

## CHAPTER TWO

# GENERAL ROPEWORK

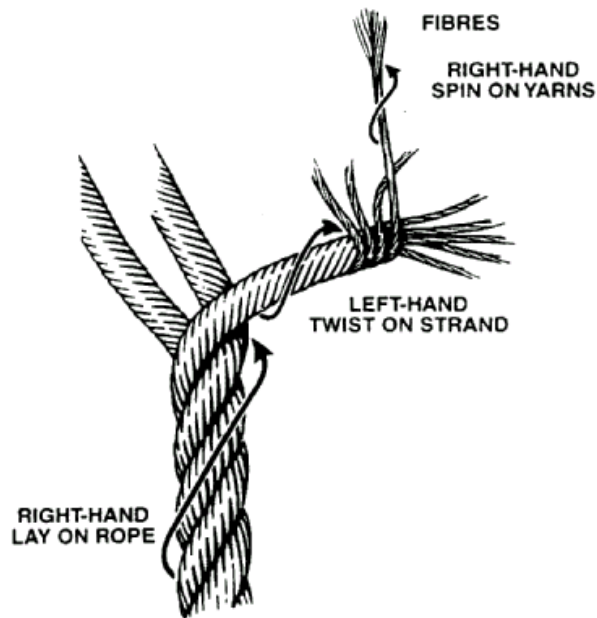
- 0201 Construction of Natural Fibre Rope
- 0202 Care and Maintenance of Natural Fibre Rope
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### 0201 CONSTRUCTION OF NATURAL FIBRE ROPE

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

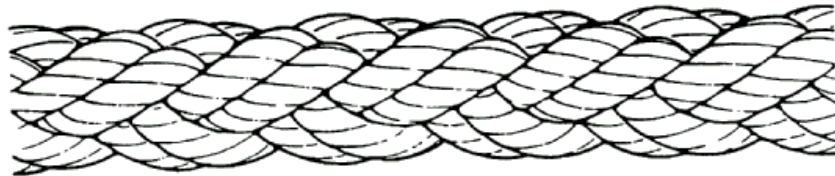
Manila	One Black yarn in each of two strands
Sisal	One Red yarn in one strand
Polyamide	One Green yarn/filament in one strand
Polyester	One Blue yarn/filament in one strand
Polypropylene	One Brown yarn/filament in one strand
Polyethylene	One Orange yarn /filament in one strand
Polyolefin	Two Orange yarns/filaments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

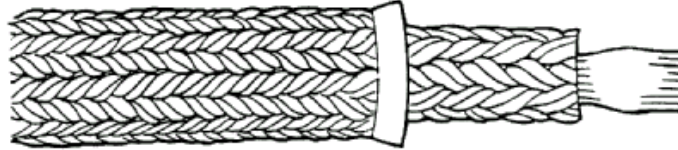


#### b) Braided Rope

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).

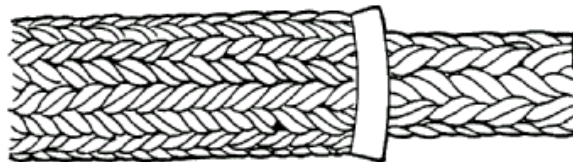
Braided Rope with Braided Core and Heart of Parallel Strands



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.

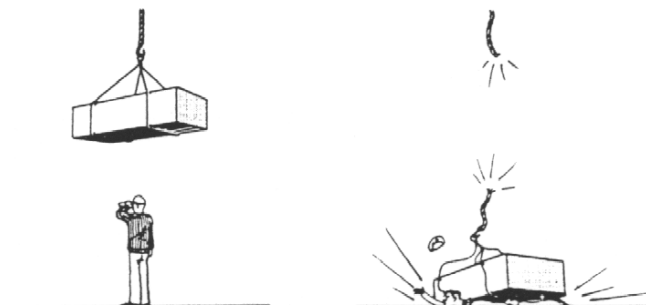
One method of avoiding these turns, should the end of the rope not be free, is to turn the coil

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.

