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Superseding **See Preface**

BR 67

ADMIRALTY MANUAL OF SEAMANSHIP

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PREFACE

This edition of the Admiralty Manual of Seamanship supersedes BR 67, Admiralty Manual of Seamanship Volumes 1 (1979), 2 (1981), 3 (1983) and 4 (1983); it also supersedes BR 68, Rigid Inflatable Boats User Instructions (1984).

The purpose of this book is to provide the Seaman Specialist with detailed information on all aspects of seamanship appertaining to the Royal Navy. It is also a source of information on seamanship matters for officers and ratings of other branches. Other publications referred to within this book are not available outside the Ministry of Defence.

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CHAPTER 1

GENERAL SEA TERMS

01001. Introduction

Every profession and trade uses its own technical terms to describe the more specialised parts of its work; nowhere is this more evident than in the language of the seaman. Many terms used by the British seaman have, in the course of time, become part of the English language. This is because so many of the inhabitants of our small island kingdom have been born and bred near the sea, and because no other country has for so long been dependent for its existence and prosperity on its Royal and Merchant Navies. To learn seamanship the seaman must first understand the more general nautical terms and expressions which are explained in this Chapter. Others, more technical, are included in the chapters on the different aspects of seamanship to which they are applied.

01002. Terms Relating to a Ship - Parts of a Ship

a. **The Hull**

(1) The main body of a ship is called the hull. It is divided approximately into three - the **fore** part, the **midship** part and the **after** part. The fore part ends in the **stem**, the after part in the **stern** (Fig 1-1). When standing anywhere inside the hull a man is facing **forward** when he faces the stem and facing **aft** when he faces the stern.

Fig 1-1. Parts of the Hull

(2) Any line which runs lengthways in the ship is said to run **fore-and-aft** and the line joining the middle of the stem to the middle of the stern is called the **fore-and-aft centre line** (middle line or centre line in ship's plans and drawings) (Fig 1-2).

Fig 1-2. Parts of the Hull

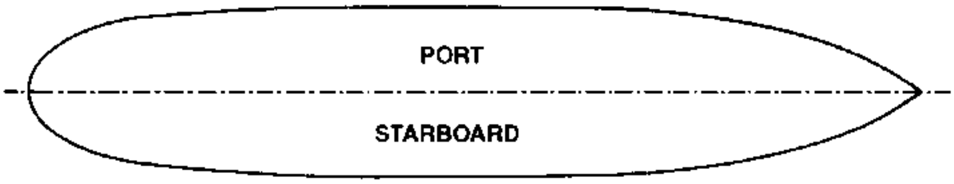


Fig 1-3. Parts of the Hull

(3) The vertical plane (surface) passing through the fore-and-aft centre line divides the ship into two halves. When facing the bow the **starboard** side is on the right hand and the **port** side is on the left (Fig 1-3). It is customary to give equipment, such as ship's boats, odd numbers on the starboard side and even numbers on the port side.

b. **Hull Surfaces** (Fig 1-4)

(1) The sides of a hull can be described generally as starboard or port, meeting under the bottom of the ship at the **keel**. The curved surface of the fore part is called the bow (port or starboard) and the curved surface of the after part is called the quarter (port or starboard); the centre part is referred to as **amidships**.

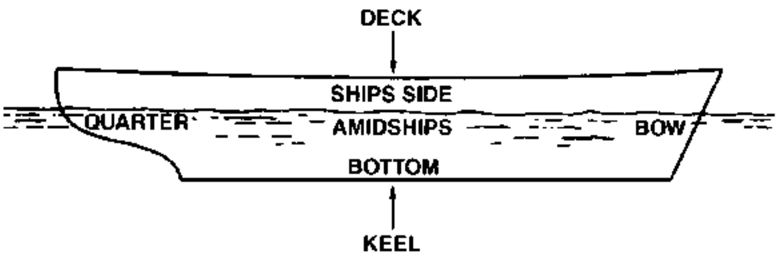


Fig 1-4. Hull Surfaces

(2) When a ship is **afloat** or **water-borne** the **waterline** divides the sides into **ship's side** above the waterline and **bottom** below it. These terms are used in a general sense, for example, when painting a ship's side or scraping her bottom. A more precise definition of an area can be achieved by referring to the side, the part and the waterline, for example - ‹the ship was holed on the starboard bow two metres below the waterline'.

(3) The continuous horizontal surfaces of a ship are called **decks**; if exposed they are called **weather decks**. Those that are not continuous are called **flats** or **platforms**.

c. **Terms Applied to The Hull** (Fig 1-5)

(1) *Freeboard.* The height of the highest continuous watertight deck (usually known as the upper deck) above the waterline at any point along the hull.

(2) *Draught.* The depth of the keel below the waterline at any point along the hull.

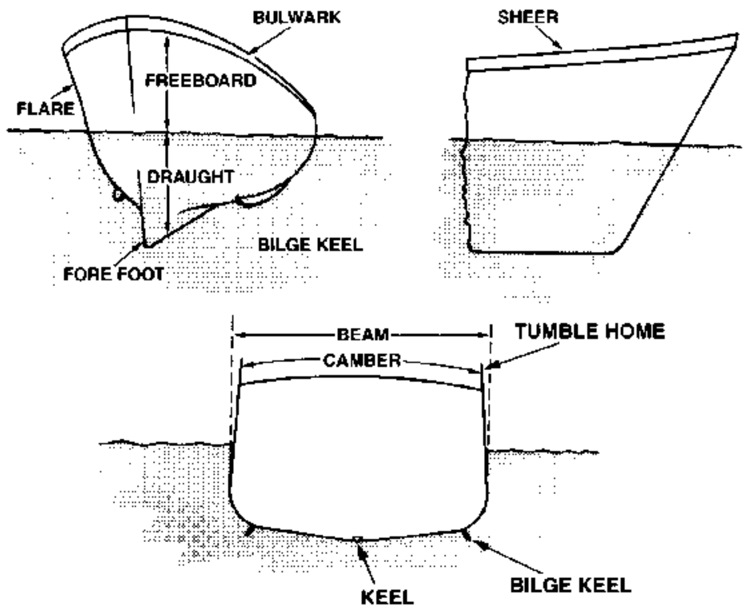


Fig 1-5. Hull Terms

(3) *Beam.* The greatest width of the hull.

(4) *Camber.* The curve given to the surface of a deck so that water will drain away to the ship's side.

(5) *Sheer.* The upward sweep from amidships to forward and aft of the upper deck.

(6) *Bilge.* The nearly flat part of the bottom of the hull both inside and out. ‹Bilge' is also the foul water that collects inside the ship in the **bilges**.

(7) *Bilge Keel.* A long projecting fin designed to decrease the rolling of a ship. It is normally secured to the hull at the **turn of the bilge**.

(8) *Tumble Home.* When the ship's sides slope or curve inwards above the waterline they are said to tumble home.

(9) *Flare.* When the ship's side curve outwards above the waterline they are said to be flared.

(10) *Flush Deck.* When the uppermost deck of a ship is continuous from stem to stern, unbroken by any raised or sunken portion (except upper works or superstructure), the ship is said to be flush-decked.

d. **Decks.** Whatever the arrangement of decks in different ships may be, it is useful and instructive to know their origin.

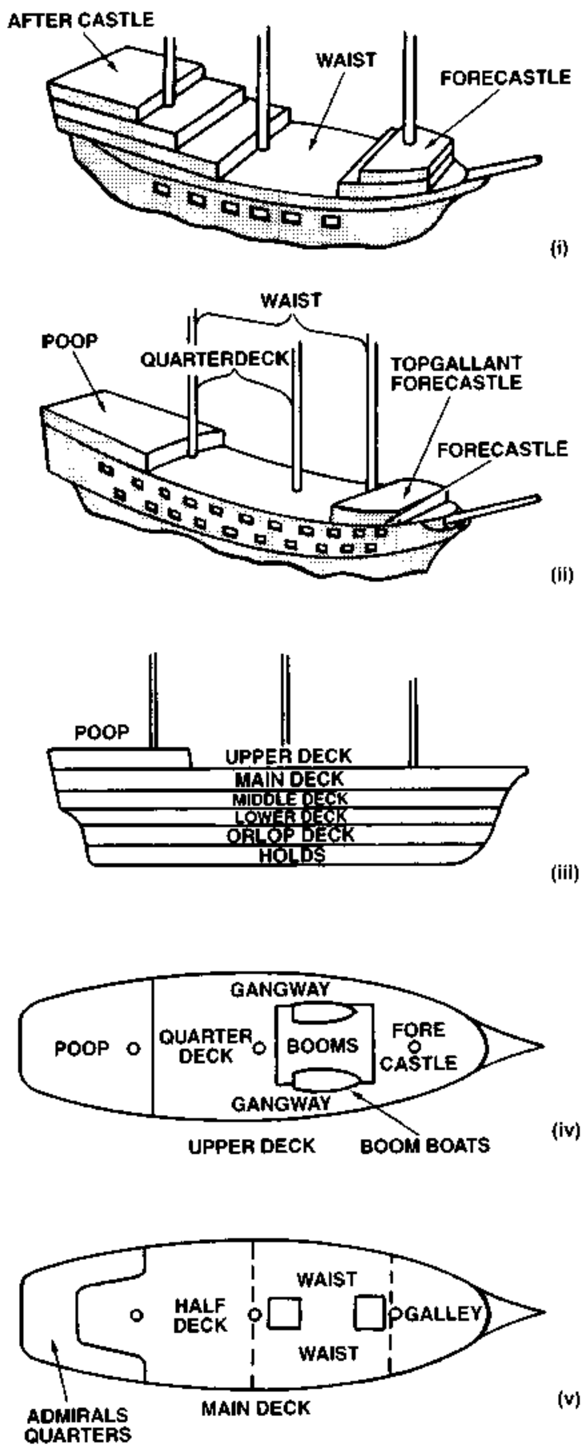


Fig 1-6. Arrangement of Decks in a Sailing Man-of-War

(1) At the time of the Armada the ends of the upper deck were built up in tiers of decks to form castles from which the soldiers could fight. They were called the **forecastle** and **aftercastle**. The lower part between the castles was called the **waist** (Fig 1-6(I)). By the end of the eighteenth century the level of the upper deck had been raised to make room for additional gun decks. Naval warfare had developed, but castles still existed. They were then called the **topgallant forecastle** and the **poop**. The forecastle was that part of the upper deck before the foremast, and the quarterdeck was that part of the upper deck between the mainmast and the poop (Fig 1-6(ii)).

(2) In a large ship of Nelson's days the waist between the topgallant forecastle and the poop was covered by an extra deck, which became the upper deck, and the poop was stepped up to make room for the Admiral's quarters. The decks below the upper deck were then named **main, middle, lower** and **orlop**, and the space below the orlop deck was known as the **hold** (Fig 1-6(iii)). On the upper deck were the **booms** amidships over the **main hatch**; as the name implies, they constituted the stowage for spare spars and the ship's boats (Fig 1-6(iv)). Right aft on the main deck were the Admiral's cabin and cabins for his staff, and the space between them and the mainmast was called the **half deck**; the space between the mainmast and foremast was the waist, and the space between the foremast and the bows, which housed the kitchens, was known as the **galley** (Fig 1-6(v)).

(3) Most of these terms have been retained in naming decks of a modern ship and adapted to suit changes in construction and design. However, in warships the decks are now numbered consecutively downwards, starting with the forecastle deck as 1 deck. The decks above 1 deck are numbered 01, 02 and so on, consecutively upward (Fig 1-7).

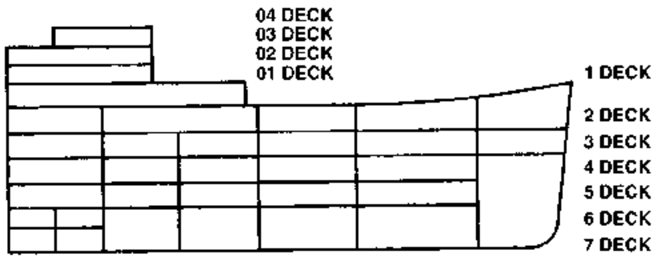


Fig 1-7. Arrangement of Decks in a Warship

(4) The highest complete deck (except in aircraft carriers) is known as the upper deck. Most modern warships are **flush-decked** and thus the upper and forecastle decks are a common deck. In aircraft carriers, the flight deck extends for the full length of the ship and is constructed above the forecastle deck, and so, in this case only, the flight deck is numbered 1 deck and the remaining decks are numbered upward and downward from it.

(5) *Parts of Decks.* Certain parts of any of these decks may also have special names. Below the upper deck a **flat** is a platform that does not run the length and breadth of a ship; a **lobby** is a space giving access to one or more compartments. These flats or lobbies may be named according to the principal adjacent compartments or equipment installed, eg wardroom flat, Captain's lobby, capstan machinery flat, or they may be referred to by deck numbers and positions in the ship relative to the bow and the centre line.

(6) The arrangement of the weather decks and superstructure of a ship is shown in Fig 1-8.

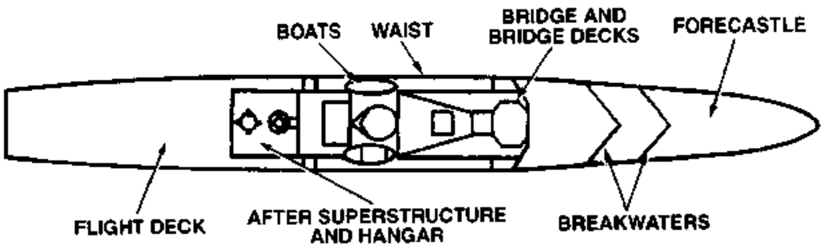


Fig 1-8. Arrangement of Weather Deck and Superstructure of a Ship

01003. Terms Defining Position and Direction in a Ship

a. Position in General

(1) A landsman lives **in** a house, therefore a seaman speaks of living **in** a ship -not **on** a ship. Let us now describe the movements of a seaman who is returning to his ship, the ship in which he is **borne**. If he arrives by boat he goes up an **accommodation ladder** which is secured **outboard** (board is the old name for a ship's side), he comes over the **side** and he is then **on board**. If the ship is lying against a dock wall it is **alongside** and the seaman crosses a **brow** from the dock to the ship and he is then on board and **on deck**, or on board and **between decks** if the brow leads into the ship below the weather deck; in either case he is **inboard** the moment he comes over the side.

(2) Having reported his return, he then goes **below** by a **ladder** which gives access to the deck below through an opening in the deck called a **hatch**. He then reaches his living quarters (**mess**) which is in a space of the ship called a **messdeck** of which the walls are called **bulkheads**, the ceiling is called the **deck head** and the floor is the **deck**.

b. Position Fore and Aft

(1) In Fig 1-9 the mast is **forward** (pronounced ‹forrard') and the funnel is **aft**. The ensign staff is right aft and the jackstaff right forward. The hatch is **amidships**.

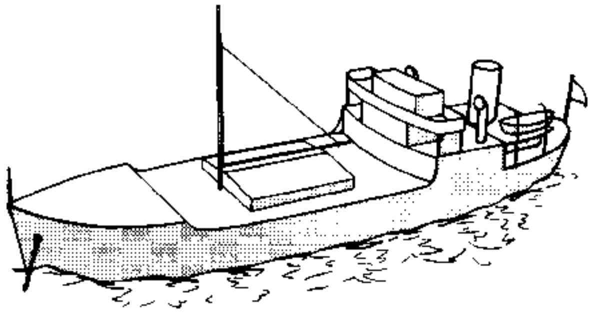


Fig 1-9. Position Fore and Aft

(2) Amidships describes the position roughly in the middle of the ship; it also describes any position on the fore-and-aft line. **Midships** is used when defining an object: for example, the midship hatch is either the one that is in the middle of the ship or, if there are two or more hatches, that which is nearest the middle.

(3) Comparing positions of objects with one another, the funnel is **abaft** (aft of) the bridge, the bridge is abaft the hatch but **before** or **forward of** the funnel.

c. **Position Athwartships**

(1) A position athwart or across the ship can be described relative to either the centre line or to the sides. The centre line divides the ship into port and starboard, while the ship's side gives an **inboard** and **outboard** position. In Fig 1-10, for example, a ship is carrying three boats; one is swung outboard to port, the other two are stowed inboard to starboard. When comparing the position of the two boats stowed on the starboard side, the black boat can be described as lying inboard of the white boat, or the white boat outboard of the black.

(2) The position of an object can be clearly described by combining the two methods, as shown in Fig 1-11.

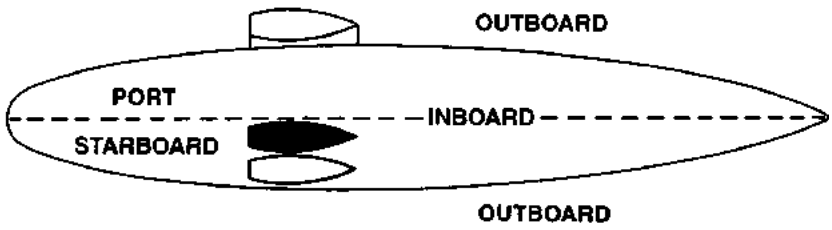


Fig 1-10. Position Athwartships

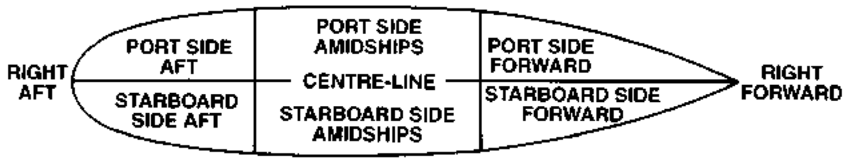


Fig 1-11. How Positions are Described

d. **Movements of Objects On Board.** A seaman speaks of going forward, aft, below, on deck and aloft (ie, anywhere in the rigging of a mast). He uses the same expression for shifting an object; thus he may shift something aft, or farther forward, to port or starboard, or nearer the ship's side. (The terms inboard and outboard should not be used to describe the movement athwartships.) The following terms are used to describe how an object is moved:

(1) To **launch** is to drag or heave an object along.

(2) To **lift and launch** is to lift an object and then to heave it along.

(3) To **fleet** is to shift an object a short distance.

(4) To **ship** is to place an object in its proper position.

(5) To **unship** is to remove an object from its proper position.

01004. Terms Defining the Movement of a Ship

a. A vessel is **under way** when she is neither anchored nor secured to a buoy, nor made fast to the shore, nor aground. When actually moving through the water, a vessel has **way** on her; if she is moving too fast she is said to have **too much way on**.

b. When moving ahead a vessel is said to be **going ahead** or **making headway**; when moving astern a vessel is said to be **going astern** or **making sternway** or **making a stern board**. A vessel **gathers way** when she begins to move through the water, and she has **steerage way** when her speed is sufficient for steering (ie the rudder is effective).

c. A vessel moving sideways is said to be moving **broadside-on** (to port or starboard); if she is making headway and at the same time being blown sideways by the wind, she is said to be making **leeway**. When the wind is blowing from one side of the vessel, that side is called the **weather side**; the other, sheltered, side is called the **lee side**.

d. A ship is said to be **adrift** when broken away from her moorings and without means of propulsion.

e. A ship is steered by compass in a direction called the **compass course** or simply the **course**. The question ‹**How is the ship's head?'** means in what direction by the compass is she heading (pointing).

01005. Terms Defining Direction and Position Outside a Ship

a. **Relative Bearings** (Figs 1-12 and 1-13)

(1) **Ahead, astern** and **abeam** are relative bearings. In addition, when an object is midway between ahead and abeam it is said to bear **on the bow**, and when midway between abeam and astern it is said to bear **on the quarter**. The expressions **fine** and **broad** may also be used relative to ahead or astern; for example, an object may be fine on the port bow, broad on the starboard quarter (or abaft the starboard beam).

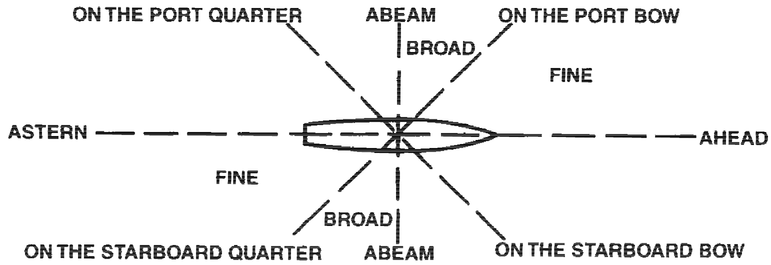


Fig 1-12. General Relative Bearings

(2) A greater degree of accuracy in relative bearings is obtained by expressing them in terms of degrees from ahead on each side of the ship. The horizon is divided in degrees from zero (right ahead) to 180 (right astern). Those on the starboard side are called green and those on the port side red. Thus, in Fig 1-13, the sailing vessel bears **red** 40 and the steamship bears **green** 130 (the word ‹degrees' is always omitted).

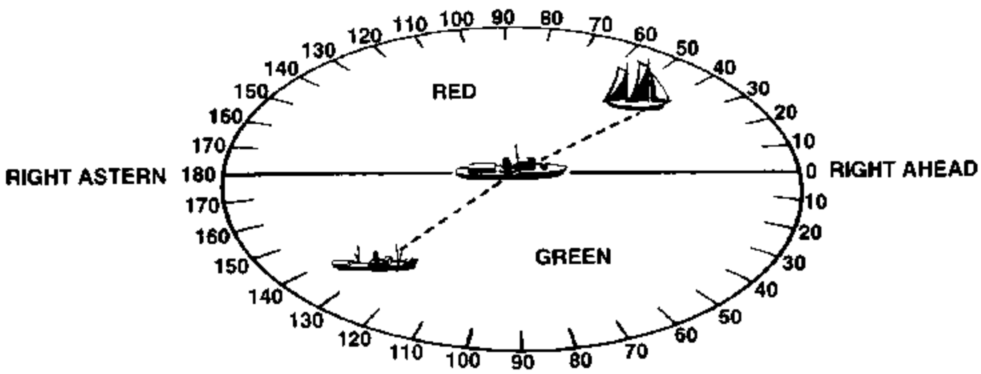


Fig 1-13. Red and Green Relative Bearings

(3) When one ship is lying next to another or on a dock wall it is said to be **alongside** the other ship or wall. When two ships are moving on the same course and level with each other they are said to be **abreast**.

b. **Compass Bearings**

(1) The bearing of an object from the ship may be given relative to **true** or **magnetic** North. If it is a gyro-compass bearing the horizon is divided into 360 degrees from true North (the meridian). If it is a magnetic-compass bearing the horizon is divided into 360 degrees from magnetic North.

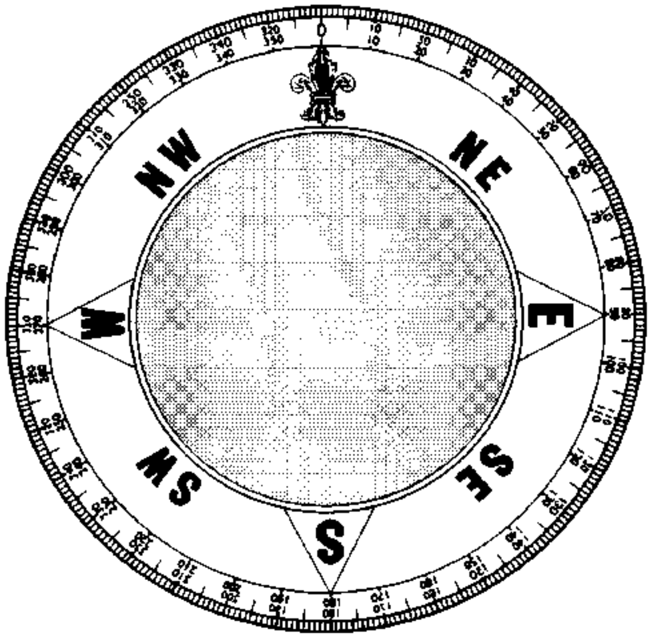


Fig 1-14. A Compass Card

(2) The **magnetic compass card** (Fig 1-14) is divided into 360 degrees from North (0°), through East (090°), South (180°), West (270°), and so back to North. The card may be divided into 32 points of 11 $^{1}/_{4}$ degrees. The principal points, North, South, East and West are called **cardinal points**; the **intercardinal points** are North-east, South-east, South-west and North-west; and the **intermediate points** are North-north-east, East-north-east, East-south-east, South-south-east, South-south-west, West-south-west, West-north-west and North-north-west. The remaining 16 points are known as **by-points**.

c. **Distances.** The distance of an object from the ship may be expressed in nautical miles (one nautical mile equals 1852 metres), in cables (one cable is one-tenth of a nautical mile) or in metres.

01006. Terms Relating to Shipping

a. Draught Marks

(1) These show the draught of the ship, measured in decimetres, and are usually positioned at the bows, stern and amidships. The marks are arabic numerals, one decimetre high and one decimetre apart, and only even numbers are used (Fig 1-15). Above the waterline they are generally engraved on plates welded to the hull and below the waterline they are painted in a contrasting colour.

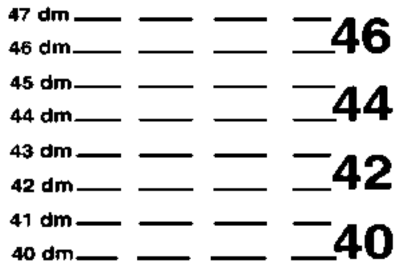
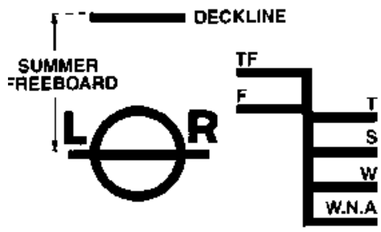


Fig 1-15.Draught Marks

(2) When a ship is drawing 42 dm forward and 45 dm aft, the waterline touches the lower edge of the mark 42 at the bows and the upper edge of the mark 44 at the stern.

b. **Load Line Disc and Load Lines.** These marks on the sides of merchant ships (Fig 1-16) indicate the greatest depth to which they may be safely loaded under various conditions in accordance with international regulations. The marks were originally known as Plimsoll marks, so named after Samuel Plimsoll, MP, who rendered a great service to seamen by introducing this legislation which was ratified under the Merchant Shipping Acts of 1876 and 1890.



TF	Tropical fresh water	WNA	Winter, North Atlantic, for vessels under 100 metres in length
F	Fresh water		
T	Tropical sea water	LR	These letters indicate the registration society, in this case Lloyd's Register
S	Summer, sea water		
W	Winter, sea water		

Fig 1-16. Load Line Disc and Load Lines

c. **Load Waterline.** This is a term chiefly used in HM ships to denote the position of the waterline when the ship is fully loaded with crew, stores, water, fuel, etc. The ship is then said to be in the **deep condition**.

d. **Tonnage Measurements.** The tonnage of a ship can be expressed in terms of weight or volume. When expressed by weight the unit of measurement is the tonne (one tonne equals 1000 kilograms), and when expressed by volume it is the ton of 2.83 cubic metres (previously 100 cubic feet). This latter measurement is derived from the earlier tun which indicated the capacity of a wine cask. The tonnage of a ship can be measured in a variety of ways of which the following are the more usual:

(1) *Displacement.* This is the actual weight of the vessel measured by the weight in tonnes of water she displaces when loaded with fuel, water, stores and with the crew on board. It is seldom used for merchant ships because of the great difference in their displacement when fully and lightly loaded. It is, however, the usual method of describing the tonnage of warships.

(2) *Gross tonnage.* This is a measure of the total internal volume of the ship, with certain exceptions such as wheelhouse, chartroom, radio room etc reckoned in tons of cubic capacity. It is the usual method of expressing the tonnage of passenger ships.

(3) *Net register tonnage.* This represents the earning capacity of a passenger ship. It is a measure in tons of cubic capacity of the space which can be used for carrying passengers and cargo. In other words, it is the gross tonnage less the capacity of spaces occupied by such items as machinery, equipment and crew. This measurement is usually employed when assessing costs such as harbour and port dues and canal tolls.

(4) *Deadweight tonnage.* This is the measurement in weight of the cargo, passengers, crew, stores, fuel and water which a ship can carry when floating at her summer load draught. It is the difference between the light and load displacements or, in other words, it is the weight of the removable or expendable items which a ship can carry. This is the normal method of expressing the tonnage of cargo ships.

01007. Shipbuilding and Launching

a. A ship is built on a **slipway**, which is a sloping platform erected on the foreshore of a deep river or estuary and extending well beyond and below the water's edge. The ship is launched in a **cradle**, which slides down the slipway until the ship becomes waterborne (Fig 1-17). Usually the ship is launched stern first, but in some shipyards the tideway (river or canal) is not sufficiently broad to allow this and the ship has to be launched sideways.

b. All the main structure of the hull up to the upper deck is completed before launching. In some cases the main machinery and other large equipment may be installed and some parts of the bridge and other superstructures may be erected.

c. After launching the ship is taken to a **fitting-out** berth in a **basin** where machinery not already fitted, internal fittings, armament, radar equipment, funnels, masts and external fittings are secured in position and the rest of the superstructure is completed. Finally the ship is ready for equipment trials and then to proceed to sea for sea trials.

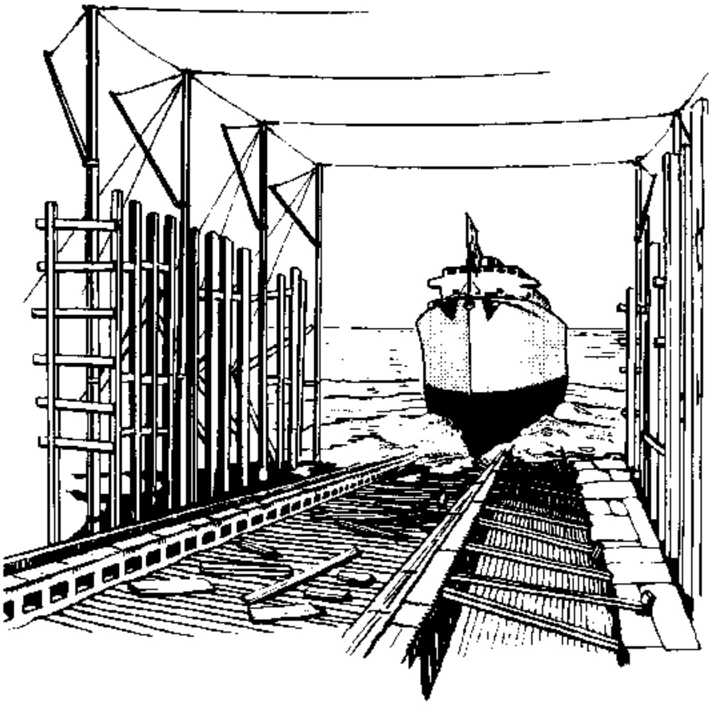


Fig 1-17. Launching a Ship from a Slipway

01008. Docks and Slips

Periodically during a ship's life it is necessary to inspect her hull below the waterline to clean the bottom, change propellers, etc; for this special docks or slips are built and the process is called **docking** or **slipping**, followed by **undocking** or **unslipping**.

a. **Dry Dock or Graving Dock** (Fig 1-18)

(1) This is an excavation faced with solid masonry, which is connected with a harbour, river or basin. The entrance is closed by a sliding **caisson** pronounced ‹cassoon'), a floating caisson, or **dock gates**. Water is admitted through valves (**penstocks**) until the level in the dock is the same as that outside; the entrance is then opened and the ship floated in. The entrance is then closed and the water pumped out, thus leaving the ship resting on **keel blocks** and supported by **breast shores** from the side of the dock to the ship's side, and by **bilge shores** to give additional support. Side keel blocks and sometimes **cradles** in the wake of (below) concentrated weights, are also used for heavier ships.

(2) Some small dry docks depend on the tide for flooding and draining. The vessel is floated in at high water, the gates are closed and, as the tide falls, the water is drained out through valves, which are shut when the dock is dry.

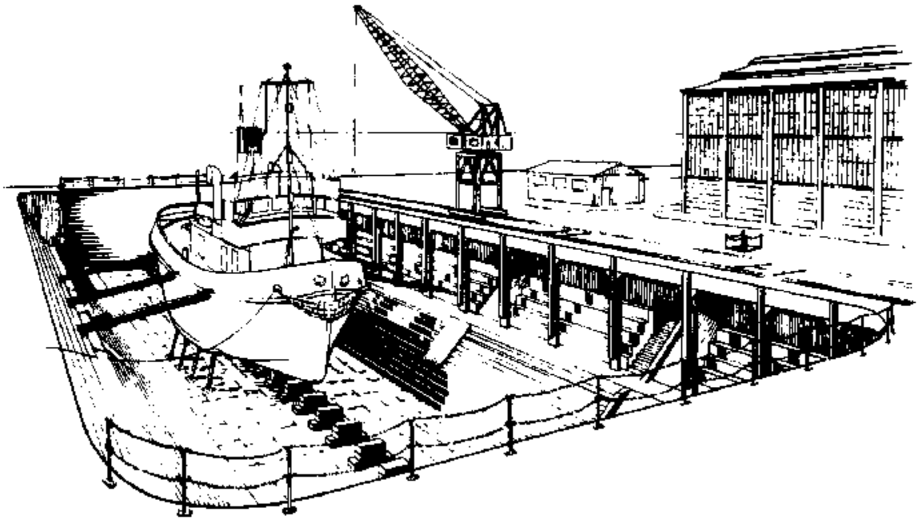


Fig 1-18. Dry Dock or Graving Dock

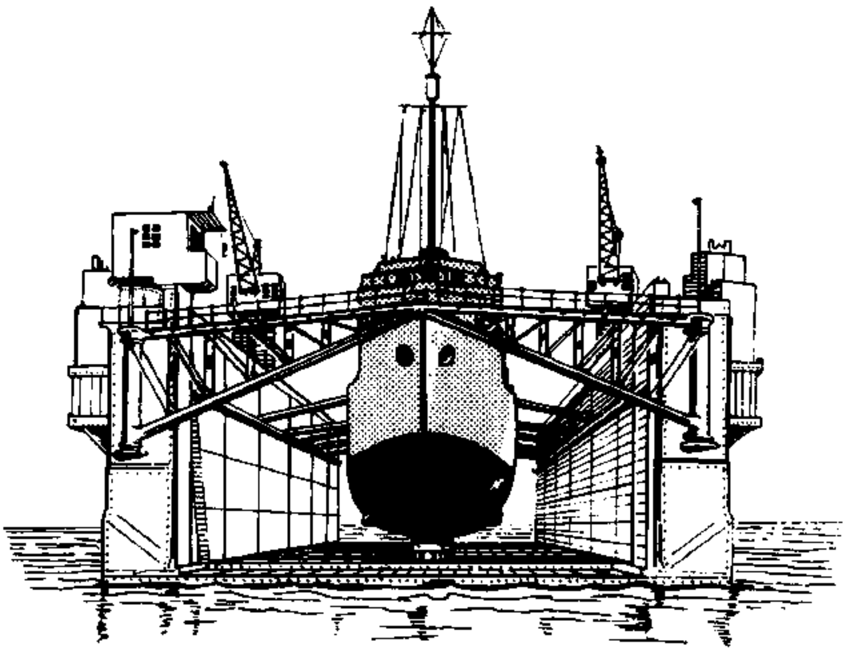


Fig 1-19. Floating Dock

b. **Floating Dock** (Fig 1-19). This is a floating watertight structure which can be submerged sufficiently to receive a ship by flooding the **pontoon tanks** which form the bottom of the dock. When the ship has been floated into the dock and secured, the pontoon tanks are pumped out until the pontoon deck and the ship are dry. The ship rests on a line of blocks under the keel and in some cases blocks are positioned under the bilges. Because of the flexibility of a floating dock, it is essential that the ship be supported by breast shores between the ship and the dockside. This is necessary to prevent the sides of the dock deflecting inwards because of the weight of the ship resting on the blocks.

c. **Patent Slip** (Fig 1-20). This consists of a sloping runway of masonry or concrete, extending some distance below the low-water mark, on which rails are laid. A cradle, fitted with a wheeled carriage, is run out to receive the vessel when there is sufficient water. The vessel and cradle are hauled up the runway by winch or capstan until they are clear of the water.

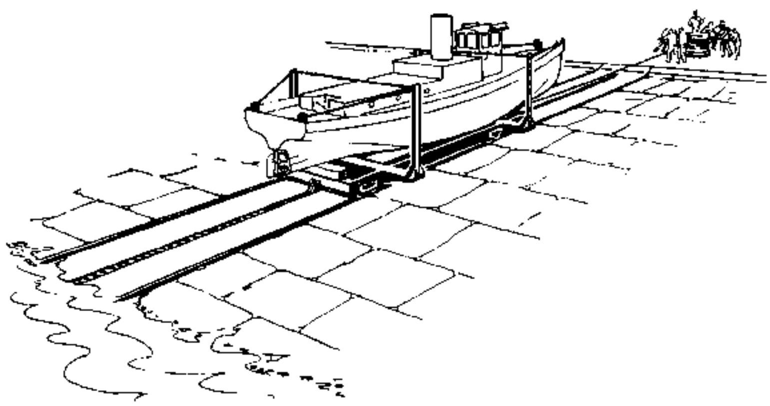


Fig 1-20. Patent Slip

d. **Marine Railway.** This is the term usually applied in Canada and the United States of America to a patent slip.

e. **Gridiron (or grid).** This is a platform, usually sited against a tidal wall of a dockyard, on which a vessel is berthed at high water for underwater inspection at low water. The grid is normally constructed of parallel baulks of timber secured to the wall.

f. **Hydraulic Synchro Lift.** This is a platform on which a craft is positioned and is capable of being raised or lowered by hydraulic power. Its use is thus independent of the state of the tide and it permits work to progress continuously. These are now built to accommodate ships of up to 60 metres in length.

01009. Basins

When a ship is loading, unloading, being repaired or fitted out (after launching) it is safer and more convenient for her to be berthed in non-tidal waters.

a. **Basin or Wet Dock** (Fig 1-21). This is an area of water which, except for its entrance, is enclosed with walls of masonry and excavated to a depth sufficient to take floating ships. The water is shut in by caissons or gates, and is kept at a level sufficient to ensure that ships remain afloat. The entrance is usually through a **lock**.

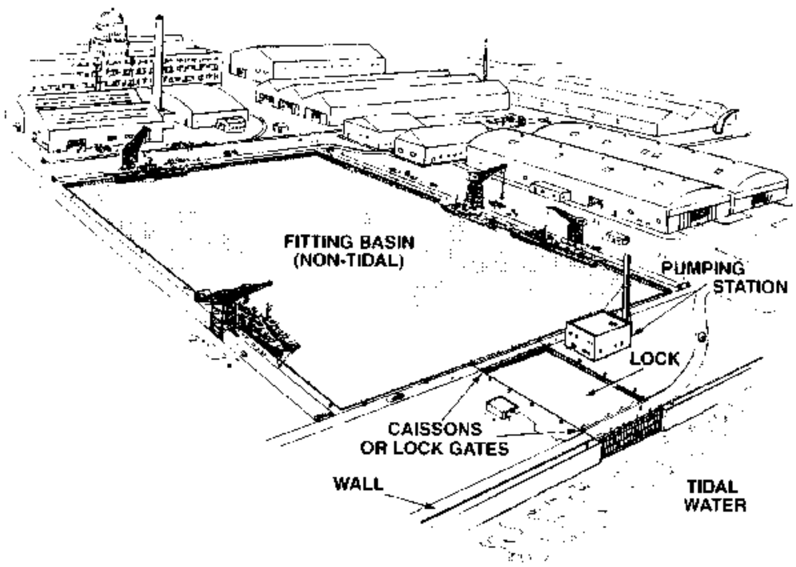


Fig 1-21. Basin or Wet Dock

b. **Locks** (Fig 1-21). This is an excavated channel or approach to a basin or wet dock, faced with masonry and fitted at each end with a caisson or gates. Ships may then be moved to or from tidal waters at certain states of the tide without appreciably altering the level of the water in the basin or wet dock. Some locks are designed for use as dry docks.

c. **Camber.** This is a made-up strip of sloping foreshore, from above high-water level to well below low-water level, used for hauling boats clear of the water. The term is also applied to a small **dock** or **tidal basin** which has an open entrance and may dry out at low water.

01010. Jetties, Piers and Similar Structures

a. **Jetty.** A structure generally of wood, masonry, concrete or iron, which projects usually at right angles from the coast or some other structure. Vessels usually lie alongside parallel with the main axis of the structure.

b. **Pier.** A structure generally of wood, masonry, concrete or iron, extending approximately at right angles from the coast into the sea. The head, alongside which vessels can lay with their fore-and-aft line at right -angles to the main structure, is frequently wider than the body of the pier. Some piers however, were built solely as promenades.

c. **Pens.** These are bays, formed by a series of jetties or piers, for accommodating a number of small ships in berths alongside.

d. **Mole or Breakwater.** A long pier of heavy masonry built on the seaward side of a harbour for protection. It may be designed for berthing ships on its shoreward side, either alongside or with anchors down and wires from the stern to bollards (mooring posts) firmly embedded in it.

e. **Groynes.** Timber and board constructions between high-water and low-water marks to prevent coast erosion by the scouring action of the sea.

01011. Sea Measures

a. **International Nautical Mile.** This is a standard fixed length of 1852 metres.

b. **British Standard Nautical Mile.** This is now an obsolete unit. It was a standard fixed length of 6080 feet which equalled 1853.18 metres.

c. **Sea Mile.** A sea mile is the distance equivalent to one minute of arc measured along the meridian at the latitude of measurement. Since the Earth is flattened at the poles and not a true sphere, this distance is not a fixed length; it varies between about 1843 metres at the equator and 1862 metres at the North and South poles. The sea mile is used for the scale of latitude on large-scale Admiralty charts because distances are measured using the latitude graduation on the chart borders.

d. **Cable.** The cable is a unit for measuring short distances and equals one-tenth of a nautical mile (608 feet or roughly 200 yards). (The length of a ship's anchor cable was once 101 fathoms (606 feet); the length of a modern ship's anchor cable bears no relation to the cable measure.)

e. **Fathom.** The fathom was the traditional nautical linear measure for ropes, hawsers, depths of water and soundings. It is now superseded for all these purposes by the metre. For conversion, if necessary:

1 fathom = 1.8288 metres
1 metre = 0.5468 fathoms.

f. **Knot.** A knot is a unit of speed equal to one nautical mile per hour (1.852 kilometres per hour or 1.15 statute miles per hour). For example, a ship may be **steaming at 15 knots**, meaning that she travels at a speed of 15 nautical miles per hour. (The expression ‹knots per hour' is incorrect and should never be used to describe speed.) The term is derived from a method of measuring speed in the days of sail, when a piece of wood attached to a line was thrown overboard; the number of equally-spaced knots in the line that passed over the taffrail in a specified time gave the speed of the ship in **knots**.

01012. Miscellaneous

a. **Bridle or Braidline Bridle.** A Bridle is referred to when using the ships cable to secure to a buoy. A Braidline Bridle is referred to when using a designated Man Made Fibre Cordage Bridle to secure to a buoy.

b. **Brow.** A narrow platform placed between ship and shore for embarkation and disembarkation, sometimes called a gangway.

c. **Between Wind and Water.** The term used to describe that part of a ship's side near the waterline which is alternately submerged and exposed by the movement of the waves and the rolling of the ship. It is also used to describe that part of a sea wall, pile, etc which is uncovered between high and low water.

d. **Dolphins.** Mooring posts, usually composed of groups of piles, driven into the bottom of a harbour.

e. **Dumb Lighter.** A lighter without means of self-propulsion (see **Lighter**).

f. **Floating Bridge.** A form of ferry which is hauled from shore to shore by hauling on chains or wires laid across the bed of a channel or river.

g. **Gang-plank.** A narrow platform placed between one ship and another for embarkation and disembarkation.

h. **Gangway.** The opening in the bulwarks or position in the ship's side by which the ship is entered or left. The term is also used to describe a passageway in a ship, and sometimes used to describe the platform between ship and shore (see **Brow**).

i. **Hard.** A made-up strip of foreshore used as a landing place for boats at low water.

j. **Lighter.** A vessel used for transporting cargo or stores to or from a ship.

k. **Piles.** Baulks of steel-pointed timber or lengths of ferro-concrete which are driven into the harbour bottom and used as the foundations for the platforms of piers and jetties. Some wooden piles are used for facing the sides of stones or concrete wharves. Some piles are made of steel sections which are embedded in rock and reinforced concrete.

l. **Stream.** The ‹stream' is a general term to describe the navigable channels and anchorages in the tidal waters of an estuary or river.

m. **Trot.** A line of moored buoys between which a number of small ships can be secured **head and stern**.

n. **Warp.** A rope extending between ship and shore, for moving (warping) the ship without using her engines.

o. **Winding.** The action of turning a ship the other way round in her berth (turning **end for end**).

CHAPTER 2

ANCHORS, CABLES AND BUOYWORK

CONTENTS

Annexes

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CHAPTER 2

ANCHORS, CABLES AND BUOYWORK

02001. Introduction

An anchor is a hook, attached to a length of chain or rope called a cable, by which a ship or boat can be held temporarily to the seabed in comparatively shallow water. The primitive anchor was a rock attached to a length of crude rope. Then, from about 400 BC until the days of Nelson, anchors made of iron and wood increased in size but changed little in design, whereas cable developed to the cable-laid hawsers that can be seen in HMS VICTORY. When iron and steel replaced wood in ship construction and sail gave way to steam, steel anchors of various designs were made, from which the modern anchor is derived, and iron and steel chain cable gradually developed into the very strong modern studded cable used today. This chapter describes anchor and cable arrangements and associated equipment fitted in HM ships, explains how a modern anchor holds and lists drills and procedures for anchoring and buoywork evolutions. Additional sources of information on the subject are: **BR 2, The Queen's Regulations for the Royal Navy**; **BR 367, Manual of Anchors, Chain Cables and Associated Equipment** and **BR 1637, Anchors for HM Service**. Details of anchor and cable outfits and associated equipment are also listed in individual ship's 'As fitted drawings' and Rigging warrants. A full list of parts to the cable outfit, ancillary equipment and spare gear, complete with test/survey certificate and birth certificates are held within the Anchors and cables Log. Navigational and shiphandling aspects of anchoring and buoywork are contained in **BR 45, Admiralty Manual of Navigation Volume 6**.

02002. Methods of Securing to the Sea Bed

a. **Anchoring.** A ship can be secured to the sea bed by means of her ground tackle, ie her anchors and cables, either with a single anchor (Fig 2-1) or with two anchors. Modern warships rarely use two anchors (certain warships are fitted with only one anchor that can be deployed) because the likelihood of the cables twisting as the ship swings with wind and tide, and the risk of damage to bow domes outweigh the advantages of the reduction in sea room and increased holding power that two anchors provide (see note). However, ships with two anchors may on occasions use both to ride out a gale. In such circumstances the anchors are let go so that the ship lies with an angle between the cables of less than 20 degrees (Fig 2-2). In a single-anchor warship, provided there is sufficient sea room, veering more cable may check a dragging anchor. If this tactic is unsuccessful the main engines should be started and the ship manoeuvred slowly ahead to take the strain off the anchor and cable. As a final resort the ship must put to sea. Drills and procedures for anchoring are described later in the Chapter.

Note. *In the past, to prevent turns forming in the cables of a ship riding at two anchors, a swivel, known as a mooring swivel, was inserted between the two cables. This procedure was discontinued because on occasions it strained and damaged the cables.*

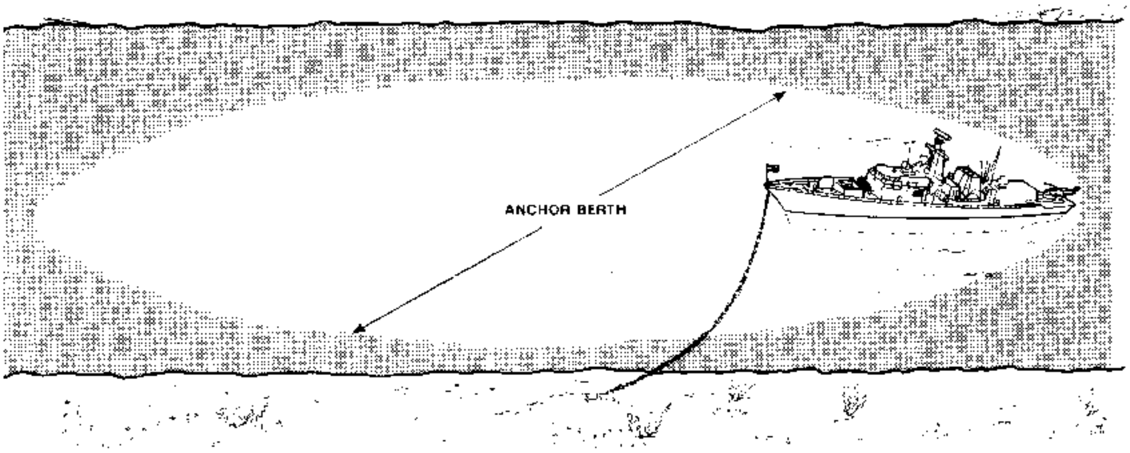


Fig 2-1. A Ship at Single Anchor

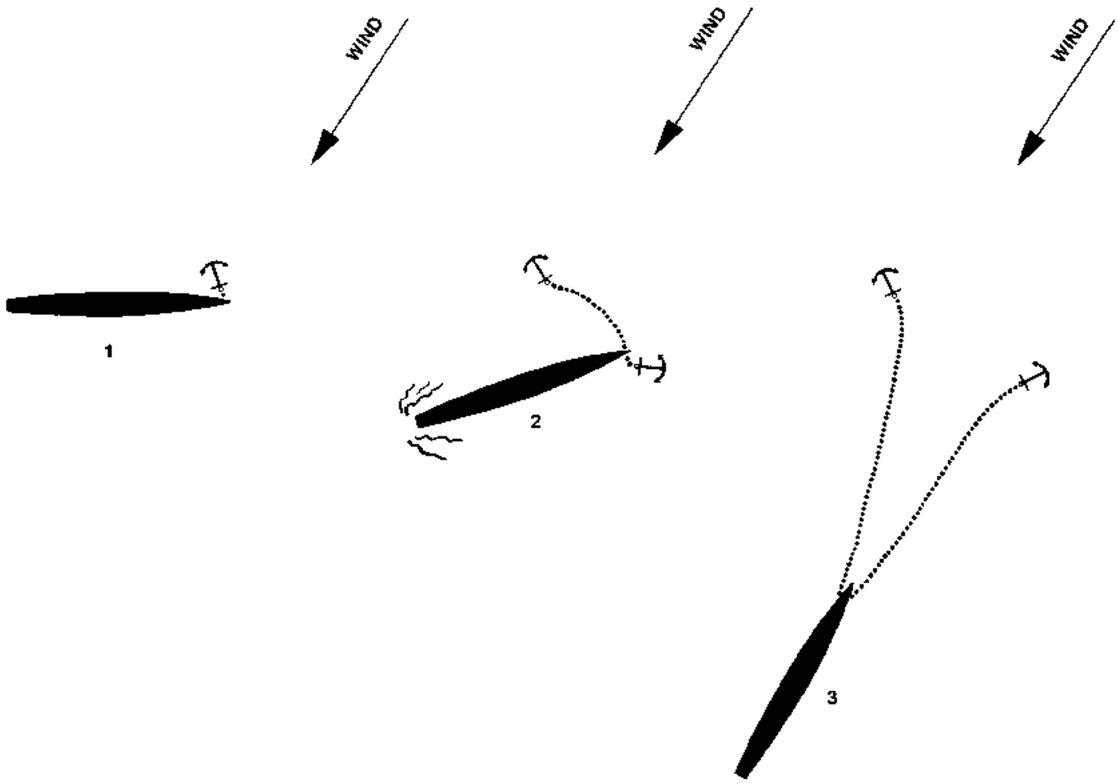


Fig 2-2. Putting Down Two Anchors in a Gale.

b. **Securing to a Buoy.** (Fig 2-3). In ports and most large harbours a ship can also be secured to the bottom by unshackling one of her cables from its anchor and shackling the cable to a mooring buoy, which in turn is secured to the bottom by its own permanently laid groundwork of mooring anchors and mooring chain. Many modern ships are supplied with Man Made Fibre bridles for securing to a buoy. Drills and procedures are described later in this chapter.

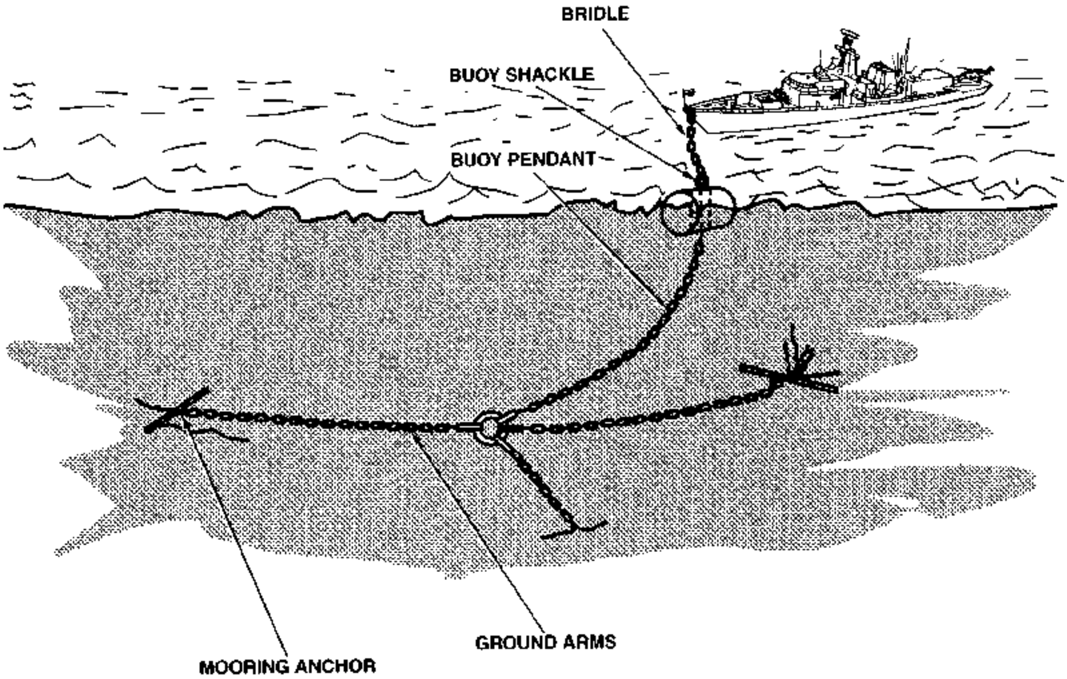


Fig 2-3. A Ship Secured to a Buoy

c. **Mediterranean Moor.** (Fig 2-4). With this type of mooring ships are obliged to berth at right angles to a jetty, with their sterns secured to the jetty by berthing lines and their anchor(s) laid out ahead. It can only be employed where there is a negligible range of tide, and it is commonly used in Mediterranean ports; for this reason it is called the **Mediterranean (or Med) moor**. Drills and procedures are described later in this chapter.

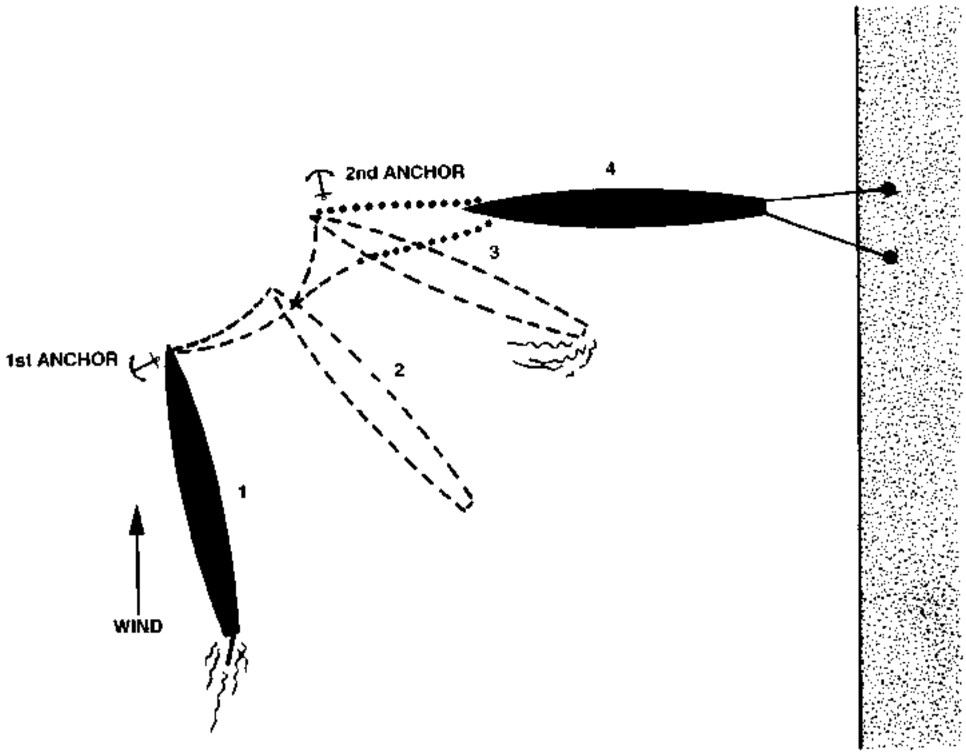


Fig 2-4. A Ship Berthing Stern To (Mediterranean Moor)

02003. Ships Anchors

a. **Bower Anchor.** A ship's main anchors are called her **bower anchors**. They are used for anchoring the ship and are stowed one on each bow, or one on the bow and one in a centreline hawsepipe. Certain ships carry only one bower anchor, which is stowed in a bow hawsepipe.

b. **Sheet Anchor.** A sheet anchor was traditionally an extra anchor carried for safety's sake to back up the main anchor or anchors. In ships fitted with a bow dome the main anchor is stowed in a centreline hawsepipe and the bow fitted anchor is referred to as the sheet anchor, for use only in an emergency because of the possibility of damage to the dome if it is deployed.

c. **Stream Anchor.** This anchor, which is used by some ships (principally RFAs) as a stern anchor, is stowed in a stern hawsepipe.

02004. Parts of an Anchor

Fig 2-5 shows a modern anchor used in the Royal Navy. It should be noted that the flukes can move through an angle of 35 degrees each side of the shank.

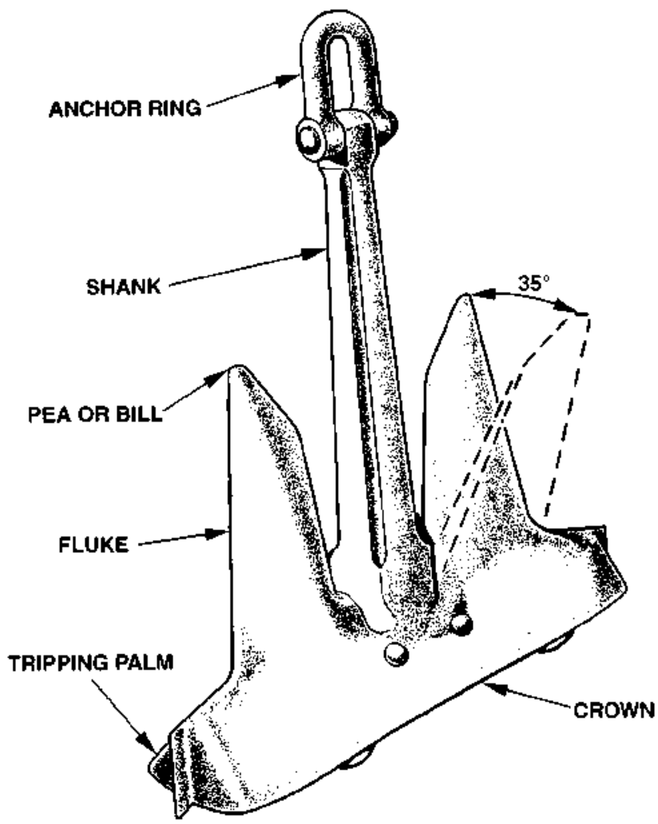


Fig 2-5. Parts of an Anchor (Illustration shows an AC 14 Anchor).

02005. How an Anchor Holds

Fig 2-6 shows how an anchor beds itself in the bottom after it has been let go and the strain comes on the cable. The anchor lies flat on the bottom until the pull of the ship on the cable drags the anchor along the bottom; the tripping palms then tilt the flukes, which then dig themselves in. After a further amount of dragging the anchor embeds itself completely until it holds. For the anchor to maintain its hold the pull of the cable must always be horizontal where the cable emerges from the sea bed.

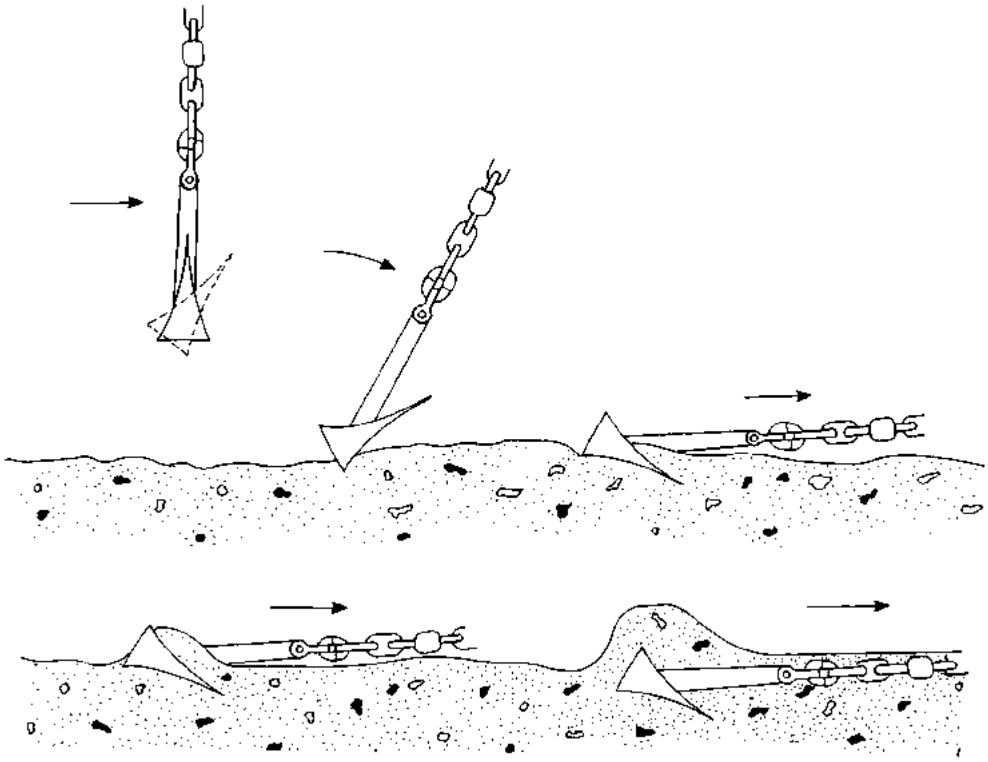


Fig 2-6. How a Modern Anchor Holds

a. **Amount of Cable Required.** The cable must be long enough to ensure that a part of it near the anchor always remains in the sea bed. In firm ground, the anchor ring takes up a position just below the top of the sea bed and therefore the cable lies almost on the sea bed. The rest of the cable acts as a spring in preventing the anchor from being jerked when the ship is yawing from side to side or pitching. The amount of cable required therefore depends on the depth of water, weight of cable, length of stay, weather, and the nature of the bottom. An approximate formula for **forged steel cable** is: **Amount of cable to veer in shackles is one-and-a half times the square root of the depth of water in metres**, and for **copper based cable** (Aluminum bronze), which is heavier and larger than forged steel, the formula is: **Amount of cable to veer in shackles is equal to the square root of the depth of water in metres**.

b. **Nature of Bottom and Anchor Design.** Older type anchors will hold satisfactorily in firm sea beds such as clay, soft chalk, sand, sand/shingle and heavy mud, but will drag in softer sea beds such as soft mud, shingle and shell. Improvements in the design of Admiralty anchors in recent years have resulted in obtaining satisfactory holds in any kind of sea bed, because the improved anchors embed themselves deeper in the softer grounds during the final period of drag before they hold. No anchor, no matter how well designed, will hold on rock, except by a fluke; nor will it hold if fouled by some extraneous material, picked up on the sea bed, which prevents the anchor operating correctly.

c. **Breaking out an Anchor.** When the anchor is weighed the upward pull of the cable should break the flukes out of the bottom. If the flukes are very firmly bedded the cable can be held at short stay and the anchor broken out using the main engines. If the flukes are caught in a rock it may be necessary to part the cable and buoy the end for recovery, if practical, by another vessel.

d. **Holding Pull of an Anchor.** The holding pull of an anchor is expressed as a ratio of holding pull and anchor weight, and varies, depending on type of anchor, from 3:1 to 10:1. The holding pull for each type of anchor is given below.

02006. Types of Anchor

The bigger the vessel, the heavier must be her anchors. Anchors also vary in design and performance as well as in size. The most common types in use in the fleet are illustrated in Fig 2-7. They are:

a. **Admiralty Plan Anchor.** In spite of its name, this anchor is much older than the Admiralty itself and was long considered by seaman to afford the greatest holding pull, ie 3 to 3 ½ times its own weight. It is used mainly for anchoring Danbuoys and markers, and occasionally as a boat’s anchor. When the anchor is let go the stock comes to rest horizontally on the bottom, and as the flukes are set at right-angles to the stock the lower fluke digs into the bottom and holds, its disadvantage is that, because the upper fluke sticks up from the bottom, the anchor may well be dislodged through being fouled by the bight of its cable as the boat swings to wind and tide; it is also dangerous if let go in shallow water, because a boat may impale herself on the upper fluke when the tide falls. It cannot be stowed in a hawsepipe, and so it must be stowed on deck or slung in some position from which it can be let go.

b. **Admiralty Standard Stockless (ASS) Anchor.** This type of anchor will soon no longer be in use in the service; however, it is still fitted in a few of the older surface ships and submarines, and as a stream anchor in some RFAs. The maximum holding pull is about the same as that of the Admiralty Plan. The flukes pivot about a pin, which passes through the crown. As the anchor is dragged along the bottom the weight of the flukes and the effect of the tripping palm tilt both flukes downwards so that they dig into the bottom.

c. **AC (Admiralty Class) 14.** In 1943 the Admiralty instituted a series of tests aimed at improving the ratio between the holding pull and anchor weight. These tests resulted in a major advance in anchor design and led to the development of the AC anchors. The AC 14, fitted in the majority of surface warships in the Royal Navy has a ratio of holding pull to anchor weight of 10:1; it is designed to quickly bite and will achieve maximum holding power after dragging 2 shank lengths.

d. **AC 16A and 17 Anchors.** The stowage of an anchor in a submarine has always been difficult, and with the introduction of high speed, heavy, nuclear powered vessels the requirement for an anchor which, when stowed, is flush with the hull and completely closes the hull opening has become important. A further requirement is for the anchor to be worked blind, by remote control. The AC 16A was designed for stowage in the bottom of the hull. To ensure correct entry of the anchor into its stowage, the shank on entering the hawsepipe rotates to line up the flukes with the hull opening. The rotation is effected by means of a guide pin in the upper end of the shank and a cam within the hawsepipe. The anchor will enter with the flukes vertical and in line with the shank and the crown completely closes the opening. The remote controls include indicators which allow the position of the anchor to be checked during the securing evolution. The ratio of holding pull to anchor weight is approximately the same as for the AC 14 anchor. The AC 17 anchor, also designed for stowage in the bottom of the hull of a submarine, has a holding pull of about 7 times its own weight, but requires to be stowed with its shank vertical, or near vertical, and at right angles to the hull opening. The flukes are so balanced that they lie in line with the shank and can thus enter a comparatively narrow opening in the hull if the anchor is rotated to the correct position (normally fore and aft) prior to entry. Rotation is effected by a ball and pin inserted between the cable and the anchor shackle; the pin connects with a guide cam within the hawsepipe. The crown of the anchor when stowed lies flush with the hull and completely closes the hull opening. Remote control and warning devices are fitted as for the AC 16A anchor.

e. **Stocked Close-stowing (Danforth) Anchor.** The stocked close-stowing anchor, fitted in some older minor war vessels, resembles a lightly built stockless anchor, both in appearance and method of operation, but it has a stock passing through the crown to prevent the anchor rolling when its flukes dig into the bottom. The ratio between holding power and anchor weight increases as the size decreases. It fits neatly into the hawsepipe and can be secured as efficiently as a stockless anchor.

f. **CQR Anchor.** The CQR anchor, so called because the letters sound like *secure*, is generally used only for small craft because it is difficult to stow in a hawsepipe. The shank can pivot about the flukes so that when dragging along the bottom the flukes will always turn over and dig in. Like the Danforth, the ratio between holding pull and anchor weight increases as the size decreases.

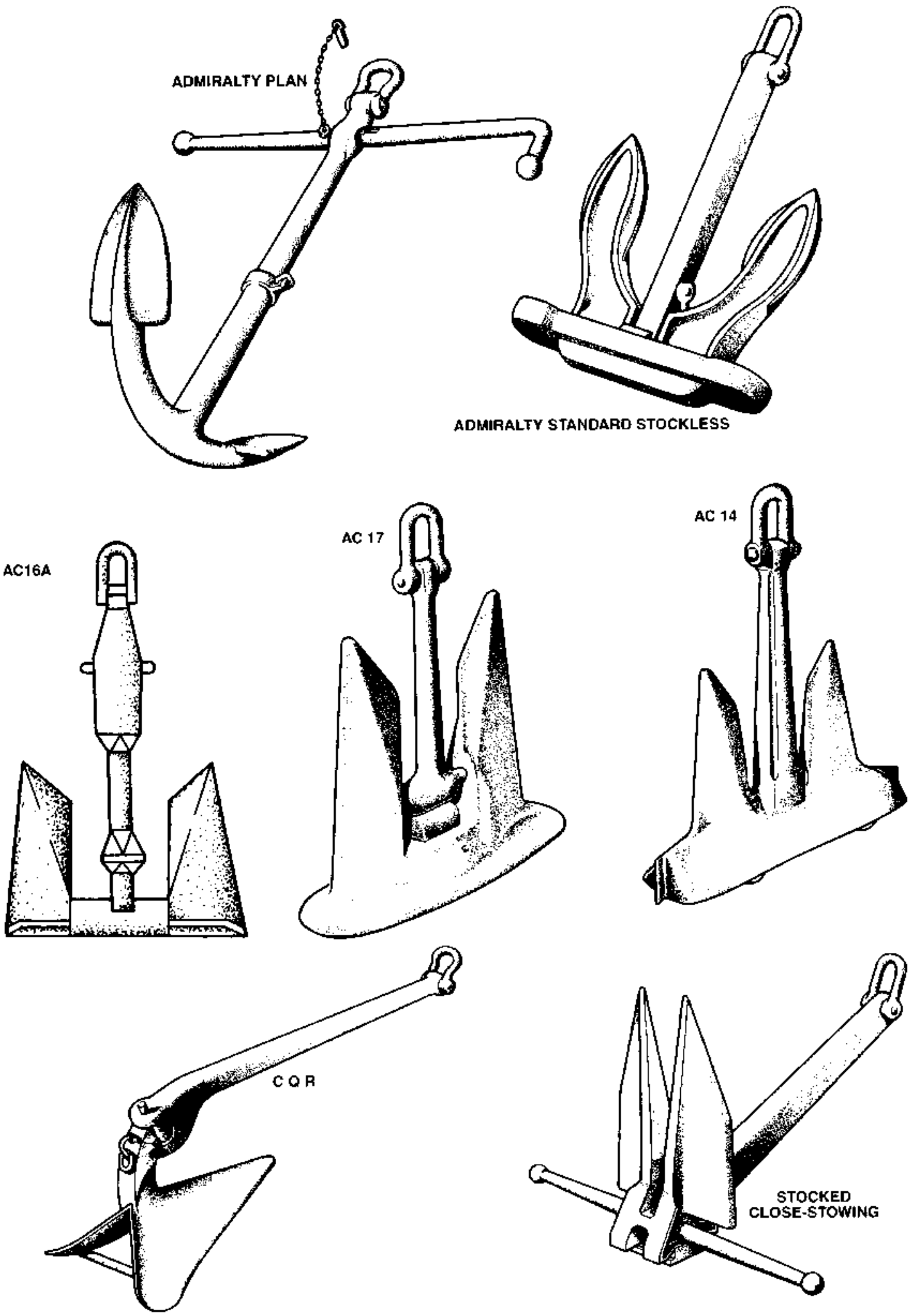


Fig 2-7. Types of Anchor used in the Fleet.

02007. Chain Cable

a. **Introduction.** A ship's anchor cable is generally assumed to be made of chain although a *cable* is strictly speaking a strong thick rope. The bower cables of warships are made of studded chain; the studs are closed in the links by pressure and act to strengthen them and prevent the cable from kinking. Studded chain cable is supplied in lengths of 27.5m and 13.75m, called **shackles** and **half shackles** respectively. A ship's bower cable is usually made up of four half shackles and a number of shackles of cables. The half shackles are usually inserted in pairs, one at the outboard end next to the anchor and the other midway between the outboard and inboard ends. In the future a ships's cable will be made up of full shackles apart from two half shackles at the outboard end. The half shackles are required when working cable during operations described later in this chapter.

Note. *Precise details of the cable fit for individual ships will be found in the Rigging Warrant, Anchors and cables Log and 'As fitted' drawings.*

b. **Types of Chain Cable.** There are basically three types of ship's chain cable. Their composition and application in the Service is as follows:

(1) *Grade 2 Non-ferrous*. Manufactured from copper based material, usually referred to as aluminium bronze. It is supplied to mine countermeasure vessels, and the precise composition of the material is dictated by the magnetic signature constraint of the class of vessel.

(2) *Grade 2 Forged steel*. Supplied to the majority of ships in the fleet.

(3) *Grade 3 Forged steel*. A higher grade steel, and consequently stronger, than grade 2. It is supplied to capital ships.

c. **Size of Cable.** Size of cable is defined as the diameter of the metal in a common link (for 'common link' see below). The size always quoted for the anchor shackle, joining shackle or other cable gear is that of the cable with which the gear is intended to be used.

d. **Components of a Shackle of Chain Cable.** The links forming each length of cable are of uniform size and are called **common links** (Fig 2-8). Shackles and half shackles of cable are usually joined with a lugless joining shackle (certain auxiliary vessels are fitted with lugged joining shackles). A length of chain cable will always contain an **odd** number of links to ensure that the joining shackle will pass around the cable holder or gypsy in the correct plane. Joining shackles, being slightly larger than the common links, should lie **vertically** as they pass round a cable holder or **horizontally** as they pass over the gypsy of a windlass. This will ensure they do not jam or strain.

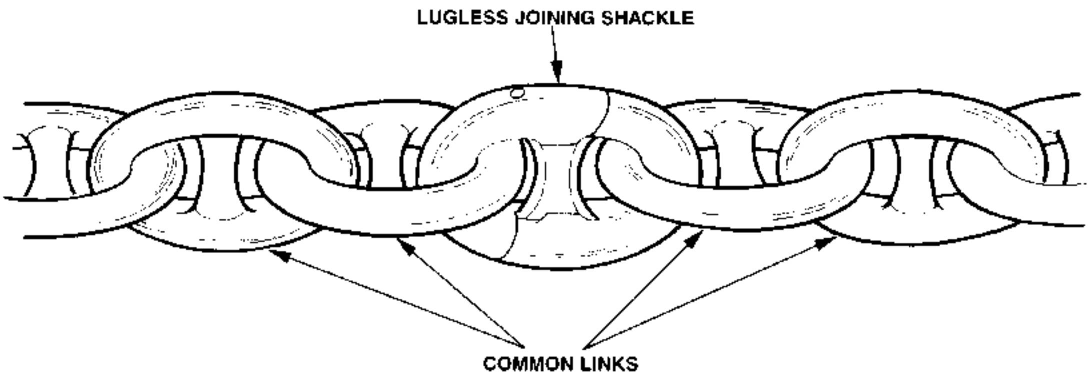


Fig 2-8. Shackles of Chain Cable joined by a Lugless Joining Shackle

e. **Marking of Cable.** The shackles and joining shackles of a cable are numbered consecutively from its outer to its inner end, the first joining shackle being that which joins the first and second shackles together. To assist in identifying the joining shackles when it is being worked, the cable is marked. Every joining shackle, except the one between two half shackles, is painted white. One link on each side of a joining shackle is also painted white and marked with a number of turns of seizing wire around the stud corresponding to the number of the joining shackle. These marked links are separated from the joining shackle by a number of unmarked links which serve to indicate the join between two particular shackles; for example, if the fourth link on each side of a joining shackle were so marked, it would indicate the join between the fourth and the fifth shackles. This marking system is illustrated in Fig 2-9, which shows the third joining shackle is on deck. Cable markings should be checked and remarked as necessary whenever weighing.

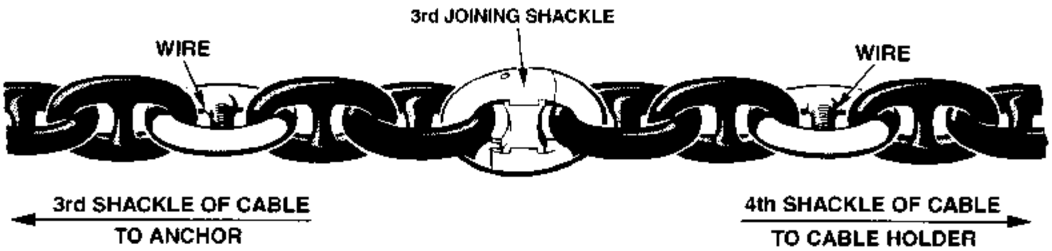


Fig 2-9. How Cable is Marked.

f. **Cable Lockers.** The cable lockers, which are usually on the lowest deck and may be sited so that one is abreast of or forward of the other, provide the stowage for the cables. Modern warships have self-stowing cable lockers so the descending cable will automatically stow itself clear for running out; they are constructed either in the form of a circular trunk or a square or rectangular locker. Drainage arrangements are provided for the removal of water. Older warships have square lockers, with perforated steel plate sides to ventilate and drain the cable. If the locker is not self stowing it must be stowed by hand. The inboard end of the cable is secured to a cable clench at the bottom of the locker by a lugged joining shackle. **The clench is tested to 20 percent above the proof load of the cable**.

02008. Associated Anchor and Cable Equipment

a. **Joining Shackles.** The shackles which join lengths of cable together may be either lugless or lugged; all warships' cables are fitted with the lugless type, but some auxiliary vessels have the lugged type. Joining shackles are also used in evolutions such as towing and buoywork. Both types are described below.

(1) *Lugless Joining Shackle.* A lugless joining shackle (Fig 2-10(I)) is of alloy steel and made in three parts, one of which is the stud. The two main parts are attached to the ends of the cable and then fitted together, and the stud then slides in place and locks the whole. The stud is secured by hammering a tapered pin and lead pellet into the hole drilled diagonally through all three parts of the shackle. The hole is tapered, and when the pin is driven right home a small conical recess called the **dovetail chamber** is left clear above its head. The lead pellet is hammered **broad end first** into this chamber so as to fill it completely and thereby keep the pin in place. To avoid danger from pieces of lead flying from the shackle during hammering goggles must be worn by personnel assembling the shackle. Before inserting a new pellet the remains of the previous pellet must be scraped out of the chamber, otherwise the new pellet may work out; this is done by a small tool called a **reamer**. When parting a lugless joining shackle a **top swage** must always be used between the hammer and shackle. It is shaped to the curvature of the shackle so that the machined surfaces of the shackle shall not be damaged.

CAUTION

THE THREE MAIN COMPONENTS OF LUGLESS JOINING SHACKLES ARE NOT INTERCHANGEABLE, BECAUSE EACH SHACKLE IS MADE AS ONE UNIT.

(2) *Lugged Joining Shackle.* A lugged joining shackle (Fig 2-10(ii)) is a straight shackle whose bolt is secured by a tapered pin and a lead pellet. The pin fits into a tapered hole drilled through the bolt and one lug of the shackle. Except for the anchor shackle all lugged shackles should be fitted into the cable with their lugs facing aft, so that they will not foul any projections on the deck as the cable runs out. Since the anchor shackle is already in the hawsepipe, there is no danger of fouling anything on the way out, but it may foul the stem or some projection on the ship's side as the anchor is being hove in, so it should be fitted with its lugs facing outboard.

b. **Securing-to-buoy Shackle** (Fig 2-10(iii)). The securing-to-buoy shackle is supplied for securing the ship's bridle(s) to the buoy shackle or reducing link of a mooring buoy, and is therefore especially wide in the clear. It can be used with either lugless or lugged joining shackles, and is tested to the **proof load of its largest associated cable**. The width of the shackle in the clear for cable of all sizes is given below in Table 2-1:

Table 2-1. Securing-to-buoy shackles. Width in the clear for given sizes.

Size of cable (mm)	Width of shackle in the clear (mm)
28 and below	95
From above 28 to 38	115
From above 38 to 48	145
From above 48 to 58	185
Above 58	210

c. **Lugged Anchor Shackle** (Fig 2-10(iv)). A lugged anchor shackle is used to join the swivel piece at the outboard end of the cable to the ring of the anchor. It is wider in the clear than the lugged joining shackle and its bolt is oval in cross-section whereas the bolt of the lugged joining shackle is egg-shaped in cross section.

d. **Towing Shackle.** Similar to, but longer than, the lugged anchor shackle, the towing shackle is designed to take the tongue of a towing slip. It is fitted between the SWR towing pendant and the chafing piece in the ‹bollard and clench' towing method.

e. **Joggle Shackle** (Fig 2-10(v)). The joggle shackle is long and slightly curved, and shaped to fit across a link of cable; it is used for attaching a wire rope to a bight of cable, or for securing the top two turns of a cable that has been turned up around bollards. The bolt fits easily in the lugs and is held in place by ‹feathers' protruding from it. To remove or insert the bolt it must first be turned until the feathers are in line with the featherways cut in the lugs of the shackle. Table 2-2 gives the size of shackle supplied for different sizes of cable:

Table 2-2. Size of Joggle Shackle Supplied for Different Sizes of Cable

Size of cable (mm)	Diameter of bolt (mm)
19 to below 28	32
28 to 36	42
38 to 52	48
54 to 60	58
62 and above	60

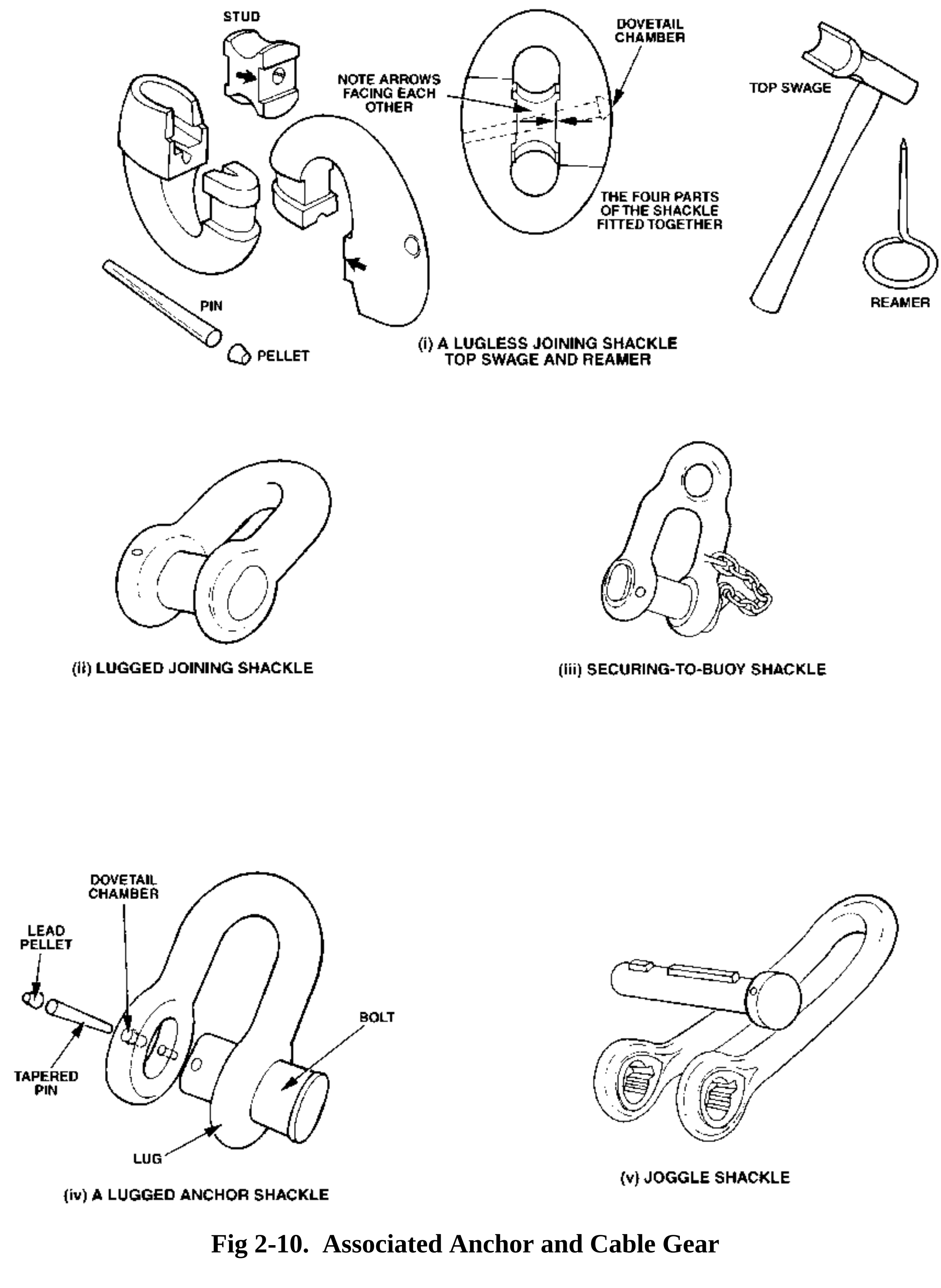


Fig 2-10. Associated Anchor and Cable Gear

f. **Adaptor Piece** (Fig 2-11(I)). An adaptor piece consists of an intermediate link and an end link together and is used to adapt the end of the cable to accept a lugged shackle which will not pass through a common link. Its principal use is for adapting the cable to accept the towing hawser.

g. **Swivel and Link Assemblies (Box and Cup)** (Fig 2-11(ii and iii)). Swivel and link assemblies are fitted to prevent the chain cable from twisting when the ship is at anchor. A swivel piece is fitted at the outboard end of the chain cable for attachment to the anchor and inboard between the end of the chain cable and the cable locker. The inboard swivel piece is always secured to the cable clench with a lugged joining shackle.

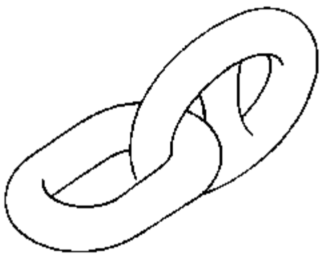
h. **Stoppers.** Cable stoppers, usually known as **slips**, are provided to hold the cable prior to letting go an anchor, or to act as preventers when the ship is riding on the brake of the cable holder, or to hold the cable temporarily so that the inboard part of the cable can be handled, or to house the anchor securely in the hawsepipe.

(1) *Blake Slip.* A Blake slip (Fig 2-11(iv)) is a general purpose slip. Its primary use is holding the cable prior to letting go an anchor (in the RN an anchor is always let go from the Blake slip). It can also be used as a preventer, or to hang the cable whilst working on its inboard part. **It is tested to half the proof load of the cable. The clench plate to which the Blake slip is secured is tested to 60 percent of the proof load of the cable**.

(2) *Blake Bottle Screw Slip.* A Blake bottle screw slip (Fig 2-11(v)) differs from the Blake slip only in that a bottle screw is incorporated in the chain between the slip and the deck clench. The bottle screw enables the anchor to be hove close home in its hawsepipe when secured for sea. **Test details are as for the Blake slip**.

(3) *Riding Slip.* A riding slip is a Blake slip, normally shackled to a deck clench on the upper deck between the navel pipe and cable holder. It is put on the cable when the ship is at anchor or secured to a buoy, and acts as a preventer should the brake of the cable holder fail to hold the pull of the anchor.

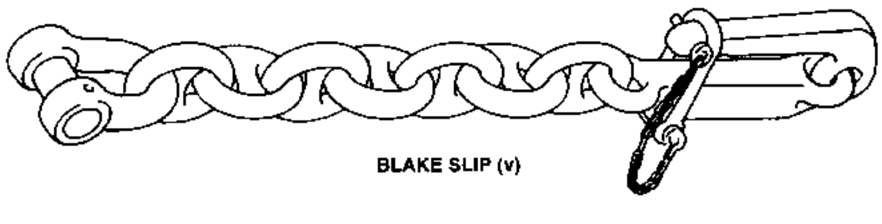
Note. *In some ships the riding slip is replaced with a compressor or guillotine.*



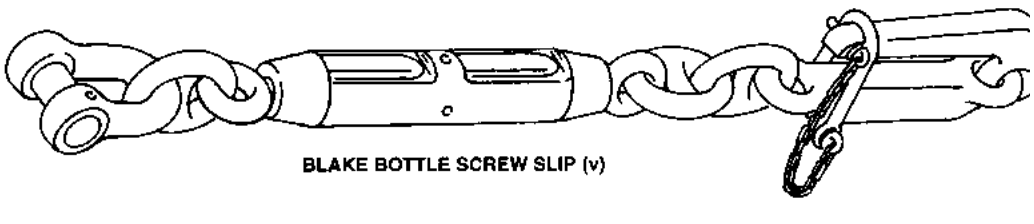
ADAPTOR PIECE (i)

BOX SWIVEL (ii)

CUP SWIVEL (iii)



BLAKE SLIP (v)



BLAKE BOTTLE SCREW SLIP (v)

Fig 2-11. Associated Anchor and Cable Gear

02009. Cable Deck Fittings

The fittings described below are used in conjunction with anchors and cables and associated gear.

a. **Navel Pipes** (Fig 2-12(i)). Navel pipes are fitted forward of the cable holder, or incorporated in the base of a windlass, for the passage of the anchor cables to and from the cable lockers. Their upper ends stand proud of the deck to ensure smooth working of the cable and prevent wash deck water finding its way below.

b. **Bonnets** (Fig 2-12(i)). A bonnet is a fixed or portable cover for a navel pipe or compressor, to stop water from flooding the cable locker. The opening, which faces aft, is made reasonably watertight by a portable steel cover, slotted to slide down over one link of the cable.

Note. *In ships fitted with a windlass the opening of the navel pipe at deck level should be fitted with a steel plate or PVC cover.* |

c. **Compressor** (Fig 2-12(ii)). Some ships with fixed bonnets have compressors fitted into the bonnets to take the place of riding slips. A compressor consists of a wedge of steel operated by a lever or handwheel; the wedge can be moved down across the mouth of the navel pipe until it nips a link of cable against the lip. A portable cover fits over the mouth of the bonnet.

d. **Guillotine** (Fig 2-12(iii)). The guillotine, which can take the place of a riding slip or compressor in vessels fitted with a windlass, is commonly found in Merchant Navy ships, but is relatively rare in Royal Navy ships.

e. **Bullring** (Fig 2-12(iv)). In most destroyers and below, a bullring is fitted to give a fair lead for the head line, picking-up rope and ship-to-buoy bridle.

f. **Hawsepipes** (Fig 2-12(v)). A hawsepipe is a steel tube which houses the anchor in its stowed position or gives a lead for the cable during anchor work. Most ships are fitted with port and starboard hawsepipes to house their bower anchors, but some have a third hawsepipe in the stem called a stem hawsepipe for giving a fairlead to the cable when the ship is secured to a buoy, or being towed. Ships fitted with a bow dome have a stem hawsepipe for the main anchor and a starboard bow hawsepipe for the sheet anchor. Cable washing sprayers are fitted in the hawsepipes of modern warships and grills are provided at the inboard end for the safety of personnel.

Note. *Hawsepipe grills must be fitted and secured at all times unless cable is being worked.* |

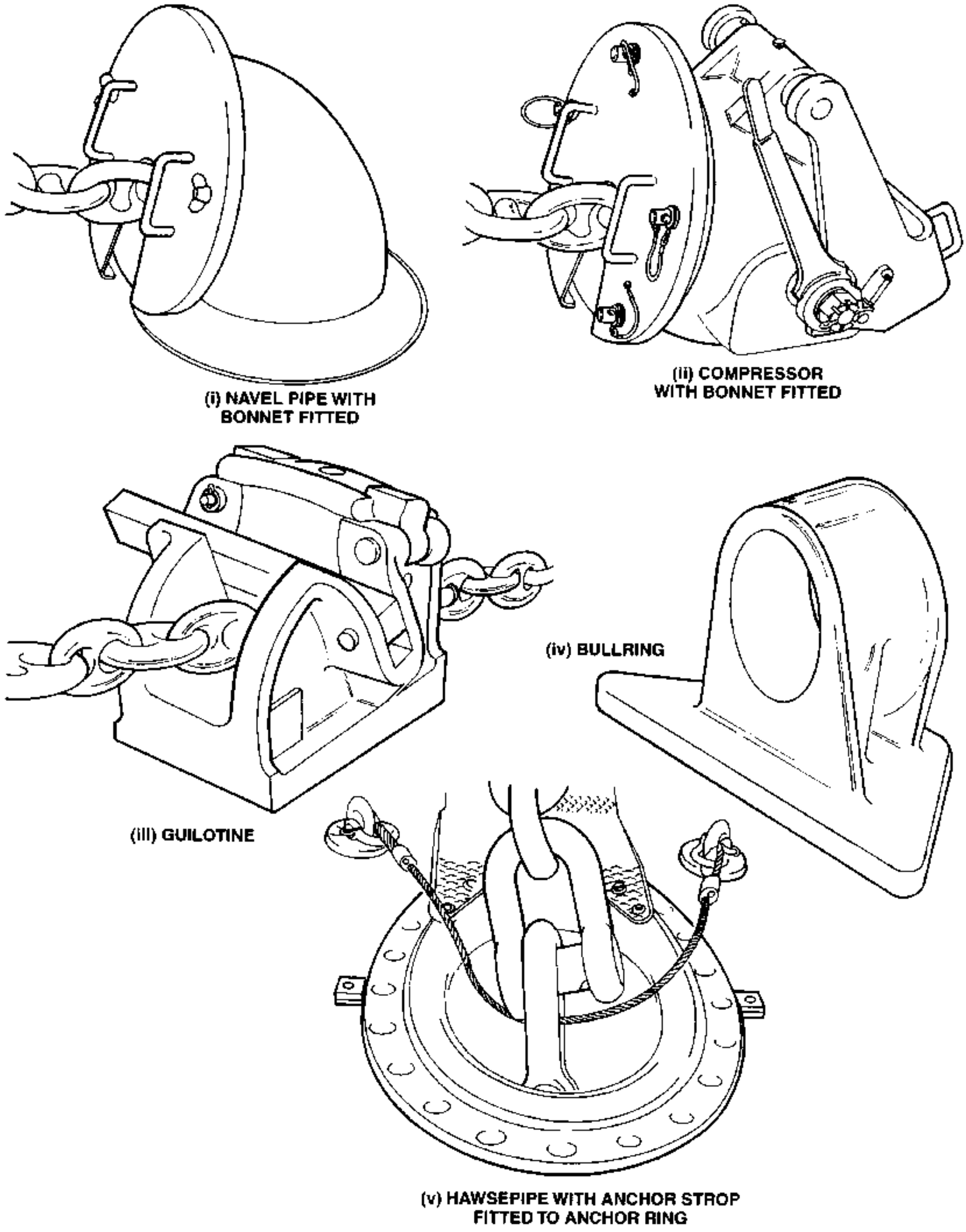


Fig 2-12. Cable Deck Fittings

02010. Capstans, Combined Capstans and Cable Holders, and Windlasses

a. Capstans. Fig 2-13 shows a typical after capstan. A capstan in its simpler form has a **barrel** or **rundle** mounted on a vertical shaft which is driven by a hydraulic or electric motor and is used for working berthing lines and other ropes. The barrel is waisted, ie made smaller in diameter at its middle than at its top or bottom, with the object of checking the tendency of the turns of rope to work up or down and so form a riding turn as the capstan revolves. Standing out at intervals from the barrel, and extending from top to bottom, are slight projections called **whelps**, which are cast with the barrel and help it to grip the rope. The same rules apply for a riding turn on a capstan as for a warping drum. If the turns of rope are reluctant to slip towards the middle of the barrel, slight surging of the rope will usually induce them to do so. If surging has no effect upon the turns building up towards the top or bottom of the barrel then it is likely that too many turns have been taken round the barrel. Onboard documentation must be checked to ascertain performance details of individual capstans.

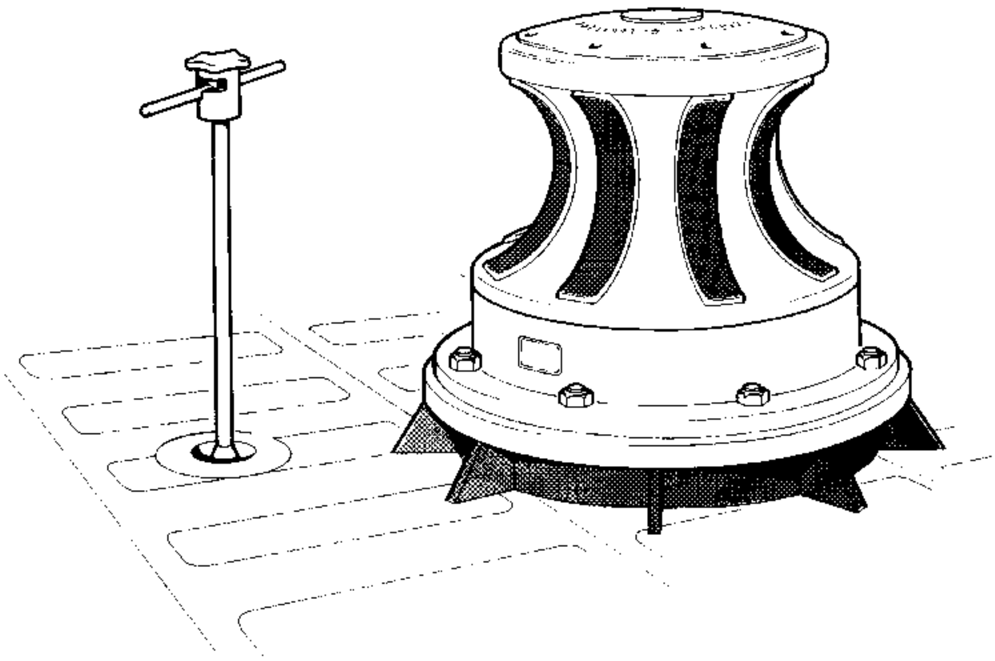


Fig 2-13. An After Capstan with Control Handle

b. **Combined Capstan and Cable Holder** (Fig 2-14). A cable holder is designed solely for working cable and is an integral part of the capstan, which is mounted above the cable holder on the same shaft and is therefore driven by the same motor which can be either electric or hydraulic. The cable holder consists of a sprocket with **snugs** to carry the links of cable. The sprocket can revolve freely on the shaft or be connected to its shaft by a **dog clutch** situated in the head of the sprocket. When it is disconnected the rotation of the sprocket can be controlled by a band brake operated by a handwheel; when connected the sprocket will hold the cable and can be made to heave in or veer the cable by turning the motor in the required direction. The capstan is mounted on a square-section shaft on which it can slide up or down. The head of the shaft is cut with a screw head which works in a nut fixed to the centre of an engaging/disengaging handwheel secured to the crown of the capstan, so that when the handwheel is revolved the capstan is raised or lowered on its shaft. A number of dogs project at intervals round the bottom of the capstan barrel, and when the capstan is lowered on to the cable holder they engage in slots cut in the head of the cable holder sprocket, thereby locking the cable holder to the capstan. When the capstan is raised by turning the handwheel the dogs are disengaged from their slots thereby freeing the cable holder. To connect the cable holder to the capstan the capstan motor is turned until the indicating mark on the bottom of the capstan barrel is in line with a corresponding mark on the head of the cable holder; the capstan is then lowered onto the cable holder by turning the handwheel on the crown of the capstan in the required direction, and the dogs then engage in their slots and lock the capstan and cable holder together. Each cable holder is fitted with a simple band brake, which bears on the skirt of the sprocket and is operated by a handwheel. Rotation of the handwheel in a clockwise or counter clockwise direction applies or releases the brake at the cable holder sprocket (Fig 2-15). The motor of the combined capstan and cable holder is usually controlled either by a T-handle or a hand wheel. An emergency stop button is located close to the controls.

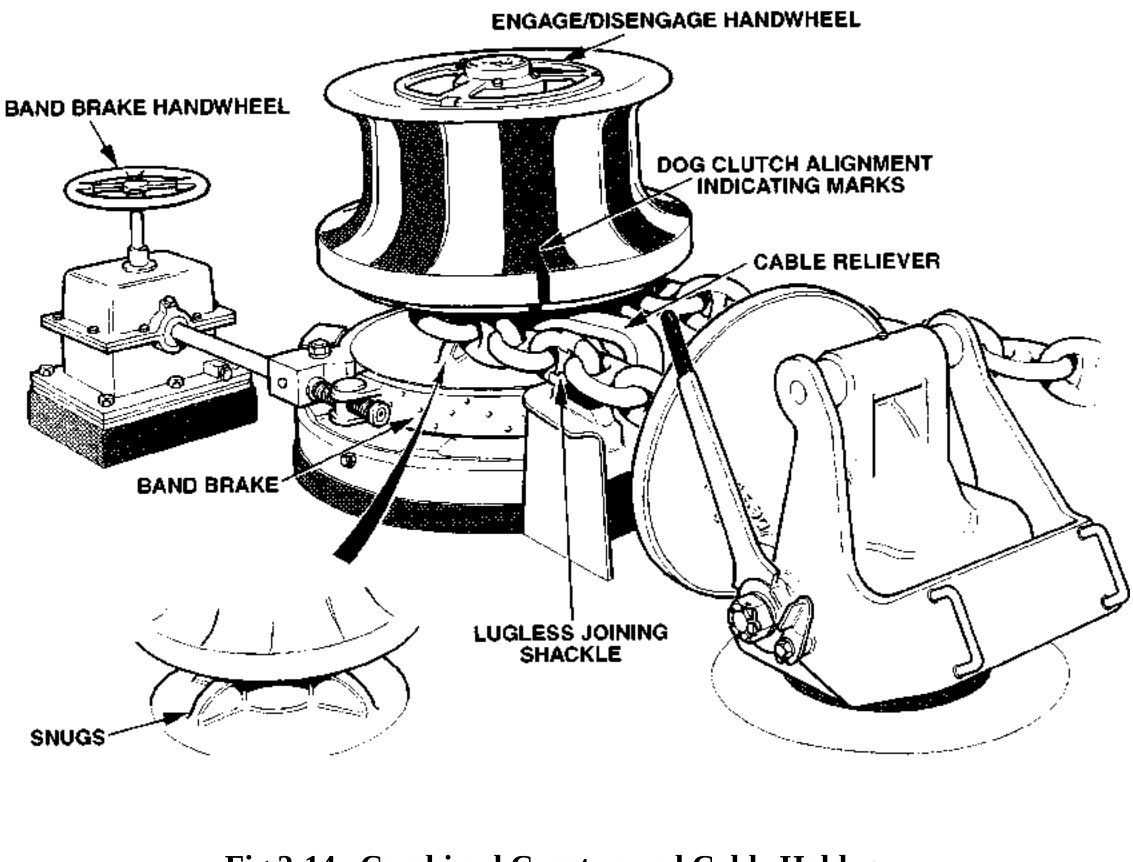


Fig 2-14. Combined Capstan and Cable Holder

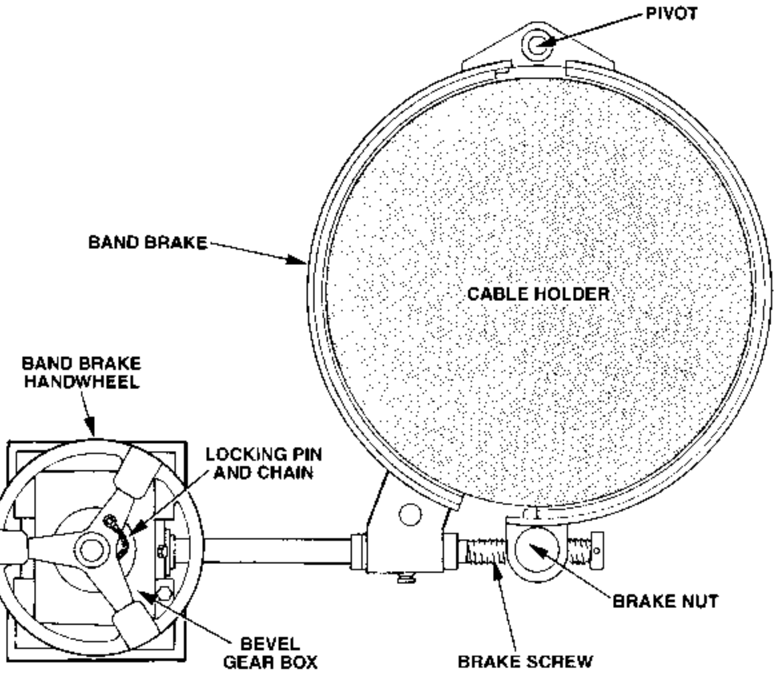


Fig 2-15. Cable Holder Band-brake

c. **Windlasses.** (Fig 2-16) The chief difference between a windlass and a combined capstan and cable holder is that the windlass is mounted on a horizontal shaft whereas the other is mounted on a vertical shaft. Although its primary function is to work the bower cables, the windlass is also fitted with warping drums for working hawsers. The motor of a windlass is usually situated directly abaft the windlass on the foc'sle deck, and for the normal requirement of anchor work both motor and windlass can be operated by one man. The shaft and warping drums are driven by the motor through gearing. The two sprockets for taking the bower cables are mounted on the shaft outside the gear wheel, and are called **gypsies**; they are exactly similar to the sprocket of a cable holder, and the joining shackles must pass over them in the correct slew. Each gypsy can revolve freely on the shaft, or be clutched to the shaft. To connect the gypsy to the shaft the motor is turned until the slots in the gypsy are in line with the dogs, and the wheel inside the warping drum is turned until the dogs engage in the gypsy, and the wheel is then locked. To disengage the gypsy the brake is applied and the wheel turned in the other direction until the warping drum dogs are clear of the gypsy slots, and the wheel is then locked. Each gypsy has a simple hand brake, operated by a handle. The windlass is operated either by a hand lever, or a T-handle inserted in a deck fitting. An emergency stop is provided.

Note. *The motors of windlasses and combined capstan and cable holders are designed to heave in both bower anchors simultaneously.*

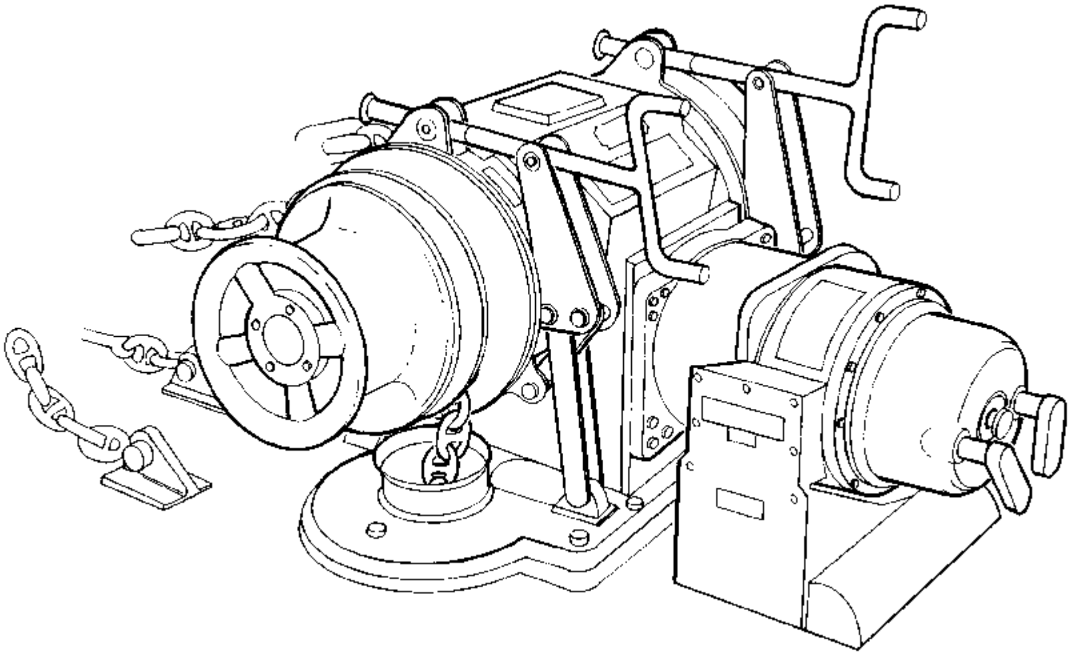


Fig 2-16. A Typical Electric Windlass

02011. Cable Deck Layouts

In recent years the arrangement of anchor and cable equipment on the foc'sle of certain warships has been influenced by the introduction of bow dome sonars, and, in some cases, the need to reduce topweight. The various arrangements found throughout the Fleet are as follows:

a. **Traditional Layout of Frigates and Above.** Fig 2-17 shows the traditional arrangement of equipment on the foc'sle of frigates and above for working the anchors and cables. From each hawsepipe each cable leads aft to its **cable holder**, then forward to its **navel pipe**, and down this pipe to the **cable locker**. The cable holders each have a capstan drum fitted above them and these are driven in either direction by the capstan engine which is fitted in the compartment below. The capstan drums are permanently connected to the capstan engine but each cable holder can be mechanically connected to or disconnected from its capstan drum. Cable can be hove in or veered under power by connecting up its cable holder and setting the capstan engine in motion in the required direction; or cable can be allowed to run out freely by disconnecting its cable holder. When both cables are being worked, this arrangement enables both of them to be hove in or veered simultaneously; it also allows either cable to run out freely while the other is hove in or veered under power. Each cable holder is fitted with a band brake, operated by a handwheel just abaft the cable holder. This brake controls the speed at which the cable is allowed to run out when the cable holder is disconnected; it also holds the cable holder fast when the ship is riding at anchor or made fast to a buoy. The cable can be stoppered (ie held temporarily) or secured by means of the slips. Abaft each hawsepipe is the Blake screw slip, used for heaving the anchor close home in its hawsepipe. Abaft each screw slip is the Blake slip, used for holding the cable temporarily and ‘letting go’ when coming to an anchor or when handling the inboard part of the cable. It may also be used as a **preventer**. Between the cable holder and the navel pipe is the riding slip which is put on the cable when the ship is at anchor, or secured to a buoy, and acts as a preventer should the brake of the cable holder fail to hold the pull of the cable. A removable **bonnet** is clamped over each navel pipe to prevent water running down to the cable locker. Each cable is provided with two swivel pieces, one next to the anchor and one on the inboard end which is shackled to a **cable clench** at the bottom of the cable locker. The foc’sle deck is strengthened and protected beneath the cable run by a strip of steel plating called a **scotsman**. In the stem is a centreline or stem hawsepipe through which the bridles are led when the ship makes fast to a buoy. Centre-line bollards are provided for use with tugs and for securing a second bridle when the ship is made fast to a buoy. Eyeplates are fitted at each side of the port and starboard hawsepipes. The **anchor strop**, which acts as a preventer when the anchor is home in the hawsepipe and secured by the screw slip, is shackled to these eyeplates. In some ships the navel pipe bonnets are fixed and have **compressors** fitted to them. When screwed down, the compressor nips a link of cable and acts as a preventer. This obviates the need for riding slips. When anchoring or secured to a buoy, the ship rides by the cable-holder brake with the riding slip or compressor acting as a preventer. The Blake slip is put on slack as an additional preventer.

Note. *When ships are operating tugs close to berth, it is at the CO’s discretion when to have the anchors fully A’cockbill. As soon as tug operations are complete both anchors are to be made ready for letting go.*

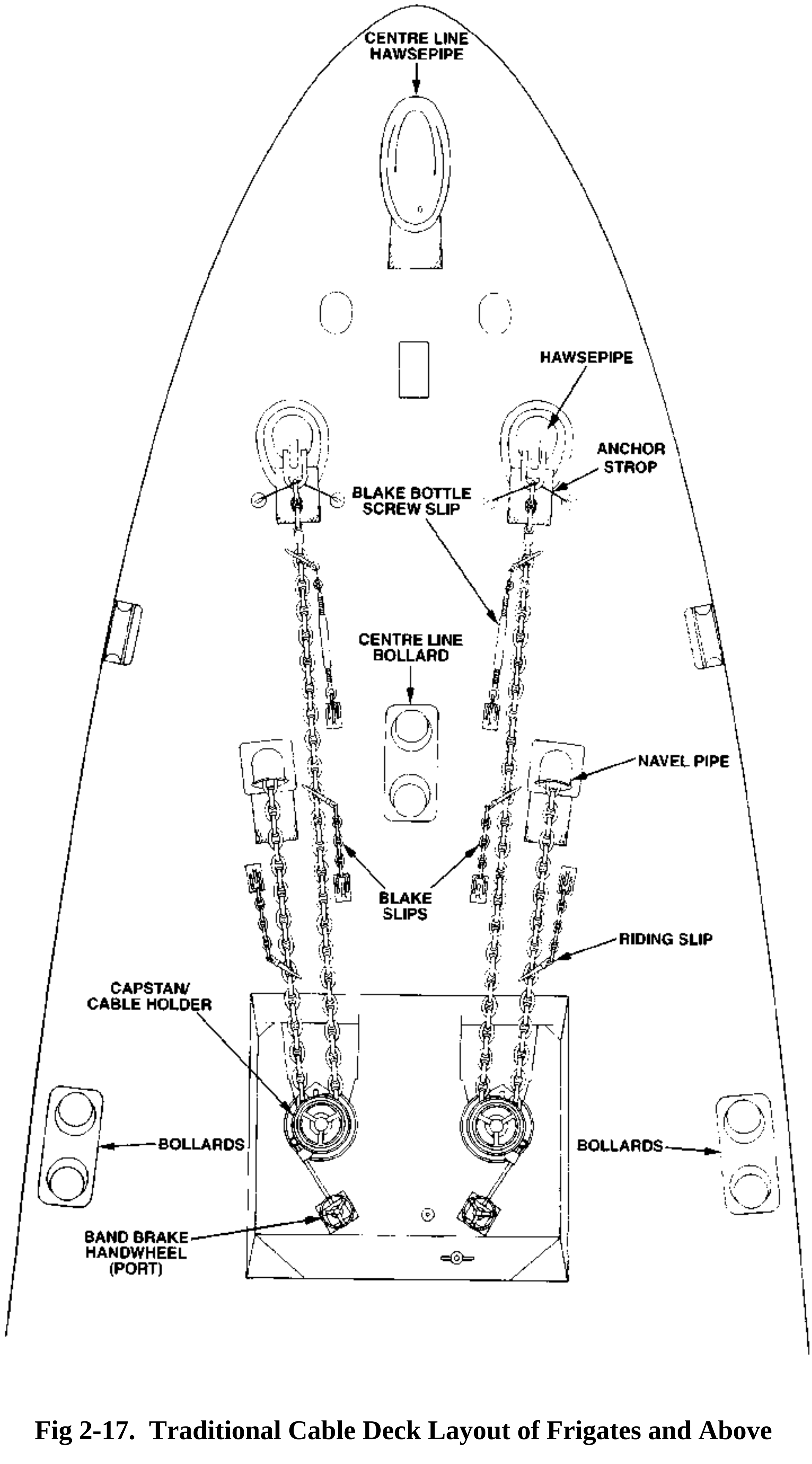


Fig 2-17. Traditional Cable Deck Layout of Frigates and Above

b. **Type 42 Destroyers.** Type 42 Destroyers are fitted with only one bower anchor, on the starboard side (Fig 2-18). A spare anchor is supplied and is secured to the foc'sle screen. From the hawsepipe the cable leads aft to one combined capstan and cable holder on the centreline and then for'ard to the navel pipe. The cable then passes down to a self stowing cable locker which is constructed in the form of a circular trunk. The inner end of the cable is fitted to a swivel piece and secured to a cable clench at the bottom of the locker. An anchor strop, a Blake bottle screw slip and a Blake slip are fitted between the hawsepipe and the cable holder, for working the chain cable. No centreline bollards are fitted but an additional Blake slip is fitted just abaft the hawsepipe and slightly to port of the centreline. A **bullring**, to pass cable out over the bow, is fitted instead of a stem hawsepipe.

c. **Type 22 Batch 2 and 3 and Type 23 Frigates.** Type 23 and Type 22 batch 2 and 3 frigates are fitted with two bower anchors, one stowed in a centreline hawsepipe, and the other, known as the sheet anchor, on the starboard side (Fig 2-19). Because of the position of the bow dome in Type 22 Batch 3 and Type 23 frigates the sheet anchor is only for use in an emergency. Other arrangements are generally as described for the traditional layout, although a single cruciform bollard (staghorn) replaces the centreline bollards, compressors are fitted in lieu of riding slips, and a bullring is fitted in addition to the centreline hawsepipe.

d. **Minor War Vessels.** The foc'sle arrangement in these vessels is shown in Fig 2-20. The capstans and cable holders are replaced by a **windlass**, which revolves on a horizontal shaft driven by a reversible electric engine situated just abaft it on the foc'sle deck. Two **gypsies**, which take the place of cable holders, are mounted on the shaft and each is provided with a band brake. As with a cable holder, each gypsy can be connected to, or disconnected from, the shaft by a clutch. **Warping drums**, which take the place of a capstan, are keyed and usually clutched, one to each end of the shaft and revolve with it. A Blake slip is fitted as in the traditional foc'sle layout, and the anchor is hove hard home in the hawsepipe by a Blake bottle screw slip. The ship rides by the windlass brake, with the Blake slip on as a preventer, when anchored or secured to a buoy.

e. **Merchant Ships.** A merchant ship's anchor and cable arrangements are generally very similar to those of a minor war vessel equipped with a windlass, except **guillotines** replace the Blake slips.

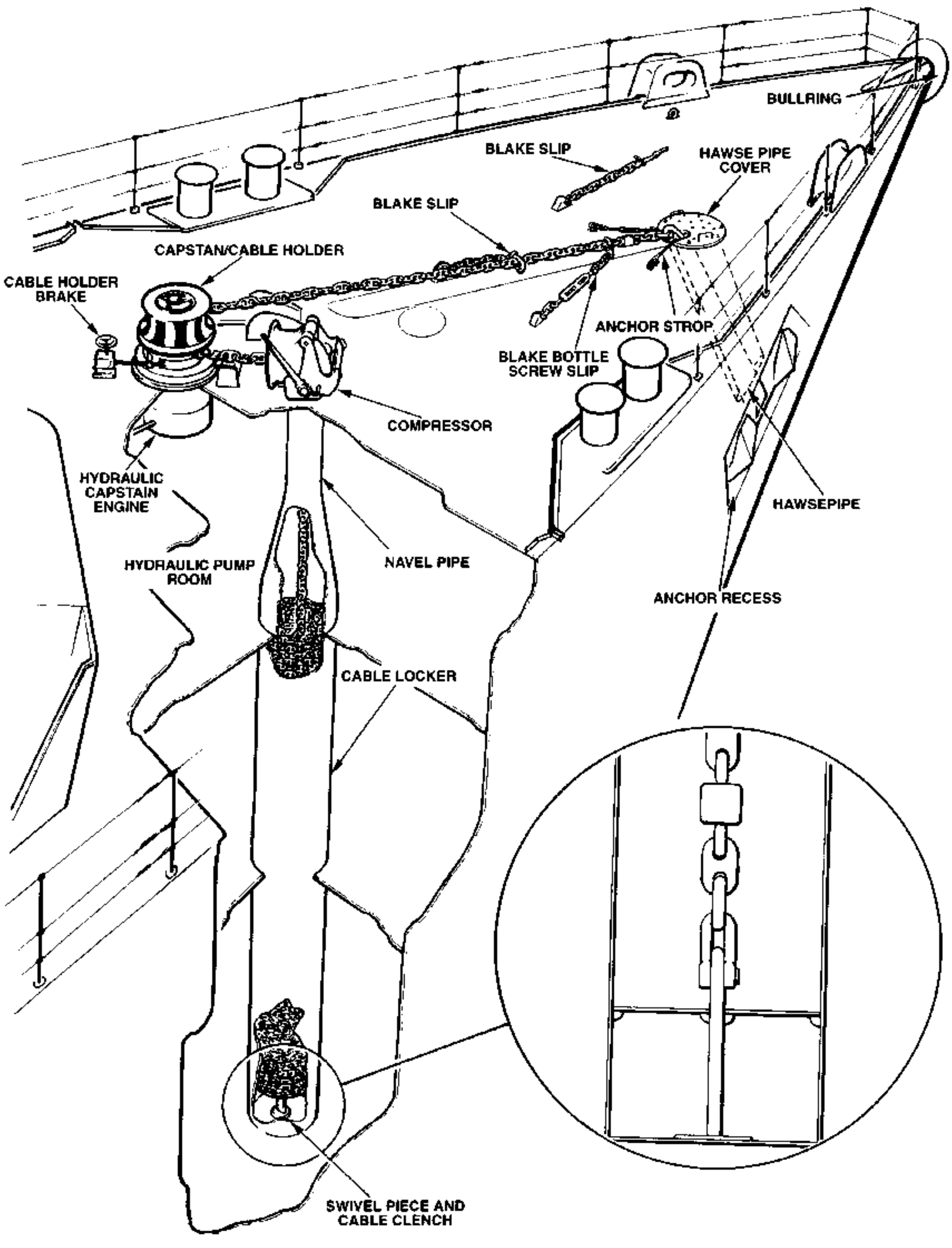


Fig 2-18. Anchor and Cable Arrangements of a Type 42 Destroyer

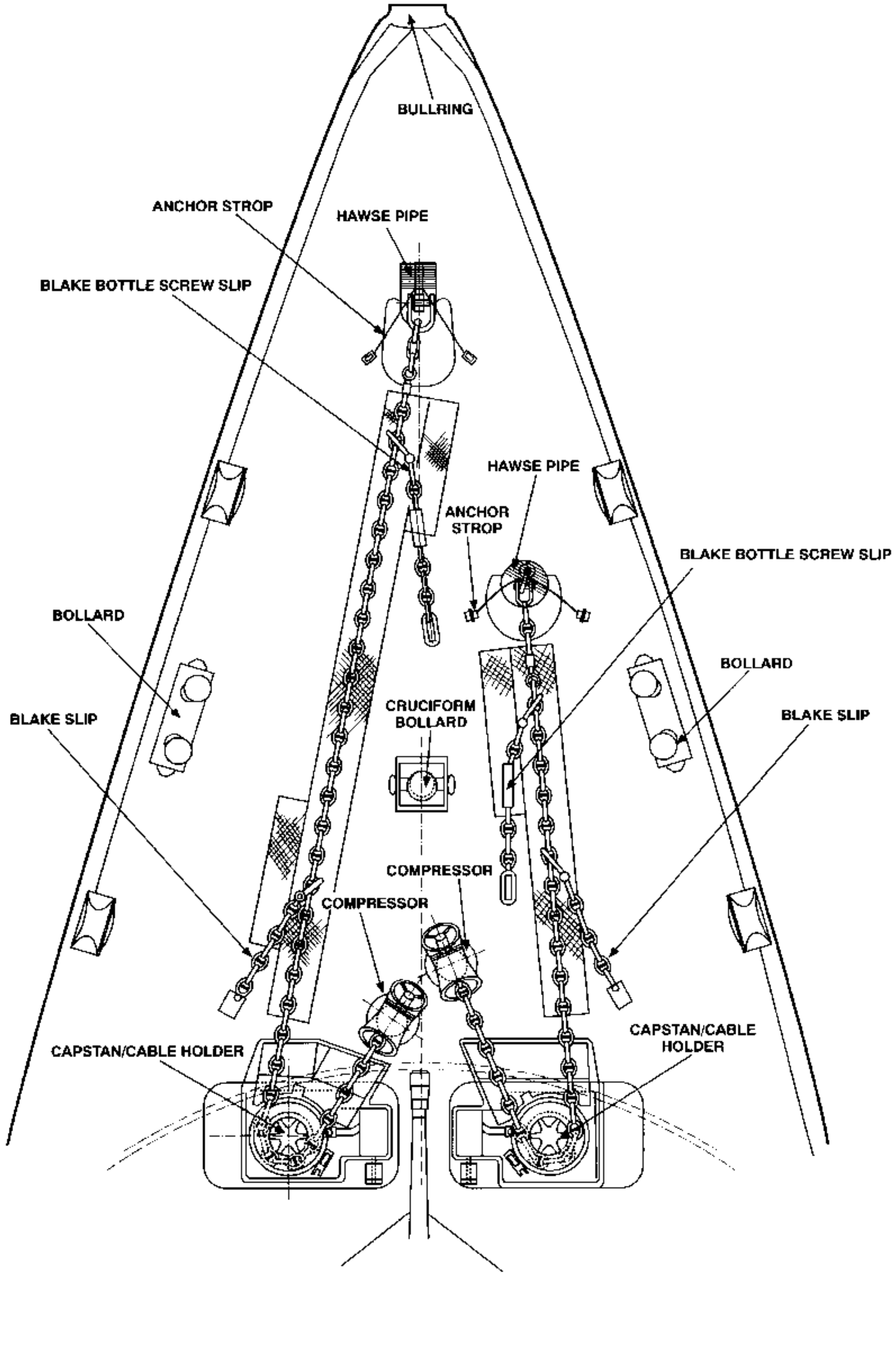


Fig 2-19. Anchor and Cable Arrangements of a Type 23 Frigate

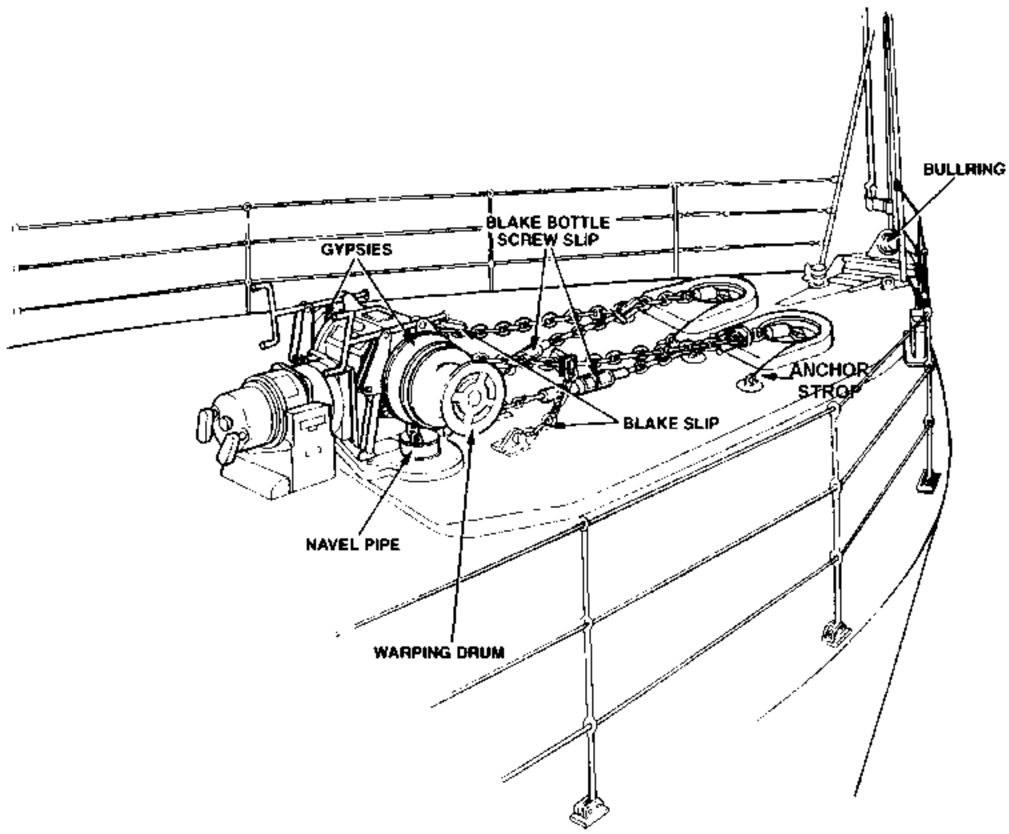


Fig 2-20. Typical Foc'sle Layout in a Minor War Vessel

02012. Miscellaneous Cable Deck Equipment

a. **Anchor Strop.** An anchor strop (Fig 2-12(v)) is used as an additional preventer when securing the anchor for sea; it consists of a wire strop rove through the ring of the anchor and shackled to an eyeplate on each side of, and just abaft, the hawsepipe. It is to be a snug fit.

b. **Anchor Buoy.** An anchor buoy is used when it is necessary to mark the position of the anchor when it is on the bottom; on such occasions it is streamed just before the anchor is let go. It is particularly useful in crowded anchorages to enable other vessels to keep clear of your anchors and cables. A danbuoy float pellet, bearing the ship's name in 50mm black lettering, is suitable for the purpose, although any similar float may be used. One end of the buoyrope (4mm-8mm polyester or polyamide is suitable) is bent to the float and the other end secured to the anchor ring. A floating line must not be used for a buoyrope as it may become a hazard to boats during low water. The length of buoy rope must be sufficient to ensure the buoy will continue to **watch** at high water. (A buoy is said to watch when it floats, and is not watching when carried under the surface by the stream or the rise of the tide).

c. **Deck Tackle.** In the past a large tackle, known as the deck tackle, was carried by all surface warships as a means of weighing anchor if the combined capstan and cable holder broke down. Modern warships are no longer provided with this equipment, and an alternative method of weighing the anchor using other available winches or forms of power must be devised by individual ships. In extreme circumstances the cable can be broken (parted) and slipped, having first attached an anchor buoy to the end.

d. **Bullrope.** A bullrope (sometimes called a heaving-out wire) is a wire used in large ships for ranging cable, lighting cable through a stem hawsepipe or bullring, and adjusting the height and position of the end of a ship's bridle to enable it to be shackled to a buoy. Made from 14mm SWR, the bullrope is fitted at one end with a wire grommet strop and a spring hook as described below for the picking-up rope.

e. **Cable Jack.** A cable jack (Fig 2-21) is supplied to capital ships only. It is a handspike mounted on a pedestal which functions as a fulcrum. It is used as a lever to lift up heavy cable so that, for example, the tongue of a slip can be passed under it.

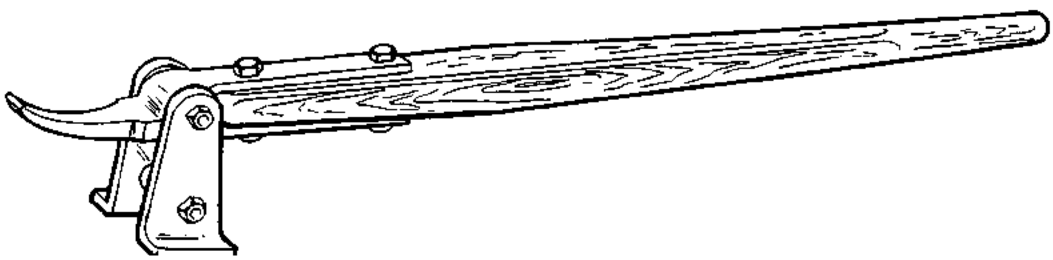


Fig 2-21. Cable Jack

f. **Picking-up Rope.** A picking-up rope is a wire or polyester rope (Fig 2-22) which has a spring hook and a long steel wire rope grommet strop at one end to hold the buoy under foot so that the bridle may be shackled on; and a soft eye at the other end so that it can be used as a sliprope to take the weight off the bridle when unshackling. To rig the picking-up rope as a slip rope the soft eye is rove through the buoy shackle then back inboard to a slip. In practice the wire picking-up rope only is used as a slip rope. Ships outfits are shown in Table 2-3.

Table 2-3. Polyester and Steel Wire Picking-up Ropes

Displacement of ship	No.	Size of Polyester	Size of wire strop	No.	Size of SWR
tonnes		mm	mm		mm
2000 and below	1	40	12 (6x36)	1	20 (6x36)
2000-3000	1	40	16 (6x36)	1	20 (6x36)
3000-5000	1	48	20 (6x36)	1	24 (6x36)
5000-10000	1	56	24 (6x36)	1	32 (6x36)
10000 and above	1	64	24 (6x36)	1	32 (6x41)

Note. *In the near future it is likely that polyester picking-up ropes will become obsolescent, being replaced with an additional SWR version. The Rigging Warrant should be consulted for pattern numbers of the materials used and for the hooks and shackles fitted to picking-up ropes.*

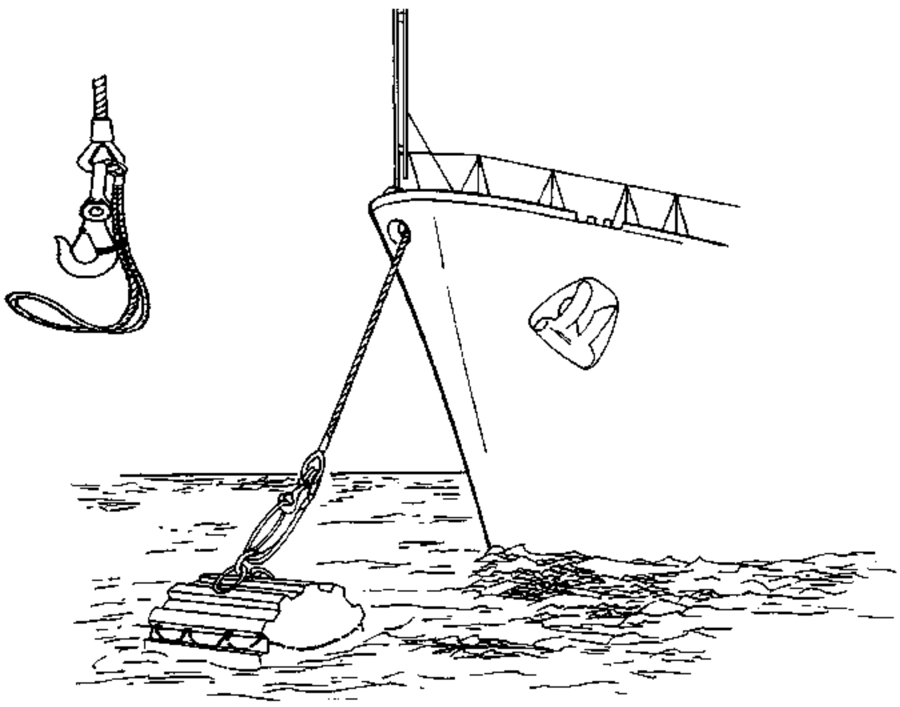


Fig 2-22. Picking-up Rope

g. **Braidline Ship-to-buoy Securing Bridle.** (Fig 2-23). These bridles enable ships fitted with a single anchor, and ships with bow domes, to secure to a buoy and still have the bower anchor available for letting go. Northern Ireland Patrol Vessels (NIPVs) are also supplied with these bridles to meet a specific requirement. The bridles are made of double braided polyamide, one end of which is fitted with a soft eye incorporating an adaptor piece to which a buoy securing shackle can be attached using a lugless joining shackle; the other end of the bridle is whipped and heat fused. A sliding gaiter is fitted to protect the bridle from chafing at the bullring or fairlead. Two bridles are supplied to eligible ships as follows:

Braided Polyamide Bridle	**Buoy Securing Shackle**	**Class of Ship**
0350/251-4431 64mm x 70m	0263/901424 (see note 1)	Type 22 batch 3 Type 23 Type 42 SVHO
0350/728-4335 40mm x 65m	0263/901421	NIPV River Class OPV

Notes:

1. Bridles supplied to Type 23 frigates are fitted with an adaptor piece Pattern No 0222/571-6162. This allows the attachment of a SWR pendant when the bridle is used for bow dome anchoring. Type 22 batch 3 frigates and Type 42s, some of which are currently supplied with bridles end fitted with a buoy securing shackle, are to request replacement bridles that conform to the configuration in Fig 2-23.

2. Bridles should not be dragged over non-skid decks. They must be checked for damage before and after use, and the leather gaiter is to be in place to protect the bridle during use. Braidline ship-to-buoy bridles are generally not to be used when compass swinging except in ships which are unable to break their cable .

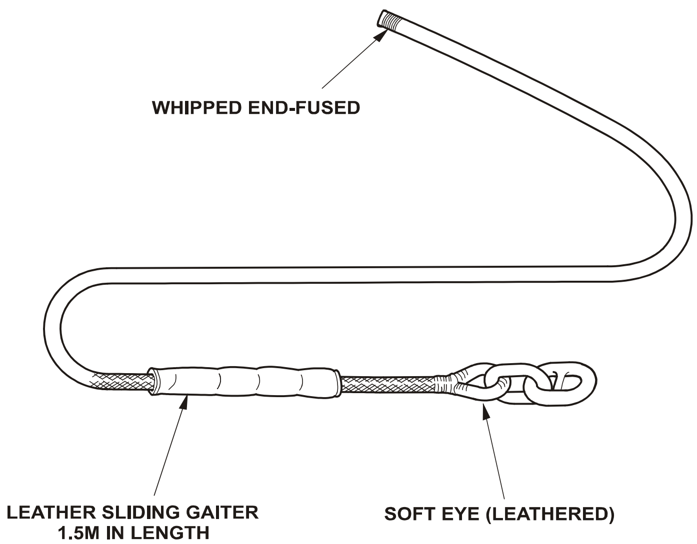


Fig 2-23. Braidline Securing to Buoy Bridle

h. **Braidline Anchoring Bridle.** This bridle (Fig 2-24) is used to enable ships with a fixed bow dome to avoid damaging the dome with the cable when the ship is at anchor. It consists of the braidline ship-to-buoy securing bridle, modified with a 28mm x 7m SWR pendant with a hard eye in each end, one end of which is shackled to the braidline bridle via a lugless joining shackle, and the other end, after the ship has anchored, to a bight of the cable using a joggle shackle. Cable is then veered, and weight transferred to the bridle. Detailed drill procedures are given later in this chapter.

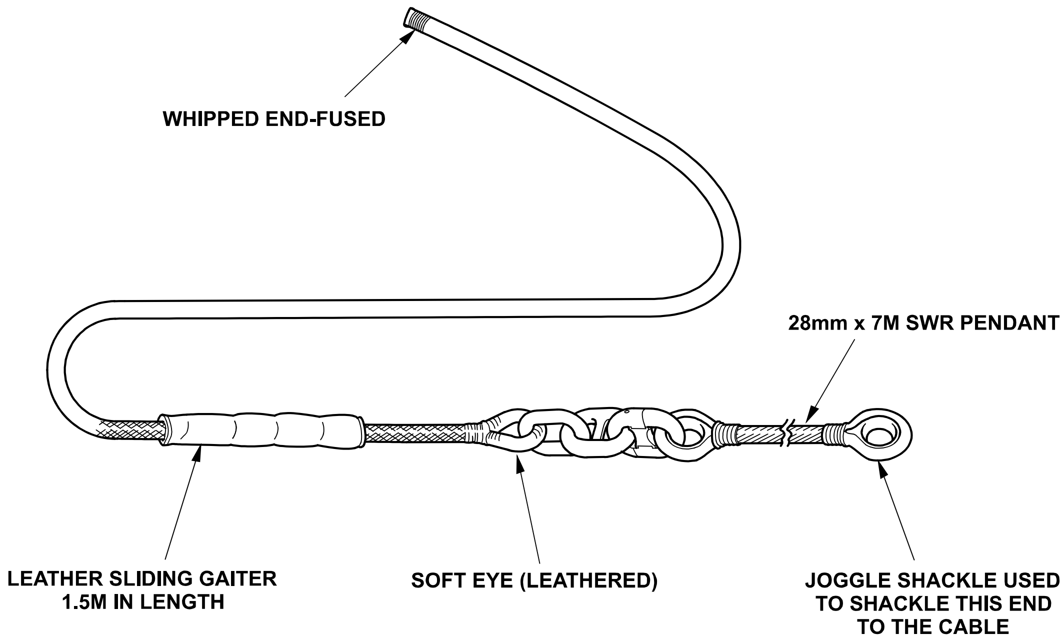


Fig 2-24. Braidline Anchoring Bridle

02013. Testing, Survey, Marking and Maintenance of Anchors, Cables and Associated Fittings.

BR 367, Manual of Anchors, Chain Cables and Associated Equipment, is the authoritative publication regarding the testing, survey and marking of anchors, cables and associated equipment; the Maintenance Management in Ships system (MMS) is also a source of information. It also gives details of cable bag equipment, including Naval Stores numbers, for all classes of ship, submarine and RFA vessels. The following data provides a broad outline of the rules for ships in commission.

a. **Requirement to Test.** Equipment is tested to a proof load on manufacture, or after repair, or as the result of a survey. **There is no requirement to test periodically**.

b. **Survey Periodicity.** The strength of cables may eventually decrease through wear, corrosion or fatigue. Fatigue is caused chiefly by the battering to which the cable is subjected when running out through the hawsepipe and the navel pipe, and when being hove in under strain. Equipment is therefore surveyed periodically. The survey should bring to light any deterioration caused by wear or corrosion, and should detect any flaw or crack in a link. The survey also provides an opportunity for rectifying minor defects, cleaning and overhauling joining shackles, and transposing the harder worked lengths with others so that the whole cable will wear evenly. The periodicity of survey is laid down in **BR 367, Manual of Anchors, Chain Cables and Associated Equipment.** Ships built to class will be surveyed in accordance with Lloyds requirements.

c. **Markings**

(1) *Anchors.* Anchors are marked (stamped) by the manufacturer with details that include the weight, the material, the initials of the Supervisor of Tests and the date of test.

(2) *Chain Cable.* Chain cable is marked on the end links with letters indicating the certifying authority, the certificate number, the year and the initials of the Supervisor of Tests. The penultimate links are stamped with the grade and size of the chain cable.

(3) *Shackles and Other Associated Cable Equipment.* All shackles and other associated cable equipment are stamped with letters indicating the certifying authority, the certificate number, the year, the initials of the Supervisor of Tests, the grade and the size of chain cable with which it will be used.

d. **Procedure for Survey.** Surveys on anchors, cables and associated equipment can only be undertaken by a suitably qualified competent person. When a survey falls due contact should be made with the surveying organisation in good time to discuss arrangements. To prepare for a survey the cable locker must first be cleared and the cable ranged (ie laid out in fleets). Depending on the requirements of the surveyors the cable may be ranged on deck, in a lighter, in a dock bottom, or possibly transported to the chain house for survey there. If desired to range the cable along the bottom of the dry dock, permission must first be sought from the General Manager of the dockyard. As part of the survey every joining shackle is examined to ensure the pin does not project, and is then broken (ie parted). The machined surfaces are cleaned and greased with XG286 before reassembly, and the dovetail chamber of each shackle reamed to remove every particle of the old lead pellet before inserting the pin and new pellet. New pins may be required for joining shackles that have been regularly broken. (They are coated with tin to prevent corrosion and the tin tends to wear off). Every link and stud of chain cable is tapped with a hammer by the surveyor, to test it for flaw, and carefully examined. Should any link be found to have lost more than one-tenth of its original size (or one-eighth if the cable is smaller than 70mm) from wear, corrosion or any other cause, the length of cable which includes the link is unfit for sea service and is to be returned to the dockyard, where the link will be replaced, or the whole length condemned. A serviceable length is to be demanded, to replace any length that is condemned. Swivels are examined. The box-type are greased with a grease gun and the cups of the cup-type are filled with soft grease. All slips, adaptor pieces and associated or spare gear is surveyed at the same time as the cable. The shackles of cable are then transposed as required to avoid undue wear on any one length, joined up together and re-marked. Finally the entire cable is coated with a lubricant rust preventative (NSN 9150-225-1556) before or as it is restowed.

e. **Restowing Cable**

CAUTION

THE CABLE MUST NEVER BE LOWERED DIRECTLY DOWN THE NAVEL PIPE

With or without the assistance of a dockside crane, the cable should never be lowered directly down the navel pipe because it may acquire several unnoticed turns which will result in severe kinking and jamming of the cable when it is run out on the next occasion of anchoring. It must first be passed round the cable holder. If a crane is used, the cable is lowered onto the foc'sle first. If no power is available the cable must still be passed round the cable holder and eased into the cable locker, using a tackle and joggle shackle. Whenever the movement of the cable is halted, for example to connect the next length of cable, the brake should be applied and a pinch bar inserted through the link of cable nearest to the top of the navel pipe; the compressor (or riding slip) need not be used unless the work is halted for a long period. The inboard end of the cable is secured to a cable clench at the bottom of the locker by a lugged joing shackle. The Executive Officer or MEO is to witness the inboard ends of the cables being secured. The Navigating Officer must know the length of each cable, where the half shackles appear and should, if available, check the securing of the inboard end of each cable.

f. **Certification.** On completion of a survey a **Form 194** is issued by the surveying authority, listing all equipment surveyed, and the outcome. A test certificate is issued for items that have been retested as a result of repair. The original Lloyds certification (Red stamped) is to be inserted into the Anchors and Cables Log.

g. **Maintenance Procedures.** Maintenance routines for anchors, cables and associated equipment are laid down in the ship's MMS system. They are devised to reduce the risk of equipment failure.

h. **Cable Bag, Cable Tools and Miscellaneous Equipment.** A cable bag (Fig 2-25) and cable tools should be readily to hand whenever cable is being worked. Other equipment may be required, depending on the nature of the task; it is listed below as miscellaneous equipment.

Cable bag Contents	Cable Tools	Misc. Equipment
1. Topswage	Maul	Brooms
2. Hammer	Tommy Bar	Hoses
3. Punches	Cable Jack	White Paint and Brush
4. Reamer	Bottlescrew Spanner	Rags
5. Spare Pins	Capstan Bar	Eyewash bottle (in plastic bag to prevent contamination)
6. Lead Pellets		
7. Goggles		
8. Seizing wire		
9. Pliers		

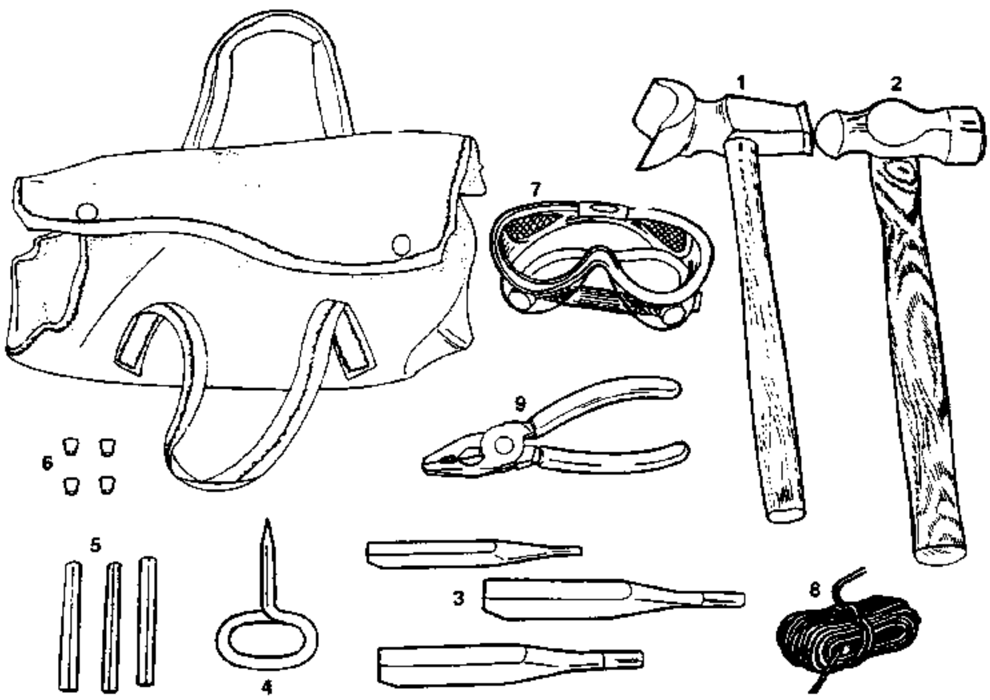


Fig 2-25. Cable Bag and Contents

02014. Safety Precautions When Handling and Working Cable

Handling or working cable safely requires observation of certain safety precautions. They are as follows:

a. DMS boots must be worn by all personnel.

b. Rope hangers (2m lengths of suitable cordage) must be used when manhandling cable. They should be rove behind the link stud to avoid jamming.

c. Personnel must never straddle the cable.

d. A topswage must be used when parting a lugless joining shackle.

e. Goggles must be worn by personnel operating the brake of a cable holder or gypsy windlass to avoid the risk of eye injuries caused from debris being thrown off as the cable is let go. Personnel in close proximity when lead pellet plugs are being hammered into joining shackles must also wear goggles.

f. Personnel detailed to knock off the slip during anchoring must stand as far aft as possible on the side of the Blake slip when letting go.

g. Because of their different diameters, the heaving and veering rates of the capstan and cable holder differ. This fact must be borne in mind, particularly when ranging cable using a bullrope.

h. Cable locker parties must be warned of all cable movements.

i. Open cable lockers must be clear of debris before cable is worked, and clear of all hands before letting go an anchor.

02015. Accident Prevention

a. **Anchoring.** The efficiency of a ship's cable is of such importance that rapidity in anchoring must give place to a method by which the strain on the cables, and in consequence the incident of failure is reduced to a minimum by ensuring that:

(1) The speed of a ship is reduced to a minimum before releasing the anchor.

(2) Anchoring in deep water is avoided as far as possible.

(3) When anchoring in deep water (over 27m) is unavoidable, the cable is veered to within approximately 18m of the bottom before anchoring.

b. **Weighing Anchor.** To avoid straining the cable when shortening-in, care must be exercised to prevent:

(1) The cable drawing under the forefoot or across the stem.

(2) The anchor swinging under the forefoot and becoming fouled.

02016. Loss or Accident

When ships fracture or part their cable the administrative authority will convene a board of inquiry to determine the cause. The loss or breakage of anchors or cables must be reported by signal. The report should include details of any associated gear lost, ie anchor and joining shackles and swivel pieces. The broken link or part should be recovered if possible and the fracture covered with tinfoil or other suitable material to prevent rusting. It should then be sent to a Naval Base for onward dispatch to a metallurgical laboratory.

02017. Terminology and Expressions Used in Anchor Work

Terms and expressions used in anchor work are as follows:

a. **A'cockbill.** An anchor is said to be a'cockbill when it has been eased just clear of the hawsepipe and its weight is taken by the Blake slip in readiness for letting go.

b. **Anchor Coming Home** means that the anchor is dragging towards the ship as the cable is hove in. When weighing her anchor, the ship should always move towards it, using her engines if necessary, and the anchor should not break out of the bottom until the cable is up and down,

c. **Anchor Aweigh.** The anchor is said to be aweigh immediately it is clear of the bottom.

d. **Clear hawse.** This term means that the cables are clear of one another when a ship is riding to two anchors.

e. **Foul Hawse.** A ship has a foul hawse if the cables are crossed or otherwise foul of each other when she is riding to two anchors. If the ship swings 180 degrees she will have a foul hawse, and the cables are then said to have a **cross** in them: another 180 degrees more in the same direction would cause an **elbow** in the cables; a further 180 degrees would cause an **elbow and a cross**, and yet another 180 degrees would cause a **round turn**.

f. **Clear or Foul Anchor.** The anchor is reported clear or foul as soon as it is entirely sighted. To be clear the anchor must be hanging from its ring and clear of its own cable and of any obstruction such as a bight of rope or chain picked up from the bottom. This visual sighting does not apply to the modern submarine's anchor.

g. **To Come To.** A ship is said to come to an anchor at the moment of letting go. The entry in the ship's log would read: ‹0900. Came to with port anchor...etc'. A ship has got her cable when she has dropped back on her cable and is riding to it.

h. **Dragging.** An anchor is said to be dragging when, instead of holding the ship, the ship drags it along the bottom; this may occur in heavy weather, in a strong current, or when insufficient cable has been paid out. A small amount of dragging on anchoring is necessary, in order to bury the anchor in the sea-bed.

i. **To Grow.** A cable is said to grow in the direction in which it leads outside the hawsepipe. When asked ‘How does the cable grow?’ the reply is given by pointing the arm in that direction, unless it grows vertically, when the report ‘Up and down’ should be given.

j. **To Hang Cable** is to hold it temporarily with a stopper.

k. **A Hanger** is usually a rope which is passed through a link of chain cable or round the bight of a rope to hang it.

l. **Long Stay.** The cable is said to be at long stay when it is taut, and reaches out well away from the hawsepipe and enters the water at an acute angle.

m. **Short Stay.** The cable is said to be at short stay when it is taut and leads down to the anchor at a steep angle, and a bridle is said to be at short stay when the mooring buoy is hove close under the hawsepipe.

n. **Shortening-in Cable.** A ship lying at anchor is said to shorten-in her cable when she heaves in part of it; for example, a ship riding to eight shackles of cable might shorten it to three shackles of cable before weighing anchor, or temporarily to reduce her swinging radius.

o. **To Snub** a cable is to restrain it suddenly when running out by applying the brake. This is damaging to the cable, so it should only be carried out in an emergency.

p. **Up-and-down.** The cable is said to be up-and-down when it is vertical. When weighing anchor the cable will be up-and-down just before the anchor is broken out of the bottom, and this usually occurs soon after it is at short stay.

q. **To Veer Cable** is to pay out or ease out cable from the combined capstan and cable holder or windlass when these are connected to and controlled by their motors; the brake should be in the ‘off’ position. It also means to allow the cable to run out by its own weight or strain on the outboard end under control by the cable holder or windlass brake.

Note. *The cable officer must qualify the order ‘Veer’ by stating whether the cable holder is to be connected or disconnected, ie, whether the cable is to be veered under power or controlled by the brake. If the cable is to be veered under power, the order would be ‘Connect up’ (port cable holder), ‘Off brake’, ‘Veer port’.*

r. **Weighing Anchor** is the operation of heaving in cable until the anchor is broken out of the bottom. (**Weigh** must not be confused with **way**, which refers to the motion of a ship through the water.)

02018. Anchoring and Weighing

Before a ship anchors the Captain studies the selected or allocated berth and decides which anchor to use and the amount of cable, taking into consideration the direction of the wind, the tidal stream, the depth of water and the nature of the bottom. When possible the weather anchor is used so the ship will swing clear of her cable. The Navigating Officer must prepare an anchoring plan so that the ship's speed may be reduced and then the engines stopped in sufficient time. HM ships, except those with underwater fittings vertically below the hawsepipe, usually let the anchor go with slight headway so that the anchor is dropped in the exact position and the cable is laid out on the sea-bed clear of the anchor. This method is called a **running anchorage**. Ships with underwater fittings that preclude this method should use the **dropping anchorage**. For this method the ship stops in the anchorage position and the anchor is let go as the ship gathers sternway. The ship continues making slight sternway to ensure the cable is laid out ahead of the ship. HM ships with two anchors always prepare both bower anchors and cables for immediate use when preparing to come to single anchor. If one anchor hangs (ie fails to move) when the Blake slip is released, the other anchor can be let go instead. See also the notes at the end of sub paragraph b.

a. **The Cable Party.** The composition of the cable party depends on the type and size of the ship, her foc'sle, the design of the cable lockers and the type and motive power of her combined capstan and cable holder or windlass. Personnel detailed for the task should dress appropriately for the prevailing weather conditions, including the wearing of lifejackets and safety harnesses if deemed necessary by the OIC. All must wear DMS boots. A typical cable party consists of:

1	Safety Officer
1	Operations/Warfare branch PO or L/S Sea I/c
1	Capstan driver
1	Operations or Warfare branch Leading Hand
4	Able Seaman/Operator Mechanic
1	Communications number.

b. **Clearing Away Anchors and Cables.** The operation of preparing the anchors for letting go is called **clearing away anchors and cables**, and this is done iaw Annex A when approaching the land, whether it is intended to enter a harbour or not.

Notes.

1. ***Anchoring drills in ships not fitted with a Blake slip****. Ships not fitted with a Blake slip let go the anchor from the brake. As far as practicable the preparations as described in Annex A. When the anchor has been veered a'cockbill the brake and compressor are put on and the cable holder disconnected. The bridge is then informed that both anchors are ready for letting go. With $^{1}/_{2}$ a cable to run the compressor is removed. At the order 'Let go' the brake is released as quickly as possible*

2. *When berthing and unberthing, ships are to have both anchors ready for letting go (one anchor in Type 42s and some patrol vessels). The offshore bower anchor, (centreline anchor in Type 22s and Type 23s) is to be prepared so that it is at the a'cockbill position and clear of the hawsepipe. The inshore bower anchor, (sheet anchor on Type 22s and Type 23s) is to be prepared so that it is eased down the hawsepipe sufficiently to ensure free running of the anchor if let go but not to the extent that it will foul any jetty/berth obstruction. The weight of the anchor is to be on the Blake slip with the brake applied to the cable holder and the cable holder disconnected.*

c. **Letting Go.** The ship approaches the anchorage at slow speed and usually heads into the wind or tidal stream. When anchoring in deep water (over 27m) the anchor is veered under power to within about 18m of the bottom before it is let go, otherwise the anchor may be damaged on hitting the bottom and the cable may become brittle as it runs out. The procedure for letting go is to be carried out iaw Annex A.

d. **Securing the Cable.** It is customary to secure the cable with the ordered joining shackle just abaft the Blake slip. Having the joining shackle in this position makes it easy in an emergency to part the cable and slip the anchor. The procedure for securing the cable is at Annex A

Notes:

1. The depth of water at the anchorage must be known by the cable officer to enable him to assess, by the number of shackles veered, whether or not the cable is piling up on itself, and also to alleviate the possibility of inadvertently snubbing the cable.

2. If the depth of water requires more shackles of cable than are available, it must be remembered should the weather deteriorate that the anchor is not providing its maximum holding pull.

3. HM ships fitted with a windlass ride by the brake of the windlass with the Blake slip and guillotine (if fitted) acting as a preventer. In ships with no Blake slip fitted the Blake bottlescrew slip, fully shortened on its screw thread, must be put on as a preventer, positioned as described above for the Blake slip.

4. Because of the length of the foc'sle, Type 22 and Type 23 Frigates should use the screw slip rather than the Blake slip as a preventer when riding at a single anchor. The bottle screw slip must be fully shortened on its screw thread before it is attached to the cable for'ard of the required joining shackle. This arrangement reduces the amount of cable passing over the deck in the event of it being necessary in an emergency to break the cable at the joining shackle.

e. **Amount of Cable to be Put Out.** The minimum amount of cable to be used with a single anchor, which will ensure that the maximum holding pull of the anchor can be developed, is that which is needed to give a horizontal pull on the ring of the anchor in all conditions of wind and stream. It depends upon the magnitude of the holding pull, the depth of water, and whether the cable is forged steel or a copper based material. Given that the cable size is selected to provide a working load equal to the maximum anchor pull, then the variation in the amount of cable required over a range of anchor pulls from 0 to 100 tonnes is quite small, and it can be assumed that the variants are only depth of water and type of cable. The formula for **forged steel cable** is: **Amount of cable to veer in shackles is one-and-a half times the square root of the depth of water in metres.** The formula for **copper based cable** is: **Amount of cable to veer in shackles is equal to the square root of the depth of water in metres**.

f. **Effect of the Cable.** The cable acts as a shock absorber between the anchor and the ship. The weight of the cable causes it to lie in a catenary between the hawsepipe and the sea-bed. The greater the force (from wind and stream) acting on a ship, the greater will be the distance between the hawsepipe and the anchor, so that the amount of cable lying on the bottom will vary. This cable on the bottom provides a holding pull of two thirds of the actual weight of the length of cable on the bottom, and this is added to the pull of the anchor. In conditions where there is a likelihood of the anchor dragging, there is unlikely to be any cable lying on the sea-bed and it is therefore safer to consider only the holding pull of the anchor.

g. **Precautions in Bad Weather.** If the ship is lying at single anchor, and if there is sufficient sea room to leeward, more cable may be veered. The cable holder must be connected while veering, because if the cable were allowed to run out on the brake, the snatch on the cable, caused by the weight of the ship suddenly coming on it after drifting astern and taking up the slack, might weaken the hold of the anchor.

h. **Yawing.** A ship, especially one with a high foc'sle, usually yaws considerably to each side of the wind when lying at single anchor in bad weather (Fig 2-26). At the end of each yaw the ship is liable to drag her anchor, because she first surges ahead and then falls back on her cable, thereby imparting a jerk to the anchor. The situation may be eased by veering more cable. The more cable, the heavier the catenary, and the greater the tension before the cable is ‹straightened out'. The tension is a measure of the force being applied to the ship by the cable, and if sufficient tension can be obtained to stop the motion of the ship before the cable is straightened out, there will be no jerk. As link after link is picked up from the bottom, weight is added to the catenary. With enough chain, the ship will usually be brought about from one tack to the other steadily, without a jerk. A large scope of cable also exerts a damping effect on the yawing by its resistance to being dragged sideways across the bottom. This adds to the catenary effect of the weight of the cable, but is more effective in pulling the bow through the wind because it causes the cable to lead more to the side as the ship sails across the wind. If the yaw becomes serious, the situation can be relieved by letting go a second anchor at the end of the yaw away from the first anchor. Both cables are then veered so that the ship rides with one anchor at long stay and the other at short stay.

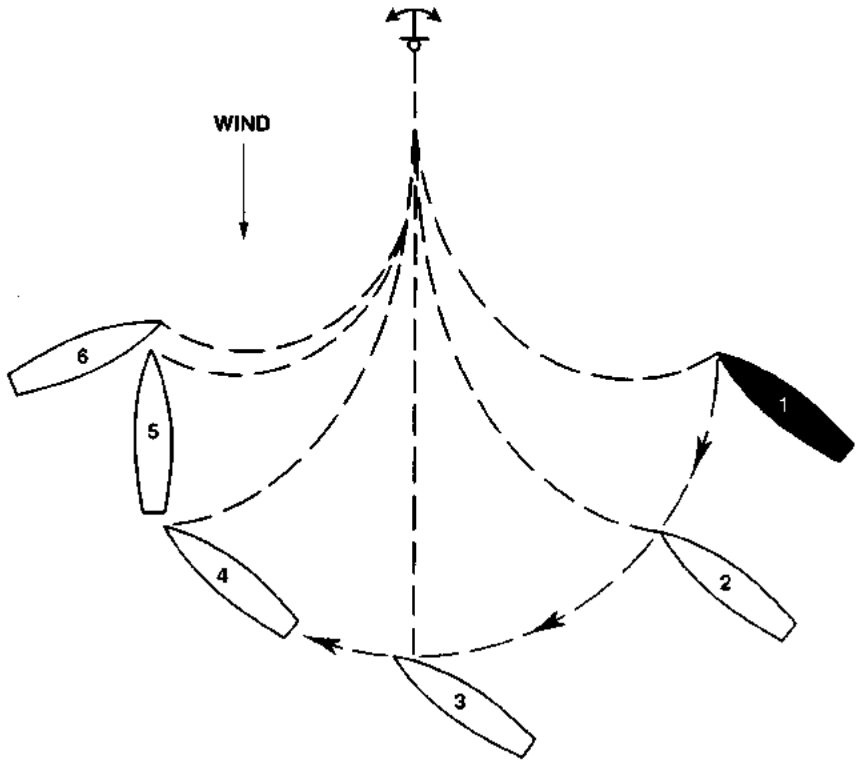


Fig 2-26. Yaw of Ship in Strong Wind

i. **Anchoring in a Gale.** If it is expected that a ship fitted with two anchors will have to ride out a strong and prolonged gale both anchors should be used. The procedure for this is fully explained in **BR 45 Admiralty Manual of Navigation Volume 6**, however, the basic method used is illustrated in Fig 2-2.

j. **Anchor Watch.** An anchor watch should always be set in bad weather. This watch consists of an officer on the bridge and a special party on or near the foc'sle ready to watch and work the cable. Power should be on the capstan and main engines, and sea dutymen should be closed up.

k. **Dragging an Anchor.** Dragging of the anchor can be detected by taking frequent compass bearings on shore objects, or by taking soundings with a hand lead line, or by the behaviour of the cable. When the anchor is dragging, the cable usually tautens and slackens alternately in a marked manner and vibration can be felt in it as the anchor is dragged along the bottom.

| l. **Shortening-in and Weighing Anchor**. (Carried out iaw Annex A)

m. **Clearing a Foul Anchor.** An anchor may come up foul of its own cable or of a bight of rope or chain picked up from the bottom. If foul of its own cable and the ship is stopped, it is best to let go the anchor as it will then usually clear itself. If foul of a bight of rope or chain it is usually best to pass a hanger round the fouled bight, lead the hanger aft, secure it and then veer the cable until the hanger takes the weight of the obstruction and the anchor comes clear. The anchor can then be hove up and the hanger slipped or cut.

n. **Clearing a Foul Hawse.** (Fig 2-27). To clear a foul hawse the non-riding cable is hung outboard below the foul, then broken inboard, and the foul is cleared by passing the free end of the non-riding cable in the reverse direction to that of the turns; only half a turn, however, should be taken out at a time. The procedure will usually entail the use of a boat, and safety aspects as described for mooring to a buoy will apply. A detailed description of this operation is given below, in which it is assumed that the ship is riding by the starboard cable and that there is a round turn to be cleared. If the turn is submerged the starboard cable is hove in to bring the turn to a convenient height above the water, and the two cables are lashed together just below the turn to prevent the turn slipping down the cables. With heavy cable there is a danger that when the lashing is cut after the hawse has been cleared the two cables will spring back and injure whoever cuts the lashing. To prevent this possibility it is best to lash the cable by reeving a length of 8mm SWR through the links, as shown in the inset in Fig 2-27 and then to belay the two ends inboard, ensuring that the rope does not take the weight of the cable while the hawse is being cleared. The cables can then be unlashed from inboard by unreeving the rope. The picking-up rope is led outboard through the port hawsepipe or a convenient fairlead and attached with a joggle shackle to the port cable below the turn (Fig 2-27(1)); it is then brought to the capstan and hove in to take the weight of the cable. The port cable is hung inboard or put on the screw slip, and then broken. A suitable **messenger** (a berthing rope will suffice) is now passed out through the port hawsepipe, dipped round the starboard cable in the opposite direction to the turn to be cleared, brought up again through the hawsepipe, and tailed on to the end of the outboard part of the port cable (Fig 2-27(ii)). The slip is knocked off and the messenger hove in (Fig 2-27(iii)); if necessary, the picking-up rope can be stoppered and the capstan used. If the cable is heavy (above 60mm) it is advisable not to let the end run out through the hawsepipe, but to ease it out on a rope fitted with a slipping arrangement. When half a turn in the cables has been cleared the messenger is stoppered, its end dipped again round the riding cable, and again hove in; this will clear the remaining half-turn. The end of the port cable is now hove back into the hawsepipe and the cable is joined up again. The picking-up rope is eased up and cast off, and the lashing is cut or slipped from inboard.

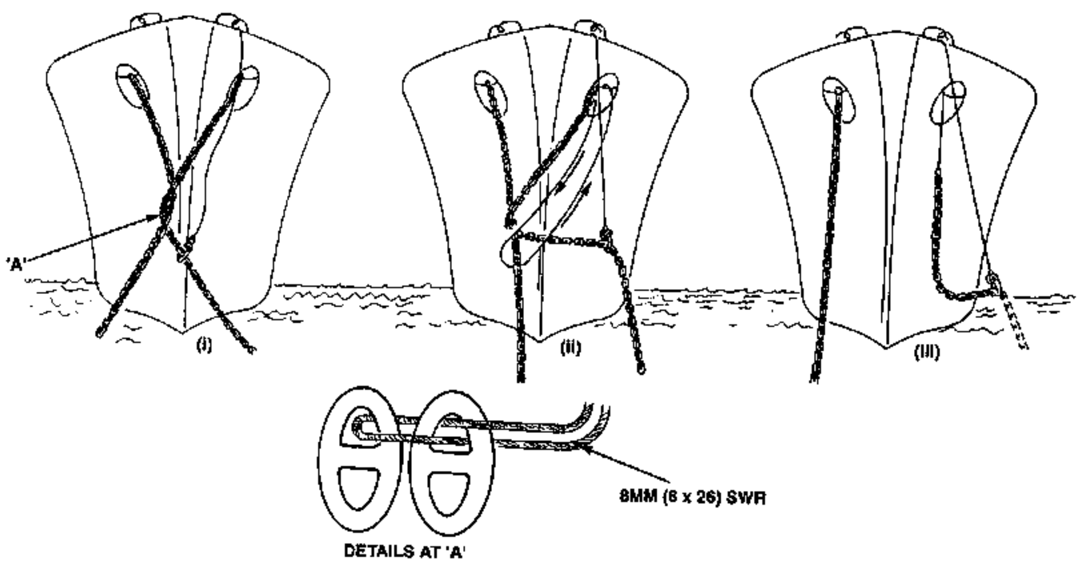


Fig 2-27. Clearing a Foul Hawse

o. **Securing Anchors and Cables for Sea.** The anchors must not be secured for sea until ordered by the Captain, who, under normal conditions, will require both anchors (where fitted) ready for letting go until the ship is clear of the harbour. Then it must be done thoroughly or the anchors will work loose in a heavy sea; and it must be done quickly iaw with Annex A.

Notes.

1. To prevent damage the anchor must not be brought fully home under power.

2. ***'Post Heavy Weather'*** *Shackle pins and leads must be checked for movement and security post heavy weather. In the event of movement they are to be re-leased and consideration must be given for backing up with an additional preventer i.e. Roundsling.*

02019. Anchoring with a Braidline Bridle

Ships fitted with a bow dome are supplied with a braidline bridle, which is secured to the cable to act as a chafing piece against the dome when the ship is at anchor (Fig 2-29). The bridle is described in para 02012(g). Braidline bridles are to be used at all times when anchoring unless the Captain is confident the cable will remain clear of the dome whilst the ship is at anchor.

a. **Equipment Required.** The following equipment is required in addition to that needed for going to single anchor:

(1) Braidline bridle with SWR pendant attached. (One end of the pendant is attached to the adaptor piece on the bridle using a lugless joining shackle). On the first occasion of use, and after the SWR pendant has been attached to the braidline bridle, a measurement of 26m (Type 22 batch 3's), or 23m (Type 23's) is taken from the free end of the pendant, and the point marked on the bridle by the insertion of a strip of red bunting or similar easily visible marking. This mark indicates the position at which the bridle will be turned up on the bollards.

(2) Shepherds crook or boat hook.

(3) Strayline.

(4) Handspikes.

(5) Joggle shackle.

b. **Preparations.** The cable party is closed up, the cables are cleared away, and the bow anchor is brought to the a'cockbill position. A strayline is rigged and used to haul the free end of the SWR pendant out through the bullring and back up the centreline hawsepipe, where it is stopped to a convenient eyeplate; ensure the pendant does not foul the anchor or cable. The remainder of the bridle is led to the first set of bollards on the starboard side, one full turn is taken round the bollards, and the remainder of the bridle is faked or coiled down abaft the bollards, free for running.

c. **Execution.** Standard anchoring procedures for anchoring with a Braidline Bridle is to be conducted iaw Annex B.

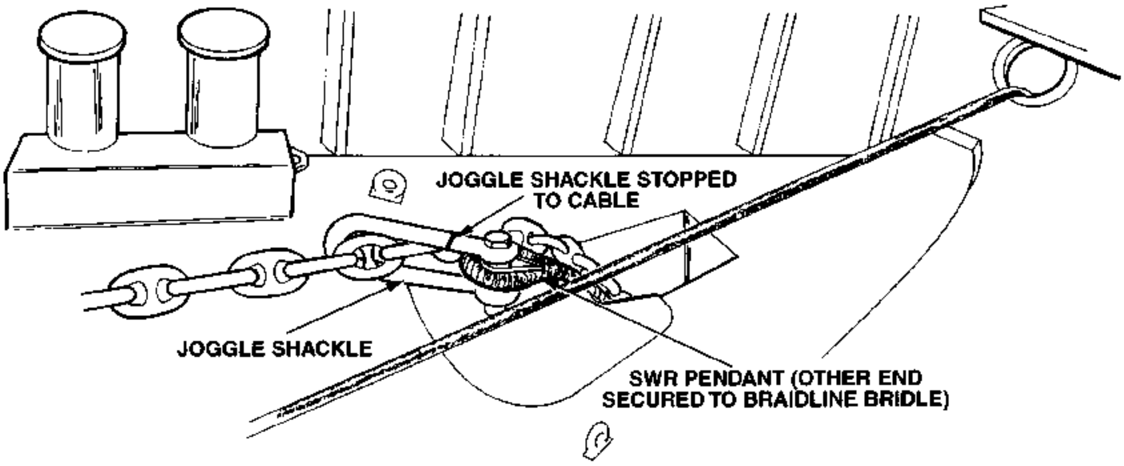


Fig 2-28. Joggle Shackle Attached to Cable and SWR Pendant

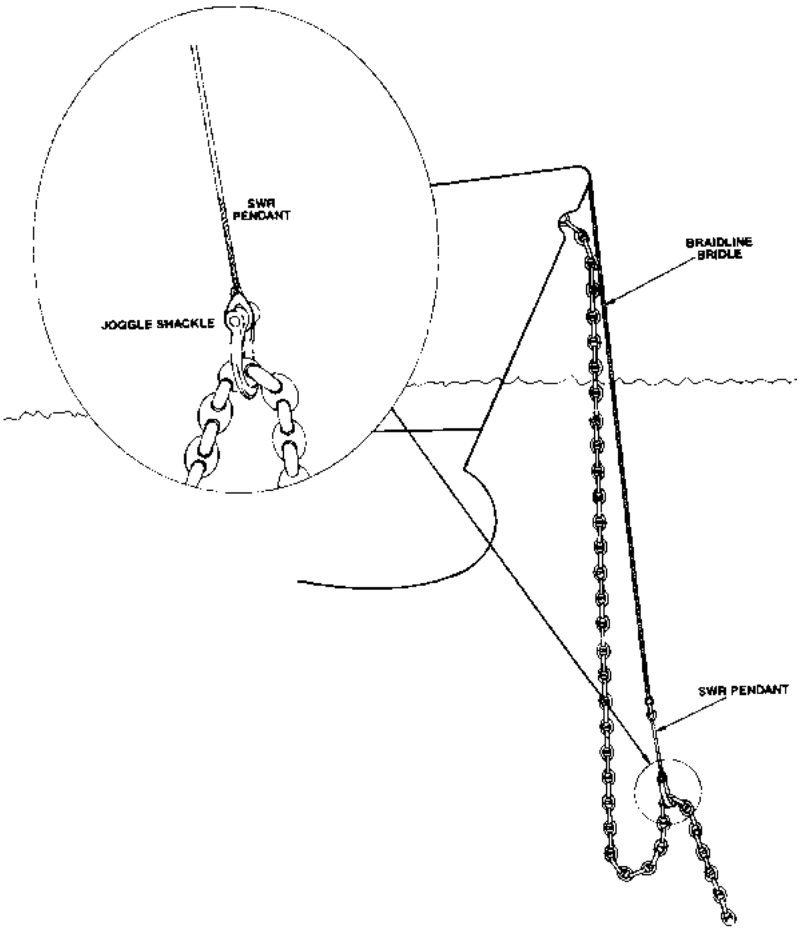


Fig 2-29. Ship Anchored with Braidline Bridle Attached to the Cable

| d. **Recovering the braidline bridle.** (Carried out iaw Annex B).

02020. Stern-to Berths (Mediterranean Moor)

In some harbours where there is insufficient room to berth many ships alongside, ships may be obliged to berth at right-angles to a jetty, with their sterns secured to it by berthing lines and their anchor(s) laid out ahead. This type of mooring can only be employed where their is a negligible range of tide, and it is commonly used in Mediterranean ports; for this reason it is often called the **Mediterranean (or Med) moor**. Navigation and shiphandling aspects of this evolution are covered in **BR 45 Admiralty Manual of Navigation Volume 6**. The major considerations are to veer sufficient cable so that the ship can swing clear of other ships at the berth when leaving, to lay the anchors sufficiently far apart to make the ship secure in a wind, and to ensure the anchors do not foul those of other ships. In a shallow harbour it is recommended that a frigate veers about 4 shackles of cable on each anchor, and that cables are spanned with an included angle of about 50 degrees, so as to make the ship more secure in a wind. It is obvious, however, that the berth will not be safe if a gale blows from abeam. If such weather is forecast it is advisable to put to sea or seek a sheltered anchor berth. Ships fitted with a single anchor can, in theory, carry out a Med moor; however, the single anchor will hold the bows steady only in benign weather conditions.

a. **Preparations.** All personnel involved in the evolution must be briefed on the task. The cable party is closed up and both anchors are cleared away and made ready for letting go; heaving lines, berthing hawsers and a 12mm polypropylene towing messenger are prepared on the quarter deck by a berthing party; the towing messenger will be used to pass the first line. The Captain decides how far from the jetty to lay the anchors, and the approach the ship will make; this will usually be parallel to the jetty towards the position the first anchor will be let go. The seaboat is deployed before the ship makes her approach, and the cox'n is ordered to stay well clear of the ship until the boat is called in to take the towing messenger to the jetty. Clear instructions from the bridge to the foc'sle, quarterdeck and seaboat are important throughout the evolution.

b. **Procedure.** The ship makes her approach and the first anchor is let go. (Fig 2-30 position 1); the bow is turned to port to prevent the cable running under the ship and to bring the starboard hawsepipe to the correct position for letting go the second anchor (position 2). When both anchors are down the boat is called in to take the first line clear of the water to the jetty. The ship is manoeuvred into her berth, veering cable as necessary during the process, and the hawsers are passed from the quarterdeck to the jetty as soon as practicable. The stern is secured to the jetty by two hawsers which provide more security if they are crossed under the stern, but in some ships this may not be practicable. After the stern has been secured the moor is tautened by heaving in and equalising the strain on the anchor cables. When secured, both anchors should be taking moderate strain and standing well out of the water. It must be remembered that no margin has been allowed for safety astern in the case of wind from ahead so there must be no slack in the cables.

Notes:

1. There are alternative methods of approach available to the Captain depending on the prevailing weather conditions and the geographical position of the berth; however, the seaman's task remains fundamentally as described above.

2. It is important that anchor buoys are used to mark anchors in congested berths.

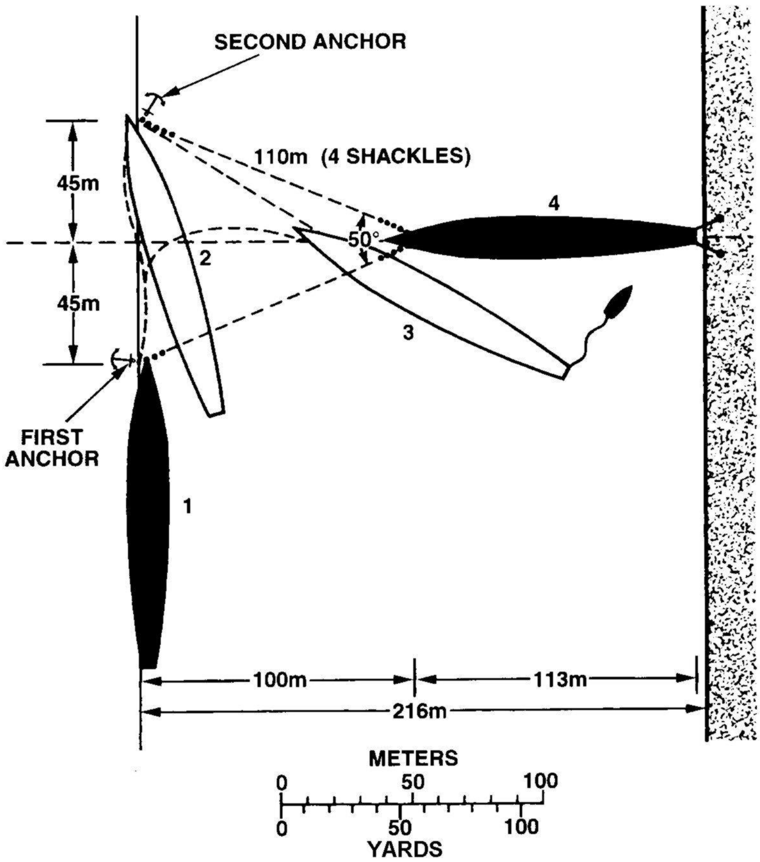


Fig 2-30. Berthing Stern To in Calm Weather

c. **Leaving a Stern-to Berth.** Opinion is divided, when slipping from a stern-to berth, on the advisability of keeping a stern rope rove while the cables are hove in. The ship does not have to move very far forward before a stern rope loses its effect in checking a swing of the stern, and it might foul a propeller or hamper the use of the engines if they are needed. Nevertheless, some shiphandlers prefer to retain the windward hawser rove as a sliprope until the ship has moved forward sufficiently for the stern rope to be of no further use in manoeuvring. The position of the anchors should be plotted and considered in relation to the direction in which the ship will swing as she leaves the berth.

02021. Use of an Anchor at an Alongside Berth

In some harbours it may be necessary to let go an anchor before going alongside, so that, when the ship subsequently casts off, her bows can be hauled clear of her berth by her cable. She can then weigh her anchor and go ahead into the fairway. The anchor should be let go in such a position that, when the ship is secured alongside, the cable grows abeam, and with sufficient scope to ensure the anchor holding when the bows of the ship are hauled off; the shallower the water, the closer to the jetty can the anchor be let go. When using an anchor at an alongside berth the anchor must be buoyed.

a. **Procedure.** In calm weather the ship approaches at right-angles to the jetty and pointing to the head of her berth; and as the anchor is let go at the required distance from the jetty the rudder is put over to swing the bows in the required direction. As the way of the ship is reduced the cable is braked to assist the swing of the bows, and a head line is passed ashore and used to prevent the bows swinging out to far. The ship is eventually stopped a little more than half a ships length ahead of her berth, when a stern line is passed ashore and the ship is backed stern first into the berth. The use of an anchor may also be dictated by a stiff onshore wind (or stream) when berthing. Details of this procedure are in **BR 45, Admiralty Manual of Navigation Volume 6**.

b. **Slipping from Alongside with an Anchor Down.** When slipping from alongside with an anchor down, the stern must be cast out on a spring or hauled out by a tug before the bows are hove out by the cable, otherwise the stern will foul the jetty and possibly damage the rudder or propeller. As the bows are hove out the stern must be held in position, either by a tug or by working the engines against the cable, otherwise the stern may swing in again and foul the jetty. The heaving out of the bows should be controlled by a fore breast rope to prevent the ship from overriding her anchor. In an onshore wind the help of a tug to haul the stern out, and to keep it from swinging in while the cable is hove in, is essential unless the wind is light and the ship particularly manoeuvrable.

02022. Pointing Ship

In an anchorage where there is little or no current or tidal stream, and in reasonably calm weather, a ship may be pointed to lie at an angle with the line of her cable by putting a spring on her cable. First heave in a shackle or so of cable. Now lead a hawser (The ship's towing hawser is suitable for the purpose) out through the aftermost quarter fairlead, then for'ard and outboard of all, and shackle it with a joggle shackle to the cable outboard of the hawsepipe, thereby forming a spring. Then belay the hawser and veer the cable, and the ship's head should pay off away from the side on which the spring is rove until pointing in the required direction. Alternatively the hawser may be brought to an after capstan and hove in as the cable is veered.

02023. Methods of Communication when Working Cables

When working cables, direct voice communication is established between the bridge and the foc'sle using either The Rationalised Integrated Communication Equipment (RICE) telephone system or a sound powered telephone. Portable radios may be used subject to the Emission Control (EMCON) policy in force at the time. To indicate progress in working cables to other ships in the vicinity 'Uniform' is hoisted at the yard-arm on the appropriate side and used as shown in Table 2-4:

Table 2-4. 'Uniform' Flag Hoists when Working Cable

Operation	Progress	Signal
Anchoring	'Anchor let go'	At the dip on appropriate side
	'Cable veered correct amount'	Close - up
	'Cable secured'	Hauled down
Weighing	'Am heaving in' (when lying to two anchors 'port' or 'starboard' may be used to indicate side)	At the dip on appropriate side
	'Anchor aweigh'	Close - up
	'Ready to proceed'	Hauled down

Note. *By night, the information is either signalled by light or passed by voice.*

a. **Captain's Anchor Flags.** These consist of two small hand flags, one red and one green, with a white anchor design on each, which may be used by the Captain to indicate the exact instant at which to let go the port and starboard anchors respectively. By night, red and green wands are used instead of the Captain's anchor flags.

b. **Example of Use of Anchor Flags.** The following example shows the cable signals used by a ship in daylight when coming to with a single anchor. The Captain shows the red anchor flag from the bridge, meaning 'Stand by to let go port anchor', and this is repeated by the Cable Officer. 'Uniform', made up ready for breaking, is hoisted at the dip at the port yard arm. The Captain lowers the red anchor flag, whereupon the slip is knocked off the port cable and the anchor let go. 'Uniform' is broken at the dip at the port yard arm. 'Uniform' is hoisted close up when cable is veered the correct amount, and hauled down when the cable is secured.

02024. Moorings

Permanent moorings may be laid for the following purposes.

To make the most of the usually limited space of a harbour anchorage.

To berth ships as near as possible to the landing places so as to facilitate embarking and disembarking stores, cargo, crew or passengers.

To provide secure moorings for ships in crowded waters, especially for those laid up and others unable to move under their own power.

To ensure that ships are berthed precisely, and in the most suitable positions for each other's safety and for the preservation of lanes for harbour traffic.

To reduce the possibility of ships dragging in heavy weather. (A ship is more secure at a permanent swinging mooring than at anchor.)

a. **Types of Mooring.** The two main types of permanent mooring are the **swinging mooring**, where a ship secures head to buoy and is free to swing to the wind and tidal stream; and the **head-and-stern mooring**, where a ship secures head-and-stern between two buoys. Swinging moorings are always laid if space permits, because ships can make fast to them and slip from them with the minimum of help. Where space is limited, however, ships must be secured to head-and-stern moorings, which have the following disadvantages:

(1) A ship usually requires tugs when securing to them and slipping from them.

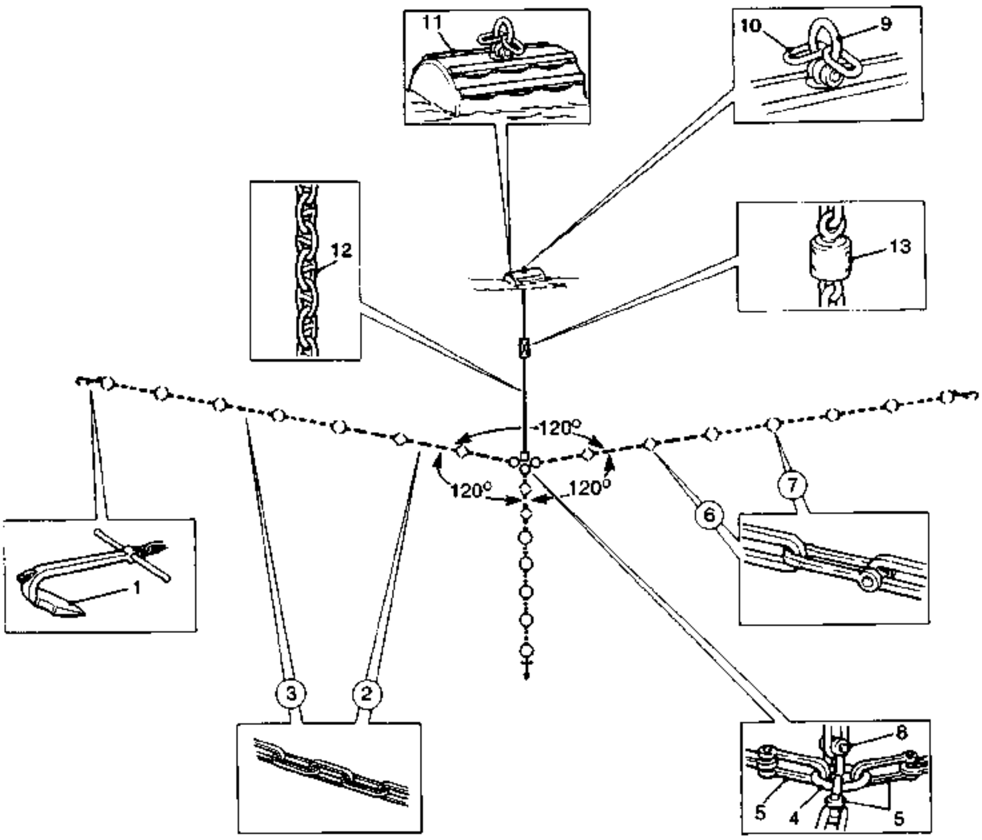
(2) When a ship is secured to them in a strong beam wind they are subjected to a very great load and so they have to be particularly strong and secure.

(3) A mooring intended for a long ship is not suitable for a short ship.

Note. *Remarks on shiphandling while securing to head buoys or between head-and-stern buoys appear in **BR 45, Admiralty of Navigation Volume 6**.*

02025. Parts of a Mooring

The three main parts of a mooring comprise the **ground tackle**, the **riser pendant** and the **buoy**. These are illustrated in Fig 2-31 which shows a first-class three-leg swinging mooring.



REF	KEY	DESCRIPTION	SIZE	QTY
1		ANCHOR MOORING c/w STOCK	9.75 TONNES	3
2	•—•—•	CHAIN MOORING - SQUARE LINK	102mm	165m
3	••••••	CHAIN MOORING - SQUARE LINK	95mm	220m
4		RING MOORING - PATTERN 'A'	102mm	1
5	O	SHACKLE - SQUARE LINK - CLENCH	102mm	3
6	<>	SHACKLE - SQUARE LINK - FORELOCK	102mm	6
7	<>	SHACKLE - SQUARE LINK - FORELOCK	95mm	15
8	□	SHACKLE ANCHOR - CLENCH	102mm	1
9		SHACKLE - BUOY RING	102mm	1
10		REDUCING LINK FOR BUOY RING SHACKLE	103mm	2
11		BUOY - CYLINDRICAL - WITH TRUNK (See note)	1st CLASS	1
12	——	RISER PENDANT - GRADE 2 STEEL CHAIN CABLE	102mm	1
13	⊠	SWIVEL	102mm (4in)	1

NOTE:
THE CYLINDRICAL BUOY DEPICTED MAY ALTERNATIVELY BE A
DRUM BUOY AS SHOWN IN FIG 2-36, BUT WITHOUT THE MOORING LUGS

Fig 2-31. A First-class Three-leg Swinging Mooring Showing the Principle Parts

a. **Ground Tackle.** This consists of two or more anchors, with a **ground arm** of mooring chain shackled to each and led to a **central mooring ring**, to which is shackled the **riser pendant**.

(1) *Mooring Anchors and Clumps.* (Fig 2-32). These are usually stocked, single-fluke anchors, and they are usually heavier than the bower anchors of the ships for which the mooring is designed. They are carefully placed and embedded to ensure that the mooring and its buoy are in the correct position. Because they are never dropped and embedded by dragging like a ship's anchor they have only one fluke, and a stock is incorporated to prevent the anchor from rolling out of its bed. Cast-iron sinkers are sometimes used in minor moorings instead of fluked anchors.

(2) *Legs of Ground Tackle.* These are made up of 18m lengths of special square-link mooring chain, each link being approximately 1m long and of square section. The lengths are joined by a special *forelock mooring shackles* (Fig 2-32). *Clenched or welded mooring shackles* are used where the inner ends of the arms are shackled to the *central mooring ring* (Fig 2-31), as most wear occurs in this position.

Note. *The special square-link mooring chain is gradually being superseded by studded chain cable.*

b. **Riser Pendants.** Pendants are made up from lengths of Grade 2 steel studded chain cable and are fitted with a swivel provided there is sufficient swinging room at the mooring. Pendants of head-and-stern moorings may be fitted with swivels so that, if necessary, they can be used as swinging moorings. The swivel is inserted at one-third of the length of the pendant from its upper end. The lower end of the riser is made of open end-link cable for a length equal to the maximum range of the tide. For any size of cable the open end links are made of the same grade steel but the diameter of the metal is 20 percent greater than that of the common studded links. This additional thickness compensates for the absence of the stud, and provides a greater margin for wear at the position where most movement and abrasion occurs. The length of the pendant of a standard mooring is equal to the depth of water at Mean High Water Springs plus two metres and the freeboard of the buoy. In exposed positions where heavy seas and swell are likely to be experienced the length is increased accordingly.

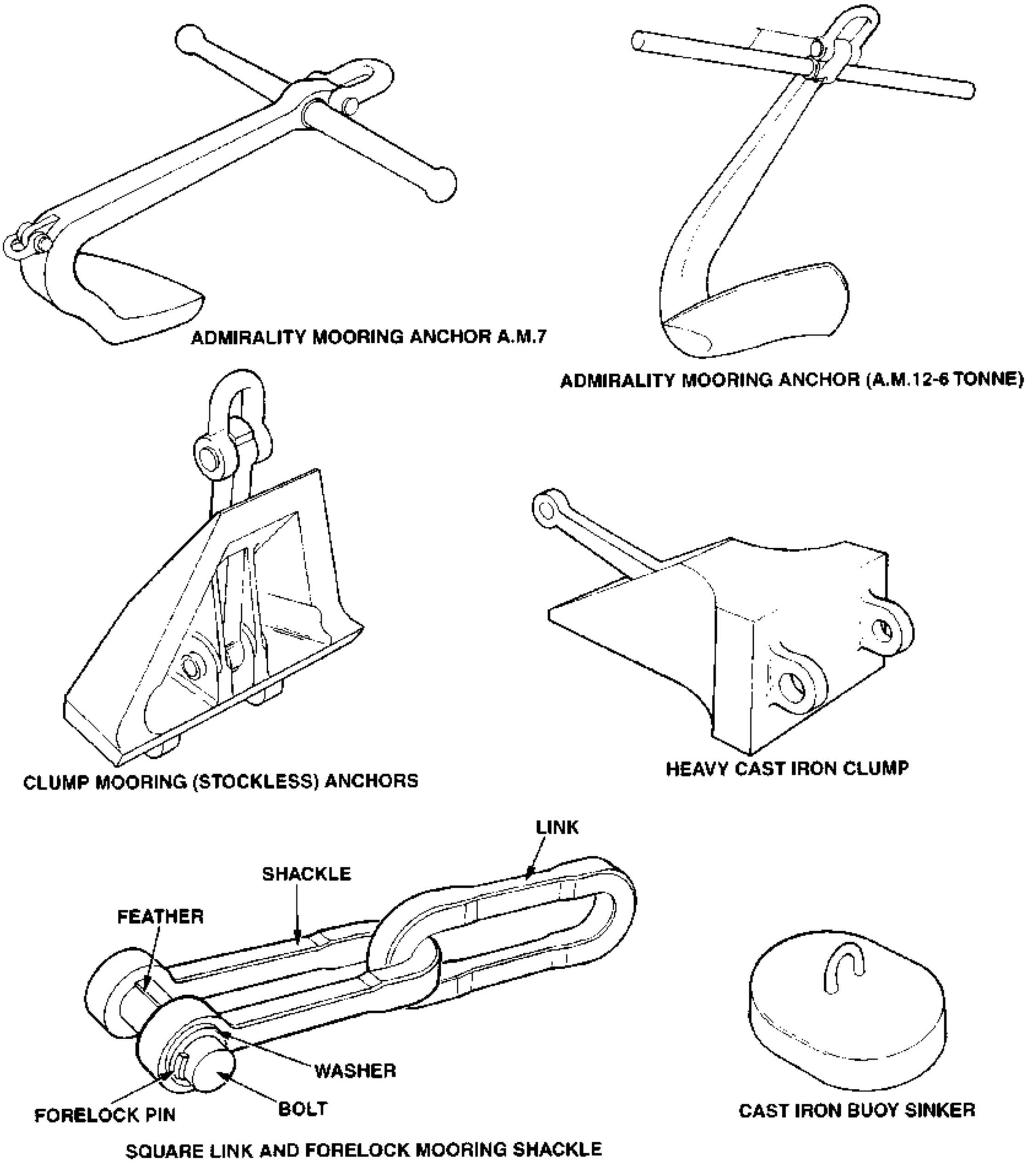


Fig 2-32. Mooring Anchors, Clumps and Types of Ground Tackle

c. **Buoys**

(1) *Mooring Buoys*. Most modern Admiralty mooring buoys are built on the trunk principle and are cylindrical in shape (Fig 2-33). The larger sizes are divided into watertight compartments by longitudinal and transverse bulkheads. The riser pendant is led up through a central trunk in the buoy, and the bolt of the buoy shackle is passed through the end link of the riser pendant. The ships cables are shackled directly to the buoy shackle using the securing-to-buoy shackle. If this is not possible because the buoy shackle is too large for the securing-to-buoy shackle, then both cables are shackled to the reducing links, using one link for each cable. The size of a buoy depends on the size and length of the pendant which it supports, and also the reserve of buoyancy required for the buoy. A reserve of buoyancy of 35 per cent is usually allowed, but this may be reduced to 25 per cent if necessary. Table 2-5 shows the various classes of mooring buoy size and maximum length of pendant with which each is designed to be used in normal circumstances. There are five classes of mooring buoy but in deep water a higher classification of buoy may be used because it has to support a longer riser pendant. Two further buoys, the **X-class** and the **Monster**, are provided to permit moorings to be laid at depths greater than those for which a first-class buoy is suitable.

(2) *Mark Buoys* (Fig 2-37). These are used to provide permanent navigational indications, eg, to mark a safe channel or a particular hazard. There are five basic buoy shapes which are fitted to the buoy body, namely; can, conical, spherical, pillar and spar. Details are given in **NP 735, IALA Maritime Buoyage System ‹A’**

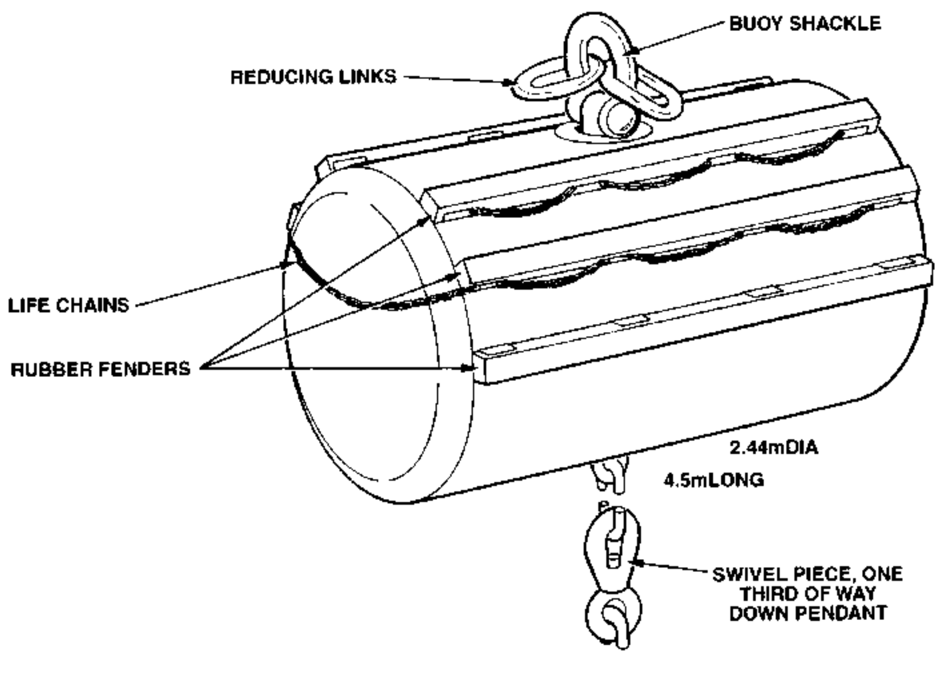


Fig 2-33. A Cylindrical Steel Mooring Buoy, 1st Class

02026. Types of Mooring for Ships

a. **Single-clump Mooring.** The simplest form of mooring (Fig 2-34) consists of a buoy, a riser pendant and a sinker or clump. It is generally used for small craft such as harbour launches.

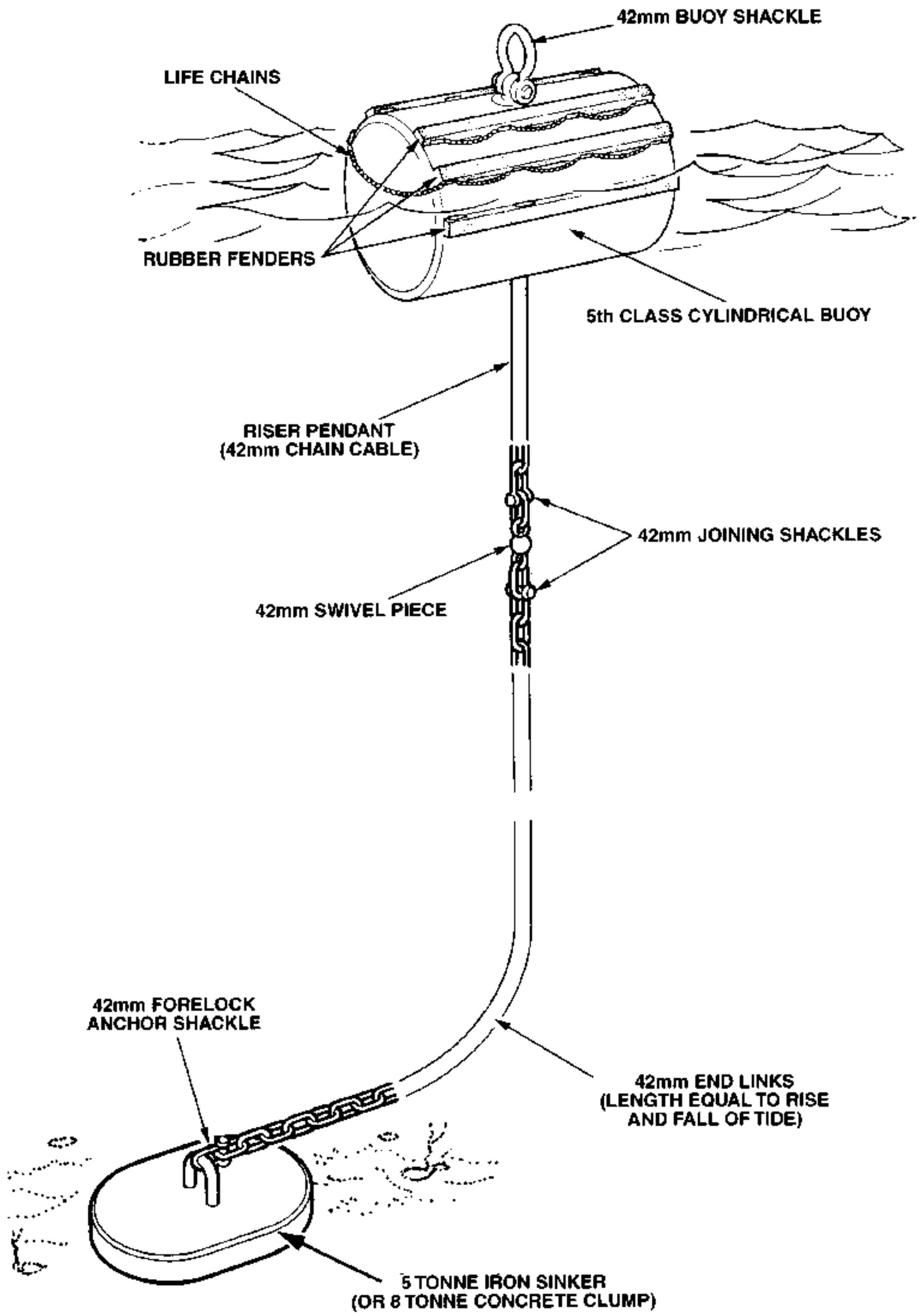


Fig 2-34. Single Mooring - 5th Class Swinging Mooring for Sheltered Sites

b. **Two-legged Swinging Mooring.** The lighter swinging moorings in restricted waterways may be of the two-legged type. (Fig 2-35(I)), one anchor being laid on a leg of chain cable upstream, and the other on a similar leg downstream. The type illustrated is **resilient mooring**, often referred to as an anti-snatch mooring in which the mooring ring is always suspended above the sea bottom, and the catenaries of the two legs are weighted with lengths of chain which acts as dampers during surge loads.

c. **Three-legged Swinging Mooring.** The three legged swinging mooring (Fig 2-35(ii)) has greater holding power than the two-legged mooring. Its resistance to dragging is nearly constant with the wind from any direction, but it occupies a wider area than the two-legged mooring.

d. **Four-legged Swinging Mooring.** A four-legged swinging mooring (Fig 2-35(iii)) is used for the heaviest types of ship. It has all the advantages of the three-legged mooring, and its four legs provide greater holding power.

e. **Head-and-stern Mooring.** The type of mooring shown in Fig 2-35(iv) is that generally used for mooring a ship head and stern. The mooring is usually laid along the direction of the tidal stream and the splayed legs are laid at an angle of 60 degrees to the fore-and-aft line of the mooring.

f. **Trot Mooring.** A trot mooring (Fig 2-35(v)) is laid for securing a number of vessels in line, head to stern, and is economical in terms of space and material. As with the head and stern mooring, it is usually laid along the direction of the tidal stream and the splayed legs are laid at an angle of 60 degrees to the fore-and-aft line of the mooring.

g. **Hauling Off Moorings.** Hauling off moorings are usually provided in a harbour which is subject to swell conditions, for holding a ship clear of a jetty against her berthing hawsers. If the weather deteriorates and the ship is in danger of bumping heavily against the jetty or catamarans, the **off-fasts** (wires from the moorings) should be used to haul her off until the wind moderates.

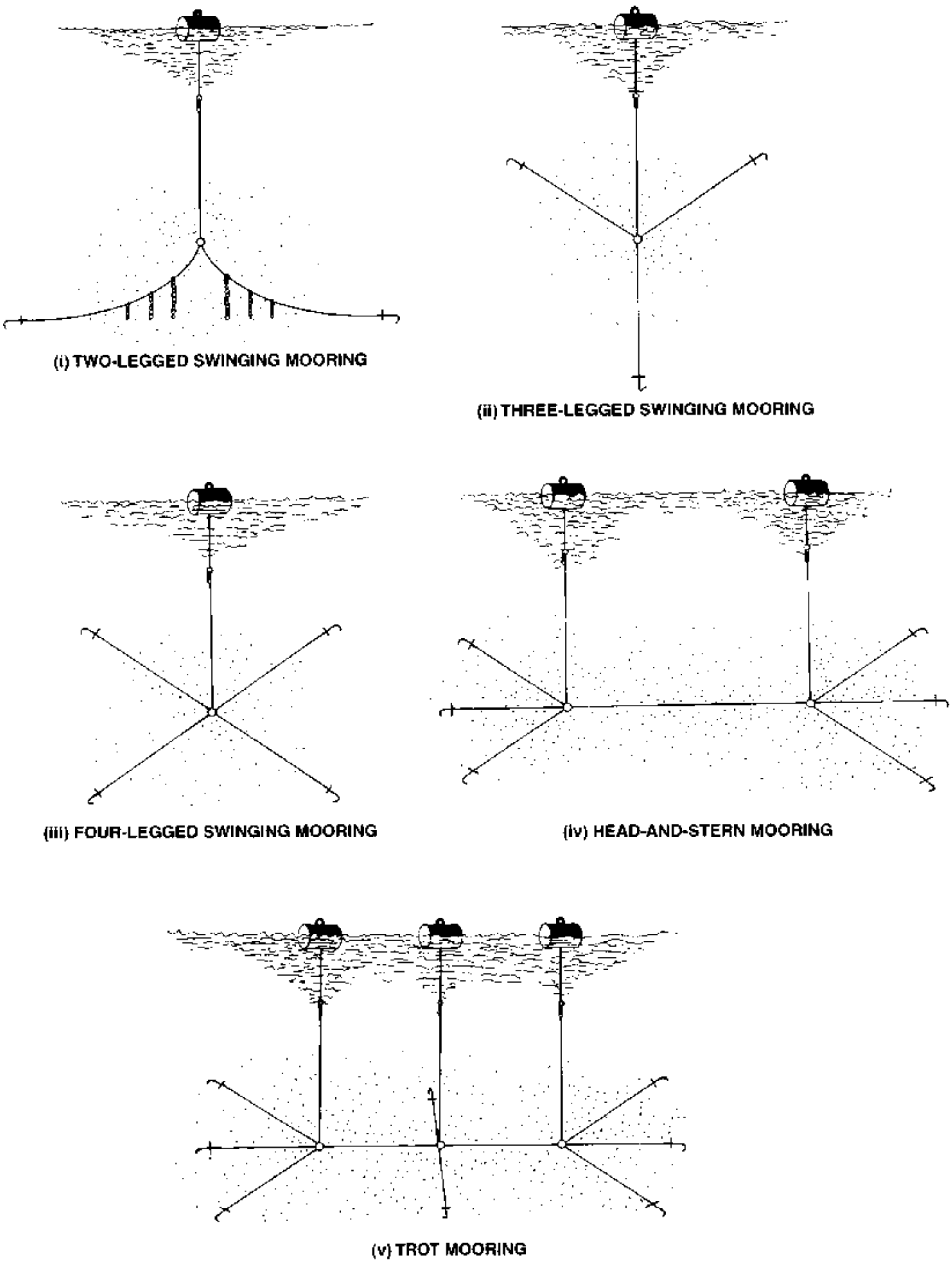


Fig 2-35. Types of Moorings for Ships

02027. Classification of Moorings

Because of the great differences in length and displacement of ships several **classes** of moorings are provided. Moorings are classified according to the proof load of the cable or the displacement tonnage of the ships which may safely use them. Generally speaking, **first-class** moorings are suitable for the largest vessels including large auxiliaries, **second-class** for vessels of cruiser size and small auxiliaries, **third-class** and **fourth-class** for destroyers or frigates, and **fifth-class** for other small ships and craft. Details of classes of moorings for HM ships and auxiliary vessels are given in Table 2-5.

CAUTION

A SHIP SHOULD NOT SECURE TO A LIGHTER CLASS OF MOORING THAN THAT DESIGNED FOR HER

A ship may use heavier swinging moorings than those designed for her, and also heavier head-and-stern moorings if the length between the head and stern buoys is not too great. For this purpose one or two special **reducing links** (Fig 2-33) are fitted to each buoy shackle of the heavier moorings to enable the securing-to-buoy shackle of a smaller ship to be joined to the buoy. Table 2-5 gives a list of the different classes of mooring, together with the size and material of ship's cable for which each class of mooring is suitable. The proof load of cable, which is related to its size and material, should always be the standard used when deciding whether a mooring is suitable for a particular ship, because it takes into account the maximum stresses involved at all states of loading, these usually being highest when the ship is at light-load draught owing to the large windage area she then presents. In the last column of Table 2-5 is given the displacement of the largest ship for which each class of mooring is suitable. In determining the number of small craft that may lie abreast at any mooring, the aggregate proof load of the several cables should be the deciding factor. In sheltered waters, the number of ships permitted to lie abreast in a head-and-stern mooring may be calculated on a displacement basis, by adding to the displacement of the largest ship one-half the displacement of each of the other ships. This rule is to be applied at the discretion of the local mooring officer, who should bear in mind that, at reduced displacements, ships present increased windage area. Proof load of a ship's cable is more reliable than her displacement tonnage when determining the class of mooring to be used because the proof load of a ship's cable is selected with due regard to her windage area. Dimensions and reserve buoyancy of mooring buoys are given in Table 2-6.

Table 2-5. Classes of Mooring

Class of mooring	Cable size of largest acceptable ship			Maximum acceptable fully-loaded displacement
	Grade 1	**Grade 2**	**Grade 3**	
1st (4-leg) 1st (4-leg, telephone)	mm 95	mm 78	mm 66	tonnes 50,800
1st (3-leg) 1st (3-leg, resilient)	89	73	62	40,650
2nd 3-leg)	70	58	48	16,260
3rd (3-leg) 3rd (3-leg, resilient)	60	50	42	8,250
4th (3-leg) 4th (3-leg, resilient)	54	44	38	4,500
5th (3-leg)	34	28	24	400
5th (Sinker)	Small craft only			150

Notes:

1. For mooring purposes of HM ships and auxiliaries, Grade 1 is considered as copper-based cable (aluminium bronze), Grade 2 as forged steel cable fitted in the majority of warships, and Grade 3 as forged steel cable fitted only in CVS's.

2. First-class swinging moorings cannot accept any ship fitted with cable of size 28mm and below, and the non-rotating telephone buoy mooring cannot accept any ship fitted with cable of size 38mm and below, because the securing-to-buoy shackles are too small to pass over the reducing links.

3. Nuclear submarines must not be secured to any mooring below 3rd class.

Table 2-6. Dimensions and Reserve Buoyancy of Mooring Buoys

Buoy (cylindrical)				**Chain cable riser pendant**		
Class (note 1)	**Length**	**Diameter**	**Class of mooring**	**Size**	**Reserve Buoyancy** 35%	25%
	m	m		mm	m	m
X-Class (4)	5.18	2.82	1st 2nd	102 90	61.87 84.43	72.24 98.15
Monster (4) (note 2)	4.88	2.44	1st 2nd	102 90	41.45 57.61	48.77 67.06
First (4)	4.47	2.44	1st 2nd	102 90	37.49 52.12	43.89 57.91
Second (4)	4.01	2.29	1st 2nd 3rd	102 90 76	28.04 39.62 56.08	32.92 46.33 65.53
Third (4)	3.51	1.98	3rd 4th	76 66	31.03 48.77	36.58 56.69
Fourth (4)	2.90	1.68	4th 5th (Exposed sites)	66 42	25.30 69.80	29.57 81.08
Fifth (2)	2.13	1.22	5th	42	21.03	24.38

Notes:

1. The number of compartments in each class of cylindrical buoy is shown in brackets.

2. The Monster class buoy is obsolescent and will be replaced, in due course, with X-class.

02028. Telephone Cables at Moorings

Certain mooring berths may be provided with telephone or teleprinter cables. For head and stern moorings the telephone cables are lead from the shore along the bottom, clear of the ground tackle, to a separate buoy, sufficient scope being allowed in the cables for tidal range. The ships telephone cables are then joined to the shore telephone cables on this buoy.

a. **Non-rotating Telephone Buoy Mooring.** The provision of telephone cables for a swinging mooring is complicated by the fact that the cables are liable to foul the riser pendant as the ship swings round the buoy. In some ports this difficulty is overcome by mooring the buoy with a three- or four-leg bridle to ground arms as shown in Fig 2-36, thus preventing rotation of the buoy. The ship's cable is then shackled to links on a spectacle lug which revolves around a collar fitted to the upper end of the buoy trunk. The shore telephone cable is led up through the buoy trunk and thus clear of the mooring. The ship's telephone cable is tensioned, either as shown in Fig 2-36 or by a patent tensioning reel fitted to the buoy, to avoid chafe by the anchor cables as the ship swings. The connection between ship and shore telephone cables is made at a connection box on the buoy which also incorporates a slip-ring unit to prevent twisting of the telephone cables. Where provision is not made at a swinging mooring to prevent a telephone cable fouling the mooring, a watch must be set to keep it clear as it swings.

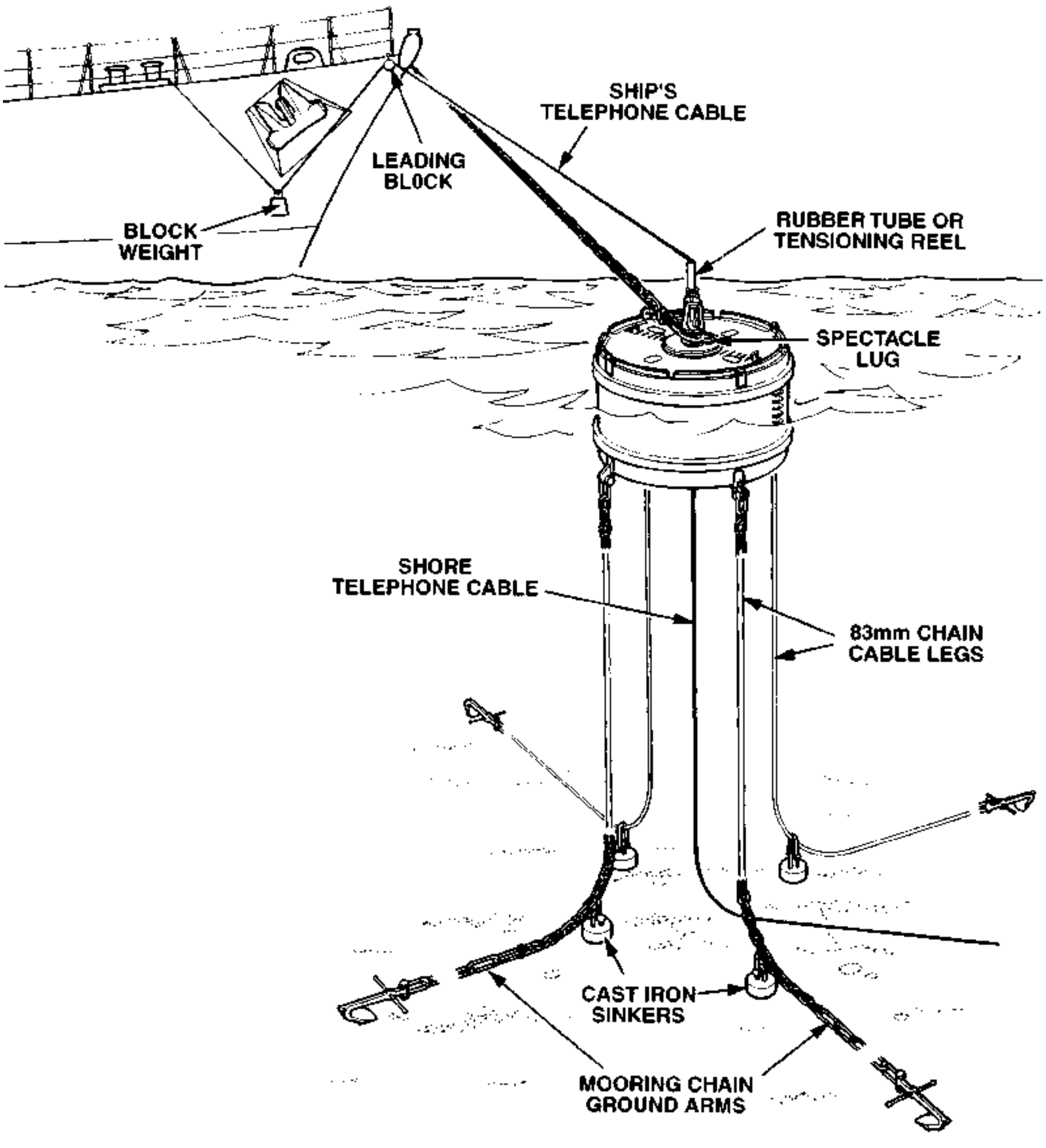


Fig 2-36. Non-rotating Telephone Buoy Mooring

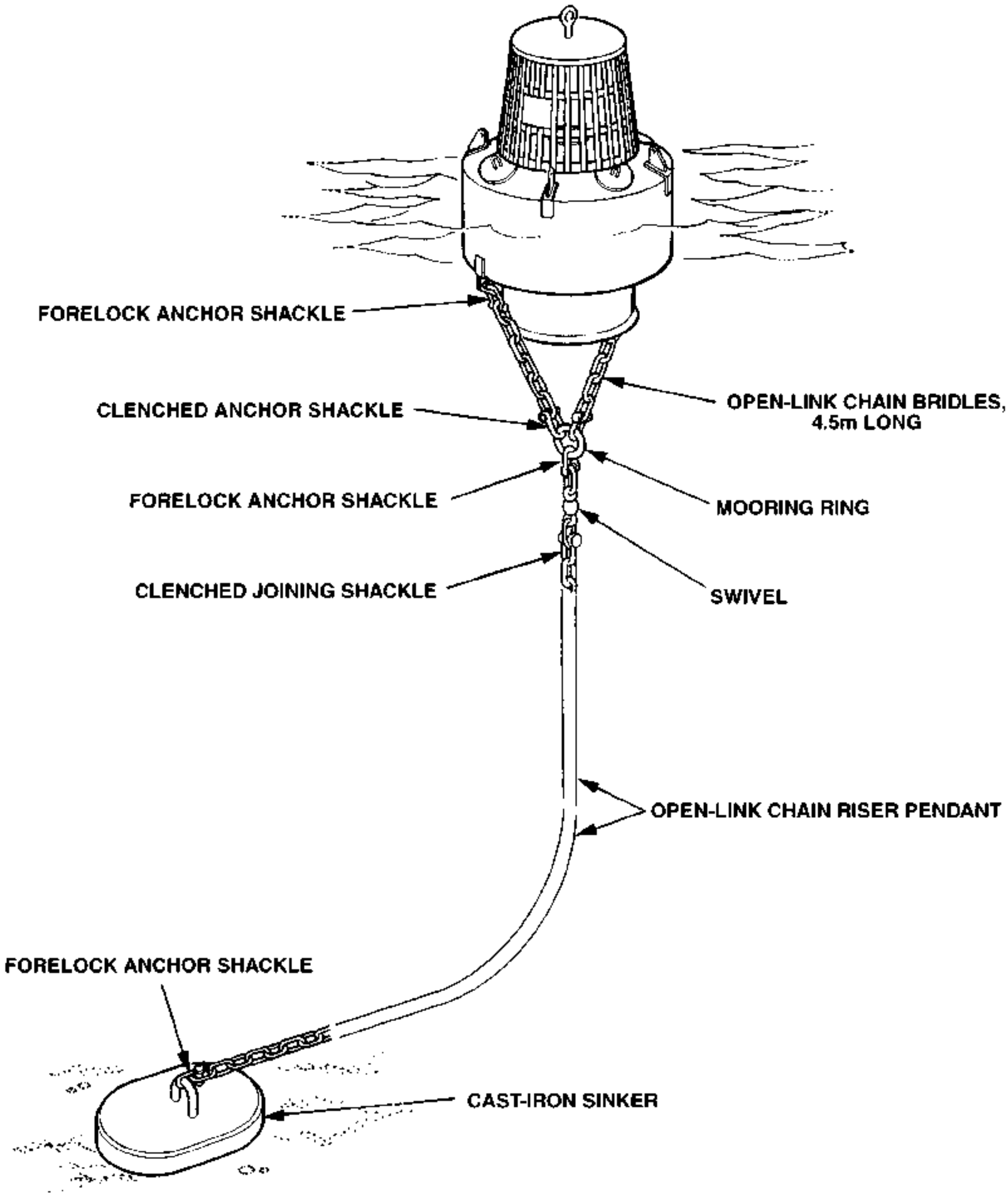


Fig 2-37. Mark Buoy Mooring

02029. Securing to a Buoy Using Ship's Cable

A ship is usually secured to a buoy with two bridles of cable (see note), both of which are provided from one of her two bower anchors, thereby leaving the other anchor and cable ready for letting go if required. The **standing bridle** consists of a convenient length of cable detached from the bower anchor, its inboard end held by bitts or bollards, and a Blake slip according to the layout of the foc'sle. The **working bridle** is the remainder of the bower cable left rove around the cable holder or windlass and held by the brake, with the Blake slip and riding slip/compressor acting as preventers. The ship approaches the buoy with her bridles and picking-up rope ready for use. The bridles lead through the stem hawsepipe or bullring. The picking-up rope can be taken through a separate fairlead, but the best lead is usually through the hawsepipe or bullring, with the bridles. As far as possible neither bridles nor picking-up rope should be allowed to show outboard until just before reaching the buoy. On arrival at the buoy a boat is used to make fast the picking-up rope to the buoy shackle, **buoy jumpers** being carried in the boat for this purpose; these men are then taken off the buoy before the ship heaves in the picking-up rope. When the buoy has been hauled underfoot the ends of the bridles are lowered to the buoy, then the buoy jumpers man the buoy and secure the ends of the bridles to the buoy shackle or its reducing links. When the bridles are shackled on, the buoy jumpers are taken off the buoy, the picking-up rope is veered until slack, then cast off, hauled inboard and stowed away.

WARNING

BUOY JUMPERS MUST NOT BE ON THE BUOY WHILE THE PICKING-UP ROPE OR CABLE IS BEING WORKED

Certain classes of ship whose anchoring arrangements preclude or restrict the use of ships cable for securing to a buoy are provided with braidline bridles for the purpose; the procedure for this method is explained later. Shiphandling aspects of buoywork are in **BR 45 Admiralty Manual of Navigation Volume 6**.

Note. *In Northern European waters, unless otherwise stated in Fleet Operating Orders Vol 2 and/or local orders, ships are normally to use two bridles when at a buoy berth between October - May inclusive, and otherwise whenever a gale warning is in force. From June - September inclusive a single bridle may be used provided the ship is at no more than 4 hours Notice for Sea and there is assessed to be less than 50% probability of a gale within the Notice for Sea period. Elsewhere, unless otherwise stated in Fleet Operating Orders Vol 2 and/or local orders, the decision to forgo the added safety provided by a second bridle in order to expedite securing/slipping rests with the CO. However, a ship at more than 4 hours Notice for Sea should always use a second bridle, and if opting to rely upon a single bridle the CO should be satisfied that there is less than 50% probability of a gale within the Notice for Sea period.*

a. **Preparations for Securing with a Single Bridle.** (To be carried out iaw Annex C).

Dress	**Equipment**
DMS boots	Tapered pins for securing to buoy shackle
Overalls	Lead pellets
Immersion suit (If necessary)	Punches
Marine Safety helmet (earplugs removed)	Hammer
Hazardous Duty Lifejacket	Reamer
Sharp seaman's knife	Goggles
	Rope hangers (2m lengths of suitable cordage)

b. **Preparations for Securing with a Double Bridle.** (To be carried out iaw Annex D).

Note. *The end of the working bridle can be veered down to the buoy, and adjusted for height as necessary using the cable holder. The end of the standing bridle must be lowered by a bullrope secured a few links from the end. Its height can then be adjusted to aid the task of the buoy jumpers in connecting the cable to the buoy.*

c. **Sending the Picking-up Rope to the Buoy.** There are various methods of sending the picking-up rope to the buoy; the principles in the two usual methods are described below. Whichever method is used the boat must be lowered in plenty of time to ensure that she gets to the buoy well in advance of the ship.

WARNING

THE COXSWAIN MUST BE CAREFUL NEVER TO LET HIS BOAT GET BETWEEN THE SHIP AND THE BUOY OR ACROSS A TAUTENING PICKING-UP ROPE. WHEN LYING OFF HE MUST ALWAYS KEEP HIS BOAT POINTED AT THE BUOY, READY TO GO ALONGSIDE IT IMMEDIATELY WHEN REQUIRED

(1) *First Method.* The boat is deployed as the ship approaches the buoy, and the bridle(s) are lowered. The boat is called in under the foc'sle, a heaving line is bent to the picking-up rope and taken in the boat to the buoy; the picking-up rope is then hove out by the buoy jumpers and made fast to the buoy shackle; it is important not to pay out more than the buoy jumpers can comfortably handle. This method is very quick, but requires the ship being brought close to the buoy.

(2) *Second Method.* The boat takes all of a 12mm polypropylene rope coiled in the stern. (A 12mm towing messenger is suitable for the task.) As the boat passes under the foc'sle, one end is passed inboard and secured below the spring hook of the picking-up rope and the strop is stopped to the rope. The boat approaches the buoy, paying out the rope; places the jumpers on the buoy; passes the end of the rope through the buoy shackle and secures it in the stern. The boat then moves away from the buoy, hauling the picking-up rope towards the buoy while the ship pays it out. When the strop passes through the buoy shackle the stops are cut and the strop is placed on the hook. The boat then recovers the rope and buoy jumpers before the picking-up rope is hove in.

Note. *Method 2 alleviates ship handling problems in poor weather conditions but is reliant on competent boat handling.*

d. **Scope of Bridles.** Bridles should be matched (of equal scope) to ensure a fair division of stress between them. The working bridle is adjusted to match the scope of the standing bridle, then the Brake is applied, the cable holder disconnected, and the Blake slip and riding slip/compressor put on slack as preventers. The standing bridle is secured as described earlier. Shackle pins must be regularly checked, particularly in bad weather.

e. **Securing to Head and Stern Buoys.** Trots of mooring buoys for securing a number of ships head-and-stern are usually laid along the line of the tidal stream or prevailing current; consequently when securing a ship between two buoys, difficulty is more likely to be caused by the wind than by the stream. Much will depend on prevailing weather conditions, and tugs will usually be required to position the ship during the initial stages of the evolution. The ship is secured to the head buoy in the manner already described, but a second picking-up rope must be sent from aft to the stern buoy. After shackling on the bridles for'ard they are veered as necessary so the ship can be dropped astern and the stern hawsers secured to the after buoy. (Most head and stern moorings have wire pendants permanently attached to the stern buoy for securing the stern of the ship, otherwise the ship's berthing hawsers are used). The method usually adopted for veering the bridles is to break the cable on the anchor kept ready for letting go and tail it on to the standing bridle, the slack then being taken down and both bridles veered together. Once the stern is secured to the after buoy the bridles are hove in and the stern hawsers paid out until the ship is middled between the buoys. The after hawsers are then turned up around bollards and racked, and the bridles secured as described earlier.

02030. Slipping from a Buoy (To be carried out iaw Annex C and D).

Note. *When singling up to one bridle or shortening in on a single bridle to pass a sliprope, strain will be put on the buoy shackle and pendant. As a precaution against the mooring parting and the ship breaking adrift the main engines should be at immediate notice.*

a. **Pointing Ship before Slipping from a Buoy.** In a crowded anchorage where there is little room for manoeuvring it may be necessary before slipping from a buoy to point the vessel in a direction other than that in which she is lying. This is done by reeving an additional sliprope, from the quarter fairlead, outboard of all, through the buoy shackle and then back through an adjacent fairlead on the same quarter. The ship is then given an initial cast using the engines, the head sliprope is surged as necessary and any slack is taken down in the after sliprope. The head sliprope is then slipped and run in, and when the ship is pointing in the required direction the after sliprope is slipped and run in.

02031. Securing to a Buoy using Braidline Bridles (To be carried out iaw Annex E).
Braidline bridles for securing to a buoy (Fig 2-23) are supplied to ships whose anchoring arrangements limit or preclude the use of chain cable for the task. Two braidline bridles must be used when securing to a buoy. A mix of braidline and chain cable bridles is not to be used.

Note. *If the required scope of the bridles is known beforehand the bridles can be brought to the bollards and fully turned up and racked as part of the preparations for the evolution.*

a. **Slipping from the Buoy** (To be carried out iaw Annex E).

02032. Securing to Z Mooring in Portsmouth.

a. **Preparations.**

(1). 4 x 70m x 43mm Dyneema mooring ropes will be delivered to the ship by road if the ship is alongside. If the ship is comming from sea or at very short notice they will be delivered by SERCO launch. Once embarked, the mooring ropes are to be inspected by the CBM to ensure they are fit for purpose. If there are any concerns regarding the mooring ropes serviceability harbour Movements are to be informed. The ship is not to procede to "Z" moorings until any concerns have been resolved.

(2). All preparations, including the placing of the 2 mooring ropes both fwd and aft are to be in place prior to the ship cold moving. The ship may be required to provide 2 buoy jumpers who will work from the RMAS or DRSO mooring boat. It is not intended to use ship's boats.

b. **Securing to the Buoys.**

(1). The 2 fwd bridles (marked 30m) are to be turned up on the forward set of bollards port and starboard making sure that both of the markings are at the fwd end of the bollards. Both bridles are then to be racked. As the ship stems the buoy both bridles are to be passed out of the bullring to the RMAS/DRSO mooring boat by use of a heaving line. When the OIC of the FX and the Pilot are content that the ship is in position, the boat is to be called in and the buoy jumpers are to alight to the buoy. The soft eyes of the bridles are to be snatched into the rams hook (Port/Stbd) making sure that they are not crossed or snagged on the safety gate. Once secure the buoy jumpers are to clear the buoy allowing the ship to be moved aft.

(2). The 2 bridles aft are to be used as a working bridle and a standing bridle. As the stern approaches the stern buoy the boat is to be called in to receive a heaving line with the after bridles attached. When the pilot is content that the ship is in position and the weight is on the fwd bridles, the buoy jumpers will be called onto the buoy. The buoy jumpers will then snatch the soft eyes of both stern bridles into the rams hook making sure that they are not crossed or snagged on the safety gate.

(3). When the buoy jumpers are clear of the buoy the working bridle is to be brought to the quarterdeck capstan and heaved in. When the working bridle is holding the stern in position, the slack is to be taken down by hand on the standing bridle, turned up on a free set of bollards and racked. The working bridle is then veered until the standing bridle has the weight. Once the working bridle is transferred to a free set of bollards the scope of the bridles are matched.

c. **Slipping from the Buoys.**

(1). The aft working bridle is to be transferred from the bollards to the capstan and heaved in to take the weight off the standing bridle. The standing bridle is then taken off the bollards and kept in hand and the working bridle is veered. When all weight is off the working bridle the boat is then called in and the buoy jumpers are ordered back onto the buoy. Both bridles are then un-snatched from the rams hook and recovered inboard. The buoy jumpers are then recovered to the boat to proceed forward to work the head buoy.

(2). Once the bridles are clear of the aft buoy the ship will be moved forward by tugs to take the weight off the fwd bridles. When the pilot is content with the position of the ship and the OIC of the FX confirms that the weight is off the bridles, both bridles can then be removed from the bollards and kept in hand. The boat is then called in and the buoy jumpers are ordered back onto the buoy. Both bridles are then un-snatched from the rams hook and recovered inboard. The ship is now clear to cold move back to her berth.

(3). On return alongside the Dyneema ropes will be collected by SERCO. Ships proceeding to sea on completion of ammunitioning will transfer the ropes to SERCO tugs.

ANNEX A TO CHAPTER 2

PROCEDURE FOR ANCHORING

CLEARING AWAY ANCHORS AND CABLES

ORDER	ACTION
Cable party close up (piped from bridge)	Muster and brief cable party (including safety -see para 02014), check power to capstans, check comms with bridge (primary and secondary), provide cable bag and all other associated equipment (pg 2-37). Obtain permission from bridge to prepare anchors.
Clear away anchors and cables (OIC)	Remove PVC covers, tackles and lashings, tommy bars from bottle screw slips, bonnet covers, hawse pipe covers and anchor strops. Remove riding slip/guillotine/compressor. The compressor must be fully eased off to prevent damage from the cable running out of the naval pipe.
Connect up (OIC) (port/stbd)	Connect the capstan to the cable holder by lining up the marks on the capstan with those on the cable holder, then engage the dog clutch by winding down on the hand wheel.
Ease back the bottle screw slip (OIC)	Start the bottle screw slip with a tommy bar or similar tool, and ease back on it until the cable becomes taut to the cable holder. (This easing back must be carried out to transfer the line of pull from the slip to the cable holder, otherwise the slip or cable might be unduly strained.)
Reposition Blake slip (OIC)	Knock off the Blake slip then re-attach it to the cable at a position that will allow the anchor to assume the a'cockbill position once the cable has been veered to the slip. Remouse the slip. ***Note**. The precise positioning of the slip will vary ship to ship.*
Off bottle screw slip (OIC)	Knock off the bottle screw slip and move it clear of the cable.
Off brake (OIC) (port/stbd)	Take off the brake.
Stand clear of the cable (OIC)	This warning is given to personnel to inform them the cable is about to be worked.
Veer (OIC) (port/stbd)	Veer the cable until the weight of the anchor is transferred to the Blake slip (check the anchor is now a'cockbill).
Avast veering, on brake (OIC) (port/stbd)	Avast veering and apply the brake.
Disconnect (OIC) (port/stbd)	Disconnect the capstan from the cable holder by using the hand wheel.

ORDER	ACTION
	The above procedure is repeated to prepare the second anchor ready for letting go. The bridge is informed when both anchors are ready for letting go and the brakes are applied.

LETTING GO THE ANCHOR AND SECURING THE CABLE DECK

ORDER	ACTION
	On the run in to the anchorage the bridge should give regular distances to run, all personnel other than the OIC and the person detailed to slip the cable should be positioned clear of the cable deck.
Two cables to run (info from bridge) **Off brake** (OIC) (port/stbd)	Take off the brake.
One cable to run (info from bridge) **Off mousing** (OIC)	Remove the mousing from the Blake slip and ensure the pin is free to rotate in its hole.
Half a cable to run (info from bridge) **Out pin** (OIC)	Place the maul against the buckler link of the Blake slip to prevent it slipping and remove the pin.
Let Go (from bridge)	The bridge will signal this by using red or green flags during daytime and wands at night. They are initially held aloft and when brought down indicate Let Go. (Red for port/bower anchor and green for stbd/sheet/ anchor).
Slip (OIC)	Knock off the Blake slip. Use the brake to control the running out of the cable.
On brake, Off brake (OIC) As required	The OIC is to watch the cable outboard and order the brake to be applied as necessary in order that the cable is laid out straight and clear along the seabed without causing undue strain or allowing it to pile up on itself. (The way of the ship must be stopped by her engines and not by the cable). Regular reports must be made to the bridge regarding the number of shackles on deck and the direction the cable grows.
On brake (OIC)	Once the required amount of cable has been paid out apply the brake. When the OIC is satisfied that the ship has her cable (ie the ship has fallen back and is held by her anchor and cable) he reports to the bridge ‘Ship has her cable’.
Secure the cable (from the bridge, specifying the number of shackles on deck)	This is the order to secure the Blake slip (or fully shortened bottle screw slip in the case of Type 22/23) to the cable just for’ard of the specified joining shackle. Secured in this manner makes it easy to part the cable and slip the anchor in an emergency.

ORDER	ACTION
Connect up (OIC) (port/stbd)	Connect up.
Off brake, veer/heave in (OIC)	Take off the brake, veer or heave in to position the joining shackle abaft of the Blake slip (or fully shortened bottle screw slip Type 22/23).
Avast, On brake (OIC)	Avast veering/heaving, apply the brake.
On Blake slip (OIC) (Fully shortened bottle screw slip Type 22/23)	Attach the Blake slip(or the fully shortened bottle screw slip for Type 22/23) to the cable.
Off brake, veer (OIC)	Take off the brake, veer the cable until just before the slip takes the weight.
On brake, disconnect (OIC)	Apply the brake hard, disconnect the capstan. Then on riding slip(slack) or guillotine (Blake slip Type 22/23) or fully shortened bottle screw slip as an extra preventer. The second anchor is left ready for letting go, with an extra preventer applied. Report to the bridge that the cable deck is secured. ***Note***. *A compressor is not to be used as an additional preventer.*

SHORTENING IN AND WEIGHING

ORDER	ACTION
Cable Party close up (piped from bridge)	Muster and fully brief the team. Check power to the capstan and comms with bridge (primary and secondary). Provide cable bag and associated equipment. Rig hoses and provide brooms ready to wash down cable as it comes in through the hawse pipe. Remove extra preventers from both cables.
Shorten-in (info from bridge)	The order to shorten-in may be given by the bridge to reduce the amount of cable on deck and therefore the time taken to weigh anchor when the ship requires to get underway. (ie a ship riding to eight shackles on deck might shorten in to three on deck.) As the cable comes in any remaining mud on it is washed and scrubbed off by the cable party. The joining shackles and appropriate links are repainted and the wire strands marking the outer painted links are renewed where necessary.
Connect up (port/stbd)**, off Blake slip** (OIC)	Connect up, take off the Blake slip.

ORDER	**ACTION**
On hawse pipe sprays, off brake, heave in (OIC) (ports/stbd)	Turn on hawse pipe sprays to clean the cable as it comes in. Take off the brake and commence heaving in the cable to the number of shackles ordered by the bridge. During this period the OIC must give frequent reports on how the cable grows and how many shackles are on deck so the bridge can use ship's engines to assist if required. Once shortened-in to the required joining shackle the OIC reports to the bridge. The bridge will either answer 'Hold at three' or 'Carry on and weigh'.
Avast heaving, On brake (OIC)	Avast heaving in and apply the brake.
Carry on and weigh (from bridge)	This is the order given by the bridge to weigh anchor.
Off brake, heave in (OIC)	Take off the brake and commence heaving in. Continue reporting how the cable grows to the bridge as the cable is hove in.
Cable up and down (OIC)	This report is made to the bridge when the cable is up and down just prior to the anchor breaking free from the seabed.
Anchor's aweigh	This report is made to the bridge when the anchor has broken clear of the seabed. Knowing the depth of water at the anchorage will assist the OIC in determining this.
Clear anchor or foul anchor (OIC)	Once the anchor is fully visible the appropriate report is made to the bridge to indicate if it is clear or foul. To be clear the anchor must be clear of its own cable and any obstructions such as a bight of rope or chain picked up from the bottom, otherwise it is reported as foul. ***Note.*** *At night a red/blue filtered torch should be available to aid the OIC in sighting the anchor*.
Avast, on brake (OIC)	Avast heaving in and apply the brake. Prepare the anchor ready for letting go again. Once the anchor has been made ready this is reported to the bridge. The bridge will order the cable deck to be secured once the ship is in open water and clear of navigational hazards.

SECURING THE CABLE DECK FOR SEA

ORDER	**ACTION**
Secure the cable deck (from bridge)	The order to secure the anchors and cable deck for sea.
Connect up (OIC) (port/stbd)	Connect up

Order	Action
Off brake, heave in (OIC)	Take off the brake and heave in, bringing the anchor into the hawse pipe, the final stages of this must be done carefully to prevent damage. ***Note**. When heaving in the bow anchor the OIC must ensure that in the final stages of recovery the flukes trip to prevent damaging the stem of the ship.*
Avast heaving, On brake (OIC)	Avast heaving, then apply the brake.
On bottle screw slip (OIC)	Put on the bottle screw slip and tighten up by hand.
Off brake, veer (OIC)	Veer the cable to the bottle screw slip.
Order	**Action**
Avast veering, on brake (OIC)	Avast veering once the weight is transferred to the bottle screw slip, then apply the brake. Fully tighten the slip using a tommy bar or bottle screw spanner.
On Blake slip (OIC)	Put the Blake slip onto the cable (slack).
Disconnect (OIC)	Disengage the capstan drum from the cable holder.
On compressor (OIC)	Wind down the compressor hand tight. Follow the same procedure to secure the second anchor.
Secure anchors and cables for sea (OIC)	On anchor strops (these are passed through the anchor ring) On bonnet covers, lash them to the deck/cable. Lash the Blake slip links to the cable. Place a tommy bar through the bottle screw slips and the cable and lash in place This will prevent the bottle screw easing back on its thread. On hawse pipe covers and secure them. Lash the two cables together using strops and tackles, to prevent banging and chaffing on the deck. Fit all PVC covers and secure in place. Take power off the capstan. Secure Comms Stow away all loose gear and clear all personnel from the Fx. On completion of above inform the bridge that the Fx is secured for sea.

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ANNEX B TO CHAPTER 2

ANCHORING WITH A BRAIDLINE BRIDLE

ORDER	ACTION
Cable party close up (piped from bridge)	Muster and fully brief cable party (including safety - see para 02014), check power to capstans, check comms with bridge (primary and secondary), provide cable bag and all other associated equipment (pg 2-37). Provide one braidline bridle and attach to it the SWR bow dome pendant using a lugless joining shackle (Fig 2-24). Provide a Joggle shackle, handspikes and shepherd's crook or boat hook.
Clear away anchors and cables (OIC)	Prepare both anchors ready for letting go as described in Annex A to this Chapter and inform the bridge.
	Attach a strayline to the free end of the SWR pendant and use it to haul the end of the pendant out through the bullring and back through the centreline hawse pipe. Stop the pendant to a convenient eyeplate and ensure it does not foul the anchor or cable. The braibline bridle is led from the bullring down the starboard side to the first set of bollards, and the remainder faked down abaft the bollards free for running. ***Note**. From this point until attaching the bridle to the cable the anchoring procedures are precisely as described in Annex A to this Chapter. It is assumed that the ship intends to anchor with six shackles on deck.*
On brake (OIC)	The Brake is applied once the 5th shackle is on deck. When satisfied that the ship has her cable the OIC reports to the bridge that the ship has her cable and requests permission to insert the braidline.
Insert the braidline (from bridge)	This order is the authority to attach the pendant to the cable and veer to 6 shackles on deck.
Connect up port (OIC)	Connect up.
Off brake, veer/heave in (OIC)	Take off the brake and veer or heave in until the 5th joining shackle is positioned between the compressor and capstan.
On brake, on Blake, attach pendant to the cable (OIC)	Apply the brake, on Blake slip then attach the pendant to the cable by the joggle shackle, as close as possible to the lip of the hawse, in the configuration shown in Fig 2-28. Mouse the joggle shackle. Take one full turn of the bridle around the stbd bollards, and stand-bye to surge.
Off Blake slip, off brake, veer the cable - surge the bridle (OIC)	Knock off the Blake slip, take off the brake, veer the cable and surge the bridle at the same rate until the red mark is at the front of the bollards (the measurement for the red mark in the bridle is described on page 2-48, paragraph 02019). OIC is to ensure the joggle shackle runs out freely through the hawse pipe.

Order	Action
Avast veering, on brake, turn up (OIC)	Avast veering, apply the brake, turn up the braidline on the bollards. Apply a racking and wrap the remainder of the braidline around the bollards.
Off brake, veer (OIC)	Take off the brake and veer until the 6th shackle is just abaft the Blake slip (fully shortened bottle screw slip for Type 22/23s). The braidline now has the weight.
Avast veering, On brake (OIC)	Avast veering, apply the brake. Report to the bridge that the braidline is attached, the 6th shackle is on deck and the ship has her braidline/cable.
Secure the cable (from bridge)	Secure the cable at 6 on deck. Once secured the pivotal point of the anchorage will be from the bridle pendant with a bight of cable paid out to protect the bow dome, see Fig 2-29.
On Blake slip (OIC) (Fully done up ottle screw slip Type 22/23s)	Attach the Blake slip to the cable for'ard of the joining shackle. (Or use fully done up bottle screw slip for Type 22/23s.)
Off brake, veer (OIC)	Take the brake off, veer the cable until just before the Blake slip has the weight (fully shortened bottle screw slip Type 22/23s).
On brake, disconnect (OIC)	From this point the cable and Fx are secured as described in Annex A to this Chapter when going to single anchor.

SHORTENING-IN AND WEIGHING ANCHOR WHEN ANCHORED WITH A BRAIDLINE BRIDLE

ORDER	ACTION
Cable party close up (piped from bridge)	Muster and fully brief the team. Check power to the capstan and comms with bridge (primary and secondary). Provide cable bag and associated equipment. Rig hoses and provide brooms ready to wash down cable as it comes in through the hawse pipe. Remove extra preventers from both cables.
Connect up (OIC) (port/stbd)	Connect up.
Off Blake slip (OIC)	Knock off the Blake slip (bottle screw slip for Type 22/23s). OIC reports to the bridge that the cable party is closed up, port/stbd (second) anchor is ready for letting go, the brake is on and all is ready to commence shortening-in to remove the braidline.

Order	**Action**.
Shorten-in, remove the braidline (from bridge)	OIC acknowledges order.
Off brake, heave in (port/stbd)	Take off the brake and heave in until there is no weight on the braidline.
Avast, on brake, off turns (OIC)	Avast heaving in and apply the brake. Take off the turns of the braidline from the bollards and take it in hand.
Off brake, heave in, haul in the braidline (OIC)	Take off the brake, commence heaving in on the cable and hauling in on the braidline bridle until the joggle shackle comes inboard and is on deck. ***Note.*** *The OIC must ensure the joggle shackle does not snag as it is heaved up the hawse pipe because it can strain the cable and damage the joggle shackle.*
Avast, on brake, on Blake slip, off joggle shackle (OIC)	Avast heaving, apply the brake, on Blake slip. Remove the joggle shackle from the cable and pendant.
Haul in braidline (OIC)	The braidline bridle and bow dome pendant are recovered through the centreline hawse pipe and moved clear. OIC reports to the bridge that the braidline and pendant are detached and clear of the cable and the number of shackles on deck and how the cable grows.
Shorten-in (from bridge)	From this point on the procedures for weighing anchor are as laid down in Annex A to this Chapter are to be followed.

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ANNEX C TO CHAPTER 2

SECURING TO A BUOY USING A SINGLE BRIDLE (CABLE)

ORDER	ACTION
Cable party close up (piped from bridge)	Muster and brief cable party (including safety - see paragraph 02014), check power to capstans, check comms (the same system is to be used by bridge, Fx and boat), provide cable bag and all other associated equipment (page 2-37). Make up two heaving lines ready for throwing and provide shot mats to protect deck area as required. Fake down the picking up rope abaft the capstan and lead the hook end out through the bullring/centreline hawse, then back inboard.
Boat's crew and buoy jumpers to muster (piped from bridge)	Muster the boat's crew and the buoy jumpers and brief them on the task. Ensure all safety aspects are covered and personnel are aware of the method being used to pass the picking-up rope (see paragraph 02029 of this Chapter). Provide heaving line and cable bag for buoy jumpers.
Clear away anchors and cables (OIC)	Clear away anchors and cables and prepare one anchor ready for letting go as described in Annex A to this Chapter. Report to the bridge when the anchor is ready for letting go. ***Note***. *Do not remove the bottle screw slip and the anchor strop from the cable that is to be used to provide the bridle.*
Prepare the bridle (OIC)	Prepare the bridle by breaking the cable at the first joining shackle, leaving the anchor secured in the hawse pipe. Attach a Securing to Buoy (STB) shackle to the end of the bridle.
Off brake, veer (OIC)	Take off the brake and veer the bridle. Use rope ends to assist in leading the cable towards the centreline hawsepipe/bullring. Ensure there is sufficient slack to enable the end of the bridle to be passed through the bullring.
Avast veering, on brake, disconnect (OIC)	Avast veering, apply the brake, disconnect. Report to bridge that the Fx is ready to come to a single bridle. The ship now approaches the buoy and at an appropriate moment the bridge orders the seaboat away.
Off brake, veer (OIC)	As the ship makes her approach to the buoy the bridle is passed out of the hawsepipe/bullring and veered until it is approximately 2m above the waterline. A bullrope may be used if required.
Avast veering, on brake (OIC)	Avast veering apply the brake. (Ships fitted with a windlass must apply the Blake slip prior to disconnecting).
Pass the picking up rope (from bridge)	The bridge gives the Fx permission to take control of the boat. The boat is called in to receive a heaving line (or messenger) which is passed from the Fx to the boat. The inboard end of the heaving line is bent to the hard eye of the picking-up rope.

ORDER	ACTION
Proceed to the buoy (OIC)	Boat proceeds to the buoy, buoy jumpers man the buoy taking heaving line with them.
Check away picking-up rope	Check away the picking-up rope as it is hauled onto the buoy and secured to the main ring of the buoy by the buoy jumpers. Once the picking-up rope has been attached the heaving line is removed. (See Fig 2-22.)
Buoy jumpers clear the buoy (OIC)	Buoy jumpers clear the buoy, boat lays off well clear. OIC reports to the bridge that the picking up rope is secured, and requests permission to bring the buoy underfoot.
Down slack, bring to on the picking up rope (OIC)	Take down the slack on the picking up rope and bring to on to the capstan.
Heave in (OIC)	Heave in on the picking up rope until the buoy is underfoot, the bridge is to be kept informed of the position of the buoy at all times.
Avast heaving (OIC)	Once the buoy underfoot, avast heaving, report to the bridge that the buoy is underfoot, request permission to connect the bridle.
Secure the bridle (from bridge)	Call the boat in to the buoy.
Buoy jumpers on the buoy (OIC)	Instruct the buoy jumpers to go onto the buoy and secure the bridle to the buoy. When the bridle is secured, buoy jumpers clear the buoy and the boat lays off. Report to the bridge that the bridle is secured.
Veer (OIC)	Veer on the picking up rope to transfer the weight to the bridle.
Avast veering (OIC)	Avast veering.
Buoy jumpers on the buoy (OIC)	Call the boat in, buoy jumpers man the buoy and remove the picking up rope. Buoy jumpers then clear the buoy, boat stands by for recovery.
Haul in picking up rope (OIC)	Recover the picking up rope on deck.
Off brake, Veer the bridle (OIC)	Take off the brake and veer the bridle to the required scope.
Avast veering, on brake (OIC)	Avast veering, apply the brake, report to the bridge that the ship is secured to the buoy at the required scope.
Secure the Fx (from bridge)	Secure the bridle and cable deck. The bridle cable is secured as if at anchor and the second anchor is secured as described in Annex A to this Chapter. On completion the boat is recovered.

SLIPPING FROM THE BUOY A BUOY USING A SINGLE BRIDLE (CABLE)

ORDER	ACTION
Cable party close up (piped from bridge)	Muster and brief cable party (including safety - see paragraph 02014), check power to capstans, check comms (the same system is to be used by bridge, Fx and boat), provide cable bag and all other associated equipment (page 2-37). Make up two heaving lines ready for throwing and provide shot mats to protect deck area as required. Fake down the slip rope ready for passing, rig a bollard strop and slip with anti-twist bar available. Prepare the anchor ready for letting go. When ready report to bridge.
Boat's crew and buoy jumpers to muster (piped from bridge)	Muster the boat's crew and the buoy jumpers and brief them on the task. Ensure all safety aspects are covered (see paragraph 02029 of this Chapter). Provide heaving line and cable bag for buoy jumpers. OIC requests permission from the bridge to shorten-in the bridle. Boat is deployed when ordered by the bridge.
Rig the sliprope	OIC requests permission to take control of the boat. Once permission is granted the OIC calls in the boat and passes a heaving line to it.
Buoy jumpers on the buoy (OIC)	Buoy jumpers man the buoy and commence hauling in on the slip rope as it is checked away on th Fx. When the sliprope is to hand it is passed through the main ring of the buoy. The free end of the heaving line is then passed back to the Fx, the other end remains bent to the sliprope.
Buoy jumpers off the buoy (OIC)	Buoy jumpers vacate the buoy and man the boat; the boat then lays off. The eye end of the sliprope is hauled inboard and attached to the bollard strop and slip. It is secured and moused, and an anti-twist bar is inserted through the slip. The free end of the sliprope is turned up on bollards or brought to the capstan; the heaving line is removed. OIC reports to the bridge that the sliprope is rigged.
Shorten in the bridle (from bridge)	
Connect up, off Blake slip (OIC)	Connect up the capstan ready to recover the bridle, take off the Blake slip and other preventors.
Off brake, heave in (OIC)	Take off the brake, heave in until the buoy is underfoot, keeping the bridge informed on the position of the buoy.
Heave in/down slack on the sliprope (OIC)	As the buoy is brough underfoot the slack in the sliprope is either hove in or taken down by hand.
Avast veering, on brake (OIC)	Avast veering, apply the brake when the buoy is underfoot, turn up the sliprope on the bollards, then inform the bridge. Permission is now sought from the command to transfer the weight from the working bridle to the sliprope.

ORDER	ACTION
Off brake, veer.	Take off the brake and veer the bridle to transfer the weight onto the sliprope.
Avast veering, on brake (OIC)	Avast veering, apply the brake.
Buoy jumpers on the buoy (OIC)	Call in the boat, buoy jumpers man the buoy and remove the STB shackle. The bridle is now free to be recovered.
Buoy jumpers off the buoy (OIC)	Buoy jumpers vacate the buoy and the boat lays off.
Off brake, heave in (OIC)	Take off the brake, heave in the bridle until the end is on deck adjacent to the swivel piece.
Avast heaving, on brake (OIC)	Avast heaving, apply the brake. Detach the STB shackle and reattach the cable to the anchor. The anchor is then made ready for letting go. Report to bridge that the anchor is ready for letting go, ready to slip the sliprope.
Stand-bye to slip (from bridge)	OIC nominates a person to knock off the slip. Turns on the bollards are reduced to two turns ready to surge the sliprope.
Surge the slip rope, off mousing out pin (OIC)	Commence surging the slip rope, take off the mousing on the slip, place the maul against the buckler link and remove the pin from the slip.
Slip (from bridge)	Knock off the slip. When the eye is clear of the buoy remove the turns and run the sliprope inboard. Inform the bridge that the sliprope is inboard.
Secure the Fx for sea (from bridge)	Secure the cable deck as described in Annex A of this Chapter then report to the bridge.

