



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

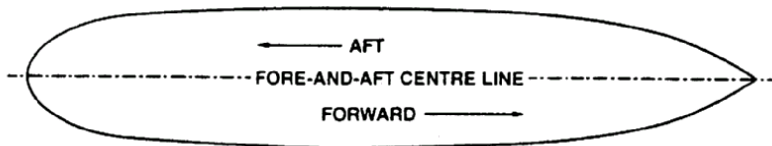
- 0101 **Principal Parts of a Ship**
- 0102 **Miscellaneous Parts of a Ship**
- 0103 **Miscellaneous Sea Terms**
- 0104 **Terms used in connection with direction relative to a Ship**

0101 **PRINCIPAL PARTS OF A SHIP**

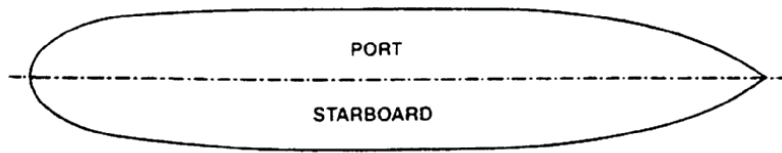
The Hull	The main body of the ship.
Stem	The very front end of the Hull.
Stern	The very back end of the Hull.
Fore Part	Front third of the Hull.
Midship Part	Middle third of the Hull.
After Part	Back third of the Hull.



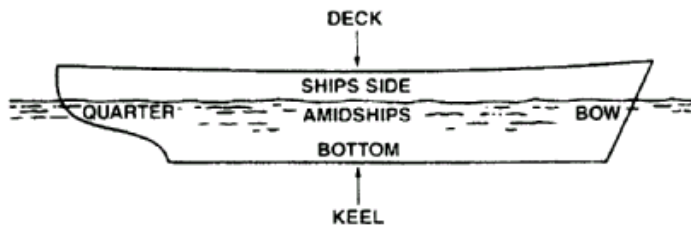
Forward	Direction towards the front of the ship (Stem).
Aft	Direction towards the back of the ship (Stern).
Fore and Aft Line	Any line which runs lengthways in the ship from end to end.
Fore and Aft Centre Line	The line joining the middles of the Stem to Stern.



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.

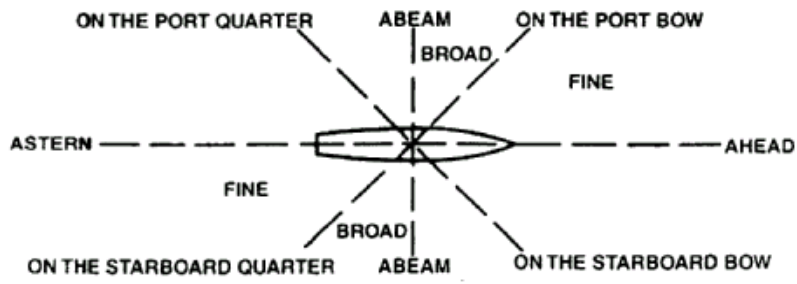
0103 MISCELLANEOUS SEA TERMS

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

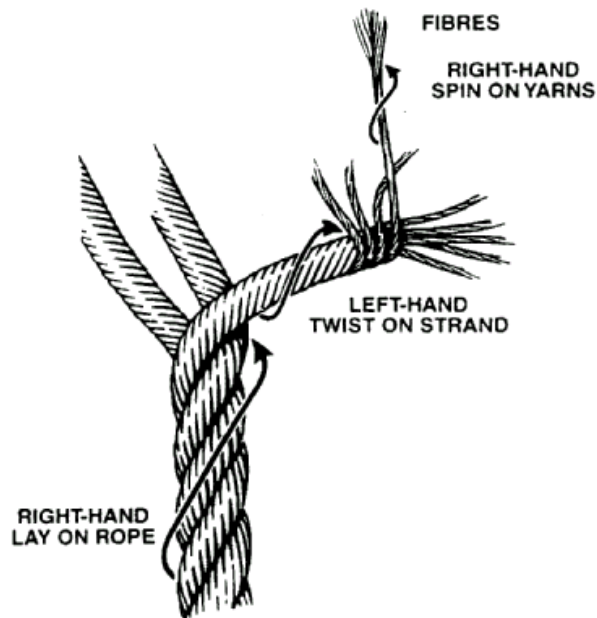
- 0201 Construction of Natural Fibre Rope
- 0202 Care and Maintenance of Natural Fibre Rope
- 0203 Types of Natural Fibre Rope
- 0204 Construction and Characteristics of Man-Made Fibre Rope
- 0205 Types of Man-made Fibre Rope
- 0206 Care and Maintenance of Man-Made Fibre Rope
- 0207 Elementary Safety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

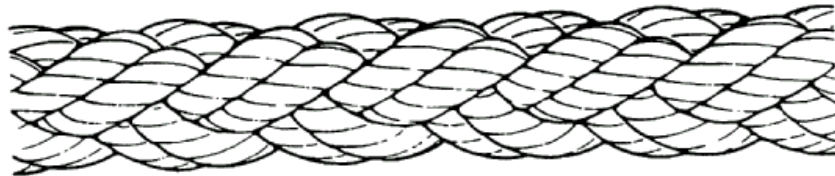
Manila	One Black yarn in each of two strands
Sisal	One Red yarn in one strand
Polyamide	One Green yarn/filament in one strand
Polyester	One Blue yarn/filament in one strand
Polypropylene	One Brown yarn/filament in one strand
Polyethylene	One Orange yarn /filament in one strand
Polyolefin	Two Orange yarns/filaments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

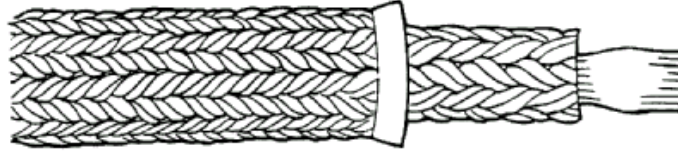


b) Braided Rope

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).

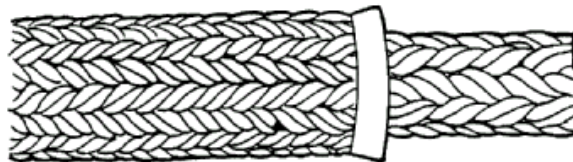
Braided Rope with Braided Core and Heart of Parallel Strands



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 Hawsers

- 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.

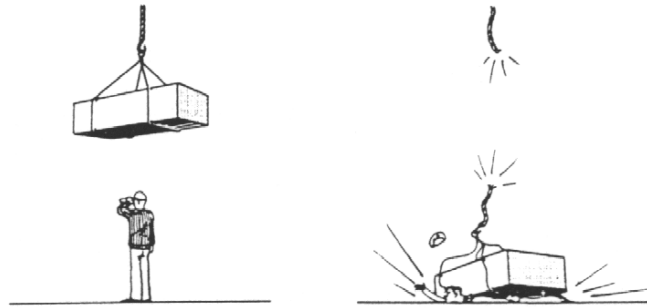
One method of avoiding these turns, should the end of the rope not be free, is to turn the coil

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.

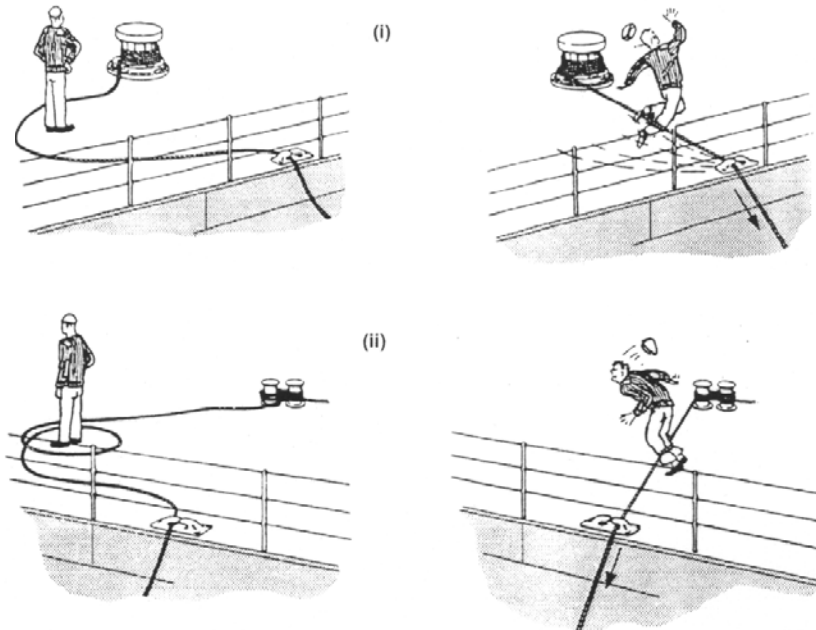
0208.2 Coiling Down

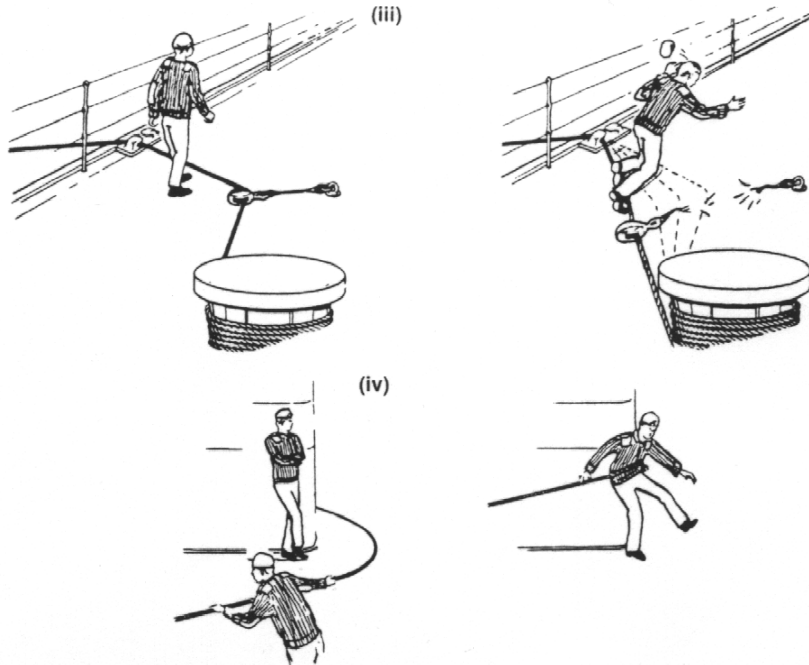
Cordage is very resilient and will absorb a number of turns in its length without becoming snarled if the length is sufficient and turns correspond with the lay of the rope; if the turns are against the lay however, it will quickly become snarled. For this reason rope of right-hand lay is always coiled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

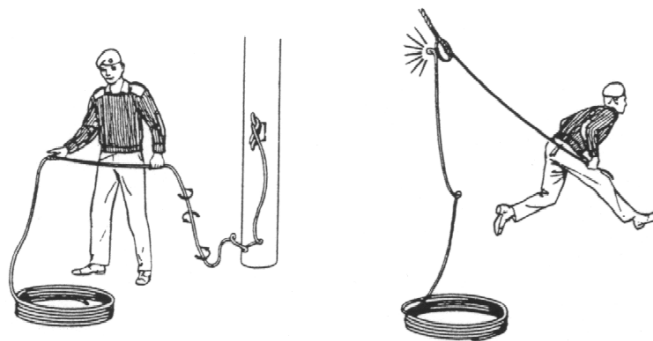




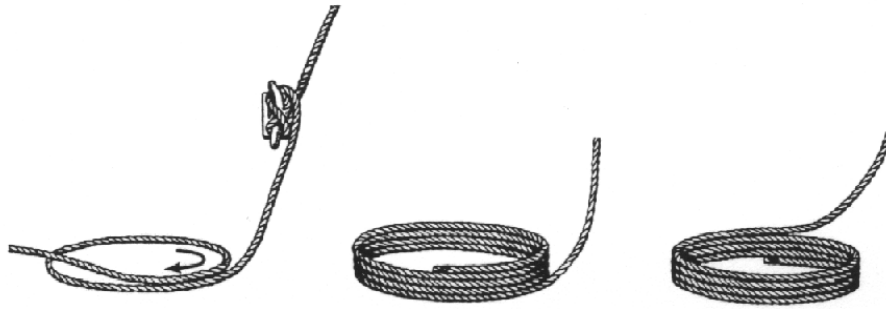
0208.3 To Coil a Rope for Running

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.



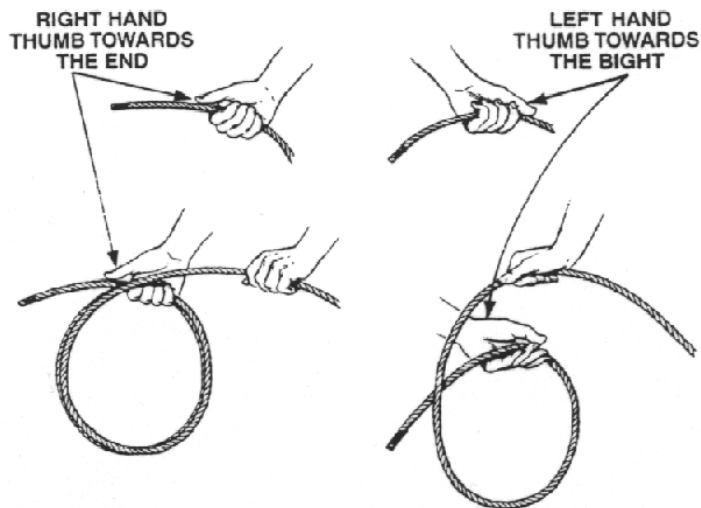
To Coil a Rope for Running.



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.

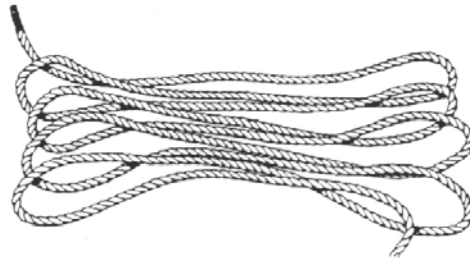
Coiling a Small Line.



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.

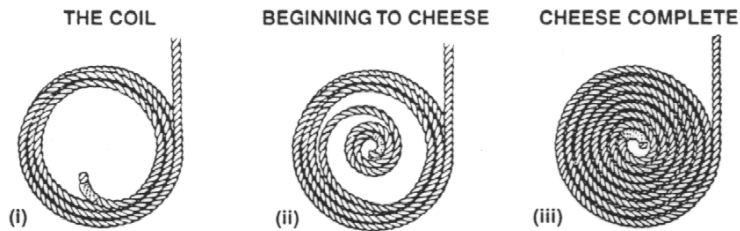
Faking down a rope.



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.

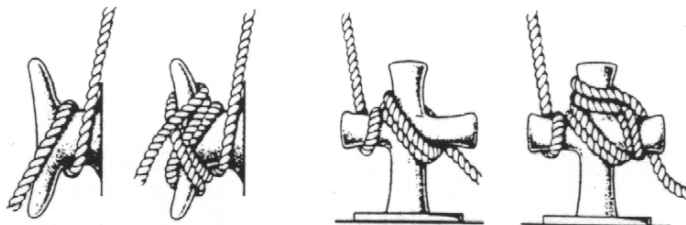


0208.7 Belaying

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

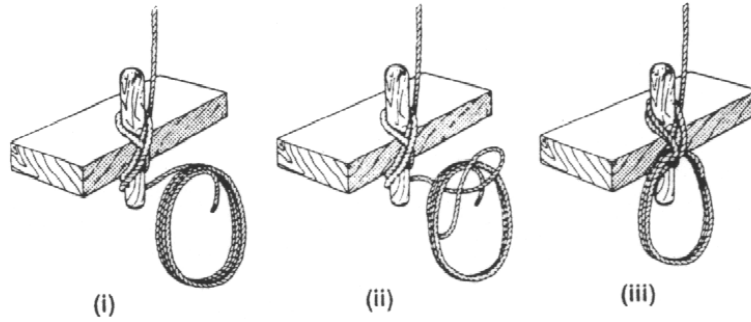


0208.8 Hanging a Coil on a Belaying Pin or a Cleat

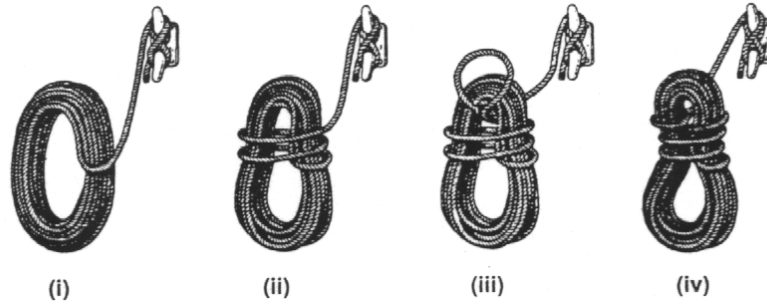
When belaying a rope to a Belaying pin the turns should be taken in the same way as for belaying to a cleat.

