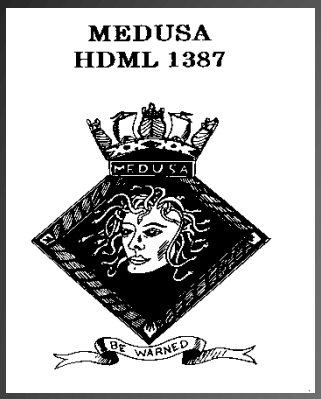

Medusa Ship Handbook

Versions of the Ship Handbook:

- Brian Holmes, 26th May 2011
- Revised August 2020

Medusa Support Group

c/o Alan Watson,
Captain and Chairman

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1. Contents

2. Ship Handbook, purpose & update

This document is the Ship Handbook for Medusa and details the current specification and equipment-specific operating procedures.

Items for update can be proposed by any member of the Medusa Support Group and will be reviewed and processed appropriately.

This document will be reviewed by Medusa Support Group Committee and approved by the Medusa Trust.

Certificate of Registry

CERTIFICATE OF BRITISH REGISTRY

The Merchant Shipping Act 1995
The Merchant Shipping (Registration of Ships) Regulations 1993, as amended

PARTICULARS OF SHIP

Name Of Ship	**MEDUSA**		
Official Number	**359766**	Radio Call Sign	**GGMB**
IMO Number / HIN		Port	**WEYMOUTH**
Type Of Ship	**PLEASURE VESSEL**		
Method Of Propulsion	**MOTOR**		
Engine Make & Model	**L GARDNER & SONS LTD**		
Total Engine Power	**224.00** kW		
Length	**21.06** metres		
Depth	**2.56** metres	Breadth	**4.72** metres
Gross Tonnage	**56.19**	Net Tonnage	**0.00**
Registered Tonnage	**23.91**		
Year of Build	**1943**		
Name of Builder	**R A NEWMAN & SON**		
Country of Build	**UNITED KINGDOM**		

This Certificate was issued on **09 April 2018** at **10:44:40**

This Certificate expires on **17 May 2023**

Signed .....

For and on behalf of the Registrar General of Shipping and Seamen

by the Maritime and Coastguard Agency, an Executive Agency of the Government of the United Kingdom

1/2

MSF 4700 REV 10/13

3. Vessel Description & Engines

Vessel's Main Details

Medusa was built by R.A.Newman & Sons Ltd of Poole, Dorset, in 1943 as Harbour Defence Motor Launch 1387, and is a veteran of the Normandy Landings of June 1944.

Overall Length	72 feet 6 inches (22 metres)
Beam	16 feet 3 inches (4·95 metres)
Draft Forward	3 feet 6 inches (1·07 metres)
Draft Aft	5 feet (1·5 metres)
Air Draft	30 feet 6 inches (9·3 metres)
Displacement	54 tons, full load
Port of Registry	Weymouth
Registered Number	359766
Gross Tonnage	56.19
Registered (Net) Tonnage	23·91
Registered Length	69·1 feet
Signal Letters & Radio Call Sign	GGMB

Main Engines

Handed pair of Gardner 8L3 8 cylinder direct injection diesel engines, developing 136 bhp each continuous at 800rpm; 152 bhp each in emergency at 900 rpm, e.g. after deploying depth charges. The port main engine was built in 1940 and the starboard main engine was built in 1942.

Maximum speed:
12½ knots at 900 rpm.

Range:
In current configuration: 1,000 Nm at 10 knots (700 rpm).
As built: 1,800 Nm from 1364 gallons at 10kts.

Fuel consumption:
Main engines at 10 knots = 7.5 gallons per hour.

Propellers:
2 x 30 inch diameter x 22¼ inch pitch, handed.

Main Generator

An Onan 12KVA 50Hz unit with a Cummins engine as the prime mover.
Fuel consumption = ¾ gallon per hour approximately, depending on load.

Deck Pump

1,390 cc Gardner 1L2 single cylinder diesel engine, rated at 9.5 hp, driving a general service pump, (and originally optionally driving a 24 volt generator).

4. Handling Characteristics

Steering

The HDML has twin outward turning propellers and large twin rudders. Part of the design criteria of the HDML was that, in their anti-submarine role, they had to be capable of turning within the turning circle of a submerged submarine and, in order to reduce the resistance to turning and achieve this, the keel ends thirteen feet from the stern. A result of this is that, although highly manoeuvrable, the vessels lack directional stability.

At sea, it demands a high degree of skill to hold a straight course and, in a heavy sea, it is virtually impossible. Helmsmen should be warned that it is a mistake to use excessive wheel when trying to correct a yaw as this will only result in a continuous, substantial, port to starboard zigzag.

The large twin rudders are semi-balanced and have a considerable effect when manoeuvring, as does the transverse propeller thrust.

When turning with one engine ahead and one astern, it is essential to have the wheel hard-over in the direction of the turn. Leaving the rudders amidships creates considerable drag and will result in a very slow turn, whilst turning the wheel in the opposite direction to the turn will result in the vessel following the rudders and turning against the engines.

Navigating Astern

In common with most vessels, the HDML does not steer very well when making way astern. When navigating astern, speed should not be increased above 250 rpm ('Slow' on the telegraphs) and not more than 5° of wheel should be used for steering - any further wheel will have little effect but will render it difficult for the helmsman to take the wheel off when required, without a kick ahead on the engines.

If the vessel is navigated astern at more than 'slow' speed, then the wheel should be kept firmly amidships and the helmsman warned not to allow the wheel to turn. If the wheel starts to turn, the rudders will immediately run to full helm with danger of the helmsman suffering injury from the spinning wheel, and with the probability of severe stern-gear damage.

Navigating Ahead

When under way 'ahead', as little wheel as possible should be put on when executing a turn. It will be found that the vessel answers the helm very quickly but if excessive helm is used, she will swing very rapidly and will 'lock' into the turn making it difficult for the helmsman to take the wheel off again and stop the vessel swinging.

Coming Alongside

When coming alongside, it should be borne in mind that the transverse propeller thrust has considerable effect and will pull the stern rapidly to port or starboard depending on which shaft is turning and in which direction. The transverse propeller thrust also makes it very difficult to manoeuvre the vessel on a single engine. It should also be borne in mind that, whilst 'down on her marks' aft, and drawing five feet, she is light compared with her design displacement and sits very high out of the water forward, drawing just 3 feet 6 inches.

This results in considerable windage, making manoeuvring difficult in a strong beam wind. She does not have direct bridge control of her engines, so all engine movements have to be actioned by the engineer on watch, in compliance with orders received on the Engine-Room telegraphs. Because of this, there is inevitable delay between an engine order being given and the propeller shaft responding. Things happen fast on so small a ship and, in order to reduce this delay to a minimum, it is wise for the person conning the vessel to operate the telegraphs himself rather than pass engine orders to a telegraphsman, as this only compounds the delay.

(HDML wartime Captains always operated the telegraphs themselves).

Telegraph Control

The telegraphs have three positions ahead and astern, and 'Stop'. These are 'Slow', 'Half', and 'Full'. If at any time 'Emergency Full' is required, with engines' is indicated by the telegraphs being rung from 'full ahead' to 'full astern' then this must be requested verbally unless a prior Engine-Room electric bell signal has been agreed.

When passing engine movement orders to both engines, as opposed to ringing engines 'on' and 'off', the telegraphs should be rung one at a time rather than both together.

Before leaving the berth, the engines are 'rung on' to 'standby' by the telegraphs being rung from 'full ahead' to 'full astern' and then back to 'stop'. This is answered, when the main engines are ready to proceed, by the sounding of the bridge reply buzzer twice.

