechanical Drawing Rear View	10028550MEC2-00-04	
11.	Mechanical Drawing P250 Engine Footprint	10028550MEC2-00-09	
12.	Mechanical Drawing P250 Details	10028550MEC2-00-10	
13.	Mechanical Drawing Shipped Loose	10028550MEC2-00-11	
14.	Mechanical Drawing Vibration Isolator (Shipped Loose)	10028550MEC2-00-12	
15.	Mechanical Drawing ZF 3050 Marine Gearbox	10028550MEC2-00-13	
Gearbox Manuals			
16.	Operating Instructions, Marine transmission, ZF 3000 series	3101.758.101d	

Equipment Location

See Figure 2-2 below.

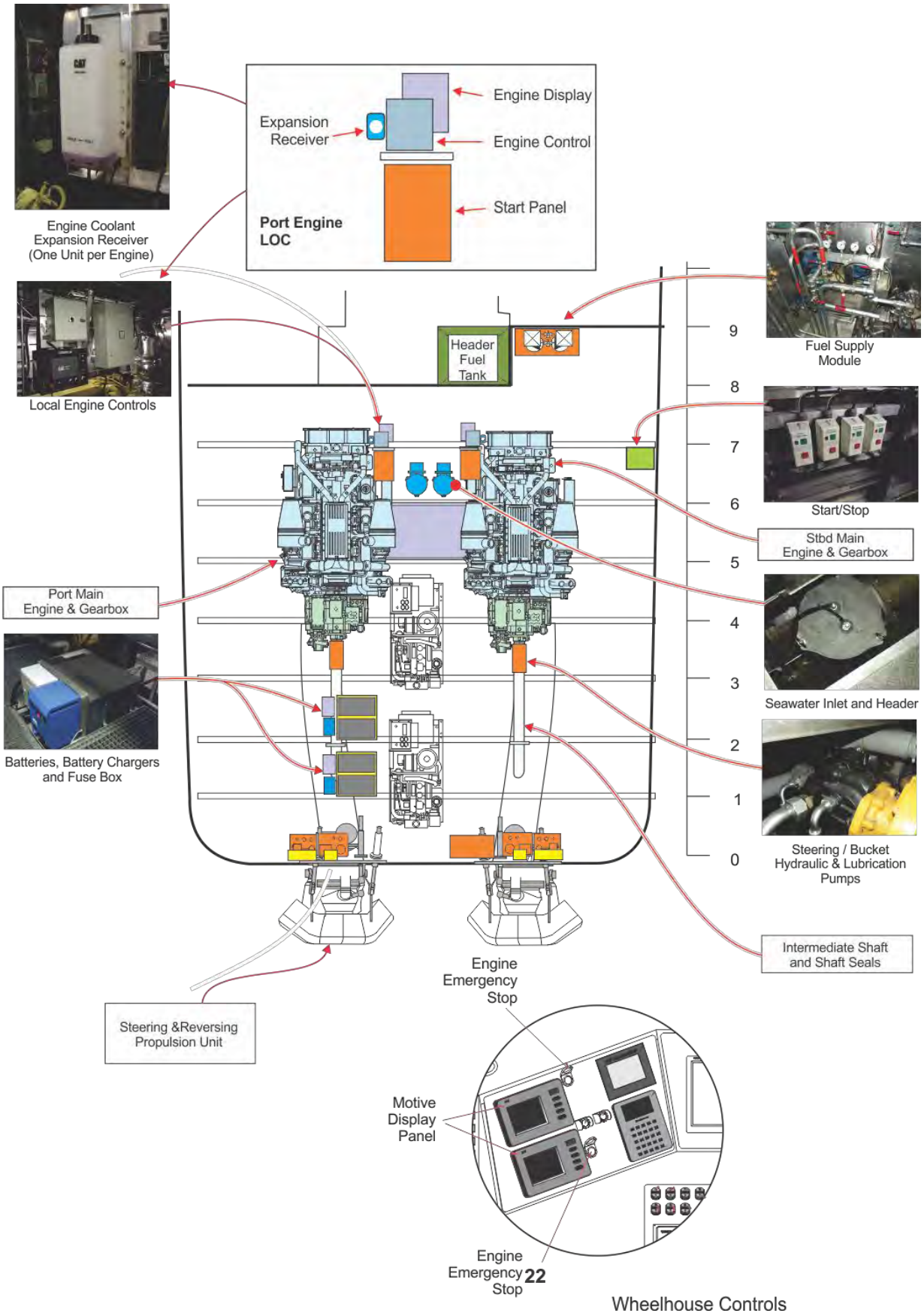


Figure 2-2: Propulsion Equipment Location Diagram

230 Water Jets

Introduction

The water jet installation comprises three sub-systems:

a. The mechanical system which includes the water jet, steering unit, shaft, hub, etc.

a. The hydraulic and lubrication sub-system which are in fact two separate systems. One the hydraulic system for controlling the hydraulic actuators for the steering and reversing unit and lubrication system for lubricating the thrust bearing in the hub unit.

The control system which controls the steering of the vessel.

Mechanical System

The two MJP500DD DRB Jet units are mounted on the outer face of the transom. Each jet unit comprises a pump unit consisting of the impeller, mounted in an impeller housing attached to a diffuser unit and a discharge nozzle. Laminated GRP water intake ducts are incorporated into the lower hull construction. The shaft assembly from the gearbox to the jet unit penetrates the water intake duct through a watertight seal. A seawater lubricated coupling in fitted on the shaft.

The two jet units are fitted with steering nozzles attached to the pump unit. Angular movement of the steering nozzles is provided by a single hydraulic cylinder mounted in the engine room with the cylinder shaft passing through the transom. The total angular movement of the nozzles is 30°.

Figure 2- DRB Waterjets with the Buckets in the Lowered Position

Reverse movement and stopping of the vessel is also a function of the outer jet units which are fitted with hydraulically operated double buckets. Lowering of the buckets over the jet pump units re-directs water flow in a forward direction. Movement of the bucket is activated by two hydraulic cylinders located in the engine room and fitted through the transom.

Hydraulic power to the cylinders and lubrication of the pump unit is provided from axial piston and gear pumps mounted on the gearboxes and driven by the gearbox PTO. Hydraulic and lubrication tanks are located above the hydraulic cylinders on the transom.

Hydraulic System

System Overview

The hydraulic system for the vessel is limited to the actuation of the steering nozzles and the lowering and lifting of the reversing buckets. Note that although Hydraulic System has the classification code 560 it is included here for clarity.

The vessel is fitted with two hydraulic power packs positioned on the transom above the centreline of the port and starboard drive shafts.

A hydraulic pump and piggy back lubrication circulation pump is fitted to the PTO of the port and starboard gearboxes.

The hydraulic system interfaces with the electronic control system, engine and gearbox and the waterjet.

Brief Description

Power Pack

The HydroSwede hydraulic power unit comprises an aluminium tank with an oil capacity of 37 litres. A level gauge is fitted to the front of the tank. The top lid of the tank is fitted with a filling point, air filter, return system hydraulic oil filter and pressure gauge and a combined temperature and level control.

An aluminium valve block incorporating four solenoid operated proportional pressure reducing valves, two to each direction control valve, is positioned on the tank lid and supports the two pressure operated directional control valves. The lower valve controls the bucket movement whilst the upper valve controls the steering. The valves are four-way, three-position and are fitted with manual override leavers. The valves are spring centred when not activated.

A label indicating valve positions when in manual override i.e. 'FORWARD', 'BACKWARD', for the bucket and 'PORT' and 'STARBOARD' for direction is positioned adjacent to the valves.

The return oil filter is fitted with a 10 µm absolute filter cartridge.

Low oil level in the tank is monitored by a level switch and activates an alarm in the wheelhouse when the level falls below 120mm. High temperature of between 60 and 70° c and low system pressure are also monitored. The low pressure setting is 1.5 ± 0.5 Mpa.

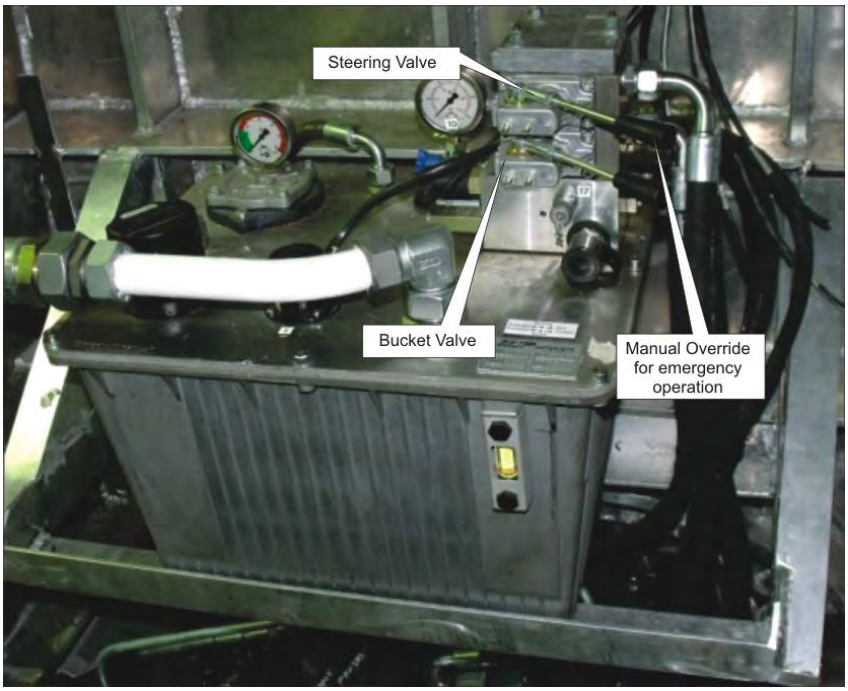


Figure 2-3: Hydraulic Power Pack

Pumps

The hydraulic system is powered by an axial piston pump with a nominal flow of 18l/min at a pressure of 140 bar.

The pump is piggy-backed to a lubrication oil pump and driven from the PTO of the port and starboard gearboxes.

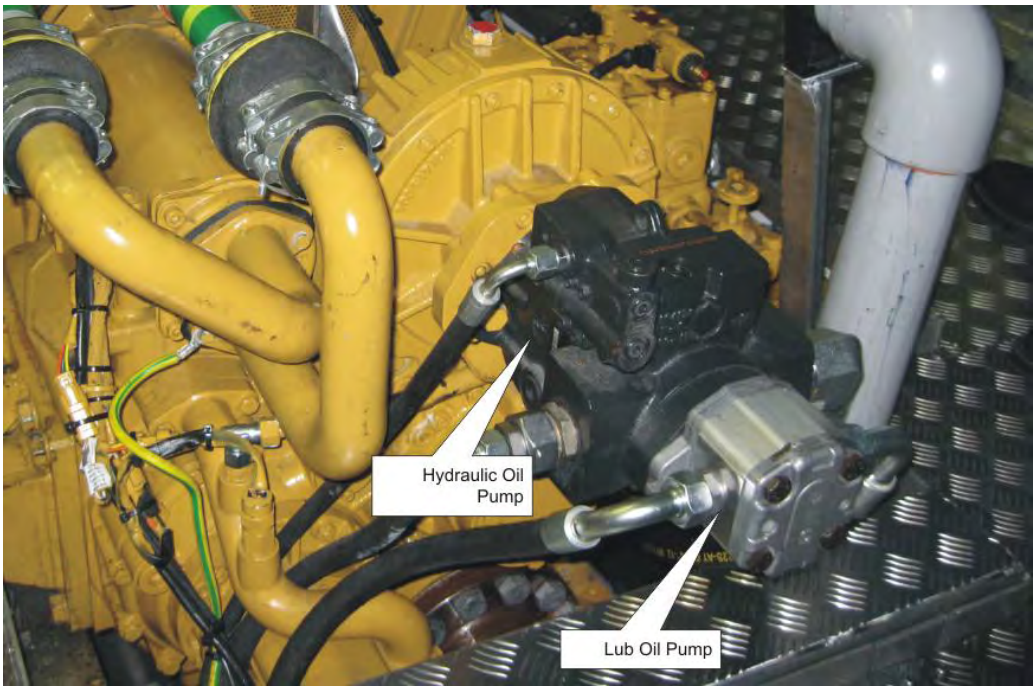


Figure 2-4: Hydraulic and Lubrication Oil Pumps

A 10 µm absolute filter and filter cartridge is installed in the pressure oil line to the hydraulic oil tank.

Hydraulic Cylinders

The hydraulic power packs activate the steering and reversing cylinders incorporated on the waterjet unit. Mechanical activation of the nozzle angle is provide by a single double acting, double end rod hydraulic cylinder. The cylinder has a 40mm diameter shaft and a stroke of 100 mm. Elevation and lowering of the bucket is performed by two double acting hydraulic double end rod cylinders coupled to a single control valve and located on either side of the steering cylinder. These cylinders have a total stroke of 213 mm. Port and starboard nozzles movement is synchronized electronically.

Movement of the cylinder rods is monitored by means of an external bar coupled to the end of the exposed cylinder rod at one end and a sensor at the other end. The sensor sends a signal to the Manoeuvre and Backup unit and then to the Central Unit to indicate the exact position of the cylinder rods.

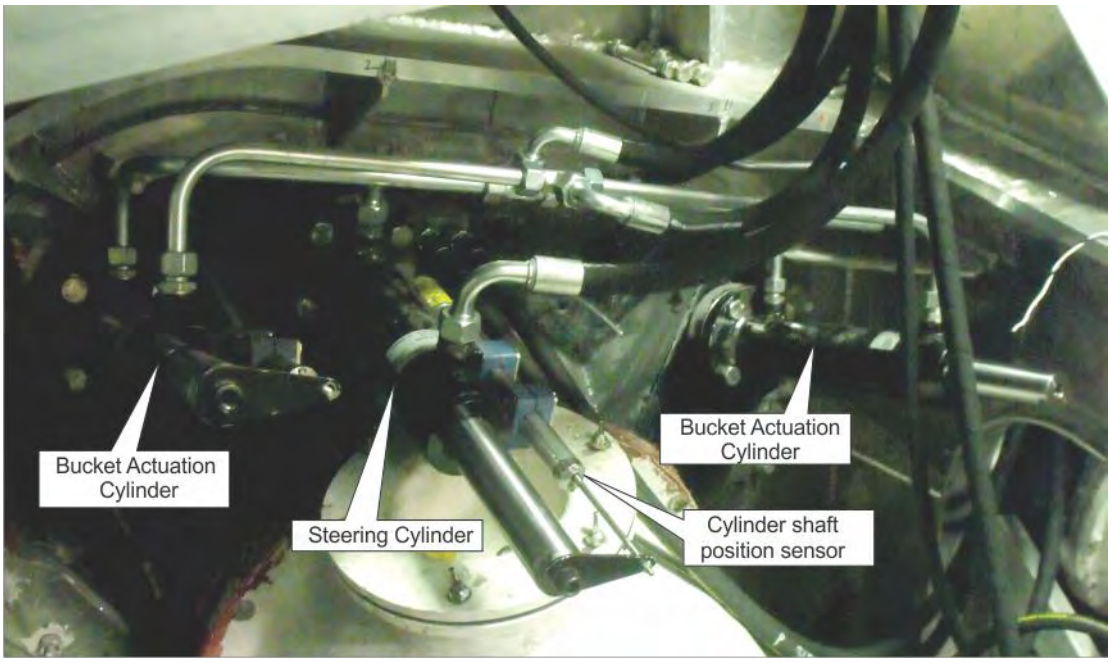


Figure 2-5: Steering and Reversing Bucket Cylinders

System Operation

The hydraulic system operation is initiated upon start up of the main port and starboard engines once the gearbox clutches have been engaged. With the directional valves in the neutral position hydraulic oil is redirected back to the oil tank. Operation of the steering wheel or joy sticks sends a signal to the proportional pressure reducing valves located in the valve block which in turn activated the solenoids on the directional valves activating either the nozzle or bucket cylinders.

Control System

Overview

The steering wheel and coupled joystick controllers (Combinator Controller) located on the wheelhouse consol are used to steer the vessel. Signals from the controller are passed to a central processing unit (CPU) and from the CPU are fed to the two sets of manoeuvre and backup units located in the engine room.

The port manoeuvre unit controls port bucket and nozzle and bucket steering as well hydraulic/lubrication alarms for the port nozzle. The starboard manoeuvre unit performs the same operation as the port unit.

An indicator panel in the wheelhouse registers port and starboard turning angles and bucket lift and drop angles. The Alarm Command Panel provides indication of the engine clutch position, i.e. IN or OUT, port, and starboard back flushing, the operating mode including the auto pilot function and alarms and alarms for the system and backup power. Note that the alarms and the required action are described on page 2-17.

Two Backup controllers for port and starboard steering and forward and reverse direction of the vessel are also located on the wheelhouse consol.

Mechanical activation of the nozzle angle is provide by a single double acting hydraulic cylinder located in the engine room with the cylinder rod protruding through the transom and coupled to the nozzle by a stepped link and nozzle arm. Elevation and lowering of the bucket is performed by two double acting hydraulic cylinders coupled to a single control valve and located on either side of the steering cylinder. Port and starboard nozzles movement is synchronized electronically.

Movement of the cylinder rods is monitored by means of an external bar coupled to the end of the exposed cylinder rod at one end and a sensor at the other end. The sensor sends a signal to the electronic control system to indicate the exact position of the cylinder rods.

With this system there are three methods of control:

a. The primary or normal system of electronic control from the wheelhouse.

b. The secondary or back up system which is a 24 VDC "Bang Bang" which is operated from the wheelhouse if a ship's AC supply system fails or a system problem occurs.

c. Manual control from the engine room described below.

Emergency Steering

In the event of an electronic and 24VDC power failure the nozzle angular movement and the bucket operation must be performed manually from the engine room. This operation must be undertaken by two crew members one for each hydraulic power unit. The two hydraulic control valves on each power pack are fitted with manual over rides to the normal servo activation. Valve lever direction is indicated on the power pack. Located adjacent to each power pack is a nozzle and bucket position indicator. The crew members must be in contact with the wheelhouse navigator at all times during this operation.

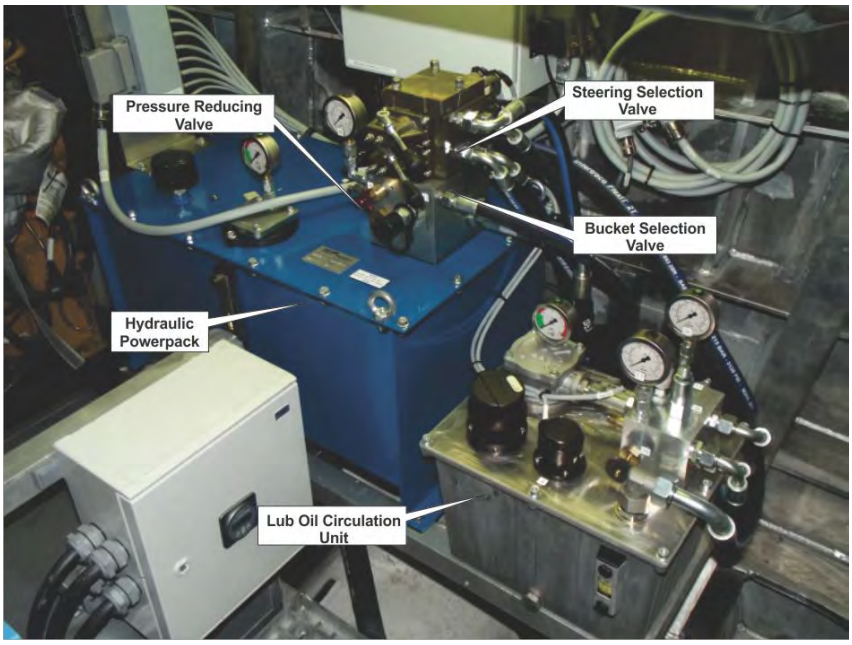


Figure 2-6: Power Pack and Control Valves

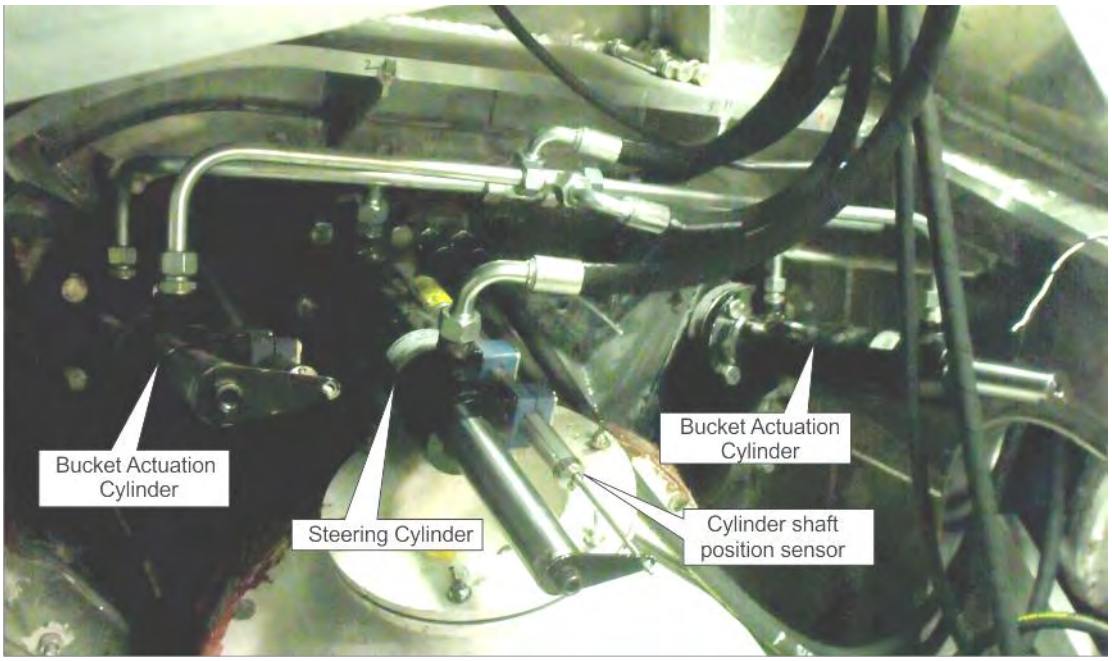


Figure 2-7: Steering and Bucket Actuation Cylinders

The steering hydraulic power packs are located on the transom at frame 0.

A steering / Bucket Indicator box showing angles of steering and bucket position is located adjacent to each hydraulic power pack on the transom.

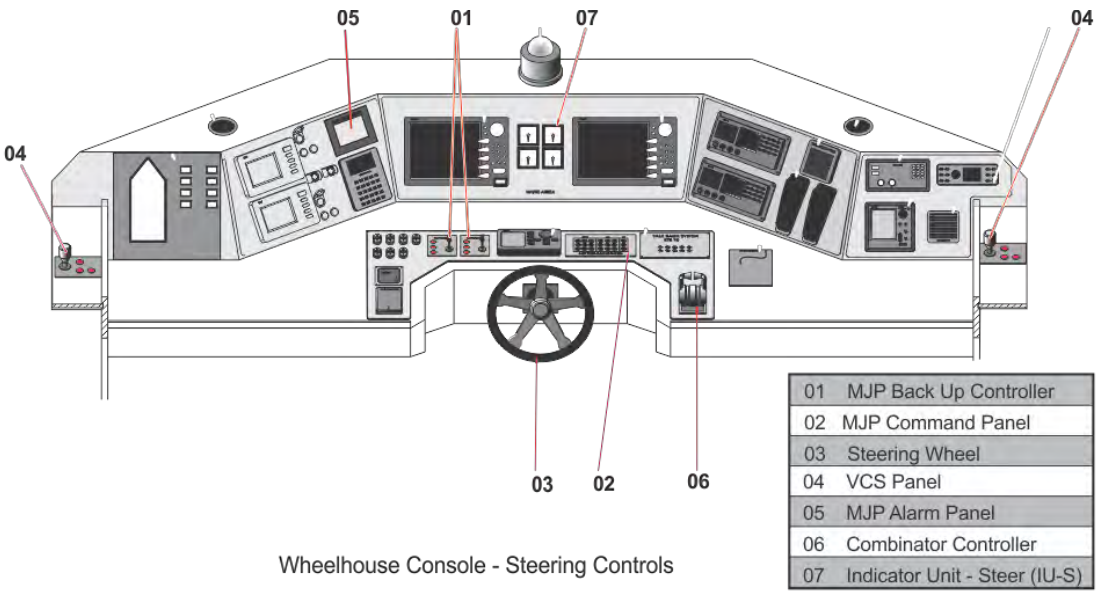
Location of Equipment

A list of the control system equipment together with its location and use is given in Table 2-5 below.

See Figure 2-8 on page 2-16 for the location of control system (steering) equipment.

Table 2-5: MJP Control System Equipment

Unit	Location	Qty	Use
Central Unit (CU)	Under Wheelhouse Console	2	Port and Starboard units which provide for interconnection of the various units and signals
Command Panel (CP)	Wheelhouse console above steering wheel on starboard side	1	Selecting CLUTCH IN and OUT for both water jets and MODE selection
Alarm/Setup Panel	Wheelhouse console, port side above ship's Alarm panel	1	Touch screen display for alarm indication and system setup.
Steering Wheel	Wheelhouse console, centre	1	Controls direction of water jet nozzles
Combinator Controller	Wheelhouse console, starboard side of wheel	1	Controls position of bucket position and rpm. One lever for each bucket/engine
Backup Unit (BU)	Wheelhouse console above steering wheel on port side	2	Port and Starboard units which provide backups for the main command panel, steering wheel and combinatory controller. Controls provided are CLUTCH IN and OUT, RPM and Joystick steering
Indicator Unit (IU)	Wheelhouse console, central above steering wheel	4	Provide indication of bucket and nozzle (steering) position
Manoeuvre and Backup Unit (MBU)	Engine Room, transom port and starboard	2	One for each water jet, provides the interface for the hydraulic actuators and forms part of the servo loop and indication feedback circuit
VCS Panel	Wheelhouse port and starboard wings	2	For harbour manoeuvring. Controls provided are thrust, rotation/direction and rpm
Hydraulic Connection Box (HCB)	Engine Room on port and starboard hydraulic pumps	2	Provides easy connection between the hydraulic system and the control system
Local Indicator Unit (LIU)	Engine Room, transom port and starboard, inboard of MBUs	2	Shows bucket and nozzle position



01	MJP Back Up Controller
02	MJP Command Panel
03	Steering Wheel
04	VCS Panel
05	MJP Alarm Panel
06	Combinator Controller
07	Indicator Unit - Steer (IU-S)

Wheelhouse Console - Steering Controls

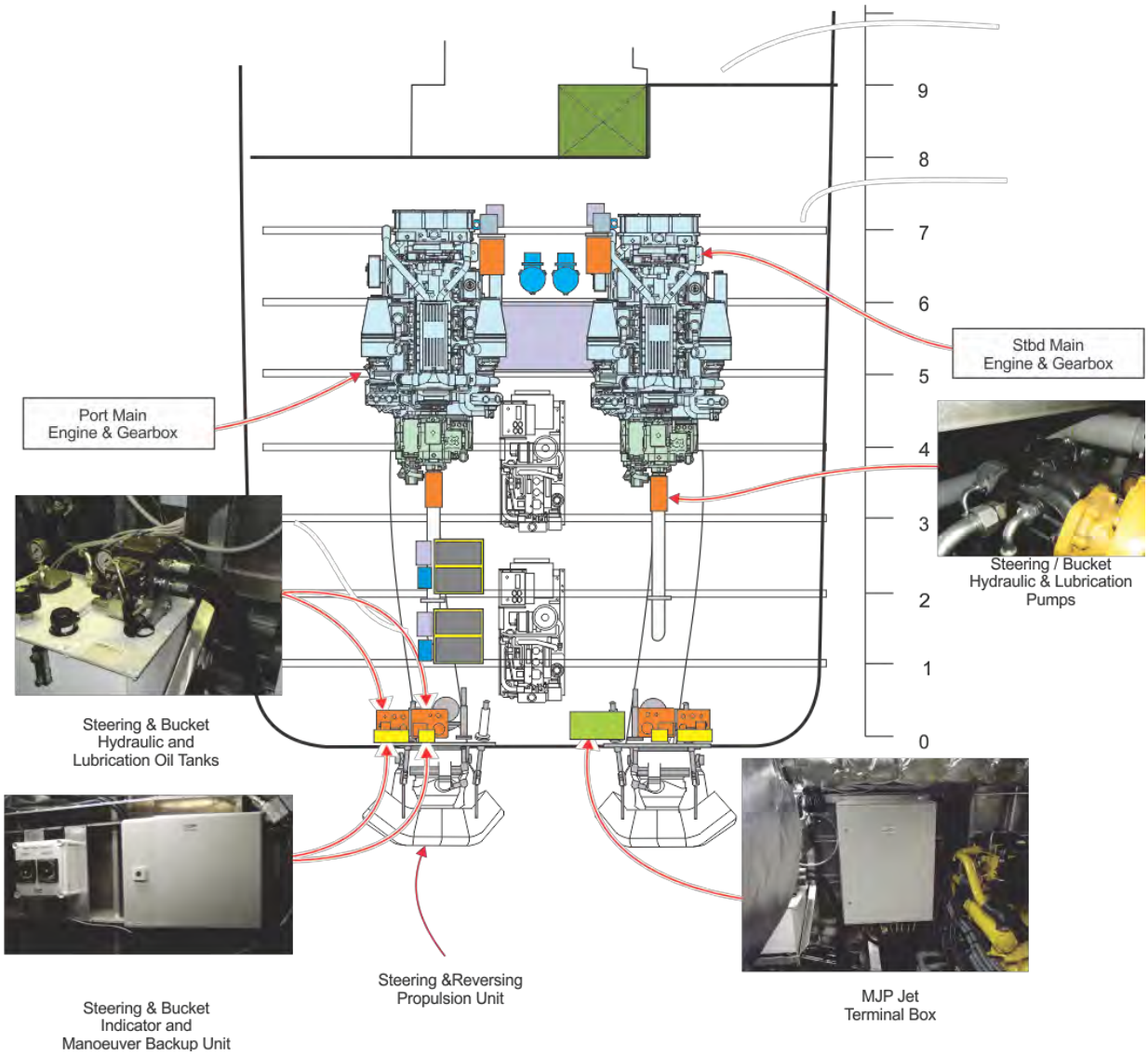


Figure 2-8: MJP Water Jet System Equipment Location Diagram

Trouble Shooting

General

Water Jet system alarms are shown on the Alarm and Setup Panel (ASP). There are 72 possible alarms that can be displayed and these are listed in the MJP Alarm List. Four of these alarms are fed to the ship's alarm system whenever an alarm is generated by that unit. This means that whenever an MJP alarm is shown on the Ship's alarm panels refer to the MJP alarm panel to identify the exact nature of the problem. The general alarms sent to the ship's system are:

a. General Alarm MJP Central Unit Port

b. General Alarm MJP Central Unit Starboard

c. General Alarm MJP Manoeuvre and Backup Unit Port

d. General Alarm MJP Manoeuvre and Backup Unit Starboard

A description of each type of alarm, the likely cause and the action to be taken is given below. Note that system alarms are also discussed in the Control System User Interface Technical Description.

Further information on faults that could occur, their cause and effect on the ship's ability to maintain station is given in MJP FMEA (Failure Mode and Effect Analysis).

Alarms

IMPORTANT:	**When an MJP system warning is displayed on the ASP, it is recommended that the first action is to CLUTCH OUT on the corresponding jet.**

External Digital Alarms

1. Lubrication Low Pressure Alarm

    a. Dirt in the pressure release valve preventing operation

    b. Lubrication pump faulty. Note that if lubrication pump fails, close BACK VALVE. In this condition you can continue operations for up to 24 hours.

NOTE:	**There is no alarm for Lubrication oil high pressure but the pressure reverse valve is set to operate at 5-bar.**

2. Lubrication Level Alarm (combined Low/High)

    a. Low level

        i. Check for Lubrication Oil Leak (low level)

        ii. Check contents of lubrication oil tank – The correct level is when the sight glass is on half. On long trips always carry spare oil.

iii. Check Temperature of Lubrication oil

b. High level

i. Lub Oil Contamination
A Milky colour indicates water contamination and the oil seal should be checked and changed if necessary. The oil will go milky if there is 1% water in the oil. If this occurs the system must be flushed (see Flushing the System on page 2-21).

3. Low Pressure Hydraulic Alarm. This is indicated by loss of control on both the main and back-up steering systems. Typical causes are:

a. Hydraulic pump failure

b. Low Level Oil

c. Dirt in the release valve. Note that the release valve is set to operate at 15 Bar

4. Low Level Hydraulic Oil

a. ACTION: SHUT DOWN ENGINE IMMEDIATELY AND RECTIFY BEFORE USING ENGINE.

5. High Temperature Alarm (Set at 70˚C)

a. If this occurs you can lose control as the valve cannot operate as it could jams due to the expansion of the material. **ACTION: IMMEDIATELY THROTTLE BACK AND IF BERTHING CLUTCH OUT AND BERTH USING ONE ENGINE.** A quick check for this condition is to feel how hot the tank is. Be careful as temperatures over 70°C can cause burns.

b. If this is a consistent problem, the hydraulic tanks need to be cooled. Options are:

- Install cooler on hydraulic tank
- Install cool air blower on hydraulic tank

Potentiometer Faults

1. The Pot type alarms indicate a potentiometer input failure. This type of alarm is indicated when the computer input reads a voltage that is more than 4% out of the calibrated span. The span is calculated from the calibrated neutral position to the calibrated end positions (i.e. to max or min).

IN THE EVENT OF A POT ALARM THE ACTION IS TO SWITCH TO BACK UP MODE

2. Possible causes are:

a. Broken potentiometer

b. PLC Input Module malfunction

c. Non calibrated parameters for the input

d. Broken wires

3. The following Pot alarms can occur:

    a. Steer Pot (Steering Wheel circuit)

    b. Thrust Pot (Port or Starboard combinator circuit)

    c. P/S Thrust Pot (Port neutral, Starboard sideway movement)

    d. Second Steer Pot (Steering Wheel circuit)

    e. Third Steer Pot (Steering Wheel circuit)

    f. Idle Pot

    g. Balance Pot

    h. Trim Tab Bow Pot

    i. Trim Tab Roll Pot

Out of Span Feedback Alarms

1. The alarms "Out Of Span" for the feedback signals indicate a none-valid value. Alarm condition occurs if the WJIF reads a value that is less than 4 mA. The sensor amplifiers should be calibrated for a span of approximately 4.5 to 19.5 mA.

    ACTION: THROTTLE BACK ON THE APPLICABLE ENGINE AND SWITCH OVER TO BACK UP MODE. IF BERTHING AND THE PROBLEM IS STILL APPARENT CLUTCH OUT GO IN ON ONE ENGINE IF BERTHING.

    NOTE: Back up is 24V "Bang bang" system and travel is to mechanical stops.

2. Possible causes are:

    a. Sensor failure, e.g. sensor on Water Jet faulty. Note that if this occurs the computer will freeze jet in current position.

    b. Sensor amplifier failure

    c. WJIF module malfunctioning

    d. No calibrated parameters for the input

3. The following Out of Span alarms exist for PORT and STBD

    a. Nozzle Feedback

    b. Bucket Feedback

    c. Rudder Feedback

    d. Trim Tab Feedback

Follow Up Alarms

1. The "Follow Up" alarm condition indicates that the feedback signal is not following the command signal; the deviation is greater than 20%. Note that you can also have a follow up alarm if the hydraulic valves are not functioning. If this is the case it is a serious problem because the back up steering will also be down.

2. Possible causes are:

    a. The most likely cause of this fault is a faulty hydraulic pump

    b. Any possible feedback failures

    c. Command signal failure or bad response

    d. Alarm parameters for the servo channel are incorrect

3. The following Follow Up alarms exist for PORT and STBD

    a. Nozzle

    b. Bucket

    c. Rudder

    d. Trim Tab

Current loop alarm

1. The 4-20 mA "Current Loop" for RPM indicates that the electrical circuit is not closed.

2. Possible causes are:

    a. No 24V DC supply to the manoeuvring and back up units in the engine room. Check electrical supply is on. If power supplies are on, switch over to back up.

    b. Cable is broken or not connected to the receiving RPM control unit.

    c. The RPM control unit is faulty and doesn't close the current-loop.

    d. The CU Analogue Output Module is malfunctioning

NOTE: If AC power is lost or a computer fault occurs, back up lights come on automatically and operations can continue from back up.

3. The following Current Loop alarms exist for PORT and STBD

    a. Nozzle Current Loop

    b. Bucket Current Loop

Maintenance

Flushing the System

If Lubrication Contamination (1% water in the oil) occurs the oil will go milky and the system must be flushed.

To flush the system:

1. Loosen Return live
2. Run engine
3. Drain hub until oil is clear
4. Connect up Return Live again

Clearing Inlet Blockages

If an inlet is blocked:

1. Use back up steering
2. Determine which inlet is blocked
3. Clutch out on the engine
4. Lift Bucket up
5. Go full reverse with opposite engine

Water Jet Lubrication

Table 2-6: Water Jet Lubrication Chart

System Code	Equipment	Make / Type	Application	Type Of Oil/Grease
230	Jet Shaft Bearings	Copper Bearing	Grease Lubricated Bearings	
230	Jet Pump Bearing Lubrication	MJP DRB 500	Oil Lubricated System	"CHEVRON TEXACO RANDO HD 68"
230	Jet Steering Hydraulics	MJP DRB 500	Hydraulic Oil System	"CHEVRON TEXACO RANDO HD 46"

Documentation

Table 2-7: MJP Controls Documentation

Item	Description	Part Number	Remarks
MJP Waterjet Control System Manuals			
1.	Software & Hardware Type Approval Certificate	Control System 1	
2.	FAT Factory Acceptance Test	Control System 2	Tests applied at the factory before system is dispatched
3.	FMEA Failure Mode and Effect Analysis	Control System 3	Lists typical defects, there effect on the system and their cause
4.	System Equipment & Cable List	Control System 4	List identifying all the system equipment and cables
5.	Cable Distribution	Control System 5	Block diagrams identifying which cables go to which equipment
6.	Installation Drawings	Control System 6	Installation wiring drawings
7.	Schematics	Control System 7	Control system schematics
8.	Assemblage Information	Control System 8	Dimensional drawings for all control system equipment
9.	Control System User Interface Technical Description	Control System 9	Technical description of all control system equipment
10.	Alarm List	Control System 10	List of ALL alarms that may be displayed
11.	Power Consumers	Control System 11	Lists the current consumption of the main control system equipment
12.	IO List	Control System 12	Lists the Inputs and Outputs to/from the control system
13.	Technical Reference Manual MJP	P092440 Edition 1.1 Revision A	Describes the mechanical and hydraulic systems including service, maintenance and trouble shooting

240 Instrumentation

Engine Control and Instrumentation

There is a Marine Power Display (MPD) for each engine mounted in the wheelhouse console. The Marine Power Display provides current engine and transmission operating data. Note that the screens can be customized to display different engine parameters using different sizes and types of gauges. For further information on the MPD refer to Operator's Guide LEBM0189-04.

All the documents and drawings associated with the installation and use of the MPD are listed in Table 2-8 below.

Table 2-8: Engine Control and Instrumentation Documentation

Item	Description	Part Number	Remarks
1.	Index Electrical Documentation		Index of the Caterpillar Documents listed below
2.	Explanations		Explanation of the Caterpillar documents listed below.
3.	Application and Installation Guide for Marine Engine Electronics C7 to C32	LEBM0001-01	
4.	Application and Installation Guide for Marine Engine Electronic Displays	LEGM0001-00 (10-08)	
5.	Operator's Guide for Marine Power Display	LEBM0189-04	
6.	Schematic C32 Marine Engine Electrical System	KENR5897-02 VOL 2	

Table 2-9: Engine Installation As-built documentation

Item	Description	Part Number	Remarks
1.	Starboard Engine Control Panel	NAU28-CAT-EL-0021(01)	Sheet 1 of 7
2.	Starboard Engine Control Panel	NAU28-CAT-EL-0021(02)	Sheet 2 of 7
3.	Starboard Engine Control Panel	NAU28-CAT-EL-0021(03)	Sheet 3 of 7
4.	Starboard Engine Control Panel	NAU28-CAT-EL-0021(04)	Sheet 4 of 7
5.	Starboard Engine Control Panel	NAU28-CAT-EL-0021(05)	Sheet 5 of 7
6.	Starboard Engine Control Panel	NAU28-CAT-EL-0021(06)	Sheet 6 of 7
7.	Starboard Engine Control Panel	NAU28-CAT-EL-0021(07)	Sheet 7 of 7
8.	Port Engine Control Panel	NAU28-CAT-EL-0022(02)	Sheet 1 of 6
9.	Port Engine Control Panel	NAU28-CAT-EL-0022(03)	Sheet 2 of 6
10.	Port Engine Control Panel	NAU28-CAT-EL-0022(04)	Sheet 3 of 6
11.	Port Engine Control Panel	NAU28-CAT-EL-0022(05)	Sheet 4 of 6
12.	Port Engine Control Panel	NAU28-CAT-EL-0022(06)	Sheet 5 of 6
13.	Port Engine Control Panel	NAU28-CAT-EL-0022(07)	Sheet 6 of 6

Item	Description	Part Number	Remarks
14.	FJP-0004 Layout	NAU28-CAT-EL-0023(01)	Sheet 1 of 3
15.	FJP-0004 Wiring	NAU28-CAT-EL-0023(02)	Sheet 2 of 3
16.	FJP-0004 Gland Layout	NAU28-CAT-EL-0023(03)	Sheet 3 of 3
17.	FJP-0002 Layout	NAU28-CAT-EL-0024(01)	Sheet 1 of 3
18.	FJP-0002 Wiring	NAU28-CAT-EL-0024(02)	Sheet 2 of 3
19.	FJP-0002 Gland Layout	NAU28-CAT-EL-0024(03)	Sheet 3 of 3
20.	FJP-0003 Layout	NAU28-CAT-EL-0025(01)	Sheet 1 of 3
21.	FJP-0003 Wiring	NAU28-CAT-EL-0025(02)	Sheet 2 of 3
22.	FJP-0003 Gland Layout	NAU28-CAT-EL-0025(03)	Sheet 3 of 3
23.	Bilges and Levels	NAU28-CAT-EL-0027	Sheet 1 of 1
24.	Level Indication	NAU28-CAT-EL-0028	Sheet 1 of 1

Autopilot

A Furuno NAVPILOT-700 autopilot is fitted. The system comprises:

a. Processor Unit FAP-7002

b. Control Unit FAP-7001

c. Heading Sensor PG-500

d. Rudder Reference Unit FAP-6112

A block diagram of the autopilot system is shown in Figure 2-9 on page 2-25.

NavPilot -700 utilizes a self-learning and adaptive software algorithm to provide a good course-keeping capability. NavPilot dynamically adjusts essential parameters during navigation, such as vessel speed, trim, draught, tide and wind effects, dead band, weather and more. These parameters are stored in system memory and continuously optimized to make the NavPilot more versatile.
From initial switch-on NavPilot continues to learn your vessel's steering characteristics, allowing for real-time, dynamic adjustments to make the boat's steering more accurate.
NavPilot can be utilised in specific situations such Man Overboard (MOB) to perform square, zigzag, circle, orbit, spiral or figure-eight manoeuvrers around a specified target at a user selected distance.

Block Diagram

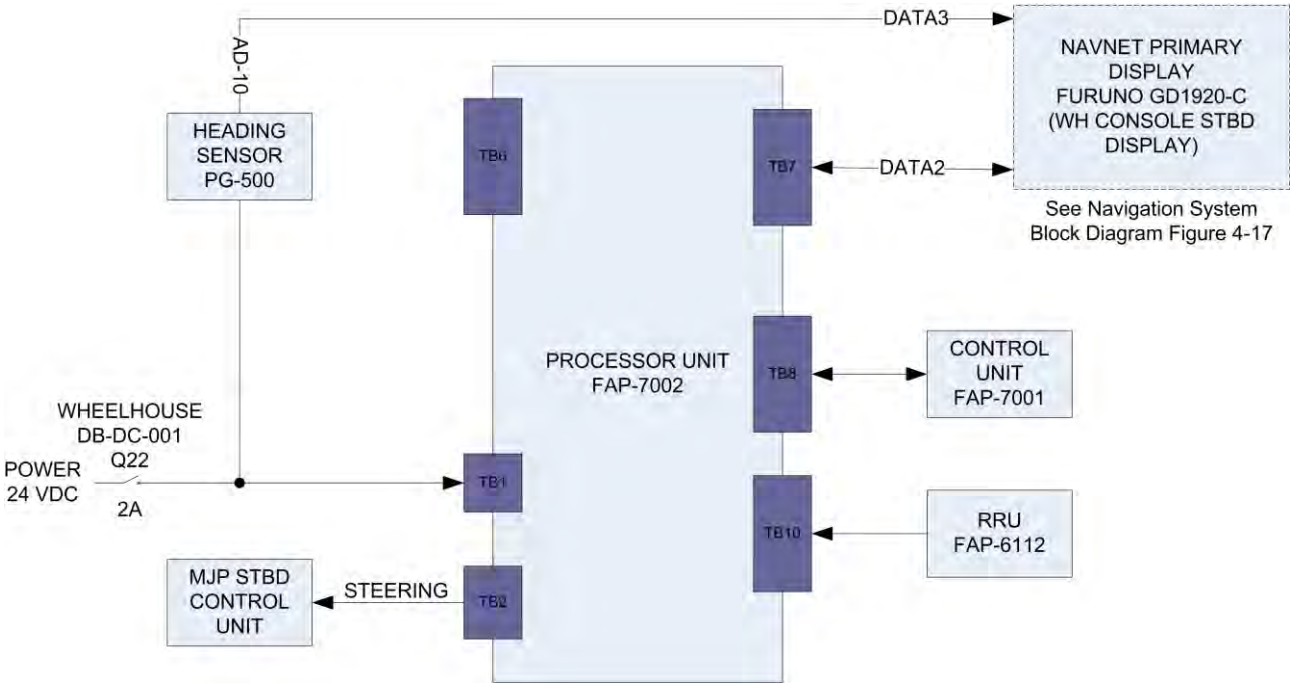


Figure 2-9: Block Diagram NAVPILOT-700 Autopilot System

Equipment Location

The location of the NavPilot system equipment is as follows:

a. FAP-7001 Autopilot Control Unit (ACU) – wheelhouse console central

b. FAP-7002 Processor Unit – Underside wheelhouse console aft face centre.

c. FAP-6112 Rudder Reference Unit –.

d. PG-500 Heading Sensor.

Figure 2-10: FAP-7002 Processor Unit Location

Documentation

NAVPILOT-700 System Documentation is listed in Table 2-10 below.

Table 2-10: NAVPILOT-700 System Documentation

Item	Description	Part Number	Remarks
1.	AUTOPILOT NAVpilot-700/711/720 Installation Manual	IME-72720-C	
2.	AUTOPILOT NAVpilot-700/711/720 Operator Manual	OME-72720-A	
3.	Integrated Heading Sensor PG-500 Operator Manual	OME-72550	
4.	AUTOPILOT NAVpilot-700/711/720 Brochure	Catalogue No. M-1551b	

290 Steering

System Description

The steering system is in fact the control sub-system of MJP Water Jet system which is described under Control System on page 2-13.

Emergency Steering Procedure

1. Mate and 2nd mate, plus engineer to man tiller flat and establish communications with master on bridge.
2. Mate to confirm rudder angle and bucket position and verify control of steering established.
3. Master to give rudder angle and engine revolutions required to mate. Mate to confirm when required rudder angle and engine revolutions have been obtained.
4. Spare crew member(s) on bridge to act as relay should communications break down between bridge and steering flat.
5. Safe speed and proper bridge lookout to be maintained. Correct signal flags to be hoisted or required lights (nuc if applicable) or required sound signals in restricted visibility.
6. All commands to be repeated back to master to confirm correct procedures.
7. Pan pan urgency message to be broadcasted if navigation becomes difficult or proves hazardous to safe navigation.
8. Proceed with haste to rectify malfunction and notify nearest coastal station of current situation.