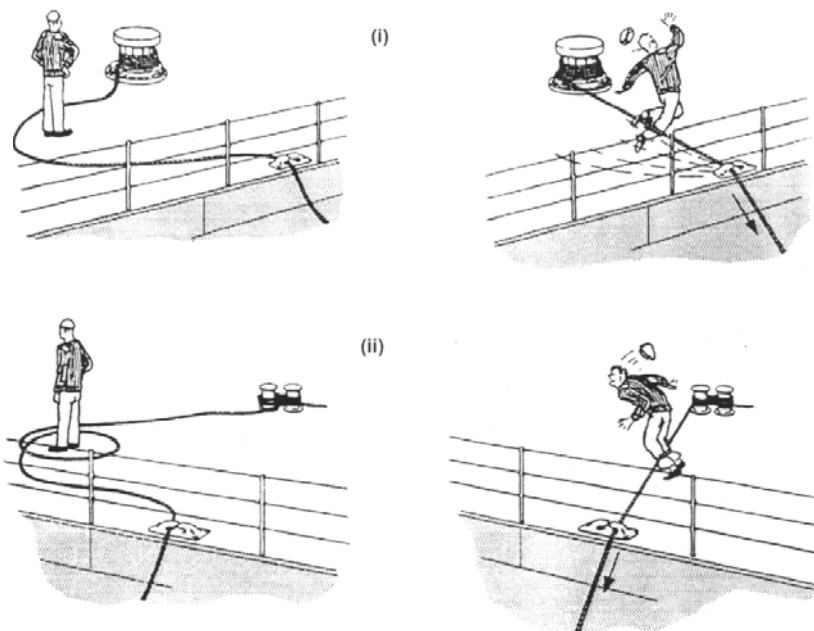
## 0208.2 Coiling Down

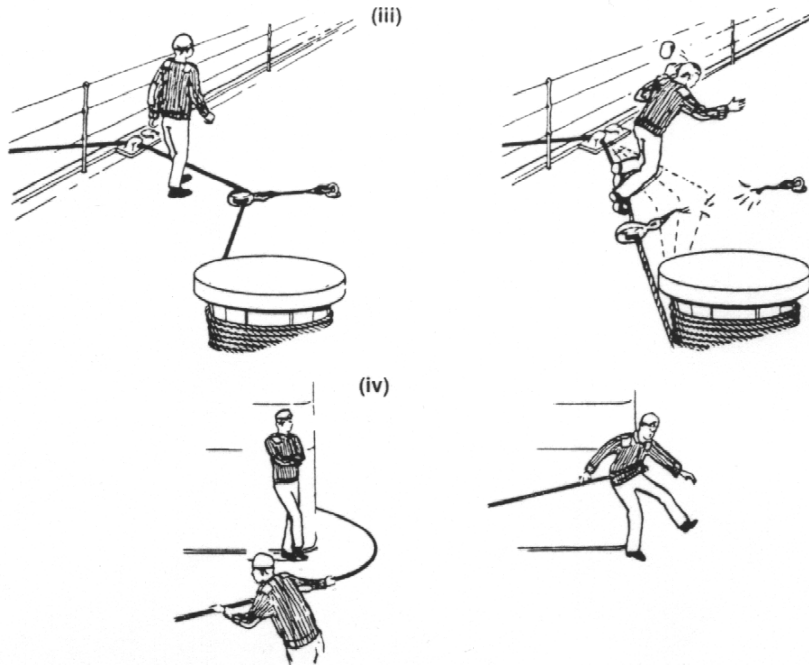
Cordage is very resilient and will absorb a number of turns in its length without becoming snarled if the length is sufficient and turns correspond with the lay of the rope; if the turns are against the lay however, it will quickly become snarled. For this reason rope of right-hand lay is always coiled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