On an offshore passage, when little traffic is being encountered and it is not necessary for the engine controls to be manned, 'full and away' may be rung so that the engineer on watch can stand down. This signal is given in a similar manner to 'stand-by', except that the telegraph is returned to the current speed setting, and is answered on the bridge reply buzzer. When engine movements are required again, then 'standby' must be rung, and replied-to, as before. It is rarely possible for the engineer to stand down whilst the vessel is navigating in the Solent.

If a problem arises with a main engine which requires that it be shut down, then the Engine-Room will sound the bridge buzzer three times. It will be necessary for communication to be established with the Engine-Room to ascertain the problem so that the correct engine can be rung off.

At the end of a passage, after the vessel is berthed or anchored, 'finished with engines' is indicated by the telegraphs being rung from 'full ahead' to 'full astern' and then back to 'stop'. Once again, this is answered by the sounding of the bridge reply buzzer twice. The main engines will then be shut down.

In view of the lack of engine controls on the bridge, it is normally necessary to have an engineer on watch in the Engine-Room at all times, but particularly in waters congested with heavy traffic.

Violent Rolling

The HDML has a considerable metacentric height with a consequent high reserve of stability. Unfortunately, lacking bilge keels, this results in violent rolling in heavy seas. Consideration should always be given, therefore, when laying-off a course, to the direction of wind and sea and, if possible, a beam sea should be avoided. It is also necessary to ensure that all items of loose gear are stowed or securely lashed prior to the vessel putting to sea.

Towing and being Towed

There are two 100m Dyneema 8 strand Towing lines.
One stored under the Bridge Deck by the Mast, the other in the Port Ammunition Locker.

Being Towed

- Send a Towing Line out through the central fairlead.
- Take three turns around the rope drum on the Windless, before making off the end.

Towing others

Preferred method:

- Rig a Bridle from Stretchy Nylon, taken from the Quarter Mooring Bitts. out through Quarter Fairleads.

or:

- Send a Towing Line out through the central aft fairlead.
- Take three turns around the Bronze bollard, before making off the end on a quarter Fairlead.

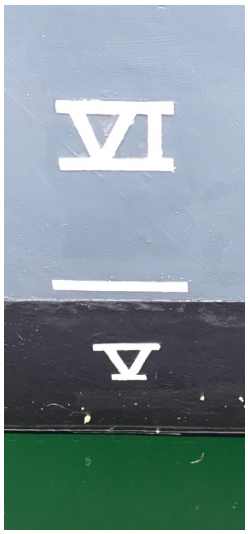
Wrap sacrificial protective material around the Line, where it passes through Fairleads.

Draught Marks

Medusa has Draught Markings on the Bow, Amidships, and at the Stern.

Under normal loading, Draught is:
3 Feet 6 Inches (1m 07cm) at the Bow, 4 Feet 6 Inches (1m 37cm) Midships and at the Stern.

Bow



Midships

Aft

Emergency Steering

In the event of loss of steering control from the bridge and chartroom, follow the Action Card in the Training Manual Appendix. The Emergency tiller position is on the after deck, to port.

The position is normally fitted with a cover that can be removed using a special tool located at the rear of the chart table and fitted as shown below.

The tiller bar is stowed on the forward bulkhead of the tiller flat and fits directly into the steering position.

5. Navigational Systems

Introduction

The primary method of navigation on Medusa is paper based and to that end corrected sets of charts for the operational area will be carried.

As well as an electronic compass Medusa has two magnetic compasses, hand bearing compass and two bridge wing compasses with azimuth rings.

Electronic navigation.

Medusa is fitted with Raymarine equipment which is updated from time to time. This section describes the system fitted; the equipment manuals should be consulted for operational instructions.

MFD – Multi Function Display

The heart of the system is the Raymarine Axiom Pro fitted at the chart table. This unit is set up to display the output of, and control of, other modules that are fitted.

Switching on the MFD will power the sonar, radar (to standby), electronic compass and AIS.

The MFD has an AR200 gyro stabilised combined GPS and Heading sensor located above the chartroom door. Keep Ferrous items well away.

Radar

The radar is an HD Digital in a 24 inch Radome on the mast. The signal output from this is Ethernet and is connected to an Ethernet switch in the engine room which in turn is connected to the MFD.

Sonar

The CP100 module is located with the rest of the electronics, starboard side of the engine room near the workbench, and the transducer is on the port side under the 1L2. The module connects via Ethernet to the network switch. (An obsolete transducer is ahead of the Stbd engine.)

Smart Heading Sensor

A precision heading sensor feeds the system. The sensor is located below the conning platform and feeds a rate gyro unit in the chart room. The output is stabilised for MARPA use.

AIS

Medusa carries an AIS transponder (Class B) located in the engine room. This powers with the MFD, and has its own GPS antenna located above the chartroom door. The AIS antenna is shared with the VHF radio.

Radar Reflector

Medusa has an X band active radar reflector, the control module is located in the chartroom and the antenna up the mast. The control box will indicate when radar signals are received from other vessels.

Navigation Lights and Shapes

Steaming Lights

The steaming lights are controlled from a rotary switch on the chartroom switchboard, which is installed on the forward chartroom bulkhead. This switches the side lights, the single masthead light, and the stern light.

Anchor Light

An Anchor Light and cable are stowed in the Port Bridge locker. This can be raised up the mast using a halliard, and connected to a 24 volt socket at the base of the mast.

Not Under Control Lights

Not Under Control Lights and cable are stowed in the Port Bridge locker. This can be raised up the mast using a halliard and connected to a 24 volt socket at the base of the mast.

Day Shapes

Three Ball shapes and one Diamond are stowed in the starboard bridge locker and can be raised on the bridge halliards.

6. Communication Systems

VHF Radio

Medusa has a fixed DSC radio located in the chartroom with a second position on the bridge. Additionally, there is a hand held DSC radio, stored in the Wardroom, and brought to the Bridge when underway.

Ship Siren

This is sited on the chartroom roof pointing ahead, sounded from push-buttons on the Bridge and on the Chartroom switchboard, via an electrically operated solenoid on the chartroom deckhead. It is powered by compressed air, stored in a 'receiver' in the engine room near the silencer, replenished by the compressor under the chartroom steps which is on plunger no.3 labelled Aux Dynamo in the engine room panel.

Alarm Buzzer

The original 'Action Stations' alarm system from the Second World War is still installed and working. This is activated from push-buttons fitted on the chartroom switchboard and the bridge. Alarms sound in the forward mess and in the Wardroom.

Engine-Room Bell

A communications bell is installed in the Engine-Room and is operated by two push-buttons, one on the chartroom switchboard and the other on the bridge. A reply buzzer is installed in the chartroom deckhead and this is operated by a push-button on the high level bulkhead in front of the starting platform in the Engine-Room.

Aldis Signalling Lamp

This is stowed under the Wardroom bunk, stbd side, and can be plugged into a 24 volt socket outlet on the bridge near the steering position.

Searchlight

This is available, although not necessarily always on board, and can be plugged into a 24 volt socket outlet on the bridge.

Flags

A set of international code flags are carried, for signalling purposes, together with duplicates of many.

A number of red ensigns are carried on board and can be worn from the ensign staff, the gaff or, when dressed overall, the top of the topmast.

There is also a 'pilot' jack.

A set of the vessel's signal letters in International Code, GGMB, are made-up on a permanent hoist which is kept in the chart table.

Her wartime signal letters, Q1387, in wartime code, are also made-up on a permanent hoist.