ANNEX D TO CHAPTER 2

SECURING TO A BUOY - DOUBLE BRIDLE USING SHIP'S CABLE

ORDER	ACTION
Cable party close up (piped from bridge)	Muster and brief cable party (including safety - see paragraph 02014), check power to capstans, check comms (the same system is to be used by bridge, Fx and boat), provide cable bag, hand spikes and all other associated equipment (page 2-37). Make up two heaving lines ready for throwing and provide shot mats to protect deck area as required. Fake down the picking up rope abaft the capstan and lead the hook end out through the bullring/centreline hawse, then back inboard. Provide a spare Blake bottlescrew slip attached to the deck clench for'ard of the bollards that are to be used to secure the standing bridle. Provide two securing to buoy (STB) shackles, one joggle shackle and a bullrope.
Clear away anchors and cables (OIC)	Clear away anchors and cables and prepare one anchor ready for letting go as described in Annex A to this Chapter. Report to the bridge when the anchor is ready for letting go. ***Note***. *Do not remove the bottle screw slip and the anchor strop from the cable that is to be used to provide the bridles.*
Boat's crew and buoy jumpers to muster (piped from bridge)	Muster the boat's crew and the buoy jumpers and brief them on the task. Ensure all safety aspects are covered and personnel are aware of the method being used to pass the picking-up rope (see paragraph 02029 of this Chapter). Provide heaving line and cable bag for buoy jumpers.
Prepare the bridles (OIC)	Prepare the standing bridle by breaking the cable at the first joining shackle, leaving the anchor secured in the hawse pipe.
Connect up, off Blake slip, off brake, veer (OIC)	Connect up the capstan, knock off the Blake slip, take off the brake and veer the cable. Use rope ends to assist leading the cable towards the centreline hawsepipe/bullring. Continue veering until a full shackle of cable has been ranged on deck.
Avast veering, on brake (OIC)	Avast veering, apply the brake. Break the cable at the second joining shackle and secure the inboard end of the standing bridle by turning it up in figure of eights (two turns) around bollards or bitts and fasten together the two parts of the final turn with a joggle shackle.
Off brake, veer (OIC)	Take off the brake and veer the cable. Use rope ends to assist in leading the cable towards the centreline hawsepipe/bullring. Ensure there is sufficient slack to enable the end of the working bridle to be passed through the centreline hawsepipe/bullring. ***Note***. *Setting up for a double bridle is time consuming and preps should be done well in advance*.

Order	Action
Avast veering, on brake (OIC)	Avast veering and apply the brake. Attach a STB shackle to the outboard end of both bridles.
Rig the bullrope, attach the bottlescrew slip (OIC)	Attach the bullrope to the standing bridle two or three links above the STB shackle. Take the free end of the bullrope to the bollards to which the standing bridle is secured and bring to with two turns ready to be backed up. Attach the bottlescrew slip (fully shortened) to a position on the standing bridle that will allow the bridle, when hung outboard on the slip, to be connected to the buoy. Report to the bridge that the Fx is ready to come to the buoy. The ship now approaches the buoy and at an appropriate moment the bridge orders the seaboat away.
Pass out the standing bridle (OIC)	As the ship makes her approach to the buoy the bridles are passed out; first the standing bridle followed by the working bridle. Manoeuvre the end of the standing bridle out through the hawsepipe/bullring (assist with handspikes if necessary). When the end of the bridle is outboard continue to ease out the bight of the bridle until the weight is held by the bottlescrew slip. Surge the bullrope (it may be necessary to reduce to one turn) until the STB shackle is in a position to be connected to the buoy.
Off brake, veer (OIC)	Pass the end of the working bridle out of the hawsepipe/bullring, off brake and veer on the working bridle (assist with rope ends if necessary) until the STB is in a position to be connected to the buoy.
Avast veering, on brake (OIC	Avast veering and apply the brake.
Pass the picking up rope (from bridge)	The bridge gives the Fx permission to take control of the boat. The boat is called in to receive a heaving line which is passed from the Fx to the boat. The inboard end of the heaving line is bent to the eye of the picking-up rope.
Proceed to the buoy (OIC)	Boat proceeds to the buoy, buoy jumpers man the buoy taking a heaving line with them.
Check away picking-up rope (OIC)	Check away the picking-up rope as it is hauled onto the buoy and secured to the main ring of the buoy by the buoy jumpers. Once the picking-up rope has been attached the heaving line is removed. (See Fig 2-22.)
Buoy jumpers clear the buoy (OIC)	Buoy jumpers clear the buoy, boat lays off well clear. OIC reports to the bridge that the picking up rope is secured, and requests permission to bring the buoy underfoot.
Down slack, bring to on the picking up rope (OIC)	Take down the slack on the picking up rope and bring to on the capstan.

Order	**Action**
Heave in (OIC)	Heave in on the picking up rope until the buoy is underfoot. The bridge is to be kept informed of the position of the buoy at all times.
Avast heaving, on brake (OIC)	When the buoy is underfoot, avast heaving, report to the bridge that the buoy is underfoot, request permission to connect the bridles. OIC checks bridles are in position to be secured and adjusts them as required.
Buoy jumpers on the buoy (OIC)	Call in the boat, buoy jumpers man the buoy and secure the bridles to the buoy (working bridle first). Once the bridles are secured, buoy jumpers clear the buoy and the boat lays off. ***Note**. To assist the buoy jumpers in connecting the bridles the height of the standing bridle can be adjusted using the bullrope.*
Veer (OIC)	Veer on the picking up rope to transfer the weight to the working bridle. Surge on the bullrope until it is slack.
Avast veering (OIC)	Avast veering on the picking-up rope once the working bridle has the weight and the picking-up is slack enough to be removed.
Buoy jumpers on the buoy (OIC)	Call the boat in, buoy jumpers man the buoy and remove the picking up rope and the bullrope. Buoy jumpers then clear the buoy, boat stands by for recovery.
Haul/heave in picking-up rope (OIC)	Recover the picking up rope and bullrope on deck.
Off bottlescrew slip (OIC)	Slip the bottlescrew slip to allow the remainder of the standing bridle to run outboard.
Off brake, veer the working bridle (OIC)	Take off the brake and veer the working bridle to the approximate scope of the standing bridle. ***Note**: do not exactly marry the scope of the two bridles because they may bang and chafe together.*
Avast veering, on brake, on Blake slip, disconnect (OIC)	Avast veering and apply the brake. On Blake slip and disconnect. Report to the bridge that the bridles are secured at the required scope.
Secure the Fx (from bridge)	Secure the bridles and cable deck. The working bridle cable is secured as if at anchor and the fully shortened bottlescrew slip is put back onto the standing bridle to act as a preventer. On completion the boat is recovered and Fx secured as described in Annex A to this Chapter.

SLIPPING FROM THE BUOY - DOUBLE BRIDLE SHIP'S CABLE

ORDER	ACTION
Cable party close up (piped from bridge)	Muster and brief cable party (including safety - see paragraph 02014), check power to capstans, check comms (the same system is to be used by bridge, Fx and boat), provide cable bag, handspikes and all other associated equipment (page 2-37). Make up two heaving lines ready for throwing and provide shot mats to protect deck area as required. Fake down the slip rope ready for passing, rig a bollard strop and slip with anti-twist bar available. Prepare the anchor ready for letting go. When ready report to bridge.
Boat's crew and buoy jumpers to muster (piped from bridge)	Muster the boat's crew and the buoy jumpers and brief them on the task. Ensure all safety aspects are covered (see paragraph 02029 of this Chapter). Provide heaving line and cable bag for buoy jumpers. Boat is deployed when ordered by the bridge.
Pass the sliprope (from bridge)	The bridge gives the Fx permission to take control of the boat and rig the sliprope. The OIC calls in the boat and passes a heaving line to it.
Buoy jumpers on the buoy (OIC)	Buoy jumpers man the buoy and commence hauling in on the slip rope as the Fx checks away. When the eye of the slip rope is to hand it is passed through the main ring of the buoy. The free end of the heaving line is then passed back to the Fx, the other end remains bent to the sliprope.
Buoy jumpers off the buoy (OIC)	Buoy jumpers vacate the buoy and the boat lays off. The eye end of the sliprope is hauled inboard and attached to the bollard strop and slip. It is secured and moused, and an anti-twist bar is inserted through the slip. The free end of the sliprope is turned up on bollards or brought to on the capstan; the heaving line is removed. OIC reports to the bridge that the sliprope is rigged and requests permission to shorten in the working bridle.
Shorten in the bridle (from bridge)	
Connect up, off Blake slip (OIC)	Connect up the capstan ready to recover the bridle, take off the Blake slip and other preventers.
Off brake, heave in (OIC)	Take off the brake, heave in working bridle until the buoy is underfoot. Keep the bridge informed on the position of the buoy.
Heave in/down slack on the sliprope (OIC)	As the buoy is brought underfoot the slack in the sliprope is either heaved in or taken down by hand.
Avast heaving, on brake (OIC)	Avast heaving, apply the brake when the buoy is underfoot. Either turn up the sliprope onto bollards or back it up on the capstan. Permission must now be sought to transfer the weight from the working bridle to the sliprope.

ORDER	**ACTION**
Off brake, veer (OIC)	Take off the brake and veer on the working bridle to transfer the weight onto the sliprope.
Avast veering, on brake (OIC)	Avast veering, apply the brake.
Buoy jumpers on the buoy (OIC)	Call in the boat, buoy jumpers man the buoy and remove the STB shackle from the working bridle. The bridle is now free to be recovered.
Buoy jumpers off the buoy (OIC)	Buoy jumpers vacate the buoy and the boat lays off.
Off brake, heave in (OIC)	Take off the brake, heave in the working bridle until the end is on deck adjacent to the joggle shackle on the standing bridle. Remove the STB shackle.
Avast heaving, on brake (OIC)	Avast heaving, apply the brake.
Reposition the bottlescrew slip (OIC)	Take off the bottlescrew slip from the standing bridle and fully open it before repositioning it back on the standing bridle. Now tighten up the bottlescrew to transfer the weight of the standing bridle from the joggle shackle to the bottlescrew slip.
Off Joggle shackle, reconnect the cable (OIC)	Take off the joggle shackle, remove the turns from the bollards and reconnect the end of the standing bridle to the cable.
Off brake, heave in (OIC)	Take off the brake and heave in to transfer the weight from the bottlescrew slip to the cable.
Avast heaving, on brake (OIC)	Avast heaving, apply the brake. Take off the bottlescrew slip and move it clear.
Off brake, heave in (OIC)	Take off the brake and heave in until all the slack of the standing bridle has been taken up.
Avast heaving, on brake (OIC)	Avast heaving, apply the brake.
Buoy jumpers on the buoy (OIC)	Call in the boat, buoy jumpers man the buoy and remove the standing bridle STB shackle from the buoy. The bridle is now free to be recovered.
Buoy jumpers off the buoy (OIC)	Buoy jumpers vacate the buoy and the boat lays off.
Off brake, heave in (OIC)	Take off the brake, heave in the bridle until the end is on deck adjacent to the swivel piece.

ORDER	ACTION
Avast heaving, on brake (OIC)	Avast heaving, apply the brake. Detach the STB shackle and reattach the cable to the anchor. The anchor is then made ready for letting go. Report to bridge that the anchor is ready for letting go and the sliprope is ready for slipping.
Stand-by to slip (from bridge)	OIC nominates a person to knock off the slip. Reduce to two turns on the bollards ready to surge the sliprope (or veer on the capstan).
Surge/veer the sliprope, off mousing out pin (OIC)	Commence surging/veering the slip rope, take off the mousing on the slip, place the maul against the buckler link and remove the pin from the slip. Stand by to slip the sliprope.
Slip (from bridge)	Knock off the slip. When the eye is clear of the buoy remove the turns and run in or heave in until the sliprope is inboard. Inform the bridge that the sliprope is inboard. Recover the seaboat.
Secure the Fx for sea (from bridge)	Secure the cable deck as described in Annex A of this Chapter then report to the bridge.

ANNEX E TO CHAPTER 2

SECURING TO A BUOY USING BRAIDLINE BRIDLES

When using Braidline Bridles the following rules apply:

1. The ship must always go to a double bridle.
2. Braidline bridles must not be used for a compass swing.
3. A mix of Braidline and cable bridles must not be used.

ORDER	ACTION
Cable party close up (piped from bridge)	Muster and brief cable party (including safety - see paragraph 02014), check power to capstans, check comms (the same comms for bridge, Fx and boat), provide cable bag and all other associated equipment (page 2-37). Bring up both braidline bridles and attach a securing to buoy shackle to the end of each. Fake down the bridles in the eyes of the ship, clear of each other, then bring to with two turns on the port and stbd bollards respectively. Place a bollard strop and slip on the bollards prior to turning up the braidlines. Fake out the picking up rope ready for passing, reeve the hook end through the bullring and back inboard. Make up two heaving lines ready for throwing. Prepare both anchors ready for letting go in accordance with Annex A. Report to the bridge when ready.
Boat's crew and buoy jumpers to muster (piped from bridge)	Muster the boat's crew and the buoy jumpers and brief them on the task. Ensure all safety aspects are covered and personnel are aware of the method being used to pass the picking-up rope (see paragraph 02029 of this Chapter). Provide heaving line and cable bag for buoy jumpers.
	The ship now approaches the buoy and at an appropriate moment the bridge orders the seaboat away. During the final approach to the buoy the bridles are lowered out of the bullring.
Pass the picking up rope (from bridge)	As the ship closes the buoy the bridge gives the Fx permission for to take control of the boat and pass the picking-up rope. The boat is called in to receive a heaving line which is passed from the Fx to the boat. The inboard end of the heaving line is bent to the eye of the picking-up rope.
Proceed to the buoy (OIC)	The boat proceeds to the buoy, buoy jumpers man the buoy taking the heaving line with them.
Check away picking up rope (OIC)	Check away the picking-up rope as it is hauled onto the buoy and secured to the main ring of the buoy by the buoy jumpers. Once the picking-up rope has been attached the heaving line is removed. (See Fig 2-22).

ORDER	ACTION
Buoy jumpers clear the buoy (OIC)	Buoy jumpers clear the buoy, boat lays off well clear. OIC reports to the bridge that the picking up rope is secured, and requests permission to bring the buoy underfoot.
Down slack, Bring to on the picking up rope (OIC)	When permission has been obtained, take down the slack on the picking up rope and bring to on to the capstan.
Heave in (OIC)	Heave in on the picking-up rope until the buoy is underfoot. The bridge is to be kept informed of the position of the buoy at all times.
Avast heaving (OIC)	Once the buoy is underfoot, avast heaving. Report to the bridge that the buoy is underfoot, request permission to connect the bridles.
Secure the bridles (from bridge)	Lower the bridles to the buoy.
Buoy jumpers on the buoy (OIC)	Instruct the buoy jumpers to go onto the buoy and secure the bridles to the buoy. When the bridles are secured, buoy jumpers clear the buoy and the boat lays off well clear. Report to the bridge that the bridles are secured. (If possible the bridles should be secured to the main ring of the buoy. If this is not possible each bridle should be secured to a separate reducing link).
Hold on both bridles, veer on the picking up rope (OIC)	Back up both bridles round the bollards. Veer the picking up rope until the weight is transferred to the bridles. When there is sufficient slack in the picking up rope for it to be removed, avast veering.
Buoy jumpers on the buoy, remove the picking up rope (OIC)	Call the boat in, buoy jumpers man the buoy and remove the picking up rope. Buoy jumpers then clear the buoy, boat stands by for recovery.
Haul/heave in picking up rope (OIC)	Recover the picking up rope on deck.
Surge on both bridles (OIC)	Surge both bridles to the required scope. Ensure they are middled and the chafing pieces are correctly positioned.
Secure bridles	Fully turn up and rack both bridles. Report to the bridge that the ship is secured to the buoy.
Secure the Fx (from bridge)	Secure the cable deck as described in Annex A to this Chapter. Report to bridge once secured.
	Note. *If the required scope of the bridles is known beforehand the bridles can be brought to the bollards and fully turned up and racked as part of the preparations for the evolution.*

SLIPPING FROM THE BUOY WHEN SECURED WITH BRAIDLINE BRIDLES

ORDER	ACTION
Cable party close up (piped from bridge)	Muster and brief cable party (including safety - see paragraph 02014), check power to capstans, check comms (the same system is to be used by bridge, Fx and boat), provide cable bag and all other associated equipment (page 2-37). Make up two heaving lines ready for throwing and provide shot mats to protect deck area as required. Fake down the slip rope ready for passing, rig a bollard strop and slip with anti-twist bar available. Prepare the anchor ready for letting go. When ready report to bridge.
Boat's crew and buoy jumpers to muster (piped from bridge)	Muster the boat's crew and the buoy jumpers and brief them on the task. Ensure all safety aspects are covered (see paragraph 02029 of this Chapter). Provide heaving line and cable bag for buoy jumpers. Boat is deployed when ordered by the bridge.
Rig the sliprope (from bridge)	OIC requests permission to take control of the boat. Once permission is granted the OIC calls in the boat and passes a heaving line to it.
Buoy jumpers on the buoy (OIC)	Buoy jumpers man the buoy and commence hauling in on the slip rope as it is checked away on the Fx. When the slip rope is to hand it is passed through the main ring of the buoy. The free end of the heaving line is then passed back to the Fx, the other end remains bent to the sliprope.
Buoy jumpers off the buoy (OIC)	Buoy jumpers vacate the buoy and man the boat, the boat then lies off. The eye end of the sliprope is hauled inboard and attached to the bollard strop and slip. It is secured and moused, and an anti-twist bar is inserted through the slip. The free end of the sliprope is turned up on bollards or brought to on the capstan; the heaving line is removed. OIC reports to the bridge that the sliprope is rigged.
Recover the bridles (from the bridge)	Transfer one of the braidline bridles from the bollards to the capstan (use the bridle on the opposite side to where the slip rope is being worked) this will become the working bridle.
Heave in on the working bridle (OIC)	Heave in on the working bridle, keeping the bridge informed on the position of the buoy.
Heave in/down slack on the slip rope (OIC)	As the buoy is brought underfoot the slack in the sliprope is either heaved in or taken down by hand.
Avast heaving (OIC)	Avast heaving when the buoy is underfoot, then turn up the sliprope on the bollards and inform the bridge. Permission must now be sought from the command to transfer the weight from the working bridle to the sliprope.

ORDER	ACTION
Veer working bridle (OIC)	Veer the working bridle to transfer the weight to the slip rope.
Buoy jumpers on the buoy (OIC)	Call in the boat, buoy jumpers man the buoy and disconnect both bridles from the buoy. Inform the bridge when bridles have been removed.
Buoy jumpers off the buoy (OIC)	Buoy jumpers vacate the buoy and the boat lays off.
Heave in/haul in both bridles (OIC)	Recover both bridles on to the Fx. Report to the bridge that the bridles are inboard. Stand-bye to surge/veer on the sliprope, and have a nominated person ready to slip the slip rope.
Stand by to slip (from bridge)	OIC nominates a person to knock off the slip. Reduce to two turns on the bollards to surge the sliprope, or if sliprope is brought to on the capstan stand by to veer.
Surge the slip rope, off mousing out pin (OIC)	Commence surging/veering the sliprope, take off the mousing on the slip, place the maul against the buckler link and remove the pin from the slip. Stand by to slip the sliprope.
Slip (from bridge)	Knock off the slip. When the eye is clear of the buoy remove the turns and run the sliprope inboard. Inform the bridge that the sliprope is inboard.
Secure the focsle for sea (from bridge)	Secure the cable deck as described in Annex A of this Chapter then report to the bridge.

CHAPTER 3

RIGGING AND DECK GEAR

CONTENTS

CONTENTS (Contd)

ANNEXES

CHAPTER 3

RIGGING

03001. Introduction to Types of Rope

Most ropes can be described as belonging to one of three main types:

Cordage made of natural fibres (NFC)
Cordage made of man made fibres (MMFC)
Steel wire rope (SWR)

In the Royal Navy, ropes are described by reference to the diameter of the rope measured in millimetres, the type of construction and the material from which it is made - for example, a 36mm braidline polyester. However, certain proprietary brand ropes contain a mixture of materials, either from two of the three main types, or from a mix of materials from one type, eg a combination of man made fibres. These ropes are usually referred to by their proprietary name.

03002. Construction, Characteristics and Details of Supply of Natural Fibre Cordage

Use in the Royal Navy of natural fibre cordage has dwindled in recent years, primarily because man made fibre cordage is stronger, harder wearing, more cost effective, and in most circumstances, more functional than natural fibre cordage. However, natural fibre cordage is still required for certain tasks, and this requirement is likely to continue for the foreseeable future. All Natural Fibre Cordage supplied to the Royal Navy comes with a test certificate, and certificate of conformity, on which are listed the date of manufacture, the British standard to which the rope has been manufactured, and the guaranteed minimum breaking strength of the rope.

a. **Construction.** Natural fibre ropes are made from fibres of varying length dependant upon their source, and the first process is to comb out these fibres into a long, even ribbon shown in Fig 3-1.

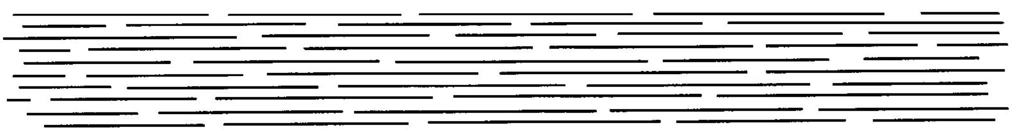


Fig 3-1. Fibres of a Natural Fibre Cordage Rope

The ribbons are then twisted up into yarns, and the twist given binds the fibres firmly together so that they hold by friction when the yarn is subjected to strain. This process is known as ‹spinning’, and the yarns are said to be spun left-handed or right-handed according to the direction of the twist. Next, a certain number of yarns are twisted together to form strands. The number and size of yarn to make each strand depends on the size of the rope it is intended to make. This stage is known as ‹twisting the strands’, and again, the twist can be left handed or right handed. Three or four strands are now made up into a left-handed or right-handed rope. This process is called ‹laying’ or ‹closing’, and is always carried out in the direction opposite to that used in the previous stage of twisting the strands; it is, moreover, distinct from the simple spin or twist and is two-fold, in that:

(1) The strands are twisted up together to form the rope, and at the same time

(2) The strands are rotated individually in the direction of the original twist.

(a) Were this not done, laying the strands up together would tend to untwist the yarns in each strand.

(b) As the rope is laid up, its length contracts like a coiled spring, giving it a certain elasticity. The harder the twist given to the strands in laying, the shorter will be the resultant rope and thus a rope is said to be **hard-laid, ordinary laid** or **soft-laid** rope. In practice, three strands of 275m lay up into a rope of about 220m in length. Three strands so laid up constitute a *hawser-laid* rope (Fig 3-2). Right-handed hawser-laid rope is the only type of natural fibre cordage now used in the Royal Navy.

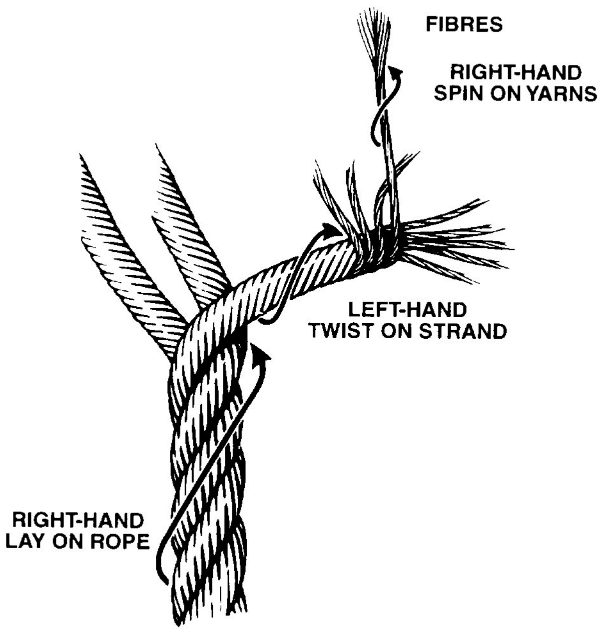


Fig 3-2. Component Parts of a Natural Fibre Right-handed Hawser-laid Rope

b. **General Characteristics.** The strands tend to unlay unless the end of the rope is whipped (ie firmly bound) with twine. The rope will stretch under load and will not completely recover when the load is removed. The rope acquires a permanent and irreversible **set**; the higher the load in relation to the breaking strength, the greater the set. The set may be observed by the extension in length and reduction in diameter when the rope is slack and will eventually render the rope unfit for service. The older and more worn the rope, the less elasticity it will possess and the weaker it will become. Rope under load will tend to twist in the opposite direction to that of its lay and thereby tend to unlay itself, but it should regain its normal form when slack. When wet, NFC will usually shrink in length in proportion to the amount by which it swells in diameter, but it will recover its original length when dry and after use. Rope which is continually subjected to heat and damp - when in the tropics, for example - will lose its elasticity and strength sooner than rope used under normal conditions of temperature and humidity.

c. **Materials Used**. There are now only two natural fibre ropes supplied to the Royal Navy, **manila** and **sisal**. The fibres of the rope are treated with a water proofing solution during the first stage of rope making when the fibres are combed into ribbons.

(1) *Manila Rope.* This rope is made from the leaf fibre of the **abaca** plant, which is grown in the Philippine islands, and shipped from the port of Manila (whence its name), and also Sumatra and Borneo. When new and untreated it is a deep golden-brown in colour. The rope is flexible, durable, strong when compared with other natural fibre ropes, impervious to salt water and stands up well to wear and tear. However, its advantages over man fibre cordage are that it stretches less, will surge more readily around a winch or capstan, and does not fuse when heated (ie when being surged under strain or used as a check stopper). It is currently used as a check stopper for towing operations. Manila rope is marked with one black yarn in each of two strands, and supplied in coils of 220m.

(2) *Sisal Rope.* This rope is made from the **Agave sisalana** plant, which is a member of the cactus plant. It is grown in Brazil, Malagasy, Kenya, Tanzania, Haiti and Java; when new and untreated it is hairy, and of a pale straw colour. New sisal is as strong as manila, but is not as flexible, durable or resistant to wear and weather. Its principle use is as a sliprope during replenishment at sea, and its advantages over man made fibre ropes are similar to those outlined for manila. Sisal rope is marked with one red yarn in one strand, and supplied in coils of 220m.

d. **Strength**. A method of finding the approximate breaking strength of manila and sisal cordage is to divide the square of the diameter of the cordage in millimetres by 200, the answer being in tonnes. This allows for a good margin of safety. To estimate the strength of a rope which is well worn but in good condition, apply the formula as for new rope, but use the **actual** and not the **nominal** diameter, however, the only really reliable method by which the strength of a rope may be determined is to test a sample of the worst part of the rope to destruction.

e. **Details of Natural Fibre Cordage Supplied to the Royal Navy**. Table 3-1 gives details of natural fibre cordage supplied to the Royal Navy.

Table 3-1. Details of Natural Fibre Cordage Supplied to the Royal Navy

Type	Size	Naval Stores No	Minimum breaking load	Supply denomination
Manila	8mm	0350/571-3074	0.45 tonnes	220m
	12mm	0350/125-0228	1.06 tonnes	220m
	16mm	0350/942-5025	2.03 tonnes	220m
	20mm	0350/571-3077	3.25 tonnes	220m
	24mm	0350/942-5026	4.57 tonnes	220m
Sisal	12mm	0350/942-5042	0.95 tonnes	220m
	16mm	0350/942-5044	1.80 tonnes	220m
	20mm	0350/942-5046	2.85 tonnes	220m
	24mm	0350/942-5048	4.07 tonnes	220m
	28mm	0350/942-5050	5.33 tonnes	220m
	72mm	0350/942-5060	32.7 tonnes	220m

f. **Care and Maintenance of Natural Fibre Rope**. Natural fibre rope does not have a permanent elastic limit. The life of a rope depends on the amount it is used under strain, because the fibres tend to slip a small amount under each load in spite of the twist given during manufacture. NFC should not be stowed away while it is wet; if this is unavoidable the rope must be brought out and dried at the first opportunity. Although any rope in good condition can be confidently expected to bear its full working load with ease, allowance for wear must be made in assessing the full strength of used rope, particularly when it has been subjected to hard conditions. Before estimating the strength of such a rope it should be examined for damage, chafe, rot and fatigue. Serious damage can be seen when the strands are distorted and bear unequal strain, or when the rope becomes opened. Rot can be detected by the smell of the rope and by opening out the strands and examining their inner surfaces. Should they be healthy and strong, all is well; if they are powdery, discoloured, weak or can be plucked out, rot exists and the rope should be condemned. Rope may also be subject to chemical attack. Many rust-removal compounds are based on phosphoric acid which has a disastrous effect on natural fibre, and for this reason cordage should always be protected from contamination. If doubt exists as to the serviceability of a rope, the rope should be condemned.

03003. Construction, Characteristics and Details of Supply of Man Made Fibre Cordage

Prior to 1939, natural fibres were the only materials available for cordage manufacture. In 1939 a new man-made yarn known as **Nylon**, invented earlier, became available to the cordage industry. From the outset it was evident that this synthetic fibre possessed such remarkable qualities that a great advance had been made in the cordage industry. The technical name for Nylon is **Polyamide**. Both names are interchangeable but the latter is preferred in the Royal Navy to distinguish it from other synthetic materials which were subsequently developed and are used for cordage manufacture. These latter materials are **Polyester**, **Polypropylene**, **Polyethylene**, and the three most recently developed, **Aramid**, a derivative of polyamide, **polyolefin**, a derivative of polypropylene, and **High Modulus Polyethylene** (HMPE). The various man made fibre ropes have different characteristics which make them specially suitable for specific tasks. For example, polyamide has greater elasticity than polyester and is therefore very suitable for use as towing hawsers and boat anti-shock strops. Polyester, because of its relatively low elasticity and excellent weather and abrasion resistance, is suitable for berthing ropes and replenishment lines, and staple spun polypropylene is appropriate when light, floating, easily handled ropes such as towing hawser messengers and swimmer recovery lines are required. Polyethylene in its basic form is used principally in ships' diving operations as a swimline, because it is orange in colour and therefore easily visible. It has similar characteristics to, but is weaker than, polypropylene. Aramid is at present used only for dressing lines, where, because it is strong, non-inductive and has little elasticity, it is replacing steel wire rope. High Modulus Polyethylene (HMPE), a very high strength, low stretch fibre, is being introduced as a replacement for steel wire rope berthing springs. Polyolefin, introduced as a first generation plaited berthing hawser, is being replaced by rope blending polyester and polypropylene. Cordage made from man made fibre is naturally rot-proof and almost impervious to water. Unless specially treated, this type of rope, except Aramid and HMPE, will stretch far more than natural fibre cordage. This stretch ranges from 25-30 percent for film-fibre polypropylene to 45-50 percent for polyamide, at breaking load. All man made fibre ropes can be considered non-flammable in that they do not readily ignite or burn with a flame. In the molten state these materials will burn but only at a temperature approximately twice that of their melting point.

a. **Construction**. Polyamide, polyester, polypropylene and polyethylene all fall into the **polymer** group. Polyamide is produced from coal whereas the remainder are produced from oil. Most man made fibres are made from either continuous filaments, or yarns of **staple** fibres, but polypropylene ropes can be manufactured from **multifilament, monofilament, staple** or **film-fibre**. Details are as follows:

(1) *Staple*. These fibres vary in length and this length is determined by the processing machine on which they are to be used. For rope-making the staple length varies between 150mm and 1300mm. Although weaker than continuous filament cordage of equivalent size and material, staple spun cordage is ideal in applications where a good grip is required.

(2) *Multifilament*. These yarns are composed of a number of very fine filaments of circular cross-section twisted together, each filament being continuous throughout the yarn length.

(3) *Monofilament*. These are usually circular in cross-section and are continuous throughout their length. Micrometer-type gauges are used to measure their diameter which, for rope making, can range from 0.125mm upwards.

(4) *Film-fibre*. Film-fibre is composed of **fibrils** produced by longitudinal splitting when an extruded tape or ribbon is twisted into a yarn.

(5) *3 Strand Hawser-laid*. Hawser-laid man made fibre ropes are manufactured in the same manner as natural fibre ropes, that is three strands laid up with a right-hand twist (Fig 3-2). Each strand is composed of a sufficient number of uniform filaments of specified polymer to give a rope the required strength. A higher twist is imparted to the strands than to those of natural fibre, and the ropes are subjected to a form of heat treatment to stabilise the lay and thereby reduce the tendency of the strands to separate in service. It is important that the twist and balance of the lay should be undisturbed, especially when being spliced.

(6) *Plaited Rope*. The rope is constructed of eight strands arranged in four pairs (Fig 3-3), two pairs of left-hand lay and two pairs of right-hand lay. This arrangement is known commercially as ‹Squareline’ but in naval use is commonly referred to as multi-plait. Its properties are very similar to hawser-laid except that it is a softer rope and does not kink.

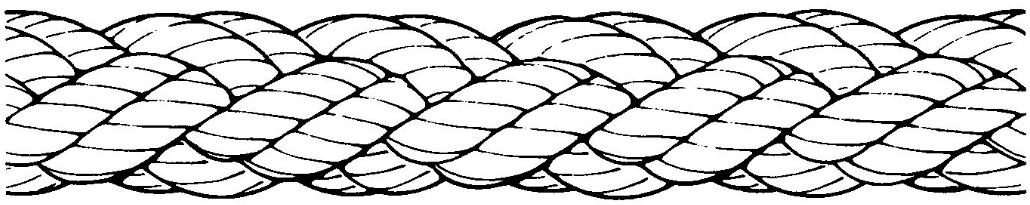


Fig 3-3. Construction of Plaited Rope

(7) *Braided Rope*. This rope, known commercially as core/cover rope, is constructed by crossing and recrossing the yarns or strands in ‹maypole’ fashion such that each yarn or strand passes alternatively over and under one or more of the others to form a circular tubular sheath, which may contain a core. All braided ropes fall into one of the following categories:

A braided sheath around a braided core having a heart of parallel strands (Fig 3-4).

A braided sheath around a hollow braided core (Fig 3-5)

A braided sheath around a core of either parallel strands, or a three strand rope, or a multiplicity of three strand rope core members. (Fig 3-6)

A braided sheath with no core (hollow-centred rope)

The use of braided cordage in the Royal Navy is limited to certain specific applications. Braided construction gives the following advantages over hawser laid ropes; good flexibility and easy handling when wet or dry, new or worn; non-rotating and will not kink; more grip on capstans or warping drums because of the greater contact area. At present the only categories of braidline in use in the Fleet are a braided sheath around a core of either parallel strands, or a three strand rope, or a multiplicity of three strand rope core members.

(8) *Guardwire.* This type of rope is constructed of a load bearing core of densely packed parallel filaments, generally polyester, and encased within a tough durable polyethylene sheath. An example of this type of rope is parafil.

(9) *Aramid.* This type of rope has a braided polyester sheath around a three stranded aramid multifilament core. 95% of the strength of this rope comes from the aramid core.

***Note**: Unlike other MMF cordage the Aramid core cannot be heat sealed.*

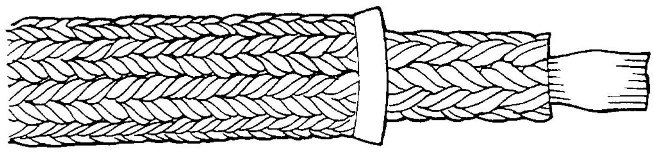


Fig 3-4. A Braided Rope with Braided Core and Heart of Parallel Strands

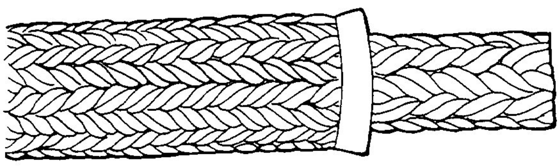


Fig 3-5. A Braided Rope with Hollow Braided Core

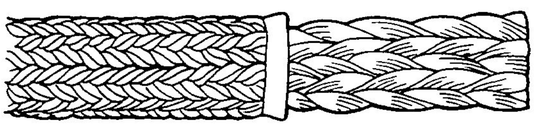


Fig 3-6. A Braided Rope with a Multiplicity of Three Strand Rope Core Members

b. **Characteristics**

(1) *Polyamide*. This multifilament cordage is approximately two-and-a-half times as strong as manila of equivalent size. It stretches by almost half its length before parting and gives little, if any, warning that it is about to reach the limit of its stretch. Used within its safe working load it will stretch approximately 25 percent of its length and has excellent recovery. It does not float and it loses approximately 10 percent of its strength when wet. The melting point is 240-260 degrees C and it is virtually unaffected by 80 degrees C of frost. The working temperature range is - 40° + 100°C. Polyamide has a good weather and abrasion resistance and a high resistance to alkalis but low resistance to certain acids, for example strong sulphuric acid will dissolve the fibres. The energy absorption qualities are excellent and are retained to a significant degree during repeat loading.

(2) *Polyester.* This multifilament cordage is nearly twice as strong as manila of equivalent size. It stretches approximately 36 percent before parting. Used within its safe working load it will stretch 14 percent of its length and has excellent recovery. The strength is virtually unchanged when wet, it does not float, the melting point is 240-260 degrees C and it is virtually unaffected by 80 degrees C of frost. The working temperature range is - 40° + 100°C. Polyester has excellent weather and abrasion resistance and high resistance to acids but not alkalis.

(3) *Polypropylene*. This cordage is nearly twice as strong as manila of equivalent size and is the lightest in weight of the man made fibres. It stretches up to 44 percent before parting. Used within its safe working load it will stretch 17 percent of its length. It retains its strength when wet and has a low water absorption. It will float indefinitely in water. The melting point is 160-170 degrees C. The working temperature range is - 40° + 80°C. Polypropylene has high resistance to acids and alkalis. Multifilament and monofilament polypropylene is not normally used for load-bearing ropes.

(4) *Polyethylene.* This cordage is about one-and-a-half times as strong as manila of equivalent size. It stretches 33 percent before parting, but used within its safe working load will stretch 14 percent. It floats, retains its strength when wet and has low water absorption. The melting point is 120-135 degrees C. Because of its low softening temperature it is not recommended for load bearing application. High Modulus Polyethlene, a recently developed derivative of polyethlene, is size for size as strong as conventional steel wire rope.

(5) Parallel Polyester covered with polyethylene sheath (guardwire). These ropes are light, thin and strong, require little maintenance and are resistant to creep and stretch. Tensile properties of parafil are close to those of steel wire rope, with the added advantage of electrical insulation and ultra-violet resistance. The dimensional and tensile properties are determined directly by the core yarn. As the polyethylene sheath is not a load-bearing component it follows that, provided the core yarn is undamaged, any damage to the sheath will not result in a loss of rope strength. These ropes are not affected by water, will not corrode or rot, and have an energy absorption two-and-a-half to three-and-a-half times that of steel wire rope of equivalent breaking load. These ropes are not suitable for winching or running through blocks because of the likelihood of sheath stripping, thereby exposing the core yarn to damage from abrasion. The smooth sheathing has excellent ice-shedding properties under severe conditions.

Note. *Because of the requirement to accurately test new guardwires manufactured from parallel polyester covered with a polyethylene sheath they can only be produced by shoreside authorities. Damaged or broken guardwires onboard ship must be temporarily replaced with a spliced 12mm Polyester rope Patt No 0350/923-7143. Whenever posible the polyester rope should form the lower guardrail, if necessary by swapping guardrails.*

(6) *Aramid.* These ropes are nearly six times as strong as manila of equivalent size. They require no maintenance and are highly resistant to stretch. However, aramid has poor U/V and abrasion resistance so the aramid core is sheathed for protection in a braided polyester cover. Aramid ropes are very susceptible to damage if run through block sheaves or around winches that have a diameter less than 30 times that of the aramid core of the rope.

c. **Identification**. Like Natural Fibre Cordage, all Man Made Fibre cordage supplied to the Royal Navy comes with a test certificate, and certificate of conformity, on which are listed the date of manufacture, the British Standard to which the rope has been manufactured, and the guaranteed minimum breaking strength of the rope **when new**. To prevent confusion, particularly between polyamide and polyester ropes whose external appearance is identical, identification yarns, where possible, are incorporated in man made fibre ropes, in accordance with British Standard BS 6033; Table 3-2 gives the details. However, with certain smaller ropes it is not possible for the manufacturer to include an identification mark, and in the most recently developed type of ropes and in certain ropes that contain a mixture of fibre types, no common standard of identification exists; therefore the test certificate and certificate of conformity supplied with the rope should be regarded as the only reliable guide to the breaking strength of the rope.

Table 3-2. Identification Yarns in Man Made Fibre Cordage

Material	Identifying colour	Identification marking
Polyamide	Green	One green yarn in one strand
Polyester	Blue	One blue yarn in one strand
Polypropylene*	Brown	One brown yarn in one strand or rope wholly coloured brown
Polyethylene	Orange	One orange yarn in one strand or rope wholly coloured orange
Aramid	None yet allocated	None yet allocated
HMPE	None yet allocated	None yet allocated
Polyester/ Polypropylene blend	None yet allocated	None yet allocated

d. **Strength**. The rule-of-thumb method of calculating the breaking strain of man made fibre rope is to divide the square of the diameter by a known factor. Table 3-3 gives the approximate strength of new cordage according to its diameter, *d*, in millimetres. However, it is emphasised that the test certificate supplied with the rope is the only accurate guide to the breaking strength.

Table 3-3. Calculation for Approximate Breaking Strength of Man Made FibreCordage

Cordage	Formula for Calculating Breaking Strength
High Modulus Polyethylene	d^2/18 tonnes
Aramid	d^2/40 tonnes
Polyamide (under 32mm)	d^2/50 tonnes
Polyamide (32mm and over)	d^2/60 tonnes
Polyester (under 32mm)	d^2/64 tonnes
Polyester (32mm and over)	d^2/66 tonnes
Polypropylene	d^2/77 tonnes
Polyethylene	d^2/106 tonnes
Berthing rope (under 32mm)	d^2/60 tonnes
Berthing rope (32mm and over)	d^2/64 tonne

e. **Uses**. The principle Service uses of man made fibre ropes are as follows:

(1) *Polyamide.* Because of its elastic properties it is used for towing hawsers and anti-shock strops.

(2) *Polyester*. Because of its low stretch, high strength, and excellent weather and abrasion resistance, these ropes are used as replenishment lines, safety nets, signal halyards and picking-up ropes. Polyester/polypropylene mix ropes.

(3) *Polypropylene*. Being a floating rope it is used in its staple form for messengers associated with towing hawsers. It is also used for boatropes, ammunition resupply whips, lifelines, and as the recovery line in swimmer of the watch rigs.

(4) *Polyolefin*. Used to manufacture first generation of multi-plait berthing hawsers. See also (8) below.

(5) *Polyethylene.* This cordage, also a floating line and easily visible, is used principally in ships' diving operations.

(6) *Aramid*. This cordage is at present used only for dressing lines.

(7) *Parallel polyester core with polyethylene sheath* . This cordage is used for standing rigging, principally guardrails.

(8) A Polyester/Polypropylene mix now specified for berthing hawsers.

(9) *High Modulus Polyethylene.* This cordage is currently under trial as a replacement for steel wire berthing springs. Its high cost is likely to limit its use in the Fleet.

f. **Details of Man Made Fibre Cordage Supplied to the Royal Navy**. Tables 3-4 to 3-10 gives details of most man made fibre cordage available through Naval stores.

Table 3-4. Polyamide Ropes and Lines Supplied to the Royal Navy

Type	**Size**	**Naval Stores No**	**Minimum breaking load**	**Supply denom-ination**
Polyamide 3 strand	24mm	0350/923-7129	12.0 tonnes	220m
Polyamide 3 strand	28mm	0350/923-7130	15.8 tonnes	220m
Polyamide 3 strand	32mm	0350/923-7131	20.0 tonnes	220m
Polyamide 3 strand	36mm	0350/923-7132	24.8 tonnes	220m
Polyamide 3 strand	40mm	0350/923-7133	30.0 tonnes	220m
Polyamide 3 strand	44mm	0350/923-7134	35.8 tonnes	220m
Polyamide 3 strand	64mm	0350/923-7137	72.0 tonnes	220m
Polyamide braided	21mm	0350/549-1143	8.70 tonnes	220m
Polyamide braided	64mm	0350/251-4431	90.0 tonnes	65m*
Polyamide multi-plait	48mm	0350/794-8239	42.0 tonnes	220m
Polyamide multi-plait	64mm	0350/543-0143	72.0 tonnes	220m
Polyamide multi-plait	80mm	0350/543-0149	110.0 tonnes	220m
Polyamide cord gunline	1.5mm	0350/571-3024	64 kg	860m

* Braidline Bridle

Table 3-5. Polyester Ropes and Lines Supplied to the Royal Navy

Type	Size	Naval Stores No	Minimum breaking load	Supply denom-ination
Polyester 3 strand	1.5	0350/833/4735	0.30 tonnes	220m
Polyester 3 strand	4mm	0350/923-7140	0.56 tonnes	220m
Polyester 3 strand	6mm	0350/923-7142	1.02 tonnes	220m
Polyester 3 strand	8mm	0350/879/5226	1.60 tonnes	220m
Polyester 3 strand	10mm	0350/923-7143	2.27 tonnes	220m
Polyester 3 strand	12mm	0350/923-7144	4.1 tonnes	220m
Polyester 3 strand	16mm	0350/923-7145	6.3 tonnes	220m
	20mm			
Polyester 8 plait blue		0350/529-7387	0.39 tonnes	220m
Polyester 16 plait blue	8mm	0350/529-7388	2.25 tonnes	220m
Polyester 16 plait blue	10mm	0350/529-7389	3.20 tonnes	220m
Polyester 16 plait blue	12mm	0350/529-7390	4.40 tonnes	220m
Polyester 16 plait blue	14mm	0350/529-7391	8.10 tonnes	220m
Polyester 8 plait red	20mm	0350/529-7392	0.30 tonnes	220m
Polyester 8 plait red	6mm	0350/529-7393	0.39 tonnes	220m
Polyester 16 plait red	8mm	0350/529-7394	2.25 tonnes	220m
Polyester 16 plait red	10mm	0350/529-7395	3.20 tonnes	220m
Polyester 16 plait red	12mm	0350/529-7396	4.40 tonnes	220m
Polyester 16 plait gold	14mm	0350/529-7397	3.20 tonnes	220m
Polyester 16 plait gold	12mm	0350/529-7398	4.40 tonnes	220m
Polyester 8 plait white	14mm	0350/529-7399	0.47 tonnes	220m
Polyester 8 plait white	6mm	0350/529-7400	0.56 tonnes	220m
Polyester 16 plait white	8mm	0350/529-7401	2.25 tonnes	220m
Polyester 16 plait white	10mm	0350/529-7402	3.20 tonnes	220m
Polyester 16 plait white	12mm	0350/529-7404	4.40 tonnes	220m
	14mm			
Polyester braided		0350/120-8768	0.40 tonnes	220m
Polyester braided	5mm	0350/571-3167	0.70 tonnes	220m
Polyester braided	7mm	0350/120-8692	0.79 tonnes	220m
	9mm			
Polyester cord		0350/520-9610	0.14 tonnes	500m
	1.5mm			

Table 3-6. Polypropylene Ropes Supplied to the Royal Navy

Type	Size	Naval Stores No	Minimum breaking load	Supply denom-ination
Polypropylene 3 strand	24mm	0350/375-2994	7.6 tonnes	220m
Polypropylene 3 strand	8mm	0350/529-9737	0.96 tonnes	220m
Polypropylene 3 strand	10mm	0350/447-1147	1.42 tonnes	220m
Polypropylene 3 strand	12mm	0350/525-6204	2.03 tonnes	220m
Polypropylene 3 strand	16mm	0350/571-3172	3.5 tonnes	220m

Table 3-7. Polyethylene Lines Supplied to the Royal Navy

Type	Size	Naval Stores No	Minimum breaking load	Supply denom-ination
Polyethylene H/L Orange	4mm	0350/571/3169	0.20 tonnes	220m
Polyethylene H/L Orange	8mm	0350/543-0141	0.70 tonnes	220m
Polyethylene H/L Orange	10mm	0350/571-3171	1.08 tonnes	220m

Table 3-8. Polyester/Polypropylene blend Multiplait Rope Supplied to the Royal Navy

Type	Size	Naval Stores No	Minimum breaking load	Supply denom-ination
Polyester/Polypropylene blend	24mm	0350/605-7959	9.92 tonnes	220m
Polyester/Polypropylene blend	28mm	0350/807-3997	13.3 tonnes	220m
Polyester/Polypropylene blend	32mm	0350/168-9190	17.1 tonnes	220m
Polyester/Polypropylene blend	36mm	0350/810-3975	21.0 tonnes	220m
Polyester/Polypropylene blend	40mm	0350/396-0753	26.1 tonnes	220m
Polyester/Polypropylene blend	44mm	0350/244-7033	31.0 tonnes	220m
Polyester/Polypropylene blend	48mm	0350/083-3184	36.5 tonnes	220m
Polyester/Polypropylene blend	64mm	0350/513-8184	63.1 tonnes	220m

Table 3-8(a). HMPE Multiplait Ropes Supplied to the Royal Navy

Type	Size	Naval Stores No	Minimum breaking load	Supply denomination
HMPE Multiplait	22mm	0350/481-9229	25 tonnes	220m
HMPE Multiplait	28mm	0350/657-6679	44 tonnes	220m

Table 3-9. Aramid (Kevlar) Ropes Supplied to the Royal Navy

Type	Size	Naval Stores No	Minimum breaking load	Supply denomination
Aramid (Kevlar)	10mm	0350/801-0503	2.5 tonnes	500m

Table 3-10. Guardwire Ropes Supplied to the Royal Navy

Type	Size	Naval Stores No	Minimum breaking load	Supply denom-ination
Guardwire rope	13.5mm	0350/635-1268	3.5 tonnes	300m

g. **Care and Maintenance of Man Made Fibre Rope**. The following advice is given for the care and maintenance of man made fibre ropes.

(1) *Exposure to Sunlight.* Although earlier experience of deterioration through exposure to sunlight, especially with polypropylene, has been mainly overcome by the use of inhibitors in the manufacturing process, man made fibre ropes should not be exposed unnecessarily to sunlight.

(2) *Exposure to Chemicals.* Avoid contamination by chemicals or fumes. Ropes that are inadvertently contaminated must be washed in cold running water.

(3) *Handling.* Do not drag ropes over sharp or rough edges. Avoid penetration of abrading particles.

(4) *Stowage.* Man made fibre ropes are resistant to bacteriological attack, so they can be stowed for long periods without deterioration and may be stowed wet; however, when coiled, man made fibre ropes should be stowed in bins or on raised boards in such a way as to allow free circulation of air beneath as well as around the rope. Ropes that are to be stowed on reels must be allowed up to six hours to recover their normal length before stowing if they have been under tension.

(5) *Wear.* The presence of a fibre nap or whiskering fuzz distributed uniformly on strand surfaces is an indication of normal wear. Some disarrangement or breaking of the outside fibre is normally unavoidable, and, if it is not excessive, harmless.

(6) *Crowsfooting.* Localised distortion of a strand by a back twist is known as ‹crowsfooting’ or ‹cockling’. It occurs when the tension in a hawser laid rope is suddenly released and the balance of the twist does not recover in time, or when kinks are forced out of the line by pulling on the rope. The distortion is often so great that the strand is unable to return to its original lay thereby weakening the rope. Any section of rope with two or more strands ‹cockled’ must be cut out and the rope joined with a short splice.

(7) *Chafing.* Chafing appears as a longitudinal line of heavy wear along the rope’s surface and can be recognised by the tufted appearance of the rope. Avoid unnecessary chafing by protecting the parts concerned.

(8) *Stretching.* The resistance of man made fibre rope to repeated loading is good, but localised temporary elongation may occur. Measurement of the distance between regularly-spaced indelible marks will indicate temporary elongation, and a reduction in diameter may be observed after loading.

(9) *Rust.* Rope that has been in contact with corroding steel shows signs of yellow or brownish black. Stains that can be removed with soapy water have no adverse effect and those that persist only detract from the rope’s appearance.

(10) *Heat.* Ropes must not be stowed where there is excessive heat.

(11) *Icing.* Although man made fire ropes are virtually unaffected by very low temperatures (-80^{0}C for polyamide and polyester) when a rope is iced it must be thawed at a **moderate** temperature before stowing.

(12) *Oil and Grease.* Oil and grease may be removed with a mild solution of soap and water, followed by thorough rinsing in fresh water; strong detergent should not be used.

03004. Twines, Lines and Spunyarn

Details of twines, lines, and spunyarn supplied to the Royal Navy are in Table 3-11.

a. **Twines** consist of a number of yarns twisted or laid to produce a balanced twisted structure of continuous length. Chalk line, used for marking material that is to be cut or stitched, is made from cotton; seaming twine is made from flax and is used for whippings and sewing canvas gear; roping twine is also made from flax but is sturdier than seaming twine, and is used for whippings and sewing canvas and other heavy cloths where seaming twine is insufficiently robust.

b. **Spunyarn** consists of a number of yarns twisted (spun) together. Originally it was made from any type of vegetable fibre or from yarns unlaid from any kind of old natural fibre rope; nowadays only three and six strand sisal spunyarn is available. It is used for servings, seizings, stops or any small work, and it has no specific strength.

Table 3-11. Twines Lines and Spunyarn Supplied to the Royal Navy

Type and size	Naval stores No	Minimum breaking load	Supply denom-ination
Chalk line (cotton)	0350/571-3260	N/A	250gm Cops
Flax seaming twine	0350/571-3267	N/A	250gm Cops
Flax seaming twine	0350/571-3269	N/A	250gm Cops
Flax roping twine	0350/571-3270	N/A	250gm Cops
Sisal spunyarn 3 strand	0350/722-2646	N/A	4kg Spools
Sisal spunyarn 6 strand	0350/722-2649	N/A	4kg Spools

03005. Junk and Rounding

Junk consists of condemned cordage of 32mm size and above, **rounding** is condemned cordage under 32mm in size. Junk and rounding are used for lashings and other securing where the use of good rope is not necessary.

03006. Construction, Characteristics and Details of Supply of Steel Wire Rope (SWR)

Improvements in the design and characteristics of man made fibre cordage and slings, and the need in ships to reduce topweight, limit noise, and minimise interference to radar equipment has resulted in a reduction in recent years in the use of SWR throughout the fleet. However, steel wire rope still has many applications aboard warships and this requirement is likely to remain in the foreseeable future.

a. **Construction**. A wire rope is constructed of a number of small wires which extend continuously throughout the entire length; these wires are laid up into strands, and the strands themselves are laid up to form the rope. With the exception of certain special types described later, all wire rope used at sea is preformed, has a galvanised finish, and consists of six strands. The wires forming a strand are laid up left-handed round a fibre or wire core and the strands forming the rope are laid up right-handed round a fibre main core (Fig 3-7).

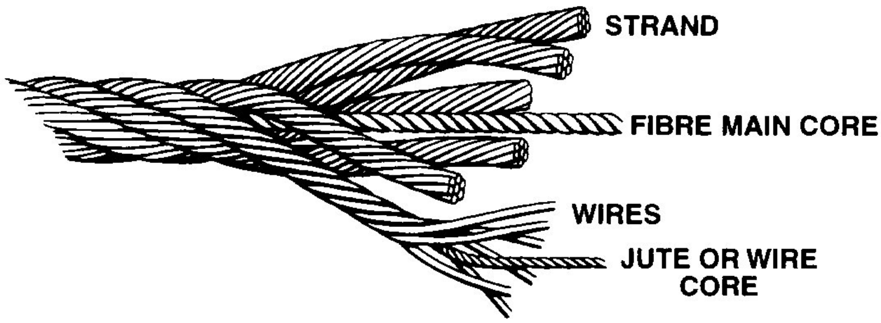


Fig 3-7. Construction of a Wire Rope

During manufacture the individual strands are preformed to give the exact spiral they take up in the completed rope. Therefore the wires and strands lie in their true positions free from internal stress and will not spring out of place should the rope break or be cut. The main fibre coir of a wire rope has two main functions:

(1) It acts as a cushion into which the strands bed, allowing them to take up their natural positions as the rope is bent or subjected to strain.

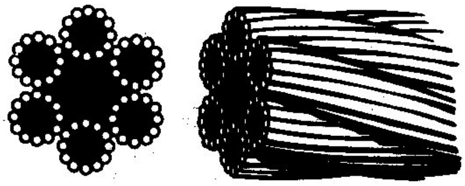
(2) It absorbs lubricant with which the rope should be periodically dressed, so that as the rope is stretched or flexed the lubricant is squeezed between the wires, thus lubricating them and reducing the friction between them.

A wire rope can be made flexible in one of two ways:

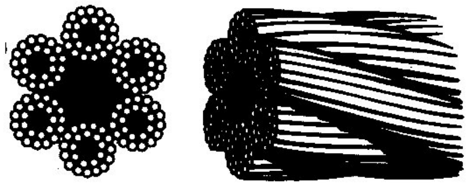
(1) By replacing the centre wires of each strand with a large fibre core, in which case strength is sacrificed for flexibility,

(2) By making up each strand with a large number of small-gauge wires round a wire core, in which case the full strength is retained.

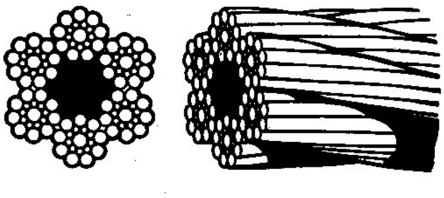
b. **Description**. In the Royal Navy the full description of steel wire rope states the diameter and construction of the rope followed by the construction of each strand, in brackets, eg 24mm 6X26 (15/9/Fibre) fibre-core steel wire rope. This indicates a diameter of 24mm, a construction of 6 strands around a central fibre main-core, each strand constructed from 26 wires, 15 of which are laid up around 9 which in turn are laid up around a fibre core (Fig 3-8). In practice a steel wire rope is identified simply by quoting the size and rope construction only and omitting the strand construction, eg 24mm 6X26 SWR. Ropes supplied to the Royal Navy are manufactured on the foregoing principles and fall into the following groups: 6X12, 6X19, 6X24, 6X26, 6X36, 6X41, 7X7 and 7X19. The degree of flexibility improves as the number of wires in the strands increases. Figures 3-8, 3-9 and 3-10 show the constructions of these groups. It will be seen that 7X7 and 7X19 constructions (Fig 3-9) can be misleading; here the main core is one of the seven strands with the other six strands laid up around it.



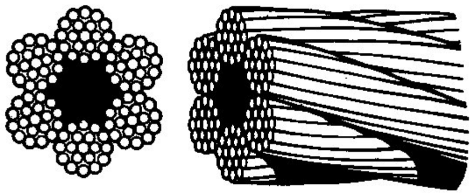
6x12 6 STRANDS 12 WIRES EACH
(12/FIB) FIBRE CORE



6x24 6 STRANDS 24 WIRES EACH
(15/9/FIB) FIBRE CORE

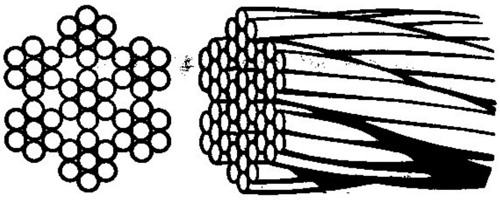


6x19 6 STRANDS 19 WIRES EACH
(9/9/1) FIBRE CORE

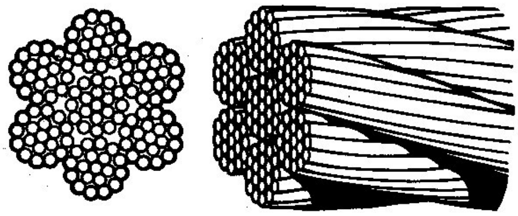


6x19 6 STRANDS 19 WIRES EACH
(12/6/1) FIBRE CORE

Fig 3-8. Construction of 6 Stranded Wire Rope

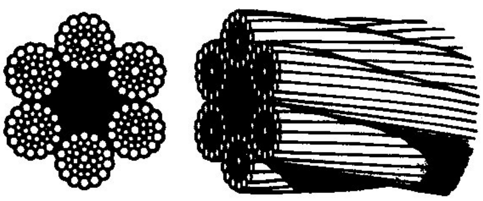


7x7 7 STRANDS
7 WIRES EACH (6/1)

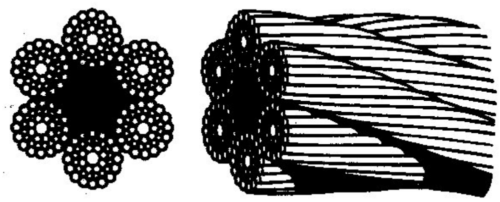


7x19 7 STRANDS
19 WIRES EACH (12/6/1)

Fig 3-9. Construction of 7 Stranded Wire Rope



6x36 6 STRANDS 36 WIRES EACH
(14/7 AND 7/7/1) FIBRE CORE



6x1 6 STRANDS 41 WIRES EACH
(16/8 AND 8/8/1) FIBRE CORE

Fig 3-10. Construction of 6x36 and 6x41 Steel Wire Rope

c. **Uses.**

(1) *Steel wire rope, 7X7 and 7X19 construction* is suitable for standing rigging such as shrouds or guys, where it is not required to be as flexible as the wire rope used for running rigging. Its strands are made up of a small number of large-gauge wires wound round a wire core and the strands themselves are made up around a main core of similar construction to the strands.

(2) *Steel wire rope, 6X12 construction* is suitable for lashings, or temporary guardrails on a ship in refit or DED. To make it flexible necessitates sacrificing a certain proportion of its strength and each strand consists of a certain number of medium-gauge wires wound round a large fibre core, the strands themselves being made up around a fibre main core.

(3) *Steel wire rope, 6X19, 6X24, 6X26, 6X36 and 6X41 construction*. This range of ropes has greater strength and flexibility, and is used for running rigging, mooring, slinging, and towing in certain auxiliary craft. The strands are constructed of a number of small-gauge wires made up around a fibre core.

d. **Strength**. The rule-of-thumb method of calculating the breaking strain of conventional steel wire rope is to divide the square of the diameter by a known factor. Table 3-12 gives the approximate strength of new steel wire rope according to its construction, and its diameter, *d*, in millimetres. However, the test certificate supplied with the rope is the most accurate guide to the breaking strength.

Table 3-12. Formula for Calculating Approximate Breaking Strength of Conventional SWR

Construction of rope	Range of sizes	Breaking load
6X19	3-8mm	d^2/17 tonnes
6X26	10-12mm	d^2/17 tonnes
6X36	14-28mm	d^2/17 tonnes
6X41	32-52mm	d^2/17 tonnes
6X12	8-16mm	d^2/34 tonnes
6X24	12-36mm	d^2/25 tonnes
7X7	5-7mm	d^2/15 tonnes
7X7	12-28mm	d^2/18 tonnes
7X19	32mm	d^2/19 tonnes

e. **Details of Conventional Steel Wire Rope Supplied to the Royal Navy.** Details of conventional steel wire rope (SWR) supplied to the Royal Navy are given in Tables 3-13 to 3-14.

Table 3-13. Details of Conventional SWR 6X12 to 6X36 available through Naval Stores

Construction	Size	Naval stores No	Minimum breaking load	Supply denomination
6X12	8mm	0235/523-8624	1.91 tonnes	250m*
6X12	12mm	0235/523-8625	4.28 tonnes	250m*
6X12	16mm	0235/523-8626	7.62 tonnes	250m*
6X19	3mm	0235/523-8627	0.49 tonnes	200m*
6X19	4mm	0235/523-8628	0.87 tonnes	200m*
6X19	5mm	0235/523-8629	1.36 tonnes	200m*
6X19	6mm	0235/523-8630	1.96 tonnes	450m*
6X19	8mm	0235/523-8631	3.75 tonnes	550m*
6X24	12mm	0235/523-8633	5.76 tonnes	550m*
6X24	14mm	0235/523-8634	7.83 tonnes	550m*
6X24	16mm	0235/523-8635	10.2 tonnes	550m*
6x24	18mm	0235/523-8636	13.0 tonnes	550m*
6X24	21mm	0235/523-8637	17.6 tonnes	550m*
6X24	22mm	0235/523-8638	19.4 tonnes	550m*
6X24	24mm	0235/523-8639	23.0 tonnes	660m*
6X24	28mm	0235/523-8640	31.3 tonnes	660m*
6X24	32mm	0235/523-8641	40.9 tonnes	660m*
6X24	36mm	0235/523-8642	51.8 tonnes	280m*
6X26	10mm	0235/523-8643	5.85 tonnes	550m*
6X26	12mm	0235/523-8644	8.41 tonnes	550m*
6X36	14mm	0235/523-8645	11.4 tonnes	550m*
6X36	16mm	0235/523-8646	15.0 tonnes	550m*
6X36	16mm	0235/523-8647	15.0 tonnes	1100m*
6X36	18mm	0235/523-8648	18.9 tonnes	550m*
6X36	20mm	0235/523-8649	23.4 tonnes	550m*
6X36	22mm	0235/523-7095	28.2 tonnes	310m*
6X36	24mm	0235/523-8650	33.7 tonnes	280m*
6X36	26mm	0235/537-0235	39.6 tonnes	280m*
6X36	28mm	0235/523-8651	45.9 tonnes	280m*

* Refers to length of full coil. Ropes can be demanded to length required in metres

Table 3-14. Details of Conventional SWR 6X41 to 7X19 available through Naval Stores

Construction	Size	Naval stores No	Minimum breaking load	Supply denomination
6X41	32mm	0235/523-8652	59.8 tonnes	280m*
6X41	32mm	0235/523-8653	59.8 tonnes	430m*
6X41	32mm	0235/523-8654	59.8 tonnes	920m*
6X41	32mm	0235/523-8655	59.8 tonnes	1010m*
6X41	36mm	0235/523-8656	75.8 tonnes	280m*
6X41	36mm	0235/523-8657	75.8 tonnes	450m*
6X41	36mm	0235/523-8658	75.8 tonnes	550m*
6X41	36mm	0235/523-8659	75.8 tonnes	1010m*
6X41	40mm	0235/523-8660	93.5 tonnes	280m*
6X41	40mm	0235/523-8661	93.5 tonnes	450m*
6X41	40mm	0235/523-8662	93.5 tonnes	650m*
6X41	44mm	0235/523-8663	113.0 tonnes	280m*
6X41	48mm	0235/523-8664	135.0 tonnes	280m*
6X41	52mm	0235/523-8665	158.0 tonnes	280m*
7X7	5mm	0235/523-8616	1.72 tonnes	350m*
7X7	7mm	0235/523-8617	3.38 tonnes	350m*
7X7	12mm	0235/523-8618	7.92 tonnes	350m*
7X7	16mm	0235/523-8619	14.2 tonnes	350m*
7X7	20mm	0235/523-8620	22.0 tonnes	350m*
7X7	24mm	0235/523-8621	31.8 tonnes	350m*
7X7	28mm	0235/523-8622	43.3 tonnes	250m*
7X19	32mm	0235/523-8623	53.0 tonnes	250m*

* Refers to length of full coil. Ropes can be demanded to length required in metres.

f. **Special Types of Steel Wire Rope**. In addition to conventional SWR, there are certain special types of wire ropes that are supplied to the Fleet. They are:

(1) *Dyform.* This is a high tensile, high grade steel wire rope of 6X36 construction. The strands are compacted, which gives greater strength size for size than a conventional 6X36, but because of its greater density it is more difficult to splice. It is used to make berthing springs for certain warships. Dyform is not available through Naval stores and can only be obtained by a local purchase order.

(2) *Non-rotating Wire.* This type of wire rope (Fig 3-11) has its strands laid up in the same direction as that in which their constituent wires are twisted. All the wires and strands are small, and the inner strands are arranged so that the tendency of the rope to rotate under load is reduced to a minimum. It is very flexible and is particularly suitable as a whip for cranes and single point davits, where strength and non-unlaying action are essential. The wire requires very careful handling before and during installation. It has no tendency to twist either way but it is so pliable that turns either way can be imparted. When making fast the plain end to the side of the drum or crane structure ensure that the entire cross-section of the rope is firmly secured. At present, non-rotating wire rope whips are supplied as made-up items, details of which can be found in the ship's Rigging Warrant or onboard spares documentation.

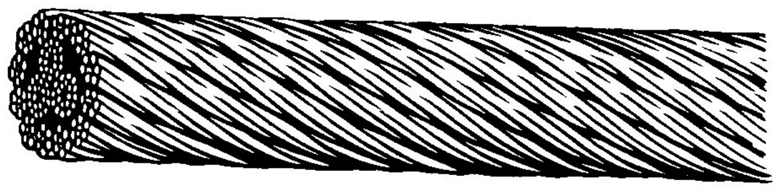


Fig 3-11. Non-rotating Wire Rope

(3) *Serrated Wire Rope.* This type of rope (Fig 3-12) is used for sweep wires when minesweeping. It consists of four strands laid up round a fibre heart. Laid up in each strand are two single wires twisted together. This feature forms, on the rope's surface, a series of serrated ridges which gives the rope its chafing and cutting qualities. The lay of the rope can be either left-handed or right-handed. Further information on its supply, use and the method of splicing is given in **BR 2215(2), Minesweeping Manual**.

Fig 3-12. Serrated Wire Rope

(4) *Aluminium Alloy Guardrail Wire.* This wire (Fig 3-13) consists of seven strands, each of which contains seven wires. Six strands are laid up right-handed round the seventh strand and the whole wire is coated with a thick layer of PVC. It is available from Naval Stores under Pattern Number 0235/747-7793. Although this wire has, in some instances, been superseded by Parafil, it is still fitted in certain warships.

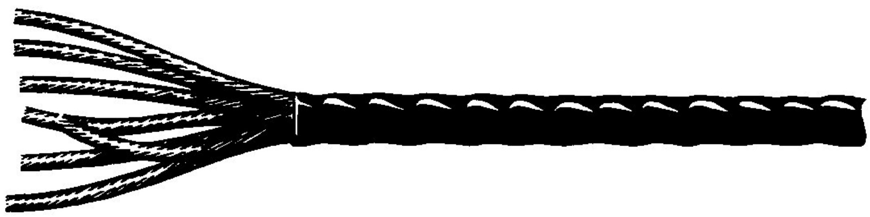


Fig 3-13. Aluminium Alloy Guardrail Wire

(5) *Flexible Mild-steel Wire* (Table 3-15). This is supplied in small sizes only, 1.7mm to 4.5mm, and used for such purposes as seizing and serving. It differs from the foregoing groups in that it is made of pliable mild steel and is much weaker. It is constructed of seven strands, each strand varying from 0.56mm to 1.6mm.

Table 3-15. Details of Flexible Mild-steel Wire available from Naval Stores

Size	**Naval stores No**	**Supply denomination**
1.7mm	0235/543-4138	500m*
2.7mm	0235/543-4137	200m*
4.5mm	0235/543-4136	200m*

* Refers to length of full coil. Wire can be demanded to length required in metres.

(6) *Malleable Stainless Steel Wire*. This wire, Pattern No 0258-361-7273, is 1mm in diameter and supplied in 2 kg coils approximately 320m in length. It is to be used for mousing stainless steel shackles and slips.

03007. Handling of Natural and Man Made Fibre Cordage

a. **Elementary Rules**. The lessons which a seaman must learn before he handles a rope are explained below:

(1) *The Seaman's Knife.* The seaman should regard his knife as his best friend. It should be worn on a lanyard round the waist and stowed in the back pocket of the trousers. The seaman's knife is a tool, not a weapon; the end of the blade should be rounded, not pointed, and the blade should be sufficiently deep and thick to cut without bending. The edge of the blade should be sharpened like a chisel to avoid wearing away the thickness and strength of the blade, and the hinge should be kept lightly oiled.

(2) *Safety of Tools.* Whenever a seaman works aloft, or over the side, he must secure whatever tools he may be using with a lanyard secured to a part of the rigging or passed round his body. This is a common-sense precaution for avoiding possible injury to men working below him or loss of the tools over the side.

(3) *Axe, Maul and Baulk of Timber.* When working ropes during seamanship evolutions, an axe, maul and baulk of timber should be ready to hand to cut away ropes in an emergency.

(4) *Rope Ends.* Before a rope is cut a whipping should be applied either side of the point at which the cut is to be made to prevent the rope unlaying. The different methods of whipping are described later in this chapter.

(5) *Coiling Down Ropes.* A heaving-line, or any line or rope which is being hauled in, should be coiled either in the hand or on the deck as it is hauled inboard. This is an elementary precaution to ensure that the line or rope is immediately ready for further use.

b. **Special Precautions When Handling Man Made Fibre Cordage**. Although the rules for handling natural fibre cordage and man made fibre cordage are generally similar, the properties and characteristics of man made fibre necessitate greater care in its handling. Many of the advantages of using man made fibre ropes can become serious liabilities if the seaman is not familiar with certain characteristics of these ropes. When a man made fibre rope parts it immediately tends to regain its original length. Polyamide when stretched over 40% is liable to part **suddenly without audible warning** and it then whips back along the line of tension and can kill or seriously injure anyone in its path. The following rules must be observed when handling man made fibre ropes:

(1) Men backing-up a man made fibre rope under tension on a capstan drum or any other holding surface must stand well back and out of the line of recoil of the rope. Fig 3-14 shows the ideal position of men backing-up (B) a man made fibre rope under tension (A), and the approximate angle (C) which is the ideal with respect to the line of recoil.

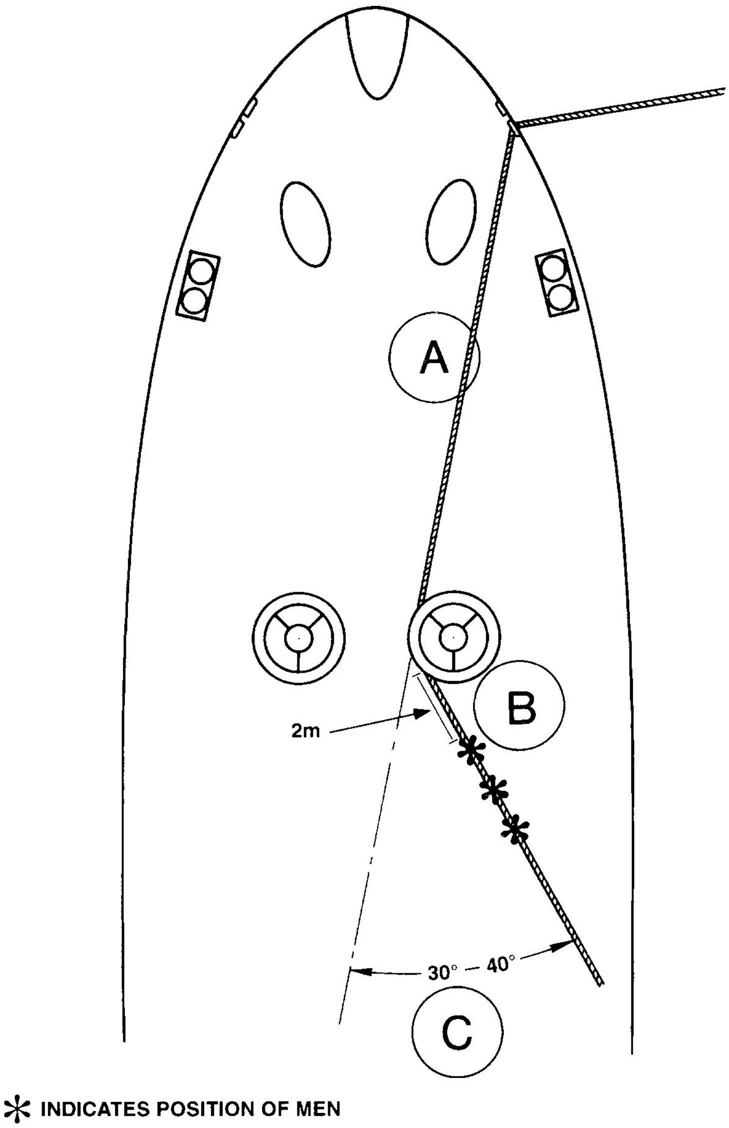


Fig 3-14. Backing-up a Man Made Fibre Rope under Tension

(2) When a man made fibre rope is turned up on any holding surface, and is in tension, a certain amount of heat is generated by friction between the rope and the holding surface. Should this heat approach the melting point of the fibres of the rope, the outer fibre will melt and create a lubricant, whereupon the rope in tension **may surge violently**. It is essential therefore that men backing-up a man made fibre rope in tension on a capstan drum, bollards or any holding surface must stand well back. The minimum distance between the first man backing-up the rope in tension and the holding surface should be 2m (Fig 3-14). Should the rope surge violently, this distance of 2m means that the first man backing-up will have some warning before he is drawn dangerously close to the holding surface.

(3) Ropes that have been subject to local permanent elongation, eg, towing hawsers, should be given time to recover to achieve their natural length if they are to be reeled up. Recovery time may be as long as six hours for a towing hawser that has been under heavy load for long periods.

(4) Do not pass man made fibre and steel wire ropes through the same fairlead. The stretch is incompatible and the resultant chafing of the man made fibre will seriously weaken it.

c. **Handling All Cordage.** From the precautions listed above for the safe handling of man made fibre cordage, the following detailed advice should always be practised when handling any ropes or lines:

(1) Avoid bad leads and sharp edges. Ensure thimbles or such fittings do not chafe or cut a rope.

(2) As a general rule rope should be veered rather than surged on a capstan or winch drum because surging induces friction and damages the surface of the rope. However, surging the sliprope during the final stages of a replenishment is accepted practice as it enables the Receiving ship to readily match the speed at which the Delivering ship is recovering the replenishment rig. **A rope should never be surged on a capstan or drum which is rotating in the same direction (turning to veer)**. This is a dangerous practice and applies to steel wire rope as well as fibre rope.

(2) Three turns are usually sufficient when hawsers are being hove in on capstans or drum ends. However, for heavy loading it may be necessary to take an extra one or two turns, giving due regard to the size and strength of the rope and equipment involved.

(3) If surging around bollards is necessary it should be done before the strain on the rope is heavy. Great care must be taken when easing out a rope around bollards if it is heavily loaded.

03008. Preparing Natural Fibre and Man Made Fibre Ropes for Use

a. **Coiling and Uncoiling.** A rope laid out straight will have no tendency to twist or turn either way, whether its lay is left- or right-handed, and from this position it can be stowed on a reel or coiled down. When stowed on a reel, or hauled off a reel, a rope will not develop any twists or turns in its length. When coiling down a rope however, the part of the rope remaining uncoiled will be given one twist or turn as each loop in the coil is formed. When coiling down a rope the end should be kept free to allow the uncoiled length to rotate and thus keep it free from becoming snarled up with kinks or turns. Similarly, a rope which is run off a coil will acquire a twist or turn for every loop in the coil, but if the end is kept free the rope will usually free itself of these turns when hauled out straight. One method of avoiding these turns, should the end of the rope not be free, is to turn the coil round while coiling down the rope, thus turning the coil into a reel. Another method, as when coiling direct from a reel, is to allow as long a length as possible between reel and coil; this length will absorb the turns until the end of the rope is free from the reel, and so can be freed of its turns. Similarly, when coiling down a rope which is led through a block, the coil should not be made too near the block, otherwise a slight check may cause a kink to develop in the rope as it is running through and thus choke the luff (Fig 3-15).

b. **Coiling Down** (Fig 3-15). Cordage is very resilient and will absorb a number of turns in its length without becoming snarled if the length is sufficient and the turns correspond with the lay of the rope; if the turns are against the lay, however, it will quickly become snarled. For this reason rope of right-hand lay is always coiled down right handed, and rope of left-hand lay is always coiled down left-handed.

c. **To Coil a Rope for Running** (Fig 3-16). Lay the rope as straight as possible along the deck; begin coiling it down close to where the standing part is made fast, and lay each loop flat upon the other below it until the bare end is reached. The size of the loops should be as large as stowage space permits. The running part is now underneath the coil, so turn the coil over and the rope should then run out freely when required. Remember that the running part or end part should always be on top of any coil.

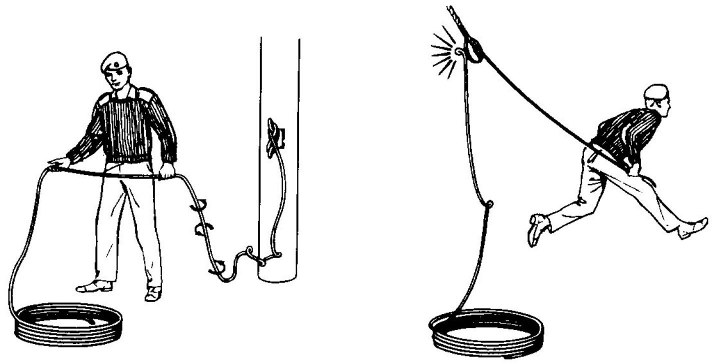


Fig 3-15. Mistakes in Coiling Down

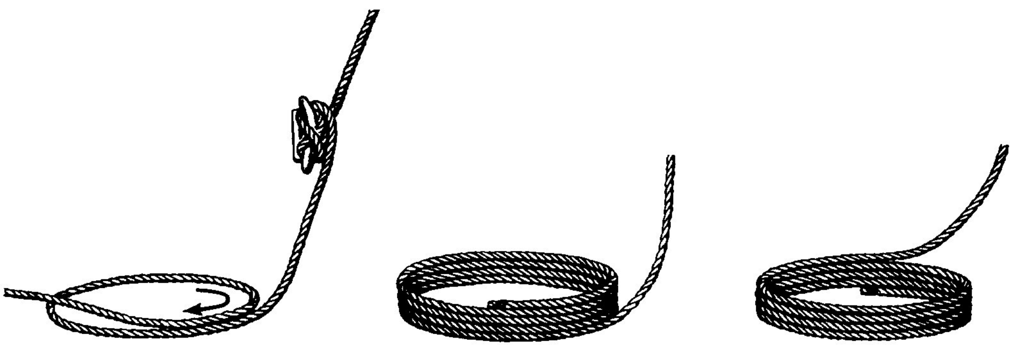


Fig 3-16. To Coil a Rope for Running

d. **To Coil a Small Line in the Hand** (Fig 3-17). When coiling in the right hand the rope should be held with the right thumb pointing towards the end; and when coiling in the left hand the thumb should point towards the bight. The coil will then form correctly.

e. **To Thoroughfoot a Rope**. This is the most effective way of taking a large number of turns out of a rope. First determine whether the turn it is required to remove are left- or right-handed. Then, to remove left-hand turns, coil down left-handed, dip the end through the coil and haul the coil out straight. To remove right-hand turns, coil down right-handed, dip the end through the coil and haul the coil out straight. If the bight of the rope is badly snarled, thoroughfoot the end for only a few metres at a time, repeating this operation as often as necessary. Thoroughfooting also describes the method of joining two ropes by their soft eyes (Fig 3-18). The eye of rope A is passed through the eye of rope B, and the bight of B is then hauled through the eye of A, thus joining the ropes by their eyes. This method is not used for joining two ropes temporarily, because it may take some time to unhitch them.

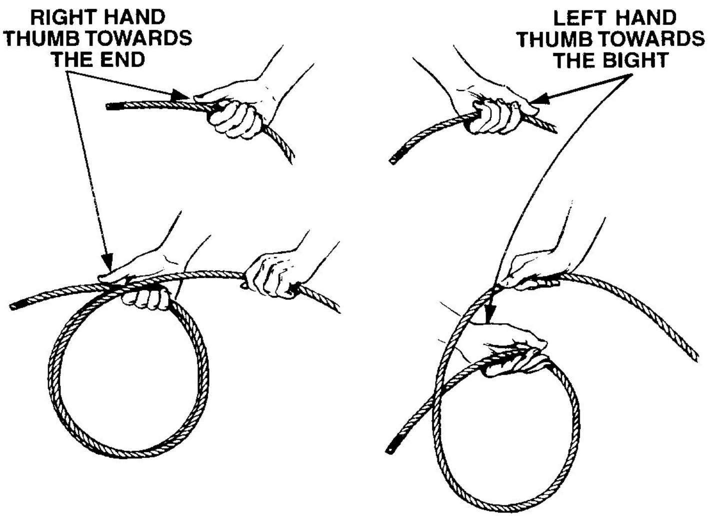


Fig 3-17. Coiling a Line

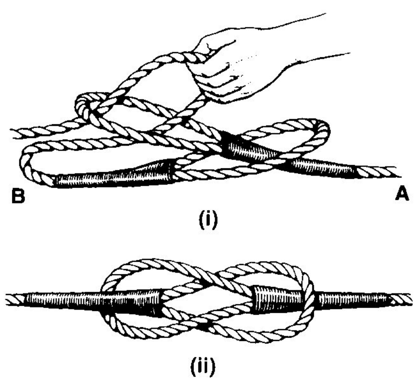


Fig 3-18. Thoroughfooting

f. **To Fake Down a Rope** (Fig 3-19). A rope that may have to be paid out quickly should be faked down in as long fakes as space allows. When faked a rope does not acquire as many turns as when coiled, and it will therefore run out with less chance of becoming snarled. Care should be taken that each bight at the end of a fake is laid under that immediately preceding it to ensure a clear run.

g. **To Cheese Down a Rope** (Fig 3-20). When a neat stow is required for a short end of rope, it may be cheesed down. This method should never be used when the rope will be required to render quickly through a block.

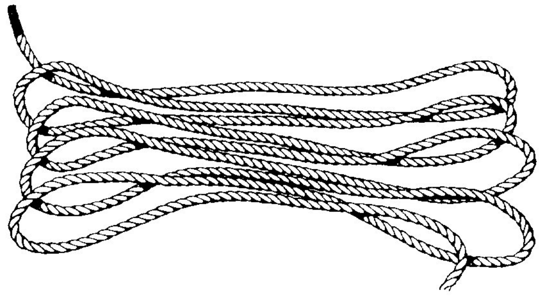


Fig 3-19. Faking Down a Rope

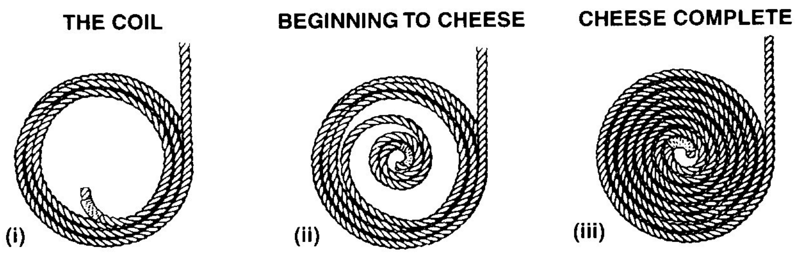


Fig 3-20. Cheesing Down a Rope

h. **Belaying.** When a rope will have to be cast off while still under strain it cannot be secured with a bend or a hitch, except perhaps a slipping one. It is therefore belayed to a fitting made for the purpose, such as a cleat, staghorn or bollard. The action of belaying consists of taking sufficient turns round the fitting to hold the rope by friction when it takes the strain. Generally speaking, four complete turns should be sufficient, but the number of turns may have to be increased according to the degree of friction existing between rope and fitting. A wet and slippery rope or bollard, or a smooth cleat or staghorn and a well worn rope may require extra turns.

i. **To Belay a Rope to a Cleat or Staghorn**. Take initial turns as shown in Figs 3-21, then continue with figure-of-eight turns round the horns of the cleat or staghorn as many times as required. It will be seen that when the figure-of-eight turns are removed the rope is ready to be checked under control. A rope belayed to a cleat or a staghorn must be ready for casting off at a moments notice; therefore the turns should not be completed with a half hitch, because this may jam them. Cleats are not suitable for belaying wire rope.

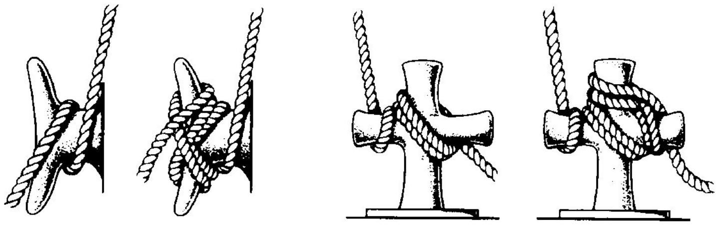


Fig 3-21. Belaying a Rope to a Cleat or a Staghorn

j. **To Hang a Coil on a Belaying Pin or a Cleat**. (Figs 3-22 and 3-23). Whenever possible a coil of rope should be hung up clear of the deck so as to keep the deck clear and the rope dry.

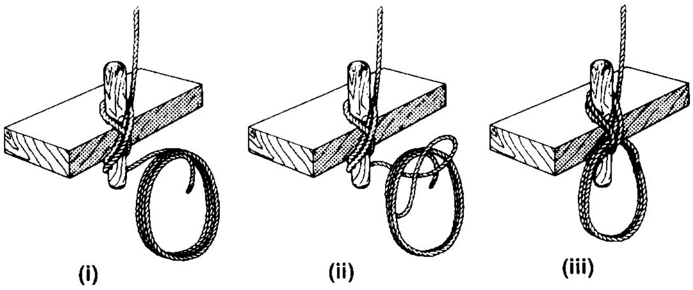


Fig 3-22. Hanging a Small Coil on a Belaying Pin

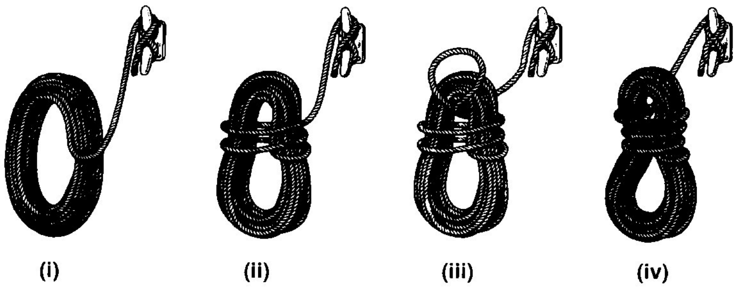


Fig 3-23. Hanging a Large Coil on a Cleat

k. **Making and Throwing a Heaving Line** (Fig 3-24). As its name implies, a heaving line is a light flexible line that can be thrown. It is used as a messenger to pass hawsers from ship to shore, or vice versa. 8mm braidline is very flexible and makes excellent heaving lines, although any similar size cordage can be used. A heaving line consists of approximately 30m of 8mm cordage. One end should be whipped and the other end weighted with a monkey's fist (Fig 3-82), a small sand-bag or a heaving line knot.

WARNING

HEAVING LINES MUST NOT BE WEIGHTED BY INSERTING INTO THE MONKEY'S FIST A STEEL NUT OR LEAD WEIGHT. NEITHER SHOULD THE MONKEY'S FIST BE PAINTED.

To prepare a heaving line for throwing, it should be wetted and from 22 to 24m should be coiled carefully in the non-throwing hand, using small coils. One third of the line is taken in the throwing hand; the line is then thrown with the throwing arm straight, and it must be allowed to run out freely from the coil in the non-throwing hand. The most frequent cause of bad casts is failure to have this coil properly clear for running. There is more than one method of heaving a line and most good throwers have their own variations. Some take rather less than half the coil in the throwing hand and throw both halves together, letting go with the throwing hand before the non-throwing hand. This method is very effective but harder to learn. Before heaving a line the standing end must be anchored between the thumb and index finger of the non-throwing hand. Never secure the standing end to the wrist or any other part of the body; the turning propellers make this a dangerous practice. As soon as the heaving line has been caught the standing end or a bight of the line should be bent with a bowline to the eye of the hawser and not before. Every effort should be made to keep the line out of the water.

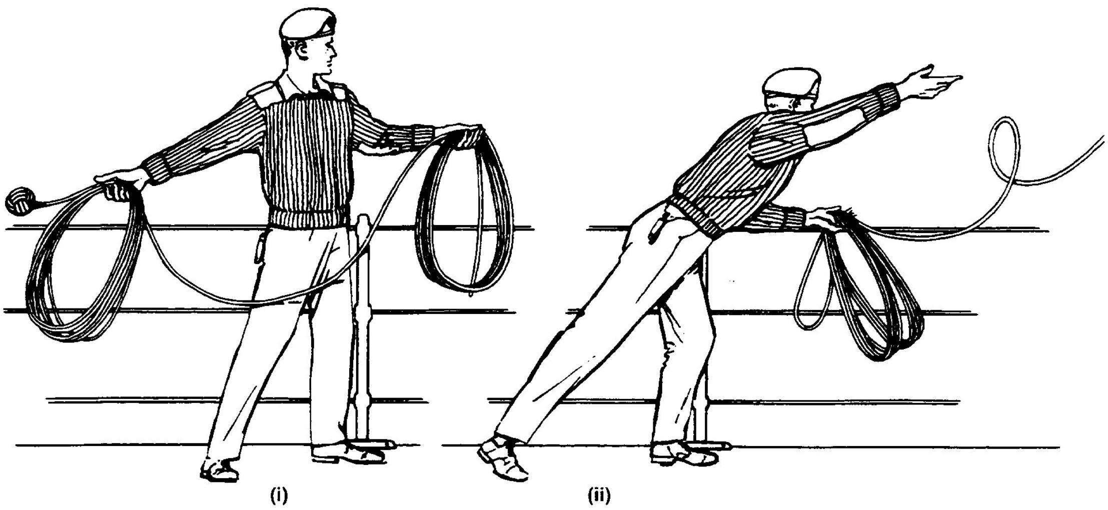


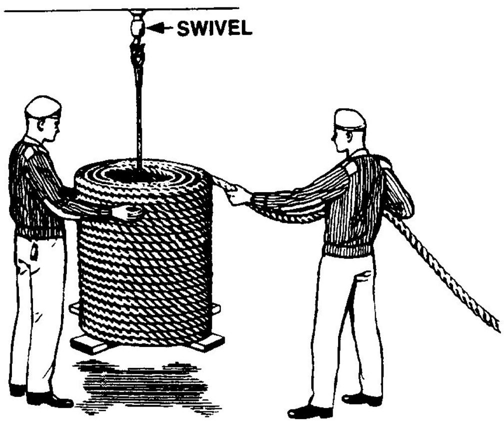
Fig 3-24. Throwing a Heaving Line

l. **Handling New Cordage.**

(1) *Opening a New Coil* (Fig 3-25). A length of rope is supplied to a ship in a compact, machine-wound coil, bound with yarns or strands. To open up a new coil of rope of less than 48mm diameter a seaman should roll it over until the outside end of the rope is at the top and pointing directly at him. He should then turn the coil over towards his left and lay it flat on its side. The lashings are now cut and the inner end of the rope is pulled out from the centre (Fig 3.25(I)). The rope will then leave the coil correctly and can then be coiled down. With rope of 48mm diameter or larger the twisting involved in the preceding method is not acceptable and the coil must be unreeled in the opposite way to that in which it was made up. The coil should be placed on a turntable, or slung so that it can be revolved (Fig 3-25(ii). Cut the lashings and haul the rope off from the outside. If this method is not possible, stand the coil on its end, and lap the rope off the top of the coil turn by turn. As each turn is removed, revolve the end of the rope to take out twists.

(2) *Cutting off a Length of Rope from a New Coil.* The required amount of rope is hauled from the coil, as previously described, then the rope is whipped or taped at each side of the position at which it is to be cut. Whenever a length of rope is cut off a coil, a label, on which should be clearly stated either the length cut off or the length remaining, should be attached to the coil.

(i) SMALL ROPE



(ii) LARGE ROPE

Fig 3-25. Opening a New Coil

m. **Storage of Cordage.** Coils of new rope should be stowed clear of the deck, in a cool, well ventilated, dry place, to allow the air to circulate freely around them. Used rope should be hung in loose coils if this is practicable. No cordage should be stowed in contact with bare steelwork. If cordage has to be stowed in the open it should be protected from sunlight because man made fibres are susceptible to deterioration caused by the suns rays.

03009. Handling of Wire Rope

Wire rope is much less resilient, and therefore much less tractable, than cordage. It resists being bent, does not absorb turns readily, and is therefore much more liable to kinking and snarling, and tends to spring out of a coil, or off a drum or bollard. If handled correctly however, it can be used for most of the purposes to which cordage is put, but bends and hitches should not be made in it.

a. **Kinking and Crippling**. Because of its construction and comparative lack of flexibility, wire rope requires more care in handling than cordage; if carelessly handled it may suffer serious damage through kinking and crippling.

(1) *Kinking*. Any loop or turn in a wire rope can all too easily be pulled into a kink which permanently damages it. If a kink is seen to be about to develop it should be removed as indicated in Fig 3-26 and no attempt should be made to pull it out in the manner shown in Fig 3-27.

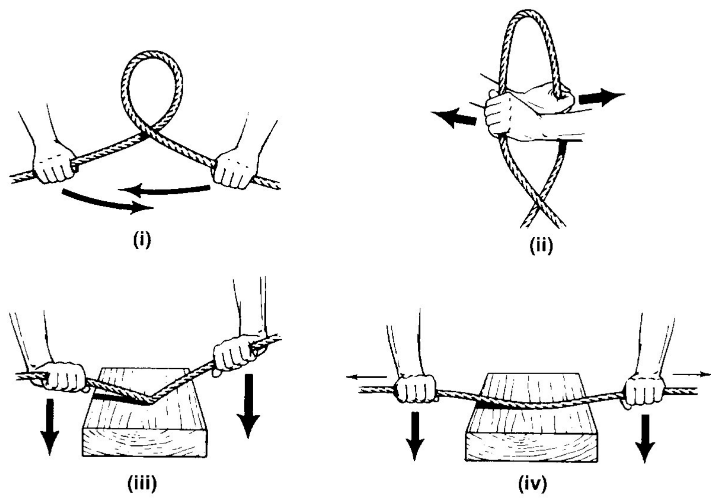


Fig 3-26. Right Way to Remove a Kink in Wire Rope

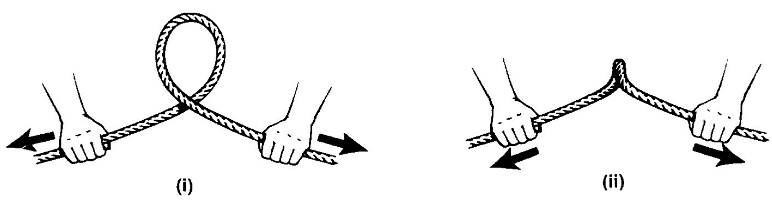


Fig 3-27. Wrong Way to Remove a Kink in Wire Rope

(2) *Crippling* (Fig 3-28). If a wire rope is bent at too acute an angle, or led over a sharp edge, it will be seriously damaged by distortion of its strands, which may result in a permanent kink or even in the rope parting. A rope so led is said to form a bad nip, and this results in it being crippled. (To freshen the nip is to veer or heave in a short length of rope that is under strain so as to bring a fresh portion of the rope to take the chafe where it passes through fairleads or around bollards). To prevent crippling, a wire rope which will come under strain should never be led through a shackle or eyeplate to alter the direction of its lead. In addition, it should not be round a bollard or drum of a diameter less than 13 times the diameter of the rope; and if it has to run through a block, the diameter of the sheaves should be at least 20 times the diameter of the rope.

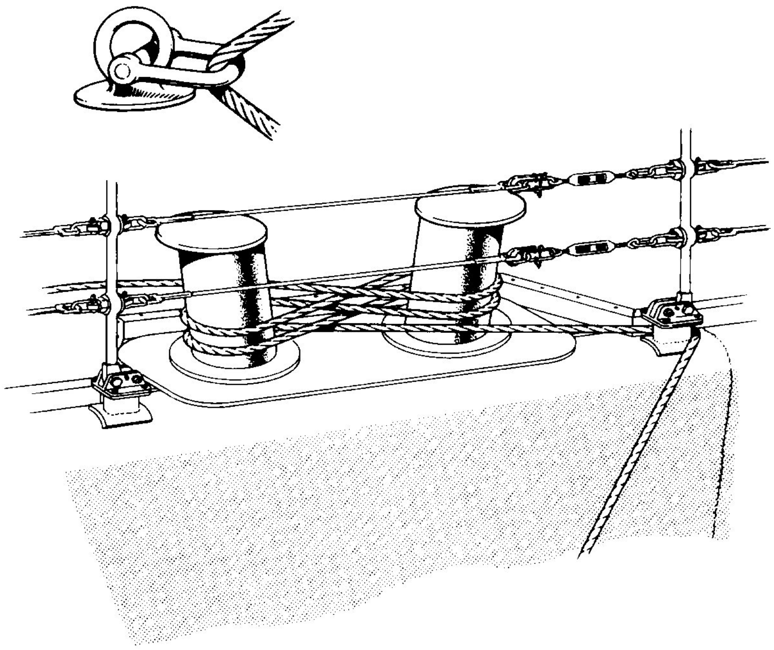


Fig 3-28. Examples of Bad Nips (Leads)

b. **Coiling and Uncoiling**. Wire rope, especially long lengths of it, should be stowed on reels, but where this is not practicable it must be coiled down. Wire rope is less able to absorb turns than fibre rope; when coiling down it is therefore all the more necessary to have the uncoiled length free to revolve. Where this is impossible an alternative is to use left-handed loops, called **frenchmen**, in the coil (Fig 3-29). These frenchmen serve to counteract the twists put in by coiling down right-handed. Frenchmen are also necessary when coiling down a wire rope of which some portions have contracted a left-hand set (as will occur when a rope belayed left-handed round a bollard has been subjected to strain). Such portions will resist being coiled right-handed and each loop must be allowed to become a frenchman. It is wise to stand clear when rope is being hauled off a coil containing frenchmen, as such turns are very likely to jump off. A coil of wire rope should always be well stopped to prevent the coils from springing out of place.

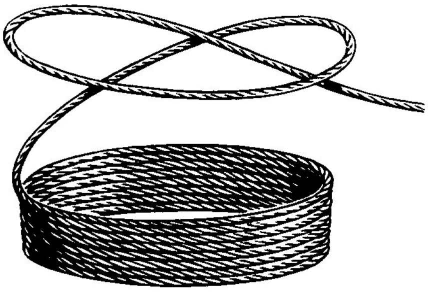


Fig 3-29. A ‹Frenchman’

The best way to run out a coiled down wire is shown in Fig 3-30.

Fig 3-30. Running Out a Coiled Down Wire

c. **Handling New Steel Wire Rope**

(1) *To Unreel or Uncoil a New Rope.* New wire ropes are supplied either in machine wound coils or on cable drums (reels). They must be taken off the coils or drums in the correct manner, or kinks will quickly develop. A small coil can be rolled along the deck, but if space does not permit, or the rope is heavy, place the coil on a turntable and lash down two strong battens crosswise on the top of the coil (Fig 3-31). This will prevent the rope springing up over the top of the coil and kinking. Then cut the stops, and haul the rope off the coil as it rotates on the turntable.

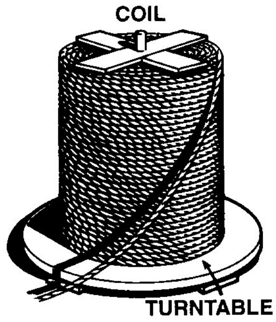


Fig 3-31. Uncoiling a New Wire Rope

To unreel the rope from a drum, pass a shaft through the drum and support the shaft at either end, thus allowing the drum to revolve; then cut the outer stops and unreel the rope off the drum (Fig 3-32). To coil down a small rope from a drum, up-end the drum as shown in Fig 3-33, and lap the rope off the top of the drum, lapping off each turn anti-clockwise. The twist put in the rope as each turn is lapped off is cancelled automatically by coiling the rope down clockwise.

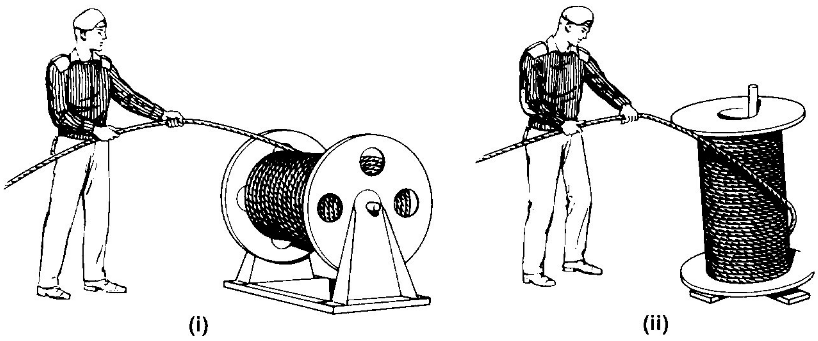


Fig 3-32. Unreeling a New Wire Rope

Fig 3-33. Lapping Off and Coiling Down a Small Wire Rope

(2) *To Cut Off a Length of Wire Rope.* The rope should be very firmly whipped about 25mm on each side of the position at which it is to be cut, then placed on the top of a bollard or similar hard surface. The strands should then be cut with a hammer and cold chisel or with a wire-cutter. Whenever a length of rope is cut off a coil or a drum, the coil or drum should be clearly marked, indicating either the length cut off or the length remaining.

d. **Care and Maintenance of Steel Wire Rope**. Wire ropes have a lubricant incorporated during manufacture. This serves a dual purpose; it provides corrosion protection and also minimises internal friction. The protection provided by this manufacturing lubricant is normally adequate to prevent deterioration due to corrosion during the early part of a rope's life. However, the lubricant applied during manufacture must be supplemented by lubrication in service. This service lubricant is termed the ‹dressing'. The kind of dressing used and the frequency of application varies with the type of rope and its usage. Details of the maintenance of steel wire rope carried by, or fitted in, HM ships is laid down in the Maintenance Management in Ships system (MMS). Wire hawsers should be stowed on reels under a fitted cover whenever possible. When being reeled in or otherwise stowed, the surface of a wire hawser should be washed with fresh water to free it from salt, then dried with cloths and lightly smeared with the appropriate lubricant.

e. **Inspecting Steel Wire Rope**. Steel wires ropes carried or fitted in HM ships must be inspected periodically in accordance with the MMS system. When inspecting, the indications described below should be sought:

(1) *Distortion of Strands*. This is the result of damage by kinking, crushing, serious crippling round a bad nip, or other mistreatment. If likely to cause the strands to bear unequal stresses they must be considered as reducing the strength of the rope by 30%; and should they be sufficiently serious to cause the heart to protrude, the rope must be discarded. A crushed rope may be restored to some extent by the careful use of a mallet.

(2) *Flattening of Some of the Outer Wires by Abrasion.* These flats are easily seen because the abrasion gives the flattened wires a bright and polished appearance, but they do not affect the strength of the rope unless they are very pronounced. Flats which extend to three-quarters of the diameter of the wires will reduce their cross-sections - and therefore their individual strengths - by 10%, and as only a limited number of wires will be affected the loss in strength of the whole rope will be very small. (These flats must not be confused with flattening of the whole rope, which indicates distortion of the strands and is therefore much more serious).

(3) *Broken Wires.* These are usually the result of fatigue and wear, and mostly occur in crane wires. It is generally accepted that a wire rope is coming to the end of its useful life when one wire of any strand breaks. To deal with a broken wire, grip with a pair of pliers the broken end and bend the wire backwards and forwards until the wire breaks inside the rope between the strands, where it can do no harm. A rope should be discarded if more than 5% of its wires are broken in a length equal to 10 times the diameter of the rope; for example a 24mm diameter, 6X24 wire rope should be discarded if seven broken wires are found in a length of 240mm. Because of the danger to handlers, berthing wires should be discarded if any broken wires are discovered.

(4) *Corrosion.* Wire rope can be corroded by:

(a) The action of damp on the wires from which the galvanising has worn off; if this occurs to the inner wires first it causes rust to fall out of the rope and is therefore easily detected;

(b) The action of fumes and funnel gases, which attack the outside wires, the effect then becomes visible on inspection;

(c) Contact with acid, which soaks into the heart and attacks the inside wires; this is not necessarily noticeable on the outside of the rope, and can be the cause of parting without warning.

Lack of lubrication is a frequent cause of corrosion. When a wire rope is under tension it stretches and becomes thinner, and during this process the individual wires are compressed and friction is set up; the fibre heart and cores are also compressed, releasing oil to overcome the friction. A wire rope of outwardly good appearance, but with a dry powdery heart or core, has not been properly maintained and should be treated with caution.

(5) *Effect of Extreme Cold.* When subjected to extreme cold a wire rope may become brittle and lose its flexibility, and an apparently sound rope may part without warning. The brittleness is not permanent and the rope will regain its resilience in a normal temperature, but the potential danger should be remembered when working wires in very cold climates.

f. **Testing of Steel Wire Rope**. The wire from which the rope is to be made is tested before manufacture of the rope to ensure it complies with the relevant British Standards Specification with regard to tensile strength, torsion and galvanising properties. After manufacture of each production length of rope, test samples are cut from the finished rope and strand. These samples are used for a tensile test to destruction, tests of preforming of the rope, and tests on a mixture of the individual wires with regard to diameter, tensile strength, torsion and quality of galvanising. Each coil of wire is accompanied by a certificate of conformity and a test certificate showing the guaranteed minimum breaking strength of the wire when new.

03010. General Remarks on Steel Wire Rope

a. **How to Measure the Size of a Rope.** The size of a wire rope is the diameter in millimetres of a true circle which will just enclose all the strands (Fig 3-34). Measure at each of three places at least 2m apart. The average of these measurements is to be taken as the diameter of the rope.

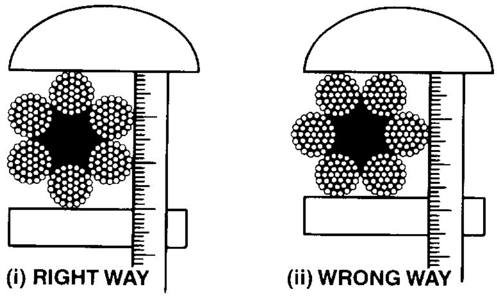


Fig 3-34. How to Measure the Diameter of a Rope

b. **Sheaves for Wire Rope**

(1) *Size of Sheave Required for a Wire Rope Hoist.* The diameter of sheave required for each type of six-strand wire rope supplied to the Royal Navy should be at least twenty times the diameter of the wire. The diameter of a sheave used for any wire rope will considerably affect the life of that rope. As the rope bends round a sheave the strands and wires farthest from the centre of curvature move apart and those nearest the centre of curvature move closer together. This results in the generation of considerable friction between these wires and strands, and the smaller the sheave the greater will be the friction. Friction also increases rapidly with the speed at which the rope is moving. While the rope is bent round a sheave the outer wires are also subjected to a marked additional stress, and the smaller the diameter of the sheave the greater will be the stress. For these reasons the **minimum** diameters of sheaves recommended from practical experience for various types of ropes at speeds not exceeding 60m per minute are 20 times the diameters of the ropes. For each increase in speed of 30m per minute, 5% must be added to these figures; this will give a rope a reasonable life, but it is emphasised that its life will be greatly increased if still larger sheaves are used. Similarly, if a smaller sheave than that recommended has to be accepted it will shorten the life of the rope, and on no account should a sheave be used that is more than 20% smaller than that determined by reference to the above criteria.

(2) *Use of Correct Sheave.* The life of a rope used for hoisting can also be considerably shortened by using the wrong **type** of sheave. The groove in the sheave must fit and support the rope as it travels round the sheave, otherwise there will be increased internal friction and external wear. Fig 3-35 (I) shows a sheave with too wide a groove, which results in a flattening of the rope and considerable distortion and internal friction. Fig 3-35(ii) shows a sheave with too narrow a groove, which results in the rope not being supported, the wires of the strands being subjected to considerable wear, and friction being set up between the rope and the sides of the groove. The groove of the correct sheave should be shaped in cross-section to the true arc of a circle for a distance equal to one-third of the circumference of the rope, and the radius of the groove should be between 5 and 10% greater than the specified radius of the rope (Fig 3-36).

Fig 3-35. Examples of Incorrect Sheaves for Wire Rope

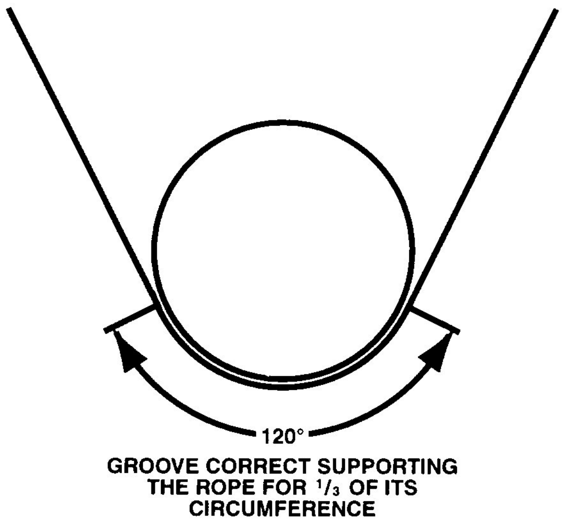


Fig 3-36. Diagrammatic Example of a Correct Sheave for Wire Rope

03011. End Terminals on Wire Rope

Besides the soft, thimble and hawser eyes, other kinds of terminals are used for the ends of wire rope and some of them are explained below.

a. **Sockets**. There are several types of socket (Fig 3-37(I)) but a standard method of attaching them to the end of a wire. The wires at one end of the rope are fluffed out like a shaving brush to fill the hollow conical head of the socket, the ends of the wire are then hooked over towards the centre and molten white metal is poured in to make the whole head solid. This skilled work is normally done by qualified dockyard personnel. A well made socket should have the strength of the rope but the rope is subject to fatigue where it enters the socket because of the abrupt loss of flexibility. Frequent examination is essential and if a single broken wire is seen near the socket the rope should be recapped without delay.

b. **Swaged Terminals** are a modern alternative to the sockets described above, and as with the socket there are various types. The end of the wire is inserted in the terminal and both are placed in a special swaging machine in which the terminal is hydraulically compacted on to the rope. This process, which is carried out cold, does not affect the temper or strength of the rope.

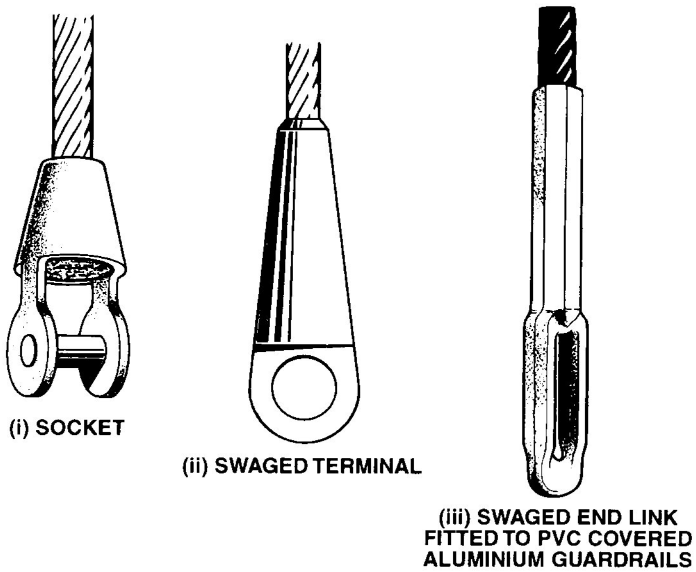


Fig 3-37. Examples of Terminals for Wire Rope

03012. Factors of Safety, Safe Working Loads and Proof Loads

a. All lifting equipment fitted in, and carried by, HM ships is of a proven and tested design and has a designated **safe working load**, which is the maximum load the equipment is designed to bear in practice. The required size and strength of all the components of the equipment has been calculated by the design authority, and the seaman will rarely be called upon to exercise his judgement on the subject. However, a knowledge of the principles involved will give a greater understanding of equipment limitations, and assist in making accurate calculations should extempore rigging of lifting equipment be necessary. To determine the size of cordage or wire rope to be used for any working load a **factor of safety** is laid down for different conditions of working; it applies to the rope only, as other components within the rig, such as shackles, hooks and blocks are unlikely to be subjected to the same stresses as the rope, and in any case such items are marked with their safe working load and this information can be taken as reliable regardless of the application of the equipment. For SWR, MMFC and NFC the following formula is employed:

$$\textit{Safe working load} = \frac{\textit{breaking strength of rope}}{\textit{factor of safety}}$$

The following factors of safety for rope are used generally in the Royal Navy:

Lifts and hoists	12
Running rigging and slings	8
Other purposes	6

b. **Proof Load.** The proof load of lifting equipment is normally twice its safe working load and this information is required when equipment is tested. For example, a shackle with a safe working load of 2 tonnes is tested to a proof load of 4 tonnes. In the past it was usual to mark equipment with details of the proof load, but current practice is for the safe working load to be shown.

03013. Orders and Terms used in Handling Hawsers, Ropes and Cables

The various orders and terms used by the seaman when handling hawsers, ropes and cables are listed below:

Order or Term	Definition
Heaving	
A Heave	A pull on a rope or cable; a throw or cast with a rope
To Heave	To throw a rope, or to pull on a rope or cable either by hand or power
Heave!	The order to give a strong pull together
Heave in!	The order to heave in on a capstan or winch
Two six, heave!	An order to men hauling on a rope to make them heave together, repeated as necessary
Hauling	
A Haul	A pull on a rope by hand
To haul	To pull by hand
To haul hand over hand	To haul a rope in quickly with alternate hands
Haul taut!	An order to take down the slack and take the strain
Haul away!	An order to haul in steadily
Avast hauling! and Avast!	Order to stop hauling
STOP	**THE WORD "STOP" CAN BE USED AT ANY TIME DURING A SEAMANSHIP EVOLUTION. IT IS MADE TO INDICATE A SAFETY ISSUE. ON HEARING "STOP" ALL PERSONNEL ARE TO STOP WHAT THEY ARE DOING IMMEDIATELY AND AWAIT FURTHER INSTRUCTIONS. NOT TO BE CONFUSED WITH AVAST**.
Hold fast!	An order to hold a rope under strain so as to keep it from moving
Hoisting	
A hoist	A system designed for lifting, or the load which is lifted
To hoist	To lift
Hoist away!	The order to haul away on a rope when hoisting something with it
High enough!	The order to stop hoisting
Marry!	The order to bring two ropes together side by side and handle them as one. Also a term used in splicing, meaning to butt two ropes' ends together with their respective strands interlocking.
Lowering	
Lower away!	The order to lower steadily
Avast lowering!	The order to stop lowering

Order or Term	**Definition**
General	
Avast!	Stop immediately, especially heaving/hauling/veering.
Handsomely!	Slowly, with care (eg, ‘lower handsomely’)
Roundly!	Smartly, rapidly
Walk back!	An order to ease a rope back or out while keeping it in hand
Light to!	The order to fleet a rope back along the deck so as to provide slack.
Belay	Make fast a rope by turning it up on a cleat/staghorn/bollard.
Bring to	Pass turns of a hawser or rope round a capstan or winch. (It is usual to specify the number of turns to be taken).
To veer	To pay or ease out a cable or hawser from the cable holder or capstan when these are connected to and controlled by their engines (veer on power); or to allow a cable to run out by its own weight or strain on the outboard end under control by the cable-holder brake (veer on the brake).
Check away!	The order to ease a rope steadily by hand while keeping a strain on it
To snub	Suddenly to restrain a rope or cable when it is running out. This may cause damage to a rope or cable and should be avoided if possible.
To surge	To allow a hawser to ease out by its own weight, or by the strain on the outboard end. A hawser slipping round the barrel of a capstan or winch is said to surge, whether the barrel is stopped or turning to heave in. **Surging when the barrel is veering is dangerous**.
To render	A rope is said to render when it surges under strain round a bollard, cleat or staghorn.
Well! or *Enough!*	Orders to stop heaving, veering, hauling, lowering checking, etc. *Enough!* is usually applied only to hoisting and lowering, and is preceded by *High* or *Low*, respectively.
To back up	To haul on the hauling part of a rope when passed round a bollard or similar fitting so that you assist the bollard to hold it. Also, to reinforce men already handling a rope.

03014. Handling Hawsers

As the name implies, a hawser was originally a heavy, natural fibre rope which was led through a hawse-pipe for use in connection with the ship’s anchors or for towing. Nowadays the term hawser is applied to any long length of heavy cordage or wire which is specially fitted and supplied to a ship as part of her outfit and used for heavy duties such as towing, berthing and working ship.

a. **Summary of Safety Rules for Handling Man-made Fibre, Natural Fibre and Steel Wire Hawsers**. Before working hawsers, the seaman should learn the simple rules for safety which are illustrated in Figs 3-38 and 3-39 and described briefly below.

(1) Look at the end of the rope or hawser and determine which is the running end, the standing part, the hauling part, and which part forms a bight or a coil.

(2) The wearing of finger rings is strongly discouraged. Serious injury, including amputation, may result if a ring snags on a broken strand of a wire hawser. The practice of taping over the ring does little to reduce the chance of injury.

(3) Don't turn up SWR and Cordage on the same bollard or cleat.

(4) Always keep a good lookout aloft and remain alert to what is happening above you. If avoidable never stand below an object that is being hoisted or lowered. The warning cry to those below if something above them is about to be let fall is 'Stand from under!' or 'Under below!'

(5) When working hawsers round equipment such as bollards, warping drums or capstans ensure there is a distance of at least 2m between the equipment and the first person manning the hawser. Other personnel manning the hawser should be spaced at least 1m apart.

(6) Always look out for chafe, and take steps to prevent or minimise it.

(7) Be aware that man-made fibre ropes and hawsers may surge round capstans and bollards without warning when in tension.

(8) Never stand within a bight or coil. Never stand directly in the line of recoil of a man-made fibre rope of hawser under tension.

(9) Wearing gloves whilst handling wires and ropes carries certain risks, for example if they snag on a broken strand in a wire, or become trapped in turns on a capstan or winch. However, in certain circumstances these risks are outweighed by other dangers, eg, frostbite in very cold weather, or the inability to grip with bare hands a greasy wire hawser. Therefore the wearing of gloves authorised in the *Note* to para 07039 is left to the discretion of the OIC, who must take account of the prevailing conditions.

(10) Whenever possible lines are to be tended from forward, this is particularly important during underway evolutions.

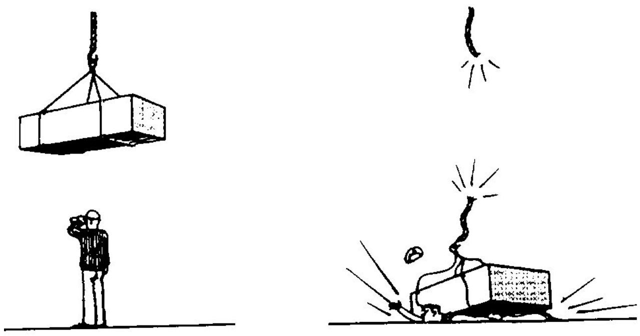


Fig 3-38. Never Stand Underneath a Hoist

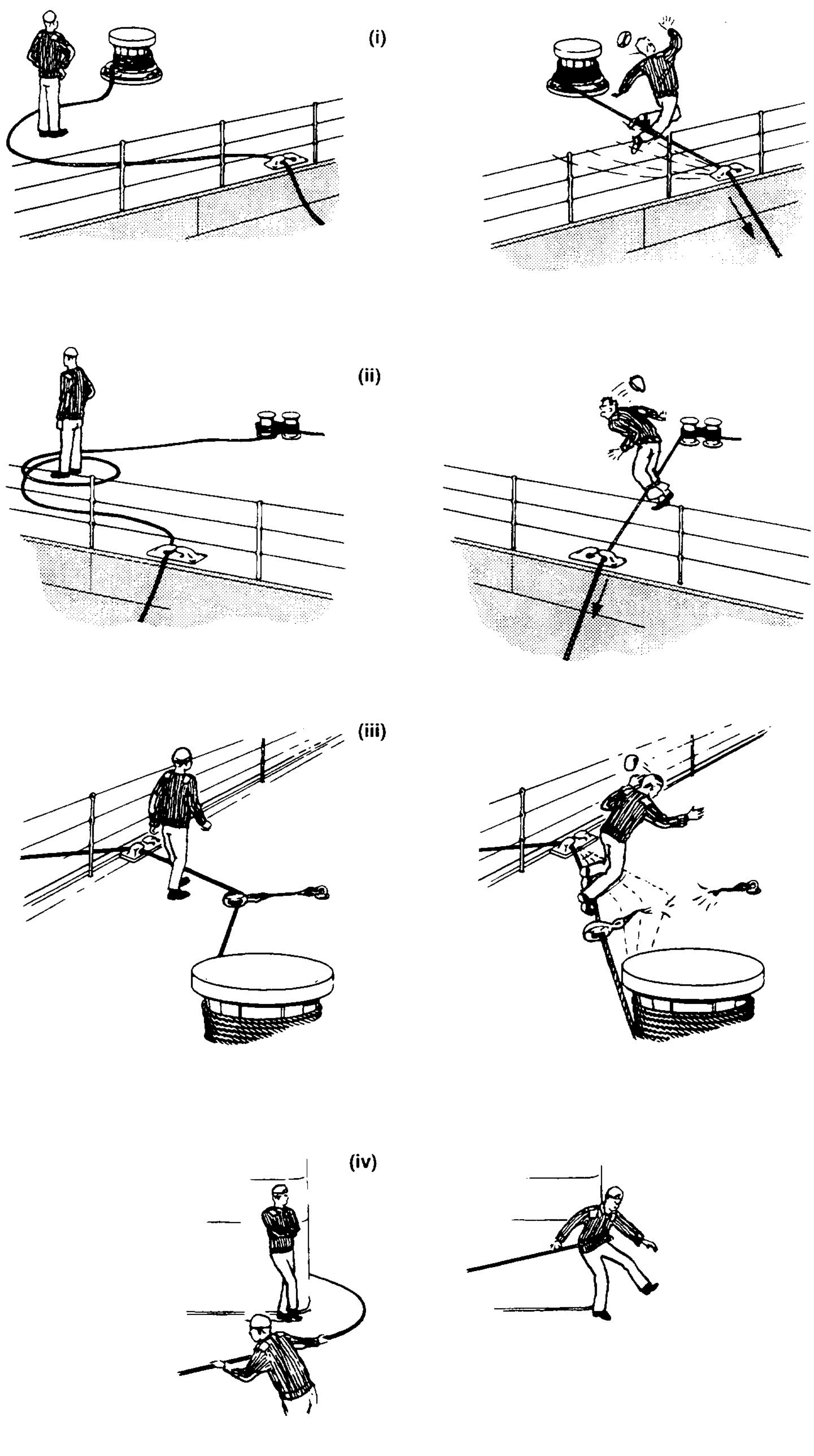


Fig 3-39. Never Stand Within a Bight or Coil.

b. **Bending Ropes to Hawsers**

(1) *To Bend a Heaving Line to a Berthing Hawser* (Fig 3-43). Secure the heaving-line to the eye of the hawser with a long bowline. This will give the men hauling it a better grip as the bollard eye of the hawser comes to fairlead or bollard and will enable the line to be slid clear as the eye is placed over the bollards.

(2) *To Bend a Messenger to a Heavy Hawser.* A messenger is used instead of a heaving-line to pass the heavier hawsers between ships, or ship and shore, as it is made of heavier stuff. It should be bent to the neck of the eye of the hawser with a rolling hitch, and firmly stopped to the crown of the eye. The eye of the hawser can then be hauled through a fairlead and the stop cut, leaving the eye free for shackling on or putting on to a slip. The rolling hitch should be well secured and stopped, and the stop on the eye should be firmly secured to prevent the hitch sliding over the shoulders of the eye (Fig 3-40).

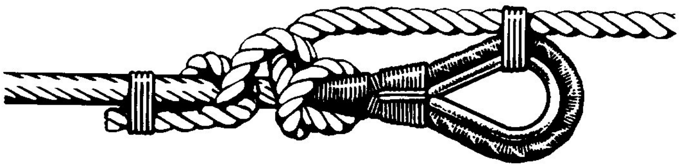


Fig 3-40. Bending a Messenger to a Heavy Hawser

c. **Belaying Hawsers to Bollards**

(1) *A Fibre Rope to a Single Bollard* (Fig 3-41). Bring the rope to the bollard and belay it as shown in the illustration. The first turn round the bollard must be as low down as possible, and overlapping or riding turns should be avoided.

(2) *A Wire Rope to a Single Bollard* (Fig 3-42). Pass the rope round the bollard with sufficient turns to grip and then rack the end to the hauling part, as shown in the illustration. The method of racking the end of a rope belayed to a single bollard is as follows:

> Middle the racking underneath the rope; pass both parts of the racking over the end and under the rope; take a turn round the end. Pass the racking under the rope, and repeat the process as often as required. To finish, separate the parts of the racking, bring them up each side of the cross, and secure them with a reef knot on the top.

Note. *Cordage of at least 4mm size should be used for racking; spunyarn is not strong enough.*

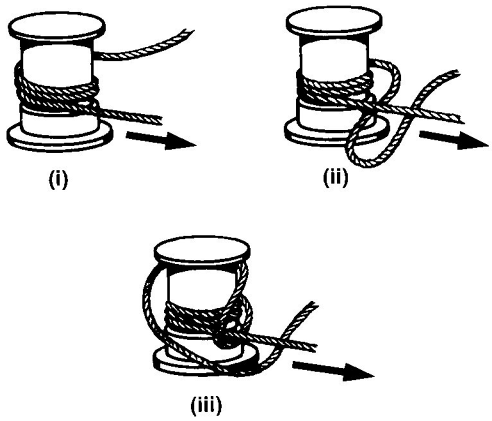


Fig 3-41. Belaying a Fibre Rope to a Single Bollard

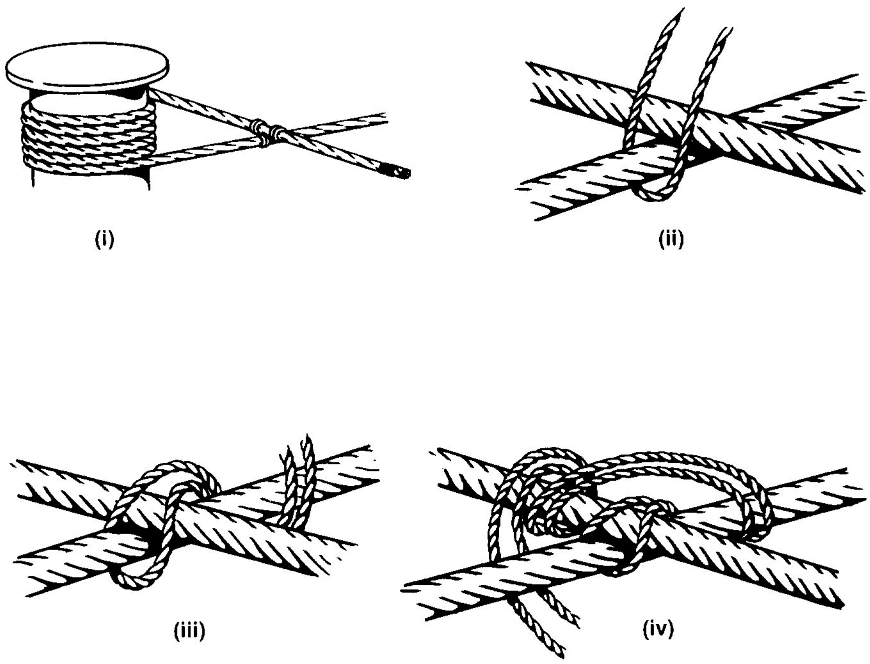


Fig 3-42. Belaying and Racking a Wire Rope to a Single Bollard

(3) *Two or More Berthing Hawsers over a Single Bollard* (Fig 3-43) When two or more berthing hawsers have to be secured to the same bollard eye the eye of the second hawser must be passed up through the eye of the first before it is placed over the bollard; similarly, the eye of a third hawser must be passed up through the eyes of the first two; this enables the hawsers to be cast off the bollard in any order. The term used for this procedure is called ‹dipping the eye’.

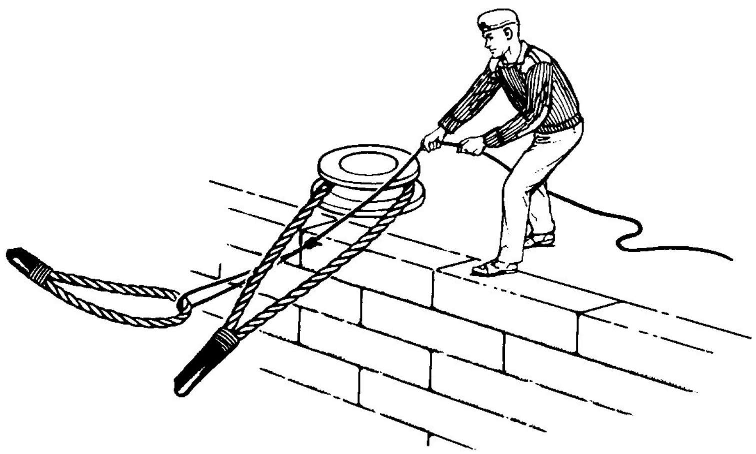


Fig 3-43. Placing the Eyes of Two Berthing Hawsers on a Single Bollard (Dipping the Eye)

(4) *A Wire or Fibre Hawser to Twin Bollards.* Lead the hawser round the bollard farthest from the source of strain, from outboard to inboard; then belay it with figure-of-eight turns as shown in Fig 3-44. If the hawser has to remain belayed for any length of time rack the two upper turns as follows (Fig 3-45):

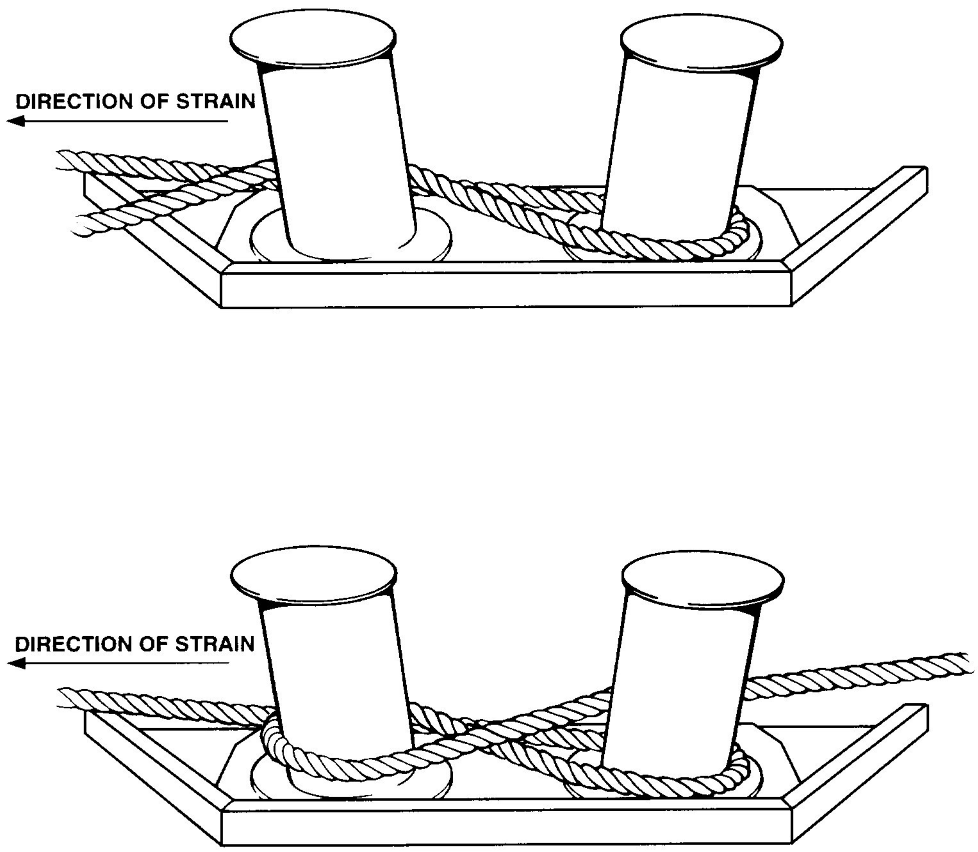


Fig 3-44. Belaying a Wire or Man-made Fibre Hawser to Twin Bollards.

Middle the racking and make an overhand knot round the cross of the two upper turns of the hawser; with each part of the racking pass racking turns round both parts of the upper turns, working outward from the cross; when sufficient racking turns have been taken, knot both parts of the racking over the cross with an overhand knot. To finish off, pass the ends in opposite directions down and round all the turns of the hawser, haul the ends taut, and finish them off with a reef knot on the top.

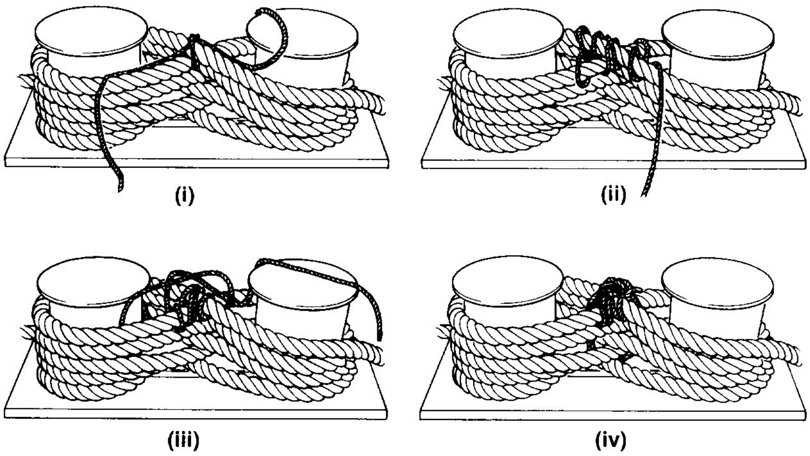


Fig 3-45. Racking a Hawser at Twin Bollards

d. **Handling Hawsers Under Strain**

(1) *To Catch a Turn on a Single Bollard* (Fig 3-46). When a rope is under strain, catching an extra turn round a single bollard is difficult unless done correctly. Careful attention should be paid to the position of the hands and fingers to prevent them being nipped, especially if the hawser should render.

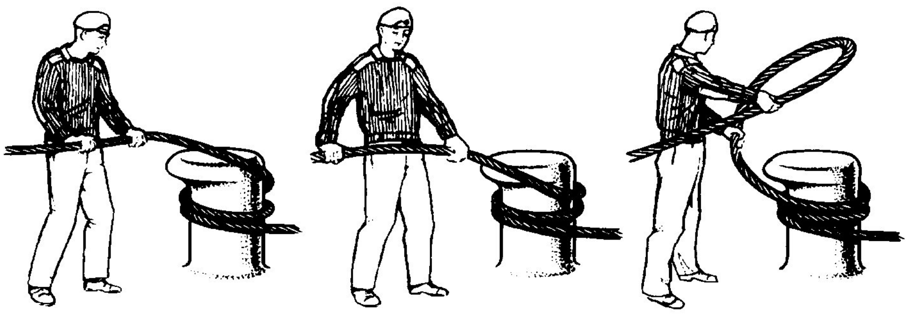


Fig 3-46. Catching a Turn on a Single Bollard

(2) *To Catch a Turn Round Twin Bollards.* Fig 3-47 shows how to catch turns with a hawser under strain round twin bollards. Note that the lead is first to the bollard farthest from the source of strain, and from outboard to inboard. Belaying turns of a hawser leading for'ard are taken right-handed on the starboard side of a ship and left-handed on the port side, and vice versa when the hawser is leading aft.

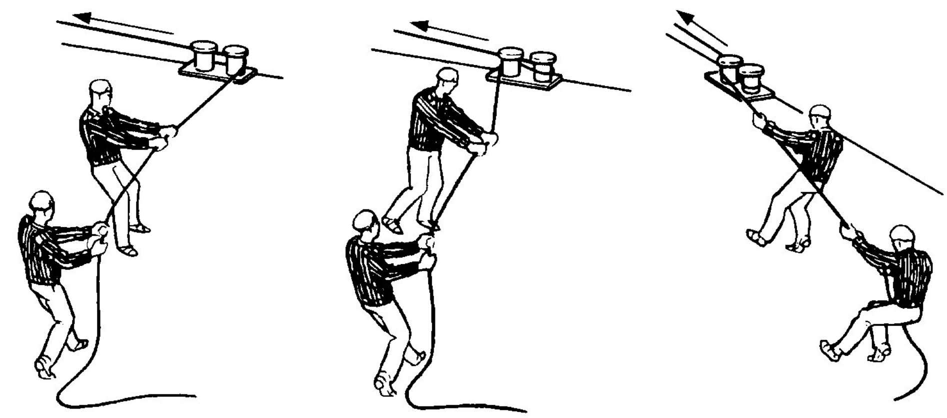


Fig 3-47. Catching a Turn Round Twin Bollards

(3) *To Handle a Heavy Rope which is Alternatively Slack and Under Strain.* If space permits, it is best to keep one turn on the bollards and man the rope as shown in (Fig 3-48). As the slack comes in, one man (or two with a very large rope) can fleet it round the bollards, and at the same time be ready to back it up and take more turns when the strain comes on.

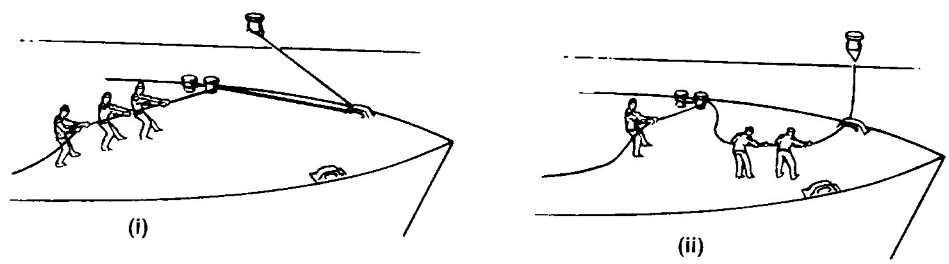


Fig 3-48. Handling a Hawser Which is Alternatively Slack and Under Strain

(4) *Paying Out a Heavy Wire Hawser* (Fig 3-49). When a heavy hawser is being paid out it must be kept under control, otherwise the weight of its bight outboard may cause the hawser to take charge and run out. It should be faked in as long fleets as the deck space permits; and the bight of each fake should be secured. Each bight should be eased out in turn by an easing-out line surged round an adjacent set of bollards, and a chain check stopper should be provided near the fairlead for use if required. When paying out, the bight should be neither too taut nor too slack, so as to keep to a minimum the effort required to haul it in.

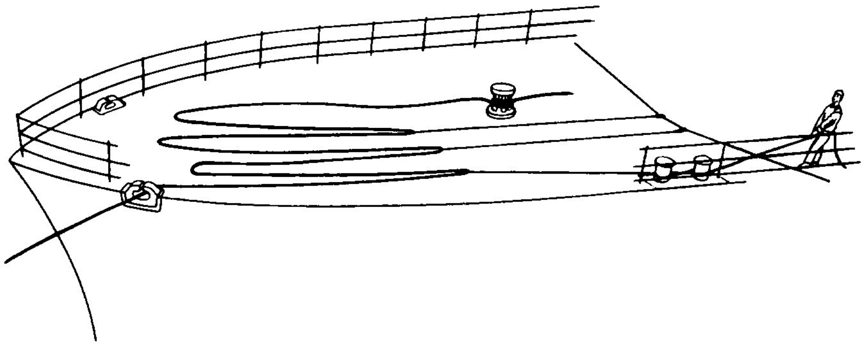


Fig 3-49. Paying Out a Heavy Hawser

(5) *Surging.* Essential rules for surging are to surge smoothly and not in jerks, and to keep sufficient control to be able to surge with the maximum safe strain on the hawser. A hawser with too many turns round the winch or bollards will not render smoothly and may therefore part, and with too few turns the hawser may take charge and run out. It should be remembered that catching an additional turn round a bollard or winch is easier than taking one off. When too many men back up a hawser they are apt to get in each other's way, with the result that efficient control of the hawser is lost. Success lies in taking a sufficient number of turns to reduce the strain on the hauling part to manageable proportions. Generally speaking, two or three turns should suffice for surging under normal conditions, and up to three men should be sufficient for backing up. An expert seaman can handle a 28mm rope by himself and keep it under complete control when surging by catching or removing turns as required. The precise number of turns for surging will always depend on the strain on the rope, the size of the rope and winch or bollards and the resultant friction between them, and the number of men backing-up on the hauling part. Under normal conditions when a man exerts a pull of 30kg when backing-up a wire, each turn round a bollard or winch reduces the strain required on the hauling part to one-quarter of the load, so that one man will be able to hold;

One-eighth of a tonne with one turn
Half a tonne with two turns
Two tonnes with three turns
Eight tonnes with four turns.

Thirty kilograms is a very conservative estimate of the effort each man can apply; three men, by backing-up, could easily part a 16mm steel wire rope with three turns round a bollard or winch, or 28mm steel wire rope with four turns; similarly, a 32mm steel wire rope with five turns round a bollard or winch could easily be parted when backed-up by one man. It is emphasised that this rough rule applies only with normal conditions of friction between the rope and the bollard or winch. With a greasy or wet rope, or a polished bearing surface on the bollard or winch, more turns or men are required. Conversely, a rusty steel wire rope, or a painted or rusty bearing surface on the winch or bollard, may increase the frictional grip of each turn by as much as eight times. For this reason the bearing surfaces of winches, bollards and capstans should be kept free of rust or paint.

e. **Stoppers and Stoppering**. To belay a rope which is under strain, the strain must be taken temporarily with a stopper. The type of stopper used depends on whether it is to hold a man-made fibre or a wire rope.

(1) *Man-made Fibre Cordage Stopper*. This is used for fibre hawsers only and consists of a length of polyester, middled to form two tails and made fast to an eyeplate or other fixture. The stopper is laid alongside the hawser with its tails pointing towards the source of strain; the tails are passed by crossing them under and over the hawser in the direction of the source of strain. The ends are kept in hand or stopped to the hawser (Fig 3-50).

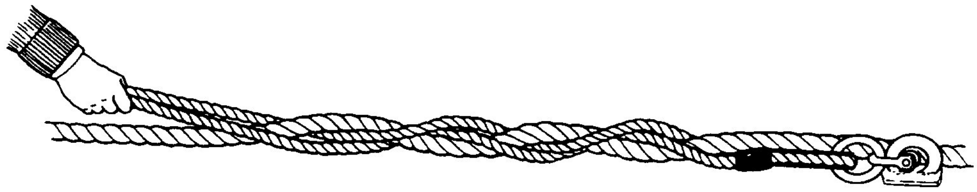


Fig 3-50. Man-made Fibre Cordage Stopper

(2) *Chain Stopper*. This is used for wire hawsers only and consists of a length of chain made fast to an eyeplate or other fixture. The stopper is laid out alongside the hawser with the tail pointing towards the source of strain; the tail is half-hitched round the hawser **with** the lay, then dogged round the hawser **against** the lay; the end is then held by hand or stoppered to the hawser (Fig 3-51). Fig 3-52 shows an example of the use of a cordage or chain stopper. The hawser, which has been hove in by the capstan, is under strain, and it is desired to belay it to a pair of bollards. The stopper should be passed as close to the fairlead as possible, and as nearly as possible in the line between the fairlead and bollards, to avoid loss of slack as the hawser is transferred from the capstan to the bollards.

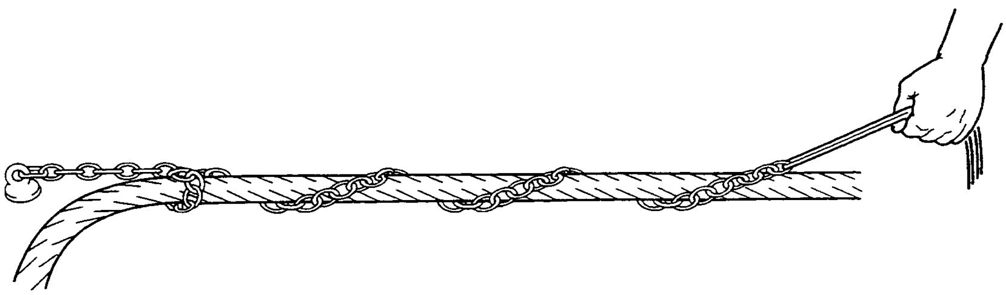
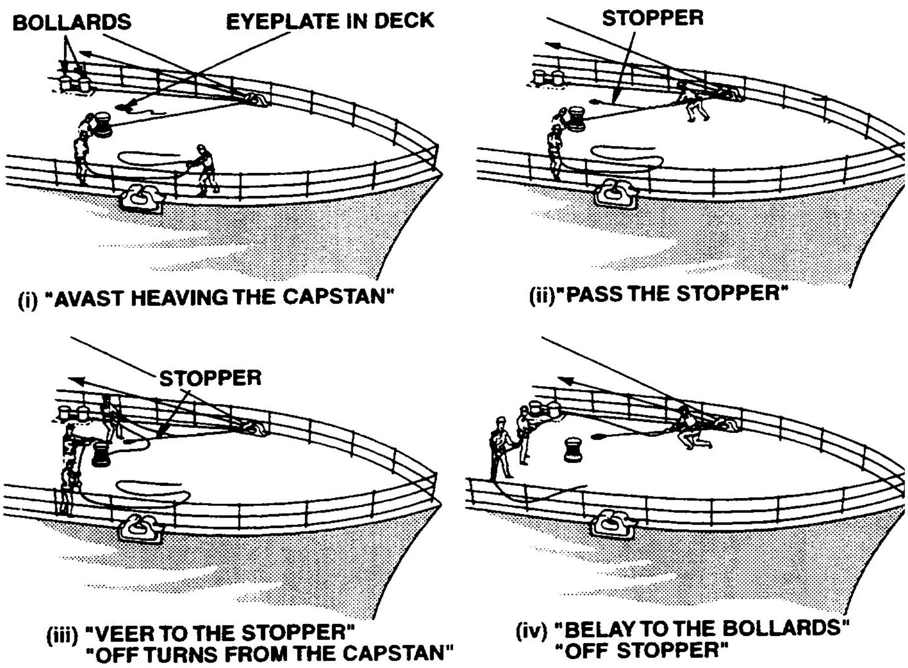


Fig 3-51. Chain Stopper



CAUTION
AT NO TIME IS THE SHIP TO BE HELD ONLY BY A STOPPER. SEE PARAGRAPH 03076d

Fig 3-52. Use of a Stopper when Berthing Ship

(3) *Chain Check Stopper* (Fig 3-53). This is used to control the speed at which a wire hawser is paid out. It is rove so that a pull on the tackle will jam the hawser against the eyeplate, thus operating as a brake and bringing it to rest.

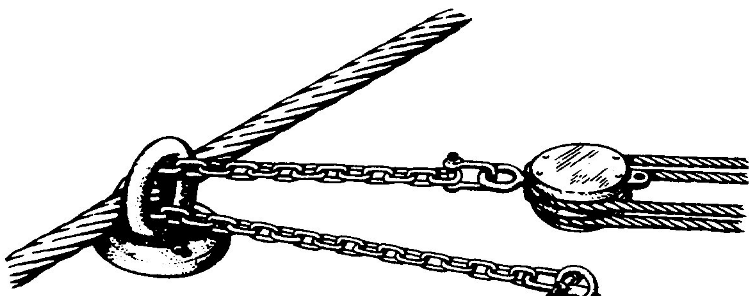


Fig 3-53. A Chain Check Stopper

(4) *Cordage Check Stopper* (Fig 3-54). As with the chain check stopper, the cordage check stopper is used to control the speed at which a man-made fibre hawser is paid out. It is rove as a chain check stopper except that the hauling part is normally kept in hand. The stopper is made of manila.

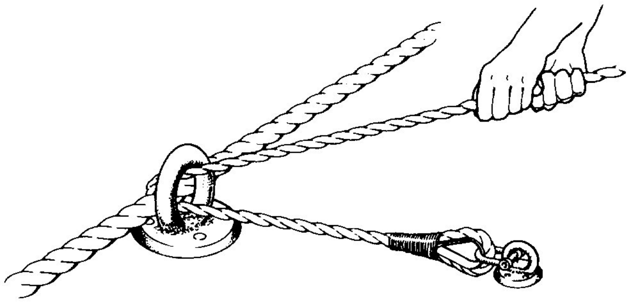


Fig 3-54. A Cordage Check Stopper

(5) *Carpenters Stopper* (Fig 3-55). This is used only on wire rope, and is used for temporarily holding a rope which is under strain. It is a mechanical device consisting of a metal block made in the form of a thick-sided box, of which both ends are open and the top is hinged to form a lid. The body of the box is made in two longitudinal halves, which are joined together at the bottom with a hinge so that it can be opened out for inserting the wire rope. Internally, one side of the box is parallel with, and the other inclined to, the lead of the rope, thus making the opening at one end wider than at the other. A groove, shaped to take the lay of the rope, is cut lengthways in the parallel side; and a wedge piece, the inner side of which is similarly grooved to grip the opposite side of the rope, slides in against the inclined side. When the rope is inserted the lid is shut and clamped and the wedge-piece then pushed home as far as it will go, so that immediately any pull comes on the rope the wedge-piece is drawn hard into the block and jams the rope. The stopper is attached by a chain bridle to a triangular link which is shackled to an eyeplate or other suitable fixture. Each stopper is supplied with two sizes of wedge-piece so that it can be used for different sizes of rope; a 16mm stopper, for example, can also be used for 20mm rope. The wedge-piece can be withdrawn and changed after slackening the set-screw securing it, which is inserted in the underside of the block.

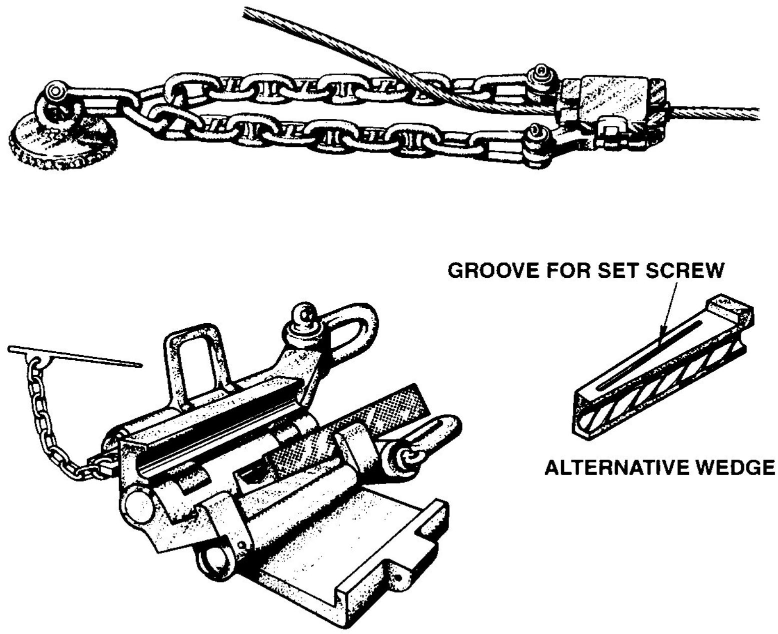


Fig 3-55. A Carpenter's Stopper on a SWR and in Detail.

f. **Stowage of Hawsers**. Hawsers can be stowed on reels (Fig 3-56). In modern ships, a hawser store is usually sited directly below the focsle deck. The drum and flanges of a hawser reel should be of skeleton construction to allow air to circulate around the hawser and thus keep it dry. Both ends of the hawser should be stopped by their eyes to the drum and flange. The reel should be secured by a lanyard, fitted on the flange, to prevent it rotating when the hawser is stowed. Most ships have been fitted with ventilated bins made either of steel or timber, for the stowage of man-made fibre hawsers. With this type of stowage man-made fibre hawsers that have been in tension can be stowed away directly, without the need to wait for the hawser to recover its length, a necessary requirement when such hawsers are stowed on reels. Cordage stowed in ventilated bins must be coiled or faked down in the bin on wooden duck boards to ensure adequate air circulation underneath as well as around the hawsers. Yet another type of hawser stowage is the bulkhead saddle, a circular or oval cluster of steel horns around which the hawser is wound.

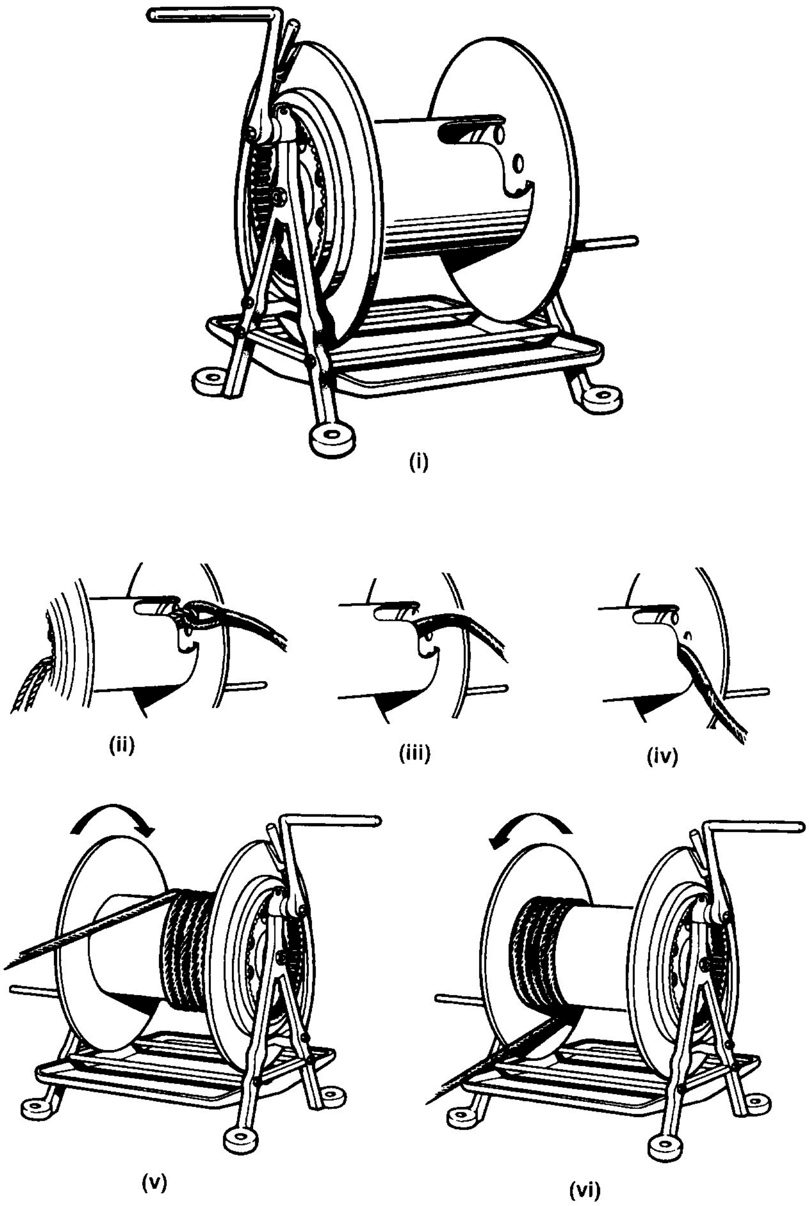


Fig 3-56. Stowage of Hawsers on Reels

g. **Calculating the Capacity of a Reel or Drum.** The following formula, used in conjunction with the information in Fig 3-57, gives an approximate indication as to what length, in metres, of rope of a given size can be installed onto any reel or drum.

$$\frac{(A+B) \times A \times C \times \pi \times 10^6}{d^2}$$

Where A, B and C are quoted in metres and *d*, the diameter of the rope, is quoted in millimetres.

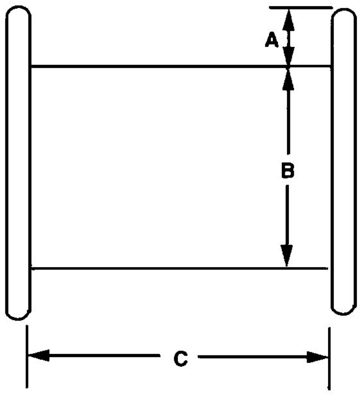


Fig 3-57. Calculation of Drum Capacity

Note. *Ropes are normally manufactured to a maximum oversize tolerance of 4%; therefore the actual diameter 'd' could be nominal diameter + 4%.*

03015. Bends and Hitches

Strictly speaking, a bend is a method of temporarily joining two ropes, a hitch is a method of temporarily joining a rope to a structure or ring, and a knot is the intertwining of strands or smaller parts of rope(s) to prevent a rope unreeving, or to provide a handhold, a weight or a stopper on any part of a rope. These definitions have become blurred with time and all three terms are now virtually synonymous. Commonly used bends and hitches are described here, and knots and their uses are described in paragraph 03016.

a. **Strength of Knotted Ropes**. All knots, bends and hitches reduce the strength of a rope in that portion of it where the knot, bend or hitch is made. This reduction varies from 40 to 60 percent, and it should be borne in mind when putting a load on a knotted rope.

b. **Terms Used**. The following terms are used when describing the formation of the various bends and hitches:

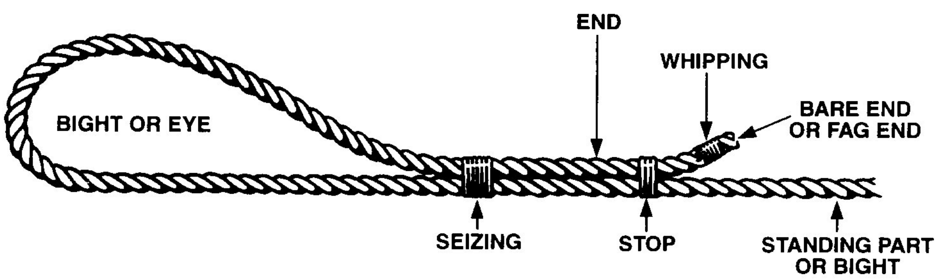


Fig 3-58. Terms Used in Describing Bends and Hitches

(1) *Bight*. The middle part of a length of rope. This term also refers to a loop of rope, and **to make a bight** is to form a loop.

(2) *End*. The short length at the end of a rope, which may be formed into an eye, or used for making a bend or a hitch with which to secure it. The end of a rope is also that length of rope left over after making such an eye, bend or hitch. The **bare end**, or **fag end**, is the extreme end of a length of rope.

(3) *Standing Part*. The part of the bight of a rope which is nearest the eye, bend or hitch, in contrast to the end.

(4) *Stopping*. A light fastening for temporarily holding in place a rope or any other object. It is not meant to bear any strain other than that required to keep the rope or other object in place.

(5) *Seizing*. A seizing is used to fasten two ropes, or two parts of the same rope, securely together, to prevent them moving in relation to each other.

(6) *Whipping*. The binding round the bare end of a rope to prevent the strands from unlaying.

c. **Elements of Bends and Hitches**. Most bends and hitches consist of a combination of two or more of the elements illustrated in Fig 3-59.

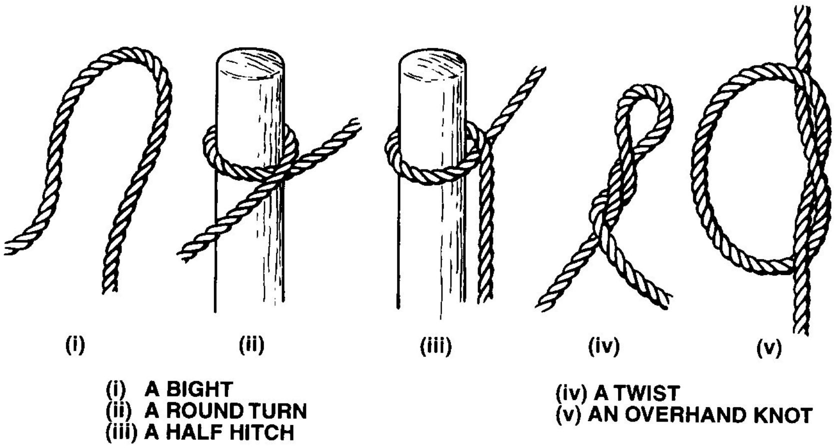


Fig 3-59. Elements of Bends and Hitches

d. **Reef Knot** (Fig 3-60). The reef knot consists of two overhand knots made consecutively, and is used as a common tie for bending together two ropes of approximately equal size. It is not likely to come undone when there is no strain on the knot, but it is not reliable if the ropes are of unequal size or very slippery unless the ends are seized back to their standing part. To form a reef knot care must be taken to cross the ends opposite ways each time they are knotted (ie right over left, then left over right, or vice versa), otherwise the result will be a **granny**, which will either slip or jam, depending upon whether it is made with or against the lay of the rope; a granny is also very likely to come undone where there is no strain on the knot.

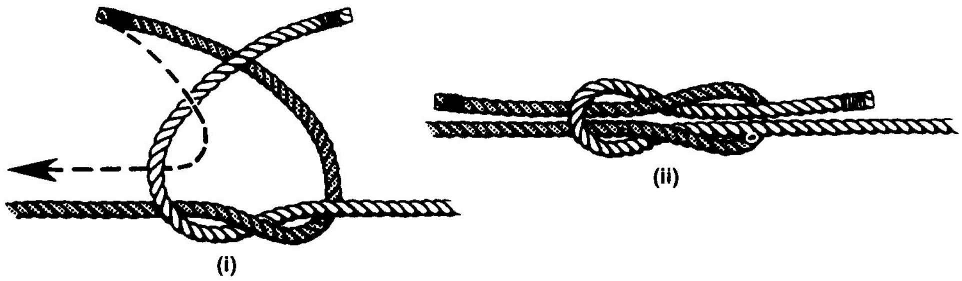


Fig 3-60. Reef Knot

e. **Figure-of-eight Knot** (Fig 3-61). This knot is used to prevent a rope unreeving through a block.

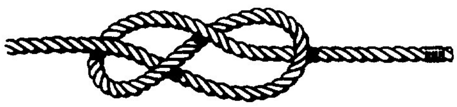


Fig 3-61. Figure-of-eight Knot

f. **Marline Spike Hitch** (Fig 3-62). This hitch is for securing a marline spike, or hook, into the bight of a line. Fig 3-62(ii) and (iii) shows how it is used to haul taut a serving or lashing with a marline spike.

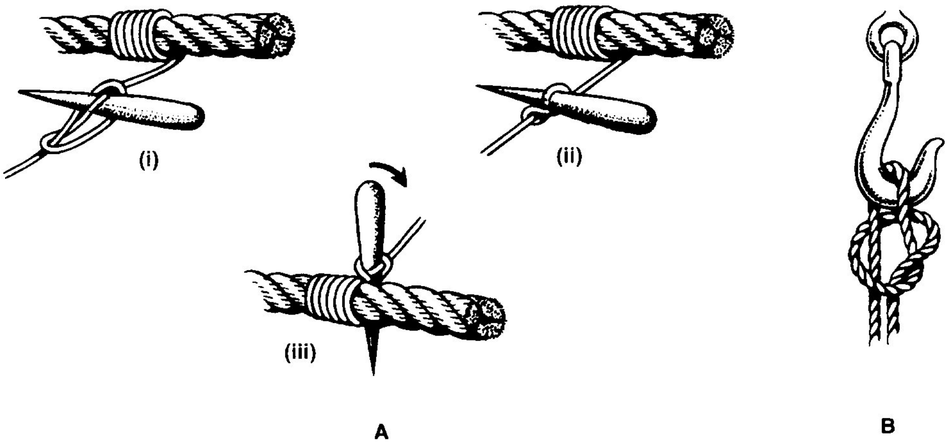


Fig 3-62. Marline Spike Hitch

g. **Marling Hitch** (Fig 3-63). For lashing long bundles such as awnings. It will be seen from the illustration that in each hitch the end is passed down through the bight, thus jamming that part against the bundle and enabling the lashing to be hauled taut. The operation of binding together ropes or yarns by a succession of closely spaced marling hitches is known as **marling down**. Marling is usually begun with a timber hitch if no eye is spliced into the end of the lashing.

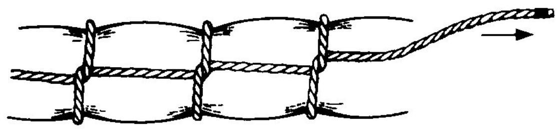


Fig 3-63. Marling Hitch

h. **Timber Hitch** (Fig 3-64). This hitch is used to secure a rope's end to a spar or bale.

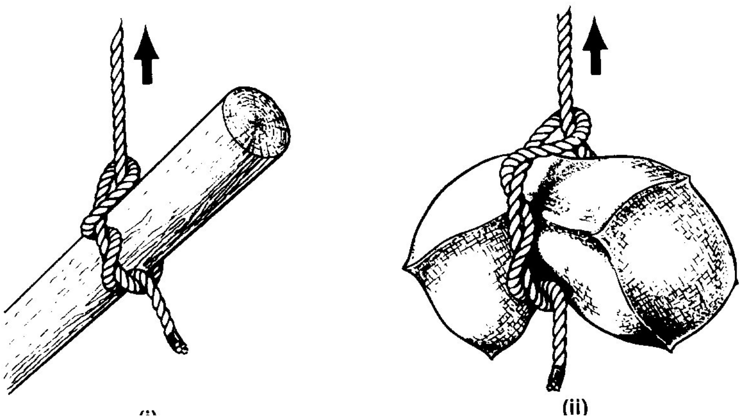


Fig 3-64. Timber Hitch

i. **Timber Hitch and Half Hitch** (Fig 3-65). Used to tow, hoist or lower a spar. If the spar is tapered it should be towed or hoisted thick end first, with the timber hitch at the thin end and the half hitch at the thick end.

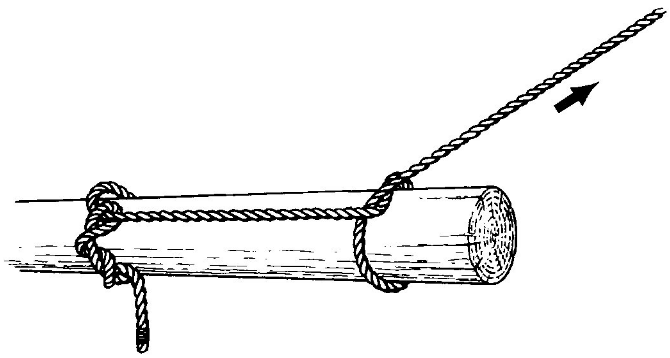


Fig 3-65. Timber Hitch and Half Hitch

j. **Clove Hitch** (Fig 3-66). This hitch is used to secure a rope to a spar, rail or similar fitting; also for many other purposes. It will slip along the spar or rail if subjected to a sideways pull. It can be made with the end or with the bight of a rope, as illustrated in Fig 3-66(a) and 3-66(b) respectively.

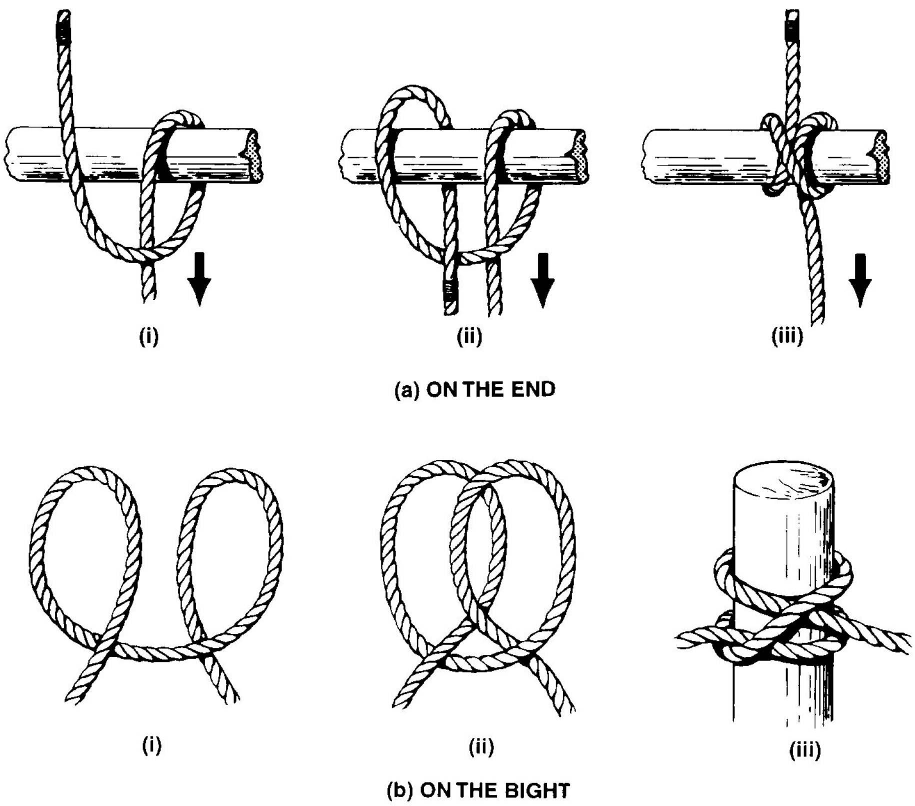


Fig 3-66. Clove Hitch

k. **Constrictor Knot**. The constrictor knot is a variation of the clove hitch, and is used when a firm grip is required, such as when holding a thimble in place prior to splicing a hawser eye. It is the most secure of all binding knots. Take a round turn, follow the arrow in Fig-67(I) and haul taut.

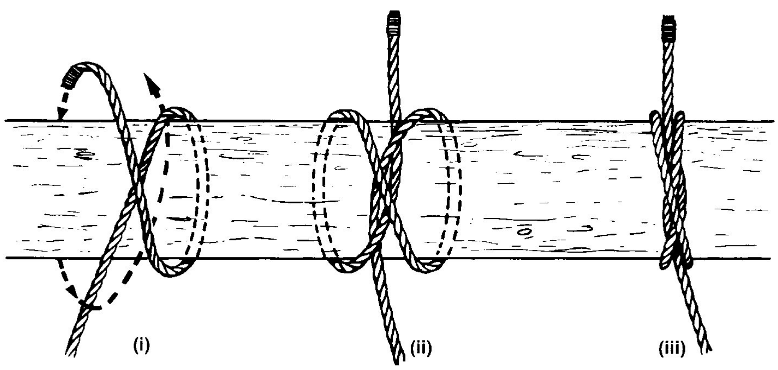


Fig 3-67. Constrictor Knot

l. **Rolling Hitch** (Fig 3-68). This hitch is also used for securing a rope to a spar, rail or similar fitting when the pull is expected to be from one side or the other, and to another rope under strain. It is made by passing the end twice round the spar or rope, each turn crossing the standing part. A half-hitch on the opposite side completes the hitch. Always pass the two turns on the side from which the pull is expected.

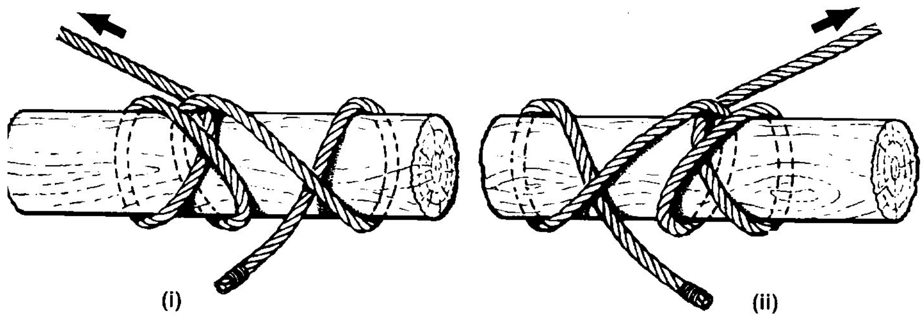
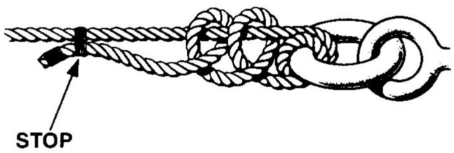


Fig 3-68. Rolling Hitch

m. **Round Turn and Two Half Hitches** (Fig 3-69). This combination is used to secure a heavy load to a spar, ring or shackle such as the buoy shackle of a mooring buoy. It will never jam and can be cast off quickly. The end should be stopped to the standing part.



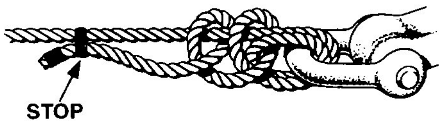


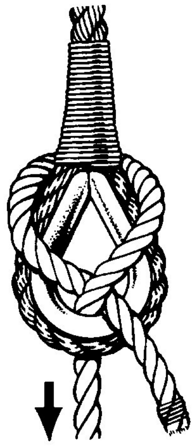
Fig 3-69. Round Turn and Two Half Hitches

Fig70. Fisherman's Bend

n. **Fisherman's Bend** (Fig 3-70). An alternative to a round turn and two half hitches, and normally used for bending a rope or hawser to the ring of an anchor. It is more suitable for a jerking pull, but will tend to jam and is not easily cast off. The end should be stopped to the standing part.

o. **Sheet Bend or Swab Hitch** (Fig 3-71). This is used to secure a rope's end to a small eye, eg, the lazy painter of a boat at a boom to the Jacob's ladder. It is also used to bend a small rope to a large one.

p. **Double Sheet Bend** (Fig 3-72). A more secure method of accomplishing the same purpose as a single sheet bend. Used to secure a boat's painter to the eye of the lizard when at a boom.



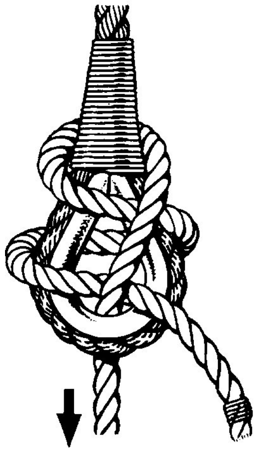


Fig 3-71. Sheet Bend **Fig 3-72. Double Sheet Bend**

q. **Buntline Hitch** (Fig 3-73) This hitch is a clove hitch on the standing part, and is used to secure a rope's end to a cringle or a small eye. It is more difficult to cast off than a sheet bend.

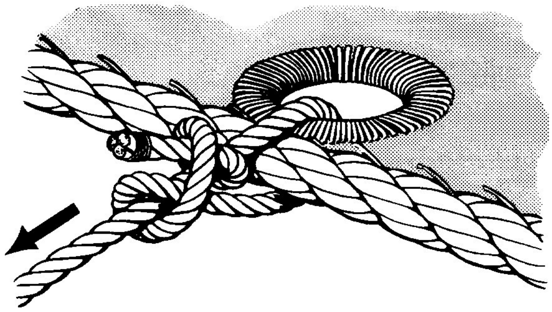


Fig 3-73. Buntline Hitch

r. **Blackwall Hitch** (Fig 3-74). A quick means of attaching a rope to a hook. It is used when the rope and hook are of equal size and it is likely to slip if subjected to more than ordinary strain.

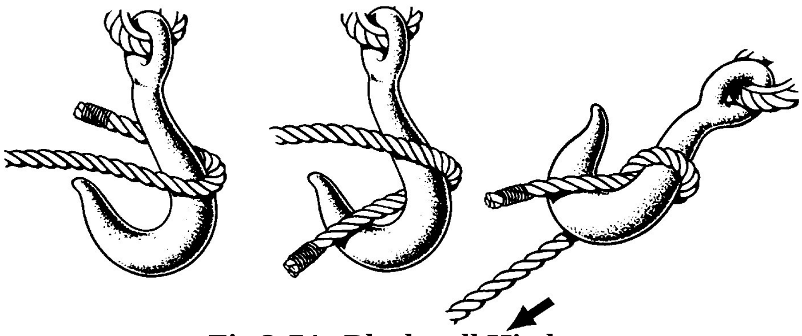


Fig 3-74. Blackwall Hitch

s. **Double Blackwall Hitch** (Fig 3-75). Used when the rope and hook are of unequal size. It is as secure as the midshipman's hitch (below).

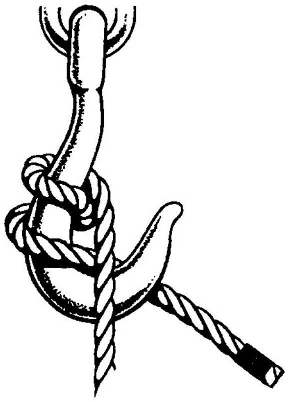


Fig 3-75. Double Blackwall Hitch

t. **Midshipman's Hitch** (Fig 3-76). An alternative to the Blackwall hitch; it is preferred if the rope is at all greasy. It is made by first forming a Blackwall hitch and then taking the underneath part and placing it over the bill of the hook.

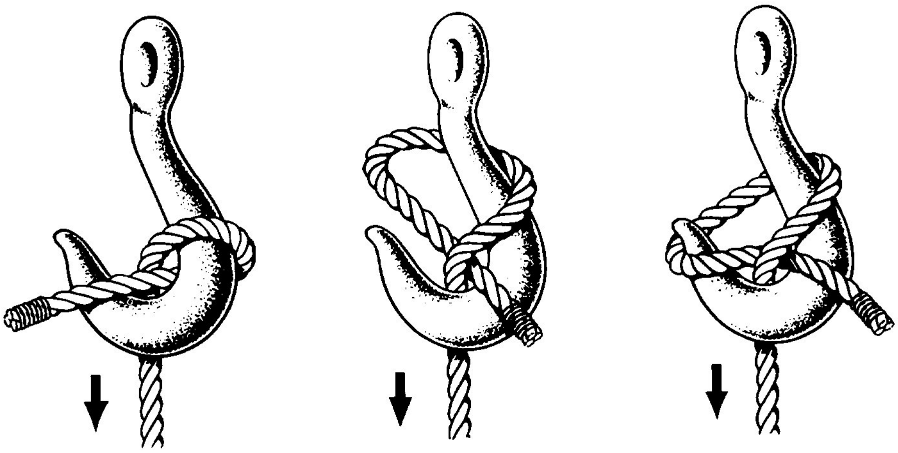


Fig 3-76. Midshipman's Hitch

u. **Bowline** (Fig 3-77). This is the most useful knot for making temporary eyes in ropes of all sizes. It is used for bending a heaving-line to a hawser, as a lifeline round a man's waist and for a great variety of similar purposes. Every member of a ship's company should be able to tie a bowline round his waist with his eyes closed. The bowline is usually made in the following manner, which enables it to be formed while there is a strain on the rope. Take the end in the right hand and the standing part in the left. Place the end over the standing part and hold the cross thus formed between the index finger and thumb of the right hand, with the thumb underneath; the loop so formed becomes the bight of the bowline, and if required it can be formed round the body of the man making the knot. Then turn the wrist to the right, away from the body, and bring the end up through the loop so formed; this loop is sometimes called the gooseneck. Now hold the cross of the gooseneck in the left hand as shown in Fig 3-77, leaving the right hand free to manipulate the end, and complete the bowline by dipping the end under the standing part, bringing it up again, and passing it down through the gooseneck.

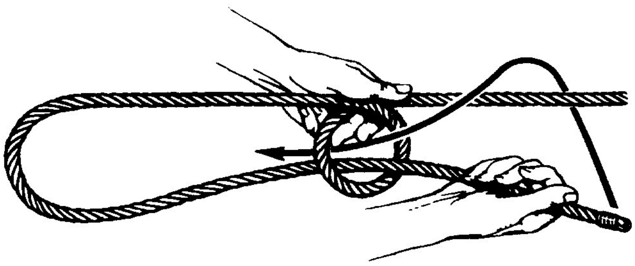


Fig 3-77. Bowline

v. **Running Bowline** (Fig 3-78). Used to make a running eye in the end of a rope; it must never be placed round a man's body.

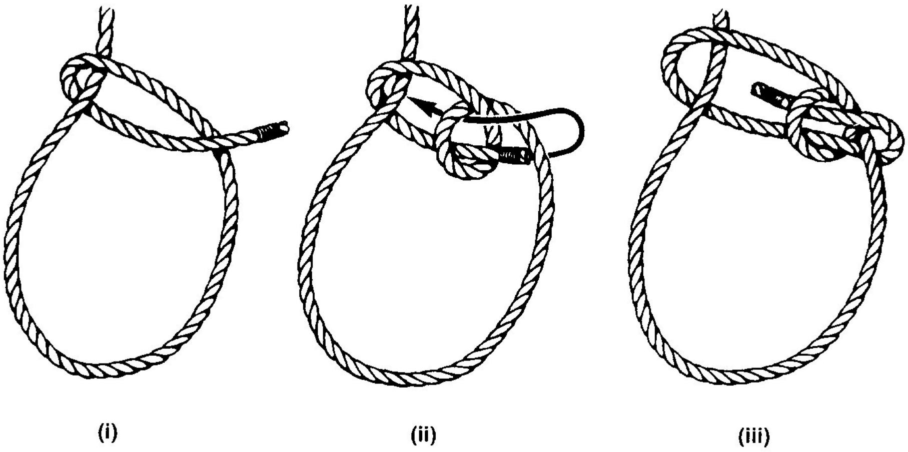


Fig 3-78. Running Bowline

w. **Bowline on the Bight**. (Fig 3-79). As its name implies, this bowline is made on the bight, the first two operations in its formation being the same as for a simple bowline. It can be used for lowering a man from aloft or over the ship's side, the short bight being placed under his arms and the long one under his buttocks.

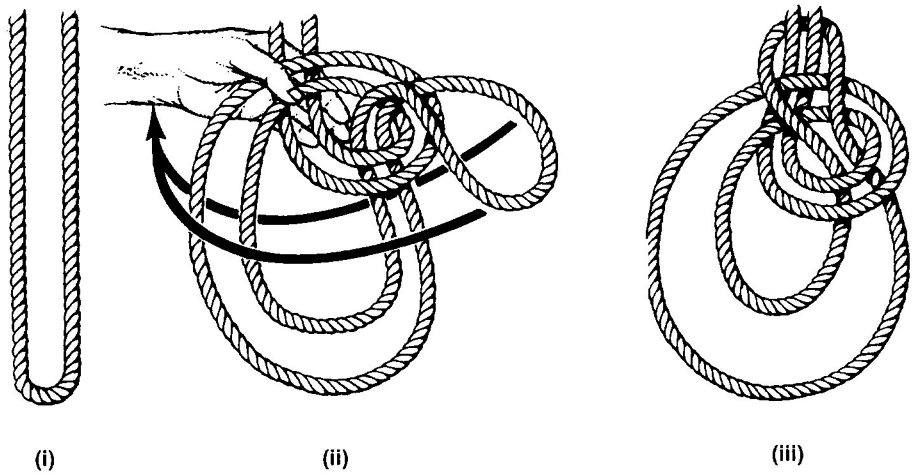


Fig 3-79. Bowline on the Bight

x. **French Bowline** (Fig 3-80). An alternative to the bowline on the bight and usually more suitable. It is made in a similar manner to a bowline, except that after the gooseneck has been formed and the end passed up through it the end is brought round and up through it again, so as to form a large bight which is passed under the man's armpits. The knot is then completed as a simple bowline. The weight of the man sitting in the main bight keeps the arm bight taut, the knot lying roughly at his breast.

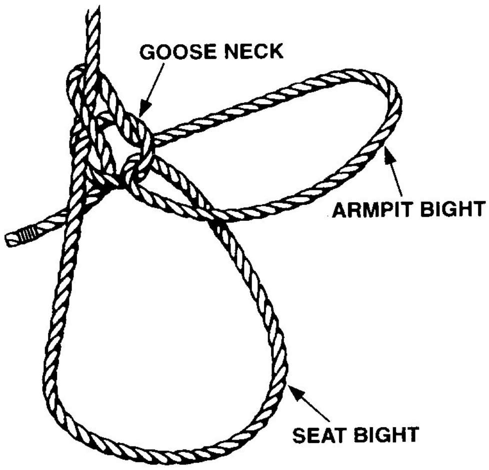


Fig 3-80. French Bowline.

y. **Slip Knots** (Fig 3-81). The sheet bend, the bowline and the clove hitch are the three main knots which can be released quickly by using a bight instead of an end in the last phase of making them. Such slip knots will hold steady strain fairly well, but cannot be trusted to stand a jerking pull.

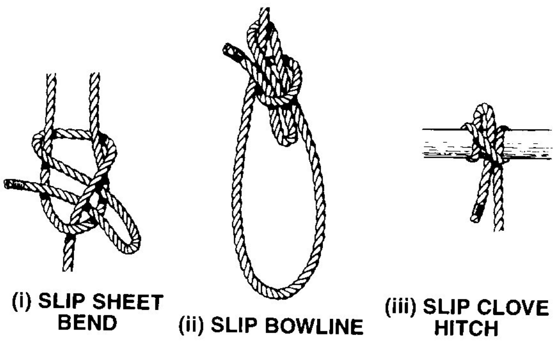


Fig 3-81. Slip Knots

z. **Monkey's Fist** (Fig 3-82). This is used to weight the end of a heaving line so that it will carry when thrown against the wind. It is made as follows:

(1) Wind three turns round the hand.

(2) Pass a second set of three turns across and round the first three.

(3) Pass a third set of three turns round and across the second set, but inside the first set and in the direction shown by the arrows; if the knot is correctly made the end will come out alongside the standing part.

(4) To finish the knot, work all parts taut and splice the end into the standing part; alternatively, tie an overhand knot in the end and finish it by tucking it inside the monkey's fist, then work all parts taut as before.

CAUTION

A MONKEY'S FIST, OR HEAVING LINE KNOT, MUST NOT BE WEIGHTED BY THE ADDITION OF A STEEL NUT OR SIMILAR ITEM.

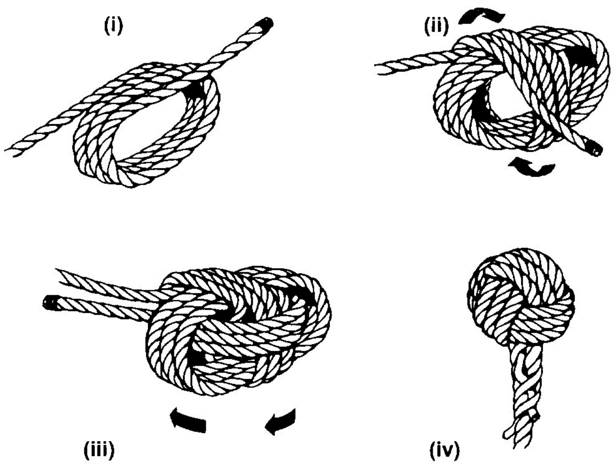


Fig 3-82. Monkey's Fist

aa. **Heaving-line Knot** (Fig 3-83). This knot is used as an alternative to the monkey's fist and is quickly and easily made. Form a bight about 1.5m long at the end of the line. Start frapping the end round both parts of the bight at about 20cm from the actual bend of the bight, and continue until it is all but expended. Then pass the end through the small loop left and haul on the standing part.

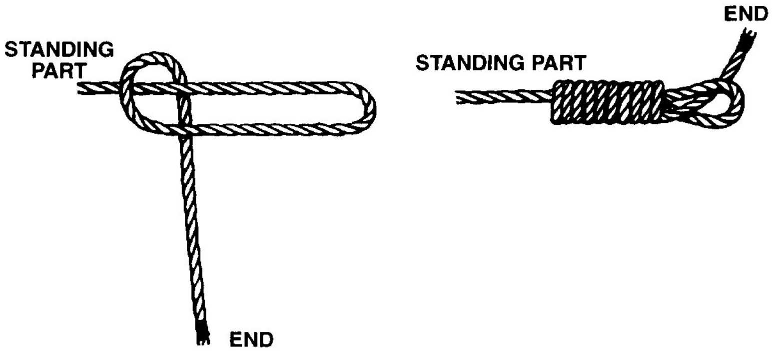


Fig 3-83. Heaving-line Knot

bb. **Fisherman's Knots**

(1) *Bending a Line to a Hook* (Fig 3-84). Reeve the end of the line through the eye, form a bight along the shank of the hook, then take several turns round the bight, starting from the eye and finishing through the end of the bight, Haul taut. This is very similar to the heaving line knot.

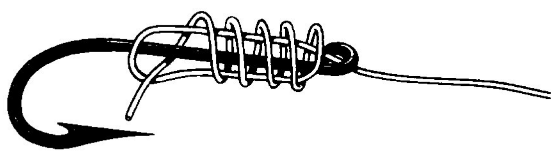


Fig 3-84. Bending a Polyamide Line to a Fishing Hook

(2) Joining a polyamide line (Fig 3-85). Make a heaving-line knot at the end of one length, then pass the other length through the bight before making a similar knot in it. Haul taut. The lines must be moistened before the knot is tied.

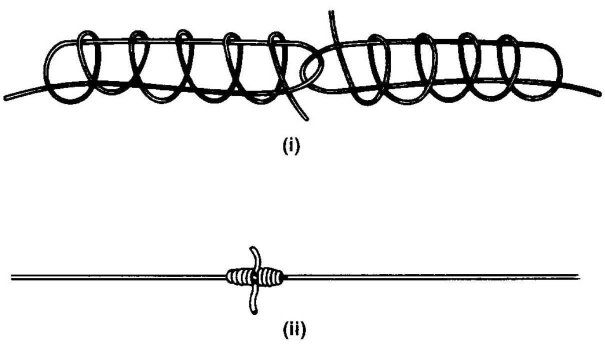


Fig 3-85. Joining Polyamide Lines

cc. **Sheepshank** (Fig 3-86). This is used to shorten the bight of a rope temporarily without cutting it. The strain on the rope will usually prevent the sheepshank from slipping, but if necessary the loops can be stopped to the standing parts or secured with a toggle.

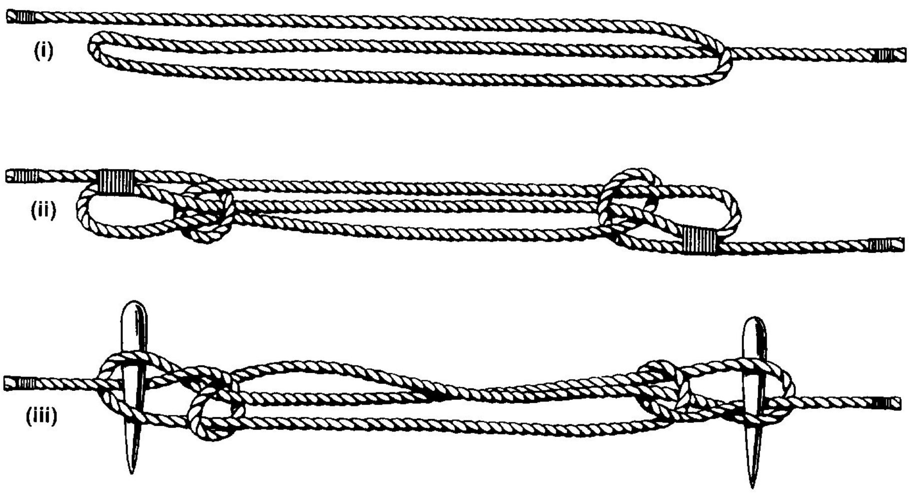


Fig 3-86. Sheepshank

dd. **Single Carrick Bend** (Fig 3-87). Used for joining two hawsers together when the join will have to pass round a capstan or winch. The ends should be stopped to their standing parts. Make a cross in one end of rope with the fag end on top, then bring the other rope's end up through the bight of the first, over the cross, down between the standing part and fag end, and back up through the bight on the **opposite** side to the first fag end.

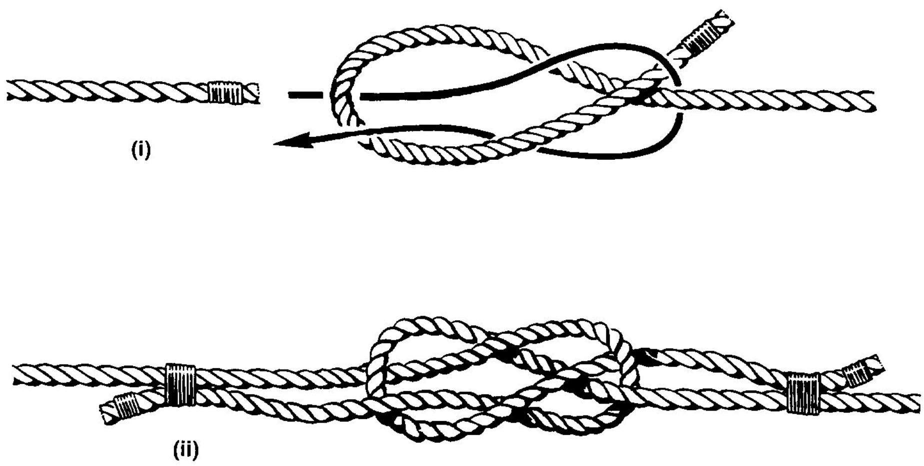


Fig 3-87. Single Carrick Bend

ee. **Double Carrick Bend** (Fig 3-88). This is used when a more secure bend than the single carrick bend is required.

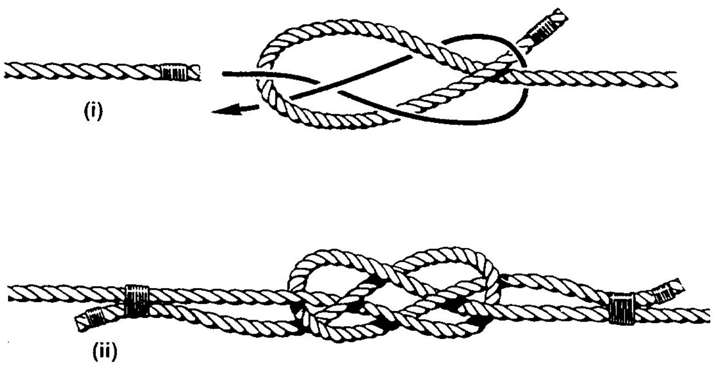


Fig 3-88. Double Carrick Bend

ff. **Lorry-driver's Hitch** (Fig 3-89). This hitch is useful as a means of gaining purchase on cover lanyards or frapping lines etc. Form an eye, as for one end of a sheepshank, at a convenient point on the bight of the rope (Fig 3-89(i)). Lead the end of the rope through or round the securing point, then through the formed eye on the bight of the rope (Fig 3-89(ii)). Haul the rope taut and secure with a rolling hitch (Fig 3-89(iii)).

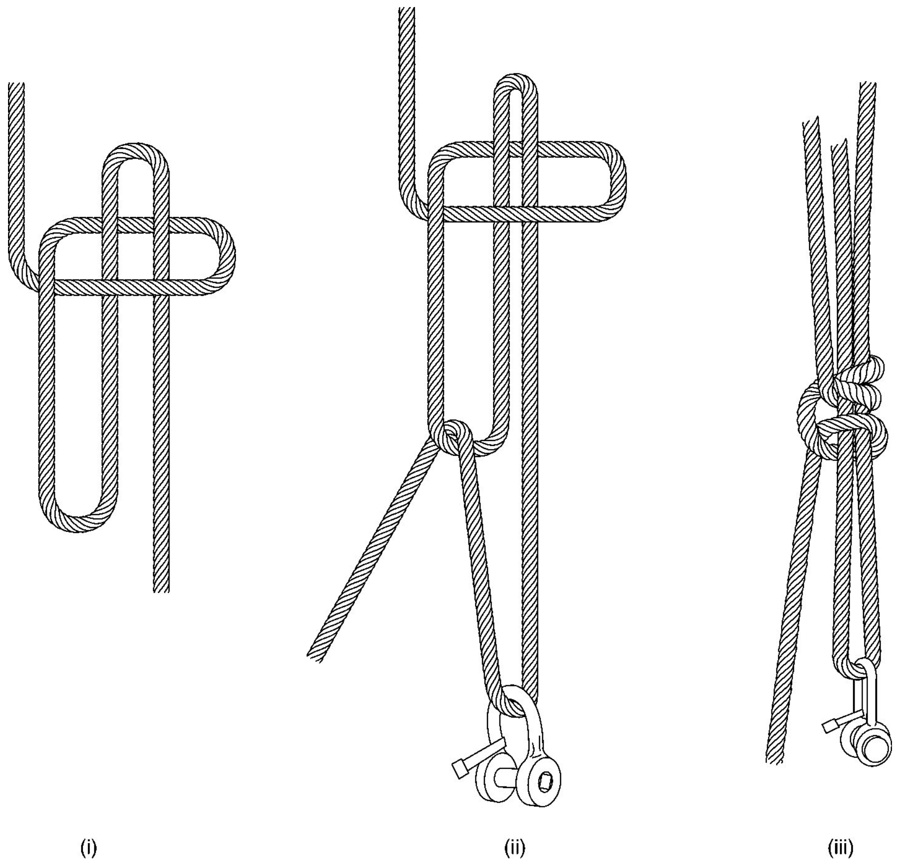


Fig 3-89. Lorry Driver's Hitch

03016. Knots

The functions of a knot have been described earlier. Here is described how a few commonly used knots are made. To assist in the description the strands are lettered A, B, C, etc., and their respective bights a, b, c, etc.

a. **Crown Knot** (Fig 3-90). When finished, the crown knot leaves the three strands pointing back along the rope. It is used to begin a back splice and as a basis for more complicated knots, but seldom on its own. To form a crown, whip the rope at a distance from its end equal to 12 times its diameter. Then unlay the strands to the whipping, whip their ends, and spread them out in the form of a star, with the centre strand farthest away from the body; and then (Fig 3-90) bring strand C to the front to form a loop (I); place strand A over C and behind B (ii); thread strand B through the loop of C (iii); pull all strands taut until knot is tidy and uniform (iv).

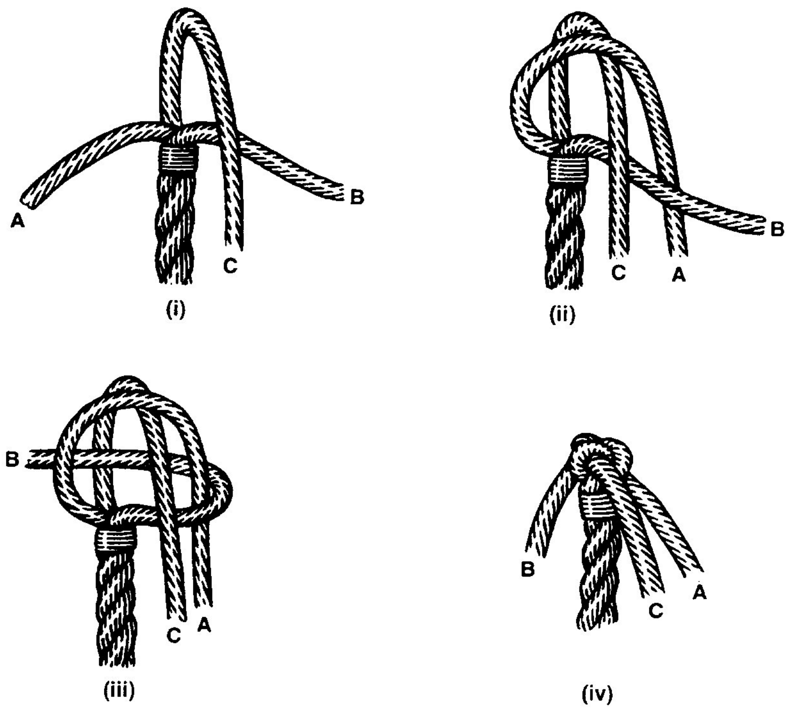


Fig 3-90. Making a Crown Knot

b. **Wall Knot** (Fig 3-91). When finished, the wall knot leaves all three strands pointing in the original direction. It is, in fact, a crown knot turned upside down. Prepare the rope as for a crown; then take strand A and pass it under B; take strand B round A so as to enclose it, and pass it under C; take strand C round B so as to enclose it and bring it **up** through the bight **a**. If the wall is to be used by itself to prevent a rope unreeving, the strands should be whipped together where they emerge from the knot and the ends should then be cut off.

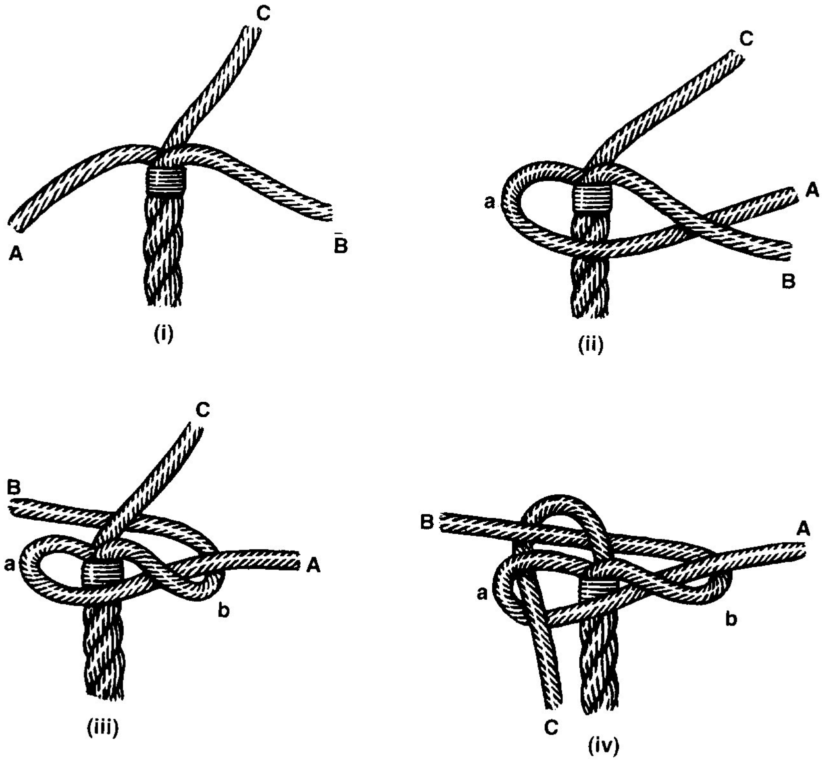


Fig 3-91. Making a Wall Knot

c. **Wall and Crown Knot**. This can be used to prevent a rope such as a rudder lanyard from unreeving, and also to form the foundation for more advanced knots. The whipping is placed at a distance from the end equal to 20 times the diameter of the rope, the wall being formed first and the crown made on top of it.

d. **Crown and Wall Knot** (Fig 3-92). This differs from the wall and crown in that the crown is made first and the wall formed under it. It is used for finishing off the end of seizings to prevent them from unreeving. The strands are unlaid right down to the turns of the seizings, against which the crown is formed as close as possible. The wall is then made under it and hauled taut, thus jamming the knot in tightly.

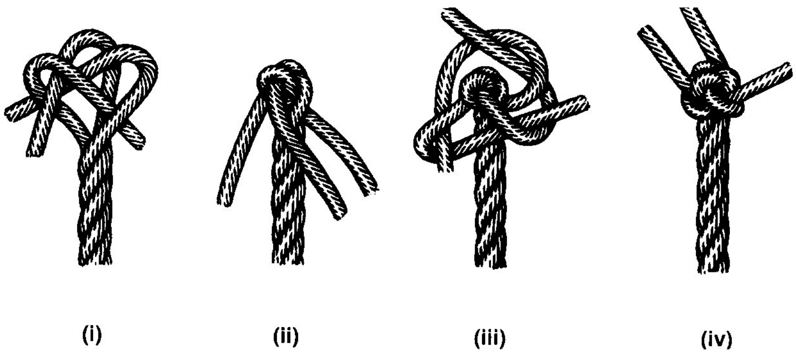


Fig 3-92. Making a Crown and Wall Knot

e. **Manrope Knot** (Fig 3-93). The manrope knot is a decorative knot made at the ends of gangway manropes to prevent them unreeving, and to afford a handhold for anyone climbing aboard. To make the knot, whip the rope at a distance from its end equal to 20 times its diameter, unlay the strands to the whipping, and whip their ends. Make a wall and crown, keeping the knot fairly loose (Fig 3-93(I)). Then take strand A and follow it round its own part, thereby doubling-up strand A (ii). Work the other two strands similarly, haul all parts taut, and cut off the ends where they protrude from the base of the knot (iii).

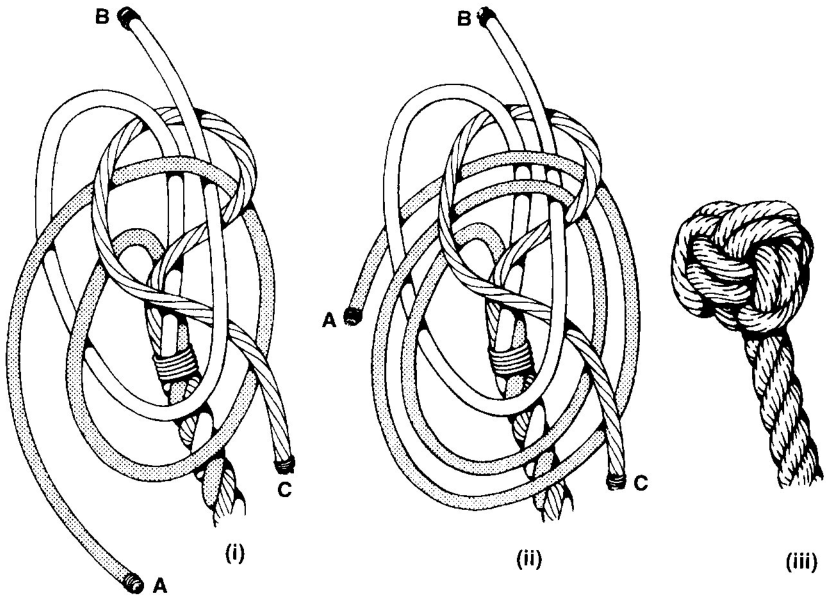


Fig 3-93. Manrope Knot

f. **Turks Head**. The turk's head is an ornamental knot supposed to resemble the turban once worn in Turkey, and should consist of three or more parts followed round two or more times. It may be made either as a standing or a running knot, according to whether it is to be fixed to an end or a bight, or is to be formed round another part of rope or a stanchion for example. Four different forms of this knot are described below.

(1) *Standing Turk's head, Made at the End of a Rope.* This is a manrope knot, but the ends are followed round a third or fourth time. Before starting the knot, however, the strands must be unlaid for a distance of not less than 25 times the diameter of the rope. (See Fig 3-94).

(2) *Running Turk's head, Made at the End of a Rope and Round its own Bight* (as in a running lanyard), is similar to a standing Turk's head made at the end of a rope, except that the wall and crown with which it is begun are made round the bight of the rope. The strands are then followed round two or more times, thereby forming a knot which will slide up and down the bight. (See Fig 3-95).

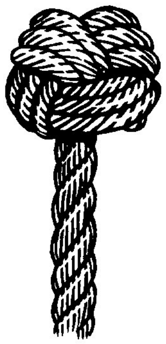


Fig 3-94. Standing Turk's Head

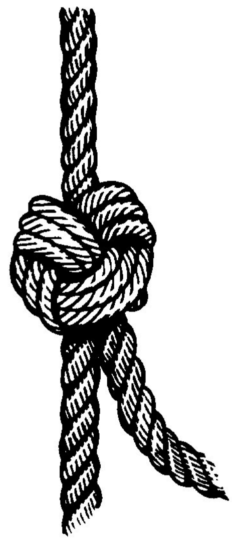


Fig 3-95. Running Turk's Head

(3) *Standing Turk's Head, Made on the Bight of a Rope.* This is formed from a three parted length of line, called a **spider**, which is tucked into the centre of the rope so that its parts emerge from the strands equidistantly. The spider is made up by tucking a length of line into the bight of another line (Fig 3-96(i). The length of each leg should not be less than 20 times the combined diameters of the rope and line. Having inserted the spider (Fig 3-96(ii)), crown the ends round the rope left-handed (Fig 3-96iii), and then turn round and crown them back right-handed (Fig 3-96(iv)). Now follow each part round with its own end two or more times (Fig 3-96(v)), work all parts taut, and cut off the ends.

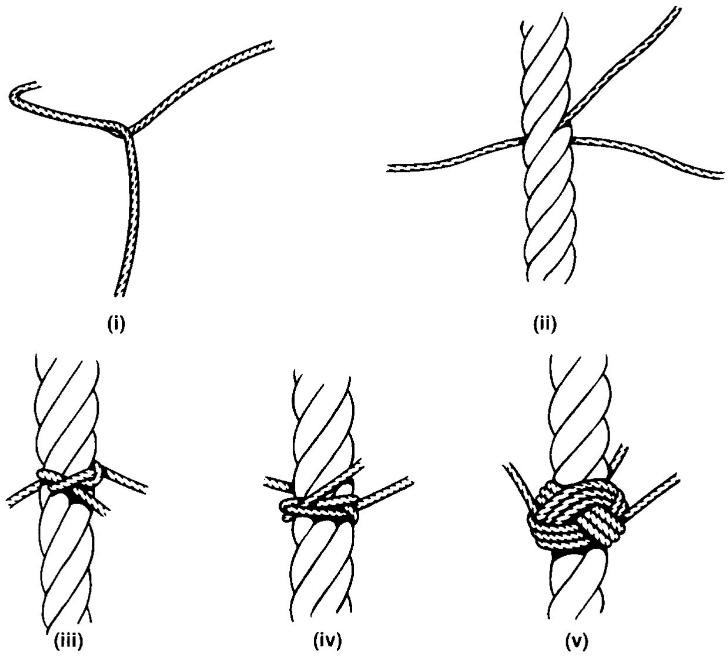


Fig 3-96. Standing Turk's Head on a Bight

(4) *Running Turk's Head, Made Round a Bight of Rope, a Stanchion or Other Fitting* is formed out of a single length of rope. A half hitch is made round the rope or fitting, and then followed by a round turn; the end is then dipped under the bight of the half-hitch (Fig 3-97(I)). The bights round the rope are crossed, the bight which is on the same side as the end of the line being placed underneath. The end is then passed down between the bights (Fig 3-97(ii)) and brought over the other side. The second and third operations are repeated until the rope is encircled (Fig 3-97(iii). The ends are then followed round as often as may be required, all parts are hauled taut (Fig 3-97(iv)) and the two ends finished off with a crown and wall.

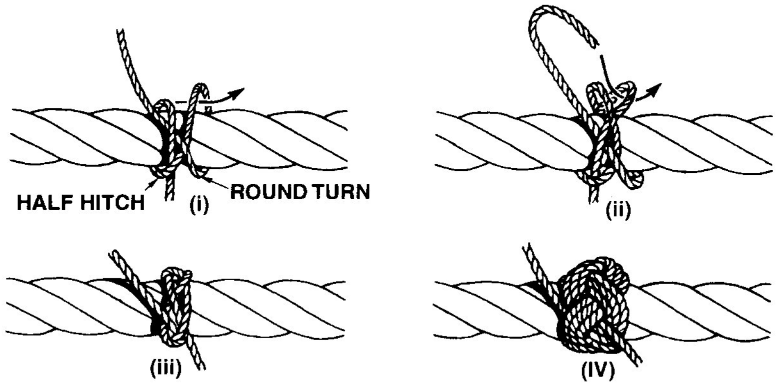


Fig 3-97. Running Turk's Head on a Bight

03017. Whippings

A whipping is the binding round the bare end of a rope to prevent the strands unlaying. Four types of whipping are described below.

a. **Common Whipping** (Fig 3-98). Seaming or roping twine is used when the rope is not large, and small stuff is used on a large rope. Place the end of the twine along the rope as in Fig 3-98(i; pass turns of the twine over the rope against its lay, working towards the end of the rope, and haul each taut. Then lay the other end of the twine along the rope, as in Fig 3-98(ii), and pass the remaining turns over it, taking the bight of twine over the end of the rope with each turn. When the bight becomes too small to pass over the end of the rope, haul this second end of the twine through the turns which you have passed over it until taut, thus completing the last turn round the rope, and cut off the end (Fig 3-98(iii and iv)). An alternative finish, which can be used when the whipping is on the bight of the rope, is to take the last three or four turns loosely over one finger and pass the end back through them. Work the turns taut, and haul the end taut as above.

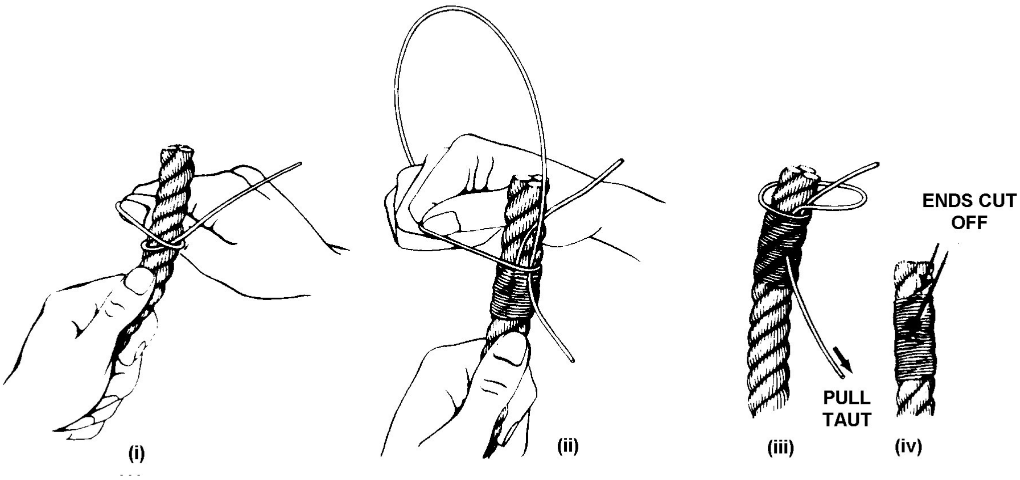


Fig 3-98. Common Whipping

b. **West Country Whipping** (Fig 3-99). Middle the twine on the rope in the position required, pass the two ends round the rope in opposite directions and half-knot them on the other side; now bring the ends up and half-knot them again, and continue in this manner, making a half-knot every half turn so that the half-knots lie alternately on opposite sides of the rope. Finish off with a reef knot.

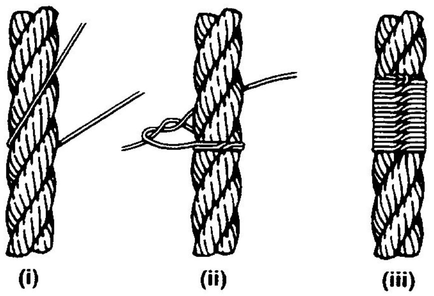


Fig 3-99. West Country Whipping

c. **American Whipping** (Fig 3-100). This is similar to the common whipping except that the first end of twine is left out clear between the first and second half of the turns. The two ends are secured together with a reef knot and cut off.

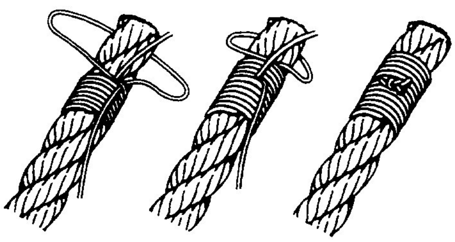


Fig 3-100. American Whipping

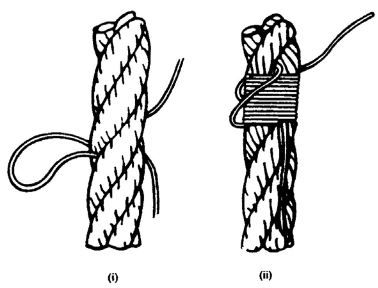


Fig 3-100. Sailmakers Whipping

d. **Sailmakers Whipping** (Fig 3-101). This whipping is the most secure, but of course it can only be used on hawser-laid rope. Unlay the end of the rope for about 50mm and hold it in the left hand pointing upwards, with the middle strand farthest away. Make a bight in the twine about 200mm long and pass this bight over the middle strand only, with the two ends towards you. With the bight of twine hanging down the back of the rope and the ends pointing down in front, lay up the rope with the right hand. Leave the short end of twine where it is and, with the long end, pass the turns of the whipping, working towards the end of the rope against the lay. When sufficient turns are on, take the bight of twine, pass it up outside the whipping, following the lay of the strand around where it was originally put, and pass it over that strand, where the latter comes out at the end of the rope (Fig 3-101(i)). Now haul on the short end so as to tighten the bight, then bring this end up outside the whipping, again following the lay of the rope, and then reef knot the two ends in the middle of the rope and out of sight (Fig 3-101(ii)).

03018. Mousing

a. **Introduction**. A mousing is used for keeping the pin of a screw shackle or slip in position, or to prevent inadvertent unhooking from an open hook. Shackle and slip pins must always be moused with seizing wire (Fig 3-102 and Fig 3-103). All hooks now in use in the Royal Navy incorporate a spring-loaded safety catch; however, should an open hook be encountered the method of mousing it with seizing wire is shown in Fig 3-104. Pattern numbers for mild steel seizing wire are given in Table 3-15. The pattern number for stainless steel seizing wire is given in the sub paragraph beneath Table 3-15.

b. To allow quicker transfer and greater use of working running rigging, whilst retaining basic safety, INSULOK ties may be used for non-standing parts. Ships may use INSULOK ties instead of wire mousing for screw shackle bolts on temporary working rigging. On completion of the evolution, temporary working rigging is to be de-rigged. Rigging which requires to remain rigged for more than 24 hours, a wire mousing is to replace INSULOK's. Where any doubt exists as to whether rigging is temporary or permanent, wire mousing should be used. Likewise INSULOK's are not to be used where there is a risk of personnel sustaining injuries or cuts, ie, on guardrails, gangway screens, hatch shackles and distance lines (cyalume attachment) etc.INSULOK's come in four sizes and are easy to apply:

(1) For screw shackles up to 3t proof load.

0262/746-8554 186mm x 4.7mm
0262/746-8555 360mm x 4.7mm

(2) For screw shackles of 3t PL and above:

0262/746-8556 339mm x 7.6mm

***Note**. To permit ease of access for damage control/fire fighting teams, shackles attaching safety chains/wires to stanchions around internal hatches are not to be moused. However, these shackles must be regularly checked to ensure the pins are fully screwed home.*

b. **Passing a Mousing**. To mouse a shackle pin with seizing wire (Fig 3-102) middle a 250mm length of the wire through the eye of the pin and twist the two parts together two or three times to attach the wire to the pin; then pass the two ends of the wire in opposite directions three or four times round the shank of the shackle and back through the eye of the pin, making sure that each turn is tight. Finish off by twisting the two parts tightly together two or three times, then cut off any surplus wire 20mm from the final twist and bend down the ends. When mousing a slip pin (Fig 3-103) attach one end of a 250mm length of seizing wire to the eye of the pin, then wind the wire tightly in figure-of-eights across the tongue of the slip and round the pin, locking the pin in position. Three or four turns of wire are normally required, but because of the possibility of an emergency breakaway, a mousing on a slip used in replenishment rigs and towing consist of one full figure-of-eight turn. A mousing on an open hook is applied as shown in Fig 3-104. 'R' clips are replacing straight pins in slips; these do not require mousing.

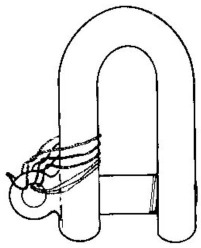


Fig 3-102. Mousing a Shackle

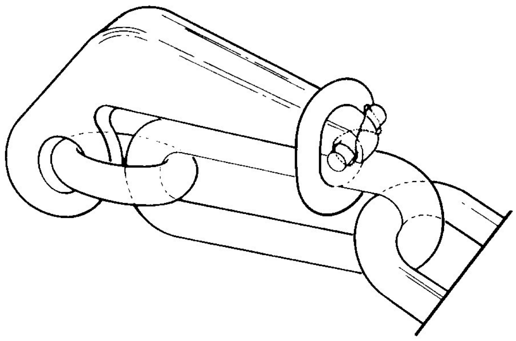


Fig 3-103. Mousing a Slip

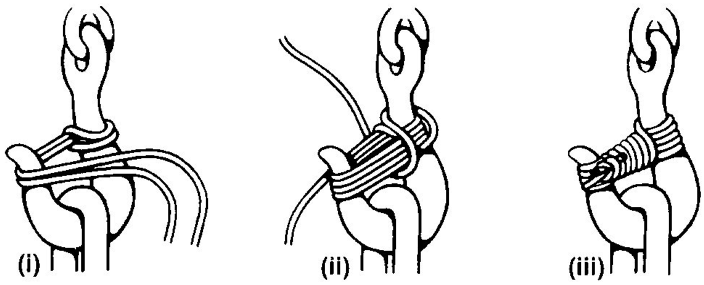


Fig 3-104. Mousing an Open Hook

03019. Seizings

a. **Types of Seizings**. A seizing is a method of fastening together two parts of rope sufficiently strongly to stand a required strain. Three standard seizings designed to meet certain specific standards are employed in the Royal Navy. Although, on occasion, departure from them in detail may be made, they should be regarded as the basis of all round work of this description.

(1) *Flat Seizing*. A light seizing for use when the strain on the two parts of rope is equal. It consists of one layer of approximately 11 round turns.

(2) *Round Seizing.* This is also used when the strain on the parts are equal, but it is stronger than a flat seizing. It consists of approximately 11 round turns and 10 riding turns; the number of riding turns is always one less than the number of round turns.

(3) *Racking Seizing.* When the strains on the parts of the rope are unequal or exerted in opposite directions a racking seizing is used. It is formed by passing one layer of racking turns, and then passing one of round turns so that they lie between the racking turns. The number of round turns is necessarily one less than the number of racking turns. Sufficient turns are taken for the length of the seizing to be equal to 3 times the diameter of the rope, eg, for racking two 24mm ropes an overall length of seizing of 72mm is required.

b. **Strength of Seizings**. For seizing cordage it is usual to use small stuff (polypropylene line, size appropriate to the rope being seized), although spunyarn is sometimes used for temporary seizings. When seizing wire ropes flexible mild steel wire is used. The number of turns to be used for a seizing depends upon the strength of the seizing stuff and the strain to which the seizing will be subjected. For cordage, 11 and 21 turns are recommended for flat and round seizings respectively, and a width of seizing equal to three times the diameter of the rope has been recommended for the racking seizing. These seizings are based on a size of seizing stuff of about one-seventh of the size of the rope, eg 6mm polypropylene line would be required for seizing a 40mm diameter polyamide rope.

c. **Making up Seizing Stuff** (Fig 3-105). Wind the seizing stuff round one hand, clockwise for left-hand lay, anti-clockwise for right-hand lay, with as many riding turns as are required, and finish with a clove hitch on the bight around the middle. Work with the first end which is drawn out through the opposite side of the coil, thus thorough-footing the seizing stuff and making it easier to work by taking the turns out of it. The turns in the coil are held in place by the clove hitch.

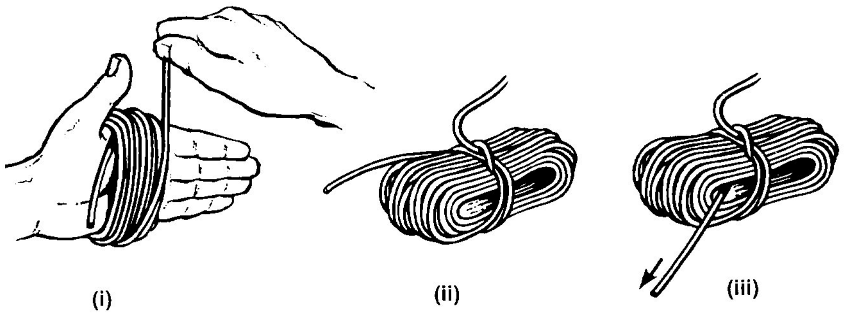


Fig 3-105. Making up Seizing Stuff

d. **Use of Heaving Mallet and Spanish Windlass**. When seizing heavy rope the turns must be hauled more than hand-taut, and for this purpose the following mechanical aids may be used:

(1) *Heaving Mallet* (Fig 3-106). The lower turns of a seizing can be tautened with a heaving mallet as follows:

(a) Lay the mallet in the bight of the line, as shown in Fig 3-106(i), and as close up to the work as possible.

(b) Take a turn diagonally round the head of the mallet, bringing the end up the opposite side of the handle (ii).

(c) Take half a turn round the handle, and take the end again behind the head (iii)

(d) Jam the end between the head and the standing part, and bring it up over the handle, as indicated by the dotted line in (iii).

(e) Place the head against the rope and heave, using the handle as a lever (iv).

(2) *Spanish Windlass* (Figs 3-107 and 3-108). This can also be used for tautening the lower turns of a seizing. The windlass is formed by taking a turn round a suitable bar with the line to be tautened, and then turning the bar with a lever inserted through a bight of this line, as shown in Fig 3-107. A Spanish windlass can also be used to rack the two parts of rope together before putting on the seizing. for this purpose it is formed with a strand, well greased along its middle part, with a spike inserted at each end of the bar for use as levers, as shown in Fig 3-108.

Note. *A metal heaving mallet is used for wire seizings, and after each heaving the mallet should be run up and down the part of the wire that has been round it, in order to straighten out the turns.*

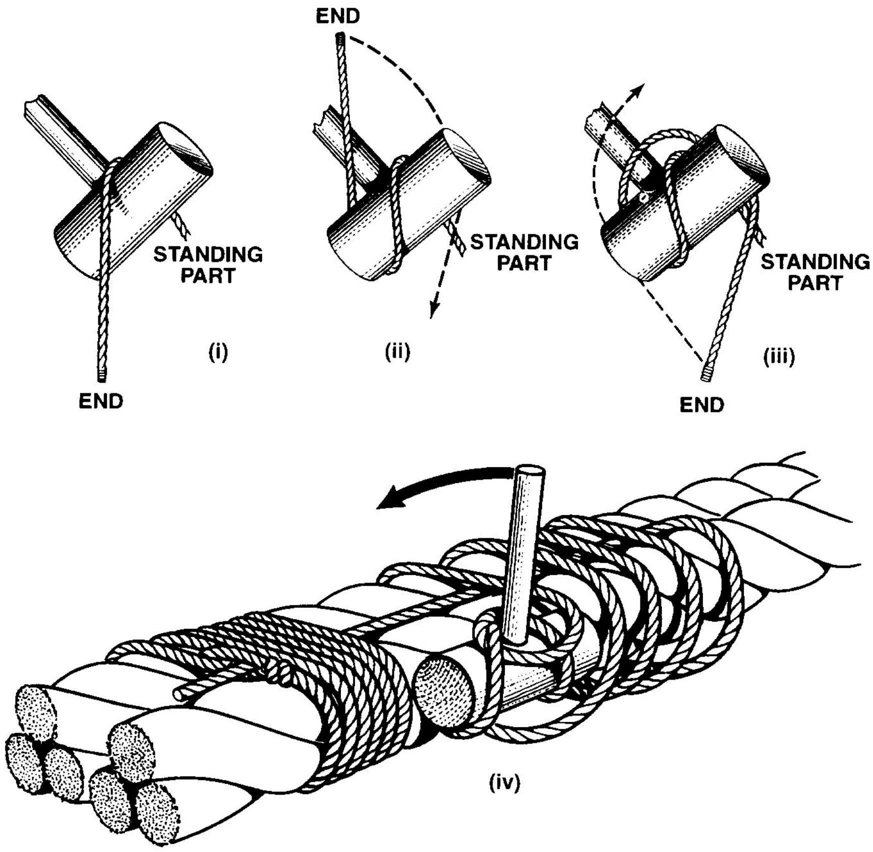


Fig 3-106. How to Use a Heaving Mallet

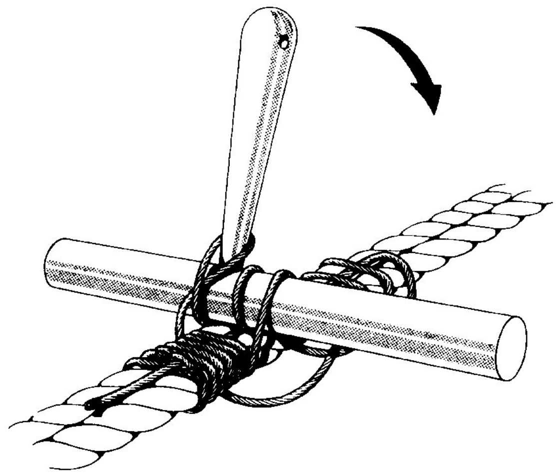


Fig 3-107. Spanish Windlass

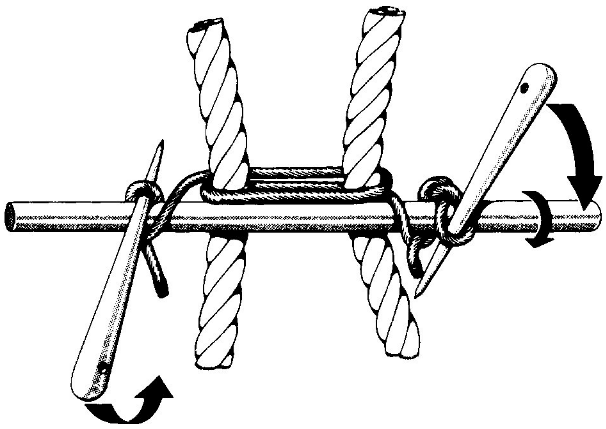


Fig 3-108. Racking Two Ropes with a Spanish Windlass

e. **Starting a Seizing**. Cordage seizings are begun by making a small eye in the end of the seizing stuff, wire seizings are started by taking the end round one of the ropes to be fastened and then half-hitching it round its own part. Take care to keep the eye or half-hitch in the centre and clear of both parts of the rope (Fig 3-109(I)).

f. **Passing a Flat Seizing**. Having begun the seizing as described, take the round turns very loosely round both parts of the rope, then pass the end back, along and between the two parts of the rope, under the turns and through the eye or half hitch of the seizing as in Fig 3-109(ii). Then heave each turn taut and take a cross turn round the seizing between the two parts of the rope, (iii). Now haul the seizing taut and secure its end with a clove hitch, one part of the clove hitch being on each side of the round turn, (iv). Finally, unlay the seizing stuff and finish off with a crown and wall close up against the hitch, or, if a wire seizing, break off the wire close to the hitch, and tuck away the ends so no harm will result when the rope is handled.

g. **Passing a Round Seizing**. Having begun the seizing as previously described, take the same round turns as in the flat seizing, pass the end down between the parts, up through the eye, and heave each turn taut with a heaving mallet or Spanish windlass as before (Fig 3-110(I)). The end is now in position to begin passing the upper or riding turns, which will become exactly between the parts of the lower turns. The number of riding turns is one less than the number of lower turns, and they are hove taut by hand. After passing the last riding turn, lead the end under the last turn of the lower turns and heave it hard taut (ii). Then take a cross turn round all parts of the seizing (iii), heave it well taut, and secure with a clove hitch each side of the round turn, as in the flat seizing (iv). Finish off as for a flat seizing.

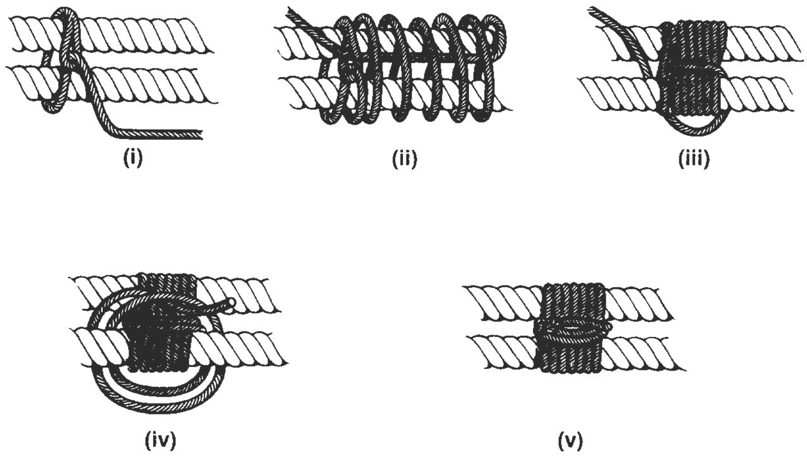


Fig 3-109. Passing a Flat Seizing

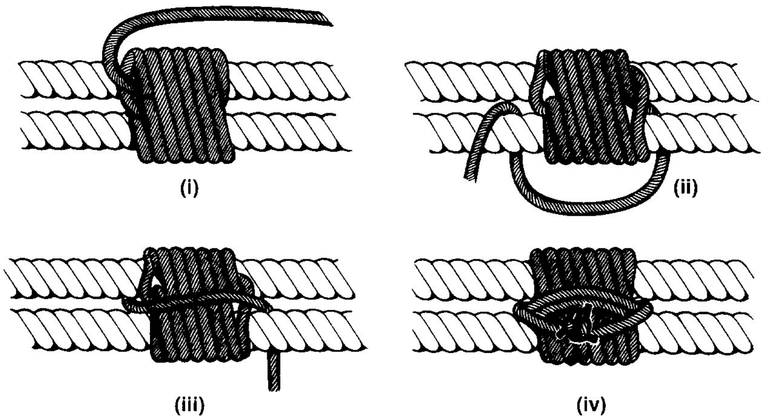


Fig 3-110. Passing a Round Seizing

h. **Passing a Racking Seizing**. Start the seizing as already described. If the seizing slips when taken round both parts of the rope, take the end round one part only and reeve it through the eye. Then dip the end between the two parts of rope and take a number of figure-of-eight turns round each part alternately, taking care to have the same number round each part and to leave room between each racking turn for the round turn which will come later (Fig 3-111(I)). When the racking turns have been hove taut, dip the end under the last turn and pass the round turns back towards the eye, filling the spaces between the racking turns (ii). When the last round turn has been passed, (see that there is one less than the racking turns), complete the seizing by taking one round turn around the whole seizing and forming a clove hitch between the two parts of the rope. Finish off as for a flat seizing.

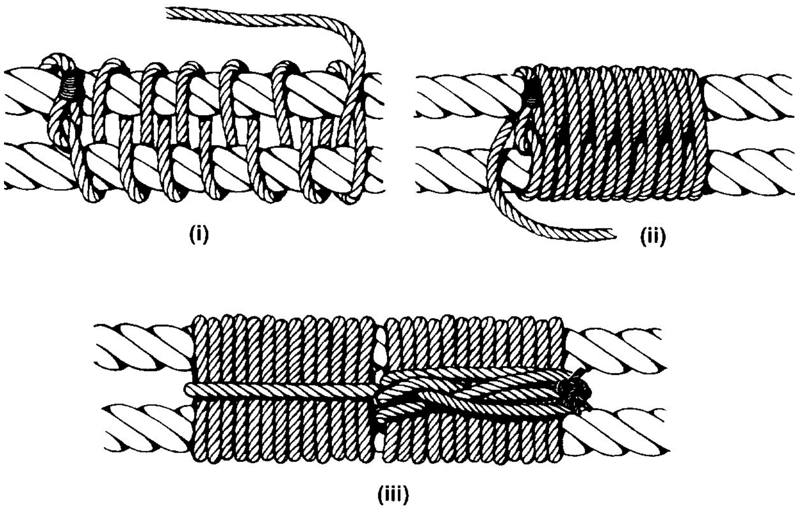


Fig 3-111. Passing a Racking Seizing

i. **Rose Seizing** (Fig 3-112). This seizing is used to secure an eye in a rope to a spar.

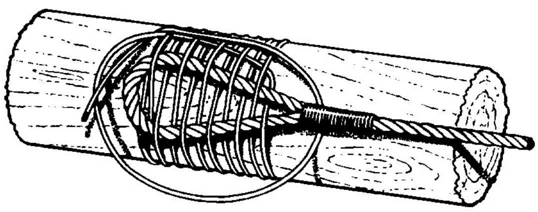


Fig 3-112. Rose seizing

03020. Worming, Parcelling and Serving

A rope or part of a rope is wormed, parcelled and served (Fig 3-113) to protect its outer surface against wear from chafing; make its outer surface smoother, so as to prevent other ropes from chafing when led over it; and, in the case of a steel wire rope, to protect the hands of those using it from the sharp ends of wire projecting from any splice in it. Worming, parcelling and serving is not necessarily damp-proof, and there is a danger that a rope may rot underneath its covering. Ropes so treated should therefore be inspected frequently for deterioration.

a. **Worming**. This consists of filling in the spaces between the strands with lengths of spunyarn or small stuff laid along the lay of the rope, and its object is to make the rope smooth and round.

b. **Parcelling**. This consists of binding the rope with strips of rot-proofed canvas, Hessian or similar material. The strips should be from 50 to 75mm wide and it is customary to bind them on in the direction of lay of the rope, working towards the eye. Each turn should overlap that preceding it by half the width of the strip, and the rope, if not man-made fibre, should first be well tallowed. When parcelling and serving a stay throughout its whole length the parcelling should be worked upwards from the eye of the lower splice to the eye of the upper splice, as this affords the maximum obstruction to the entry of water.

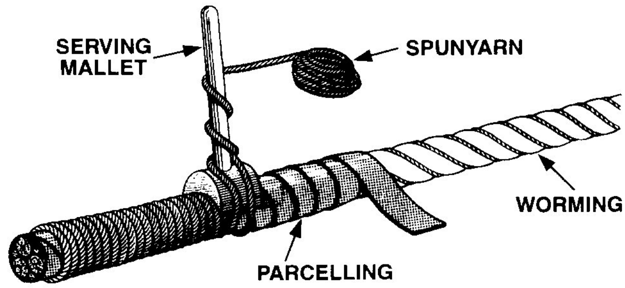


Fig 3-113. Worming, Parcelling and Serving

c. **Serving**. This consists of binding a splice or a length of rope with close turns of polypropylene line or spunyarn. (Flexible mild-steel wire rope can be used to serving steel wire rope). Each turn is hove taut with a special serving mallet which has a score in its head, to fit the rope, and a wooden handle about 400mm long. A service is always bound on in the direction opposite to that of the parcelling, so as to avoid bunching up the latter. It is therefore put on against the lay of the rope, a rule which can be memorised thus: **Worm and parcel with the lay, turn and serve the other way**. A serving is begun as for a common whipping, although when serving with the larger sizes of flexible mild-steel wire it may be necessary to stop the first end down to the rope until sufficient turns have been applied to hold it firmly. The first few turns are put on by hand and hauled taut with a spike or heaving mallet. The serving mallet is then placed on the rope and the turns of the service are passed as follows:

(1) Take a half-turn round the handle; then one turn round the fore end of the head of the mallet and the rope; then dog the serving round the handle of the mallet.

(2) To put on a serving, stand with the rope on your left side while facing in the direction in which the turns are advancing. Then pass the ball of spunyarn round and round in step with the serving. Having completed the required length, finish off the service by passing the end back under the last four turns, hauling all parts taut, and making a crown and wall, or, if finishing a wire seizing, break off the wire close to the hitch, and tuck away the ends so no harm will result when the rope is handled. Also, it is customary to finish the serving of a wire serving on an eye splice in a similar manner to that of a seizing; a cross turn is therefore taken round the last few turns of the serving, inside the neck of the eye, and is followed by a clove hitch, the ends of the wires being then broken off and tucked away.

Notes:

1. If serving over a restricted length of rope - up to an eye splice for example - which does not allow the mallet to advance ahead of the last turns, the serving stuff should be brought to the mallet as follows:

Up over the cut in the fore in the fore end of the head; one-quarter turn round the handle; one turn round the rope and rear end of the head (taken in the direction of the service, ie against the lay of the rope); and then dogged round the handle.

03021. Lashing

Two crossed spars can be secured together either with a **square lashing** or a **diagonal lashing**. Specific types of lashing are employed in rigging sheers or gyns and they are described later in this chapter. A square lashing is used when the spars are to be secured at right-angles to each other, and the diagonal lashing when they are to be secured at an acute angle to each other.

a. **Square Lashing** (Fig 3-114). Make fast one end of the rope to one of the spars with a timber hitch and haul it taut. Then cross the spars with the smaller spar lying underneath. Bring the other end of the lashing up over the larger spar, down and under the smaller, up and over the larger, and so on until sufficient turns have been taken. To avoid riding turns, the turns on the larger spar should lie in succession outside those first applied, and those on the smaller spar should lie in succession inside those first applied. Finish by taking two or three frapping turns round the parts between the spars, and make fast with a clove hitch round all parts or round one of the spars.

b. **Diagonal Lashing** (Fig 3-115). Make fast one end of the rope as for a square lashing, and pass as many turns as are required diagonally round both spars. Then bring the end up over one spar and take a few more turns across the opposite diagonal, finishing off as for a square lashing.

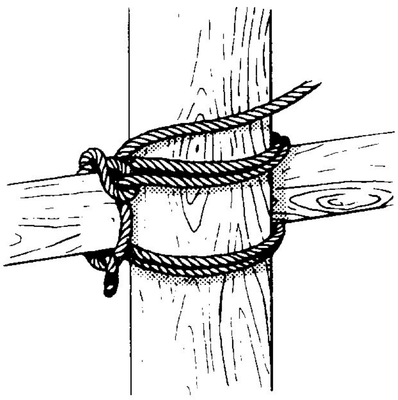


Fig 3-114. Square Lashing

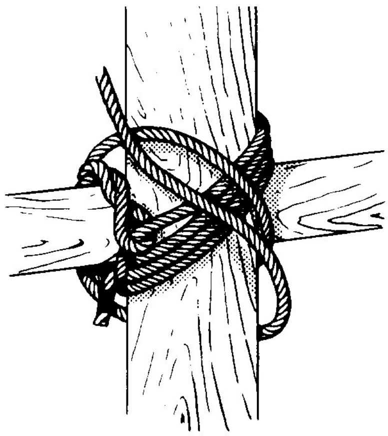


Fig 3-115. Diagonal Lashing

03022. Splicing Hawser-laid and Multi-plait Cordage

Splicing is a method of joining the ends of two ropes together, or of making an eye in the end of a rope, by interlocking the strands. Unless otherwise stated it should be accepted that all splices reduce the strength of a rope by one-eighth. The tools and equipment required for splicing hawser-laid or multiplait cordage are: a fid, which is a pointed wooden spike made of hardwood, a heaving mallet for heaving tucks into place, a sharp knife, and seaming twine, sailmaker's twine and PVC insulating tape for marling or taping up where necessary. A hot knife or candle should be available to heat fuse the ends of man made fibre cordage. When reference is made in the text on splicing to the **left** or **right** of a rope imagine yourself to be looking along the rope towards the end which you are handling.

a. **Special Considerations When Splicing Man-made Fibre Cordage**. Special care is needed when splicing man-made fibre cordage because an unsatisfactory splice may be dangerous. When unlaying strands make sure that the yarns are disturbed as little as possible. Each strand should be marled, or taped every 50mm, along its length to maintain its form. Firm whippings of twine or tape must be used and the ends of the strands must be heat fused. When making an eye splice a throat seizing is recommended. Serving a MMF cordage splice is not recommended because it tends to loosen when the rope's diameter decreases under load; if such a rope has to be served it must be very tight. When splicing man-made fibre hawser-laid rope five full tucks should be made if the ends of strands are to be dogged; to complete the splice the ends of strands should be fused. Four full tucks reduced to two-thirds and one-third should be made if the splice is tapered. If the splice is then served the first three tucks should be left uncovered. When splicing man-made fibre cordage take care that:

(1) Strands lifted for tucking are not kinked. To avoid strand distortion use a small fid of oval cross-section; then follow this with larger fids until it is just possible to pass the strand without distorting it.

(2) Strands are pulled back as far as possible.

(3) The rope is kept level the whole time and strands are lifted only high enough for the tuck to take place.

(4) The rope itself is not allowed to kink.

b. **Types of Splice**

(1) *Back Splice*. For finishing the end of a rope which is not required to be rove through a block; it prevents it from unlaying.

(2) *Eye Splice.* For making a permanent eye in the end of a rope. A **soft eye** is a small eye spliced in the end of a rope, and a **thimble eye** is formed by fitting and splicing the end of the rope round a thimble, the splice holding the thimble in place. It is fitted in the ends of cordage and wire ropes which are intended to be used in conjunction with a joining shackle or other rigging fittings. The **hawser eye** is an alternative to the thimble eye and just as efficient.

The eye is first spliced larger than the thimble, then the thimble is fitted into the eye and secured in place by a strong seizing just below it. This enables the thimble to be easily removed and replaced, merely by cutting the seizing and then renewing it. A **bollard eye** is a long soft eye, 1.5m long from crown to splice, fitted in the ends of berthing hawsers so it can be placed over bollards.

(3) *Short Splice.* For joining two ropes not required to pass through a block.

(4) *Long Splice.* For joining two ropes which are required to pass through a block. A well-made long splice does not increase the diameter of the rope and should not reduce its strength.

(5) *Cut Splice*. For making a permanent eye in the bight of a rope.

(6) *Chain Splice.* For splicing a rope tail into a chain which has to be led through a block of fairlead. The chain splice is not more than two-thirds of the strength of the rope.

c. **Back Splice in Hawser-laid Rope** (Fig 3-116). If splicing man made fibre cordage read Paragraph 03022a. This method of finishing the end of a rope must not be used if the rope is to pass through a block, eyeplate or similar fitting. Whip the rope at a distance from its end equal to 20 times the diameter of the rope, then unlay the strands to the whipping and whip the end of each strand. Make a crown knot (I), cut the whipping and then tuck each strand over one strand and under the next, to the left and against the lay of the rope, as shown in (ii). After each strand is tucked, pull the strands taut and tidy up this first tuck until each strand is uniform. Repeat this tucking twice more (iii), four times more if splicing MMF cordage. Always tuck to the left, using the next strand to the left. If the splice is to be served, as shown in Fig 3-117, taper it down after the third tuck (or fourth if splicing MMF) as follows:

(1) Take one-third of the yarns out of each strand and tuck the remaining two-thirds once, as already described; though discarded, the thirds should not be cut off until the splice is completed.

(2) Halve the reduced strands, then tuck one-half of each and leave the other.

(3) Haul all parts taut, including the discarded ends, which should now be cut off.

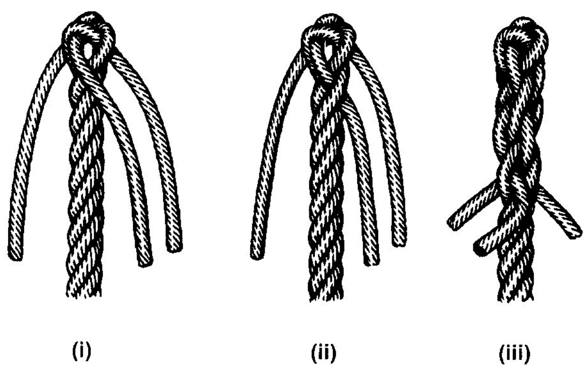


Fig 3-116. Making a Back Splice

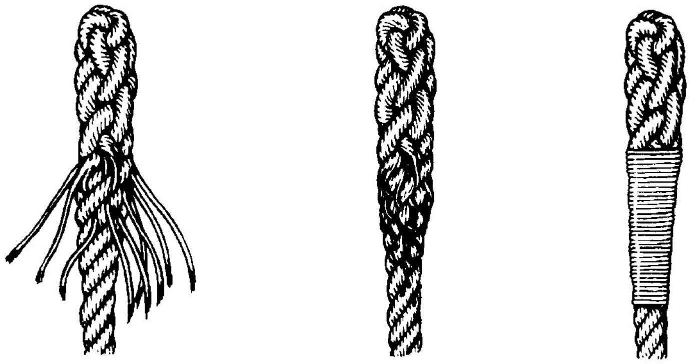


Fig 3-117. Tapering and Serving a Back Splice

d. **Soft Eye Splice in Hawser Laid Cordage**. If splicing man made fibre cordage read Paragraph 03022a. Whip the rope at a distance from its end equal to 20 times the diameter of the rope, then unlay it to the whipping and whip the end of each strand. Mark the place intended for the crown of the eye, and bend the rope back from there so as to bring the unlaid strands alongside the place where the splice is to be made, with the left and middle strands lying on the top of the rope (Fig 3-118); the set of the splice will depend on selecting this middle strand correctly.

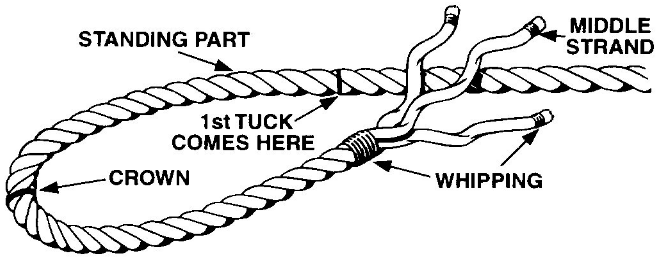


Fig 3-118. The Start of an Eye Splice in Hawser-laid Cordage

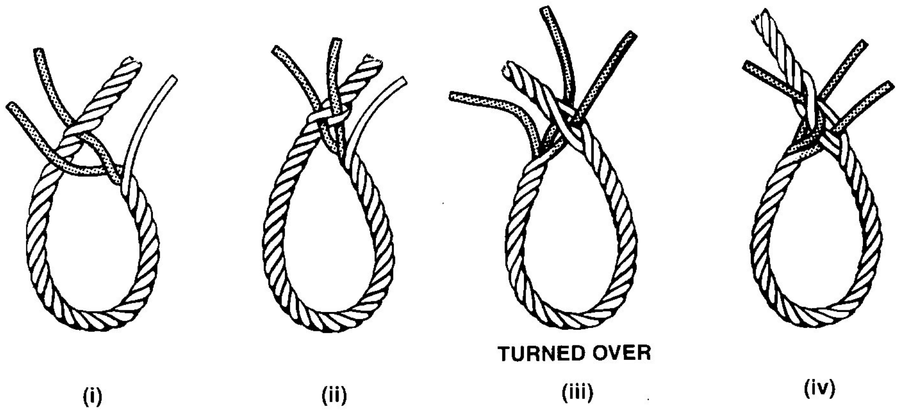


Fig 3-119. Making an Eye Splice

Now refer to Fig 3-119, in which the middle strand is marked A, the left-hand strand B, and the right-hand strand C, and make the splice as follows:

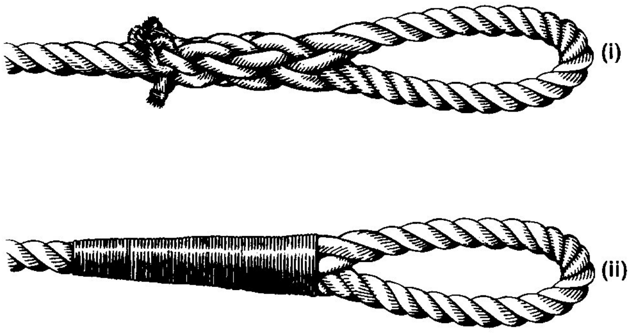
(1) Tuck A, from right to left, under the nearest strand of the standing part.

(2) Tuck B, from right to left, under the next strand of the standing part.

(3) Now turn the rope right over so as to bring the remaining strand C on the top, and then tuck C from right to left under the unoccupied strand of the standing part. Care must be taken to retain the lay of the rope in the last strand tucked, as this enables it to lie closer.

(4) Now, beginning with C, heave each strand taut with a heaving mallet. Then tuck all three strands a second and third time, (fourth and fifth time if splicing MMF cordage).

(5) Finish off by tapering the splice as described for the back splice or, if the appearance of the splice is of secondary importance and maximum strength is required, dogging the ends by halving each of the three strands and whipping each half to its neighbour over the adjacent strand as shown in Fig 3-120.



(i) Dogged (ii) Tapered and served

Fig 3-120. Eye Splice Finishes

e. **Thimble Eye Splice in Hawser-laid Cordage**. A thimble eye is formed by fitting and splicing the end of the rope round a thimble, the splice holding the thimble in place. It is fitted in the ends of cordage and wire ropes which are intended to be used in conjunction with a joining shackle or other rigging fittings. The procedure for seizing the thimble in place temporarily while the rope is spliced is similar to that when making a thimble eye in a wire, described later in this chapter. Splicing procedures are as described for a soft eye.

f. **Short Splice in Hawser-laid Rope**. (Figs 3-121 and 3-122). If splicing man made fibre cordage read Paragraph 03022a. The strands of each rope are tucked between the strands of the other rope against the lay, each strand being taken over the strand on its left, then under the next strand and emerging between this and the subsequent strand. In Fig 3-121 the ends of the rope are lettered A and B, and there unlayed strands C, D and E, and F, G and H respectively. Certain whippings and stops have been omitted to show the tucking of the strands more clearly.

(1) Whip each rope at a distance from its end equal to 20 times the diameter of the rope (this whipping has been omitted from rope A in the illustration).

(2) Unlay the strands to the whipping and whip their ends (these whippings have also been omitted).

(3) Marry the two ropes so that one strand of each lies between two strands of the other (Fig 3-121(I)).

(4) Having ensured a close marry, whip the strands strongly round the join to prevent them slipping, and stop ends C, D and E to rope B with a strong stop (whipping and stops have been omitted).

(5) Cut the whipping on A.

(6) Take F over C, under E, and bring it out between D and E (ii).

(7) Take G over E, under D, and bring it out between D and C (ii and iii).

(8) Take H over D, under C, and bring it out between C and E (iii).

(9) Stop G, F and H to A, cut the stop and whipping on B, and tuck C, D and E in similar manner.

(10) Heave all six strands equally taut with a heaving mallet.

(11) Again tuck each strand over the strand on its left and under the next one, and then repeat this operation a third time (fourth and fifth time if splicing MMF cordage).

(12) Finish off as described for an eye splice.

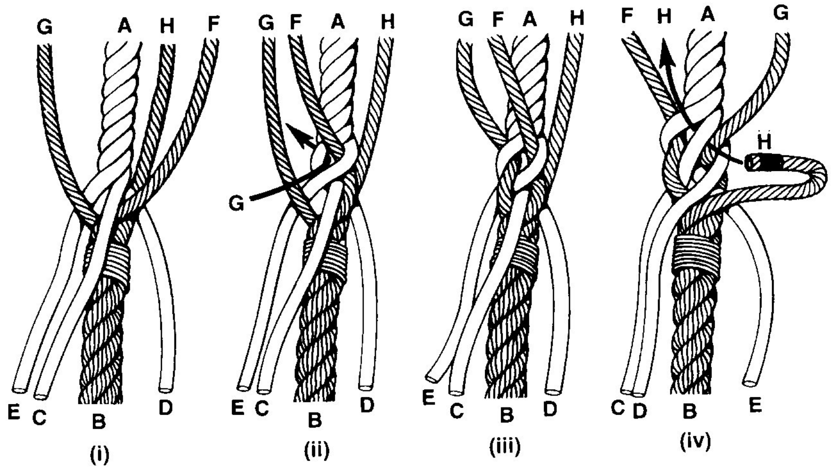


Fig 3-121. Making a Short Splice

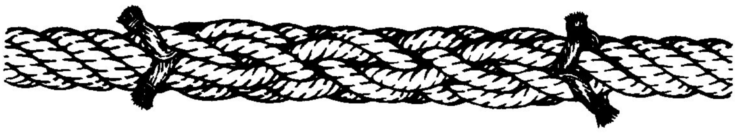


Fig 3-122. Finishing a Short Splice by Dogging

g. **Cut Splice in Hawser-laid Cordage**. If splicing man made fibre cordage read Paragraph 03022a. This splice is used when it is required to make a permanent eye in the bight of a rope. Whip each rope at a distance from its end equal to 20 times the diameter of the rope, then unlay it to the whipping and whip the end of each strand, (Fig 3-123(i)). Place the ends of the two ropes alongside and overlapping each other, and stop them together. Tuck the unlaid strands of both ropes as for an eye splice and finish off as for an eye splice.

