



SEAMANSHIP TRAINING MANUAL

2001 SECOND EDITION

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Foreword

These notes are produced to assist both Staff and Cadets with Seamanship Training, to provide an individual ready reference for subjects contained within the Sea Cadet Training Syllabus. They are by no means a definitive reference manual with comprehensive notes, they are however produced to a level required for Sea Cadet Corps reference.

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Sources of Reference

Sea Cadet Training Instructions
BR 67 Admiralty Manual of Seamanship (1995)
BR 67(1) Admiralty Manual of Seamanship (1979)(Volume 1)
BR 67 (2) Admiralty Manual of Seamanship (1981)(Volume 2)

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CHAPTER ONE

GENERAL SEA TERMS

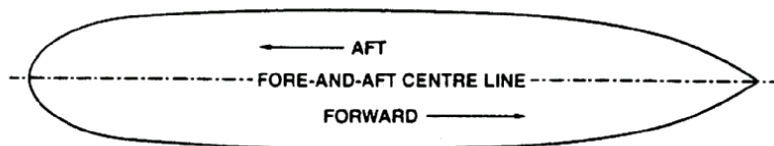
- 0101 **Principal Parts of a Ship**
- 0102 **Miscellaneous Parts of a Ship**
- 0103 **Miscellaneous Sea Terms**
- 0104 **Terms used in connection with direction relative to a Ship**

0101 **PRINCIPAL PARTS OF A SHIP**

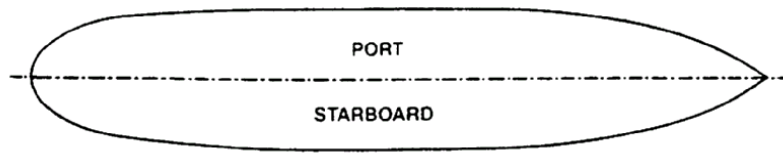
The Hull	The main body of the ship.
Stem	The very front end of the Hull.
Stern	The very back end of the Hull.
Fore Part	Front third of the Hull.
Midship Part	Middle third of the Hull.
After Part	Back third of the Hull.



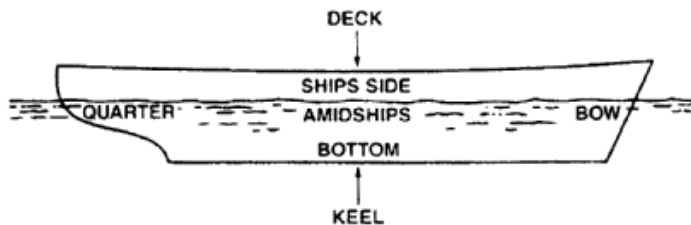
Forward	Direction towards the front of the ship (Stem).
Aft	Direction towards the back of the ship (Stern).
Fore and Aft Line	Any line which runs lengthways in the ship from end to end.
Fore and Aft Centre Line	The line joining the middles of the Stem to Stern.



Port Side	Left hand side of the ship when facing forward.
Starboard Side	Right hand side of the ship when facing forward



Bow	Curved surface of the Hull either side of the Stem.
Quarter	Curved surface of the Hull either side of the Stern.
Amidships	Surface of the Hull between the Bow and the Quarter.
Deck	Any surface underfoot or the floor of a compartment.
Upperdeck	The highest complete deck (except in aircraft carriers) usually incorporating the Forecastle and Quarterdecks on modern flush-decked ships.
Lowerdeck	The area inside the Hull normally reserved for accommodation.
Quarterdeck	Deck in the after part of the ship.
Forecastle	Deck in the fore part of the ship above the bow.
Waist	Deck in the middle of the upperdeck, between the Quarterdeck and the Forecastle.
Beam	The greatest width of the Hull.



0102 MISCELLANEOUS PARTS OF A SHIP

Inboard	Closer to the Fore and aft Centre line.
Outboard	Closer to the Ship's side.
Athwartships	Direct across the ship from side to side.
Overboard	Over the Ship's side.
Bridge	Part of the ship from where it would be controlled (by the Captain in normal circumstances).
Brow	A narrow platform placed between ship and shore for embarkation and disembarkation.
Gangway	The position in the Ship's side by which the ship is entered or left. Also describes a passageway in a ship and sometimes used to describe the Brow.

Galley	Ship's kitchen.
Heads	Ship's toilets.
Hatch	An opening in the deck to give access to the compartment below.
Ladder	Structure allowing vertical access.
Deckhead	The ceiling of a compartment.
Bulkhead	Walls of a compartment or structure.
Keel	The central spine of the Hull, located on the bottom of the ship and extending Fore and Aft along the centreline.
Draught	The depth of the keel, at its lowest point, below the waterline.

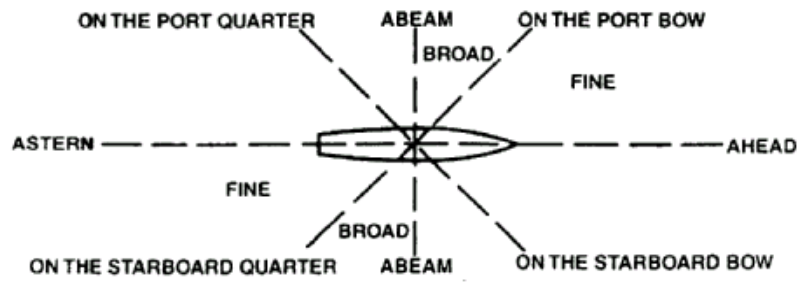
0103 MISCELLANEOUS SEA TERMS

Adrift	Broken away or no longer attached or driven at random by wind and tide. Also meaning late.
Awash	Flooded or level with the surface of the sea.
Way	Movement or momentum through the water, e.g. Headway - a forward movement, sternway - a backward movement.
Underway	A vessel is underway when she is neither anchored, nor secured to a buoy, nor made fast to the shore nor aground.
Belay	To make fast or attach to, e.g. Belay a rope to a cleat. Also meaning to stop or cancel.
Shipshape	Seaman like in appearance, tidy or ready to use.

0104 TERMS USED IN CONNECTION WITH DIRECTION RELATIVE TO A SHIP

Bearing	Direction.
Relative Bearing	Direction of an object relative to the ship. Given either in relation to a part of the Ship or as a bearing in degrees between 0 and 180 from Ahead on each side of the ship. 0 being Right Ahead and 180 being Right Astern. All bearings are prefixed with Red to indicate the Port Side or Green to indicate the Starboard side, e.g. Red 45 or on the Port Bow.
Ahead	Directly in front.
Astern	Directly behind.
Abeam	Directly at right angles to the fore and aft centre line (Port and Starboard).
On the Bow	Midway between Ahead and Abeam (Port or Starboard).
On the Quarter	Midway between Astern and Abeam (Port or Starboard).
Fine	Meaning closer to Ahead or Astern than to Abeam, e.g. Fine on the Port Bow, Fine on the Port Quarter.
Broad	Meaning closer to Abeam than to Ahead or Astern.

General Relative Bearings.



CHAPTER TWO

GENERAL ROPEWORK

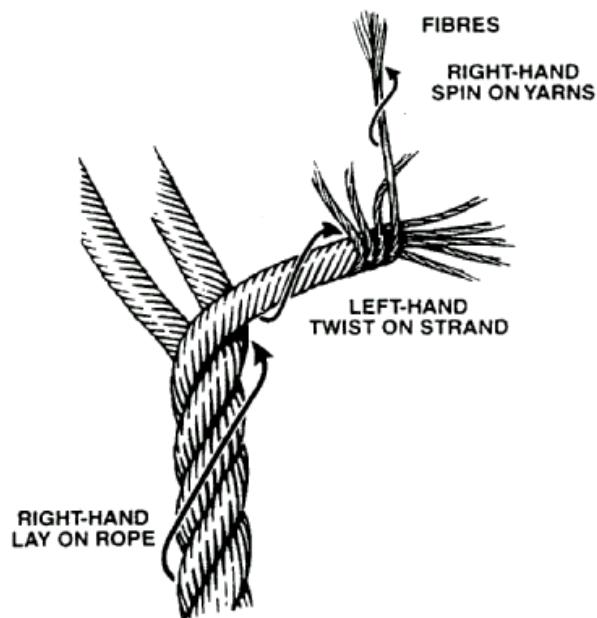
- 0201 Construction of Natural Fibre Rope
- 0202 Care and Maintenance of Natural Fibre Rope
- 0203 Types of Natural Fibre Rope
- 0204 Construction and Characteristics of Man-Made Fibre Rope
- 0205 Types of Man-made Fibre Rope
- 0206 Care and Maintenance of Man-Made Fibre Rope
- 0207 Elementary Safety Rules for Handling Ropes and Hawasers
- 0208 Preparing Ropes for Use
- 0209 Orders and Terms used in Handling Hawasers, Ropes and Cables
- 0210 The Heaving Line

0201 CONSTRUCTION OF NATURAL FIBRE ROPE

Natural fibre ropes are made from **fibres** of varying lengths dependent on their source. These are first combed to make a long even ribbon then twisted into **yarns**. The twist binds the fibres firmly together under strain by friction; the twist can be either right or left-handed. Next a certain number of yarns are twisted together to form **strands**, which are normally 275 metres in length when completed. The number and size of yarns required to make each strand depends on the size of the rope it is intended to make.

Three or four **strands** are now made up into left-handed or right-handed rope. This process is called 'Laying' or 'Closing' and is always carried out in the opposite direction used in the twisting stage. The most common is right-handed laid rope. As the rope is **laid up** its length contracts like a coiled spring, giving it a certain elasticity. In practice, three strands of 275 metres lay up into a rope of about 220 metres in length. The harder the twist given to the strands in laying, the shorter will be the resultant rope and thus a rope is said to hard-laid, ordinary-laid or soft-laid rope. Three strands laid up constitute 'Hawser Laid' rope, which is the type of natural fibre cordage most commonly used within the Corps.

Component parts of a Natural Fibre, Right-handed, Hawser Laid Rope



General Characteristics.

The strands tend to unlay unless the end of the rope is whipped (i.e. bound firmly) with twine. The rope will stretch under load and will not completely recover when the load is removed. The greater the weight on the rope the more it is weakened. 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, the rope shrinks in length in proportion to the amount by which it swells in diameter, but it will recover its length when dry and after use. Rope, which is continually subjected to heat and damp, will lose its elasticity and strength sooner than rope used under normal conditions.

0202 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. Never stow natural fibre cordage away if it is wet, if this is unavoidable it should be brought out and dried at the earliest 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. Rope should be examined for damage, rot and fatigue regularly. Serious damage can be seen when the strands are distorted and bear unusual strains or when the rope becomes opened. Chafing will cause a loss of strength. Rot can be detected by the smell of the rope and by opening out the strands for examination. If the fibres are powdery, discoloured, weak or can be plucked out, rot exists and the rope should be condemned.

Should the fibres appear healthy and strong, all is well. 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 rope. (Battery acid has the same results). Fatigue will show itself in the reduction of the diameter of the rope below its specified size.

If a rope is showing no signs of damage, rot or fatigue, it is unlikely to be much below its full strength but some consideration must be given to its age, weakening may have been caused by constant stretching under heavy load, stowing away wet, subject to extremes of heat and damp, or external or internal friction. If doubts exist as to the serviceability of a rope, it should be condemned.

0203 TYPES OF NATURAL FIBRE ROPE

There are now only two main types of natural fibre rope in use, Manila and Sisal. The fibres of the rope are treated with a rot resistant solution called Pentachlorophenyl laurate (PCPL), which is a fungicide, during the first stage of rope making when the fibres are combed into ribbons.

0203.1 MANILA

This is made from the leaf fibres of the Abaca plant, which is grown in the Philippine islands, also Sumatra and Borneo. When new and untreated it is a deep golden-brown colour. The rope is flexible, durable, strong, impervious to salt water and stands up well to wear and tear. Its advantages over man-made rope are that it stretches less, will surge more readily around a winch or capstan, and does not fuse when heated. In the Royal Navy it is currently used for ammunition whips and as check stoppers for towing operations. More general uses within the Sea Cadet Corps will be where strength and safety are required. Supplied in coils of 220 metres it is marked with a **BLACK ROGUES YARN** in each of two strands throughout its length, (the standard RN supplied Grade 2 rope). Superior Grade 1 rope has a black rogues yarn in each of three strands and the Merchant Grade 3 rope has a black rogues yarn in one strand only.

0203.2 SISAL

This is made from the Agave Sisalana plant, which is a member of the cactus plant. It is principally grown in Brazil, Kenya, Tanzania, Haiti and Java and when new and untreated is hairy and of a pale straw colour. New sisal is as strong as manila, but not as flexible, durable or resistant to wear and weather. It should therefore be examined more frequently for signs of deterioration: It is the most generally used rope within the Corps. Supplied in coils of 220 metres it is marked with one **RED ROGUES YARN** in one strand throughout its length.

0203.3 HEMP

Is not generally available because of its scarcity and high cost. Italian Hemp is the strongest vegetable fibre used in rope making, it is heavier than Manila but is more flexible.

0203.4 COIR

Whilst no longer used in a rope form it is used in the manufacture of fenders and mats. It is made from coconut husk fibres, is very hairy and is dark brown in colour. The weakest of all cordage it is flexible, light and springy.

0204 CONSTRUCTION AND CHARACTERISTICS OF MAN-MADE FIBRE ROPE

The first of the man-made yarns developed for the cordage industry in 1939 was Nylon. Since then there have been many additions with newer materials being developed. Man-made fibre ropes are far stronger than any natural fibre rope size for size, is rot-proof and almost impervious to water. They can be considered non-inflammable in that they do not readily ignite or burn with a flame, but with most they do have a low melting point. Most man-made fibre ropes are made from either continuous filaments, or yarns of staple fibres, but polypropylene ropes can be manufactured from **multifilament, monofilament, staple or film fibre**.

Staple - these fibres vary in length and the processing machine on which they are to be used determines this. 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.

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.

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.

Film-fibre - is composed of fibril produced by longitudinal splitting when an extruded tape or ribbon is twisted into a yarn.

In addition to the yarn/fibre make-up the ropes are laid up as Hawser Laid, Plaited or Braided forms.

0205 TYPES OF MAN-MADE FIBRE ROPE

0205.1 POLYAMIDE

Normally known as Nylon. It is a by-product of coal, of multifilament construction and 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% of its length and has excellent recovery. It does not float and loses approximately 10% of its strength when wet. It has a high melting point, is unaffected by frost and wet, has a high resistance to alkalis but a low resistance to certain acids (may dissolve the fibres). It is supplied in coils of 220 metres and the RN supplied rope is identified by a **GREEN ROGUES YARN** in one strand throughout its length. Because of its elastic properties the RN uses it for towing hawsers and anti-shock strops. Commercially produced Nylon is available however the rogues yarn is BLACK throughout its length.

0205.2 POLYESTER

Normally known as Terylene. It is a by-product of oil, of multifilament construction and is approximately twice as strong as manila of equivalent size. It stretches approximately 36% before parting, used within its safe working load it will stretch 14% of its length and has excellent recovery. The strength is virtually unchanged when wet, it does not float,

has a high melting point and is virtually unaffected by frost. It has a high resistance to acids but not alkalis and has excellent weather and abrasion resistance. It is supplied in coils of 220 metres and the RN supplied rope is identified by a **BLUE ROGUES YARN** in one strand throughout its length. Because of its low stretch, high strength, and excellent capabilities, these ropes are used for replenishment lines, safety nets and signal halyards.

The larger proportion of commercially produced braided ropes are made of polyester and are in general use in numerous situations. The commercial rogues yarns vary greatly in colour therefore care should be taken to identify the type of rope from the drum it is supplied on.

0205.3 POLYPROYLENE

Also known as Ulstron, it is a by-product of oil and is nearly twice as strong as manila of the same size yet is the lightest in weight of the man-made fibre ropes. It stretches up to 44% before parting and used within its safe working load will stretch 17% of its length. It retains its strength when wet, has a low water absorption and will float indefinitely in water; it has a medium melting point and has a high resistance to acids and alkalis. Multifilament and monofilament polypropylene is not normally used for load bearing ropes. It is supplied in coils of 220 metres and is commonly found in varying colours without an identifying rogue's yarn. RN supplied polypropylene is identified by a **BROWN ROGUES YARN** in one strand or the rope is wholly coloured BROWN.

0205.4 POLYETHYLENE

Also known as Courline, it is a by-product of oil. It is of monofilament construction and is about one-and-a-half times as strong as manila of equivalent size. It stretches 33% before parting but used within its safe working load will stretch 14%. It floats, retains its strength when wet and has low water absorption. It is not recommended for load bearing applications (normally used for messengers or divers lines). It has a medium melting point. It is supplied in coils of 220 metres and is identified by one **ORANGE ROGUES YARN** in one strand or the rope is wholly ORANGE.

A recently developed derivative of polyethylene, High Modulus Polyethylene (HWE), is size for size as strong as conventional steel wire rope.

0205.5 POLYOLEFIN

Is a derivative of polypropylene. It is black throughout its length and has two **ORANGE ROGUES YARNS**. It is used for berthing Hawsers and is currently of 8 stranded multiplait construction.

0205.6 PARAFIL

This type of rope is constructed of a load bearing core of densely packed parallel filaments, generally polyester, and cased within a tough durable sheath of alkathene. 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. They are not affected by water, will not corrode or rot. The main strength is within the core yarn and provided that it is not damaged will retain its strength even if the sheath has sustained damage.

0205.7 ARAMID

This is a new type of rope derived from polyamide. It is currently used for dressing lines. It is strong, non-inductive and has little elasticity and is gradually replacing wire rope in the RN.

0205.8 ROGUES YARNS

A Rogues Yarn is a coloured strand/fibres/filaments, which manufacturers use to identify the type of rope. When all rope supplied to the admiralty was natural fibre and came from Chatham it was relatively easy to identify its type. Whilst rope currently supplied to the admiralty carries standard colours to identify the type of rope, commercially available ropes, some of the same type, have varying rogues yarns. It is important therefore to try to identify the information from the drum on which it was supplied or from the supplier. Nowadays the coding for rogue's yarns is laid down in British Standard 603. The greatest number of Rogues yarn variations appears with Polyester rope.

Admiralty Supplied Rope

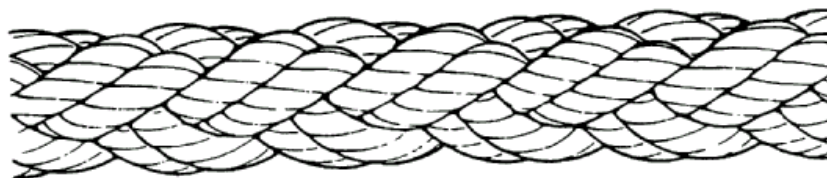
Manila	One Black yarn in each of two strands
Sisal	One Red yarn in one strand
Polyarnide	One Green yarn/filament in one strand
Polyester	One Blue yarn/filament in one strand
Polypropylene	One Brown yarn/filament in one strand
Polyethylene	One Orange yarn /filament in one strand
Polyolefin	Two Orange yarns/filaments in one strand

0205.9 TYPES OF MAN-MADE FIBRE CORDAGE CONSTRUCTION

As well as the new types of rope available there are a number of different types of construction associated with them.

a) Plaited Rope

The rope may be constructed of 16 strands or more popularly 8 strands. The eight strands are arranged in four pairs, two pairs of left-hand lay and two of right-hand lay. This arrangement is known commonly as 'Squareline' but in naval use is commonly referred to as 'Multi-plait'. Its properties are very similar to hawser laid rope except that it is softer and does not kink. Polyolefin Hawasers are an example of this type of construction however; there are a number of commercial brands of Polyester and Polyamide rope available.

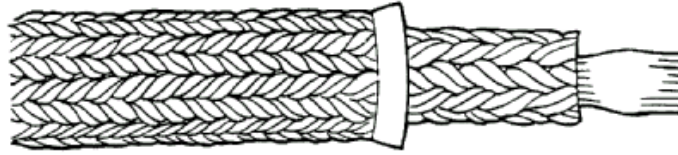


b) Braided Rope

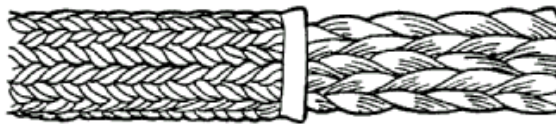
This rope, known commercially as 'Core/Cover' rope is constructed by crossing and re-crossing the yarns and strands in 'maypole fashion', such that each yarn or strand passes alternately over and under one or more of the others to form a circular tubing sheath, which may contain a core. (The core may vary between tight hawser laid, loose hawser laid, braided or straight strands) All braided ropes fall into one of the following categories:

Braided Sheath with no Core (Hollow Centred Rope).

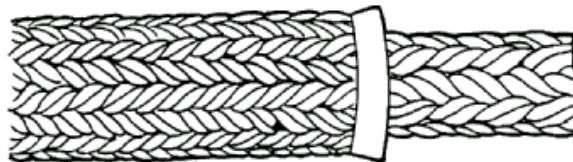
Braided Rope with Braided Core and Heart of Parallel Strands



Braided Rope with Hollow Braided Core



Braided Rope with a Multiplicity of Three Strand Rope Core members.



0206 CARE AND MAINTENANCE OF MAN-MADE FIBRE ROPE

- a) **Exposure to Sunlight** - despite the use of ultra violet inhibitors being used in the manufacturing process, man made ropes should not be exposed unnecessarily to sunlight.
- b) **Chemicals** - try to avoid contamination by chemicals or fumes. If ropes are inadvertently contaminated they should be washed in cold running water.
- c) **Handling** - do not drag ropes over sharp or rough edges.
- d) **Stowage** - Although man-made ropes are resistant to bacteriological attack they may be stowed away wet. When coiled they should ideally be stowed in bins or on raised boards to allow free circulation of air beneath and 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.
- e) **Wear** - some wear such as breaking of the outside fibres is normally unavoidable, however provided this is not excessive this will be harmless.
- f) **Crowsfooting** - localised distortion of a strand by a back twist is known as 'crowsfooting' or 'cockling'. It occurs when the tension in a hawser lay 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.

g) **Chafing** - this appears as long lines of heavy wear on the rope's surface and will have a tufted appearance. Avoid unnecessary chafing by protecting the parts concerned.

h) **Rust** - if rope has been in contact with corroding steel it will show signs of yellow or brownish staining. These can be removed using soapy water although some may be more resistant than others. Avoid using bleach or bleaching agents.

i) **Heat** - avoid stowing ropes where there is excessive heat, e.g. near radiators or hot pipes.

j) **Oil and Grease** - these may be removed using a mild solution of soap and water followed by thorough rinsing in fresh water. Strong detergents should not be used.

0207 ELEMENTARY SAFETY RULES FOR HANDLING ROPES AND HAWSERS

0207.1 Basic Rules

- a) **The Seaman's Knife** - this should be regarded as a seaman's best friend. It should be worn on a lanyard round the waist and stowed in the back pocket of the trousers. It 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.
- b) **Safety of Tools** - when working aloft or over the side, ensure that tools are secured with a lanyard to a fixture, rigging or around the body. This is a common sense precaution to avoid possible injury to personnel below or the loss of tools.
- c) **Ropes 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.
- d) **Coiling Down Ropes** - a heaving line, or any line or rope being hauled in, should be coiled either in the hand or on the deck as it is hauled in. This is an elementary precaution to ensure that the rope or line is immediately ready for further use.

0207.2 Special Precautions

Although the rules for handling natural fibre and man-made fibre cordage are generally similar, the properties and characteristics of man-made fibre cordage necessitate greater care when 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

warning and then it 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:

- a) Personnel backing-up a 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.
- b) When a 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 fibres will melt and create a lubricant, whereupon the rope in tension may surge violently. It is essential therefore that personnel backing-up a man-made fibre rope under tension on a capstan drum, bollards or any holding surface must stand well back. The minimum distance between the first person and the holding surface should be 2 metres. Should the rope surge violently, this distance of 2m means that some warning will be given before being drawn dangerously close to the holding surface.
- c) Ropes that have been subjected to tension or elongation should be given time to recover to achieve their natural length.
- d) 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 damage it.

0207.3 Handling All Cordage

In addition to the previously mentioned rules the following should always be practiced when handling any ropes or lines:

- a) Avoid bad leads and sharp edges. Ensure thimbles or such fittings do not chafe or cut a rope.
- b) 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. A rope should never be surged on a capstan or drum which is rotating in the same direction. This is a dangerous practice and applies to steel wire rope as well as fibre.
- c) 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.
- d) 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.

(Whilst most of the safety rules appear to apply to capstan or drum work which Cadets and Staff may only experience in Offshore Training Vessels, there may well be circumstances locally where some of the rules apply – e.g. turning-up around posts, trees etc, towing boats ashore, lifting heavy objects, to name but a few).

0207.4 Summary of Safety Rules for Handling Ropes and Hawser

- a. Look at the end of the rope or hawser to determine which is the running end, the standing part, the hauling part, and which part forms a bight or a coil.
- b. Never wear finger rings, they may snag on broken strands.
- c. Don't turn up Steel Wire Rope and Cordage on the same bollard or cleat.
- d. 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 lowered or hoisted. The warning cry to those below if something above them is about to be let fall is 'Stand from Under' or 'Under Below'.
- e. 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 placed 1m apart.
- f. Always look out for chafe, and take steps to prevent or minimise it.
- g. Be aware that man-made fibre ropes and hawsers may surge round capstans and bollards without warning when in tension.
- h. Never stand within a bight or coil. Never stand directly in the line of recoil of a man-made fibre rope or hawser under tension.
- i. Wearing gloves whilst handling wires and ropes carries certain risks, for example if they snag on a broken strand of wire, or become trapped in turns on a capstan or winch. The risks are sometimes outweighed by other dangers such as cold weather, or the inability to grip a greasy wire hawser with bare hands. Therefore the wearing of gloves must be considered carefully.
- j. Wear a Safety Hat whenever you are working in an area with loads or equipment being raised above head height.

0208 PREPARING ROPES FOR USE

0208.1 Coiling and Uncoiling

A rope laid out straight will have no tendency to twist or turn wither 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 on 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.

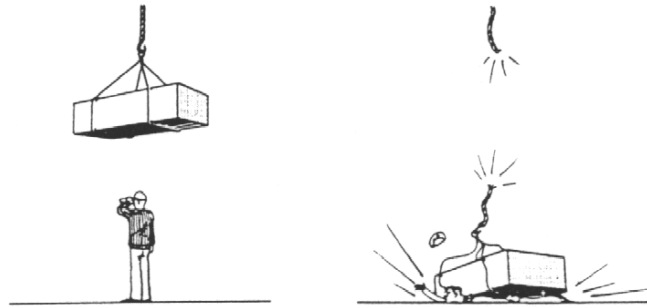
One method of avoiding these turns, should the end of the rope not be free, is to turn the coil

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 swallow.

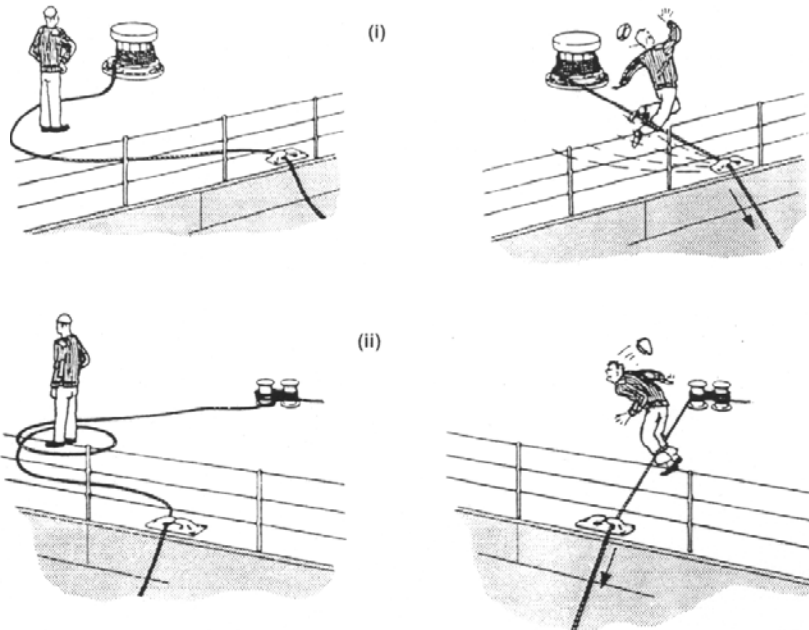
0208.2 Coiling Down

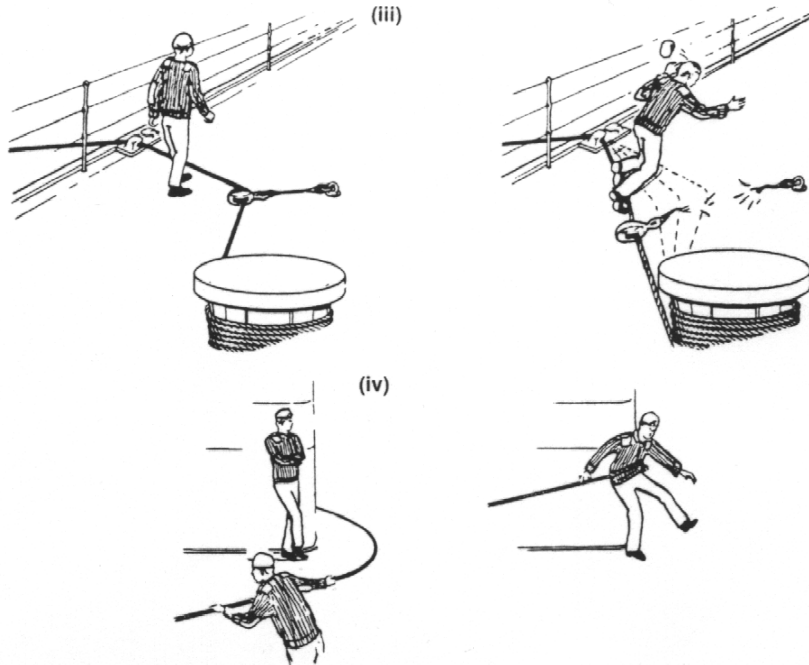
Cordage is very resilient and will absorb a number of turns in its length without becoming snarled if the length is sufficient and turns correspond with the lay of the rope; if the turns are against the lay however, it will quickly become snarled. For this reason rope of right-hand lay is always coiled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

Never stand underneath a hoist



Never stand within a bight or coil

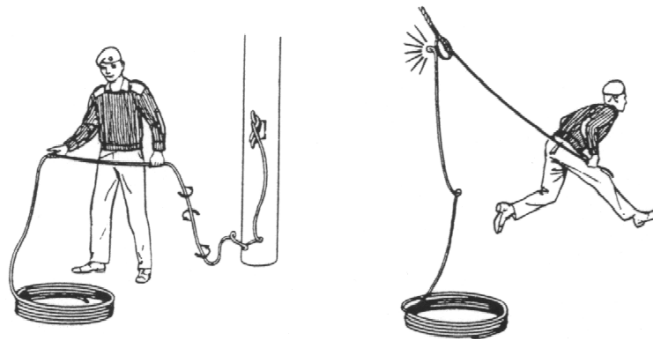




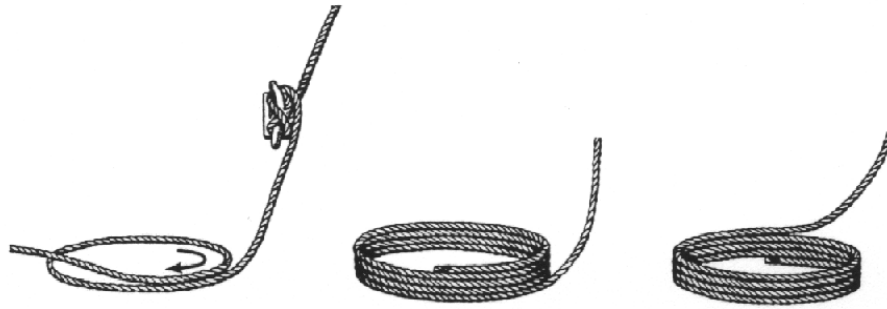
0208.3 To Coil a Rope for Running

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 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 it 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.

Mistakes in Coiling Down.



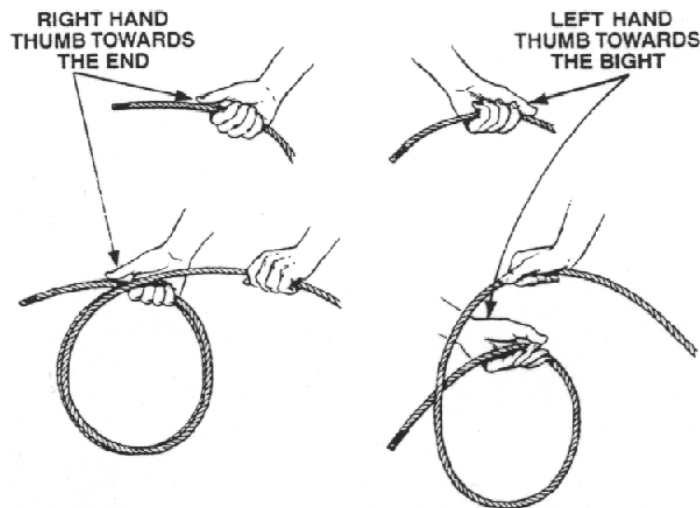
To Coil a Rope for Running.



0208.4 To Coil a Small Line in the Hand

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.

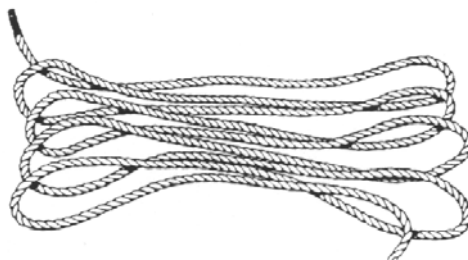
Coiling a Small Line.



0208.5 To Fake Down a Rope

A rope, which 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.

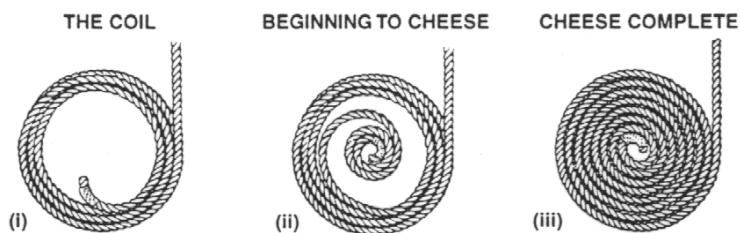
Faking down a rope.



0208.6 Cheesing Down a Rope

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.

Cheesing down a rope.

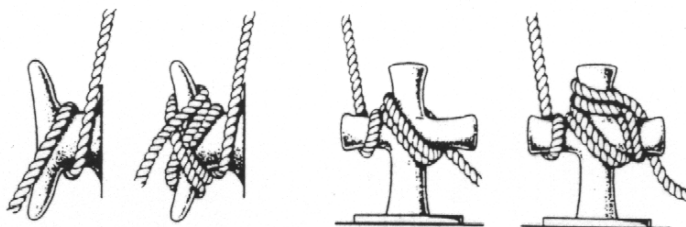


0208.7 Belaying

When a rope will have to be cast off while still under strain, it cannot be secured with a bend or hitch, except perhaps a slipping one. It is therefore belayed to a fitting 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.

To belay to a cleat or staghorn, take the initial turns as shown in the diagram below, then continue with figure-of eight turns round the horns as many times as required. A rope belayed to a cleat or staghorn must be ready for casting off at a moment's 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.

Belaying a rope to a Cleat or staghorn

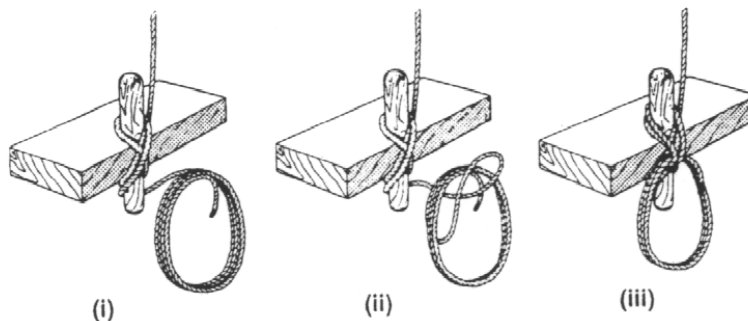


0208.8 Hanging a Coil on a Belaying Pin or a Cleat

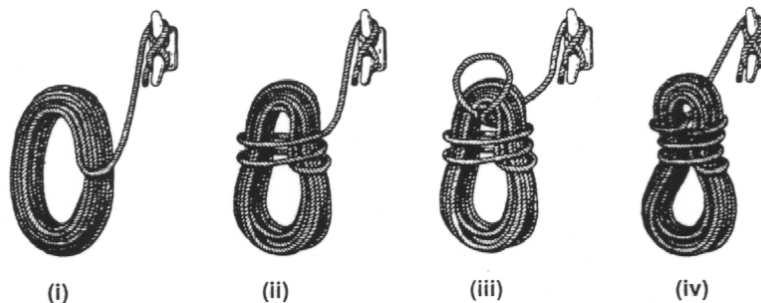
When belaying a rope to a Belaying pin the turns should be taken in the same way as for belaying to a cleat.

Whenever possible a coil should be hung up clear of the deck so as to keep the deck clear and the rope dry.

Hanging a Small Coil on a Belaying Pin

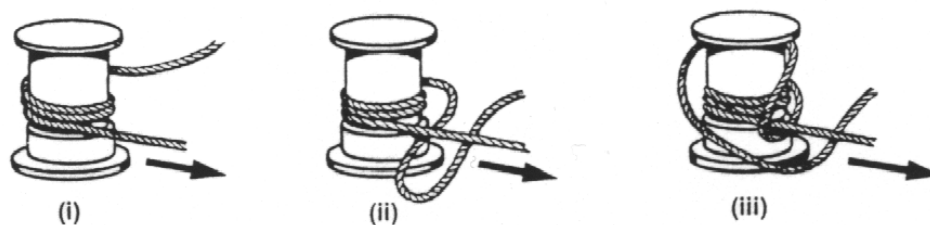


Hanging a Large Coil on a Cleat

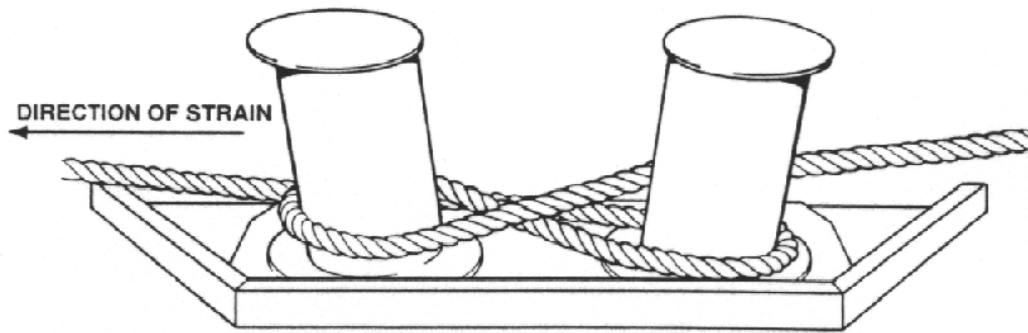


0208.9 Belaying to Bollards

a) Belaying a Fibre Rope to a Single Bollard

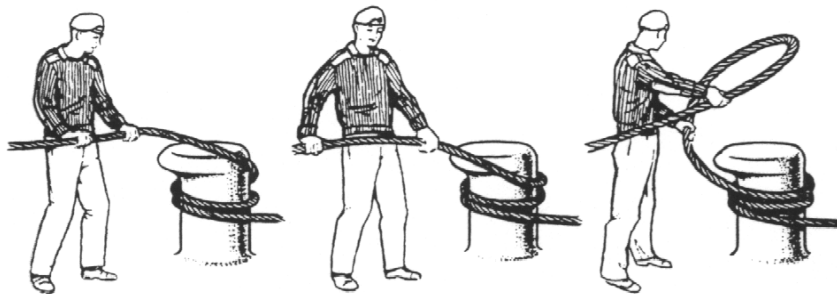


b) *Belaying a Wire or Fibre Rope to Twin Bollards*



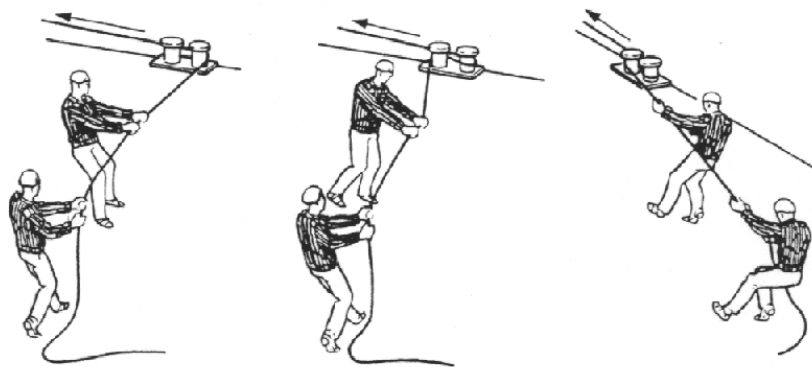
0208.10 Catching a Turn on a Single Bollard

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 hands and fingers to prevent them being nipped, especially if the hawser should render (slip round the bollard).



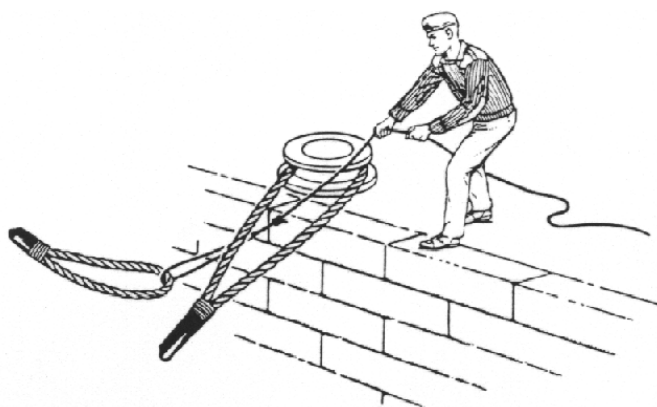
0208.11 Catching a Turn Round Twin Bollards

Care should be taken when the hawser is under strain. The lead is first to the bollard farthest from the source of the strain, and from outboard to inboard. Belaying turns of a hawser leading forward 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. The first person on the hawser nearest the bollards should ensure that they do not get too close to the bollards and are to ensure that hands are kept clear to avoid injury in the event of the hawser rendering (slipping).



0208.12 Placing the Eyes of Two or more Berthing Hawser on a Single Bollard

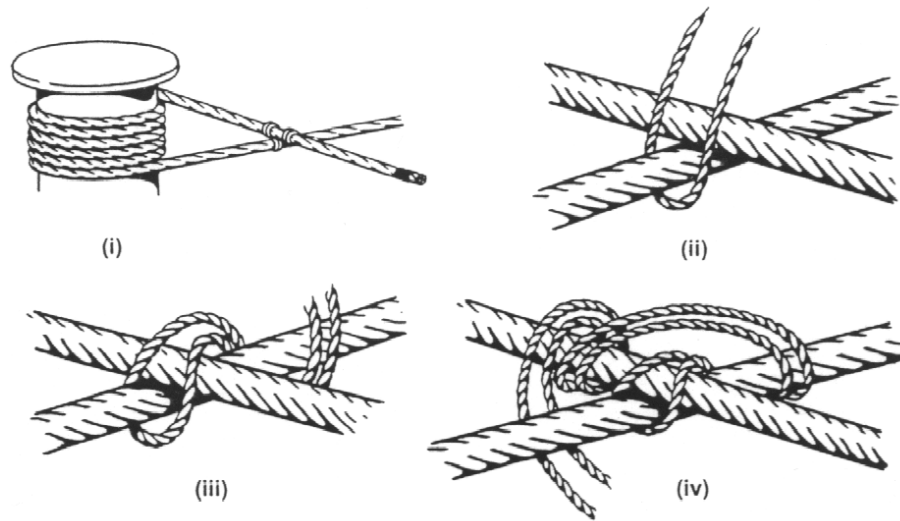
When it is necessary to secure two or more berthing hawsers to a single bollard, the eye of the second hawser should be passed through the eye of the first hawser and then secured to the bollard; similarly, the eye of a third hawser would be passed through the eyes of the first two; this enables the hawsers to be cast off in any order. This procedure is called '*dipping the eye*'.



0208.13 Racking Lines on a Bollard

a) Racking a Wire Rope to a Single Bollard

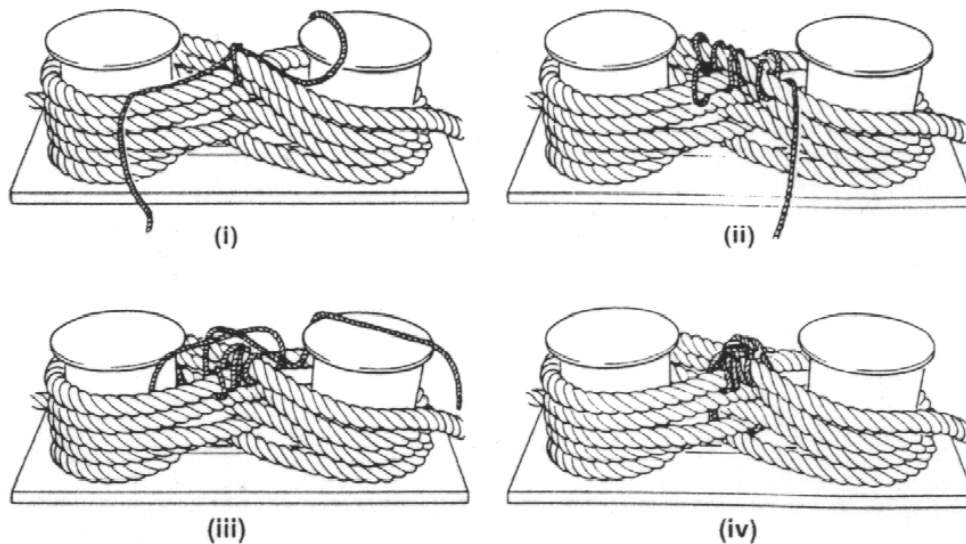
A length of line is used for the racking. Middle the racking underneath the rope; pass both parts of the racking over the end and under the rope; take a turn round the end. Pass the racking under the rope, and repeat the process as often as required. To finish, separate the parts of the racking, bring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



b) Racking a Hawser at Twin Bollards

If a hawser has to remain belayed for any length of time the two uppermost turns are racked to prevent the hawser unlaying.

A length of 8-10mm rope is used for the racking and should be middled and passed under the two upper turns, securing with an overhand knot. Pass each part of the racking round both parts of the upper turns working away from the cross, using figure of eight turns. When sufficient turns have been applied 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 both ends taut and finish off with a reef knot on top.



0209 ORDERS AND TERMS USED IN HANDLING HAWSERS. ROPES AND CABLES

Order or Term	Definition
<i>Heaving</i>	
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
<i>Hauling</i>	
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! Avast!"	The order to stop hauling
"Hold Fast!"	An order to hold a rope under strain so as to keep it from moving
<i>Hoisting</i>	
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 rope's ends together with their respective strands interlocking
<i>Lowering</i>	
"Lower Away!"	The order to lower steadily

"Avast Lowering!"	The order to stop lowering
General	
Handsomely!	Slowly, with care (e.g. '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 for belaying it
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 turning to veer 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
"Down Slack!"	The order to take up the slack in a rope
Riding Turns	When the turns on a bollard or capstan drum overlap. This stops the rope running freely

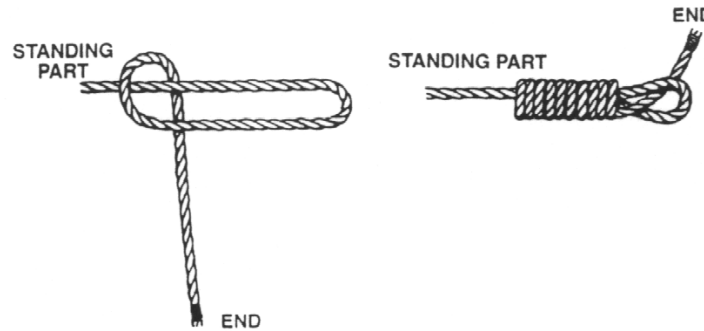
0210 THE HEAVING LINE

A Heaving Line is a light, flexible line with a small weighted end that can be thrown. It is used as a messenger to pass hawsers from ship to shore, or vice versa. It consists of

approximately 30 metres of 10mm cordage, with one end whipped and the other end weighted with a Monkey's Fist or Heaving Line Knot.

0210.1 Heaving Line Knot

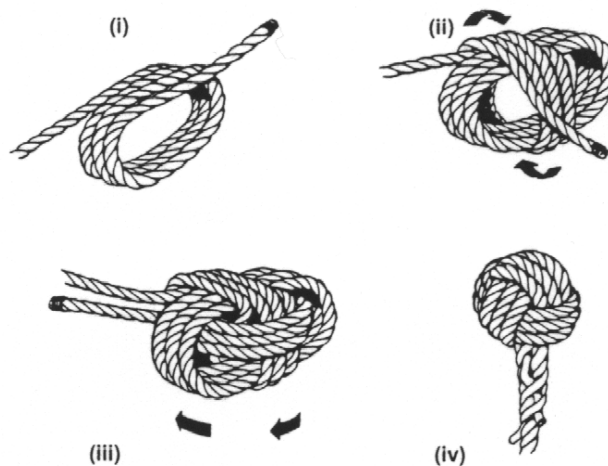
This provides a temporary weight in the end of a rope and is quickly and easily made. Form a bight at the end of the line then take turns round the bight back towards the loop. When reaching the end of the rope having applied sufficient turns, take the end through the loop, hold the complete knot in one hand and haul on the standing part until the loop is pulled through to grip the end.



0210.2 Monkey's Fist

This provides a permanent weight in the end of a rope. To make it, wind three turns round the hand (away from you); pass a second set of three turns across and round the first three (work back towards you); then pass a third set of three turns round and across the second set, but inside the loops of the first set; if the knot is correctly made the end will come out alongside the standing part. (Decide how you wish to finish your knot, hawser laid rope may be spliced or the end tucked). If tucking the end, tie an overhand knot in the end of the rope and tuck it into the centre of the monkey's fist, then starting at the end work backwards round the turns pulling each one taut the slack being taken up by the standing part. HINT: When tightening the monkey's fist it is better to take up the slack a little at a time, this will ensure a rounder finish.

Caution: A monkey's fist, or heaving line knot, must not be weighted by the addition of steel nuts, washers or similar items Nor should the monkey's fist be painted. If greater weight is required more turns may be included OR the monkey's fist may be wetted prior to use.



0210.3 Making up a Heaving Line to Throw

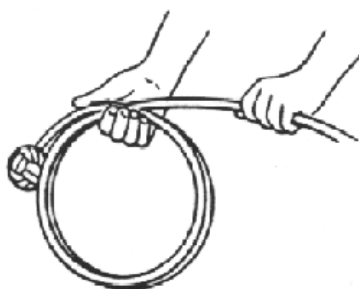
When possible, it should be wetted (provides additional weight) prior to making up. The non-weighted end should be secured to a rail, stanchion or post (if passing a hawser ashore - secure to the eye with a bowline). The standing end should never be secured to the wrist.

There are two ways of making up a heaving line for throwing; firstly if aboard a ship or in a boat and having secured the end, throw the heaving line over the side, this will not only wet the line but will take out any turns allowing easier making up for throwing on recovery. Make large coils in the non-throwing hand then for the final 5-6 metres make smaller coils finishing at the monkey's fist. The small coils can then be transferred to the throwing hand.

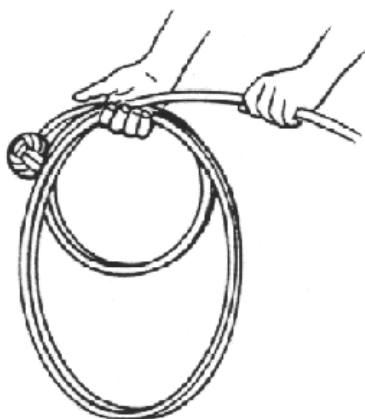
The second method is used if you are unable to throw the heaving line over the side. Start with the monkey's fist in the throwing hand, make small coils with the first 5-6 metres then make larger coils with the remainder of the heaving line. The end can then be secured and the large coils transferred to the non-throwing hand.



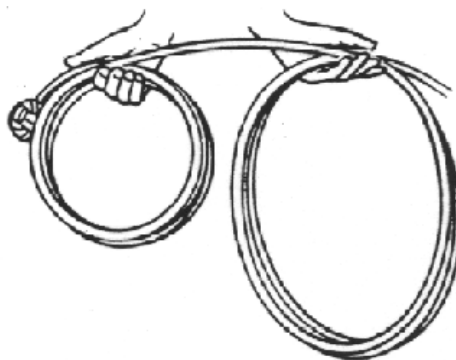
STAGE 1



STAGE 2



STAGE 3



STAGE 4

0210.4 Throwing the Leaving Line

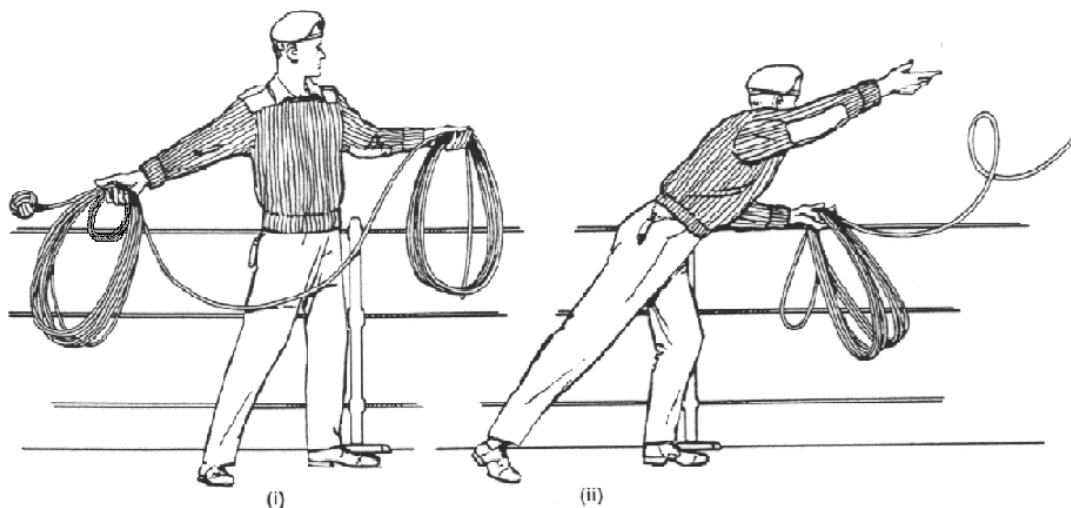
There is more than one method of throwing a heaving line and each thrower will adapt their own technique. Avoid throwing upwards, over the head throws and under-arm throws. Try to avoid swinging the throwing arm backwards and forwards to build up

momentum as this often leads to the monkey's fist being snarled up in the coils. The ideal throw should start with the body standing sideways on to a selected target point, body balanced with both feet apart. The non-throwing hand should be extended forward with the palm of the hand flat, the coils anchored between the thumb and forefinger and ready to be released when thrown. A fully extended throwing arm to the rear which sweeps strongly forward in a single motion often achieves the best results. The monkey's fist and small coils are released as the throwing arm comes in line with the target point.

Common faults include: not ensuring that the coils are made up properly for running, holding onto the large coils instead of letting them uncoil from the hand, the monkey's fist being tangled in the coils and letting go of the heavy coils too soon causing the weighty line to drop before the remainder of the heaving line has had a chance to reach the target (cuts short the throw).

Never attempt to throw the heaving line over a great distance - in most cases it cannot be thrown more than 22 metres even by an experienced thrower.

Throwing a Heaving Line



0210.5 Recovering and Making up a Heaving Line to Stow Away

How the Heaving Line is coiled up depends on two factors, the type of rope used and whether the coiler is right or left-handed. With right hand lay, hawser laid rope, the coils should be made to avoid putting turns into them. The following examples are for coiling hawser laid rope:

(Right-handed People) - Hold the weighted end in the left hand with the monkey's fist facing towards the body. To ensure that all the loops to be made are to the same size, lock the elbow of the left arm into the side, leaving the right arm free to extend out along the rope. Make the loops by bringing the hands together with the rope being coiled away from the body, the coils being held in the left hand. (It may be necessary to give the rope a little twist to take out any turns). Continue making the coils until approximately 2 metres of rope remain, then take wrapping turns around all the coils pulling them taut with each wrap. Finally finish by taking a loop of the wrapping end through the top bight

of the coils, then looping over the top of all the coils before hauling taut. The remaining end of rope is used to secure the heaving line to a rail or other fitting. ('The system of coiling the heaving line is the same as for coiling a large coil of rope to secure on a cleat or belaying pin).

(Left-handed People) - Hold the weighted end in the right hand with the monkey's fist facing towards the body, lock the elbow into the side leaving the left arm free to extend out along the rope. Instead of making the loops away from the body, make them towards the body (with twists as necessary to take out turns). Continue making up the coils and finish in the same way as explained above.

Left-handed people when coiling hawser laid rope should bear the coiling principles mentioned above in mind for ease of coiling. (Unfortunately most of the information available in reference books is reference for right-handed people).

Man-made braided rope can be coiled more easily regardless of whether the coiler is right or left-handed.

CHAPTER THREE

BENDS AND HITCHES

0301 Terms Used

0302 Knots

Overhand knot

Figure of eight knot

Reef knot

Clove Hitch

Rolling Hitch

Bowline

Timber Hitch

Sheetbend

Round Turn and Two Half Hitches

Fishermans Bend

Marline Hitch

Marline Spike Hitch

Constrictor Knot

Jury or Masthead knot

Hunters Bend

Waggoner's or Lorry Driver's Hitch

Double Blackwall Hitch

Sheepshank

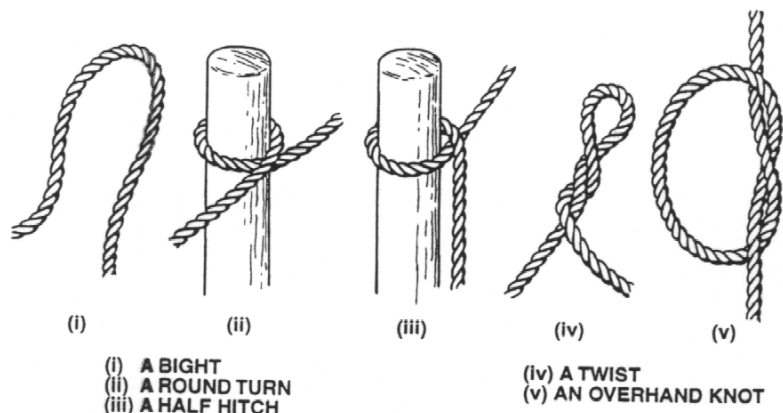
Running Bowline

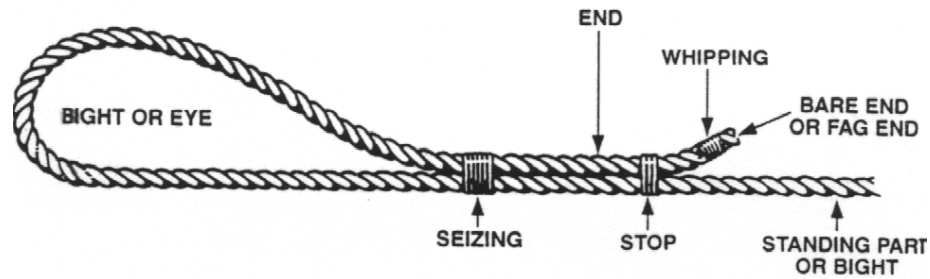
Bowline on the Bight

0301 TERMS USED

A Knot	Is where the rope is tied back on itself, or where it is tied in one end only, such as a stopper knot.
A Bend	Is a method of temporarily joining two ropes.
A Hitch	Is a method of temporarily joining one or more ropes to a third object such as a ring, post or rail.
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.
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 which is 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.
Standing Part	The part of the bight of a rope which is nearest the eye, bend or hitch, and which is not available for use. It could be secured somewhere.
Stopping	A light fastening for temporarily holding a rope or any other object in place. It is not meant to bear any strain other than to keep the object in place.
Seizing	A seizing is used to fasten two ropes, or two parts of the same rope, securely together, to prevent them moving or coming apart.
Whipping	The binding round the bare end of a rope to prevent the strands from unlaying.