9. Once rectified, notify shipping in close proximity and coastal station of return to normality.
10. Take extreme precautionary measures in case of possible repeat of problem.

Chapter 3: 300 Electrical

310 Electrical Power Supply

Overview

Two 64 kVA 400 V 50 Hz diesel powered generators (Genset 1 and Genset 2) serve as primary power sources for the vessel. They are located inline in the Engine room with Genset 1 forward of the two between the main engines.

Each generator can supply the entire vessel's electrical requirements. Note that synchronised running of two generators is not available.

The backbone network consists of both gensets feeding the vessel main switch board, MSB-001. MSB-001 allows for a redundantly configured electricity distribution to all key electrical users and sub-distribution boards.

Lighting and consumer power (hotel services) are provided from DB-AC-001. This sub-network provides electricity to commercial equipment.

The shore supply service is established on one bus section of MSB-001 only. The shore supply is connected via an isolation transformer.

Emergency users are connected on a 24VDC system serviced by fully redundant, dedicated, batteries and chargers.

An overview of the electrical distribution system is shown in Figure 3-7 on page 3-33. The location of electrical generation and distribution equipment is shown in Figure 3-5 on page 3-30 for below main deck equipment and Figure 3-6 on page 3-31 for main deck, deckhouse and wheelhouse equipment.

311 Generator Set

Two Caterpillar C4.4 86 kVA 400 V 50Hz gensets are installed aft of the main engines and one behind the other on the centreline in the engine room.

NOTEE: The diesel engines of the genset's are supplied from the main fuel oil supply system of the vessel (see Figure 5-7 on page 5-15 for further information).

Genset features include:

a. Canister type air cleaner with service indicator

b. Heat exchanger type cooling system (See Cooling System – Electrical Generator Sets on page 5-27 for information on the seawater supply to the heat exchanger cooling system).

c. Exhaust System - Dry insulated turbocharger, water-cooled exhaust manifolds

d. Fuel System - Primary fuel filter/water separator, secondary fuel filter (LH), fuel priming pump

e. Generator - IP23 water protection, solid state voltage regulator with integral voltage adjustment potentiometer, Class H insulation, connection poles

f. Governing System - Electronic governor

g. Lube System - Lubricating oil, oil filter (LH), dipstick (LH), fumes disposal (closed system)

Fuel Oil Quality

Diesel fuel quality is an important factor in satisfactory engine life and performance (see Fuel Oil Quality on page 2-2 for further detail).

Generator Lubrication

Table 3-1: Generator Lubrication Chart

System Code	Equipment	Make / Type	Application	Type Of Oil/ Grease
310	Generator Engine	Caterpillar C4.4	Oil Lubricated System	DEO 15W-40

Maintenance Schedule

The maintenance schedule for the generator is given on page 108 of the Operation and Maintenance Manual for C4.4 Marine Generator Sets (see item 1 in Table 3-2 below) and must be complied with.

Included in this maintenance schedule is a daily inspection, which comprises:

- Electrical connections inspection
- Engine air cleaner service indicator service inspection
- Coolant level check
- Generator load check

Generator System Documentation

Generator system documentation is listed in Table 3-2 below:

Table 3-2: Electrical System Documentation

Item	Description	Part Number	Remarks
1.	Operation and Maintenance Manual for C4.4 Marine Generator Sets	SEBU7919-02	

Item	Description	Part Number	Remarks
2.	Installation and Maintenance Instructions for IS Leroy Somer LSA 43.2/.44.2 – 4 Pole Alternators	F25T002 Rev/F	
3.	SSO Operators Manual for Deep Sea Electronic PLC	057-018	
4.	Caterpillar C4.4 Generator Set Parts Manual	SERP4152-02 (Electronic Copy) SERP4152-02 (Hard Copy)	
5.	Caterpillar C4.4 Generator Set Electronic Manual	Main Menu	Contains: Parts Manual Battery Guide Battery Specification Work Tool Catalogue Service Tool Catalogue Shops Supplies & Tools Caterpillar General Parts Catalogue

312 Shore Power

Brief Description

An 80 Amp, 400V, 50Hz, 3 Phase, 3 wire (IT) shore supply arrangement, complete with coupling cable and isolation transformer is installed.

The connection point (125A, 4 pin weatherproof socket) is located on the starboard side on the forward face of the forward vent box. The connection point is connected to MSB-001 via a distribution box and isolating transformer. The distribution box is located in the Fire Equipment locker on the port side of the passageway outside the engine room access door.

The 25 m shore supply connection cable can be stored either in the forward store or the wheelhouse. Note that the remote (land-side) cable ends are fitted with lugs suitable for bolting to the shore supply arrangement. Each core is tagged to identify the phase or earth. Pin 4/core 4 is an earth connection to bond vessel and shore earths during shore supply operations.

The supply system is configured so that it is not possible to connect the Vessel's main alternators to MSB-001 with the shore supply connected, i.e. any condition where the shore supply contactor in MSB-001 is "closed". Note that a "shore supply connected" signal is fed into the ship's alarm system.

320 Switchboards and Distribution Boards

Main Switchboard MSB-001

MSB-001 is located in the below deck switchgear room forward of the engine room.

The MSB-001 bus bar is split, and contains a bus coupler which is closed under normal conditions. MSB-001 is arranged such that the two bus sections are individually serviced from the gensets. The incoming lines from the gensets each contains a circuit breaker fully rated for the associated genset. In addition, each incoming line contains synchronizing gear, and a synchronizing selector arrangement to allow synchronization of the gensets with the main bus bars and "no break" load transfer of power between the sources for vessel electrical requirements only.

Either generator (providing that it is ready for service) may be started and synchronized from MSB-001. Note that the necessary opening and closing of the appropriate circuit breakers in the main switchboard for synchronizing purposes is done automatically. Manual synchronization of the gensets is available if required as a back-up capability.

MSB-001 is in 3 sections, the first section or forward section contains the synchronising equipment, control circuitry and circuit breakers for the two generators and the shore supply. The second section contains TRF-001 which is power transformer that provides the power supply for the lighting and power sockets throughout the vessel. This is known as the Small Power (Hotel) Supply. The third section contains MDB-001 (connected to bus section A) and MDB-002 (connected to bus section B) which are the main distribution boards that distribute the 400 VAC 3 phase to the user equipment throughout the ship.

400V/230V A.C. Small Power (Hotel) Supply

The vessel's small power distribution for hotel requirements is a 400V, 3phase, 4-wire earthed system.

An earthed system is used for operational and safety reasons and due mainly to the use of commercial equipment in the galley and passenger areas.

The hotel supply is fed from MDB-002 in the switchboard room to the Main Small Power DB (DB-AC-001).

DB-AC-001 services the following areas:

1. Accommodation users , (from DB-AC-001)
2. Galley (DB-AC-003)
3. Engine room lights and plugs (from DB-AC-001)
4. Main deck/General users (from DB-AC-002)
5. Wheelhouse (DB-AC-002)

The hotel services earth is connected to the MSB earth point. Note that all appliances to be plugged into the hotel system should have a connected earth wire in its power cable.

MDB-001 feeds 400V 3 Phase 50 Hz to the A/C distribution box SDB-003 from where 230V is distributed to the A/C cassette units located in the wheelhouse, accommodation areas, galley and mess room.

340 Batteries and Chargers

Engine Starting

There are 2 x Battery banks for engine and generator starting: Each bank comprises 2 x 12 V 200 Ah batteries and provides enough power for six starts providing the batteries are fully charged. Each battery bank has a dedicated battery charger and battery monitor which provides an input to the alarm system if the battery voltage is low.

The port and starboard starting systems each comprising the batteries in their enclosure, the battery charger, fuse box and monitor are located aft in the engine room on the port side outboard of the aft generator. The port battery bank starts the port engine and generator no 1 while the starboard battery bank starts the starboard engine and generator no 2.

Note that the forward battery bank, battery charger and fuse box are identified battery bank 3, battery charger 3 and fuse box 3 and form the port starting system while the aft battery bank, battery charger and fuse box are identified battery box 4, battery charger 4 and fuse box 4 and form the starboard starting system.

Connection to the starter circuits on the user equipment is via DB-DC-004 for the "port" installation and DB-DC-005 for the "starboard" installation. Each DB contains a battery isolator and fuse unit for each starter circuit it supplies. In addition there, is a removable cable link which connects DB-DC-004 to DB-DC-005. This is to enable the either group's equipment to be started by the other group's supply if required. Note that Isolators in DB-DC-004 and DB-DC-005 have to be made to enable this link.

The battery chargers receive their supply from MDB-001 (port) and MDB-002 (starboard).

DC Main and Emergency Supplies

Main Supply

There are 2 x battery banks for DC Main and Emergency supplies: Each bank comprises 2 x 12 V 200 Ah batteries located in a battery enclosure located in the technical space underneath the wheelhouse floor. Each battery bank has a dedicated battery charger and battery monitor which provides an input to the alarm system if the battery voltage is low. The battery chargers and monitors are located in the wheelhouse on the starboard side aft.

Note that the forward battery bank, associated battery charger and fuse box are identified battery bank 1, battery charger 1 and battery box 1 while the aft battery bank, associated battery charger and battery box are identified battery box 2, battery charger 2 and battery box 1.

For further information see 370 DC Power Supplies on page 3-9.

Emergency Supply

The battery banks described above also provide the emergency power supply for the vessel and together provide a minimum stand-by capacity of not less than 6 hours. When one set is discharged, the other set is automatically brought on-line. When required, change over will be automatic and seamless under PLC control.

All emergency services are run from 24 VDC. These include:

a. Navigation lights

b. Emergency lighting

c. Communication systems

d. Navigation systems

e. Alarm system

f. Fire detection system

g. Steering gear

350 Lighting

General

Below Decks Accommodation Area

Below deck accommodation and galley area: flush mount fittings (area outfitted with drop down ceilings). Wall mounted reading lamps are fitted at each bunk and desk. Shower and toilet cubicles are fitted with overhead lights and shaving lights.

Switchboard Room and Engine Room

In the switchboard room and engine room light levels of 200 Lux or more are provided as per industry standards. Flush fittings are used in the switchboard room whereas surface mounted fittings are used in the engine room as this area is not outfitted with drop down ceilings.

Passenger Area

In the passenger area, flush mount fittings are used in the drop down ceilings. The toilet cubicles are supplied with overhead lights.

Wheelhouse

The wheelhouse is equipped flush mount fittings. The two main fittings are supplied with one half fitted with a red louver for night operations. The red section of the fitting is supplied from the emergency supply and the clear section from the AC supply.

Above deck

The main lighting for the cargo area is provided by a floodlight mounted on the deckhouse aft railing. In addition, infill lighting is provided using surface mounted fittings against the engine room vent cowls and the superstructure. Floodlights are also used to illuminate the foredeck and the RIB/Davit installation. In both cases, infill lighting is also provided using surface mount fittings. Note that emergency lighting is also provided at the RIB/davit position.

LED Floodlights are used in both Working Areas and Movement Areas.

Navigation Lights

The Navigation lights installed are the double lens type and powered from the DC system. The lights are controlled from the navigation light panel fitted on the port side of the wheelhouse console.

The following navigation lights are provided.

Table 3-3: Navigation Lights

Type	Qty	Shape	Remarks
Anchor	1	All round white	
Masthead	1	225° White	
Not Under Command (NUC)	4	All round red	Top & Bottom Port & Starboard
Restricted Manoeuvre	2	All round white	Port & Starboard
Port	1	112.5° Red	
Starboard	1	112.5° Green	
Stern	1	135° White	

Navigation Panel Operation

See Circuit Diagram MES-A00857-NLP REV 1

Power Supply

The panel is fed by a primary and secondary supply that is controlled by a rotary switch with three selections, Primary, Off and Secondary. The whole panel is then protected through two 50A fuses (F1 &F2).

Light Circuits

The light circuits are fed via two 5A fuses (F4 & F5) and the controls are fed via a 1A fuse(F6). The circuit is switched on with a toggle switch (S1) – Navigation light (L1), relay K4, relay K5 and indication LED(H2) is energised. A PNP Transistor (TR1) is used to check for a fused light or a cable break. When such a fault occurs relay K4 and indication LED (H2) is de-energised, a fault LED (H1) is energised and a signal is sent to the Buzzer circuit.

Buzzer Circuit

The fault output from a light circuit energises relay K3 (for PLC) and the Buzzer through relay K2 contact. When the alarm acknowledge button (S2) is pressed the Buzzer is silenced by latching relay K1 which in turn energises relay K2.

LED Dimmer

The dimmer circuit is fed from a 1A fuse (F3) through a variable resistor (VR1).

Light Test Button

This circuit is fed from a 1A fuse (F3) and switched through a push button(S1).

Navigation Panel Documentation

Table 3-4: Navigation Panel Documentation

Item	Description	Part Number	Remarks
1.	Navigation Lights Panel	MES-A00857-NLP REV 1	General outline and circuit diagram
2.	Navigation Light Descriptions	ICD	Identification and Check Document

Emergency Lighting

Emergency lights are fitted in the passenger areas, wheelhouse, galley, accommodation area, switch board room and engine room to illuminate escape routes and exit points. Emergency lights are provided on the main deck. Emergency lighting is automatically switched on, on failure of the AC mains supply.

360 AC Power Supplies

400V/230V A.C. Small Power (Hotel) Supply

The vessel's small power distribution for hotel requirements is a 400V, 3phase, 4-wire earthed system.

An earthed system is used for operational and safety reasons and due mainly to the use of commercial equipment in the galley and passenger areas.

The hotel supply is fed from MDB-002 to the Main Small Power DB (DB-AC-001).

DB-AC-001 services the following areas:

1. Accommodation users , (from DB-AC-001)

2. Galley (DB-AC-003)
3. Engine room lights and plugs (from DB-AC-001)
4. Main deck/General users (from DB-AC-002)
5. Wheelhouse (DB-AC-002)

The hotel services earth is connected to the MSB earth point. Note that all appliances to be plugged into the hotel system should have a connected earth wire in its power cable.

370 DC Power Supplies

24V D.C. Supply

The 24 V DC supply is provided from two off 24VDC DB's as follows:

1. DB-DC-001 – Wheelhouse 24VDC DB
2. DB-DC-003 – SWBD Room 24VDC DB

DB-DC-001 has two battery banks designated 1 and 2. Each bank has 2 x 12 V 200 Ah batteries with each bank serviced by dedicated battery chargers. The battery chargers are configured in a dual redundant mode.

DB-DC-001 is split into 3 sections. Two of the sections, DB-DC-001A is fed by Battery Set "1" and DB-DC-001B is fed by Battery set "2" and the third, common section is fed from sections 1 and 2 via an automatic change-over arrangement. The reason for sections DB-DC-001A and DB-DC-001B is to provide independent main and standby supplies to the user equipment that requires two independent supplies.

DB-DC-003 is fed from DB-DC-001. Similar to DB-DC-001, DB-DC-003 is also split into 3 sections. Sections DB-DC-003A and DB-DC-003B are fed by DB-DC-001A and DB-DC-001B respectively and the third, common section fed from sections A and B via an automatic change-over arrangement.

12V D.C. Supply

The 12 V DC supply is obtained from two 24 VDC to 12 V DC converters located in the wheelhouse adjacent to DB-DC-002, which is the 12 V DC DB. Both converters are fed from DB-DC-001 section C. DB-DC-002 is split into two separate sections with converter 1 servicing DB-DC-002A and converter 2 servicing DB-DC-002B.

Electrical Procedures

Connecting the Shore Supply

Make sure both generator breakers are locked out and Shore Supply Breaker in main board is switched "OFF" and the Isolator in the Shore Supply Box opposite the Main Board MSB-001 is also switched "OFF". Connect shore supply cable to Quayside.

1. Plug shore supply cable into shore supply connection box (Situated on Main Deck starboard side on ER ventilation inlet).
2. Check for correct voltage at isolator inside the shore supply DB (in FE locker on port side of engine room door – see Figure 3-1 on page 3-10).
3. If the correct voltage is measured switch "ON" isolator inside shore supply DB.
4. Make sure Bus Coupler is closed.
5. Switch ON shore supply breaker in main board MSB-001.
6. "Controls On" and "Offload" lights will be ON.
7. Press "Connect Button". If power does not go "on" turn the "changeover switch" and press "Connect Button" again.
8. Power will go "on", "Off Load" light will go "OFF" and "On Load" light will go "ON".
9. Make sure Feeder 1 and Feeder 2 is closed.
10. MDB 001 and MDB 002 will now have power.

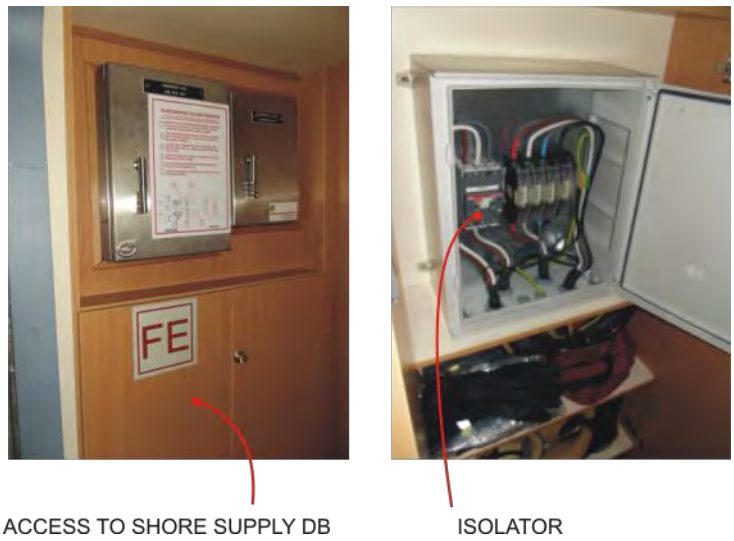


Figure 3-1: Shore Supply Distribution Box

Disconnecting the Shore Supply

1. Switch OFF Shore Supply Breaker on Main Board MSB-001.
2. Switch OFF Isolator inside Shore Supply Box (in FE locker on port side of engine room door).
3. Disconnect Shore Cable on Quayside.
4. Roll Shore Cable onto vessel.
5. Unplug Shore Cable from Shore Supply Connection Box.

Run Generator

1. Ensure that:
    a. The Shore Supply Breaker on the Main Board MSB-001 is in "OFF" position and Locked Out.
    b. The key is still in Bus Coupler and always in "CLOSED" position.
2. If Generator 1 is going to be used, put the remaining key into Generator 1.
3. Turn the "Key Switch" to enable the breaker.
4. Once generator is running close Generator 1 breaker.
5. "Controls ON" and "Off Load" lights will be on.
6. Press "Connect Button', if power does not go "ON" turn the "change over switch".
7. Press "Connect Button" again.
8. Power will be "energised", the "Off Load" light will go "OFF" and "On Load" light will go "ON".
9. MDB 001 and MDB 002 will now have power.
10. If using Generator 2, repeat above procedure substituting Generator 2 for Generator 1.

NOTE: Only 2 out of the 3 Breakers, e.g. Generator 1 and Generator 2 or any Generator and Bus Coupler can be used (Closed) at any given time.

Main Engine/Generator Starting from other Battery Bank

Normally the port engine and forward genset are started using battery bank 3, while the starboard engine and the aft genset are started using battery bank 4. If either battery bank fails the corresponding engine and genset can be started from the other battery bank.

To start both engines and both generators when either of the battery banks are not operational:

1. Ensure the faulty battery bank is isolated by opening Isolator Q1 in DB-DC-004 if battery bank 3 is faulty or DB-DC-005 if battery bank 4 is faulty.

2. Ensure that Isolator Q1 in the DB for the operational battery bank is closed.

3. Open Isolators Q4 in both DB-DC-004 and DB-DC-005 to interconnect the two systems.

4. Both port and starboard engines and generators 1 and 2 can now be started from one battery bank.

Circuit Breakers

Table 3-5 below lists all the circuit breakers by system description and gives the switchboard or distribution box in which they are installed together with the voltage and rating. Note that circuit breakers in AC and DC distribution boxes are included

Table 3-5: Circuit Breakers All Switchboards and Distribution Boards

Equipment	Supply	Line	CB	Voltage	A
Input MDB-002 (4-Pole Isolator)	DB-AC-001	3ϕ	Q1	3ϕ 400 V	40A
Plugs (P11 & P12)	DB-AC-001	L2	Q10	1ϕ 230 V	63A
P11 Plugs Captain's & Engineers Cabins	DB-AC-001	L2	Q11	1ϕ 230 V	20A
P12 Plugs Switchboard Room & Engine Room	DB-AC-001	L2	Q12	1ϕ 230 V	20A
Input to DB-AC-002 (Wheelhouse)	DB-AC-001	3ϕ	Q13	3ϕ 400 V	25A
Input to DB-AC-003 (Galley)	DB-AC-001	3ϕ	Q14	3ϕ 400 V	25A
E-Stop Control Circuit (K1) (Emergency Trip for Vent fans)	DB-AC-001	L1	Q15	1ϕ 230 V	2A
Vent Fan Supply	DB-AC-001	3ϕ	Q16	3ϕ 400 V	10A
Starboard Vent Fan Galley	DB-AC-001	L1	Q17	1ϕ 230 V	6A
Vent Fan Forward WC No 1	DB-AC-001	L2	Q18	1ϕ 230 V	6A
Vent Fan Forward WC No 2	DB-AC-001	L3	Q19	1ϕ 230 V	6A
Vent Fan Forepeak	DB-AC-001	L1	Q20	1ϕ 230 V	6A
Lights Galley/Accommodation Aft	DB-AC-001	L2	Q3	1ϕ 230 V	10A
Lights Accommodation Forward	DB-AC-001	L3	Q4	1ϕ 230 V	10A
Lights Bunk Accommodation Aft	DB-AC-001	L3	Q5	1ϕ 230 V	10A
Lights Bunk Accommodation Forward	DB-AC-001	L3	Q6	1ϕ 230 V	10A
Plugs (P6 & P10)	DB-AC-001	L1	Q7	1ϕ 230 V	63A
P6 Plugs Forward Cabin/Laundry	DB-AC-001	L1	Q8	1ϕ 230 V	20A
P10 Plugs Aft Port Cabin & Technical Space	DB-AC-001	L1	Q9	1ϕ 230 V	20A
Input From DB-AC-001 (Switchboard Room)	DB-AC-002	3ϕ	Q1	3ϕ 400 V	25A
Protection Plugs (P5 & P13)	DB-AC-002	L3	Q10	1ϕ 230 V	63A
Plugs Passenger Area Forward (P5)	DB-AC-002	L3	Q11	1ϕ 230 V	20A

Equipment	Supply	Line	CB	Voltage	A
Plugs Passenger Area Aft (P13)	DB-AC-002	L3	Q12	1ϕ 230 V	20A
Searchlight Control Panel	DB-AC-002	L1	Q13	1ϕ 230 V	10A
Fire Detection System 230 V Supply	DB-AC-002	L3	Q14	1ϕ 230 V	2A
E-Stop (Emergency Trip for A/C fans)	DB-AC-002	L1	Q15	1ϕ 230 V	2A
Supply to Vent Fans	DB-AC-002	3ϕ	Q16	3ϕ 400 V	10A
Vent Fan Saloon Port Aft	DB-AC-002	L2	Q17	1ϕ 230 V	6A
Vent Fan Saloon Starboard Aft	DB-AC-002	L3	Q18	1ϕ 230 V	6A
Vent Fan Saloon Port Forward	DB-AC-002	L1	Q19	1ϕ 230 V	6A
Lights Wheelhouse & Passenger Area (L4)	DB-AC-002	L1	Q2	1ϕ 230 V	10A
Vent Fan Port Forward Wheelhouse	DB-AC-002	L2	Q20	1ϕ 230 V	6A
Vent Fan Starboard Forward Wheelhouse	DB-AC-002	L3	Q21	1ϕ 230 V	6A
Lights Flood Main Deck Forward (L6)	DB-AC-002	L2	Q3	1ϕ 230 V	10A
Lights Flood Main Deck Aft (L7)	DB-AC-002	L3	Q4	1ϕ 230 V	10A
Lights Main Deck Starboard	DB-AC-002	L1	Q5	1ϕ 230 V	10A
Lights Water Jets (L8)	DB-AC-002	L1	Q5	1ϕ 230 V	10A
Protection Plugs (P1, P3 & P4)	DB-AC-002	L1	Q6	1ϕ 230 V	63A
Plugs Main Deck Storage (P1)	DB-AC-002	L1	Q7	1ϕ 230 V	20A
Spare	DB-AC-002	L3	Q7	1ϕ 230 V	10A
Plugs Wheelhouse (P3)	DB-AC-002	L1	Q8	1ϕ 230 V	20A
Plugs Wheelhouse (P4)	DB-AC-002	L1	Q9	1ϕ 230 V	20A
Mains Feed from DB-AC-001	DB-AC-003	3ϕ	Q1	3ϕ 230 V	25A
Plugs Galley P8	DB-AC-003	L2	Q3	1ϕ 230 V	20A
Plugs Mess P9	DB-AC-003	L2	Q4	1ϕ 230 V	20A
Stove Point Galley (P7)	DB-AC-003	L1	Q2	1ϕ 230 V	25A
Geyser Galley P2	DB-AC-003	L3	Q5	1ϕ 400 V	20A
Input from Battery Fuse Box No 1	DB-DC-001		Q1	DC 24V	100A
Input from Battery Fuse Box No 2	DB-DC-001		Q7	DC 24V	100A
24V to DB-DC-003B Output to DB in Switchboard Room Section B	DB-DC-001	B	Q8	DC 24V	40A
Navigation Light Panel Secondary Supply Wheelhouse	DB-DC-001	B	Q9	DC 24V	20A
Earth Fault Monitor	DB-DC-001	B	Q10	DC 24V	6A
Output to Selector Switch DB-DC-001C	DB-DC-001	B	Q11	DC 24V	2A
Emergency Lights Wheelhouse/Saloon	DB-DC-001	C	Q13	DC 24V	16A
24V to DB-DC-003A Output to DB in Switchboard Room Section A	DB-DC-001	A	Q2	DC 24V	40A
Emergency Lights Main Deck Forward	DB-DC-001	C	Q14	DC 24V	16A
Emergency Lights Main Deck Port	DB-DC-001	C	Q15	DC 24V	16A

Equipment	Supply	Line	CB	Voltage	A
Emergency Lights Main Deck Aft	DB-DC-001	C	Q16	DC 24V	16A
Emergency Lights Main Deck Stbd	DB-DC-001	C	Q17	DC 24V	16A
E-Stop Control Box Wheelhouse	DB-DC-001	C	Q18	DC 24V	2A
PLC Panel Wheelhouse	DB-DC-001	C	Q19	DC 24V	10A
Radar Antenna Unit Furuno RSB-007	DB-DC-001	C	Q21	DC 24V	6A
Display Secondary (Port) Furuno GD1920-C Wheelhouse	DB-DC-001	C	Q23	DC 24V	2A
Autopilot Processor Unit Furuno FAP-7002 Wheelhouse	DB-DC-001	C	Q22	DC 24V	6A
Display Primary (Stbd) Furuno GD1920-C Wheelhouse	DB-DC-001	C	Q24	DC 24V	2A
Intercom ETB10 Wheelhouse	DB-DC-001	C	Q20	DC 24V	10A
NavTex Furuno NX-7001 Wheelhouse	DB-DC-001	C	Q28	DC 24V	2A
Windscreen Wipers & Washers Wheelhouse	DB-DC-001	C	Q29	DC 24V	6A
AIS Furuno FA50 Wheelhouse	DB-DC-001	C	Q26	DC 24V	2A
Heading Sensor Furuno PG500 Wheelhouse	DB-DC-001	C	Q25	DC 24V	2A
Depth Sounder Furuno DFF1 Wheelhouse	DB-DC-001	C	Q27	DC 24V	2A
Thermal Imaging System	DB-DC-001	C	Q30	DC 24V	6A
CAT Port Engine MPD	DB-DC-001	C	Q34	DC 24V	2A
CAT Stbd Engine MPD	DB-DC-001	C	Q35	DC 24V	2A
Horn Wheelhouse	DB-DC-001	C	Q33	DC 24V	6A
K2 DB-DC-001C	DB-DC-001	B	Q12	DC 24V	63A
24V to DB-DC-002A Output to 12V DC DB Section A Wheelhouse	DB-DC-001	C	Q31	DC 24V	20A
24V to DB-DC-002B Output to 12V DC DB Section B Wheelhouse	DB-DC-001	C	Q32	DC 24V	20A
Navigation Light Panel Primary Supply Wheelhouse	DB-DC-001	A	Q3	DC 24V	20A
Earth Fault Monitor	DB-DC-001	A	Q4	DC 24V	6A
24V to DB-DC-001 Section C	DB-DC-001	A	Q6	DC 24V	63A
12V Output from Converter 1 Input to DB-DC-002	DB-DC-002	A	Q1	DC 12V	32A
Chart Light	DB-DC-002	B	Q10	DC 12 V	6A
Compass Light	DB-DC-002	B	Q11	DC 12 V	6A
VHF IC-M604 (1) Wheelhouse Port	DB-DC-002	A	Q2	DC 12V	2A
GMDSS Sailor SP3520	DB-DC-002	A	Q3	DC 12V	2A
MF/HF Transceiver ICOM M802	DB-DC-002	A	Q4	DC 12V	32A
12V Output from Converter 2 Input to DB-DC-002	DB-DC-002	B	Q5	DC 12V	32A

Equipment	Supply	Line	CB	Voltage	A
VHF IC-M604 (2)	DB-DC-002	B	Q6	DC 12V	2A
GMDSS Sailor SP3520	DB-DC-002	B	Q7	DC 12V	2A
NavNet Hub	DB-DC-002	B	Q8	DC 12V	2A
DVD Player	DB-DC-002	B	Q9	DC12V	6A
DC Input from DB-DC-001A in Wheelhouse (Isolator)	DB-DC-003	A	Q1	DC 24V	40A
K2 DB-DC-003C	DB-DC-003	B	Q10	DC 24V	63A
Emergency Lights Engine Room (EL1)	DB-DC-003	C	Q11	DC 24V	16A
Emergency Lights Switchboard Room (EL2)	DB-DC-003	C	Q12	DC 24V	16A
Emergency Lights Galley/Forward Accommodation (EL3)	DB-DC-003	C	Q13	DC 24V	16A
Emergency Lights Tech Space & Forepeak (EL4)	DB-DC-003	C	Q14	DC 24V	16A
PLC Panel Engine Room	DB-DC-003	C	Q15	DC 24V	10A
Talk Back Engine Room Forward	DB-DC-003	C	Q16	DC 24V	2A
Talk Back Engine Room Aft	DB-DC-003	C	Q17	DC 24V	2A
MJP Manoeuvre & Backup Unit Port Secondary	DB-DC-003	A	Q2	DC 24V	6A
MJP Manoeuvre & Backup Unit Starboard Secondary	DB-DC-003	A	Q3	DC 24V	6A
Selector Switch DB-DC-003 Section C	DB-DC-003	A	Q4	DC 24V	2A
K1 DB-DC-003C	DB-DC-003	A	Q5	DC 24V	63A
DC Input from DB-DC-001B in Wheelhouse (Isolator)	DB-DC-003	B	Q6	DC 24V	40A
MJP Manoeuvre & Backup Unit Port Primary	DB-DC-003	B	Q7	DC 24V	6A
MJP Manoeuvre & Backup Unit Starboard Primary	DB-DC-003	B	Q8	DC 24V	6A
Selector Switch DB-DC-003 Section C	DB-DC-003	B	Q9	DC 24V	2A
Supply from Battery Fuse Box No 3 (Isolator)	DB-DC-004	-	Q1	DC 24V	200A
Port Engine Starting (Fuse Unit)	DB-DC-004	-	Q2	DC 24V	200A
Forward Generator Starting (Fuse Unit)	DB-DC-004	-	Q3	DC 24V	200A
Link to DB-DC-005	DB-DC-004	-	Q4	DC 24V	200A
Supply from Battery Fuse Box No 4	DB-DC-005	-	Q1	DC 24V	200A
Starboard Engine Starting (Fuse Unit)	DB-DC-005	-	Q2	DC 24V	200A
Aft Generator Starting (Fuse Unit)	DB-DC-005	-	Q3	DC 24V	200A
Link to DB-DC-004	DB-DC-005	-	Q4	DC 24V	200A
Supply from DB-DC-001	E-Stop Control Box	-	Q1	24 VDC	10A
Input from MSB-001A (Isolator)	MDB-001	3ϕ	Q1	3ϕ 400 V	80A

Equipment	Supply	Line	CB	Voltage	A
Water Pressure Pump Standby	MDB-001	-	Q10	3ϕ 400 V	6A
Anti-fouling Engine Room	MDB-001	L1	Q11	1ϕ 230 V	6A
Battery Charger No 3 (Port Engine Starting) (1.2 kW)	MDB-001	-	Q12	3ϕ 400 V	10A
Battery Charger No 1 (Wheelhouse) (2.4 kW)	MDB-001	-	Q13	3ϕ 400 V	16A
E-Stop Control Box	MDB-001	L1	Q2	1ϕ 230 V	2A
A/C SDB3 Saloon	MDB-001	3ϕ	Q3	3ϕ 400 V	60A
Vent Fan F1 Engine Room	MDB-001	3ϕ	Q4	3ϕ 400 V	6A
Vent Fan F2 Engine Room	MDB-001	3ϕ	Q5	3ϕ 400 V	6A
Fuel System Header Tank Pump Standby Pump (1.1 kW)	MDB-001	-	Q6	3ϕ 400 V	6A
Bilge Pump Standby (3 kW)	MDB-001	-	Q7	3ϕ 400 V	10A
Input from MSB-001B (Isolator)	MDB-002	3ϕ	Q1	3ϕ 400 V	80A
Waste Water Discharge Pump (1.1 kW)	MDB-002	3ϕ	Q10	3ϕ 400 V	6A
Mains Feed to DB-AC-001 (Small Power)	MDB-002	-	Q11	3ϕ 400 V	40A
Under Frequency Signal to PLC	MDB-002	L1	Q12	1ϕ 230 V	2A
E-Stop Control Box	MDB-002	L1	Q2	1ϕ 230 V	2A
Battery Charger No 4 (Starboard Engine Starting) (1.2 kW)	MDB-002	-	Q3	3ϕ 400 V	10A
Battery Charger No 2 (Wheelhouse) (2.4 kW)	MDB-002	-	Q4	3ϕ 400 V	16A
Water Pressure Pump Main	MDB-002	L3	Q5	1ϕ 230 V	6A
Water Maker Panel	MDB-002	L3	Q6	1ϕ 230 V	25A
Windlass (2.2 kW)	MDB-002	3ϕ	Q7	3ϕ 400 V	10A
Bilge Pump Main (3 kW)	MDB-002	3ϕ	Q8	3ϕ 400 V	10A
Fuel System Header Tank Pump (1.1 kW)	MDB-002	3ϕ	Q9	3ϕ 400 V	6A
Shore Supply Input from Isolating Transformer	MSB-001	3ϕ	Q25	3ϕ 400 V	80A
MDB-001 Bus Section A to Bus Section B	MSB-001	3ϕ	Q9B	3ϕ 400 V	100A
Supply to MDB-001	MSB-001	3ϕ	Q9A	3ϕ 400 V	80A
Supply to MDB-002	MSB-001	3ϕ	Q9C	3ϕ 400 V	80A
400 V 3 Phase 50 Hz (Generator No 1)	MSB-001	3ϕ	Q1	3ϕ 400 V	100A
400 V 3 Phase 50 Hz (Generator No 2)	MSB-001	3ϕ	Q3	3ϕ 400 V	100A
Feed from MDB-001 (Isolator)	SDB-003	3ϕ	Q1	3ϕ 400 V	60A
AC Cassette Unit 1	SDB-003	L1	Q2	1ϕ 230 V	20A
AC Cassette Unit 2	SDB-003	L2	Q3	1ϕ 230 V	20A
AC Cassette Unit 3	SDB-003	L3	Q4	1ϕ 230 V	20A
AC Cassette Unit 4	SDB-003	L1	Q5	1ϕ 230 V	20A
AC Cassette Unit 5	SDB-003	L1	Q6	1ϕ 230 V	20A

Equipment	Supply	Line	CB	Voltage	A
AC Cassette Unit 6	SDB-003	L1	Q7	1ϕ 230 V	20A
AC Cassette Unit 7	SDB-003	L1	Q8	1ϕ 230 V	20A

380 Alarm Systems

Fire Detection System

Brief Description

The Fire Detection system comprises a Synchro ASM Single Loop Control panel linked to fire detection devices and modules. The main control panel is mounted in the Wheelhouse on the port side just aft of the console.

The system is divided into zones which monitor the various detectors. The control panel is equipped with a large graphic display, indicators and the controls to operate the panel, providing the user with versatile Fire Detection annunciation features.

If the system detects an input from a sensor, the control panel will give a visual and audible alarm. In the event of the alarm not being accepted by a crew member within 2 minutes the system activates the PA system.

The zones and detection devices and modules in them are listed below (see Figure 3-2 on page 3-18 for the identification of fire system components):

a. Zone 1(a) Wheelhouse
   Optical Smoke Detector
   Fire Alarm Panel
   Manual Call point (Stairway)
   Siren
b. Zone 1(b) Passenger Saloon
   Optical Smoke Detector (Qty 2) – 1 in the saloon and 1 in the wheelhouse entrance.
   Manual Call Points - 1 at the saloon entrance from the deck.
   Alarm Bell with strobe at the saloon entrance from the deck.
c. Zone 1(c) Forward Store (Geyser Installation)
   Optical Smoke Detector
d. Zone 2(a) Crew Accommodation Forward
   Optical Smoke Detector
   Manual Call Point Qty 1 – in crew cabin
   Alarm Bell with strobe
e. Zone 2(b) Galley/mess room, laundry room, store
   Optical Smoke Detectors (Qty 3) 1 in galley, 2 in passageway
   Heat Detector (Qty 4) – 1 in galley, 1 in laundry room, 1 in mess room, 1 in store
   Manual Call Point at entrance to area from aft accommodation
   Alarm Bell with strobe
f. Zone 3(a) Accommodation passage/Galley Door
   Optical Smoke Detector

g. Zone 3(b) Captain's Cabin
   Optical Smoke Detector
h. Zone 3(c) Ablution area
   Optical Smoke Detector
   Heat Detector
i. Zone 3(d) Aft Accommodation Passage
   Optical Smoke Detector (Qty 2) 1 forward, 1 aft
   Manual Call Point
   Alarm Bell with strobe
j. Zone 3(e) Engineer's Cabin Starboard
   Optical Smoke Detector
k. Zone 3(f) Passenger Cabin Port
   Optical Smoke Detector
l. Zone 4(a)Engine Room
   Heat Detector (Qty 2) – 1 forward, 1 aft
   Manual Call Point by engine room door
   Alarm Bell with strobe

Figure 3-2: Fire Detection System Components

Fire Detection System Operating Procedures

Silence Alarm and Reset Panel

When a fire condition exists a light on the panel will be lit to show which zone the fire is in. The display also indicates as to in which area the fire is and the LED for the call point which triggered the alarm will be lit.

To silence an alarm, on the Master Panel:

1. Press 2 five times and the press ENTER. You are now in Access Level 2, which allows you to silence sirens, reset panel, etc.).
2. Press SILENCE ALARM to cancel the siren.
3. When the fire condition has been cleared, press RESET to reset the panel.
4. Press EXIT to exit Access Level 2.

General Fault Clearing

In case of faulty circuit a light on the panel will be lit to indicate that there is a general fault and the display will give an indication as to which area the fault is in.

To clear the general fault, on the Master Panel:

1. Press 2 five times and the press ENTER. You are now in Access Level 2, which allows you to silence sirens, reset panel, etc.).
2. Press SILENCE BUZZER to cancel the buzzer.
3. When the fault condition has been cleared, press RESET to reset the panel.
4. Press EXIT to exit Access Level 2.

Fire Detection System Documentation

Table 3-6: Fire Detection System Documentation

Item	Description	Part Number	Remarks
1.	Syncro ASM Analogue Addressable Marine Fire Control Panel User Manual	Man-1100M	Issue 02 October 2009
2.	Syncro Multi Loop Analogue Addressable Fire Control Panel Product Manual	Man-1055	Issue 21 September2010
3.	Syncro ASM Analogue Addressable Marine Fire Control Panel Product Manual	Man-1096M	Issue 05 February 2010
4.	Fire Panel Prompt Card 1	Fire	Cancel siren & reset panel
5.	Fire Panel Prompt Card 2	Fault	Cancel fault & reset panel
6.	Hochiki Smoke Chamber Replacement for ALG-E/SLR-E/SLR-E3	AP063/ISS1/NOV03	Smoke chamber replacement instructions for smoke detectors

Instrumentation and Alarms

Brief Description

A combined vessel information system which operates on a PLC platform is installed. Connections to the system include both OEM equipment that have "General" or "Common" alarm circuits available for monitoring and alarm circuits that are controlled by the PLC itself.

Examples of OEM equipment whose alarm circuits are monitored are the Fire Detection System, Water Jets, Main Engines and Generators.

Alarms and information messages that are controlled by the PLC are displayed on four operator panels (OP) located in the Engine Room, Switchboard Room, Captain's Cabin and the wheelhouse console (see Figure 3-3 on page 3-21).

Any alarm is displayed on all four OPs and is accompanied by a siren to distinguish it from normal information displays. Note that the siren accompanying an engineering alarm is not as loud as the siren accompanying a general alarm. The OP in the engine room is also fitted with a warning strobe in addition to the audio warning to attract attention. Note that the siren will sound until the "ACK" (Acknowledge) key on an alarm panel is pressed.

An event log is kept by the PLC, which retains time-tagged events in a rolling database of 500 events before overwriting of the oldest event. It is not possible to print a hardcopy of the event log; however it is possible to call up the event log from the wheelhouse OP for review on-screen.

There are two PLC panels, FJP-001 in the Wheelhouse and FJP-002 in the Switchboard Room. FJP-001 has one input card and one output card while FJP-002 has three input cards and one output cards. Signals into the system are connected to an input card while signals out of the system are from the output card. Outputs include signals to alarm sounders and trip signals to vent fans, ect.

PLC Controlled Alarms & Information messages are listed below in Table 3-7.

Figure 3-3: Location of Alarm Panels

Operation

When the alarm system is powered up the display on the alarm panel will show the location of the alarm panel, e.g. Wheelhouse and any active alarms. The bottom of the screen identifies the active keys below:

1. F1: Silence Alarm – Pressing this key silences the audio warning associated with the alarm. Note that if a silenced alarm is still active the RED LED remains lit.

2. F3: Menu –This key accesses the System Level menus which are used for configuring the alarm system and should be used by operating personnel.

3. F4: Level Menu – Pressing this key accesses the Levels menu which:

    a. Displays contents of the port and starboard fuel oil tanks and Port and starboard freshwater tanks as a percentage.

    b. When this screen is displayed the message above the F4 key changes to "More". Pressing F4 again displays the contents of the tanks in litres.

c. When the contents of the tanks is displayed in litres, the F1 key changes to "Day Tank". Press F1 to display the contents of the day tank as a percentage or alternatively press F4 to return to the Main Menu.

d. Pressing F4 when the day tank contents are displayed returns the display to the tank contents in litres.