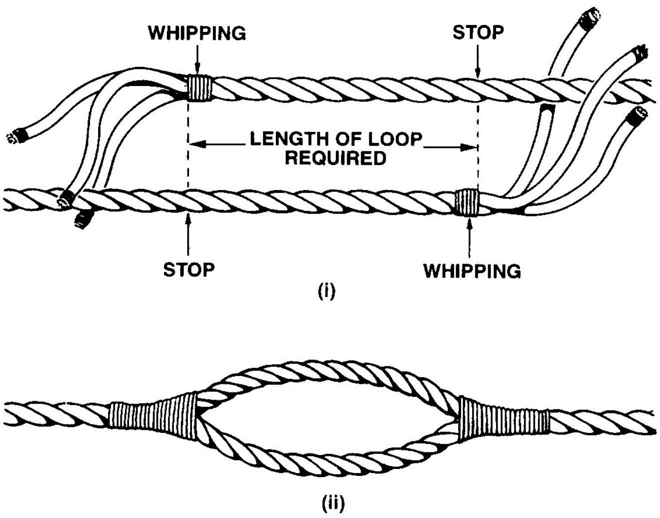


Fig 3-123. Making a Cut Splice

h. **Long Splice in Hawser-laid Cordage** (Natural fibre cordage only). This splice is used to join two ropes which are required to pass through a block. Provided the splice is well made, it will not increase the diameter or weaken the rope. It is possible to make a long splice in man-made fibre cordage, but results are usually unsatisfactory. The principle of the long splice (Fig 3-124) differs radically from that of the short splice. One strand from each rope is unlaid, and the corresponding strand of the other rope is given a twist and laid up in its place; the remaining strand from each rope remains at the marry, resulting in three pairs of strands spaced equidistantly along the married ropes. One third of the yarns is now taken out of all strands (not shown in (iv) and, though discarded, these yarns should not be cut off until the splice is completed. Each pair of strands is then tied in an overhand knot (left over right for a right-hand laid rope), and each strand is tucked over one strand and under the next, as for a short splice. Half of the yarns in each strand are now taken out and the remaining yarns tucked once more, to give a gradual taper (v). The splice is finished off by stretching it, hauling all ends taut (including the discarded yarns) and then cutting them off. To make a long splice, whip each rope at a distance from its end equal to 40 times the circumference of the rope, then unlay the strands to the whipping and whip their ends. Marry the two ropes together, as in a short splice. Each strand unlaid as described above is followed up by the strand from the other rope which lies on its right in the marriage, so that H is unlaid and followed up by E, D is unlaid and followed up by F, and C and G remain at the marry. Each strand is unlaid until the length of the end of the strand following it up is reduced to 12 times the diameter of the rope. The splice is now finished off as described above.

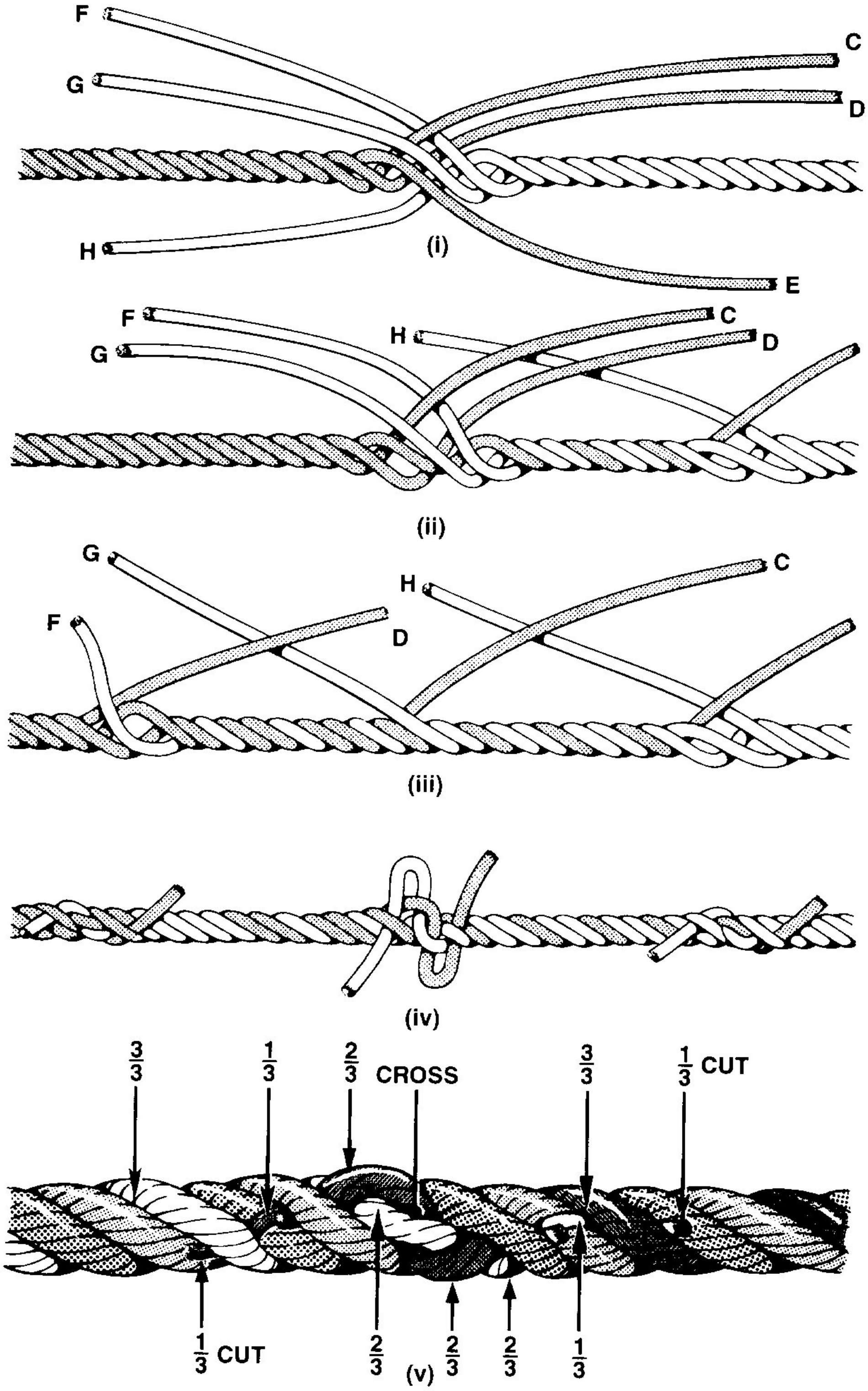


Fig 3-124. Making a Long Splice

i. **Chain Splice in Hawser-laid Rope** (Natural fibre only). This splice is used for splicing a cordage tail into a chain which is required to be led through a block or fairlead. Its strength is not more than two-thirds the strength of the rope. Prepare the rope as for an eye splice, but do not place a whipping round the rope, and unlay the strands to a length 30 times the diameter of the rope. Then unlay one strand, A, for another 150mm, or twice the intended length of the eye (Fig 3-125(I)). Now pass strands B and C through the link on the end of the chain and marry up with A, thus forming the eye (Fig (ii). Then further unlay strand A and lay up B in its place for about 300mm, and finish off these two strands as for a long splice (iii) and (iv). Now tuck strand C into the standing part below the eye as for a short splice, with about three tucks, so as to meet strand A (v). All ends are then hauled taut and cut off; the one-third strands of A and B are not shown in (v).

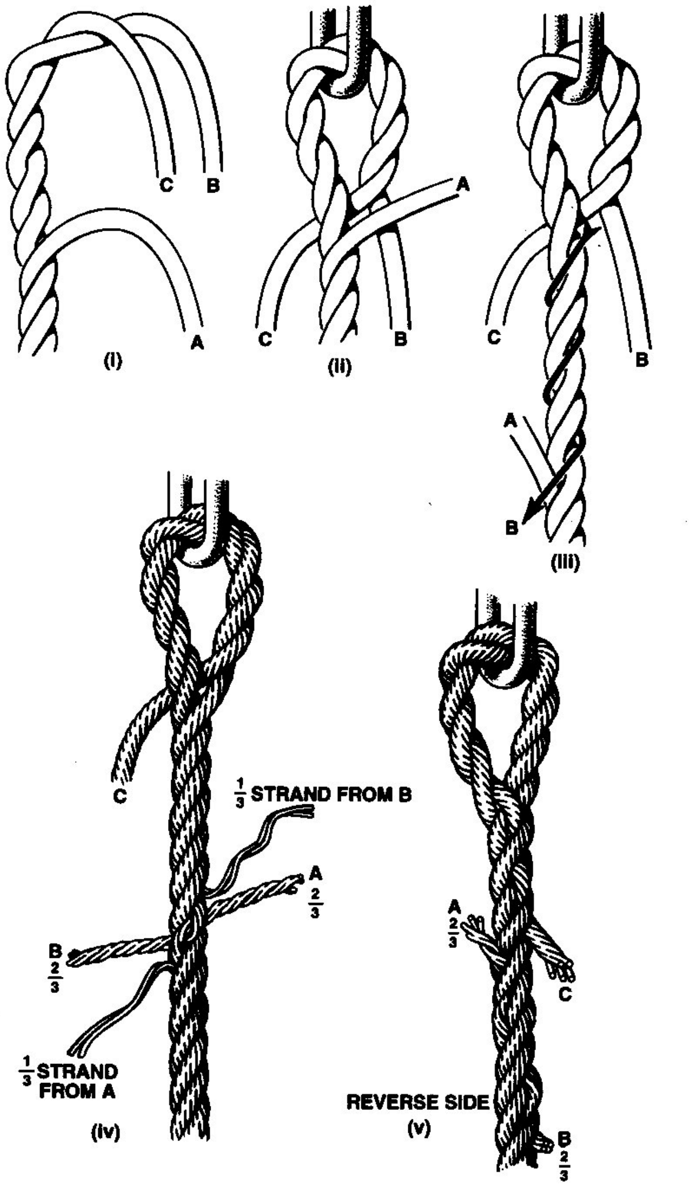


Fig 3-125. Making a Chain Splice

j. **Eye Splice in 8-strand Plaited Rope (Multi-plait)**. The eye splice in multi-plait rope is governed by the construction, which has both Z (right-handed) lay strands and S (left-handed) lay strands. Fig 3-126 shows the stages of making the splice, as follows:

(1) Read paragraph 03022a.

(2) Make a throat seizing at a distance of eight 'knuckles' from the end of the rope (point of splice), then unlay the strands. (See note).

(3) Marry pairs of Z strands and pairs of S strands making four pairs in all.

(4) Commence the tucking sequence by passing a pair of Z strands under the nearest convenient pair of Z-lay strands in the standing part of the rope, followed by the adjacent pair of S strands, tucked under the pair of S-lay strands of the rope unoccupied adjacent to the Z lay. (Fig 3-126(i)).

(5) Turn the rope right over and repeat (3) with the remaining two pairs of Z and S strands (ii). This completes the first full tuck required using paired strands.

(6) Divide all four pairs of Z and S strands and tuck these strands singly, one S strand under one S strand in the standing part and one Z strand under one Z strand in the standing part (iii). Continue this tucking sequence for four tucks thus giving a total of five tucks to the splice (iv). (See note)

(7) The ends of the strands should now be dogged as shown in Fig 3-122.

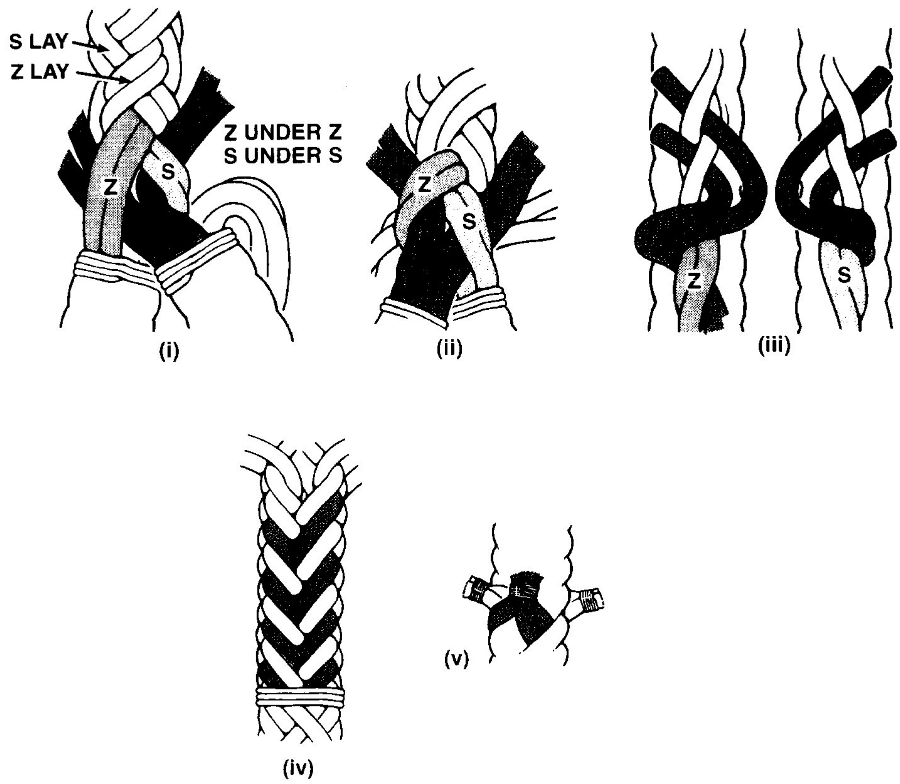


Fig 3-126. Eye Splice in Multi-plait Rope

k. **Thimble Eye Splice in 8 Strand Plaited Rope** (Multi-plait). A thimble eye is formed by fitting and splicing the end of the rope round a thimble, the splice holding the thimble in place. The procedure for seizing the thimble in place temporarily while the rope is spliced is similar to that when making a thimble eye in a wire, described later in this chapter. Splicing procedures are as described for a soft eye.

l. **Short Splice in 8-strand Plaited Rope** (multi-plait). Fig 3-127 shows the stages in the short splicing of multi-plait rope. For clarity the strands are numbered and referred to as black or white strands.

(1) Read paragraph 03022a.

(2) Unlay each rope for a distance equal to eight ‘knuckles’ along its length, this ensures sufficient length of strand to complete the four tucks required (See note). Separate the pairs of strands, and temporarily whip the ends of the pairs together. In Fig 3-127(I) the right-hand strands are black; left-hand strands are white. The pairs are designated 1R to 4R meaning right-hand lay (black) and 1L to 4L meaning left-hand lay (white).

(3) Marry the strands of the **same lay** in each rope together and tie off the ends. Tie together 2R and 3R, 2L and 4L, 1L and 3L, 1R and 4R (ii). Tying together these strands ensures easy identification during the tucking sequence.

(4) Untie strands 1L and 3L and commence tucking 1L under the nearest convenient pair of (black) strands as shown in (iii) and (iv). Tuck 1L for 4 tucks, following the same direction as the white strands in the whole portion of the rope.

(5) Follow number 1L with 3L in the opposite direction and complete 4 tucks (v).

(6) Repeat the tucking sequence for 2L and 4L, thus completing the tucking of all white right-handed strands as shown in (vi).

(7) Repeat sequence 3 to 5 with 1R and 4R. followed by 2R and 3R, for four tucks. (See note).

(8) To finish off the splice remove the temporary whippings and dog the ends of the strands as shown in Fig 3-122.

Note. *When splicing HMPE an additional 4 full tucks must be taken, making a total of eight tucks. Therefore a length equal to 12 ‘knuckles’ must be unlaid before commencing the splice.*

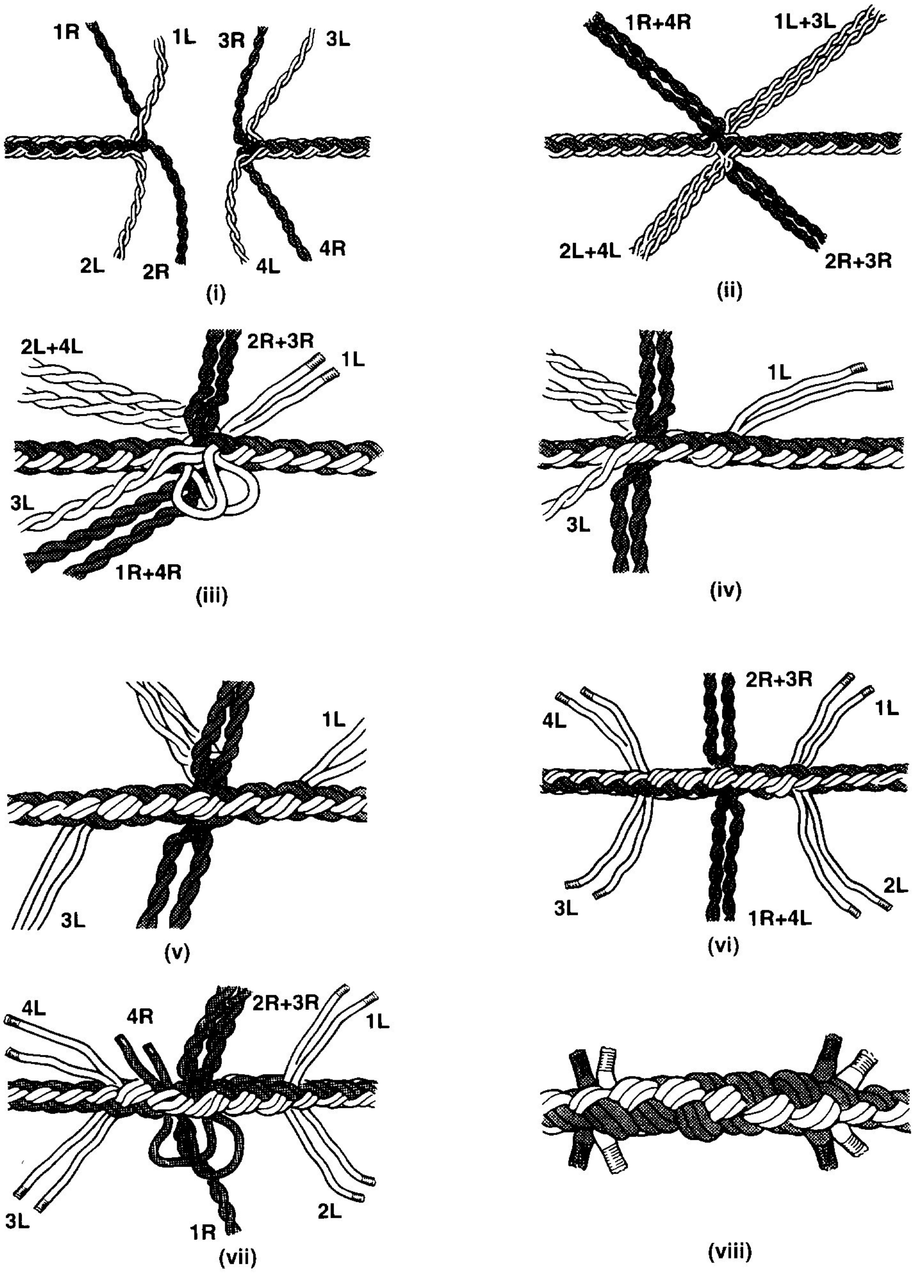


Fig 3-127. Making a Short Splice in Multi-plait Rope

03023. Splicing Braided Cordage

The splicing of braided cordage differs from orthodox splicing in the techniques and tools which are employed. As explained in paragraph 03003a(7), braided cordage falls into four main categories and by examining the end of any length of braidline cordage the general construction of the rope can be identified. However, because all man-made fibre cordage must be spliced in accordance with the manufacturers recommendations, and there are numerous variations to the construction of braided cordage within the four main categories, it is not practical in this publication to provide detailed guidance for splicing all versions that the seaman may encounter. Therefore the splicing of such cordage can only safely be carried out by the manufacturers of the rope, or by suitably trained personnel within a recognised rigging organisation. Damaged braidline ropes that cannot be readily replaced should be substituted temporarily with a suitable size and strength hawser-laid rope until a proper replacement can be obtained.

03024. Splicing Steel Wire Rope

Wire rope is spliced in roughly the same way as hawser-laid fibre rope; but, wire being much less tractable, greater skill is required and particular care must always be taken with whippings and seizings. The bending of the wires during the process of splicing may injure their galvanised surface; therefore when possible splices should be dipped in a preservative, such as mineral tar or tallow, before being wormed, parcelled and served. Splicing reduces the strength of wire rope by approximately one-eight, but a badly made splice will reduce it appreciably more; the less the strands are distorted and disturbed when tucking, the less will be their loss of strength. A marline spike with a long tapered point should be used to open the strands; the correct way to use it is best demonstrated by an experienced wire-splicer, but proficiency will not come without practice. The spike should be inserted before each strand is tucked, and withdrawn after that tuck is complete. The tucking strand is passed through the rope in the same direction as, and beyond, the spike, and is then pulled into place in the splice. The twisting and pulling caused in tucking the strands tends to distort their natural set and must be reduced to a minimum. Distortion is greatest when the strands are inserted close to the point at which they emerge from the last tuck (ie with a short nip), and it will be found that the strands go more readily into place if the spike is introduced under the correct strand but some distance farther down the rope. The tucking strand should then be passed through, as already described, and hauled into place while working the spike back along the lay of rope. In the Royal Navy all strands are tucked against the lay, as in cordage splicing.

a. **Types of Wire Splice**

(1) *Eye Splice*. For making a permanent eye in the end of a rope. A **soft eye** is a small eye spliced in the end of a rope, and a **thimble eye** is formed by fitting and splicing the end of the rope round a thimble, the splice holding the thimble in place. It is fitted in the ends of cordage and wire ropes which are intended to be used in conjunction with a joining shackle or other rigging fittings. The **hawser eye** is an alternative to the thimble eye and just as efficient. The eye is first spliced larger than the thimble, then the thimble is fitted into the eye and secured in place by a strong seizing just below it. This enables the thimble to be easily removed and replaced, merely by cutting the seizing and then renewing it. A **bollard eye** is a long soft eye. 1.5m long from crown to splice, fitted in the ends of berthing hawsers so they can be placed over bollards.

(2) *Short Splice.* For joining two ropes not required to pass through a block.

(3) *Long Splice.* For joining two ropes which are required to pass through a block. A well-made long splice does not increase the diameter of the rope and should not reduce its strength.

(4) *Cut Splice*. For making a permanent eye in the bight of a rope.

(5) *Chain Splice.* For splicing a rope tail into a chain which has to be led through a block of fairlead. The chain splice is not more than two-thirds of the strength of the rope.

b. **Tucking Sequence**

(1) *For wires up to and including 32mm diameter.*

(a) One tuck with the core in each strand

(b) Two tucks after the core of each strand has been removed.

(c) One tuck with two-thirds of each strand.

(d) One tuck with half of each remaining strand.

(2) *For wire above 32mm diameter.* A third tuck is made after the core of each strand has been removed. The gradual reduction in the size of each strand gives the splice its uniform taper.

c. **To Make an Eye Splice** (Fig 3-128)

(1) Put a stout whipping on the rope at a distance equal to 40 times the diameter of the wire. The whipping should be put on with a serving mallet and the length of the serving should be equal to the circumference of the rope. Whip the end of each strand, unlay the strands to the whipping, and cut out the exposed main core of the rope (I).

(2) Form the size of eye required and stop the two parts of the wire firmly together to prevent movement during the tucking of the strands (stopping not shown here).

(3) Place three strands on one side of the wire and the remaining three on the opposite side of the wire.

Note. For convenience in the following instructions the strands are numbered from 1 to 6, the top strand being No 1 as shown in (I). The parts of the rope are distinguished by naming them the standing part and the tucking end (the terms are self-explanatory) and all reference to the right and left apply only when looking down the rope from the crown of the eye.

(4) When ready for splicing, place the eye so that the tucking end lies to the left of the standing part, as shown in (I), thus enabling No 1 strand to be inserted from the right-hand side and against the lay.

(5) Tuck No 1 strand under the strand immediately below it (ii).

(6) Tuck Nos 2, 3 and 4 under successive strands of the standing part, as shown in (iii) and (iv) and (v).

(7) Tuck No 6 under the remaining two strands of the standing part (vi).

(8) Finally, tuck No 5 so that it emerges between the two strands under which No 6 lies and after passing under one strand only as shown in (vii). This will result in the six strands emerging equidistantly around the standing part, the variation in the regular sequence of tucking being necessary for a locking tuck and to make a neat splice, as shown in (viii).

(9) Now pull the strands down towards the crown of the eye, taking care not to cripple the wire, and place a seizing outside the tucks to prevent them easing back during the subsequent stages. Then, if the strand cores are fibre, remove the whippings at the ends of the strands, cut out the cores, and then replace the whippings.

(10) Tuck these coreless strands in regular sequence again, twice for rope up to and including 32mm, and three times for rope above 32mm. but remember to place a seizing outside each series of tucks. Then take one-third of the wires out of each strand and stop them back towards the crown of the eye. Tuck the remaining two-thirds once, and then stop back half the wires in each strand again. Tuck each of the one-third strands once, remove the seizings from each tuck, and then tap down all tucks with a hammer, starting from the first tuck and finishing off at the tail, to remove any slack and to round up the splice.

(11) Using wire cutters or a hammer and chisel, cut off all the tails, close to the body of the wire, and tap down the ends with a hammer.

(12) If required, the splice can now be wormed, parcelled and served as described earlier in the chapter.

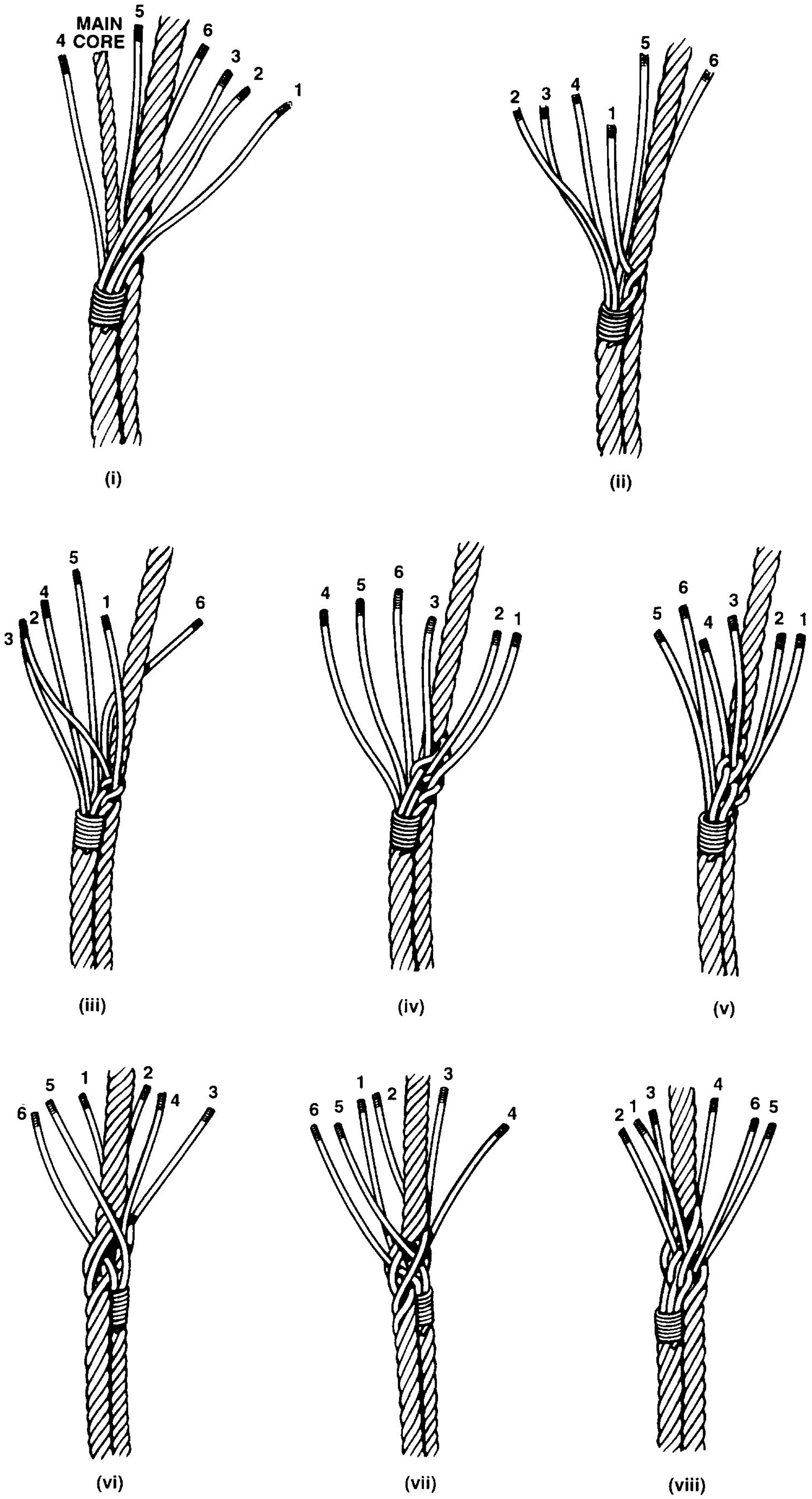


Fig 3-128. Making an Eye Splice in Wire

e. **To Make a Thimble Eye**. Whip the wire at a distance from the end equal to 40 times the diameter of the wire, as described for an eye splice. Measure with a piece of twine the outer perimeter of the thimble to be used, halve the twine, place it on the wire at the beginning of the whipping and leading away from the end of the wire, and make a chalk mark to denote the position where the crown of the thimble is to be seized to the wire, then break in the thimble. To do this, find the position on the rope which will lie at the crown of the thimble and seize the rope firmly into the crown at this point. Then secure the thimble and haul the rope into the form of a U, as close round the thimble as possible. Rig a Spanish windlass (Fig 3-129) on the two parts of the rope below the neck of the thimble to haul them together. It will be necessary to put a light stop on the roller or bar of the Spanish windlass to counter the tendency of the windlass to slip down the rope as the parts come in. Bind the rope close in to the thimble at shoulder and throat with seizing stuff; each of these seizings should be secured with a constrictor knot. Haul the seizings taut with a heaving mallet, then walk back on the Spanish windlass and take it clear. **Sweat up** first the shoulder seizings and then the throat seizing with a heaving mallet, as follows: after every heave take another turn round with each part round thimble and rope; heave again, and repeat until the seizing is of sufficient size and the rope lying snug against the thimble at that point; then secure it and sweat up the next seizing. An occasional tap with a maul during the final stages will help to settle the rope into its place round the thimble.

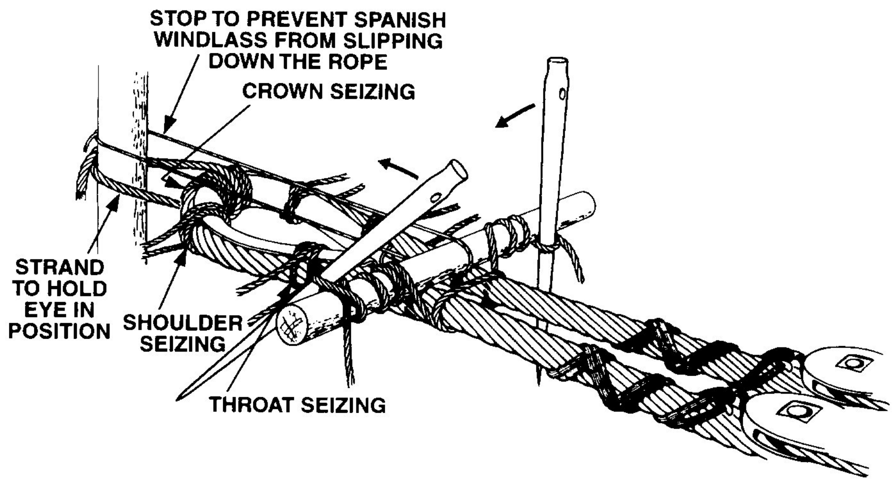


Fig 3-129. Breaking in a Large Wire Rope round a Thimble

An alternative to the Spanish windlass when using small and medium wire rope is to cross the parts and press the cross against a fixed metal bar or other fixture, as in Fig 3-130 (i). Having closed-in the parts as far as possible, pass a seizing round the cross. If the parts are now uncrossed and laid side by side, as in Fig 3-130 (ii), the rope will be found to fit fairly snugly round the thimble. Finally, put on the two seizings and complete the join with a heaving mallet. When breaking-in small and medium sized wire ropes it is not necessary to use shoulder seizings, and an ordinary vice can be of great assistance.

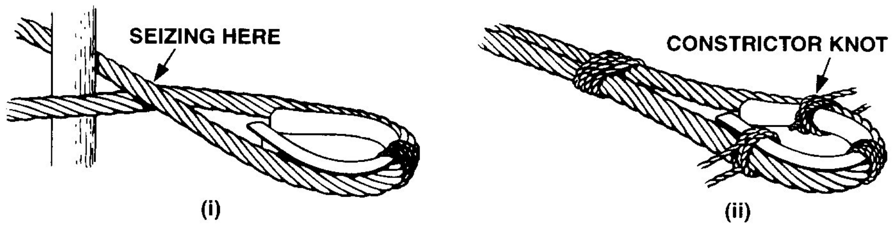


Fig 3-130. Breaking-in a Small Wire Rope Round a Thimble

When the thimble has been seized into position whip the end of each strand, unlay the strands to the original whipping, and cut out the heart of the wire. Place three strands on one side of the wire and the remaining three strands on the opposite side of the wire (Fig 3-131) and start to tuck the strands as for an eye splice. The first strand must be tucked under its proper strand in the standing part so as to give the eye a bowsing-in moment; otherwise, when the crown and throat seizings are removed after the completion of the tucking, it will be found that the thimble is loose within the eye. The splice is finished off as for an eye splice.

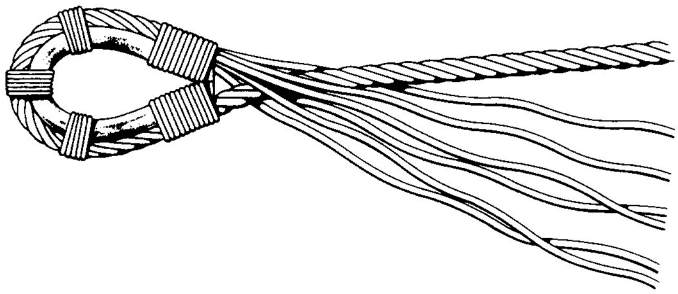


Fig 3-131. Preparation for a Thimble Eye

f. **To Make a Hawser Eye**. A hawser eye (Fig 3-132) is an alternative to the thimble eye and is just as efficient. The eye is first spliced larger than the thimble, and the thimble is then fitted into the eye and secured in place by a strong seizing just below it. This enables the thimble to be easily removed and replaced, merely by cutting the seizing and then renewing it. Thimble sizes should correspond to the size of the rope with which they are used; however, if the eye is parcelled and served, the thimble required for the larger diameter of the served wire must be that for a wire 4mm larger. It is no longer common practice to serve the eyes of wire, but it may occasionally be necessary. Having selected the correct thimble for the size of rope, whip the rope as for an eye splice, and from the whipping measure along the rope a distance equal to the circumference of the rope plus one and a half times the length of the grooves in the thimble. This gives the position for the first tuck. Form the eye and then tuck and finish as for an eye splice. If required, the splice itself may be parcelled and served, using three-yarn spunyarn for the serving if the rope is 32mm or less, and four-yarn spunyarn if more than 32mm. Insert the thimble and seize in place with a flat seizing, using the number of turns and size of seizing indicated in Table 3-17.

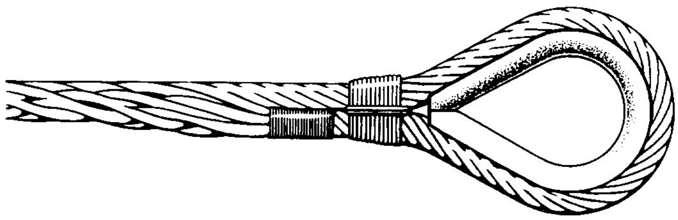


Fig 3-132. A Hawser Eye

Table 3-17. Thimbles and Seizings for Unserved Hawser Eyes

Size of SWR	Size of thimble	Size of seizing wire	Number of turns
20mm	20mm	2.7mm	12
24mm	24mm	2.7mm	12
28mm	28mm	2.7mm	14
32mm	32mm	2.7mm	14
36mm	36mm	2.7mm	14
40mm	40mm	4.8mm	18
44mm	44mm	4.8mm	18
48mm	48mm	4.8mm	18
52mm	52mm	4.8mm	18

g. **To Make a Short Splice** (Fig 3-133). Put a stout whipping on each rope at a distance from its end equal to 40mm for each millimetre of its diameter, securely whip the ends of the strands, unlay to the whippings, and cut out the hearts. Marry the two ropes so that each strand of one lies between two of the other, hitch a line to the strands of each rope and haul the marry as taut as possible with a tackle or Spanish windlass, occasionally tapping the strands with a hammer to assist them to settle in. When married, the distance between the two whippings for a short splice in wire should be a little more than one and a half times the diameter of the rope. Seize the strands on one side of the marry to the standing part of the other with a strong seizing; having hauled the first turns taut with a heaving mallet, it is advisable to put on the remainder with a serving mallet as for a serving. Cut the whipping on the opposite side of the marry and begin normal tucking. As with fibre rope, each strand is taken over the strand on its left and tucked under the next one, and it emerges between the latter and the subsequent one. Having tucked each strand on that side of the marry once, place a seizing outside these tucks to prevent them easing back during the subsequent stages, and then unlay each strand and cut out the core if of fibre; if of wire however, the cores are not removed. Then lay-up the strands again. Tuck these relaid strands again, three times for rope of 32mm or less, and four times for rope of over 32mm. Then take one-third out of each strand and stop it back. Tuck the remaining two-thirds once, and then stop back half of each. Tuck each of the one-third strands once, and then tap down all strands with a hammer. Using hand-held wire cutters or a hammer and chisel, cut off all the tails, close to the body of the wire, and tap down the ends with a hammer. Now remove the seizings and cut the whippings from the other side, and tuck the strands on that side in the same manner. On completion, round up the whole splice.

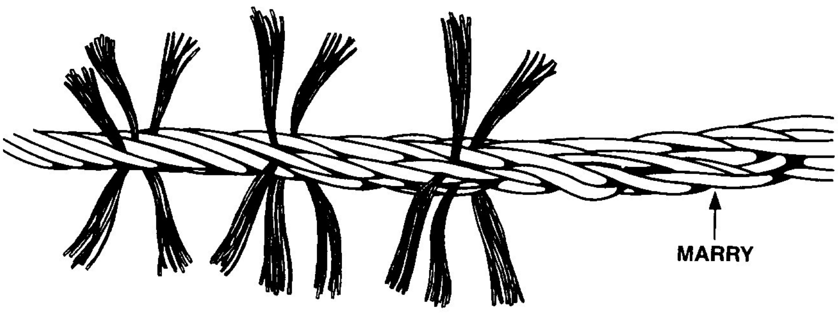


Fig 3-133. A Short Splice

h. **To Make a Bale-sling Strop**. Take a length of wire rope and join the two ends together with a short splice. Before marrying take a half-turn out of the rope, otherwise the strop will tend to form a figure-of-eight. If required, parcel and serve over the splice.

I. **To Make a Bollard Strop** (Fig 3-134). Work the rope as for a bale-sling strop, marrying at 4.25 metres. Tuck each side four times, breaking down the strands after each tuck, as follows:

(1) Make the first tuck with the whole strands

(2) Make the second tuck with whole strands, less their cores

(3) Make the third tuck with two-third strands; and

(4) Make the fourth tuck with one-third strands.

Serve the splice and then break it symmetrically round a thimble, which must be seized in place with a round wire seizing. The thimble selected should, if possible, be some four sizes larger than the normal thimble for the rope used to make the strop; a strop made from 28mm SWR, for example, would need a thimble designed for a 44mm SWR.

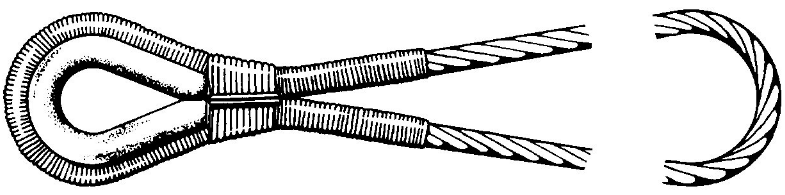


Fig 3-134. Making a Bollard Strop

j. **To Make a Long Splice**. Whip each rope at a distance from its end equal to 110mm for every millimetre of its diameter, unlay to the whippings and cut out the hearts. To assist in dealing with the long lengths of strands, some of which lengthen in the process of splicing, both ropes must be further prepared, before marrying, by whipping and cutting every other strand to a convenient length of between 150 and 300 millimetres. Marry the ropes so that each short strand has a long strand from the other rope on its right and a short one from the other rope on its left. As in the short splice, haul the marry very taut, seize the long strands on one side to the standing part, and cut the whippings on the other side. Unlay one short strand and follow it up with the long one from the opposite rope, which lay on its right in the marry, until reaching a distance from the marry equal to 100 times the diameter of the rope. This requires more knack than with NFC rope, and when once started it will help if each pair of ends is crossed so that each now has the other on its left instead of its right. Crossing a pair of strands also has the effect of locking them so that they will not unlay and will therefore remain in place when let go. Now take the second pair of strands, and then the third, and lay them up in the same manner, but lay up the second pair to a distance from the marry equal to 60 times, and the third pair to 20 times, the diameter of the rope. Remove the seizing on the rope on the other side of the marry, cross each pair of strands to lock them, cut the whipping, and repeat the above operation on the rope on that side. The result will be six pairs of strands equally spaced from each other at a distance equal to 40 times the diameter of the rope.

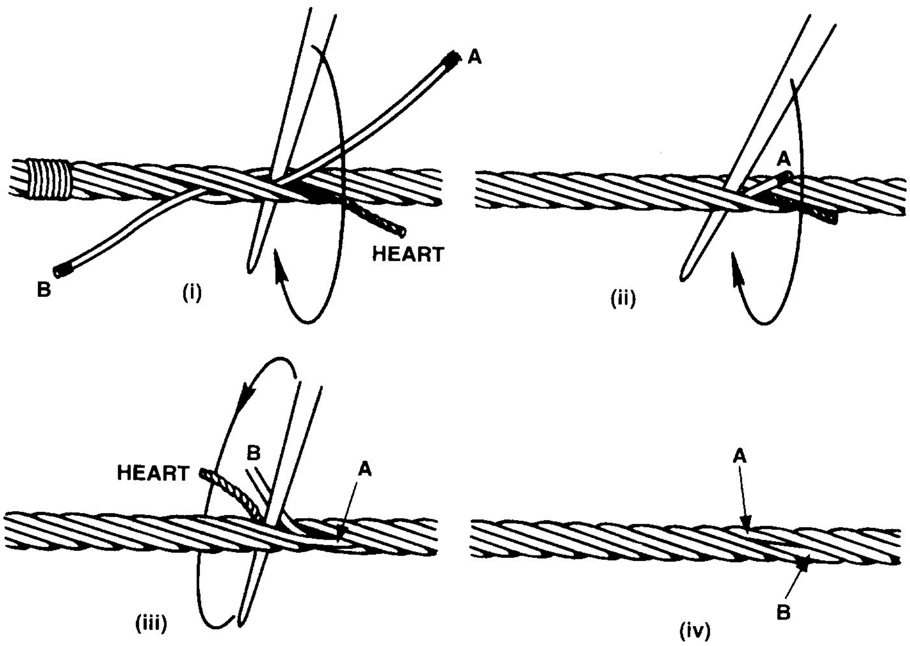


Fig 3-135. Finishing a Long Splice

To finish off (Fig 3-135), the ends of the strands are buried inside the rope, the heart being cut out where each strand is buried and the buried strand taking its place; this finish requires skill. The following method is used for the six pairs of strands, working from the marry outwards. Take end A over its opposite number B and tuck it under three strands; the temporary whipping shown in (I) will help hold the ends in place when the tuck is made. Insert the spike under the next three strands, pull out the end of the heart, and bring round the strand just tucked so that it lies on the underside of the spike (I). (As it is very difficult to insert a spike under more than two strands a second spike must be used when tucking under three strands, the first being withdrawn after inserting the second under all three strands). Now work the spike along the lay, pulling out the heart, and it will be found that the end below the spike is forced into the centre of the rope in place of the heart (ii). Repeat this operation with the end of the second strand, but instead of taking it over one strand and under three, cut the whipping, insert the spike under three strands, and bury this end as already described (iii). On completion the two strands will be lying side by side where they disappear into the centre of the rope, making a very neat finish (iv). Now treat the other five pairs of strands similarly, and, when completed, the buried ends should always have replaced the heart for the whole length of the splice, a distance 230 times the diameter of the rope. The lengths of the ends must be adjusted individually so that they should butt as near as possible.

k. **Making Wire Grommet Strops**. The simplest form of grommet strop is known as a **two-parted** strop and is made from a single strand formed into a ring and laid-up round its own part until the ends meet again. If the ends are taken round again the result is a **three-parted** strop, and so on until a **six-parted** strop is achieved. In practice only three-, four- and six-parted strops are used. To make any of the strops it is necessary to measure off accurately the length of wire required; otherwise wastage of wire will ensue. The formula for finding the length of strand required is the sum of twice the length of grommet required and twice the circumference of the wire used; multiply this sum by the number of strands in the strop, and finally add the tucking allowance for both ends. For example, if a four-parted grommet strop with a length of 1.5 metres and made up of a strand of 24mm wire is required the strand length is calculated thus:

	Metres
Twice the size of grommet required	3.00
Twice the circumference of wire 2π x24mm	<u>0.15</u>
Multiplied by four	3.15
Tucking allowance (40mm for every millimetre diameter of wire)	12.60
Total length of strand	<u>0.96</u>
	13.56

l. **Four-parted Strop**. Unlay the strand (after the wire has been measured off and cut) and mark it off from one end to a distance equal to the sum of twice the length of the grommet, twice the circumference of the wire, and half the tucking allowance. Therefore in the example above the distance would be 3.63m. Now make a second mark at a distance from the first mark equal to a sum of twice the length of the grommet and twice the circumference of the wire, ie, 3.15m. These two marks are married to give the correct length of the strop, and, for the purpose of this description, are called the **short** end and the **long** end. To make a strop, marry the strands at the marks so as to form a ring and lay-up the short end with the lay. Turn the strop round and lay-up the long end to form a three-parted grommet. This can be done with the fingers, but care must be taken to keep the strand in its natural lay, particularly the second time round. Take care that whenever the strands meet they are crossed as in a long splice. At any stage of these operations the end which is not being laid-up will have to be held in place, either by a stop or by hand, until the ends cross again. Laying-up the fourth part will require the use of a marlin spike. Stop the short end and insert the spike under two parts of the strop, close to where the ends cross, so that the third part and the long end lie beneath it (Fig 3-136(I)). Work the spike along with the lay and the fourth part will fall into place correctly. Both the three-parted and four-parted strops are finished off in the following manner: for wire up to and including 24mm each strand is tucked over one and under two, the core is cut out, and the strand tucked again over one and under two; for wire over 24mm each strand is tucked over one and under two, the core is cut out, the strand is tucked over one and under two, each strand is halved, and the remaining half-strand is finally tucked over one and under two. The ends of the strand are then cut off and that portion of the strop is served over.

m. **Five-parted Strop**. If it is required to make a five-parted strop it is necessary to introduce a false heart into the strop after the four-parted strop is completed but not tucked (Fig 3-136 (ii) and (iii) and (iv)). A high degree of skill is required both for this strop and the six-parted strop described later. As when laying-up the fourth part, insert the spike under two parts of the strop. Take another length of strand equal to the circumference of the ring and insert one end into the centre of the strop, beneath the spike, to form the heart. The long end of the strop is also placed beneath the spike, but must always be kept outside the heart or it will tend to take its place. The short end is held in place by a stop. Work the spike along with the lay, and, with care, the heart will disappear inside the strop and the long end take up its own place as the fifth part. Before its last end disappears it is important that the length of the heart should be adjusted so that the ends almost butt. If correctly laid-up a gap will show between two of the parts of the five-parted strop, and this gap is filled in the six-parted strop.

n. **Six-parted Strop**. Proceed as for a five-parted strop; then fill the gap as follows: stop the short-end, then insert the spike under three parts, close to where the ends cross, and place the long end beneath it (Fig 3-135 (v)). Work the spike along the lay, persuading the sixth part into place, and, at the same time, watch the heart carefully for any inclination to come out. It is a matter of choice whether to have the spike under or over the heart. The strop is now finished as for a long splice, the heart being pulled out and replaced by the remaining ends of the original strand (Fig 3-136 (vi) and (vii)). These ends must be of a length so that they almost butt.

o. **Strength of Grommet Strops**. The approximate breaking strength of the single leg of a grommet strop can be calculated from:

BS (strop) = (*n/ns)* x BS tonnes, where
n is the number of parts of the strop;
ns is the number of strands in the original wire;
BS is the breaking strength of the original wire.

Example

What is the breaking strength of a four-parted grommet strop constructed from a strand taken from 12mm, 6x24 steel wire rope?

BS of 12mm 6x24 SWR = $d^2/25$ = 144/25	= 5.75 tonnes
Number of parts of strop	= 4
Number of strands in the original wire	= 6
Therefore BS (strop) =(4/6)x5.75	= 3.84 tonnes approx.

If the strop is to be used doubled, its breaking strength will be twice 3.84 = 7.68 tonnes approximately.

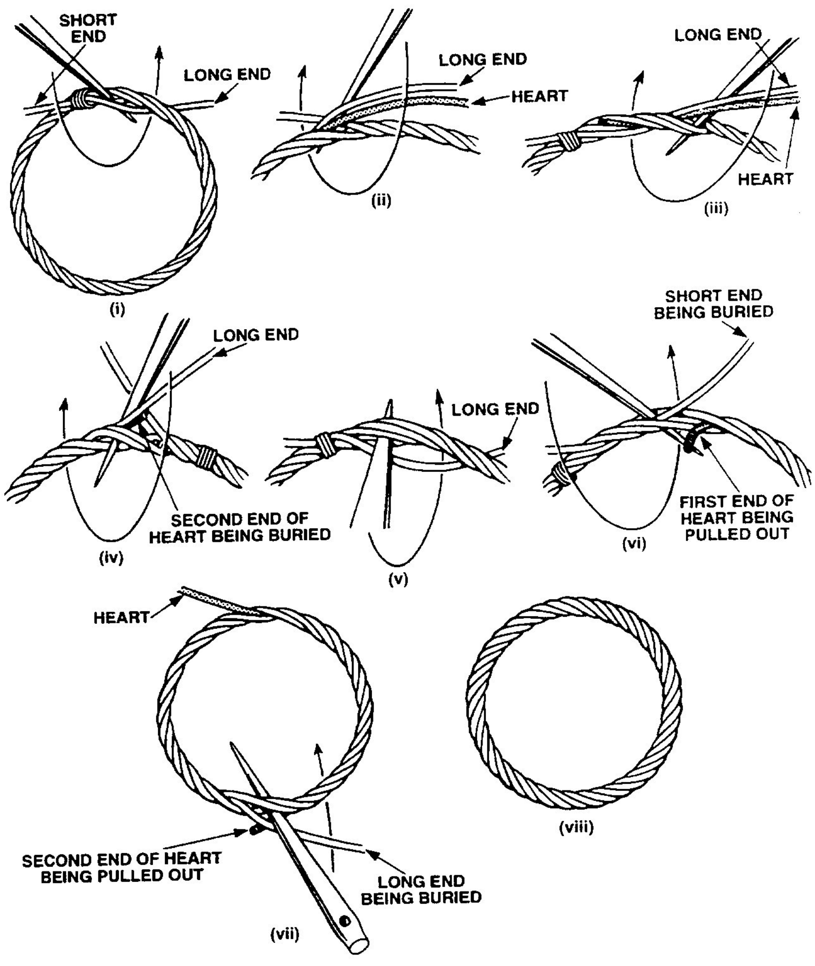


Fig 3-136. Making a Wire Grommet Strop

03025. Splicing Cordage into Wire

To splice three-stranded cordage into wire, unlay the wire rope as for a short splice, keeping the strands in pairs, and remove the heart. Splice the wire and rope together as for three-stranded rope, inserting the appropriate number of tucks for NFC or MMFC. Taper the strands as for a short splice, marl down and serve over. Splicing braidline cordage into wire is a more complicated procedure which must be in accordance with methods specified by individual braidline manufacturers. For this reason such splicing is only undertaken by the manufacturers of the braidline, or by suitably trained personnel within a recognised rigging organisation. Damaged wire/braidline ropes that cannot be readily replaced should be substituted temporarily with a suitable size and strength hawser-laid rope until a proper replacement can be obtained.

03026. Mechanical Splicing

Mechanical splicing, known under various trade names including Marisplice, Superloop and Talurit is carried out by dockyard authorities, commercially under contract, or in capital and repair ships. The splice gives comparable strength to a hand splice, and has the following advantages: it uses less wire, requires no worming, parcelling and serving, and is completed in much less time; in a great many cases it has superseded the hand splice. A mechanically spliced wire should be tested by a competent testing authority before use; however, if this is not possible, a local test is acceptable in the short term, but the splice must be properly tested at the first opportunity. The use of mechanical splicing machines in Royal Naval ships is to be controlled, and a list of all gear produced must be kept by the Boatswain or Chief Boatswain's Mate.

a. **Making a Mechanical Splice**. Ensure that any excessive oil or grease is cleaned off the wire in the position where the ferrule is to be fitted. Thread the end of the rope through an alloy **ferrule** of suitable size (Table 3-18) and back on itself through the ferrule to form a loop (Fig 3-137(I)). The bitter end of the rope must not terminate within the ferrule; it should extend past the end of the ferrule for a distance of at least one half of the rope diameter. If a thimble or other type of fitting is required, it is placed in the loop in the necessary position. The ferrule is then put in the hydraulic press between two **swages** which are of a size to deal with that particular ferrule, and the swages are closed until they slightly grip the ferrule. The rope is then pulled through until the loop of the required size is fashioned or the tightest possible fit to the thimble or other fitting is obtained. Further pressure is then applied until the swages meet; the splice is then complete. The pressure exerted does not harm the rope in any way, neither is the lay disturbed - the metal of the ferrule **flows** round the rope strands, holding each strand firmly in position. (Fig 3-137(ii)). Mechanical splicing is occasionally used to splice MMF and NFC ropes; however, such splices are not to be used where life and limb will be endangered if the rope parts.

Table 3-18. Size of ferrules for use with SWR

Size of Rope	Naval stores No of ferrule	Size of rope	Naval stores No of ferrule	Size of rope	Naval stores No of ferrule
1mm	0263/411-9765	6.5mm	0263/411-9772	24mm	0263/411-9743
1.5mm	0263/411-9766	7mm	0263/411-9773	28mm	0263/411-9744
2mm	0263/411-9767	8mm	0263/411-9735	30mm	0263/411-9745
2.5mm	0263/411-9768	10mm	0263/411-9736	32mm	0263/411-9746
3mm	0263/411-9732	12mm	0263/411-9737	36mm	0263/411-9747
3.5mm	0263/411-9769	14mm	0263/411-9738	38mm	0263/411-9748
4mm	0263/411-9733	16mm	0263/411-9739	40mm	0263/411-9749
4.5mm	0263/125-0131	18mm	0263/411-9740	44mm	0263/411-9750
5mm	0263/125-0132	20mm	0263/411-9741		
6mm	0263/411-9734	22mm	0263/411-9742		

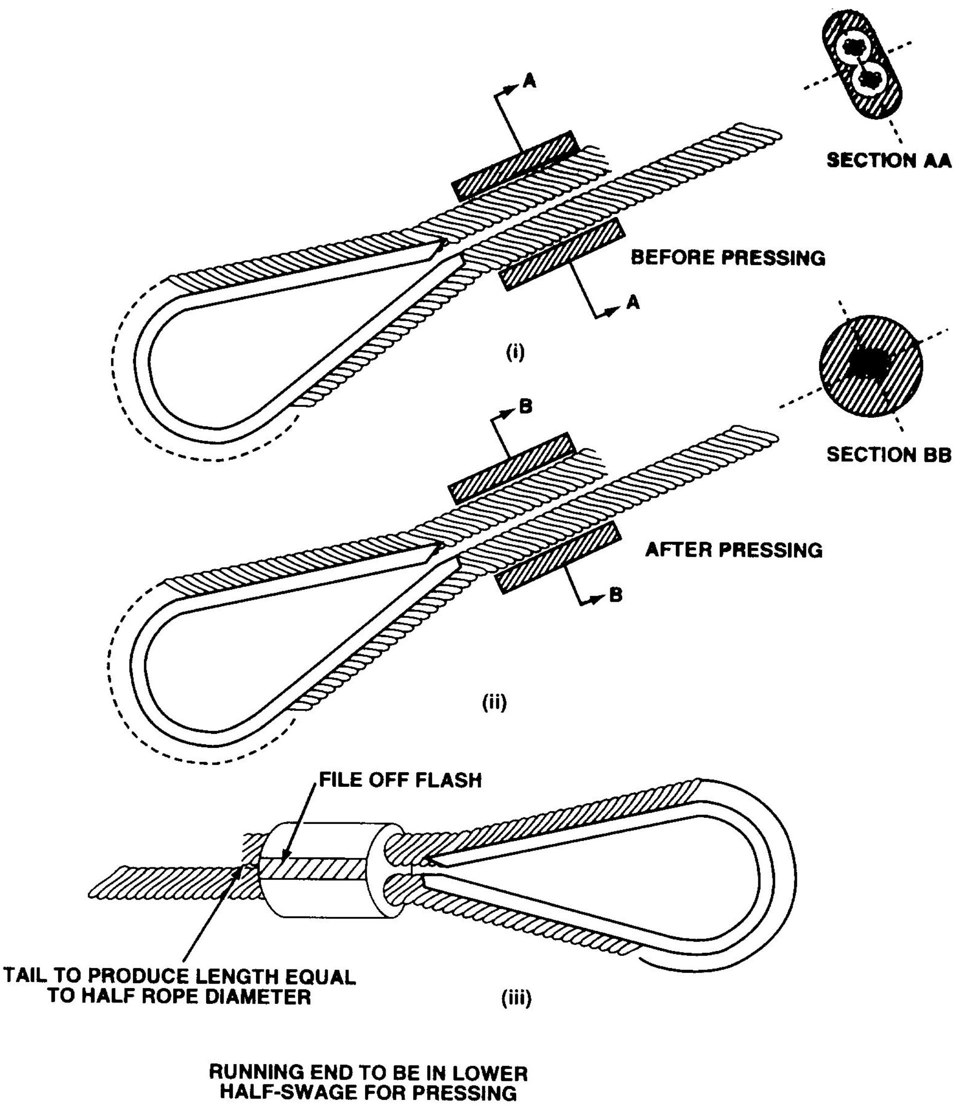


Fig 3-137. Making a Mechanical Splice

03027. Making a Temporary Eye using Bulldog Grips

A temporary eye, either soft or thimble, can be made in wire rope by using bulldog grips (Fig 3-138), which are screwed clamps holding the two parts of the rope together. It is important that the grips should be fitted with the U-bolt over the tail end of the rope and the bridge on the standing part, as shown in Fig 3-138. Grips should be spaced at a distance of six times the diameter of the rope as follows:

SWR up to 19mm	-	3 grips
20mm to 32mm	-	4 grips

Grips are supplied in various sizes to fit each size of wire rope up to and including 32mm (Table 3-19). Bulldog grips for larger ropes are not available in the RN. It is essential that the correct sized grip is used and that grips are fully tightened. Failure to comply with these requirements will greatly reduce the efficiency of the termination. Grips are apt to mark or crush the rope, and both grips and rope should be inspected for security and wear before and after use and grips retightened as necessary. Bulldog grips must not be used to join two wire ropes together.

WARNING
BULLDOG GRIPS ARE NOT TO BE USED FOR LIFTING PURPOSES OR FOR JOINING TWO WIRE ROPES TOGETHER

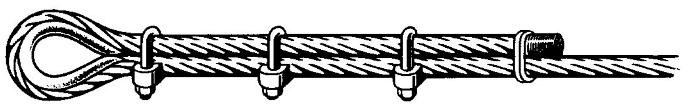


Fig 3-138. Making a Temporary Eye with Bulldog Grips

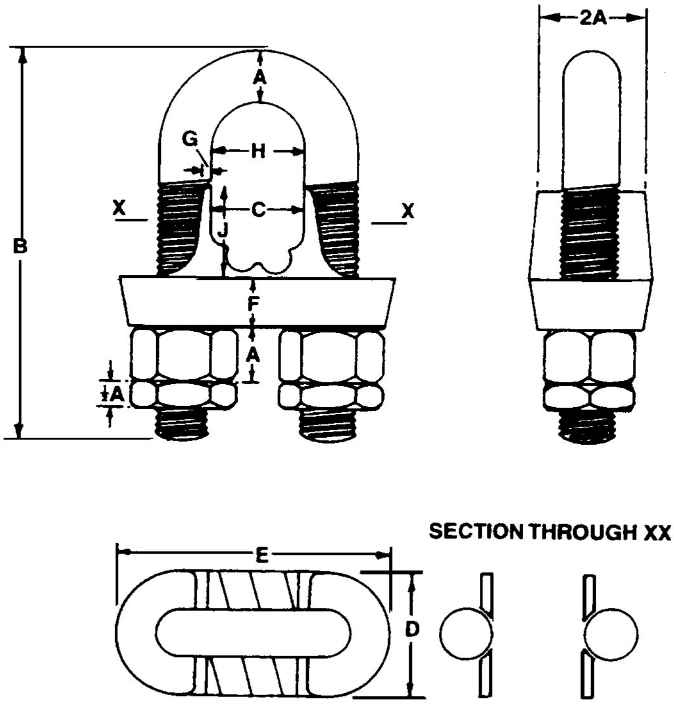


Fig 3-139. Dimensions of Bulldog Grips

Table 3-19. Details of Bulldog Grips available through Naval Stores

Naval Stores No	**For use with SWR diameter**	**Dimensions** A	B	C	D	E	F	G	H	J
0263/571-	*mm*	*millimetres*								
5319	4	5	27	5	14	28	5	2	9	7
5320	6	6	30	7	14	25	6	-	7	5
5312	8	8	40	9	18	33	8	-	9	6
5313	11	12	58	12	28	48	12	-	12	10
5314	13	14	68	14.5	32	56	14	-	14.5	11
5315	14	14	70	16	32	58	14	-	16	11
5316	22	18	98	25	41	79	18	-	25	14
5317	29	20	118	32	46	92	20	-	32	16
5318	32	22	130	35	51	101	22	-	35	28

03028. Nets - Provision and Cargo

The nets most commonly used in the Royal Navy for handling provisions and stores in bulk are manufactured from polyester webbing, man-made fibre cordage or steel wire rope. The flat polyester webbing nets, usually associated with Vertrep, are discussed fully in Chapter 6. Man-made fibre cordage and steel wire rope provision nets are available for general use and are obtainable through naval stores, sizes and pattern Numbers as follows:

Type of net	Dimensions	SWL	Naval stores No
SWR provision net	2.45m square	3 tonnes	0246/923-9438
MMFC provision net	2.5m square	1.5 tonnes	0246/923-3572

03029. Nets - Brow Safety

Whenever a brow is rigged into a ship a brow safety net must be rigged beneath it. Each net must be secured by means of its fitted lanyards and positioned so that it is directly beneath the brow with the centre of the net lower than its edges. The net must extend from ship to ship or ship to dock wall and have sufficient spread on both sides to safely catch a person or object falling from the brow. The nets must be inspected before and after use, and at frequent intervals whilst they are rigged; they must be adjusted as necessary to allow for the rise and fall of tide. The nets are manufactured by the Master Rigger's department in accordance with Service drawing No 0035 45042/01 and two nets per ship are carried. When longer than usual brows are put into a ship, for example if a frigate docks down in a large dry dock, nets suitable for the task should be requested from the shoreside authorities. In such circumstances a ship's own brow safety nets can be securely lashed together for fitting beneath one of the brows.

03030. Rigging Shackles

Rigging Shackles are coupling links used for joining ropes, webbing and chain together or to some fitting, and are usually forged from carbon magnesium steel. This section deals only with shackles used with rigging; shackles which form part of anchor and cable, or towing arrangements, are dealt with in the relevant Chapter. Details of rigging shackles available through naval stores are given in Tables 3-20 to 3-25. U-shaped shackles are called **straight** or **D shackles**, and those which have curved sides are called **Bow shackles**. A bow shackle is weaker than a straight shackle, but is the more convenient to use with hooks or sling chains because a large hook may be used with such a shackle having a relatively short pin; bow rather than straight shackles are also used in conjunction with boats' webbing slings because the relatively greater width in the clear at the crown of the shackle prevents pinching of the webbing at the bearing point. The size quoted for a straight or bow shackle used with rigging is the diameter of the metal at the crown. The safe working load for each size and type of shackle is therefore included in the details given in Tables 3-20 to 3-25.

a. **Parts of a Shackle** (Fig 3-140). The ends of a shackle are called the **lugs**, the space between them is called the **jaw**, and the part opposite the jaw is called the **crown**. The inside width or length of a shackle is called the **clear**; thus a shackle may be described as being ‹long in the clear' or ‹wide in the clear'; the jaw is closed by a removable **bolt** which passes through a hole in each lug. Rigging shackles are usually named by reference to the manner in which its bolt is secured in place.

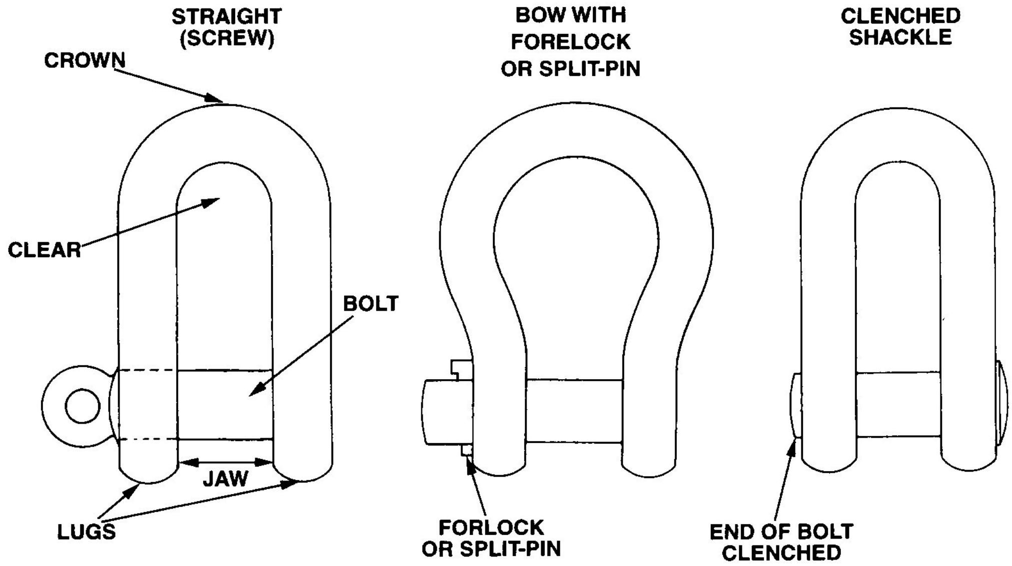


Fig 3-140. Parts of a Shackle

b. **Types of Shackle**

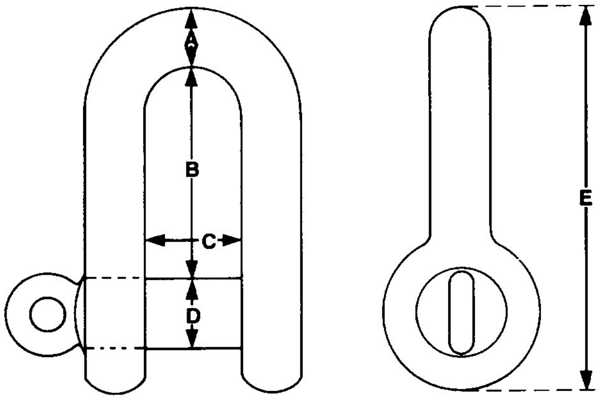
(1) *Screw Shackle*. May be a bow or straight shackle. The end of the bolt is screwed into one of the lugs, and the bolt is fitted with a flange at its head. This type of bolt should be moused.

(2) *Forelock Shackle*. May be a bow or straight shackle. The end of the bolt projects beyond one of the lugs, and a flat tapered split-pin (forelock) is passed through a slot in the end of the bolt. For most applications the forelock shackle has been superseded by a split-pinned shackle (see below), but the forelock method of securing the bolt is still used on moorings. The forelock may be attached to the shackle by a keep chain.

(3) *Split-pinned Shackle.* May be a bow or straight shackle. This type of shackle is of similar design to the forelock shackle, but is supplied with a galvanised split pin to serve the same purpose as a fore-lock. The split-pin is attached to the shackle by a keep chain.

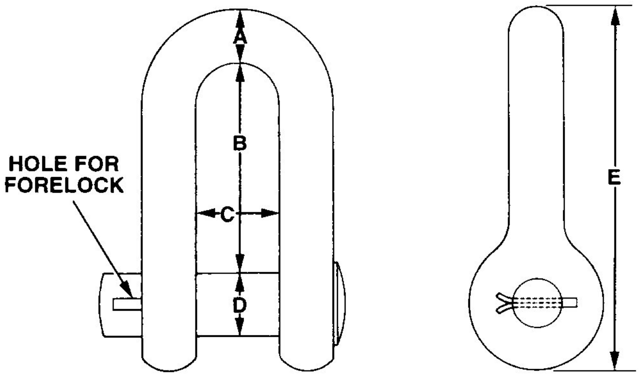
(4) *Pin and Pellet Shackle.* A tapered hole is drilled through one of the lugs and the end of the bolt. The bolt is secured in place by a similarly tapered pin being driven into this hole and held in place by a lead pellet hammered into the mouth of the hole over the head of the pin. This very secure method of locking the shackle bolt is a common arrangement on shackles that are part of anchor and cable outfits, but is also used on the shackle that attaches the hook to a picking-up rope. Details of these shackles are given with the details of the hooks used for picking-up ropes.

Table 3-20. Rigging Shackles - Straight Shackle with Screw Bolt



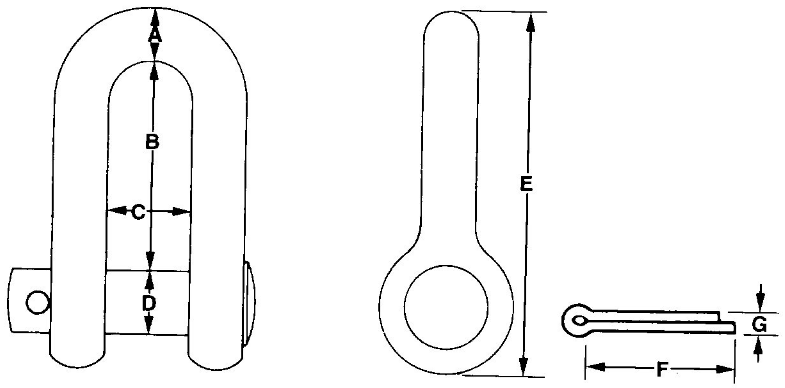
Naval Stores No	Nominal size A	Dimensions B	C	D	E	SWL
	mm	mm	mm	mm	mm	tonnes
0263/721-6087	6	24	10	10	45	0.3
0263/721-6088	10	35	16	13	64	0.6
0263/721-6089	13	46	21	16	83	1.05
0263/721-6090	16	57	25	19	102	1.8
0263/721-6091	19	68	31	25	125	2.55
0263/721-6092	22	81	36	29	146	3.55
0263/721-6093	25	92	41	32	165	4.6
0263/733-1299	29	103	46	35	184	5.6
0263/721-6094	32	114	51	38	203	7.1
0263/721-6095	35	125	56	44	226	8.15
0263/721-6096	38	138	61	48	248	10.9
0263/721-6097	41	149	67	51	266	13.2
0263/721-6098	44	160	71	54	285	15.0
0263/721-6099	48	171	76	57	305	17.0
0263/721-6100	51	183	82	64	330	19.5

Table 3-21. Rigging Shackles - Straight Shackle with Forelock



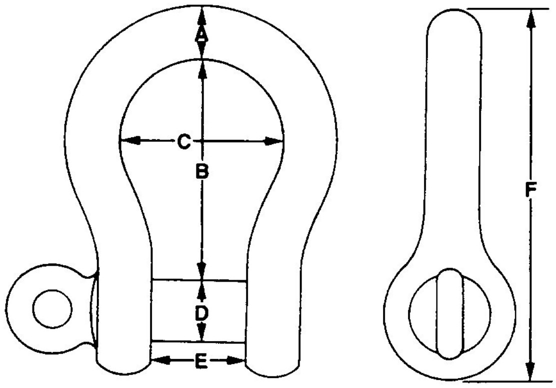
Naval Stores No	Nominal size A	Dimensions B	C	D	E	SWL
	mm	mm	mm	mm	mm	tonnes
0263-543-4298	13	46	21	16	83	1.05
0263-543-4299	19	68	31	25	125	2.55
0263-543-4300	25	92	41	32	165	4.6
0263-543-4301	32	114	51	38	203	7.1
0263-543-4302	38	138	61	48	248	10.9
0263-543-4303	44	160	71	54	285	15.0
0263-543-4304	50	183	82	64	329	19.5

Table 3-22. Rigging Shackles - Straight Shackle with Split Pin



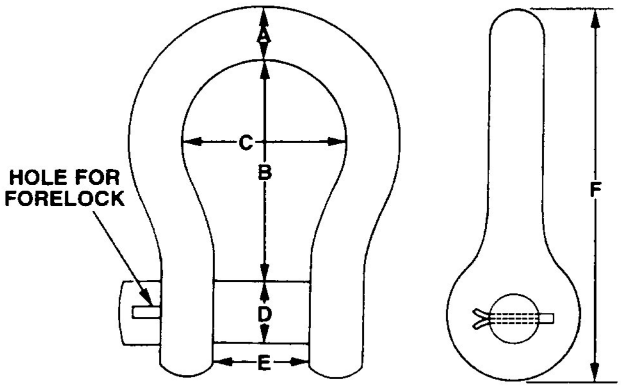
Naval Stores No	Nominal size	Dimensions						SWL
	A	B	C	D	E	F	G	
	mm	mm	mm	mm	mm	mm	mm	tonnes
0263-543-4528	6	24	10	10	45	15	2.5	0.3
0263-543-4529	10	35	16	13	64	20	4.0	0.6
0263-543-4530	13	46	21	16	83	25	4.0	1.05
0263-543-4531	16	57	25	19	102	30	4.0	1.8
0263-543-4532	19	68	31	25	125	40	5.0	2.55
0263-543-4533	22	81	36	29	146	45	5.0	3.55
0263-543-4534	25	92	41	32	165	50	5.0	4.6
0263-543-4535	29	103	46	35	184	55	6.3	5.6
0263-543-4536	32	114	51	38	203	60	6.3	7.1
0263-543-4537	35	125	56	44	226	70	6.3	8.15
0263-543-4538	38	138	61	48	248	75	8.0	10.9
0263-543-4539	41	149	67	51	266	80	8.0	13.2
0263-543-4540	44	160	71	54	285	85	13.0	15.0
0263-543-4541	48	171	76	57	305	90	13.0	17.0
0263-543-4542	51	183	82	64	330	100	13.0	19.5
0263-543-4543	54	216	87	67	349	105	13.0	20.5
0263-543-4544	57	228	92	70	372	110	13.0	23.0
0263-543-4545	60	241	97	73	395	115	13.0	25.5

Table 3-23. Rigging Shackles - Bow Shackle with Screw Bolt



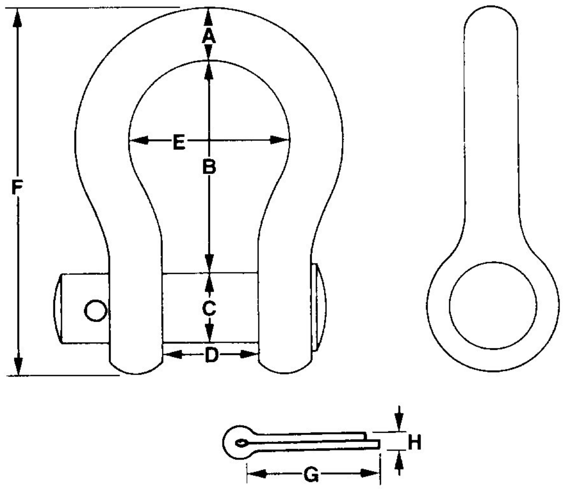
Naval Stores No	Nominal size	Dimensions					Safe working load
	A	B	C	D	E	F	
	mm	mm	mm	mm	mm	mm	tonnes
0263/721-6101	6	25	19	10	13	46	0.15
0263/721-6102	10	38	29	13	17	67	0.45
0263/721-6103	13	51	38	16	24	88	0.75
0263/721-6104	16	64	48	19	29	109	1.25
0263/721-6105	19	76	57	25	35	133	2.05
0263/721-6106	22	89	67	29	41	154	2.80
0263/721-6107	25	102	76	32	46	175	3.80
0263/721-6108	29	114	86	35	52	195	4.85
0263/721-6109	32	127	95	38	57	216	5.85
0263/721-6110	35	140	105	44	64	241	7.35
0263/721-6111	38	152	114	48	70	262	8.65
0263/721-6112	41	165	124	51	75	282	9.65
0263/721-6113	44	178	133	54	81	303	11.7
0263/721-6114	48	191	143	57	86	326	13.2
0263/721-6115	51	203	152	64	92	350	15.25

Table 3-24. Rigging Shackles - Bow Shackle with Forelock



Naval Stores No	Nominal size A	Dimensions B	C	D	E	F	Safe working load
	mm	mm	mm	mm	mm	mm	tonnes
0263-543-4291	13	51	38	16	24	88	0.75
0263-543-4292	19	75	57	25	35	132	2.05
0263-543-4293	25	102	76	32	46	175	3.80
0263-543-4294	32	127	95	38	57	216	5.85
0263-543-4295	38	152	114	48	70	262	8.65
0263-543-4296	44	178	133	54	81	303	11.70
0263-543-4297	51	203	152	64	92	349	15.25

Table 3-25. Rigging Shackles - Bow Shackle with Split Pin



Naval Stores No	Nominal size A	Dimensions B	C	D	E	F	G	H	SWL
	mm	mm	mm	mm	mm	mm	mm	mm	tonnes
0263-543-4546	6	25	10	13	19	46	15	2.5	0.15
0263-543-4547	10	38	13	17	29	67	20	4.0	0.45
0263-543-4548	13	51	16	24	38	88	25	4.0	0.75
0263-543-4549	16	64	19	29	48	109	30	4.0	1.25
0263-543-4550	19	76	25	35	57	133	40	5.0	2.05
0263-543-4551	22	89	29	41	67	154	45	5.0	2.8
0263-543-4552	25	102	32	46	76	175	50	5.0	3.8
0263-543-4553	29	114	35	52	86	195	55	6.3	4.85
0263-543-4554	32	127	38	57	95	216	60	6.3	5.85
0263-543-4555	35	140	44	64	105	241	70	6.3	7.35
0263-543-4556	38	152	48	70	114	262	75	8.0	8.65
0263-543-4557	41	165	51	75	124	282	80	8.0	9.65
0263-543-4558	44	178	54	81	133	303	85	13.0	11.7
0263-543-4559	48	191	57	86	143	325	90	13.0	13.2
0263-543-4560	51	203	64	92	152	350	100	13.0	15.25
0263-543-4561	64	254	76	114	191	432	115	13.0	22.85

03031. Roller Blocks

Roller blocks are very wide in the clear, and used for diverting the lead of a rope or line in situations where a conventional leading block is inappropriate, for example where two wires have been shackled together and the shackle is required to pass through the block. The three types of roller block commonly used in the Royal Navy are described below:

a. **Astern Fuelling Roller Block** (Fig 3-141). This roller block, Naval stores number 0263/770-9716, is used during astern refuelling to provide the hoseline with a fair lead to the capstan. It has a safe working load of 6.1 tonnes.

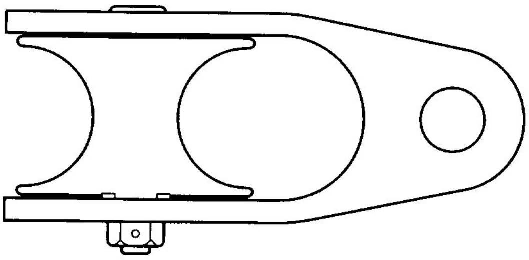


Fig 3-141. Astern Fuelling Roller Block

b. **Roller Block with Pivotal Cheek Plates** (Fig 3-142). This roller block, Naval stores number W200/525-6391, is predominantly used for danbuoy and marker buoy recoveries, but it can also be used with the easing/out recovery rope during ship-to-ship towing evolutions. The cheeks of the block can pivot around the centre sheave pin, enabling the block to be attached to the bight of a rope before the two cheeks are shackled together. It has a safe working load of 1.5 tonnes.

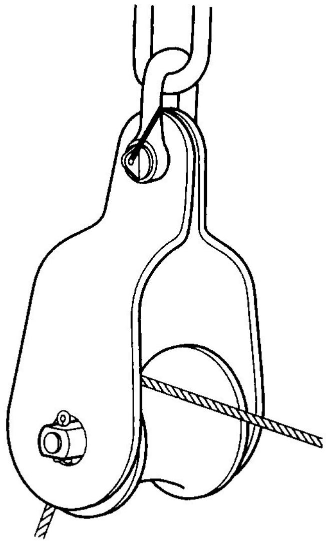


Fig 3-142. Roller Shackle with Pivotal Cheek Plates

c. **Awning Roller Blocks** (Figs 3-143 and 3-144). As their name implies, these roller blocks are used in the rigging of awnings. There are two types, the **short link roller block**, naval stores number 0263/766-7781, and the **long link roller block**, naval store number 0263/767-2435. Ship's drawings specify the type to be used for particular applications.

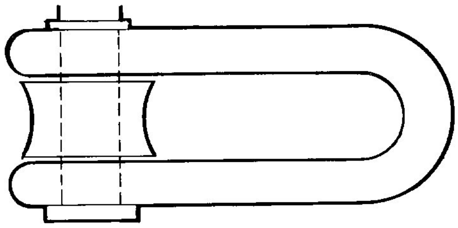


Fig 3-143. Short Link Roller Block (Awnings)

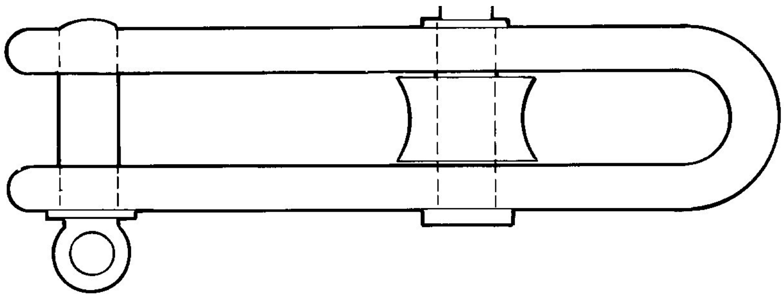


Fig 3-144. Long Link Roller Block (Awnings)

03032. Swivel Ring Shackles (Fig 3-145)

These shackles, also known as a swivel eye and jaw, are used predominantly on boat anti-shock strops. There are four sizes available, detail as shown in Table 3-26.

Table 3-26. Details of Swivel Ring Shackles

Naval Stores No	Dimensions			SWL
	A	B	C	
	mm	mm	mm	tonnes
0263/414-9939	22.5	48	41.5	1.52
0263/414-9938	25	57.5	45	2.54
0263/414-9940	29	67.5	51	3.55
0263/414-9941	35	83.5	57.5	5.08

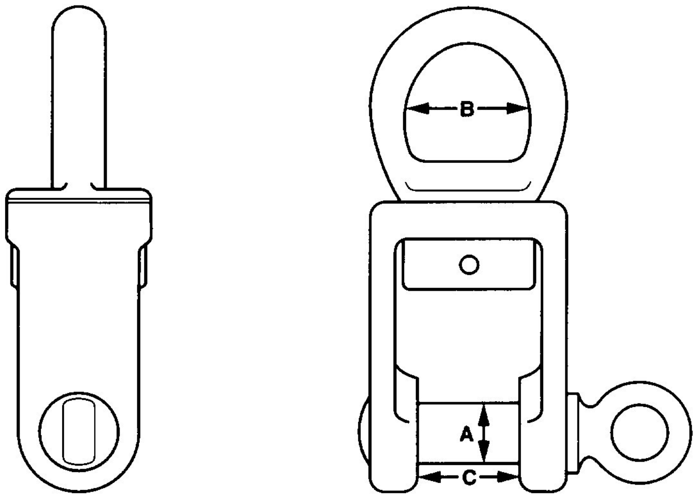


Fig 3-145. Swivel Ring Shackle

03033. Thimbles

Thimbles (Fig 3-146) are classified according to the diameter of the rope for which they are intended and also their shapes; most thimbles are manufactured from galvanised mild steel, although for certain applications stainless steel, phosphor bronze or polyamide thimbles are used. The latter three types are not available through Naval stores and can only be obtained through local purchase. When an eye splice is formed at one end of a fibre or wire rope a thimble is inserted to take the chafe of a shackle or shackle bolt and also to support the eye formed in the rope. The support given by the thimble prevents a bad nip in the rope when under tension. Large thimbles are made from material of special section and bent to shape; small thimbles are cast in one piece. Thimbles are either round or heart-shaped and open or welded. The gap formed at the throat can be sprung open to allow the eye of a tackle hook or lug of a shackle to enter. Heart-shaped thimbles are preferable for thimble or hawser eyes, in both wire and fibre ropes, because the rope can be spliced close to the throat of the thimble. Details of thimbles available though naval store are given in Tables 3-27 to 3-29.

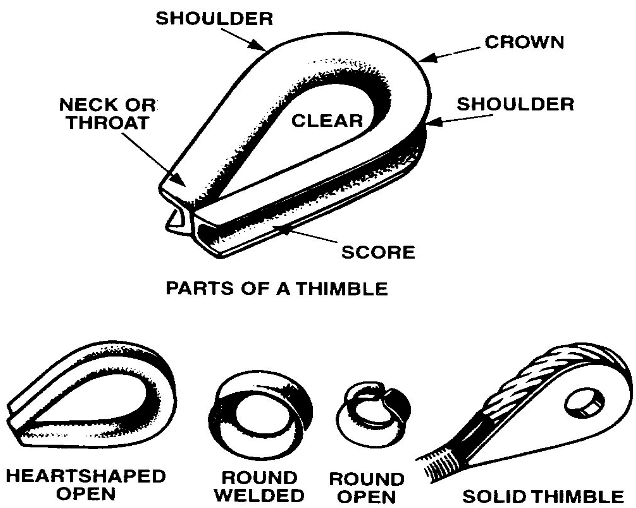


Fig 3-146. Thimbles

a. **Types of Thimble**

(1) *Round Welded Thimbles.* These are used for boom gear and in the edges and corners of awnings.

(2) *Round Open Thimbles.* These are used when it is necessary to insert something in them; for example, the wire grommet at the end of a light jackstay, or the eye at the tail of a block.

(3) *Heart-shaped Open Thimbles.* These are the most commonly used thimble for forming a hard eye or hawser eye in the end of a rope or wire.

(4) *Solid Thimbles.* These are fitted to the end of certain crane and davit whips. The thimbles are designed to accept a bolt or pin and are sufficiently robust not to collapse under stress. They are normally supplied commercially or manufactured by dockyard blackmiths. They are not available through naval stores.

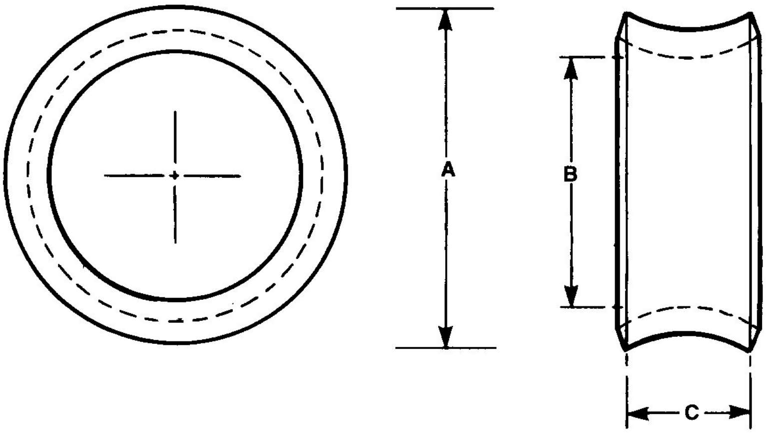
b. **Selecting the Correct Size Thimble**. The size of rope which a thimble will take depends on both the width and depth of the score, but for practical purposes the sizes are as follows:

Wire rope	$d = w$
Served wire rope	$d = 0.83w$
Fibre rope	$d = 0.91w$

Where d is the diameter of the rope in millimetres, and w is the width of the score in millimetres.

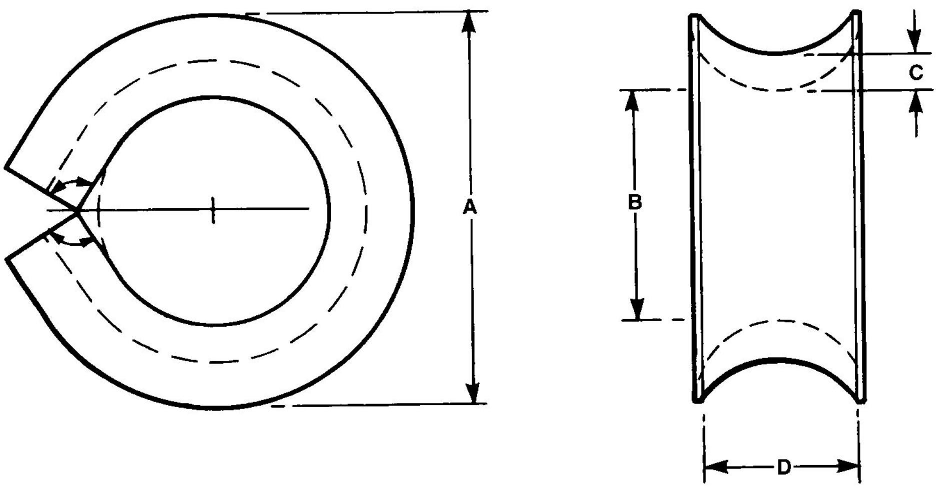
c. **Strength of a Thimble**. Thimbles have no specific strength, but a mild steel thimble should not be distorted by a pull of $d^2/128$ tonnes, where d is the diameter of the wire in millimetres for which the thimble is designed, and it will usually crush at about $d^2/85$ tonnes.

Table 3-27. Details of Round Welded Thimbles



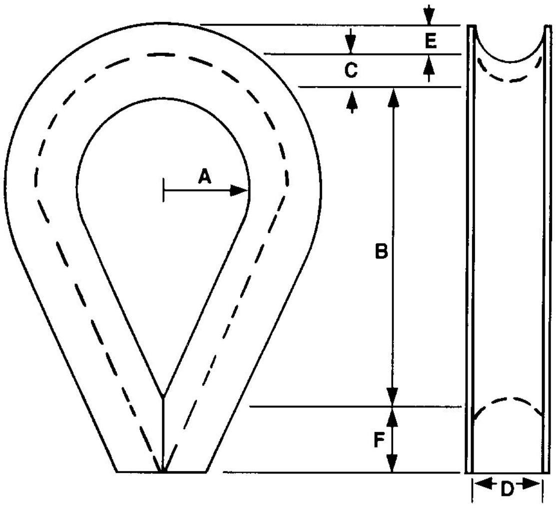
Naval Stores No	A	B	C
	mm	mm	mm
0263/421-8799	35	20	13
0263/421-8800	45	25	16
0263/421-8801	50	30	19
0263/421-8802	65	45	22
0263/421-8803	75	50	25
0263/421-8804	75	50	29
0263/421-8805	90	64	32

Table 3-28. Details of Round Open Thimbles



Naval Stores No	A	B	C	D
	mm	mm	mm	mm
0263/421-8807	30	15	3	12
0263/421-8808	45	25	5	16
0263/421-8809	50	30	5	19
0263/421-8810	60	35	6.5	26
0263/421-8974	100	57	10	39

Table 3-29. Details of Heart-shaped Open Thimbles

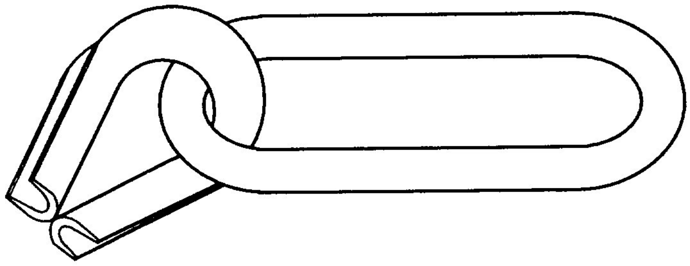


Naval stores No	A	B	C	D	E	F
	mm	mm	mm	mm	mm	mm
0263/414-9630	8	25	4	8	3	6
0263/923-6988	11	40	4	10	4	8
0263/923-6987	13	50	5	11	5	10
0263/414-9633	17	60	5	14	6	12
0263/441-2980	20	70	6	16	7	14
0263/414-9635	22	80	8	18	8	16
0263/332-5187	27	95	8	23	10	20
0263/414-9637	32	110	10	27	12	24
0263/414-9638	37	130	11	31	14	28
0263/414-9639	40	140	13	35	16	32
0263/414-9640	45	155	20	42	18	36
0263/414-9641	50	180	20	42	20	40
0263/414-9642	55	195	25	55	22	44
0263/414-9643	60	205	25	55	24	48
0263/414-9644	65	225	27	57	36.5	52
0263/414-9645	80	280	29	60	38	54

03034. Thimble and Link Assembly for Towing Hawsers

To simplify connection to cable or towing slips, and to meet NATO requirements, polyamide towing hawsers and towing pendants are fitted at both ends with a special link and thimble assembly. There are three sizes available, details are given in Table 3-30.

Table 3-30. Details of Link and Thimble Assemblies for Towing Hawsers

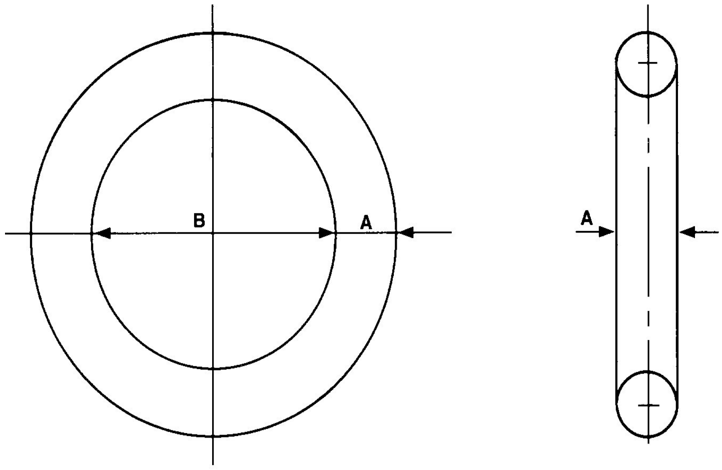


Naval Stores No	Size of towing hawser
0263/529-0651	40mm and 48mm
0263/529-0649	64mm
0263/529-0648	72mm and 80mm

0335. Common Rings

Common rings are forged from carbon magnesium steel, and the size quoted for a ring is the diameter of the metal. It is intended that in the future all common rings will be marked with their safe working load; however it is likely that a number of rings not marked in such a manner will remain in service for many years to come, therefore the safe working load for each size of common ring is included in the details given in Table 3-31.

Table 3-31. Details of Common Rings



Naval Stores No	A	B	SWL
	mm	mm	tonnes
0263/549-1952	76	260	23
0263/549-1953	70	241	19
0263/549-1954	64	222	15.75
0263/549-1955	57	228	12.7
0263/549-1956	50	178	10.15
0263/549-1957	44	165	7.6
0263/549-1958	41	165	6.6
0263/549-1959	38	152	5.6
0263/549-1960	35	140	4.85
0263/549-1961	32	127	3.9
0263/549-1962	29	114	3.05
0263/549-1963	25	102	2.55
0263/549-1964	22	89	2.05
0263/549-1965	19	76	1.55
0263/549-1966	10	57	0.25

03036. Hooks

There are various types of hooks used in the Royal Navy. They are usually made of carbon manganese steel, and are generally much weaker than shackles of similar size. All hooks used for lifting purpose in the Royal Navy must be fitted with a safety catch (spring-mousing). Open (tackle) hooks may still be encountered in certain roles, for example on awning tackles, but it is likely that all such hooks will eventually be replaced with a spring-moused equivalent. In use, open hooks must always be moused. It is intended that eventually all hooks in service will bear evidence of their safe working load; however, it is unlikely that this requirement will be fully met for many years to come. Details of hooks in regular use in the service are given on the following page and in Tables 3-32 and 3-33.

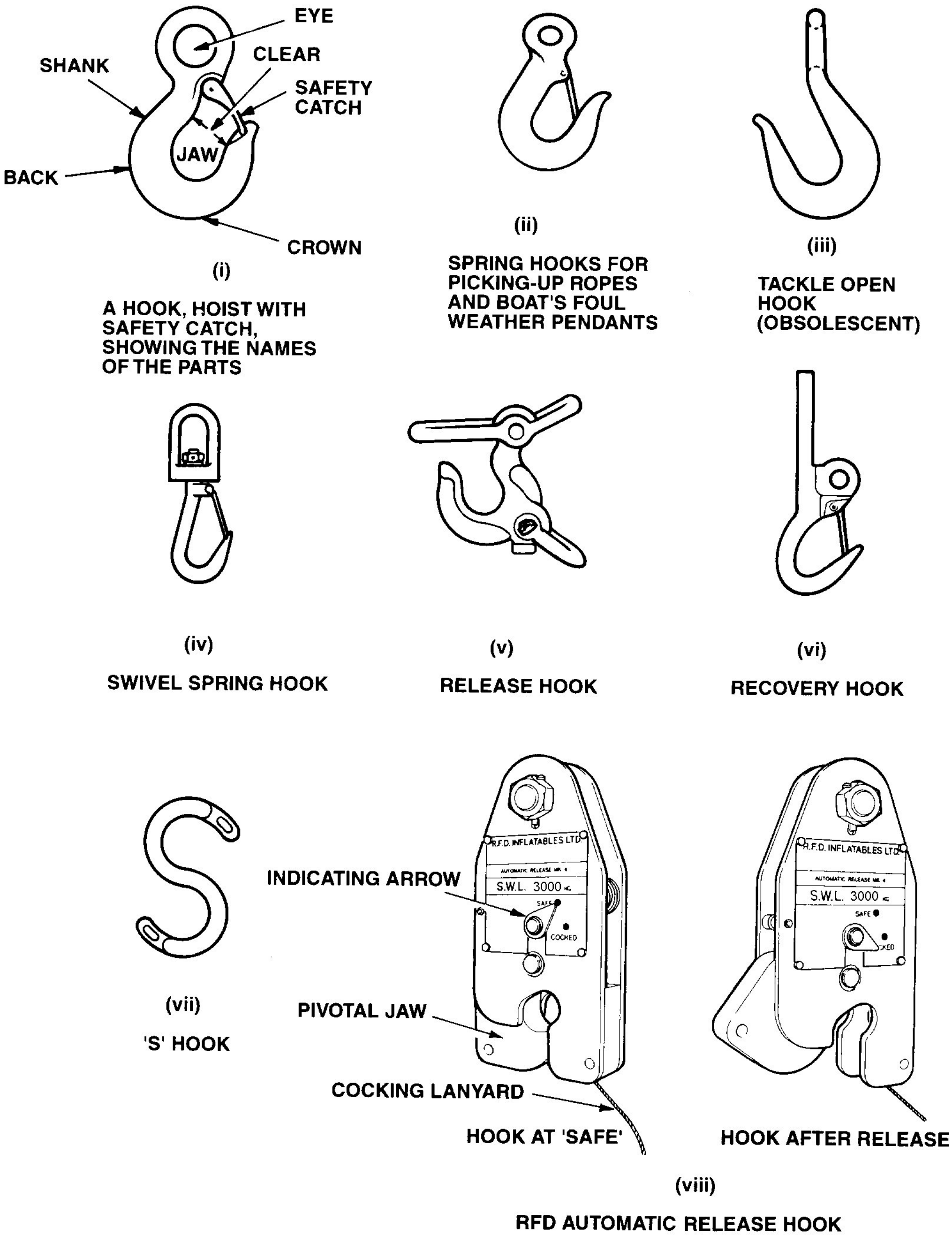


Fig 3-147. Hooks Used in the Royal Navy

(1) *Hook, Hoist, with Safety Catch* (Fig 3-147(i) and Table 3-32). This type of hook is the most commonly used in the Royal Navy; it has a safety catch in the form of a spring-operated tongue which dispenses with the requirement for a mousing. The hook is designed for use in conjunction with an appropriate size shackle, although in certain applications it is acceptable to spring a thimble though the eye and splice the cordage or wire round the thimble. Cordage must not be spliced direct to the eye.

(2) *Spring Hook for Picking-up Ropes and Boat's Foul Weather Pendants*. (Fig 3-147(ii)). This hook also has a safety catch to prevent accidental unhooking. It is used in conjunction with a pin and pellet shackle and has machined surfaces either side of the shackle bolt-hole to facilitate a snug fit between shackle and hook. Details of the hook and corresponding shackle are shown in Table 3-33.

(3) *Tackle hook.* (Fig 3-147(iii). As explained earlier, this hook, which is incorporated into the eye of metal and wooden tackle blocks, is gradually being replaced by the hook, hoist, with safety catch, which can be shackled to an SRBF block. The tackle hook is no longer available from naval stores.

(4) *Swivel Spring Hook.* (Fig 3-147(iv). These hooks, Naval stores number 0263/414--9753, are fitted with a swivel which prevent any twists in the whip being transmitted to the hook. They are specified for certain minesweeping and storing tasks. The hook has a safe working load of 0.625 tonnes.

(5) *Release Hook.* (Fig 3-147(v)) This hook, Naval stores number 0263/414-9746, is designed for slipping a load in mid-air. An eye is forged at the back of the hook to which a tripping line is secured; this line is turned up when the load is to be released; by continuing to lower the load the hook is up-ended and the load released. The hook, which has a safe working load of 0.65 tonnes, is used when deploying mine-sweeping equipment or danbuoys.

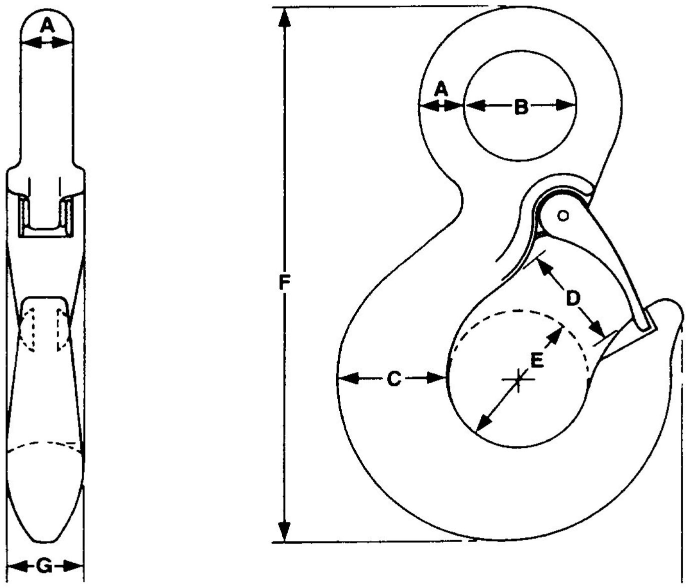
(6) *Recovery Hook.* (Fig 3-147(vi)). This hook, Naval stores number 0232/414-9748, is used in conjunction with an aluminium stave, Patt No 0573/529-6304, to attach the whip of a crane or derrick to an object in the water. The most common use for the hook is when recovering mine-sweeping floats or danbuoys. The end of the crane whip is shackled to the eye of the hook, then the squared shank of the hook is inserted into the recess in the end of the stave, and held in place by maintaining light tension in the whip. The stave is then used to place the hook onto the object to be recovered. Once the hook is attached the tension is relaxed on the whip and the stave is pulled clear. The hook has a safe working load of 0.65 tonnes.

(7) *'S' Hook or Awning Hook.* (Fig 3-147(vii)). This hook is used in certain awning configurations. The hook is available in two sizes, Naval stores number 0263/414-9627 for frigates and destroyers, and 0263/414-9628 for larger ships. The hook has no specific safe working load.

(8) *RFD Automatic Release Hook Mk 5.* (Fig 3-147(viii) This hook NSN F218/513-8208 is a development of the **davit release hook,** designed originally for the Merchant fleet to provide a method of automatically releasing davit-launched liferafts when they became waterborne; it has a safe working load of 3 tonnes and is used extensively in the Royal Navy for deploying RIB and Gemini seaboats. The RFD hook is not to be used for lifting operations other than the launch and recovery of boats. If the boat davit is to be used for other lifting operations, eg torpedo recovery, the RFD hook must be removed and an appropriate end attachment fitted to the hard eye of the davit whip. Fitting and operating procedures for the hook are described in Chapter 5 paragraph 05074.

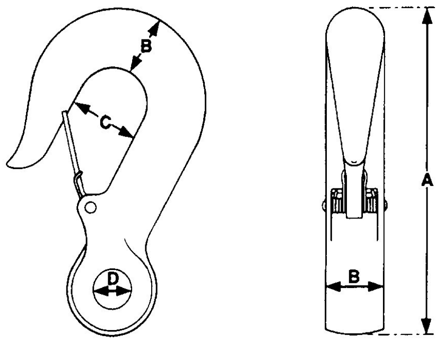
(9) *Screw-gate Karabiner*. This hook is used during astern fuelling to attach the float assembly to the hoseline. It is illustrated in Fig 6-45.

Table 3-32. Details of Hook, Hoist, with Safety Catch

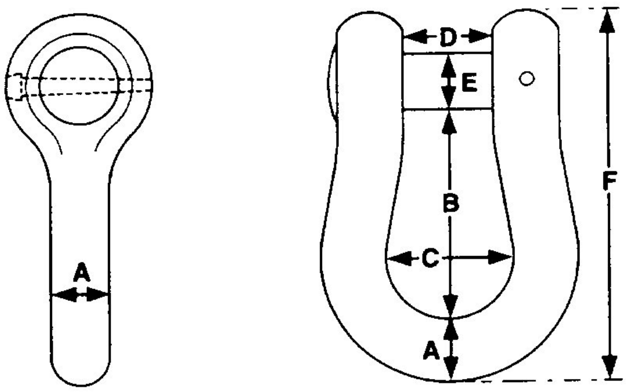


Naval stores No	A	B	C	D	E	F	G	SWL
	mm	mm	mm	mm	mm	mm	mm	*tonnes*
0263/539-3519	9.0	19	21	26	30	110.0	14.0	0.75
0263/539-3520	11.0	23	24	29	35	126.0	16.0	1.0
0263/539-3521	11.5	29	30	29	37	140.5	19.0	1.5
0263/539-3522	14.5	32	33	33	40	163.0	21.5	2.0
0263/539-3523	17.5	40	41	40	49	200.0	29.0	3.0
0263/539-3524	23.0	51	52	49	64	256.0	35.0	5.0
0263/539-3525	28.5	62	67	60	70	316.0	41.0	7.5

Table 3-33. Details of Spring Hooks and Shackles for Picking-up Ropes and Boat's Foul Weather Pendants



Naval stores No of hook	For use with SWR: Diameter	For use with SWR: Naval stores No	SWL	Dimensions A	B	C	D
	mm		*tonnes*	mm			
0263/414-9774	20	0235/523-8649	3.03	203	38	44	27
0263/414-9773	28	0235/523-8640	6.09	241	44	60	33
0263/414-9775	32	0235/523-8641	7.62	286	51	64	46



Naval stores No of pin and pellet shackle	For use with SWR: Diameter	For use with SWR: Naval stores No	SWL	Dimensions A	B	C	D	E	F
	mm		*tonnes*	mm					
0263/2024	20	0235/523-8649	3.03	25	89	54	35	25	155
0263/414-9606	28	0235/523-8640	6.09	32	108	64	46	32	193
0263/414-9608	32	0235/523-8641	7.62	38	127	76	64	44	233

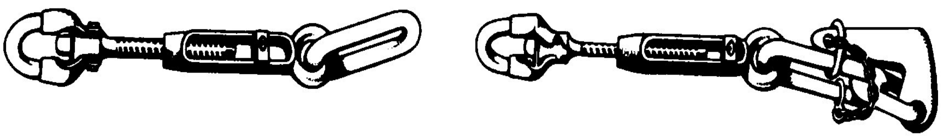
03037. Rigging Screws (Also Known as Turn-buckles or Bottlescrews)

Rigging screws (Fig 3-148) are used to **set-up**, ie adjust for length or tension, any rigging equipment. There are two types;

a. A screw fitting into an internally threaded sleeve, with a swivel eye at the head of the screw and a standing eye on the sleeve.

b. A similar assembly. but with the standing eye incorporating a slip.

Details of both types are given in Tables 3-34 and 3-35.



Screw Without Slip **Screw With Slip**

Fig 3-148. Rigging screws

Table 3-34. Details of Rigging Screws Without Slips

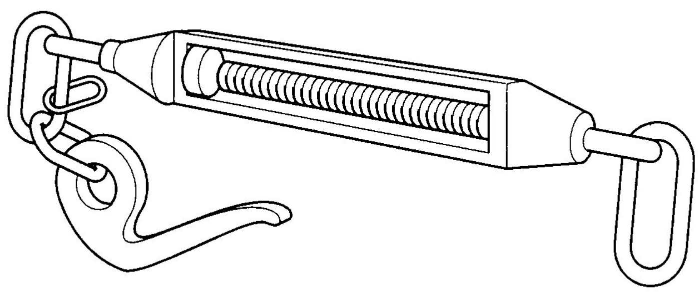
Naval stores No	Suitable for SWR	SWL
0263/413-5784	40mm	14.62 tonnes
0263/413-5785	36-32mm	9.93 tonnes
0263/413-5786	28mm	6.12 tonnes
0263/414-9745	20mm	3.25 tonnes
0263/413-5787	16mm	1.81 tonnes
0263/413-5788	14-12-10-8-6mm	1.25 tonnes

Table 3-35. Details of Rigging Screws With Slips

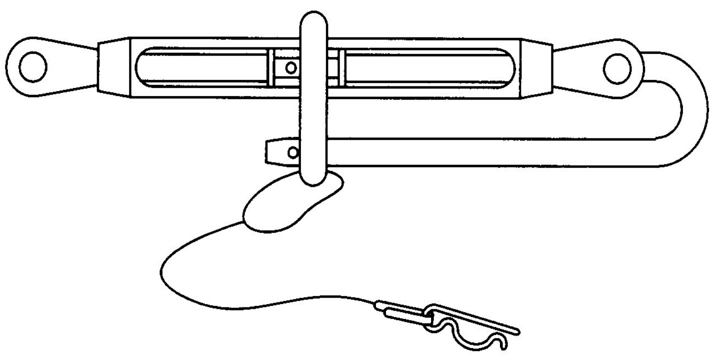
Naval stores No	Suitable for SWR	SWL
0263/413-5781	36-32mm	9.93 tonnes
0263/413-5782	28mm	6.12 tonnes
0263/414-9743	20mm	3.25 tonnes
0263/413-5783	16mm	1.81 tonnes
0263/414-9744	14-12-10-8-6mm	1.25 tonnes

03038. Guardrail Turnbuckle Assemblies

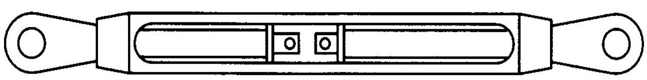
Prior to 1991, all warships, excluding MCMVs, were fitted with mild-steel galvanised turnbuckle assemblies, Naval stores number 0263/414-9836 (Fig 3-149(i)) for tightening and slipping guardrails. Since then, to reduce maintenance requirements, the policy has been to replace this fitting with stainless-steel turnbuckles and slips. The new type of turnbuckle is available with a slip (Fig 149(ii)), and without a slip (Fig 149(iii). Because the new and old style assemblies are not interchangeable a complete outfit change is necessary and it is likely to be several years before the changeover is complete. The Naval stores numbers for the stainless steel turnbuckles are given in Table 3-36.



(i) OLD TYPE



(ii) NEW TYPE WITH SLIP



(iii) NEW TYPE WITHOUT SLIP

Fig 3-149. Guardrail Turnbuckle Assemblies

Table 3-36. Details of Stainless Steel Guardrail Turnbuckle Assemblies

Description	Naval stores No	SWL
Turnbuckle assembly with slip	0263/539-6386	0.75 tonnes
Turnbuckle assembly without slip	0263/539-6387	0.75 tonnes

03039. Eyeplates and Eyebolts

Steel eyeplates (Fig 3-150) are used for securing an eye to a structure. In steel ships they are usually welded permanently in position, but in certain instances they may be bolted in place when required for a specific task, then removed on completion; eyeplates in GRP ships may be bolted to a backing plate, or screwed to a plate set in the gel, or glued in position with a special adhesive. It must never be assumed that the strength of an eyeplate is necessarily determined by its size, because the strength of the structure to which it is attached is equally important. For this reason there is a requirement that a tally plate giving details of the testing and safe working load of eyeplates must be fastened to the adjacent structure. Details of eyeplate sizes and their safe working loads are given in ship's 'As Fitted' drawings. Eyebolts are often employed for lifting heavy concentrated loads such as machinery, but the seaman will rarely come across them. They are fully described in BR 3027.

Fig 3-150. Eyeplate

03040. Union Plates (Fig 3-151)

These are triangular or square metal plates with a hole drilled at each corner. They are used as links for shackling the ends of three or four ropes or lengths of chain together; the triangular plates are usually known as **monkey faces** or **shamrock plates**.

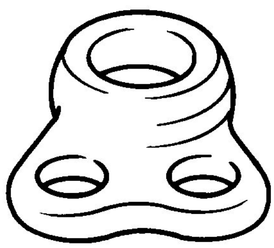
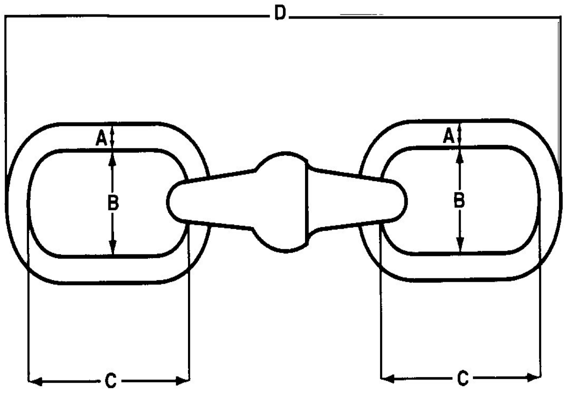


Fig 3-151. Union Plate or Monkey Face

03041. Swivels

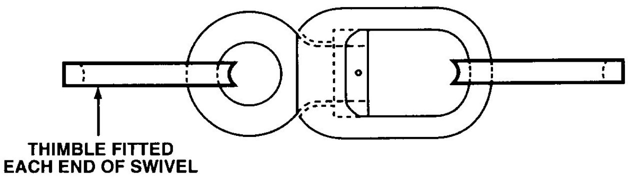
A swivel is a connection allowing revolution between component parts, usually wires or ropes, either when slack or under strain. There are two types of swivel; the general purpose swivel, Table 3-37, used extensively in minesweeping and target towing operations, and the swivel assembly incorporating thimbles in the end links (Table 3-38) used with dressing lines.

Table 3-37. Details of General Purpose Swivels



Size of swivel *millimetres*	Naval stores No	SWL *tonnes*	Dimensions A	B	C	D *millimetres*
10	0573/422-9985	0.89	11	19	54	190
13	0573/422-9974	1.52	14	25	76	258
19	0263/422-9924	3.05	19	29	89	364

Table 3-38. Details of Swivels for Dressing Lines



Size of swivel	Naval stores No	SWL *tonnes*
For use with 8mm SWR	0263/414-9624	1.01
For use with 12mm	0263/414-9625	1.01

03042. Rigging Slips

A rigging slip is a quick-release link used for joining the end of a rope or chain to a fitting when the end may have to be cast off frequently or rapidly; all such slips are properly called senhouse slips, with the tongue of the slip passing though an end link in the rope or chain. There are three types of rigging slip used in the Royal Navy and they are described below, they differ little in design, and although certain slips are specified for certain evolutions, the main criterion for their use is that the safe working load of the slip must not be exceeded.

a. **Types of Rigging Slip.**

(1) *Slip and Shackle for General Use.* (Fig 3-152). This slip, Naval stores No 0263/414-9835, is always used with a straight screw shackle Pattern No 0263/721-6096. The slip has a safe working load of 9 tonnes, and is predominantly used for RAS heavy jackstay and RAS jackstay refuelling.

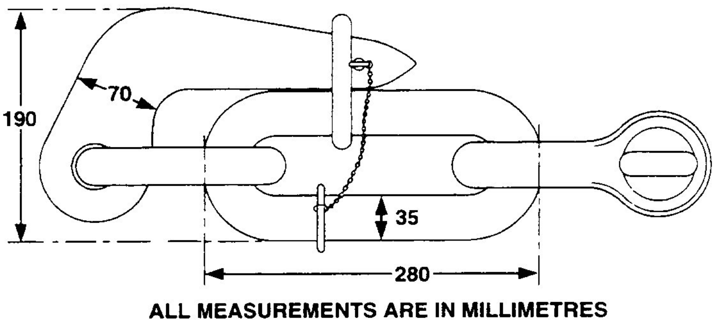


Fig 3-152. Slip and Shackle for General Use

***Note**. To ensure the slip operates correctly the clearance between the pin hole and the buckler link (end link) when the slip is rigged must not exceed 15mm. If this distance can be exceeded the slip must be removed from service.*

(2) *Slip for Replenishment Rigs.* (Fig 3-153). This slip, Naval stores No 0263/414-9747 (F905/99/867-8379 MCMV), is primarily used in replenishment operations, where it is used to secure the light jackstay, and during certain refuelling operations, the sliprope and hose-hanging pendant.

Note. *To ensure the slip operates correctly the clearance between the pin hole and the buckler link (end link) when the slip is rigged must not exceed 15mm. If this distance can be exceeded the slip must be removed from service.*

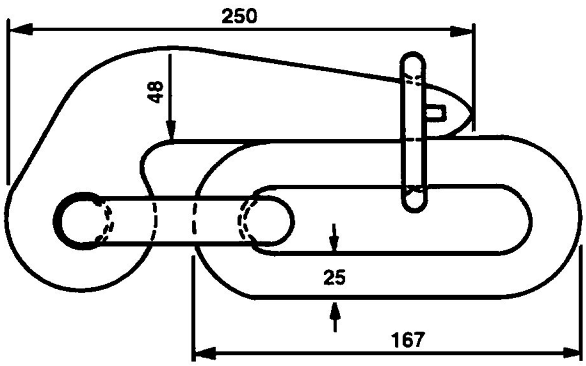
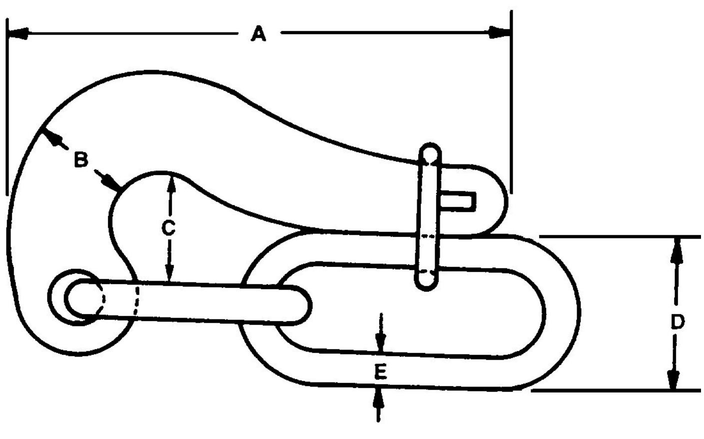


Fig 3-153. Slip for Replenishment Rigs

(3) *Slip for Rigging*. (Table 3-39). This type of slip, available in four sizes, is now little used in the service, but still has certain specific applications, for example in minesweeping operations.

Table 3-39. Details of Slip for Rigging



Naval stores No	**A** *mm*	**B** *mm*	**C** *mm*	**D** *mm*	**E** *mm*	**SWL** *tonnes*
0263/414-9831	145	30	32	45	10	0.825
	190	40	43	60	15	1.525
	230	45	50	70	20	2.350
	295	50	52	75	20	3.430

03043. Blocks

A block is a pulley, made of metal, metal and synthetic-resin bonded fibre (SRBF) or, in some cases, wood and metal. Only SRBF and metal blocks are used in the Royal Navy, and Naval stores numbers for those in common use are given in Tables 3-40 and 3-41.

a. **Parts of a Block.** (Fig 3-154(I). The main parts of a block are called the **shell** or body; the **sheave** or wheel over which the rope runs; the **pin** on which the sheave turns; the **bush** or bearing between the sheave and the pin; and the **head fitting**, usually an eye, by which the block is secured in the required position. The top of the block is called the **crown**; the bottom of the block is the **tail**; the sides of the shell are called the **cheeks**, the opening between the sheave and shell through which the rope passes is the **swallow**; and the eye sometimes fitted at the tail is called the **becket**. Blocks may have more than one sheave: a single block has one sheave, a double has two, a triple block has three, and so on. A **snatch block** is a single block, metal or SRBF, in which part of the shell is hinged to form a 'gate' which allows a bight of rope to be inserted into the swallow from one side. Snatch blocks should not be used when a solid block is suitable for the job. They should never be used when the safety of life depends on them, because the gate may open if a sideways pull is exerted. Figs 3-154(ii) and (iii) show an SRBF snatch block with the gate open and closed.

***Note**. A Modified style of block is being introduced into service as stocks of the existing type run out. Fig 154(iv) shows an example. The most notable difference from the existing style is the shape of the cheek plates. Pattern numbers for the new style blocks are the same, size for size, as the originals, and, size for size, new and old style blocks are fully interchangeable.*

b. **Classification and Description of Blocks**. Blocks are classified and described by their type (SRBF or metal); the number of sheaves; the head fitting (the means of attachment, usually a swivel eye); the size and type of rope for which they are designed and the safe working load (SWL) of the block. The SWL, stock number, maker's name and year of manufacture is usually marked on the block by stamping on the metal **binding**, but see also paragraph 03043d.

c. **Types of Block**

(1) *Synthetic Resin-bonded Fibre (SRBF) Block.* This block is built up of steel bindings, and its means of attachment and sheave pins are of steel; the cheek plates and sheave(s) are made of synthetic-resin bonded fibre. SRBF blocks are for use with man-made fibre and natural fibre ropes, and can be single, double or triple blocks or snatch blocks with safe working loads of one, two or four tonnes. They are designed to accept a maximum size of cordage and must not be used for wire rope. Details of those SRBF blocks in common use are given in Table 3-40.

***Note**. The safety catch assembly must be checked to ensure that the plunger extends a minimum of 10mm into the securing bolt. Blocks that do not meet this criterion must be returned to stores.*

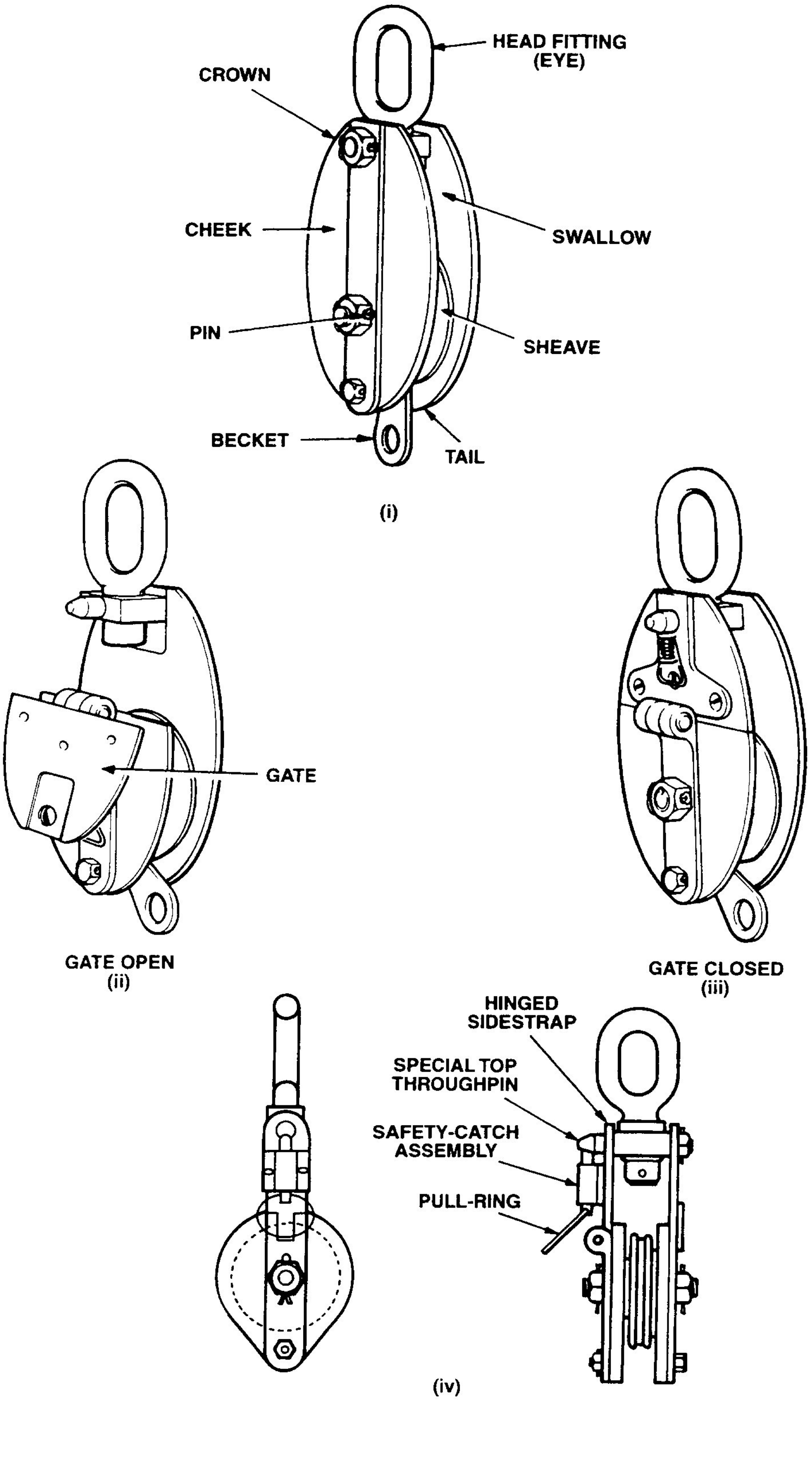
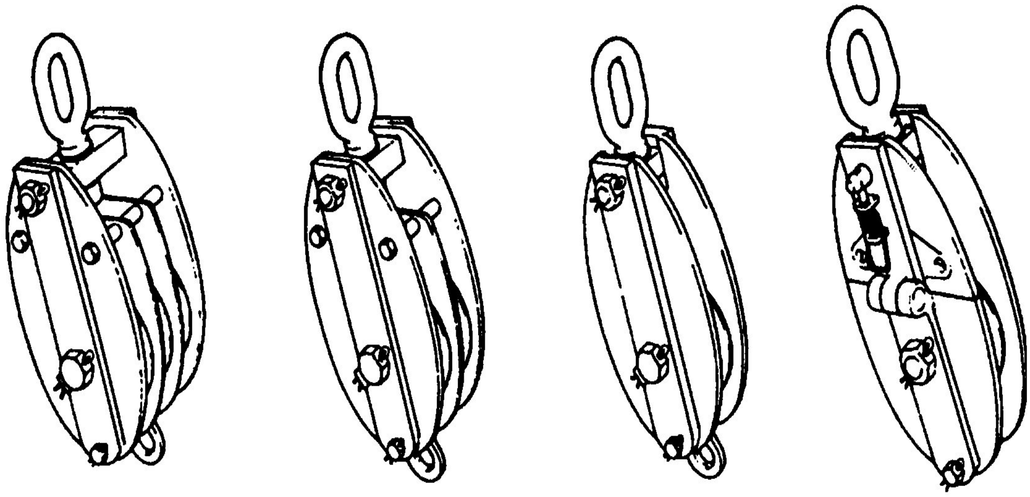


Fig 3-154. Parts of a Block

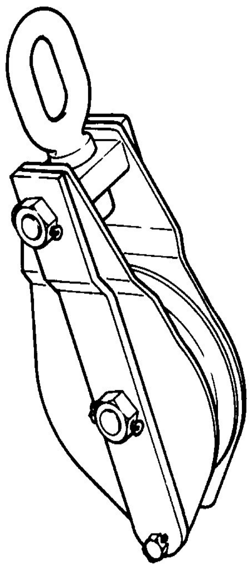
Table 3-40. Details of Synthetic Resin Bonded Fibre Blocks in Common Use

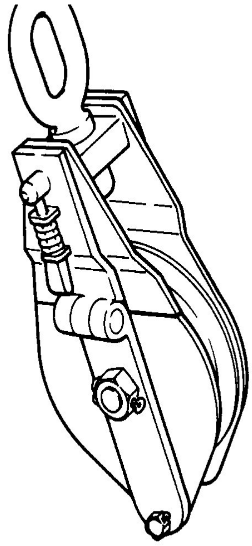


Description of Block	Naval stores Number	Maximum Size of Rope	Safe working load
	0246/521-	mm	
Treble with swivel oval eye and becket	2725 2726 2727	20 20 36	See Annexe 3A-1 See Annexe 3A-1 See Annexe 3A-1
Double with swivel oval eye and becket	2791 2792 2793	20 20 36	See Annexe 3A-1 See Annexe 3A-1 See Annexe 3A-1
Single with swivel oval eye and becket	2797 2798 2799	20 20 36	See Annexe 3A-1 See Annexe 3A-1 See Annexe 3A-1
Snatch with swivel oval eye	2794 2795 0246/190- 6915	20 20 36	See Annexe 3A-1 See Annexe 3A-1 See Annexe 3A-1

(2) *Metal Blocks*. These blocks are usually built up of steel plates and fittings, their shells have a binding which supplies the strength, but the cheeks, etc., are of light plating. However, some types of metal block have their shells cast in one piece. Certain special purpose blocks are made entirely of gunmetal or phosphor bronze, which do not corrode as easily as steel when exposed to the weather and are unlikely to cause sparks when working. Details of metal blocks in common use are given in Table 3-41.

Table 3-41. Details of Metal Blocks in Common Use





Description of Block	Naval stores Number	Size of SWR Rope	Safe Working load
	0246/521-	mm	
Single with swivel oval eye and becket	0660	12	See Annexe 3A-1
	0661	16	See Annexe 3A-1
	0662	20	See Annexe 3A-1
Snatch with swivel oval eye	0663	12	See Annexe 3A-1
	0664	16	See Annexe 3A-1
	0665	20	See Annexe 3A-1

d. **Safe Working Load of Blocks**. The safe working load (SWL) of a block is the maximum load that can be safely applied to the head fitting of the block, but the seaman must be aware that this loading depends on the way the block is used; for example, the loading on the head fitting of a block used as the standing or upper block of a purchase is not the same when it is used as the lower or moving block of the same purchase; this principle is illustrated in Fig 3-155. In Fig 3-155(I), ignoring friction, angle and weight of block, the head fitting of the single block is subjected to a load equal to twice the weight of the load being lifted. Therefore in such circumstances a single block with a SWL at the head fitting of at least 2 tonnes must be used to lift a 1 tonne load if rigged as shown in Fig 3-155(I). Similarly, a single sheave block with a SWL at the head fitting of $1^1/_2$ tonnes is adequate to lift a 1 tonne weight if rigged as the standing block in the configuration shown in Fig 3-155(ii). The Table at Annexe A to this Chapter gives the SWL of the head fitting for all blocks in use in the Royal Navy and shows the maximum load that can be lifted with each block in its various tackle configurations (See also paragraph 03045).

Note. *At present blocks are marked with a variety of data. Some bear only the proof load, others show the SWL at the head fitting, and others bear the SWL Per Part Of Rope (PPOR). To avoid errors and confusion when using blocks the seaman should refer to the information given at Annexe 3-A. This information is accurate. (See also paragraph 03044).*

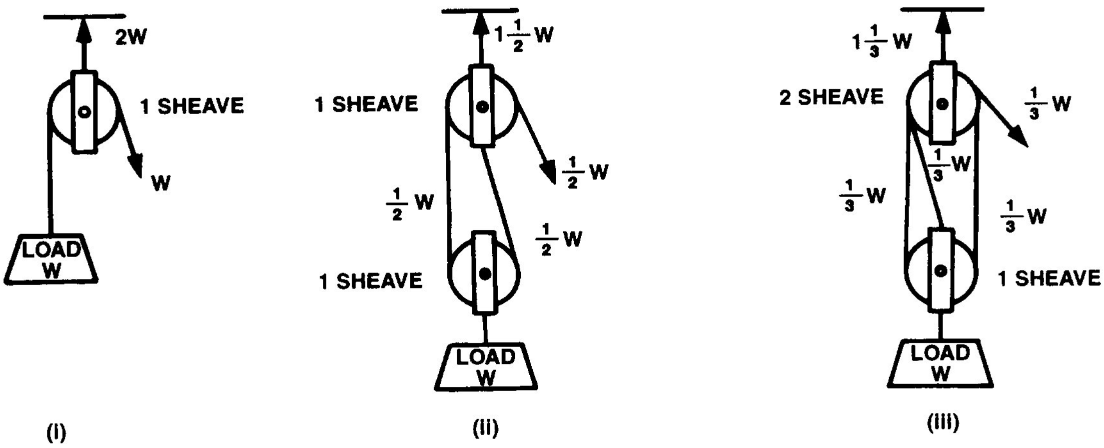


Fig 3-155. Examples of Different Loading on a Block

03044. Marking and Identifying Portable Rigging Fittings

It is MOD(N) policy that, where possible, all portable items of rigging equipment (often referred to as loose gear), will be marked with the following information:

a. The safe working load of the equipment.

b. The date of test.

c. Test authorities unique mark (if different from manufacturer).

d. Markings and symbols which indicate the manufacturer of the equipment and means of identifying the equipment with the manufacturers certificate of test and examination.

e. The NATO stock number.

Note. *It is likely to be several years before this policy is fully implemented, and there will always be exceptions, for example very small items and certain proprietary equipment not specifically produced for MOD(N) use.*

03045. Purchases and Tackles - Introduction

A purchase is a mechanical device by means of which an applied pull or force is increased; it may be a system of levers, a system of revolving drums or wheels geared to one another, or a combination of blocks or pulleys rove with rope or chain. A tackle (pronounced 'taycle') is a purchase consisting of a rope rove through two or more blocks in such a way that the force of any pull applied to its hauling part is increased by an amount depending upon the number of sheaves in the blocks and the manner in which the rope is rove through them.

a. **Parts of a Tackle** (Fig 3-156). The blocks of a tackle are termed the **standing block** and the **moving block**; the rope rove through them is called the fall, which has its **standing**, **running** and **hauling** parts. The size of a tackle is described by the size of its fall; a 24mm luff, for example, would be rove with a 24mm fall.

b. **Mechanical Advantage**. The amount by which the pull on the hauling part is multiplied by the tackle is called its mechanical advantage (MA) and, if friction is disregarded, this is equal to the number of parts of the fall at the **moving block**. In Fig 3-157 for example, there are two parts at the moving block, therefore the mechanical advantage is two; in other words, a pull on the hauling part of 50kg, would, if friction were disregarded, hold a weight of 100kg. Friction has been taken into account when determining the SWL of a block. However, when calculating the effort (pull) required to lift a weight using a block or tackle the general approximate rule for estimating the amount of friction set up in a tackle is to allow one-tenth for every sheave in the tackle. Therefore if one tonne is to be lifted and there are six sheaves in the tackle, the total allowance for friction will amount to six-tenths of a tonne. The formula for this calculation is given on the following page in sub paragraph e.

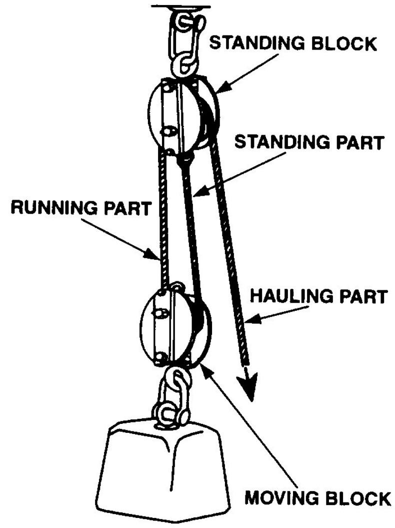


Fig 3-156. Parts of a Tackle

c. **Velocity Ratio**. Mechanical advantage is gained only at the expense of the speed of working. In Fig 3-157, for example, the weight will be raised only half a metre for every metre of movement of the hauling part. The ratio between the distance moved by the hauling part and that moved by the moving block is known as the velocity ratio (VR) and is always equal to the number of parts of the fall at the **moving** block.

d. **Reeving a Tackle to Advantage and Disadvantage**. The number of parts at the moving block, and therefore the mechanical advantage, is always greater when the hauling part comes away from the moving block, and such a tackle is said to be **rove to advantage**. Conversely, a tackle in which the hauling part comes away from the standing block is said to be **rove to disadvantage** (see Fig 3-158). Where practicable, therefore, it is beneficial to rig a tackle so that the hauling part leads from the moving block, and the block with the greater number of sheaves is the moving block.

e. **Calculating the Effort (Pull) Required to Lift a Weight with a Tackle**. To calculate the effort (pull) to lift a given load using a tackle the following formula should be used:

$$P = \frac{W}{V}\left(1 + \frac{N}{10}\right)$$

P = Pull required (in Kgs)
W = Weight to be lifted(in Kgs)
V = Velocity Ratio
N = Number of sheaves in tackle

The average man can comfortably exert a pull of 25 Kgs. Therefore to determine the number of personnel required to man the hauling part of the tackle divide the answer to the equation above by 25.

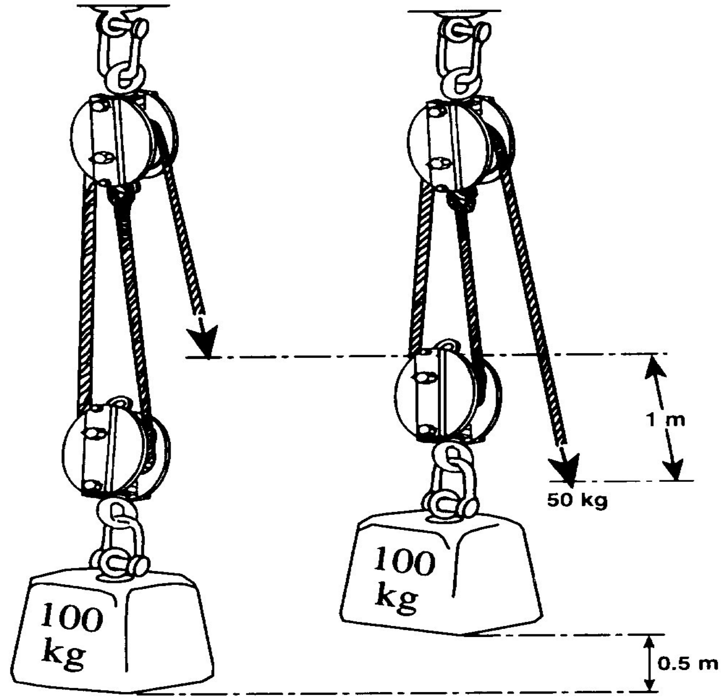


Fig 3-157. Mechanical Advantage and Velocity Ratio of a Tackle

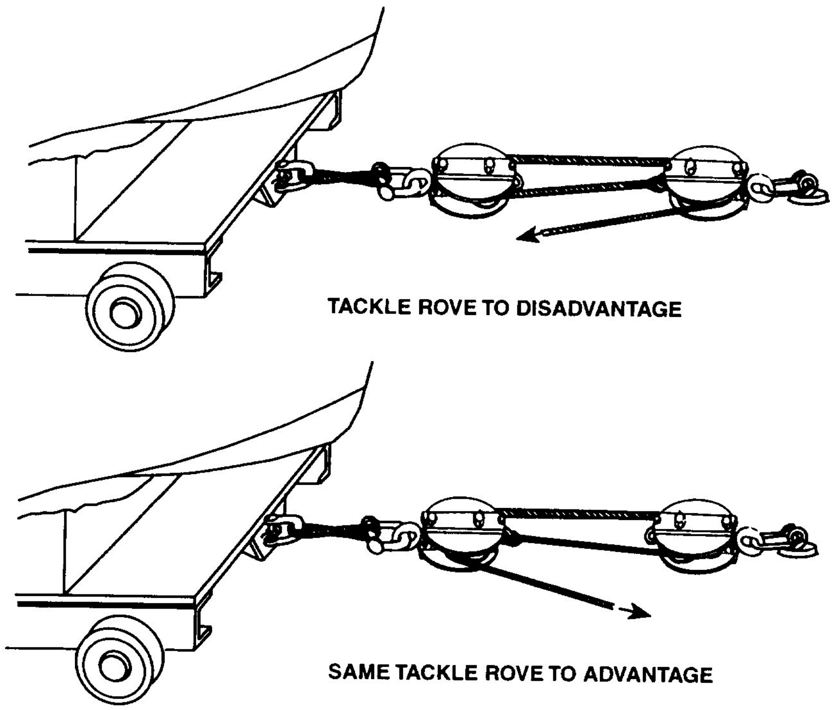


Fig 3-158. Reeving a Tackle to Advantage and Disadvantage

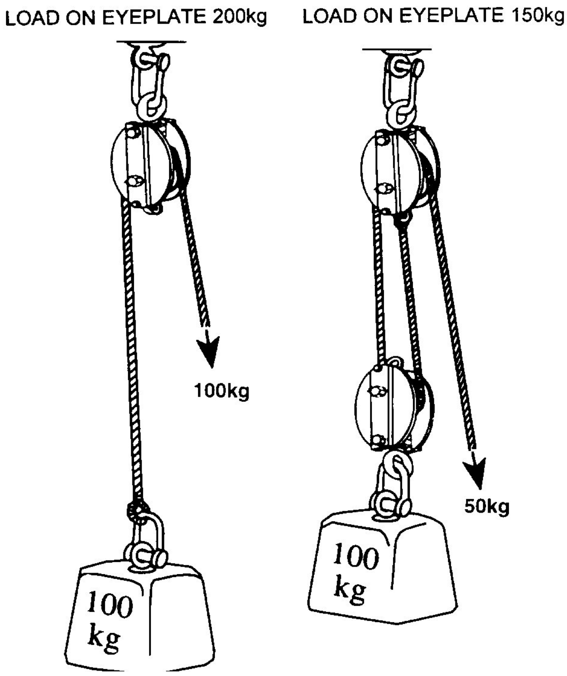


Fig 3-159. Load on the Standing Block

03046. Examples of Tackles and Purchases

Examples of whips, tackles and purchases, together with their velocity ratio and mechanical advantage are given below; in each the approximate loss of mechanical advantage due to friction has been taken into account. Tackles should be rove as illustrated; this is particularly important for the three fold purchase to prevent turns forming in the tackle and avoid any tendency for the block to cant sideways as the load comes on it.

a. **Single Whip** (Fig 3-160). This consists of a fall rove through a single standing block; no mechanical advantage is gained. It is used for hoisting light loads, and where speed of hoisting is an important factor.

b. **Runner** (Fig 3-161). This consists of a rope through a single moving block. As there are two parts of the fall in the moving block, the VR is 2 and the MA is 1.82.

c. **Double Whip** (Fig 3-162). This is a purchase used for hoisting and consists of two single blocks with the standing part of the fall made fast near, or to, the upper block, and it cannot be rove to advantage. The VR is 2 and the MA is 1.67.

d. **Gun Tackle** (Fig 3-163). This is the term usually applied to a purchase consisting of two single blocks, but which is not used for hoisting; it cannot then be called a double whip, as this is a term applied only when it is used for hoisting. In the gun tackle the standing part of the fall is always made fast to one of the blocks. The name originates from the small tackle which was used to run out the old muzzle-loading guns after they had recoiled. The VR is 3 if rove to advantage, or 2 if rove to disadvantage, and the MA is respectively 2.5 or 1.67.

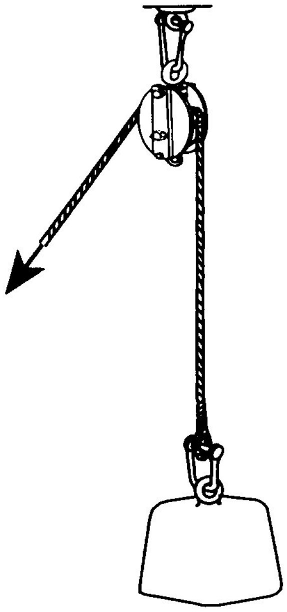


Fig 3-160. Single Whip

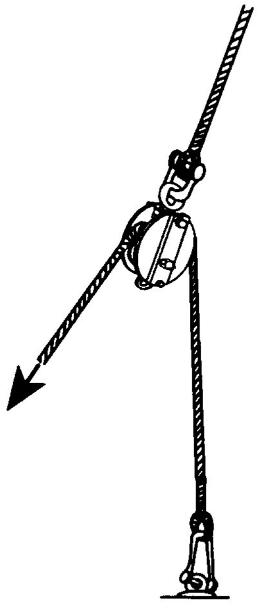


Fig 3-161. Runner

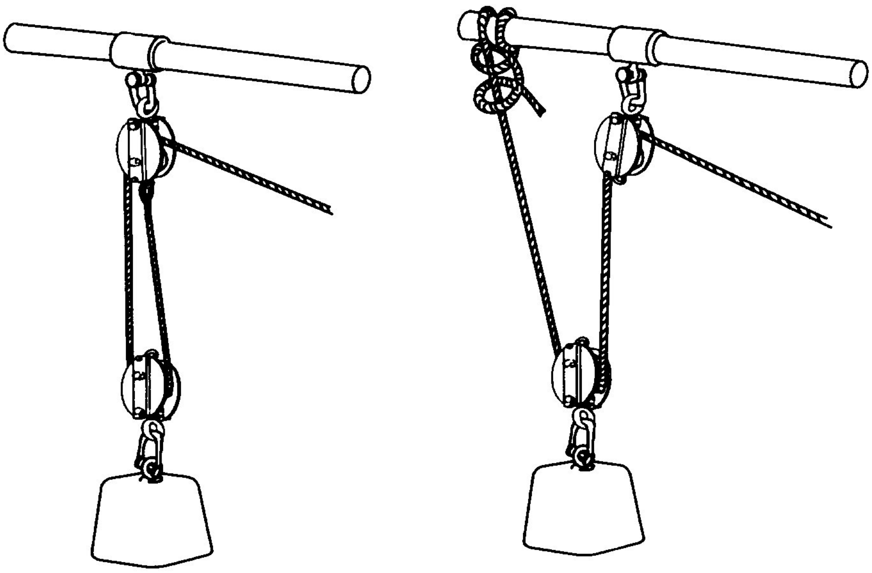


Fig 3-162. Double Whip

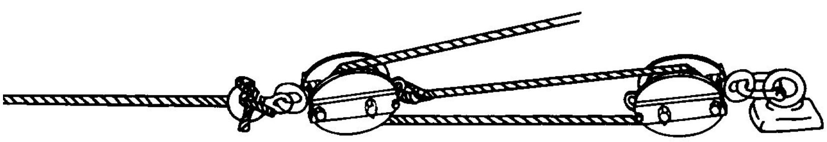


Fig 3-163. Gun Tackle

e. **Luff** (Fig 3-164). This is a purchase of size 24mm or greater. It consists of a double and a single block, with the standing part of the fall made fast to the single block. The VR is 4 if rove to advantage, or 3 if rove to disadvantage, and the MA is respectively 3.08 or 2.3.

f. **Jigger**. This is similar to a luff, but is from 16mm to 20mm in size.

g. **Handy Billy**. This is a small tackle of less than 16mm in size; it is usually rove as a jigger but can be rove as a small gun tackle.

h. **Two-fold Purchase** (Fig 3-165). This consists of two double blocks and is a useful general-purpose tackle. The VR is 5 if rove to advantage, or 4 if rove to disadvantage, and the MA is respectively 3.57 or 2.86.

i. **Three-fold Purchase** (Fig 3-166). This consists of two treble blocks; the VR is 7 if rove to advantage, or 6 if rove to disadvantage, and the MA is respectively 4.37 or 3.75. Tackles having more than three sheaves are not provided because they are too cumbersome to handle efficiently and because the friction in their sheaves reduces their gain in mechanical advantage. If additional mechanical advantage is required it is better to combine two simple tackles.

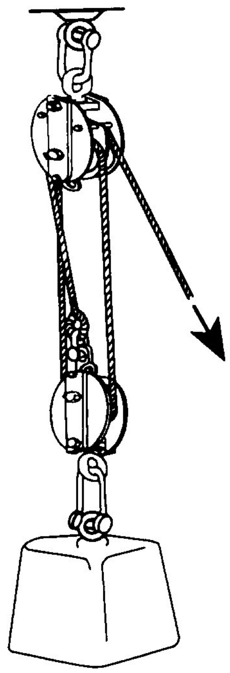


Fig 3-164. Luff

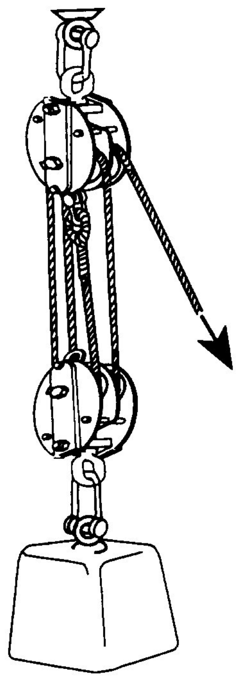


Fig 3-165. Two-fold Purchase

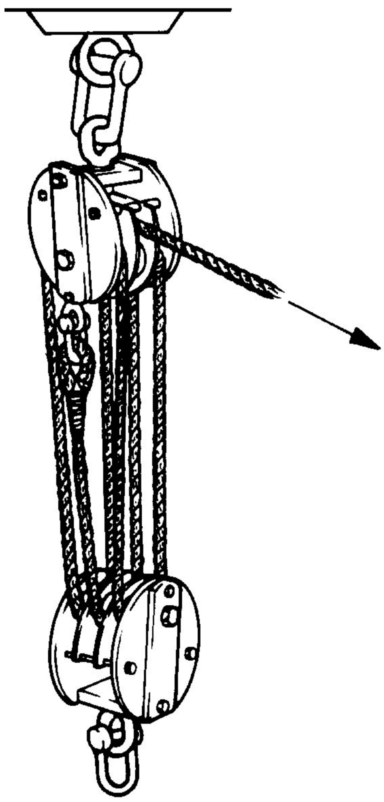


Fig 3-166. Three-fold Purchase

j. **Luff upon Luff.** This is a general term used to describe the combined use of two tackles in which the moving block on one is **clapped on** (secured) to the hauling part of the other; its mechanical advantage is the product of the mechanical advantage of each tackle. Fig 3-167 shows two luffs rove to advantage and as a luff upon luff whose VR = 4 x 4 = 16; its MA is 9.49.

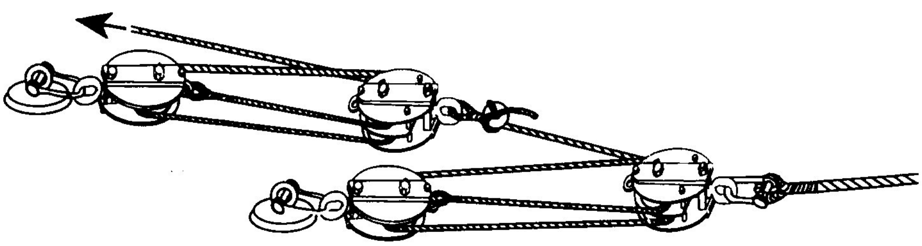


Fig 3-167. Luff upon Luff

k. **Dutchman's Purchase**. This is a tackle used in reverse to take advantage of the velocity ratio of the tackle; an example of its use is to drive a light whip at fast speed from a slow but powerful capstan. In the example illustrated in Fig 3-168 the whip would move a distance of 5 metres for every metre travelled by the moving block. When using a tackle in this manner the pull exerted by the capstan must be equal to the product of the weight to be hoisted and the velocity ratio of the tackle, plus the friction in the tackle and its leading blocks; in this case a pull of at least 5.6 times the weight to be hoisted. Ensure the tackle and pendant are strong enough for the job.

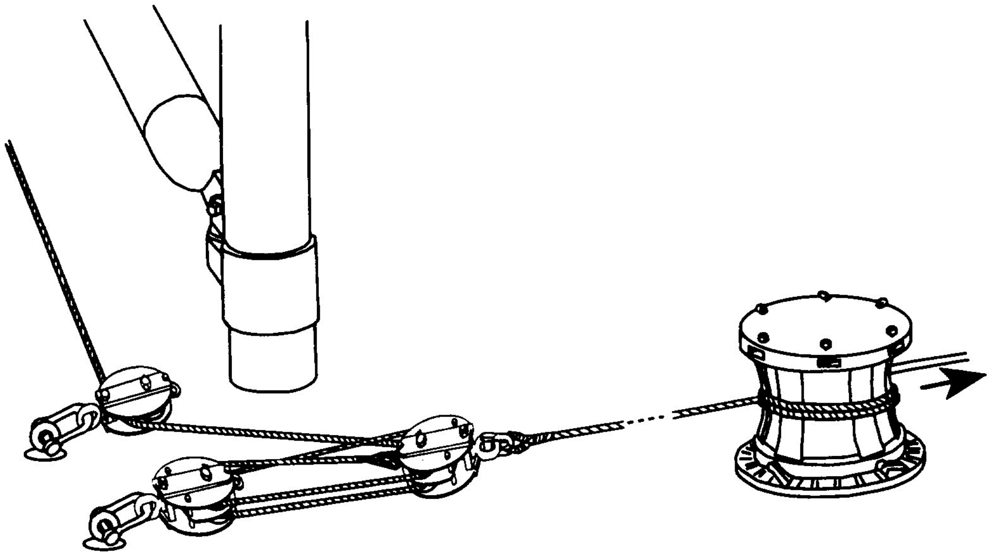


Fig 3-168. Dutchman's Purchase

03047. Hand Operated Chain Blocks (Fig 3-169)

Hand operated chain blocks are mechanical purchases designed for lifting weights and have a number of advantages over the simple tackle. They usually consist of a sprocket, worked by an endless hand chain which operates the load sprocket through some type of gearing; the load sprocket carries the load chain, to which the hoisting hook is attached. The blocks may be of a suspended or a built-in pattern. Suspended types (I) have a top hook, shackle, or eye from which the block is hung and which allows a degree of articulation between the block and the supporting structure. Built-in types (ii) are usually combined with a purpose made travelling trolley. Chain blocks supplied for use in confined spaces have a lever and ratchet (iii) instead of the endless chain. Geared blocks have a very large mechanical advantage and little friction, so that the full safe working load of the gear equipment can be raised by one man. Blocks supplied to the Royal Navy have a safe working loads of from 0.25 tonnes to as much a 10.0 tonnes, but those of over 4 tonnes are not widely used.

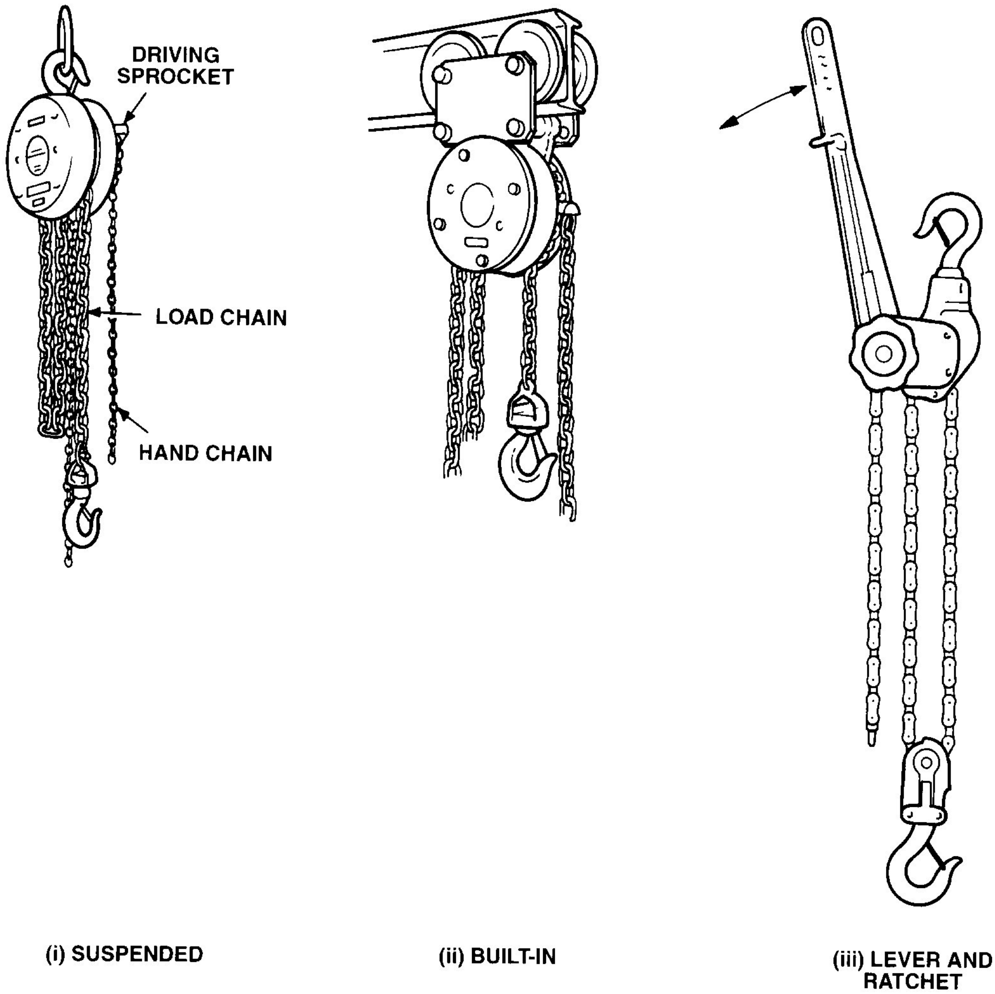


Fig 3-169. Types of Chain Block

03048. Tirfor Pulling and Lifting Machines (Fig 3-170)

The Tirfor is a patented hand operated pulling and lifting machine similar in operation to the lever and ratchet chain block, although wire rope rather than chain is used as the fall. It works by pulling directly on the rope, the pull being applied by means of two pairs of self-energising smooth jaws which exert a grip on the rope in proportion to the load being lifted or pulled. The initial pressure which causes the jaws to grip the rope and give the self-energising action is provided by powerful springs. Each machine has a **stub operating handle** over which an **operating handle** fits and by pumping the handle back and forth the hook is drawn towards the block (hoisting the load); shear pins that activate when the safe working load of the machine is exceeded by 60% are fitted to the handle stub of the two smallest type of machine. To reverse the process, ie, to move the hook away from the block (lower the load), the operating handle is placed over the **reversing lever** and pumped as described above. To release the jaws from the rope the **rope release lever** is operated. This must never be attempted when the machine is under load. **Maxiflex** wire rope falls are supplied with each machine; other types of wire must not be used. There are three sizes of machine available through Naval stores, details of Pattern numbers for the machines and the wire whips are given in Table 3-42. An operator's handbook is supplied with each machine, spare copies are available from the manufacturers, Tirfor Ltd, Old Lane, Sheffield S19 5GZ.

Table 3-42. Details of Pulling and Lifting Machines

Pattern No of Machine	Safe Working Load	Pattern No of Wire Whip
0246/202-9035 0246/137-2655 0246/137-1594	0.762 tonne 1.625 tonne 3.04 tonne	0246/202-9037 (10m length) 0246/202-9038 (18m length) 0246/202-0013 (10m length) 0246/137-1595 (37m length)

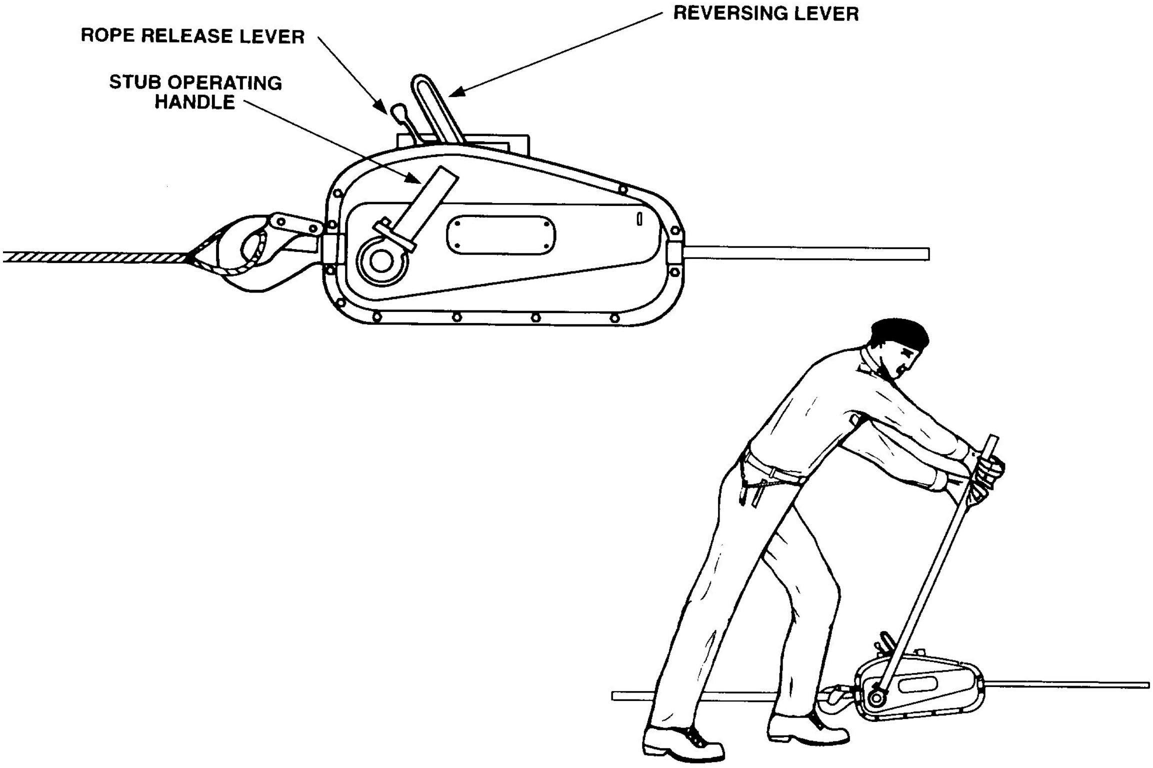


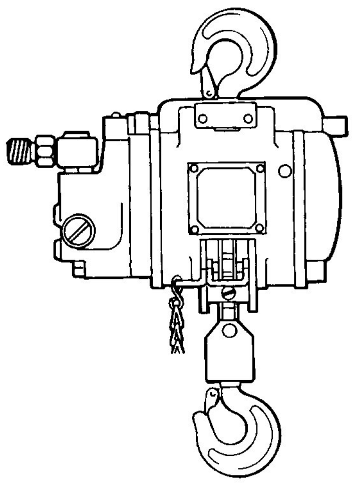
Fig 3-170. Pulling and Lifting machine. (Tirfor Block)

03049. Air-powered Hoist (Fig 3-171(i))

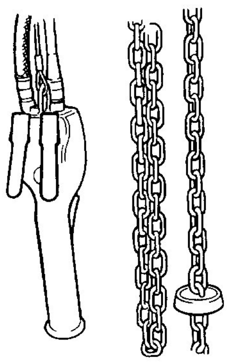
The air-powered hoist relies on compressed air for power. The unit is connected to a low pressure (LP) air supply, and operated by a **pendant control handle** (Fig 3-171(ii). The pendant handle control is fitted with separate levers for raising or lowering the load, and a safety lever which must be depressed by gripping the handle before the hoist becomes operative. Depression of the ‹up' or ‹down' levers on the control handle causes air pressure to be released on the appropriate side of the throttle valve so that it moves to one side of the chamber and air passes to the motor. The brake is held in the ‹off' position by air pressure, so that if the operator releases the pendant control, the brake is automatically applied and will safely hold the maximum load until the ‹down' lever is operated. The hoist, which has a maximum lifting distance of 6m, has a safe working load of 400 kgs and is available from Naval Stores on Pattern number F205/772-9185.

WARNING

AIR-POWERED HOISTS ARE NOT TO BE USED FOR THE LOWERING OR HOISTING OF PERSONNEL



(i)



(ii)

Fig 3-171. Air-powered Hoist

03050. Slinging

The information given here provides an introduction to slinging, and is sufficiently comprehensive to enable the seaman to safely carry out routine slinging tasks. More information on slinging is given in **BR 6004 Slingers Handbook**, and **BR 3027 Manual of Inspection and Test of Lifting Plant.** Slings are used for hoisting, lowering or supporting loads; they may be directly attached to (or passed round) the load, and, depending on the nature of their duty, can be of chain or steel wire rope, or proprietary man-made fibre lifting slings made of polyester or polyamide; hawser-laid cordage slings are no longer used in the Royal Navy. The choice of sling and the manner in which it is used depends upon whether one or a number of objects are to be slung in one hoist, the weight of those objects and whether they are robust or fragile. If a number of loads are to be slung in one hoist the load is called a **set**. The main requirement when slinging is that the sling should be sufficiently strong to hold the load securely without crushing it, and the simpler the sling the easier it will be to handle.

a. The duties and responsibilities of a slinger are:

(1) To prepare the set or load.

(2) To select and prepare the appropriate slings, pan them round or connect them to the set or load.

(3) To correctly hook or shackle the sling or slings to the crane, derrick or lifting appliance.

(4) To tend and steady the load before lifting and to control by line while the load is slung, and to tend, steady and position the load on lowering.

(5) To be fully responsible for the safe transfer of the load from one position to the other.

(6) To be solely responsible for giving the orders to the crane driver, derrick winchman, or man tending the lifting appliance. (Second slinger.)

(7) To be conversant with the Standard Crane Signals and to use them at all times. (see Fig 3-192).

(8) To inspect the lifting gear before use to ensure it is in a satisfactory condition and suitable for the job. Also to inspect the gear after use and report any defects.

(9) To check that each item of lifting gear employed is marked with its safe working load and identification number.

(10) To make sure that the outriggers of mobile cranes are extended **before** lifting operations commence.

b. **Slinging Constraints.** The constraints that apply to safe slinging are:

(1) All slings must be registered in the lifting plant record. The use of unregistered slings is unlawful.

(2) A load label is attached to all registered slings showing the total weight (safe working load) the complete sling is designed to lift with the legs at an inclined angle of not more than 90^0 (90^0 angle between sling legs), and with all legs in use. If only one leg of a double-leg sling is used then only half the weight indicated by the load label can be lifted. If the angle between the sling legs is greater than 90^0 then the weight lifted must be less than that indicated on the load label (see Fig 3-175).

(3) A sling must not be used to lift a weight greater than that indicated on the label. Therefore the weight of the load must be determined prior to slinging.

(4) Use long slings whenever possible to reduce the angle of the sling. It is important to remember that the lifting capacity of the sling is affected by the angle of the sling legs.

(5) Always use two or more legs of a wire rope sling with hook and spliced eye. A single wire can untwist allowing the splice to open and slip.

(6) When an object with sharp corners or rough edges is to be lifted, slings must be protected by pads of suitable thickness and material.

(7) Do not rest a load on a sling. If necessary use suitable supports to avoid trapping the sling.

(8) Slings must not be knotted.

(9) Slings must not be dragged either loaded or unloaded across the deck. This is particularly important with fibre slings.

(10) Ensure the crane hook is placed centrally over the load to prevent swinging when the load is being raised.

(11) Stow slings in their designated stowage; don't leave them lying about.

c. **Sling Configuration.** Each of the different types of material may be encountered in any one of five basic configurations for general purpose slings, ie, single leg, two leg, three leg, four leg and endless sling.

(1) *Single Leg Sling.* This sling may be used to connect a lifting appliance to a load with a single lifting point such as the eyebolt on an electric motor (Fig 3-172(i)). It may also be used as a choke hitch, either by back hooking (ii) or reeving one end of the sling through the other (iii), (iv) and (v). Or, where possible, it may be passed as a basket hitch through the load to be lifted (vi). Two single leg slings may be used to form, in effect, a two leg sling (Fig 3-173).

Where this is done, the included angle between the sling legs should not exceed 90° and care must be taken to ensure that the hook is not overcrowded. The method of attaching the sling to the crane hook should ensure that the sling's eyes, links or rings are not damaged. Two single legs slings used as a two leg sling must be treated as a two leg sling for rating purposes and the combined safe working load when used at all angles between 0 and 90^0 must be considered at 1.4 times the safe working load of the single sling.

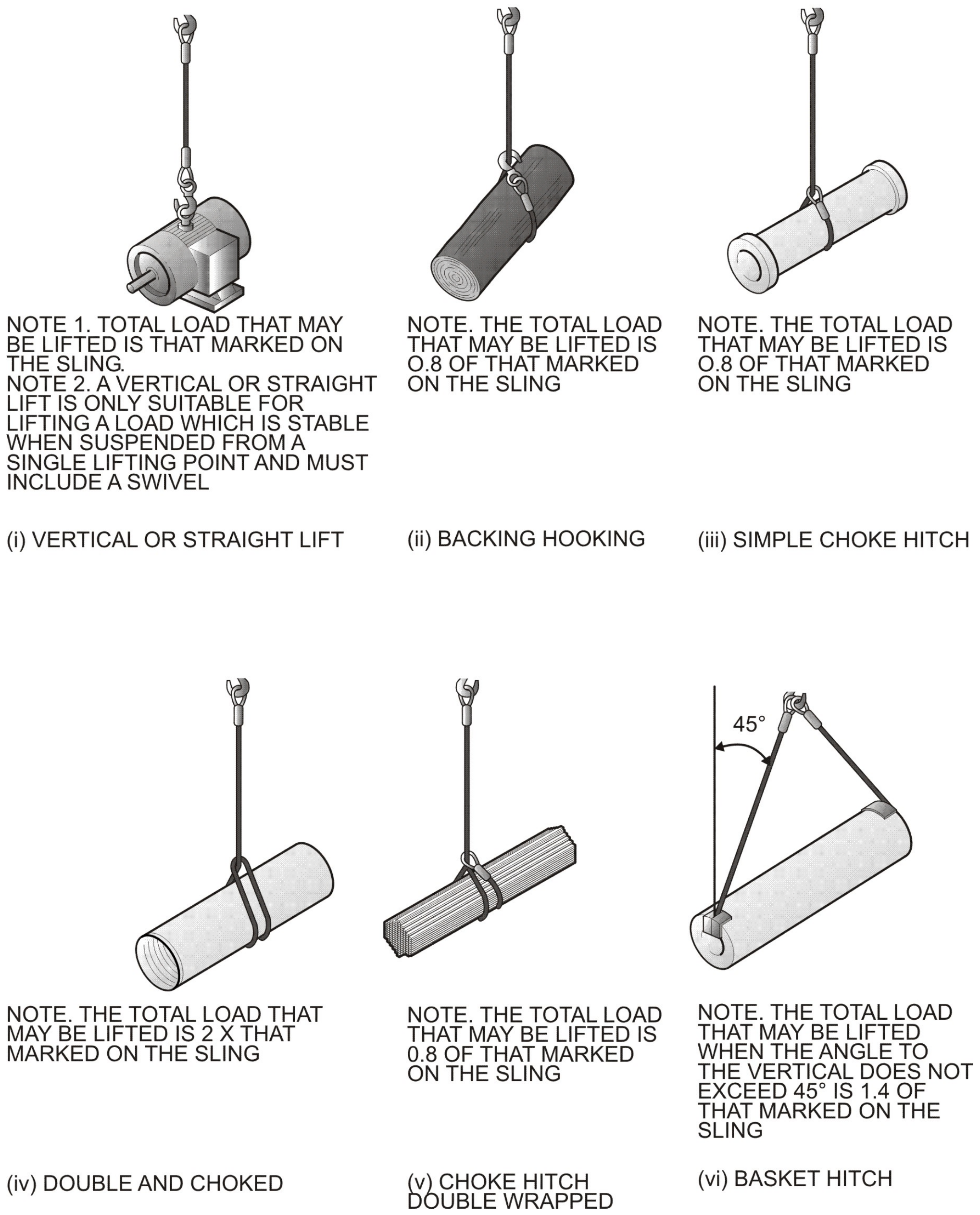
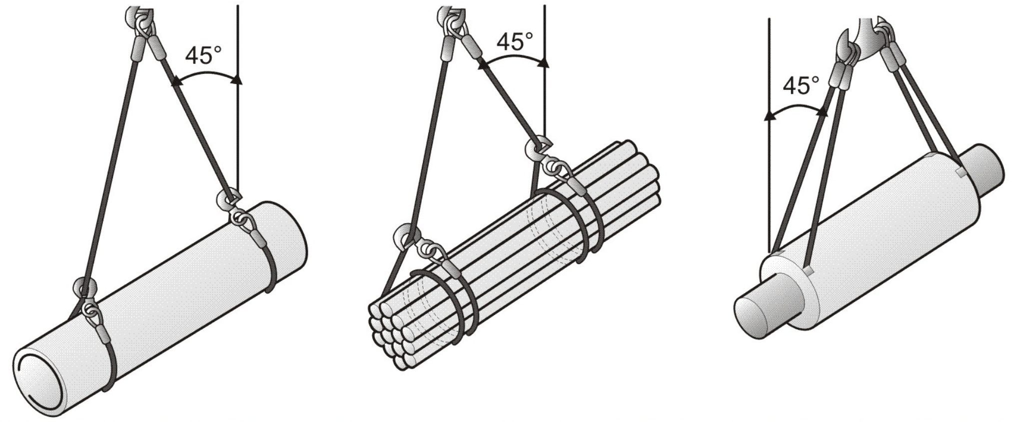


Fig 3-172. Single Leg Sling in Various Configurations



NOTE: THE TOTAL LOAD THAT MAY BE LIFTED WHEN THE ANGLE TO THE VERTICAL DOES NOT EXCEED 45° IS 0.8 X 1.4 TIMES THAT MARKED ON THE SINGLE SLING

NOTE: THE TOTAL LOAD THAT MAY BE LIFTED WHEN THE ANGLE TO THE VERTICAL DOES NOT EXCEED 45° IS 0.8 X 1.4 TIMES THAT MARKED ON THE SINGLE SLING

NOTE: THE TOTAL LOAD THAT MAY BE LIFTED PROVIDED NO ANGLE TO THE VERTICAL EXCEEDS 45° IS 2.1 TIMES THAT MARKED ON THE SLING

Fig 3-173. Two Single Leg Slings in Various Configurations

(2) *Two Leg Sling* (Fig 3-174). A two leg sling comprises two legs connected at their upper ends by a master link. Two leg slings may be used to handle a wide range of loads.

(3) *Three Leg Sling* (Fig 3-174). A three leg sling comprises three legs connected at their upper ends by a master link. Three legs are commonly used to handle circular or irregularly shaped loads where the legs can be equally spaced.

(4) *Four Leg Sling* (Fig 3-174). A four leg sling comprises four legs connected to a main lifting ring via two intermediate rings. Four legged slings are mainly used to handle square or rectangular (four cornered) loads.

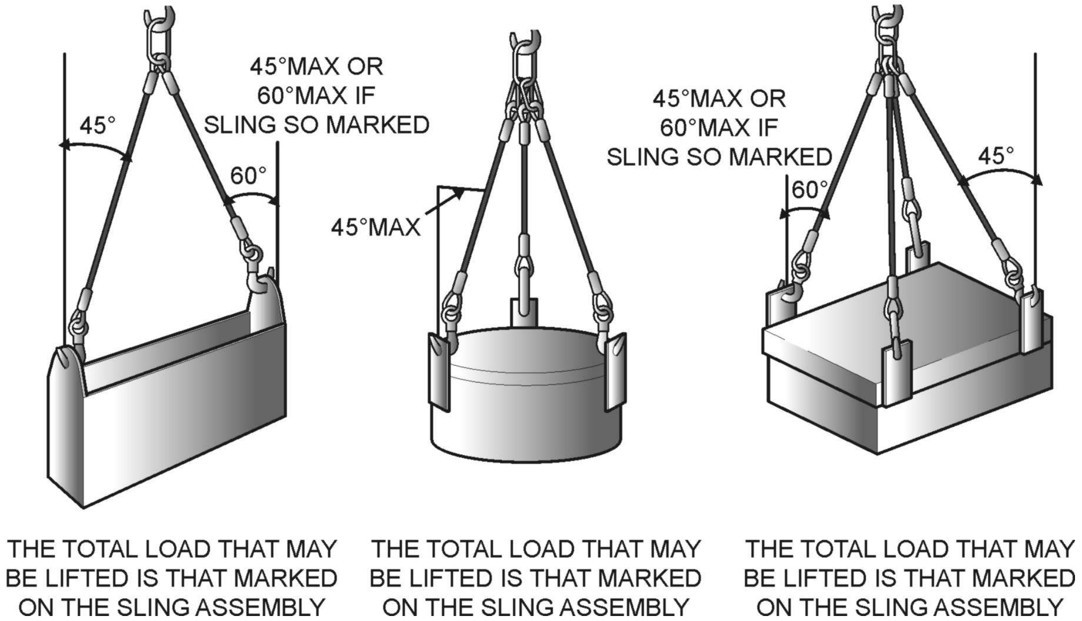


Fig 3-174. Two- Three- and Four legged Slings

d. **Method of Rating Lifting Slings**. When a multi-leg sling is used with the slings at an angle, the tension in the individual sling legs will increase as the angle to the vertical becomes greater (Fig 3-175). If a sling is to be used safely, allowance must be made for this angle; there are various ways of calculating this allowance but the simplest way is by the ‘Uniform Load Method’. This method permits only one Working Load Limit (WLL) for angles up to 45° to the vertical and a reduced WLL for angles between 45° and 60° to the vertical. This is the only method to be used for all multi-purpose slings. The calculation is made by utilising mode factors as follows:

Single leg sling	=	1.0 x WLL of a single leg
Two leg sling (included angle 0-45°)	=	1.4 x WLL of a single leg
Two leg sling (included angle 45°-60°)	=	1.0 x WLL of a single leg
Three and four leg sling (included angle 0-45°)	=	2.1 x WLL of a single leg
Four leg sling (included angle 45°-60°)	=	1.5 x WLL of a single leg

Notes.

1. These calculations assume that: the slings are symmetrically disposed in plan, and equally stressed under load; that all legs of multi-leg slings are made of identical material, and the method of attachment to the load allows for a ‘straight pull’, ie the legs are not bent around the load, choked, back hooked or otherwise prevented from taking up a straight line under load.

2. 3 and 4 leg slings are rated the same for 0 -45°. This takes into account that at any one time one leg will have no load.

*3. 3 leg slings **MUST NEVER** be rated for angles greater than 45° due to the excessive stresses created at the larger angles.*

4. The mode factors used are based on the percentage of loading in the single leg of the sling regardless of the material used.

e. **Markings on the Sling.**

Uniform method rated slings (range of angles)

WLL / SWL xt 0 - 45°

WLL / SWL yt 45° - 60°

Note. *Older slings may be marked for the included angle: 0 - 90° and 90° - 120°*

f. **Multi-leg Slings with less than the full number of legs in use.** If a multi-leg sling is used with less than the actual number of legs attached to the load, then the safe working load of the sling must be reduced. An easy way of ensuring that the sling is never overloaded is to reduce the safe working load from that marked on the sling according to the number of legs in use in the following manner;

(1) 2 leg sling with one leg in use = ½ marked SWL

(2) 3 leg sling with two legs in use = $^1/_3$ marked SWL

(3) 4 leg sling with three legs in use = ¾ marked SWL

g. **Rating Assumptions and Deviations from the Assumed Conditions.** Both rating methods assume certain conditions of use, which ensure that no part of the sling is overloaded. It is important to understand that although the weight to be lifted may be within the maximum lifting capacity of the sling, using it in the wrong way can overload part of the sling. Some deviations from the assumed conditions are prohibited such as loading a hook on the tip. Others are permitted provided an appropriate allowance is made. With multi-purpose slings, the designer has little if any information about the intended use so the onus to make such allowances falls on the user.

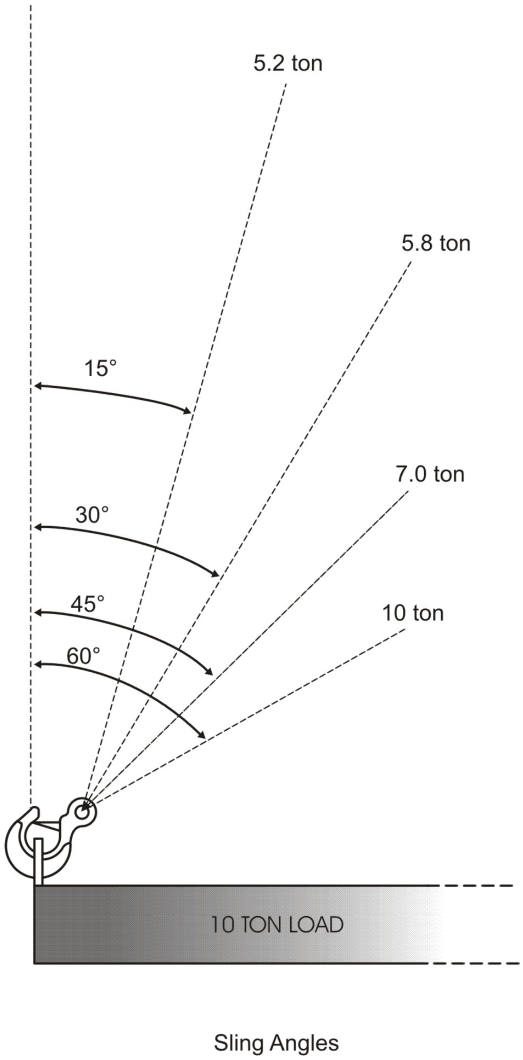


Fig 3-175. Illustration of How Tension Increases in Legs of Sling as Angle Increases

h. **Other Factors Affecting the Strength of Slings.** If a wire or chain sling is hooked back on itself, or secured by a choke hitch, ie by reeving one end of the sling through the other, it is said to be **snickled**. This method of securing the slings to the load will reduce the working strength of a chain sling by 50%, and a wire sling by up to 66%. The reduction in working strength with regard to proprietary polyester slings is given in Table 3-43.

i. **Estimating Sling Angles**. In practice it is not possible to measure sling angles accurately, and the slinger must therefore use his judgement. Fig 3-176 shows how to estimate angles of 30^0, 60^0, 90^0 and 120^0 by relating the span to the length of one leg of the sling. All references to sling angles refers to the angle to the vertical that the sling creates when in use.

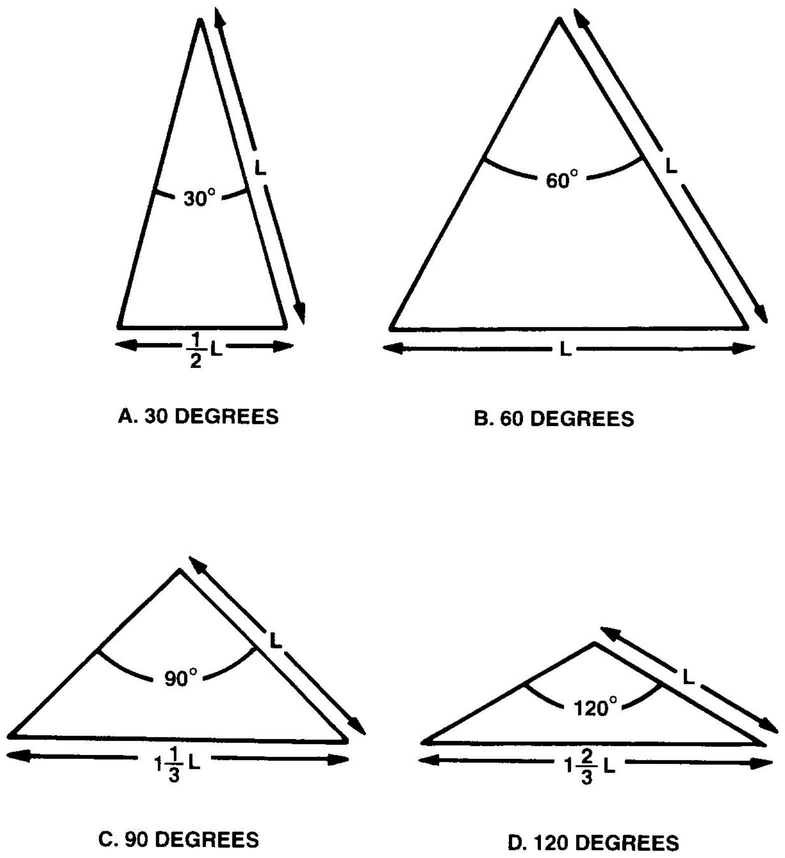


Fig 3-176. Estimating Sling Angles

j. **Using Spreaders** (Fig 3-177). Spreaders are used in conjunction with slings primarily to prevent the sling crushing and damaging the load in instances where softwood or other packing in way of the sling gives insufficient protection. Spreaders are usually made of 180mm x 180mm Canadian elm or English oak up to about 3.6m in length. It is important that the correct length of spreader for the job is used; as a rule of thumb the spreader should be no longer than is necessary to prevent crushing of the load.

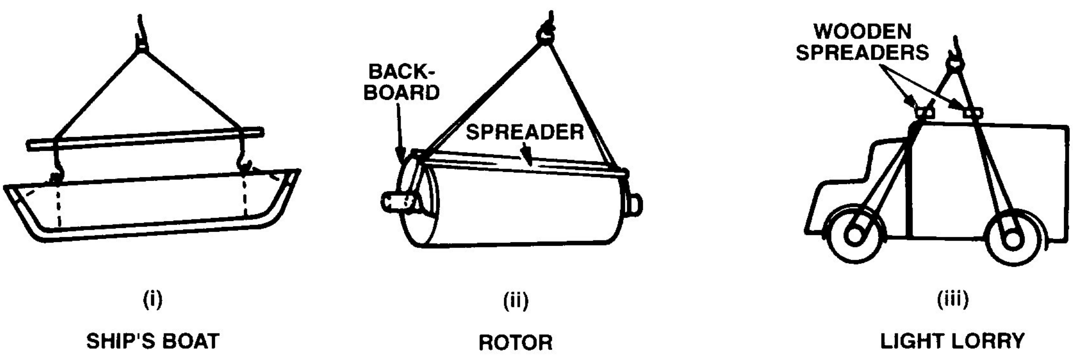


Fig 3-177. Using Spreaders

k. **Slinging Boats**. When a boat, normally hoisted at davits, is hoisted by dockside or mobile crane, either a two leg sling with a spreader is used (Fig 3-177(i)), or two specially made flat webbing slings are passed around the keel and positioned at pre-determined points to ensure a balanced lift. Whenever possible it is advisable to seek advice from an experienced slinger before undertaking this evolution.

l. **Slinging a Vehicle**. Special wheel net slings are normally used for loading and discharging vehicles from ships (Fig 3-178). These slings can also be used for loading and unloading stores. The gear consists of two wire nets 2.6m x1m fitted with shackles, two wooden spreaders 3m x 100mm x 100mm fitted with slotted ends and retaining bolts, four 24mm SWR single slings 7m in length fitted to intermediate links and a master link at the top and a thimble eye at the bottom, and eight bulldog grips. The bulldog grips are secured to the single slings on each side of the spreaders to prevent them slipping. The SWL of this type of vehicle sling is 6 tonnes. The correct procedure for lifting is as follows:

(1) Move the vehicle as near to the crane plumb as possible, and spread out the nets in front of each pair of wheels.

(2) Move the vehicle onto the nets, making certain that the wheels rest centrally upon them.

(3) Lower the four-leg sling about the vehicle and shackle each pair of legs to a net; leave the vehicle brakes off.

(4) Take up the slack of the sling and the nets and, with padded material, pack between the nets and the body where the nets may bear.

(5) Lift the vehicle, taking care that the wheels are riding snugly in the nets.

Points to remember when using vehicle lifting gear:

(a) Spreaders must be used, otherwise much damage will be done.

(b) Ensure the bulldog grips are firmly in position and place the bolt through the end of the spreader.

(c) When lowering a vehicle, lower the purchase slowly once the vehicle has touched, otherwise the spreader may damage the vehicle or the stores.

(d) It is often possible to leave the nets shackled to the slings, and to run the next vehicle onto them without dismantling the gear.

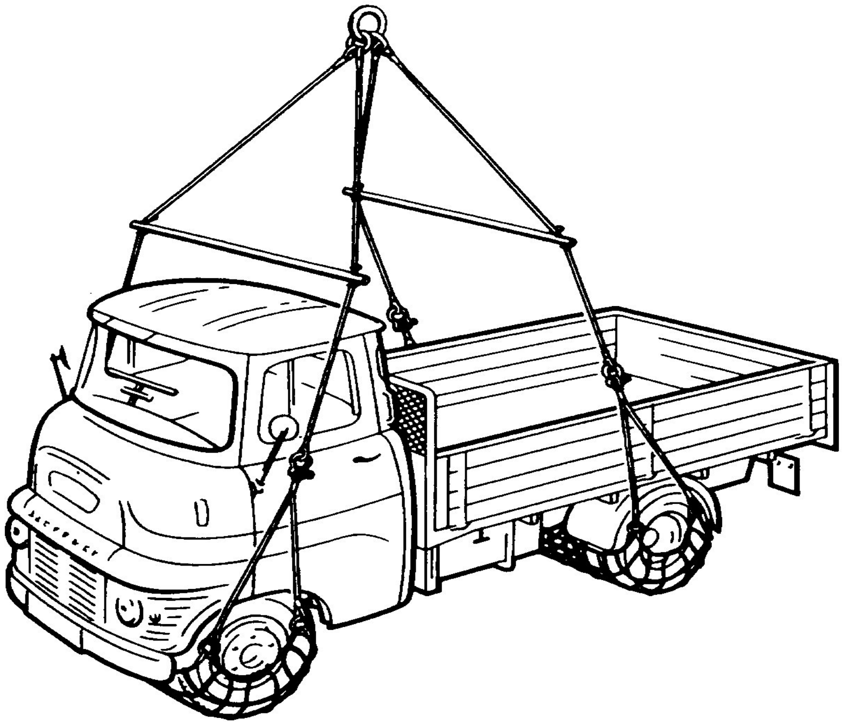


Fig 3-178. Slinging a Vehicle

m. **Cargo Nets** (Fig 3-179(i)). Cargo nets are a practical way of handling loads which will not suffer damage when subjected to the bowsing-in movement inherent when lifting equipment in nets; objects such as drums are most safely transferred in this manner. The versions currently available are made of steel wire rope or cordage; details are as follows:

Cordage cargo net	2.76m x 2.76m SWL 1.5 tonnes Pattern No 0246/923-3574
Steel wire rope cargo net	2.6m x 2.6m SWL 3.0 tonnes Pattern No 0246/923-9438

n. **Pallet and Pallet Sling (Palnets) Fig 3-179(ii)**. The pallet is of wooden or aluminium construction which, when loaded with stores can be lifted by fork-lifted truck or can be hoisted by the pallet sling without the necessity of reeving the sling under the pallet before it is loaded. This arrangement is ideal for the transfer of bulk stores of the same size.

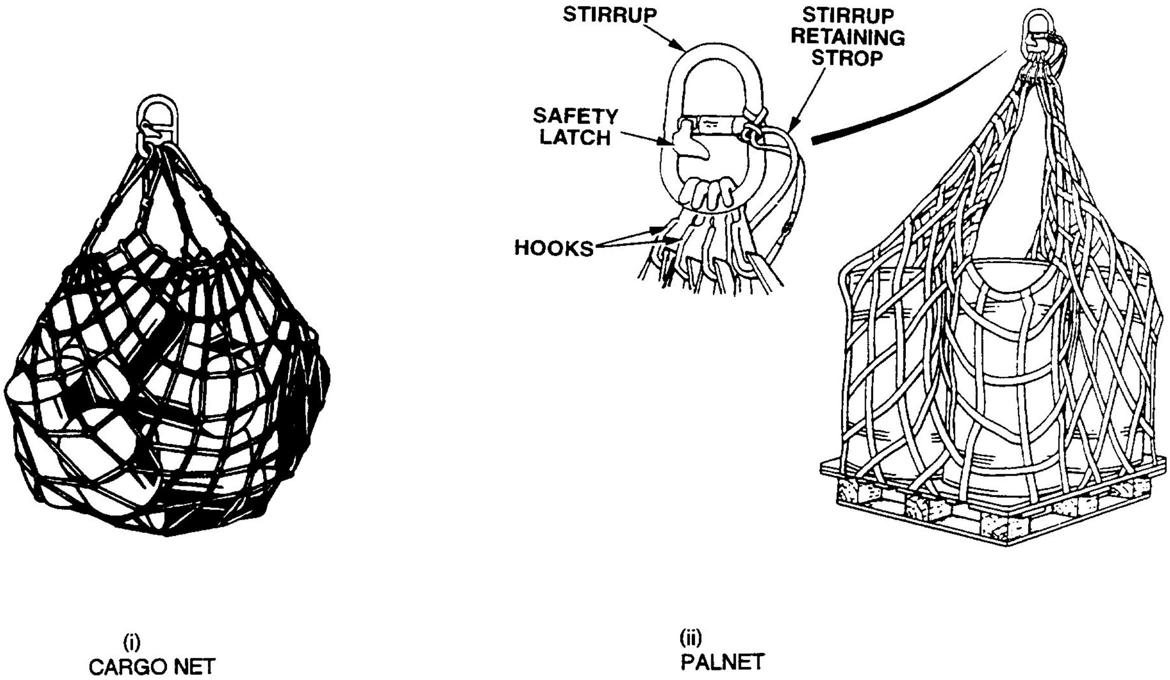


Fig 3-179. Cargo Nets and Palnets

03051. Proprietary Lifting Slings

An increased use is being made of proprietary lifting slings for a wide variety of tasks in the Royal Navy. These slings are usually standard stock items which either meet a specific lifting requirement, or provide a general lifting facility on a ship. They are available in a number of lengths, with a variety of end termination. The types of proprietary lifting sling used in the Royal Navy are described below:

a. **Basic Polyester Roundsling** (Fig 3-180). This type of sling is the most commonly used in the service. It has an outer protective casing made from reinforced monofilament polyester yarn with the inner core made up from an endless hank of polyester. The slings are colour coded in accordance with the relevant British Standard which helps to ensure easy recognition of the safe working load of the sling; in addition the safe working load is marked at regular intervals on the sling's outer case. This safe working load applies only when the sling is used in a straight lift, in any other configuration the safe working load is changed. Details are given in Table 3-43. Every roundsling bears a unique identification number and is issued with a certificate of conformance. In use the round sling flattens to provide a safe grip on its load; it is extremely light in weight, is very resistant to wear and damage, and the elongation at the safe working load is only 3%. The sling requires little or no maintenance other than an occasional cleaning in fresh water with a mild detergent. It is fully resistant to corrosion and has a high resistance to hydrocarbons, most chemicals and solvents. However, ammonia, alkalis and certain acids can cause damage. These slings are never load tested, but are subject to inspection before and after use, and are periodically surveyed in accordance with BR 3027.

If the outer casing is intact the slings may be considered usable, because the inner core determines the strength of the sling. If the outer case is damaged to the point where the inner yarns are visible the sling should be cut up and discarded.

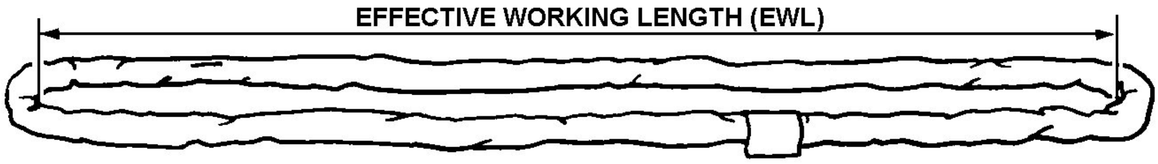


Fig 3-180. A Basic Polyester Roundsling

Table 3-43. Details of Basic Polyester Roundslings

SAFE LIFTING CHART

(7-1 Safety Factor)
Complying with the supply of Machinery (Safety) Regulations 1992

Description	Colour	W.L.L. Straight Lift *M = 1	W.L.L. Choke Lift *M = 0.8	W.L.L. 45° Beta Angle (90° inc. Angle) Basket Lift *M = 1.4	W.L.L. 60° Beta Angle (120° inc. Angle) Basket Lift *M = 1.0	Multi-leg Slings: W.L.L. 0-45° Beta Angle (0-90° inc. Angle) 2-Leg *M = 1.4	Multi-leg Slings: W.L.L. 0-45° Beta Angle (0-90° inc. Angle) 4-Leg *M = 2.0
Roundslings & Flat Web Slings Manufactured to BS 6668 part 2 BS 3481 part 2	1. Roundslings and all endless webbing slings will now show their length as Effective Working Length *EWL *NOT CIRCUMFERENCE	kg	kg	kg	kg	kg	kg
	Violet	1000	800	1400	1000	1400	2000
The Supply of Machinery (Safety) Regulations 1992	Green	2000	1600	2800	2000	2800	4000
	Yellow	3000	2400	4200	3000	4200	6000
	Red	5000	4000	7000	5000	7000	10 000
EN 1492-1/2	Brown	6000	4800	8400	6000	8400	12 000
	Blue	8000	6400	11 200	8000	11 200	16 000

Larger Capacity Slings Available *Mode Factor!! Important - The Max. W.L.L. Depends on The Angle!!

SG 2003/014

b. **'Supra' Polyester Roundslings and Associated Fittings**. 'Supra' polyester round slings are manufactured, marked and coloured coded in the same way as basic polyester roundslings; however, the outer protective sheath of the 'Supra' version is of superior quality to the basic round sling and for ease of identification the word 'Supra' is woven at intervals into the outer casing. Metal end fittings are available for 'Supra'roundslings, enabling them to be assembled into one, two, three or four leg sling configurations; in addition; three types of anti-chafing sleeves are available for use with the slings. Although at present the supply of this type of sling and the associated fittings is limited to certain ships for the removal of equipment from machinery rooms and other specified tasks, it is likely that in the future the equipment will be made available for use in all vessels, for most slinging tasks.

There are four metal component end fittings for use with the 'Supra' round slings. They are as follows:

(1) *Master Link* (Fig 3-181(i)). This consists of a main link with two intermediate links attached. It is available in two sizes, Naval stores No 0263/930-5752 for use with slings that have a SWL of 2.0 tonnes, and Naval stores No 0263/404-2154 for use with slings that have a safe working load of 5.0 tonnes. The former bears the manufacturers mark OTF-6-8 and the latter is marked OTF-10-8.

(2) *Roundsling Coupling* (Fig 3-181(ii)). This fitting has a faired bearing surface that permits direct contact with the roundsling without causing chafe; it has a double and a single lug which interlock into corresponding lugs on the half link. The coupling is available in two sizes, Naval stores No 0263/660-2625 for use with slings that have a SWL of 2.0 tonnes, and Naval stores No 0263/594-5352 for use with slings that have a SWL of 5.0 tonnes. The former bears the manufacturer's mark SKR 7-8 and the latter is marked SKR 13-8.

(3) *Half Link* (Fig 3-181(iii)). The half link is of round section and has a double and single lug which interlock into corresponding lugs on the roundsling coupling. Each half link is supplied complete with a locking set consisting of a collar and locking pin. The collar fits between the lugs of the half link and roundsling coupling as shown in Fig 3-181(iii), and the complete assembly is locked together by the locking pin. There are two types of locking set in service and the pins and collars are not interchangeable. Locking sets must only be used with the half link with which they have been supplied. The half link is available in two sizes, Naval store No 0263/255-4156 for use with slings that have a SWL of 2.0 tonnes, and Naval stores No 0263/133-4642 for use with slings that have a SWL of 5.0 tonnes. The former bears the manufacturer's mark G 7-8 and the latter is marked G 13-8.

(4) *Swivel Safety Hook* (Fig 3-181(iv)). This hook is fitted with a spring-operated tongue, and incorporates a swivel link eye for attachment to a half link. The hook is available in two sizes, Naval stores No 0263/513-5616 for use with slings that have a SWL of 2.0 tonnes, and 0263/877-7632 for use with slings that have a SWL of 5.0 tonnes. The former bears the manufacturer's mark BKL 7-8 and the latter is marked BKL 13-8.

Notes:

1. Metal end fittings are not available for use with the 20 tonne SWL roundslings.

2. By design, metal end fittings of a given size are not interchangeable with any other size.

3. Metal end fittings are periodically surveyed in accordance with BR 3027.

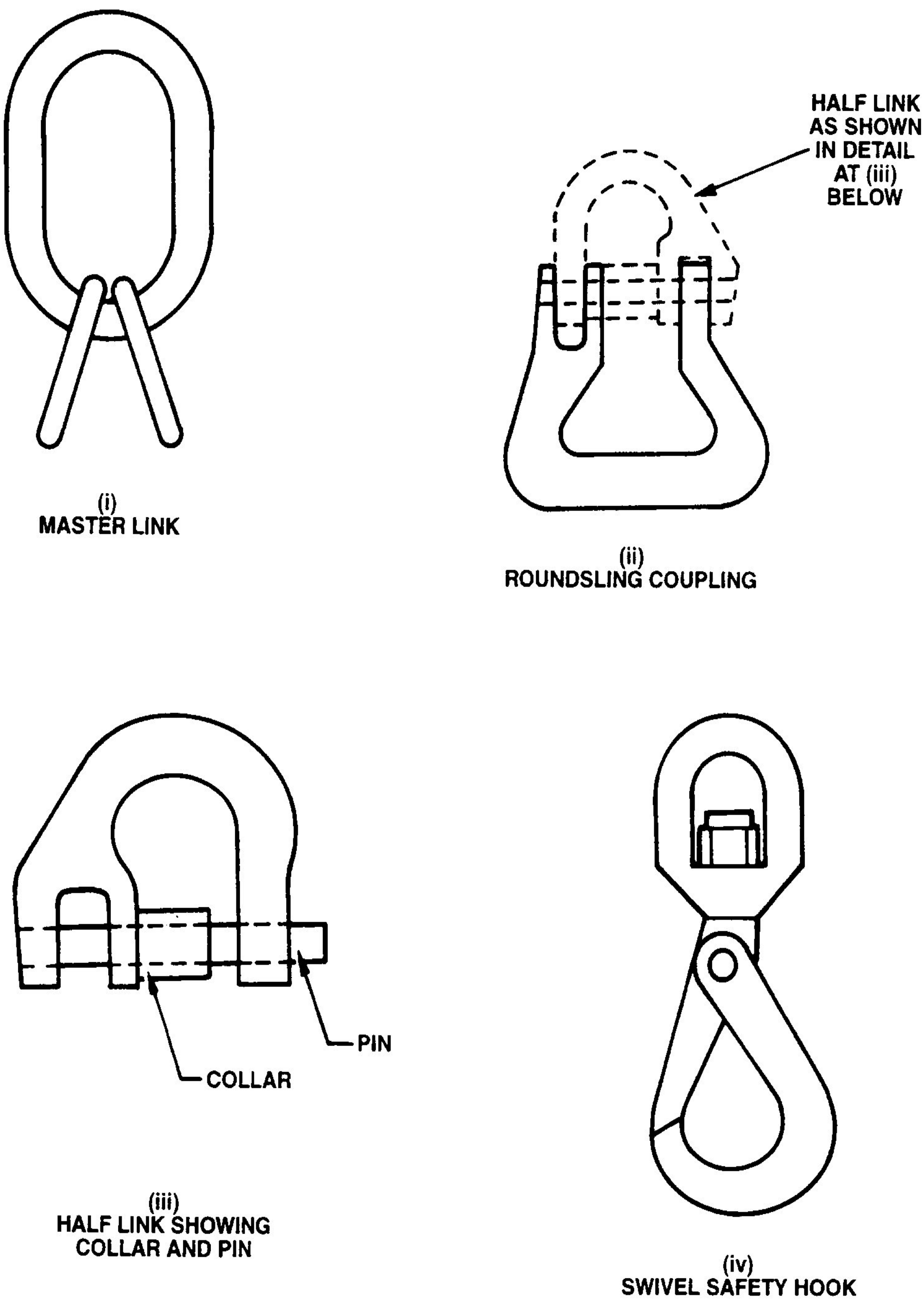


Fig 3-181. End Fittings for use with ‹Supra' Roundslings.

There are three types of chafing piece available for use with either basic or 'Supra' round slings. They are as follows:

(1) *Sleeve, Anti-abrasion* (Fig 3-182(i)). This tubular sleeve consists of two pieces of webbing stitched together; it is slid over the sling and positioned as required where chafe is expected. Anti-wear sleeves are available in different lengths and sizes as follows:

(a) Length 0.5m for use with slings that have a SWL of 2.0 tonnes. Naval stores No 0263/110-0736.

(b) Length 1.5m for use with slings that have a SWL of 2.0 tonnes. Naval stores No 0263/720-9679.

(c) Length 0.5m for use with slings that have a SWL of 5.0 tonnes. Naval stores No 0263/906-7617.

(d) Length 1.5m for use with slings that have a SWL of 5.0 tonnes. Naval stores No 0263/215-2741.

(2) *Sleeve, Anti-cutting, Double Sided* (Fig 3-182(ii). This sleeve, manu-factured from a polyurethane polymer, is highly resistant to cuts and abrasions. It is slid over the sling and positioned as required where very heavy chafe or abrasions are expected. Two sizes are available, details as follows:

(a) Length 0.5m for use with slings that have a SWL of 2.0 tonnes. Naval stores No 0263/227-5956.

(b) Length 0.5m for use with slings that have a SWL of 5.0 tonnes. Naval stores No 0263/807-1268.

(3) *Sleeve, Anti-cutting, Clip-on* (Fig 3-182(iii). This sleeve is a short, clip-on version of the anti-cutting sleeve described above. It can be clipped to a sling where cutting or chafing points occur, without the need to unhook or dismantle sling assemblies.

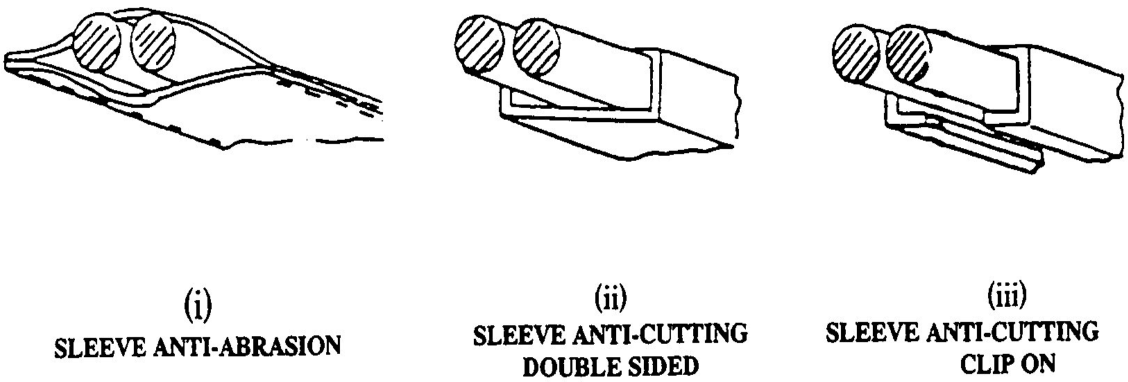


Fig 3-182. Chafing Piece Attachments for use with Roundslings

c. **Assembling Single and Multi-leg 'Supra' Polyester Roundslings.** With the use of the associated metal component end fittings, ‹Supra' polyester roundslings can be assembled into two, three and four leg sling assemblies, or a single leg sling fitted with a lifting hook at one end. Tools and equipment required for the job are: a hammer, a block of timber and a roll of masking tape. Always select the correct size end fittings appropriate to the roundslings being used, and ensure all legs of a multi-leg sling have the same SWL. After assembly of multi-leg slings, consult para 03050d to ascertain the SWL of the complete assembly, then attach a tally, marked with the SWL, to the assembly.

(1) *Assembling a single leg with swivel hook end attachment*

(a) Study Fig 3-183. Lay out the sling to its maximum effective length, and tape a soft eye into one end; this eye should be large enough to comfortably accommodate the appropriate roundsling coupling (Fig 3-184(i)). Introduce the coupling into the soft eye (see note 1).

(b) Insert the half link into the swivel eye of the hook, then, with the collar positioned as shown in Fig 3-184(i), offer up the half link to the coupling.

(c) When the coupling, collar and half link are accurately aligned (Fig 3-184(ii)) and with the timber block positioned under the assembly, tap the locking pin home. When the pin is fully home (Fig 3-184(iii)), check that the collar rotates freely.

Notes:

1. Ensure a coupling, not a half link, is inserted into the soft eye. If a half link is used the SWL of the sling is considerably reduced.

2. A single leg sling fitted with a swivel hook at one end does not require a master link in the 'free end'; the free end of the sling can be directly hooked over the hook of the crane or lifting appliance.

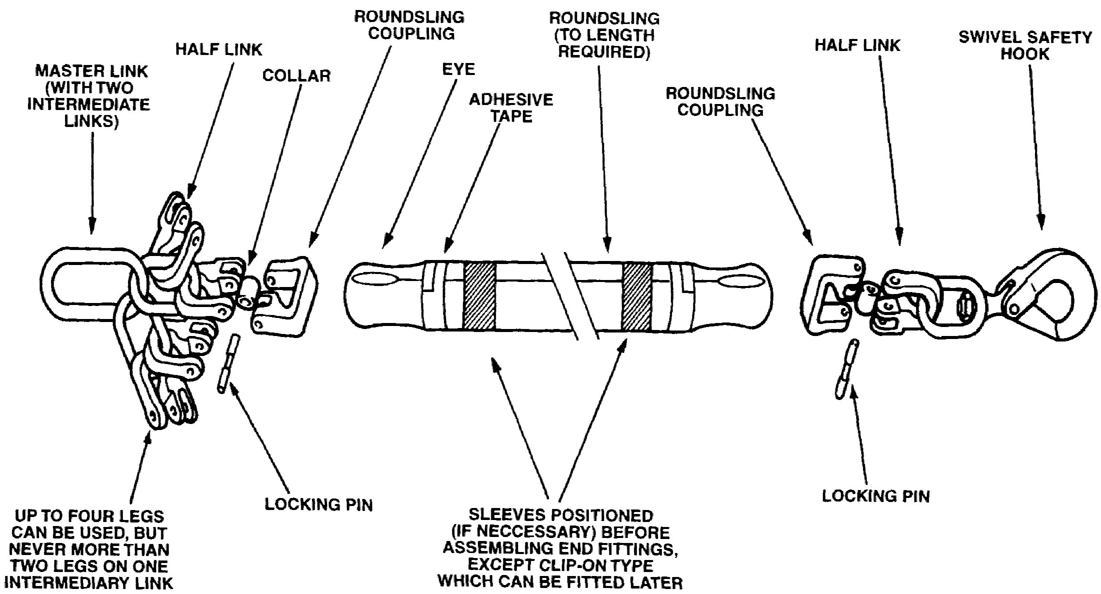
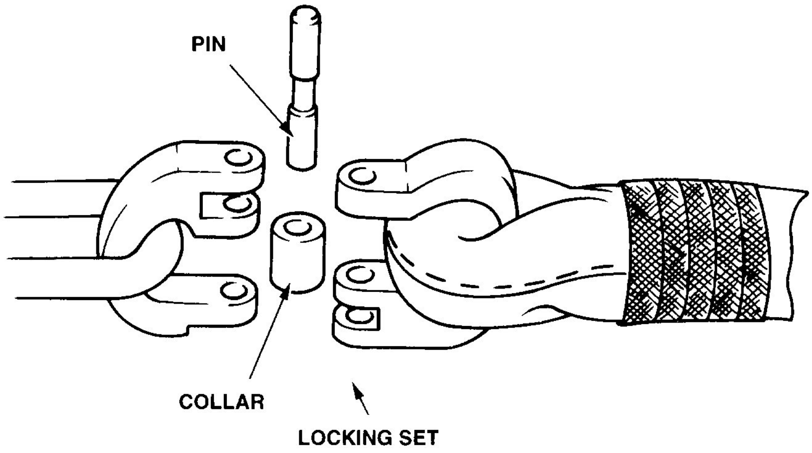
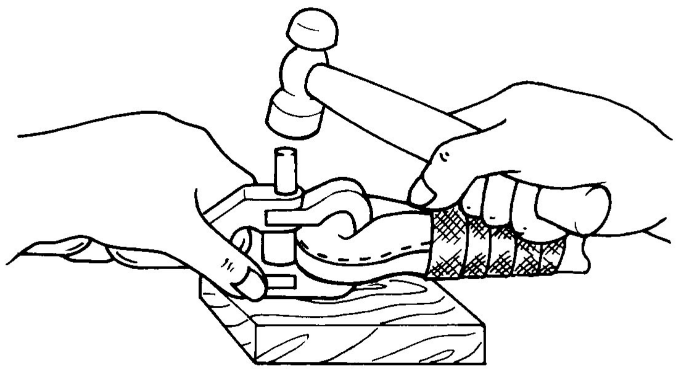


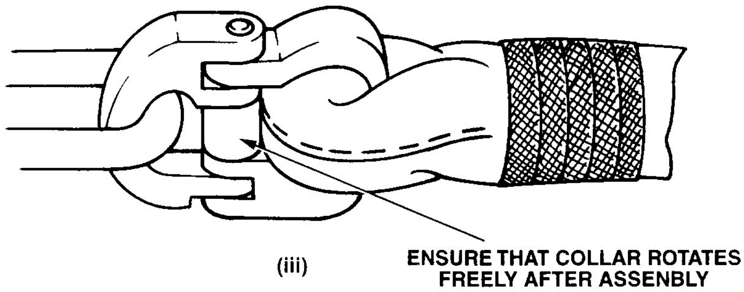
Fig 3-183. Components of a Single Leg Sling



(i)



(ii)



(iii)

Note. *The pin is held in position by a helical spring sited inside the collar*

Fig 3-184. Securing a Half-link to a Coupling with a Locking Set

(2) *Constructing a Two-leg Sling Assembly* (Fig 184a(i))

(a) Fit one end of each of the two legs with a swivel hook, as described for the single leg sling.

(b) Select the appropriate size master link, and, using the correct size couplings and half links, connect a leg to each of the two intermediate links attached to the master link.

(c) Attach to the assembly a tally showing the SWL. (Details of how to establish the SWL are given in paragraph 03050d).

(3) *Constructing a Three-leg Sling Assembly* (Fig 184a(ii))

(a) Fit one end of each of the three legs with a swivel hook, as described above for the single leg sling.

(b) Select the appropriate size master link, and using the correct size couplings and half links, connect two of the legs to one of the intermediate links on the master link, and the remaining leg to the remaining intermediate link.

(c) Attach to the assembly a tally showing the SWL. (Details of how to establish the SWL are given in paragraph 03050d).

(4) *Constructing a Four-leg Sling Assembly* (Fig 184a(iii))

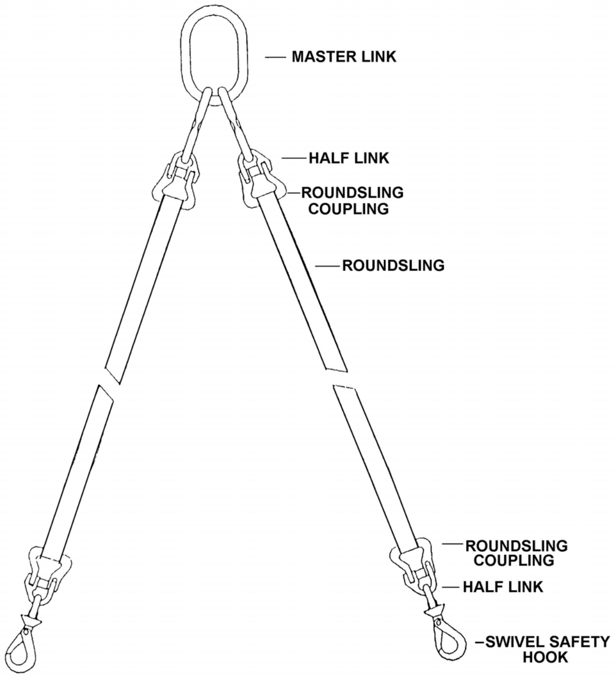
(a) Fit one end of each of the four legs with a swivel hook, as described above for the single leg sling.

(b) Select the appropriate size master link, and using the correct size couplings and half links, connect two legs to each of the intermediate links attached to the master link.

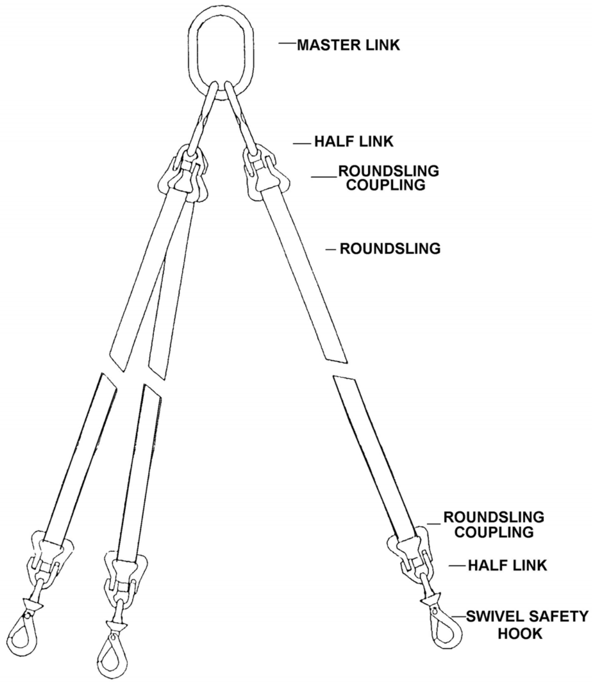
(c) Attach to the assembly a tally showing the SWL. (Details of how to establish the SWL are given in paragraph 03050d).

Note. *To dismantle the end fittings, position the assembly on a wooden block (Fig 3-184(ii)) but with the base of the pin clear of the block. Then use an appropriate sized drift to drive out the pin.*

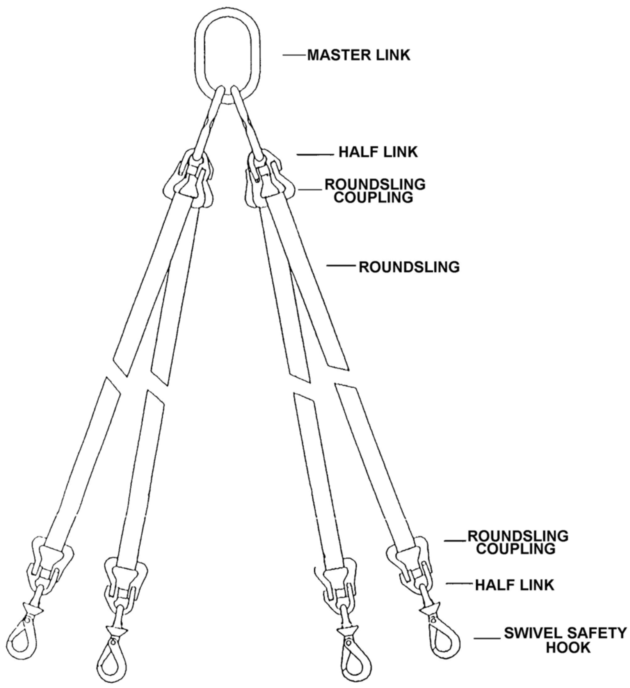
d. **Accounting for Roundslings and Assemblies**. Ships and Units that carry roundslings are required to produce a local log book that lists all roundslings and associated metal fittings carried, and provides a record of their control and issue. Details are given in Annex B to this Chapter.



(i)



(ii)



(iii)

Fig 184a. Two, Three and Four- Legged Slings

e. **Flat Webbing Slings** (Fig 3-185). These type of slings are fabricated from a single length of polyester webbing, with various terminals as appropriate; Simplex slings have the webbing stitched close to the terminals, whereas Duplex slings are effectively stitched through two thicknesses throughout most of their length. Slings are terminated either in a reinforced soft eye or in any combination of metal end fittings. The marking, colour coding, maintenance and sling configuration safe working loads for flat webbing slings is the same as that for polyester roundslings. Flat webbing slings are used where a flat bearing surface can be critical in protecting the surface of the load, examples being GRP boats, machine bearings and pipework; they are also used in the Royal Navy for hoisting and lowering rigid inflatable boats and Geminis.

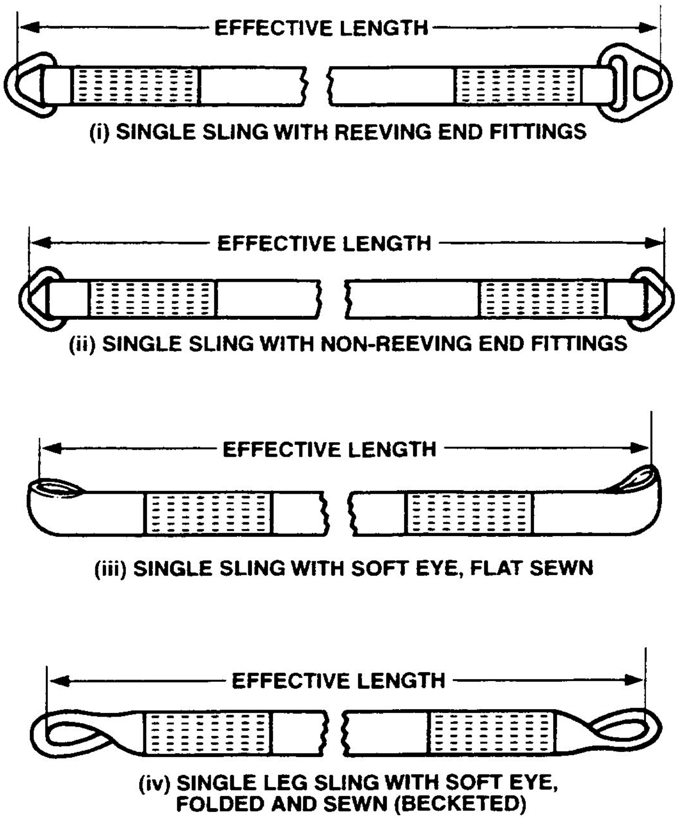


Fig 3-185. Examples of Flat Webbing Slings

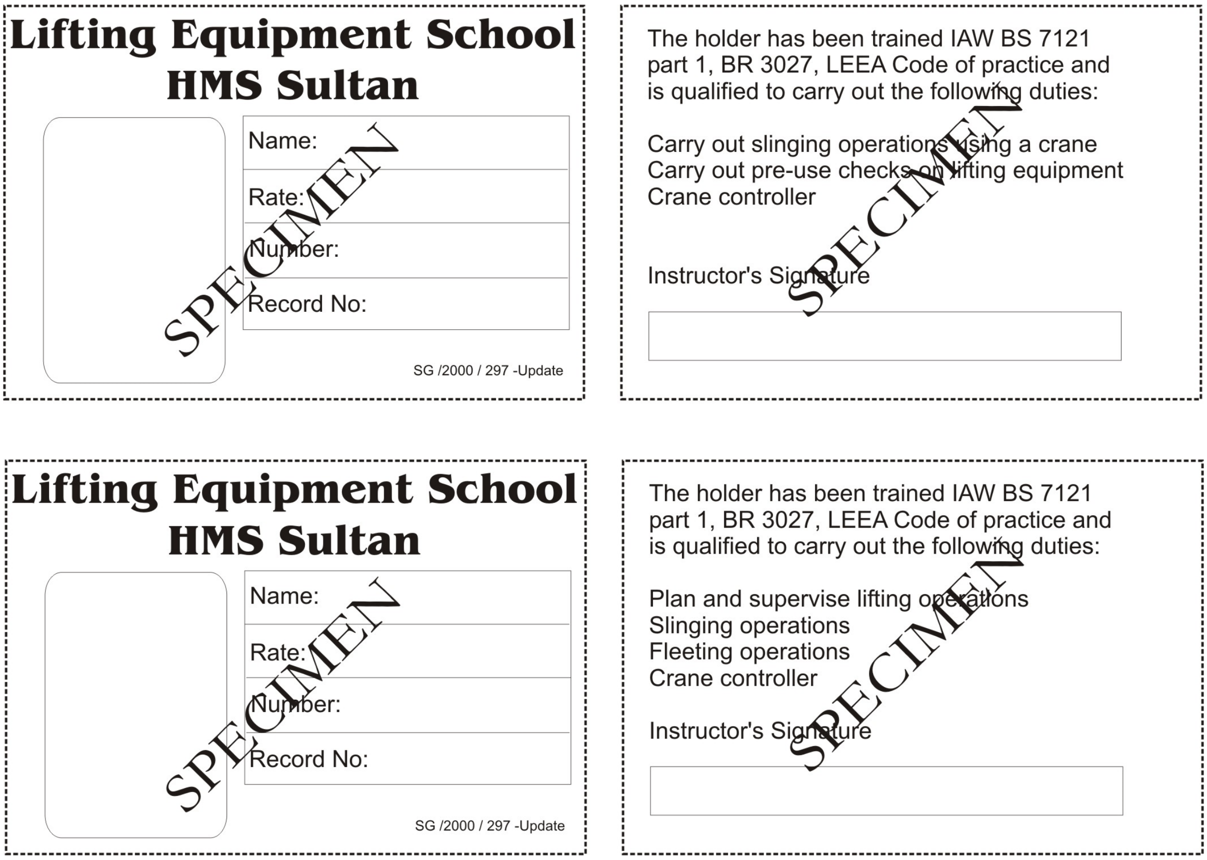
03052 Special Slinging Precautions

a. **Slinging from Shoreside Crane to a Vessel Afloat**. Great care should be taken when the load is being transferred to or from the hook of the crane. Keep a close watch on the water level of basins and docks, which may alter considerably while lifts are in progress. A drop in the water level may cause the rings to tighten, and impose dangerous stresses on slings, the load and the crane. An increase in the water level will cause the slings to slacken with consequential surging of the load. Therefore check frequently the tension of the slings when such lifts are being made, and adjust as necessary. Never leave a job unattended; a competent slinger must always be in attendance when a lift is in progress.

b. **Slinging from a Floating Crane to a Vessel Afloat**. Great care should be taken when the load is being transferred to or from the hook of the crane. Make full allowance for the heel of the crane and of the ship; it may be necessary to adjust the jib while these lifts are being made.

03053. Slinging and Responsibilities in HM Ships

All slinging tasks undertaken in HM ships must be planned and overseen by a Slinging Supervisor. To obtain this Adqual it is necessary to complete the ME418 ADSLING / ME418A ADHOOK course at HMS SULTAN. Seaman Specialists drafted to nominated billets within a ship's scheme of complement are required to undertake the course as a PJT before joining a ship. The qualification will remain extant unless the Licence holder or his/her line manager feels that he/she is incapable of carrying out a slinging operation. In this case the guidance in BR 3027 Vol 1 should be followed. A new qualification will be required if deemed necessary. Crane control is critical in slinging operations. The slinger in charge is to consult with, and notify the crane driver of the nature of the lift to be undertaken and who will be giving the signals. Details of the safe operation of cranes are given in Paragraph 03057c.



Specimen Photo Card Licences

• **Photo Card Licence.** All qualified personnel having completed the ME418A Adhook and/or the ME418 Adsling course will carry a photo card licence showing the qualification. Examples shown above are, Top ME418A, coloured white and Bottom ME418 coloured Grey.

03054. Ammunition Secondary Resupply Equipment

The safe performance of resupply drills relies on adequate training, comprehensive briefing and firm control. **BR 862, Naval Magazine and Explosives Regulations** is the authoritative publication on the subject and all personnel involved in the evolution should be conversant with the relevant chapter. The Chief Boatswain's Mate has custody of the lifting equipment and acts as the Competent Person regarding the inspection and testing of such equipment, but it is the responsibility of the Specialist User Officer (SUO) to ensure that ammunition emergency resupply equipment is rigged in accordance with the ship's drawings, and operated correctly. It is not possible to produce a detailed drill for each of the diverse arrangements used in the Fleet, but the following general guidance, along with regular practice, should ensure safe operation:

a. Clear, concise orders are to be used by the rating in charge.

b. Only the approved rig in accordance with ship's drawings is to be used, and all shackles must be moused.

c. When heavy objects are being rigged, unrigged, hoisted or lowered, personnel beneath are to keep well clear.

d. Two men must always be used to rig and unrig Miller's flaps. One man holds the flap in place whilst the other inserts the securing pins.

e. Sufficient hands must be detailed to safely operate tackles and other lifting equipment.

***Note**. Blocks used in Ammunition Secondary Resupply Equipment must be of SRBF construction, and handling lines and whips must be 16mm staple spun polyester.*

03055. Estimation of Stresses

Before cranes and derricks, etc. are described it is first necessary to emphasise that the seaman must be able to calculate the stresses in the parts of the gear that he is using. Without this knowledge it is possible that a derrick, while hoisting an apparently safe load, will collapse; or that one of its fittings or a part of the rigging will fail, with dangerous consequences.

a. **Triangle of Forces**. The stresses to which a derrick or fittings may be subjected when supporting a load can be estimated approximately and very simply by the diagrammatic method known as the **triangle of forces**. The principles upon which this method is based can be stated as follows:

(1) If the magnitude and direction of a force are known they can be represented by a straight line, called a **vector**, the length of which indicates the magnitude, and the direction of which, denoted by an arrow, gives the direction in which the force acts.

(2) If three forces acting at a point are in equilibrium, and the vectors representing them are drawn end to end so that the directions in which they act are maintained, ie, so that the arrows follow one another, they will form the three sides of a triangle.

(3) If three forces acting at a point are in equilibrium and the magnitude and direction of only two of them are known, the magnitude and direction of the unknown force can be found as follows. Draw the vectors of the known forces end to end so that the arrows follow one another. Complete the triangle. The third side will then represent the unknown force in magnitude and direction, the arrow pointing from the head of the second vector to the foot of the first.

(4) When three forces acting at a point are in equilibrium, if the magnitude and direction of one force and the direction only of the other two are known, the magnitude of these two unknown forces can also be found by drawing a triangle of forces.

b. For three forces in equilibrium, the arrows denoting the directions of the vectors always follow one another round a triangle of forces. If more than three forces in equilibrium and acting at a point are involved, the same principles apply. The resulting figure, whose sides represent these forces, is then known as a **polygon of forces**. The following two examples show the application of this method for finding the approximate stresses in masts, derricks and their rigging and fittings. In the examples it is assumed that the systems and their loads are at rest, and the effects of any friction are disregarded.

EXAMPLE 1

A derrick is topped at an angle of 45 degrees with the horizontal and is supporting a weight of 5 tonnes hung on the end of its whip (Fig 3-186). Find the magnitude and direction of the tension in the strop of the head block.

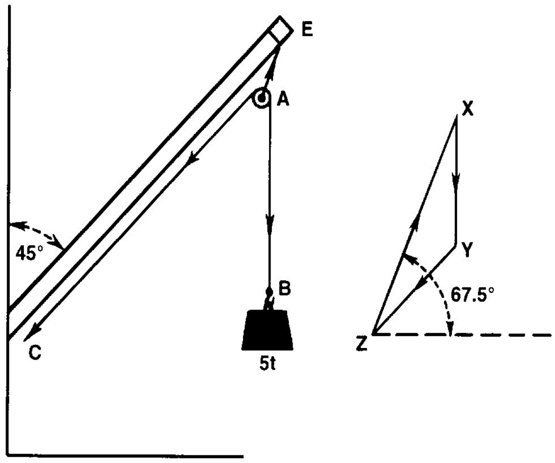


Fig 3-186. Estimation of Stresses by Triangle of Forces (1)

c. The tensions in the running and hauling parts of the whip are the same, namely 5 tonnes, so by drawing a triangle of forces based on the block **A**, the tension in the strop **AE** and the direction in which it acts can be found in the following manner. To a scale of 4 tonnes to 10mm draw the vector **XY**, 12.5mm in length, to represent the vertical downward pull of the weight on the running part of the whip, and on it mark its arrow pointing downwards. From the point **Y** draw another vector **YZ**, parallel with **AC** and 12.5mm in length, to represent the downward tension in the hauling part of the whip, and on it mark its arrow, also pointing in a downward direction. Complete the triangle by joining **Z** to **X**. Then: **ZX** is the vector representing the tension, both in magnitude and direction, in the strop **AE** of the head block, and when measuring it will be found to be approximately 24mm, representing a tension of 9.5 tonnes acting upwards at an angle of 67.5 degrees with the horizontal.

EXAMPLE 2

A span is rigged between two masts, and a weight of 10 tonnes is hung on it so that the left leg of the span makes an angle of 65 degrees with its mast (Fig 3-187). Find the pull on each of the shackles which join the span to the masts.

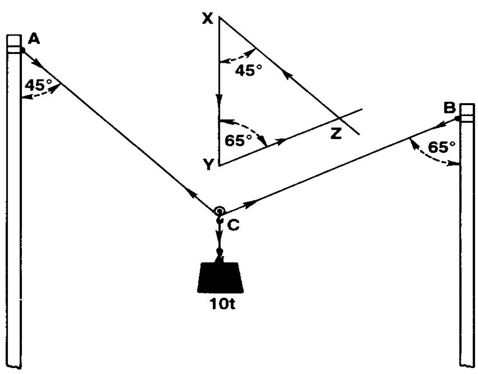


Fig 3-187. Estimation of Stresses by Triangle of Forces (2)

d. The pull on the shackles will be equal and opposite to the tensions in the respective legs of the span, and these tensions are found by considering the forces acting at the point **C**, where the magnitude and direction of the pull of the weight on the span are known, ie 10 tonnes vertically downwards, and the directions of the tensions in the legs of the span are known, ie upwards at an angle of 45 degrees and 65 degrees respectively with the perpendicular. To a scale of 4 tonnes to 10mm draw the vector **XY** 25mm in length, to represent the vertical downward pull of the weight, and on it mark its arrow, pointing downwards. From the point **Y** draw a line parallel with **CB** and on it mark an arrow to represent the direction of the upward tension in the right leg of the span. From the point **X** draw a line parallel with **AC** so that it cuts the preceding line at **Z**, and on it mark an arrow to represent the direction of the upward tension in the left leg of the span. Then: **YZ** is the vector representing the tension in the right leg of the span, which will be found to be 19mm long (approximately), representing a force of 7.5 tonnes; and **ZX** is the vector representing the tension in the left leg of the span, which will be found to be 25mm long (approximately), representing a force of 10 tonnes.

e. The approximate pull on the shackles at **A** and **B** will therefore be 10 tonnes and 7.5 tonnes respectively.

f. In a similar manner the stresses on other parts or fittings of a mast and a derrick, such as the tension in the topping lift and the thrust in the derrick, can be found if the magnitude and direction of two of the three forces involved are known, or if the magnitude and direction of one force and the direction of the two other forces are known. Care should be taken when determining the direction in which a force acts; for example, when considering the stresses at the derrick head the tension in the topping lift of a derrick will be acting in a direction from the head of the derrick towards the mast, but when considering the stresses at the masthead fitting it will be acting in the reverse direction.

03056. Derricks

A derrick is a spar, made of wood or steel, rigged as a swinging boom and used for hoisting boats, stores, cargo, ammunition or gear in and out of a ship. It can be fitted to a mast or a king-post, when it is called a **mast derrick**, or to the side of a ship's superstructure, when it is called a **screen derrick**. Only screen derricks are fitted in HM warships. The lower end or **heel** is pivoted in a **goose-neck**, allowing the derrick to pivot both vertically and horizontally. The upper end or **head** is supported by a topping lift and stayed by guys. The load is hoisted or lowered by a whip or a purchase, which is rove through a block at the derrick head and a leading block at the heel and then taken to a winch. The rig of a derrick varies considerably in detail according to the purpose for which it is provided, the weight it is designed to hoist, and the position in which it is fitted. A simple mast derrick as fitted in merchant ships is illustrated in Fig 3-188. The topping lift and guys are shackled to a spider band at the derrick head. The topping lift of a mast derrick is usually led to the masthead, and that of a screen derrick to a point on the superstructure directly above the heel of the derrick; the guys are led to positions on deck near the ship's side and well before and abaft the heel. Topping lifts are of two main kinds, **standing** and **working**.

Guys usually take the form of short pendants tailed with tackles; two are usually fitted, but heavy derricks may be fitted with as many as four; some derricks are provided with standing guys called **preventer guys**, which are fitted to prevent the derrick from swinging too far in a certain direction. A screen derrick as fitted in warships is illustrated at Fig 3-189. This is shown rigged with a standing topping lift but sometimes it may be rigged with a working topping lift. As well as the simple mast derrick illustrated at Fig 3-188, merchant ships may be fitted with derricks of different types and rigs, capable of very heavy lifts, and employing various methods of operation; further information on these rigs is contained in British Standard MA:1976, **Design and Operation of Ships' Derrick Rigs**.

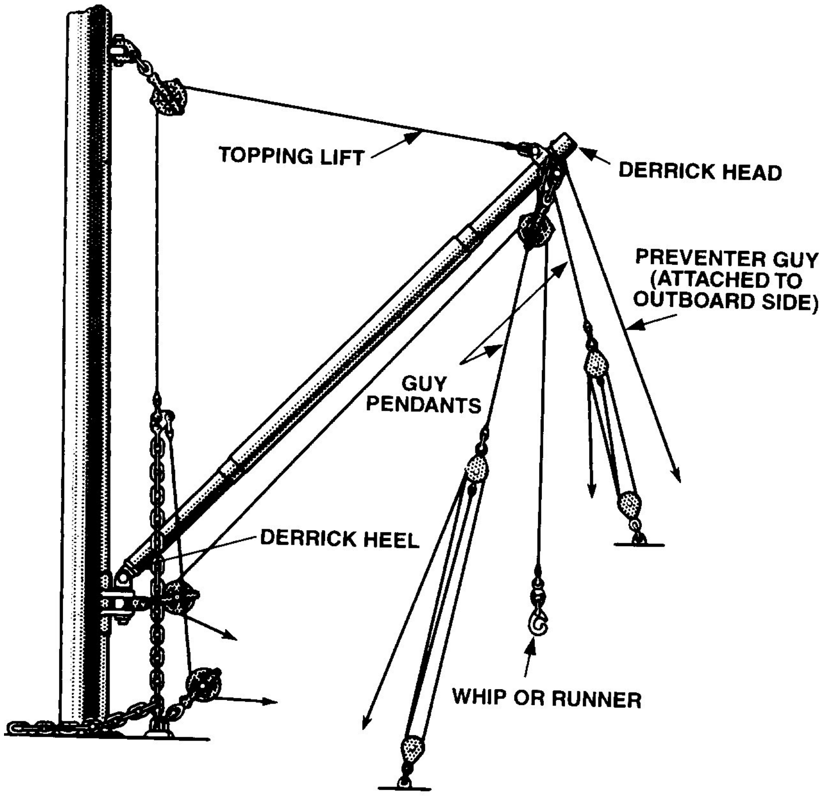


Fig 3-188. A Simple Mast Derrick (Merchant Navy).

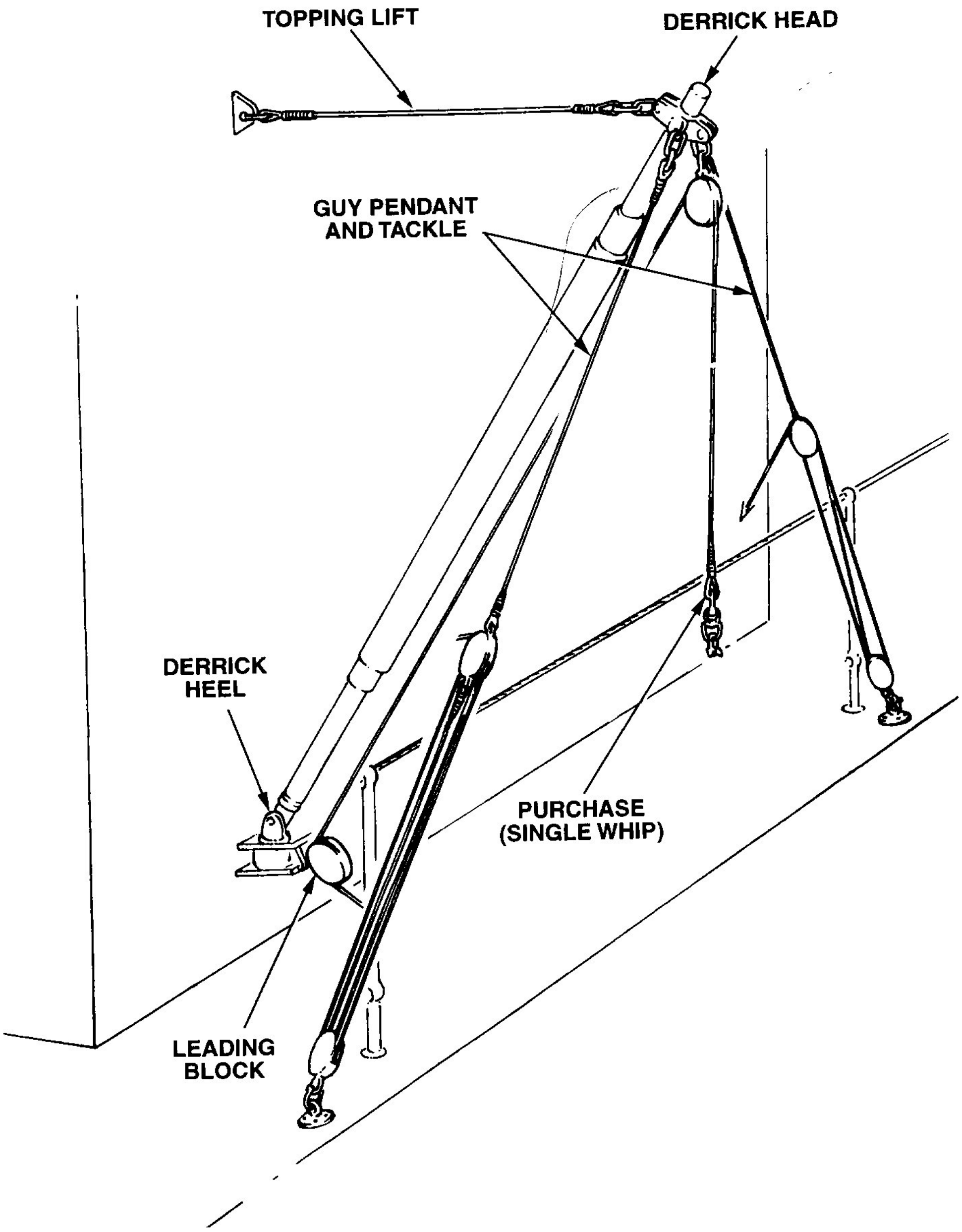


Fig 3-189. Screen Derrick

03057. Cranes

Cranes supplied for shipborne use are quicker and more convenient in operation than derricks, and with the development of the articulated folding crane their use in the Fleet has increased in recent years. They are used for hoisting boats, stores, cargo, ammunition or gear in and out of a ship. The characteristic feature of a crane is a jib, or projecting hinged arm, which may be rigid, or telescopic, or articulated and telescopic. Fixed cranes in use in the Royal Navy fall into two categories; the rigid jib type of crane, fitted only in major warships, RFAs and certain hydrographic survey ships, and the articulated and/or telescopic jib type fitted in many warships, primarily as a method of deploying the seaboat. Both types are described below. Certain major warships carry mobile cranes, which are of the telescopic jib type.

a. **Rigid Jib Crane** (Fig 3-190). The wire rope purchase is rigged as a single or double whip and leads from the purchase winding drum to a sheave at the head of the jib. Between the purchase wire and the lifting hook is a **ponders ball**, the function of which is to assist the purchase to overhaul when there is no load on the hook; in some cranes the ponders ball is made in two halves for ease of removal, and some incorporate a shock-absorbing device. Besides hoisting and topping, the crane can be trained to plumb a hoist, the arc of training being restricted by an electrical limit switch to prevent damage to the crane and superstructure. The topping and purchase motions are similarly protected by limit switches at the extremities of their travel and the topping motion is usually protected by buffers at its fully topped-up position. The safe working load and maximum radius permitted are marked on a tally, and must in any case be known by the crane driver.

Note. *Fixed jib cranes must not be operated below 45° elevation.*

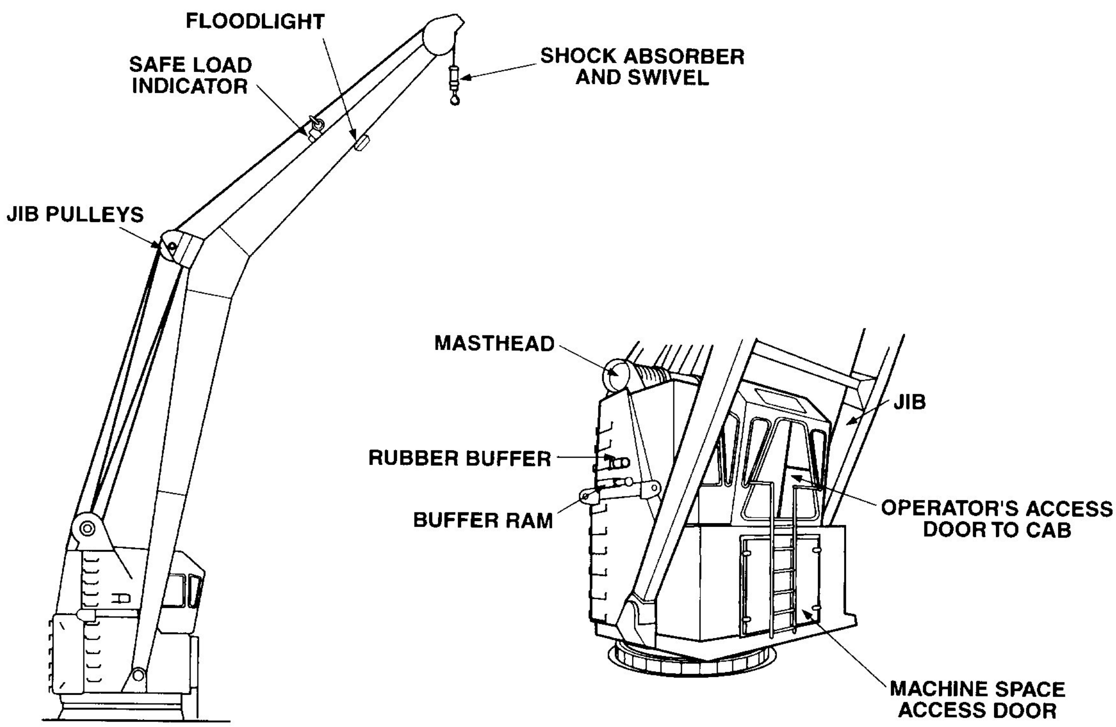


Fig 3-190. Example of a Rigid Jib Crane as fitted in Major Warships

b. **Articulated and/or Telescopic-jib Crane** (Fig 3-191). There are a variety of cranes in use in the Fleet that fall into this category . The jib is articulated and the outer section of jib may be telescopic; to protect the surfaces of the chromium plated hydraulic cylinders the jib can be folded into the ‹stowed' position when the crane is not required for use. In use, the telescopic outer section of jib can be ‹jibbed out' to increase its length. It is important that operators are aware of the safe working load of the crane for any given radius of operation. The radius of operation is the horizontal distance between the cranes centre of rotation and a vertical line drawn through the centre of the hook.

WARNING

THE SAFE WORKING LOADS FOR ANY GIVEN RADII OF OPERATIONS MUST BE MARKED ON A TALLY PLATE CLEARLY VISIBLE TO THE OPERATOR.

These type of cranes are not normally fitted with limit switches, and because guardrails, aerials, launchers, lockers etc may all be within the operating radius of the crane careful operation is essential. The rig of the wire purchase rope from the winch to the hook varies with the type of crane and onboard documentation must be checked to ascertain the precise fit.

Note. *Articulated and/or Telescopic-jib Cranes must not be operated with the jib lower than 0° elevation.*

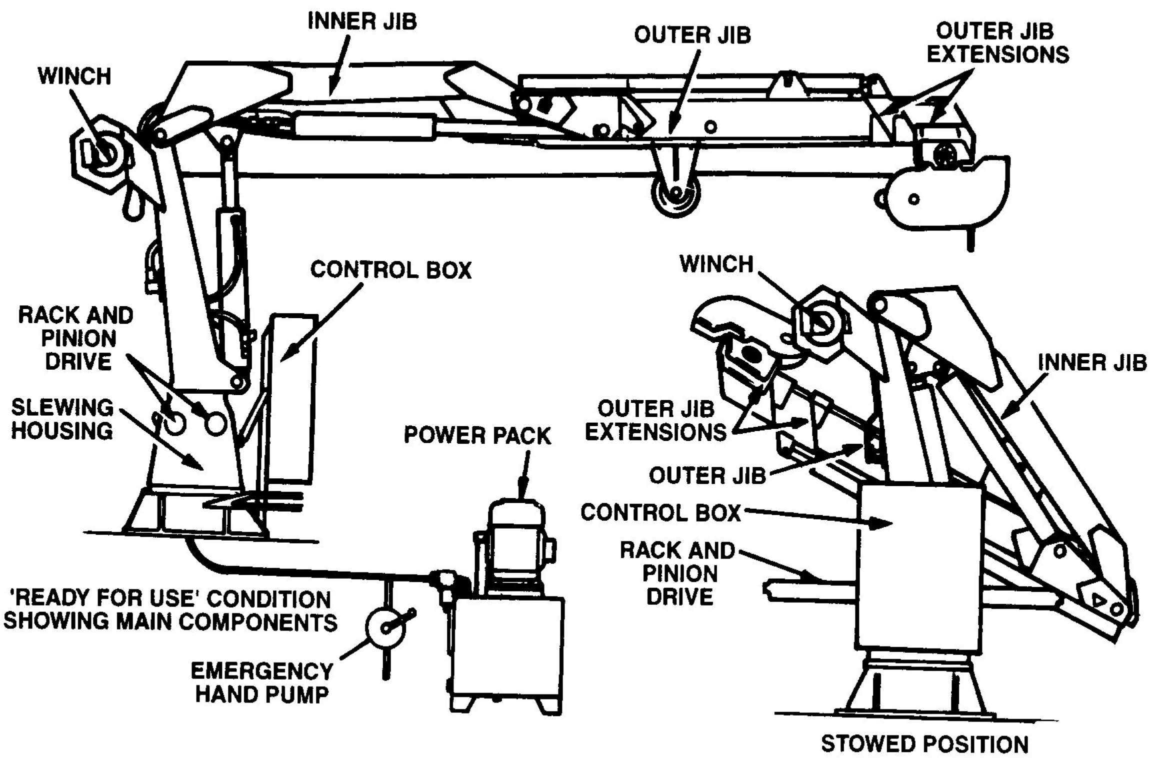


Fig 3-191. Example of an Articulated, Telescopic-jib Folding Crane

c. **Operation of Cranes**. Personnel acting as crane drivers or crane controllers must be trained to a level that enables them to perform competently day or night; details are as follows:

(1) *Crane/Davit Controllers.* The Chief Bosun's Mate is responsible for the supervision and training of personnel required to direct cranes. The controllers must be fully conversant with standard crane signals, have a sound knowledge of slinging procedures, and the operating limitations of the crane/davit they are controlling. Before being allowed to carry out the duty of crane/davit controller they must be examined and confirmed competent. A certificate to this effect (example below) is to be completed and retained in the Seamanship Data Book. The certificate expires when the holder is drafted. Crane controllers must wear an orange safety helmet and a Dayglow orange armband and should be positioned so that the crane driver has clear visual observations of the signals at all times during the lifting operation. Under no circumstances is a load to be directly attached to the crane hook until it has been ascertained that the load is free from any restraining connections. If for any reason the load cannot be freely suspended, for example if adjusting or 'inching' a load that is being bolted or welded into position on the ship, then a chain block, pull lift or similar **manual** apparatus must be inserted between the load and stationary crane hook. Standard crane signals are illustrated in Fig 3-192. Signals must be made clearly and distinctly.

CERTIFICATE OF COMPETENCE

This is to certify that ...NAME AND RATING...has proved himself to be competent to carry out the duty of Crane/Davit Controller in accordance with BR 6004.

Signed..Chief Bosun's Mate

Name...Rate.......................................

Date...HMS......................................

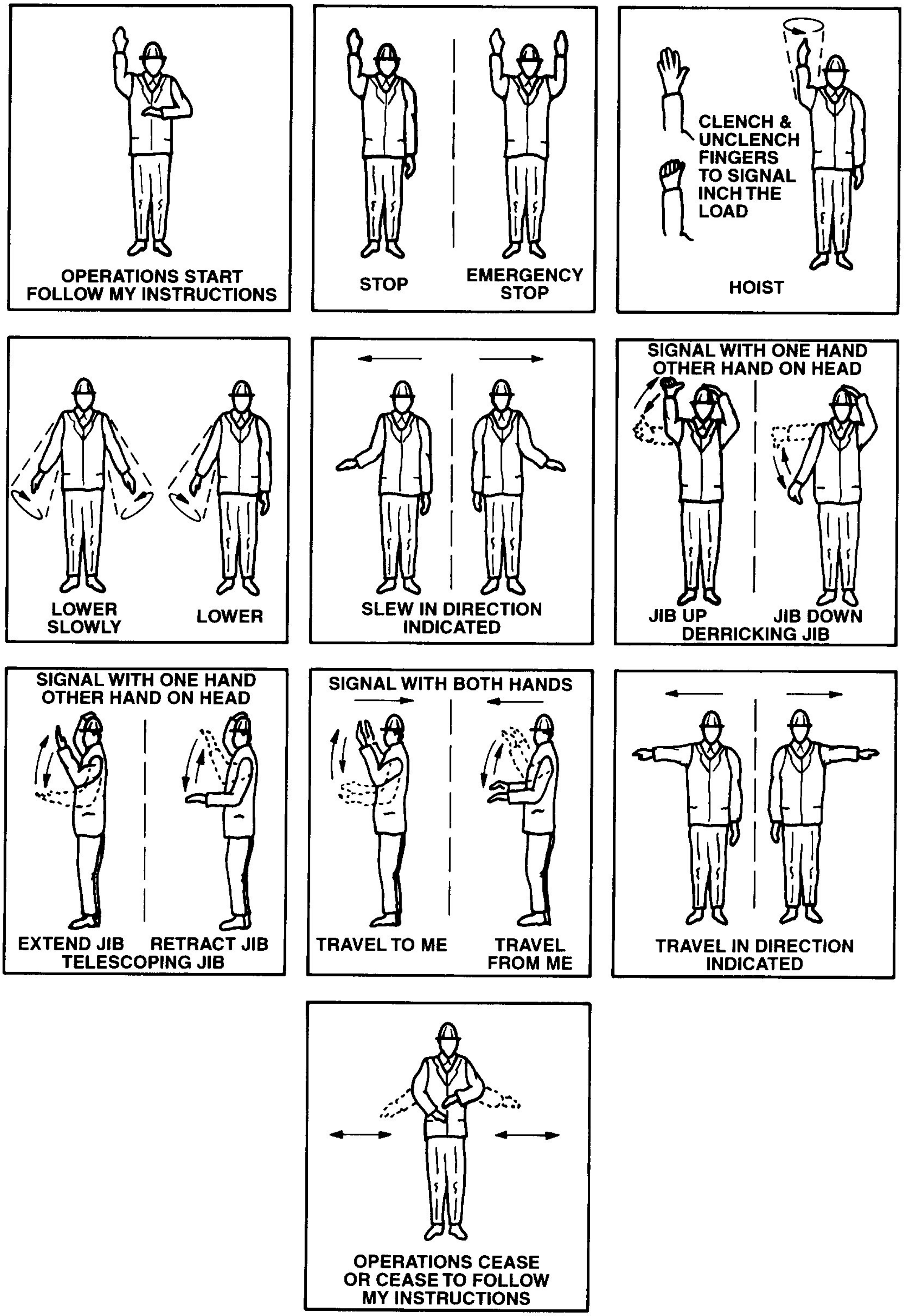


Fig 3-192 Standard Crane Signals

(2) *Crane/Davit Drivers*. Ships' cranes/davits must be driven by competent persons. Where no evidence exists that the potential crane/davit driver has completed a recognised course, instruction must be carried out onboard by the crane/davit maintainer, utilising information given in the relevant operators guidance instructions, and **BR 3027, Manual of Inspection and Tests of Lifting Plant**. The driver must be fully conversant with standard signals. The Chief Bosun's Mate and the maintainer must be satisfied that the person is capable of carrying out the task safely and in accordance with the operating instructions. A certificate to this effect (example below) is to be completed and retained in the Seamanship Data Book. The certificate expires when the holder is drafted.