7. Anchoring

Anchor Winch

The winch is fitted on the foredeck and is hydraulically driven from a pump supplying oil under pressure which is installed in the Engine-Room and driven from the front of the port main engine. When it is required to use the winch, then word must be passed to the Engine-Room to engage the hydraulic pump. (See page 34). The Engine-Room must also be informed when the winch is no longer needed so that the pump can be disengaged.

The winch is fitted with a warping drum and a de-clutchable chain gypsy. A handbrake operates on the chain gypsy at all times. There are two hydraulic controls: a spring-loaded by-pass relief valve, which controls the power delivered by the winch; and a reversing lever which controls the direction in which the winch rotates.

In use, the by-pass valve can be wound right out, in which case the winch does not rotate; and then wound in through its total travel, which slowly increases the pulling power of the winch; until the valve is fully closed, when the winch will deliver full power governed only by the pressure relief valve in the Engine-Room or the slipping of the pump drive belt, which sometimes occurs.

The reversing lever, which has an upright 'stop' position, is moved to port to wind out and starboard to heave in.

Chain

90 metres of short-link calibrated galvanised anchor chain is stowed in the chain locker at the base of the spurling pipe under the fo'c'sle floor. Marked as: one link painted at ten metres, two links painted at twenty metres, etc.

Anchors

Two anchors are provided:

The Bower anchor, which is of the 'CQR' pattern and is stowed in chocks on the starboard side of the foredeck.

The Kedge anchor, which is also of the 'CQR' pattern and is stowed in chocks on the port side of the foredeck.

When recovering the anchor, this has to be man-handled aboard using a rope strop, once the anchor is close up to the bull ring. At sea the bower anchor is kept permanently shackled on to the anchor chain, through the bull ring.

There is an Anchoring Action Card in the Training Manual

8. Deck Arrangements

Berthing Warps and Ropes

Adequate berthing warps are provided.

Fenders

Adequate fenders are provided around the deck, and at sea these are normally lashed inside the rail around the aft gun.

Mooring Bollards

These are fitted at strategic points around the deck to cater for bow and stern warps and springs. There is also a large towing bollard in the middle of the aft deck together with a large fairlead.

Wooden Handrail

This is provided on top of the stanchions at the deck edge and has three opening positions: (a)&(b) Hinged opening positions either side of the aft end of the bridge superstructure, adjacent to the positions for the accommodation ladder.

(c) A large removable section which comes out complete with one deck stanchion adjacent to the dinghy stowage, historically enabling the dinghy to be lifted over the side.

There is also an opening on the port side of the aft rail but above which the rail is fixed. This is provided for boarding from the dinghy over the stern when the vessel is rolling too heavily for the accommodation ladder to be used in one of the beam positions.

Dinghy & Davit

Davit

The davit is installed adjacent to the dinghy stowage. It may also be used to recover an unconscious MoB.

Dinghy

It should be noted that an authentic 10 feet long wartime naval rowing dinghy is carried, but this is for exhibition purposes only (the vessel carried an identical dinghy during the war). The dinghy is provided with no equipment and is not watertight and so should not be put in the water.

Towing. *Section 4, Handling Characteristics, covers Towing and being Towed.*

9. Electrical system

Introduction

Medusa has two main systems:

240V AC provided by either shore power or by a 240V 50Hz 12KVA diesel generator. The installation is to ISO13297 and British Marine code of practise.

24V system powered from dual battery banks. The installation is to ISO10133 and the British Marine code of practice.

This section is a description of the systems suitable for operations. For more detail and maintenance see the ship electrical handbook.

240V systems.

Power may be fed from the shore via a 32A connection on the starboard waist. This connection then passes to a 240V isolation transformer which gives total isolation from shore supply and from shore earth thus protecting the vessel from reverse polarity and earth leakage currents which would give rise to galvanic action.

The shore supply is protected by an RCD before passing to the main switch board located on the after engine room bulkhead.

The 240V feed from the on board generator is also protected by an RCD before passing to the main board.

The main switch board has a selector switch that will select between ship and shore supply and will also show which supplies are available. This switch should only be operated under light load conditions. The supply is metered for Volts, Amps and Frequency.

From this board the various circuits are fed via switch breakers which are labelled. The water heater circuit has an additional switch box to allow the engine room to select which ones are in operation (important if a 16A shore supply is taken). This is located above the isolation transformer on the aft starboard engine room bulkhead. The water heaters have a local isolator in addition.


WATER HEATERS
ON
OFF
GALLEY
PETTY
OFFICERS
WARDROOM
FO'C'SLE
CLOSED

240V Generation

The generator is an Onan 12KVA 50Hz unit with a Cummins engine as the prime mover. The engine is started from a dedicated 24V battery adjacent to the generator. Above the battery is a battery selector Switch.

The switch has 4 positions:

Off

Position 1	***Generator started from generator battery***
Position 2	***generator started from main engine battery***
Both	***Main engine and generator battery paralleled***

The normal operating position is 1.

The switch must not be operated with the generator running.

The generator may only be started by trained personnel.

To start:

a) Ensure cooling water seacock open
b) Battery selector at position 1
c) Engine level checks have been done.
d) Press start switch which will initiate the start sequence
e) Select generator on the main board

To shut down operate the stop switch and once shut down close the seacock. The generator should not be shut down after running on heavy load but run lightly loaded for a while to cool the alternator.

The generator has its own charging alternator which will charge its own battery and also charge the main engine battery if the parallel position is selected on the battery switch.

24 Volt Systems.

The 24V system is powered by two battery banks of 180Ah located on the starboard aft side of the engine room.

Each battery bank has its own isolator located on the after bulkhead adjacent to the battery.

From the isolators power is fed to the main isolator switch on the port aft bulkhead of the engine room.

The switch has three positions:

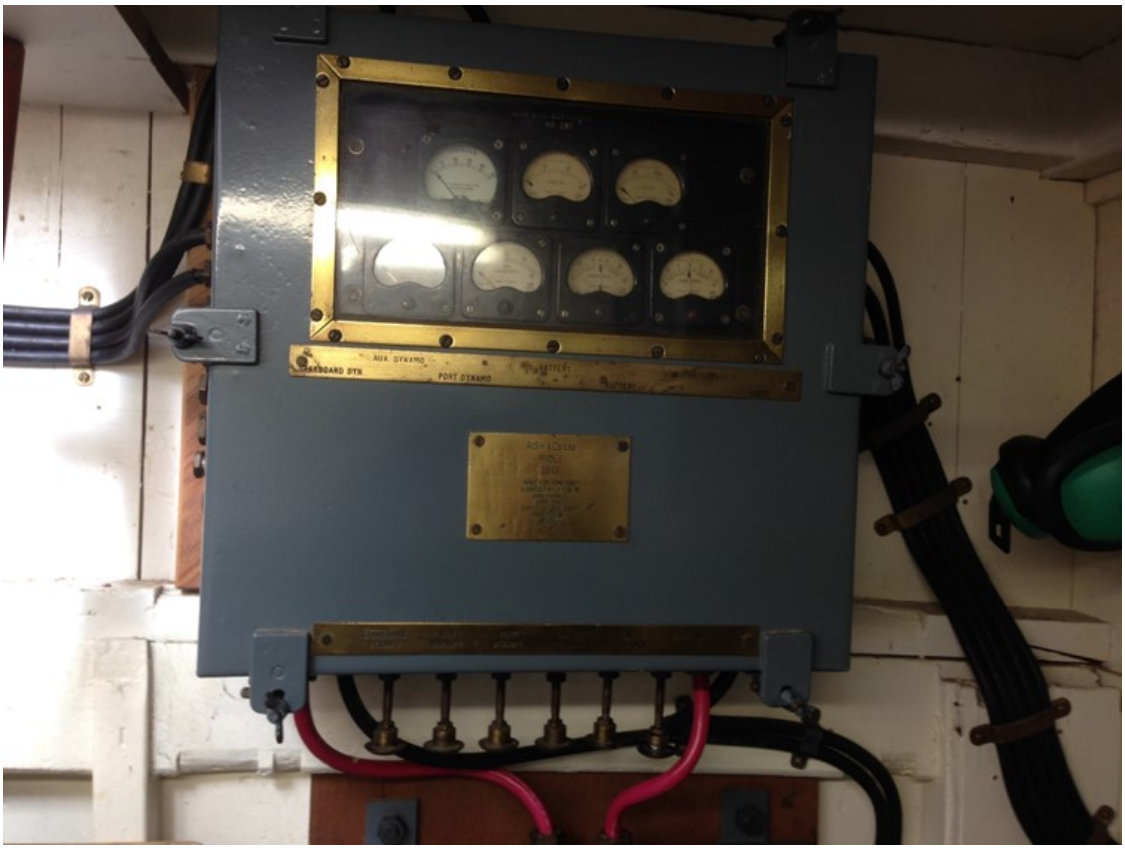
Off

Battery bank A for engine start and bank B for boat systems

Battery B for engine start and A for boat systems.

This avoids any spikes on engine start damaging boat systems and balances the load.

From the main isolator, power is fed to the start motors on the two main engines and to the main 24 distribution board located immediately above the main isolator.



The main board provides load and voltage metering and distribution to the various parts of the ship is via plunger operated circuit breakers along the bottom of the board.

At sea, those commonly operated (down = on) are:

- **Boat Load** which supplies three sub boards for lighting and 24V sockets
- **W/T Supply** which powers the electronic navigation systems and radio.
- **Port Dynamo** powers the compressor for the ships air horn.

The Gardner Auxiliary engine has a 24V dynamo which can charge batteries and supply the vessel and is engaged via the **Aux Dynamo** plunger, (at April 2020 inactive).

Charging of the 24V system is normally via a battery charger operated off 240V (ship or shore)

The battery charger has three isolated outputs, one for each main engine bank and one for the generator. It has load and voltage metering.

Boat Load.

The boat load supply from the main board feeds three sub boards, one each side of the after end of the engine room and on the forward starboard bulkhead of the engine room.

The light/power systems are mirror image about the centre line of the boat, the port sub board feeds the port side and similarly the starboard. The boards contain fuses to protect the sub circuits.

The sub board at the forward end of the engine room feeds navigation lights, alarms and systems critical to operating the vessel (but not the electronic navigation systems)

W/T

The plunger marked W/T feeds a fuse box on the after engine room bulkhead and from there feeds the distribution board for the navigation equipment.

The electronic navigation systems board is fed with 24V and contains a solid state dropper to produce 12V. Each outgoing circuit is then protected by a circuit breaker, those down the left hand side of the board are 24V and those down the right are 12V.

For detail of the navigation systems see Chapter 5.

10. Water System

There are fresh water storage tanks installed below the floor in the following compartments:-

1. Forward Messdeck

2. Tankspace

3. Aft accommodation lobby

4. Wardroom

Tanks no. 3 & 4 are normally isolated from the rest of the system by a valve under the Petty Officers' Heads. This is in case the rest of the system becomes contaminated.

There are also two wing tanks installed to port and starboard in the Engine-Room. These two tanks can be valved-off from the system and are useful in trimming the ship.

The water system is filled through two fillers on the main deck, one either side of the chartroom, which connect directly with the two Engine-Room wing tanks. The fillers are locked in place using a special tool that is stowed in the Chartroom Table.

Two 'Header' tanks are installed under the bridge floor and are connected to, and provide gravity feed to, the taps in the galley and the three toilets.

Water is pumped up to the Header tanks using an electrically driven pump fitted in the forward starboard side of the Engine-Room. The valve adjacent to the pump must be opened before pumping commences, and closed when pumping is finished.

Four electric water heaters are provided :-

1. 5 gallon capacity water heater supplying the galley. Installed in the Galley.

2. 2 gallon capacity water heater in forward toilet.

3. 2 gallon capacity water heater in POs' toilet.

4. 2 gallon capacity water heater in Wardroom toilet.

The vessel's total water capacity, including the header tanks, is approximately 2 tons.

11. Fuel Stowage, Cut Offs & Trim

Fuel Stowage

There are four main tanks situated just forward of the Engine-Room, two to port and two to starboard. The fillers for these tanks are situated under screwed brass deck covers just forward of the chartroom.

Each tank has a threaded stainless steel cap through which it is filled and the level dipped using a graduated dipstick. The graduations on the dipstick are set to reflect the different tank dimensions for the inner and outer tanks on opposite sides of the dipstick and tank types are engraved.

The key for the deck covers and fuel caps, is hung up by the starboard fresh water tank in the Engine-Room, together with the brass dipstick.

When dipping the tanks, it is necessary to ensure that the dipstick goes to the bottom of the tank and does not foul a tank baffle, and thus give a false reading. Care should be taken not to drop the dipstick onto the bottom of the tank.

Fuel is fed to the engines from two Service Tanks, one to port and one starboard at the forward end of the Engine-Room. These tanks are fitted with graduated sight glasses, each graduation indicating five gallons.

The Service Tanks are filled from the main tanks using the Hand Pump on the forward Engine-Room bulkhead. A Main Tank is selected using one of the four valves across the forward engine room bulkhead, supplying the suction side of the pump. The Service Tank to which the fuel is to be pumped is selected using one of the two valves either side of the pump on its outlet.

Whilst filling a Service Tank it is important to watch the sight glass, and to stop pumping before the fuel level reaches the top graduation. This is because the gauge lags behind the tank level and, if care is not taken, the tank will be overfilled.

After filling the tank, the water trap at the bottom of the tank should be drained until clean fuel issues from the drain cock. The amount of fuel transferred must be entered into the Engine-Room fuel log, and the fuel on board totalled.

Total fuel capacity is 5½ tons (1,500 gallons).

Good Practice suggests:

i) re-filling Service Tanks before they are empty to avoid drawing air into the Fuel Line in a heavy sea-way; i.e. with about 15galls remaining = 1Hr on both engines.

ii) re-filling Service Tanks from different Main Tanks, to preserve trim, and to avoid contaminated fuel from one Main Tank filling both Supply Tanks.

Fuel Flow Control

Each Service Tank has a Wheel Valve fitted near the top of its water trap and this controls the fuel flowing to the main **fuel line**.

There are three valves fitted with dual filters in the **fuel line** on the forward Engine-Room bulkhead: The port one feeds the port main engine, the midships one feeds the auxiliary generator and the starboard one feeds the starboard main engine. To port, above the port main engine filter, is a small red painted wheel valve with a single filter. This feeds the main generator.

Fuel Cut Offs

There are emergency Fuel Cut Off pull-knobs at the forward end of the Chartroom, to Port and to Starboard, which shut off fuel flowing from their respective Supply Tank. This cuts fuel from all of: the two Main engines, the 1L2 Aux, and Onan Generator.

Individually, there are separate remote Cut-offs:

- to cut fuel from either Main Engine - using the knob connected to their Fuel Rack; located inboard of the Chart-room steps;
- for the 1L2 Aux engine – above the Engine-room hatch: and for
- the Onan Generator, which can be remotely stopped as described later in its section.

Trim

It is important, for the sake of the appearance of the vessel, to keep her floating upright and without a list. In order to assist with this, a bubble clinometer is fitted to the forward Engine-Room bulkhead and this should be inspected prior to moving fuel in order that the correct tanks can be used to prevent the vessel listing.