Most Bends and Hitches consist of a combination of two or more of the elements shown below.





0302 KNOTS

0302.1 Overhand Knot

Mainly used as an element of a larger knot. It may be used on its own as a stopper on the end of a rope to prevent it un-laying.



0302.2 A Figure of Eight Knot or

Used to prevent a rope from un-reeving through an eye block.



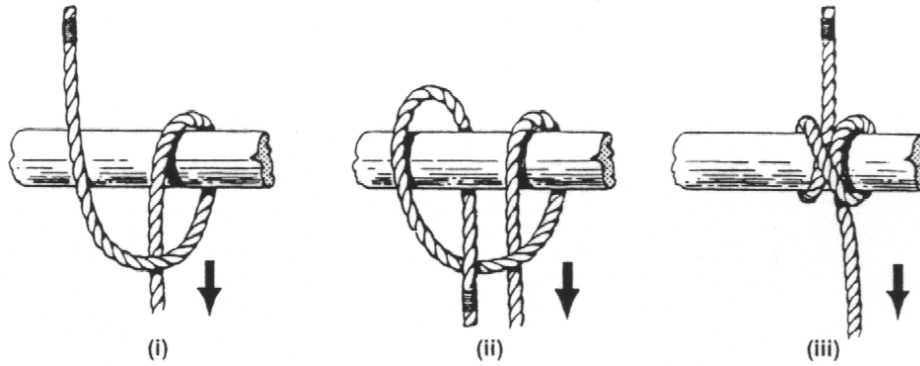
0302.3 Reef Knot thickness.

Used as a common tie for two ropes of equal



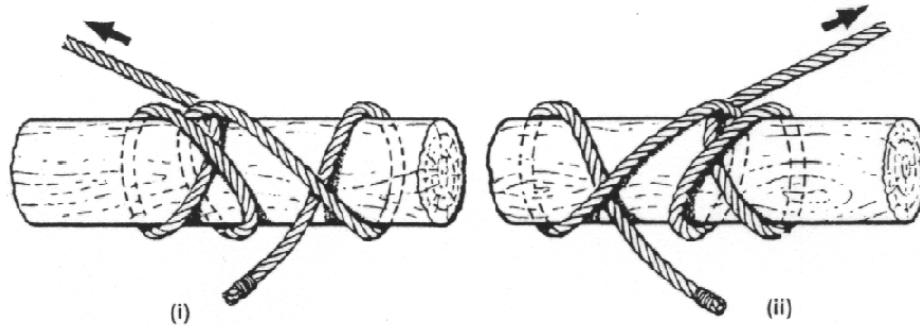
0302.4 Clove Hitch

Used to secure a rope to a rail, spar or similar fitting.



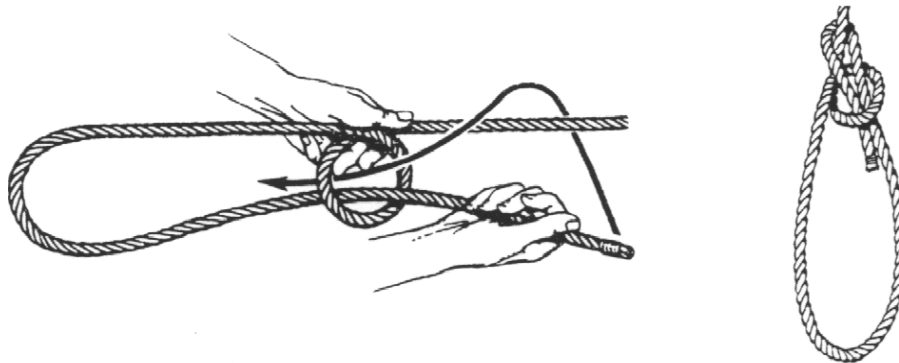
0302.5 Rolling Hitch

Used for securing a rope to another rope or spar where there is a strain to either side, prevents the hitch slipping.



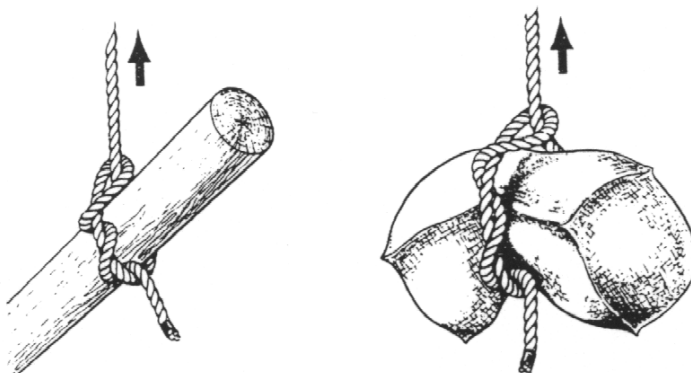
0302.6 Bowline

Used for making a temporary eye in a rope, a lifeline around the body or for bending a heaving line to a mooring line.



0302.7 Timber Hitch

Used to secure a rope to a spar, a bale or an irregularly shaped object.



0302.8 Sheetbend

Used to join two ropes of unequal size, or for securing a rope to a hard eye. For a more secure version or where the sizes of rope vary greatly, a Double Sheetbend is used.



0302.9 Round Turn and two Half Hitches

Used for securing a rope to a ring or spar.(e.g. Boats headrope to a ring of a buoy).



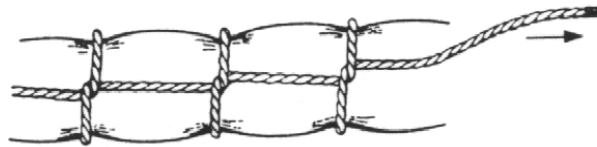
0302.10 Fishermans Bend

An alternative to the Round Turn and Two Half Hitches. Normally used to secure a rope to the ring of an anchor.



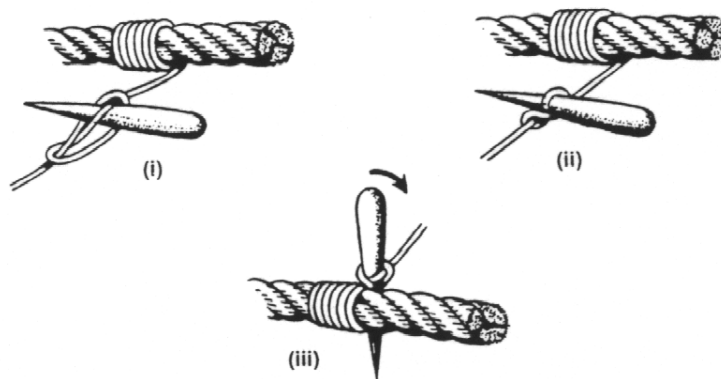
0302.11 Marline Hitch

Used for lashing long bundles such as awnings and sails.



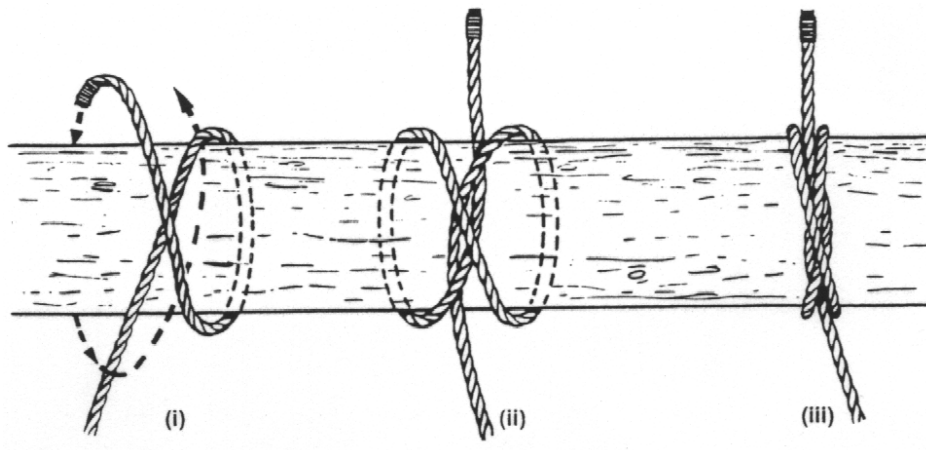
0302.12 Marline Spike Hitch

Used for securing a marline spike, or hook, into the bight of a rope.



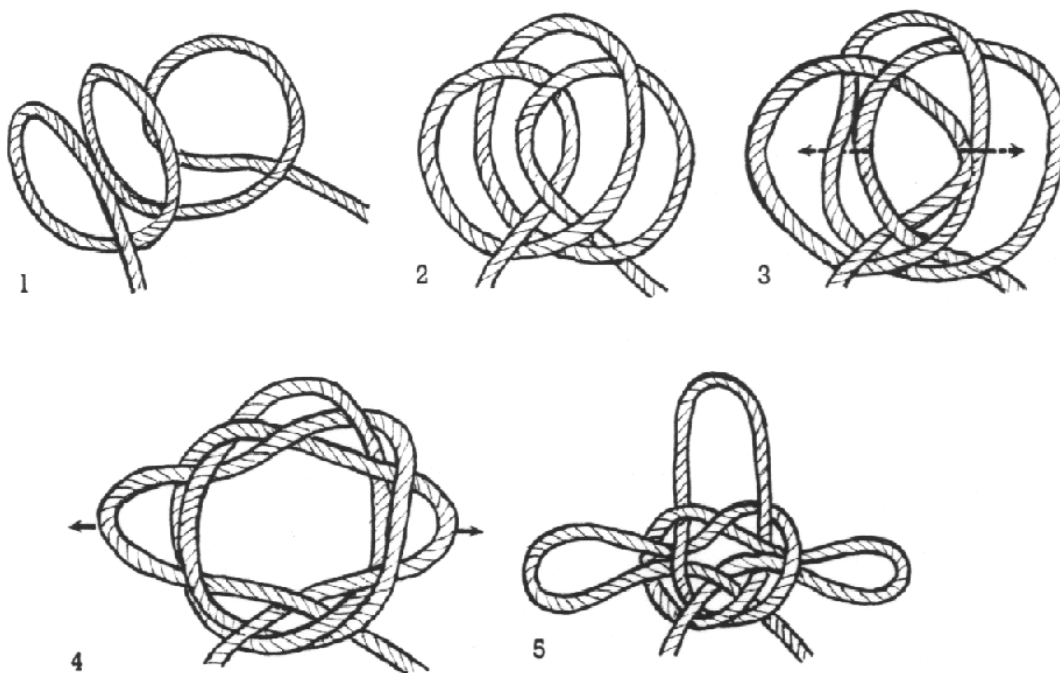
0302.13 Constrictor Knot

A variation of the Clove Hitch, it is used when a firm grip is required. It is the most secure of all binding knots.



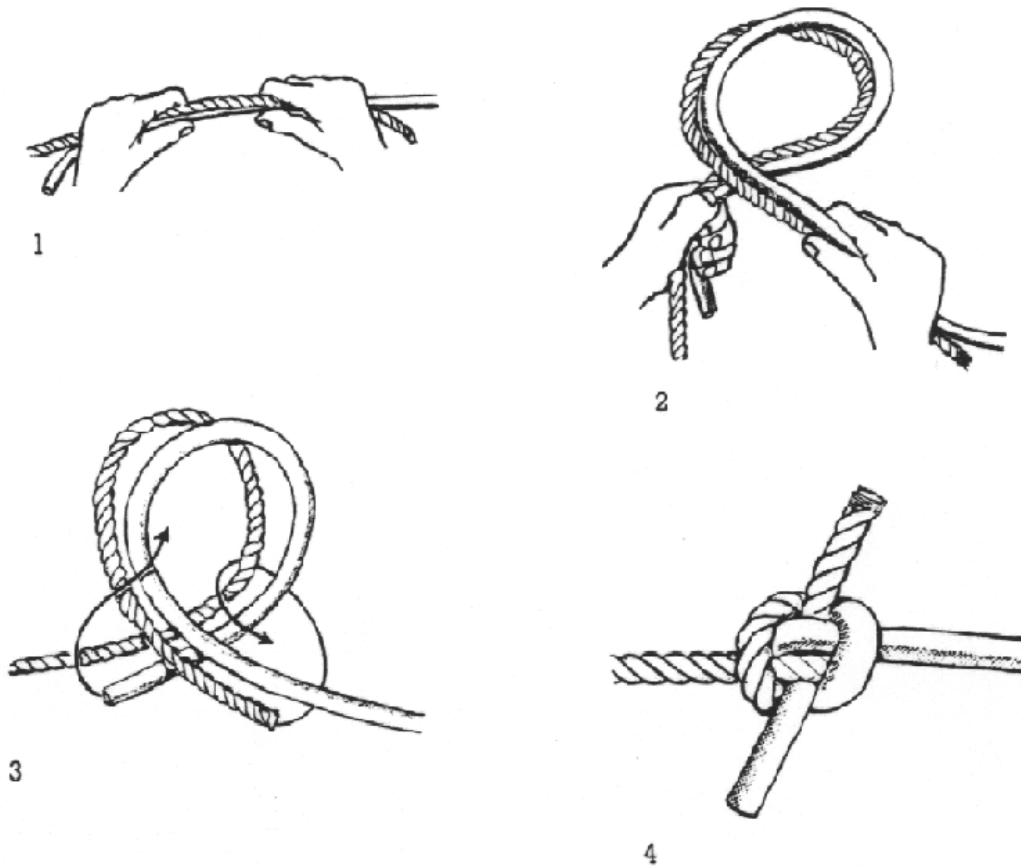
0302.14 Jury or Masthead Knot

Used for attaching shrouds to a jury mast or for erecting a temporary flagpole or similar.



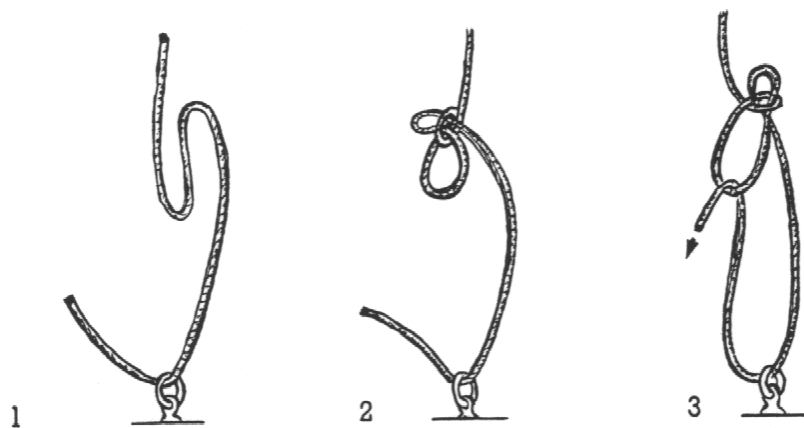
0302.15 Hunters Bend

Used for joining two slippery synthetic ropes together



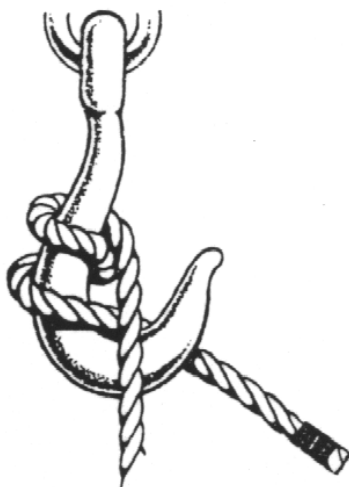
**0302.16 Waggoner's or Lorry
Driver's Hitch**

Used for lashing down loads on trailer units where
additional purchase is required to take strain.



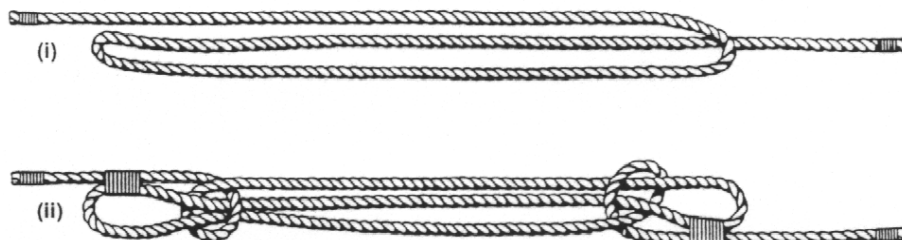
0302.17 Double Blackwall Hitch

Used to secure a line to a hook. (To be used when Using two luff tackles, luff on luff, if fitted with hooks).



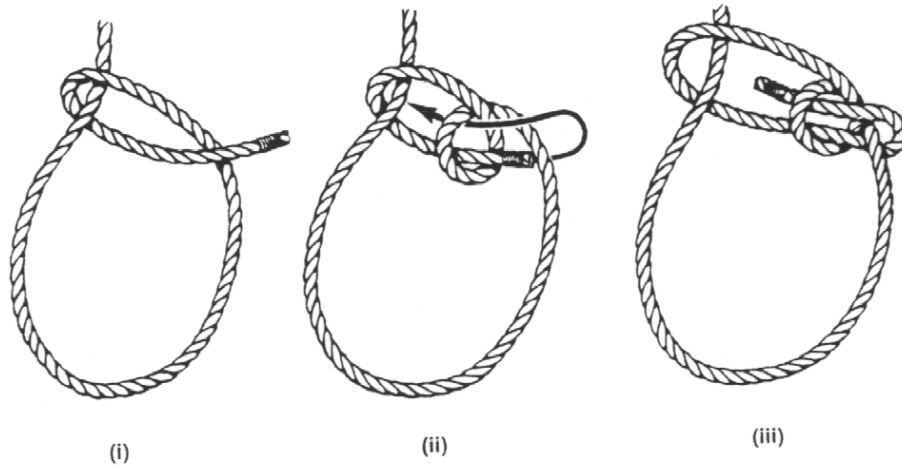
0302.18 Sheepshank

Used for temporarily shortening the bight of a rope without cutting it.



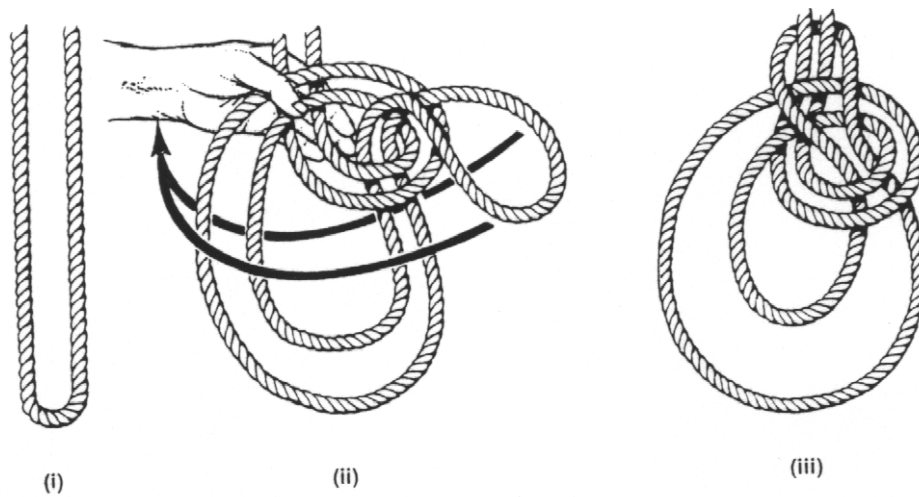
0302.19 Running Bowline

Used for making a temporary running eye.
(Should not be secured round a person's body)



0302.20 Bowline on the Bight

Can be used for lowering a person from aloft or over the side. The short bight is placed under the arms and the long one under the buttocks.



CHAPTER FOUR

WHIPPING AND SPLICING

0401	Whipping	West Country Whipping. Sailmakers Whipping Common Whipping Palm and Needle Whipping
0402	Splicing	Tools and equipment for Splicing Types of Splice in the syllabus Dogging Back Splice - Hawser laid rope Soft Eye Splice - Hawser laid rope Short Splice - Hawser laid rope Hard Eye Splice - Hawser laid rope Seized Thimble eye Soft Eye Splice - 8 Stranded Multi-plait rope Soft Eye Splice - Braided Rope

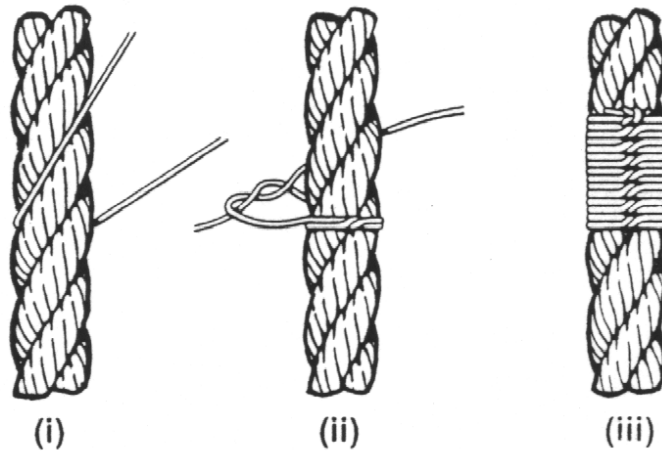
0401 WHIPPING

A Whipping is the binding round the bare end of a rope to prevent the strands from unlaying. It should be applied as taut as possible throughout the whipping, this will prevent it from slipping off and prolong its life. Seaming or roping twine is used when the rope is not too large, and small stuff is used on a large rope. When whipping man-made fibre ropes use a man-made twine instead of natural fibre twine, this will avoid burning the whipping if the end is heat sealed. The whipping should be about equal to approximately one-and-a-half times the diameter of the rope. Care should be taken when trimming the rope's end not to cut too close to the whipping to avoid cutting through the whipping.

0401.1 West Country Whipping

This whipping is the easiest to do and can be applied to any type of rope or part of the rope. Middle the twine on the rope in the required position, pass the two ends round the rope in opposite directions and tie a half hitch; pass them round the rope and tie another

half hitch opposite the first one on the other side; now bring the ends up and half hitch them again, continuing in this manner, making half hitches every half turn so that the half hitches lie alternately on opposite sides of the rope. Finish with a reef knot.

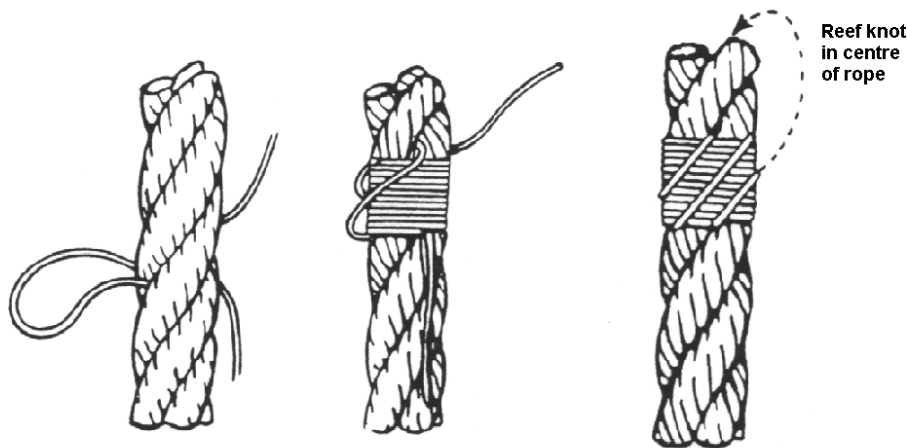


0401.2 Sailmakers Whipping.

This whipping is the most secure however it can only be used on hawser laid rope. It is ideally suited to the end of a rope but can be applied in the bight when the rope has been carefully unlayed then layed back up again. Care should be taken not to let the strands unlay.

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 the 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 the twine where it is and, with the long end, pass the turns of the whipping, working towards the end of the rope and against the lay. When sufficient turns are on, take the bight of twine, pass it outside the whipping, following the lay of the strand around where it was originally put, and pass it over the strand where it will come out at the end of the rope. Now haul carefully 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, then tie the two ends with a reef knot in the middle of the rope and out of sight. Leave a short end then trim the ends of the rope taking care not to cut through the reef knot.

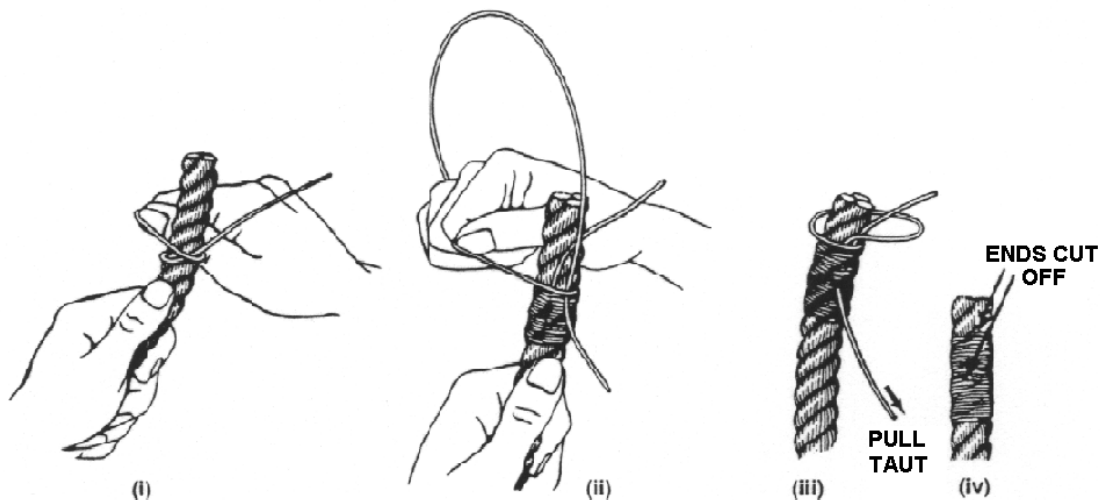
Sailmakers Whipping.



0401.3 Common Whipping

This can be applied to any type of rope, is ideally suited to the end of the rope however, it can be applied to the bight of a rope. The longer the ropes end the greater the difficulty it is to work. Place the end of the twine along the rope (i); pass the turns of twine against the lay, working towards the end of the rope, and haul each turn taut. At a halfway point, lay the other end of the twine along the rope (ii), then pass the remaining turns over it, taking the bight of the twine over the end of the rope with each turn. Care should be taken as the twine will begin to twist. When the whipping has reached the required length (iii) haul the second end of the twine through the turns until tight. Trim off loose ends. If the twine has twisted during the turns care should be taken when hauling the second end through.

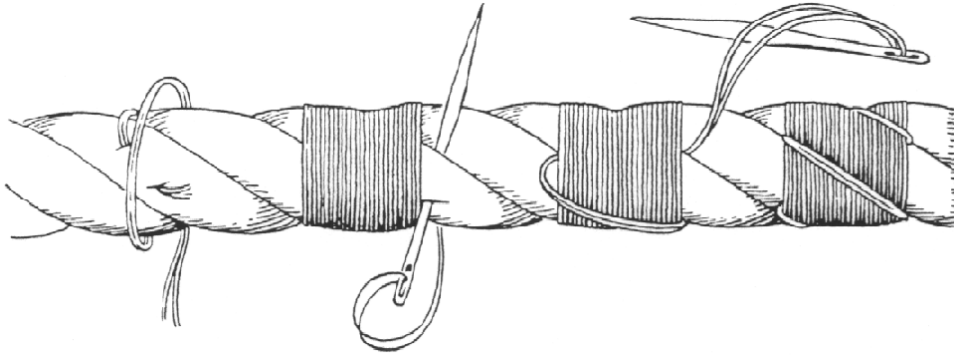
An alternative finish, which can be used when the whipping is on the bight of the rope, is to take the last three or four turns loosely over one finger and pass the end back through them. Work the turns taut and haul the end through and taut in the normal way.



0401.4 Palm and Needle Whipping

This is a neat and more permanent method by applying a whipping using a sailmakers palm and needle. When complete its appearance is similar to the Sailmakers Whipping.

It is ideally suited for use with Braided Man-made Fibre Ropes where a stronger, more secure whipping may be required.



0402 SPLICING

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. It is important therefore to ensure that all splices are completed as tight as possible not only to retain strength, but to ensure that in the event of the rope getting wet that water is absorbed less easily. Care should be taken when un-laying any hawser laid rope to ensure that the yarns are disturbed as little as possible; when tucking the strands they should be twisted in the direction of their lay to regain their former tightness.

Basic Principles: Use natural fibre twine with natural fibre rope and man-made twine with man-made rope if it is to remain on the rope.

A small whipping or stopper applied prior to un-laying the strands will ensure that the first tuck of the splice will sit tight against the standing part.

Make three tucks with natural fibre cordage and five tucks with man-made cordage.

Avoid kinking the rope when tucking. With new rope use a fid to open up the strands.

Always finish the splice by dogging the ends, do not cut off the strand ends as these will unlay in due course. (Tapering and serving are an alternative way to finish the splice but are not included in the Sea Cadet Syllabus).

There are a number of different principles that have to be adopted with man-made fibre, hawser laid rope, compared to natural fibre rope.

The fibres and strands should be disturbed as little as possible. Each strand should be marled or taped up every 50mm along its length to maintain its form (it has a tendency to unlay very quickly and work loose). Firm whippings of twine (or tape) must be used and the ends of the strands must be heat fused.

0402.1 Tools and Equipment for Splicing

A sharp knife, seaming twine or other sailmakers twine, pvc insulating tape or masking tape (paper masking tape is best), a fid, (a pointed wooden spike made of hardwood) are the basics required for splicing. A hot knife, candle or butane burner will be required to heat seal man-made fibre rope.

Other tools such as a Swedish Fid may be available, this has a channel down which to run the tucking strand whilst the standing strand is being held open, and for splicing braidline (a more advanced splice) hollow fids or hooks are required.

0402.2 Types of Splice (In the Syllabus)

Back Splice	This is used for finishing the end of a rope, which is not required to be rove through a block or any eyed fitting. It prevents the end from unlaying.
Eye Splice	A soft eye splice is used for making a permanent eye in the end of a rope.
Hard Eye Splice	A soft eye with a thimble spliced in it. Used to prevent unnecessary wear when a metal object e.g. a shackle, continually comes in contact with the rope.
Short Splice	This is used to join two ropes that are not required to pass through a block or any eyed fitting.

0402.3 Dogging

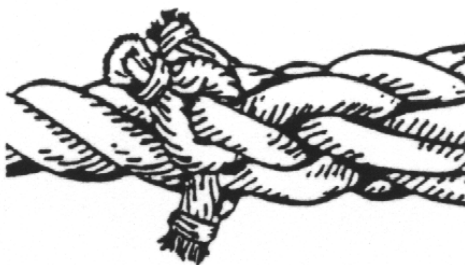
This is a method of finishing splices made in all types of hawser laid rope and multi-plait man-made rope. The end of strands are secured to prevent the splices from unlaying. With three stranded rope, having completed the required number of tucks, split the strands in half then marry one half to the adjoining one over the top of the standing strand and twist up tight. Apply a West Country whipping round both strands.

A Tip: (This will prevent the whipping from being pulled off).

Before commencing the whipping, pass the twine under the standing strand where it is to be applied, middle up the twine then cross the ends; take the ends round the strands in opposite directions and tie an overhand knot, pushing it down as close to the standing strand as possible, hauling the twine taut Bring the ends round to the front and tie another overhand knot, then complete the whipping to the required length.(Use the same number of turns on each of the west country whippings to ensure that they are all the same size).

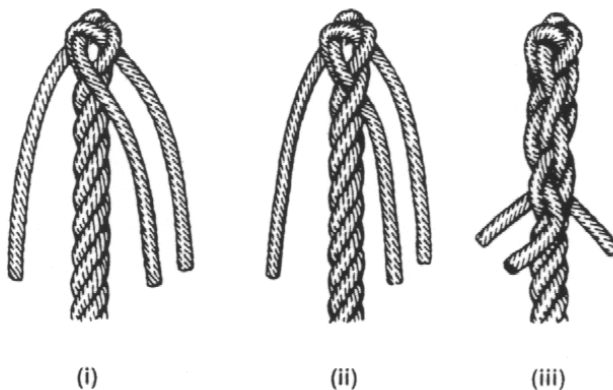
Having completed dogging each of the strands, with a sharp knife carefully trim the ends ensuring to take care not to cut too close to the whipping.

When dogging eight stranded, multi-plait rope, whole strands are married and whipped using a West Country whipping.



0402.4 Back Splice - Hawser laid rope

- a. Apply a short whipping or stopper at a distance from its end equal to 20 times the diameter of the rope, then unlay the strands to the stop. Whip the ends of each strand. (Competent splicers may choose to omit this practice).
- b. Make a Crown Knot and work this tight up against the whipping or stopper (i).
- c. Cut off the whipping/stopper and then tuck each strand over one strand and under the next, to the left and against the lay of the rope (ii). After each strand is tucked, twist and pull each strand taut until each strand is uniform. Repeat the tucks twice more until three full tucks have been made (iii).
- d. Complete the splice by Dogging the ends.

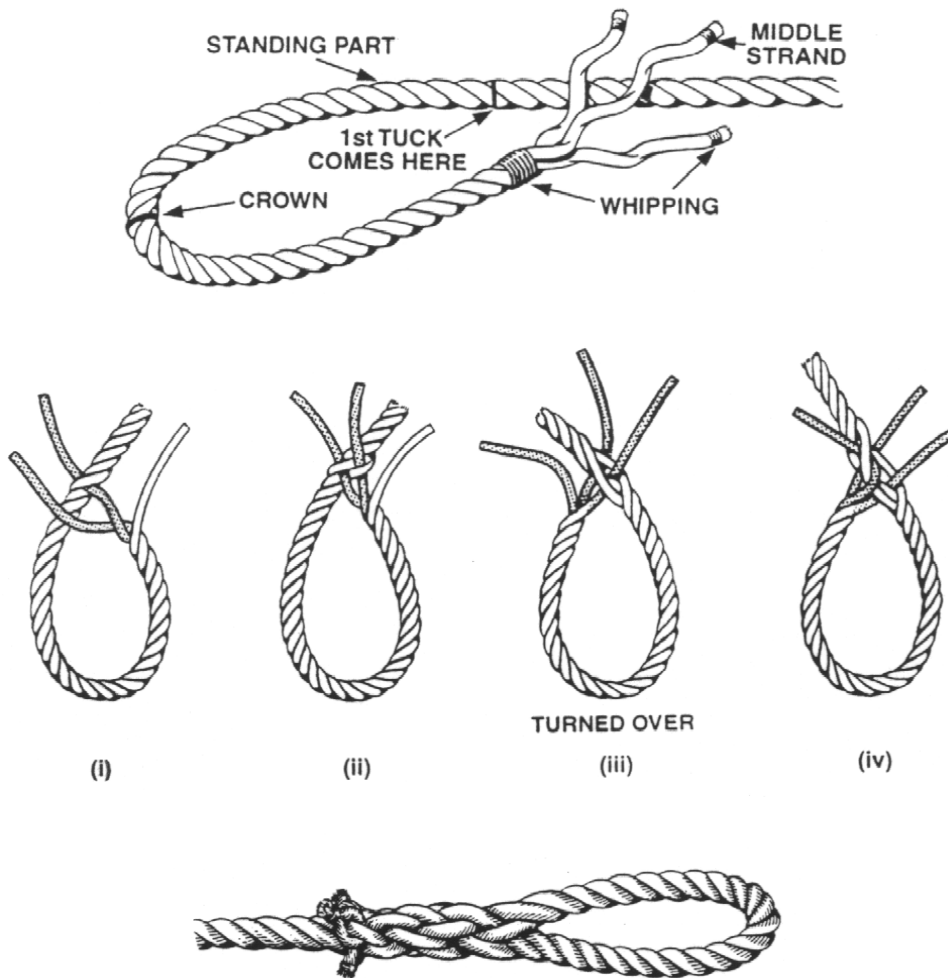


0402.5 Soft Eye Splice - Hawser laid rope

- a. Whip the rope at a distance from its end equal to 20 times the diameter of the rope, then unlay it to the whipping. Whip the ends of each strand. (Competent splicers may choose to omit this practice).
- b. Decide on the size of the eye required (the crown and the start point on the standing part may be marked), and bend the rope to make the eye, with the whipping level to the start point. The middle and left strands should be on top of the rope. Care should be taken so as not to put a twist in the rope.

- c. Tuck the middle strand (A), from right to left, under the nearest strand on the standing part.
- d. Tuck the left hand strand (B), under the next strand on the standing part.
- e. Turn the rope over so as to bring the right hand strand (C) on top, then tuck the strand from right to left under the unoccupied strand on the standing part. (This will provide a locking strand for the splice).
- f. Starting with the right hand strand, twist and pull each of the strands taut; then continue tucking twice more until three full tucks have been made.
- g. Complete the splice by dogging the ends.

Soft Eye Splice – Hawser laid rope.



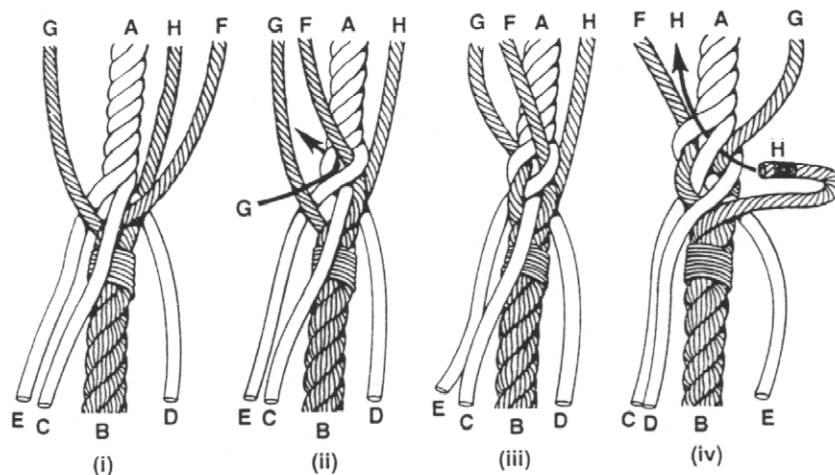
0402.6 Short Splice - Hawser laid rope

- a. Whip each rope at a distance from its end equal to 20 times the diameter of the rope. (This whipping has been omitted from one rope in the diagram).

If a small whipping is applied this may be left in the splice, larger whippings will have to be removed.

- b. Unlay the strands to the whipping and whip their ends.
- c. Marry the two ropes so that one strand of each lies between two strands of the other (i).
- d. Ensure both whippings are married as tightly as possible. (A whipping may be applied round the join to prevent them slipping). Stop the ends to one rope, (in the diagram ends C,D, & E to rope B - not shown in diagram).
- e. Remove a large whipping then commence tucking over one strand and under another. (In the diagram (ii) strands F over C, under E, then G over E, under D, then H over D, under C). Remove the stop and tuck the strands on the opposite side ensuring that the strands are twisted and pulled tight to ensure a close join. Complete three full tucks on each side then complete the splice by dogging all strands.

Short splice – Hawser laid rope.



0402.7 Hard Eye Splice - Hawser laid rope

(Often referred to as a Thimble Eye). The thimble eye is formed by fitting and splicing the end of a rope round a thimble, the splice holding the thimble in place. It is important therefore to ensure that the thimble is the correct size and the splice is as tight as possible to prevent the thimble from falling out.

- a. Whip the rope and unlay it to the whipping, then whip the ends of the strands.
- b. Form the eye round the thimble with the whipping near to the neck of the thimble. Apply a stop (or constrictor knot) to hold the thimble in place: apply a second stop at the crown of the thimble ensuring that the rope has been kept taut; then apply a third stop at the opposite neck.
- c. Commence tucking the strands in exactly the same way as for the soft eye splice. When the first tuck is completed for all three strands, twist and haul each strand as taut as possible then continue with the remaining tucks.
- d. Remove the stops from around the thimble. If the splice has been completed correctly the thimble will be firmly gripped, if it is not, it is best to start again.
- e. Complete the splice by dogging the ends as normal.

0402.8 Seized Thimble Eye

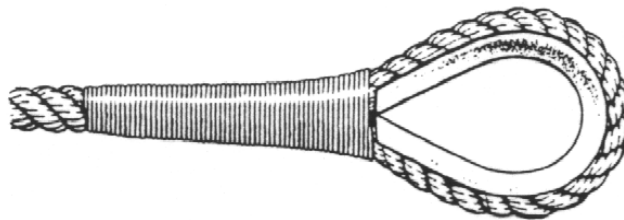
This is an alternative to the thimble eye and is just as efficient. It is ideal for converting a soft eye to a hard eye and then allows for the thimble to be easily removed or replaced.

The soft eye splice needs to be larger than the thimble. When the thimble has been inserted and stopped in place, a flat seizing is applied to seize the thimble in as tight as possible. When required to remove the thimble to revert to a soft eye the seizing is simply removed.

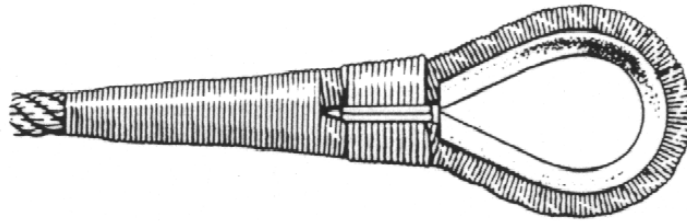
This method may be used on all types of rope including wire rope.

Examples of Hard Eye Splices

Thimble Eye

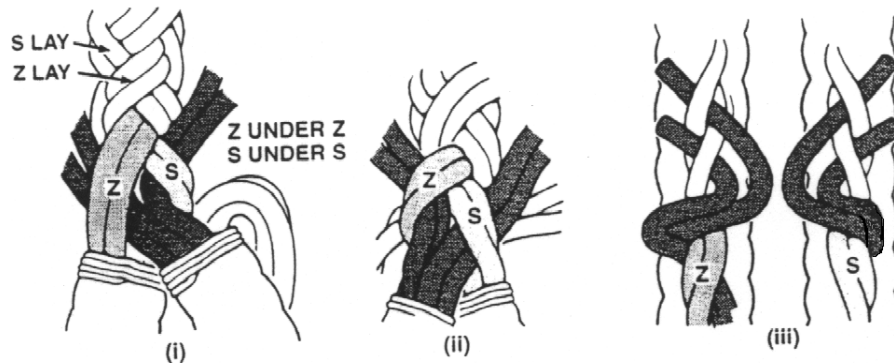


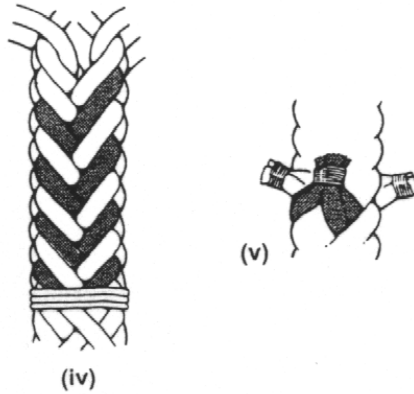
Hawser Eye



0402.9 Soft Eye Splice - 8 stranded Multi-plait rope

- a. Make a throat seizing at a distance from its end of approximately 20 times the diameter of the rope (point of splice), then unlay the strands. (Ends may be whipped)
- b. Marry pairs of Z strands (right hand lay) and pairs of S strands (left hand lay), making four pairs in all. The ends may be whipped or taped together.
- c. Commence the tucking sequence by passing pairs 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 i).
- d. Turn the rope over and repeat with the remaining pairs of strands until the first full tuck with paired strands is complete. (Fig ii).
- e. 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 (Fig iii). Complete this tucking sequence for four tucks thus giving a total of five tucks to the splice (Fig iv).
- f. Finally complete the splice by dogging the ends (Fig v).

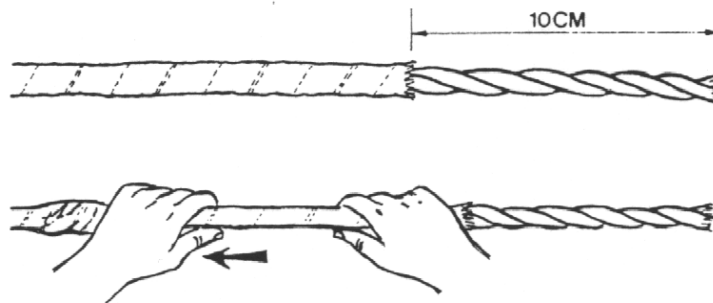




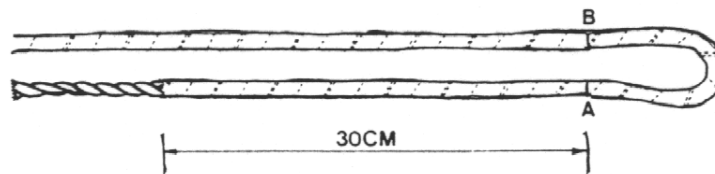
0402.10 Soft Eye Splice - Braided rope

This splice if completed correctly will return 95% of the strength of the rope.

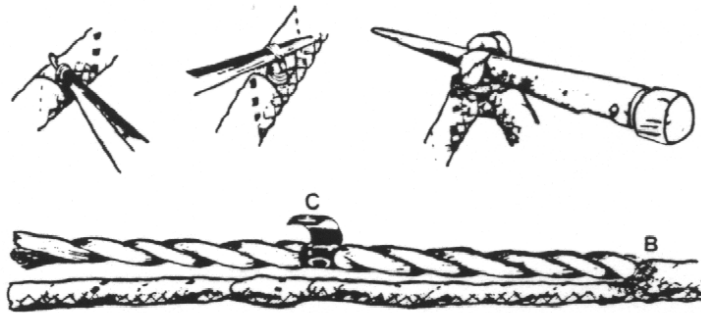
- a. Cut off the heat sealed end and push back the outer case exposing 10cms of inner core. Holding the end of the case to the core, push back the slack for about 1 metre. (An overhand knot can be tied to prevent the slack recovering).



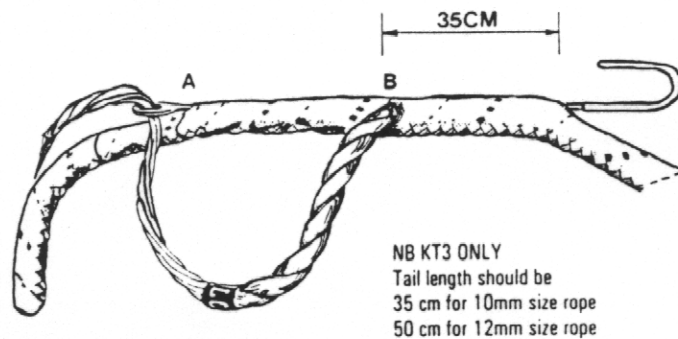
- b. Bend the rope and measure 30cms from the end of the case and mark (A) then mark (B) to the size of the eye required.



- c. With Swedish fid or pricker, open the case at mark (B) by lifting the strands making a small hole through which the inner core can be seen, then hook out the inner core. Pull out the core completely and the rope appears to have two tails. Pass a piece of tape around the inner core at point (C), then taper the end by removing 50% of the yarns. The end may be taped.



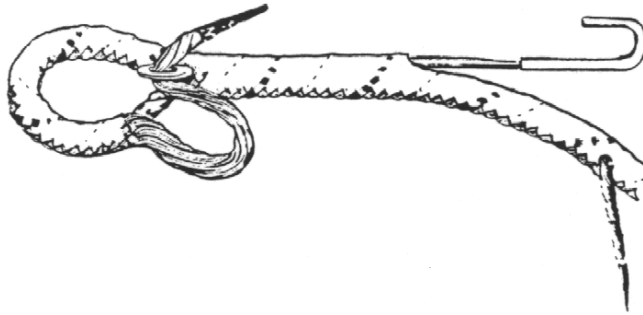
- d. Insert the splicing needle at a position 35cms from (B), taking care not to ensnare the inner core, push the needle down inside the outer case until it emerges at (A). Thread the tapered end into the eye of the needle.



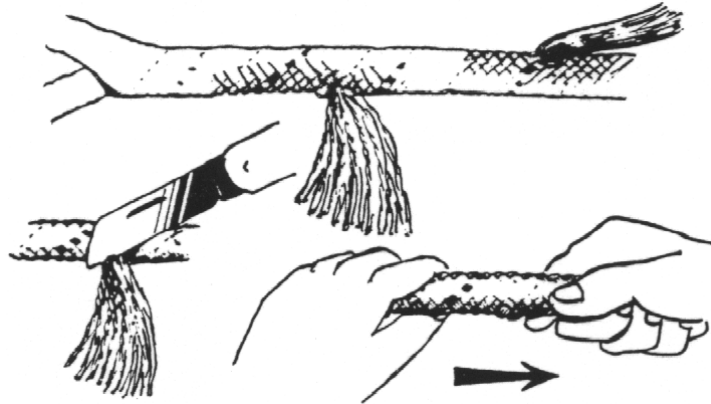
- e. Pull the splicing needle through the case and keep pulling until the eye has formed and the end of the inner core has emerged. Now push back some of the loose case in the outer cover towards the eye ready for the next stage of the splice.



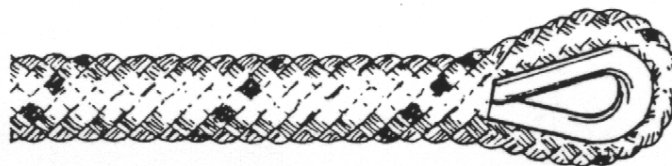
- f. Unpick and cut out 6 yarn ends approximately 5cms from the eye end of the outer case tail. Insert the splicing needle 20cms from the neck of the eye and push through, exiting at point (B). Thread the outer cover tail then pull this through the middle of the rope.



- g. The splice should now have the outer cover tail and the inner core tail emerging from different positions (and preferably on different sides). Pull everything tight and give the splice a good snatch to bed the yarns down then trim the ends with a sharp knife. Finally run a hand over the outer cover from the eye end down until the cut ends disappear inside the rope.



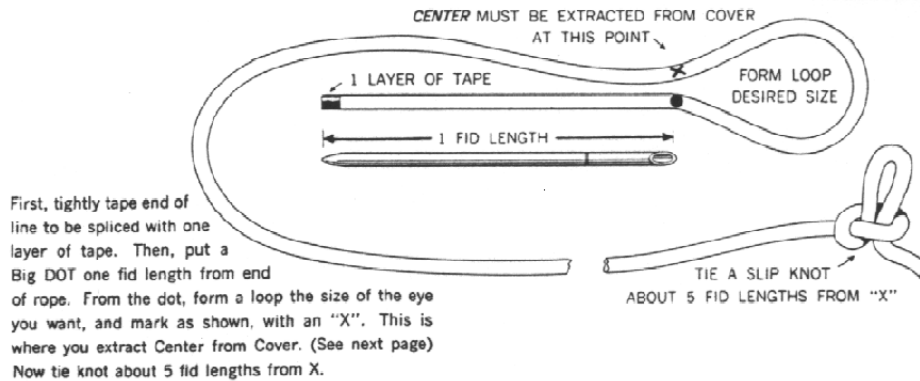
- h. If a thimble is required this can be inserted while the eye is being formed and before the ends are pulled tight.



Option Two

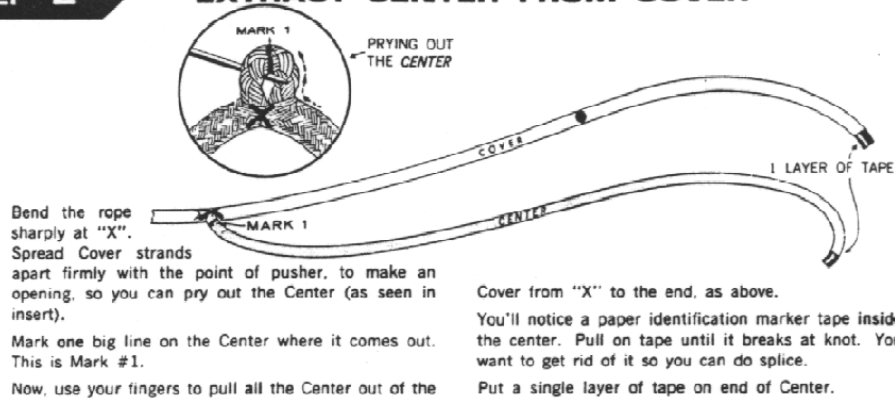
MEASURE THE EYE

STEP 1



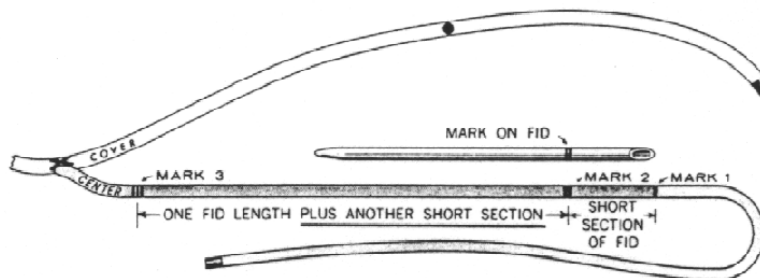
STEP 2

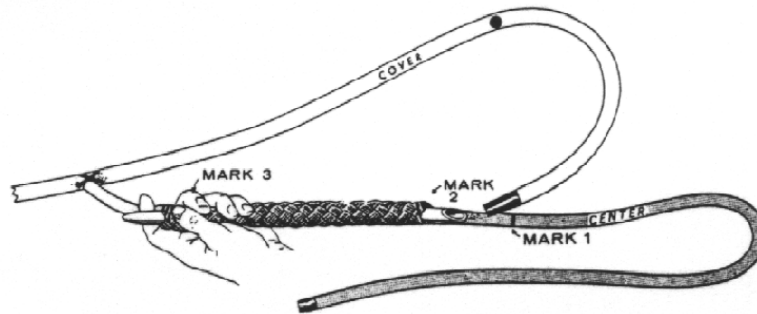
EXTRACT CENTER FROM COVER



MARK THE CENTER

STEP 3

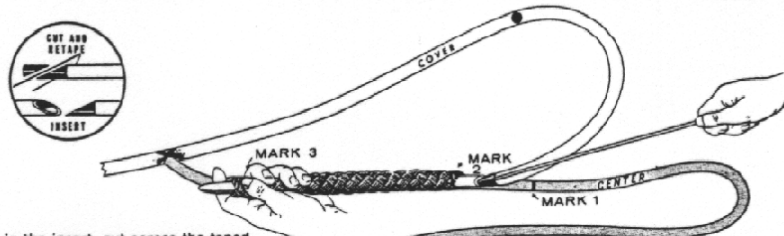


STEP 4**PUSH FID THROUGH CENTER "TUNNEL"**

Using a thimble? See "Tips" on Back Cover.

Insert fid into Center at Mark #2. Slide fid lengthwise

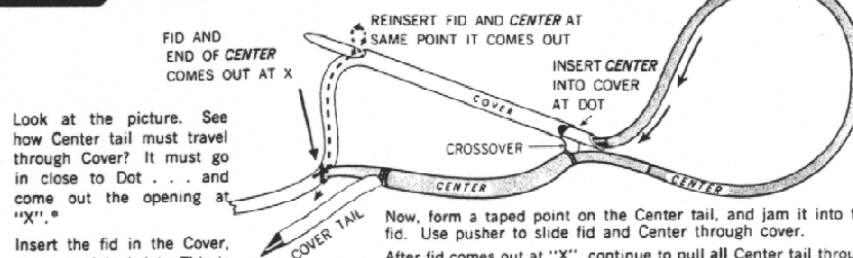
thru "tunnel" from Mark #2 until the point sticks out at Mark #3 as shown.

NOW, PUSH COVER THRU CENTER TUNNEL**STEP 5**

As in the insert, cut across the taped end of the Cover to form a point. Retape tightly with one layer of tape to make the point firm. Now, jam the taped point of the cover into the open end of the fid.

Next, jam the pusher into the fid behind the tape.

Holding the Center gently at Mark #3, push both fid and cover through the "tunnel" from Mark #2 to Mark #3, until the Dot almost disappears into center at Mark #2. Leave the cover tail sticking out and turn to the next page.

STEP 6**PUSH CENTER TAIL THRU COVER**

Look at the picture. See how Center tail must travel through Cover? It must go in close to Dot . . . and come out the opening at "X".

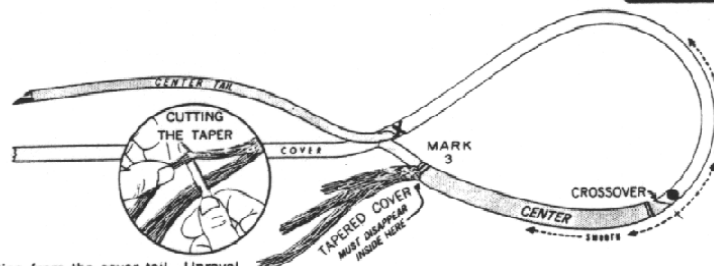
Insert the fid in the Cover, at your original dot. This is the "Crossover". Slide fid through the "tunnel", pointing towards "X". If it reaches "X", fine. If not, push the point through the cover strands, as in picture, for later reinsertion.

Now, form a taped point on the Center tail, and jam it into the fid. Use pusher to slide fid and Center through cover.

After fid comes out at "X", continue to pull all Center tail through the "tunnel". Pull it tight.

Now go back to Cover tail and pull it tight, too, so crossover is tight in both directions.

*NOTE: One pass is enough for small eye. On large eyes several passes may be necessary for the fid to reach the "X". When this occurs simply reinsert fid at exact place it comes out, and continue to "X".

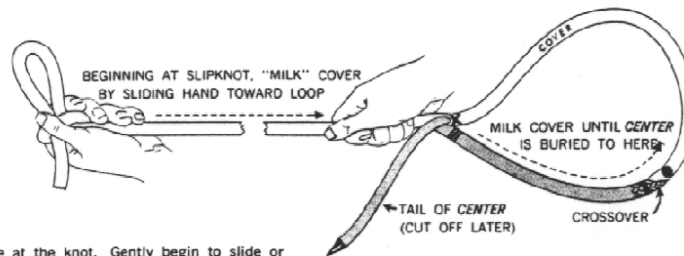
TAPER THE END OF THE COVER**STEP 7**

Cut off taped section from the cover tail. Unravel the cover tail braid (see insert) all the way to where it comes out of center of Mark #3. Cut off groups of strands at staggered intervals, as shown, to form a tapered end.

Now hold the loop in one hand at the crossover. Firmly smooth both sides of the loop away from crossover. Do this until the tapered cover tail section completely disappears inside Mark #3.

