25¢

rope knowledge for riggers

The Cordage Group®

DIVISION OF
COLUMBIAN ROPE COMPANY
AUBURN, N.Y. 13021

THIS booklet has been compiled as an aid to anyone who needs to understand the basic essentials of rope care and use.

The material covered includes all common splicing and tying techniques which pertain to 3, 4 and 8 strand rope.

Ropes by

The Cordage Group

MANILA

"Tape Marked"®, this is first-grade rope made by expert workmen, from high grade fiber. A general all purpose rope that will perform well in most applications.

PURITAN® SISAL ROPE

A good grade of sisal rope for general, light utility work. Not recommended for heavy-duty or where personal safety is involved.

FILAMENT NYLON (Polyamide) ROPE

A general all-purpose rope made of continuous filaments for exceptional strength and handling ease. Spun Nylon is also available.

FILAMENT POLYESTER ROPE

Available in fine, plied yarn construction. While slightly lower than nylon in strength, Dacron has the best abrasion resistance and least stretch of any commercially available synthetic fiber rope. Spun Dacron is also available.

INTREPID® LINE

In 8 strand, Pli-moor construction, using Type 77 Dacron, this rope is somewhat stronger than 3 strand Filament Dacron and is slightly lower in weight.

POLYPRO 6® (Olefin) ROPE

Made from continuous monofilament polypropylene yarns, extruded in our own mills. This rope has about half the strength of nylon, but is so light it floats. The strength-to-weight ratio is close to three-quarters that of nylon.

POLYETHYLENE (Olefin) ROPE

Almost as light as Polypro 6, this rope is more slippery to the touch and offers slightly less strength.

P/D 10®, P/D 100®, P/D 101® ROPES

These ropes are a skillful combination of two or more synthetic fibers to a blend which takes maximum advantage of the best attributes of each.

PLI-MOOR®

Our name for a special 8-strand construction which is torque-free, non-kinking and usually lasts longer than conventional 3 strand. It is standard for Intrepid Line and available in all other fibers, filaments and combinations.

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* DuPont Trademark

HOW TO OPEN COILS AND REELS OF ROPE

While we offer a wide variety of sizes and constructions, we utilize only two basic rope put-ups.

COILS

Our coils are either in cartons or wrapped in burlap.

If the coil is in a carton, there can be no confusion since the punch-out tells you to set the carton with that end up; punch out; cut the lashings and pull the rope up through the hole. Even if you intend to use all of the rope immediately, it will stay cleaner and save tangling if you leave it in the carton.

If the coil is wrapped in burlap, look for either an outside yellow or an inside white tag. The tag end should be placed flat on the floor. Cut all lashings, but do not remove the burlap as this will help keep the unused portion clean. Pull the rope up through the eye, or center of the coil.

REELS

Our reels of rope are either packed in cartons or wrapped with burlap or heavy, treated paper. On very large reels there is planking nailed on for extra protection.

Remove the wrapping or remove the reel from the carton. To dispense properly you should place the reel on a rod or spindle, preferably in a horizontal position. By allowing the reel to turn freely, you can remove the rope without kinking or tangling.

Whether dispensing rope from coils or reels, it is very important that the preceding steps be followed. To proceed in any other manner will probably result in paying the rope out in such a way as to impart more twist to the lay of the rope. If this happens, the rope will hockle or kink. Any kinks must be removed by untwisting the rope before it is used. A rope that is used with kinks present will not run freely through tackle, it will twist and tangle; worse yet, placed under a load, serious damage can result.

STORAGE

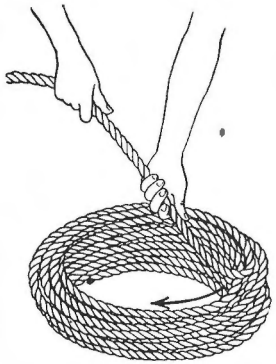
Dirty cordage should be washed and thoroughly dried before storing.

Cordage should be stored in a cool, dry, and well-ventilated warehouse. It should be kept up off the floor, on racks to provide ventilation underneath. If stored outdoors, place on pallet and cover to protect from sunlight.

Never store on concrete or dirt floors, and under no circumstances should cordage and acid be kept in the same building.

If warehouse is covered with galvanized iron, allow ample space above the cordage for air circulation.

HAND COILING



Always coil a rope when you have finished using it. The correct method is to coil a rope clockwise, or to the right as shown. This is because of the twist imparted to the rope in manufacture. However, if the rope tends to kink when coiling this way, it is because a reverse twist has been imparted to the rope in use and to take out this twist, the rope must be coiled counter-clockwise.

CHAFING GEAR

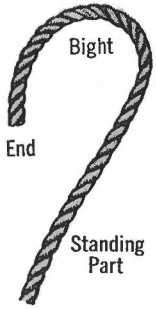
Always rig chafing gear where rope is apt to rub. Old fire hose slipped over the line or pieces of canvas wrapped around and tied with marlin are often used.

Definitions of Terms

IN KNOTTING—A ROPE HAS 3 PARTS

Used in Handling and Tying Rope

1. THE END is the end of the rope with which you are working when you tie a knot.
2. THE STANDING PART is the inactive length of the rope.
3. THE BIGHT is the central part of the rope between the working end and the standing part.



AN OVERHAND LOOP is made by crossing the end *over* the standing part.

AN UNDERHAND LOOP is made by crossing the end *under* the standing part.

A Turn

A TURN is taken by looping the rope around an object —often another section of itself.

A Round Turn

A ROUND TURN is taken by looping the rope *twice* around an object, as shown.