If it is not possible to maintain level trim when moving fuel, it is often possible to adjust this by using the wing water tanks. If these are normally kept valved-off after filling, then water can be drained into the bilge tanks from whichever tank is on the heavy side of the vessel in order to correct any list.

12. Engine-Room Equipment

Operating Main Engines

There are no engine controls fitted on the bridge of the vessel and so all engine movements must be actioned by the engineer on watch in response to the Engine-Room telegraphs. It cannot be too heavily stressed that the safety of the vessel depends, to a considerable extent, upon engine movements being carried out promptly and accurately.

Starting

1. Check seacock is open.
2. Check oil level in engine sump.
3. Check oil level in gearbox.
4. Check Fresh Water Header Tank level
5. Check cooling water by-pass valve closed.
6. Push ‘stop’ lever forward to release fuel pump rack, at same time pulling governor arm back.
7. If engine is cold, press up ‘excess fuel’ button on underside at front of fuel pump, at same time pulling governor arm back.
8. Check engine throttle is closed (it takes some time for the oil to begin to circulate and, to avoid excessive load on the unlubricated bearings, the engine should be run as slowly as possible until the oil pressure builds).
9. Depress starting button on starter contactor box until engine starts (if difficulty is encountered because the starters fail to engage, release starter button and try again). It is usually only necessary to allow one cylinder to go over TDC before the engine will fire and run.

When Engine is Running

1. Check that oil pressure reads at least 30 psi.
2. Check that salt water is circulating.
3. Once fresh water circulation is established, open cooling water by-pass valve.

While Under Way

1. Check that oil pressure does not fall below 30 psi.
2. Maintain cooling water temperature at 142°F (may not always be attainable) by means of the by-pass valve.

Stopping Engine

1. Close throttle.
2. Close cooling water by-pass valve.
3. Move ‘stop’ lever back to shut off fuel.
4. Close seacock (if required).

Starting Problems

Occasionally, it will be found that the starting motors will not engage.

This is due to the teeth on the starting pinions not lining-up with the gaps between the teeth on the flywheel gear ring. If the starter button is released and another attempt at starting made, the motors will usually engage. In very cold weather, when the oil in the flywheel housing is thick, then this problem may persist, and several attempts at starting may be necessary.

If, when attempting to start the engines, it is found that the batteries have insufficient power to pull the engines over compression, then it is sometimes possible to start with the engines decompressed. This will involve lifting the decompressor lever on each cylinder head to the horizontal, 'decompressed', position, operating the starter button and then, when the engine is turning, moving the decompressor lever on No 8 cylinder to the vertically down 'compression' position. This should result in the engine starting on No 8 cylinder. The other seven decompressor levers can then be returned to the 'compression' position, when the engine will commence to run on all eight cylinders.

Injectors

Each injector can be tested separately when the engine is stopped by using the injection pump element priming lever. The levers are situated on the side of the fuel injection pump, one for each cylinder.

The engine stop control must first be set to 'run' and then the lever for the required injector pulled sharply down, when the injector will be heard to spray. If the lever can be operated with little resistance, then this indicates that the cylinder in question is on its firing stroke.

In this situation, it is necessary to turn the engine through at least one revolution, either using the barring gear or by operating the starting motors, in order to place the element tappet on the base of the cam so that the priming lever becomes operational.

Problems at Sea

In the unlikely event of a problem in a cylinder at sea, e.g. piston seizure, then the cylinder in question can be shut down so that it does not fire and exacerbate the trouble. This is achieved by 'latching out' the pumping element on the fuel injection pump for that cylinder by pulling down the priming lever and locking it down by means of the latch. The decompressor lever should be left in the 'run' position as, if the cylinder is decompressed, then there is a hammering effect which may cause damage to the inlet push-rod ball, cup, or cam-follower.

Cooling Water Bypass

Opening the cooling water by-pass valve allows some of the hot water leaving the engine to be recirculated back to the suction side of the cooling water pump and mix with the incoming cold water, thus increasing the engine temperature. Unfortunately, even using this valve, it is rare for the engines to reach their designed running temperature of 142°F (61°C). Please note that when starting the engines, it is important to ensure that the by-pass valve is closed to ensure that cooling water is circulating before opening this valve.

Oil Leakage

Provision is made to retain any oil leakage within the confines of the engine space and to prevent absorption of oil into the structure.

Drip trays are fitted underneath each main engine which are inspected and accumulated oil is removed.

Oil which accumulates in the bilge can be manually recovered using absorbent mats

Oil that is recovered is stowed in dedicated containers for correct disposal ashore.

Telegraph Signals

Before leaving the berth, the engines will be 'rung on' to 'standby' by the telegraphs being rung from 'full ahead' to 'full astern' and then back to 'stop'. This is answered, when the main engines are ready to proceed, by sounding the bridge reply buzzer twice.

Telegraph Positions and Engine Speeds :-

Slow 250 rpm (idle)

Half 600 rpm

Full 800 rpm (full throttle)

To obtain 'Emergency Full' (will be requested verbally from the bridge unless an Engine-Room electric bell signal has been agreed) :- Lift latch at front of throttle control on engine and move lever through to 'emergency' position. This will increase engine speed to 900 rpm. With engine at 900 rpm, the water temperature should be checked more frequently as the extra fuel being burned tends to increase the engine temperature.

On an offshore passage, 'full and away' may be rung in a similar manner to 'stand-by' when it is not necessary for the engine controls to be manned and the engineer on watch can stand down. This is answered on the bridge reply buzzer. When engine movements are required again, then 'stand-by' will be rung, and replied-to, as before.

It is rarely possible for the engineer to stand down whilst the vessel is navigating in the Solent.

At the end of a passage, after the vessel is berthed or anchored, 'finished with engines' will be indicated by the telegraphs being rung from 'full ahead' to 'full astern' and then back to 'stop'. Once again, this is answered by sounding the bridge reply buzzer twice. The main engines may then be shut down.

General

Although the Engine-Room is well lit, it is advisable to have the low voltage telegraph lights illuminated whenever the vessel is under way.

Having battery back-up, these lights will remain on in the unlikely event that the generator is shut down, which will extinguish the mains lighting.

Whilst the vessel is under way, the Engine-Room log should be completed at half-hourly intervals, noting down details of engine temperatures, oil pressures, electrical loadings, service tank fuel levels, etc. In this way, early warning is given of anything about to go wrong, and the possibility of the engines being starved of fuel is obviated. If continuous engine movements are being carried-out when the log is due to be completed, then the engineer on watch should seek assistance from his relief.

If problems occur with the main engines which require an engine to be shut down, then the bridge must be informed immediately but the engine left running until the relevant telegraph orders are received.

The Engineer should alert the Bridge by sounding the bridge reply Buzzer three times.

The Bridge can communicate with the Engineer by an Electric Bell is fitted on the high level bulkhead in front of the starting platform and this is operated from push-buttons on the bridge and in the chartroom. Although there are no specific signals laid down for this bell, from time to time it may be necessary for it to be brought into use. The meaning of any signals to be used will be agreed, and confirmed, prior to any passage where its use is envisaged.

The oil pump in each gearbox is fitted on the output shaft. This means that when the engine is running with the gearbox in neutral, there is no pressure-fed lubrication to the gearbox. For this reason, the engines should not be run with the gearbox in neutral for excessive periods.

The steering gear needs no maintenance other than that laid down in the Maintenance Schedule. It is operated using 'Renold' chains and a shaft running under the port side deck from the Engine-Room to the tiller flat. In the tiller flat the shaft is connected to a worm and peg gearbox, with rod connection to the two rudders. An extension to the steering shaft runs to the forward end of the Engine-Room, where a chain connects to the chartroom wheel via a dog clutch.