4. Red LED operates as follows:

a. If all alarms are cleared then red led goes off.

b. If a new alarm is detected then the red led flashes at a frequency of 0.5 Hz

c. If an alarm has been acknowledged but still active the red LED remains on (solid red)

Table 3-7: PLC Controlled Alarms and Messages

Slot Nr	PLC Address	Alarm Description	Category	Sensor type	Action	Timer
WH slot 4	I 10.0	General Alarm Nav Light Panel	General Alarm	DO from device		No Delay
WH slot 4	I 10.1	General Alarm Fire Detection Panel	General Alarm	DO from device		No Delay
WH slot 4	I 10.2	General Alarm MJP Central Unit STBD	General Alarm	DO from device	Immediately observe MJP Alarm panel to identify exact nature of problem	No Delay
WH slot 4	I 10.3	General Alarm Fwd Console Switch	General Alarm	Pushbutton		No Delay
WH slot 4	I 10.4	A Battery Low Voltage	General Alarm	DO from device	Battery Bank A (Emergency Power) Low voltage – Manually select Battery Bank B	No Delay
WH slot 4	I 10.5	B Battery Low Voltage	General Alarm	DO from device	Battery Bank B (Emergency Power) Low voltage – Manually select Battery Bank A	No Delay
WH slot 4	I 10.6	Source Selected A System Battery -DB-DC-001	General Alarm	DO from device	Emergency power Battery Bank A manually selected	No Delay
WH slot 4	I 10.7	Source Selected B System Battery -DB-DC-001	General Alarm	DO from device	Emergency power Battery Bank B manually selected	No Delay
WH slot 4	I 11.0	General Alarm A Charger	General Alarm	DO from device	AC Supply to Battery Charger A failed	No Delay
WH slot 4	I 11.1	General Alarm B Charger	General Alarm	DO from device	AC Supply to Battery Charger B failed	No Delay
WH slot 4	I 11.2	Insulation fault Section A DB-DC-001	General Alarm	DO from device		No Delay

Slot Nr	PLC Address	Alarm Description	Category	Sensor type	Action	Timer
WH slot 4	I 11.3	Insulation fault Section B DB-DC-001	General Alarm	DO from device		No Delay
WH slot 4	I 11.4	Hatch Open FWD Peak	Hatch	Switch	Hatch/Door OPEN - All watertight access hatches and doors should be secured when at sea and closed immediately after use	No Delay
WH slot 4	I 11.5	Hatch Open FWD Accommodation	Hatch	Switch		No Delay
WH slot 4	I 11.6	Door Open FWD Accommodation	Door	Switch		30
WH slot 4	I 11.7	General Alarm MJP Central Unit PORT	Spare		Immediately observe MJP Alarm panel to identify exact nature of problem	
ER Slot 4	I 14.0	Hatch Open ER	Hatch	Switch	Hatch/Door OPEN - All watertight access hatches and doors should be secured when at sea and closed immediately after use	No Delay
ER Slot 4	I 14.1	Door Open ER	Door	Switch		30
ER Slot 4	I 14.2	Breaker Closed Bus coupler	General Alarm	DO from device		No Delay
ER Slot 4	I 14.3	Breaker Closed Shore Supply	General Alarm	DO from device		No Delay
ER Slot 4	I 14.4	Breaker Closed Incomer A	General Alarm	DO from device		No Delay
ER Slot 4	I 14.5	Breaker Closed Incomer B	General Alarm	DO from device		No Delay
ER Slot 4	I 14.6	General Alarm FWD Charger	General Alarm	DO from device	AC Supply to Forward Engine/Generator Starting Batteries Charger Failed	No Delay
ER Slot 4	I 14.7	General Alarm AFT Charger	General Alarm	DO from device	AC Supply to Forward Engine/Generator Starting Batteries Charger Failed	No Delay
ER Slot 4	I 15.0	FWD Battery Low voltage	General Alarm	DO from device	Forward Batteries cannot be used to start port engine/forward generator. To start connect link from DB-DC-005 to DB-DC-004	No Delay
ER Slot 4	I 15.1	AFT Battery Low voltage	General Alarm	DO from device	Aft Batteries cannot be used to start Stbd engine/aft generator. To start connect link from DB-DC-004 to DB-DC-005	No Delay

Slot Nr	PLC Address	Alarm Description	Category	Sensor type	Action	Timer
ER Slot 4	I 15.2	General Alarm FWD Genset	General Alarm	DO from device	Alarm condition Forward Generator. Determine cause of alarm at LOP in ER	No Delay
ER Slot 4	I 15.3	General Alarm AFT Genset	General Alarm	DO from device	Alarm condition Aft Generator. Determine cause of alarm at LOP in ER	No Delay
ER Slot 4	I 15.4	General Alarm Port Engine	General Alarm	DO from device	Alarm condition Port Engine. Determine cause of alarm at MPD in wheelhouse or LOP in ER	No Delay
ER Slot 4	I 15.5	General Alarm STBD Engine	General Alarm	DO from device	Alarm condition Stbd Engine. Determine cause of alarm at MPD in wheelhouse or LOP in ER	No Delay
ER Slot 4	I 15.6	DB-DC-03 System A selected	General Alarm	DO from device	Emergency power Battery Bank A manually selected	No Delay
ER Slot 4	I 15.7	DB-DC-03 System B selected	General Alarm	DO from device	Emergency power Battery Bank B manually selected	No Delay
ER Slot 5	I 16.0	Level High Bilge FWD Peak	Bilge	Switch		8
ER Slot 5	I 16.1	Level High Bilge FWD Accommodation	Bilge	Switch		8
ER Slot 5	I 16.2	Level High Bilge AFT Accommodation	Bilge	Switch		8
ER Slot 5	I 16.3	Level High Bilge ER FWD	Bilge	Switch		8
ER Slot 5	I 16.4	Level High Bilge ER AFT	Tank High	Switch		8
ER Slot 5	I 16.5	Level High PORT Freshwater	Tank High	Switch		8
ER Slot 5	I 16.6	Level Low PORT Freshwater	Tank Low	Switch		8
ER Slot 5	I 16.7	Level High STBD Freshwater	Tank High	Switch		8
ER Slot 5	I 17.0	Level Low STBD Freshwater	Tank Low	Switch		8
ER Slot 5	I 17.1	Level High FWD Fuel	Tank High	Switch		8
ER Slot 5	I 17.2	Level Low FWD Fuel	Tank Low	Switch		8
ER Slot 5	I 17.3	Level High AFT Fuel	Tank High	Switch		8
ER Slot 5	I 17.4	Level Low AFT Fuel	Tank Low	Switch		8
ER Slot 5	I 17.5	Level High Oil/Bilge Water Tank	Tank High	Switch		8
ER Slot 5	I 17.6	Level High Sewage Tank	Tank High	Switch		No Delay

Slot Nr	PLC Address	Alarm Description	Category	Sensor type	Action	Timer
ER Slot 5	I 17.7	Level High Oil/Bilge Seperator	Tank High	Switch		8
ER Slot 6	I 18.0	Level High Header tank fuel oil	Tank High	Switch		8
ER Slot 6	I 18.1	Level Low Header tank fuel oil	Tank Low	Switch		8
ER Slot 6	I 18.2	General Alarm Fire suppression	General Alarm	DO from device		No Delay
ER Slot 6	I 18.3	Main SWBD earth fault	General Alarm	DO from device		No Delay
ER Slot 6	I 18.4	Shore Supply Earth Fault	General Alarm	DO from device		No Delay
ER Slot 6	I 18.5	Earth Current monitor	General Alarm	DO from device		No Delay
ER Slot 6	I 18.6	E-Stop on switchboard activated	General Alarm	E-Stop		No Delay
ER Slot 6	I 18.7	Low Frequency	General Alarm	DO from device		No Delay
ER Slot 6	I 19.0	Level High Port Fuel Oil	Tank High	Switch		8
ER Slot 6	I 19.1	Level Low Port Fuel Oil	Tank Low	Switch		8
ER Slot 6	I 19.2	Level High Stbd Fuel Oil	Tank High	Switch		8
ER Slot 6	I 19.3	Level Low Stbd Fuel Oil	Tank Low	Switch		8
ER Slot 6	I 19.4	Level High Extractor Tank	Tank High	Switch		No Delay
ER Slot 6	I 19.5	General Alarm MJP Manoeuvre and Backup Panel STBD	Spare	DO from device	Immediately observe MJP Alarm panel to identify exact nature of problem	No Delay
ER Slot 6	I 19.6	General Alarm MJP Manoeuvre and Backup Panel PORT	Spare	DO from device	Immediately observe MJP Alarm panel to identify exact nature of problem	No Delay
ER Slot 6	I 19.7	E-Stop Status Activation	Spare	E-Stop		No Delay

Alarm System Documentation

Table 3-8: Alarm System Documentation

Item	Description	Part Number	Remarks
1.	Siemens Marshalled Termination Assemblies for ET200M Remote I/O Modules Manual	A5E00482820-05	
2.	Siemens SIMATIC S7-300 CPU 31xC and CPU 31x: Technical specifications	A5E00105475-09	02/2009

Alarm System As-Built Drawings

The as-built electrical drawings for the alarm system are listed below in . To open the PDF file for a drawing click on the corresponding hyperlink.

Table 3-9: As-built Drawings for Alarm System

ITEM	DRAWING NAME	DRAWING NO.	NO. OF DRAWINGS
1	Layout FJP002 Engine Room	NAU28-AI-MA-0019 (4)	1 of 8
2	FJP001 Engine Room 24VDC	NAU28-AI-MA-0019(5)	2 of 8
3	FJP001 Engine Room 24VDC Control Circuit	NAU28-AI-MA-0019(6)	3 of 8
4	FJP001 Engine Room Input Card 1	NAU28-AI-MA-0019(7)	4 of 8
5	FJP001 Engine Room Input Card 2	NAU28-AI-MA-0019(8)	5 of 8
6	FJP001 Engine Room Input Card 3	NAU28-AI-MA-0019(9)	6 of 8
7	FJP001 Engine Room Output Card 1	NAU28-AI-MA-0019(10)	7 of 8
8	FJP001 Engine Room Analogue Card 1	NAU28-AI-MA-0019(11)	8 of 8
9	Wheelhouse PLC Layout	NAU28-AI-MA-0018(2)	1 of 5
10	Wheelhouse PLC 24VDC	NAU28-AI-MA-0018(3)	2 of 5
11	Wheelhouse PLC 24VDC Control Circuit	NAU28-AI-MA-0018(4)	3 of 5
12	Wheelhouse PLC Input Card 1	NAU28-AI-MA-0018(5)	4 of 5
13	Wheelhouse PLC Output Card 1	NAU28-AI-MA-0018(6)	5 of 5
14	PROFIBUS Layout	NAU28-AI-MA-0020	1 of 1

Other Electrical Equipment

Searchlight

A Seematz 351 230V Searchlight is mounted on top of the wheelhouse. The searchlight is manual operated from inside the wheelhouse.

Searchlight Documentation

Table 3-10: Searchlight Documentation

Item	Description	Part Number	Remarks
1.	Seematz Operating Manual	WS 463 HGS 230V-1000W	

Anti Fouling

An Impressed Current Anti Fouling (ICAF) system supplied by Corrosion and Water Control BV is installed. The system comprises four anodes, two plug boxes and A power unit (DPU). The plug boxes and the DPU

are located in the engine room on the starboard side (see Figure 3-4 below) and the anodes are all mounted on the strainer boxes.

The 230 VAC supply for the DPU is from Q6 on MDB-001

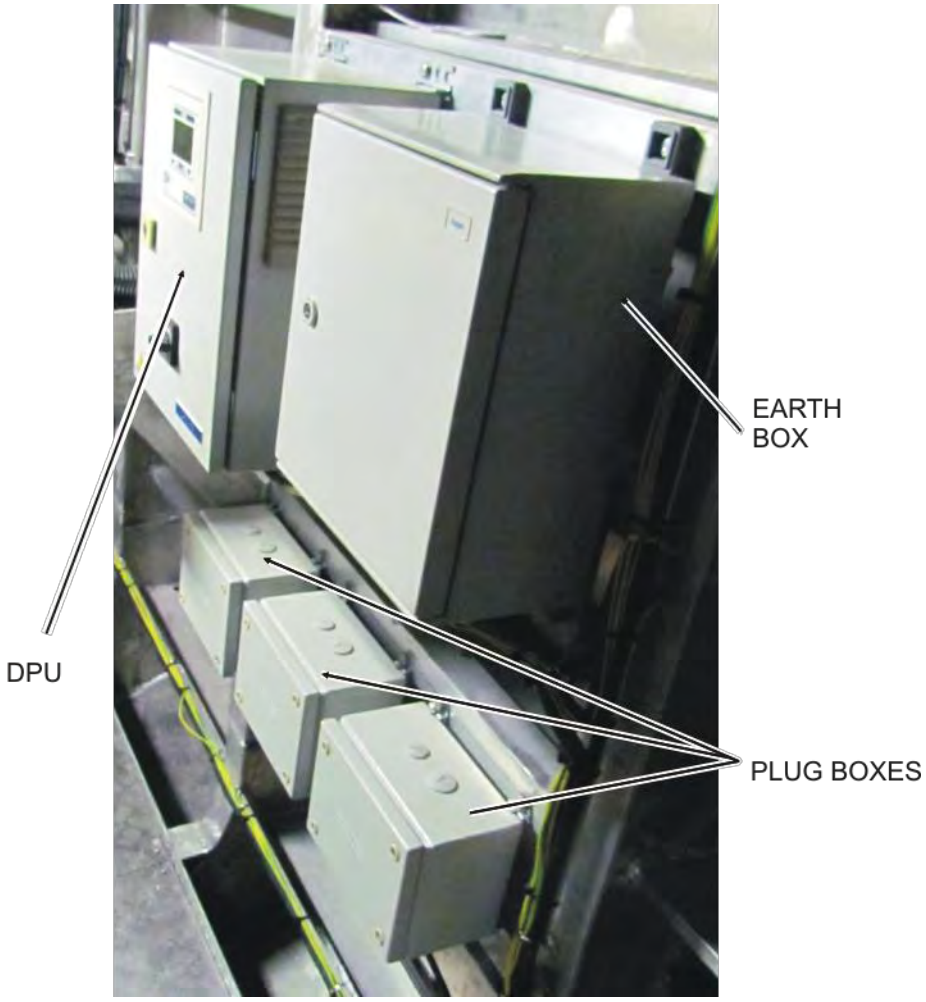


Figure 3-4: ICAF System Equipment

Table 3-11: ICAF System Documentation

Item	Description	Part Number	Remarks
1.	ICAF System Drawings		Drawings for Anode, DPU, Plug Box, Anode Clamp Box and Strainer Anodes
2.	ICAF User manual Clients	Version 2.0 English	
3.	Servicing Report	Commissioning ICAF V01	Commissioning ICAF V01 New Touch Screen

As Built Drawings

The as-built electrical drawings for I.H. Pepple are listed in Table 3-12 below. To open a PDF copy of the drawing when using the electronic version of this manual, simply click on the required title. Note that the

PDF contains all the drawings in that group. For example, the drawings for all three AC Distribution Boards (DB-AC-001, DB-AC-002 and DB-AC-003) are contained in one PDF file. Thus, the procedure to follow is: Click on the Hyperlink to open the PDF file then page through the file until the correct drawing is displayed.

Table 3-12: List of As-Built Electrical Drawings

ITEM	DRAWING NAME	DRAWING NO.	NO. OF DRAWINGS
1	Shore Supply	NAU28-EL-MA-0002	1 Sheet
2	MSB-001 Sheet 1	NAU28-EL-MA-0003 (1)	Sheet 1 of 4
	MSB-001 Sheet 2	NAU28-EL-MA-0003 (2)	Sheet 2 of 4
	MSB-001 Sheet 3	NAU28-EL-MA-0003 (3)	Sheet 3 of 4
	MSB-001 Sheet 4	NAU28-EL-MA-0003 (4)	Sheet 4 of 4
3	MDB-001	NAU28-EL-MA-0004 (1)	Sheet 1 of 2
	MDB-001	NAU28-EL-MA-0004 (2)	Sheet 2 of 2
4	MDB-002	NAU28-EL-MA-0005 (1)	Sheet 1 of 3
	MDB-002	NAU28-EL-MA-0005 (2)	Sheet 2 of 3
	MDB-002	NAU28-EL-MA-0005 (3)	Sheet 3 of 3
5	SDB-003 (Engine Room A/C)	NAU28-EL-MA-0006 (1)	Sheet 1 of 2
	SDB-003 (Engine Room A/C)	NAU28-EL-MA-0006 (2)	Sheet 2 of 2
6	DB-AC-001	NAU28-EL-MA-0007 (1)	Sheet 1 of 3
	DB-AC-001	NAU28-EL-MA-0007 (2)	Sheet 2 of 3
	DB-AC-001	NAU28-EL-MA-0007 (3)	Sheet 3 of 3
7	DB-AC-002	NAU28-EL-MA-0008 (1)	Sheet 1 of 3
	DB-AC-002	NAU28-EL-MA-0008 (2)	Sheet 2 of 3
	DB-AC-002	NAU28-EL-MA-0008 (3)	Sheet 3 of 3
8	DB-AC-003	NAU28-EL-MA-0009	1 Sheet
9	Battery Chargers 1 & 2	NAU28-EL-MA-0010 (1)	Sheet 1 of 2
	Battery Chargers 3 & 4	NAU28-EL-MA-0010 (2)	Sheet 2 of 2
10	DB-DC-001	NAU28-EL-MA-0011 (1)	Sheet 1 of 5
	DB-DC-001	NAU28-EL-MA-0011 (2)	Sheet 2 of 5
	DB-DC-001	NAU28-EL-MA-0011 (3)	Sheet 3 of 5
	DB-DC-001C	NAU28-EL-MA-0011 (4)	Sheet 4 of 5
	DB-DC-001C	NAU28-EL-MA-0011 (5)	Sheet 5 of 5
11	DB-DC-002A/B	NAU28-EL-MA-0012	1 Sheet
12	DB-DC-003A	NAU28-EL-MA-0013 (1)	Sheet 1 of 3
	DB-DC-003B	NAU28-EL-MA-0013 (2)	Sheet 2 of 3
	DB-DC-003C	NAU28-EL-MA-0013 (3)	Sheet 3 of 3
13	DB-DC-004	NAU28-EL-MA-0014	1 Sheet
14	DB-DC-005	NAU28-EL-MA-0015	1 Sheet
15	E-Stop Box	NAU28-EL-MA-0016	1 Sheet

ITEM	DRAWING NAME	DRAWING NO.	NO. OF DRAWINGS
16	Navigation Lights Panel	NAU28-EL-MA-0017	
17	FJB-001 Wheelhouse (Fire Detection)	NAU28-EL-MA-0018	1 Sheet
18	FJB-002 Switchboard Room (Fire Detection)	NAU28-EL-MA-0019 (1)	Sheet 1 of 3
	FJB-002 Switchboard Room (Fire Detection)	NAU28-EL-MA-0019 (2)	Sheet 2 of 3
	FJB-002 Switchboard Room (Fire Detection)	NAU28-EL-MA-0019 (3)	Sheet 3 of 3
19	Waste Water Pump	NAU28-EL-MA-0029	1 Sheet
20	Searchlight	NAU28-EL-MA-0030	1 Sheet
21	Wheelhouse Lighting	NAU28-EL-MA-0031	1 Sheet
22	Horn	NAU28-EL-MA-0032	1 Sheet

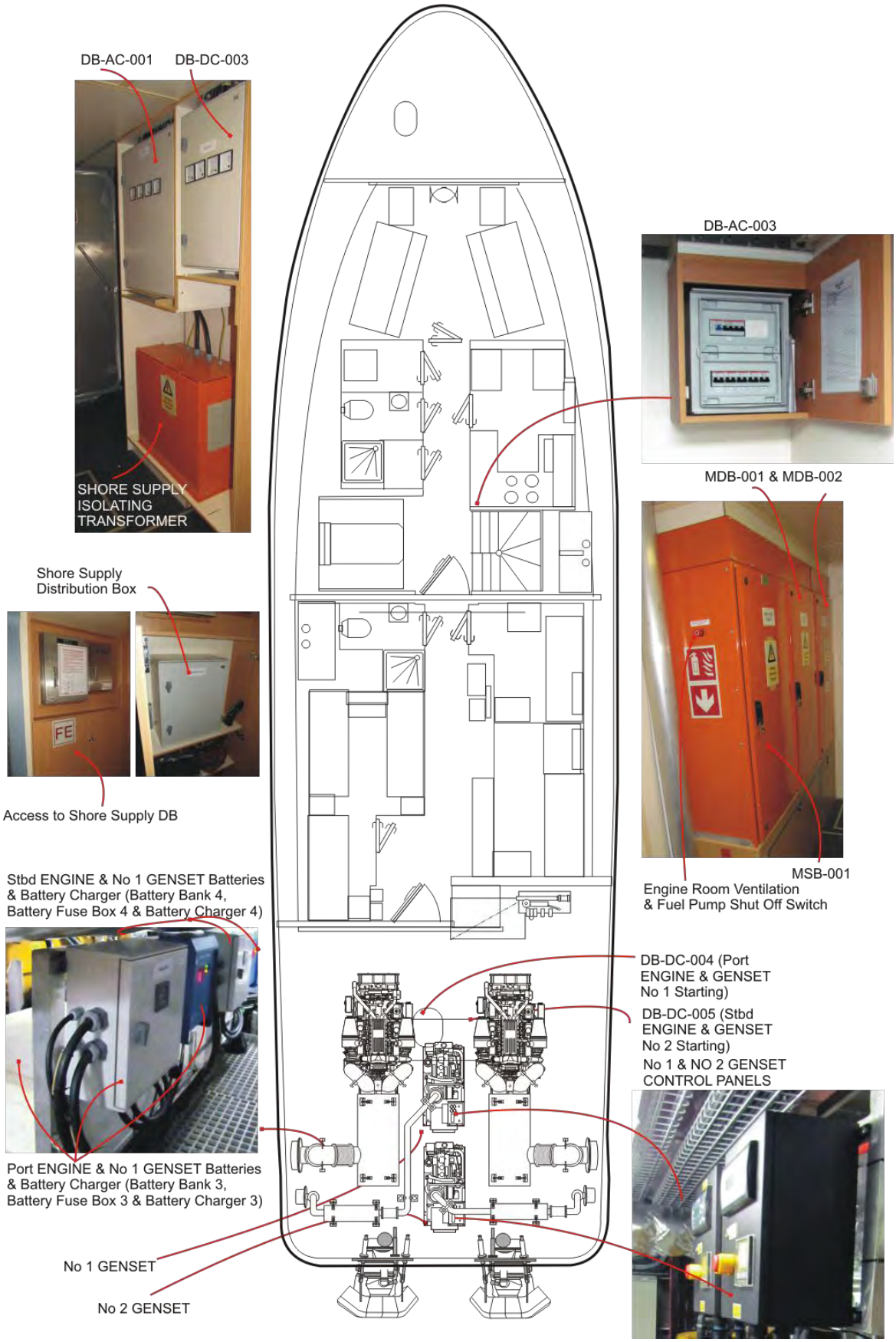
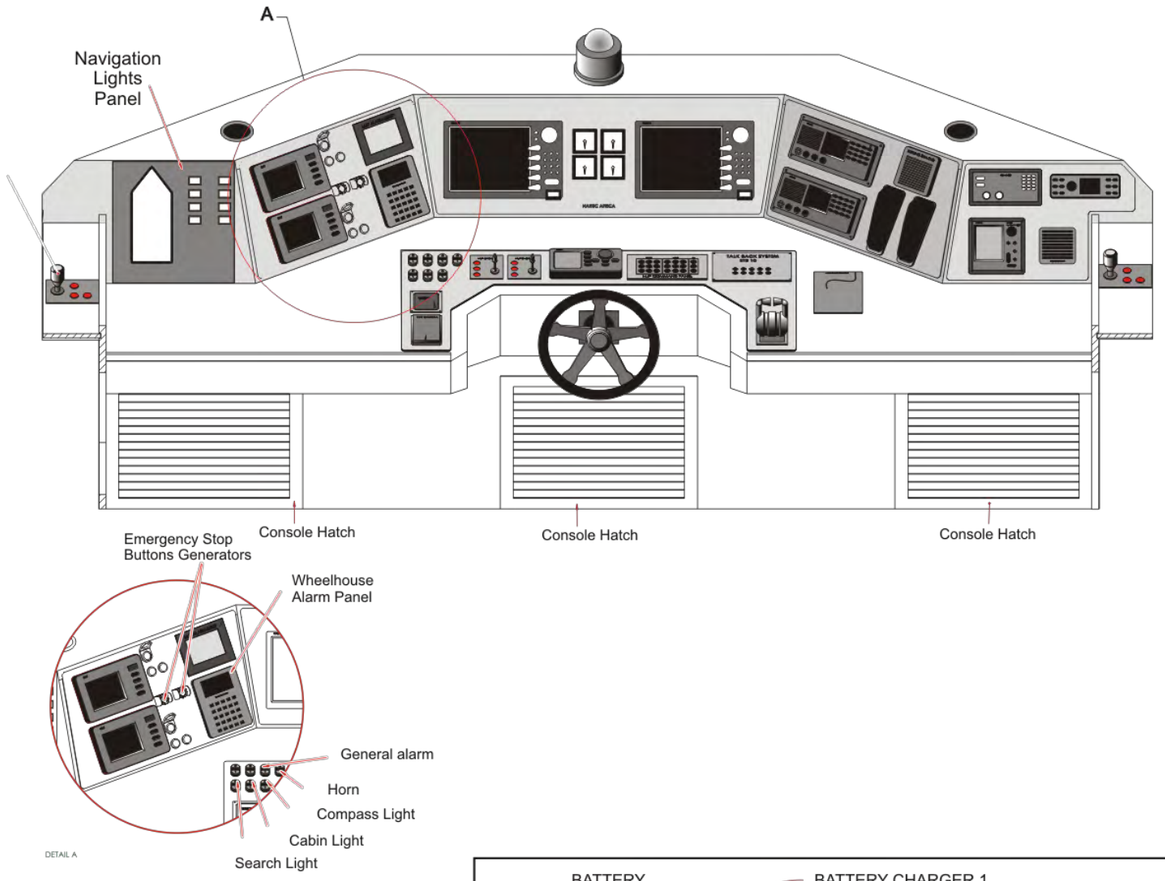
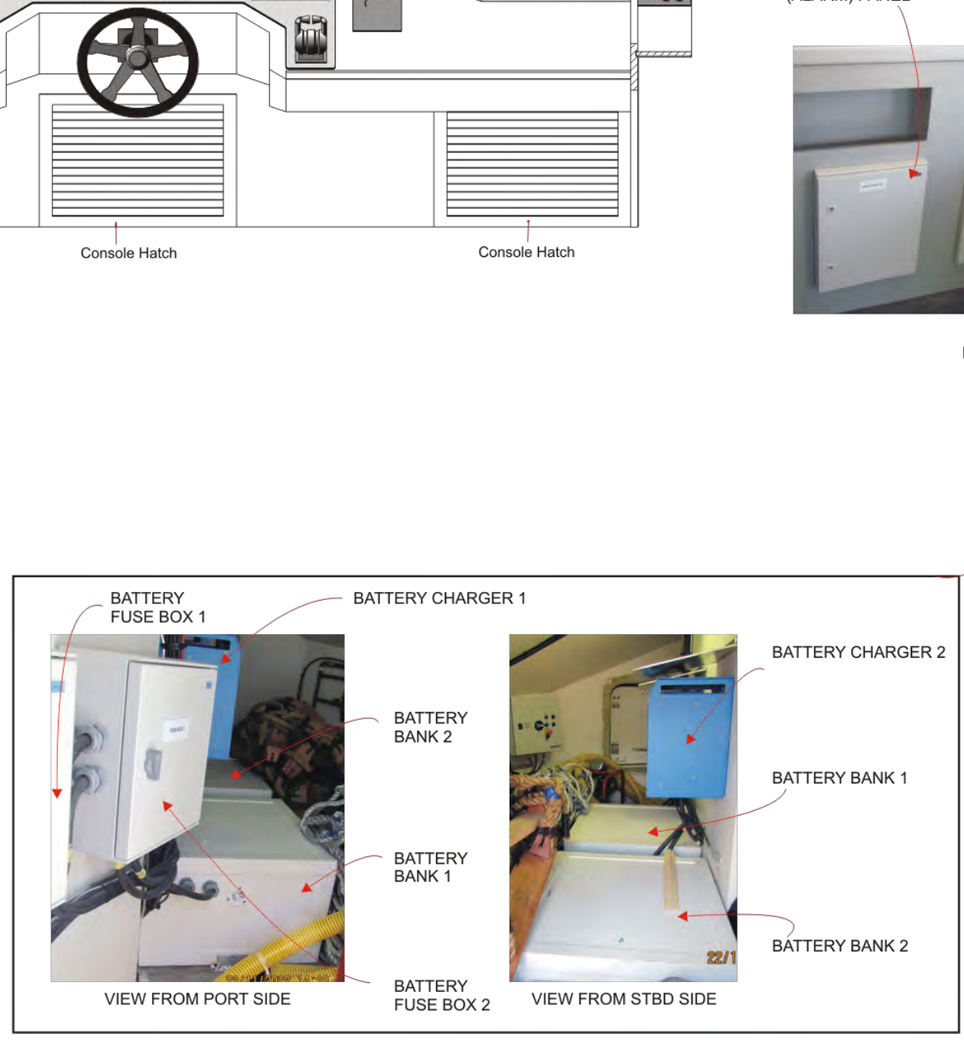
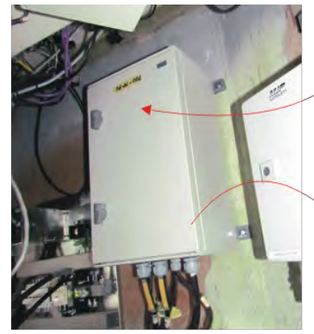


Figure 3-5: Location of Electrical Generating and Distribution Equipment below Main Deck







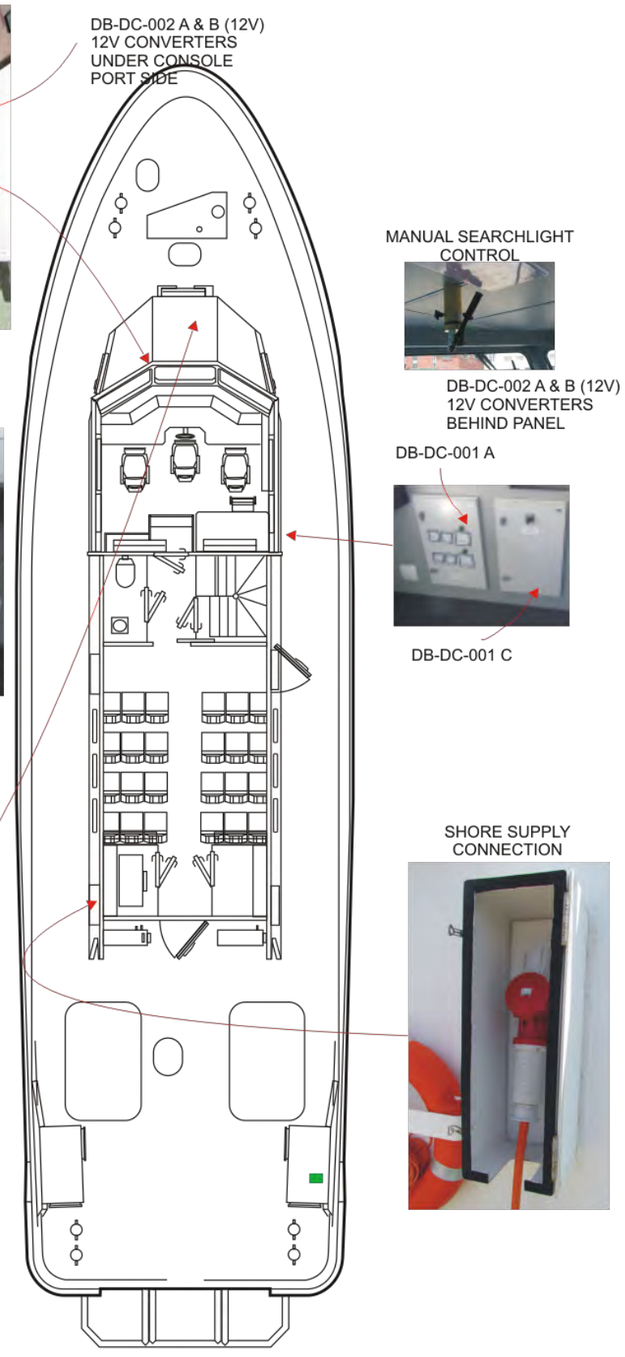


Figure 3-6: Location of Electrical Generation and Distribution Equipment Main Deck, Deckhouse and Wheelhouse

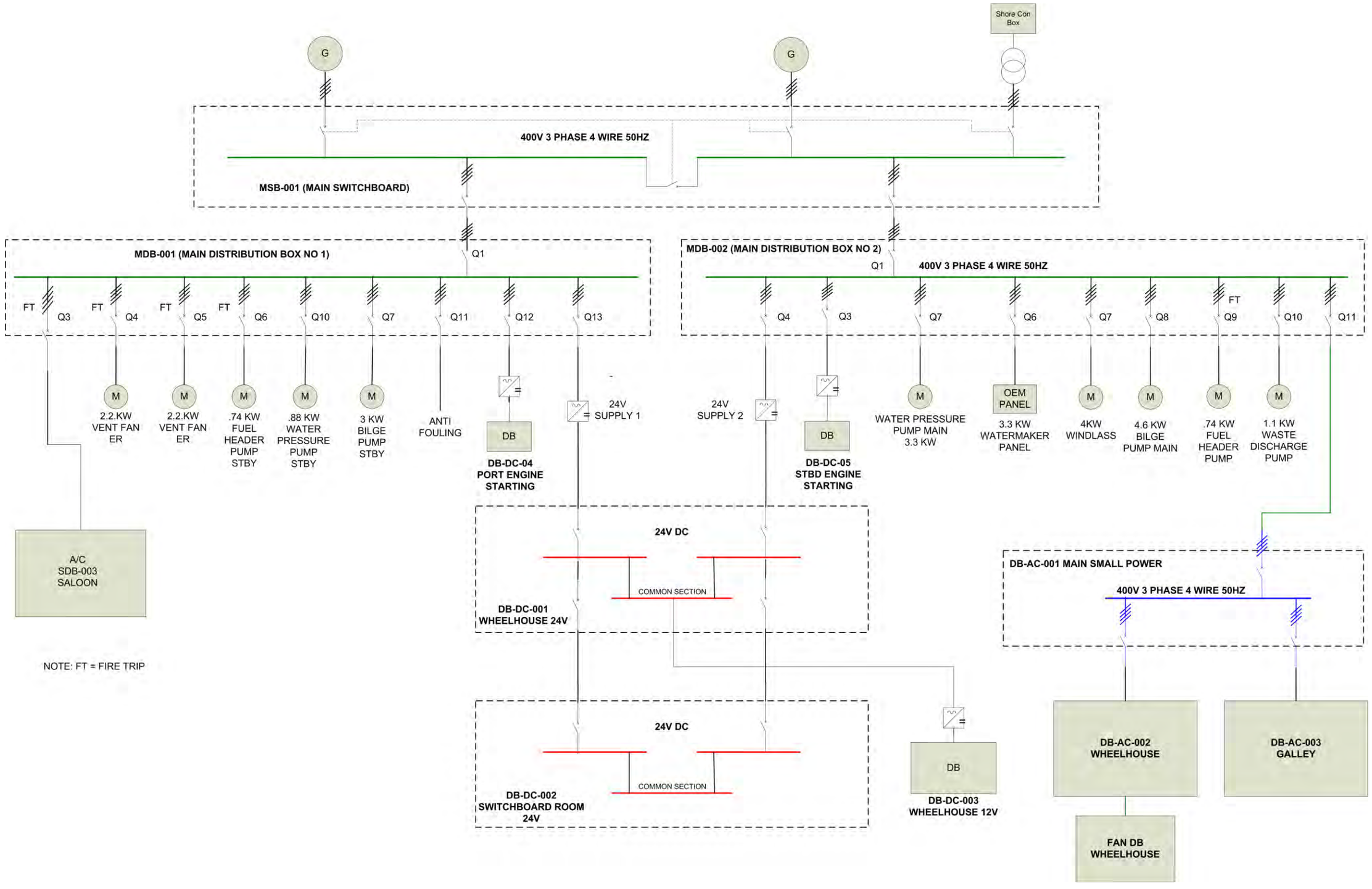


Figure 3-7: I.H. Pepple Electrical Distribution System Overview

Chapter 4: Electronics

420 Navigational Systems

Integrated Navigation System

Introduction

The I.H. Pepple has a Furuno integrated navigation system where the various systems are linked by the Model 1944C NAVNET vx2 system. The system basic comprises the radar and the two display units which are connected via a hub to other NAVNET equipment. This means that all the information can be viewed and controlled (in the case of the NAVNET equipment) from either of the two system displays.

The two displays are GD-1920C 10.4 inch Colour LCDs and are identified Master (starboard) and Slave (Port). The master display is connected directly to the Radar, GPS, Autopilot and Heading Sensor while the slave display receives these inputs via the network. The slave display also receives composite video from the thermal imaging camera. AIS and Depth information are also connected via an 8-port hub.

The two VHF radio telephones, the NAVTEX receiver and the HF radar are linked into the system via an NMEA buffer. Note that the NMEA connection to these units is for position and UTC time data.

The systems that are on the network are:

- Radar Model 1944C
- GPS Receiver GP-320B
- Network Sounder DFF1 coupled with through hull transducer 520-5PSD
- AIS Transponder FA-50 with VHF Marine Antenna CX4 and GPS Antenna GPA-017
- Heading Sensor PG-500
- NavPilot 700. Note the NavPilot 700 autopilot system is described in Chapter 2 on page 2-24.

In this chapter the various systems are described individually, but the systems that are on the network are all included on the integrated navigation system block diagram (see Figure 4-6 on page 4-17).

NavNet Model 1944C

Brief Description

The NavNet Model 1944C comprises RSB0070-059 radar and the two GD-1920C displays. The high performance radar has an output power of 6 kW and a range of 64 nm. It comprises a 4 foot open antenna mounted upon the combined processor and gearbox.

The GD-1020C display units are 10.4 inch high brightness, sunlight viewable LCD's. They provide excellent all-round presentation with a wide viewable angle with the VGA screen resolution ensuring a superbly detailed picture.

Specification

DISPLAY	10.4" COLOUR LCD
NavNet Interface	Ethernet 10-BaseT
Map Scale	0.125 to 2,048 nm
Display Modes	Course plot, Nav data, Steering display, Highway
Presentation Modes	TM/RM North-up, Course-up, Auto Course-up
Memory Capacity	Up to 8,000 points for ship's track and marks, 999 waypoints, 35 quick points, 1 MOB, 200 planned routes (max. 35 waypoints/route), 1 quick route
Radar Display Modes	Head-up, Course-up
Radar Range Scales (nm)	0.125 to 64 nm, 17 steps
Rotation Speed	24 rpm
ANTENNA	4 ft OPEN
Output Power	6 KW
POWER SUPPLY	12-24 VDC, 115 W

Equipment Location

The radar scanner is mounted on the main mast (see Figure 4-8 on page 4-21) and the GD-1920C Displays in the wheelhouse console (see Figure 4-9 on page 4-23).

NavNet vx2 Documentation

Table 4-1: NavNet vx2 Documentation

Item	Description	Part Number	Remarks
1.	Operator's Manual Marine Radar 1944C and Colour Video Plotter GD-1920C	Pub No. OME-35430-G	
2.	Installation Manual Marine Radar	Pub. No. IME-35430-H	

Item	Description	Part Number	Remarks
	Model 1944C and Colour Video Plotter GD-1920C		
3.	MODEL 1944C GD-1920C Operator's Guide	Pub. No. OSE-35430-A	

GPS

Brief Description

The I.H. Pepple is fitted with a GP-320B GPS Receiver. GPS information is relayed via the NavNet network and displayed on the GD-1920C 10.4 inch multifunction displays.

The GPS System is shown in the integrated navigation system block diagram Figure 4-6 on page 4-17.

Specification

General

Receiving Channels	:	GPS 12 channels parallel, 12 satellites tracking WAAS 1 channel
Rx Frequency	:	1575.42 MHz
Rx Code	:	C/A code, WAAS
Position Fixing System	:	All in view, 8-state Kalman filter
Position Accuracy	:	GPS 10 m (95% of the time, HDOP_ 4) DGPS 5 m (95% of the time, external data required) WAAS 3 m (95% of the time)
Tracking Velocity	:	999 kt
Position-fixing Time	:	Warm start: 12 s approx., Cold start: 90 s approx.
Position Update Interval	:	1 s
I/O Interface		
Data format	:	IEC 61162-1 (NMEA 0183 Ver 2.30)
Output data	:	DTM, GGA, ZDA, VTG, GLL, RMC
Input data	:	DGPS: RTCM SC-104 Control command

Equipment Location

The GP-320B antenna is mounted at the foot of the main mast on the port side, aft (see Figure 4-8 on page 4-21) and the GD-1920 Multifunction Displays in the wheelhouse console (see Figure 4-9 on page 4-23).

GPS System Documentation

Table 4-2: GPS System Documentation

Item	Description	Part Number	Remarks
1.	Operator's Manual GPS Receiver Model GP-320B	Pub. No. OME-44220-B2	This manual contains installation information only. For information on the GPS refer to the GD-1920C Display manuals (see Table 4-1 on page 4-2)

AIS FA-50

Overview

The FA-50 is a Class B AIS (Automatic Identification System) capable of exchanging navigation and ship data between own ship and other ships or coastal stations.

FA-50 installation consists of CX VHF marine antenna, a GPA-017 GPS antenna and the FA-50 transponder unit. The transponder contains a VHF transmitter, two TDMA receivers on two parallel VHF channels, interface, communication processor, and internal GPS receiver. The internal GPS is a 12-channel all in-view receiver with a differential capability. It also gives position, COG and SOG when the external GPS. FA-50 receives DSC, time-sharing with TDMA receiver.

The main features are:

a. Safety of navigation by automatically exchanging navigational data

b. Static data
   MMSI (Maritime Mobile Service Identity)
   Call sign & Ship's name
   Type of ship
   Location of position-fixing antenna on the ship

c. Dynamic data
   Ship's position with accuracy indication and integrity status
   Universal Time Coordinated (UTC)
   Course over ground (COG)
   Speed over ground (SOG)
   Heading

d. Voyage-related data
   Hazardous cargo (type)

e. Short safety-related messages, pre-set messages

f. Built-in GPS receiver for position-fixing device

The A150 is connected to VHF and GPS antennas. It is included in the integrated navigation block diagram (see Figure 4-6 on page 4-17).

Specifications

General

Display	:	In this application AIS information is displayed on the NavNet vx2 GD-1920C LCDs
Type	:	Class B AIS Transponder

Standards	:	IMO MSC.140 (76), IEC 62287-1, ITU-R M.1371-2, DSC ITU R M.825-3, IEC 60945 ed.4 adopted
Frequency range	:	156.025 MHz to 162.025 MHz
Output power	:	1W/2W
GPS Receiver		
Receiving frequency	:	1575.42 MHz
Tracking code	:	C/A code
Number of channel	:	12 channels parallel, 12 satellites
Position accuracy	:	10 m approx., 95% of the time, (HDOP ≤ 4)

Equipment Location

The FA-50 is mounted under the wheelhouse console (see Figure 4-1 below) and the VHF and GPS antennas are mounted at the foot of the mast, aft on the port side as shown in Figure 4-8 on page 4-21.

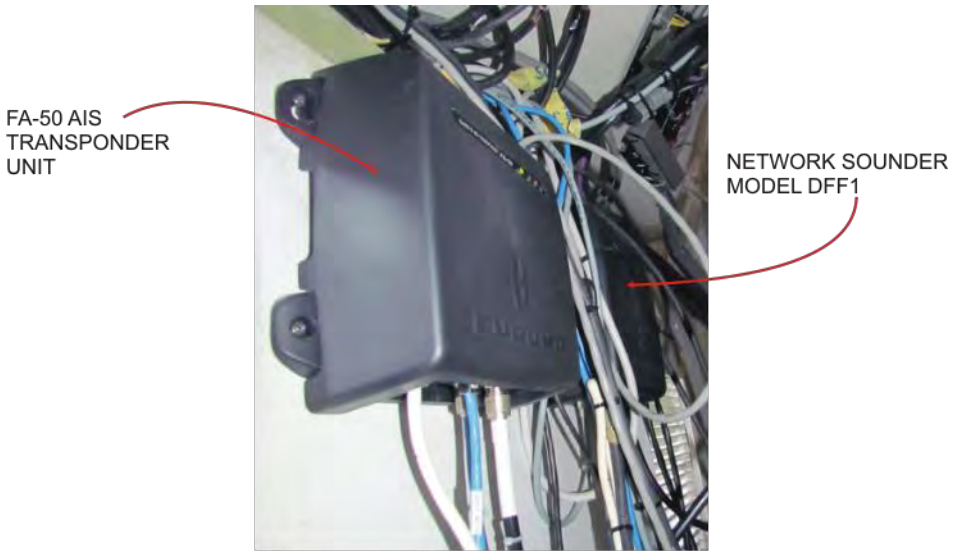


Figure 4-1: Location of FA-50 Transponder Unit and Network Sounder Model DFF1

Documentation

Table 4-3: AIS Documentation

Item	Description	Part Number	Remarks
1.	Operator's Manual FA-50 Class B AIS Transponder	Pub. No. OME-44420-C2	This manual contains mainly installation nd maintenance information. For information on the AIS operation refer to the GD-1920C Display manuals (see Table 4-1 on page 4-2)

Heading Sensor PG-500

Brief Description

The PG-500 consists of a fluxgate sensor, solidstate rate gyroscope, processor and serial data interfaces. The sensor detects the heading relative to the magnetic north as induced within the fluxgate coils by terrestrial magnetism. The processor monitors the Coriolis force output by the solid-state rate gyroscope and stabilizes the compass heading. In this application PG-500 NMEA 0183 format output is fed to the NavNet vx2 and The PG-500 outputs the heading data in NMEA 0183 to the NavPilot 700 FAP-7002 processor and FURUNO AD-10 format to the starboard GD-1923C display.

The PG-500 can provide True Heading by using its correction facilities for magnetic deviation and variation. Deviation (errors mainly caused by shipboard environment) can be automatically corrected by swinging the vessel.

The PG-500 Heading Sensor is included in the integrated navigation system block diagram (see Figure 4-6 on page 4-17).

Specification

Power Supply	12-24 VDC: 0.12-0.03A
Heading Accuracy	1° rms (horizontal) 1.5° rms (within 30°)
Display Resolution	0.1°
Follow-up	30°/s rate-of-turn
I/O Port	Input: 1 Port Output: 2 Ports (one port drives 3 outputs)
Interface	Output: Furuno AD-10 Format, IEC 61162-1 (NMEA 0183 Ver2.0), HDG, HDT, HDM Input: IEC 61162-1 (NMEA 0183 Ver1.5/2.0), RMC, VTG
Data Update	AD-10 formatted: 25 ms IEC 61162-1 (NMEA 0183) 100 ms, 200 ms or 1 s selected
Ambient temperature	-15°C to +55 °C
Relative Humidity	95% at 40°C

Heading Sensor Documentation

Table 4-4: Heading Sensor Documentation

Item	Description	Part Number	Remarks
1.	Operator's Manual Integrated Heading Sensor PG-500	Pub. No. OME-72550	

Magnetic Compass

A Ritchie SP-5B Globemaster (binnacle mount) magnetic steering compass is installed in the wheelhouse above the console on the centreline. A dedicated compass light is controlled by the compass light switch on

the desk panel on the port side of the wheel. See Figure 4-9 on page 4-23 for the location of the compass and compass light switch.

Magnetic Compass Documentation

Table 4-5: Magnetic Compass Documentation

Item	Description	Part Number	Remarks
1.	Magnetic Compass Deviation Card	I.H. PEPPLE Table of Deviations	
2.	Data Sheet Ritchie SP-5B Globemaster magnetic steering compass	SP-5B Binnacle Mount	

Thermal Imaging System

The vessel is fitted with a FLIR maritime thermal Imaging System. In this installation a single payload M324XP thermal imaging camera is installed on top of the wheelhouse forward of the mast (see Figure 4-8 on page 4-21). Note that the dual payload system is equipped with both a thermal imaging camera and a visible-light camera. The infrared (IR) thermal camera provides night-time imagery, even in total darkness, based on temperature differences. The thermal camera provides a clear video image even under completely dark conditions because it is sensitive to thermal infrared energy.

The camera is controlled using the JCU (Joystick control unit) located in the wheelhouse console on the port side (see Figure 4-9 on page 4-23). The JCU is used to move the camera (pan or tilt), electronically zoom the camera in and out, adjust the image quality, and access the on-screen menus The JCU connects to the camera by way of an Ethernet network connection, and that same connection provides power to the JCU via a POE injector.

The composite (also known as analog) video signal from the thermal (infrared) camera is fed to the vessel's port (slave) GD-1920C display.

The camera's 24 VDC power is from DB-DC-001 circuit breaker Q29.

Thermal Imaging System Documentation

Table 4-6: Thermal Imaging System Documentation

Item	Description	Part Number	Remarks
1.	M-Series Thermal Imaging System Operators Manual	432-0003-00-10, Version 120	
2.	M-Series Installation Guide	432-0003-00-12 Revision 100 June 2009	

Searchlight

A Den Haan 230V 1000W searchlight is fitted on top of the wheelhouse (see Figure 4-8 on page 4-21). The searchlight's position in azimuth and elevation is manually controlled from inside the wheelhouse (see Figure 4-9 on page 4-23).

The searchlight control is via the searchlight switch on the wheelhouse console port side, immediately above the windscreen wiper control panel (see Figure 4-9 on page 4-23).

430 Communication Systems

431 External Communication System

VHF Marine Transceivers IC-M604

Brief Description

The IC-M604 is a combined VHF radio and Class D Digital Selective Calling (DSC) unit. It supports the making of digitally selected calls, which are quicker and simpler to make than traditional voice calls using channel 16. Should a distress situation occur, using the IC-M604 you can quickly raise an alert, indicating your identity, your position, and automatically establish distress communication on the emergency voice channel.

Other features include:

- 55 marine channels with TAG scan
- 70 private channels available
- Built in DSC (Digital Selective Calling) Class D
- Position request & position report (NMEA input & output)
- Built in 30 Watt 2 way Hailer with Foghorn
- Rx speaker function (Received radio audio from hailer)
- Large dot-matrix LCD

The VHF transceiver installation is included in the integrated navigation system block diagram (see Figure 4-6 on page 4-17).

Specification

General

Frequency coverage :	TX 156.025–157.425 MHz
	RX 156.050–163.275 MHz
Mode :	FM (16K0G3E), DSC (16K0G2B)
Current drain (at 13.8 V) :	TX high (25 W) 5.5 A

	Max. audio 1.5 A
Power supply requirement :	13.8 V DC ±15% (negative ground)
Frequency stability :	±5 ppm
Operating temp. range :	–20°C to +60°C; –4°F to +140°F
Antenna impedance :	50 Ω nominal
Input impedance (MIC) :	2 kΩ
Output impedance (audio) :	4 Ω
Dimensions :	220(W) · 110(H) · 109.4(D) mm
Weight :	Approx. 1400 g; 3.09 lb
Transmitter	
RF output power :	25 W and 1 W
Modulation system :	Variable reactance frequency modulation
Max. frequency deviation :	±5.0 kHz
Spurious emissions :	Less than –70 dBc
Adjacent channel power :	More than 70 dB
Audio harmonic distortion :	Less than 10% (at 1 kHz, 60% deviation)
Residual modulation :	More than 40 dB
Audio frequency response :	+1 to –3 dB of 6 dB/octave range from 300 Hz to 3000 Hz
Receiver	
Receive system :	Double conversion superheterodyne
Sensitivity (12 dB SINAD) :	0.22 µV (typical) 0.22 µV (typical) (CH 70 receiver)
Squelch sensitivity :	Less than 0.32 µV
Spurious response :	More than 80 dB
Intermodulation :	More than 80 dB
Adjacent channel selectivity :	More than 80 dB
Hum and noise :	More than 40 dB
Audio output power :	5.0 W (typical) at 10% distortion with a 4 Ω load

Equipment Location

The VHF Transceivers are located in the wheelhouse console (see Figure 4-9 on page 4-23) and the 1.6 m antennas on the mast (see Figure 4-8 on page 4-21).