STEP 8

MILK COVER DOWN TO BURY CENTER



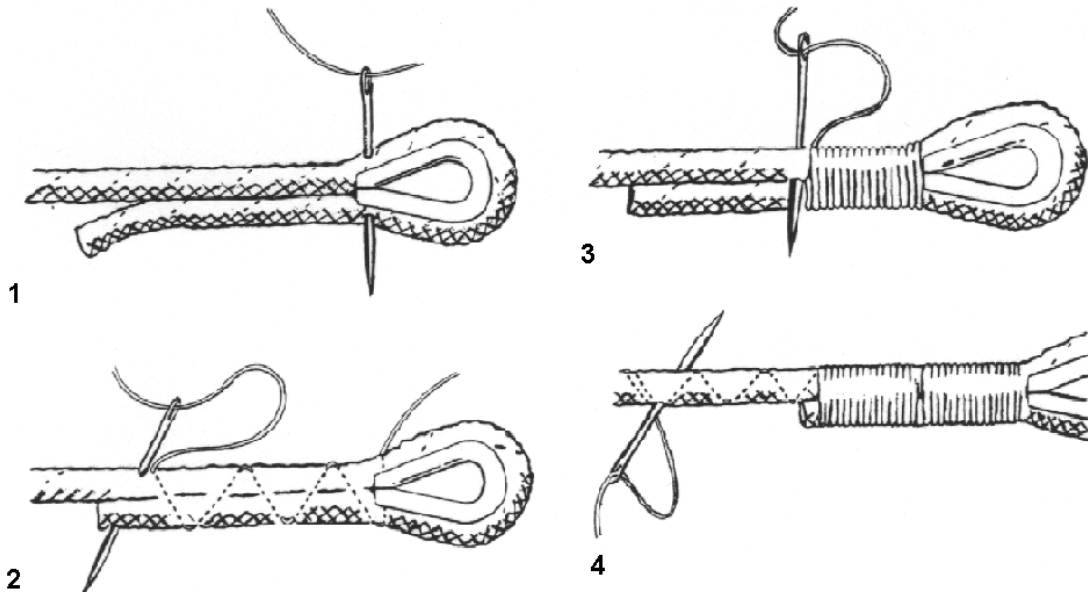
Next hold rope at the knot. Gently begin to slide or "milk" the Cover slack toward the loop. You'll now see the Center begin to disappear or "bury" in the Cover. Go back to the knot, and continue milking more

and more firmly until all Center and the Crossover are buried inside the Cover.

FINALLY, CUT OFF THE CENTER TAIL. After burying is completed, firmly smooth the finished eye in the direction of the tail. Then cut off the center tail "fairly close" to the cover. The cut end should just barely disappear at X, when you tug at the top of the eye.



Stitch and Whip Method



CHAPTER FIVE

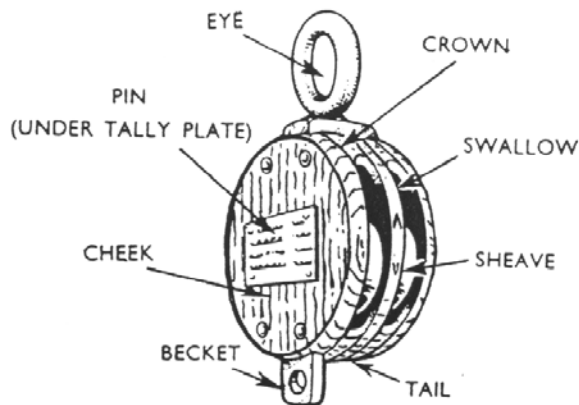
GENERAL RIGGING

0501	Blocks	Parts of a Block
0502	Types of Block	Internal-bound block Metal Block Synthetic-resin Bonded Fibre Block Snatch Block Examples of Blocks.
0503	Purchases and tackles	Parts of a tackle Reeving to Advantage and Disadvantage Mechanical Advantage Velocity ratio Friction in a tackle Examples of tackles Racking and Choking
0504	Associated Rigging Fittings	Shackles Parts of a Shackle Types of rigging shackle
0505	Thimbles	
0506	Hooks	Parts of a Hook
0507	Mousings	Mousing a Hook Mousing a Shackle Mousing a Slip
0508	Strops	Types of strop Attaching a Strop to a spar Securing a Strop on a rope
0509	Seizings	Flat Seizing
0510	Lashings	Square and diagonal
0511	Stoppers	Natural Cordage Stopper Man-made Fibre Cordage Stopper Chain Stopper
0512	Examples of Practical Rigging Exercises	A Standing Derrick A Swinging Derrick Sheers A Gyn Simple Ropeway Holdfasts Marker Buoy

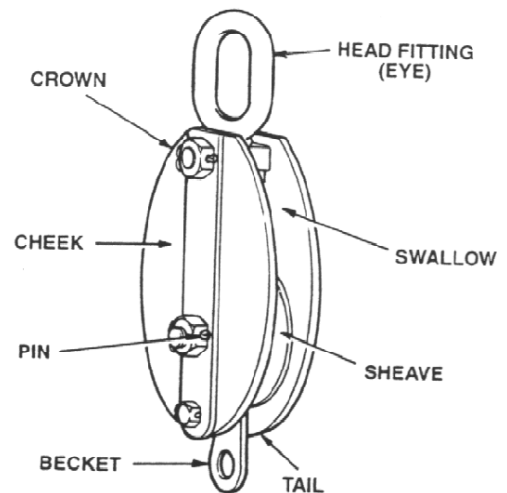
0501 BLOCKS

A block is a portable pulley, made of wood, metal, synthetic-resin bonded fibre (SRBF) or combinations of materials. Smaller commercially produced blocks are constructed of stainless steel and plastic (mainly used for boating purposes).

0501.1 Parts of a Block



Older style Internal Bound Block



Synthetic-Resin Bonded Fibre Block

General Information

Blocks can be fitted with a hook as an alternative to an eye, and the hook or eye can be fixed or swivel types. They may have more than one sheave; a single block has one sheave, a double block has two and a triple has three.

Wooden Blocks are classified by their size, which is the length from crown to tail measured in millimetres round the shell; and it will take a rope one-tenth of its size. (Rope measured by its diameter in millimetres).

Metal Blocks are classified by the size of rope for which they are designed and this is normally marked on a plate affixed to the cheek.

SRBF Blocks are also classified by the size of rope for which they are designed and this is stamped on the binding of the block.

0502 Types of Block

0502.1 Internal-bound Block (IB)

This type has a shell partly of wood and partly of metal, and is a version of a wooden block. The metal portion consists of a fork shaped steel fitting called 'the binding' which incorporates both the eye or hook and becket when fitted. The sheave is made of phosphor bronze which is less corrosive and does not create sparks as the pin is made of steel. This type of block can be used for rope or wire. A tally plate is found only on this type of block; it has two practical purposes, to hold in the pin and to supply information about the block. This information will contain the Pattern number (a computerised

number to identify the block), the size of the rope for its use and the safe working loads for use. In addition to allow for lost or damaged plates, information about the block will also be stamped on the hook or eye.

This will contain the pattern number, the size of the rope to be used, the tested weight (which will be higher than the safe working load) and the test date (month and year). All tests are normally carried out in HM Dockyard Test Centres.

Very little maintenance is required for these blocks. Even if the wood is split or chipped it can be repaired by using a wood filler or synthetic resin paste. The swivel hook or eye, whichever is fitted, should be kept free of dirt and given a light oiling to ensure it swivels freely. As most of the metal parts are galvanised only the pin requires a light coating of grease to ensure free running of the sheave. The sheave should be checked for wear periodically, any rough edges should be filed down to prevent damage to rope.

0502.2 Metal Block

Usually built of steel plates and fittings, their shells have a binding which supplies the strength but the cheeks are of light plating. Some types have their shells cast in one piece. Where possible metal blocks should be used when using wire rope. (Built-up metal blocks which were the main type of block used by the RN for awning tackles make ideal heel tackles for rigging evolutions).

A light application of grease should be used on the moving parts. Steel blocks showing signs of rusting should be wire scrubbed, treated with a rust inhibitor and lightly greased. A coating of linseed oil will prevent rust on the shell. Galvanised metal blocks generally require less maintenance, a light oiling normally only required. The pin which is of steel should be given a light coat of grease or oil. Wire brushes should not be used on galvanised metal blocks as this may damage or remove the coating, instead a nylon pad may be used to remove any corrosion.

0502.3 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. These blocks are for use with natural fibre and man-made fibre ropes only and can be single, double, triple or snatch blocks with safe working loads of one, two or four tonnes. They must not be used with wire rope. (This type of block is currently on issue to units. Because of the block's size it is not often practical to use these as heel tackles, although they make ideal purchases).

0502.4 Snatch Block

These are single metal, internal bound or SRBF blocks, in which part of the shell is hinged to form a 'gate' which allows a bight of a rope to be inserted into the swallow from one side. They should not be used when a solid block is available for the job and they should NEVER be used when the safety of life depends on them because the gate may open if a sideways pull is exerted. Ideally these blocks should be used for lead blocks during rigging evolutions.

The maintenance required depends on the type of block, additionally the gate will require a light greasing or oiling. Avoid applying too much grease to pin springs as this generally attracts dirt and more frequent checks and maintenance may be required.

0502.5 Examples of Blocks

Metal Blocks

Cast type

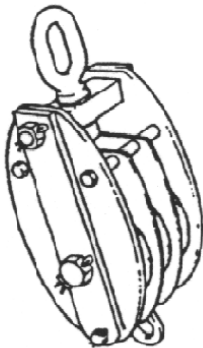


Built up type



Synthetic-resin Bonded Fibre (SRBF) blocks

Treble block



Double block



Single block

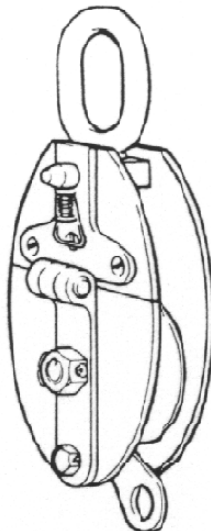
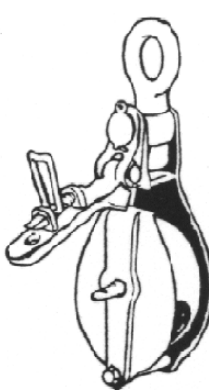
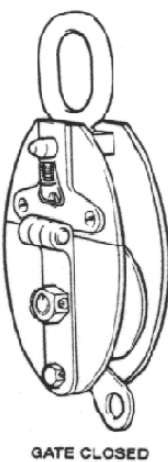
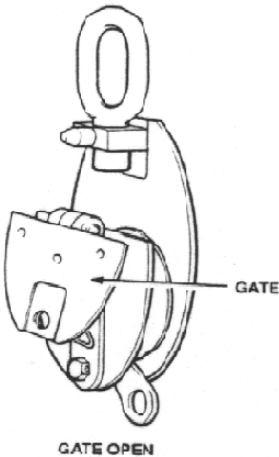


Snatch blocks

*The principle of the block
(showing the gate open and closed)*

Metal

SRBF

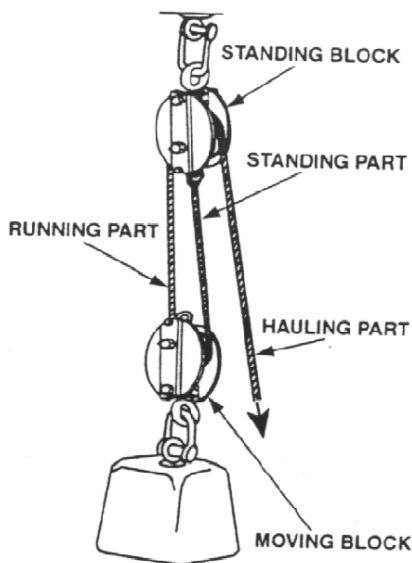


0503 PURCHASES AND TACKLES

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 on the number of sheaves in the blocks and the manner in which the rope is rove through them.

0503.1 Parts of a Tackle



0503.2 Reeving a Tackle to Advantage and to 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**'. When practicable, rig a tackle so that the hauling part leads from the moving block and make the block with the greater number of sheaves the moving block.

0503.3 Mechanical Advantage (MA)

This is the amount by which the pull on the hauling part is multiplied by the tackle. If friction is disregarded, this is equal to the number of parts of the fall at the moving block. (e.g. if there are two parts at the moving block the mechanical advantage is two, a pull on the hauling part of 50kg would, if friction is disregarded, hold a weight of 100kg).

0503.4 Velocity Ratio (VR)

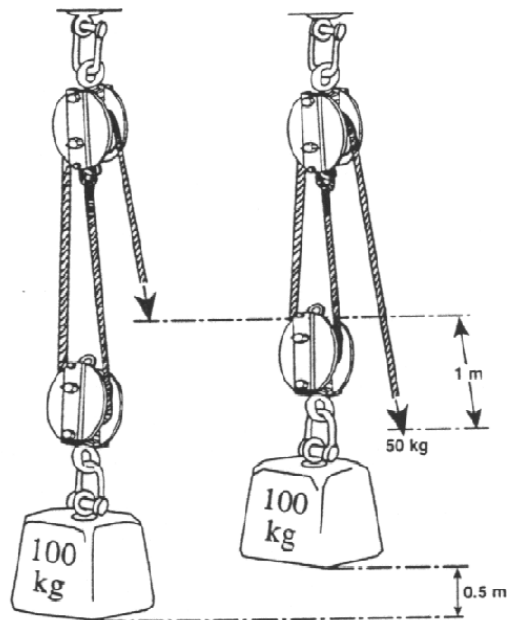
Mechanical Advantage is gained only at the speed of working. The ratio between the distance moved by the hauling part and that moved by the moving block is known as the Velocity Ratio (VR) and is always equal to the number of parts of the fall at the moving block.

0503.5 Friction in a Tackle

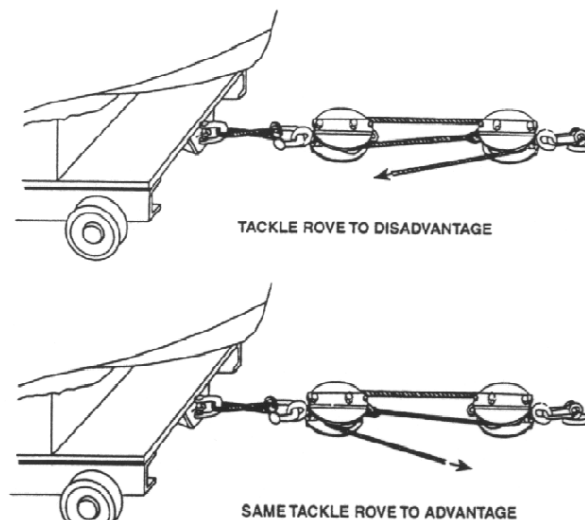
When a tackle is being worked considerable friction is set up, both in the bearings of the blocks and within the fall as it bends round the sheaves. This friction accounts for the difference between the velocity ratio (VR) of the tackle and its mechanical advantage (MA). (It is important therefore to ensure that the sheaves run as smoothly as possible and that the tackle is correctly made up so as to ensure that the moving parts do not cross over and rub against each other).

0503.6 Examples

Mechanical Advantage & Velocity Ratio of a Tackle



Tackles rove to Disadvantage and Advantage



0503.7 Tackles and Purchases

These are considered to be the only types found in units or required to be used within the Training Syllabus.

Runner - consists of a rope rove 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.

Single Whip - consists of a fall rove through a single block; no mechanical advantage is gained. It is used for hoisting light loads.

Double Whip - consists of two single blocks rove with the standing part of the fall made fast near, or to, the upper block. It cannot be rove to advantage. The VR is 2 and the MA 1.82.

Luff - is a purchase 24mm or greater. It consists of a double block and a single block, with the standing part of the fall made fast to the single block. To Disadvantage the VR is 3 and the MA 2.3, to Advantage the VR is 4 and the MA 3.08.

Two-fold Purchase - consists of two double blocks and is a useful general purpose tackle. To Advantage the VR is 5 and the MA 3.75, to Disadvantage the VR is 4 and the MA 2.86.

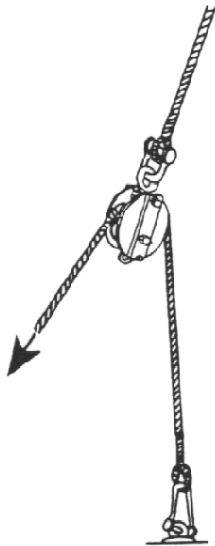
Three fold Purchase - consists of two treble blocks and is used where a heavier weight is required to be lifted. To Advantage the VR is 7 and the MA 4.37, to Disadvantage the VR is 6 and the MA 3.75.

(It is common practice in a number of circumstances, mainly because of convenience, to use a tackle rigged to disadvantage. When dealing with light loads there is very little noticeable difference however, with heavier loads try to rig and use the tackle to advantage where there may be a very noticeable difference).

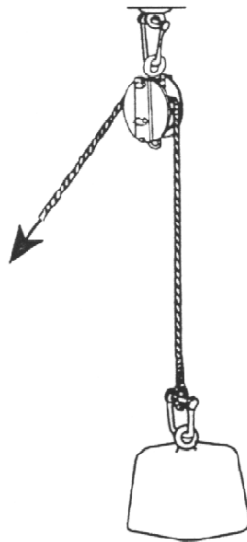
No block is to be used for lifting loads greater than the Safe Working Load shown on it.

Examples of Whips and Tackles

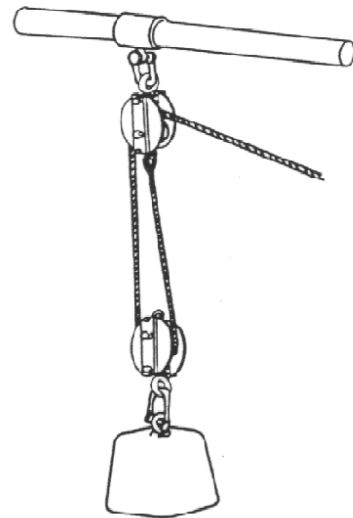
A Runner



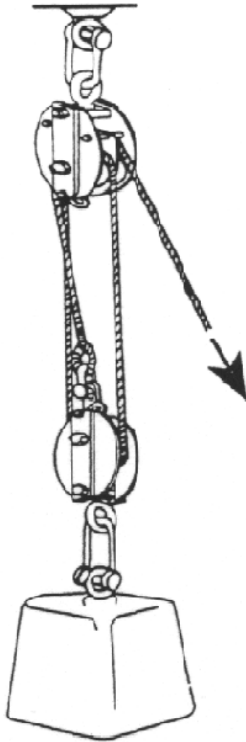
A Single Whip



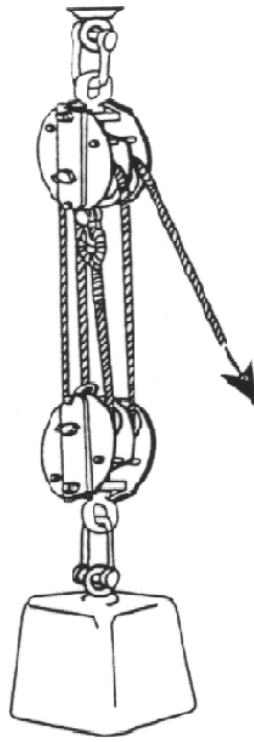
A Double Whip



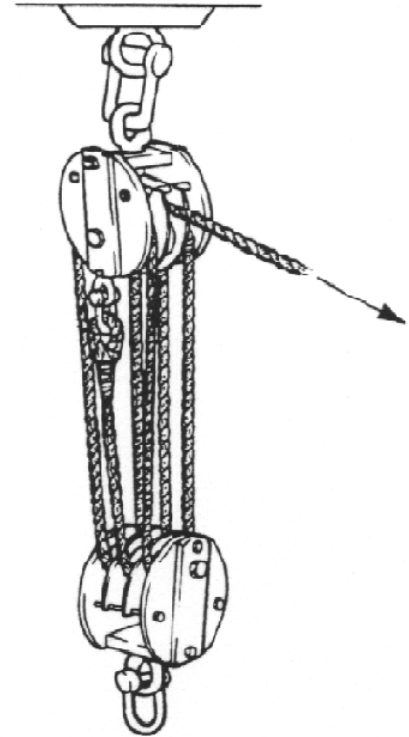
A Luff



A Two Fold Purchase



A Three Fold Purchase



0503.8 Racking and Choking

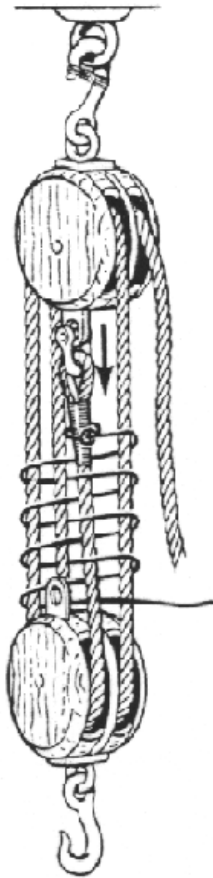
Racking

This is used to hold a tackle temporarily whilst the fall is being belayed; if the strain is too great for this to be done by holding the opposite running parts, or the running and standing parts together with the hands. The racking turn are passed with a short length of line, taking figure of eight turns round the standing and running parts, the end being held in the hand or secured round the parts. The hauling part is kept clear of the racking in order for it to be moved. Racking is the better option as no additional strain or wear is put onto the rope.

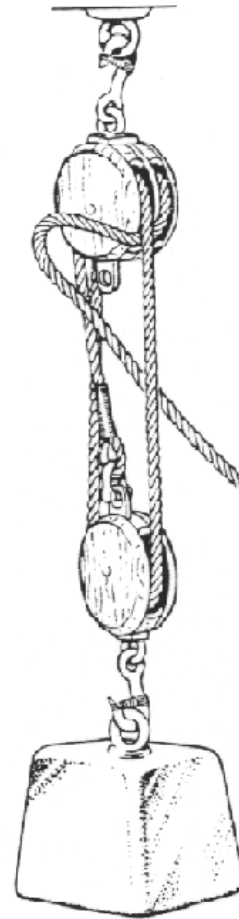
Choking the Luff

This method of holding a small tackle temporarily should only be used when no cleat is available and the load is light. The bight of the hauling part is pulled through the centre of the moving parts and wedged between the moving parts and the block. This method is bad for the rope as it has to be jammed into the swallow which can cause damage to the rope. It is unsafe as the weight of the bight dropping often causes the rope to be pulled out thereby causing the weight to drop. In addition to this, if the hauling part is accidentally pulled, the weight may drop without control. In the interests of safety this method should not be used unless it is absolutely necessary, the preference being to Rack the tackle.

Racking



Choking the Luff



0504 ASSOCIATED RIGGING FITTINGS

0504.1 Shackles

These are coupling links used for joining ropes, webbing and chain together or to some fitting and those supplied by the Royal Navy (and Sea Cadet Stores) are usually forged from carbon

magnesium steel. Shackles are available commercially from a number of sources either forged from steel or stainless steel. Those shackles supplied from HM Dockyards show a test load and a test date most commercial shackles do not. (Test loads are not for each individual shackle but calculated from a specimen test to apply to a particular size of shackle).

0504.2 Parts of a Shackle

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 and the jaw is closed by a removable bolt which passes through a hole in each lug.

All rigging shackles are supplied as 'lugged shackles', the U-shaped ones with straight lugs are called Straight shackles, and those which have curved lugs are called Bow shackles. There are different types of straight and bow shackle and these are usually named by reference to the manner in which its bolt is secured in place.

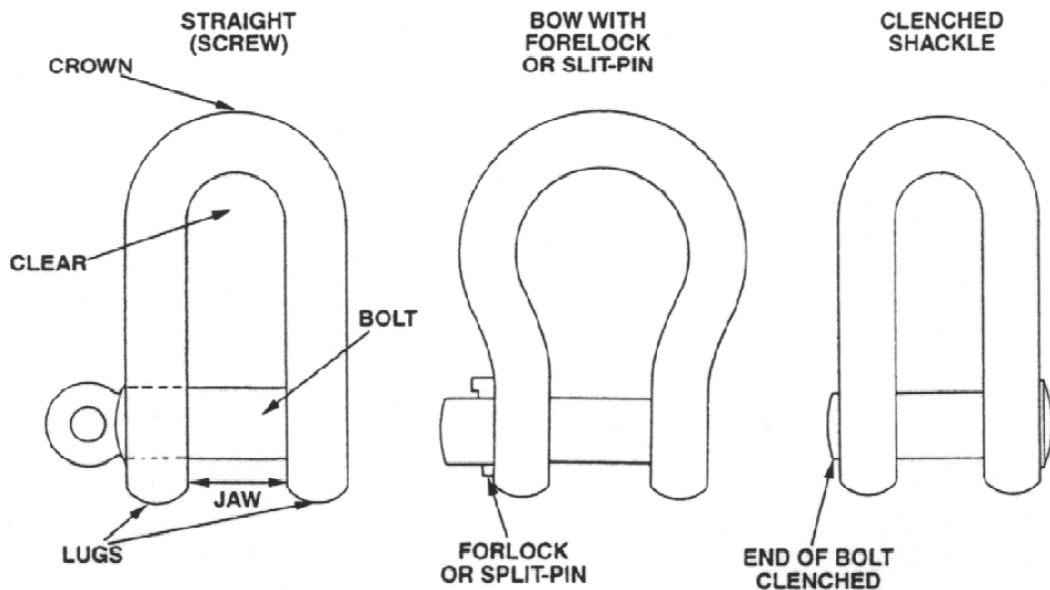
0504.3 Types of Rigging Shackle

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.

Fore-lock 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 (fore-lock) is passed through a slot in the end of the bolt. It is secured by opening the jaw of the pin. The fore-lock may be attached to the shackle by a keep chain or a length of wire.

Split pinned shackle - may be a bow or straight shackle. This type of shackle is of similar design to the fore and fore-lock shackle, but is supplied with a galvanised split pin to serve the same purpose as a fore-lock. The pin may be attached to the shackle by a keep chain or a length of wire.

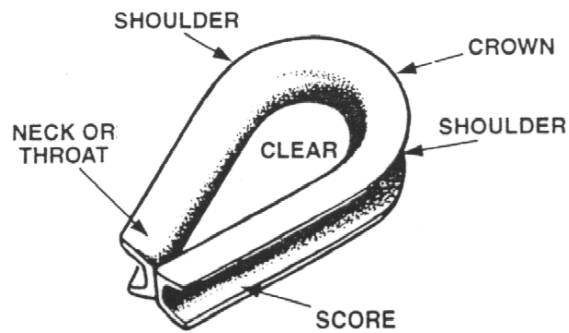
Examples of Rigging Shackles



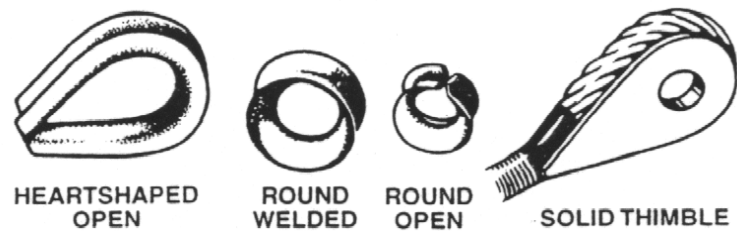
0505 THIMBLES

Thimbles are used and spliced into the end of a fibre or wire rope 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. They are classified according to the diameter of the rope for which they are intended and also their shape; most thimbles being manufactured of galvanised steel, although they may be made of stainless steel, phosphor bronze or polyamide.

Thimbles are either solid, round or heart-shaped and open or welded at the neck; the gap formed at the neck can be sprung open to allow the eye of a tackle hook or lug of a shackle to enter.



Parts of a Thimble

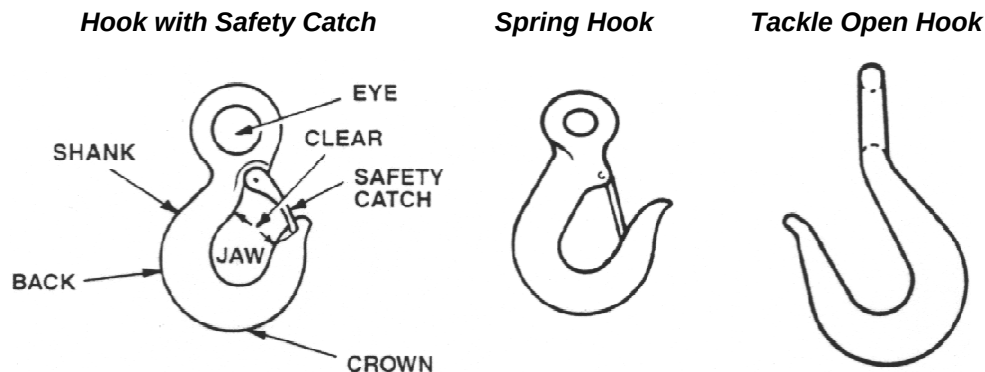


0506 HOOKS

There are various types of hooks available. Most are manufactured of carbon manganese steel, and are generally much weaker than shackles of similar size. Open (tackle) hooks must always be moused when in use. Safety hooks are manufactured with a fitted safety catch (spring-mousing) and should always be used when lifting heavy objects.

0506.1 Parts of a Hook

The point of the hook is called the bill, the body is called the shank, and the bottom the crown; the part opposite the bill is the back; the jaw is the space between the bill and the top of the shank, and the clear is the inside diameter of the crown.



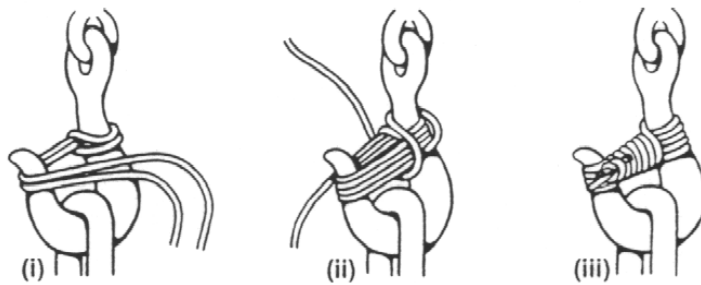
0507 MOUSINGS

A mousing is a length of line or wire which is used to prevent the screw of a shackle undoing or to prevent an open hook from unhooking. Pins in slips can also be moused with wire to prevent the pin from falling out and the retaining hooks on the gate of an IB Snatch Block may also be moused with wire.

0507.1 Mousing a Hook

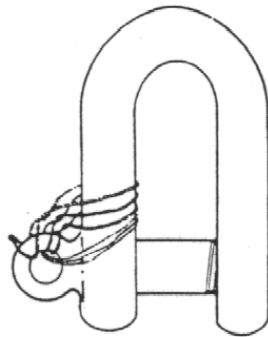
A length of line will provide a tighter mousing in preference to wire. The line should be

middled and looped round the shank then passed around the bill and shank a number of times; one end is then taken around the turns and pulled taut finally securing both ends of the line with a reef knot. By tightening around the turns this will prevent the loops from slipping over the bill.



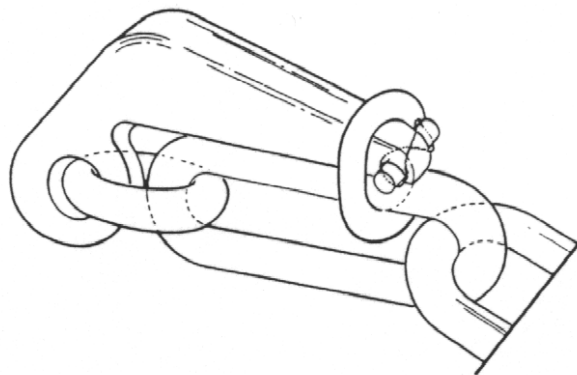
0507.2 Mousing a Shackle

A length of wire is used and three or four turns are passed round the lug and through the eye of the pin and the ends are then twisted tightly together. Surplus wire is cut off.



0507.3 Mousing a Slip

A length of wire is used and figure-of-eight turns are taken around the exposed ends of the pin.



0508 STROPS

A strop is a ring of cordage or wire rope, which can be used to pass round a rope, spar or other fitting so as to provide an eye for attaching a hook or shackle.

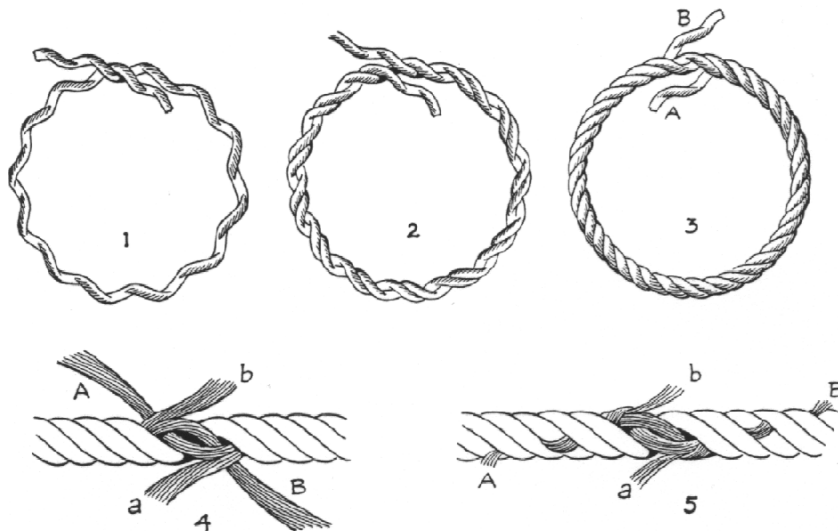
0508.1 Types of Strop

Common Strop - this is made from a short length of rope with the ends bent or spliced together. A Common Strop made from hawser laid rope may be made up using a single strand of rope laid up in the form of a grommet. This will provide a stronger strop as it will be laid up as for the original rope.

Bale Sling Strop - this is of similar construction to the common strop but much longer. It is primarily used as a sling for hoisting larger objects.

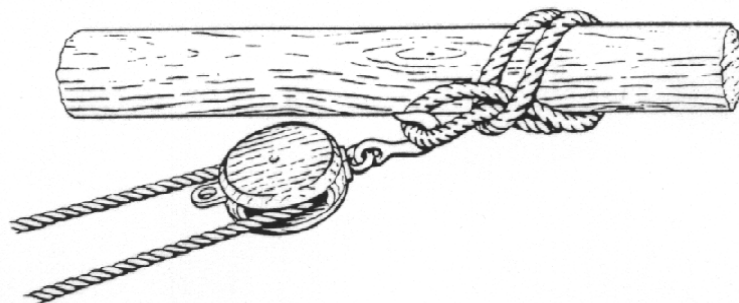
Salvagee Strop - this is used for the same purposes as the common strop, but has the virtue of being able to grip a spar, or other object, more strongly so that it will withstand a sideways pull. It is made of spun yarn and has no specified length or breaking strain. (To make the strop, use two pegs, nails (or even chair legs) at a set distance apart; pass the spun yarn around both pegs keeping the spun yarn tight. When the strop is of the required thickness marl it down with a series of marlin hitches and finish by stopping the loose ends).

Grommet Strop - this may be long or short and differs from the other strops only in its construction: It is formed from one strand laid up around its own part to form a ring: When complete it will resemble the original laid up rope. A wire grommet strop is the strongest type of strop used and is therefore used for the heavy work.



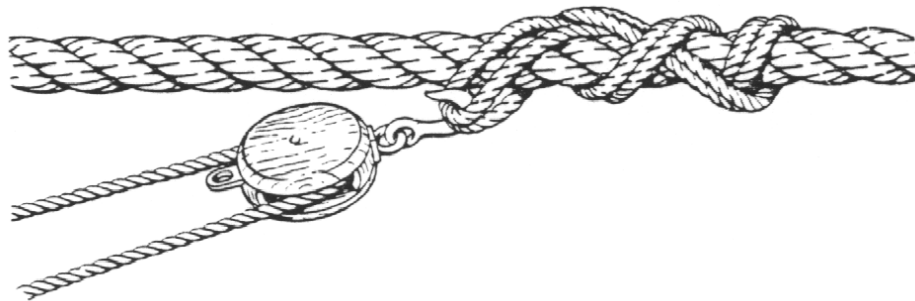
0508.2 Attaching a Strop to a Spar

Use a common strop, loop round the spar and pass one end through the loop of the other. If the strop has been joined with a short splice ensure that the splice is round the spar and not forming part of the eye on which to attach the hook or shackle. (If the pull is from one side so that a strong grip is required, use a salvagee strop).



0508.3 Securing a Strop on a Rope

Use a common or salvage strop, middle it on the rope; overlap the bights in opposite ways and the hook, or shackle is secured to both parts.



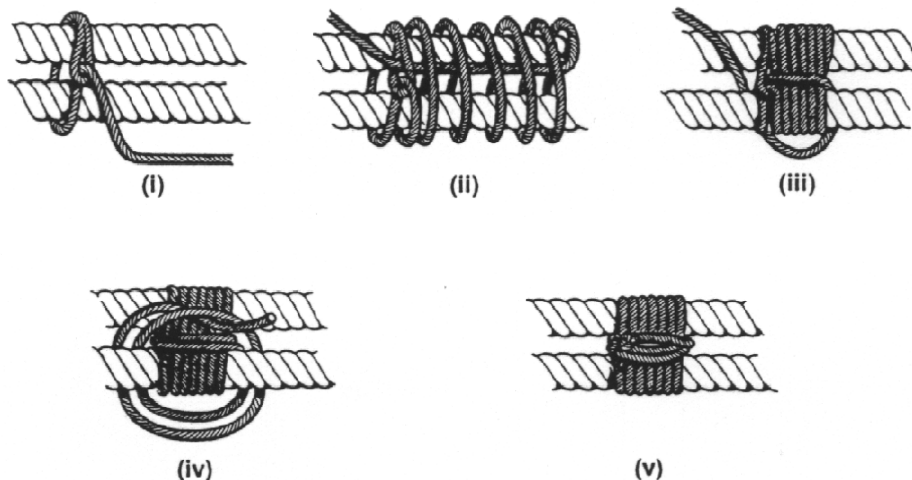
0509 SEIZINGS

A seizing is used to bind two pieces or sections of rope or wire together; (an example of this is when it is necessary to convert a soft eye splice into a hard eye splice by simply seizing in a thimble), additionally two poles may be lashed together using a number of seizings.

All seizings on cordage are begun by making a small eye in the end of the seizing stuff and a timber hitch is used when securing the seizing to a spar (s).

0509.1 Flat Seizing

This is a light seizing used when the strain on both parts of the rope is equal. Having made an eye in the seizing stuff pass this round both parts and pass the end through the eye, taking care to keep the eye in the centre and clear of both parts (i). Take approximately 11 turns loosely round both parts then pass the end back through the turns bringing the end up through the eye (ii). Pull all the turns taut and haul the slack through the eye (iii); finish with a clove hitch around the centre. (If using small hawser laid rope for the seizing and to ensure that it does not come undone, finish off the end with a crown and wall knot close up to the hitch).



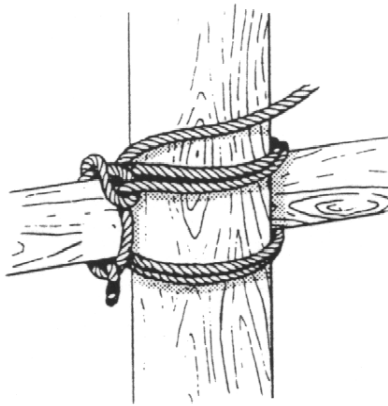
(Other seizings currently included in the Admiralty Manual of Seamanship are not included in the Sea Cadet Seamanship syllabus).

0510 LASHINGS

Lashings are used when it is necessary to secure two poles or spars together. A length of rope or spunyarn is used for the lashing.

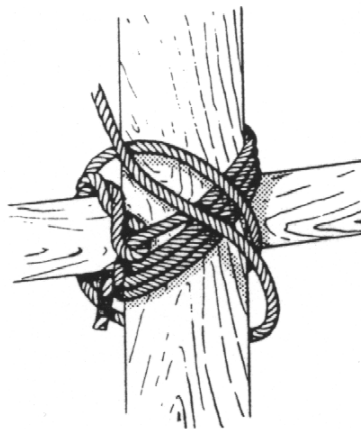
0510.1 Square Lashing

This is used when the poles or spars to be secured are at right-angles to each other. Make fast one end of the rope to one of the spars with a timber hitch and haul it taut. Then crossing at right angles continue to lash until sufficient turns have been taken. Keep the rope as tight as possible at all times and avoid riding turns. To ensure that the turns are bound tight, finish by taking two or three frapping turns around the parts between the spars, and make fast with a clove hitch round all the parts or round one of the spars.



0510.2 Diagonal Lashing

This is used when the poles or spars are to be secured at an acute angle to each other. Make fast one end using a timber hitch then pass as many turns as are required diagonally round both spars. Then bring the end up and over one spar and take a few more turns across the opposite diagonal, finishing off with frapping turns as for the square lashing.



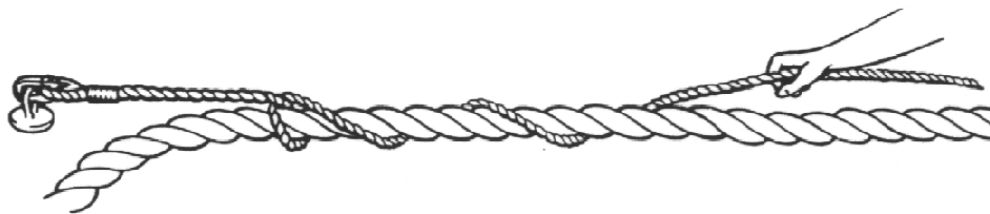
If two or more poles or spars are required to be lashed together side by side, a lashing in the form of a flat seizing should be used. The number of seizings required will vary depending on the length of the poles or spars at the join. (Two wedges or spikes are recommended to keep both poles or spars apart sufficiently to apply frapping turns). A minimum of three seizings should be used, one seizing complete with frapping turns at each end of the join, applied as tightly as possible; the third centrally placed between both of the other seizings. (If the third seizing is applied taut it will take up any of the slackness left by the other two. Without the third seizing the poles will tend to give when stood upright because the frapping turns may be flexible).

0511 STOPPERS

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 natural fibre, a man-made fibre or a wire rope and on the strain it is required to take.

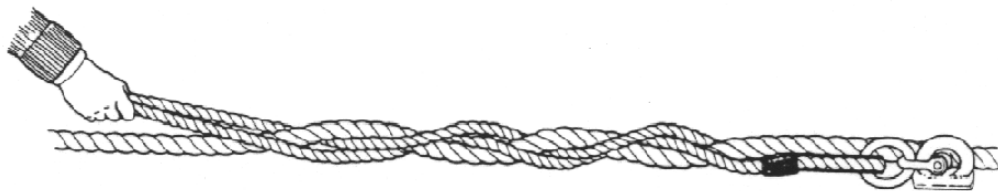
0511.1 Natural Cordage Stopper

This is used for fibre hawsers only and consists of a length of natural cordage made fast to an eyeplate or other fixture. The stopper is laid alongside the hawser with its tail pointing towards the source of the strain; the tail is half hitched round the hawser **against the lay**, and then dogged round the hawser with the lay ; the end is then held by hand or stopped to the hawser.



0511.2 Man-made Fibre Cordage Stopper

This is used for man-made fibre hawsers and consists of a length of polyester, middled to form two tails and made fast to an eyeplate or similar fixture. The stopper is laid alongside the hawser with its tails pointing towards the source of the strain; the tails are passed by crossing them under and over the hawser in the direction of the source of the strain. The ends are kept in hand or stopped to the hawser.



0511.3 Chain Stopper

This is used for wire hawsers only and consists of a length of chain made fast to an eyebolt or similar fixture. The stopper is laid out alongside the hawser with the tail pointing towards the source of the 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 stopped to the hawser.



0512 EXAMPLES OF PRACTICAL RIGGING EXERCISES

0512.1 A Standing Derrick

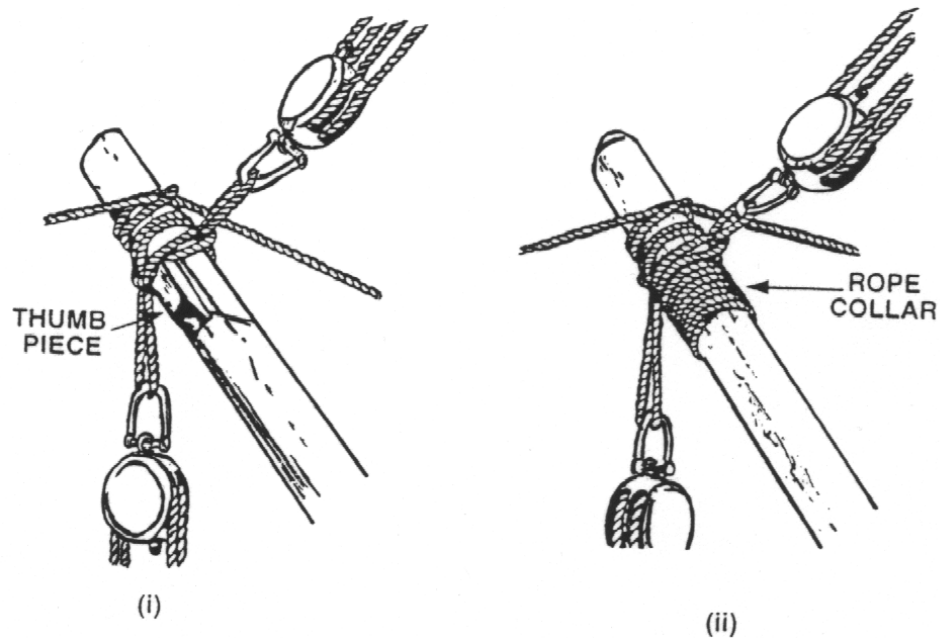
This is a single spar stayed by rigging and having a tackle at its head for hoisting a load. Its head is supported by a topping lift, or, if there is no suitable overhead attachment point for a topping lift, it is supported by a back guy. Side guys are fitted to give lateral support, and if there is a suitable attachment point, a martingale or fore guy may be led downwards from the head to prevent the head from springing upwards or backwards when hoisting or lowering a load.

To Rig a Standing Derrick - Strops for attaching the purchase and topping lift (or back guy) are placed over the head of the spar, and are prevented from slipping down either by wooden projections called **thumb pieces** (blocks of wood screwed or nailed in place), or by a rope collar (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 rope or cordage, are then middled and clove hitched over the head of the spar, above the strops, tackles being attached if required. The heel of the derrick rests in a shoe (a block of wood with a turned out recess) to protect the deck, and is kept in place by tackles, (heel tackles), which must be led so that they will support it in every direction, particularly from the direction that 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.

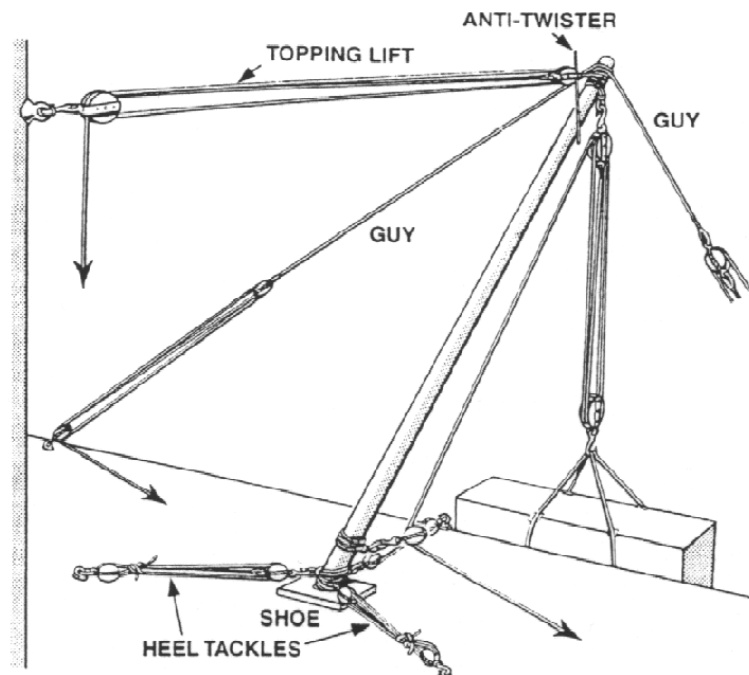
Handy hints:

- i) *If three tackles are used they should be secured 120 degrees apart so that they take equal strain.*
- ii) *Attach four strops around the base of the spar, three for the heel tackles, the fourth to hold a lead block for the purchase.*
- iii) *The bottom strop is used for the lead block (and will pull upwards), the top strop is used for a heel tackle (to pull downwards), so that when under strain will result in both strops forcing towards each other locking the other strops and preventing them all slipping.*

Methods of Rigging the Head of a Derrick Using Rope Collars or Thumb-pieces



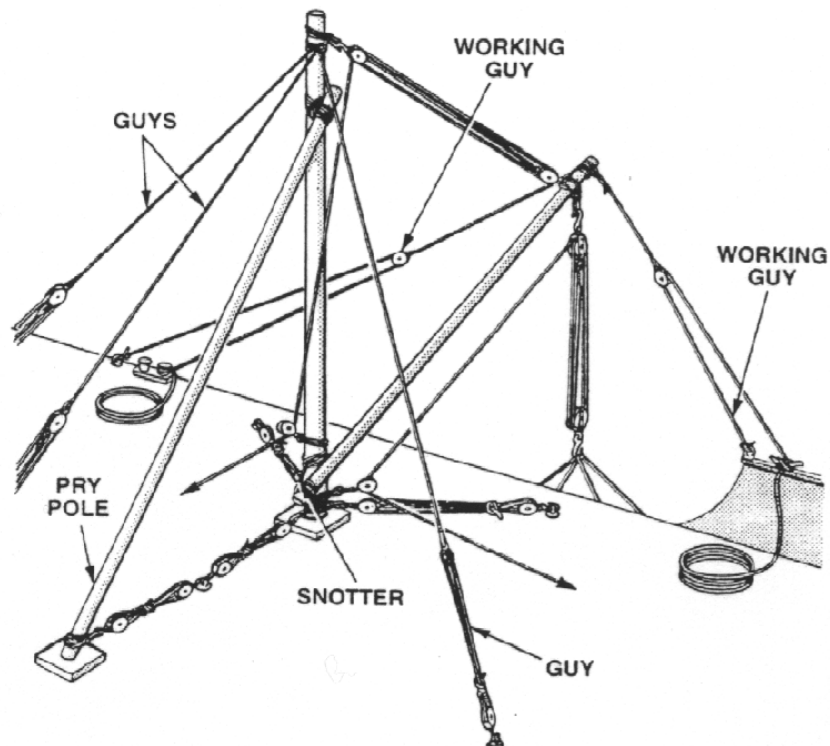
Example of a Standing Derrick



0512.2 A Swinging Derrick

This is made up of two spars, one upright and well stayed by guys, and the other secured to the first by a stop called a snorter 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 raised, lowered and slewed (swung) through an angle of

up to 120 degrees when the load is slung. This type of derrick is not suitable for heavy loads because of the stress imposed on the snotter.

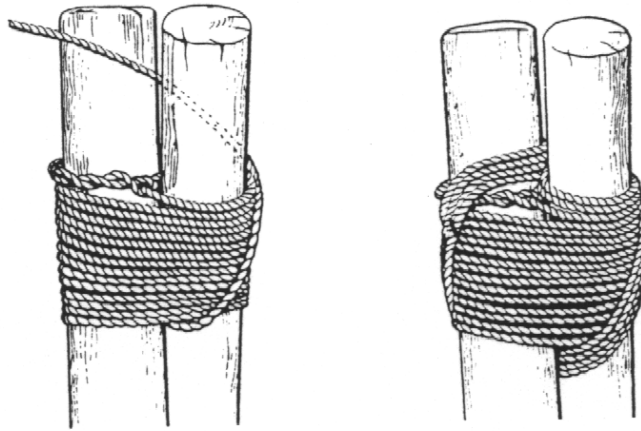


0512.3 Sheers

These consist of a pair of spars called legs, which are lashed together and crossed near their heads; the cross being 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**.

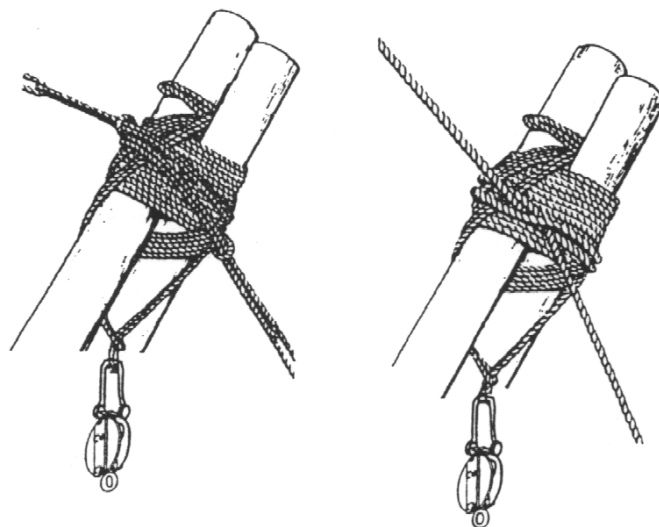
To Rig Sheers - The spars for the legs are laid side by side, with their heels together and their heads supported conveniently clear of the deck; then lashed together. The legs are first crossed and the lashing is made fast to one leg by a timber hitch, either above or below the cross, and then a sufficient 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 frapping turns are applied and 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 applied, close to each other, and hauled taut. Choice of the rope used for the head lashing depends on the size of the spars and the weight to be lifted.

Passing the Head Lashing of Sheers

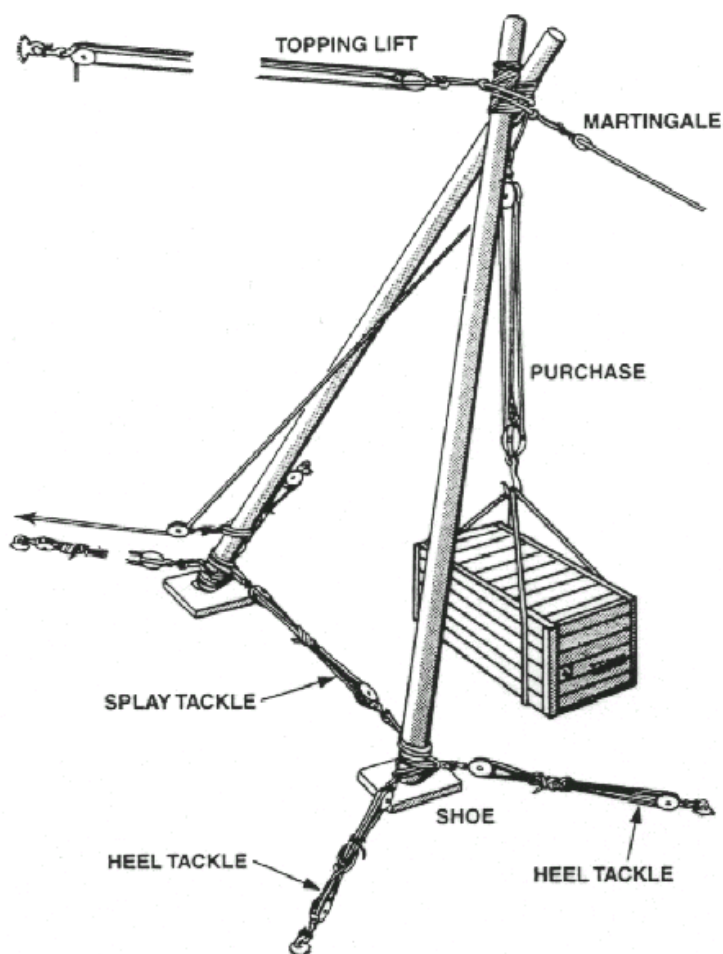


When the head lashing has been completed the heels of the legs are opened out to the required distance; the action of opening them out sets up the head lashing so taut that it binds the legs securely together where they cross. The strop for the purchase is now put on and must be long enough to enable the block to swing clear between the legs; it is applied 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. Chafing pieces (canvas, leather or other material) 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, each principle should have the pull on the guy assisting to bind the sheers together, and the purchase strop should be free to take up its natural position as the weight comes on it. The necessary tackles for the guys and other rigging is then secured in place. The sheers are placed in position, the heels in shoes, 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 other, each end being secured to a strop. Two heel tackles are secured to each spar and as with the derrick, are kept as low as possible (rope collars may be tied on to prevent slippage). The leading block for the fall of the purchase is then attached to one leg. (An alternative means of splaying the legs is to lash a third spar across the heels. The heel tackle strops should be placed above the spar so that when under tension they lack against the spar).

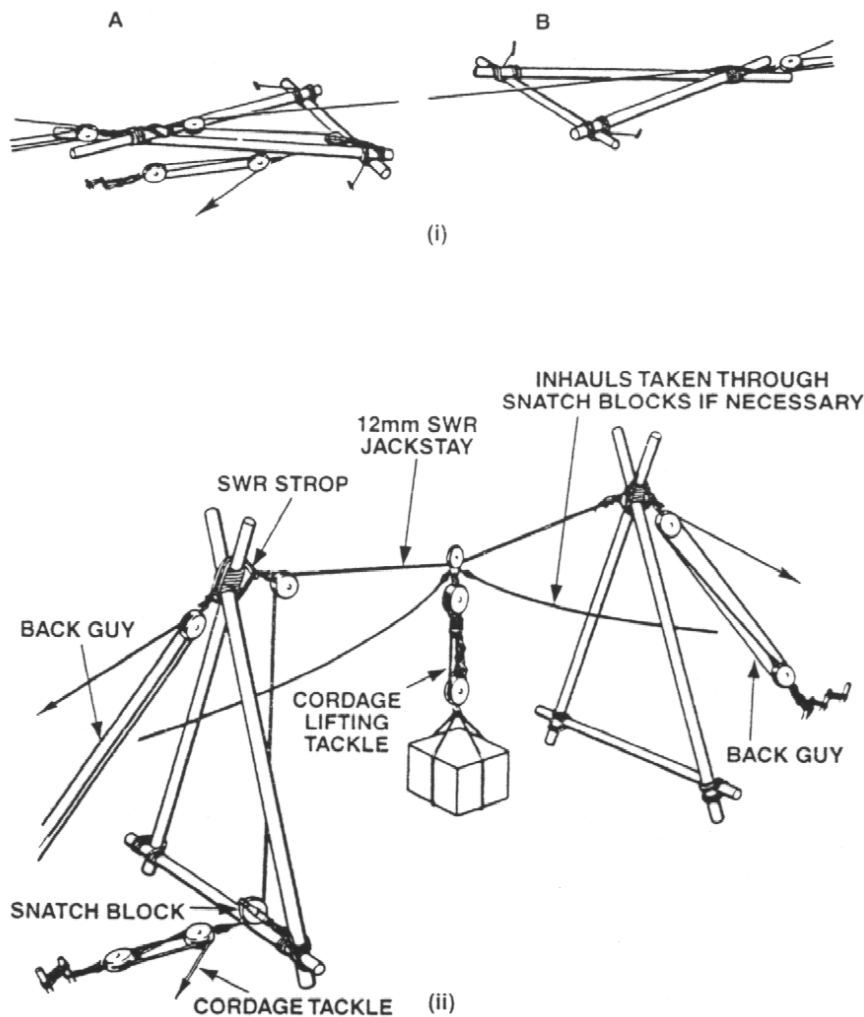
Methods of rigging the Heads of Sheers



Example of Sheers



Example of a Simple Jackstay Rigged with two Sheerlegs



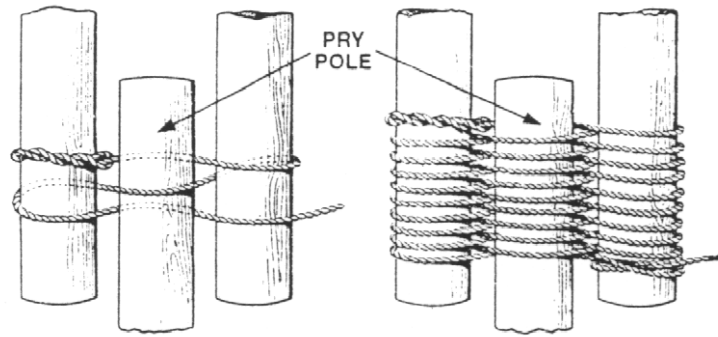
0512.4 Gyn

This 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.

To Rig a Gyn - 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 two the cheeks. The lashing is then put on by applying a timber hitch round one **cheek**, then from six to eight figure-of-eight turns are taken with the lashing being completed with a clove hitch round the other cheek.