"OVER-AND-UNDER" SEQUENCE In tying a knot, whenever two sections of the rope cross each other, one must go *over* and the *other,* under. Be careful to follow this "over-and-under" arrangement exactly — otherwise you get either an entirely different knot or no knot at all.

"DRAWING UP" Once formed, a knot must be "drawn up" or tightened, *slowly and evenly* to make sure that all sections of the knot arrangement keep their place and their shape. Quick or careless tightening may result in a useless tangle.

Knots, Bends and Hitches

WEAKENING EFFECT OF KNOTS

The rigger should bear in mind that the sharp bends necessary to form a knot weaken the fibers of the rope; particularly fibers on the outside of the bend which are apt to strain and break. When they break, the entire strain is thrown on the other fibers which in turn break and before long the entire rope has parted. Therefore, you can readily see that the knot which requires the least abrupt bends will weaken the rope least. Use knots only where necessary to make a temporary fastening. If a rope breaks, do not knot the ends together; cut out the bad section and splice the rope into one piece.

Type of knot, bend or hitch	*Percentage of Retained Strength*
Anchor Bend over ⅝" dia. ring over 4" dia. post	 55-65% 80-90%
Two Half Hitches over ⅝" dia. ring over 4" dia. post	 60-70%* 65-75%*
Square Knot	43-47%**
Sheet Bend	48-58%*
Fisherman's Knot	50-58%
Carrick Bend	55-60%
Bowline	65-75%

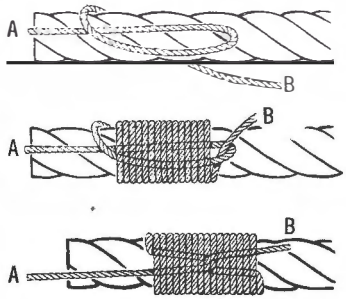
* Smaller sizes of Nylon are liable to slip without breaking.

** Both Nylon and P/D combination ropes in smaller sizes are liable to slip.

These percentages of efficiency are average values and will vary under various conditions of test and stress. However, they serve as a standard to base your calculations upon, and show how knots reduce the actual strain that may be safely applied to any rope.

Whipping

A good rope deserves good care. And in order to prevent unravelling in the rope, the ends always should be bound or "whipped". In splicing — the separate strands of the rope may also be whipped for convenient handling while splicing.



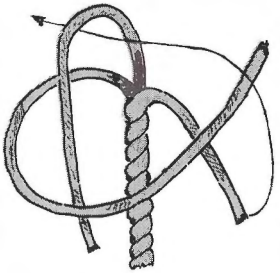
To make the whipping, a fine yarn, marlin or spun-yarn is generally used. The most common whipping is made by placing the end of the yarn along the end of the rope, and then laying a loop along the rope. You then wind the yarn tightly around both the loop and the rope, being sure to leave a small portion of the loop uncovered. Wind the whipping for a distance roughly equal to the diameter of the rope.

The whipping is finished by putting the winding end "B" through the uncovered end of the loop — then pulling end "A" tight, until the loop is drawn back out of sight. Both ends of the whipping are then cut short for a neat finish.

Synthetic rope ends can be secured by wrapping with plastic tape or holding them in a flame.

CROWN KNOT

A quick way to prevent unlaying of 3 strand rope. Used until you have time to whip.



SLIP KNOT

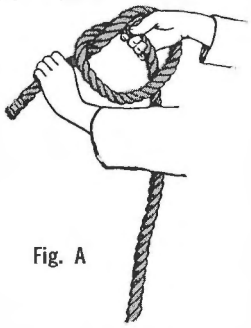


Fig. A

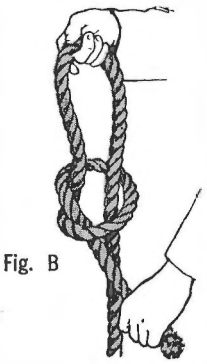


Fig. B

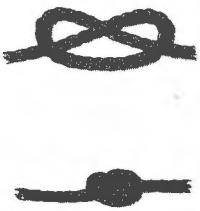
The slip knot is the most simple slip loop to tie. Starting with the position shown in A, the end is held in the left hand and the loop is formed by twirling the rope to the right between the thumb and the fingers of the right hand. Note loop in right hand and end in left, in B.

Stopper Knots

Keep Rope Ends From Slipping Through An Opening

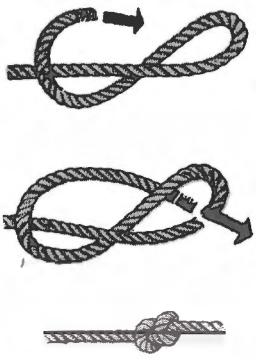
End or Stopper Knots are generally tied to keep a rope end from slipping out of a hole or a pulley — also to stop a rope end from sliding through the loop of another knot and thus untying.

THE OVERHAND KNOT



This is the simplest and smallest of all knot forms and the beginning of many more difficult ones. In general, use it only on small cord and twine, since it jams and is hard to untie, often injuring the fiber. To Tie: Make an overhand loop. Pass the end *under* and up *through* the loop. Draw up tight.

THE FIGURE EIGHT KNOT



This is much easier to untie than the Overhand Knot — is larger, stronger and does not injure rope fibers. It is the best knot to use to keep the end of a rope or "fall" from running out of a tackle or pulley. To Tie: Make an underhand loop. Bring the end around and *over* the standing part. Pass the end *under,* and then up *through* the loop. Draw up tight.