VHF Transceiver Documentation

Table 4-7: VHF Transceiver Documentation

Item	Description	Part Number	Remarks
1.	Instruction Manual VHF Marine Transceiver IC-M604	A-6527D-1US-1	
2.	Data Sheet CX4 VHF Marine Antenna	Version, 19.06.2012	

VHF Handheld Transceiver

Brief Description

A Sailor SP3520 handheld GMDS VHF is supplied. It comprises the transceiver and antenna, belt clip and lanyard and is equipped with a Lithium battery for GMDSS application. The unit is easy to operate and use and has large tactile buttons and a knob easing operation. The display is red back lit easing reading at night. The unit is waterproof rated to IP67 (submersible to ½ metre for ½ hour). The SP3520 is supplied with the international channels that are required for a portable GMDSS VHF. Additional features include dimming and backlight control, battery indicator and battery saving function, quick channel select button and keypad lock.

Equipment Location

The SP3520 is stowed in the wheelhouse on the starboard side.

Documentation

Table 4-8: VHF Handheld Documentation

Item	Description	Part Number	Remarks
1.	User Manual SP3520 GMDSS Handheld VHF Transceiver	TT-98-124294-F Issue: F/0945	Thrane &nThrane

HF/MF Transceiver

Brief Description

An Icom IC-M802 HF Marine Transceiver with HF Automatic Tuner is installed. The system comprises:

a. IC-M802 Remote controller with HM-135 Hand Microphone

b. IC M802 Main unit

c. AT-130 HF Automatic Antenna Tuner

d. Whip antenna

e. SP-24 External Speaker

f. Standby antenna (kept in wheelhouse)

The controller has a large LCD display and 2 large rotary controls for bank and channel selection. DSC emergency communications is by means of guarded switch to avoid accidental DSC activation.

The one piece, die cast aluminium chassis and a large cooling fan allows continuous transmission at full output power (150W) which is very important for data communications, like e-mail. The main unit is connected to the NMEA network for GPS input.

The HF transceiver installation is included in the external communication system block diagram (see Figure 4-7 on page 4-19).

Specification

Frequency range	Tx	1.6–2.9999 MHz 4.0–4.9999 MHz 6.0–6.9999 MHz 8.0–8.9999 MHz 12.0–13.9999 MHz 16.0–17.9999 MHz 18.0–19.9999 MHz 22.0–22.9999 MHz 25.0–27.5000 MHz
	Rx	0.5–29.9999 MHz
Power supply requirement		13.6V DC ±15% (negative ground)
Dimensions (W×H×D) (Projections not included)		Main unit: 240×94×238.4 mm; Controller unit: 220×110×84.4 mm
Weight (approx.)		Main unit: 4.7kg Controller unit: 570g
Current drain (approx.)	Transmit (High)	30A typical at max. power
	Max. audio output	3.0A
Sensitivity	J3E, A1A, J2B, F1B (at 10dB S/N; 1.8–29.999MHz)	0.5µV
	H3E (at 10dB S/N; 1.8–3.999MHz)	3.2µV
	DSC (J2B) (at 10dB S/N; 0.5 –29.999MHz)	0.5µV (at 1% error rate)
Selectivity	J3E, R3E, J2B, A1A	2.4kHz/–6dB 3.6kHz/–60dB
Audio output power (10% dist/ 4Ω load)		4.0W
RF output power (PEP) (output power differs depending on version)		150/60/20W

Equipment Location

The HF Antenna and AT130 Antenna Coupler are located on the deckhouse roof aft on the port side. See Figure 4-8 on page 4-21 for location of HF antenna. Note that the AT130 is located at the base of the antenna. The Main unit is located on the forward face of the Technical Space below the wheelhouse deck (see Figure 4-2 below) and the control unit (together with speaker) is mounted on the wheelhouse console (see Figure 4-9 on page 4-23).

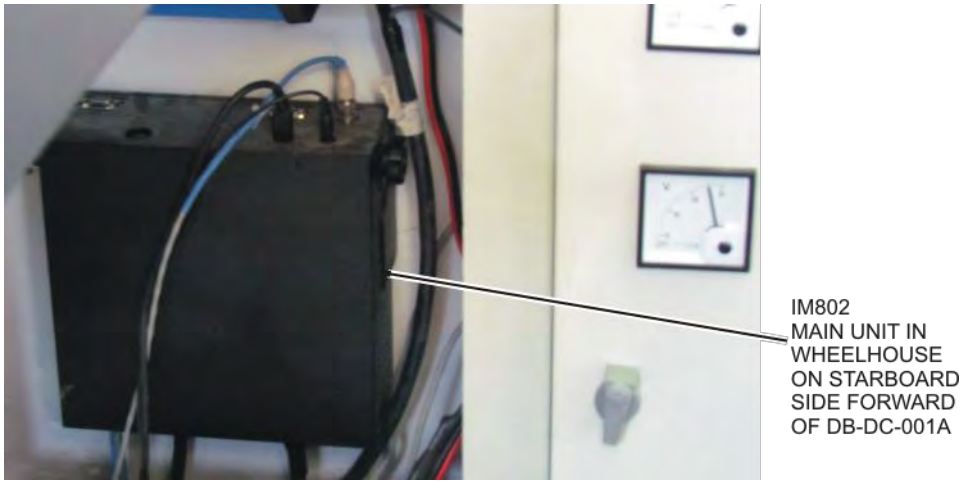


Figure 4-2: HF Main Unit Location

Documentation

Table 4-9: HF System Documentation

Item	Description	Part Number	Remarks
1.	Icom MF/HF Marine Transceiver iM802 Instruction Manual	A-6154H-1US	
2.	Icom AT-130 HF Automatic Antenna Tuner Instruction Manual	A8163S-1EX	

NAVTEX

Brief Description

The FURUNO NX-700 is a dual-channel NAVTEX receiver for SOLAS ships complying with the NAVTEX performance standard MSC.148(77). It comprises a NX-7001 receiver, a NX-700B display unit and a NX-7H antenna unit.

The NX-700 can receives two channels simultaneously. One is set for 518 kHz to receive international NAVTEX messages and another is selectable from 490 or 4209.5 kHz for domestic or local NAVTEX messages. These messages include a variety of safety information such as Navigational Warnings, Meteorological Warnings, Search and Rescue (SAR) information and other information for ships sailing within the reach of each service station's coverage.

Every incoming message is stored in non-volatile memory and is displayed on a clear 5" silver bright LCD. Three different font sizes are available and can be selected from the menu. The antenna unit is an

umbrella-type H-field antenna that incorporates a high-performance preamp, which gives reliable and uninterrupted reception.

The Navtex system is included in integrated navigation system block diagram (see Figure 4-6 on page 4-17.

Equipment Location

The NX-7001 Navtex Receiver is mounted under the wheelhouse console (see Figure 4-3 below) and the NX-700B display in the wheelhouse console (see Figure 4-9 on page 4-23) and the antenna is mounted on the wheelhouse deck, aft on the starboard side as shown in Figure 4-8 on page 4-21.

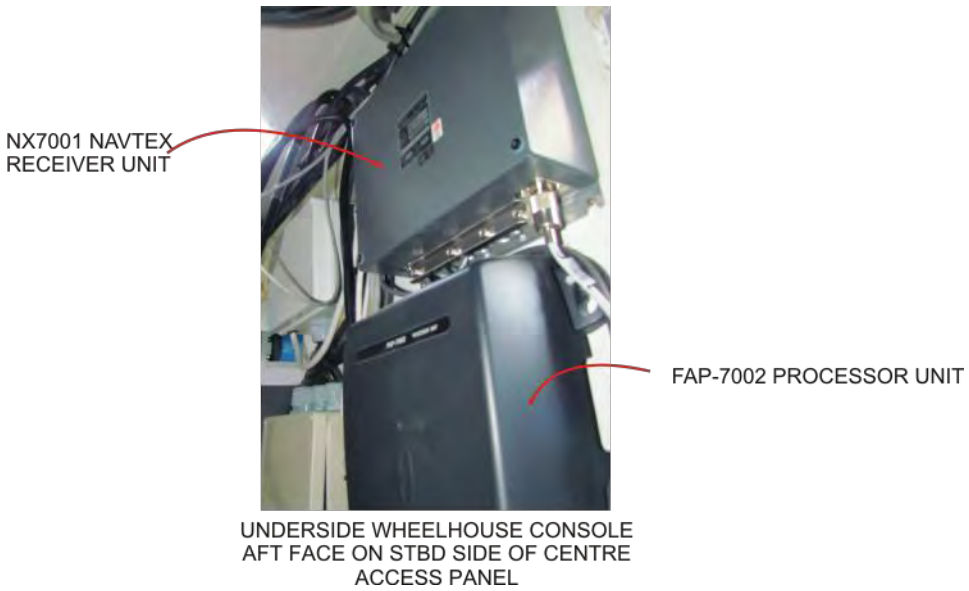


Figure 4-3: Location of NX-7001 NAVTEX Receiver Unit

Navtex System Documentation

Table 4-10: Navtex System Documentation

Item	Description	Part Number	Remarks
1.	Operator's Manual Navtex Receiver NX-700A/B	Pub. No. OME-56490-D1	

432 Internal Communication System

Brief Description

The internal communication system is a Vingtor ETB10 Internal Intercom and Loudhailer system. The system comprises a central panel with up to 10 extensions of which eight are used in this installation. Various stations are available depending on the location and/or environment. In this system the following stations are fitted:

a. ETB10 Master Station in wheelhouse console to the starboard of the wheel

b. 2 x HE-112M Outdoor loudspeakers with call buttons located one on the foredeck in the enclosure house the winch control and the other in the entrance to the passenger saloon from the aft deck.

c. 4 x STB-1 Wall mounted indoor loudspeakers with call and answer buttons located in the crew's accommodation forward, mess room/galley on starboard side of door, in the Captain's cabin and the Engineer's cabin.

d. 2 x STB-3 Engine Room Units one located on the starboard side of the access door and the other amidships on the transom. Each STB-3 is equipped with a PMT7 Headset with 10 metre cable, VML-1520 loudspeaker and EHS-24 rotary signal light

A block diagram of the ETB10 talk back system is shown in Figure 4-7 on page 4-19.

Equipment Location

Illustrations of the control unit and various substations fitted are shown in Figure 4-4 below.

Figure 4-4: General View of ETB 10 System Equipment

Talk Back System Documentation

Table 4-11: ETB10 System Documentation

Item	Description	Part Number	Remarks
1.	ETB10 Command Talk Back System Technical and User Manual	ETB10.TU Rev.0 2000.11.30	

441 Depth Sounder

Brief Description

The depth sounder is a Furuno Network Sounder DFF1 coupled with a plastic through hull transducer 520-5PSD. The DFF1 connects to the NavNet vx2 integrated navigation system via a 8-port hub. Depth information is displayed on either of the two GD-1923C 10.4 inch LCDs (see Figure 4-6 on page 4-17).

Specification

Output Power: 600 W/ 1 kW rms nominal

Tx Frequency: 200 kHz, (50/200 kHz exchangeable)

Amplifier Type: Wide dynamic linear amp (double superheterodyne)

Network Protocol: Ethernet 100/10BASE-TX

Depth Range and Pulse Repetition Rate

Range (m)	PRR (/min.)
2	3000
5	3000
10	1990
40	485
100	195
200	95
400	65
1200	34

Power Supply: 12-24 VDC: 1.1-0.4 A (at 1 kW output

Equipment Location

The DFF1 network sounder is mounted under the wheelhouse console on the port side of the centre access panel (see Figure 4-1 on page 4-5) and the 520-5PSD transducer is mounted in a stainless steel housing and installed through the hull adjacent to the centreline between frames 11 and 12 (access via floor plate in aft accommodation passageway) (see Figure 4-5 below).

Transducer Documentation

Table 4-12: DFF1 Network Sounder Documentation

Item	Description	Part Number	Remarks
1.	Operator's Handbook Network Sounder Model DFF1	Pub. No. OME-20360-C1	

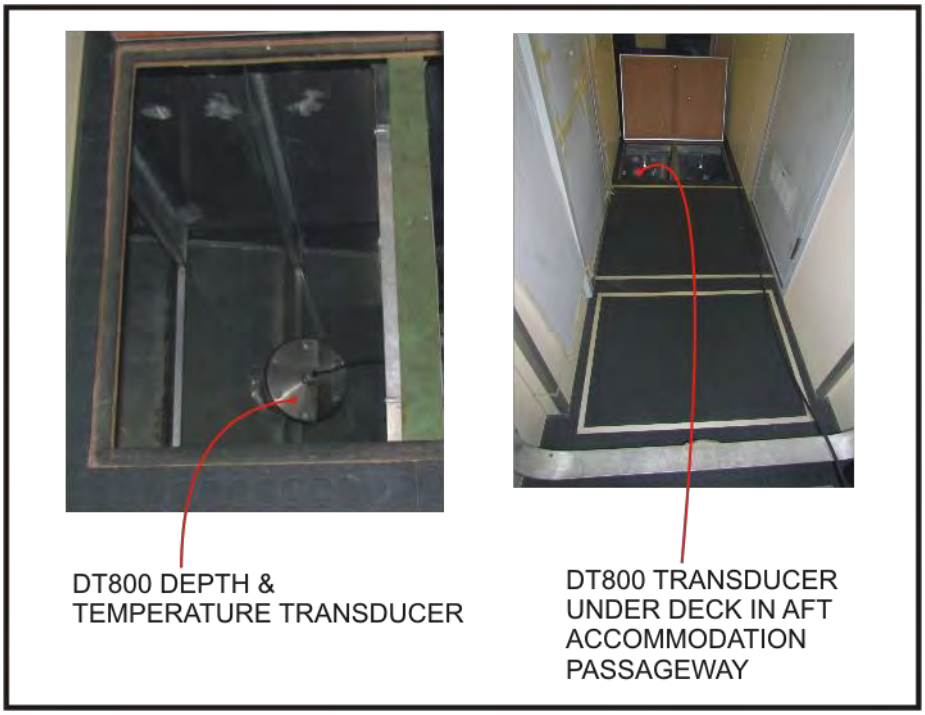


Figure 4-5: DT800 Transducer Location

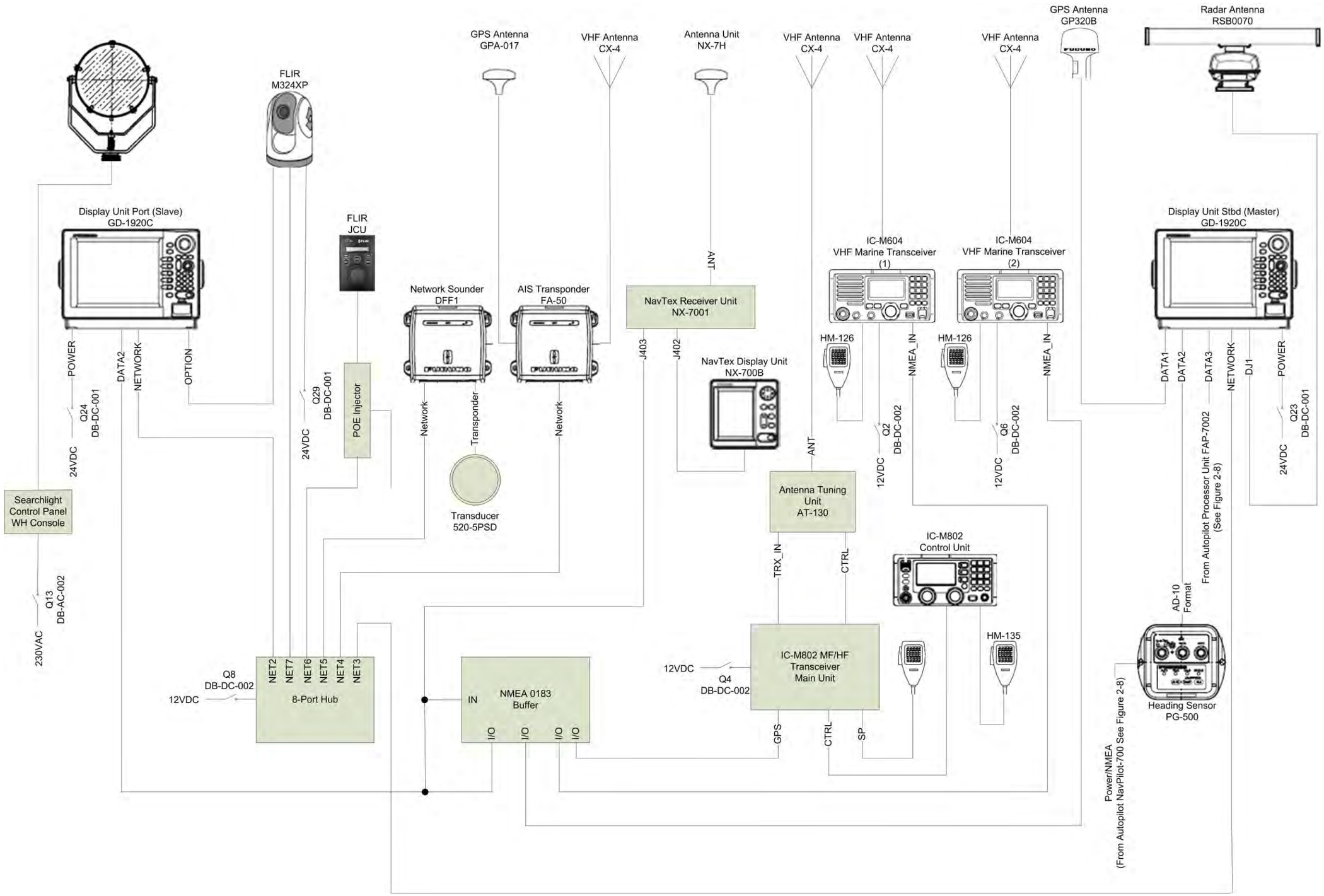


Figure 4-6: Block Diagram Integrated Navigation and Communications

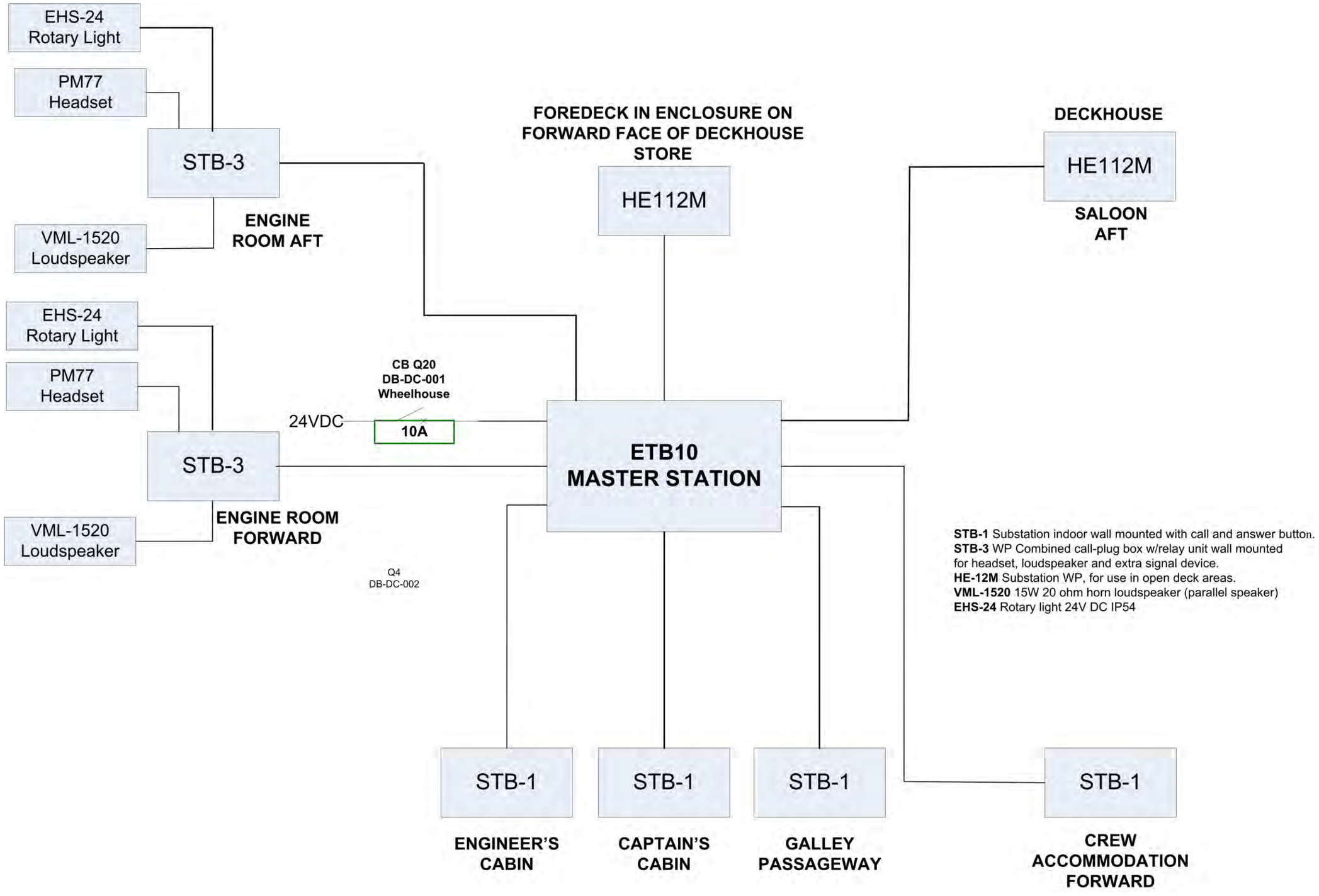


Figure 4-7: Block Diagram ETB10 Talk Back System

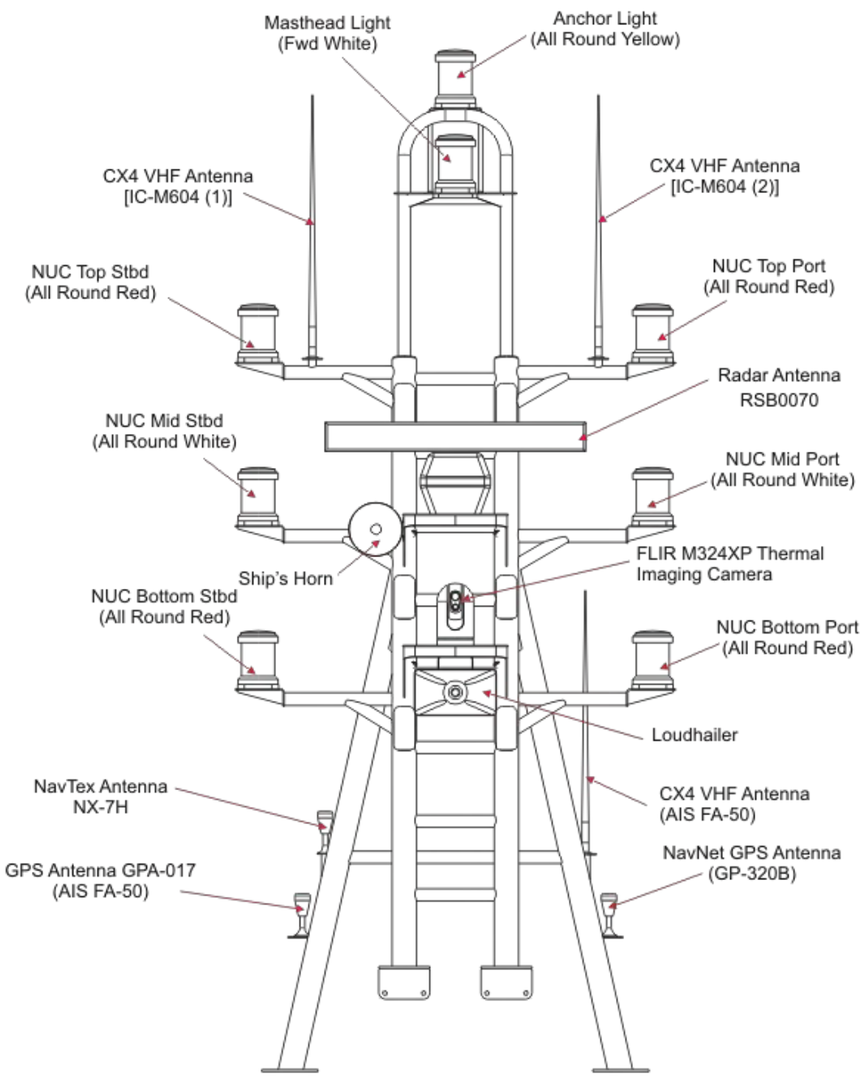


Figure 4-8: Mast Arrangement Identifying Antennae, Scanners, etc

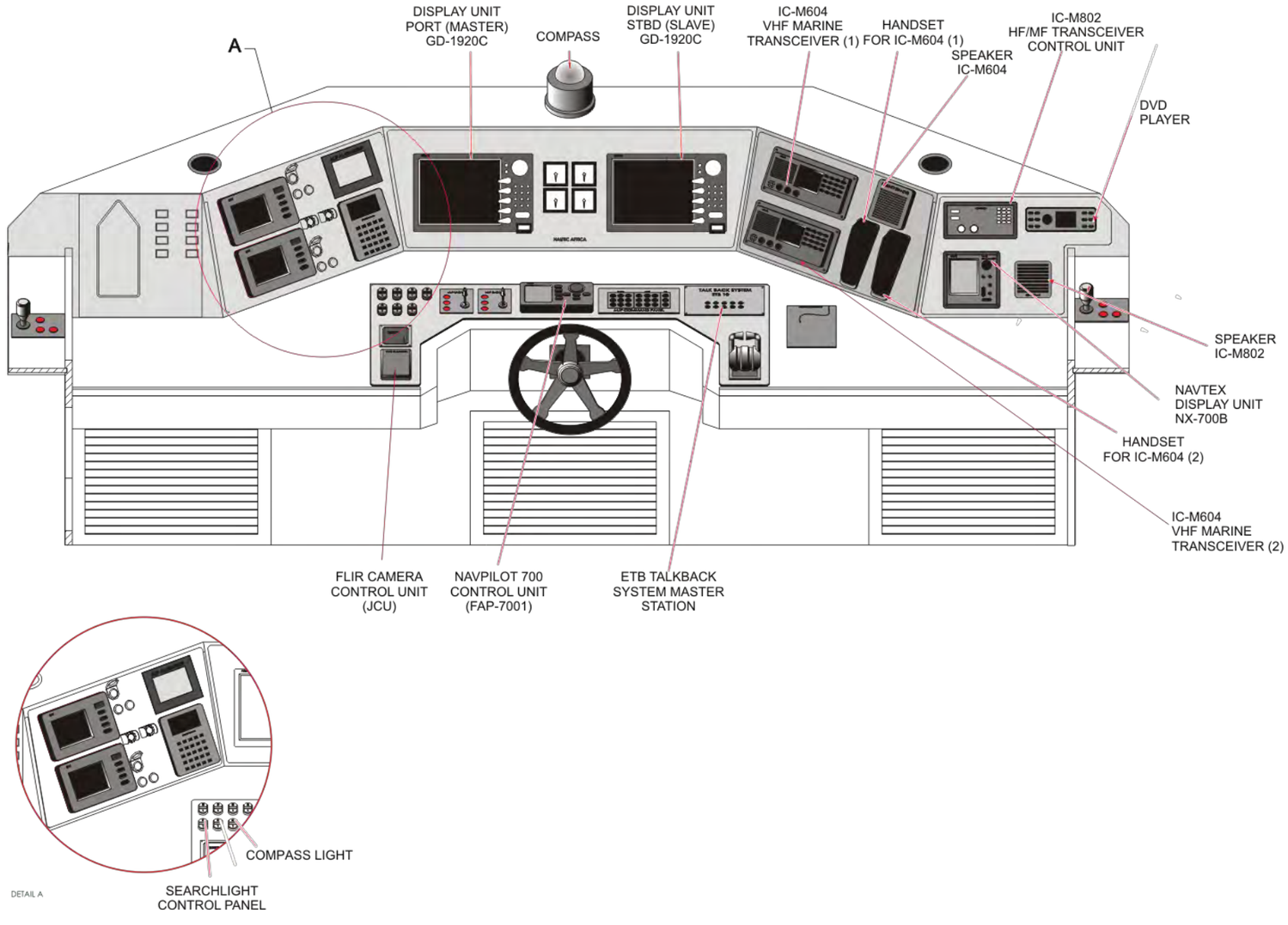


Figure 4-9: Wheelhouse Console Layout Identifying Navigation and Communication Equipment

Chapter 5: Ship's Systems

501 Pipe Work

All ship's system pipes are marked in accordance with ISO 14726 (see Figure 5-1 below).

COLORCODE FOR PIPING SYSTEMS ACCORDING TO ISO 14726

SYSTEM	COLOR	RAL NO. DIN 2403
Fuel oil	Brown	8001
Lubricating oil	Orange / green (ring)	2003 / 6018
Pressure air HP	Grey / red (ring)	7001 / 3000
Cooling fresh water	Blue / violet (ring)	5015 / 4001
Cooling sea water	Green / yellow (ring)	6018 / 1021
Hydraulic oil	Orange / grey (ring)	2003 / 7001
Fire fighting	Red	3000
Bilge water	Black / green (ring)	9005 / 6018
Sanitary discharge / Sewage	Black / yellow (ring)	9005 / 1021
Ballast water	Green / violet (ring)	6018 / 4001
Sanitary fresh water	Blue / brown (ring)	5015 / 8001
Sanitary sea water	Green / brown (ring)	6018 / 8001
Fire fighting foam	Red / yellow (ring)	3000 / 1021
Oils other than fuel (oil suppression means)	Orange	2003
Thermal oil	Orange / blue (ring)	2003 / 5015
Fire fighting CO_2 gas	Red / grey (ring)	3000 / 7001
Waste oil	Black / grey (ring)	9005 / 7001

Figure 5-1: ISO 14726 Pipe Colour Coding

510 Bilge System & General Service

Refer Bilge System Equipment Location (Figure 5-4 on page 5-8) and Bilge System Block Diagram (Figure 5-6 on page 5-11) when reading the following descriptions.

Tank location is shown in Figure 1-2 on page 1-5 and Tank Vents and Filling Points in Figure 1-3 on page 1-6.

Overview

The bilge system comprises a bilge pumping module located in the engine room on the port side adjacent to the inner hull between frames 5 and 7. Four bilge suction points are located throughout the vessel. The bilge module incorporates two SPX (Johnson) bronze impeller pumps (001-01&02) fitted with inlet suction and outlet pressure indicators, a bilge suction header, and a Gusher-Titan diaphragm hand pump (002-01).

Bilge lines from the vessel's suction points connect to a suction header pipe on the bilge module. The two pumps, one dedicated to bilge water extraction (001-01) and the second for fire-fighting duty (001-02), draw bilge water from either end of the header. A bypass line is interposed between the two bilge pump suction points and flow to this line is controlled via two three way valves (006-01&02).

A hand operated bilge pump (002-01) is coupled to the bypass line and discharges back into the bilge system via second cross-over line before entering the main bilge line on the pump discharge side. Normally closed (NC) isolation ball valves (008-01 & 02) are located in the bypass line on either side of the hand pump.

A raw water connection from the port sea water inlet chamber is connected to the bypass and can be isolated from the system by a NC valve in the in-coming line. A third line connects to the oily bilge tank to enable oily bilge to be pumped overboard whilst at sea. A cross-over line connects the bilge and the fire water systems on the discharge side of the pumps. The discharge from the hand pump couples into this line before entering the main bilge discharge. A fire hose adapter (015-01) is fitted into the cross-over line. A normally closed (NC) isolating valve (007-06) mounted in the cross-over separates the two systems.

An independent and manually operated system is located in the forepeak to pump bilge water from this space. The hand pump (002-02) for this system is located in the forepeak and discharges the bilge water overboard. Access to the forepeak is via an access hatch on the main deck. The chain locker drains into the bilge space and it is essential that periodic inspection and removal of seawater from the forepeak is undertaken as there is no wheelhouse indication of water accumulation.

Operation

The bilge pumping module extracts bilge water from four locations, two in the engine room (004-01 & 02) and one each from beneath the main accommodation area (004-03) and the crew accommodation (004-04) spaces. In addition to the suction points above there are two self-closing valves (009-01 & 02) located on port and starboard and below the engine room flooring to allow for removal of bilge from a void between frames 8 and 9. As these are manually opened it will necessary for periodic inspection to prevent an excessive build-up of bilge water.

With the exception of the bilge suction point located at the aft end of the engine room (004-01), which is designated as the main bilge point, the remaining three points are isolated from the suction header by NC

ball valves (007-02,03 & 04). This prevents the bilge pump from drawing air when there is no bilge water present. In the event of an excess of water build up to these areas then level switches (022-02, 03 & 04) will provide visual and audio indication in the wheelhouse.

Bilge from the aft location in the engine room will always be extracted on operation of the pumps but the remaining areas must be connected to the system by manually opening the normally closed isolating valves (007-02, 03 &04) on the bilge module. The extracted bilge water is pumped overboard through a locking bonnet type swing check valve (011-01) located above the water line between frames 5 and 6 on the port side. A vacuum breaker (023-01) is located at the highest part of the system.

A 3-way valve (006-03) located in the line from the bilge pump discharge directs oily bilge to an oily bilge/sludge tank. If on inspection the bilge is found to contain oil sludge or other contaminants the bilge water must be pumped to the bilge sludge tank which is located under the engine room plating between frames 5 and 6 on the vessel centre line. This tank is vented to the main deck and must be pumped out by harbour facilities from an international connection located on the main deck between frames 7 and 8 on the port side. In addition the oily bilge tank can be pumped out using the bilge pump. To facilitate this operation the 3-way valves (006-01 and 04) on the bilge module must be opened to the bypass line.

Oily water from the three aft fuel tanks is discharged from manual self-closing valves (006-01 & 02 and 008-12 on drawing P253-030-520-000 – Fuel System) into the space between frames 7 and 8 and is removed by the bilge suction point at this location. Water from the two forward fuels tanks is drained via low level bungs (plugs) and is extracted by the bilge suction located between frames 13 - 14 and 18 -19. This oily bilge must be directed to the oily bilge tank via the bilge module.

The fire water pump (001-02) draws raw water from the port raw water strainer, located between frames 6 and 7, via the bilge water bypass line to supply an engine room hydrant point (015-01) and two main deck hydrants, one located on the aft deck (012-01 adjacent to the aft machinery space and the second hydrant (012-02) on the foredeck in front of the fwd. machinery space.

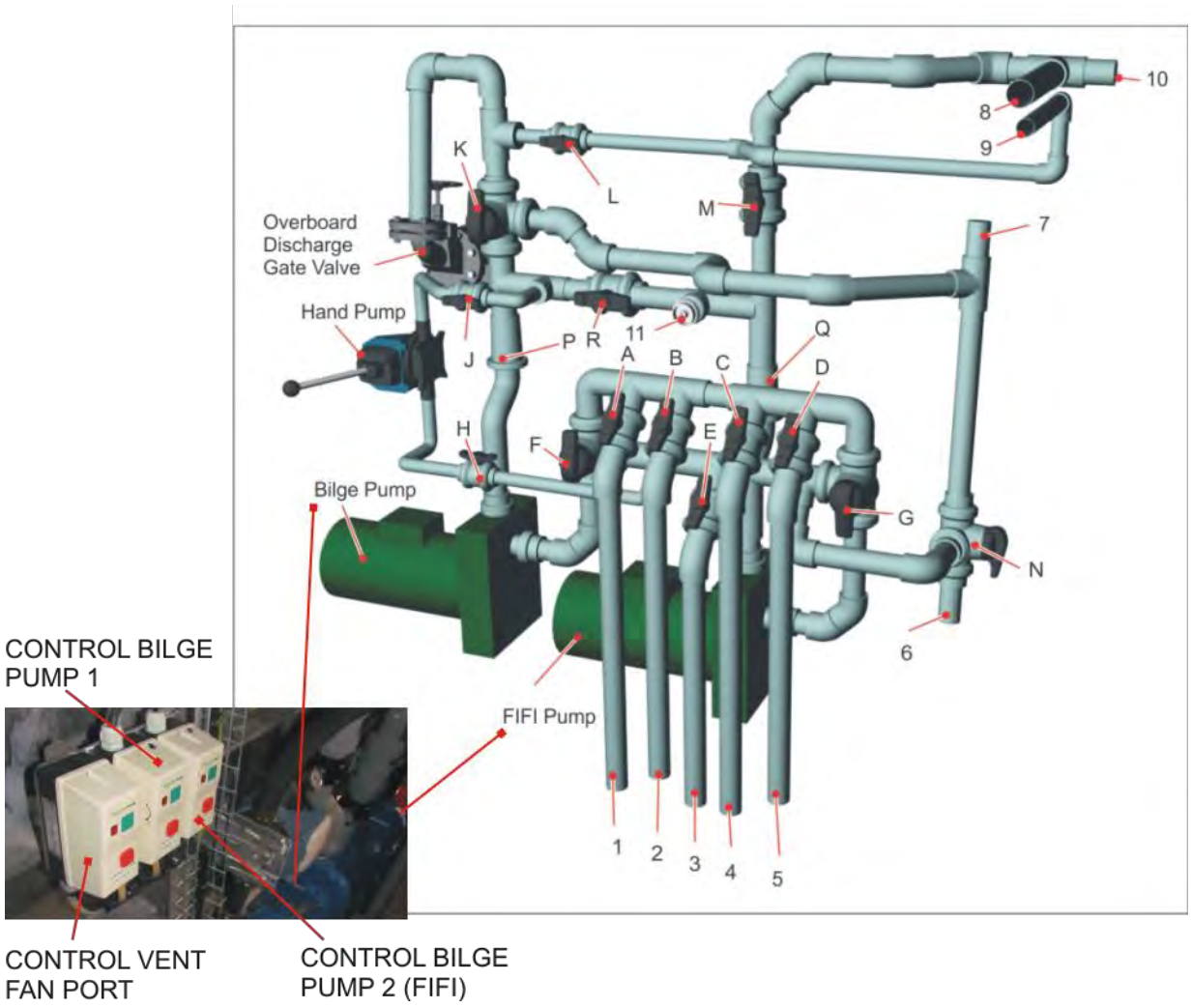


Figure 5-2: Bilge Module

A 3-way valve (006-03) located in the line from the bilge pump discharge directs oily bilge to an oily bilge/sludge tank. If on inspection the bilge is found to contain oil sludge or other contaminants the bilge water must be pumped to the bilge sludge tank which is located under the engine room plating between frames 5 and 6 on the vessel centre line. This tank is vented to the main deck and must be pumped out by harbour facilities from an international connection located on the main deck between frames 7 and 8 on the port side. Oily water from the three fuel tanks is discharged from manual self closing valves (006-01 & 02 on drawing P250-030-520-000 – Fuel System) into the space between frames 7 and 8 and is removed by the bilge suction point at this location. In addition the oily bilge tank can be pumped out using the bilge pump. To facilitate this operation the 3-way valves (006-01 and 04) on the bilge module must be opened to the bypass line.

The fire water pump (001-02) draws raw water from the port raw water strainer, located between frames 6 and 7, via the bilge water bypass line to supply an engine room hydrant point (014-01) and two main deck hydrants, one located on the aft deck (011-01 adjacent to the accommodation entrance and the second hydrant (011-02) on the foredeck in front of the forward machinery space.

Valve Operation

Under normal operating conditions only one bilge pump is used but the second pump can be utilized under emergency conditions or when the primary pump is non-operative. The secondary pump's main function is in the event of a fire where it will be used to supply seawater to deck and engine room hydrant points.

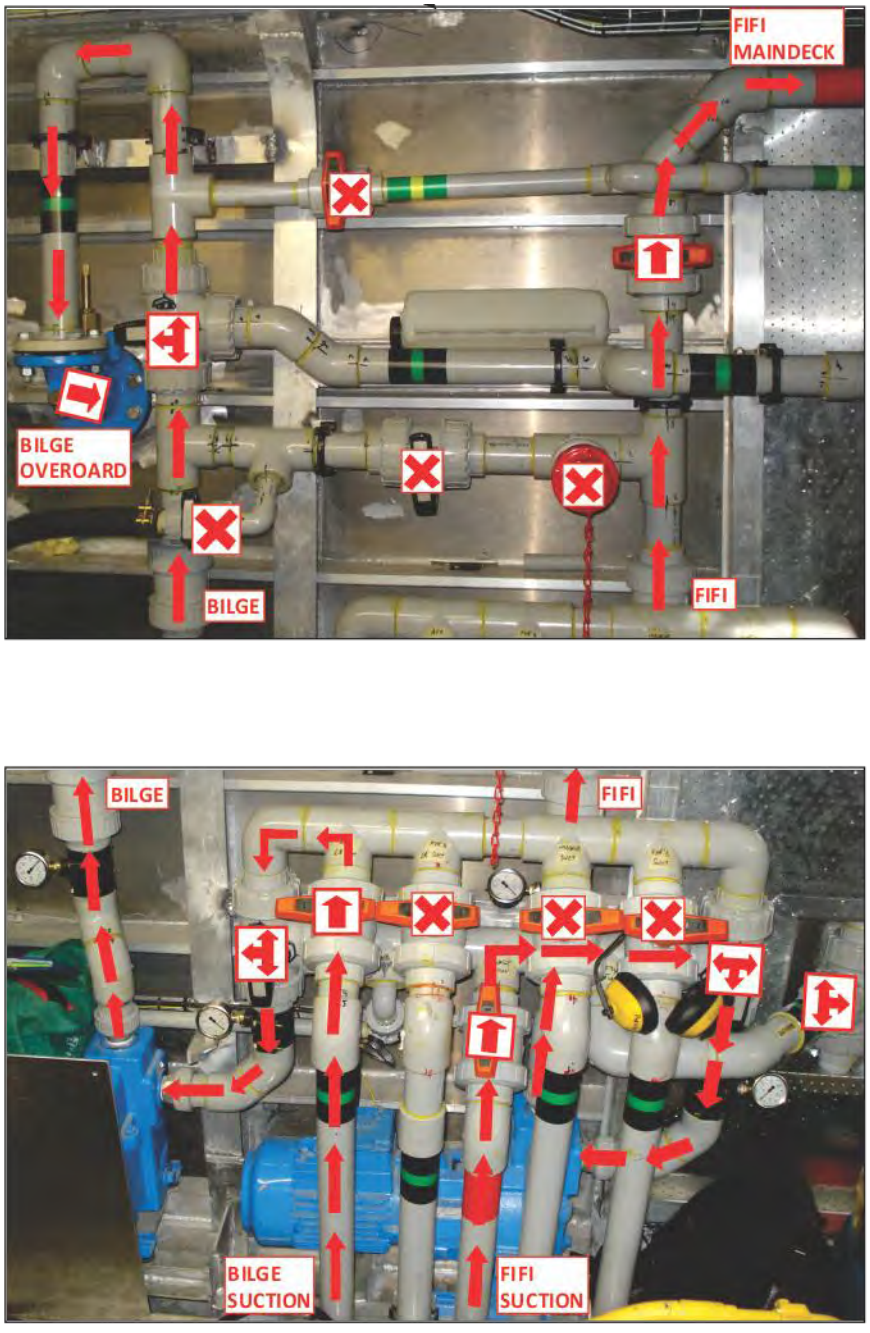


Figure 5-3: Bilge Module showing Valves in Default Positions

In the event of bilge pump malfunction the fire fighting pump must be used for bilge suction. To undertake this operation the setting of the following valves must altered:

Table 5-1: Configuring the Bilge System Valves for Bilge Suction using the Fire Fighting Pump

Valve No	Valve Type	Valve Location	Change from	Change To
007-06	2-Way	Bilge Module	NC	NO
006-01	3-Way	Bilge Module	Straight Through	Open to by-pass
006-02	3-Way	Bilge Module	Open to by-pass	Open to header
007-07	2-Way	In-Line	NO	NC

NOTE: Upon re-commencement of the bilge pump operation the valve setting shown above must be reset to their normal position.

In the event of fire pump malfunction the bilge water pump must be used for fire fighting. To undertake this operation the setting of the following valves must altered

Table 5-2: Configuring Bilge System Valves for Fire Fighting using the Bilge Water Pump

Valve No	Valve Type	Valve Location	Change from	Change To
006-01	3-Way	Bilge Module	Straight Through	Open to by-pass
006-02	3-Way	Bilge Module	Open to by-pass	Straight Through
007-06	2-Way	In-Line	NC	NO
006-03	3-Way	Bilge discharge line	Straight through.	Close

Note: Upon re-commencement of the fire pump operation the valve setting shown above must be reset to their normal position.

The Normal position for the bilge module is the positions listed in the "Change From" column of Table 5-2 above.

System Control

The complete system is operated from a control and alarm panel located in the wheelhouse. Level switches are located at each bilge suction point providing bilge level warning to the ship's alarm system.

FIFI System

A portable diesel FIFI pump is stored in the forward machine space on the main deck. When needed for fire fighting the pump can be coupled to hose, nozzle and fire hose adaptor and an inlet hose for seawater drawn from overboard.

Pump Specifications

a. **Bilge Pump and Fire Fighting Pump**: Johnson SPX self-priming centrifugal pump with cast iron housing, bronze impeller and mechanical seals delivering 18m3/hour at 3 bar. The pumps are coupled to 4kW motors operating at 3000 rpm, 380V 3ph 50Hz. Electrical supply for the bilge pump is via CB Q7 on MSB-001 and for the fire fighting pump is via CB Q18 on MSB-001.
b. **Bilge Hand Pump** – WHALE – Gusher Titan hand diaphragm pump delivering 76 l/min (60 strokes / min) with a lift of 2m.