A careful watch should be kept on the fuel levels in the main fuel tanks and the fuel situation regularly reported (normal practice is for the fuel situation to be entered in the deck log at the beginning of each day).

The Engine-Room is responsible for providing fresh water for domestic consumption and so, on a daily basis, the fresh water header tanks should be topped-up. Every opportunity should be taken to top-up the main fresh water tanks when lying alongside, if a fresh water supply is available.

Hydraulic Pump

This is driven from the front of the port main engine by means of a single rubber 'V'-belt. It provides oil under pressure to power the anchor winch on the foredeck. The unit is a three cylinder reciprocating pump in which the pistons are forced upwards on the delivery stroke by a camshaft having roller bearing cams, and return by spring pressure.

The pump camshaft rotates all the time that the port engine is running but the pistons can be lifted clear of the cams when the pump is not required for use, by means of a control lever on its starboard side.

Operating Onan Main Generator

Starting

1. Open seacock (located just inboard and below generator).
2. Check cooling water level in Header Tank on ship's side.
3. Check oil level in engine sump.
4. Rotate 24 volt battery isolator to 'normal'.
5. Check fuel cock is open (located on the forward Engine-Room bulkhead, forward of port main engine).
6. On generator panel, check that 'Emergency Stop' is set to 'on'.
7. Depress start button. Please note that starter button must remain engaged for a few seconds after engine begins to fire until the engine runs up to speed, in order to keep the fuel interlock made.

When Engine is Running

1. Check overboard cooling water discharge.
2. To bring generator onto mains load, switch 'Supply' switch to 'Generator'.

Note :- If the generator shuts down. It is tripped by: no Raw Water Flow, Low Oil Pressure, or High Coolant temperature. If the generator has shut down, or fails to start; check the Control Panel outboard of the Chartroom Wheel, which gives an indication of the fault, according to the number of flashes of the Indicator light. *Picture below*.

If the Mains Breaker has been activated, then the reason for this should be established, and any fault rectified, before restarting the generator.

Normal Close Down

1. Switch mains load on 'Supply' switch to 'Shore'.
2. Run generator on 'no load' for two minutes to cool the windings.
3. Push the black rocker switch to 'stop'.
4. Close seacock.

Remote Close Down

This can be stopped from outside the engine room from a Control Panel placed next to the wheel in the chartroom. *Picture below.* Operation is by pressing the rocker switch at the Stop/Prime position.

There are facilities to start the generator from this panel however this process is not to be employed. The generator will always be started locally in the engine room.

Indicator lights display operational and **fault conditions** as shown in the picture above.

Starting 1L2

1. Check oil level in engine sump.
2. Check seawater inlet open
3. Check Fresh Water header tank level.
4. If general service pump is to be used, clutch-in pump and check positions of intake and discharge valves (see appendix ‘A’ for valve locations and operation)
5. Lift decompressor lever.
6. Release ‘stop’ control lever.
7. If exceptionally cold, lift ‘excess fuel’ latch and push fuel pump rack to its maximum travel (excess fuel is not normally needed to start this engine).
8. Fit starting handle.
9. Crank handle until engine is rotating as fast as possible, and then push decompressor lever down. Engine will immediately fire and start.

13. Engineers' Maintenance Schedule

This section covers regular maintenance items which should be undertaken by the Engine-Room personnel. If the vessel is not operational, then the 'daily' items should be carried-out on a weekly basis.

Daily

1. Check lubricating oil levels in main engines, main engine gearboxes, main generator and auxiliary generator (the lubricating oil storage tank is situated above and forward of the main generator – not installed at Aug 2020).
2. Lubricate governor and throttle linkages on main engines and auxiliary generator, and fill oilers on main engine circulating pumps, auxiliary generator engine circulating pump, and general service pump.
3. Check cooling water level in main generator heat exchanger.
4. Check bilge water levels and pump-out as necessary (if Engine-Room bilge needs pumping, then permission of the Officer of the Day should be sought before undertaking this).
5. If vessel is operational, check and adjust stern glands at end of each day's run.
6. Check all light fittings and replace defective bulbs as necessary.

Weekly

1. If vessel is operational, turn greasers on propeller shaft glands in aft Engine-Room bulkhead.

Monthly

1. Grease anchor winch.
2. Turn greasers on rudder bearings.
3. Turn greasers on vibration dampers on main engine crankshafts and on main engine fuel pump camshafts.
4. Turn greasers on steering shaft bearings.
5. Turn greaser on general service pump.
6. Lubricate davit base bearing.
7. Check level of hydraulic fluid in anchor winch header tank.

Annually

1. Adjust valve rocker clearances on main engines, main generator and auxiliary generator.
2. Unship top rudder bearings and apply grease to rudder shafts (tiller arms will need to be wedged up before removing bearings to prevent rudders dropping).
3. Remove top cover from steering housing on bridge and lubricate helm indicator scroll plate and linkages, and lubricate wheel spindle and chains.
4. Lubricate helm indicator scroll plate and linkages, and lubricate wheel spindle and chain on chartroom steering gear.
5. Lubricate all hinges to lockers in accommodation and on deck.

14. Safety Aspects

Escape Routes

In any emergency situation it is essential that areas below deck can be evacuated

There are four specific areas, below deck, that are accessible to crew and visitors.

Forward Messdeck / Tankspace

Exit is either;

- Up the forward ladder to the deck
- Up the ladder to the chartroom and through there to the bridge

Chartroom

Exit is either;

- Up the steps to the Bridge
- Down the ladder to the Forward Accommodation and then Up the forward ladder to the deck

Engine Room

Exit is either;

- Up the ladder to the Bridge
- Through the escape hatch to the Chartroom

Aft Accommodation

Exit is either;

- Up the ladder to the deck
- Through the escape hatch in the Wardroom Heads

Operational Hazards

There is guidance in the Staff Training Manual for crew to minimise the potential hazards of Fire & Flood. Equipment and operational procedures are described below:

Fire Detection & Suppression Equipment

Indication

Fires may be discovered by crew members and will be reported to the bridge. One long ring on the Emergency Alarm, actuated from bridge or chartroom, will indicate a fire to crew members throughout the boat who then muster to fight the fire.

Additionally, there are 6 wireless-linked smoke/heat detectors in the Fo'c'sle, Galley, Chart Room, PO's Mess, Radio Room, and Wardroom, which sound a loud alarm.

The crew **Training Manual** sets out safety matters. Fire can be fought using the following equipment as appropriate:

- 1L2 Generator/Pump
- Fire Extinguishers, or Blanket
- Fire Buckets

1L2 Generator/Pump

The pump feeds a fire hydrant on the starboard side of the upper deck and a hose is fitted that will reach any part of the vessel.

Fire Extinguishers

One 6 Litre Gas/Water extinguisher with a fire rating of 13A located at the base of the forward ladder into the accommodation

One fire blanket is located on the inner bulkhead in the galley.

One 6 Litre Gas/Water extinguisher with a fire rating of 13A located inside the chartroom door

One 6 Litre Foam extinguisher with a fire rating of 13A located inside the chartroom door

One 12kg Automatic Powder extinguisher located forward in the engine room, Heat Triggered

One 6kg Powder extinguisher with a fire rating of 34B located in the engine room

One 2kg CO_2 extinguisher with a fire rating of 34B located in the engine room

One 2kg CO_2 extinguisher with a fire rating of 34B located in the Radio Room

One 6 Litre Gas/Water extinguisher with a fire rating of 13A located in the wardroom lobby

One 6 Litre Gas/Water extinguisher with a fire rating of 13A located in the wardroom heads

Fire Buckets

Two Fire Buckets with lanyards are kept in the Starboard Bridge Locker.