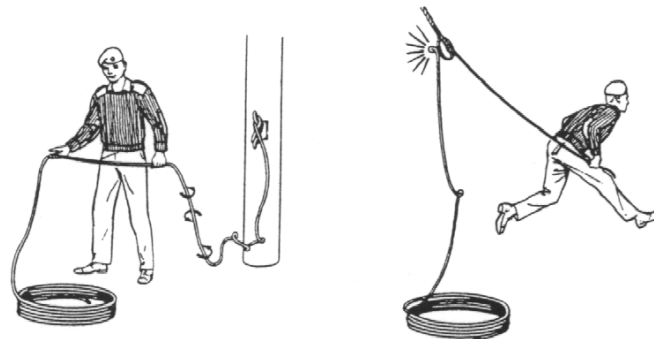




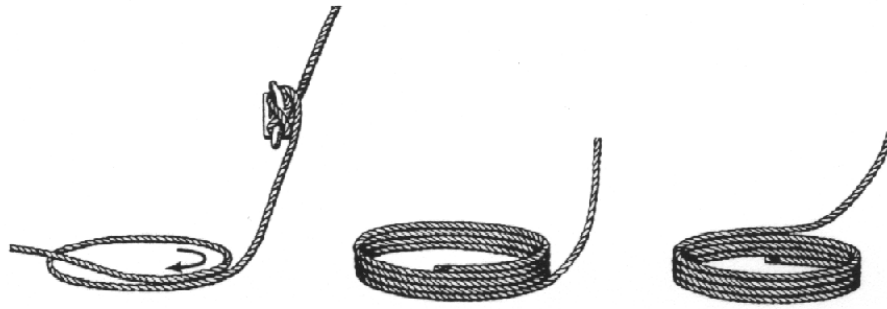
**0208.3 To Coil a Rope for Running**

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.*



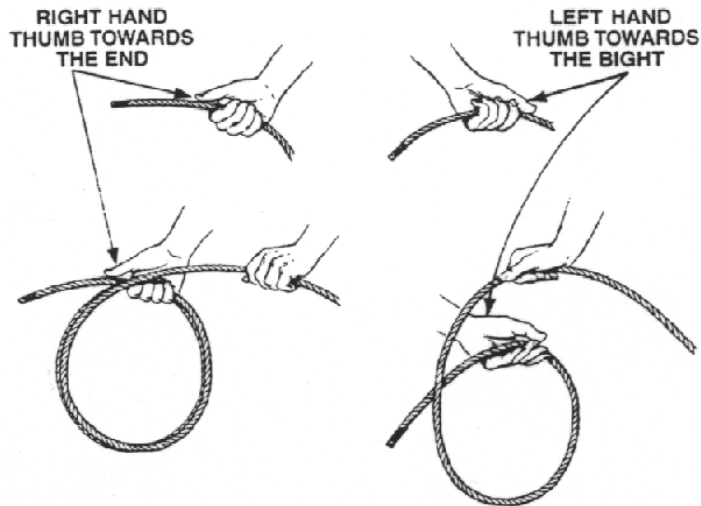
*To Coil a Rope for Running.*



**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.

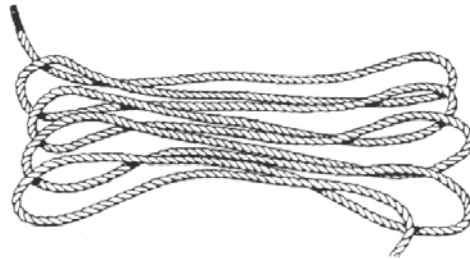
*Coiling a Small Line.*



**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.*

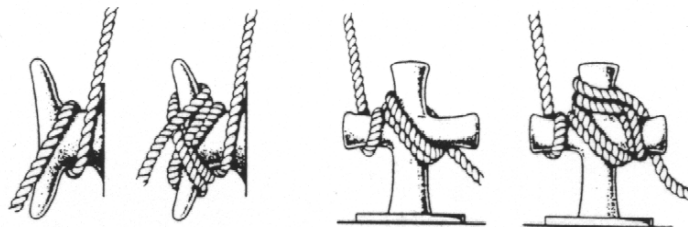


**0208.7 Belaying**

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*

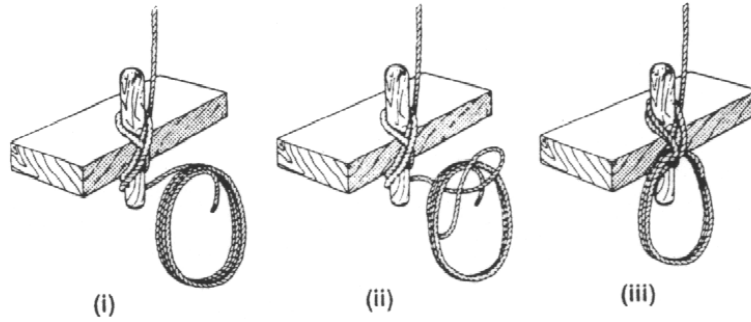


**0208.8 Hanging a Coil on a Belaying Pin or a Cleat**

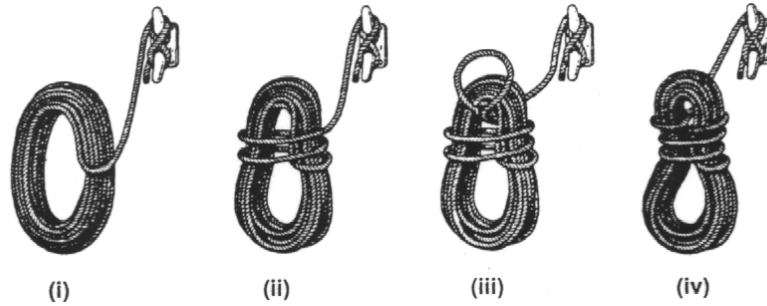
When belaying a rope to a Belaying pin the turns should be taken in the same way as for belaying to a cleat.