Handy Hint: If all three poles are the same size and have smoothed surfaces, they can be lashed with all poles laying alongside each other - when the required length of lashing has been loosely applied the centre pole (prypole) can be slid out prior to tightening. This is an easier way of applying the head lashing.

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 far too taut great difficulty will be experienced in raising the gyn. 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 splay tackles taut. When the head of the gyn reaches a convenient height the strop for the upper block of the purchase is applied and the block secured on it. The heels of the poles should be set in shoes before finally securing the heel tackles.

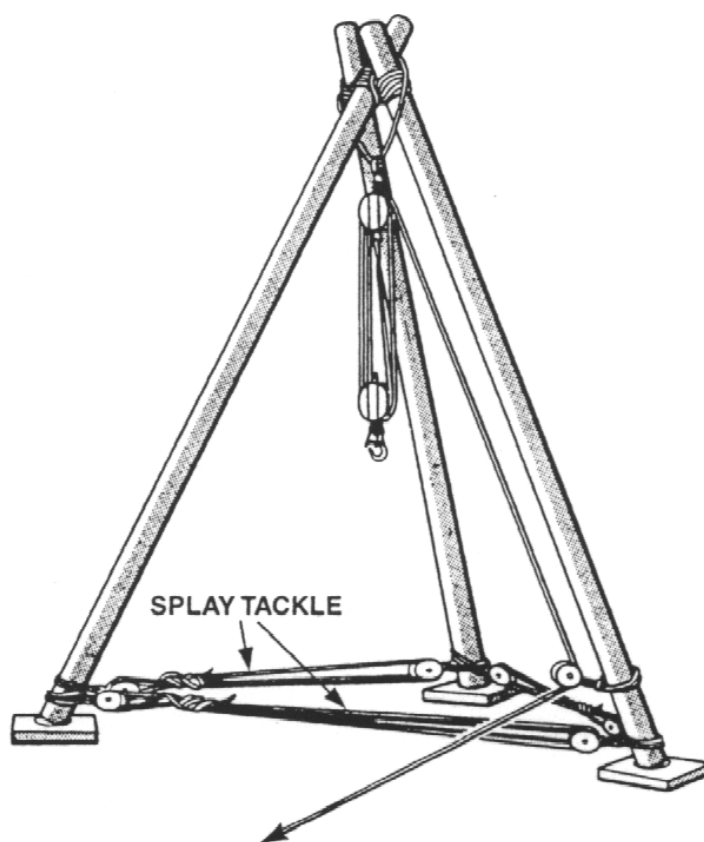
An option to secure the heels of the poles could be the use of additional poles used as splay poles, securely lashed to the uprights, which will provide a firmly secured, freestanding gyn.

If it is necessary to secure the gyn down then additional heel tackles or lashings will be required.

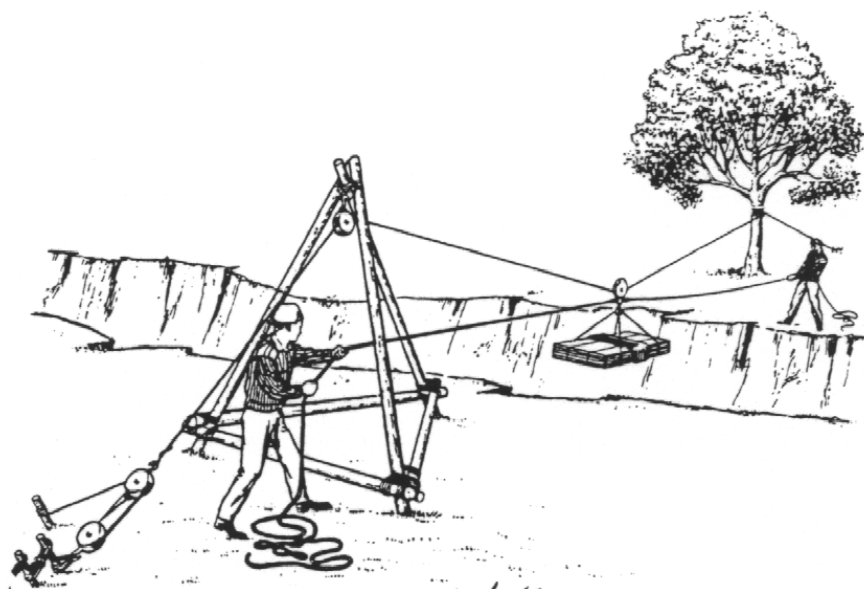
0512.5 Ropeways

Where no suitable trees or other fixing positions are available for supporting the jackstay of a ropeway, Gyns or sheers may be used. Gyns are preferable to sheers because they are more stable. The stresses set up in a jackstay are considerable and in practice can be taken as being five or six times the weight of the load. Strong holdfasts must therefore be applied 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 the stresses imposed on its anchorages and supports, but the easier it will be to haul the load across. 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. A traveller will be required to run along the jackstay and this may be a purpose built traveller or a single block. The gyn should have the heel of the prypole facing towards the gap to be traversed, but slightly to one side of the jackstay.

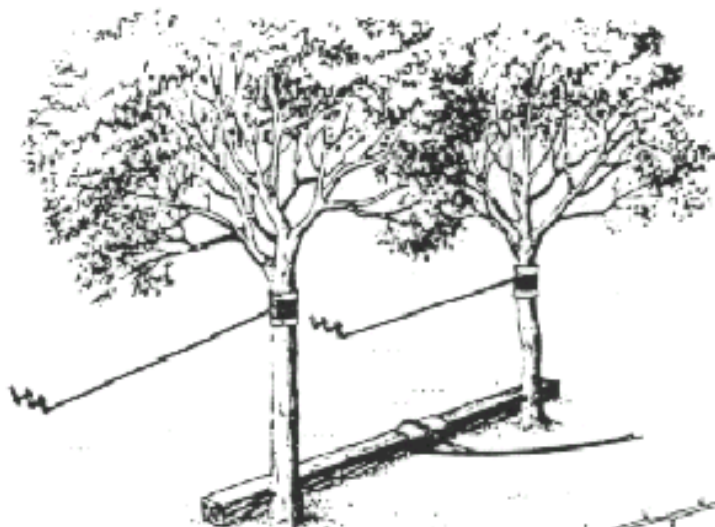
A Gyn



A Simple Ropeway



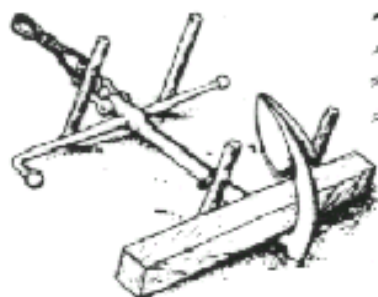
Examples of Holdfasts



BAULK ACROSS TWO TREES



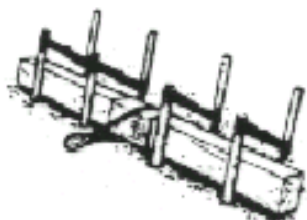
**PICKET HOLDFAST
(3:2:1 COMBINATION)**



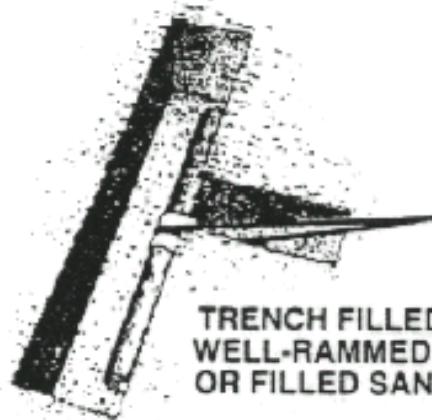
ANCHOR HOLDFAST



**BAULK ACROSS A GAP
IN MASONRY**



BAULK AND PICKET HOLDFAST



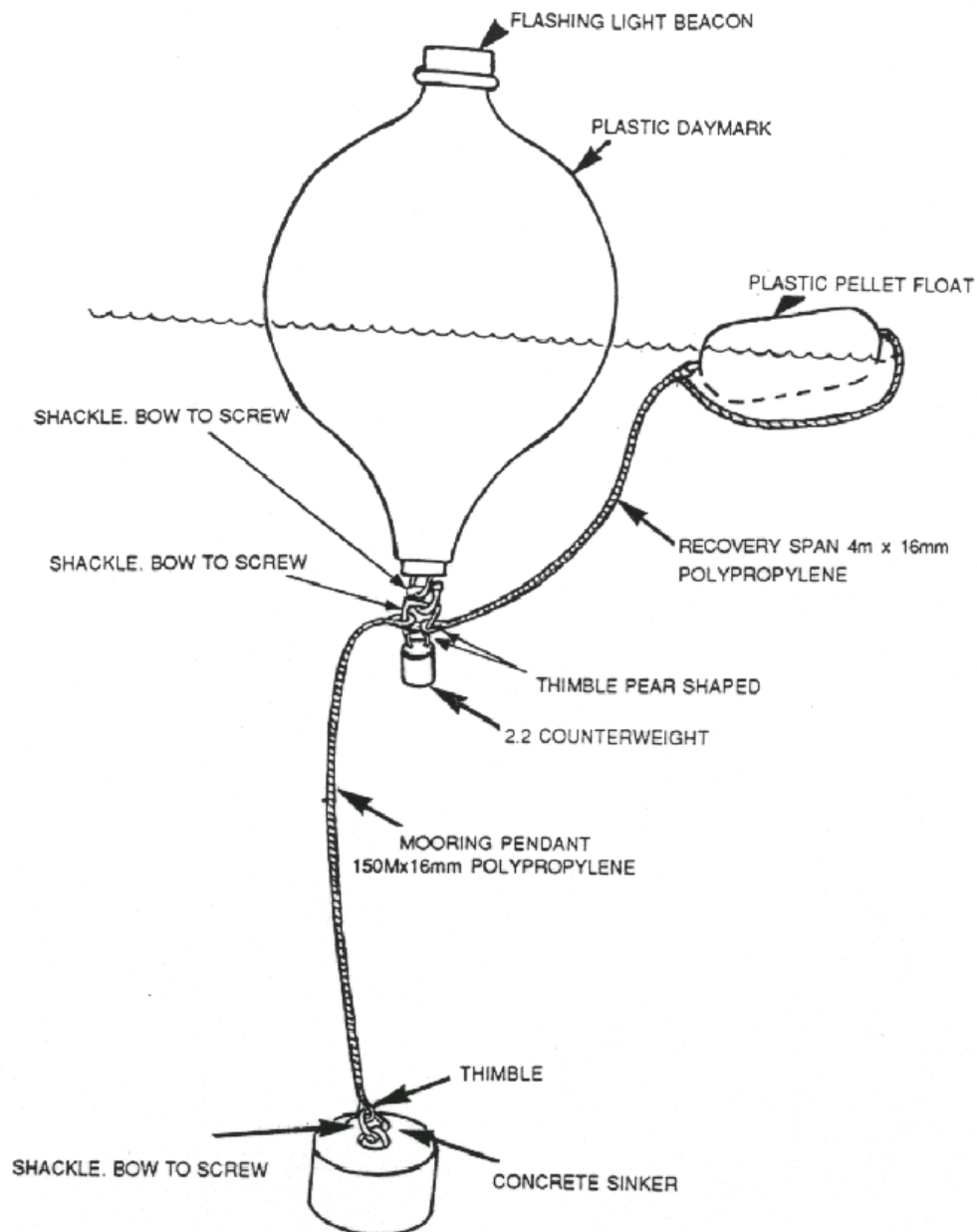
**TRENCH FILLED WITH
WELL-RAMMED EARTH
OR FILLED SANDBAGS**

BURIED HOLDFAST

0512.7 Temporary Marker Buoy

The Royal Navy's version of a Quick Release Marker Buoy is capable of being laid within 3 minutes. It is a quick, but temporary method of marking a location without the need to construct and lay a danbuoy.

It can be easily adapted for Sea Cadet activities without the requirement to have the correct marker buoy available. Any sealed container could be used as the buoy with a smaller container used as a pellet float. The weights may be any heavy object adapted to meet the need.



CHAPTER SIX

BASIC SAILMAKING

0601	Types of Material	
0602	Make-up of Canvas	
0603	Sailmakers Tools	
0604	Sewing Skill	Hand Sewing Flat Sewing Round Sewing Tabling
0605	Repairing Canvas	Patching Darning
0606	Grommets	

0601 TYPES OF MATERIAL

a) **Canvas** – is a cloth woven from yarns, which can be made from fibres of flax or hemp. It can be treated to provide flame-resistance, water-repellent and rot-resistance capabilities. The strength of any type of canvas is obtained through the different types of weave in the manufacturing process. Canvas supplied by the Royal Navy is provided in different weights, No 1 being the thickest and heaviest and No 7 the thinnest and strongest.

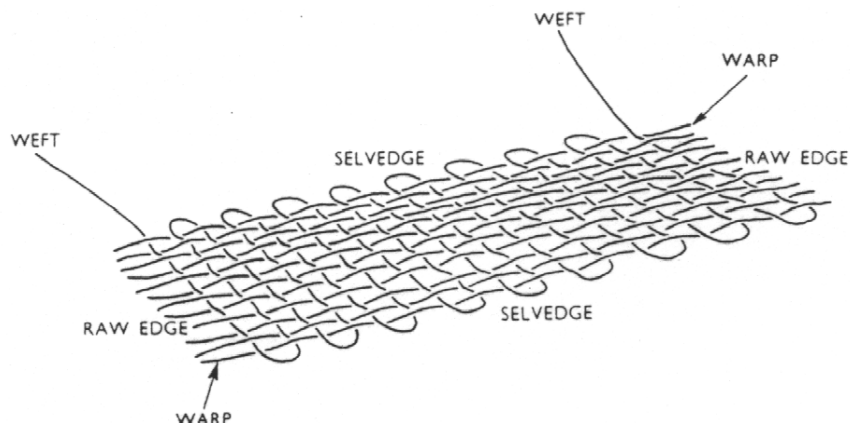
b) **Cotton** - there are several types available ranging from heavy to light material.

c) **Synthetic Fabrics** - manufactured from materials such as Nylon and Polyester. The yarns and cloth are heat set at manufacture to prevent stretching.

d) **Coated Fabrics** - Nylon, Terylene and natural fabrics can be coated with various substances to produce fabrics which combine the advantages, such as lightness, strength or cheapness, of the base fabric with additional advantages conferred by the coating. The principal coatings in use are PVC (Polyvinylchloride), Neoprene, Polyurethane, other synthetic rubbers and natural rubber, each of which has particular advantages for the user of the finished fabric.

0602 MAKE-UP OF CANVAS

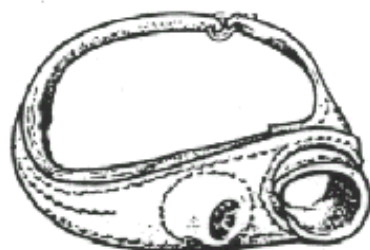
The threads that run across the breadth of the canvas are called the weft, and those which run throughout its length and are rove alternately over and under the threads of the weft are called the warp. As the weft is continuous and unbroken the canvas does not fray at the selvages (sides of each strip), but it will fray at the ends of each strip and wherever it may be cut; such an edge is known as a raw edge and is never permitted in sailmaking, either when sewing canvas or in the completed job.



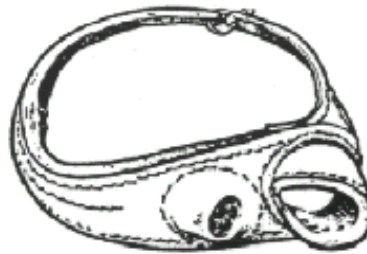
0603 SAILMAKERS TOOLS

- a) **Hand Sewing Needles** - these are known by their numbers - No 17 being the smallest. The most common sizes used as sailmaker's needles are No 17 and a No 14.
- b) **Hand Sewing Palm** - the sailmaker's palm replaces the thimble used in domestic sewing and is used to push the needle through the material. Palms are of two types, the seaming palm which is used for ordinary sewing and the roping palm used with the heavier needles and twine to sew rope and canvas.
- c) **Sail Hook** - is a metal hook secured to a lanyard and used to hold one end of the canvas while sewing. It acts as a 'third hand' for the sailmaker.
- d) **Rubber** - this is a metal tool with a wooden handle, used to flatten out the stitching of a round seam after sewing and also to rub down a turned-in edge before sewing.
- e) **Sailmaker's knife** - an open bladed knife used for cutting material.
- f) **Pricker** - a round metal spike with a wooden handle, used for making small holes in canvas.
- g) **Splicing Fid** - made of a hard wood and used for splicing rope and opening out cringles.
- h) **Punches and Dies** - supplied in various sizes they are used to fasten metal grommets to canvas.
- i) **Grommets** - consist of a metal eyelet and a spur-toothed washer which are used to put a solid eye into canvas or other material.

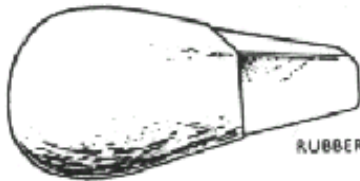
Examples of Tools



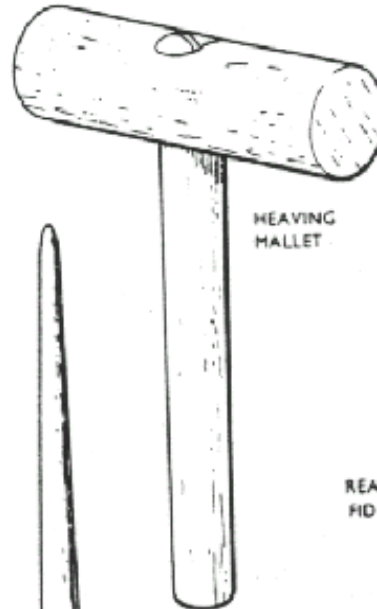
SEAMING PALM



ROPING PALM



RUBBER



HEAVING
MALLET



SHOEMAKER'S
KNIFE



SAIL
HOOK



PRICKER



CANVAS
PIERCER



No. 14 NEEDLE



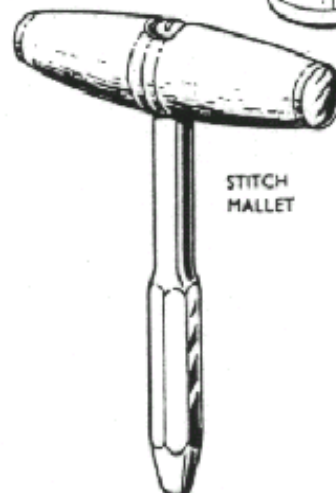
No. 12 NEEDLE



SPLICING
FID



REAMING
FID



STITCH
MALLET

0604 SEWING SKILLS

0604.1 Hand Sewing

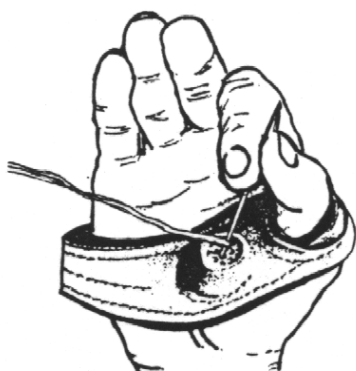
Before starting to sew, the palm should be adjusted so that it fits the hand comfortably. A palm which is too tight or stiff, is likely to cause cramp in the hand and this can be prevented by soaking the palm in hot water to make it pliable.

When making stitches, the point of the needle should be held between the forefinger and the thumb, the middle finger being used to guide the eye of the needle to the pellet of the palm each time the needle is pushed through the material.

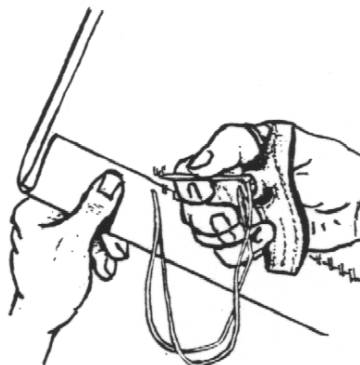
Stitches should be hand taut (an approximate pull of 7 lb) and each stitch must be as taut as the others. When sewing with twine it should be well rubbed with beeswax which helps to preserve the twine, prevent tangles while sewing and lubricate the twine so that it will pass through the material more easily.

When turning in the edge of canvas before sewing a seam, it is necessary to rub down the new edge with a rubber or other suitable tool (the back of a knife blade will do), this keeps the fold in position while sewing. The process is also carried out after the seam has been sewn to make the seam lie flat.

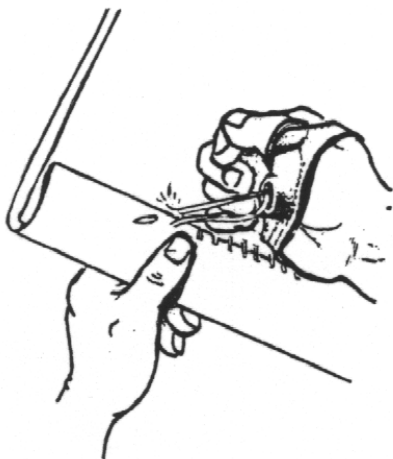
Holding the Needle



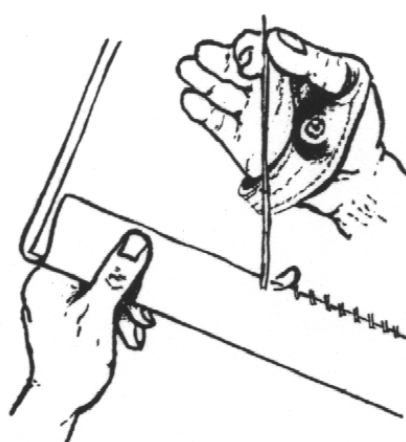
Inserting the Needle



Pushing the Needle through

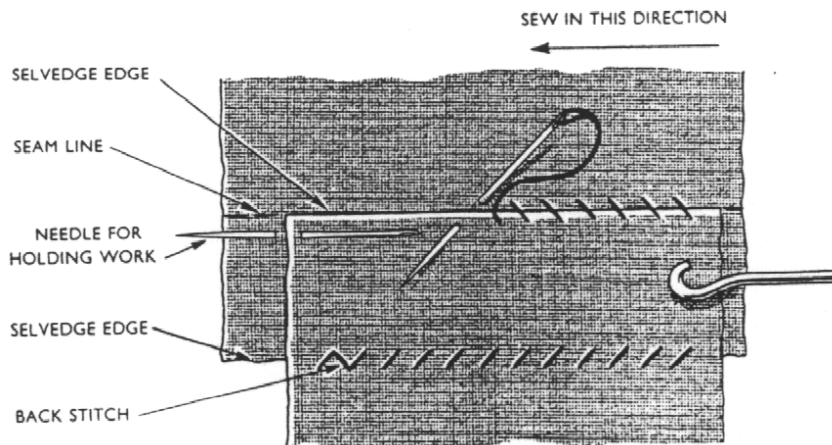


Completing a Stitch



0604.2 Flat Sewing

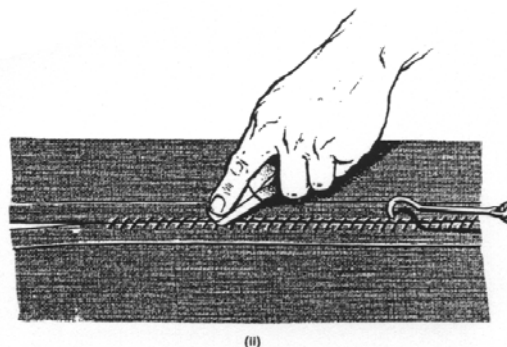
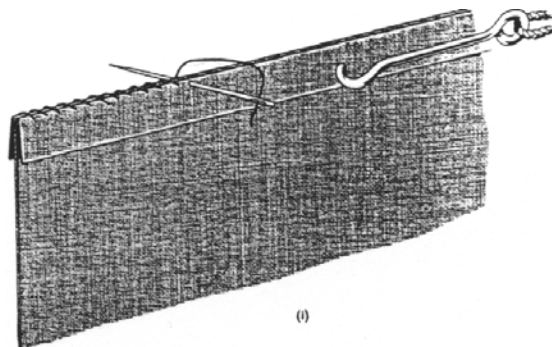
This is a simple method of joining two pieces of fabric when strength is not particularly required. Place the selvedge of one piece of canvas onto the seam line of the other, hook both pieces of canvas on to a sailmaker's hook, keep the cloths flat on the knee and sew away from the hook using approximately 3 stitches to 25mm (1 inch). The needle should pass through the single cloth close to the selvedge and seam line and up through the two cloths close to the other side of the selvedge. The job should then be reversed and the other selvedge sewn to the other seam line.



0604.3 Round Sewing

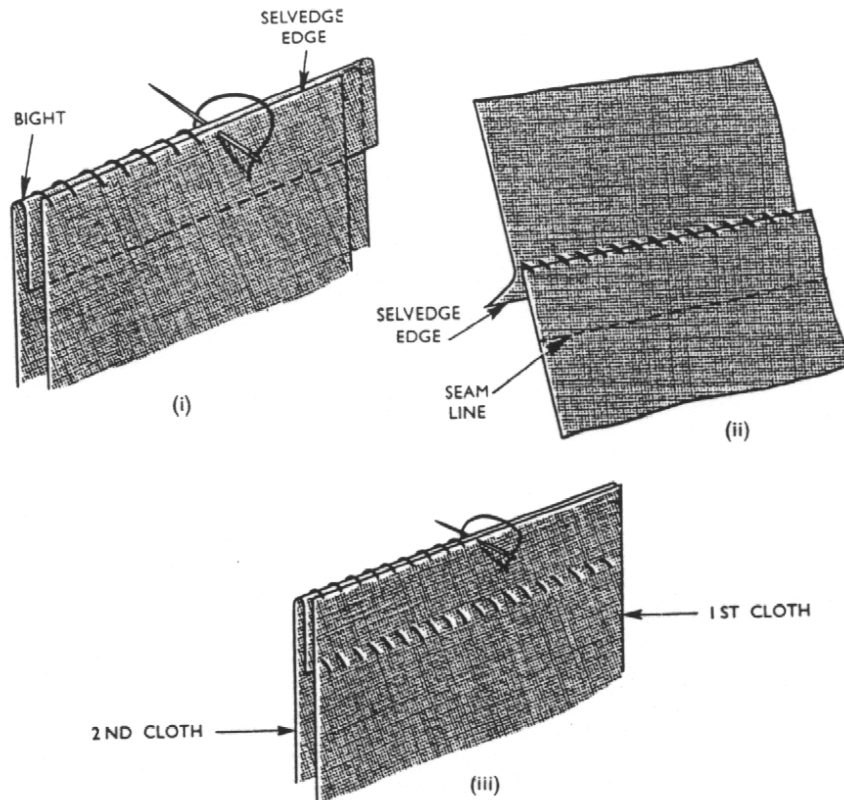
Because the stitches in round sewing pass through more parts of the fabric this gives a stronger joint than flat sewing.

- a) **Single Last** - to sew, turn both cloths at the edge about 13mm and rub down; place the two cloths together with the turned-in edges outwards, fasten both cloths to the sailmaker's hook, start sewing at the end furthest from the hook and work towards it. The stitches should be made by passing the needle through all four parts of the canvas about 3mm from the edge and back over the top making three or four stitches to every 25mm (1 inch). When finished, open out the two cloths and rub down the seam to flatten it out. This seam can also be sewn with the turned-in edges of the cloths towards each other.



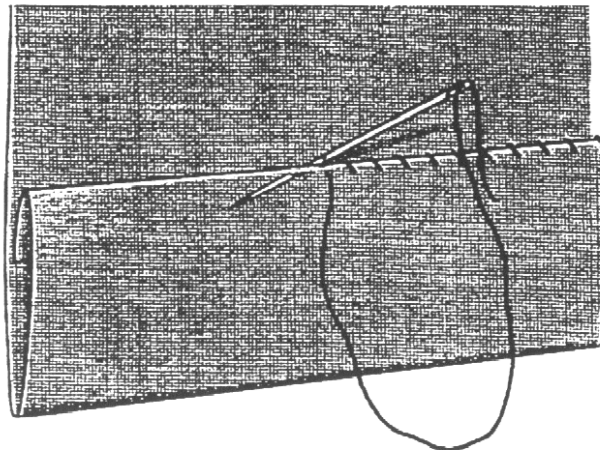
- b) **Single Round Seam** -to sew a round seam, turn in one cloth at the seam line, rub down and place the rubbed-down edge on the selvedge of the other cloth with the turned-in part towards it. Fasten both cloths to the sail hook with the unfolded cloth

towards you and sew towards the hook making approximately four stitches to 25mm (1 inch), the needle passing through all three parts of the material and back over the top. After sewing open out the cloths and rub down the seam.



0604.4 Tabling

Tabling is the name for the double thickness of material at the edge of a job similar to the hem in a garment. Besides giving a neat finish to the article, it prevents the edge, and particularly a raw edge, from fraying, and gives added strength where it is necessary to fit grommets, cringles, etc. Tabling is made by turning in the edge of the material, and then turning in the edge again underneath its own part and sewing the folded edge to the material as in the diagram below, then sewn as a flat seam.



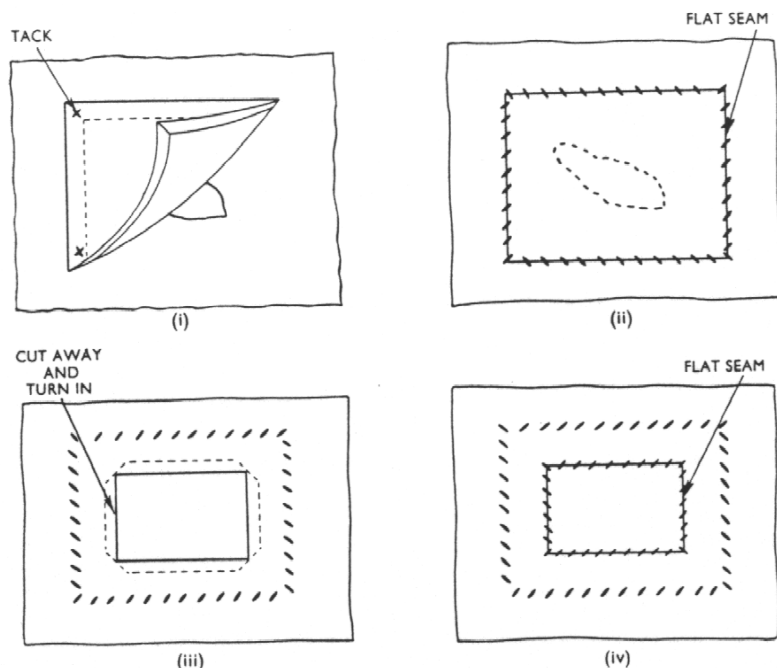
0605 REPAIRING CANVAS

Damage to canvas is likely to be in the form of a tear or a hole. If a hole is very large, extending over half the width of a cloth, it will be advisable to replace the whole width of the cloth.

0605.1 Patching

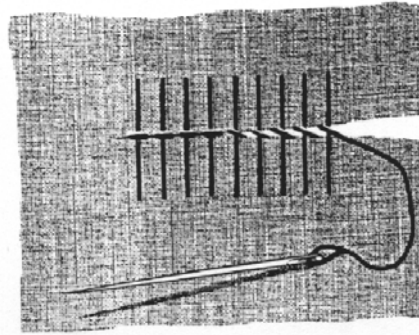
A piece of canvas of the same grade as the damaged canvas is cut to a size which, when laid over the hole, extends 50 to 75 mm beyond the limits of the hole in all directions. Lay the patch over the hole so that the warp threads run in the same direction as those of the canvas being repaired, then put a small stitch in each corner to hold the patch in position. Turn in 13mm on all sides of the patch, mitring the corners, and sew the patch on to the canvas with a flat seam, taking care to secure the corners properly. If one edge of the patch is selvedge there is no need to turn it in.

The work is then turned over and the edges of the hole are trimmed with a knife so as to leave a strip 40mm wide (50mm in No 2 canvas) all round inside the line of stitching. Cut the corners so that 13mm of the strip can be turned in and sewn down with a flat seam.



0605.2 Darning

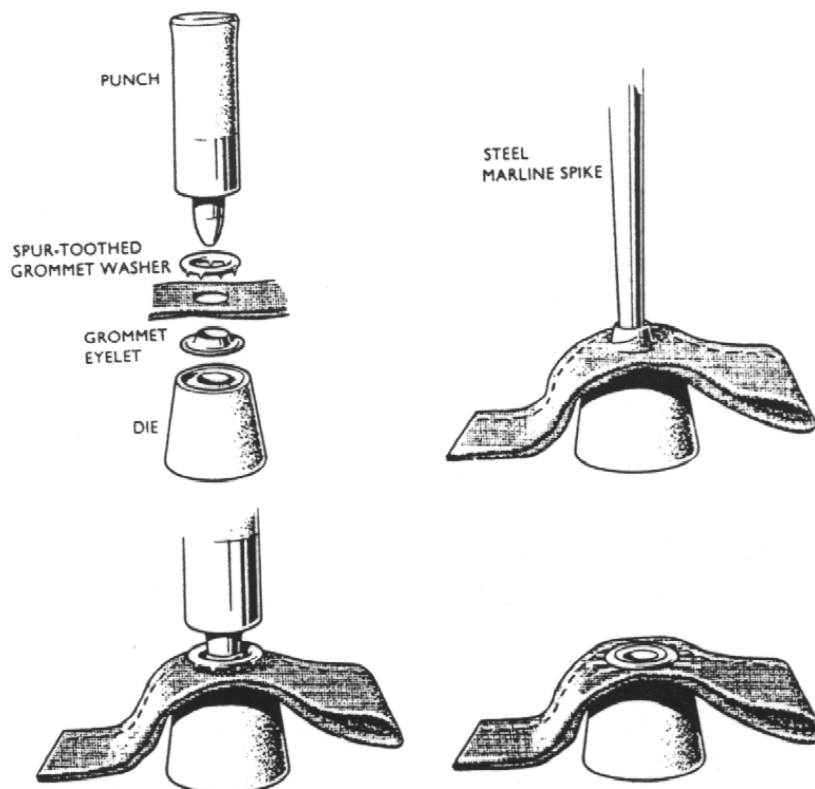
This is used for repairing small tears. The canvas is held so that the tear points directly at the sailmaker. The first stitch is made by bringing the needle up through the canvas, just to the left of the end of the tear, then down through the canvas on the right side and up through the tear, and then through the bight of the twine so formed. Subsequent stitches are made by passing the needle down through the tear, up through the canvas on the left side, down through the canvas on the right side, leaving a small bight in the twine, then up through the tear and the bight. Each stitch is drawn taut as it is finished, and the darn consists of a series of locked stitches sewn closely together.



0606 GROMMETS

If a hole were cut into material and used without strengthening, the material would quickly tear; so it is strengthened with a grommet of metal or rope.

a) **Metal Grommets** - are normally made of brass in two halves. A hole is first made in the material with a piercer or wad punch. The appropriate die, the spur-toothed grommet washer, the hole in the material and the grommet eyelet are aligned with a metal or wooden spike (not a fid). The punch is then hammered down so that the spur teeth grip the cloth and the shaft of the eyelet splays out and grips the material between the two halves.



b) **Rope Grommets** - are made from a single strand of rope. To 'work an eye', place the grommet on the material, mark inside the circumference and cut out this circle. Sew the grommet to the material on the same side as any roping, passing the needle down through the material outside the grommet and up through the hole until the grommet is well covered by the twine.

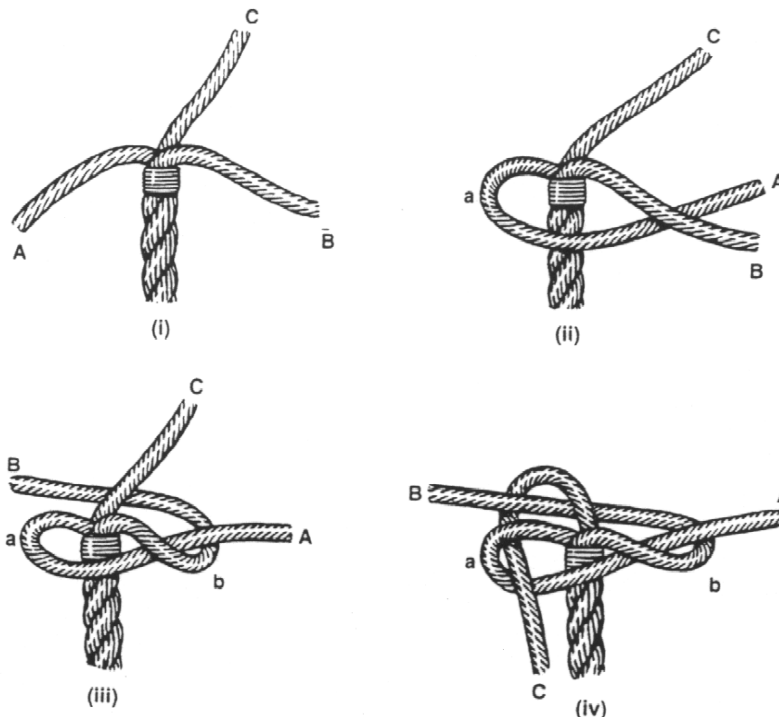
CHAPTER SEVEN

DECORATIVE ROPEWORK

0701	Wall and Crown knot
0702	Crown and Wall Knot
0703	Turks Head
0704	Man-rope Knot
0705	Cockscombing
0706	Chain Shortening
0707	Sennits
0708	Coachwhipping

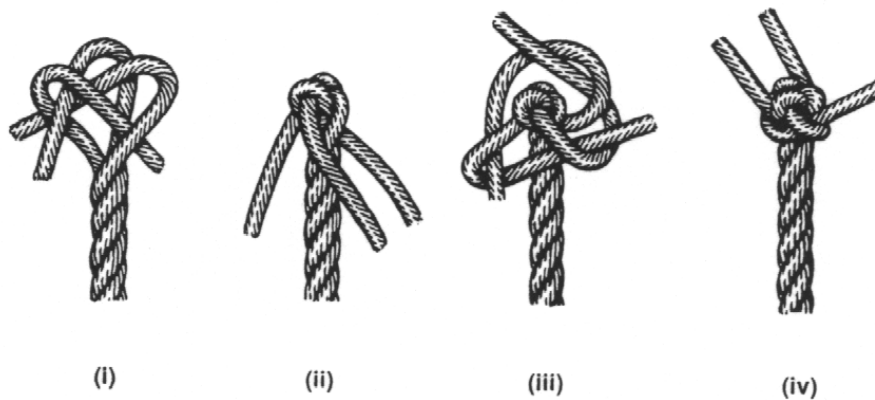
0701 Wall and Crown Knot

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.



0702 Crown and Wall Knot

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 unlaied 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.



0703 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 post or stanchion for example.

- a) **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. To make the Manrope knot, whip the rope at a distance of not less than 25 times the diameter of the rope, unlay the strands to the whipping, and whip the ends. Make a wall and crown knot, keeping the knot fairly loose. Then take each strand and follow its own part until three parts have been made. Haul all parts taut and cut off the ends where they protrude from the base of the knot.
- b) **Running Turk's Head, made at the end of a rope or round its own bight,** (as in a running lanyard). This is similar to a standing turk's head 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.

Standing Turk's Head

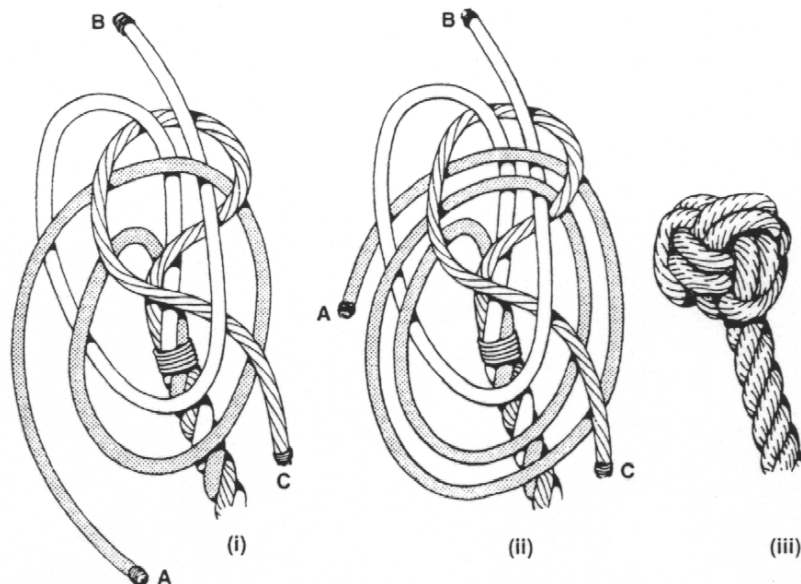


Running Turk's Head



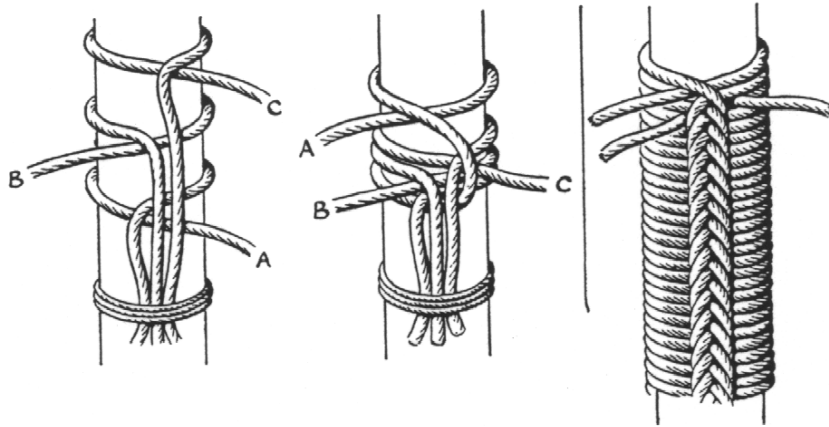
0704 Manrope Knot

This is used as a decorative knot on the end of a rope. Make a fairly loose Wall and Crown knot, then starting with strand A follow it round its own part, so doubling-up strand A. Work the other strands the same way then haul all parts taut. Cut off the ends where they protrude from the base of the knot.



0705 Cockscombing

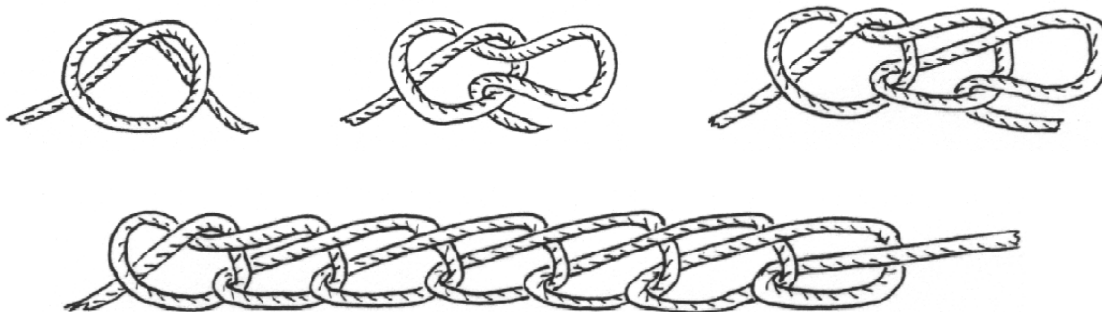
This is generally used to cover a ring or an eye but can be used as a neat finish on bag handles or on lengths of rope. Seize the ends of three lengths of cord or line to the fitting, allowing two lengths to hang on the right and one on the left (i). Take the furthest right-hand part and make a half hitch round the fitting, with the end coming out to the left and top of the fitting (ii). Then take the part which has not been used and make a half hitch round the fitting to the left, with the end coming out to the left and on top of the fitting (iii). Continue this half hitching with each part in succession, alternately to one side and to the other and always using the farthest-back part, until the fitting is covered (iv). Finish off each part either by making a crown and wall knot, by passing the strands through the laid up length and trimming off, or by whipping all the ends together and trimming the ends. The whipping may then be covered with a Turks Head.



0706 Chain Shortening

This is a series of hitches used for shortening the end of a rope; it looks very neat, and is useful when only a short length of rope can be handled at a time. It is made as follows:

- Form a loop in the rope.
- Pull the bight up through the loop, to form another loop.
- Pull the bight through again, and repeat until the shortening is sufficient.
- Secure the last loop, either with a toggle or by passing the end of the rope through it.



0707 Sennits

There are a number of different types of Sennit, the most popular being a Portuguese Sennit, which can be made flat, spiral or a combination of both. (This type of decorative ropework is very popular for covering belts and making light pull cords).

There are only two working strands, which sit either side of a central heart, which could be a number of strands, usually two or three, or a single core (rope or a belt).

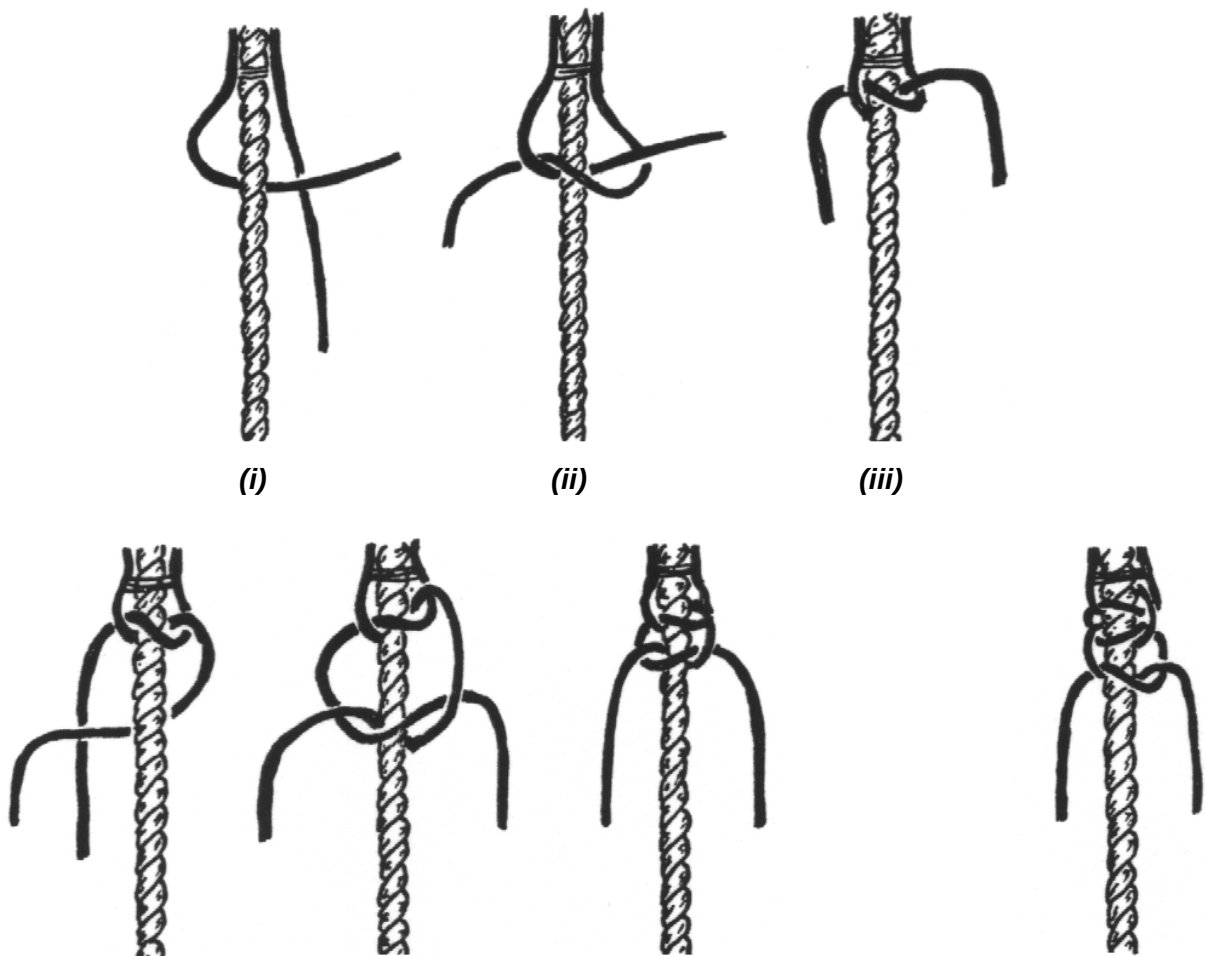
To start the sennit the left hand strand is passed under the heart and over the right hand strand, a bight being retained on the left (i). The right hand strand is brought across, over the heart, down through the bight (ii), and both ends are drawn tight (iii).

Having completed the first tuck of each working strand, if a spiral is required repeat the process commencing with the looping of the left hand strand as at the start. After a number of tucks a spiral will clearly be formed.

The spiral can be reversed by commencing with the right hand strand being passed under the heart and over the left hand strand, a bight being retained on the right. The left hand strand is brought across, over the heart, down through the bight and both ends drawn tight.

To ensure a Flat Sennit, complete the first series of tucks and draw tight. Having commenced with the left hand strand making the loop, now make a loop with the right hand strand, pass the left hand strand over the heart, down through the bight and draw tight. Continue to alternate the tucks left and right.

The sennit may be completed by whipping or heat sealing the ends or by tucking back on itself and trimming the ends.



0708 Coachwhipping

Coachwhipping is a covering based on the square sennit. The most common method is to use eight strands, formed by attaching four strands at their mid points to the fitting to be covered, by a means of a twine seizing. This will provide eight strands, four above and four below the seizing.

Take the four above down and to the right of the seizing, whilst the four below are taken to the left.

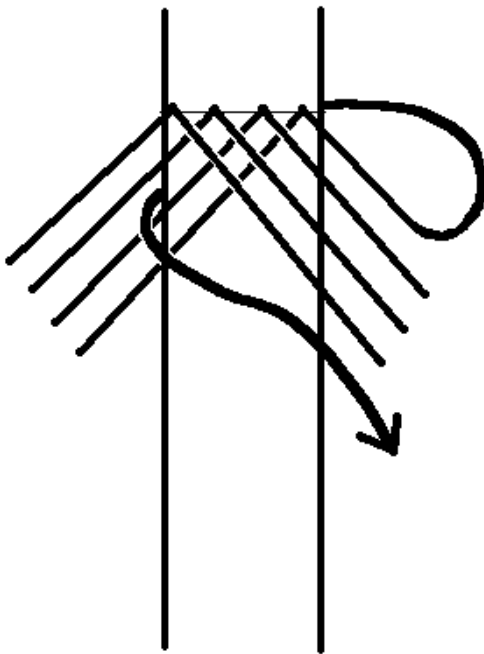
Then take the strand furthest to the right round the back of the fitting, returning to the front between the second and third strands from the left, leaving the worked strand as the new fourth strand from the right at the finish.

Then take the strand furthest to the left round the back of the fitting, returning to the front between the second and third strands from the right, leaving the worked strand as the new fourth strand from the left at the finish.

The previous two stages are then repeated until the desired length of covering is achieved, finishing with another twine seizing around all eight strands and the fitting. This gives a finished appearance of four lengthwise rows of ***herringboning*** along the covering.

Both ends would often be covered with Turk's Heads to hide the seizings and cut ends.

First tuck



Finished appearance



CHAPTER EIGHT

BASIC BOATWORK

0801 Ceremonial Boathook Drill

0802 Securing and Anchoring a Boat

801 CEREMONIAL BOATHOOK DRILL

Ceremonial Boathook Drill is carried out in boats when Senior Officers, in Uniform, are being conveyed to and from Official visits or functions. It may be used at events such as Regattas where Dignitaries and Senior Officers are being conveyed.

The drill is normally carried out by a Bowman and a Stern sheetsman, on a Ceremonial Barge with both crew members standing firmly on a bow and stern platform. This drill may also be carried out by a single bowman.

When coming alongside a jetty or ship, the Ceremonial Boathook Drill is carried out when the boat is approximately 50 metres away. This allows sufficient time to complete the drill without rushing, before making use of the boathook to hook on.

On leaving from alongside, the drill is carried out immediately when the boat is at least 2 metres clear of it's alongside position.

The following drill if carried out correctly will allow for boat's crew standing in a boat instead of on an upper platform, and will avoid the necessity to swing and turn the boathook thereby avoiding accidents. It is important that the Coxswain designate which side he will be coming alongside to in plenty of time for the crew to prepare.

STAGE 1

The bowman should be standing at ease with the boathook stave firmly held straight up and down, the hook facing downwards. The top hand will be either the left hand (when coming alongside Starboard Side to) or the right hand (when coming alongside Port side to). The hand is turned palm outwards so that the boathook is correctly held when raised aloft. The other hand grasps the boathook stave in the normal manner.

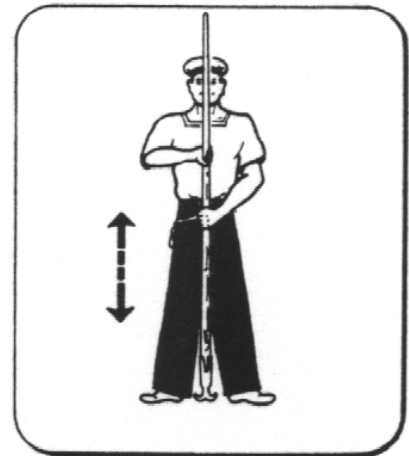
In the event that a Bowman and a Stern sheetsman are detailed for the Ceremonial Boathook Drill, both will be standing At Ease and in the same positions with boathooks.



The drill is carried out dwelling a pause of **two marching paces** between each movement.

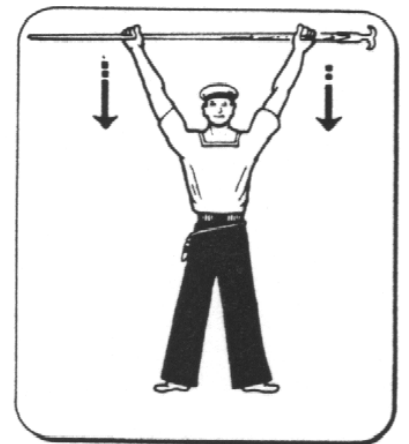
STAGE 2

The bowman taking the lead will raise and lower the boathook twice striking the deck on each lowering of the boathook. This will signal to the stern sheetsman to prepare for the drill. A pause of two marching paces are then dwelt before going to Stage 3.



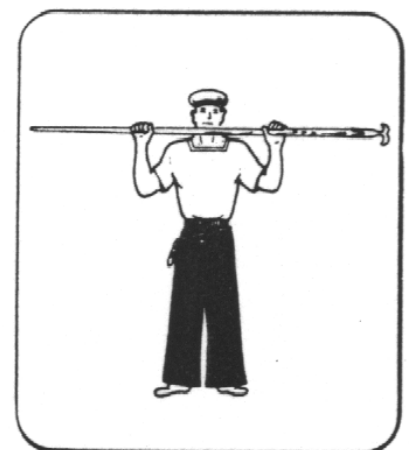
STAGE 3

The boathook is then raised smartly, horizontally and at full aims length above the head. (The hook will face the direction of the side going along to).



STAGE 4

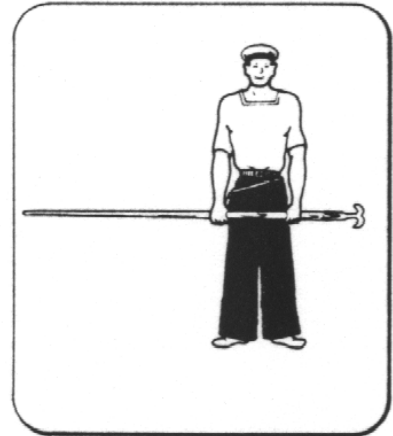
Having dwelt a pause of two marching paces the boathook is lowered to shoulder height.



STAGE 5

After a further two marching paces the boathook is lowered to the full extent of the arms.

The boathook is then prepared for use on the respective side.



Having left along side the crew will fall in as at Stage 1. When ordered by the Coxswain to 'Fall Out' the Drill is carried out again to Stage 5 then the boathook(s) are stowed away.

0802 SECURING AND ANCHORING A BOAT

0802.1 Securing Alongside

Boats are normally secured alongside by use of **Bow and Stern lines** known as **Head and Stern ropes**. Where possible the ropes are passed from the boat, out through fairleads, around bollards or through rings in either the jetty or other boat that you are alongside. Both ropes are then returned into the boat, via fairleads, and secured to rings, cleats or round the forward thwart.

It may not be possible to pass your bow and stern lines back into the boat, so they should be secured to the jetty fixture by a round turn and two half hitches.

Care should be taken to allow for the rise and fall of the tide (Tidal Range) in tidal waters, so that sufficient slack is left in both ropes in order that the boat is not left hanging nor sunk, by them.

Fenders are positioned along the boats side to prevent damage between the boat and the jetty/other boat. Fenders are normally brought inboard when a boat is underway and so it must be remembered to order "Out Fenders" in good time before coming alongside. They must be placed where the boat is most likely to make contact with another boat or jetty, this includes not only their present position laterally but their height as well. Fenders are normally secured to inboard cleats or the risings by lanyards. A lanyard at each end of a fender thus securing it horizontally in two places offers more control, especially important in tidal waters where fenders will tend to ride up and roll with the movement of the tide.

0802.2 Securing for a long stay or rough weather

In rough weather a boat secured only by Head and Stern lines will tend to move backwards and forwards along a jetty, swinging on her lines. In order to prevent, this additional lines called **Springs** may be used. Additional fenders may also be required.

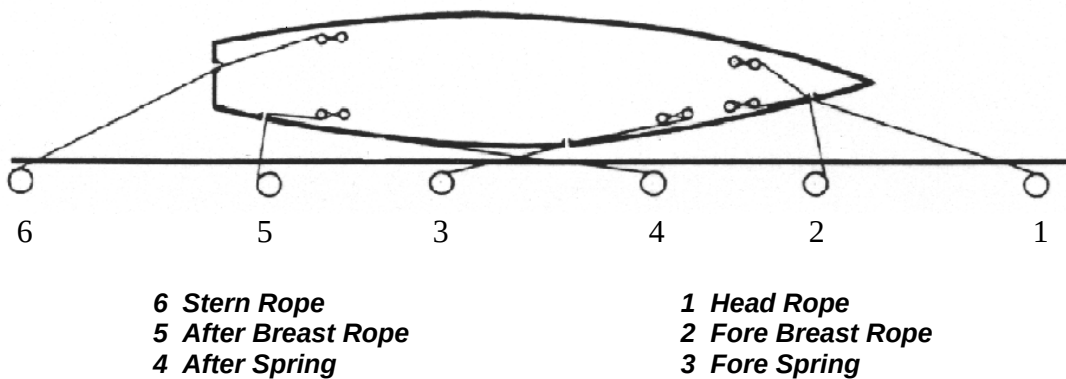
A **Fore Spring** is used to stop the boat moving forward. It is attached in the fore part of the boat then runs aft to the jetty.

A **Back Spring (After Spring)** is used to stop the boat moving backwards. It is attached in the after part of the boat and runs forward to the jetty.

An additional option may be to include two lines known as **Breast Lines, Fore and After**.

These lines help to hold the boat into the jetty.

Example of Securing Lines



0802.3 Anchoring

The type of anchor used in small boats will in most cases be either an Admiralty Plan (Fishermans), Plough or CQR or Danforth type as these are the most popular types of small boats anchor.

When anchoring the most important thing to remember is to ensure that the inboard end of the anchor cable (warp) is secured to a strong point in the boat. The outboard end of the cable should be securely fastened (bent) to the anchor ring; by shackle if using chain cable or by a Fishermans Bend for a rope warp. If using an Admiralty Pattern anchor ensure that it is correctly made up, stock in position, forelock in place and moused.

Before anchoring you will need to know:

- Direction of the current.
- Depth of the water.
- Nature of the Seabed.
- Direction of the wind.