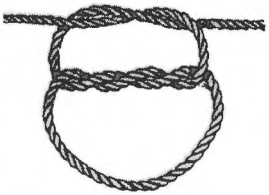
STEVEDORE'S KNOT

The Stevedore's Knot is tied the same as the Figure Eight Knot except that two turns are taken around the rope instead of one. By inserting a small stick or shackle, the knot can be easily untied.

Binding Knots

Tie One or More Objects Snugly Together

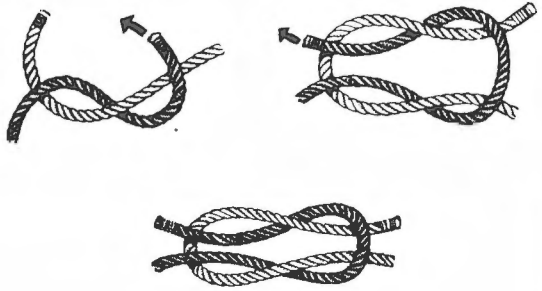
THE SURGEON'S KNOT



Often used for twine — chiefly to keep the first tie from slipping before the knot is completed. To Tie: With one end, take three turns about the other end. Bring both ends up. Pass one end over and under the other end. Draw up tight.

THE SQUARE OR REEF KNOT

Used at sea in reefing and furling sails — ashore as the universal package knot for parcels and bundles. Though often used, it is a dangerous knot for tying two ropes together, since it unties easily when either free end is jerked. To Tie: Pass the left end *over* and *under* the right end. Curve what is now the left end towards the right. Cross what is now the right end *over* and *under* the left. Draw up tight.



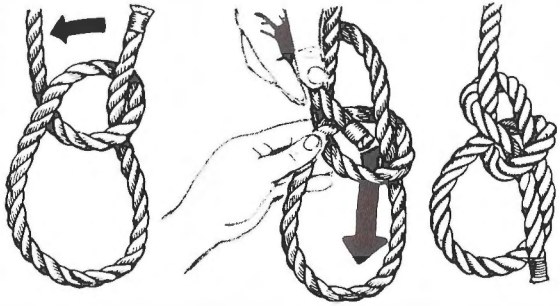
DON'T TIE THE WEAK GRANNY KNOT

Remember that the Square Knot presents two ends lying together *under* one loop and *over* the opposite loop — while the Granny presents one end under and one over on *both* loops. *Watch out for the Thief Knot, too.* This has the two loose ends coming out of *opposite* sides—instead of from the same side as in the true Square Knot.

Loop Knots

Hold to an Object When Security Comes First

A Loop Knot, like a Hitch, fastens a rope to another object. But usually, the Loop Knot is first tied in the hand and then placed over the object — while the Hitch is tied directly around the object. In general, the Loop Knot is a more secure and permanent type of knot than the Hitch, because properly tied and drawn tight, it will not slip. Also, since it does not lose its shape, the same knot may be used many times over.



THE BOWLINE

User for Mooring, Hitching, Lifting, and Joining

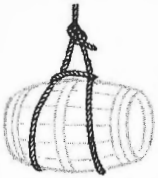
Sometimes called the "king of knots", the Bowline never jams or slips if properly tied. Generally tied in the hand, it can also be used as a hitch and tied directly around the object.

To Tie: Make an overhand loop with the end held toward you. Pass the end up through the loop, then up behind the standing part — then down through the loop again. Draw up tight.

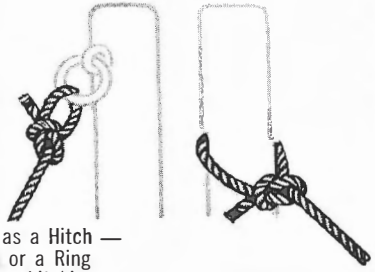
SOME USES OF THE BOWLINE

Two Interlocking Bowlines can be used to Join Two Ropes Together

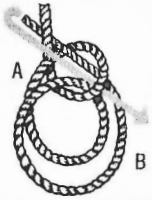
The Bowline is Tied in a Hawser and Thrown over a Post when Mooring

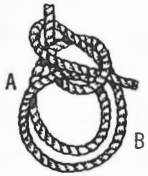


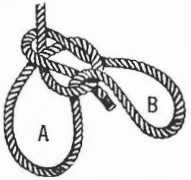
A Bowline is Tied in the end of a Rope for Hoisting —



A Bowline can be tied as a Hitch — directly around a Post or a Ring when mooring a boat or hitching a horse.





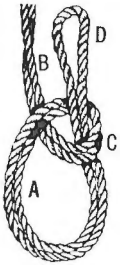


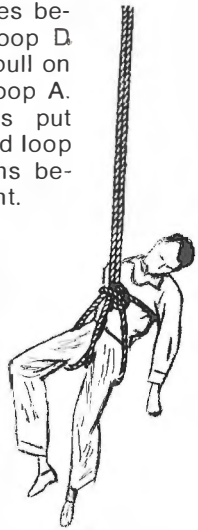
THE DOUBLE BOWLINE

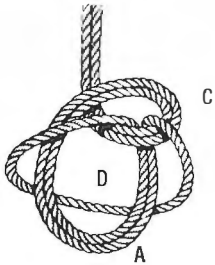
To Tie: Make an overhand loop with the end held toward you, exactly as in the ordinary Bowline. The difference being that you pass the end through the loop *twice* — making *two* lower loops, A and B. The end is then passed *behind* the standing part and down through the first loop again as in the ordinary Bowline. Pull tight. Outside loop B goes under the arms — inside loop A forms the seat.

BOWLINE ON BIGHT

To Tie: Double the rope, make overhand loop C, and draw loop-end D up through it. Then pass loop end D, towards you, down and over loop section A. Bring up in back until D lies behind loop A. Draw loop D tight by a slow even pull on upper right side of loop A. To use, one leg is put through each loop and loop D passed under arms before being drawn tight.