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

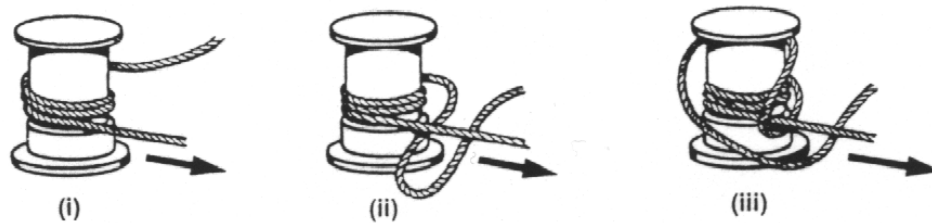


Hanging a Large Coil on a Cleat

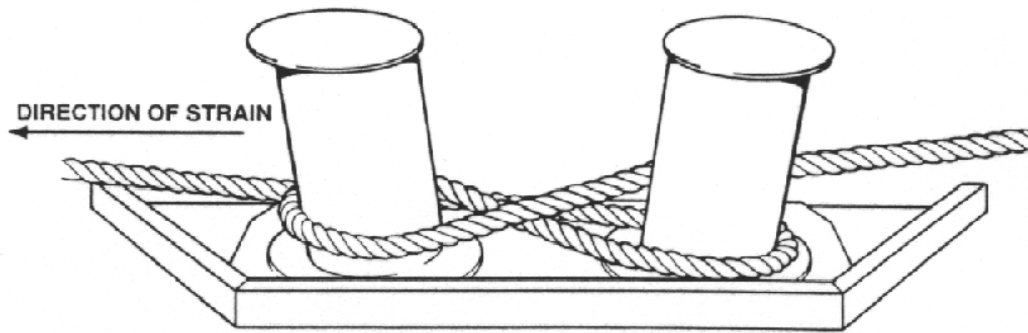


0208.9 Belaying to Bollards

a) Belaying a Fibre Rope to a Single Bollard

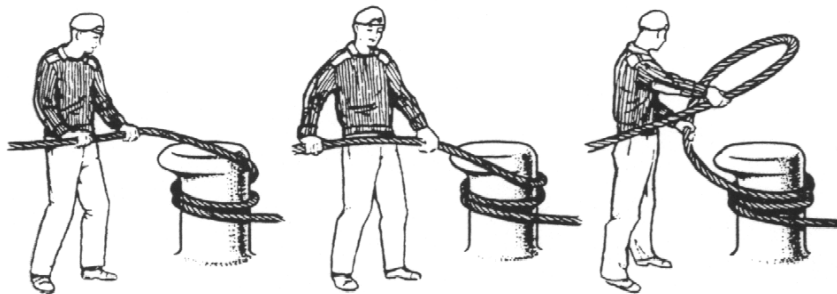


b) Belaying a Wire or Fibre Rope to Twin Bollards



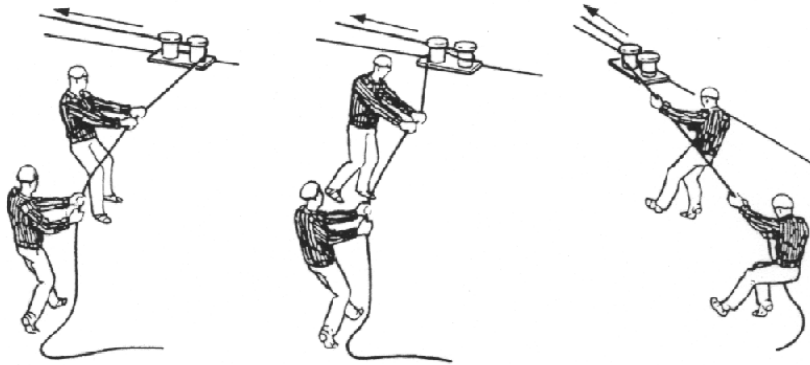
0208.10 Catching a Turn on a Single Bollard

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).



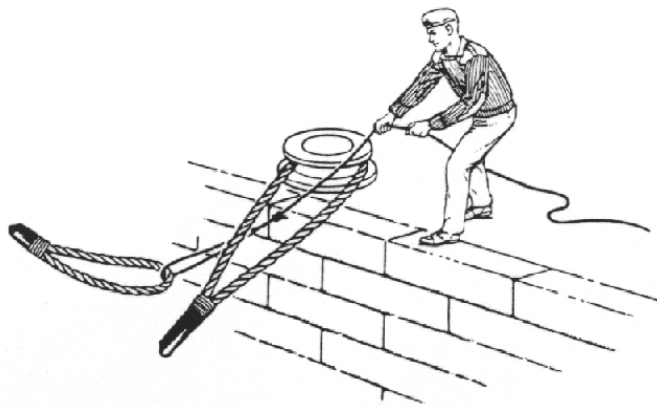
0208.11 Catching a Turn Round Twin Bollards

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

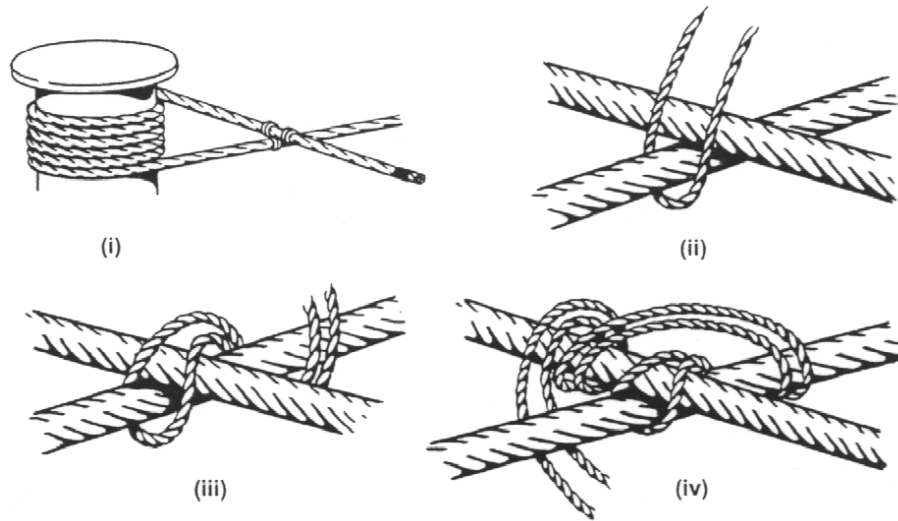
When it is necessary to secure two or more berthing hawsers to a single bollard, the eye of the second hawser should be passed through the eye of the first hawser and then secured to the bollard; similarly, the eye of a third hawser would be passed through the eyes of the first two; this enables the 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

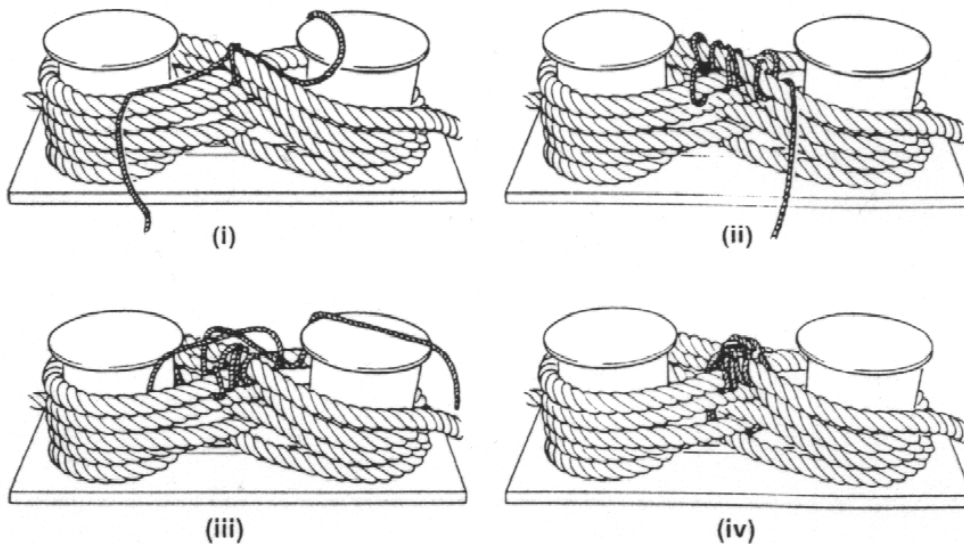
A length of line is used for the racking. Middle the racking underneath the rope; pass both parts of the racking over the end and under the rope; take a turn round the end. Pass the racking under the rope, and repeat the process as often as required. To finish, separate the parts of the racking, bring 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

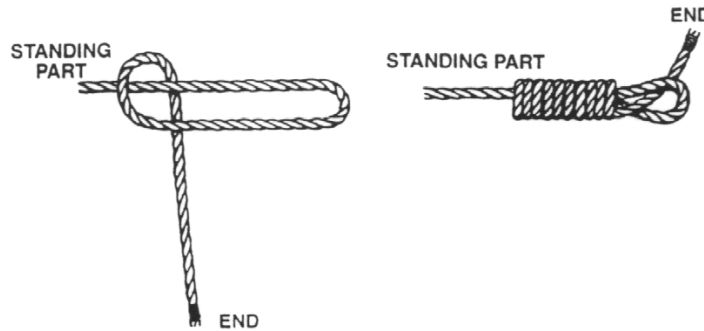
0210 THE HEAVING LINE

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

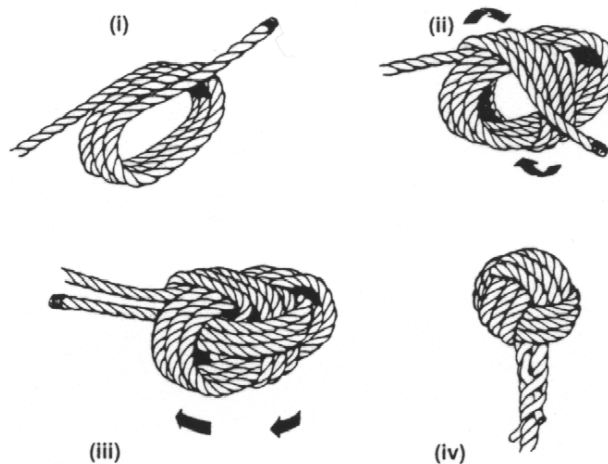
This provides a temporary weight in the end of a rope and is quickly and easily made. Form a bight at the end of the line then take turns round the bight back towards the loop. When reaching the end of the rope having applied sufficient turns, take the end through the loop, hold the complete knot in 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

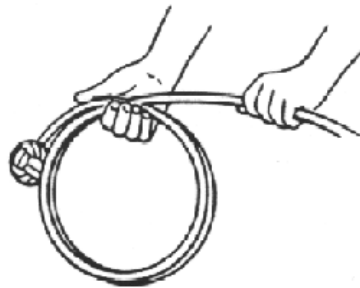
When possible, it should be wetted (provides additional weight) prior to making up. The non-weighted end should be secured to a rail, stanchion or post (if passing a hawser ashore - secure to the eye with a bowline). The standing end should never be secured to the wrist.

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.

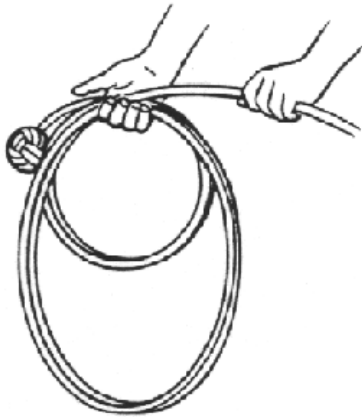
The second method is used if you are unable to throw the heaving line over the side. Start with the monkey's fist in the throwing hand, make small coils with the first 5-6 metres then make larger coils with the remainder of the heaving line. The end can then be secured and the large coils transferred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



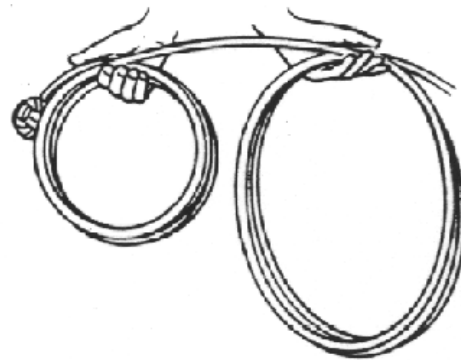
STAGE 1



STAGE 2



STAGE 3



STAGE 4

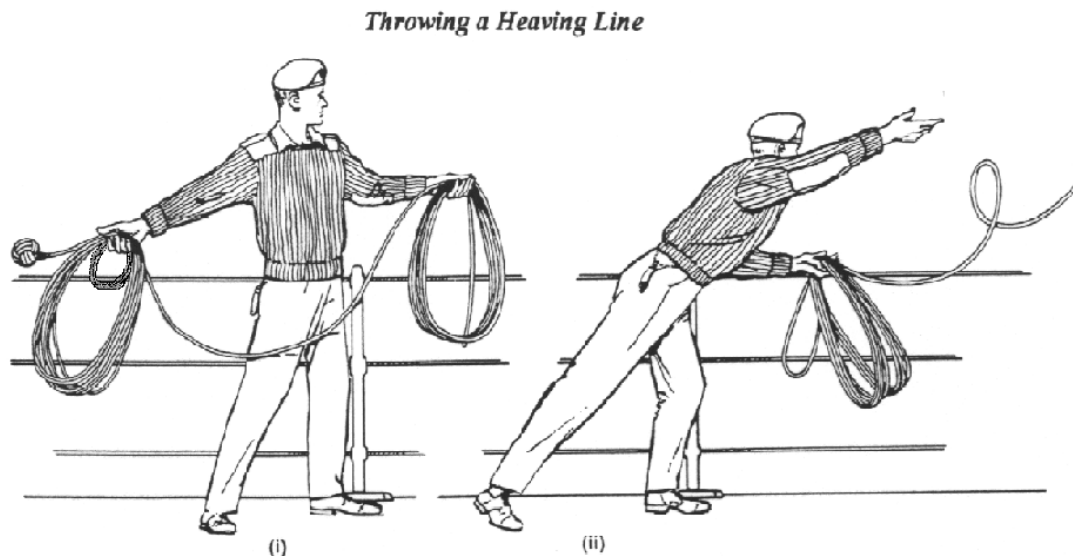
0210.4 Throwing the Leaving Line

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.