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*

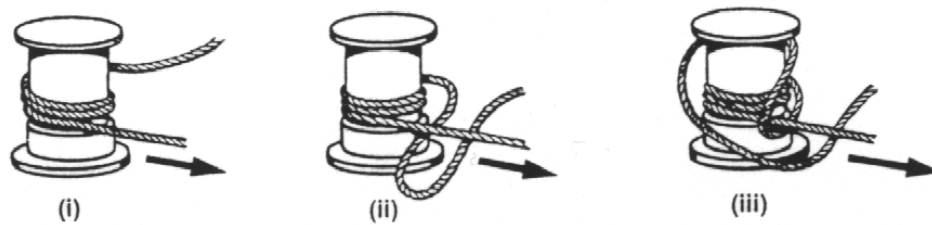


*Hanging a Large Coil on a Cleat*

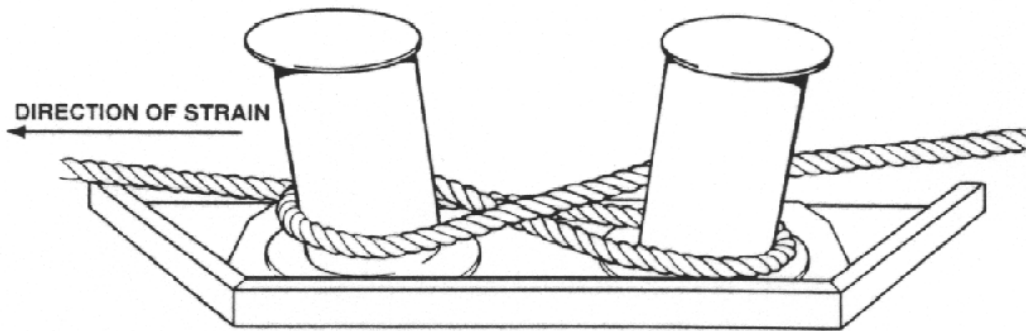


**0208.9 Belaying to Bollards**

*a) Belaying a Fibre Rope to a Single Bollard*

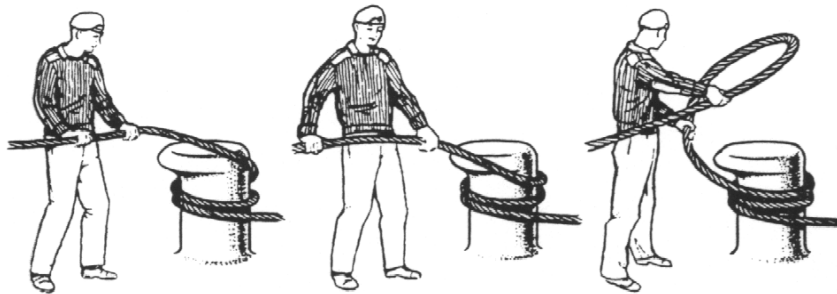


**b) Belaying a Wire or Fibre Rope to Twin Bollards**



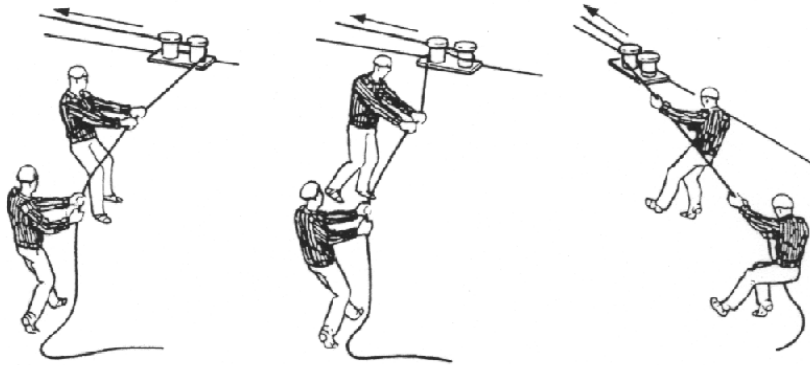
**0208.10 Catching a Turn on a Single Bollard**

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).