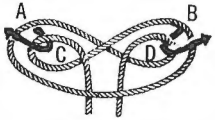


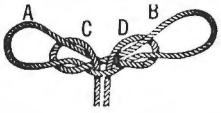


THE SPANISH BOWLINE

Form three loops, as shown, in any central section of the rope. Turn the large center loop A-B down. Enlarge it so that it encircles the smaller loops C and D. Put your hands through each of the small loops C and D, grasp each side of large loop A and B . . . and pull up through to complete the knot.

Used to lift an injured man like the Bowline on Bight, above — or to sling a ladder as shown.



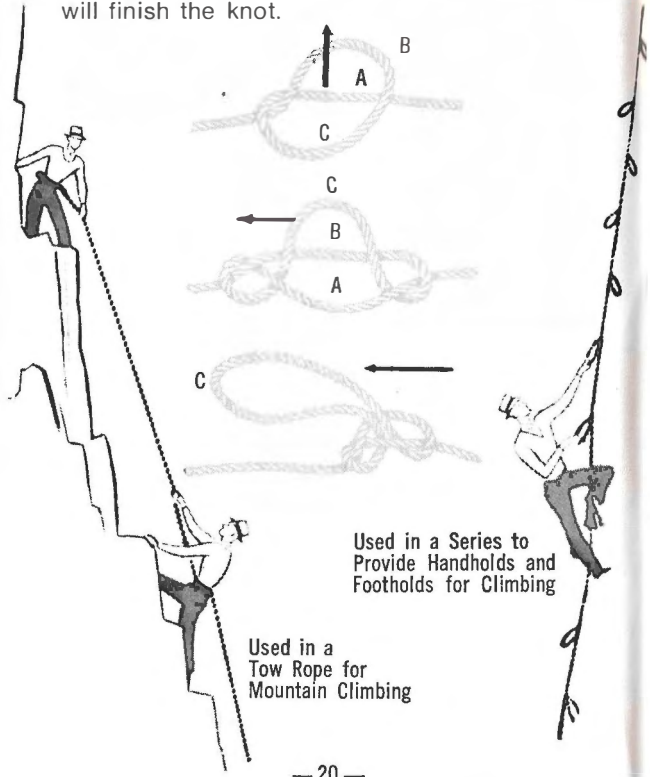


A USEFUL LOOP KNOT

THE MAN HARNESS

Used for Hauling, Mountain Climbing

This knot should be tied large enough to go around a man's shoulder, leaving both his hands free. It is used in tow and climbing ropes as sketched below. To Tie: Make a loop in the rope and fold it forward and slightly to the right to get a loop shaped like the one in the first sketch above. Then take C up and under A and over B, as shown in the second sketch. A good hard yank on C, to the left, will finish the knot.



Hitches

For Temporary Fastenings That Untie Readily

Most Hitches differ from Loop Knots in being tied directly around an object — instead of first being tied in the hand and then placed over the object. Hitches are generally used as a speedy, temporary means of fastening to an object and many Hitches conveniently untie by themselves when the object is removed.

THE HALF HITCH

A Basic Knot Form

The Half Hitch is generally used for fastening to an object for a right-angle pull. To Tie: Pass the end of the rope around the object and tie an Overhand Knot to the standing part. Figure I shows the Half Hitch tied with the end pulled close around the standing part. This is the first step in tying many more complicated Hitches, such as the thoroughly reliable Timber Hitch shown on page 28. But for use by itself, it is unsafe tied in this way, since it quickly slips untied. Figure II shows the Half Hitch tied with the end nipped under the turn of the rope some distance *away* from the standing part — this method is fairly reliable for temporary use — if the pull is steady and the arrangement is not disturbed.

Fig. I
Untrustworthy

Fig. II
Fairly Reliable

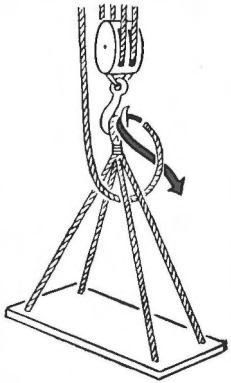
TWO HALF HITCHES

Quite Secure — Used for Mooring

Just as its name states, Two Half Hitches is simply a Half Hitch tied twice — in the manner shown. For extra security use two round turns in mooring. It is quickly tied, reliable, can be put to almost any general use. It is the usual method of tying a line to a ring hook in handline and pole fishing.

BOATSWAIN'S HITCH

A simple hitch used by most workmen who have to go aloft — riggers, painters, steeplejacks, etc. To tie, a bight is pulled forward under the eye support for the chair, ladder or plank. Then a half-turn forms the single hitch required on the hook of the block.

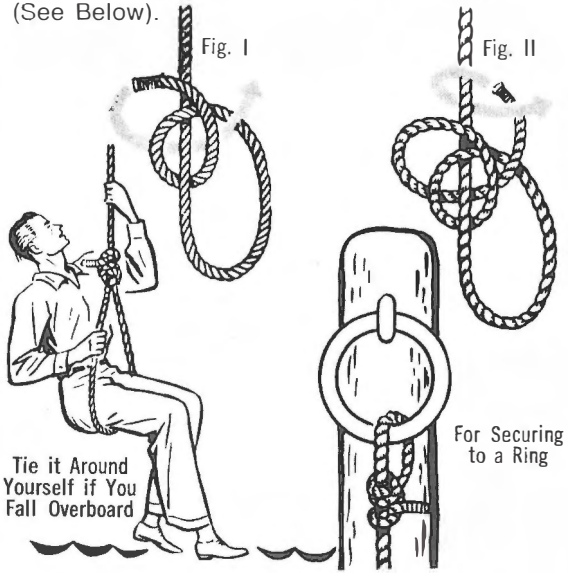


MIDSHIPMAN'S HITCH

To Tie: Take a Half Hitch around the standing part. Then, take an extra turn around that Half Hitch, so that it is wedged inside it when tightened, coming up through the loop again (Figure I). Finish with a Half Hitch around the standing part above the loop (Figure II). Tied this way, the Midshipman's Hitch is adjustable — it can be slid to any position on the standing part where it will hold under strain.