Documentation

Table 5-3: Bilge System Documentation

Item	Description	Part Number	Remarks
1.	Instruction Manual Johnson Pump	FRE/EN (0912) 9.0	Manual Starts on Page 61 of PDF
2.	Whale Gusher Titan Bilge Pumps	Ref 180.15 V3/00	Manual Starts on Page 166 of PDF

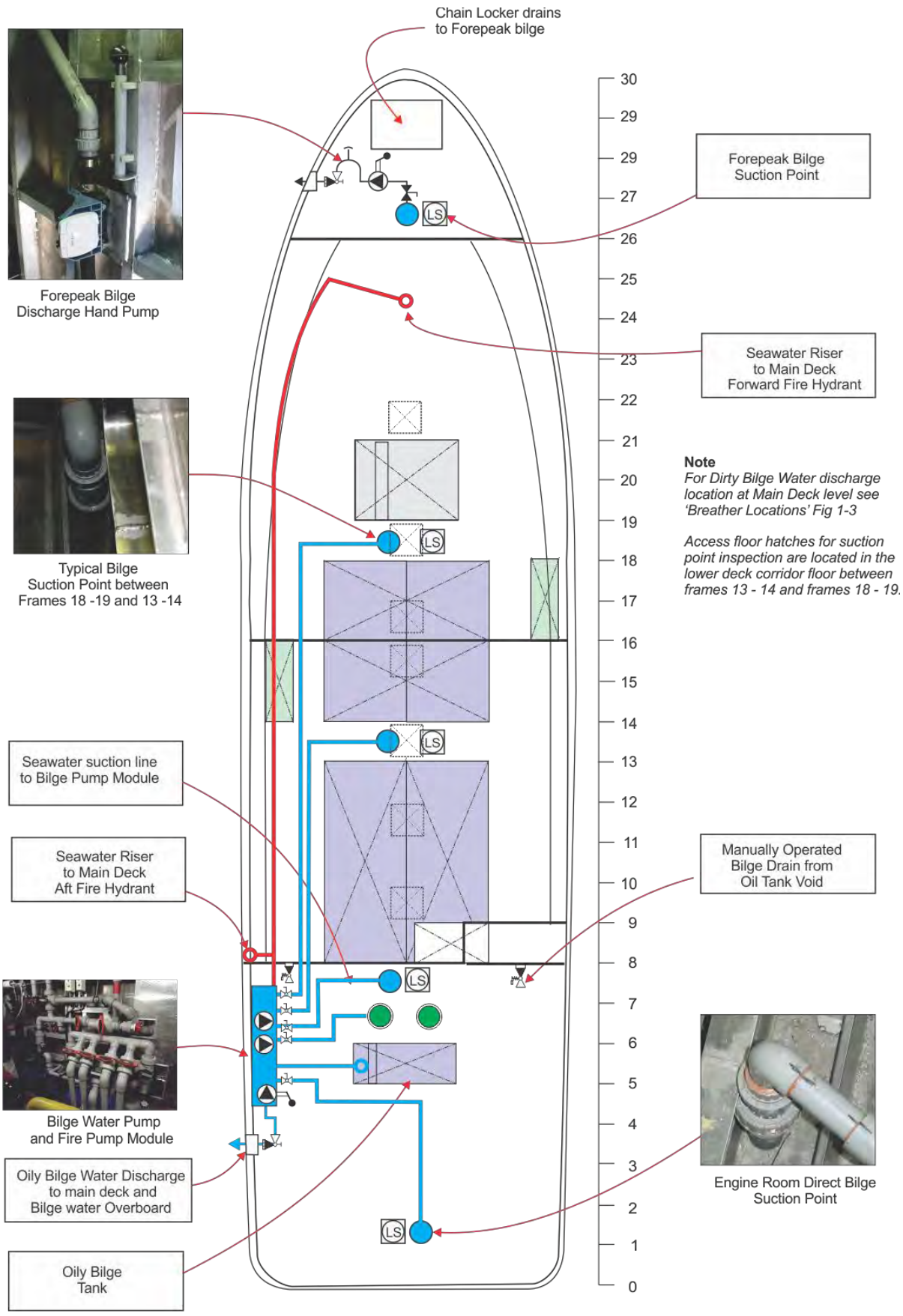


Figure 5-4: Bilge System Equipment Location

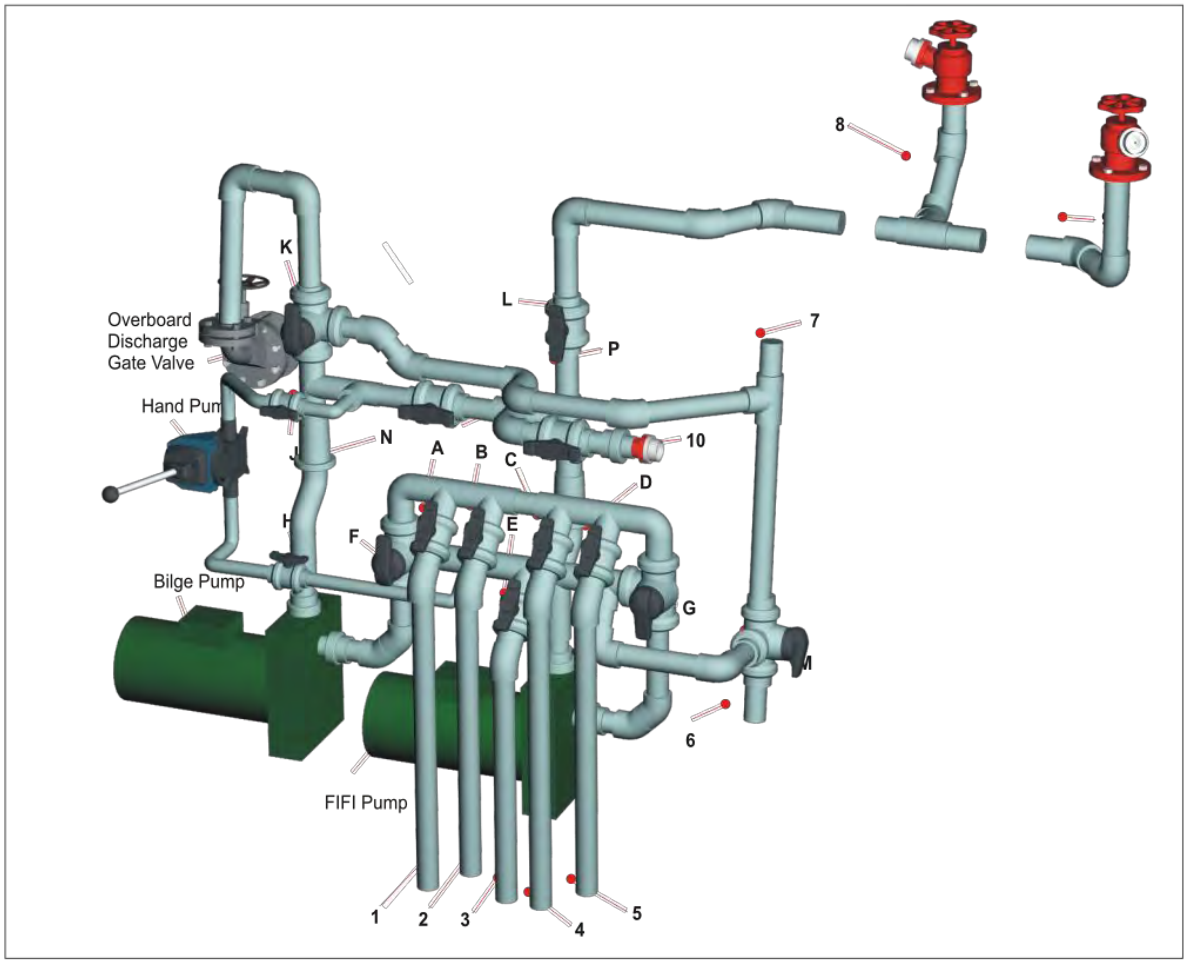


Figure 5-5: Bilge Module

Table 5-4: Identification of Bilge Lines (from Figure 5-5)

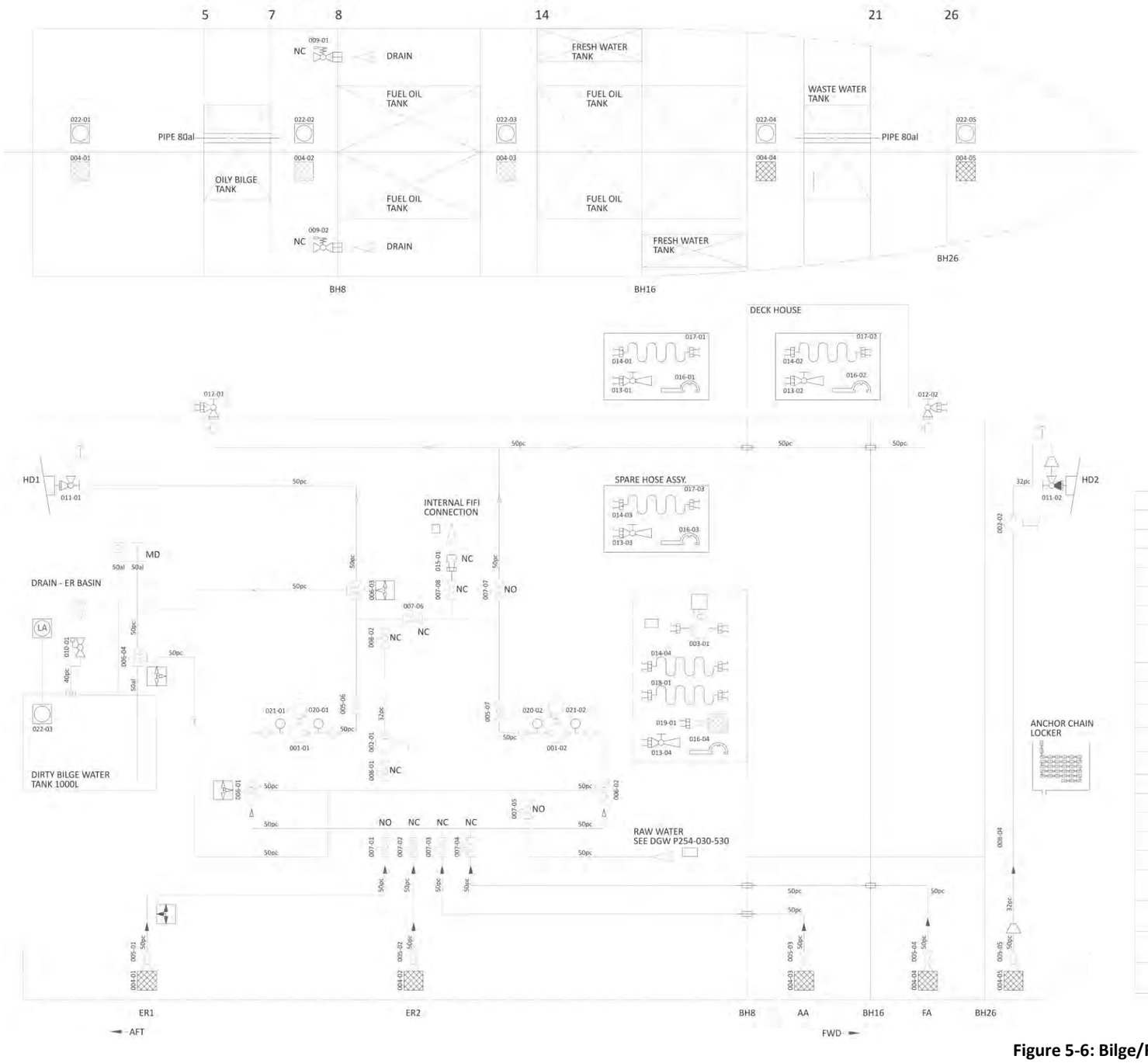
Pipe Lines	Descripion
1	Bilge Suction - Engine Room - Aft
2	Bilge Suction - Engine Room - Fwd
3	Raw Water Suction from Port Sea Water Inlet
4	Bilge Suction - Midship Section
5	Bilge Suction - Fwd. Section
6	Suction - Dirty Oil Tank
7	Dirty Oil Discharge to Deck
8	Raw water to Aft Main Deck Fire Hydrant
9	Raw water to Fwd Main Deck Fire Hydrant
10	FIFI Pump Connection

Table 5-5: Identification of Bilge Valves (from Figure 5-5)

Valves	Valve Function	Valve No.	Normal Position
		(See System Diagram)	
A	Bilge Suction Engine Room - Aft	007-01	NO
B	Bilge Suction Engine Room - Fwd.	007-02	NC
C	Bilge Suction - Midship Section	007-03	NC
D	Bilge Suction - Fwd. Section	007-04	NC
E	Raw Water Suction from Port Sea Water Inlet	007-05	NC
F	3-way Valve - Bilge Suction Pump	006-01	Thro' to Overboard
G	3-way Valve - FIFI Pump Suction Pump	006-02	Thro' to Deck
H	Isolating Valve - Hand Pump Suction	008-01	NC
J	Isolating Valve - Hand Pump Discharge	008-02	NC
K	3-way Valve - Oily Bilge to Oily Bilge Tank	006-03	Thro' to Overboard
L	Isolating Valve - to Deck Hydrants	007-07	NO
M	3-way Valve - Suction from Oily Bilge Tank	006-04	Thro' to Deck
N	NRV - Bilge Discharge System	005-06	
P	NRV - Fire Fighting System	005-07	

PIPE	DESCRIPTION	MATERIAL	NOTE
80al	100 x 8.0, SEAMLESS	AL 5083	
50al	60.3 x 3.2, SEAMLESS	AL 5083	
50pc	63 x 4.6, 900kPa	PVC-C	
32pc	40 x 3.0, 900kPa	PVC-C	

ABBREVIATIONS	
	AFT ACCOMODATION
	AIR CONDITIONING
	BULKHEAD
	ENGINE ROOM
	FORWARD ACCOMODATION
	FOREPEAK
	FRESH WATER
	HULL DISCHARGE
	INTERNAL FIFI
	MAIN DECK
	MOBILE FIFI PUMP
	NORMALLY OPEN
	LEVEL SWITCH
	RAW WATER



	QTY	PART	TYPE	MATERIAL	MAKE	DESCRIPTION
		LEVEL SWITCH			MOBREY	003S2, NPT 2"
		SUCTION INDICATOR	1/2	S/S 316	WIKA	213.53, GAUGE SUCTION., WETTED DIAL
		PRESSURE INDICATOR	1/2	S/S 316	WIKA	213.53, GAUGE PRESS., WETTED DIAL
		FOOT VALVE				BALL CHECK, WITH SUCTION SCREEN, STORZ TYPE-C
		SUCTION HOSE				STEEL HELIX WIRE, STORZ C ALU ADAPTERS,
		STORAGE CABINET		STEEL	VIKING	STORE SOS11
		COUPLING SPANNER		CAST IRON	ECONOSTO	FIG. 9205, STORZ TYPE C
		FIRE HOSE ADAPTER		ALU	ECONOSTO	FIG. 914, STORZ TYPE C
		FIRE HOSE			ECONOSTO	STANDARD, 15m, STORZ C ALU ADAPTORS
		NOZZLE		ALU	ECONOSTO	FIG. 924, HS, 16mm THROAT, STORZ C ALU ADAPTOR
		VALVE, FIFI		BRASS	ECONOSTO	FIG. 2057, 30 DIAGONAL, EPDM DIAPHRAGM, STORZ C ALU ADAPTOR, BLANKING CAP & CHAIN
		VALVE, STORM	DN50	CAST IRON	ECONOSTO	FIG.1207 SWING CHECK, LOCKING, WITH CERTIFICATE
		VALVE, SELF CLOSING		BRONZE	ECONOSTO	FIG. 724, NPT BOTTOM FEMALE END, NPT TOP MALE END
		VALVE, SELF CLOSING		BRONZE	ECONOSTO	FIG. 605, STRAIGHT, FIXED DISC, LEVER OPERATED
		VALVE, BALL	DN32	PVC-C	GF / FIP	VXIV, PLAIN
		VALVE, BALL	DN50	PVC-C	GF / FIP	VXIV, PLAIN
		VALVE 3-WAY	DN50	PVC-C	GF / FIP	TXIC, 3-WAY, T TYPE, PLAIN
		VALVE, NR	DN50	PVC-C	GF / FIP	VZIV, BALL CHECK, PLAIN
		SUCTION SCREEN	DN50	PVC-C	GF / FIP	SZIV,SCREEN, PLAIN
		MOBILE FIFI PUMP		CAST IRON	HYMECH	50EH, DIESEL ENGINE DRIVEN, YANMAR L48N, 3600RPM, SELFPRIMING CENTRIFUGAL PUMP, 6.6m3/hr @2.0bar, STORZ C
		HAND PUMP		NITRILE	WHALE	GUSHER TITAN, DIAPHRAGM, 76 L/min, 2m @60st/min, UNDERDECK MOUNT
		PUMP ELECTRICAL	BSP 1.1/2"	CAST IRON	SPX	FRES 40-170, SELF-PRIMING, CENTRIFUGAL, CAST IRON HOUSING, MECH. SEAL, Br IMPELLER, 18m3/hr @ 3bar, MOTOR 4KW 380/3/50, 3000RPM

Figure 5-6: Bilge/FiFi System Block Diagram (drawing P254-030-510-A)

520 Fuel and Lube Oil System

System Overview

A block diagram detailing the filling and transfer of fuel oil as well as the fuel distribution system is shown on drawing Figure 5-12 on page 5-23 and the location of fuel oil tanks and equipment is shown in Figure 5-11 on page 5-21.

Tank location is shown in Figure 1-2 on page 1-5 and Tank Vents and Filling Points in Figure 1-3 on page 1-6.

Diesel fuel and lubrication oil quality is an important factor in satisfactory engine and other user equipment life and performance. For information on fuel oil to be used see Fuel Oil Quality on page 2-2. The lubrication oil to be used is listed under the user equipment as follows:

a. Engine and gearbox see Table 2-3 on page 2-6

b. Water jets see Table 2-5 on page 2-15

c. Generator see Table 3-1 on page 3-2

Brief Description

Fuel Oil Storage and Supply

The vessel is fitted with four bulk fuel oil tanks located beneath the lower deck and integral with the vessel's hull construction. The two forward fuel tanks, with a capacity of 3800l each, are located between frames 14 -18 and installed on either side of the watertight bulkhead at frame 16. The two aft tanks, with a capacity of 4500l each are located between frames 8 - 13 and are positioned on either side of the vessel centre line. Access to level control indicators and switches is via a floor hatch located in the passageways.

The forward bulk tanks are filled from two international shore connections on the main deck located between frames 14 -16 on the port side of the vessel. The aft bulk fuel tanks are filled from points on either side of the vessel adjacent to frames 7 and 9. During filling overflow from the tanks will collected in drip trays mounted under the filling points. Two service/inspection hatches are fitted into each tank and these are accessible through the accommodation and mess floors.

A diesel oil header tank with a capacity of 1800 litres is located between frames 8 and 9 on the stbd side at lower deck level. This tank supplies fuel for the two main engines and two generator sets. An inspection/service hatch is fitted to the side of the tank and is accessed from the engine room side of bulkhead 8.

A fuel oil transfer station located in a recess on the starboard side against the water tight bulkhead between frames 8 and 9. Operation of the fuel transfer pumps is initiated from the Fuel Transfer Start/Stop switches located in the engine room on the starboard side next to frame 7 upon indication of header tank low level.

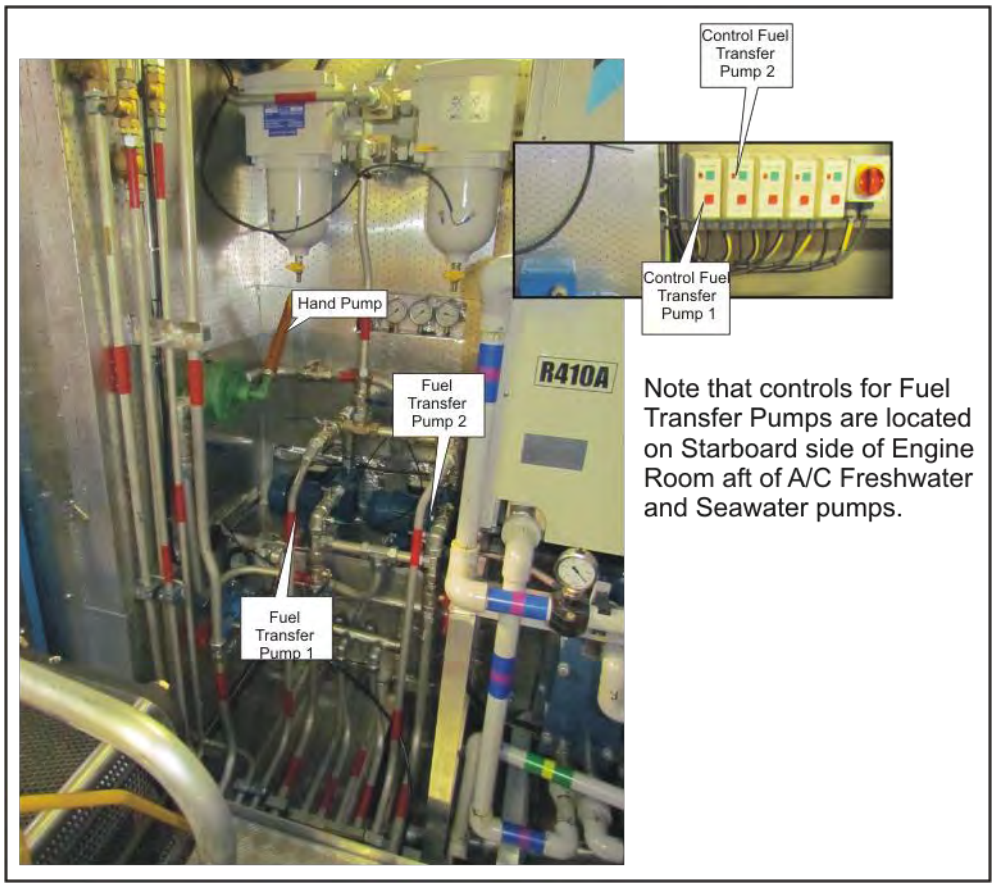


Figure 5-7: Fuel Oil Transfer Station

The fuel oil transfer station comprises two electrical driven FORAS pumps(001-01 & 02) capable of delivering 2.4m^3/hour at 3 bar each and a hand operated priming pump (002-01) delivering 22.5l per 110 strokes. The inlet and discharge of the pumps are interconnected with a suction header and a discharge header. The two fuel pumps are fitted with local isolation valves (008-03, 04, 09 and 10).

The suction header is connected by pipework to the four main storage tanks with each line fitted with an isolation valve at point of entry to the header. Valves from the two aft fuel tanks – between frames 8- 13 are set to a normally open (NO) position whilst the valves fitted to the two lines from the forward tanks are normally closed (NC). A further connection from the suction header feeds to the hand operated transfer pump.

There are five connections leaving the discharge header four of which are used for fuel transfer between the main storage tanks. The fifth connection is used for fuel transfer via a fuel/water separator to the day tank. A sixth connection connects to the hand operated transfer pump. All the fuel transfer lines are fitted with isolation valves at the header. The valve serving the day tank transfer line is normally open (NO) the remaining four are normally closed (NC) and can be opened depending upon which tanks transfer operation are required. Either end of the discharge header is fitted with in-line non-return valves (NRV).

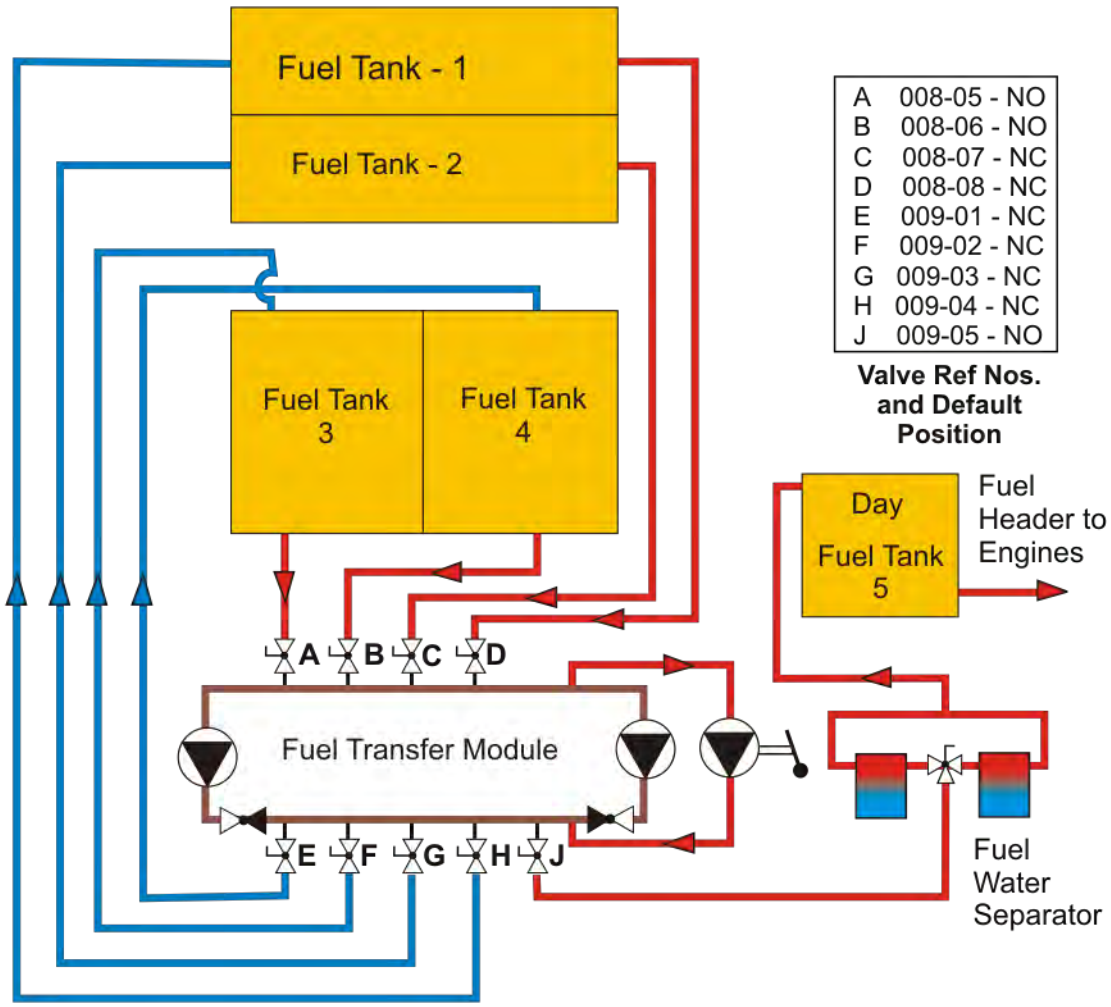
Fuel Transfer

All fuel tanks are fitted with high and low level ultrasonic level sensors and level transmitters with corresponding high and low level alarms and level indicators located in the wheel house.

Fuel transfer pumps are started from a Start/Stop switch located on the stbd hull adjacent to frame 7.

Fuel will normally be supplied to the day header tank from either or both of the aft bulk fuel tanks.

Fuel in these tanks can be replenished from the forward bulk fuel tanks. The valves needed to undertake fuel transfer from the various tanks is shown in Figure 5-8 below.



From Tank	To Tank	Suction Header		Discharge Header	
		Open	Closed	Open	Closed
1	3	D	A,B,C	F	E,G,H,J
1	4	D	A,B,C	E	E,G,H,J
2	3	C	A,B,D	F	F,G,H,J
2	4	C	A,B,D	E	F,G,H,J
3	5	A	B,C,D	J	E,F,G,H
4	5	B	A,C,D	J	E,F,G,H

Figure 5-8: Fuel Transfer Diagram

Fuel from the bulk tanks is drawn in to the fuel transfer module by one or both of the fuel transfer pumps from where it is pumped to the header tank via a fuel/water separator (003-01) in the engine room located

against the bulkhead on frame 9. The filters are located above the fuel transfer module. The duplex fuel/water separator comprised two filters separated by a manually operated three way valve. Dirty oil/water from the strainers is deposited in a local sump/drip tray and gravity drained to the dirty bilge/sludge water tank beneath the engine room flooring between frames 5 and 6.

Water levels in the separators are indicated by a level alarm (018-04) on the bridge display in the wheelhouse. Isolating valves are fitted on both sides of the fuel/water separators (009-05 & 10). These valves are set in the normally open (NO) position for standard operation.

A hand operated priming pump is installed as part of the fuel oil transfer station.

Fuel Oil to Engines

Fuel is drawn from the header tank, through a 40mm diameter fuel header pipe, by the respective main engine and generator set fuel pumps. Fuel to the main engine goes via an in-line engine mounted duel filter with change over three-way valves. Fuel oil to the generator sets is via engine mounted single filter. Oversupply of fuel oil from the main and the auxiliary engines is individually returned to the header**.**

Fuel tank levels are monitored by low and high level switches (018-01 to 10) mounted in the tanks and providing level indication and audio alarms on the bridge display. Ultrasonic level senders are mounted on top of the tanks and send level signals to the PLC Alarm System.

Over filling of the day tank is prevented by a high level fuel return pipe which drains back to the two bulk tanks.

The fuel contents can be viewed on any of the vessel's four alarm panels (see Figure 5-9 below) and in the case of the day tank by visual inspection of the tank sight glass (see Figure 5-9 below). See Instrumentation and Alarms on page 3-20 for information on the key sequence required and the alarm system.

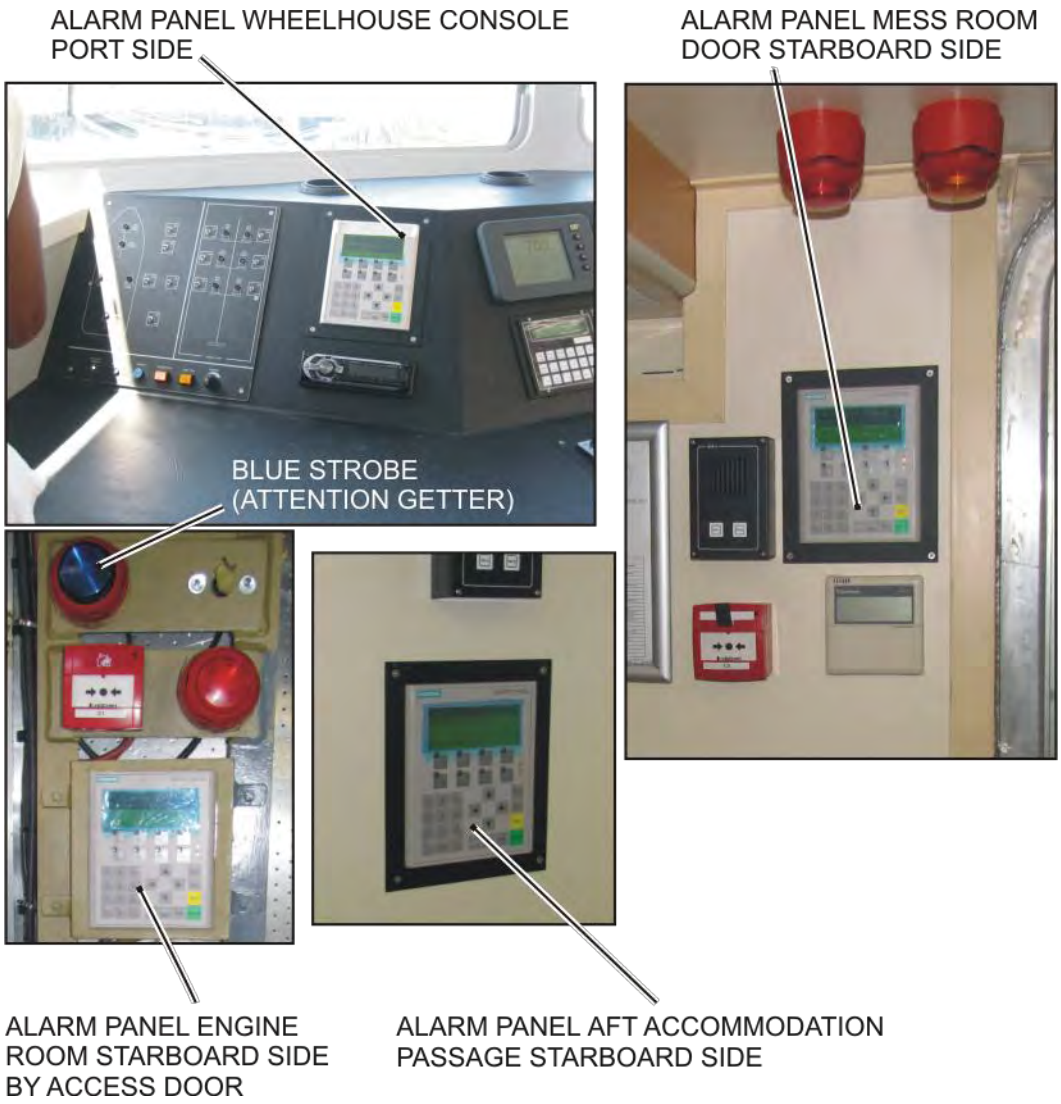


Figure 5-9: Location of the Alarm Panels

All five tanks are fitted with low level manually operated self-closing valves to enable the removal of oily water from the bottom of the tanks. The oily water is discharged into the lower level of the engine room between frames 7 and 8 and is removed by the bilge suction point at this location (see Bilge Water System on page 5-1).

In the event of fire or other emergency the supply of fuel from the bulk tanks and from the header tank can be isolated by in-line quick closing valves (004-01 to 05) operated by shut-off levers and wire rope connections. The emergency fuel shut off box is positioned forward of bulkhead 8 next to the engine room access door on the port side.

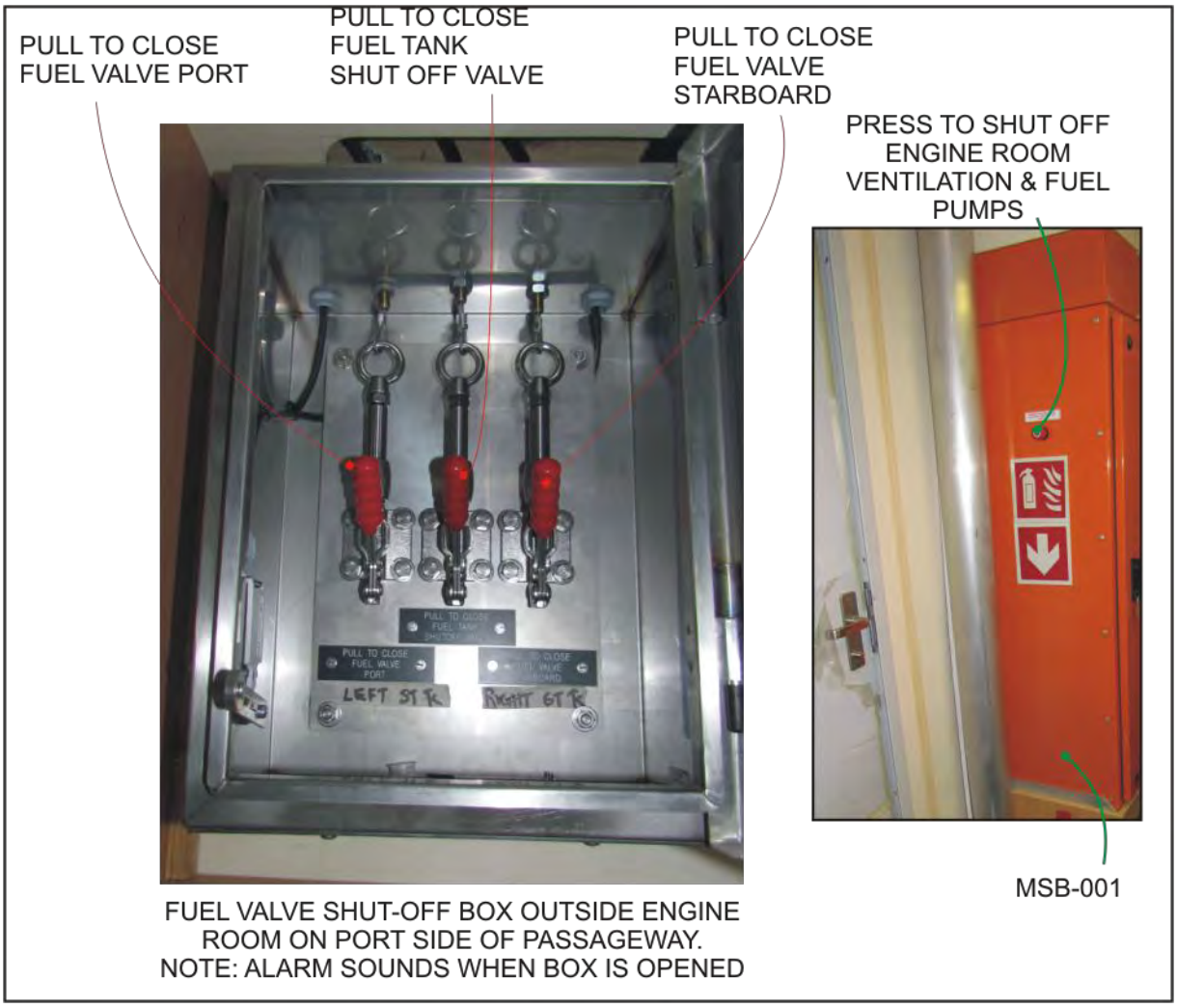


Figure 5-10: Fuel Oil Emergency Shut-Off Levers

Maintenance

Inspection of the fuel tanks to remove the accumulation of water in the tanks due to condensation or moisture introduced during tank filling should be undertaken at least twice a week. This process entails opening the self-closing drain valves (006) and allowing the water to flow into the bilge until only fuel oil appears.

It is essential that the bilge areas adjacent to the tanks being purged are clear of accumulated bilge water before the tank draining operation takes place. The bilge water after the draining process has been undertaken must be ported to the oily bilge tank.

Cleaning and or changing of the oil filters fitted to the main engines, generators and fuel water separators must be carried out in accordance with the OEM instructions.

Pump Specification

The transfer pumps are manufactured by Foras and have cast iron casings with PL 100 T bronze impellers, AISI 316 stainless steel shafts and mechanical seals. The pumps deliver 2.1m3/hour @ 2 bar. Electrical

supply is 400V, 3 phase 50Hz. Electrical supply to the Main Pump is from Q9 on MDB-002 and the Standby Pump from Q6 on MDB-001.

Fuel Oil Transfer Procedure

System Components

a. 4 x Fuel Storage Tanks = Port, Starboard, Forward and Aft.
b. 1 x Daily/Header Tank (Fuel Tank 5)
c. 2 x Fuel Transfer pumps (Fuel Transfer Pump 1 and Fuel Transfer Pump 2)

Procedure

Refer to Figure 5-7 on page 5-14, Figure 5-8 on page 5-15 and Figure 5-11 on page 5-21 when carrying out the following procedure.

1. Determine the fuel levels in the storage tanks and the daily tank.
2. Take into consideration the amount of fuel to be transferred in relation with tank emptying sequence.
3. Tanks to be emptied in the following sequence:
    a. Starboard (Fuel Tank 4)
    b. Port (Fuel Tank 3)
    c. Forward (Fuel Tank 1)
    d. Aft (Fuel Tank 2)
4. Select the preferred storage tank and open the suction valve from the tank.

CAUTION: WATER CAN BE DRAINED DIRECTLY FROM THE PORT AND STARBOARD TANKS BUT NOT FROM THE FORWARD AND AFT TANKS. THEREFORE FUEL FROM FORWARD AND AFT FUEL TANKS MUST ONLY BE TRANSFERRED TO EITHER THE PORT OR STBD TANKS AND NOT DIRECTLY TO THE DAY TANK

5. Refer to the Fuel Oil Transfer Diagram (Figure 5-8 on page 5-15) and open the relevant pump suction and discharge valves and confirm the standby pumps valves are shut.
6. Confirm all other storage tanks suction and filling valves are closed.
7. Open the valves to the RCI and filters and ensure the bypass valve is shut.
8. Open filling valve to daily tank (Tank 5).
9. Start the fuel pump to commence transferring of fuel.

NOTE: Monitor the differential fuel pressures at the pump and filters

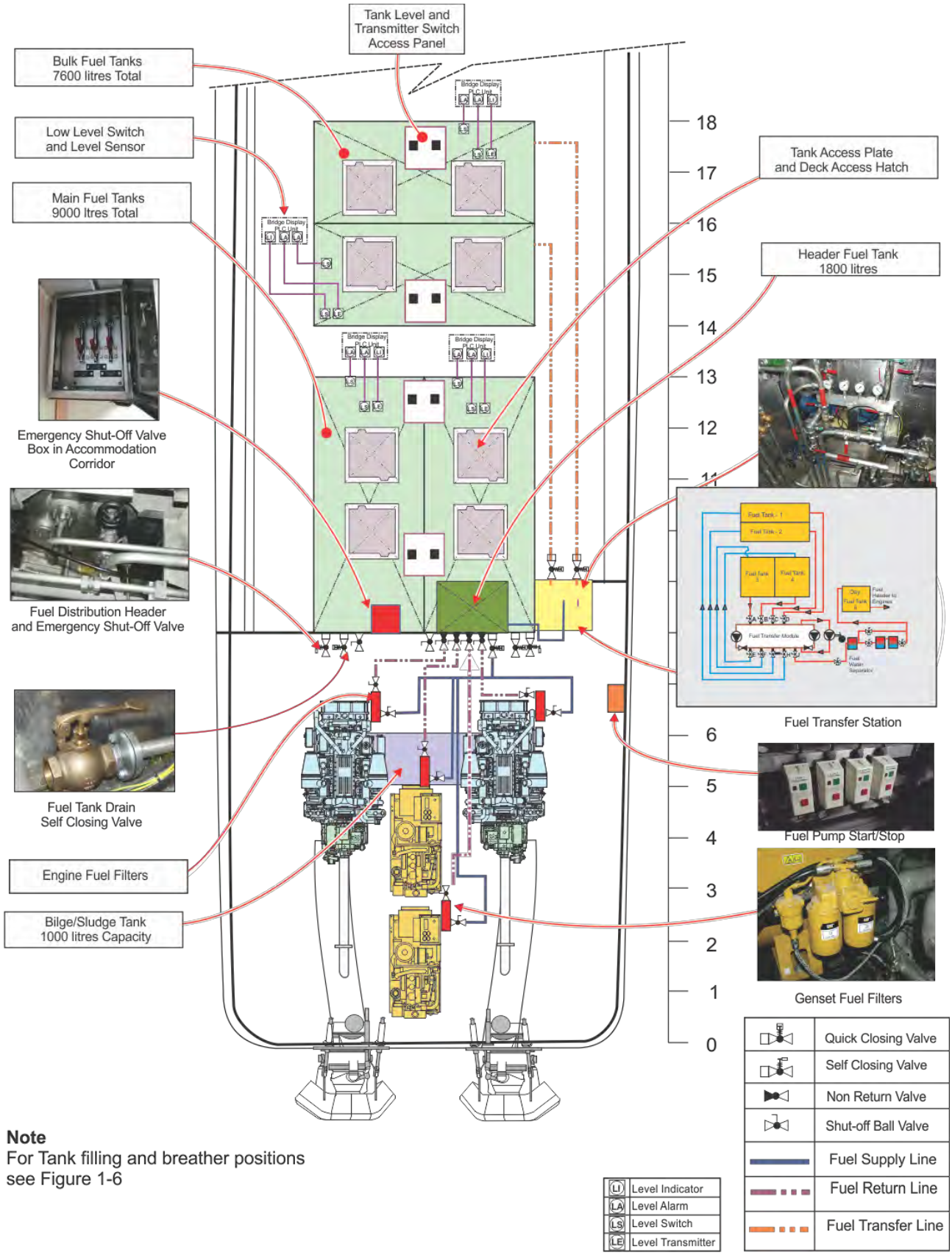
10. On completion of fuel transfer, shut all valves.

NOTE: Log all fuel transferred and remaining.

Documentation

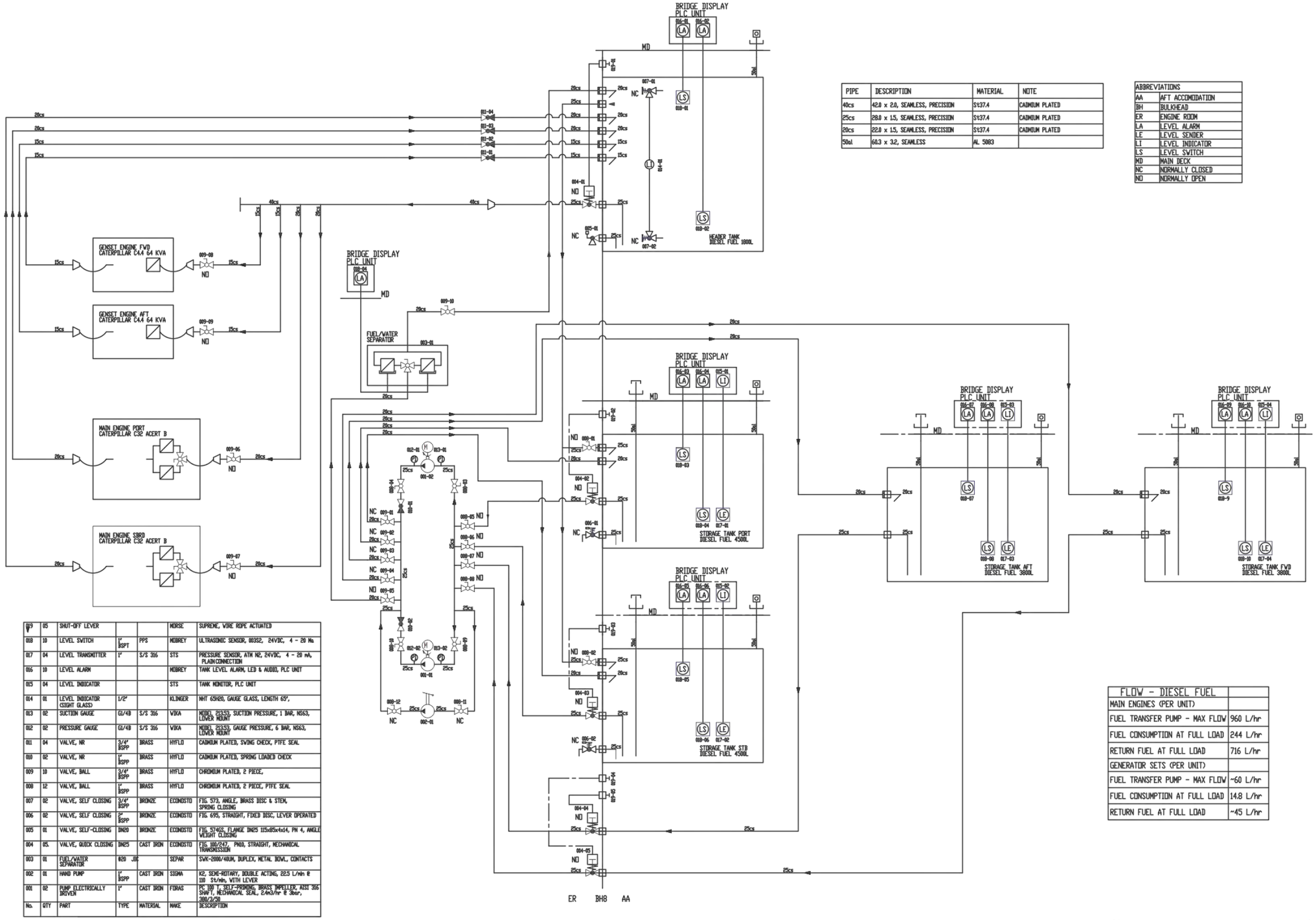
Table 5-6: Fuel System Documentation

Item	Description	Part Number	Remarks
1.	Model PL 100T Peripheral Pump	PL 100T	
2.	Data Sheet Fuel Header Tank Priming	K2 Wing Pump	Manual Starts on Page 178 of PDF



Note
For Tank filling and breather positions see Figure 1-6

Figure 5-11: Location of Components in the Fuel Oil System



PIPE	DESCRIPTION	MATERIAL	NOTE
40cs	42.0 x 2.0, SEAMLESS, PRECISION	St37.4	CADMIUM PLATED
25cs	28.0 x 1.5, SEAMLESS, PRECISION	St37.4	CADMIUM PLATED
20cs	22.0 x 1.5, SEAMLESS, PRECISION	St37.4	CADMIUM PLATED
50al	60.3 x 3.2, SEAMLESS	AL 5083	

ABBREVIATIONS	
AA	AFT ACCOMODATION
BH	BULKHEAD
ER	ENGINE ROOM
LA	LEVEL ALARM
LE	LEVEL SENDER
LI	LEVEL INDICATOR
LS	LEVEL SWITCH
MD	MAIN DECK
NC	NORMALLY CLOSED
NO	NORMALLY OPEN

No.	QTY	PART	TYPE	MATERIAL	MAKE	DESCRIPTION
019	05	SHUT-OFF LEVER			MORSE	SUPREME, WIRE ROPE ACTUATED
018	10	LEVEL SWITCH	1" BSPT	PPS	MOBREY	ULTRASONIC SENSOR, 00352, 24VDC, 4 - 20 Ma
017	04	LEVEL TRANSMITTER	1"	S/S 316	STS	PRESSURE SENSOR, ATM N2, 24VDC, 4 - 20 mA, PLAIN CONNECTION
016	10	LEVEL ALARM			MOBREY	TANK LEVEL ALARM, LED & AUDIO, PLC UNIT
015	04	LEVEL INDICATOR			STS	TANK MONITOR, PLC UNIT
014	01	LEVEL INDICATOR (SIGHT GLASS)	1/2"		KLINGER	NHT 65H20, GAUGE GLASS, LENGTH 65",
013	02	SUCTION GAUGE	GI/4B	S/S 316	WIKA	MODEL 21353, SUCTION PRESSURE, 1 BAR, NS63, LOWER MOUNT
012	02	PRESSURE GAUGE	GI/4B	S/S 316	WIKA	MODEL 21353, GAUGE PRESSURE, 6 BAR, NS63, LOWER MOUNT
011	04	VALVE, NR	3/4" BSPP	BRASS	HYFLO	CADMIUM PLATED, SWING CHECK, PTFE SEAL
010	02	VALVE, NR	1" BSPP	BRASS	HYFLO	CADMIUM PLATED, SPRING LOADED CHECK
009	10	VALVE, BALL	3/4" BSPP	BRASS	HYFLO	CHROMIUM PLATED, 2 PIECE,
008	12	VALVE, BALL	1" BSPP	BRASS	HYFLO	CHROMIUM PLATED, 2 PIECE, PTFE SEAL
007	02	VALVE, SELF CLOSING	3/4" BSPP	BRONZE	ECONOSTO	FIG. 573, ANGLE, BRASS DISC & STEM, SPRING CLOSING
006	02	VALVE, SELF CLOSING	2" BSPP	BRONZE	ECONOSTO	FIG. 695, STRAIGHT, FIXED DISC, LEVER OPERATED
005	01	VALVE, SELF-CLOSING	DN20	BRONZE	ECONOSTO	FIG. 574GS, FLANGE DN25 115x85x4x14, PN 4, ANGLE WEIGHT CLOSING
004	05	VALVE, QUICK CLOSING	DN25	CAST IRON	ECONOSTO	FIG. 100/247, PN10, STRAIGHT, MECHANICAL TRANSMISSION
003	01	FUEL/WATER SEPARATOR	020	JBC	SEPAR	SWK-2000/40UM, DUPLEX, METAL BOWL, CONTACTS
002	01	HAND PUMP	1" BSPP	CAST IRON	SIGMA	K2, SEMI-ROTARY, DOUBLE ACTING, 22.5 L/min @ 110 St/min, WITH LEVER
001	02	PUMP ELECTRICALLY DRIVEN	1"	CAST IRON	FORAS	PC 100 / SELF-PRIMING, BRASS IMPELLER, AISI 316 SHAFT, MECHANICAL SEAL, 2.4m3/hr @ 3bar, 380/3/50

FLOW - DIESEL FUEL	
MAIN ENGINES (PER UNIT)	
FUEL TRANSFER PUMP - MAX FLOW	960 L/hr
FUEL CONSUMPTION AT FULL LOAD	244 L/hr
RETURN FUEL AT FULL LOAD	716 L/hr
GENERATOR SETS (PER UNIT)	
FUEL TRANSFER PUMP - MAX FLOW	~60 L/hr
FUEL CONSUMPTION AT FULL LOAD	14.8 L/hr
RETURN FUEL AT FULL LOAD	~45 L/hr

Figure 5-12: Block Diagram Fuel Oil System (from drawing P254-030-520-A)

530 Cooling System

Refer Cooling System Equipment Location (on page 5-31) and Cooling System Block Diagram (Figure 5-16 on page 5-33) when reading the following descriptions.