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

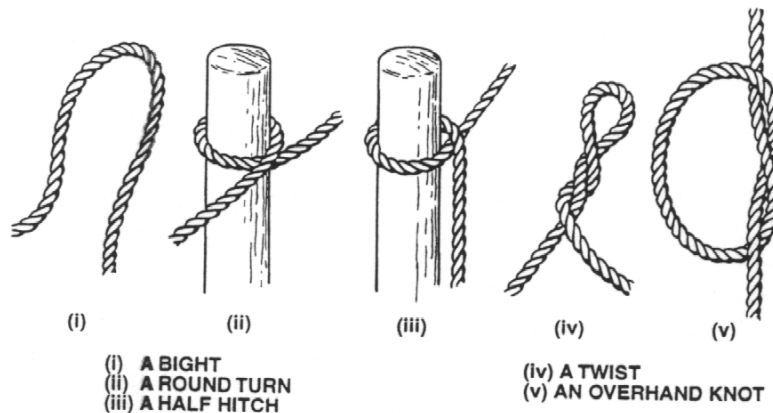
Running Bowline

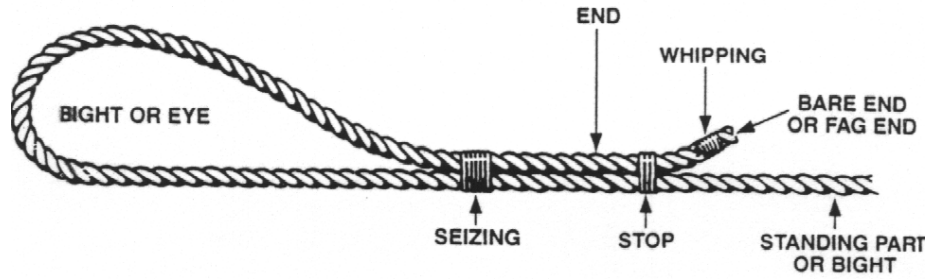
Bowline on the Bight

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.



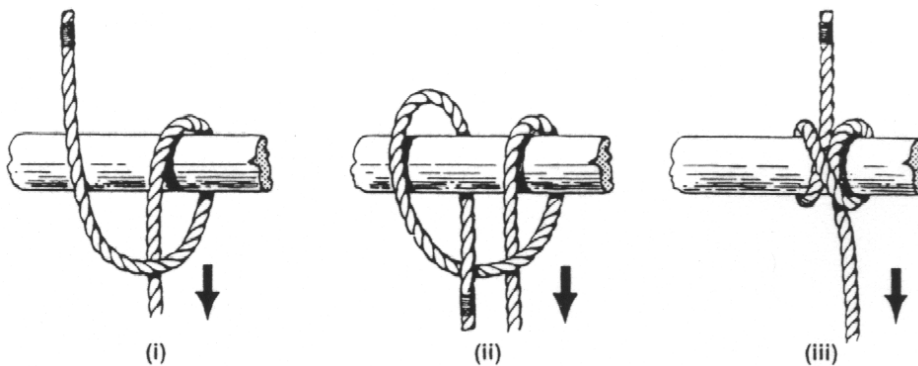
0302.3 Reef Knot
thickness.

Used as a common tie for two ropes of equal



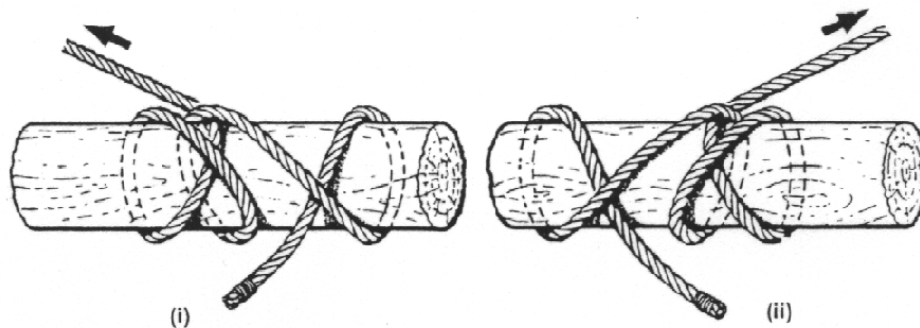
0302.4 Clove Hitch

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



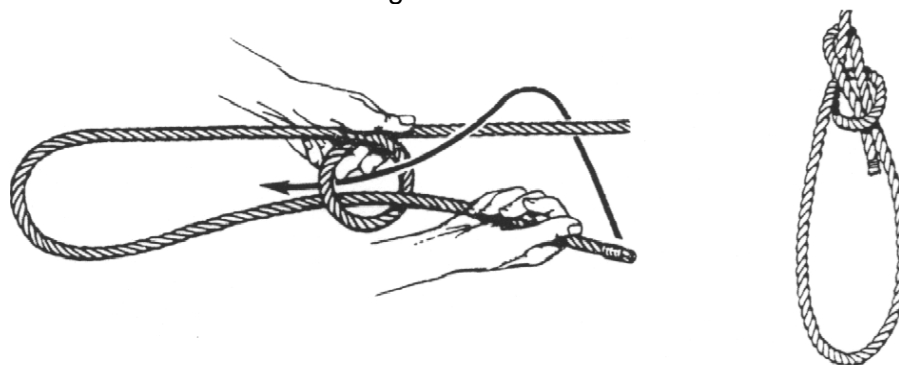
0302.5 Rolling Hitch

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



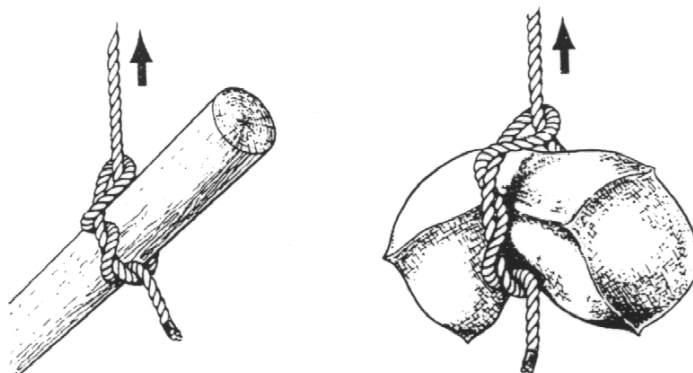
0302.6 Bowline

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).



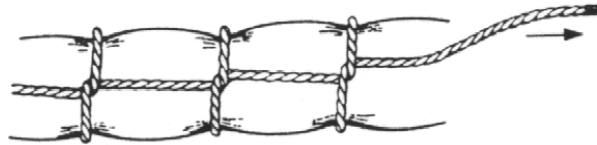
0302.10 Fishermans Bend

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

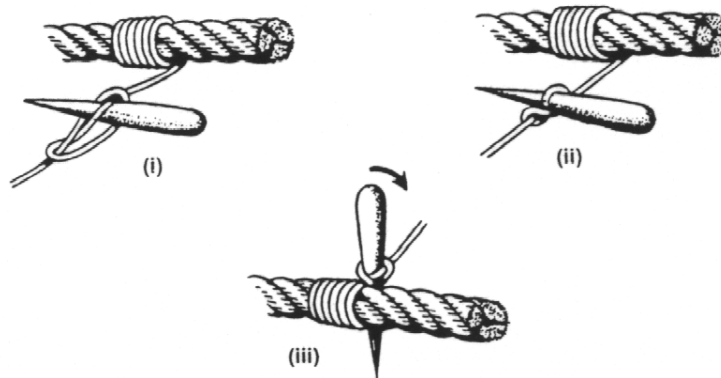


0302.11 Marline Hitch

Used for lashing long bundles such as awnings and sails.

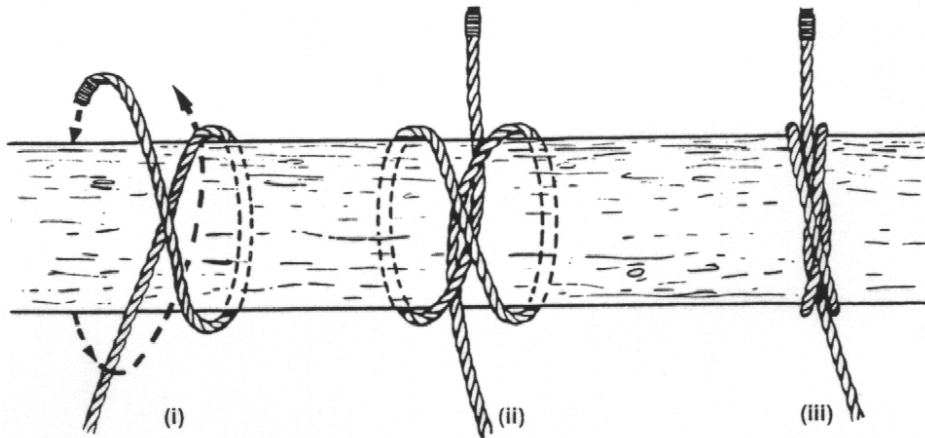


0302.12 Marline Spike Hitch Used for securing a marline spike, or hook, into the bight of a rope.



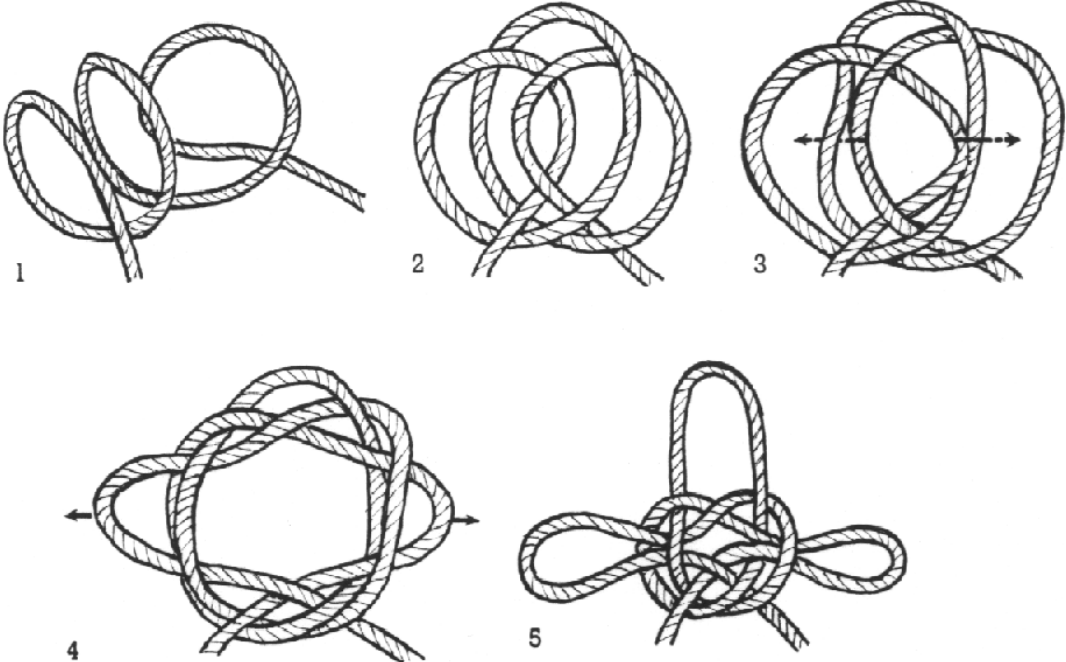
0302.13 Constrictor Knot

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



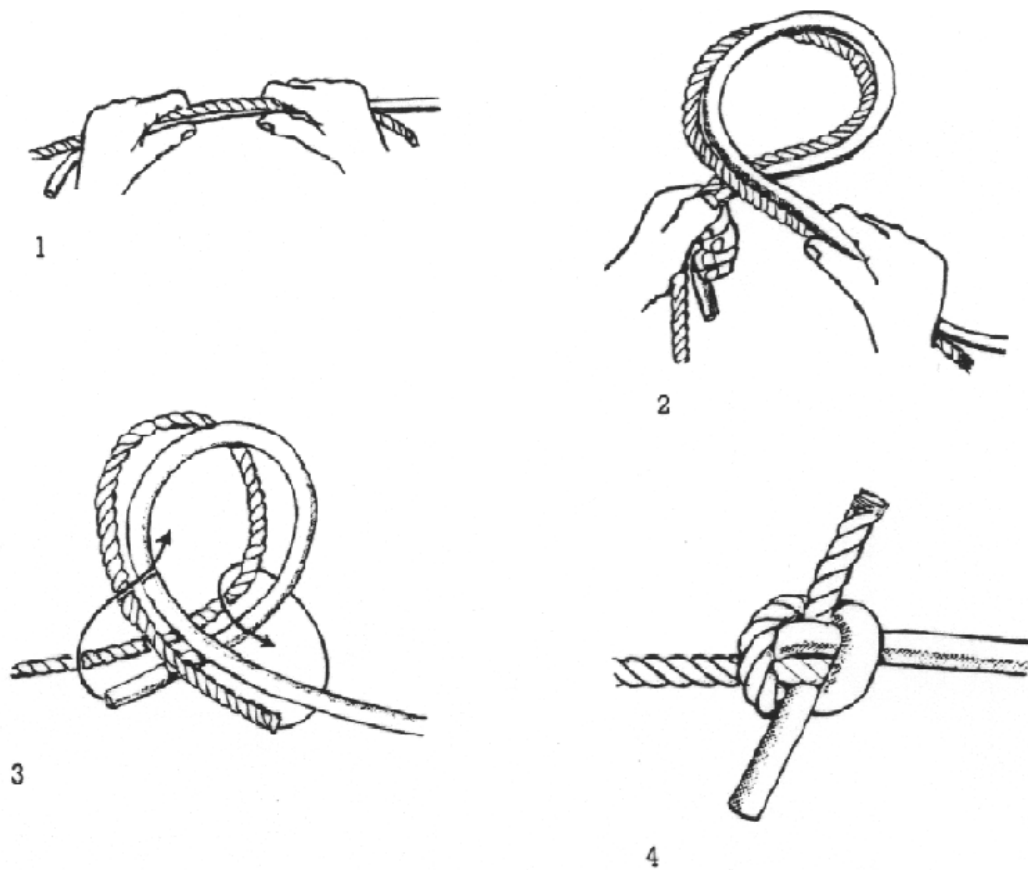
0302.14 Jury or Masthead Knot

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



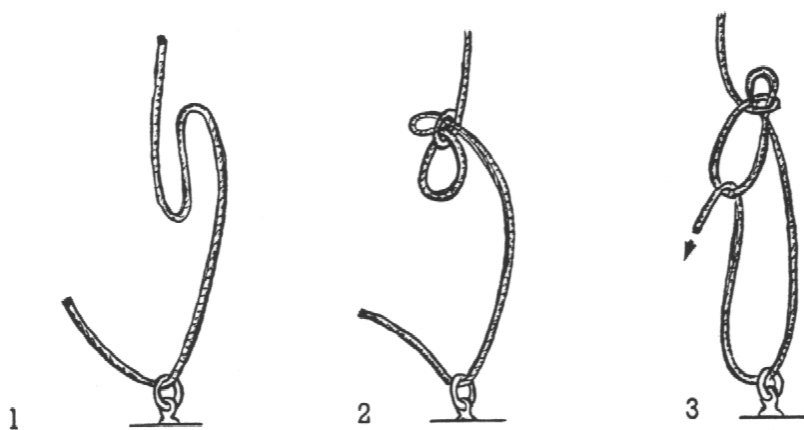
0302.15 Hunters Bend

Used for joining two slippery synthetic ropes together



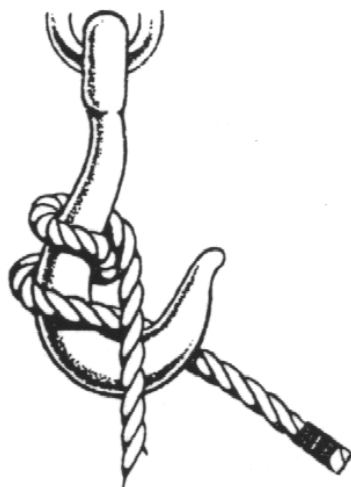
0302.16 Waggoner's or Lorry Driver's Hitch