When one line is to be fastened to a working line for the purpose of temporarily taking load or strain off part of that working line, the Midshipman's Hitch can be used as the stopper (or fastening) knot.

If you ever fall overboard, tie this knot in the line thrown to you by first passing the end under your legs, thus forming the loop, and then take the hitch around the standing part (See Below).



SCAFFOLD HITCH

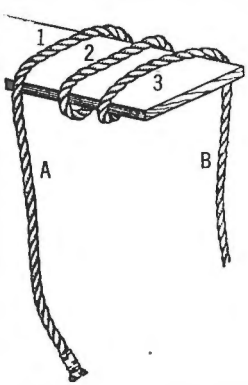


Fig. I

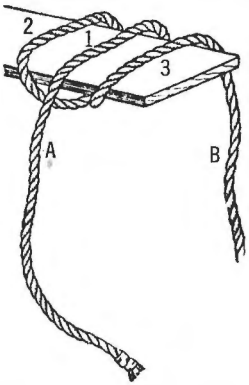


Fig. II

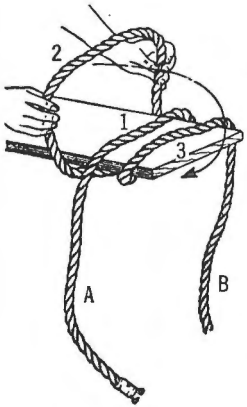


Fig. III

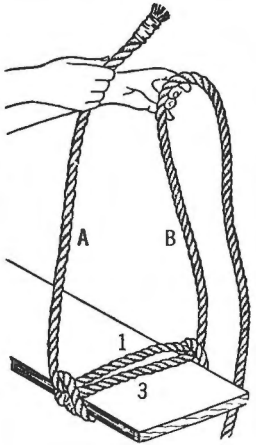


Fig. IV

SCAFFOLD HITCH

Many occasions arise for the need of a single board scaffold hung by a single rope at each end. For safety, a scaffold of this kind must be hung so that it will not turn.

Lay the short end (A) of the rope over the top of the plank (Fig. I) leaving enough hanging down to the left to tie to the long rope, as shown in Fig. V. Wrap the long end (B) loosely twice around the plank, letting it hang down to the right as shown in Fig. I. Now, carry rope 1 over rope 2 and place it next to rope 3 (Fig. II). Pick up rope 2 (Fig. III) and carry it over 1 and 3 and on over the end of the plank. Take up the slack by pulling rope (A) to the left and rope (B) to the right. Draw ropes (A and B) above the plank (Fig. IV) and join the short end (A) to the long rope (B) by an overhand bowline (Fig. V). Pull the bowline tight, at the same time adjusting the lengths of the two ropes so that they hold the plank level. Attach a second rope to the other end of the plank in the same way and the scaffold is now ready for safe use.

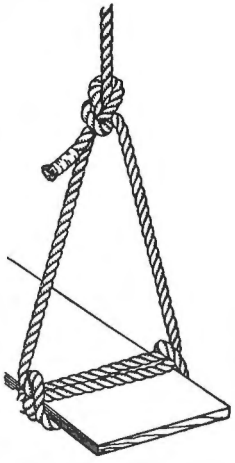


Fig. V

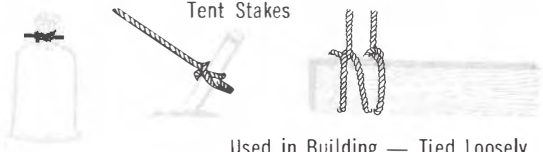
CLOVE HITCH

The "General Utility" Hitch

The Clove Hitch is a quick, simple method of fastening a rope around a post, spar or stake. It is sometimes called the "Builder's Hitch" because of its extensive use in fastening staging to upright posts. It can be tied in the middle or end of a rope. But since it has a tendency to slip when used at the end of a rope, the end should be half-hitched to the standing part for greater security.

To Tie: Make a turn with the rope around the object and over itself. Take a second turn around the object. Pull the end up under the second turn so it lies between the rope and the object. Tighten by pulling on both ends.

Commonly Used on Tent Stakes



Used in Building — Tied Loosely to Sling a Plank on Edge

Tied on a Bag as a Binding Knot

In Building — for Fastening Staging to Upright Posts

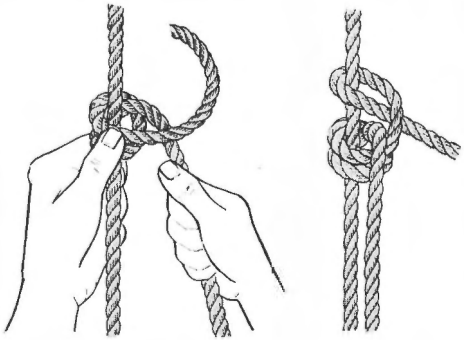
As a Strong Crossing Knot in Lashing Heavy Parcels

TAUT-LINE HITCH

Many times it is necessary to attach a rope to a second rope that is supporting a load and cannot be bent, i.e.—a strand may break and it becomes necessary to attach a new rope above the break, to support the load while the break is repaired.