CERTIFICATE OF COMPETENCE

This is to certify that ...NAME AND RATING...has proved himself competent to carry out the duty of Crane/Davit Driver on ...TYPE OF CRANE/DAVIT.....................................

Signature CBM...Signature Maintainer....................................

Name..............................Rate....................Name ....Rate....................

Date..HMS....................................

d. **Maintenance and Testing of Cranes**. Maintenance and testing of cranes is to be carried out in accordance with the Maintenance Management System (MMS).

03058. Winches

Winches are used for heaving and veering ropes and wires. Those fitted in Royal Navy ships may be powered either electrically or hydraulically, and various forms of drive, clutch and brake are fitted, depending on the use for which the winch is intended. Winches are normally stool-mounted, and may be fitted with a single **warping drum**, or a single **rope drum** (often referred to as a **captive drum**), or, as shown in Fig 3-193, a warping drum and a rope drum. To bring a rope to a warping drum take three turns of the rope round the drum in the required direction and back up the hauling part as it comes off the drum. Three turns are usually sufficient when hawsers are being hove in, but for heavy loading it may be necessary to take an extra one or two turns, giving due regard to the size and strength of the rope and equipment involved. As the rope passes round the drum the turns have a tendency to ride from the middle towards one end; this tendency is counteracted by the load on the rope forcing the turns down the curve to the narrowest part of the drum. To hold the rope stationary while the drum is heaving in, ease the pull on the hauling part sufficiently to allow the turns to slip, or **surge** round the drum. Never surge the rope when the drum is veering, and do not allow riding turns to develop on a warping drum, because if this happens control of the rope is lost unless the drum is stopped. Rope drums are normally used only during replenishment evolutions. A 1m tail of 8mm polypropylene is hitched or spliced to the rope-end anchoring plate of the drum; the rope to be heaved in, also end fitted with an Inglefield clip, is clipped to the outboard end of the tail. By heaving in on the winch the rope is wound onto the drum. To ensure reasonably even distribution of the rope on the drum it may be necessary to use wooden handspikes to force the lead of the rope back and forth across the drum. Ships fitted with single warping drums for replenishment have no choice in their method of working lines. Ships fitted with a single captive drum are to tail hoselines, heavy jackstay outhauls and remating lines to the drum. If a sliprope is required it is to be fed onto the drum immediately the hoseline has been removed, then the outboard end rigged as a sliprope. The captive drum must never be used as a warping drum because of the danger of riding turns.

Ships fitted with a combination captive/warping drum are to tail heavy jackstayinhauls to the captive drum. Hoselines used in probe refuelling may be taken to the warping drum or tailed to the captive drum as required by individual ships. When the rig requires a sliprope this is to be fed onto the captive drum as part of RAS preparations and the rig brought across on the warping drum. When the hoseline has been removed the sliprope is rigged. If a remating line is employed it must be taken to the warping drum.

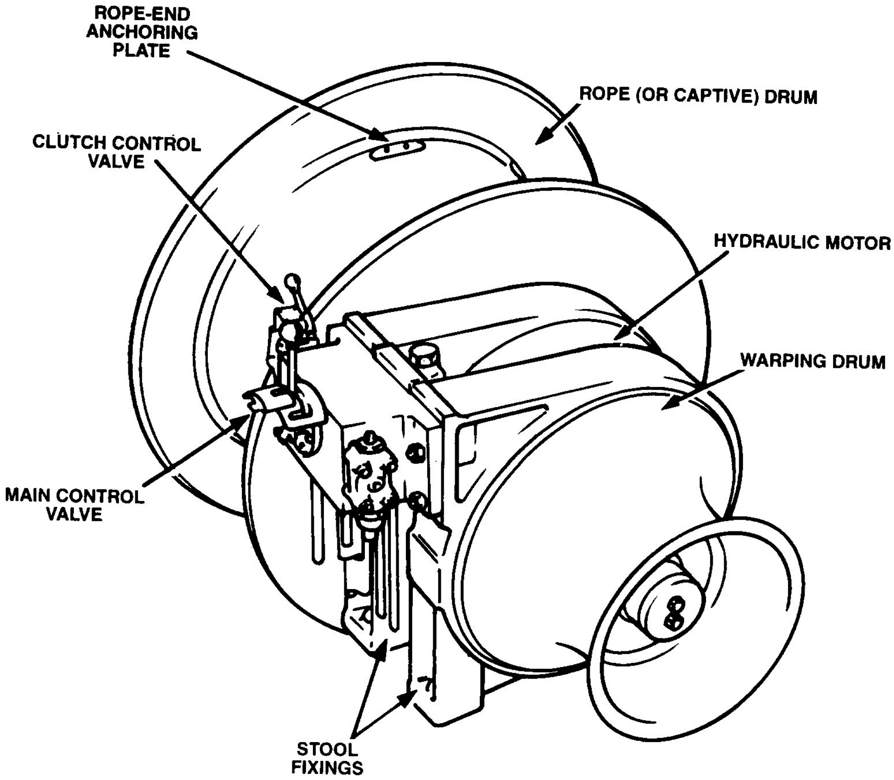


Fig 3-193. A Typical Winch fitted with Warping Drum and Rope (or Captive) Drum

03059. Introduction to Improvised Rigs of Derricks, Sheers, Gyns and Ropeways

With modern developments of hydraulics, and the increasing availability of portable and mounted cranes, the requirement to improvise lifting rigs has greatly reduced; however, in certain circumstances the seaman may still be called upon to use his ingenuity, either on board or ashore, to rig some form of derrick, sheers or gyn to lift or handle heavy stores or equipment. He will have to do this using his own ship's gear, supplemented sometimes by anything he can find ashore. Ships no longer carry timber spars specifically for improvised lifting rigs and the only available onboard source of timber is the Douglas Fir shores supplied for Damage Control purposes. Table 3-45 gives the approximate safe working thrust applicable to most timber other than softwoods and allows a factor of safety of 10. However, timber obtained from outside sources or cut down ashore should be treated with caution and the seaman must exercise his judgement in deciding the realistic loading such timber is likely to safely withstand. The **derrick** is a single upright spar; the swinging derrick consists of an upright spar with a swinging boom pivoted at its foot. **Sheers** consist of two upright spars with their heads lashed together and their feet splayed out. A **gyn** is a tripod formed by three spars with their heads lashed together. A **ropeway** consists of an overhead jackstay of rope set up between two sheers, or gyns, along which a travelling block is hauled back and forth.

Table 3-45. Approximate Safe Working Thrust of Timber Spars

Mean Diameter	**Length**								**Size of Equivalent Square Baulk**
	mm								
	3000	4000	5000	6000	7000	8000	9000	10000	
mm	*Approximate Safe Working Thrust in tonnes*								mm
150	0.78	0.46	0.30	0.21	0.16	0.12	0.10	0.08	133
175	1.40	0.84	0.55	0.39	0.29	0.22	0.18	0.14	155
200	2.29	1.40	0.93	0.66	0.49	0.38	0.30	0.24	177
225	3.50	2.17	1.46	1.04	0.78	0.60	0.48	0.39	199
250	5.19	3.21	2.18	1.56	1.17	0.91	0.72	0.59	222
275	7.09	4.57	3.12	2.25	1.69	1.32	1.05	0.86	244
300	9.55	6.24	4.31	3.14	2.37	1.85	1.48	1.21	266

a. **Standing Derrick.** A standing derrick is a single spar (Fig 3-194) stayed by rigging and having a tackle at its head for hoisting a load. Its head is supported by a **topping lift**, or, if there is a no suitable overhead attachment point for a topping lift, it is supported by a **back guy. Side guys** are fitted to give lateral support and, if there is a suitable attachment point, a martingale or **fore guy** may be lead downwards from the head to prevent the head from springing upwards or backwards when hoisting or lowering a load. If it has an efficient topping lift led from a point vertically above the heel, the derrick can be slewed to a limited extent as well as being topped and lowered. If the load is heavy, or if a back guy is fitted, or if the topping-lift attachment point is not vertically above the heel, slewing must not be attempted. The safe working load of the derrick is governed by the size and material of the spar and the strength of the rigging gear available.

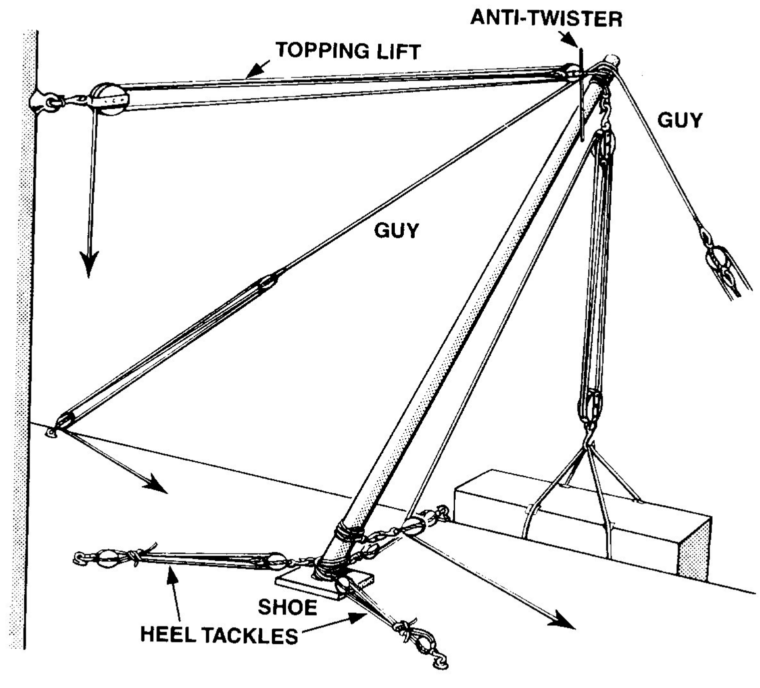


Fig 3-194. Standing Derrick

b. **Swinging Derrick**. A swinging derrick is made up of two spars (Fig 3-195), one upright and well stayed by guys, and the other secured to the first by a strop called a **snotter** and a topping lift, so that it forms a swinging boom. Working guys are led from the head of the boom as in a permanent derrick, and the boom can be topped, lowered and slewed through an angle up to 120 degrees when the load is slung. A derrick of this type is not suitable for heavy loads, however, because of the stress imposed on the snotter. In addition, it is often difficult to rig a martingale (foreguy) for the upright spar, though another spar lashed to it so as to form a strut (called a **prypole**), as illustrated in Fig 3-195, affords an effective alternative. Although this derrick is more complicated in rig than either a standing derrick or sheers, it is particularly useful for disembarking stores from a boat to a jetty.

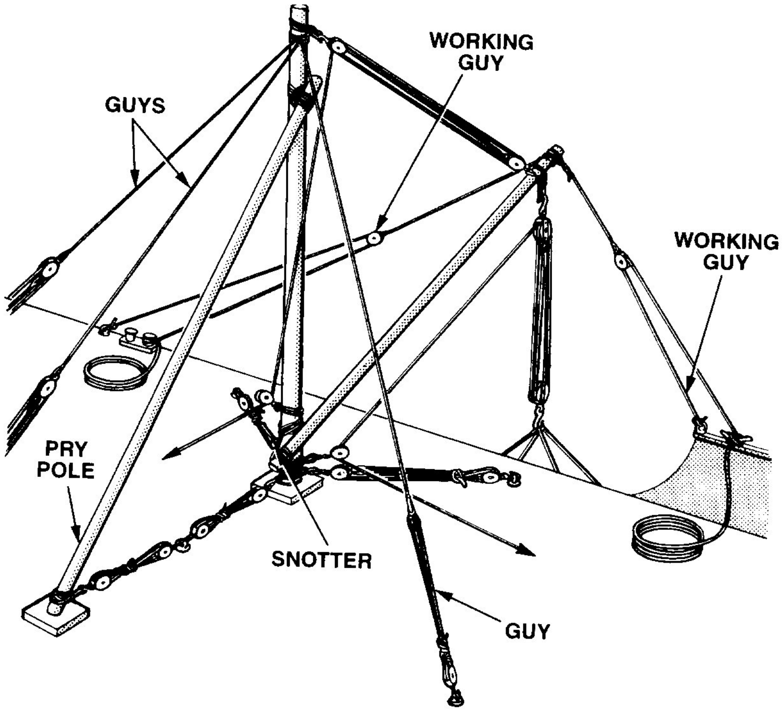


Fig 3-195. Swinging Derrick

c. **Sheers**. Sheers consist of a pair of spars called **legs**, which are lashed together and crossed near their heads (Fig 3-196); the cross is called the **crutch.** They are supported in a vertical or an inclined position by rigging, and a tackle for hoisting the load is secured to the crutch. The overhead rigging consists of either a topping lift and martingale or a back guy and fore guy; as sheers need no lateral support, side guys are not fitted. If a topping lift is fitted it should be led to a point aloft so that it makes, as nearly as possible, a right-angle with the sheers **when they are loaded.** If a back guy is fitted it should be led to a point equidistant from the heels of the legs and making as broad an angle as possible with the sheers. Sheers can be topped -up or lowered through a limited angle, the extent depending on the lead of the topping lift; if a back guy is rigged, however, neither sheers nor derricks may normally be canted to an angle of more than 20 degrees with the vertical. As sheers are made from two spars they are, of course, stronger than a derrick of equal size and of the same materials. Sheers are particularly suited for use when the load is not required to be slewed, such as on the edge of a wharf or the banks of a river, or in lifting a weight from a boat to the deck of a ship.

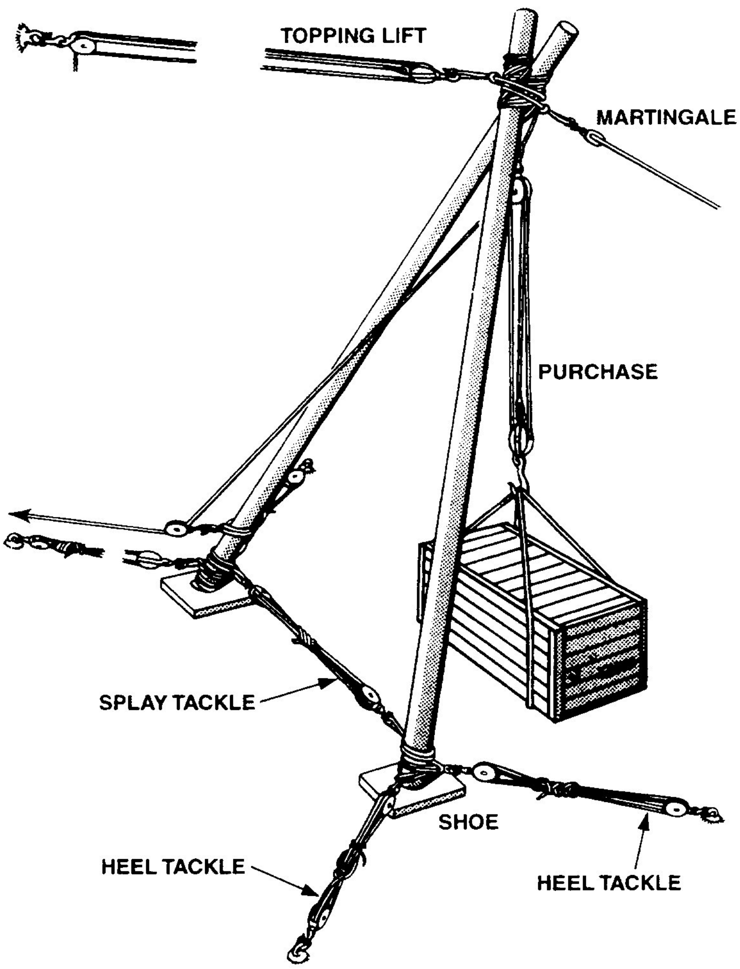


Fig 3-196. Sheers

d. **Gyn**. A gyn (Fig 3-197) consists of three spars with their heads crossed and lashed together and their heels splayed out to form a tripod. A gyn is stronger than sheers and derricks, and it requires no rigging to support it, but it can only be used for a straight lift and cannot normally be traversed with its load slung.

e. **Ropeway**. A ropeway (Fig 3-198) is used to transfer loads across a river or a ravine. Gyns are preferable to sheers as supports for the jackstay, because they are more stable and need less guying. An improvised ropeway is usually confined to transferring light stores and equipment, because of the heavy stresses set up in the jackstay when transferring a load; a 60m, 24mm SWR jackstay, for example, is limited to a maximum load of only 1118 kgs, using a factor of safety of 4. The formula to calculate the theoretical tension in a jackstay between supports at the same level is:

$$Tension = \frac{Wl}{4s}$$

Where:

W is the total weight of the load, including traveller and slings,
l is the distance between supports,
s is the dip of the centre of the jackstay (in same units as *l*).

Winnets or thumbpieces can be used to stop the snotter rising up the pole

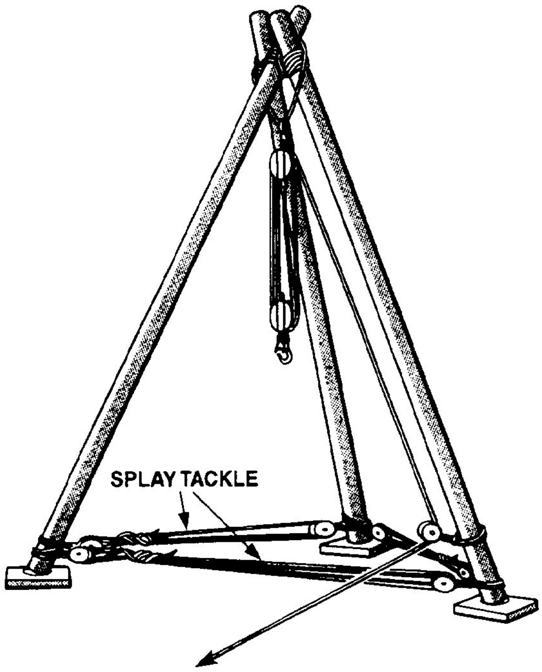


Fig 3-197. A Gyn

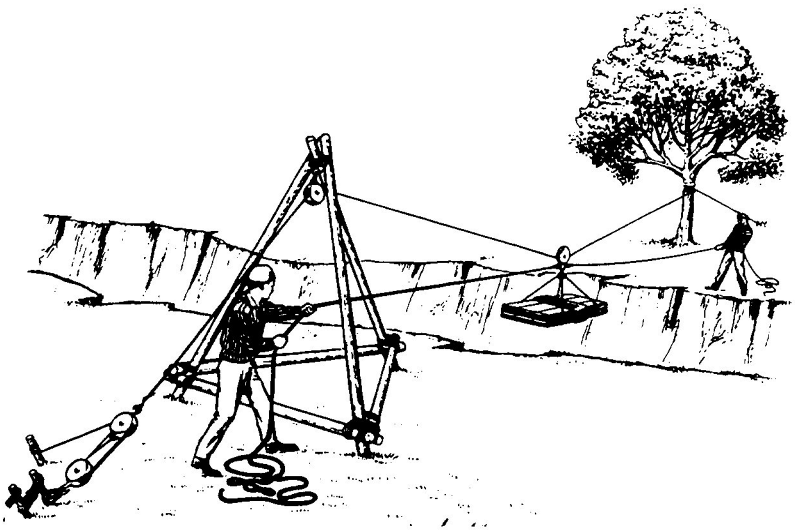


Fig 3-198. Simple Ropeway

03060. Gear Required and Principles Involved When Rigging Improvised Lifting Gear.

The rigging for derricks, sheers and ropeways must be led so that it does its work efficiently. As already stated the best lead for a topping lift is at right-angles to the derrick and towards a point vertical above the heel, but this will often not be possible in practice; an angle of 60 degrees or more between the topping lift or back guy and the derrick will be reasonably effective, and it should never be less than 45 degrees. Similarly, the angle between the side guys and the derrick should, if possible, be 60 degrees or more, and these should not be inclined at a greater angle than 30 degrees - ie at a slope of not more than 1 in 2 - with the horizontal.

a. **Guys**. The guys of derricks and sheers, particularly those used for heavy loads, stretch considerably when under load, and all guys must therefore be working guys so that there tensions can be adjusted. When picking up a load, a derrick or sheers should be heeled over to a few degrees less than the required angle to allow for the stretch in the topping lift or back guy; with heavy sheers this allowance may be as much as 8 degrees. For light derricks or sheers the guys are usually wire pendants tailed with luff tackles, but for heavy derricks and sheers the guys should be at least runners rove through blocks at the head of the derrick or sheers and tailed at their hauling part with luff tackles or two-fold purchases. If sheers are required only to traverse a load as far as their heels, the martingale (or fore guy) only acts as a preventer and therefore may be about half the strength of the topping lift or back guy; but if a load is to be traversed to a position behind their heels the martingale and topping lift must be of equal strength. If a derrick is required to slew a load through an angle of less than 90 degrees the side guy on the training side and the martingale (or fore guy) act only as preventers and need not be as strong as the other guys or topping lift; but if the slewing angle is 90 degrees or more, all guys and the topping lift should be of equal strength. To give a guy a slope of 1 in 2 when ashore and on firm and level ground, the distance of a **holdfast**, described later, from the foot of a derrick or sheers should be twice the effective length of the derrick or sheers, and to give it a slope of 1 in 3 it should be three times the effective length. To obtain the correct lead for the guys on sloping ground the uphill and downhill holdfasts must be placed closer to and farther from the foot than is normally done (Fig 3-199). If a guy holdfast is inaccessible - for example, an anchor laid off shore - the hauling part of the guy tackle must be led to the head of the derrick or sheers and thence to the foot.

b. **Shoes.** A shoe for a light derrick, sheers or a gyn is usually a square slab of hardwood with a recess in its upper surface to take the heel of its spar. The length of each of its sides should be not less than four times the diameter of the spar. For heavy spars the shoe is of metal or made up from baulks of timber. A shoe is used to distribute the weight of the load and the thrust of the spar over an area of deck, or, when used ashore, to distribute the weight so as to prevent the spar from sinking into the ground. When used ashore the shoe should be sunk level and held in place by **pickets** (described later) driven in at intervals along its sides and with their heads flush with the shoe. Shoes should always be used for spars of improvised lifting rigs, except when handling light loads, and must be placed at the same level; otherwise an undue stress will be placed on one of the legs and the sheers or gyn will tend to capsize. When using spars aboard ship, the deck on which they stand must be well shored-up below.

c. **Heel Tackles**. Heel tackles are used to prevent unwanted movements at the heels of spars used for derricks and sheers. However, the heel tackles can be used to move sheers about the deck if required. The angle between the tackles should be 120 degrees wherever possible (Fig 3-196).

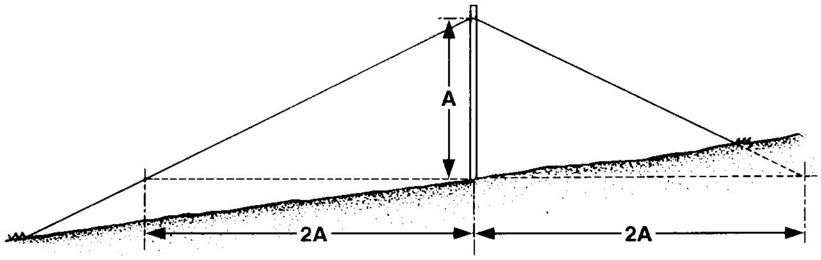


Fig 3-199. Correct Lead for Guys on Sloping Ground

d. **Splay Tackles and Belly Tackles**. A splay tackle is used to prevent the heels of spars from moving farther apart (Fig 3-196 and 3-197). Belly tackles are secured to the middle of a spar when there is doubt concerning its strength for a particular job. The spar is then stayed to the deck or ground.

e. **Holdfasts for Use on Shore**. In a warship it is a relatively simple task to find eyeplates or other permanent fittings to hold fast improvised rigging; but when ashore, and probably under adverse conditions, the seaman must find or construct an anchorage to hold his improvised gear firmly and safely in place. Holdfasts (Fig 3-200) may consist of existing natural or structural features; or pickets driven singly or in combination into the ground; or baulks of timber placed behind a line of driven pickets; or ships' anchors embedded in the ground and held by driven pickets; or baulks of timber buried in trenches dug in the ground. Whatever the type of holdfast it must be more than strong enough for the stress it is intended to bear, because once a holdfast starts to give it is difficult to strengthen it. A holdfast must be so arranged that the maximum resistance it can offer is in line with the stress it can bear; a buried baulk of timber, for example, should lie at right angles to the pull, whereas a combination of pickets should be driven exactly in line with the direction of the pull.

(1) *Existing holdfasts* should be used whenever it is practicable, provided that they are conveniently situated and strong enough for the job. The holding power of a tree is uncertain, because so much depends on the depths of its roots and the nature of the soil; a tree can be considerably strengthened, however, by fitting it with a back guy, and if two trees are growing close together their combined holding power can be used by placing a baulk of timber across them. A baulk of timber placed across a gap in masonry makes a good holdfast, provided that the stress is distributed over a sufficiently large area of the masonry by placing planks vertically and horizontally between the baulk and the masonry. The pier of a bridge or the base of a tower can be used by encircling it with a strop, but the strop should be protected from chafe or bad nips.

(2) *Picket holdfasts* may be used in ordinary soils for pulls not exceeding 2 tonnes. The normal picket is an ash stake 1.5m long and 75mm in diameter, with one end pointed (and, when possible, shod with iron) and the other end bound with an iron hoop; it should be driven to a depth of 1m at an inclination of about 20 degrees to the vertical. Pickets may be used singly, or lashed together in combinations of one-and-one, two-and-one, or three-two-and-one, as shown in Fig 3-200.

(3) *A baulk and picket holdfast* consists of a baulk of timber placed behind a line of driven pickets which are backed by another line of pickets; it may be used for pulls of between 2 and 10 tonnes. Only two lines of pickets should be used, driven in combinations of one-and-one or two-and-one, with each combination at least half a metre from the next. A three-two-one combination of pickets should not be used, because of the difficulty of driving the pickets so that each will bear its fair proportion of the stress. The front row of pickets should be exactly in line so that the stress on the baulk is divided equally among them, and the ground under the baulk should be cut away to allow the face of the baulk to bear evenly against the inclined pickets (Fig 3-200). The baulk should be well parcelled where the strop passes round it.

(4) *An Anchor Holdfast* consists of an Admiralty Plan anchor embedded and supported by pickets, as shown in Fig 3-200. If the pull is horizontal it will take a stress up to the strength of its ring, but it is not very suitable as the holdfast for a guy, because the upward pull of the guy tends to dislodge the anchor. When an offshore underwater holdfast is required for the fore guy of a derrick or sheers the anchor should be laid in a position which gives the guy plenty of scope, and its angle of scope should not be steeper than one in three; that part of the guy which will be underwater should be of chain. Backing one anchor with another gives greater holding power, provided that the anchors are well separated.

(5) *A Buried Holdfast*, used for pulls of over 10 tonnes consists of a baulk or baulks of timber laid in a trench and then covered with well rammed earth. The trench should be 0.6m longer than the baulk and have a vertical face; its depth will depend on the nature of the soil and the pull which the holdfast is required to withstand. A subsidiary trench to take the strop must be cut, as shown in Fig 3-200; its slope should not be steeper than one in three and chocks should be placed to support the baulk clear of the bottom of the trench to enable the strop to be passed. Planks can be laid vertically and horizontally between the baulk and the face of the trench to distribute the stress over a greater area.

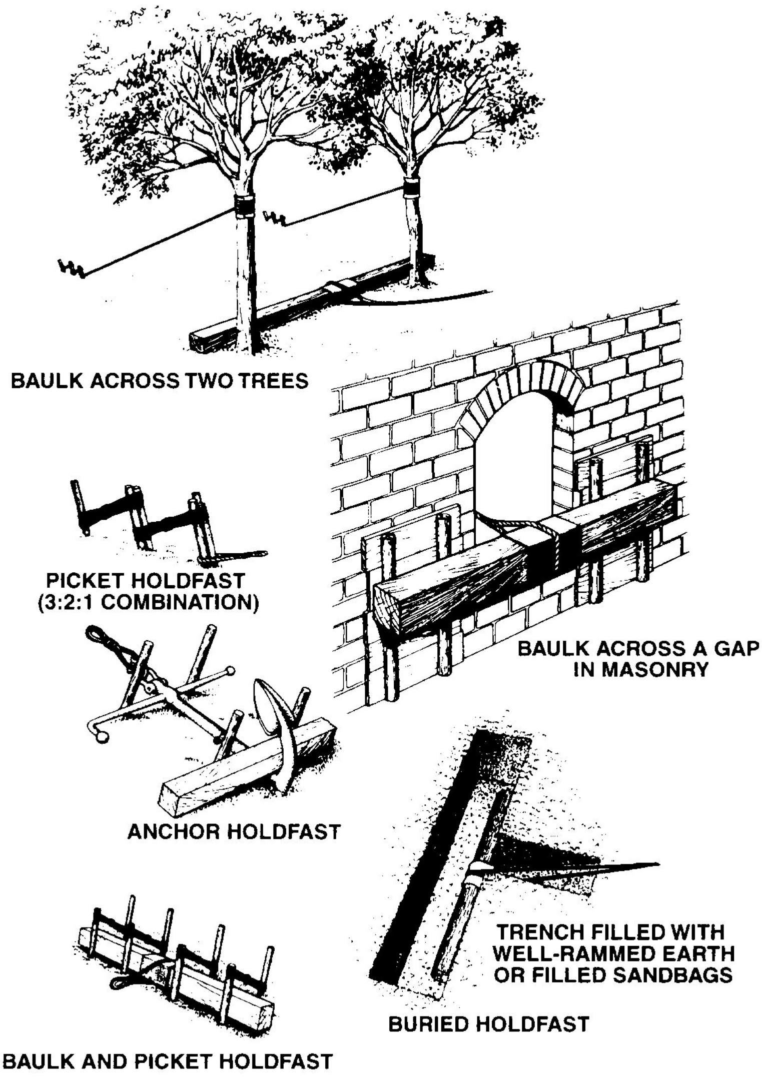


Fig 3-200. Holdfasts

03061. Rigging Derricks, Sheers, Gyns and Ropeways

Obstructions in the vicinity, lack of a clear lead for purchase, topping lift or guy, and other special circumstances make it impossible to give detailed instructions for rigging these appliances, so the seaman must achieve the best he can with the available equipment.

a. **To Rig a Standing Derrick** (Figs 3-194 and 3-201). Strops for attaching the purchase and topping lift (or back guy) are placed over the derrick head, and are prevented from slipping down either by wooden projections called **thumb-pieces** (Fig 3-201(I)) screwed or nailed in place, or by a rope **collar** (Fig 3-201(ii)) put on the spar like a whipping. These strops should lie close together so as to avoid a bending stress on the spar. The guys, which consist of single parts of cordage or rope, are then middled and clove-hitched over the head of the spar, above the strops, tackles being attached if required. The distance from the foot of the derrick to the point of attachment of the purchase and topping lift is known as the **effective length** of the derrick. The heel of the derrick is kept in place by tackles, which must be led so that they will support it in every direction, and particularly from that in which the derrick will be raised and lowered. The strops for the heel tackles must be kept as low as possible, otherwise the tackles will be heavily stressed as the derrick is raised.

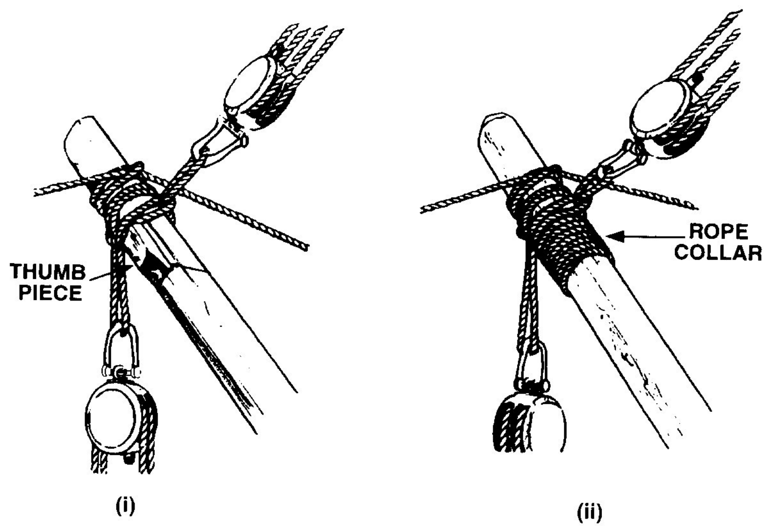


Fig 3-201. Methods of Rigging the Head of a Derrick, Using Rope Collars or Thumb-pieces

b. **To Rig a Swinging Derrick** (Figs 3-195 and 3-201). The upright spar is first erected, and is inclined somewhat away from the load so that it will become vertical as the boom takes the weight. It must be well supported by guys, each strong enough to take the entire pull of the topping lift as the boom swings round. The arc through which the boom is required to swing must, of course, be left clear. A strop to take the upper block of the topping lift is placed over the head of this spar above the guys. The spar which is to form the boom is now laid midway between the intended limits of its horizontal travel, and with its heel close against the upright spar and projecting on the side away from the load. The head of the boom is rigged as for a standing derrick, but the heel is attached to the upright by a snotter, as shown in Fig 3-195. If no suitable strop is available a bight of rope can be passed round the boom, then through its own bight, and then half-hitched and dogged round the upright spar in the same way as a stopper is put on a wire rope. The falls of the topping lift and purchase are led through blocks shackled to strops at the foot of the upright spar, the strops being kept in place by thumb-pieces or rope collars.

As the leading block for the hauling part of the purchase fall is to one side of the boom, the latter is subjected to a sideways pull when the purchase takes the weight, and the boom must therefore be adequately guyed. In order to keep the stresses on the boom, topping lift and guys to a minimum the boom should cross the upright as low down as possible without fouling the ground or deck, and the effective length of the boom (from where the spars cross to the topping lift and purchase are attached) should be as short as the reach required will allow.

c. **To Rig Sheers**. (Figs 3-196, 3-202 and 3-203). The spars for the legs are laid side by side, with their heels together and their heads supported conveniently clear of the ground or deck; those parts which will be covered by the lashing are then parcelled to prevent chafe, and the heads are then lashed together as described below and illustrated in Fig 3-202. The legs are first crossed and the lashing is made fast to one of them by a timber hitch, either above or below the cross, and then a sufficient number of round turns (usually 14 or more) to cover the cross are taken round both legs. The end is then brought up between the legs, passed down between them on the opposite side of the cross, and brought up again as before, so as to form a frapping turn binding the whole lashing together. Four or five of these frapping turns having been applied, the lashing is completed by a clove hitch taken round the leg opposite to the one to which it was originally attached; it is important that the frapping turns are correctly put on, close to each other, and hauled taut. Choice of the rope to be used for the head lashing depends on the size of the spars and the weight to be lifted; this is best judged at the time, but the following is given as a general guide:

Weight to be lifted	**Lashing**
Below 2 tonnes	20mm Polypropylene
2 tonnes to 5 tonnes inclusive	16mm (6 x 24) SWR
Over 5 tonnes up to 20 tonnes	20mm (6 x 24) SWR

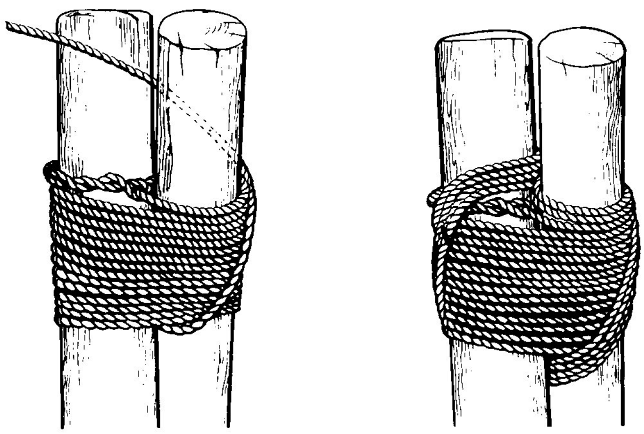


Fig 3-202. Passing the Head Lashing of Sheers

When the head lashing has been completed the heels of the legs are opened out to the required distance ; the action of opening them out sets up the head lashing so taut that it binds the legs securely together where they cross. The strop for the purchase is now put on and must be long enough to enable the block to swing clear between the legs; it is put on by slipping it up to the top leg and passing it down over the head of the lower leg, so that it will bind the two together when under load (Fig 3-203). Chafing pieces must be placed under the strop to prevent it chafing the lashing. The topping lift and martingale, or fore and back guys, are then secured to the head of the sheers. There are several equally good ways of doing this, two of which are illustrated in Fig 3-203 and each of which the principles are that the pull of the guys should assist in binding the sheers together, and that the purchase strop should be free to take up its natural position as the weight comes on it.

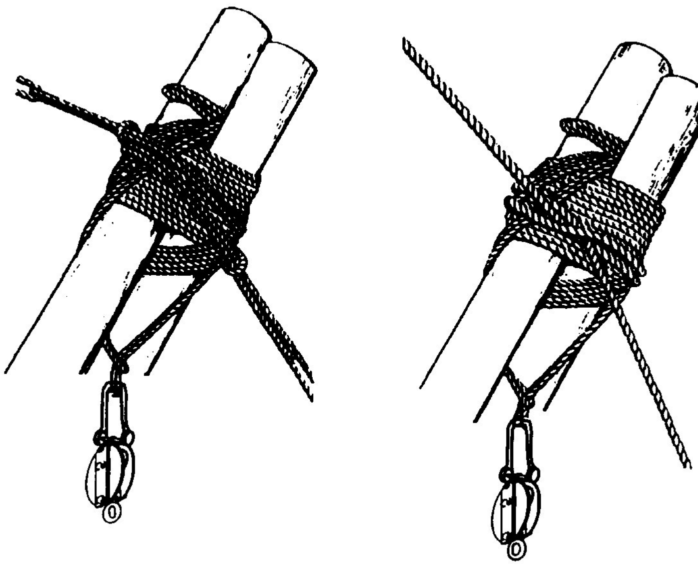


Fig 3-203. Head of Sheers - Methods of Rigging

The necessary tackles for the guys and other rigging are then shackled to the strops or clapped on to the end of the ropes, as required, and finally if required, a small block is attached to each leg above the cross and a single whip then rove through each to serve as gantlines for sending a man aloft to make any adjustments after the sheers have been raised. The sheers are then placed roughly in position for raising, the heels being pointed to the shoes prepared for them and supported laterally by **splay** and **heel tackles**. The distance between the shoes should be one-third of that from the foot of the sheers to the crutch, which is the effective length of the sheers. As its name implies, the splay tackle leads from the heel of one spar to the heel of the other, being secured to each by a strop. The heel tackles guy down the heels laterally and, as with a derrick, their strops should be kept as low down as possible. The leading block for the fall of the purchase is then attached to one leg, and, after fitting thumb-pieces or rope collars to prevent all the strops at the feet of the legs from slipping upwards, the sheers are then ready for raising.

d. **To Rig a Gyn** (Figs 3-197 and 3-204). The position for the head lashing is first marked on all three spars which are to be used for the legs. These legs are then laid parallel with each other, about 50mm apart and with the heel of the centre leg pointing in the opposite direction to those of the other two. The centre spar is called the **prypole** and the other spars the **cheeks**. The marks must be in line and the heads of the legs should be supported clear of the deck. The lashing is then put on at the marks. It is begun with a timber hitch round one cheek, then from six to eight figure-of -eight turns are taken, as shown in Fig 3-204, and the lashing is completed with a clove hitch round the other cheek.

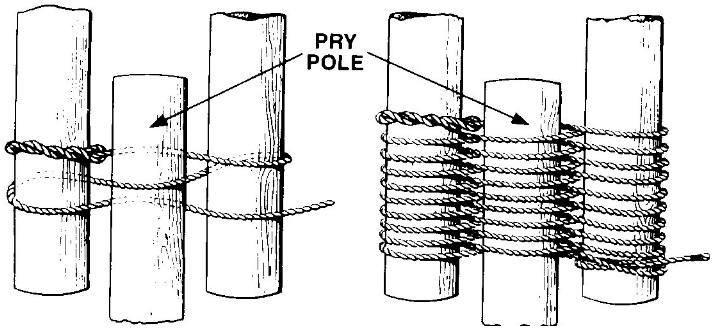


Fig 3-204. Passing the Head Lashing of a Gyn

The lashing must be applied loosely; it cannot slip down once the gyn is erected, and if it is too taut great difficulty will be experienced in raising the gyn; it is usual, however, to place a rope collar round the prypole below the lashing to prevent it slipping down during the process of raising. The heels of the cheeks are now opened out, and the splay tackles are rigged between the feet of each pair. The gyn is then raised by lifting its head and hauling the heel of the prypole towards the heels of the cheeks by means of the splay tackles. When the head reaches a convenient height the strop for the upper block of the purchase is put on and the block itself secured to it. Then tackles are rigged as required to haul the feet into place on their shoes. When correctly placed the heels are secured by lashing or heel tackles led so as to give the necessary lateral support, and the hauling part of the purchase is led through a block secured to the heel of one cheek. As with derricks or sheers, thumb-pieces or rope collars are required to prevent the strops at the heels from slipping up the spars. With very small gyns splay tackles are not necessary, and their feet can be manhandled into place and then secured, either by lashings or by short spars lashed across them.

e. **To Rig a Ropeway** (Fig 3-198, 3-205 and 3-206). Where no suitable trees are available for supporting the jackstay of a ropeway, gyns or sheers must be used. Gyns are preferable to sheers because they are more stable, but sheers may have to be used for long jackstays with a high ground clearance if suitable spars are available. The stresses set up in a jackstay are considerable and in practice can be taken as being up to five or six times the weight of the load. Strong holdfasts must therefore be provided for the jackstay or any back guys, and they should be placed so that the slope of the jackstay or guy from the ground to the head of the support is not steeper than one in four. The tauter the jackstay the greater will be the stresses imposed on its anchorages and supports, but the easier it will be to haul the load across.

On the other hand, if the jackstay is too slack, though the stresses in it will be reduced it will be difficult or impossible to haul the load across, and also the load will tend to become laterally unstable. The practical compromise between these extremes is to adjust the tension in the jackstay to give it a dip of between one fiftieth and one-twentieth of its effective length when loaded, so that when loaded at its centre it will assume a dip of between one-twentieth and one-tenth of its effective length. For practical purposes the dip in the jackstay when loaded at its centre should not exceed one-tenth of its effective length. The jackstay can be rigged with each end secured to a holdfast and rove through a block slung from the head of each of its supports; or its standing end can be secured to the head of one support, which will then require a back guy. It is usual to set up a tackle on its running end, but for heavy loads its final adjustment must be made by a rigging screw. The traveller can be an inverted block hooked to a light tackle for hoisting the load to the required height before it is traversed, but for heavy loads the traveller should consist of two blocks lashed to a spar fitted with lifting tackles as shown in Fig 3-205.

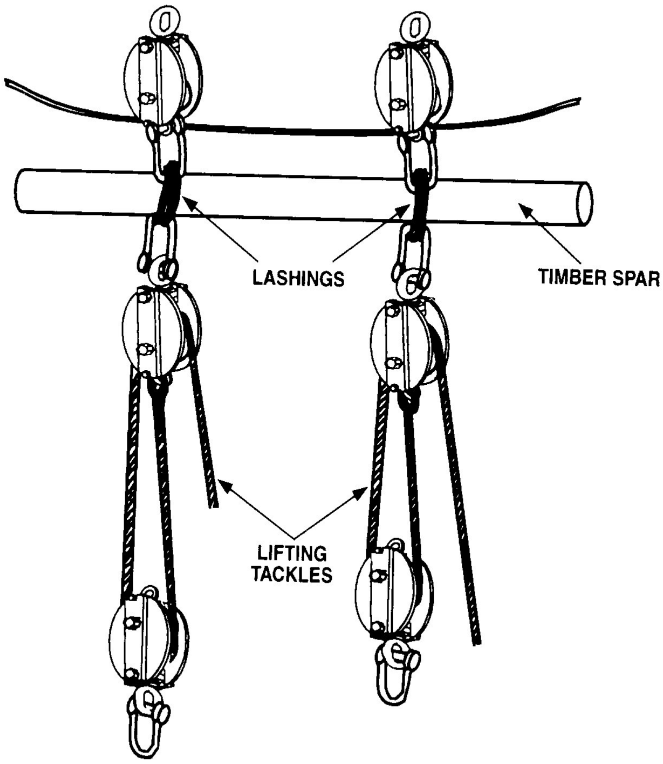


Fig 3-205. Traveller for Slinging Heavy Weights on a Jackstay

The gyn or sheers must be stepped sufficiently far back from the edge of the gap to allow room to sling the gear on one side and land it on the other. For light loads no leading blocks are required for the traveller inhauls or outhauls, but for heavy loads the inhaul should be led through a leading block at the head of the gyn or sheers but below the jackstay block. If gyns are used each should be stepped with the heel of its prypole towards the gap but slightly to one side of the jackstay, and the inhauls should be led on the opposite side of the prypole to the jackstay. A simple ropeway using a gyn and a tree as supports is shown in Fig 3-198.

A method of rigging a ropeway between two sheers in which the jackstay is used to erect both sheers is shown in Fig 3-206. The sheers are laid with their heels facing each other and with the standing end of the jackstay secured to the head of the sheers marked B, which are temporarily secured to the ground. The sheers marked A are first raised as high as possible by hand, and then to their full height by hauling on the tackle at the hauling end of the jackstay. The back guy of sheer A is then set up and sheers B are raised in a similar manner.

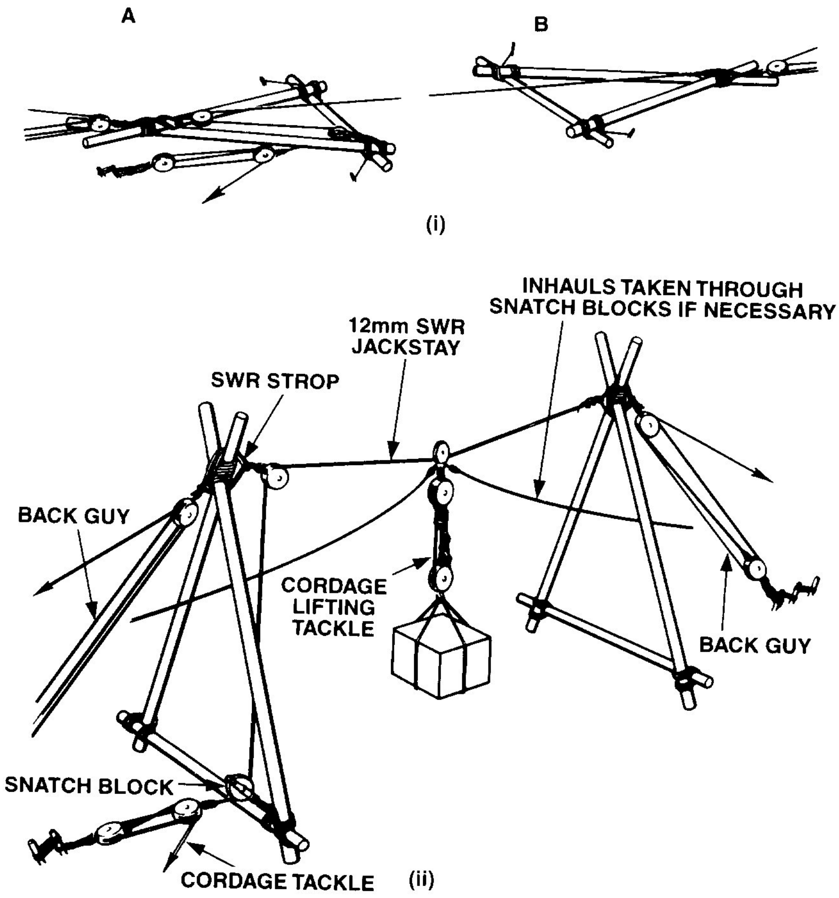


Fig 3-206. A Light Ropeway

03062. Raising Derricks and Sheers

The methods of raising a derrick described here can be applied equally well to sheers. It is assumed that the derrick is fully rigged with its head lashing, main tackle, guys and heel tackle, and that it heel is pointed towards its shoe. As the derrick is swayed up, the side guys must be tended to guide the foot into its shoe and then to prevent it from slipping. Before the derrick becomes vertical the martingale or fore guy must be tended to prevent the derrick from falling backwards. A derrick is hauled upright mainly by its topping lift or back guy, but its head must first be raised high enough to allow the pull of the guy to exert an effective leverage without putting undue stresses on the guy, the derrick and its heel tackles. The head of the derrick must therefore be raised by some means until the angle between the back guy and the derrick is between 15 and 20 degrees; the greater this angle the less will be the stresses involved. Lowering derricks or sheers is carried out in the reverse manner to that in which they are raised.

a. **By Manhandling**. The head of a light derrick can be manhandled to the required height by means of a long handspike placed under and athwart the derrick head, which is then lifted by two or more men on each end of the handspike. A low trestle should be placed under the derrick and worked towards its heel with each lift until the head of the derrick has been raised high enough.

b. **By Moving Lever**. The moving-lever method (Fig 3-207) is suitable for a derrick which is rather too heavy to be raised initially by manhandling, and which is fitted with a back guy consisting of a pendant tailed with a tackle. The lever should be a light spar about half as long as the derrick and fitted with side guys, and it is placed alongside the derrick, with its heel at about a quarter of the way from the heel of the derrick to its head. The head of the lever is then lashed to the back guy at a position which will allow it to be raised through an angle of at least 45 degrees before it begins to raise the head of the derrick (Fig 3-207). The lashing is made with figure-of-eight turns and finished with a slip knot, and its end should be long enough to enable the lashing to be slipped from the ground as soon as the lever ceases to act. The head of the lever is raised initially by manhandling and then by the back guy, while its head is kept over the derrick by means of its side guys. When the lever has been raised by an angle of 45 degrees it will begin to raise the derrick and will continue to do so until it is a little beyond the vertical, when it will cease to act. At this stage the lashing is slipped and the lever is withdrawn, otherwise it will be lifted off the ground as the derrick is raised by its back guy. The derrick side guys are not shown in Fig 3-207.

c. **By Standing Lever**. The standing-lever method (Fig 3-208) is suitable for a rather heavier derrick which is fitted with a back guy rigged as a runner and tailed with a purchase. The lever can be a spar or light sheers, and its length and position in relation to the derrick are the same as those for a moving lever. The lever is fully guyed with strong fore and back guys and is fitted with an extra guy on the side where the hauling part of the guy is rove. If the lever is a spar a slot is cut in its head into which is placed the standing part of the back guy; if sheers are used as a lever the standing part is placed over the crutch. The lever is then raised and its guys are set up, except the additional side guy, which is rove **underneath** the hauling part of the back guy and left slack. The derrick is then raised by hauling on its back guy, and as the head rises so the hauling part of the back guy will rise until it fouls the side guy of the lever. Raising the derrick is then halted while the additional side guy of the lever is set up and the other side guy is cast off. The raising of the derrick is then completed by means of its back guy. The derrick side guys are not shown in Fig 3-208.

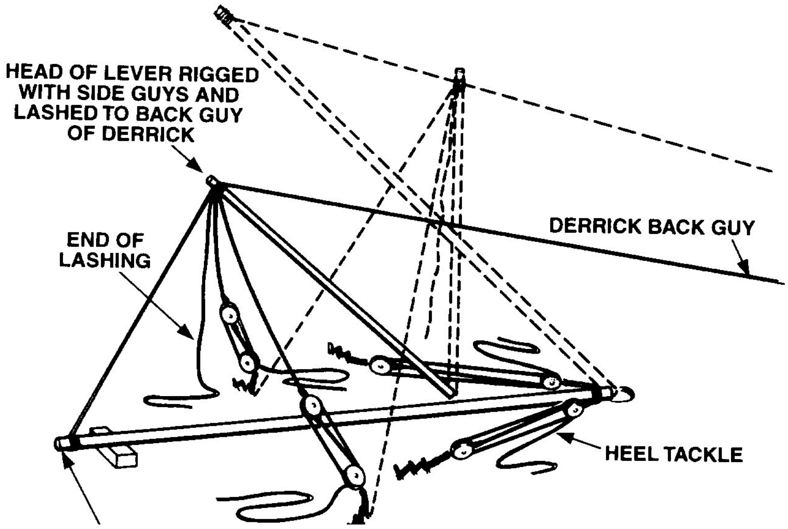


Fig 3-207. Raising a Derrick by a Moving Lever

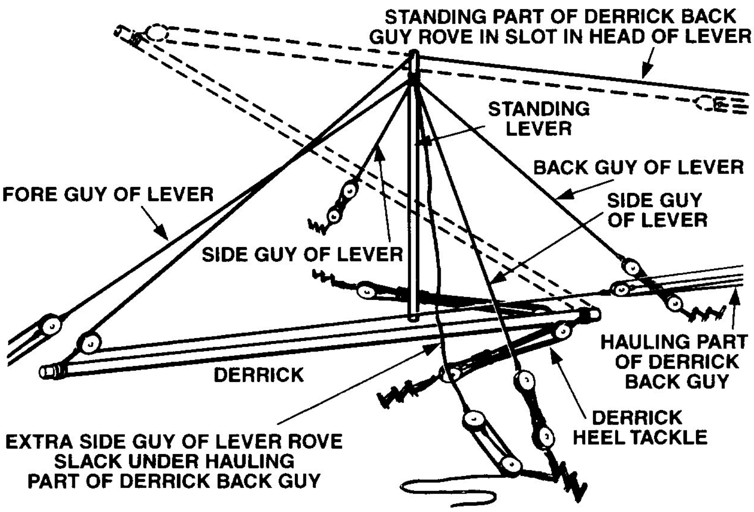


Fig 3-208. Raising a Derrick by a Standing Lever

d. **Walking a Derrick or Sheers.** If it is not convenient to erect a derrick at the place where it is required, it must first be rigged and raised and **walked** there. It is not usual on shore to walk a derrick on its shoe; the shoe is first embedded in its proper position and the derrick is then walked over the ground to its shoe. If the ground is too soft it is walked along a gangway of planks, reinforced if necessary by baulks of timber. To walk a derrick, cross-lash a spar to its foot about three-quarters of a metre above the heel (above the ground for sheers); then, by lifting on the spar, levering the heel(s) with handspikes, and hauling on the forward heel-tackles, the derrick or sheer is walked towards its shoe(s). A derrick must be kept upright by adjusting the side guys. If fitted with a strong fore-guy, walking is facilitated by inclining the derrick or sheers backwards about 10 degrees; a rear heel-tackle must be fitted - otherwise the inclination should be slightly forward.

03063. Plank Stage

Plank stages, suspended by 20mm polypropylene rope lanyards at each end, are used to support **a maximum of two people only** when working over the ship's side, or on superstructures and funnels. The lanyards are secured to a small crosspiece of wood, called a **horn**, at each end of the stage; these project from the stage and so keep it a convenient distance from the fleet to be worked.

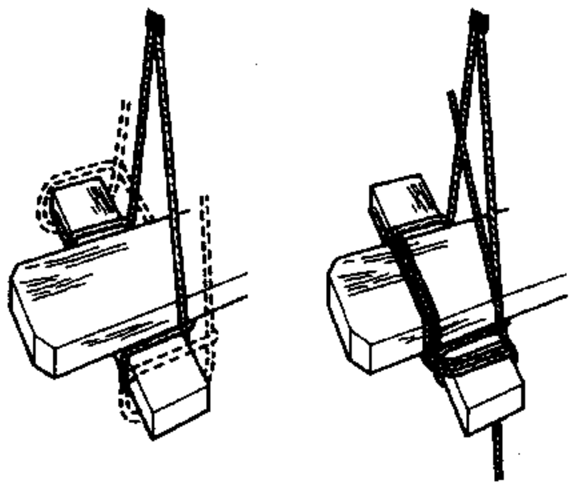


Fig 3-209. Securing a Lanyard to the end of a Plank stage

A long soft eye is either spliced or made with a bowline in one end of each lanyard and then placed under the end of the stage, with a half-hitch taken round each horn (Fig3-209). The lanyard is then passed round a cleat or similar tested fitting near the gunwale above, and the end brought down and belayed round the horns of the stage, thus enabling those working on the stage to lower themselves to the position required. **The lanyard should never be rove round or secured to a guardrail**. Maintenance schedules are given in the ship's MMS system and Service Drawing Number 020 032 722/02 gives details of the plank stage and its test requirements.

03064. Bosun's Chair

A bosun's chair is a piece of marine plywood shaped as in Fig3-210 and 610mm long, 200mm wide and 250mm thick. It has 2 holes at each end, through which 2 SWR strops are rove and then spliced underneath. A thimble is seized into the bights of both SWR strops and a 20mm polypropylene gantline either shackled into the thimble or secured with a double sheet bend. Maintenance schedules are given in the ship's MMS system and Service Drawing Number 040004306/1-3 gives details of the chair and test requirements. A man must be tended from the deck when he is aloft or over the side in a bosun's chair. The gantline must be manned by at least three experienced seaman when adjusting the height of the chair and the gantline must be properly belayed to a tested fitting when it is turned up. Personnel using a bosun's chair must be properly briefed for the task and must, when appropriate, wear a safety harness, and, if working over water, a Hazardous Duty Lifejacket.

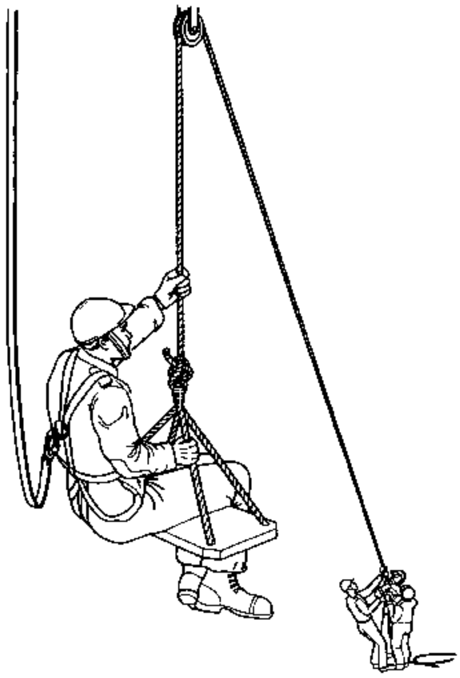


Fig 3-210. A Bosun's Chair on a Gantline

03065. Manpower Calculations

The force a man can be expected to exert depends chiefly on whether the effort is momentary or sustained, whether it is made quickly or slowly, and on the manner in which the force is to be applied. It also depends to a certain extent on the number of men employed; the larger the body of men the less will be the individual effort. In parties of up to 30 men, and for sustained efforts, each man can be expected to do the following work:

Exert a standing pull of from 25 to 40kgs (eg on the fall of the tackle).

Exert a walking pull of from 18 to 22kgs (eg on a purchase fall).

Push or pull with a force of from 7 to 9kgs.

Carry from 25 to 40 kgs.

In parties of up to four men, and for short periods only, each man can be expected to work as follows:

Exert a standing haul of from 55 to 60 kg (provided he has a good foothold).

Exert a stationary push of 45kgs (provided he has a good foothold)

Bear down on a lever with a force of from 30 kgs to his own weight.

Lift up a lever at knee-level with a force of 70kg.

Carry on his shoulders a weight of 60kgs.

03066. Boat Booms

Boat booms are fixed or swinging spars of wood or steel that may be rigged from the ship's side on the quarter port and starboard (**quarter booms)** or right aft projecting aft (**stern booms**). Major warships have swinging quarter booms (Fig 3-211) that are attached to the side by a gooseneck fitting and when not in use they are swung for'ard or aft and the outboard end is housed within a clamp and secured by a drop nose pin. Booms are supported horizontally by a SWR standing topping-lift which can be adjusted by a rigging screw and slip; and they are kept square, if of the swinging type, by a standing guy and a working guy which is secured to a tackle for swinging the boom out into its correct position. Lizards, boatrope blocks and Jacob's ladders are shackled to thimbles seized into wire grommets placed at intervals round booms. The tops of the booms are flat to afford a foothold, and from a convenient height a lifeline of SWR is secured from the bight of the topping lift to a convenient point inboard. Boatropes of 24mm polypropylene are secured inboard well before the boom to give them plenty of scope, thus providing a spring to take the snatch off the boom in a seaway. Boatropes are rove through a boatrope block on the boom, the outboard end of each is fitted with a thimble eye and grommet strop. When unoccupied the end hangs a short distance above the water, being held in this position by a wooden toggle fitted in the boatrope abaft the boatrope block. The traditional method of securing a boat to a boom is to attach the boat's painter to the eye at the end of the lizard and the lazy painter to the Jacob's ladder. Heavy boats are secured to the wire strop at the end of the boatrope. Personnel using a boom must always wear DMS boots and a Hazardous Duty Lifejacket. A second person must always be in attendance as a safety number and during the hours of darkness lighting must be provided to ensure the boom and boat(s) are visible to all personnel involved.

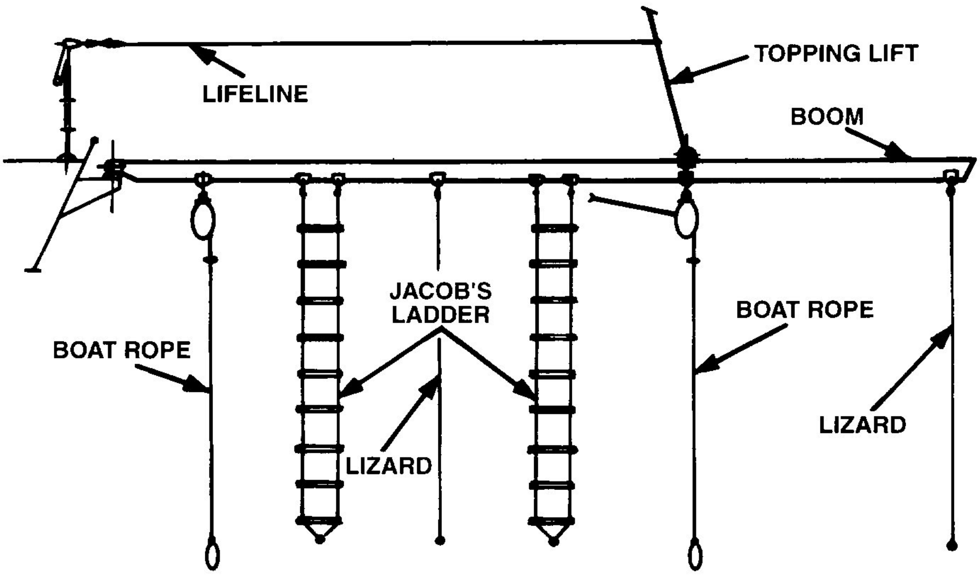


Fig 3-211. A Quarter Boom

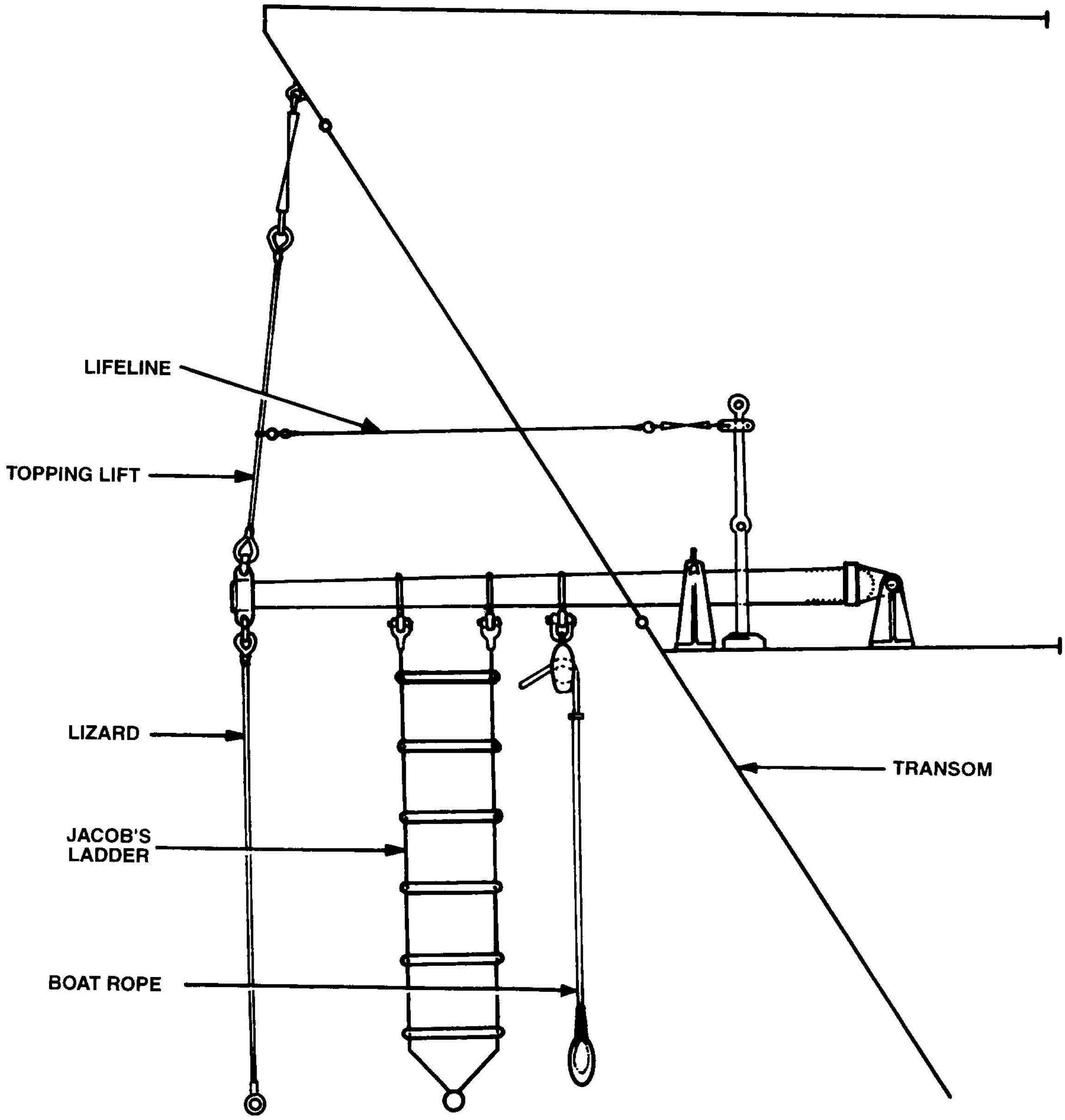


Fig 3-212. A Stern Boom

03067. Accommodation Ladder (Fig 3-213)

The standard accommodation ladder is made of aluminium; it has an upper and lower platform for ease of embarkation and disembarkation. The ladder hinges from the after end of the upper platform which in turn hinges on the main deck edge. The lower platform is bolted to the ladder and is supported by two stays fastened to the ladder. Both the lower platform and the ladder are braced from the ships side by **telescopic arms** which fit into sockets recessed into the ship's side. The lower platform has two positions to keep the platform at a convenient height above the water at deep and light conditions of the ship. The gangway **furniture** consists of wooden handrails, complete with electric-light fittings for illumination, which are supported by lightweight stanchions mounted on the ladder and platforms.

| On some ladders a wire or braidline guardrail is rove through the stanchions halfway between the wooden handrail and the ladder. For raising and lowering the ladder a purchase wire is rove from the bottom of the ladder through a lifting arm to a powered winch. A hand winch is also fitted in case of power failure. When in its lowered position the ladder may hang on the purchase wire, or, in certain ships, from a SWR pendant of a fixed length so that the purchase wire can be removed. When not in use the accommodation ladder is stowed in its outboard recess, and secured into its supporting stanchions after removal of the furniture, stanchions and lower platform.

a. **Gangway and Ladder Gear**

(1) The **gangway boatrope**, similar to that described for the boom boatrope except both end are finished with a whipping, can be of great assistance to a boat coming alongside in a rough sea or tideway, but it is useless unless led well for'ard so that it lies nearly in the fore-and-aft line of the boat when she is alongside.

(2) A length of smaller rope, known as a **strayline**, is spliced into the boatrope near the after end and belayed to a cleat abreast the upper platform, it is used for tricing up the boatrope when not in use. It is the duty of the gangway staff to lower the boatrope to each boat as she comes alongside, so that the bowman can belay it in the boat; the weight of the boat must be taken by the boatrope and not by the strayline. The coxswain of the boat can be assisted in positioning his boat alongside correctly, if the boatrope is marked at a point where the bowman belays it in the boat. When a ship is secured head and stern to buoys in a tideway, a second boatrope should be rigged abaft the ladder for the use of boats coming alongside bow to stern.

(3) **Check line** is a short length of cordage, spliced round one of the outboard stanchions of the lower platform of the accommodation ladder, and it is used by boats for checking their way and for keeping the stern in the proper position relative to the ladder. When a boat approaches, a member of the gangway staff should be at the bottom of the ladder to pass the check line to her; the line requires careful watching, because, if washed off the platform, it may foul the propeller of the boat. When not in use the line is cheesed down.

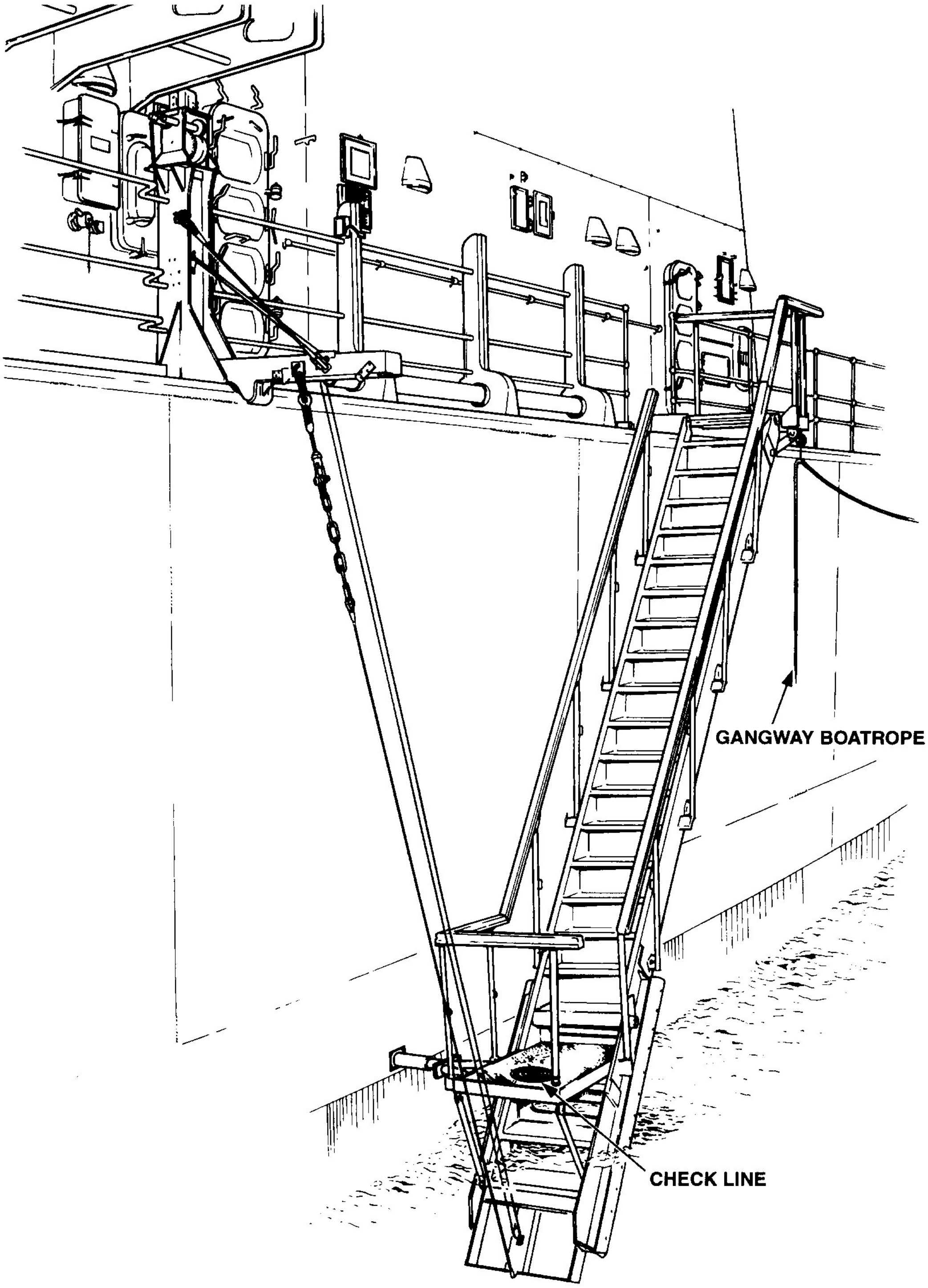


Fig 3-213. Accommodation Ladder

b. **Safety Measures**. When lying in a strong current or tidal stream it is necessary to prevent a boat that overshoots the gangway from being jammed by the current under the ladder, and if ships' boats only are concerned this can be done by rigging a simple **tide spar**. This spar is laid out from the outer stringer of the ladder to the ship's side and lashed in position, but it must not project outboard of the stringer.

If the ship is moored head and stern so that she cannot swing with the tide, a similar spar must be rigged abaft the ladder to protect boats coming alongside bow to stern when the ship is stern-on to the tidal stream. When heavy harbour craft are employed as tenders, a ship lying in the stream should secure **catamarans**, some 3.5 or 4.5m long, on either side of her accommodation ladder.

WARNING

AN ACCOMMODATION LADDER SHOULD NOT BE USED WHEN THERE IS A SEA OR SWELL HIGH ENOUGH TO RENDER BOATS LIABLE TO BE CAUGHT UNDERNEATH THE LOWER PLATFORM; A PILOT LADDER SHOULD BE USED INSTEAD.

03068. Mediterranean Ladder (Fig 3-214)

The Mediterranean ladder is a portable, rigid, vertical ladder usually provided in smaller ships for use on occasions when the accommodation ladder is not rigged; in many ships it is chiefly used for diving operations. The treads and side stringers are of aluminium channel bars with the latter reinforced at the lower end with Canadian elm and the ladder is braced off the ship's side by an aluminium holding-off bracket padded with Canadian elm. Tubular aluminum handrails are fitted to the top of the ladder and drop-nose pins passed through lugs on the ladder and deck secure the ladder inboard.

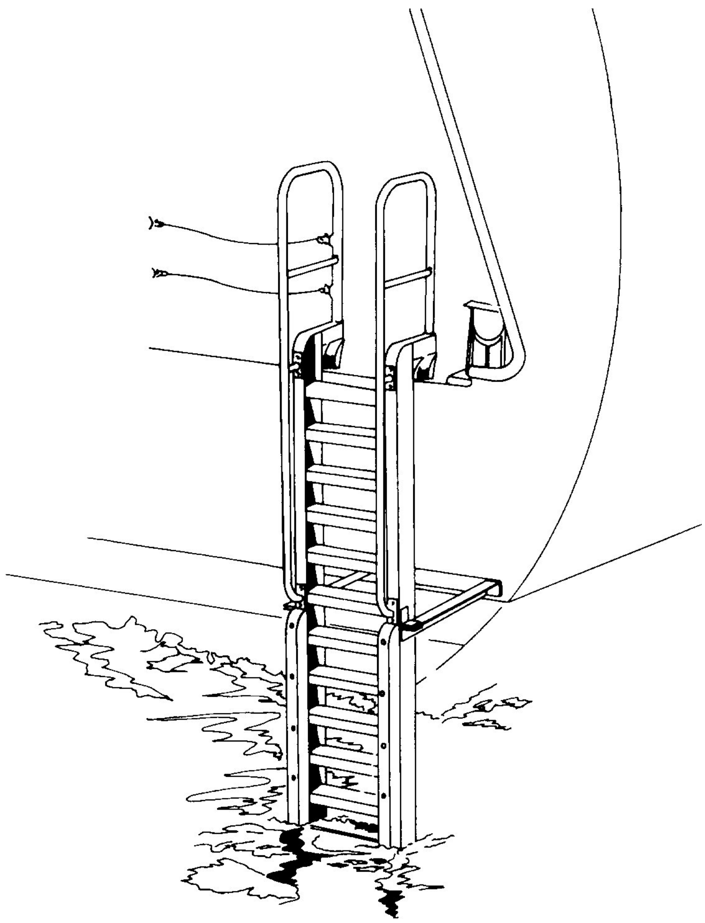


Fig 3-214. Mediterranean Ladder

03069. Pilot Ladder (Fig 3-215).

This is a portable 'roll-up' ladder that can be hung over the ship's side for embarking and disembarking boat passengers. Pilot ladders of the correct length for the class of ship are supplied by naval base Master Riggers. The ladder when rigged is to terminate 300mm above the surface of the water in calm conditions, when the ship is in its normal seagoing state; ie, fully stored, manned and upright. The pilot ladder is constructed of serrated, non-slip treads with side ropes threaded through their ends. The bottom four treads are made of moulded rubber and the remainder from hardwood; winnets are seized between the two parts of each side rope to keep the treads in position. 3m x 20mm polypropylene securing lanyards are spliced to thimble eyes at the inboard end of the ladder; where possible the ladder should be secured by shackling the thimble eyes direct to suitable strong points in the ship, but where this is not possible the lanyards must be used. To prevent the ladder twisting, 1.8m anti-twist spreaders with an integral serrated tread are fitted to the ladder at regular intervals, depending on the length of the ladder; details are given in Table 3-46.

Table 3-46. Position of Anti-twist Spreaders Fitted to Pilot Ladders

Total number of treads in ladder	Position of spreader
6-13	As the 5th tread
14	As the 5th and 12th tread
15	As the 5th and 13th tread
16-22	As the 5th and 14th tread
23	As the 5th, 14th and 21st tread
24	As the 5th, 14th and 22nd tread
25-30	As the 5th, 14th and 23rd tread

a. **Two 24mm staple spun polypropylene manropes must be provided**. These are to be rigged at all times when the ladder is in use. They must be securely hitched, above the middle knuckle of the hand-hold stanchions where possible, or to other suitably positioned fixtures, and should extend for the length of the ladder, terminating with a manrope knot in the end of the rope.

b. A swimmer of the watch marine rescue strop and recovery line, properly tended, must be available for use by transferring personnel who request them, or for use by all transferring personnel when deemed necessary by the OIC of the transfer point.

c. When underway and embarking or disembarking stores or personnel via the pilot ladder, a boatrope must be rigged and taken by the boat to hold the boat in position under the ladder.

d. Hook ropes, and a lifebuoy with man overboard marker are to be available. At night the ladder and reception area must be illuminated.

e. Unless the boat conducting the transfer is very small the ladder is to be lowered after the craft is alongside the ship; ladders are not to be lowered into boats. Fenders must be positioned either side of the ladder.

f. Only one person at a time is to be on the ladder.

g. In ships where an extra line is required for the recovery of the ladder, the line (Hook Rope) is to be passed down to the boat and attached to the bottom of the ladder. It is to be kept clear, by leading fwd or aft to prevent inadvertent hand hold use until completion of personnel transfer.

h. FF/DD are not to use the AX position for boat transfers other than in totally benign conditions and with the Commanding Officers approval.

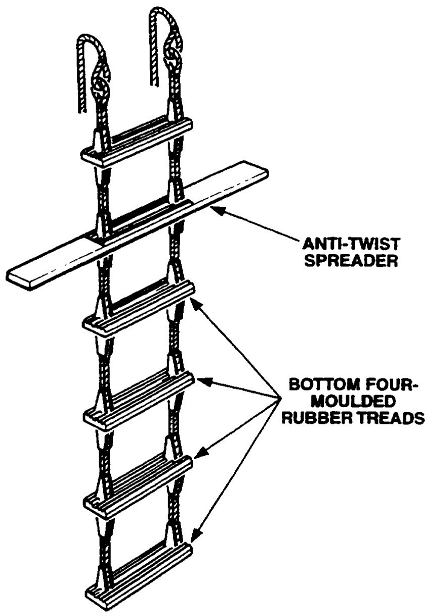


Fig 3-215. Pilot Ladder

03070. Brows

a. **Introduction**. The purpose of a brow is to provide a gangway between ship and shore or ship and ship. As a general rule, ship-to-shore brows are provided by the dockyard authorities and ship to ship brows are provided by the outer ship. To fulfil the latter requirement destroyers and below are supplied with a portable ship-to-ship lightweight brow of aluminium construction, Pattern number 0232/736-7283 (Fig 3-216). It is supplied as two identical 3m units that may be used singly or joined together to make one 6m brow; at some small commercial ports where no dockyard brow is available it may be necessary to rig the lightweight brow for ship to shore use. It is a simple task to remove guardwires, stanchions and stays when the brow has to be stowed.

Note. *Brow and guardwires must bear evidence of test.*

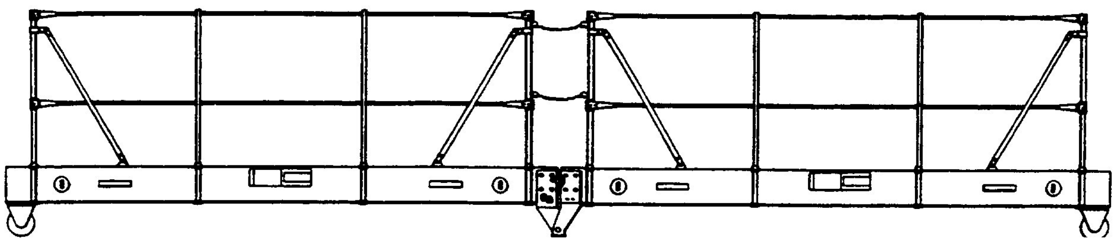


Fig 3-216. Ship to Ship Lightweight Brow

b. **Rigging a Brow and General Safety Measures**

(1) *General Principles*. When a dockyard supplied brow is put into a ship in a non-tidal basin it is the responsibility of the dockyard staff to secure the inboard end, whereas at tidal berths the dockyard staff are responsible for seeing that the inboard end is properly secured by ship's staff. Any gap between the break in the ship's guardrails and the brow must be securely roped off using12mm Polyester cordage. This roping must form an effective and safe barrier for personnel and is to extend from the stanchion at which the guardrails have been broken to an appropriate stanchion on the brow that is in line with, or **inboard** of, the fore-and-aft line of the ship's guardwires. On no account is the line of the roping to lead **outboard** of the fore-and-aft line of the ship's guardwires. The minimum height of the roping must not be less than 1.15m, and to achieve this it may sometimes be necessary to rig a temporary stanchion or extend an existing one by lashing to it a suitable length of 50mm x 50mm timber. The lanyards which secure the brow must be secured to eyeplates, bollards, or other permanent fittings, and never to stanchions. The approaches to the jetty end of the brow must be kept clear of obstacles, and at night brows must be well illuminated. The brow handling party must wear safety helmets and HDLJs.

(2) *Ships berthed Alongside Each Other*. When ships are berthed alongside each other it is the responsibility of the outer ship to supply a properly rigged brow, but it is the responsibility of **both** ships to ensure that their end of the brow is properly tended and secured, and that any gap between the ship's guardrails and the guardwires of the brow is securely roped off as described in (1) above.

(3) *Fendering*. A mat, fender or other suitable material should be used as a scotsman, and placed under the end of a brow which is in contact with the deck; if a brow is fitted with a roller, a sheet of metal should be placed over the area of movement, and a guard fitted or notice displayed warning people of the danger as the brow rolls with the movement of the ship.

(4) *Rigging a Brow Safety Net.* Two nets per ship are to be carried. Whenever a brow is rigged a brow safety net must be rigged beneath it. Each net must be secured by means of its fitted lanyards and positioned so that it is directly beneath the brow with the centre of the net lower than its edges. The net must extend from ship to ship or ship to dock wall and have sufficient spread on both sides to safely catch a person or object falling from the brow (see note 3). Where no suitable securing positions are available on the jetty a spreader bar of sufficient length is to be secured to or through the brow so that the net lanyards can be secured to it thus achieving the correct spread. A length of 100mm x 100mm timber or other suitable material is to be used as a spreader. The nets must be inspected before and after use, and at frequent intervals whilst they are rigged. They may need to be adjusted to allow for the rise and fall of tide. When longer than usual brows are put into a ship, for example if a ship docks down in a large dry dock, nets suitable for the task should be requested from the shoreside authorities. In such circumstances a ship's own brow safety nets may be securely lashed together and fitted beneath one of the brows.

Safety Notes:

1. When a ship is berthed close to a quay or jetty that has no catamarans the safety net must be rigged so that it affords protection from the area immediately below the brow position.

2. When a ship is berthed close to a quay or jetty that has no catamarans, and with a brow that is at a steep angle, the net must be positioned so that it affords protection for a person or object falling from the upper portion of the brow or the gangway area. This may involve reducing the size of the safety net by folding it over, or increasing the area of net by lashing two nets together and adding extra securing lines (12mm Polyester).

3. The height of the net must always be sufficient to ensure the safety of a person falling into it. If any doubt exists a functional test is to be carried out by pushing the Man Overboard dummy over the edge of the brow into the net and checking that the fall of the dummy is arrested before it comes into contact with the catamaran/jetty. This should not be considered as proof that the net is safe for all eventualities but will provide a means of establishing the likely distortions of the net downwards should a person fall into it. It may be necessary to repeat the tests for various states of the tide.

4. Once the safety net is securely rigged it, and any roped off sections, must be monitored and adjusted to take account of the range of tide.

5. In some specific circumstances (for example a ship alongside a jetty without catamarans and the brow almost horizontal) it may not be possible to rig a safety net that achieves any useful function. In such circumstances appropriate warning notices are to be placed at each end of the brow and firm control of personnel should be exercised in the gangway area.

6. No one, other than those responsible for placing it, is allowed to cross a brow until it is secured and the guardrails are set up.

7. A ship in dry dock presents a particular risk to personnel crossing a brow and for this reason added safety measures are necessary. The stanchions and guardchains that surround a dock must always be in position. If for any reason their removal is necessary, the gap must be patrolled by a sentry until they are replaced. ***At night these stanchions and chains must never be unshipped.***

8. When preparing to leave harbour ships are not to single up their own berthing lines until brow slings have been shackled to the brow, hooked to the crane, all slack taken up and brow securing lanyards have been singled up and are in hand.*

** Dockyard supplied berthing lines can be singled up/removed at any time at the discretion of the Captain in consultation with the relevant port authorities.*

03071. Scrambling Nets

Scrambling nets made of 16mm polypropylene cordage are provided for situations such as abandon ship when it is necessary to get large numbers of personnel safely into liferafts or the water without them having to jump. The nets may also be used by boarding parties when embarking or disembarking from a boat and are also available as an option for enabling survivors to board a ship, although it should be borne in mind that the effort of climbing a scrambling net is likely to be beyond the capabilities of personnel who have been in the water for any length of time, or who are suffering from shock or exposure. The nets are stowed along the ship's side at places where freeboard is lowest, but well clear of propellers. When unstopped they hang about 300mm clear of the ship's side with their lower edges at least one metre under the water when the ship is at light draught; the nets are spread on wooden battens fitted at 1m intervals and when the net is suspended over the ship's side the battens must be on the inboard side of the net, ie, between the net and the ship's side. The lower edges of the net are weighted with metal tubes or bars. In their stowed position the nets are protected from the elements and funnel gases etc by PVC covers; the covers have eyelets to allow drainage of water.

03072. Sounding

A measurement of the depth of water is called a **sounding**. On modern charts it ismeasured in metres or metres and decimetres; on older charts it may be measured in feet or fathoms, or a combination of both. A fathom measures 6 feet (1.8288 metres). Soundings are usually taken by echo sounder, or a **lead and line**, described below. However, the simplest method of taking a sounding in shallow water is with a pole, and for this reason boat-hook staves of ship's boats should be marked off in metres.

03073. Boats Lead and Line (Fig 3-217)

In less-shallow water, harbour craft and boats use a boat's lead and line for sounding. It consists of a weighted line marked at intervals along its length. The weight or **lead**, Pattern number 0262/463-7107 is of leg-of-mutton shape and weighs 3kgs and the **line** consists of 26m of 9mm pre-stretched polyester Pattern number 0350/120-8692. When soundings are taken due allowance must be made for the speed of the boat through the water. This is done by heaving the lead ahead of the boat and reading off the sounding when the line is vertically up and down with the lead on the bottom. The lead must also be heaved ahead when the boat is stationary but stemming a tidal stream and the sounding taken when the line is vertical.

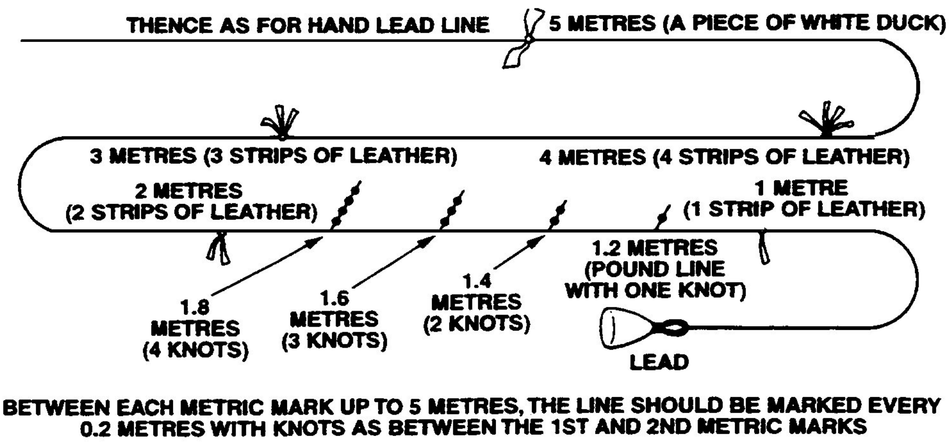


Fig 3-217 Boat's Lead and Line

03074. Hand Lead and Line (Fig 3-218)

a. **Introduction**. This is for emergency use in ships should the echo sounder fail; it can be used for sounding to a depth of 40m and at speed not exceeding 10 knots. An echo sounder can be checked by means of a hand lead line in harbour, if the bottom is firm and flat. The lead consists of a tapered bar of lead, Pattern number 0232/545-7948, weighing 6.3kgs, to which is bent a 50m length of 9mm pre-stretched polyester cordage, Pattern number 0350/120-8692. The base of the lead is hollowed out to receive tallow, and the head is shaped into an ‹eye' through which is rove a hide becket. The placing of tallow in the base of the lead is called **arming** it, and its purpose is to pick up a sample of the sea bed for examination if required. The lead line has a long eye splice at one end and a back splice at the other. It is bent to the lead by reeving the eye splice through the hide becket and passing the lead through the eye.

b. **Markings**. The hand lead line is marked as follows:

2m -	**two** strips of leather	13m -	a piece of **blue serge**
3m -	**three** strips of leather	15m -	a piece of **white duck**
5m -	a piece of **white duck**	17m -	a piece of **red bunting**
7m -	a piece of **red bunting**	20m -	**two** knots
10m -	a piece of **leather** with a **hole** in it	then repeat up to 40m.	

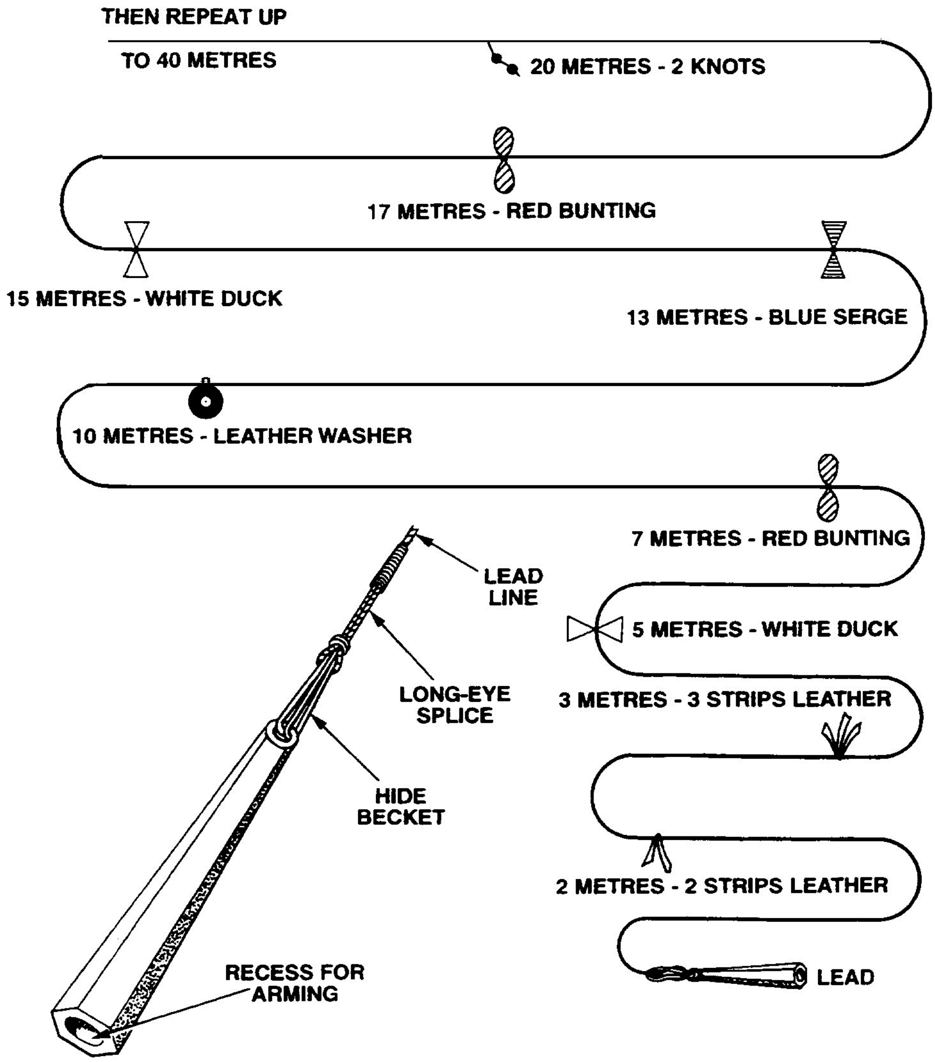


Fig 3-218. Hand Lead and Line

03075. Dress Ship

The flying of flags to celebrate an occasion or an event is one of the oldest customs. At one period our ships on occasions of celebration used to display flags and trophies captured from the enemy; nowadays full instructions in regard to dress ship are laid down in **BR 222(2)**, **Visual Signalling Equipment**. Flags and pennants of the signal codes, disposed in as variegated and symmetrical a manner as possible, are used. Except for the masthead ensigns, national flags and ensigns are not included, because the order in which they were flown might possibly give offence. **Dressing lines** consist of 10mm aramid rope lines to which the dressing flags are permanently bent; the lines are tailed with 12mm pre-stretched polyester downhauls used for hoisting them into position. The foremost line is called the **fore-down**, the amidships line is called the **fore-to-main**, and the after one the **main-down**; Fig 3-219 shows a typical example of a ship dressed overall. Ships with a single mast are fitted with a fore-down and a main-down only. Dressing lines must be rigged in accordance with ships ‹As fitted' drawings and there must be an organisation for manning the dressing lines and downhauls and for stationing men at positions where the dressing lines may snag in upperworks. This organisation must take account of radio precautions and the necessary Radhaz precautions must be observed. The communications department is responsible for rigging, unrigging, maintaining and stowing dress ship gear. However, the Chief Bosun's Mate usually assumes responsibility for arranging the test and survey of the equipment in accordance with the MMS.

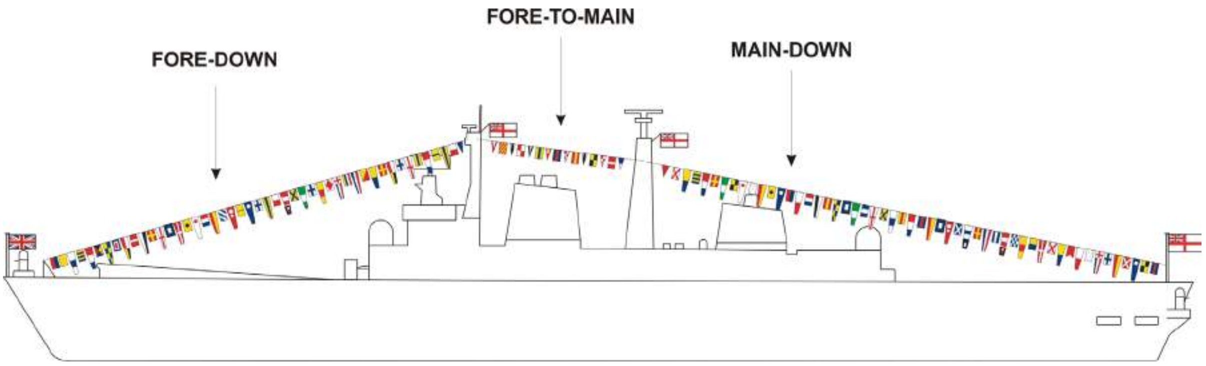


Fig 3-219. A Ship Dressed Overall

03076. Awnings

a. **Introduction**. Awnings are fitted over certain exposed decks to give protection from the sun. Side curtains and gable ends are provided to screen and shelter the areas below large awnings such as those fitted over foc'sles or flight decks. Awnings are supplied to HM ships in accordance with an ‹As fitted' drawing for the class or individual ship that shows the general arrangement of the awnings, rigging fittings and the stores required to complete the outfit; they are manufactured from flax canvas that has been chemically treated to increase its resistance to rot. Most modern ships are provided with one major awning under which a large number of people may be sheltered or entertained, and smaller awnings for suitable areas to protect the gangway staff. Certain older ships may, in addition, carry minor awnings for waists, bridge wings and other areas. Major awnings are supported by a central wire called the ‹ridge rope' or **backbone** and hauled out at the edges to awning stanchions by awning tackles and earrings; minor awnings are laced to a wire rope passing through the tops of the surrounding stanchions, called the **edge rope**. Technically a backbone is a ridge rope sewn into the awning, but this is now seldom found and the separated ridge rope will hereafter be referred to as the backbone.

b. **Major Awnings**. Foc'sle and flight deck awnings, classified as major awnings, are made of RN No. 2 canvas for large ships, and RN No. 4 canvas for Destroyers and Frigates. These awnings are supported by a backbone of canvassed SWR shackled to an eyeplate or special stanchion at the midship end and secured by bottle-screw and slip at the jackstaff or ensign staff. The edges are hauled out to awning stanchions and the edge rope. The description that follows is of a destroyer or frigate flight deck awning. (A foc'sle awning is in every way similar except the awning is shaped to fit, and is secured at, the after end and hauled out for'ard). The awning is made of cloth running athwartships. It has a wire boltrope, served with spunyarn and marled with polypropylene to its outboard edges; and a cordage boltrope at its forward end. A thimble is fitted to an eye worked into the boltrope at the after end, and a large cringle is worked into the cordage boltrope at the centre of the fore edge. Cringles are worked into the outboard edges abreast the stanchions, and holes with thimbles between the stanchions. The latter are used for sloping awnings, and at both positions the canvas is strengthened by patches. The centre-line is strengthened by a 600mm wide 'saddle-cloth' or 'middle-band' sewn under the awning to take the chafe of the backbone, and hide patches are sewn on where there is additional chafe from the screw slip, centre stanchions or structural corners. A curtain line of polypropylene line is attached at intervals on the topside of the awning, close to the outboard edges, to which the top of the side curtain is secured. Furling stops for securing the awning when it has been rolled before stowage, are sewn on top of the awning at alternate seams. Where an outboard edge is attached to the ship's structure running fore and aft, it is fitted with S-hooks moused into brass grommets with roping twine. Athwartship edges are always rope laced.

(1) *Securing the Awning*. The flight deck awning is cut to fit at selected points of its fore-end, and any stretch is allowed for by cutting the remainder slightly smaller than the area it is designed to cover. Therefore, whenever the awning is spread it must be secured first at its fitted end. The centre cringle of the fore end is secured by shackle to an eyeplate or special stanchion just above the securing point of the backbone. The other selected points are then secured. A pendant (earring) is shackled to the thimble eye in the wire boltrope at the after end; and a tackle, secured to the ensign staff above the backbone, hauls the awning aft. The sides are then hauled out by the awning tackles (Fig 3-220). Inboard edges are clipped by S-hooks or rope lacings to jack rods welded to the superstructure.

c. **Minor Awnings**. Waist and bridge wing awnings are classified as minor awnings. They have bolt ropes sewn round all edges on the underside to strengthen them and help to retain their shape. Brass grommets, through which the awning is laced to the edge rope, are inserted at regular intervals. Where an inboard edge abuts the ship's structure running fore and aft, S-hooks clip the awning to a jack rod or wire. Athwartship edges should always be rope laced. When an awning has to pass round obstructions, such as rigging, davits or fan trunking, a laced opening called a **shark's mouth** or a slotted approach to a hole called a **banjo** is made; if the obstruction is a ladder, portions of the awning are cut away and the edges roped. When one awning butts against another a canvas flap, called an **apron**, is sewn to one and laced across the gap to fill a narrow flap, called a **frog**, sewn on the other.

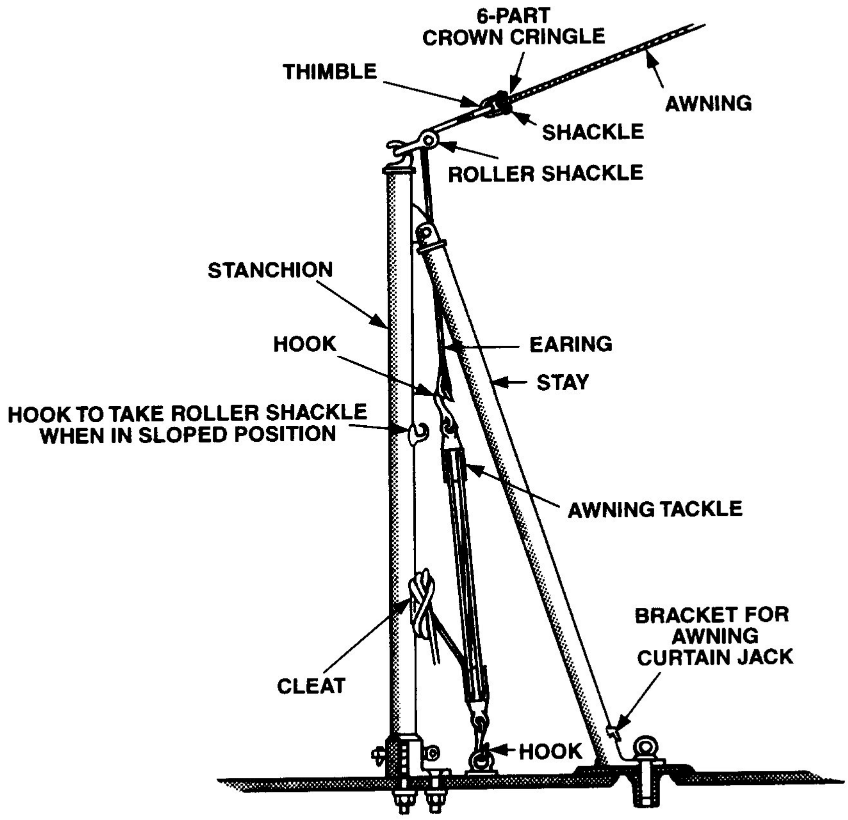


Fig 3-220 Awning Stanchion

d. **Awning Curtains and Gable Ends**. Awning curtains of RN No. 6 flax canvas are provided to screen and shelter major awnings. They are fitted with grommets for stopping the top to the curtain line, the bottom to screwed eyes in the deck or a fine wire tricing line secured to the foot of each stanchion and the sides for lacing to each other. The quarterdeck can also be screened by a gable end, of the same material as the curtains, running athwartships. It is stopped to a line sewn across the topside of the awning; the bottom is weighted, and one or two flap entrances are cut in it.

e. **Ceremonial Awnings**. Frigates and larger ships are supplied with a ceremonial awning and side curtains made from bunting of alternate coloured and white cloths: the colour may be red, blue or green. The awning is spread beneath the main awning on ceremonial and state occasions, cocktail parties, etc. The side curtains are hooked at the curtain line and laced at the bottom.

f. **Spreading Awnings**. Since the canvas of an awning is subject to stretching, care must be taken to preserve its shape when spread. A baggy, wrinkled or torn awning is usually the result of mistreatment. A minor awning such as a bridge wing or waist awning, should first be lashed by the earrings on its windward clews, and then unfurled to leeward and its leeward clews secured. The clew earrings can then be hauled taut and the sides hooked or laced to the edge ropes or awning rails. A major awning needs more care, and the method of spreading a flight deck awning is given here as a guide; but it is necessary to know how an awning is folded for stowage.

Before stowing an awning it is spread on the deck with its upper side down, and the two sides are then folded to the centre-line and squared off. The two doubled sides are then rolled towards one another to meet at the centre-line and the whole is then secured by the stops fitted along the top of the centre-line. The earrings and tackles are always detached and stowed separately, but the lacings of a small awning can be made up with it.

g. When spreading an awning in a cross wind it should always be passed over the backbone from the leeward to the windward side; if passed over from the windward side the pressure of the wind on its sloping surface up to the backbone will make it difficult to haul over. Before spreading a flight deck awning it is laid out along the deck with its stops uppermost. The stops are then cast off and each side is unrolled, and the boltrope on each side is then hauled clear to the leeward side of the deck. The leeward earrings are then secured to their cringles, which are rove slack through their roller shackles and belayed to their cleats. Then hauling-over lines are bent to the windward cringles and passed over the backbone to the other side, where they are manned. In a high wind the awning tackles on the windward side can be clapped on to the hauling-over lines and used to assist in hauling the awning over the backbone; these tackles are also useful for anchoring the weather edge to the far side and for holding it down while the earrings are being secured and rove. Similarly, the leeward awning tackles can be hooked direct to the lee cringles and set up to ensure that the wind does not blow under the lee side of the awning. It is usual to rig **tent lines** over the backbone, from the feet of the leeward awning stanchions, to support and guide the awning as it is hauled over. At the order ‹Haul over' the awning is hauled over the backbone to the other side and the fore end of the awning is secured to its fixed points. The earrings are then shackled on and rove, and the awning tackles are hooked on and manned. The after clew is hauled aft by its earring tackle, thus tautening the centre-line of the awning; then the side earrings are hauled out together, care being taken to keep the centre of the awning in line with the backbone. The tackles are then belayed to the cleats and the ends cheesed down at the feet of the stanchions.

h. **Care of Spread Awnings**. A new awning will stretch considerably athwartships but very little in a fore-and-aft direction, and this is allowed for when the awning is first cut to shape. If a good spread is finally to be obtained the stretching must be done gently and gradually. A new awning must therefore never be hauled out or kept too taut until it has been fully stretched, and this stretching must be done by hauling it out a little more each day. Canvas shrinks when wet, but it should regain its shape when dry if meanwhile it has not been overstretched. A fully stretched awning has little elasticity and may easily be ruined by overstretching when damp or wet. Earrings should be eased off in damp weather, and always at night on account of dew. Awnings should not be fully spread until they are dry.

(1) *Sloping Awnings*. When it is raining awnings should be sloped. This is done by shifting the roller shackle of alternate earrings to the lower hook (if fitted) and by unshackling the remaining cringles and hooking them directly to their awning tackles by which the awning is bowsed down. This should prevent pools of water from collecting on top of the awning and forcing it out of shape.

(2) *Frapping an Awning*. If caught unawares or short-handed by a sudden squall a major awning should be fully sloped and **frapping lines** rove. These lines, of strong cordage, are rove athwartships over the awning and belayed at each side on deck so that they help to keep the awning from billowing and slatting. To rig frapping lines overnight as a matter of routine is not advised because even in light winds their chafe will soon wear holes in the awning. They should be rigged only when a sudden blow is possible but it is better still to furl the awning overnight. If frapping lines are rigged, hauling-over lines should also be rigged, and tent lines, if used, should be rove and stopped to the heads of the awning stanchions and all gear should be prepared for furling.

i. **Furling Awnings**. Major Awnings, if well fitted, fairly flat and tautly spread, will stand up to winds of about force 5 Beaufort scale, but in stronger winds they are liable to slat badly and may then carry away. Minor flat awnings should stand up to winds of force 6 quite comfortably. All awnings should be furled well before the danger point is reached, and it is always best to furl them if in doubt rather than have them suddenly blown away. An awning is usually furled to windward and the procedure is the reverse of that by which it is spread. With a flight deck awning, tent lines and hauling-over lines are rigged, earrings are eased away squarely and evenly, and the earring tackle at the after end of the centre-line is eased off. The lee earrings are unrove and manned; the weather earrings are unrove and, if the wind is strong, the weather awning tackles are hooked into the weather cringles and belayed. The after clew is eased forward on its earring; the fore end of the awning is cast off and then, at the order ‹Haul over’, the lee side is hauled over the backbone. As the lee side is hauled over, the weather side is hauled across the deck to the lee side, so that the awning is eventually laid out underside uppermost and ready for making up. When furling an awning in a strong wind care must be taken that the wind does not get under the awning and blows it overboard. In a short-handed ship, when it comes on to blow hard the flight deck awning may be safely furled to leeward under frapping lines in the following manner. The awning is fully sloped, with the awning tackles secured to the cringles, and a large tackle is then shackled to the fore weather clew and belayed. The after clew is let go from its earring and gathered, and the awning is passed over progressively from aft for’ard, each part being gathered as it comes to hand. Eventually all hands are available to hold and gather the windward clew as it is eased over by its tackle.

j. **Maintenance of Awnings**. An awning - or, for that matter, any canvas gear -should never be stowed below wet, because it will not only rot but may easily catch fire from spontaneous combustion. A wet awning should be temporarily stowed in a sheltered place on deck until an opportunity occurs for drying it; the quickest way of drying it is to spread it in good weather. An awning should always be lifted and carried, never dragged along the decks and if it is necessary for it to be laid down on deck, it should be laid on battens or gratings in order to keep it clear of the deck and any dirt. As awnings are spoilt by frequent scrubbing, every care should be taken to keep them clean. Decks should be swept before spreading or furling awnings, and when made up they should be protected from dirt and damage. Bags or covers are provided for gable ends and ceremonial awnings, and they should be stowed in them when not in use. When stowing away equipment, awning tackles should be hung up, and earrings and backbones coiled up and tallied to assist in identification on the next occasion of their use.

Note. *Cleaning, repair or the manufacture of new awnings, upperdeck covers and ceremonial canvas work is to be assessed by the CBM and discussed with the area Surveyor of Stores who will produce a contract for any necessary work required.*

03077. Fendering

A ship going alongside another ship or a jetty requires a resilient fender to absorb any impact, but the fender must be sufficiently unyielding to provide protection and sufficient separation to allow for any overhanging structure, proud propellers, etc. For boats and other small craft whose sides are strong in comparison with the weight of the vessel, fendering presents no difficulties and any soft fender is adequate. For larger vessels fendering must be sufficiently robust to withstand the crushing of the weight of the ship, and it must be large enough and sufficiently resilient to spread and absorb the shock over a large area of comparatively weak hull plating. Fenders must be placed where the hull can best withstand the impact; to some extent this applies to all ships, but in modern warships they must be placed at specified positions where the hull is strengthened by additional stiffeners near the waterline; tally plates on the weatherdeck show the limit of the stiffening. The fenders described below are divided into three categories, those that are fixed to the structure or jetty of a pier, those that are mobile and provided in port (too heavy for ships) and those that are portable (carried in ships).

a. **Fixed Fendering**. The solid walls of berths and the piles of jetties have vertical baulks of timber attached to protect the masonry or concrete and to provide fendering to ships alongside. In some commercial ports no other form of fendering is provided, but the use of suspended rubber units is increasing. In a tideway, to lessen the impact when a ship is brought alongside, some springing device is included between the timber and the masonry.

b. **Port Fenders**.

(1) *Catamaran*. This is a stoutly constructed rectangular wooden or steel raft used in dockyards between ship and jetty. The bearing surfaces are usually fitted with rubber rubbing pieces.

(2) *Compression Catamaran* (Fig 3-221). Designed for use with light-hulled vessels, this catamaran consists of two rectangular tanks, of a length not less than three ship-frame spaces, separated by resilient units fitted vertically on chains. The bearing faces and corners are fitted with rubber rubbing pieces.

(3) *Large Pneumatic Fenders* (Fig 3-222). These are increasingly being used instead of catamarans for ships lying alongside a dock wall or other ships, although they are not suitable for use on piled jetties unless the area on which they will bear has first been sheeted over with steel plate or similar material to ensure the load is spread. The fenders are manufactured from textile reinforced rubber, and there are two types in use, the low pressure type with a diameter of 2.3m and a length of 12m, Pattern number 0232/605-6437, and the high pressure type, produced in various sizes, obtainable only by local purchase.

(4) *Pontoon*. This may be any floating structure used as a buoyant support. It may be used in salvage work to buoy up a damaged vessel, or it may be used to support a bridge across water. In tidal waters a pontoon is used as a landing place for boats and ferries on a muddy foreshore, or alongside piers and jetties where the range of tide is considerable; such pontoons are usually connected to the shore or jetty by a hinged bridge.

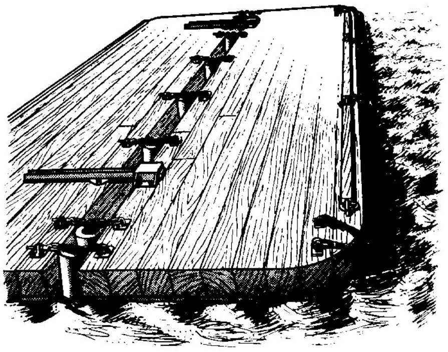


Fig 3-221. Port Fendering - Compression Catamaran

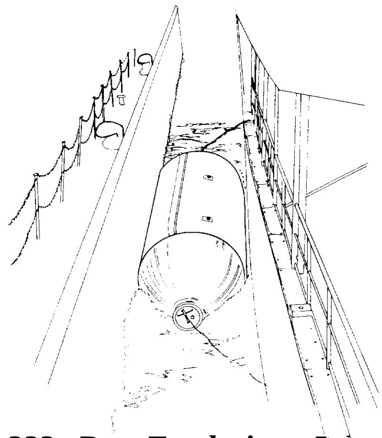


Fig 3-222. Port Fendering - Large Pneumatic Fender

c. **Portable Fenders**. Portable fendering currently in use in the Royal Navy is as follows:

(1) *Rattan Fenders* (Fig 3-223(i). Two sizes are available, 1.2 x 0.5m, Pattern number 0232/441-2933; and 0.6m x 0.3m, Pattern number 0232/470-5213.

(2) *Low Pressure Portable Pneumatic Fenders* (Fig 3-223(ii). Two sizes are available 0.96 x 2.2m, Pattern number 0232/923-3651; and 0.64m x 1.12m, Pattern number 0232/923-3652.

(3) *High Pressure Pneumatic Fenders.* These are gradually being introduced into service as replacements for the fenders described above. They are high energy absorbing, lightweight, non marking and durable, with an expected life of at least 10 years. They are grey in colour and are fitted with a towing eye at each end. Each 'ship outfit' of fenders comes complete with an operating manual and an inflation/repair kit. Supply details are given below, allowances are given on the following page.

Supply Details of High Pressure Pneumatic Fenders

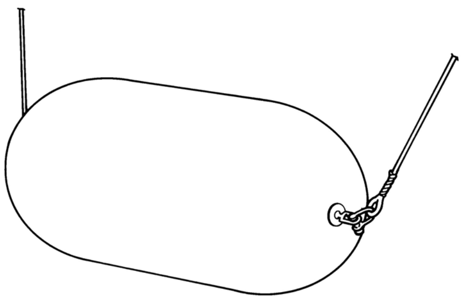
Stores No	Description	D of Q	Status
0232/535-3390	Fender pneumatic. Rubber HP. 0.5m dia x 1.0m long. Towing eye each end. Grey in colour	Each	P
0232/885-0321	Fender pneumatic. Rubber HP. 1m dia x 1.5m long. Towing eye each end. Grey in colour	Each	P
0232/623-9360	Yokohama Fender Repair Kit	Each	P

Allowances of High Pressure Pneumatic Fenders (Issue controlled by FOSF)

Class of Vessel	**Patt No of Fender 0232/885-0321**	**Patt No of Fender 0232/535-3390**
Capital Ships	6	8
Frigates and Destroyers	3	8
Minor War Vessels	2	6

Note. *Portable fenders are to be fitted with 16mm polypropylene lanyards of sufficient length to permit the fender to reach the waterline. Lanyards on rattan fenders are to be thoroughfooted to the eye at one of the fender, then passed through the body of the fender and out through the other end. Rigged and tended this way ensures the eye is not pulled from the fender when under stress.*

(i) **Rattan**



(ii) **Pneumatic**

Fig 3-223. Portable Fenders

(4) *Brambleleaf Fender*. This fender consists of a spar served with cordage and passed through a number of old motor tyres. A wire lanyard is shackled to each end so that the fender can be slung horizontally. It is a durable fender, but very heavy.

Note. *Old motor tyres, fuelling hoses, cordage and timber are all suitable materials for manufacturing 'home-made' fenders.*

03078. Berthing

At least 48 hours before a ship enters a harbour to berth she sends a signal to the relevant port authorities, detailing her logistic requirements; this includes any requirement for tugs and cranes, and the position that the brow(s) are required. If berthing in a foreign or commercial port details of the ship's length and draught are also included. In naval bases a common system of berth marking has been adopted for the guidance of ship's officers. The marks are tabulated below but it must be noted that the bow and stern marks are optional and that night marking is provided only if the lighting at the berth is insufficient for the day marking to be identified.

Berthing Marks at Naval Bases

	Bow	**Compass**	**Stern**
Day	Red Flag*	Green Flag	Blue Flag*
Night	Fixed Red Light*	Fixed Green Light	Fixed Blue Light*

* These marks are optional

a. **Briefing for Berthing Alongside**. Before a warship ship enters harbour to berth the Navigating Officer briefs key officers and senior rates on the berthing plan. At this briefing, in addition to shiphandling aspects of the evolution, it is established if a pilot is to be embarked, whether it is intended to use tugs to assist the berthing, which side to the ship will berth, and, if known, relevant details of the jetty, pier or wharf to which the ship is going, including the siting of bollards. The seaman department then prepares accordingly.

b. **Berthing Hawsers**. Fig 3-224 shows how berthing hawsers (often referred to as berthing lines or ropes) are used to secure a ship alongside a wall or jetty. At present berthing hawsers are of multi-plait polyolefin, multiplait Supermix and steel wire rope; details of the allowance of berthing hawsers are given in Table 3-47. The functions of the various berthing hawsers are as follows:

(1) *Breast Ropes*. It will be seen that the ship has two breast ropes, marked 2 and 5, which are known respectively as the fore and after breast rope. The breast ropes are used to breast the ship bodily towards the jetty when coming alongside, and when belayed they limit her distance from the jetty. They are also used to hold a small ship against a jetty when she is resting on the bottom.

(2) *Springs*. The hawsers marked 3 and 4 are known as springs - respectively the fore spring and the after spring. Any spring which prevents the ship from moving back (aft) is known as a **back spring**, and one that prevents a ship from moving forward (ahead) is known as a **head spring**. When a ship is secured alongside, the head and back springs prevent her from **surging** ahead or astern at her berth, and together they assist the breast ropes to keep her close alongside. For a large ship berthed near a busy fairway where she is more liable to surge, or for any ship berthed in heavy weather, the springs may be duplicated as shown in Fig 3-225. These springs are then named as follows:

1. Fore head spring
2. Fore back spring
3. After head spring
4. After back spring

***Note**. During manufacture MMFC berthing hawsers must be fitted with chafing pieces. The bollard eye in the end of each hawser is to have a 1.4m length fitted at the crown of the eye and a 1m length of hose to act as a sliding gaiter for positioning at the fairlead is to be on the bight at each end of the hawser.*

(3) *Head and Stern Ropes*. The hawsers marked 1 and 6 in Fig 3-224 are known respectively as the head rope and stern rope. They assist the springs in preventing the ship from surging, and they are also used to adjust the position of the ship along the jetty, especially when she is going alongside.

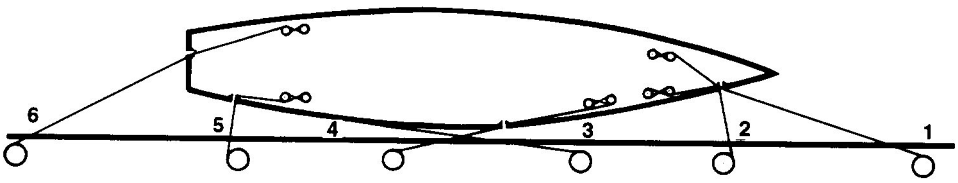


Fig 3-224. Berthing Hawsers

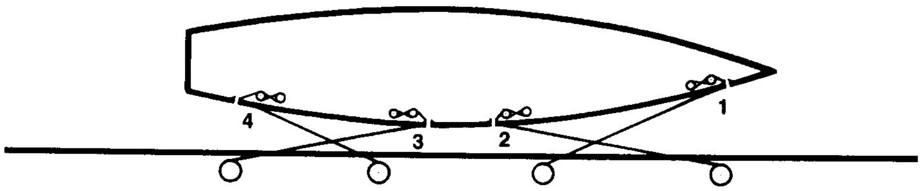


Fig 3-225. Springs

c. **Preparations for Berthing**. The following preparations must be made before a ship goes alongside:

(1) Fake out springs, breasts and head and stern ropes.

(2) Position fenders ready for use.

(3) Prepare the brow and its gangway position.

(4) Rig ensign staff and jackstaff. (Safety Helmets to be worn).

(5) Provide stoppers.

(6) Make up heaving lines for throwing.

(7) Provide bollard strop and slip (if required).

(8) Provide axe, maul and baulk of timber, for’d and aft.

(9) Prepare both anchors ready for letting go.

(10) Provide line recovery grapnels.

(11) Provide Handy Billy (for middling berthing lines).

(12) Provide Ratguards.

Figs 3-226 and 3-227 respectively show a foc'sle and quarterdeck prepared ready for berthing starboard side to. |

d. **Securing Alongside**. When a ship goes alongside, the berthing hawsers required for working the ship to her berth will normally be a head rope, a stern rope, one head spring and one back spring, and perhaps two breast ropes. The order in which they will go out depends upon the circumstances, but each berthing hawser required for working the ship should be ready faked for running. Its bollard eye is led out through the correct fairlead, then back inboard where it will be ready for a heaving line to be bent to it by the time the ship is within heaving distance of the jetty. If the capstans are going to be used, it will probably be for breasting the ship in with the breast ropes, or for adjusting her distance along the jetty with the head and stern ropes. When a ship is secured alongside in a tideway, particular attention must be paid to her berthing hawsers as she rises and falls with the tide, and, whenever possible, the hawsers should be so belayed that they can be tended without disturbing another. A berthing hawser may be **doubled up** by a second hawser between ship and shore; such hawsers are usually **singled up** as soon as the brow is removed when the ship is due to unberth. A berthing hawser may also be **rove doubled** when there is nobody on shore to cast it off when the ship unberths; both ends of the hawser are made fast inboard.

Note. *The following points are applicable when berthing:*

(1) The procedure for doubling-up the berthing lines is as follows: heave in the first line on the capstan, pass and turn up the second line, then transfer the first line from the capstan to the bollards. At no point should the ship be held only by a stopper.

(2) Chafing pieces must be correctly positioned at fairleads, bollards and bad nips.

(3) Ratguards must be positioned on all lines.

e. **Casting Off**. When a ship leaves a jetty the number of berthing hawsers required will depend upon circumstances, but normally the head and stern ropes and one head and one back spring should suffice. The head and stern ropes may have to be brought to the capstans and the springs may have to be surged. When a ship is being **warped** (moved along the jetty without her engines) by her berthing hawsers each hawser should be tended, and the hands tending them should back-up, surge, take down the slack, bring to the capstan, or belay them, as required.

Table 3-47. Outfits of Berthing Hawsers

Class of ship/submarine	Polyolefin or Supermix			Steel Wire Rope or HMPE			
	No	Length	Size	No	Length	Size	Const'n
		m	mm		m	mm	
CVS	4 4	175 110	64 64	6	110	28	HMPE
LPD	10	110	64	2	110	28	HMPE
LPH	10	110	64	2	110	28	HMPE
Type 42 Destroyer	4 2	73 110	44 44	2	*110	20	6x36
Type 23 Frigate	4 2	73 110	44 44	2	*110	20	6x36
Type 22 Frigate	4 2	110 73	44 44	2	*110	20	6x36
OPV Castle	2 2	110 74	44	2	*85	20	6x36
OPV (River Class)	6	160	32	2	160	2	HMPE
Roebuck	2 4	110 73	36 36	2	*110	20	6x36
MCMV Hunt	2 4	110 74	36 36				
SRMH Sandown	2 2 2	50 70 105	32 32 32				
SVHO	6	110	32	2	110	32	HMPE
Scott	10	110	64	2 2	110 80	24 24	6x36 6x36
Endurance	4 2 2	150 150 90	64 64 64				
Vanguard	6	120 (Super Line)	36				
Trafalgar	2 4	110 72	44 44				
Swiftsure	2 4	110 72	44 44				

***Note**. Multiplait High Modulus Polyethylene (HMPE) is to be used to replace steel wire rope springs when existing fit becomes unserviceable. 22mm HMPE is to be used in T22 & T23 frigates, T42 destroyers, OPVs and HMS Roebuck.*

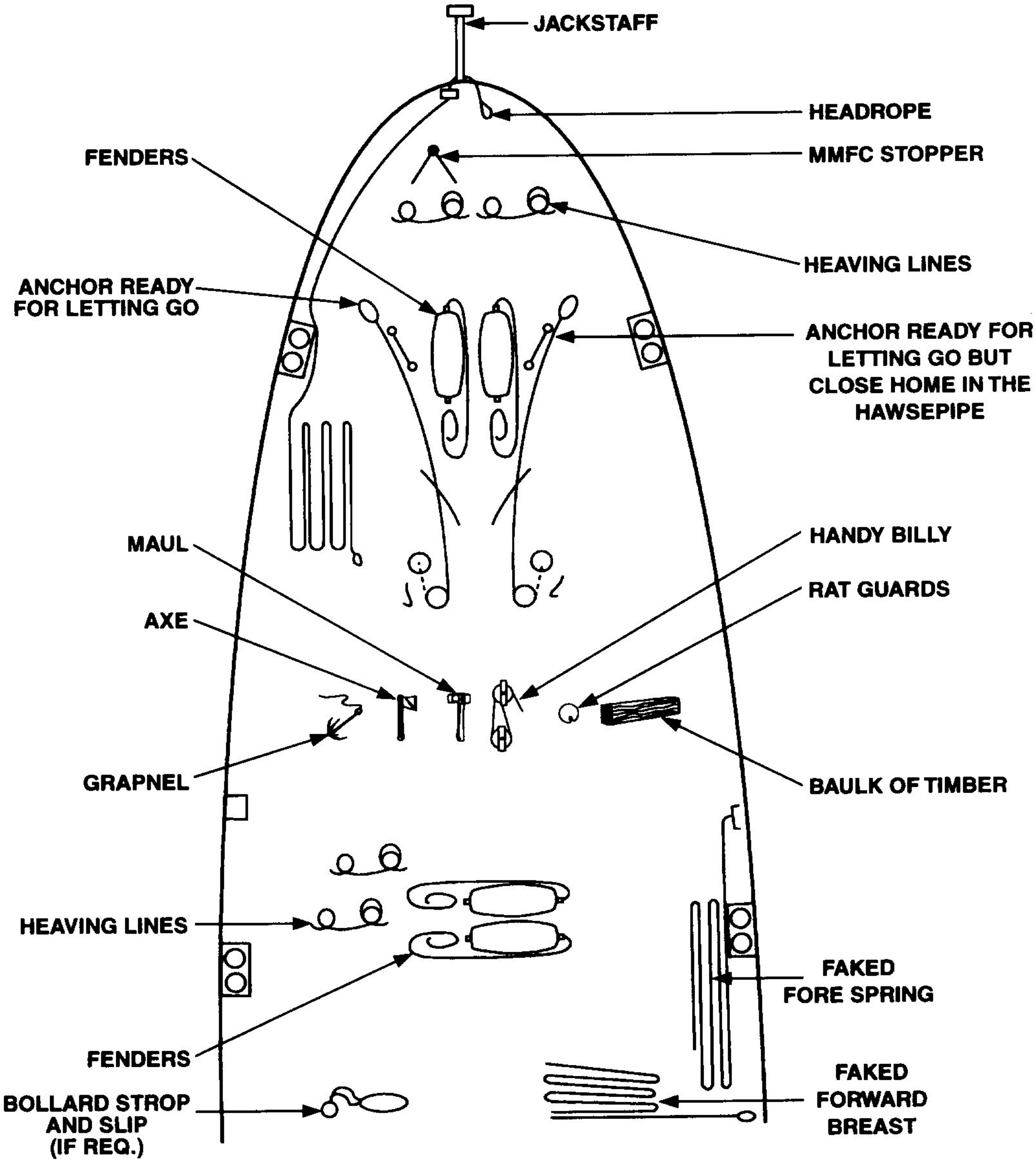


Fig 3-226. Foc'sle Prepared for Berthing Starboard Side To

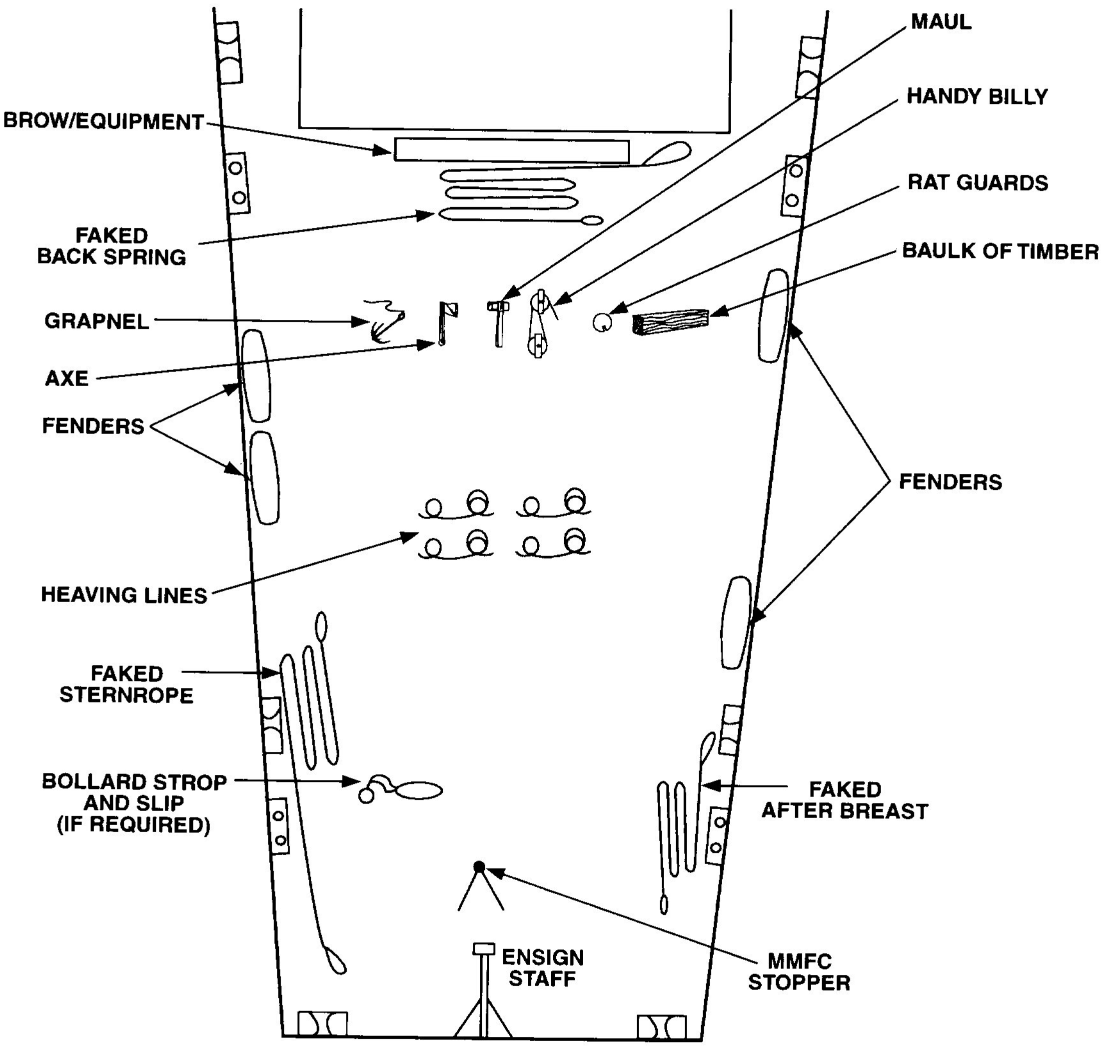


Fig 3-227. Quarterdeck/Top Prepared For Berthing Starboard Side To

f. **Off-Fast Moorings**. At certain exposed berths a ship can haul herself just clear of the berth by using special off-fast or hauling-off moorings laid for this purpose. Each mooring consists of an anchor, a length of chain and a wire which is normally secured to one of the jetty bollards. On taking up her berth, a ship takes the ends of the wires, brings them through her outboard fairlead, and adjusts the tension in them according to the weather. When properly adjusted, the risk of damage to a ship alongside is much reduced.

g. **On-Fast Moorings**. At certain exposed berths, usually where the shore bollards or dolphins may not be strong enough to hold a ship in high winds, on-fast or holding-on moorings are provided. Each mooring consists of an anchor, a length of chain and a wire which is normally secured to one of the bollards. On taking up her berth, a ship takes the ends of the wires, brings them (sometimes the chain as well) through her inboard fairleads and secures them.

h. **Precautions when Berthed**

(1) *Ratguards*. When a ship is berthed alongside and the Captain deems there is a risk of rat infestation, rat guards are to be clamped on each berthing hawser as soon as the ship is secured. Rat guards are circular metal discs about 600mm in diameter, and they prevent rats from climbing inboard along the berthing hawsers.

(2) *Propeller Boards*. These are boards on which is painted the word ‹Propeller’; they are displayed in ships whose propellers project outboard from the side of the hull. They are shipped in brackets, facing outboard at upperdeck level, over each propeller. They indicate to harbour craft the position of the propellers and they should be shipped whenever the ship docks or berths alongside, or whenever she is manoeuvred by tugs, or when other vessels are berthed alongside.

i. **Spring and Hurricane Hawsers**. These are heavy-duty berthing hawsers that are doubled-up with SWR springs to provide extra security when a ship is alongside a berth in heavy weather, or alongside a berth where factors such as passing traffic are likely to cause excessive movement of the ship. Spring and hurricane hawsers are of polyamide and steel wire rope construction and are made up in two ways, as shown in Fig 3-228. Ships of frigate size and above carry two spring hawsers but hurricane hawsers are held by dockyards only. Spring and hurricane hawsers must be rigged slightly tauter than the SWR springs they supplement so that they are the first to come under strain if the ship moves. The shortest wire tail of a spring hawser goes to the jetty and the long wire tail is turned up on bollards inboard. The shortest wire tail of a hurricane hawser goes to the ship and the long wire tail is turned up on bollards on the jetty.

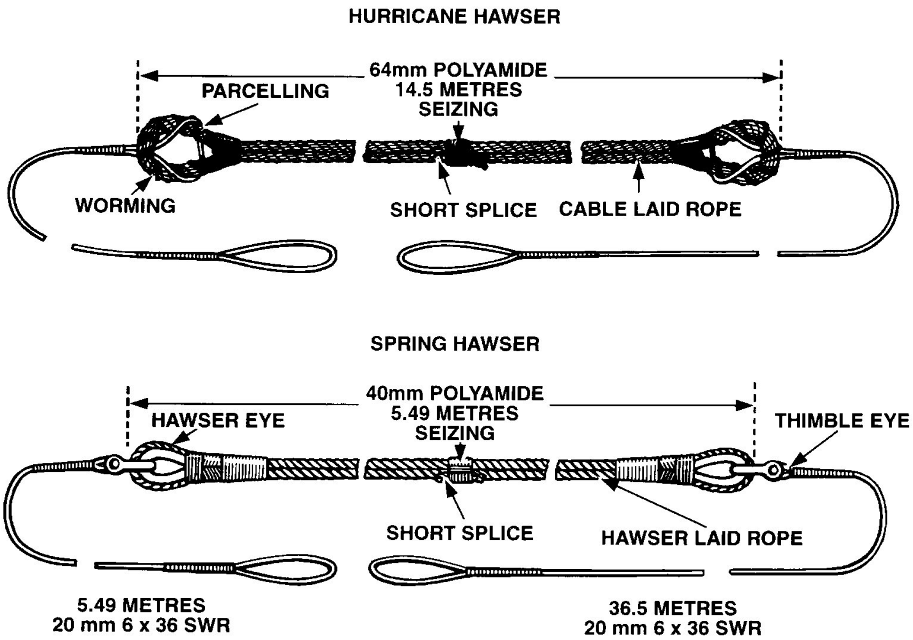


Fig 3-228. Hurricane and Spring Hawsers

| **03079. Ship Movement in Dockyards**

When ships are being moved by the Dockyard (ie, by tugs or wires, in the charge of a Pilot or Master Rigger) certain requirements must be met. These requirements are listed in **Fleet Operating Orders Volume (FLOOs) paragraph 2111.**

| **03080. Designated Tug Lines.**

| Berthing evolutions require a designated tug line, capable of being rigged easily whilst
| maintaining their optimum strength characteristics. The use of ship fit berthing hawsers has
| become unacceptable for the purpose. Therefore, to enable ships to pass standard made up ropes
| designated for the task, tug lines are to be used. If there exists a requirement to shorten the tug
| line to a short lead, then it is to be turned up round bollards and racked. It is imperative that the
| racking is applied before the weight is taken on the line to avoid the line surging, causing friction
| and ultimately parting. Tug lines are to be manufactured from 28mm HMPE Multiplait, NSN
| 0350/657-6679. 110m in length for Major Warships and 50m in length for Minor Warships.
| Each end is to be fitted with a Hawser soft eye with a leather chaffing piece incorporated

| **03081. Seamanship Stowages**

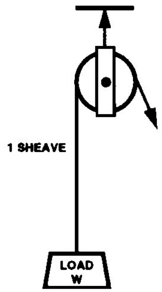
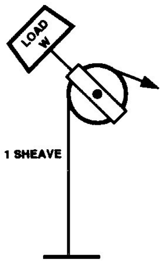
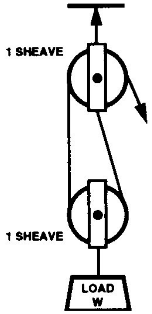
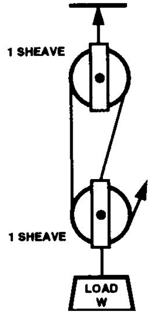
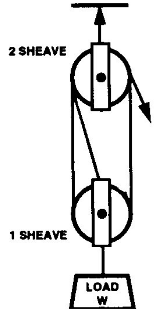
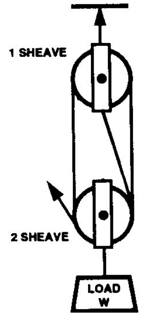
Stowages designated for seamanship equipment are usually only just large enough for their purpose and for this reason it is important that best use is made of the space available by ensuring gear is stowed neatly and logically. A contents board listing all the equipment within the stowage should be sited adjacent to the access of the compartment, and where necessary individual items of equipment should be tallied to aid identification.

a. **Control of Substances Hazardous to Health** (COSHH). **JSP 375, Control of Substances Hazardous to Health**, must be consulted and complied with regarding the stowage of substances that may be hazardous to health.

b. **Acoustic Hygiene**. Passive Sonar fitted in modern submarines is able to detect at great ranges noise generated within a ship or other submarines; the process of reducing noise to a minimum within a ship is known as acoustic hygiene. Regarding stowages it involves ensuring that all equipment is stowed securely, and, where necessary, lashed in position. Metal to metal contact should be avoided, and where this is not possible rubber matting should be used to deaden noise.

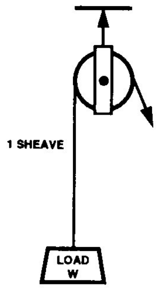
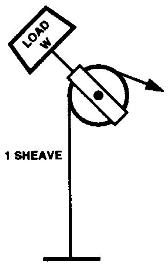
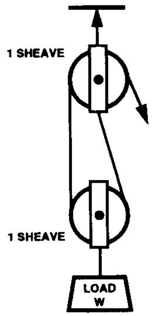
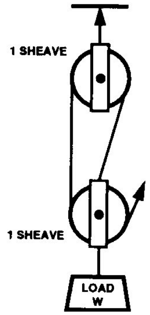
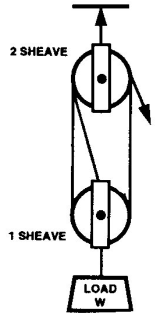
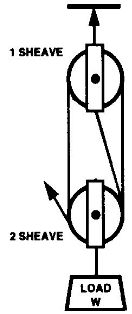
ANNEX A TO CHAPTER 3

SWL OF BLOCKS IN VARIOUS TACKLE CONFIGERATIONS

			MAXIMUM LOAD TO BE LIFTED (TONNES) (Assuming standing and moving blocks are of the same SWL, and fall is of the required strength)					
NATO STOCK No	SWL ON HEAD FITTING TONNES	PROOF LOAD TONNES	SINGLE WHIP 	RUNNER 	DOUBLE WHIP (D) 	DOUBLE WHIP (A) 	LUFF/ JIGGER/ HANDY BILLY (D) 	LUFF/ JIGGER/ HANDY BILLY (A) 
0246/521-2794	1.0	2.0	0.5	1.0				
521-2795	2.0	4.0	1.0	2.0				
190-6915	4.0	8.0	2.0	4.0				
521-0663	2.0	4.0	1.0	2.0				
521-0664	4.0	8.0	2.0	4.0				
521-0665	6.0	12.0	3.0	6.0				
463-3880	0.315	0.63	0.158	0.315				
0246/521-0660	2.0	4.0	1.0	2.0	1.33	2.0	1.5	2.0
521-0661	4.0	8.0	2.0	4.0	2.67	4.0	3.0	4.0
521-0662	6.0	12.0	3.0	6.0	4.0	6.0	4.5	6.0
463-3858	0.375	0.75	0.188	0.375	0.25	0.375	0.28	0.375
521-2797	1.0	2.0	0.5	1.0	0.67	1.0	0.75	1.0
521-2798	2.0	4.0	1.0	2.0	1.33	2.0	1.5	2.0
521-2799	4.0	8.0	2.0	4.0	2.67	4.0	3.0	4.0

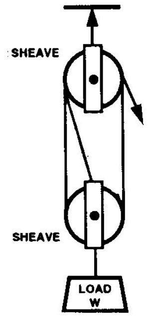
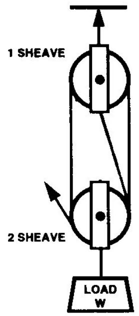
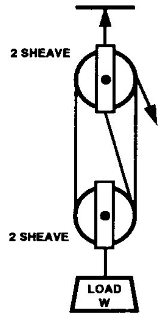
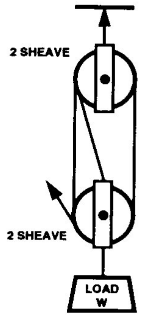
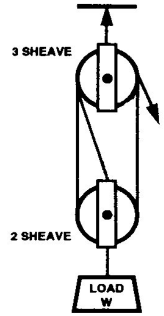
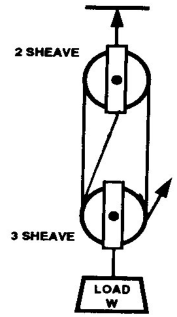
Key: (A) - Rigged to Advantage. (D) - Rigged to Disadvantage

SWL OF BLOCKS IN VARIOUS TACKLE CONFIGERATIONS (Cont.)

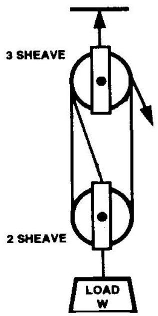
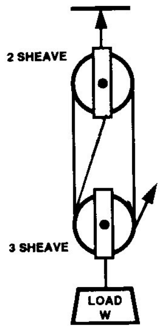
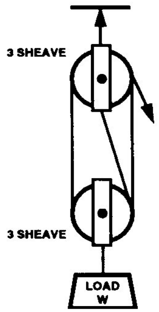
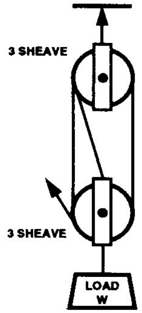
NATO STOCK No	SWL ON HEAD FITTING TONNES	PROOF LOAD TONNES	MAXIMUM LOAD TO BE LIFTED (TONNES) (Assuming standing and moving blocks are of the same SWL, and fall is of the required strength)					
			SINGLE WHIP	RUNNER	DOUBLE WHIP (D)	DOUBLE WHIP (A)	LUFF/ JIGGER/ HANDY BILLY (D)	LUFF/ JIGGER/ HANDY BILLY (A)
								
0246/411-9644	0.15	0.3	0.075	0.15	0.10	0.15		
463-3875	2.0	4.0	1.0	2.0	1.33	2.0	1.5	2.0
463-3882	0.5	1.0	0.25	0.5	0.33	0.5		
463-3883	0.5	1.0	0.25	0.5	0.33	0.5	0.375	0.5
463-3884	0.5	1.0	0.25	0.5	0.33	0.5		
463-3885	0.5	1.0	0.25	0.5	0.33	0.5		
463-3891	12.0	24.0	6.0	12.0	8.0	12.0	9.0	12.0
525-0092	0.169	0.337	0.169	0.085	0.113	0.169		
0579/539-4691	1.0	2.0	0.5	1.0				
539-4693	4.0	8.0	2.0	4.0				
539-4694	1.0	2.0	0.5	1.0	0.67	1.0		

Key: (A) - Rigged to Advantage. (D) - Rigged to Disadvantage

SWL OF BLOCKS IN VARIOUS TACKLE CONFIGERATIONS (Cont.)

			MAXIMUM LOAD TO BE LIFTED (TONNES) (Assuming standing and moving blocks are of the same SWL, and fall is of the required strength)					
			LUFF/ JIGGER/ HANDY BILLY (D)	LUFF/ JIGGER/ HANDY BILLY (A)	TWO-FOLD PURCHASE (D)	TWO-FOLD PURCHASE (A)	3 X 2 PURCHASE (D)	3 X 2 PURCHASE (A)
								
NATO STOCK No	SWL ON HEAD FITTING TONNES	PROOF LOAD TONNES						
0246/463-3860	0.65	1.3	0.488	0.65	0.52	0.65	0.54	0.65
463-3870	1.75	3.5	1.313	1.75	1.4	1.75	1.458	1.75
463-3876	0.5	1.0	0.375	0.5	0.4	0.5	0.417	0.5
463-3878	1.0	2.0	0.75	1.0	0.8	1.0		
463-3881	0.5	1.0	0.375	0.5	0.4	0.5		
0246/521-2791	1.0	2.0	0.75	1.0	0.8	1.0	0.83	1.0
521-2792	2.0	4.0	1.5	2.0	1.6	2.0	1.67	2.0
521-2793	4.0	8.0	3.0	4.0	3.2	4.0	3.33	4.0
441-9645	0.15	0.3	0.113	0.15	0.12	0.15		
525-0093	0.228	0.456	0.171	0.228	0.182	0.182		
0579/539-9821	1.0	2.0	0.75	1.0	0.8	1.0	0.83	1.0

Key: (A) - Rigged to Advantage. (D) - Rigged to Disadvantage

NATO STOCK No	SWL ON HEAD FITTING TONNES	PROOF LOAD TONNES	MAXIMUM LOAD TO BE LIFTED (TONNES) (Assuming standing and moving blocks are of the same SWL, and fall is of the required strength) 3 X 2 PURCHASE (D) 	3 X 2 PURCHASE (A) 	THREE-FOLD PURCHASE (D) 	THREE-FOLD PURCHASE (A) 		
0246/521-2725	1.0	2.0	0.83	1.0	0.86	1.0		
521-2726	2.0	4.0	1.67	2.0	1.71	2.0		
521-2727	4.0	8.0	3.33	4.0	3.43	4.0		
525-0094	0.342	0.684	0.285	0.342				

Key: (A) - Rigged to Advantage. (D) - Rigged to Disadvantage

ANNEX B TO CHAPTER 3

POLYESTER ROUNDSLINGS - PRODUCTION OF A LOG BOOK

a. Ships and units that hold polyester roundslings are required to produce a local log book that lists all roundslings and associated metal fittings carried, and provides a record of their control and issue; an ADSLING/ADLEE qualified person is to be nominated to produce and maintain the log. Depending on the size of ship it may be necessary to divide the control and issue of roundslings into departments, ie Seaman, WE and ME. In such cases a log book is to be produced for each department. Sample recording cards that can either be photocopied or used as a template to assist in making up the log are produced on the following pages.

b. All slings and sling assemblies must be inspected by the user before and after use.

c. All slings and associated equipment must be formally inspected annually in accordance with BR 3027 and the MMS.

D. Test certificates for all slings and associated equipment must be retained by the log holder, or as directed by the Commanding officer.

POLYESTER ROUNDSLING LOG - LIST OF ALL ROUNDSLINGS CARRIED

Unique ID No	Naval Stores No	Test Cert No	SWL	Length	Colour	Date Brought into Service	Stowage	Remarks

POLYESTER ROUNDSLING LOG - LIST OF ALL METAL COMPONENTS CARRIED

Unique ID No	Naval Stores No	Description	Test Cert No	SWL	Date Brought into Service	Stowage	Remarks

RECORD OF POLYESTER ROUNDSLING ASSEMBLY - ONE ITEM PER PAGE

Section 1 - The description and details of the assembly

Assembly Description	Safe Working Load (Tally Required)	Local ID Number (Tally Required)	Date of Assembly	Stowage	Signature of Competent Person

Section 2 - The description and details of all the components that make up the assembly

Sub-Component Description	Unique ID No	Remarks	Sub-Component Description	Unique ID No	Remarks

POLYESTER ROUNDSLING LOG - ISSUES AND RETURNS

Unique ID No	Description of Roundsling or Assembly	SWL	Issued To	Date	Date Returned	Remarks

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CHAPTER 4

TOWING

CONTENTS

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CHAPTER 4

TOWING AND TAKING IN TOW

04001. Introduction

Towing can be defined as either receiving motive assistance from, or rendering it to, another vessel; the assistance can be classed as **emergency**, when one ship takes another in tow on the high seas, using the gear available in both ships; or **planned**, when the towed ship is prepared for towing from one place to another. A warship should always be prepared to take another ship in tow at short notice or be taken in tow herself, from either for'ard or aft. All warships are equipped for towing or being taken in tow and this chapter describes the various arrangements and methods used within the Fleet (including submarine tows) for the preparation, passing and securing of towing gear, the means of communication between the towed and towing vessel, points on safety when working gear, the preparations required before a 'dumb' (unmanned) or 'live' (manned) vessel can be moved from one place to another, and hints and precautions when being moved by tug. The seaman should also be prepared to jury rig a tow if the types of ship involved, or the condition of the towed ship preclude the use of standard gear and procedures. Equipment, procedures and instructions relating to ship-to-ship towing between NATO units is covered in **ATP 43(B)/MTP 43(B) Ship To Ship Towing**. **BR 45 Admiralty Manual of Navigation Volume 6** addresses shiphandling aspects of towing and gives guidance on safe towing speeds. Information found in **BR 2000(91) Towing Equipment Manual** is in the process of being updated and transferred to **BR 367 Survey of Chain Cable and Associated Gear.**

04002. Towing Arrangements (Surface Warships)

The tow should be capable of being slipped at a moment's notice in an emergency, and provision is made for this in the towing ship by securing the towing hawser to a towing slip fitted either on the stern of the ship, or to a steel wire rope (SWR) towing pendant that is shackled to a special deck clench and belayed to bollards. (The latter arrangement is known as the bollard and clench method and is mainly confined to large warships, although certain minor war vessels have this configuration). With modern towing arrangements, chafing on bearing surfaces is virtually eliminated because the complete towing hawser is outboard where the towing slip is fitted to the stern, or, for the bollard and clench arrangement, a forged steel cable or steel wire rope chafing piece is incorporated where the tow passes through the towing fairlead. A polyamide towing hawser, in spite of its great elasticity and ability to absorb shock-loading, benefits from an additional spring to prevent overstretching; therefore one or two shackles of cable (depth of water permitting) should be included in the tow. A ship may be towed with a towing hawser led through a bower anchor hawsepipe, stem hawsepipe, foremost fairlead or bullring depending on its foc'sle arrangements. The preparations for towing or being taken in tow vary slightly with the type of ship and the layout of her quarterdeck, foc'sle and upperdeck. Examples of typical towing arrangements in warships are described later in this chapter. Royal Fleet Auxiliary vessels are provided with compatible equipment and fittings, and the same methods of towing and being towed are employed.

CAUTION

IT IS IMPORTANT WHEN TOWING THAT SHIP'S 'AS FITTED' DRAWINGS ARE FOLLOWED TO DETERMINE THE APPROVED LAYOUT OF TOWING GEAR. IF UNABLE TO COMPLY OTHER SUITABLE SITES MAY BE USED FOR THE LAYOUT OF THE GEAR ONLY, HOWEVER AN S2022 MUST BE RAISED. IF A SAFE RIG CANNOT BE ACHIEVED OPDEF ACTION IS TO BE TAKEN.

04003. Towing Equipment Used by HM Ships

a. **Towing Hawsers**. The towing hawser supplied to a surface warship for the purpose of emergency towing is of the multi-plait polyamide type, fitted at each end with a thimble that incorporates a special ovoid link, large enough in the clear to fit towing slips in Royal Navy and NATO warships. The size and length of towing hawsers are shown in Table 4-1. A towing hawser is designed principally to tow the ship to which it is provided.

b. **Towing Pendants**. Warships fitted with an outboard towing slip are provided with a multi-plait towing pendant of the same diameter as the towing hawser, each end of which is fitted with a link and thimble assembly identical to those of the towing hawser; this pendant is required when receiving a tow aft, as it enables the connection to be made on deck. Ships with the bollard and clench arrangement are supplied with a SWR towing pendant of comparable strength to the towing hawser, and a forged steel cable or SWR chafing piece incorporating a towing slip. The SWR towing pendant of the bollard and clench arrangement is used when receiving or providing a tow aft. Towing pendants vary in length to suit individual classes of warship and details can be found in ship's rigging warrants.

c. **Stress Line**. A polyamide towing hawser which is stretched to more than 25% of its original length may suffer a permanent loss of strength. To show when the limit is approaching, a warning indicator is provided by incorporating a **stress line** in each end of a towing hawser. The stress line is a loose bight of light rope spliced into the towing hawser in a position where it can be seen from the ship. As the tension in the hawser increases the slack in the stress line is taken up so that it becomes taut when the towing hawser's limit of stress is reached. The towing ship should act to reduce tension in the tow before the limit is reached, otherwise the towing hawser may be weakened. Stress lines are fitted to the following specifications:

(1) Cut 4.5m of 10mm polyethylene rope, Pattern No 0350/571-3171 for use as the stress line. Mark points 0.5m from each end and 3.5m apart.

(2) Select a length of the towing hawser which is well clear of the end fittings and which will be visible to the towing ship when in use. Mark the points of attachment 2.8m apart somewhere on this length.

(3) Pass the ends of the stress line around a pair of strands of the towing hawser at each of the marked points and complete by splicing it in with 5 tucks and dogging the ends. This will leave a 3.5m bight with the ends secured 2.8m apart on the towing hawser.

Note. *A stress line is also required in polyamide towing pendants as the length of these pendants may prevent the easy sighting of the towing hawser's stress line.*

d. **Towing Messengers.** To enable the towing hawser to be passed from one vessel to another, two polypropylene messengers are provided, one of 24mm and one of 12mm diameter. The smaller and lighter messenger is attached to the 24mm version when passing the tow by helicopter, or when circumstances make the extra length desirable. A non-rotating Inglefield clip is fitted to the outboard end of the 24mm messenger and to both ends of the 12mm messenger, and to simplify procedures the 24mm messenger is two parted; the short, inboard part being 5m in length; thimble eyes are fitted to allow the two parts to be shackled together. When the tow has been passed and the towing hawser connected the two parts of the messenger are unshackled, leaving the short part secured to the towing hawser. The two parts are shackled together when the tow is completed and the gear is to be returned. Lengths and allowances of towing messengers are given in Table 4-2.

e. **Easing Out/Recovery Rope.** The easing out/recovery rope is made up of 24mm polyamide and is of suitable length to reach from the bollards on which it is turned up to a point just outboard of the towing fairlead or hawsepipe. Its function is two-fold; firstly it enables the last fake of the towing hawser to be eased out under control when passing the tow, and secondly it acts as a recovery rope to haul on deck sufficient towing hawser for it to be manhandled. For safety reasons it is prudent to use a two parted easing out/recovery rope that allows the two parts to be unshackled at a convenient point, thus avoiding the danger of cordage running away out of control on deck should the tow be carried away. The two parts of the rope are made up in the following manner; the short part is fitted with a thimble eye at each end and is of sufficient length to reach, when the tow is rigged, from the inboard end of the towing hawser to the recovery position, with enough slack for ease of handling and for stopping it to a convenient guardrail stanchion; the longer part is fitted with a thimble eye at one end and a whipping at the other, and is of sufficient length to manhandle at the easing out/recovery position. Lengths and allowances of easing out/recovery ropes are given in Table 4-3.

Note. *If an easing out/recovery rope is not two-parted and cannot be unshackled then it must be coiled up and stopped outboard of the guardrails.*

Table 4-1. Polyamide Multi-plait Towing Hawsers supplied to RN Ships

Class of ship	No	Size	Length
CVS	1	80mm	220m
LPD	1	80mm	220m
LPH	1	80mm	220m
Type 42	1	64mm	202m
Type 23	1	64mm	202m
Type 22	1	48mm	220m
SVHO	1	56mm	20m
	2	24mm	85m
Scott	1	80mm	215
Endurance	1	64mm	202m
River Class OPV	1	48mm	220m
Castle class OPV	1	48mm	220m
Hunt class	1	48mm	105m
Sandown class	1	40mm	105m
Roebuck	1	48mm	220m

Table 4-2. Staple Polypropylene Towing Messengers Supplied to RN Ships

Class of ship	No	Length	Diameter
Frigates and above	1	220m	24mm
	1	220m	12mm
All other classes	1	110m	24mm
	1	110m	12mm

Table 4-3. Polyamide Easing Out/Recovery Ropes supplied to RN Ships

Class of ship	No	Length	Diameter
Frigates and above	1	To suit	24mm
All other classes	1	To suit	24mm

f. **Towing Slips**. During towing operations the tow should be capable of being slipped at a moments notice in an emergency. Provision is made for this in the towing ship by securing the towing hawser to a towing slip. The two types of towing slip used in the Fleet are illustrated in Fig 4-1. Details of slip sizes for individual ships are shown in ‘As fitted’ drawings and ships’ Rigging Warrants.

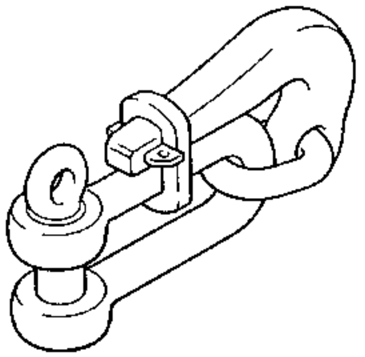
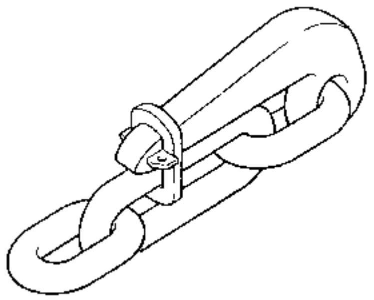
 **Transom fitted towing slip (also used with bollard strop)**	Fitted to certain warships as an outboard towing slip, and used by all warships, in conjunction with a bollard strop, for harbour movements that involve the use of tugs. There are 3 sizes, details as follows: 0263/523-8137 (24mm) 8138 (32mm) 8139 (42mm)
 **Bollard and clench towing slip**	Supplied for ‘bollard and clench’ towing. There are nine sizes, details as follows: 0263/523-8143 22mm 8144 28mm 8145 32mm 8147 35mm 8149 38mm 8152 48mm 8154 52mm 8158 60mm 8160 70mm

Fig 4-1. Towing Slips Used in the Fleet.

g. **Towing Shackle**. A towing shackle is a specially long lugged shackle. It is used in bollard and clench towing systems where it is shackled to the chafing piece and takes the tongue of the towing slip. It may also be used to connect the towing hawser to the towing pendant/chafing piece when the towed ship supplies the tow, or the cable to the tow via an adapter piece when the towing ship supplies the tow.

h. **Smit Bracket.** The Smit Bracket is fitted to the SVHO class of ship for securing the tow rope. It is used instead of the normal towing slip and deck clench arrangement.

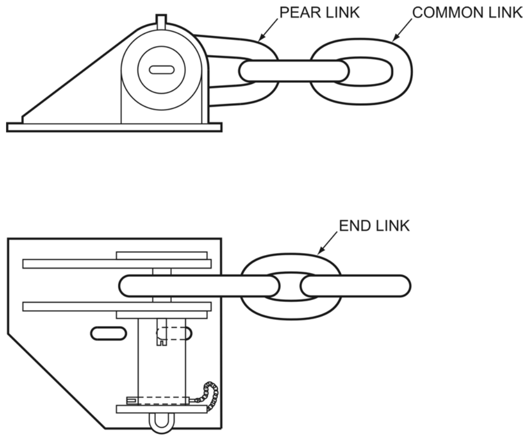


Fig 4-1a. Smit Bracket

i. **Strongback**. During preparations to supply a tow the fakes of the towing hawser are stopped to a strongback (which may be a baulk of timber or a wire jackstay) by cordage stops which should be strong enough to arrest temporarily the towing hawser should the hawser run out too fast. The stops are cut in the normal course of events as the tow is passed.

j. **Check Stopper**. A 24mm natural fibre cordage check stopper, fitted with a thimble eye one end, is provided during preparations to supply a tow. It is rigged as shown in Figs 3-54 and 4-3 and used to assist in controlling the speed at which the tow is run out.

04004. Tow For'ard Preparations

a. **Providing the Tow - All Ships** (Fig 4-2). The warship to be towed should normally provide the towing hawser and messenger, but the towing ship should always be ready to provide them. Break the selected cable abaft the swivel piece and put the Blake slip on the cable as a preventer, to stop the cable from dropping off the cable holder snugs and running back down the navel pipe. Fake down the towing hawser on the foc'sle and connect one end to the end of the broken cable by a lugged anchor shackle and adaptor piece. Lead the other end of the towing hawser for'ard to a point adjacent to the centreline hawsepipe or bullring and bend the 24mm messenger to it with a rolling hitch (see inset Fig 4-2). It is important that the ovoid link at the end of the towing hawser is properly and firmly stopped to the end of the messenger; if this is not done the towing ship will have difficulty in receiving the tow when the ovoid link passes through her towing fairlead. Stop the fakes of the towing hawser to a strongback and shackle a check stopper to a convenient eyeplate adjacent to the centreline hawsepipe. Fake down the messenger on the foc'sle, one end having been bent to the towing hawser as described above, pass the other end down through the centreline hawsepipe and bring it to a position on the foc'sle where a gunline can be bent to it in due course. Rig the easing out/recovery rope with a large bow shackle (or split roller shackle Pattern No 0573/525-6391) passed over the last bight of the towing hawser to be passed out.

b. **Receiving the Tow - All Ships**. Break the cable to which the tow is to be connected abaft the swivel piece, and put the Blake slip on the cable as a preventer. Shackle an adaptor piece to the end of the cable and provide a lugged anchor shackle or a towing shackle ready to connect the towing hawser to the adaptor piece.

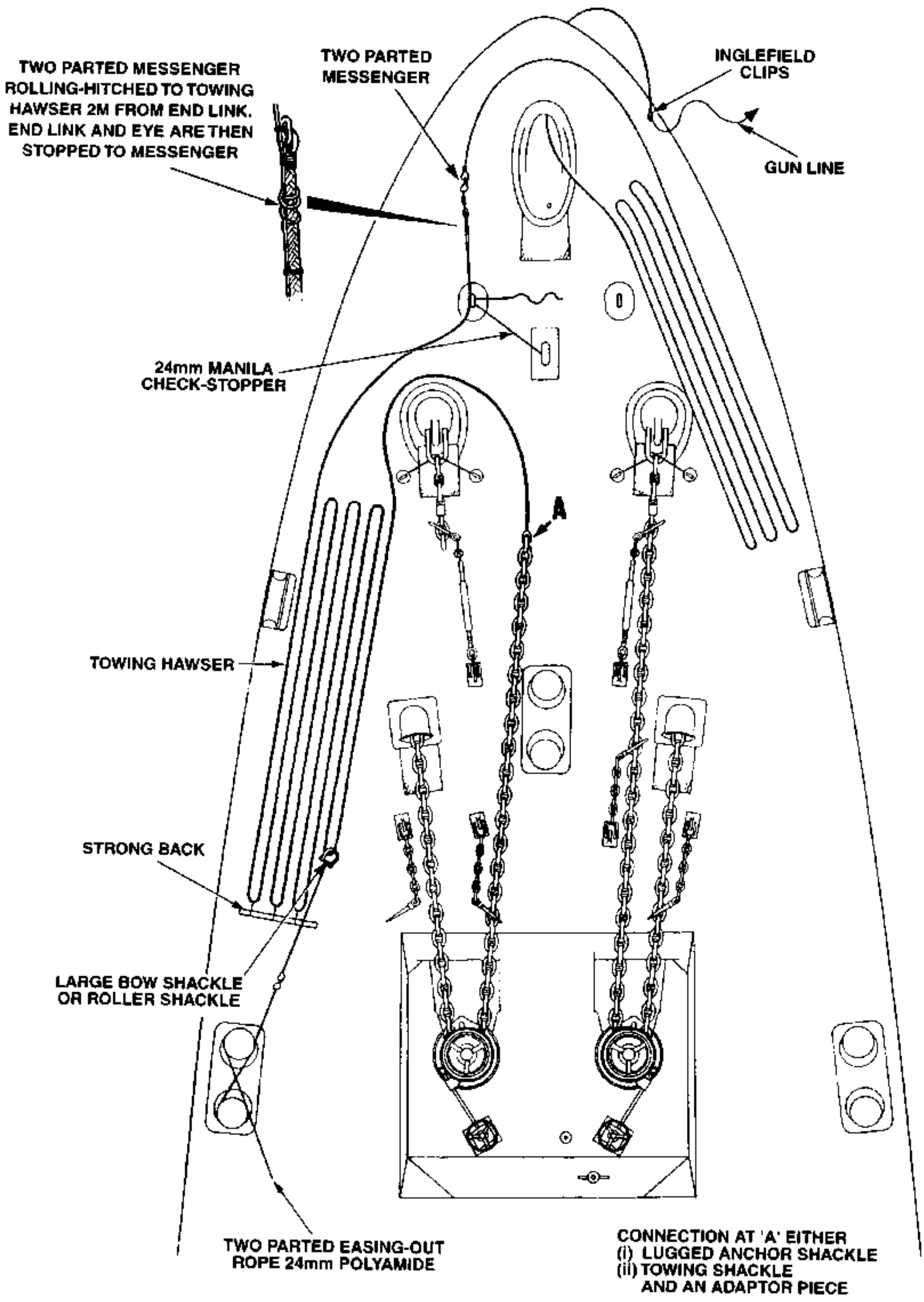


Fig 4-2. Tow For'ard - Preparations in a Warship Providing the Tow

04005. Tow Aft Preparations

a. **Providing the Tow - Ships Fitted with the Towing Slip Outboard**. The preparations for towing and providing the gear for ships fitted with an outboard towing slip are illustrated in Fig 4-3. Fake down the towing hawser on the more convenient side of the quarterdeck or flight deck to ensure a fair lead for the hawser. Pass one end of the hawser through the towing fairlead and secure it to the towing slip, and mouse the pin. Lead the other end of the hawser to a point adjacent to the towing fairlead and bend the 24mm messenger to it with a rolling hitch. It is important that the ovoid link is firmly stopped to the messenger. Fake down the messenger in a manner similar to that for towing for'ard. Rig the easing out/recovery rope with a large bow shackle (or split roller shackle Pattern No 0573/525/6391) passed over the last bight of the towing hawser to be passed. **Before** the tow is passed, ensure that the bow shackle/roller shackle will pass through the towing fairlead. Stop the fakes of the towing hawser to a strongback and shackle a check stopper to a convenient eyeplate adjacent to the towing fairlead.

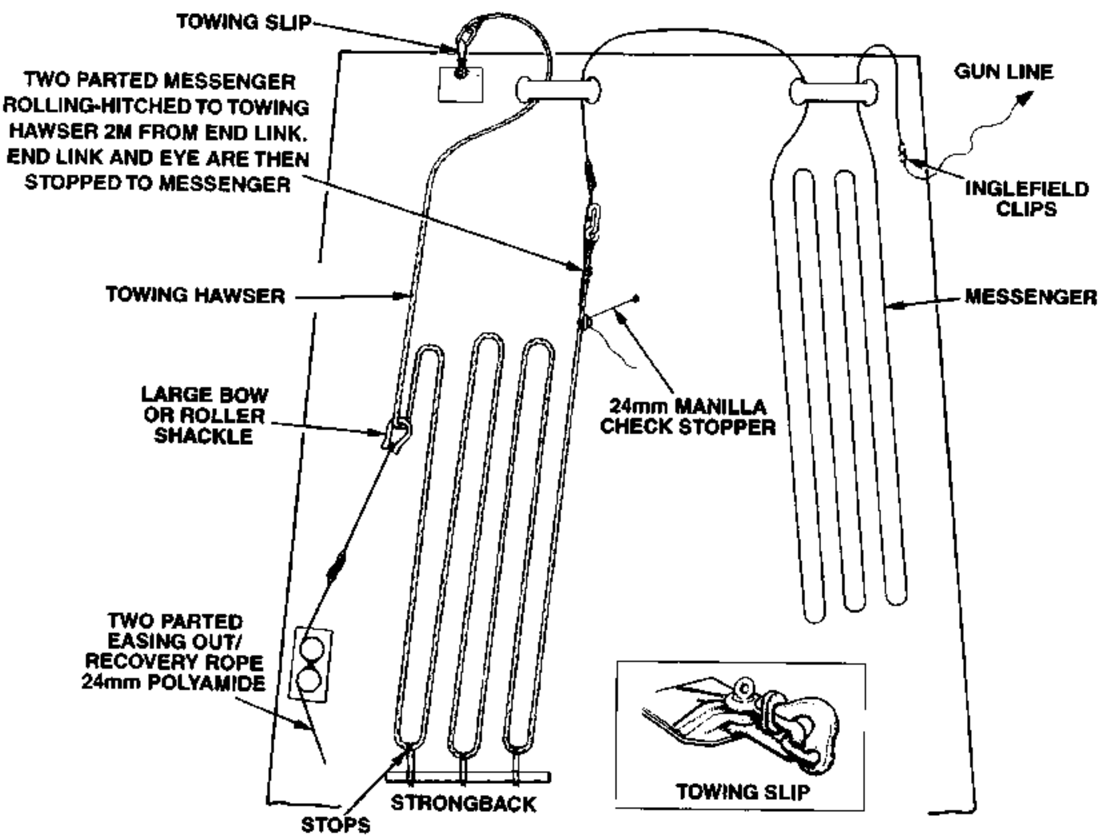


Fig 4-3. Tow Aft - Providing the Tow - Ships fitted with Outboard Towing Slip

b. **Providing the Tow - Ships fitted with the Bollard and Clench Towing System.** The preparations in a warship that tows by the bollard and clench method are illustrated in Fig 4-4. Fake down the towing hawser and messenger, and rig the strongback, easing out/recovery rope and check stopper as described for ships fitted with an outboard towing slip. Belay the SWR towing pendant to the bollards as shown in the inset of Fig 4-4, then shackle one end of the pendant to the deck clench, and the other end to the towing slip, using a lugged joining shackle for both tasks. Shackle the inboard end of the towing hawser to one end of the chafing piece using a lugged joining shackle or anchor shackle, and attach a towing shackle to the other end of the chafing piece. Now connect the towing slip to the towing shackle.

Note. *The precise configuration and detail of ironwork from deck clench to towing hawser varies by class of ship. Ship's drawings must be checked to ascertain precise arrangements for individual ships.*

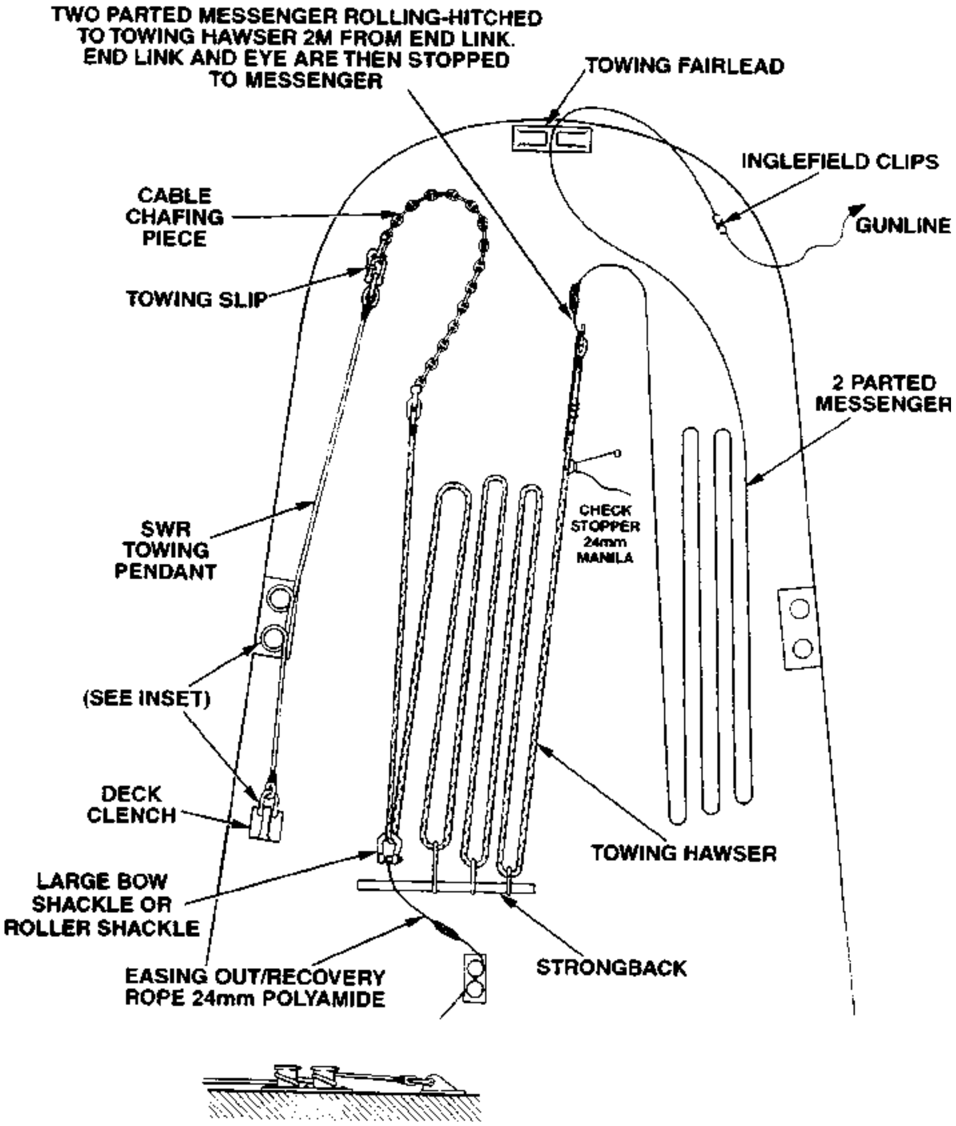


Fig 4-4. Tow Aft - Providing the Tow - Ships fitted for Bollard and Clench Towing Slip

c. **Receiving the Tow - Ships fitted with an Outboard Towing Slip**. Fig 4-5 shows the towing pendant rigged in a ship fitted with an outboard towing slip. Its purpose is to enable the towing hawser from the providing ship to be connected up safely on deck. An anchor shackle or towing shackle should be provided to connect the towing pendant to the towing hawser and the easing out/recovery rope must be rigged over the towing pendant.

d. **Receiving the Tow - Ships fitted for Bollard and Clench Towing.** The SWR towing pendant, towing slip and chafing piece are rigged as described for providing the tow. An anchor shackle or towing shackle should be provided to connect the chafing piece to the towing hawser and the easing out/recovery rope must be ready to hand.

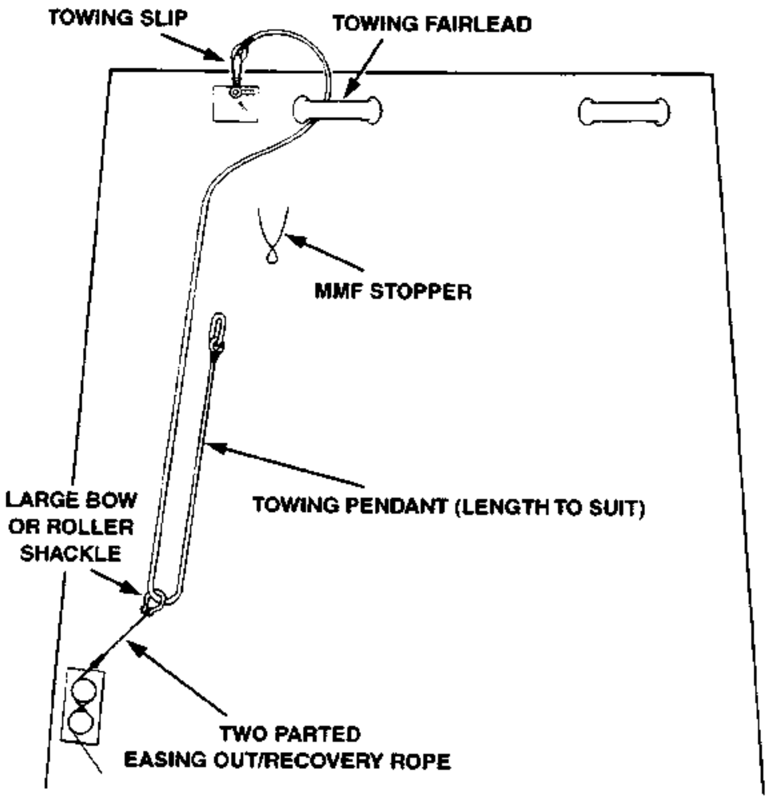


Fig 4-5. Tow Aft - Receiving the Tow - Ships fitted with Outboard Towing Slip.

04006. Methods of Approach

The Captain has a variety of options for making his approach to the casualty, and these are fully discussed in **BR 45 Admiralty Manual of Navigation Volume 6**. Whatever method is chosen the seaman must appreciate that the optimum position for establishing contact and passing the gear is likely to be difficult to maintain for all but a short period of time. Consequently the tow must be passed and connected as quickly as is safely possible.

Note. *As part of the final preps before making the approach the end link of the towing hawser should be eased out through the fairlead/bullring to avoid any possibility of the tow snagging during the initial stages of the towing hawser being passed.*

04007. Methods of Establishing Contact

Contact with the ship to be towed may be established by gunline, bolas, helicopter or boat towing a messenger, although if the disabled ship is short-handed or abandoned boat work should be avoided as an unnecessary complication. If the ship to be towed is drifting fast she may stream a messenger bent to a small buoy or float so that it lies to windward of her and can be grappled by the towing ship; or the towing ship may tow a buoy secured to a messenger across the other ship's bow or quarter for her to grapple as she drifts across it.

a. Making Contact by Gunline. This is the usual method of establishing contact, and at least 3 gunlines should be made ready, if possible in both ships. The line is usually fired from the ship providing the tow but in some circumstances it may be easier for the receiving ship to fire; this must be agreed beforehand. If the towing ship is providing the tow and firing the line it can be fired from the quarterdeck or flight deck so that it is close to the scene of operations, or it can be fired from the foc'sle so that the Captain has an unobstructed view of the proceedings during the critical early stages when he is manoeuvring the ship to get as close as possible. If the latter method is chosen the messenger must be prepared by leading it aft from the foc'sle, outboard of all, stopped at intervals to the base of guardrail stanchions, and then inboard through the towing fairlead on the quarterdeck, where it is secured to the towing hawser. Gunline firing procedures are to be in accordance with **BR 8988**.

b. **Making Contact by Bolas.** This method is rarely used but is a useful alternative should the line throwing rifle become defective. A 12mm cordage monkey's fist with a 0.5m tail is Inglefield clipped to the gunline and used as a bolas.

c. **Making Contact by Helicopter**

(1) *Ships with Large Flight Decks* (ie sufficient space to lay out the gear and range the helicopter). The 12mm messenger is used because it is much lighter than the 24mm messenger. The messenger **must not** be made fast to the aircraft but must be held approximately 300mm from its end by a 10mm rope stopper, one end of which is secured to the floor mat ringbolt and the other end held by the crewman, with a knife available in case of a jam. For passing the end of the messenger to the vessel to be towed, a heaving line is bent to the messenger with a rolling hitch about 600mm from the end. The heaving line is coiled up and stopped to the messenger by its own tail, and the monkey's fist is weighed to about 2 kilograms so that it can be lowered through the downwash of the helicopter rotor (and not wave about). In the ship about 18m of the messenger is faked down on the flight deck to the quarterdeck and the remainder led over the edge of the flight deck where it is faked down as for a normal tow aft; the 24mm messenger is also faked down, ready to bend on. It is advisable to have men, wearing ear defenders, lying on the ends of the flight deck fakes and releasing them as the helicopter rises from the deck. The best flight path for the helicopter is about 185m up wind, so the towing vessel must be to leeward of the disabled ship when the helicopter is launched.

(2) *Ships with Small Flight Decks* are advised if at all possible to use a helicopter operating from another ship. To use one's own helicopter poses more problems than it solves and often leads to the breaking of helicopter safety regulations. It is normally quicker, and certainly quieter, to pass the tow by gunline.

04008. Passing the Tow

a. **In the Towed Ship - Providing the Tow**. After contact is established, pay out the messenger and then the towing hawser under the control of the check stopper and the stops on the bights of tow secured to the strongback; control the last fake of the towing hawser with the easing out/recovery rope. The link and thimble assembly of the towing hawser may have to be guided around obstructions using a wooden handspike. Once the tow has been passed and the weight is on the cable, unrig the easing out/recovery rope and prepare it for the recovery phase. When the towing ship reports that the tow is secured, connect up the cable holder, remove the Blake slip and veer one or two shackles of cable (depth of water permitting), then secure the cable in the same manner as for coming to single anchor, ie put the Blake slip on slack, veer until just before the Blake slip has the weight, then on brake hard, on riding slip/compressor/guillotine as an additional preventer, disconnect the cable holder. This method of securing the cable is the only satisfactory and safe method in most ships. However, in ships built to commercial standards it is common practice for a centre-line Blake slip to be fitted for towing. In these ships the weight of the tow is to be taken on the centre-line Blake slip and the windlass brake is to be put on as a preventer.

b. **In the Towing Ship - Receiving the Tow**. Run in the messenger by hand, then bring to on a capstan and heave in until there is sufficient towing hawser on deck to make the connection between the hawser and the towing pendant/chafing piece. During this operation hold the weight of the towing hawser on the messenger at the capstan, and pass a MMFC stopper as an additional preventer. Connect the towing pendant/chafing piece to the towing hawser by inserting either a towing shackle or an anchor shackle, the criterion being that the shackle pin must be secured with a pin and pellet. Once the connection has been made rig the easing out/recovery rope over the towing hawser (only ships fitted with the bollard and clench method need do this, ships with an outboard towing slip will have rigged the easing out/recovery rope during preparations). Remove the MMFC stopper and veer on the messenger to transfer the weight to the easing out/recovery rope. When this has been accomplished unshackle the two parts of the messenger, leave the short length bent to the towing hawser and stopped up, then coil the longer part of the messenger and place it ready to hand for use when the tow is recovered. The final bight of the tow can now be eased out on the easing out/recovery rope. When this has been achieved unshackle the two parts of the easing out/recovery rope, leave the short part shackled over the towing pendant/towing hawser and coil and stop, outboard of the guardrails, any surplus of the short part.

Note. *The towing ship must avoid placing weight on the tow until the towed ship has signalled that she is ready to commence the tow.*

c. **In the Towing Ship - Providing the Tow**. The methods employed are similar to those for passing the tow for'ard. Pay out the tow under the control of the check stopper, cutting the stops on the fakes of the hawser at the strongback as paying out the hawser progresses (if possible retain a few fakes of the towing hawser inboard until the towed ship is ready to be towed. This will assist the towing ship to manoeuvre onto the required heading for towing before putting weight on the towing hawser). Finally, ease the last fake of the towing hawser outboard using the easing out/recovery rope. The easing out/recovery rope remains shackled over the towing hawser, but the two parts of the easing out rope are unshackled and dealt with as described for the messenger.

Note. *The towing ship must avoid placing weight on the tow until the towed ship has signalled that she is ready to commence the tow.*

d. **In the Towed Ship - Receiving the Tow.** Break the selected cable abaft the swivel piece, and light it for'ard to a point just abaft, but adjacent to, the centreline hawsepipe or bullring. Shackle an adaptor piece to the end of the cable, and provide an anchor shackle or towing shackle to make the connection between the adaptor piece and the ovoid link of the towing hawser; provide a MMFC stopper as an additional preventer to hold the towing hawser when this connection is being made. Run the messenger in by hand, bring it to the capstan and heave in until the towing hawser is on deck with the ovoid link slightly abaft the end of the cable; this eases the work of connecting the hawser and cable. Pass the MMFC stopper, then with the weight of the towing hawser held by the messenger, and the MMFC stopper passed, connect the cable to the towing hawser. When the connection has been made, remove the MMFC stopper, then transfer the weight of the towing hawser to the cable by veering the messenger. Unshackle the two parts of the messenger and deal with them as described in sub paragraph b, connect up the cable holder and veer one to two shackles of cable (depth of water permitting). If necessary, manhandle with rope tails the first few metres of cable down the centreline hawsepipe. Secure the cable in the manner previously described.

04009. Checks Before Commencing the Tow

Before commencing the tow a rating in the towing ship must be detailed off as emergency slipping number; he must be equipped with an axe and a maul, and sited in a safe position out of the line of recoil should the tow part, but close enough to be able to react quickly in an emergency. Spare gear must be stowed away, and all personnel other than the emergency slipping number cleared from the area before towing commences.

04010. Commencing the Tow

As the towing ship moves ahead and weight comes on the tow, the towed ship may take a sheer. This can make it very difficult to bring her round to the required heading and there is a danger that the tow may be over-stressed in the attempt. The stress line must be carefully watched and the necessary reports made to the Captain should over-stressing occur. Manoeuvring aspects of this problem, and possible solutions, are discussed in **BR 45 Admiralty Manual of Navigation Volume 6**.

04011. Slipping and Recovering the Tow

Before slipping and recovery of the tow can commence both ships must be stopped. The towing ship must reduce speed gradually, ensuring the towed vessel does not overrun the towing vessel. All personnel involved in recovery of the tow must be fully briefed on the task, with particular emphasis on safety aspects (See Caution Box overleaf).

a. **Slipping.** The method of slipping is similar whatever the rig. If the **towed ship** has provided the towing ship must shackle together the two parts of the easing out/recovery rope and heave/haul in the towing hawser/chafing piece/towing pendant until the connection is on deck. Shackle together the two parts of the messenger, then turn up the messenger and ease out the easing out/recovery rope to transfer the weight to the messenger. Pass a MMFC stopper as an addition preventer, unshackle the tow from the towing pendant/chafing piece, firmly stop the ovoid link to the messenger, remove the MMFC stopper then pay back the tow on the messenger. If the **towing ship** has provided the tow, shackle together the two parts of the recovery rope, then heave/haul in sufficient towing hawser for it to be manhandled and run in (or brought to the capstan and hove in).

Note. *While the weight of the towing hawser is borne by the messenger during the operation of passing the tow back to the supplying vessel, the messenger must be veered under control at the capstan until it is apparent that the weight is off the messenger; turns can then be removed from the capstan and the messenger paid back, hand over hand.*

b. **Recovery.** In the **towed ship** (if the **towed ship** has provided the tow). Lead the recovery rope for'ard to a point adjacent to the centreline hawsepipe, or bullring, ready to bring to on the capstan; provide a polyamide stopper ready to hand. Connect up the cable holder, knock off the riding slip and Blake slip, take off the brake, then heave in the cable until the towing hawser is inboard and the ovoid link is just abaft the broken end of the cable. Pass the stopper, shackle the recovery line to the ovoid link, then bring the recovery line to the capstan. Veer the cable until the weight of the tow is on the stopper and recovery rope, unshackle the towing hawser from the cable, and when the tow is slipped in the towing ship remove the stopper and heave in on the recovery rope until the eye of the hawser is close up to the capstan. With several metres of the towing hawser on deck it should be possible to run it in by hand, but if this proves difficult the stopper must be passed again, and the recovery rope bent to the hawser with a rolling hitch and hove in. If the tow is being returned from the **towed ship** to the **towing ship** the end of the tow is brought inboard as described above. The short part of the messenger is then reshackled to the long part, the messenger brought to on the capstan and hove in until the weight of the tow is transferred to the messenger. The rope stopper is passed, the cable disconnected from the towing hawser, and the ovoid link firmly stopped to the messenger. The stopper is removed and the towing hawser paid out on the messenger by veering the capstan. Because the messenger bears the weight of the towing hawser it must be carefully controlled, when veering, until the weight is no longer likely to constitute a hazard.

CAUTION

WHEN THE TOW IS BEING RUN IN BY HAND NO ATTEMPT SHOULD BE MADE TO ASSIST THE PROCESS BY SIMULTANEOUSLY HEAVING IN ON THE RECOVERY ROPE. SUCH ACTION IS LIABLE TO RESULT IN INJURY TO PERSONNEL BY THE BOW/ROLLER SHACKLE.

04012. Submarine Towing

Submarines are not well designed or equipped for towing at sea. The low freeboard in conjunction with lack of proper foc'sle arrangements means that a long ocean tow is not feasible without special arrangements and modifications to the structure. The following information applies to the emergency tow situation where a submarine has to be taken in tow following a breakdown at sea.

a. **Standard Arrangement of Towing Equipment in RN Submarines**. The arrangement consists of a 78m length of 72mm polyamide braidline towing hawser which is stowed in a towing trough situated in the bows of the submarine. The inboard end of the hawser is connected to a slip operated manually from within the submarine and the outboard end of the hawser is spliced to a ‘rip-out’ pendant consisting of a 35m length of 52mm jacketed Kevlar. The rip-out pendant is packed in a recess in the casing extending from the towing hawser stowage trough to the top of the bridge fin on the starboard side; when the pendant is stowed the recess is covered with a membrane and tiled over. The outboard end of the pendant, which is positioned behind a portable plate in the bridge fin, is finished with a link and thimble assembly. RN submarines are supplied with a line throwing device called a Pains Wessex Speedline 250; this equipment is used to establish initial contact.

b. **Preparations in the Towing Ship**. Preparations are similar to those described earlier for the towing vessel receiving the tow. However, the submarine does not carry a messenger, and this must be provided by the towing vessel. It is advisable to prepare for use both the 12mm and 24mm messenger. Although the 24mm version must be passed first to the submarine it is possible the vessels will drift apart during the period the submarine is attaching the messenger to the rip-out pendant; in such circumstances the 12mm messenger can be tailed to the 24mm messenger.

c. **Preparations in the Submarine**. The portable plate covering the outboard end of the rip-out pendant is removed, the Pains Wessex line throwing equipment is taken to the bridge and prepared for firing and signal bats and rope stops are placed ready to hand.

d. **Passing the Tow**. The towing vessel takes up a position as close as possible off the starboard beam abreast the fin of the submarine. The submarine fires the line, which is taken in hand in the towing ship and secured to the messenger; the submarine then hauls over the messenger and secures it to the outboard end of the rip-out pendant as described earlier for securing a messenger to a towing hawser. Once secured to the rip-out pendant the messenger is brought to a capstan or winch in the towing vessel, and, by heaving in on the messenger, the rip-out pendant is ‘started’ out of its stowage. Experience has shown that the towing vessel must not be ahead or astern of the submarine’s fin by more than 15° during the initial phase of the rip-out process. The towing vessel then moves slowly ahead, pulling out the remainder of the pendant and subsequently the towing hawser from its trough stowage. When the outboard eye of the rip-out pendant is to hand in the towing ship it is secured to the towing pendant as described earlier in this chapter for receiving the tow in the towing ship. From this point procedures for towing are as for warship towing.

e. **Recovering the Tow**. A submarine has no facility for recovering a tow. On completion of the evolution the tow is slipped by the submarine and recovered in the towing vessel as described for warship towing.

04013. SVHO Towing

a. Survey vessels HMS ECHO and HMS ENTERPRISE have been constructed to Lloyds rules and are fully supported by Vosper Thorneycroft. Their towing arrangements differ from other RN ships by the use of a SMIT bracket and the cable not having to be broken for attaching the tow. Their system consists of :

(1). SMIT Bracket.

(2). Chaffing Wire

(3) 3 parted tow, 2 x 24mm x 85m Dynex HMPE and 1 x 56mm x 20m Polyamide.

b. The remainder of equipment required for the tow is as the current arrangements on RN vessels. Each ship will hold its own SOP and Service Drawing for this method.

04014. River Class Towing
This arrangement is similar to the deck clench layout on RN vessels with the exception that the wire chaffing piece is attached to a bollard strop using a shackle. The remainder of equipment is laid out as with other RN vessels. Each ship will hold its own SOP and Service Drawing for this method.

04015. Communications
Good, reliable communications are essential for towing evolutions. The following methods are considered to be most effective:

a. **Bridge to Foc'sle or Bridge to Quarterdeck**. Whenever practicable, RICE or sound powered telephone should be used.

b. **Ship to Ship**. It is common practice, depending on the EMCON policy in force, to communicate between ships by ship-fitted radio or portable radio. However, communications between the officers-in-charge in the towed ship and in the towing ship should be made primarily by hand signals, using replenishment-at-sea bats by day and wands by night. The signals used are as described in Chapter 6, Annex A. International flag hoists should be used in the event that language difficulties and ignorance of hand signals hamper communications.

c. **Propeller Flags** should be provided on the quarterdeck and used to indicate immediately to the bridge when there is a danger of the messenger or hawser fouling a propeller. When **red** is shown it is an immediate indication that a hazard exists near the propeller on the side indicated. Normally **white** is shown to indicate that no hazard exists.

04016. Safety
The following safety precautions should be observed during towing operations.

a. Personnel must be suitably dressed for the task, giving due consideration to the prevailing weather conditions. Men in exposed positions must wear Hazardous Duty Lifejackets, and safety harnesses when required to work outboard of guardrails. All personnel, including the recovery team, must wear DMS boots.

b. Personnel engaged in handling the tow must be aware of the dangers of handling man made fibre cordage under tension.

c. When the tow is being passed or recovered clear visual hand signals must be used to control it. Care must be exercised to prevent the tow from bottoming in shallow water.

d. Sharp knives should be worn by all men, and an axe and a maul must always be available to cut away the tow.

e. Binoculars must be provided at the towing point of the towed and towing ship.

04017. Precautions when Towing or Being Towed

a. **Reducing Chafe**. Chafing is virtually eliminated with modern towing methods. However, where chafing may occur with polyamide hawsers, the hawsers must be parcelled with a proprietary anti-chafe fitting or any hard wearing materials such as leather, canvas or sacking. Cable and steel wire rope must be well greased where it is in contact with bearing surfaces such as hawsepipes or fairleads.

b. **Extension in Polyamide Hawsers.** It will be found that the hawser will stretch considerably during a prolonged tow, and the extension will remain in the hawser for some time when on deck on completion of towing. Consequently a polyamide towing hawser should not be reeled up until it has fully recovered.

c. **Connecting Links**. Lugged anchor shackles or towing shackles should always be used as connecting links in towing hawsers, because they are long enough in the clear to take the ovoid links; they will pass through fairleads and hawsepipes and over obstructions without opening or being damaged, and they are positively locked by pins and pellets. It is important to ensure that the shackles are as strong as the hawsers and cables with which they are used.

04018. Planned Tows using Tugs

Certain basic principles should be applied when preparing a planned tow, because ships vary in size and shape and each has to be treated individually. Several classes of ship have standard towing rigs available on application to the Chief Executive (Marine Services); but these rigs may have to be modified to suit the individual ship, because the positions of bollards, etc may differ in ships of the same class. The method of rigging the towing ship, and the gear used in it, must satisfy the towing master, who is usually master of the tug and responsible for the safe delivery of the tow. If there is lack of uniformity in the preparation of the rig the towing master will require alterations to be made before he will accept responsibility; therefore the local naval authority or relevant dockyard department should always be consulted. The towed ship can be a ‹live’ (manned) tow or a ‹dumb’ (unmanned) tow; unless the size and condition of the ship are unsuitable for manning, a tow should always be manned. Whether the tow is manned or not difference in the rig is slight. When manned, the towed ship should be able to slip the towing hawser from inboard and the tug can then quickly recover it. When the tow is unmanned, the tug should be able to disconnect her towing hawser from a position just outboard of the towed ship; this entails manoeuvring close to the tow, and recovery takes much longer.

Note. Trim. *Excessive weight for’ard should be avoided, if possible; otherwise a towed ship may have to be ballasted. Ships should normally be trimmed 6 to 10 decimetres by the stern; the reasons for this are given in* ***BR 45 Admiralty Manual of Navigation Volume 6****.*

a. **Types of Rig**. There are three main types of towing rig; the two-tug rig for ships of LPD size and above, the bridle rig for all other types of ship where there are adequate strong points on the foc'sle for securing the rig, and the necklace rig for those small vessels whose foc'sle fittings are not strong enough for a bridle rig. The two-tug and bridle rigs should be as simple as possible, using the strongest securing points and the most suitable fairleads. All gear must be sufficiently strong and must have been tested within the established periods for testing. A towing pendant is always included in the rig between the towing hawser and ring, so that the towing hawser need nor pass through and be chafed by a hawsepipe, bullring or fairlead when the ring is inboard, and to make it easier for the tug to shackle on her towing hawser to the end of the pendant, which is always outboard in a manned or unmanned tow. A spare towing pendant should always be provided by a manned tow and unmanned tow when the ring is inboard. It should be secured to the ring, led through the towing lead and stopped outboard to the heels of guardrail stanchions. A slip should never be placed in the catenary of the tow rope. A preventer is essential in unmanned bridle or necklace rigs, desirable in manned bridle rigs, and unnecessary in two-tug rigs. It should be of 6 x 36 or 6 x 41 construction steel wire rope, be secured to a deck fitting or bollard strong enough to take the towing strain, and be shackled to the mooring ring. The preventer should be slack enough to take no strain from the main ring, and it may be used as a recovery wire for the main rig after the tug has unshackled its towing hawser.

(1) *Two-Tug Rig.* LPD size ships and above are usually towed by two tugs with separate rigs each side of the foc'sle. Each rig is secured to bollards, and the towing pendant, led through a fairlead, is secured to the rig by a slip (Fig 4-6).

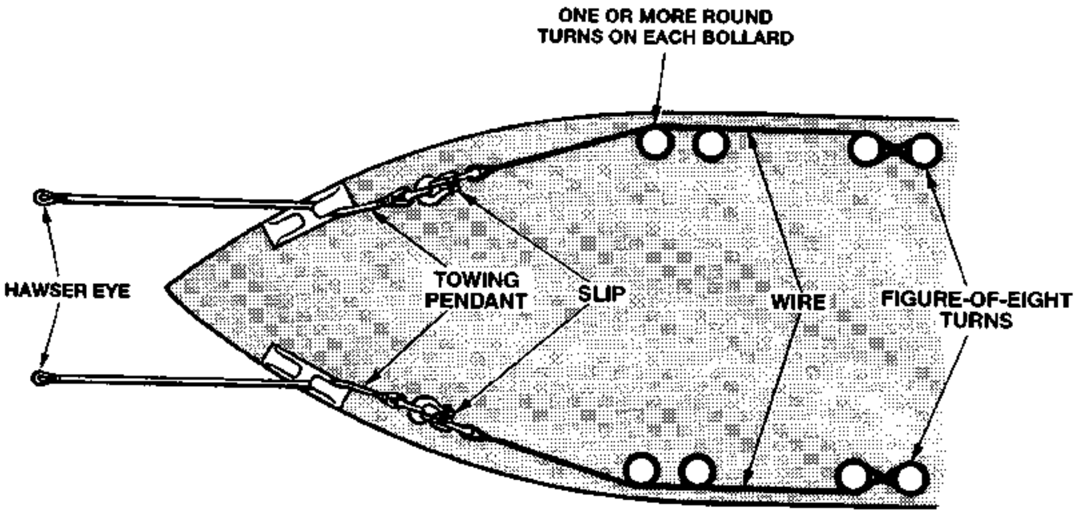


Fig 4-6. Towing Rig for Manned Tow - Two Tug Rig - LPD and Above

(2) *Two-legged Bridle Rig.* This is the rig used for all ships with adequate foc'sle securing arrangements, other than LPDs and above. It consists of two wire or chain bridles originating from bollards (two pairs, if possible) on each side of the ship and terminating at a mooring ring. The bridles are of wire rope for MCMVs and below, and of chain cable for larger ships. The mooring ring for a manned tow and unmanned MCMVs, with bullring or stem hawsepipe, is on deck; and a towing slip, shackled to it, takes the tug's towing pendant (Fig 4-7). The mooring ring for a manned tow not fitted with a bullring or stem hawsepipe is outboard, so that it just touches the water when the bridle leads for'ard at an angle of 45 degrees (Fig 4-8). The rig illustrated at Fig 4-8 is to be used for unmanned tows with the exception of MCMVs.

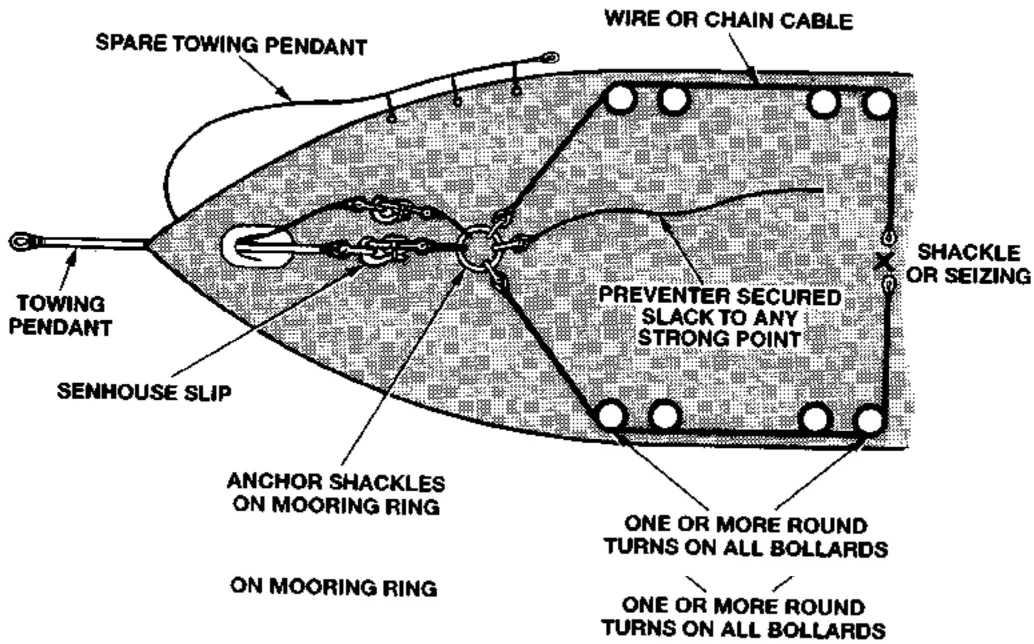


Fig 4-7. Towing Rig for Manned Tow - with Bullring or Stem Hawsepipe

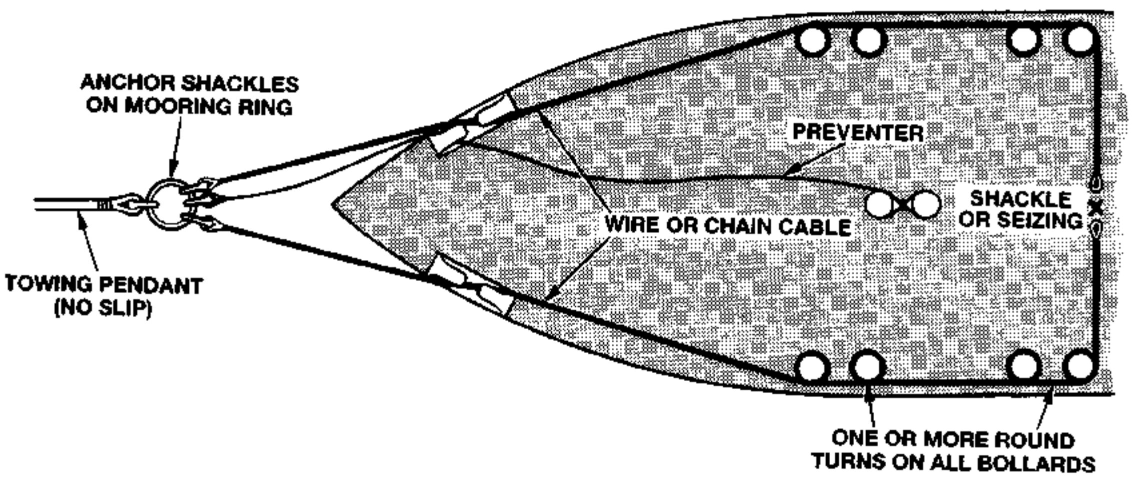


Fig 4-8. Towing Rig for Manned Tow not fitted with Bullring or Stem Hawsepipe

(3) **Necklace Rig**. Although most lighters are now fitted with a bullring, deck clenches, bollards and fairleads, the necklace rig is still used for small vessels that lack deck fittings of adequate strength to secure a bridle rig. The rig consists of a necklace of wire encircling the hull of the vessel, supported by wooden chocks or wire pendants (hangers) rigged over the vessel's upper deck so that they support both sides of the necklace. Certain vessels have towing diagrams from which their rigs can be prepared; other small vessels for which no diagram exists should be rigged in a manner similar to that illustrated in Fig 4-9. The fixed metal plate at the stern prevents the necklace from sliding bodily round the hull, which would give the tow a sheer to one side or the other. In vessels with transom sterns the necklace is secured to plates on each quarter and crossed at the stern so that the port necklace is shackled to the plate on the starboard quarter and vice versa. The hangers are shackled to rings inserted at intervals in the necklace, thereby reducing the chafe and bad nips; and hardwood chocks are shaped over the deck edge in the wake of the hangers and under the rings to give a fair lead and reduce chafe. It may be necessary to rig a martingale for'ard under the hull to prevent the necklace from riding up, particularly when there is a pronounced tumble-home. A preventer wire is fitted each side and shackled to the foremost necklace rings. If the for'ard hanger, which bears most of the weight of the towing hawser, parted on deck, the preventer would stop the necklace falling down and act as a secondary towing-point. A chain cable bridle is shackled to each for'ard ring of the necklace, and the two legs are shackled to the mooring ring. A recovery wire may also be shackled to the ring.

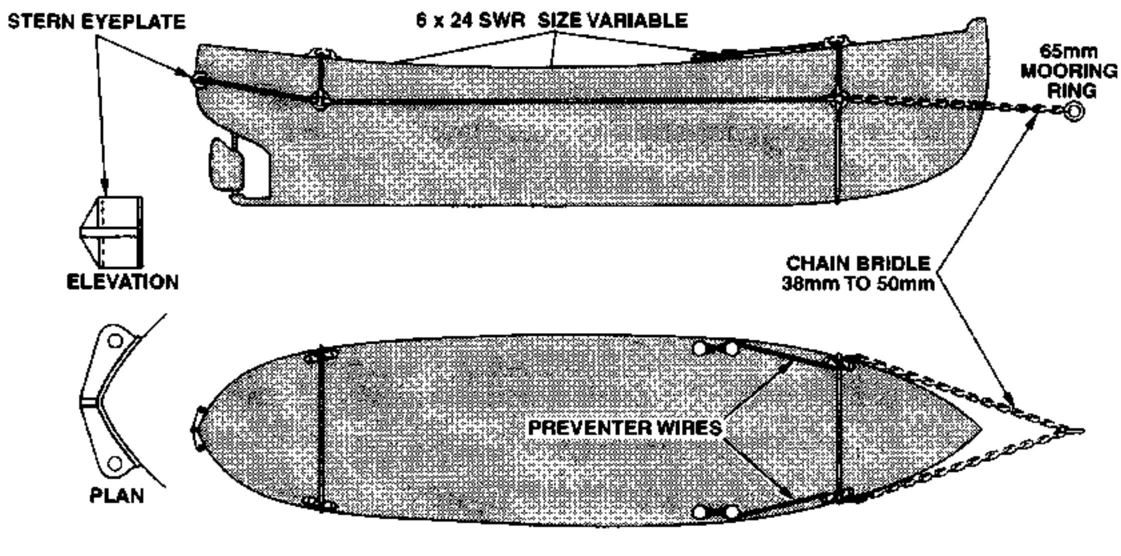


Fig 4-9. Necklace Towing Rig

b. **Advice on Preparation**

(1) Ensure that the components of the towing rig are ‹in date’ with regard to survey and test.

(2) All wires should be fitted with hawser eyes, so that the thimbles can be changed if they are distorted.

(3) Adaptor pieces are required when using forged steel cable.

(4) Demand towing gear by NS Catalogue Number from **BR 2000(91), Manual of Towing Equipment**.

(5) Have all bollards, fairleads and other strong-points surveyed; they may be defective in ships that have lain idle for long periods.

(6) When rigging the gear, avoid bad nips and foul leads, especially where the bridles pass outboard. In unmanned tows the bridles should lead through fairleads, if possible, otherwise the hawsepipes must be used. Sharp edges play havoc with any rig; therefore no angle of lead should be less than 135 degrees.

(7) Supply as much hardwood chocking as possible, especially in the way of deck fittings; grease all leads and deck edges.

(8) When preparing a manned tow at least one anchor should be available for use.

(9) When securing the rig to bollards, start from for’ard so that the strain on each set of bollards originates from the bottom of the bollard.

(10) All unmanned, and some manned, tows must be fitted with gas navigation lights, which are usually supplied by the tug. Advice on the preparations for fitting gas bottles and lights should be sought from the local naval authority.

04019. Manoeuvring with Tugs

When a ship has to be handled in confined waters there are occasions when the use of tugs is necessary, even by quite small ships. Particulars of the principal types of tug used in HM dockyard ports and naval bases are shown in Table 4-4.

Table 4-4. Details of Tugs used in HM Dockyard Ports and Naval Bases

Class	Bollard pull	Overall length	Draught	Speed (knots)	Type of propulsion
Impulse	38 tonnes aft 36 tonnes fwd	32.5m	4.0m	1212986	Twin stern Azimuth drive. Bow thruster
Adept	27.5 tonnes	38.1m	4.6m		Twin cycloidal propulsion units
Dog	16.0 tonnes	28.7m	3.8m		Twin propellers
Felicity	5.5 tonnes	23.8m	3.4m		Cycloidal propulsion unit
Triton	3.0 tonnes	17.0m	2.0m		Cycloidal propulsion unit

a. **Securing the Towing Hawser of a Naval Base Port Tug.** Tugs in Naval Base Ports have an eye on the outboard end of their towing hawser. The hawser should be brought in through an appropriate fairlead and the eye placed on a bollard. (The eye of the hawser may have a lanyard attached to ease handling. Care must be taken to ensure this lanyard is not 'pinched' when the eye is placed on the bollard). Towing hawsers fitted in commercial tugs are not always fitted with an eye; in this case the hawsers must be turned up round bollards and racked. All tugs have arrangements for slipping towing hawsers from their end, but as an additional safety measure HM Ships should have an axe, maul and baulk of timber ready to cut the towing hawser should it become necessary (this is only practicable with a MMFC towing hawser). Furthermore, whenever tugs are employed, Commanding Officers of HM ships and Masters of RFAs must always know exactly how towing hawsers have been secured and they must ensure that the tug masters are informed.

b. **Ships Entering Port at Locations Other than Naval Base Ports**. In some ports bollard strops and slips may be required. Ships are to state in their Logreq that bollard strops and slips are available if required. These bollard strops are made up of 24mm steel wire rope for frigates and above, and 20mm steel wire rope for all other vessels. Individual ships must ensure that the strops are of a suitable length that enables them to be placed under tension without straining the seizing of the strop, but not so long that the slip fouls the fairlead thorough which the towing hawser passes. Where practicable a tommy bar should be lashed to the slip, as shown in Fig 4-10, to act as an anti-twist bar.

c. **Tugs Positioned for Push -Pull**. Tugs that are positioned against a ship for push-pull normally pass a bow rope and several other ropes to maintain their position against the effects of tidal stream or ahead or astern movements of the tow. These ropes need not be secured to slips but a seaman must be in attendance to let them go quickly when required.

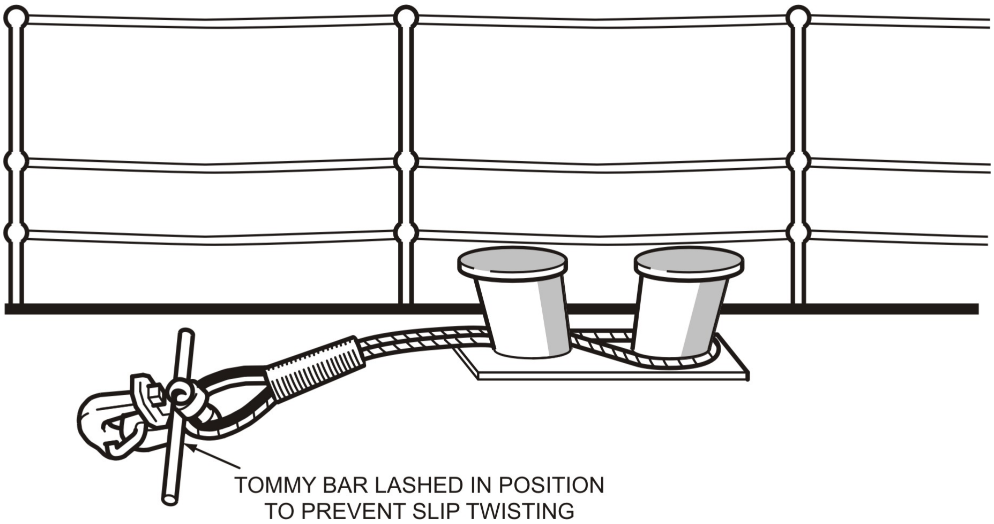


Fig 4-10. Bollard Strop and Slip (Only Rigged if Required)

d. **Slipping a Tug**

WARNING

IT IS EXTREMELY DANGEROUS TO SLIP A TOWING HAWSER WHILST IT IS UNDER TENSION, AND IT SHOULD NOT BE DONE EXCEPT IN AN EMERGENCY, WHEN THE ORDER 'SLIP THE TUG' WILL BE GIVEN

Furthermore, when slipping from a high freeboard ship it must be remembered that if the hawser is in tension it will be flung down on to the crew of the tug. In normal conditions therefore, the tension should be eased before the wire is slipped or surged round the bollards. Whatever the tension, the seaman knocking off the slip must stand well back and be prepared for either the slip or the towing hawser or both to fly up. If the towing hawser has been turned up round bollards and racked, it must be backed up before the racking is removed, then surged roundly under complete control, paying attention to the danger from its bights or fakes on deck.

e. **Girding.** A tug is girded when she is towed broadside by her own towing hawser and is unable to manoeuvre out of this position. The risk is greatest when the tug is towing on the beam and only a small movement of the towed ship can place her in a helpless position and possibly capsize her; many modern tugs are fitted with cycloidal propellers which give exceptional manoeuvrability and greatly reduce the chance of a tug being girded, but propeller driven tugs may be held beam-on by the towing hawser if the ship is moving noticeably ahead or astern. If the ship is putting much weight on the tug the hawser will have to be slipped quickly to prevent the tug being capsized.

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CHAPTER 5

BOATS

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CHAPTER 5

BOATS

05001. Introduction

When in harbour a warship's boats are used for embarking, disembarking, and transferring mail, stores, armed parties, force protection, working parties, fire parties, liberty men, passengers and visitors; also for training and recreation. When at sea a warship's boats are used for rescue, as in man overboard or ditched helicopter; for transferring men and stores to and from another ship, for transferring a boarding party to another ship, or for landing and embarking personnel and stores. Special boats are used for surveying, mine clearance, minehunting and other specific duties. Descriptions of the power boats currently carried in warships are given in the following paragraphs.

05002. Gemini Craft - Introduction

Inflatable Gemini craft are made in three sizes; small, medium and large. The small and medium sizes are carried by warships for use where a fast, manoeuvrable and lightweight boat with a low freeboard is a prime requirement, and the large (or jumbo) Gemini is available mainly, but not exclusively, to ships on particular patrols or deployments where its carrying capacity or its roll on, roll off facility for vehicles up to short wheel-base Landrover dimensions may be required. Within the medium-size range there are three types of craft available and these are described later. The Gemini hull consists of an inflatable U-shaped buoyancy tube of rubber-proofed fabric. A **transom board**, on which the outboard engine is mounted, is attached to the tube and to the floor. A **butterfly board**, **collapsible keelson** and **floorboards** are used to keep the floor rigid. The buoyancy tube is divided into five airtight compartments (six in the case of the jumbo Gemini), each provided with a combined **inflation/deflation valve** and a **safety-topping-up-valve**. The craft is designed so that it will remain afloat when fully loaded if any two compartments are deflated.

a. **Seaworthiness** of the Gemini is excellent under power. The craft is fast, light to handle and manoeuvrable when unladen, but slow and heavy-handed when laden. The difference between the two conditions is much greater than in the case of a conventional boat. A peculiarity of the Gemini is the stern-wave, and this can be disconcerting when it overruns the boat on deceleration. The deceleration is much greater in the case of a laden boat and the wave may break over the transom if deceleration is rapid.

b. **Hull Inflation**. There are four possible methods of inflating the hull. They are **bellows**, **air blower**, **bottle** and **air main**. Bellows are used when there is no great urgency to inflate the craft, and is the method used to top-up the buoyancy tube in normal use. Air-blower inflation is the normal method of inflating the craft. Bottle inflation is available for craft performing specific duties, and air-main inflation may be used where suitable air-pressure systems are available.

05003. Gemini Craft - Crewing

The small and medium Geminis carry a crew of two: a coxswain and bowman. The coxswain of a Gemini must have completed a Gemini coxswain course at an authorised training school and, if handling a Gemini as a seaboat or crash boat, he must have completed onboard training and be deemed and certified competent by the Seamanship Training Officer before being allowed to coxswain the craft unsupervised.

He must have a complete working knowledge of his craft and its engine, and be capable of rectifying minor engine defects. The bowman must have completed onboard training to a level where he is capable of taking over from the coxswain, re-starting the engine, manoeuvring the boat safely to recover a man overboard and taking the boat alongside. Because it is fitted with two independently operated outboard engines the jumbo Gemini requires a crew of three; two coxswains and a bowman. Dress in Geminis must conform to that given for RIBs.

05004. 3.9m Gemini - Specification

The 3.9m Gemini (Small), Naval stores number 0479/425-9728, is a fully inflatable rubber boat with rigid aluminium or plywood keel, bottom boards and transom. It is used for general duties in certain minor war vessels and submarines and is basically a small version of the 4.6m General Purpose Gemini illustrated in Fig 5-1. The boat is normally stored inflated, ready to use, by RN ships. It can also be packed into three canvas valises. **BRF 6595(600) Gemini Craft** is the authoritative publication for this craft.

a. **Performance**

Capacity	6 persons (including crew)
Crew	2
Speed	10-18 knots
Endurance	50nm

b. **Dimensions**

Length	3.9m overall
Width	1.6m overall
Height	0.41m

c. **Maximum Hoisting Weight - 250 Kg**

Weight of boat with engine	145 Kg
One tank of fuel	20 Kg
Crew of one	75 Kg
Boat's bag	10 Kg
Total Weight	250 Kg (No spare capacity)

d. **Propulsion**

Engine	20 hp outboard
Fuel	Petrol/oil 2 x 25 litres - embark 2nd tank after boat has been lowered (if required)

e. **Slings.** A four-legged webbing lifting sling, naval stores number GX 0479/0001090, is used for hoisting and lowering the craft.

05005. 4.65m Gemini - Specification

The 4.65m Gemini (Medium) is a fully inflatable rubber boat with rigid aluminium or plywood keel, bottom boards and transom. There are three types of Gemini craft in general use in the Fleet; assault; mine clearing and general purpose. Fig 5-1 shows the general purpose type. The construction and appearance of all three types is similar but minor differences occur in their fittings and equipment consistent with the duties for which they are intended. Each type of craft is normally stored inflated, ready to use, by RN ships; each can also be packed into three canvas valises. **BRF 6595(600) Gemini Craft** is the authoritative publication for these craft. Table 5-1 gives details of Pattern numbers, carrying capacities and size of outboard motor for the existing three types.

Table 5-1. Types of Gemini (Medium)

Description	Pattern No	Normal carrying capacity	Motor HP	Function
Gemini Craft Medium - 4.6m	0479/425-9727	7+2 crew	40	Assault and Patrol Duties
Gemini Craft Medium - 4.6m	0479/425-9729	9+2 crew	20 or 40 (special)	Mine Clearance
Gemini Craft Medium - 4.6m	0479/425-9730	9+2 crew	40	Training and General Duties

a. **Performance**

Speed	10-18 knots

b. **Dimensions**

Length	4.65m overall
Width	1.9m overall
Height	0.91m

c. **Maximum Hoisting Weight - See Individual Type**

(1) *Assault Gemini - Maximum Hoisting Weight 350 Kg*

Weight of boat with engine	210 Kg
Two tanks of fuel	40 Kg
Boat’s bag	10 Kg
Crew one	75 Kg
Total	335 Kg (15 Kg spare capacity)

(2) *General Purpose Gemini - Maximum Hoisting Weight 350 Kg*

Weight of boat with engine	222 Kg
Two tanks of fuel	40 Kg
Boat's bag	10 Kg
Crew of one	75 Kg
Total	347 Kg (3 Kg spare capacity)

(3) *Mine clearance Gemini - Maximum Hoisting Weight 460 Kg*

Weight of boat (fitted with bow fairlead and 20 hp engine)	209 Kg
Two tanks of fuel	40 Kg
Boat's bag	10 Kg
Crew of two	150 Kg
Total	409 Kg (51 Kg spare capacity)

d. **Propulsion**

Engine	See Table 5-1
Fuel	Petrol/oil 2 x 25 litres

e. **Slings.** A four-legged webbing lifting sling, naval stores number GX 0479/0001091, is used for hoisting and lowering the GP and Assault craft. The Mine clearance Gemini is provided with a six-legged sling, naval stores number GX 0479/0001089.

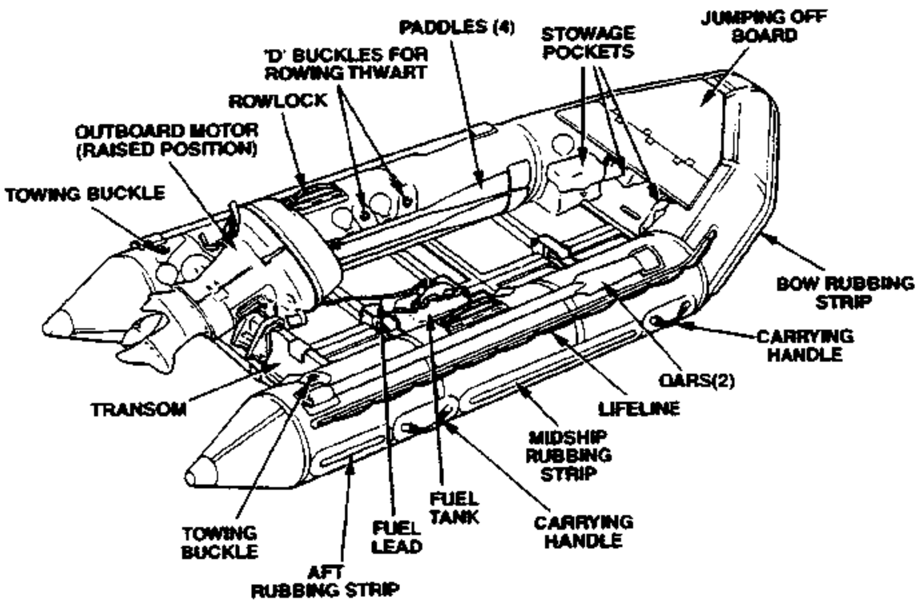


Fig 5-1. General-purpose Gemini Craft

05006. 7.8m Jumbo Gemini - Specification

The 7.8m Jumbo Gemini craft (Fig 5-2) is a large fully inflatable rubber boat with an inflatable keel, rigid aluminium bottom boards and a plywood transom. It is a naval stores item, Patt No 0479-818- 3558, but demands are automatically forwarded for approval to the MOD Boat Manager. Before demanding this craft ships should consider the question of stowage, lifting out and recovery, and suitability of the craft for the ship's role. Aluminium ramps are supplied with the craft and with the bow section of the Gemini deflated the ramps provide a roll-on roll-off facility for embarking or disembarking a vehicle. A user manual in the form of a manufacturer's handout is supplied with the craft. Spare copies of this publication are available from: ML Lifeguard Equipment Limited, Lon Parcwr, Ruthin, Clwyd, LL15 1YU.

a. **Supply Arrangements**. The raft and associated equipment is supplied in four valises, each of which is on its own pallet tray:

Pallet tray	Containing	Size	Height
No 1	Hull Section	0.84m x 2.4m	0.6m
No 2	Deck Plates	1.1m x 1.0m	1.0m
No 3	Ramps and Extension	0.5m x 2.4m	0.4m
No 4	5 Inflation Cylinders	0.8m x 5.4m	0.8m

b. **Performance**

Capacity	40 + 3 crew (or 4 tonnes of stores)
Crew	3
Speed	10-18 knots
Endurance	50nm

c. **Dimensions**

Length	7.8m overall
Width	3.25m overall

d. **Maximum Hoisting Weight**

Boat + 2 engines + 1 air cylinder	=	875 Kg
Four tanks of fuel	=	80 Kg
Crew of two	=	150 Kg
Total	=	1105 Kg

e. **Propulsion**

Engine	2 x 40 hp outboard
Fuel	Petrol/oil 4 x 25 litres

f. **Slings.** An eight-legged lifting sling is supplied with the craft.

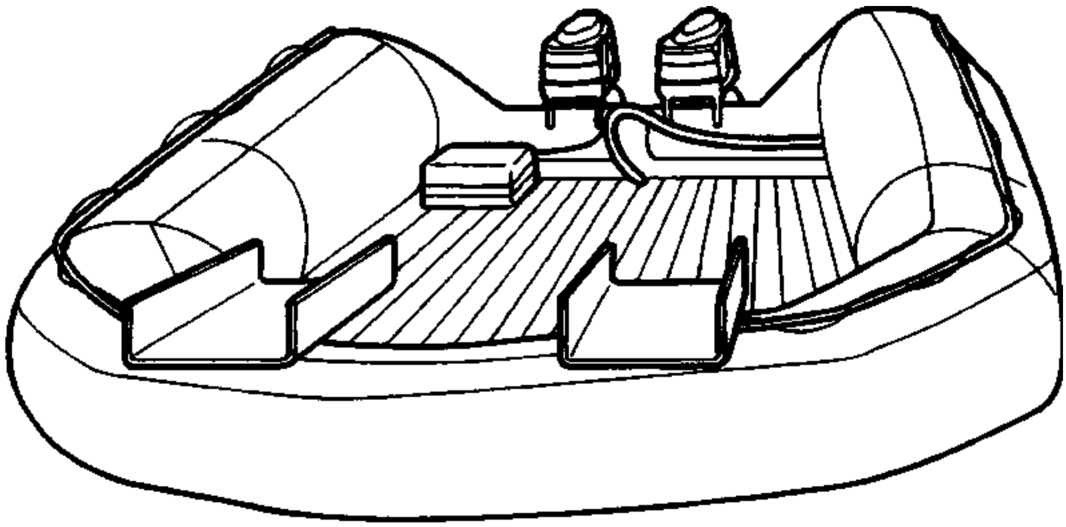


Fig. 5-2. Jumbo Gemini

05007. Gemini Boat's Bag and Other Equipment

The equipment list for the jumbo Gemini is given in the manufacturer's handout and should be referred to when the craft is delivered. For Geminis carried in HM Ships the following equipment is to be carried in the boat:

Equipment	Naval stores number
2 x paddles	0472/923-0766
VHF hand held radio (Cougar)	
Bellows	0479/425-9838
Manual Line Thrower	0472-781-0504
Horn	0268/407-9681
Sea Anchor	0479/GX0003965
Spare 'Kill cord' (ready to hand)	0482/250-0801
*Small CQR Anchor	
Bag Stores (Boats Bag)	0479/531-8185
(containing)	
4 x Distress Flares (to be removed in harbour)	
Leakstopper S1 (2)	0479/923-0767

Leakstopper S2 (2)	0479/923-0768
Leakstopper S3 (2)	0479/923-0769
Repair clamp (2)	0479/923-0770
Bailer	0479/461-6177
Torch (with a signalling capability)	
First Aid Kit	6545/211-1573
BR 98 Boats Signal Book	
Blanket in waterproof bag (if rigged as a seaboat)	
*Patch Set 9" x 9"	0479/923-0791
*Patch Set S4	0479/923-0796
*Patch Set S6	0479/923-0797
*Patch Set S7B	0479/923-0798
*Adhesive (6 months shelf life)	0479/225-5449

Additional equipment required for the outboard engine. (These items to be stowed in a separate container).

Spare starting cord
Fuel lead, fuel filter, and fuel lead adaptor if required
Spark plugs (2)
Socket and torque handle for spark plug removal
Pliers
Screwdriver
*Spare propeller, nut, washer and split pin
*Suitable sockets for propeller removal

*Carried in boat at Commanding Officer's discretion.

05008. Gemini Engine - Operating.

The Mariner 40 hp outboard engine is used to power all Geminis except the 3.9m Gemini (small), which is powered by a 20 hp Mariner. The 4.6m Mine clearance Gemini is powered by a 40 hp Mariner specially adapted for the task.

CAUTION

AN OPERATION AND MAINTENANCE MANUAL IS AVAILABLE FOR ALL THESE OUTBOARD ENGINES, AND ALTHOUGH OPERATING PROCEDURES ARE SIMILAR, USERS MUST BE CONVERSANT WITH THE MANUAL APPLICABLE TO THE ENGINE FIT.

When in use the outboard engine must be firmly clamped to the transom; it must also be secured to the transom by a 6mm wire preventer strop. Whenever an engine is being shipped or unshipped it must be secured to a safety line.

a. **Requirement to fit a Propeller Guard**. A propeller guard must be fitted unless the subsequent reduction in the speed and power of the boat is inappropriate to the role in which the boat is operating. For example, no propeller guard is required when the boat is used as a seaboat, or for boarding operations, or when it is necessary to demonstrate the full capabilities of the craft during training courses.

b. **Cut-out Switch.** A 'Kill cord' hooks over the ignition cut-out switch on the front of the powerhead; during normal operations the switch is in the 'Run' position. One end of the cord hooked over the switch; the other end is secured to the leg of the coxswain. By tugging on the cord the switch is pulled to the 'Off' position, the ignition circuit is broken and the engine stops. A spare cord must be readily available.

05009. Gemini Engine - Checks

The coxswain should make the following general checks daily and again on each occasion after the Gemini has been hoisted. Additionally the Operator's manual applicable to the engine fit should be read to ensure any other requirements are met.

a. **Engine Checks**

(1) Outboard motor firmly clamped to the transom and wire retaining strop in position.

(2) The motor tilts freely.

(3) The gear shift lever is in the neutral position.

(4) No obstructions fouling the propeller.

(5) Fuel tanks full and shaken well to mix the contents.

(6) Fuel line connector is correctly snapped on and fuel line is primed.

(7) Kill cord is fitted to the cut-out switch and a spare Kill cord is readily available.

| **05010. Gemini Engine - Starting Procedures**

a. **Pre-start Checks**. Once in the boat the coxswain should carry out the following pre-start checks (these checks are general, the relevant operator's manual for the engine fit should be studied for variations).

(1) Ensure the fuel tank is filled with unleaded gasoline and the correct grade oil (OMD 45) mixed in a gasoline/oil ratio of 50:1.

(2) Shake the fuel tank to ensure the contents are thoroughly mixed and the tank vent is open.

(3) Slide fuel connector on to the motor.

(4) Prime carburettors by squeezing the primer bulb.

(5) Confirm that the gear shift is in neutral.

b. **To Start** (These procedures are general, the relevant manual for the engine fit should studied for variations).

(1) Attach Kill cord to leg.

(2) Set the throttle control to 'Start', and, if the engine is cold, pull out the choke (if fitted).

(3) Pull the starting cord slowly out until resistance is felt, then pull it out firmly and sharply to revolve the flywheel. If necessary, repeat until the engine starts.

c. **Once Started**

(1) Check the flow of cooling water through the tell-tale discharge. (If there is no cooling water, stop the engine immediately).

(2) Reduce the engine speed to idling. An oil slick may be observed - this is normal. Push the choke in (if fitted).

05011. Gemini Engine - Running Procedures and Checks
Once the outboard motor is running the Gemini is ready to be operated.

a. **To Go Ahead**

(1) Move the gear shift lever smoothly and firmly forward to engage ahead gear.

(2) Increase speed by twisting the throttle towards the 'Fast' position.

(3) Do not race the engine, particularly when it is cold.

(4) When under way the coxswain must adjust the speed to suit the sea and wind conditions.

b. **To Go Astern**

(1) Throttle back to the slow position; pause until the engine drops to idling speed, then move the gear lever smoothly and firmly backwards to engage astern gear.

(2) Increase speed by twisting the throttle towards the 'Fast' position until the engine reaches the required speed.

c. **Changing Gear**. Always allow the engine revolutions to drop to idling speed in the neutral position before going on to engage ahead gear from astern gear or vice versa.

d. **Checks While Running**. Periodically check:

(1) Flow of water through the cooling water discharge.

(2) Tightness of the engine clamps on the transom.

(3) Fuel level of the in-use tank.

05012. Gemini Engine - Stopping Procedures

a. **Normal Methods**. There are the following alternative methods of stopping:

(1) Put the engine in neutral and pull off the Kill cord.

(2) Put the engine in neutral, disconnect the fuel line and allow the carburettor to run dry (see note).

Note. *Method 2 should be used when the boat is not going to be used for some time, or when it is required to drain the carburettor of fuel for servicing or safety*.

05013. Gemini Engine - Fault Finding (These checks are general, the relevant operator's manual for the engine fit should studied for variations).

a. **If The Engine Will Not Start**

Symptom	**Remedial Action**
Engine will not turn over	Check gear shift is in neutral.
Engine will not fire	Check Kill cord is attached.
	Check fuel level.
	Check fuel line lead is primed and tank vent is open.
	Check fuel filter is clear.
	Check spark plugs; change if oiled up.

b. **Lack of Power**. Ascertain whether any of the following causes are reducing the power output.

(1) Engine overheating because the cooling system is not operating properly - obstruction at the water intake?

(2) Fuel contamination, water in the fuel?

(3) Fuel pump filter partially blocked?

(4) Plugs dirty?

(5) Damaged propeller or fouling beneath the hull?

(6) Damaged sparking plugs, i.e. insulator cracked?

05014. Gemini Craft - Rigging and Operating as a Seaboat

The 4.65m Gemini may be rigged and used as a seaboat when conditions are suitable and a large carrying capacity is not required. Before it can be used in this role it must be rigged with a towing bridle and a boatrope; details are as follows:

a. **Fitting a Towing Bridle and Boatrope to a GP or Assault Gemini**. (Fig 5-3)

(1) *Bridle Components*

Ring: Mild steel 76mm inside diameter (0263/549-1965).
Bridle legs: 8.5mm braided polyester (0350/120-8692).
Boatrope: 16mm HL Polypropylene (0350/531-6376).
Boatrope Recovery Line, 8mm HL polypropylene (0350/529-9737).
Toggle (as shown in Fig 5-24).
Toggle Release Lanyard: 8mm HL polyethylene (0350/543-0141).

(2) *Fitting and Operation*

(a) Attach the three 8.5mm braided polyester legs to the ring using a round turn and two half hitches. Whip or stitch the fag ends back on the standing part.

(b) Sit the bridle ring on the nose of boat so that it is just facing down the slope of the jumping off board.

(c) Hold the ring and tie off the centre of the three legs to the forward lower carrying handle, using a round turn and two half hitches. Whip or stitch the fag ends back on the standing part.

(d) Centralise the ring, then tie off the port and starboard after legs through the soft eye splices of the forward lifeline points, using a round turn and two half hitches. Continue with the loose end and tie it off through the next soft eye aft, using a round turn and two half hitches. Whip or stich the fag ends back on the standing part.

(e) Splice a 150mm soft eye in one end of the boatrope, then splice in the 8 mm polypropylene close to the eye. This allows the recovery line to also be used when necessary as a steadying line.

(f) The toggle is attached to the polyethylene release lanyard using a soft eye splice. Lead the release lanyard to the sternsheets of the boat through any convenient eyes/buckles on the buoyancy tube, and secure the inboard end to one of the lifting rings on the transom. This enables the Bowman or Coxswain to release the boatrope toggle.

(g) Pass the soft eye of the boatrope up through the bridle ring, insert the toggle.

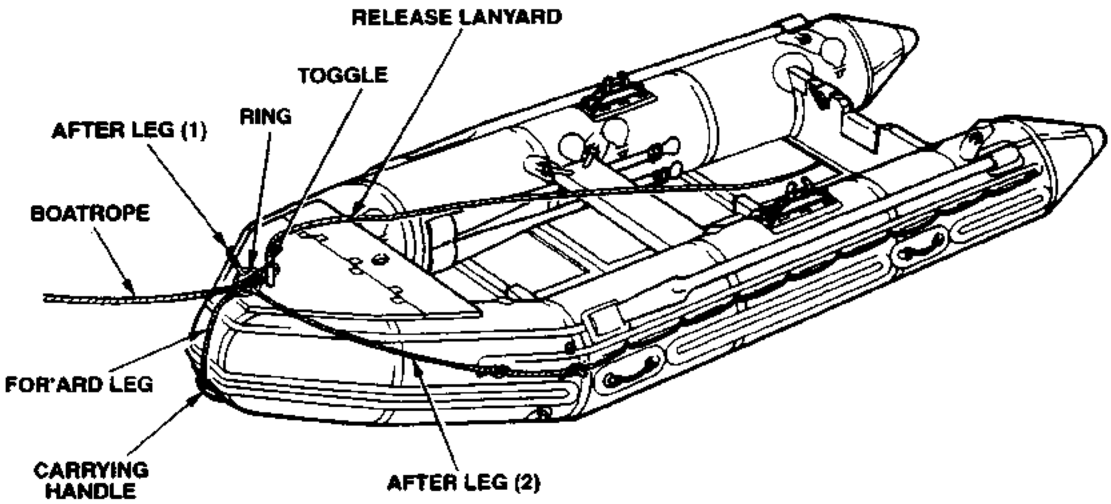


Fig 5-3. Towing Bridle Fitted to a General Purpose Gemini

b. **Fitting a Towing Bridle and Boatrope to a Mine Clearance Gemini**. When a Mine Clearance Gemini is fitted with an aluminium bow fairlead there is no requirement to rig a towing bridle. The boatrope can be led though the fairlead and toggled off as shown in Fig 5-4, allowing the craft to be towed on the boatrope with the bow fairlead taking the strain. Should it be necessary to prepare as a seaboat a Mine Clearance Gemini not fitted with an aluminium bow fairlead, a towing bridle as described for the GP Gemini must be rigged, but because the MC Gemini has no lifelines the after bridle legs must be secured to the two for'ard lifting points, using a round turn and two half hitches. The fag ends should be whipped or stitched back to the standing part.

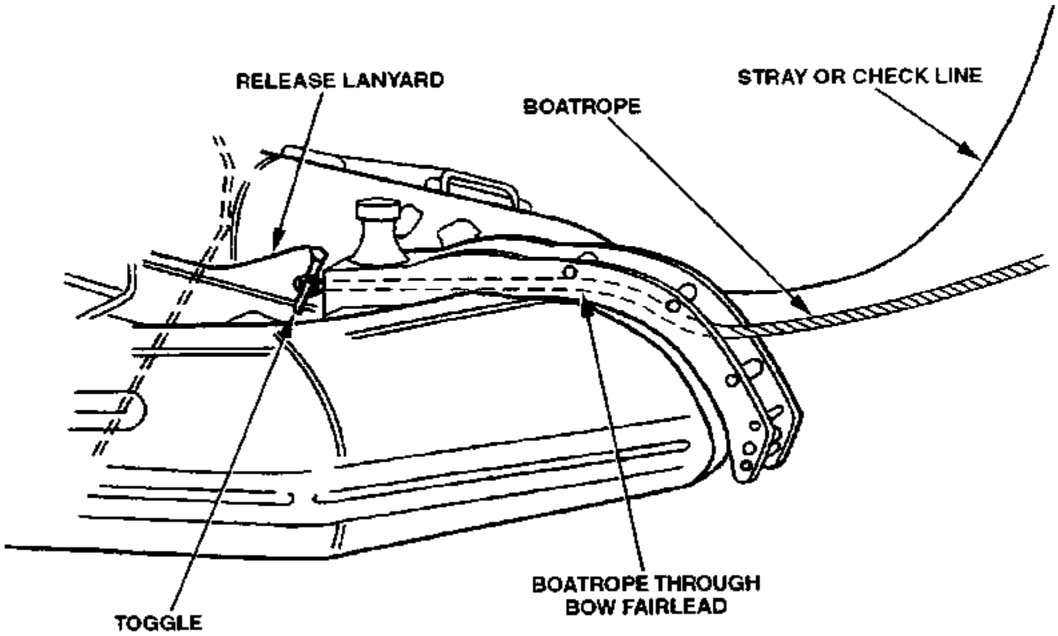


Fig 5-4. Securing a Boatrope to a Mine Clearance Gemini Fitted with a Bow Fairlead

c. **Preparing a Gemini as a Seaboat**. Place the inflated craft, with the engine secured to the transom on deck under the crane or derrick. Secure the webbing slings to the boat, the longer legs going forward to the two D-rings on the outer sides of the buoyancy tubes, the two shorter legs to the slinging points on the transom (if a Mine Contermeasures Gemini is used a six-legged sling must be fitted, in which case the two middle sling legs are attached to the two D-rings amidships on the outer sides of the buoyancy tubes). Toggle the soft eye in the boatrope to the towing bridle (or aluminium bow fairlead) as described earlier, then lead the boatrope outboard of the ship's guardrails and other fittings and secure it to bollards or a cleat sited well for'ard in the ship. The purposes of the boatrope are:

(1) During launching, to keep the boat heading in the same direction as the ship until the RFD hook has slipped.

(2) If necessary, to tow the boat alongside the ship.

(3) During recovery, to hold the boat directly under the davit while it is being hooked on.

The optimum length of the boatrope is that which allows the boat to ride in the water directly under the fall during launching and recovery. Once the ideal position has been established the rope should be marked with bunting at the point at which it is to be turned up. This length must be regularly checked for accuracy, particularly when the boatrope is new and liable to stretch.

d. **Rigging a Gemini Seaboat Derrick**. If a derrick is to be used to launch and recover the craft it should be rigged with a standing wire topping lift, light tackles for the guys, and a 20mm polyester fall. The fall must be fitted with an RFD hook.

e. **Crew and Lowerers**. The crew of a Gemini seaboat consists of a coxswain and a bowman. A Petty Officer or Leading Seaman is in charge of the lowerers and is responsible for the operation of lowering and launching the seaboat. The lowerers should comprise a Winch Driver, two hands to back up on the fall and, depending on the weather conditions, from one to three hands to man each guy.

f. **Launching**. Drills for launching a Gemini rigged as a seaboat are similar to those given for RIBs in paragraph 05097, except during launch and recovery of a Gemini the ship should maintain a speed of between 2 and 5 knots, depending on the prevailing weather conditions and the experience of the crew. In the mine countermeasures Gemini the coxswain and bowman can both be lowered in the boat, but in the other types of Gemini the coxswain only can be lowered in the boat and the bowman must man the craft as soon as the RFD hook has tripped and the engine has been started, but before the boatrope has been slipped. To man the craft the bowman climbs down the pilot ladder. The coxswain swings the engine into the down position whilst the boat is at deck-edge level and before the lowering sequence has commenced. Once the boat is in the water and the RFD has tripped the coxswain starts the engine before embarking the crew. The craft is then moved ahead to take the weight off the boatrope before giving the bowman the order to slip the boatrope.

g. **Handling a Gemini on the Open Sea**. The handling characteristics of a Gemini in sheltered waters will be well understood by a qualified coxswain. However, it should be borne in mind that handling a Gemini on the open sea can present additional difficulties; they are:

(1) *Overturning*. An unladen Gemini is easily overturned when heading into a strong wind or heavy sea, and in such conditions the coxswain and bowman should sit as far forward as possible. The boat must be kept well balanced and speed must be reduced when making a turn.

(2) *Going Alongside*. The most significant factors in bringing a Gemini alongside in the open sea are the considerable drift caused by wind and the effect of the overtaking stern wave. The angle of approach is not too critical and the best line to minimise the effects of sea and wind can therefore be selected. The buoyancy tube acts as a large fender, but the fabric must not be allowed to chafe on abrasive surfaces or be torn by any projections.

h. **Recovery**. Drills for recovering a Gemini rigged as a seaboat are similar to those laid down for RIBs. The boatrope is always used in the first stage of the recovery. After any passengers have disembarked from the craft the bowman ensures the slings are ready for hooking on before he disembarks via the pilot ladder. The ladder is then taken inboard in the ship, the coxswain attaches the RFD to the slings and reports the boat ready for hoisting. The engine is cut and the boat hoisted. At deck-edge level the engine is housed. After hoisting and placing on deck, the Gemini is prepared as a seaboat and a check is made of the seaboat's equipment and the derrick's rigging.

Note. *In a mine countermeasures Gemini both coxswain and bowman can be hoisted in the craft.*

05015. Gemini Craft - Safety Procedures

The following safety procedures are to be observed in Gemini craft on all occasions:

a. Smoking in the boat is never permitted. A **NO SMOKING** notice should be clearly displayed when the boat is 'fuelled up' ready for use. When the craft is not required for use fuel tanks must be out of the boat and stowed in a designated stowage.

b. The painter must be 0.6 metres shorter than the length of the boat in order not to risk fouling the propeller. It is not to be used as a steadying line for people embarked.

c. Outboard motors must be secured with a safety line when being moved or placed in the boat. Whenever a motor is shipped it must be secured to the transom by a 6 mm SWR safety strop.

d. In strong winds the boat should be kept well balanced and speed should be reduced when making a turn.

e. Petrol should be stowed as far forward in the boat as possible.

f. Gemini craft should not be used for painting operations. If paint is accidentally spilled on any part it is to be removed immediately with a clean rag. Solvents are not to be used.

g. The side manned by the coxswain in a Gemini is optional. However, in a Seaboat launch or recovery he is best seated on the outboard side and adjacent to the toggle release lanyard.

05016. Heavy Duty Medium Inflatable Boat (HD MIB)Mk 2 - Introduction

a. **The Heavy Duty Medium Inflatable Boat (Fig 5-5)** has been developed as a replacement for the Gemini Boat, which has given excellent service to the Royal Navy for many years. The HD MIB consists of an inflatable U-shaped tube, manufactured in a proofed fabric which forms the sides and bow, the bow being double skinned on the bottom quadrant. A transom board of marine plywood, on which the engine is mounted, is bonded to the tube and floor panel. Like the Gemini the buoyancy tube is divided into five compartments, plus keel, each provided with a combined **inflation/deflation valve** and a safety **top-up-valve.** The craft is designed so that it will remain afloat when fully loaded if any two compartments are deflated. A roll away slatted deck with three thrust boards forward forms a semi-rigid deck, below which is the inflatable keel and fabric floor assembly. The HD MIB may be equipped with a long-shafted Mariner 40 HP min mag outboard engine for use in the mine clearance role or a Yanmar D27 (diesel) outboard engine for general use. By fitting the appropriate equipment the General Service HD MIB is capable of fulfilling the following roles:

(1) Mine clearance.

(2) Clearance diving.

(3) General purpose diving boat for bottom search, deep diving, etc.

(4) Patrol and assault.

(5) Rescue at sea.

(6) Communications at sea.

(7) Boom defence maintenance.

(8) General purpose sea boat.

b. **Seaworthiness.** Once at sea, the coxswain must continuously assess how wind and sea are affecting the performance of the boat. He must be prepared to reduce the speed and adjust the rate of turn to suit the weather conditions and the sea keeping characteristics of the boat. In rough weather a HD MIB can be driven fast towards and away from the direction of the waves, provided good judgment is exercised and the boat is not allowed to slam dangerously. Considerable care must be taken if the boat is turned across the sea as exaggerated corkscrewing may occur at speed and this may lead to capsizing. If caught in very bad weather, speed must be reduced until the boat comes off the plane. This can be extremely uncomfortable and should only be used as a last resort should the boat begin to slam exceptionally hard.

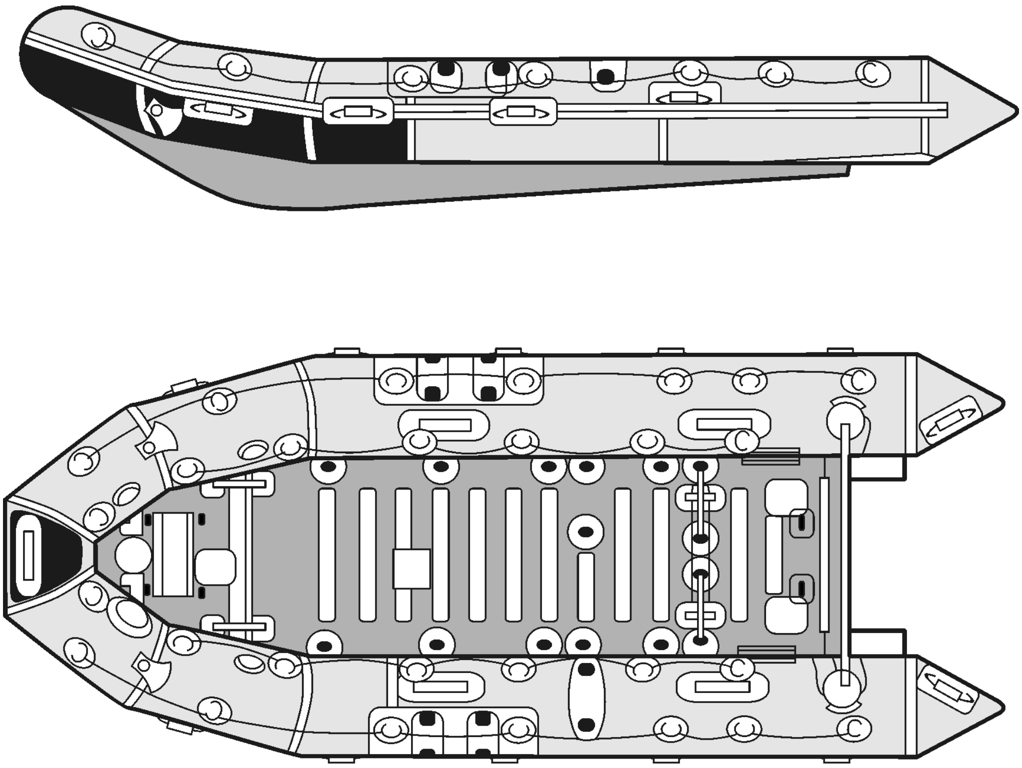
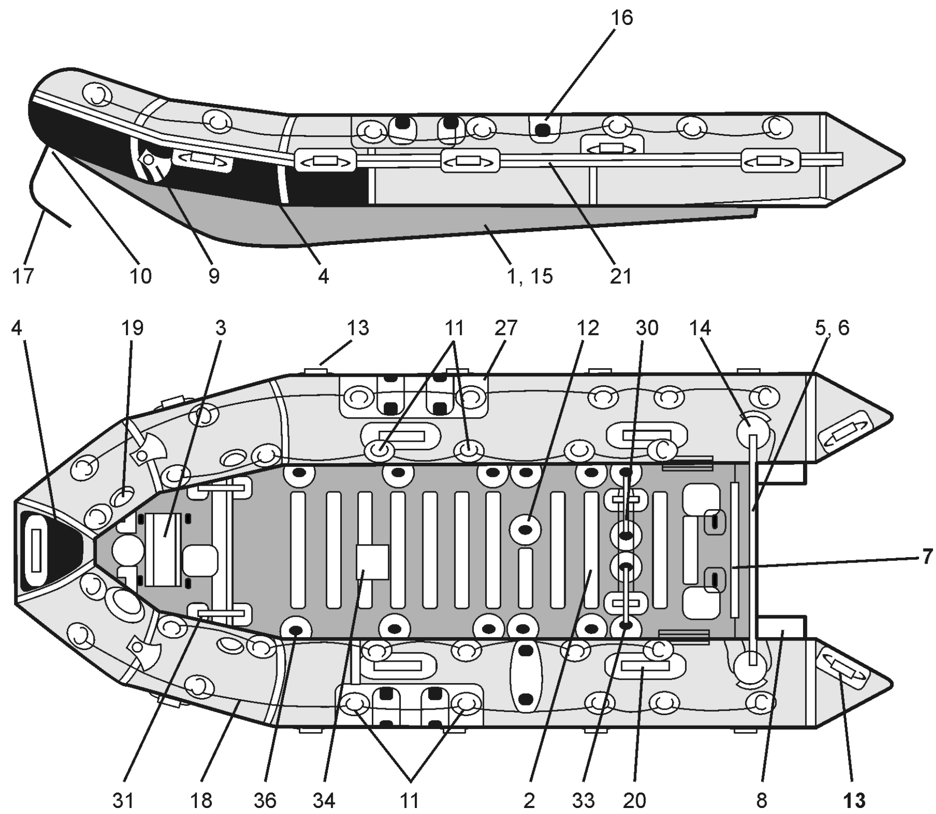


Fig 5-5. Medium Inflatable Boat

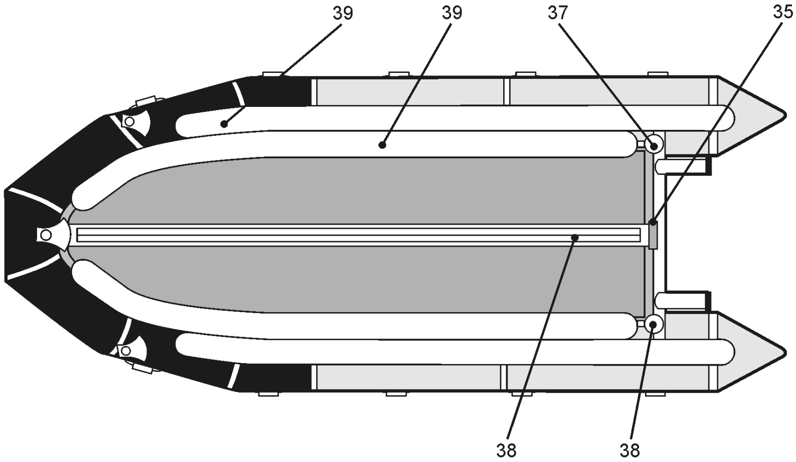
05017. HD MIB - Specification.

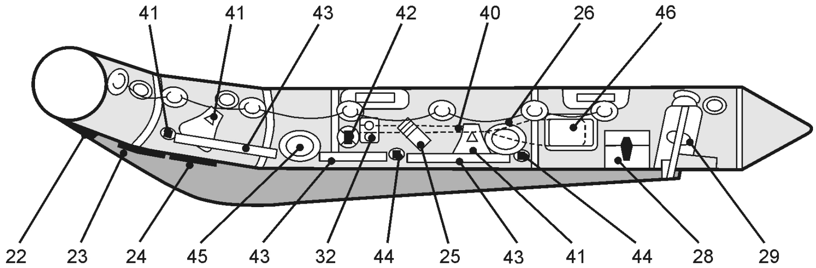
The HD MIB General Service Naval stores number 1940-99-169-0738 is a fully inflatable rubber boat with a rigid plywood transom. The boat is packed away in its canvas valise and inflated as and when required, normally by ships diving teams or as back up boarding boats on Type 42 Destroyers. **BR 7909 Inflatable Raiding Craft Mk2 and Heavy Duty Medium Inflatable Boat - General Service** is the authoritative publication for this craft.