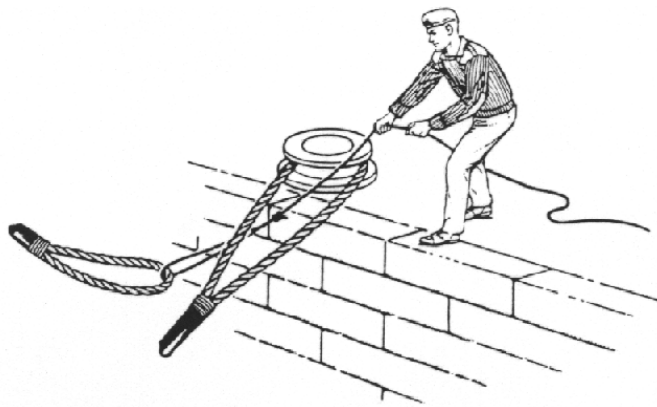
**0208.11 Catching a Turn Round Twin Bollards**

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**

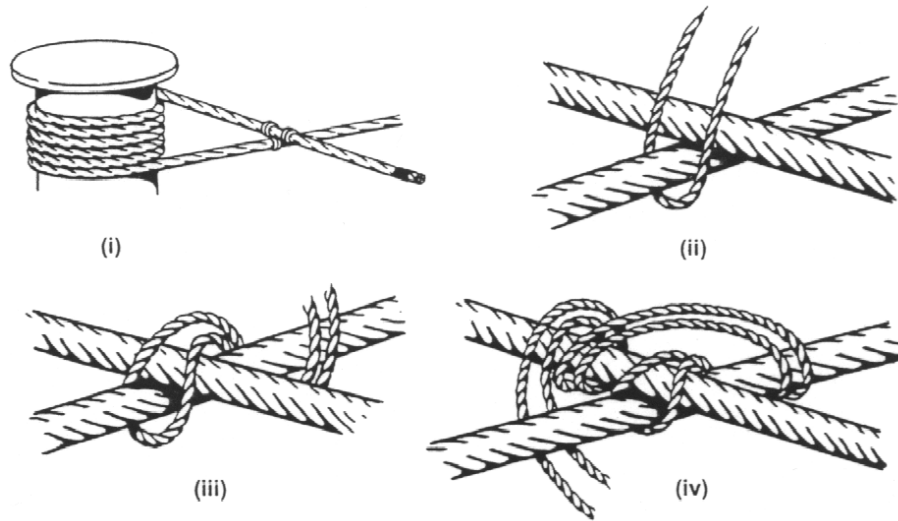
When it is necessary to secure two or more berthing hawsers to a single bollard, the eye of the second hawser should be passed through the eye of the first hawser and then secured to the bollard; similarly, the eye of a third hawser would be passed through the eyes of the first two; this enables the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