To work out the total amount of cable or warp required to anchor a boat a basic calculation is used:

- Man-made fibre cordage - 6 times the depth of water at high tide.
- Natural fibre cordage - 5 times the depth of water at high tide.
- Cordage and chain - 4 times the depth of water at high tide
- All Chain - 3 times the depth of water at high tide.

It is advisable when using warps a & b to trip the anchor before using it. To do this, take the cordage of the warp to the crown of the anchor and secure it by tying a clove hitch and racking seizing the end. (The trip can be made by using one yarn from a strand of cordage). Lay the cordage alongside the anchor and stretched chain, then allow another 1/2 metre of the cordage. At this mark, join up your trip. When you have joined the trip to the cordage thread it through the end link of the chain and pull it down until the chain is about 4"(10cm) away from the cordage and secure by a series of about 4 half hitches. If the anchor jams under a rock when being hauled in the stop will part (come apart) and allow the anchor to be hauled clear and weighted by it's crown.

Some types of manufactured anchors have an eye or bar already at the crown for securing the warp, if this is the case then it would be easier to have the eye spliced to the end of the warp and shackle it direct. ***Don't forget to mouse the shackle.***

Having been given your anchor berth or selecting it, and having calculated the above, mark off the amount of warp required. If space allows fake enough cable from the anchor to reach the seabed and then fake out the remainder of the cable required for anchoring separately. (In a small boat it may only be possible to coil the warp).

(Handy hint: A large plastic bucket can be used to hold the anchor warp. A hole should be drilled out in the bottom with the end of the warp passing through it to secure inboard If stowed correctly in the bucket the warp will be free to run out).

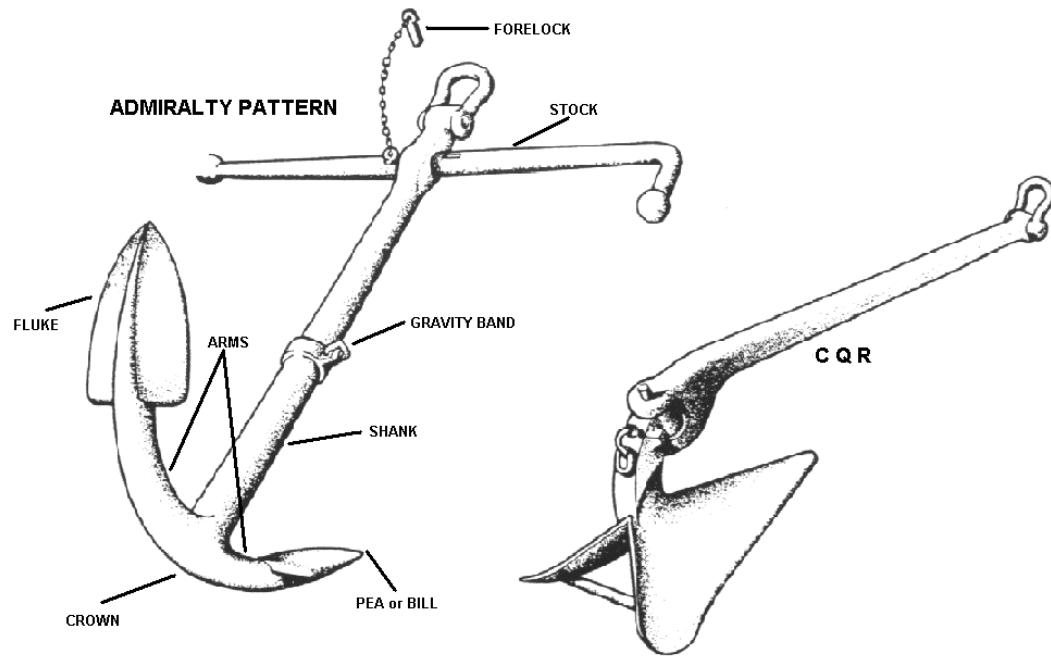
Approach the anchorage either up wind (against) or against the tide, whichever is the stronger. Ensure that you are in the correct position by taking a transit bearing. When in position stop the boat, stream (cast overboard) the cable required to reach the seabed, followed by the anchor. The boat should have gentle sternway on her as the wind or tide push the boat backwards, if not gentle use of the engine (if power boat) is required. Do not go ahead as you may run over or foul (pass the cable around) the anchor. The remainder of the cable should be paid out hand over hand until it is fully paid out to the length required. As the boat drifts back with the current, the bows will pay away from the wind. When the boat has drifted the full length of its warp the bows should pull around to line up with the warp.

This is the first indication that you have got that the anchor has begun to bite. To confirm this take another transit on the beam as this is where the most movement will be noticed if the anchor is dragging.

If when at anchor, the wind or sea gets up (becomes rougher) the boat may start snatching at the anchor. If this is the case there are three options of remedy:

- a) Pay out more warp, the extra weight of the cable laying on the seabed acts as a counter balance.
- b) If this fails a 25kg weight could be secured to the cable by a lizard (use bow or stem line) and allowed to run half way down the cable to the seabed to increase the counter balance effect.
- c) Weigh anchor and head for home.

Examples of Small Boat Anchors



Chapter 9

CHARTWORK

0901 THE CHART

0901.1 The need for a Chart

A ship can be navigated safely from one port to another by following a selected route on a chart, this is virtually a contour map of the sea bed and its surrounding coastline except, whereas, a land map gives the height of the land contours above sea level, a chart gives the depth of the bottom below sea level. The selected route takes into account the draught of the ship so that there is always enough water under her bottom. Land features and floating marks shown on the chart can be used to fix a vessel's position.

The conventional signs used on a chart are similar to those used on a map and are to be found listed in Chart No 5011 (Symbols and Abbreviations used on Admiralty charts)

0901.2 Latitude

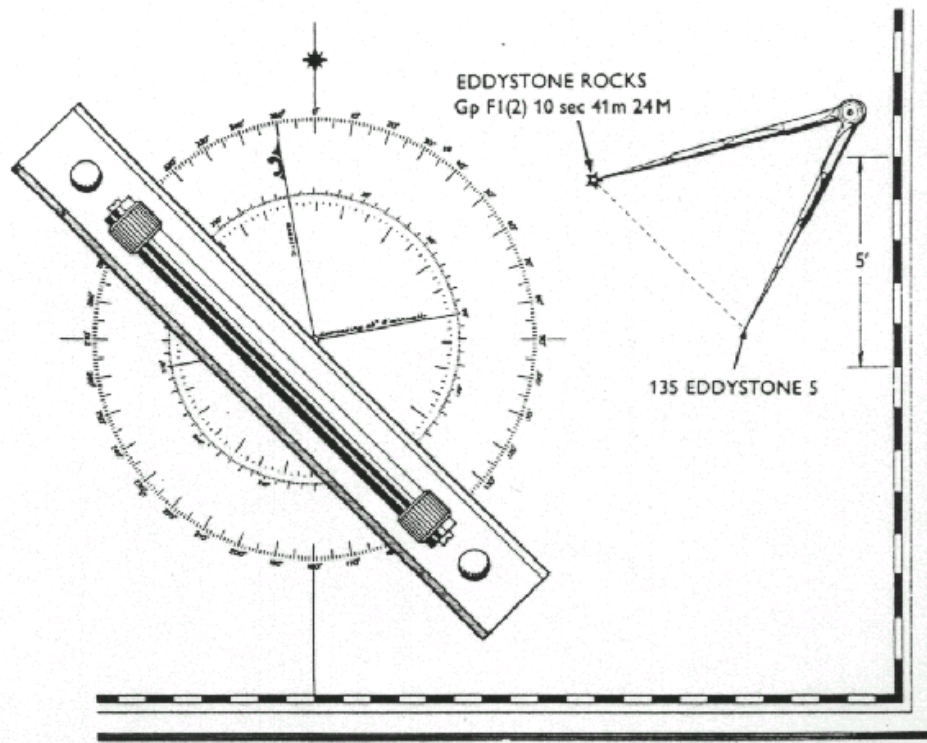
The Latitude of a place is the angular measurement between its parallel of Latitude and the Equator. The angle is measured at the centre of the earth and is expressed in degrees, minutes and seconds (or in degrees, minutes and decimals of a minute) from 0-90 North or South from the Equator. **(ACROSS THE CHART)**

0901.3 Longitude

The Longitude of a place is the angular measurement between its meridian and the meridian of Greenwich. The angle is measured at the centre of the earth and is expressed in degrees, minutes and seconds (or in degrees, minutes and decimals of a minute) from 0-180 East or West of the Greenwich Meridian. **(UP AND DOWN THE CHART)**

0901.4 Distance

The distance scale is the scale of Latitude at the side of the chart, one minute of Latitude being equal to One sea Mile. It is important to remember that this scale alters with the latitude, and that the distance should therefore be measured off that portion of the Latitude scale, which is abreast the position which is to be recorded.



0901.5 Distance

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. (A land mile = 1609 metres).

0902 COMPASSES

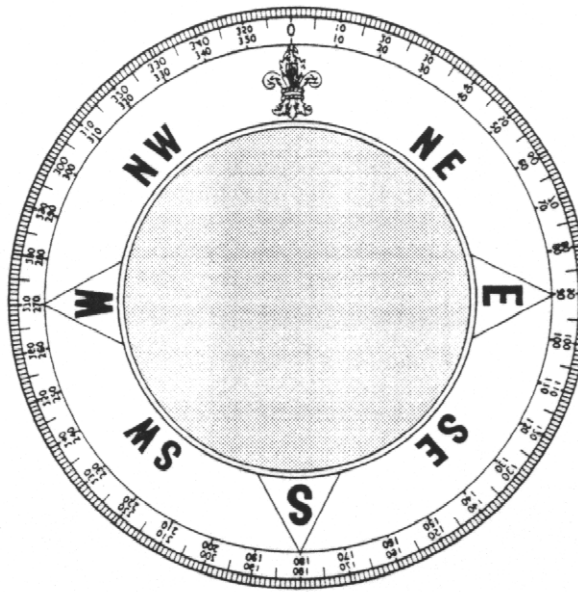
0902.1 The Compass Card

The Magnetic Compass Card 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 11¼ degrees. The principal points, North, South, East and West are called **Cardinal Points**.

The **Inter-cardinal Points** are North-East, South-East, South-West and North-West.

Example of a Compass Card

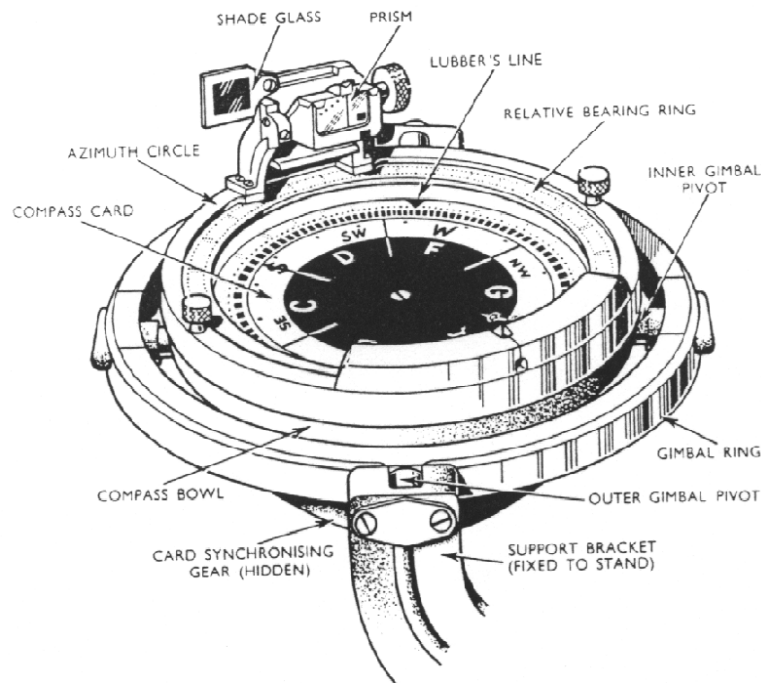


0902.2 Types of Compass

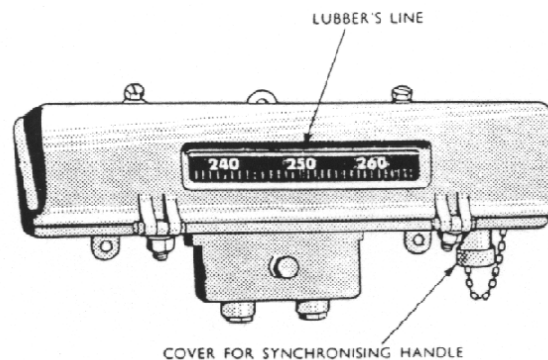
a) **Gyro Compass.** This type of compass obtains its directive force from the rotation of the Earth and seeks True North. The gyroscope is mechanically and electrically dependent upon the ship's power supplies and proper maintenance. It is normally sited as near as possible to the centre of the ship to obtain best performance. By means of electrical transmissions a series of repeaters are used and situated in various parts of the ship for Navigational purposes. There are two main types, a **Bearing Repeater** and a **Steering Repeater**. The bearing repeaters are always mounted in gimbals and gimball rings in order to maintain the repeater bowl and its compass card in a horizontal position when the ship pitches and rolls. The direction of the ship's head is indicated by a pointer called the 'lubber's line', which is set in the direction of the fore-and-aft line of the ship. The repeater at the primary Navigation position on the compass platform, is mounted in a special stand known as a '**Pelorus**'. Wing repeaters are fitted on brackets in the bridge wings, the bearing repeaters are fitted with a portable Azimuth Circle, which can be rotated round the top of the repeater bowl.

There are two types of steering repeater, one is similar to the bearing repeater, the other more regularly used is a tape repeater. This is an endless tape, mounted on rollers and is viewed through a small window, which allows up to about 15 degrees on either side of the ship's head to be seen.

Example of a Gyro Compass Bearing Repeater



Example of a Steering Tape Repeater

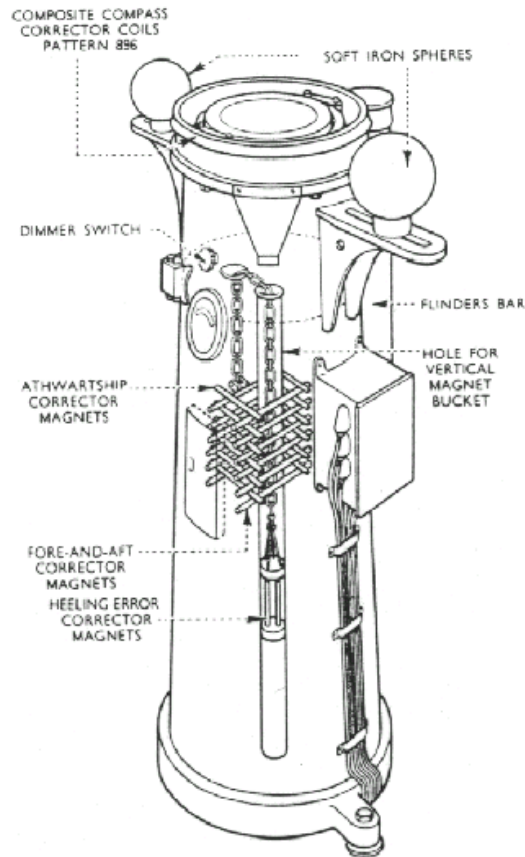


b) ***Gyro-magnetic Compass.*** This combines the Magnetic North seeking properties of the Magnetic Compass with the stabilising property of a gyroscope.

c) ***Magnetic Compass.*** This is normally mounted in a binnacle. It is gimballed in order to maintain the compass card in a horizontal position when the ship rolls and pitches. Because the Magnetic compass has its own zone of magnetic influence known as the 'magnetic field', other items of magnetic material in this field will tend to align themselves in the direction of the lines of force. It is important to remember that the functioning of a magnetic compass can be considerably influenced by any magnetic substance close to it. The binnacle therefore is constructed of non-magnetic materials such as wood, brass, and copper as are the fixings. Any magnetic material such as steel and iron, or wires and cables carrying electrical current are kept as far away from the compass as possible. The compass needle is a magnet seeking Magnetic

North. Its accuracy is dependant upon the magnetic properties surrounding it. These properties cause deviation (to be covered later). In order to eliminate the deviation as much as possible, a process known as 'Swing ship' is carried out, whereby the ship is swung through the points of the compass and during the process the deviation is reduced to a minimum by adding permanent magnets, flinders bars and soft iron spheres, details are then recorded on a deviation chart, (updated at regular intervals).

Example of a Binnacle

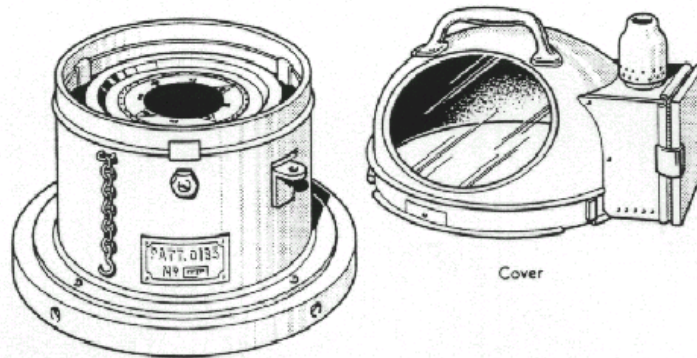


d) ***Boats Magnetic Compass.*** These are similar to or a smaller version of the Ship's Magnetic Compass. The compass is housed in a non-magnetic container often fitted with a cover. When used in a boat it should be placed with the 'lubbers line' in the fore-and-aft line of the boat and as far away as possible from the engine and other magnetic items. Small magnetic compasses are affected by metal objects such as watches, coins and bunches of keys which may cause inaccuracies in bearings.

Whenever a course is steered by eye the corresponding compass course should be noted and recorded, due allowance being made for the effects of wind and current so that in the event of fog or reduced visibility a correct course may be steered by compass.

The best way to take a bearing of an object from a boat is to point the bow of the boat at the object, taking care to have sufficient room to manoeuvre, then read off the compass card.

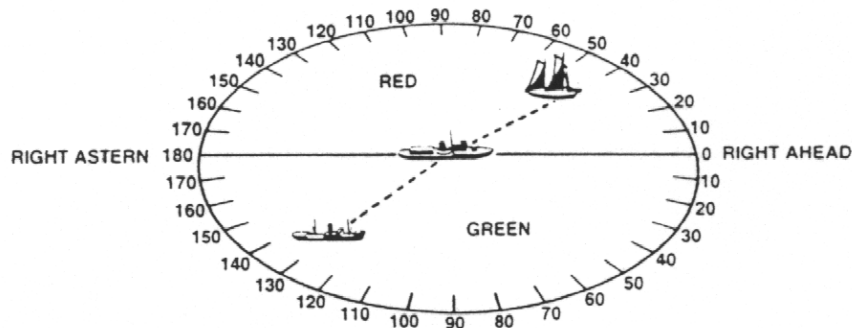
Example of a Boats Magnetic Compass



0902.3 Relative Bearings

- a) For General Relative Bearings see Chapter 1.
- b) 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 into 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 the picture below, the sailing vessel bears **red 40** and the steamship bears **green 130**. (The word 'degrees' is always omitted)

Red and Green Relative Bearings



0902.4 Compass Bearings

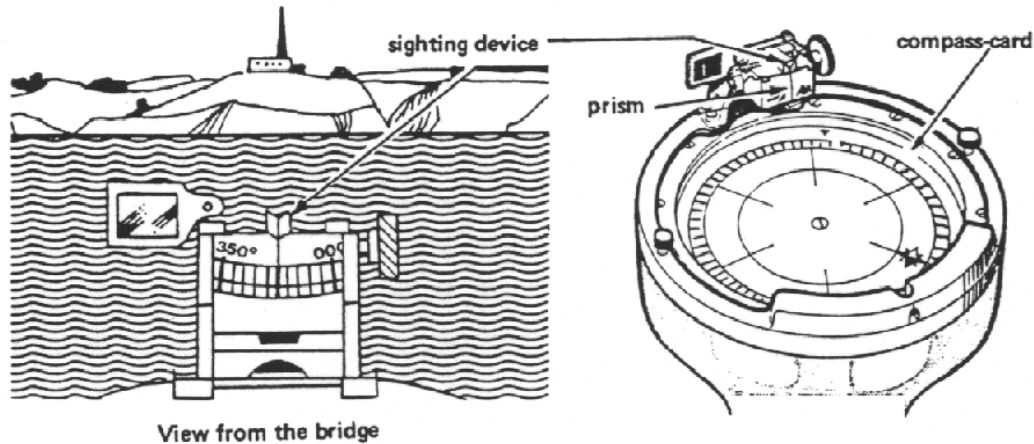
The bearing of an object from the ship may be given relative to **True** or **Magnetic** North. If it is a gyro-compass the horizon is divided into 360 degrees from True North (the Meridian), whilst a magnetic compass is divided into 360 degrees from Magnetic North.

The bearing of an object can be obtained from the Compass a bearing repeater (known as a Pelorus) or hand bearing compass by sighting along an imaginary line joining the centre of the compass card to the object and reading the graduations on the edge of the card, which is cut by the line of sight. To make bearings easy, the compass is fitted with an Azimuth Circle, which has a 'V' sight and a prism whereby the bearing is reflected and magnified, this direction or bearing is known as a Compass Bearing.

In the illustrated diagram the bearing of a church is obtained by lining up the church with the 'V' shaped sighting device. The bearing is then read off as 355 degrees.

This bearing could then be plotted onto the chart by using a parallel ruler which ensures an accurate transfer of the bearing measured from the compass rose to the position line through the mark (the church).

Taking a Compass Bearing



0903 COMMON MARKINGS ON A CHART

0903.1 Scale

Charts are issued to cover large or small areas of the seas and Coastal Regions of the land.

A chart which represents a small area is called a '**Large Scale Chart**' and one which covers a large area is called a 'Small Scale Chart'. The terms Large or Small scale refer to the ratio between the size of details shown on the chart and their actual size. If, for example the scale of a chart is shown as 1/12500, it means that the details shown on the chart have been reduced 12,500 times. When approaching land, Large Scale Charts are used and finally, when entering harbour, the largest scale charts called Plans are used.

0903.2 Depth Markings

The depths shown on a chart are related to an arbitrary level of the sea called Chart Datum, which is a low water level which the tide will seldom fall beyond. In the area covered by the chart, the depths shown on the charts are usually in metres, but where the depth is under 20 metres, it is indicated in metres and decimetres.

0903.3 Rocks

Rock that does not cover height above high water.

Rock which covers and uncovers height above Chart Datum, where known.

Rock awash at the level of Chart Datum.

Rock over which the depth is unknown but is considered dangerous to navigate.

Dangerous under water rock of a known depth.

For diagrams see Section IK of Chart 501 I (1994)

0903.4 Bottom

S = Sand

f = fine

c = coarse

M = Mud	Wd = Weed	
Sh = Shells	bk = Broken	
St = Stones	R = Rock	P = Pebbles

For further details see Section IJ of Chart SOI I (1994)

0903.5 Wrecks

Wreck which does not cover, height above Height Datum
 Wreck which covers and uncovers, height above Chart Datum
 Wreck submerged, depth unknown (ditto Known)
 Wreck showing any part of hull or superstructure at Chart Datum
 Wreck over which depth has been obtained by sounding only
 Wreck of which mast and/or funnels visible at Chart Datum
 Wreck which has been swept by wire to depth shown
 Wreck depth unknown which is considered dangerous to surface navigation
 Wreck depth unknown which is not considered dangerous to surface navigation

For diagrams see Section IK Chart 501 I (1994)

0903.6 Lights

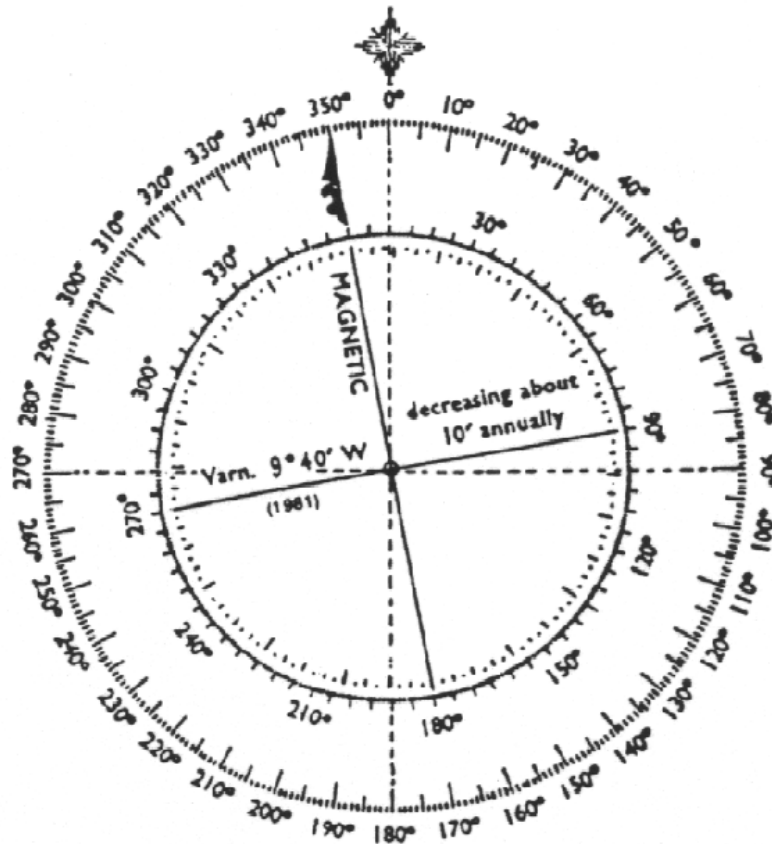
Characteristics - the nature of the beam exhibited by a light is known as its characteristic, of which there are four main types, namely:

- a) ***Fixed (F)*** - a light which appears continuous and steady to an observer whose position remains unchanged in relation to it.
- b) ***Flashing (FI)*** - a light showing intermittently with regular periodicity. Lights in which the duration of light in each period is shorter than the total duration of darkness.
- c) ***Occulting (OCC)*** - a light in which the total duration of light in each period is longer than the total duration of darkness and in which the intervals of darkness occultation's are usually all of equal duration.
- d) ***Alternating (AL)*** - a continuous steady light which shows a change of colour

For all details of lights see Section IP of Chart 5011 (1994)

0903.7 Compass Rose

Most charts have printed on them one or more Compass Roses from which a line of bearing can be drawn with the aid of a parallel ruler. Each Rose has an inner and outer circle of graduations; the outer circle shows true directions and the inner circle shows magnetic directions for a stated year. The variation that year and its annual change is indicated on this circle.



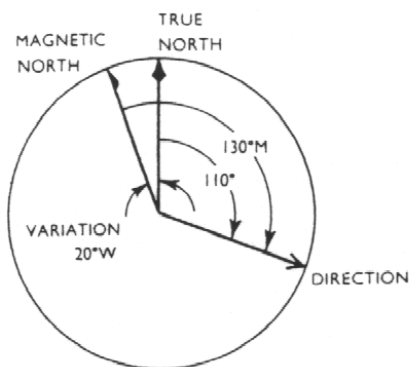
0904 VARIATION AND DEVIATION

0904.1 Variation

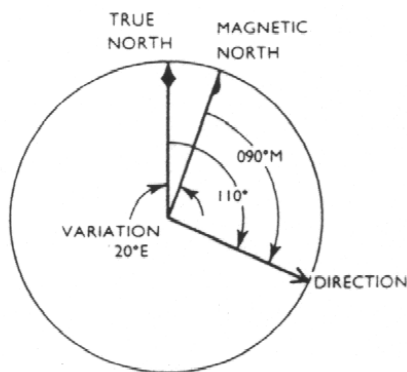
This is the angular difference between True North and Magnetic North. The True or geographical North Pole is a point where the meridians of Longitude meet. The Magnetic North is at present situated in the Hudson Bay area of Canada, this being the pole to which the Magnetic Compass relates, (does not point at the North Magnetic pole directly) with the variation being dependant upon the location of the observer on the earth's surface. Variation for an area on a given date is shown inside the Compass rose on the chart.

Example of Variation

<u>Magnetic Direction</u>	<u>Variation</u>	<u>True Direction</u>
Position A 130°M	20°W (- magnetic best)	110°
Position B 090°M	20°E (+ magnetic least)	110°



Direction at position A



Same direction at position B

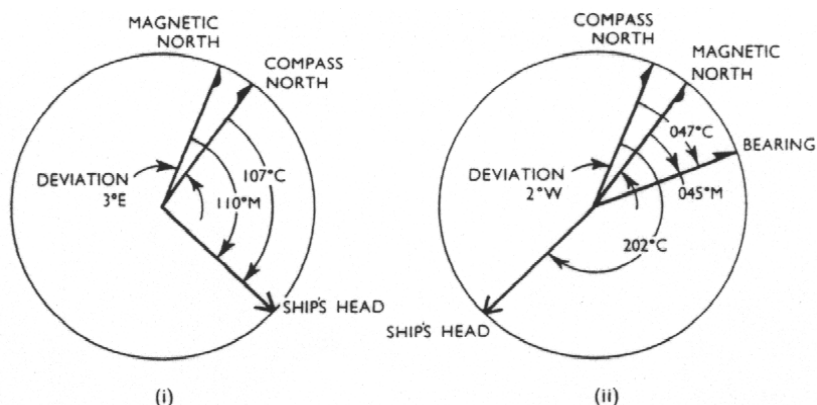
0904.2 Deviation

The needle of the magnetic compass aligns itself to the magnetic field by which it is influenced.

On a boat, this field has two components, the earth's magnetic field, (variation) and the field created by any electrical equipment or ferrous metal in the boat. (Deviation)

Deviation varies according to the Ship's Head.

Example of Deviation



Ship's head or course, by
Compass 107°C
Deviation for 107°
(compass least - add) 3°E
Ship's head or course,
magnetic 110°M

Bearing of an object, by
compass 047°C
Ship's head 202°C
Deviation for 202°
(compass best - subtract) 2°W
Bearing of the object,
magnetic 045°M

Example of a Deviation Card (Not related to the previous examples)

Ships Head	Deviation	Ships Head
(Compass)		(Magnetic)
000°	2° W	358° (M)
010°	4° W	006° (M)
020°	5° W	015° (M)
030°	7° W	023° (M)
040°	9° W	031° (M)

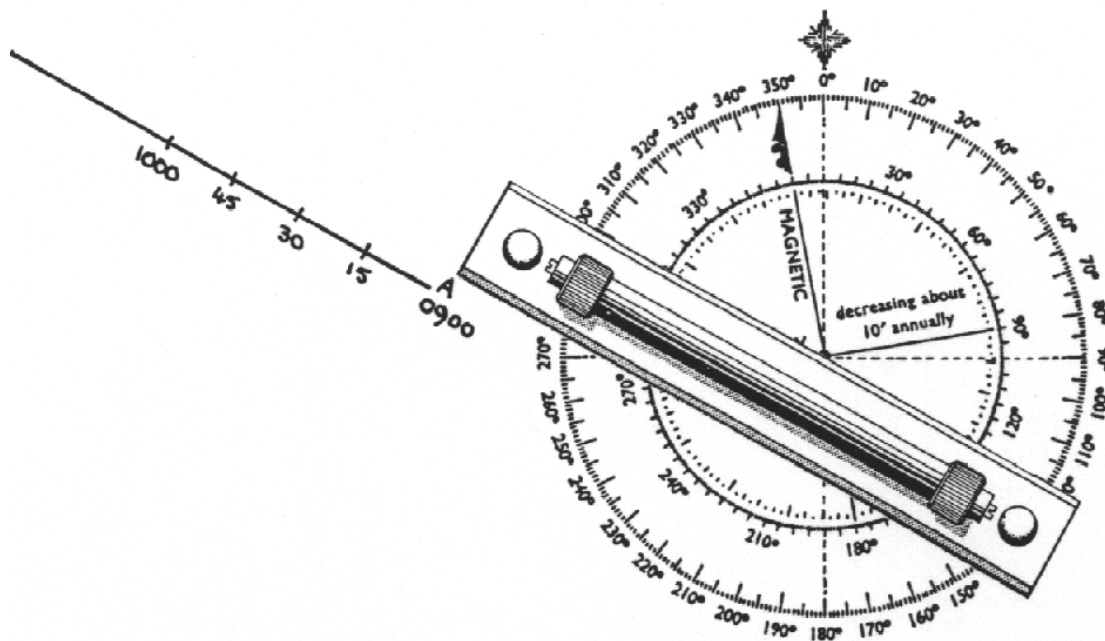
Ships Head	Deviation	Ships Head
(Compass)		(Magnetic)
180°	0° W	180° (M)
190°	3° E	193° (M)
200°	5° E	205° (M)
210°	7° E	217° (M)
220°	9° E	229° (M)

050°	11° W	039° (M)
060°	12° W	048° (M)
070°	13° W	057° (M)
080°	14° W	066° (M)
100°	12° W	088° (M)
110°	11° W	099° (M)
120°	10° W	110° (M)
130°	9° W	121° (M)
140°	8° W	132° (M)
150°	7° W	143° (M)
160°	5° W	155° (M)
170°	3° W	167° (M)

230°	11° E	241° (M)
240°	12° E	252° (M)
250°	13° E	263° (M)
260°	14° E	274° (M)
270°	13° E	283° (M)
280°	12° E	292° (M)
290°	11° E	301° (M)
300°	10° E	310° (M)
310°	9° E	319° (M)
320°	7° E	327° (M)
330°	5° E	335° (M)
340°	3° E	343° (M)

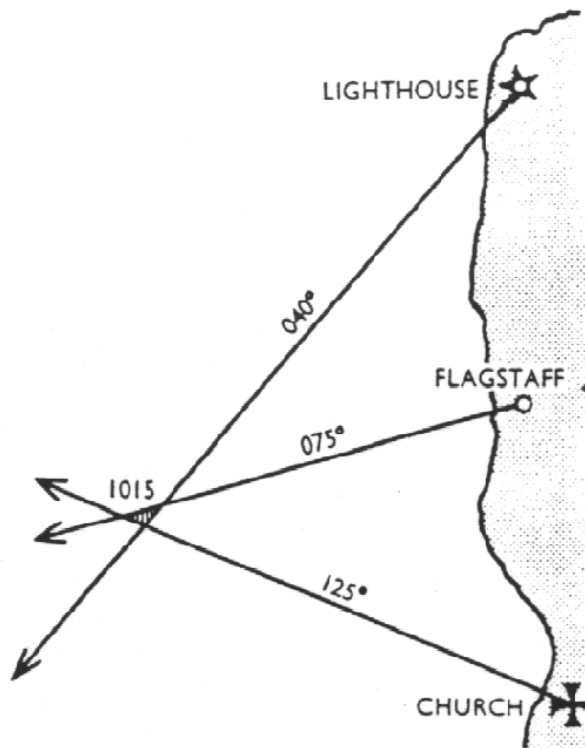
0904.3 Laving off a course

The starting point 'A' may be a fix, a Latitude and Longitude position or a bearing and distance from a given object. Place the parallel ruler on the nearest compass rose and 290 degrees, (the course being steered) on the outer circle of graduations, and for increased accuracy make sure that it also passes through 110 degrees, the reciprocal of the course. With the parallel ruler transfer this direction so as to pass through starting point 'A' and draw a line of sufficient length to show the whole run. This will be the ships course.



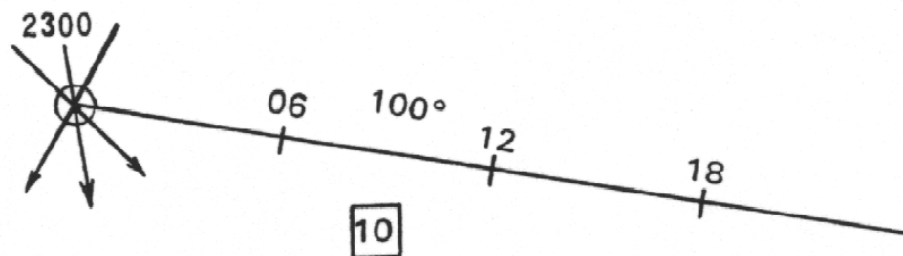
0904.4 Plotting a Fix

When a ships position is fixed by three bearings, the objects selected should, if possible, lie so that their bearings differ by about 60 degrees; the position lines will then make a good cut.



0904.5 Dead Reckoning

Having obtained a fix you must immediately forecast the future position of the ship. This can be illustrated by an example.



A fix obtained at 2300 is plotted on the chart. From the fix the navigator then draws a line representing the course that is being steered, in this case 100°. The ship's speed, as recorded by the ship's log, is 10 knots: this works out at 1 mile every 6 minutes. So at one mile intervals on the line he has drawn, the navigator marks the ship's forecast positions with a cross.

Note that the course being steered is written alongside the line on the chart and the speed is shown in a box. In addition, the Dead reckoning (D.R.) positions must always be accompanied by the time. Use 2-figure times except for the first DR in a new hour.

In the above example we have chosen to forecast the ship's future positions at 6 minute intervals. What interval you will use will depend on the circumstances - check this point with your instructor - but 6 minutes is a very convenient interval, allowing you to divide the ship's speed by 10. For example a ship's speed of 19 knots represents 1.9 miles

travelled every 6 minutes. Many navigators use this system, which is sometimes called the 'six minute rule'.

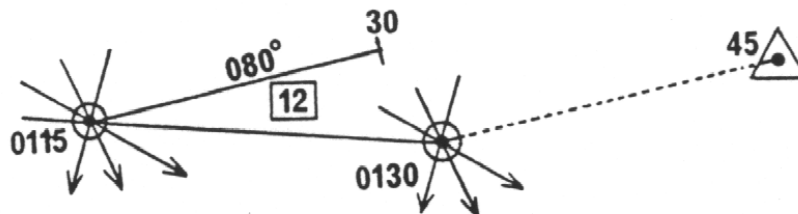
0904.6 Estimated Position

In order to have a really effective forecast, the navigator needs to make the best possible estimate of the ship's future position. Such a position is called an 'Estimated Position', and is marked thus:

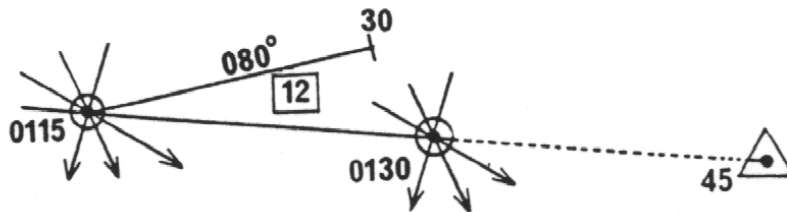


In the example below, a fix was obtained at 0115 and the DR positions calculated using this fix.

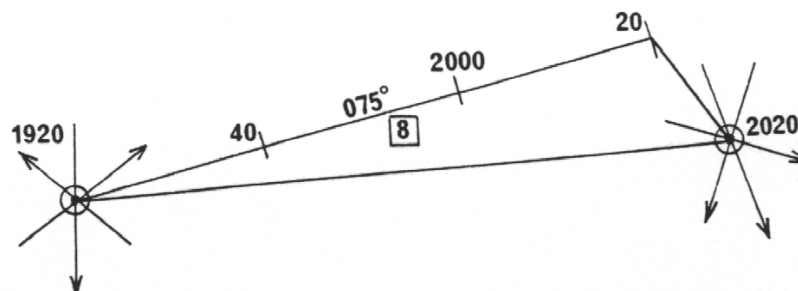
A fix is subsequently obtained at 0130, as shown. You do not alter course or speed and you want to calculate the 0145 Estimated Position. This is most likely to be your chosen position:



In the absence of other evidence it is more likely that the ship will continue to be carried down to the south (probably by a tidal stream) and therefore we would say that most navigators would assume that the speed and direction of the ship **over the ground** from 0115 to 0130 will probably be continued from 0130 to 0145 as shown below.



In the example below the DR position for 2020 has been forecast and a fix for 2020 obtained. For the purposes of the exercise we will assume that the difference between the two (in this case the DR position for 2020 and the fix for 2020) is attributable to the force of the tidal stream. (For large displacements this is the most likely cause).

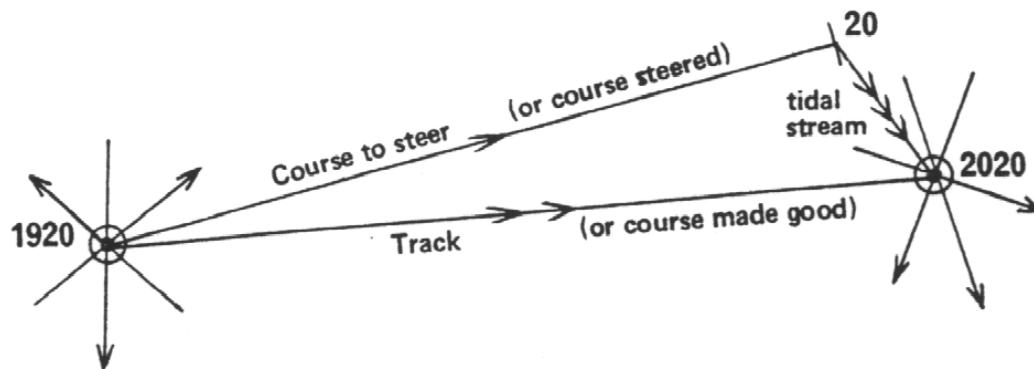


To understand how tidal stream effects the ship, do not think of it as pushing the ship

somewhere -this implies resistance. Picture the whole surface of the sea moving in a certain direction at a certain rate and carrying the ship along with it like a man walking up an escalator, or on a Travolator strip at an airport. Bearing in mind the effect of the tidal stream, you can see that the course steered by the ship is different from the actual track of the ship over the ground.

Which line of the diagram show the actual track of the ship?

The answer is - the line joining the 1920 fix to the 2020 fix.



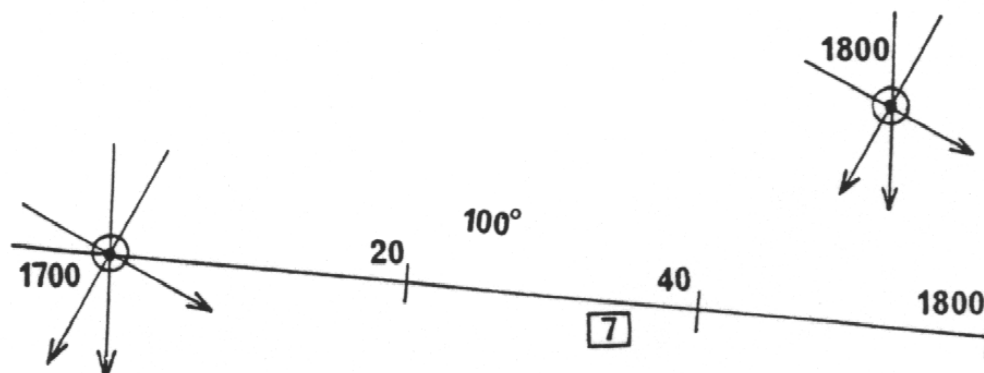
The three lines can be treated as vector, making up a vector triangle. It will be useful at this point to learn how they are referred to and the conventions used to distinguish them.

Course to steer (or course steered) - this is the line giving the DR positions and is marked with a single arrow.

Track (or course made good) - this is the line representing the ship's track over the ground and is marked with a double arrowhead.

Tidal Stream - the line representing the tidal stream is marked with three arrowheads.

If we assume that the force moving the ship from its DR position is tidal stream we can find the direction and rate of the tidal stream, given the course steered and the ship's track.



The direction of the tidal stream can now be found - by inspection it is approximately 340° . It can be measured accurately by using parallel rulers and a compass rose. The

rate can be found by measuring the length of the tidal stream vector, say 2 miles - this means a rate of 2 knots if your vector triangle is for one hour as in this example.

Vector triangles can be used to find not only the tidal stream, but also the track and the course to steer to maintain a course allowing for tidal stream.

GIVEN

Course steered and ship's track

Course steered and tidal stream

Ship's track and tidal stream

FIND

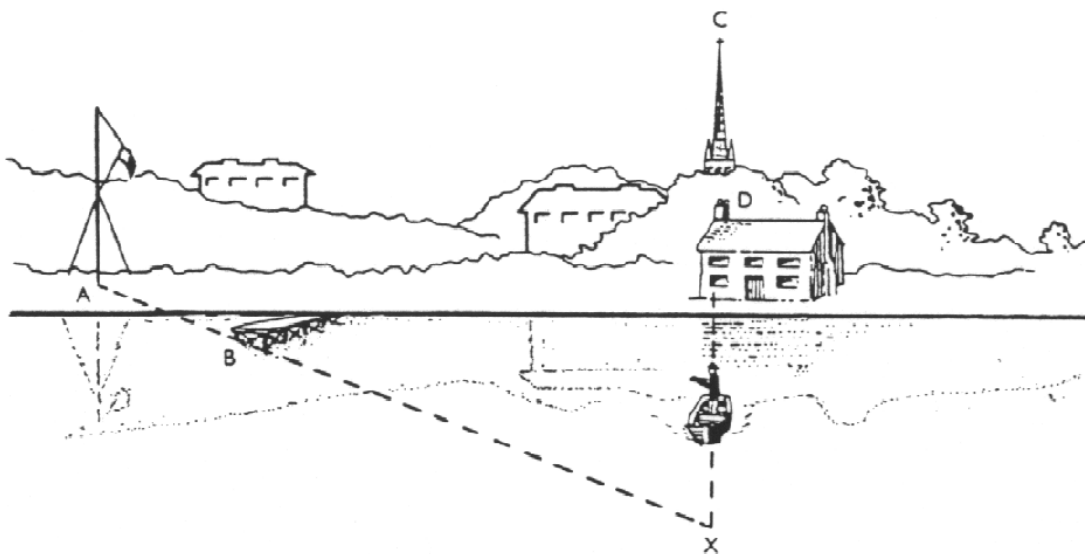
Tidal Stream

Ship's track

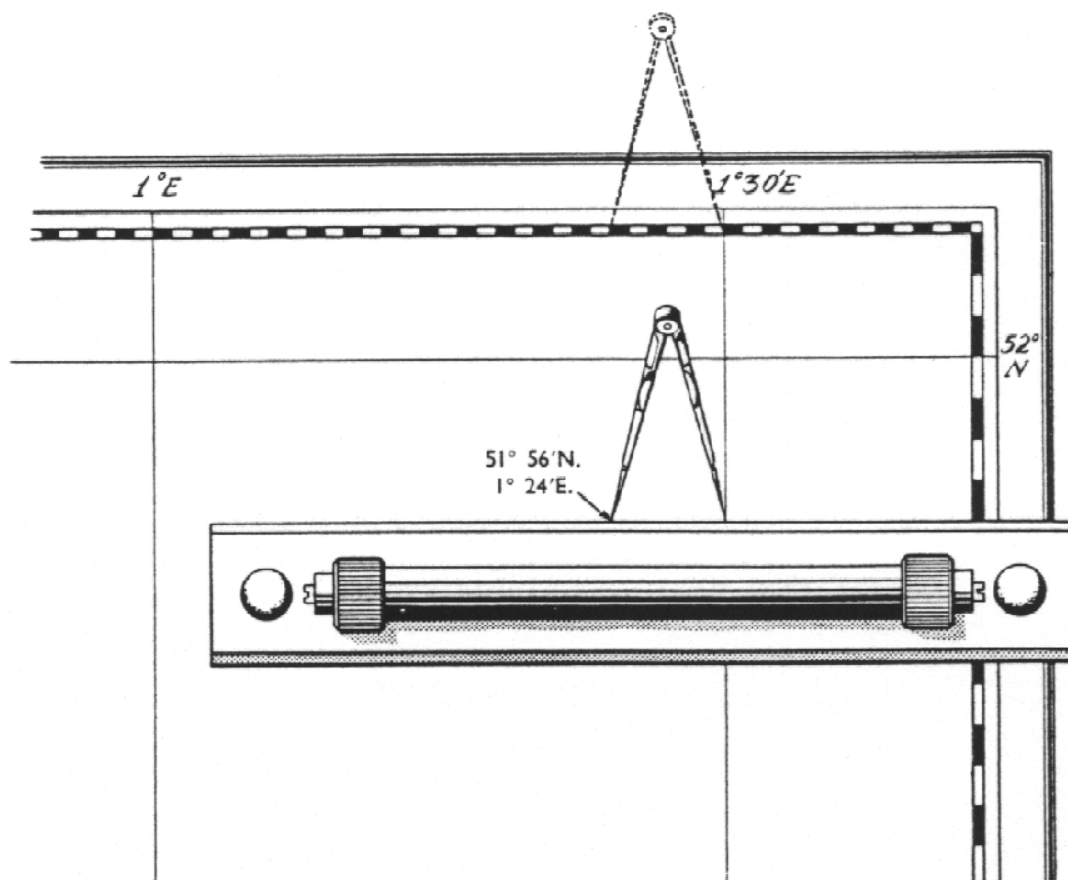
Course to steer

0904.7 Transits

This method is used for checking the accuracy of a compass. It is also the simplest method of establishing a position without the aid of a compass or a chart. A transit is achieved by lining up two or more fixed objects in each of two different directions. The resultant crossing point of the two transit lines will represent your boat's position.



0904.8 Plotting a Position using Latitude and Longitude



0905 TIDES

0905.1 Causes of Tides

The periodic rising and falling of the sea levels constitute what are known as tides.

Local Tides : Those tides around Great Britain, are semi-diurnal in character, i.e. two High waters and two Low waters daily.

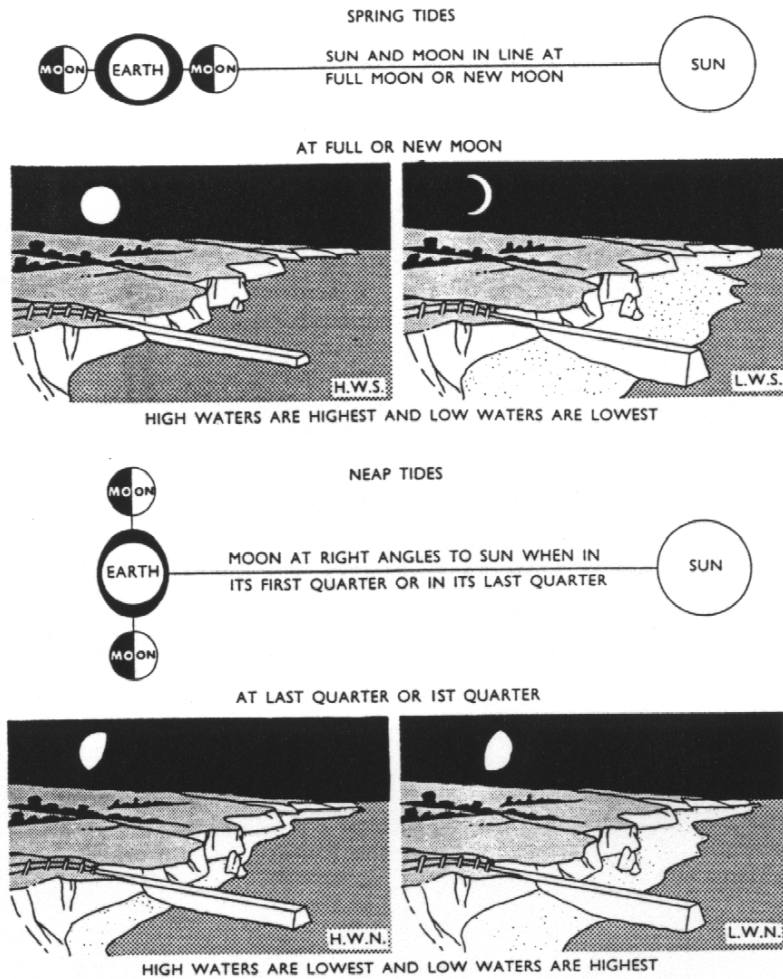
Springs and Neaps : The combined tide raising forces of the moon and the sun have their greatest effect when the sun and moon are in line with the earth, i.e. at new and full moons. And their least effect when they are at right angles to each other, i.e. first and last quarters.

Shortly after Full and New Moon a locality will experience its highest High Waters and lowest

Low Waters of that lunar month. These tides are called **Springs**.

Conversely around the times of First and Last Quarters of the moon, the lowest High Waters and the highest Low Waters will be experienced. These tides are called **Neaps**.

Examples of Spring and Neap tides



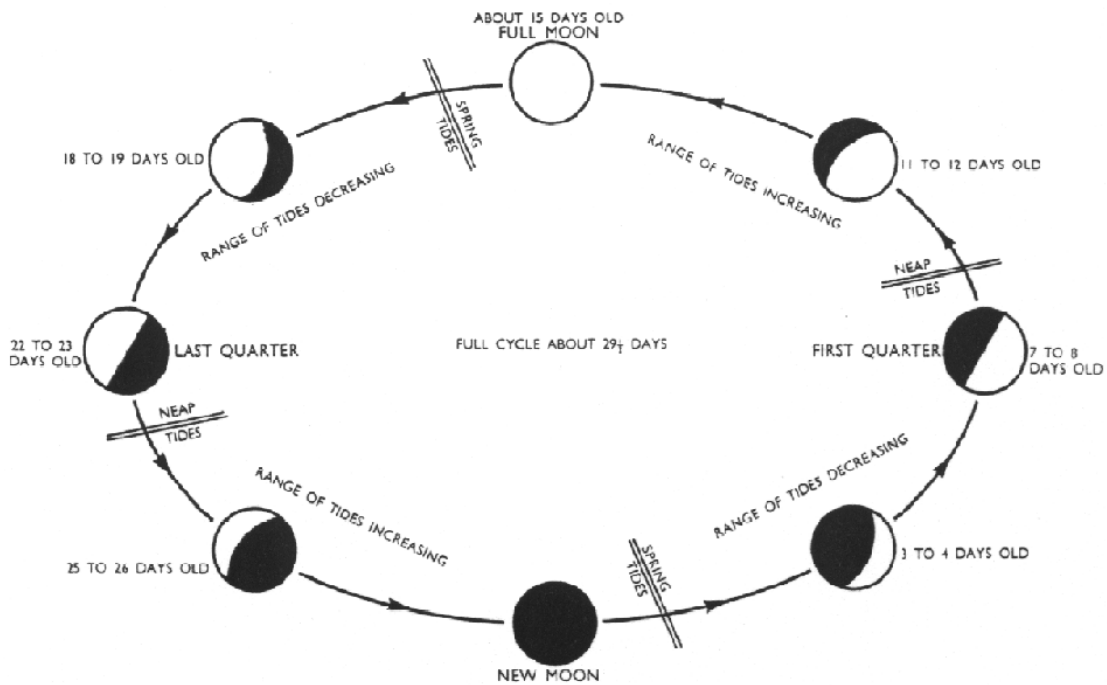
0905.2 The Stand and Slack Water

The period at High or Low Water during which no rise or fall can be detected is also known as **The Stand**.

SLACK WATER is the period when there is no horizontal movement of water as a tide is about to turn from Ebb to flood or Flood to Ebb.

N.B. Slack water and the Stand frequently do not coincide.

Spring and Neap Tides in the British Isles relative to the phases of the Moon



0905.3 Tidal Streams

Although the tidal wave does not carry the water along with it, its passage along the coast does produce horizontal movements of water called ***Tidal Streams***, which flow in and out of harbours along the coast. The Incoming tidal stream is known as the Flood and the Outgoing tidal stream the ***Ebb***.

Weather Going streams : whenever a strong stream is flowing against the wind, an uncomfortably short, steep sea is raised. This usually abates noticeably at the turn of the tide. Such conditions call for extra care in handling boats and in tending boats secured alongside a ship in a tideway.

0905.4 The Tidal Wave

In many cases the tidal wave appears to advance from the centre of an ocean along the surrounding coasts. The advance of the tidal wave around the coasts of Great Britain has a period of oscillation of about 12 hours and moves approximately as follows :

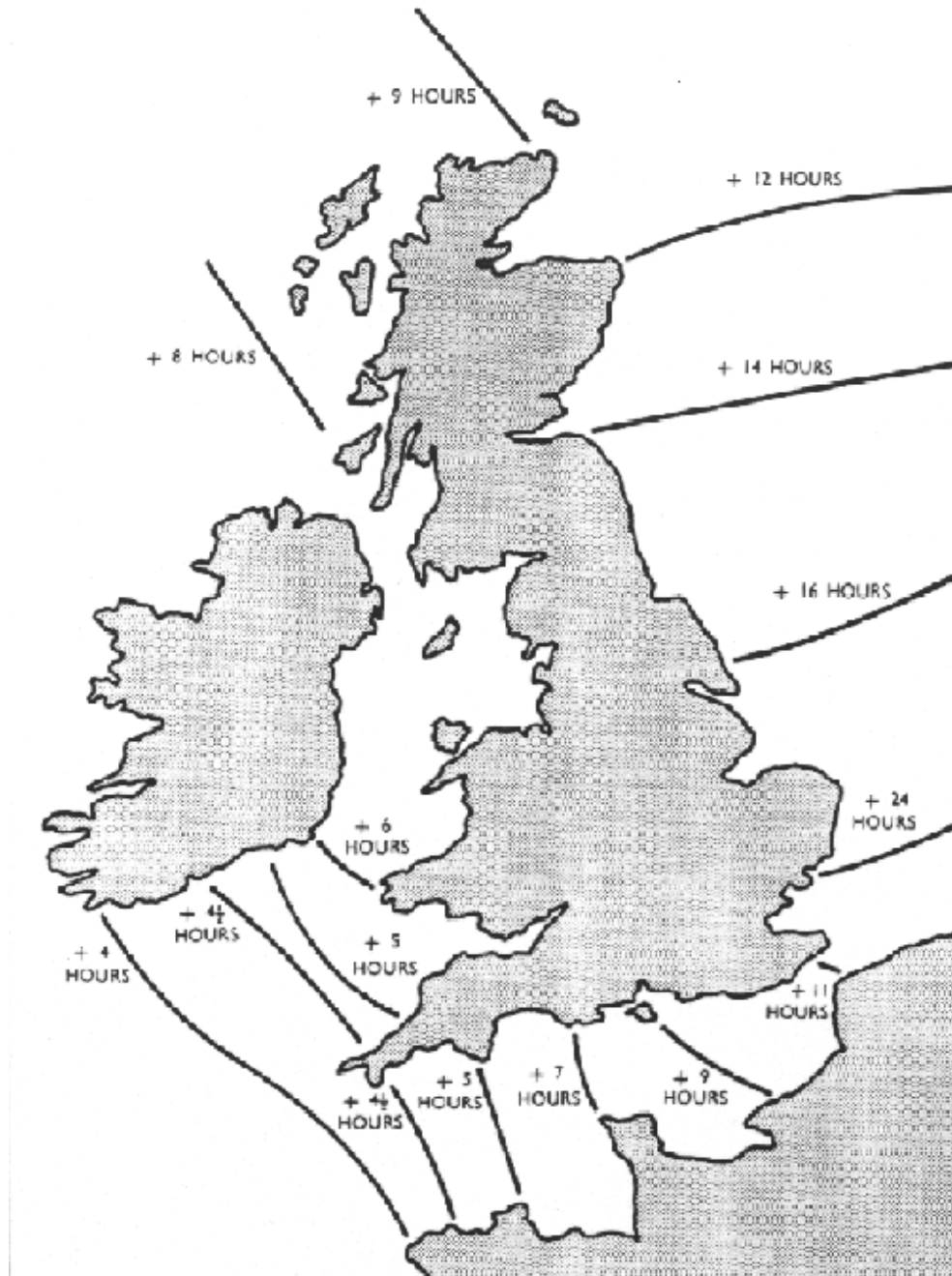
- at zero + 2 hours it arrives off the coast of Portugal;
- at zero + 3 hours it arrives off the western coast of France;
- at zero + 4 hours it arrives off Land's End.