Item No	Avon Part No	Description
1	741246	Fabric Floor
2	741251	Roll up Slatted Deck
3	740497	Forward Floor Cover
4	700718	Double Skin Bow
5	420027	Transom Short Shaft
6	420116	Transom Long Shaft
7	420028	Transom Batten
8	740474	Drain Sock
9	740460	Towing Patch
10	740461	Painter Patch
11	740449	Lifeline Patch (& Jasons Cradle Attachment)
12	740449	Internal Tie Off Patch (Kit)
13	740450	Carrying Handle
14	740462	Transom Support Patch
15	741244	Inflatable Keel
16	741250	Compass Retention Patch
17	140005	Painter Line
18	144643	Lifeline
19	300010	B5 Manual Inflation Tube
20	708632	Letter Box Patch
21	170191	Rubbing Strake

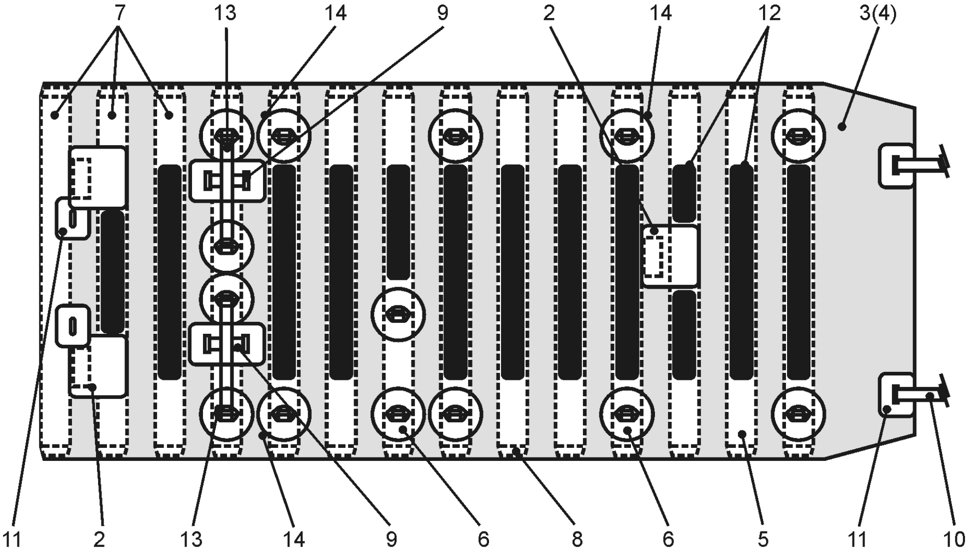
Fig 5-6. Boats Fittings, Parts List 1

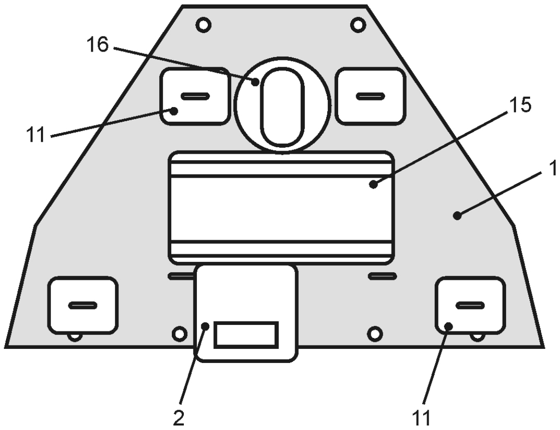




Item No	Avon Part No	Description
22	741248	Deltaboard
23	740484	Forward Thrustboard
24	741247	Stern Thrustboard
25	740427	‘A’ Clamp Pocket
26	144643	Internal Lifeline
27	700725	Bottle Double Skin
28	740465	Stern Painter Line Pocket
29	850002	‘U’ Bolt
30	740441	Stern Webbing Strap
31	740440	Bow Webbing Strap
32	708632	Letter Box patch
33	744507	Fuel tank Strap
34	740475	Flap Assembly
35	230078	Protection Plate S.S.
36	740049	‘D’ Ring Patch
37	740904	Transom Corner Port
38	740904	Transom Corner Starboard
39	090812	Anti Chafe Strip
40	460009	Paddle
41	740473	Davit Lift Patch
42	190072	Becket (Canopy)
43	740913	Conduit (H.P. Hoses)
44	320119	H.P. Valve (Blank)
45	313599	A3 Pressure Relief Valve
46	300010	B5 Manual Inflation Valve

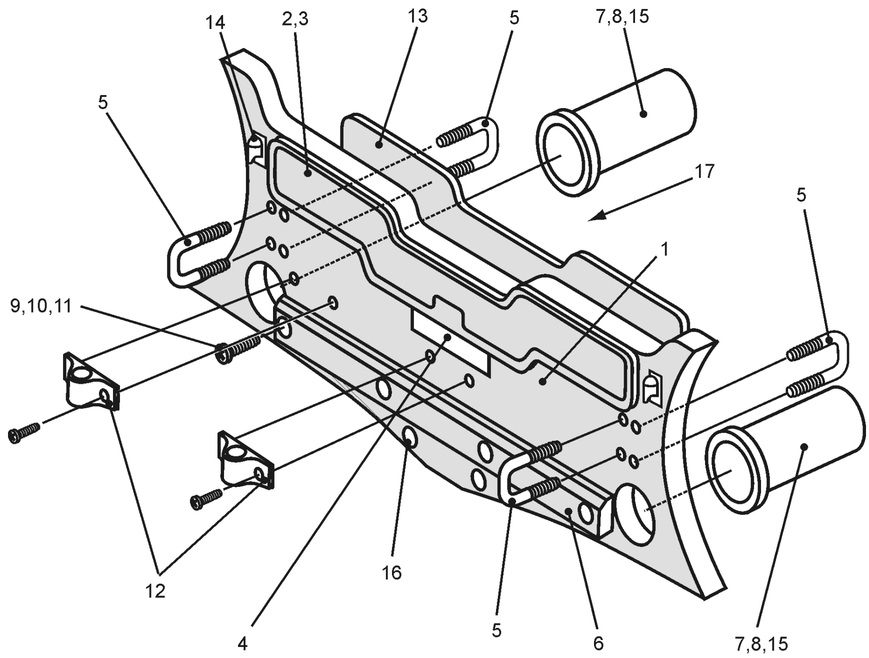
Fig 5-7. Boat Fittings. Parts List 2





Item No	Avon Part No	Description
1	740479	Bow Area Cover
2	740475	Flap Assembly
3	741251	Main Deck Assembly C/W Slats
4	740486	Main Deck Assembly Without Slats
5	440002	Deck Slats
6	740449	'D' Ring Patch
7	440001	Deck Slat (Reinforced)
8	204647	Deck Slat End Cap
9	740441	Stern Internal Deck Strap
10	740440	Bow Internal deck Strap
11	707778	Patch Webbing Hole
12	090048	Non Slip Panels
13	744507	Fuel tank Strap
14		Reinforced Hole for H.P. Air Lines
15		Air Cylinder Stowage
16	707780	Reinforced hole for Keel Inflation Valve

Fig 5-8. Deck Parts List



Item	Avon Part No	Description
1	420116	Transom
2	210002	Motor Clamp Plate
3	604058	Fixing Screw
4	970056	Capacity Plate
5	850002	‘U’ Bolt
6	420028	Transom Batten
7	740474	Drain Sock
8	603174	Self Tapping Screw No 12 x 3/4"
9	613357	Bolt M10 x 70
10	613357	Nut
11	623231	Washer
12	230071	Navigation Light Support
13	420026	Sacrificial Transom Plate
14 `	204229	Jam Cleats
15	202103	Bobble
16	202003	Drain Plug, Self Bailer
17	192004	Bung, Self Bailer

Fig 5-9. Transom Assembly

a. **Environmental Conditions**

Maximum Sea State	4
Maximum Wind Force	5
Operating Temperatures	-30 to + 45°C

b. **Dimensions**

Inflated

Length	5.20m
Beam	2.18m
Tube diameter	0.57m
Maximum engine size	1 x 40 HP (30 kW)

Stowed in Valise

Length	1.60m
Breadth	0.78m
Height	0.50m

c. **Maximum Hoisting Weight - 700kg**

Weight of boat with engine & fuel	393 kg(engine weight 94kg)
Crew of two	150 kg
Boats Bag	10 kg
Total weight	553kg

d. **Boat Assembly Time**

Manual inflation 10 mins
HP Air inflation 1 min approx.

e. **Performance**

Speed	10-18 knots
Capacity	12 (including crew)
Crew	2

05018. HD MIB - Crewing

The HD MIB carries a crew of two: a coxswain and bowman. The coxswain of the HD MIB must have completed a Gemini coxswains course at an authorised training school and, if handling a HD MIB as a seaboat or crash boat, he must have completed onboard training and be deemed and certified competent by the Seamanship Training Officer before being allowed to coxswain the craft unsupervised. He must have a complete working knowledge of his craft and its engine, and be capable of rectifying minor engine defects. The bowman must have completed onboard training to a level where he is capable of taking over from the coxswain, re-starting the engine, manoeuvring the boat safely to recover a man overboard and taking the boat alongside. Dress in the HD MIB must conform to that given for RIBs.

05019. HD MIB - Assembly

The HD MIB is designed for simplicity of assembly. When the boat is initially assembled, everything is a tight fit. This is normal, as during the first few hours of service the boat is inclined to stretch a little and the fabric will become more flexible. After a small amount of use the boat will be easier to assemble, to use and to pack into its valise. The boat is to be manually inflated in the following manner:

a. Open the valise by releasing the quick release buckles.

b. The valise is now free to open, allowing the boat to be unrolled, exposing the manual inflation valves.

c. Inflate the boat through the “B5" valves in the buoyancy tubes and the “A7" valve in the keel, using the inflate/deflate bellows.

d. The boat must be inflated to full working pressure for optimum performance. This pressure of 4 psi in the buoyancy tubes and 6 psi in the keel, is reached when air can be heard escaping from the relief valves.

05020. **HD MIB General Service Packing Details**

Stage 1. With the tubes deflated but not “sucked out”, pull the port and starboard buoyancy tubes inboard against the sides of the deck.	**Stage 2.** Fold the cone ends of the buoyancy tube to the same width as the transom and inboard to lay flat on the transom face.

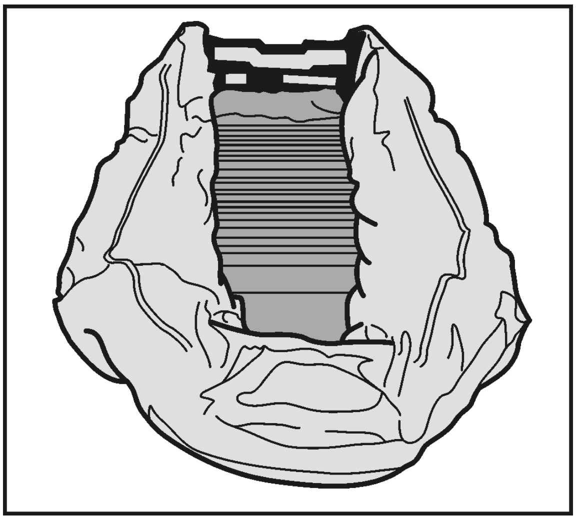
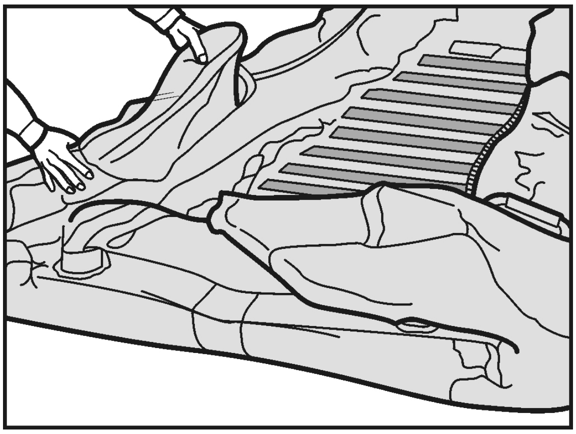

	

Fig 5-10	**Fig 5-11**

Stage 3. With the boat now folded, extract any remaining air from the stern chambers using the bellows and ensure that the valve diaphragms are in the reset positions and caps are correctly fitted.

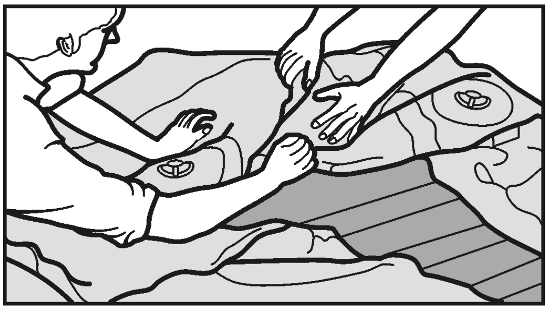


Fig 5-12

Stage 4. Roll the folded boat from the transom forward. Roll the stern squarely and tightly towards the bow (twice). Extract the air from the bow chambers and keel.

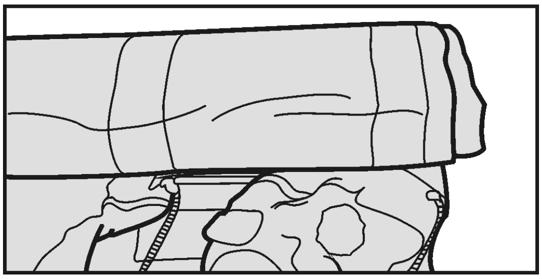


Fig 5-13

Stage 5. Fold the bow towards the stern using the forward edge of the stern thrustboard as a fold line.

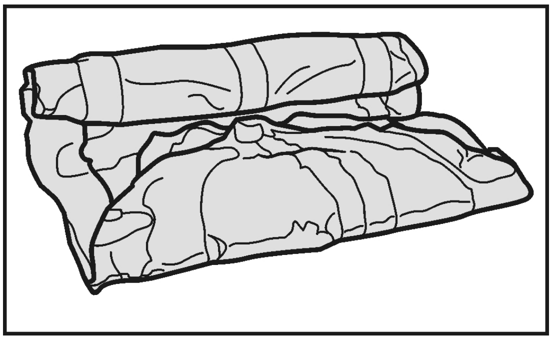


Fig 5-14

Stage 6. Fold the bow section on top of the pack.

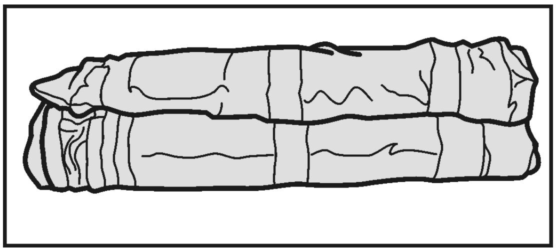


Fig 5-15

Stage 7. Place the boat into the valise. The pack must fill the full area of the valise and sit squarely.

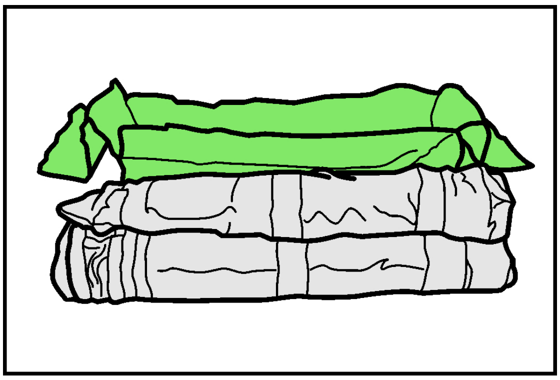


Fig 5-16

Stage 8. Fold the straps of the valise over the pack and secure the quick-release buckles. Fold the side flaps of the valise over and secure the quick-release buckles.

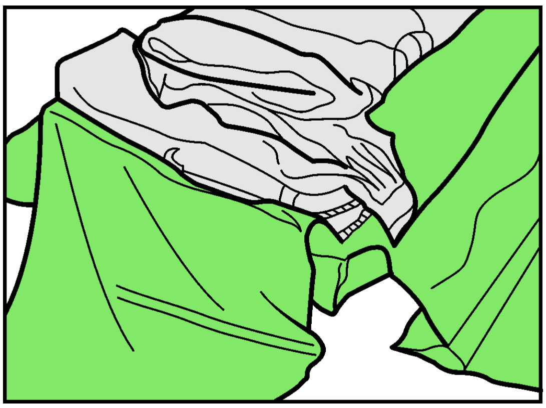


Fig 5-17

05021. HD MIB - Lighting Mast and Assembly

a. A five light 2400mm long mast (Fig 5-18) is fitted to the General Service HD MIB which is assembled from three sections: the mounting clamp, the lower mast section, fitted with a locating pintle and clamp arrangement for securing it to a locating block on the transom, and the upper mast section. The mast is to be assembled by mating the three sections together and securing them with Protex over-centre fastening devices as follows:

(1) Fit the upper and lower sections together using the ‘over-centre’ latch.

(2) Secure the lower section to the mounting clamp using the ‘over-centre’ latch.

(3) Place the mast on the transom, positioning the mast spigot on the transom location. For single engine installations the mast must be fitted on the starboard location, and for twin engine installations the mast must be fitted on the central location.

(4) Secure the mast firmly in position with the hand clamp.

(5) Connect the waterproof plugs and sockets between the mast sections and connect the lower plug to the battery box.

Note 1. *Care must be taken with the plugs and sockets to ensure that mating surfaces and threads are kept clear of sand and grit.*

Note 2. *A radar reflector can be fitted at the top of the mast. An internally threaded aluminium insert welded into the top section receives an M12 bolt fitted to the reflector.*

b. The mast has a three-position, single pole, centre-off switch to select the navigation lights (switch up) and diving lights (switch down). Two in-line, double pole plugs and sockets connect the middle and upper mast sections, to provide the electrical supply to the upper lights. A cable from the switch box terminates in a double-pole plug that connects to the battery box socket. The centre and top section of the mast are electrically connected by two double pole connectors, one in each circuit. All light fittings are Aqua Signal 25 Series and are fitted to the mast as detailed below.

(1) **Navigation Lights.** The Masthead Light is all round white, mounted 360mm from the top of the mast and a Bicolour Light, red and green, mounted approximately half way up the mast.

(2) **Diving Lights.** Diving Lights are two all round red, mounted one at the top of the mast and one approximately 660mm above the transom, and one all round white, 1455mm above the transom. Navigation and Diving Lights all face forward.

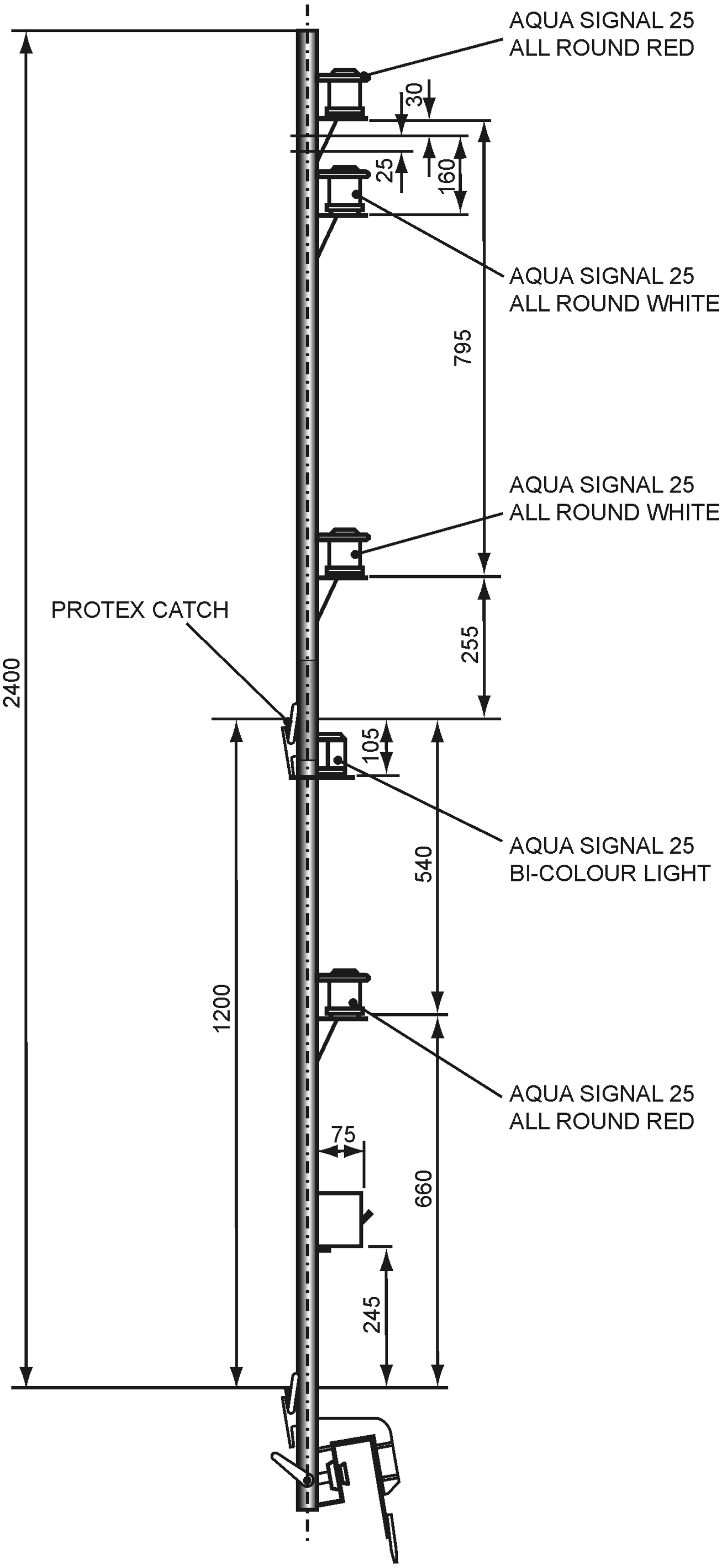
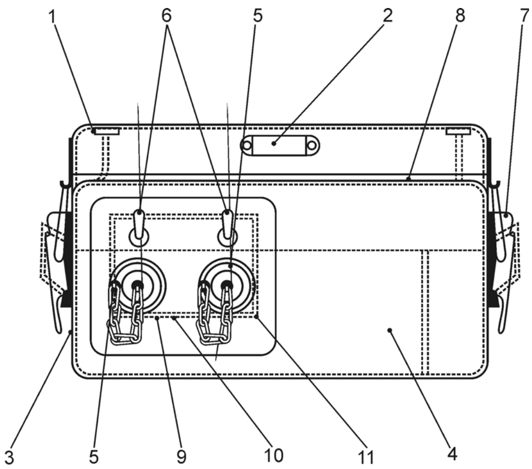


Fig 5-18. Light Mast, HD MIB - General Service

05022. HD MIB - Battery Box

The battery box, which is manufactured from high impact plastic, holds a 12v, 55Ah battery packed in closed-cell PVC foam. Fitted to the front of the box are two 12 A Niphan sockets which mate with the plugs on the mast lighting cable. Adjacent to the sockets are two 20 A waterproof toggle switches which switch the battery power. The lid is retained by two Protex catches and is hinged at the rear. Two webbing handles are provided for lifting and carrying the box which are secured on the boat by two strap locators fitted to the front and rear of the lid. At the rear of the sockets and switches is a small waterproof enclosure on top of which are mounted two fuse holders. Two fuse holders which carry spare fuses are also enclosed in the battery box.



Item No	Description
1	Lid seal
2	Strap Locator
3	Battery Box
4	Foam Packing
5	Niphan Socket
6	Toggle switch
7	Protex Catch
8	Battery AC Delco-30-55
9	Electrical Enclosure
10	Fuse Holder
11	Spare Fuse Holder
	Spare Fuse

Fig 5-19. Battery Box

05023. HD MIB - Boat Rope Towing Arrangement

Like the Gemini and Searider when the HD MIB is operated as a seaboat the boat must be fitted with a boatrope towing bridle to provide a means of attachment to the boatrope. Details of the bridle, its components and fitting instructions are similar to those given for the 6.5m RIB, with the following exceptions:

a. The HD MIB towing bridle consists of a stainless steel ring to which are attached three lengths of 2m x 14mm dia, 3 strand, black nylon rope. Each rope is soft spliced to the ring with a 75mm long eye into a 120mm long splice. The second end of each rope is similarly eye spliced to a karabiner hook with a screw down collar locking device, for securing the central main bridle leg to the “D” ring on the stern thrustboard and the port and starboard bridles to the tow patches fitted on top of the tube as shown in Fig 5-20.

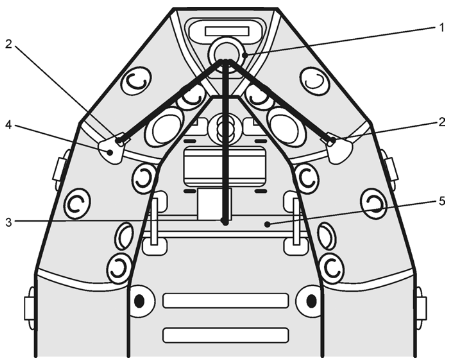


Fig 5-20. Towing bridle Arrangement

b. When towing with the HD MIB, the towline is attached to a bridle fitted to the two U bolts that face outboard on the transom.

Note. *A bow fairlead can be fitted to the HD MIB (similar to the Gemini shown in Fig 5-4) when used in the Mine Clearance Role. It has three arms fitted with rollers and a winch attached to a fabricated section which is fitted to the bow of the boat. Further details will be found in Category three of BR 7909.*

05024. HD MIB - Lifting Arrangements

a. **Lifting Points.** The HD MIB lifting points are: two stainless steel U bolts, mounted on the transom and facing inboard, one lifting patch port and starboard midships and one lifting patch port and starboard forward are provided as attachments for a six legged sling.

b. **Lifting Slings.** The HD MIB six legged lifting sling consists of an oval forged steel ring which carries three mild steel slotted shackle plates fitted to the ring before closure. Each shackle plate carries two 50mm wide webbing straps, each pair indelibly stencilled **FORWARD LEG, MID LEG OR AFT LEG.** Each strap terminates in a single "snap-on" hook. The lifting sling strap lengths for use with the HD MIB using a diesel engine, differ from those used when a gasoline engine is fitted. The two lifting slings are not interchangeable, each must only be used for its designated purpose. If a boat is to be hoisted when a gasoline engine is fitted then the sling used must be coloured **Drab Green.** When a diesel engine is fitted a **Bright Orange** sling is used. Lengths of sling legs are as follows.

Boat Type	**Fwd Leg**	**Middle Leg**	**After Leg**
Standard (gasoline)	1.913m	1.113m	1.523m
Diesel	2.31m	1.40m	1.50m

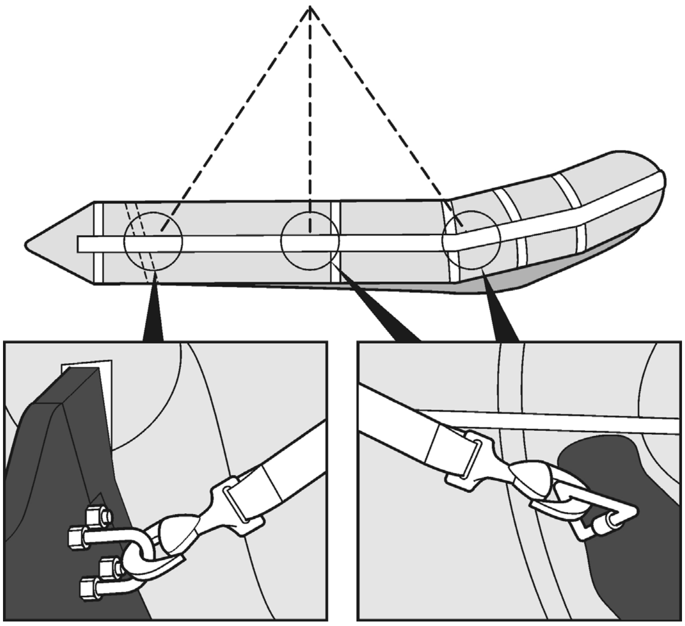


Fig 5-21. Hoisting the Boat.

Each lifting sling has a stainless steel chain tag engraved or stamped containing the following details:

(1) Safe Working Load
SWL = 0.70 tonnes.

(2) Test Load: 1.40 tonnes.

(3) Test Certificate Serial Number.

(4) Date of Test.

(5) Test Authority: eg Spanset Ltd.

Note. *Should no chain tag be fitted, or if more than 12 months has passed since the last proof test, then the appliance is considered unserviceable and must not be used.*

05025. HD MIB - Fuel

Diesel fuel used for the Yanmar (D27) outboard engine is to be contained in 5 gallon **Flexible Fuel Tanks** NSN 0479-99-642-2317. These tanks are designed to be attached to the inside of the boat as shown in Fig 5-22. This method of stowage ensures that the bag maintains its shape and reduces the risk of damage. When not in use the bayonet fuel connector should always have the protection plug fitted to prevent damage to the bayonet socket.
Type 23 Frigates that have been using the HD MIB for some considerable time will continue to use the two 5 gallon Petrol Fuel cans designated “DIESEL” until further notice.

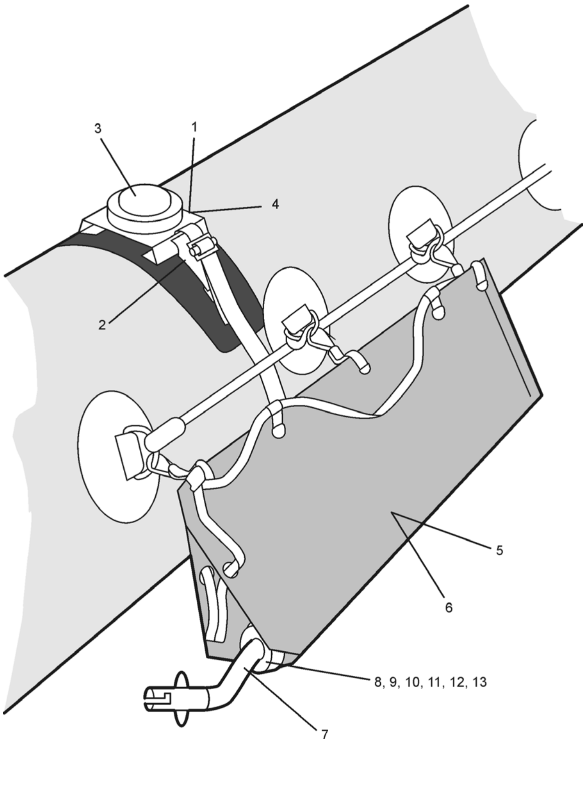


Fig 5-22. The Flexible Fuel Tank.

05026. **HD MIB - Compass**.

The HD MIB can, when required be fitted with a compass. This is mounted on a bracket and secured to the buoyancy tube.

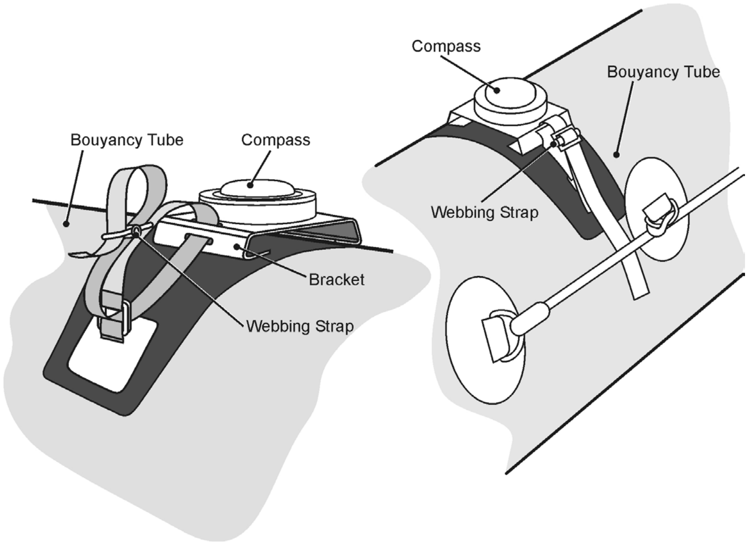


Fig 5-23. Fitting The Compass

05027. HD MIB - Operating Checks and Procedures

The Following checks are to be made at first deployment following removal from the valise and at regular intervals if the boat is to remain inflated and rigged for any length of time to ensure availability for immediate use.

a. Inspect the hull to ensure that it is free from abrasions or damage to the fabric.

b. Ensure that the buoyancy chambers are completely inflated to the correct working pressure and that the valves, including the caps and valve inserts are tightened correctly to prevent air loss.

c. Ensure that the grab line fixings are secure.

d. Check that all shackles are in place and secure: pin heads must face away from inflation chambers.

e. The outboard engine is to be checked to ensure it is firmly clamped to the transom and secured by a 6mm wire retaining strop. The propeller guard is to be inspected for damage and security.

Notes:

1. Avoid leaving a fully inflated boat in direct sunlight as this can cause premature wear of the valves.

2. Do not use the carrying handles for towing or mooring the boat. The "D" rings specifically designed should be used.

3. Do not inflate the boat using an air line without pressure reduction equipment.

05028. HD MIB - Maintenance

a. **HD MIB.** Maintenance schedules have been prepared for the HD MIB, these can be found in Category 5 of BR 7909, the authoritative publication for this type of boat.

b. **Yanmar D27 engine.** There are no books of Reference for this type of outboard engine, however, Manufacturers Workshop Manuals and Parts Books may be ordered using the engine type correct description of, Yanmar D27AXLE Build standard 0183, NSN 0482-99-957-4638.

05029. HD MIB - Boats Bag and other Onboard Equipment

For normal operations the stores and equipment to be carried in the boat is the same as that given for the Gemini with the addition of the battery.

05030. HD MIB - Launch and Recovery Procedures

Drills for launching and recovering a HD MIB when rigged as a seaboat are similar to those given for RIBs in paragraph 05097.

05031. Rigid Inflatable Boats (RIBs) - Introduction

Topweight is a key factor in warships. In the mid 1970s an urgent need to reduce topweight caused a critical review to be made of the boats borne in HM ships. Conventional boats with GRP or wooden hulls slung on twin davits contributed a considerable amount to the topweight of a ship, so it was decided to try to find a lighter design of ship's boat which could be hoisted on a lighter type of davit or crane. The Gemini inflatable craft, which the Royal Navy had considerable experience in operating, was considered not to have sufficient strength or directional stability to provide a satisfactory replacement for standard ship's boats, but a development of the Gemini - the Rigid Inflatable Boat - seemed to possess the lightness and seakeeping qualities which were required; this type of boat had been used as a small lifeboat by the RNLI for several years. The 5.4m Searider was introduced into service with the Offshore Patrol Vessels and ships of the Fishery Protection Squadron in the late seventies. This craft proved its versatility and seaworthiness in operations around the world. Since then another RIB, the 6.5m Pacific, has been introduced to replace some of the older types of ship's boat, and a 4.7m version of the Searider 5.4m Searider has been procured for fitting in ships with insufficient available deck space to accommodate either a 5.4m Sea Rider or 6.5m Pacific.

05032. RIBs - Operating Features

As already mentioned the key factor hastening the introduction of the RIB as a ship's boat was the saving in ship's topweight, but this type of craft has other advantages. The RIB is fast and seaworthy, it can operate in worse sea conditions than the Motor Whaler and can reach the scene of an incident more quickly than any conventional ship's boat. The single-fall davit or hydraulic crane is simple to operate and lowering and recovery is quick and efficient. The coxswain has a good all-round view from a powerful and easily manoeuvred boat. These features make the RIB an excellent seaboat. The drawbacks of the Rigid Inflatable design are that this type of boat has a smaller carrying capacity than a traditional boat and provides little protection from wind and spray. However the reduced carrying capacity is compensated for by the RIB's high speed. The RIB is not a comfortable means of transport between ship and shore; this disadvantage of RIB operation must be recognised and passengers must be properly briefed and equipped before embarking.

05033. RIBs - General Construction

The term Rigid Inflatable Boat is derived from the manner of its construction. RIBs are built with a ‹V' shaped hull surmounted by an inflatable U-collar to form the gunwale. They have a wide square transom suitably strengthened to provide a mounting for an outboard motor in the smaller craft or a flexible stern drive unit in the 6.5m RIB. RIBs are designed for speed and stability. All non-essentials have been dispensed with: there are no canopies or cabins, the controls are simple and there is no rudder. All RIBs have a high power-to-weight ratio and a planing type of hull. They start to plane at about 15 knots and once on the plane will achieve a considerably higher top speed, depending on the type of RIB, weather and load.

05034. RIBs - Design Features

a. **Hull**. The deep 'V' hull of a RIB is derived from offshore racing boat designs. It provides a very stable platform when the boat is stopped and draws sufficient depth under water to give reasonable control at slow speed in a wind. The shape of the bow deflects the force of the waves when the boat is planing; this reduces deceleration and slamming in a rough sea. The buoyancy tube, which adds to the freeboard of the hull, produces lift while the RIB is heeling inwards when turning under power. The combination of lift from the buoyancy tube and the inherent stability in the hull design makes the RIB safe to turn at high speed; there is little danger of capsizing. The bonding of the buoyancy tube to the hull is very strong as it is subjected to high stresses at the sides and in the bow.

b. **Propulsion**. The smaller types of RIB are currently propelled by gasoline driven outboard motors. This type of fuel is a fire and explosion hazard so a 'No Smoking' sign must be displayed adjacent to the boat when fuel is embarked: the portable fuel tanks must be removed from the boat and stowed in the designated gasoline tank stowage when the boat is not being used as a seaboat or operated in harbour. The 6.5m RIB is fitted with an internally mounted diesel engine driving a flexible propulsion unit mounted on the transom.

c. **Control**. The coxswain's control position in a RIB is astride the jockey seat at the console amidships. The simple controls consist of a steering wheel and a combined gearshift/throttle lever. The number of instruments and switches on the control panel vary depending upon the type of engine and the electrical installation fitted in the boat, but are sufficient to allow the coxswain to monitor the performance of his engine when under way. Battery power is used for starting the RIB engines and electrical outlets are provided for navigation lights, the radio and the signalling lamp.

05035. RIBs - Crewing

The minimum crew for a RIB is two: a coxswain and a crewman, but the 6.5m RIB is more easily worked with a crew of three. The coxswain of a RIB must have completed the appropriate RIB coxswain course at an authorised training school and, if handling a RIB as a seaboat or crash boat, he must have completed onboard training and be deemed and certified competent by the Seamanship Training Officer. He must have a complete working knowledge of his boat, its engine and its electrical system, and be capable of rectifying minor defects. Crew members other than the coxswain must have received onboard training to a level where they are capable of taking over from the coxswain, re-starting the engine, manoeuvring the boat safely to recover a man overboard and taking the boat alongside. Because all RIBs bounce and slam when under way, the crew must be physically fit and have the necessary stamina and endurance needed to handle and man the boat effectively for several hours. All crew members are to be first-aid trained to Level 1 by the Senior Medical Branch rating ashore/afloat every 3 months, and also be familiar with casualty handling procedures. Common sense dictates that the judgement of the crew of any boat must not be affected by alcohol; this is particularly true with regard to RIBs, where fast reflexes are required to handle these high performance craft. Therefore personnel called upon, or liable to be called upon, to crew a RIB must not consume alcohol for a period of at least 8 hours before the event.

05036. RIBs - Dress and Safety

a. RIBs are fast and provide no shelter from wind or sea; this adds considerably to the dangers of exposure or of being accidentally thrown overboard in a rough sea or during a violent manoeuvre. To minimise this possibility all crew and passengers must use toe straps, although this requirement can be relaxed for passengers in the following circumstances:

(1) When 6.5m RIBs are fitted with propeller guards during diving operations.

(2) In an emergency.

(3) During supervised operational sea training.

On occasions when there are insufficient toe straps, handholds must be used and personnel must not sit on the inflatable collar for'ard of the coxswains console.

b. **Winchmans Suit/Multifab**. To avoid the danger of hypothermia or drowning if personnel are thrown out of the boat, the crew and passengers must be dressed appropriately. Crew members are to wear a Winchman's suit, Immersion suit or similar garment with appropriate undergarments to suit the prevailing conditions. This is mandatory when operating in water temperatures up to and including 15°C, but is left to the discretion of the Commanding Officer in water temperatures between 16°C and 20°C, giving due consideration to the nature of the task and the risk of cooling from wind-chill, spray and wave splash. Above 20°C there are very few circumstances in which the wearing of such clothing is of value, and the penalties from overheating are likely to outweigh any benefits. A hazardous duty lifejacket and DMS boots are to be worn. Properly sheathed seaman's knives are to be carried. When personnel from other nations or navies are being carried as passengers they must conform to the dress requirements outlined above. They must carry a properly sheathed seaman's knife.

c. **Lifejackets for Passengers.** All passengers must be instructed in the operation of lifejackets and must always wear either a hazardous duty lifejacket or a landing craft lifejacket when embarked. Armed troops and armed boarding parties must wear the appropriate lifejacket commensurate with the weight of their equipment, and the task (see para 07042). Ties and belts should be loosened and collars unbuttoned.

d. **Marine Safety Helmet.** Marine Safety Helmets (MSH) are designed for cranium protection and are to be worn during launch, recovery and transiting in RIBS, Gemini's Mib's and small craft operation. It is supplied with foam earplugs that are to remain inserted in the helmet at all times. However, earplugs can be removed during boarding operations to aid hearing when the craft is closing the target vessel but are to be replaced for transit back to the parent ship. Specialist comms fitted boats will be supplied with the MSH with the appropriate comms fitted to the helmet. Armed boat personal ear defenders (NSN 6515-99-1226-3570) are to be worn in addition to the comms fitted helmet. The wearing of the helmet is mandatory whilst the craft is underway. However, this rule can be relaxed at the discretion of the craft's Coxn if:

(1) The craft is in a waiting station during boarding operations (motionless).

(2) The craft is motionless.

(3) At a dive site conducting diving ops.

(4) In extreme hot weather conditions if the craft is loitering (2 - 3 knots) in the patrol area for long periods of time to prevent the wearer from overheating, however:

(a) If the craft is called into a chase senario then the helmet is to be replaced immediately before the craft is powered up onto the plane.

(b) At no time is the helmet to be relaxed for transits or long insertions into rivers or estuaries.

(c) The coxswain is to risk assess the likelyhood of head injury against heat exhaustion in each instance.

Note. *The coxswain must, whenever practicable, inform all personnel in the boat of imminent course alterations or manoeuvres.*

| **05037. RIBs - Seaworthiness**

RIBs have excellent seakeeping qualities and perform well in bad weather. They are extremely stable and unlikely to capsize, but certain precautions must be taken in handling RIBs in bad weather. A RIB should not be driven at high speed into a steep head sea, instead it should be steered on a diagonal course or series of courses across the direction of the waves. In a strong wind, a RIB should not be turned tightly at high speed across the wind, instead speed should be reduced before entering the turn and a gentle turn made. If the waves are short and steep, speed must be adjusted to prevent the RIB slamming too hard; in some circumstances this may require the boat to come off the plane. Coxswains must appreciate right from the beginning that RIBs carry very little headway and are almost totally dependent upon their engines for manoeuvring. In order to be able to handle a RIB well, a coxswain must acquire a deft and precise 'feel' for the controls so that he knows, without looking down, the direction and power that he is applying from the propulsion. A RIB is very responsive and can be manoeuvred with great accuracy while its engine is running.

| **05038. RIBs - Requirement to Fit Radar Reflectors**

To enhance the radar signature of RIBs operating as seaboats (or whenever required), radar reflectors are provided; one reflector and mounting kit per RIB. The pattern numbers are as follows:

|	Radar Relector	0480-225-7922	EA	P
|	Mounting Bracket	0480-490-4034	EA	P

The same size reflector is supplied for each type of RIB, with a mounting bracket capable of adaption to each RIB. Detailed fitting instructions are provided with each reflector. Reflectors are to be placed in a readily accessible stowage and rigged when the boat is to be deployed outside the range of visibility of the ship, and/or at the Commanding Officer's discretion.

| **05039. 4.7m RIB - Specification**

a. **Introduction**. The 4.7m RIB is a shortened version of the 5.4m Searider described later. It has a carrying capacity of 6 passengers or a payload of 450 kg in addition to its crew of two. The boat is powered by a 60hp Mariner 'Bigfoot'gasoline driven outboard motor. No formal BR is available for this craft, but an Operator's Manual is available from Avon Inflatables Ltd, Dafen, Llanelli, Dyfed, Wales, SA14 8NA. The dimensions of the 4.7m RIB are:

Length overall	4.7m
Beam overall	2.03m

b. **Performance**. The 4.7m RIB is the lightest of the RIBs currently in use in the service. It is a very stable boat in a seaway and will operate effectively in sea state 6 (wave height 4-6 metres). In high sea states loads and engine power will have to be reduced. In good weather when lightly loaded the 4.7m RIB starts to plane at about 15 knots and achieves a top speed of about 36 knots. When fully loaded with a payload of 450 kg or 6 passengers the maximum speed attainable will drop by up to 12 knots. Fuel consumption at maximum continuous engine speed is approximately 1 hour per tank of fuel.

c. **Weight and Capacity**. The following table gives the weights of the boat, personnel and component items, and should be used when calculating hoisting out and recovery weights. The maximum Safe Working Lift for this craft is 1.0 tonne; assuming that the lifting device is capable of this lift, there is a spare capacity of 212 Kg when the boat is loaded as shown below. It is necessary on occasions to utilise this spare capacity, for example when conducting boarding operations or recovering survivors, but whenever possible stores or additional personnel should be embarked or disembarked when the boat is in the water to reduce unnecessary stress on the boat when it is suspended on its slings.

Weight of boat with 60 hp engine	563 Kg
Two tanks of fuel	40 Kg
Boats bag	10 Kg
Crash bag	25 Kg
Crew of 2	150Kg
Total	788 Kg
Carrying capacity in the water	450 Kg or 6 Passengers

Note. *Weight of boat allows for 134 kgs of water ballast in the free-flooding hull.*

d. **Hull**. As for the 5.4m RIB.

e. **Transom**. As for the 5.4m RIB

f. **Buoyancy Tube**. As for the 5.4m RIB

g. **External Design and Fittings**. As for the 5.4m RIB

h. **Slings and Slinging Points**. As for the 5.4m RIB

i. **Navigation Lights**. As for post 1991 5.4m RIBs

j. **Toe Straps**. As for the 5.4m RIB

k. **Painter and Sternfast.** As for the 5.4m RIB

l. **Anchor and Cable.** As for the 5.4m RIB

m. **Boatrope and Boatrope Towing Bridle** (Fig 5-25). When operated as a seaboat the craft must be fitted with a boatrope towing bridle to provide a means of attachment to the boatrope. In principle the bridle is similar to that described for the Gemini, although certain component parts differ. The purposes of a boatrope are explained in paragraph 05014c. The procedure for fitting a towing bridle to a 4.7m RIB is as follows:

(1) *Bridle Components*

Ring: Mild steel 102mm inside diameter (0263/549-1963).
Main Bridle leg 16mm Polyester (0350/923-7144)
Thimble, MS (0263/441-2980)
Shackle, Bow (0263/721-6104)
Port and starboard bridle legs: 12mm Polyester (0350/923-7143).
Boatrope: 24mm HL Polypropylene (0350/375-2994).
Boatrope Recovery Line, 16mm HL polypropylene (0350/571-3172).
Toggle, Beech wood, with hole for attachment of release lanyard (See Fig 5-24).
Toggle Release Lanyard: 8mm HL polyethylene (0350/543-0141).

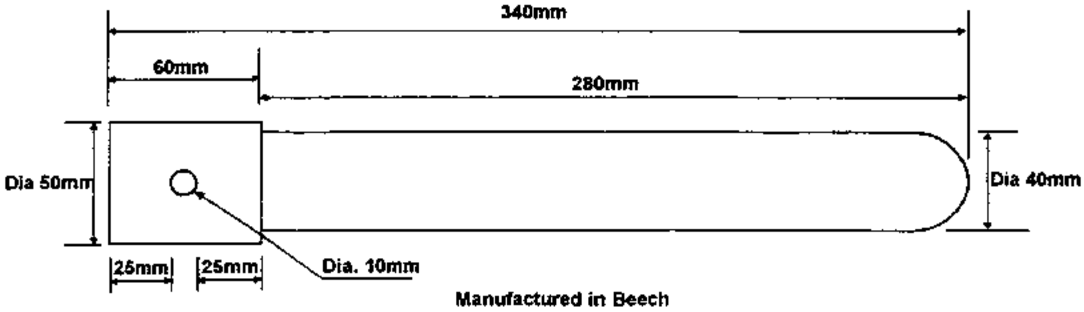


Fig 5-24. Boatrope Toggle

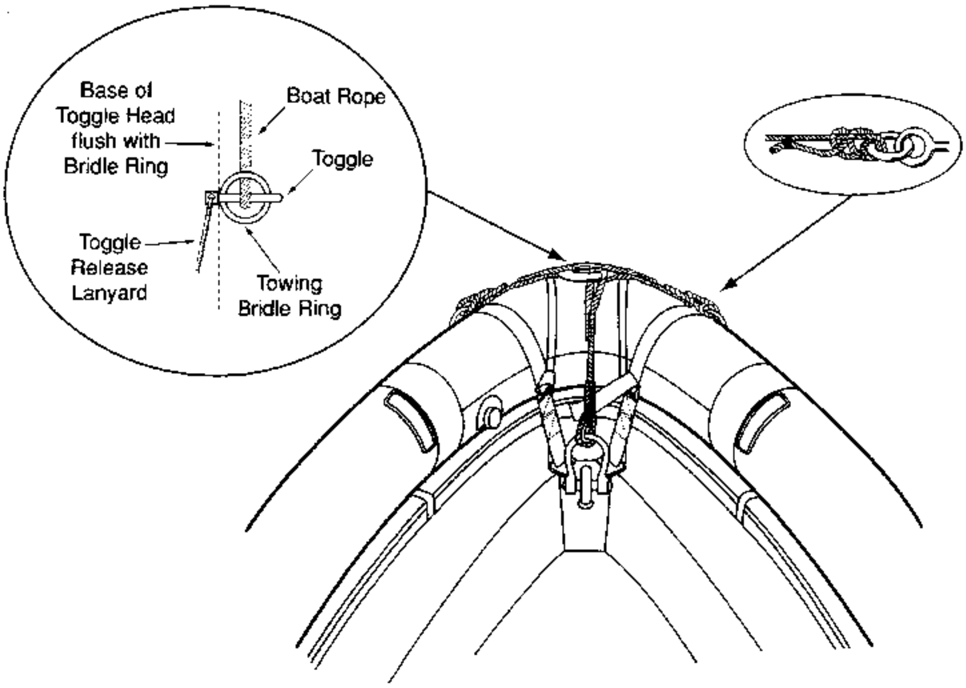


Fig 5-25. 4.7m RIB - Boatrope Towing Bridle

(2) *Fitting and Operation*

(a) Splice the thimble into one end of the main bridle leg, then shackle that end to the for'ard slinging point of the boat. Now place the ring well for'ard on the nose of the boat and splice the outboard end of the main bridle leg to the ring.

(b) Splice the port and starboard 12mm polyester bridle legs to the ring, centralise the ring, and tie off the port and starboard legs through the D rings on the port and starboard bow of the craft, using a round turn and two half hitches. Whip or stitch the fag ends back to the standing part. (Rigged in this manner the towing bridle is portable and can be easily transferred from one boat to another).

(c) Splice a 150mm soft eye in one end of the boatrope, then splice in the 16mm polypropylene recovery line close to the eye. This allows the recovery line to also be used when necessary as a steadying line.

(d) Drill a hole in one end of the toggle and attach the polyethylene release lanyard using a soft eye splice. Run the toggle releasing lanyard through the hand holds on the outboard buoyancy tube to a position abreast the console; this will enable the boatrope to be slipped without the crew going forward.

(e) Pass the soft eye of the boatrope up through the bridle ring, insert the toggle.

05040. 4.7m RIB - Boat's Bag and Other Onboard Equipment

For normal operations the following items should be carried in the boat.

Equipment	**Naval stores number**
VHF hand held radio (Cougar)	
2 x Paddles.	0472/923-0766
Manual Line Thrower	0472/781-0504
Horn	0268/407-9681
4 x Distress Flares (to be removed in harbour)	
Bailer	0479/923-0770
Bellows	0468/425-9838
Sea anchor	0468/GX0003965
Spare 'Kill cord'(ready to hand)	0482/250-0801
Compass (fitted in consol)	0671/525-2105
Boat's bag	0479/531/8185
(containing)	
Leak stopper S1	0468/923-0767
Leak stopper S2	0472/923-0768
Leak stopper S3	0472/923-0769
Repair clamp	0472/923-0770
Torch (with a signalling capability)	
First Aid Kit	6545/211-1573
*Repair kit	0472/721-6941
*Adhesive	0442/220-2553
*Radar Reflector (See Para 05038)	

Additional equipment required for the engine
(These items to be stowed in a separate container)

Emergency starting cord
Fuel lead, fuel filter, and fuel lead adaptor if required
Spare fuses
Spark plugs (2)
Socket and torque handle for spark plug removal
Pliers
Screwdriver
*Spare propeller, nut, washer and split pin
*Suitable sockets for propeller removal

***Note**. Items marked with a * are carried in the boat at Commanding Officer's discretion.*

| **05041. 4.7m RIB - Hull - Operator Checks**
As laid down for 5.4m RIB

| **05042. 4.7m RIB - Propulsion and Electrical System**

a. **The Engine**. The engine for the 4.7m RIB is the 60 hp 'Bigfoot' Mariner outboard motor. Fuel is supplied from a 25 litre portable fuel tank fitted with a snap or bayonet connector on its flexible fuel line which allows it to be connected quickly to the outboard motor. Two portable fuel tanks are normally embarked in the boat. The carburettors on the outboard motor holds sufficient fuel for the supply to be exchanged from one tank to the other without stopping the engine.

CAUTION

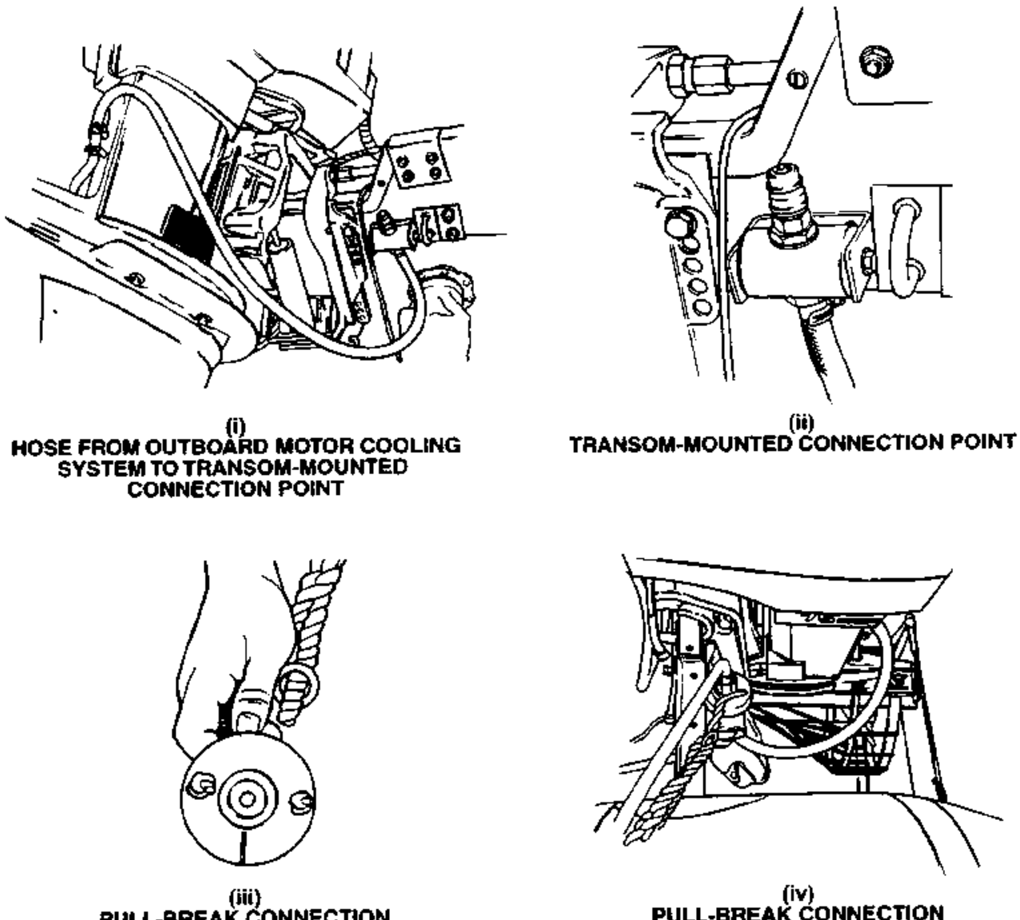
AN OPERATION AND MAINTENANCE MANUAL IS AVAILABLE FOR THIS ENGINE AND ITS ASSOCIATED EQUIPMENT. USERS MUST READ THE MANUAL AND FOLLOW THE PROCEDURES LAID DOWN.

b. **Requirement to Fit a Propeller Guard Propeller**. A propeller guard must be fitted unless the subsequent reduction in the speed and power of the boat is inappropriate to the role in which the boat is operating. For example, no propeller guard is required when the boat is used as a seaboat, or for boarding operations, or when it is necessary to demonstrate the full capabilities of the craft during training courses.

c. **Cooling System**. The engine will seize up within a few seconds if run without cooling water. There is a tell-tale discharge on the starboard after side of the powerhead, which, if water is flowing from it, indicates that the cooling system is functioning. The coxswain must always turn round to check the discharge as soon as the engine has been started; he should also make further checks while the engine is running. If the flow of water through the tell-tale discharge stops, the coxswain must cut the engine immediately. There are two sources of supply for cooling water: from the sea, after the boat has been lowered, or from the ship's fresh or salt water services during lowering procedures through a polythene hose known as the ‹umbilical connection'.

(1) *Normal Circulation*. When the boat is in the water, sea water for cooling is drawn in through the cooling water intake situated low on the gear case, pumped through the cooling system and finally discharged through an outlet in the propeller boss with the exhaust.

(2) *Umbilical Connection* (Fig 5-26). To permit starting the outboard motor when the boat is out of the water, a modification has been made to allow the ship’s fresh or salt water main to supply cooling water. A polythene hose is connected to the outboard motor cooling system by a pull-break coupling fitted on the transom of the boat. A suitable access point from the ship’s fresh or salt water services is then used to supply cooling water through this ‹umbilical connection’. The pressure range should be between 0.3 to 7.0 bar. A recovery line, shorter in length than the hose, is secured between the ship and the coupling so that when the boat moves away the coupling is disconnected before the hose is parted. Cooling water is drawn in through the normal intake on the outboard motor once the boat has been lowered into the sea. The umbilical cord only supplies a small volume of cooling water to the engine; the outboard motor must therefore be kept at idling speed until the boat is in the water.



(i) HOSE FROM OUTBOARD MOTOR COOLING SYSTEM TO TRANSOM-MOUNTED CONNECTION POINT

(ii) TRANSOM-MOUNTED CONNECTION POINT

(iii) PULL-BREAK CONNECTION

(iv) PULL-BREAK CONNECTION FITTED TO CONNECTION POINT

Fig 5-26. Umbilical Cord Arrangement

d. **Cut-out Switch**. See Operator's Manual

| **05043. 4.7m RIB - Engine and Electrical - Operator Checks**
Procedures are as laid down for the 5.4m RIB

| **05044. 4.7m RIB - Controls at the Console**
As shown for the 5.4m RIB

| **05045. 4.7m RIB - Engine Starting Procedures**

a. **Pre-start checks**. Procedures are as laid down for the 5.4m RIB

b. **Once Started**. Procedures are as laid down for the 5.4m RIB

| **05046. 4.7m RIB - Running Procedures and Checks**
Operating procedures are as laid down for the 5.4m RIB

| **05047. 4.7m RIB - Stopping Procedures**
Stopping procedures are as laid down for the 5.4m RIB

| **05048. 4.7m RIB - Fault Finding on the Engine**
See Operator's manual

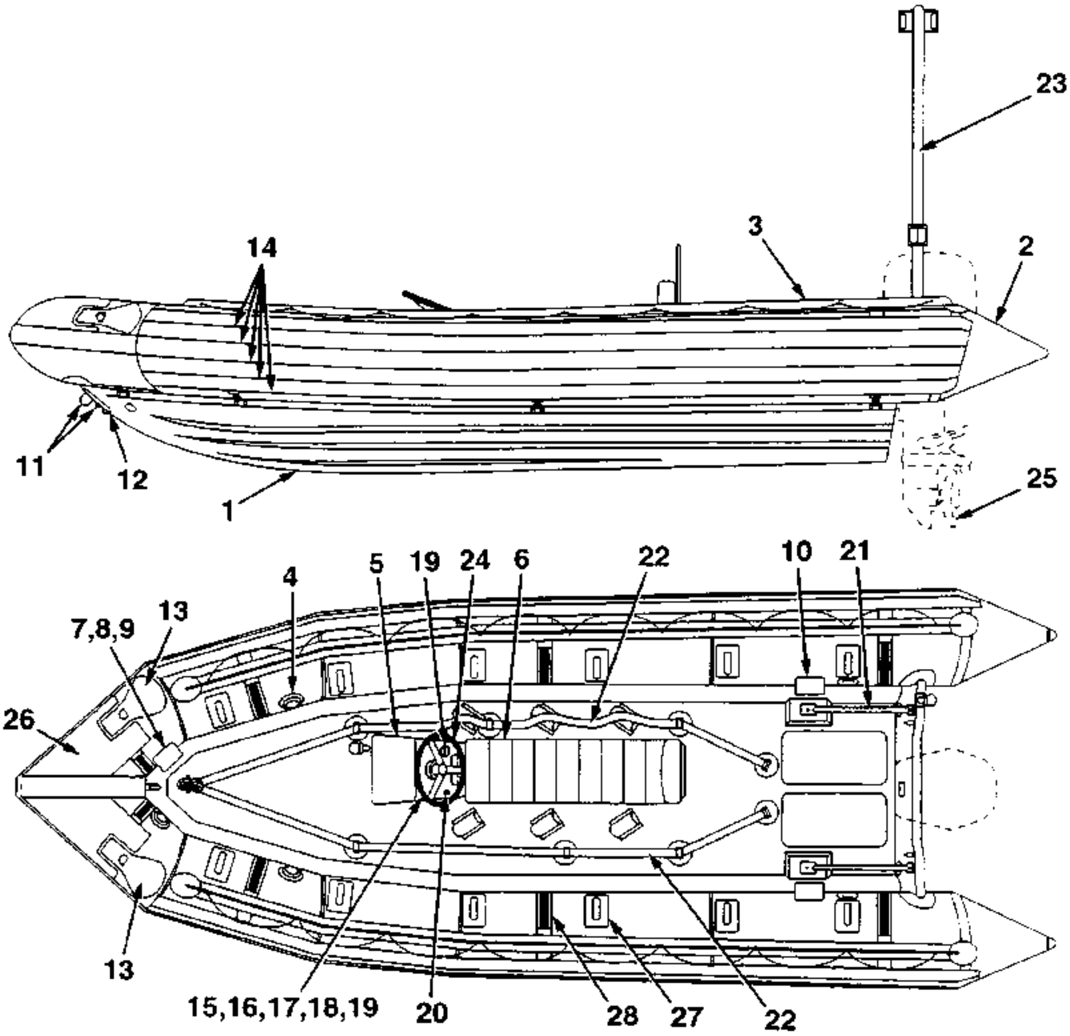
05049. 5.4m RIB - Specification

a. **Introduction.** The 5.4m RIB (Fig 5-27), also known as the Searider, is a fast medium-sized RIB. In addition to its normal crew of two it has a carrying capacity of 8 passengers or a payload of 600 Kg. The boat is powered by a gasoline driven Mariner 75 outboard motor bolted to the transom. Fuel is supplied from a portable gasoline tank, and there is space for two tanks to be strapped into position between the transom stays. The coxswain controls the Searider from a console amidships which is fitted with a steering wheel, combined gearshift/throttle lever and a switch and instrument panel. A 12V battery, housed beneath the coxswain's jockey seat, provides power for starting the engine. There are three mechanical control cables leading from the console housing to the outboard motor for the remote control of the steering, gear selection and engine speed; a loom of electrical cables connects the starting, lighting and charging services. The authoritative maintenance publication for this craft is **BR 3970 - 5.4m Searider Maintenance Manual**.

The dimensions of the Searider are:

Length overall	5.46m
Beam	2.06m
Height	1.45m
Internal width	1.07m

b. **Performance**. The 5.4m RIB is the fastest of the 3 RIBs in general use in the Fleet. In calm conditions, lightly loaded, the boat will start to plane at about 15 knots and reach a top speed of approximately 38 knots. In conditions up to sea state 4 (wave heights 1.25 - 2.5m) or with heavier loads the boat will still plane, but the maximum speed attained will drop by up to 12 knots. In higher sea states the engine power must be reduced to give a safe speed according to the strength and direction of the wind and sea. Two portable fuel tanks are normally carried with a combined capacity of 50 litres. With consumption of 25 litres an hour at maximum continuous engine rating the two tanks give an endurance of approximately 2 hours. The limiting distance of operation will depend upon the speed attainable with the payload that the Searider is required to carry under the prevailing weather conditions. For certain roles additional fuel tanks may be embarked.



1 - GRP Hull
2 - Buoyancy
3 - Hogging Strip & Lifeline Assembly
4 - Inflation/Deflation Valve
5 - GRP Console
6 - Seat Assembly
7 - Rescue Quoit
8 - Rescue Line
9 - Quoit Pocket
10 - Stern Line Pocket
11 - 'U' Bolts
12 - Bow Reinforcing Plate
13 - Towing Patch Assembly
14 - D Section Rubbing Strake
15 - Steering Helm
16 - Steering Cable
17 - Steering Wheel
18 - 90° Bezel & Mounting Kit
19 - Volt Meter
20 - Cut-out Switch
21 - Transom Stays
22 - Toe Strap Assembly
23 - Nav Light Mast
24 - Electrical System
25 - Outboard Engine
26 - Bow Double Skin
27 - Internal Grab Handles
28 - Tube Attachment Strap Assembly

Fig 5-27. 5.4m RIB - General Arrangements

c. **Weight and Capacity**. The following table gives the weights of the boat, personnel and other items, and should be used when calculating hoisting out and recovery weights. The maximum Safe Working Lift for this craft is 1.5 tonnes, thus assuming the lifting device is capable of this lift there is a spare capacity of 475 Kg when the boat is loaded as shown below. It is necessary on occasions to utilise this spare capacity, for example when conducting boarding operations or recovering survivors, but whenever possible stores or additional personnel should be embarked or disembarked when the boat is in the water to reduce unnecessary stress on the boat when it is suspended on its slings. The weight of the boat includes the weight of the water ballast that automatically enters the hull when the boat slows down and comes off the plane.

Weight of boat with 75 hp engine	800 Kg (see note)
Two tanks of fuel	40 Kg
Boat's bag	10 Kg
Crash bag	25 Kg
Crew of two	150 Kg
Total	1025 Kg
Carrying capacity in the water	600 Kgs or 8 passengers

Note. *Add 20 Kg to weight of boat if first two digits of boat serial number are 91 or greater.*

d. **Hull**. The hull of the 5.4m RIB is constructed of moulded GRP with a nominal thickness of 9 mm. The deck of GRP coated marine ply is bonded in place to form an inner skin. The space between the deck and the hull is free-flooding and draining, except for two foam filled buoyancy tanks sited forward and aft. The remainder of this space is free to fill with 160 kg of seawater (134 kg in the 4.7m RIB) as ballast through two flooding ports on either side of the bow. Seawater ballast flows into the bottom compartment when the Searider comes off the plane, and flows out again through the large port in the centre of the transom when speed is increased.

e. **Transom**. The transom (Fig 5-28) is constructed of 2 sheets of marine ply coated with GRP. It is braced for extra strength by two sloping stainless steel stays which also provide an anchorage for the fuel tank securing straps. Viewed from astern (Fig 5-29) there are three drainage ports in the transom. The ballast drain port is on the centreline; this is open to the sea and is designed to allow the ballast water to flow out of the boat as it gathers speed. At deck level on either side are the two deck scuppers for draining away sea water shipped over the gunwale or stern. These are fitted on the outboard side with scupper hoses made of light rubber tubing. The purpose of these is to prevent water flowing back onboard when the boat is stopped and lying low in the water. The scupper hoses should be triced up by their lanyards when the boat slows down and should be allowed to trail when the boat is gathering speed to go on the plane. The transom provides the mounting for the outboard motor and there are four holes drilled through the upper part to take the securing bolts. Fitting the engine is a delicate operation which requires suitable lifting gear, and the process should normally be carried out by the maintainer.

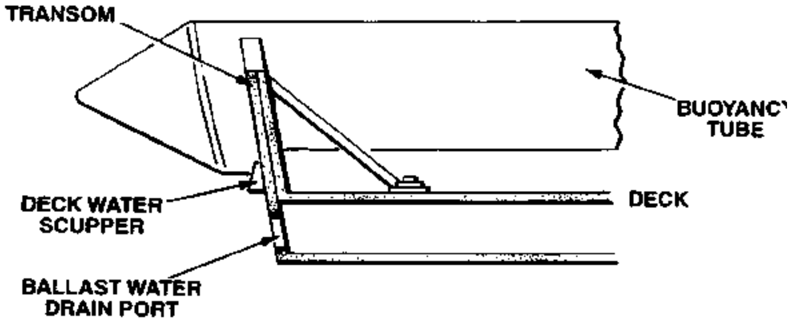


Fig 5-28. 5.4m RIB - Side View of Transom

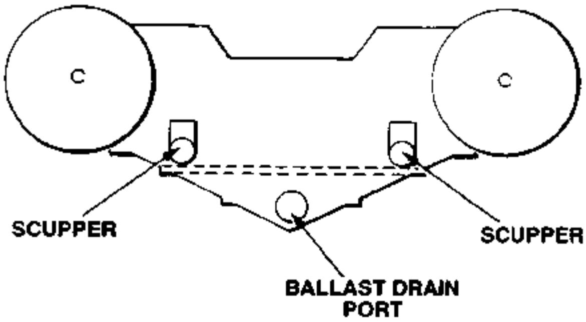


Fig 5-29. 5.4m RIB - Transom from Astern

f. **Buoyancy Tube**. The buoyancy tube of the Searider has five separate compartments, each of which is inflated through its own valve. The layout of the compartments and the positions of the valves are shown in Fig 5-30. Either an electric blower or the foot pump provided with the boat may be used to inflate the buoyancy tube. The design of the valve is shown in Fig 5-31 and the procedure is simple:

(1) Remove the dust cap.

(2) Ensure that the valve is screwed tightly into the buoyancy tube.

(3) Insert the air supply hose, taking care not to damage the valve diaphragm by forcing it in too far, then pump.

(4) When the tube feels firmly inflated at a pressure of between 0.14 and 0.2 bar (2 - 3 lbf/in^2), remove the air hose and replace the dust cap.

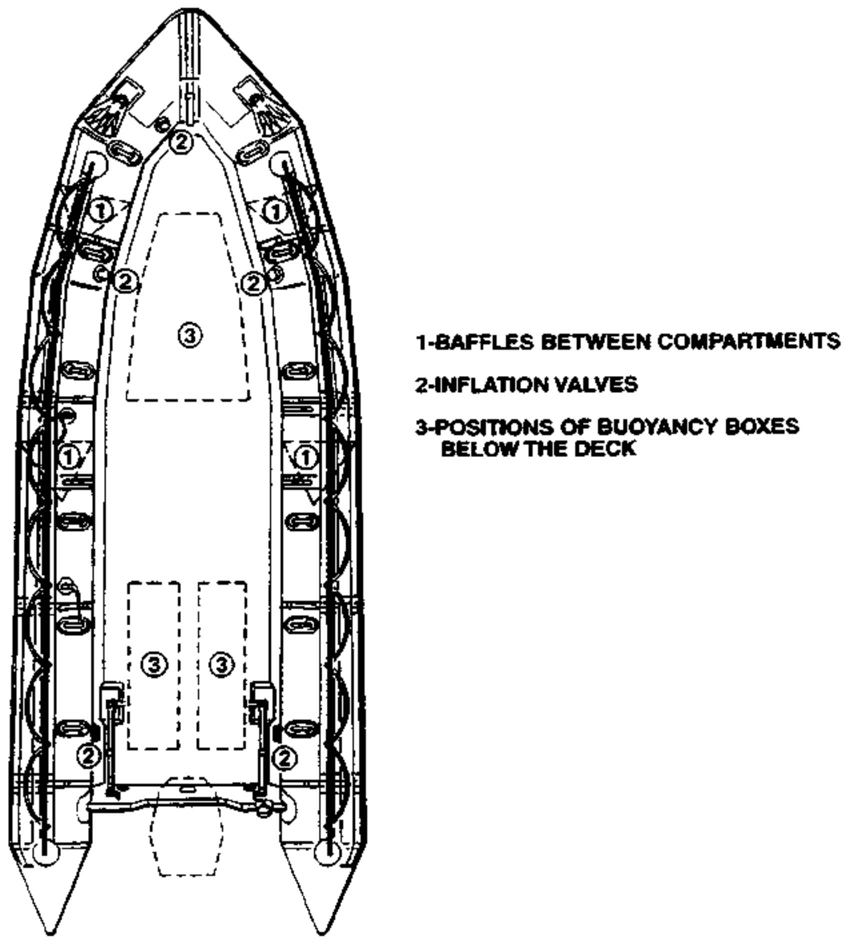


Fig 5-30. 5.4m RIB - Buoyancy Tube - Compartments and Valves

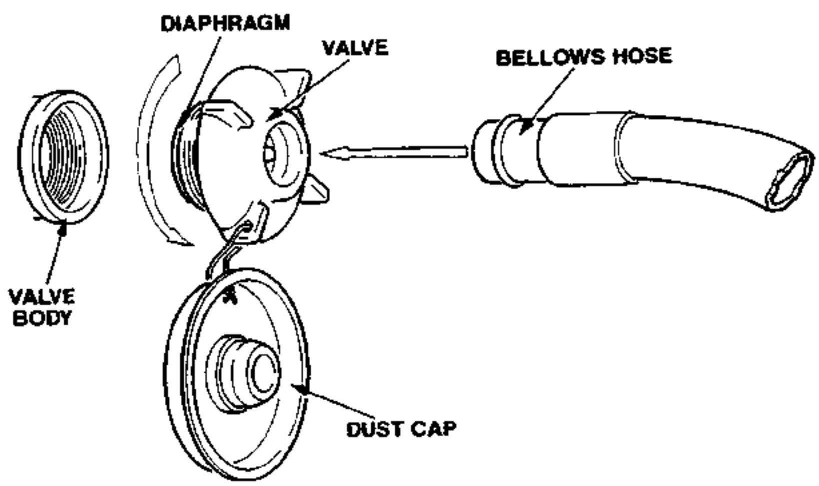


Fig 5-31. 5.4m RIB - Buoyancy Tube Valve Assembly

The bonding of the buoyancy tube to the top edge of the GRP hull is reinforced by a number of webbing straps passed around the tube from anchorages on the hull. In spite of the additional reinforcement, damage may be done to the tube if it is allowed to drop below its operating pressure and the bonding (to the hull) may be strained in rough weather or when the boat is brought alongside. The coxswain should check that the buoyancy tube is always kept inflated so that it feels taut and firm. There are the following fittings on the buoyancy tube:

(1) Metal 'D' rings, one on either side forward. These are secured by patches to the top of the tube.

(2) 6 steadying handles on top of the tube each side.

(3) 8 lifeline handholds on each side for supporting men in the water.

(4) Rescue quoit and line in a pocket in the port bow.

Any defects to the buoyancy tube or its fittings must be repaired quickly to prevent further deterioration; the coxswain should watch the following points for signs of damage:

(1) Tapes covering seams becoming unstuck.

(2) Abrasion or cracks.

(3) Patches lifting.

(4) Labels detaching.

(5) Valves leaking.

(6) Loss of pressure.

g. **External Design and Fittings**. Fig 5-27 gives a side view of the 5.4m RIB. A stainless steel eyeplate is fixed to the sharply raked stem to act as a towing point; this should be used for prolonged tows. Four longitudinal chines run along the outside of the hull. These act as spray deflectors but, because of their angular shape, they are susceptible to chipping. If any damage to the chines or the outside of the hull is found, it must be repaired quickly. This will prevent water penetrating the protective external gel coat of the GRP hull.

h. **Slinging Points** (Fig 5-32). There are three slinging points - 1 forward and 2 aft - in the Searider. A three-leg polyester webbing sling, naval stores number 0479/761-2880, is shackled to these slinging points by bow screw shackles. The bolts of these shackles must always be moused to prevent them working loose. The sling has a safe working load of 1.5 tonne and an in use life of two years, commencing from the date the sling is removed from its bag. A history card giving instructions for surveying the sling comes with each set. The sling is designed to place the RIB horizontally in the water. During lowering or hoisting the coxswain should be seated at the console and the Bowman should sit on the seat directly behind him. Any additional load in the boat should be positioned to give the boat a slight nose up attitude. Fig 5-32 also shows the chocking points for stowage on crutches.

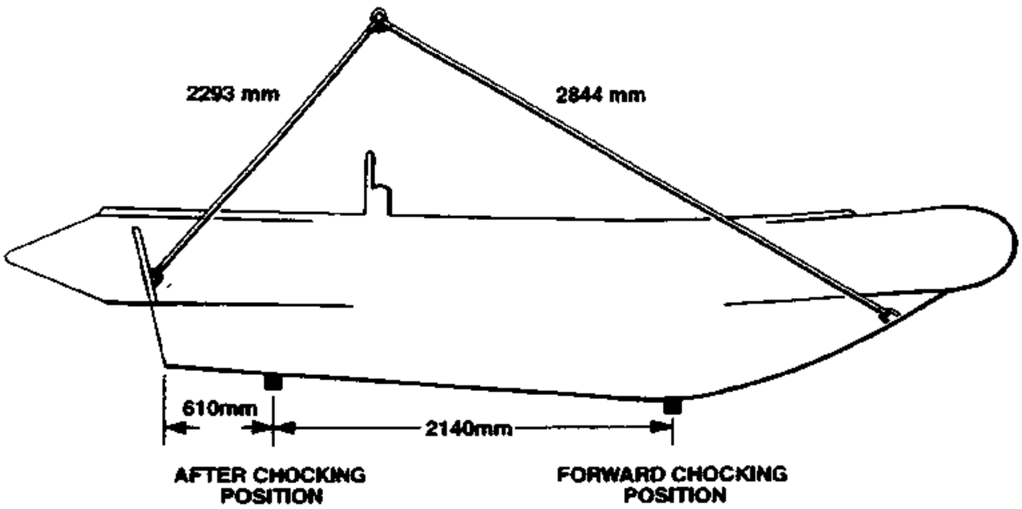


Fig. 5-32. 5.4m RIB - Slinging Arrangements

i. **Navigation Lights and Masts**. Pre 1991 Models. Two navigation light masts are supplied. The forward mast, which carries the masthead light and sidelights, is fitted into a bracket and step on the front of the GRP console and is removable. The stern light is carried on a shorter mast bolted on the transom. The forward navigation lights are connected to two sockets on the front end of the console. The stern light is permanently connected to a cable in the electrical loom leading aft out of the back of the jockey seat. Post 1991 Models. All the navigation lights are fitted to a removable 'A' frame that slots into metal tubes fitted on the transom. The lights are connected to a socket on the transom.

j. **Toe Straps** are provided for the coxswain and two other persons to sit astride the jockey seat. Additional toe straps in the form of webbing straps running from for'ard to aft either side of the consul are provided for passengers.

k. **Boatrope and Boatrope Towing Bridle**. When operated as a seaboat the craft must be fitted with a boatrope towing bridle to provide a means of attachment to the boatrope. Details of the bridle, its components, and the fitting instructions are the same as those given for the 4.7m RIB.

l. **Painter and Sternfast**. The painter and sternfast are made of 12mm polyester rope. The painter is 5m in length to prevent any risk of fouling the propeller; it should be secured to the forward slinging point. The sternfast is secured to the starboard after slinging point and must be kept well clear of the control cables and the outboard motor.

m. **Anchor and Cable**. When carried, the anchor is stowed on deck in the starboard bow. The 12mm polyester rope anchor cable is secured to the forward slinging point.

05050. 5.4m RIB - Boat's Bag and other Onboard Equipment

For normal operations the following items should be carried in the boat.

Equipment	Naval stores number
VHF hand held radio (Cougar)	
2 x paddles.	0472/923-0766
Manual Line Thrower	0472-781-0504
Horn	0268/407-9681
Bailer	0479/923-0770
4 x Distress Flares (to be removed in harbour)	
Bellows	0468/425-9838
Spare Kill Cord (ready to hand)	0482/250-0801
Compass (fitted in consol)	0671/525-2105
Boat's bag	0479/531/8185
(containing)	
Leak stopper S1	0468/923-0767
Leak stopper S2	0472/923-0768
Leak stopper S3	0472/923-0769
Repair clamp	0472/923-0770
Sea anchor	0468/GX0003965
Torch (with a signalling capability)	
First Aid Kit	6545/211-1573
Blanket in waterproof bag (if rigged as a seaboat)	
*Radar Reflector (See Para 05038)	
*Repair kit	0472/745-8853
*Adhesive	0442/220-2553
Additional equipment required for the engine	
(These item to be stowed in a separate container)	

Emergency starting cord
Fuel lead, and fuel lead adaptor if required
Fuel filter, cable snips and tie-wraps
Spark plug
Spare fuses
Socket and torque handle for spark plug removal
Pliers
Screwdriver
*Spare propeller, nyloc nut and special tab washer
*Suitable sockets for propeller removal

Note. *Items marked with an * are carried in boat at Commanding Officer's discretion.*

05051. 5.4m RIB - Hull - Operator Checks

The coxswain should make the following visual checks of the hull, buoyancy tube and equipment each day, and again after the boat has been hoisted.

a. **External**

(1) Drain hoses open to allow drainage of rain/spray.

(2) No damage to hull or outside of the buoyancy tube.

(3) Buoyancy tube firmly clamped to the hull.

(4) Nothing fouling the outboard motor or propeller.

b. **Internal**

(1) Slings clear of obstructions and not worn or frayed. Slinging points secure and shackle pins in place and moused.

(2) Boatrope strop securely attached and toggle ready for use.

(3) Painter and sternfast secured and coiled down.

(4) Equipment safely and securely stowed.

c. **Buoyancy Tube**

(1) Inflated so that it is taut to the touch.

(2) All patches, tapes and bonding strips firmly stuck down.

(3) No signs of abrasion, cracks or damage.

05052. 5.4m RIB - Propulsion and Electrical System

a. **The Engine**. The engine for the 5.4m RIB is the 75 hp ‘longshaft’ Mariner outboard motor. Gasoline is supplied unmixed from a 25 litre portable fuel tank fitted with a snap or bayonet connector on its flexible fuel line which allows it to be connected quickly to the outboard motor; two portable fuel tanks are normally embarked in the boat. The carburettors on the outboard motor holds sufficient fuel for the supply to be exchanged from one tank to the other without stopping the engine.

CAUTION

AN OPERATION AND MAINTENANCE MANUAL IS AVAILABLE FOR THIS ENGINE AND ITS ASSOCIATED EQUIPMENT. USERS MUST READ THE MANUAL AND FOLLOW THE PROCEDURES LAID DOWN.

b. **Requirement to Fit a Propeller Guard Propeller**. A propeller guard must be fitted unless the subsequent reduction in the speed and power of the boat is inappropriate to the role in which the boat is operating. For example, no propeller guard is required when the boat is used as a seaboat, or for boarding operations, or when it is necessary to demonstrate the full capabilities of the craft during training courses.

c. **Cooling System**. The engine will seize up within a period of a few seconds if run without cooling water. There is a tell-tale discharge on the starboard after side of the powerhead, which, if water is flowing from it, indicates that the cooling system is functioning. The coxswain must always turn round to check the discharge as soon as the engine has been started; he should also make further checks while the engine is running. A warning horn is fitted to indicate if the cooling water temperature rises above the permitted limit. If this alarm (a continuous tone) is heard or the flow of water through the tell-tale stops, the coxswain must cut the engine immediately. There are two sources of supply for cooling water: from the sea, after the boat has been lowered, or from the ship's fresh or salt water services through a polythene hose known as the ‹umbilical connection'.

(1) *Normal Circulation*. When the boat is in the water, sea water for cooling is drawn in through the cooling water intake low on the exhaust housing above the gear case, pumped through the cooling system and finally discharged through an outlet in the propeller boss with the exhaust. There are bypass and relief valves to regulate the temperature and pressure of the cooling water as the speed of the engine increases.

(2) *Umbilical Connection*. This arrangement is the same as that described for the 60 hp Mariner 'Bigfoot' illustrated in Fig 5-26. The umbilical cord only supplies a small volume of cooling water to the engine; the outboard motor must therefore be kept at idling speed until the boat is in the water.

d. **Cut-out Switch**. See Operator's Manual

05053. 5.4m RIB - Electrical Installation
See Operator's Manual

05054. 5.4m RIB - Engine and Electrical - Operator Checks
The coxswain should make the following checks daily and on each occasion after the Searider has been hoisted. (These checks are general, the Operator's manual should be read to ensure any other requirements are met.)

a. **Engine Checks**

(1) The 4 bolts securing the motor to the transom are fully tightened.

(2) The motor tilts freely, and is down in the 'Run' position.

(3) The steering wheel swivels the motor easily between the port and starboard stops.

(4) There are no obstructions resting on the control cables.

(5) The gear shift/throttle lever is in the neutral position. It should never be forced out of neutral when the engine is stopped.

(6) There is nothing fouling the propeller.

(7) The fuel tanks are full and the fuel line is primed.

(8) The fuel tanks are strapped tightly into position.

(9) The fuel line connector is correctly snapped on.

(10) Integral oil tank is topped up.

(11) When required: the umbilical connection is properly coupled to the engine and the recovery line secured.

(12) Water supply for the umbilical connection available and at the correct pressure.

b. **Electrical Checks**

(1) Leads to battery terminals tight and uncorroded, and the lid to battery box firmly in place.

(2) Battery isolating switch closed.

(3) Caps on the electrical power sockets on the forward and after ends of the GRP console housing in place, but free to be taken off.

(4) Navigation lights functioning correctly.

(5) Kill cord fitted, and spare readily available.

05055. 5.4m RIB - Controls at the Console

The Searider controls and instruments are mounted on the console in front of the coxswain; the precise layout differs slightly depending on the age of the craft but the general arrangement is shown in Fig 5-33. The gear shift and throttle control box is mounted on the port side of the console housing. Three mechanical cables lead aft from the console for steering, gear shift and throttle control. An electrical loom containing cables for the starting, ignition control and charging circuits also leads aft, together with a supply to the navigation lights. In certain older Seariders there are three switches on the instrument panel to control the ignition, starting motor and fuel enrichment pump (or choke) respectively. Recently manufactured craft have a three-way key switch on the after side of the throttle box to perform these functions.

a. **Gear shift and Throttle control**. A single lever controls both the gear shift and the engine speed through a linkage contained in the throttle control box. In the central position the lever is locked, the gears are in neutral and the engine is idling. To move from neutral to ahead squeeze the grip beneath the handle to unlock the catch, then move the throttle lever forward. Ahead gear will have been engaged when a spring-loaded catch is felt to fall into a small recess. Moving the lever further forward opens the throttle and increases the engine speed. Similarly, to go astern, unlock the throttle lever from neutral and move it backwards until the catch falls into the astern gear recess, then increase speed as required by pulling the lever steadily aft.

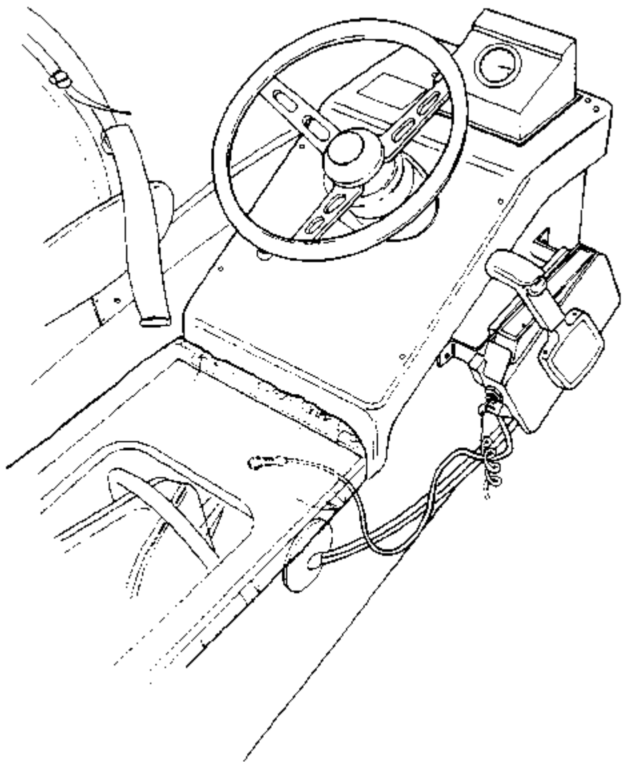


Fig 5-33. 5.4m RIB - Controls at the Console

b. **Fast-idle Control**. The engine can only be started when the Gear shift/Throttle control lever is in neutral. In this position the throttle opening is set to idling speed. Because this may not be sufficiently fast for the engine to warm up satisfactorily, a separate engine speed control, called the fast-idle control, is provided. This is operated by the fast-idle lever which is fitted flush with the top of the throttle box. This lever should always be raised when starting the outboard motor from cold, and the coxswain must remember to return it to the housed position once the engine has warmed up. It is not required if the engine has just been running.

c. **Fuel Injection Primer**. This pumps fuel directly into the engine to assist starting. On Seariders fitted with a three-way key switch the fuel injection pump is operated by pushing the key inwards against a spring for a few seconds before turning it to the second position to operate the starter motor. On certain older craft the pump (marked 'Choke') is operated from a switch on the console.

05056. 5.4m RIB - Engine Starting Procedures |

a. **Pre-start Checks**. Before getting into his seat the coxswain should carry out the following pre-start routine:

(1) Ensure the fuel tank is filled with unleaded gasoline and the correct grade oil is in the integral tank.

(2) Slide the fuel line connector onto the outboard motor.

(3) Prime the carburettor by squeezing the fuel bulb.

(4) Check that the engine is firmly bolted to the transom.

(5) Check that the tilt mechanism is in the ‹Run’ position.

(6) Confirm that the pull-break coupling of the umbilical cord is firmly connected (if in use) and that the water supply is available.

(7) Confirm that the gear shift/throttle lever is in neutral and raise the fast-idle lever.

b. **To Start**. After getting into his seat the coxswain should:

(1) Ensure the Kill cord is secured to the cut-out switch, then secure the other end of the Kill cord to his leg.

(2) If using the umbilical connection - order the cooling water to be turned on and then check the flow of water from the motor.

(3) Switch on the ignition switch.

(4) Operate choke or primer pump, but only if the engine is being started from cold.

(5) Depress starter motor switch (turn key in models where fitted) and run starter motor for not more than 10 seconds. If the engine fails to start - stop and repeat after a short pause.

(7) As the engine starts, release both switches.

c. **Once Started**

(1) Check the cooling water flow through the tell-tale discharge.

(2) Reduce the engine speed to idle by housing the fast-idle warm up lever.

| **05057. 5.4m RIB - Running Procedures and Checks**

Once the outboard motor is running and the boat is in the water, the Searider is ready to be operated.

a. **To Go Ahead**

(1) Release the ‘neutral safety lock’ on the underside of the throttle handle and move the gear shift/throttle lever smoothly and firmly forward about 30° to engage the propeller drive in ahead gear.

(2) Increase speed by continuing to move the gear shift/throttle lever forward. When the weight is off the boatrope the cox’n orders it to be released.

(3) Once the Searider is on the plane throttle back to the required operating speed. The engine must not be allowed to race, particularly when it is cold.

(4) The coxswain should keep his hand on the gear shift/throttle lever all the time the boat is underway in order to be able to change speed quickly to adjust to wind and sea.

b. **To Go Astern**

(1) Move the lever to the neutral position, pause until the engine is at idling speed, then release the neutral safety lock and pull the lever smoothly and firmly back to the recess to engage astern gear.

(2) Increase speed as required by pulling the lever further back until the required astern power is obtained.

c. **Checks while running**. Periodically check:

(1) Flow of cooling water through the tell-tale discharge.

(2) Tightness of the engine bolts on the transom.

(3) Fuel level of the in-use tank.

| **05058. 5.4m RIB - Stopping Procedures**

a. **Normal Methods**. There are the following alternative methods of stopping:

(1) Put the engine in neutral and turn the ignition switch to ‘off’.

(2) Put the engine in neutral and disconnect the fuel line to allow the carburettor to run dry. This method should be used to ensure reliable restarting after being stopped for a period or if the engine is to be serviced.

b. **Emergency Method**. The cut-out switch is actuated by a pull on the Kill cord attached to the coxswain's leg. The coxswain should not employ this as a routine method of stopping the engine, but he may, however, test it from time to time provided that the gear shift/throttle lever is put in neutral first.

05059. 5.4m RIB - Fault Finding on the Engine (These checks are general, the relevant manual for the engine fit should be studied for variations)

a. **If The Engine Will Not Start**

Symptom	**Remedial Action**
Engine will not turn on starter	Check battery charge level and battery terminals.
	Check throttle/gear shift is in neutral.
	Check 20amp fuse.
	Check all electrical connections.
Engine will not fire	Check cut-out switch is attached.
	Check fuel level.
	Check fuel line lead is primed and tank vent is open.
	Check fuel filter is clear.
	Check spark plugs; change if oiled up.

b. **Lack of Power**. Ascertain whether any of the following causes are reducing the power output.

(1) Engine overheating because the cooling system is not operating properly, obstruction at the water intake?

(2) Fuel contamination, water in the fuel?

(3) Fuel pump filter partially blocked?

(4) Plugs dirty?

(5) Damaged propeller or fouling beneath the hull?

(6) Damaged sparking plugs, i.e. insulator cracked?

05060. 6.5m RIB - Specification

a. **Introduction.** The 6.5m RIB (Fig 5-34 and 5-35) is the largest of the three RIBs in general use in the Service. It is often referred to by its commercial name, the 'Pacific 22'. It is usually manned by a crew of three and can carry up to 10 passengers or a payload of 900 Kg. The boat is propelled by a diesel engine mounted inside an insulated casing on the centreline. Power is transmitted to a left-handed propeller through a 'Sterndrive' unit mounted on the transom. The sterndrive is designed to move laterally for steering, and to tilt for raising and lowering the propeller. The engine is started from a 24V battery and supplied with fuel from a 91 litre tank below deck. The coxswain controls the boat from amidships. Controls are mounted on the console housing, with switches and instruments sited on the panel in front. Most of the mechanical, hydraulic and electrical leads running from the console to the engine and sterndrive are below deck and cannot be obstructed by passengers or loads. The authoritative publication for this craft is **BR 7852 6.5m Pacific Rigid Inflatable Boat - General Information**.

Note. *6.5m RIBs procured since 1996 are powered by a Yanmah diesel engine. A commercial Operating and Maintenance manual is supplied with these boats.*

The dimensions of the 6.5m RIB are:

Length overall	6.7 m
Beam	2.44 m
Height: keel to steaming light	2.92 m
Draught with propeller lowered	0.88 m
Internal width	1.48 m

b. **Performance**. The 6.5m RIB handles safely in rough weather. It may be operated with a full load in sea state 5. In higher sea states than this it may be employed with reduced loads and at lower speeds. It has a maximum speed of 27.5 knots in good conditions. Fuel consumption at this speed is 22.7 litres/hour which gives an endurance of 4 hours on a full tank of 91 litres of diesel fuel. The 6.5m RIB is a stable boat and is well suited to the tasks of seaboat and fast transport for passengers and stores.

c. **Weight and Capacity**. The following table gives the weights of the boat, personnel and other items, and should be used when calculating hoisting out and recovery weights. The maximum Safe Working Lift for this craft is 2.25 tonnes, thus assuming the lifting device is capable of this lift, there is a spare capacity of 305 Kg when the boat is loaded as shown below. It is necessary on occasions to utilise this spare capacity, for example when conducting boarding operations or recovering survivors, but whenever possible stores or additional personnel should be embarked or disembarked when the boat is in the water to reduce unnecessary stress on the boat when it is suspended on its slings.

Weight of boat, engine and fuel	1685 Kg
Boat's bag	10 Kg
Crash bag	25 Kg
Crew of three	225 Kg
Total	1945 Kg

Carrying capacity in the water 900 kg or 10 passengers

d. **Hull**. The hull of the 6.5m RIB is constructed of moulded GRP to a nominal thickness of 9mm. Four longitudinal girders on the inside of the bottom run the length of the craft and support the deck. These girders form 5 bilge sections, and the two inner girders closest to the centreline support the engine and the fuel tank. The deck is made of mahogany ply with removable centre panels which can be unscrewed from the longitudinals to give access to the bilges. The bilges are kept dry by operating either an electrical or a mechanical bilge pump. There is a circular hatch in the deck aft for access to the electrical bilge pump.

e. **Transom** (Fig 5-36). The transom which is robustly constructed of marine ply coated with GRP provides a mounting for the external sterndrive unit. At deck level there are two rectangular openings in the transom for deck scuppers; these are fitted with flaps to prevent water returning through them; the outlet hoses from the bilge pumps are arranged to discharge through the port scupper. The other outlet through the transom is on the port side, this is for the discharge of the exhaust and cooling water. Because the freeboard of the transom is low - 225mm above the waterline - the boat is liable to ship water over the stern when slowing down suddenly or making a sternboard into a following sea. This, although uncomfortable, is not dangerous and the water will drain away quickly on going ahead. The stern rail and navigation light mast are permanently fixed to the transom. Two fairleads are fitted on top of the transom and there are two associated cleats on the inboard side. The transom is not designed for towing. If a boat is taken in tow, the towrope must be passed over the top of the transom and secured to a suitable strong point on deck such as a slinging point or cleat.

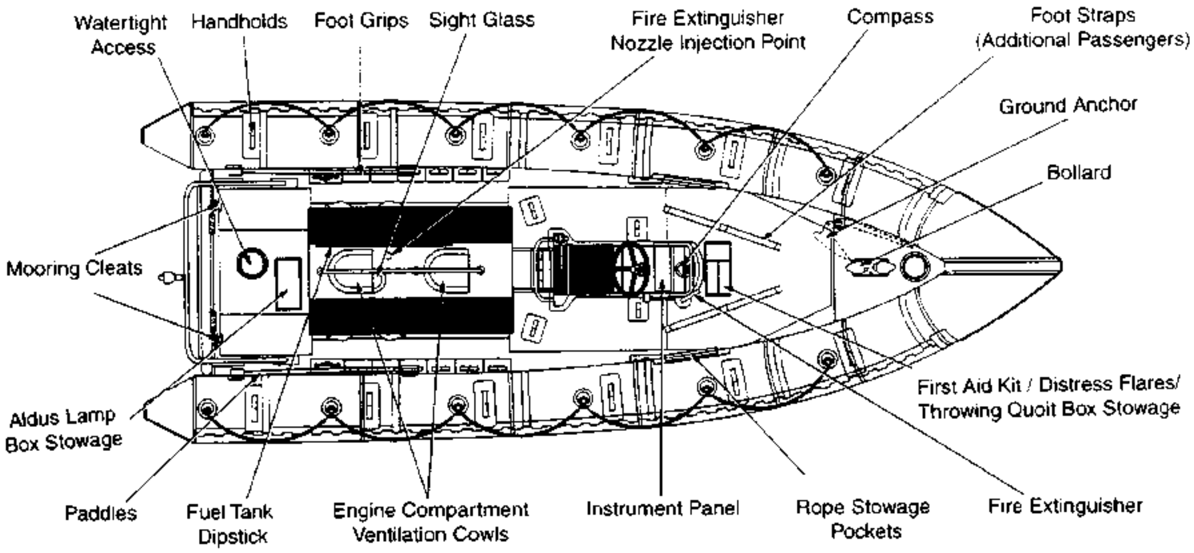


Fig 5-34. 6.5m RIB - General Arrangements

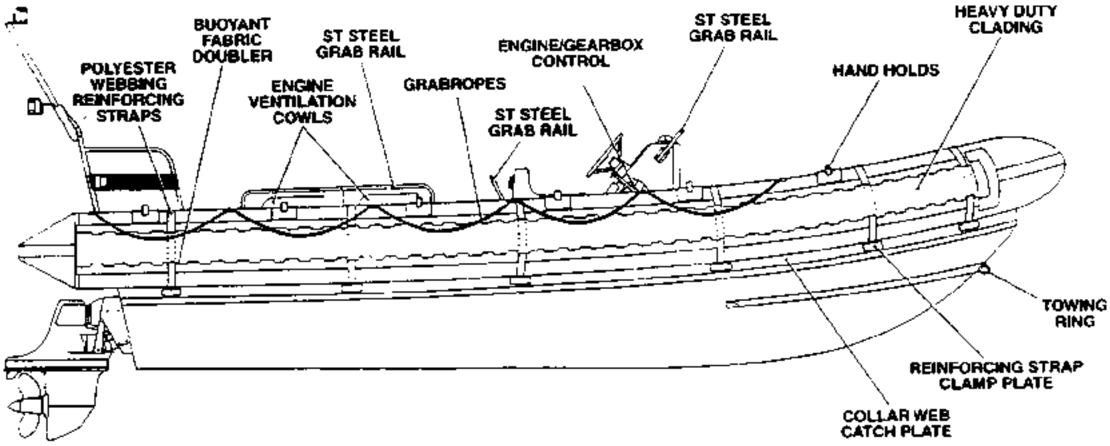


Fig 5-35. 6.5m RIB - Side View

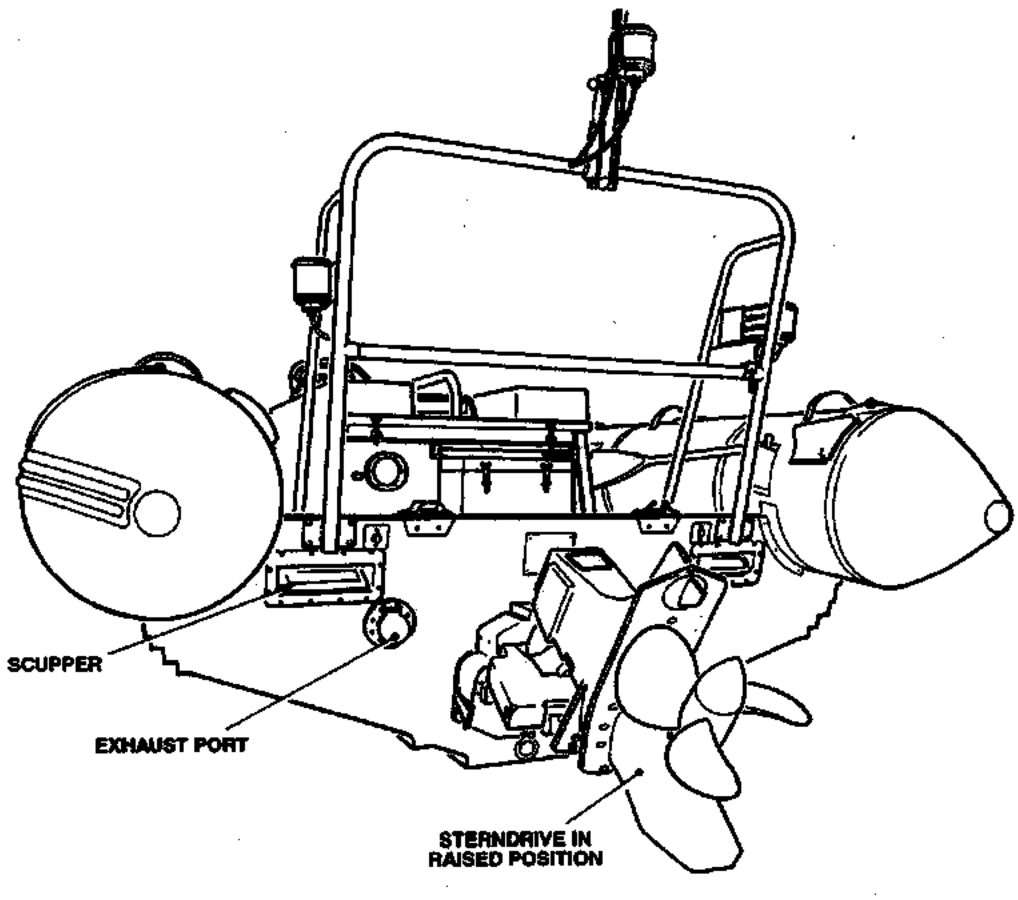


Fig 5-36. 6.5m RIB - Transom

f. **Buoyancy Tube**. The buoyancy tube (Fig 5-37) is an inflatable collar made of neoprene composite material and is subdivided into 7 compartments. The air pressure in each compartment should be maintained at 0.10 bar (1.5 lbf/in^2) so that the covering is kept taut and firm. If the pressure is allowed to drop to the point where any section becomes flabby, damage may be done to the GRP hull or to the tube itself when the boat is being brought alongside. The positions of the 7 inflation valves and the cones dividing the buoyancy tube internally are shown in Fig 5-37. A foot pump is provided for inflation or an electric blower may be used. Every compartment must be fully inflated so that it feels firm to the touch. The following points should be borne in mind:

(1) Ensure the valve is screwed up tightly on its seating.

(2) Do not force the air hose in too far and thereby damage the valve diaphragm.

(3) Inflate to a pressure of 0.10 - 0.13 bar.

(4) Replace the dust cap on completion.

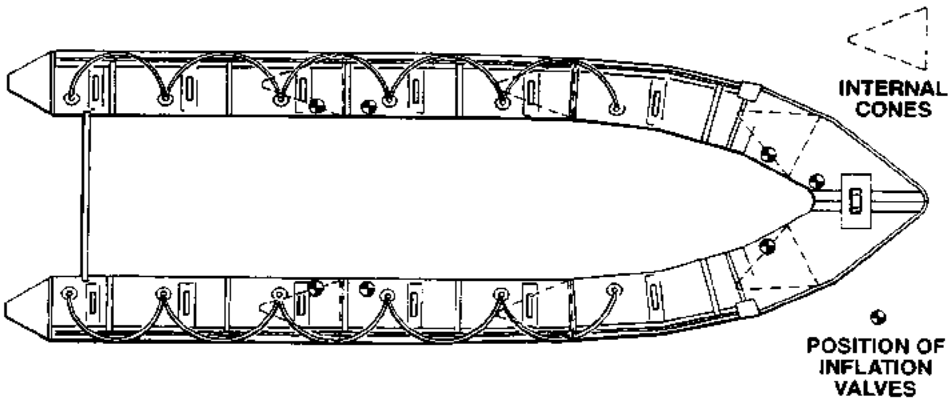


Fig 5-37. 6.5M RIB - Buoyancy Tube

g. **Buoyancy Tube Fittings**. The buoyancy tube forms the gunwale of the boat and is secured to the GRP hull by two neoprene collar webs bonded to the bottom of the tube and running its length as shown in Fig 5-38. The outer collar web is clamped to the outboard side of the hull and the inner collar web to the deck. Both are secured by continuous metal catch plates screwed to plywood backing strips. 12 polyester webbing straps spaced at intervals reinforce this strong system of attachment. To resist wear and damage, abrasion doublers are bonded to the bow and to the outboard faces of the buoyancy tube. The following fittings are attached to the top and sides:

(1) 6 lifelines on either side for supporting men in the water.

(2) 6 rigid handholds on top of the tube on each side.

(3) Fairlead on the centre-line in the bow.

(4) Paddle stowages either side forward.

(5) Rescue quoit stowage on either side amidships.

(6) 2 ‘D’ rings for being towed at speeds of up to 5 knots.

Any damage to the buoyancy tube or its fittings must be repaired quickly to prevent further deterioration. The coxswain should watch carefully for signs of the following defects:

(1) Tapes covering seams becoming unstuck.

(2) Abrasion or cracks.

(3) Patches lifting.

(4) Labels detaching.

(5) Valves leaking.

(6) Loss of pressure.

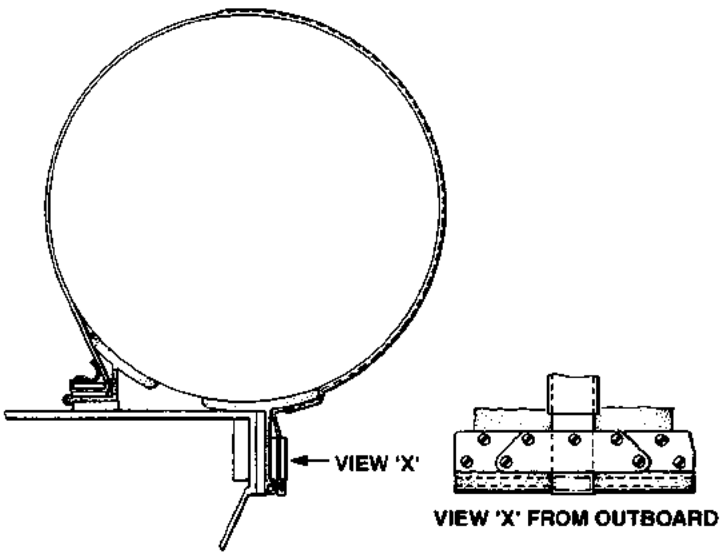


Fig 5-38. 6.5m RIB - Buoyancy Tube Securing Arrangement

h. **External Fittings**. The 6.5m RIB has the following fittings on the outside of the hull in addition to those on the transom described earlier:

(1) *Towing Ring*. This is made of stainless steel and fitted low down on the stem; it should be used if the Pacific 22 has to be taken in tow for a prolonged period.

(2) *Seawater Cooling Intake*. This is sited on the starboard side abreast the after end of the engine; it must not be allowed to become choked.

(3) *Backing Plates for the Slinging Points*. There are two of these on either side of the boat; they provide a useful guide to placing the boat in the correct stowage position on crutches. The after backing plate should be just abaft the after crutch and the forward plate just before the forward crutch.

i. **Slinging Points**. There are four slinging points fitted in the positions shown in Fig 5-39. A four-leg polyester webbing sling, naval stores number 0479/GX0005139, is shackled to these slinging points by special straight screw shackles. Each shackle bolt is secured by a nut which is prevented from working loose by a split pin, these split pins must always be in place. The sling for the 6.5m RIB has a Safe Working Load of 2.25 tonnes and has an in use life of two years, commencing from the date the sling is removed from its bag. A history card giving instructions for surveying the sling comes with each set. The sling is designed to place the RIB horizontally in the water. During lowering or hoisting the coxswain should be seated at the console and the remainder of the crew should sit on the outboard tube. Any additional load in the boat should be positioned to give the boat a slight nose up attitude.

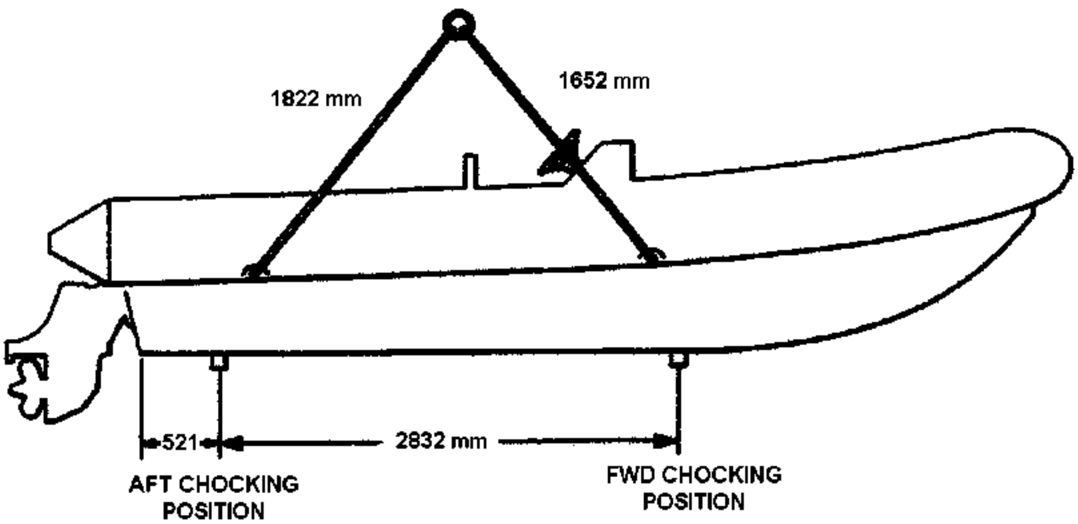


Fig 5-39. 6.5m RIB - Slinging Arrangements

j. **Support for main ring of boats lifting sling.** To facilitate hooking the RFD hook to the main lifting ring of the sling prior to hoisting a 6.5m RIB, a wooden support has been designed and approved for use. The support, which fits over the handrail on the engine cowling and cradles the ring, has the following advantages:

(1) The bowman’s task of hooking the RFD to the main ring is simplified because the ring is held in the ideal position.

(2) It prevents the slings sculling in the boat when not in use and reduces any snagging/trip hazard.

Note. The support is to be locally manufactured in accordance with the drawings below, using a suitable hardwood block with two aluminium blanking plates on the uppermost groove (where the ring sits) and two aluminium retaining straps on the lower groove (which hold the support in position over the handrail).

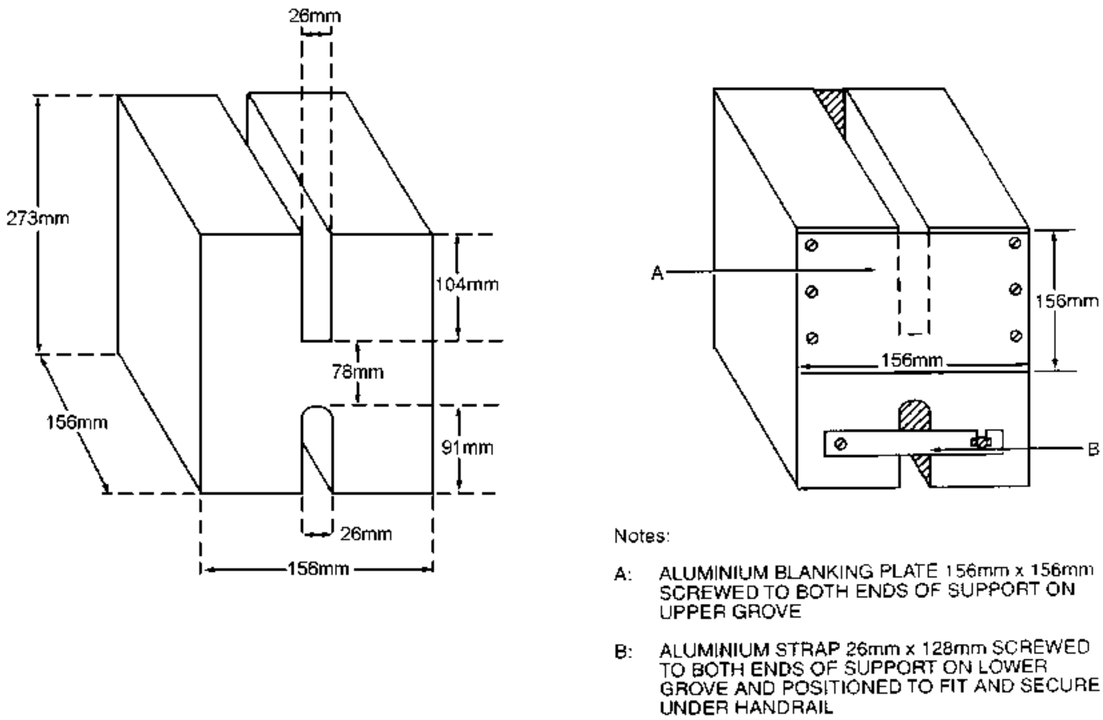


Fig 5-40. Diagram of Main Lifting Ring Support

k. **Navigation Lights**. The masthead and stern lights are mounted on the mast above the stern rail, and the side lights are mounted on the stern rail itself. These lights are kept permanently in position and are operated by switches on the coxswain's console.

l. **Toe Straps**. Toe straps are provided for all passengers and crew.

m. **Boatrope and Boatrope Towing Bridle**. When operated as a seaboat the 6.5m RIB must be fitted with a boatrope towing bridle (Fig 5-41) to provide a means of attachment to the boatrope. Details of the bridle, its components, and the fitting instructions, are similar to those given for the 4.7m RIB, with the following exceptions:

(1) The inboard end of the 16mm polyester main bridle leg is attached to the bollards sited in the bow of the boat. This is achieved by splicing a soft eye in the end of the main bridle, passing it over the after bollard, then seizing it into position (Fig 5-41(i)).

(2) The 12mm polyester port and starboard steadying lines are made from one length of cordage. The line is passed though the towing eye in the stem of the boat, middled, then seized into position (Fig 5-41(ii)). With the main bridle leg attached and the ring correctly positioned on the bow of the craft, one end of the steadying line is secured to the port side of the ring using a round turn and two half hitches and the other end is secured in a similar fashion to the starboard side of the ring. The fag ends are whipped or stitched to the standing part. Fig 5-41(iii) shows the bridle with the boatrope rigged.

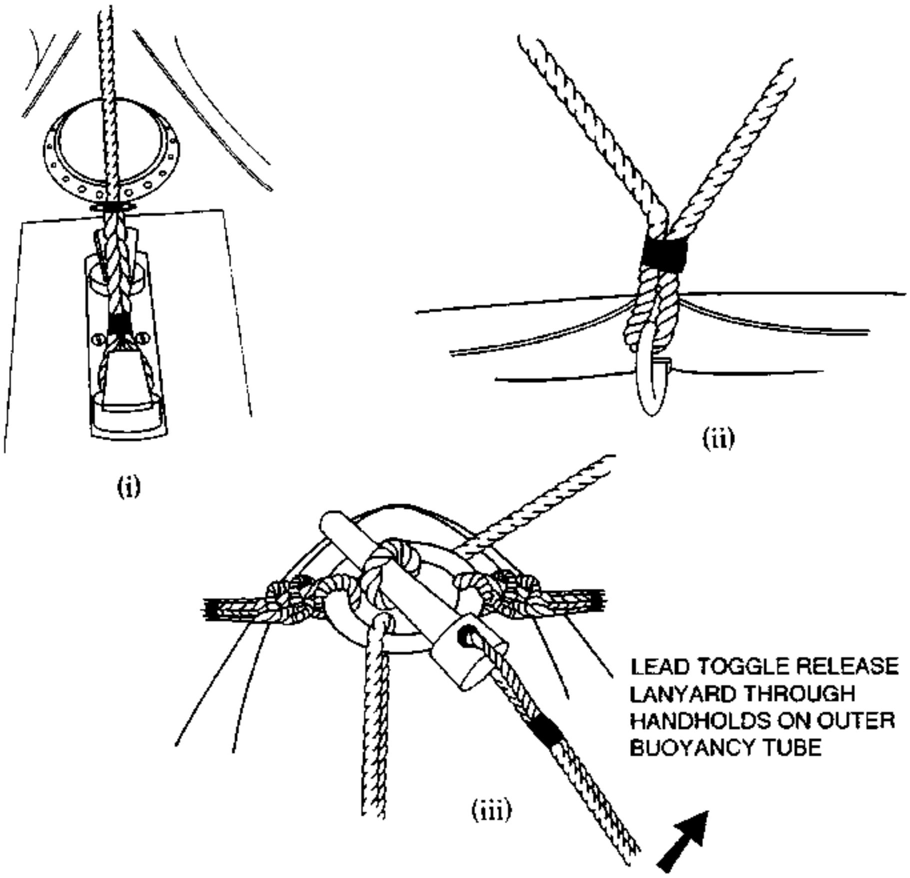


Fig 5-41. 6.5m RIB - Boatrope Towing Bridle Arrangement

n. **Painter and Sternfast**. The painter and sternfast are made of 12mm polyester rope. The painter is 5m in length to prevent any danger of fouling the propeller; it should be secured to the for'ard cleat. The sternfast is secured to the port after slinging point.

o. **Anchor and Cable**. When carried, the anchor is stowed on deck in the bows with 37m of 12mm polyester cable secured to the deck cleat.

| **05061. 6.5m RIB - Boat's Bag and other Onboard Equipment**

For normal operations the stores and equipment to be carried in the boat, excluding items listed for the engine, is the same as that given for the 5.4m RIB, with the addition of a 4 kg CO^2 fire extinguisher and a lifebuoy.

| **05062. 6.5m RIB - Hull - Operators Checks**

The coxswain should make the following visual checks of the hull, buoyancy tube and boat's equipment each day, and also after the boat has been hoisted:

a. **External**

(1) Scuppers, exhaust and bilge drain ports clear, scupper flaps free.

(2) Nothing fouling propeller or sterndrive unit.

(3) No damage to hull or outer side of buoyancy tube.

(4) Bonding of the buoyancy tube secure.

(5) Cooling water intake on starboard side unblocked.

b. **Internal**

(1) Slings clear of obstruction and not worn or frayed. Slinging points secure and split pins in place in the shackle bolt nuts. (Split pins must be clear of the inflation tube).

(2) Boatrope strop and toggle securely attached.

(3) If not in use - Painter and Sternfast secured out of the way with light stops.

(4) Embarked equipment securely stowed.

(5) Bilges pumped dry.

(6) Stowage boxes firmly secured.

(7) Retaining pins in position on Navigation lights.

(8) Engine cover firmly clipped on in position.

c. **Buoyancy Tube**

(1) Inflated to correct pressure.

(2) All patches, tapes and bonding strips securely stuck down.

(3) No signs of abrasion, cracks or damage.

05063. **6.5m RIB - Propulsion and Steering System**

The propulsion system of the 6.5m RIB consists of the engine, gearbox, transmission and sterndrive. The layout appropriate to the engine fit (Mermaid or Yanmah) is given in the relevant publication, ie **BR 7852 6.5m Pacific Rigid Inflatable Boat - General Information**, for craft fitted with a Mermaid engine, and the manufacturer's commercially produced Operation and Maintenance manual supplied with all craft fitted with a Yanmah engine.

a. **Fuel System**. The 91 litre fuel tank is situated forward of the engine below the coxswain's control position with the fuel filling point on the port side abaft the jockey seat. A calibrated aluminium dipstick is used to check the amount of fuel in the tank by dipping at the filling point.

b. **Steering System**. The steering wheel controls the direction of thrust from the sterndrive unit by moving the power leg to port or starboard through a direct drive dual-flow hydraulic pump. Three and a half turns of the wheel are required to move between the port and starboard limits. The system is filled with OM 15 oil.

c. **Lift/Trim System**. The sterndrive is tilted by the operation of a two-way, spring-loaded tilt switch on the console. On switching to 'raise' or 'lower' hydraulic pressure is exerted in the required direction until switched off or the limit is reached. When the switch springs back to the centre position the sterndrive is hydraulically locked at the chosen angle of tilt. The system is filled with OMD 15 oil.

05064. 6.5m RIB - Electrical Installation

See relevant Operator's Manual.

05065. 6.5m RIB - Engine and Electrical - Operator Checks

See relevant Operator's Manual.

05066. 6.5m RIB - Controls and Switches

The majority of these are mounted on or in the console in front of the coxswain. The precise layout varies slightly depending on the year the craft was manufactured. Consult relevant Operator's Manual.

a. **Emergency Engine Cut-out**. This switch, which is mounted behind the coxswain's seat, is kept open by a forked toggle attached to the coxswain's leg by a Kill cord. When the Kill cord is removed it operates a solenoid to close a flap over the engine air supply intake at the turbocharger. After stopping the engine with the emergency cut-out, allow a period of at least 20 seconds to elapse before restarting. This will permit the vacuum in the engine to equalise with atmospheric pressure and the shut off valve to be released from its seating. Use the emergency cut-out switch only for emergencies.

05067. 6.5m RIB - Engine Starting Procedures

a. **Pre-start Checks**. (These checks are general, the manual for the particular engine fit should be studied for variations).

b. **Initial Settings**

(1) Disengage gear shift control and move the throttle lever forward to the half speed position.

(2) Confirm that the engine stop control is pushed right in.

(3) Fit the Kill cord switch lanyard and secure lanyard to leg.

c. **Starting (in the water)**

(1) Turn three-way key-switch to ‹ready to start’ position. (In cold weather turn to ‘heat’ position for 20 seconds and then return to ready to start’.)

(2) Press starting button on instrument panel and hold until engine fires. This should happen within 5 seconds.

(3) As the engine speed increases, check that the charge warning lamp goes off.

(4) Keep the engine speed below 1000 rev/min for about one minute and check that cooling water from the sea water circuit is discharging from the exhaust port in the transom.

d. **Starting (out of the water)**

(1) Check that there is no-one near the propeller.

(2) Follow steps 1-3 in para c above.

(3) Maintain engine speed at the minimum (800 rev/min).

(4) If on fresh water cooling alone: do not run the engine for more than 5 minutes; do not start again within one hour, except for operational purposes when the engine should be started just before the boat enters the water.

(5) Watch the cooling water temperature closely and stop the engine as soon as it rises above 95°C.

| **05068. 6.5m RIB - Running Procedures and Checks** (These procedures and checks are general, the relevant operator’s manual for the engine fit should be studied for variations).

a. Engage control of the gearbox by returning the gear shift/throttle lever to the neutral position. Then move the lever slightly ahead and slightly astern to confirm that the engine and gearbox respond.

b. Run the engine up to cruising speed as soon as possible. Avoid long periods of idling. This achieves the normal engine operating temperature quickly and prevents unnecessary wear.

c. Confirm that cooling water is discharging through the exhaust outlet.

d. Keep the continuous running speed 100 rev/min below the permitted maximum.

e. Periodically check that the readings on the instruments are within the laid down limits shown on the card on the panel.

f. Watch for leaks from the lubricating, fuel and cooling systems.

g. Do not let the engine idle for too long when alongside.

05069. 6.5m RIB - Stopping the Engine

a. Put the throttle to 'slow idle' for approximately 2 minutes.

b. Pull out the 'engine stop control' on the forward end of the engine housing. Remember to return it after the engine has stopped.

c. Switch the 'three-way starter key switch' on the distribution panel to 'off'. This breaks the circuit to all engine instruments and to the starter button.

If it is not required to operate the boat for some time:

a. Close the fuel line shut-off valve.

b. Close the sea water cooling circuit inlet valve.

c. Check that the flap on the exhaust discharge in the transom is shut.

d. Pump the bilges dry. Check that the bilge drain plugs on the transom are secure.

e. Switch off all electrical equipment and open the 'battery isolator switch' and remove the handle.

05070. RIB Handling - General Information

a. **Introduction**. RIBs are fast, seaworthy and easy to deploy. However, a high standard of skill is required to operate them, and in the hands of an inexperienced or poorly trained crew the potential for an accident is high. Training requirements for RIB crews are given in para 05035. The training programme progresses through the following stages:

(1) Acquiring boat knowledge. (covered in the RIB course).

(2) Handling in harbour. (covered in the RIB course).

(3) Handling in the open sea. (covered in the RIB course).

(4) Operating as a seaboat. (onboard training).

b. **Establishing Confidence**. Skill and confidence go hand in hand. It is important that the basic handling skills are acquired in calm water before putting them to the test in more demanding conditions. Coxswains and crew members under training must get the 'feel' of a RIB's controls before going on to learn to operate this type of boat in the open sea. The instructor must concentrate on supervising details of handling performance closely, but at the same time be prepared to inspire confidence when conditions are difficult. The final assessment of a RIB coxswain's competence should be made after he has had the opportunity to demonstrate both ability and confidence by taking a RIB away from a ship at sea without immediate supervision in the boat.

CAUTION

RIBS ARE NOT DESIGNED FOR BEACHING AND DAMAGE TO THE CRAFT CAN BE EXPECTED IF THEY ARE ALLOWED TO GROUND

| **05071. RIB Handling - Behaviour and Seakeeping**

a. **On a Straight Course**. RIBs are light, powerful boats, which respond quickly to changes in engine power. When moving slowly a RIB has a tendency to wallow, but on reaching planing speed it adopts a horizontal attitude and becomes directionally stable. At high speed in a seaway the hull will slam into the waves causing the boat to bounce sharply, but without pitching to any great extent. At full speed the 4.7 and 5.4m RIBs may develop a corkscrewing motion which can be controlled by adjusting speed.

b. **When Turning**. RIBs lean steeply inwards when turning at speed, but 'lift' from the immersed side of the buoyancy tube keeps the boat stable at a constant angle of heel during the turn. All RIBs can be turned with complete confidence under full wheel and power in calm water. It is however unwise to manoeuvre as sharply as this because a RIB will skid in a hard turn and the engine may race due to cavitation. A more effective turn can be made by reducing speed before putting the wheel over and then increasing speed again when the turn is completed. In rough weather altering course across the direction of the waves requires care so that the RIB does not expose too much of its underside to a strong gust risking a capsize.

Note. *The coxswain must, whenever practicable, inform all personnel in the boat of imminent course alterations or manoeuvres.*

c. **In a Seaway**. Manned by an experienced crew RIBs can operate safely in seas up to state 6 (wave height 4-6m) but loads and speeds may have to be reduced. When running across a beam sea the buoyancy tube on the upwind side absorbs the shock of the waves and the buoyancy tube on the downwind side gives lift contributing to stability. When heading into the sea the buoyancy tube lifts the bows to the oncoming waves and little water will be shipped. At high speed considerable stresses are placed on the bonding between the buoyancy tube and the bow; in rough weather it is advisable to reduce violent slamming by steering in a series of zigzags across the direction of the sea, and, if the waves are very steep, to reduce speed. When running down sea a RIB is less easy to handle. Constant attention to the boat's speed is required and frequent throttle adjustments are needed. The most important principle to be followed is to present a high bow to the wave which the RIB is about to overtake. The bow of a RIB lifts as the boat comes off or goes onto the plane, so by slowing down just before the moment of encounter and accelerating quickly to start planing again a RIB can be made to climb a wave rather than to plunge into it. The surfing situation should be avoided if possible as this may lead to a RIB burying her bows into the tail of the wave ahead. Lastly it must be remembered that the stern of a RIB is less buoyant than the bows, so it is inadvisable to allow a steep following wave to overtake and possibly swamp the boat over the transom. This is uncomfortable and the RIB will have to be manoeuvred to drain away the water.

d. **With a Payload or Passengers**. The distribution of load in a RIB affects its performance. A RIB is ‹bows heavy' when stopped or proceeding at slow speed so the boat should be loaded with the weight towards the stern until it reaches sufficient speed to plane. Tilting the outboard motor or sterndrive to different angles produces the effects shown in Fig 5-42. The coxswain must be sensitive to the RIB's performance and trim the propulsion unit to the optimum angle of tilt. An incorrect angle of tilt will reduce both speed and range.

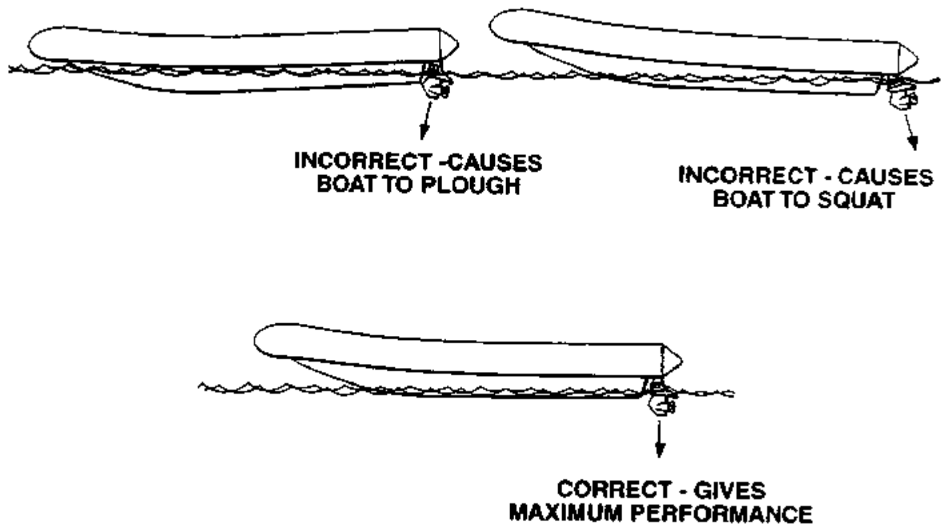


Fig 5-42. Engine Rake Settings

| 05072. RIB Handling - Boat Control

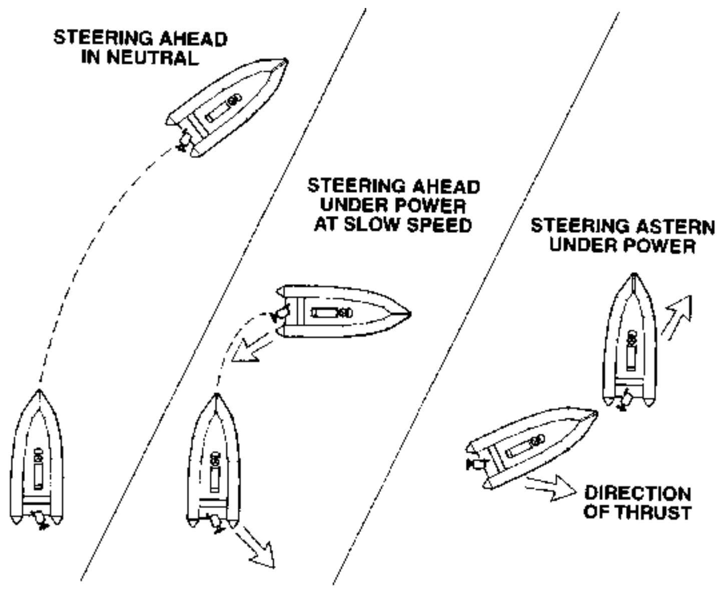
The first step towards learning to handle a RIB is to acquire a feel for the controls. The helmsman needs to know instinctively when he has moved out of neutral and engaged the ahead or astern gear, he needs to know how far he has to move the throttle to produce the power he requires, and he needs to know, without looking, where the wheel is. It is worthwhile spending some time in open water to become familiar with these controls before starting to learn how to manoeuvre the boat.

| 05073. RIB Handling - Visual Lookout

There is a good all-round view from the helmsman's position. Because these boats are fast a careful look-out must be kept and bold action taken to prevent close quarters situations developing. At high speed, rain and spray may make it difficult to see ahead and protection such as a visor or goggles should be used.

| 05074. RIB Handling - Manoeuvring

a. **At Slow Speed**. RIBs are steered by altering the direction of the thrust or drag of the propeller. When the engine is clutched to ‹ahead' or ‹astern' this has the effect of adding power to the steering, but when the engine is in neutral the steering is sluggish
| (see Fig 5-43). Because the response to the direction of thrust or drag is so quick when engine power is applied, the technique of manoeuvring at slow speeds is different to that required for conventional boats with rudders. The important point for the helmsman to remember is that the wheel must be put over before power is applied. When manoeuvring a RIB alongside or in a restricted space, it is important to think out the control movements in advance and to make them as a series of distinct steps with the wheel movement always being made before the engine movement.



| **Fig 5-43. Comparison of Steering Performance**

b. **Accelerating**. Once the ahead gear is engaged the throttle can be pushed forward firmly to give a very fast acceleration. A RIB will gain speed quickly and start to plane in a few seconds. In harbour care must be taken to conform with the speed regulations and to ensure that no damage or disturbance is caused by the wash, which is considerable. At sea this powerful acceleration is useful when the RIB is being operated as a seaboat. Speed can be rapidly and accurately adjusted to match the ship's speed and so facilitate returning for hoisting and recovery.

c. **Stopping**. The ability to judge speed and distance in making an approach must be acquired early since it is an essential part of the skill in handling a RIB effectively. A RIB loses speed quickly when the engine is put into neutral. The distance that it will carry its way is short because RIBs are comparatively light boats. If the speed of approach has been misjudged and the boat is found to be approaching too fast, damage can be prevented by using astern power; but control may be lost and another approach may have to be made.

d. **Manoeuvring in Neutral**. A RIB holds her course well while moving slowly through the water without engine power, but, being a light boat, sufficient allowance must be made for leeway if there is any wind. As soon as the engine is put into neutral a greater amount of wheel will be required and the helmsman must be prepared to work harder at steering the boat. Because of the leeway made at low speeds an experienced helmsman may, if there is a strong wind, decide to hold on under power until a later stage than usual, and then rely on going astern more sharply to take the way off the RIB.

e. **Manoeuvring Astern**. There are two important points to be remembered when making a sternboard:

(1) The stern will move in the direction in which the propulsion unit is pointing as soon as astern power is applied.

(2) Water will flood over the transom if speed is allowed to build up. The helmsman must therefore be careful to put the required wheel on before engaging astern gear and not to go astern too fast. At slow speeds all RIBs can be steered astern very accurately and turned in a tight circle. This is a useful feature which facilitates handling in a confined space.

05075. RIB Handling - Going Alongside (Fig 5-44)

a. The procedure for bringing a RIB alongside is as follows:

(1) Approach under power at an angle to the line of the jetty.

(2) At 3-5 boat lengths away put the engine into neutral.

(3) When the boat has closed to about one boat length put the wheel away from the jetty.

(4) As the boat begins to swing, reverse the wheel.

(5) Clutch to astern and increase power as necessary to stop the boat and bring the stern towards the berth.

(6) When alongside and stopped - put the clutch in neutral.

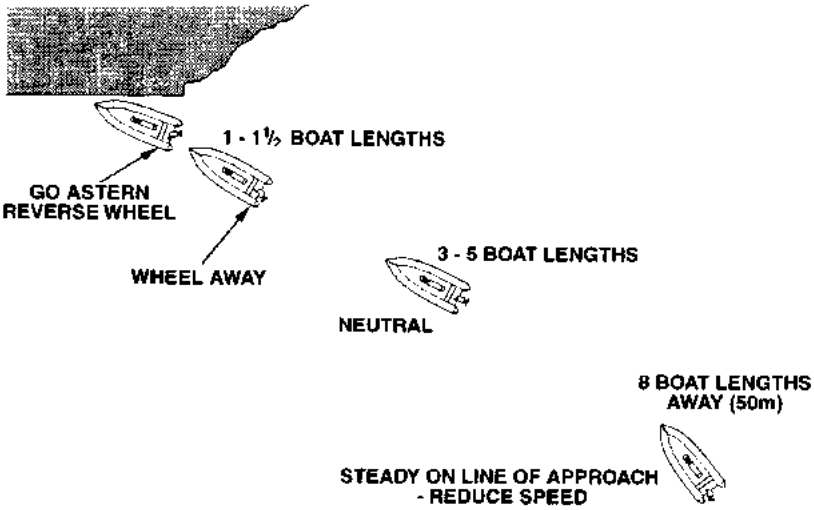


Fig 5-44. Approach to an Alongside Berth

b. Before starting his approach the coxswain must plan his manoeuvre in advance and decide how he is going to carry it out by considering the following three points:

(1) *Choice of Berth*. It is important to establish early exactly where to lay the RIB alongside. In some cases the aiming point may be quite evident and there will be no alternatives. In other cases the coxswain will have to take into account such factors as snags on the side of the jetty, wind and tide, obstructions in the approach, the proximity of ladders and the presence or otherwise of fenders. It can be helpful to sight the berth beforehand so that a last minute decision on the exact position of berthing does not have to be made. If taking a RIB alongside an unfamiliar berth remember that the buoyancy tube and hull of a RIB are easily damaged by protruding bolts and bars and also that RIBs are sufficiently powerful to be held off in the last stage of berthing if in doubt.

(2) *Selecting the Angle of Approach*. The best angle of approach is at about 30° to the line of the ship or jetty. This angle gives plenty of scope to adjust course either way to allow for leeway and set while keeping the boat moving steadily towards the aiming point. It must not however be taken as a hard and fast rule that an approach angle of 30° must be used, as there may be good reasons for adopting a different line. It should be borne in mind that, if a shallow approach angle is adopted, there will be less control over sideways drift in the latter stages, resulting in rubbing along the jetty. This is not desirable as it wears the buoyancy tube unnecessarily. If an approach is made at a steep angle the RIB closes the jetty much faster, and the coxswain has to place greater reliance on the RIB's engine power astern and his own judgement.

At an approach angle of 30° the lateral rate of closing the jetty is at only half the speed of the boat through the water. The RIB is sufficiently light, powerful and manoeuvrable for a competent coxswain to handle it successfully from a variety of different angles of approach.

(3) *Judging the Speed of Approach*. Judgement of the speeds to be used in an approach to a berth will improve as experience is gained. A RIB steers better with the engine clutched in to ahead than in neutral, so, to start with, speed should be reduced to slow at about 50 metres from the berth and the boat driven in at reasonably slow speed until some 3 to 5 boat lengths off. The engine should then be put in neutral for the last short stretch. Steering will become less positive and the speed will fall off fast; if headway or control appear about to be lost, a short burst of ahead power should be given, but it must be remembered that RIBs accelerate very quickly.

05076. RIB Handling - Leaving from Alongside

There are two methods of making a departure from alongside in a RIB.

a. **Sternboard Method**. The usual method of leaving a jetty is to make a short sternboard to take the RIB clear and then, when there is sufficient sea-room for the stern to swing, to go ahead and move steadily away from the berth. This method avoids rubbing the buoyancy tube along the jetty or wall. As in going alongside, leaving requires control of the wheel and engine to be exercised separately; the sequence of control movements should be as follows:

(1) Put the wheel away from the berth.

(2) Bear off the bow.

(3) Engage slow astern to draw the stern away from the jetty.

(4) When the stern has swung out to an angle of about 20-30 degrees, put the wheel amidships to stop the swing.

(5) Make a short sternboard to draw clear.

(6) Put the engine into neutral.

(7) Put the wheel away from the berth.

(8) Engage slow ahead, and watch the stern to prevent it swinging in to touch the jetty.

(9) Steady on a suitable course.

b. **Proceeding Ahead**. The other method of leaving from alongside is to go ahead directly after slipping and bearing off. This is a satisfactory method provided that it is possible to bear off sufficiently to prevent the boat rubbing when being manoeuvred on to her departure course. Precise engine and wheel control is required; small amounts of wheel and low engine speeds should be used until the RIB is well clear. The control movements required should be in the following sequence:

(1) Bear off the boat broadside on.

(2) Put on about 5 degrees of wheel away from the berth.

(3) Engage slow ahead and watch the stern.

(4) Steady on a course about 10-15 degrees out from the berth.

(5) When clear, alter to the required course.

(6) Increase speed.

***Note**. This method is not advocated if there is an onshore wind or set.*

c. **Precautions after Departure from Alongside**. RIBs gather speed very quickly, so great care must be taken after leaving a jetty not to disturb ships and boats in the vicinity with the wash. The sudden appearance of a RIB accelerating fast round a corner can embarrass other boats and cause a hazardous close quarters situation to develop quickly. Passengers must be safely settled in the boat (see para 05036), and the painter and sternfast must be coiled down inboard before accelerating and starting to plane.

05077. RIB Handling - Operating in Harbour

The coxswain of a RIB must comply with the local port regulations, particularly those governing the maximum speeds and routes within a harbour. The Rule of the Road must be closely observed. Because of its high speed a RIB will often be the overtaking craft (if the speed restrictions permit); plenty of sea room must be given to any ship or boat being overtaken to allow for unexpected alterations of course by the ship or boat being overhauled. In harbour a good lookout must be kept for logs and baulks of timber floating in the water; these will cause great damage if hit, as there is no protection or fendering on the GRP hull of a RIB. RIBs create a considerable amount of wash; take care not to upset men working over the side, or to endanger divers or disturb people in small boats.

05078. RIB Handling - Operating in the Open Sea

RIBs are reassuringly seaworthy and are capable of operating in worse weather conditions than a motor whaler. They may be lowered with safety at speeds of between 5 and 12 knots. Before being lowered or leaving the ship for an open sea passage the coxswain is responsible that the RIB is fully prepared. Besides making the operator checks listed for the class of boat he should see that the following preparations are made:

1. Crew and passengers correctly briefed, dressed and equipped.

2. Instructions on the objective and method of carrying out the operation are understood by all concerned.

3. Communications between ship and boat tested.

Once at sea the coxswain must continuously assess how the wind and sea is affecting the performance of the boat. He must be prepared to reduce the speed and ease the rates of turn to conform with the weather conditions, and must bear in mind the points made about the sea keeping behaviour of RIBs. In rough weather, a RIB can be driven fast towards or away from the direction of the waves, provided good judgement is exercised and the boat is not allowed to slam dangerously. Considerable care must be taken if the boat is turned across the sea as exaggerated corkscrewing may occur at speed and this could lead to the boat capsizing. If caught in very bad weather speed will have to be brought right down so that the RIB comes off the plane; this is uncomfortable and should only be resorted to if the boat starts to slam unacceptably hard.

05079. RIB Handling - Handling on being Lowered at Sea

The engines of RIBs fitted with appropriate cooling water arrangements should be started while being lowered. RIBs not so fitted should be started as soon as the boat reaches the water. Once the RFD hook has released the coxswain should steer slightly away from the ship's side and move ahead to take the strain off the boatrope. When ordered by the cox'n the boatrope should be released and recovered on deck. The coxswain must keep the RIB clear of the boatrope after it is slipped and then increase speed and move outwards away from the ship. Once clear turn to the course required, but do not cross close ahead of the ship, as a breakdown or engine failure in this position would prove disastrous.

05080. RIB Handling - Recovery of Survivors

A RIB should be stopped several metres upwind of the man in the water; the engine must then be put into neutral so that there is no chance of the propeller injuring the man. The boat should be allowed to drift down on to the survivor who, when close enough, should be lifted into the boat (see note 1); if the man is uninjured remember a Manual Line Thrower may be thrown to him. If the RIB has stopped in the wrong position and is drifting clear of the man it must be manoeuvred upwind and the process repeated. In those RIBs manned by a crew of two men only the coxswain may, in exceptional circumstances, have to assist in lifting the casualty over the buoyancy tube. Once inboard the casualty must be protected from exposure, then positioned on the port side of the RIB (see note 2) between the buoyancy tube and the consul, clear of the boat's slings, with his feet in the bows and his head aft. This position will ease his transfer from boat to ship, and will satisfy the medical requirement for a casualty's posture to be such that the feet are raised higher than the head. The boat's lifting slings ring should be placed on the starboard side of the boat. The crew must be prepared to give basic first-aid if necessary, and in any case must report by radio the condition of the survivor(s). When practicable, the casualty should remain in the boat and be transferred to the care of a medical team after the boat has been hoisted into its stowage. Where this procedure is not workable the transfer should take place with the boat at deck-edge level and bowsed into the ship's side. There are various methods of removing the casualty. A common practice is to provide a door-size board with a batten fixed at a suitable point to its underside. The board is rested athwartships on the centre guardwire and the casualty is slid onto the board, then transferred to a lightweight or canvas stretcher and conveyed to a dry area for treatment.

Notes:

1. Removal of a Man Overboard from the water when the Jasons Cradle is not embarked is best carried out by positioning the victim so he has his back to the boat. The person carrying out the recovery reaches outboard, passes his hands under the victim's armpits and clasps them together on the victim's chest before heaving the casualty inboard. If this is not possible firmly grasp the victim's clothing at the shoulders, push down (to gain momentum), then heave upward and pull the casualty inboard.

2. Applies to boats that are operated from the starboard side of the ship. The opposite applies to boats operated from the port side of the ship.

05081. Recovering a Person from the water using a Jason's Cradle

a. **Introduction.** The Jason's Cradle lifting frame has been introduced into RN service to improve rescuer safety, reduce the risks to the health of the casualty, and facilitate recovery of a casualty from the sea into a rescue boat. It is a ladder-like device constructed from a number of units (rungs). The inboard end of the device is secured to the inflation tube of the rescue craft. When used for man overboard recovery, the outboard end the cradle is kept in hand and the bight is lowered into the water. This action automatically forms an articulating non-collapsible loop. The casualty is floated into the loop and lifted from the water (horizontally) as the cradle is pulled aboard. The device can be fitted to the 6.5m RIB, 5.4m RIB, 4.9m RIB, Gemini and MIB. It is assumed that the 6.5m RIB has a crew of three; all the other craft operate with a crew of 2. The operation of the cradle in the 6.5m RIB is two-handed. In the other craft the operation is single-handed unless prevailing conditions are such that the coxswain can assist.

b. **Description.** The Jason's Cradle is four rungs wide by fifteen rungs long and has a deployment strop that is adjustable to a maximum length of 1.1m. The cradle, which has a carrying strop fitted to the outside of the stowage bag, can be fitted to either the port or starboard inflation tube. It is fitted forward of the coxswain's console in a RIB, but because the coxswain is positioned in the stern of a Gemini/MIB, the cradle must be positioned slightly further aft. Naval stores numbers of the equipment are as follows:

Jason's Cradle (complete unit)	0472-709-0889
D-Ring Patch Assembly	0472-723-0441
Bag for Stowage and Transport	0472-348-9911
Carbine Clip	0472-327-9614
Strap Webbing	0472-862-3287
End Nut	0472-864-6877

c. **Training.** Rescue boat crews must be trained to use the equipment safely and effectively. The procedures outlined in this guide should assist in meeting this objective.

d. **Installation into the Rescue Boat.**

(1) Study Fig 5-47b to ascertain the fitting positions for the various rescue craft, then attach the cradle to the appropriate port or starboard tube D-rings using the attachment clips (the D-ring patches must be fitted by qualified personnel from the Upkeep Group). The attachment clips should protrude from the two holes in the stowage bag. The cradle should be attached with the bag flap uppermost, see Fig 5-47a.

(2) Open the bag and fold the flap over the inflation tube.

Notes on Installation*:*

1. Even when the cradle is tightly rolled-up in its stowage bag, it is relatively bulky (approx. 710mm long by 330mm in diameter) and heavy (approx. 17kg). Therefore, due care should be taken when placing the cradle into the boat, to minimise the manual handling risks.

2. The preferred position for the cradle in a RIB is on the port side. This maximises the space available for casualty recovery.

3. *Wherever possible, all objects which may hinder casualty recover must be relocated. For example, in a RIB the tool box (usually) positioned forward of the coxswain's console should be relocated. The relocation of such objects is especially important in the 5.4 and 4.9m RIB as space forward of the coxswain's console is very limited.*

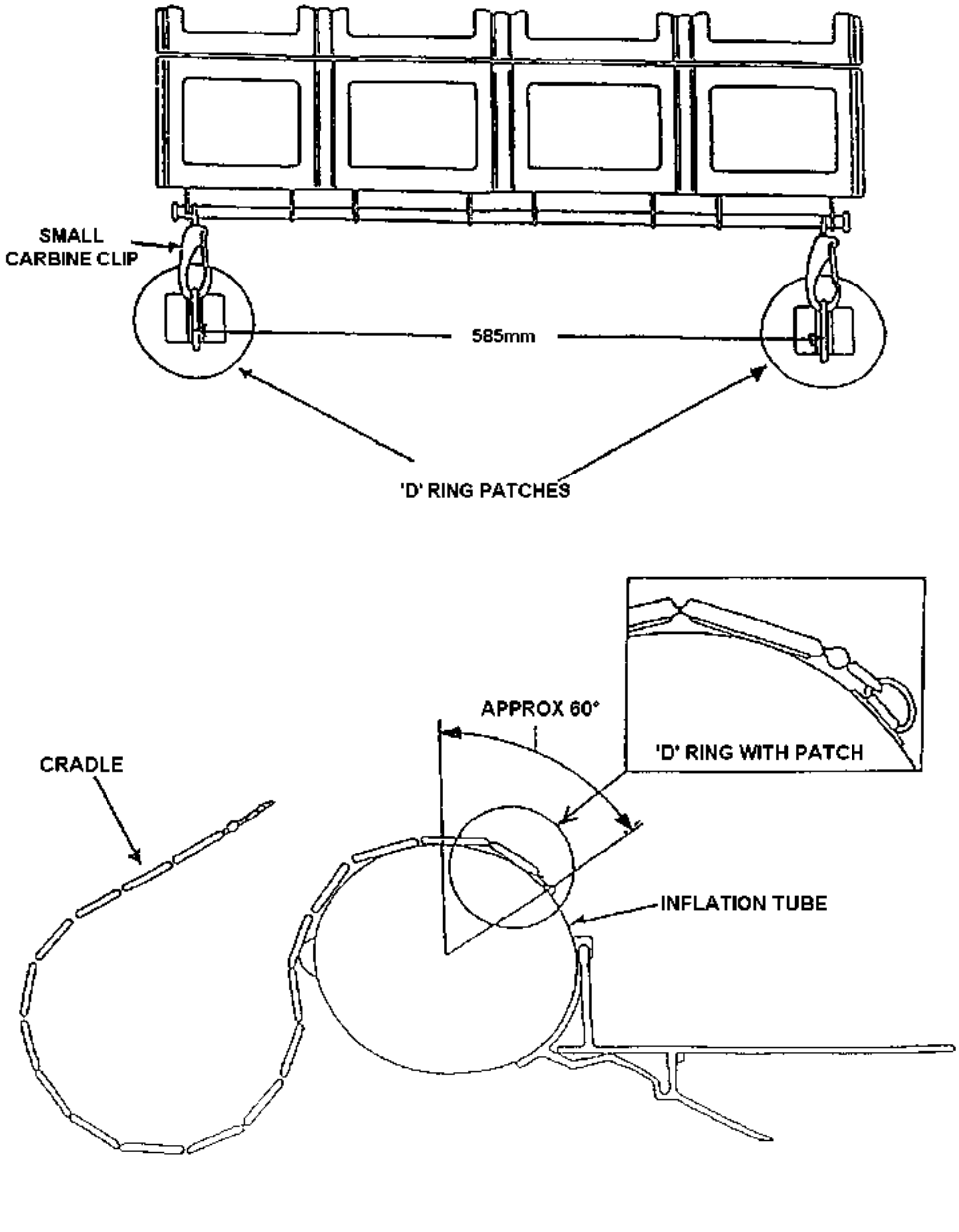
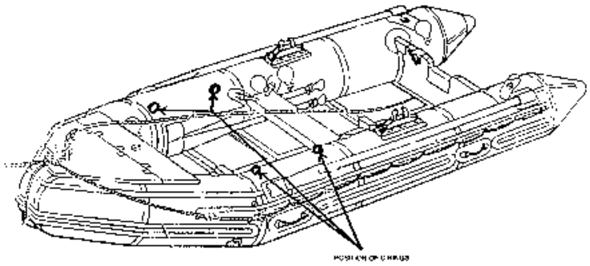
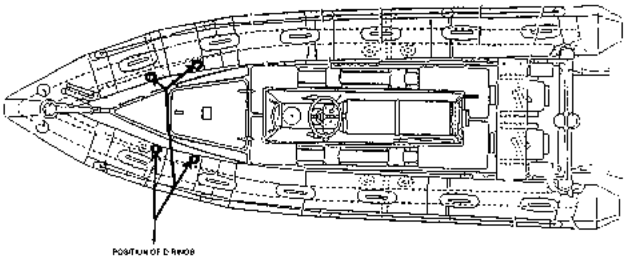


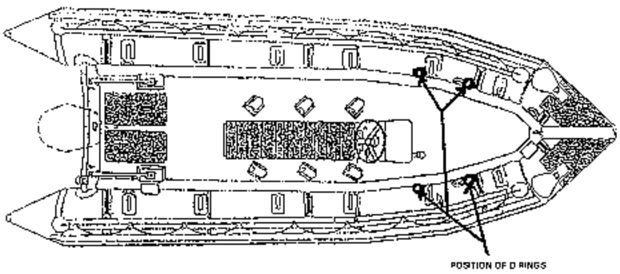
Fig 5-45. Installing a Jason's Cradle



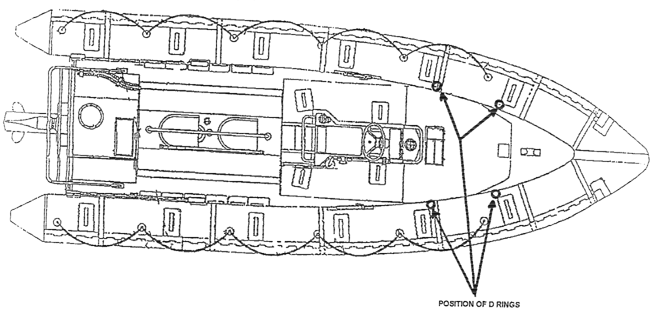
(a) Gemini/MIB



(b) 4.9m RIB



(c) 5.4m RIB



(d) 6.5m RIB

Fig 5-46 Jason's Cradle Fitting Positions in Rescue Craft

05082. **Safety Considerations and general Guidance for all users**

a. **Minimising the Risk of Manual Handling Injury**. Care should be taken when carrying out the rescue procedures using a Jason's Cradle. The rescuers must maintain stable postures during the recovery of the casualty to minimise the risk of falling overboard. To reduce the risk of incurring a manual handling injury when the casualty is being pulled aboard in the cradle, the rescuers must maintain an upright stance and avoid either leaning forward or flexing the spine excessively. Additionally, the rescuers should take care to avoid minor finger injuries when using the cradle (fingers can be nipped in the hinged joints of the cradle). Finally, the rescue must be conducted in a methodical, controlled manner to reduce the risk of injury to the rescuers and to ensure that the casualty's injuries are not exacerbated.

b. **Use of Gloves**. The use of suitable gloves will improve the rescuers grip whilst using the cradle and reduce the risk of minor finger injuries. In extreme cold conditions the use of gloves is strongly recommended.

c. **Stowing the Jason's Cradle.** Preparing the cradle for stowage is more easily achieved on the ship's deck, therefore the cradle should be removed from the rescue boat before it is placed into its stowage bag. Care should be taken when removing the cradle from the boat to minimise the manual handling risks.

(1) After use the cradle should be washed with fresh water.

(2) The following steps describe the easiest method for placing the cradle into its stowage bag:

(a) Stand the cradle on its edge and coil up tightly with the free end (the end not attached to the bag) innermost.

(b) Fit the bag around the cradle, ensuring that the attachment clips protrude from the holes in the bag, and seal the Velcro flap.

(c) Fasten the buckle and tighten (the Velcro may need to be re-sealed).

Note. *The cradle should not be lifted by the carrying strop until the buckle fastener and Velcro flap are fully secure.*

(3) Store in a dry location close to the boat deck(s) or in the designated rescue boat.

Note. *The basic sequence for deploying the Jason's Cradle is shown pictorially in Fig 5-47c.*

05083. 6.5m RIB Procedure (Two Handed Operation.) The cradle strop should be adjusted to its maximum length of approx 1.1m for use with this type of RIB. This ensures that when the cradle is deployed, the deployer does not have to lean out excessively.

a. **Approach to the Casualty.** The approach should be at low speed, with the cradle and casualty on the leeward side of the boat. During heavy seas (and high winds) it may be safer to position the casualty on the windward side of the boat. This will ensure that the boat does not drift over or land on top of the casualty as it is lifted on the swell. The two crew position themselves on either side of the cradle, Crewman 1 forward and Crewman 2 aft, Crewman 2 being the first-aider.

(1) During the final stages of the approach, Crewman 2 begins to deploy the cradle. This can be partially achieved by unrolling the cradle on the deck of the boat. To deploy the cradle, guide it over the side of the inflation tube whilst holding onto the strop, and lower it towards the water. The cradle will form a non-collapsing loop. A normal hand-grip on the strop will suffice. The strop should not be wound around the hand or secured to Crewman 2 in any way. The cradle should be fully deployed before reaching the casualty, with the cradle submerged in the water so that approximately one rung of the free end is above the water surface, this will ensure that the loop is deep enough to allow the casualty to float in. The strop adjustment ensure that Crewman 2 does not have to lean out excessively to perform this task.

(2) Crewman 1 should establish verbal contact with the casualty (if conscious) and explain the basic rescue procedure.

b. **Placing the Casualty in the Cradle**. Prior to starting the recovery, the crew are to assume kneeling postures against the inboard side of the inflation tube. This will place the crew close to the water and casualty, in a safe and stable posture.

(1) On reaching the casualty the Coxswain is to put the engine into neutral; Crewman 1 prepares to guide the casualty into the cradle. The casualty should be guided into the cradle head first (to ensure a feet towards bow attitude once the casualty is in the boat), this may require the casualty to be turned in the water. If the local conditions are such that turning the casualty in the water is not feasible, then the recovery should be made with the feet aft and if possible the casualty turned in the boat. Crewman 2 is to ensure that the loop is wide enough to accommodate the casualty and help Crewman 1 with the casualty when within reach. The casualty's arms should remain in the cradle during the recovery.

(2) When the casualty's shoulders are slightly overhanging the edge of the cradle (torso fully contained in the loop) Crewman 2 should pull on the strop to close the loop and secure the casualty in the cradle.

(3) If the sea conditions are heavy, 'slamming' of the bow of the rescue boat may occur. In these conditions it may be safer to guide the casualty into the cradle from aft. The most effective way to achieve this is for Crewman 1 to deploy the cradle and Crewman 2 to guide in the casualty. Again, the casualty's arms should be inside the cradle prior to the recovery commencing.

c. **Recovering the Casualty.**

(1) Both crew take hold of the free end of the cradle (with one hand) and pull until the free end is over the inflation tube. Crewman 1 should then adopt a standing posture, with the lower leg/knee braced against the inboard side of the inflation tube, Crewman 2 should then do the same. During these posture changes a firm grip should be maintained on the cradle. To ease this change of posture the free hand should be used to push off the inflation tube. Placing a knee against the inflation tube will also assist in securing the casualty on top of the inflation tube, as this will prevent the casualty dropping onto the deck of the boat.

(2) To complete the recovery task, the cradle should be pulled in at an angle of approximately 45˚ to the horizontal. This is the optimum pull angle for the cradle, therefore the rescuers can fully benefit from the cradle's 2 to 1 mechanical lifting advantage. Attempting to pull at a lower angle will make the recovery task difficult to complete and will increase the risk of a manual handling injury occurring.

(3) To assist in the co-ordination of the shared lift, instructions should be shouted by Crewman 1 during the following steps. To ease the recovery when pulling the cradle (and casualty) aboard, the rescuers should adopt a palm-down grip.

(4). Both crew should pull in the cradle (at approx. 45˚) with one hand, whilst the other hand reaches under the cradle for the next hand-hold. This new hand-hold should be two rungs down, and once located, the first two rungs should be folded over the top of the cradle.

(5) The cradle should be pulled in again, another hand-hold located (a further two rungs down the cradle), and the excess rungs folded over the top again.

(6) After another short pull on the cradle, the casualty should be lying face-up on the inflation tube. Crewman 1 may have to pull in the legs, and then keep a firm grip on the casualty. Crewman 2 should find a suitable hand-hold on the upper torso of the casualty.1

(7) Once the casualty is securely held on the top of the inflation tube, the free end of the cradle should be released to allow the cradle to hang over the side of the boat. Conscious casualties should be instructed to remain horizontal and should not be allowed to sit up until an initial first aid assessment has been conducted.

(8) The crew should now take up positions at the head and foot of the casualty and conduct a controlled lift to place the casualty onto the deck of the boat immediately adjacent to the inflation tube. This will place the head and shoulders of the casualty next to the coxswain's console, with Crewman 2 further aft.

d. **Preparation for Return to Ship.**

(1) Crewman 2 should immediately proceed with an initial first aid assessment, the priority task being to check the casualty's breathing. The first aider (Crewman 2) is in a good position to perform mouth-to-mouth resuscitation if required.

(2) Whilst Crewman 2 is assessing the casualty, Crewman 1 can retrieve the cradle. This can be achieved by pulling in the cradle in a controlled manner and laying it across the casualty to the other side of the boat. The weight of the cradle on the casualty is minimal and should not cause distress. Once the cradle is onboard it can be unclipped from its anchor points and temporarily stowed along the opposite side of the coxswain's console. Alternatively, if moving the cradle elsewhere causes an obstruction, it can be left lying across the casualty (if this does not cause problems for the casualty). The cradle stowage bag has been designed to remain attached to the cradle.

(3) Once the first aider has stabilised the casualty, the rescue boat can return to the ship.

05084. Searider, Gemini & MIB Procedure (Single-Handed Operation). If the rescue conditions are such that the coxswain cannot assist in the recovery of the casualty, the recovery must be conducted single-handed. The cradle strop is to be adjusted to a length suitable for these type of rescue craft. The optimum length of strop should allow the cradle to be fully deployed (cradle submerged in the water so that approximately one rung of the free end is above the water surface) without the deployer leaning out excessively.

a. **Approach to Casualty.** The final approach should be at low speed, with the cradle
and casualty on the leeward side of the boat. During heavy seas (and high winds) it may be safer to position the casualty on the windward side of the boat. This will ensure that the boat does not drift over the casualty or land on top of the casualty as it is lifted on the swells.

(1) During the approach, the bowman should begin to deploy the cradle. This can be partially achieved by unrolling the cradle on the deck of the boat. To deploy the cradle, guide it over the side of the inflation tube whilst holding onto the strop, and lower it towards the water. The cradle will form a non-collapsing loop. A normal hand-grip on the strop will suffice. The strop should not be wound around the hand or secured to the bowman in any way. The cradle should be fully deployed before reaching the casualty, with the cradle submerged in the water so that approximately one rung of the free end is above the water surface, this will ensure that the loop is deep enough to allow the casualty to float in.

(2) The bowman should establish verbal contact with the casualty (if conscious) and explain the basic rescue procedure.

b. **Placing the Casualty in the Cradle.** Prior to starting the recovery, the bowman should assume a kneeling posture against the inboard side of the inflation tube. This will place the bowman close to the water and casualty, in a safe and stable posture.

(1) On reaching the casualty, the Coxswain puts the engine into neutral and the bowman prepares to guide the casualty into the cradle, having checked that the loop is wide enough to accommodate the casualty. The casualty should then be guided into the cradle head first (to ensure a feet towards bow attitude once the casualty is in the boat), this may require the casualty to be turned in the water. If the local conditions are such that turning the casualty in the water is not feasible, then the recovery should be made with the feet aft and if possible (due to the restricted space) the casualty turned in the boat. The casualty's arms should remain in the cradle during the recovery.

(2) When the casualty's shoulders are slightly overhanging the edge of the cradle (torso fully contained in the loop) the bowman pulls on the strop to close the loop and secure the casualty in the cradle.

(3) If the sea conditions are heavy, 'slamming' of the bow of the rescue boat may occur. Under these conditions, it may be safer to guide the casualty into the cradle from aft. Again, the casualty's arms should be inside the cradle prior to the recovery commencing.

c. **Recovering the Casualty**

(1) The bowman should take hold of the free end of the cradle (with one hand) and pull until the free end is over the inflation tube. The bowman then adopts a standing posture, with the lower leg/knee braced against the inboard side of the inflation tube. During this posture change a firm grip should be maintained on the cradle. To ease this change of posture the free hand should be used to push off the inflation tube. Placing a knee against the inflation tube will also assist in securing the casualty on top of the inflation tube, as this will prevent the casualty dropping onto the deck of the boat.

(2) To complete the recovery task, the cradle should be pulled in at an angle of approximately 45˚ to the horizontal. This is the optimum pull angle for the cradle and ensures the rescuer fully benefit from the cradle's 2 to 1 mechanical lifting advantage. Attempting to pull at a lower angle will make the recovery task difficult to complete and will increase the risk of a manual handling injury. To ease the recovery when pulling the cradle (and casualty) aboard, the bowman should adopt a palm-down grip.

(3) The bowman pulls in the cradle (at approx. 45˚) with one hand, whilst the other hand reaches under the cradle for the next hand-hold. This new hand-hold should be two rungs down, and once located, the first two rungs should be folded over the top of the cradle.

(4) The cradle should be pulled in again, another hand-hold located (a further two rungs down the cradle), and the excess rungs folded over the top again.

(5) After another short pull on the cradle, the casualty should be lying face-up on the inflation tube. The bowman may have to pull in the legs, and then keep a firm grip on the casualty.

(6) Once the casualty is securely held on the top of the inflation tube, the free end of the cradle should be released to allow the cradle to hang over the side of the boat. Conscious casualties should be instructed to remain horizontal and should not be allowed to sit up until an initial first aid assessment has been conducted.

(7) The bowman should then take up a position at the head of the casualty and conduct a controlled lift to place the casualty onto the deck of the boat immediately adjacent to the inflation tube. In the Searider, this will place the head and shoulders of the casualty next to the coxswain's console, with the bowman further aft.

d. **Preparation for Return to Ship**

(1) The bowman should immediately proceed with an initial first aid assessment, the priority task being to check the casualty's breathing. If the coxswain is the first aider, they must swop places. The first aider is in a good position to perform mouth-to-mouth resuscitation if required.

(2) Once the first aider has stabilised the casualty, the cradle can be retrieved. This can be achieved by pulling in the cradle in a controlled manner and laying it across the casualty to the other side of the boat. The weight of the cradle on the casualty is minimal and should not cause distress. Once the cradle is onboard it can be unclipped from its anchor points and temporarily stowed along the opposite side of the coxswain's console (in Searider). Alternatively, if moving the cradle elsewhere causes an obstruction, it can be left lying across the casualty (if this does not cause problems for the casualty). The cradle stowage bag has been designed to remain attached to the cradle. The rescue boat can then return to the ship.

05085. Searider, Gemini & MIB Procedure (Two-Handed Recovery). When the rescue conditions allow, the coxswain should assist in the recovery of the casualty. The cradle strop should be adjusted to a length suitable for these type of rescue craft. The optimum length of strop should allow the cradle to be fully deployed (cradle submerged in the water so that approximately one rung of the free end is above the water surface) without the deployer leaning out excessively.

a. **Approach to Casualty**

(1) The approach should be at low speed, with cradle and casualty on the leeward side of the boat. During heavy seas (and high winds) it may be safer to position the casualty on the windward side of the boat. This will ensure that the boat does not drift over the casualty or land on top of the casualty as it is lifted on the swells.

(2) The bowman should establish verbal contact with the casualty (if conscious) and explain the basic rescue procedure.

b. **Placing the Casualty in the Cradle**. Prior to starting the recovery, the bowman should assume a kneeling posture against the inboard side of the inflation tube. This will place the bowman close to the water and casualty, in a safe and stable posture.

(1) On reaching the casualty, the coxswain puts the engine into neutral and the bowman secures the casualty. Once the casualty is secured, the coxswain should join the bowman to complete the recovery. The current design of boat cut-out switch uses a 'Kill Cord' system which stops the engine when the cord is pulled. Therefore, the only way to allow the coxswain to assist without stopping the engine is to detach the Kill Cord from the coxswain.

(2) The Crewman who is first aid trained should take up a kneeling posture aft of the cradle (Crewman 2), with the other crewman forward (Crewman 1). If the bowman is the first-aider, the crew must change places. Care is to be taken to ensure the casualty remains secure during the hand-over.

(3) Crewman 2 deploys the cradle. This can be partially achieved by unrolling the cradle on the deck of the boat. To deploy the cradle, guide it over the side of the inflation tube whilst holding onto the strop, and lower it towards the water. The cradle will form a non-collapsing loop. A normal hand-grip on the strop will suffice. The strop should not be wound around the hand or secured to Crewman 2 in any way. The cradle should be submerged in the water so that approximately one rung of the free end is above the water surface, this will ensure that the loop is deep enough to allow the casualty to float in.

(4) Crewman 2 should ensure that the loop is wide enough to accommodate the casualty. The casualty should then be guided into the cradle head first (to ensure a feet towards bow attitude once the casualty is in the boat), this may require the casualty to be turned in the water. If the local conditions are such that turning the casualty in the water is not feasible, then the recovery should be made with the feet aft and if possible (due to the restricted space) the casualty turned in the boat. The casualty's arms should remain in the cradle during the recovery.

(5) When the casualty's shoulders are slightly overhanging the edge of the cradle (torso fully contained in the loop) Crewman 2 should pull on the strop to close the loop and secure the casualty in the cradle.

(6) If the sea conditions are heavy, 'slamming' of the bow of the rescue boat may occur. Under these conditions, it may be safer to guide the casualty into the cradle from aft. Again, the casualty's arms should be inside the cradle prior to the recovery commencing.

c. **Recovering the Casualty**

(1) Both crew should then take hold of the free end of the cradle (with one hand) and pull until the free end is over the inflation tube. Crewman 1 then adopts a standing posture, with the lower leg/knee braced against the inboard side of the inflation tube, Crewman 2 does the same. During these posture changes a firm grip should be maintained on the cradle. To ease this change of posture the free hand should be used to push off the inflation tube. Placing a knee against the inflation tube will also assist in securing the casualty on top of the inflation tube, as this will prevent the casualty dropping onto the deck of the boat.

(2) To complete the recovery task, the cradle should be pulled in at an angle of approximately 45˚ to the horizontal. This is the optimum pull angle for the cradle and allows the rescuers to fully benefit from the cradle's 2 to 1 mechanical lifting advantage. Attempting to pull at a lower angle will make the recovery task difficult to complete and will increase the risk of a manual handling injury occurring.

(3) To assist in the co-ordination of the shared lift, instructions should be shouted by Crewman 1 during the following steps. To ease the recovery when pulling the cradle (and casualty) aboard, the rescuers should adopt a palm-down grip.

(4) Both crew should pull in the cradle (at approx. 45˚) with one hand, whilst the other hand reaches under the cradle for the next hand-hold. This new hand-hold should be two rungs down, and once located, the first two rungs should be folded over the top of the cradle.

(5) The cradle should be pulled in again, another hand-hold located (a further two rungs down the cradle), and the excess rungs folded over the top again.

(6) After another short pull on the cradle, the casualty should be lying face-up on the inflation tube. Crewman 1 may have to pull in the legs, and then keep a firm grip on the casualty. Crewman 2 should find a suitable hand-hold on the upper torso of the casualty.

(7) Once the casualty is securely held on the top of the inflation tube, the free end of the cradle must be released and allowed to hang over the side of the boat. Conscious casualties should be instructed to remain horizontal and should not be allowed to sit up until an initial first aid assessment has been conducted.

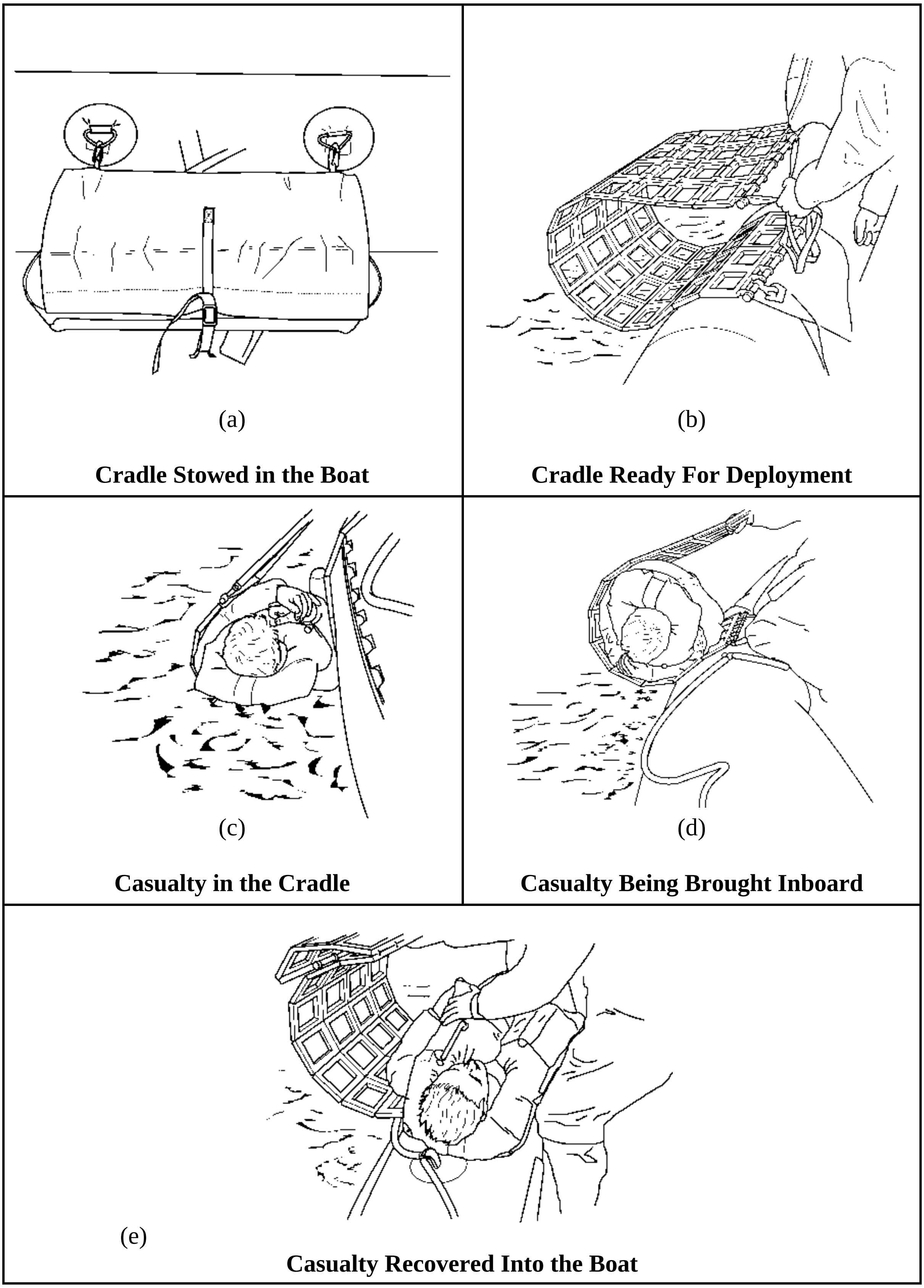
(8) The crew then take up positions at the head and foot of the casualty and conduct a controlled lift to place the casualty onto the deck of the boat immediately adjacent to the inflation tube. In the Searider, this will place the head and shoulders of the casualty next to the coxswain's console, with Crewman 2 further aft.

d. **Preparation for Return to Ship**

(1) Crewman 2 must immediately proceed with an initial first aid assessment, the priority task being to check the casualty's breathing. The first aider (Crewman 2) is in a good position to perform mouth-to-mouth resuscitation if required.

(2) Whilst Crewman 2 is assessing the casualty, Crewman 1 can retrieve the cradle. This can be achieved by pulling in the cradle in a controlled manner and laying it across the casualty to the other side of the boat. The weight of the cradle on the casualty is minimal and should not cause distress. Once the cradle is onboard it can be unclipped from its anchor points and temporarily stowed along the opposite side of the coxswain's console (in Searider). Alternatively, if moving the cradle elsewhere causes an obstruction, it can be left lying across the casualty (if this does not cause problems for the casualty). The cradle stowage bag has been designed to remain attached to the cradle.

(3) Once the first aider has stabilised the casualty, the rescue boat can return to the ship. **The Kill Cord must be re-attached to the Coxswain soon as possible after the casualty has been recovered**.



(a) **Cradle Stowed in the Boat**

(b) **Cradle Ready For Deployment**

(c) **Casualty in the Cradle**

(d) **Casualty Being Brought Inboard**

(e) **Casualty Recovered Into the Boat**

Fig 5-47 Recovering a Casualty Using the Jason's Cradle

05086. RIB Handling - Return for Hoisting in the Open Sea

Passengers or survivors should normally be disembarked alongside before a RIB is hoisted, unless it is decided to hoist the boat with an incapacitated person onboard. The ship should make a lee so that passengers can leave the RIB in shelter. A pilot ladder or davit hoist can be used for disembarking passengers depending on the weather conditions. As soon as the RIB has been unloaded and is ready for hoisting, the ship's speed should be increased to at least 5 knots and the RIB sent round under the seaboat fall. The coxswain must manoeuvre to pick up the boatrope and keep the RIB away from the ship's side. Once the boatrope has been secured he should reduce speed, allow the RIB to lie back on the boatrope and hook on to the fall. When hooked on he indicates to the Petty Officer on deck that the RIB is 'hooked on and ready for hoisting'. The engines of the 5.4m and 4.7m RIB must be stopped before the boat is hoisted since they must not be run without cooling water. The engine of the 6.5m RIB has an internal cooling system and may be allowed to run for a short time until the boat is clear of the water.

05087. RIB Handling - Emergencies

An emergency may occur occasionally as the result of mechanical faults - such as engine failure - bad handling or inattention to correct procedures by the crew. The coxswain and crew must be aware that these incidents can happen and know what action to take in the event.

a. **Engine Failure**. The immediate result of a sudden engine failure will be that the RIB stops suddenly and may fill with water over the transom. The coxswain should try to find out the cause of the engine stopping; the immediate checks to be made are:

(1) Inadvertent operation of the emergency cut-out switch.

(2) Fuel tank empty or fuel supply cut off.

(3) Ignition failure.

b. **Subsequent Action if Engine is Not Re-started**. If the cause cannot be found quickly, the sea anchor should be streamed to prevent the RIB drifting fast downwind and a more detailed investigation made to find the fault. The ship should be informed of the time and position of stopping and the direction and rate of drift. The crew should then take the following action:

(1) Tend the sea anchor line to stop it snubbing and to reduce the rate of drift.

(2) Bale out any water on deck.

(3) Try paddling (if likely to be effective in the prevailing weather).

(4) Have the distress signal flares available.

(5) Maintain radio contact with the ship.

c. **Steering Jammed** (in the 5.4 and 4.7m RIB). This is likely to be caused by either a bent rod in the through-tube or the remote steering cable seizing. If this occurs in narrow or crowded waters, slow down and stop immediately; this will bring the boat under control. The usual remedy is to grease the steering rod in the through-tube. If this does not free the steering inspect the steering cable linkage under the wheel.

d. **Deflation of the Buoyancy Tube**. RIBs have buoyancy tubes with either 5 or 7 compartments and it is unlikely that the whole buoyancy tube will become deflated. If one or more compartments are deflated the height of the gunwale will be lowered and, in the open sea, the boat should be manoeuvred to prevent water being shipped. It is preferable to bring a RIB alongside with the damaged part of the buoyancy tube outboard. Losing air out of the buoyancy tube does not affect the immediate buoyancy of a RIB. The RIB with a defective buoyancy tube is, however, much less seaworthy and repairs should be made without delay.

e. **Fire**. Fire in a RIB must be dealt with quickly. Identify the area, isolate the cause and extinguish.

(1) *6.5m RIB*. If fire breaks out in the engine compartment or below deck:

(a) Shut down all machinery.

(b) Close fuel supply valve.

(c) Unscrew brass fire access cap on top of the engine casing.

(d) Operate fire extinguisher through the access port.

(e) Allow heat to dissipate before removing cover from the engine.

(2) *Petrol engined RIBs*. Fire is most likely to be caused by an electrical fault. If this is the cause:

(a) Stop the engine.

(b) Disconnect fuel leads.

(c) Isolate the battery.

(d) Extinguish fire.

(e) Re-start engine when the cause has been identified and the boat has been made safe.

f. **Swamping**. This may occur if the boat slows down suddenly and is overtaken by a following sea. A burst of power ahead will clear the RIB of water provided the scupper hoses - (in boats so fitted) - are streamed. The 6.5m RIB must never be allowed to fill with so much water that the engine casing is flooded. Minor swamping is not dangerous, but can affect the handling of a RIB. As a matter of principle water on deck should be discharged as quickly as possible.

g. **Corkscrewing**. This may occur - particularly in the 5.4m RIB - if a RIB is being driven too fast across the sea in unfavourable weather conditions. If it starts to corkscrew a RIB is out of control and the coxswain must act immediately by reducing the speed and altering the course to bring the boat under control again.

h. **Man Overboard**. In the event of someone going overboard, the coxswain must bring the boat round by the shortest possible way to a point about 5 metres upwind of the man in the water; then carry out the recovery procedure given in paragraph 05080. If the coxswain is accidentally jerked overboard the engine will be stopped by operation of the emergency cut-out switch. A member of the crew must then take over as helmsman. After resetting the emergency cut-out switch and securing the Kill cord to his leg, he should re-start the engine and manoeuvre the RIB as described above.

05088. RIB Handling - Towing

a. **Taking in Tow**. RIBs are not designed for towing and should be employed in this role only for short periods. In the 6.5m RIB the weight of the tow should never be taken by the transom; when taking a tow astern the towing line must draw clear on the quarter so that it does not foul the sterndrive or outboard motor. Sufficient length of towrope must be streamed to prevent snatching and the speed of tow should be kept low. When towing alongside, fenders must be placed in suitable positions to prevent damage to the GRP hull if the object under tow is low in the water. If the craft under tow bears on the buoyancy tube it must be firmly secured to reduce rubbing and great care must be taken to see that there are no projections which might tear the fabric.

b. **Being Towed**. All RIBs may be towed for short periods on the boatrope bridle, but care must be taken to prevent the bridle from chafing the buoyancy tube. The crew should insert a wooden or canvas scotchman to absorb any wear from the movement of the towrope. The 6.5m and 5.4m RIB have a towing eyeplate fitted on the forefoot. If possible the tow should be connected to this eyeplate if it is expected to tow either of these RIBs for a long distance. The eyeplate is not easily reached and in rough weather in the open sea it may be less hazardous to connect the tow to the towing bridle instead. The coxswain of the RIB under tow should try to keep the boat steering as steadily as possible.

05089. 6.5m RIB - Pacific 22 Mk 2 (Jetpac)

a. **Introduction.** The 6.5m RIB Fast Rescue Craft (FRC) is constructed in accordance with SOLAS requirements for Life Saving Appliances for a Fast Rescue Craft and is approved for 8 persons. The boat is also built in compliance with MoD(N) specifications. It comprises a deep V hard chine-planning hull, constructed from GRP, surmounted by a mechanically inflated tube (flotation collar). One diesel engine is mounted inboard within an enclosure located behind the coxswains position. Drive is transmitted from the engine via a drive shaft through a water jet mounted reinforced transom. The coxswain is provided with a straddle type seat and backrest, aft of the console. Bench type seats for passengers are provided either side of the engine cowling. Toe straps and grab-rails provide added support. The ROB incorporates a tubular frame, with integral lifting ring, situated between the coxswain's seating position and gear box, for specific use with a single point lifting system. At the stern a manually operated, gas inflated, self-righting bag is fitted on a dedicated framework. Also fitted at the stern is a set of rollers to assist in recovery of casualties, and secured to the transom is a tubular water jet guard with a ladder, to further assist in recovery of personnel/divers from the water.

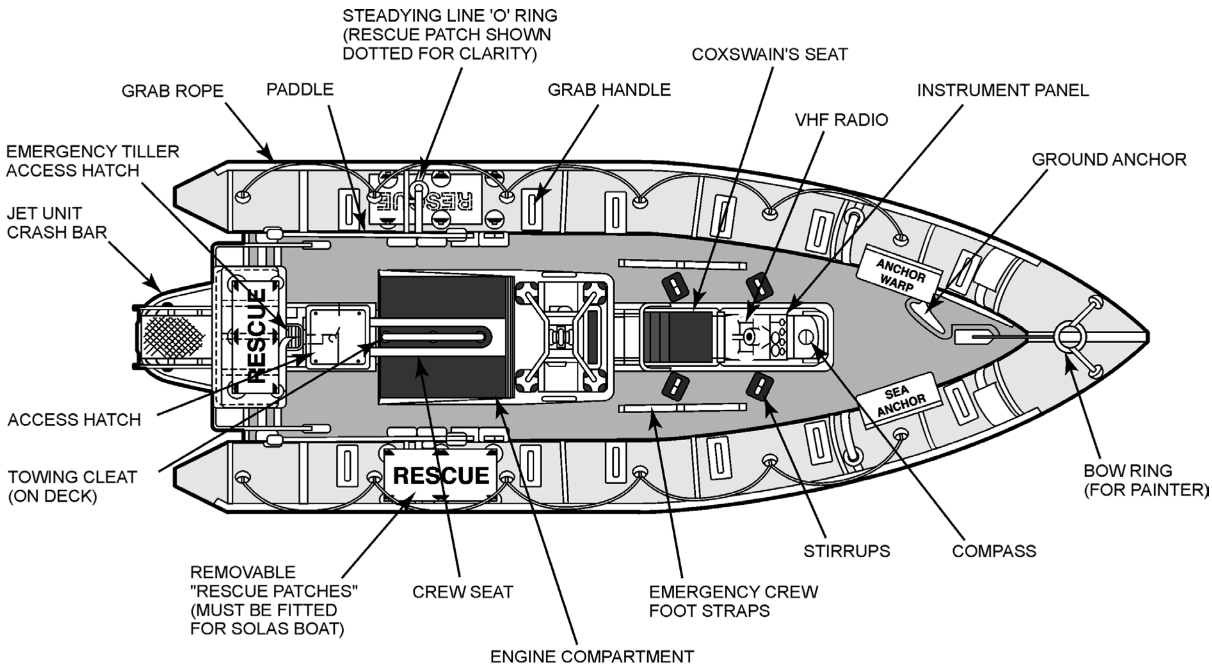


Fig 5-48. 6.5m RIB - Pacific 22 Mk 2

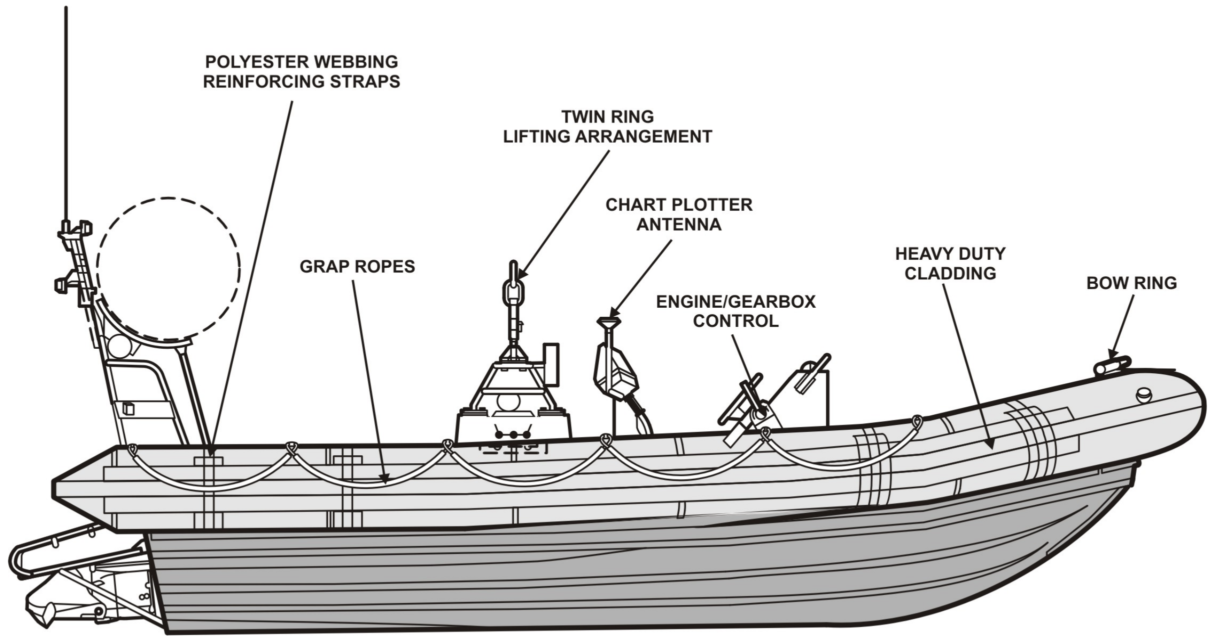


Fig 5-49. 6.5m RIB

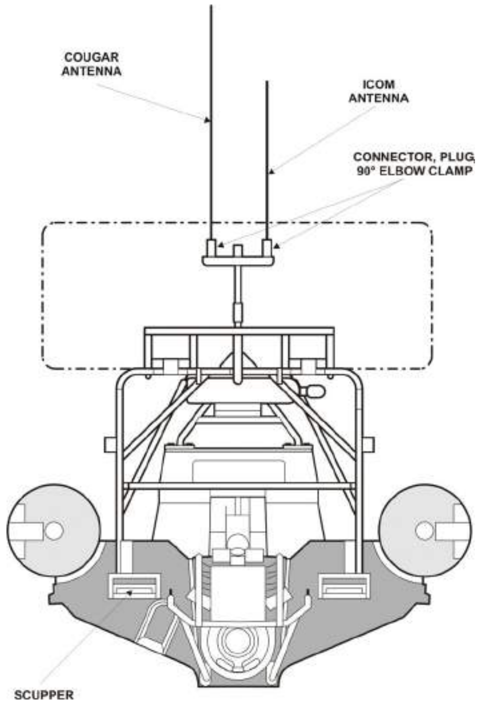


Fig 5-50 .6.5m RIB

b. **Dimensions of the 6.5m RIB - Pacific Mk 2.**

Length overall	7.10m (23ft 3.5in)
Length rigid hull	6.12m (20ft 9.5in)
Beam overall	2.44m (8ft)
Beam rigid hull	2.03m (6ft 8in)
Draught (operational)	0.50m (1ft 7.5in)

c. **Performance.** The 6.5m RIB - Pacific Mk 2 handles safely in rough weather and may be operated with a full load in a sea state 5. In higher sea states than this the load and speed may have to be reduced. It is capable of achieving 32 knots (approx) under optimum sea conditions and a full load. At 20 knots with 8 persons and a full load, the fuel tank with a capacity of 142 litres will give an endurance of approx 4.5 hours.

d. **Weight and Capacity.** Before attempting to lift the RIB ensure that adequate lifting capacity is available. The maximum operational boat weight is 2500Kg. The following table gives the weight of the boat, personnel and other equipment and should be used when calculating hoisting out and recovery weights.

(1) Fast Rescue Craft / Seaboat / Crashboat "A"

Weight of boat, fuel and 2 crew	2040 Kg
Boats Bag "A"	10 Kg
Crash Bag	25 Kg
Total	2075 Kg

(2) Force Protection Craft GPMG Mounted (not Xeres fitted)

Weight of boat, fuel and 2 crew	2040 Kg
Boats Bag	10 Kg
Unloaded GPMG	11 Kg
Ammunition X3 boxes of 200 rds	18 Kg
GPMG Fenlow Mount	32 Kg
Total	2111 Kg

(3) Force Protection Craft GPMG Mounted (Xeres fitted)

Weight of boat, fuel and 2 crew	2040 Kg
Boats Bag	10 Kg
Xeres Equipment	130 Kg
Ammunition X3 boxes of 200 rds	18 Kg
GPMG Fenlow Mount	32 Kg
Total	2230 Kg

(4) Boarding Craft Xeres fitted (GPMG not fitted)

Weight of boat, fuel and two crew	2040 Kg
Boats bag	10 Kg
Xeres equip (inc boarding suitcasses)	130 Kg
GPMG Fenlow Mount	32 Kg
Boarding ladder 3m	10 Kg
Boarding Ladder 2m	10 Kg
Stihl Saw X1	10 Kg
Spare fuel for Stihl Saw	5 Kg
Total	2247 Kg

(5) Boarding Craft Xeres fitted (GPMG not fitted) utilised as a Seaboat / Crash boat “A”

Weight of boat, fuel and three crew (SOW)	2115 Kg
Boats Bag	10 Kg
Crash Bag “A”	25 Kg
Xeres Equipment	130 Kg
GPMG Fenlow Mount	32 Kg
Total	2212 Kg

(6) <u>Boarding Craft Xeres fitted (GPMG not fitted) utilised as a Seaboat / Crash boat "B"</u>

Weight of boat, fuel and three crew (Diver)	2115 Kg
Boats Bag	10 Kg
Diving Set and weights	50 Kg
Xeres equipment	130 Kg
GPMG Fenlow Mount	32 Kg
Total	2337 Kg

Note: *Crash Bag "B" (Flotation and Salvage Equipment weight varies depending on number and type of equipment and must be established by individual ships.)*

e. **Boats Roles.** The Pacific Mk 2 can be role changed to provide the command with a versatile platform for ever changing world-wide tasking. The legacy statement that the seaboats primary role was life saving has now changed to the following:

(1) Boarding Operations

(2) Force Protection

(3) Lifesaving

(4) Passenger / Stores Transfer

05090. 6.5m RIB - Pacific 22 Mk 2 Boarding Operations.

a. **Introduction.** As more RN ships are tasked to conduct Maritime Interdiction Operations (MIO) in support of the United Nations. A new generation of ship's boats had to be procured to replace legacy boats, to fulfil this task. The Pacific Mk 2 was identified as a suitable craft for this MIO role. Enhancing the standard Mk 2 Pacific with Xeres equipment allows the boat to become a capable platform from which boarding parties can be deployed in excess of 10nm from the mother ship. Xeres equipment allows for automatic navigation and tracking for two seaboats as well as providing secure communications between both boats and the mother ship.

b. The Pacific Mk 2 can be configured to carry Xeres communication and tracking equipment in support of boarding operations. The following equipment is fitted to the craft:

(1) Oceana Seaboat Computer.

(2) KY 100 Secure comms radio.

(3) Harris military radio.

(4) Man overboard alarm facility.

c. **Boarding Role/XERES Fit.** Current concept of operations requires a two-boat capability to board targets over the horizon (10 - 12nm), with the mother ship and the seaboats maintaining tracking and secure communications. A two-boat deployment gives the command an extra capability for:

(1) Men and equipment can be inserted to the target vessel in one operation.

(2) Gives the command the flexibility to board multiple target vessels whilst in congested waters (fishing fleet / estuaries).

(3) Xeres fitted equipment allows the command to vector both boats to a specific target area / vessel whilst tracking both boats on the mother ship's bridge.

(4) Secure communications to both boats allows for the element of surprise.

(5) Two boat deployment allows a Safety boat coverage whilst conducting boarding operations. One boat proceeds alongside the target vessel whilst the second boat sits in the waiting station. This allows the second boat to act as a safety boat, incase of man overboard or loss of equipment.

(6) Due to the distances being deployed and the Pacific Mk 2 being single engined, deployment in pairs gives the crews confidence of recovery or assistance if the craft suffers from mechanical or technical problems.

d. **Force Protection Role.** When deploying in the Force Protection Role the Pacific Mk 2 can be fitted with a General Purpose Machine Gun (GPMG) and Fenlow Mount. Ships Staff are to take note of all up hoisting weights listed in para 05089 when the GPMG is fitted to the craft. The Bowman will be the GPMG aimer when in the Force Protection Role.

e. **Armed RIB.** Use of the GPMG during Boarding Operations is limited in that the weapon may be rigged during the transit of personnel, however, no current clearance is available for it to be manned other than those occasions listed in BR 8988 Chapter 27 para 13. During the transit, when rigged, the weapon is to remain in the stowed position with the bowman seated accordingly. When laying off having delivered the Stick, the armed RIB may be used as required by the Command.

f. **Boat deployment.** Units being deployed for Armilla tasking will be outfitted with Xeres equipped boats. (Lift capability dependent). Ship's will be informed by CINC FLEET on delivery dates of the Xeres fitted Pacific Mk 2.

Notes:

1. The instructions for the operation procedures for RIB Mounted GPMGs are contained in BR 8295 Chapter 6B; ***for safety reasons, the procedures are not for interpretation.***

2. The Tactical Guidance when a RIB is tasked in the Force Protection Role is contained in BR 8988 Chapter 27.

g. **Boat handling during Launch and Recovery.** In contrast to conventional screw driven RIBs the Pacific MK 2 Jetpac is prone to directional instability at slow speeds. (See warning box below). If slow speeds are unavoidable, the command needs to be aware of the potential for instability and ensure the cox'n takes special care with particular reference to the trim.

h. To aid the cox'n in positioning the craft correctly under the falls, a small visual/reference mark should be made on the ships side to enable the cox'n to maintain steerageway and prevent him from putting to much weight on the boatrope.

i. To prevent an unexpected boatrope release during the recovery phase, I/C's are to ensure that whilst the weight is not on the boatrope , the boatrope stray line is kept taught at all times.

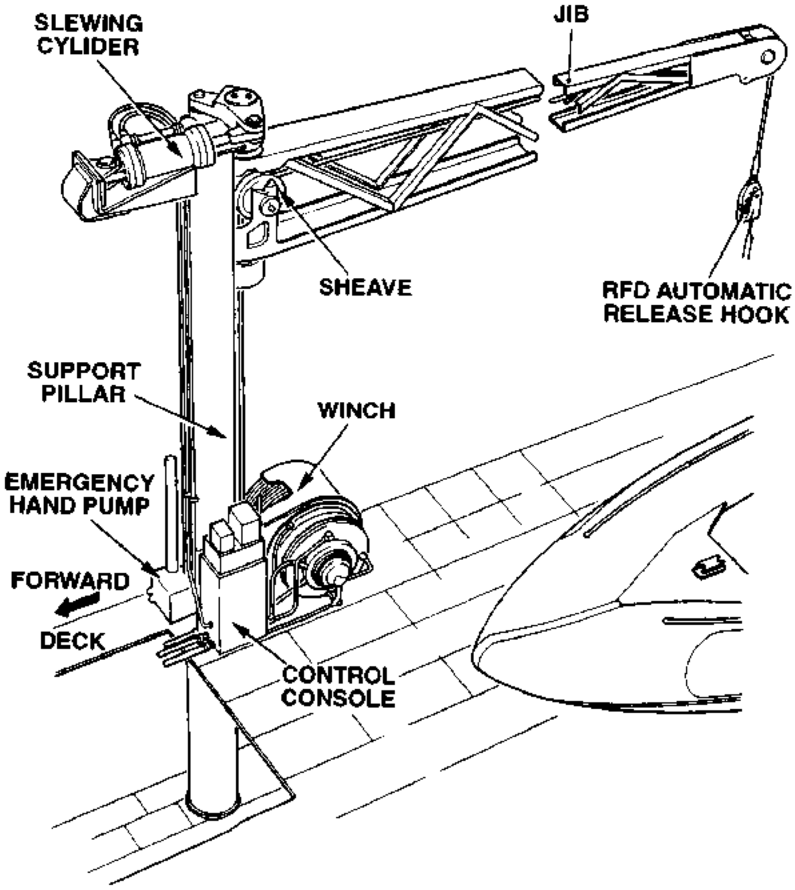
WARNING

DURING LAUNCH/RECOVERY OF THE JETPAC, THE SHIPS SPEED SHOULD IDEALLY BE BETWEEN 10-12 KNOTS AND SHOULD NOT REDUCE BELOW 8 KNOTS WITHOUT COMMAND APPROVAL. TO MINIMISE THE RISK OF CAPSIZE THE JETPAC SHOULD NOT LIE BACK ON THE BOATROPE BUT SHOULD MAINTAIN POSITION ALONGSIDE USING ITS OWN POWER (SEE ALSO BR 45(6) PARA 0533). WHEN COMING ALONGSIDE AT ANY VESSEL AT SPEED THE COX'N IS TO AVOID USING THE BUCKET IN THE ASTERN OR NEUTRAL POSITION AS THIS CAUSES THE BOW TO DIP RESULTING IN A POSSIBLE CAPSIZE SITUATION.

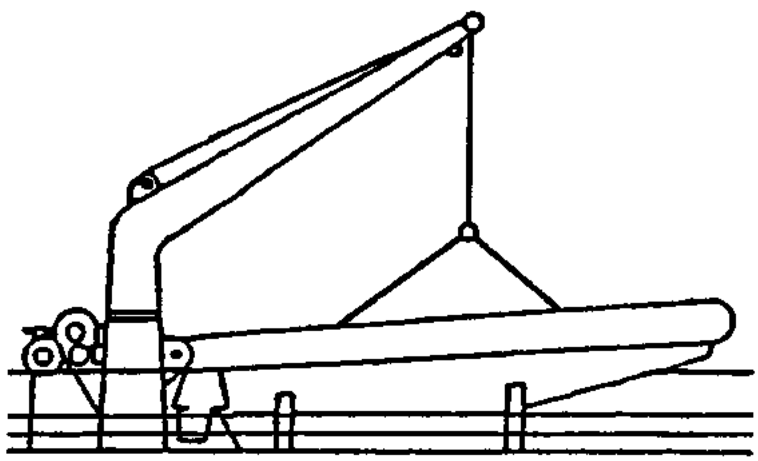
05091. RIBs - Lifting Devices

a. **Introduction**. A variety of cranes and single-arm davits are fitted in HM Ships for hoisting RIBs; examples are shown in Fig 5-51 and 5-52. The single-arm davit has one horizontal arm that can be slewed laterally between the RIB's stowage position and the ship's side. It is fitted in ships where there is sufficient space among the superstructure to permit the arm of the davit to slew without being obstructed. Cranes have an elevating jib that enables them to be operated in a more confined space; the jib can be raised before being slewed and so controlled to hoist the RIB clear of obstructions. Some cranes are designed with folding jibs; this type is likely to be found in ships where space on deck is very limited.

b. **Operation of Lifting Devices**. The requirement to train and qualify crane operators is laid down in Chapter 3; similar criteria are be applied to the training of davit operators. It is important to ensure that detailed operating procedures are produced onboard for each type of crane or davit in the ship. These procedures should be produced by the Seamanship Training Officer in conjunction with the equipment maintainer and must comply with the equipment manufacturer's instructions. Copies of procedures are to be held in the Seamanship Data Book.



(i) McTaggert Scott single Arm Davit



(ii) Schat Davit

Fig 5-51. Examples of Single Arm Davits for Lowering and Hoisting RIBs

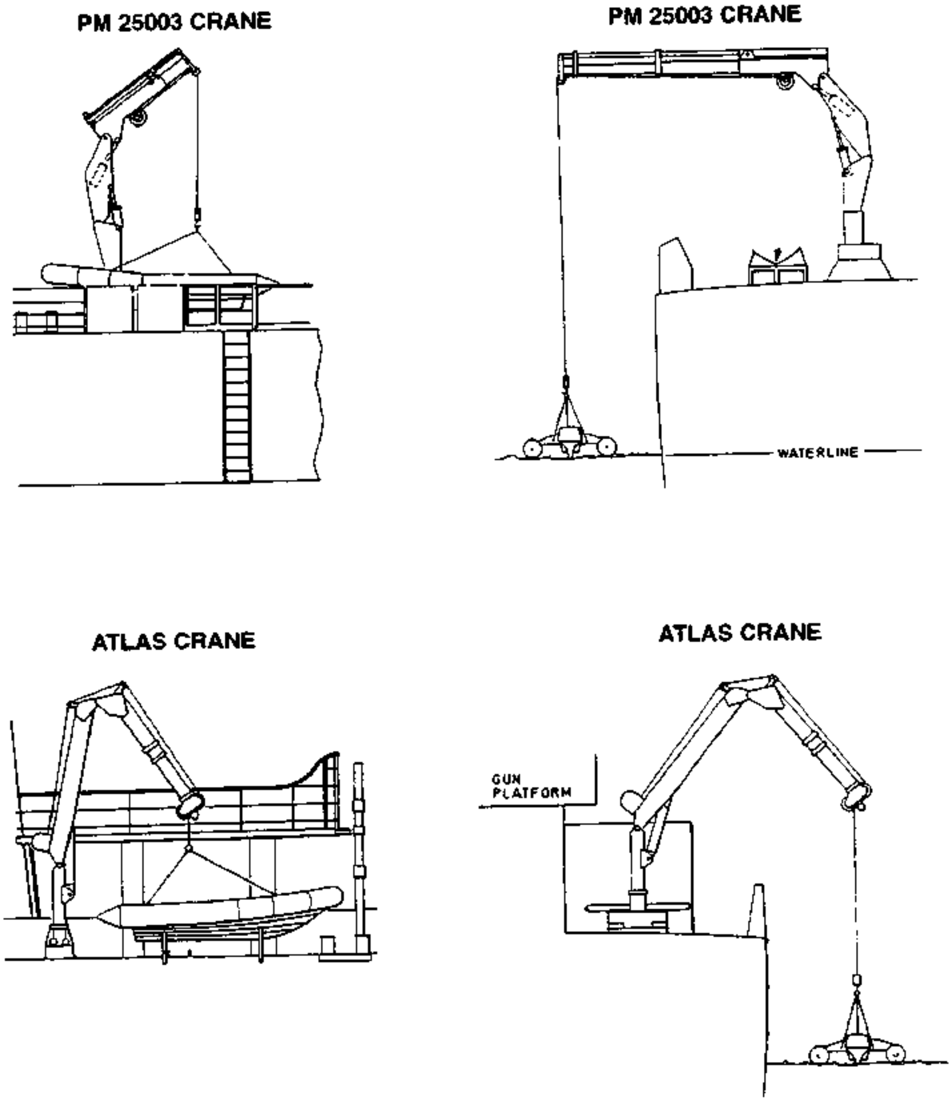


Fig 5-52. Examples of Cranes used for Lowering and Hoisting RIBs

05092. Release Hook (RFD)

a. **Introduction**. In order to operate the RIB as a seaboat the fall of the lifting device must be fitted with a release hook. The RFD Automatic Release Hook Mk 5, Naval stores No F218-513-8208 (Fig 5-53), which is supplied for this purpose, is designed to trip automatically when the weight of the boat comes off the fall. It has two operating positions: ‹Safe’ and ‘Cocked’. The ring of the boat’s sling is engaged by lateral pressure on the back of the hook; this sets a pointer on the cheek-plate to ‹safe’ and makes the release mechanism inoperative. The coxswain sets the automatic release mechanism by giving a pull on the cocking lanyard after the boat has been lowered to a approximately 1m above the top of the waves, this moves the pointer to the ‘cocked’ position. The hook then trips when the tension in the hoist falls below 9 kg as the RIB enters the water.

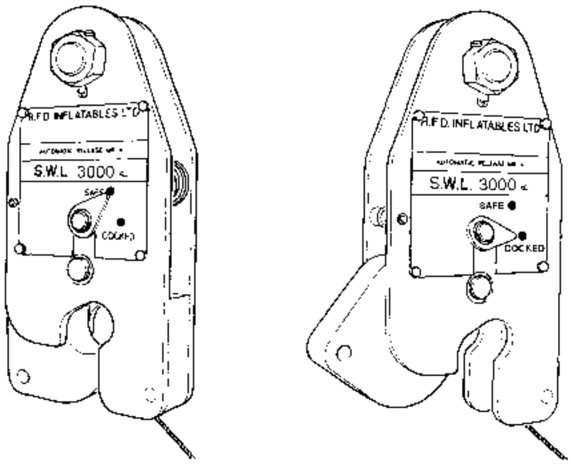


Fig 5-53. RFD Automatic Release Hook

b. **Load Specification and Test Requirements**. The RFD Automatic Release Hook has a safe working load (SWL) of 3 tonnes and is only to be used for Gemini/MIB/RIB operations. Each hook is supplied in a sealed package and is accompanied by a History Card. On receipt the history card is to be checked, and if not signed by the Naval Stores then it is to be signed on receipt in the Naval stores section. The hook must not be dismantled on board. If a fault occurs it must be returned to stores for inspection by the manufacturer. The hook has an onboard life of two years and an in-service life of one year, after which it must be returned to the manufacturer with History card via naval stores for servicing and retesting. If the hook remains 'On the shelf' for more than a year the in-service life is reduced accordingly, ie, if the hook has been 'On the shelf' for eighteen months the in-service life of the hook is reduced to 6 months before it must be returned to the manufacturer via naval stores for inspection and retesting.

Note. *The in-service life commences once the sealed package containing the hook has been broached.*

c. **Fitting the RFD Hook to the Fall** (Fig 5-54). A visual inspection is to be carried out first by the maintainer, then; fit the cones (1) in the eye of the fall and insert between the cheek plates of the RFD block. Thread the washers on to the bolt so that the right-angled tabs (2) on the washers engage in the recesses on the cheek plates, then screw on and tighten the nut; finish by knocking down the locking tabs onto the flats of the nut. The washers are essential to prevent the nut and bolt from working loose.

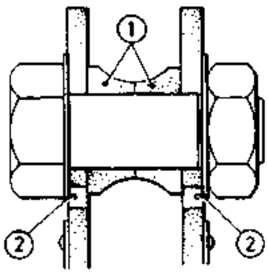


Fig 5-54. Fitting an RFD Hook to the Fall

d. **Maintenance**. Maintenance of the RFD Hook must be in accordance with the MMS.

Note. *To facilitate hooking the RFD hook to the main lifting ring of the sling prior to hoisting the 6.5m Pacific RIB, a wooden support has been designed and approved for use. See para 05060j for details.*

05093. RIBs - Lifelines (General Use)

Modern methods of davit launch and recovery including MCA Fast Rescue Craft requirements negate the use of lifelines. Therefore, when operating RIB's lifelines are not to be rigged or used. However, for high sided vessels that operate gemini's and Displacement boats lifelines are to be rigged and used.

05094. RIBs - Safety Preventer

A preventer consisting of a length of chain fitted with a spring hook one end and a shackle the other is available for use as an added safety measure whenever a RIB (or Gemini) is lowered or hoisted with an RFD hook. Two sizes of preventer are issued: one with a SWL of 2.5 tonnes, naval stores number 0263/796-5046, for the 6.5m RIB, the other with a SWL of 1.5 tonnes, naval stores number 0263/798-3984, for the 5.4m and 4.7m RIB. The preventer is attached to the fall by a shackle resting on top of the RFD hook (Fig 5-55). Although inadvertent release when the RFD hook is in the ‹SAFE' position cannot occur, it is possible for release to take place following snagging or jerking when the hook is in the 'COCKED' position. Rules for the use of the preventer are given in the notes following the RIB hoisting and lowering drills.

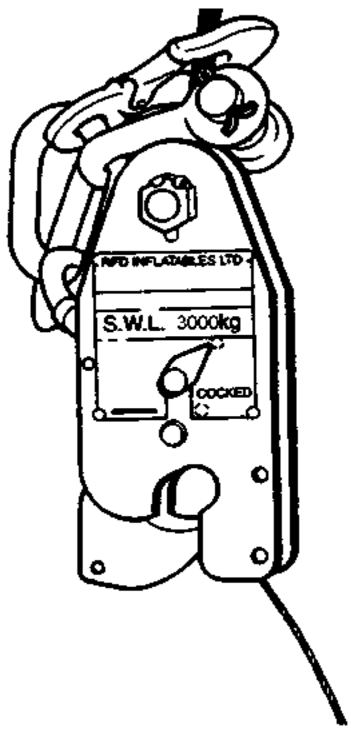


Fig 5-55. Preventer Rigged and Hooked Back to Fall

05095. RIBs - Use as a Seaboat

When at sea all ships must have a boat, known as the seaboat, ready for lowering at a moments notice; most warships and RFAs use a RIB for this duty. A seaboat may be used for rescuing a man who has fallen over the side, communicating with another ship or the shore, or for any other occasion when a boat is required at short notice at sea. The necessary personnel must be detailed, and all involved must know their duties. The coxswain of the seaboat is responsible for checking that the boat is correctly secured, equipped and ready for immediate use until the ship returns to harbour. When leaving harbour and at the beginning of each watch or period of duty the coxswain musters and briefs the crew, inspects the boat, functionally checks the Automatic Release Hook, then reports to the Officer of the Watch that all is correct, or whether there are any deficiencies he is unable to rectify. When leaving harbour and at the beginning of each watch or period of duty the PO of the watch on deck musters and briefs the lowerers and handlers, and checks that the lowering device is operating correctly. He then reports to the Officer of the Watch that all is correct, or whether there are any deficiencies he is unable to rectify.

05096. RIBs - Preparations and Personnel Required for Lowering and Hoisting a RIB

a. **The Deck Team** must consist of the following as a minimum:

(1) Safety Officer

(2) Petty Officer/Leading Hand in Charge (i/c).

(3) Competent Davit/Crane Operator.

(4) Boatrope Handler.

(5) After Steadying Line Handler.

(6) Flag/wand person.

In rough weather if the ship is rolling the number of handlers may have to be increased. Many ships are able to utilise cleats/fittings to facilitate the handling and control of the boat steadying lines; in ships without such fittings up to three men at each end of the craft may be required to manhandle the RIB safely while it is being turned out from its stowage. The i/c of the lowering party is responsible for the safe conduct of the whole evolution to the point where the boatrope is slipped. He must supervise preparations being made beforehand for hoisting out and recovery, and he must be in good communication with the bridge throughout the evolution.

***Note**. Davits are to be marked with training limit marks to assist the i/c when turning boats outboard/inboard.*

b. **The Crew** consists of a coxswain and at least one crewman who must be capable of driving the boat in an emergency (See paragraph 05035). The coxswain is responsible for making all preparations within the boat and ensuring that the RIB is fully fuelled and equipped. He is in charge of the crew members and must check that they are properly dressed for manning the boat; he must also ensure that they know how to handle and slip the boatrope, how to operate the RFD hook and how to clip on and release the steadying line. As a general rule during lowering /hoisting operations, only the coxswain should sit in the centre of the boat, the remainder of the crew should sit on the outboard tube then transfer to nominated seats when the boat is in the water. However, during Searider lowering operations the Coxswain and Bowman should sit on the centre console.

c. **Preparations at The Start of The Watch**. The i/c should:

(1) Confirm that power is available at the davit or crane.

(2) Confirm that the boatrope and steadying line are ranged ready for use.

(3) If the guardrails have to be lowered for hoisting out the boat check that a temporary guardrail is available and HDLJs are provided for lowerers.

(4) Test communication with the bridge, and check that flags and wands are available as secondary methods of communication (see sub paragraph d. below).

(5) Ensure Safety Helmets are provided for the lowering party.

(6) Davit/Crane to be inspected iaw S2022A 4757/1.

The Coxswain should:

(1) Check boat's bag and all other ancillary equipment is correct.

(2) Make the pre-start checks for the RIB.

(3) Check that the boatrope and toggle are rigged ready for use.

(4) Carry out a functional check and ensure that the Automatic Release Hook is set to 'Safe'.

(5) If an umbilical connection is being used, confirm that a cooling water supply is available from ship's services.

(6) Test radio communications (if applicable).

(7) Instruct crew members on their tasks and check their dress and equipment

.

CAUTION
TO PREVENT THE RISK OF RADHAZ SHOCK THE CRANE/DAVIT OPERATOR AND BOAT'S CREW MEMBERS WHO OPERATE THE RFD HOOK/PREVENTER MUST WEAR GLOVES

d. **Bridge/Boat-deck Communications**. Communications between the bridge and the boat deck are usually achieved either by upperdeck broadcast or flag/wand signals; the most suitable of these two methods will vary ship to ship. Wherever practicable both methods should be available but using a combination of the two should be avoided. The flag/wand signalling system is shown below. All personnel involved must be aware that if a flag or wand is not showing, no action is to be taken.

Note. *Certain ships are fitted with a dedicated system of boat control lights similar to those fitted for Flying Operations.*

Seaboat Lowering/Hoisting - Flag/Wand Signals

Lowering

Position	Flag or Wand	Meaning
Bridge	Green	Lower boat to deck-edge level
Bridge	Red	Hold boat at deck-edge level
Boat deck	Red	Preparing boat
Boat deck	Green	Ready in the Boat
Bridge	Green	Carry on with the seaboat

Hoisting

Position	Flag or Wand	Meaning
Bridge	Red	Boat lay off
Boat deck	Red	Preparing for recovery
Boat deck	Green	Ready to recover seaboat
Bridge	Green	Recover seaboat
Boat deck	Red	Seaboat at deck-edge level
Boat deck	Green	Permission to hoist seaboat inboard
Bridge	Green	Hoist the seaboat inboard

| **05097. RIBs - Hoisting and Lowering Drills**

The following procedures are to be used for the launch and recovery of a RIB when being used as a seaboat. During launching the ship should maintain a speed of between 5-12 knots, taking into account prevailing weather conditions and the experience of the crew. In heavy weather it is advantageous to turn the ship slowly to provide a calm slick of water into which the boat can be launched.

CAUTION

GRAVITY LOWER IS ONLY TO BE USED IN EMERGENCIES

a. **Launching the Seaboat** The following drills are written for the launch of a seaboat to recover a man overboard. The initial pipe must be modified as appropriate if the seaboat is being launched for any other purpose.

	Bridge		**Boatdeck**
OOW	Pipe 'Man overboard, Man overboard, Man overboard, Away Seaboat, Away SOW'. (When the quickest method of recovery has been determined, Pipe:) 'Recovery will be by Seaboat/SOW'.		This pipe is the authority from the OOW to the i/c of the boat deck to prepare the boat, slip the gripes and hoist the boat outboard to deck edge. If using flags, the bridge should at this stage show a <u>GREEN FLAG</u>. However, should conditions not be suitable the bridge may order 'Hold the Boat in the Crutches' or show a <u>RED FLAG.</u>
		i/c	I/c establish comms with bridge on Upperdeck broadcast or flags/wands.
		i/c	Lowering Party close up, check steadying lines and power to davit/crane. 'Slip the gripes'.
			Seaboat's crew dresses at full speed and establishes comms with bridge.

	Bridge		Boatdeck
		i/c i/c i/c i/c i/c i/c	‘Man the steadying lines’. ‘Hoist’. (The handlers must keep the RIB firmly under control whilst it is being hoisted clear of its stowage and turned outboard). When RIB is clear of crutches/guardrail, ‘Avast hoisting, slew outboard’. When RIB is clear of ship’s side. ‘Avast slewing, lower to deck level’. ‘Avast lowering, slew inboard’. When buoyancy tube rests on ship’s side at deck level: ‘Avast slewing’. Reports to bridge: ‘Boat at deck level’ <u>RED FLAG</u>.
OOW	‘Roger’ <u>RED FLAG</u>		
OOW	Report on upperdeck broadcast relative bearing and range of MOB.		
		Cox’n i/c	Crew man the boat. Cox’n conducts checks and starts engine, then checks cooling water and that boatrope is correctly toggled in. Steadying lines are removed, i/c confirms brief with Cox’n who reports: ‘Ready in the boat’. <u>GREEN FLAG</u>
OOW	‘Carry on with the Seaboat’ <u>GREEN FLAG</u>		
		i/c	‘Roger, carry on with the seaboat’.
		i/c i/c	‘Slew outboard, lower away’. Use the ship’s side to steady the boat during lowering. At 1m above waves: ‘Avast lowering, cock the RFD hook/off umbilical’ (if fitted).
		Cox’n	Crewman cocks the RFD hook, Cox’n checks it and reports: ‘RFD cocked’.
		i/c	‘Lower away’.
		Crew i/c	Hook automatically releases when boat enters the water and weight comes off the hook. (For 6.5m RIB operations where the Cox’n cannot easily see the hook, the crewman taps the Coxswain’s shoulders firmly and reports loudly to Cox’n:) ‘Hook Released’. When hook has released from the sling, ‘Avast lowering’.

	Bridge		Boatdeck
		i/c	‘Hoist roundly’ or ‘Bowse in’ (Bowsing in the fall to the ship’s side is quicker than hoisting but may not always be practicable). When fall is clear of the boat, Cox’n engages throttle using the boatrope to clear ship’s side, moves ahead and, when appropriate, orders the bowman to slip the boatrope.
		i/c	Report to bridge: ‘Seaboat clear of ship’s side’. RED FLAG Rigging for recovery.
		i/c	‘Ready to recover the seaboat’ GREEN FLAG

WARNING

IF THE BOATROPE IS INADVERTENTLY SLIPPED BEFORE THE RFD HOOK HAS RELEASED THE BOAT MUST BE HOISTED AND THE BOATROPE RE-ATTACHED. ATTEMPTING TO LAUNCH THE BOAT WITHOUT A BOATROPE RIGGED WILL ALMOST CERTAINLY RESULT IN THE BOAT CAPSIZING.

b. **Recovery and Hoisting.** The ship should provide a lee for the boat and maintain a minimum speed of 5 knots to facilitate hoisting the returning boat. In heavy weather it is advantageous to turn slowly towards the boat to create a calmer slick for hoisting. After approaching, the coxswain should assess, then match, the ship’s speed, paralling the ship’s course before steering in to capture the boatrope. The boatrope is captured, secured to the bow of the boat and the RIB allowed to lie back on the boatrope while the RFD hook is hooked on. As soon as the sling has been attached the coxswain reports, ‘Hooked on in the boat’, the RIB is hoisted at full speed until clear of the crests of the waves. The RIB should be hoisted with the boat touching the ship’s side to check adverse movement. The boatrope strayline should be manned and used as the forward steadying line throughout the hoisting procedure.

	Bridge		Boatdeck/Seaboat
OOW	‘Recover the seaboat’ GREEN FLAG		
			I/c calls RIB alongside. Cox’n matches ship’s speed, places craft parallel to boatrope and then steers in to capture the boatrope. Toggle in and haul in tight on the strayline to prevent inadvertent release. Bowman retires aft, sternsheets man presents sling ready to hook on RFD. When boatrope is secured the Cox'n reduces speed to allow the RIB to lie back gently on the boatrope, coming to rest directly under the fall.
		i/c	‘Lower roundly’ or ‘Pass the fall’. Davit operator lowers or passes the fall until the RFD hook is in the boat.
		Cox’n	Crew hook on the RFD hook. Cox’n checks indicator is to green and reports: ‘Hooked on in the boat’.

	Bridge		**Boatdeck/Seaboat**
		i/c	'Hoist roundly'. Davit/crane operator moves control lever to fastest hoist position. Boatrope handlers tend boatrope and maintain tension to ensure that the toggle does not slip out.
			When boat is clear of the water, Cox'n stops the engine.
OOW	'Roger, boat at deck level'. <u>RED FLAG</u>	i/c i/c i/c i/c i/c i/c	I/c reports to bridge: 'Boat clear of the water'. When boat clear of the water, 'Hoist handsomely'. When seaboat is at deck level or high enough to safely evacuate passengers/casualties: 'Avast hoisting, slew inboard'. Davit/crane is slewed inboard until the RIB's buoyancy tube rests gently on the ship's side or guardrail stanchions, clear of all protrusions. 'Avast slewing'. I/c reports to bridge: 'Boat at deck level'. <u>RED FLAG</u>
		i/c	Steadying lines are passed.'Clear the casualty from the boat' (See para 05069), crew assist in casualty evacuation, then clear the boat.
			'Permission to recover the seaboat inboard' <u>GREEN FLAG</u>
OOW	'Hoist the seaboat inboard'. <u>GREEN FLAG</u>		
		i/c i/c i/c i/c i/c	'Man the steadying lines, slew outboard'. The davit/crane is slewed outboard until the boat is clear of the ship's side. 'Hoist handsomely'. Boat is hoisted until it is clear of the guardrails. 'Avast hoisting, slew inboard'. Davit/crane is slewed inboard until boat is directly above crutches. 'Avast slewing, lower away'. Boat is lowered gently into its crutches, line handlers preventing swinging. When boat is firmly in crutches the gripes are passed. I/c reports to bridge 'RIB in crutches and rigged as a seaboat'
OOW	'Roger, seaboat secured'.		

Notes:

1. Although inadvertent release when the RFD hook is in the 'SAFE' position cannot occur, it is possible for release to take place following snagging or jerking when the hook is in the 'COCKED' position. Rules for the use of the preventer are as follows:

a. For normal operations - the preventer is to be available and remain shackled to the whip, but hooked back on itself or to the whip. (Continued overleaf).

b. If for any reason the RIB has to be hoisted with the RFD hook in the ‘COCKED’ position (for example if the launch is aborted after cocking), the preventer is to be hooked to the lifting ring of the sling without delay.

2. Ships should be aware that instances have occurred when it has been found impossible to cock the RFD hook with the weight of the boat on the hook. With design adjustments and improved machining of the hook this problem has virtually been eliminated, but coxswains should be briefed that if it does occur the hook should be cocked when the boat is in the water; the hook will then release.

05098. Petrol (Gasoline) Tanks and Stowages

a. **Outboard Engine Gasoline Tanks**. Outboard engine gasoline tanks, Pattern No 0482-234-3346, are manufactured in a light grey plastic material. They must be marked in accordance with **BR 1754, Safety Regulations for Storing and Handling Petroleum Oils, Lubricant and Certain Other Hazardous Stores in HM Ships**. The number of tanks carried by a ship is not to exceed the number that can be stowed in the ship's gasoline tank stowage.

b. **Gasoline Tank Stowages**. Ships with a requirement to carry gasoline for outboard engines are fitted with gasoline tank stowages that permit the tanks to be jettisoned in an emergency. The stowages are to be painted to match the ship. They are to be locked at all times and the key kept on the Important Key Board.

05099. Displacement Boats - Introduction

The phrase ‘Displacement Boats’ has come to be accepted as the generic term applied to all motor powered Service craft other than RIBs and Inflatable craft. With the need in ships to reduce topweight and decrease the maintenance load the numbers of such craft in use in the Service have reduced in the last few years, and this trend is likely to continue. However, displacement boats are still required for certain tasks and duties.

05100. Displacement Boats - Davit Arrangements

a. **Introduction**. Displacement boats are usually stowed in ships on a pair of **gravity davits** (Fig 5-56). Each davit consists of a **cradle**, which supports the boat, moving on rollers up or down an inclined track called a **skid**. This skid is angled so that the cradle and boat will operate under gravity when the ship is heeled up to 30 degrees away from the boat. There are two types, the main differences being the positions of the hydraulic or electric motors and rope drums, and the rig of the wire falls. The falls may be of the **ball-weight** (single-part fall) type or **floating-block** (two-part fall) type. The floating-block type of fall is generally incorporated into davits used for the stowage of the heaviest displacement boats. The gravity davit of the ball-weight type (Fig 5-56) consists of a trackway of two channels curving inwards from the deck edge, and a cradle fitted with rollers running inside the trackway. The davits operate in two stages: the movement of the cradle down or up the trackway, and the movement of the boat, down or up, when the cradle is at the lowering position. Both stages are controlled by the wire falls. Regardless of the position of the rope drums and electric or hydraulic motor, all of which are mounted on the trackways, the single wire fall passes round an intermediate sheave, and then through a tube and over the top sheave which are both inside the cradle. The fall then passes through a **stirrup**, hinged at the end of the cradle, and terminates in a tapered **ferrule**.

Shackled to the ferrule is an end fitting (ball weight and linkage) which has a **swivel-ring shackle** for attachment of the boat's slings. Two **tusks**, projecting from the underside of the cradle end, fit underneath the ferrule when the cradle is raised. The cradles are locked in the raised position by **trigger levers** mounted on the trackways. These levers engage with pins on the cradles when the **gripe wires**, shackled to the ends of the levers, are in tension. The boat is carried on the **keel rests** and it lies against the gunwale chocks. In this position the tension in the falls can be released. Pointers on the trackway and cradle indicate the stowed position. The cradles can also be locked to the trackways by passing **harbour stop pins** through holes in both of them.

b. **Lowering Action**. When the gripes are slipped, the triggers automatically release the cradles, allowing them to be lowered by power or gravity (power for light falls only, ie without a boat slung). When the cradle head moves outboard to swing the boat clear of the ship's side, the boat leaves the cradles and hangs on the ferrules supported by the tusks. When the cradles are near the outermost position, the ferrules leave the tusks and the weight of the boat is transferred to the falls, further movement of the falls lowers the boat, because the cradles have now reached their lower stops.

c. **Raising Action**. The boat is raised until the ferrules strike the stirrups and further movement of the falls moves the cradles inboard until the pin on the cradles engages with the trigger lever. The hydraulic or electric motor is stopped. The boat is then secured at the davits by passing the gripes when at sea or inserting the stop pins in harbour. Gravity davits fitted with floating blocks are very similar in operation, the principle difference being the two-part instead of the single-part falls.

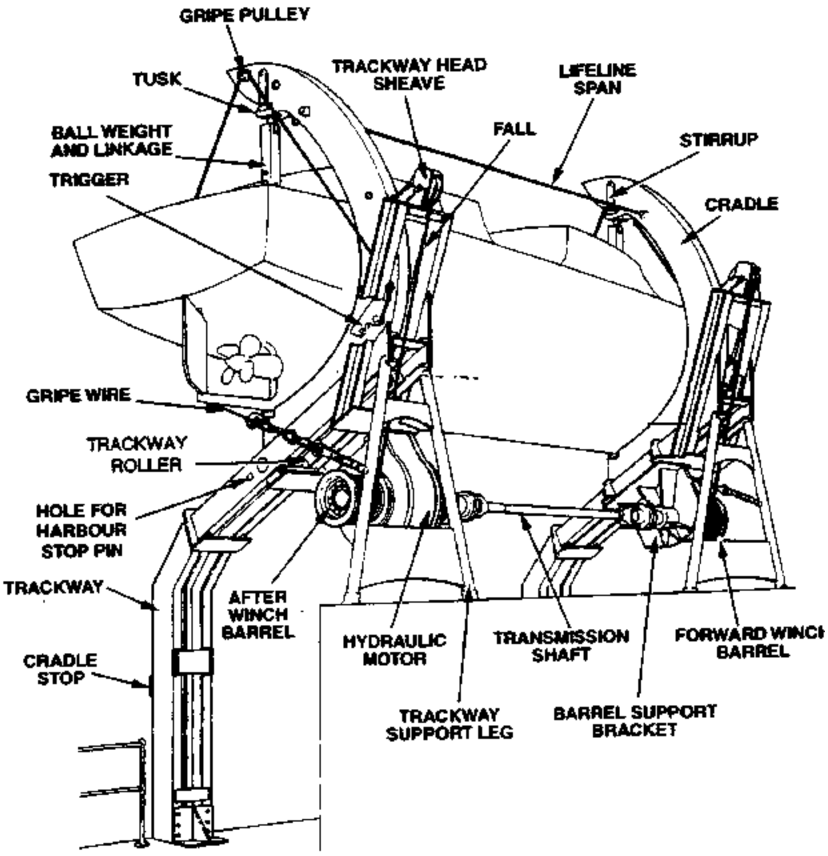


Fig 5-56. Overhead Gravity Davit - Ball Weight Type

05101. Displacement Boats - Slinging Arrangements

The slings in displacement boats consist of two sets, one for'ard and one aft. The precise arrangements vary depending on the type of boat and details can be found in the relevant BR. Boats slings are fitted in the dockyards by experienced shipwrights so that the weight of the boat will be correctly distributed between the legs. The slings are carefully adjusted to conform to the span of the davits; a boat should therefore be hoisted by her own slings at her own davits whenever practicable. When lowered, her slings should always remain in the boat.

05102. Anti-shock Strops and SWR Hanging Pendants

Anti-shock strops (Fig 5-57) and SWR hanging pendants are provided for all displacement boats hung at davits. The anti-shock strops are attached to the boat's falls prior to hoisting the boat to prevent shock-loading when the weight of the boat is first taken up, and the SWR hanging pendants, one fitted to each davit cradle head, are provided to take the weight of the boat at the end of the hoisting sequence so that the anti-shock strops may be removed from between the falls and the slings, and the falls then re-attached to the slings. Fig 5-58 shows the arrangement of the anti-shock strop and steel wire hanging pendant at the point in the boat-hoisting procedure when both are attached to the lifting gear.

***Note**. The precise arrangements for attaching the anti-shock strops and SWR hanging pendants to the slings vary depending on the type of boat being hoisted. The relevant BR for the type of boat must be referred to.*

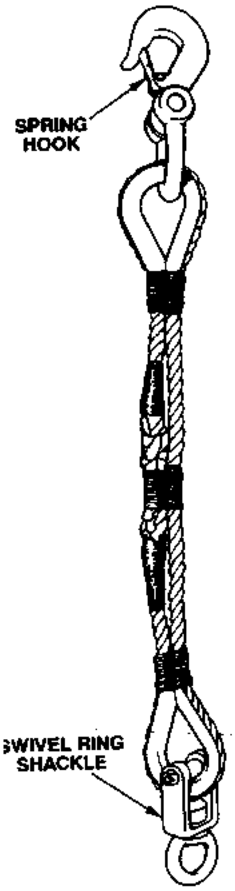


Fig 5-57. Anti-shock Strop

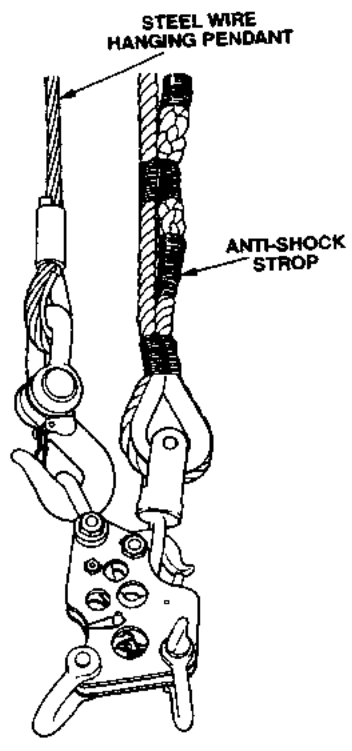


Fig 5-58. SWR Hanging Pendant and Anti-shock Strop

05103. Displacement Boats - General Stores and Equipment.

For normal operations the following list of equipment, in addition to the boats bag, should be carried in all displacement boats. Other equipment is specified in the relevant paragraphs on each type of boat.

Equipment	Naval Stores Number
VHF hand held radio (Cougar)	
Boat hook	0262/16895
(With stave)	0472/923-0765
Bailer	0255/320-4496
Manual Line Thrower	0472-781-0504
4 x Distress Flares	
Horn	0268/407-9681
Hand signalling lamp	0558/527-7235
First aid kit	6545/211-1573
Fire extinguishers (2)	
Compass (if required)	
Boat's Lead Line (if required)	

05104. Displacement Boats - Boats Bag

A boat's bag should always be carried in the boat. It is made up in PVC cloth and contains sufficient equipment to repair a damaged hull or fittings. The contents of the boat's bag should be: hand drill and two 3.8mm twist drills, crosspoint screwdriver, rasp, hand axe, marline spike, two Gemini repair clamps, three assorted Gemini leak stoppers and roping twine. Four locally manufactured 'patch packets' should be included, each containing copper sheets in sizes from 75x50mm to 300x230mm, tallow-coated fearnought in sizes from 100x75mm to 330x250mm, and self-tapping screws, in boxes, of 9, 11, 21 and 31. Each patch packet should contain instructions for fixing.

05105. Displacement Boats - Crewing

The criteria regarding the training and qualifying of a displacement boat coxswain and crew is similar to that laid down in paragraph 05020 for RIB coxswains and crew. However, certified displacement boat coxswains are permitted to locally train potential coxswains. To gain certification once the potential coxswain is deemed competent he/she must either undergo a formal assessment at HMS Raleigh, or it can be requested of HMS Raleigh that a qualified assessor visits the parent ship/establishment to carry out the assessment.

05106. Securing a Displacement Boat for Sea

When securing a displacement boat for sea the following points should be followed:

1. The boat should be hoisted close up to the davit head with harbour stop pins in.

2. The gripes should be shackled to the trigger levers of the davits and well set up around the boat so that she is firmly bowsed-in to her griping pads.

3. The guys (if fitted) and davit span should be set up. The two **lizards** (fitted only in some high sided ships and only required if lowering the boat in a seaway) should be rove on two **sea jackstays** (Fig 5-59). The lower ends of the jackstays are secured to recessed eyeplates at the waterline on the ship's side; the upper ends are secured to an eyeplate at the base of each davit trackway.

Whenever possible the jackstays should be secured in harbour from a boat. The lizards should be lightly stopped inboard in the ship, and passed into the boat when at the deck edge. Lizards when kept in hand enable the boat's crew to steady the boat during hoisting and lowering when in a seaway. Destroyers and below do not normally rig sea jackstays and lizards.

4. The lifelines, one for each crew member, (one lifeline fitted to each davit head and any others free running on the davit span) should be coiled down free for running in the boat.

5. The steel wire hanging pendants should be shackled to each davit head and stopped back along the davit cradles **clear of the falls and the boat**, until required for boat hoisting.

6. The anti-shock strops should be available in the vicinity of the davits.

7. Bottom boards should be secured, but those in the way of the slings should be removed and secured inboard.

8. The hooks of sling steadying chains should be hooked bill uppermost . The slings must be free of twists.

9. The boat should be dry with the plug in place.

10. The boat's outfit of stores and equipment should be complete.

11. When not required for use the boat should be covered.

| **05107. Displacement Boats - Preparations and Personnel Required for Lowering and Hoisting**

a. **Introduction**. Displacement boats stowed in gravity davits sit on their keel rests, with gripes and the harbour stop pins inserted into the trackways to prevent movement of the cradles. Whenever power-operated davits are to be used it is essential to check that power is available to the system. As a check before lowering with davits the boat should be inched up under power when stowed in the davits.

CAUTION

1. IT IS INADVISEABLE, UNLESS IN AN EMERGENCY, TO LOWER A DISPLACEMENT BOAT IF THE SWELL EXCEEDS 0.5M

2. WHEN HOISTING A DISPLACEMENT BOAT IN EVEN A SLIGHT SEA OR SWELL IT IS NECESSARY TO USE ANTI-SHOCK STROPS

3. IF LOWERING/HOISTING IN A SEAWAY A BOATROPE SHOULD ALWAYS BE RIGGED.

b. **Safety**. No one in a boat is allowed to place his hands on the falls, and everyone in the boat must hold a lifeline during hoisting and lowering. Whenever a boat is being manned, lowered or hoisted no one is allowed **before the foremost fall** or **abaft the aftermost fall** because, if one fall were to part, a man in either of these positions would be crushed between the other fall and the bow or stern of the boat. The steel wire hanging pendants must always be shackled with pin and forelock shackles to the head of the davits. They must be stopped in such a way that they can be released easily without need to climb on the davits. When a boat is being hoisted or lowered the rating operating the control handle **must not direct the hoisting or lowering operation**. The boat should not normally be lowered under power. Power-operated davits are potentially dangerous except when in the stowed position with the harbour stop pins inserted. The following points must be adhered to:

1. Personnel are to be warned to keep clear of davits whilst they are being operated.

2. No one is allowed on the davits unless the davits are in the stowed position with harbour stop pins inserted.

3. The access holes in the davits are never to be used as hand or foot-holds.

c. **The Lowering and Hoisting Party** is to consist of the following as a minimum:

Petty Officer in Charge.

Davit Control Operator.

Ratings to remove harbour stop pins and to tend fenders at the ship's side.

Boatrope Handler (if required)/Headfast tender.

After Steadying Line Handler.

In marginal conditions the number of handlers may need to be increased. The Petty Officer in charge of the lowering party is responsible for the safe conduct of the whole evolution to the point where the boat is released from the falls. He must supervise preparations for hoisting out and recovery, and he must be in good communication with the bridge throughout the evolution.

d. **The Crew** usually consists of a coxswain and two crewman. The coxswain is responsible for making all preparations within the boat and ensuring that the boat is fully fuelled and equipped. He is in charge of the crew members and must check that they are properly dressed before manning the boat; he must also ensure that they know how to handle and slip the boatrope, how to safely unhook the falls and how to clip on and release the steadying line(s). At least one member of the crew must be capable of taking over from the coxswain, and be fully prepared to do so in an emergency.

e. **Preparations for Lowering**. The Petty Officer in charge is to:

1. Brief the lowering party.

2. Confirm that power is available at the davit or crane.

3. Have the steadying line(s) ranged ready for use.

4 Test communication with the bridge.

The Coxswain is to:

1. Make the pre-start checks for the boat.

2. Check the boat's stores and equipment are correct for the task.

3. If required, check that the boatrope is rigged ready for use.

4. See that lifelines are rigged.

5. Test radio communications.

6. Instruct crew members on their tasks and check their dress and equipment.

| **05108. Displacement Boats - Lowering and Hoisting Drills**

When lowering or hoisting a boat in harbour a boatrope will not normally be required. However, if lowering or hoisting a boat in a seaway a boatrope should always be rigged.

a. **Lowering Procedure**

Order	Action/Remarks
'Away....crew, hands detailed close up'	Crew muster abreast the boat, dressed for the conditions (always wearing safety helmets and DMS boots) then man the boat. The boat is to be inched up to establish there is power on the davits. Lowerers then remove harbour pins.
'Slip the gripes'	Lowerers knock off the slips and recover the gripes inboard. Because of the tendency for a boat to swing out this order must not be given before the boat is fully manned and lifelines have been passed over the side of the boat (outboard) and are in hand.
'Lower to the deck edge'	Rating manning the control puts lever to **lower** until the boat is level with the deck edge. The boat can now be checked.
'Lower away'	Rating manning the control puts lever to lower. When the boat is waterborne the lowerer selects **Power Lower**.
'Avast lowering'	Rating manning the control puts lever to **stop**. This order is given when there is enough slack to unhook the boat.
'Unhook the falls'	Crewman unhooks after fall and reports loudly, 'After fall released'. The bowman then releases for'ard fall and reports loudly, 'For'ard fall released'. Cox'n moves the boat ahead and, when appropriate, orders the bowman to slip the boatrope.

When the boat is clear, the falls can be hoisted.

b. **Preparations before Hoisting**. Whilst the boat is away from the ship the following preparations for her recovery are to be made. The procedures below assume that a boatrope and anti-shock strops are being used. Fig 5-59 shows the arrangement of davit fittings for hoisting a boat in a seaway.

1. The davits are to remain in the outboard position unless ordered to be fully recovered. (This will be governed by time and the ship's movements.)

2. Hoist the falls until their bottom ends are level with the deck edge.

3. Recover the falls inboard with a boat-hook. Hook the anti-shock strops into the ends of the falls then lower the falls over the side, taking care to leave a clear run for the boat beneath them.

4. Release the hanging pendants and pass them outboard to hang free from the davit head. (If allowed to swing outboard they are likely to foul the falls.)

5. If required, hold the boatrope outboard on its strayline with the eye about one 1m clear of the water.

6. Prepare fenders.

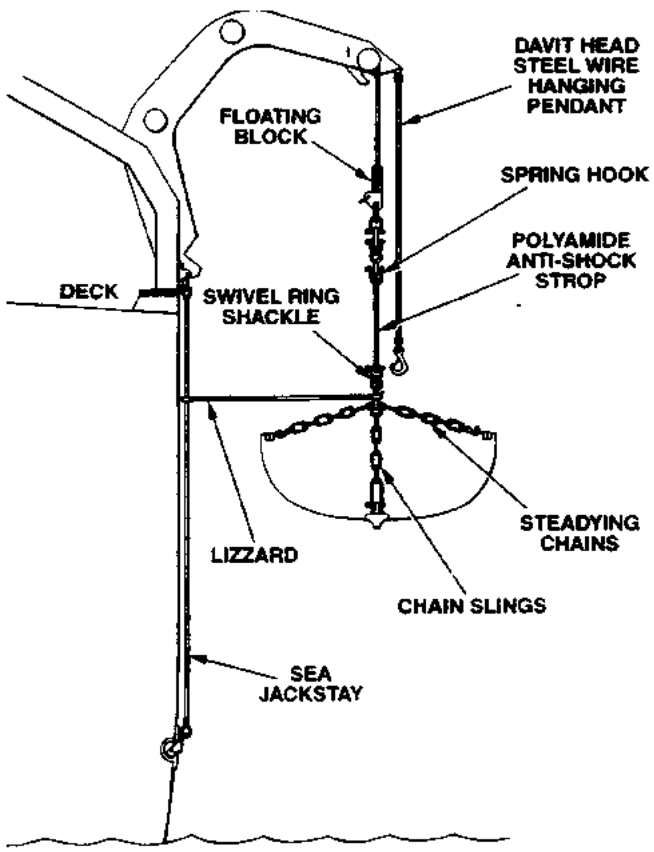


Fig 5-59. Arrangement of Davit Fittings for Hoisting a Boat in a Seaway

c. **Summary of Hoisting Procedure**. If underway the ship should, if possible and necessary, manoeuvre to provide a lee. When the boat comes alongside it is steered to a position slightly for'ard of the falls. The bowman recovers and secures the boatrope. When the boatrope is secured the coxswain drops the boat astern until it is under the falls. The falls are then lowered and the anti-shock strops hooked to the boat's lifting arrangements (for'ard fall first). The coxswain reports 'Hooked on in the boat'. When this report is received the boat is hoisted roundly clear of the water. At the same time a sternfast (if necessary) is passed to the coxswain who secures it aft; the sternfast is tended inboard to prevent the boat surging. When the boat is clear of the water the order 'Handsomely' is given and the boat continues to be hoisted until she is high enough for the steel wire hanging pendants to be hooked on to the lifting arrangements. The pendants are hooked on and the boat is lowered until the pendants take the weight. The anti-shock strops are removed, the falls are lowered and hooked direct to the lifting arrangements and the hoisting of the boat is then continued. The hanging pendants are unhooked and passed outboard for safety when the weight is taken on the falls. After the gripes have been passed the pendants are stopped to the davits with parting stops and the boat is re-secured. Detailed hoisting drills are given on the following page.

d. **Hoisting Procedure**. On receipt of the report ‘Hooked on in the boat’, the boat is hoisted using the following procedures.

Order by PO I/c	Action/Remarks
‘Hoist roundly.’	Rating manning the control puts lever to **fastest hoist** position . The sternfast is manned inboard and tended to reduce the boat’s surging. The coxswain stops the engine. Hands on deck man their fenders and follow up the boat as she is hoisted.
‘Hoist handsomely’	Rating manning the control puts lever to a **slower hoist** position.
‘Avast hoisting. On hanging pendants.’	Rating manning the control puts lever to **stop**. This order is given when the boat is high enough for the wire pendants to be hooked on. The coxswain and bowman hook on their respective pendants to the lifting arrangements, raising a hand when the hook is properly engaged. Coxswain reports ‘Hanging pendants hooked on in the boat’.
‘Lower to the hanging pendants.’	Rating manning the control puts lever to **lower** until the pendants take the weight of the boat and the falls slacken.
‘Off anti-shock strops.’	The anti-shock strops are removed and the falls hooked on to the lifting arrangements. Coxswain reports ‹Falls hooked on in the boat.
‘Stand clear of the davits - hoist away.’	Rating manning the control lever puts lever to **hoist**. The hanging pendants are unhooked and passed outboard.
‘High enough.’	Rating manning the control puts the lever to **stop**. This order is given just before the cradle reaches its stops. The gripes are then passed and set up, and the boat is re-secured. The hanging pendants are restopped to the davits and the crew clear the boat.

The coxswain thoroughly checks the boat and then reports to the OOW/OOD that the boat is correct, or otherwise if any defects or deficiencies exist.

05109. 7.5m Cheverton Motor Boat - Specification

This motor boat (Fig 5-60) is carried in some ships primarily for the transportation of stores and passengers in harbour. It is of GRP construction with round bilge hull, and has a single diesel engine mounted amidships. The layout provides space for 20 persons in two cabins, one for’ard of the engine bay and one aft, with an uncovered after steering position. The authoritative publication for this craft is **BR 6595 (002) 24 Ft Motor Boat**.

a. **Performance**

Capacity	20 persons (excluding crew)
Crew	2
Speed	9 to 10 knots
Endurance	70nm

b. **Dimensions**

Length	8.23m
Width	2.74m
Height	2.82m
Weight (Max Hoisting)	2.75 tonnes

c. **Propulsion**

Engine	1 x Perkins 68 hp
Fuel	205 litres of Diesel

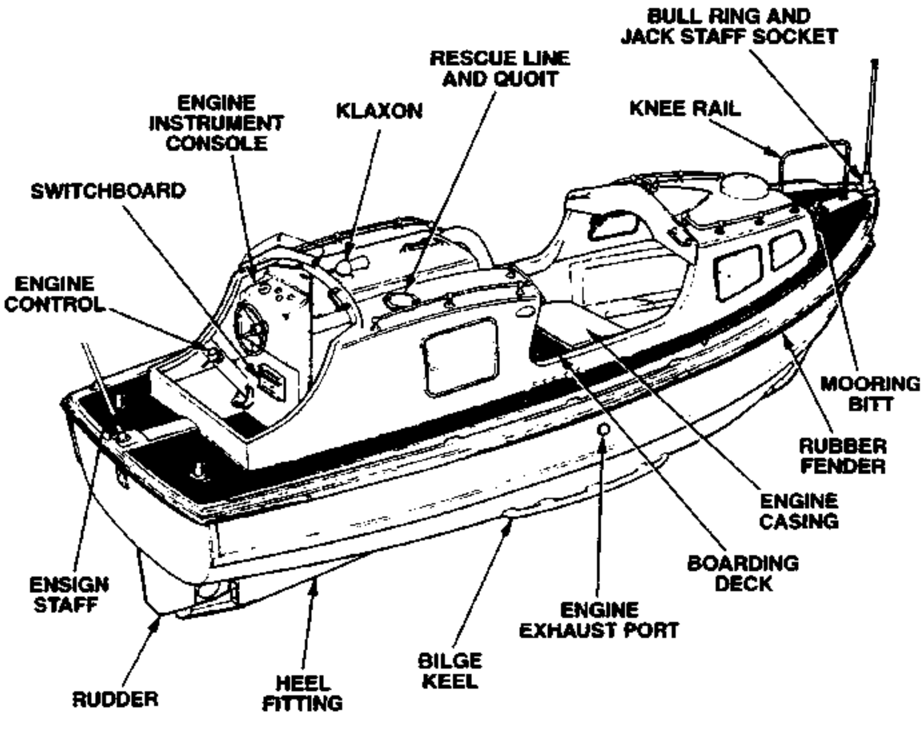


Fig 5-60. 7.44m Motor Boat (Cheverton)

d. **Slinging Arrangements**. The slinging arrangements, and the criteria for their fitting are given in **BR 6595(002)**.

e. **Boatrope Securing Arrangements**. If the Cheverton is being lowered in a seaway a boatrope should be secured to the for'ard mooring bitt on the for'ard decking of the boat.

f. **Anchor and Cable**. The anchor for the boat is an 11.5 Kg CQR (naval stores number 0232/21025), fitted with a 12mm x 37m polyester cable.

g. **Painter and Sternfast**. The painter and sternfast are made of 12mm polyester and are 11m and 7m long respectively.

h. **Stores and Equipment**. See paragraph 05103

i. **Boat's Bag**. See Paragraph 05104

j. **Propulsion and Electrical System**. The propulsion and electrical system fitted in the boat are comprehensively explained in **BR 6595 (002)**. Also included in that publication are details of engine starting and stopping procedures and a guide to fault finding should the equipment not operate correctly.

k. **Crewing**. See Paragraph 05105

l. **Dress for Crew and Passengers**. The boat provides shelter for crew and passengers, consequently the requirement to wear suitable foul weather clothing is left to the discretion of the CO. However, because on occasions the crew are required to move around the boat outside the confines of the cabin areas they must wear Hazardous Duty Lifejackets at all times. Passengers are not normally required to wear lifejackets but may be ordered to do so by the CO if deemed necessary. It is prudent to suspend passenger boat operations in all but emergency situations if the prevailing or forecast weather conditions indicate a possible hazard to personnel.

m. **Davit Arrangements**. See paragraph 05100.

05110. 9.0m Motor Survey Boat (Medium)

The 9m Survey Boat (Fig 5-61) is designed to conduct coastal survey operations in areas inaccessible to large survey vessels. It is carried in davits by some survey ships. The boat is of GRP construction, has a large cabin for'ard, a well deck amidships, a large after cabin and an aft steering position. The for'ard cabin is fitted out as an accommodation space with sleeping and cooking facilities while the after cabin is fitted with the hydrographic recording equipment. The vessel is fitted with a single diesel engine, Kitchen rudder gear and Mills disengaging gear. Details of the craft, its equipment and operating procedures are given in **BR 3937 9.0m Survey Boat (Medium)**. All personnel qualifying in the Survey branch are taught to operate and coxswain this boat. However, the lowering and hoisting drills, and the guidance on crew and passenger dress given for the 7.44mMotor Boat (Cheverton) are applicable to this craft.

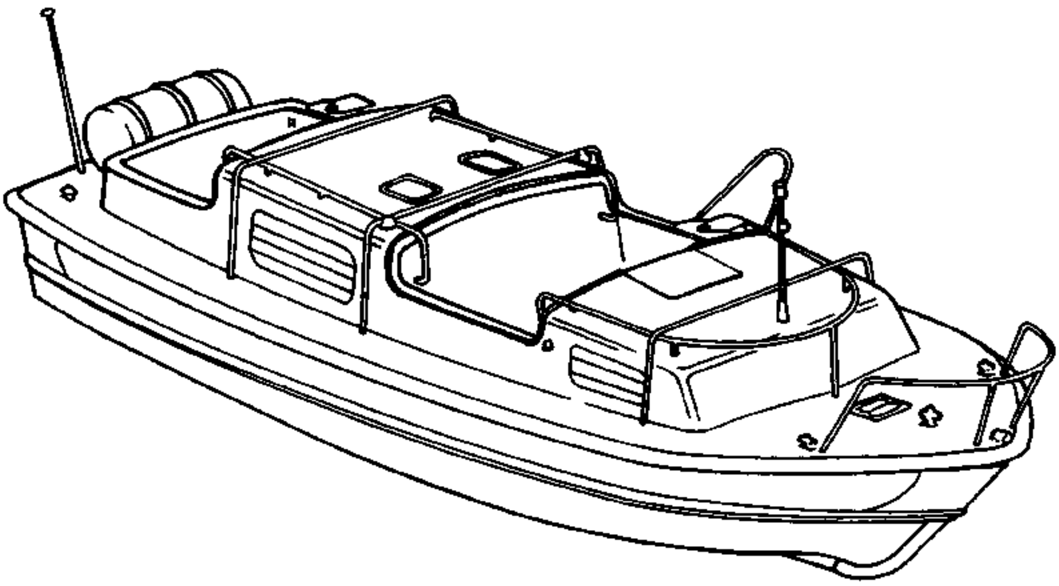


Fig 5-61. 9.0m Survey Boat

05111. 9.0m Motor Survey Boat Mk II and "Ice Variant" (Fig 5-62)

This boat is designed to replace the 9m Survey Boat (Medium) and perform similar duties. It is of GRP construction and is powered by two 115 hp engines. The for'ard cabin is fitted out as an accommodation space whilst the hydrographic recording equipment is fitted in the wheelhouse. The 9.0m Survey Boat (Ice Variant) is similar to the Mk 11 with additional strengthening and protection of the hull to permit operation in Arctic/Antarctic conditions. Details of the craft, its equipment and operating procedures are given in **BR 7837 9.0m Survey Boat Mk II**. All personnel qualifying in the Survey branch are taught to operate and coxswain this craft. However, the lowering and hoisting drills, and the guidance on crew and passenger dress given for the 7.44m Motor Boat (Cheverton) are applicable to this craft.