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



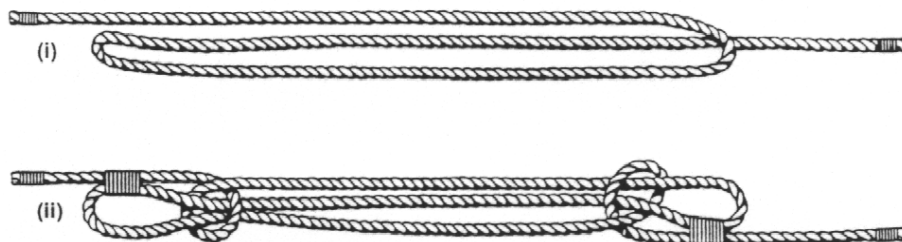
0302.17 Double Blackwall Hitch

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



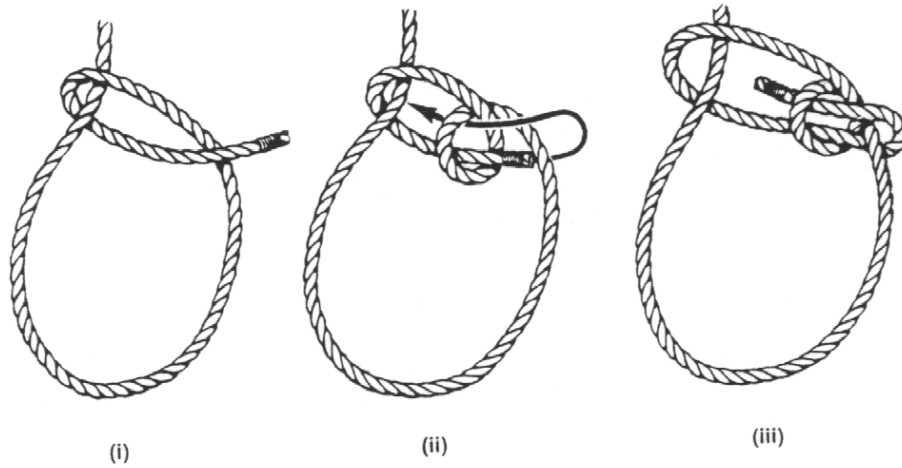
0302.18 Sheepshank

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



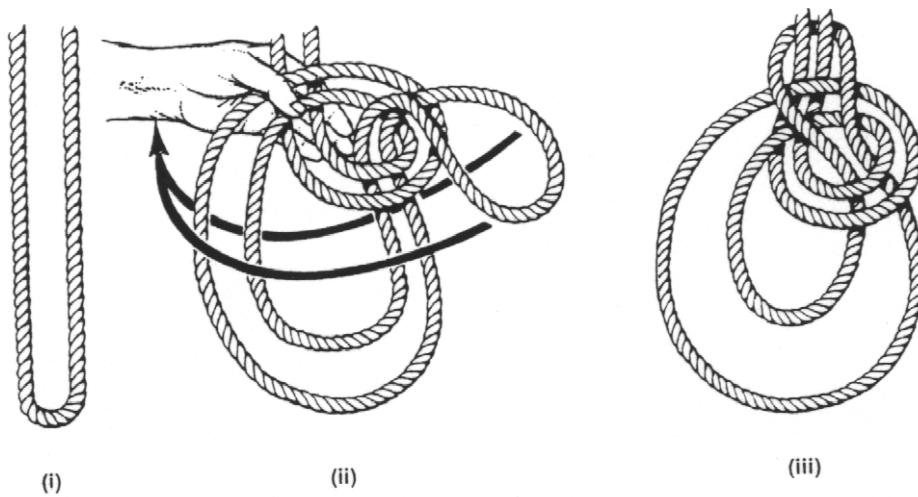
0302.19 Running Bowline

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**

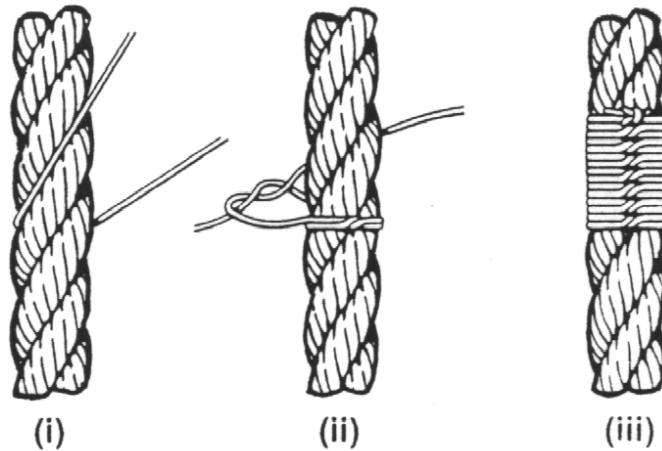
0401 WHIPPING

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.

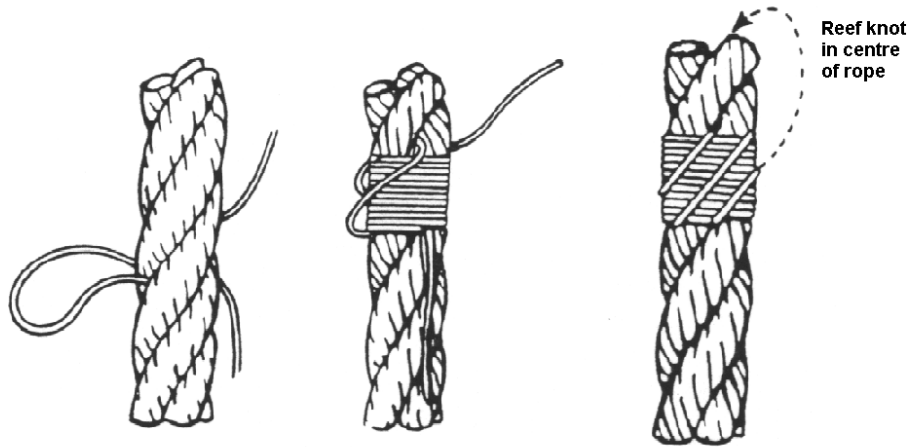


0401.2 Sailmakers Whipping.

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.

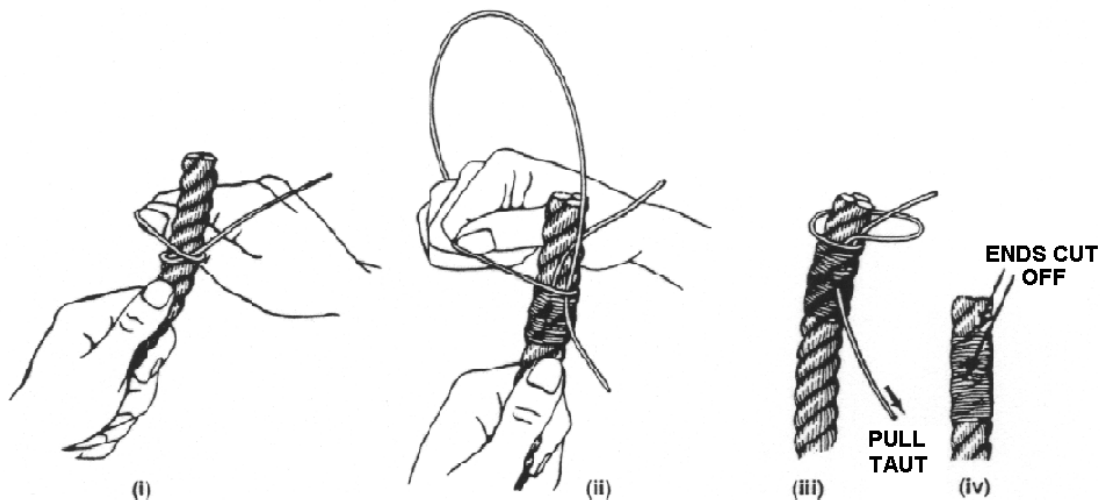
Sailmakers Whipping.



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.

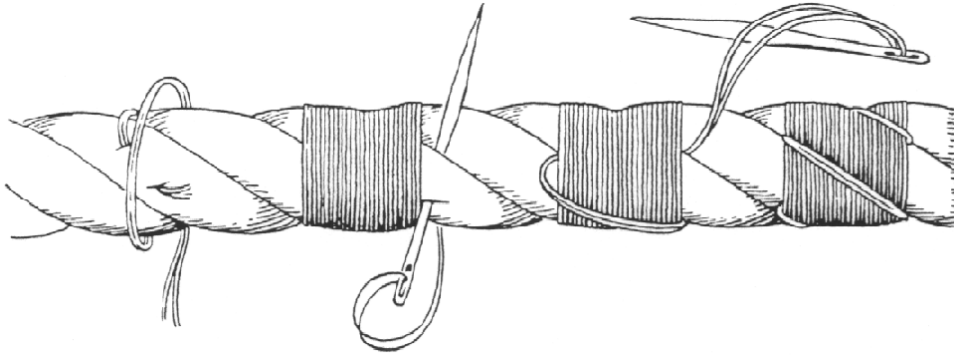
An alternative finish, which can be used when the whipping is on the bight of the rope, is to take the last three or four turns loosely over one finger and pass the end back through them. Work the turns taut and haul the end through and taut in the normal way.



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.

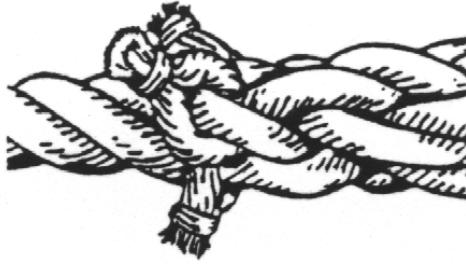
0402.3 Dogging

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).***

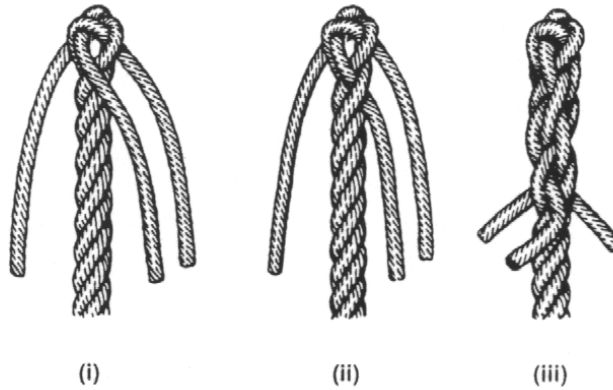
Having completed dogging each of the strands, with a sharp knife carefully trim the ends ensuring to take care not to cut too close to the whipping.

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.

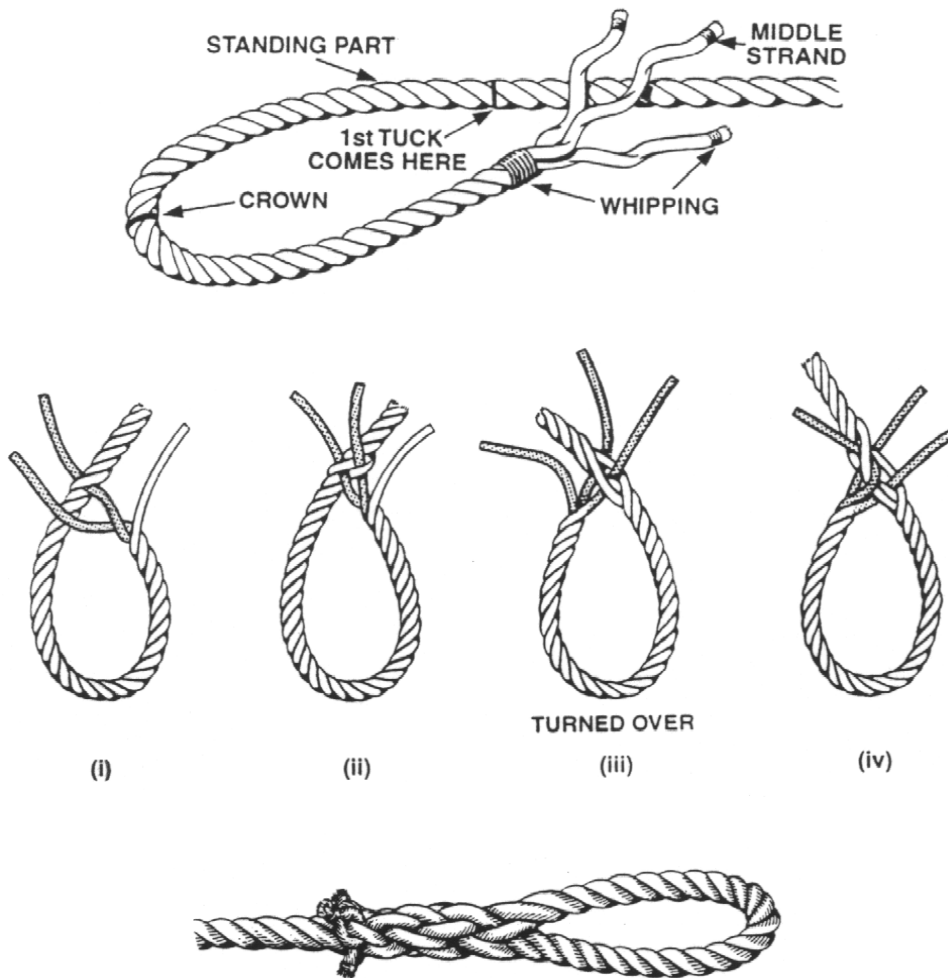


0402.5 Soft Eye Splice - Hawser laid rope

- 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.



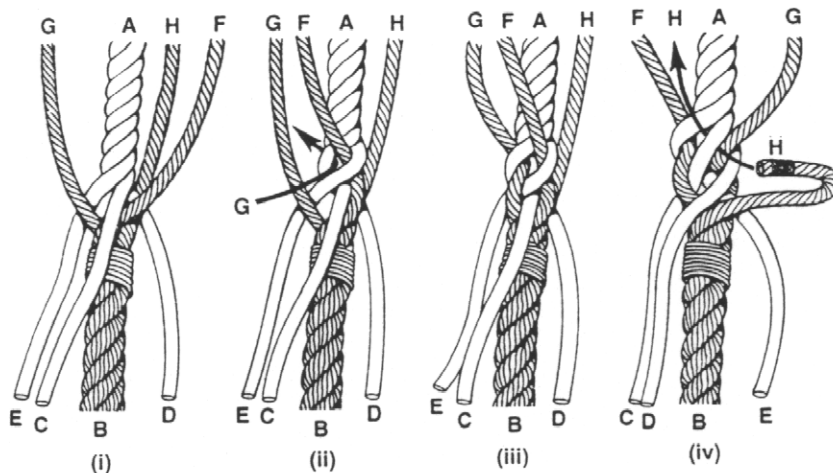
0402.6 Short Splice - Hawser laid rope

- 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

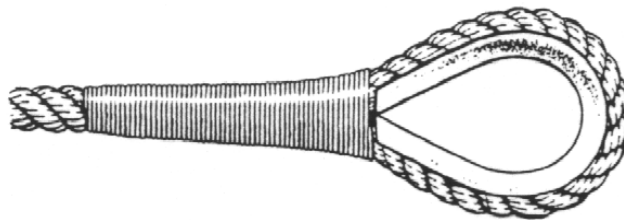
This is an alternative to the thimble eye and is just as efficient. It is ideal for converting a soft eye to a hard eye and then allows for the thimble to be easily removed or replaced.

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.

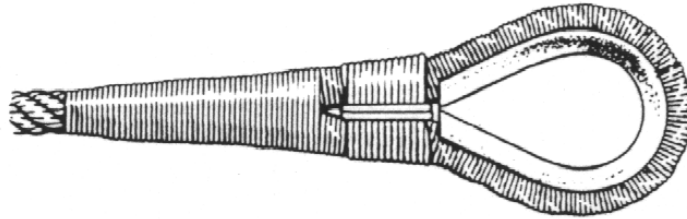
This method may be used on all types of rope including wire rope.

Examples of Hard Eye Splices

Thimble Eye

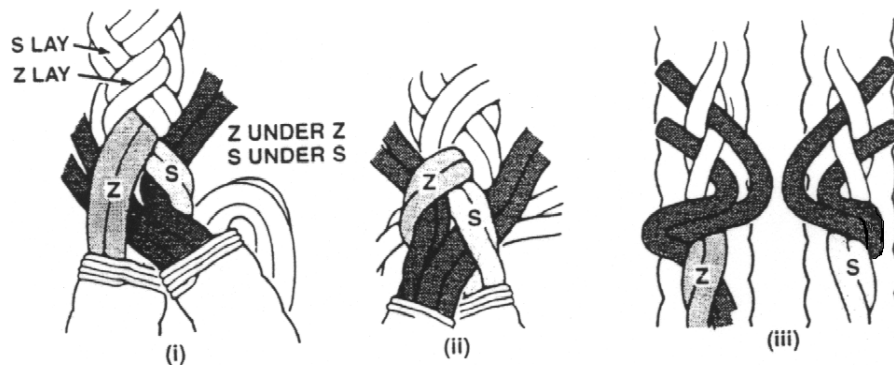


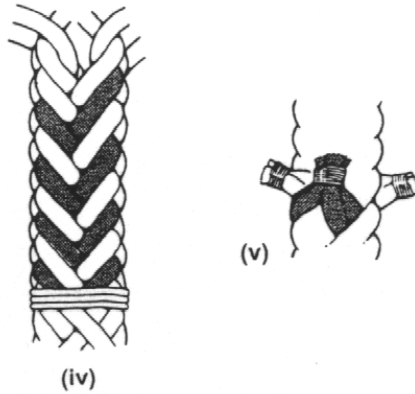
Hawser Eye



0402.9 Soft Eye Splice - 8 stranded Multi-plait rope

- 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)
- 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.
- 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).
- Turn the rope over and repeat with the remaining pairs of strands until the first full tuck with paired strands is complete. (Fig ii).
- 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).
- Finally complete the splice by dogging the ends (Fig v).