At Land's End part of the tidal wave travels up the English Channel and reaches the Strait of Dover at zero + 11 hours, while the remainder continues northward up the West coast of Ireland until:

- at zero + 9 hours it arrives west of the Orkney Islands, and then passes into the North Sea;
- at zero + 12 hours it arrives off Peterhead;
- at zero + 24 hours it arrives off Harwich.

Off Harwich this tidal wave meets its successor, which set out from mid-Atlantic at about zero + 12 hours and had travelled up the Channel through the Strait of Dover in the intervening period.

Approximate advance of a tide-wave around Great Britain



0905.5 Calculation of Tides by using the Twelfths Rule

Before we can apply the calculations to work out tidal depths at any given time we need to know what the tidal range is for the given area. The range of any tide is the difference

between the levels of successive high and low waters. Admiralty Tide Tables provide information on the tidal range for a given area, which will provide figures with which to work on,
e.g. Times and Heights of High and Low Water on a given date.

The twelfths rule assumes that the duration of the tide is always six hours, a fact that is not always true and so a slight error will exist. The rate of flow of the tide is not constant per hour, but increases towards mid-tide and decrease again towards the last hour. If we know the rate of change of flow, we can then calculate the depth at any given time.

Sequence

1st hour - it rises or falls 1/12 of the range
 2nd hour - it rises or falls 2/12 of the range
 3rd hour - it rises or falls 3/12 of the range
 4th hour - it rises or falls 3/12 of the range
 5th hour - it rises or falls 2/12 of the range
 6th hour - it rises or falls 1/12 of the range

The Range of the Tide

Example: To find the range	High Water 0600		height 7.8 metres (a)
	Low Water 1210		height 3.0 metres (b)
	Therefore the range	=	4.8 metres (a - b)
	1/12 of the range	=	0.4 metres

Example: To find the depth of water at 0800 working from High water:

	High Water 0600		height 7.8 metres
	Low Water 1210		height 4.8 metres
	Range	=	3.0 metres
	1/12 range	=	0.4 metres
	number of 12ths req'd		3 (2 hours after High Water)

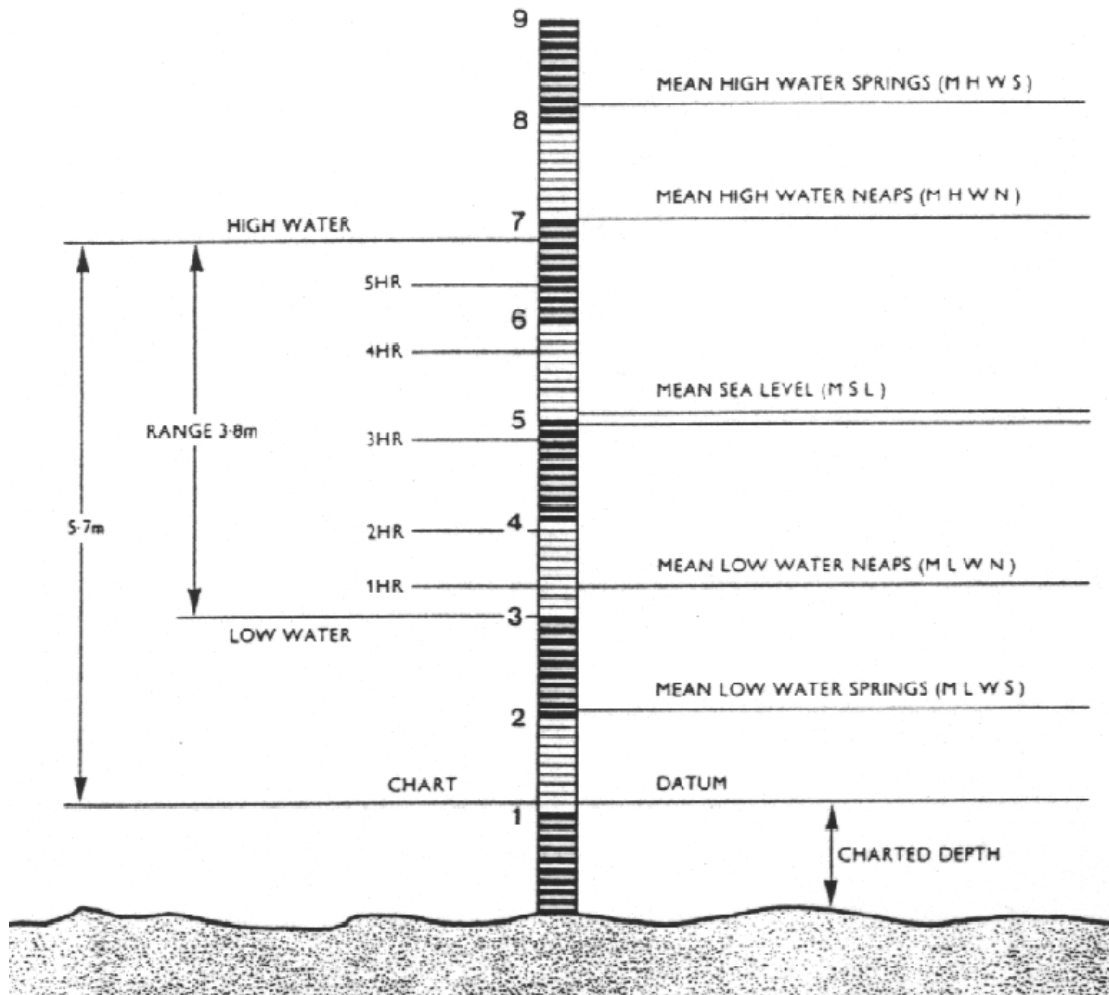
			1.2 metres (0.4 x 3)
	Subtract for High Water		7.8 metres
			1.2 metres

<i>Total height to be added to the Charted depth</i>		=	6.6 metres

0905.6 Chart Datum

Chart datum is the level below which depths are given on a chart, and above which the height of the tide is measured; the height of the tide at any moment must therefore be added to the charted depth to give the actual depth or sounding. The Chart datum is selected during the initial survey of an area and varies from place to place depending upon the range of the tide in the area. By international agreement, the Chart datum should be a plane so low that the tide will not frequently fall below it. The heights of features never or rarely covered by the sea are referred to the high water plane.

In the example below the tide pole is graduated in metres and decimetres, situated where the charted depth is 1.1 metres on a day when the rise of the tide is, say 5.7 metres.



0905.7 Tide Tables

The Admiralty Tide Tables give daily predictions of the times and heights of high and low water for a selected number of Standard Ports. For all other ports, called Secondary Ports, sufficient information is given in the back of the Tide Tables to enable the times and heights of tides to be calculated. The computed predictions are based on the analysis of one year's observations at least, and can be taken as correct for all occasions except for abnormal weather conditions. The time used in the Admiralty Tide tables is always local time. The amount that you have to add or subtract to get Greenwich Mean Time is always shown against **'Time Zone'** on the top left-hand corner of the page.

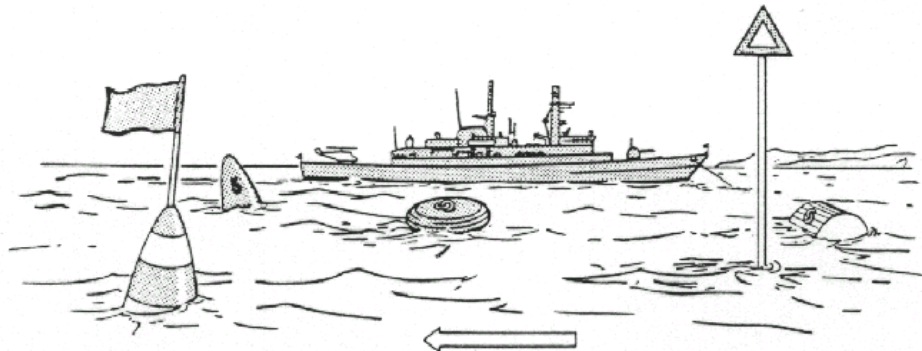
Example of a Tide Table for Margate

ENGLAND, EAST COAST - MARGATE

TIME ZONE GMT		TIMES AND HEIGHTS OF HIGH AND LOW WATERS												YEAR 1985	
		JANUARY				FEBRUARY				MARCH				APRIL	
TIME	M	TIME	M	TIME	M	TIME	M	TIME	M	TIME	M	TIME	M	TIME	M
1 0041	1.7	16 0052	1.4	1 0155	1.6	16 0315	1.2	1 0553	3.7	16 0131	1.3	1 0152	1.5	16 0356	0.8
0653	3.9	0700	4.3	0806	3.7	0928	4.1	1221	1.6	0744	3.9	0815	3.8	1010	4.3
TU 1333	1.3	W 1351	0.8	F 1429	1.4	SA 1549	1.2	F 1839	3.7	SA 1413	1.5	M 1426	1.6	TU 1616	1.3
1948	3.9	1958	4.1	2051	3.9	2159	4.1			2016	3.8	2046	3.9	2212	4.2
2 0149	1.6	17 0212	1.3	2 0303	1.5	17 0433	1.0	2 0103	1.7	17 0307	1.1	2 0311	1.2	17 0449	0.6
0758	3.9	0812	4.2	0917	3.8	1044	4.2	0713	3.6	0925	4.0	0928	4.2	1058	4.4
W 1430	1.2	TH 1458	0.9	SA 1529	1.3	SU 1654	1.1	SA 1341	1.6	SU 1538	1.4	TU 1538	1.3	W 1659	1.1
2047	4.0	2105	4.2	2153	4.1	2259	4.2	2005	3.7	2142	4.0	2146	4.2	2255	4.3
3 0250	1.5	18 0324	1.2	3 0406	1.3	18 0530	0.7	3 0223	1.5	18 0423	0.8	3 0416	0.8	18 0527	0.6
0857	4.0	0927	4.2	1019	4.1	1139	4.3	0844	3.7	1034	4.3	1026	4.5	1134	4.5
TH 1521	1.2	F 1600	0.9	SU 1628	1.2	M 1742	1.1	SU 1456	1.5	M 1644	1.2	W 1634	1.0	TH 1729	1.0
2139	4.2	2210	4.2	2247	4.3	2344	4.3	2121	3.9	2242	4.2	2237	4.5	2329	4.4
4 0343	1.3	19 0430	1.0	4 0504	1.0	19 0615	0.6	4 0339	1.3	19 0518	0.6	4 0506	0.5	19 0556	0.7
0952	4.1	1038	4.3	1112	4.3	1222	4.4	0955	4.0	1125	4.4	1115	4.8	1204	4.5
F 1607	1.1	SA 1657	1.0	M 1722	1.0	TU 1818	1.0	M 1604	1.3	TU 1729	1.1	TH 1720	0.8	F 1754	0.9
2227	4.3	2306	4.3	2334	4.5			2220	4.2	2327	4.3	2320	4.8	2357	4.5
5 0433	1.2	20 0527	0.8	5 0556	0.8	20 0622	4.4	5 0442	0.9	20 0558	0.6	5 0551	0.2	20 0619	0.7
1041	4.3	1137	4.4	1200	4.6	1300	0.5	1052	4.4	1205	4.5	1201	4.9	1229	4.5
SA 1652	1.0	SU 1744	1.0	TU 1808	0.8	W 1259	4.5	TU 1702	1.0	W 1800	1.0	F 1803	0.6	SA 1819	0.9
2312	4.5	2353	4.4			1848	0.9	2309	4.5						
6 0520	1.0	21 0617	0.7	6 0619	4.7	21 0655	4.5	6 0534	0.6	21 0601	4.4	6 0603	4.9	21 0627	4.6
1127	4.4	1225	4.5	0642	0.5	0723	0.5	1142	4.7	0629	0.6	0635	0.1	0645	0.7
SU 1737	0.9	M 1825	0.9	W 1245	4.7	TH 1330	4.5	W 1749	0.8	TH 1236	4.5	SA 1245	5.0	SU 1253	4.5
2354	4.6			1852	0.7	1919	0.9	2354	4.7	1825	0.9	1845	0.5	1849	0.8
7 0607	0.9	22 0034	4.5	7 0100	4.6	22 0126	4.6	7 0621	0.3	22 0029	4.5	7 0046	5.0	22 0056	4.6
1212	4.5	0659	0.6	0726	0.4	0752	0.6	1227	4.8	0655	0.6	0717	0.1	0712	0.8
M 1821	0.9	TU 1309	4.6	TH 1330	4.8	F 1359	4.5	TH 1831	0.6	F 1303	4.5	SU 1327	4.9	M 1317	4.5
		1903	0.9	1934	0.7	1948	0.9			1850	0.9	1927	0.5	1921	0.8
8 0035	4.7	23 0112	4.6	8 0141	4.9	23 0157	4.6	8 0035	4.9	23 0057	4.6	8 0130	5.1	23 0126	4.6
0652	0.7	0740	0.5	0809	0.3	0822	0.6	0703	0.2	0720	0.6	0759	0.2	0738	0.9
TU 1255	4.7	W 1348	4.6	F 1413	4.8	SA 1427	4.4	F 1310	4.9	SA 1327	4.5	M 1409	4.8	TU 1342	4.5
1903	0.9	1940	0.9	2015	0.7	2019	0.9	1912	0.6	1919	0.8	2009	0.6	1952	0.9
9 0116	4.7	24 0147	4.6	9 0220	4.9	24 0226	4.6	9 0116	5.0	24 0126	4.6	9 0215	5.0	24 0157	4.5
0737	0.8			0851	0.3			0116	0.1	0745	0.7	0842	0.5	0808	
W 1338	4.7									1351	4.6	1450	4.6	W 1417	

0905.8 Estimating Tidal Strength and Direction

Clear indication of the set or direction of the stream is given by ships/boats riding head on to it, or buoys canting away from it, (except the spar buoy which is moored so that its staff inclines upstream or down wind whichever is the stronger), or by the ripple of water in the wake of the moored object such as a buoy. Inshore indicators are given by drifting flotsam and by the ripple in the wake of posts or piles. (By noting such indications coxswains of boats can save themselves much time and labour and avoid possible damage to their craft when coming alongside).



0906 RULE OF THE ROAD

0906.1 Basic Rule of the Road

Vessels sailing on the high seas have to abide by certain rules, otherwise there would be many collisions. These rules are called ***The International Regulations for Preventing Collisions at Sea*** or '***Rule of the Road***'. The full regulations can be found in the **Admiralty Manual of Seamanship volume II (1981)** and a ***Seaman's Guide to the Rule of the Road (BR 453)***.

They are not available in the new Admiralty Manual of Seamanship (BR 67) dated 1995.)

0906.2 General Definitions

The word '**vessel**' includes every description of watercraft including non-displacement (Basics) craft and seaplanes, used or capable of being used as a means of transport on water.

The term '**power-driven vessel**' means any vessel propelled by machinery.

The term '**sailing vessel**' means any vessel under sail provided that propelling machinery, if fitted, is not being used.

The word '**underway**' means that a vessel is not at anchor, or made fast to the shore, or aground.

The term '**restricted visibility**' means any condition, in which visibility is restricted by fog, mist, falling snow, heavy rainstorms, sandstorms or any other similar causes.

Every vessel shall at all times maintain a proper look-out.

Keep to the starboard side of any narrow channel.

0906.3 Assessing the Risk of Collision.

When two vessels appear to be on converging courses the possibility of collision depends on their relative courses and speeds. The only certain way of determining whether the risk of collision exists is to take a compass bearing of the other vessel. If the bearing ***does not alter***, or ***alters only slightly***, then the risk of collision exists. If the bearing ***draws forward***, then the other vessel should pass ahead; if the bearing ***draws aft***, she should pass astern.

If a compass is not available, the relative bearing of the other vessel gives an indication of the risk of collision provided that your own vessel **remains on a steady course**.

0906.4 Steering and Helm Orders

As Quartermaster or Helmsman at sea, you will be required to carry out various Helm Orders as given by the Officer of the Watch.

Before handing over the wheel the outgoing helmsman will confirm the course to steer, the engine speed and revolutions set with the incoming helmsman then the following report is made:

Helmsman calls: "**Bridge - Wheelhouse**"

OOW Reply: "**Bridge**"

Helmsman calls: **"Permission for ...Rank and Name..... to take the wheel sir"**

OOW Reply: **"Very Good"**

New Helmsman takes over the wheel ensuring that the correct course is maintained, then makes a report to the bridge.

Helmsman calls: **"Bridge-Wheelhouse"**

OOW Reply: **"Bridge"**

Helmsman reports: **"... Rank and Name... on the wheel Sir, course to steer ... e.g. 175 degrees, both/engine showing half ahead, 100 (one zero zero) revolutions set"**.

OOW Reply: **"Very Good"**

Helmsman must maintain the course as accurately as possible while making the report. In rough weather a greater degree of care should be exercised as greater amounts of wheel may be required to keep the ship on course.

When is it necessary to alter course or change the engine or revolution mode the OOW will call to the Helmsman with the order, the helmsman confirms the order, carries it out and then reports back to the OOW that the order has been carried out. Here is a simple example for altering course:

OOW orders: **"Starboard Fifteen" (15).**

Helmsman replies: **"Starboard Fifteen"** then turns the wheel to apply 15 degrees to starboard.

Helmsman reports: **"Fifteen of Starboard wheel on Sir"** (the word degrees is omitted).

OOW orders: **"Midships"**.

Helmsman replies: **"Midships"** then turns the wheel back to the midships position.

Helmsman reports: **"Wheel Amidships Sir"**.

OOW Orders: **"Port Ten"**.

Helmsman replies: **"Port Ten"** then applies 10 degrees of port wheel.

Helmsman reports: **"Ten of Port wheel on Sir"**.

OOW orders: **"Midships"**

Helmsman replies: **"Midships"** then returns to the midships position.

Helmsman reports: **"Wheel Amidships Sir"**.

If the OOW has manoeuvred the ship onto its new chosen course or is very close to it;

OOW orders: **"Steer Two Zero Zero"**.

Helmsman replies: **"Steer Two Zero Zero"** and when he is on the chosen course;

Helmsman reports: **"Course Two Zero Zero Sir"**.

OOW replies: **"Very Good"**.

Or if the OOW has not manoeuvred the ship onto its new chosen course and is within a few degrees - after Helmsman reports "Wheel Amidships Sir"

OOW orders: **"Steady"**

Helmsman reports: **"Course Two Zero Zero Sir"** this will be the compass heading the ship currently lies on.

OOW orders: **"Very Good, Steer Two Zero Zero"**.

The helmsman then maintains the course until ordered to change by the Officer of the Watch.

0906.5 Overtaking Rules

- a) Any vessel overtaking another shall keep out of the way of the vessel being overtaken.
- b) A vessel shall be deemed to be overtaking when coming up with another vessel from a direction more than 22.5 degrees abaft her beam.(i.e. in the stern light area)
- c) When a vessel is in any doubt as to whether she is overtaking another, she shall assume that this is the case and act accordingly.
- d) Any subsequent alteration of the bearing between the two vessels shall not make the overtaking vessel a crossing vessel within the meaning of these rules or relieve her of her duty of keeping clear of the overtaken vessel, until she is finally past and clear.

0906.6 Restricted Waters (Narrow Channels)

- a) A vessel proceeding along a course of a narrow channel or fairway, shall keep as near to the outer limit of the channel or fairway, which lies on her starboard side as is safe and practicable.
- b) A vessel of less than 20 metres in length, or a sailing vessel, shall not impede the passage of a vessel, which can safely navigate only within a narrow channel or fairway.
- c) A vessel engaged in fishing, shall not impede the passage of any other vessel navigating within a narrow channel or fairway.
- d) A vessel shall not cross a narrow channel or fairway, if such crossing impedes the passage of a vessel, which can safely navigate only within such channel or fairway. The latter vessel may use the prescribed sound signal (in Rule 34(d)) see below if in doubt as to the intention of the crossing vessel.
- e) In a narrow channel or fairway when overtaking can take place only if the vessel to be overtaken has to take action to permit safe passing, the vessel intending to overtake shall indicate her intention by sounding the appropriate signal (Rule 34 (c)) see below:

The vessel to be overtaken shall, if in agreement, sound the appropriate signal, (Rule 34(c)) see below and take steps to permit safe passing. If in doubt she may sound the signals prescribed (Rule 34(d)) see below. This rule does not relieve the overtaking vessel of her obligation under the overtaking rules.

- f) A vessel nearing a bend or an area of a narrow channel or fairway, where other vessels may be obscured by an intervening obstruction, shall navigate with

particular alertness and caution, and shall sound the appropriate signal prescribed (Rule 34(e)).

- g) Any vessel shall, if the circumstances of the case permit, avoid anchoring in a narrow channel.

0907 SOUND SIGNALS

0907.1 Manoeuvring Sound Signals - Definitions

- a) The word '**whistle**' means any sound signalling appliance capable of producing the prescribed blasts.
- b) The term '**short blast**' means a blast of about 1 second duration.
- c) The term '**prolonged blast**' means a blast of 4 - 6 seconds duration.

0907.2 Manoeuvring Sound Signals

- a) **One short blast** means: 'I am altering my course to Starboard'
Two short blasts means: 'I am altering my course to Port'
Three short blasts means: 'I am operating astern propulsion'
- b) These signals may be supplemented by the same sequence of flashes of light whilst the manoeuvre is being carried out.

Rule 34 c) When in sight of one another in a narrow channel or fairway; a vessel intending to overtake another shall indicate her intention by the following signals on her whistle :

1. **Two prolonged blasts** followed by **one short blast** means:
'I wish to overtake you on your Starboard side'
2. **Two prolonged blasts** followed by **two short blasts** means:
'I wish to overtake you on your Port side'
3. The vessel about to be overtaken shall indicate her agreement by sounding the following signal:
One prolonged blast, one short blast, one prolonged blast, one short blast, in that order. (i.e. 'C' - Yes, Affirmative)

Rule 34 d) When vessels in sight of each other are approaching one another, and either vessel fails to understand the intentions of the other, shall sound at least **five short blasts** in rapid succession. Such a signal may be supplemented by a light signal of at least five short and rapid flashes.

Rule 34 e) A vessel nearing a bend or area of a channel or fairway, where other vessels may be obscured, shall sound **one prolonged blast** . Each signal shall be answered with **a prolonged blast** by an approaching vessel, that may be within hearing around the bend or behind an intervening obstruction.

0907.3 Sound Signals in Restricted Visibility

- a) A **Power Driven vessel making way** shall sound at intervals of not more than two minutes, **'One prolonged Blast'**.
- b) A **Power driven vessel under way** but stopped and making no way, shall sound at intervals of not more than two minutes, **'Two Prolonged blasts'**. (2 seconds between the blasts).
- c) A vessel **not under command**, a vessel **restricted**, a vessel **constrained by her draft**, a **sailing** vessel, a vessel engaged in **fishing** and a vessel engaged in **towing** or pushing, shall sound, at intervals of not more than two minutes, three blasts in succession, namely **'One Prolonged blast** followed by **Two Short blasts'**.
- d) A vessel **towed** or if more than one vessel is towed the last vessel of the tow, if manned, shall at intervals of not more than 2 minutes sound four blasts in succession, namely **'One prolonged blast** followed by **Three short blasts'**. When practicable, this signal shall be made immediately after the signal made by the towing vessel.
- e) A vessel **at anchor** shall at intervals of not more than one minute ring the bell rapidly for about 5 seconds. If 100 metres or more long she sounds the bell forward followed by 5 seconds on a gong aft. She may in addition sound three blasts in succession, namely **'One Short, One Prolonged** and **One short blast'** to give warning of her position and of the possibility of collision to an approaching vessel.
- f) A vessel of **less than 12 metres** in length shall not be obliged to give warning signals as prescribed for other vessels, but if she does not, shall make some other efficient sound signal at intervals of not more than 2 minutes.

0907.4 Signals to attract attention

If necessary to attract the attention of another vessel any vessel may make light or sound signals that cannot be mistaken for any signal authorised elsewhere within the Rules, or may direct the beam of her searchlight in the direction of the danger, in such a way as not to embarrass any vessel.

0907.5 Power Driven Vessel's Sound Signals

Summary of Sound Signals

Abbreviations.	●	-	1 short blast of 1-2 seconds duration
	■	-	1 prolonged blast of 4-6 seconds duration
	PDV	-	Power Driven Vessel
	ev 2	-	Every 2 minutes

For vessels in sight of each other:

Signal Meaning	Meaning
<i>Whistle blast</i>	
•	I am altering course to Starboard
• •	I am altering course to Port
• • •	I am operating astern propulsion
- - •	I intend to overtake you on your starboard side
- - • •	I intend to overtake you on your port side
• • • • •	I do not understand your intentions (known as the 'wake up' signal)
-	Approaching a bend in a river
- • •	A vessel a) Not under command (NUC) b) Restricted in her ability to manoeuvre c) Constrained by her draught d) Engaged in Fishing e) Engaged in Towing or Pushing f) Sailing Vessel under way in poor visibility
- • • •	A vessel being towed
• • • •	A Pilot boat engaged on duty

Bells

Rapid ringing for 5 seconds every minute (or less)	A vessel under 100 metres in length at anchor
Rapid ringing for 5 seconds forward followed by a gong for 5 seconds aft, may be followed by • - • on a whistle	A vessel over 100 meters in length at anchor
Three strokes of a bell followed by rapid ringing of a bell for 5 seconds and then 3 strokes of the bell	A vessel under 100 metres aground.
3 strokes of a bell followed by Rapid ringing of a bell for 5 seconds followed by 5 seconds sounding of a gong followed by 3 strokes of a bell	A vessel 100 metres or more aground

To Attract Attention: If necessary to attract the attention of another vessel, any vessel may make light or sound signals that cannot be mistaken for any signal authorised elsewhere in these rules.

0908 STEERING RULES

0908.1 Lookout

Every vessel shall at all times, maintain a proper lookout by sight and hearing, as well as by all available means appropriate in the prevailing circumstances and conditions, so as to make a full appraisal of the situation and of the risk of collision.

0908.2 Safe Speed

Every vessel shall at all times, proceed at a safe speed, so that she can take proper and effective action to avoid collision and can be stopped within a distance appropriate to the prevailing circumstances and conditions. In determining a safe speed the following factors shall be among those taken into account:

- By all vessels
- a) The state of visibility.
 - b) The traffic density.
 - c) The manoeuvrability of the vessel.
 - d) At night, the presence of background lights.
 - e) The state of wind, sea, current and proximity of navigational hazards.
 - f) The draught in relationship to the depth of water.

0908.3 Risk of Collision

- a) Every vessel shall use all available means appropriate to the prevailing circumstances and conditions, to determine if a risk of collision exists. If there is any doubt such a risk shall be deemed to exist.
- b) In determining if the risk exists, the following conditions shall be among those taken into account:
 - 1. Such risk shall be deemed to exist if the compass bearing of an approaching vessel does not appreciably change.
 - 2. Such risk may sometimes exist, even when an appreciable bearing change is evident, particularly when approaching a large vessel or a tow or when approaching a vessel at close range.

0908.4 Action to avoid a Collision

- a) Any action to avoid collision shall, if the circumstances of the case permit, be positive, made in ample time and with due regard to the observance of good seamanship.
- b) Any alteration of course and/or speed to avoid collision shall, if the circumstances permit, be large enough to be readily apparent to another vessel observing visually or by radar. A succession of small alterations of course and/or speed should be avoided.

0908.5 The Giving Way Vessel (for 2 or more unhampered power driven vessels converging)

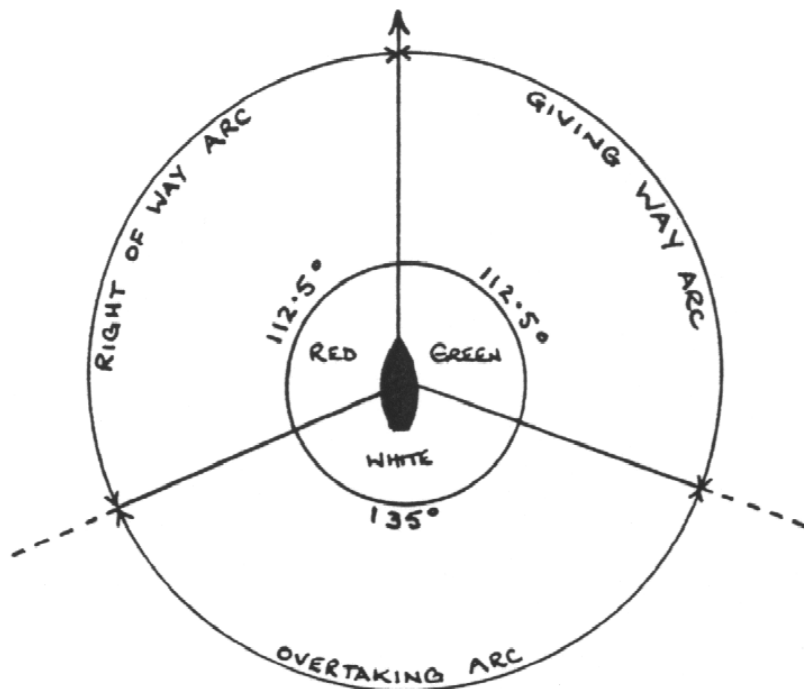
The circle of the horizon around a ship is divided up into three arcs, which represent the arcs of visibility of the two sidelights and the stern light. These arcs are referred to as the Right of Way arc, the Giving Way arc and the overtaking arc.

a) **Head on situation** - when two Power Driven Vessels are meeting on reciprocal or nearly reciprocal courses so as to involve Risk of Collision, each shall alter her course to starboard so that each shall pass on the Port side of the other.

b) **The Right of Way arc** - any vessel approaching your ship within this arc must take avoiding action to prevent a risk of collision. Your ship maintains its course and speed.

c) **The Giving Way arc** - if there is a risk of collision with any vessel approaching your ship within this arc you must take avoiding action.

d) **The Overtaking arc** - it is the responsibility of any vessel approaching you within this arc to take avoiding action. If the vessel on overtaking moves into the Giving Way arc she must keep clear of you until she is finally past and clear ahead.



0908.6 A Power Driven Vessel's Conduct

When obeying the steering and sailing rules, the following rules should be borne in mind:

a) If yours is the giving way vessel, always give the other vessel as wide a berth as circumstances allow. It is dangerous to pass close to another vessel.

b) If yours is the giving way vessel, your avoiding action should be made in such a manner so as to leave no doubt of your intentions in the mind of the person in charge of the other vessel.

You should therefore:

1. Take avoiding action in plenty of time.
2. Make a sufficiently large initial alteration of course for your intentions to be made clear both visually and on radar.
3. Steady on your new course without undue yawing.
4. Make appropriate sound signals if you are in sight of another vessel.

c) When another vessel is approaching, steer as steady a course as possible and make allowance for the other vessel yawing. A vessel approaching nearly head on, on an opposite course may appear to be end on now and again because she is yawing. Under such circumstances, she should be treated as approaching end on and you should alter course to Starboard and give her as wide a berth as practicable.

d) In a narrow channel or fairway, keep to that side of the channel, which is on your starboard side.

0909 LIGHTS ON VESSELS

0909.1 Definitions

a) **Masthead Lights**: means a white light placed over the fore and aft centreline of the vessel showing an unbroken light over an arc of horizon of 225 degrees. It shall be fixed so as to show the light from right ahead to 22.5 degrees abaft the beam on either side of the vessel.

b) **Sidelights**: means a green light on the starboard side and a red light on the port side, showing an unbroken light over the arc of the horizon of 112.5 degrees, and so fixed to show the light from right ahead to 22.5 degrees abaft the beam on its respective side. In a vessel of less than 20 metres in length, the sidelights may be combined in one lantern carried on the fore and aft centreline of the vessel.

c) **Stern Light**: means a white light placed as near as practicable at the stern, showing an unbroken light over an arc of the horizon of 135 degrees. It shall be fixed so as to show the light 67.5 degrees from right aft on each side of the vessel.

d) **Towing Lights**: means a yellow light having the same characteristics as the 'Stern light'.

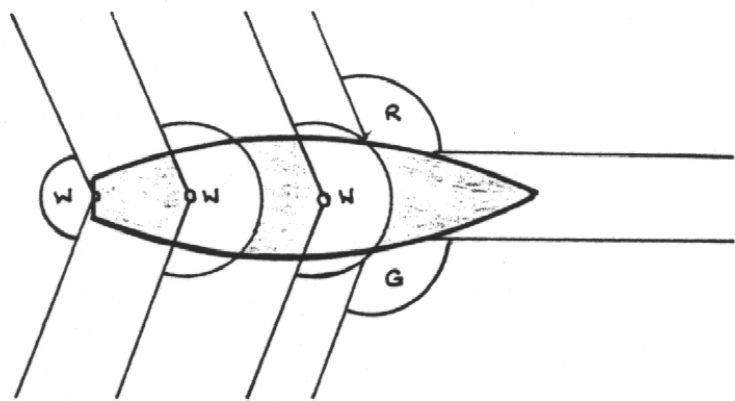
e) **All Round Light**: means a light showing an unbroken light over an arc of the horizon of 360 degrees.

f) **Flashing Light**: means a light flashing at regular intervals at a frequency of 120 flashes or more per minute.

0909.2 Visibility of Lights

	Vessels 50 metres or more in length	Vessels 12 metres but less than 50 mtrs		Vessel less than 12 metres in length
Masthead Light	6 miles	5 miles * 3		2 miles
Sidelights	3	2	2	1
Stern Lights	3	2	2	2
Towing Light	3	2	2	2
Red, white, green or yellow all round light	3	2	2	2

* Where the length of the vessel is less than 20 metres.



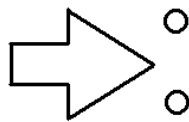
0910 BUOYAGE

0910.1 Lateral Marks

Port Hand Buoys are left to Port and **Starboard Hand Buoys** are left to Starboard when:

- a) Approaching or entering a Port or Estuary
- b) Going in the "General direction".

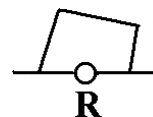
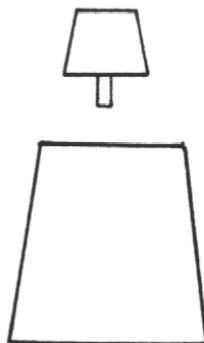
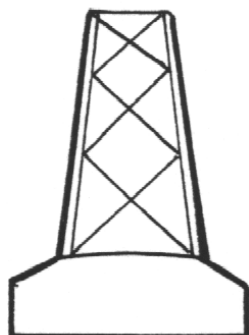
If there could be doubt the direction is marked on the chart.



0910.2 Port Hand Mark

Buoy shapes
Colour
Top Marks
Lights

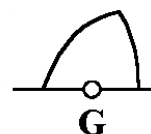
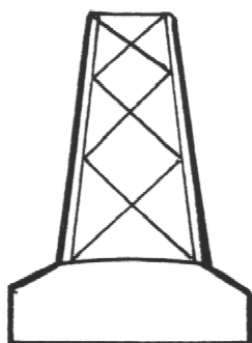
Pillar, Spar or Can
Red
Can Shaped if any
Red Flashing - any rhythm - if lit



0910.3 Starboard Hand Mark

Buoy shapes
Colour
Top marks
Lights

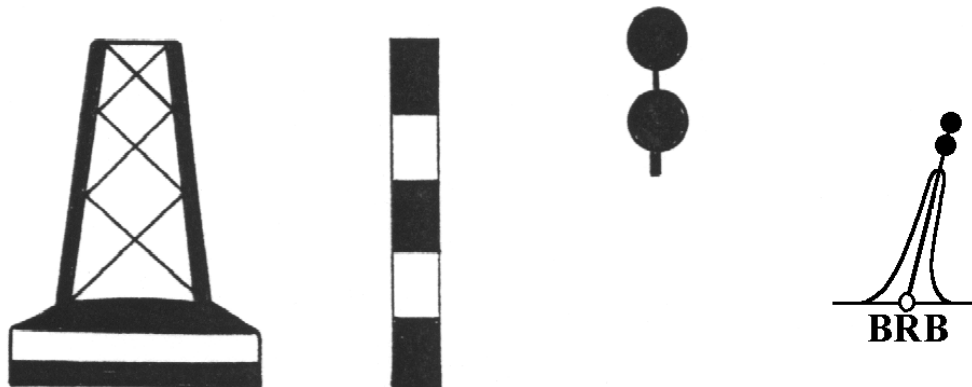
Pillar Conical or Spar
Green (very occasionally Black)
Cone Shape if any
Green Flashing, any rhythm - if lit



0910.4 Isolated Danger Marks

Buoy shapes	Pillar or Spar
Colour	Red and Black bands
Top Marks	2 Black Spheres
Lights	White Group Flashing (2) - if lit

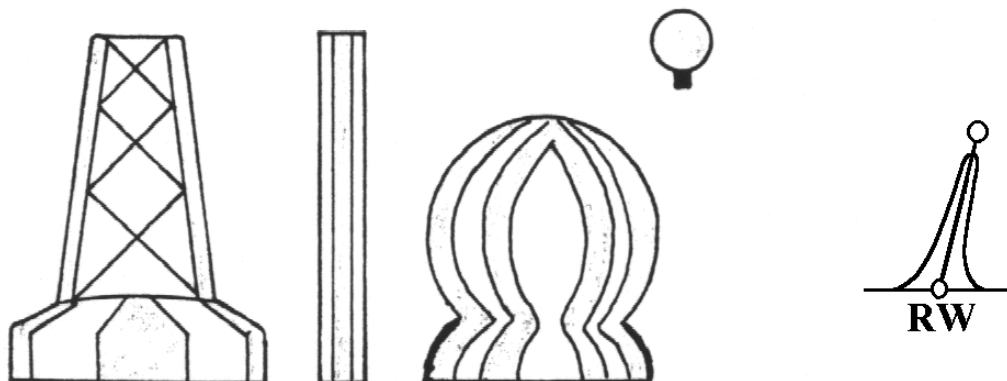
These buoys are stationed over a danger with navigable water round it.



0910.5 Safe Water Mark

Buoy Shapes	Pillar, Spar or Spherical
Colour	Red and White Vertical Stripes
Top Marks	Red Sphere if any
Lights	White Isophase, Occulting or Long Flashes every 10 seconds - if lit

Used to mark Mid Channel or Landfall



0910.6 Special Marks

Buoy shapes	Pillar, Spar, Barrel, Conical, Spherical or Can shaped
Colour	Yellow
Top Marks	A Yellow Cross if any

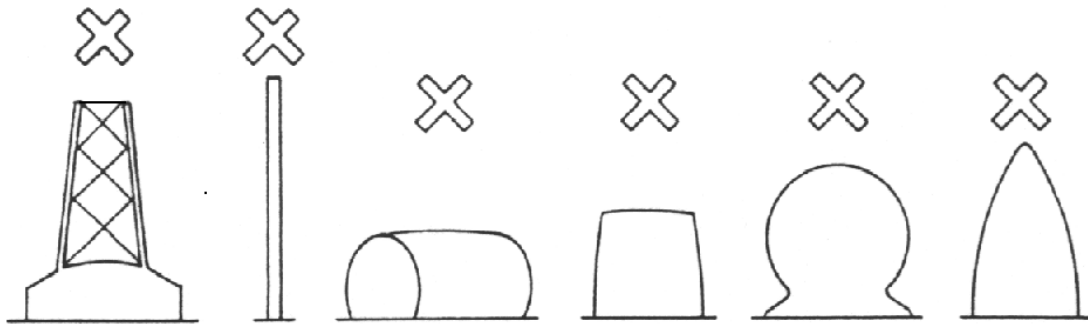
Lights
lights

Yellow if any and may have a rhythm not used by white

These buoys are not primarily to assist in navigation, but to indicate special features. If Can, Spherical or Conical shapes are used they will indicate the side on which the buoy should be passed.

Uses of Special Marks

- a) Ocean Data Acquisition Systems: ODAS for short - buoys carrying oceanographic or meteorology sensors
- b) Traffic Separation marks: Where the use of conventional channel markings might cause confusion.
- c) Spoil ground marks
- d) Military Exercise Zone marks
- e) Cable or Pipeline marks including outfall pipes
- f) Recreation Zone marks
- g) To define a channel within a channel

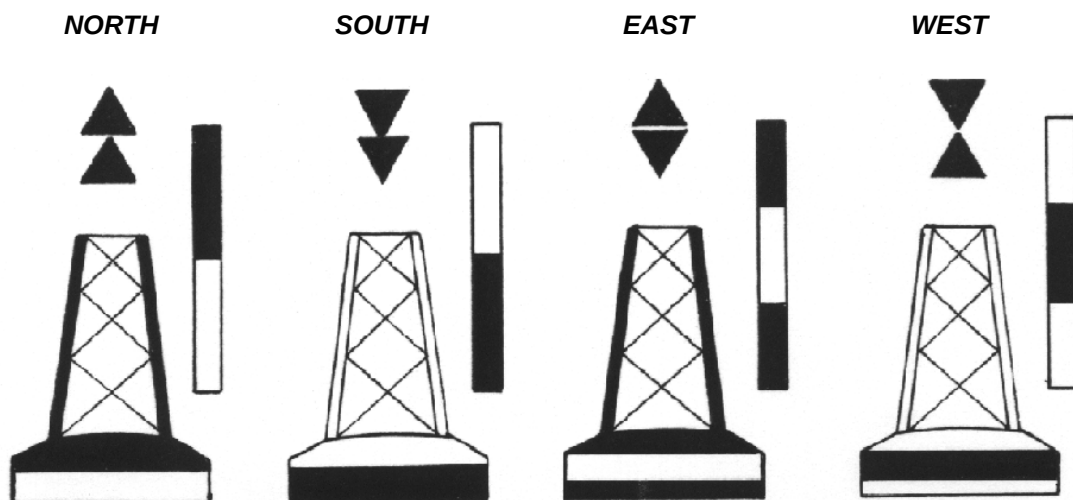


0910.7 Cardinal Marks

Buoy Shapes
Colours
Top Marks
by day.
Lights

Pillar or Spar
Black and Yellow
Black double cones - These are the most important features

White in colour.



Lights if lit

*Continuous
Flashing (9)*

*Group Flashing (6)
+ 1 Long Flash*

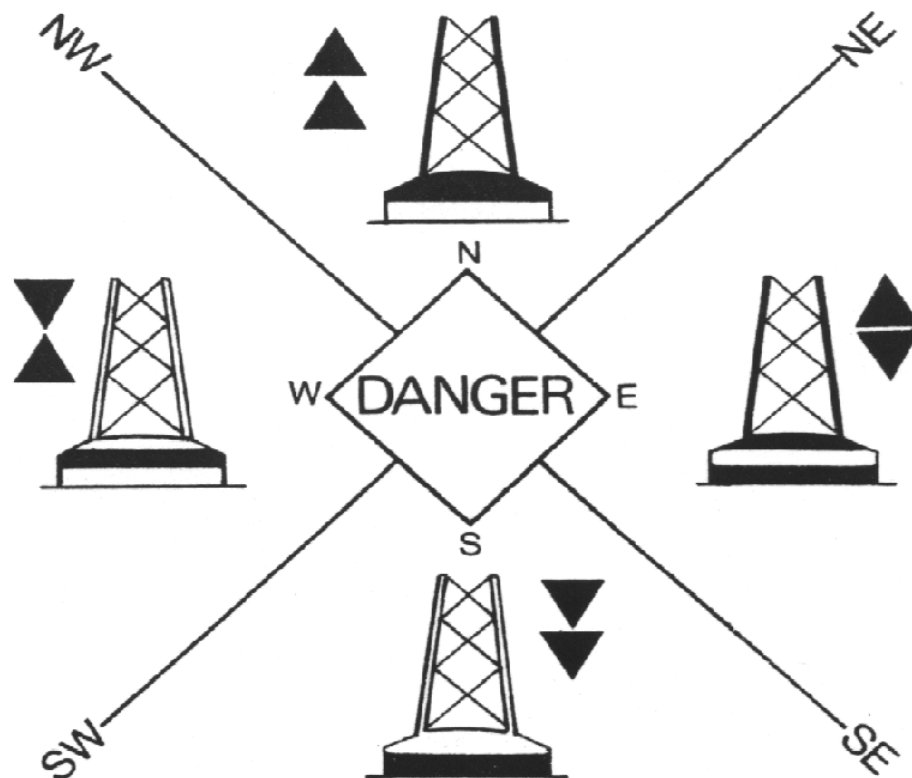
Group Flashing (3)

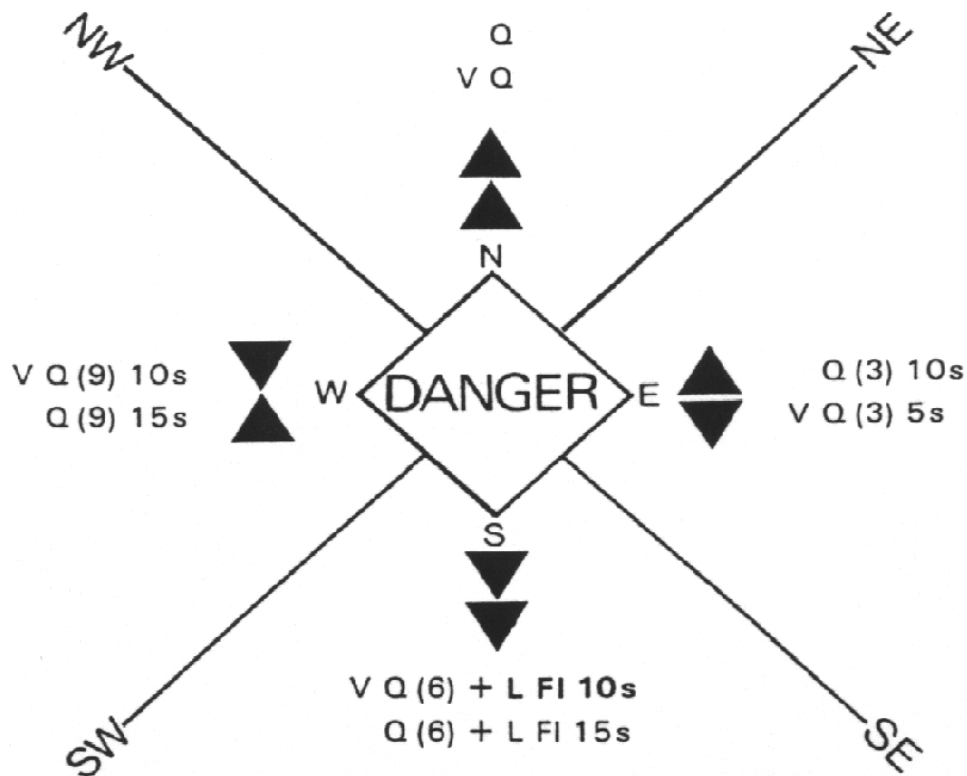
Group Flashing

You pass North of a Northerly Buoy and South of a Southerly Buoy etc.

Cardinal marks can be used to mark hazards and dangers and they indicate the navigable water to the named side of the mark.

All cardinal marks are either pillar or spar buoys – cone and can buoys are not used.





0911 SAFETY AND DISTRESS

0911.1 Distress Signals

The following signals, used or exhibited either together or separately, indicate distress and need of assistance:

- A Gun or other explosive signal fired at intervals of about one minute.
- A continuous sounding with any fog-signalling apparatus.
- Rockets or shells, throwing Red Stars one at a time at short intervals.
- S.O.S by light or sound.
- The spoken word "MAYDAY".
- International code signal of distress, flags November Charlie.
- A square flag with above or below it, a ball or anything resembling a ball.
- Flames on a vessel (as from a burning tar barrel or oil barrel etc).
- Rocket parachute or hand flare showing a Red light.
- Orange Smoke.
- Slowly and repeatedly raising and lowering of outstretched arms to each side.
- Signals transmitted by emergency position-indicating radio beacons.
- A piece of Orange canvas with either a Black Square or Circle.
- A dye marker.
- A diver on the surface - clenched fist arm wave, bending at the elbow.

REMEMBER THAT THE LACK OF A SIGNAL COULD ALSO MEAN DISTRESS.

CHAPTER 10

ELECTRONIC NAVIGATION

THIS CHAPTER COVERS THE NEW ADDITIONAL ITEM OF ELECTRONIC NAVIGATION AND CONSISTS OF THREE PARTS:

1001 ELECTRONIC CHARTS

1002 SATELLITE NAVIGATION

1003 RADAR

Author: Lt Cdr (SCC) K. G. Booth AFRIN RNR ASO (Sea) NW

Suggestions for additional items or improvements are welcomed and should be submitted to the Author either by post or e-mail.

(e-mail: ken_booth @rnli.org.uk)

30.07.2005

Reading/Video/CD ROM list:

E Charts:

CD – RYA Chart Plotter (£21.00 in 2005)

GPS:

Book – “GPS Afloat” by Bill Anderson. Pub: Fernhurst. (£14.95 in 2005)

Radar:

Video – “Radar” by Amberley Marine. (29.50 in 2005)

CD – “Radar Trainer” by Lightmaster Softwear. (£ nk)

Book – “An Introduction to Radar” by the RYA (£nk)

1001 ELECTRONIC CHARTS

1001.1 General

There are both Official Government and Commercially produced electronic charts. There are however only two basic types – Raster and Vector – depending on the electronic make up of the charts produced.

1001.2 Raster data Charts

These are pure electronic reproductions of the paper charts.

They are not intelligent i.e. you cannot ask questions about chart features using the chart plotting systems electronic cursor. What you see is what you get – just like a paper chart.

The British Admiralty (BA) electronic charts fall into this category. The BA system is called ARCS – Admiralty Raster Chart Service.

1001.3 Vector data Charts

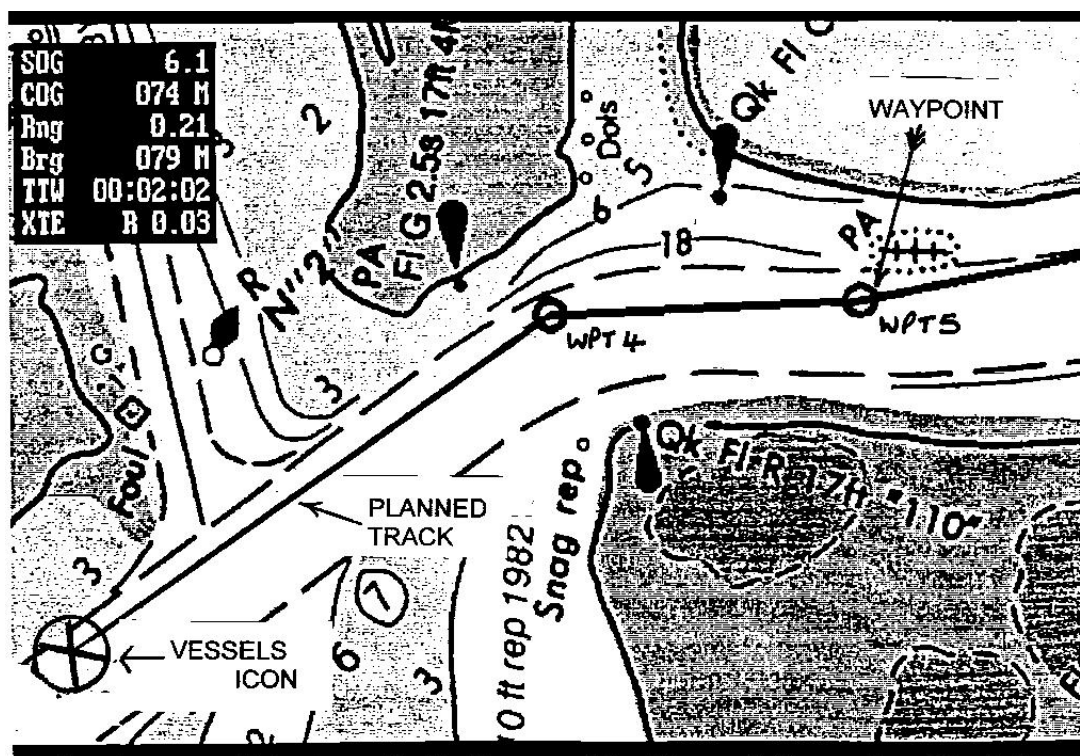
These charts owe much too modern computer technology.

They are intelligent – you can ask questions and get information extra to that given on the chart - such as for a Coastal Light. By using the chart plotting systems electronic cursor you can find details of the structure e.g. white concrete tower. This is information useful in passage planning (see Passage Planning section) and would otherwise have to be obtained from Admiralty Lights Lists (ALL) or Nautical Almanacs.

Drawing lines e.g. marking off 'No go areas' (see Passage Planning section) on the chart is easily achieved. It is very similar to drawing on your PC.

All Electronic charts allow you to draw courses on them – just like a paper chart. The lines – usually referred to as a 'route' - are drawn using an electronic cursor. The places where you will alter course are called waypoints.

1001.4 The Electronic Chart



Example of an Electronic chart – showing a route and waypoints

This route and its waypoints, once checked for navigational safety, can be down loaded into a GPS (see section 2) and used to navigate a vessel. When underway and following a route a moving icon represents the vessels position.

Some chart plotting systems will allow the plotting of ranges and bearings to fix a position.

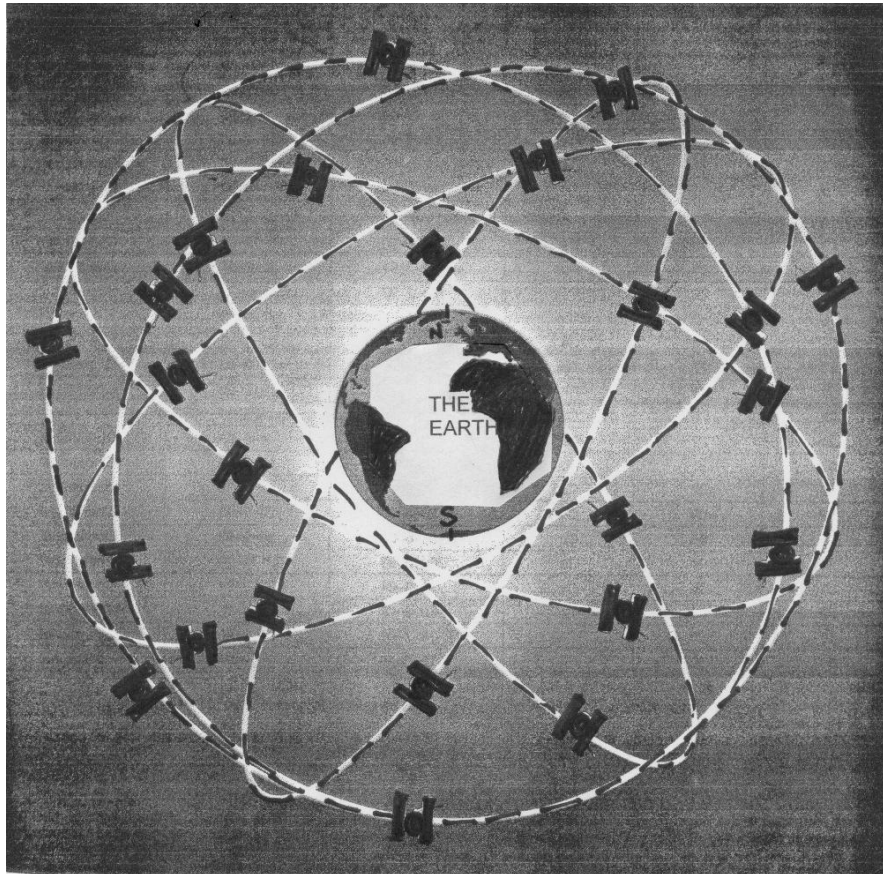
There are both simple and complex systems available. For example you can have combined chart plotting/GPS systems. It is possible to overlay an electronic chart with the picture from radar. In the today's marine electronics industry the world truly is your oyster.

1002 SATELLITE NAVIGATION (GPS)

1002.1 Navstar GPS

GPS or to give it its full title "NAVSTAR Global Positioning System" is a satellite navigation system owned and operated by the United States Department of Defence. It is freely available to all mariners.

The system consists of 24 satellites, about 11,000 miles above the Earth, evenly spaced between 6 orbital planes.



GPS: Satellites

1002.2 Other systems

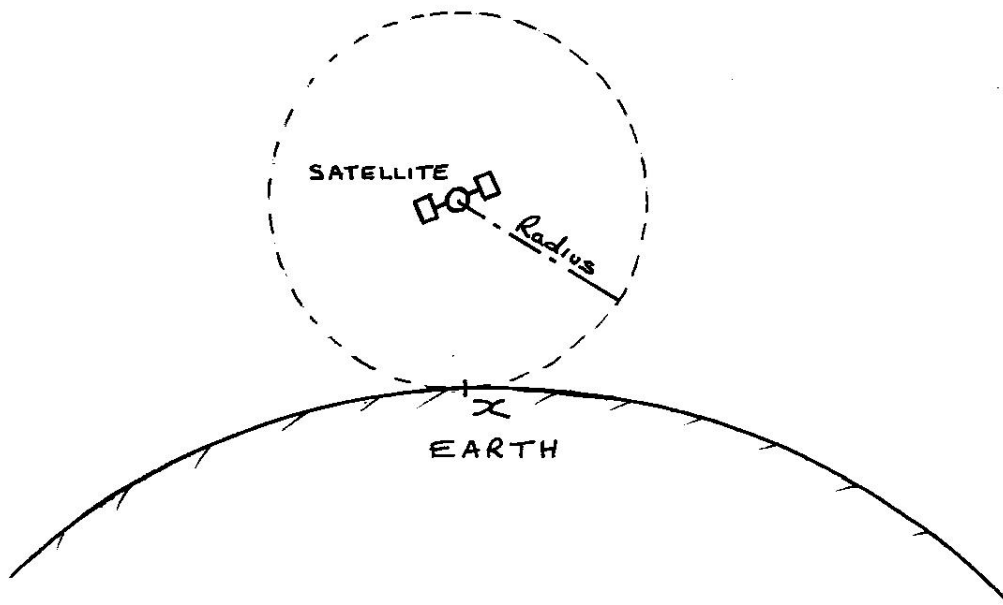
"GLONASS" is a similar Russian operated system.

"GALILEO" is a European system presently (2005) under development.

1002.3 How GPS gives a position

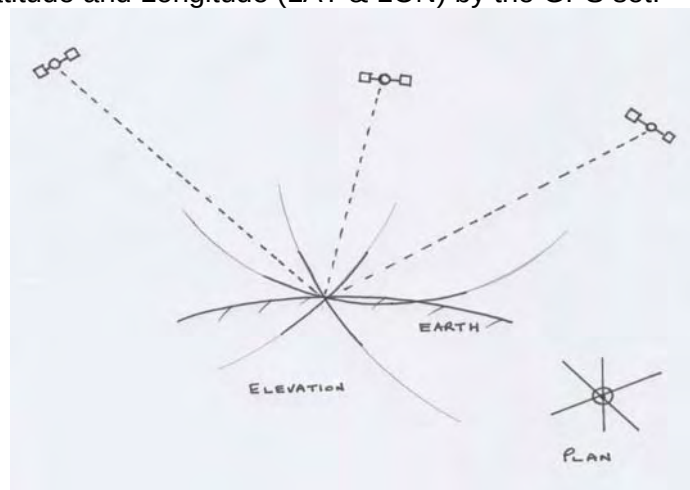
Four satellites (with a good angle of cut) are required to give a good fix or position. Your GPS set will (in normal circumstances) have up to 12 satellites available at any one time. It will select the satellites that give the best angle of cut for a good fix.

The system works by the satellite making a transmission that is received by the observing vessels aerial/set. The time taken by the signal from transmission to reception is used to produce a radius. Thus it places the vessel somewhere on the circumference of a circle, the centre of which is the satellite. We are interested in the part of this circle that touches the Earth's surface.



GPS: Single position line

The other satellites selected by the set will each produce a position line. The point where these position lines all cross on the Earth's surface gives our position. This is converted to Latitude and Longitude (LAT & LON) by the GPS set.