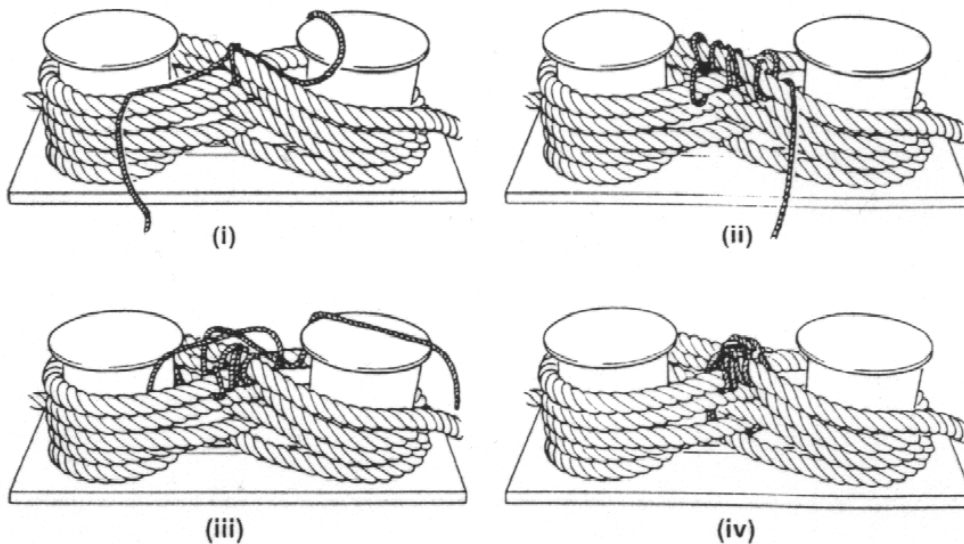
A length of line is used for the racking. Middle the racking underneath the rope; pass both parts of the racking over the end and under the rope; take a turn round the end. Pass the racking under the rope, and repeat the process as often as required. To finish, separate the parts of the racking, bring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

<b>Order or Term</b>	<b>Definition</b>
<b><i>Heaving</i></b>	
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
<b><i>Hauling</i></b>	
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
<b><i>Hoisting</i></b>	
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
<b><i>Lowering</i></b>	
"Lower Away!"	The order to lower steadily

"Avast Lowering!"	The order to stop lowering
<b>General</b>	
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

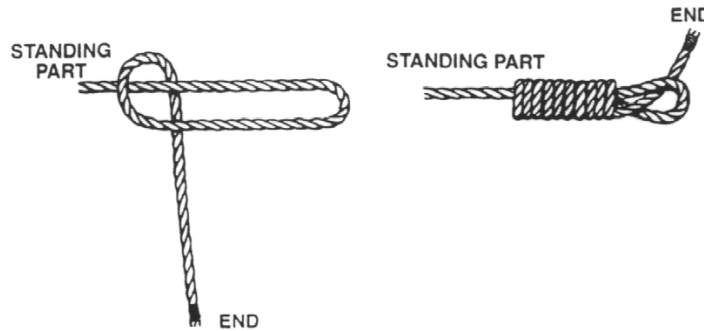
## 0210 THE HEAVING LINE

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

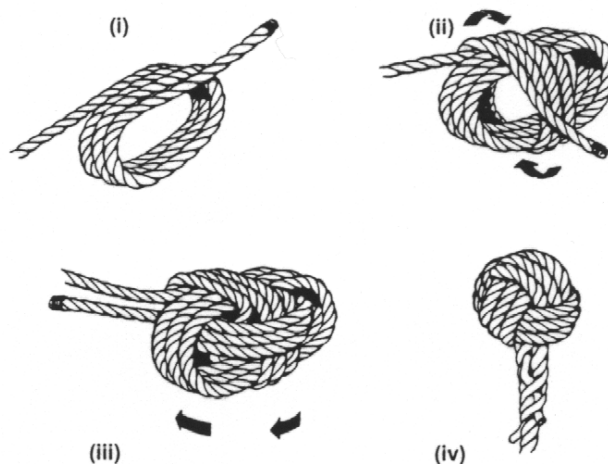
This provides a temporary weight in the end of a rope and is quickly and easily made. Form a bight at the end of the line then take turns round the bight back towards the loop. When reaching the end of the rope having applied sufficient turns, take the end through the loop, hold the complete knot in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