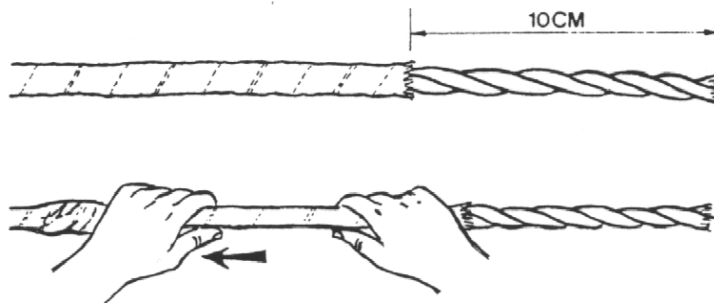




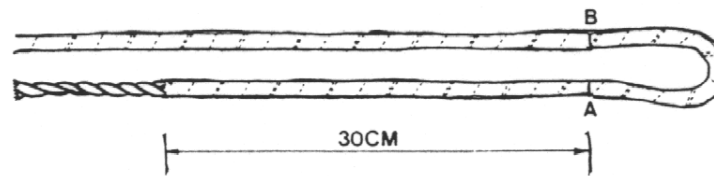
0402.10 Soft Eye Splice - Braided rope

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

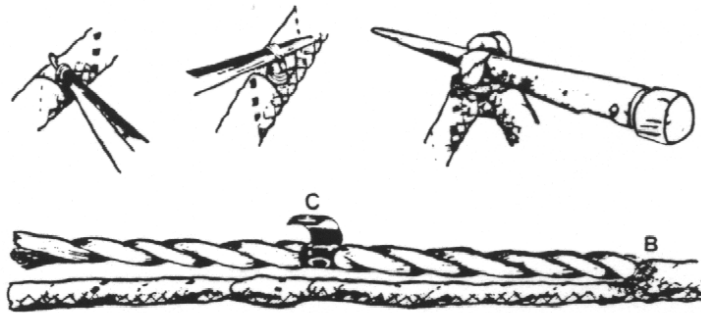
- a. Cut off the heat sealed end and push back the outer case exposing 10cms of inner core. Holding the end of the case to the core, push back the slack for about 1 metre. (An overhand knot can be tied to prevent the slack recovering).



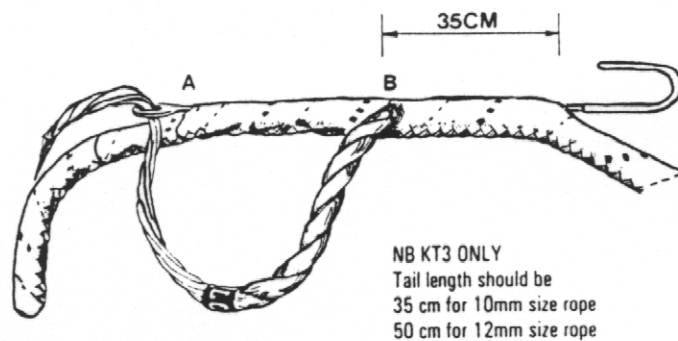
- b. Bend the rope and measure 30cms from the end of the case and mark (A) then mark (B) to the size of the eye required.



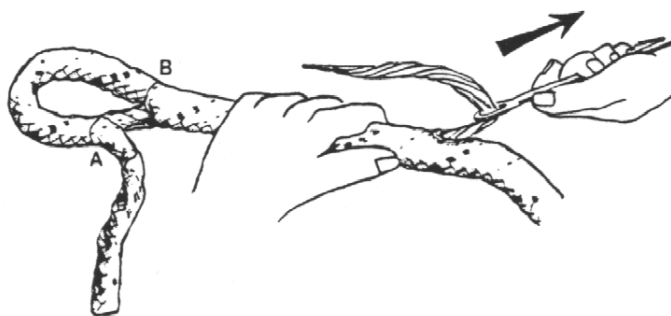
- c. With Swedish fid or pricker, open the case at mark (B) by lifting the strands making a small hole through which the inner core can be seen, then hook out the inner core. Pull out the core completely and the rope appears to have two tails. Pass a piece of tape around the inner core at point (C),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



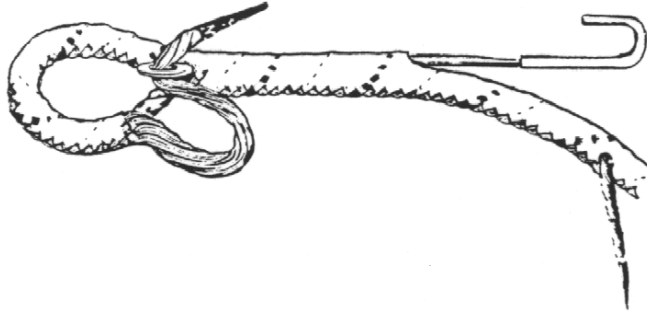
- d. Insert the splicing needle at a position 35cms from (B), taking care not to ensnare the inner core, push the needle down inside the outer case until it emerges at (A). Thread the tapered end into the eye of the needle.



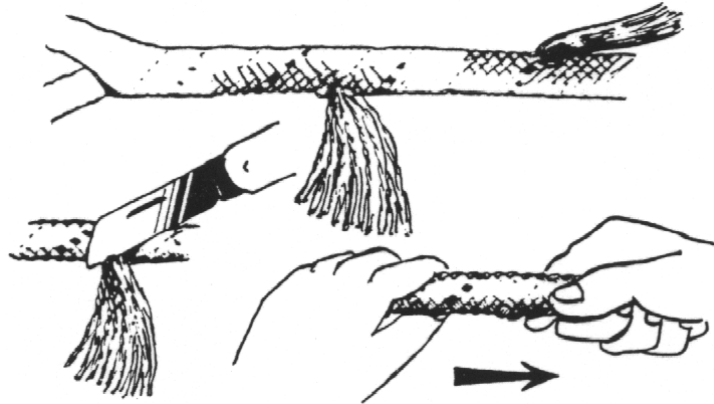
- e. Pull the splicing needle through the case and keep pulling until the eye has formed and the end of the inner core has emerged. Now push back some of the loose case in the outer cover towards the eye ready for the next stage of the splice.



- 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.



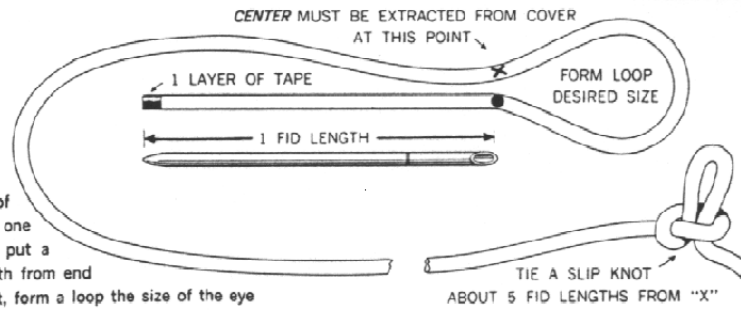
- h. If a thimble is required this can be inserted while the eye is being formed and before the ends are pulled tight.



Option Two

MEASURE THE EYE

STEP 1



First, tightly tape end of line to be spliced with one layer of tape. Then, put a Big DOT one fid length from end of rope. From the dot, form a loop the size of the eye you want, and mark as shown, with an "X". This is where you extract Center from Cover. (See next page) Now tie knot about 5 fid lengths from X.

STEP 2

EXTRACT CENTER FROM COVER



Bend the rope sharply at "X". Spread Cover strands apart firmly with the point of pusher, to make an opening, so you can pry out the Center (as seen in insert).

Mark one big line on the Center where it comes out. This is Mark #1.

Now, use your fingers to pull all the Center out of the

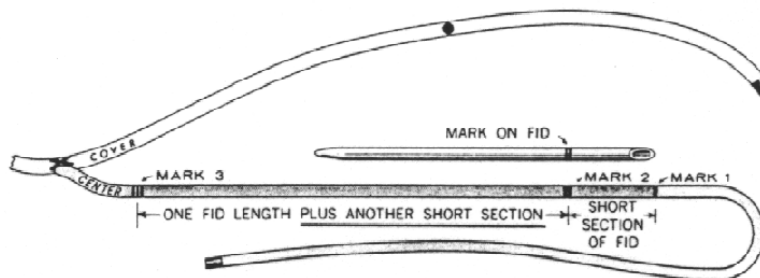
Cover from "X" to the end, as above.

You'll notice a paper identification marker tape inside the center. Pull on tape until it breaks at knot. You want to get rid of it so you can do splice.

Put a single layer of tape on end of Center.

MARK THE CENTER

STEP 3

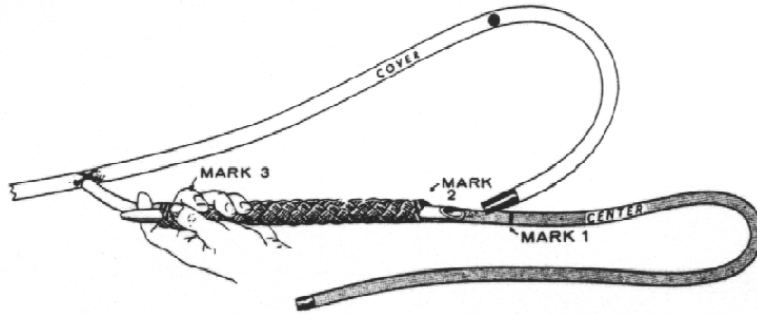


As shown, pull out more of the Center. From Mark #1, measure a distance equal to the short section of the fid. Mark two heavy lines. This is Mark #2. Now,

mark three heavy lines at a distance one fid length plus one short section of fid from Mark #2. Call this Mark #3. Compare your marks with picture above.

STEP 4

PUSH FID THROUGH CENTER "TUNNEL"



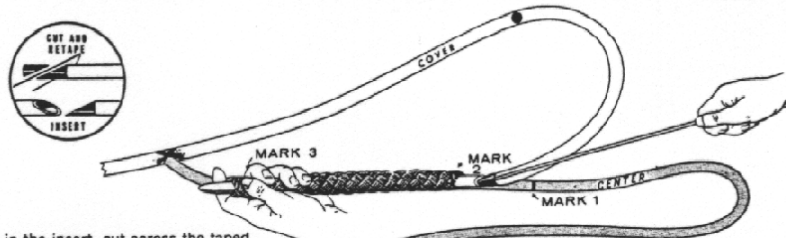
Using a thimble? See "Tips" on Back Cover.

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



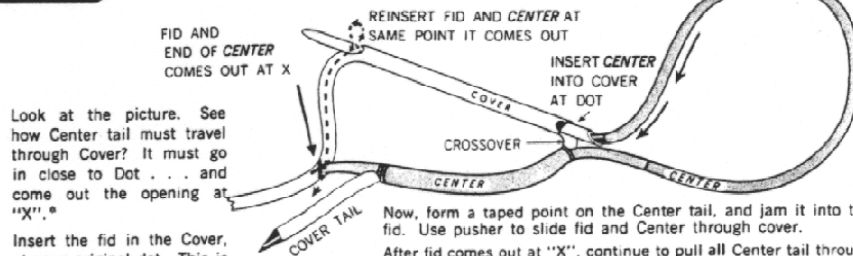
As in the insert, cut across the taped end of the Cover to form a point. Retape tightly with one layer of tape to make the point firm. Now, jam the taped point of the cover into the open end of the fid.

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.

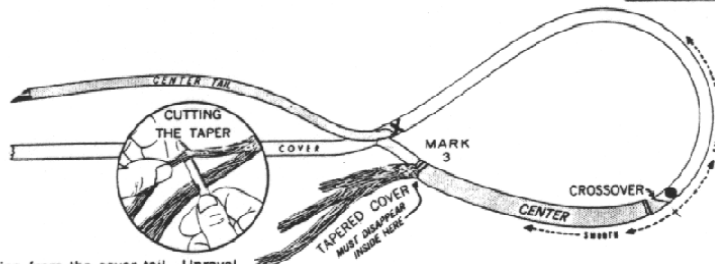
After fid comes out at "X", continue to pull all Center tail through the "tunnel". Pull it tight.

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

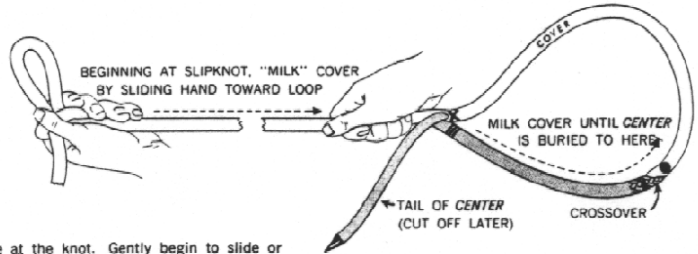


Cut off taped section from the cover tail. Unravel the cover tail braid (see insert) all the way to where it comes out of center of Mark #3. Cut off groups of strands at staggered intervals, as shown, to form a tapered end.