Brief Description

Seawater System Overview

Seawater enters the vessel through three independent strainers located in the engine room. The two main strainers are positioned below the engine room decking between frames 6 and 7 and on either side of the vessel centre line. Access to the strainer housing is via the floor plating in the central walkway. A smaller strainer serving the generator sets is located on the starboard side of the forward generator set between frames 4 and 5.

Each strainer can be isolated by butterfly valves fitted on the inlet and outlet of the casing. Access to the strainer is via a top lid secured to strainer casing by three hinged eye bolts. Before removal and cleaning of the filter both isolating valves must be closed either from the engine room or main deck.

As the top of the casings are below sea level one large and one smaller service tubes are provided. Once the casing cover plate has been removed the service tubes can be fitted utilizing the same retaining eye bolts that secured the cover. The filters can now be removed through the service tube. Care must be taken not to damage the sealing o-ring located on the top surface of the filter casing. In the event of the lower gear operated butterfly valve (001-01 & 02) failing to close fully then a certain amount of seawater will spill over the top of the filter box. This will cease with the fitting of the service tube.

Seawater from the port strainer enters a header pipe from which water is supplied to port main propulsion engine cooling, gearbox, port shaft seal and exhaust spray as well as the bilge/FIFI pumping module.

Seawater from the starboard strainer enters a header pipe from which water is supplied to starboard main propulsion engine cooling, gearbox, starboard shaft seal and exhaust spray. . The two main cooling systems are coupled together after the strainer boxes with the two systems separated with an isolating valve (005-03).

The third seawater filter provides cooling water for the generator sets before being discharges overboard.

A back-up supply line from the FIFI pump feed couples into the generator cooling water line adjacent to the single raw water inlet between frames 4 and 5. This line will supply cooling water to the generators in the event of the generator raw water inlet undergoing servicing. A normally closed valve is fitted to this line.

Figure 5-13 below shows the location of the various intakes and valves.

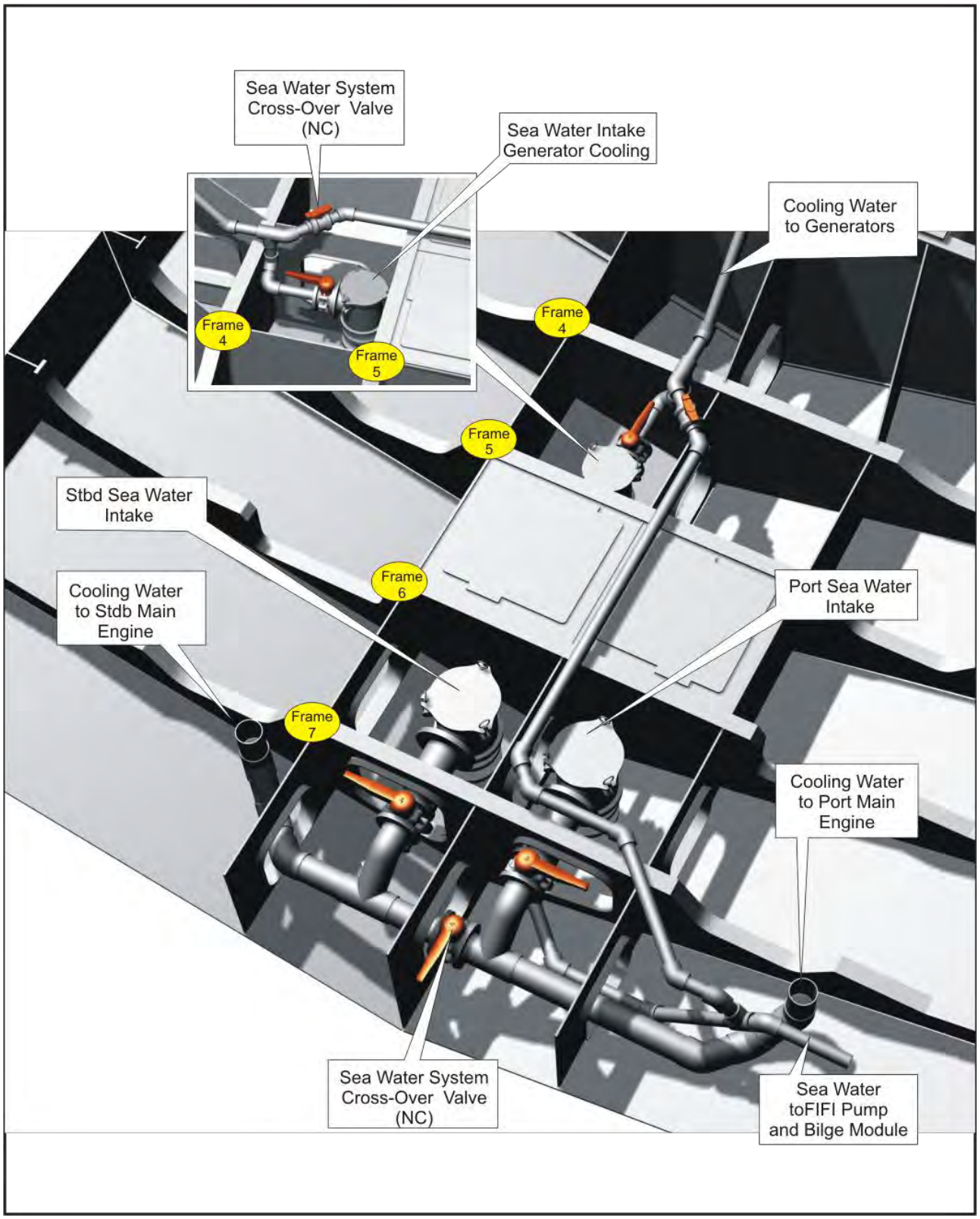


Figure 5-13: Seawater Inlet Filters and Distribution Header

CAUTION: After cleaning of the filter and replacement of the lid ensure that both inlet and discharge valves are fully opened.

Cooling System - Main Engines

The cooling system employed by each main engine is via a primary seawater system, heat exchanger and engine side secondary cooling medium. The engine cooling pumps draw water from the seawater inlet header and through the heat exchanger and discharge back into the header. A separate line from the engine cooling header provides cooling water to the gearbox oil coolers. The return from the gearbox heat exchanger also returns to the main cooling line. Balancing valves (002-01, 02) are located between the gearbox cooling inlet and outlet. Throttling of these valves allows for the correct cooling water flow through the gearbox heat exchangers whilst still maintaining the correct system pressure to meet the demands of the exhaust sprays and shaft seal pressures.

Figure 5-14: Gearbox Heat Exchanger and Flow Balance Valve

Take-off connections on the cooling lines from the gearbox feed seawater to the drive shaft seals and engine exhaust spray nozzles. The remaining cooling water is discharged overboard via hull mounted butterfly valves. Balance between nozzle spray discharge water and direct seawater discharge is set during trials.

Cooling System – Electrical Generator Sets

The two generators are cooled by a primary seawater system, heat exchanger and engine side secondary cooling medium. The engine cooling pumps draw water from the aft seawater inlet header and through the heat exchanger. Seawater discharge from the heat exchangers is directly over board through a hull mounted butterfly valve.

FIFI System Pump

The FIFI fire fighting pump mounted as part of the bilge module draws seawater from the port end of the seawater inlet manifold (See Bilge water system on page 5-1).

Hull Discharge Valve Locations

Seawater discharge valves are located in the following positions:

a. Port propulsion engine Between frames 3 and 4 port

b. Starboard propulsion engine Between frames 3 and 4 starboard

c. Forward generator engine Between frames 1 and 2 starboard

d. Aft generator engine Between frames 1 and 2 starboard

Seawater Flow

Cooling water pump flow

a. Main Engine @ 2250 RPM 1050 l/m

b. Generator Set @ 1500 RPM 86 l/m

c. FIFI system pump – flow ~ 300 l/m

Cooling Water Switch-on Procedure

Cooling water to the main engines and generators must be switched on before either main engine or generator is started.

Refer to Figure 5-15 on page 5-31 for the location/identification of valves identified in the following two procedures.

Diesel Generator

The generator seawater suction valve can either be opened from the engine room or from the upper deck (starboard side).

1. Open the generator seawater suction valve.

NOTE: If the generator seawater inlet becomes blocked, seawater from the port inlet can be used by opening valve 006-02.

2. Open the strainer discharge valve (006-01).
3. Open the overboard discharge valve (004-01 forward generator or 004-02 aft generator).
4. Confirm that the emergency seawater valve (006-02) is closed.
5. Confirm that the valve (007-01) to the Watermaker is open
6. Start the generator and observe if the cooling water is exiting via the overboard discharge valve.

Main Engines

The port and starboard seawater suction valves can be opened either from the engine room or from the upper deck (starboard side).

1. Open the port, starboard or both seawater suction valves.

2. Open the strainer discharge valve (005-01 port inlet, 005-02 starboard inlet).
3. Open the overboard discharge valve (002-01 port main engine, 002-02 starboard main engine).
4. Confirm that the emergency seawater valve 005-03 between the port and starboard systems is closed.
5. Confirm that the balance valve between the gearbox/s inlet and outlet is correctly positioned in accordance with the Gearbox Cooling Procedure below.
6. Confirm that the seawater feed to the shaft/s seal is open (009-01 port, 009-02 starboard).
7. Confirm that the discharge valve to the exhaust spray is open (004-03 port, 004-04 starboard).
8. Start the main engine/s and observe if the cooling water is exiting via the overboard discharge valve/s.

Gearbox Cooling

Set the gearbox bypass cooling valve as follows (see Figure 5-14 on page 5-27):

1. At start-up of Main Engines set the gearbox bypass cooling valve for both main engines to 2/3 open.

2. Monitor the gearbox lubrication oil temperature and if necessary adjust valve setting as follows:

    a. If temperature of the lubrication oil rises above the normal operating temperature, slightly close the bypass valve and continue monitoring carrying out further adjustments if necessary.

    b. If temperature of the lubrication oil drops below the normal operating temperature, slightly open the bypass valve and continue monitoring carrying out further adjustments if necessary.

Cleaning the Seawater Inlet Strainers

Refer to Figure 5-15 on page 5-31 for the location/identification of valves identified in the following two procedures.

Diesel Generators

If the generator seawater strainer is blocked proceed as follows:

1. Open the generator cooling water emergency supply valve 006-02 in the Port Main Engine suction supply line.
2. Close the generator seawater suction valve. Note that the generator seawater suction valve can either be opened from the engine room or from the upper deck (starboard side).
3. Close the strainer discharge valve 006-01.
4. Remove strainer and clean as required.

Main Engines

If either the port or starboard seawater strainer is blocked proceed as follows:

1. Open the emergency seawater valve 005-03 between the port and starboard systems.
2. Close the seawater suction valve requiring attention. Note that the port and starboard seawater suction valve can be opened either from the engine room or from the upper deck (starboard side).

CAUTION: IF THE PORT SEAWATER SYSTEM AND THE GENERATOR SEAWATER SYSTEM ARE BLOCKED THE WATERMAKER MUST BE SHUTDOWN.

3. Close the strainer discharge valve of the faulty system (005-001 port, 005-02 starboard).
4. Remove strainer and clean as required.

Documentation

Table 5-7: Cooling System Documentation

Item	Description	Part Number	Remarks
1.	Instruction Manual Stork Combi Block	CB32-125	Manual Starts on Page 2 of PDF

Valve	Function
002-01	Port Engine CW Discharge Thro' Hull
002-02	Stbd Engine CW Discharge Thro' Hull
004-01	Fwd Genset CW Discharge Thro' Hull
004-02	Aft Genset CW Discharge Thro' Hull
004-03	Port Engine Exhaust Spray Isolator
004-04	Stbd Engine Exhaust Spray Isolator
005-01	Port Engine CW Circuit Isolator
005-02	Stbd Engine CW Circuit Isolator
006-01	Gensets CW Circuit Isolator
006-02	Port Seawater Intake to Genset CW isolator
006-03	Seawater Intake Crossover
007-01	Watermaker Isolation Valve
008-01	Fwd Genset Isolation Valve
008-02	Aft Genset Isolation Valve
009-01	Port Driveshaft Seal CW Isolator
009-02	Stbd Driveshaft Seal CW Isolator
011-01	Port Main Engine Exhaust Spray Nozzle
011-02	Stbd Main Engine Exhaust Spray Nozzle
000-01	Port Gearbox Cooling By-pass Valve
000-02	Stbd Gearbox Cooling By-pass Valve

Main Engines - Seawater Inlet Closing Valves

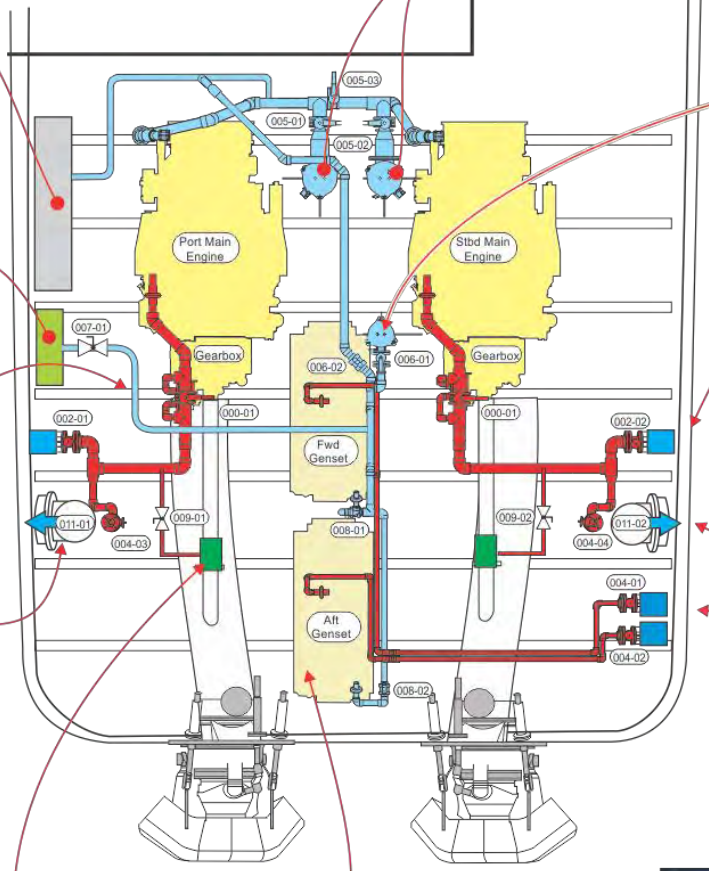
Main Engines - Seawater Inlet and Strainers

Bilge Module

Water Maker

Gear Box Cooling Water By-pass Valve

Port Main Engine Exhaust Injector



Generator - Seawater Inlet and Strainers

Main Engine Cooling Water OB Valve

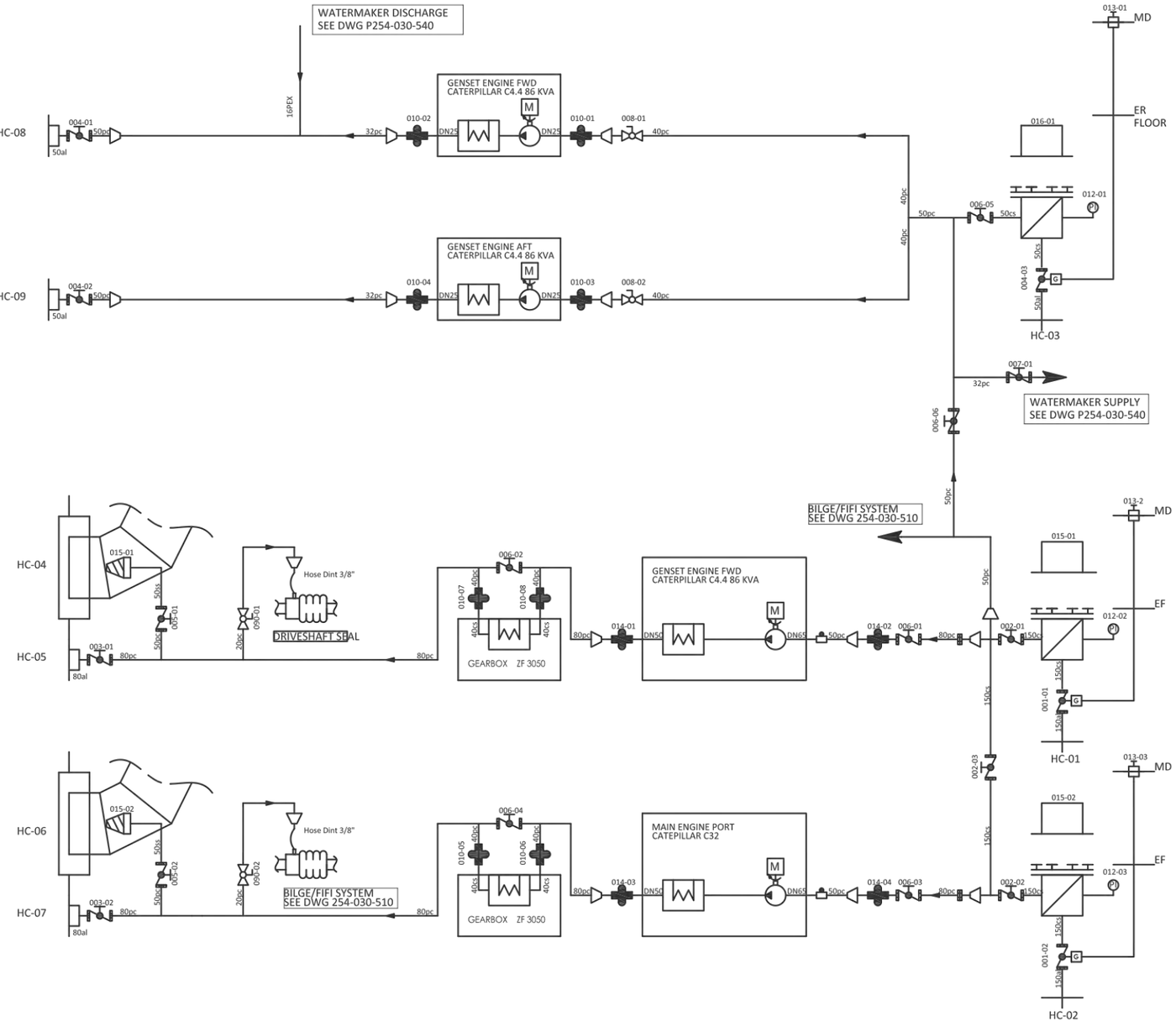
Stbd Main Engine Exhaust Spray

Generator Cooling Water OB Valves

Shaft Seals

Fore and Aft Generator Heat Exchangers

Figure 5-15: Cooling Water Equipment Location Diagram



PIPE	DESCRIPTION	MATERIAL	NOTE
150al	168.3 x 9.5, SEAMLESS	AL5083	GIZOM
50al	60.3 x 5.5, SEAMLESS	AL5083	GIZOM
150cs	168.3 x 5.0, SEAMLESS	St37.4	GALVANIZED AFTER WELDMENT
65cs	76.1 x 3.6 SEAMLESS	St37.4	GALVANIZED AFTER WELDMENT
50cs	60.3 x 5.0, SEAMLESS.	St37.4	GALVANIZED AFTER WELDMENT
50ss	60.3 x 9.0, SEAMLESS.	SMO254	GALVANIZED AFTER WELDMENT
100pc	110 x 8.2, PN16	PVC-C	GF / FIP
80pc	90 x 6.7, PN16	PVC-C	GF / FIP
50pc	63 x 4.7, PN16	PVC-C	GF / FIP
40pc	50 x 3.7, PN16	PVC-C	GF / FIP
32pc	40 x 3.0, PN16	PVC-C	GF / FIP
20pc	25 x 1.9, PN16	PVC-C	GF / FIP

REV	CHANGES
A	INITIAL RELEASE
B	BOM QTY'S CORRECTED
C	PIPE ROUTES CORRECTED
D	GEARBOX COOLING ROUTE CORRECTED
E	MAIN CONNECTION LINE ADDED

No.	QTY	PART	TYPE	MATERIAL	MAKE	DESCRIPTION
016	01	SERVICE TUBE	DN200	AL5083	-	STRAINER SERVICE TUBE, 400mm LONG, AS PER DWG P249-533-070
015	02	SERVICE TUBE	DN250	AL5083	-	STRAINER SERVICE TUBE, 400mm LONG, AS PER DWG P249-531-070
014	02	RUBBER BELOW	ID: 82.0	EPDM	RUBBER DESIGN	
013	03	REMOTE VALVE HANDLE	-	-	-	LOCATED ON STB AFT MAIN DECK
012	03	PRESSURE INDICATOR	G1/4B	S/S 316	WIKA	213.53 NS60, GAUGE SUCTION, WETTED DIAL, LOWER MOUNT
011	02	SPRAY NOZZLE	DN50	S/S 316	BETE	TF64FCN, FULL CONE, 90DEG, NPT 1- 1/2"""""
010	08	RUBBER BELLOW	ID 32.0	EPDM	RUBBER DESIGN	PART NO. KV032.0G1000, DOUBLE POWER CLAMP SS316
009	02	VALVE, BALL	DN25	PVC-C	GF / FIP	VXIC, PLAIN
008	02	VALVE, BALL	DN40	PVC-C	GF / FIP	VXIC, PLAIN
007	01	VALVE, BUTTERFLY	DN32 PN16	PVC-C	GF / FIP	FKOC/LM, PLAIN, WITH LEVER
006	06	VALVE, BUTTERFLY	DN50, PN16	PVC-C	GF / FIP	FKOC/LM, PLAIN, WITH LEVER
005	02	VALVE, BUTTERFLY	DN100, PN16	PVC-C	GF / FIP	FKOC/LM, PLAIN, WITH LEVER
004	03	VALVE, BUTTERFLY	DN50, PN16	CAST IRON	ECONOSTO	FIG.4621, ALU-BRONZE DISC, NBR LINING, WITH LEVER, INCLUDE CERTIFICATE
003	02	VALVE, BUTTERFLY	DN50, PN16	CAST IRON	ECONOSTO	FIG.4623, ALU-BRONZE DISC, NBR LINING, WITH CAST IRON GEARBOX, INCLUDE CERTIFICATE
002	03	VALVE, BUTTERFLY	DN80, PN16	CAST IRON	ECONOSTO	FIG.4621, ALU-BRONZE DISC, NBR LINING, WITH LEVER, INCLUDE CERTIFICATE
001	02	VALVE, BUTTERFLY	DN150, PN16	CAST IRON	ECONOSTO	FIG.4623, ALU-BRONZE DISC, NBR LINING, WITH CAST IRON GEARBOX, INCLUDE CERTIFICATE

RAW WATER FLOW	
RAW WATER PUMP (PER UNIT)	
MAIN ENGINE - @ 2250 RPM	1050 L/min
GENERATOR SET - @ 1500 RPM	86 L/min
FIFI SYSTEM PUMP	~ 300 L/min
HVAC RAW WATER PUMP	~ 210 L/min
HVAC FRESH WATER PUMP	~ 130 L/min

ABBREVIATIONS	
G	GEARBOX
HC	HULL CONNECTION
MD	MAIN DECK

Figure 5-16: Block Diagram Raw Water System (drawing P254-030-530-A)

540 Sanitary Systems

System Overview

The vessel is provided two fresh water tanks one on the portside between frames 13 – 16 and the other on the starboard side between frames 16 – 18. Two ablution facilities are located on the lower deck between frames 18 and 20vc on the stbd and 13 and 16 on the port side. Each ablution contains a wash hand basin, shower and WC. A third ablution is located in the cross corridor adjacent to the wheelhouse on the main deck and is fitted with a basin and WC. In addition there is a basin located in the engine room, a double sink in the galley and a cold water supply to a washing machine located in the laundry room. Hot and cold water is provided to all basins, the sink and showers with the exception of the engine room which is only supplied with cold water.

The WCs are fitted with a high pressure freshwater flushing system. In addition the freshwater system provides for a window wash/spray system in the wheelhouse. A reverse osmosis water-maker is fitted in the engine room. Hot water is provided from a 150l hot water cylinder located in the fwd. machinery space on the main deck.

Fresh, grey and black water tanks are incorporated into the hull construction below the lower deck.

Fresh water filter/UV sterilization and twin pumping and system pressurisation units are located in the port aft machinery space behind the ablution room between frames 13 and 14. Black water pumping modules are allocated in the port forward. machinery space and accessed through the store room adjacent to the laundry between frames 19 and 20.

The following descriptions should be read with reference to the Sanitary System block diagram (see Figure 5-22 on page 5-45). Sanitary system equipment location is shown in Figure 5-21 on page 5-43.

Freshwater System

Freshwater Tanks

Tank location is shown in Figure 1-2 on page 1-5 and Tank Vents and Filling Points in Figure 1-3 on page 1-6.

The two freshwater tanks are fitted against hull construction and are located between frames 14 and 16 on the portside and 16 – 18 on the starboard. The tanks each have a capacity of 1800 litres. Tank filling and vent points are located on the port main deck.

The tanks are fitted with level switches (032-01 & 02) and level senders (033-01 & 02) with corresponding wheelhouse PLC displays of level alarms (035-01 & 02) and level indicators (034-01 & 02). Access to the port tank and switches is via the aft machinery space behind the aft ablution. Access the starboard tank through the storage cupboard in the stairwell.

Reverse Osmosis Water Maker

A water maker (Aquamarine ROSW-2540-2) reverse osmosis type producing 200L/h is located on the port side of the engine room between frames 4 and 5. The water maker derives its water supply from the generator cooling water strainer and feeds fresh water into the fresh water port tank. The unit comprises a feed booster pump, pre filtration cartridges (20 micron and 5 micron), low and high pressure switches, high pressure piston pump, two (2) FRP pressure vessels, two (2) filmtec SW30-2540 reverse osmosis membranes and all the necessary low pressure PVC pipe work.

The brine residue from the water maker is discharged into the generator raw water discharge. A freshwater connection from the engine room wash basin system allows for automatic freshwater flushing of the complete system on shutdown. This reduces membrane fouling and will enhance membrane performance.

Daily Maintenance

a. Check piping and filter vessels for leaks

b. Check the condition of the pre filter cartridges and replace if dirty

c. Read pressure gauges and compare readings with previous readings

d. Check the motor and high pressure pump for heat, vibration, excessive noise and damage

e. Check if the motor ventilation system is free from dirt

NOTE: On new installations the crankcase oil in the high pressure pump has to be changed after the first 50 hours and then after every 500 hours.

Pre- Filters

As filter becomes clogged, the flow through the filters is restricted. If the flow is allowed to become to restrict then the high pressure pump will become starved of water. When the high pressure pump is starved of water it cavitates or runs dry in extreme cases. Cavitation can cause loss of pressure or internal damage to the pump.

The high pressure pump can only run dry for a maximum of 30 seconds after which the heat generated by the ceramic pistons burns out the internal seals and can damage the pistons.

NOTE: Do not attempt to prolong the running of the unit with dirty filter cartridges, it is false economy.

Do's and Don'ts

Do not attempt to wash and re-use disposable filter cartridges unless they are specifically sold as washable cartridges.

Do not run the unit in dirty harbours or close to the shore line where there is a visible deterioration in the water quality, be aware of floating oil or plankton blooms, all of which can block the filters very quickly.

Do not run the unit in fresh water estuaries or areas of low salinity. This will ruin the membrane. If the unit must be used in areas of low salinity, increase the back pressure regulating valve only to the point where the unit is producing the same flow rate as it was in the open sea conditions.

Daily record the product water flow rate. When the flow at the same pressure drops by more than 10% the membranes will require to be cleaned.

Documentation

Table 5-8: Water Maker Documentation

Item	Description	Part Number	Remarks
1.	Reverse Osmosis Plant Operation and Maintenance Manual	Nautic Africa_J120010_Manual_00.doc	

Freshwater Supply

A UV filter/strainer (006-01) and twin pumping module (001-01 &02) fitted with two pressure accumulators (007-01 & 02) are positioned in the mid. machinery space located behind the aft ablution room on the port side between frames 14 and 16. The black water pump (002-01) and hand pump (003-01) are located in machinery space behind the forward ablution room wall between frames 19 and 20. Access to these areas is via drop-down removable wall panels at the rear of each compartment.

Freshwater is drawn from both water tanks by the pump unit before passing through the double strainer and the ultraviolet filter. The pumping module is fitted with two pumps and pressure accumulators. The water system is arranges such that either pump can draw water from a single tank or both tanks simultaneously.

The system is pressurized by the two accumulators (main and standby units). A drop in the system pressure is sensed by a pressure switch (038-01) which initiates the pump operation. The pumps will start when the line pressure falls to below 3.6 bar and shut down when the pressure reaches 4 bar. After passing through the filter/UV sterilizer the freshwater is provided first to the toilet flushing system before filling the hot water cylinder, located in the forward machinery space on the main deck, and supplying the rest of the cold water system. An isolating valve (012-10) and a pressure relief valve (009-01) adjacent to the hot water cylinder separate the flushing water portion of the system from the remainder. The exception is the cold water supply to the engine room basin and two freshwater taps on the main deck located fwd. of the wheelhouse and on the aft side of the port engine room dorade which are fed from the flushing system.

An 18mm take off provides freshwater to the six wheelhouse windows wash sprays. A normally closed (NC) solenoid valve (020-01) is fitted in the line and is operated from the wheelhouse to supply the sprays.

A 150 litre pressurized hot water cylinder is located in the machinery space on the main deck forward of the wheelhouse. Hot water is provides to all basins, showers and the galley sink with the exception of the laundry and the engine room. A drip tray is installed beneath the HW cylinder.

Localized isolation valves are fitted to all taps with self closing FJ2.001 Junior Flush Master valves fitted for the toilets.

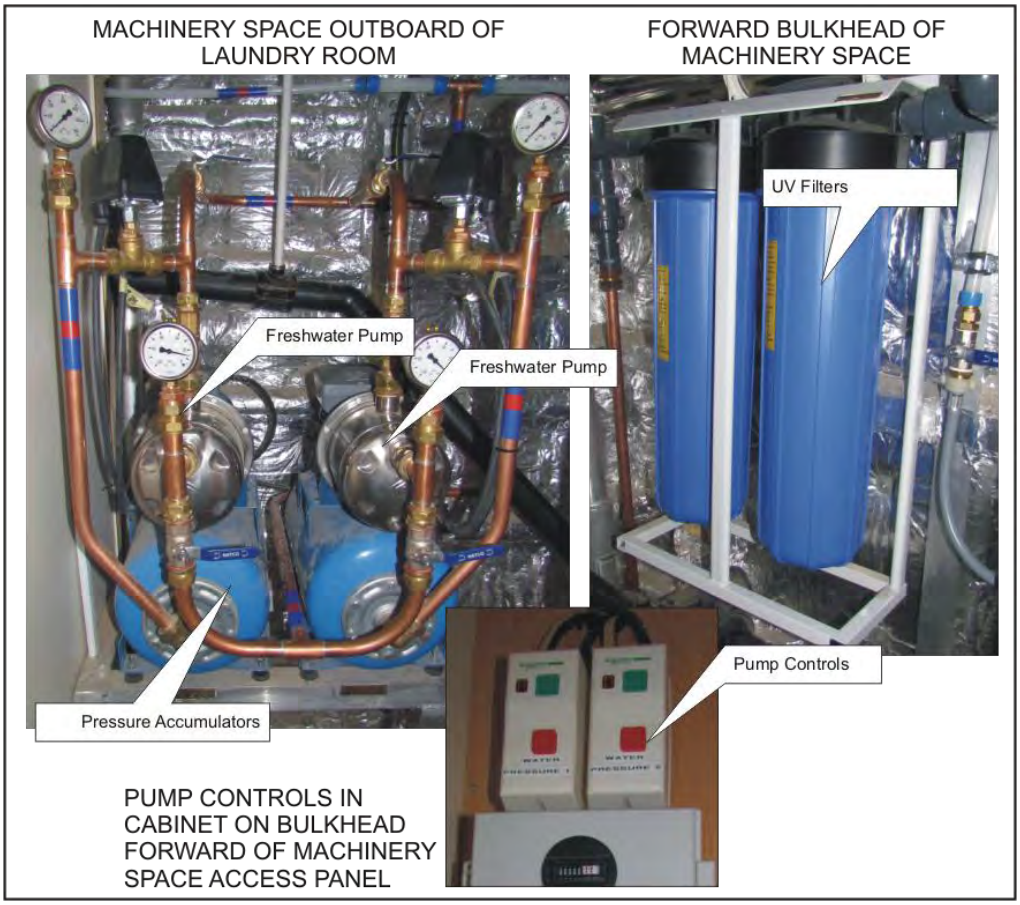


Figure 5-17: Freshwater System Equipment Space

Figure 5-18: Hot Water Cylinder

Specifications

Fresh Water Pump - FORAS – JXM 120/5 close coupled, self priming pump delivering 3m3 / hour @ 3.5 Bar. The pump is driven by a 2 pole 380V 3 ph 50Hx electric motor

Wastewater

Brief Description

Tank location is shown in Figure 1-2 on page 1-5 and Tank Vents and Filling/Discharge Points in Figure 1-3 on page 1-6.

A 2200 litre black water tank is located between frames 19 and 21 and is incorporated beneath the lower deck construction. Two 20 litre grey water tanks are attached fwd and aft of the black water tank. The grey water tanks are fitted with an internal vertical baffle closed at the top and open at the bottom creating a water trap between the grey and black tanks. A third 40L tank for both grey and black water is located within the hull construction and lies aft of the fwd. fuel tanks. This tank collects grey water from the port ablution shower and basin and condensate drainage from the captain's, the engineer's and six man cabins as well as black water from the port toilet. Grey water from the galley drains to the aft 20L grey water tank attached to the main black water tank. Condensate from the mess AC unit also feed to this tank. The drain from the galley sink passes through a grease trap which must be cleaned at regular intervals.

The default black water discharge is from the single sump using the black water pump and discharging into the black water tank. This operation is initiated by a level switch in the sump.

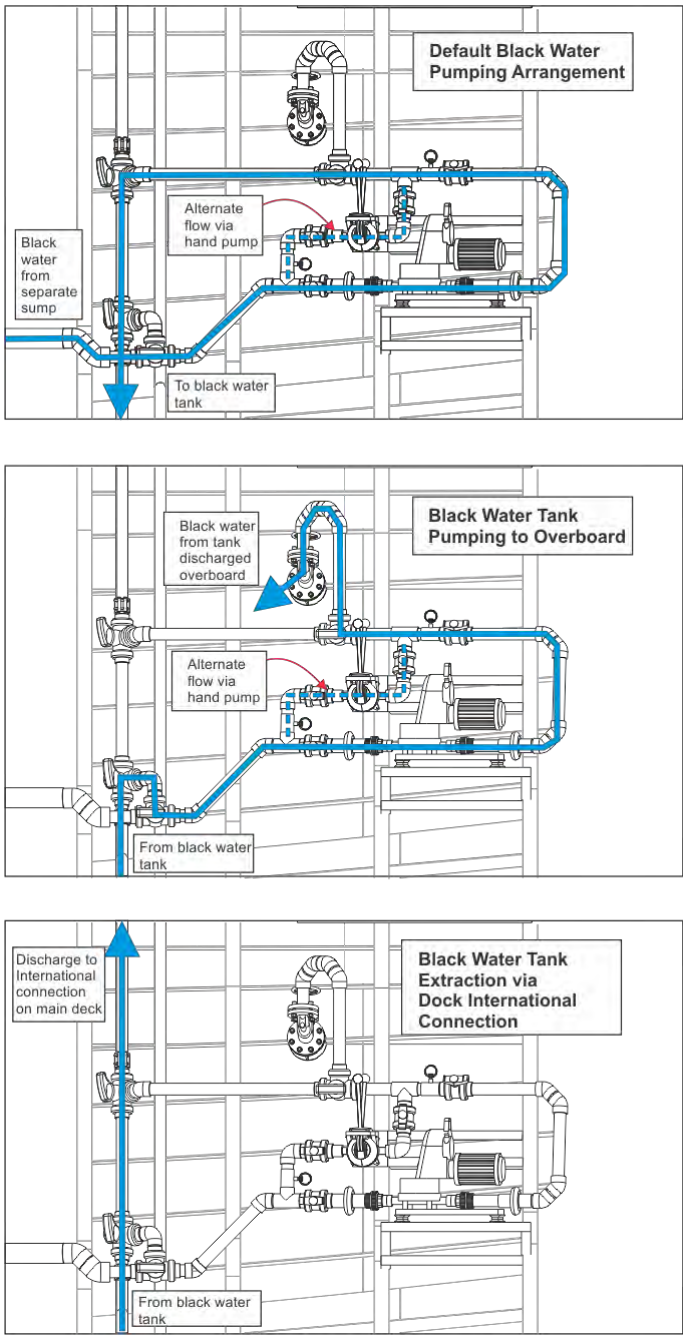


Figure 5-19: Black Water Discharge Routes

Normally the emptying of the black water tank is carried out using the harbour pumping facilities via an IMO flange (023-01) located on the port side of the main deck between frames 18 and 19. The black water can also be pumped overboard via a certified butterfly valve (009-01) or to the harbour facility by a wastewater pump and back-up hand pump located in the port machinery space next to the fresh water pumps.

The black water tank is fitted with level sender (025-03) and a high level switch (023-01) providing high level alarm (027-03) and level indication (026-03) to the PLC alarm system. Alarms and levels are displayed on all of the 4 Alarm Panels. The levels and alarms are displayed on all of the vessel's four alarm panels (see Figure 5-9 on page 5-17). See Instrumentation and Alarms on page 3-20 for information on the key sequence required to display the levels and the alarm system.

Two access panels for tank maintenance are located in the lower deck between frames 19 and 21. A tank breather pipe is positioned adjacent to the tank discharge flange on the port main deck.

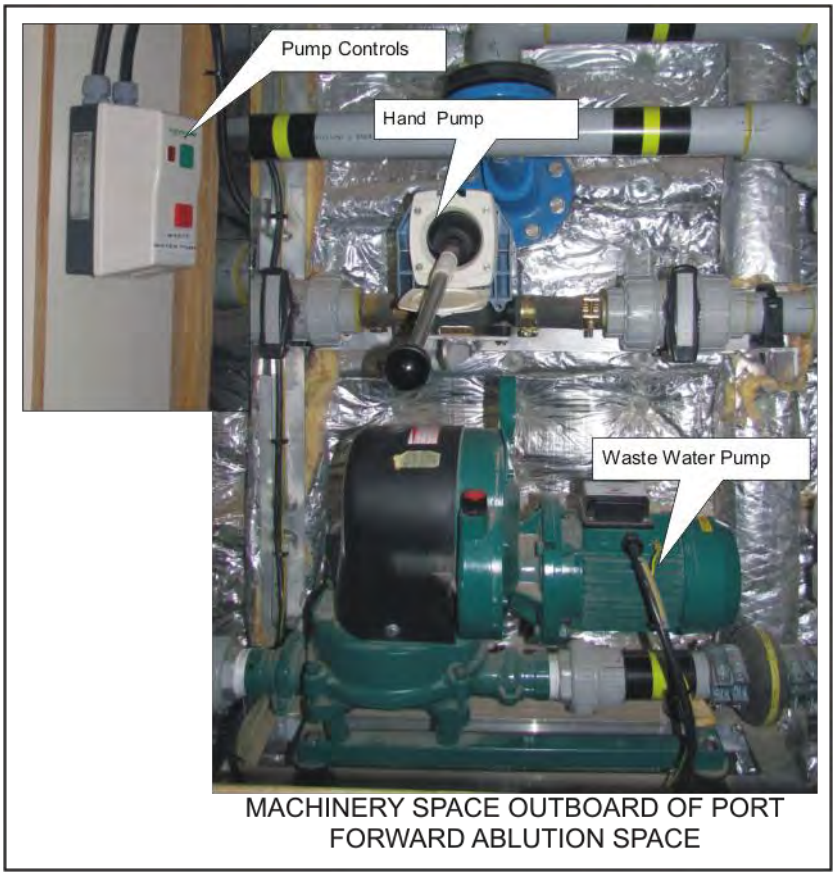


Figure 5-20: Black Water Pump Installation

Black Water Discharge Overboard

1. Ensure black water pump suction valve from the tank is open.
2. Ensure discharge valve to the upper deck is **CLOSED**.
3. Start pump for normal operation.
4. On completion of discharge, ensure pump is switched OFF, and that all valves are returned to original positions.

Specifications

Wastewater Pump – CAFFINI – Supermicrolib 2" self priming, neoprene diaphragm capable of delivering 5.5m3 / hour @ 0.5 bar. The pump is driven by a 400V AC 50 Hz electric motor. The electrical supply is via CB Q23 on MSB-001.