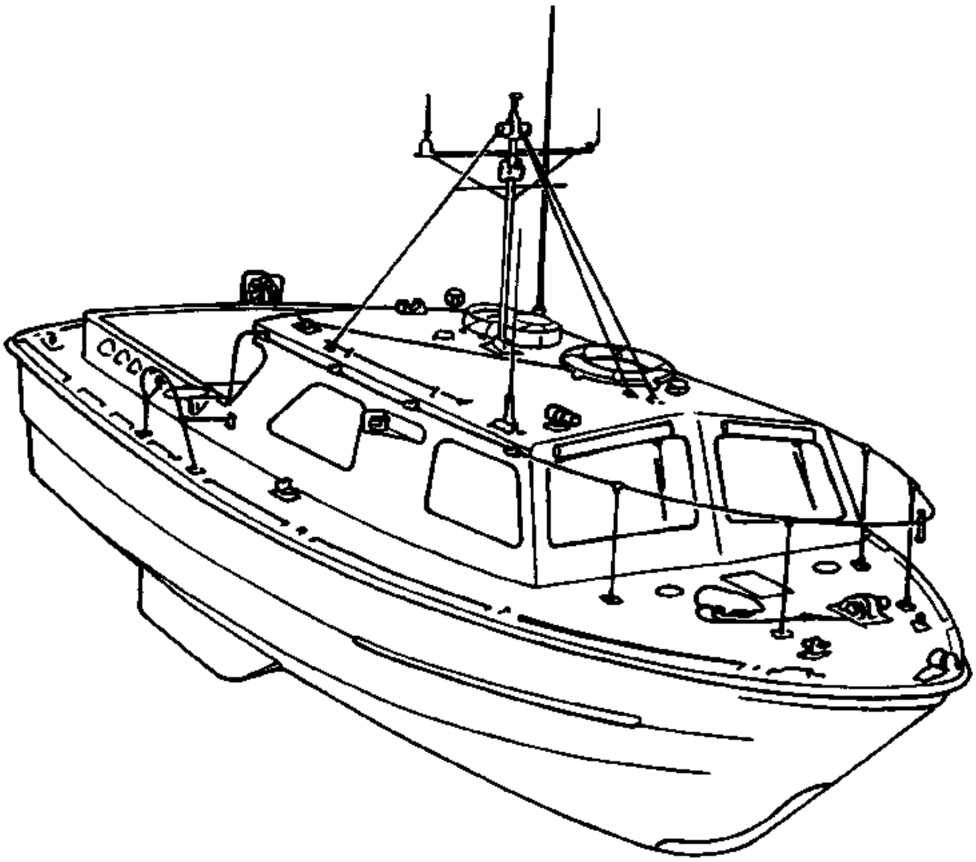


Fig 5-62. **Motor Survey Boat Mk 11**

05112. 10.0m Fast Motor Launch (FML) Mk VIII and Mk X - Specification

The Mk VIII and Mk X derivatives of the standard 10.0m Fast Motor Launch (Fig 5-63) are in service as Prestige and liberty boats. They are of GRP construction with a semi-planing hull giving it a wide economic speed range dependent on fit-out. The layout provides a large cabin for'ard, a covered steering position amidships, and a large, partly covered well deck aft with twin diesel engines mounted amidships. The Mk X version is lighter and fitted with larger engines giving higher speeds. The Mk X version is in service primarily as a police boat and because of the lifting arrangements is not suitable for use in warships. The authoritative publication for the FML is **BRF 6595 (006) 34 ft Fast Motor Launch**.

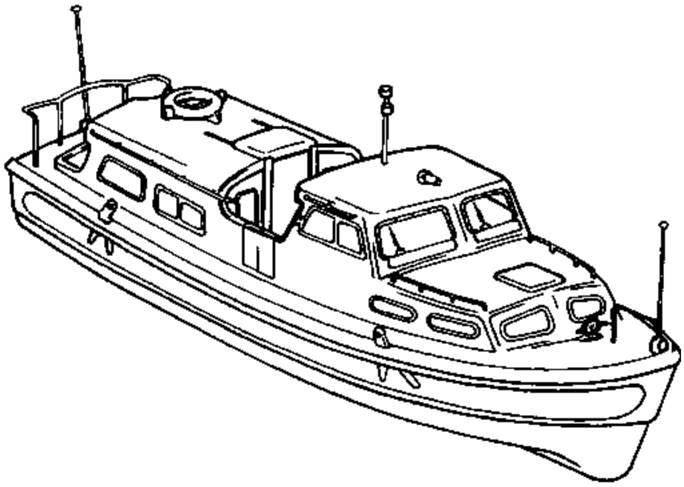


Fig 5-63. 10.0m Fast Motor Launch Mk VIII and Mk X

a. **Performance**

(1) *Mk VIII*

Capacity	20 persons (excluding crew)
Crew	2
Speed	18 to 21 knots
Endurance	150nm

(2) *Mk X*

Capacity	20 persons (excluding crew)
Crew	2
Speed	22.5 knots
Endurance	160nm

b. **Dimensions**

(1) *Mk VIII*

Length	10.15m
Width	2.82m
Height	2.05m
Weight (Max Hoisting)	7.2 tonnes

(2) *Mk X*

Length	10.37m
Width	3.05m
Height	2.97m
Weight (Max Hoisting)	4.76 tonnes

c. **Propulsion**

(1) *Mk VIII*

Engine	2 x Perkins 129 hp
Fuel	400 litres of Diesel

(2) *Mk X*

Engine	2 x Sabre 212 hp
Fuel	368 litres of Diesel

d. **Slinging Arrangements**. The slinging arrangements for these craft when carried in davits are given in Service Drawing numbers 002202075 (Mk VIII FML) and 002549695 (Mk X FML).

e. **Boatrope Securing Arrangements**. If the boat is being lowered in a seaway a boatrope should be secured to one of the cleats on the for'ard decking of the boat.

f. **Anchor and Cable**. The anchor for the boat is an 18 Kg CQR (naval stores number 0232/21026), fitted with a 16mm x 37m polyester cable.

g. **Painter and Sternfast**. The painter and sternfast are made of 16mm polyester and are 11m and 7m long respectively.

h. **Stores and Equipment**. See paragraph 05103

i. **Boat's Bag**. See paragraph 05104.

j. **Propulsion and Electrical System**. The propulsion and electrical system fitted in these craft is described fully in **BR 6595 (006)**. Also included in that publication are details of engine starting and stopping procedures and a guide to fault finding should the equipment not operate correctly.

k. **Crewing**. See paragraph 05105

l. **Dress for Crew and Passengers**. Dress requirements for passengers and crew are identical to those laid down for the Cheverton. It is prudent to suspend passenger boat operations in all but emergency situations if the prevailing or forecast weather conditions indicate a possible hazard to personnel.

m. **Davit Arrangements**. See paragraph 05100.

n. **Lowering and Hoisting**. See paragraph 05107.

05113. 11.0m Work Boat - Specification

The 11.0m Work Boat (Fig 5-64) is carried in CVSGs and certain RFAs for the carriage of stores or personnel. It is of GRP construction with a shallow Vee hull and spoon bow suitable for beaching. Layout provides a large open deck for'ard, the steering position aft, and a single diesel engine mounted aft with ‹Vee' drive to the propeller. The authoritative publication for this craft is **BR 6595 (007) 36 Ft Work Boat**.

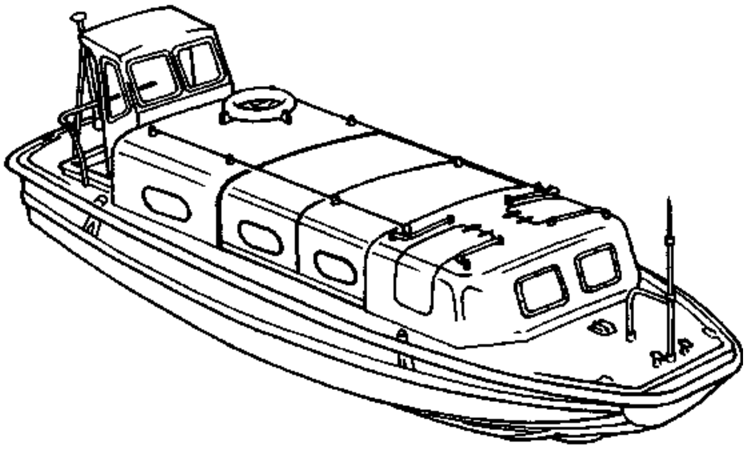


Fig 5-64. 11.0m Workboat

a. **Performance**

Capacity	50 persons (excluding crew)
Crew	3
Speed	9 knots
Endurance	180nm

b. **Dimensions**

Length	11.22m
Width	3.48m
Height	3.1m
Weight (Max Hoisting)	7.2 tonnes

c. **Propulsion**

Engine	1 x Perkins 130 hp
Fuel	405 litres of Diesel

d. **Slinging Arrangements**. The slinging arrangements for this boat are given in Service Drawing numbers 002549685/25.

e. **Boatrope Securing Arrangements**. If the Workboat is being lowered in a seaway a boatrope should be secured to one of the staghorns on the for'ard decking of the boat.

f. **Anchor and Cable**. The anchor for the boat is an 18 Kg CQR (naval stores number 0232/21026), fitted with a 16mm x 37m polyester cable.

g. **Painter and Sternfast**. The painter and sternfast are made of 16mm polyester and are 11m and 7m long respectively.

h. **Stores and Equipment**. See paragraph 05103.

i. **Boat's Bag**. See paragraph 05104.

j. **Propulsion and Electrical System**. The propulsion and electrical system fitted in these craft is described fully in **BR 6595 (007)**. Also included in that publication are details of engine starting and stopping procedures and a guide to fault finding should the equipment not operate correctly.

k. **Crewing.** See paragraph 05105.

l. **Dress for Crew and Passengers**. Dress requirements for passengers and crew are identical to those laid down for the Cheverton. It is prudent to suspend passenger boat operations in all but emergency situations if the prevailing or forecast weather conditions indicate a possible hazard to personnel.

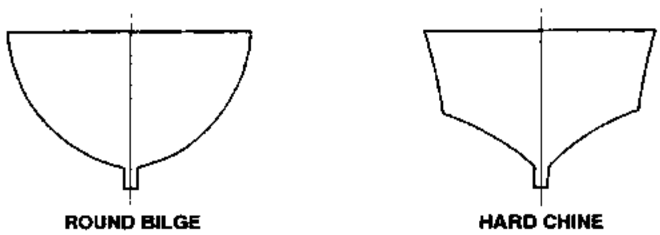
m. **Davit Arrangements** See paragraph 05100.

n. **Lowering and Hoisting**. See paragraph 05107.

05114. Handling Power Boats - General Information

a. **Introduction**. The handling of any type of power boat is governed in general by the commonsense rules of seamanship, but the method of manoeuvring one boat may differ considerably from that of another owing to differences in the shape of their hulls, the number of propellers and the type of rudders. The rotary movement of a boat's propeller (or propellers) exerts a considerable effect on the directive powers of her rudder, not only when she is moving through the water but also when she has stopped or lost steerage way. The extent to which the steering of a boat is affected by the movement of her propellers depends upon their number and size, the direction in which they revolve, the speed of their revolution, the distance from the rudder and the shape of the boats hull. The particular handling characteristics of Geminis and Rigid Inflatable Boats, which are steered by altering the direction of the thrust or drag of the propeller were explained earlier in this Chapter.

b. **Hull Forms.** The hull form of a Rigid Inflatable boat, known as a Deep-Vee, is described earlier in this Chapter. Hull forms for other types of service power boat are of two main types, one where the athwartship section is **round-bilge** (Fig 5-65(i) and the other where they are **hard-chine** (Fig 5-65(ii)). The hard-chine boat planes at speed and is therefore faster than a round-bilge boat, but it has inferior sea-keeping qualities.



(i) (ii)

Fig 5-65. Hull Forms - Conventional Boats

c. **Direction of Rotation of a Propeller**. The direction of rotation of a propeller is described as being either right-handed or left-handed; a right-handed propeller is one that turns in a clockwise direction when driving the boat ahead and viewed from astern, and a left-handed propeller is one that turns in a counter-clockwise direction under the same conditions. Single-screw Service boats or vessels have right-handed propellers. In general twin-screw Service boats have outward-turning propellers (right-handed on the starboard side and left-handed on the port side), but a few have propellers turning the same way.

d. **Use of the Rudder.** The turning effect of the rudder when the boat is under way increases with an increase in the speed of the boat as well as with an increase in the angle between the rudder and the fore-and-aft line of the boat, and it reaches its maximum value when the latter is about 35°. Beyond 35° the turning effect begins to decrease and the retarding effect of the rudder on the speed of the boat increases rapidly. The rudder angle of a boat is therefore limited to 35°. When the boat turns under the effect of her rudder she turns about a pivoting point which is usually about one-third of her length from the bows in round-bilge boats, and farther forward or aft in hard-chine boats. This pivotal point should be borne in mind when leaving an accommodation ladder or landing-place, because if the rudder is put over to swing the bows outwards the stern may swing in towards the ladder or landing-place and so damage the boat or the ladder. When turning at speed, particularly if the rudder is put hard over, the boat skids over the water broadside-on and outwards as she turns before gathering way in the direction in which her bows are pointing; this is more marked in a shallow-draught or a hard-chine boat than in a deep draught or round-bilge boat. As the boat skids the resistance of the water to the hull heels the boat outwards to an angle depending on the type of boat, her speed and loading; it will be more marked in a round-bilge than in a hard-chine boat, and in a boat laden with top-weight than in a normally loaded boat. **The rudder should therefore never be used drastically, particularly in boats laden with men or gear, or in a heavy sea, on which occasions the speed of the boat should be reduced before altering course**. When proceeding at full speed a boat is very sensitive to even a slight touch of wheel, so a large amount of rudder should then only be used in an emergency. Except in emergency or at low speed, drastic use of the rudder shows lack of foresight, and is therefore bad seamanship. When proceeding slowly, however, or when manoeuvring a boat in a confined space, it will often be necessary to use full wheel, ie to put the rudder hard over. The trim of the boat has a great effect on her steering; if she is down by the head or stern she will be difficult to manoeuvre, and men or weights should therefore be kept distributed evenly amidships as far as possible.

e. **Handling in a Seaway**. When running before a sea, or when towing, the boat should be trimmed by the stern to keep her propeller immersed and improve her steering qualities. When running before a swell which appears to be moving at the same speed as the boat reduce speed immediately, if necessary by streaming a drogue; otherwise your boat may be carried along on the front of a wave and may broach-to and capsize. When running before a quartering sea or swell be on your guard against a wave bearing under the weather counter and so broaching the boat to. When sea or swell are on the bow meet the larger waves head on, and reduce speed as necessary. Alteration of speed in a seaway has a great effect on the behaviour of the boat, so speed should be adjusted to suit the state of the sea.

f. **Regulation of Speed.** When under way in harbour proceed with due consideration for others. The wash made by a boat at high speed can damage boats alongside ladders or jetties, and cause great inconvenience to small boats and men on painting catamarans; so reduce speed or give a wide berth in these circumstances, and always keep a good lookout for diving operations.

g. **Going Alongside.**

(1) *Accommodation Ladder*. When going alongside an accommodation ladder in a tideway avoid overshooting and getting the stream on the outer bow; otherwise the boat may be jammed by the stream under the forward side of the ladder and may even be heeled over and swamped. When lying alongside a ladder in a tideway secure the boatrope over the inner bow, and steer the boat so that she rides by the boatrope with her side about one-third of a metre clear of the ladder.

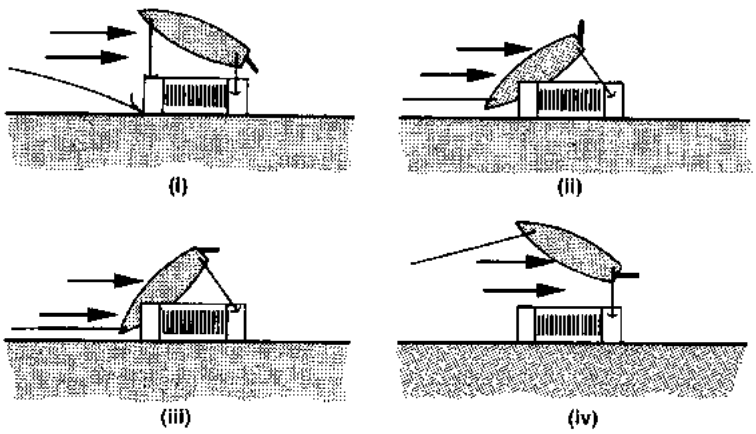


Fig 5-66. Faults in Handling a Boat Alongside

(a) In Fig 5-66(i) the bowman has failed to secure the boatrope, the sternsheetsman has griped the stern to the ladder and the bows have swung out, the stream bearing on the inner bow. The remedy is to let go for’ard and aft, go ahead and come alongside again.

(b) In Fig 5-66(ii) the boat has overshot the ladder, the bowman has griped-in the bows and the stream on the outer bow has forced the boat under the ladder; the sternsheetsman cannot haul the stern into the ladder. The remedy is to let go aft, go full astern and come alongside again.

(c) In Fig 5-66(iii) the bowman has secured the boatrope, but the boat is too far ahead and the coxswain has forgotten to use his rudder, thereby allowing the bows to swing into the ship’s side. The sternsheetsman cannot haul the stern into the ladder. The remedy is to put on starboard rudder until the bows swing out, then steer the boat so that she remains parallel to the ships side. If the bows will not swing out, the boat must be worked astern a short distance.

(d) In Fig 5-66(iv) the bowman has secured the boatrope and the sternsheetsman has griped the stern to the ladder, but the coxswain has failed to use his rudder to keep the boat parallel to the ship's side. The remedy is to let go aft, put on port rudder until the boat is riding head to stream and clear of the ladder; then steer her gently in until she lies alongside.

(2) *Landing-place*. When going alongside a landing-place take into account the direction and strength of the wind and tidal stream; whenever possible go alongside head-to-wind or stream, whichever has the most effect on the boat. A 1-knot stream is about equivalent to a wind of force 3 to 4, and a 2-knot stream to a wind of force 5 to 6. If the landing-place lies across wind or stream and there is a choice of sides, choose the lee side. Always approach at slow speed and keep the boat heading in a safe direction in case her engines fail to go astern. If manoeuvring space near the landing-space is limited, it may be an advantage to leave bows first, particularly in single-screw boats; the approach must then be made stern first, or the boat turned when alongside. When going alongside a strange landing-place in suspected shallow water, approach slowly, taking soundings with a boat-hook.

g. **Use of Springs**. In Fig 5-67(I) a headrope has been made fast and the boat can be brought alongside either by going slow astern or by allowing the wind or stream to do the work. In Fig 5-67(ii) a headspring has been made fast on the jetty and is secured abreast the pivoting point of the boat. By going slow ahead with the rudder to starboard, the stern will be brought into the jetty. Once alongside, particularly when lying head to wind or stream, the head and stern ropes should be secured as springs (Fig 5-68(i)); they will be more effective in holding the boat alongside and are ready for springing off (described below).

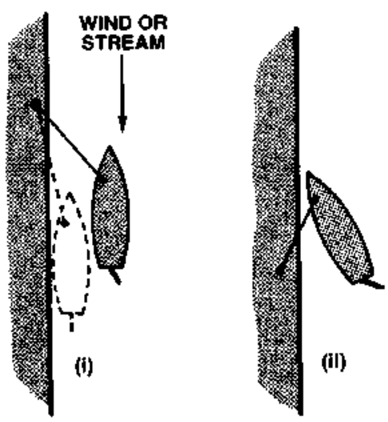


Fig 5-67. Use of Springs When Going Alongside

h. **Casting Off**

(1) *From a Boom*. When leaving an inner billet at a boom in a tideway, drop astern to clear the outer boat(s); if you try to pass ahead of them the stream may set your boat athwart their bows.

(2) *From a Landing-place*. When leaving a landing-place always shove the boat well off before using the engines; if the boat is too heavy to shove off, cast her off on her springs with the help of the wind or the stream, or by using the engines.

(3) *Springing Off*. When there is a head wind or stream, the bows can be sprung off by putting the rudder to starboard and letting go the head spring. When the bows have swung out far enough, go slow ahead with rudder amidships and let go the backspring (Fig 5-68(ii). When there is little or no wind, the stern can be sprung off by letting go the backspring, putting the rudder to port and going slow ahead (Fig 5-68(iii); or the bows may be sprung off by holding on to the backspring and going slow astern until the bows have paid off far enough (Fig 5-68(iv)).

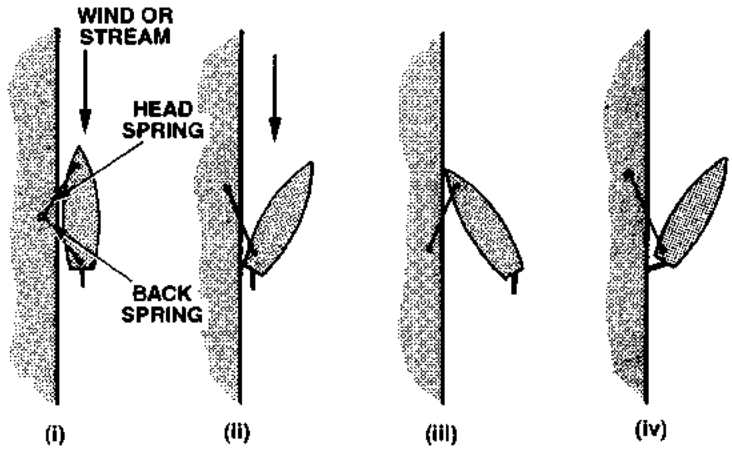


Fig 5-68. Use of Springs when Casting Off

i. **Shallow Water**. A boat running into shallow water at speed settles deeper in the water and trims by the stern; at the same time her hull wash increases, a stern wave builds up and the hull vibrates. If these signs become evident stop immediately and go astern into deep water on the opposite course. Avoid taking a boat into shallow, muddy or sandy water, because the mud or sand will be churned up and may choke the cooling system of water-cooled engines.

j. **Towing**. When towing a boat it is usual to use her painter as the towrope, bringing it to your lee quarter cleat with one round turn round the stem of the cleat and half a turn round its after horn, the end being tended by the sternsheetsman so that the tow can be slipped at a moment's notice; on no account should a hitch be made or the end left unattended. When towing more than one boat the heaviest should be first in the line of tow and the lightest last. Boats may be towed in calm water at a fairly short stay, but in a lop or heavy sea the length of the tow should be increased until both boats ride comfortably. The total weight of the tow should not normally exceed the weight of the towing boat, otherwise an unfair strain will be put on her engines. To tow a heavier vessel, such as a lighter, make her tow rope fast as near to the pivoting point of your boat as possible; this may necessitate removing the after canopy. If the tow rope is made fast to the quarter cleat the weight of the tow will gird the stern of the boat so that she will not answer the helm readily.

If the tow yaws badly pass another tow rope from one quarter of the towing boat to the opposite bow of the tow (Fig 5-69(i)) and equalise the strain on both ropes. Another method is to tow the vessel on a bridle, one leg of which is shorter than the other (Fig 5-69(ii). To tow a lighter alongside secure the boat to her quarter, as shown in Fig 5-69(iii). The rudder and propeller are not blanketed by the lighter's wash, and the rudder exerts a far better turning moment about the combined pivoting point of the two craft than it would if the boat were made fast to the lighter amidships.

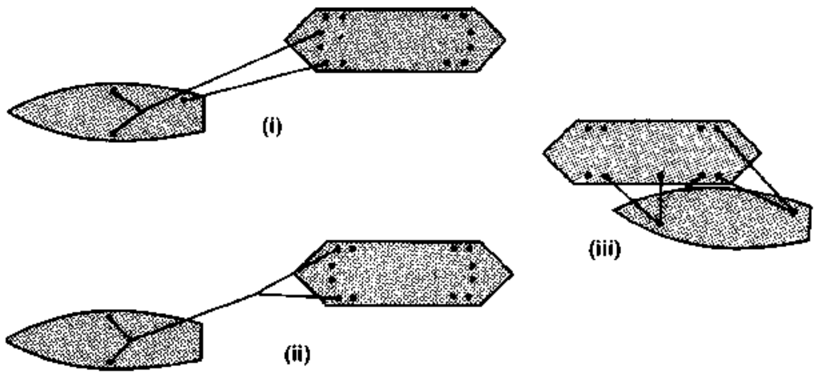


Fig 5-69. Methods of Towing

05115. Handling Power Boats - Round-bilge, Single-screw Boats

a. **Introduction**. A revolving propeller exerts a sideways thrust on the after part of the hull, and the extent of this thrust and its effect on the boat depends upon:

(1) Whether the boat is at rest or moving;

(2) Whether she is moving ahead or astern;

(3) The speed at which she is moving;

(4) The rate at which the propeller is turning.

It is not necessary for the coxswain to understand the theory underlying the effects of a revolving propeller, but he should know what effects it has on the steering of his boat under various circumstances. The most important of these effects in a boat with a single right-handed propeller are described here (there are no boats in service with a single, left-handed propeller). The faster the propeller is revolving and the slower the boat is moving the greater will be these effects.

b. **Boat at Rest, Propeller Going Ahead**. If the rudder is amidships or to port the stern kicks to starboard, but if the rudder is to starboard the kick is counteracted (Fig 5-70(i)).

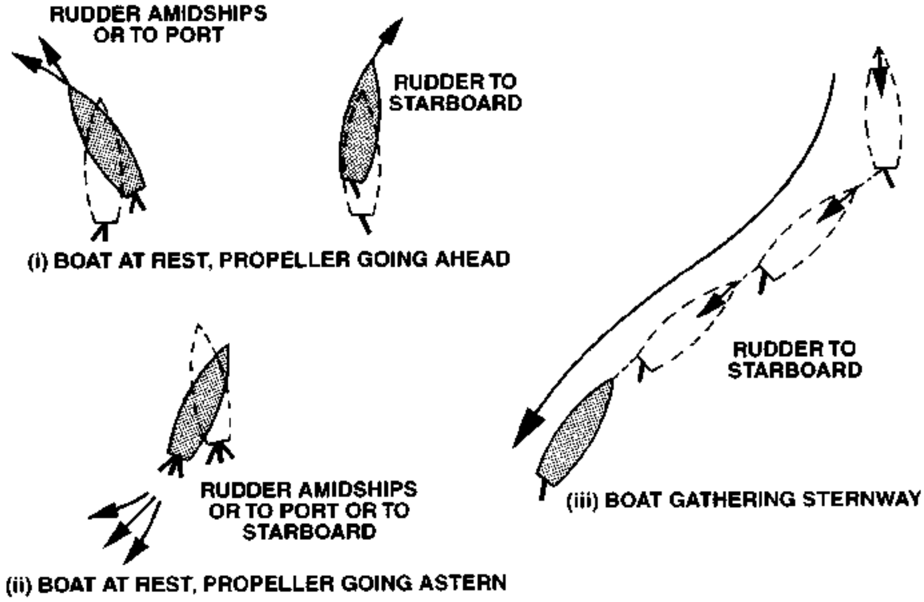


Fig 5-70. Right-handed Single-screw Boat; From Rest

c. **Boat Gathering Headway**. As the boat gathers headway the side thrust of the propeller diminishes, and becomes imperceptible as soon as the boat gets steerage way.

d. **Boat at Rest, Propeller Going Astern**. The stern kicks to **port** whatever the position of the rudder, but the kick is more pronounced if the rudder is to port (Fig 5-70(ii)).

e. **Boat Gathering Sternway**. As the boat gathers sternway the stern continues to swing to **port** to a lesser or greater degree, according to the setting of the rudder (Fig 5-70(iii)) but as the speed of the boat increases so the turning effect of the rudder increases, and with starboard rudder the swing is reduced and, in some boats, may be checked completely. Very few right-handed single-screw boats can be made to swing stern to starboard when going astern, even with the engine at full speed, but if the propeller is stopped when the boat has good sternway the rudder exerts its full effect.

f. **Boat Going Ahead, Propeller Going Astern**. This is in some respects the most important reaction, because it occurs in emergency and when going alongside. As soon as the propeller starts to turn, the boat fails to obey in the normal manner and her subsequent behaviour depends on the position and size of her rudder. In the following examples (Fig 5-71) it is assumed that the engine is suddenly reversed to full speed astern when the boat is going full speed ahead, but the slower the boat is going ahead and the faster the propeller is turning the more marked will be her behaviour.

(1) *Rudder Amidships* (Fig 5-71(i)). The boat's head falls off to starboard and the boat gains ground to starboard before losing her way.

(2) *Rudder to Port* (Fig 5-71(ii)). The boat's head usually goes to port first, but not far; it then begins to swing to starboard.

(3) *Rudder to Starboard* (Fig 5-71(iii)). The boat's head pays off to starboard because both rudder and propeller tend to turn the boat that way.

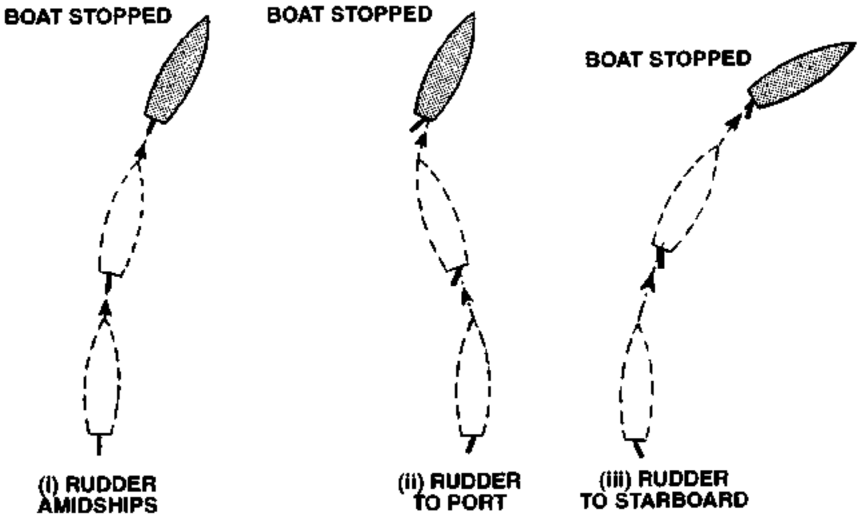


Fig 5-71. Right-handed Single-screw Boat: Engine Full Astern When Boat is going Full Speed Ahead

g. **Boat Going Astern, Propeller Going Ahead**. Here again the behaviour of the boat depends on the position and size of her rudder, her speed and the engine speed. If the engine is put to full speed ahead when the boat is going full speed astern, the boat reacts as illustrated in Fig 5-72.

(1) *Rudder Amidships*. No definite forecast of the boat's behaviour can be given, because so much depends on the type of boat.

(2) *Rudder to Starboard* (Fig 5-72(i)). The boat's head pays off to starboard - slowly at first, then more rapidly as the wash of the propeller impinges on the rudder.

(3) *Rudder to Port* (Fig 5-72(ii)). The boat's head pays off to port.

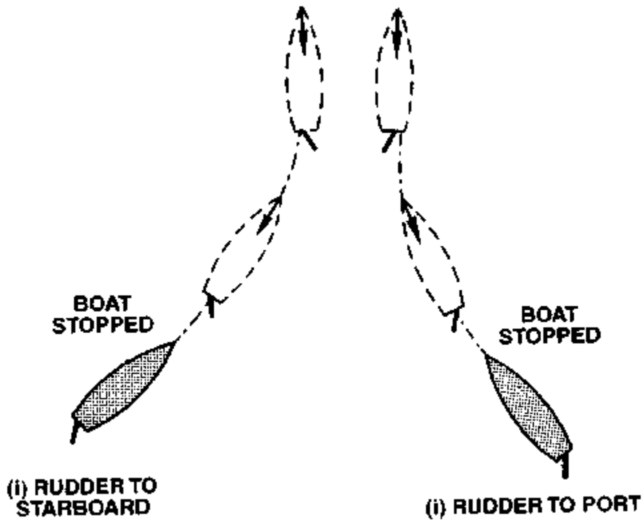


Fig 5-72. Right-handed Single-screw Boat:
Engine Full Ahead when Boat is going Full Speed Astern

h. **Turning a Right-handed Single-screw Boat in Narrow Waters**. It will now be seen that the best way to turn a right-handed single-screw boat in narrow waters is to starboard, as follows (Fig 5-73):

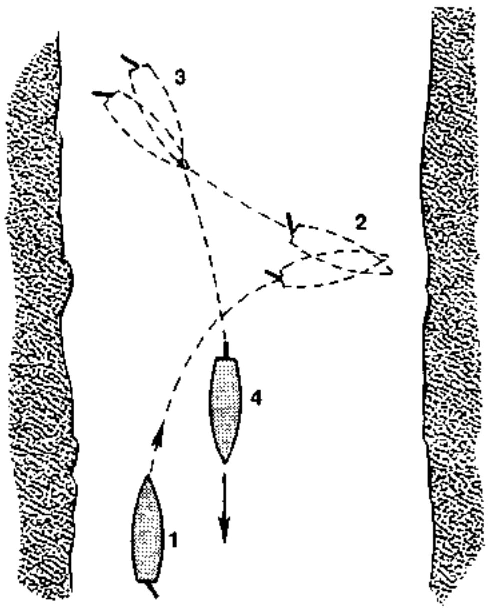


Fig 5-73. Right-hand Single-screw Boat; Turning in Narrow Waters

(1) Put the rudder to starboard and go ahead; the stern immediately kicks to port and will swing more rapidly as she gathers headway.

(2) Reverse the engine and put the rudder to port; the stern continues to swing to port.

(3) Go ahead and put the rudder to starboard; continue the movement of (2) an (3) as necessary until the vessel can achieve position 4.

If it is more convenient to go astern first, begin by going astern with the rudder to port. If there is a strong breeze from the starboard side, avoid going astern too far or the vessel will tend to back into the wind. If the breeze is from the port side it will be advantageous to continue the sternboard until the stern is into the wind, if there is room to do so. If there is sufficient room to go ahead and astern at fair speed for some distance it may be possible to turn to port, but the turn to starboard is always more easily and rapidly made.

i. **Going Alongside in a Right-handed Single-Screw Boat**. When going alongside port side to, the boat can approach on a steady course at a small angle to the jetty or ladder, and when her engine is put astern to reduce her way the action of the propeller kicks her stern in towards the ladder so that she brings up squarely abreast of it (Fig 5-74).

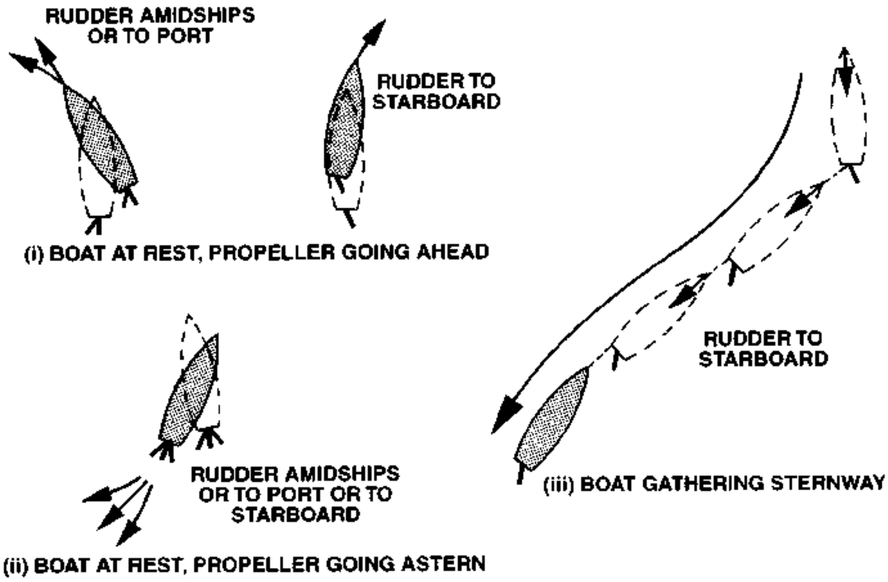


Fig 5-74. Going Alongside in a Right-handed Single-screw Boat

05116. Handling Power Boats - Round-bilge, Twin-screw Boats

Manoeuvring a twin-screw, round-bilge boat is much easier than manoeuvring a similar single-screw boat. All such service boats have out-turning propellers. When both propellers are going ahead or astern at the same rate the sideways thrust of one cancels that of the other, and the boat answers her rudder in the normal manner provided she has steerage way. The boat can be tested at rest on her heel with her rudder amidships by going ahead with one propeller and astern with the other, and by adjusting their rates of revolution so that the boat does not gather way either ahead or astern. But, if manoeuvring space allows, the boat can be turned more quickly if she is given a little headway or sternway with the rudder set in the direction of the turn. Some boats turn better when going ahead and some when going astern. If there is a wind blowing some turn better if manoeuvred head to wind, and some stern to wind. Each boat has its own peculiarities so no hard and fast rules can be laid down, but when the boat is at rest, or moving slowly ahead or astern, she answers to the thrust of her propellers rather than the setting of her rudder.

| 05117 Handling Power Boats - Hard-chine Boats

a. **Introduction.** A hard-chine boat is designed to plane on the surface of the water at comparatively high speed, and therefore has a shallow draught, a flat bottom, and a greater beam than a round-bilge boat of similar length. The trim of the boat and her steering qualities are very different at high and low speeds. All hard-chine boats in use in the service have twin, out-turning propellers and handling is similar to that of twin-screw round-bilge boats, but because of the shallow draught the kick of the propellers is more marked.

b. **At High Speeds**. The boat has a hull of V-shaped cross-section forward and of rectangular cross-section aft. When at rest or moving slowly the draught is greater forward than aft, the pivoting point is at or near the bows and the boat tends to skid when under wheel. Because she is trimmed by the head the boat answers her rudder sluggishly and, when at rest, the rudder has little or no effect.

c. **At Higher Speeds**. When the boat is moving at speed in her planing trim the forefoot is out of the water and the stern and rudder are well immersed; the pivoting point moves aft, and she steers well. Under normal conditions the boat should be run at a speed which will allow her to attain her planing trim, but if she is overloaded she will be unable to attain it and will plough sluggishly through the water, shipping water and straining the engine and hull.

d. **Topweight**. Because of their shallow draught and high freeboard these boats are particularly susceptible to top-weight; therefore they should never be overloaded, and passengers and stores must be stowed within the hull, never on the deck or canopies.

e. **In Heavy Sea**. The behaviour of a hard-chine boat in a heavy seaway depends upon the length and steepness of the seas in relation to the length and speed of the boat. In favourable conditions she will plane at high speed with comparative ease over seas which would be uncomfortable for a round bilge boat; but in unfavourable conditions she will pound and slam so badly that her speed will have to be reduced below her planing speed, and then she will wallow sluggishly and require very careful handling, particularly in a quartering sea.

| 05118. Guidance for all Boat Coxswains

a. **Introduction**. It is an old Service saying that a ship is known by her boats; when away in a boat remember that you are in charge of the boat and the reputation of your ship depends partly on you. Check the gear and equipment regularly. This should be done when the boat is being cleaned, or before she is called away for the first trip of the day, or before she is lowered, or when you take over a watch or period of duty. Make good defects between trips; report any which you cannot make good to the Officer of the Watch and the Boat Officer. After the last trip of the day make sure that the boat is ready in all respects for the first trip of the following day.

b. **Briefings for Trips**. Ensure you are briefed on the nature and purpose of your trip before you leave the ship. In certain circumstances this may be a simple brief from the PO I/c of lowering the boat, for example in a man overboard situation; or it may involve a lengthy briefing from the Officer of the Watch or Navigating Officer if a long or complicated trip is to be undertaken. Familiarise yourself with important features of a harbour, including the position of any buoys or other marks, and be aware of the tidal stream and the times of high and low water. Remember that at night a harbour looks different and can be confusing.

c. **Dress and Behaviour in the Boat**. Always check that your crew are properly dressed in the correct rig; if caps are being worn chin-stays must be down. The crew and passengers should not be allowed to stand up, except when necessary to carry out their duties. Nobody should be allowed to place their arms or hands on the washstrakes or gunwales, especially when the boat is alongside or about to go alongside. Do not allow skylarking in a boat; even in a recreational environment the potential for an accident is high. **Smoking is forbidden in all Service boats**.

d. **Unhooking**. When unhooking a boat from her falls always unhook the after fall before the foremost fall. If the foremost fall is unhooked first the boat may swing out, and in a strong tideway may broach-to. For the same reason, when hooking a boat to her falls the foremost fall should always be hooked on before the after fall.

e. **Carrying Passengers and Stores**. You must know the maximum number of persons and the maximum weight your boat is allowed to carry in calm weather (see the relevant paragraphs in this Chapter); remember that these are maximum limits for calm weather, and that you must reduce them according to the conditions and sea which your boat will encounter. Passengers must embark and disembark one at a time as directed by the coxswain to keep the boat stable; the sequence for embarking passengers is Junior Rates first, followed by Senior Rates, then Officers; this sequence is reversed when disembarking. When embarking stores they should be placed as near as possible amidships and low down in the boat. If the centre of gravity of the stores is above the gunwale the boat will be top-heavy and tender; if weights are placed right forward she will not rise to the waves and will be in danger of broaching-to, and if placed right aft she will be in danger of being pooped by a following sea. When loaded, your boat should have an even trim and no list, but when running before a heavy sea it is best to trim the boat slightly by the stern. If you are carrying top-weight alter course carefully, and if you are heavily loaded remember that the boat will carry her way for a much greater distance than when she is lightly loaded.

f. **Carrying Money or Valuable Stores**. Before a large sum of money or a valuable item of stores is embarked the bag containing it should be secured to a buoy-rope, which should be long enough easily to reach the bottom at any point on your passage back to the ship; should any accident then occur the item can be recovered later by picking up the buoy and buoy-rope. When disembarking the item the buoy and buoy-rope should be passed first into the ship.

g. **When Under Way**. In setting your course make due allowance for leeway or the set or current of any tidal stream. If your course lies beam-on to a heavy sea or swell it is better to steer a dog-leg course to windward than to steer a direct one. Meet the wash of passing craft bows on, and do not pass under the bow or stern of a ship at anchor. Do not cross the bows of your superiors. Be thoroughly conversant with the Rule of the Road.

h. **Gangway Hand Signals**. Fig 5-75 shows the code of gangway hand signals. If you have to wait before going alongside another ship, lie off well clear on her quarter and keep a lookout for the signal or hail to call you alongside.

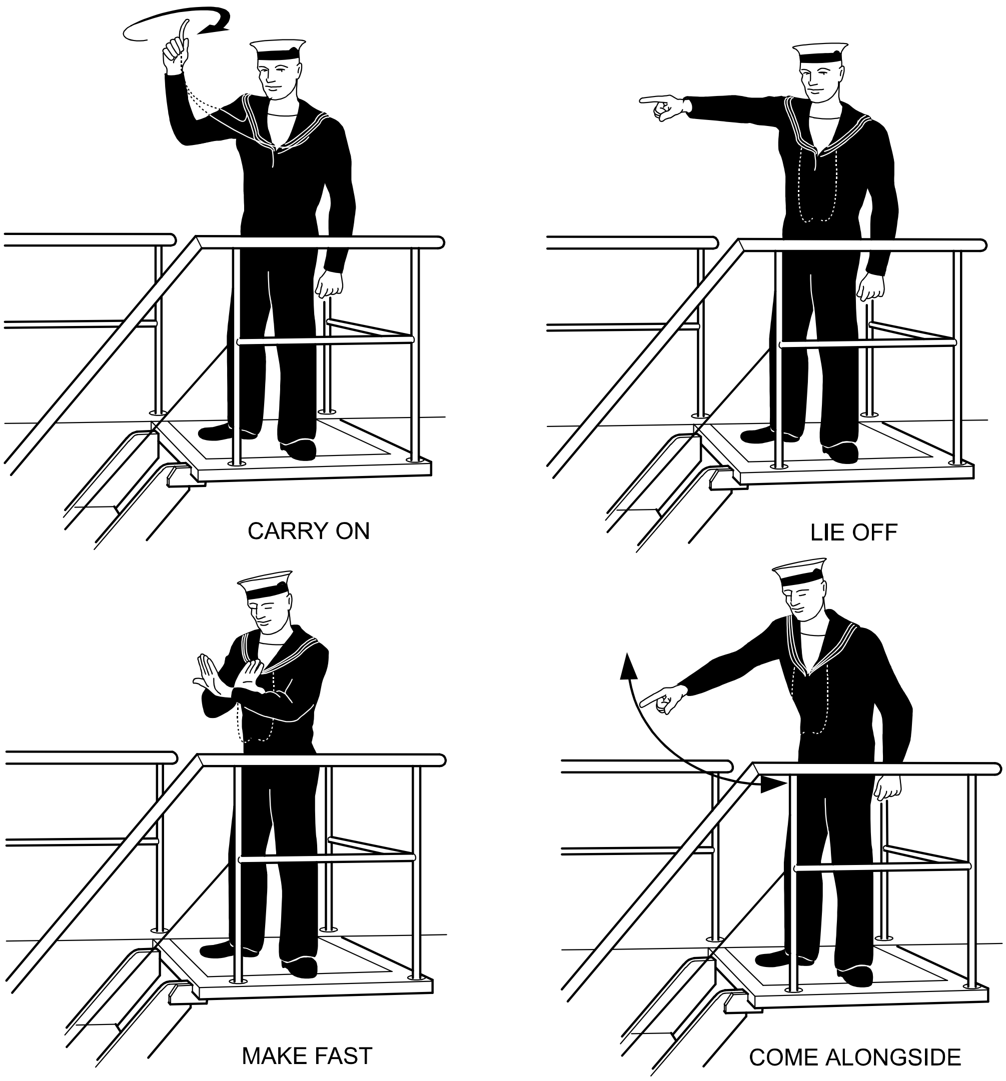


Fig 5-75. Code of Gangway Hand Signals

i. **Securing a Boat**

(1) *To a Jetty or Alongside Another Boat*. Ensure the craft is well fendered. The securing lines should be led **down** through a ring or around a bollard on the jetty or boat to which you are making fast, then back into your boat and secured to a cleat.

(2) *To a Boom*. Pass the eye of strop of the boom boatrope through the eyeplate on the boat's bow and then over a cleat. The boat's painter is secured to the lizard by a double-sheet-bend and the lazy painter is secured to the Jacob's ladder by a single-sheet-bend.

(3) *To an Accommodation Ladder*. Pass the end of the gangway boatrope through the eyeplate on the boat's bow and secure it around a cleat. Do not remain alongside an accommodation ladder unless ordered to do so.

(4) *To a Buoy*. Secure the boat's painter to the buoy ring by a round-turn-and-two-half-hitches.

05119. Guidance for Seaboat Coxswains

a. **Use of RFD Hook and Preventer**. Ensure your crew are fully conversant with the use and operation of the RFD hook. If the boat has to be recovered when the RFD hook is in the ‹cocked' position, for instance if a seaboat evolution is terminated after the boat has been lowered but before it has been launched, then the preventer must be hooked to the lifting sling ring before the boat is hoisted.

b. **Recovery and Care of a Casualty.** The procedure for the recovery and care of a casualty when operating a RIB is given in paragraph 05069; this procedure, suitably modified for the type of boat being used, is applicable to any other boat being used as a seaboat.

c. **Use of the Boatrope**. When going alongside to hook on for hoisting or to conduct a transfer of stores or personnel a boatrope should be rigged. It is better to overshoot than undershoot the falls (or transfer position). If you overshoot, the boatrope can be recovered and secured, and the wind and sea will soon drop the boat astern; but if you undershoot, it can be difficult to smoothly regain the momentum necessary to get the boat forward into the correct position. Do not be afraid to use the engine to keep the boat correctly positioned until the boatrope is secured. See also paragraph 03067 in Chapter 3 regarding the use of a pilot ladder.

d. **Signals**. When away from your ship keep an eye on her for signals; on your outward passage one member of the crew should be facing the ship to watch for flag, lamp or other signals. If you are to pick up a man or some other inconspicuous object, the ship may have to direct you to the position. In order to standardise light signals in this situation, the following indications are to be used:

Series of long flashes	Turn to starboard
Series of short flashes	Turn to port
Steady light	Go straight ahead
Series of 'ROMEOs' (· — ·)	Return to ship

e. **Suitability of Transfer Positions**. Should the coxswain of a boat have doubts about the feasibility of conducting a transfer from a particular point on a ship's side because of prevailing weather conditions at that point, or for any other reason, he should express his concerns to the CO of the ship concerned and request an alternative position.

05120. Assistance to Ditched Helicopters - Introduction

a. **Foreword**. Helicopters which operate over the sea are usually fitted with flotation gear which inflates in the event of ditching. The primary purpose of the gear is to allow time for the escape or rescue of the aircrew; their rescue is the first priority for ships and helicopters arriving on the scene. However, rapid action by a ship or Search and Rescue (SAR) helicopter during this period may prevent the ditched helicopter sinking and will greatly facilitate its recovery. Helicopters are extremely expensive and even though one that has ditched may appear a complete write-off, an inspection will almost certainly reveal the cause of ditching and may make its recovery worth while. Furthermore, if through good seamanship the helicopter suffers little damage and repair is possible, it may even fly again. HM Ships are well fitted out for locating an aircraft or helicopter that has come down in the sea and for rescuing survivors. Many ships are able to assist a helicopter to keep afloat, but, apart from capital ships, they have no capability to recover aircraft and no warship has the capability to salvage aircraft that have sunk. The role of a warship is therefore generally limited to search and rescue, marking the position of the accident and, if the aircraft is afloat, preventing it from sinking by attaching additional flotation gear and/or securing it to the ship by hawsers pending the arrival of a recovery vessel.

b. **Flotation Gear and Escape Panels**. The positions of the inflated flotation gear and escape panels (indicated by the shaded areas) for the Sea King, Lynx, Merlin and Apache AH Mk 1 helicopters are shown in Figs 5-76, 5-77, 5-78 and 5-79.

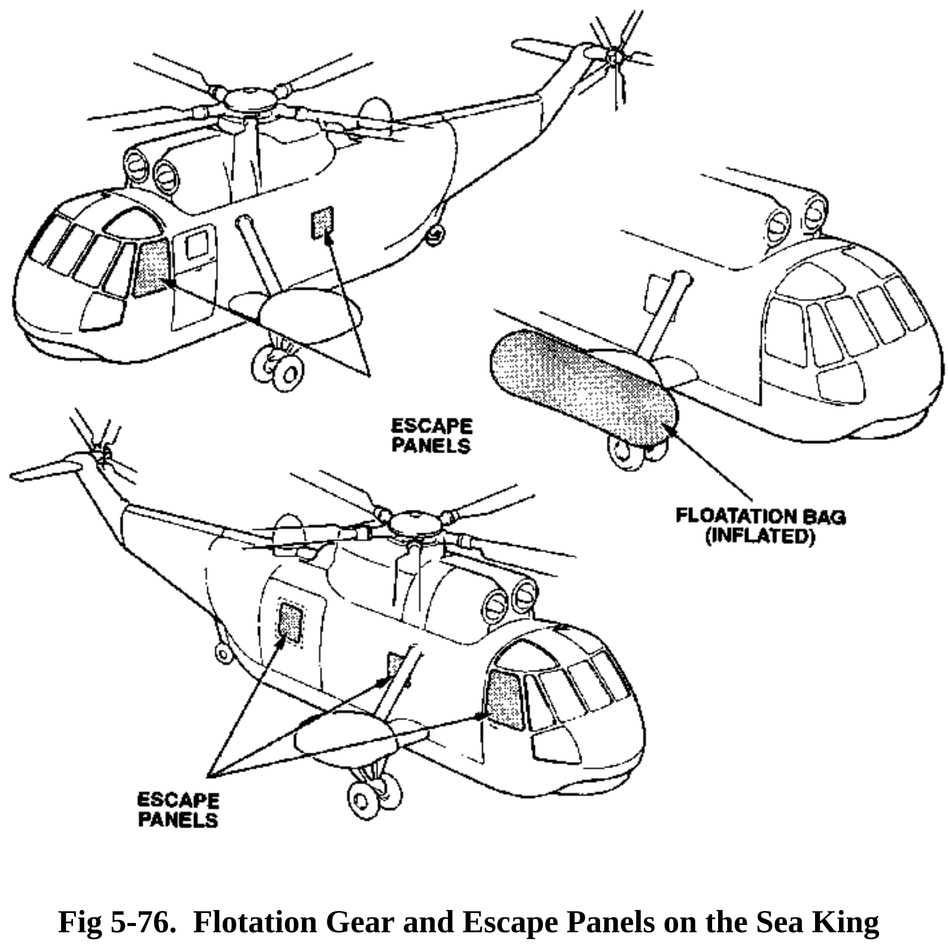


Fig 5-76. Flotation Gear and Escape Panels on the Sea King

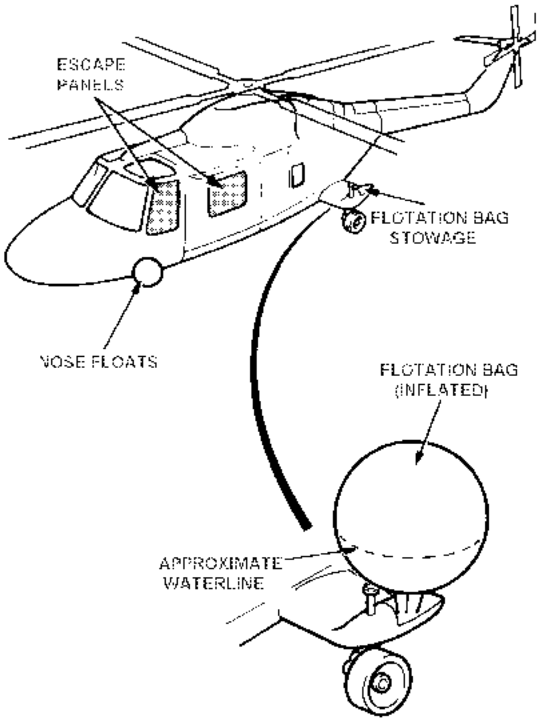


Fig 5-77. Flotation Gear and Escape Panels on the Lynx

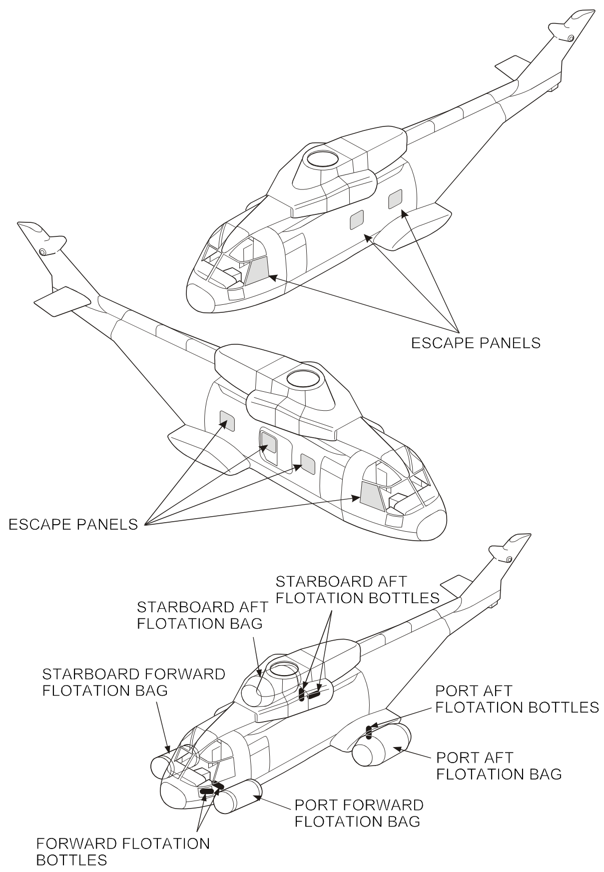


Fig 5-78. Flotation Gear and Escape Panels on the Merlin

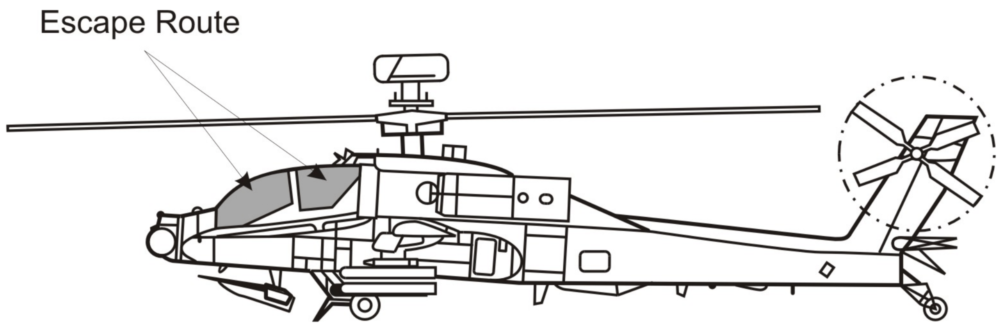


Fig 5-79. Escape Panels on the Apache

Note: *With the Apache AH Mk 1 having no Flotation Gear fitted it is reasonable to expect that in the circumstances of a ditching it is unlikely that the aircraft will remain afloat. If, however, it is feasible to attach salvage bags the recommended primary attachment points are: Port and Stbd main landing gear rings or axle extensions (if fitted), two bags per side; and the port and stbd aft lashing points on the tailboom, two bags per side. For salvage of the aircraft a 10m roundsling (4A 1670-132-9905) should be choke hitched around the helicopter main rotor head, in this state it has a SWL of 14125 kgs. Aircrew emergency escape in the event of the crew station doors being unable to open freely, is by means of the canopy jettison system which is pyrotechnically operated. This system operates independently without electrical power. The jettison system has three initiator handles and operation of any one of the three starts the operation of the canopy jettison system. The explosion time is less than one second.*

c. **Roles of Ships**. In addition to assisting the SAR helicopter, if one is present, ships should take the following action in order of priority.

(1) Rescue survivors.

(2) Mark the ditched helicopter or the position of ditching, for future salvage operations where practicable.

(3) Prevent the helicopter from sinking, by the attachment of additional buoyancy and/or securing to the ship.

(4) Recover the helicopter, where possible. (Capital ships only).

05121. Assistance to Ditched Helicopters - Preparations

a. **Crash Boat**. Whenever flying operations involving fixed-wing aircraft or helicopters are taking place a crash boat is kept at immediate notice, with all its equipment ready and the crew on call. The seaboat and/or the Gemini should be prepared, depending on the sea state, the weather conditions and the serviceability of boats. Ideally the seaboat should be used to recover survivors and a Gemini should be used for helicopter recovery work.

b. **Manning the Crash Boat**. The crew of the crash boat consists of at least a Coxswain and a Bowman. In addition there should be a Diver or Swimmer, and, if available, a Flight Rating ready to embark immediately. The Flight Rating, whose task is to assist generally and give specialist advice on the layout of the aircraft, survival equipment and buoyancy arrangements may have to embark after the crash boat is in the water. Where reaction time is of overriding importance it may be decided not to delay to embark the Flight Rating. The precise deployment of manpower will differ from ship to ship, depending on the type of boat(s) used and the SWL of boat(s) lifting device(s). Individual ships must produce their own plan, utilising the information given earlier in this Chapter on the Maximum Safe Working Lift for the type of boat(s) being used, and being mindful of the Safe Working Load of their lifting appliance.

Note. *The rules for crew and passengers regarding the wearing of HDLJs and Safety Helmets during boat operations (paragraph 05021) also apply to the Diver/Swimmer.*

c. **Crash Gear.** The crash equipment is divided into two sets. The first (set A), which must be taken in the boat comprises the Rescue and Marker equipment and this is placed in the boat beforehand and lowered with it. The second (set B) comprises the Flotation and Salvage gear, and because of the size and weight of this equipment it is necessary to either send it in the crash boat after the survivors have been rescued or to send it in another boat; warships that do not carry helicopters are required to carry set 'A' only. The sets of crash boat equipment consist of the following items:

<u>Rescue and Marker Equipment</u> Set A (Approximate weight 25 Kg)

1. Radio (Clansman if other aircraft assisting)
2. Basic first aid kit (Part of boat's bag)
3. Two blankets (sealed in a polythene bag)
4. Marker float with 100m of line
5. Fireman's axe (0243/534-6513)
6. DC lamp (unless Aldis lamp already carried)
7. Rescue knife (0091/977-2081)
8. Rescue quoit with 10m of 8mm polyethylene line
9. Bolt cutters (6273/120-4678)

<u>Flotation and Salvage Equipment</u> Set B (Weight varies depending on number and type of equipment and must be established by individual ships). Should consist of:

1. Supplementary flotation gear (Portable Salvage Equipment for ditched helicopters, 5 sets for Lynx, 10 for Sea King and Merlin, and 8 for the Apache).

2. A 12m 20 tonne SWL polyester Roundsling (0246/149-2991) . When choke-hitched to the rotor head this Roundsling has a SWL of 16 tonnes.

d. **Preparation of the Crash Boat**. The crew and extra hands for the crash boat should be briefed, lowerers detailed, the engine tested and the equipment listed above provided. All hands must then stay readily available, although they may continue with their work until 'secure from flying stations' is ordered, at night they must keep their night vision unimpaired.

e. **Other Seamanship Preparations**. A danbuoy should be at 30 minutes notice and the Quick Reaction Marker Buoy ready for immediate deployment. A picking-up rope and two berthing hawsers should be made ready. Pneumatic fenders should be available for use as additional flotation bags.

| **05122. Assistance to Ditched Helicopters - Approach Phase**

During the approach to the ditched helicopter the men involved in the operation must be briefed, and if appropriate, immediate onboard preparations for securing/recovering the helicopter should be made.

a. **Briefing**. After the crash boat has been called away, and before the boat is launched, its crew should be briefed on the following points:

(1) The type of helicopter, and its escape arrangements and flotation gear.

(2) The number of persons on board the ditched helicopter.

(3) To report the number of persons rescued.

(4) To return to the ship with survivors before commencing any attempt to recover the helicopter.

(5) Any ordnance or underslung load known to be attached to the helicopter or any pyrotechnics known to be in the cabin. Advice on the removal of these items should be obtained from the ship's Flight or the ditched helicopter's parent unit.

(6) The risk of fire from fuel spillage.

(7) To keep the boat clear of the ditched helicopter to avoid damage to either the boat or the portable flotation gear.

(8) Callsigns of assisting helicopters for direct communications by portable radio.

b. **Recovery Gear**. Recovery gear should be prepared in the ship to provide as many options of securing and recovering the helicopter as are practicable. As already mentioned, only capital ships have the capability to fully recover a ditched helicopter; minor war vessels are equipped only to rescue survivors and mark the helicopter and its position, and the limit of assistance FF/DDs can realistically provide is to attach supplementary flotation gear to the helicopter and/or secure the helicopter alongside to prevent it sinking pending the arrival of a suitable recovery vessel.

| **05123. Assistance to Ditched Helicopters - Rescuing the Aircrew**

Aircrew close to or trapped in the helicopter should be assisted by a swimmer or ship's diver operating from the crash boat. Swimmers and divers working beneath the rotor disc are at considerable risk and must be warned of the hazards (see below). Survivors that are in the water but clear of the helicopter should be recovered as quickly as possible, followed by those in dinghies.

05124. Assistance to Ditched Helicopters - Divers and Swimmers

Clearance divers and SAR divers may dive without a lifeline; ship's divers and swimmers must wear a lifeline except when directly involved in the rescue of aircrew from inside the helicopter. The SAR diver is trained specifically for first-aid helicopter salvage and, when available, is the most suitable choice for this type of work. Even though ditched helicopters may float for a period of 20 minutes or more, experience has shown that they are prone to sink or capsize suddenly. Divers and swimmers should not enter a helicopter except for the rescue of aircrew. Work on the rotor head should be conducted from above and clear of the rotor blades. Divers and swimmers on lifelines are **not to work under the helicopter** on any account. Before they enter the water they must be thoroughly briefed on the procedure to be adopted. The combination of a damaged helicopter and a high sea state may make it inadvisable to attempt first-aid salvage or even to mark the helicopter.

Note. *Swimmers/Divers must provide their own lifelines etc.*

05125. Assistance to Ditched Helicopters - Marking the Helicopter

The line of the spherical float which is used as a marker buoy should be attached to the helicopter by a swimmer. A stick should be passed through the float and the line coiled round it in figure-of-eight turns. This ensures that the line has no loose bights to foul the swimmer or the helicopter and also that the line will run freely should the helicopter sink.

Possible attachment points, in order of preference, are the undercarriage oleo legs, the sea-anchor/bow-towing bridle (Sea King only) and the helicopter picketing points. If none of these positions can be used the line will have to be secured to the rotor head. This position has the disadvantage that when the helicopter sinks, the rotation of the rotor winds up the line and may submerge the float. If the helicopter has sunk, the position of ditching should be marked with a quick reaction marker buoy to serve as a datum for any subsequent search for the wreck.

05126. Assistance to Ditched Helicopters - Prevention of Sinking

On completion of the initial urgent actions of recovering the aircrew and marking the helicopter, and given that weather conditions are suitable, an attempt to prevent it from sinking must be made as quickly as possible. It must be decided whether to achieve this by the use of portable salvage equipment or a hawser from the ship to the rotor head. The Portable Salvage Equipment sets can be used by divers working from the ship and will support the helicopter, a metre or so beneath the surface, until it can be recovered. However, if the ship can be kept close to the helicopter a hawser can probably be attached more quickly. Either operation should be carried out by a ship's diver or swimmer with the Diving Officer working from the crash boat, preferably the Gemini.

a. **Attaching the Portable Salvage Equipment**. The Portable Salvage Equipment set comprises an inflatable bag packed in a valise. It is provided with securing lines fitted with snap hooks for attachment to the helicopter and is inflated by pulling the toggle of a lanyard which is stowed in a patch pocket at one end of the valise. Inflation takes about 25 seconds and, when fully inflated, the bag provides 450 Kgs of buoyancy. The scale of supply is such that a ship may not have sufficient sets of Portable Salvage Equipment to support the type of helicopter which has ditched (see crash bag contents Set B). In these circumstances additional sets will have to be obtained, if possible, from ships in company. It may be possible to inflate a Portable Salvage Equipment set inside the helicopter but there is a strong likelihood that it will be punctured by sharp projections.

Such a measure can only be considered a temporary supplement to existing buoyancy while additional buoyancy is provided outside the helicopter. The bags should be attached to strong points around the outside of the helicopter such as picketing eyes, main undercarriage and the main rotor head. The positions of the bags should be disposed around the helicopter, and during inflation small adjustments may be made, to support the helicopter in a level plane.

b. **Securing the Helicopter to the Ship by a Hawser**. If it is intended to secure the helicopter to the ship by a hawser, the round sling should be attached to the helicopter by taking two full turns around the main rotor shaft below the rotor head. The sling should then be secured to a MMF berthing hawser or picking-up rope. Secured in this manner it should be possible to bring the helicopter into the ship's side, having first protected the side with fendering. Steadying lines will be required, and if possible a second hawser should be secured to the tail, by means of a wide padded strop or net, to keep the helicopter horizontal. Depending on the weather conditions the helicopter can safely hang in this manner under the ship for subsequent transfer to a salvage vessel.

c. **If the Helicopter has Capsized**. If the helicopter has capsized, strops may be attached to the main undercarriage or fuselage securing points to prevent it sinking. However, it must be borne in mind that the main rotor head is the only single point capable of supporting the whole weight of the helicopter, and righting a capsized helicopter requires a heavy lift that is beyond the capabilities of an FF/DD or smaller ship.

| **05127. Assistance to Ditched Helicopters - Hoisting**

Capital warships have the capability to hoist inboard a ditched helicopter and the procedures for this are given in **BR 766 Aircraft Operating Handbook**. However, the majority of warships are not equipped for this task and preventing the helicopter sinking, described earlier, is the most that can be achieved.

| **05128. Ceremonial in Boats**

The authoritative publications dealing with ceremonies in the Royal Navy are **BR 1834, Royal Naval Ceremonial and Drill**, and **BR2 Chapters 91 and 92** and these publications should be referred to when dealing with all but routine ceremonial procedures. The information given here is intended as a guide to boat coxswains.

a. **Wearing of Ensigns**. Boats belonging to HM ships or establishments wear ensigns on the following occasions:

(1) Between 'Colours' and sunset whenever wearing a Royal Standard or a distinguishing flag of an authority other than a naval authority;

(2) In foreign waters on all occasions during daylight hours;

(3) Whenever going alongside a foreign warship, day or night;

(4) Whenever HM ships are dressed;

(5) Whenever carrying a corpse, the ensign being then worn at half-mast;

***Note**. When the ensign is half-masted in HM ships, boats' ensigns (if worn) should also be half-masted.*

b. **Flying of Distinguishing Flags or Pennants**. Any of the persons authorised to fly a distinguishing flag or pennant may fly the appropriate flag (or pennant) in the bows of a boat when under way and proceeding on occasions of ceremony, such as official visits or inspections. If the person is other than a naval authority the boat also wears her ensign. The flag (or pennant) is to be flown only between the hours of ‹Colours' and sunset. The masthead pennant is flown in a boat under similar circumstances, by officers holding an appointment in command of one of HM ships, seagoing tenders, or shore establishments. The masthead pennant is also flown in a boat between the hours of 'Colours' and sunset if she is carrying members of a court-martial who are proceeding to or from the court. It is also flown by day and by night by a boat carrying the Officer of the Guard. A Queen's Harbour Master or his deputy may fly his flag in the bow of a boat or vessel when in the execution of his duty.

c. **Flag Discs**. Flag discs are displayed in boats on occasions when a distinguishing flag is not flown to denote the presence of senior officers. The following flag discs are authorised for this purpose when proceeding on duty:

the 'red disc', consisting of a white St. George's cross on a red background;

the 'blue disc', consisting of a white St. George's cross on a blue background;

the 'white disc', consisting of five black crosses on a white background;

All the discs are approximately 250mm in diameter.

The **red disc** denotes that the boat is carrying an officer entitled to fly a flag or broad pennant on a formal occasion, but that the full ceremonial due to his rank is not required. The **blue disc** denotes that the boat is carrying on a formal occasion an officer of Flag rank or a Commodore not entitled to fly a flag or broad pennant, or Matron-in-Chief QARNNS. On such occasions the officer is received with the 'Alert'. The **white disc** denotes that the boat is carrying an officer entitled to fly a flag or broad pennant on an informal occasion when only courtesy salutes are accorded.

d. **Saluting of Standards and Distinguishing Flags**. When a boat flying a standard or a distinguishing flag passes a ship at anchor, the ship should parade a guard and band and accord the appropriate salute unless orders to the contrary have been given. Should the ship be flying the flag or broad pennant of an officer senior to the officer in the boat, the guard and band are not paraded and the 'Alert' only is sounded. If he passes a ship underway, the ship should pipe the 'Still', and if her guard and band are paraded the guard should come to the ‹Shoulder' and no musical salute should be accorded. When a boat displaying the red or the blue disc passes a ship at anchor the ship should sound the 'Alert' only. A ship underway should pipe the 'Still'. When a boat displaying the white disc passes a ship at anchor, the Officer of the Watch (or in his absence the quartermaster) should salute from the gangway.

e. **Salutes and Marks of Respect**. All officers when embarking or disembarking are saluted by the officer in charge of the boat or the coxswain. The following rules govern the exchange of salutes between Service boats under way:

(1) The officer or coxswain in charge of the boat will always salute, except that when he is in an inconspicuous position one of the boat's crew will be detailed instead.

(2) The senior of the officers in the boat will also salute whenever this is practicable.

(3) The salute will be acknowledged by the officer being saluted, unless he details an officer or the coxswain to do so.

(4) No salutes are exchanged between boats carrying officers of equal rank.

In boats other than service boats, whether alongside or underway, officers and men should pay and return salutes as indicated by courtesy, but only the officer or man in the most convenient position should salute. In addition to these salutes, special marks of respect are paid to royal and important personages and senior officers; these are shown in Table 5-2.

f. **Ceremonial Boat Hook Drill**. When coming alongside or leaving a jetty or ship during ceremonial occasions Ceremonial Boathook Drill should be carried out. The drill should be performed when the boat is approximately 50m from its destination during berthing, and immediately the boat is clear of its berth during unberthing. The drill is shown in Fig 5-80.

g. **Boat Hails**. At night any boat approaching within hailing distance of a ship is challenged by the hail 'Boat ahoy'. If the boat is not calling alongside the hailing boat she will reply 'Passing'. If the boat is to call alongside, her reply will be governed by the rank or status of the person she is carrying, in accordance with Table 5-3.

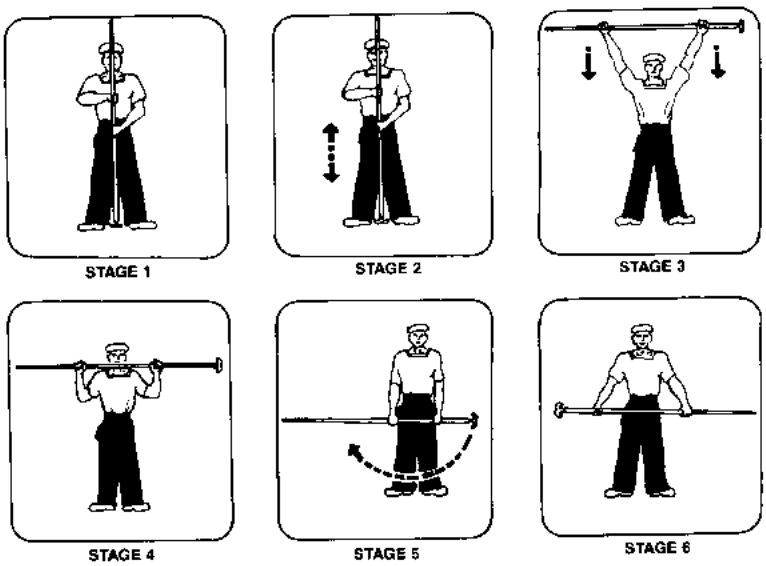


Fig 5-80. Ceremonial Boat Hook Drill (Starboard Side To)

Table 5-2. Special Marks of Respect to be Paid in Boats

<table>
<tr><th rowspan="2">Personage to whom, or occasion on which, marks of respect should be paid</th><th colspan="2">Marks of respect by boats under way</th><th rowspan="2">Marks of respect by a boat alongside a landing place, an accommodation ladder, or made fast</th></tr>
<tr><th>Power boat</th><th>Boat under sail</th></tr>
<tr><td>1. The Sovereign; members of the Royal Family and equivalent personages in other nations; Ambassadors, Governors-General, and their equivalents in other nations. (Standard or appropriate flag is flown in the boat).

2. Commanders-in-Chief, Flag Officers and Commodores, and their equivalents in other services and nations, when flying the appropriate flag of their command in their barges or boats.

3. A boat containing a Service funeral party with the body. (Ensign at half-mast is worn by the boat).

4. During the hoisting and lowering of colours in harbour, and during the firing of gun salutes</td><td>Stop the boat</td><td rowspan="2">Let-fly sheets</td><td rowspan="2">Crew called to attention (see Notes 2, and 3,).</td></tr>
<tr><td>5. Commanders-in-Chief, Flag Officers, Commodores, Commodores and above holding staff appointments, and officers or personages of equivalent rank in other Services or nations, when displaying a red or blue disc in the boat.

6. Commanders-in-Chief, Flag Officers, Commodores, and officers of equivalent rank in uniform or plain clothes, when displaying a white disc in the boat.

7. Any British or foreign naval officer flying a pennant in a boat.</td><td>Reduce speed to slow</td></tr>
</table>

Notes:

1. Marks of respect are paid in all boats on occasions (3) and (4); otherwise only in boats in which officers junior to the personage or officer passing are passengers.

2. In decked-in boats, members of the crew who are not engaged in keeping the boat alongside, and all passengers, stand to attention and face in the direction of the personage or officer being saluted.

3. In open boats of all types, members who are not engaged in keeping the boat alongside, and all passenger, sit at attention.

4. It is the custom in the Royal Navy for a boat to avoid crossing close ahead of any boat which is carrying an important personage or a senior officer, even if the former boat has the right of way by the Rule of the Road

Table 5-3. Boat Hails

Person carried	**Reply**
A Royal Personage or Head of State	'Standard'
An officer of Flag rank or a Commodore entitled to fly his broad pennant	'Flag', followed by the name of his flagship when appropriate
A Chief-of-Staff or Chief Staff Officer (when no Chief-of-Staff is allowed)	'Staff' with the name of the flagship
Commanding Officer of a ship	Name of the ship which he commands
Other officers	'Ay, Ay'
Officer of the Guard	'Guard boat'
All other persons and all boats going alongside not otherwise provided for	'No, no'

05129. Repair and Replacement of Ship's Boats

a. **Introduction**. If a ship's boat is damaged or unserviceable to such an extent that it cannot be quickly repaired onboard then a replacement must be obtained. All replacement boats for the Fleet are allocated by the MOD Boat Manager, WSA/WAB IPT B2a, Elm 1, #129 MOD Abbey Wood, Bristol, BS34 8JH, or by signal address DLO Bath FAO MBM, SIC H5H/H4C. Geminis (other than Jumbo Geminis) and paint punts are Naval Stores items and should be demanded from DGST(N).

b. **Rigid Inflatable Boats - Replacement Policy**. All RIBs in naval service are disposed of after 14 years service. All ships' RIBs, including those belonging to RFAs, are routinely replaced by new RIBs after eight years (short extensions can be granted via the MOD Boat Manager). These 8 year old craft are refurbished, then reallocated to shore authorities and establishments. Ships under construction are not allocated new RIBs until shortly before acceptance; refurbished boats are made available for ship fitting purposes and Contractors Sea Trials. RIBs supplied to HMS ENDURANCE are specially constructed and are dealt with separately.

c. The above information is a summary of the information contained in BR 8161 The MOD BOAT MANUAL. This BR should be referenced in all cases of boat procurement requests, refits, repair and disposal.

05130. Boat Hanging Pendants and Anti-shock Strops

Tables 5-4, 5-5 and 5-6 give details of Hanging Pendants and Anti-shock Strops for use with ship's boats.

Table 5-4. SWR Hanging Pendants for RIBs

SWR Hanging Pendants For RIBs				
Type of Boat	**SWR**	**Thimble**	**Straight Shackle with Split pin**	**Welling Spring Hook**
6.5m RIB 5.4m RIB 4.9m RIB	0231/523-8649 (20mm 6 x36)	0263/332-5187	0263/543-4532	0263/539-3523

Table 5-5. SWR Hanging Pendants for Boats (Excluding RIBs)

SWR Hanging Pendants For Boats (Excluding RIBs)					
Type of Boat	**SWR**	**Thimble**	**Bow Shackle with pin**	**Spring Hook**	**Straight Shackle (with split pin)**
	0235/523-	0263/414-	0263/	0263/414-	0263/543
7.5m Motor Boat	8649 20mm 6x36	0263/332-5187	2024	9774	4534
10.0m FML	7095 22mm 6x36	9637	414-9606	9773	4535
11.0m Work Boat	8652 32mm 6x41	9639	414-9606	9773	4535
13.1m LCVP	8656 36mm 6x41	9641	N/A	Straight Screw Shackle 0263/721-6097	4538

Table 5-6. Polyamide Anti-shock Strops for Boats (Excluding RIBs)

Polyamide Anti-shock Strops for Boats (Excluding RIBs)					
Type of Boat	**Polyamide Rope**	**Thimble**	**Bow Shackle with Pin**	**Spring Hook**	**Swivel Ring Shackle**
	0350/923	0263/414-	0263/	0263/414-	0263/543
7.5m Motor Boat	7129 24mm	9637	2024	9774	9938
10.0m FML	7132 36mm	9640	414-9606	9773	9940
11.0m Work Boat	7134 44mm	9642	414-9606	9773	9941
13.1m LCVP	7137 64mm	9645	N/A	Straight Screw Shackle 0263/721-6097	Straight Screw Shackle 0263/721-6097

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CHAPTER 6

REPLENISHMENT AT SEA

CONTENTS

ANNEXES

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CHAPTER 6

REPLENISHMENT AT SEA

06001. Introduction

The technique of Replenishment at Sea (RAS) permits the restocking of a ship with personnel, ammunition (including missiles), provisions, fuel and water while under way. The book of reference giving details of, and procedures for, the various replenishment rigs within NATO navies is **ATP 16**, **Replenishment at Sea**, which also gives information on any changes to equipment and the current policy on conducting replenishment at sea. This Chapter describes replenishment between Royal Navy and Royal Fleet Auxiliary vessels. Replenishment must be accomplished in the shortest possible time consistent with safety, because the ships engaged are restricted in movement and therefore more vulnerable to attack. However, speed of replenishment depends on the experience of the shiphandler and the efficiency of those working the gear; consequently a newly worked-up ship will not normally attain the same speed of transfer as a ship which has carried out numerous transfers. Individual ships are provided with ‹As fitted' drawings which give full details of the layout of RAS gear and of highpoint and screen attachment points for slips and leading blocks. These drawings also show the test diagrams for the RAS rigs of the ship. **BR 3027, Management of Safe Use, Examination and Testing of Lifting Plant** gives details of the test loads to be applied to replenishment-at-sea equipment and rig attachment points.

06002. Types and Methods of Replenishment

a. **Abeam Transfer of Solids.** Heavy stores and ammunition up to a maximum load of two tonnes can be transferred by Heavy Jackstay, using the Conventional rig, GEC Mk 1A rig, or the Clarke Chapman moveable highpoint rig. These are described later in this chapter.

b. **Vertical Replenishment (Vertrep).** Vertrep is defined as the use of helicopters for the transfer of stores or ammunition between ships or between ship and shore, by day or night. It is particularly useful for small-scale replenishment, because there is no need for ships to work at close quarters. Modern RFA stores-ships are equipped with one or more helicopters assigned to the Vertrep task. The method is described later in this chapter.

c. **Abeam Transfer of Liquids.** Fuel, Water and Lub oil can be transferred by abeam replenishment. The types of rig used; Probe, Jackstay, Derrick and Crane, are described later in this chapter.

d. **Astern Transfer of Liquids.** Fuel only can be transferred by astern replenishment. The methods used are described later in this chapter.

e. **Light Stores and Personnel.** For personnel and light stores up to 250 Kilograms the Light Jackstay rig is used. Stores up to 14 Kilograms in weight can be transferred by Light Line transfer. Both methods are described later in this chapter.

WARNING

WHEN SIMULTANEOUSLY REPLENISHING FROM FOR'ARD AND AFT RIGS FUEL MUST NOT BE REPLENISHED FROM THE FOR'ARD RIG IF AMMUNITION IS BEING REPLENISHED AFT

06003. Definitions within a Replenishment Unit

A **REPLENISHMENT UNIT** is defined as a group of ships consisting of one or more delivering ships with one or more receiving ships replenishing and/or ships in waiting and/or lifeguard station. Within a replenishment unit the following definitions apply:

a. **Control Ship.** The ship controlling the RAS operation of the unit.

b. **Unit Guide.** The replenishment unit guide

c. **Delivering Ship.** The ship delivering the rig(s)

d. **Receiving Ship.** The ship receiving the rig(s).

e. **Approach Ship.** The ship making the approach/ship which has made the approach.

f. **Supplying Ship.** The ship that supplies the item(s) to be transferred.

g. **Customer Ship.** The ship that receives the transferred items.

The above definitions are the central factors that control the RAS organisation. Unless otherwise ordered, the **Control Ship** will be the **Unit Guide** and the **Delivering Ship**. Where this is not the case the OTC must designate these tasks to the desired ship. Similarly, the **Receiving Ship** will be the **Approach Ship** unless otherwise ordered by the OTC. It should be noted that the **Delivering Ship** (the ship that provides the rigs) need not necessarily be the **Supplying Ship** (the ship that provides the stores).

06004. Types of RAS Points in Warships

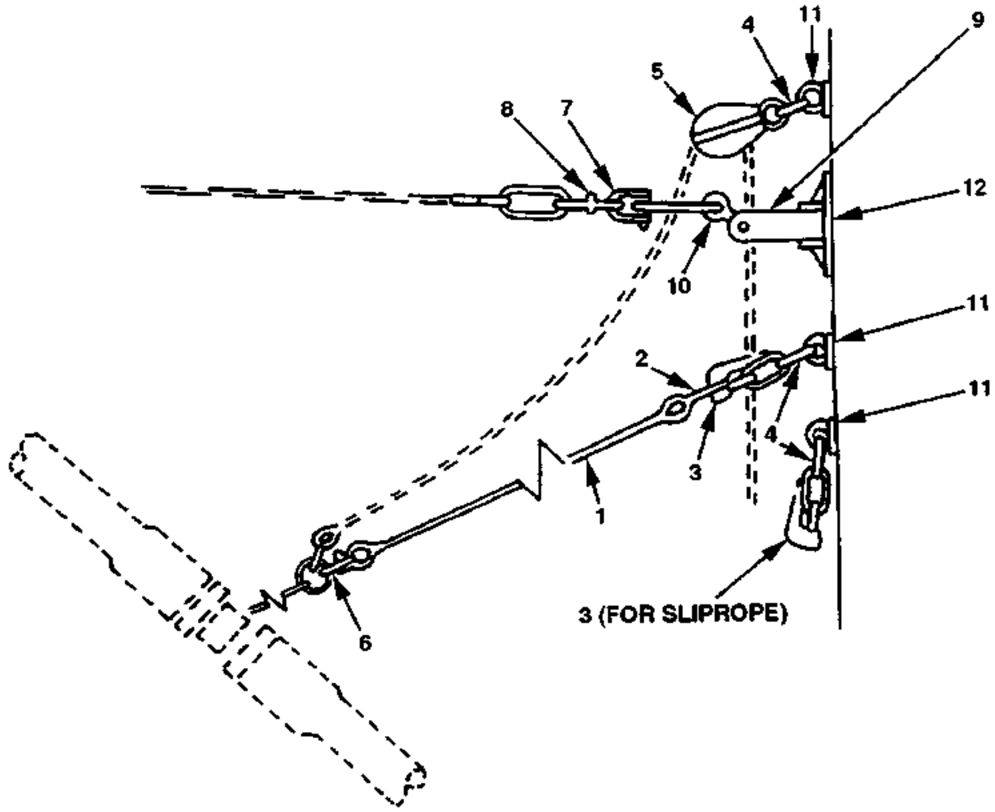
RAS points, often referred to as high points, are locations in the ship from which replenishment evolutions are conducted; they can be one of the following types:

a. **Deck Attachment Point.** For astern fuelling only. Consists of an eyeplate for the connection of a hose hanging pendant, and eye plate(s) for the connection of roller shackle(s) for the hoseline lead.

b. **Screen Attachment Points.** Figs 6-1 and 6-2 show a multi rig reception arrangement capable of receiving all types of abeam refuelling rigs. It consists of eyeplates to carry a leading block and hose hanging pendant, and a base plate to which can be connected, depending on requirements, either a probe receiver or swivel joint link assembly for the connection of a jackstay. Figs 6-3 to 6-5 show screen attachment points capable of receiving derrick, crane and boom refuelling rigs, and Heavy and Light Jackstay rigs. Various permutations of these arrangements will be found throughout the fleet and it is important that 'As fitted' drawings are examined to ascertain precise rigging arrangements for individual ships, but see also the Warning box on the following page.

WARNING

IT IS IMPORTANT WHEN RIGGING RAS POINTS THAT SHIP'S 'AS FITTED' DRAWINGS ARE FOLLOWED TO DETERMINE THE POSITION OF BLOCKS, SLIPS, PENDANTS, GUYS AND STAYS. IF UNABLE TO COMPLY OTHER SUITABLY SITED AND TESTED EYEPLATES MAY BE USED, HOWEVER AN S2022 MUST BE RAISED. IF A SAFE RIG CANNOT BE ACHIEVED OPDEF ACTION IS TO BE TAKEN.

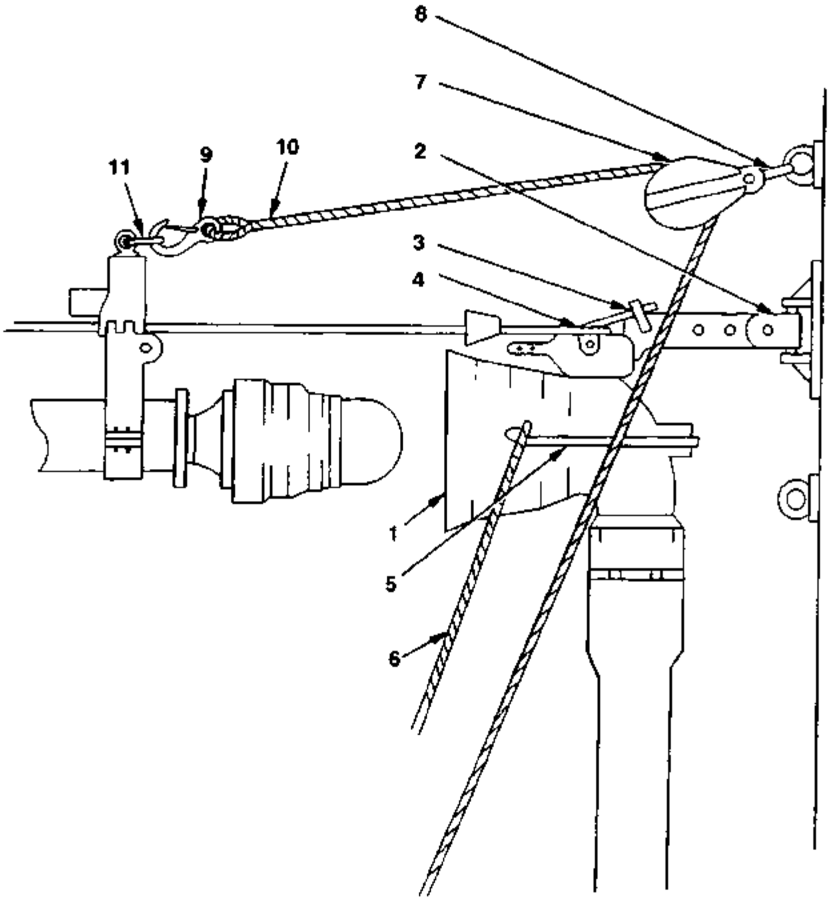


No	ITEM	PATTERN No	No	ITEM	PATTERN No
1*	Hose Hanging Pendant 20mm 6 X 36 SWR	0231/523-8649	7	Shackle	0263/721-6096
			8	Slip	0263/414-9835
2*	Link	0249/458-9487	9	Swivel Arm Joint	0249/525-7299
3	Slip	0263/414-9747	10	Swivel Joint Link Assy	0249/525-7325
4	Shackle	0263/721-6093	11	Eyeplate	5120/419-5144
5	Snatch Block	0246/521-2796	11	Eyeplate	DRG 002541826
6*	Spring Hook	0263/539-3523	12	Baseplate	

* Integral part of Hose hanging Pendant

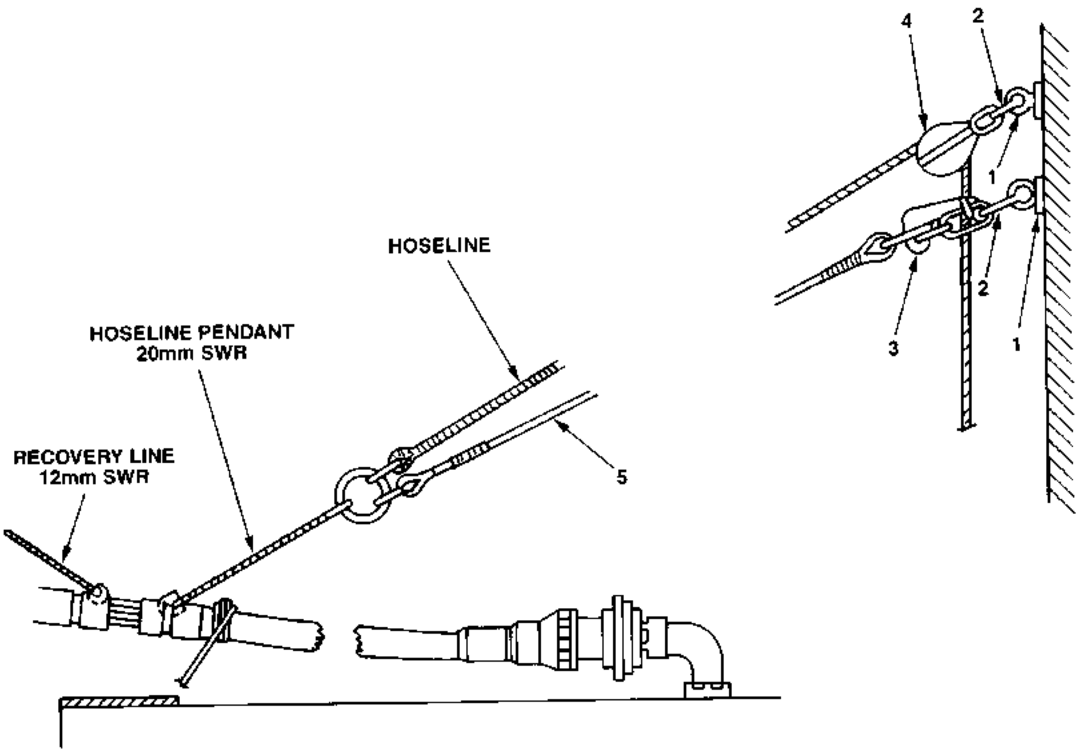
Note. *Items 7, 8, 9 and 10 required for Jackstay rig only.*

Fig 6-1. Screen Attachment Multi Rig Reception Point Rigged for Jackstay/Derrick Fuelling



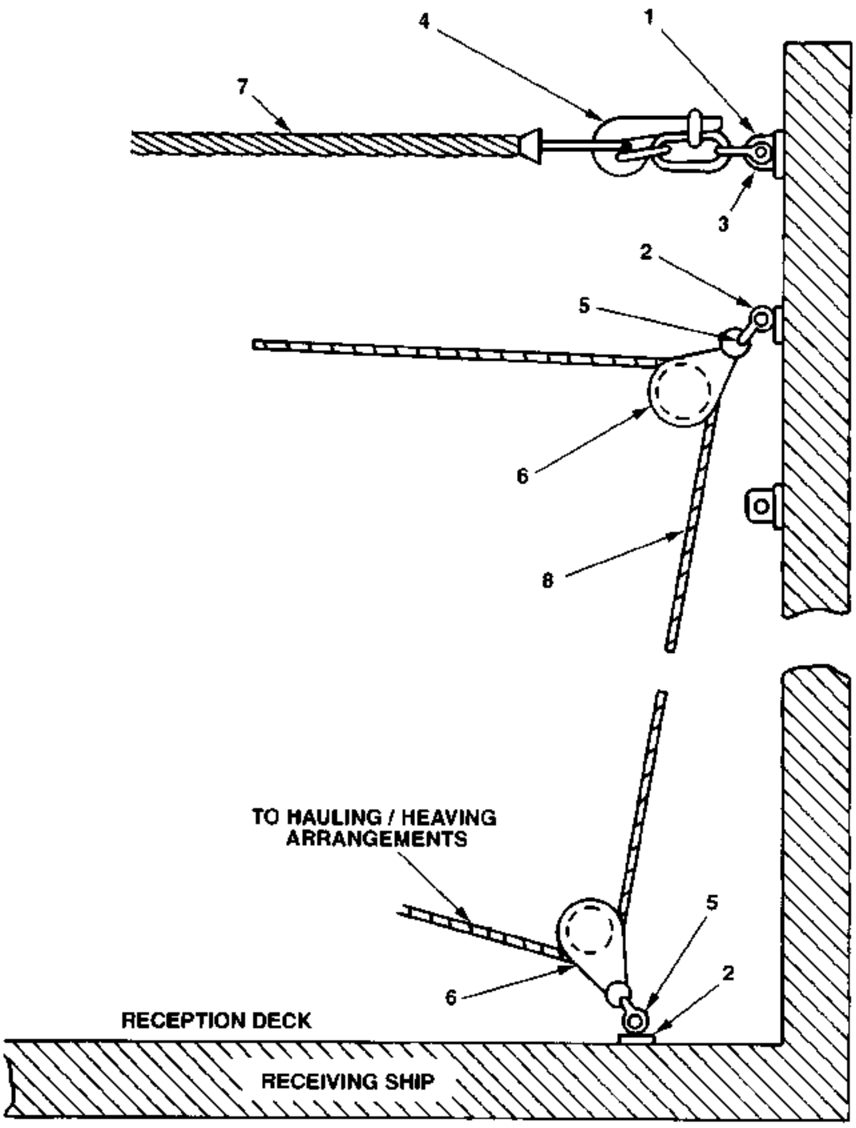
No	ITEM	PATTERN No
1	Probe Receiver	0249/00-850-5146
2	Swivel Arm Joint	0248/525-7299
3	Pelican Hook	0249/525-7298
4	Jackstay Terminal Fitting	0249/529-2242
5	Release Lever	
6	Release Lanyard	
7	Snatch Block	0246/521-2796
8	Shackle	0263/721-6093
9	Welling Spring Hook	0263/539-3523
10	Hoseline	
11	Shackle	0263/543-4551

Fig 6-2. Screen Attachment Multi Rig Reception Point Rigged for Probe Refuelling



No	ITEM	PATTERN No
1	Eyeplate	5120/419-5144
2	Shackle	0263/721-6093
3	Slip	0263/414-9747 F905/867-8379 (MCMV)
4	Snatch Block	0246/521-2796
5	Hose Hanging Pendant	

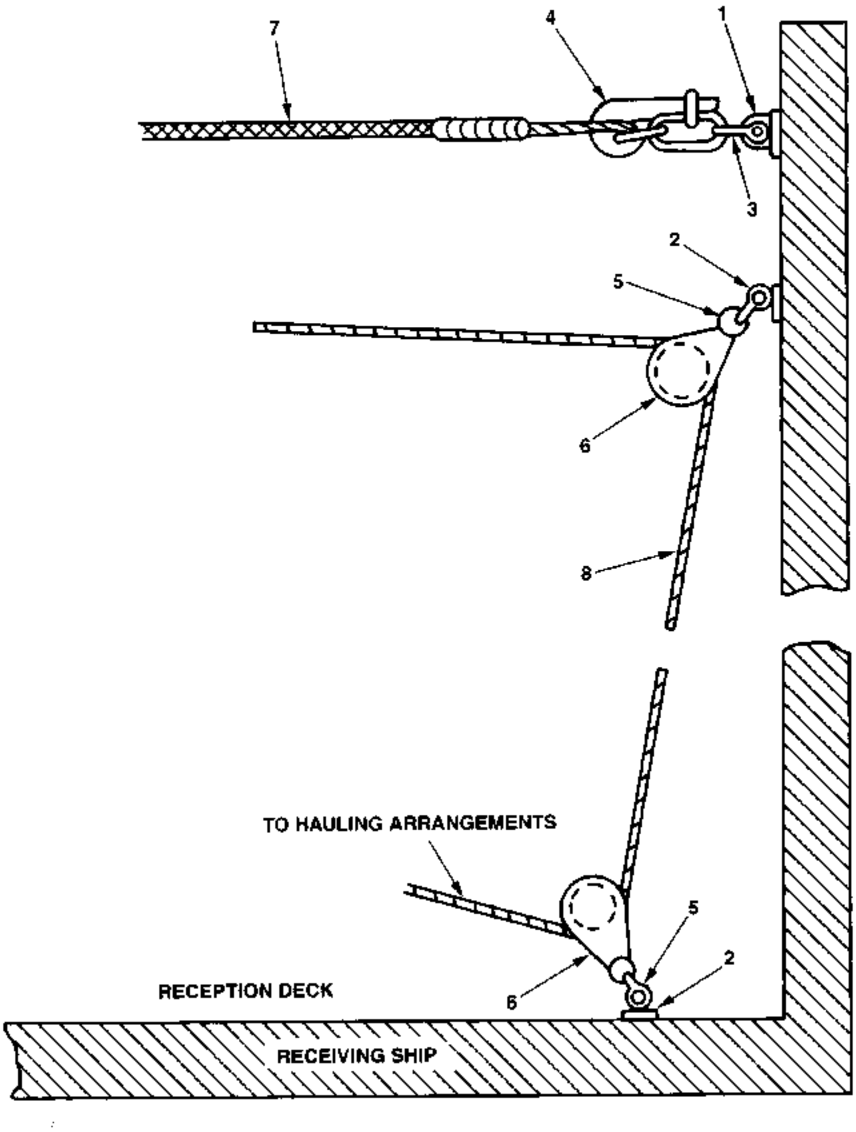
Fig 6-3. Screen Attachment Point for Reception of Derrick, Crane and Boom Refuelling Rigs



No	ITEM	PATTERN No
1	Eyeplate	0262/419-5146
2	Eyeplate	0262/419-5144
3	Shackle	0263/721-6096
4	Slip	0263/414-9835
5	Shackle	0263/721-6093
6	Snatch Block	0246/521-2796
7	Jackstay Wire	
8	Inhaul	

Note. *Light Jackstay rigs can be secured to Heavy Jackstay rig screen attachment points.*

Fig 6-4. Screen Attachment Point Rigged for Heavy Jackstay Reception

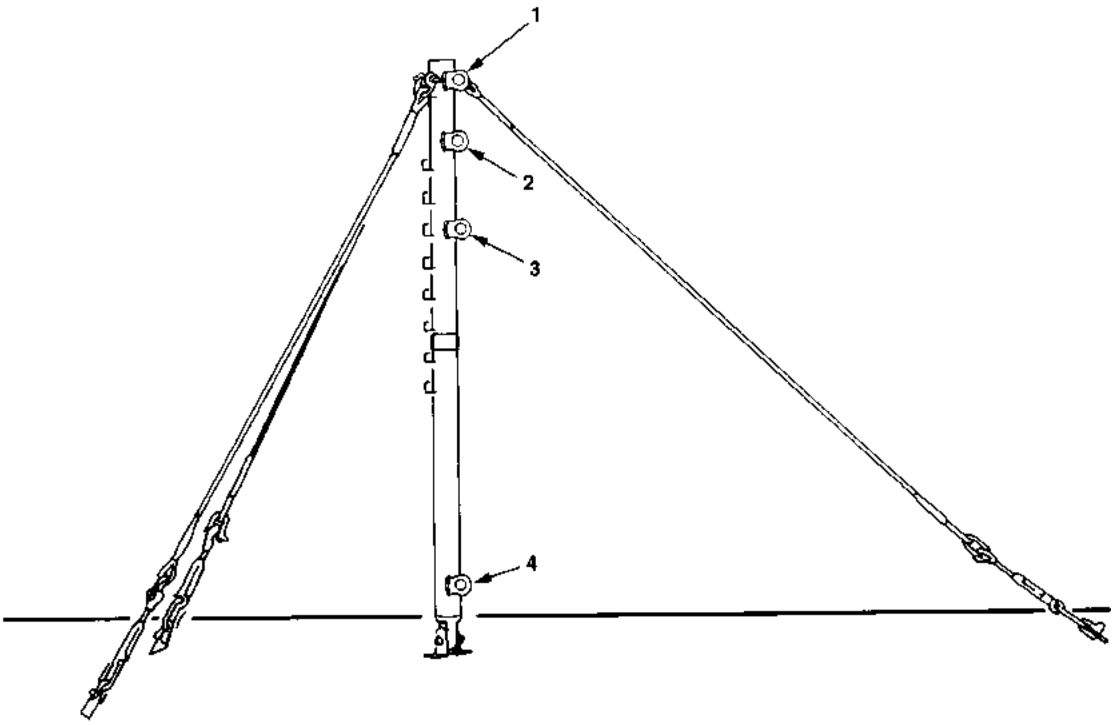


No	ITEM	PATTERN No
1	Eyeplate	0262/419-5144
2	Eyeplate	0262/419-5143
3	Shackle	0263/721-6093
4	Slip	0263/414-9747 F905/99/867-8379 (MCMV)
5	Shackle	0263/721-6090
6	Snatch Block	0246/521-2794
7	Light Jackstay	
8	Inhaul	

Note. *When rigged for supplying Light Jackstay, item 4 is replaced by a leading block, Pattern No 0246/521-2799.*

Fig 6-5. Screen attachment point for Light Jackstay

c. **Portable Stump Mast.** (Fig 6-6). Certain ships are provided with a portable stump mast for abeam replenishment in locations where permanent RAS points are impractical, ie flight decks. It consists of a tubular steel mast supported by guys and backstay(s). Eyeplates on the mast allow for the attachment of blocks and rigging slips similar to screen attachment points. Mast height, size and configuration of stays, and details of rig reception capabilities vary and ship's ‹As fitted' drawings must be consulted to ascertain precise details.



No	ITEM	PATTERN No
1	Jackstay eyeplate	5120/419-5146
2	Outhaul block eyeplate	5120/419-5144
3	Hose hanging pendant eyeplate	5120/419-5144
4	Outhaul block eyeplate	5120/419-5144

Fig 6-6. Typical Portable Stump Mast

d. **Type 42 Destroyers** are fitted with a retractable stump mast that incorporates a swinging arm at the head of the mast (Fig 6-7). The system is capable of accepting all types of heavy and Light jackstay rigs.

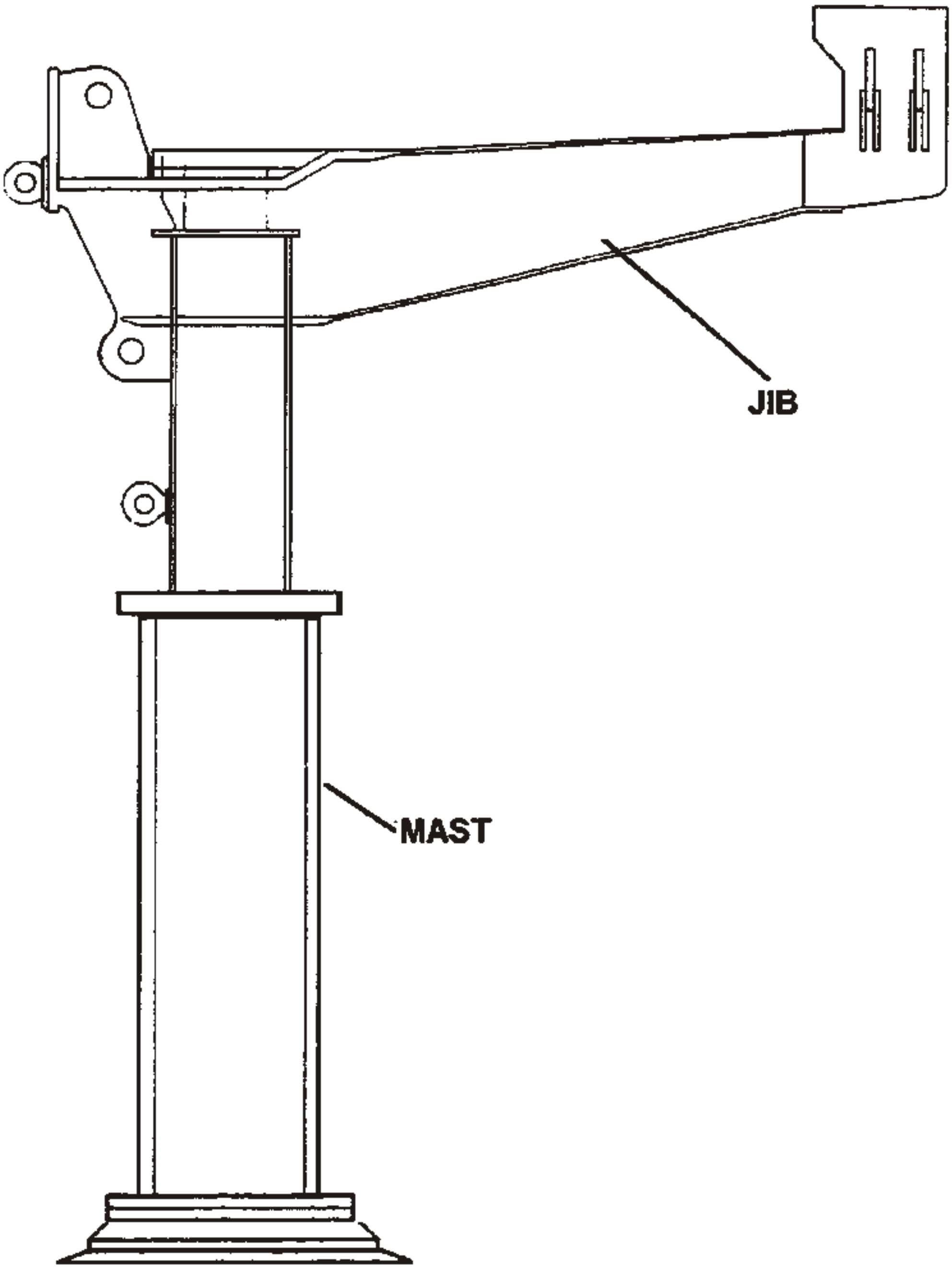


Fig 6-7. Retractable Kingpost fitted in Type 42 Destroyer

e. **Universal Drop-reel Traveller System.** Using a conventional jackstay rig, the Universal Drop Reel traveller (UDRT) system allows the jackstay to remain tensioned while the load is lowered on to the receiving ship's deck by use of the outhaul winch. The system is mounted at the head of a stump mast, as shown in Fig 6-8. The latch arm holds the traveller at a fixed distance from the stump mast and is secured to a fitting at the head of the mast by means of a universal joint. This allows the latch arm to rest on the tensioned jackstay. The latch arm lever provides control of the arm while the jackstay is being rigged. The traveller is in two parts. The upper section, with the extended sheave spindles, runs on the jackstay and carries the upper outhaul pulley. The traveller hook section is held to the upper support section by the reeving of the outhaul. These two sections are positively locked together for the transfer operation. On arrival at the latch arm, the traveller is locked by a mechanically operated latch. A device in the traveller's upper support section allows the traveller hook latch to be released. The load can then be lowered by veering on the outhaul. To disengage the traveller for return to the delivering ship, the two sections are automatically locked together by tensioning the outhaul and then the latch arm release is manually operated.

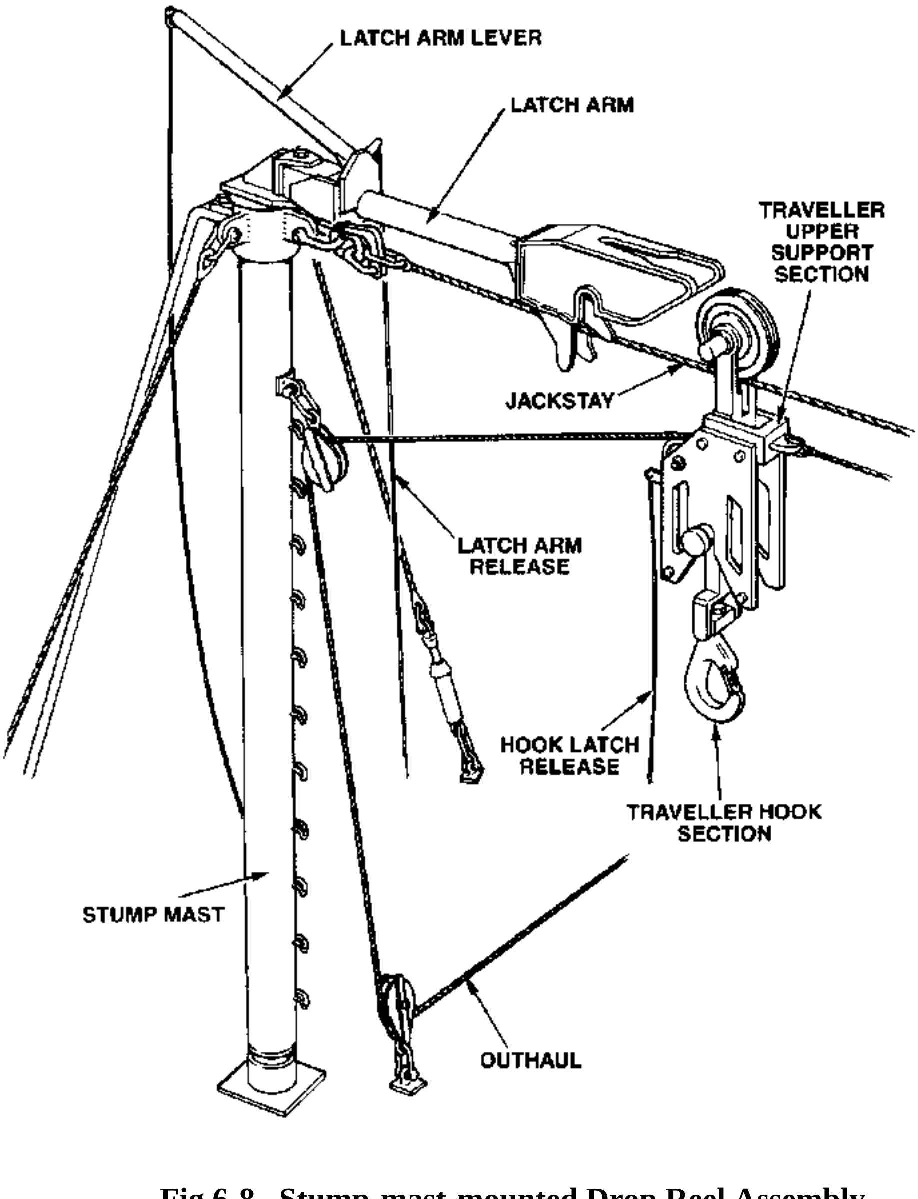


Fig 6-8. Stump-mast-mounted Drop Reel Assembly

f. **Moveable Reception Highpoint (Sliding Pad-eye).** This arrangement, (Fig 6-9) fitted in Type 23 frigates and certain other ships, has been designed primarily to receive the moveable highpoint replenishment rig, although it is capable of receiving conventional rigs (See Figs 6-10 to 6-12). The height of the pad-eye, to which is welded eyeplates for the attachment of replenishment rigs, is adjusted on a vertical trackway by means of an electric motor powered chain drive, allowing the jackstay to remain under tension whilst loads are traversed, lowered or hoisted. The two types of Sliding Pad-eye are shown in Fig 6-9.

Note. *The upper and lower travel limits of the sliding pad-eye are to be marked on the frame of the structure with 50mm black painted lines. Operators must raise/lower the pad-eye between these marks and not rely on the limit switches. (The limits vary ship to ship and must be established by the maintainer).*

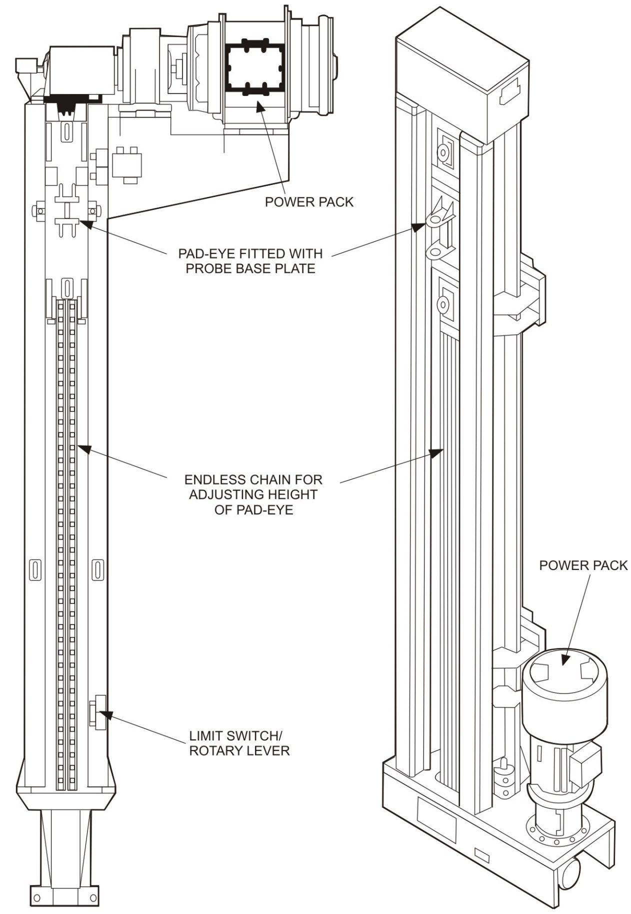


Fig 6-9. Moveable Reception Highpoints

No	Item	Pattern No
1	Eyeplate	0232-419-5144
2	Baseplate	
3	Eyeplate	0232-419-5144
4	Slip	0263-414-9749
5	Shackle	0263-721-6093
6	Slip	0263-414-9835
7	Hose Hanging Pendant (20mm)	F218-523-8649
8	Snatch Block	0246-521-2796
9	Spring Hook	0263-539-3523
10	Sliprope	
11	Shackle	0263-721-6093
12	Link	F217-458-9487
13	Shackle	0263-721-6093
14	Shackle	0232-419-5144
15	Swivel Joint Link Assembly	0249-525-7325

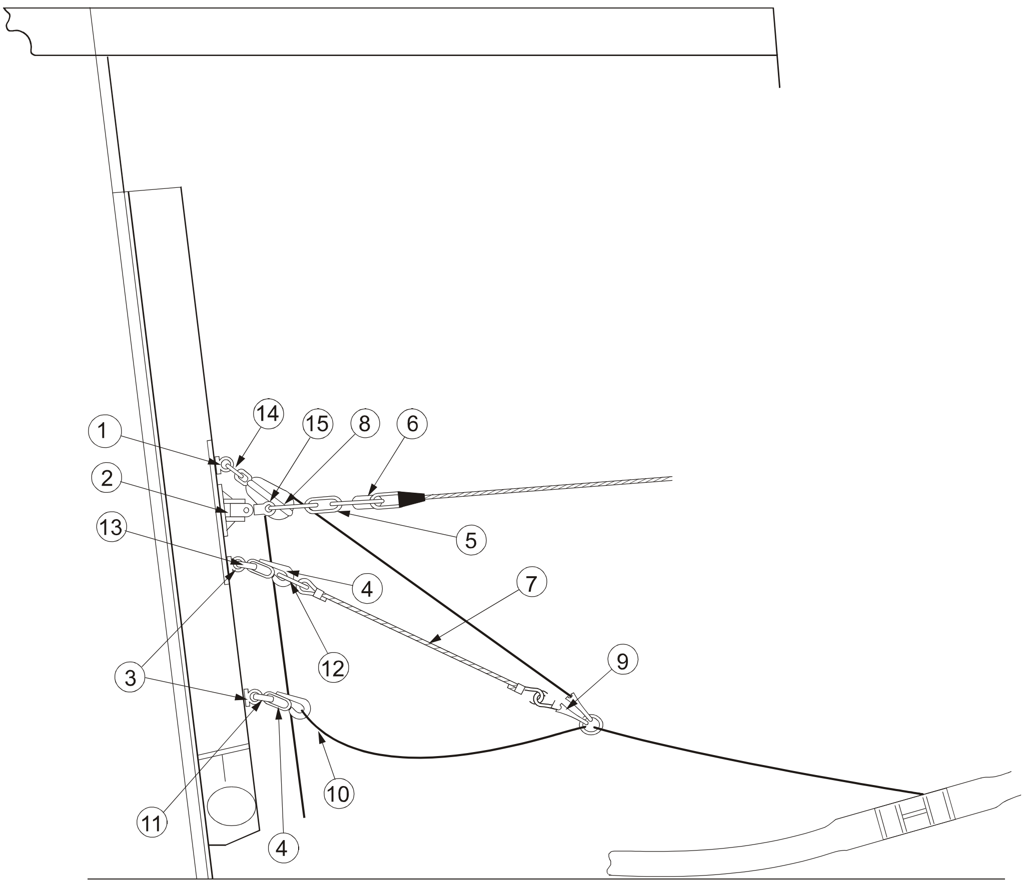


Fig 6-10. Sliding Pad-eye Jackstay Fuelling Reception

No	Item	Pattern No
1	Eyeplate	0232-419-5144
2	Shackle	0263-721-6093
3	Snatch Block	0246-521-2796
4	Hoseline	F032-357-2994
5	Thimble	
6	Spring Hook	0263-539-3523
7	Release Lever	
8	Probe Receiver	F217-00-850-5146
9	Release Lever Lanyard	
10	Adaptor	0249-206-8596
11	Fuel Hose to Deck Connection	0249-533-4450
12	Retaining Pendant	
13	Eyeplate	0232-419-5144
14	Shackle	0263-721-6093
15	Swivel Arm Assembly with Pelican Hook	See BR 6583(001)

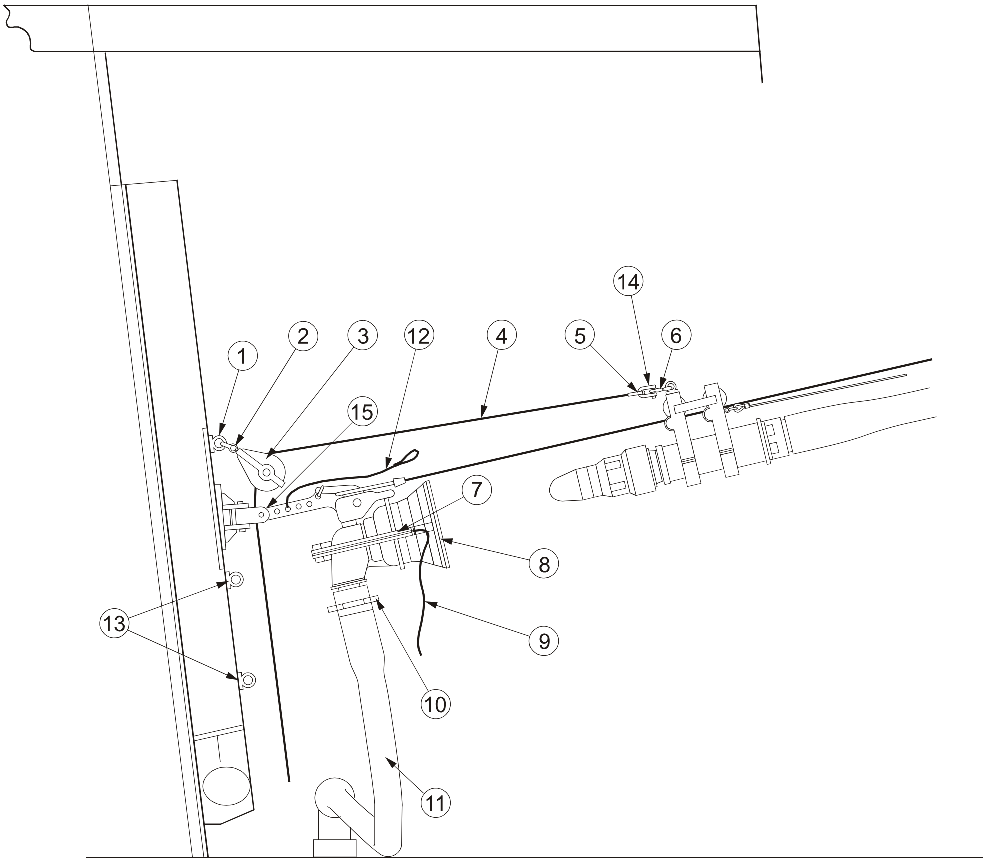


Fig 6-11. Sliding Pad-eye Probe Fuelling Reception

No	Item	Pattern No
1	Eyeplate	0232-419-5144
2	Slip	0263-414-9747
3	Eyeplate	0232-419-5144
4	Snatch Block	0246-521-2796
5	Hose Hanging Pendant (20mm)	F218-523-8649
6	Spring Hook	0263-539-3523
7	Sliprope	
8	Slip	0263-414-9747
9	Shackle	0263-721-6093
10	Link	F217-458-9847
11	Shackle	0263-721-6093

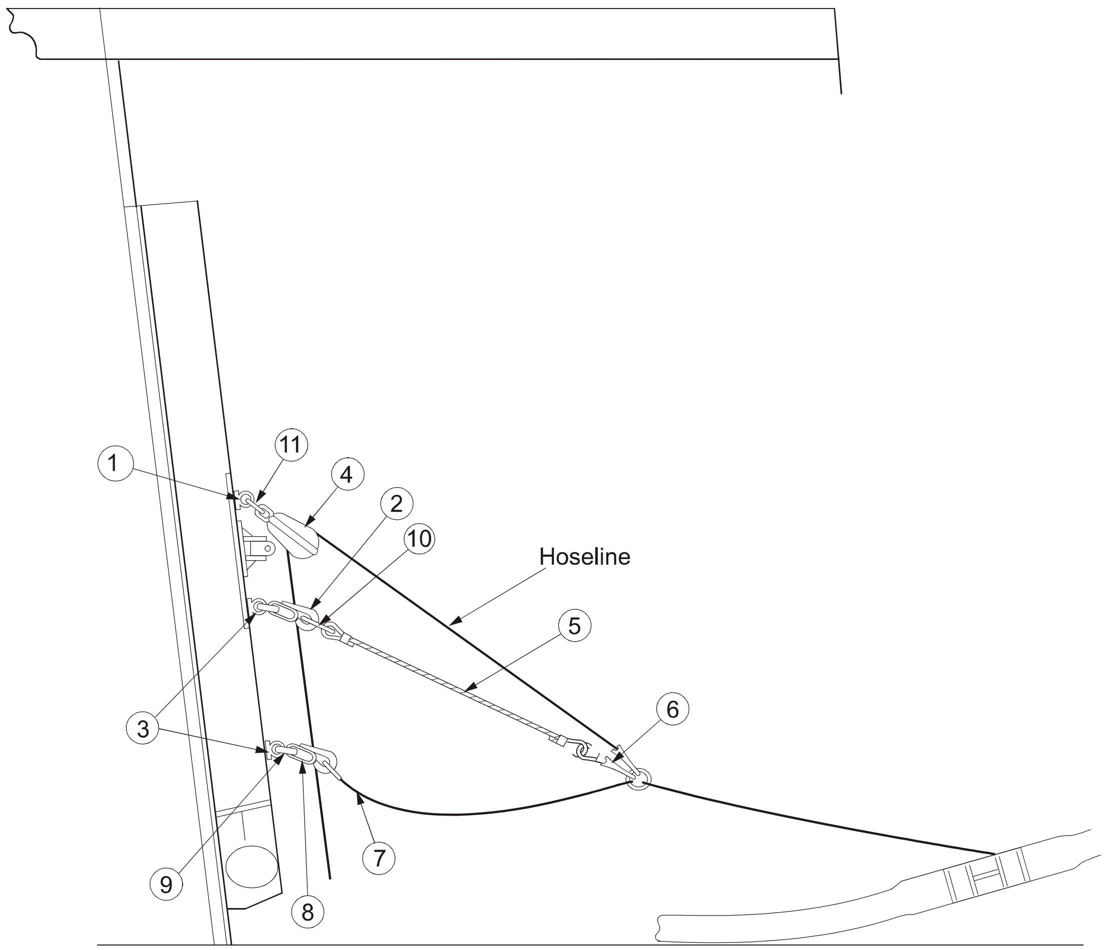


Fig 6-12. Sliding Pad-eye Derrick Fuelling Reception

06005. Stationkeeping - Distance Line for Abeam Replenishment

A steady course and speed by the delivering ship and correct station-keeping by the receiving ship are most important. For abeam transfers the distance between ships is measured by a **distance line**. (Fig 6-13). The zero end is secured to a strong point in the guide ship, with the zero flag parallel to the ship's side, and the other end is kept taut in the consort at a position visible from the bridge and at right angles to the fore and aft line. The UK RAS distance line can be adapted for either day or night replenishment and, for daylight replenishment, may be rigged as a self-tautening line. Specification for the line and markers is as follows:

Line	102 metres of 8.5mm braided polyester (0350-120-8692) with an Inglefield clip at each end.
Marker flags	230mm Canvas Acrylic equilateral triangles (Fig 6-13a), painted in the colours shown. The numbers, painted on both sides of the triangle, have a minimum height of 75mm. Numbers on white or yellow background are to be black, those on other backgrounds are to be white.
Night colours	A blue cyalume light is to be inserted in each pocket of the 18, 30, 42 and 54 metre markers. All other markers are to have a red cyalume light inserted in the pocket. Fig 6-13a shows details of cyalume light pocket arrangements.
Weight	2.5m of 8.5mm polyester braidline, finished at one end with a monkeys fist weighted to 1 Kg, and, at the other, with an Inglefield clip.

a. **Operating Procedure (by day).** The receiving ship provides the weighted monkey's fist. When the distance line comes to hand it is lead through the for'ard fairlead on the engaged side and the monkey's fist is clipped to the outboard end. It is then lead across the foc'sle and out through a fairlead on the opposite side, the end is allowed to trail freely in the sea so that the drag tautens the line. Two ratings are needed to tend the line.

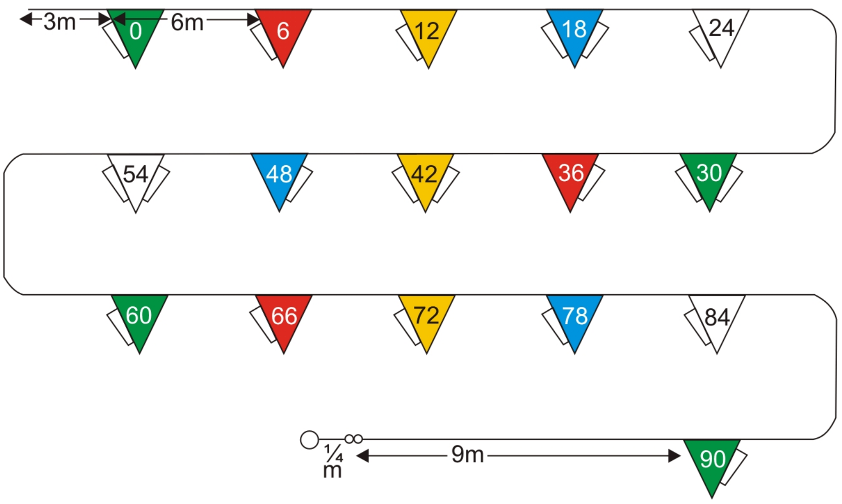
b. **Operating Procedure (by night).** Because of the likelihood of the cyalume lights snagging and breaking free in the fairleads, the night distance line must be hand held and not rigged as a self-tensioning line. Two hands are normally required for this task.

c. **Minor War Vessels (MWVs) - Modified Distance Line.** When MWVs are operating together conducting light line transfers, there exists the possibility that the full length distance line, streamed astern in the self-tautening mode, could foul the ships propellers. To alleviate this potential problem the following onboard modification allows a 60m distance line to be available for light line transfers with other MWVs, whilst retaining the facility of a full length distance line when operating with RN/RFA/Nato units other than MWVs:

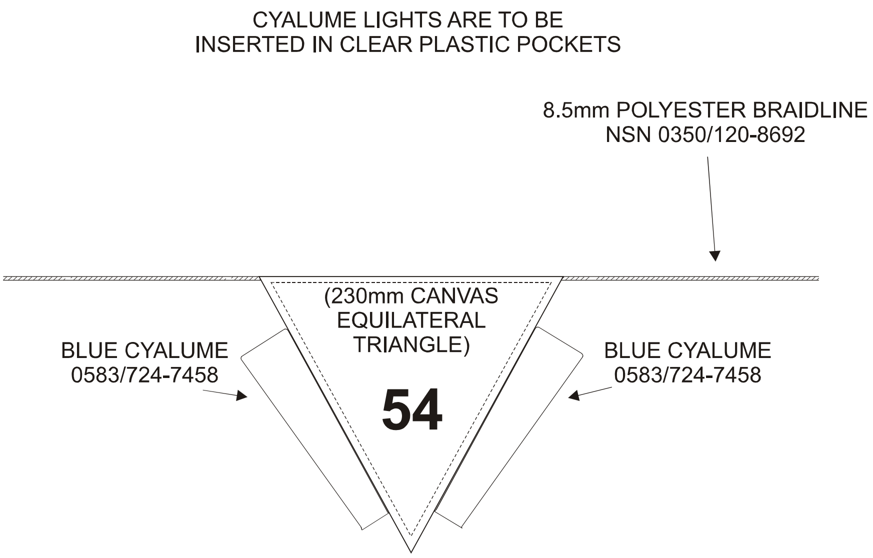
(1) Measure and cut the line at 3.2m from the leading edge of the 60m pennant.

(2) Attach non-swivel Inglefield clips, Pattern No 0330/749-7124, 200mm from each bitter end, and secure in place by a half-hitch and whipping.

(3) From 8.5mm braidline, Pattern No 0350/120-8692, manufacture a pendant to a finished length of 400mm, with non-swivel Inglefield clips attached at each end as described above. This pendant is used to join the two sections when a full length distance line is required. The 60m distance line can be used in the self tautening mode, but full length distance lines when used in MWVs must always be manned.



| **Fig 6-13. Self-tautening Distance Line showing position of Day and Night Markings**



| **Fig 6-13a. Details of Day and Night Mark Fittings on Distance Line**

06006. Stationkeeping - Distance Astern

When fuelling astern the receiving ship keeps station on a **marker float/buoy** streamed by the delivering ship (Fig 6-14). This marker is initially streamed to the same distance astern as the hose end. Once the hose has been connected and is towing in the correct catenary the delivering ship can be requested to adjust the position of the station marker to assist station keeping.

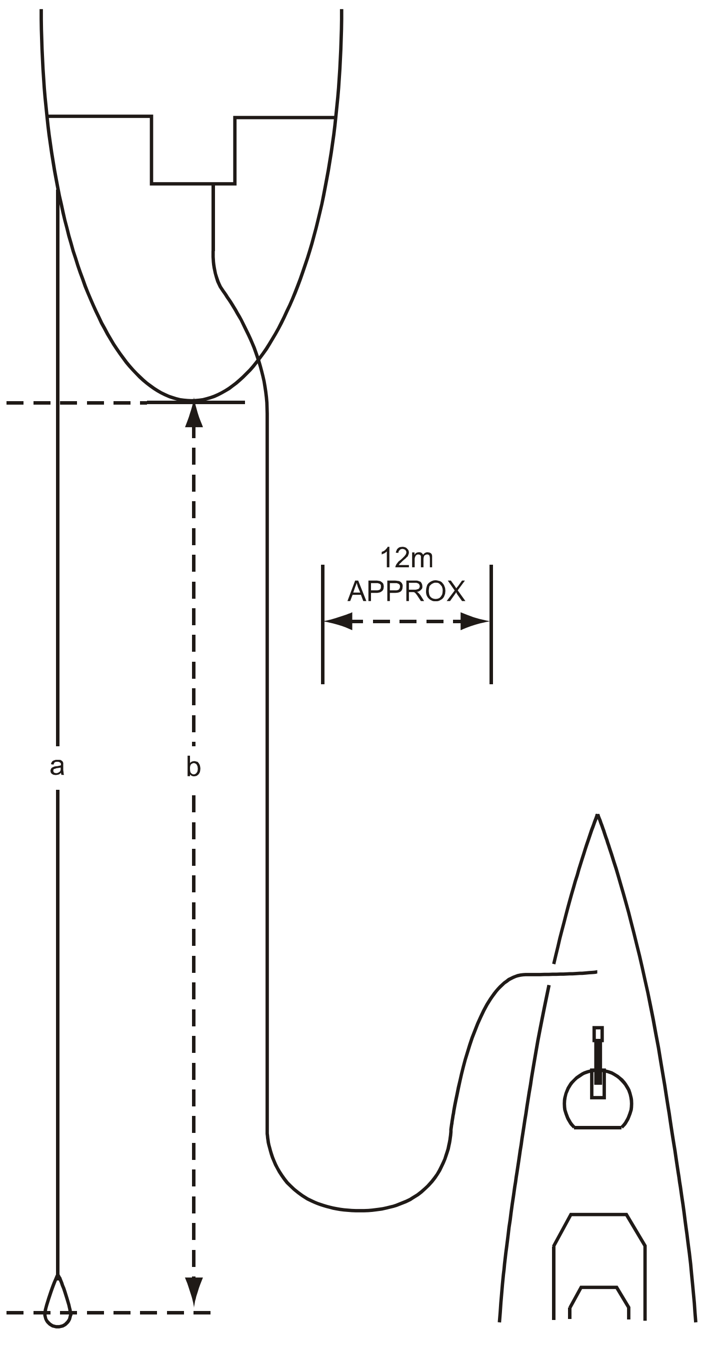


Fig 6-14. Stationkeeping Distances for Astern Fuelling

a = Length of Marker Buoy line. This marker is initially streamed to the same distance astern as the hose end. Once the hose has been connected and is towing in the correct catenary the delivering ship can be requested to adjust the position of the station marker to assist station keeping.

b = Length of fully streamed hose. In the case of the Hudson Reel Astern Rig fitted in RFAs Fort George, Fort Victoria, Wave Ruler and Wave Knight, this length is approximately 225m. In all other RFAs fitted with the traditional 'Laid out' Astern Rig the length is approximately 190m.

06007. Communications and Signalling

Before a RAS operation can be conducted, information and executive signals must be exchanged between all ships participating in the operation. The operation may range from a full-scale replenishment, to RAS conducted by two ships, or to a simple transfer of mail by helicopter. In every instance, however, command relationships must be understood by all concerned. This aspect of replenishment is covered fully in **ATP 1, Volume 1** and in **ATP 16**. However, the seaman should be aware that the Maritime Tactical Message System for replenishment involves the use of five standard signals. They are as follows:

OPSTAT RASREQ*	For use by a combatant ship to signal its requirements, either direct to the supplying ship or to the OTC.
OPTASK RAS	For use by the OTC to promulgate the replenishment programme.
OPSTAT UNIT*	For use by all ships to promulgate details of transfer stations.
OPSTAT CARGO	For use by supplying ships to report cargo remaining to the OTC after a RAS operation and on changing operational control.
STANDING RAS GOLD	For use by the OTC when requirements of ships and rigs to be used are known in advance.

CAUTION

WHEN REPLENISHING FROM US SHIPS THE OPSTAT UNIT/OPSTAT RASREQ SHOULD STATE THAT THE MAXIMUM RIG TENSION IS NOT TO EXCEED 8 TONNES

a. **Flag Hoists**. Fig 6-15 gives details of flag hoists used during daylight replenishment operations. By night the morse equivalents of ‹R’ and ‹Prep’ may be flashed four times without call or ending, using the following coloured lights, as appropriate:

WHITE LIGHT	Signal at the DIP
RED LIGHT	Signal CLOSE UP

SIGNAL	MEANING
 Romeo Displayed on fore yardarm on side rigged	**Replenishment Unit Guide** (abeam method) **At the dip**: Am steady on course and speed and am preparing to receive you on side indicated. **Close up**: Ready to receive you on side indicated. **Hauled down**: When messenger is in hand.
 Romeo Displayed on side hose is being used	**Replenishment Unit Guide** (astern method) **At the dip**: Am steady on course and speed and am preparing to stream hose on this quarter. **Close up**: Am ready for your approach. **Hauled down**: Hose is on deck of receiving ship.
 Romeo Displayed on fore yardarm on side rigged	**Approach ship** (abeam method) **At the dip**: Am ready to come abeam. **Close up**: Commencing approach. **Hauled down**: When messenger to hand.
 Romeo Displayed on side hose is being received	**Approach ship** (astern method) **At the dip**: Am ready to close and take hose. **Close up**: Am commencing approach. **Hauled down**: Hose grappled and in hand on deck.
 PREP Displayed at the outboard yardarm	**At the dip**: Expect to disengage in 15 minutes. **Close up**: Am disengaging at final station. **Hauled down**: All lines are clear.
 Bravo Displayed where best seen	**Close up**: Transferring fuel or explosives. **At the dip**: Temporarily stopped transfer. **Hauled down**: Transfer completed.

Fig 6-15. Flag Hoists used during Daylight Replenishment

b. **RAS Bats and Wands**. For all methods of transfer the primary means of communication are hand signals, using red, green or amber bats by day and illuminated wands by night. In addition, commodity bats and wands are used to indicate the commodity to which pumping signals refer. Both signal and commodity bats are back-to-backed to minimise the number of bats required for each replenishment operation. Colours and pattern numbers of bats and wands are as follows:

Details of Bat Pattern numbers

Description	**Pattern number**
RAS Signal Bat - Red and Green	F217/561-4763
RAS Signal Bat - Amber and Green	F217/700-7240
RAS Commodity Bat - AVCAT/Lub Oil	F217/956-9007
RAS Commodity Bat - Dieso F76 and Water	F217/212-1437

Details of Bat colours

Red Signal Bat	-	Solid red
Green Signal Bat	-	Green with 25mm diagonal white stripe
Amber Signal Bat	-	Solid amber
AVCAT	-	Yellow and Blue divided diagonally
Lub Oil	-	Black and Yellow quarters
Dieso F76	-	Red and blue divided diagonally
Water	-	Solid White

Details of Wand Pattern Numbers

Light wand complete with conical baton	0583-00-926-4331
Conical baton	0583-00-691-1407
Filter Red	0583-00-111-0190
Filter Green	0583-00-504-8341
Filter Amber	0583-00-504-8342

Details of wand colours

Red Signal Wand	-	Solid red
Green Signal Wand	-	Solid green
Amber Signal Wand	-	Solid amber
AVCAT	-	Top half yellow, bottom half blue
Lub Oil	-	Amber wand with two black bands
Dieso F76	-	Top half blue, bottom half red
Water	-	Solid white

Note. *For the time being commodity wands must be produced onboard. The white wand is created by using a wand without a filter and the two black bands for the lub oil wand are achieved with strips of masking tape. Careful painting of the outside of a wand with a* ***thin*** *coat of paint will give the appropriate effect for the Dieso and AVCAT wands. Professionally produced commodity wands will be available in the future.*

c. **Bat and Wand Stowage**. To ensure bats and wands are securely stowed but readily accessible during replenishment, canvas stowage wallets are required; Guidance drawings are shown at Fig 6-16 and 6-17.

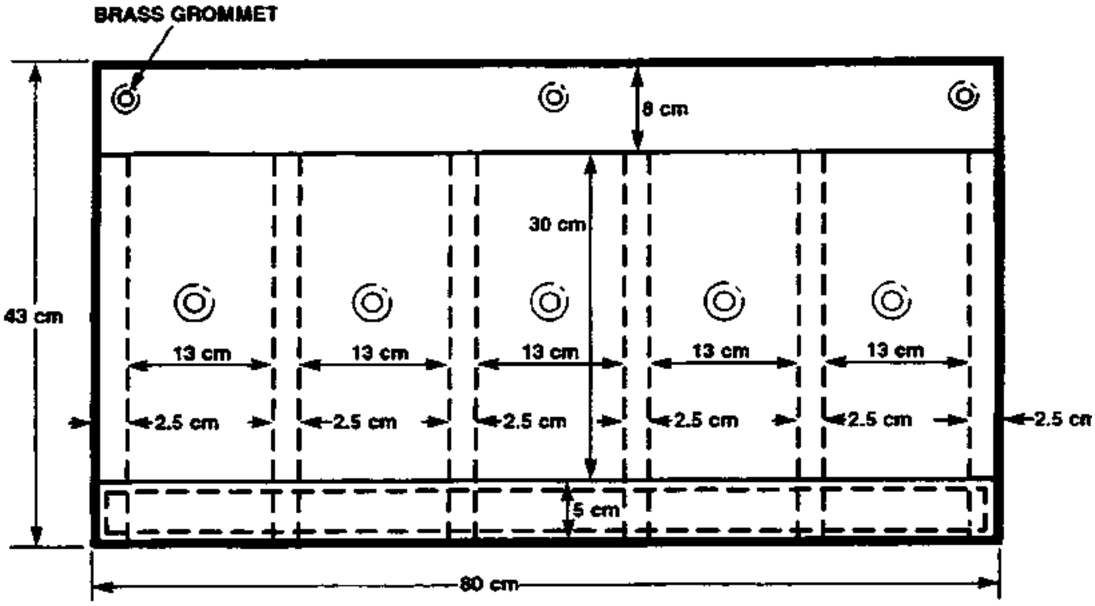


Fig 6-16. Drawing of RAS Wand Stowage

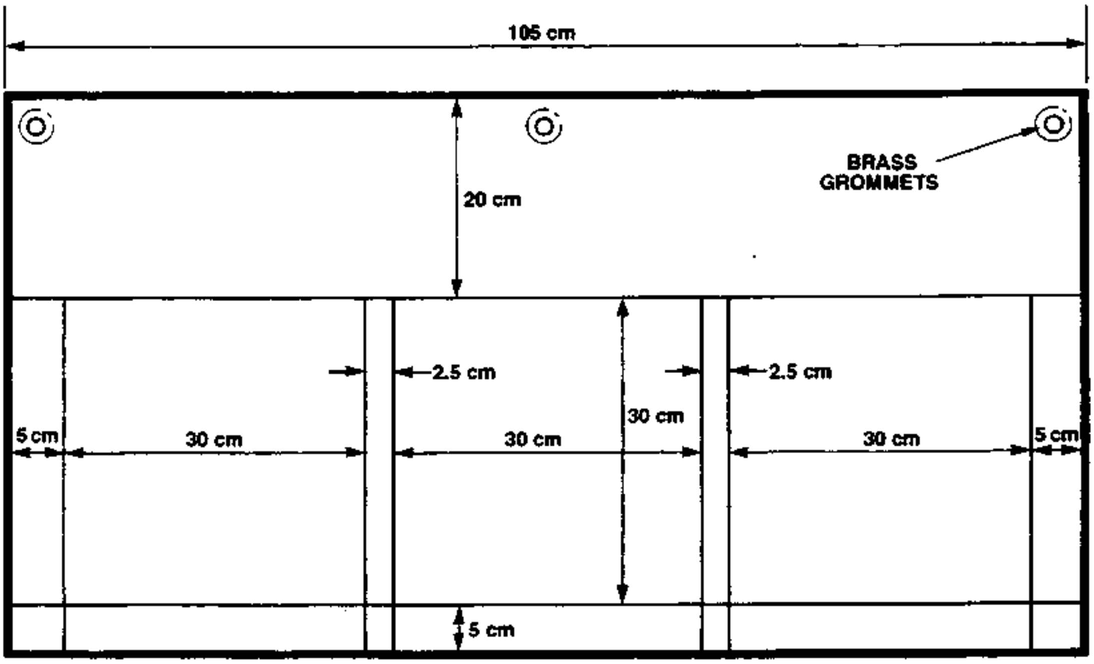


Fig 6-17. Drawing of RAS Bat Stowage

d. **Hand Signals used during Replenishment.** Hand signals are used in conjunction with sound powered communications. The fundamental premise in the hand signal method of communication is instant communications between stations. The batman must be sited adjacent to the transfer/reception station where he is easily seen by his opposite number and can observe replenishment operations affecting his particular rig. The hand signal describes that particular action that one ship requires of the other, or is a response indicating the required action is understood or being carried out. The use of commodity bats/wands is only necessary during multiple commodity replenishment; the appropriate commodity bat/wand is held vertically above the head in one hand while the other hand is used to give the start or stop pumping signal. Standard hand signals are shown at Annex A to this chapter.

06008. Making Contact by Gunline or Bolas

Contact between ships is established with a **gunline** or **bolas**. The bolas is heaved by hand and the gunline, which is the more common method, is projected by a line-throwing rifle. The rifle used is a standard operational weapon which propels a soft-nosed projectile, with considerable velocity, to a distance of approximately 100m, and therefore, has the potential to kill or cause considerable injury. **BR 8988** is the authoritative publication for maintenance, storing and use of the line throwing rifle and projectile. (These projectiles are to be locally numbered and the number of firings of each projectile is to be noted and recorded on separate pages in the Seamanship Data Book). To minimise the risk of snagging during firing, gunlines should be piled loosely in long cylindrical containers such as empty Schumuly cartridge cases; to prevent the cases overturning they should be stowed in a locally manufactured portable container (Fig 6-18). Three lines should be made ready for each replenishment point.

WARNING

DRILLS AND PROCEDURES LAID DOWN IN BR 8988 MUST BE FOLLOWED WHEN USING THE LINE THROWING RIFLE

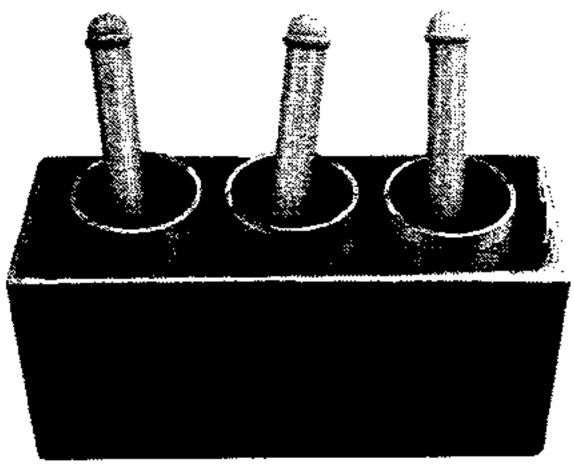


Fig 6-18. Example of Locally Manufactured Gunline Container Stowage

a. **Signals by Whistle.** Before the line throwing rifle is fired, the receiving ship must confirm that all personnel have taken cover and that it is, in all respects, safe to fire the projectile. For this reason, the following signals by whistle are to be made by the firing or receiving ship:

One Blast	**By Firing Ship** Prepare to receive my gunline.
Two Blasts	**By Receiving Ship** Ready to receive your gunline, personnel have taken cover.
Three Blasts	**By Firing Ship** All lines have been passed.
Three Blasts	**By Receiving Ship** Line(s) lost. Pass another line. (Commence cycle again with one Blast).

Notes:

1. In order to reduce the danger to personnel on the receiving ship the line-throwing rifle is to be LOADED, MADE READY AND FIRED after the two whistle blasts have been given from the receiving ship. The order to LOAD is not to be given until the Safety Officer has confirmed that all exposed personnel have taken cover and are clear of the firing team with their backs turned towards the firing position. They are to remain under cover until 3 whistle blasts are heard.

2. Personnel in the receiving ship should not break cover until three blasts from the firing ship are heard.

3. If the firing is seen as unsuccessful, another line is passed without further whistle signals. Only when three whistle blasts are sounded by the receiving ship should the sequence begin again with one whistle blast.

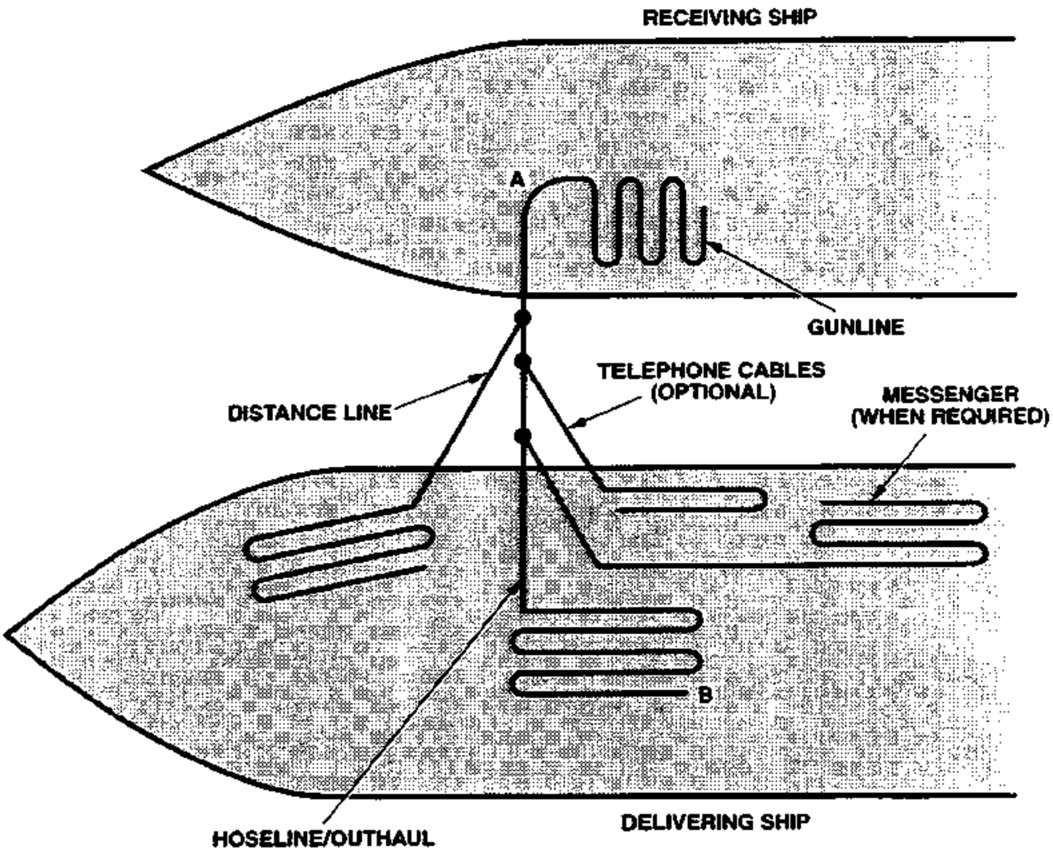
4. The whistle signals have the same meaning when a heaving line or bolas is to be passed instead of a gunline.

5. Red bats/wands are to be used during replenishment to indicate the dump area in the firing ship and the position the gunline is required in the non-firing ship.

b. **Firing Sequence**. In a replenishment between an RN warship and an RFA the warship is to fire the gunline(s) to avoid the risk of damaging expensive equipment fitted externally in HM ships. An RFA which is carrying a dangerous or vulnerable cargo on deck may, however, request the OTC to arrange for the RFA to fire the gunline(s); if this is agreed, the OTC will detail the firing ship. To avoid possible injury to personnel in a multi-ship replenishment, only the first warship to approach will fire the gunline(s); the unit in the centre of the replenishment is to fire the gunlines to the second ship coming up to replenish. In replenishment between either two RN warships or two RFAs the delivering ship will fire the gunline unless the OTC orders otherwise.

06009. Methods of Establishing Rigs between Ships

When the gunline has been passed, the lines required for the transfer can be passed to the receiving ship and these include the messenger, distance line and telephone cables. While being passed these lines are secured temporarily by Inglefield clips either to the outhaul tail (for storing rigs) or to the hoseline tail (for fuelling rigs with the exception of astern fuelling). In the case of storing rigs the outhaul is temporarily secured to the jackstay and for fuelling rigs the hoseline is secured to either the hose or the jackstay which will support the hose troughs. For each rig there are variations to the above arrangements and the method of passing each rig is explained later in this chapter. The basic method is shown at Fig 6-19.



A. Gunline clipped to Hoseline/Outhaul

B. Hoseline/Outhaul toggled and gripped to Jackstay (Toggled to Light Jackstay) or secured to Hose.

Fig 6-19. Usual Sequence of Passing Lines for Replenishment

06010. List of RAS Equipment in Common Use

Replenishment evolutions involve the use of much standard equipment. The following list gives details of such equipment and its application:

a. **Slips and Associated Shackles:**

(1) *Rigging Slip* Pattern No 0263/414-9747 with associated *Straight Screw Shackle* Pattern No 0263/721-6093. Used for Light Jackstay attachment, Hose Hanging Pendant attachment and Sliprope attachment.

(2) *Rigging Slip* Pattern No 0263/414-9835 with associated **Straight Screw Shackle** Pattern No 0263/721-6096. Used for Heavy Jackstay attachment and Jackstay Fuelling attachment.

b. **Quick Release Device**. To improve safety and ease of operation, a Quick Release Device (QRD) 4030-99-814-9390 is being introduced as a replacement, in certain replenishment operations, for the 0263/414-9835 slip and shackle. The QRD (Fig 6-20) can be activated from the deck in complete safety even in emergency conditions, whether the jackstay is slack or under tension.

Note. *The QRD cannot be used on a Type 42 Retractable Kingpost*

(1) *Safety Pin*. The release mechanism incorporates a safety pin of the pip-pin type which prevents inadvertent operation of the QRD. The pin can only be removed when its central spindle is pulled to release the locking balls; this is achieved by pulling on a lanyard attached to the pin. To insert the pin, close the jaw of the QRD to engage the trigger. Insert the pin into the block by pushing on the slotted end of the central spindle. Continue pushing and move the trigger slightly until the pin slides fully into place.

(2) *Preparing the QRD*. Ensure that the QRD is clean, undamaged, and that the jaw and trigger can move freely. Charge the grease nipple of the main pivot with XG 286 grease; rotate the jaw several times to ensure thorough greasing. Close the jaw, engage the trigger and insert the safety pin. Splice a 12mm polypropylene lanyard to each of the two operating lanyards. The lanyards should terminate 1m above the deck when the reception point is at its maximum height.

(3) *Rigging the QRD.* Attach the QRD to the RAS highpoint using the special 0263/306-2860 shackle supplied with the device. Ensure the release lanyards are ready to hand, but not in danger of fouling loads or other equipment.

(4) *Connecting the Jackstay to the QRD.* Heave the jackstay inboard and engage the jackstay long link past the spring-loaded keep plates and into the jaw. The jackstay load can now be applied once the gripper has been released.

(5) *Releasing the Jackstay from the QRD.* Stand slightly for'ard of the rig. On the order 'slip the jackstay' pull the safety pin lanyard to remove the safety pin, then pull the trigger lanyard to operate the trigger and release the jackstay.

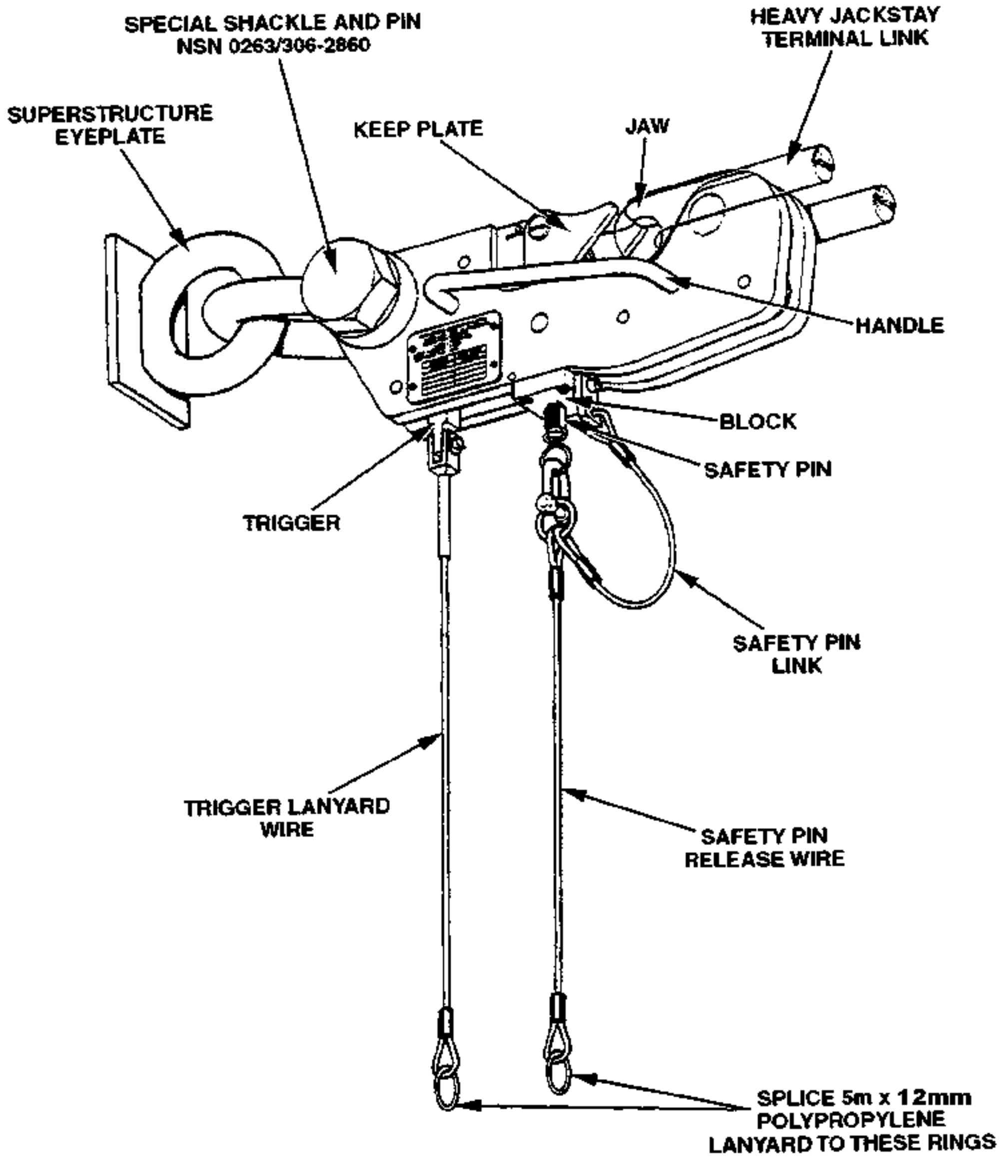


Fig 6-20. Quick Release Device

Notes:

1. If, during a replenishment, the release lanyard fouls and the safety pin is pulled out prematurely, the jackstay must be de-tensioned at the first opportunity and the pin re-inserted. During this operation there is a possibility the device will operate and the jackstay will be slipped. For this reason, before attempting to re-insert the pin a 16mm polypropylene retaining line must be hitched to the jackstay outboard of the terminal link, hove taut and secured inboard.

c. **Jackstay Gripper.** The *Jackstay Gripper* (Fig 6-21) is used for passing the Heavy Jackstay, Probe, and Jackstay fuelling rigs. The gripper has a spring-loaded jaw designed to clamp to a 28mm wire. The outhaul/hoseline is attached to it by passing a bight through the shackle on the leading edge of the gripper and taking a round turn around the toggle as shown below. There are two methods of releasing the gripper when the eye of the Jackstay has been connected to the highpoint, each should be trialled to establish the most effective technique at each RAS position.

(i) *First Method*. Attach the release lanyard to a secure point inboard. When the tension in the outhaul/hoseline is eased the gripper should release.

(ii). *Second Method*. Take the release lanyard in hand and give it a sharp pull inboard in line with the jackstay.

***Notes**:*

1. Receiving ships must include in their OPSTAT RASREQ the distance between the leading block and the slip/pelican hook so that the RFA can set the gripper at the appropriate distance from the end of the jackstay.

2. When heaving in a jackstay on a hoseline/outhaul care must be taken to avoid the gripper sliding down the jackstay, thus making it difficult to connect the end link to a slip/pelican hook. If the gripper does slide down the jackstay a retaining pendant should be used to take the weight of the jackstay whilst the gripper is repositioned.

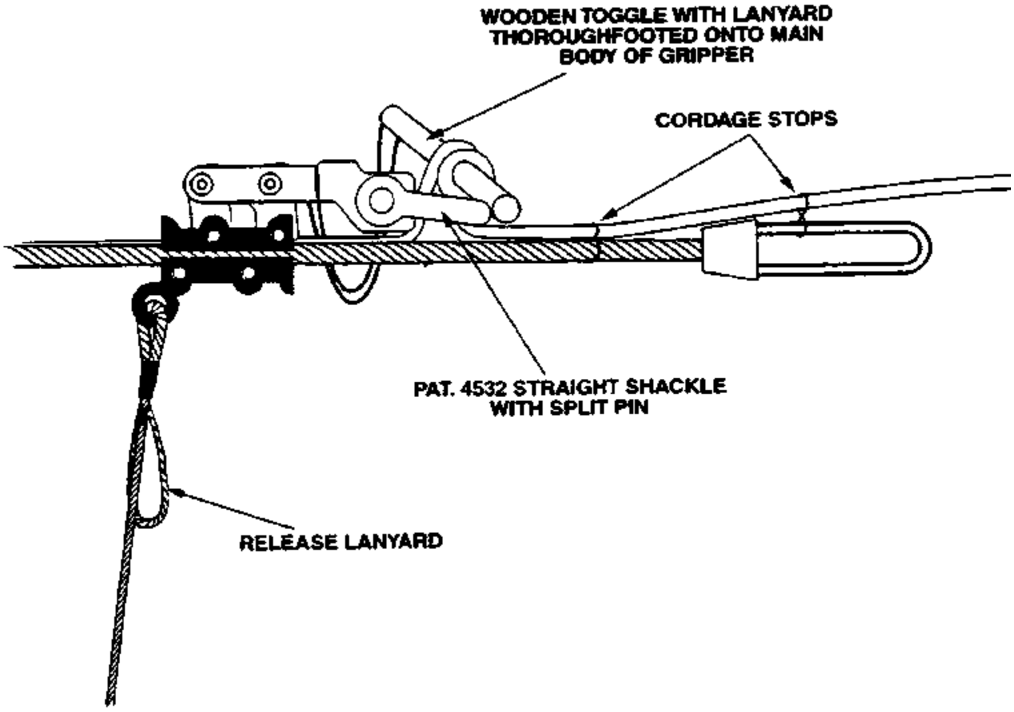


Fig 6-21. Jackstay Gripper

d. **Blocks and Associated Shackles**

(1) *Snatch Block* Pattern No 0246/521-2794 with associated Straight Shackle Screw 0263/721-6090. Used for Light Jackstay inhaul and outhaul lead.

(2) *Snatch Block* Pattern No 0246/521-2796 with associated Straight Screw Shackle 0263/721-6093. Used for Hoseline lead for all abeam refuelling rigs and inhaul lead for Heavy Jackstay.

(3) *Block* Pattern No 0246/521-2799 with associated Straight Screw Shackle 0263/721-6093. Used for Light Jackstay lead.

(4) *Roller Shackle* Pattern No 0263/770-9716. Used as Hoseline lead for Astern Fuelling, float and gunline methods. Associated shackle varies ship to ship. ‹As fitted' drawings must be consulted to ascertain precise fit.

e. **Links**

(1) *Swivel Joint Link Assembly* Pattern No 0249/525-7325. Connects to the Swivel Arm joint Pattern No 0249/525-7299, converting the Swivel Arm Joint from Probe reception to reception of Jackstay fuelling. Both items are illustrated in Fig 6-22.

(2) *NATO Standard Long Link* Pattern No 0263/537-1659. No longer fitted as an integral part of RAS reception points, the NATO Long Link is carried by ships as a portable standardized link which may occasionally be required with associated Straight Screw Shackle 0263/721-6096 to permit connect-up of replenishment at sea rigs between ships of various NATO nations; in practice it is seldom required. Details of the link and possible applications can be found in **ATP 16B Chapter 7**.

(3) *Swivel Joint Adaptor* Pattern No F217-514-9334. Used on the Swivel Arm joint to permit the connection of the QRD to the Probe Base Plate to allow heavy jackstay and jackstay fuelling to be conducted from the Sliding Pad-eye.

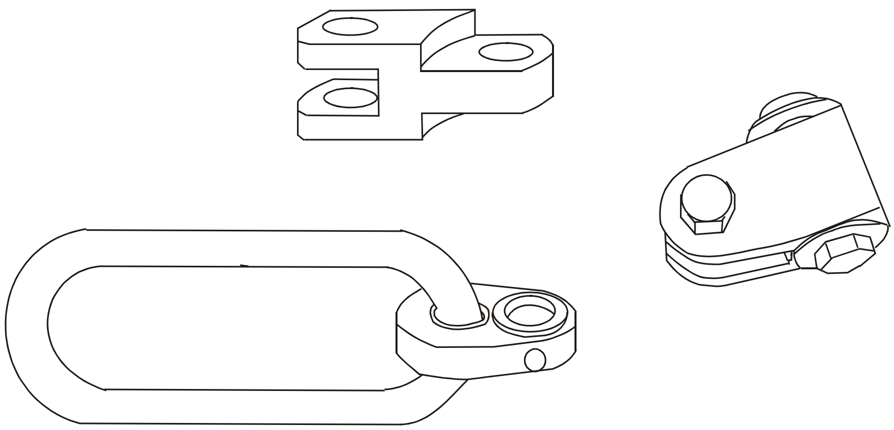


Fig 6-22. Swivel Joint Link Assembly

f. **Hose Hanging Pendants.** The Hanging Pendants for abeam and astern fuelling are made up as follows:

Steel Wire Rope 20mm (6x36) - 0235/523-8649	Length to suit.
Thimbles 0263/332-5187	Fitted both ends - ferrules as necessary
Link - 0249/458-9487	Fitted at one end
Spring Hook 0263/539-3523	Inserted directly into thimble opposite end to the link

g. **Lines used during Replenishment**

(1) *Combined Hoseline/Heavy Jackstay Outhaul.* This line serves all types of abeam fuelling and the heavy jackstay transfer rig. It is made up of 110m of 21mm polyamide braidline, tailed with 50m of 12mm hawser-laid polyester. The opposite end to the tail is finished with a thimble eye incorporating a 3 tonne SWL spring hook. Non-swivel Inglefield clips are seized at 40, 41 and 42 metres from the outboard end of the tail for attachment of the distance line, telephone cables and messenger. A clip is fitted at the bitter end of the tail for attachment of the gunline and strayline. Leather chafing pieces are fitted to areas subject to heavy wear such as the hose lashing points section.

(2) *Remating Line.* This line is required during probe fuelling should the probe accidentally disengage (and during heavy jackstay should the RSA accidentally disengage). It is manufactured from 20 mm hawser-laid polyester to a length equal to the distance from the reception point to the RAS winch plus 40m. One end is finished with a soft eye into which is fitted a 2 tonne SWL Welling spring hook for attachment to the 0263/543-4551 bow screw shackle fitted to the probe trolley block. The opposite end is finished with a 150mm soft eye; this end is for attachment to the probe trolley in NATO ships that are fitted with open remating line hooks. To prepare the remating line for use, fake it down at deck edge, on top of a shot-mat and adjacent to the fuelling point, clear of all personnel and the working area. Lead the standing end to the deck-edge and lightly stop it to a suitable deck fitting. Place the end to be attached to the probe trolley ready to hand, then place a shot-mat on top of the fakes. Warn all personnel of the danger arising from the remating line if the probe suddenly disengages.

(a) Retaining Pendant. This pendant is used in conjunction with the remating line as described below in sub para (c). It is to be locally manufactured from 20mm hawser-laid polyester; one end is finished with a soft eye into which is fitted a 3 tonne SWL spring hook, and the opposite finished with a 150mm soft eye. The finished length of the pendant is to be 1m. This length permits connection of the appropriate end to the probe trolley (UK or NATO) and the opposite end to a 0263/721-6093 straight screw shackle attached to the third hole from outboard of the probe swivel arm. As part of the RAS preparations the retaining pendant is to be attached to the probe swivel arm and lightly stopped clear of other equipment.

Note*. The Retaining Pendant should be available at all Jackstay replenishment serials in case it is required if the gripper slips and needs to be repositioned.*

(b) Procedure. After the hose has been pressurised, attach the remating line to the probe trolley, then detach the hoseline from the trolley and unsnatch it from the leading blocks. If the probe disengages it must be allowed to run its course down the jackstay. Only then should the remating line be snatched into the leading blocks, brought to the winch/capstan and hove in until the probe remates. When this has been achieved, attach the free end of the retaining pendant to the probe trolley, remove the remating line, fold back the top shot mat, coil down the remating line on the bottom shot-mat, then cover the coil with the top shot mat before re-attaching the spring hook end of the remating line to the probe trolley. Once the remating line has been re-attached remove the retaining pendant. The remating line can be removed at any time up to 'RAS complete' if the conditions no longer justify its use.

(c) Ships replenishing Dieso and Avcat (or fresh water) simultaneously from a probe rig reception point. In this situation there is a risk of damaging the Avcat (or water) hose should the probe accidentally disengage. To eliminate this risk the retaining pendant described above is used. The free end of the pendant is to be attached to the probe trolley as soon as the hose is pressurised and before the hoseline is removed; in this situation the remating line is not attached to the trolley. If the probe accidentally disengages it is prevented by the pendant from travelling down the jackstay. The remating line is then connected and the probe hove in and remated, when this has been achieved the remating line is removed. When replenishment of Avcat and/or fresh water is complete, disconnect the hoses and make them up for return (as received). Then attach the remating line before removing the retaining pendant.

(d) Emergency breakaway procedure if retaining pendant and/or ancillary hoses are connected. In the event of an emergency breakaway in this situation, the 'Ready' signal must only be given by the receiving ship when the Avcat/Fresh Water hose is disconnected, the retaining pendant has been removed or cut and the probe released. The delivering ship must not heave in on the red runner until the 'Ready' signal is seen.

***Note**. Ships should be aware that NATO units will not be conversant with the use of a retaining pendant. Therefore should a NATO delivering ship attempt to recover the probe before the 'Ready' signal has been given the retaining pendant must be cut.*

(3) *Jackstay Control Line.* This line is used to control violent movement in all Jackstay rigs during the connecting up procedure or whilst hooking on/unhooking loads; its use is not mandatory and depends predominantly on prevailing weather conditions and reception point location. The line consists of 12m of 16mm MMFC, one end of which may be fitted with a spring hook. During preparations for Jackstay replenishment rigs one end of the line is secured (or hooked) to a deck fitting, and the other end made ready for passing over the jackstay if required.

***Note.** If a spring hook is fitted for securing the line to the deck it may be necessary to attach a suitable bow shackle to the deck fitting to provide an eye large enough for the hook.*

(4) *Strayline.* A strayline consists of a length of 8-12mm MMFC with a non swivel Inglefield clip fitted to one end. Straylines are rigged as part of replenishment preparations and are used as a means of transferring the lead of an incoming line from one point to another. For example, a strayline is rigged through the leading blocks from the dump area to the winch prior to a fuelling or heavy jackstay transfer. When the end of the hoseline/outhaul comes to hand it is clipped to the strayline, effectively transferring it directly to the winch. Similarly straylines may be rigged and used to transfer the lead of a line under a replenishment rig. The length of a strayline is determined by its use.

(5) *Captive Drum Tail Line.* This consists of a 1m length of 8mm polypropylene cordage fitted with a non swivel Inglefield clip at the outboard end. The inboard end of the line is hitched to the anchor plate on the barrel of the captive drum to facilitate the attachment of lines.

(6) *Sliprope.* This is a suitable length of 28mm(20mm MCMV) NFC, with a reduced soft eye in one end and the other end whipped. The sliprope is used to take the weight of the rig during the disengaging phase of Astern, Derrick and Jackstay refuelling. The inboard end can either be attached to a 9747 slip or tied off with a round turn and two half hitches and then cut at the appropriate moment. In ships fitted with captive drums the whipped end of the sliprope is to be fitted with an Inglefield clip for attachment to the tail line.

(7) *Temporary Guardrails.* (Fig 6-23). Before guardrails are struck at a transfer point, a temporary guardrail is to be rigged in their place, and secured. A temporary guardrail is manufactured from 16mm staple spun polypropylene of sufficient length to bridge the opening plus 4m, with a thimble eye fitted one end to enable it to be shackled or hooked to the last standing guardrail stanchion. The temporary guardrail is weighted with either a running shackle or a 25mm length of metal pipe. Two are shackled together for derrick and crane refuelling, when a double arrangement is required. In such instances only one leg requires weighting. Drills and procedures for temporary guardrails are described later in this chapter in RAS preparations and procedures.

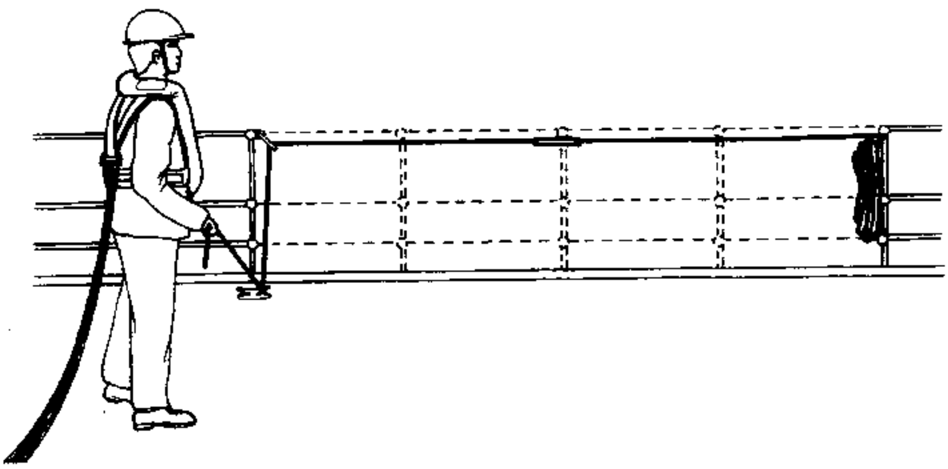


Fig 6-23. Rigged and Tended Temporary Guardrail

(8) *Hose Securing Strops.* (Fig 6-23a). The recommended method of passing the Hose Securing Strops are shown in the attached diagram from where it can be seen that the tackle hooks are fitted with safety catches for additional safety. If during an Emergency Breakaway, time does not permit to remove the hooks then the strops can be removed quickly by cutting either part of either strop. As these tackles are not being used for lifting purposes they should be set aside, marked up, and only used for RAS steadying tackles. This means that the requirement for regular re-testing does not apply. As long as the tackle has it's original Certificate of Conformity and passes a visual inspection before and after use it may continue to be used.

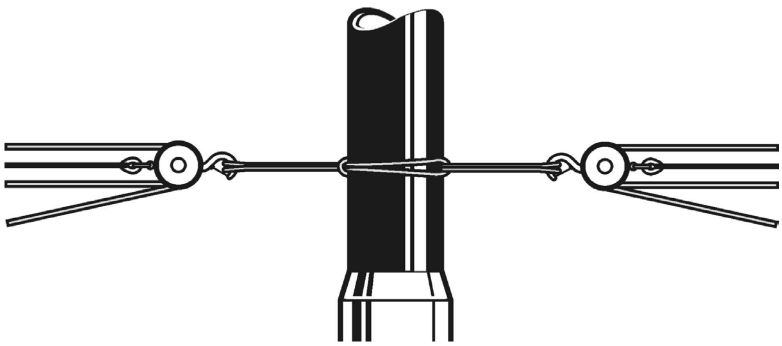


Fig 6-23a. Hose Securing strops

h. **Emergency Tools.** Emergency tools, stowed in a box or a bag, are to be readily accessible at each transfer station. Contents are as follows:

Axe and Maul
Hammer
Hatchet, hand
Pliers
Marline spikes
Adjustable wrench/socket set $1^1/_8$"
Wire/bolt croppers
Eye wash bottle and goggles
Mousing wire

i. **Hose Support Cradle** (Fig 6-23b). The Hose Support Cradle is used to support the QRC or NATO Breakable Spool coupling during fuelling operations. It prevents damage to equipment and facilitates connecting/disconnecting of the hoses. When used with the NATO Breakable Spool coupling an additional wooden chock must be inserted beneath the weakened groove of the coupling. See Fig 6-40.

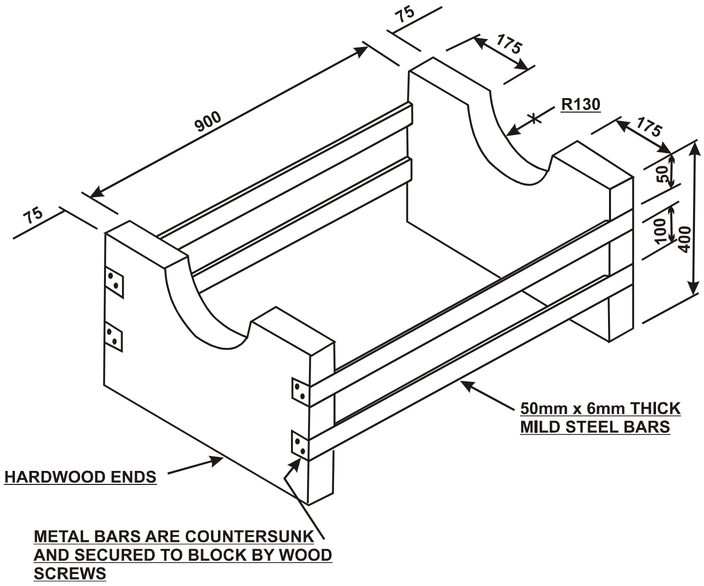


Fig 6-23b. Hose Support Cradle

Note*.* *Ships not in possession of a cradle should raise a Form S340 for local manufacture of the cradle in accordance with the Fig 6-23b .*

06011. General Preparations for all Types of Replenishment

These general (Part 2) preparations are common to all types of replenishment and should be made at each transfer station immediately after the Part 1 preparations detailed with the procedures for each type of RAS.

Secure shot mats over deck edge and screen projections. For Heavy Jackstay protect vertical surfaces with wooden battens. Provide emergency tools.

Detail swimmer of the watch (ready dressed) to act as lifebuoy sentry. He must close up on the engaged side adjacent to a lifebuoy stowage, before guardrails are struck.

Rig temporary guardrail(s) before permanent guardrails are struck; safety harnesses or safety belts must be worn by all personnel involved in this task. It is preferable to man the temporary guardrail from forward of the rig, although it is acceptable to man it from aft if this is the only position that provides an escape route for the handler in the event of an emergency. (A single temporary guardrail can be used for Light Jackstay, Heavy Jackstay and Probe replenishment).

Provide RAS bats and/or wands (including Commodity bats/wands if required). Provide safety harness, hammer, spike and pliers for highpointman (tools must be on a lanyard).

Provide a heaving line and boathook for the recovery of stray gunlines and a bucket into which the fired gunline(s) can be gathered.

Provide loudhailer. Check communications (two methods to be available) to bridge and to winch or capstan. Ensure power is on winch or capstan.

Provide MARPOL equipment for all fuelling replenishments.

For night replenishment, subject to command decision, provide red deck lighting and blue shaded torches. Remainder of the upperdeck should be darkened.

Find out if two gunlines are required (separate one for distance line); the whistles used with two gunlines should have different tones. Brief line-throwing party(s), check that they are correctly dressed and supplied with 3 gunlines in cylindrical containers, a rifle and three separate magazines each containing 1 (one) Ballastite round. (See **ATP 16** regarding the firing ship in a NATO Force and **BR 8988** for firing procedures).

Ensure men are correctly dressed for the task and the weather. All personnel must wear hazardous duty lifejackets (HDLJs) and safety helmets, and carry a Standard Rigging Set (Patt No 0275/755-2103). Immersion/Crewman suits should be considered for men in particularly exposed positions. A risk assessment is to be carried out by the CBM to establish if safety harnesses or safety belts may be appropriate for some or all personnel. For fuelling evolutions, goggles are to be provided for all personnel at risk from fuel spillage or fuel atomisation. Out of date LJ2 battery and light assemblies can be utilised to identify personnel at night. The white lens fitted must be replaced with a red lens (Patt No 0472/234-4370) and the battery must be inscribed unserviceable (US) in bold permanent marker. Assemblies are to be checked by the SE rate before and after use to ensure serviceability.

Check firefighting equipment has been provided (where necessary).

Brief all personnel involved.

***Note**. For certain types of replenishment it is necessary to train specific weapons to a particular bearing or to remove the weapon barrels to ensure the dump area is clear of all obstructions 30° either side of the centre. For example when replenishing Seadart missiles in a Type 42 the turret must be trained 60° to Port. Such tasks are the responsibility of the Warfare branch but it is prudent to double check.*

06012. Light Line Transfer

The light line transfer rig has evolved from the heaving line transfer and is predominantly for use by ships that do not carry a light jackstay rig. The equipment, which can be used for the transfer of weights up to 14kg, is made up from 150m of 16mm hawser-laid polyester rope fitted with non swivel Inglefield clips attached to each end by an 8mm polyester tack line, and additional Inglefield clips whipped to the line 40m from either end, for hauling over a distance line. A piece of red bunting worked into the lay marks the centre of the line. A 0246/521-2794 snatch block with associated 0263/721-6090 straight shackle may be used as a leading block for the line if a suitable eyeplate is available. Ships not entitled to the rig may carry out light line transfers by using the light jackstay inhaul and outhaul clipped together.

a. **Preparations in the Delivering Ship**

Rig high point (if required).

Rig leading block(s) (if required).

Provide Light Line.

Provide waterproof transfer bag.

Provide distance line (zero end to the guide).

Detail off a rating to cut the light line/distance line if the line snags in an emergency.

Complete RAS general preparations (as applicable) given in para 06011.

Note. *There is no requirement to drop guardrails for this evolution.*

b. **Preparations in the Receiving Ship**

Rig high point (if required).

Rig leading block(s) (if required).

Rig stray lines for distance line and light line.

Detail off a rating to cut the light line/distance line if the line snags in an emergency.

Complete RAS general preparations (as applicable) given in para 06011.

Note. *There is no requirement to drop guardrails for this evolution.*

c. **Light Line Transfer Procedures.**

(1) *Orders and Signals.* Orders are shown in quotation marks and signals are underlined. Signals and Replies between Delivering and Receiving ships are indicated by (D) and (R) respectively as well as being underlined.

Order/signal	**Response/signal**	**Action**
Red bat	Red bat	During approach, Red bat held aloft in firing ship to indicate dump area and in non- firing ship to indicate position gunline required.
‘Prepare the rifle for line throwing’ (Safety officer firing ship)		Prepare the rifle iaw **BR 8988**.
One whistle blast (Safety officer firing ship)		Safety officer in non-firing ship ensures all exposed personnel take cover behind ship’s superstructure.
	Two whistle blasts (Safety Officer non-firing ship).	
‘With a magazine of one round, load’ (Safety officer firing ship)		Load the rifle iaw **BR 8988**
‘Make ready’ (Safety officer firing ship)		Make the rifle ready iaw **BR 8988**
‘Fire when ready’ (Safety officer firing ship)		Fire the rifle iaw **BR 8988**
Three whistle blasts (Firing ship)		Safety Officer in non-firing ship orders personnel to break cover and retrieve gunline (using heaving line to recover stray gunlines).
	Three whistle blasts (Non-firing ship)	Signal only given if line is out of reach or lost. Firing ship starts firing sequence again with one whistle blast.
(D) Avast ‘Attach Light line’	(R) Avast ‘Avast’	Gunline is held while outhaul is attached in Delivering ship (using additional loose Inglefield clip).
(D) Heave in ‘Check away outhaul’	(R) Check away ‘Haul in gunline’	Receiving ship hauls in gunline, clearing the surplus from the deck into a large container (bucket) to keep it clear of personnel. When outhaul comes to hand detach gunline and attach bitter end of outhaul to strayline. Delivering ship checks away light line until the next clip is approaching the ship’s side.

Order/signal	**Response/signal**	**Action**
(D) Avast 'Avast - Clip on distance line'	(R) Avast 'Avast'	Receiving ship stops hauling on the stray line/light line and Delivering ship stops checking. Clip distance line to light line.
(D) Heave in 'Check away light line and distance lines'	(R) Check away 'Haul away'	Receiving ship hauls away on stray line/light line whilst Delivering ship checks away light line and distance line until the distance line is in the Receiving ship.
(D) Avast 'Avast'	(R) Avast 'Avast'	Stop hauling in light line, unclip the distance line, clip on strayline and pass it for'ard. Secure zero end of distance line in the guide.
(D) Heave in 'Check away light line'	(R) Check away 'Haul away'	Receiving ship hauls in light line until the red bunting is in the reception area of the Delivering ship.
(D) Avast	(R) Avast	Stop hauling in the light line.
(D) Commence transfer	(R) Commence transfer	Transfer bag in the Delivering ship is bent to the light line at the red bunting mark.
(D) Heave in 'Check away light line'	(R) Check away	The bag is now conveyed between the ships until all packages have been transferred. The bag then returns to the Delivering ship.
(D) Transfer complete	(R) Transfer complete	
(D) Check away 'Haul away light line and distance line'	(R) Heave in 'Check away light line and return distance line'	Receiving ship checks away the light line and distance line.
(D) Avast	(R) Avast	Disconnect stray line from the light line in the dump area of the Receiving ship.
(D) Check away	(R) Heave in	Light line and distance line are paid out to the bitter end then cast overboard. Delivering ship recovers all lines.

(2) *Emergency Breakaway (see also para 06025).* An Emergency breakaway may be initiated by either ship. As soon as the requirement for an emergency breakaway is apparent the order must be passed between bridge and RAS point and ship to ship. The aim is to disengage as quickly as possible without endangering life and with minimum damage to equipment; coils are not to be thrown overboard as the snatch loading may cause injury to men recovering lines in the Delivering ship; lines that foul must be cut. The quickest way of alerting personnel is to sound six short blasts; however, the executive order to conduct an emergency breakaway must come from the Command. The procedure is as follows:

Ship	**Order**	**Signal**	**Action**
Initiating ship (may be either ship)	'Emergency breakaway'	<u>Prepare for emergency breakaway</u> (other ship acknowledges with: <u>Prepare for emergency breakaway</u>	Initial action depends on position of the transfer bag. a. If transfer bag is in transit: complete the run, and on arrival detach the bag. b. If bag is in one or other of the ships: detach the bag and retain.
Delivering ship	'Ready'	<u>Ready</u>	
Receiving ship	'Ready'	<u>Ready</u>	
Delivering ship	'Execute'	<u>Execute emergency breakaway</u>	
Receiving ship			Roundly pays back light line and distance line.
Delivering ship			Recovers all lines.

***Notes**:*

1. Automatically pay back distance line when Emergency breakaway is ordered.

2. During 'Corpen November' manoeuvres the transfer of stores may continue at the Captain's discretion.

06013. Light Jackstay Transfer

The light jackstay (Fig 6-24) is used for transferring personnel, provisions and light stores, and has a maximum transfer load of 250 kg. The hauling end of the jackstay is manned by at least 25 men (28 in high sea states) and the other end is secured by a grommet strop to a slip in the receiving ship. The traveller block is hauled back and forth along the jackstay by an **outhaul** in the receiving ship and by an **inhaul** in the delivering ship, manned by 6 men in each ship. Working distance limits for the rig are 24-61m, with a normal working distance of 34m. The standard transfer rate is 35 loads per hour in reasonable weather conditions.

Note. *When conducting a light jackstay transfer from a sliding pad-eye the height of the pad-eye can be raised/lowered to facilitate the connecting/disconnecting process, but is to remain at a suitable fixed height during the actual transfer.*

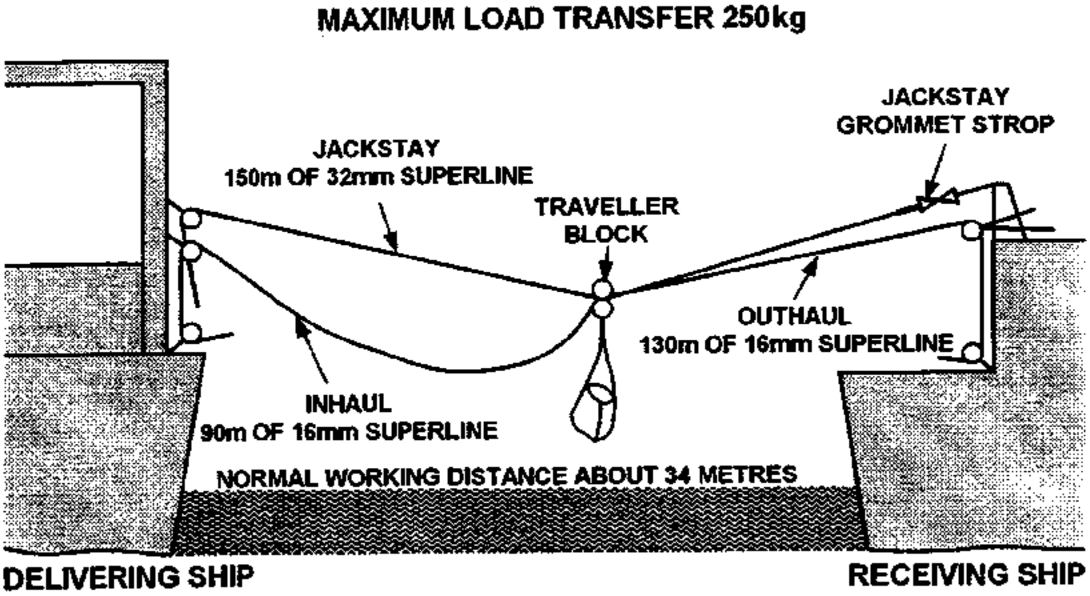


Fig 6-24. Light Jackstay Transfer

Note. *ATP 16 (NATO Replenishment at Sea Manual) states that if personnel are not being transferred the Light Jackstay rig (or high-line as it is known in some NATO navies) can be tensioned by taking it to a winch or capstan. Once tensioned in this way the jackstay can never again be used to transfer personnel. For this reason RN and RFA are not to tension the light jackstay using mechanical power unless emergency circumstances deem it necessary.*

a. **Details of Light Jackstay, Inhaul and Outhaul**

Jackstay (0246/776-5755)

150 metres 32mm Superline	With round thimble eye and six parted wire grommet fitted one end, other end whipped and heat sealed. No toggle or toggle stowage is provided.(See note 1).

Inhaul (0246/776-5756)

90 metres 16mm Superline	Thimble eye fitted one end, to which is attached an 0263/721-6090 straight screw shackle (or 0263/721-6103 bow shackle) to an 0263/539-3519 Welling spring hook. The other end is whipped and heat sealed.

Outhaul (0246/776-5757)

130 metres 16mm Superline	Thimble eye one end with fittings as for inhaul. Other end tapered and fitted with non-swivel Inglefield clip on a tack line. Inglefield clips are also fitted at 40, 41 and 42 metres from outboard end. Mark the outhaul at a point 10m from the thimble end by working a piece of red bunting into the lay.

Notes:

1. A wooden toggle approximately 250mm long and 40mm diameter is to be made up by ships staff. It is to have a lanyard attached capable of being thoroughfooted onto the jackstay.

2. Some inhauls and outhauls may be supplied with the spring hook spliced directly into one end. This arrangement is acceptable, but the configuration should be modified to reflect the details listed above when the hooks become due for test.

3. The jackstay has a maximum life of twelve years commencing from the date of its first use. After six years it is end-for-ended for a further maximum life of six years.

4. Jackstay and lines should be stowed in a bin. Where this is not possible they should be thoroughly dried before being wound on to a reel.

5. MMF is easily damaged by chafe. It must not be dragged over non-skid decks or similarly mistreated. The jackstay, inhaul and outhaul must be coiled, not faked, to reduce chafing caused by the lines dragging across the deck.

6. The date of first use (life start date) and annual inspections are to be recorded on the history card that comes with each new jackstay. The Senior Seaman Specialist Rate, RFA Boatswain or Dockyard Surveyor of Rigging is to carry out these inspections. In addition the jackstay and associated lines are to be carefully examined before and after use, and if there is doubt as to serviceability the line must be withdrawn from service and the history card annotated. The item should be tallied 'unserviceable', with brief reasons given, and returned to store. The history card must accompany light jackstay equipment that is being transferred between ships or returned to stores.

b. **Traveller Block and Pigtail.** The traveller block, Pattern No 0246/463-3880, is to be fitted with a 2m long pigtail as shown in Fig 6-25 to assist control whilst loads are being hooked on/unhooked. The Welling spring hooks fitted to the inhaul and outhaul may be hooked directly to the eyes of the traveller; however, with older style travellers it may be necessary to attach 0263/721-6090 straight shackles to the eyes in order to achieve a secure fit.

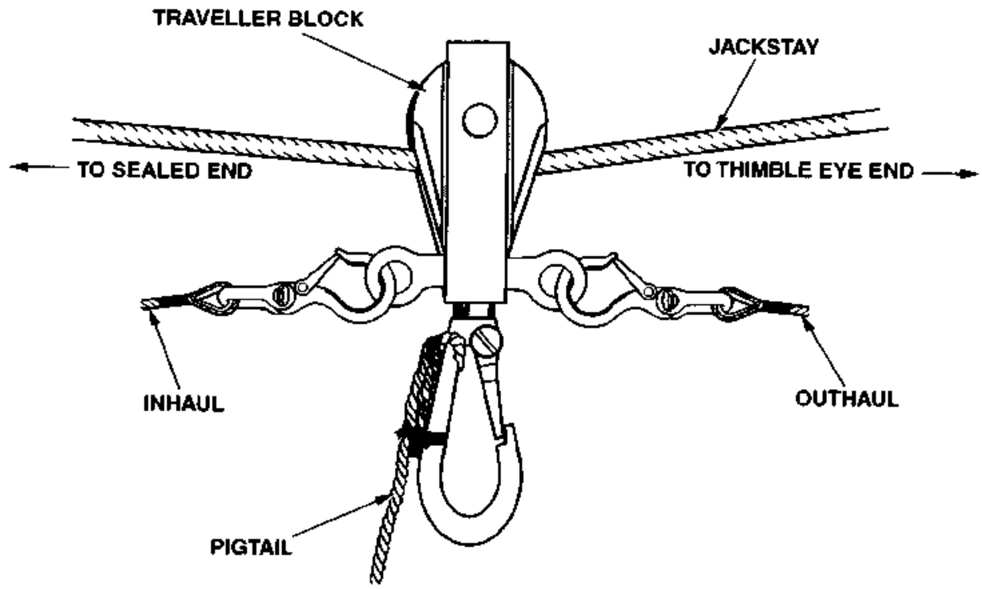


Fig 6-25. Light Jackstay Traveller with Inhaul, Outhaul and Pigtail Attached

c. **Test Weight.** Once a light jackstay rig has been set up it is proved safe before any stores or personnel are transferred. This is done by transferring a 135kg test weight (Fig 6-26) from the delivering ship to the receiving ship and back again. The weight is manufactured to Service drawing number 003504076 and consists of 5 removable discs on a central rod. A tested strop or suitable round sling is used to attach the weight to the traveller.

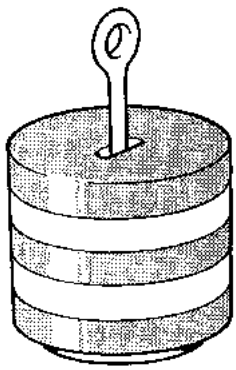


Fig 6-26. Light Jackstay Test Weight

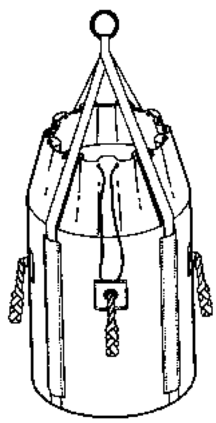


Fig 6-27. RAS Bag

d. **RAS Bag.** A RAS bag is used for the transfer of light stores (Fig 6-27). These bags are locally manufactured and details of the construction are given in **BR 2176 Sailmaker's Handbook**. A buoyancy aid (polypropylene float or fully inflated General Service Lifejacket) must be secured to the bag before commencing a transfer.

e. **Telephone Cables.** It is inter RN/RFA practice to pass the telephone cables secured by Inglefield clips to the outhaul. Two cables marked 'Bridge' and 'Transfer station' are provided by the delivering ship. Each line consists of approximately 90m of cable, Pattern No 0561/103-8301. The telephone lines are tended in the delivering ship to keep them clear of the water. Details concerning connecting procedure and arrangements with ships of NATO countries are to be found in **ATP 16**.

f. **Preparations in Delivering Ship**

Rig reception highpoint or stump mast. Tighten bolts, secure locking nuts on rigging screws.

Provide jackstay with detachable wooden toggle (See note.)

Provide traveller with control pigtail, and a suitable roundsling to act as a traveller holding down strop.

Rig 0246/521-2799 jackstay leading blocks.

Provide inhaul and outhaul. (To assist in the recovery phase of the evolution the outhaul is to be marked at a point 10m from its shackled end. This is achieved by working a piece of red bunting into the lay of the rope at the appropriate spot).

Rig 0246/521-2794 inhaul and outhaul leading blocks.

Provide distance line with an Inglefield clip at each end (zero end to the Guide).

If required: provide telephone line, end-fitted with Inglefield clips and taped to an 8mm MMF line.

Provide test weight.

Provide two marine rescue strops fitted with moused Patt 6103 bow shackles.

Provide 2 spare General Service lifejackets complete with lights and batteries, 2 safety helmets, and Immersion suits if conditions dictate.

Provide RAS bag. A buoyancy aid must be secured to the bag.

Provide Jackstay team of at least 25 men (28 in adverse weather conditions). See also lifesaving equipment matrix in Chapter 7.

If required, provide lightweight stretcher, sling fitted with 6103 bow shackle.

Brief passenger handlers and one other rating to cut the inhaul immediately if the jackstay parts. (Personnel must not be transferred during course alterations).

Complete RAS general preparations given in para 06011.

Note. *When passing a Light Jackstay the procedure is simplified and control made easier if the jackstay is passed to the receiving ship ' through the blocks'. As part of preparations the jackstay is fed through the leading blocks, the inboard end is coiled down and the outboard (grommet) end is left ready to hand. After toggling in, the jackstay is taken in hand by the jackstay party and passed hand over hand to the receiving ship.*

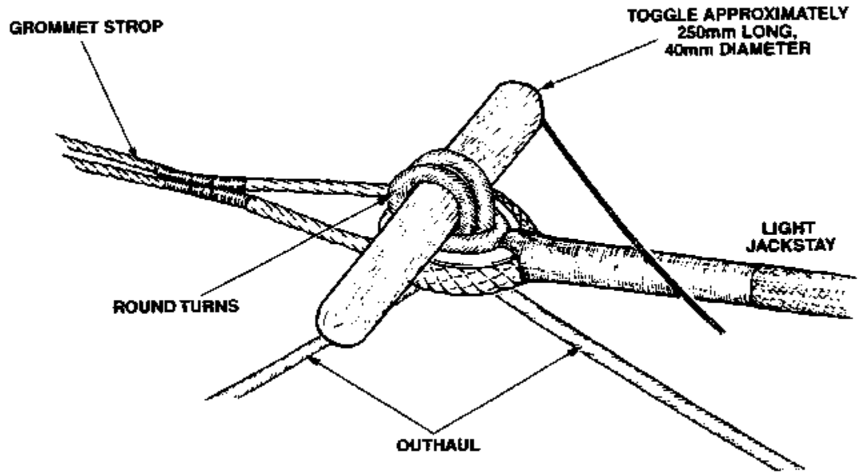


Fig 6-28. Outhaul Toggled to Jackstay

g. **Preparations in Receiving Ship**

Rig reception highpoint or stump mast. Tighten bolts; secure locking nuts on rigging screws.

Rig Patt 0263/414-9747 (F905/99/867-8379 MCMV) slip for jackstay.

Rig 0246/521-2794 inhaul leading blocks. Reeve strayline through blocks from dump to manning position.

Provide 2 marine rescue strops fitted with shackles (as Delivering ship).

Provide 2 safety helmets, 2 spare General Service lifejackets complete with lights and batteries, and Immersion suits if conditions dictate.

Provide RAS bag. A buoyancy aid must be secured to the bag.

Detail a rating to cut the outhaul immediately if the jackstay parts during transfer.

Complete RAS general preparations given in para 06011.

h. **Light Jackstay Transfer Procedures**

(1) *Orders and Signals.* Orders are shown in quotation marks and signals are underlined. Signals and Replies between Delivering and Receiving ships are indicated by (D) and (R) respectively as well as being underlined.

Order/signal	**Response/signal**	**Action**
<u>Red bat</u>	<u>Red bat</u>	During approach, Red bat held aloft in firing ship to indicate dump area and in non- firing ship to indicate position gunline required.
'Prepare the rifle for line throwing' (Safety officer firing ship)		Prepare the rifle iaw **BR 8988**.
<u>One whistle blast</u> (Safety Officer firing ship)		Safety officer in non-firing ship ensures all exposed personnel take cover behind ship's superstructure.
	<u>Two whistle blasts</u> (Safety officer non-firing ship)	
'With a magazine of one round, load' (Safety officer firing ship)		Load the rifle iaw **BR 8988**.
'Make ready' (Safety Officer firing ship)		Make the rifle ready iaw **BR 8988**.
'Fire when ready' (Safety officer firing ship)		Fire the rifle iaw **BR 8988**.
<u>Three whistle blasts</u> (Firing ship)		Safety Officer in non-firing ship orders personnel to break cover and retrieve gunline (using heaving line to recover stray gunlines).
	<u>Three whistle blasts</u> (Non-firing ship)	Signal only given if line is out of reach or lost. Firing ship starts firing sequence again with one whistle blast.
(D) <u>Avast</u> 'Attach outhaul'	(R) <u>Avast</u> 'Avast'	Gunline is held while outhaul is attached in Delivering ship (using additional loose Inglefield clip).

Order/signal	**Response/signal**	**Action**
(D) <u>Heave in</u> ‘Check away outhaul’	(R) <u>Check away</u> ‘Haul in gunline’	Receiving ship hauls in gunline, clearing the surplus from the deck into a large container (bucket) to keep it clear of personnel.
(R) <u>Avast</u>	(D) <u>Avast</u>	Detach gunline and attach bitter end of outhaul to strayline when received.
(R) <u>Check away</u> ‘Haul away outhaul’	(D) <u>Heave in</u> ‘Check away outhaul’	Delivering ship checks away outhaul until next clip is approaching the ship’s side.
(D) <u>Avast</u> ‘Avast - Clip on distance line’	(R) <u>Avast</u> ‘Avast’	Receiving ship stops hauling on the outhaul and Delivering ship stops checking away. Clip on distance line (and telephone line if required) to outhaul.
(D) <u>Heave in</u> ‘Check away outhaul and other lines’	(R) <u>Check away</u> ‘Haul away’	Receiving ship hauls away on strayline/outhaul whilst Delivering ship checks away outhaul and attached lines until Receiving ship has sufficient outhaul in hand.
(D) <u>Avast</u> ‘Avast - toggle in’	(R) <u>Avast</u>	Delivering ship attaches outhaul to the jackstay (Fig 6-28).
<u>(D) Heave in</u>	(R) <u>Check away</u>	Delivering ship pays out jackstay and outhaul well separated in the form of a V. Both lines must be manned.
<u>(R) Avast</u> ‘Avast - Take distance line forward’, (Remove telephone line if supplied)	(D) Avast	Stop heaving outhaul, unclip distance line and take it for’ard. Secure zero end of distance line in the guide. Remove telephone line (if used), take clear and man.
(R) <u>Check away</u> ‘Haul away outhaul’	(D) <u>Heave in</u> ‘Check away jackstay and outhaul’	Delivering ship pays out jackstay and outhaul and receiving ship hauls in outhaul until jackstay strop reaches high point.
(R) <u>Avast</u> ‘Avast, on slip’	(D) <u>Avast</u>	Receiving ship stops hauling in outhaul. Highpointman checks that there are no turns of the outhaul around the jackstay, attaches the slip and mouses the pin with one figure of eight turn of wire.
	‘Check away outhaul’	Check away outhaul until weight is on the slip.

Order/signal	Response/signal	Action
	(R) 'Out toggle'	Remove toggle from jackstay. Check personnel and highpointman clear.
(R) Connected	(D) Connected	
(D) Heave in 'Check away'	(R) Check away 'Haul away outhaul'	Pay out remainder of outhaul until it leads from the Receiving ship directly to the traveller.
(D) Avast 'Avast'	(R) Avast 'Avast'	Receiving ship stops hauling on outhaul. Delivering ship unhooks traveller from the holding down strop.
(D) Tension (jackstay) 'Haul taut jackstay'	(R) Tension (jackstay)	Jackstay party takes down all slack hand over hand and tensions the jackstay. Check rig for turns and correct leads.
(D) De-tension (jackstay) 'walk back jackstay'	(R) De-tension (jackstay)	Jackstay party checks away hand over hand.
(D) 'Avast checking jackstay'		Jackstay party stops checking, but maintains sufficient catenary in jackstay to hook traveller to test weight and to keep jackstay clear of the water.
(D) 'Hook on test weight'		Dump party hooks on test weight and reports when ready.
(D) 'Down slack inhaul'		Inhaul party take down slack to prevent traveller running outboard as jackstay is hauled taut.
(D) Tension (jackstay) 'Haul taut jackstay'	(R) Tension (jackstay)	Jackstay party hauls taut on the jackstay.
(D) Heave in 'Check away inhaul'	(R) Check away 'Haul away outhaul'	Delivering ship checks away inhaul whilst Receiving ship hauls in outhaul. The guardrail handler lowers the temporary guardrail as the load approaches the deck edge, and raises it again as soon as the load has passed. The Receiving ship continues to haul in until the load is over the dump area.
(R) Avast	(D) Avast	Receiving ship stops hauling in on the outhaul and the Delivering ship stops paying out the inhaul. Tension is kept on the outhaul until the load is lowered on deck.

Order/signal	**Response/signal**	**Action**
(R) De-tension (jackstay)	(D) De-tension ‘Walk back jackstay’	Jackstay party checks away until test weight is on deck. (It is not to be unhooked).
	(R)’Down slack’	Receiving ship takes down the slack in the outhaul to prevent load running outboard as jackstay is tensioned.
(R) Tension (jackstay)	(D) Tension ‘Haul taut jackstay’	Jackstay party hauls taut on the jackstay.
(R) Heave in ‘Check away outhaul’	(D) Check away ‘Haul away inhaul’	Receiving ship checks away outhaul while Delivering ship hauls away on the inhaul until load is in the Delivering ship (temporary guardrails are lowered to allow the load to pass).
(D) De-tension (jackstay) ‘Walk back jackstay’	(R) De-tension	Jackstay party checks away until the test weight is on deck. Dump party unhooks test weight and takes it clear of the dump. Transfer continues, repeating this drill, until all personnel and stores are transferred.
(D) Replenishment complete	(R) Replenishment complete	Delivering ship hooks traveller to strop on deck.
(D) Check away ‘Haul away outhaul’	(R) Heave in ‘Check away’	Delivering ship dump party takes the outhaul in hand and hauls in to the 10m mark. (This allows for ship movement during retoggling).
(D) Avast ‘Avast hauling outhaul’	(R) Avast ‘Avast - toggle in’	Delivering ship stops hauling on the outhaul. Receiving ship stops checking outhaul. The Receiving ship dump party takes the outhaul in hand outboard of the toggle position while the highpoint-man toggles the outhaul to the jackstay. When toggled securely the Receiving ship dump party releases the outhaul.
	(R) ‘Haul away’	Receiving ship outhaul party hauls in until the weight is off the slip.
	(R) ‘Off slip’	Highpointman knocks off the slip and clears the highpoint.

Order/signal	Response/signal	Action
(R) <u>Heave in</u> 'Check away'	(D) <u>Check away</u> 'Haul away jackstay - Haul away outhaul'	Delivering ship hauls away on the jackstay with the jackstay party, and on the outhaul with the dump party. (The outhaul is coiled clear of the dump or into a dustbin).
(D) 'Recover distance line'	(R) 'Return distance line'	Batman indicates distance line and signals check away. Distance line party hauls in the distance line while the Receiving ship checks away and finally lets go. Telephone line is returned.
(D) 'Avast hauling jackstay'		Jackstay party stops hauling. Dump party takes up outhaul outboard of toggle and continues hauling away and coiling down. Receiving ship checks away outhaul until strayline is through blocks and over dump area.
(R) <u>Avast</u> 'Avast-remove strayline'	(D) <u>Avast</u>	Receiving ship unclips strayline from outhaul and drops outhaul over ships side.
(D) <u>Check away</u> 'Haul away'	(R) <u>Heave in</u> 'Check away'	Delivering ship hauls in the outhaul until it is inboard. When all lines are clear or recovered, men fall in and face outboard. (Safety officer ensures men are safe in area of struck guardrails).

Notes:

1. Personnel are not to be transferred during 'Corpen November' manoeuvres. The transfer of stores may continue at the Commanding Officer's discretion.

2. Outgoing passengers must be kept clear of the transfer area until required. They must be mustered at a convenient point and fitted with safety helmet and fully inflated General Service Lifejackets. Any luggage should be transferred in the RAS bag. Passengers being fitted with rescue strops are to be kept clear of the rig and only brought forward when required for transfer.

3. Incoming passengers must be unhooked as soon as they arrive on deck. Each passenger is to be taken clear of the dump, to a position where the rescue strop and lifejacket can be removed, and then directed into the ship.

(2) *Emergency Breakaway (see also para 06026).* An Emergency breakaway may be initiated by either ship. As soon as the requirement for an emergency breakaway is apparent the order must be passed between bridge and RAS point and ship to ship. The aim is to disengage as quickly as possible without endangering life and with minimum damage to equipment; coils are not to be thrown overboard as the snatch loading may cause injury to men recovering lines in the Delivering ship; lines that foul must be cut. The quickest way of alerting personnel is to sound six short blasts; however, the executive order to conduct an emergency breakaway must come from the Command. The procedure is as follows:

Ship	**Order**	**Signal**	**Action**
Initiating ship (may be either ship)	'Emergency breakaway'	<u>Prepare for emergency breakaway</u> (other ship acknowledges with: <u>Prepare for emergency breakaway</u>	Initial action depends on position of the traveller: a. If traveller in transit: complete the run, and on arrival unhook the load. b. If traveller is in one or other of the ships: unhook the load and retain.
Delivering ship	'Walk back jackstay'		Jackstay is kept fully de-tensioned, but clear of the water.
Delivering ship	'Ready'	<u>Ready</u>	
Receiving ship			Dump area is cleared. When ordered, highpointman removes the mousing, places the hammer against the inboard face of the buckler link and removes the pin.
Receiving ship	'Ready'	<u>Ready</u>	
Delivering ship	'Execute'	<u>Execute emergency breakaway</u>	
Receiving ship	'Slip'	<u>Execute emergency breakaway</u>	Slip the jackstay.
Delivering ship	'Haul away jackstay - Haul away outhaul'		Delivering ship recovers jackstay and outhaul, (jackstay has priority).
Receiving ship	'Check away outhaul'		Pay out outhaul to end and let go. Cut outhaul if it fouls. Re-rig temporary guardrail.

Notes.

1. Automatically pay back distance line and telephone line when Emergency Breakaway is ordered.

2. Care must be taken when executing Emergency Breakaway with the traveller in the receiving ship as only 6 men will be controlling the weight of the jackstay, outhaul and traveller.

06014. Heavy Jackstay Transfer

The heavy jackstay is used for the transfer of heavy loads of stores including ammunition up to a maximum weight per load of 2 tonnes. The receiving ship arrangements and drills are similar when being supplied from a delivery ship by Fixed Highpoint (Fig 6-29), Moveable Highpoint (Fig 6-30), and GEC Mk 1 and GEC Mk 1A Systems (Fig 6-31). These are referred to as conventional Heavy Jackstay rigs and are described here. Later in this Chapter the Sliding Pad-eye rig is described. In principle the Heavy Jackstay is very similar to the light jackstay rig. The jackstay and the delivering ship's inhaul are worked by winches (the former by an automatic tensioning winch), and the receiving ship's outhaul is worked by the warping drum of a winch, or tailed to a captive drum, or by hand. The standard transfer rate per rig is 20 loads per hour in reasonable weather conditions.

Note. *It is important to ensure that dump and stores parties in receiving ships are properly briefed and prepared for load reception, distribution and preparation of loads for return. Where practical this should entail liaising with STO(N) personnel in the delivering ship prior to the RAS to ascertain precise requirements.*

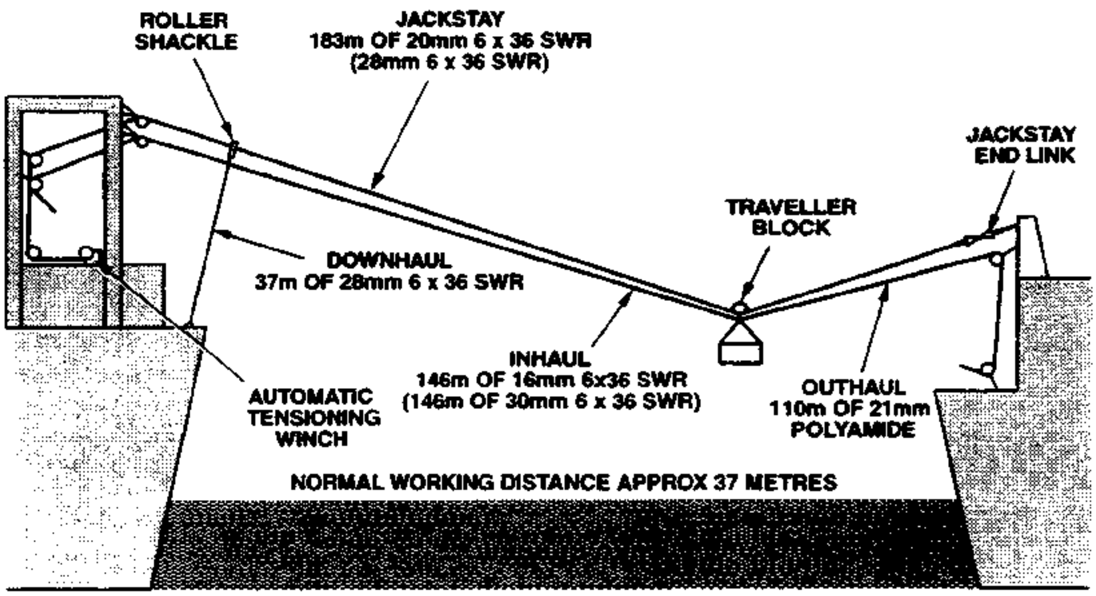


Fig 6-29. Heavy Jackstay Fixed Highpoint Rig

Note. *When this rig is connected to a sliding pad-eye the load can be lowered or raised on the pad-eye as required.*

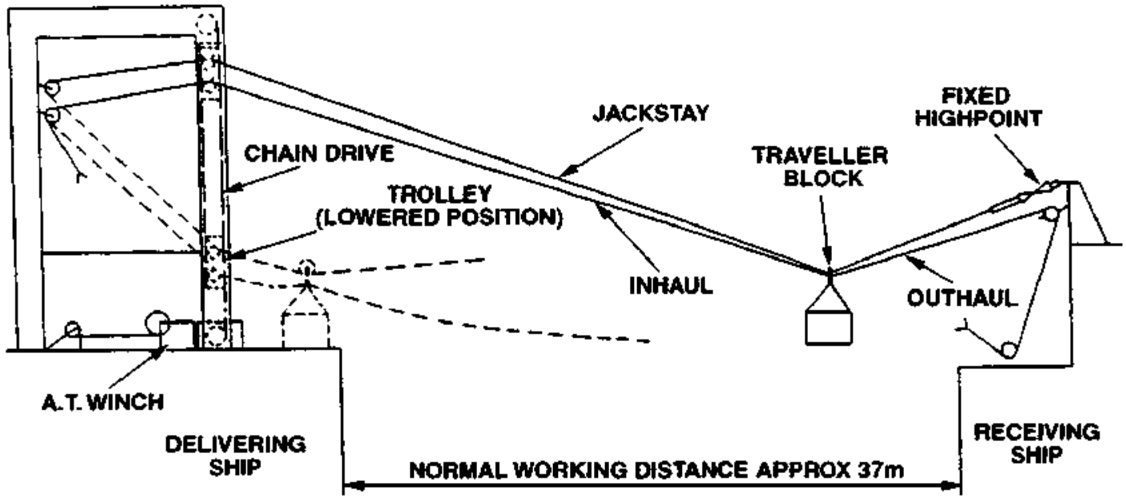


Fig 6-30. Heavy Jackstay Rig Moveable Highpoint Rig

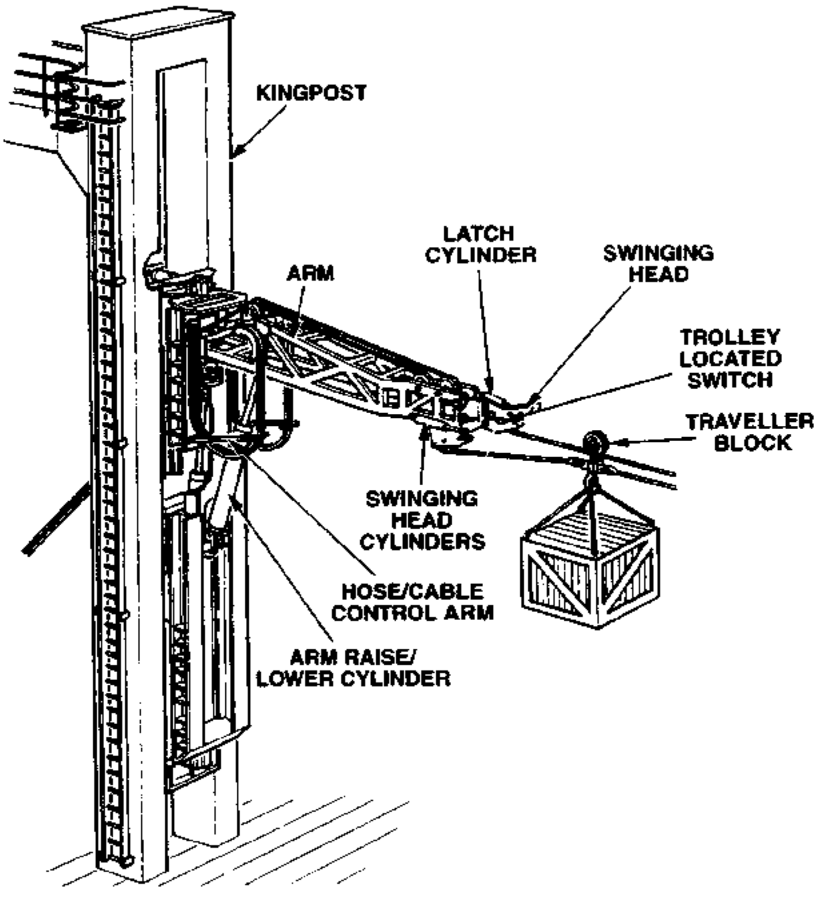


Fig 6-31. GEC Mk 1 and Mk 1A Heavy Jackstay

a. **Preparations (Part 1) in Receiving Ship**

Rig gantry, tripod or stump mast in accordance with 'As-fitted' drawings. Screw up shackles fully and mouse; tighten nuts and bolts; secure rigging screws with locking nuts. Fit Patt 0263/414-9835 slip with Patt 0263/721-6096 straight shackle to the correct eyeplate, or rig QRD and provide 16mm polypropylene line of suitable length (see note on page 6-28).

Rig leading blocks Patt 0256/521-2796 with Patt 0263/721-6093 shackles to take outhaul. Reeve strayline from dump area through leading blocks to winch/capstan/captive drum.

Provide probe retaining pendant (see page 6-31). In the event of the gripper sliding to the jackstay terminal link, hook the retaining pendant to the jackstay terminal link and secure the free end of the pendant inboard to hold the jackstay whilst the gripper is reset at the appropriate distance.

Rig straylines for distance line, and telephone cables and messenger if required.

Provide jackstay control line(s).

Check power is on capstan, winch or captive drum, and test for correct operation.

Detail stores party and plan storing routes.

Follow immediately with Part 2 Preparations given in para 06011.

Notes:

1. In ships with slow capstans or winches it may be preferable to work the outhaul by hand. In such cases it is essential that sufficient hands are detailed for the task.

2. When using a captive drum the 'Heave in' signal should not be given until the winch control lever is set to 'Free'. Paying out the outhaul must be carefully controlled on the brake.

3. Once the jackstay is tensioned prior to a load being passed from the Delivering ship it is permissible to remove the turns of the outhaul from the capstan/warping drum and haul it in by hand if the angle allows. The outhaul must be brought to once the load is inboard and before the de-tension signal is passed to the Delivering ship; this is to prevent the load carrying outboard as the jackstay is de-tensioned.

4. When unhooking loads the outhaul must be adjusted to enable the traveller to be easily unhooked by the dump party.

5. Care must be taken to ensure the load is not supported by excessive tension in the inhaul and outhaul.

6. A Messenger will not be passed unless the OPSTAT RAS specifies there is a requirement.

b. **Safety**

Personnel must not stand beneath the load, or between the load and the deck edge or ship's superstructure. Nor must they manhandle the load as it is being lowered.

Five hands (including the truck driver) are required to control a heavy load being moved by pallet truck.

Keep all lines free for running and ensure personnel stay clear of bights.

Do not allow hands to work across the jackstay or lean over the traveller whilst hooking on/unhooking loads.

On occasions when the jackstay control line is used it should, wherever possible, be passed between the load and the highpoint, never outboard of the load.

Hands should not stand in the vicinity of stump mast guys longer than is necessary to complete essential tasks.

c. **Sequence of Orders (in quotation marks) and Signals (underlined)**

Order	**Signal**	**Action**
	<u>Red Bat</u>	During approach, Red bat held aloft in firing ship to indicate dump area and in non-firing ship to indicate position gunline is required.
'Prepare the rifle for line throwing' (Safety Officer firing ship)		Prepare the rifle iaw **BR 8988**.
<u>One whistle blast</u> (Safety Officer firing ship)		Safety Officer in non-firing ship ensures all exposed personnel take cover behind ships superstructure.
	<u>Two whistle blasts</u> (Safety Officer non-firing ship)	
'With a magazine of one round, load' (Safety officer firing ship)		Load the rifle iaw **BR 8988.**
'Make ready' (Safety officer firing ship)		Make the rifle ready iaw **BR 8988.**
'Fire when ready' (Safety Officer firing ship)		Fire the rifle iaw **BR 8988**.
<u>Three whistle blasts</u> (Safety officer firing ship)		Safety Officer in non-firing ship orders men to break cover and retrieve gunline (using a heaving line to recover stray gunlines).
	<u>Three whistle blasts</u> (Safety Officer non firing ship)	This signal is only given if gunline is out of reach or lost. Firing ship starts sequence again with one whistle blast.

Order	Signal	Action
'Haul away'	Check away	Receiving ship hauls in the gunline, clearing the surplus from the deck into a large container (bucket) to keep it clear of personnel.
'Avast hauling'	Avast	When the outhaul comes to hand detach gunline and attach bitter end of outhaul to the strayline.
'Haul away'	Check away	Continue hauling in until the distance line is inboard.
'Avast hauling'	Avast	Stop hauling. Unclip distance line, telephone lines and, if applicable, the messenger. Pass them to their respective parties (using straylines if necessary).
'Haul away'	Check away	Haul in the outhaul and coil it down on the other side of the winch or capstan until the weight of the jackstay is on the outhaul.
'Avast hauling'	Avast	Stop hauling.
'Bring to'		Bring outhaul to winch/capstan with three turns.*
'Heave in'	Check away	Heave in until the jackstay terminal link is within reach of the slip/QRD.
'Avast heaving'	Avast	Stop heaving and cut the stop(s) securing the terminal link to the outhaul.
'Pass the control line'		(Optional order depending on weather conditions). Pass control line over the jackstay to prevent violent movement.
'On slip'		Highpointman checks for turns, then places terminal link onto slip/QRD. The pin is inserted and moused with one figure of eight turn; the remaining stops are then cut.
'Veer'		The outhaul is veered until the weight of the jackstay is taken on the slip/QRD and the outhaul becomes slack.

Order	**Signal**	**Action**
'Avast veering-Off Gripper'		Gripper is released from jackstay and untoggled from the outhaul. It is taken clear of the dump but kept available to be passed back on the first available free traveller. Highpointman clears highpoint.
'Off control line'		If used - control line is removed Dump party stand clear.
'Connected'	<u>Connected</u>	Informs Delivering ship jackstay is secured to slip/QRD.
'Off turns, Haul away'	<u>Check away</u>	Haul in outhaul until all slack is taken down.
'Avast'	<u>Avast</u> Repeated by RS	Order given by Delivering ship.
	<u>Tension</u> Repeated by RS	Delivering ship tensions jackstay to check for turns and correct leads.
	<u>De-tension</u> Repeated by RS	Delivering ship de-tensions jackstay then hooks on test weight.
	<u>Tension</u> Repeated by RS	Delivering ship tensions jackstay.
'Bring to' (See notes)		Outhaul is brought to winch/capstan with three turns.*
'Heave In' (See notes)	<u>Check away</u>	As outhaul is hove in it must be coiled down free for running (or into a dustbin).
'Down temporary guardrail'		Temporary guardrail is lowered to allow test weight to pass inboard.
'Up temporary guardrail'		When test weight is inboard temporary guardrail is raised.
'Avast heaving'	<u>Avast</u>	Stop heaving in the outhaul but keep it under tension.
	<u>De-tension</u> Repeated by DS	As jackstay is de-tensioned the test weight is lowered to the shot mat. No attempt should be made to steady or unhook it.

Order	Signal	Action
'Tension jackstay'	Tension Repeated by DS	Delivering ship tensions jackstay.
'Reduce to one turn on the outhaul'		Outhaul is reduced to one turn on winch/capstan.*
'Down temporary guardrail'		Temporary guardrail is lowered.
'Surge outhaul'	Heave in	Delivering ship heaves in on inhaul and recovers test weight. Outhaul is surged on winch/capstan.
'Up temporary guardrail'		Temporary guardrail is tensioned when test weight has passed outboard. Remove shot mat from deck, clear dump area on completion.
'Avast surging outhaul'	Avast	Keep outhaul slack but clear of the water.
	De-tension Repeated by RS	Delivering ship de-tensions jackstay until test weight is on deck. It is unhooked and the transfer proceeds. The first load will be pallet trucks and package notes and the evolution continues until all stores have been transferred and pallets and pallet trucks returned to the delivering ship. (Pallets and pallet trucks must be returned separately). The gripper is to be returned on the first available free traveller.
'Replenishment complete'	Replenishment complete (May be given as last load returns to DS)	Delivering ship removes last load from traveller, then unhooks and recovers the outhaul.
'Check away'	Heave in	Check away outhaul until outboard end of strayline is at the dump.
'Avast, remove strayline'	Avast	Stop checking outhaul and disconnect the strayline. The bitter end of the outhaul is held aloft before being cast overboard.
'Man the highpoint'	Prepare to trip Pelican hook (DS) (copied by RS)	When ordered, highpointman removes the mousing, places the hammer against the inboard face of the buckler link and removes the pin.
'Clear the dump, down temporary guardrail'		Dump is cleared then temporary guardrail is lowered.
	Ready to trip Pelican hook (RS)	Signal given when ready.

Order	Signal	Action
	Trip Pelican hook (DS) (copied by RS)	
'Slip'		Jackstay is slipped.
'Up temporary guardrail'		Temporary guardrail is raised immediately the jackstay has passed outboard.
'Return distance line/telephone cables'	Indicate lines mentioned and signal Heave in	Pay out distance line and telephone cables to their bitter end and let go. These lines can be returned earlier if approved by the Captain.

*Not applicable to captive drum fitted ships.

Emergency breakaway (see also para 06026)

An Emergency breakaway may be initiated by either ship. As soon as the requirement for an emergency breakaway is apparent the order must be passed from Bridge to RAS point and from ship to ship. The aim must be to disengage as quickly as possible without endangering life and with minimum damage to equipment; coils are not to be thrown overboard as the snatch loading may cause injury to men recovering lines in the Delivering ship; lines that foul must be cut. The quickest way of alerting personnel is to sound six short blasts; however, the executive order to conduct an emergency breakaway must come from the command. The procedure is as follows:

Ship	Order	Signal	Action
Initiating ship (may be either ship)	'Emergency breakaway'	Prepare for Emergency breakaway (other ship acknowledges with Prepare for emergency breakaway)	Telephone cables, distance line and messenger are automatically returned.
			The traveller is returned to the Delivering ship by the quickest means. If the traveller is on its way into the receiving ship, the delivering ship is to avast checking away on the inhaul. The receiving ship must stop hauling on the outhaul, remove turns from the winch, then give the Ready signal. (In ships using a captive drum, the control lever must be set to 'Free' before the Ready signal is given)

Ship	Order	Signal	Action
Receiving ship	‘Ready’	Ready	Given when turns are removed and it is safe for the delivering ship to recover the load.
Delivering ship			Recovers the load, de-tensions the jackstay then unhooks the load.
Delivering ship	‘Ready’	Ready	
Receiving ship			As jackstay detensions, highpointman removes the mousing, places the hammer against the inboard face of the buckler link and removes the pin.
‘Clear the dump, down temporary guardrail’			Dump area is cleared then temporary guardrail is lowered.
Delivering ship	‘Execute’	Execute Emergency breakaway	As soon as both ships are ready:
Receiving ship	‘Slip’	Execute Emergency breakaway	Slip the jackstay.
Receiving ship	‘Up temporary guardrail’		The temporary guardrail is immediately set up.
Receiving ship	‘Check away outhaul’		Pay back outhaul quickly, keeping it under control if possible. If the outhaul is attached to a captive drum, it must be unclipped, or the tail cut.

06015. Sliding Pad-eye Rig

The Sliding Pad-eye Rig (Fig 6-32(I)) is fitted in RFAs FORT VICTORIA and FORT GEORGE. It is designed to operate using a permanently tensioned jackstay between 2 sliding pad-eye attachment points, with a multi-sheave latched trolley assembly allowing the Delivering ship to traverse the traveller back and forth on the wire jackstay. The sequence for connecting-up the rig is shown in Fig 32(ii). The rig can be connected to a fixed heavy jackstay reception point, in which case a cargo drop-reel (CDR) is used (see para 06016). The following drills have been written for a Type 23 using a sliding pad-eye reception point. However, Type 42s operating the rig from their retractable stump-mast can utilise the drills by substituting the words 'pad-eye' with 'stump-mast'. Fig 32(iii) shows the rig connected to a retractible stump-mast. Ships operating the rig from a fixed highpoint and therefore using a CDR should follow the operating procedures for connecting and disconnecting the rig at para 06016. The distance line, telephone lines and messenger are passed and dealt with as for the conventional heavy jackstay rig. Notes for the Delivering ship are given at the end of these drills.

CAUTION

1. WHEN USING A CARGO DROP REEL (CDR) NO ATTEMPT SHOULD BE MADE TO LOWER THE TEST WEIGHT TO THE DECK.

2. THE CDR WEIGHS 0.5 TONNES. THEREFORE THE TRANSFER LOAD MUST NOT EXCEED 1.5 TONNES

3. BACK-RASING LOADS OVER 68 KGS USING THE CDR IS NOT POSSIBLE IN CERTAIN CLASSES OF SHIP - CHECK WITH DELIVERING SHIP.

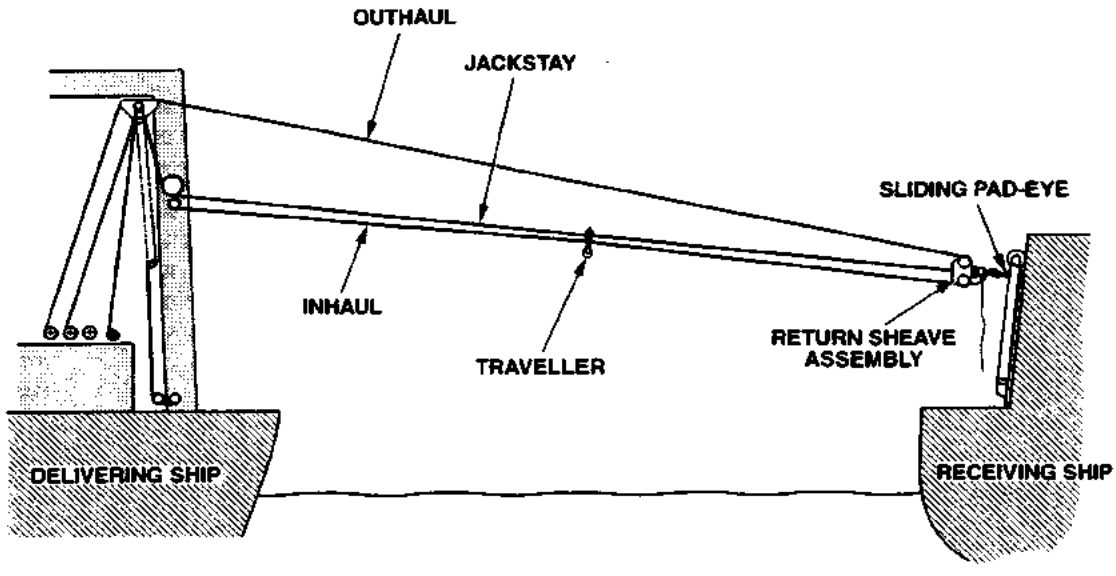
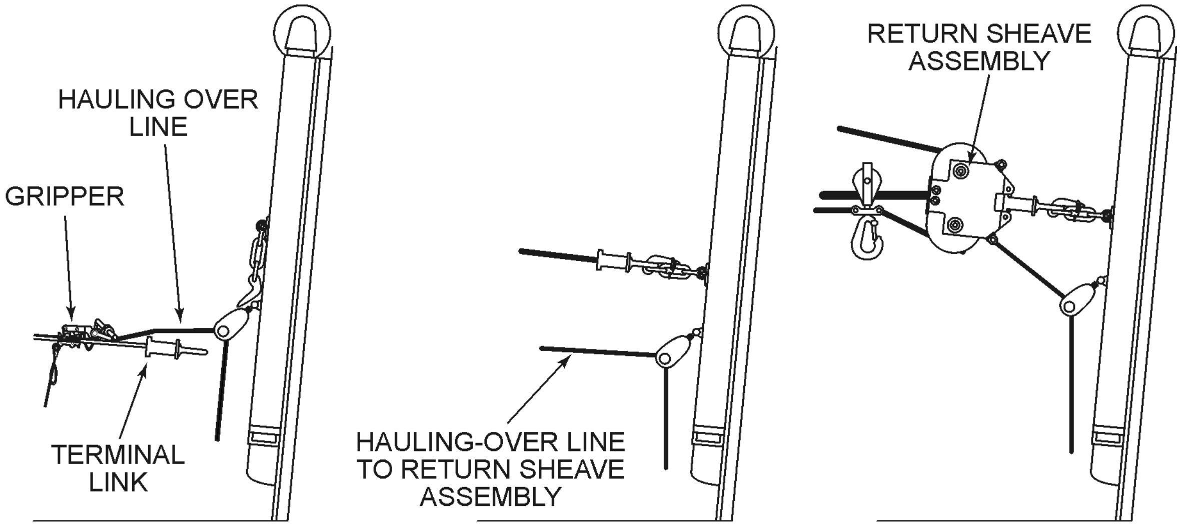


Fig 32(i). Sliding Pad-eye Rig - General Arrangements



(a)	(b)	(c)
The jackstay being hauled across on the hauling-over line	Terminal link connected to the slip	Return Sheave Assembly mated with the terminal link

Fig 32(ii). Sliding Pad-eye Rig - Connecting-up Sequence

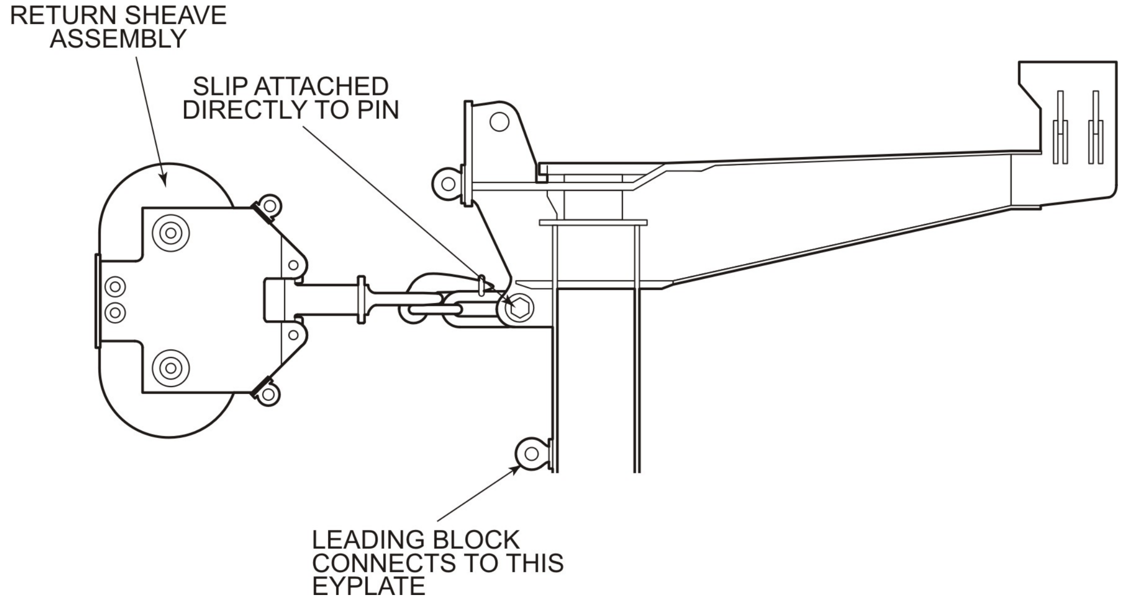


Fig 32(iii). Sliding Pad-eye Rig Connected to a Retractable Kingpost in a Type 42

***Note**. In most cases the pin that attaches the slip to the Kingpost of a Type 42 is a nut and bolt arrangement, with the bolt drilled to take a split-pin that locks the bolt in position. However, in certain ships the for'ard cheek of the pin recess has been threaded and the pin is screwed directly into this. Eventually all Type 42s will be fitted with the nut and bolt arrangement, meanwhile ships fitted with the latter method must ensure the pin is tightly screwed home, and it must be regularly checked throughout the RAS to ensure it is not working loose.*

a. **Preparations (Part 1) in Receiving Ship**. Preparations are similar to those described for the conventional Heavy Jackstay rig, except that a 16mm polypropylene easing-out rope is required for disengaging the rig, and the probe remating line must be available should the Return Sheave Assembly (RSA) accidentally disengage from the terminal link after the hauling-over line has been returned. Once the rig is set up there is no requirement for an inhaul party because the Delivering ship controls both the inhaul and outhaul. For the purpose of setting up the rig a hauling-over line takes the place of an outhaul. When rigging for replenishment from the kingpost in Type 42s the 6096 shackle must be removed from the 9835 slip and the slip is to be bolted directly to the stump-mast (see Fig 6-32(iii)). This allows the traveller to be brought far enough inboard to enable a Seadart container to line up with the silo rails.

b. Ships operating Sliding Pad-eyes fitted with the Probe Base Plate to permit probe refuelling are to use the Swivel Joint Adapter (F217-514-9334) attached to the Swivel Arm Joint when rigging the QRD. This allows ships to conduct Heavy Jackstay and Jackstay fuelling from the Sliding Pad-eye

***Notes**:*

1. A Messenger will not be passed unless the OPSTAT RAS specifies there is a requirement.

2. When setting up or disengaging the rig the pad-eye in the Receiving ship should be positioned at a convenient height for handling the equipment. When loads (or the test weight) are being traversed the pad-eye should be in the fully raised position. Operation of the temporary guardrail during the connecting up and transfer phase is as and when required; it is specifically referred to in the disengaging phase. The drill procedures given below are written for the Receiving ship (RS). References to the Delivering ship are indicated by the suffix (DS).

Order	Signal	Action
<u>Red bat</u>	<u>Red bat</u>	During approach red bat is held aloft in firing ship to indicate dump area and in non-firing ship to indicate position gunline required.
‘Prepare the rifle for line throwing’ (Safety Officer firing ship)		Prepare the rifle iaw **BR 8988**.
<u>One whistle blast</u> (Safety Officer firing ship)		Safety Officer in non firing ship ensures all exposed personnel take cover behind ship’s structure.
	<u>Two whistle blasts</u> (Safety Officer non-firing ship)	
‘With a magazine of one round, load’ (Safety officer firing ship)		Load the rifle iaw **BR 8988**.

Order	Signal	Action
'Make ready' (Safety officer firing ship)		Make the rifle ready iaw **BR 8988**.
'Fire when ready' (Safety Officer firing ship)		Fire the rifle iaw **BR 8988**.
Three whistle blasts (Safety Officer firing ship)		Safety Officer in non-firing ship orders personnel to to break cover and retrieve gunline (using heaving line to recover stray gunlines).
	Three whistle blasts (Safety Officer non-firing ship)	This signal is only given if line is out of reach or lost. Firing ship start firing sequence again with one whistle blast.
'Haul away'	Check away	Receiving ship hauls in gunline, clearing the surplus from the deck into a large container (bucket) to keep it clear of personnel.
'Avast Hauling'	Avast	When hauling-over line comes to hand detach gunline and attach bitter end of hauling-over line to strayline.
'Haul away'	Check away	Continue hauling in until the distance line is inboard.
'Avast Hauling'	Avast	Stop hauling. Unclip the distance line, telephone lines and messenger. Pass lines to appropriate parties (using straylines if necessary). Do not lead the lines across the rig. Take the distance line to a position in clear view of the bridge and haul taut. Haul in approximately 15m of messenger and keep it clear of the water.
'Haul away'	Check away	Haul in the hauling-over line and coil it down adjacent to the winch ready to bring to when the weight of the jackstay is on the line.
'Avast hauling'	Avast	Stop hauling.
'Bring to'		Bring the hauling-over line to the winch using three turns.*
'Heave in'	Check away	Heave in until the jackstay terminal link is within reach of the slip/QRD.
'Avast heaving'	Avast	Stop heaving.

Order	Signal	Action
'Pass the control line'		(Optional order depending on weather conditions). Pass control line over the jackstay to prevent violent movement. Cut the stops securing the terminal link to the hauling-over line (having first checked for turns).
'On slip'		Highpointman checks again for turns, then places terminal link, the correct way up, onto slip. (The top of the terminal link is marked 'Top'). Insert the slip pin and mouse it with one figure of eight turn, then cut the remaining stops.
'Veer'		The hauling-over line is veered until the weight of the jackstay is taken on the slip and the hauling-over line becomes slack.
'Avast veering-off Gripper'		Gripper is released from jackstay and untoggled from the hauling-over line. It is taken clear of the dump but kept available to be passed back on the first available free traveller. Highpointman clears highpoint.
'Off control line'		If used - control line is removed. Dump party stand clear.
'Connected'	<u>Connected</u> Repeated by DS	Informs Delivery ship jackstay is secured to slip.
	<u>Tension</u> Repeated by DS	Delivering ship ensures that the hauling-over line and jackstay have no turns round each other, then tensions the jackstay and raises her Sliding Pad-eye.
'Heave in'	<u>Check away</u>	Delivering ship checks away on the outhaul, allowing the Return Sheave Assembly (RSA) to ride down the jackstay and mate with the terminal link latching mechanism. The Receiving ship must maintain a steady, but not excessive, pull on the hauling-over line throughout the traversing of the RSA.

Order	Signal	Action
	Tension Repeated by DS	This signal is given when the OIC judges the RSA has mated with the terminal link (the release lever falls then rises as the mating occurs but this movement is slight and is not always apparent). Before giving the signal the Receiving ship must remove the hauling-over line from the warping drum and light to, or veer sufficient slack from the captive drum, to allow the hauling-over line to run free if the RSA has not mated correctly. The Delivering ship tensions the outhaul to prove the RSA has mated correctly. If the RSA pulls free from the terminal link the return sheave must be checked to see if it needs re-setting (see notes 1 and 2 below). Once re-set the assembly is to be passed as detailed above.
'Mating confirmed'	Connected Repeated by DS	This signal is given to confirm a successful mating between the RSA and the terminal link.
'Disconnect the hauling over line'		Disconnect the hauling-over line and prepare it for return on the first available traveller. Ensure release lanyards are stopped and clear of any snagging hazards, they are to be available for use at short notice if required..
'Raise the pad-eye'		Receiving ship raises pad-eye to a suitable height ready to receive traveller.
	Check away	Delivering ship traverses traveller block to Receiving ship.
	Avast	This signal is given when the empty traveller block is in its ideal position for subsequent load drops in the dump area. If the traveller stops in the wrong position it must be adjusted by giving the Heave in or Check away signal followed by the Avast signal until an accurate marking has been achieved; the red bat is then held aloft.

Order	Signal	Action
'Traveller block in correct position'	Red bat (held aloft)	This signal informs the Delivering ship that the traveller is correctly positioned. The Delivering ship acknowledges this signal, enters the position in the rig computer, then recovers the traveller and engages the automatic distance mode. On completion of this procedure the rig will operate in the automatic mode, and stop the traveller at the correct position each time.
	Heave in(DS)	This signal is given by the Delivering ship to indicate that the traveller is being sent over to check that the automatic distance mode is operating correctly. The traveller should stop at the marked position over the dump area of the Receiving ship.
	Red bat (held aloft)	Indicates to the Delivering ship that the traveller has stopped at the correct position. If further adjustment to the position of the traveller is required the procedure described for initially establishing its position should be followed. When the red bat is held aloft the Delivering ship will recover the traveller, hook on the test weight and raise her pad-eye.
'Raise the pad-eye'		Raise the pad-eye to its full height.
	Heave in (DS)	Given by Delivering ship to indicate test weight is traversing. The test weight will automatically stop over the dump area.
'Lower pad-eye'		Lower the pad-eye until test weight rests on the deck. Do not unhook test weight from traveller.
'Raise pad-eye'		When pad-eye is raised in the correct position the return of the test weight can proceed.

Order	Signal	Action
	Heave away	Delivering ship recovers test weight. The test weight will automatically stop over the Delivering ship's dump area. Delivering ship lowers the pad-eye and unhooks the test weight. The replenishment now proceeds.
'Return the hauling over line'		Hauling over line to be returned with the gripper on the first available traveller.
	Disengaging	
	RAS complete (copied by DS)	Delivering ship removes last load from traveller then de-tensions the outhaul.
'Lower pad-eye'		Pad-eye is lowered.
'Release the Return Sheave Assembly'		This order is given when the outhaul is seen to go slack. The release lanyards are to be placed through the terminal link lanyard guide. Pull the yellow lanyard to release the safety "R" clip. The release "R" clip (blue) is now ready to be operated. When ready release the RSA by pulling the Blue lanyard.
	Heave in(DS)	The RSA is pulled clear of the terminal link by the Delivering ship. Once the RSA is in the Delivering Ship the jackstay it is then de-tensioned. Coil and stop back the release lanyards to the terminal link.
'Man the highpoint'	Prepare to trip Pelican hook (DS) (copied by RS)	When ordered, highpoint man removes the mousing, places the hammer against the inboard face of the buckler link and removes the pin.

Order	**Signal**	**Action**
'Clear the dump, down temporary guardrail'		Dump is cleared of personnel and temporary guardrail is lowered.
	Ready to trip Pelican hook (RS)	Signal given when ready.
	Trip Pelican hook (DS) (copied by RS)	
'Slip'		Jackstay is slipped.
'Up temporary guardrail'		Temporary guardrail is raised.
		Pay out distance line and telephone cables to their bitter end and let go. (These lines can be returned earlier if required).
* Not applicable to ships fitted with a captive drum.		

Notes:

1. If the return sheave assembly fails to mate, (indicated by the inner levers opening) it is to be returned to the Delivering ship to be re-set.

2. Care is to be taken at this stage with the control of the hauling over line. The Receiving ship must ensure that the hauling over line remains slack but clear of the water at all times.

EMERGENCY BREAKAWAY PROCEDURE (see also para 06026)

An Emergency breakaway may be initiated by either ship. As soon as the requirement for an emergency breakaway is apparent the order must be passed from Bridge to RAS point and from ship to ship. The aim must be to disengage as quickly as possible without endangering life and with minimum damage to equipment; coils are not to be thrown overboard as the snatch loading may cause injury to men recovering lines in the Delivering ship; lines that foul must be cut. The quickest way of alerting personnel is to sound six short blasts; however, the executive order to conduct an emergency breakaway must come from the command. The procedure is as follows:

Order	Signal	Action
Either ship 'Emergency Breakaway'	Initiating Ship <u>Prepare for Emergency Breakaway</u>. Other ship acknowledges signal with: <u>Prepare for Emergency Breakaway.</u>	The initial action is for the Delivering ship to recover the traveller, and load if it is hooked on. This may involve stopping the traveller on an outboard run. If the traveller is on the deck in the Receiving ship with the load hooked on, the pad-eye must be raised and the <u>Heave in</u> signal given before continuing with the <u>Prepare for Emergency Breakaway</u> signal. Receiving ship prepare lanyards once own dump area is clear.
	Both ships continue signalling <u>Prepare for Emergency Breakaway</u>	Delivering ship recovers the load and/or traveller, then de-tensions the outhaul. As soon as this is observed the Receiving ship unhooks the preventer from the terminal link and releases the RSA as described earlier.
	<u>Ready for Emergency</u> Breakaway (RS)	As the Delivering ship is recovering the RSA, dump area is cleared, highpointman removes the mousing and pin from the slip, places the hammer against the inboard face of the buckler link and removes the pin. Lower the temporary guardrail.
	<u>Ready for emergency breakaway (DS)</u>	The Delivering ship only gives this signal once the above procedures have been carried out.

Order	Signal	Action
'Slip'	Execute emergency breakaway (DS)	As soon as both ships are ready.
	Execute emergency breakaway (RS)	The Receiving ship slips the jackstay, then raises the temporary guardrail.

Note. *Automatically pay back distance and telephone lines when emergency breakaway is ordered. Fouled lines are to be cut.*

Notes for the Delivering ship:

1. When operating this rig it is likely that a regular requirement to communicate dump-to-dump will arise, either to request a specific action that is not covered by conventional bat signals, or to offer guidance and advice. It is therefore advisable to pass two telephone lines; bridge-to-bridge and dump-to-dump.

2. Receiving ships operating this rig from a fixed high-point have great difficult retrieving the operating lanyards of the gripper, RSA release and cargo drop reel if the lanyards are stopped up in hanks. In such circumstances the Delivering ship should ensure that all these lanyards hang free, and are of sufficient length to be easily taken in hand in the dump area of the Receiving ship.

06016. Cargo Drop Reel Traveller. The Cargo Drop Reel Traveller (CDRT) is a self contained spring loaded winch used for transferring heavy stores from a delivering ship fitted with a Moving Highpoint System to a receiving ship fitted only with a fixed highpoint facility. It consists of the main self contained winch attached to the Jackstay by way of a gate and rollers with the inhaul and outhaul wires attached to the respective ends of the winch. The hook is held on the underside of the winch by its own wire and has a locking chain which can be passed through the hook (rigged by the delivering ship),and pinned in place. Additionally, the operating lever has a lanyard attached so that the winch can be operated. The CDRT itself weighs 0.5T, therefore only a 1.5T test weight or load can be passed. Although heavy loads can be transferred from the delivering ship, the CDRT is restricted to a 68kg back RAS facility (para 06015 refers).

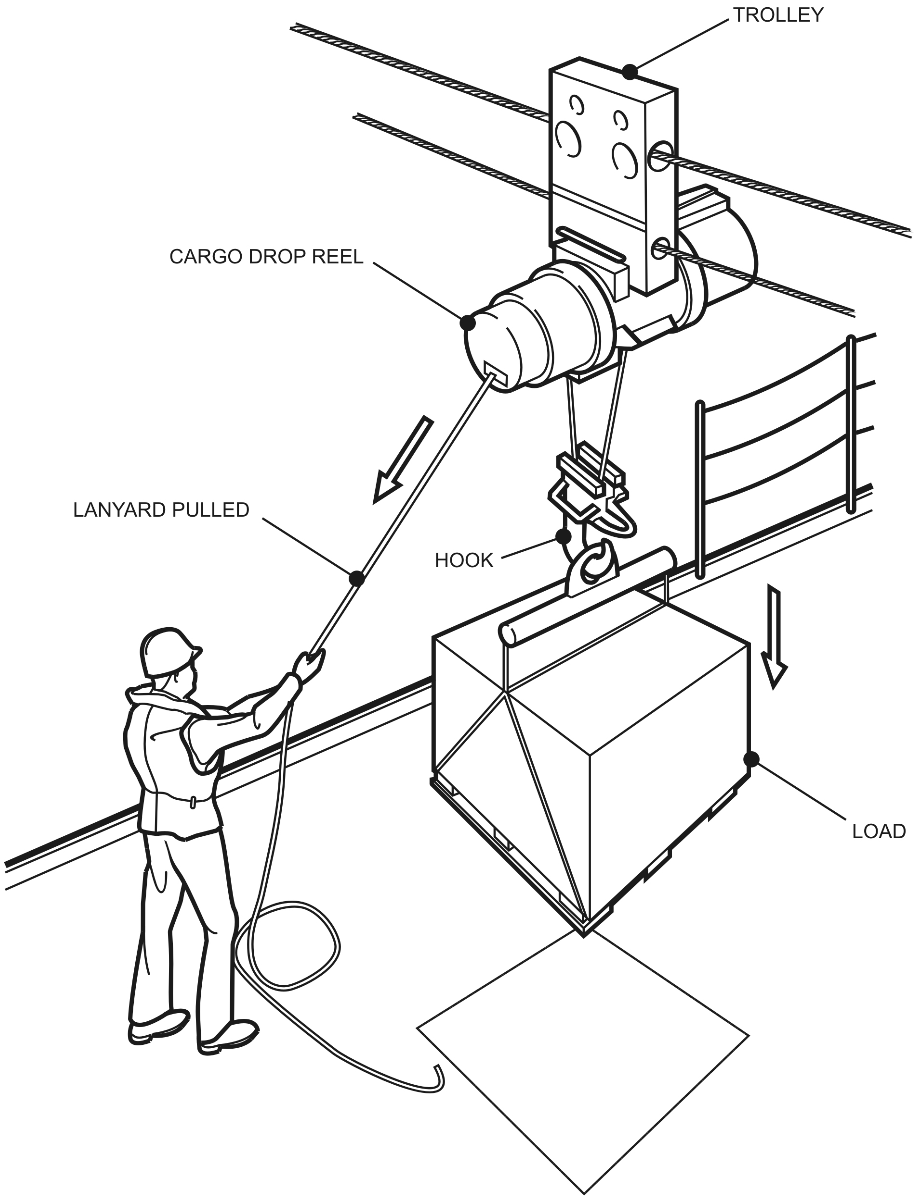


Fig 6-32(iv). Cargo Drop Reel Traveller

Operation

a. The rig is set up in the way it would be to a moveable highpoint, up to and including the passing of the test weight. It is recommended that a block is rigged above the slip so that a line can be attached to the terminal link. This will allow personnel on deck to assist the highpoint man in attaching the terminal link to the ship by holding the weight.

b. The test weight will be sent with the operating lever release lanyard wrapped around the winch. Under no circumstances is the test weight to be landed as the winch will not be able to pick the weight back up.

c. When the first load is sent the operating lever release lanyard will be hanging underneath the winch. When the load is above the dump area (in the receiving ship), the dump party are to give one sharp pull on th operating lanyard. This will release the pin in the hook safety chain. The safety chain will fall clear and remain attached to the winch by a shackle.

d. The operating lanyard will now be hanging directly underneath the operating lever. Two members of the dump party are to pull down on the release lanyard and maintain the downward pull. This will operate the winch in its first phase and lower the hook.

e. When the load is on deck, two personnel are to be sent into the dump area to apply weight to the hook until there is sufficient slack for the load to be removed from the hook.

f. At this point the operating lanyard is released. This will operate the winch in its second phase and apply the brake leaving the hook suspended over the load. The load can now be removed from the hook and taken clear of the dump area.

g. If there are no back loads for transfer the operating lanyard is to be pulled down. This will operate the winch in its third phase and retract the hook back into the winch. When the hook hits the base plate on the winch the operating lanyard is to be released. This will operate the winch in its final phase and apply the brake.

h. The winch is then sent back to the delivering ship using the standard bat signals, leaving the operating lanyard hanging below the winch. The safety chain does not have to be rigged by the receiving ship.

i. The above procedures are then repeated until the RAS is complete.