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



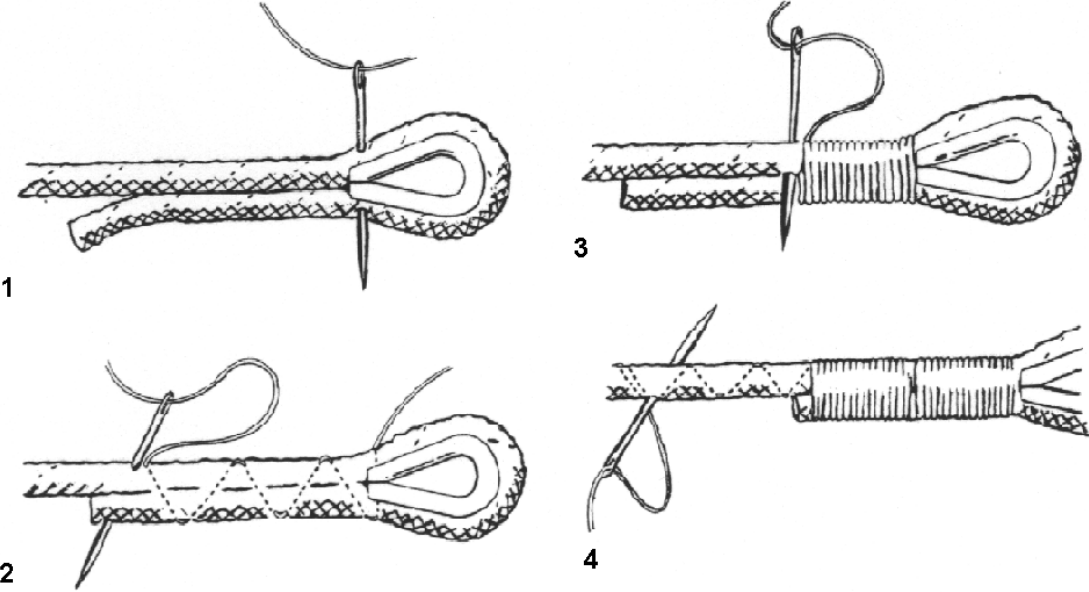
Next hold rope at the knot. Gently begin to slide or "milk" the Cover slack toward the loop. You'll now see the Center begin to disappear or "bury" in the Cover. Go back to the knot, and continue milking more

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

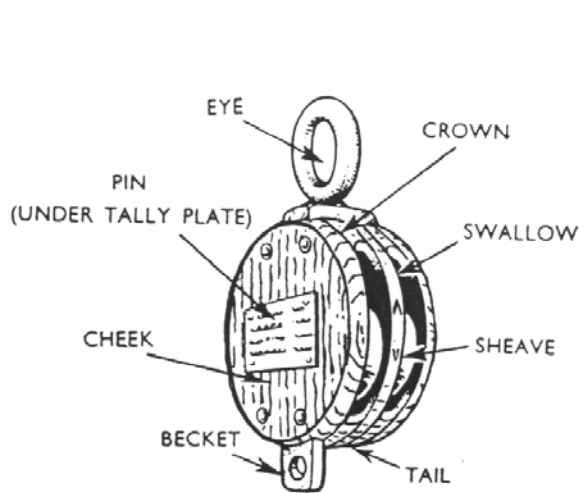
GENERAL RIGGING

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

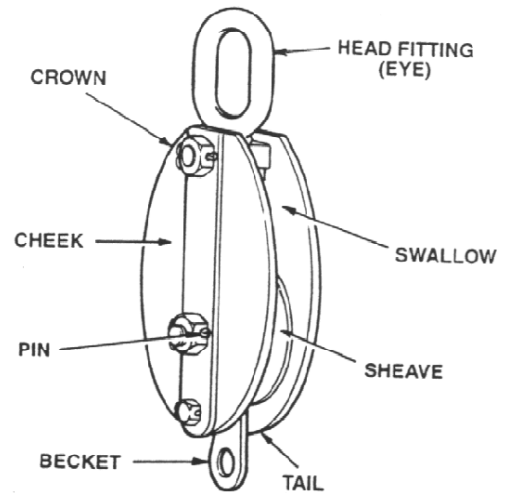
0501 BLOCKS

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

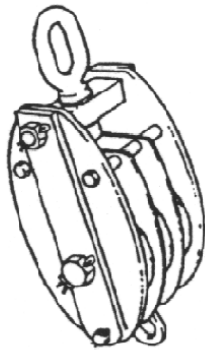


Built up type



Synthetic-resin Bonded Fibre (SRBF) blocks

Treble block



Double block



Single block

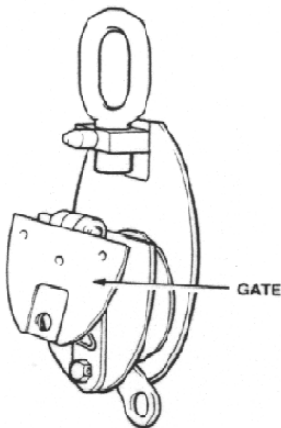


Snatch blocks

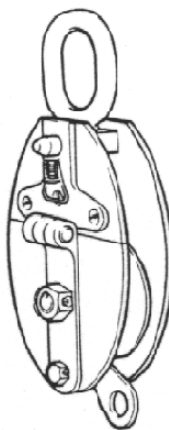
The principle of the block (showing the gate open and closed)

Metal

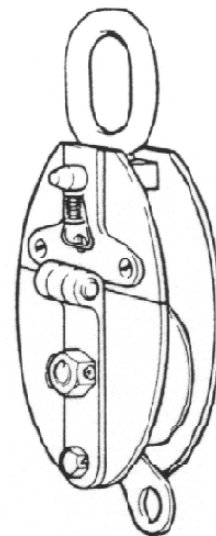
SRBF



GATE OPEN



GATE CLOSED

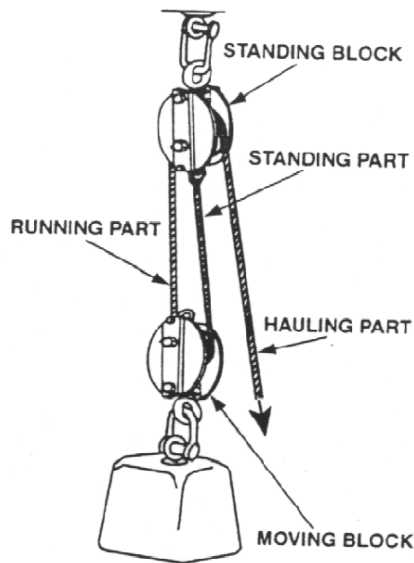


0503 PURCHASES AND TACKLES

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)

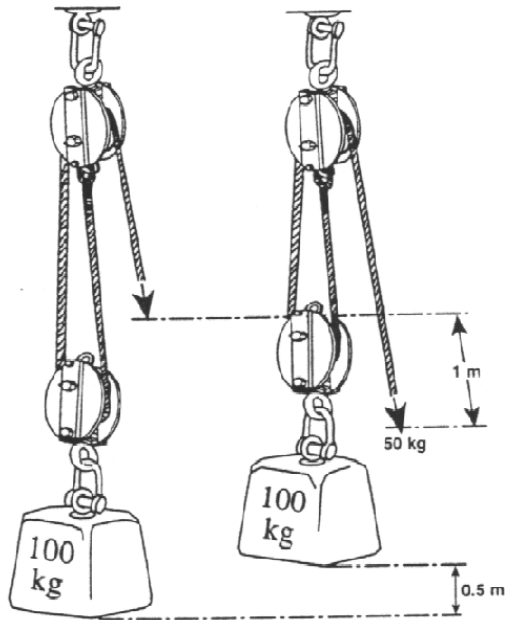
Mechanical Advantage is gained only at the speed of working. The ratio between the distance moved by the hauling part and that moved by the moving block is known as the Velocity Ratio (VR) and is always equal to the number of parts of the fall at the moving block.

0503.5 Friction in a Tackle

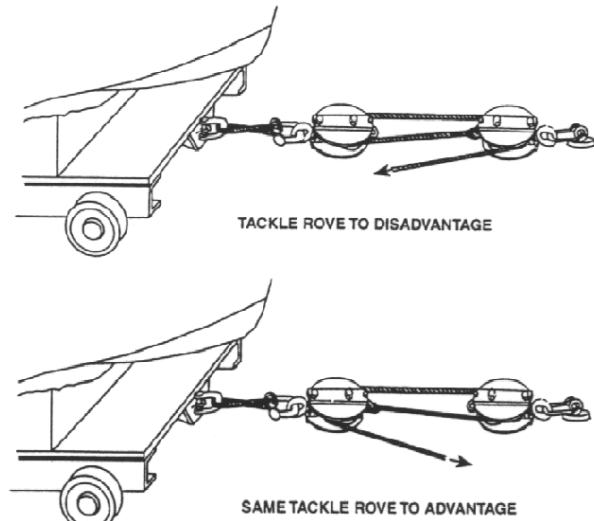
When a tackle is being worked considerable friction is set up, both in the bearings of the blocks and within the fall as it bends round the sheaves. This friction accounts for the difference between the velocity ratio (VR) of the tackle and its mechanical advantage (MA). (It is important therefore to 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.

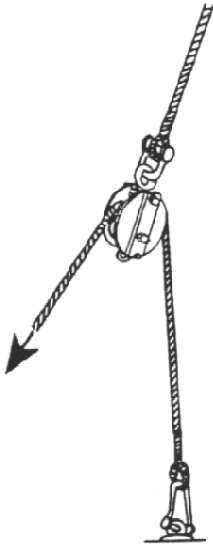
Three fold Purchase - consists of two treble blocks and is used where a heavier weight is required to be lifted. To Advantage the VR is 7 and the MA 4.37, to Disadvantage the VR is 6 and the MA 3.75.

(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).

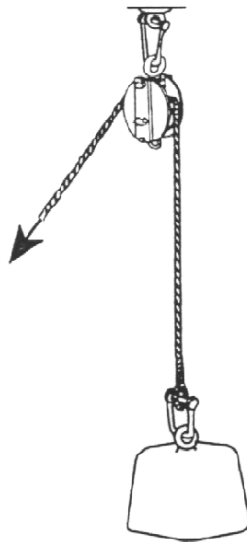
No block is to be used for lifting loads greater than the Safe Working Load shown on it.

Examples of Whips and Tackles

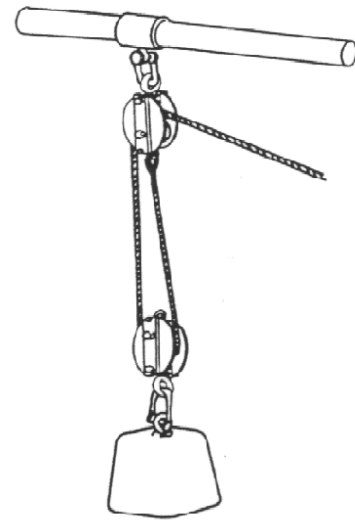
A Runner



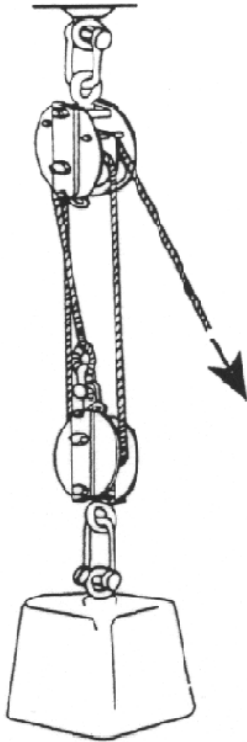
A Single Whip



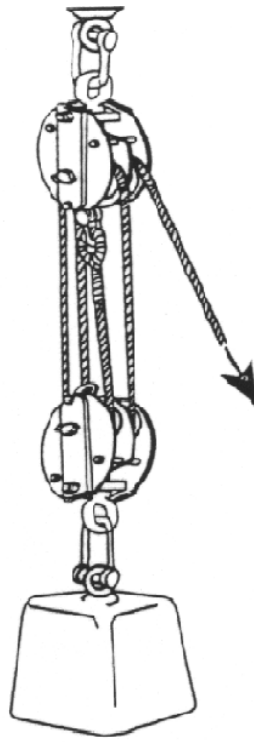
A Double Whip



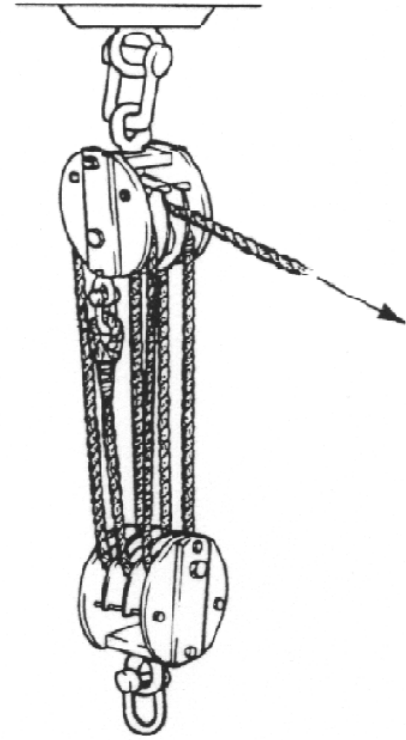
A Luff



A Two Fold Purchase



A Three Fold Purchase



0503.8 Racking and Choking

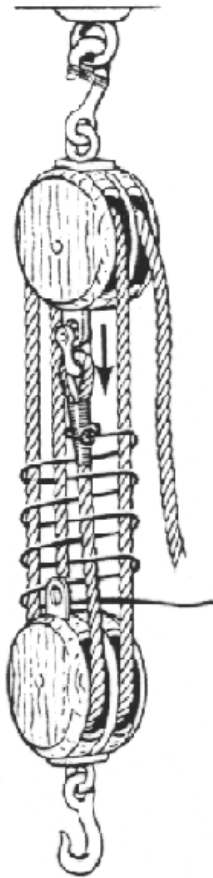
Racking

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.

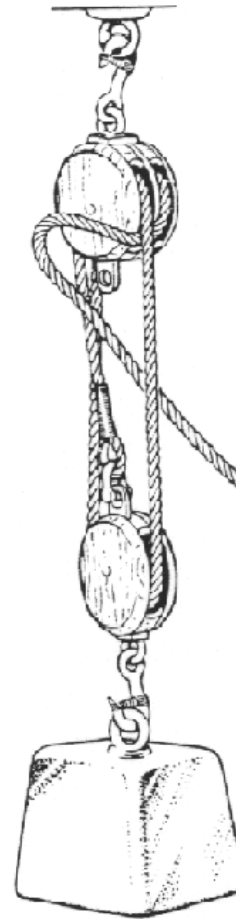
Choking the Luff

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.

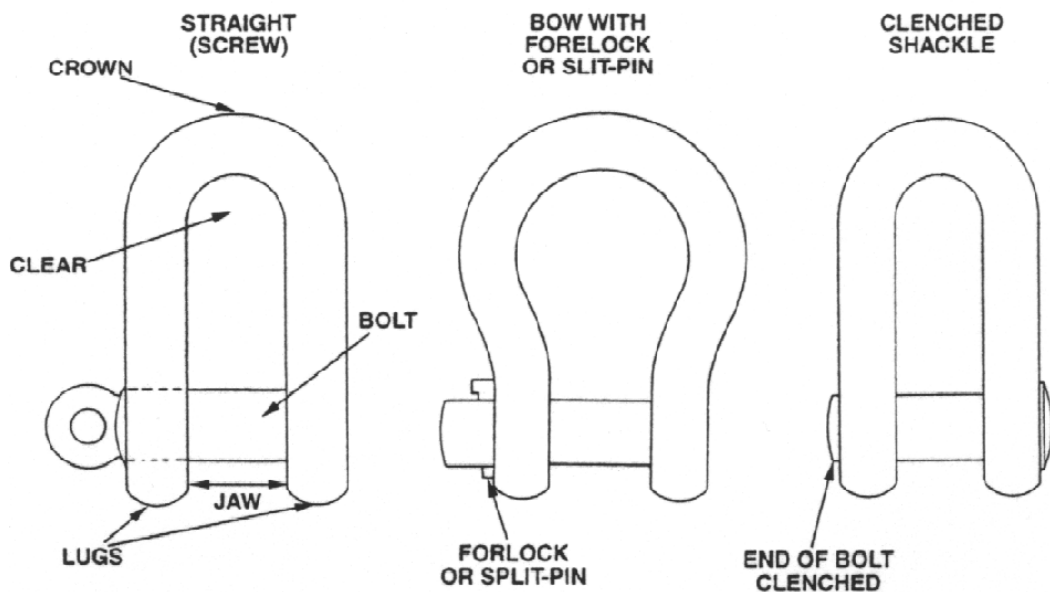
0504.3 Types of Rigging Shackle

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.

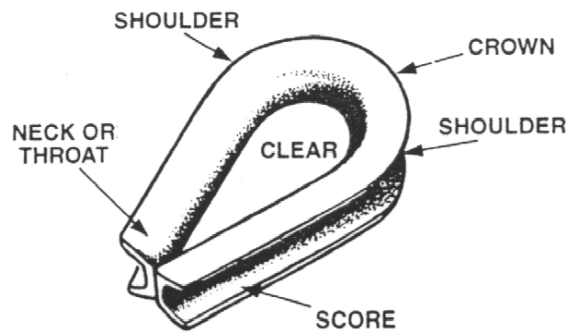
Examples of Rigging Shackles



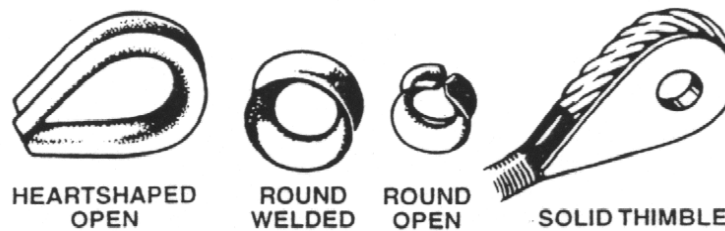
0505 THIMBLES

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

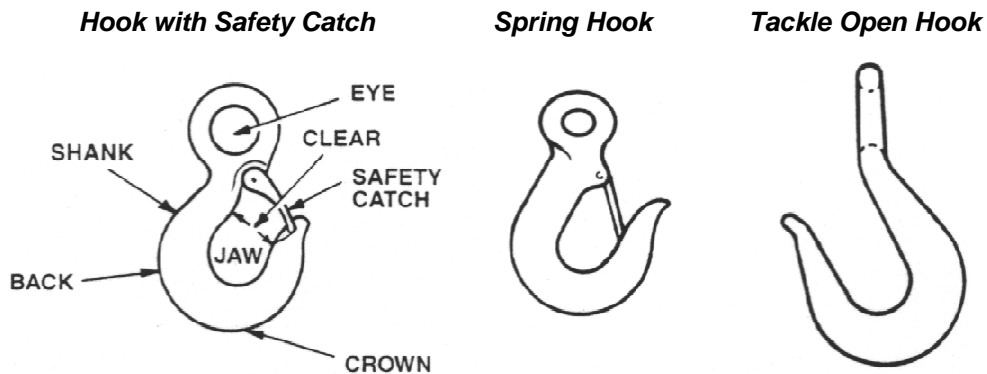


0506 HOOKS

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.