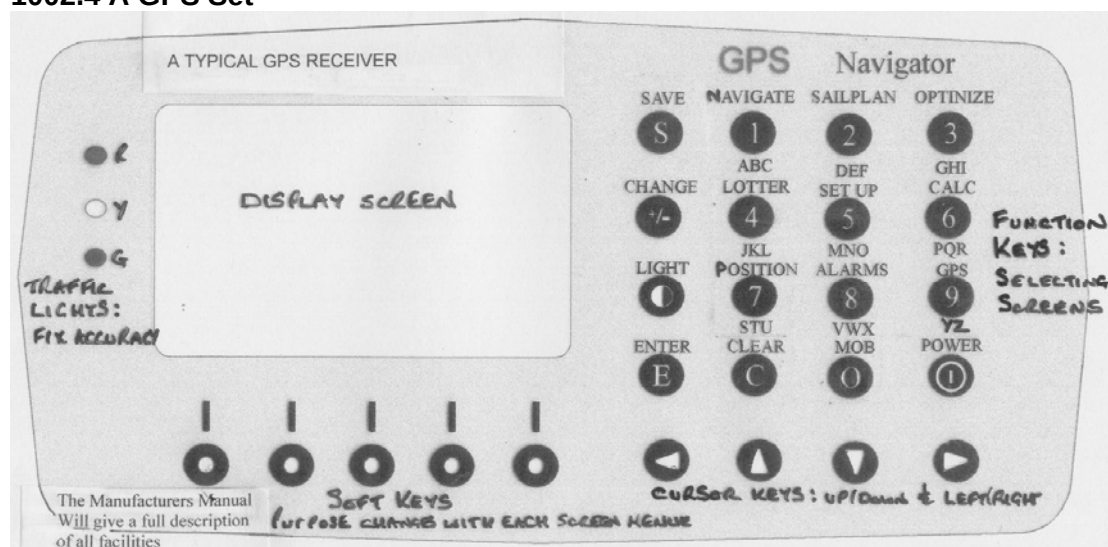
GPS: Position lines and fix

POSITION		WGS 84 Datum	
N	52° 37'.068		
W	009° 22'.123		
COG	180°	SOG	25 Kn

GPS: The set – A positional screen

The system has an accuracy of +/- 10metres on your actual position. The position can be made even more accurate by the use of Differential GPS (DGPS).

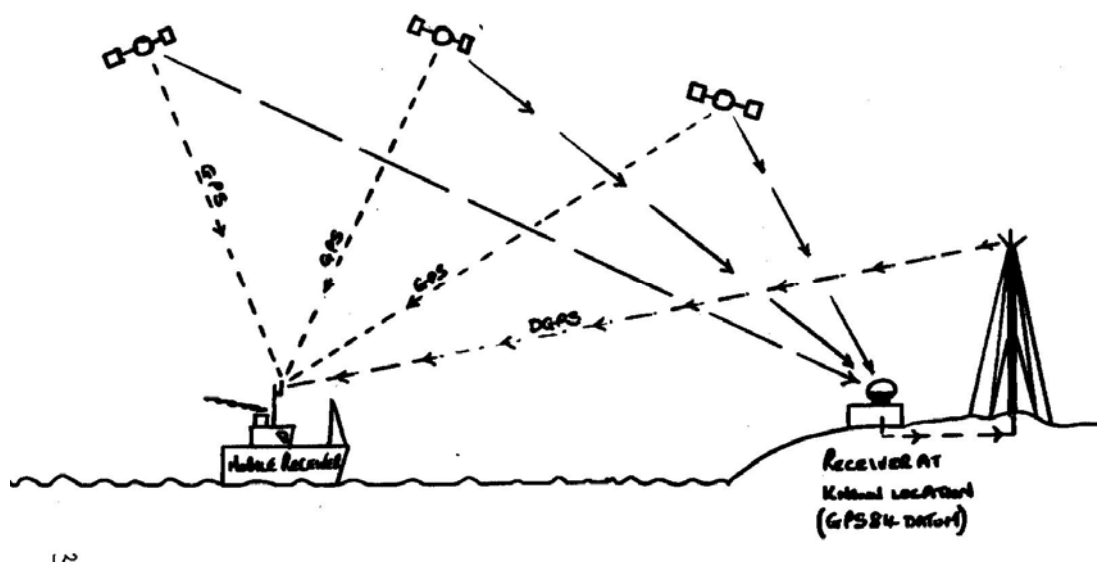
1002.4 A GPS Set



A typical GPS Receiver (By kind permission of RNLI)

1002.5 Differential GPS (DGPS)

There are various forms of DGPS – we will look at the coastal system. DGPS is a land based radio system that sharpens up the accuracy of GPS in coastal waters. The use of DGPS produces an accuracy of +/-5metres.



DGPS: The system

Essentially the land based Reference Station (RS) knows exactly where it is by the datum used by the GPS system – WGS84 - World Geodetic Survey 1984.

This is the same datum that is used for all current (i.e. say from 2004) British Isles Admiralty paper charts.

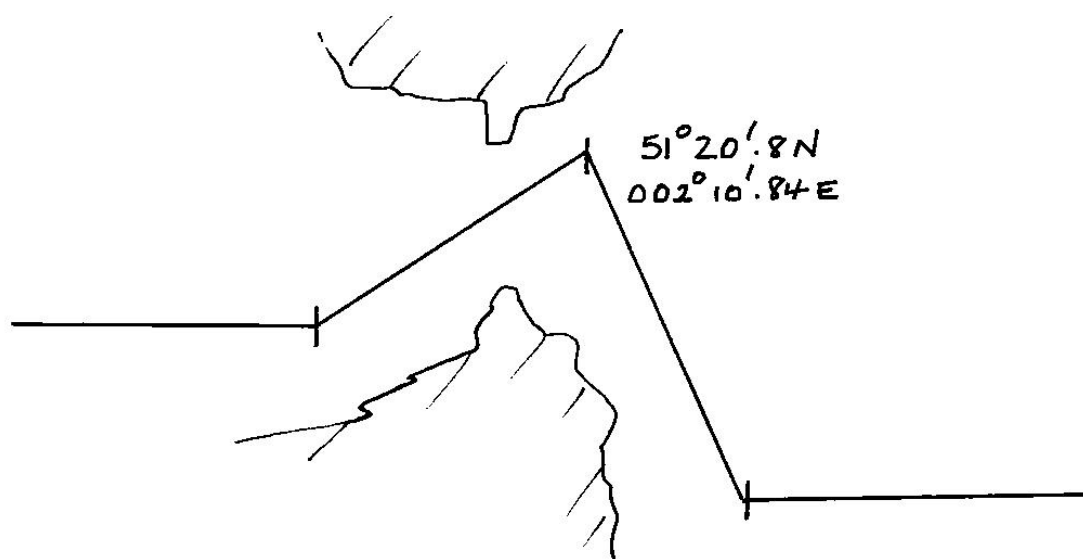
The observed differences between the actual position of the RS and its position as given by an individual satellite are broadcast by a radio signal to vessels fitted for DGPS. This produces a more accurate position.

1002.6 The navigational use of GPS

Apart from giving a constant Lat & Lon position of your vessel the GPS can be used for Navigating.

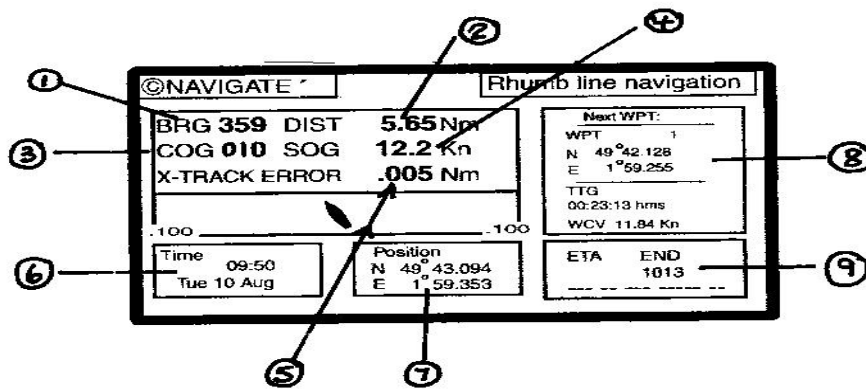
Many vessels use electronic charts in conjunction with GPS. This aspect is discussed under section 1 - Electronic Charts.

Without Electronic chart plotting systems your planned route on a paper chart can be input manually to the GPS. Each course alteration point becomes a Waypoint (Wpt). You work out the Lat & Lon of each waypoint in turn and input them to the GPS



Waypoints: the paper chart – working out Lat & Lon

The GPS will produce navigational information such as:



GPS: The Set – Navigational information

- 1: The course to steer to the waypoint – this will allow for TS&D
- 2: Distance to run – to waypoint
- 3: Course made good – over the ground
- 4: Speed made good – over the ground
- 5: Cross track error – how much and to what side you are off course/track
- 6: Local time – BST or UTC
- 7: Vessels current position
- 8: Details of the waypoint you are approaching:
 - a. The number in your route/passage plan (see section 4 for Passage Planning)
 - b. Its Lat & Lon and c. TTG – Time to go to the waypoint
- 9: An Estimated Time of Arrival (ETA) at the last waypoint in your loaded route

1003 RADAR

1003.1 A Radar set



A typical radar set (By kind permission of RNLI)

1003.2 General

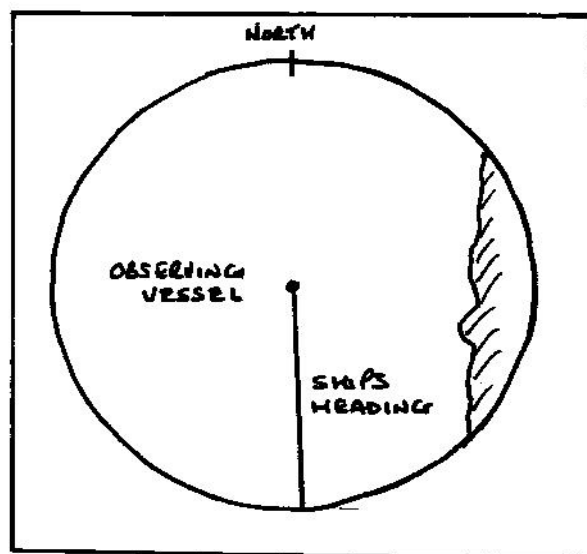
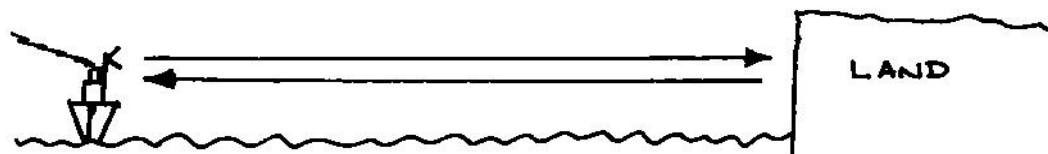
Radar stands for:

Radio
Aid
For determining
Direction
And
Range

Radar can be used both as an aid to collision avoidance and an aid to navigation. It is the navigational aspects of radar we will discuss here.

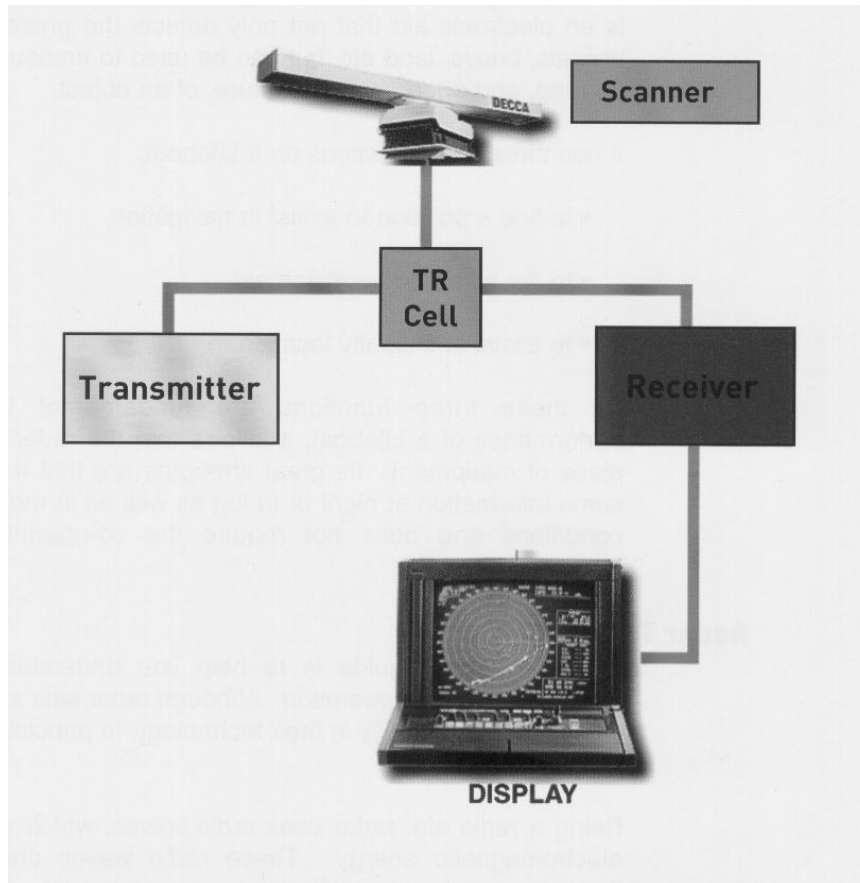
1003.3 The Echo Principle

Radar works by transmitting a pulse of radio energy and receiving some of that energy (the echo) back. Energy is reflected back when it hits an object (target) such as land, a vessel or navigational mark etc. This returning echo from the target paints in a picture on the radar screen



Radar: The Echo Principle

1003.4 Components of the Radar Set (By kind permission of RNLI)



The Transmitter produces correctly formed pulses of energy.

This pulse of energy goes via the T/R Cell (Transmit/Receive) to the Scanner. The Scanner is also known as the Aerial or Antenna.

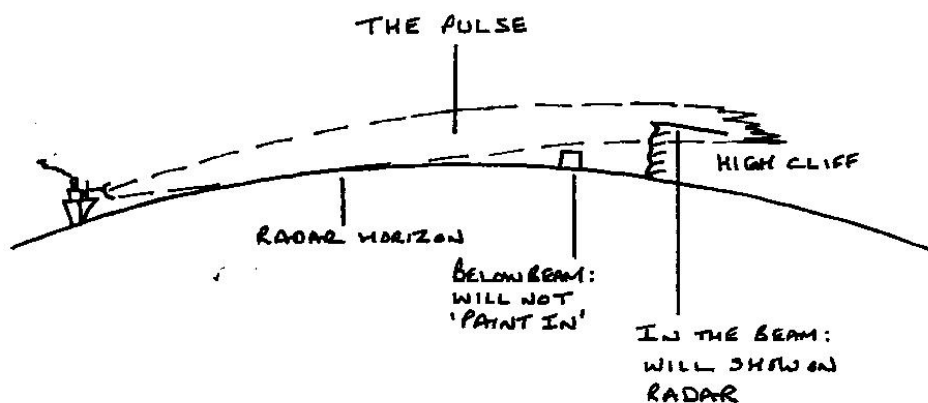
As soon as the scanner has transmitted the pulse, the T/R cell switches from Transmit to Receive.

A scanner spends 99.5% of its time listening for returning echoes.

The Receiver receives then amplifies the returning echoes and sends them to the Display. The Display is the radar screen itself.

1003.5 Radar Horizon

As we have seen the scanner transmits a pulse of energy. The path of the pulse may be considered 'line of sight'. The higher the scanner the further the radar can see. You will note that the pulse/beam bends slightly over the horizon – thus it is sometimes possible to detect a target that may be below your visible horizon.



Radar Horizon & Beam

The radar beam has a vertical and horizontal component:

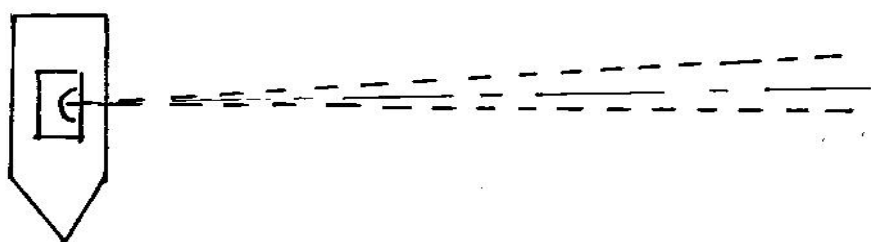
1003.6 Vertical Beamwidth (VBW)



Vertical Beamwidth – typically 20° to 30°

This ensures that at least some part of the beam is horizontal even when the vessel pitches and rolls.

1003.7 Horizontal Beamwidth (HBW)



HBW – much smaller between 2° and 5°

1003.8 Radar Bearings

As all the energy is concentrated in one narrow direction at a time the radar is able to measure a bearing along the axis of the beam. The narrower the Beam the better the accuracy.

CHAPTER 11

PASSAGE PLANNING

Suggestions for alterations, improvements and additional material are welcome.

These should be sent via post or e-mail to the author:

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Lt Cdr (SCC) K. G. Booth AFRIN RNR
ASO (Sea) NW
26.09.2005

Reading/Video/CD ROM list

Book/Charts – RYA Practice Navigation Tables and 2 Charts (8.75 in 2005)

Book – HMSO “Admiralty Manual of Navigation Vol 1” 1987Ed

MCA – Latest ‘MSN’ on Passage Planning

1100 PASSAGE PLANNING

1101 Preamble

These notes are written with the intention of assisting Chartwork Instructors who may have no practical experience of the art of Passage Planning.

Passage Planning is included in the Cadet Chartwork syllabus for several reasons:

- To provide a logical conclusion to a Cadet/Adults Chartwork Training.
- To demonstrate the practical application of what has been taught and learnt.
- To encourage cadets to go to sea with the Corps and apply their newly acquired skills.
- To encourage interest and further study in the noble art of Chartwork/Navigation e.g. through the Royal Yachting Associations (RYA) Dayskipper courses.

1101a The Task

1. Cadets are to plan a short daylight passage of between ? and ? miles.
2. The vessel used when setting the task is to be under 25 metres LOA. The Instructor is to set realistic draught and maximum speed.
3. The location of the passage along with its departure and arrival ports will depend on the materials available to the Instructor.
▽ Training suggestion:
Use the RYA charts and the associated Practice Navigation Tables (PNT). The PNT holds all the information required for a passage on those charts. The RYA charts are specially prepared British Admiralty (BA) training charts.
4. The task can be completed individually or as a group activity.

▽ Training suggestion:

Where possible split the group into teams of two cadets. The Instructor leads and demonstrates the skill and the Cadets apply the techniques.

▽ Training suggestion:

Once planned make it a 'virtual voyage'.

When the Instructor has approved the plan, exact dates, departure time etc can be given to the teams. With a little ingenuity the Instructor can (when the plan is presented for approval) plan in fixing information; put in Collision Regulation (Coll Regs) and safety situations; request ETA's etc etc.

This technique makes it doubly interesting and enjoyable – the next best thing to actually going to sea! – and has been used very successfully by the author when teaching Adult RYA courses.

The plan will form the basis of the Class I assessment.

1101B Assessment of Cadets

The plan (charts and notebook) will form the basis of the Class I assessments. The assessor can ask questions and require demonstration of practical competence based around the passage.

1102 Introduction to Passage Planning

Navigational passages must be carefully planned "Everyone is liable to make mistakes; over three quarters of all groundings are attributable to human error of some kind" (Admiralty Manual of Navigation). A sound passage plan may not prevent a grounding but it does reduce the chances of making mistakes.

In the notes the term 'Master' refers to the person in charge of the vessel. It is assumed that the vessel is less than 25 metres LOA as larger vessels have additional items to consider. All guidance refers equally to motor and sailing vessels.

Voyages (berth to berth) regardless of length can be split into two major parts:

- PREPARATION – This includes:
 - o APPRAISAL (gathering information)
 - o PLANNING (preparation of the detailed plan)
- EXECUTION – This includes:
 - o ORGANISATION (tactics for execution of the passage)
 - o MONITORING (of progress)

We will now explore each section in detail.

1103 The Plan: Preparation - Appraisal

The risks of any voyage need to be assessed - Appraisal is the process of examining these risks. It is at this stage that all relevant information is gathered and a good foundation for the plan is laid.

INFORMATION SOURCES:

- BA Chart Catalogue
NP109 – Covers North West Europe inc the British Isles. This publication is issued annually and is available gratis from Admiralty Chart Agents and most Chandlers.
- Navigational charts
In the Corps we use BA charts. Commercial charts (e.g. IMRAY) are also available.
- Notice to Mariners (NTM)
This is the publication – issued weekly – that contains chart corrections and updates/corrects BA publications. Charts should, of course, be up to date when used.
- Reeds Nautical Almanac
Published yearly it contains all the information necessary for small vessel passage planning.

If using BA publications you require several publications. These include:

- o Pilot books (NP various)
These contain detailed passage/pilotage information.
- o Admiralty Tide Tables (ATT) (Vol 1 NP201)
- o Admiralty List of Lights (ALL) Vol A NP74)
- o Admiralty List of Radio Signals (ALRS)
Vol 6 lists Port and information services etc.
- o Admiralty Tidal Stream Atlases (NP various)
There are several books required to cover the British Isles.
- Mariners Handbook (NP100)
A BA publication containing items of general interest.
- Electronic Navigation systems handbooks
Operator's guides to the navigational systems fitted on the vessel.
- Weather information
Obtaining the latest information covering the dates of the passage.

Full weather information is obtainable from a very wide variety of sources. These range from the traditional radio broadcasts via facsimile reception to the downloading of satellite images.

The timings for reception of weather information should be researched and noted.

- Vessels characteristics
 - o Deepest draught – required for tidal calculations.
 - o Air draught (maximum height) – to check overhead clearances such as bridges.
 - o Length overall (LOA) – tip to toe fore and aft measurement.
 - o Beam (maximum width) – required if entering marinas/locks etc.
- Personal experience

Has someone on the Crew been there before? If so their experience may be of use.

When the information is collected together the Master, in consultation with his officers, will make an overall appraisal of the passage

The main consideration at this stage will be to determine the distance tracks should be laid off coastlines and dangers.

The distances off any particular point will be determined by such factors as the vessels draught relevant to the availability of safe water etc.

Once the Master has made his appraisal he will delegate one of his Officers to plan the voyage. It is however the Master who carries the final responsibility for the plan.

1104 The Plan : Preparation - Planning

See Appendix 1

- Charts

Collect together all of the charts for the intended voyage. Place and number them in passage order. Check that charts are corrected to the latest NTM. Charts adjacent to the passage area or those for diversion ports should be included.
- No-go areas

Outline and crosshatch areas on the route where the vessel should not go. Be careful not to obscure important detail such as a navigational mark. In confined waters no-go areas will vary according to the time of passage – taking into account the height of tide. Areas less than your vessels draught (plus safety margin) will be considered no-go.
- Distances off

This will have been decided during the 'broad brush strokes' process of appraisal. This together with no-go areas will shape up the limits/areas available for the passage.
- Planned track

The decisions made (distances off and no-go areas) enable the track to be drawn from port to port on small-scale charts. This is the passage overview.

These tracks will enable distances and steaming/journey times to be obtained. When departure time is known the estimated times of arrival (ETA) at various points can be calculated.

The tracks are now transferred (with great care) to larger scale charts for navigational purposes. You always use the largest scale chart available.

The following can be marked on your track:

- o Distances to run – a countdown mileage to the destination.
- o The true (T°) direction of the track i.e. the course to be made good.
- o Changes of chart – points where you transfer to another chart.
- o Identifiable features.
- o Tide, set and drift (TS&D). This information can be adjusted as required.

At this stage the Latitude and Longitude (LAT & LON) of course alteration points (etc) can be input to the Global Positioning System (GPS) navigator if fitted.

- Selection of objects for fixing
If the vessel is fitted with radar – radar conspicuous targets and RACONS should be identified.

Select leading marks, transits and conspicuous objects that can be used to fix your vessel.

- Tidal information
Calculate tidal heights, times and ranges. Mark up tidal graphs as required.
Check to ensure you have enough water for your purposes. Remember to allow a realistic under keel clearance.
- Radio
Channels/times etc of Port radio services should be noted in the plan.
- Alternative strategy
Have your 'bolt holes' planned – alternative ports or an anchorage – just case you run into problems e.g. bad weather, mechanical failure etc etc.
You should also consider the possibilities of a port approach in bad visibility or at night i.e. if conditions deteriorate or you are running late!
It is also a good idea to have a waiting area – off a port – in mind in case you have to wait to gain entry.
- Navigators notebook – see Appendix 2
Write up the complete berth to berth plan including port (etc) sketches.
 - o Port sketches – these are used to assist with port entry. You put in them the information you require.
- Completion
On completion the plan must be submitted to the Master for approval.

1105 The Plan: Execution - Organisation

- Tactics
The methods used to carry out the plan and to make the best uses of resources.
Final details of the plan can be confirmed when the actual timing of the passage is known
This will include such areas as:
 - o Up dating TS&D for actual departure.
 - o ETA's for tide – expected ETA's to take advantage of the tide.
 - o Always bear in mind that safe execution of the passage may only be achieved by modifying the plan.
- Crew briefing
ALL concerned should be given details of the passage and their duties.
- Voyage/Bridge repatriation

Checklists are most useful to ensure you have all necessary kit/documentation etc aboard.

Check lists can cover whatever you want. Appendix 3 gives an example for a small yacht. For our purposes it would include basic Chartwork kit like 2B pencils, parallel rules, dividers etc, etc. Also to be included - the testing of Electronic navigation equipment.

1106 The Plan: Execution – Monitoring of Progress

Monitoring is ensuring that the vessel follows the passage plan.

It consists of following a series of actions, checking the results and taking action.

- Fixing – knowing your position and responsibilities.
 - o The first requirement of monitoring is establishing the vessels position. This can be done in several ways:
 - A 3 bearing fix.
 - With radar
 - GPSRemember electronic equipment such as radar and GPS are aids to navigation not a single means of same.
 - o Fixing should be accurate and regular. The frequency will depend on your circumstances e.g. more frequent in confined waters.
 - o Each time the vessel is fixed an estimated position (EP) of the next fix is worked up. Should the next fix not coincide with the EP immediate action to check the reason(s) must be taken. GPS sets will give – cross track error – i.e. the side and distance you are off track.
- Soundings
Should be observed by using the echo sounder in pilotage waters.
- Rule of the Road – IRPCS/Coll Reg situations
On or off track you must still observe IRPCS requirements – nothing exempts you or your vessel from conforming to the rules.
- Debrief
As we briefed the Crew at the start so should we discuss the passage after its completion. Any problems areas can be highlighted and lessons learned actioned in future passages.

1107 Authors note:

Although this all seems an immense amount of work the reality is that you put into the plan the items you yourself require to plan a safe passage.

Also with practice and experience the time taken is much shorter than may appear after reading this tome!

1108 APPENDICES:

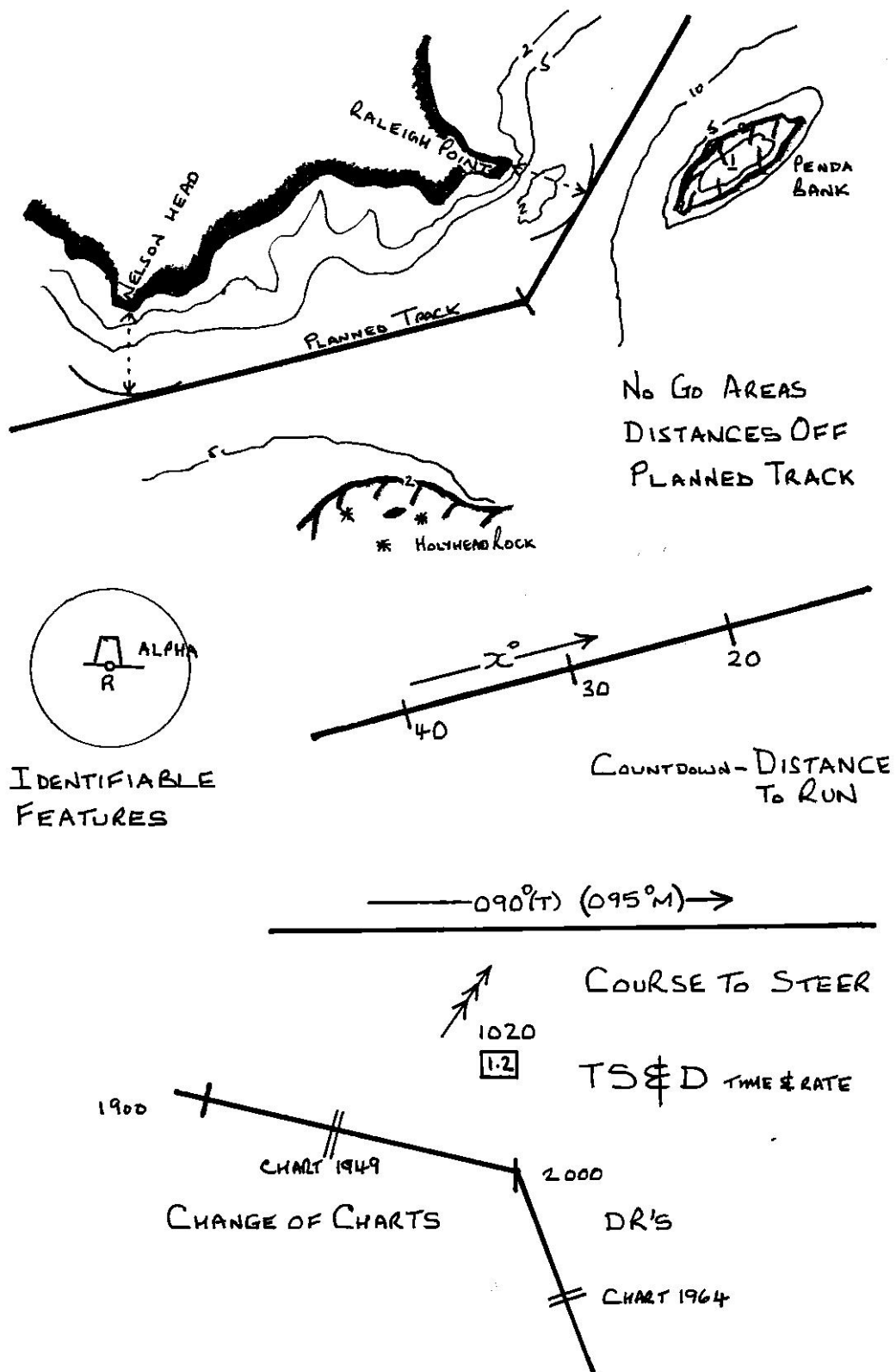
APPENDIX 1: Planning symbols

APPENDIX 2: The Navigators Note Book

This contains samples of an actual Passage Plan from Dover to Boulogne plus Port Plans for Boulogne and Douglas in the Isle of Man.

APPENDIX 3: A sample check list for a small yacht

APPENDIX 1



APPENDIX 2

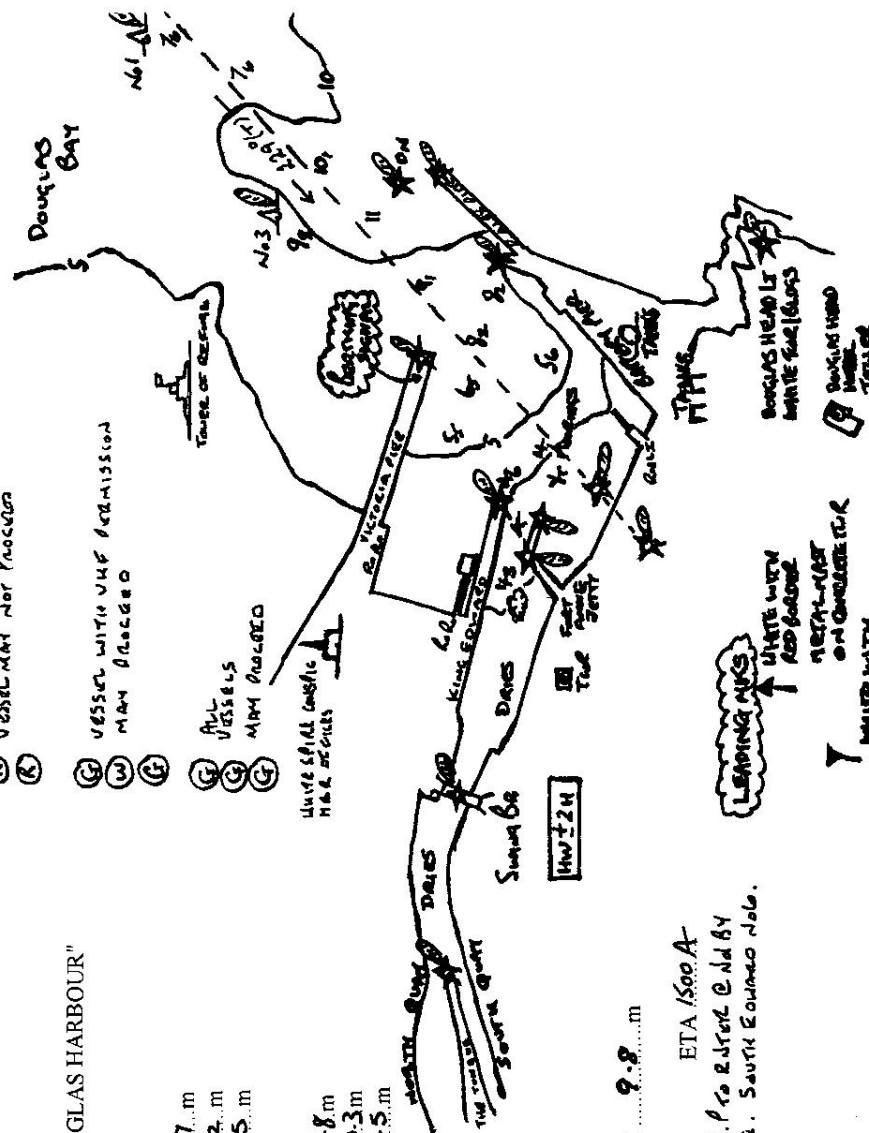
C _o	TS#D	C _o TO SECTOR	V ^o D ^o	T ^o	Dist SP	ETA	PASSAGE PLAN
							PASSAGE PLAN DUTY W/ ENTRANCE TO BOULOGNE 10F3 ETD DOVER WESTERN ENTRANCE: 0800A HW-4M <u>RT</u> CLEARED AWAY READY FOR IMMEDIATE USE. <u>VHF</u> CONTACT "DOVER BUT CONTROL" CH 74 CH 12 REQUEST PERMISSION TO SLIP & PROCEED VIA WESTERN ENT. <u>INTSS</u> CHECK AD. ON EXT SIGNALS <u>RAONE</u> OPERATIONAL & MANUED <u>END</u> OPERATIONAL <u>UNOS</u> OPERATIONAL & MANUED TO <u>CUATS</u> 1698 (DOVER) 1892 (DUSW) 438 (BOULOGNE) <u>NET</u> FOR EXERCISE DEEMED SUITABLE FOR INTENDED PASSAGE. <u>PUBLICATIONS</u>: ATT 61 ALIS 616 TSA: DUTY SERAITS ALL VLA TAF LOG OF SIGS MARLERS HANDBOOK CHART 5011 HWCAT NTMS + ANNUAL SUMMARY.
ENTRANCE 130°(r)	0.2 ASGLEN 2.3 236°	TMD 121°(r)	-	-	4.315	0817 WPT 1	<u>CLEAR</u> K0.05 OTHER SIDE <u>WAKE</u> TSD 2.7K 230° TEE ENTRANCE <u>DEVIATION CK</u> <u>DOVER CG</u> <u>WAKE</u> TTRAFFIC <u>RAONE</u> ASGLEN 357°(r) 000 M <u>SECURE</u> <u>WAKE</u> <u>AND HINIS</u> 382 HOOGHART <u>MONITOR</u> CNIS CH 11 <u>WAKE</u> TSS MAINTAIN TRACK AT 6 TO TRAFFIC. <u>ID</u> VARNE LAMBY RACON(T) <u>FIX</u> R# BEG OF VARNE LBY <u>TS#D</u> IN TSS: <u>230° 2.3K</u> <u>WAKE</u> WPT 2 CHECK ACTUAL POINT OF LEAVING T.S.S <u>ID</u> BUOYAGE CONTROL FEATURES & KNOWN COMSEC ITEMS. <u>FIX</u> AS MARKED ON CHART <u>FIX</u> 61 AVAILABLE MEANS <u>WAKE</u> DEPTHS LESS THAN 20M
136°(r) WPT 1	SEE NOTES RE T.S.S	136°(r)	-	-	10.415	0902 WPT 2 Δ	

C ₀		TS # D	C ₀ T ₀	V ₀ °	C °	D ₀ Sp	ETA	2003	
209°(T) WPT 2	202112.7	209°(T)	—	—	—	4.4	0917 WPT 3 50°45'5N 01°30'0E	ISO DANGER Mk. ZCZ BY RADAR CANSAC: CAPGIS-NEZ. RADAR RANGE & BANK OR RADAR RANGES. NOTE START OF FERRY CHANNEL. START OF ELSHORE TRAFFIC ZONE.	
185°(T) WPT 3	202110.9	183°(T)	—	—	—	6.7	0941 WPT 4 50°46'5N 01°29'8W	ISO BOULOGNE: COLUMN GRANDE DOME 1000M WPT 4 VHF 1011 CONTROL TOWER BOULOGNE CH12 ETA ENT ——— Time Zone B (BST) A +1HR. ↓ CLEARED AWAY	
100°(T) WPT 4	202110.8	097°(T)	—	—	—	1.8	0946A 1006B WPT 5	WPT 4 REDUCE TO 10KN.	
ENTRANCE T.M.O	SEE HARBOUR PLAN							WPT 5 POINT OF NO RETURN 1NM TO G TO ENTRANCE. CONSIDER ACTION GO AHEAD IF REQ'D. ENTRANCE 1 CANAL TO GO SPEED REDUCE TO 5KN CHECK SOUNDINGS	

KEEP TO NORTH OF LINE FT ANNE JERRY TO
NO. 14 BERTH ON BATTERY PIER

↑ WHITE WITH
RED BORDER
NEUTRAL
ON QUARTER TLR

↓ WHITE WITH
RED BORDER ON
NEUTRAL
NEUTRAL



28.12.97

11 - 12

APPENDIX 3: A SAMPLE YACHTS CHECK LIST

SAFETY EQUIPMENT

Harnesses

harnesses.....Num.

lines and fixings in cockpit.....

Flares

parachute rockets.....Num.

hand-held flares.....Num.

buoyant smokes.....Num.

orange smokes.....Num.

Other

Dan Buoy.....

Lifebuoys.....Num.

Life raft.....located

Lifejackets.....Num.

EPIRB.....Num.

Fire extinguishers.....Num.

Dry Powder.....Num.

Helon (.....Num.

CO₂ (.....Num.

Fire Blanket.....Num.

Automatic in Engine Compartment.....

VHF.....

Radar reflector.....

Navigation Instruments

Compass.....

Hand-bearing compass.....

Deviation chart.....

Log.....Type

Log location.....

Spare Impeller ?.....

Walker Log backup.....Manual

GFS.....Manual

RDF.....Manual

Lead-line.....

Navigation Tools

Parallel rulers.....

Breton Plotter.....

Dividers.....

SAFETY EQUIPMENT

Pencils.....

Charts.....

Sailing Instruments

Pilot Books.....

Tidal Atlas.....

Speedo.....

Wind speed.....

Wind direction.....

Tell-tales.....

Other

Autohelm.....

Signal flags.....

Day shapes.....

ELECTRICAL SYSTEM

Generation and storage

Batteries.....

Battery switch.....

Switch panel.....

Charge meter.....

Navigation lights

Masthead.....

Steaming.....

Compass lights.....

Deck lights.....

Other

Water pump.....

Electric Blyge pump.....

Spare bulbs.....

Distilled water.....

AUXILIARY POWER

Diesel operation.....

Keys.....

Fuel filter location.....

Stern Glands.....

Access.....

Hand cranking / cranking.....

SALES AND RIGGING

Head sail

Reefing.....

Garnoa.....

Jib 1.....

Jib 2.....

Jib 3.....

Jib 4.....

Storm Jib.....

Mainsail

Reefing (Roller-) Slab-O).....

Sheets.....Num.

Rigging

Stays.....

forward stay.....

aft stay.....

Spare shackles.....

Spare sail ballans.....

CABIN EQUIPMENT

Galley

Cooker.....

Pans.....Num.

Plates.....Num.

Bowls.....Num.

Glasses.....Num.

Cups.....Num.

Cutlery.....Num.

Food Storage.....

Cold storage.....

Heads

Pump toilet (slop cock).....

Shower.....

Other

Sleeping bags.....Num.

Sleeping bag liners.....Num.

Cushions.....Num.

FUELS AND FLUIDS

Diesel.....Ltr.

Gas.....Bottles.

Fresh Water.....Ltr.

Petrol for outboard.....Ltr.

Two-stroke oil.....Ltr.

Funnel.....

Dipstick.....

NOTES

AUXILIARY GEAR

Hand bilge pump.....

Tools.....

Boat cutters.....

Pliers.....

Socket set.....

Screw drivers.....

Spanners.....

Insulating tape.....

Duct tape.....

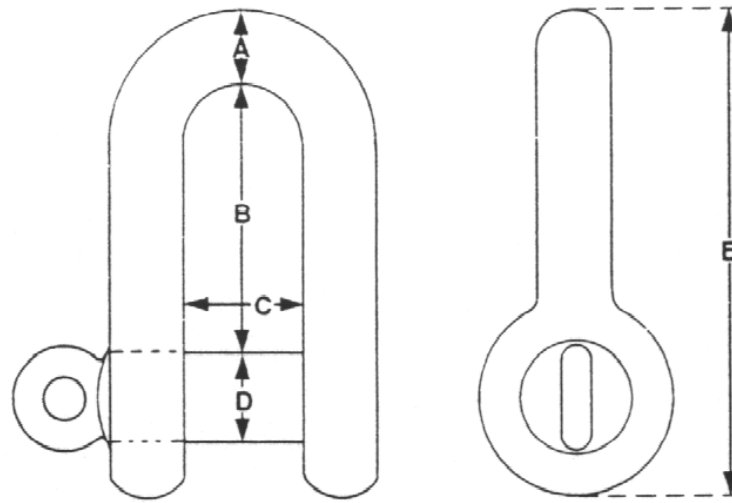
Bosons chair.....

ANNEX A

SAFE WORKING LOADS OF RIGGING EQUIPMENT

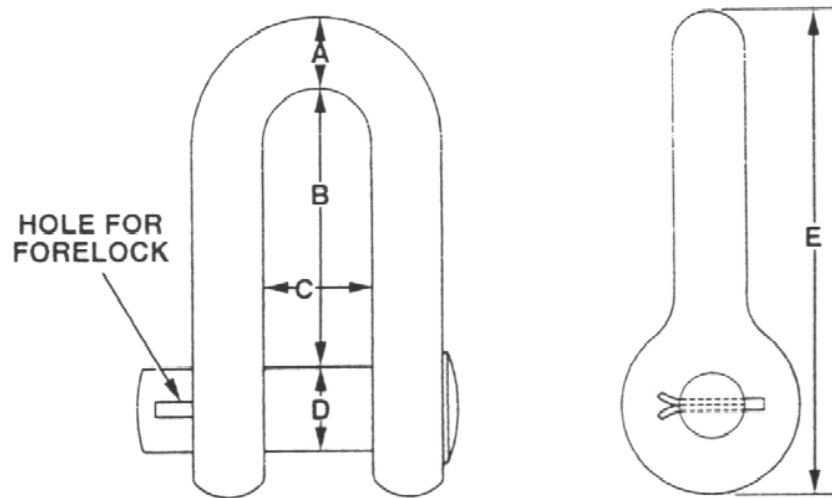
- 1. Straight Screw Shackle**
- 2. Straight Shackle with Pin and Forelock**
- 3. Straight Shackle with Split Pin**
- 4. Bow Screw Shackle**
- 5. Bow Shackle with Pin and Forelock**
- 6. Bow Shackle with Spilt Pin**
- 7. SWL of Blocks in Various Tackle Configurations**
- 8. SWL of Blocks in Various Tackle Configurations**
- 9. Natural Fibre Cordage**
- 10. Polyamide Ropes**
- 11. Polyester Ropes**
- 12. Polypropylene Ropes**
- 13. Polyethylene Ropes**

1. Straight Screw Shackle



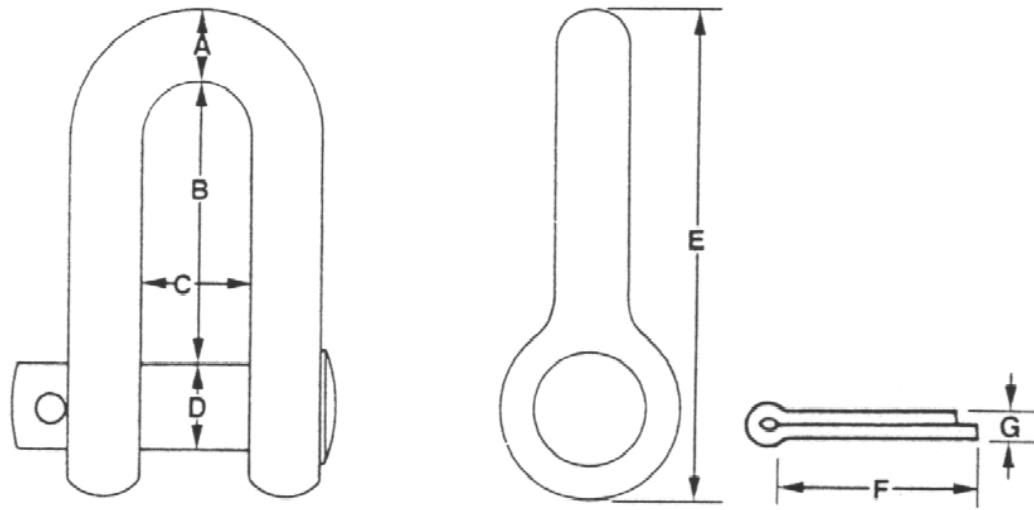
Naval Stores No	Nominal Size	Dimensions				SWL
	A	B	C	D	E	
	mm	mm	mm	mm	mm	tonnes
0263/721-6087	6	24	10	10	45	0.3
0263/721-6088	10	35	16	13	64	0.6
0263/721-6089	13	46	21	16	83	1.05
0263/721-6090	16	57	25	19	102	1.8
0263/721-6091	19	68	31	25	125	2.55
0263/721-6092	22	81	36	29	146	3.55
0263/721-6093	25	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

Straight Shackle with Pin and Forelock



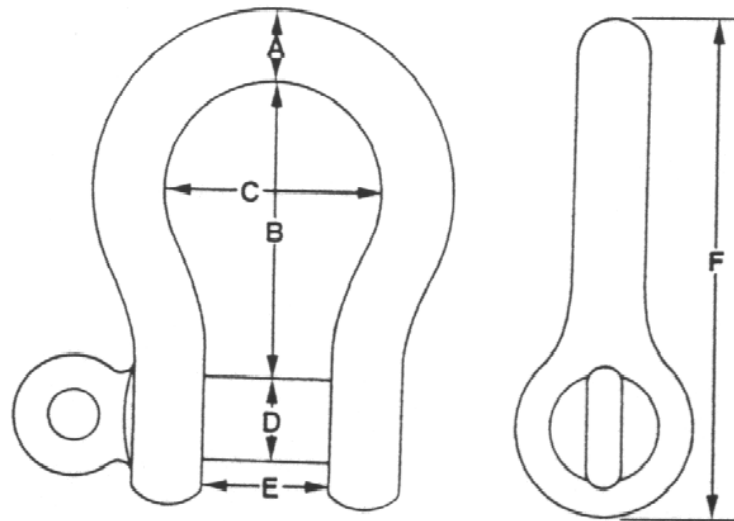
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	mm	mm	mm	mm	mm	tonnes
0263/543-4298	13	46	21	16	83	1.05
0263/543-4299	19	68	31	25	125	2.55
0263/543-4300	25	92	41	32	165	4.6
0263/543-4301	32	114	51	38	203	7.1
0263/543-4302	38	138	61	48	248	10.9
0263/543-4303	44	160	71	54	285	15.0
0263/543-4304	50	183	82	64	329	19.5

Straight Shackle with Split Pin



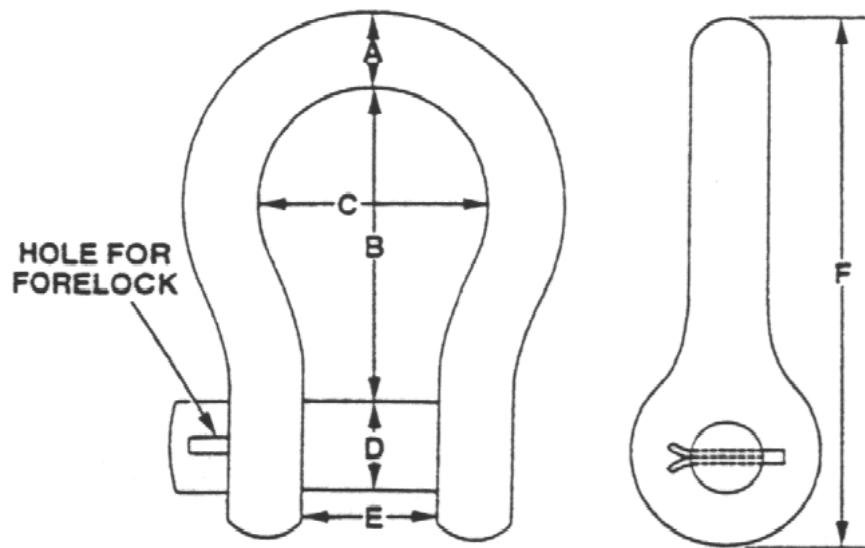
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	mm	mm	mm	mm	mm	mm	mm	tonnes
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0263/543-4529	10	35	16	13	64	20	4.0	0.6
0263/543-4530	13	46	21	16	83	25	4.0	1.05
0263/543-4531	16	57	25	19	102	30	4.0	1.8
0263/543-4532	19	68	31	25	125	40	5.0	2.55
0263/543-4533	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

Bow Screw Shackle



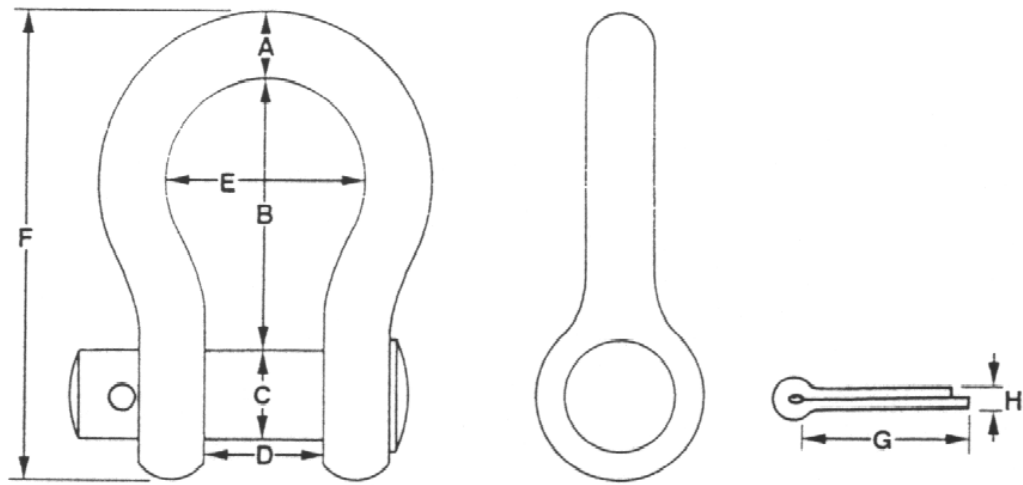
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	A	B	C	D	E	F	
	mm	mm	mm	mm	mm	mm	tonnes
0263/721-6101	6	25	19	10	13	46	0.15
0263/721-6102	10	38	29	13	17	67	0.45
0263/721-6103	13	51	38	16	24	88	0.75
0263/721-6104	16	64	48	19	29	109	1.25
0263/721-6105	19	76	57	25	35	133	2.05
0263/721-6106	22	89	67	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

Bow Shackle with Pin and Forelock

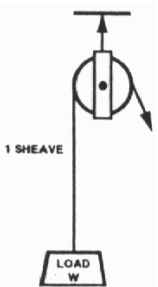
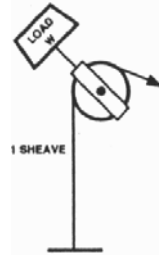
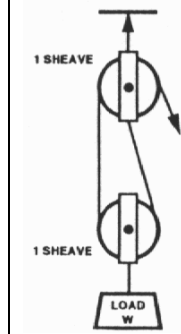
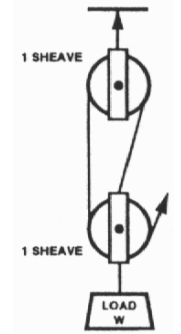
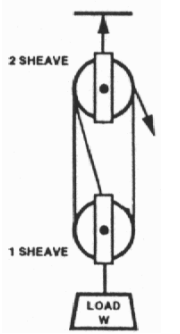
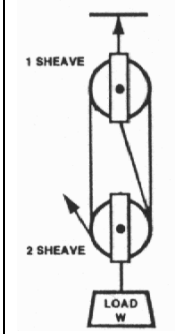


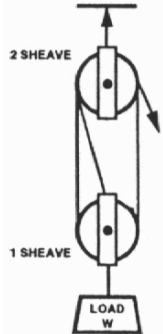
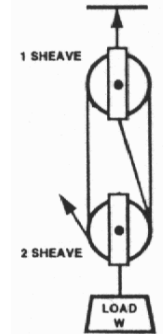
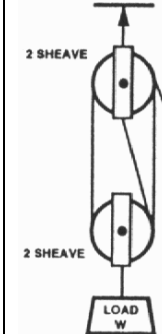
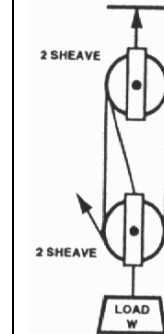
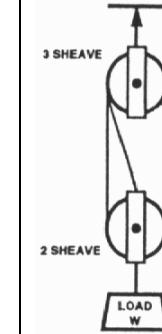
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	A	B	C	D	E	F	G	H	
	mm	mm	mm	mm	mm	mm	mm	mm	tonnes
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0263/543-4292	19	75	57	25	35	132	2.05	19	75
0263/543-4293	25	102	76	32	46	175	3.80	25	102
0263/543-4294	32	127	95	38	57	216	5.85	32	127
0263/543-4295	38	152	114	48	70	262	8.65	38	152
0263/543-4296	44	178	133	54	81	303	11.70	44	178
0263/543-4297	51	203	152	64	92	349	15.25	51	203

Bow Shackle with Split Pin



Naval Stores No	Nominal Size	Dimensions							SWL
	A	B	C	D	E	F	G	H	
	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

			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 FITTINGS 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				
/521-2796	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

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 FITTINGS TONNES	PROOF LOAD TONNES	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) 
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

Natural Fibre Cordage

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	5mm	0350/942-5039	0.33 tonnes	220m
	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
Coir	16mm	0350/571-3032	N/A	220m
	24mm	0350/571-3034	N/A	220m
	20mm	0350/942-5018	N/A	220m
	24mm	0350/571-3034	N/A	220m
	32mm	0350/942-5019	N/A	220m
	40mm	0350/942-5020	N/A	220m
	48mm	0350/942-5021	N/A	220m
	64mm	0350/571-3041	N/A	220m
	80mm	0350/571-3042	N/A	220m

Polyamide Ropes

Type	Size	Naval Stores No	Minimum breaking load	Supply denomination
Polyamide H/L	6mm	0350/923-7119	0.75 tonnes	220m
Polyamide H/L	8mm	0350/923-7121	1.35 tonnes	220m
Polyamide H/L	10mm	0350/923-7123	2.08 tonnes	220m
Polyamide H/L	12mm	0350/923-7124	3.00 tonnes	220m
Polyamide H/L	16mm	0350/923-7126	5.30 tonnes	220m
Polyamide H/L	20mm	0350/923-7128	8.30 tonnes	220m
Polyamide H/L	24mm	0350/923-7129	12.0 tonnes	220m
Polyamide H/L	28mm	0350/923-7130	15.8 tonnes	220m
Polyamide H/L	32mm	0350/923-7131	20.0 tonnes	220m
Polyamide H/L	36mm	0350/923-7132	24.8 tonnes	220m
Polyamide H/L	40mm	0350/923-7133	30.0 tonnes	220m
Polyamide H/L	44mm	0350/923-7134	35.8 tonnes	220m
Polyamide H/L	56mm	0350/923-7136	56.0 tonnes	220m
Polyamide H/L	64mm	0350/923-7137	72.0 tonnes	220m
Polyamide braided	21mm	0350/549-1 143	9.50 tonnes	160m
Polyamide braided	40mm	0350/251-4429	36.0 tonnes	65m*
Polyamide braided	56mm	0350/251-4430	69.0 tonnes	65m*
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	72mm	0350/543-0150	90.0 tonnes	220m
Polyamide multi-plait	80mm	0350/543-0149	110.0 tonnes	220m
Polyamide cord gunline	1.5mm	0350/571-3024	64 kg	160m 860m

Polyester Ropes

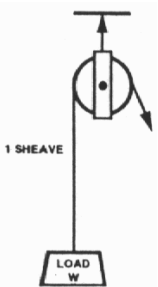
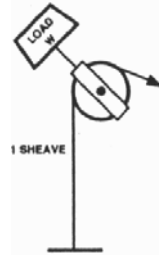
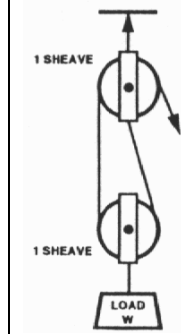
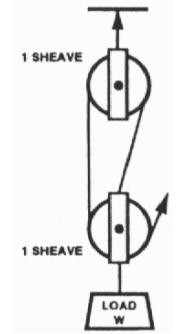
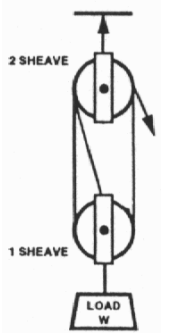
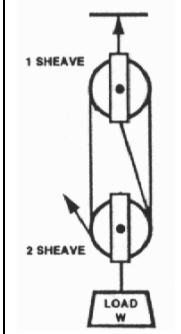
Type	Size	Naval Stores No	Minimum breaking load	Supply denomination
Polyester H/L	5mm	0350/923-7140	0.40 tonnes	220m
Polyester H/L	8mm	0350/923-7142	1.02 tonnes	220m
Polyester H/L	12mm	0350/923-7143	2.27 tonnes	220m
Polyester H/L	16mm	0350/923-7144	4.1 tonnes	220m
Polyester H/L	20mm	0350/923-7145	6.3 tonnes	220m
Polyester Superline	32mm	0350/744-2499	24.0 tonnes	156m
Polyester Superline	16mm	0350/746-5139	7.0 tonnes	220m
Polyester 8 plait blue	8mm	0350/529-7387	0.39 tonnes	150m
Polyester 16 plait blue	10mm	0350/529-7388	2.25 tonnes	150m
Polyester 16 plait blue	12mm	0350/529-7389	3.20 tonnes	150m
Polyester 16 plait blue	14mm	0350/529-7390	4.40 tonnes	150m
Polyester 16 plait blue	20mm	0350/529-7391	8.10 tonnes	150m
Polyester 8 plait red	6mm	0350/529-7392	0.30 tonnes	150m
Polyester 8 plait red	8mm	0350/529-7393	0.39 tonnes	150m
Polyester 16 plait red	10mm	0350/529-7394	2.25 tonnes	150m
Polyester 16 plait red	12mm	0350/529-7395	3.20 tonnes	150m
Polyester 16 plait red	14mm	0350/529-7396	4.40 tonnes	150m
Polyester 16 plait gold	12mm	0350/529-7397	3.20 tonnes	150m
Polyester 16 plait gold	14mm	0350/529-7398	4.40 tonnes	150m
Polyester 8 plait white	6mm	0350/529-7399	0.47 tonnes	150m
Polyester 8 plait white	8mm	0350/529-7400	0.56 tonnes	150m
Polyester 16 plait white	10mm	0350/529-7401	2.25 tonnes	150m
Polyester 16 plait white	12mm	0350/529-7402	3.20 tonnes	150m
Polyester 16 plait white	14mm	0350/529-7404	4.40 tonnes	150m
Polyester braided	5mm	0350/ 120-8768	0.40 tonnes	150m
Polyester braided	7mm	0350/571-3167	0.70 tonnes	150m
Polyester braided	8.5m	0350/120-8692	0.79 tonnes	150m
Polyester braided	16mm	0350/939-2764	4.1 tonnes	150m
Polyester cord	1.5mm	0350/520-9610	0.14 tonnes	510m