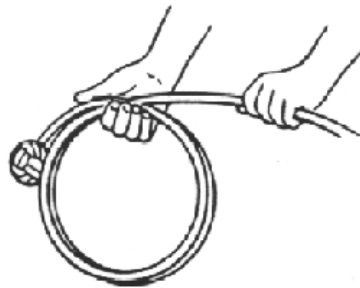
When possible, it should be wetted (provides additional weight) prior to making up. The non-weighted end should be secured to a rail, stanchion or post (if passing a hawser ashore - secure to the eye with a bowline). The standing end should never be secured to the wrist.

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.

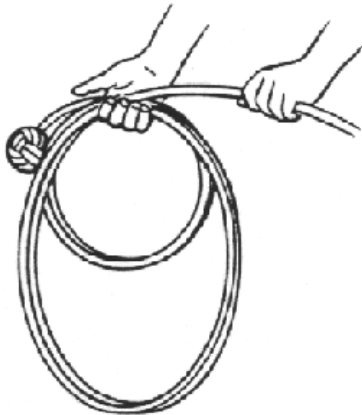
The second method is used if you are unable to throw the heaving line over the side. Start with the monkey's fist in the throwing hand, make small coils with the first 5-6 metres then make larger coils with the remainder of the heaving line. The end can then be secured and the large coils transferred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



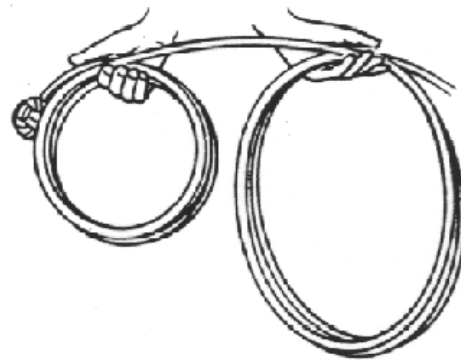
STAGE 1



STAGE 2



STAGE 3



STAGE 4

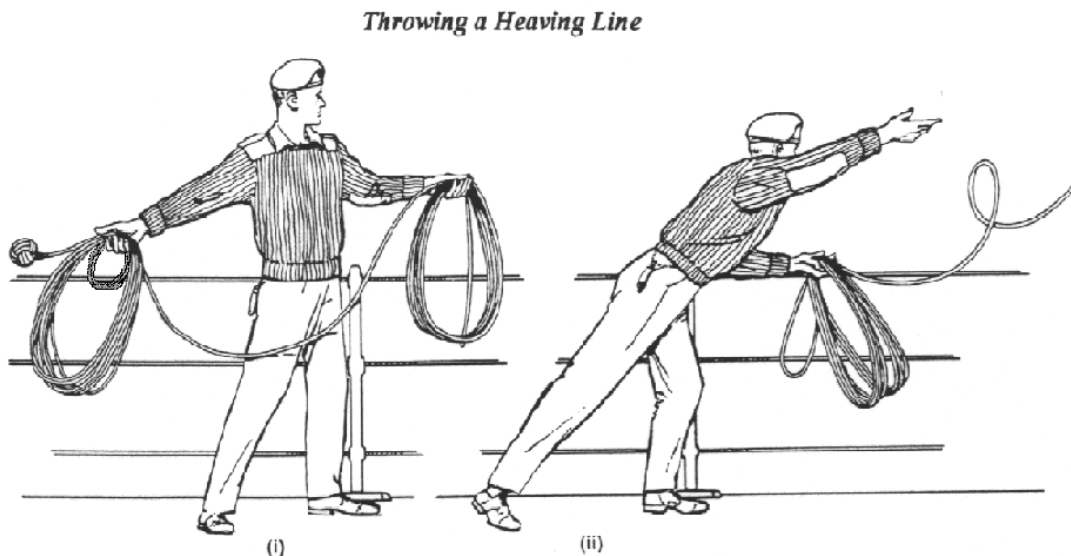
### 0210.4 Throwing the Leaving Line

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.***