Appendix D is plan of Medusa's Extinguishers and Fire Alarms.

Flood Monitoring & Prevention

Medusa is divided into a number of watertight sections that can limit or delay the spread of flooding.

Bilge Level Monitoring

A display is fitted in the Chartroom providing a visual display of excessive bilge levels with an audible alarm. The display has a test facility.

Sensors are fitted in the following places within the bilge:

1. Forward Bilge
2. Tank Space
3. Engine Room
4. Aft Accommodation

Numbered lights on the display equate to the sensor numbers above

The display has a Test button which, when operated illuminates all four lights and sounds the alarm.

Sensors can be tested by manually lifting the Float.

Forward Watertight Panel

This is a single panel secured by four butterfly nuts fitted in the watertight bulkhead in the forward heads. A warning notice is fitted to the outside of this panel stating that it is to be closed at sea.

This panel must be fitted and secured before proceeding to sea and reported, to the Captain, as part of seagoing checks.

Closing of Scuttles

Scuttles fitted in forward accommodation galley and forward heads could admit water in rough conditions or allow rapid release of air in a flooding condition.

All scuttles below Deck level must be closed and secured before proceeding to sea and reported, to the Captain, as part of seagoing checks.

Watertight Door

A watertight door is fitted between the forward accommodation and the tank space. This door is secured by one clip in the tank space and has a quick manual closing capability.

This door is normally open for access but can be closed by manual order from the Officer of the Watch or by an individual crew member in the case of an emergency.

Flood Handling

Water can be removed using the following equipment:

- 1L2 Pump
- Portable Electric Pump
- Hand Pumping Facilities
- Tiller Flat Pump
- Fire Buckets

1L2 Pump

The pump is located in the engine room and is started manually. Instructions for starting are provided in Section 11.

Valves are provided in the engine room to allow pumping from selected sections of bilge. Valve allocations are detailed in Section 17.

Portable Electric Pump

A portable electric pump and hoses are located in the engine room and can be moved by hand to the site of a flood. 240 volt power is taken from the nearest socket, the input is at the base of the pump which can be lowered into the flooded area and the control valve is placed above the pump. The output hose is taken through a hatch or scuttle to the sea.

Hand Pumping Facilities

Pipes, (with strainers), are fitted from the upper deck to the bilges in four positions:

A T handle (Fitted with a rubber valve) is stowed on the after bulkhead of the engine room behind the access ladder. The handle is taken to the appropriate pipe and fitted manually. Operation is by movement up and down in the pipe and water is extracted to the upper deck.

Tiller Flat Pump

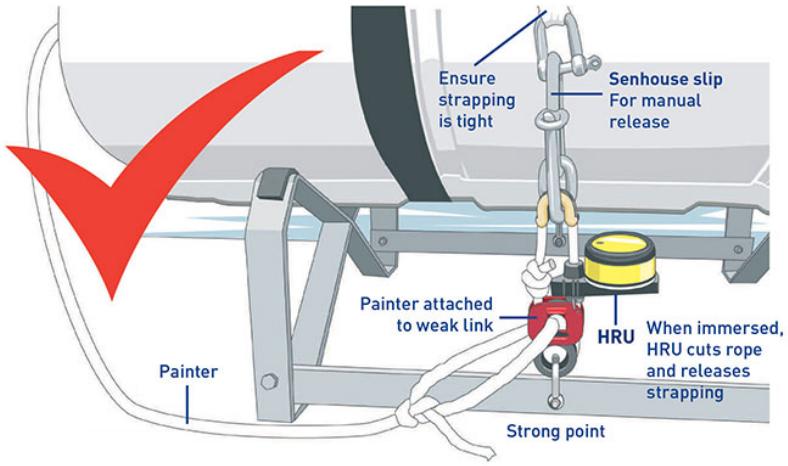
A hand operated pump is fitted on the upper deck by the port side of the Tiller Flat hatch with a pipe and strainer down to the base of the flat. Operation is by reciprocal movement of the handle.

Fire Buckets

The two Fire Buckets with lanyards, which are kept in the Stbd Bridge Locker, can be used.

Liferaft

A Liferaft capable of embarking the maximum personnel allowed on a seagoing trip is located forward on the upper deck and is maintained annually. The raft can be released manually and also has a Hydrostatic Release Unit. The Painter is between 10 and 20 metres long, and tied to the vessel through a Red 'weak-link'. Deployment is described in the Training Manual.



Life Raft Equipment

The Life Raft is equipped with a SOLAS B Pack which consists of the following:

Rescue Quoit

One buoyant rescue quoit attached to not less than 30 m of buoyant line

Safety Knives

One non-folding safety knife with a buoyant handle and hand guard, attached and stowed in a pocket on the exterior of the canopy adjacent to the painter. This will be used to detach the raft from Medusa once the crew has transferred.

A second non folding knife is provided

Bailers
Two buoyant bailers are provided.

Sponges
Two sponges are provided which can be used to mop up water within the life raft.

Sea Anchors
Two sea anchors are provided

One anchor is a spare and the other permanently attached to the life raft in such a way that, when the life raft inflates and is waterborne, the sea anchor causes the life raft to lie oriented to the wind in a stable manner

Each anchor is provided with a shock-resistant hawser and a tripping line, both the hawser and the line being strong enough for all sea conditions.

Paddles
Two buoyant paddles are provided which can be used to manoeuvre the raft.

Sound Signalling
One whistle or equivalent sound signalling device is provided.

Distress Signals
Six pyrotechnic distress signals, of which two are rocket parachute flares, three are hand flares and one is a buoyant smoke signal.

Flashlight
One watertight electric flashlight suitable for Morse signalling and, in a watertight container, one spare set of batteries and one spare bulb for the flashlight are provided

Seasickness Cover
Seasickness will remove precious body fluid, makes people prone to hypothermia and impairs the will to survive.

Ninety doses of anti-seasickness medicine and fifteen seasickness bags are provided. Take a dose of the seasickness medicine once the raft has been boarded.

Heliograph
One heliograph for signalling to ships and aircraft, with instructions for its use is provided.

First Aid Kit
A Cat C First Aid Kit is provided. Its use will be controlled by the designated First Aider.

Signal Instruction
A copy of life saving signals set out on a waterproof card or in a watertight container.

Instructions
How to survive until rescued.

The steps to be taken by members of the complement immediately after boarding the life raft.

Thermal Protection Aids
Two thermal protective aids are provided.

Repair Kit
One repair kit for repairing punctures and one topping-up bellows or pump is provided.

Radar Reflector
One radar reflector is provided and needs to be rigged.

Lifejackets - Auto-Inflatable

17 Lifejackets are in two holdalls in the Chart Room while operational, forward starboard; each with a built-in Harness, Crutch Strap, manual activation Red Toggle, Light, Whistle, Top-up Tube, Lifting Becket, & Yellow Floating Loop. Also 2 Jackstays, & 2 Strops to clip Lifejackets onto the Jackstays. More detail for use is set out in the **Training Manual**.