Note 1. *It is important that personnel are sent into the dump area to pull down on the hook when the load has landed on the deck, to get sufficient slack so that the load can be unhooked. If the lanyard is released before sufficient slack in the wire is obtained it will operate the winch in its second phase and apply the brake. On pulling the lanyard again it will operate in its third phase and retract the hook with the load still attached.*

Note 2. *Personnel may be required to enter the dump area and physically assist the hook in retracting the return load to the winch.*

Note 3. The delivering ship is to attache a round sling or lanyard to the hook so that the hook can be pulled down in the receiving ship if no load is attached. This applies to return loads and when returning HPT's at the end of the RAS.

06017. Vertical replenishment (Vertrep)

In this section a broad outline of the Vertrep method as it affects the seaman is described. The concept, planning, and details of helicopters and equipment are covered in Chapter 9 of **ATP 16**.

a. **Planning a Vertrep.** Prior to a major replenishment operation, representatives from the ships concerned usually meet on board one of the ships. At this meeting the numbers and types of helicopters to be used, radio frequencies, and order, description and type of stores to be transferred are discussed.

b. **Command and Control Organisation.** This organisation, which covers such aspects of the Vertrep as the duties of the Vertrep control officer, helicopter director and Vertrep supply officer, and the control of helicopters, is fully described in **ATP 16**.

c. **The Supplying Ship.** Aboard the supplying ship (store ship) preparations for a Vertrep operation may commence several days in advance of the replenishment. Delivery sequences are planned to allow proper breaking out of stores; this planning is very important because of the diversity of loads, for example the time that frozen foods can be handled out of refrigeration is strictly limited.

d. **Preparations in the Receiving Ship.** To ensure a smooth Vertrep operation the receiving ship must make the following preparations and checks:

(1) The command and control organisation must be fully understood.

(2) Men with key tasks must be fully briefed.

(3) Sufficient men and equipment must be made available to handle the transferred loads (see note below).

(4) An organisation must be set up for striking down stores and returning empty pallets.

(5) Establish the **Vertrep Drop Zone** in accordance with **ATP 16** and ensure that the area is clear of moveable obstructions. Unship ensign staffs and jackstaffs, lower safety nets (if fitted), provide communications (including hand bats or fireball gloves for aircraft marshalling signals) and provide a fire party equipped with the means of making foam.

(6) Prepare the seaboat as a crash boat.

(7) Provide an earthing pole (described later).

Note. *Men engaged in moving stores to or from the drop zone must wear safety helmets, protective goggles, ear defenders and hazardous duty lifejackets, and their arms and legs must be covered.*

e. **Equipment.** RN helicopters normally carry loads in nets or pallets which may be used in conjunction with an extension strop, suspended from a **cargo release unit** (cargo hook) beneath the aircraft. The cargo release unit may be an integral part of the airframe or, more commonly, may be suspended on four slings beneath the aircraft. All types of cargo release unit are provided with facilities for :

(1) Electrically controlled release of the load by the aircrew

(2) Hand-operated release of the load by the aircrew in an emergency

(3) Hand operation of the release mechanism by the deck handlers

(4) The **cargo net** (Fig 6-33) is the most common method of transferring loads. The net is constructed of polyamide webbing and is fitted with hooks of the type shown in Fig 6-34 by which it is slung from the cargo release unit. The net has a safe working load of 1360 kilograms. Each of the four hooks is made from flat steel plate. The hooks can be readily removed from or attached to the stirrup over the waist by operating the safety latch. All hooks **must** be attached to the stirrup before lifting.

(5) The **extension strop** (2.4m). This strop is manufactured from doubled polyamide webbing and has a safe working load of 2724 kilograms. It is fitted with a shackle at its upper end and with a swivel and spring hook at its lower end.

(6) *Pallets.* The commonly used pallets for Vertrep are the 1 tonne and 2 tonne types. Full details are given in **ATP 16**, including the permissible load for each type of pallet when used for Vertrep. The pallet sling has a safe working load of 1016 kilograms which is a limiting factor for pallet loading.

(7) *Earthing pole.* To overcome the dangers of static electricity when hooking on or releasing a load, the helicopter must be earthed to the ship by means of an earthing pole. A patternised version, 26SH/780-2036, is available through naval stores. Fig 6-35 shows an example of a locally produced earthing pole.

f. **Safety.** Loads must not be steadied. Sudden movement of the helicopter may endanger personnel attempting to control a swinging load. Before a load is handled it must be earthed (Fig 6-36). The earthing pole must be hooked to the winch wire or cargo hook each time **before** a load is hooked on or unhooked.

WARNING

DO NOT STAND UNDER A LOAD, OR BETWEEN A LOAD AND THE SUPERSTRUCTURE OR SHIP'S SIDE

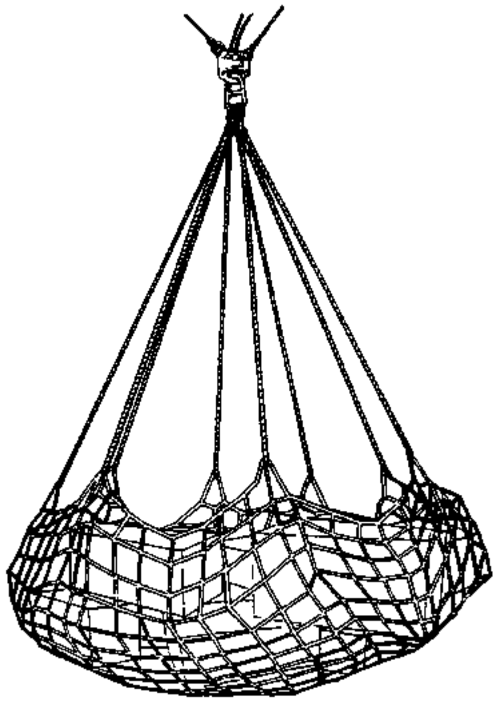


Fig 6-33 Cargo Net for Vertrep

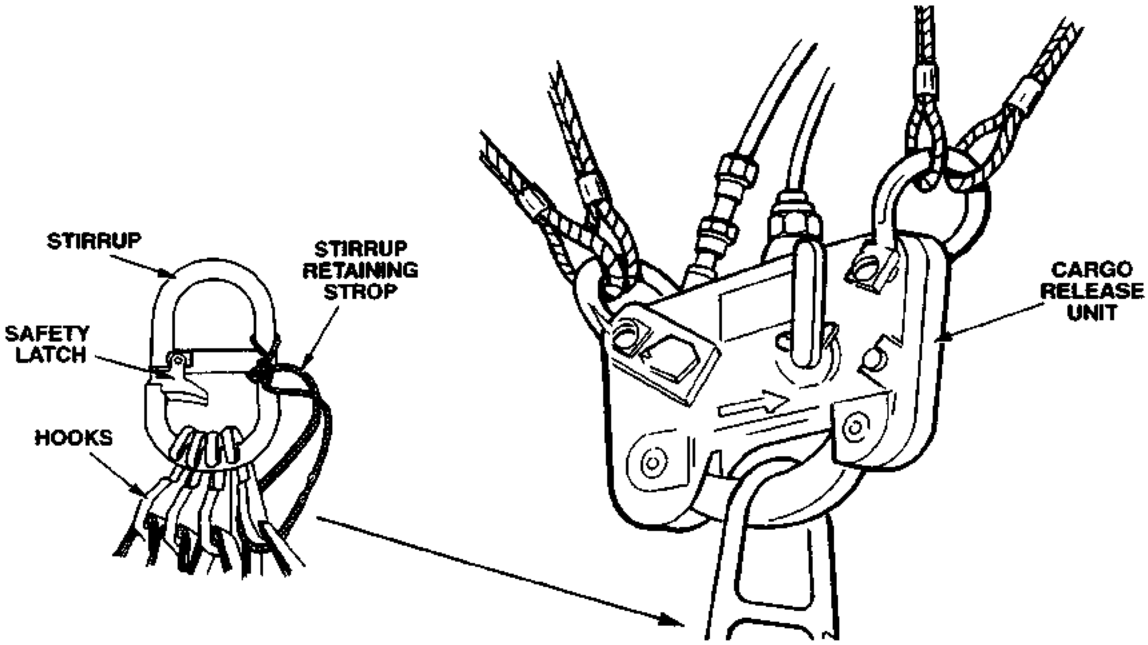


Fig 6-34. Cargo Net Hooking Arrangements

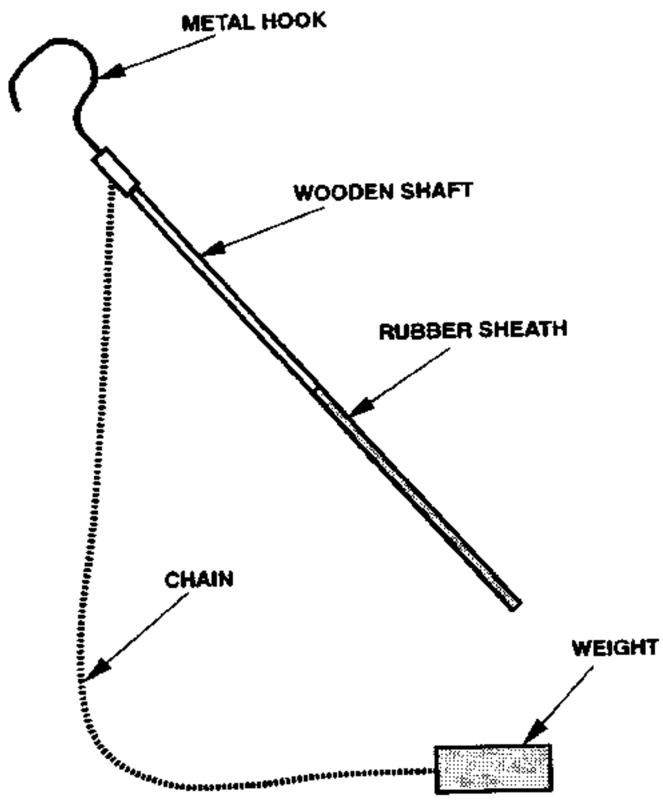


Fig 6-35. A Locally Manufactured Earthing Pole

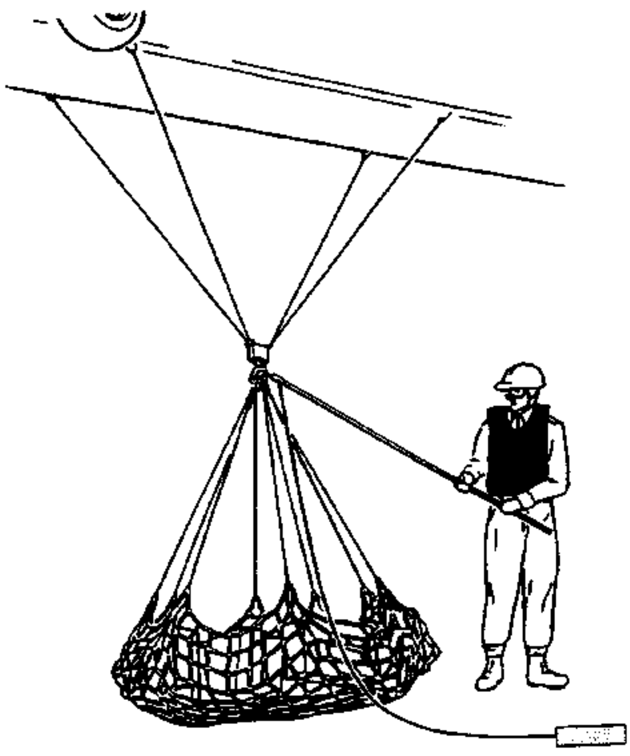


Fig 6-36. Earthing Pole In Use

06018. Introduction to Transferring Liquids by the Abeam Method

Warships can be fuelled from RFA tankers while underway and abreast each other by the following rigs: probe, large derrick, crane, and jackstay. Although minor variations to these rigs may be encountered, preparations and drills in the receiving ship, described later for each type of rig, vary little. All the methods are described in the following paragraphs.

06019. Crane Fuelling Rig

Certain major warships can fuel smaller warships by the crane rig; drills and procedures for receiving this rig are the same as those described for the large derrick rig. Fig 6-37 shows a typical crane fuelling rig. The hose is slung from the delivering ship's crane in two troughs: the working trough is on the crane purchase and the static trough is on the 24mm polypropylene tackle secured half-way along the crane jib, with the hauling part taken through a leading block on the deck where it is manned or taken to a suitable winch. A **recovery line**, 73m of 12mm SWR is shackled to the securing adaptor and clamp, which is positioned 4.5m from the outboard end of the hose. The recovery line takes the weight of the end of the hose when it is being offered to the receiving ship and when it is being recovered after fuelling. This line is rove through a block at the head of the crane jib and another on deck; if it is taken to a captive drum care must be taken to ensure all the line will stow on the drum. Working distance limits for the rig are 21m-37m, with a normal working distance of 30m.

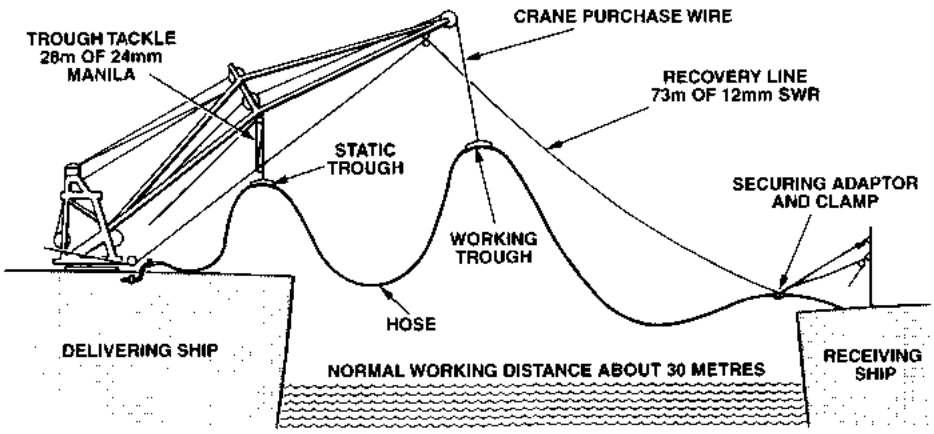


Fig 6-37. Crane Refuelling Rig

a. **Rigging for Crane Fuelling in the Delivering Ship**. Hoses are supplied in 4.5m and 9m lengths. Five or six 9m lengths (iaw ship's drawings) and a 4.5m length are coupled together and connected to the ship's deck fuelling connection. To the outer end are connected the shut-off valve and the male portion of the quick-release coupling. The static and working troughs are placed about 9m and 24m respectively from the deck fuelling connection, leaving approximately 27m of hose from the working trough to the adaptor and clamp which is 4.5m from the outboard end of the hose. The hose is lashed in the troughs by 16mm polypropylene and protected from chafe by sword matting or canvas. The recovery line and hoseline pendant are shackled to the securing adaptor and clamp, and the end 4.5m hose is stopped to the hoseline by lashings passed around the hose and hoseline as dry turns and finished with a reef knot. The crane purchase is hooked to the slings of the working trough using a short wire grommet seized to the crane hook, and the static trough tackle and recovery line are positioned and rove through their leading blocks. The recovery line and hoseline are tended and the troughs are hoisted into position.

A handling pigtail made up of a 3m length of 16mm polypropylene with an 0263-539-3519 spring hook spliced into one end is hooked into the eye of the hose-end protector cap. A round turn is passed over the hoseline and the remainder of the pigtail is coiled up and taped to the hoseline so it can be easily broken free by the receiving ship as it comes into the dump area (See Fig 6-38). The hoseline is made up as described on page 6-31.

b. **Passing and Working the Crane Rig.** To avoid the hoses becoming twisted it is preferable to supply the hoseline from aft of the rig. If this is not possible the hoseline should be stopped to the deck aft of the crane, then led outboard to the position from which it and the ancillary lines are to be supplied from. The relative positions of the ships will be continuously altering and the rig must therefore be tended and adjusted by the delivering ship throughout the transfer. The bights of the hose should not be allowed to trail in the sea, and the crane should be trained in line with the lead of the hose to avoid any sideways stress on the jib-head. When the ships close, the working trough should be raised and the jib topped up; when they open, the working trough and jib are lowered. The static trough requires little adjustment unless the ships open to nearly the full scope of the rig.

Note. *A CVS delivering fuel by the crane rig must blow through on completion to reduce difficulty in recovery of the rig.*

c. **Hose End Arrangements**. The hose end and securing arrangements in the receiving ship are shown in Fig 6-38. The hoseline is hooked to a ring, which in turn is shackled to the securing adaptor and clamp by a hoseline pendant. The hoseline is secured to the outboard 4.5m length of hose by means of cordage lashings which are cut as the hose comes inboard, allowing the hose end to be carefully lowered to the deck by means of the control pigtail. A shut-off valve is fitted at the end of the hose and the hose is connected to the receiving ship's fuel system by a **quick-release coupling** (Fig 6-39). The male part, fitted with a protector cap, is sent across on the end of the delivering ship's hose, and the female part, incorporating a non-return valve, is provided by the receiving ship. The handwheel of the female part operates three dogs which hold the coupling in engagement, and has two working positions - 'RELEASE' and 'ENGAGE'. When ships of different countries are transferring fuel a **breakable-spool coupling** (Fig 6-40) may have to be used. Of the two parts, the 'B' section is sent over on the end of the delivering ship's hose and the 'A' section is provided by the receiving ship. The protector cap of the QRC coupling and the end-plate of the breakable-spool coupling should be secured to the alloy hose connection using a short 5mm SWR retaining pendant fitted with a small spring hook in one end and a soft eye in the other. The wire pendant is thorough-footed to the alloy connection then seized in position. The deck elbow connection should be supplied with a pressure gauge and an air-cock to facilitate fuel sampling and the connection of LP air for blow through. Ships replenishing AVCAT, and MCMVs replenishing Dieso abeam use a 65mm coupling (Fig 6-40a).

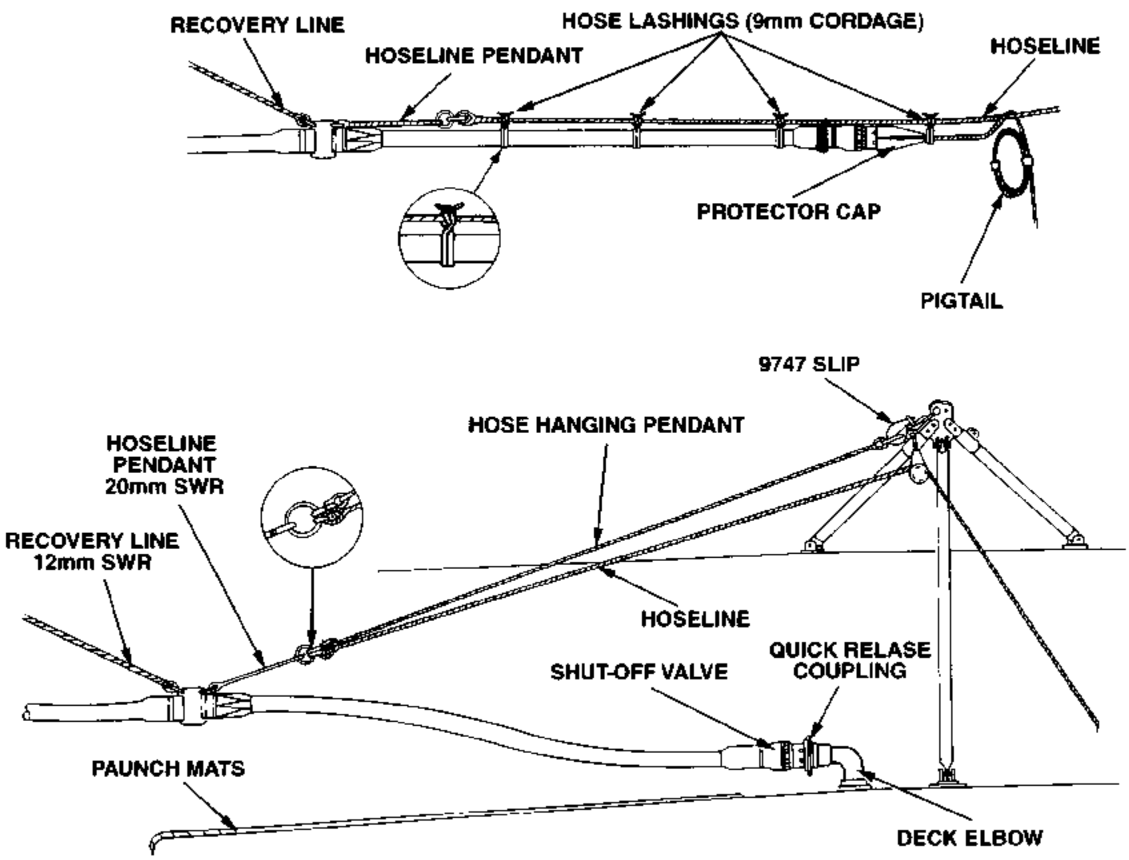


Fig 6-38. Hose End Securing Arrangements

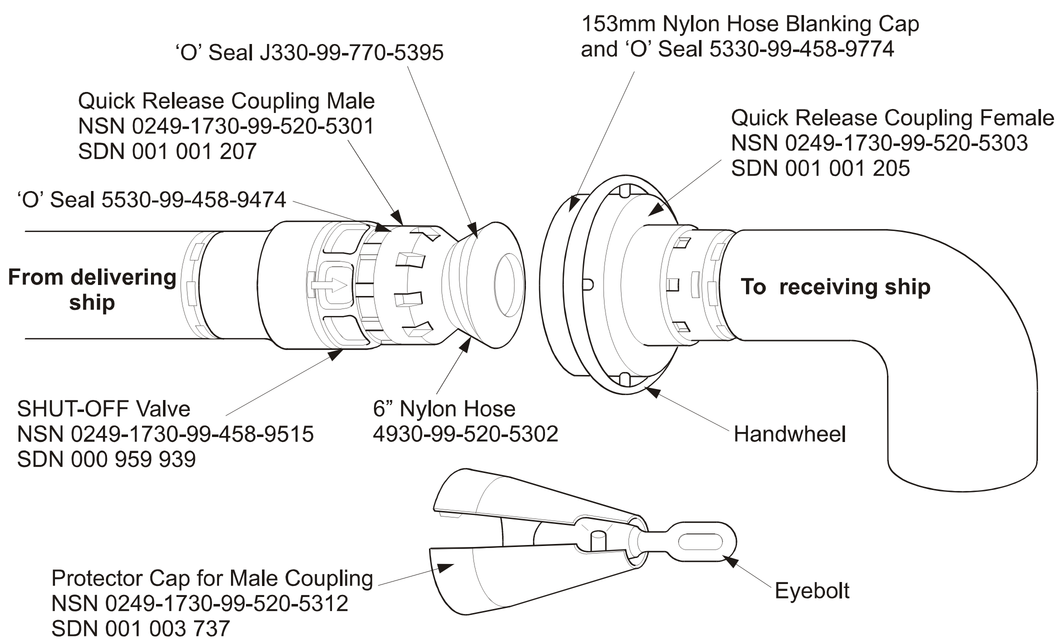


Fig 6-39. Quick-release Coupling

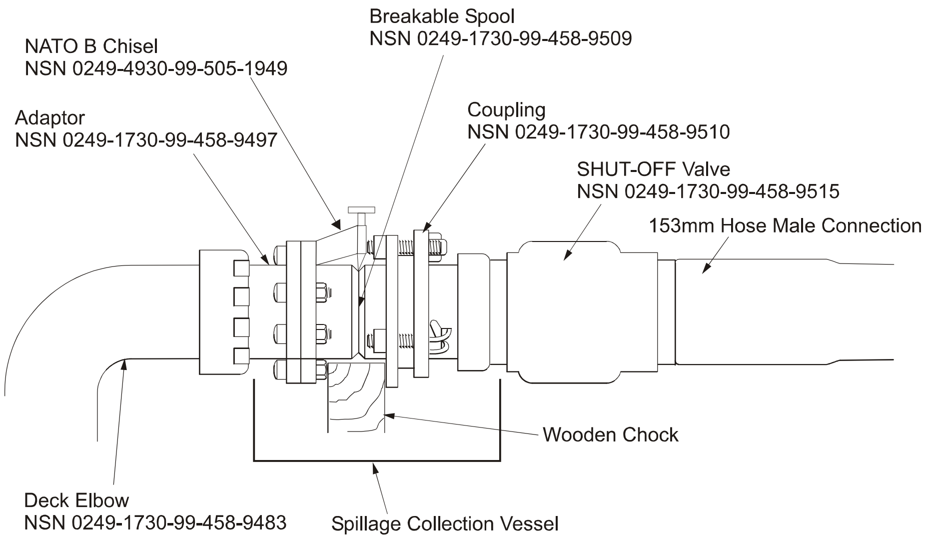


Fig 6-40. Breakable-spool Coupling

***Note**.* *Ensure wooden chock is placed beneath weakened groove once coupling is connected.*

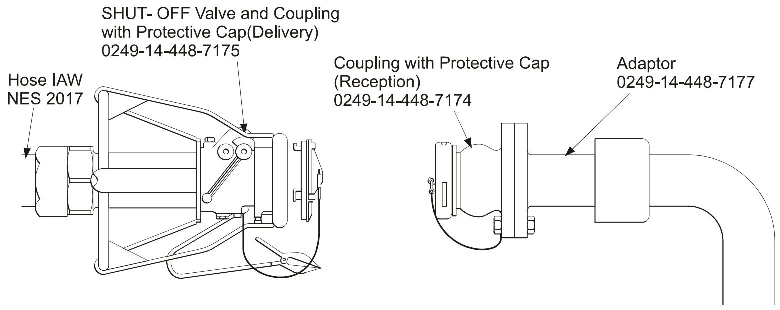


Fig 6-40a. 65mm Coupling (For AVCAT and MCMV Dieso Replenishment)

06020. Large Derrick Fuelling Rig

The large derrick rig is fitted in all RFA tankers. The derrick, which is longer than a ship's crane, has the fuelling hose slung from it in three troughs: the static, inner and outer troughs (Fig 6-41). A greater length of hose is used and therefore the distance between the two ships can be increased. Working distance limits for the rig are 30m-54m, with a normal working distance of between 37m-43m.

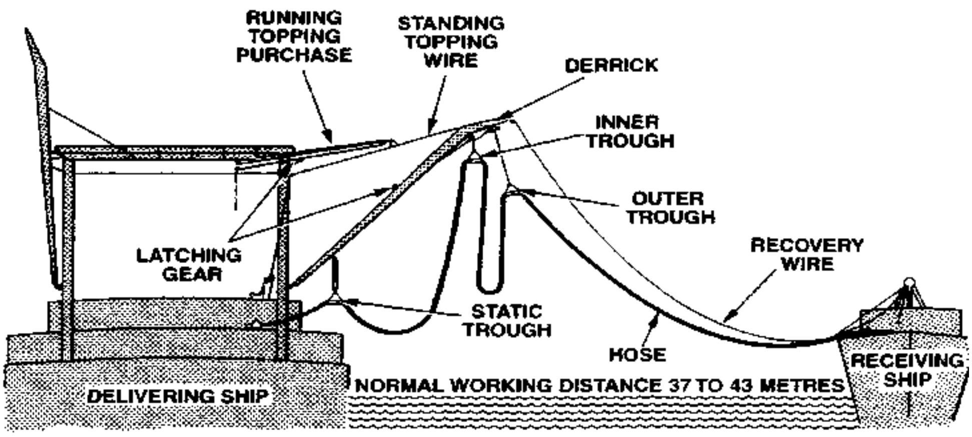


Fig 6-41. Large Derrick Rig

a. **Derrick/Crane fuelling procedures - Preparations (Part 1) in receiving ship**

(1) Rig gantry, tripod or stump mast. Screw up and mouse shackles; tighten nuts and bolts; secure rigging screws with locking nuts.

(2) Rig Patt 0263/414-9747 (F905/99/867-8379 (MCMV) slip using Patt 0263/721-6093 shackle for HHP attachment. (Provide a second Patt 9747 slip if it is intended to slip, rather than cut, the sliprope).

(3) If using NATO Breakable Spool, provide and fit the EBA Chisel (See Fig 6-40).

(4) Rig Patt 0256/521-2796 blocks using Patt 0263/721-6093 shackles for hoseline lead. Rig hose-hanging pendant.

(5) Rig fuel riser, required hose lengths, correct coupling, and sampling tap/hose.

(6) Rig steadying tackles and strops. The strops should be of the bale sling type, long enough to pass around two 6 inch hoses. Once rigged the tackles may be secured and left unmanned. Ensure they can be easily removed in an emergency.

(7) Provide sliprope of 28 mm (20mm MCMV) NFC (length to suit), with reduced soft eye in one end.

(8) Rig strayline through leading blocks to capstan, winch or captive drum.

(9) Provide C spanners, ratchet/socket spanners, chocks or saddle block, drip tray, eye wash bottle and emergency tools.

(10) Provide goggles for all personnel in the vicinity of the dump area.

(11) Ensure firefighting equipment has been rigged.

(12) Check power on capstan/winch/captive drum and test for correct running.

(13) Follow immediately with Part 2 Preparations given in para 06011.

Note. *Type 42 Destroyers Refuelling at Station 5 or 6 using the Derrick/Crane Rig. To prevent the hose-ends causing damage to ship's fittings during the disengaging phase a 12mm x 2m SWR Nose Cone Pendant, end fitted with a spring hook, is incorporated into the rig. Before the rig is passed this pendant is shackled to the bridle ring by the RFA, coiled and lightly stopped. Drill for use of the Nose Cone Pendant on completion of the replenishment is as follows:*

'Replenishment complete'	Replenishment complete	Once the signal is acknowledged and the hoses have flattened, close the shut-off valve, disconnect hoses, replace blanking plate/end cap. Cut stop on Nose Cone Pendant and attach spring hook to blanking plate/end cap. Ensure pigtail is attached to nose cone pendant SWR, and clear for return outboard.

Drills up to and after this procedure are as laid down in the following pages.

b. **Orders and signals**. Orders are shown in quotation marks and signals are underlined.

Order	**Signal**	**Action**
	<u>Red bat</u>	During approach, Red bat held aloft; in firing ship to indicate dump area and in non- firing ship to indicate position gunline required.
'Prepare the rifle for line throwing' (Safety Officer firing ship)		Prepare the rifle iaw **BR 8988**.
<u>One whistle blast</u> (Safety officer firing ship)		Safety officer in non-firing ship ensures all exposed personnel take cover behind ship's superstructure.
	<u>Two whistle blasts</u> (Safety Officer non-firing ship)	
'With a magazine of one round, load' (Safety Officer firing ship)		Load the rifle iaw **BR8988**.
'Make ready' (Safety Officer firing ship)		Make the rifle ready iaw **BR 8988**.
'Fire when ready' (Safety Officer firing ship)		Fire the rifle iaw **BR 8988**.
	<u>Three whistle blasts</u> (Safety Officer firing ship)	Safety Officer in non-firing ship orders men to break cover and retrieve gunline (using heaving line to recover stray gunlines).
	<u>Three whistle blasts</u> (Safety Officer non-firing ship)	This signal is given if gunline is out of reach or lost. Firing ship starts sequence again with one whistle blast.
'Haul away'	<u>Check away</u>	Receiving ship hauls in gunline, clearing the surplus from the deck into a large container (bucket) to keep it clear of personnel. When hoseline comes to hand detach gunline and attach bitter end of hoseline to strayline. Haul away until the distance line is inboard.

Order	Signal	Action
'Avast hauling'	Avast	Stop hauling. Unclip the distance line, telephone lines and messenger. Pass lines to appropriate parties (using straylines as necessary). Do not lead lines across the rig. Take the distance line to a position in clear view of the Bridge and haul taut. Haul in the messenger and keep it clear of the water.
'Heave in'	Check away	Heave in the hoseline by captive drum or haul in by hand. Take all slack to the other side of capstan or winch and coil it down carefully. Do not man at the RAS point or between the blocks. Continue to heave in until all slack is taken down and the weight comes on the hoseline.
'Avast heaving'	Avast	Bring to the hoseline with three turns.*
'Heave in'	Check away	Heave in until the hose end is over the deck edge. Lower the temporary guardrail to the deck to allow the hoses inboard; pass the second length of temporary guardrail over the hoses and tend.
'Avast heaving'	Avast	Remove pigtail coils from the hoseline, clear coils and pass pigtail over the hoseline then inboard to the dump party, ensuring the bitter end is passed outboard. Cut the stop at the hose end and use the bight of the pigtail to carefully lower hose end(s) to the deck, then clear the pigtail from the hoseline, passing the end back outboard so it does not foul the dump area.
'Heave in'	Check away	Heave in and cut each stop as it comes to hand, taking care not to cut the hoseline. Using the pigtail walk hoses straight inboard until all the stops are cut and the bridle ring is within reach of the hose-hanging pendant.
'Avast heaving - on hose-hanging pendant'	Avast	Stop heaving on the hoseline. Hook on the hose-hanging pendant with the bill of the hook uppermost.

Order	Signal	Action
'Veer to the hanging pendant'		Veer until the weight is on the pendant. Keep hoseline backed up.
'Avast veering - connected'	Connected	(This signal gives the Delivering ship clearance to adjust the hose troughs).
'On tackles'		Attach strops and steadying tackles and haul taut. Where there is a screen aft of the hoses, attach the forward tackle first and get the hose under control before men start to work aft. Tie off the tackles if required.
'Connect up' (Order is given once tackles are rigged if considered safe to do so, if not, defer until sliprope is rigged).		Check hose is not twisted and connect to fuelling point. Open the shut off valve in the hose (330 degrees).
'Off Hoseline'		Unhook the hoseline from the ring and remove it from the leading blocks. (This may be done as the tackles are being rigged if it is considered safe to do so).
'Rig the slip rope'		Snatch the sliprope into the leading blocks, pass down through the ring and secure to the high point. Bring the slip rope to the winch as required and back up with two turns if it is on a warping drum.
'Heave in'		Heave in the sliprope until taut, but leave weight on hose hanging pendant.
'Avast heaving'		Stop heaving in. Sliprope remains backed up.
'On goggles'		All personnel at risk from fuel spills, or atomised fuel, don goggles.
'Start pumping'	Start pumping	Pressurise hose. Clear the area except for men taking fuel samples. Secure temporary guardrail.
'Attach the hoseline to the messenger' (hook end first)		Given when the messenger is no longer required

Order	Signal	Action
'Check away messenger' (may be given before 'Connect up' if required)	Heave in (indicating the messenger)	Pay out the messenger hand over hand followed by the attached hoseline (If the Command wishes to retain messenger the hoseline should be passed back using the central loop in the messenger). The strayline, if still attached, should be removed before letting go. Lines should be kept slack but clear of the water.
'Stop pumping'	Stop pumping	
'Replenishment complete'	Replenishment complete	Once signal is acknowledged and the hoses have flattened, close the shut off valve, disconnect hoses, replace blanking plate/end cap. Ensure pigtail is attached and clear for return outboard. Ensure 2 turns only on winch, capstan or warping drum and sliprope well backed up.
'Off tackles'		Remove tackles and strop(s) and quickly pull clear. Where there is a screen abaft the hose(s) remove the after tackle first.
'Return telephone cables'	Heave in (indicating line)	Pay out telephone cables to the end and let go. (This may be completed earlier if required).
'Heave in'		Heave in on sliprope until the hose-hanging pendant is slack.
'Avast heaving'		Stop heaving in.
'Off pendant'		Unhook hose-hanging pendant and stow clear of the rig. Unrig the top temporary guardrail.
'Surge'	Heave in	Surge the sliprope.** Raise the bottom temporary guardrail when the hoses are clear. Continue surging until the hoses are under the derrick head and the signal trip pelican hook is received from the Delivering ship. The temporary guardrail tender must remain well clear until the hose-ends are outboard.

Order	Signal	Action
'Slip/cut the sliprope'	Trip pelican hook (DS) Copied by RS	Slip or cut the sliprope.
'Recover the sliprope'		Quickly recover the sliprope by hand or power.
'Return the distance line'	Heave in (indicating line)	Pay out the distance line to the end and let go. (May be done earlier at discretion of Command.)

* Not applicable to captive drum fitted ships.

** It may be necessary initially to veer the sliprope until it has sufficient weight to promote surging. In such circumstances care must be taken to avoid riding turns, and no attempt should be made to veer and surge simultaneously.

(1) *Emergency Breakaway (see also para 06026).* An Emergency breakaway may be initiated by either ship. As soon as the requirement for an emergency breakaway is apparent the order must be passed between bridge and RAS point and ship to ship. The aim is to disengage as quickly as possible without endangering life and with minimum damage to equipment; coils are not to be thrown overboard as the snatch loading may cause injury to men recovering lines in the Delivering ship; lines that foul must be cut. The quickest way of alerting personnel is to sound six short blasts; however, the executive order to conduct an emergency breakaway must come from the command. The procedure is as follows:

Ship	Order	Signal	Action
Initiating ship (either ship)	'Emergency breakaway'	Prepare for emergency breakaway (other ship acknowledges with Prepare for emergency breakaway)	Receiving ship: Close shut off valve, disconnect QRC or break NATO B spool, remove tackles (Cut strops if necessary). Personnel clear area as tasks complete. Delivering ship:- Stop pumping and prepare for hose return. Both ships:- Automatically return/recover distance line, telephone cables and messenger.
Delivering ship	'Ready'	Ready	

Ship	Order	Signal	Action
Receiving ship	'Heave in'		Heave in sliprope until weight is off the pendant.
Receiving ship	'Off pendant'		Unhook hose-hanging pendant and hold clear of rig, remove top temporary guardrail. (See Note 1).
Receiving ship	'Ready'	<u>Ready</u>	
Delivering ship	'Execute'	<u>Execute Emergency breakaway</u>	As soon as both ships are ready.
Receiving ship	'Surge'	<u>Execute Emergency breakaway</u>	Surge sliprope until the hose end(s) is just outboard.
Receiving ship	Cut the sliprope'		Cut the sliprope. When clear, re-rig temporary guardrail quickly.

Notes on Emergency Breakaway

*1. The orders 'Heave in' and 'Off pendant' are not dependent on the Delivering ship's **Ready** signal. The **Execute** signal is always initiated by the Delivering ship.*

2. If the hoseline is still attached to the messenger the Delivering ship can recover the hoseline intact. The receiving ship pays the hoseline back at the 'Prepare' signal or on receiving the executive order to conduct EBA.

3. If the hoseline has not been removed from the ring then the hoseline itself is used exactly as if it were the sliprope (See EBA drill). This means that when the Delivering ship executes the EBA the hoseline is to be cut as soon as the hoses are clear of the ships side.

4. If the hoseline has been removed but the sliprope not yet rigged, the hose hanging pendant must be slipped.

5. If the hoseline has been removed and not attached to the messenger it remains in the Receiving ship.

6. If the hoseline is in the process of being returned, continue returning.

*7. **If the hoseline or messenger is being returned <u>under</u> the rig:** The line must be cut before the main rig is slipped.*

06021. Jackstay Fuelling Rig

When tankers replenish larger units of the fleet, the jackstay fuelling rig can be used as an alternative to the probe rig which is described later. It gives a greater separation between ships than the large derrick rig. The jackstay fuelling rig is similar to the heavy jackstay rig used for transferring solids except the jackstay carries several travelling blocks to support the hose in troughs (Fig 6-42). The rig consists of a 28mm SWR, 155m in length, secured to a slip in the receiving ship. In the delivering ship it is led through blocks at the head and foot of a kingpost and taken to an automatic tensioning winch. The hose is lashed in four troughs; one is triced to the kingpost and the other three are slung on travellers which run along the jackstay. Each trough traveller has a recovery wire shackled to it; these wires are led through leading blocks at the head and foot of the kingpost to separate winches.

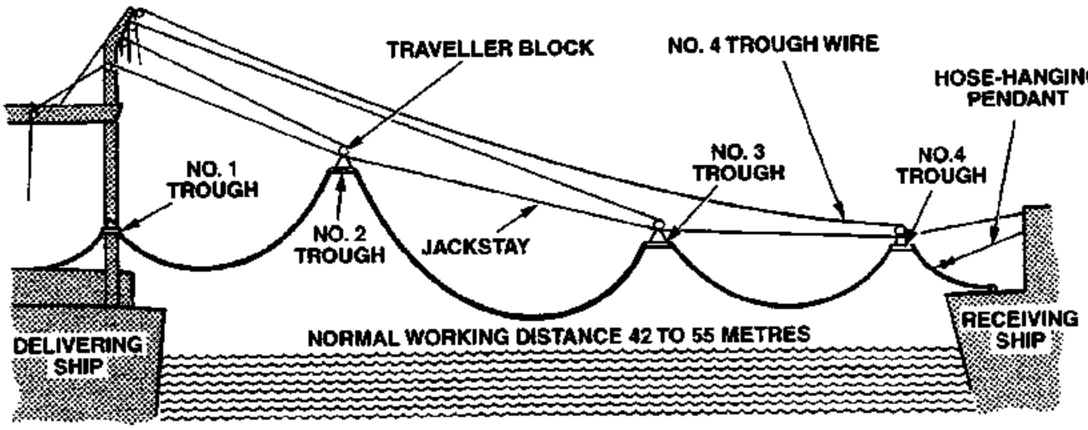


Fig 6-42 Jackstay Fuelling Rig

Initial procedures for passing the rig are identical to those for setting up the Heavy jackstay rig. Once the jackstay has been secured and tensioned the hose(s) are hauled across and procedures similar to those for crane/large derrick rig are followed. Details of preparations and drills are as follows: (see over).

a. **Jackstay fuelling procedures - Preparations (Part 1) in the receiving ship**

Rig gantry, tripod or stump mast. Screw up shackles fully and mouse; tighten nuts and bolts; secure rigging screws with locking nuts.

Fit Patt 0263/414-9835 slip to the correct eyeplate using Patt 0263/721-6096 shackle (for jackstay), or rig QRD and provide 16mm polypropylene line of suitable length (see note on page 6-28).

Rig Patt 0263/414-9747 slip using Patt 0263/721-6093 shackle for HHP attachment. (provide a second Patt 9747 slip if required for sliprope).

Provide hose hanging pendant.

Rig Patt 0246/521-2796 blocks using Patt 0263/721-6093 shackles for hoseline lead.

Provide probe retaining pendant (see page 6-31). In the event of the gripper sliding to the jackstay terminal link, hook the retaining pendant to the jackstay terminal link and secure the free end of the pendant inboard to hold the jackstay whilst the gripper is reset at the appropriate distance.

Rig fuel riser, required hose lengths, correct coupling, gauge, and sample tap/hose.

Rig steadying tackles and strop(s). The strop(s) should be of the bale sling type, long enough to pass around two 6 in hoses. Once rigged the tackles may be secured and left unmanned. Ensure they can be easily removed in an emergency.

Provide sliprope of 28 mm NFC (length to suit).

Rig strayline through leading blocks to capstan, winch or captive drum.

Provide emergency tools, C spanners, ratchet/socket spanners, chocks or saddle block, drip tray and eye wash bottle at fuelling point.

Provide jackstay control line.

Ensure firefighting equipment has been rigged.

Check power is on capstan, winch or captive drum; test for correct running.

Follow immediately with Part 2 Preparations given in paragraph 06011.

b. **Sequence of orders** (in quotation marks) and signals (underlined)

Order	**Signal**	**Action**
	Red bat	During approach, Red bat held aloft in firing ship to indicate dump area and in non-firing ship to indicate position gunline required.
'Prepare the rifle for line throwing' (Safety officer firing ship)		Prepare the rifle iaw BR 8988.
One whistle blast (Safety Officer firing ship)		Safety Officer in non-firing ship ensures all exposed personnel take cover behind ship's superstructure.
	Two whistle blasts (Safety Officer non-firing ship)	
'With a magazine of one round, load' (Safety Officer firing ship)		Load the rifle iaw **BR 8988**.
'Make ready' (Safety Officer firing ship)		Make the rifle ready iaw **BR 8988**.
'Fire when ready' (Safety officer firing ship)'		Fire the rifle iaw **BR 8988**.
	Three whistle blasts (Firing ship)	Safety officer in non-firing ship orders personnel to break cover and retrieve gunline (using heaving line to recover stray gunlines).
	Three whistle blasts (Non-firing ship)	This signal only given if line is out of reach or lost. Firing ship starts firing sequence again with one whistle blast.
'Haul away'	Check away	Haul in the gunline, clearing the surplus from the deck into a large container (bucket) to keep it clear of personnel. When the hoseline comes to hand detach the gunline and attach the bitter end of the hoseline to the strayline. Continue hauling in the hoseline/stray line until the distance line and telephone cables are inboard.
'Avast hauling'	Avast	Stop hauling. Unclip distance line, telephone cables and messenger (using straylines if necessary). Ensure that the lines do not cross the rig.

Order	Signal	Action
'Haul away'	Check away	Haul in the hoseline coiling it the other side of the winch/capstan until the weight of the jackstay is on the outhaul.
'Avast hauling'	Avast	Stop hauling.
'Bring to*'		Bring to the capstan with three turns.*
'Heave in'	Check away	Heave in until the end of the jackstay is at the high point.
'Avast heaving'	Avast	Stop heaving in and cut the stop(s) on the end link.
'Pass the control line'		(Optional order depending on weather conditions). Pass control line over the jackstay to prevent violent movement.
'On slip'		Highpointman checks for turns then places terminal link onto slip/QRD. Mouse the pin with one figure-of- eight turn.
'Veer'		Veer hoseline until the weight is on the slip and the hoseline is slack.
'Avast veering - off gripper'		Gripper is released from jackstay and untoggled from the hoseline then gripper and toggle are taken clear. Highpointman clears highpoint.
'Off control line'		If used -control is removed, dump party stand clear
'Connected'	Connected	(This signal gives the Delivering ship clearance to tension the jackstay).
'Heave in'	Check away	Haul in the hoseline by hand (or captive drum). Take all slack to the other side of the capstan or winch, coiling it down carefully. Do not man at the RAS point or between the blocks. Heave in until all slack is down and the weight comes on the hoseline.
'Avast heaving'	Avast	Bring to the hoseline with three turns.*

Order	**Signal**	**Action**
'Heave in'	<u>Check away</u>	Heave in until hose end(s) are over the deck edge. Lower temporary guardrail to allow the hose(s) inboard. Pass second, unweighted, leg of guardrail over the hose and tend.
'Avast heaving'	<u>Avast</u>	Remove pigtail coil from hoseline, clear coils and pass pigtail over the hoseline then inboard to dump party, ensuring the bitter end is passed outboard. Cut the stop at hose end and use the pigtail to carefully lower hose ends to the deck then clear the pigtail from the hoseline, passing the end back outboard so it does not foul the dump area.
'Heave in'	<u>Check away</u>	Heave in; cut each stop as it comes inboard, taking care not to cut the hoseline . Keep tension on pigtail and walk hose(s) straight inboard until all stops are cut and the bridle ring is within reach of the hose-hanging pendant.
'Avast heaving, on pendant'		Stop heaving in. Hook on hose-hanging pendant with bill of hook uppermost.
'Veer to the hanging pendant'		Veer until the weight is on the pendant (keep hoseline backed up).
'On tackles'		Attach strop(s) and steadying tackles and haul taut. Where there is a screen aft of the hoses, attach the forward tackle first and get the hose under control before men start to work aft. Tie off the tackles if required.
'Connect up' (Order is given once tackles are rigged if considered safe to do so, if not, defer until sliprope is rigged).		Check hose is not twisted then connect to fuelling point. Open shut-off valve.
'Off hoseline'		Unhook the hoseline from the ring and remove it from the leading blocks.(This may be done as the tackles are being rigged if it is safe to do so).
'Rig the sliprope'		Snatch the sliprope into the leading blocks, pass down through the ring and secure at the highpoint. Bring the sliprope to the winch as required and back up with two turns if it is on a warping drum.
'Heave in'		Heave in the sliprope until it is taut, but allow weight to remain on the pendant.

Order	**<u>Signal</u>**	**Action**
'Avast heaving'		Stop heaving in. Sliprope remains backed up.
'On goggles'		All personnel at risk from fuel spillage, or fuel atomisation, don goggles.
'Start pumping'	<u>Start pumping</u>	Pressurise hose. Clear the area except for men taking samples. Secure temporary guardrails.
'Attach the hoseline to the messenger'		Given when the messenger is no longer required. Attach the shackle on the gripper to the hook on the hoseline, then hook into the soft eye in the end of the messenger.
'Check away messenger' given before connect up if required)	<u>Heave in</u> (Indicating messenger)	Pay out the messenger and the attached hoseline (if the Command wishes to retain the messenger the hoseline should be passed back using the central loop in the messenger). Stop to remove ship's strayline before letting go. Lines should be kept slack, but clear of the water.
'Stop pumping'	<u>Stop pumping</u>	
'Replenishment complete'	<u>Replenishment complete</u>	Once signal is acknowledged by supplying ship and the hoses have flattened, close the shut-off valve. Disconnect the hoses and replace blanking plate/conical cap. Ensure pigtail is attached and clear for return outboard.
'Off tackles'		Remove tackles and strops and quickly pull clear. Where there is a screen abaft the hose(s) remove the after tackle first.
'Return telephone cables'	<u>Heave in</u> (indicating line)	Pay out telephone cables to the end and let go (may be done earlier if telephone is not required).
'Heave in'		Heave in on sliprope until the hose hanging pendant is slack.
'Avast heaving'		Stop heaving in.
'Off pendant'		Unhook hose-hanging pendant and stow clear of rig. Unrig top temporary guardrail and clear the area.
'Surge sliprope'	<u>Heave in</u>	Sliprope is surged until hoses are outboard.**

Order	**Signal**	**Action**
Cut the sliprope’	Avast	Cut the sliprope.
‘Heave in’	Heave in	Quickly haul in the sliprope by hand or power. Delivering ship continues to heave in hoses.
‘Return distance line’	Heave in (indicating line)	Pay out the distance line to the end and let go (may be done earlier at command discretion).
‘Man the highpoint’	Prepare to trip Pelican hook (DS) (copied by RS)	When ordered, highpointman removes the mousing. places the hammer against the inboard face of the buckler link and removes the pin.
‘Clear the dump, down temporary guardrail’		Dump area is cleared then temporary guardrail is lowered.
	Ready to trip Pelican hook (RS)	Signal is given when ready.
	Trip pelican hook(DS) (copied by RS)	
‘Slip’		Jackstay is slipped and temporary guardrail immediately set up.

*Not applicable to captive drum fitted ships.

**It may initially be necessary to veer the sliprope until it bears sufficient weight to promote surging. In such circumstances care is to be taken to avoid riding turns, and no attempt should be made to veer and surge simultaneously.

(1) *Emergency Breakaway (see also para 06026).* An Emergency breakaway may be initiated by either ship. As soon as the requirement for an emergency breakaway is apparent the order must be passed between bridge and RAS point and ship to ship. The aim is to disengage as quickly as possible without endangering life and with minimum damage to equipment; coils are not to be thrown overboard as the snatch loading may cause injury to men recovering lines in the Delivering ship; lines that foul must be cut. The quickest way of alerting personnel is to sound six short blasts; however, the executive order to conduct an emergency breakaway must come from the command. The procedure is as follows:

Ship	**Order**	**Signal**	**Action**
Initiating ship (either ship)	'Emergency breakaway'	Prepare for emergency breakaway (other ship acknowledges with Prepare for emergency breakaway)	Receiving ship:- Automatically close shut off valve, disconnect QRC or break NATO spool, remove tackles. Heave in on sliprope, unhook hanging pendant and stow it clear. Clear top temporary guardrail, surge on sliprope until line is slack or hose-end outboard. Slip or cut the sliprope. Personnel clear area as tasks are completed. Delivering ship:- Automatically stop pumping and prepare to recover hose and jackstay. Both ships:- Automatically return/recover distance line, telephone cables and messenger.
Receiving ship	'Ready'	Ready	This signal is ONLY given when the hose is fully ready for safe recovery.
Delivering ship	'Recover the hose'		When the 'Ready' signal has been given by the RS, and not before, DS recovers the hoses and de-tensions the jackstay.
Receiving ship	'Off mousing - out pin'		As the jackstay de-tensions, remove mousing, place hammer against the buckler link, out pin from the slip, down temporary guardrail.
Delivering ship	Ready	Ready	
Delivering ship	'Execute'	Execute emergency breakaway	When hose is recovered and jackstay de-tensioned.
Receiving ship	'Slip'	Execute emergency breakaway	Slip the jackstay. Re-rig temporary guardrail.

Notes on Emergency Breakaway:

1. If the messenger is still attached to the hoseline the Delivering ship can recover the hoseline intact. The Receiving ship pays the hoseline back at the 'Prepare' signal or on receiving the executive order to conduct EBA.

2. If the messenger has been removed from the hoseline and the hoseline has not been removed from the ring then the hoseline itself is used as if it were the sliprope (See EBA drill). This means that when the Delivering ship executes the EBA the hoseline is to be cut as soon as the hoses are clear of the ship's side.

3. If the hoseline has been removed but the sliprope not yet rigged, the hose hanging pendant must be slipped.

4. If the hoseline has been removed and not attached to the messenger it remains in the Receiving ship.

5. If the hoseline is in the process of being returned, continue returning.

*6. **If the hoseline or messenger is being returned under the rig**: The line must be cut before the main rig is slipped.*

| **06022. Probe Fuelling Rig**

The probe rig (Fig 6-43) is almost identical to the jackstay fuelling rig except that the end 4.5m length of hose is fitted with a probe which mates into the probe receiver in the receiving ship (Fig 6-44)). The system, which allows for speedier replenishment with safer working areas on deck, is now the most commonly used method of fuelling. For this rig the derrick is latched back into the kingpost and not topped out as for the orthodox large derrick rig. The jackstay, distance line, messenger and telephone cables are passed to the receiving ship in the same manner as for the jackstay fuelling rig and the end link of the jackstay is secured to the **pelican hook** on the probe receiver. When the jackstay has been set up the probe is hauled across on the jackstay by the receiving ship and engaged into the probe receiver.

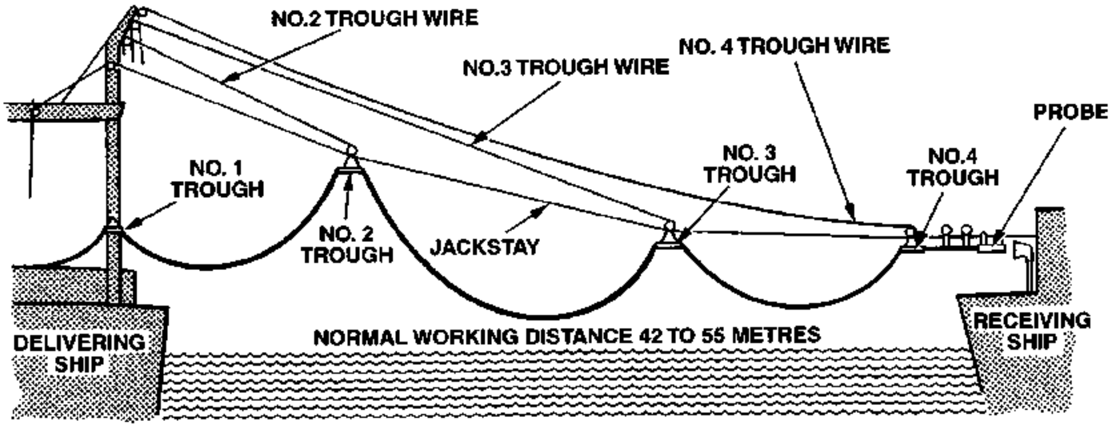


Fig 6-43. The Probe Rig

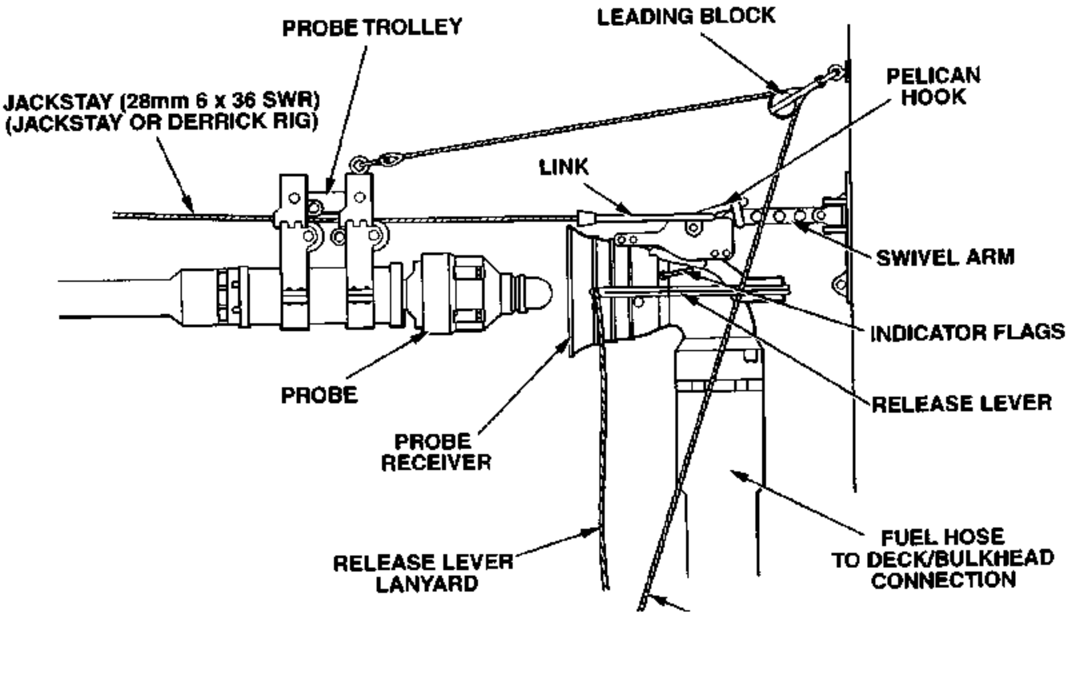


Fig 6-44. Probe and Receiver Assembly

a. **The Probe**. The probe is mounted on the outboard end of a probe tube, the other end of which is connected to the outboard end of the 4.5m length of hose. The probe tube is mounted on the underside of the probe trolley which runs on the jackstay. The trolley is hinged so that it can be easily fitted to the jackstay without dismantling. The probe is fitted with latching mechanisms which lock it into the probe receiver by spring force. A pulling force of approximately 1 tonne is required to separate the probe from the receiver should it be necessary to disengage in emergency.

b. **The Probe Receiver**. The probe receiver consists of an angled bell-mouthed assembly supported by a swivel arm which permits the receiver to pivot in the vertical and horizontal directions to align with the probe and to allow for movement between the two ships. The receiver is connected to a deck or bulkhead connection on the receiving ship's fuel system by a length of flexible hose. Correct engagement of the probe is shown by small indicator arms (flags) which rise to an angle of 30 degrees and fall to the stowed (horizontal) position when the probe is disengaged.

c. **Preparations (Part 1) in the Receiving Ship**

(1) Rig gantry, tripod or stump mast. Mouse all shackles; tighten nuts; provide locking nuts on rigging screws.

(2) Check that split pins are in the nuts and bolts of the probe receiver; that indicator flags are working correctly and washers are inserted above and below the swivel joint. Check the pelican hook is fitted with an 'R' clip and operates correctly; remove the stowage pendant and cap from the receiver; ensure that hose is correct length and joints are fully tightened.

(3) Rig Patt 0246/521-2796 blocks using Patt 0263/721-6093 shackles for the hoseline lead. Reeve strayline through blocks to capstan, winch or captive drum.

(4) Provide remating line and retaining pendant (see para 06010g(2)).

(5) Provide goggles for all personnel at risk from fuel spillage or fuel atomisation.

(6) Ensure firefighting equipment has been rigged.

(7) Test power on capstan, winch or captive drum, and check correct running.

(8) Provide jackstay control line.

(9) Follow immediately with Part 2 Preparations given in para 06011.

d. **Orders and signals.** Orders are shown in quotation marks and signals are underlined.

Order	**Signal**	**Action**
	Red bat	During approach, Red bat held aloft; in firing ship to indicate dump area and in non- firing ship to indicate position gunline required.
'Prepare the rifle for line throwing' (Safety officer firing ship)		Prepare the rifle iaw **BR 8988** .
One whistle blast (Safety officer firing ship)		Safety Officer in non-firing ship ensures all exposed personnel take cover behind ship's superstructure
	Two whistle blasts (Safety officer non-firing ship)	
'With a magazine of one round, load' (Safety officer firing ship)		Load the rifle iaw **BR 8988**.
'Make ready' (Safety officer firing ship)		Make the rifle ready iaw **BR 8988**.
'Fire when ready'(Safety Officer firing ship)		Fire the rifle iaw **BR 8988**.
	Three whistle blasts (Safety Officer firing ship)	Safety Officer in non-firing ship orders personnel to break cover and retrieve gunline (using bolas, boathook or heaving line to recover stray gunlines).
	Three whistle blasts (Safety Officer non-firing ship)	Signal only given if line is out of reach or lost. Firing ship starts firing sequence again with one whistle blast.
'Haul away'	Check away	Haul in gunline taking it well clear of the RAS point; ensure no man is in a bight and the gunline is not being trampled underfoot. Continue hauling in until the tailed hoseline is in hand. Separate the gunline and hoseline and clip the hoseline to the stray-line. Continue hauling in until the distance line, telephone cables and messenger are in hand.

Order	**Signal**	**Action**
'Avast hauling'	Avast	Stop hauling. Unclip distance line, telephone cables and messenger; pass them to their respective parties (using straylines as necessary). Ensure that the lines do not cross the rig.
'Heave in'	Check away	Heave in the hoseline by captive drum or haul in by hand. Take all slack to the other side of the capstan or winch and coil it down carefully. Do not man at the RAS point or between the blocks. Continue to heave in until all slack is taken down and the weight of the jackstay is on the hoseline.
'Avast heaving'	Avast	Bring to on the capstan with three turns.*
'Heave in'	Check away	Heave in until the end of the jackstay is at the pelican hook.
'Avast heaving'	Avast	Stop heaving and cut the stop(s) on the terminal link.
'Pass the control line		(Optional order depending on weather conditions). Pass control line over jackstay to prevent violent movement.
'On pelican hook'		Ensure that the hoseline and jackstay are free of turns and attach the pelican hook to the terminal link on the jackstay.
'Veer'		Veer hoseline until the weight is on the pelican hook.
'Avast veering - Off Gripper'		Gripper is released from jackstay, gripper toggle is removed from hoseline and both gripper and toggle are taken clear, ready for return.
'Off control line		If used - control line is removed.
'Clear Highpoint'		Clear the highpoint
'Connected'	Connected	(This signal gives the Delivering ship clearance to tension the jackstay).
'Heave in hoseline'	Check away	Delivering ship tensions the jackstay and checks away on the recovery line as the Receiving ship heaves in on the hoseline. Continue to heave in on the hoseline until the probe engages in the receiver and the indicator flags rise to 30°.
'Veer hoseline'		Confirm probe has mated correctly.
'On goggles'		Personnel in the dump area don goggles.
'Start pumping'	Start pumping	Delivering ship starts pumping.
'Rig Remating line'		Remating line is rigged when positive pressure is achieved.

Order	**Signal**	**Action**
'Unhook hoseline'		When the hose has been pressurised unhook the hoseline, unsnatch it from the blocks and prepare for return.
'Return the hoseline'	<u>Heave in</u> (indicating messenger)	Attach the shackle on the Gripper to the Welling hook on the end of the hoseline, then hook this to the soft eye in the end of the messenger. Pay out messenger hand over hand followed by the attached gripper and hoseline (If the Command wishes to retain the messenger the hoseline should be passed back using the central loop in the messenger). Lines should be kept slack but clear of the water. If a captive drum is used, disconnect the drum and pay out the hoseline using the brake. Stop to remove strayline before letting end go. Lines may be passed back diagonally under the rig if required.
'Stop pumping'	<u>Stop pumping</u>	Remove remating line.
'Replenishment complete'	<u>Replenishment complete</u>	
'Release probe'		Allow hoses to drain, then remove pin from probe-disengaging lever and operate lever.
	<u>Heave in</u>	Delivering ship heaves in on the recovery wire taking the probe back inboard. Reset disengaging lever. The jackstay is then de-tensioned.
'Return telephone cables'	Heave in (indicating line)	Telephone cables and distance line are paid out to the end and let go. (This may be done earlier if telephones are not required).
'Return distance line'	Heave in (indicating line)	
'Man the highpoint'	<u>Prepare to trip Pelican hook (DS) (copied by RS)</u>	When ordered, highpointman holds hammer against face of buckler link, then removes 'R' clip from slip.
'Clear the dump, down temporary guardrail'		Dump cleared of personnel and temporary guardrail is lowered.
	<u>Ready to trip Pelican hook</u> (RS)	Signal given when ready.
	<u>Trip Pelican hook (DS)</u> (copied by RS)	
'Slip'		Jackstay is slipped and temporary guardrail immediately raised.

(a) *Emergency Breakaway (see also para 06026).* An Emergency breakaway may be initiated by either ship. As soon as the requirement for an emergency breakaway is apparent the order must be passed between bridge and RAS point and ship to ship. The aim is to disengage as quickly as possible without endangering life and with minimum damage to equipment; coils are not to be thrown overboard as the snatch loading may cause injury to men recovering lines in the Delivering ship; any line that fouls must be cut. The quickest way of alerting personnel is to sound six short blasts; however, the executive order to conduct an emergency breakaway must come from the command. The procedure is as follows:

Ship	**Order**	**Signal**	**Action**
Initiating ship (either ship)	'Emergency breakaway'	<u>Prepare for emergency breakaway</u> (other ship acknowledges with <u>Prepare for emergency)</u>	Delivering ship: Stop pumping. Receiving ship: Remove remating line/hoseline/ retaining pendant if time permits, or cut. Operate probe release handle. Non-essential personnel clear dump area.
Receiving ship	'Ready'	<u>Ready</u>	Delivering ship recovers the hose. Both ships:- Return/recover distance line, telephone cables and messenger.
Receiving ship	'Out 'R'clip, down temporary guardrail'		Hold hammer against face of buckler link and remove 'R' clip. Lower temporary guardrail.
Delivering ship	'Ready'	<u>Ready</u>	When probe is recovered and jackstay detensioned.
Delivering ship	'Execute'	<u>Execute emergency breakaway</u>	As soon as both ships are ready.
Receiving ship	'Slip'	<u>Execute emergency breakaway</u>	Trip pelican hook. Quickly re-rig temporary guardrail when jackstay is clear.

Notes on Emergency Breakaway:

1. ***If the hoseline is being returned****:- Return is to continue and the hoseline is to be paid out to the end and let go.*

2. ***If all the hoseline is in Receiving ship****:- The messenger is to be paid out to the end and let go; hoseline is to remain in the Receiving ship.*

3. ***Remating Line/Retaining Pendant.*** *In the event of an emergency breakaway, the remating line/Retaining Pendant should be removed if time permits. If not, it must be cut.*

4. ***If the hoseline or messenger is being returned under the rig****: The line must be cut before the main rig is slipped.*

Notes on Probe Fuelling*:*

<u>Preparations</u>

1. The height of the pelican hook above the deck and the length of the swivel arm may make it difficult to work on the pelican hook from the deck or the high point. It is advisable to provide a box or steps for the rating attaching the pelican hook to stand on.

2. It is easier to attach the jackstay to the pelican hook if the receiver is held upwards by the dump party or, if practical, a small tackle. This tackle must be removed before the 'Connected' signal is given.

<u>Mating</u>

3. If mating does not occur at the first attempt there may be an obvious reason for failure such as a turn of hose line round the jackstay or insufficient impetus; or the receiver may be fouled by a bight of hose line. If such is the case, rectify the fault and signal the Delivering ship to heave in until the hose is about 3 metres clear of the receiver. Then signal ***avast*** *followed by* ***check away*** *and attempt to mate again. If mating still does not occur, consider the following points:*

> *a. Are the indicator arms working correctly? Were pre-use checks properly carried out? If the indicator arms are poorly maintained, they may fail to indicate that mating has occurred.*
>
> *b. Is the leading block directly above the probe on the correct eyeplate? If it is attached to the wrong eyeplate the incorrect lead will pull the probe out of line and prevent mating.*

Note*. The Delivering ship will hold the probe approximately 5m outboard of the Receiving ship to allow the slack in the hoseline to be recovered.*

c. Are the ships the optimum distance apart? Reducing the distance will usually give a better chance of mating because the angle of the jackstay will be steeper.

d. With the smaller jackstay used by some foreign tankers, the probe trolley wheels may have to be reversed top for bottom to provide the correct entry angle. This can only be undertaken by the Delivering ship.

4. If there is no apparent reason for failure to mate an attempt should be made by heaving in handsomely on the hoseline.

Gravity Probe Method

5. Some foreign tankers favour a method whereby the probe is mated by force of gravity and the hoseline (inboard end) is retained in the tanker and recovered at 'Start pumping'. This method may be used in RN/RFA fuellings after agreement from the RFA Master provided the angle between the highpoints is deemed sufficient to facilitate easy mating. Details can be found in ATP 16.

06023. Additional Factors to Consider when Fuelling Abeam

a. The distance line and telephones may be returned earlier to suit the requirements of the command. They are recovered by indicating the line in question with an Amber bat in one hand and signalling 'Heave in' with a Red bat in the other hand.

b. If it is intended to return the hoseline diagonally under the rig it is advisable to have a pre-positioned strayline passing under the fuelling point outboard to enable the messenger end to be transferred to the hoseline return position.

c. A portable telephone connection is required in the Receiving ship to enable the connecting point to be taken to the telephone cable without the latter crossing the rig.

d. If the sliprope is to be cut apply a whipping outboard of the intended cutting point to prevent the end fraying.

e. When controlling the hose-ends inboard it is important to keep tension on the pigtail to prevent the hose-ends striking the deck and sustaining damage (a fender can be provided if appropriate).

f. The pigtail is used by the Delivering ship to recover the hose-ends safely. It should remain attached to the cone/blanking plate (which in turn is attached to the hose) throughout the replenishment, and be kept clear for running outboard. If it has to be removed to facilitate removal of the cone/blanking plate it must be reattached before the rig is returned.

g. For NATO B couplings it is best to introduce the first bolt at the top (12 o'clock) position in the connection. The use of ratchet spanners improves connecting times. The 'weakened groove' in these couplings must be firmly supported by chocks to enable it to be broken easily in the event of an emergency.

h. Once the hose has pressurised and a sample taken, the pressure should be adjusted by signal to achieve the maximum possible fuelling rate.

i. In some circumstances it is easier and safer to attach the inboard end of the sliprope to a slip instead of taking a round turn and two half hitches to a strong point. If this option is chosen, an additional 9747 slip should be shackled to a tested eyeplate; If no eyeplate is available two 9747 slips should be attached to the hose hanging pendant eyeplate by a single 19mm bow shackle pattern number 0263-721-6105 (see Fig 6-44a). The slip securing pins are to be inserted from outside in, thus ensuring easy access for removal. A 20 cm reduced soft eye should be spliced at the end of the sliprope and served. This method should not be used with foreign tankers where the hose line remains attached to the bridle ring during return. Slipropes should always be cut during an emergency breakaway.

j. In the event of a bat or wand signal being sent and the recipient not being ready then the 'Avast' signal is passed followed by the correct signal when ready to continue. This is particularly relevant during the disengaging phase of the replenishment. This procedure should not be used during an EBA.

k. Type 42 destroyers replenishing at stations 5/6 should use the warping drum to work the hoseline, and remating line if applicable, for all types of abeam fuelling. The captive drum should only be used only for the sliprope during Derrick and Jackstay fuelling.

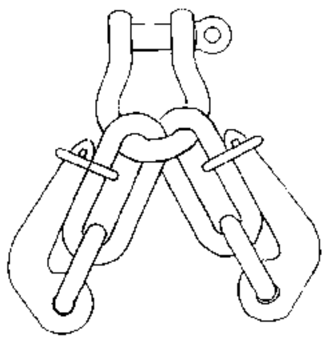


Fig 6-44a. 9747 Slips Attached to Bow Shackle

06024. Introduction to Fuelling by the Astern Method

In the astern method the tanker streams a buoyant hose which is brought on to the foc'sle of the receiving ship. There are two methods of passing the end of the hose from the tanker to the receiving ship: the **float method**, in which the tanker streams the hoseline and hose, and the receiving ship grapples the float on the end of the hoseline and then hauls in the end of the hose; and the **gunline method**, in which the tanker streams a bight of hose and the receiving ship approaches close enough to the tanker's quarter to receive a gunline by which the end of the hose is transferred. The float method is easier and safer, and with the introduction of the netted float (Fig 6-45) to replace the traditional metal spout float the likelihood of damage to bow dome fitted ships carrying out the float method has been eliminated; consequently all RFAs now supply the float rig only. However, it is possible, although unlikely, that the gunline rig may be supplied by tankers of other NATO countries, and drills for this method are laid down in **ATP-16**; drills and procedures for the float method are explained in paragraph 06025.

a. **NATO Reelable Astern Rig (Hudson Reel).** Until recently all astern fuelling rigs were laid out on the deck of the delivering ship prior to the evolution. Whilst this is still common practice in many tankers, an electrically powered reel, capable of stowing and deploying a continuous 'lay flat' 150mm hose of the appropriate length, has been introduced into service and is presently fitted in RFAs FORT GEORGE, FORT VICTORIA, WAVE KNIGHT and WAVE RULER This rig (Fig 6-46), known as the NATO reelable astern rig, greatly simplifies procedures in the delivering ship and can be used for both float and gunline methods. Procedures in the receiving ship are unchanged with the exception of the requirement to clean through the hose on completion of fuelling with a 'poly-pig'. A description of this procedure is given in para 06025(f).

Note. *Receiving ships should be aware that to facilitate the passing of the 'poly-pig' no shut-off valve is fitted to the end of the Hudson Reel rig.*

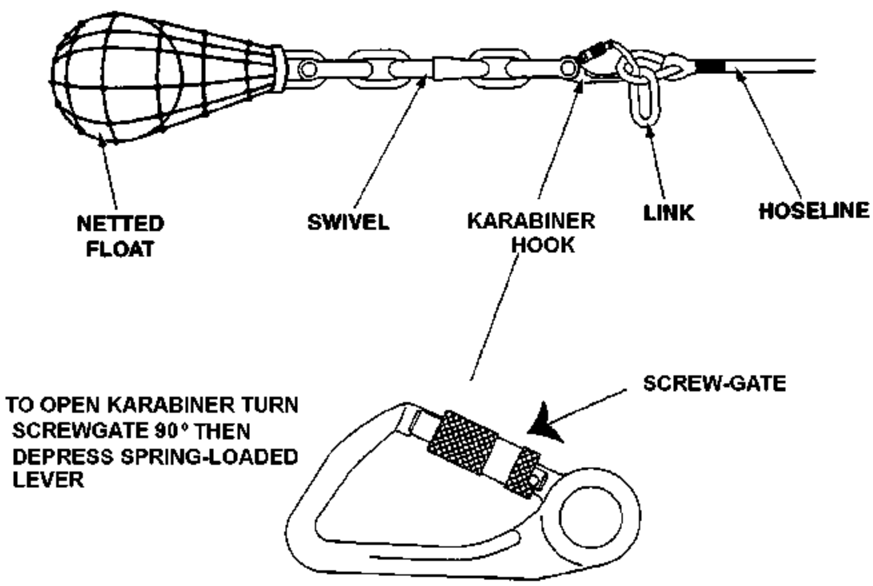


Fig 6-45. Netted Float for Astern Fuelling

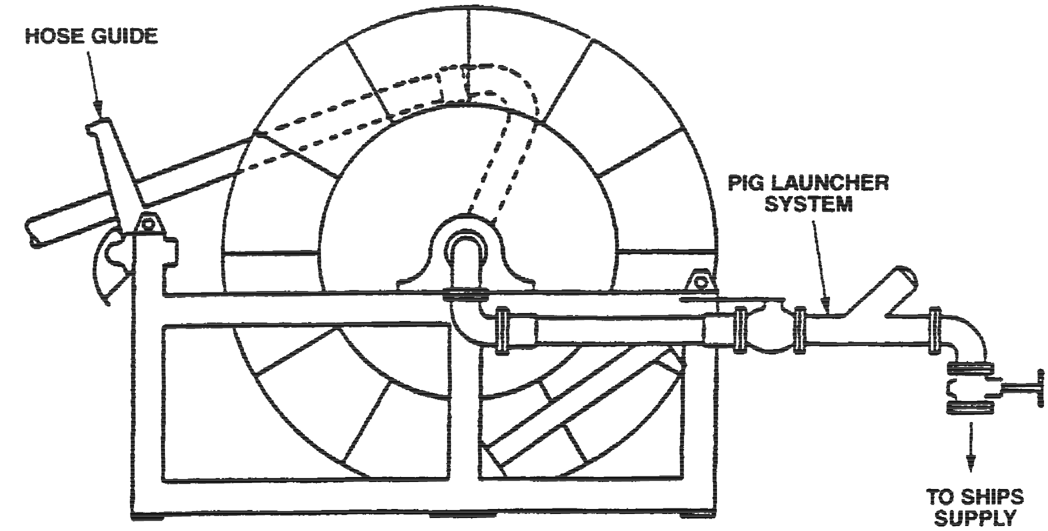


Fig 6-46. NATO Reelable Astern Rig

b. **Hose-end Arrangements for Astern Fuelling** (Fig 6-47). A securing clamp is fitted at the connection of the outboard 4.5m length of hose and a two-legged bridle is shackled to the clamp. Two bridle pendants incorporating three ring-and-link fittings and a swivel connect the bridle to the hoseline. The hose-end is attached to the last ring and link fitting by a hose pendant. A quick-release coupling is normally used for RFA/RN astern fuelling; however, the breakable spool coupling is supplied by all other NATO tankers.

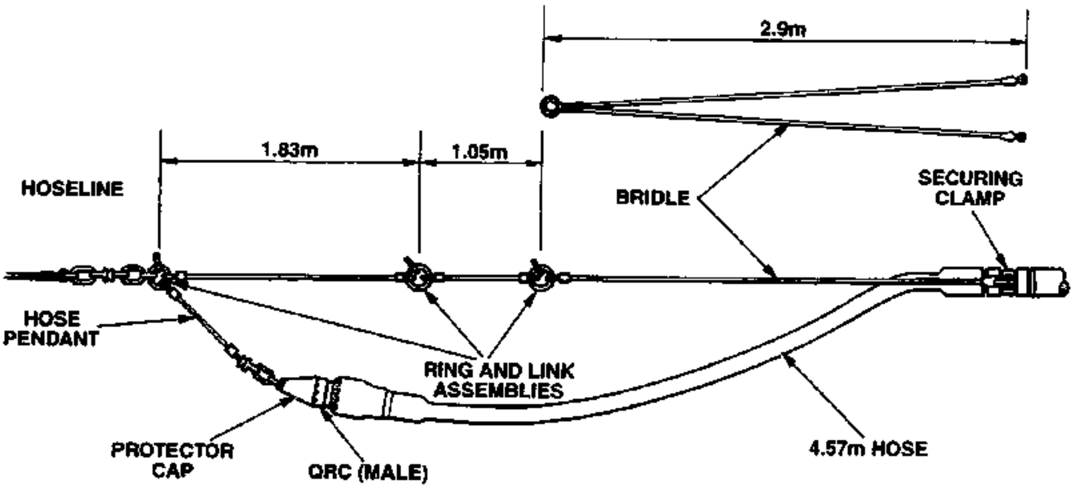


Fig 6-47. Astern Fuelling - Hose End Arrangements for Astern Fuelling

Note. *No shut-off valve is fitted to the end of the Hudson Reel rig.*

06025. Astern Fuelling - Float Method

The tanker streams from her stern a netted float which identifies the end of the rig and helps keep it near the surface. Attached to the float is a hoseline of 80m of 21mm braidline tailed with 30m of 14mm SWR, connected to the bridle ring of the hose. The length of hose streamed by the tanker depends on the type of ship being refuelled, and prevailing weather conditions (See para 06006). The tanker also streams a **marker buoy** on which the receiving ship keeps station. The distance to which the marker buoy is veered is adjusted to allow a deep bight in the hose when it is connected in the receiving ship. The bight allows for slight errors in stationkeeping. Fig 6-48 shows the rig streamed.

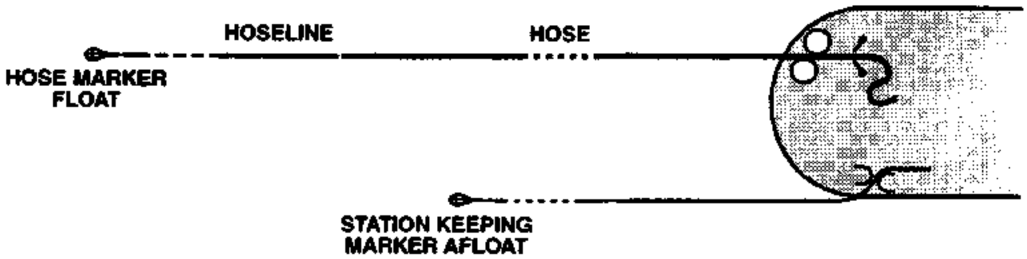


Fig 6-48. Fuelling Astern by the Float Method - Rig Streamed by Tanker

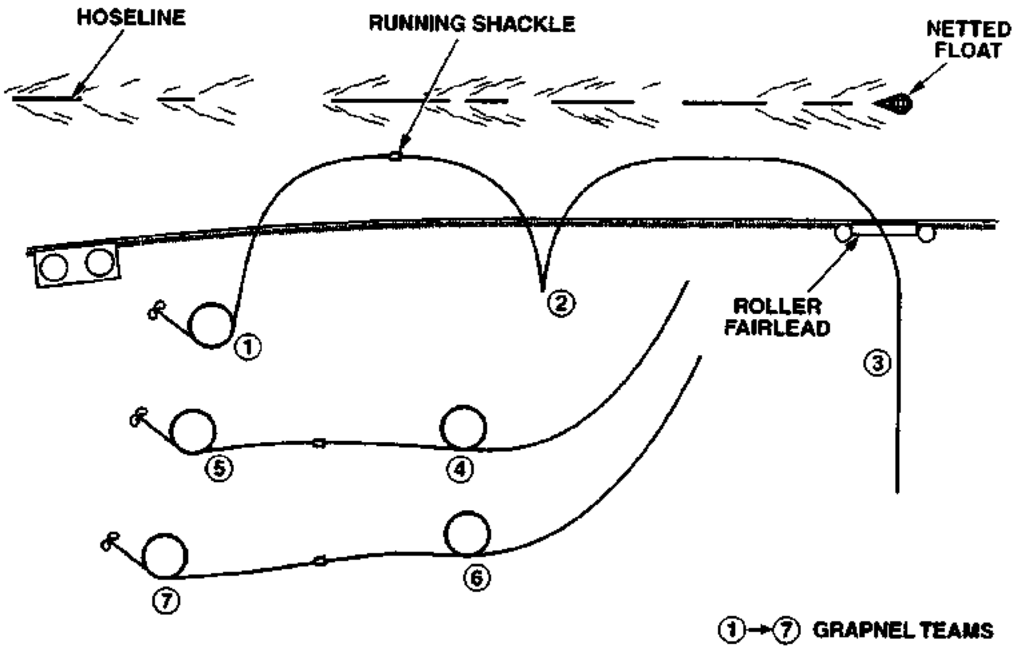


Fig 6-49. Arrangement of Grapnel Teams for Astern Fuelling

a. **Preparations (Part 1) in Receiving Ship (Float Method)**

(1) Attach Patt 0263/414-9747 slip to eyeplate using Patt 263/721-6093 shackle, in accordance with ships drawings.

(2) Provide hose hanging pendant and attach it to slip. Ensure pendant is of the correct length.

(3) Rig Patt 0263/770-9716 roller shackle(s) using correct size straight screw shackle(s) to secure to eyeplate(s) in accordance with ships drawings.

(4) Provide 3 grapnels (creepers) on 40 metre x 16 mm polypropylene lanyards. Provide 3 x large bow shackles (0263/721-6113) for use with creepers.

(5) Rig additional Patt 9747 slip for sliprope (required only if it is intended to slip, not cut, the sliprope).

(6) Provide slip rope of 28 mm NFC (length to suit), and a suitable length of line to hold the hose-end netted float outboard until the hoseline has been disconnected.

(7) Rig steadying tackles and strops. The strops should be of the bale sling type. It should be possible to slip the tackles from either side.

(8) Provide inhaul line, (16 mm polypropylene or 21 mm braidline length to suit) with a hard eye one end, fitted with a Patt 6090 shackle. This line is used to transfer the lead of the hoseline to the winch or capstan.

(9) Provide a good supply of robust NFC stops for general use and to stop the hoseline outboard ready for return.

(10) Provide 'sliding' shot mat with hauling tails.

(11) Provide 2 wooden handspikes. (Only to be used if the hose fouls on the Roller Fairlead).

(12) Rig fuel riser, correct coupling (check it is operable) and sample tap/hose.

(13) Provide sledge hammer, axe, C spanners, ratchet/socket set spanners (NATO 'B' only), chocks or saddle block, drip tray and eyewash bottle at fuelling point.

(14) Ensure firefighting equipment has been rigged.

(15) Check power on capstan or winch and test for correct running.

(16) Follow immediately with relevant Part 2 preparations given in para 06011.

b. **Shiphandling Guidance**

(1) When carrying out a Float (Grapnel) method of astern fuelling the ship should approach to a point where the hoseline spout float/orange daymark is 4-6 metres abeam and 20 metres abaft the roller fairlead. When the ship is settled, the float/daymark should be closed to within 2-4 metres to allow the hoseline to be grappled.

(2) Once the hoseline is in hand and the float/daymark has been removed the distance between ship and hoseline should be opened to between 6 and 9 metres. Speed is now increased by about 1 knot, maintaining the hoseline at an angle of 90° - 120° to the fore-and-aft line of the ship as the hoseline is hove in and the hose brought inboard.

(3) Once the hose is inboard and connected and the steadying tackles secured, the ship should open further to 12 metres from the hose and then adjust the fore and aft position to maintain a shallow (walking stick) bight of hose in the water (approximately 30 metres). If the bight of either the hoseline or hose grows too large then speed must be reduced as damage to the rig can occur.

(4) The marker float/buoy provides a relative datum and will therefore not necessarily be in line with the Bridge when the ship is in the correct position for the hose. Once the hose is connected the Delivering ship may be requested to adjust the station marker to assist station keeping.

c. **Execution and General Comments.** Three grapnel teams should always be provided with gear made up ready to throw. In each team one man holds the grapnel, a second tends the weighted bight and the third passes the disengaged end through the roller fairlead, and acts as lead man of the lanyard party. During the approach phase grapnel team No 1 should take up position adjacent to the roller fairlead; the second and third teams should make up their gear, stand directly in rear of team No 1 and be ready to move up and replace the previous team if they fail to grapple the hoseline (Fig 6-49). Grapnels used for astern fuelling evolutions do not require a SWR chafing piece.

d. **Orders and signals**. Orders are shown in quotation marks and signals are underlined

Order	Signal	Action
'Throw the grapnel'		Ensure grapnel lanyard has been led through the roller fairlead and is backed up, and that the weighted bight has been paid out to just above the waterline. Grapnel team throw the grapnel to straddle the hoseline with grapnel and bight weighted with running shackle, haul away grapnel tail. If successful haul bight of hoseline up to the roller fairlead. If unsuccessful recover grapnel and move away to allow second team to get into position.
'Avast hauling'		Avast hauling on grapnel lanyard, take bight of hoseline in hand, bring inboard and back up.

CAUTION

THE FLOAT MUST NOT BE BROUGHT INBOARD UNTIL IT HAS BEEN UNHOOKED

Order	Signal	Action
		Manoeuvre float to mouth of roller fairlead and unhook it from the hoseline. Do not bring float inboard until it has been unhooked. In fair weather when the ship is in station with no weight on the rig, lead the disengaged end of the hoseline through the roller shackle(s) and haul/ heave in by hand or power. In good conditions the initial haul-in can be done by hand, but once the wire tail of the hoseline is visible the line should be brought to. In marginal conditions, having pre-rigged the inhaul line, attach shackle direct to delivering ship's hoseline link, take down all slack and bring to. Transfer weight of rig to inhaul line, take off float, prepare to heave in.
(After advising the Bridge to start moving ahead) ... 'Heave in'		Ship moves ahead to allow hoseline to be heaved in at an angle of 90° - 120° on the bow.

Order	**Signal**	**Action**
'Avast heaving'		May only be needed in later stage to allow the ship to get into the correct position relative to the hose. Hoseline may need to be veered if ship loses position.
'Heave in'		Heave in the hoseline to bring the hose-end through the roller fairlead on deck. Then continue to heave in until the required bridle ring and link assembly is near the hook of the hanging pendant. Use handspikes to assist the hose through the roller fairlead and a sliding shot mat or fender to fleet the hose ends to the connection point. **(Handspikes are only to be used if the hose fouls on the roller fairlead when heaved onto the forecastle and not for chasing the hose across the deck).** **Ensure the hose securing clamp always remains outboard of the roller fairleads**.
'Avast heaving, on hanging pendant'		Stop heaving in the hoseline and connect the hose hanging pendant to appropriate elongated link on the bridle ring and link assembly (3 link option).
'Veer to the pendant'		Veer hoseline until the weight is on the pendant.
'Rig steadying tackles'		Rig steadying tackles. (Bridge is informed once this is done). Ship then opens the lateral distance from the hose to 12 metres, forming a towed 'walking stick' catenary bight of about 30 metres.
'Connect up' (Order is given once tackles are rigged if considered safe to do so, if not, defer until sliprope is rigged)		Connect the hose end coupling (see Para 06025(f)). Then open the shut off valve (not Hudson Reel rig) and position drip tray.
'Off hoseline, rig the sliprope'		Remove the hoseline and rig the sliprope through the ring furthest from the clamp. Bring the sliprope to with two turns and heave in until just before it takes the weight. Keep the sliprope manned throughout the fuelling.

Order	Signal	Action
'On goggles'		Personnel in the dump are to don goggles.
'Start pumping'	Start pumping	Pressurise hose. Clear the area except for men taking samples.
'Rig the hoseline'		Bring the bridle end of the hoseline back through the roller fairlead and stop it to a deck fitting adjacent to the hose (do not re-connect at this stage). Stop the hoseline in large bights over the side to suitable deck fittings, working for'ard to aft, ensuring the first bight will not be fouled when the hose is slipped (Fig 6-50). Stops must be secured as shown in Fig 49(a). Rigged in this manner they are secure, easily cut, and do not foul the hoseline during recovery. Reattach the marker to the hoseline then lower the marker over the side.
'Stop pumping'	Stop pumping - Start Blow Through (see Para 06024(f))	Initiated by Receiving ship and stopped by Delivering ship (allow 5-10 minutes). Re-shackle hoseline to bridle ring, leaving elongated link free for use by delivering ship.
	Stop Blow Through (repeated by RS)	Check hose is clear. (Blow through may be restarted by RS if hose is not clear. RS then signals Stop blow through when clear).
	RAS Complete	Passed by both ships in confirmation that hoses are blown through and the replenishment is complete. Close shut-off valve (not Hudson Reel rig), disconnect coupling and replace nose cone/plate securely.
'Off steadying tackles'		Remove tackles and strops and take well clear.

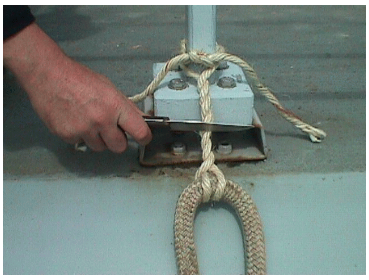


Fig 6-49(a). Correct Method of Rigging Hose Stops

Order	Signal	Action
'Heave in sliprope'		Heave in sliprope until the weight is off the hose hanging pendant.
'Avast heaving - off Hanging Pendant'		Stop heaving sliprope. Unhook hanging pendant and pull well clear of sliprope and hose.
'Surge sliprope'		Surge the sliprope until the hose is outboard, use handspikes to help it through the roller fairlead as necessary.*
'Avast'		Stop surging the sliprope. Order ship to reduce speed by 1 - $1^1/_2$ knots (must not be done until hose is outboard).
'Surge sliprope'		Continue to surge sliprope until hose end is just clear of the water (See Fig 6-51).
'Cut/Slip the sliprope'**		When lead of hose has drawn ahead to about 90° to the fore and aft line, the sliprope is cut or slipped, thereby effectively laying the rig back into the water. Run in the slip rope.
'Cut the first stop'		Normally done immediately after the sliprope is cut, but dependent on the position of the hose/hoseline at this stage. As subsequent bights of hoseline begin to straighten to 90° to the fore and aft line individual stops are cut. The cutting of stops (Fig 6-49(a)) should be firmly controlled and the operation is largely governed by the relative position of the ship. On completion inform bridge when all lines are clear and it is free to manoeuvre.

* It may be necessary initially to veer the sliprope until it has sufficient weight on it to promote surging. In such circumstances care is to be taken to avoid riding turns, and no attempt should be made to veer and surge simultaneously.

** When refuelling from the Hudson reel rig the sliprope must be cut, this is because the bridle ring is too small to allow a spliced eye to pass through it. As soon as the sliprope has been rigged, place a wooden block beneath it, as near to the splice as possible. When ordered, cut the sliprope with a sharp axe.

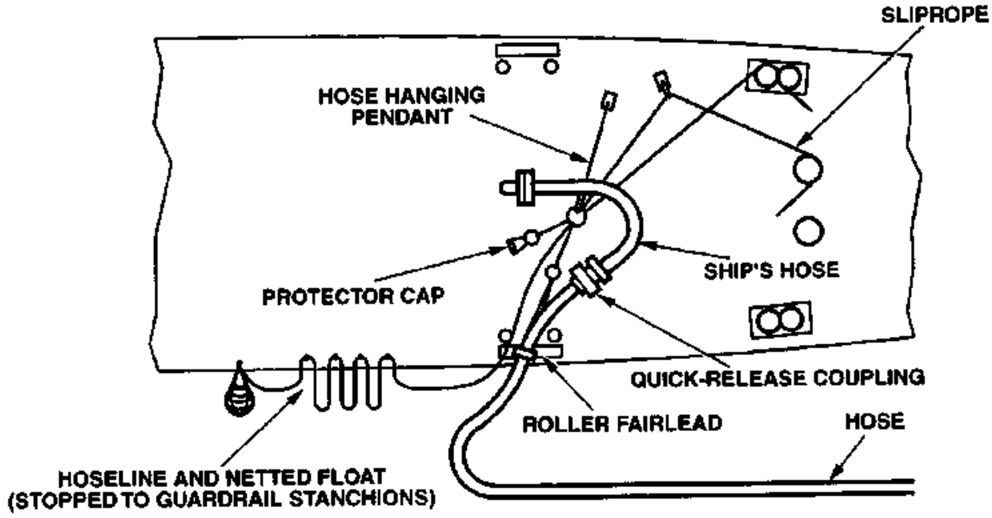


Fig 6-50. Fuelling Astern - Foc'sle Arrangements

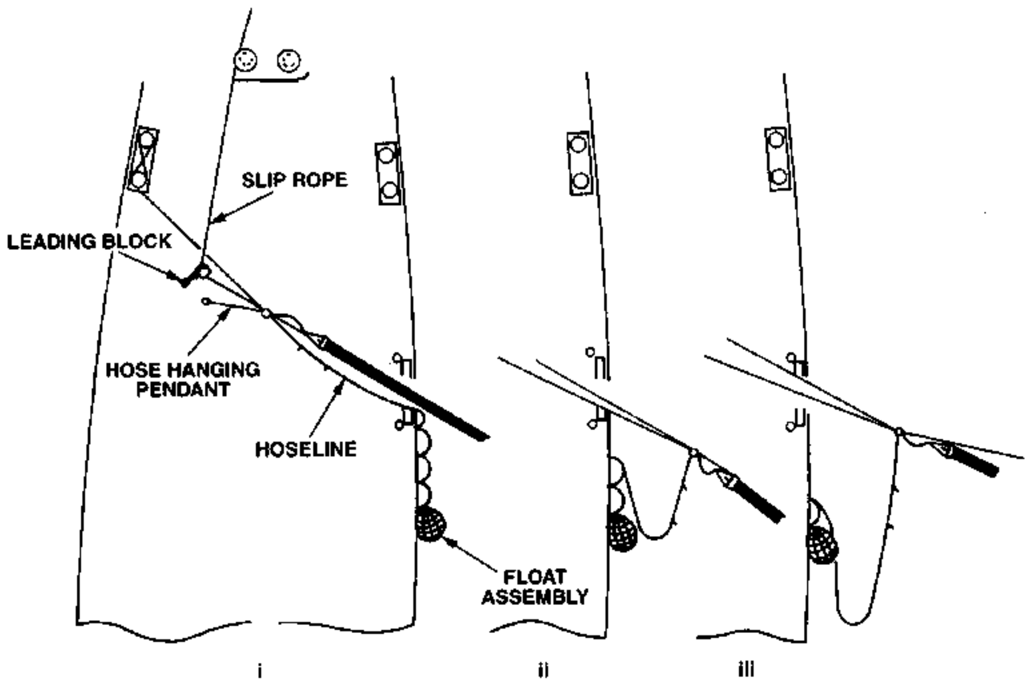


Fig 6-51. Fuelling Astern - Disengaging the Rig

e. **Emergency Breakaway (see also para 06026).** An Emergency breakaway may be initiated by either ship. As soon as the requirement for an emergency breakaway is apparent the order must be passed between bridge and RAS point and ship to ship. The aim is to disengage as quickly as possible without endangering life and with minimum damage to equipment; lines that foul must be cut. The quickest way of alerting personnel is to sound six short blasts; however, the executive order to conduct an emergency breakaway must come from the command. The procedure is as follows:

Ship	**Order**	**Signal**	**Action**
Initiating ship (either ship)	'Emergency breakaway'	Prepare for emergency Breakaway (other ship acknowledges with Prepare for Emergency Breakaway)	Receiving ship:- Close shut off valve (not Hudson Reel rig), disconnect QRC or break NATO 'B' spool, remove tackles. Clear the area as tasks are completed. Delivering ship: stop pumping.
Delivering ship	'Ready'	Ready	Tanker will always be ready once pumping has stopped.
Receiving ship	'Heave in'		Heave in sliprope until weight is off the hose hanging pendant.
Receiving ship	'Off pendant'		Unhook pendant and keep well clear of the rig. If the weight cannot be taken off the pendant, or it is inaccessible, then it must be slipped.
Receiving ship	'Ready'	Ready	Passed only as information to own bridge and tanker respectively.
Receiving ship	'Surge'		Sliprope is surged until hose is just outboard of the roller fairlead.

Ship	Order	Signal	Action
Receiving ship	'Cut'		Cut and recover the sliprope (the sliprope is cut whether a slip is fitted or not). If the hoseline has not been re-attached, then it remains in the receiving ship. If the hoseline has been re-attached then it should be possible to cut the stops in the normal manner. If, because of the nature of the Emergency Breakaway this is not possible, or if the hoseline snags, it should be cut.

***Notes on Emergency Breakaway**:*

1. Little action is possible by the tanker in this situation other than to shut off the fuel supply.

2. If the hoseline has been removed, but the sliprope has not yet been rigged, the hose hanging pendant must be slipped to disengage the rig.

3. If the hoseline has not been removed, it is utilised as if it were the sliprope, although the float is not re-attached.

4. The nature of this type of breakaway dictates that the tanker's hose will not have been blown through and will therefore have to be recovered fully charged. An exercise of this type of breakaway should only be carried out after the hose has been blown through, or if a different scenario is required, with the tanker's agreement.

5. If the sliprope is to be cut an axe in conjunction with a baulk of timber must be used.

f. **Blow through procedure using a 'poly-pig'.** On completion of fuelling astern from the Hudson Reel system, the hose is cleaned out using a 'poly-pig' (Fig 6-51). This device is a polyurethane foam cylinder whose outside diameter is slightly larger than the inside diameter of the fuel hose. The pig is introduced into the system by the delivering ship, forced through the hose by air pressure, then caught by a pig-receiver (Fig 6-52) that has been fitted into the B end of the NATO coupling by the delivering ship during RAS preparations. Procedures in the receiving ship are as follows:

(1) Ensure that pig receiver is present in NATO coupling before connecting A and B sections of coupling together.

(2) After fuelling operations are completed, and 'Stop blow through' signal has been acknowledged by delivering ship: disconnect hose at NATO coupling and remove the pig receiver from the end of the hose; remove pig from pig receiver and dispose of pig; replace pig receiver in NATO coupling B end and secure blanking plate to coupling.

(3) Carry out disengaging procedure as described earlier.

Note. *Occasionally during the blow-through procedure the Poly-pig has either jammed in the hose between the delivering and receiving ship, or has broken up and passed through the pig receiver. If, on completion of the fuelling and after disconnecting the breakable spool it is found that the Poly-pig is not located in the pig receiver, the receiving ship must pass the following message to the delivering ship:* ***'Poly-pig not located in the pig receiver'****. If, after receiving this message and on recovering the hose the delivering ship subsequently finds the Poly-pig in the hose, the following signal must be sent to the receiving ship :* ***'Poly-pig found in hose'****. If this signal is not sent the receiving ship must assume the Poly-pig has broken up and passed through the pig receiver into the fuelling system and the appropriate action, depending on the receiving ship's fuel system, must be taken.*

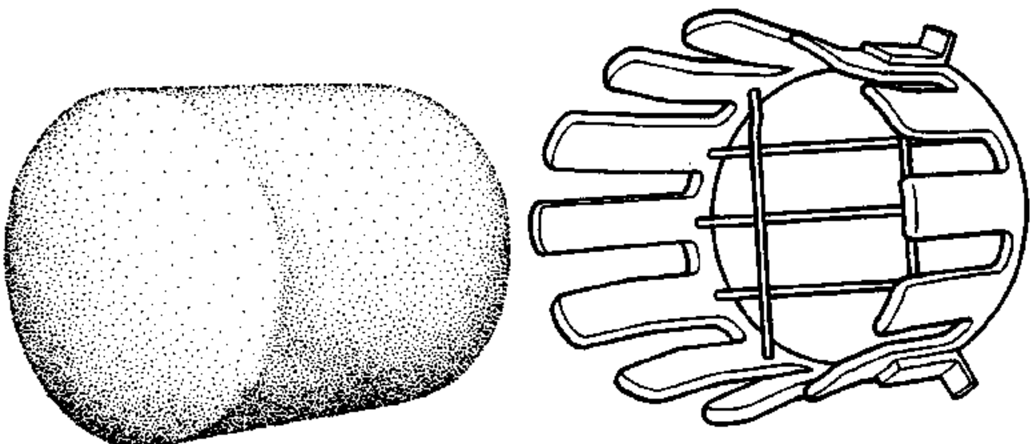


Fig 6-52. Pig Receiver (Right) and Poly-Pig (Left).

06026. Emergency Breakaway

The emergency breakaway procedures laid down in the drills for each type of replenishment are written for situations in which participating ships are able to maintain station-keeping, and control equipment, until gear is clear of the receiving ship. However, in exceptional circumstances, for example equipment failure, a situation can arise in which the only practical action that can be taken is to clear the replenishment areas of all hands in both ships until the situation has stabilised. It is not possible to provide guidance for every conceivable eventuality and the OIC must exercise judgement at the time. As a general rule no attempt should be made to slip a wire rope under tension.

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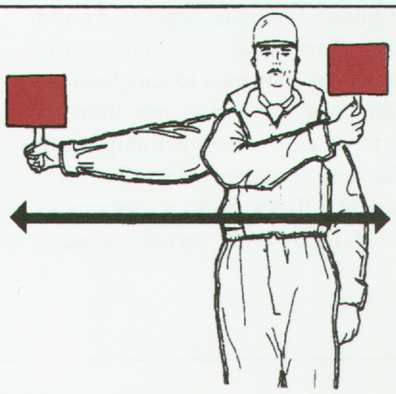
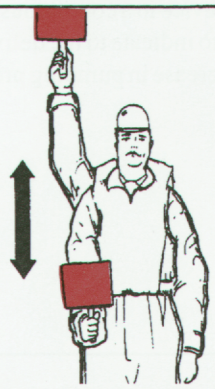
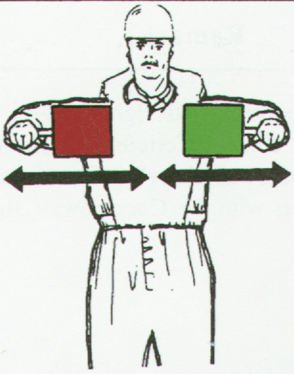
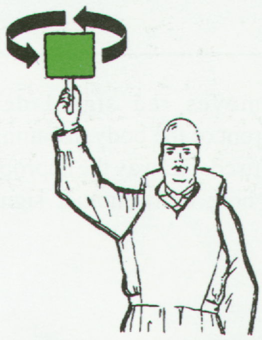
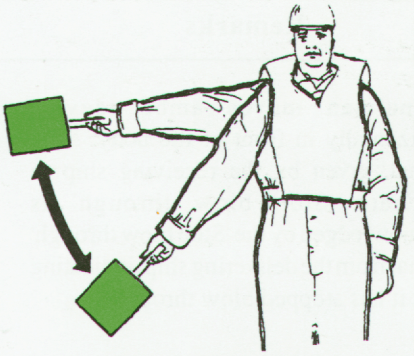
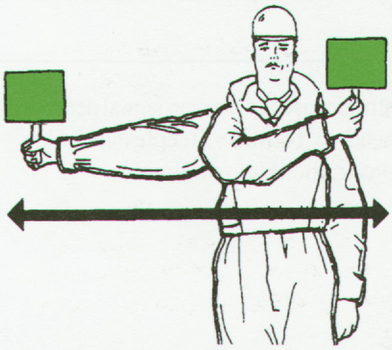
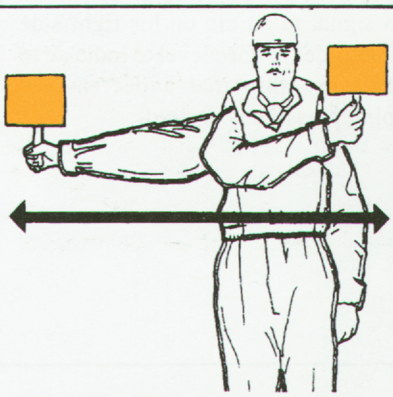
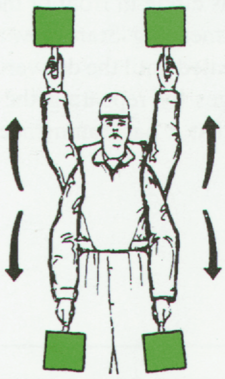
ANNEX A TO CHAPTER 6

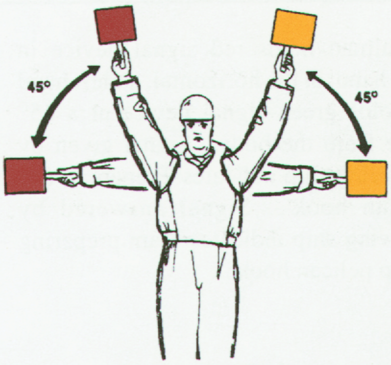
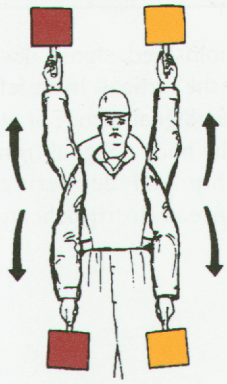
REPLENISHMENT BAT SIGNALS

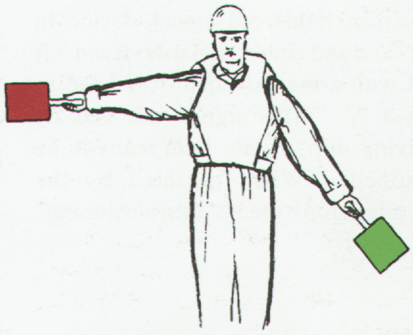
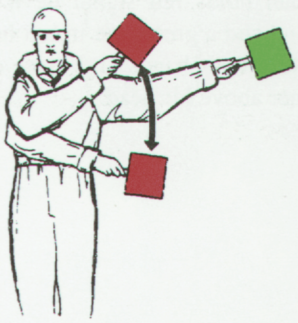
Signal	Remarks
 HEAVE AROUND	Signalman moves red signal device in a continuous complete circle in front of the body. When/where appropriate the other ship answers with the 'Check away' signal.
 AVAST	Signalman moves red signal device horizontally in front of the body, meaning for the other ship to avast heaving or checking away as appropriate.
 SLACK OFF (CHECK AWAY)	Signalman moves red signal device vertically in front of the body, meaning for the other ship to check away the appropriate line, wire or hose until another signal is given.

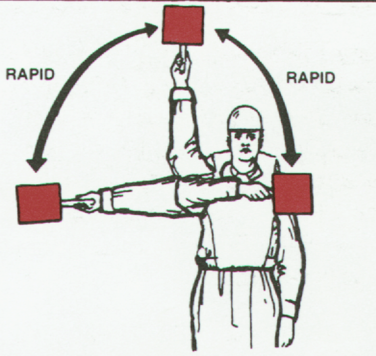
Signal	Remarks
 HOOKED UP OR CONNECTED	Signalman, with red signal device in right hand and green signal device in left hand, touches devices horizontally in front of the body at shoulder height, meaning 'Hooked up or connected'. Initiated by receiving ship and acknowledged by delivering ship with same signal.
 START PUMPING OR COMMENCE TRANSFER	Signalman moves green signal device in a continuous complete circle in front of the body. This signal, executed by either ship, indicates 'I am ready to start pumping' or 'I am ready to commence transfer'. When repeated by the other ship, begin transfer and commence signalling with red paddle. If not ready to commence operation, the AVAST signal is used.
 DESIRE INCREASE IN PUMPING PRESSURE	Signalman on the receiving ship moves green signal device in a continuous circle over his head to indicate to the delivering ship that an increase in pumping pressure is desired.

Signal	Remarks
 **DESIRE DECREASE IN PUMPING PRESSURE**	Signalman on the receiving ship moves green signal in an arc on his right side from shoulder to knee level to indicate to the delivery ship that a decrease in pumping pressure is desired.
 **STOP PUMPING OR CEASE TRANSFER**	Signalman moves green device horizontally in front of the body. This signal, executed by either ship, indicates 'Stop pumping' or 'Cease transfer'.
 **START BLOW THROUGH**	Signalman moves amber signal device in a continuous circle in front of the body. The signal, meaning 'Start blow through now' is repeated until the delivering ship acknowledges by repeating the signal, indicating that it has commenced blow through.

Signal	Remarks
 **STOP BLOW THROUGH**	Signalman moves amber device horizontally in front of the body. The signal, given by the receiving ship to indicate 'Stop blow through' is acknowledged by the 'Stop blow through' signal from the delivering ship, indicating that it has stopped blow through.
 **TEST S/P PHONE LINE**	Signalman raises two green signal devices overhead to form a 'Steeple', meaning 'Test your phone/phone lines'.
 **REPLACE S/P PHONE LINE**	Signalman waves two green signal devices vertically in front of the body, meaning 'Replace your phone line'.

Signal	Remarks
 TENSION	Signalman holds red signal device in right hand and amber signal device in left hand with arms extended over head to form a 'V'. This signal, initiated by receiving ship, means 'I am ready to be tensioned,. When initiated by the delivering ship it means 'I am tensioning'.
 DETENSION	Signalman, with red signal device in right hand and amber signal device in left hand, arms extended vertically over head, waves both signal devices vertically in front of the body until acknowledged by other ship. Initiated by receiving ship means 'Detension'. Answered by delivering ship or initiated by delivering ship, signal means 'I am detensioning'.
 REPLENISHMENT COMPLETED AT THIS STATION, COMMENCE UNRIGGING	Signalman holds red signal device in right hand and a green one in left hand. He crosses both hands and arms over each other above his head.

Signal	Remarks
 **PREPARE/PREPARING TO TRIP PELICAN HOOK**	Signalman holds red signal device in right hand, in the horizontal. In left hand he holds green signal device at a 45° angle from the body. Signal given by delivering ship indicates 'Prepare to trip pelican hook'. Signal answered by receiving ship indicates 'I am preparing to trip pelican hook'.
 **READY TO TRIP PELICAN HOOK**	Signalman holds red signal device in right hand, at the vertical. In the left hand he holds green signal device at at a 45° angle from the body. Signal from both receiving ship and delivering ship indicates 'I am ready to trip pelican hook'.
 **TRIP PELICAN HOOK**	Signalman holds red signal device in right hand and green one in left hand. He makes chopping motion with right arm on left elbow which is raised about shoulder height. Signal given by delivering ship indicates 'Trip pelican hook'. Signal answered by receiving ship indicates 'I am tripping pelican hook'. When pelican hook is tripped, receiving ship signals 'Heave around'.

Signal	Remarks
 **PREPARE FOR EMERGENCY BREAKAWAY**	The delivering ship or receiving ship may initiate an emergency breakaway. Signalman of initiating ship rapidly waves red signal device in a semi-circular arc overhead, meaning 'Prepare for an emergency breakaway'. Other ship acknowledges by repeating the signal with a red signal device, meaning 'Understood. 'I am preparing for an emergency breakaway'. Once initiated, the delivering ship assumes control.
 **READY FOR EMERGENCY BREAKAWAY**	Each ship continues making the prepare signal until ready to execute the emergency breakaway. When ready, each signalman holds the red signal device vertically overhead, to indicate 'Ready for emergency breakaway'.
 **EXECUTE EMERGENCY BREAKAWAY**	The signalman of the delivering ship drops the red signal device straight downwards, meaning 'Execute emergency breakaway <u>now</u>'. The receiving ship acknowledges by repeating the signal.

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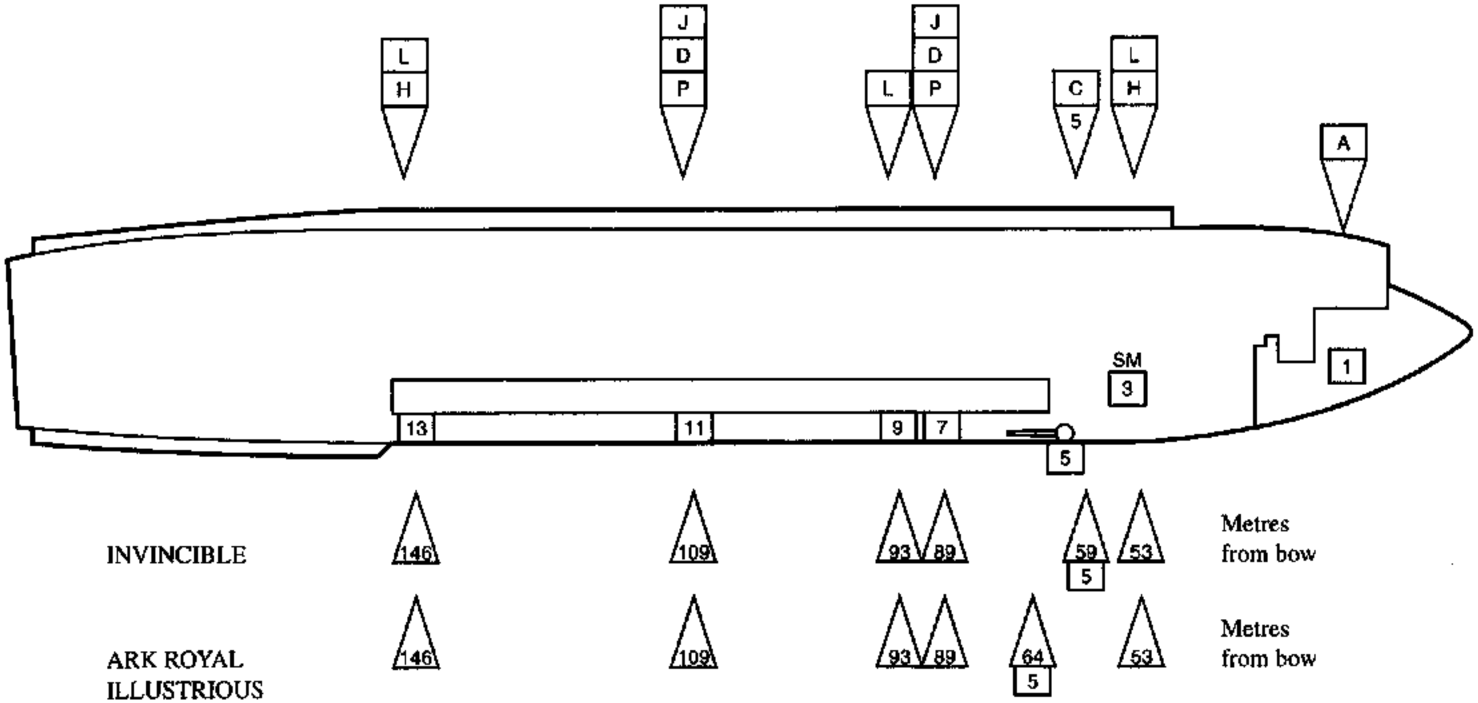
ANNEX B TO CHAPTER 6

POSITIONS OF RAS ARRANGEMENTS IN HM SHIPS (LEGEND)

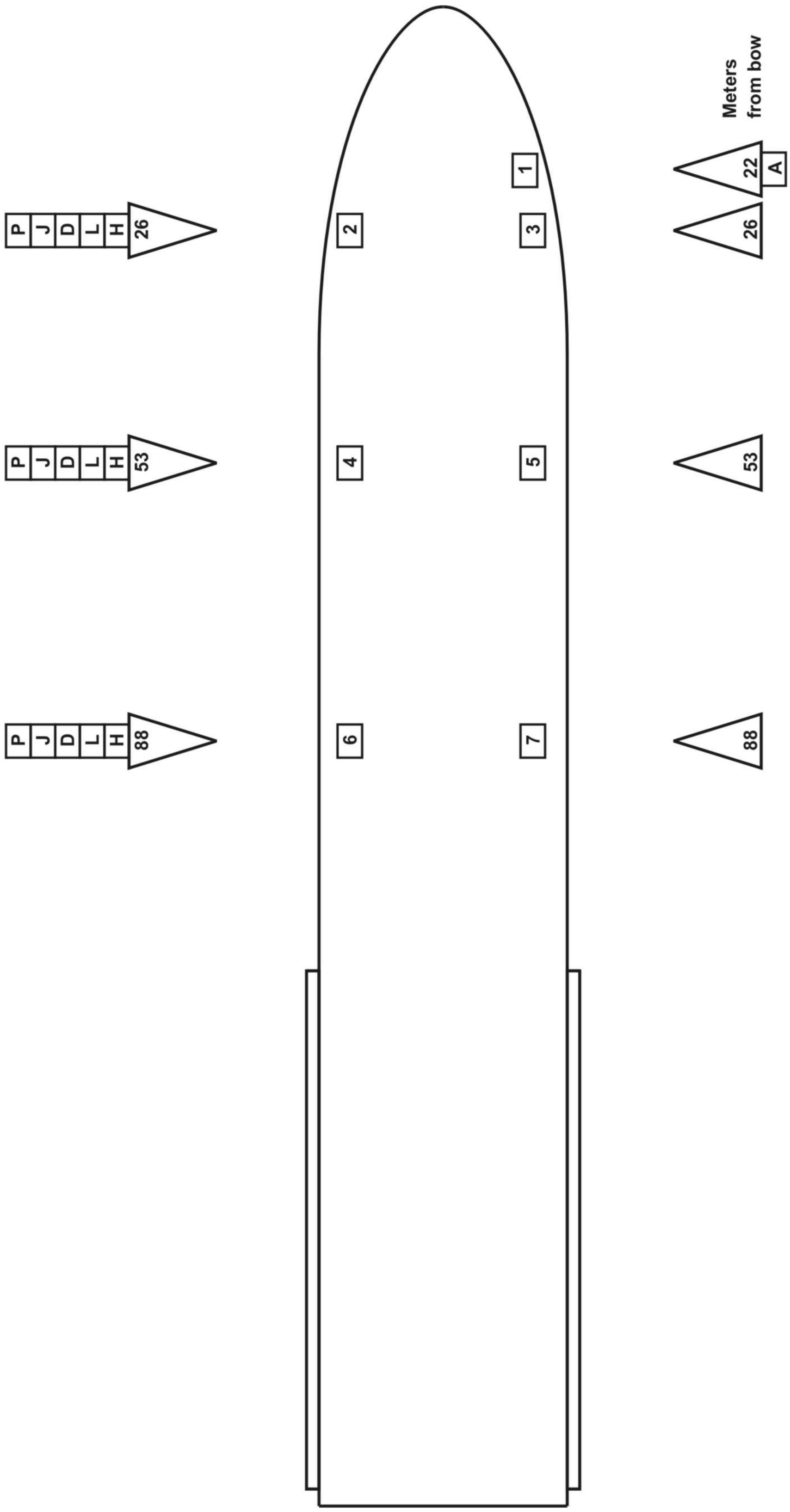
	REPLENISHMENT STATION
A	ASTERN RIG
P	PROBE RIG RECEPTION
D	DERRICK RIG RECEPTION
J	JACKSTAY FUELLING RIG RECEPTION
H	HEAVY JACKSTAY RECEPTION
L	LIGHT JACKSTAY (RECEPTION & DELIVERY)
L(R)	LIGHT JACKSTAY (RECEPTION ONLY)
C	CRANE RIG
SM	STUMP OR STUMP MAST

Scale 1:800 (approx) RAS position arrows are approximate. Distance from bow, shown in triangles, is accurate.



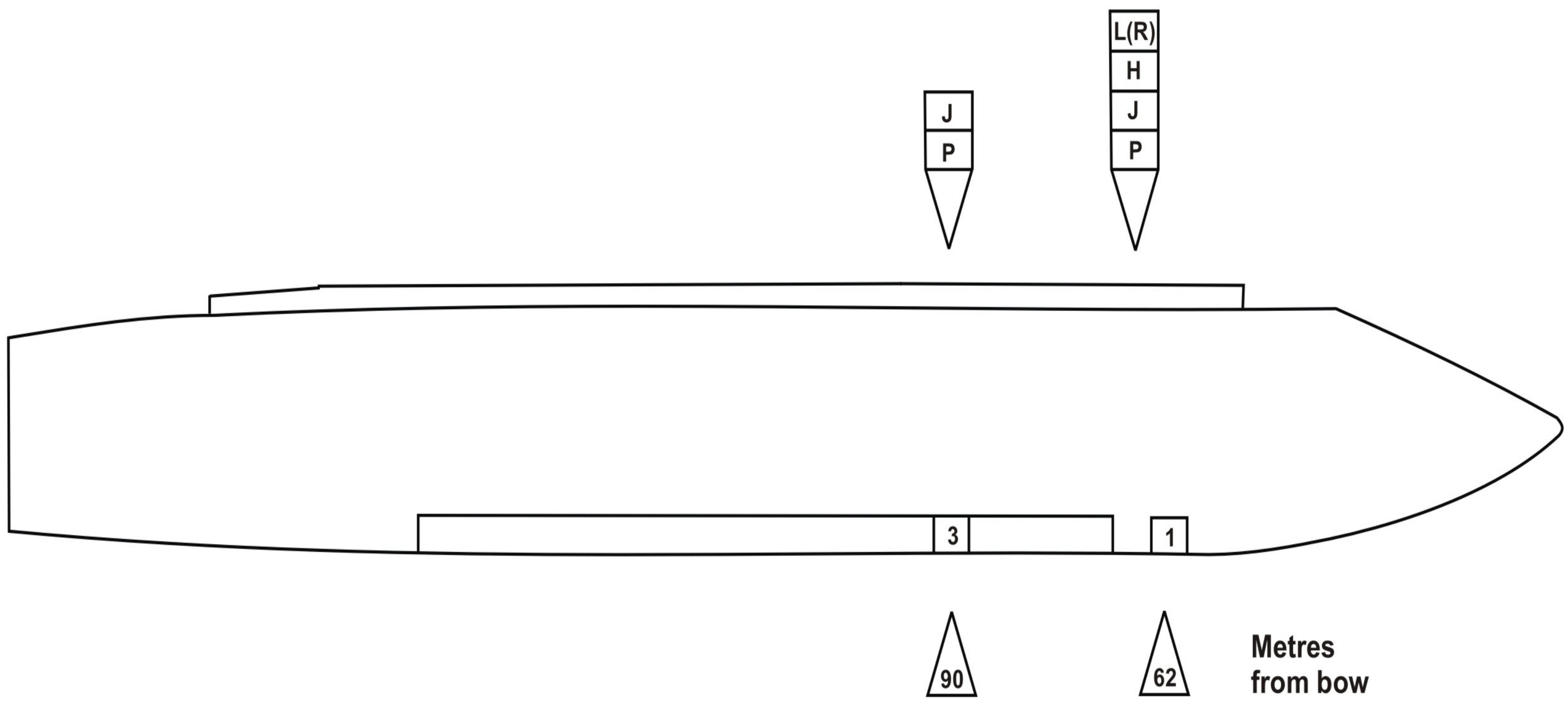
CVS - RAS ARRANGEMENTS

Scale 1:800 (approx) RAS position arrows are approximate. Distance from bow, shown in triangles, is accurate.



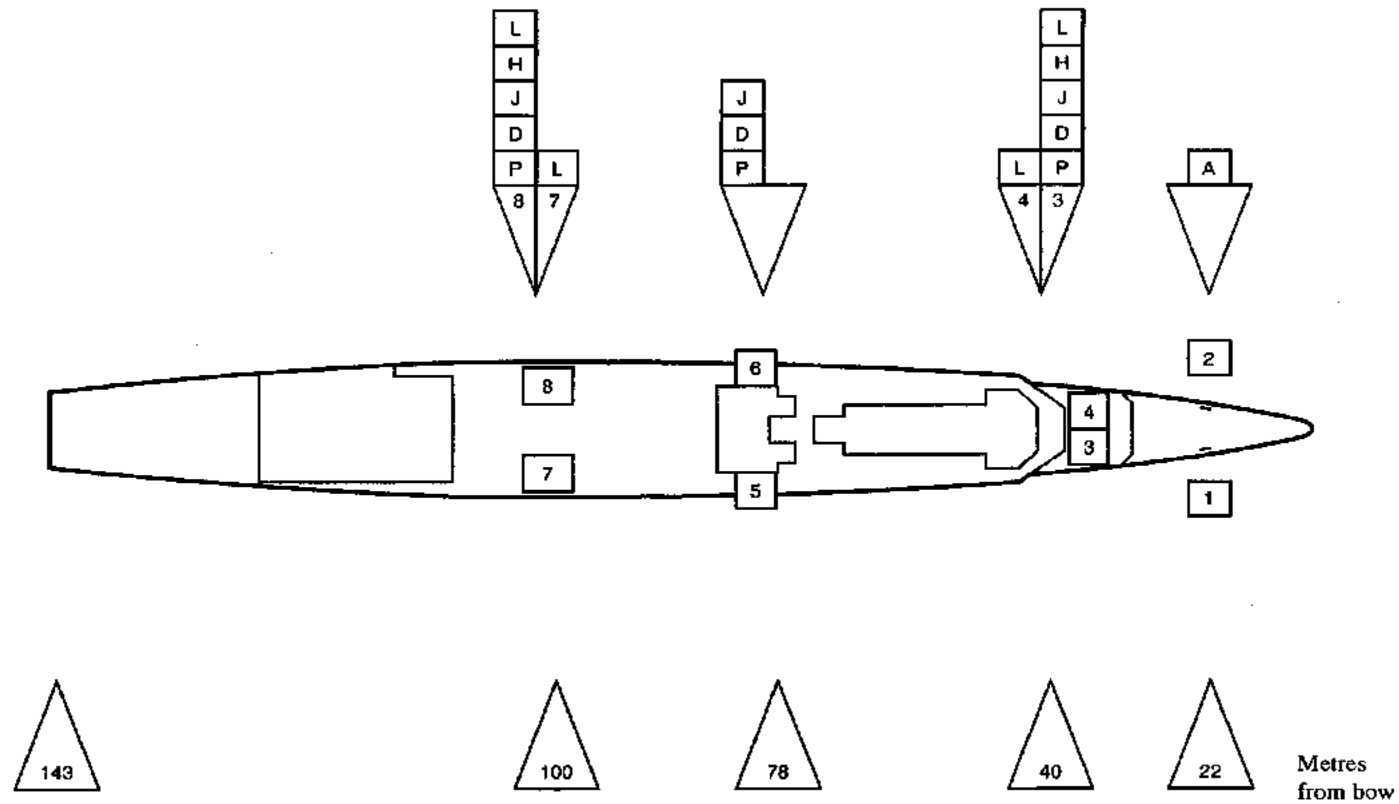
LPD - RAS ARRANGEMENTS

Scale 1:800 (approx) RAS position arrows are approximate. Distance from bow, shown in triangles, is accurate



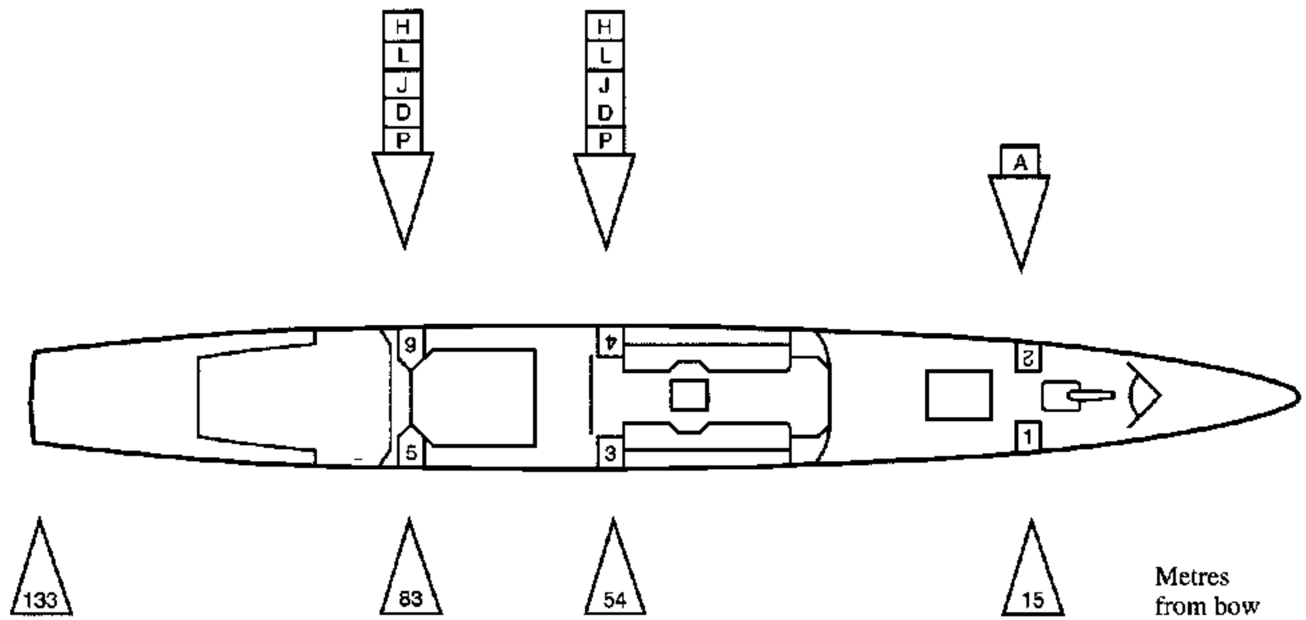
LPH - RAS ARRANGEMENTS

Scale 1:600 (approx) RAS position arrows are approximate. Distance from bow, shown in triangles, is accurate.



TYPE 22 FRIGATE - RAS ARRANGEMENTS

Scale 1:600 (approx) RAS position arrows are approximate. Distance from bow, shown in triangles, is accurate.

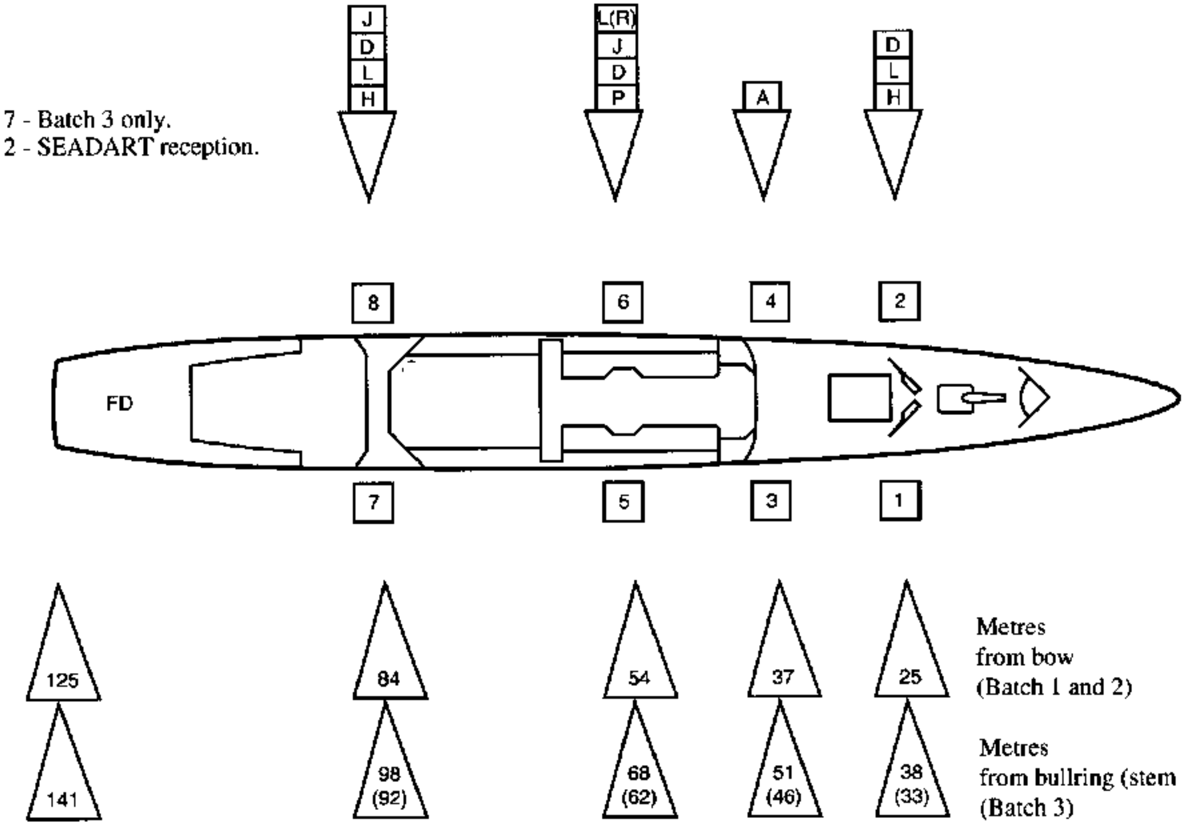


TYPE 23 FRIGATE - RAS ARRANGEMENTS

Scale 1:600 (approx) RAS position arrows are approximate. Distance from bow, shown in triangles, is accurate.

Remarks

1. Station 7 - Batch 3 only.
2. Station 2 - SEADART reception.

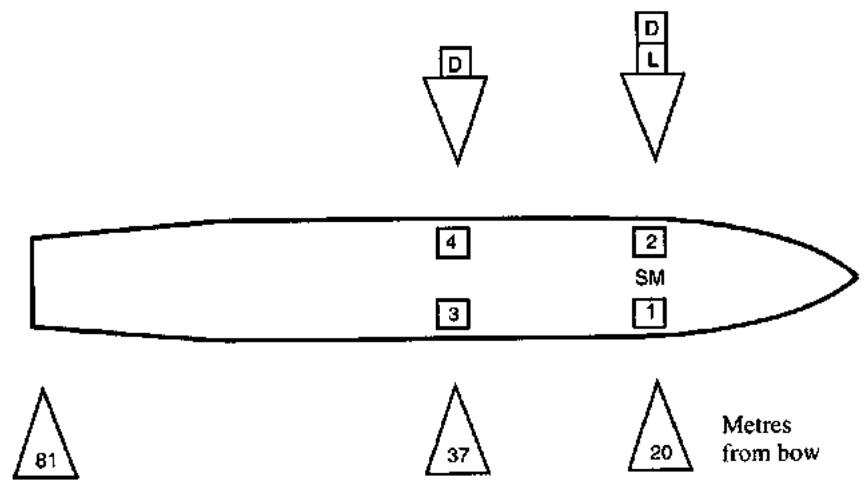


TYPE 42 DESTROYER - RAS ARRANGEMENTS

Scale 1:600 (approx) RAS position arrows are approximate. Distance from bow, shown in triangles, is accurate.

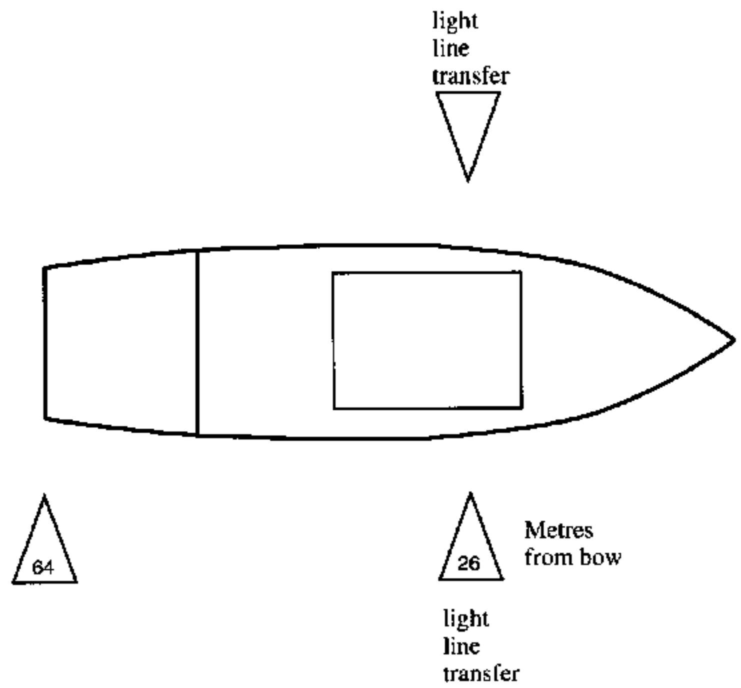
Remarks

Light jackstay not normally carried



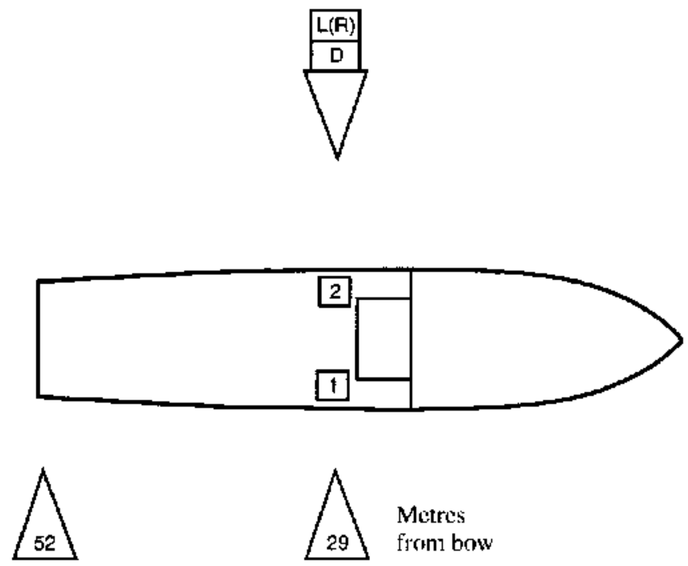
CASTLE CLASS OPV - RAS ARRANGEMENTS

Scale 1:600 (approx) RAS position arrows are approximate. Distance from bow, shown in triangles, is accurate



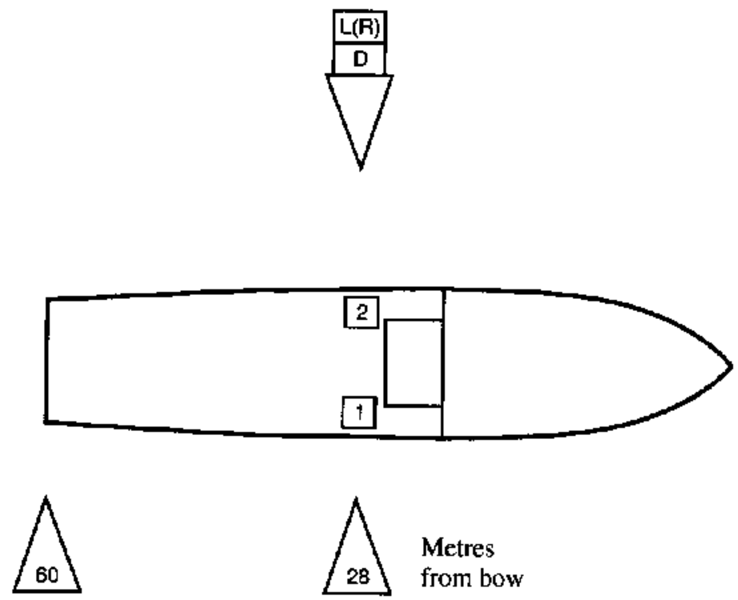
HMS ROEBUCK - RAS ARRANGEMENTS

Scale 1:600 (approx) RAS position arrows are approximate. Distance from bow, shown in triangles, is accurate



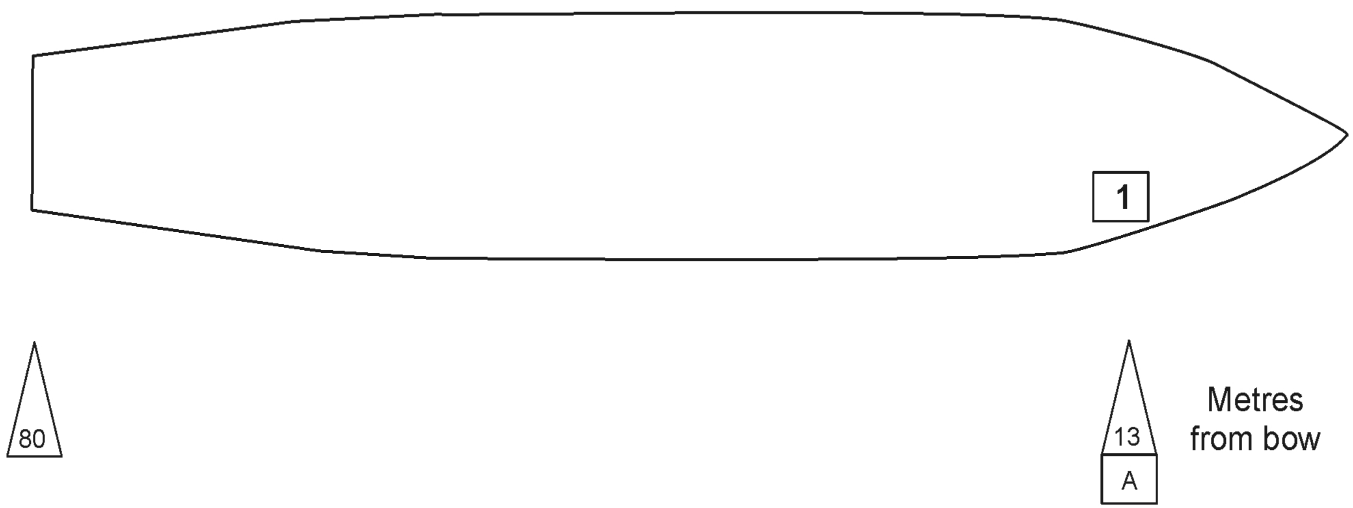
SANDOWN CLASS SRMH - RAS ARRANGEMENTS

Scale 1:600 (approx) RAS position arrows are approximate. Distance from bow, shown in triangles, is accurate



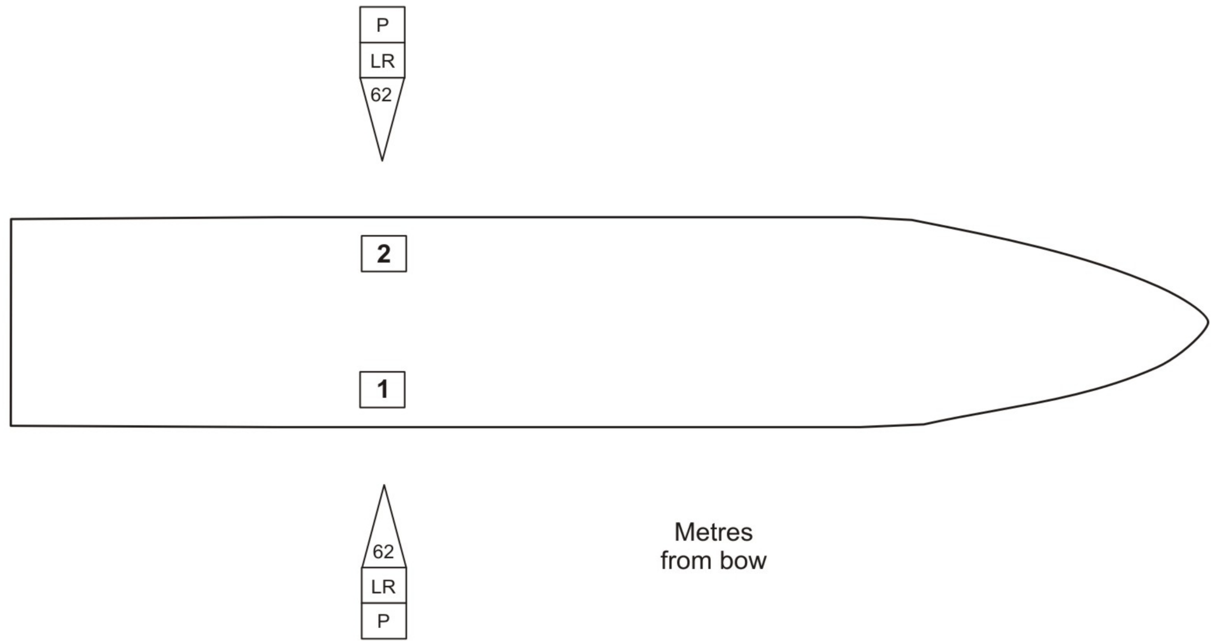
HUNT CLASS MCMV - RAS ARRANGEMENTS

Scale 1:600(approx) RAS position arrows are approximate. Distance from bow, shown in triangles, is accurate.



RIVER CLASS OPV - RAS ARRANGEMENTS

Scale 1:600(approx) RAS position arrows are approximate. Distance from bow shown in triangles, is accurate.



SVHO CLASS - RAS ARRANGEMENTS

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ANNEX C TO CHAPTER 6

STANDARD RAS BRIEFING FORMAT

1. Whenever practicable RAS teams must be briefed in good time before a replenishment serial is to be carried out. The content and style of the brief is dependant upon the experience of the RAS team. For inexperienced teams the use of RAS videos, on-site briefs at a fully rigged RAS station, diagrams and view-graphs should be considered. The following pages contained a standard briefing format for each type of replenishment, the headings should be used as an aide memoire to enable the full sequence of events to be covered. Formats should be amended as necessary to suit particular RAS rigs or associated equipment.

PAGE

STANDARD RAS BRIEF FORMAT

DAY
DATE
TIME
RAS STATION
CONSORT
TYPE OF RAS
NO OF LOADS/PASSENGERS/PUMPING TIME
CONSTRAINTS (INCLUDING THREATS)
SERIAL TIME/DURATION
CLOSE UP AT

PROBE FUELLING

CLOSE UP LBS/SOW REPORT TO OOW - STRIKE GUARDRAILS

GUNLINE FIRING SEQUENCE

HAULING IN THE GUNLINE

ATTACHING HOSELINE TO STRAYLINE

REMOVING ANCILLARY LINES

USE OF STRAYLINES TO PASS ANCILLARY LINES TO THEIR NOMINATED POSITION

CUTTING STOPS

REMOVING ANY TURNS OF HOSELINE FROM JACKSTAY

CONNECTING JACKSTAY TO PELICAN HOOK

TRANSFER WEIGHT TO JACKSTAY - REMOVE GRIPPER - UNTOGGLE - CONNECTED

JACKSTAY IS TENSIONED

HEAVE IN HOSELINE - ENGAGE PROBE

START PUMPING

RIG REMATING LINE - REMOVE HOSELINE

RETURN HOSELINE AND GRIPPER ON MESSENGER

STOP PUMPING - DRAIN DOWN

RELEASE PROBE

RETURN DISTANCE LINE/TELEPHONE LINES

JACKSTAY DETENSIONED

OUT ‘R’ CLIP - LOWER TEMPORARY GUARDRAIL

SLIP JACKSTAY

UP TEMPORARY GUARDRAIL

PROBE FUELLING - EMERGENCY BREAKAWAY PROCEDURES (EBA)

THE AIM OF EMERGENCY BREAKAWAY MUST BE TO DISENGAGE QUICKLY WITHOUT ENDANGERING LIFE AND WITH MINIMUM DAMAGE TO EQUIPMENT

EBA MAY BE INITIATED BY EITHER SHIP

AUTOMATICALLY RETURN/RECOVER DISTANCE LINE/TELEPHONE LINE/ MESSENGER

REMOVE OR CUT HOSELINE/REMATING LINE/RETAINING PENDANT - OPERATE RELEASE HANDLE - PERSONNEL TO CLEAR AREA AS TASKS ARE COMPLETED

OUT ‘R’ CLIP - LOWER TEMPORARY GUARDRAIL

PERSONNEL CLEAR THE AREA AS TASKS ARE COMPLETED

WHEN BOTH SHIPS ARE READY THE **DELIVERING SHIP** WILL EXECUTE EBA

ON EXECUTE EBA - TRIP PELICAN HOOK

UP TEMPORARY GUARDRAIL

BRIEF THE EMERGENCY BREAKAWAY PROCEDURE FOR ALL STAGES OF THE RAS

HOSE LINE BEING RETURNED - CONTINUE TO END AND LET GO

HOSELINE IN RECEIVING SHIP - RETAIN - PAY OUT MESSENGER TO END AND LET GO

ANY LINE THAT FOULS OR PASSES UNDER THE RIG SHOULD BE CUT

DERRICK/CRANE REFUELLING - QRC OR NATO ‹B‹ COUPLING

CLOSE UP LBS/SOW REPORT TO OOW - STRIKE GUARDRAILS

GUNLINE FIRING SEQUENCE

HAULING IN THE GUNLINE

ATTACH HOSELINE TAIL TO THE STRAYLINE

REMOVING ANCILLARY LINES

USE OF STRAYLINES TO PASS ANCILLARY LINES TO THEIR NOMINATED POSITION

HAULING IN HOSELINE BY HAND (OR USE POWER)

HEAVING ACROSS THE HOSE

PASSING THE TWO-PARTED TEMPORARY GUARDRAIL

USE OF PIG TAIL

CUTTING THE STOPS

LOWERING HOSE(S) TO THE DECK

ON HOSE HANGING PENDANT

CONNECTED

ON STROPS AND TACKLES

RIGGING OF SLIPROPE AND CONNECTION OF HOSES AT OIC/SAFETY OFFICER’S DISCRETION - REMEMBER TO OPEN SHUT-OFF VALVE

START PUMPING

RETURN HOSELINE ON MESSENGER

STOP PUMPING - CLOSE SHUT OFF VALVE

RAS COMPLETE

OFF STROPS AND TACKLES

HEAVE IN ON SLIPROPE

OFF HOSE HANGING PENDANT

RECOVER TOP LEG OF TEMPORARY GUARD RAIL

SURGE THE SLIPROPE

CUT/SLIP THE SLIPROPE - RETURN TELEPHONE/DISTANCE LINE

UP TEMPORARY GUARDRAIL

DERRICK/CRANE FUELLING - EMERGENCY BREAKAWAY PROCEDURE (EBA)

THE AIM OF EMERGENCY BREAKAWAY MUST BE TO DISENGAGE QUICKLY WITHOUT ENDANGERING LIFE AND WITH MINIMUM DAMAGE TO EQUIPMENT

EBA MAY BE INITIATED BY EITHER SHIP

AUTOMATICALLY RETURN/RECOVER DISTANCE LINE/TELEPHONE LINE/MESSENGER

CLOSE SHUT OFF VALVE/DISCONNECT QRC/BREAK NATO B SPOOL

REMOVE TACKLES

PERSONNEL CLEAR AREA AS TASKS ARE COMPLETED

HEAVE IN SLIP ROPE - REMOVE HOSE HANGING PENDANT - REMOVE TOP TEMPORARY GUARDRAIL

WHEN BOTH SHIPS ARE READY THE **DELIVERING SHIP** WILL EXECUTE EBA

ON EXECUTE EBA - CUT SLIPROPE ONCE HOSES ARE OUTBOARD WHETHER SLIP FITTED OR NOT

BRIEF THE EMERGENCY BREAKAWAY PROCEDURE FOR ALL STAGES OF THE RAS

MESSENGER STILL ATTACHED TO HOSELINE - PAY BACK AT EXECUTE EBA

MESSENGER REMOVED FROM HOSELINE - HOSELINE STILL ATTACHED TO RING - USE HOSELINE AS SLIPROPE

HOSELINE REMOVED - SLIPROPE NOT RIGGED - SLIP HOSE HANGING PENDANT

HOSELINE REMOVED - NOT ATTACHED TO MESSENGER - RETAIN HOSELINE

HOSELINE IN PROCESS OF BEING RETURNED - CONTINUE RETURNING

COILS NOT TO BE THROWN OVERBOARD

ANY LINE THAT FOULS OR PASSES UNDER THE RIG SHOULD BE CUT

JACKSTAY FUELLING PROCEDURES

CLOSE UP LBS/SOW REPORT TO OOW - STRIKE GUARDRAILS

GUNLINE FIRING SEQUENCE

HAULING IN THE GUNLINE

ATTACH HOSELINE TAIL TO THE STRAYLINE

REMOVING ANCILLARY LINES

USE OF STRAYLINES TO PASS ANCILLARY LINES TO THEIR NOMINATED POSITION

HAUL IN HOSELINE BY HAND (OR USE POWER)

BRING TO ON THE WINCH

HEAVE IN UNTIL JACKSTAY LINK AT HIGH POINT - CUT STOPS

REMOVE ANY TURNS OF HOSELINE FROM JACKSTAY

CONNECT JACKSTAY LINK TO SLIP - MOUSE PIN

TRANSFER WEIGHT TO SLIP - REMOVE GRIPPER AND TOGGLE - CONNECTED

HAUL IN HOSELINE BY HAND (OR USE POWER)

BRING TO ON THE WINCH

HEAVE IN HOSES - LOWER TEMPORARY GUARDRAIL AS NECESSARY

PASS TOP LEG OF TEMPORARY GUARDRAIL OVER HOSES

REMOVE PIGTAIL (1 DRY TURN) - CUT HOSE END STOP (DO NOT DROP HOSES)

CONTINUE HEAVING IN - CUTTING STOPS - USE OF PIGTAIL

WHEN IN REACH HOOK ON HOSE HANGING PENDANT

VEER HOSELINE TO HOSE HANGING PENDANT

ATTACH STROPS AND TACKLES (OPTIONAL)

OFF HOSELINE - RIG SLIPROPE (REMAINS BACKED UP)

CONNECT HOSES - OPEN SHUT OFF VALVE - START PUMPING

RETURN GRIPPER AND HOSELINE ON MESSENGER

JACKSTAY FUELLING PROCEDURES - CONTINUED

STOP PUMPING - CLOSE SHUT OFF VALVE - REPLENISHMENT COMPLETE

OFF TACKLES - RETURN TELEPHONE LINES

HEAVE IN SLIPROPE - OFF HANGING PENDANT - REMOVE TOP TEMPORARY GUARDRAIL

SURGE SLIPROPE - SLIP/CUT SLIPROPE WHEN HOSES ARE OUTBOARD

RECOVER SLIPROPE - RETURN DISTANCE LINE

REMOVE MOUSING - OUT PIN - LOWER TEMPORARY GUARDRAIL

WHEN TRIP PELICAN HOOK SIGNAL RECEIVED

SLIP JACKSTAY

UP TEMPORARY GUARDRAIL

JACKSTAY FUELLING PROCEDURES - EMERGENCY BREAKAWAY PROCEDURES (EBA)

THE AIM OF EMERGENCY BREAKAWAY MUST BE TO DISENGAGE QUICKLY WITHOUT ENDANGERING LIFE AND WITH MINIMUM DAMAGE TO EQUIPMENT

EBA MAY BE INITIATED BY EITHER SHIP

AUTOMATICALLY RETURN/RECOVER DISTANCE LINE/TELEPHONE LINE/MESSENGER

CLOSE SHUT OFF VALVE/DISCONNECT QRC/BREAK NATO B SPOOL

REMOVE TACKLES - PERSONNEL CLEAR THE AREA AS TASKS ARE COMPLETED

HEAVE IN SLIPROPE - REMOVE HOSE HANGING PENDANT - REMOVE TOP TEMPORARY GUARDRAIL

SURGE SLIPROPE UNTIL UNTIL SLACK - THEN CUT

GIVE ‹READY’ SIGNAL ONLY WHEN HOSE IS READY FOR SAFE RECOVERY

DELIVERING SHIP RECOVERS HOSES

OFF MOUSING - OUT PIN

WHEN BOTH SHIPS ARE READY THE **DELIVERING SHIP** WILL EXECUTE EBA

ON EXECUTE EBA - SLIP THE JACKSTAY

UP TEMPORARY GUARDRAIL

BRIEF THE EMERGENCY BREAKAWAY PROCEDURE FOR ALL STAGES OF THE RAS

MESSENGER STILL ATTACHED TO HOSELINE - PAY BACK AT EXECUTE EBA

MESSENGER REMOVED FROM HOSELINE - HOSELINE ATTACHED TO RING - USE HOSELINE AS SLIPROPE

HOSELINE REMOVED - SLIPROPE NOT RIGGED - SLIP HOSE HANGING PENDANT

HOSELINE REMOVED - NOT ATTACHED TO MESSENGER - RETAIN HOSELINE

HOSELINE IN PROCESS OF RETURN - CONTINUE RETURNING

COILS NOT TO BE THROWN OVERBOARD

ANY LINE THAT FOULS OR PASSES UNDER THE RIG SHOULD BE CUT

ASTERN FUELLING - FLOAT METHOD

MAKE UP GRAPNELS (RUNNING SHACKLE)

THROW GRAPNELS

HEAVING IN HOSELINE BIGHT

REMOVING THE FLOAT

FAIR WEATHER: PASS DISENGAGED END THROUGH ROLLER SHACKLES - HAUL IN

MARGINAL WEATHER: ATTACH PRE-RIGGED INHAUL WIRE THROUGH ROLLER SHACKLES - BRING TO - HEAVE IN

AS SHIP COMES AHEAD HEAVE IN HOSELINE

HOSE END THROUGH ROLLER FAIRLEADS

ATTACH HOSE HANGING PENDANT

ON STROPS AND TACKLES

OFF HOSELINE - ON SLIPROPE

CONNECT HOSE - OPEN SHUT OFF VALVE - PRESSURISE HOSE

CLEAR AREA OF NON-ESSENTIAL PERSONNEL

BRING HOSELINE THROUGH ROLLER FAIRLEAD - STOP CLOSE TO BRIDLE

RE-RIG HOSELINE

RE-ATTACH FLOAT

STOP PUMPING

CONNECT HOSELINE TO BRIDLE RING

BLOW THROUGH

RAS COMPLETE

DISCONNECT HOSE

REMOVE TACKLES AND STROPS

HEAVE IN SLIPROPE

ASTERN FUELLING - FLOAT METHOD - CONTINUED

OFF HANGING PENDANT

SURGE SLIPROPE

CUT SLIPROPE WHEN HOSE END IS JUST CLEAR OF THE WATER

COMMENCE CUTTING STOPS ON HOSELINE

LAST STOP IS THE FLOAT

ASTERN FUELLING - EMERGENCY BREAKAWAY PROCEDURES (EBA)

THE AIM OF EMERGENCY BREAKAWAY MUST BE TO DISENGAGE QUICKLY WITHOUT ENDANGERING LIFE AND WITH MINIMUM DAMAGE TO EQUIPMENT

EBA MAY BE INITIATED BY EITHER SHIP

CLOSE SHUT OFF VALVE/DISCONNECT QRC/BREAK NATO B SPOOL

REMOVE TACKLES AND STROPS

PERSONNEL CLEAR AREA AS TASKS ARE COMPLETED

HEAVE IN SLIPR0PE - REMOVE HOSE HANGING PENDANT

IF PENDANT CANNOT BE REMOVED IT MUST BE SLIPPED

SURGE SLIPROPE

WHEN HOSES ARE JUST OUTBOARD - CUT SLIPROPE

BRIEF THE EMERGENCY BREAKAWAY FOR ALL STAGES OF THE RAS

HOSELINE REMOVED - SLIPROPE NOT RIGGED - SLIP HANGING PENDANT

HOSELINE NOT REMOVED - USE AS SLIPROPE - DO NOT RE-ATTACH FLOAT

HOSES WILL BE RETURNED FULLY CHARGED - DO NOT BLOW THROUGH

HEAVY JACKSTAY - CONVENTIONAL

REMOVE GUARDRAILS - OOW INFORMED - LBS/SOW TO BE CLOSED UP

GUNLINE FIRING SEQUENCE

HAULING IN THE GUNLINE

ATTACH OUTHAUL TAIL TO THE STRAYLINE

HAULING/HEAVING IN THE OUTHAUL TAIL

REMOVING ANCILLARY LINES

USE OF STRAYLINES TO PASS ANCILLARY LINES TO THEIR NOMINATED POSITION

HEAVING ACROSS THE JACKSTAY ON THE OUTHAUL USING GRIPPER AND TOGGLE

CUTTING THE STOPS

PASS JACKSTAY CONTROL LINE (IF REQUIRED)

CONNECTING JACKSTAY TO 9835 SLIP OR QRD

TRANSFER WEIGHT TO SLIP/QRD

REMOVE GRIPPER AND TOGGLE

CONNECTED

DOWN SLACK ON OUTHAUL

RFA TENSIONS JACKSTAY

RFA DETENSIONS JACKSTAY

HOOK ON TEST WEIGHT

RFA TENSIONS JACKSTAY

PASS TEST WEIGHT

RFA DETENSIONS JACKSTAY - LOWERS TEST WEIGHT TO SHOT MAT

ROUGH WEATHER USE OF JACKSTAY CONTROL LINE

DO NOT UNHOOK TEST WEIGHT

HEAVY JACKSTAY - CONVENTIONAL - CONTINUED

RFA TENSIONS JACKSTAY.

REDUCE TURNS ON WINCH (OR DECLUTCH CAPTIVE DRUM)

PAY BACK TEST WEIGHT TO RFA

SURGE THE OUTHAUL (BRIEF TEAM IF OUTHAUL TO BE WORKED BY HAND/CAPTIVE DRUM - AND USE OF OUTHAUL WHEN UNHOOKING LOADS/NOT SUPPORTING LOAD WITH INHAUL)

REMOVE TEST WEIGHT SHOT MAT

COMMENCE PASSING LOADS

PAY BACK MESSENGER IF USED

LAST LOAD PALLETS/PALLET TRUCKS

RAS COMPLETE

RFA RECOVERS OUTHAUL

RFA DETENSIONS JACKSTAY

OFF MOUSING - OUT PIN

CLEAR DUMP AREA

DOWN TEMPORARY GUARDRAIL

SLIP THE JACKSTAY

UP TEMPORARY GUARDRAIL

RETURN TELEPHONE LINES AND DISTANCE LINE

REPLACE GUARDRAILS

HEAVY JACKSTAY - CONVENTIONAL - EMERGENCY BREAKAWAY PROCEDURE (EBA)

THE AIM OF EMERGENCY BREAKAWAY MUST BE TO DISENGAGE QUICKLY WITHOUT ENDANGERING LIFE AND WITH MINIMUM DAMAGE TO EQUIPMENT

AUTOMATICALLY RETURN/RECOVER DISTANCE LINE/TELEPHONE LINE/MESSENGER

RETURN TRAVELLER TO DELIVERING SHIP

DELIVERING SHIP UNHOOKS LOAD AND DETENTIONS JACKSTAY

OFF MOUSING - OUT PIN - LOWER TEMPORARY GUARDRAIL

WHEN BOTH SHIPS ARE READY THE **DELIVERING SHIP** WILL EXECUTE EBA

ON EXECUTE EBA - SLIP THE JACKSTAY

UP TEMPORARY GUARDRAIL

PAY OUT OUTHAUL

COILS ARE NOT TO BE THROWN OVERBOARD

ANY LINE THAT FOULS OR PASSES UNDER THE SHOULD BE CUT

HEAVY JACKSTAY - SLIDING PAD-EYE RIG

REMOVE GUARDRAILS - OOW INFORMED - LBS/SOW TO BE CLOSED UP

GUNLINE FIRING SEQUENCE

HAULING IN THE GUNLINE

ATTACH HAULING OVER LINE TO THE STRAYLINE

REMOVE ANCILLARY LINES

USE OF STRAYLINES TO PASS ANCILLARY LINES TO THEIR NOMINATED POSITION

HEAVING ACROSS JACKSTAY ON HAULING OVER LINE USING GRIPPER AND TOGGLE

CUTTING THE STOPS

PASS JACKSTAY CONTROL LINE (IF REQUIRED)

CONNECTING JACKSTAY TO 9835 SLIP/QRD (TERMINAL LINK CORRECT WAY UP)

TRANSFER WEIGHT TO SLIP/QRD

REMOVE GRIPPER AND TOGGLE

REMOVE JACKSTAY CONTROL LINE (IF USED)

CONNECTED

DOWN SLACK ON HAULING OVER LINE

RFA TENSIONS JACKSTAY

HEAVE IN HAULING OVER LINE WITH RETURN SHEAVE ASSEMBLY ATTACHED

RETURN SHEAVE ASSEMBLY MATED WITH TERMINAL LINK

REMOVE HAULING OVER LINE FROM WARPING DRUM (OR VEER SUFFICIENT

SLACK FROM CAPTIVE DRUM) TO ALLOW HAULING OVER LINE TO RUN FREE

IF RETURN SHEAVE ASSEMBLY DOES NOT MATE CORRECTLY, SIGNAL ‘TENSION’

IF RETURN SHEAVE ASSEMBLY PULLS FREE, SIGNAL ‘HEAVE IN’ THEN ‘CHECK AWAY’

CONTINUE UNTIL SUCCESSFUL MATING IS ACHIEVED

HEAVY JACKSTAY -SLIDING PAD-EYE CONTINUED

CONNECTED - ON PREVENTER

REMOVE HAULING OVER LINE AND RETURN AS LOAD WITH GRIPPER

RFA PASSES LIGHT TRAVELLER

AVAST WHEN TRAVELLER IS IN REQUIRED POSITION

HOLD RED BAT ALOFT IF TRAVELLER IS CORRECTLY POSITIONED

RFA RECOVERS TRAVELLER (MARKS TRAVELLER POSITION IN DELIVERING SHIP)

RFA PASSES LIGHT TRAVELLER TO CHECK MARKED POSITION CORRECT

HOLD RED BAT ALOFT IF MARKED POSITION CORRECT

REPEAT MARKING PROCEDURE IF REQUIRED

HOOK ON TEST WEIGHT

PASS TEST WEIGHT

LOWER TEST WEIGHT TO SHOT MAT

PASS CONTROL LINE IF REQUIRED

DO NOT UNHOOK TEST WEIGHT

RFA RECOVERS TEST WEIGHT

REMOVE SHOT MAT

COMMENCE PASSING LOADS

LAST LOAD PALLETS/PALLET TRUCKS

RAS COMPLETE

RFA DETENSIONS OUTHAUL

OFF PREVENTER - RELEASE THE RETURN SHEAVE ASSEMBLY - RFA RECOVERS

HEAVE JACKSTAY - SLIDING PAD-EYE CONTINUED

RIG THE EASING-OUT ROPE

RFA DETENSIONS JACKSTAY

HEAVE IN EASING-OUT ROPE

OFF MOUSING - OUT PIN

CLEAR DUMP AREA

DOWN TEMPORARY GUARDRAIL

SLIP THE JACKSTAY

SURGE OR VEER THE EASING-OUT ROPE

WHEN TERMINAL LINK IS OUTBOARD - CUT THE EASING-OUT ROPE

UP TEMPORARY GUARDRAIL

RETURN TELEPHONE LINES AND DISTANCE LINE

REPLACE GUARDRAILS

HEAVY JACKSTAY - SLIDING PAD-EYE RIG - EMERGENCY BREAKAWAY PROCEDURE (EBA)

THE AIM OF EMERGENCY BREAKAWAY MUST BE TO DISENGAGE QUICKLY WITHOUT ENDANGERING LIFE AND WITH MINIMUM DAMAGE TO EQUIPMENT

EBA MAY BE INITATED BY EITHER SHIP

AUTOMATICALLY RETURN/RECOVER DISTANCE LINE/TELEPHONE LINE/MESSENGER

RFA RECOVERS TRAVELLER (IF THE LOAD IS ON DECK RAISE THE PADEYE AND GIVE ‘HEAVE IN’ THEN CONTINUE WITH DRILL)

RFA DETENSIONS OUTHAUL

OFF PREVENTER

RELEASE RETURN SHEAVE ASSEMBLY

RFA DETENSIONS JACKSTAY

OFF MOUSING - OUT PIN - LOWER TEMPORARY GUARDRAIL

WHEN BOTH SHIPS ARE READY THE **DELIVERING SHIP** WILL EXECUTE EBA

ON EXECUTE EBA - SLIP THE JACKSTAY

UP TEMPORARY GUARDRAIL

COILS ARE NOT TO BE THROWN OVERBOARD

ANY LINE THAT FOULS OR PASSES UNDER THE RIG SHOULD BE CUT

LIGHT JACKSTAY - RECEIVING

REMOVE GUARDRAILS - OOW INFORMED LBS/SOW TO BE CLOSED UP

GUNLINE FIRING SEQUENCE

HAULING IN GUNLINE

ATTACHING OUTHAUL TO STRAYLINE

REMOVING ANCILLARY LINES

USE OF STRAYLINE TO PASS ANCILLARY LINES TO THEIR NOMINATED POSITION

HAULING ACROSS THE JACKSTAY ON THE OUTHAUL

CONNECTING JACKSTAY SWR GROMMET TO 9747 SLIP

TRANSFERRING WEIGHT OF JACKSTAY TO SLIP

REMOVING THE TOGGLE

CONNECTED

DOWN SLACK ON OUTHAUL

TENSIONING THE JACKSTAY

CHECK FOR TURNS IN ALL ROPES

HOOKING ON TEST WEIGHT

HAULING ACROSS TEST WEIGHT

RECEIVING TEST WEIGHT INBOARD - LOWERED ON TO SHOT MAT

DO NOT UNHOOK TEST WEIGHT

RETURNING TEST WEIGHT - REMOVE TEST WEIGHT SHOT MAT

BRIEF RATING TO CUT INHAUL AUTOMATICALLY IF JACKSTAY SHOULD PART

COMMENCING TRANSFER OF PERSONNEL/LOADS (RAS BAGS)

RAS COMPLETE

DELIVERING SHIP RECOVERS 10 METRES OF OUTHAUL

LIGHT JACKSTAY - RECEIVING - CONTINUED

TOGGLE IN JACKSTAY

SLIP JACKSTAY AND RETURN WITH OUTHAUL

RETURN ANCILLARY LINES

LIGHT JACKSTAY - RECEIVING - EMERGENCY BREAKAWAY PROCEDURES (EBA)

THE AIM OF EMERGENCY BREAKAWAY MUST BE TO DISENGAGE QUICKLY WITHOUT ENDANGERING LIFE AND WITH MINIMUM DAMAGE TO EQUIPMENT

EBA MAY BE INITIATED BY EITHER SHIP

AUTOMATICALLY RETURN/RECOVER DISTANCE LINE/TELEPHONE LINE/MESSENGER

TRAVELLER IN TRANSIT - COMPLETE RUN THEN UNHOOK LOAD

TRAVELLER IN EITHER SHIP - UNHOOK LOAD AND RETAIN

DELIVERING SHIP DETENSIONS JACKSTAY

OFF MOUSING - OUT PIN - LOWER TEMPORARY GUARDRAIL

WHEN BOTH SHIPS ARE READY THE **DELIVERING SHIP** WILL EXECUTE EBA - ON EXECUTE EBA - SLIP THE JACKSTAY - IF TRAVELLER IS IN RECEIVING SHIP WHEN THE JACKSTAY IS SLIPPED THE WEIGHT OF THE JACKSTAY AND TRAVELLER WILL BE ON THE OUTHAUL

UP TEMPORARY GUARDRAIL

PAY OUT OUTHAUL

COILS ARE NOT TO BE THROWN OVERBOARD

ANY LINE THAT FOULS SHOULD BE CUT

LIGHT JACKSTAY - DELIVERING SHIP

REMOVE GUARDRAILS - OOW INFORMED - LBS/SOW TO BE CLOSED UP

GUNLINE FIRING SEQUENCE

ATTACH OUTHAUL TO GUNLINE - PAY OUT

ATTACH DISTANCE LINE (AND TELEPHONE LINE IF REQUIRED) TO OUTHAUL -PAY OUT

ATTACH OUTHAUL TO JACKSTAY WITH TOGGLE (DOUBLE LOOP) - PAY OUT (JACKSTAY IS PAYED OUT ‹THROUGH THE BLOCKS’)

WHEN JACKSTAY CONNECTED IN RECEIVING SHIP PAY OUT REMAINDER OF OUTHAUL

TENSION JACKSTAY - CHECK RIG FOR TURNS AND CORRECT LEADS

DETENSION JACKSTAY - HOOK ON TEST WEIGHT - DOWN SLACK INHAUL

TENSION JACKSTAY - LOWER TEMPORARY GUARDRAIL - PASS TEST WEIGHT

DETENSION JACKSTAY - TEST WEIGHT LOWERED TO SHOT MAT - **NOT UNHOOKED**

TENSION JACKSTAY - RECOVER TEST WEIGHT

DETENSION JACKSTAY - UNHOOK TEST WEIGHT TAKE CLEAR OF DUMP

BRIEF RATING TO CUT INHAUL AUTOMATICALLY IF JACKSTAY SHOULD PART

CONTINUE TRANSFER

REPLENISHMENT COMPLETE

RECOVER 10 METRES OF OUTHAUL

OUTHAUL TOGGLED TO JACKSTAY - SLIP REMOVED (RECEIVING SHIP)

HAUL IN JACKSTAY AND OUTHAUL

RECOVER DISTANCE LINE (AND TELEPHONE LINE IF USED)

LIGHT JACKSTAY - DELIVERING SHIP - EMERGENCY BREAKAWAY PROCEDURE (EBA)

THE AIM OF EMERGENCY BREAKAWAY MUST BE TO DISENGAGE QUICKLY WITHOUT ENDANGERING LIFE AND WITH MINIMUM DAMAGE TO EQUIPMENT

EBA MAY BE INITIATED BY EITHER SHIP

AUTOMATICALLY RETURN/RECOVER DISTANCE LINE/TELEPHONE LINE/MESSENGER

TRAVELLER IN TRANSIT - COMPLETE RUN THEN UNHOOK LOAD

TRAVELLER IN EITHER SHIP - UNHOOK LOAD AND RETAIN

DETENTION JACKSTAY - KEEP CLEAR OF WATER

WHEN BOTH SHIPS ARE READY THE **DELIVERING SHIP** WILL EXECUTE EBA

RECOVER JACKSTAY AND OUTHAUL

ANY LINE THAT FOULS SHOULD BE CUT

LIGHT LINE TRANSFER - DELIVERING SHIP

RIG DUMP AREA

GUNLINE FIRING SEQUENCE

ATTACH GUNLINE TO INGLEFIELD CLIP IN END OF LIGHT LINE

PAY OUT LIGHT LINE

WHEN SECOND INGLEFIELD CLIP (40M MARK) IS IN THE DUMP

ATTACH DISTANCE LINE

PAY OUT LIGHT LINE AND DISTANCE LINE

WHEN MID-WAY MARK (RED BUNTING) IS IN DUMP AREA - AVAST

ATTACH LOAD TO BE TRANSFERRED (MAX 14KG)

CONTINUE TRANSFER OF LOAD(S)

RAS COMPLETE RECOVER LIGHT LINE

RECOVER DISTANCE LINE

LIFEBUOY SENTRY/SWIMMER OF THE WATCH BRIEF

DRESS READY ON ENGAGED SIDE ADJACENT LIFEBUOY IN ALLOCATED STOWAGE

TO BE CLOSED UP PRIOR TO GUARDRAILS BEING STRUCK

NORMAL CLOSING UP PROCEDURE SHOULD BE FOLLOWED

TO REMAIN CLOSED UP UNTIL GUARDRAILS ERECTED ON COMPLETION OF RAS AND STOOD DOWN BY OOW

SAFETY EQUIPMENT BRIEF (RECOMMENDED BRIEF GIVEN BY LS SPECIALIST)

HAZARDOUS DUTY LIFEJACKET (INFLATE FOR NEW RAS TEAM)

OTHER APPROPRIATE LIFEJACKET

MULTIFAB SUITS (IF REQUIRED FOR DISTANCE LINE/TEMPORARY GUARDRAIL)

SAFETY HARNESS

DRESS FOR LIGHT JACKSTAY PASSENGERS

LIGHT JACKSTAY PASSENGER CONDUCT AND USE OF RESCUE STROP

SAFETY HELMET - CHECK ISSUE/RETURN DATE - USE OF CHINSTRAP

SAFETY OFFICER'S BRIEF

MOVING WEIGHTS	DO NOT STAND BETWEEN LOADS AND BULKHEADS DO NOT STAND BETWEEN RIGS AND BULKHEADS
TENSIONED LINES	DO NOT CROSS OVER/UNDER RIGS DO NOT CROSS/STRADDLE/STAND UNDER LINES DO NOT STAND OUTBOARD OF LOAD
WINCHES/CAPSTANS	STAND 2 METRES CLEAR WHEN TENDING ROPES DO NOT STAND IN LINE OF RECOIL BEWARE OF RIDING TURNS
DUMP AREA	ONLY ENTER WHEN ORDERED GUARDRAILS - USE OF SAFETY HARNESS WHEN STRIKING/ERECTING - OOW INFORMED - LBS/SOW TO BE CLOSED UP
ROPES/LINES	DO NOT STAND IN BIGHTS DO NOT TAKE TURNS ROUND THE BODY WITH ROPES DO PASS ROPES HAND OVER HAND TEND LINES FROM FOR'D WHEN POSSIBLE FAKE/COIL LINES WHEN RECEIVED INBOARD
STOP	**THE WORD "STOP"CAN BE USED AT ANY TIME DURING THE RAS TO INDICATE A SAFETY ISSUE. ON HEARING "STOP" ALL PERSONNEL ARE TO STOP WHAT THEY ARE DOING IMMEDIATELY AND AWAIT FURTHER INSTRUCTIONS.**
DRESS	DMS BOOTS - HDLJ - SHARP KNIFE - SAFETY HELMET- WARM CLOTHING/FOUL WEATHER GEAR/IMMERSION SUITS WHERE APPROPRIATE - GOGGLES AND SAFETY HARNESS SCARVES - SWEAT RAGS - OTHER NECK WEAR - LOOSE CLOTHING - FINGER RINGS - JEWELLERY ETC **CAN BE HAZARDOUS** - REMOVE THEM
WEATHER CONDITIONS	SEA STATE/PREVAILING WIND/ TEMPERATURE RAS COURSE INTO SEA/DOWN SEA/ OTHER

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ANNEX D TO CHAPTER 6

RAS TEAM FORMAT

1. The following information is provided to assist in the planning of RAS teams and to make best use of limited manpower. The example below lists the personnel required for a large derrick fuelling. For other types of replenishment the manpower requirement should be adjusted as necessary.

2. Breakdown of personnel (one rating unless stated).

Safety Officer	
CBM	
Batman	
Winch/Capstan Operator	
Communications Number	
Lifebuoy Sentry/Swimmer of the Watch	
Gunline/I/C Dump/Fuelling Party	L/Sea Specialist
Gunline/Tackle/Highpoint/Dump/Fuelling Party	
Dump Fuelling Party	2 Ratings
Messenger	2 Ratings
Steadying Tackles	
Hoseline/Sliprope	3 Ratings
Distance line	2 Ratings
Temporary Guardrail	

Total 19

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CHAPTER 7

SURVIVAL AND SAFETY

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CHAPTER 7

SURVIVAL AND SAFETY

07001. Historical Background

During the Second World war most Royal Navy shipwreck survivors were rescued within 12 hours of their ship sinking and in only a very few cases was rescue delayed for over 24 hours. Despite this timely response the death rate was extraordinarily high. It is estimated that two-thirds of all Royal Navy fatalities at sea abandoned ship successfully only to die in the water or on Carley floats before rescue. The sinking of the aircraft carrier HMS GLORIOUS is a frightening example of this point. Of the 1000 or more ship's company who, it is estimated, abandoned ship, only about 400 were able to board the rafts and of these only 36 survived the two-and-a-half winter days in the North Sea before being rescued in a very degraded physical condition. There were many contributing reasons for the high fatality rate but undoubtedly the major blame must lie with the lifesaving equipment of the time. The equipment did little to reduce the excessive loss of body heat on immersion, even in subtropical waters, and when a survivor slowly became unconscious the flotation aid provided did not keep the wearer's mouth and nose above water. Analysis has shown without doubt that the greatest threat to shipwrecked survivors is the cold. The incidents on the graph (Fig 7-1) indicate the distribution of probable survival times for unprotected casualties immersed in water of various temperatures. The curve indicates the estimated time for which only 50 per cent of unprotected casualties may expect to survive immersion at given water temperatures.

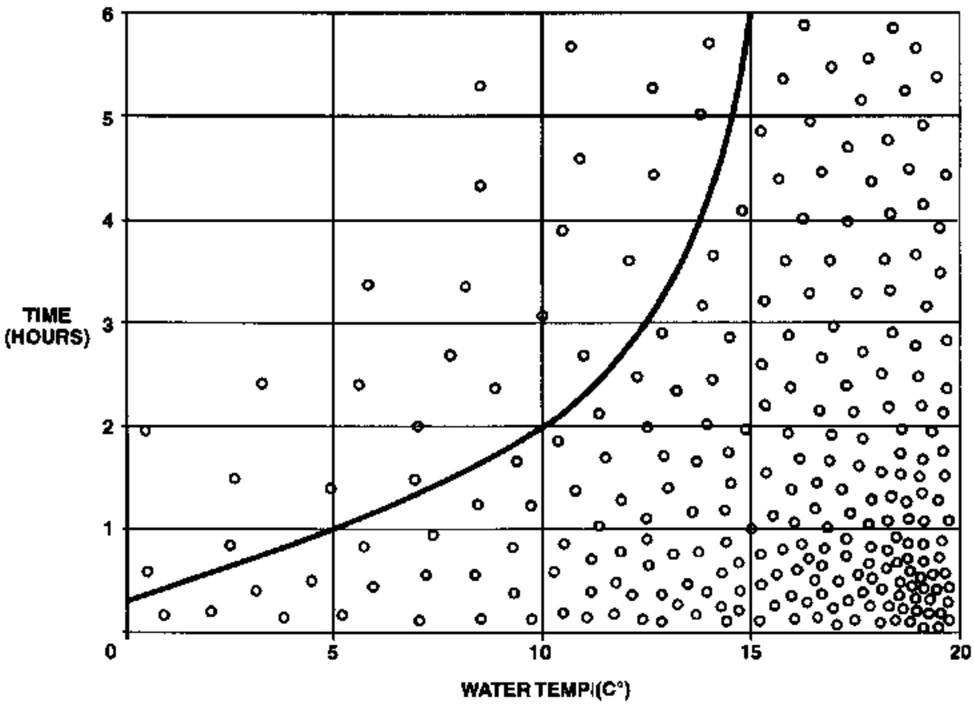

Fig 7-1. Curve of Estimated Time Against Water Temperature for which 50% of Unprotected Casualties May Expect to Survive Immersion

Modern lifesaving equipment has been designed specifically to counteract the dangerous heat-loss from the body. Additionally, in the event of consciousness being lost, it will give the individual the best possible protection against drowning. Good knowledge of lifesaving equipment, especially personal equipment, is essential in order to survive the rigours of a cold sea. Accounts of recent loss of life at sea, where modern equipment was available to men who did not know how to use it to the best advantage, reveal the importance of such knowledge and training. However remote may be the possibility of disaster from fire, collision, stranding or enemy action, seafarers should always be prepared to abandon ship when necessary and take to the liferafts. Every seafarer should also be prepared to rescue survivors from another ship. Preparation for such eventualities includes the provision of lifesaving equipment and training in its use, but the best equipment is of little value without good organisation and high standards of discipline, leadership and morale. The chance of survival after shipwreck is better today than at any time in the past. A General Service lifejacket is designed to enable the wearer to jump safely into the sea from a considerable height and to keep the wearer's mouth and nose out of the water should they be unconscious or asleep. A survival suit keeps them dry, and an enclosed liferaft protects them from the elements and provides them with food and water until rescued. The prospects of rescue from liferafts have also been improved by radio beacons and other aids to detection. The following paragraphs give details of the survival and safety equipment used in the Royal Navy.

07002. The General Service lifejacket Mk 4.(Fig 7-2)

a. **Introduction**. A General Service Lifejacket (GSLJ) is supplied to every person in the ship; it should be carried at Emergency Stations and Action Stations, and when the ship is in Defence Watches in wartime.

b. **Description**. The GSLJ is carried ready for use in a pouch attached to a waist belt. This is secured round the wearer's waist belt by an interlocking nylon buckle. There is a plastic name tag in a clear-view pocket on the pouch for showing the holder's name and official number. (written in pencil). **This is the only method authorised for marking the GSLJ**. The lifejacket is used by removing it from its pouch, passing the head through the neck aperture of the stole and then adjusting the belt to a snug fit around the waist. Incorporated in the construction of the lifejacket are a hood with a transparent visor, handling harness, a whistle, reflective patches, a lifeline and toggle and a sea light and battery.

c. **Operation**. The lifejacket has to be orally inflated by means of the mouthpiece and inflation tube. Depression of the mouthpiece when blowing opens a valve which allows air to enter the stole. The valve is spring-loaded to the closed position and can also be turned to a locked closed position to prevent inadvertent deflation. If the valve cannot be depressed, rotate it one-half turn to the right and then depress. **The lifejacket is only to be used fully inflated.**

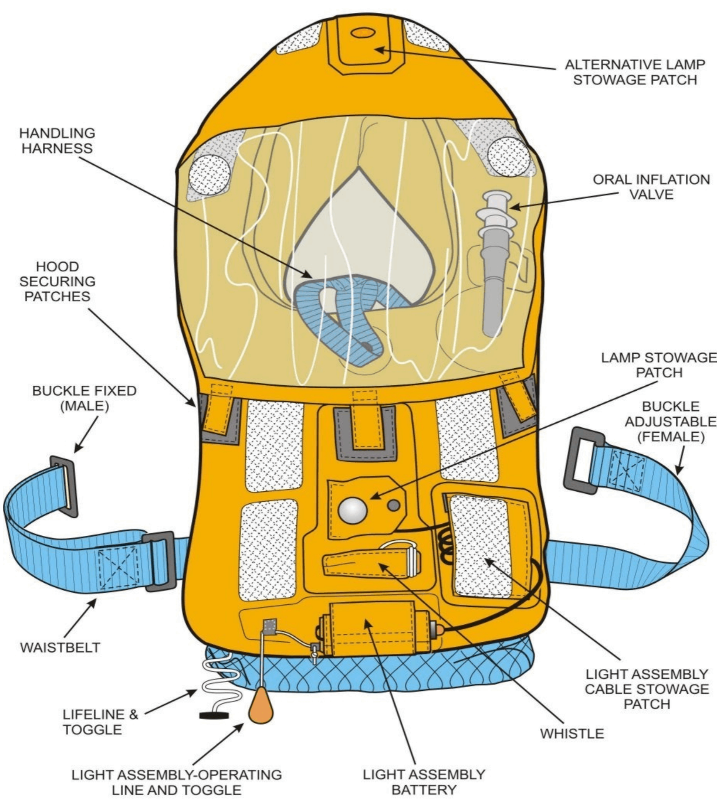

Fig 7-2. General Service Lifejacket Mk 4

d. **Maintenance**. The GSLJ must be maintained and inspected in accordance with the schedules laid down in the Sea Survival Equipment Log.

e. **Allowances.** In addition to the GSLJs issued on personnel loan to the ship's company a further number, equal to 50% of the ship's company, are individually heat-sealed in plastic bags and stowed in Emergency Lifejacket boxes fitted on the upper deck, adjacent to exits, escape and evacuation routes. A further quantity equal to 5% of the ship's company are held as spares by the Chief Bosun's Mate. (In circumstances, such as liberty men returning by boat the OOW may authorise Emergency Lifejacket boxes to be placed in the boat. Coxswains of boats are to inform the ship's Safety Equipment Supervisor if any of the boxes are opened). There is no separate allowance of GSLJs for boats.

f. **Emergency Lifejacket Stowages**. As already mentioned, a quantity of GSLJs equal to 50% of the ship's company are carried in Emergency Lifejacket boxes fitted on the upper deck adjacent to exits, escape and evacuation routes; where possible the boxes should be 'float-free'. The stowage boxes come in two sizes:

(1) Emergency Lifejacket Box (Large) Stores No 0472/520-5493 for 25 jackets maximum. (These boxes can also be used to stow 24 Once Only suits).

(2) Emergency Lifejacket Box (Small) Stores No 0472/758-2407 for 10 jackets maximum. (These boxes can also be used to stow 10 Once Only suits).

Boxes must be clearly marked in red 25mm lettering 'EMERGENCY LIFEJACKETS'. The number of lifejackets contained in the box (10 or 25 maximum) is to be stencilled below in black lettering . Additionally, to assist in identification for maintenance purposes the boxes are marked with a local letter. To prevent tampering, the clips of each box cover are to be sealed with copper wire which breaks easily on opening the box.

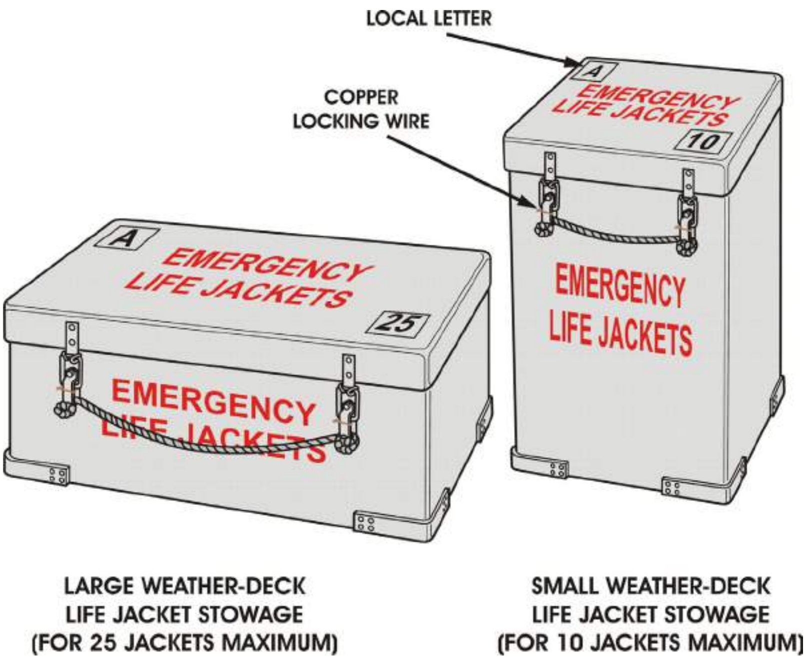

Fig 7-3. Weather-deck Emergency Lifejacket Stowage (Example)

07003. Hazardous Duty Lifejacket Mk 3. (Fig 7-4)

a. **Introduction**. The Hazardous Duty Lifejacket (HDLJ) is issued as and when required for use by personnel whose duty or work puts them at risk on the weather decks. It must not be worn in aircraft. A limited quantity are supplied to each ship, and these are used by personnel working in hazardous situations. The wearer is limited to 2.5kg of additional equipment.

b. **Description**. The lifejacket is contained in a blue halter-type valise and is fitted with an adjustable belt by which it is secured to the body of the wearer. It has a buoyancy of 169N. Incorporated in the construction of the lifejacket are a hood with a transparent visor which gives good spray protection to the face and is provided with effective location aids, a whistle, reflective patches, a lifeline with toggle and an LJ2 lamp assembly with alternative fitting positions for the light on the hood. After inflation of the jacket the battery is activated automatically. It can be switched off when not required. Scarlet thread tell-tale ties are fastened through eyelets to both sides of the valise. These ties act as a guide to the user, if one or both of the threads are broken it must be assumed that the jacket has been inadvertently inflated and it must be returned to the SSE rating for servicing. **It must not be used in this condition.**

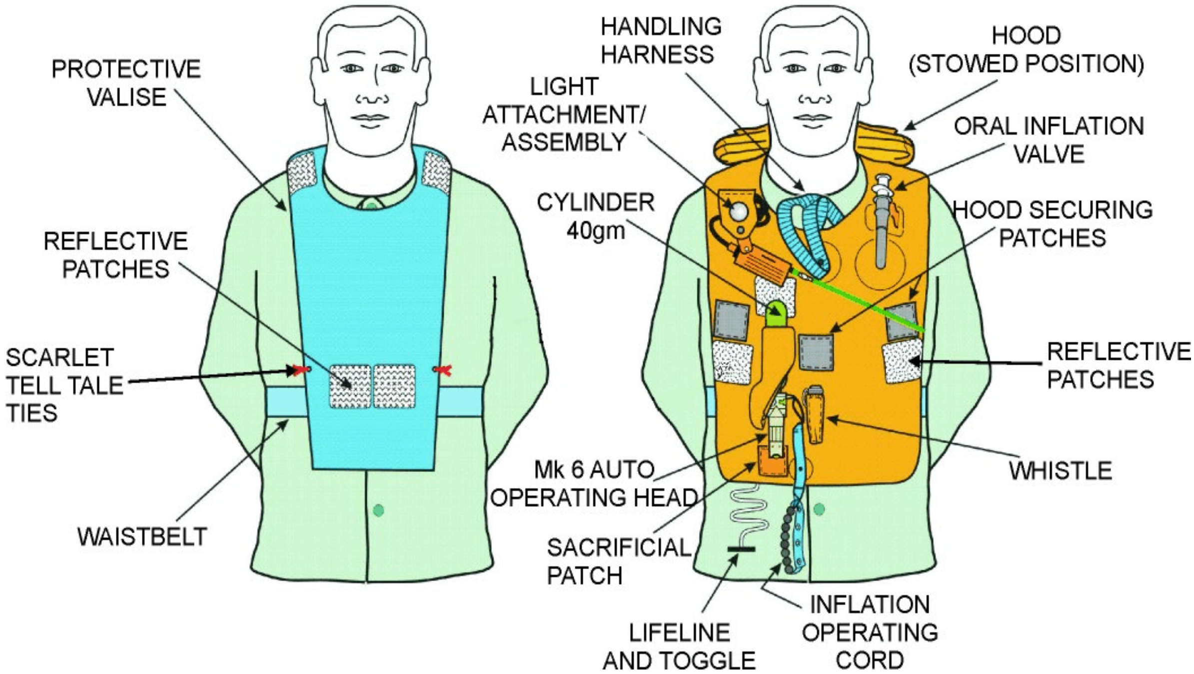

Fig 7-4. Hazardous Duty Lifejacket Mk 3

c. **Donning the Lifejacket.** Insert the head through the neck aperture of the halter-type valise. Fasten the belt around the body by means of the hook and buckle, and adjust to ensure a firm but comfortable fit. Check that the beaded operating handle protrudes from the lower edge of the valise. **Do not attempt to open the valise**.

d. **Operation.** The lifejacket is designed to be inflated automatically by carbon dioxide on immersion in water. The gas is contained in a replaceable cylinder attached to an operating head which is an integral part of the lifejacket. On immersion in water the lifejacket will automatically inflate and burst from the valise within a few seconds and without any action by the wearer. However, the automatic mode of operation should be treated as a back-up system in case the wearer is unconscious or unable to inflate the lifejacket on immersion. A person falling overboard should, on entering the water, give a sharp downward pull on the operating beaded handle; if the manual and the automatic mechanism fail to function the oral inflation tube should be used. Topping-up can be achieved with the oral inflation tube, **but an orally-inflated lifejacket should not subsequently be inflated by gas.**

e. **Maintenance.** HDLJs must be maintained and inspected by the SSEM in accordance with the schedules laid down in the Sea Survival Equipment Log.

f. **Stowage.** The ideal stowage to avoid damage and the possibility of premature inflation is a locker of sufficient size ventilated with warm dry air. The lifejackets should be hung on a supporting bar, of not less than 25 mm diameter, shaped to the curvature of the neck aperture. Space should be left between the lifejackets for air to circulate. The stowage should be secure with limited access, to prevent tampering. Patternised lockers are available, NSN 0281/531-6921. These have a maximum capacity of 6 lifejackets and should be stowed within the ship near weatherdeck accesses.

g. **Allowances.** Allowances vary by class of ship but are generally as follows: Minor War Vessels 10 to 16; Frigates and Destroyers 57 to 67; Large Warships 67 to 102. The precise number, which appears on the ship's Consolidated Allowance List, is decided by the Ships Platform Section after consultation with CINCFLEET.

h. **Cold Weather Limitations**. The operating head does not quite meet the RN criteria for operation at the lower end of the temperature scale. Below minus 20^0C, including wind chill factor, automatic inflation takes longer than the stipulated 5 seconds if the lifejacket has been exposed for long periods. In icy conditions, or if the temperature equivalent is minus 20^0C or below, fresh lifejackets should be drawn when the watch changes over. In these conditions when not in use the lifejackets should be stowed between decks.

07004. Assault Troop Lifejacket Mk 4 (Fig 7-5).

a. **Introduction**. The Assault Troop Lifejacket (ATLJ) has a buoyancy of 489N. It is designed for use in amphibious operations; in conjunction with stretchers when transferring patients at sea; and when personnel (eg landing parties) are carrying heavy equipment attached to their person. The ATLJ may be used in aircraft as it is inflated by manual operation. It is neat and compact in the folded state and allows complete freedom of movement by the wearer when worn in this condition. When inflated it will support the wearer together with 45 kilograms of equipment. It is fitted with a quick-release clip so that it can be quickly discarded when no longer required. Discarding can be effected whilst on the move and can be achieved in three seconds with practice.

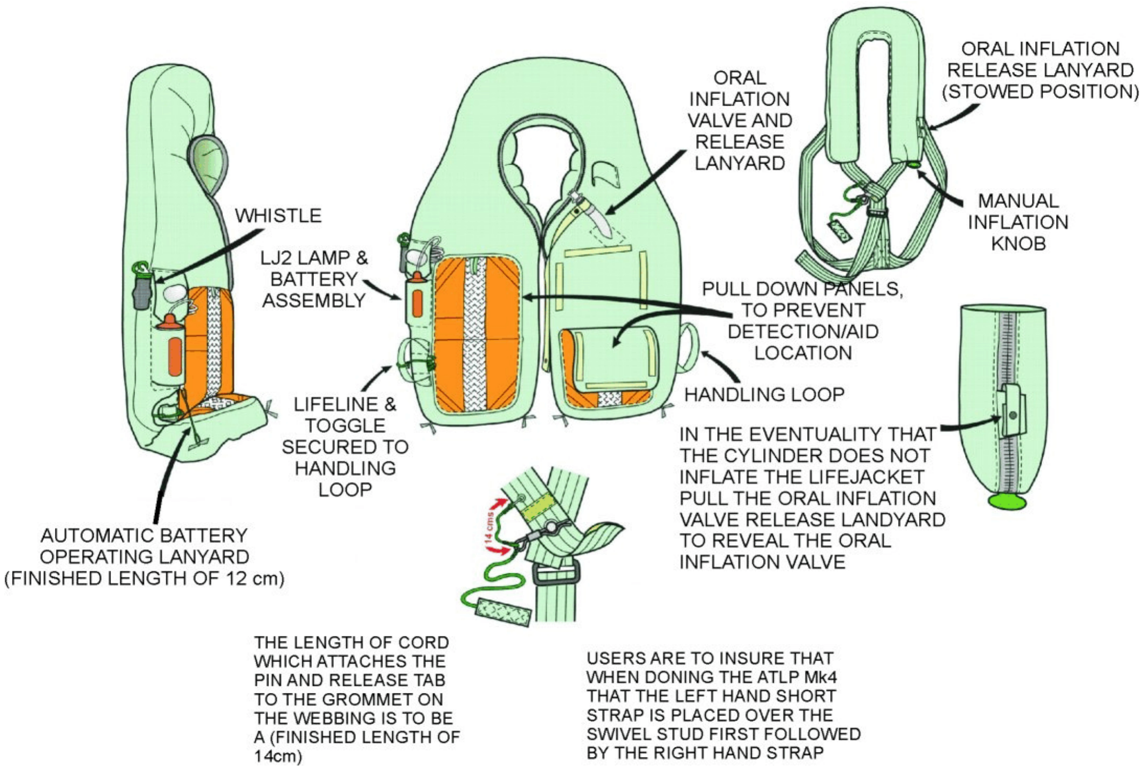

Fig 7-5. Assault Troop Lifejacket Mk 4

b. **Description**. The lifejacket consists of an inflatable stole, an adjustable webbing harness and inflation equipment. The inflatable stole consists of a pillow section and two lobe sections. The lifejacket is inflated from a nitrogen cylinder with a manually operated head. The lifejacket is operated manually by pulling on the operating handle which protrudes from the bottom of the left-hand lobe of the jacket. **There is no automatic inflation facility**. An oral inflation tube and valve are fitted to the left-hand lobe so that the valve is convenient to the mouth of the wearer. This facility is for emergency inflation and topping-up during long periods of flotation. The valve can be locked in the closed position by rotating it on the inflation tube. The stole is packed in a zipped outer cover which will open on inflation. Each lobe has a reflective panel system which can be opened or closed. A handling loop is fitted to each lobe and a light and whistle are provided. A spray hood is fitted with an alternate position for the light.

c. **Allowances**. The lifejackets are issued to all Assault Troops on an individual basis when appointed to an HM Ship in accordance with the Matrix DCI.

d. **Maintenance**. ATLJs must be maintained and inspected by the SSEM in accordance with the schedules laid down in the Sea Survival Equipment Log.

e. **Stowage**. The ideal stowage to avoid damage and the possibility of premature inflation is a locker of sufficient size ventilated with warm dry air. The lifejackets should be hung on a supporting bar, of not less than 25 mm diameter. Space should be left between the lifejackets for air to circulate. ATLJs in their bags may be stowed in racks.

07005. Landing Craft Lifejacket (LCLJ) Mk 2/3 (Fig 7-6/7-6a)

a. **Introduction**. Originally developed for use by the crews of landing craft. This lifejacket is used for certain specific small boat operations in accordance with the Matrix DCI. The lifejacket has 260N buoyancy, is light and comfortable to wear, and has an automatic inflation assembly with a manual override facility. The wearer is limited to 8.6 kg of additional equipment. **At present it is not cleared for use in aircraft, even when set to operate in the manual mode**.

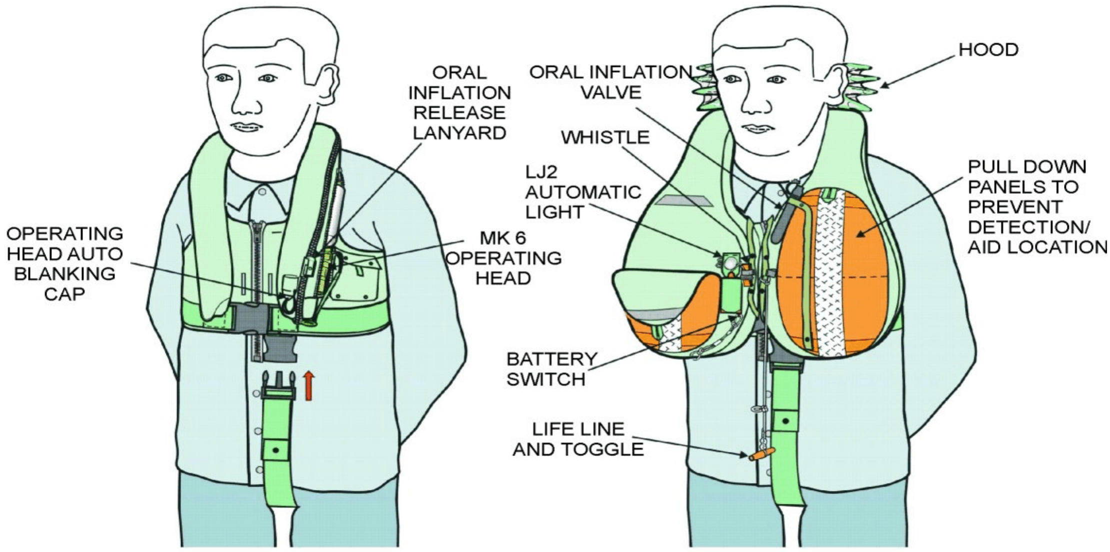

Fig 7-6. Landing Craft Lifejacket Mk 2

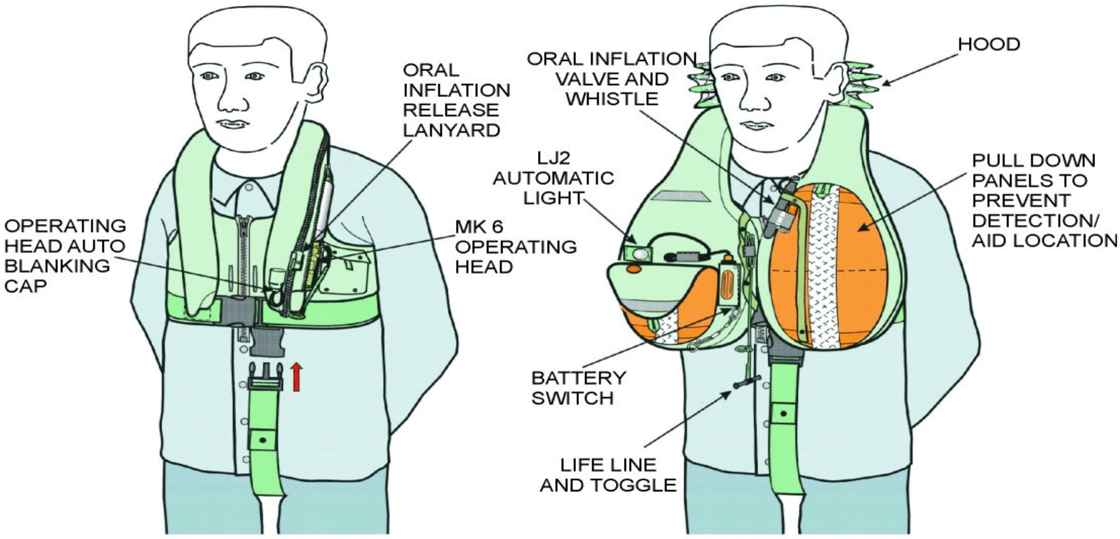

Fig 7-6a. Landing Craft Lifejacket Mk 3.

b. **Description**. The LCLJ comprises an adjustable waistcoat and an inflatable stole which is contained within a protective pouch by means of a velcro fastener. Front closure of the waistcoat is achieved by means of a heavy-duty zip fastener and a large nylon buckle. The buckle is attached to a wide webbing belt which, in addition to facilitating girth adjustment. A battery and lamp assembly, attached to the stole, activates automatically upon lifejacket inflation. The battery is fitted with an on/off switch. A sprayhood is attached to the pillow section of the stole. It is stowed in a folded condition and can be deployed quickly and simply, it is fitted with an alternate light position. Additional features include large-capacity pockets for the stowage of survival/location aids and a small pocket on the rear of the waistcoat which is intended to accommodate a chemical light stick and which is fitted with a facility to permit the light to be covered or exposed as required. Handling Loops, a lifeline and a whistle are also fitted.

c. **Operation**. The LCLJ is designed to be inflated automatically on immersion in water. The gas is contained in a replaceable cylinder attached to the operating head which is an integral part of the lifejacket. On immersion in water the lifejacket will automatically inflate and burst from the valise within a few seconds without any action by the wearer. However, the automatic mode of operation should be treated as a back-up system in case the wearer is unconscious or unable to inflate the lifejacket on immersion. A person falling into the water should give a sharp downward pull on the operating handle; if the manual and automatic mechanism fail to function the oral inflation tube should be used. If required, the automatic operating facility can be temporarily nullified by opening the valise at a point adjacent to the cylinder and placing the operating head sealing cap over the operating head. This practice is only necessary for certain operations conducted by Royal Marines.

d. **Allowances**. Allowances are given in the ship or unit's consolidated allowance list (CAL) and the Matrix DCI.

e. **Maintenance**. LCLJs must be maintained and inspected by the SSEM in accordance with the schedules laid down in the Sea Survival Equipment Log.

f. **Stowage**. The ideal stowage to avoid damage and the possibility of premature inflation is a locker of sufficient size ventilated with warm dry air. The lifejackets should be hung on a supporting bar, of not less than 25 mm diameter. Space should be left between the lifejackets for air to circulate.

07006. Survival Suits.

a. **Once Only Survival Suit** (Fig 7-7) **- Introduction**. Clothing is very important in prolonging the survival of a person in the water. All clothes, including socks and footwear, should be kept on. In tropical conditions, where generally only light clothing is worn, the wearing of clothing in the water is as important as it would be in temperate climates. If time and situation permit, as much clothing as possible should be put on prior to entering the water. To enable survivors to reach liferafts dry-shod, and to prolong chances of survival in the sea, survival suits are provided as standard equipment to HM ships and are pre-packed in glass-reinforced plastic (GRP) containers sited at central points on weather decks. In times of conflict survival suits maybe issued to all personnel and must be carried at Defence Stations and Action Stations as directed by the Command.

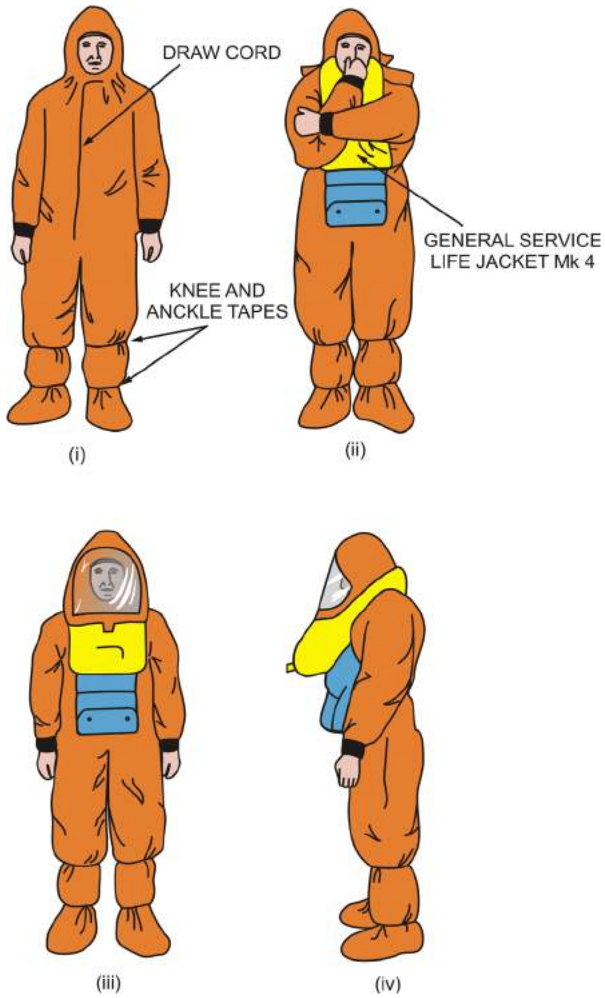

Fig 7-7. Survival Suit

b. **Description**. The suit is constructed of orange rubberised cotton fabric, is waterproof and is packed in a black valise. The valise is fitted with beckets for securing to the underside or belt of a lifejacket. Although the fabric of the survival suit is relatively strong it is designed to be used once only, that is in the Abandon Ship situation.

c. **Donning the Survival Suit**. It is important that the lifejacket should be worn outside the survival suit whenever possible; this gives the wearer access to the lifejacket oral inflation tube and visor, and they will float in a more stable attitude with the lifejacket outside the suit rather than inside. However, on occasions it may be necessary to abandon ship in a great hurry. In this case it is more important to have a fully-inflated lifejacket than a survival suit, even in violent weather and, if time permits, the suit can be quickly donned over it. Assuming a lifejacket is worn, and time permits, the following procedure should be followed:

(1) Remove the suit from the valise and shake it out so that it is positioned in front of the body, neck-opening uppermost.

(2) Sit down, then place the feet into the suit and pull the suit up to the waist.

(3) Kneel on one knee, and with the leg stretched forward and the toes pointed, secure the leg ties of the non-kneeling leg. Repeat the process for the other leg.

(4) Stand up, spread the legs, then bend forward and allow the suit to rest on the hips.

(5) Unfasten the lifejacket belt from the waist (leave the stole over the neck), draw the suit up over the body, placing the arms in the sleeves and taking care not to damage the rubber seals at the cuffs. To ensure a water tight fit, check the seals are in contact with the skin of the wrist.

(6) Refasten the lifejacket belt around the waist, on top of the survival suit, remove the stole of the lifejacket from around the neck (deflating the jacket as necessary) and allow it to hang down in front of the body.

(7) Place the hood over the head and close the draw-cord tightly around the neck by sliding the toggle.

***Note**. Although the draw-cord can be tightened by the wearer of the suit, it is more effectively tightened by a second person.*

(8) Place the lifejacket stole over the head and fully inflate the lifejacket.

***Note**. For personnel who cannot reach liferafts immediately, the survival suit will give protection from cold in Winter/North Atlantic conditions for up to 6 hours.*

d. **Allowances**. The scale of allowance is 110% of the ship's wartime complement including all embarked personnel. 5% of suits are for personnel up to 1.64m (5 feet 4 inches tall), the valise of these suits is marked with a large letter ‹S'. 75% of suits are for personnel up to 1.83m (6 feet) tall, and 20% for personnel over 1.83m (6 feet) tall); the latter suits are identified by a large letter ‹L' on the valise.

***Note 1**. In circumstances where a small person's personal issue survival suit is required but not readily to hand, a medium size suit should be donned*

***Note 2.** The current OOSS sizes should fit 98% of RN personnel, however, a specially made to measure suit is available for those personnel identified during training as being too large to fit into a standard size suit comfortably. The technical authority for Sea Survival Equipment is to be advised of the person's details and measurements. Two suits will be issued to the individual. When the first suit has become B.E.R. a replacement is to be demanded from the technical authority.*

e. **Stowage**. 10% of the allowance is held by the CBM. In HM ships with a complement of over 100 the remaining survival suits are provided prepacked in 25 man GRP liferaft containers (Fig 7-8). Each of these containers holds 100 survival suits with a 75%:20%: 5% mix of medium, large and small suits respectively. In ships with a complement of less than 100 the remaining survival suits are stowed in either large or small Emergency Lifejacket boxes. All types of containers should be clearly marked ‹ONCE ONLY SURVIVAL SUITS' in 50mm black lettering.

f. **Maintenance**. Survival suit containers, and survival suits on personal issue, must be maintained, inspected and exchanged in accordance with the schedules laid down in the Survival and Safety Equipment Log.

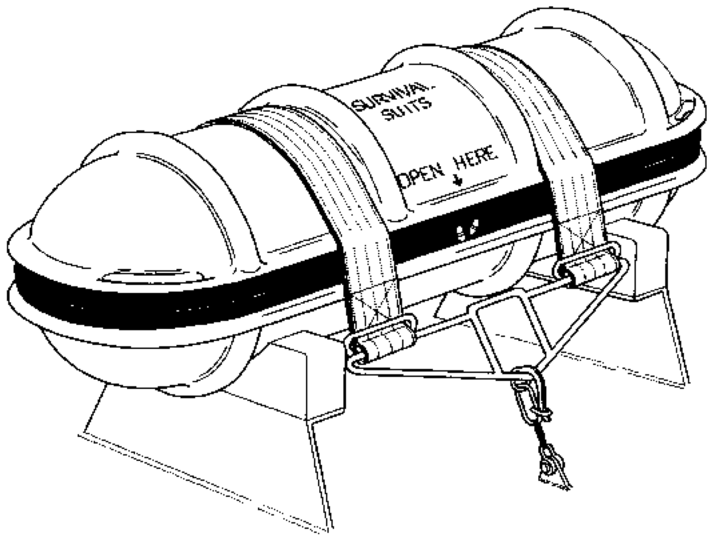

Fig 7-8 Survival Suit Container

g. **Intrepid - Once Only Survival Suit.** The Intrepid Once Only Survival is a replacement for the old style OOSS described above and will be issued under a rolling programme over the next two years commencing Oct 04. The suit is single sized and comes in a sealed foil bag. The principle differences to the OOSS are:

(1) The suit is constructed from a red coloured, coated nylon.

(2) Closure is by a waterproof zip and integrated neoprene hood.

(3) It has integrated rubber gloves.

(4) Is fitted with Velcro leg and wrist ties.

h. **Training Requirement.** Demonstrations will be given to all personnel conducting ISSC, BSSC and ODSSC courses and training suits will be supplied to ships to allow onboard training. Ships will also receive photographs demonstrating the donning procedure.

i. **Donning Procedure.** When donned correctly the INTREPID suit is easier and quicker to use and with the zip fully closed will prove almost waterproof. The following procedure is to be followed when donning the suit:

(1) Don Lifejacket and fully inflate.

(2) Open suit packaging, unzip and place feet into suit.

(3) Draw suit up to waist, kneel or sit and secure velcro leg ties.

(4) Undo belt of Lifejacket and draw suit up body placing arms into suit.

(5) Secure velcro wrist ties.

(6) Replace Lifejacket belt.

(7) Deflate Lifejacket sufficiently to remove from head.

` (8) Draw suit hood over head, grip lower body of zip and using zip tape close zip fully.

(9) Replace Lifejacket and fully inflate.

(10) Pre-vent suit by crouching down and placing fingers into face seal.

Note. *As with the current OOSS it is imperative that secure contact with the GSLJ is maintained at all times and the Lifejacket remains inflated throughout.*

j. **Insulated Abandonment Suit**. For ships deploying for extended periods in Arctic or Antarctic waters, insulated abandonment suits are to be held in addition to the ships complement of Once Only Survival Suits. The suits are on individual issue. A small number of spare suits are to be stowed in boxes on the upper deck in suitable locations for ease of access during abandon ship. The ship is to inform the technical authority for "Sea Survival Equipment" in plenty of time to enable the suits to be specially ordered, as stores do not hold them in stock. Suits are supplied in the following sizes:

(1) Universal 0472-99-420-5871
(2) Large 0472-99-549-3995

07007. 25 Man Liferaft - General Arrangements (Figs 7-9/7-9a)

a. **Introduction**. The 25 Man inflatable liferaft is fitted as standard equipment in all HM ships, and is supplied on a scale to provide liferafts for the full war complement plus 10% spare. There are 2 designs of 25 man liferaft in service. The original NILE (Fig 7-9) and the newer Naval Liferaft Mark 1 (NLMk1) (Fig 7-9a). The NILE is an all glued Liferaft and the NL Mk1 is a welded construction. The basic design of the two liferafts are very similar. A ships fit of Liferafts is either the NILE design or the NL Mk1. They are never supplied as a mixture. The liferaft is supplied packed in a weather-tight GRP container and is fitted in a weather-deck stowage either singly or in pairs. The stowage is designed so that the liferaft(s) will fall unobstructed into the sea when released manually (Fig 7-10), or will release hydrostatically should the ship founder and sink. Associated with the liferaft and packed in the same GRP container are survival packs which are described later.

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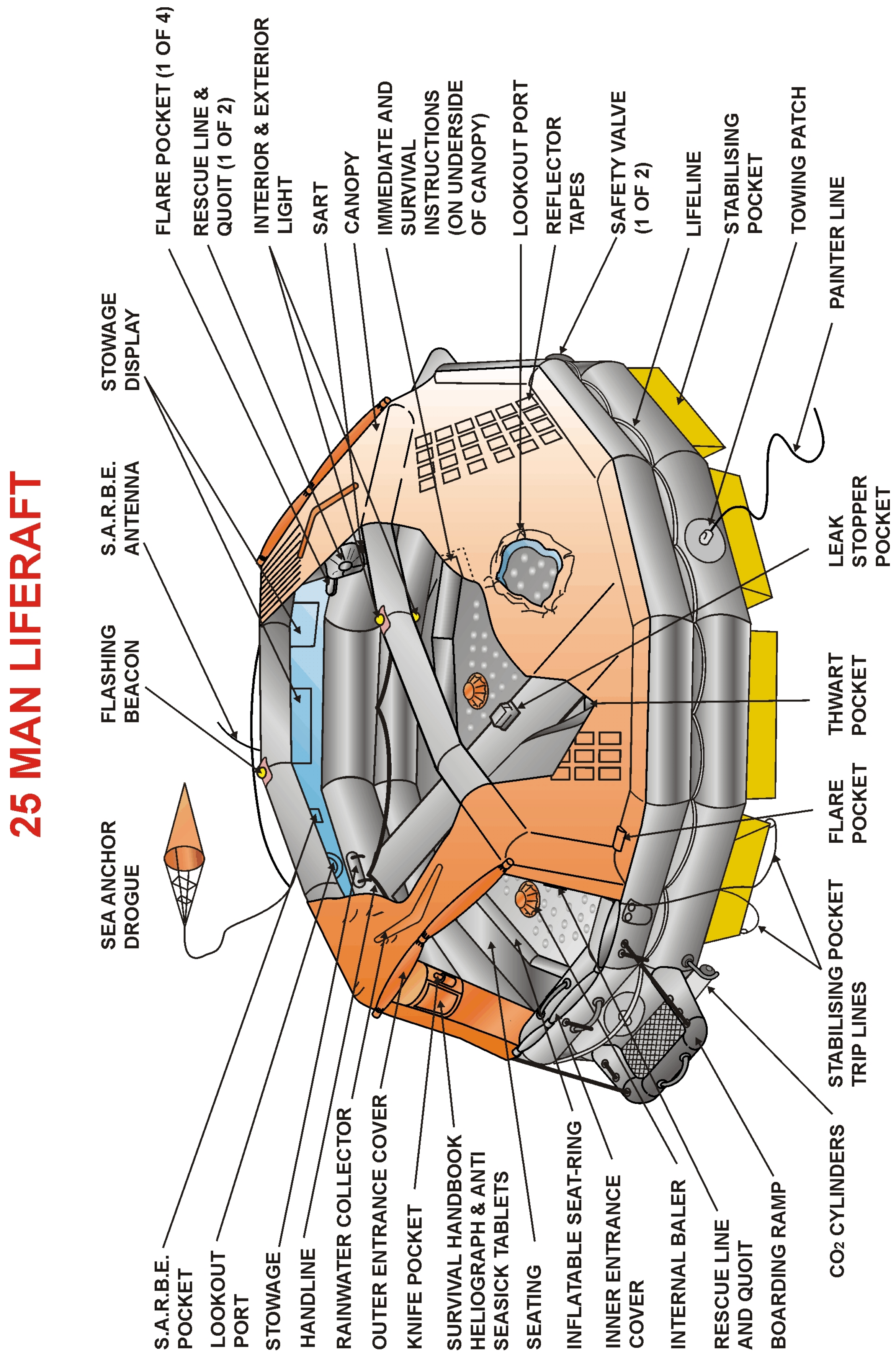


Fig 7-9. 25-Man Liferaft.

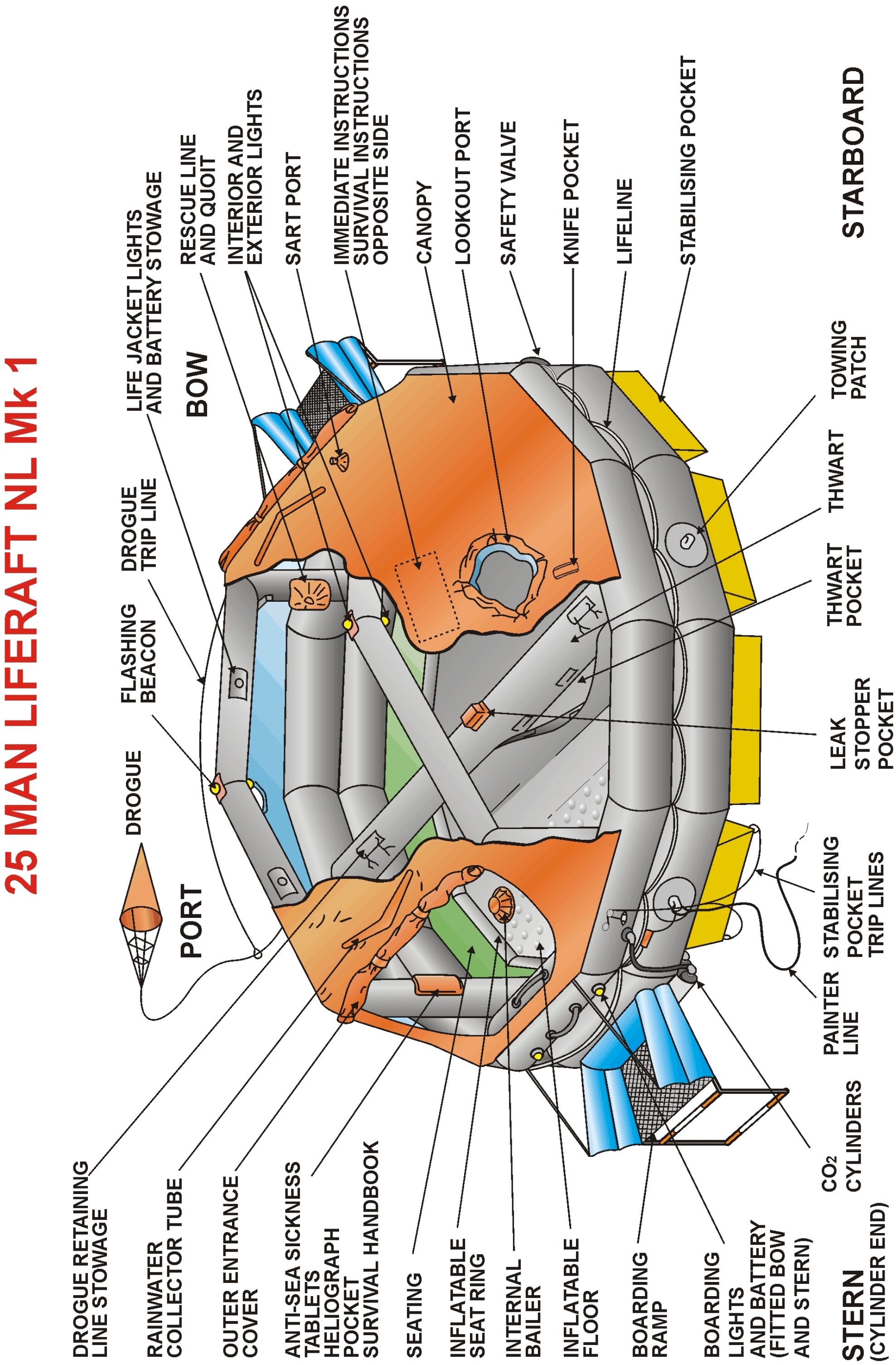


Fig 7.9a. 25 Man NL Mk 1

b. **General Description**. Liferafts are approximately 4.3 metres in diameter and 1.6 metres high, consists of two 12-sided buoyancy chambers to which are attached two canopy arches, a thwart, a floor, a seat and two boarding ramps, all of which are inflatable. The floor consists of two layers of fabric with an air space to provide insulation (not automatically inflated). The canopy, which is made from two layers of fabric separated by an air space, is supported by the two arches and fixed to the main buoyancy chambers. An inflatable ring supports the seat unit which extends around the internal periphery of the liferaft. The occupants of the raft are therefore protected by a layer of gas or air which insulates them from extremes of temperature outside the raft. A horizontal internal bulkhead runs the length of the thwart and acts as a seal, or reserve wall, should the thwart be punctured. Entry to the liferaft is by either of two boarding ramps. Each entrance is made watertight by a double cover which is also used, in conjunction with the lookout ports, to regulate ventilation. The entrance covers are normally stopped back by tapes but can be closed by drawstrings/zips. Two lookout ports with sleeves are provided on opposite sides of the liferaft. Rain-water collecting points are built into the top of the canopy; from these points tubes extend into the liferaft, for filling water containers. A righting strap and a number of sea-water ballast pockets are fitted to the underside of the liferaft. The function of these is described later.

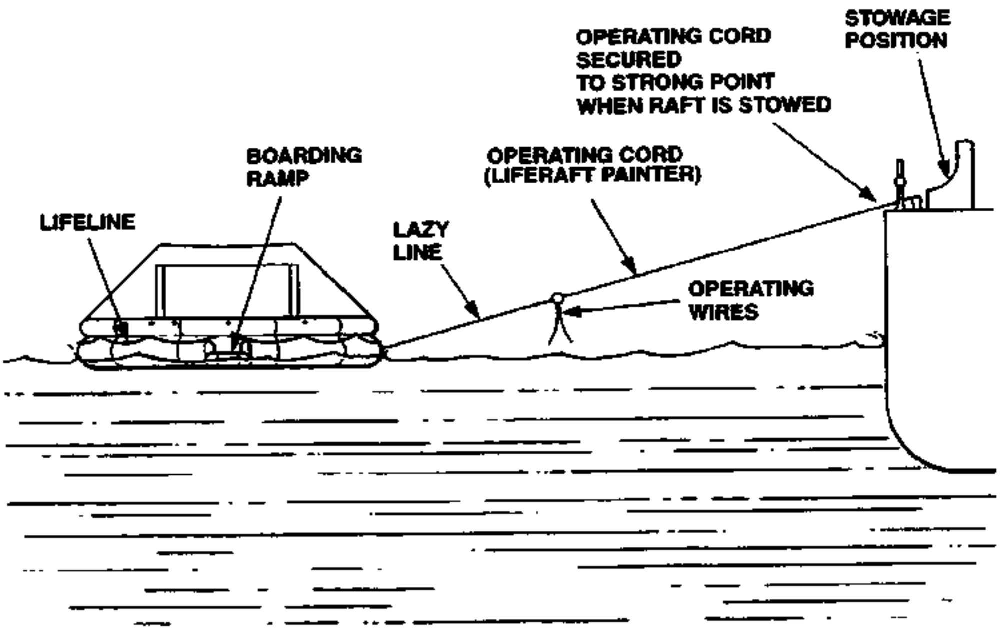


Fig 7-10. Liferaft Manually Launched. Showing Arrangement of Operating Cord

c. **Inflating the Raft**. The two buoyancy chambers are inflated automatically and independently by two cylinders of gas sited on the underside of the liferaft. Each cylinder contains a mixture of carbon dioxide and nitrogen; the nitrogen content acting as an anti-freezing agent. Both gas cylinders are activated by an **operating cord** attached to operating heads fitted to the cylinders. Two safety valves are fitted outside the liferaft adjacent to the boarding ramps.

One gas cylinder inflates the upper buoyancy chamber and also the canopy arches which are sealed off from the upper chamber except for two non-return valves. The other cylinder inflates the lower buoyancy chamber and also the boarding ramps, thwart and seat ring which are similarly sealed off except for pressure transfer valves. A defect in either buoyancy chamber will not affect the rest of the raft nor will it decrease the survivor-carrying capacity. The painter line, of braided polyester, is faked inside the GRP container during packing and the outer end, a ‘weak link’ consisting of a short length of 3-4mm polyester is secured to a metal strong point with a taped or stitched bowline. The operating heads of the gas cylinders are activated by pulling the painter line. This happens automatically should the ship sink, releasing the liferaft by hydrostatic action, which is described later. If the liferaft is released manually the painter line has to be cut free of the liferaft. The weak link will break if the liferaft is released automatically by hydrostatic action. The operating cord is attached to one of two towing patches fitted to the liferaft, being first attached to the wires of the operating heads. A lazy line completes the connection to the towing patch. A short length of braided polyester (breaking line) makes the connection between the operating cord at the GRP container and a metal strongpoint at the liferaft stowage. The connections are made by bowlines at each end. At the container connecting point, the end of the operating cord is covered with neoprene to prevent ingress of water to the container. Figs 7-10 and 7-11 show the general arrangement of the operating cord and how breaking is achieved when a ship sinks.

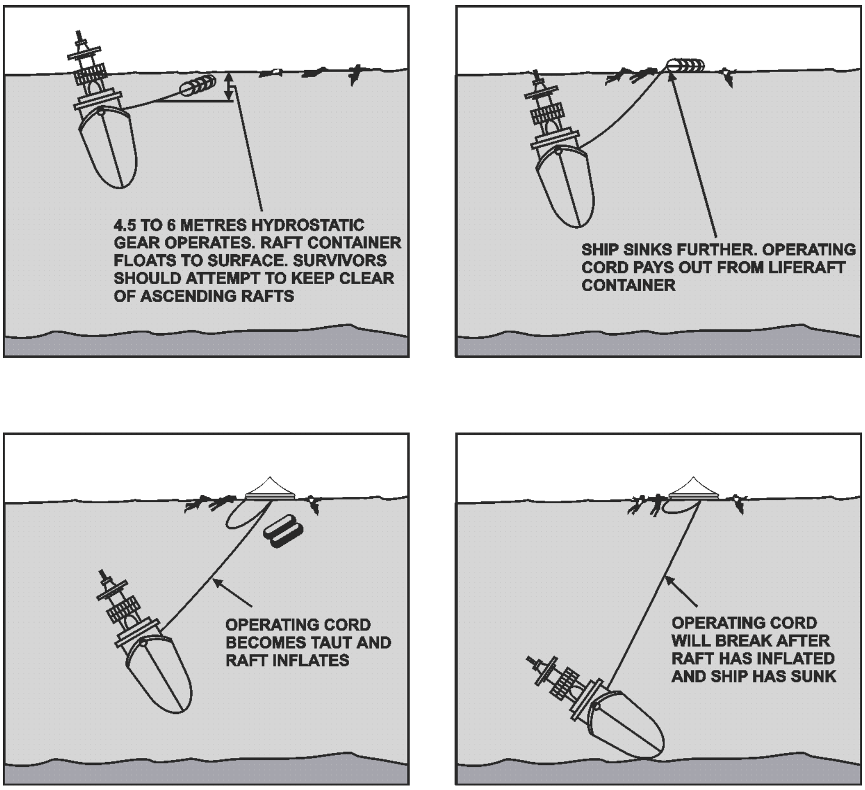


Fig 7-11. Operation of Hydrostatic Release

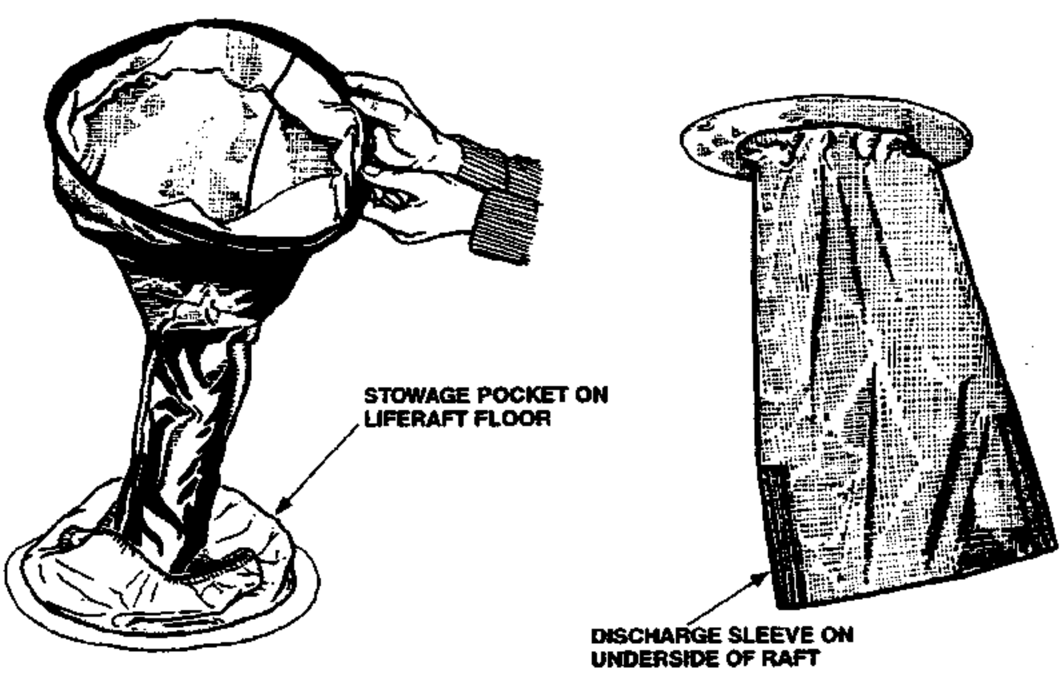


Fig 7-12. Baling Appliance

d. **Baling Appliance**. Two manually operated baling appliances are fitted into the floor of the liferaft (Fig 7-12). Each appliance is designed to drain the liferaft of water to the sea, through a non-return sleeve arrangement. The lip of the funnel is pushed beneath the level of water within the raft, then raised out of the water to its full extent. This action enables the water contained in the funnel to drain out through the sleeve fitted to the underside of the raft. This action is continued until the liferaft is drained. Hand Bailers/Sponges are then used to complete the drying out operation.

e. **Stowage of Liferafts**. Each liferaft is packed in a GRP container and these are stowed on suitably designed platforms on the weather decks (Figs 7-13 and 7-14). Fig 7-14 shows a pair of GRP containers in a weather-deck stowage: note that the lip (at the join of the upper and lower halves of the container) of the outboard container is above the lip of the inboard container. This method of stowage is essential to enable both containers to roll free of the stowage when released. The liferaft in its container is held securely in the stowage by two polyester webbing straps; the outboard ends of these straps are shackled to the stowage platform and the inboard ends are secured to a ‘coat hanger’ arrangement, Fig 7-15. A hydrostatic release mechanism is incorporated between the ‘coat hanger’ and the deck connection. Buckles are fitted in the straps to adjust their tension and ensure a secure stowage for the container. The end of the liferaft from which the operating cord protrudes must face aft to minimise water ingress; the the operating cord is secured to a ‹weak-link’ line, which in turn is secured to a strong point in the ship.

Note. *The NL Mk1 container is different in design as shown in Figs 7-15a to the NILE Liferaft, the securing arrangements and release procedures remain the same.*

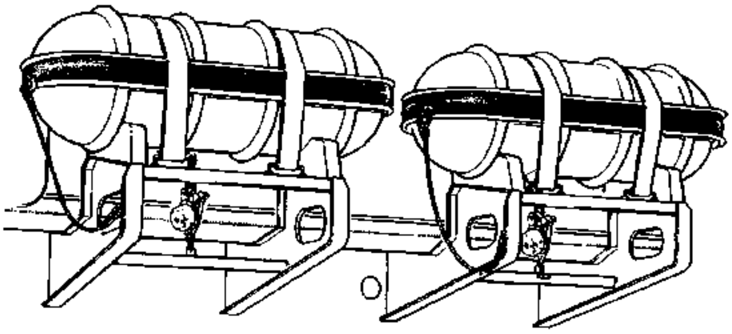


Fig 7-13. Weather-deck Single Liferaft Stowage

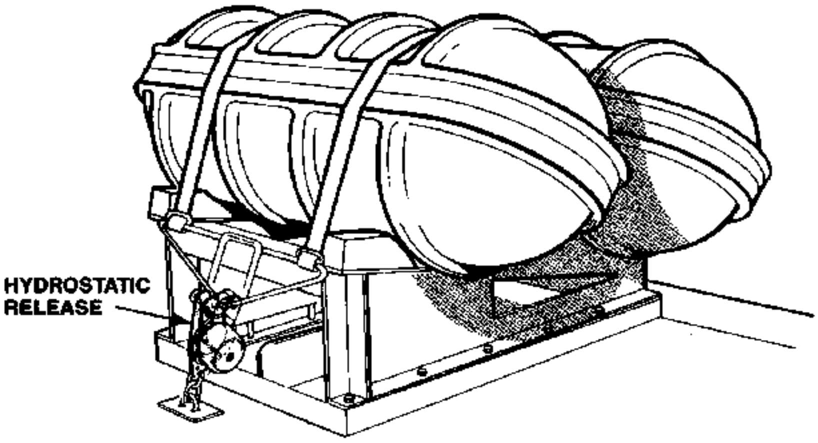


Fig 7-14. Weather-deck Double Liferaft Stowage

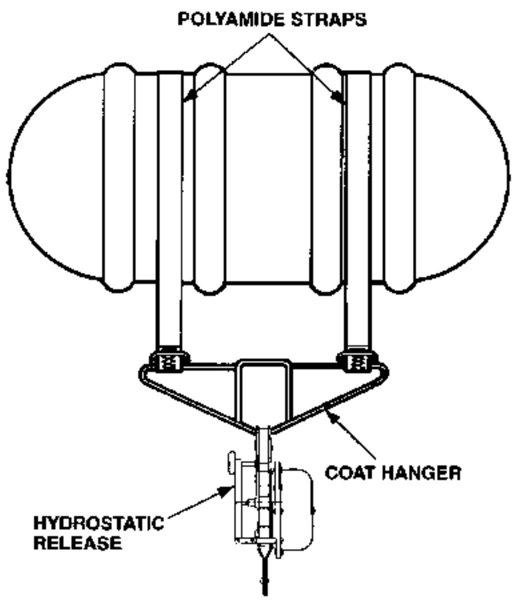


Fig 7-15. Securing Arrangement for NILE Liferaft Container

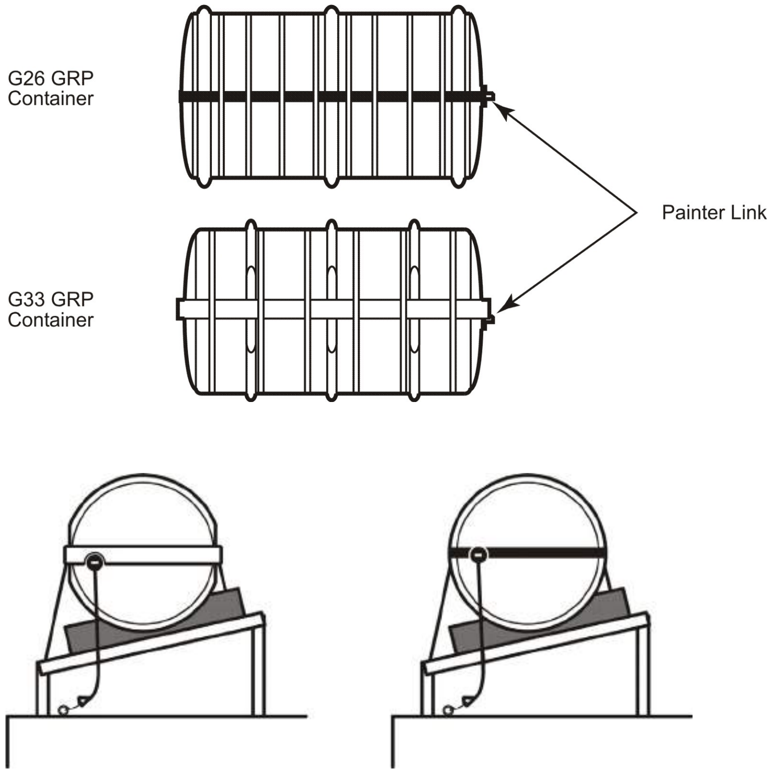


Fig 7-15a. NL Mk1 Container

f. **The Hydrostatic Release** (Fig 7-16). This mechanism is designed to release the liferaft in its containers should the ship founder. It is operated by the ingress of water through apertures in the body of the release. The pressure of the sea water at a depth of approximately 6m below the surface causes a diaphragm to trip the pawl of the Hydrostatic Release, thus releasing the 'coat hanger' from the jaws of the unit. The hydrostatic release **must not** be painted. Foreign matter and paint will block the apertures, preventing the mechanism from operating at the correct depth. The unit can be operated manually by removing the safety ‹R' clip from the operating arm and pressing hard on the 'push to release' button.

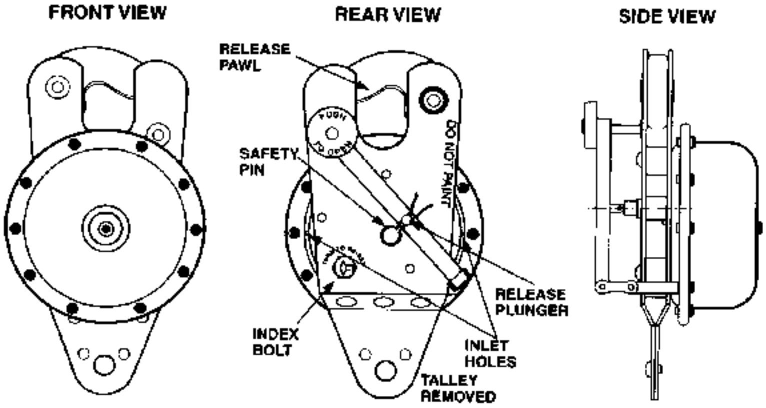


Fig 7-16. Hydrostatic Release - Thanner

g. **Handling Liferaft Containers**. The total weight of the GRP container and its contents is approximately 180 kilograms. The use of a dockside crane is required when containers have to be removed, shipped or unshipped. Only round slings should be used for lifting the containers. The containers should not be rolled during shipment or stowage and care must be taken to avoid bumping, especially on deck projections.

h. **Marking of GRP Containers**. Stuck on the top half of the container is a label which gives details of packing date and place, details of manufacture and whether or not a SARBE beacon is installed. This label should face inboard so that the information can be read with ease. Additionally, if a SARBE is fitted, the word SARBE is displayed in 50mm black lettering on the container.

i. **Maintenance**. Maintenance on the container and associated equipment is to be in accordance with the schedule given in the Sea Survival Equipment Log. No work is to be carried out on the stowages, and no welding or burning is to take place within a 2m radius of a liferaft stowage whilst the rafts are in situ.

j. **Exchanging Liferafts**. HM Ship's 25-Man liferafts run on a 2 year cycle in accordance with the Sea Survival Equipment Log.

k. **Liferaft Equipment**. Items of essential equipment are either fitted to the liferaft or stowed inside the survival packs. They are as follows:

(1) *Topping-up Valves*. These are valves inside the liferaft to which the **topping-up pump** can be connected to top-up any part of the liferaft with air. They are clearly marked.

(2) *Deflation Plugs*. These are fitted for **maintenance purposes only** and are identified by their slotted heads and identification labels. They are not to be removed.

(3) *Leakstoppers*. These are conical rubber plugs with serrated shanks, stowed in pockets on the thwart. The plugs are used as a temporary repair for holes. They are inserted by a gentle screwing action into the hole to be plugged. Care must be taken that the hole is not enlarged by the screwing action. Large tears can be repaired by using repair clamps from the survival pack.

(4) *Topping-up Pump*. This is stowed in a Survival pack and is used to top-up any part of the liferaft with air, by inserting the tube into a topping-up valve.

(5) *Rescue Quoit and Lines*. These are stowed on the right-hand side of both entrances, and consist of a rubber grommet and 18m of cordage.

(6) *Handbook for Survivors* (**BR 1329**). This handbook is stowed in a pocket on one of the arches. It should be read as soon as possible by the person assuming command of the liferaft and in due course by all the occupants of the liferaft. All the information required for survival will be found in the handbook. Additional information, eg immediate action drill, is printed on large panels displayed on the underside of the canopy.

(7) *Heliograph*. This is used to attract the attention of ships and aircraft by reflecting the sun's rays in the required direction. It is stowed in the same pocket as the **Handbook for Survivors**.

(8) *Hand Bailers and Sponges*. These are provided to dry out the inside of the liferaft and are stowed in the survival packs.

(9) *Seasickness Tablets*. These are stowed on an arch, in the same pocket as the **Handbook for Survivors**. Tablets should be issued to all personnel as soon as possible - **whether they suffer from seasickness or not**. Extra tablets are provided in the survival pack.

(10) *Floating Knives*. These knives have blunt ends and two are supplied, each fitted with a lanyard. One is stowed on the arch at the liferaft entrance adjacent to the carbon dioxide cylinders and the other is stowed on the top buoyancy tube above the drogue stowage adjacent to the lookout port, where it is available to cut the painter.

(11) *Water Pockets*. To stabilise the liferaft and reduce drift from windage, eleven water pockets are fitted to the bottom of the raft. To increase the rate of drift of the raft the pocket either side of each entrance can be ‹tripped' by pulling lines located at each entrance. The other seven pockets are not fitted with trip lines and therefore cannot be emptied.

(12) *Drogue or Sea Anchor*. This device, which resembles a small parachute, is secured by 9 metres of cordage to the outside of the lower buoyancy tube at a position 90° counter-clockwise to the carbon dioxide cylinders. Its purpose is to slow the rate of drift and to assist in the stabilisation of the raft. It should therefore be streamed as soon as possible after boarding. The drogue also provides limited assistance in manoeuvring the liferaft in calm weather conditions. This is achieved by bunching up the drogue, throwing it in the required direction, and then pulling on the line to manoeuvre the raft towards the drogue. When manoeuvring in this manner the water pockets either side of each entrance should be tripped.

(13) *Distress Signals*. The distress signals are stowed in a survival pack. At the earliest opportunity they should be removed from the pack and fitted in their designated stowages on the top buoyancy tube at the entrances either side of the inflatable arch. Instructions for use are printed on a label attached to the body of the signal. The signals will emit a bright flare light for night use and red smoke for day use, according to which end is operated. To simplify identification in the dark the **day** signal end is smooth and the **night** signal end has two ridges around it (knobbly for night is an easy aide memoire). On rare occasions, the smoke signal may produce a flame. Should this occur, immerse momentarily in water; smoke should then be emitted. On completion of burning, douse the signal in water and retain for use of the other signal end.

(14) *First -aid Kit*. A First aid kit is stowed in a survival pack. Full instructions for the use of the contents are supplied with the kit. Additionally an inflatable arm and leg splint are supplied.

(15) *Survival Suits and Mittens*. 3 spare survival suits and 2 pairs of mittens are stowed in a survival pack. They are primarily for the use of lookouts but may be utilised as necessary.

(16) *Flashing Beacon*. All liferafts are fitted with a Flashing Beacon sited on the centre top of one of the arches. It is powered by lithium batteries that are automatically activated by an operating cord when the raft inflates; an ON/OFF switch is located on the end of the batteries. The light will give out a flashing frequency of between 50-70 flashes per minute over a period of $4^1/_2$ hours. The GSLJ LJ2 light battery can be utilised to power the flashing beacon.

(17) *Rations*. Rations of water and glucose sweets as listed below are provided in the survival packs. The policy of issue is explained fully in **BR 1329, Handbook for Survivors**.

(18) *Miscellaneous Items*. In addition to the items listed above the survival packs contain playing cards, plastic beakers and a waterproof torch. Certain rafts carry a set of paddles to assist in manoeuvring the raft.

Rations	**Quantity**
Water	100 x 385ml or 80 x 500ml sachets
Glucose sweets	351 x 34gm pks or 200 50gm pks

07008. Global Maritime Distress and Safety System (GMDSS)

All HM Ships are provided with Global Maritime Distress and Safety System (GMDSS) equipment to alert search and rescue services in the event of an emergency, and then guide them to your position. The system consists of the following kit:

a. **Emergency Position Indicating Radio Beacon (EPIRB)**. An EPIRB (Fig 7-17) is installed on the upperdeck of all HM Ships. A crew member is delegated to retrieve it and stow it aboard his liferaft. However, if your ship sinks or capsizes before the EPIRB can be manually removed from its stowage a hydrostatic release system will ensure it automatically disengages and activates. If the EPIRB is seen floating (it will be emitting a powerful flashing light) every effort should be made to retrieve it and tether it to your raft. It is designed to alert search and rescue services that your ship has sunk; it does this by transmitting a coded message on the 406MHz distress frequency. This message is relayed via satellite to the nearest rescue co-ordination centre. The satellite system can determine the position of your EPIRB as it makes its distress transmissions; it also recognises the unique number contained within the coded transmission. This number is registered to your ship when the EPIRB is installed. The EPIRB also transmits a ‹homing' signal on the 121.5MHz international distress frequency. This acts as a back-up for the 406MHz transmission and also enables rescue vessels to ‹home in' on the EPIRB during the final stages of the rescue. To activate the EPIRB manually:

(1) Remove the plastic AUTO/ON switch cover.

(2) Set switch to ON position. The EPIRB will now start to flash repeatedly; this indicates it is transmitting.

(3) Tether the EPIRB to the liferaft and allow to float in the sea a few metres from the raft.

Note. *The EPIRB can be de-activated by lifting it clear of the water and setting the AUTO/ON switch to AUTO.*

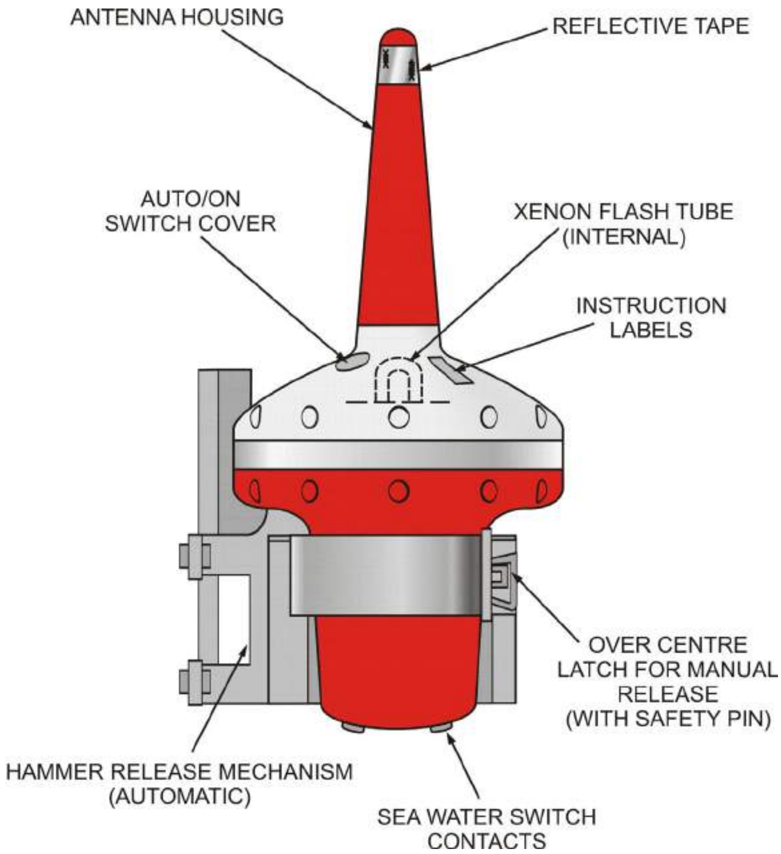


Fig 7-17. Emergency Position Indicating Radio Beacon (EPIRB)

b. **Search and Rescue Radar Transponder - SART (Shipborne Model)**. All HM Ships carry at least one shipborne SART (Fig 7-18); certain ships in certain areas of operation carry two. Shipborne SARTs are stowed in canisters sited adjacent to escape routes and a crew member is delegated to retrieve it and stow it aboard his liferaft in emergencies. The SART is designed to help rescue services quickly locate your position. It is a radar transponder which will operate with most maritime radars. When the SART is switched on, it waits with its green light flashing until it detects a radar signal (usually at about 40 miles if the signal is from an aircraft, or 5 miles if it is from a ship) at which point it starts to transmit back. When it transmits back its red light will flash. The aircraft or vessel transmitting will see a line of dots on its radar screen, enabling the position of the liferaft to be pinpointed.