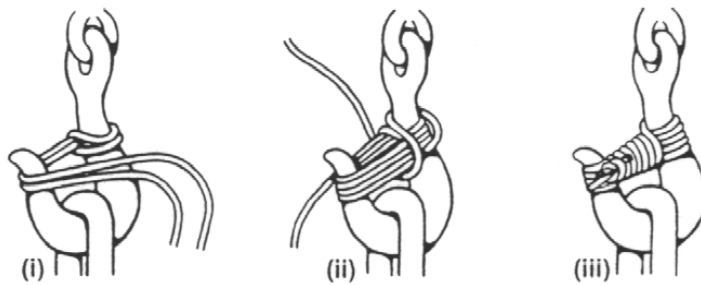
0507 MOUSINGS

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

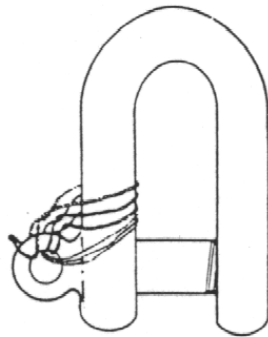
A length of line will provide a tighter mousing in preference to wire. The line should be

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.



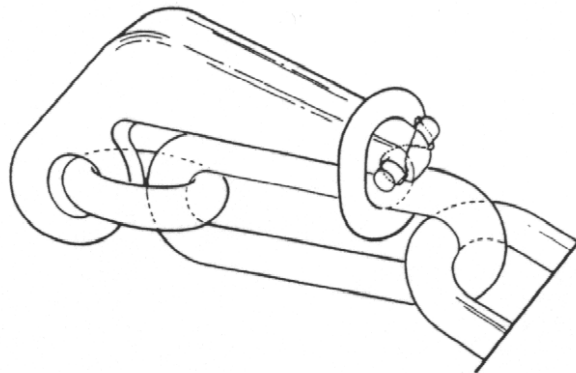
0507.2 Mousing a Shackle

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.

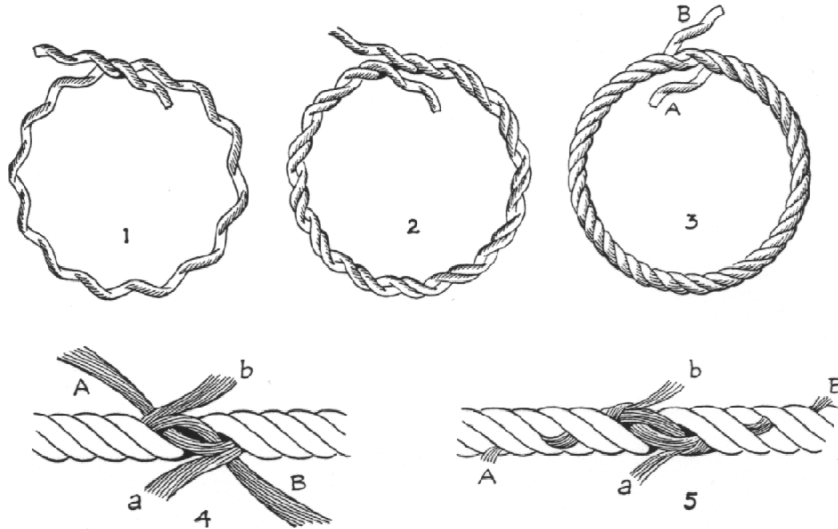
0508.1 Types of Strop

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.

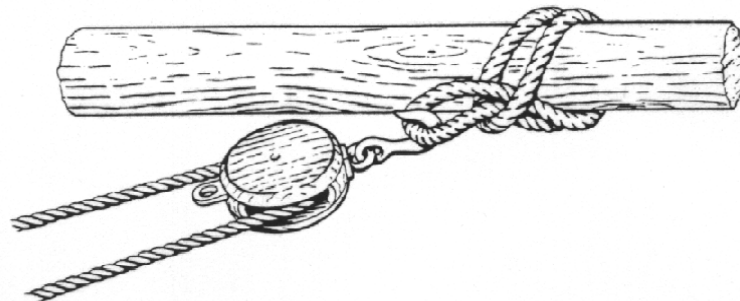
Salvagee Strop - this is used for the same purposes as the common strop, but has the virtue of being able to grip a spar, or other object, more strongly so that it will withstand a sideways pull. It is made of spunyarn and has no specified length or breaking strain. (To make the strop, use two pegs, nails (or even chair legs) at a set distance apart; pass the spunyarn around both pegs keeping the spunyarn 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.



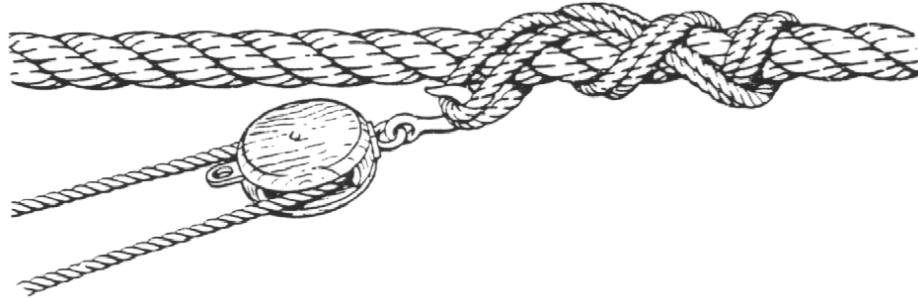
0508.2 Attaching a Strop to a Spar

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



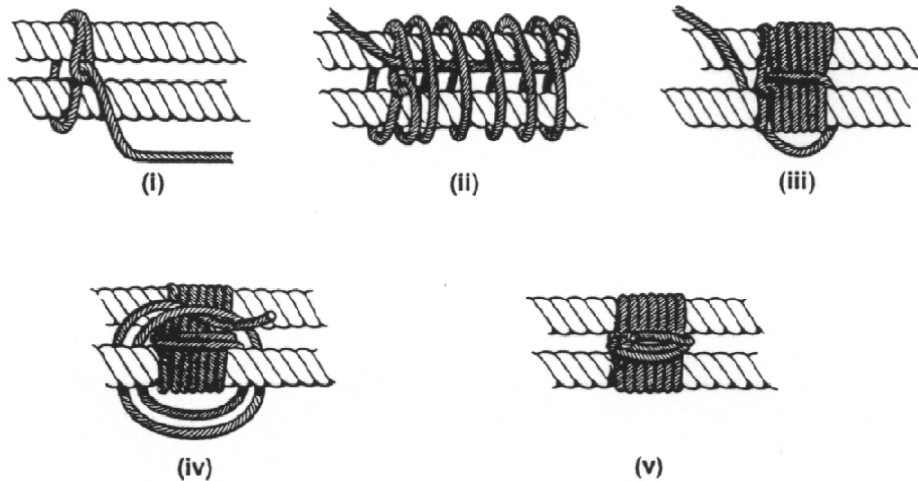
0509 SEIZINGS

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).



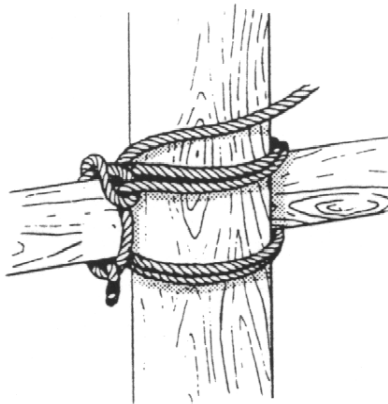
(Other seizings currently included in the Admiralty Manual of Seamanship are not included in the Sea Cadet Seamanship syllabus).

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.

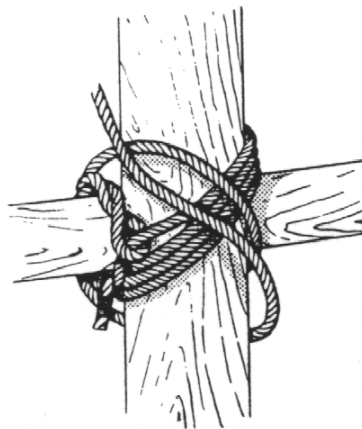
0510.1 Square Lashing

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.



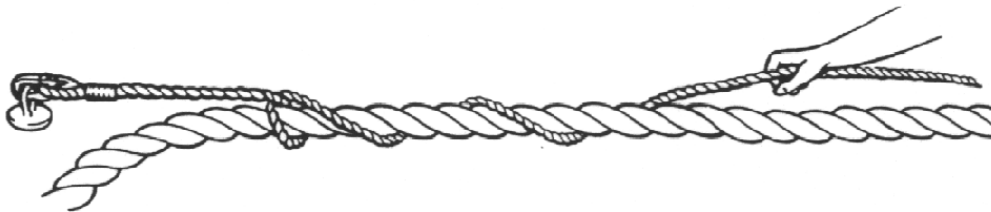
If two or more poles or spars are required to be lashed together side by side, a lashing in the form of a flat seizing should be used. The number of seizings required will vary depending on the length of the poles or spars at the join. (Two wedges or spikes are recommended to keep both poles or spars 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.

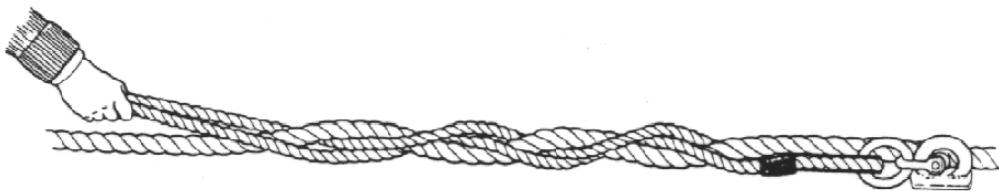
0511.1 Natural Cordage Stopper

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

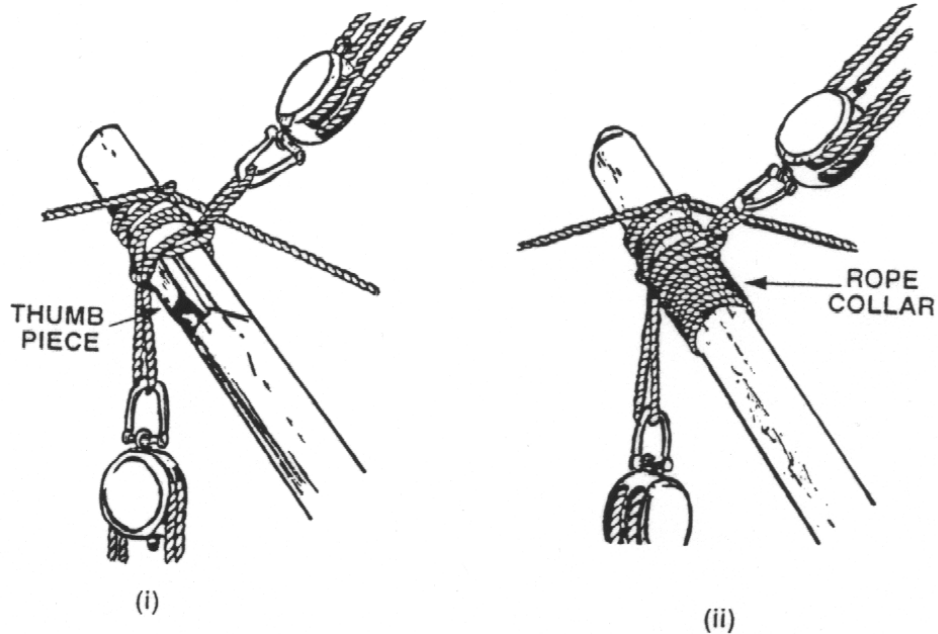
This is a single spar stayed by rigging and having a tackle at its head for hoisting a load. Its head is supported by a topping lift, or, if there is no suitable overhead attachment point for a topping lift, it is supported by a back guy. Side guys are fitted to give lateral support, and if there is 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.

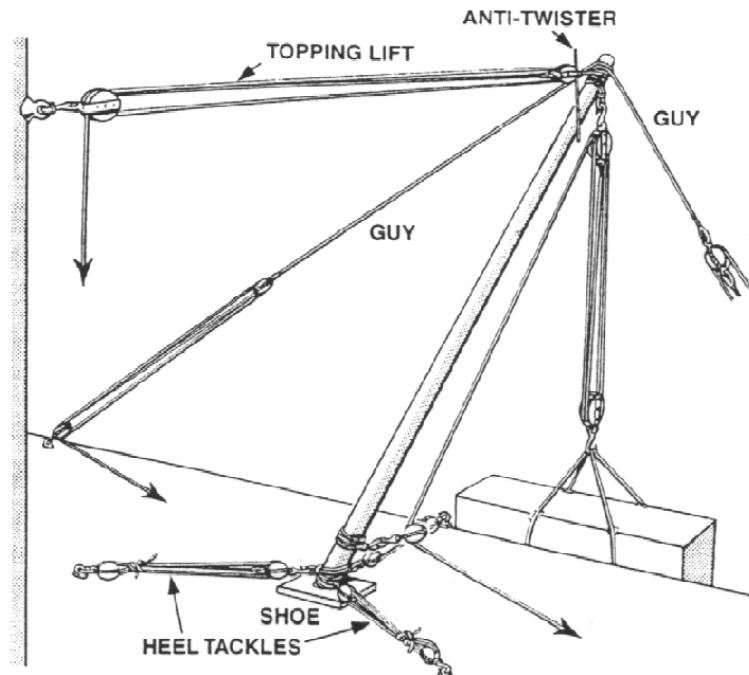
Handy hints:

- 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



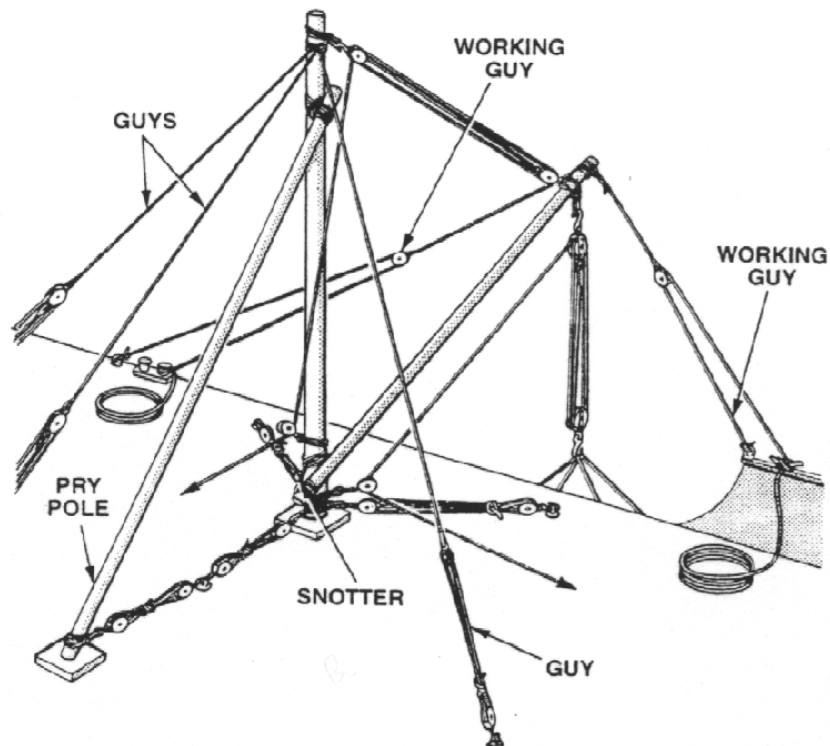
Example of a Standing Derrick



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 strop 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.