Wastewater Hand Pump – WHALE – Gusher Titan hand diaphragm pump delivering 76 l/min (60 strokes / min) with a lift of 2m

Documentation

Table 5-9: Sanitary System Documentation

Item	Description	Part Number	Remarks
1.	Date Sheet and Spare Parts Caffini Microlib Diaphragm Pump	C6163	Manual Starts on Page 184 of PDF
2.	Whale Gusher Titan Bilge Pumps	Ref 180.15 V3/00	Manual Starts on Page 166 of PDF
3.	Operating Instructions Wonder Series EB and UB Ultraviolet Water Sterilizer	Series EB & UB	
4.	Aquamarine Water Maker		Single page brochure

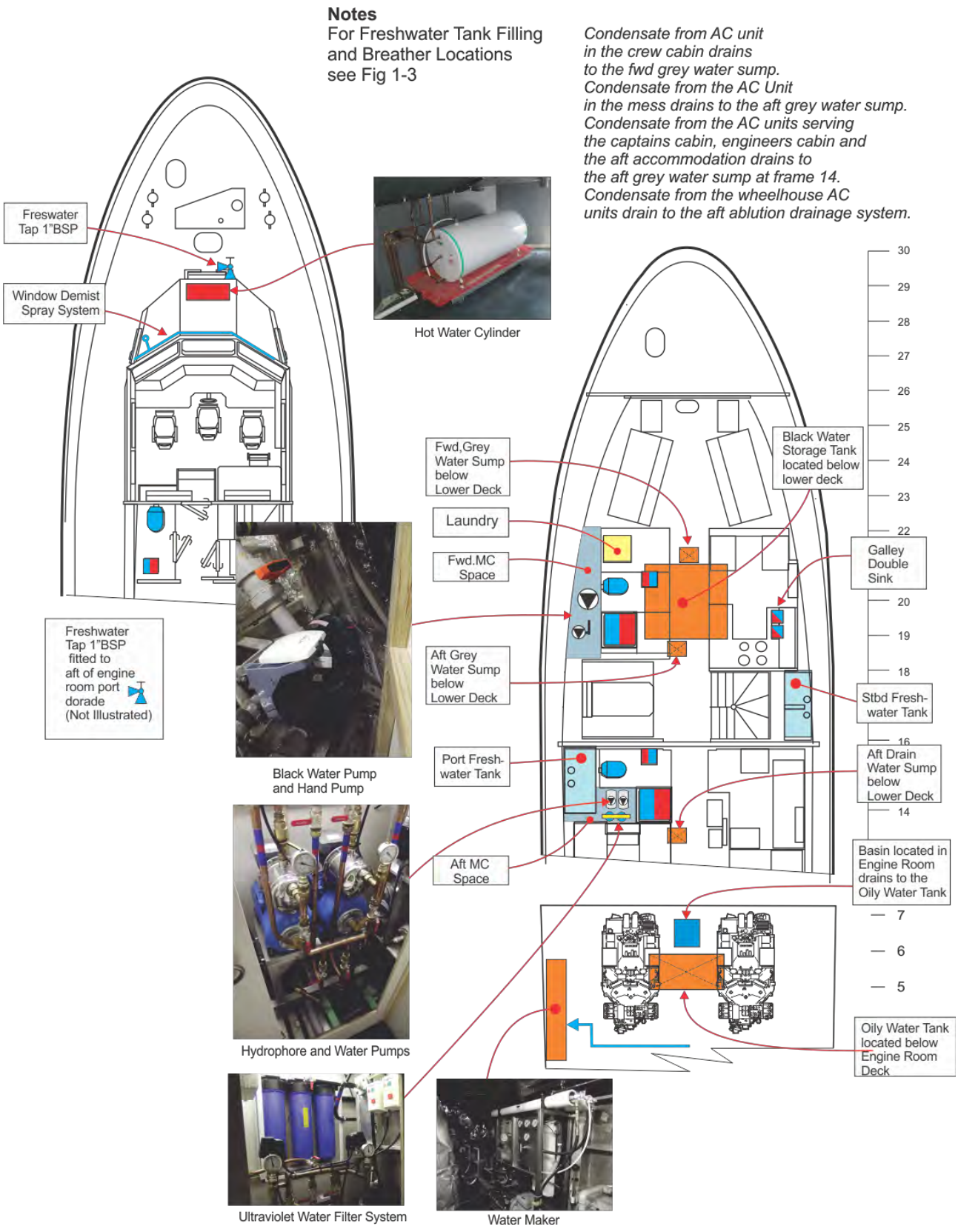
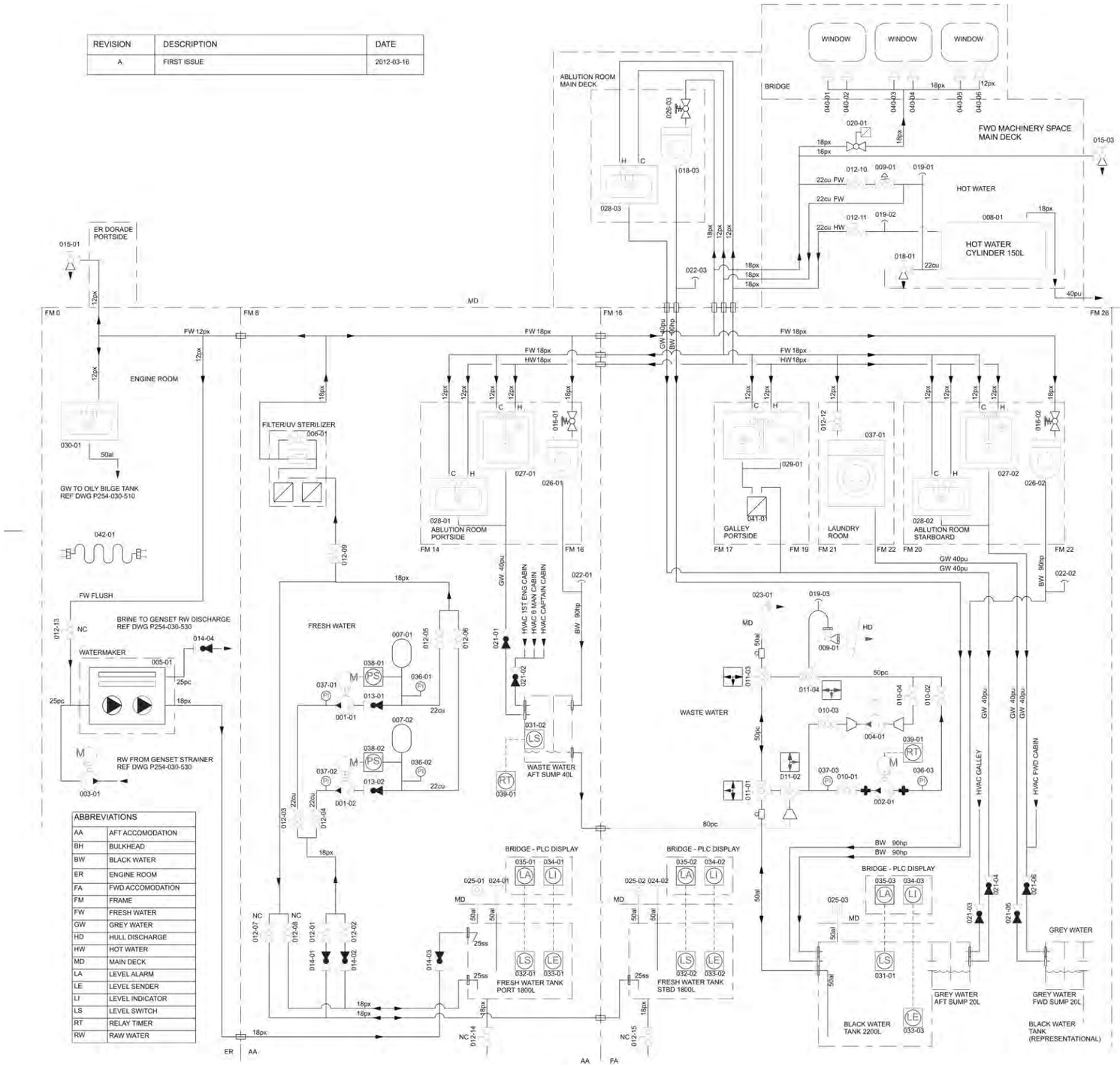


Figure 5-21: Sanitary System Equipment Location



PIPE	DESCRIPTION	MATERIAL	COMMENT
50al	60.3 x 4.8. SEAMLESS	AL5083	GIZOM
25ss	31.8 x 3.2, PRECISION	SS316	
90hp	90 x 3.5	HDPE	GEBERIT
40pu	40 x 3.5	PVC-U	GEBERIT
80pc	90 x 6.7, 900kPa	PVC-C	FIP/GF
50pc	63 x 4.7, 900kPa	PVC-C	FIP/GF
25pc	32 x 2.4, 900kPa	PVC-C	FIP/GF
22cu	22 x 0.9, 2MPa	Cu	
18px	25 x 3.5, PN10	Pex-Al-Pex	COMPOSITE
12px	16 x 2.2, PN10	Pex-Al-Pex	COMPOSITE

042	01	FLEXIBLE HOSE WATER	-	-	3/4"
	ea.		-	GARDENA	
041	01	GREASE TRAP	-	-	-
	ea.		SS316	-	-
040	06	WASHER NOZZLE	-	-	-
	ea.		-	-	-
039	01	RELAY TIMER	-	-	-
	ea.		-	-	-
038	02	PRESSURE SWITCH	PM/5	-	MBR MEMBRANE - PORT FEMALE G1/4F - SHUT-OFF 4.0bar - START-UP 3.6bar - 220/1/50
	ea.		St GALV	ITALTECNICA	
037	03	SUCTION INDICATOR	213.53.NS60.S	-	GAUGE SUCTION - WETTED DIAL - LOWER MOUNT - PORT MALE G1/4B
	ea.		SS316	WIKA	
036	03	PRESSURE INDICATOR	213.53.NS60.P	-	GAUGE PRESSURE - WETTED DIAL - LOWER MOUNT - PORT MALE G1/4B
	ea.		SS316	WIKA	
035	04	LEVEL ALARM	-	-	PLC INPUT - LED & AUDIO
	ea.		-	-	
034	03	LEVEL INDICATOR	-	-	PLC INPUT
	ea.		-	-	
033	03	LEVEL SENDER	ATM/N2	-	PRESSURE TRANSMITTER - 24VDC 4-20 mA - 24mm PLAIN CONNECTION
	ea.		-	STS	
032	02	LEVEL SWITCH	0035/2	-	ULTRASONIC SENSOR - 24VDC 4-20 mA
	ea.		PPS	MOBREY	
031	02	LEVEL SWITCH	M-SWITCH	-	FLOAT TYPE, A FLANGE
	ea.		SS316	MOBREY	
030	01	BASIN SET - OILY BILGE	-	P253-505-014	BASIN AS PER DWG - HOSE BIB TAP COBRA 106-20 - G3/4" MALE CONNECTION
	ea.		-	-	
029	01	GALLEY SINK SET	-	-	SINK SS310 - SINGLE BOWL - 40mm DRAIN - MIXER SET COBRA 206 - HOT & COLD - 1/2"
	ea.		-	-	
028	03	BASIN SET	-	-	BASIN VAAL 7030 - 40mm DRAIN - PILLAR TAP COBRA 111-15 - HOT & COLD - 1/2"
	ea.		-	-	
027	02	SHOWER SET	-	-	GRP TRAY 800 x 800mm 40mm DRAIN - SHOWER SET COBRA 431 1/2" CONNECTIONS
	ea.		-	-	
026	03	TOILET - EUROPEAN	VAAL 750100	-	AFSAN LOW LEVEL PAN - 90 deg OUTLET - 110mm
	ea.		CERAMIC	VAAL	
025	03	PIPE HEAD - BREATHER	-	P253-505-005	DN 50 - WITH WINTEB 2000 BREATHER HEAD - SMALL FLANGE
	ea.		SS316	PBA ENGINEERING	
024	02	PIPE HEAD - FILLER	-	P253-505-006	DN50 - BRASS CAP GZ" - WITH CHAIN
	ea.		SS316	PBA ENGINEERING	
023	01	PIPE HEAD - DISCHARGE	-	P253-505-009	MARPOL FLANGE DN50 - BLACK WATER
	ea.		SS316	PBA ENGINEERING	
022	03	VACUUM BREAKER	-	-	40mm PLAIN CONNECTION
	ea.		PVC-C	-	GEBERIT
021	06	VALVE - ONE WAY	HEPVO 40	-	SELF SEALING - 40mm COMRESSION SOCKET
	ea.		PVC-U	HEPVO	
020	01	VALVE - SOLENOID	BURKERT 5282	-	2/2 WAY - SERVO DIAPHRAGM - PORTS G1" NORMALLY CLOSED - 24VDC - 0 2-10.bar
	ea.		BRASS	BURKERT	
019	03	VACUUM BREAKER	COBRA PB6.303	-	DOUBLE JUMPER - 22mm CONNEX
	ea.		BRASS	COBRA	
018	01	VALVE - DRAINCOCK	COBRA 550-22	-	SPANNER CONTROL - 22mm CONNEX
	ea.		BRASS	COBRA	
017	01	VALVE - PRESSURE CONTROL	COBRA PA4.332	-	400 kPa SYSTEM PRESSURE - 22mm CONNEX
	ea.		BRASS	COBRA	
016	03	VALVE - SELF CLOSING	COBRA FJ2.000	-	JUNIOR FLUSHMASTER - EXPOSED TYPE - G3/4" FEMALE CONNECTION
	ea.		BRASS	COBRA	
015	02	VALVE - TAP	COBRA 106-20	-	HOSE BIB TAP - G3/4" MALE CONNECTION
	ea.		BRASS	COBRA	
014	04	VALVE - NON-RETURN	COBRA 1022-20	-	SWING CHECK - G3/4" FEMALE CONNECTION
	ea.		BRASS	COBRA	
013	02	VALVE - NON-RETURN	COBRA 1025-20	-	SPRING CHECK - G3/4" FEMALE CONNECTION
	ea.		BRASS	COBRA	
012	15	VALVE - BALL	COBRA 1090-20	-	G3/4" FEMALE CONNECTION - STEEL LEVER.
	ea.		BRASS	COBRA	
011	04	VALVE - BALL 3-WAY	TKIC 63	-	DN50 - T BORE - PLAIN CONNECTION
	ea.		PVC-C	GF / FIP	
010	04	VALVE - BALL	VXIC 63	-	DN50 - PLAIN CONNECTION
	ea.		PVC-C	GF / FIP	
009	01	VALVE - STORM	ECON FIG.1207	-	DN50 - SWING CHECK - LOCKING - DN65 FLANGE - WITH CLASS CERTIFICATE
	ea.		CAST IRON	ECONOSTO	
008	01	HOT WATER CYLINDER	KOMPAKT 150 LITRE	-	PEX LINING - 150L - 400kPa - 220/1/50 - WITH DRIP TRAY
	ea.		St GALV	DURATHERM	
007	02	PRESSURE ACCUMULATOR	INTERVAREM 6201936BP	-	HORIZONTAL - BUTYL MEMBRANE - PORT G1" DRAWDOWN 10 L @ 3.6 bar
	ea.		St	VAREM	
006	01	FILTER - STERILIZER	EB - 20	-	UV STERILIZER - PORTS G1-1/2" - 220/1/50 - SLIMLINE FILTERS - 1x 20 um - 1x 5um
	ea.		SS316	AQUAMARINE	
005	01	WATERMAKER	CLASSIC ROSW-2540- 2	-	REVERSE OSMOSIS - FRESH WATER 150 L/h - HP PUMP GP WM4215CL - 1.5 KW 220/1/50
	ea.			AQUAMARINE	
004	01	PUMP HAND DRIVEN	GUSHER 30	-	PORTS 2" - NITRILE DIAPHRAGM - 76 L/min - 2m @60 st/min -
	ea.		AL LM6	WHALE	
003	01	PUMP SET ELECTRICAL	PKS-60	-	CLOSE-COUPLED - SELF PRIMING - G1" - 1.4 m3/hr @ 2.0 bar - 0.37kW 2 POLE 220/1/50
	ea.		CAST IRON	PEDROLLO	
002	01	PUMP SET ELECTRICAL	SUPERMICROLIB 2"	-	CLOSE-COUPLED - NEOPRENE DIAPHRAGM - G2"- 5.5 m3/hr @ 0.5 bar - 1.1kW 2 POLE 380/3/50
	ea.		SS304	5012-0002 CAFFINI	
001	02	PUMP SET ELECTRICAL	JXM 125/5	-	CLOSE-COUPLED - SELF PRIMING - G1" - 3 m3/hr @3.5 bar - 0.85KW 2 POLE 380/3/50
	ea.		SS304	5012-0003 FONAS	
ITEM No.	QTY	CLASS	TYPE	DRAWING No.	DESCRIPTION
	UNIT		MATERIAL / ITEM CODE	MAKE	

Figure 5-22: Block Diagram Sanitary System (Drawing P254-030-540-A)

560 HVAC and Ventilation System

System Overview

The air-conditioning of the vessel is designed as a split refrigerant cooled system comprising a number of air cooled condensers on the main and upper deck providing refrigerant to ceiling mounted independent AC units positioned throughout the vessel.

Fresh air is ducted to the conditioned spaces with in-line duct fans drawing air from a number of closable air heads. Over pressure air from accommodation spaces passes through door grilles to the corridors and is mechanically extracted via the galley cooker hood, the ablutions and the laundry.

The forepeak and fwd. machinery space (housing the hot water cylinder) have independent supply and extract ventilation systems.

Two axial fans on the port side of the vessel provide cross ventilation to the engine room with sufficient capacity to meet the fresh air requirements of the all the engines as well as ventilating the engine room. Over pressure air is force out of on the starboard side at main deck level.

Wheelhouse windows are fitted with a separate demisters system drawing air via Winteb and inline axial fan. The Winteb is mounted on the wheelhouse roof.

System Operation

Air Conditioning

The vessel is fitted with 4 Daikin single split systems and 3 Daiken multi split systems. The air cooled condensers are located on the main deck aft of the saloon (superstructure technical space) and two units on the upper deck aft of the wheelhouse. The areas which the condensers serve are identified in Figure 5-23 below.

Served Area	Qty	A/C Unit	Condenser	Capacity (BTUs)	Electrical Supply (SDB-003)
Wheelhouse (starboard)	1	FTXS50J	RXN50K	18000	Q4
Wheelhouse (port)	1	FTXS50J	RXN50K	18000	Q5
Saloon (port)	1	FTXS60G	RXN60K	24000	Q2
Saloon (starboard)	1	FTXS60G	RXN60K	24000	Q3
6 - Man Cabin and Mess	2	FTXS25J & FTXS50J	5MXS90E	30000	Q6
Captain's Cabin and Engineer's Cabin	2	FTXS25J	5MXS90E	24000	Q7
Galley and 4 Man Cabin	2	FTXS50J & FTXS25J	5MXS90E	30000	Q8

The individual air conditioning units are fitted to the walls and are supplied with individual hand held temperature controllers. Their electrical supply is from SDB-003 which is located in the technical space at the aft end of the passenger saloon.

Water condensate from the a/c unit in the fwd. crew cabin drains into the grey water line from the forward ablution space. Condensate from the galley AC unit drains directly to the aft sump on the black water tank. Captain, engineer's and 6-man cabin ac units are coupled together and drain to the aft waste sump. The Mess unit drains to the aft ablution system.

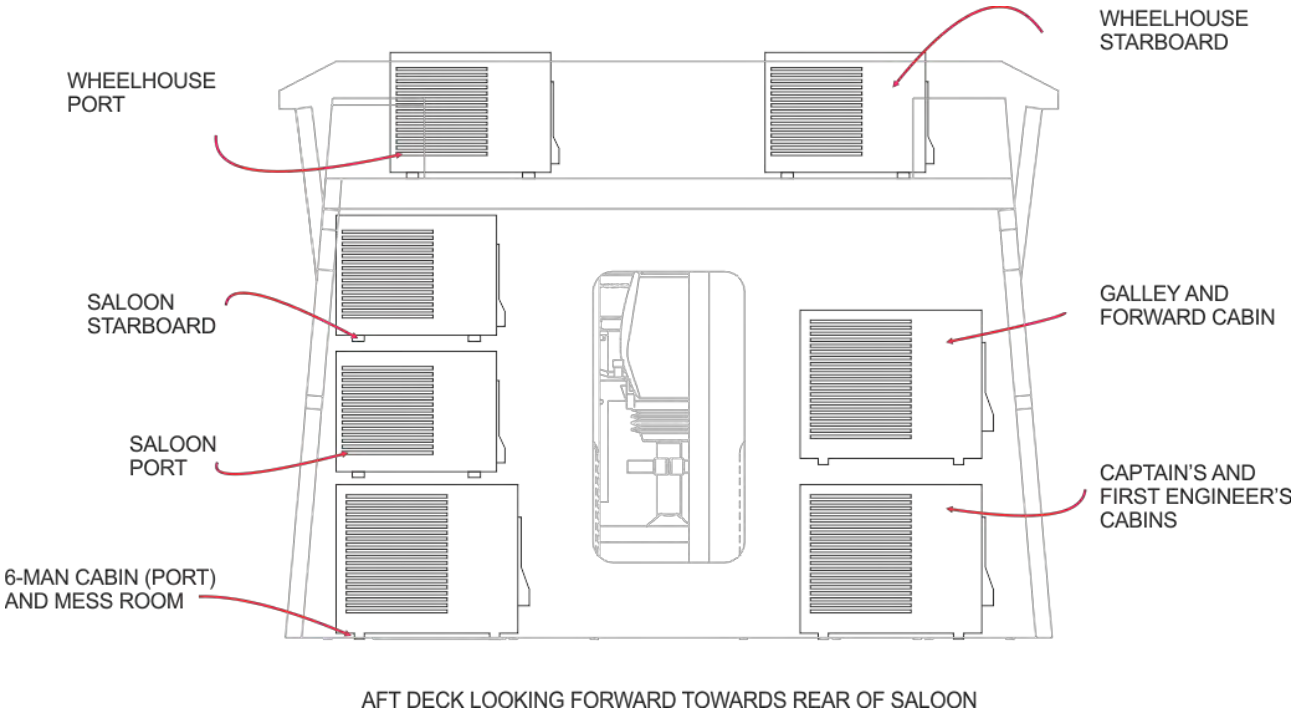


Figure 5-23: A/C Condenser Identification

Ventilation

Fresh air is introduced into the air conditioned spaces as well as the engine room, forepeak and the main deck forward machinery space.

The engine room ventilation consists of two DONKIN (HOWDEN) MAXFLO vane axial fans which are located on the port side of the engine room. The fans draw outside air through louvers and mist eliminators positioned at the main deck level and are rated to supply sufficient air to meet the combustion requirements of the four diesel engines as well as engine room heat dissipation. Over pressure air is forced out of the engine room through an extract air shafts on the inlet starboard side. The discharge shaft opening is fitted with mist eliminators and louvers. The fans supply 5.0 m3/sec of air each at 2850 rpm.

The electrical supply for the fans is from Q4 and Q5 on MDB-001 which is located in the switchboard room on the starboard side (see Figure 3-5 on page 3-30 for location).

In case of fire the fans are shut of automatically by the PLC alarm system (see Instrumentation and Alarms on page 3-20 for further information on the alarm system).

The inlet and exhaust shafts are fitted with fire dampers on the outer face of the intake and discharge louvers which must be manually closed in the event of an engine room fire.

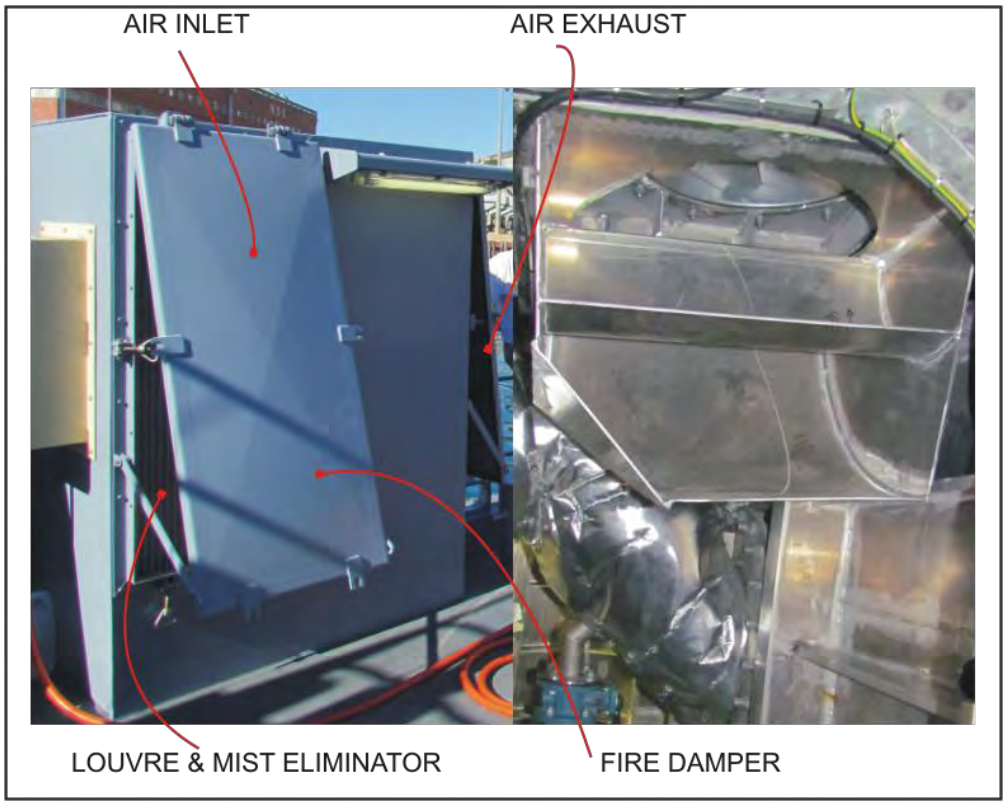


Figure 5-24: Engine Room Ventilation Shaft and Fans

Fresh air is ducted to all occupied areas and is supplied by VORTICE LINEO series mixed flow in-duct axial fans and roof mounted air pipe heads. The fans are arranged for 2 speed operation. Duct work from the air pipe heads to the fan is circular in section with rectangular or round duct section work positioned behind bulkheads and in ceiling spaces. Air enters the conditioned spaces through round ceiling diffusers. The fans can be serviced via means of a double lever closure which allows the fan to be removed without affecting the duct installation or the use of special tools.

Fresh Air Supply

The fresh air supply system is divided in to eight (8) circuits:

Table 5-10: Fresh Air Supply

Area Served		Fans	Type	Air Quantity		Electrical Supply
				Min	Max	
1	Saloon	2	125VO	250	365	Q17 & Q18 DB-AC-002
2	6-man, Engineer and Captain's Cabins	1	100VO	180	255	Q18 DB-AC-001
3	Mess	1	100V0	180	255	Q19 DB-AC-001
4	Galley and 3-man cabin	1	125VO	250	365	Q17 DB-AC-001
5	Wheelhouse	1	100V0	180	255	Q20 DB-AC-002
6	Wheelhouse – De-mister	1	100VO	180	255	Q21 DB-AC-002
7	Forepeak	1	100VO	180	255	Q20 DB-AC-001

Area Served		Fans	Type	Air Quantity		Electrical Supply
				Min	Max	
8	Main Deck Fwd. machinery Space	1	100VO	180	255	DB-AC-002

Over pressure air from all the cabins and the mess spills into the corridor through door grilles from where it is extracted via the corridor, ablution areas, the laundry and the dry stores room.

Extract ducting from the lower deck fwd. ablution, fwd. accommodation corridor, the laundry, 3-man cabin and the dry store are feed to a plenum from where the exhaust air is extracted by toe LINEO 100 VO fans. The plenum and fans are located beneath the wheelhouse flooring and the air is discharged through the port side of the wheelhouse between frames 21 - 22.

Extracts from the mess and the aft ablution as well the lower deck aft corridor are fitted with in-line fans and discharges through an air head pipes on the saloon roof.

As the galley is a fire hazard area it is fitted with its own extract system with air being drawn through the cooker hood and grease filters by a Lineo 200VO fan and discharged on the stbd. side at main deck level between frames 21 – 22.

Over- pressure air from the saloon extracts through the main deck ablution.

The forepeak is ventilated with a separate system and employs a Lineo 100 VO in-duct supply fan and filter drawing in fresh air via a Winteb on the stbd bow between frames 26 and 27. Overpressure air is forced through ducting starting below the forepeak flooring and discharging through a Winteb located on the main deck.

Documentation

Table 5-11: A/C Documentation

Item	Description	Part Number	Remarks
1.	Daikin Industries Air Conditioners Self-Diagnosis Procedure		

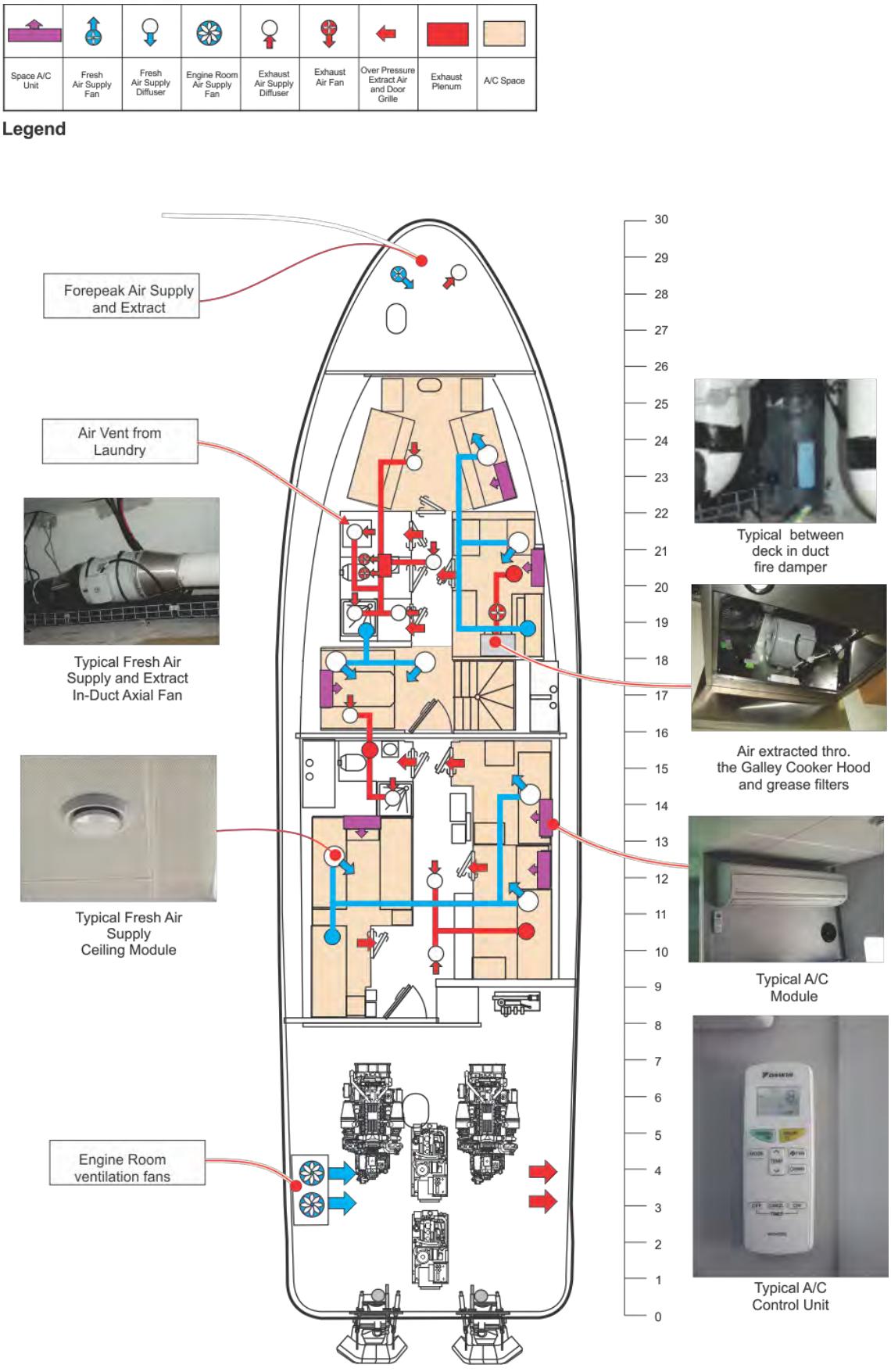


Figure 5-25: A/C and Ventilation Equipment Location Diagram Lower Deck

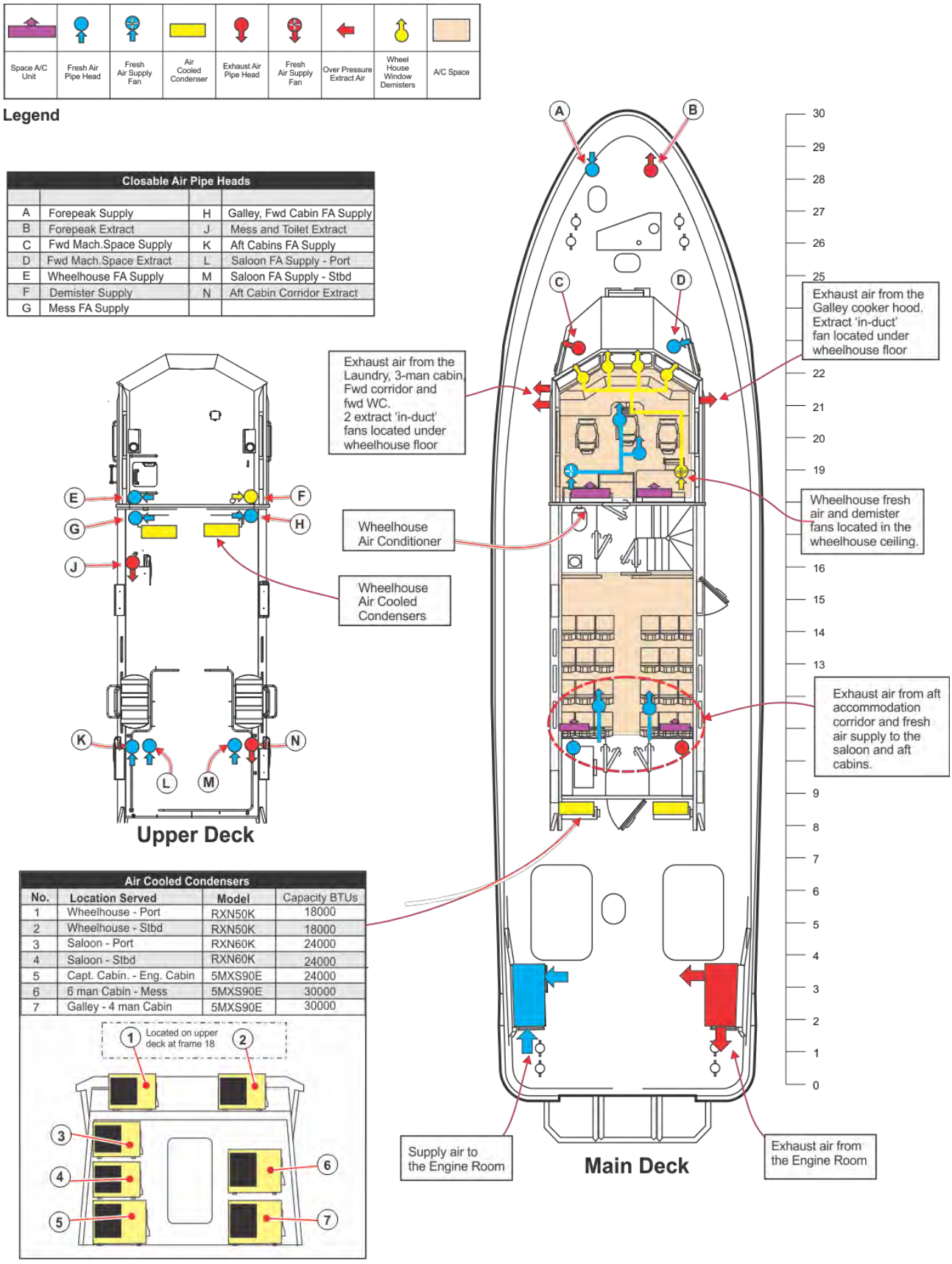


Figure 5-26: A/C and Ventilation Equipment Location Diagram Top Deck

580 Exhaust System

Brief Description

All the engines are fitted with high level thermally insulated duplex stainless steel exhaust systems. Two exhaust pipes from each main engine, one from each turbocharger, enter a single silencer before discharging exhaust fumes overboard. The gensets are fitted with a single exhaust pipe.

All discharge outlets are fitted with goosenecks and non-return flaps. Cooling water sprays are fitted to the main engine at the discharge end of the exhaust ducts for heat and noise reduction. Anti-vibration bellows are installed at the turbocharger outlets and the silencer discharge. The exhaust pipes are suspended from the underside of the main deck by anti-vibration hangers.

The exhaust ducts discharge through the hull at the following positions:

a. Port main engine between frames 2 and 3 port side

b. Forward generator set between frames 1 and 2 starboard

c. Starboard main engine between frames 2 and 3 starboard

d. Starboard generator set between frames 1 and 2 starboard

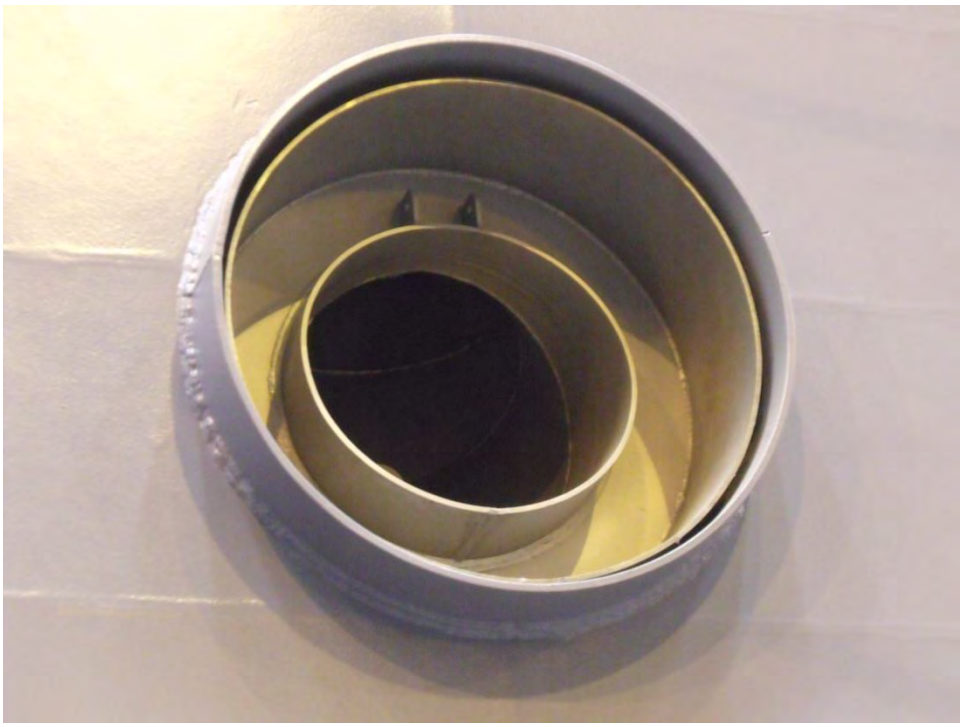


Figure 5-27: Typical Main Engine Exhaust Outlet (Flap removed for clarity)

Equipment Location

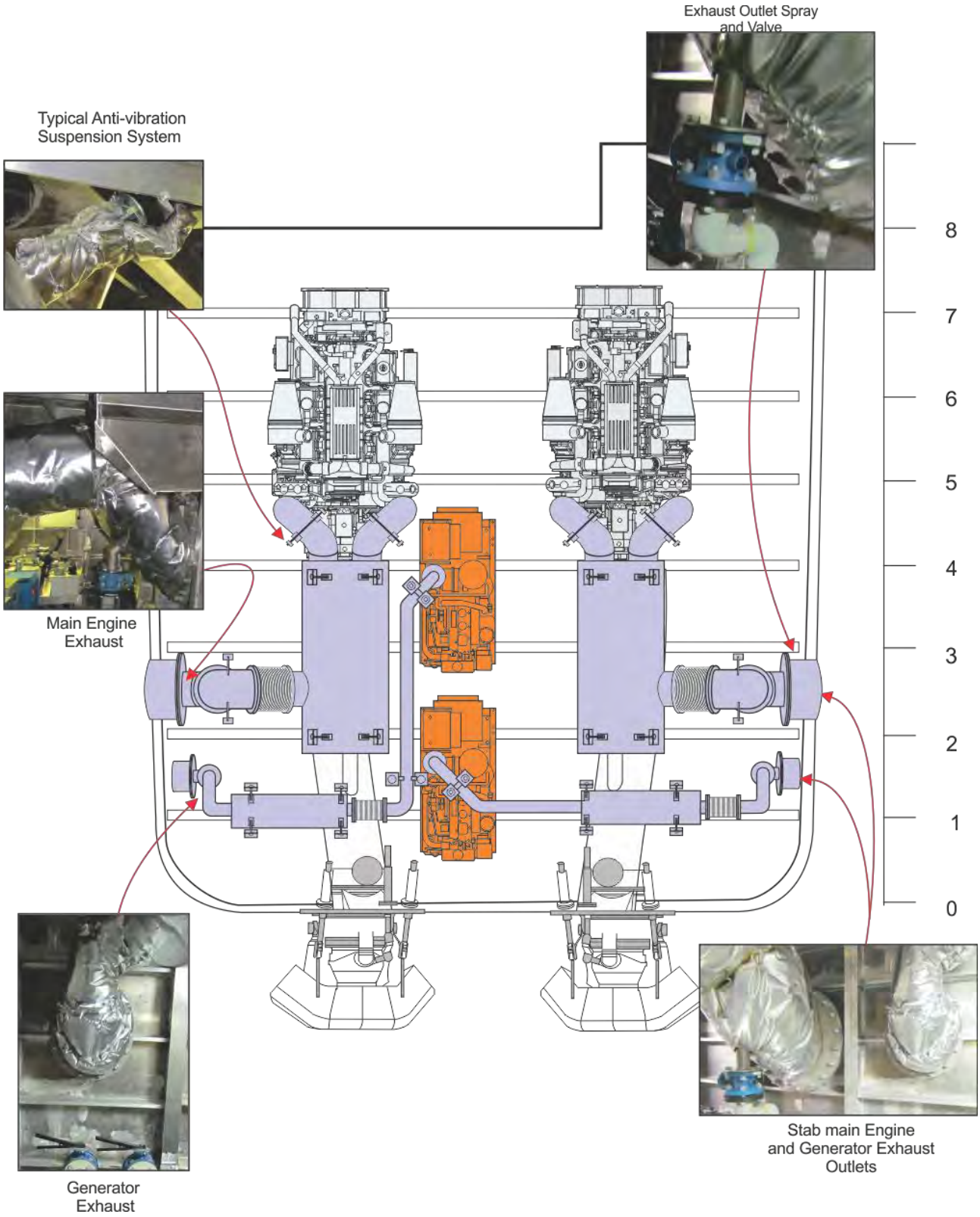


Figure 5-28: Exhaust System Equipment Location Drawing

Chapter 6: Outfitting

Deck Arrangement (610)

Anchor Equipment (611)

The vessel is fitted with one 105 kg HHP (High Holding Power) anchor. The anchor is fitted with 110 metres of 13mm DIN766 Short Link Chain and is operated by the VRC4500 vertical windlass on the ship's foredeck (see below).

Anchor Winch

Brief Description

A Muir VRC4500 Vertical Windlass (AC electric motor variant) is fitted on the foredeck.

The VRC4500 Model Vertical Windlass is powered by an electric motor through a single stage worm drive reduction. The windlass consists of a gypsy and capstan mounted on a stainless steel drive shaft supported by low friction bearings, mounted on a bronze base plate.

The clutch handle fitted into the Clutch Nut is used to de-clutch the drive and free wheel the chain gypsy. The brake band controls the run of the anchor and chain. The capstan is keyed directly to the drive shaft and the gypsy is driven by engaging the clutch. All components are of bronze or stainless steel construction.

The remote control for the windlass is stored in the talk-back system call box enclosure on the forward face of the wheelhouse forward store.

The Motor's electrical supply is from Q2 on MSB-001

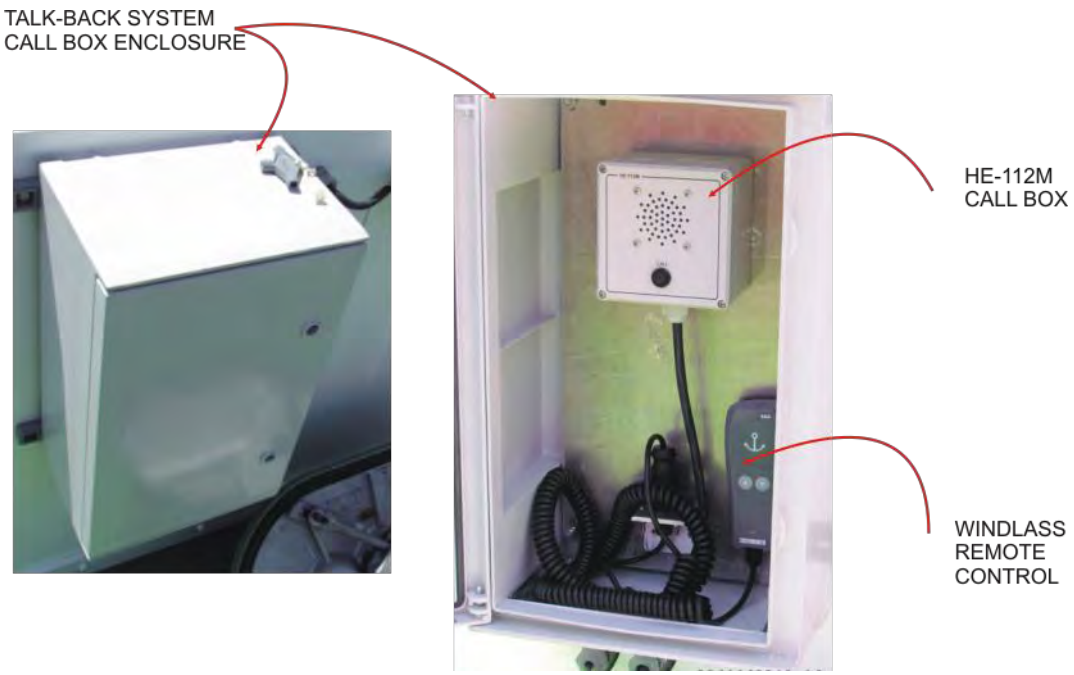


Figure 6-1: Windlass Remote Control Stowage

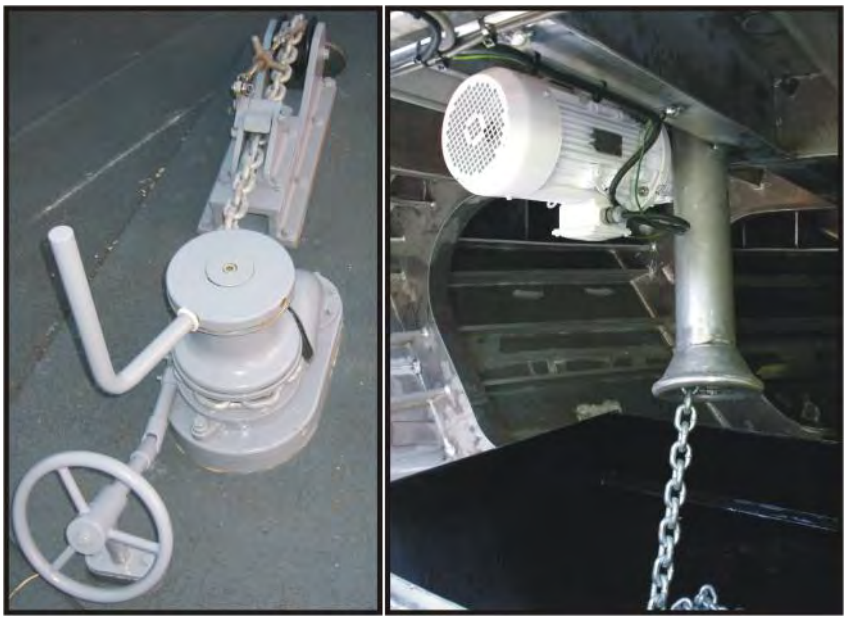


Figure 6-2: Anchor Winch Installation

Specification

Maximum Load:	2500 kg
Work Load	600 kg
Maximum Line Speed:	15 metres per minute
Chain Size:	13mm DIN766 Short Link Chain

Motor: 400V / 4kW / 3Ph / 50Hz

Maintenance

General

Twice yearly it is recommended that the above deck running gear is disassembled, all salt crust removed, the parts thoroughly cleaned, greased and the windlass reassembled.

It is good practice to wash salt water off all running parts with fresh water, after every use to avoid corrosion. The use of a close fitting cover when the winch is not in use is highly recommended.

Ensure the main drive shaft remains greased at all times.

Gearbox Oil

The oil level in the gearbox should be checked every 6-8 weeks. The recommended oil is SHELL TRIVELA S320.

For full maintenance information on the winch refer to Maintenance on page 9 of the Installation and Instruction manual.

Anchor Winch Documentation

Table 6-1: Anchor Winch Documentation

Item	Description	Remarks
1.	Muir VRC4500 - Vertical Windlass Installation and Instruction Manual	Applicable to VRC4500 anchor winches serial numbers 7064516A and 7064516B

630 Paint & Corrosion Protection

Paint

The type and specification used to paint the various parts and compartments of the vessel are detailed in the tables below.

Table 6-2: Paint used on Underwater Surfaces

Product	Coat	Lit	Colour	Sigma Thinner	Description
Sigmacover 280	100%	42	yellow/green	91 - 92	1st full coat primer for aluminium
Sigmashield 420	100%	29	Grey	91 - 92	2nd full anticorrosive primer
Sigmacover 525	100%	39	black	91. 92	3rd full tie coat

Product	Coat	Lit	Colour	Sigma Thinner	Description
S'Ecofleet 290 brown	100%	33	Brown	21. 06	1st full coat antifouling
S'Ecofleet 290 Redbrown	100%	33	R/Brown	21. 06	2nd full coat antifouling

Table 6-3: Paint used on Topside Surfaces

Product	Coat	Lit	Colour	Sigma Thinner	Description
Sigmacover 280	100%	59	yellow/green	91 - 92	1st full coat primer for aluminium
Sigmashield 420	100%	48	D/Grey or	91 - 92	2nd full anticorrosive primer
Sigmacover 456	100%	62	colour	91 - 92	3rd full build coat
SigmaDur 550	100%	71	colour	21. 06	1st full coat top coat

Table 6-4: Paint used on Walk Decks

Product	Coat	Lit	Colour	Sigma Thinner	Description
Sigmacover 280	100%	24	yellow/green	91 - 92	1st full coat primer for aluminium
Sigmacover 456	100%	21	colour	91 - 92	intermediate coat
Sigmacover 456	100%	21	colour	21. 06	final coat

Table 6-5: Paint used on Freshwater Tanks (interior surfaces)

Product	Coat	Lit	Colour	Sigma Thinner	Description
Sigmacover 280	100%	17	yellow/green	91 - 92	1st full coat primer for aluminium
Sigmagaurd 720	100%	14	white	91 - 92	intermediate coat
Sigmagaurd 720	100%	14	white	21. 06	1st full coat top coat

Table 6-6: Paint used on Engine Room Bilge

Product	Coat	Lit	Colour	Sigma Thinner	Description
Sigmacover 280	100%	1	yellow/green	91 - 92	1st full coat primer for aluminium
SigmaCover 630	100%	2	D/Grey or	91 - 92	2nd full high build epoxy

Table 6-7: Paint used on Grey Water Tank (interior surfaces)

Product	Coat	Lit	Colour	Sigma Thinner	Description
Sigmacover 280	100%	4	yellow/green	91 - 92	1st full coat primer for aluminium
Sigmaguard 790	100%	3	white	91 - 92	intermediate coat
Sigmaguard 790	100%	3	white	21. 06	final coat

Table 6-8: Paint used on Bulwarks

Product	Coat	Lit	Colour	Sigma Thinner	Description
Sigmacover 280	100%	25	yellow/green	91 - 92	1st full coat primer for aluminium
Sigmacover 456	100%	26	chem plant grey	91 - 92	intermediate coat
SigmaDur 550	100%	30	colour	21. 06	final coat

Corrosion Protection

Cathodic anode protection is fitted for all hull parts including water jets. Two x 2.2 kg zinc anodes are installed on the transom adjacent to the water jets and 8 x 7 kg zinc anodes are installed on the hull. The actual location of the anodes is shown in Figure 6-3 on page 6-7.