(1) *To operate the SART*. Remove the SART from its storage container. Slide the safety lock down (Fig 7-18), then turn the knurled ring clockwise to the ON position. Check that the green light is flashing.

(2) *Rigging the SART*. The SART must be raised at least 1m above the level of the sea for efficient operation; an extendable pole is supplied with the SART to cater for this. Screw the pole into the base of the SART, then undo the velcro strap and extend the pole. Twist and pull hard across the pole joints to lock them. Tie the safety lanyard provided to the liferaft then push the SART through the liferaft observation port. An effective method of ensuring the pole is braced and remains vertical is to slide the pole through the lifejacket belt of the lookout. Alternatively it can be tended by hand from within the liferaft.

Note. *The SART should be kept as near vertical as possible.*

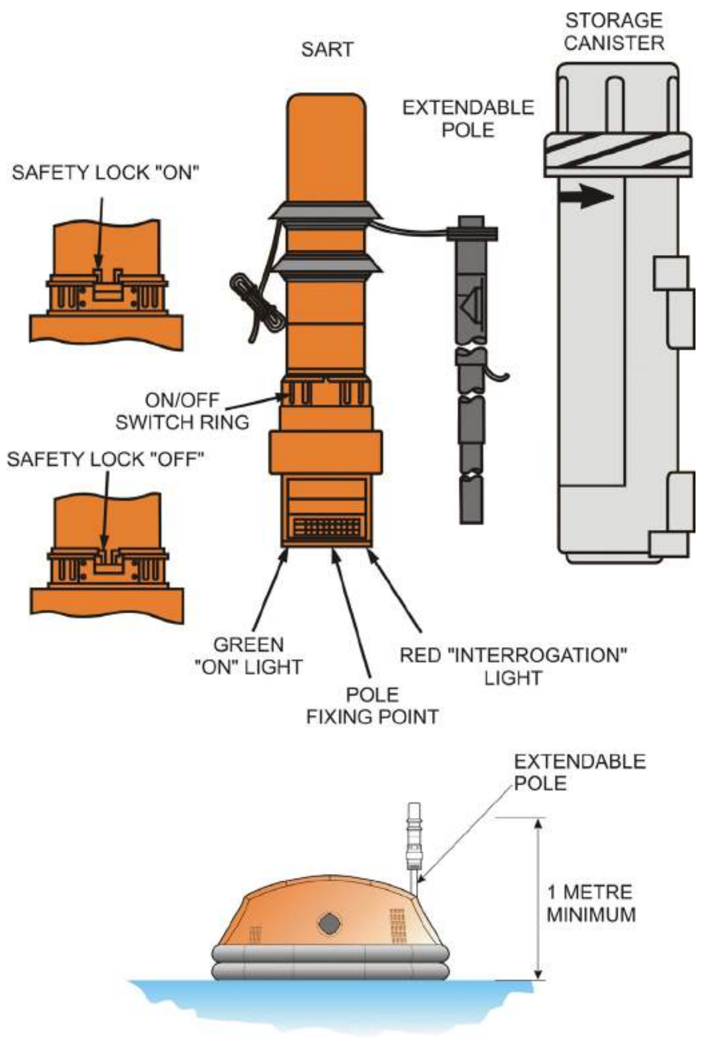


Fig 7-18. SART (Shipborne Version)

c. **Search and Rescue Radar Transponder - SART (Liferaft Mounted Model)**. It is intended that eventually all liferafts will carry a SART as standard equipment. However, this policy will take several years to implement fully so your liferaft may or may not carry one. The liferaft fitted SART (Fig 7-19) operates on the same principle as the shipborne model, but is designed specifically for use in a liferaft. It is in two parts: the antenna, which is sited in a pocket outside on the top of the raft canopy, and the battery and switch assembly which is housed in a pocket inside the raft. The two parts are connected by a cable running from the antenna to a plug connection on the battery and switch assembly.

(1) *To operate the SART*. Remove the plastic switch guard (not shown in Fig 7-19) and depress the push button switch. A bleep will sound and a light will flash at the transparent spacer below the switch. This happens every 12 seconds and indicates that the unit is ‹on' but no other radar is within range. When a search and rescue vessel or aircraft transmitting on radar comes within the SART range (similar to that given for the shipborne SART), the unit will start to flash and bleep every 2 seconds. The aircraft or vessel transmitting then sees a line of dots on its radar screen, enabling the position of the liferaft to be pinpointed.

(2) *Rigging the SART*. The equipment is fitted during the liferaft packing procedure.

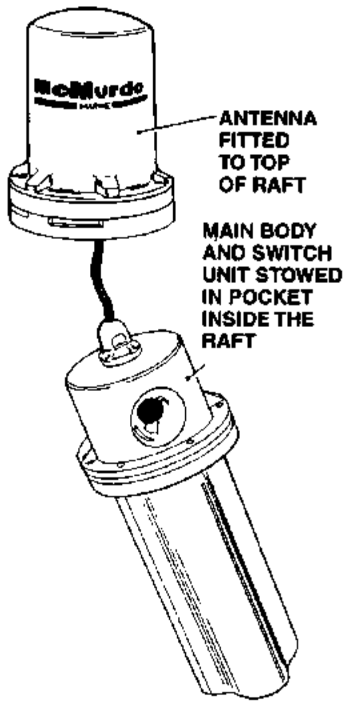


Fig 7-19. SART (Liferaft Fitted Version)

d. **Portable Waterproof VHF Radio**. GMDSS requirements call for ships to carry two or three portable waterproof VHF radios (Fig 7-20). These radios are stowed in racks onboard the ship and a crew member is delegated to retrieve them and stow them aboard his liferaft when the ship is abandoned; the senior officer or rating must decide which rafts will carry the radios. The principle uses of the radios are to provide a means of communication with other rafts and to liaise with rescue services as they approach. They can also be used to transmit MAYDAY broadcasts, monitor channel 16 for rescue activity and during Man Overboard recovery. As the batteries have a maximum life of 12 hours the radios must be used sparingly.

To operate the radio. The radio uses a combination of push buttons and rotary control. An audible 'beeb' is emitted as confirmation whenever a button is pushed or the channel switch is rotated. The controls are illustrated in Fig 7-20 and described further as follows:

ON/OFF	This push button turns the radio on and off.
PTT	The Press To Talk button must be held down to make a voice transmission.
HI/LOW	This push button toggles the transit power level between high (5W) and low (0.8W). The current level status is indicated by the TX indicator. See below.
SQUELCH	When pressed, this button defeats the squelch and can be used to set the squelch level.
VOLUME	This rotary control varies the loudspeaker listening level to suit ambient conditions.
CHANNEL SWITCH	This is a 16 position rotary switch.
LAMP	This push button illuminates the channel select dial to improve visibility.

In addition to the listed controls, there are 3 indicator lamps with the following functions:

TX LAMP	Indicates either HI or LO power transmission.
BAT LAMP	Flashes when battery is nearly exhausted.
RX LAMP	Blinks to indicate the radio is squelched.

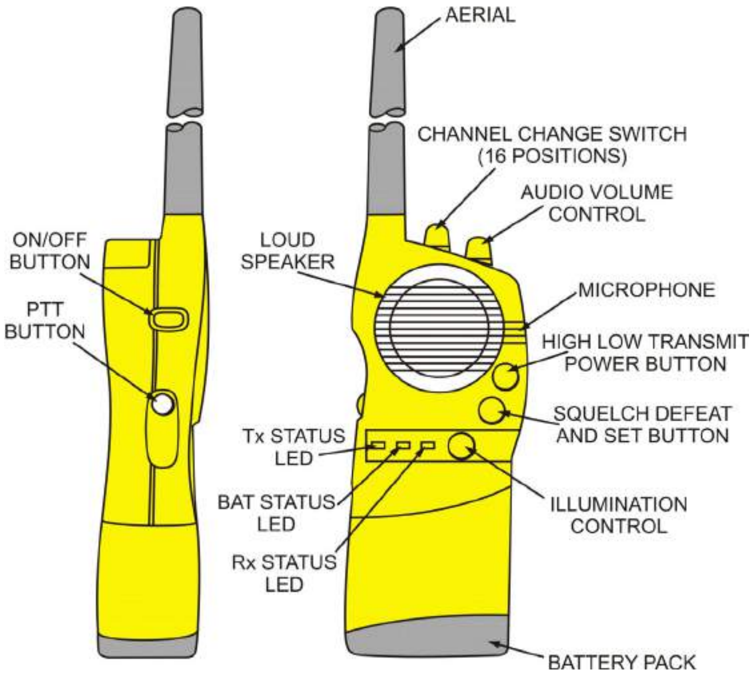


Fig 7-20. Portable Waterproof VHF Radio

e. **SARBE Locator Beacon** (SARBE). In selected liferafts a SARBE (Fig 7-21) is fitted. Although not part of the GMDSS kit it is nevertheless a useful aid in survival situations. This lightweight radio operates automatically on an International Aviation UHF Distress Frequency and is also equipped with facilities for transmission and reception of speech on this frequency. Additionally, an auxiliary channel is incorporated which operates on an International Scene-of-Search frequency of 282.8 MHZ.

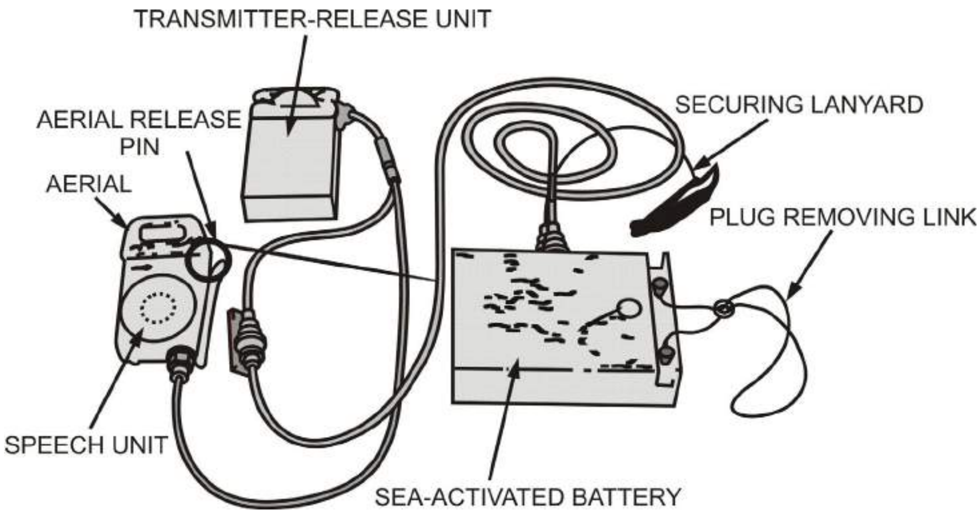


Fig 7-21. SARBE Locator Beacon

(1) CONTROLS. The Sarbe Locator Beacon is equipped with three controls which are simple to operate. It is emphasised, however, that these are mainly for two-way speech operation, and do not control transmission of the distress frequency, which is automatic. The controls are:

(a) PRESS-TO-TALK/PRESS-TO-LISTEN. A rocker switch situated conveniently so that the voice receive/transmit facilities are easily selected when the beacon is held in the palm of the hand.

(b) CHANNEL CHANGE. This control, pre-set to the DISTRESS beacon transmission position on removal of the auto-activate pin, can be switched to either the AUXILIARY ‹Scene-of-Search' channel or to ‹OFF' as required.

(c) VOLUME. This controls the level of all received signals and side tone and is continuously variable. It is inoperative in the transmission modes.

(2) OPERATION

(a) Ensure that the water-activated battery is connected to the beacon unit and that the battery is secured to a strong point on the liferaft. Remove the two nylon sealing plugs from the battery and immerse the battery in the water.

(b) Transmission of the DISTRESS signal commences as soon as the operating lanyard is pulled and the ‹auto-activate' pin is withdrawn from the top of the unit. Survivors should not normally touch the test lever. (The green/red lights are for pre-issue/packing checks only.) Survivor confidence check, in use, of the green indicator lamp situated adjacent to the selector switch will confirm that radio-frequency power of a satisfactory level is available at the aerial.

(c) Two-way speech is selected by operation of the press-to-talk/press-to-listen rocker switch located on the side of the unit.

(d) Once visual rescue contact has been established the selector switch should be turned to the AUXILIARY channel (to enable the DISTRESS channel frequency to be cleared for further search as required, at the same time allowing two-way communication to continue during the rescue operation).

(e) Should more than one Sarbe Locator Beacon be available in situations where liferafts are congregated and tied together, battery power should be conserved by the operation of one unit only.

(f) Instructions for the fitting of the Sarbe Unit and aerial to the liferaft are in the polythene package containing the beacon.

Note*. To avoid wasting the battery do not use the transmit/receive speech facility until such times as search aircraft or shipping have been located.*

07009. Emergency Stations

a. **Organisation and Procedure**. In the Royal Navy the procedure for abandoning ship is part of the ‹Emergency Stations' organisation. The word ‹emergency' is used to avoid any confusion with the final ‹Abandon Ship', which is ordered if necessary only after all available liferafts have been slipped and when the ship is about to founder. Emergency Stations are exercised regularly so that the ship's company are familiar with the organisation and order is maintained throughout. Emergency Stations have been developed over many years to provide a simple standard procedure that will bring a ship to a high state of personnel and material preparedness to deal with any hazardous situation in which Action Stations would not be appropriate. The routine thus evolved is a rapid and effective countermeasure which will provide the command with an organisation capable of regaining the initiative in the event of:

Fire.

Collision or grounding.

Aircraft or explosive incident.

Flooding.

The pipe ‹Hands to Emergency Stations' should be made personally by the Executive Officer if the circumstances permit. It should always be preceded by the main broadcast alarm. The Officer of the Watch at sea has the authority (vested in him by the Commanding Officer) to pipe ‹Emergency Stations'.

Men not closed-up on watch, or not involved in first-aid measures as part of the firefighting or damage-control teams, are to act as ordered by the Command either to remain in their present positions or to proceed to stated muster points. The firefighting and damage-control teams are not to be impeded. Hands are **not** to return to collect lifejackets from messdecks; however, lifejackets are to be carried, if to hand, when 'Emergency Stations' is broadcast. A more comprehensive explanation of Emergency Stations is described in **BR 2170 Ship NBCD Manual**. It is important to remember that Emergency Stations does not necessarily mean that the next step is Abandon Ship; however, should that situation arise, personnel are better prepared to abandon ship from Emergency Stations than they would otherwise have been.

b. **Preparation and Issue of Survival Equipment**. Much will depend on the type of emergency and the material state of the equipment. However, the following points provide general guidelines:

(1) Check the status of survival equipment and inform the XO/1st Lt.

(2) When ordered, breakout and issue Emergency Lifejackets and Once Only Suits. (Lay aside sufficient for personnel closed up).

(3) Prepare for use scrambling nets, ladders, lifelines, boats and liferafts.

07010. Abandon Ship.

a. **Introduction**. The order to Abandon Ship will be given by the Command, and the responsibility for deploying the liferafts/lifeboats when ordered rests with the senior officer or rating in the vicinity of a particular group of liferafts/lifeboats or men. It is likely, particularly after a collision or fire, that some liferafts/lifeboats will be unserviceable through damage; therefore it is impracticable to detail individual members of the ship's company to particular liferafts/lifeboats from the Watch and Station Bill. An appraisal of the situation at the time of abandoning ship rests with the Executive Officer, who has to ensure that the ship's company are deployed to liferafts/lifeboats as the situation dictates.

b. **Leaving the Ship**. When the order ‹Abandon Ship' is given, Survival Suits should be donned and General Service Lifejackets should be worn outside the suits. The lifejacket should be fully inflated, the hood and visor must be kept in the stowed position behind the neck, and the waist belt must be adjusted to a snug fit. The Survival Suit and General Service Lifejacket, and their method of use were described earlier. At the order 'Abandon Ship' board the raft as quickly as you can; if you can climb down a rope or hose and enter the raft dry-shod so much the better; do **not** attempt to jump directly on to liferafts or dive head first into the sea. If you have to jump into the water this can be done quite safely from the upperdeck or weather decks when wearing a fully inflated General Service lifejacket. You should jump feet first with eyes looking at the horizon. Keep the feet together, place one arm over the front of the Lifejacket stole, grasping the opposite forearm or elbow and pinch the nostrils with the other hand (see Fig 7-7(ii)). The elbows should be kept as close to the sides as possible. During this procedure is it essential that the hood and faceshield of the General Service Lifejacket are kept in the stowed position until you have entered the water. This method will ensure a safe drop into the water, prevent any undue movement of the lifejacket and prevent water being forced up the nose. Anyone left on the ship after the rafts have got away should abandon ship and swim as far as possible, to avoid being sucked down or entangled as the ship founders and to avoid being struck by wreckage which might subsequently rise to the surface with great force. The only efficient way to swim when wearing an inflated jacket is on the back.

c. **Points to Remember**.

(1) If the ship is drifting it is better to leave her over the weather side, otherwise it may be difficult to swim clear; but jump well clear of the side and swim quickly away to avoid being washed back on board by the sea. If the ship has a list, leave her over the bows or stern if possible.

(2) After launching, liferafts should be worked to the bow or stern, preferably while still in their GRP containers before inflation. In this way they are unlikely to be abraded on the ship's side and they will be easier to board. If you jump from the high side you may strike the bilge keel or propellers or injure your hands and feet on barnacles on the exposed part of the ship's bottom, and if you leave by the low side you may be struck by the superstructure, masts or funnels if the ship capsizes before you can swim clear.

(3) If anti-submarine weapons are being fired or any underwater explosions appear imminent, swim on the back and lift the trunk as high as possible out of the water to avoid the pressure wave of the explosion.

(4) When clear of the ship, swimmers should make for the nearest liferaft or, failing that, cling to any floating wreckage available and form themselves in compact groups to provide mutual support and encouragement. When possible, swimmers in a group should rope themselves together by means of the toggle and line on the lifejackets, preferably in a circle facing outwards, and they should avoid undue exertion. A group of swimmers stands a better chance of being rescued than do individuals.

(5) Men have safely negotiated a patch of more than 100m of burning oil in the following manner. Deflate your lifejacket; take a deep breath and jump into the water feet first; swim under water for as long as possible, then spring above the flames and take another breath while pushing away the flames with a breast stroke; then sink and swim under water again.

07011. Mass Evacuation Systems (MES). Also referred to as Rapid Evacuation Systems (RES). Certain high sided ships in service are fitted with a MES that permits the safe, fast and dry shod evacuation of a large number of personnel from the ship in an 'Abandon Ship' situation. Ships fitted with a MES are provided with the appropriate operating, training and maintenance documentation. There are two systems in use at present:

a. **The DBC system.** This consists of a steel housing containing a tubular fabric escape chute, an inflatable platform and fender. The equipment is deployed by removing two safety pins and operating the release lever. The Slide Way slides outboard on angled rails, a trap door on the bottom of the Slide Way opens allowing the chute and platform to drop into the water, the platform and fender automatically inflate. The platform is then bowsed into the ships side using a manual winch. The Liferafts are individually launched and retrieved one at a time via a retrieval line system, this enables the liferafts to be secured to the platform and inflated via their short pull painter line.

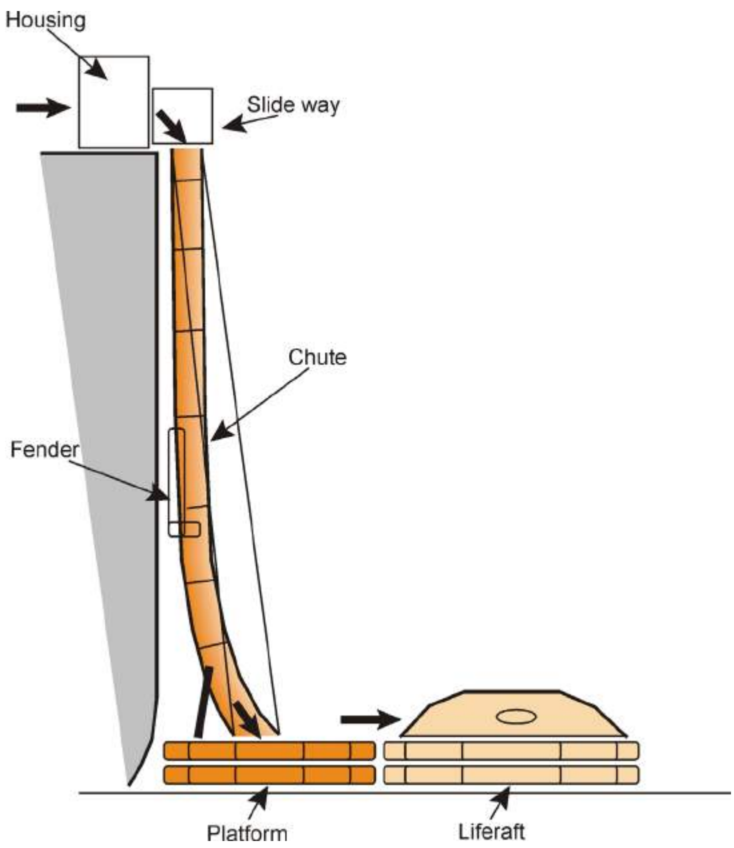


Fig 7-22a. DBC Mass Evacuation System

b. **The MarinArk System.** This system consists of a GRP housing containing two tubular fabric escape chutes, and four inflatable Liferafts (109 man each). The equipment is deployed by pulling a pump handle, the deployment is fully automatic (there are three other methods of deployment should the previous one fail). The platform is pushed automatically outboard on rails. At the end of the travel the platform tips over allowing the chutes and Liferafts to drop into the water. The Liferafts are inter-connected and inflate automatically. The Liferafts are then bowsed into the ships side via an electric winch with a manual override facility. The system is then ready for use.

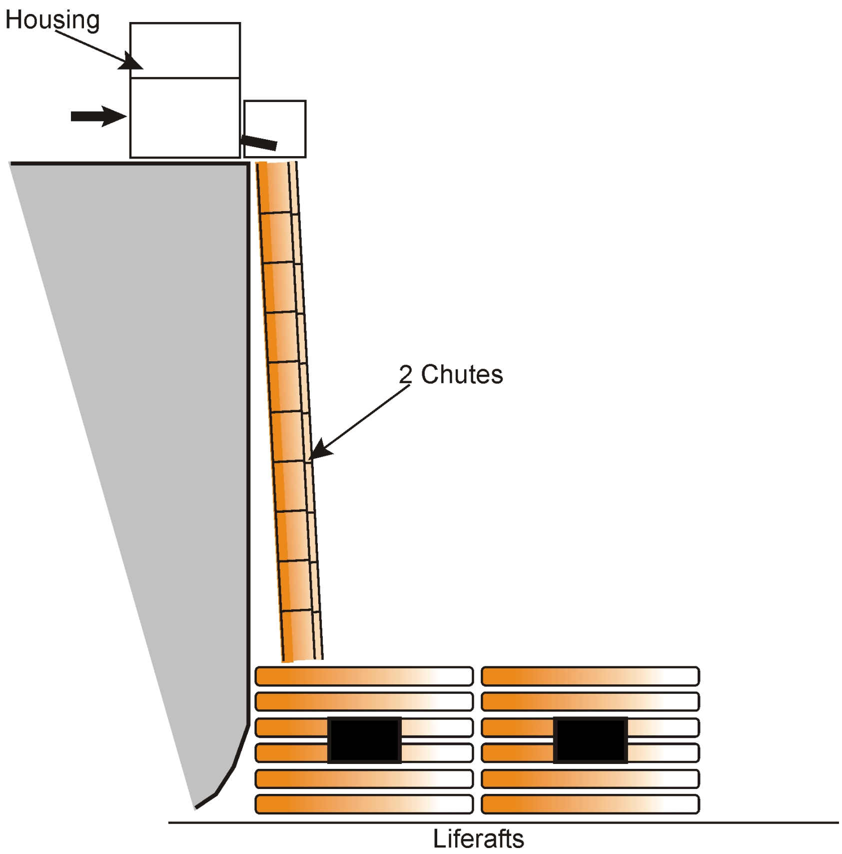


Fig 7-22b. MarinArk - Mass Evacuation System

| **07012. Liferaft - Immediate Action on Boarding.**

a. **Search for Survivors**. Listen for whistles; post look-outs to search for survivors, spot signalling lights and lights of other rafts, ships and aircraft during the hours of darkness. Cut painter with the knife stowed adjacent to the drogue. **Ensure the drogue is streamed**. In calm weather limited assistance in manoeuvring the raft for short distances can be obtained by using the drogue and/or paddles. When there is a strong breeze blowing, the raft may drift faster than even good swimmers can swim; survivors may then be found to windward of the raft. The drogue will reduce the drift speed of the raft. If survivors are to leeward, speed downwind can be increased by tripping the drogue and water pockets.

b. **Examine the Raft Thoroughly for Leaks**. Carbon dioxide gas in concentrated form is dangerous. It is therefore important to make sure that there are no serious internal leaks when both entrances are closed. The gas cannot be detected by smell but its presence should be suspected if survivors are panting for breath and/or developing headaches. Immediately leakage of gas is suspected, first thoroughly ventilate the raft, then trace and deal with the cause. Instructions for repair are given later.

c. **Bail Raft Dry**. The liferaft is fitted with two integral bailers fitted to the floor of the raft, one either side of the centre thwart. After removing a bailer from its stowage bag, operation and subsequent draining of water from the liferaft is achieved by pushing the lip of the funnel beneath the level of water within the raft, raising the funnel out of the water to its full extent and allowing the water to drain out through the sleeve to the outside of the liferaft. Continue this action until the liferaft is drained of water. After use, to seal off the bailer opening and prevent ingress of water the bailer should be wound around itself to form a spiral before it is stowed. Residual water in the liferaft can be mopped up using sponges found in the survival pack.

d. **Inflate the Floor**. Inflate the floor by means of the topping-up pump.

e. **Issue Anti-Seasickness Tablets**. Anti-seasickness tablets are stowed in a pocket adjacent to the entrance port and must be issued to every-one in the liferaft as soon as practical after boarding. Dosage instructions are printed on the outside of the packet and extra supplies of tablets are in the First Aid kit in the survival pack. **Everyone** should take the tablets for the first 48 hours; even if you have never been seasick before you may become so in the raft, and a lot of body fluid can be lost by vomiting. After 48 hours you should be accustomed to the raft motion and need only take the tablets if you are actually suffering from seasickness. The tablets may make your mouth dry, cause some minor visual disturbance or make you a little drowsy, but they will not cause you any serious harm.

f. **Activate EPIRB and SART**. If your raft is fitted with a SART, or a shipborne EPIRB or SART has been transferred to your raft, they must be activated. Instructions are printed on the side of the equipments. See also paragraph 07008.

g. **Treat Injuries**. Even minor injuries should be treated at once. Instructions for using the First Aid kit are included with the kit, and instructions in First Aid are given in **BR 1329, Handbook for Survivors**, a copy of which is in each liferaft.

h. **Gather Wreckage**. Gather any wreckage that you may consider to be useful to you either in the raft or on land. Containers of any type are valuable. Extra clothing is of vital and immediate importance in cold weather. Strip all belongings off the bodies of drowned men. Retain any similarly recovered Identity Discs and personal gear. Be careful to stow metal containers and sharp objects where they will not wear and puncture the fabric of the raft.

i. **Ventilate Raft**. Adjust entrances and ports as required to reduce CO_2 content and foul air. In cold climates and/or high wind and sea states the CO_2 content can be lowered by opening a look-out port for 5 minutes every 30 minutes for 20 plus survivors, 5 minutes every 60 minutes for 10-20 survivors, or 5 minutes every 90 minutes if there are less than 10 survivors in the raft.

j. **Congregate Rafts**. When the above instructions have been carried out all rafts should, if possible, congregate and be secured to each other by means of long lines tied to the towing patches. Apart from the ability to transfer men and stores, such a collection of rafts is better for morale and is far easier to spot from the air than isolated rafts.

07013. Liferaft - Subsequent Actions on Boarding.

a. **Designate Command**. When the rafts are congregated and secured, the senior officer or rating fit to do so should assume command of the flotilla and appoint a leader in each raft.

b. **Muster Survivors**. A muster of survivors is to be taken. **In warm climates**, transfers of men from one raft to another to equalise the numbers may be carried out immediately (the fewer men in each raft the cooler they will be). **In the Arctic**, bring rafts up to full complement for mutual warmth, and secure any empty rafts by lines approximately 10m in length attached to Painter Line/Towing Patches.

Note. *In a cold environment where the liferaft is completely closed down, entrances and ports must be adjusted for the ventilation of CO_2 from the occupants' respiration.*

c. **Organise a Duty Roster**. A roster should be started as soon as possible, and the men in each raft detailed for domestic and other duties. It is most important that the minds of survivors be kept occupied, whilst keeping physical exertions to a minimum.

d. **Detail Look-outs**. Look-out duties should be kept to a maximum of ½ hour on watch dependent on weather conditions. **In hot climates**, shirt sleeves must be rolled down, and heads covered to give protection from sunburn, sunstroke etc. **In cold inclement weather** it is important that look-outs are suitably clothed in survival suits, lifejackets and survival mitts when carrying out their duties. Ensure signalling aids are immediately to hand, particularly at night or during poor visibility. **Prevent Damage to the Raft.** No sharp-edged pieces of hard material must be allowed to lie about the raft. Unsheathed knives, jagged tins, the sharp points of the tongues of buckles on overalls, sandals etc., may cause leaks which are difficult to trace, and endanger your safety.

f. **Share Stores and Equipment**. When all stores, equipment and spare clothing in each raft has been mustered it should be shared out equally amongst the flotilla. **In the Arctic** this procedure should be delayed until the men are rewarmed.

g. **Adapting To Conditions**. You should now settle down to life on the raft. Familiarise yourself with the raft and its equipment; Read **BR 1329** and take its advice. You will appreciate that every situation cannot be allowed for; common sense and initiative must prevail to deal with unexpected situations.

07014. Liferaft - Food and Water

a. **Introduction**. Survivors can live for weeks without food provided they have water. It is for this reason that as much water has been supplied as can be stowed in the rafts. The food ration, consisting of glucose sweets, has been found by experiment to be the kind of diet most suitable for survivors. It has been designed to give you sufficient energy to keep you fit for the period you may expect to be adrift. The diet contains no meat foods, which would make you pass more urine than does the sugar of your ration, and, therefore, it helps to conserve your body water. The ability to survive can be increased by avoiding vomiting and sweating, which result in loss of liquid from the body.

b. **Water**. Drinking water is supplied in cans or sachets stowed in the survival packs. There are rations for 25 persons for 3days. **Do not issue any water during the first 24 hours.** Your body is already full of water - if you put more in during the first 24 hours it will be wasted in the form of urine. After 24 hours your body will be drier and will absorb any water you drink, just as a dry sponge will hold water but a wet sponge will not hold any more. The only exception is for a casualty who has severe external wounds. If they are wounded and have obviously bled a lot, or if they have been badly burned, they must start their water ration on the first day, if conscious.

c. **Daily Water Ration**. The daily ration of water per man is 18 fluid ounces (approx. 0.5 litre). Because of the various can or sachet sizes stowed in the survival pack, and to ensure that rules regarding rationing and drinking of water are adhered to, the raft commander should supervise the issue of water. The plastic beaker supplied is marked in graduations, the 6-oz mark being one third of the total daily ration. A beaker of water filled to the 6-oz mark should be issued to each survivor in the raft at morning, noon and night. **Issue the amount recommended**. Resist the temptation to cut down the ration below this level. If you do, you are going to get weak very quickly and your chance of survival is lessened. However, when you are left with your last day's ration is it permissible to half the ration to provide water for the next day.

d. **Sea Water**. **It is fatal to drink sea water**. Numerous lives were lost from this cause during the last war. Madness and death follow very quickly after drinking sea water. (It is useless, and may actually be harmful, to try to introduce sea water into the back passage). It is better not to use sea water for the dry and cracked lips which are particularly liable to occur in the tropics. For this purpose, de-oiling cream may be smeared on the lips. Forcibly restrain anyone who tries to drink sea water.

e. **Urine**. Since you are drinking less water than you normally do, you will pass much less urine. It will be more concentrated and will, therefore, appear dark coloured. It may even cause a burning sensation when you pass it, which you will do much less frequently than is your normal habit: this is nothing to worry about. You may have experienced the same sort of thing after sweating a lot in the tropics. **Urine should not be drunk**; it is of no benefit, and can be harmful.

f. **Saving Drinking Water. In the Tropics** carry out the following instructions to reduce the need for water:

(1) Keep out of the sun and try to prevent the sun's rays shining directly into the liferaft.

(2) Align the drogue with an entrance and adjust entrances and ports to allow as much breeze as possible to blow through the raft. Deflate the floor during the day to enable the floor area to be kept cool by the outside sea water. Inflate again at night.

(3) To help reduce the temperature inside the raft keep the outside of the canopy wet with sea water throughout the heat of the day, but avoid the rain water catchments on the canopy. Detail individuals for spells of dousing duty of not more than 10 minutes each in turn.

(4) Keep your clothing wet during the day by immersing your shirt in the sea and putting it on soaking wet, even if you are not feeling hot. Rinse your clothes before sundown and squeeze it out to get rid of any accumulated salt. Your clothing and the floor of the raft should be dried before sundown.

(5) Don't go swimming. Swimming wastes energy and will increase your thirst. Your food ration is not enough to allow for wasted energy. Swimming is dangerous in that the raft may be drifting faster than you can swim. Also remember sharks.

g. **Supplementing Water Rations**. You must make every effort to add to your water rations, by the collection of rain-water. **In the Tropics**, storms can be very heavy and may be frequent at certain seasons. With care and common sense, large quantities of rain-water may be collected and stored and so life be saved. It is, therefore, important that a night look-out should be detailed, not only to look for rescuing craft, but to rouse companions should rain occur. Rain-water may be collected and stored by the following methods:

(1) The roof of the canopy has two rain-water catchments. Drain tubes from these catchments allow for the filling of water containers. Ensure the water is free from salt before starting to collect it in containers.

(2) Fill every container that you can find, such as water bags, empty water cans, lifejackets and even boots and shoes. The end of the rain-water drain tube fits snugly over the mouthpiece of the lifejacket. Press the valve down to allow the water to pass into the lifejacket.

(3) The entrance closure sleeves and look-out ports of the raft can be arranged to collect rain-water if weather conditions permit.

When all possible containers are filled, then drink your fill of the rain that follows. Once the rain stops, carry on your normal ration routine, but remember to use the stored rain-water first. Water will condense on the inner lining of the canopy. Collect this if possible, but take care that it is not contaminated with sea water from the raft floor. **In the Arctic**, water can be obtained from sheltered pools in blue icebergs (i.e. old icebergs) and from the ice of those bergs. New icebergs are milky-grey in colour; their ice is salty and must **not** be used for drinking water. Do not suck ice. First let it melt and then drink the water only if it is not salt.

h. **Food**. Each liferaft carries sweet rations for a three-day period. Each day's ration should be equally distributed among the liferaft's complement of survivors prior to the first issue of the day's water ration. It may be left to each man's discretion at what time he actually eats the sweets, but each man must eat his daily ration. As the food does not leave any useless residue there is nothing for your bowels to pass on. You will, therefore, appear to be constipated. This need not worry you; in fact, it is beneficial since the less your bowels work the less water you are wasting.

i. **Supplementing the Food Ration with Seafood**. Many varieties of fish will be seen from a quietly floating raft, particularly in tropical waters. These will range from flying fish, crabs or octopus-like animals to barracuda, turtles, porpoises, giant rays, sharks and whales. **You must not eat fish flesh** unless you have, the same day, been able to drink at least a pint of rain-water over and above your canned ration; that is about 2 to $2^1/_2$ pints in all.

The reason is that when such fish or animal flesh is eaten the body has to make urine to get rid of the waste products of flesh digestion. The water for this urine comes out of the water stored in your body. You cannot afford to waste this amount of water if you are on your ration only. (It is important to remember that water is of more value to you than food).

Note. *Sharks, porpoises, giant rays and whales will not deliberately attack the raft if they are left alone. Never try to catch a shark from a raft; never bathe or dangle arms or legs in the water for amusement, nor trail anything to attract sharks. Sharks may lurk in the shade underneath the raft out of your vision, showing a somewhat unnerving desire to sometimes buffet the raft, either in an attempt to brush parasites from the body or to catch the numerous sucker fish that may cling to the underside of the liferaft.*

07015. Liferaft - General Raftsmanship

a. **Control and Command**. Keep rafts congregated and secured to each other. This will assist morale, and provide mutual aid as well as presenting a bigger target for searchers to spot. The senior officer or rating will take charge of the flotilla and appoint a leader in each raft. A daily routine should be worked out and the leader of each raft should see that this routine is carried out. The person in charge of the flotilla should draw up a schedule on the use of distress flares, bearing in mind the need to spread supplies over five days. The search will start at the place where your ship was lost, due allowances being made for wind and current drift. You should stream the drogue and ensure the water pockets are untripped at all times to cut down wind and drift. If the drogue is carried away a spare can be found in the survival packs. The search for the rafts may be made by either aircraft or ships, or both combined.

b. **Navigating the Raft**. In relatively calm conditions it is possible to manoeuvre the raft for short distances by working the drogue. To navigate with the drogue, haul the raft up to the drogue, take the drogue out of the water, bunch it and throw in the direction required. Pull the raft up to it and repeat as necessary. To throw the drogue to its full length of line and to achieve a faster sink rate, tie a weight such as a spare shoe or boot to it. Certain rafts are supplied with paddles to assist manoeuvring. When manoeuvring the raft, trip the water pockets either side of each entrance by means of the trip lines. Speed downwind is increased by tripping the drogue and the water pockets. Navigation against a wind of any strength will not be possible, so navigation should always be across the wind or downwind. When rafts are congregating, progress should be made towards those downwind; those furthest downwind should stream their drogue to reduce the rate of drift.

c. **Boarding Raft and Distributing Weight**. The normal method of boarding is by the boarding ramps situated at each entrance. As soon as one person is aboard he should assist others. On boarding, survivors should occupy the windward side of the liferaft first, to minimise the danger of capsizing in strong winds. In a partially occupied liferaft, survivors should always occupy the windward side. Once aboard the raft survivors not involved in rescuing other should avoid congestion around the entrance unless assisting other survivors to board.

d. **Raft Capsizing**. If there is danger of your raft capsizing, everyone should don lifejackets, and inflate them. If the raft capsizes **do not panic**; the raft will float upside down and you will be able to vacate it through either of the entrances. The raft should then be righted and boarded again by the survivors. Take care that the liferaft - when upside down and empty of survivors - does not blow away.

e. **Righting a Capsized Raft** (Fig 7-23). Righting of the NILE liferaft can be carried out by one person. However, two or more persons may be required to carry out this operation on the NL MK1 liferaft. In a wind the raft should be manoeuvred so the topside/canopy of the raft is facing upwind; the wind can then assist the righting process. The person should manoeuvre themselves to a position close to the gas cylinders. They should then climb on to the cylinders (outboard cylinder if possible) and adjust their hold as high as possible on the righting strap. A pull on the strap together with a downward pressure of the feet on the cylinders, at the same time throwing the weight backwards, should right the raft. As the raft is coming over the person righting it should gather the righting straps in one hand, bunch the fist of the other hand and make a 'tent' of the raft bottom by extending the free arm upwards; this will create an airpocket beneath the raft. It may be necessary to ‹bounce' one's weight on the cylinders to break any suction there may be between the raft and the water. Due to the large diameter of the raft the person righting it must be prepared to submerge for a few seconds before swimming out from under it. Assistance can, of course, be rendered by other survivors pushing up on the arches.

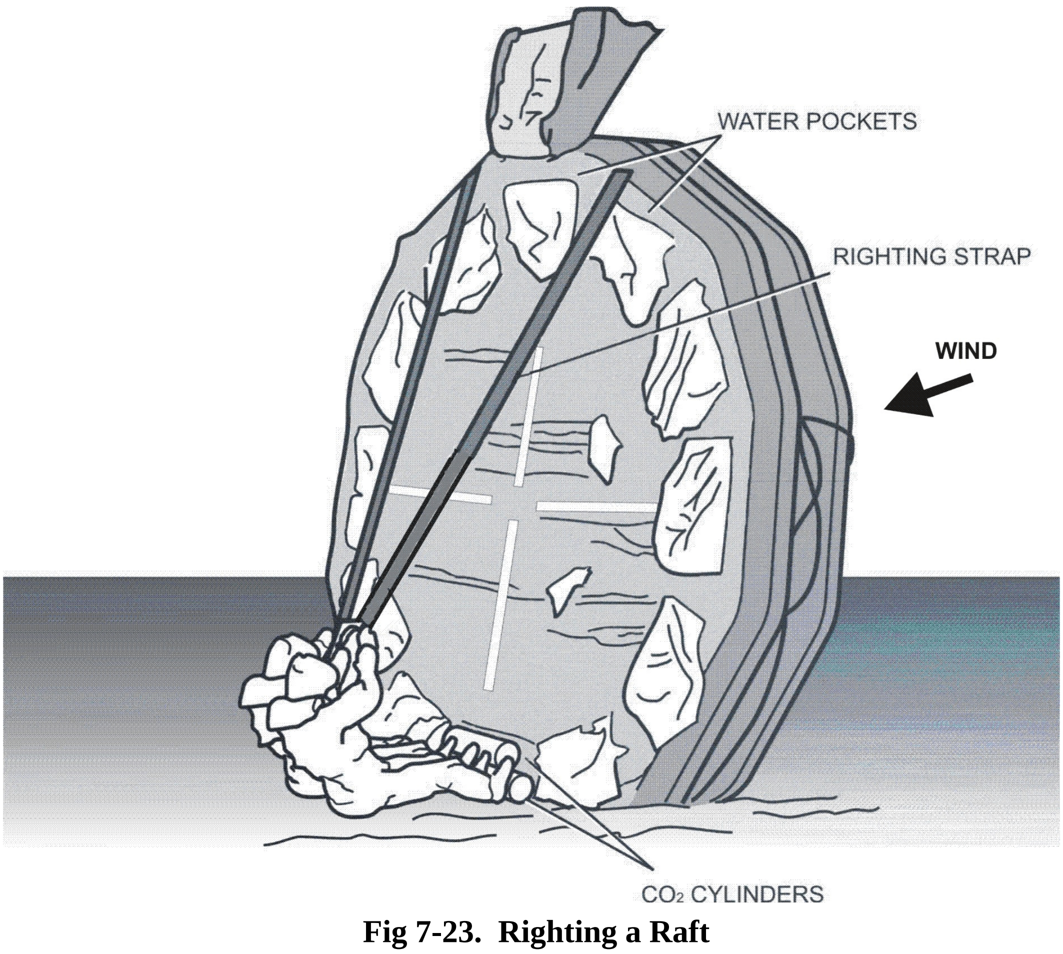


Fig 7-23. Righting a Raft

f. **Hauling an Injured Person into a Raft** (assuming the injured person is incapable of assisting the rescuers).

(1) *Two Person Routine*. If an injured survivor is floating some distance away one person should swim to them with the rescue quoit and line, the other end of which is secured onboard. Both can then be hauled towards the raft. The injured person should be brought close alongside with their back to the raft and then, if possible, sat in the boarding ramp. Removal of the injured person from the water into the liferaft is best carried out by two people sitting astride the buoyancy chamber facing each other, with their backs against the arches. In this position the rescuers reach outboard and, while holding the safety straps on the arch tube with one hand, clasp the survivor under the armpits, or their clothing at the shoulders, and ease them onto the boarding ramp and then into the raft. Other personnel in the raft should assist as necessary.

(2) *One Person Routine*. If only one person is available for carrying out the recovery of the survivor, the rescuer should stand with feet fairly close together and legs pressed hard against the buoyancy chamber. Reaching outboard, the rescuer should, if possible, pass their hands under the armpits of the injured person and clasp them together on the injured person's chest. If this is not possible, firmly grasp the clothing on the survivor's shoulders. Push them downwards first before starting the upward pull, when the rescuer's arms and body should be straightened and the weight thrown backwards. By thus employing the full length of the body as a lever against the weight of the injured person, the latter will more easily be hauled inboard.

g. **Maintaining and Repairing the Raft**. Your raft is designed not only to keep you afloat but to surround you with a layer of still air which will insulate you against extremes of temperature. **Keep it so**.

(1) *Inflating the Floor*. Inflate the floor by means of the topping-up pump and use it to keep the raft topped up.

(2) *Examining the Raft for Damage*. One of the first actions on boarding the raft is to examine it thoroughly for damage. Pay particular attention to buoyancy chamber and arch pressures; flabbiness may indicate leakage from unsuspected or minor sources.

(a) Examine the topping-up valves and deflation plugs (The deflation plugs have a slotted head and if loose should be tightened with a coin).

(b) Examine the fabric parts of the raft.

(3) *Repairing a Small Hole or Tear*. If a small hole or tear is found, plug it at once with the smallest leak stopper that can be used. Care must be exercised in using the stopper. A slight screwing motion may be necessary to seat it correctly, but do not keep on screwing, as this will enlarge the hole.

(4) *Repairing Large Holes*. Four repair clamps are provided for this purpose. Instructions for their use are as follows:

(a) Unscrew butterfly nut fully from thread.

(b) Separate the oval-shaped metal plates.

(c) Insert metal plate with rubber washer through the hole or tear and turn into a position whereby damaged area is covered.

(d) Place second plate over exterior of damaged area and mate up with plate in (c).

(e) Screw butterfly nut onto thread and fully tighten up to ensure an air-tight and water-tight seal.

07016. Liferaft - Raftsmanship in the Arctic

In the Arctic first close the outer cover and inner sleeve at both entrances, and inflate the floor. Make sure there are no leaks of CO_2 gas into the raft.

a. **Closing the Outer Cover:**

(1) Untie the securing tapes and slip the boarding ramp support straps.

(2) Position the outer cover over the top buoyancy tube adjacent to the entrance and tuck it into the crease formed between the top and bottom buoyancy tube.

(3) Do up the zips or pull the closure cords taut and secure them around their rubber securing buttons.

(4) Close the inner sleeve by doing up the zips or securing the door ties sited on the inside of the inner sleeve to the ties on the top buoyancy chamber, then slide the rubber toggle as far along the drawstring as possible.

(5) Tie off by bunching the fabric of the sleeve together and lashing round with the ends of the drawstring.

b. **Dealing with Chilled Survivors.** If there are survivors in your raft chilled from immersion and shivering uncontrollably, warm them and ensure they have their once-only survival suits on. Three Thermal Protection Aids can be found in the survival bags. Huddle everybody together, ensuring that any persons without survival suits are situated between those people wearing suits. In a partially occupied liferaft survivors should always occupy the windward side.

c. **Maintaining a Comfortable Environment.** When you are warm and the atmosphere in the raft is heavy and uncomfortable, survival suits may be removed to prevent sweating and to distribute body heat equally throughout the raft. If necessary, open the entrance ports slightly at each end to provide ventilation, adjusting as required to suit conditions. Then:

(1) Keep as dry and warm as possible.

(2) Mop up the floor of the raft and keep it as dry as you can at all times.

(3) Huddle together - the closer you huddle together the warmer you will be.

(4) Cover yourselves with all the spare clothing you have been able to salvage.

Notes:

1. *It is particularly important that your feet are kept warm. Keep moving your toes, fingers, hands and feet, clench your fists and stretch your limbs. This provides a little warmth and will keep the circulation going in the hands and feet.*

2. *Avoid exposure to the cold. Remember the face, ears and hands are quickly affected by frostbite. Look-outs should be well wrapped up, and monitored for signs of oncoming frostbite and cold as the persons themselves may be unaware.*

07017. Liferaft - Raftsmanship in the Tropics

In the Tropics instructions are designed to preserve your body water. Water is lost from the body in the breath, in the urine, in bowel motions and most of all by evaporation from the skin. Obviously you lose water when you sweat, but you are also losing water if your skin feels dry. Keep out of the sun; wet your shirts with sea water by day, and take turns to douse the raft; align the drogue onto a position on the raft which will allow as much breeze as possible to blow through the entrances. You will be cooler by day if the floor of the raft is deflated, but inflate it at night, and ensure any clothing used for dousing of the raft in the day is dry by nightfall, as tropical nights can be cold. Look-outs must be well protected from the sun.

07018. Liferaft - Organising Watches

Ideally the personnel in each raft should be divided into 5 watches; each watch should do a 2-hour turn of duty. Such arrangements may not be practicable and circumstances will dictate the precise organisation.

a. **Duties**. The following duties have to be carried out, and men in each watch should be detailed to do them.

(1) Inspection of raft hourly; baling and drying out; topping up the buoyancy tube and repairs.

(2) Collection of rain-water; in tropics, dousing outside of liferaft with sea water.

(3) Care of injured men, distribution of rations at morning, noon and night.

(4) Signalling (using distress flares, heliograph, Sarbe Locator Beacon and GMDSS where fitted).

(5) Look-out duty - ideally not longer than ½ hour on watch; less, if weather conditions dictate.

b. **Keeping a Log**. The raft leader should keep a log recording incidents of weather, morale, and conditions within the raft. The log should also contain issue of rations, condition of injured personnel. Remember, valuable information can be gathered from a log, which will greatly assist the raft designer and medical authorities. Blank pages are provided at the back of **BR 1329** for the keeping of such a log.

07019. Land Survival

a. **Making for land**. Although you are advised not to attempt to navigate your liferaft away from the scene of a sinking in mid-ocean, you should attempt to reach land if such is in sight or is known to be in the immediate vicinity. There are numerous islands in certain tropical seas. It is possible to locate a tropical island, although not directly visible, by:

(1) Noticing the presence of low cloud which does not alter its position, in an otherwise clear sky.

(2) Watching the flight of birds. Where birds are seen in numbers flying in a fixed direction in the evening, they are flying towards land. The presence of occasional birds at sea does not mean land is near.

(3) Noticing a localised green haze in the sky caused by reflection from lagoons.

b **Reefs**. Tropical islands are usually surrounded by coral reefs. Such coral is sharp and causes quite severe wounds which often become infected and ulcerate very easily. Coral reefs are often covered by dangerous surf and by breaking seas. A smooth break in the line of surf will indicate a passage through the reef. Always try to make for this smooth patch. The chances are that your raft will be badly damaged by the coral. Before reaching such a reef you must:

(1) Don and inflate your life jacket.

(2) Put on boots and protect your hands with strips of cloth or similar material.

(3) Get outside the canopy - so that you are not trapped if the liferaft strikes, or in case you capsize in the breakers.

***Note**. All these points are equally applicable when approaching any rocky, rough type of coastline.*

c. **Salvaging Equipment**. The liferaft and equipment are valuable items for survival on land. Attempts should be made to salvage all available items of equipment. Where conditions permit, exercise patience and navigate the raft so as to get the most favourable approach for landing.

d. **Survival on Land in the Tropics**

(1) *Obtaining Water*. If you land on a tropical island your problem will be that of a water supply. If the island is inhabited, water must be available and your problems are over. It may, however, be small and uninhabited. Even so, water can still be found or made. If no stream can be found, dig in the sand above the high water mark. As soon as you strike damp sand stop digging and let water accumulate in the sandpit. It will taste salty or brackish. Continue such diggings farther away from the sea until you find water which is drinkable. Water may be obtained from:

(a) Vines and Rattan (Not with red sap)

(b) Bamboo

(c) Coconuts

(d) Palms

(e) Natural pools and ponds

(f) Pitcher plants

(2) *Boiling Water*. Water should be boiled for 5 minutes before being used for drinking whenever the island is inhabited by natives or where pollution of a stream is suspected. It is possible to boil water in the stems of bamboo trees. Cut off a suitable length just below a cross partition; fill the hollow stem with water and lay it across your fire at an angle of 45°. The water will boil before the wood burns.

(3) *Wading*. Do not wade in the lagoons. There are dangerous fish which inhabit the sand and hollows in the reefs. Beware at all times of sharp coral.

e. **Survival in the Arctic Snow or Ice**. In the winter your main problem is to keep warm and find food. Water should not be difficult to obtain from snow and ice and in summer from freshwater pools on ice floes.

(1) *Shelter*. If your liferaft is intact it will provide you with a shelter - it will be as effective on land as afloat. Place your liferaft in a sheltered spot, and if possible keep it off the snow or ice by putting mosses, lichens or other soft vegetation under the floor. The inside of the liferaft will be even warmer if you can cover the tent with light vegetation to increase the insulation. Should your liferaft be destroyed, it is possible to build a shelter from snow-blocks, igloo fashion, or a shelter may be provided by a dug-out in the snow.

(2) *Warmth*. If you are able to build a fire, build it just outside the entrance to the raft/shelter, **far enough away to avoid the risk of burning your raft, which is flammable**. A screen of logs behind the fire will reflect heat towards the liferaft/shelter. Brush off **all snow** from clothing before entering the shelter; otherwise the snow will thaw with the warmth inside and freeze when you go out again, when it cannot be easily got rid of. Boots and socks should be carefully dried out at night, in order to guard against frostbite and help preserve the footwear. Footwear is a vital part of your clothing which you may not be able to replace. Do not leave it unattended near a fire.

f. **Rescue Hints - All Climates.** Always keep dry material ready for use as a signal fire should rescue aircraft or ships appear. If possible, a large SOS sign should be made on any beach or open ground - using coloured/contrasting materials such as dark soil, stones, seaweed, lifejackets etc on a sandy beach or on snow. Make the letters as large as possible with the materials available. You should make actual letters, rather than the morse dots and dashes (which may be mistaken for natural markings). If you have any matches, hoard them for use as a signal emergency - when you will need a light urgently. Keep dry material under nearby shelter, so that a signal fire can be started at a moment's notice. When once ablaze make smoke with damp vegetation. You will now appreciate the reason for gathering as much wreckage, clothing and personal effects as possible at the time of abandoning ship.
Even trivial things like pins, bits of string, wrist watches and the like, may provide the materials you will require if compelled to survive on land.

07020. Training and Familiarisation

a. **Introduction**. Training prepares the individual psychologically for an emergency and reduces the mental and emotional shock caused by fear. This is attributable partly to familiarity with the procedure or drill, and partly to knowledge gained of the dangers to be faced and of the capabilities of the equipment provided. The passengers of a liner, for example, are less likely to panic when ordered to their boat station in emergency if they have already attended several boat drills. In the Royal Navy everyone must have a thorough knowledge of the lifesaving equipment and should be drilled in its use.

b. **Training for Service Personnel**. All new-entry personnel receive instruction in the use of lifejackets, survival suits and liferafts as part of their basic training. Additionally, before joining a ship, Junior Rates should attend a Basic Sea Survival Course (BSSC) and Officers and Senior Ratings an Intermediate Sea Survival Training Course (ISSC) at the Royal Naval Sea Survival Training Centre. On the first occasion of joining a ship personnel should be briefed on the Safety and Survival equipment carried by the ship, and provided with a diagram of the ship showing the disposition of the equipment and the action to be taken in the event of hands being ordered to Emergency Stations. Thereafter continuation training should be in accordance with BRd 9274.

c. **Training and Familiarisation for Casual Visitors**. There are many occasions when a ship embarks casual visitors: these may be service or civilian. On joining a ship that is at or going to sea, such visitors should, when practicable, be briefed on the Safety and Survival equipment carried by the ship. In any event they should be provided with a diagram of the ship showing the disposition of the equipment, and the action to be taken in the event of hands being ordered to Emergency Stations. When the number of visitors is small the spare capacity in the number of lifejackets carried by the ship can be utilised. For large numbers of visitors see sub para d.

d. **Provision of Lifejackets for Large Numbers of Civilian Visitors**. Maritime Coastguard Agency (MCA) lifejackets must be embarked for such occasions. The procedure for demanding (and returning) these lifejackets, and details of briefs and demonstrations that must be given prior to the ship sailing are laid down in FLAGOs.

e. **Survival Equipment Location Diagram**. In all HM Ships diagrams are to be sited in prominent positions throughout the ship showing the stowage positions of lifesaving equipment. An example is shown in Fig 7-24.

f. **Instructional Illustrations**. These are available for various types of life saving equipment and are supplied by HMS SULTAN Graphics and distributed through DSDC(L) Llangennech. The following are available to date:

25 Man Liferaft NL Mk1 General View		SG 2002-522A
25 Man Liferaft NL Mk1 Vital Actions	RN S3246	SG 2002-522B
25 Man Liferaft Old Type Vital Actions	RN S3252	SG 2003-708
Once Only Survival Suit	Out Soon	SG 2003-692
General Service Lifejacket Mk 4	RN S3245	SG 2003-781
Hazardous Duty Lifejacket Mk3	RN S3253	SG 2003-826
Assault Troop Lifejacket Mk4	RN S3248	SG 2003-396-2
Landing Craft Lifejacket Mk2	On Going	SG 2003-709-1
Landing Craft Lifejacket Mk3	RN 3258	SG 2003-709
UML Mk6 Operating Head/Cartridge	RN S3247	SG 2003-396-1

07021. Maintenance of Sea Survival Equipment

All ratings of the Seaman Specialist branch are qualified in the use and maintenance of lifesaving equipment. HM ships not complemented with a Seaman Specialist carry at least one rating specially trained in the use and maintenance of lifesaving equipment; he is designated the title Sea Survival Equipment Maintainer (SSEM) rating. Courses on the Maintenance of Sea Survival Equipment are given by the Royal Naval Survival Equipment School HMS SULTAN and by the Royal Navy School of Seamanship (RNSOS) HMS RALEIGH. Equipment must be maintained in accordance with the procedures and schedules laid down in the **Sea Survival Equipment Log**, which is part of the ship's Maintenance Management System (MMS). All maintenance carried out is to be supervised by a suitably qualified person.

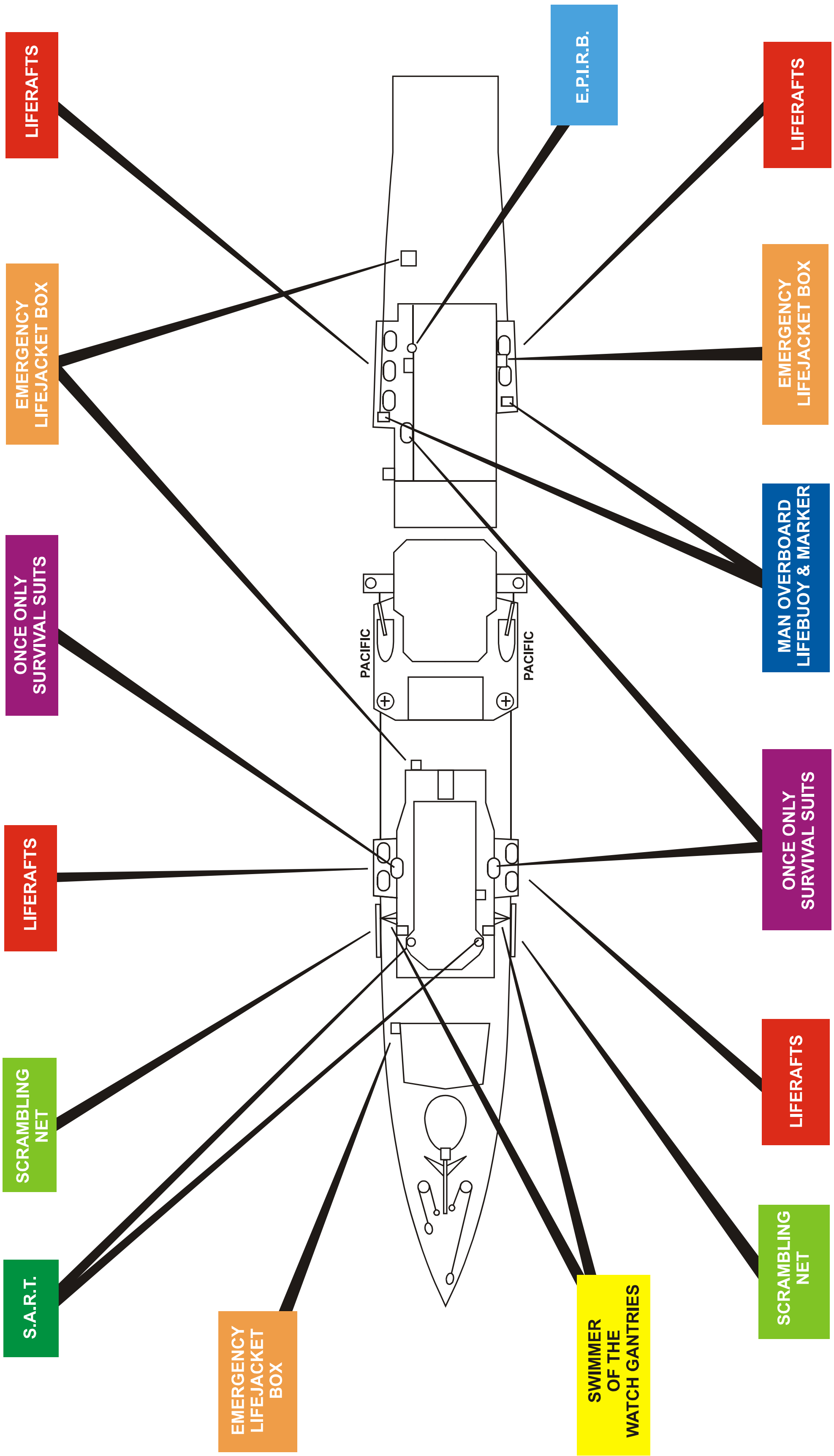


Fig 7-24. Stowage Positions for Lifesaving Equipment (Example).

07022. Sea Survival Equipment Log

This log forms part of a ship's Maintenance Management System (MMS) and is used to plan and record the servicing tests and inspections called for on a ship's outfit of survival and safety equipment. Details of the criteria regarding the qualifications necessary for Survival Equipment Maintainers and Survival Equipment Supervisors are given in the foreword of the log.

07023. Swimmer of the Watch Recovery Rig (Fig 7-25)

a. **Introduction**. The Swimmer of the Watch (SOW) rig is a very effective method of recovering a person from the water, particularly when rough seas or other circumstances preclude the safe use of a boat. The swimmer should be a volunteer. However, should no volunteer be forthcoming Commanding Officers have the authority to nominate suitable personnel to undertake this important lifesaving role. Before assuming the duties of SOW the person must be trained and deemed competent by the ship's Diving Officer (or any other Officer nominated by the Commanding Officer) in all aspects of the drills, maintenance of equipment, and ability to function effectively in the water.

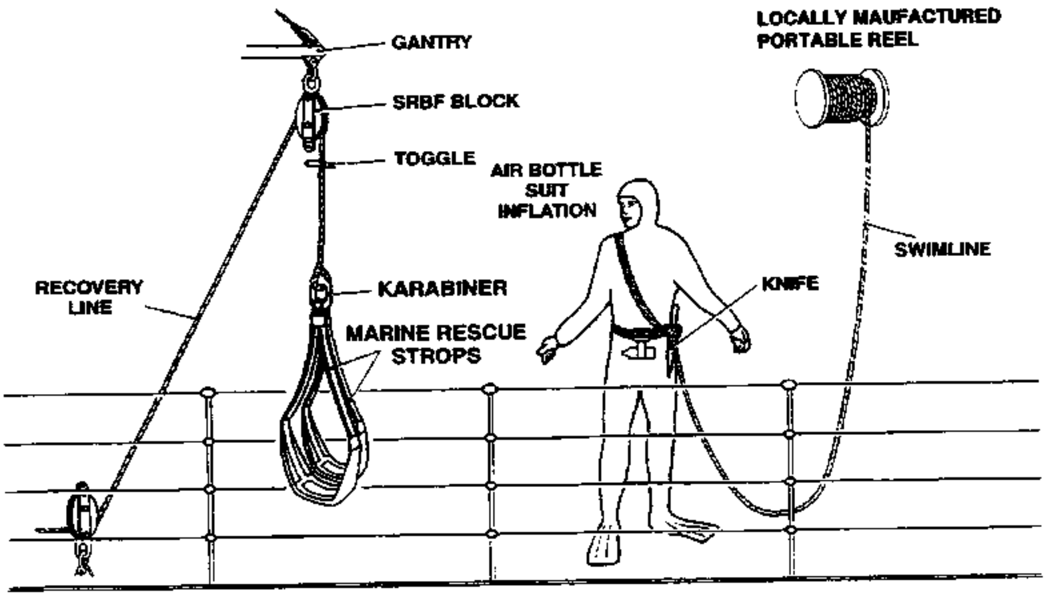


Fig 7-25. Swimmer of the Watch Recovery Rig (Rigged For SOW Recovery)

b. **Training.** SOW training is now given in the form of a Targeted Employment Module (TEM) at HMS RALEIGH. On completion of training, a locally produced Certificate of Competency Record Card is to be made up see example overleaf) as proof that the SOW is safe to conduct the required tasks involved. The certificate is to be retained within the Seamanship Data Book and is to be used to record each task that the SOW undertakes. The remarks Column should be used to record the duration of the task and any other relevant information.

CERTIFICATE OF COMPETENCE

SWIMMER OF THE WATCH

SHIP/UNIT.....................................

NAME......................   RATE...........................

DATE OF TRAINING/QUALIFIED AS COMPETENT..

SIGNED...................   DIVO/NOMINATED OFFICER

RECORD OF SOW TASKS				
Date	**Sea Conditions**	**Serial No**	**Remarks**	**Supervisors Signature**

c. **Gear Required**. The following equipment is used to make up the rig:

SOW Recovery Gantry	Rigged iaw ships drawings	
Recovery Line		
16mm Polypropylene, length to suit, stowed on a portable reel, SDN 004515659. End fitted with soft eye 4" or 10cm long with leather chaffing piece:	0350/075-0861	The toggle is to be fitted to stop the splice being pulled into the block. Its precise position is optional, as it can be used to indicate the 'high enough' position for the recovery of the casualty or swimmer.
	0476/924-4520	
Wooden toggle	Local manufacture	
Swimline		
8mm Polyethylene	0350/543-0141	110m, stowed on a portable reel with both ends whipped and heat sealed.
Blocks	0263/521-2797	SRBF block with swivel, oval eye and becket.
Shackles for Blocks		
Straight screw	0263/721-6090	Straight shackle - straight pull.
Bow screw	0263/721-6105	Bow shackle - angled pull.
Man Overboard Recovery Stretcher(MORS)	0472/980-8683	2 x legged Sling
	0472/974-9030	3 x legged Sling
For'ard steadying line for MORS		
Polypropylene line	0350/075-0861	For'ard steadying line for MORS. Made from 16mm Polypropylene, length to suit. fitted with a Karibiner hook at one end.
Karabiner hook	0475/770-7551	
Rescue Strop Assemblies		
Yellow (upper) 2 in number	0472/904-0115	The strops are to be provided at the recovery point to recover the Swimmer of the Watch. See details of preparing the rig on following page.
Blue (lower) 1 in number	0472/904-0116	
Karabiner hook 2 in number	0475/770-7551	
Swimmer's Equipment		
Diving suit dry, neoprene hood, neoprene gloves, inflation bottle, Sam Brown harness, fins and diver's knife.	Supplied and maintained by the diving yeoman or nominated deputy	Suit must be a good fit, hoods are to be worn, gloves are optional. Inflation bottle and Sam Brown harness must be fitted. The knife, which can be strapped to the swimmer's leg if preferred, must be secured to the scabbard with a line long enough to allow work at arm's length.
Directional Pointers	Local Manufacture	One for daylight and one for darkness

d. **Personnel**

1. OIC as detailed by CBM. (OIC is to wear a HDLJ and a white safety helmet).
2. Swimmer.
3. Swimline tender.
4. Minimum of 6 hands to man recovery line.
5. Swimmer director (Carrying the appropriate pointer).
6. Hand (wearing a HDLJ) to operate top guardrail and assist swimmer/casualty.
7. Medical Team (with stretcher for transportation of casualties if required).
8. Safety Officer.

Note. *The team is to be dressed to suit weather conditions. Dress is to be specified in the initial broadcast.*

e. **Preparing the Rig**. Rig the SOW recovery gantry or davit in accordance with ship's drawings. Splice a soft eye 4" or 10cm long with a leather chaffing piece inserted one end of the Recovery Line. Whip and heat seal the other end of the recovery line, then reeve this end from outboard to inboard through the leading block(s) and onto the portable reel. Reel the swimline onto a locally manufactured portable reel and place this close to the rescue station. Check the Man Overboard Recovery Stretcher is correctly stowed . Attach an upper body strop, by its 'D' rings, to a Karabiner hook; this becomes the Single Strop Assembly. Attach an upper body strop and a lower body strop, by their 'D' rings, to a Karabiner hook; this becomes the Double Strop Assembly. When required for use one of these assemblies is attached to the spring hook on the recovery line and used to recover the SOW. The SOW will usually be recovered using the Single Strop Assembly. If the SOW appears fatigued, or requests it, the Double Strop Assembly is used. The strops are to be stowed with the swimmer's equipment until required for use.

f. **Care of Equipment**. Maintenance, testing and replacement of equipment should be in accordance with the MMS and SSEL. For management purposes the Double Strop Assembly and the Single Strop Assembly are to be retained as unique assemblies and identified with a local ID number. Strops used for SOW must not be used for any other purpose.

g. **Actions on Closing Up**

1. Swimmer dresses and is checked by the OIC.

2. The swimline is attached to the swimmer by passing the outboard end through the loop on the right shoulder of the swimmer's Sam Brown harness, then around the body of the swimmer before finally securing it to its own part by means of a bowline (any member of the recovery team can tie the bowline, but it must be 'proved' to the swimmer). The swimline tender now pulls from the reel a bight of swimline sufficient to reach the waterline and either leads it over the ship's side or coils it neatly in one hand free for running. (The swimline reel should be sited so that the bight of swimline is well clear of the swimmer's entry position).

3. The recovery team takes the MORS from its stowage, removes the recovery line from its reel and hooks the outboard end of the recovery line to the slings of the MORS. The recovery line is then manned by the recovery team.

4. The swimmer director is to be positioned as ordered by the OIC. The medical team are to be sited in a convenient position so that they can be quickly brought in to remove the casualty, but not hamper the recovery. They must provide a stretcher ready for use. If there is only one casualty the MORS stretcher is used to remove the casualty, if there is more than one casualty the additional stretcher provided by the medical team can be used to remove victims as they are brought inboard (see drills for operating the rig).

h. **Operating the Rig**

ORDER	ACTION	SIGNAL
Swimmer ready (OIC)		
Carry on with the swimmer (OOW)	Lower the top guardrail. The swimmer positions himself at the deck edge, looks to the horizon and steps off. Set up the top guardrail. When the swimmer surfaces he vents his suit and checks the swimline is clear.	Thumbs up by swimmer
Swimmer is directed to the casualty by pointer	Swimmer swims on his back to the casualty, directed by the pointer. On reaching the casualty the swimmer cracks the inflation bottle to give extra buoyancy, reassures the casualty if conscious, then manoeuvres into position before grasping the casualty securely from behind. After checking the swimline is clear, he indicates he is ready to return.	Thumbs up by swimmer
Check away recovery line (OIC)	As soon as the swimmer is clear the for'ard steadying line is hooked to the MORS and the MORS is hoisted outboard and lowered into the water.	
Haul away swimline (OIC)	Swimline is hauled in to assist the swimmer's return to the recovery position. Care is to be taken not to haul away too quickly as this may cause the swimmer and casualty to be dragged beneath the surface.	
Avast hauling on the swimline (OIC)	This order is given when the swimmer is beneath the recovery position.	
Insert the casualty into the stretcher (OIC)	The swimmer, working from aft of the MORS, manoeuvres the casualty, upper torso first, into the MORS.	Thumbs up by the swimmer.
Swimmer swim clear (OIC)	Swimmer swims clear of the casualty, checking that his swimline is not fouled.	Thumbs up by swimmer
Walk away recovery line (OIC)	The recovery team walk away with the recovery line, taking care the MORS is hoisted smoothly without jerking.	
Avast recovery line (OIC)	The recovery team stop walking away and hold on to the recovery line.	
Recover MORS inboard (OIC) Walk back recovery line (OIC)	Bring the MORS inboard by grasping the inboard rungs of the stretcher and hauling it over the top guardrail. The recovery team carefully walk back with the recovery line in hand, allowing the MORS to be lowered to the deck. Unhook the MORS.	
Medical team in (OIC)	The medical team enter the recovery position and, using the MORS, quickly remove the casualty for treatment. If there is more than one casualty to be recovered the first casualty can be transferred to the spare stretcher supplied by the medical team. The MORS is then reattached to the recovery line and the rescue procedure repeated. Alternatively the OIC can decide to use the double strop method to recovery any additional casualties.	

ORDER	ACTION	SIGNAL
Prepare the recovery line for swimmer recovery (OIC)	Once the MORS has been removed, hook the single upper recovery strop to the recovery line and lower it to the swimmer, who places it over his head and tightens the becket. If the swimmer appears fatigued, or requests it, the double strop should be passed and the SOW secures himself into the double strop, the upper strop under the armpits, the lower strop behind the knees. The toggles of both strops are then tightened and the SOW is hoisted inboard as described for the MORS. However, if using the single strop, once the SOW is at deck-edge level the upper guard-wire must be lowered so the SOW can be assisted inboard and lowered to the deck. Immediately the SOW is inboard the top guard-wire must be re-set.	Thumbs up by swimmer when ready to be hoisted.
Swimmer inboard (OIC)	Set up the top guardrail (if necessary). Check on the swimmer's well-being, then send him to report to the medical team or sickbay.	
Secure the recovery position. (OOW)	Secure the recovery position, carry out 'After use' routines on all equipment. Ensure all gear is ready for immediate use.	

07024. Man Overboard Recovery Stretcher (MORS)

a. **Introduction**. The Man Overboard Recovery Stretcher (MORS), (Fig 7-26) stores number 0472-99-974-9030 allows the horizontal recovery of casualties from the water; it replaces the Single and Twin Marine Rescue strop Assemblies for this purpose. The MORS is a floating stretcher made up of plastic rungs (similar to the Jason's cradle fitted in RN rescue boats) and is supported in the water by two attached buoyancy aids; two in number two or three legged slings are used to facilitate deployment and recovery. Operating instructions are supplied with the MORS and servicing and maintenance procedures for the equipment are given in PMS 1-5923-000. Recovery of Man Overboard drills and procedures when using the MORS are given in paragraph 07023 of this Chapter. When not in use the MORS is to be stowed in the PVC bag supplied in accordance with the instructions supplied with the equipment.

Note. *One set of single and twin Marine Rescue strop Assemblies are to be retained onboard to facilitate recovery of the Swimmer of the Watch (SOW).*

b **Standard Operating Procedures**. When fitted on the upperdeck the MORS is to be situated in the vicinity of the SOW gantry and secured to fixed guardrails or other suitable fixtures depending on class of ship. Where there is a shortage of stowage space at the recovery station alternative stowage arrangements can be used provided reaction times are not compromised.

c. Ships staff are to rig the SOW gantry and all associated equipment. The MORS is to be attached to the SOW recovery line and the stretcher raised to a ensure there is clearance between the MORS and the top guardrail. If the MORS fails to clear the guardrail due to the limiting toggle on the recovery line the toggle is to be repositioned to allow adequate clearance.

d. A forward steadying line fitted with a Karibiner hook (0471/136-6582) is to be manufactured from 16mm Polypropylene, length to suit. The steadying line is to be available with the MORS and is to be attached to the forward inboard end of the stretcher and led forward in the ship prior to the MORS being lowered. This line is to be used to steady the stretcher at all times during recovery operations.

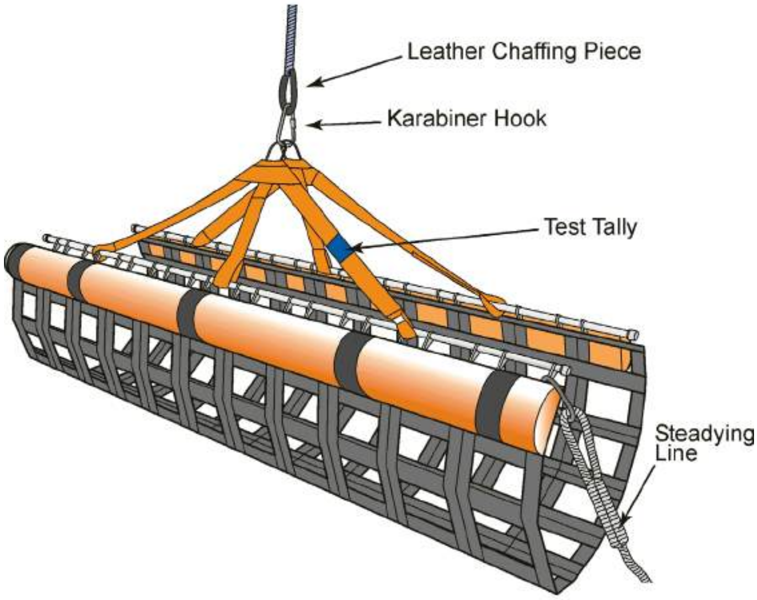


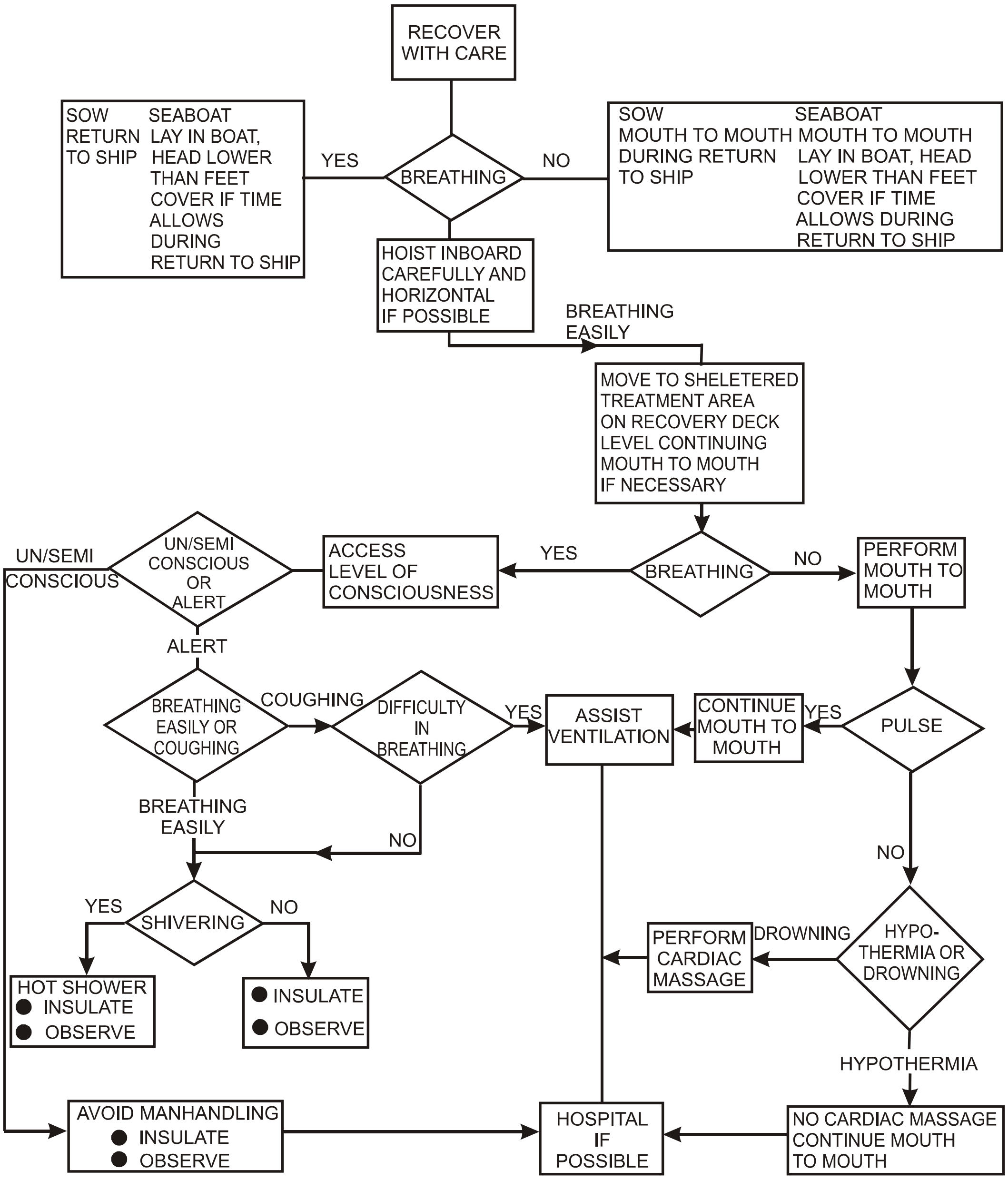
Fig 7-26. Man Overboard Recovery Stretcher (MORS).

07025. Man Overboard Dummy

A 75 Kg waterproof dummy (0472/783-7372) is allocated to give realism to man overboard exercises. The dummy has considerable deadweight in the water and is difficult to manipulate like any unconscious or frightened person. Each dummy is to be fitted with a lifejacket 0472/568-6142 with a light attached.

07026. First-aid for the Apparently Drowned

The type of first-aid needed for a person who is apparently drowned depends upon their condition. Fig 7-27 indicates the type of first-aid treatment required for different states of rescued person at various stages of the rescue. The coxswain of the seaboat and the swimmer of the watch must assess the condition of the casualty in the water when they reach them and be prepared to give the necessary first-aid treatment while they are being returned to the ship.



- OBSERVE FOR EARLY SIGNS OF RESPIRATORY DISTRESS.
- IF WATER INHALATION WAS MINIMAL, THE PATIENT MAY BE DISCHARGED AFTER REWARMING.
- CUT OFF LOOSE CLOTHING PLACE IN BED AND WARM SLOWLY.

Fig 7-27. Flow Chart Showing Recovery and First-aid Treatment

07027. Rescue Stations

a. **Introduction** The SOW rig is ideal for rescuing and recovering a single casualty from the water. However, each ship should have its own internal organisation for rescuing survivors in the event of a shipwreck or other major disaster when large numbers of personnel may require rescue. The organisation should provide for rescuing as quickly as possible as many survivors as the ship can carry; hoisting inboard the sick and wounded; feeding, clothing and accommodating the survivors on board; and giving medical care and treatment to the sick, injured or wounded and to those suffering from shock and exposure.

b. **Seamanship Equipment Preparations**. Much will depend on the nature of the rescue to be undertaken and the prevailing weather. In addition to preparing the SOW recovery rig(s) some or all of the following preparations may be appropriate:

(1) *Boats*. These may be used to recover or assist men in the water. Boats' davits or cranes may be used to hoist casualties inboard by rigging them as additional SOW recovery rigs.

(2) *Liferafts*. These can be launched to provide shelter for men waiting to be recovered from the water.

(3) *Swimmers*. Ship's divers and swimmers not required for the designated SOW recovery rig(s) should be available to render assistance to survivors in the water as directed by the OIC; they must wear lifelines and two attendants should be detailed for each swimmer. Reliefs for swimmers must be provided at regular intervals.

(4) *Ladders and Scrambling Nets*. In favourable conditions active survivors may be able to board a ship by ladder or scrambling net, but as a general rule the physical effort required will be beyond them. However, such equipment is likely to prove useful for swimmers and divers, and it gives survivors something to cling to prevent them from drifting away from the rescue ship, until they can be hoisted or assisted on board.

(5) *Heaving Lines and Lifelines*. Heaving lines, and a plentiful supply of 16mm polypropylene lifelines should be provided. A 24mm polypropylene hawser can be bent to a buoy and fitted at intervals of 1m with long beckets. It is streamed astern so that survivors can grasp the line and put the beckets either round their waists or through the beckets of their lifejackets. The inboard bight of the hawser is snatched into a block well forward; the survivors can then be hauled alongside.

(6) *Gangway Safety Nets or Cargo Nets*. It may be possible to rig these from a davit or crane. They can then be lowered beneath the surface and used to hoist a number of survivors at a time.

(7) *A Lightweight Transport Stretcher* or some form of stretcher with slings, which can be submerged sufficiently for an injured survivor to be floated over it and then hoisted on board should be prepared.

(8) *A Line-throwing Rifle* can be used to pass a line to an isolated survivor.

c. **Recovery of Men in Rafts**. The recovery of men in rafts is effected by the ship drifting down to the raft and making a lee for it. If the survivors are active and the conditions are favourable, they may be able to board the rescue ship by scramble net or ladder. If the survivors are distressed, or conditions are unfavourable, recovery should be made by the SOW recovery rig. If survivors are not able to help one another the rescue ship should put two fit people on board the raft to assist.

d. **Recovering a Liferaft**. If it is required to recover the raft, trip the water pockets and remove all loose gear to reduce the weight. Pass two lengths of webbing or rope at right-angles to each other under the raft, and then connect them together centrally above the canopy to form a sling for hoisting the raft by crane or derrick.

e. **Recovery of Men from the Water**. Survivors will probably have little or no reserve of energy, and they will either be unable to help themselves or will expend their remaining energy in trying to climb out of the water. In the past many survivors have been lost while floating alongside a rescue ship because they were unable to climb up her nets or ladders, or even bend lifelines round themselves. Whenever possible, persons swimming should be hoisted on board, not assisted up scramble nets or ladders, because the latter method wastes their rescuers' time and energy. When a ship is rolling there is considerable surge close alongside, particularly on the lee side, which tends to draw a swimmer under the ship. For this reason swimmers must ensure their suit inflation is sufficient to overcome this effect.

07028. **Rescuesling Manual Line Thrower**

a. The Rescuesling is used to assist in the safe rescue of personnel who have fallen into the water from a ship alongside, at anchor or secured to a buoy.

b. **Stores. -** Each ship is to carry the following equipment:

(1) Man overboard inflatable rescuesling with a 70ft line 0472-99-676-4518.

(2) 4 x Mk 6 Auto head service kit 0472-99-573-6823.

(3) 4 x Disposable CO2 cylinder 18g 0742-99-131-4419.

c. **Ship's allowances.**

CVS/LPD/LPH	3 per ship
DD/FF	2 per ship
MCMV	1 per ship
NI/FI/GIB/Cyprus	1 per ship
River Class	1 per ship
Castle Class	2 per ship
P2000	1 per ship
Survey Squadron	1 per ship
SSN's	2 per ship
SSBN's	2 per ship
RFA Units	2 per ship
HMS Bristol	1 only
HMS Raleigh/Sultan	2 per establishment (for training purposes only)

d. **Instructions for use.** The Rescuesling Manual Line Thrower is stored in a box and is to be sited on the gangway alongside or at anchor/buoy. It comprises of a small fabric bag housing an automatic inflatable ring, which is attached to approximately 70ft of floating cordage. One end of the cordage is attached to a strong point on the vessel and the bag is thrown to the MOB. On contact with the water the ring will inflate automatically and can be donned. Once the MOB is recovered to the waters edge or ships side using the attached line, he/she can then be recovered using whatever means are available. Operational instructions are clearly displayed on the side of the storage container.

e. **Care and Maintenance.** The CBM is responsible for the safe storing and maintenance of the equipment at sea. Maintenance is to be carried out in accordance with the relevant instructions in the Sea Survival Equipment Log, PMS 1-5960-0000. Servicing and maintenance must only be carried out by a trained maintainer.

f. **Training.** SEG HMS Sultan and RNSOS HMS Raleigh conduct maintainer courses. Onboard training is to be co-ordinated by the CBM and conducted quarterly for all personnel.

07029. Stretcher - Neil Robertson Stretcher

a. **Introduction and Description**. The Neil Robertson stretcher (Fig 7-28a) is designed for the transportation of casualties in difficult or unusual circumstances. It may be lifted or lowered with the patient either in the vertical or in the horizontal attitude. The casualty is enveloped in a protective flexible case which takes up as little space as possible and can bend slightly to negotiate difficult routes. It can be used for moving casualties up ladders, down from superstructures, through hatches or in fact from any position of difficult access. This stretcher is well known in the service, yet often misused. In the diagram the pillow takes the head, which can be steadied by the canvas strap fastened across the forehead. The portion which has the three canvas chest straps is wrapped around the chest, notches being cut to fit under the arms, and is secured by the upper and lower straps, the centre strap of the three is to control the arms of an unconscious patient. In the conscious patient the head and arms need not be secured if the patient can control himself, in which case the redundant straps are secured behind the stretcher. The portion that fits around the thighs and legs is secured by two straps. The whole stretcher is stiffened by bamboo slats sewn across the canvas. Rope loops are fitted at the shoulder and thigh positions on either side by which the stretcher party carry it. At top and bottom a steel ring provides for the attachment of steadying lanyards. These lanyards are not to be fitted to stretchers used in ships. However, a 15m length of 16mm Polyester NSN 0350-923-7144 with a soft eye at one is to be stowed with each stretcher. When required this line can be thorough-footed to to the ring at the head of the stretcher and used for assisting the hoisting/lowering of a casualty.

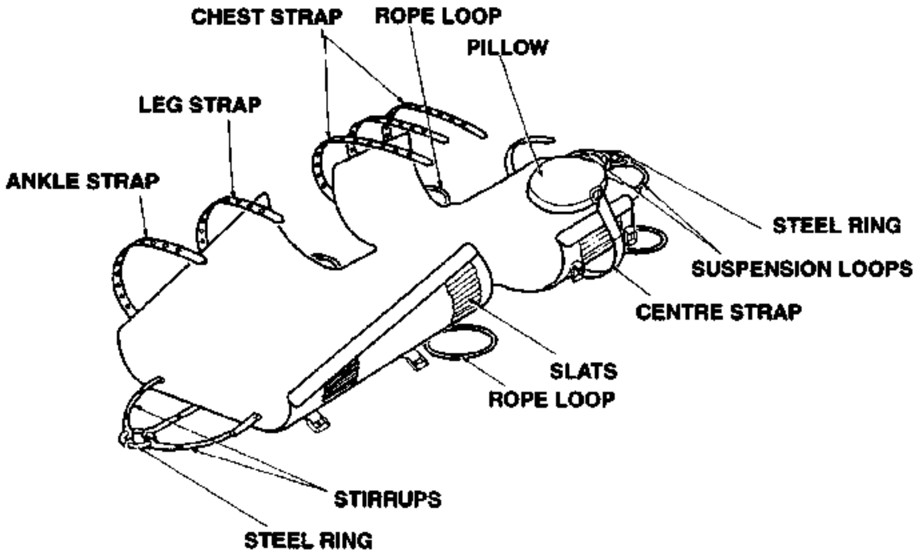


Fig 7-28a. Neil Robertson Stretcher

b. **Harness for Use with the Neil Robertson Stretcher**. The lightweight transport stretcher, described later, is the normal method of transferring a patient in a helicopter. However, in the event that a Neil Robertson must be used for the task, a harness for use with helicopters enables the Neil Robertson stretcher to be lifted with a casualty already strapped in position; **these harnesses are carried only by helicopters operating in the SAR role and are transferred to the ship when required**. The harness, manufactured from polyamide webbing, has a blue centre-strap, white shoulder-straps and olive-drab foot-straps. Spring hooks are fitted at the following positions: two at the head and one at the foot of the centre-strap, one at the end of each foot-strap and one at the end of the left-hand shoulder-strap. A shackle and ring are fitted to the right-hand shoulder-strap to secure the opposite spring hook and the winch wire.

c. **Fitting the Harness to The Stretcher**. The harness is fitted as shown at Fig 7-28b The casualty must always be fitted with an Assault Troop lifejacket and before the stretcher is lifted the steadying lanyards must be removed. Illustrations are also provided inside the valise in which the harness is supplied. Fig 7-28c shows the stretcher rigged for a helicopter lift.

d. **Maintenance**. Neil Robertson Stretchers are held and maintained by the medical branch.

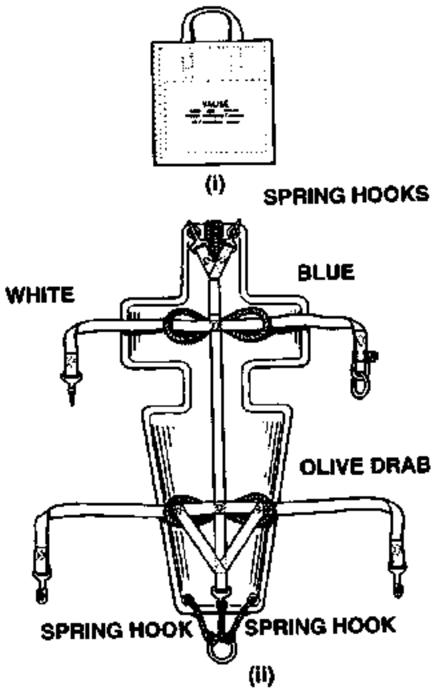


Fig 7-28b. Neil Robertson Stretcher Fitted with Harness

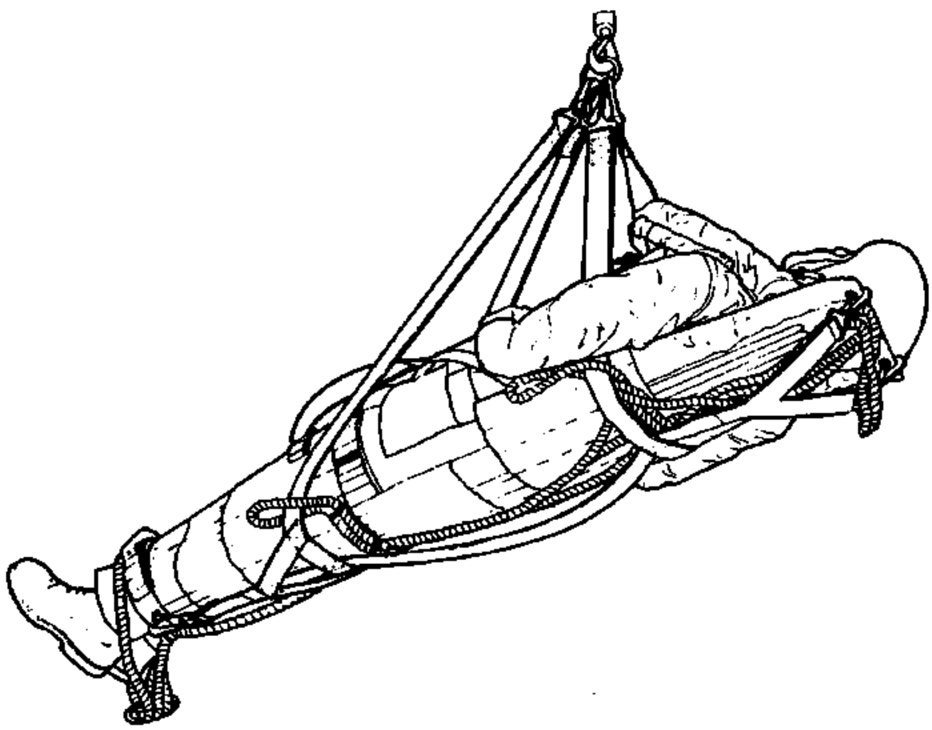


Fig 7-28c. Neil Robertson Stretcher Rigged for Helicopter Lift

| **07030. Stretcher - Lightweight Transport Stretcher and Harness** (Fig 7-29)

This outfit, comprising a stretcher, harness and sling is provided in ships and air stations for the movement of patients by helicopter or jackstay. The equipment, which must be maintained in accordance with the MMS, can be utilised for training purposes.

a. **The Stretcher.** This consists of a rectangular tubular-steel frame fitted with a sheet-metal floor. The stretcher is supported by four tubular-steel skids on the underside and four lifting-eyes are fitted to the upper side of the frame. Metal rings are fitted at suitable points to attach the harness. On completion of load testing (see MMS) the head and foot rails are to be painted yellow.

b. **The Harness.** This is designed to restrain movement of the patient, thus ensuring, as far as possible, protection from aggravation of his injuries by violent movement during flight or transfer. The harness consists of a set of upper straps designed to fit over the patient's shoulders, lower straps which pass across the legs and abdomen and a waist strap which passes round both patient and stretcher. The upper and lower straps connect into a quick-release fitting secured to the waist strap. The harness is attached to the metal rings of the stretcher by spring hooks which are fitted to the ends of the straps. Buckles are fitted to the upper, longer lower and waist straps to permit adjustment of the harness and enable the waist strap and quick-release fitting to be positioned clear of the patient's injuries.

c. **The Sling.** A four-legged polyamide webbing bridle is secured to a metal D-ring which forms the lifting point. Spring hooks are fitted to the ends of each leg by which the sling is attached to rings shackled to the lifting-eyes of the stretcher. When used to transfer a casualty by light jackstay an 0263/721-6103 bow shackle is to be used to attach the D-ring to the jackstay traveller. The sling has a ten year life from the date of manufacture.

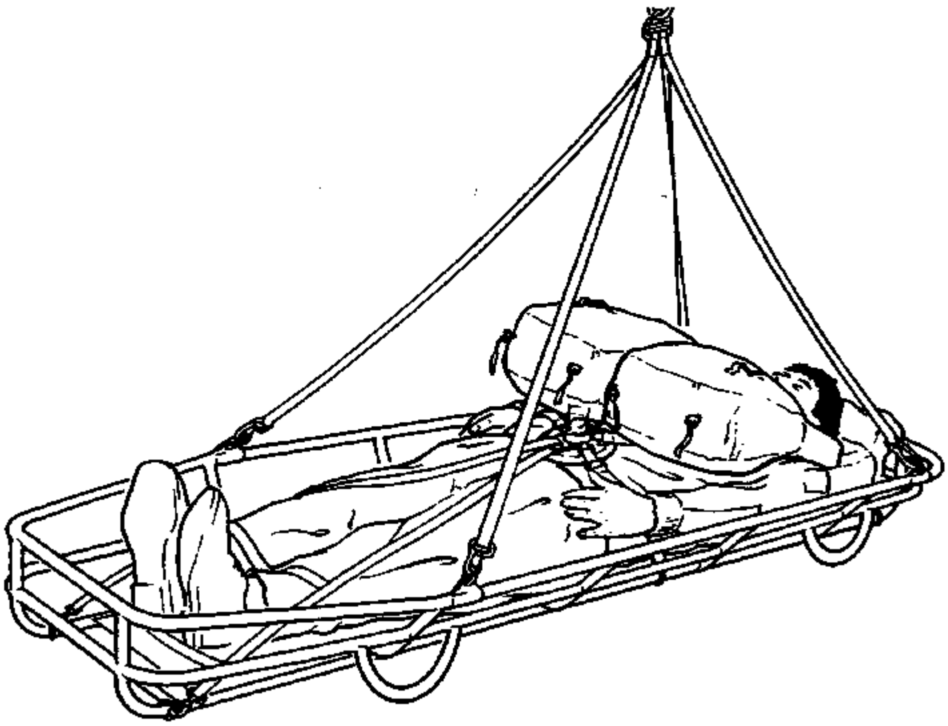


Fig 7-29. Lightweight Transport Stretcher, Harness and Sling Rigged for Transfer by Helicopter or Light Jackstay

d. **Associated Equipment.** The following items are used in conjunction with the stretcher:

(1) *Assault Troop Lifejacket.* The Assault Troop Lifejacket is worn by the patient to enable both him and the stretcher to remain afloat should they become disengaged from the aircraft winch wire or the jackstay traveller. The lifejacket is to be inflated **before** the patient is transferred by light jackstay or boat but **not before** being winched into a helicopter. Further advice on the transfer of stretcher patients by helicopter is given in **BR 766, Helicopter Operating Handbook.**

(2) *Head cushion.* The cushion is attached to the head of the stretcher by two straps, fastened with press-studs, to form a head rest.

e. **Equipping the Stretcher.** The harness and cushion are fitted as follows:

(1) Position the harness on the stretcher with the adjusting buckles and quick-release fitting uppermost.

(2) Clip the spring hooks at the ends of the upper, lower and waist straps to the metal rings at the head, foot and sides of the stretcher.

(3) Place the cushion at the head of the stretcher and secure the two straps by the press-studs.

f. **Strapping the Patient in The Stretcher.** The patient is strapped-in by the following method:

(1) Fit the Assault Troop Lifejacket to the patient, ensuring that the crutch strap is adjusted to a loose fit with the patient lying down.

(2) Lay the patient on the stretcher with his head on the head rest. The patient should be as near the head end of the stretcher as possible without actually touching the end bar.

Note. *The webbing cross-strap passes under the patient's head and not over the forehead as in the Neil Robertson stretcher.*

(3) Position the quick-release fitting in the centre of the patient's abdomen, clear of the ribs and hips, ie approximately over the navel.

(4) Ensure that the harness upper straps are passed under the lobes of the lifejacket.

(5) The position of the waist strap is dependent upon the size of the patient. Position it so that it is transversely at right-angles to the patient when tightened, with the quick-release fitting in the correct position.

(6) Tighten all the harness straps, ensuring that the quick-release fitting remains in the correct position and the patient's arms are free and clear of the harness.

(7) Clip the sling to the rings at the lifting eyes of the stretcher.

07031. Man Overboard Smoke and Light Marker

a. **Introduction**. The man overboard smoke and light marker, illustrated in Fig 7-30, with a lifebuoy attached, is carried in all HM ships. The marker is secured to the lifebuoy by 4m x 4mm of polyethylene. At the top of the marker is a ring to which one end of the polyethylene cordage is secured with a bowline, the other end being secured similarly to the lifebuoy. For tidiness the line is made up into a hank and tucked behind the lifebuoy.

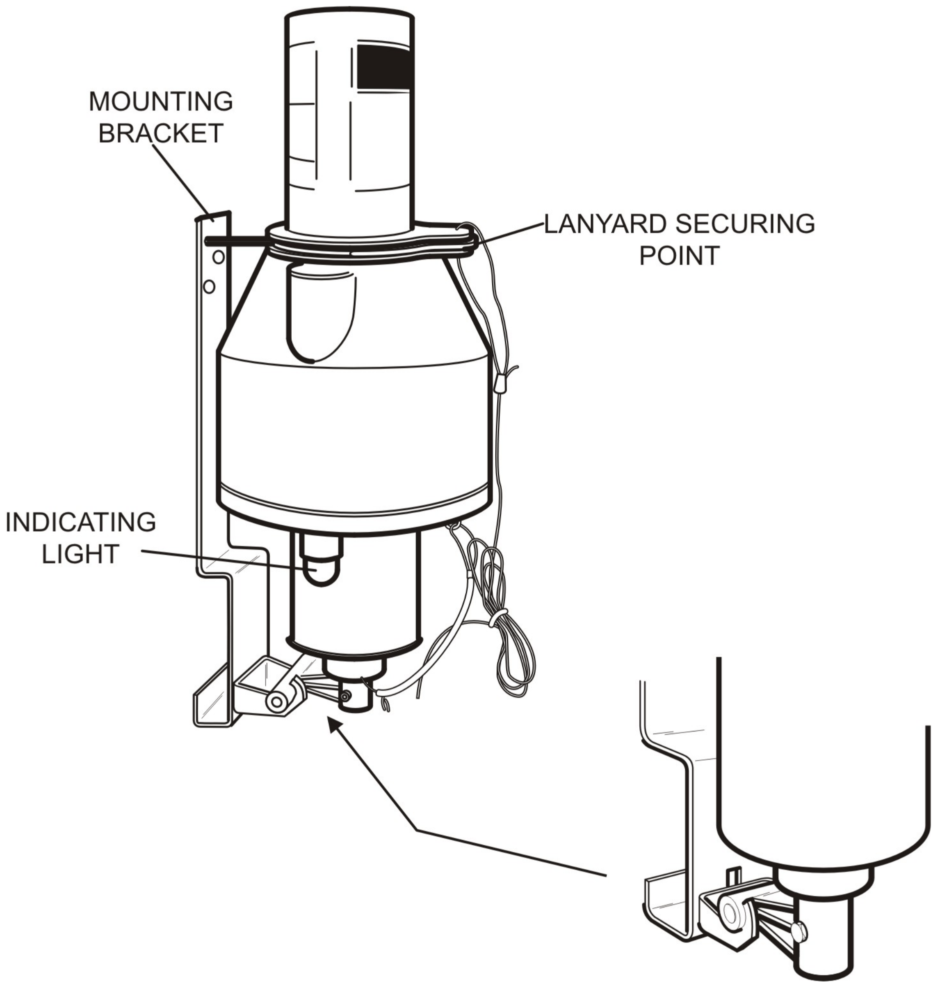


Fig 7-30. Man Overboard Smoke and Light Marker

The marker is mounted in such a position that it can be released from its stowage to fall unobstructed into the sea, or can be easily cast into the sea to give a seamark by day or night for a man overboard casualty. Markers are sited on both bridge wings and on both sides in the after part of the ship; certain large warships may carry additional markers amidships. (Port and Starboard). The marker is secured in a spring clip, from which it is pulled by the weight of the lifebuoy when it is released or thrown. When activated, the marker gives off a dense orange-coloured non-toxic smoke for approximately fifteen minutes and shows two white lights for a minimum of 2 hours thus having a day and night location facility. The smoke is produced by the action of two strikers igniting a composition in the body of the marker, the strikers being activated when the weakened alloy T-shaped cap nut (Fig 7-30) breaks off during release. The lights are activated by the entry of sea water into two sea-cell batteries, the batteries remaining sealed until a plastic lanyard is pulled by the releasing action of the marker.

b. **Stowage**.

(1) *Automatic Release Stowage*. The stowage is sited at least 5m above the waterline to enable the lifebuoy to pull the marker out of its retaining clip before reaching the sea. There are two types of automatic release stowage; Fig 7-31(I) shows a stowage operated by a lifebuoy release toggle; Fig 7-31(ii) shows a stowage operated either by remote control from the bridge, or by a push button control at the site of the stowage. In the event of a power failure at the latter type of stowage the marker and lifebuoy can be released manually by disconnecting the two Inglefield clips incorporated in the lifebuoy restraining line.

(2) *Hand Operated Stowage*. In ships where the 5m requirement cannot be met the marker must be pulled by hand from its stowage bracket and then cast over the side with the lifebuoy; a typical stowage for this arrangement is shown in Fig 7-32, and the procedure is illustrated in Fig 7-33. Where manual operation of markers is required, ship's personnel must be briefed, and a warning sign (yellow background/black letters) reading 'Hand Operated' must be provided at each position.

Note. *Markers are supplied with a rubber storm clip (Fig 7-33). Users must be aware that fitting the clip will prevent automatic or manual release until the clip is removed. Clips are therefore only to be fitted to marker stowages where it is deemed acceptable to prevent accidental detachment due to adverse weather conditions or vibrations. A warning sign reading* ***Storm Clip Fitted - Remove Before operating*** *must be provided at each such marker position.*

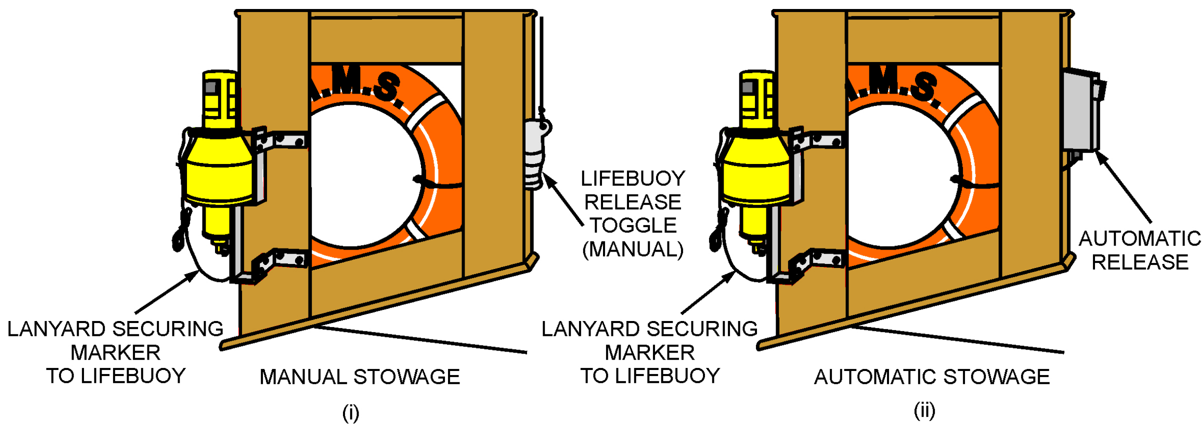


Fig 7-31. Smoke and Light Marker - Automatic Release Stowage

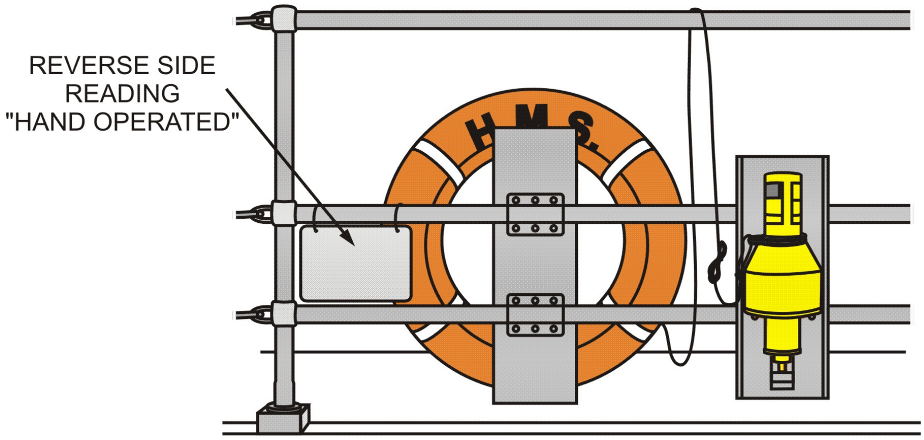


Fig 7-32. Smoke and Light Marker - Hand Operated Stowage

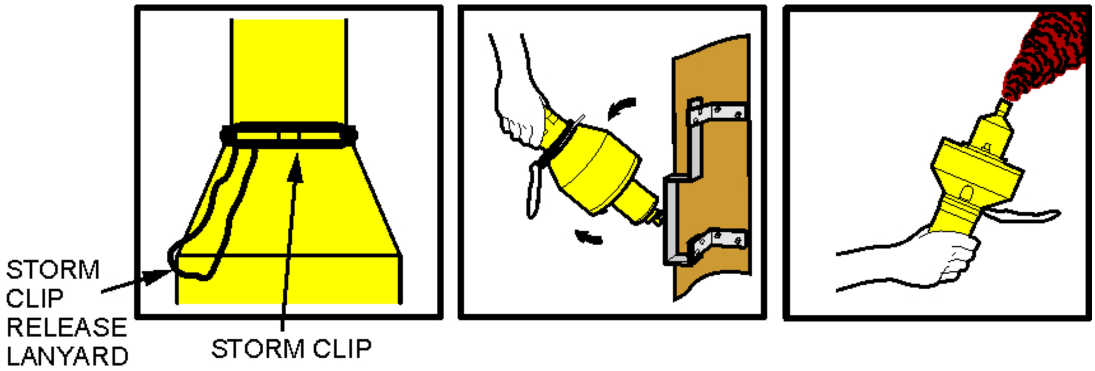


Fig 7-33. Smoke and Light Marker Manual Operation

d. **Maintenance.** Smoke and Light Markers, associated Lifebuoy and stowage release mechanisms are to be maintained, inspected and exchanged in accordance with the procedures laid down in the SSEL.

07032. Lifebuoy

The standard lifebuoy in service with the Royal Navy (Figs 7-31 and 7-32) is constructed of polyurethane foam with a covering of flame-orange polyvinyl chloride. Lifebuoys used for general purpose should not be painted, except for the ship's name in 50mm black lettering. Those required for ceremonial use should be painted white using the appropriate two-pack polyurethane paint.

07033. Safety Harnesses

a. **Introduction**. Should it be necessary to send a man aloft or to work in an exposed or potentially dangerous position, a safety harness must be worn. There are currently two types of harness available in the fleet, an example is shown in Fig 7-34. Both types incorporate belt, braces and crotch straps, to ensure a snug fit and to reduce the risk of injury to the wearer's back in the event of a fall. In situations where there is a risk of a fall, a fall arrest lanyard or retractable lanyard must be used. In other circumstances restraint lanyards are available in 1m, 1.5m and 1.75m lengths A **pole strap** is also available. This is an adjustable webbing strap with a karabiner hook fitted to each end. The strap can be passed around a pole or mast and attached to 'D' rings on the belt of the harness. The wearer can then lean back and work with both hands. The pole strap must only be used **in addition to** a fall arrest lanyard or a restraint lanyard. Safety harnesses are only issued by authorised personnel (see the following sub paragraphs) and before going aloft users **must** read the user instructions.

b. **Custody and Issue of Safety Harnesses - During Working Hours**. Safety harnesses are held and issued by the Safety Equipment Maintainer. They must be returned on completion of the task.

c **Custody and Issue of Safety Harnesses -Out of Working Hours**. The Duty Petty Officer or a nominated Leading Hand must undertake this task. The Safety Equipment Maintainer should set aside two harnesses for issue out of hours with the appropriate documentation kept in a loose-leaf binder separate from the SSEL. These harnesses and the documentation can be kept in the same stowage as the other harnesses or they can be kept in a suitable 'out of hours' stowage such as a spare Hazardous Duty Lifejacket stowage.

d. **Wearer's Checks**. Prior to donning the harness the wearer must inspect the harness in accordance with the the instructions given in the SSEL.

Note. *A traffolite tally must be fitted adjacent to safety harness stowages listing the checks the wearer must make.*

e. **Documentation Requirements**. When the issuer is satisfied that the correct wearer checks have been completed the wearer's name must be inserted in block capitals in column 22 and the date in column 19 of the appropriate Form S2007. If the harness is returned to the Safety Equipment Maintainer the appropriate checks/maintainance must be carried out and the relevant columns of Form S2007 filled in before the harness is re-issued. If the harness is returned to the 'out of hours' issuer it must be withdrawn from service until the Safety Equipment Maintainer has carried out the appropriate checks/maintenance in accordance with the SSEL.

Notes

1. Full body harnesses only are permitted for use by Service personnel.

2. Established standards require the testing of fall protection systems to 100kg which traditionally was seen as representative of a single worker. However, most modern fall protection systems are typically rated to 130kg to facilitate for the greater mass of the average worker, individual equipment must be checked to ensure that it is correctly rated for the climber. All up mass is the total sum of the workers body including attached tools, equipment and clothing etc.

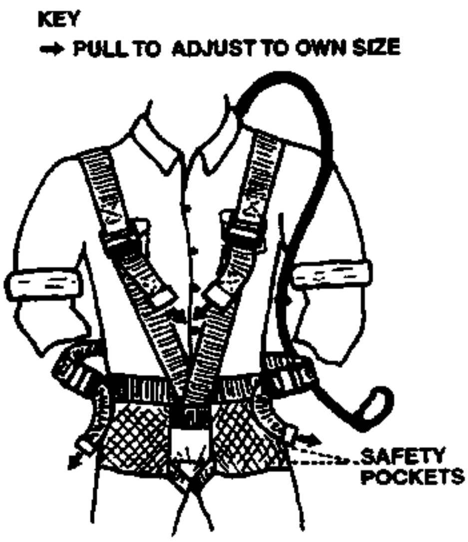


Fig 7-34 Standard Safety Harness

07034. Safety Helmets

A safety helmet (Fig 7-35) is to be worn by personnel employed in areas where there is a danger of being struck on the head. The tough shell provides protection against penetration by sharp objects whilst the cradle will minimise the shock loading and crushing effect of the impact. It is essential that the cradle is kept in position and that the designed gap between the cradle and the top of the shell is maintained for the helmet to perform effectively. There are four colours available; white, blue orange and red. White helmets are worn by Safety Officers and OICs of evolutions; red by gunline firers, orange by crane controllers and blue by all other personnel. The pattern numbers are as follows:

Red	VO52-920-0977	White	VO52-132-1013
Blue	VO52-132-1014	Orange	VO52- 132-1015

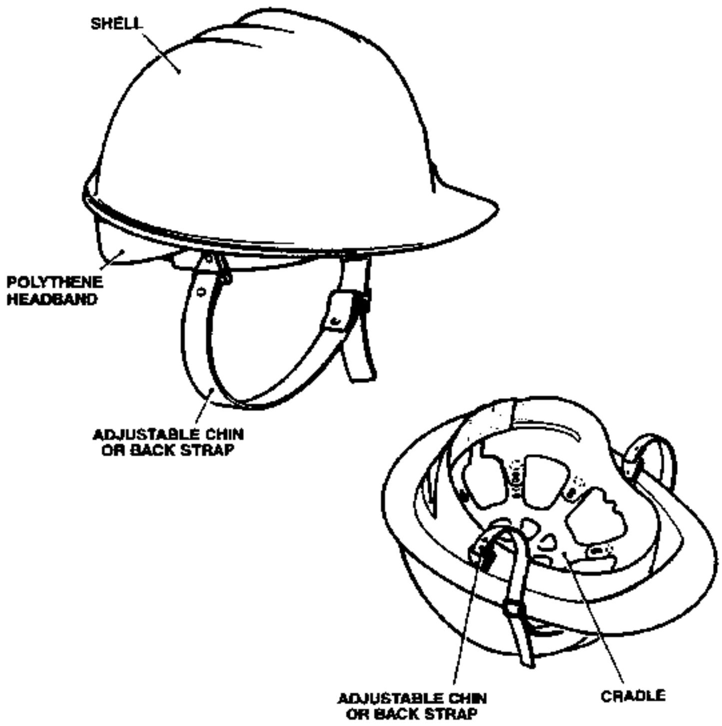


Fig 7-35. Safety Helmet

Rules for the care of safety helmets are as follows:

(1) The date of issue and a local number is to be marked with a ball-point pen on the manufacturers label inside the helmet.

(2) Helmets must not be left for long periods in strong sunlight.

(3) Helmets must not be painted, nor have adhesive stickers applied as these actions may disguise cracks or other damage to the helmet.

(4) Helmets should not be washed in strong detergent.

(5) If a helmet is struck by a falling object or otherwise suffers a heavy impact it should be discarded.

(6) Helmets should be checked regularly by the wearer for cracking or other damage and should be replaced if any faults are found.

(7) Irrespective of appearance or condition, helmets must be replaced in accordance with the manufacturers instructions. For most manufacturers this period is five years. However, the literature that accompanies each hat must be read to ascertain the precise period recommended.

Note. *The adjustable headband and chinstrap (which can be used alternatively as a back strap) should be adjusted to ensure that the helmet is held firmly in position on the head.*

07035. Safety Glasses and Goggles

Many of the seaman's tasks, such as splicing SWR, chipping, scaling, or hammering a lead pellet into a shackle involve a risk of eye injury. Anyone engaged in such work must take precautions to protect their own eyes and also ensure that the eyesight of other people nearby is not endangered. Wherever work constituting an eyesight hazard is taking place, the officer or rating in charge must make certain that the appropriate visors or goggles are made available and worn. Personnel having to work in the neighbourhood must also protect their eyes, but other persons should be forbidden to enter the area. Information on the protection of eyesight, together with a table of processes for which appropriate eye protection appliances are supplied, is given in **BR 2000(20), Safety Considerations and Precautions.**

07036. Working Aloft

a. **Introduction**. Men working aloft on masts, funnels or other high points are at risk unless they follow the correct procedures given in BR 2000(20) for working aloft chit. The accidents that could occur include:

(1) Falling due to:

Ship movement.

The movement of an aerial.

Loose clothing catching.

Uncertain foothold on wet or greasy rigging.

The reaction to electric shock arising from current induced into the rigging by radio transmissions.

The reaction to the unexpected sounding of sirens or noisy discharges from funnels.

Being overcome by funnel gases.

(2) Suffering from exposure. The wind, where there is no shelter, will lower the effective temperature below the ambient temperature at deck level.

(3) Radiation from microwave transmissions, ie from radar aerials.

(4) Injury from falling tools and equipment either to those already aloft or to those on the weather decks below.

b. **Precautions Before Proceeding Aloft**. Before going aloft personnel concerned are to :

(1) Obtain permission of the OOW/OOD. (Permission to Work Aloft Chit).

(2) Complete the hazard state board in accordance with **BR 2924** (A.25).

(3) Inform Machinery Control Room.

(4) Dress in overalls or No 4s with trousers tucked into socks and with nonslip heeled footwear securely fastened.

(5) Wear industrial safety helmet.

(6) Wear a safety harness.

(7) Ensure their are no loose or heavy articles in their pockets.

(8) Secure all tools by line to the person or to a halyard.

c. **Ships Alongside**. Where there is another ship alongside that could irradiate the mast or produce a discharge from its funnel the hazard state board for that ship is to be completed and her OOW and Machinery Control Room informed.

d. **Tending a Person Working Aloft**. A responsible person is to be in attendance at all times on men working aloft, keeping them in view at all times and warning personnel in the area of work in progress above.

e. **Completion of Work**. The OOW/OOD is to be informed and the ship returned to the normal radhaz state as soon as work aloft is completed.

07037. Working over the Side

a. **General Precautions**. The following precautions must be taken by personnel working over the side.

(1) Permission must be obtained from The OOD/OOW.

(2) The flag hoist ‘Romeo Yankee’ must be hoisted at the yardarm on the side the work is to take place.

(3) All personnel working over the side must wear a HDLJ.

(4) Personnel working over the side must be tended at all times.

b. **Paint Catamarans**. These catamarans are cantilever platforms for use when painting the ship's side. Personnel working from a paint catamaran should wear an HDLJ. Alternatively they may wear a safety harness. The catamaran securing lines must be tended from inboard of the ship's guardrails, and breast ropes should be used to bowse the catamaran close in to the ships side before work commences.

| **07038. Weather-deck Lifelines**

Before adverse weather is encountered, lifelines must be rigged on the weather decks. Personnel required to proceed on to the weather decks in inclement weather are to wear a safety harness fitted with two safety lines. This enables the wearer to traverse the lifeline shackles or change from one section of lifeline to another by securing one safety line before releasing the other.

Note*. Weather-deck lifelines are rigged at the discretion of the Commanding Officer, who will give due consideration to the time and difficulty involved and the prevailing and forecast weather conditions.*

| **07039. Working on Deck in Heavy Weather**

There is a risk to men working on the upperdeck in rough weather with high seas running. An unexpected wave may wash over the upper deck or an awkward movement of the ship may throw people off balance. To minimise such hazards the Command should take the following precautions whenever it is necessary to send personnel on the upper deck in bad weather:

1. Brief the team formally on the task.

2. Keep the team as small as sensibly possible.

3. Obtain permission from the OOW and ensure good communication between the bridge and the upperdeck in order to be able to warn the team of changes in sea and weather.

4. Ensure that everyone going on the upperdeck wears lifejackets, safety helmets and safety harnesses. The latter must be clipped to the weather-deck lifelines whenever possible.

5. Select the course and speed that gives most protection from the wind and sea.

| 6. A responsible person is to be in attendance at the exit/entry point whilst personnel
| are on the upperdeck, monitoring wherever possible.

| **07040. General Onboard Safety Considerations**.

| a. **Clothing and Footwear**. For safety and comfort a seaman must be appropriately dressed and equipped when working on the upperdeck. Number 4's and/or overalls, beret, woollen pullover and DMS boots are the basic requirements, and a knife and spike should always be carried. In cold or inclement weather foul weather gear is
| worn, and personnel in very exposed areas should don Immersion suits. The loss of body heat through wind chill can easily be underestimated; even off the south coast of England in summer this can be a problem. To retain body heat several layers of loose fitting clothing should be worn under the outer garments.

Wearing gloves whilst handling wires and ropes carries certain risks, for example if they snag on a broken strand in a wire, or become trapped in turns on a capstan or winch. However, in certain conditions these risks are outweighed by other dangers, eg frostbite in very cold weather, or the inability to grip with bare hands a greasy wire hawser. Therefore the wearing of gloves is left to the discretion of the OIC, who must take account of the prevailing conditions.

***Note**. Gloves PVC fabric* VO51-978-4507/9 *are currently supplied for use by personnel working on the upperdeck. Alternatives are being investigated.*

b. **Guardrail Safety**. The following points apply to guardrail safety:

(1) It is dangerous and unseamanlike to lean or stand on guardrails.

(2) Guardrails must be set up taut, and all shackles should be moused. Additionally, before entering a dry dock, all guardrail slip pins must be moused in position.

(3) Whenever guardrails are broken, for example to allow a brow into a ship, the gap must be roped off as soon as possible using 12mm Polyester. (See also paragraph 03070).

c. **Flight-deck and Weapon-deck Safety Nets**. Guardwires are not appropriate around flight-decks and certain weapon-decks where there is a frequent requirement to lower stanchions in order to safely operate equipment. In such areas nets are laced between the stanchions so that when the stanchions are lowered outboard a degree of protection in the form of a safety net is provided to personnel working in the area. The nets must be installed in accordance with the relevant ship's drawing, and they should be checked regularly to ensure that they remain properly secured. Stanchions must be 'toed-in' at all times whenever the nets are not lowered for use.

d. **Guarding of Hatches and Edges**. Any opening, open hatchway or dangerous edge into, through or over which a person may fall are to be fitted with secure guards or fencing. Guard-chains fitted with a shackle/spring hook are to be rigged at accommodation ladder gangways, around hatches and at the top of vertical screen ladders. Where an opening affords a permanent means of transit about the ship, the chain offering access to the opening may be stopped back. The chain should be re-rigged in the event of foul weather, removal of the ladder or where the safety of personnel is at risk.

07041. Health and Safety at Work.

The Health and Safety at Work Act (HSWA), and its implications for service personnel, is fully covered in **JSP 375 - Application of the Health and Safety at Work Act**, which is the authoritative publication on the subject. The duties of personnel aboard ships are summarised as follows:

a. The duty of Commanding Officers and all superiors at all levels to :

(1) Ensure that compartments and access thereto are kept in a safe condition.

(2) Ensure that equipment and machinery can be safely operated.

(3) Inform personnel who may be at risk of the existence of hazards and the precautions to be taken.

(4) Ensure that material used can be handled and stowed safely.

(5) Provide sufficient training and supervision to maintain safe conditions.

b. The duty of all officers and ratings to:

(1) Take care of themselves and those with whom they work.

(2) Co-operate with others in health and safety matters eg by obeying lawful orders.

c. The duty of suppliers of materials to ships or installers of equipment to:

(1) Check that materials and equipment have been tested and are safe.

(2) Inform possible users of any hazards that could arise from material or equipment and of the safety precautions and procedures.

07042. Lifejackets and Safety Aids - What to Wear and When
As required by the Matrix DCI .

CHAPTER 8

TARGETS, DECOYS, MARKERS AND RECOVERIES

CONTENTS

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CHAPTER 8

TARGETS, DECOYS, MARKERS AND RECOVERIES

08001. Surface Targets - Introduction

In recent years the requirement to tow targets for surface or aircraft weapon practice has diminished. Consequently the only such target the seaman is likely to be required to deploy is the Larne Target, described below. **BR 1043(General), Gunnery and Guided-Weapon User Instructions** gives details of other types of target that are currently available.

08002. Larne Target.

a. **Description.** The Larne target is a simple raft target measuring 1.5m x 1.3m, consisting of a centre and two wing scoop boards, a tie bar and a planing board. The target is very small and is difficult to sight or detect by radar. However, when towed, the scoops produce plumes of water which are clearly visible and show on radar.

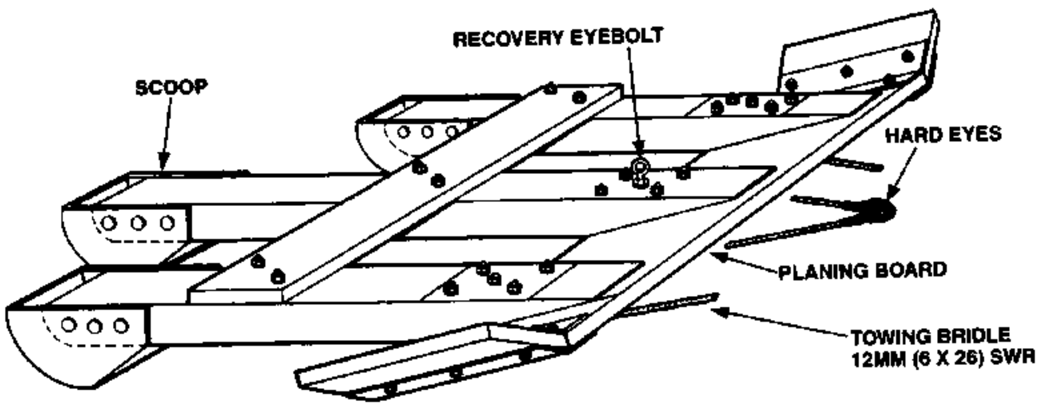


Fig 8-1. Larne Target

b. **Details of the Tow**. The make up of the Larne target is shown in Fig 8-2. It consists of a two-legged SWR bridle shackled to eyebolts on the underside of the target; a swivel piece connects the towing bridle to a 50m braided polyester towing pendant, which in turn is shackled to a 500m towing hawser. The inboard end of the towing hawser is shackled to a chafing piece which in turn is connected to a slip. An easing out/recovery rope is used to stream and recover the target.

Note. *Certain ships have been supplied with a three-link ganger piece instead of the elongated link shown in Fig 8-2. This arrangement is sometimes prone to jamming. Ships experiencing such difficulties should replace the ganger piece with an elongated link.*

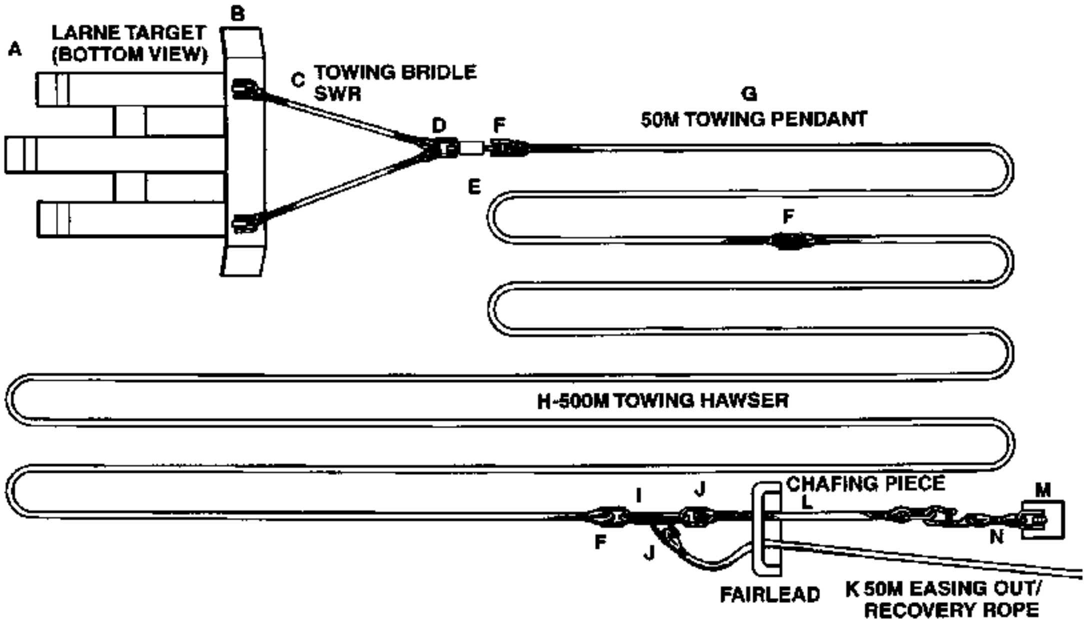


Fig 8-2. Larne Target Towing Gear

The components of the Larne target towing arrangements are as follows:

A.	Larne target	0474/525-9549
B.	Straight shackle with split pin	0263/543-4531
C.	Towing Bridle - 2 x 1m legs	0231/523-8644
D.	Bow shackle with split pin	0263/453-4551
E.	Swivel piece	0263/422-9924
F.	Straight shackle with split pin	0263/543-4532
G.	Towing pendant 50m x 16mm braided polyester	0350/587-8367
H.	Towing Hawser 500m x 16mm braided polyester	0350/851-7796
I.	Elongated link	0249/458-9487
J.	Straight screw shackle	0263/721-6091
K.	Easing out/ Recovery rope 50m x 16mm braided polyester	0350/587-8367
L.	Chafing piece (Length to suit) 12mm SWR	0231/523-8644
M.	Shackle	0263/721-6093
N.	Slip	0263/414-9747

c. **Speed Limitations.** The target is designed to be towed at speeds, in good sea conditions, of up to 30 knots. This speed should be reduced to 24 knots (reducing) in sea states above State 4. During streaming and recovery operations ship's speed should not exceed 5 knots.

d. **Preparing the Equipment**. The target is to be streamed from an after capstan. Shackle the slip and chafing piece to the deck clench, leaving the outboard end of the chafing piece ready to hand. Now shackle together, via the elongated link, the easing out/recovery rope and towing hawsers with towing pendent attached and coil them down well for'ard of the capstan. Pass the outboard end of the towing pendant out through the towing fairlead and back inboard over the top of the guardrails , then shackle it to the target towing bridle. If a capstan is being used, take a bight of the towing hawser to the capstan and bring to with three turns. Now lift the target outboard and hang it on rope hangers ready for deploying. (This last procedure can be delayed until just before the target is streamed, or, alternatively, ships with a low freeboard may dispense with the hangers and manhandle the target into the water when required).

e. **Streaming the Target**. When authorised by the bridge, lower (or manhandle) the target into the water. When it enters the water there is a tendency for the target to topple and several attempts may be necessary before it planes correctly. Veer the towing hawser, taking care that the target continues to plane correctly and, if a capstan is being used, riding turns are avoided. Avast veering when the towing hawser has been streamed and the elongated link is on deck, then shackle the outboard end of the chafing piece to the elongated link. Recommence veering until the weight of the tow is transferred from the capstan or winch onto the slip. Unshackle the easing out/recovery rope, or coil it up and stop it adjacent to the towing fairlead. Towing can now commence.

f. **Recovering the Target.** When authorised by the bridge, reconnect the easing out/recovery line. Heave in until the weight is off the slip and the slip can be removed, then heave in until the target is just outboard of the towing fairlead. The target can now be manhandled inboard and the rig dismantled and stowed.

| **08003. Standard Danbuoys**

a. **Introduction**. Standard Danbuoys (SDBs) Mk 3 are used by mine countermeasures vessels (MCMVs) to mark out an area or channel as it is searched or cleared. SDBs Mk 2 are used by vessels other than MCMVs to temporarily buoy a position where there is an underwater hazard, or to mark an object for subsequent recovery. The basic rigs of the SDB Mk 2 and 3 are the same, the differences between them is the material used. The Mk 2 uses some non-magnetic materials whilst the Mk 3 is made up entirely of non-magnetic materials to meet the stringent non-magnetic requirement of MCMVs. Given here is a description of the SDB Mk 2, one method of laying it, and suggestions for recovering it.

b. **Description of the Standard Danbuoy Mk 2.** The SDB Mk 2 consists of a cylindrical non-magnetic can fitted with a recovery ring. A tube through the centre takes the danbuoy mast which is clamped in position. The danbuoy mast is fitted at the bottom for a buoy weight, and fittings at the top of the mast provide for the attachment of a radar reflector and light. If required, a flag can be lashed to the mast. The buoy is moored by a mooring wire (or wires) to which is secured a concrete sinker and an anchor. The weight of the mooring wire(s) is supported by a number of plastic floats rove on a pellet span. This span is secured to the mooring wire with a running shackle and to a lug on the side of the can. Fig 8-3 shows the SDB Mk 2.

c. **Details of the Equipment**

(1) <u>Danbuoy Float and Fittings</u>

|	Mast	W200/923-8735
|	Float, Danbuoy	W200/923-8736
|	Recovery ring	W200/923-8740
|	Weight, buoy	W200/923-8741
|	Target, radar	W200/923-8742
|	Flashing Light Beacon	W200/923-9608
|	Battery dry 1.5v (70 hours) 8 in number	0562/910-1101
	Battery dry 1.5v (250 hours) 8 in number	0562/956-2583
	Spares for flashing light beacon	See E list GSO 14

(2) Pellet Span

Float Pellet (six per span)	W200/923-8737
Rope Polypropylene 16mm (5.5m finished length)	0350/571-3172
Thimble Steel (2 per span)	F219/414-9635
Adaptor Pump	W200/543-2668

(3) Mooring Equipment

Anchor 22Kg	F220/665/5773
Mooring Chain	F220/422-9922
Concrete Sinker	W200/729/2588

(4) Clamps

Clamp	W200/523-3005
Clamp Bolt	0214/137-4143
Clamp Bolt Nut	F219/136-4876

(5) Mooring wires and Picking-up wire

Length	*Colour Code*	
10m	Yellow/Blue	F218/543-4876
15m	Yellow/Green	F218/543-4878
20m	Red/Red	F218/543-4880
30m	Blue/Blue	F218/543-4882
40m	Green/Green	F218/543-4883
50m	Black/Black	F218/543-4884
100m	White/Blue	F218/543-4885
180m	White/Green	F218/543-4886
7.3m	Picking-up Wire	F218/543-4887

Note*. The radar reflector and buoy weight should not be fitted until preparing the danbuoy for laying.*

d. **Assembling the Danbuoy**. Danbuoys should be at 30 minutes notice to lay; individual ships must decide how best to meet this requirement. In most ships it is usual to assemble and deploy the danbuoy from the quarterdeck; the danbuoy float one side and the sinker the other. This is to avoid any possibility of sinker and buoy becoming entangled on laying. The following procedures are applicable to most ships, but may need to be modified to suit circumstances:

(1) Pass the lower end of the mast through the recovery ring and float and slide these up until the ring butts against the flange on the mast. Secure the float in position, hard up against the ring, by means of a split clamp secured below the float.

(2) Pass an assembled radar target over the top of the mast. Check the duration of the lay, and if required insert a light beacon, fitted with the correct batteries, into the top of the mast and secure it by passing a bolt through the upper collar and the eye on the end of the battery container. If the light is not fitted, the radar target must be secured in place, butting against the upper collar on the mast, by means of a split clamp round the mast above the reflector. Secure the nut on the bolt with seizing wire. If required, lash a signal flag to the mast.

(3) Secure a lead buoy weight on the end of the stave by means of two bolts through the collars and the mast, securing the nuts with seizing wire or split pins.

(4) Spans of 6 pellets are made up on board. The pellets are rove on a 5.5m length of 16mm polypropylene rope and spaced approximately 300mm apart by means of overhand knots. A hard eye is spliced at each end. The pellets must be fully inflated. The number of pellet spans required is given in Table 8-1. If two spans are needed they are shackled alongside each other, in parallel.

(5) Shackle one end of the pellet span to the dan float. Lash the soft eye of the picking-up rope to the danbuoy mast above the recovery ring.

(6) Make up the correct length mooring wire in accordance with Table 8-1. The crown of the joining shackles must face inboard on recovery. Shackle the inboard end of the mooring wire to the picking up wire as shown in Fig 8-3 (a running shackle on the end of the pellet span is secured around and below the hard eye of the mooring wire, which is free to run through it).

(7) Place a 111 Kg sinker on the opposite quarter to that on which the danbuoy float is rigged, and lash it securely in place. Ensure the sinker can be easily pushed overboard when the lashings are cut.

(8) Lead the free end of the mooring wire outboard of everything and shackle it, and the anchor and mooring chain, to the sinker as shown in Fig 8-3.

(9) Check all shackles are moused and all clamp bolt nuts secured with split pins or seizing wire. Lash the anchor securely outboard.

Table 8-1. Danbuoy Pellet Spans and Mooring Wire Length

Tidal Stream	Slack Water	1 Kt	2 Kt	3 Kt	4 Kt	5 Kt
Maximum depth using one pellet span	200m	140m	105m	65m	45m	30m
Maximum depth using two pellet spans	200m	200m	190m	130m	95m	60m
Minimum length of mooring wire	1 1/4 x Depth	1 1/3 x Depth	1 ½ x Depth	2 x Depth	2 ½ x Depth	3 x Depth

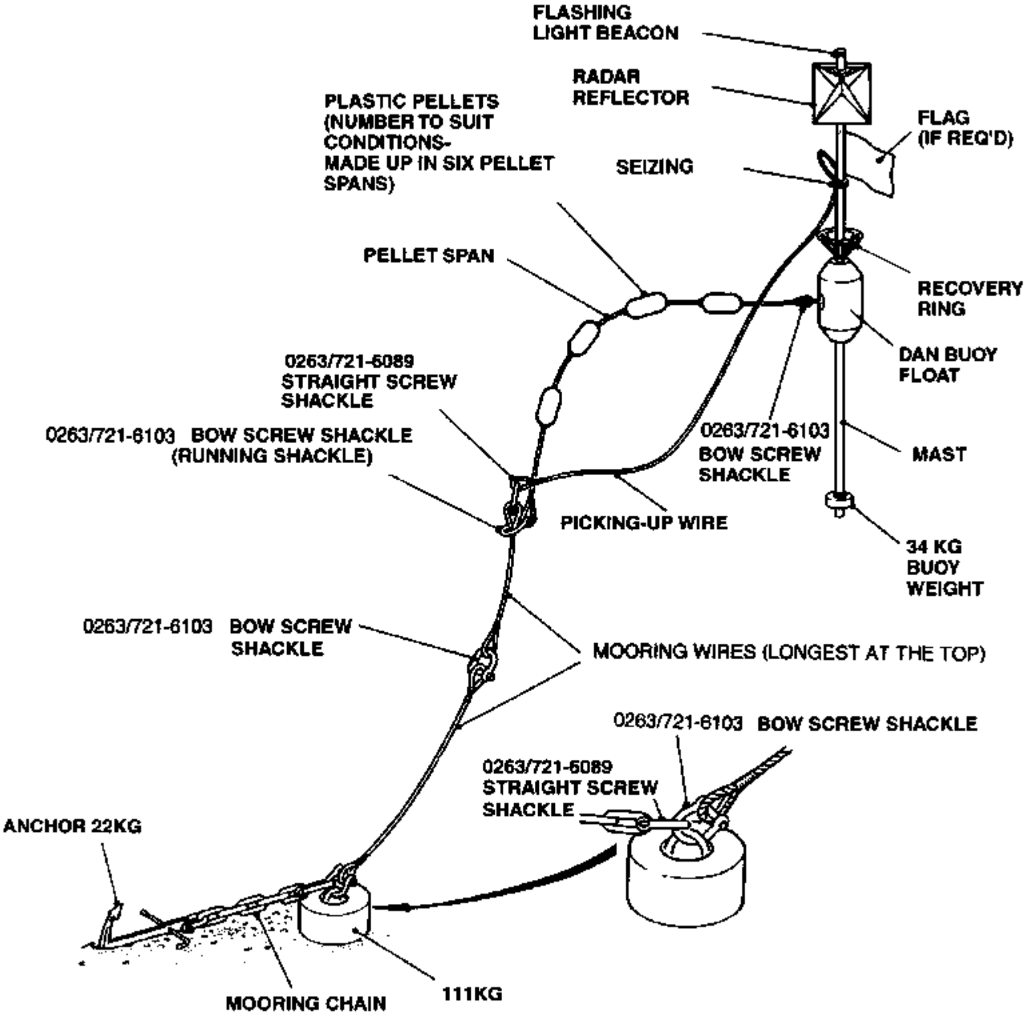


Fig 8-3. Rig of Standard Danbuoy MK 2.

e. **Manpower Requirements**. The manpower requirements for laying a danbuoy are as follows:

1 PO or Leading Seaman Specialist as danbuoy laying team OIC (DLTOIC)

4 Ratings as float assembly handlers

2 Ratings as sinker and anchor handlers

2 Ratings to stream the bight

1 Rating for communications number

f. **Laying the Danbuoy**. The drill for laying is common to all ships. However, in ships with a high freeboard it may be necessary to hang the danbuoy float assembly outboard on a rope hanger to avoid possible damage if it is dropped from too great a height when manhandled as described below. To lay the danbuoy proceed as follows:

Order/Report	Action
When the ship has approximately one mile to run the OOW orders STANDBY TO STREAM THE BIGHT.	Danbuoy laying team close up at their allocated positions. Lift the danbuoy (radar target facing for'ard) from the deck and manoeuvre it outboard until it rests on the top of the bulwark or guardrail stanchions. Keep it in hand.
DLTOIC reports READY TO STREAM THE BIGHT. OOW acknowledges the report. When the ship is at streaming speed (8-10 knots) the OOW orders FIVE CABLES TO RUN, STREAM THE BIGHT.	The mooring wire and pellet span are paid out until they are streamed astern. A small bight of mooring wire is kept in hand to prevent jerking or vibrations being imparted to the buoy.
DLTOIC reports BIGHT STREAMED. OOW gives a countdown to the lay position TWO CABLES TO RUN. ONE CABLE TO RUN. HALF A CABLE TO RUN. STANDBY.	At STANDBY the sinker and anchor lashings are cut and the anchor allowed to hang outboard on the end of its chain. The danbuoy is lifted clear of the guardrails in readiness for launching.
OOW orders LAY, LAY, LAY.	The danbuoy is thrown clear of the ship's side on the third LAY (or the rope hanger is cut). Immediately the buoy enters the water and is clear of the stern the sinker and anchor are pushed overboard. DLTOIC observes the mooring to ensure it is correct.
DLTOIC reports BUOY LAID, WATCHING CORRECTLY.	

CAUTION

THE BUOY SHOULD BE THROWN CLEAR OF THE SHIPS SIDE IN A HORIZONTAL ATTITUDE. AS IT FALLS IT WILL TEND TO ENTER THE WATER WEIGHT FIRST AND WHILE THE HANDLERS SHOULD ASSIST THIS TURNING TO PREVENT DAMAGE TO THE RADAR TARGET THEY MUST TAKE CARE THEY ARE NOT ENDANGERED BY THE REFLECTOR AS IT ASSUMES THE VERTICAL POSITION.

g. **Recovering the Danbuoy**.

(1) *Introduction.* The procedures for danbuoy recovery are suitable for MCMVs, where it is usual to recover a danbuoy using a davit or derrick rigged with two roller blocks at the davit/derrick head (Fig 8-4). A wire whip is rove through each roller block, one whip is fitted with a recovery hook and is used for lifting the danbuoy float, the other whip is shackled to the picking-up wire and is used to recover the mooring wire(s), sinker and anchor. This arrangement can be adopted in certain other types of ship, but it is not always appropriate, relying as it does on the availability of two winches/capstans. Also the procedure of grappling the pellet span and hauling the danbuoy alongside to the recovery position can prove difficult in ships with a high freeboard. An alternative procedure is to reeve a recovery wire through a roller block shackled to the davit/derrick head, then send away the seaboat to shackle the outboard end of the wire to the danbuoy picking-up rope and cut its lashing. The boat's crew then unshackles the pellet span from the mooring wire, and takes the danbuoy float assembly clear. All slack is taken down on the recovery wire before it is brought to a winch or capstan and hove in until the sinker is level with the bulwark/top of the guardrails. The sinker and anchor are hauled inboard, surging on the mooring wire as necessary. The boat then brings the danbuoy float under the recovery position, the recovery wire is attached to the recovery ring, and the danbuoy float is hoisted inboard and recovered.

(2) *Use of a Suitable Davit, Derrick or Crane*. The weight, in air, of danbuoy moorings is up to 182 Kg. During recovery considerable additional strain and shock loading can be imposed on the derrick/davit, particularly in rough weather or if the ship is allowed to drift over the mooring wire. The anchor and sinker may be embedded in the bottom, or caught on rocks, therefore the winch or capstan must be operated with care and consideration for the strain on the wire. Because of the potential load to which the davit/derrick may be subjected, ships with davits, derricks or cranes with a Safe Working Load (SWL) of less than 1.25 tonnes should bring the mooring wire direct to a winch or capstan via a convenient fairlead at deck edge level, adjacent to a derrick or davit capable of lifting 182 Kgs. When the sinker is at deck edge level the load can be transferred to the derrick, davit or crane. Alternatively the RAS roller fairleads may be utilised and the sinker and anchor manhandled inboard when they are the deck edge. The danbuoy float can only be recovered using a derrick, davit or crane.

(3) *Preparations*. All personnel involved must be briefed on the task and normal seamanship safety precautions must be taken. Spare mooring wires of a suitable length should be used as recovery wires. If a derrick is being used for recovery it should be topped up to an angle of 45 degrees; cranes, davits or derricks should be trained outboard until an imaginary buoy hanging from the head could be reached by hand from the upper deck. If it is intended to grapnel the danbuoy place two grapnels on the focsle, and one adjacent to the recovery position. Shackle a recovery hook, 0232/414-9748 to one of the recovery wires, then fit the hook to an aluminium stave, 0573/529-6304.

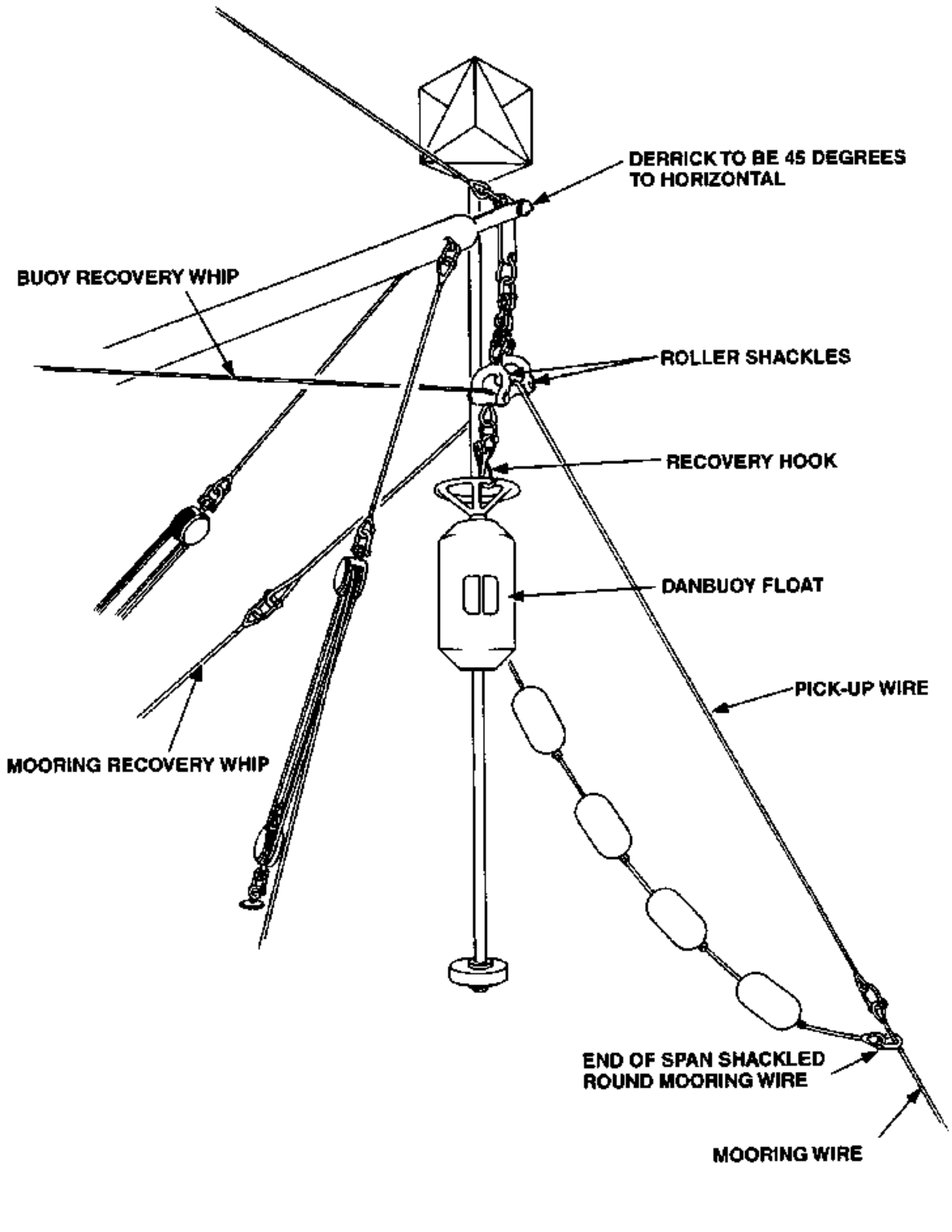


Fig 8-4. Derrick Arrangement for Recovery of a Danbuoy

(4) *Points on Recovery*. Approach the buoy head to wind or tide, whichever has most effect on the ship. If a boat is being used to take the recovery wire to the danbuoy it may be necessary, depending on how far away the buoy is, to tail the wire with a length of 16mm polypropylene. As the float assembly is hoisted care must be taken to avoid jamming the radar reflector against the derrick head.

08004. Quick Reaction Marker Buoy

a. **Introduction**. All HM and RFA Ships must have a Quick Reaction Marker Buoy (QRMB) made up ready for immediate use when proceeding to sea. The QRMB is to be made up by Ship's Staff in accordance with Fig 8-5 and is to be rigged in a suitable position on the upper deck. The QRMB is available for laying an immediate, accurate datum on ditched helicopters or other items of lost, valuable equipment. **However, a danbuoy must be available at thirty minutes notice to replace the QRMB and act as a more permanent marker.**

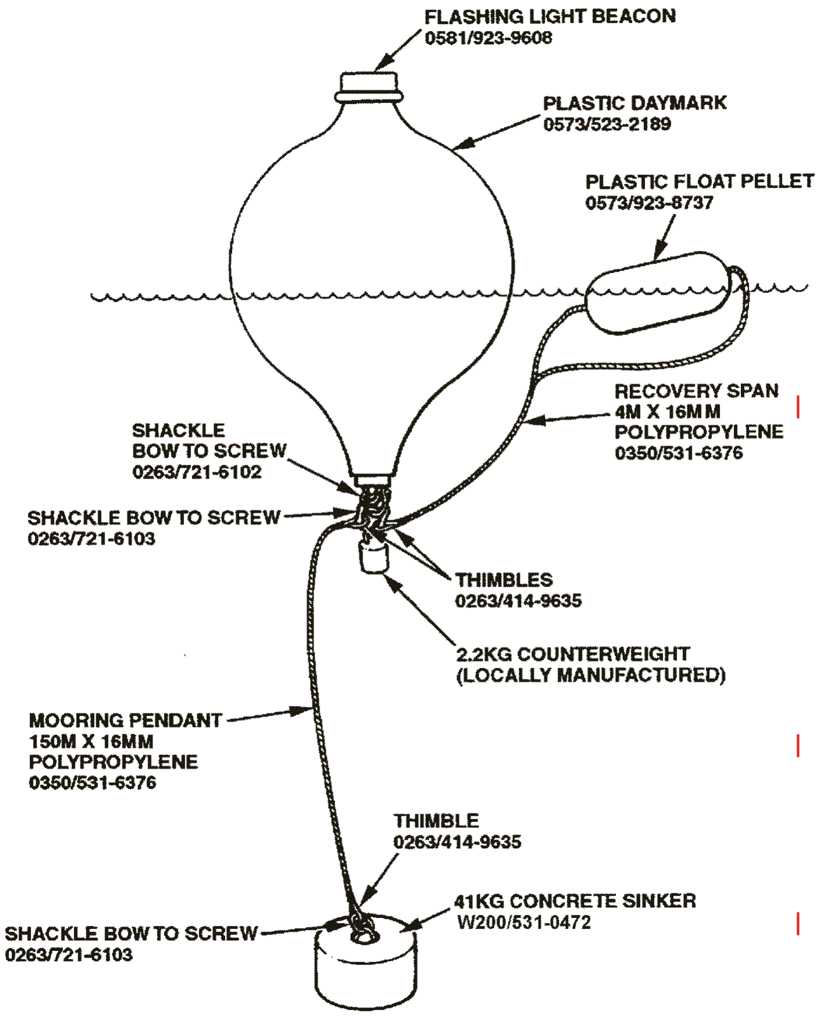


Fig 8-5. Quick Reaction Marker Buoy

Note. *To simplify the rigging/unrigging procedure the mooring pendant can be attached to the daymark by an 0263/539-3520 spring hook.*

b. **Stowage**. There are a variety of QRMB stowages in use throughout the fleet; some ships have purpose built stowages, whilst others utilise containers such as dustbins. Whatever the arrangements, the requirement is that the equipment must be secure in all weather, yet quickly and easily deployed when necessary.

c. **Laying the Marker**. Drills for individual ships must be devised and proved by ship's staff. Details are to be inserted in the Seamanship Data Book and Bridge Card, and a tally outlining the operating instructions is to be sited adjacent to the stowage. One simple method of laying the marker is to follow the danbuoy laying procedure, ie the bight is streamed just prior to the dropping site, then at the appropriate moment the sinker is cast overboard, followed by the float.

d. **Recovering the QRMB**. The QRMB can normally be recovered by grappling the plastic float recovery span. Alternatively, it can be recovered by boat.

08005. Radar and Sonar Alignment Target (RASAT)

a. **Introduction**. The RASAT is a self-contained, battery driven, universal Sonar target. It is designed to be suspended, at variable depths, below a Danbuoy. It can be launched from either a surface vessel or a helicopter and is used for Sonar/Radar alignment checks and/or operator training. It comprises two major items of equipment; a Launch Frame and an Acoustic Unit. Fig 8-6 shows the equipment secured to a danbuoy ready for launching. Full details of the equipment are given in **BR 8837, Radar and Sonar Alignment Target**, the authoritative publication for the equipment.

b. **Fitting the RASAT to the Danbuoy**. Fitting the RASAT to the danbuoy mast is the responsibility of Warfare branch personnel. The Chief Bosun's Mate is responsible for ensuring that the danbuoy float, pellet span, reflector, recovery ring and buoy weight are correctly fitted as described in paragraph 08003.

c. **Launching the RASAT**. Drills for launching the RASAT from a helicopter are laid down in **BR 8837**. For a shipborne launch the Seamanship procedures are similar to those given for laying a danbuoy (paragraph 08003), except of course the danbuoy is ‹free floating' and no mooring equipment is attached. As with the normal danbuoy-laying procedures in ships with a high freeboard, it may be necessary to hang the danbuoy float assembly outboard on a rope hanger to avoid possible damage if the buoy is dropped from too great a height.

d. **Recovering the RASAT**. Preparations are similar to those for recovering a danbuoy laid down in paragraph 08003. Either use a swimmer or seaboat to attach a recovery line to the danbuoy, or alternatively grapple the pellet span. Hoist the danbuoy to deck level, and recover the RASAT acoustic unit. (It will be suspended at a pre-determined depth beneath the launch frame on a suspension lanyard). Then recover the danbuoy. On completion, thoroughly wash down all the equipment with fresh water.

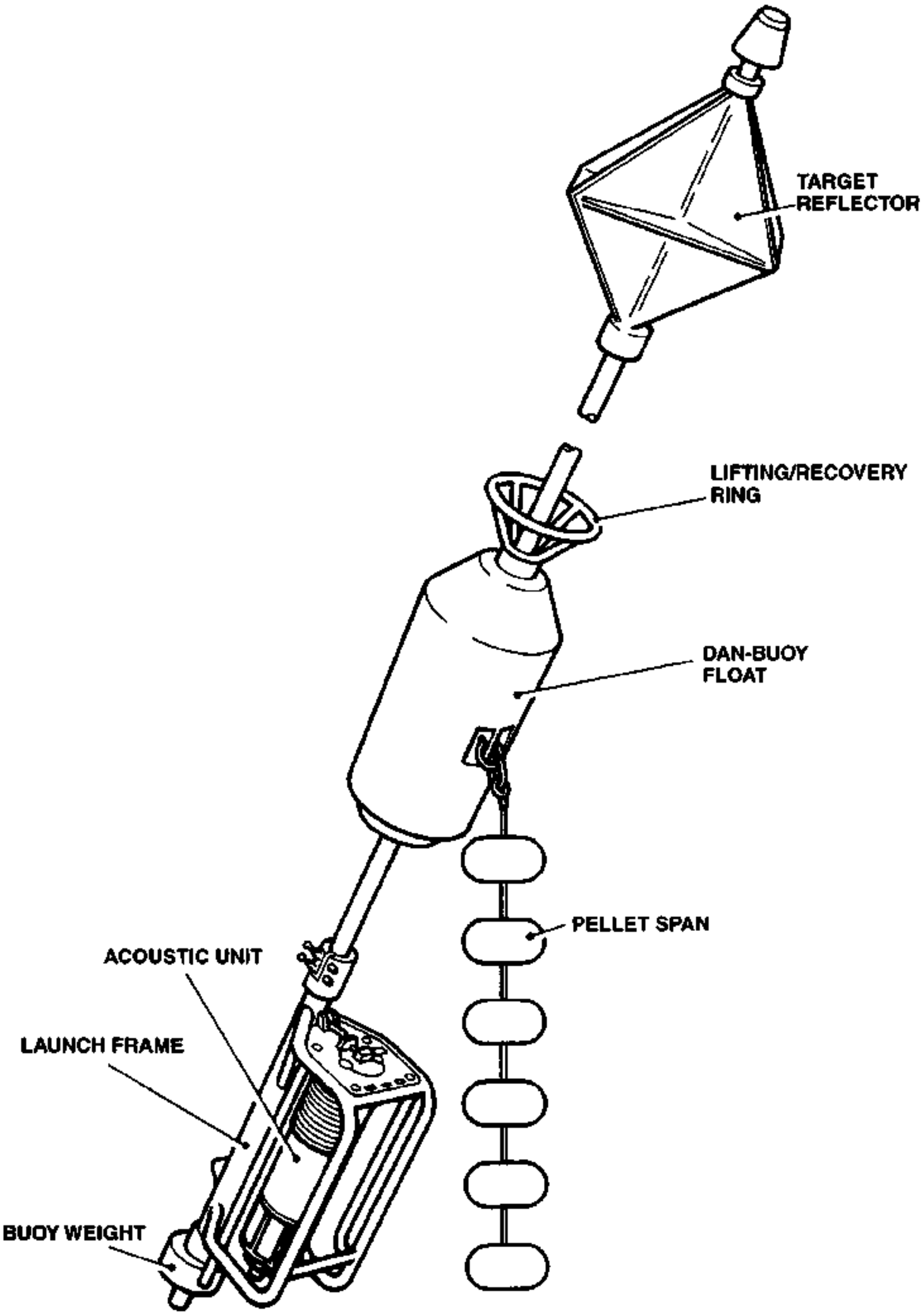


Fig 8-6. RASAT General Arrangement

08006. Ship Launched Underwater Transponder Target (SLUTT)

a. **Introduction**. The SLUTT is a self-contained, battery driven, Sonar target, designed to be suspended, at variable depths, below a danbuoy. It is launched from a surface vessel and is used for Sonar/Radar alignment checks and/or operator training. The SLUTT is only intended to be used with Sonar 2016 fitted ships. Fig 8-7 shows the equipment secured to a danbuoy ready for launching. Full details of the equipment are given in **BR 8556, Ship Launched Underwater Transponder Target**, the authoritative publication for the equipment. The rigging arrangements described here differ slightly from those given in **BR 8556**. These differences reflect changes introduced to simplify the rig and have the approval of the relevant authority.

b. **Fitting the SLUTT to the Danbouy**. The SLUTT is fitted to the danbuoy as shown in Fig 8-7. The suspension line (length between 9 and 27m, as decided by the PWO) must be fitted with a hard eye at each end. The recovery line, with a hard eye one end and a 300mm soft eye the other, is then manufactured to a length 6m longer than the suspension line. The Chief Bosun's Mate is responsible for ensuring that the equipment is correctly rigged; it is the responsibility of Warfare branch personnel to ensure the SLUTT body is correctly prepared prior to launching.

c. **Launching the SLUTT**. Drills for launching the SLUTT are similar to those given in this Chapter for laying a danbuoy, although for this evolution the ship must be stopped. Manoeuvre the ship on to a down-wind heading, then stop the ship. Using the suspension line and the recovery line, fully lower the SLUTT into the water then launch the danbuoy using the standard quarterdeck launch method. As with the normal danbuoy-laying procedures in ships with a high freeboard, it may be necessary to hang the danbuoy float assembly outboard on a rope hanger to avoid possible damage if the buoy is dropped from too great a height.

d. **Recovering the SLUTT**. Preparations are similar to those described earlier for recovering a danbuoy. Either use a swimmer or seaboat to attach a recovery line to the danbuoy, or alternatively grapple the pellet span. Hoist the danbuoy to deck level, and recover the SLUTT body, then recover the danbuoy. Alternatively, the SLUTT body can be recovered into a boat before the danbuoy is hoisted. On completion, thoroughly wash down all the equipment with fresh water.

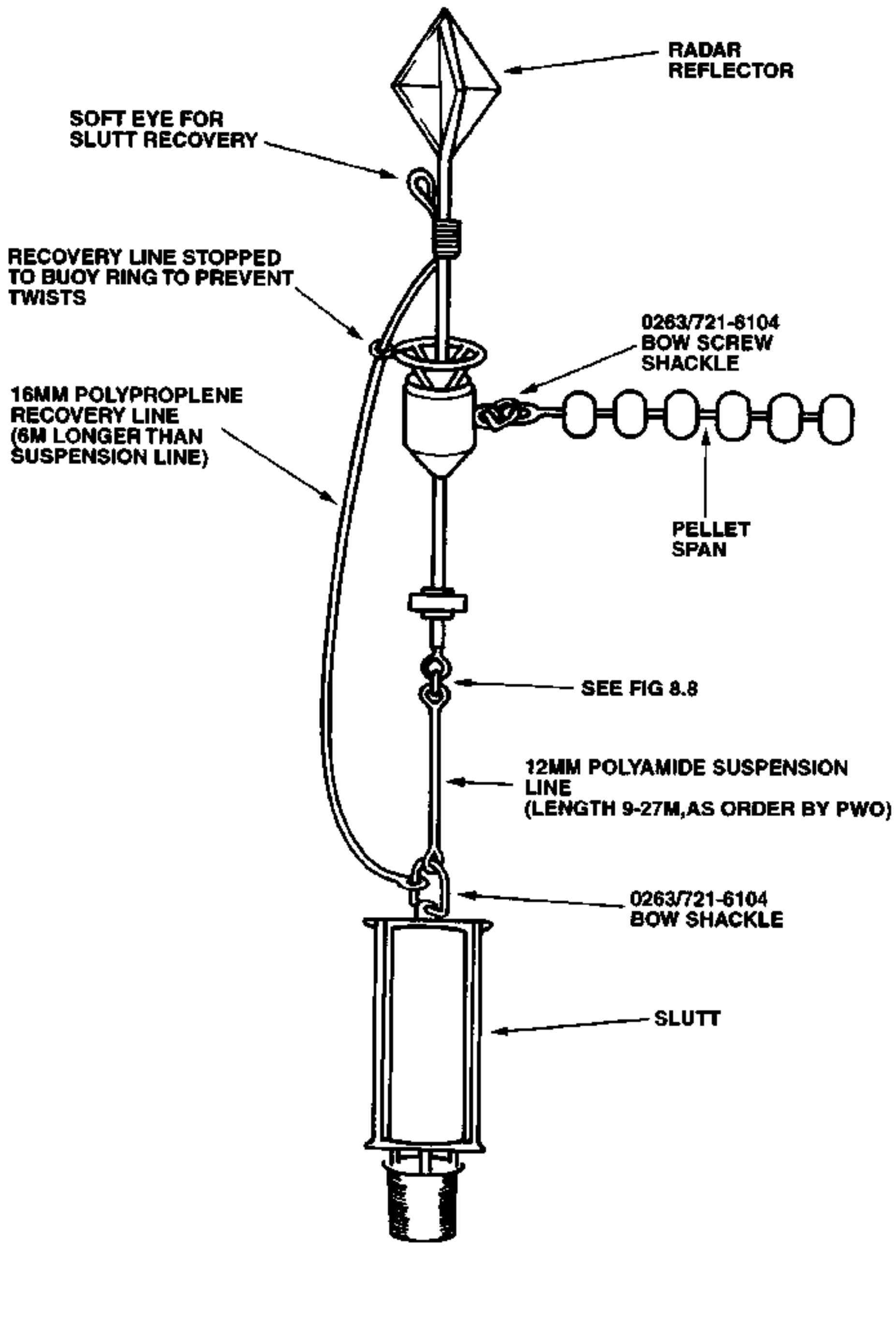
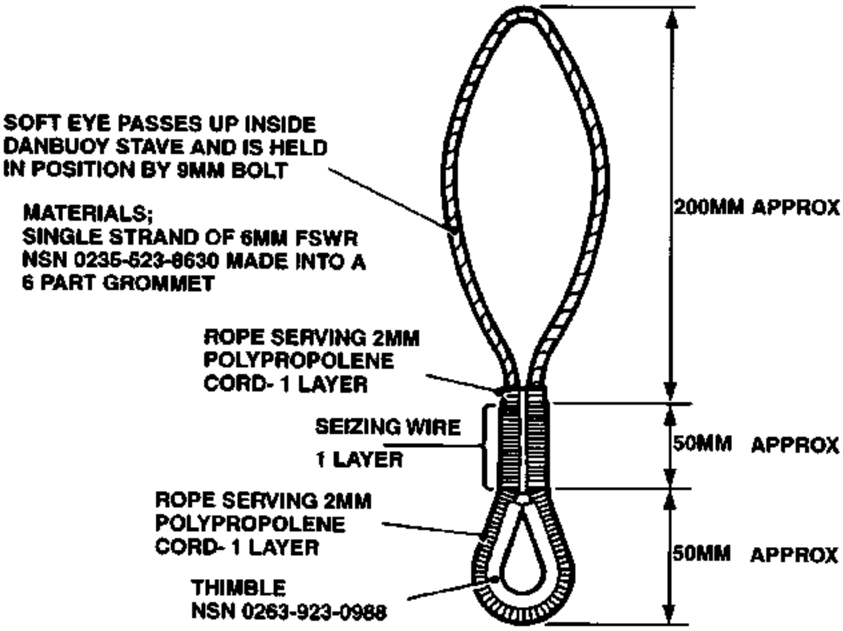
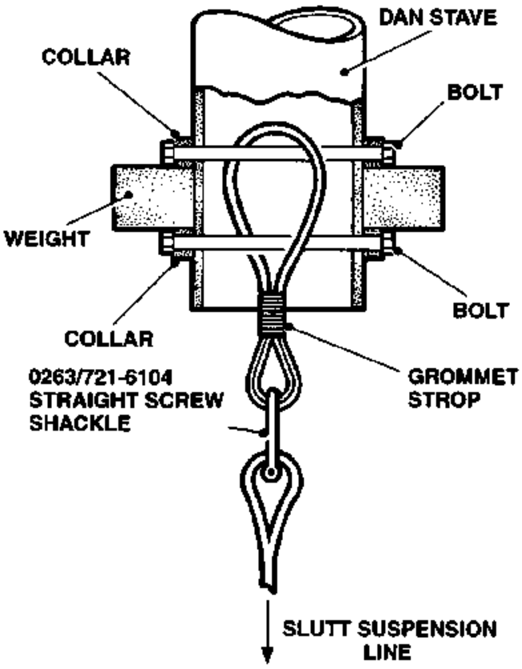


Fig 8-7. Dan-buoy Rig for Ship Launched Underwater Transponder Target



(i)
Wire Grommet Strop
for SLUTT



(ii)
Securing the SLUTT to the
Danbuoy Mast

Fig 8-8. Danbuoy SLUTT Suspension Method

08007. Torpedo Recovery

a. **Introduction**. The only type of torpedo that warships are normally required to recover is the Sting Ray Torpedo Training Variant (TVT), an inert torpedo. Recovery may be by helicopter or seaboat. Other types of torpedo, such as the Sting Ray Exercise Variant Torpedo (EVT) or torpedoes fired from submarines are normally recovered by specially equipped Torpedo Recovery Vessels, although occasionally they are recovered into a warship by specially trained and equipped personnel who are embarked for the task. The authoritative publication for torpedo recovery is **BR 2777, Torpedo Identification and Recovery**. Information given here refers only to recovery by seaboat of a Sting Ray TVT torpedo. The principle of this type of recovery is that the torpedo is ‹captured’ by boat and towed to the ship for hoisting inboard.

b. **On-deck Preparations**

(1) *Hoisting Equipment*. If the torpedo is to be hoisted by crane, a steadying line should be made fast close to the ponders ball to check excessive movement caused by the roll of the ship. Whatever lifting device is used it must have a SWL of at least 160Kg, the weight of a Sting Ray (TVT).

(2) *Fenders*. Two fenders should be placed over the ship’s side abreast the recovery position to prevent damage to the torpedo against the ship’s side during hoisting. Fenders must be tended and worked up the ship’s side level with the torpedo.

(3) *Head and Sternfast*. A head and sternfast should be rigged ready for passing down to the recovery boat.

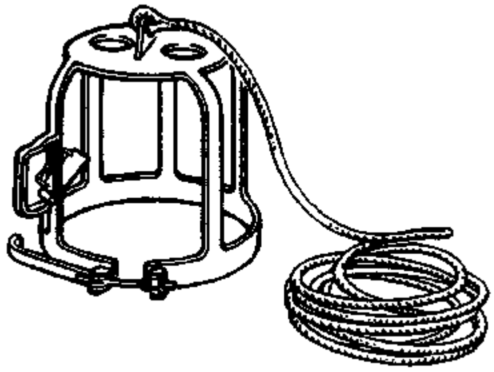
(4) *Hook Ropes*. Two 16mm polypropylene hook ropes, of sufficient length to reach the water should be placed adjacent to the recovery position.

(5) *Torpedo Loading Trolley*. To be placed adjacent to the recovery position.

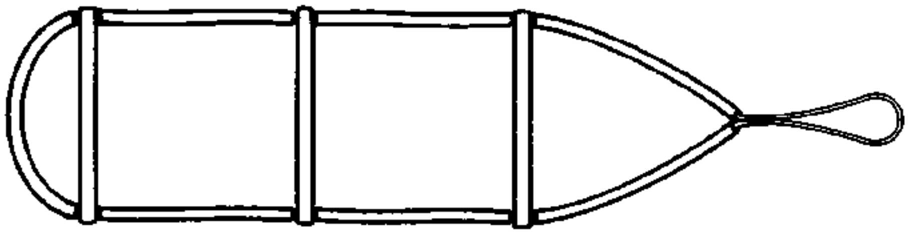
(6) *Deck Team*. The handling team on deck should consist of a PO or Leading Seaman Specialist, 3 Ratings and an appropriately qualified member of the Warfare branch to provide technical attention to the torpedo.

c. **Boat Preparations**. A RIB or Gemini can be used as the recovery boat. The boat must be adequately fendered for towing a torpedo alongside. The usual method of achieving this is to secure shot mats over the gunwale or buoyancy tube on the towing side of the boat; the mats must be well secured. The boat should be manned by its normal crew, plus two additional hands to handle the torpedo. The equipment shown in Fig 8-9 should be placed in the boat.

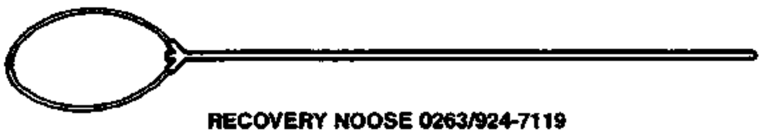
Note. *The towing side of the recovery boat will be the opposite to the side on which the recovery ship will be hoisting the torpedo, so that, on coming alongside the torpedo is between the ship’s side and the recovery boat.*



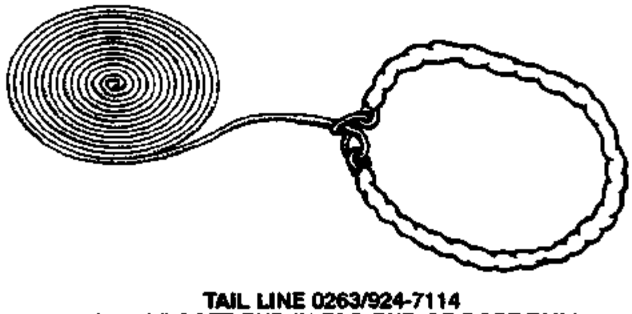
CAGE TORPEDO TOWING 0263/924-7112
(SPLICE SOFT EYE IN FAG END OF ROPE TAIL)



STROP TORPEDO RECOVERY 0263/745-3929
(JACOBS LADDER)



RECOVERY NOOSE 0263/924-7119



TAIL LINE 0263/924-7114
(SPLICE SOFT END IN FAG END OF ROPE TAIL)

Fig 8-9. Boat Recovery Equipment for Sting Ray TVT

CAUTIONS

1. IF THE TORPEDO HAS BEEN LAUNCHED FROM A HELICOPTER A PARACHUTE WILL STILL BE ATTACHED TO THE TAIL OF THE WEAPON. THIS CAN BE A HAZARD TO THE BOAT'S PROPELLER.

2. THE TAIL ‹T' FINS ARE SHARP. TAKE CARE THAT THEY DO NOT DAMAGE THE BOAT.

d. **Recovery Procedure**. The recovery ship approaches, and slips the recovery boat, close to the torpedo. The ship remains in a position to give the recovery boat as short a distance as practicable to tow the torpedo and also to provide a lee for the boat when it returns alongside.

The boat's crew carry out the following recovery procedures:

(1) Approach the weapon and bring it, using the recovery pole, nose facing for'ard, alongside the boat.

(2) Remove parachute, if fitted, either by releasing the para-pack releasing pin, or by cutting the parachute lines.

(3) Loop the eye of the tail line over the tail and haul it ahead of the fins before tightening the noose and securing the line in the stern of the boat.

(4) Place the ‹nose cage ' over the nose of the torpedo and lock the clamping band into position. Secure the nose cage line for'ard in the boat.

(5) Choke hitch the Strop Torpedo Recovery around the torpedo at the point of the Centre of Gravity (Fig 8-10). The strop must remain in hand while the boat returns to the ship.

(6) Manoeuvre the boat to the recovery ship's side, abreast the hoisting station.

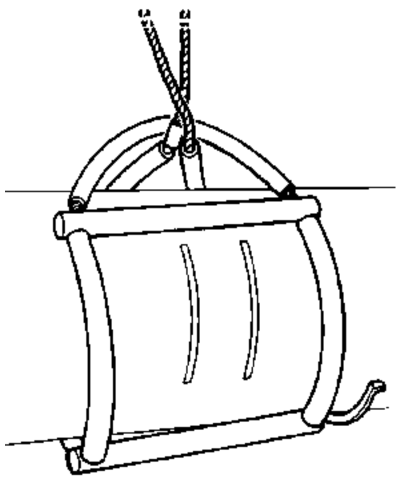


Fig 8-10. Recovery Strop (Jacob's Ladder) Choke-hitched to the Torpedo

At this point the head and sternfast are passed to the boat and secured. These should be tended inboard so the position of the boat can be adjusted as required. The hook ropes are passed to the boat's crew who hook one into the soft eye in the end of the nose cage line and the other to the soft eye in the tail line. Nose cage line and tail line are hauled up on the hook ropes and tended in the recovery vessel. The hoisting whip is now passed to the boat and hooked to the Strop Torpedo Recovery. As soon as the weight of the torpedo is taken, check that the torpedo is horizontal. The recovery boat then clears the ship's side and prepares to be hoisted. As the torpedo is hoisted to deck level the position of the ship's side fenders must be adjusted as necessary to prevent damage to the torpedo against the ship's side. The torpedo is trained inboard, lowered and steadied on to its trolley, then strapped in position. The Warfare branch rating fits nose and tail protectors before the torpedo is transported to a servicing area for a post recovery servicing routine to be carried out.

| **08008. Air Drop**

a. **Introduction**. Urgent stores affecting operational capability can be air-dropped by RAF. **Fleet Operating Orders** gives full details of the procedures to be followed, information given here refers only to the seamanship aspects of the evolution.

b. **Details of the Load**. The stores are packed in a buoyant waterproof container. This container, normally siliconed cardboard, is lashed to a wooden pallet which in turn is placed inside a strong polypropylene net. The four corners of the net are each fitted with a lifting strop that is attached to a net recovery shackle. Secured to the net recovery shackle is a parachute fitted with an automatic parachute release mechanism that operates a few seconds after the load is dropped into the water. A retaining line ensures the parachute remains connected to, but clear of, the load. The maximum weight per load will not exceed 1 tonne although there will be a slight increase in the overall weight caused by wetting of the container. Helicopter/GP Davit lift capacity should take account of this fact and the ship should report any weight limitation or restriction in the Airdrop request signal. The approximate size of the largest load is 1.3m wide x 1.1m deep x 1.8m high. To allow for the length of the slings a deck-edge clearance of approximately 2.3m is necessary at the recovery point.

c. **Methods of Recovering the Loads**. The loads may be recovered from the sea by helicopter or by seaboat and GP davit. Helicopter recovery is quick and effective, but is limited to sea state 3 or below in order to avoid the risk of snagging or injuring the swimmer during attachment of the lifting hook to the net recovery shackle. Seaboat recovery with a large load alongside is sluggish, and above sea state 4 the boat could be swamped when turning or when alongside the ship for load recovery. The most common method of recovery is to send a seaboat away to secure one end of a 24mm polypropylene towing messenger to the load; the other end of the messenger is retained in the ship. The load can then be heaved or hauled to the recovery position ready for hoisting.

d. **Preparations for a Seaboat Recovery**. Prepare a suitable lifting device, taking into account the weight and dimensions of the load. Provide steadying lines and fenders at the reception point, and wooden rollers (or a pallertron trolley if available) to assist in manhandling the load out of the reception area to clear space for the next load. Coil or fake down the 24mm towing messenger adjacent to the recovery position. In addition to the seaboat, which should be equipped with 2 hook ropes, a Gemini or second boat should be prepared as the parachute recovery boat.

e. **Drop Sequence**. It is preferable that the ship is underway, and steaming with the relative surface wind at Red 45°. The aircraft will drop the stores approximately 50-100m on the starboard bow. Ideally, loads will be dispatched singly, allowing sufficient time for recovery between runs. However, if aircraft endurance is limited it may be necessary to continue dropping whilst loads are being recovered.

Note. *At night, or in poor visibility, loads will be marked with a SARBE beacon and a strobe light. A maximum of four containers will be dropped on each run. Further runs will not be made until the beacons on the loads previously dropped have been de-activated. The ship's recovery party must de-activate SARBE beacons as soon as possible to enable subsequent runs to take place.*

f. **Recovery Procedures**. Air Drop positions are shown in Fig 8-11. The recommended method of recovery is:

(1) Ship to Flying Stations. Lower the Seaboat and Parachute Recovery Boat.
(2) Boats take station on the lee side of the ship to await air drop.

(3) Aircraft drops stores approximately 50-100m on the starboard bow.

(4) Parachute Recovery Boat approaches parachute from apex end, gathers parachute and lines inboard, then cuts retaining line as close to the load as possible.

(5) Parachute Recovery Boat returns to ship.

(6) Seaboat takes away one end of the 24mm towing messenger, approaches load and secures alongside with hook ropes, then hitches the towing messenger to the load before returning to the ship. The load is then hauled or heaved to the recovery position beneath the ship's lifting device.

(7) The lifting whip and steadying lines are attached to the load and the load is hoisted inboard.

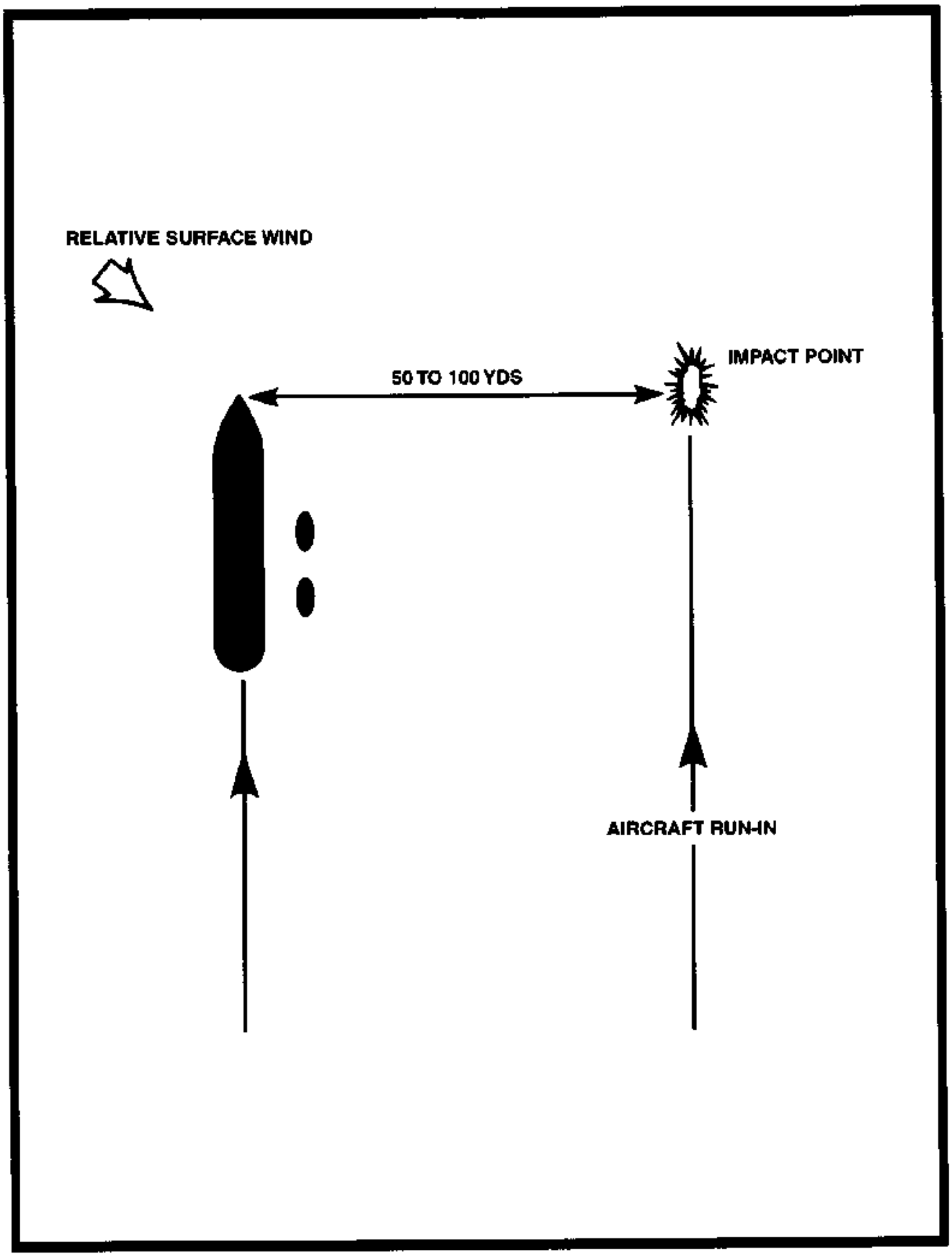


Fig 8-11. Air Drop Positions

CHAPTER 9

SEAMANSHIP ORGANISATION AND UPKEEP

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CHAPTER 9

SEAMANSHIP ORGANISATION AND UPKEEP

SECTION 1 - SEAMANSHIP ORGANISATION IN WARSHIPS

09001. Introduction

The normal complement of Seaman Specialists in Frigates and above is one CPO or PO who acts as the Chief Bosun's Mate (CBM), and two Leading Seaman who work as directed by the CBM. Certain Minor War Vessels are complemented with one Petty Officer or Leading Seaman Specialist who acts as CBM. Mine Countermeasure Vessels are usually complemented with a Leading Operator Mechanic(MW) to act as CBM. The following paragraphs give examples of Terms of Reference, and duties, of personnel undertaking seamanship tasks or duties within a ship's seamanship organisation. The duties of the Bosun, carried only in large ships and certain minor war vessels, are given in **BR 2, Queen's Regulations for the Royal Navy**.

09002. Chief Boatswain's Mate (CBM) - Specimen Terms of Reference

The following specimen Terms of Reference are generally applicable to the Chief Bosun's Mate of a warship:

a. **Accountability**. Accountable to the Executive Officer (or his nominated deputy) for:

(1) Coordinating the work on the upper deck (and in certain cases between decks) to minimise conflicts of activity and ensure a uniform and smart appearance of the ship.

(2) Seamanship, sea survival and safety equipment maintenance, standards and training.

b. **Authority**. The Chief Boatswain's Mate has authority over:

(1) The Leading Seaman Specialist(s) and/or Boatswain's Yeoman, Sea Survival and Safety Equipment Maintainer and Painter.

(2) Any ‹Ad hoc' parties deemed to be his responsibility by the Executive Officer or nominated deputy.

(3) Senior ratings of all departments when coordinating upper deck work or activities that could affect other parts of ship (particularly regarding ship's appearance).

(4) Warfare department senior ratings for the re-allocation of hands working parts of ships to meet unforeseen and unplanned short term requirements.

(5) The Chief Boatswain Mate has functional authority over all ratings in the execution of maintenance, sea survival and safety and seamanship tasks.

c. **Tasks**. To carry out the following tasks:

(1) To take charge of all major (or unusual) seamanship evolutions as required by the Executive Officer (or his nominated Deputy). These evolutions include:

(a) Acting as the Officer in Control (OIC) of replenishment at sea.

(b) Target and decoy streaming and recovery.

(c) Recovery of men and materials from the water.

(d) Danbuoy and marker buoy laying and recovery.

(e) Seamanship aspects of salvage, towing and disaster relief.

(f) Heavy lifting and slinging (by whatever means).

(g) Advanced anchor, cable and mooring work.

Note. *Delegation may take place at the Executive Officer's discretion if he considers that the person concerned has the necessary training and experience to correctly and safely carry out the task. Routine delegation (ie seaboat, anchoring, etc) must be covered in ship's orders.*

(2) To act as replenishment at sea Safety Officer (as required) (Senior Rate Seaman Specialist only).

(3) To advise other departments on the correct rigging, operation and maintenance of their portable lifting equipment, and taking personal charge if deemed necessary (to include engine removal, stores and hull outfit lifting gear).

(4) To supervise the upper deck during Action and Defence Stations taking charge of any evolutions as required by the Command (to include NBCD roving commission in Action).

(5) To oversee all boat operations.

d. **Material and Maintenance**

(1) To run the upper deck and designate seamanship Maintenance Management System (MMS) holding the relevant section logs as provided by the Marine Engineering Department.

(2) To co-ordinate husbandry work by all departments on the upper deck to ensure a minimum conflict and a uniform standard of maintenance combined with a smart and seamanlike outward appearance of the ship in accordance with current instructions.

(3) To maintain rigging or issue upkeep instructions to parts of ship (including that held by other departments) providing the MMS Coordinator with collated returns on completion.

(4) To prepare (in liaison with the ME department) the seamanship, sea survival and safety defect list for refits and other designated maintenance periods.

(5) To have charge of the replenishment at sea gear and maintain a register of seamanship equipments (to include torpedo recovery, target, danbuoy and decoy gear).

(6) To act as the competent person regarding the periodic survey and inspection of seamanship equipment in accordance with **BR 3027**, which should include all loose gear and also to carry out the duties of the Departmental ADLEE on ships that have been LESM implemented. (Senior Rate Seaman Specialist only).

(7) To supervise the onboard production and replacement of seamanship and rigging equipment (including canvas gear) and arranging, through the ME department, for localised load testing if necessary.

(8) To store and issue paint, painting materials and personnel protection equipment for whole ship use and to ensure security, updating and stowage of stock in accordance with promulgated holdings (may be under the direct control of the senior Hull rating in certain ships).

(9) To advise all departments on cleaning methods and equipment available.

10. Act as departmental overseer for all contracted husbandry activities.

e. **Safety and Survival**

(1) To act as the ship's Safety Officer's Assistant monitoring all aspects of health and safety at work, but with particular regard to the proper provision of safety equipment and clothing and the correct use of seamanship and lifting equipment.

(2) To supervise sea survival and safety equipment maintenance and the running of the Sea Survival and Safety Equipment Log (normally carried out by a Senior Rating, however, exceptionally may be done by a LS(SEA)/LOM who is borne as the Chief Boatswains Mate and who has completed the SE Supervisors Course. The Supervisor is not to be the Maintainer).

(3) To instruct (and exercise) the ships company on all aspects of sea survival and safety equipment (keeping a training record in the Seamanship Data Book).

(4) To ensure visitors to the ship are in possession of (or have ready access to) a lifejacket and that they are properly briefed on matters of sea survival and safety as it affects them.

f. **Manpower and Training**

(1) To be the Divisional Senior Rating for seaman specialists (and other members of his party, if so required).

(2) To instruct seamanship on a whole ship basis and act as the Seamanship Training Coordinator.

(3) To train personnel to carry out particular seamanship evolutions with special emphasis being placed on:

(a) Junior Officers/Senior Ratings so that routine evolutions may be delegated to them.

(b) Seamanship Task Books.

(c) Boat coxswains and crews (Note 1).

(d) Whole Ship Defence Watch RAS Teams (Note 2).

Notes:

1. Appropriate boat handling course at RN Seamanship School to be completed.

| *2. A Targeted Employment Module (TEM) at HMS RALEIGH RAS Rigs are available for training RAS teams.*

g. **Publications and Records**

(1) To hold (on behalf of the XO) the Seamanship Data Book ensuring its timely updating and its safe keeping during refitting periods.

(2) To hold the ship's Rigging Warrant (D6f) ensuring its periodic updating with the copy held by the Base Port Master Rigger.

(3) To hold the sub department's Permanent Load Record.

(4) To hold a central outfit of publications on general seamanship matters and on subjects relative to the ship.

(5) To supervise (with the ME department) the correct and timely entries into the boat's engine running logs.

(6) To supervise the COSHH log for the paint shop.

09003. Employment of Leading Seaman Specialists
Where Leading Seamen Specialists are carried:

a. They should be employed under the direction of the CBM to:

| (1) Supervise/carry out sea survival and safety equipment maintenance.

(2) Maintain the SSEL.

(3) Rig for all seamanship evolutions, and fulfil key roles in those evolutions.

(4) Act as a Coxswain of all ship's boats.

(5) Carry out repairs to canvas gear and supervise the work of the Boatswain's Yeoman in this field.

(6) Carry out inspections of ships rigging items, and execute ship husbandry tasks allocated by the CBM.

(7) To be ADSLING / ADHOOK qualified and to assist with operations involving slinging.

(8) Act as ship's paint shop rating when required.

(9) Conduct musters of the CBM Permanent Loan List, and order/return naval stores as directed.

(10) Assist in the conduct of Seamanship Task Book Training.

b. They should be employed:

(1) *In the Action State.* As necessary to meet Quarterbill requirements but preferably on the upper deck (normally Local Gun Directors).

(2) *In the Defence Watch State.* As Crashboat/Lifeboat Coxswain, and on call for all commitments at sub para a. as appropriate. If two L/S (Sea) are available they should watchkeep.

(3) *In Cruising Watches.* Include in Leading Seaman of Watch On Deck roster and as 1 in 3/4 Seaboat/RIB Coxswain, plus commitments at sub para a. as appropriate.

(4) *In Harbour.* Under the direction of the CBM on tasks at sub para a. as required, and included in Duty L/H roster only. (Where practical, opposite other than Warfare branch Duty Petty Officer).

Note. *In order that the Leading Seaman Specialist remains available to fulfil his primary roles he should not be employed:*

(1) On routine communal tasks.

(2) As Quartermaster at sea or in harbour.

(3) On routine watchkeeping tasks other than those specified in sub para a and b.

These are important points particularly since the bulk of the seamanship/SSE maintenance load inevitably occurs in harbour - especially during AMP/Leave periods - and it will not be possible to job change the Leading Seaman Specialist by use of other Warfare Branch Leading Hands since they will lack the necessary skills.

09004. Boatswain's Yeoman - Specimen Duties

a. **Accountability**. The Boatswain's Yeoman is accountable to the Boatswain/CBM.

b. **Tasks**:

(1) To assist the Boatswain/CBM to plan and control the maintenance of seamanship equipment and survival equipment allocated to the Warfare department.

(2) To carry out maintenance as directed by the CBM.

(3) To repair or renew small covers and screens.

(4) To assist the Boatswain/CBM with his storekeeping duties.

09005. Paint Shop Rating - Specimen Duties

a. **Accountability**. The Paint Shop Rating is usually accountable to the Boatswain/CBM.

b. **Tasks**

(1) To account for all paint, informing the CBM in good time if any shortage is likely to occur.

(2) To issue paint, painting materials and personal protection equipment against a signed paint application form in accordance with current instructions.

09006. Petty Officer of the Watch at Sea (POOW) - Specimen Duties

a. **Accountability**. The POOW is accountable to the OOW.

b. **Tasks**

(1) To supervise the part of the Watch on Deck, allocating hands to duties as required.

(2) To ensure that the upper deck is properly secured for sea.

(3) To ensure the watertight integrity of the ship in DC State 3.

(4) To carry out security and NBCD rounds of the ship, and rounds of the weatherdecks:

(a) Once a watch during the forenoon, afternoon and dog watches.

(b) Once an hour during the first, middle and morning watches.

(5) To take charge of:

(a) Lowering and hoisting the seaboat.

(b) Swimmer of the Watch operations.

(c) Evolutions carried out by the part of the watch.

(6) To assist the OOW on the bridge when not carrying out the duties listed above.

09007. Leading Hand of the Watch at Sea (LHOW) - Specimen Duties

a. **Accountability**. The LHOW is accountable to the POOW, but subject to the functional authority of the OOW for the seaboat.

b. **Tasks**. As coxswain of the seaboat he is to:

(1) Ensure the seaboat is correct, properly secured and engine tested.

(2) Carry out a functional check and ensure that the Automatic Release Hook is set to ‘Safe.

(3) Ensure that the crew is briefed.

(4) Report the status of the seaboat to the OOW at the start of his watch.

(5) Take away the seaboat when ordered.

(6) To undertake those duties ordered by the POOW

09008. Lifebuoy Sentry and Stern Lookout (LBS) - Specimen Duties
Unless otherwise decided by the Command, ships do not require to post a lifebuoy sentry for normal operations. A lifebuoy sentry must be posted on those occasions when hazardous evolutions are being carried out (eg RAS) or when prudence dictates there is a need for a stern lookout (ie slow night transit of the Dover Strait). It is the responsibility of the OOW to ensure compliance with Rule 5 of the International Regulations for Preventing Collisions at Sea.

a. **Accountability**. The LBS is accountable to the POOW.

b. **Tasks**

(1) To stand his watch within earshot of the bridge telephone and alarm, and where he has an unobstructed view astern.

(2) To check lifebuoys and telephone communications on closing up and then to report to the bridge.

(3) If specified in ship’s standing orders, to test the lifebuoy alarm and inform the OOW if it is not correct.

Note. *The procedures for taking over a watch and reporting incidents are given in BR 67(SUPP) Notes on Seamanship, issued to all Warfare branch personnel.*

(4) If he sees a man go over the side he is to:

(a) Release the nearest lifebuoy.

(b) Press the lifebuoy alarm.

(c) Release second lifebuoy.

(d) Continue watching and reporting.

(5) If he hears the alarm he is to drop both lifebuoys and report to the Bridge by telephone.

(6) To dip the ensign when ordered by the Bridge.

(7) To act as stern lookout and report all objects sighted between green 120° and red 120°.

(8) During replenishment he is to close up abaft the replenishment point as detailed, adjacent to a lifebouy and marker.

(9) At Flying Stations he is to close up in the hangar with a lifebuoy. By night and in bad visibility an N2 light and smoke float is to be attached. By day an A5 Marker is to be attached.

09009. Swimmer of the Watch (SOW) - Specimen Duties (See also paragraph 0602)

a. **Accountability**. The SOW is accountable to the POOW.

b. **Tasks**

(1) To be ready for the recovery of men from the water throughout his watch, as laid down in ship's orders.

(2) To ensure the following gear is complete and in working order, reporting to the POOW if it is not correct:

(a) One Sam Brown harness with lifeline.

(b) One diving suit, including suit-inflating bottle and knife.

(c) One pair of fins.

(d) One hood and a pair of gloves.

(e) One recovery strop.

(f) One recovery line.

(g) One indicator bat and wand for night.

09010. Parts-of-Ship Organisation

For the purposes of routine maintenance and cleanliness, and the conduct of certain seamanship evolutions, a warship's upper deck is divided into a number of areas known as parts-of-ship. There can be three seaman parts-of-ship; Forecastle (FX), Top (T) which may include the boats, and Quarterdeck (AX). A number of Warfare branch ratings, overseen by a Warfare branch Petty Officer, are allocated to each part-of-ship; these personnel are then known as forecastlemen, topmen, etc. Each part-of-ship has a part-of-ship officer who is in overall charge. However, in practice his role tends to focus on divisional matters concerning the ratings working his part-of-ship, and day to day management of maintenance and cleanliness is undertaken by the part-of-ship PO. Precise arrangements for the allocation of manpower differ from ship to ship, but with the trend towards smaller ship's companies it is important that whatever system is employed it must be as simple and flexible as possible.

09011. Part-of-Ship Petty Officers - Role

The role of the POS PO is to allocate and supervise the work in his part of ship. He is accountable to the part-of-ship officer and is subject to the authority of the CBM for standards of seamanship and ship husbandry. It is the responsibility of the XO/CBM to assess POS POs and, where necessary, provide onboard training in the conduct and supervisory aspects of seamanship evolutions and part-of-ship duties. Whatever the organisation it is important the PO knows where he stands, what is expected of him and to whom he is accountable.

09012. Both Watches of the Hands

FLAGOs state that musters need to be kept to a minimum and should not be held as a matter of routine. The value of musters such as a daily Both Watches is that the officers and men get to know each other, information can be given out, standards of health and cleanliness can be monitored and it is a tidy way to start off the working day. On the other hand it removes responsibility from the POS PO's for getting their hands turned to, and often reduces the need for the PO's to think and plan ahead. In fact if the CBM details the hands off for work the role of the POS PO is reduced to that of a work supervisor only. Early on in a ship's commission or after major personnel changes the advantages of having Both Watches twice daily may outweigh any disadvantages. But once the ship has settled and is a running concern (ie Post BOST), the need for Both Watches twice daily may not be as strong and the frequency could be reduced to once a day with hands turning to by POS in the afternoon. There will be a number of occasions when the mustering of both Watches is inappropriate (eg on exercise at sea).

09013. Side Party

A party of ratings may be formed occasionally from parts of ship for cleaning and touching up the ship's side. The party normally works under the direction of a Petty Officer or Leading Hand who is referred to as the Captain of the Side.

09014. Boatswain's Party

A small party of ratings including the Boatswain's Yeoman, usually in the charge of a Leading Seaman Specialist, works under the direction of the Chief Boatswain's Mate, or the Boatswain in larger ships. The party is responsible for the maintenance and issue of survival and safety equipment, the cleanliness and condition of gear in the CBM's store and for canvas and rope gear not issued to parts of ship. The party also carries out certain repairs to rigging and maintains rigging fittings.

| **09015. Cable Party** (See also paragraph 02018a)

A standing cable party is usually detailed from each watch to work the cables when the ship comes to anchor, weighs or makes fast to or slips from a buoy. It consists of a Petty Officer, a number of seaman and a Communications rating. The cable party also includes the appropriate ratings of the Marine Engineering department dependent upon the ship's capstan arrangements.

| **09016. Anchor Watch** (See also paragraph 02018j)

In heavy weather, or when the ship is anchored in an exposed roadstead or in a strong tideway, an anchor watch is set, ie detailed to watch the cable, veer it or heave it in, let go a second anchor, slip the cable, or weigh anchor as may be necessary. An anchor watch includes an officer on the bridge, two or more seamen under the charge of a petty officer and the appropriate ratings of the Engineering branches. A Quartermaster and Bosun's Mate are also detailed if main engines are at short notice; ships at anchor normally use the Quartermaster and Bosun's Mate currently on watch.

09017. Seamanship Evolutions - Planning and Training

In addition to her normal tasks, a ship must be prepared to deal with any emergency or contingency which may arise. It would not be possible to issue detailed orders to meet every situation, but it is possible to issue orders for some duties or emergencies which it is known, from past experience, are likely to be encountered; these are known generally as evolutions. Each evolution requires a certain number of men for its efficient execution. It is usual to make out stations on the watch and station bill for certain tasks such as berthing and unberthing the ship, replenishment at sea, landing parties and boarding parties. This provides a sound basis to work from, but will require regular amendment to meet routine requirements such as job changes. The manpower requirements for minor evolutions such as streaming or recovering danbuoys, decoys and targets can also be included on the watch and station bill, or can, depending on the type of ship and the manpower available, be met as required from watch on deck personnel. Other evolutions, such as Rescue Stations, may well require lower deck to be cleared to meet manpower needs. As part of the planning process the CBM should provide the Warfare Branch Coordinator with written details of the manpower requirements for each seamanship evolution that the ship may be required to perform, whether in Action, Defence or Cruising watches. Additionally, training time must be allocated to enable personnel involved in the evolutions to receive appropriate instruction. The importance of planning and training cannot be over-emphasised if best use is to be made of the manpower available.

09018. Seamanship Evolutions - Safety Officer

A Safety Officer is to be nominated to oversee the safe conduct of all seamanship evolutions. It is essential that whoever is nominated has the necessary experience and training to competently carry out this important role. Prior to the evolution the Safety Officer, who is to be identified to all participating personnel, must ensure that all personnel are briefed on the aim and conduct of the evolution, any significant risks and hazards, and details of individual tasks. He must ensure that appropriate control measures are taken to remove or reduce risks as much as possible. For the duration of the evolution the Safety Officer must take up a position that provides an overall view of the proceedings. He should avoid becoming actively involved but must be ready to interrupt or halt the evolution if a dangerous situation is or may be developing. On completion of the evolution the Safety Officer is to ensure that the area is safely restored as necessary and all personnel are properly debriefed.

SECTION 2 - SEAMANSHIP EQUIPMENT UPKEEP AND ACCIDENT/INCIDENT REPORTING

09019. Introduction

Upkeep is defined as 'The use of any or all the resources required to assure or restore a specified material condition or level of performance'. In the broadest terms, when applied to a ship, this means the whole range of activities required to maintain the designed performance of the ship and her equipment throughout her useful life. Every ship needs upkeep; the requirement can either be met in a planned and organised manner or it will be imposed as a result of a breakdown - it cannot be escaped. The practical implementation of preventive maintenance and planned upkeep involves the provision to ships of a standard documentation system titled the Maintenance Management System (MMS). The essential features of the system are given below; full details of the system are contained in **BR 1313, Maintenance Management in Ships**.

09020. Maintenance Management System

The work involved in the upkeep of a ship falls into 5 categories:

a. Condition Monitoring

b. Preventive Maintenance

c. Corrective Maintenance

d. Modifications

e. Alterations and Additions

The Maintenance Management System (MMS), run by the Engineering department, is a shipborne bring-up system primarily intended for planning, requisitioning, controlling, recording and reporting those parts of this work which fall to be done by the Ship's Staff or by Base Maintenance staff. Provision is also made for bringing up, recording and reporting upkeep work in those categories done by a Contractor or other repair agency. An integral part of the system is a comprehensive set of ship equipment files for storing important facts about the ship and her equipment and information of lasting relevance about performance and upkeep. It is usual for the CBM to manage the MMS with regard to seamanship equipment.

09021. Types of Maintenance Period

Certain maintenance can only be carried out alongside or in dry dock, with support from shore based staff. The various types of maintenance period, (listed below), depend on the type of ship and the nature of the work involved. Further details are given in **Fleet Engineering Orders** and **BR 1313**:

a. Assisted Maintenance Period (AMP) (Not CVS)

b. Base Assisted Maintenance Period (BAMP) (CVS only)

c Base Maintenance Period (BMP) (Certain Small Vessels and Craft)

d. Docking and Essential Defects (DED) (Not CVS)

e. Docking and Assisted Maintenance Period (DAMP) (CVS only)

f. Refit

09022. Preparations for AMP, BAMP, BMP, DED, DAMP or Refit

This subject is fully covered in **BR 1313**. Suffice to say here that the Engineering Department processes the documentation for all refits or maintenance periods; consequently close liaison with that department is important. See also the following Paragraph.

09023. Seamanship Equipment Checks and Inspections

The various Seamanship equipment checks associated with maintenance periods and refits are as follows:

a. **Pre-refit Assessment**. Carried out 6-9 months prior to a refit, this assessment forms the basis of the refit work package. On notification from the ship's administrative authority of the impending refit a Seamanship check-off list is sent to the ship to assist with compilation of the Defect List. The assessment is normally carried out by ship's staff, although ships not complemented with a senior rate Seaman Specialist as CBM can request assistance from COMPORFLOT Seamanship Staff.

b. **Harbour Acceptance Trial (HAT) (Seamanship)**. This formal inspection by COMPORFLOT Seamanship staff is part of the Operational Date Material Assessment (ODMA) carried out on completion of a refit, but is also mandatory for ships completing a DED. The inspection covers all Seamanship equipment and documentation. It is recommended that provisional dates are agreed prior to a formal application. Ships undergoing a commercial refit/DED should ratify dates with the relevent Integrated Project Team in the refit/DED plan. Duration of this inspection is as follows: CVS/LPD 5 days, DD/FF 3 days, Minor War Vessels 2 days.

***Note**. If a ship is required to proceed to sea before completion of a refit/DED, A full HAT Seamanship must be conducted. Completion of the starred items in the seamanship HAT document is mandatory. Approximately 6 weeks prior to a HAT ships are to request a pre-HAT from COMPORFLOT-WOSEA by telephone or signal (including SIC LAB). Contact points are given overleaf.*

c. **Annual Seamanship Safety Check (ASSC)**. All RN ships are required to undergo an Annual Seamanship Safety Check. This check equates approximately to the starred items of the HAT document and an audit check of the SSEL (ships that undertake a DOST or BOST will have undergone all the necessary checks and are exempt for 12 months). Ships are to request an ASSC from FOST CMST by signal (including SICs LDB, LAQ and LMB).

09024. Points of Contact for CINCFLEET Seamanship Staff

Title	Rank	Responsibilities, CHOtS and Postal Address
SO1N7RFA	Chief Officer	Development of Seamanship Policy. RFA Issues. FLEET W-RFASO1, CinC Fleet HQ, Mail point 2-4, Leach Building, Whale Island, Portsmouth, Hants, PO2 8By Tele No 93832-5402
Fleet Seamanship Officer	Lt Cdr	Seamanship Policy. FLEET W-SEASO2. Tele No 93832-5396. Address as above.
Deputy Fleet Seamanship Officer 1	WO(Sea)	Seamanship Policy FLEET W-SEA1WO. Tele No 93832-5397. Address as above.
Deputy Fleet Seamanship Officer 2	WO(Sea)	Seamanship Policy (including Submarines) FLEET W-SEA2WO. Tele No 93832-5399 Address as above.
FOST Seamanship Staff	Lt Cdr & Staff	Planning and Conducting Seamanship Sea Training. Not on CHOts. Tele No 9375 67789/68272. Address: Flag Officer Sea Training, Raleigh Block, HMS Drake,, Devonport, Devon PL2 PGB (FAO SOS)
COMPORFLOT WOSEA	WO(Sea)	Planning, Coordinating and Conducting HATs. CHOts PORFLOT-WOSEA.Tele No 9380 26394. Address: Rm 26, Old Sail Loft, Lochinvar Bdg, PP 71, HM Naval Base, Portsmouth PO1 3NH
AS6B2c	WO(Sea)	Quality control of all 23C items Working at Height Personal Protection Equipment (WAHPPE), advice on working at height issues. Not on CHOts Tele No 95371-4749. Address, Room V106 Palmer Pavilion, RAF Wyton, Huntington Cambs PE28 2EA

09025. Seamanship Publications and Records

The following list of publications and records pertain to seamanship matters or contain information of use to the seaman:

a. **Rigging Warrant (D6F)**. All HM Ships and Submarines are provided with a Rigging Warrant. It is a statement of all rigging equipment pertaining to the vessel, and is an authority for demanding replacement items of such equipment. The D6f is compiled by the shipbuilder, who produces three copies; copy No 1 (the master copy) is forwarded to the Master Rigger of the ship’s Base Port, copy No 2 is held on board and copy No 3 is forwarded to DG Ships for use in the appropriate Ship Section.

b. **Seamanship Data Book (S2676)**. The Seamanship Data Book is designed to ensure continuity of knowledge of seamanship affairs affecting the ship during its lifetime and is valuable as a ready reference. It is supplied on first commissioning to all warships and submarines. The book is divided into sections, each section initially having blank pages which are progressively completed by the ship’s staff, typed or in manuscript, with sketches and photographs as appropriate. The information for inclusion in the book is gleaned from various sources such as the Rigging Warrant, ‘As fitted’ drawings, FTMs, DCIs and experience gained when rigging for or conducting evolutions. Lists of qualified coxswains, crane drivers, crane controllers and slingers should also be included in the book.

c. **Sea Survival and Safety Equipment Log.** This log is part of, but maintained separately from, the MMS system. It provides details of the maintenance and routines for Sea Safety and Survival, and is also used to record details of maintenance carried out.

d. **ATP-16 Replenishment at Sea**. The authoritative publication for replenishment between ships of NATO.

e. **Other Publications**

BR 1329	Handbook for Survivors
BR 2176	Sailmakers Handbook
BR 6003	Instructions for Crane Drivers and Crane Pilots
BR 6004	A Safety Handbook for RN Slingers
BR 3027	Manual of Safe Use, Examination and Testing of Lifting Appliances
BR 2203	Ships Husbandry Manual
BR 8106	Standard Danbuoys, Short Scope Buoys and Markers
ATP 43/MTP 43	Ship to Ship Towing between NATO Ships
BRd 1043(Series)	Gunnery and Guided Weapon User Instruction
BR 1313	Maintenance Management in Ships
BR 1754	Safety Regulations for Storing and Handling Petroleum Oils, Lubricants and Certain other Hazardous Stores in HM Ships
BR 2000(20)	Safety Considerations and Precautions
BRd 4023	Ship Guide to Underwater Warfare (see also BR 214(4))
BR 2777	Torpedo Identification and Recovery
BR 367	Manual of Anchors, Chain Cables and Associated Equipment.
BR 3939	Hull Preservation Processes
BR 6583(001)	Replenishment at Sea Probe Receiver Fuel Coupling
BR 6595(800)	25-Man Liferaft in GRP Container
BR 8837	Radar and Sonar Alignment Target (RASAT) MOD 11
BR 8988	RN Manual of Military Training, Operations and Tactics
BRd 9275(1)	Operational Sea Training Guide (OSTG)
BR 9275(2)	Operational Sea Training Guide (MPVOSTG)
ATP-17	Naval Arctic Manual
JSP 375	MOD Health & Safety Handbook Vol 2

09026. Form S2022.

Form S2022 is a report of shortcoming/changes in material, design support or documentation. Details of how to complete and submit the form are laid down in **Fleet Engineering Orders**. However, to ensure that the relevant authorities are kept informed and are able to undertake, where appropriate, the necessary investigative action, a photocopy of all S2022s raised concerning Seamanship and Survival Equipment is to be sent to the relevant authorities at the addresses below:

a. Seamanship and Survival and Safety Equipment	Deputy Fleet Seamanship Officer (See Page 9-15 for Address)
b. Survival Equipment	The Captain HMS SULTAN, fao AESD(SEG) Military Road Gosport PO12 3BY
c. Working At Height Personal Protective Equipment. AS6B	AS6B2c. (See Page 9-15 for Address)

09027. Form 760

Form 760 is a defect reporting form for Working At Height Personal Protective Equipment. Forms are to be filled in and forwarded to the AS6B address on page 9-15. A copy of the form is also to be forwarded to CINC FLEET Seamanship Office**.**

09028. Seamanship Incident Reporting

It is important that all seamanship incidents are reported, not just those involving injury to personnel. The procedure to be followed is laid down in **FLAGOs** Article 2643.

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CHAPTER 10

HELMSMANSHIP

CONTENTS

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CHAPTER 10

HELMSMANSHIP

10001. Conning and Steering - Introduction

A ship is manoeuvred by the combined use of her engines and rudder(s). When underway and going ahead the ship's speed is determined by the speed at which her propellers rotate, in revolutions per minute, or, in the case of controllable pitch (CP) propellers, by maintaining constant revolutions and altering the pitch of the propeller blades. The ship's course is either maintained or altered by her rudder. Most modern warships are fitted with twin rudders which are linked and work in unison. In a warship the Captain or Officer of the Watch cons the ship by giving wheel or engine orders from the compass platform on the bridge. The wheel orders are applied by the helmsman and engine orders are either applied directly or passed to the ship control centre or engine rooms to be applied. In modern warships the helmsman is stationed on the bridge and steers the ship either by a miniature wheel or by a handle-bar similar to an aircraft joystick. Engine speed and propeller pitch controls are also sited on the bridge and together with the steering control they form part of an integrated ship control system. Fig 10-1 shows an example of a quartermaster's console on the bridge of a ship, from where the helmsman steers the ship and controls the main engines under the direct supervision of the Officer of the Watch. The console also includes facilities for automatic steering (`auto-pilot') controlled by one of the ship's gyro compasses.

10002. How a Ship is Steered

The movement of the steering wheel or handle-bar sets in motion the steering mechanism which turns the rudder(s). When the ship is moving ahead the rudder turns the ship by swinging her stern away from, and her bows towards, the direction desired; it has the opposite effect when the ship is moving astern. When going ahead the ship's head always pays off in the same direction as the top spokes of the wheel or the top of the hand-grips of the handle-bar. If you wish the ship's head to go to port the top spokes of the wheel or the top of the hand-grips must be moved to the left. When moving astern the direction in which the stern pays off is the same as that in which the top spokes or top of the hand-grips are moved. As ships are fitted with either a wheel or handle-bar, the term wheel in the remainder of the chapter means either wheel or handle-bar as appropriate.

a. **Rudder Angle**. Within the limits of the movement of the rudder, the greater the angle between the rudder and the fore-and-aft line of the ship the quicker she will swing and the smaller will be her turning circle. A ship is usually designed to allow for a maximum rudder angle of 35° each side of the midships position; although in some larger ships this angle may be increased up to 45°.

b. **Putting on or Taking Off Rudder**. Movement of the wheel is indicated by a pointer which moves over a scale graduated either side of midships to the maximum rudder angle. The control should be moved steadily until the required rudder angle has been put on. Any desired rudder angle can be put on, up to the maximum when the wheel or handle-bar, and rudder, are said to be hard over. It is usual to limit the normal maximum rudder angle to 5° less than the maximum either way.

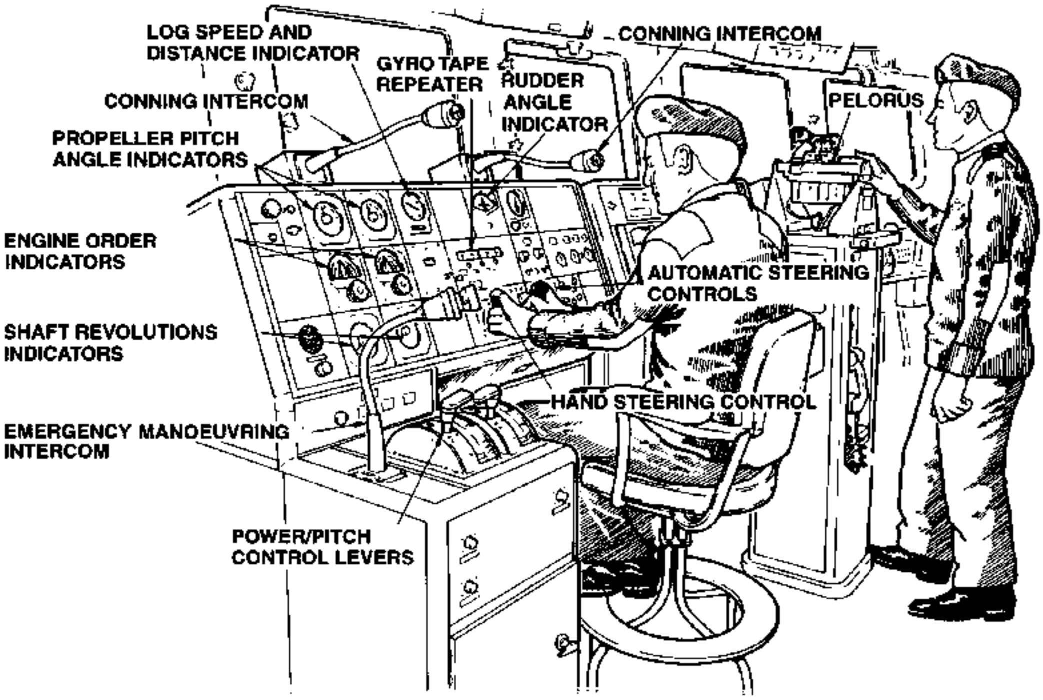

Fig 10-1. Steering and Conning Instruments on the Bridge

10003. Types of Propeller

Conventional propellers are of two main types: *Fixed-pitch (FP)* and *Controllable-pitch(CP)*. There are also some more specialised types of propellers, of which the *Vertical Axis or Cycloidal* propeller, the *Bow Thruster* and the *Active Rudder* are those which concern the Royal Navy. Conventional propellers rotate in the vertical or nearly vertical plane and the shiphandler describes the direction of rotation as *right-handed* or *left-handed.* A right-handed propeller turns in a clockwise direction when viewed from aft, and a left-handed propeller turns counter-clockwise.

a. *Fixed-pitch (FP) propellers.* The blades and the boss of a fixed pitch propeller are manufactured as one solid unit. The designer sets the blades at a fixed angle in order to generate thrust efficiently at economical speed. As it is not possible to alter the pitch of the blades, a fixed-pitch propeller must rotate in the opposite direction when astern thrust is required. So ships fitted with fixed pitch propellers must have the means of reversing the direction of shaft rotation. This, in the days of steam-turbines required a separate astern turbine; but nowadays, warships fitted with fixed-pitch propellers have either reverse gearing to change the direction of rotation or, if powered by diesel-electric, have electric motors that can be put into reverse. The only way of increasing or decreasing the thrust of a fixed-pitch propeller is by altering the speed of rotation. Single fixed-pitch propellers fitted to H M Ships are all right-handed. Twin fixed-pitch propellers in H M Ships are always arranged to turn outwards when going ahead, the port turning to the left and the starboard turning to the right. This ensures maximum lateral turning forces when turning at rest.

b. *Controllable-pitch (CP) propellers*. Fitting controllable-pitch propellers avoids having complex reversing gear for high-speed engines such as gas turbines. To change a controllable-pitch propeller from propulsion ahead to propulsion astern, the blades are rotated in the hub from ahead-pitch to astern-pitch while the propeller continues to revolve in the same direction. This is done hydraulically. Once the blades are set at maximum pitch, more thrust is obtained by increasing shaft revolutions with more engine power. The twin CP propellers fitted in H M Ships are inward-turning, ahead and astern. That is to say, the port propeller is right-handed and rotates clockwise and the starboard propeller is left-handed and rotates counter-clockwise. This has the advantage of focusing the wake and increases the effectiveness of the rudders. The important point to remember is that each propeller always rotates in the same direction, irrespective of whether ahead, astern or zero-pitch has been selected. The only way of stopping the propeller is to apply the shaft brake.

10004. Bow Thrusters (Fig 10-2)

A bow thruster is fitted to enable precise manoeuvring, and consists of one or more impellers mounted in a tunnel that runs from side to side of the ship near the bow. The impeller generates a flow of water to push the bow in the required direction. Some bow thrusters are fitted with a controllable-pitch impeller to allow the direction of flow to be altered by reversing the pitch; others have two separately driven impellers, one to produce flow to starboard and the other a flow to port. A bow thruster exerts more sideways force when a ship is stopped than when she is under way; since this force decreases when the ship's speed is above 4 knots and becomes negligible at 7 knots, they are not used to assist altering course at any speed.

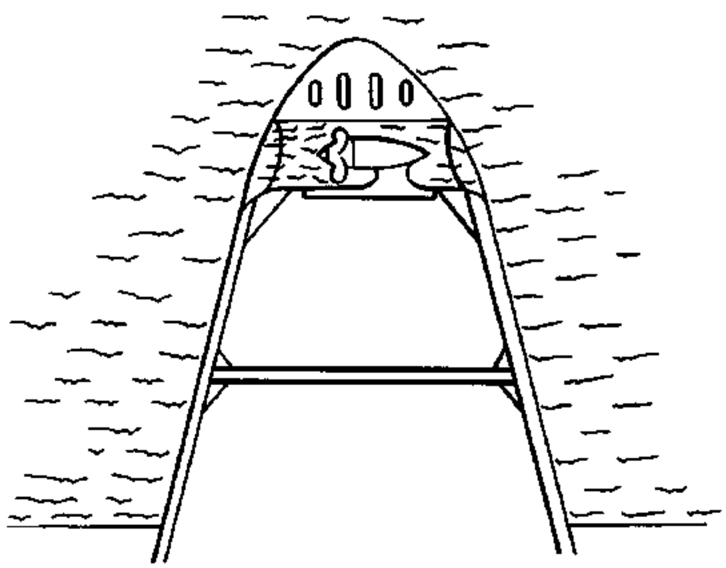

Fig 10-2. Bow Thruster Arrangement

10005. The Voith-Schneider Propulsion System (Fig 10-3)

A Voith-Schneider propulsion unit is a vertically mounted paddlewheel with blades that are controlled to feather at different angles during each rotation of the unit. A full description of the system is given in **BR 45(6) Admiralty Manual of Navigation**.

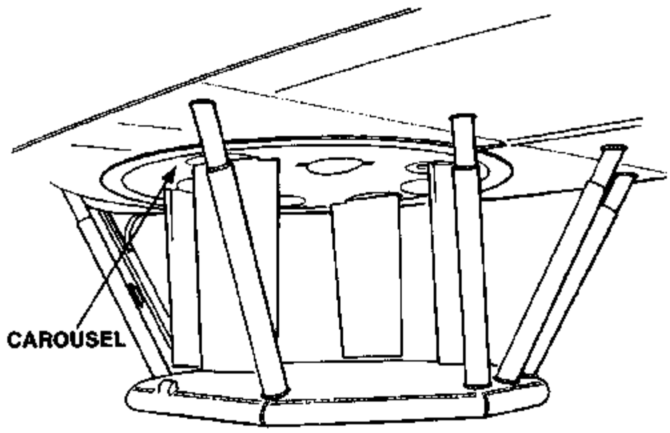

Fig 10-3. Voith-Schneider Propulsion Unit

10006. Active Rudder (Fig 10-4)

The active rudder is constructed with a small propeller built into the trailing edge. The propeller axis turns with the rudder, and the propeller itself can be reversed to produce a flow in either direction on to the rudder. An active rudder is used for accurate manoeuvring when the vessel is stopped or nearly stopped and also for propelling the vessel at very slow speeds. An active rudder propeller may be driven either by a reversible electric motor mounted in the rudder or by a mechanical shaft passing through the rudder stock. Some classes of MCMV have active rudders.

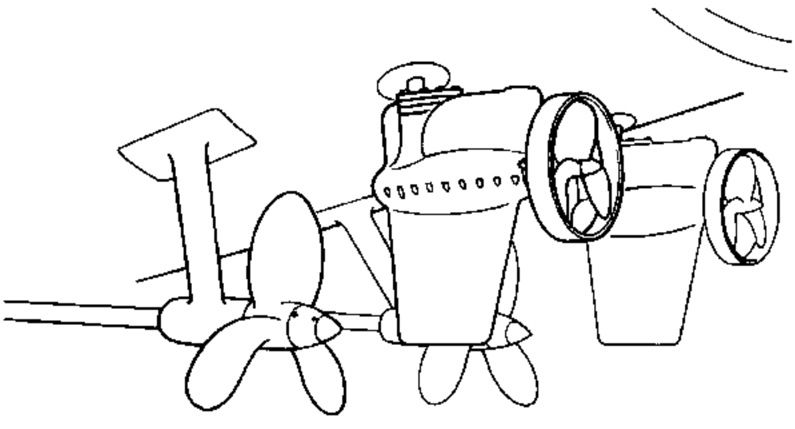

Fig 10-4. Active Rudder

10007. Types of Propulsion System

As shown in Table 10-1, gas turbines, diesel engines and diesel-electric units form the main propulsion systems in the surface fleet and the steam turbine has been largely replaced. Officers of the Watch, quartermasters and helmsmen must be thoroughly familiar with the arrangements in their ships and the methods by which they are controlled.

Table 10-1. Propulsion Systems Fitted in HM Ships

	Engine	**Propellers**	**Rudders**
LPD	2 x 6.25MW Diesel Electric 1 x 5.6 MW Diesel Generator Bow Thruster	2 FP outward	2
LPH	2 Diesel Bow Thruster	2 FP outward	2
CVS	4 Olympus COGAG	2 FP outward	2
Type 42	2 Olympus 2 Tyne COGOG	2 CP inward	2
Type 22 Batch III	2 Spey 2 Tyne COGAG	2 CP inward	2
Type 23	2 Diesel Electric 2 Spey CODLAG	2 FP outward	2
Castle OPV	2 Diesel	2 CP inward	2
Hunt class MCMV	2 Diesel 1 Diesel Slow Speed Drive Bow Thruster	2 FP outward	2
Sandown class SRMH	2 Diesel through fluid couplings 1 Diesel Electric for Slow Speed Drive	Voith-Schneider cycloidal propeller units. Bow-thruster with electric pumps	
River class OPV	2 Diesel	2 CP inward Bow Thruster	2
SVHO	Diesel electric 3 main Generators	Azimuthing Thrusters Bow Thrusters	
Archer	2 Diesel	2 FP outward	2

10008. Gas Turbine Propulsion

Gas turbines are now the most widely fitted main propulsion machinery in the Royal Navy. They respond well to control by automated, remote control systems, which saves significantly on operating manpower. Their maintenance is straightforward, which again reduces the manpower required, and the engines themselves produce a high power output for their weight. Another significant advantage of gas turbine engines is that they can be quickly started, so the notice required to obtain propulsion power is much less than that for steam plant. This improves safety considerably when at anchor. The marine gas turbines now in service in H M Ships are derived from their aero engine counterparts. The three engines in use are: the Olympus (rated at 18.3 MW), the Tyne (3.5 MW), a smaller, faster running engine used for cruising at economical speeds, and the Spey (12.6 MW). With the exception of the Type 23 frigates, which are powered by diesel-electric propulsion, one or two of these three types of gas turbine will be found in the CVS and all destroyers and frigates in the fleet.

10009. Arrangements of Gas Turbines in HM Ships

There are two arrangements of engines to be found in gas turbine powered ships. The first arrangement is *Combined Gas OR Gas (COGOG)* in the Type 42 destroyers, and the Type 22 (Batch 1 and 2) frigates. These ships are fitted with 2 Tyne and 2 Olympus or Spey engines. Only one type of engine at a time can be clutched to each propeller shaft, thus the OR, but there is no reason why an Olympus engine should not drive one shaft and a Tyne the other. The basic COGOG arrangement is to have an Olympus engine driving one end of the primary pinion shaft in the gearbox and a Tyne engine driving the other end. The engines drive through Synchronous Self Shifting (SSS) clutches, which give a smooth changeover from one engine to the other to drive the propeller shaft. The other arrangement is *Combined Gas AND Gas (COGAG)*. The Type 22, Batch 3 frigates, fitted with 2 Spey and 2 Tyne engines, and the CVS, fitted with 4 Olympus engines, have this arrangement. It allows either one or two engines together to drive the same shaft. Because the Tyne engine runs at approximately four times the speed of rotation as the Olympus and Spey engines, its output has to be reduced by a primary gearbox between the engine and the main gearbox.

10010. The Controllable Pitch Propeller System

The propeller shafts in the Type 22 frigates and the Type 42 destroyers rotate inwards only, so astern power is produced by changing the controllable pitch propeller blades to astern pitch. Fine control of the ship's speed at slow speeds is achieved by varying the pitch of the blades. For the first 22% of power ahead or astern, blade pitch is altered as necessary from fine to maximum while shaft rotation is maintained at a constant 50 rpm by varying the engine power. Above lever 22, the propeller blades are set at maximum pitch and speed depends on the rate of rotation produced by engine power. The Type 22, Batch 3 frigates are fitted with a Spey and Tyne COGAG arrangement on each shaft. The options in this arrangement are to drive each shaft with a Tyne alone, a Spey alone or with both engines together. This gives even more flexibility than the COGOG arrangement.

10011. The COGAG Arrangement in the CVS

The CVS has four Olympus engines in a COGAG arrangement. Each shaft can be driven either by one or both of their respective engines. This class of ship has fixed pitch propellers and is therefore fitted with reversing gearboxes on each shaft. Fluid couplings provide the drive through SSS clutches at slow speeds and when manoeuvring. At higher speeds the engines are connected to the shafts by a direct drive.

10012. Control of Propulsion Machinery in COGOG and COGAG ships

In the Type 42 destroyers and Type 22 frigates, the direct control of the propulsion machinery is either from the SCC/MCR or from the bridge. The COGOG or COGAG destroyers and frigates, which have controllable-pitch propellers are fitted with Power Pitch Control Levers (PPCL) for controlling the pitch, the power and the direction of thrust from the bridge. When manoeuvring, the propulsion of these ships will therefore usually be in 'Bridge Control'. When in 'MCR/SCC Control', orders are transmitted from the bridge to the MCR/SCC by *lever order units* and *engine telegraphs*. If the propulsion controls malfunction, there are a number of fallback options. In the Type 22, the SCC can revert to servo-manual operation of the plant by using push buttons on the control console to operate the Controllable Pitch Propeller (CPP) pumps and the engine throttles independently. The Type 42 does not have this facility, but in both classes of ship, if a complete failure of the automatic machinery control system occurs, the engine throttles, CPP pumps and shaft brakes can be manually operated in *Local Control*. Personnel have to be stationed at each shaft for 'Local Control', and this method of propulsion control gives the slowest response because engine orders and PPCL changes have to be relayed from the MCR/SCC. Although there are facilities for 'Bridge Control' in the CVS, the propulsion is usually controlled in these ships by the MCR. There are also local controls in the CVS for controlling engine throttles and gearboxes by hand if the MCR control system breaks down.

10013. The Type 23 frigate (CODLAG)

The requirements for a low noise signature and high endurance have led to the adoption of a new type of propulsion system for the Navy. This is a Combined Diesel Electric AND Gas Turbine arrangement (CODLAG). The Type 23 frigate has two shafts with fixed pitch propellers. Each shaft can be driven by an electric motor wound directly on to it and by a Spey gas turbine through a double reduction gearbox and SSS clutch. The ship has four 1.3 MW electric generators to supply power for propulsion and for the ship's electrical requirements. Under normal circumstances, the electric motors will produce up to 1.5 MW on each shaft at 90 rpm, which is equivalent to about 14 knots. The Spey gas turbines can then provide another 12.75 MW of power on each shaft to bring the ship up to full speed at 180 rpm. CODLAG ships, such as the Type 23, do not have arrangements for 'Bridge Control' and are, therefore, always handled in 'SCC Control' with orders transmitted to the SCC by Power/Revolution and Engine telegraphs.

10014. The Electro-hydraulic Steering System

The steering system in major warships is electro-hydraulic. Steering control instruments generate electrical signals to control hydraulic pumps to turn the rudder, a feed-back signal from the rudder head then stops the rudder at the required angle. To reduce the chances of total steering failure, ships are fitted with duplicate systems, one to port and the other to starboard, and arrangements are made that, if one system breaks down, the other automatically takes over. The quartermaster's console contains the following three instruments: the *hand steering unit* for steering by hand, and the *set course* and *auto-steering* units for steering a course automatically.

10015. Operation of the Electro-hydraulic Steering System

A simplified diagram of a steering system is shown in Fig 10-5. The components are situated in three compartments: the bridge, the secondary steering position (SSP) and the steering gear compartment. The signal generated by movement of the handlebar is routed through the hand steering unit in the SSP to the steering gear compartment. There it is fed to the *rudder servo amplifier* to produce power for the *rudder servo gearbox* to operate the *Steering Control Box* mechanically. The function of the Steering Control Box is to control the hydraulic output from a continuously running VSG pump. The hydraulic pressure from the VSG pump moves the rudders through a *rotary vane actuator*. In order to stop the rudders at the required angle, there is a mechanical link from the rudder heads to a reset mechanism in the steering control box, this centres the control levers of the VSG pumps and so stops the delivery of hydraulic pressure.

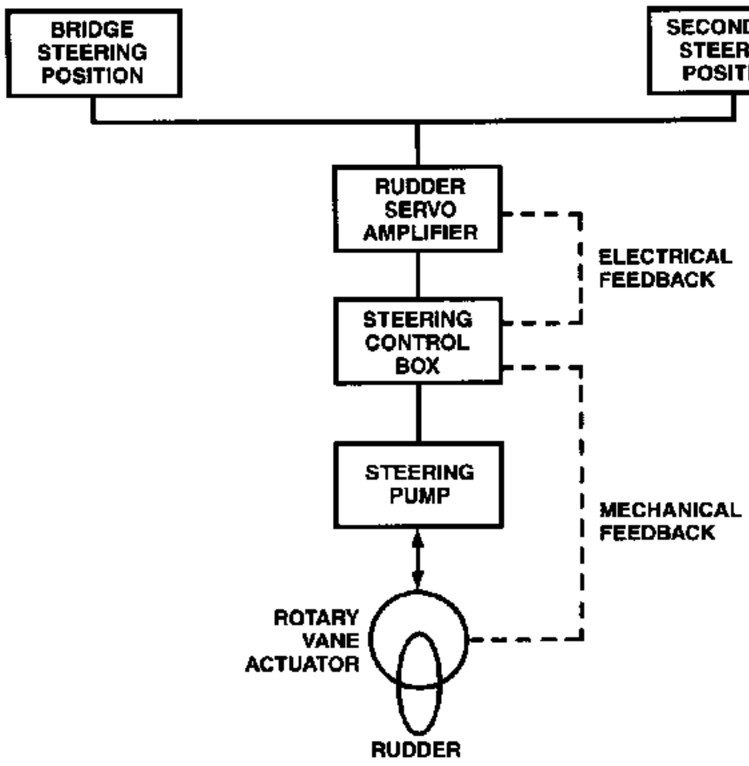

Fig 10-5. Electro-hydraulic Steering System

10016. Hand Steering Unit (Fig 10-6)

This unit is fitted with a handlebar for steering the ship by hand and has the various selection and alarm buttons that are described below.

a. **Handlebar Steering**. The helmsman steers by rotating the handlebar to the required rudder angle up to a limit of 35 degrees as shown by the pointer. There are two methods of hand steering: *self centring* where the handlebar returns to amidships when released; *ratchet* where the rudder is offset in 1° steps to port or to starboard if, say, weather helm is required, but the handlebar does not automatically re-centre when switched to 'ratchet'.

b. **Mode Selection**. There are buttons on the Hand Steering Unit for changing from hand to automatic steering. The appropriate button lights up to show which mode is in use.

c. **The System Selection Switch** switches to either the port or starboard steering control circuit. An indicator lamp shows when there is a fault in the steering control system in use.

d. **Weather Helm Trim Control**. The helmsman use this control to set rudder trim to an angle of up to 10º to port or starboard.

e. **The Off-course Alarm** warns if there is any deviation from the set course when in automatic steering.

f. **The Compass Follow Alarm** illuminates when there is a gyro compass error of more than 2º. It is then necessary to change to hand steering.

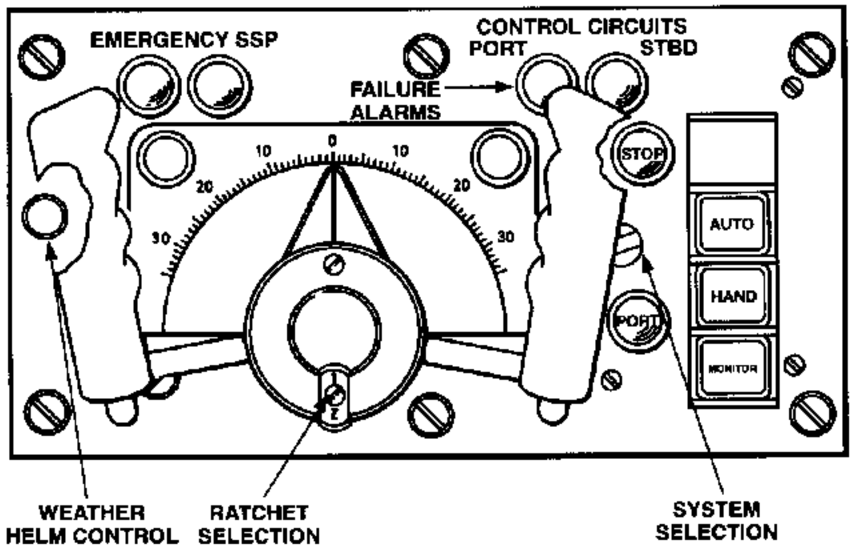

Fig 10-6. Hand Steering Unit

10017. Automatic Steering

The quartermaster's console contains the *Set Course Unit* and the *Auto-steering Unit*, both of which are used for automatic steering.

a. **Set Course Unit**. The helmsman sets the course to the nearest ten degrees on the 'ship outline' control (Fig 10-7) and then to the nearest degree on the inner, fine control. The unit compares the ordered course with the compass course and generates an error signal to operate the rudder.

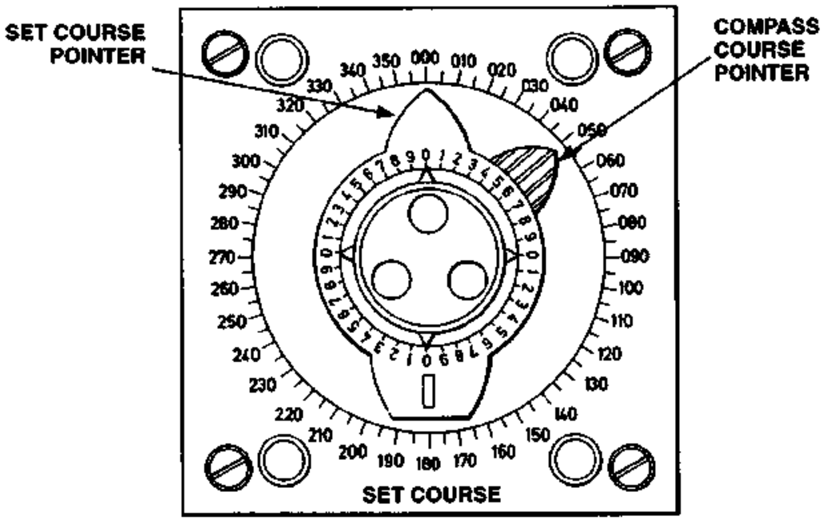

Fig 10-7. Set Course Unit

b. **Auto-steering Unit**. This allows the rudder control signal to be modified to allow for *rudder limits, yaw, ship's speed* and *weather helm*. Fig 10-8 shows the switches for setting rudder limits and yaw. Ship's speed is fed from the ship's log; if the log fails, however, there is a switch for setting the ship's speed manually. Weather helm, which is monitored continuously when in hand steering, is stored in the unit's memory and becomes immediately available on changing over to automatic steering.

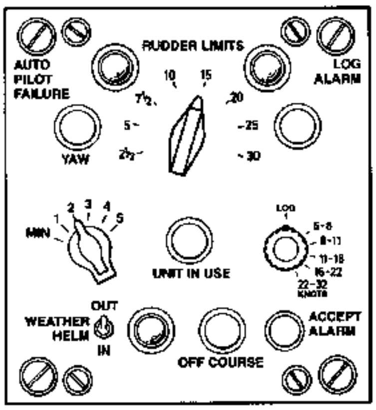

Fig 10-8. Auto-steering Unit

10018. Selection of Steering Control

In an emergency, the helmsman can change from automatic steering to hand steering by rotating the handlebar fully in either direction. This overrides the automatic mode of steering and immediately puts on full port or starboard rudder. The helmsman must ease the wheel as soon as the indicator lamp lights to show that the steering is in the hand mode.

a. **Changing to the Secondary Steering Position** is controlled by a changeover switch on the Hand Steering Unit in the SSP. The procedure for doing so will be laid down in Ship's Standing Orders. Automatic steering is not available in most warships at the SSP.

b. **Emergency Steering**. Should damage or an electrical fault in either control system make it impossible to steer from the bridge or the SSP, the ship can be steered under local control from the Steering Gear Compartment. Provided one of the two steering motors is running to produce hydraulic power, the *local handwheel* will control rudder movement. But, if there is no electrical power, resort must be made to the hand pump to centralise the rudder or set it to a given angle.

c. **Steering Positions**. All major warships can be steered either automatically or by hand from the Quartermaster's console. If the bridge is damaged, the *Secondary Steering Position* has facilities for steering by hand and for transmitting propulsion orders to the SCC/MCR. As a last resort, warships have an emergency steering position in the Steering Gear Compartment.

10019. Conning Orders

The term *Conning the ship* means controlling the ship by giving steering or propulsion orders to the helmsman. Other than the Captain, only the Officer of the Watch may give conning orders. The helmsman always acknowledges a conning order by repeating it before taking action. When a conning order is not repeated correctly, the Officer of the Watch should give the order again firmly and clearly. The OOW should always check the rudder indicator to see if the rudder has moved in the right direction. If the helmsman puts on wheel in the wrong direction, the OOW should correct it by ordering 'MIDSHIPS' and then giving the wheel order again.

10020. Manual Steering Conning Orders

a. **Wheel Orders**. These are conning orders to put the rudder over in a given direction to a particular angle, eg. '*STARBOARD TWENTY*'. Wheel orders are given by the Captain or OOW when he wishes either to start altering to a given course, or to control the heading of a ship when no course has been ordered. On receiving a wheel order, the helmsman repeats the order and turns the handlebar or wheel in the required direction to the angle shown on the wheel indicator on the Quartermaster's Console. The OOW checks the rudder indicator. When this has been done, he reports that the amount of wheel ordered is 'on', eg. '*TWENTY OF STARBOARD, ON*'.

b. **Altering Course**. To alter course by more than 20^o, the Officer of the Watch starts by giving a wheel order, and follows this by telling the helmsman the new course to which the ship is turning, eg. *'STARBOARD TWENTY, ALTERING 340o'*. The helmsman acknowledges by repeating the order, and reports the rudder angle set, eg. *'STARBOARD TWENTY, ON'*. As the lubbers line passes through a heading 15^o before the new course, the helmsman reports to the OOW, eg. *'PASSING 325'*. From this point, the Officer of the Watch cons the ship on to the new course, first by easing the helm as she approaches it, eg. '*EASE TO TEN*', and then by taking the swing off with opposite wheel, eg.*'PORT TEN'*. Finally, when on or near the new course, he will order '*MIDSHIPS, STEADY*'; the helmsman will steer the heading shown by the lubbers line when the order '*STEADY*' is given unless the Officer of the Watch gives him a another course close to it to steer, eg.'*STEER 342 DEGREES'*.

c. **Small Alterations of Course**. When making a small alteration of course of up to 10^o, the OOW will give a wheel order followed by the course required to steer, eg. '*STARBOARD FIFTEEN, STEER 312^o'*. The helmsman repeats this, brings the ship to the course ordered and, when steady on the new course, reports: eg.*'COURSE 312^o*.

10021. Automatic Steering Conning Orders

When ordered, the helmsman changes from *hand* to *automatic steering* by pressing the mode selection button on the Hand Steering Unit; the helmsman then steers by setting courses on the Set Course Unit. To alter course, the Officer of the Watch gives the order `Set course ....', eg.*'SET COURSE 053 DEGREES'*. The helmsman then rotates the outer `ship-shaped' knob to the approximate course and adjusts to the exact course with the inner, fine control knob (Fig 10-7). Automatic steering brings a ship the short way round to a new course; so, if the Officer of the Watch wishes to make an alteration of course of more than 180^o, he must order the alteration in two steps.

To change the rudder limits, reduce yaw, apply weather helm or to set ship's speed if the log breaks down, the Officer of the Watch orders the helmsman to make settings on the Auto-steering Unit, eg. *`SET RUDDER LIMITS TO 20 DEGREES'*.

10022. Propulsion Control

Propulsion control varies with the propulsion machinery fitted and whether the ship has Fixed Pitch or Controllable Pitch propellers. Most warships, except for the Type 23 Frigate, have the choice of altering the direction and power of propulsion thrust either directly from the bridge (*Bridge Control)* or by transmitting telegraph (and sometimes telephone) orders to the MCR/SCC (*MCR/SCC Control*). The conning orders to be given depend on which method of control is being used and what propulsion control instruments are fitted. The instruments used in different classes of ship for Bridge Control and MCR/SCC Control are shown in Tables 10-2 and 10-3 below.

Table 10-2. Instruments for 'Bridge Control'

CLASS OF SHIP	DIRECTION OF THRUST	PROPULSION POWER
CVS	Engine Telegraphs	Power Demand Lever (PDL) for each shaft *or* Revolution Telegraph for each shaft
TYPE 22	Power Pitch Control Lever(PPCL) for each shaft	
TYPE 42	Power Pitch Control Lever(PPCL) for each shaft	
TYPE 23	-	-

Table 10-3. Instruments for 'MCR/SCC Control'

CLASS OF SHIP	ENGINE/DIRECTION OF THRUST ORDERS	PROPULSION POWER ORDERS
CVS	2 Engine Telegraphs	2 Revolution Telegraphs (1 for each shaft)
TYPE 22	2 Engine Telegraphs	2 Lever Order Instruments. (1 for each shaft)
TYPE 42	2 Engine Telegraphs	1 Lever Order Instrument Telephone (for ordering different power on each shaft)
TYPE 23	2 Engine Telegraphs	2 Digital Power Telegraphs (1 for each shaft)

Notes.

1. The CVS, in Bridge Control, has Power Demand Levers for the direct control of propulsion power on each shaft from the bridge, but reversing or stopping shaft rotation has to be ordered by Engine Telegraph. When in MCR/SCC control, either the Lever Order Instrument or the Revolution Telegraph may be used.

2. The Type 22 frigates have twin Lever Order Instruments for transmitting separate propulsion power orders for each shaft when in SCC Control.

3. The Type 42s have only a single Lever Order Instrument for the transmission of propulsion power orders to the MCR/SCC when in MCR/SCC Control. These will apply to both shafts. A separate order for one shaft may be given by telephone, if different power is required on each.

4. The Type 23 frigate does not have arrangements for Bridge Control. Engine orders are transmitted to the SCC by Engine Telegraphs and power orders as a percentage by Digital Power Telegraphs. In order to standardise conning orders between different classes of ship, a power order in a Type 23 is given as a 'lever percentage'.

*5. Minor war vessels are equipped with the various types of propulsion control arrangements described in **BR 45(4) Admiralty Manual of Navigation.***

10023. Propulsion Conning Orders

These come under three headings:

a. **Engine Orders** to order the direction and overall amount of propulsion thrust: *Ahead, Astern* and *Stop, Slow, Half, Full.*

b. **Power Orders** to order the propulsion power by lever percentage or shaft revolutions.

c. **Shaft Brake Orders** to stop a shaft from rotating by applying the brake, or to release the brake.

10024. Propulsion Conning Orders when in Bridge Control

These are preceded by the order 'Set', followed by which lever or levers are to be used, then the direction of thrust and the power required, eg. '*SET: PORT LEVER - ASTERN - FIVE ZERO'*. This is repeated by the helmsman. In the CVS, the helmsman first transmits 'Astern' on the port engine telegraph and then sets the port Power Demand Lever to 50. In the Types 22 and 42 frigates and destroyers, the helmsman has only to operate one control for each side of propulsion machinery - the Power Pitch Control Lever - so he sets the port PPCL to 50 astern. When using Power Pitch Control Levers,'*LEVER ZERO'* replaces the engine order'Stop', and the orders 'Slow Ahead/Astern' and 'Half Ahead/Astern' are not used. When the order '*FULL AHEAD'* or '*FULL ASTERN'* is given, MCR/SCC Control is adopted immediately.

10025. Propulsion Conning Orders when in MCR/SCC Control

The Engine telegraph order precedes the lever percentage order or, when being used, the revolution order. Engine orders take the following form:

STOP / SLOW / HALF / FULL

AHEAD / ASTERN

PORT / STARBOARD / BOTH ENGINES

a. In ships fitted with two Lever Order Instruments, the order 'Set' precedes the shaft and lever power required, eg.

'SET - PORT/STARBOARD LEVER - FOUR ZERO'

b. In ships fitted with one Lever Order Instrument, the order ‘Set’ precedes the lever power required on both shafts, eg.

‘SET - LEVER - FIVE FOUR’.

Note. *Both propulsion units will then produce the same power if both engine telegraphs are at Half, although one engine may be Ahead and the other Astern. If different power settings are required on each shaft, orders for this are given to the MCR/SCC by telephone.*

c. Revolution orders are given as follows, eg.

‘SET - (PORT/STARBOARD) REVOLUTIONS FIVE FOUR’

10026. Emergency Slow Procedure

If an emergency develops requiring the MCR to reduce power, EMERGENCY SLOW procedure will be initiated by the MCR. It should be noted that the MCR will misalign the telegraphs to SLOW **In the direction propelling at the time of the emergency**. Hence, if propelling ahead, SLOW AHEAD will be used but if propelling astern, telegraphs will be misaligned to SLOW ASTERN. Standard class emergency procedures should then be followed.

10027. Starting-up Procedure

Condition	-	Telegraph at Stop, Lever Order Instrument(s) at zero. Levers at zero position.
OOW to SCC/MCR	-	"Confirm propulsion is in SCC/MCR control"
SCC/MCR to OOW	-	"In SCC/MCR control".
OOW orders	-	"Start and select Port and Starboard Tyne" (or Spey or Olympus).
MCR/SCC	-	Repeats Order
MCR/SCC reports	-	"Port and Starboard Tynes running and selected in MCR/SCC control. Ready to obey telegraphs. Limitations ......"
OOW to QM	-	"Check telegraphs at stop".
QM to OOW	-	"Telegraphs at Stop".
OOW to QM	-	"Ring on Lever ......" (Lever setting as required).
QM to OOW	-	"..... Lever setting ordered".
OOW to EOOW	-	"Obey Telegraphs"

EOOW to OOW	-	"Obey Telegraphs"
OOW to QM	-	"Obey Telegraphs"
QM to OOW	-	"Obey Telegraphs"

If the intention is to leave harbour in bridge control:

OOW to SCC/MCR	-	"Prepare to change to Bridge Control".
SCC/MCR	-	Repeats Order.
QM	-	Uncovers levers and aligns them with repeat pointers.
OOW to SCC/MCR	-	"Levers aligned change to Bridge Control"
SCC/MCR	-	Selects Bridge Control and reports, "Bridge Control Selected".
OOW to SCC/MCR	-	"Testing" Tests Bridge Control and reports "Bridge Control Confirmed".
OOW to SCC/MCR	-	"In Bridge Control, disregard Telegraphs".
OOW to QM	-	"Obey Lever Orders".
OOW to QM	-	"Set Port and Starboard Telegraphs half ahead and lever order instrument(s) to 30".
QM to OOW	-	"Port and Starboard Telegraphs half ahead, lever order instrument(s) set to 30".
OOW to SCC/MCR	-	"Any deviation from half ahead, lever 30, and the MCR/SCC are to assume MCR/SCC control and obey telegraphs".

10028. Shaft Brake Orders

Before ordering a shaft brake to be operated, the ship's speed and the shaft revolutions should be brought below the operating limits required, and the bridge should warn the MCR/SCC. In Bridge Control in the Types 22 and 42, the helmsman operates the shaft brakes directly from the bridge by putting the lever into the *brake indent.* In MCR/SCC control, the bridge will order the MCR/SCC to operate the shaft brakes by telephone or, in the case of the Type 22, by putting the Engine Telegraph to *Brake*. In all cases the Officer of the Watch gives the conning order:

`APPLY / RELEASE - PORT/STARBOARD/BOTH - SHAFT BRAKE(S)'.

The helmsman then takes the following action:

a. If in Bridge Control in a Type 22 or 42, he reports

‘PORT/STARBOARD/BOTH - SHAFT BRAKES - APPLIED’

b. If in MCR/SCC control in a Type 22 with a brake telegraph, he reports:

‘PORT/STARBOARD/BOTH - SHAFT BRAKES - REPEATED BRAKED’

c. If in MCR/SCC control in a Type 42, he puts the telegraph to ‘Stop’ and passes the following order to the MCR/SCC by telephone:

‘APPLY - PORT/STARBOARD/BOTH - SHAFT BRAKES’

After which, the MCR/SCC reports ‘....BRAKE(S) APPLIED - SHAFT STOPPED’.

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LIST OF EFFECTIVE PAGES

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	3-101/3-102	Change 1
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	3-113/3-114	Change 2
	3-115/3-116	Change 8
	3-117/3-118	Change 4
	3-119/3-120	Change 1
	3-121/3-122	Original
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	3-155 to 3-162	Original
	3-163 to 3-172	Change 8
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	3-175 to 3-180	Change 3
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	3A-1/3A-2	Change 5
	3A-3/3A-4	Change 1
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Chapter 4 Divider		Original
Chapter 4	4-1/4-2	Change 8
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	4-11/4-12	Change 2
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	4-15/4-16	Change 2
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Chapter 5 Divider		Original
Chapter 5	5-1/5-2	Change 8
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Chapter 6 Divider		Original
Chapter 6	6-1/6-2	Change 8
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	6-53/6-54	Change 4
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	6A-1 to 6A-6	Original
	6A-7/6A-8	Change 8
	6B-1 to 6B-14	Change 8
	6C-1 to 6C-24	Change 4
	6C-25/6C-26	Change 8
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Chapter 7 Divider		Original
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Chapter 8 Divider		Original
Chapter 8	8-1/8-2	Change 8
	8-3/8-4	Change 1
	8-5 to 8-10	Change 8
	8-11/8-12	Original
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	8-17/8-18	Original
	8-19 to 8-22	Change 8
	8-23/8-24	Original

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Subject/Chapter	Page	Status
Chapter 9 Divider		Original
Chapter 9	9-1/9-2	Change 8
	9-3/9-4	Change 6
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Chapter 10 Divider		Original
Chapter 10	10-1/10-2	Change 8
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