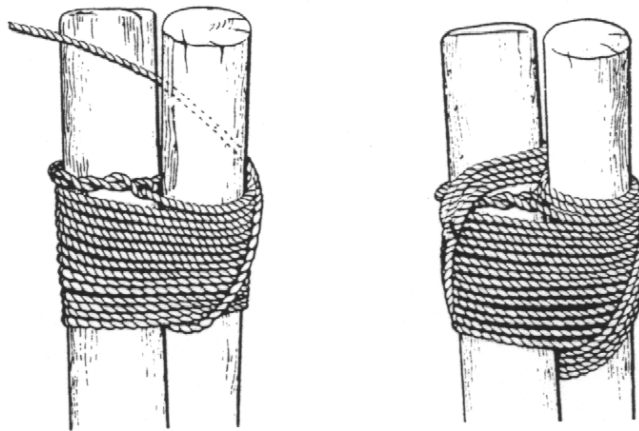


0512.3 Sheers

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**.

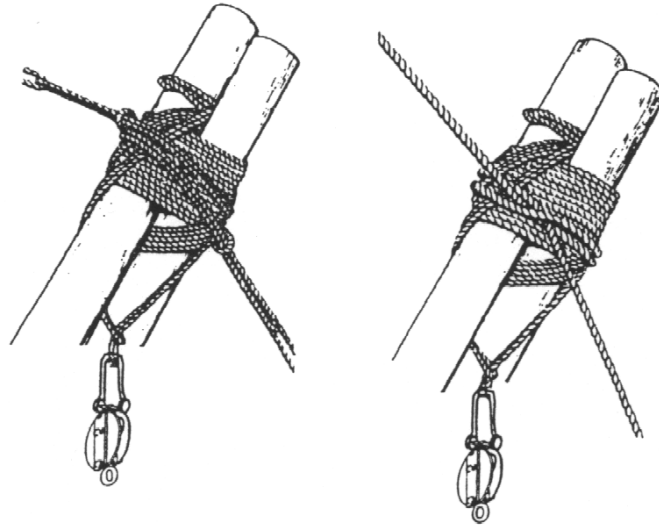
To Rig Sheers - The spars for the legs are laid side by side, with their heels together and their heads supported conveniently clear of the deck; then lashed together. The legs are first crossed and the lashing is made fast to one leg by a timber hitch, either above or below the cross, and then a sufficient 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

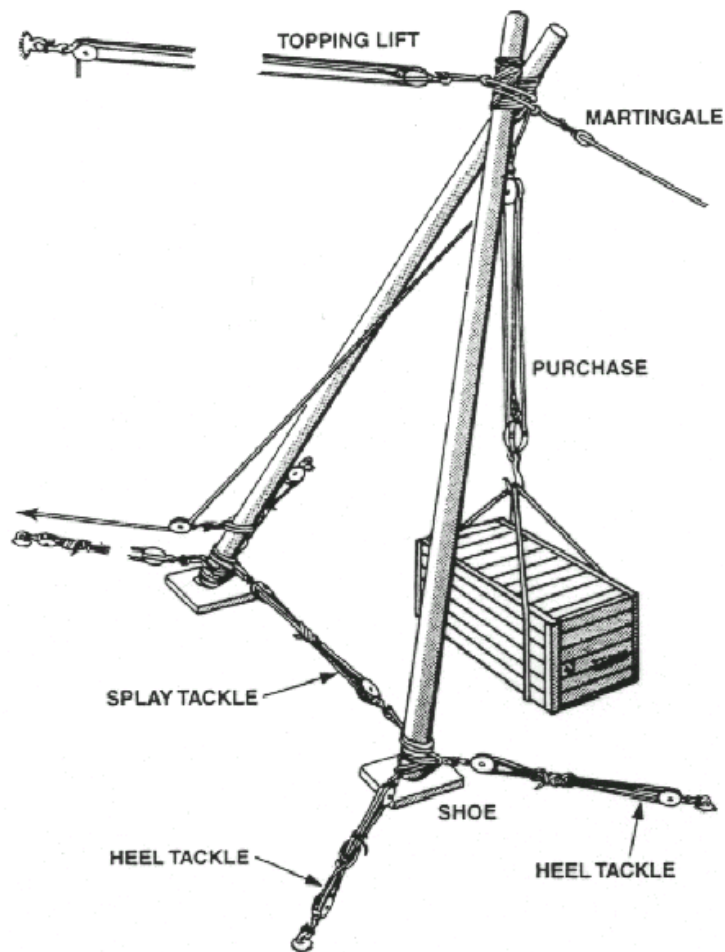


When the head lashing has been completed the heels of the legs are opened out to the required distance; the action of opening them out sets up the head lashing so taut that it binds the legs securely together where they cross. The strop for the purchase is now put on and must be long enough to enable 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).

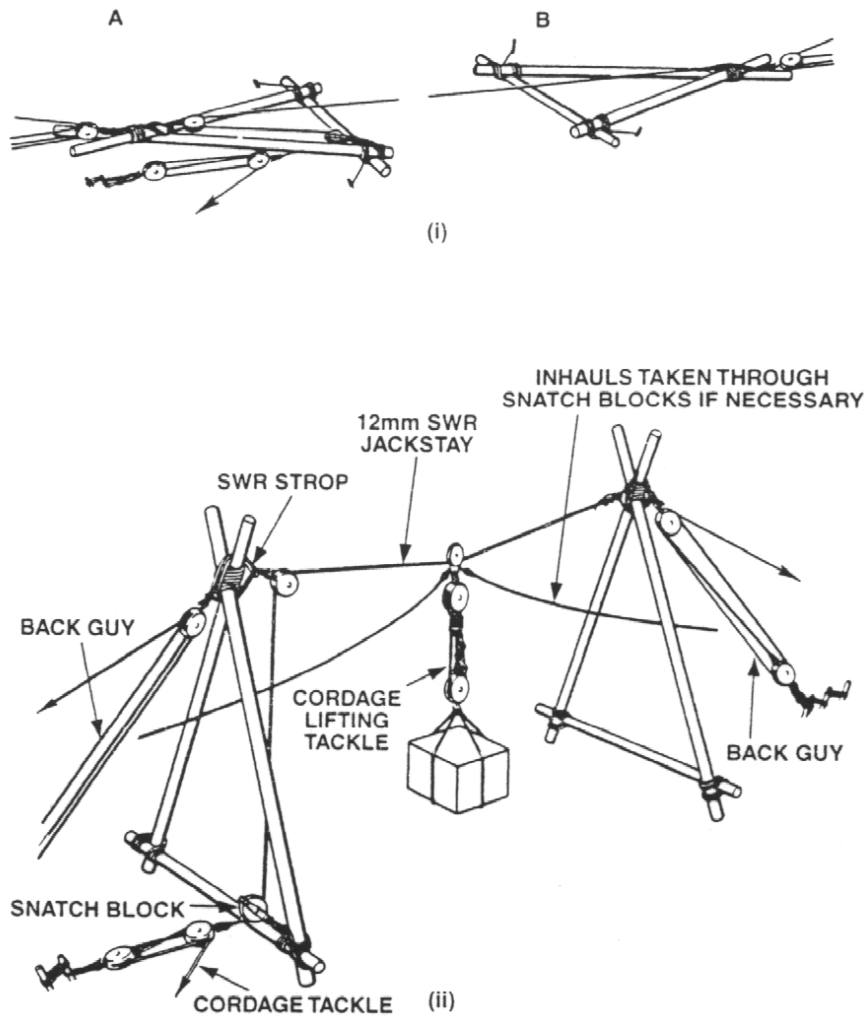
Methods of rigging the Heads of Sheers



Example of Sheers



Example of a Simple Jackstay Rigged with two Sheerlegs



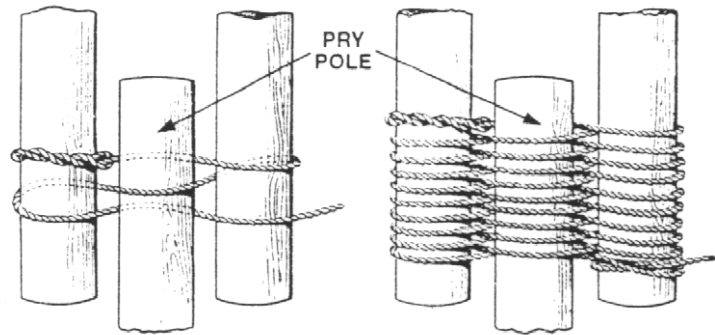
0512.4 Gyn

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 **cheek**. 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.

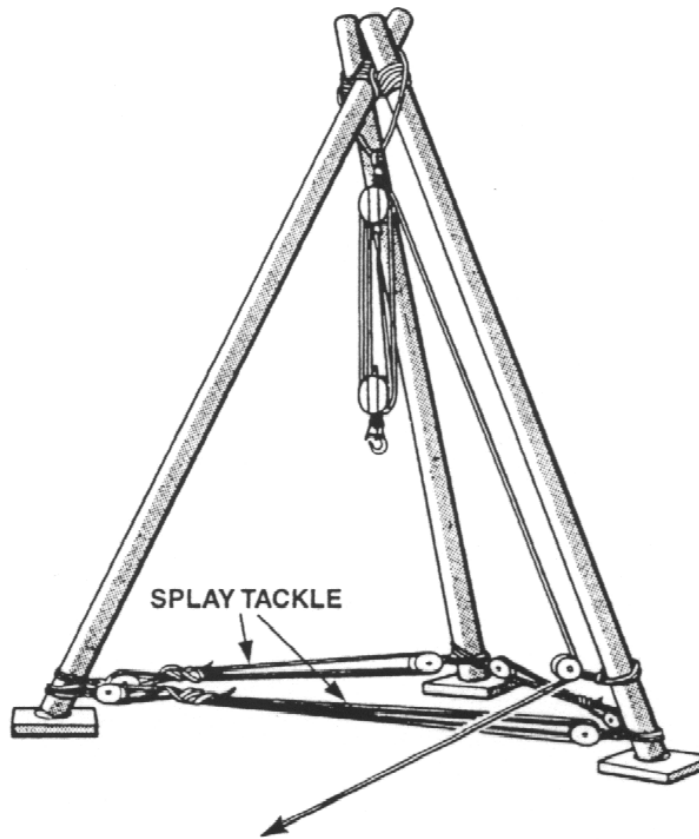
An option to secure the heels of the poles could be the use of additional poles used as splay poles, securely lashed to the uprights, which will provide a firmly secured, freestanding gyn.

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

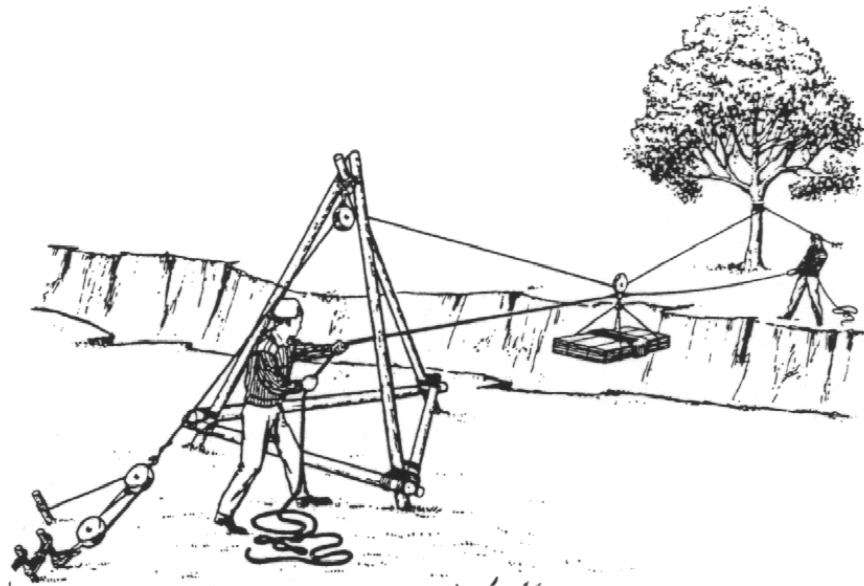
0512.5 Ropeways

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.

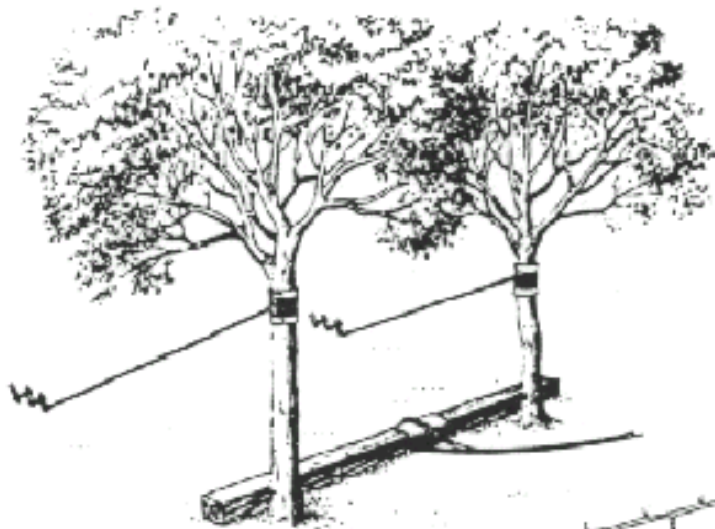
A Gyn



A Simple Ropeway



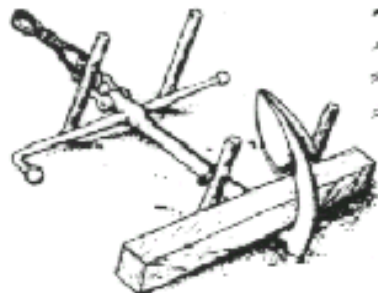
Examples of Holdfasts



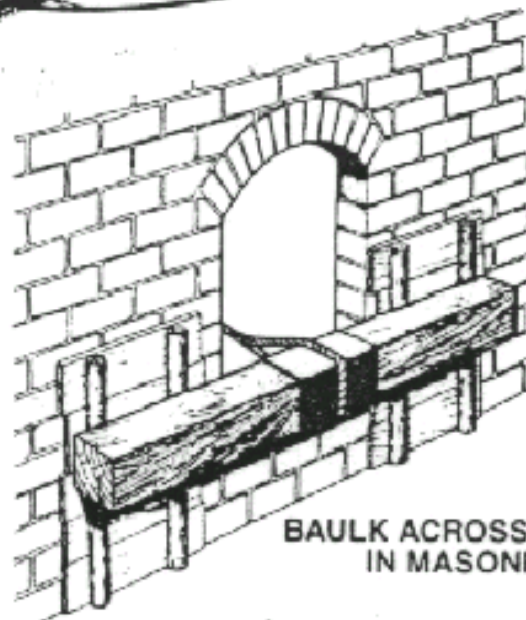
BAULK ACROSS TWO TREES



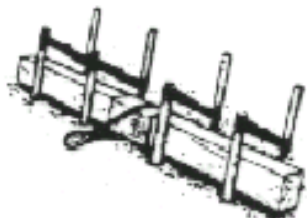
**PICKET HOLDFAST
(3:2:1 COMBINATION)**



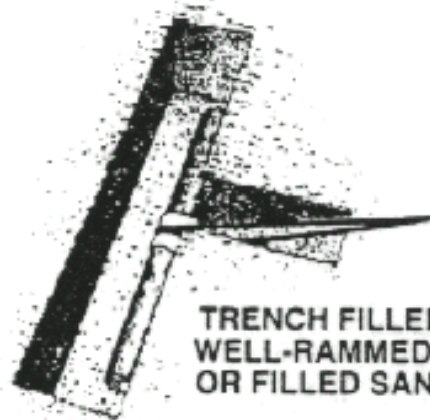
ANCHOR HOLDFAST



**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.