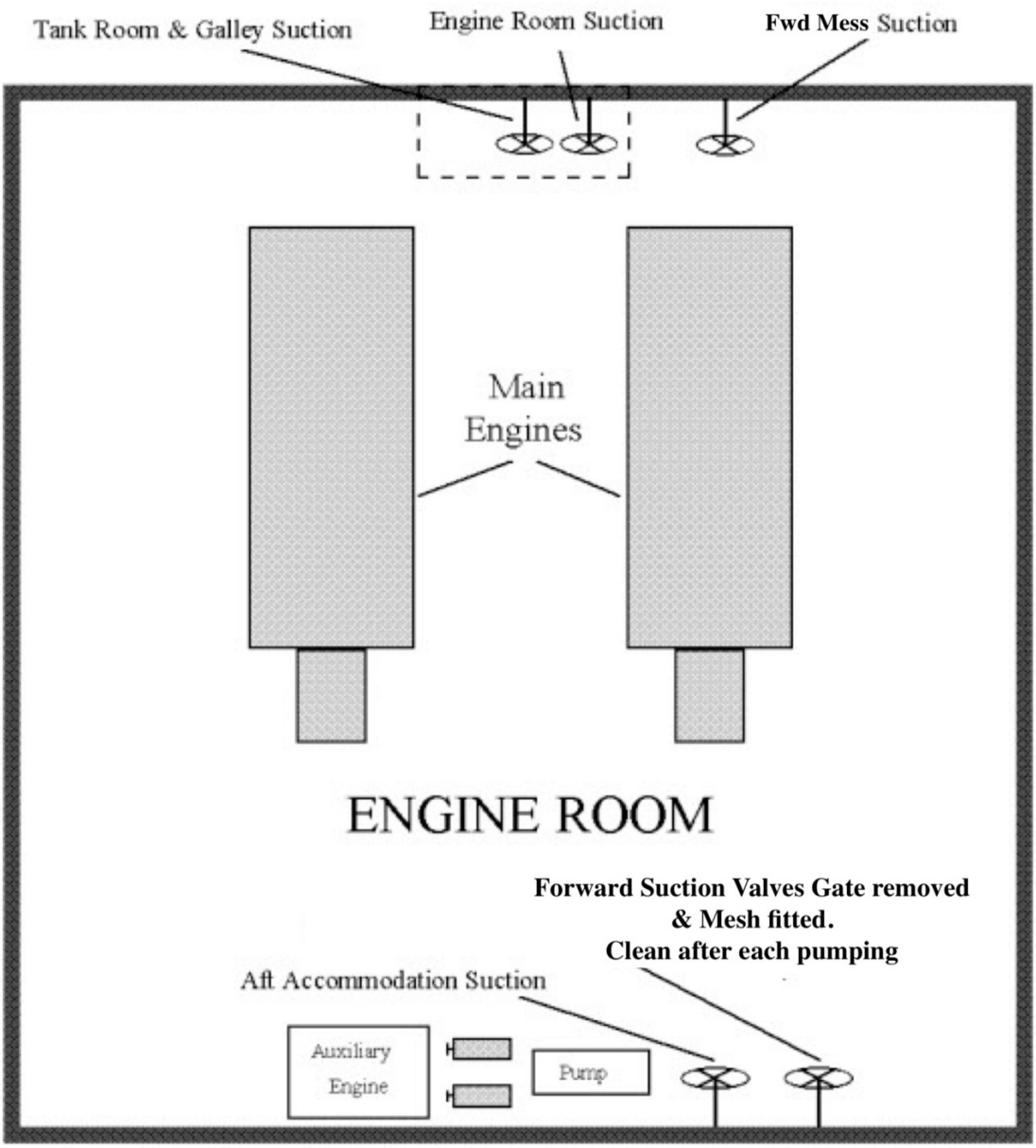
Thermal Protective Aids

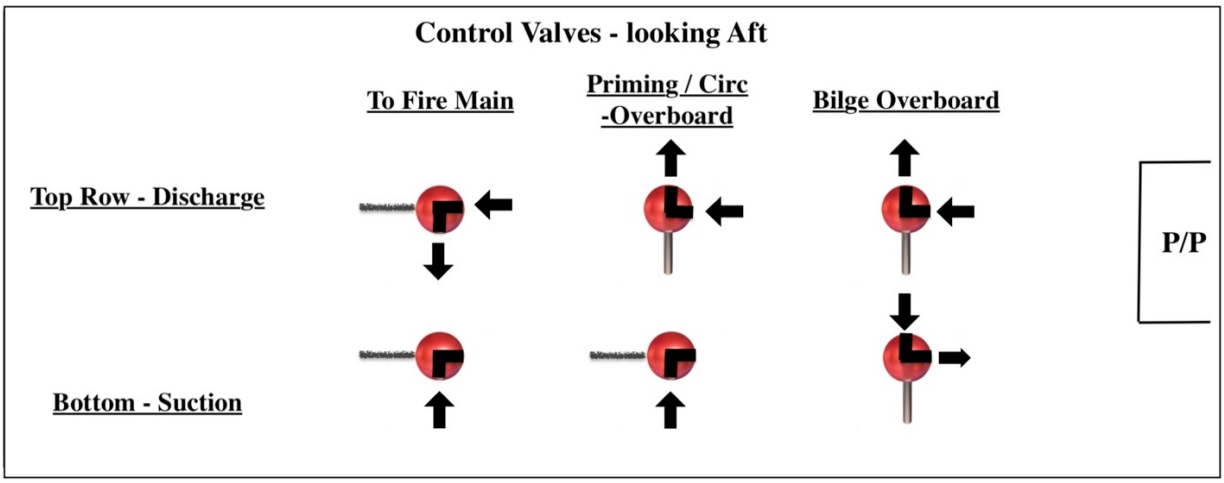
15 Thermal Protective Aids, individually vacuum packed, are stowed in the Radio Room and instructions are shown on the pack.

Instructions fur use:

1. Remove bag from zip-lock storage case and inner plastic pouch. Unfold bag fully.
2. Put on as much clothing as possible. If wet, wring out before entering. Don life jacket.
3. Step into bag and cover full length of body. Close by using zipper in front and tightening draw-string around hood.
   NB: To avoid asphyxiation caused by CO2 build-up leave airways free
4. Remove the bag before entering the water

Appendix A - Bilge & Salt Water Pumping System





Appendix B - Hull Water Intakes & Discharges

Fo'c'sle Heads

(i) WC discharge.

(ii) Wash basin discharge.

(iii) WC salt water intake.

Forward Mess

(iv) Galley waste discharge (starboard side).

Engine Room

(v) Port main engine sea intake (Aft end of engine and below the large vertical strainer).

(vi) Main generator sea intake.

(vii) Starboard main engine sea intake.

(viii) Auxiliary generator sea intake (adjacent to the starboard main engine sea intake).

(ix) Port main engine exhaust, and raw water discharge via the silencer.

(x) Starboard main engine exhaust, and raw water discharge via the silencer.

(xi) Generator exhaust.

(xii) Auxiliary generator exhaust.

(xiii) General service pump discharge.

PO's Mess

(xiv) WC discharge (adjacent to the forward end of the lower bunk).

(xv) WC salt water intake. This is situated under the floor in the toilet.

Under Floor near Stern Glands

(xvi) Port shaft bearing lubrication water intake.

(xvii) Starboard shaft bearing lubrication water intake.

Aft Toilet

(xviii) WC discharge, in the locker adjacent to the WC pan, Stbd.

(xix) WC salt water intake, Stbd.

(xx) Wash basin discharge, Port above waterline.

Appendix C - Speedboard

SPEEDBOARD			
Speed	Engine Revolutions	Engine Revolutions	Speed
3½ knots	250	250	3.5 knots
4 knots	280	300	4.2 knots
5 knots	350	350	5.0 knots
6 knots	420	400	5.6 knots
7 knots	500	450	6.3 knots
8 knots	560	500	7.0 knots
9 knots	630	550	7.7 knots
10 knots	700	600	8.4 knots
11 knots	770	650	9.1 knots
12 knots	840	700	10.0 knots
12½ knots	900	750	10.7 knots
		800	11.4 knots
		850	12.1 knots
		900	12.5 knots

Appendix D - Plan of Extinguishers and Fire Alarms