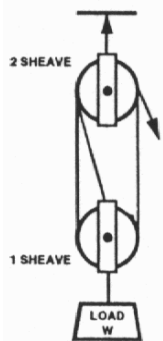
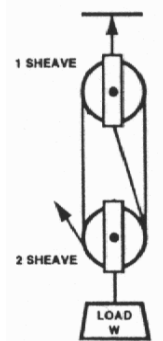
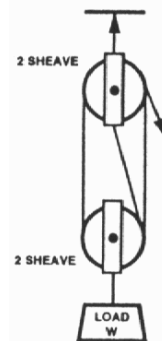
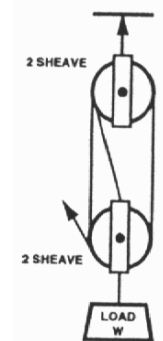
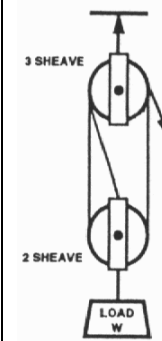
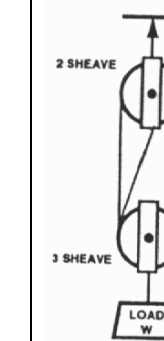
Polypropylene Ropes

Type	Size	Naval Stores No	Minimum breaking load	Supply denomination
Polypropylene H/L *	16mm	0350/075-0861	3.5 tonnes	220m
Polypropylene H/L *	20mm	0350/906-7361	5.37 tonnes	220m
Polypropylene H/L *	24mm	0350/375-2994	7.6 tonnes	220m
Polypropylene H/L	8mm	0350/529-9737	0.96 tonnes	220m
Polypropylene H/L	10mm	0350/447-1147	1.42 tonnes	220m
Polypropylene H/L	12mm	0350/525-6204	2.03 tonnes	220m
Polypropylene H/L	16mm	0350/571-3172	3.5 tonnes	220m
Polypropylene H/L	20mm	0350/906-7361	5.37 tonnes	220m

Polyethylene Ropes

Type	Size	Naval Stores No	Minimum breaking load	Supply denomination
Polyethylene H/L Orange	4mm	0350/571-3169	0.20 tonnes	300m
Polyethylene H/L Orange	8mm	0350/543-0141	0.70 tonnes	220m
Polyethylene H/L Orange	10mm	0350/571-3171	1.08 tonnes	220m

			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 FITTINGS 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				
/521-2796	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
			MAXIMUM LOAD TO BE LIFTED (TONNES) (Assuming standing and moving blocks are of the same SWL, and fall is of the required strength)					
			LUFF/	LUFF/	TWO FOLD	TWO FOLD	3 X 2	3 X 2

NATO STOCK No	SWL ON HEAD FITTINGS TONNES	PROOF LOAD TONNES	JIGGER/ HANDY BILLY (D)	JIGGER/ HANDY BILLY (A)	PURCHASE (D)	PURCHASE (A)	PURCHASE (D)	PURCHASE (A)
								
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

Natural Fibre Cordage

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	5mm	0350/942-5039	0.33 tonnes	220m
	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
Coir	16mm	0350/571-3032	N/A	220m
	24mm	0350/571-3034	N/A	220m
	20mm	0350/942-5018	N/A	220m
	24mm	0350/571-3034	N/A	220m
	32mm	0350/942-5019	N/A	220m
	40mm	0350/942-5020	N/A	220m
	48mm	0350/942-5021	N/A	220m
	64mm	0350/571-3041	N/A	220m
	80mm	0350/571-3042	N/A	220m

Polyamide Ropes

Type	Size	Naval Stores No	Minimum breaking load	Supply denomination
Polyamide H/L	6mm	0350/923-7119	0.75 tonnes	220m
Polyamide H/L	8mm	0350/923-7121	1.35 tonnes	220m
Polyamide H/L	10mm	0350/923-7123	2.08 tonnes	220m
Polyamide H/L	12mm	0350/923-7124	3.00 tonnes	220m
Polyamide H/L	16mm	0350/923-7126	5.30 tonnes	220m
Polyamide H/L	20mm	0350/923-7128	8.30 tonnes	220m
Polyamide H/L	24mm	0350/923-7129	12.0 tonnes	220m
Polyamide H/L	28mm	0350/923-7130	15.8 tonnes	220m
Polyamide H/L	32mm	0350/923-7131	20.0 tonnes	220m
Polyamide H/L	36mm	0350/923-7132	24.8 tonnes	220m
Polyamide H/L	40mm	0350/923-7133	30.0 tonnes	220m
Polyamide H/L	44mm	0350/923-7134	35.8 tonnes	220m
Polyamide H/L	56mm	0350/923-7136	56.0 tonnes	220m
Polyamide H/L	64mm	0350/923-7137	72.0 tonnes	220m
Polyamide braided	21mm	0350/549-1 143	9.50 tonnes	160m
Polyamide braided	40mm	0350/251-4429	36.0 tonnes	65m*
Polyamide braided	56mm	0350/251-4430	69.0 tonnes	65m*
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	72mm	0350/543-0150	90.0 tonnes	220m
Polyamide multi-plait	80mm	0350/543-0149	110.0 tonnes	220m
Polyamide cord gunline	1.5mm	0350/571-3024	64 kg	160m 860m

Polyester Ropes

Type	Size	Naval Stores No	Minimum breaking load	Supply denomination
Polyester H/L	5mm	0350/923-7140	0.40 tonnes	220m
Polyester H/L	8mm	0350/923-7142	1.02 tonnes	220m
Polyester H/L	12mm	0350/923-7143	2.27 tonnes	220m
Polyester H/L	16mm	0350/923-7144	4.1 tonnes	220m
Polyester H/L	20mm	0350/923-7145	6.3 tonnes	220m
Polyester Superline	32mm	0350/744-2499	24.0 tonnes	156m
Polyester Superline	16mm	0350/746-5139	7.0 tonnes	220m
Polyester 8 plait blue	8mm	0350/529-7387	0.39 tonnes	150m
Polyester 16 plait blue	10mm	0350/529-7388	2.25 tonnes	150m
Polyester 16 plait blue	12mm	0350/529-7389	3.20 tonnes	150m
Polyester 16 plait blue	14mm	0350/529-7390	4.40 tonnes	150m
Polyester 16 plait blue	20mm	0350/529-7391	8.10 tonnes	150m
Polyester 8 plait red	6mm	0350/529-7392	0.30 tonnes	150m
Polyester 8 plait red	8mm	0350/529-7393	0.39 tonnes	150m
Polyester 16 plait red	10mm	0350/529-7394	2.25 tonnes	150m
Polyester 16 plait red	12mm	0350/529-7395	3.20 tonnes	150m
Polyester 16 plait red	14mm	0350/529-7396	4.40 tonnes	150m
Polyester 16 plait gold	12mm	0350/529-7397	3.20 tonnes	150m
Polyester 16 plait gold	14mm	0350/529-7398	4.40 tonnes	150m
Polyester 8 plait white	6mm	0350/529-7399	0.47 tonnes	150m
Polyester 8 plait white	8mm	0350/529-7400	0.56 tonnes	150m
Polyester 16 plait white	10mm	0350/529-7401	2.25 tonnes	150m
Polyester 16 plait white	12mm	0350/529-7402	3.20 tonnes	150m
Polyester 16 plait white	14mm	0350/529-7404	4.40 tonnes	150m
Polyester braided	5mm	0350/ 120-8768	0.40 tonnes	150m
Polyester braided	7mm	0350/571-3167	0.70 tonnes	150m
Polyester braided	8.5m	0350/120-8692	0.79 tonnes	150m
Polyester braided	16mm	0350/939-2764	4.1 tonnes	150m
Polyester cord	1.5mm	0350/520-9610	0.14 tonnes	510m

Polypropylene Ropes

Type	Size	Naval Stores No	Minimum breaking load	Supply denomination
Polypropylene H/L *	16mm	0350/075-0861	3.5 tonnes	220m
Polypropylene H/L *	20mm	0350/906-7361	5.37 tonnes	220m
Polypropylene H/L *	24mm	0350/375-2994	7.6 tonnes	220m
Polypropylene H/L	8mm	0350/529-9737	0.96 tonnes	220m
Polypropylene H/L	10mm	0350/447-1147	1.42 tonnes	220m
Polypropylene H/L	12mm	0350/525-6204	2.03 tonnes	220m
Polypropylene H/L	16mm	0350/571-3172	3.5 tonnes	220m
Polypropylene H/L	20mm	0350/906-7361	5.37 tonnes	220m

Polyethylene Ropes

Type	Size	Naval Stores No	Minimum breaking load	Supply denomination
Polyethylene H/L Orange	4mm	0350/571-3169	0.20 tonnes	300m
Polyethylene H/L Orange	8mm	0350/543-0141	0.70 tonnes	220m
Polyethylene H/L Orange	10mm	0350/571-3171	1.08 tonnes	220m

ANNEX B

STORES NUMBERS FOR EQUIPMENT

Item	Stores Number	Supply Denom.
Flax Seaming Twine – Fine	0350/571-3269	250gm Cops
Flax Whipping Twine – Medium	0350/571-3270	250gm Cops
Flax Roping Twine - Course	0350/571-3267	250gm Cops
Twine Hemp	0330/533-2358	
Twine Polypropelene	0330/533-2360	
Sisal Spun yarn 3 Strand	0350/722-2646	6kg Skeins
Sisal Spun yarn 6 Strand	0350/722-2649	6kg Skeins
Rope - Sisal 8mm	0350/529-9737	
Rope - Sisal 12mm	0350/942-5042	
Rope - Sisal 16mm	0350/942-5044	
Rope - Sisal 32mm	0350/942-5051	
Knives - Sailmaker's	0275/910-5292	
Knives - Rigger's	0273/437-5839	
Marlin Spikes - 9inch	0273/910-5444	
Fid- Splicing - 10 inch	0273/910-4594	
Pricker 5 inch	0273/910-5544	
Pricker 3 inch	0273/910-5543	
Palm Seaming	0273/437-5868	
Palm Roping	0273/437-5867	
Needles – Straight – Size 11	0247/522-4327	
Size 13	0247/522-4326	
Needles Assorted	0275/923-9064	Pack
Hooks - Sailmaker's	0273/910-4761	
Brass Grommets - Spur/Tooth	0250/411-9617	
Sizes 000 to 8	to 9623	
Braidline Splicing Needle (Hook)	0273/760-2290	
Canvas - Flax RN1	0310/942-7514	
Canvas - Flax RN2	0310/942-7515	

ANNEX C

RIGGING EXERCISE TRAINING BOARD

To make your own cost effective training boards, which would be suitable for use in large or small classroom areas, the following equipment would be required.

1. THE BASE

- 1 Sheet of 8' X 4' Plywood (Flooring ply will suffice)
- 1 Sheet of 4' X 2' Plywood (allow extra 6" for join if necessary)
- Both sheets may be joined using bolts through the overlap area or by making a simple fixing plate with studs to locate into holes.
- Plywood for Shoes (off cuts from timber merchant)
- 7 Eye plates or Screw Eyes (available from hardware stores)

2. CORDAGE

- 75 metres X 8mm Polyester or other cordage available.
- Strops (made from spare cordage).
- Head Lashing.

3. BLOCKS

- Makes of Blocks vary, both Barton Blocks and Holt Allen have been successfully used.
- 2 X Treble Blocks
- 10 X Double Blocks (4 with beackets)
- 2 X Single Blocks (with beackets)
- 3 X Single Blocks (without beackets)
- 20 X Stainless Steel Shackles

4. APPARATUS

Heel Tackles

- 3 X Double Blocks (with beackets)
- 3 X Double Blocks (without beackets)
- 18 mtrs cordage (6 metres each tackle)

Purchase

- 1 X Treble Block (with becket)
- 1 X Treble Block (without becket)
- 15 mtrs cordage

Topping Lift

- 1 X Double Block (with becket)
- 1 X Double Block (without becket)
- 20 mtrs cordage

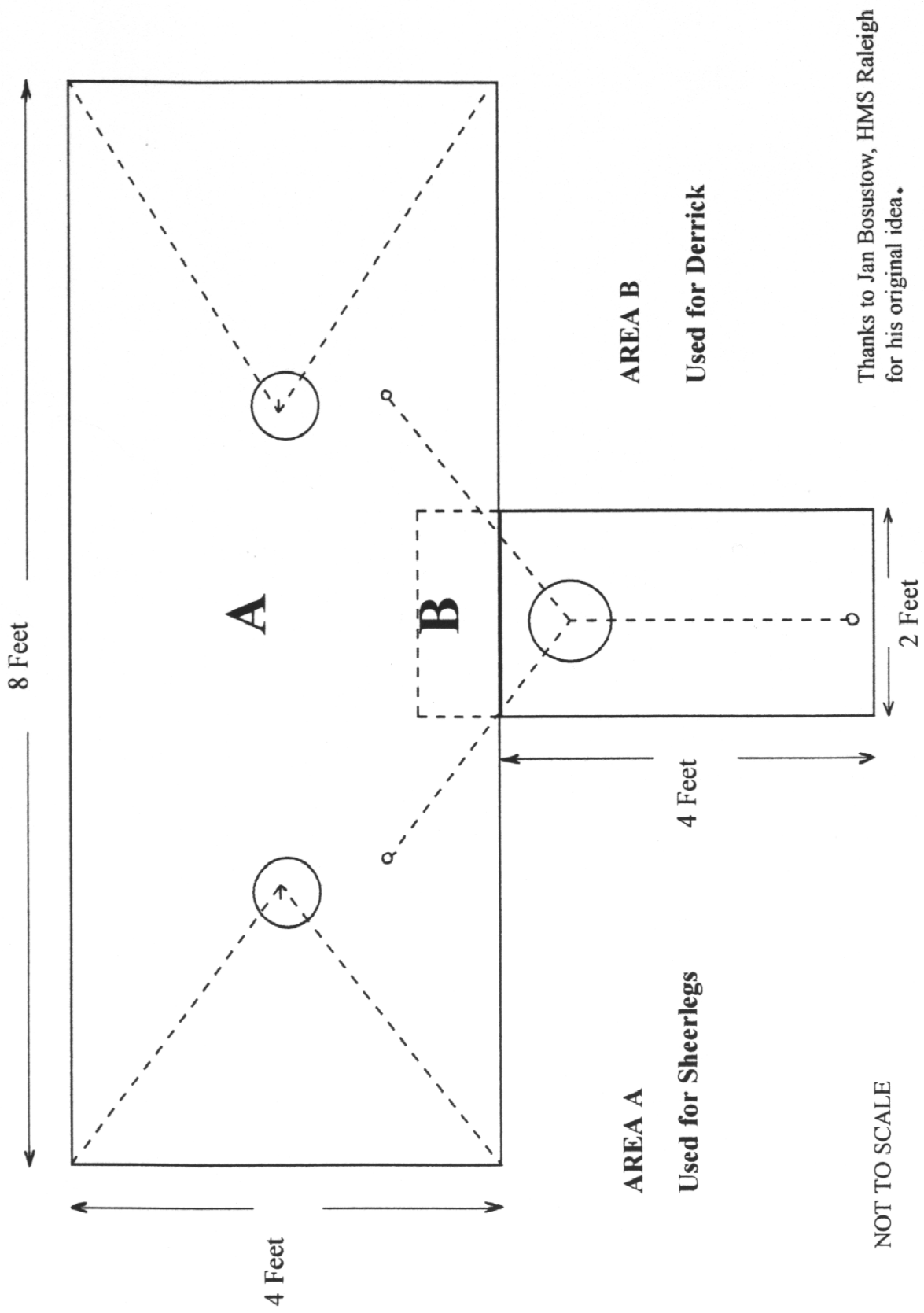
Guy Tackles

- 2 X Double Blocks (with beackets)
- 2 X Double Blocks (without beackets)
- 20 mtrs cordage (10 mtrs each guy)

5. SPARS

Minimum of 3 required

6' - 8' (max) in length, between 2 - 3" ideal thickness (old wooden tent poles are ideal)



Thanks to Jan Bosustow, HMS Raleigh
for his original idea.

RIGGING EXERCISE TRAINING BOARD

ANNEX D

INTERNATIONAL REGULATIONS FOR PREVENTING COLLISIONS AT SEA

Rule 1

Application

- (a) These Rules shall apply to all vessels upon the high seas and in all waters connected therewith navigable by seagoing vessels.
- (b) Nothing in these rules shall interfere with the operation of special rules made by an appropriate authority for roadsteads, harbours, rivers, lakes or inland waterways connected with the high seas and navigable by seagoing vessels. Such special rules shall conform as closely as possible to these rules.
- (c) Nothing in these rules shall interfere with the operations of any special rules made by the Government of any State with respect to additional station of signal lights, shapes or whistle signals for ships of war and vessels proceeding under convoy, or with respect to additional station or signal lights or shapes for fishing vessels engaged in fishing as a fleet. These additional station or signal lights, shapes or whistle signals shall, so far as possible, be such that they cannot be mistaken for any light, shape or signal authorised elsewhere under these rules.
- (d) Traffic separation schemes may be adopted by the organisation for the purpose of these rules.
- (e) Whenever the Government concerned shall have deemed that a vessel of special construction or purpose cannot comply fully with the provisions of these rules with the respect to the number, position, range or arc of visibility of lights and shapes, as well as to the disposition and characteristics of sound signalling appliances, such vessels shall comply with such other provisions in regard to the number, position, range and arc of visibility of lights and shapes, as well as the disposition and characteristics of sound signalling appliances, as her government shall have deemed to be the closest possible compliance with these rules in respect of that vessel.

Rule 2

Responsibility

- (a) Nothing in these rules shall exonerate any vessel, or the owner, master or crew thereof, from the consequences of any neglect to comply with these rules or of the neglect of any precaution which may be required by the ordinary practice of seamanship, or by special circumstances of the case.
- (b) In construing and complying with these rules due regard shall be had to all dangers of navigation and collision and to any special circumstances, including the limitations of the vessels involved, which may make a departure from these rules necessary to avoid immediate danger.

Rule 3

General Definitions

For the purpose of these rules, except where the context otherwise requires:

- (a) The word “**vessel**” includes every description of watercraft, including non-displacement craft, WIG craft and seaplanes, used or capable of being used as a means of transportation on water.
- (b) The term “**power driven vessel**” means any vessel propelled by machinery.
- (c) The term “**sailing vessels**” means any vessel under sail provided that propelling machinery, if fitted, is not being used.

- (d) The term “**vessel engaged in fishing**” means any vessel fishing with nets, lines, trawls or other fishing apparatus which restricts manoeuvrability, but does not include a vessel fishing with trolling lines or other fishing apparatus which does not restrict manoeuvrability.
- (e) The word “**seaplane**” includes any aircraft designed to manoeuvre on the water.
- (f) The term “**vessel not under command**” means a vessel which through some exceptional circumstance is unable to manoeuvre as required by these rules and is therefore unable to keep out of the way of other vessels.
- (g) The term “**vessel restricted in her ability to manoeuvre**” means a vessel which from the nature of her work is restricted in her ability to manoeuvre as required by these rules and is therefore unable to keep out of the way of other vessels. The term “**vessel restricted in their ability to manoeuvre**” shall include but not be limited to:
 - (i) a vessel engaged in laying, servicing or picking up a navigation mark, submarine cable or pipeline;
 - (ii) a vessel engaged in dredging, surveying or underwater operations;
 - (iii) a vessel engaged in replenishment or transferring persons, provisions or cargo while underway;
 - (iv) a vessel engaged in launching and recovery of aircraft;
 - (v) a vessel engaged in mine clearance operations;
 - (vi) a vessel engaged in towing operations such as severely restricts the towing vessel and her tow in their ability to deviate from their course;
- (h) The term “**vessel constrained by her draft**” means a power driven vessel which, because of her draft in relation to the available depth and width of navigable water is severely restricted in her ability to deviate from the course she is following.
- (i) The word “**underway**” means that a vessel is not at anchor or made fast to shore or ground.
- (j) The words “**length**” and “**breadth**” of a vessel means her length overall and her greatest breadth.
- (k) A vessel shall be deemed to be in sight of one other only when one can be observed visually from the other.
- (l) The term “**restricted visibility**” means any condition in which visibility is restricted by fog, mist, falling snow, heavy rain storms, sand storms or any other similar causes.
- (m) The term “**Wing-in-Ground Effect (WIG) craft**” means a multimodal craft which, in its main operation mode, flies in close proximity to the surface by utilizing surface-effect action.

Steering and Sailing Rules

Rule 4

Application

Rules in this section apply to any condition of visibility.

Rule 5

Look-out

Every vessel shall at all times maintain a proper lookout by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so far as to make full appraisal of the situation and of the risk of collision.

Rule 6

Safe Speed

Every vessel shall at all times proceed at safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions. In determining a safe speed the following factors shall be among those taken into account:

- (a) By all vessels:
 - (i) The state of visibility:
 - (ii) The traffic density including concentrations of fishing vessels or any other vessels:
 - (iii) The manoeuvrability of the vessel with special reference to stopping distance and turning ability in the prevailing conditions:
 - (iv) At night in the presence of background light such as from shore lights or from back scatter of her own lights:
 - (v) The state of wind, sea and current, and the proximity of navigational hazards:
 - (vi) The draught in relation to the available depth of water:
- (b) Additionally, by vessels with operational radar:
 - (i) The characteristics, efficiency and limitations of radar equipment:
 - (ii) Any constraints imposed by the radar range scale in use:
 - (iii) The effect on radar detection of the sea state, weather and other sources of interference:
 - (iv) The possibility that small vessels, ice and other floating objects may not be detected by radar at an adequate range:
 - (v) The number, location and movement of vessels detected by radar:
 - (vi) The more exact assessment of the visibility that may be possible when radar is used to determine the range of vessels and other objects in the vicinity.

Rule 7

Risk of Collision

- (a) Every vessel shall use all available means appropriate to the prevailing circumstances and conditions to determine if risk of collision exists. If there is any doubt such risks shall be deemed to exist.
- (b) Proper use shall be made of radar equipment if fitted and operational, including long range scanning to obtain early warning of risk of collision and radar plotting or equivalent systematic observation of detected objects.
- (c) Assumptions shall not be made on the basis of scanty information, especially scanty radar information.
- (d) In determining if risk of collision exists the following considerations shall be among those taken into account:
 - (i) Such risks shall be deemed to exist if the compass bearing of an approaching vessel does not appreciably change;

- (ii) Such risk may sometimes exist even when an appreciable bearing change is evident, particularly when approaching a very large vessel or a tow or when approaching a vessel at close range.

Rule 8

Action to Avoid Collision

- (a) Every action to avoid collision shall, if the circumstances of the case admit, be positive, made in ample time and due regard to the observance of good seamanship.
- (b) Any alteration of course and/or speed to avoid collision shall, if the circumstances of the case admit, be large enough to be readily apparent to the other vessel observing visually or by radar; a succession of small alterations of course and/or speed should be avoided.
- (c) If there is sufficient sea room, alteration of course alone may be the most effective action to avoid a close-quarter situation provided that it is made in good time, is substantial and does not result in another close-quarters situation.
- (d) Action taken to avoid collision with another vessel shall be such as to result in passing at a safe distance. The effectiveness of the action shall be carefully checked until the other vessel is finally passed and clear.
- (e) If necessary to avoid collision or to allow more time to assess the situation, the vessel shall slacken her speed or take all way off by stopping or reversing her means of propulsion.
- (f)
 - (i) A vessel which, by any of these rules, is required not to impede the passage or safe passage of another vessel shall, when required by the circumstances of the case, take early action to allow sufficient sea room for the safe passage of the other vessel.
 - (ii) A vessel required not to impede the passage or safe passage of another vessel is not relieved of this obligation if approaching the other vessel so as to invoke risk of collision and shall, then take action, have full regard to the action which may be required by these rules of this part.
 - (iii) A vessel the passage of which is not to be impeded remains fully obliged to comply with these rules of this part when the two vessels are approaching one another so as to involve risk of collision.

Rule 9

Narrow Channels

- (a) A vessel proceeding along the course of a narrow channel or fairway shall keep as near to the outer limit of the channel or fairway which lies on her starboard side as it is safe and practicable.
- (b) A vessel of less than 20 metres in length or sailing vessel shall not impede the passage of a vessel which can safely navigate only within a narrow channel or fairway.
- (c) A vessel engaged in fishing shall not impede the passage of any other vessel navigating within a narrow channel or fairway.
- (d) A vessel shall not cross a narrow channel or fairway if such crossing impedes the passage of a vessel which can safely navigate only within such channel or fairway. The latter vessel may use the sound signal prescribed in Rule 34 (d) if in doubt as to the intention of the crossing vessel.

- (e)
 - (i) In a narrow channel or fairway when overtaking can take place only if the vessel to be overtaken has to take action to permit safe passing, the vessel intending to overtake shall indicate her intention by sounding the appropriate signal prescribed in Rule 34 (c) (i). The vessel to be overtaken shall, if in agreement sound the appropriate signal prescribed in Rule 34(c)(ii) and take steps to permit safe passing. If in doubt she may sound the signals prescribed in Rule 34 (d).
 - (ii) This rule does not relieve the overtaking vessel of her obligation under Rule 13.
- (f) A vessel nearing a bend or an area of narrow channel or fairway where others may be obscured by an intervening obstruction shall navigate with particular alertness and caution and shall sound the appropriate signal prescribed in Rule 34 (e).
- (g) Any vessel shall, if the circumstances of the case admit, avoid anchoring in a narrow channel.

Rule 10

Traffic Separation Schemes

- (a) This rule applies to traffic separation schemes adopted by the organisation and does not relieve any vessel of her obligation under any other rule.
- (b) A vessel using a traffic separation scheme shall;
 - (i) proceed in the appropriate traffic lane in the general direction of the traffic flow for that lane;
 - (ii) so far as practicable keep clear of a traffic separation line or separation zone;
 - (iii) normally join or leave a traffic lane at the termination of the lane, but when joining or leaving from either side shall do so at a smaller angle in the general direction of the flow as practicable.
- (c) A vessel shall as far as practicable, avoid crossing traffic lanes but if obliged to do so shall cross on the heading as nearly as practicable at right angles to the general direction of traffic flow.
- (d)
 - (i) A vessel shall not use an inshore traffic zone when she can safely use the appropriate lane within the adjacent traffic separation scheme. However, vessels of less than 20 metres in length, sailing vessels and vessels engaged in fishing may use the inshore traffic zone.
 - (ii) Notwithstanding subparagraph (d) (i), a vessel may use an inshore traffic zone when en route to or from a port, offshore installation or structure, pilot station or any other place situated within the inshore traffic zone, or to avoid immediate danger.
- (e) A vessel other than a crossing vessel or a vessel joining or leaving a lane shall not normally enter a separation zone or cross a separation line except;
 - (i) In case of emergency to avoid imminent danger.
 - (ii) To engage in fishing within a separation zone.
- (f) A vessel navigating in areas near the terminations of traffic separation schemes shall do so with particular caution.
- (g) A vessel shall so far as practicable avoid anchoring in a traffic separation scheme or in areas near its terminations.

- (h) A vessel not using a traffic separation scheme shall avoid it by as wide a margin as practicable.
- (i) A vessel engaged in fishing shall not impede the passage of any vessel following a traffic lane.
- (j) A vessel of less than 20 metres in length or a sailing vessel shall not impede the safe passage of a power driven vessel following a traffic lane.
- (k) A vessel restricted in her ability to manoeuvre when engaged in operation for the maintenance of safety of navigation in a traffic separation scheme is exempted from complying with this rule to the extent necessary to carry out the operation.
- (l) A vessel restricted in her ability to manoeuvre when engaged in an operation for the laying, servicing or picking up of a submarine cable, within a traffic separation scheme, is exempt from complying with this rule to the extent necessary to carry out the operation.

CONDUCT OF VESSELS IN SIGHT OF ONE ANOTHER

Rule 11

Application

Rules in this section apply to vessels in sight of one another.

Rule 12

Sailing Vessels

- (a) When two sailing vessels are approaching one another, so as to involve risk of collision, one of them shall keep out of the way of the other as follows;
 - (i) When each has the wind on a different side, the vessel which has the wind on the port side shall keep out of the way of the other;
 - (ii) When both have the wind on the same side, the vessel which is to windward shall keep out of the way of the vessel which is to leeward;
 - (iii) If a vessel with the wind on the port side sees a vessel to windward and cannot determine with certainty whether the other vessel has the wind on the port side or the starboard side shall keep out of the way of the other vessel.
- (b) For the purpose of this rule the windward side shall be deemed to be the opposite side to that on which the mainsail is carried or, in the case of a square rigged vessel, the side opposite to that on which the largest fore and aft sail is carried.

Rule 13

Overtaking

- (a) Notwithstanding anything contained in these rules of Part B, Sections I and II any vessel overtaking any other shall keep out of the way of the vessel being overtaken.
- (b) A vessel shall be deemed to be overtaking when coming up with another vessel from a direction more than 22.5 degrees abaft her beam, that is, in such a position with reference to the vessel she is overtaking, that at night she would be able to see only the stern light of that vessel but neither of her side lights.

- (c) When a vessel is in any doubt as to whether she is overtaking another, she shall assume that this is the case and act accordingly.
- (d) Any subsequent alteration of the bearing between the two vessels shall not make the overtaking vessel a crossing vessel within the meaning of these rules or relieve her of the duty of keeping clear of the overtaking vessel until she is finally passed and clear.

Rule 14

Head-On Situation

- (a) When motor driven vessels are meeting on reciprocal or nearly reciprocal courses so as to involve risk of collision each shall alter her course to starboard so each shall pass on the port side of each other.
- (b) Such a situation shall be deemed to exist when a vessel sees the other ahead or nearly ahead and by night she should see the masthead lights of the other in a line or nearly in a line and/or both side lights and by day she observes the corresponding aspect of the other vessel.
- (c) When a vessel is in any doubt as to whether such a situation exists she shall assume that it does exist and act accordingly.

Rule 15

Crossing Situation

When two power driven vessels are crossing so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way and shall, if the circumstances of the case admit, avoid crossing ahead of the other vessel.

Rule 16

Action by Give-Way Vessel

Every vessel which is directed to keep out of the way of another vessel shall, as far as possible, take early and substantial action to keep well clear.

Rule 17

Action by Stand-On Vessel

- (a)
 - (i) Where one of two vessels is to keep out of the way the other shall keep her course and speed.
 - (ii) The latter vessel may however take action to avoid collision by her manoeuvre alone, as soon as it becomes apparent to her that the other vessel required to keep out of the way is not taking appropriate action in compliance with these rules.
- (b) When, from any cause, the vessel required to keep her course and speed finds herself so close that collision cannot be avoided by the action of the give-way vessel alone, she shall take such action as will best aid as to avoid collision.
- (c) A power driven vessel which takes action in a crossing situation in accordance with sub-paragraph (a)(ii) of this rule to avoid collision with another power driven vessel shall, if the circumstances of the case admit, not alter course to port for a
- (d) This rule does not relieve the give-way vessel of her obligation to keep out of the way.

Rule 18

Responsibilities Between Vessels

Except where Rules 9, 10 and 13 otherwise require:

- (a) A power driven vessel under way shall keep out of the way of:
 - (i) A vessel not under command;
 - (ii) A vessel restricted in her ability to manoeuvre;
 - (iii) A vessel engaged in fishing;
 - (iv) A sailing vessel.
- (b) A sailing vessel under way shall keep out of the way of:
 - (i) A vessel not under command;
 - (ii) A vessel restricted in her ability to manoeuvre;
 - (iii) A vessel engaged in fishing.
- (c) A vessel engaged in fishing when underway shall, so far as possible, keep out of the way of:
 - (i) A vessel not under command;
 - (ii) A vessel restricted in her ability to manoeuvre.
- (d)
 - (i) Any vessel other than a vessel not under command or a vessel restricted in her ability to manoeuvre shall, if the circumstances of the case admit, avoid impeding the safe passage of a vessel constrained by her draft, exhibiting the signals in Rule 28.
 - (ii) A vessel constrained by her draft shall navigate with particular caution having full regard to her special condition.
- (e) A seaplane on the water shall, in general, keep well clear of all vessels and avoid impeding their navigation. In circumstances, however, where risk of collision exists, she shall comply with the rules of this part.
- (f)
 - (i) A WIG craft, when taking off, landing and in flight near the surface, shall keep well clear of all other vessels and avoid impeding their navigation.
 - (ii) A WIG craft operating on the water surface shall comply with the rules of this part as a power-driven vessel.

Conduct of Vessels in Restricted Visibility

Rule 19

- (a) This rule applies to vessels not in sight of one another when navigating in or near an area of restricted visibility.
- (b) Every vessel shall proceed at a safe speed adapted to the prevailing circumstances and conditions of restricted visibility. A power driven vessel shall have her engines ready for immediate manoeuvre.
- (c) Every vessel shall have due regard to the prevailing circumstances and conditions of restricted visibility when complying with the rules of Section I of this part.
- (d) A vessel which detects by radar alone the presence of another vessel shall determine if a close quarter situation is developing and/or risk of collision exists. If so, she shall take avoiding action in ample time, provided that when such action consist of an alteration of course, so far as possible the following shall be avoided;
 - (i) An alteration of course to port for a vessel forward of the beam, other than for a vessel being overtaken;
 - (ii) An alteration of course towards a vessel abeam or abaft the beam.

- (e) Except where it has been determined that a risk of collision does not exist, every vessel which hears apparently forward of her beam the fog signal of another vessel, or which cannot avoid a close quarter situation with another vessel forward of her beam, shall reduce her speed to a minimum at which she can be kept on her course. She shall if necessary take all her way off and in any event navigate with extreme caution until the danger of collision is over.

Lights and Shapes

Rule 20

Application

- (a) Rules in this part shall be complied with in all weathers.
- (b) The rules concerning lights shall be complied with from sunset to sunrise and during such times no other lights shall be exhibited, except such lights as cannot be mistaken for lights specified in these rules or do not impair their visibility or distinctive character, or interfere with the keeping of a proper lookout.
- (c) The lights prescribed by these rules shall, if carried, also be exhibited from sunrise to sunset in restricted visibility and may be exhibited in all other circumstances when it is deemed necessary.
- (d) The rules concerning shapes shall be complied with by day.
- (e) The lights and shapes specified in these rules shall comply with the provisions of Annex I of these regulations.

Rule 21

Definitions

- (a) ***“Mast headlight”*** means a white light placed over the fore and aft centre-line of the vessel showing an unbroken light over an arc of the horizon of 225 degrees and so fixed as to show the light from right ahead to 22.5 degrees abaft the beam on either side of the vessel.
- (b) ***“Side lights”*** means a green light on the starboard side and a red light on the port side each showing an unbroken light over an arc of the horizon of 112.5 degrees and so fixed as to show the light from right ahead to 22.5 degrees abaft the beam on its respective side. In a vessel of less than 20 metres in length the side lights may be combined in one lantern on the fore and aft centre line of the vessel.
- (c) ***“Stern light”*** means a white light placed as near as practicable at the stern showing an unbroken light over an arc of the horizon on 135 degrees and so fixed as to show the light 67.5 degrees from right aft on each side of the vessel.
- (d) ***“Towing light”*** means a yellow light having the same characteristics as the ***“stern light”*** defined in paragraph (c) of this rule.
- (e) ***“All round light”*** means a light showing an unbroken light over the arc of the horizon of 360 degrees.
- (f) ***“Flashing light”*** means a light flashing at regular intervals of a frequency of 120 flashes or more per minute.

Rule 22

Visibility of Lights

The lights prescribed in these rules shall have an intensity as specified in Section 8 of Annex I to these regulations so as to be visible at the following minimum ranges:

- (a) In vessels of 50 metres or more in length:
 - a masthead light, 6 miles;
 - a sidelight, 3 miles;
 - a sternlight, 3 miles;
 - a towing light, 3 miles;
 - a white, red, green or yellow all-round light, 3 miles.
- (b) In vessels of 12 metres or more in length but less than 50 metres length:
 - a masthead light, 5 miles: except that where the length of the vessel is less than 20 metres, 3 miles;
 - a sidelight, 2 miles;
 - a sternlight, 2 miles;
 - a towing light, 2 miles;
 - a white, red, green or yellow all-round light, 2 miles.
- (c) In vessels of less than 12 metres in length:
 - a masthead light, 2 miles;
 - a sidelight, 1 mile;
 - a sternlight, 2 miles;
 - a towing light, 2 miles;
 - a white, red, green or yellow all-round light, 2 miles.
- (d) In inconspicuous, partly submerged vessel or objects being towed:
 - a white all-round light, 3 miles.

Rule 23

Power-driven Vessels Underway

- (a) A power-driven vessel underway shall exhibit:
 - (i) A masthead light forward;
 - (ii) A second masthead light abaft and higher than the forward one; except that a vessel of less than 50 metres in length shall not be obliged to exhibit such light but may do so;
 - (iii) Sidelights;
 - (iv) Sternlight.
- (b) An air-cushioned vessel when operating in the non-displacement mode shall, in addition to the lights prescribed in paragraph (a) of this rule, shall exhibit an all-round yellow flashing light.
- (c) A WIG craft only when taking off, landing and in flight near the surface shall, in addition to the lights described in paragraph (a) of this rule, exhibit a high intensity all-round flashing red light.
- (d)
 - i) A power-driven vessel of less than 12 metres in length may in lieu of the lights prescribed in paragraph (a) of this rule exhibit an all-round white light and side-lights.
 - (ii) A power-driven vessel of less than 7 metres in length whose maximum speed does not exceed 7 knots may in lieu of the lights prescribed in paragraph (a) of this rule shall exhibit an all-round white light and shall, if practicable, also exhibit sidelights.
 - (iii) The masthead light or all-round white light on a power-driven vessel of less than 12 metres in length may be displaced from the fore and aft centre line of the vessel if the centre line fitting is non practicable, providing that the sidelights are combined in one lantern which shall

be carried on the fore and aft centre line of the vessel or located as nearly as practicable in the same fore and aft line as the masthead light of the all-round white light.

Rule 24

Towing and Pushing

- (a) A power-driven vessel when towing shall exhibit:
 - (i) Instead of the light prescribed in Rule 23 (a)(i) or (a)(ii), two masthead lights in a vertical line. When the length of the tow, measuring from the stern of the towing vessel to the after end of the tow exceeds 200 metres, three such lights in a vertical line:
 - (ii) Sidelights;
 - (iii) A sternlight;
 - (iv) A towing light in a vertical line above the stern light;
 - (v) When the length of the tow exceeds 200 metres a diamond shape where it can best be seen.
- (b) When a pushing vessel and a vessel being pushed ahead are rigidly connected in a composite unit they shall be regarded as a power-driven vessel and exhibit the lights prescribed in the Rule 23.
- (c) A power-driven vessel when pushing ahead or towing alongside, except in the case of a composite unit shall exhibit:
 - (i) Instead of the light prescribed in Rule 23 (a)(i) or (a)(ii), two masthead lights in a vertical line:
 - (ii) Sidelights;
 - (iii) Stern light.
- (d) A power-driven vessel to which paragraphs (a) or (c) of this rule apply shall also comply with Rule 23 (a)(ii).
- (e) A vessel or object being towed, other than those mentioned in paragraph (g) of this rule, shall exhibit:
 - (i) Sidelights;
 - (ii) Sternlight;
 - (iii) When the length of the tow exceeds 200 metres, a diamond shape where it can best be seen.
- (f) Providing that any number of vessels being towed alongside or pushed in a group shall be lighted as one vessel,
 - (i) A vessel being pushed ahead not being part of a composite unit, shall exhibit at the forward end, sidelights;
 - (ii) A vessel being towed alongside shall exhibit a stern light and at the forward end, sidelights.
- (g) An inconspicuous, partly submerged vessel or object, or combination of such vessels or objects being towed, shall exhibit:
 - (i) If it is less than 25 metres in breadth, one all-round white light at or near the forward end and one at or near the after end except that dracones need not exhibit a light at or near the forward end.
 - (ii) If it is 25 metres or more in breadth two additional all-round white lights at or near the extremities of its breadth;
 - (iii) If it exceeds 1,000 metres in length additional all-round white lights between the lights prescribed in sub-paragraphs (i) and (ii) so that the distance between the lights shall not exceed 100 metres;
 - (iv) A diamond shape at or near the aftermost extremity of the last vessel or object being towed and if the length exceeds 200 metres an

additional diamond shape where it can best be seen and located as far forward as it is practicable.

- (h) Where from any sufficient cause it is impracticable for a vessel or object being towed to exhibit the lights or shapes prescribed in paragraph (e) or (g) of this rule, all possible measures shall be taken to light the vessel or object being towed or at least to indicate the presence of such a vessel or object.
- (i) Where from any sufficient cause it is impracticable for a vessel not normally engaged in towing operations to display the lights prescribed in paragraph (a) or (c) of this rule, such vessel shall not be required to exhibit these lights when engaged in towing another vessel in distress or otherwise in need of assistance. All possible measures shall be taken to indicate the nature of the relationship between the towing vessel and the vessel being towed as authorised by Rule 36 in particular by illuminating the towline.

Rule 25

Sailing Vessels Under Way and Vessels Under Oars

- (a) A vessel under way shall exhibit:
 - (i) Sidelights;
 - (ii) Sternlight.
- (b) In a sailing vessel of less than 20 metres in length the lights prescribed in paragraph (a) of this rule may be combined in one lantern carried at or near the top of the mast where it can best be seen.
- (c) A sailing vessel under way may, in addition to the lights prescribed in paragraph (a) of this rule, exhibit at or near the top of the mast, where they can best be seen, two all-round lights in a vertical line, the upper being red and the lower being green, but these lights shall not be exhibited in conjunction with a combined lantern permitted by paragraph (b) of this rule.
- (d)
 - (i) A sailing vessel of less than 7 metres in length shall, if practicable exhibit the lights prescribed in paragraph (a) or (b) of this rule, but if she does not, she shall have ready at hand an electric torch or lighted lantern showing a white light which shall be exhibited in sufficient time to prevent a collision.
 - (ii) A vessel under oars may exhibit the lights prescribed in this rule for sailing vessels, but if she does not, she shall have ready at hand an electric torch or lighted lantern showing a white light which shall be exhibited in sufficient time to prevent collision.
- (e) A vessel proceeding under sail when also being propelled by machinery shall exhibit forward where it can best be seen a conical shape, apex downwards.

Rule 26

Fishing Vessels

- (a) A vessel engaged in fishing, whether under way or at anchor, shall exhibit only the lights and shapes prescribed in this rule.
- (b) A vessel when engaged in trawling, by which is meant by the dragging through the water of a dredge net or other apparatus used as a fishing appliance, shall exhibit:

- (i) Two all-round lights in a vertical line, the upper being green and the lower white, or a shape consisting of two cones with their apexes together in a vertical line one above the other;
- (ii) A mast head light abaft of and higher than the all-round green light; a vessel of less than 50 metres in length shall not be obliged to exhibit such a light but may do so;
- (iii) When making way through the water, in addition to the lights prescribed in this paragraph, side lights and a sternlight.
- (c) A vessel engaged in fishing, other than trawling shall exhibit:
 - (i) Two all-round lights in a vertical line, the upper being red and the lower white or a shape consisting of two cones with apexes together in a vertical line one above the other;
 - (ii) Where there is outlying gear extending more than 150 metres horizontally from the vessel, an all-round white light or a cone apex upwards in the direction of the gear;
 - (iii) When making way through the water, in addition to these lights prescribed in this paragraph, sidelights and a stern light.
- (d) The additional signals described in Annex II to these regulations apply to a vessel engaged in fishing in close proximity to other vessels engaged in fishing.
- (e) A vessel when not engaged in fishing shall not exhibit the lights or shapes prescribed in this rule, but only those prescribed for vessel of her length.

Rule 27

Vessels Not Under Command or Restricted in their Ability to Manoeuvre

- (a) A vessel not under command shall exhibit:
 - (i) Two all-round red lights in a vertical line where they can best be seen;
 - (ii) Two balls or similar shapes in a vertical line where they can best be seen;
 - (iii) When making way through the water, in addition to the lights prescribed in this paragraph, sidelights and sternlight.
- (b) A vessel restricted in her ability to manoeuvre, except the vessel engaged in mine clearance operations, shall exhibit:
 - (i) Three all-round lights in a vertical line where they can best be seen. The highest and lowest of these lights shall be red and the middle light shall be white;
 - (ii) Three shapes in a vertical line where they can best be seen. The highest and lowest of these shapes shall be balls and the middle one a diamond;
 - (iii) When making way through the water, a masthead light or lights, sidelights and a starlight, in addition to the lights prescribed in sub-paragraph (i);
 - (iv) When at anchor, in addition to the lights or shapes prescribed in sub-paragraphs (i) and (ii) the light, lights or shape prescribed in Rule 30.
- (c) A power-driven vessel engaged in a towing operation such as severely restricts the towing vessel and her tow in their ability to deviate from their course shall, in addition to the lights and shapes prescribed in Rule 24(a), exhibit the lights and shapes prescribed in sub-paragraphs (b) (i) and (ii) of this rule.

- (d) A vessel engaged in dredging or underwater operations when restricted in her ability to manoeuvre, shall exhibit the lights and shapes prescribed in sub-paragraphs (b) (i) (ii) and (iii) of this rule and shall in addition, when an obstruction exists, exhibit:
 - (i) Two all-round red lights or two balls in a vertical line to indicate the side on which the obstruction exists;
 - (ii) Two all-round green lights or two diamonds in a vertical line to indicate the side on which the other vessel may pass;
 - (iii) When an anchor, the lights and shapes prescribed in this paragraph instead of the lights or shapes prescribed in Rule 30.
- (e) Whenever the size of the vessel engaged in diving operations make it impracticable to exhibit all lights and shapes prescribed in paragraph (d) of this rule, the following shall be exhibited:
 - (i) Three all-round lights in a vertical line where they can best be seen the highest and lowest of these lights shall be red and the middle lights shall be white;
 - (ii) A rigid replica of the International Code flag "A" not less than one metre in height. Measures shall be taken to ensure its all-round visibility.
- (f) A vessel engaged in mine clearance operations shall in addition to the lights prescribed for a power driven vessel in Rule 23 or to the lights and shapes for a vessel at anchor in Rule 30 as appropriate, exhibit three all-round green lights or three balls. One of these lights or shapes shall be exhibited near the fore mast head and one at each end of the fore yard. These lights and shapes indicate that it is dangerous for another vessel to approach within 1,000 metres of the mine clearance vessel.
- (g) Vessel of less than 12 metres in length, except those engaged in diving operations, shall not be required exhibit the lights and shapes prescribed in this rule.
- (h) The signals prescribed in this rule are not signals of vessel in distress and requiring assistance. Such signals are contained in Annex IV to these regulations.

Rule 28

Vessels Constrained by their Draft

A vessel constrained by her draft may, in addition to the lights prescribed for power driven vessels in Rule 23 exhibit where they can best be seen three all-round red lights in a vertical line or a cylinder.

Rule 29

Pilot Vessels

- (a) A vessel engaged on pilotage duty shall exhibit:
 - (i) At or near the masthead two all-round lights in a vertical line, the upper being white and the lower red;
 - (ii) When under way, in addition, sidelights and sternlight;
 - (iii) When at anchor, in addition to the lights prescribed in sub-paragraph (i) the light, lights or shapes prescribed in Rule 30 for a vessel at anchor.
- (b) A pilot vessel when not engaged on pilotage duty shall exhibit the lights and shapes prescribed for a vessel of her length.

Rule 30

Anchored Vessels and Vessels Aground

- (a) A vessel at anchor shall exhibit where it can best be seen:
 - (i) In the fore part, an all-round white light or one ball;
 - (ii) At or near the stern and at a lower level than the light prescribed in sub-paragraph (i), and all-round white light.
- (b) A vessel of less than 50 metres in length may exhibit an all-round white light where it can best be seen instead of the lights prescribed in paragraph (a) of this rule.
- (c) A vessel at anchor may, and a vessel of 100 metres and more in length, shall also use the available working or equivalent lights to illuminate her decks.
- (d) A vessel aground shall exhibit the lights prescribed in paragraph (a) or (b) of this rule and in addition, where it can best be seen;
 - (i) Two all-round red lights in a vertical line;
 - (ii) Three balls in a vertical line.
- (e) A vessel of less than 7 metres in length, when at anchor, not in or near a narrow channel, fairway or anchorage, or where other vessels normally navigate, shall not be required to exhibit the lights or shape prescribed in paragraphs (a) or (b) of this rule.
- (f) A vessel of less than 12 metres in length, when aground, shall not be required to exhibit the lights or shapes prescribed in sub-paragraph (d) (i) and (ii) of this rule.

Rule 31

Seaplanes and WIG Craft

Where it is impracticable for a seaplane or a WIG craft to exhibit lights and shapes of the characteristics or in the positions prescribed in the rules of this part she shall exhibit lights and shapes as closely similar in characteristics and position as it is possible.

SOUND AND LIGHT SIGNALS

Rule 32

Definitions

- (a) The word “***whistle***” means any sound signalling appliance capable of producing the prescribed blasts and which complied with the specification in Annex III of these regulations.
- (b) The term “***short blast***” means a blast of about one second’s duration.
- (c) The term “***prolonged blast***” means a blast of from four to six seconds’ duration.

Rule 33

Equipment for Sound Signals

- (a) A vessel of twelve metres or more in length shall be provided with a whistle, a vessel of 20 metres or more in length shall be provided with a bell in addition to the whistle, a vessel of 100 metres in length shall, in addition, be provided with a gong, the tone and sound of which cannot be confused with that of the bell. The whistle, bell and gong shall comply with the specification of Annex III of these regulations. The bell and gong or

both may be replaced by other equipment having the same respective sound characteristics, provided that manual sounding of the required signals shall always be possible.

- (b) A vessel of less than 12 metres in length shall not be obliged to carry the sound signalling appliances prescribed in paragraph (a) of this rule but if she does not, she shall be provided with some other means of making an effective sound signal.

Rule 34

Manoeuvring and Warning Signals

- (a) When vessels are in sight of one another, a power-driven vessel under way, when manoeuvring as authorized or required by these rules, shall indicate that manoeuvre by the following signals on her whistle:
 - one short blast to mean ***"I am altering my course to starboard"***;
 - two short blasts to mean ***"I am altering my course to port"***;
 - three short blasts to mean ***"I am operating astern propulsion"***.
- (b) Any vessel may supplement the whistle signals prescribed in paragraph (a) of this rule by light signals, repeated as appropriate, whilst the manoeuvre is being carried out:
 - (i) These light signals shall have the following significance:
 - one flash to mean ***"I am altering my course to starboard"***;
 - two flashes to mean ***"I am altering my course to port"***;
 - three flashes to mean ***"I am operating astern propulsion"***;
 - (ii) The duration of each flash shall be about one second, the interval between flashes shall be about one second, and the interval between successive signals shall be not less than ten seconds;
 - (iii) The lights used for this signal shall, if fitted, be an all-round white light visible at a minimum range of five miles and shall comply with the provisions of Annex I to these regulations.
- (c) When in sight of one another in a narrow channel or fairway:
 - (i) A vessel intending to overtake another shall in compliance with Rule 9 (e) (i) indicate her intention by the following signals on her whistle:
 - Two prolonged blasts followed by one short blast to mean ***"I intend to overtake you on your starboard side"***;
 - Two prolonged blasts followed by two short blasts to mean ***"I intend to overtake you on your port side"***;
 - (ii) The vessel about to be overtaken when acting in accordance with Rule 9 (e) (i) shall indicate her agreement by the following signal on her whistle:
 - one prolonged, one short, one prolonged and one short blast, in that order;
- (d) When vessels in sight of one another are approaching each other and from any cause either vessel fails to understand the intentions or action of the other, or it is in doubt whether sufficient action is being taken by the other to avoid collision, the vessel in doubt shall immediately indicate such doubt by giving at least five short and rapid blasts on the whistle. Such signal may be supplemented by a light signal of at least five short and rapid flashes.
- (e) A vessel nearing a bend or an area of channel or fairway where other vessels may be obscured by an intervening obstruction shall sound one prolonged blast. Such signal shall be answered with one prolonged blast

by any approaching vessel that may be within hearing sound around the bend or behind the intervening obstruction.

- (f) If whistles are fitted on a vessel at a distance apart of more than one hundred metres, one whistle only shall be used for giving manoeuvring and warning signals.

Rule 35

Sound Signals in Restricted Visibility

In or near an area of restricted visibility, whether by day or night, the signals prescribed in this rule shall be used as follows:

- (a) A power driven vessel making way through the water shall sound at intervals of not more than two minutes one prolonged blast.
- (b) A power-driven vessel under way but stopped and making no way through the water shall sound at intervals of not more than two minutes two prolonged blasts in succession and an interval of about two second between them.
- (c) A vessel not under command, a vessel restricted in her ability to manoeuvre, a vessel constrained by her draft, a sailing vessel, a vessel engaged in fishing and a vessel engaged in towing or pushing another vessel shall instead of the signals prescribed in paragraphs (a) or (b) of this rule, sound at intervals of not more than two minutes three blasts in succession namely one prolonged followed by two short blasts.
- (d) A vessel engaged in fishing, when at anchor, and a vessel restricted in her ability to manoeuvre when carrying out her work at anchor, shall instead of the signals prescribed in paragraph (g) of this rule sound the signals prescribed in paragraph (c) of this rule.
- (e) A vessel towed or if more than one vessel is towed the last vessel of the tow, if manned, shall at intervals not more than two minutes sound four blasts in succession, namely one prolonged followed by three short blasts. When practicable, this signal shall be made immediately after the signal made by the towing vessel.
- (f) When a pushing vessel and a vessel being pushed ahead are rigidly connected in a composite unit they shall be regarded as a power driven vessel and shall give the signals prescribed in paragraphs (a) or (b) of this rule.
- (g) A vessel at anchor shall at intervals of not more than one minute ring a bell rapidly for about five seconds. In a vessel of 100 metres or more in length the bell shall be sounded in the forepart of the vessel. Immediately after the ringing of the bell the gong shall be sounded rapidly for about five seconds in the afterpart of the vessel. A vessel at anchor may in addition sound three blasts in succession, namely one short blast, one prolonged and one short blast, to give warning of her position and of the possibility of collision to an approaching vessel.
- (h) A vessel aground shall give the bell signal and if required the gong signal prescribed in paragraph (g) of this rule and shall, in addition, give three separate and distinct strokes of the bell immediately before and after the rapid ringing of the bell. A vessel aground may in addition sound the appropriate whistle signal.
- (i) A vessel of twelve metres or more but less than 20 metres in length shall not be obliged to give the bell signals prescribed in paragraphs (g) and (h)

or this rule. However, if she does not, she shall make some other efficient sound signal at intervals of not more than two minutes.

- (j) A vessel of less than 12 metres in length shall not be obliged to give the above mentioned signals but, if she does not, shall make some other efficient sound signal at intervals of not more than two minutes.
- (k) A pilot vessel when engaged in pilotage duty may in addition to the signals prescribed in paragraphs (a), (b) or (g) of this rule sound an identity signal consisting of four short blasts.

Rule 36

Signals to Attract Attention

If necessary to attract the attention of another vessel any vessel may make light or sound signals that cannot be mistaken for any signal authorized elsewhere in these rules, or may direct the beam of her searchlight in the direction of the danger, in such a way as not to embarrass any vessel. Any light to attract the attention of another vessel shall be such that it cannot be mistaken for any aid to navigation. For the purpose of this rule the use of high-intensity intermittent or revolving lights, such as strobe lights, shall be avoided.

Rule 37

Distress Signals

1. When a vessel is in distress and requires assistance she shall use or exhibit the signals described below.
 - (a) A gun or other explosive signal fired at intervals of about one minute;
 - (b) A continuous sounding with any fog signalling apparatus;
 - (c) Rockets or shells, throwing red stars fired one at a time at short intervals;
 - (d) A signal made by radiotelegraph or by any other signally method consisting of the group ...---... (SOS) in the morse code;
 - (e) A signal sent by radiotelephony consisting of the spoken word **mayday**;
 - (f) The International code signal of distress indicated by NC;
 - (g) A signal consisting of a square flag having above or below it a ball or anything resembling a ball;
 - (h) Flames on the vessel (as from a burning tar barrel, oil barrel, etc.);
 - (i) A rocket parachute flare or a hand flare showing a red light;
 - (j) A smoke signal giving off orange coloured smoke;
 - (k) Slowly and repeatedly raising and lowering arms outstretched to each side;
 - (l) The radiotelegraph alarm signal;
 - (m) The radiotelephone alarm signal;
 - (n) Signals transmitted by emergency positioning-indicating radio beacons;
 - (o) Approved signals transmitted by radio communication systems including survival craft radar transponders.
2. The use or exhibition of any of the foregoing signals except for the purpose of indicating distress and need of assistance and the use of other signals which may be confused with any of the above signals is prohibited.
3. Attention is drawn to the relevant sections of the International Code of Signals, the Merchant Ship Search and Rescue Manual and the following signals:
 - (a) A piece of orange coloured canvas with either a black square and circle or other appropriate symbol (for identification from the air);
 - (b) A dye marker.

EXEMPTIONS

Rule 38

Exemptions

Any vessel (or class of vessels) provided that she complies with the requirements of the International Regulations for Preventing Collisions at Sea, 1960, the keel of which is laid or which is at the corresponding stage of construction before the entry into force of these regulations may be exempt from compliance therewith as follows:

- (a) The installation of lights with ranges prescribed in Rule 22, until four years after the date of entry into force of these regulations.
- (b) The installation of lights with colour specifications as prescribed in Section 7 of Annex I to these regulations, until four years after the date of entry into force of these regulations.
- (c) The repositioning of lights as a result of conversion from Imperial to Metric units and rounding up measurement figures, permanent exemption.
- (d)
 - (i) The repositioning of mast headlights on vessels of less than 150 metres in length, resulting from the prescriptions of Section 3 (a) of Annex I to these regulations, permanent exemption.
 - (ii) The repositioning of masthead lights on vessel of 150 metres or more in length, resulting from the prescriptions of Section 3(a) of Annex I to these regulations, until nine years after the date of entry into force of these regulations.
- (e) The repositioning of mast headlights resulting from the prescriptions of 2(b) of Annex I to these regulations, until nine years after the date of entry into force of these regulations.
- (f) The repositioning of side lights resulting from the prescriptions of Sections 2(g) and 3(b) of Annex I to these regulations, until nine years after the date of entry into force of these regulations.
- (g) The requirements of sound signal appliances prescribed in Annex III of these regulations, until nine years after the date of entry into force of these regulations.
- (h) The repositioning of all-round lights resulting from the prescription of Section 9(b) of Annex I to these regulations, permanent exemption.