Visual inspection of the condition of each anode should be carried out annually and replacements made as necessary. Note that there is no need to remove the vessel from the water to carry out the inspection, i.e. inspection can be carried out by divers.

The electrical systems earth points are connected to various anodes. For example, the earth DB is connected to the hull anodes in the vicinity of the engine room. For further information see drawing KND-EL-MA-0013.

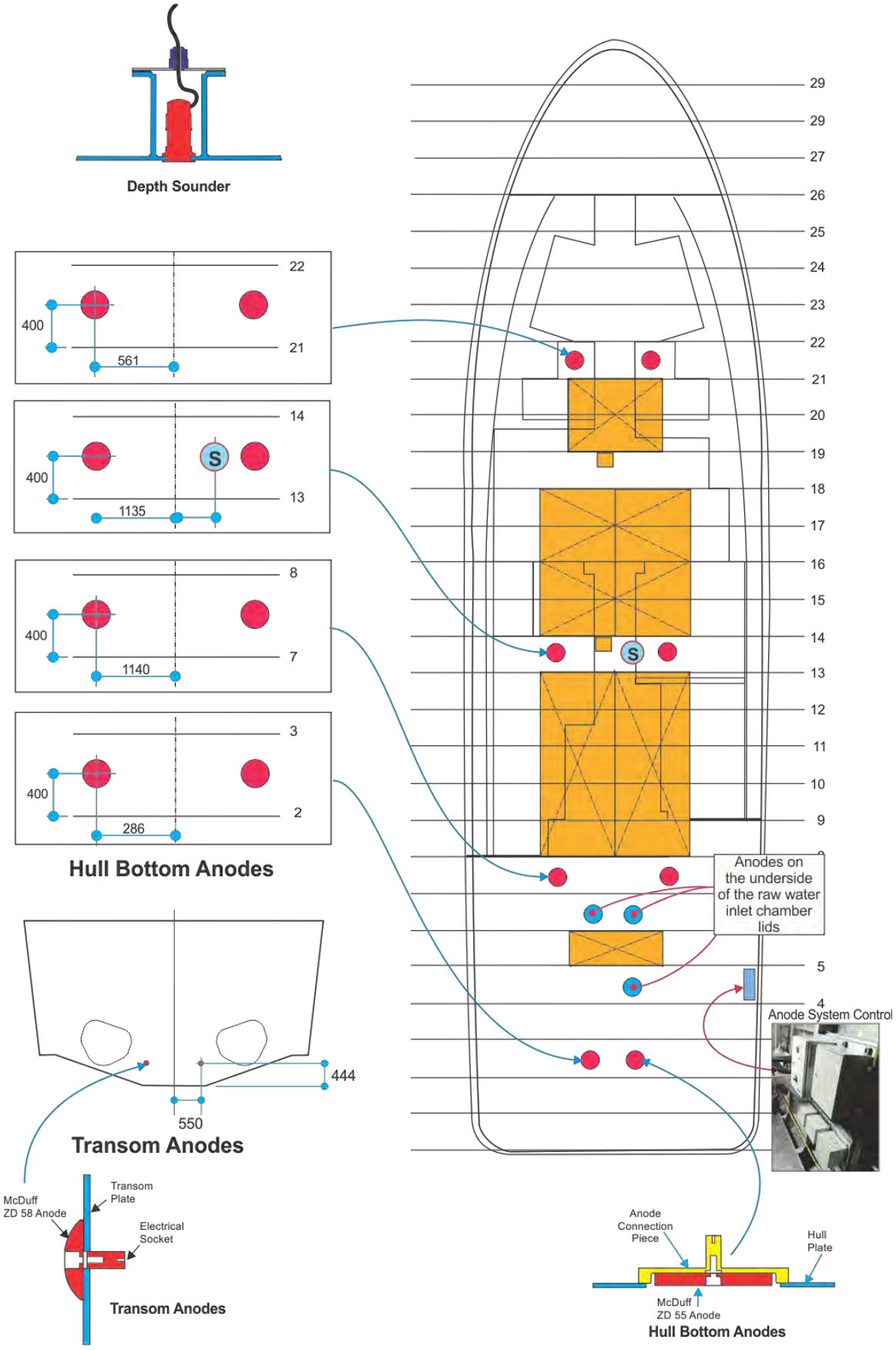


Figure 6-3: Ship's Hull showing position of Sacrificial Anodes

Chapter 7: Safety

710 Fire Fighting System

General

The vessel carries fire-fighting equipment in compliance with BUREAU VERITAS – Classification of High Speed Craft – Chapter 7. The use of this equipment is intended to be part of the vessel's procedures as laid down by the vessel operator.

Fire Wall Ratings

The watertight bulkhead at frame 8 between the engine room and the electrical control room has a fire rating of A 30. Lower deck accommodation internal walls between the electrical control room, the two six berth cabins and the accommodation corridor as well as, the Mess/ Galley have a fire rating conforming to B15.Watertight bulkhead doors are positioned at frame 8 and between the forward accommodation/galley/mess room and aft accommodation in the corridor at frame 16.

Escape Hatches.

Escape hatches accessing the main deck from the lower deck are positioned in the engine room between frames 5 and 6 and from the crew cabin between frames 25 and 26. Fixed ladders are positioned adjacent to the escape hatches.

Alarm Activation

Breaking the glass of the Break Glass unit and pressing the button at the call point activates an alarm. This causes an alarm to flash on the Fire Alarm Panel and all the vessel's fire alarms sound. The fire alarm Panel will indicated the zone affected. The panel is located in the wheelhouse on the starboard side. The alarm will only switch off on entry of the 'alarm PIN number" at the panel. The alarm PIN number should be available to the on duty watch keeper.

Operating Information

The existence of the equipment detailed in this chapter should be made known to all crew members as part of the standard vessel's procedures as laid down by the vessel's operator. The equipment should always be maintained to the highest standard according to the individual manufacturers' instructions. Regular checks by a competent authority should be conducted to ensure adherence to BV regulations.

System Overview

The fire fighting system on the vessel comprises:

a. A seawater fire and deck wash system

b. An emergency diesel driven fire pump (FIFI)

c. Foam loaded fire extinguishers 9 litre

d. Portable 4.5 kg powder extinguishers

e. Portable 5 kg CO2 Extinguishers

f. FM 200 Gas System – 64 litre

g. Fire Hoses and Nozzles

h. Fire Blanket

i. Fireman's Equipment

Identification and Location of Equipment

The following equipment is carried or installed on the vessel as indicated on the SAFETY PLAN. KND Document No P254-700-000

Fire and Safety Plan Locations

The safety plan is displayed at a number of points throughout the vessel. The display points are listed in Table 7-1 below. The Safety and Evacuation Plan is included in this chapter for reference (see Figure 7-3 0n page 7-15). Note that the legend from the Safety and Evacuation Plan enlarged for ease of reading is included as Figure 7-4 on page 7-16.

Table 7-1: Location of Safety Plan Display Points

No	Location	Frame	Remarks
1	Wheelhouse Access Corridor		Main Deck
2	Passenger Seating Area (port side of aft access door)		Main Deck
3	Wheelhouse Starboard Side Aft		Main Deck
4	Laundry Room Door		Lower Deck
5	Galley		Lower Deck
6	Mess		Lower Deck
7	Captain/Passenger Cabin Corridor		Lower Deck
8	Engine Room		Lower Deck

Seawater Fire and Deck Wash System

Two pumps (Fire and Bilge) are located on the port side of the engine room between frames 4 and 5. Seawater is drawn from the seawater inlets and supplies two hydrant/deck wash points on the main deck, one on the forward machinery space and the other next to the ladder to the deckhouse upper deck. This system also serves a hydrant point located in the engine room. The fire pump can deliver 26m3/hour

In addition a portable emergency diesel driven FIFI pump, stored on the roof of the deckhouse, can be connected to the fire main in the engine room or deck hydrants.16m fire hose reels and nozzles are located beside the hydrant points.

Location of Equipment

Location of Portable Extinguishers

Dry Powder Extinguishers – 4.5kg – (Quantity 5)

Table 7-2: Location of Dry Powder Extinguishers (4.5 kg)

No	Location	Frame	Remarks
1	Passenger Saloon – Main Deck	15-16	Outside toilet door
2	Wheelhouse Corridor	15-16	Top of stair well – Main deck
3	Crew Accommodation	22	Door port side
4	Galley	20	Starboard side
5	Mess	18	Corridor
6	Switchboard Room Forward	12	Starboard Side (adjacent to engineer's accommodation door)
7	Switchboard Room Aft	11	Port side (adjacent to passenger accommodation door)

One spare charge for the powder extinguisher is located in the side locker outboard of the wheelhouse stairsstore adjacent to the laundry room on the lower deck.

CO2 Extinguishers – 5kg – (Quantity 2)

Table 7-3: Location of CO2 Extinguishers

No	Location	Frame	Remarks
1	Foot of Wheelhouse Stairs	16	
2	Wheelhouse	20	Wheelhouse Starboard Side

One spare CO2 charge is stored in the dry store adjacent to the laundry room on the lower deck.

Foam Extinguishers – 9 litre – (Quantity 2)

Table 7-4: Location of Dry Powder Extinguishers (9 litre)

No	Location	Frame	Remarks
1	Engine Room	8	Engine room forward (port side)
2	Engine Room	9	Engine room forward (starboard side)

Location of General Alarms/Fire Alarms and Call Points

Table 7-5: Location of General Alarm / Fire Alarms – (Quantity 10)

No	Location	Frame	Remarks
1	Engine Room (Qty 2)	8	Watertight bulkhead - port
2	Aft Accommodation (Qty 2)	12	Corridor outside Engineer's cabin
3	Mess/Galley	18	Access to stairs to wheelhouse
4	Crew Accommodation	22	Cabin corridor
5	Passenger Saloon Aft	9	Access door starboard
6	Forward Machinery space	24	Wheelhouse forward
7	Wheelhouse (Qty 2)	21	Fire alarm panel port side

Table 7-6: Manually Operated Call Points – (Quantity 6)

No	Location	Frame	Remarks
1	Engine Room	8	Watertight bulkhead - amidships
2	Aft Accommodation	13	Corridor wall - port
3	Mess/Galley area	18	Bottom of staircase
4	Crew Accommodation	22	Crew cabin port side of door
5	Passenger Saloon	9	Aft wall – starboard side
6	Wheelhouse Corridor	18	Top of stairwell

Location of Space Mounted Smoke Detectors and Heat Detectors

Table 7-7: Location of Space Mounted Smoke Detectors – (Quantity 12)

No	Location	Frame	Remarks
1	Passenger Saloon Aft	12	Centre line in line with aft row of seats
2	Passenger Saloon Forward	14-15	Centre line in line with forward row of seats
3	Wheelhouse	20	Centre line behind Captain's seat
4	Forward Machinery Space	24	Main deck
5	Electrical Equipment Space	10	Corridor
6	Engineer's Cabin	11	Starboard
7	Captain's Cabin	14	Starboard
8	Store area	13-14	Behind aft ablution area
9	Aft Accommodation Passage	15-16	Outside Captain's cabin door

No	Location	Frame	Remarks
10	Mess	17	Mess ceiling
11	Galley	20-21	Galley ceiling
12	Crew Cabin	22	Port side of door

Table 7-8: Space Heat Detectors – (Quantity 6)

No	Location	Frame	Remarks
1	Engine Room	8	On centreline
2	Aft ablutions	15-16	
3	Mess area	18	
4	Forward ablutions	19	
5	Galley	20-21	Galley ceiling
6	Laundry room	22	

Engine Room Fire Protection

General

The engine room is supplied with a DuPont FM200 gas smothering system. The 64 litre cylinder is mounted by the engine room escape ladder and is coupled to two spray nozzles positioned adjacent to the two main engines. The system is activated from a lever in the emergency shutdown box located outside the engine room on the port side just forward of the watertight bulkhead. The gas capacity is sufficient for two operations.

In an emergency it is essential the that the air supply and discharge ventilations shafts to the engine room are closed off at the main deck level by manually releasing the fire dampers mounted over the inlet and exhaust louvers.

Emergency Shut Down

Emergency shut-down equipment is located in the aft accommodation passageway. Controls are available for the shutdown or closure of the following equipment.

1. Main Fuel Tank – Port – Fuel Supply Valve
2. Main Fuel Tank – Starboard – Fuel Supply Valve
3. Main Fuel Tank - Forward– Fuel Supply Valve
4. Main Fuel Tank - Aft– Fuel Supply Valve
5. Day Fuel Tank – Fuel Supply Valve
6. Fire Pump Remote Control
7. FM 200 gas smothering system – Opens the system

8. Ventilation shut down to all spaces

9. Fuel Pump remote shut off.

Two main engine shut down points are also positioned in the wheelhouse

FM200 Operating Procedure

In the event of a fire in the engine room, the following steps must be followed in sequence for the FM200 suppression system to be effective!

1. Ensure that the engine room has been completely evacuated, and that the escape hatch and the watertight doors are properly closed.

2. The Ventilation Fans and Fuel Pumps are wired to shut off automatically when the Fuel Shut Off Box door is opened.

3. If the Automatic Shut Off of the fuel pumps and ventilation fans fails to operate, press the Emergency Shut Off Switch on the forward end of MSB-001.

4. Switch OFF All Fuel Supply by pulling the three Remote Shut Off Levers.

5. Close the four engine room ventilation flaps located on the main deck.

6. Release the FM200 Suppression System by pulling the remote lever.

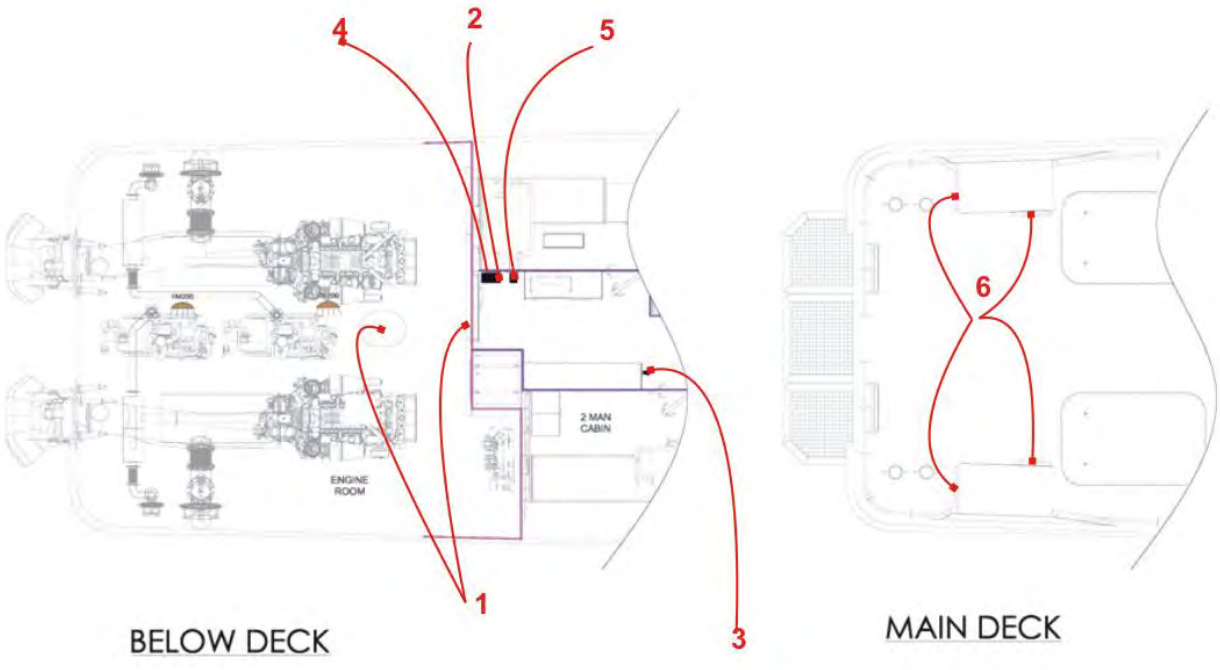


Figure 7-1: FM200 Release Procedure

FM200 Documentation

Table 7-9: FM200 Documentation

Item	Description	Part Number	Remarks
1.	FM200 Fire Suppression System for KND Naval Design	Kidde Fire Systems	
2.	Weighing of FM200 Cylinders	17717K-P250-710	
3.	P250 FM200 Emergency Release Instructions	Nautic Africa	Print if copy of instructions is required for Switchboard Room

Fireman's Equipment

There are two sets of fireman's equipment, one set located in a cupboard adjacent to the stairwell at the entrance to the wheelhouse and the second set in switchboard room in the cupboard just outside the engine room access door.

Each set of equipment consists of:

1. Fire protection suit
2. BULLARD Helmet
3. Gloves
4. Visor for Bullard Helmet
5. Neck Protection for Bullard Helmet

730 Life Saving Equipment

Life Rafts

The vessel is supplied with three VIKING 'throw overboard' containerized life rafts positioned on the top deck. These comprise two 25 person rafts, one port and one starboard and a six person life raft on the portside.

Escape Routes

In the event of a fire or should the vessel have to be abandoned the main assembly point is the aft main deck. Escape routes are listed below.

Table 7-10: Main Escape Routes

Area	Escape Route
Engine Room	Central corridor, Stairs, Wheelhouse Corridor to Main Deck-Port
Port passenger Accommodation	Central corridor, Stairs, Wheelhouse Corridor to Main Deck-Port
Starboard Passenger Accommodation	Central corridor, Stairs, Wheelhouse Corridor to Main Deck-Port
Captain's Cabin	Central corridor, Stairs, Wheelhouse Corridor to Main Deck-Port
Mess/galley	Central corridor, Stairs, Wheelhouse Corridor to Main Deck-Port
Crew Cabin	Central corridor, Stairs, Wheelhouse Corridor to Main Deck-Port
Seating Accommodation	Through Aft Access Door to Main Deck Starboard
Wheelhouse	Wheelhouse Corridor to Main Deck-Port

Table 7-11: Secondary Escape Routes

Area	Escape Route
Engine Room	Engine Room Escape Hatch
Port passenger Accommodation	Engine Room Escape Hatch
Starboard Passenger Accommodation	Engine Room Escape Hatch
Captain's Cabin	Engine Room Escape Hatch
Mess/galley	Crew Cabin Escape Hatch
Crew Cabin	Crew Cabin Escape Hatch
Seating Accommodation	Wheelhouse Corridor to Main Deck-Port
Wheelhouse	Wheelhouse Corridor to Main Deck-Port

Life Jackets and Lifebuoys

Table 7-12: Life Jackets with Light – (Quantity 32)

No	Location	Qty	Remarks
1	Passenger Saloon	20	Storeroom Aft of passenger accommodation starboard side
2	Wheelhouse access - Starboard	8	Starboard side locker
3	Wheelhouse Stairway	12	Life jacket Cupboard

Table 7-13: Lifebuoys (Quantity 4 – All Types)

No	Type	Qty	Remarks
1	Lifebuoy with Line	1	Transom - Starboard
2	Lifebuoy with Line & Smoke	1	Transom - Port
3	Lifebuoy with Line & Smoke	1	Top Deck – Port Railing
4	Lifebuoy with Line	1	Top Deck – Starboard Railing

Flares

Table 7-14: Red Hand Flares (Quantity 6)

No	Location	Qty	Remarks
1	Wheelhouse	6	Emergency Cupboard

Table 7-15: Rocket Parachute Flares (Quantity 12)

No	Location	Qty	Remarks
1	Wheelhouse	12	Emergency Cupboard - Port

Communications Equipment

Table 7-16: Two-Way VHF Radio Telephone Apparatus G.M.D.S.S. (Quantity 1)

No	Location	Qty	Remarks
1	Wheelhouse	1	Emergency Cupboard - Starboard

Table 7-17: PA Speaker Point with Talk Back Function (Quantity 1)

No	Location	Qty	Remarks
1	Foredeck	1	Outside Forward Machinery Space/Store Room

Table 7-18: Intercom Stations with Headset and Strobe (Quantity 2)

No	Location	Qty	Remarks
1	Engine Room	1	Starboard Side of access door
2	Engine Room	1	Transom between water jets

Table 7-19: Intercom Stations (Quantity 5)

No	Location	Qty	Remarks
1	Amidships Accommodation corridor	1	Frame 13 Starboard side of corridor
2	Mess / Galley	1	Entrance to Accommodation Corridor
3	Crews' Cabin	1	Port side of access door
4	Aft Deck	1	Port side of passenger seating access door
5	Wheelhouse	1	Master station console starboard side

Additional Safety Equipment

Table 7-20: Additional Equipment

No	Equipment	Qty	Location
1	Portable Daylight Signal Light	1	Wheelhouse
2	SART	1	Wheelhouse
3	Rope Ladder	1	Outside Forward Machinery Space/Store Room

No	Equipment	Qty	Location
4	Scramble Net	1	Outside Forward Machinery Space/Store Room
5	Emergency Flash Light	1	Wheelhouse Emergency Cupboard - Starboard
6	Loud Hailer	1	Mast Head

Emergency Lights

A general Alarm light is located in the engine room.

Emergency lights are located throughout the vessel.

Table 7-21: Emergency Floodlights 250W HPS (Quantity 2)

No	Light Location	Qty	Location
1	Flying Deck	1	Deckhouse aft bulkhead
2	Flying Deck	1	Above Wheelhouse Forward - Starboard

Table 7-22: Emergency Lights Luminaire (Quantity 13)

No	Light Location	Qty	Location
1	Deckhouse access	1	Outside Deckhouse Aft Window
2	Deckhouse technical area	1	
3	Passenger Saloon	1	Centre line
4	Wheelhouse Stairwell	1	
5	Wheelhouse Corridor	1	Outside of Fire and Lifejacket Cupboards
6	Wheelhouse	1	Above Wheelhouse Console
7	Forepeak – Main Deck	1	Front of Forward Machinery / Store Space
8	Engine Room	2	Frame 3 – Port and Frame 6 - Starboard
9	Switchboard room	1	Corridor frame 10
10	Aft Accommodation Corridor	1	Corridor frame 13
11	Storeroom	1	Aft of aft ablution block
12	Mess / Galley	2	Mess Corridor access to wheelhouse stairs and corridor outside laundry room
13	Technical Space forward	1	Outboard of forward ablutions
14	Crew Accommodation	1	Accommodation Corridor
15	Forepeak	1	
16	Deckhouse	7	3 x Port side, 3 x Starboard side, 1 forward
17	Flying Bridge	2	At life raft positions

Ballistic Protection

Ballistic protection against small arms fire is provided around the wheelhouse and the passage area immediately behind the wheelhouse. Note that the wheelhouse deck head is not protected. The Protection provided meets Euro Ballistic Standard EN1532 Class FB6 and NIJ Standard Class III+.

The wheelhouse area which has ballistic protection is shown in Figure 7-2 on page 7-12.

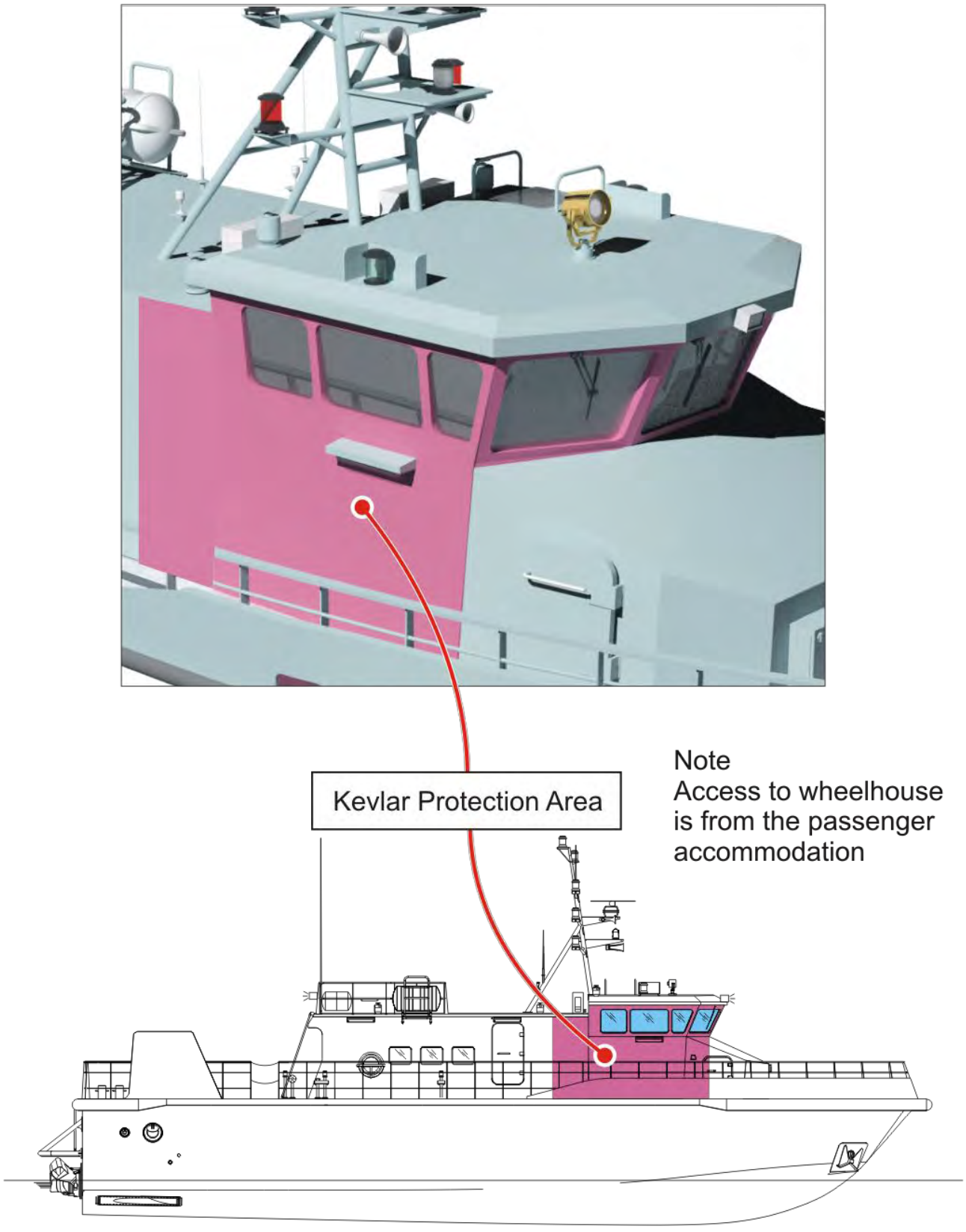
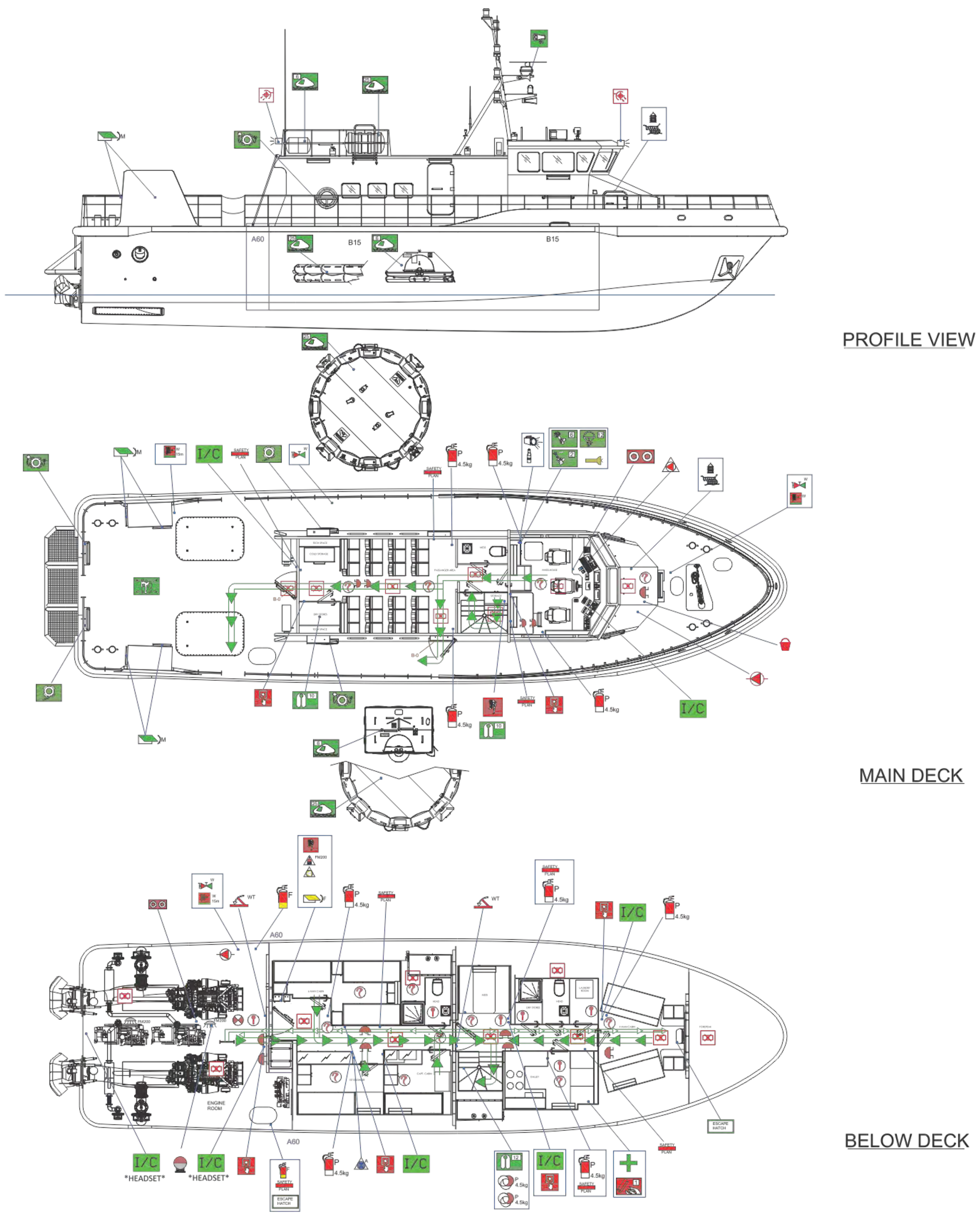
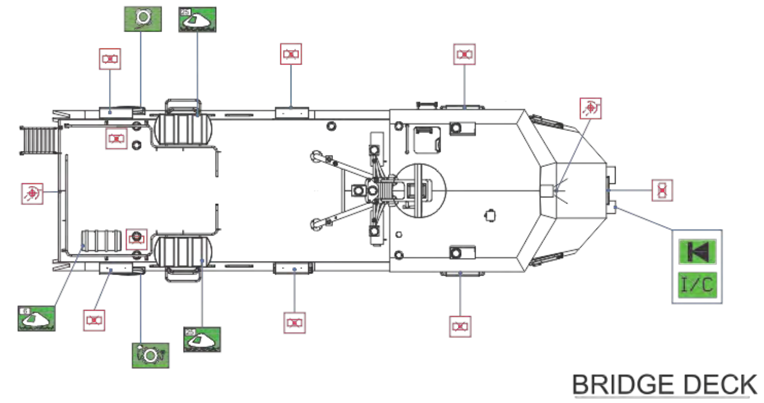


Figure 7-2: Ballistic Protection Area





SYMBOL	QTY.	DESCRIPTION
SAFETY PLAN	8	PLAN FOR LIFE-SAVING APPLIANCES AND MEANS OF ESCAPE
	32	LIFEJACKET WITH LIGHT
	2	LIFERAFT FOR 25 PERSONS
	1	LIFERAFT FOR 6 PERSONS
	2	LIFEBUOY WITH LINE
	2	LIFEBUOY WITH LIGHT AND SMOKE
	6	RED HAND FLARES
	12	ROCKET PARACHUTE FLARES
	1	FIRST AID KIT, TYPE A
	1	EMERGENCY FLASHLIGHT
	1	TWO-WAY VHF RADIOTELEPHONE APPARATUS (G.M.D.S.S.)
	1	LOUD HAILER
	1	PA SPEAKER POINT WITH TALK BACK FUNCTION
I/C	6	INTERCOM STATION
I/C *HEADSET*	2	INTERCOM STATION WITH HEADSET AND STROBE
M	4	CLOSING DEVICE FOR VENTILATION IN MACHINERY SPACE
F	1	CLOSING DEVICE FOR FUEL SUPPLY
WT	2	WATERTIGHT DOOR (open/close indicating at bridge)
	1	SECONDARY ESCAPE ROUTE
	1	PRIMARY ESCAPE ROUTE
	1	ASSEMBLY STATION
	1	PORTABLE DAYLIGHT SIGNALLING LIGHT
	1	SART
	1	ROPE LADDER
	1	SCRAMBLE NET

SYMBOL	QTY.	DESCRIPTION
P 4.5kg	9	DRY POWDER EXTINGUISHER
P 4.5kg	2	SPARE CHARGES FOR POWDER EXTINGUISHER
F	2	FOAM EXTUINGISHER
	1	FIRE BLANKET
	2	FIRE PUMP (GENERAL SERICE PUMP) (26m³/hr, 5 bar)
	1	SPARE FIFI/BILGE PUMP
W	3	FIRE HYDRANT
W	3	FIRE HOSE AND NOZZLE -WATER
FM200	1	FIXED FM200 BOTTLE PLACED IN PROTECTED AREA
	12	GENERAL ALARM / FIRE ALARM SIREN
	11	SPACE MONITORED BY SMOKE DETECTOR(S)
	5	SPACE MONITORED BY HEAT DETECTOR(S)
	6	MANUALLY OPERATED ALARM ACTIVATION POINT
	2	STOP MAIN ENGINES
	2	FUEL PUMP REMOTE SHUT-OFF
A	1	VENTILATION REMOTE SHUT-OFF ALL SPACES
	1	REMOTE CONTROL FOR FIRE PUMP
FM200	1	REMOTE CONTROL FM200 RELEASE
	1	GENERAL ALARM LIGHT
	2	EMERGENCY FLOODLIGHT 250W HPS
	20	EMERGENCY LIGHT LUMINAIRE
	2	FIREMAN'S OUTFIT
	2	FIRE BUCKET

Figure 7-3: Safety and Evacuation Plan

SYMBOL	QTY.	DESCRIPTION
SAFETY PLAN	8	PLAN FOR LIFE-SAVING APPLIANCES AND MEANS OF ESCAPE
	32	LIFEJACKET WITH LIGHT
	2	LIFERAFT FOR 25 PERSONS
	1	LIFERAFT FOR 6 PERSONS
	2	LIFEBUOY WITH LINE
	2	LIFEBUOY WITH LIGHT AND SMOKE
	6	RED HAND FLARES
	12	ROCKET PARACHUTE FLARES
	1	FIRST AID KIT, TYPE A
	1	EMERGENCY FLASHLIGHT
2	1	TWO-WAY VHF RADIOTELEPHONE APPARATUS (G.M.D.S.S.)
	1	LOUD HAILER
	1	PA SPEAKER POINT WITH TALK BACK FUNCTION
I/C	6	INTERCOM STATION
I/C "HEADSET"	2	INTERCOM STATION WITH HEADSET AND STROBE
M	4	CLOSING DEVICE FOR VENTILATION IN MACHINERY SPACE
F	1	CLOSING DEVICE FOR FUEL SUPPLY
WT	2	WATERTIGHT DOOR (open/close indicating at bridge)
	1	SECONDARY ESCAPE ROUTE
	1	PRIMARY ESCAPE ROUTE
	1	ASSEMBLY STATION
	1	PORTABLE DAYLIGHT SIGNALLING LIGHT
	1	SART
	1	ROPE LADDER
	1	SCRAMBLE NET

SYMBOL	QTY.	DESCRIPTION
P 4.5kg	9	DRY POWDER EXTINGUISHER
P 4.5kg	2	SPARE CHARGES FOR POWDER EXTINGUISHER
F	2	FOAM EXTUINGISHER
1	1	FIRE BLANKET
	2	FIRE PUMP (GENERAL SERICE PUMP) (26m³/hr, 5 bar)
	1	SPARE FIFI/BILGE PUMP
W	3	FIRE HYDRANT
W	3	FIRE HOSE AND NOZZLE -WATER
FM200	1	FIXED FM200 BOTTLE PLACED IN PROTECTED AREA
	12	GENERAL ALARM / FIRE ALARM SIREN
	11	SPACE MONITORED BY SMOKE DETECTOR(S)
	5	SPACE MONITORED BY HEAT DETECTOR(S)
	6	MANUALLY OPERATED ALARM ACTIVATION POINT
	2	STOP MAIN ENGINES
	2	FUEL PUMP REMOTE SHUT-OFF
A	1	VENTILATION REMOTE SHUT-OFF ALL SPACES
	1	REMOTE CONTROL FOR FIRE PUMP
FM200	1	REMOTE CONTROL FM200 RELEASE
	1	GENERAL ALARM LIGHT
	2	EMERGENCY FLOODLIGHT 250W HPS
	20	EMERGENCY LIGHT LUMINAIRE
	2	FIREMAN'S OUTFIT
	2	FIRE BUCKET

Figure 7-4: Legend from Safety & Evacuation Plan (Enlarged)

Chapter 8: Drawing and Certificates

Table 8-1: BV Approved Drawing List

No.	Drawing Number:	Drawing Name:
1	P254-000-000-F	General Arrangement AAC
2	P254-030-510-A	Bilge & FiFi Schematic
3	P254-030-530-A	Raw Water Schematic
4	P254-030-540-A	Sanitary Schematic
5	P254-111-001-A	Hull bottom transverse sections aft
6	P254-111-002-A	Hull bottom transverse sections mid
7	P254-111-003-A	Hull bottom transverse sections fwd
8	P254-111-004-A	Hull bottom longitudinal sections aft
9	P254-111-005-A	Hull bottom longitudinal sections mid
10	P254-111-006-A	Hull bottom longitudinal sections fwd
11	P254-111-007-A	Shell plates and keelson
12	P254-111-008-A	Bulkhead on frame 8
13	P254-111-009-A	Bulkhead on frame 16
14	P254-111-010-A	Manholes
15	P254-113-001-A	Hull sides aft
16	P254-113-002-A	Hull sides mid
17	P254-113-003-A	Hull sides fwd
18	P254-113-004-A	Hull sides overall
19	P254-114-001-A	Forepeak detail
20	P254-115-005-C	Dorade box detail
21	P254-116-001-A	Transom detail
22	P254-117-001-A	Aft platform
23	P254-119-001-A	Fender plate detail
24	P254-130-001-0	Doors Arrangement
25	P254-200-001-B	Propulsion Arrangement
26	P254-230-002-A	Jet Unit Foundations
27	P254-310-002-A	Generator foundation
28	P254-505-001-B	Filling and venting pipe routes
29	P254-505-002-A	Filling and venting pipe routes
30	P254-505-003-B	Filling and venting pipe routes
31	P254-505-004-B	Filling and venting deck arrangement
32	P254-510-001-A	Bilge suction detail

No.	Drawing Number:	Drawing Name:
33	P254-510-002-A	Bilge suction detail
34	P254-510-003-A	Bilge FIFI suction manifold detail
35	P254-510-004-A	Bilge delivery system
36	P254-510-005-A	Bilge delivery system
37	P254-510-006-A	Bilge and AC outlet connections
38	P254-510-007-A	Forepeak bilge system
39	P254-530-003-0	Main Engine RW Intake Connection
40	P254-530-004-A	Main Engine RW Intake Strainer Assembly
41	P254-530-010-A	Raw water outlet connection
42	P254-530-011-0	Auxillary RW Intake Connection
43	P254-530-012-0	Genset RW Intake Strainer Assembly
44	P254-530-016-A	Cooling system through hull fittings
45	P254-530-017-A	Port Engine Cooling Route
46	P254-530-018-A	STB Engine Cooling Route
47	P254-530-019-A	Genset Cooling Route
48	P254-540-001-C	STBD water tank detail
49	P254-540-002-B	STBD fresh water tank bracket detail
50	P254-540-004-B	PORT fresh water tank detail
51	P254-540-005-A	PORT fresh water tank bracket detail
52	P254-540-011-0	Black Water Arrangement
53	P254-540-012-0	Grey Water Arrangement
54	P254-540-013-A	Fresh Water Arrangement
55	P254-540-014-0	Waste Water Discharge Arrangement
56	P254-545-150-A	Waste Water Overboard Connection Detail
57	P254-560-008-A	Forepeak ventilation pipe route
58	P254-562-001-0	HVAC Layout
59	P254-580-001-A	Portside main engine exhaust
60	P254-580-002-A	STBD main engine exhaust
61	P254-580-010-A	STBD genset exhaust assembly
62	P254-580-011-A	Portside generator exhaust assembly
63	P254-580-025-A	Exhaust hull connections
64	P254-603-001-0	Fire, Sound and Insulation Plan
65	P254-611-001-A	Anchor arrangement
66	P254-611-002-A	Hawse pipe detail
67	P254-612-001-A	Aft bollard detail
68	P254-612-002-A	Fwd bollard detail
69	P254-612-003-A	Midship bollard detail

No.	Drawing Number:	Drawing Name:
70	P254-613-002-A	Fairlead positions
71	P254-632-001-A	Depth sounder and anodes APP
72	P254-640-011-0	ER arrangement
73	P254-700-001-F	Fire, Safety & Evacuation Plan

Table 8-2: Certificate List

Item	Description	Certificate Number or Date of Issue
	100 Structure	
	101 Hull	
1.	Extrusion Inspection Certificates	Various
2.	Plate 5mm	1012LB8419
3.	Plate 6mm	1012LB8396
4.	Plate 8mm	1012LB8407
5.	Plate 8 mm	1012LB8408
6.	Plate 8 mm	1107LB6675
7.	10mm Plate - 3.1b	W1025867
8.	10mm Plate - 3.1a	W1025867
9.	10mm Plate - 3.2abs-a	1378/ABS
10.	10mm Plate - 3.2abs-b	1378/ABS
11.	10mm Plate - 3.2lrs-a	2077/LR
12.	10mm Plate - 3.2lrs-b	2077/LR
13.	10mm Plate - 3.2lrs-c	2077/LR
14.	10mm Plate - 3.2lrs-d	2077/LR
15.	12mm Plate	1012LB8391
16.	12mm Plate	1012LB8409
17.	12mm Plate	1108LB3867
18.	20mm Plate	1012LB8397
19.	20mm Plate	1107LB6803
20.	30mm Plate	1012LB8400
21.	Cutting Files Nesting - I.H. Pepple	L90***
22.	Welding Wire	5356-30110
23.	Welding Wire	5356-30910
	120 Superstructure	
24.	AMS Batch Certificates	Various
25.	AMS QA Certificate Compartment Rear Wing Port	Various
	130 Doors	
26.	Fire Door Alvadoor A-15	MED-B-5633

Item	Description	Certificate Number or Date of Issue
27.	Fire Door Alvadoor B-15M	MED-B-7759
28.	Libra Watertight Alu Doors Type WR11	ULS-12-3016
29.	Libra Watertight Doors Type WTD	S-5101
200 Propulsion		
	210 Engines	
30.	Anti Vibration Mountings	09077/C1 BV
31.	Caterpillar C32 and C32 (Acert) Marine Engines	13596/C1
	222 Shafting	
32.	Drive Shaft	0049SSB12
33.	Shaft Coupling	0048SSB12
	230 Waterjets	
34.	Hydraulic Power Unit	122GTB12A
35.	MJP Hydraulic Cylinders	1111-01
36.	Remote Control Unit	170GTB12
37.	Waterbox & Shell	078GTB12
38.	Waterjet Components - Various	2012.058
39.	Waterjet Propulsion & Components	118GTB12
40.	Waterjet Propulsion & Components	124GTB12
300 Electrical		
41.	Caterpillar C4.4 Marine Generator Sets	CC2223
500 Ships Systems		
	500 - Piping	
42.	C-PVC Pipes, Fittings and Valves	07124/C1 BV
43.	PVC-U and PVC-C Pipes, Fittings and Valves	06298/CO BV
44.	PVC-C Pipes, Fittings and Valves	90433-97HH
	500 - Valves	
45.	DN50 Valves	0196AVS12-2
46.	DN80 Valves	0196AVS12-3
47.	DN150 Valves	0196AVS12-1
	510 Bilge	
48.	Bilge/Fire Pump Hand Pump	Whale Gusher – Manual Diaphragm Pump
49.	Bilge/Fire Pump	FRES 40-170 Self Priming Pump
	520 Fuel	
50.	Fuel System Pump	VPC 100 T Peripheral Pump
51.	Fuel System Pump Hand Pump	Model #2 Semi Rotari Wing Pump
	540 Sanitary	

Item	Description	Certificate Number or Date of Issue
52.	Black Water Pump	FORAS JXM 125-5 Multistage S/Priming Pump
53.	Waste Water Pump	Caffini Microlib Diaphragm Pump
600 Outfitting		
	603 Insulation	
54.	A 60-al Rockwool	45 122-07 HH
	611 Anchor Equipment	
55.	Chain Stopper	12-129
56.	Anchor Capstan	12-00001
57.	Anchor Chain 13 mm	DTM 1113188/1BA
	662 Interior Walls	
58.	HGP	164.112/1121/WCL MED0253TE
59.	Marhino B-15 Bulkhead	21716/A0 EC
60.	Marhino 400	16681/B0 BV
61.	C Class Bulkheads	05991/D0 BV
	663 Ceilings	
62.	Dampa C Class Ceilings	MED-B-5732
63.	Dampa Continuous Ceiling	MED-B-5733
700 Safety & Life Saving Equipment		
64.	Buoyant Smoke Signal Orange	423.002
65.	Dual Jet/Spray Water Nozzles	08096/CO BV
66.	First Aid Kit for Survival Craft and Rescue Boats	MCA0950002
67.	Hand-Held Battery Operated Flashlight Model 2317	DEMKO 04 ATEX 133435
68.	Lifebuoy XT5555	59 799-08 Lux
69.	Lifebuoy XT5555-1	59 801-08 Lux
70.	Lifejacket PV9509	DK-0200-MarED-127 Version 3
71.	Lifejacket Lights	SAS S080003
72.	Life Raft 6DK+ and Life Raft 25DK+	11573261
73.	Life Raft 25DK+	11573248
74.	Life Raft 25DK+	11595663
75.	Life Raft Hydrostatic Release Units	07943/D2 EC
76.	Light and Smoke Signal for Lifebuoy	422.006
77.	PS3795 Heat Protective Suit	DK-FC-CAC-006
78.	Rocket Parachute Flare Red	425.005
79.		
80.		