Wrap the new rope two full turns around the taut one, progressing away from the load or in the direction of the pull. Pass the end over the wrapping and toward the load; draw it firmly, and take one or two half hitches about the taut rope between the wrapping and the load. The hitch will not hold unless the wrapping and the half hitch are pulled up securely in the first place and are tightened as the strain is put on the new rope.

With this taut-line hitch above the break the rope may be spliced or the strand repaired with no danger of the load slipping.



SINGLE BLACKWALL HITCH

Frequently, it is necessary to attach a rope to a hook. A quick and secure, temporary fastening is the Single Blackwall Hitch. The Double Blackwall Hitch, however, is much safer.

To tie the single blackwall hitch, form a bight (C) in the rope, placing the short end (A) in back of the standing part (B) as shown in Fig. I. Bring this bight up around the hook, as shown in Fig. II. Draw up the bight by pulling on the long end while holding the short end, and then slide the bight down into position (Fig. III). A loop is thus formed around the shank of the hook with the free end (A) pressed against the hook by the tension in the main rope (B).

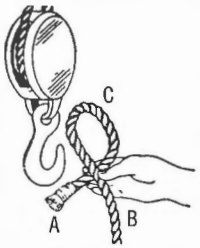


Fig. I

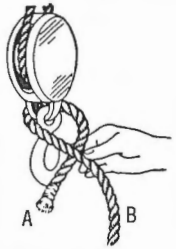


Fig. II

Fig. III

DOUBLE BLACKWALL HITCH

Form a loop (C) in the rope, placing the short end (A) in front of the standing part (B) as shown in Fig. IV. Bring the loop up around the hook as shown in Fig. V. Bring the free end (A), from the left, and lay it in the hook, as indicated by the arrow (Fig. V) so that it points to the right as in Fig. VI. Now, bring the long end (B) to the right around the back of the hook and lay it in the hook, across end A, (Fig III). Note that the long end, B, crosses over the short end twice, once at the back and again in the hook.

Fig. IV

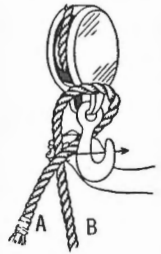


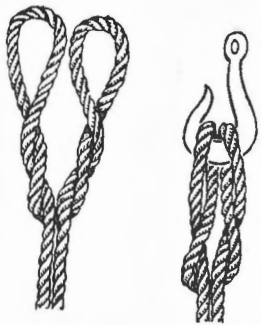
Fig. V

Fig. VI

THE CATSPAW

Hook Hitch for Heavy Loads

This is the Hook Hitch generally tied in a "sling" or continuous wreath of rope — for heavy hoisting. It does not jam and unties by itself when removed from the hook. It is tied by grasping two bights held well apart — and twisting each of them away from you. The two loops thus formed are then brought together and placed over the hook.



Bends

To Tie Two Ropes Together

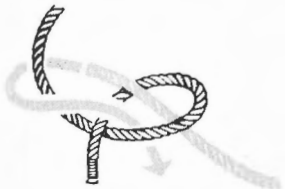
A Bend is tied when it is necessary to lengthen a rope by joining it to another. A Bend should be used for a temporary purpose only — if the joining is intended to be permanent, a Splice is both stronger and safer. In general, Bends should be tied only in two ropes of the same size, stiffness, and smoothness — otherwise the Bend is not considered dependable.

SHEET BEND OR WEAVERS KNOT

To Join Light and Medium Ropes of Equal or Unequal Size

This is the common utility Bend used aboard ship, and unties easily without injuring rope fibers. While it can be tied in larger ropes, such as hawsers and cables, the Carrick Bend is preferable. Remember that its construction is like that of the Bowline — only instead of an end being tied to its own bight, one end is tied to the bight in the end of another rope — and you should find it most easy to tie.

To Tie: Make an overhand loop with the end of one rope. Pass the end of the other rope through the loop thus formed, then up behind its standing part — then down through the loop again. Draw up tight.

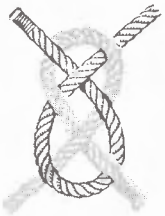


CARRICK BEND

For Heavy Ropes, Hawsers, Cables

The Carrick Bend is one of the strongest of knots. It cannot jam and it unties easily. Under strain it always draws up tight correctly — which is important, because very heavy ropes usually cannot be fully tightened by hand. However, (although the precaution often is overlooked) for maximum security the ends always should be seized to the standing part.

To Tie: With one rope-end form an underhand loop — with both the free end and standing part pointing away from you. Start the second rope end beneath both sides of the loop. Cross it over the standing part of the first rope. Then under the free end of the first rope. Then over the left side of the loop. Cross it under itself — and let the second free end lie over the right side of the loop. Finish by seizing each end to the standing part.

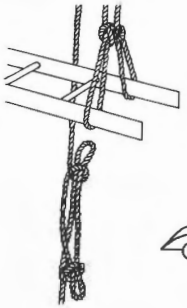


THE SHEEPSHANK

Used to Shorten a Rope

The Sheepshank is intended to shorten a rope for temporary use only. Carefully tied and drawn up tight, it is fairly reliable under a steady pull. But to make it secure for any length of time, both loops should be "stopped" to the standing parts. (An ordinary "Stopping" is made with marlin or spun yarn. It consists of several round turns about the parts to be fastened together — the ends finished off with a square knot.)

To Tie: Form an S loop as shown in the top diagram, above. Then with one free end of the rope make a Half Hitch and slip it over one of the loops. Tighten. Repeat procedure with the other loop.



Sling a ladder with Half Hitches drawn together firmly (to prevent material from one loop slipping into the other)

Shorten an Auto Tow Rope

THE FISHERMAN'S KNOT

Joins Fishlines, Small Rope, Twine

The Fisherman's Knot is very strong and in common use by anglers. It's also a very handy knot to know in case you're short of twine and must join two lengths together for tying up a package.

To Tie: Lay the two ends together — each pointing in the opposite direction. Then tie an Overhand Knot in the end of each — *around* the standing part of the other. When drawn tight the two knots slide together, will not slip.

HOW TO MAKE FAST

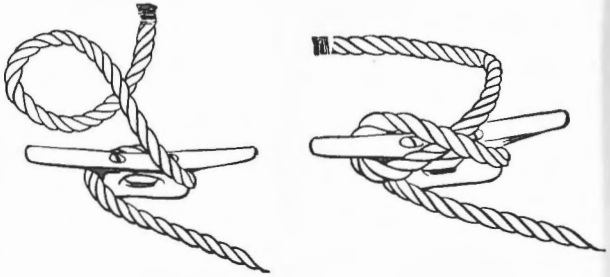
Many methods of making fast are used but the correct one is usually the easiest. One easy but effective method is illustrated here.

To make fast: loop the running part around the cleat's far side, away from the direction of the strain. Then take a turn around the stem with the running part and up and over the center (additional turn would jam the line.)

Add several more figure eights or slip a half-hitch over a horn of the cleat immediately if there is little strain.

Your line is now made fast, yet ready for prompt cast off with no part under tension binding loops.

This method makes it easy to cast off without having to take up the slack in the standing part, and ensures against accidents that occur when lines could not be freed quickly.



Splicing

Why it is Safer

While the knot itself will not part, the knotting process creates a shearing effect on the fibers and lowers their resistance to strain.

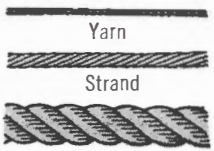
In splicing, the fibers are not subject to this weakening effect. Result: a good splice has up to 95% of the breaking strength of the rope . . . while a knot may weaken the rope as much as 50%. (See the knot efficiency chart on page 9.)

ROPE STRENGTH RETAINED IN SPLICE

Type of Splice	*3 Strand*	*8 Strand*
Eye	100%	100%
Short	95-100%	95-100%
Long	85-90%	70-80%
Long Blind	50-60%	

MORAL: Whenever possible, use a *splice* rather than a knot.

YOU'LL FIND IT HELPS TO NOTE HOW ROPE IS CONSTRUCTED



3 Strand Rope, Right Laid

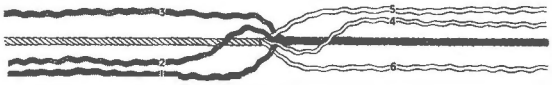
STANDARD ROPE has three strands. A *strand* is made of a number of *yarns* twisted together.

THE LAY of a rope is the direction in which the strands are twisted together. Most rope is "right-laid" — the strands spiraling upward to the right — when you hold it vertically.

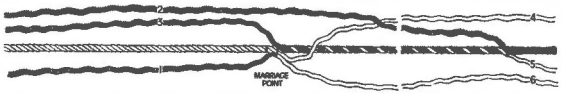
HOW TO SPLICE A THREE STRAND ROPE

LONG SPLICE

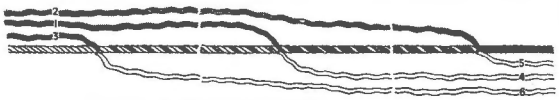
This splice is good for any pulley work except power transmission.



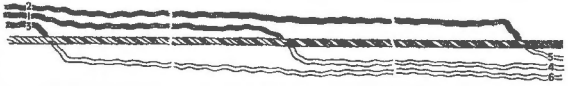
1. Unlay the end of each rope a minimum of 30 turns for manila, 6 to 10 turns more for nylon. Lash securely with twine as shown to prevent ropes from coming apart further. Place ropes together, alternating the strands from each. Note how strands are numbered to show their relative positions throughout the long splice procedure.



2. Take lashing off one side. Unlay one strand (2) a minimum of 25 turns and replace it with a strand from the other side (5) as it is being unlaid. Lash securely as shown to hold strands in place. Be sure to place lashing at the "marriage point" to hold strands securely.



3. Step 3 is like step 2, except in the opposite direction. One strand (6) is replaced with another (3). Each point is securely lashed. This leaves strands 1 and 4 at the "marriage point."



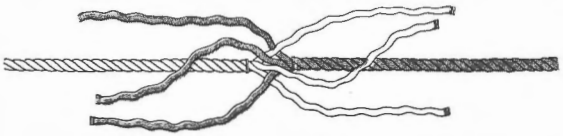
4. Remove lashings and tie each pair of opposing strands (2/5, 6/3, 1/4) with an overhand knot. Be sure knot is tied in the direction of strand twist.

5. Tuck each strand 4 times for synthetic fiber ropes, or 3 times for manila. These tucks should be at right angles to the direction of the twist in the rope.

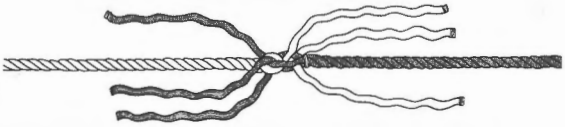
6. The splice may be tapered by adding an additional ⅔- and ⅓-strand tuck at each strand junction. Now roll and pound well. Finally cut the strands off close to the rope.

SHORT SPLICE

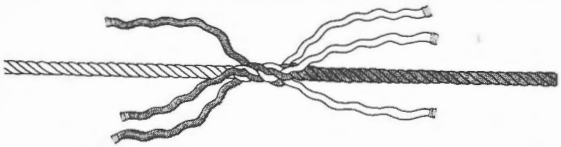
This method is very satisfactory when only a small amount of rope can be spared for making a splice or when the usage will permit an increase of about 50 percent in rope diameter.



1. Unlay ends of ropes to be spliced six or eight turns, depending on the lay of the rope. The softer the rope, the longer the splice should be. Lash as shown, and whip ends of the strands to keep them from coming apart. Bring the two pieces of rope together so that each strand of one part alternates with a strand of the other.



2. Cut the lashing on left side and start tucking strands from the right side over and under next adjacent strands on the left side.



3. Remove lashing from right side and begin tucking the strands from the left side by bringing a strand up over the nearest strand on the right side and down under the next. The tucking should be done at right angles to the direction of the twist in the rope. Pull all strands with a sharp yank on left and right. This tightens up the first tuck.

4. Tuck each strand, from left and right side, at least two more tucks for manila and three more for synthetic rope.

5. The splice may be tapered by adding one ⅔- and one ⅓-strand tuck. Now cut off all ends and roll the splice beneath your foot or between two boards to give a smooth appearance.

EYE SPLICE OR SIDE SPLICE

The eye splice (sometimes called the side splice) is used for forming an eye or loop in the end of a rope by splicing the end into the side.

Untwist the strands of the rope end four to six turns. Select as No. 1 the strand that is on top of the rope and in the middle between the other two strands. Raise a single strand on the top of the solid rope and pass strand No. 1 under this single strand diagonally to the right, as in Fig. I.

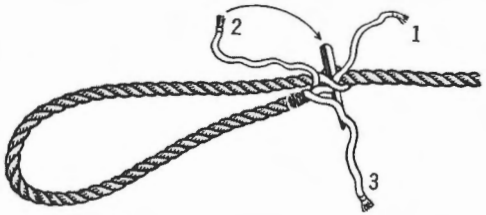


Fig. I

Insert the marlinspike as shown in Fig. I, so that it forces out from the main rope a single strand and so that the end of the marlinspike comes out where strand No. 1 went in. The marlinspike must *not* enter where strand No. 1 comes out. Tuck strand No. 2 so that it passes through the rope in the same direction as the marlinspike did.

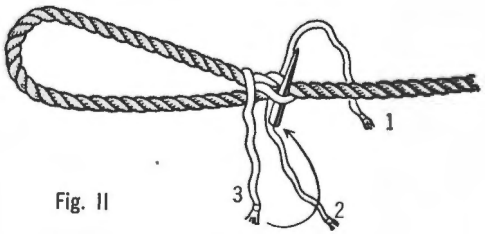


Fig. II

Next, insert the marlinspike as shown in Fig. II starting it where strand No. 1 comes out and bringing it out where strand No. 2 goes in. Turn the two ropes over, remove the marlinspike and push strand No. 3 through. Pull this strand up snugly and the others also. It will now be seen that all three strands come out of the main rope in the same place and that each is separated from the others by a strand of the main rope. Proceed to splice the ends into the solid rope as shown in Figs. III to VI inclusive. This is in the same manner as given for the short splice with the exception that now we have but three strands and need to work only in one direction. The splice may be finished by dividing each strand as in the short splice and rolling the finished splice under foot.

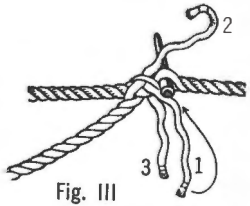


Fig. III

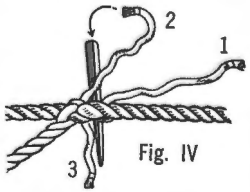


Fig. IV

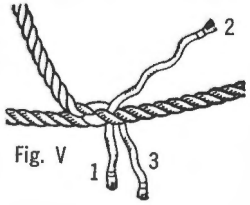


Fig. V

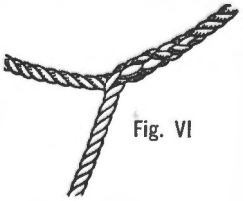


Fig. VI

SPLICING SYNTHETIC FIBER ROPE

Eye splices and short splices in nylon should be given an additional full tuck. When making a long splice in nylon, it is well to unlay one strand 6 to 10 additional turns (more than Manila) before locking the ropes together, to prevent slippage. When these ropes are cut, the ends should be seized to prevent fraying.

SPLICING SKI-TOW ROPE

Use only the long blind splice which does not increase rope diameter. The splice should be at least 15 feet long and can be adapted from the 4 strand Transmission Rope splice shown on pages 46, 47 and 48.

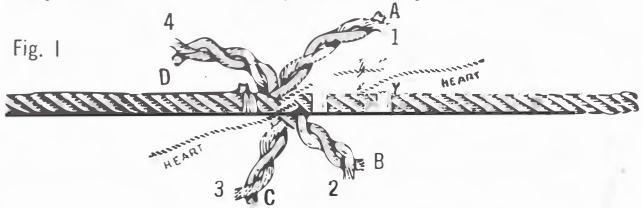
To eliminate yarn unraveling and to facilitate tucking and splice finishing, tape the ends of each strand as soon as the cut is made.

TRANSMISSION SPLICE

Here, we are working with a *four*-strand rope, with a heart. A 16-foot splice is about the proper length for a ¾″ diameter rope. Larger ropes should be given proportionately longer splices, up to 42 feet for a 2″ diameter rope. *This example* is for a 1¼″ rope.

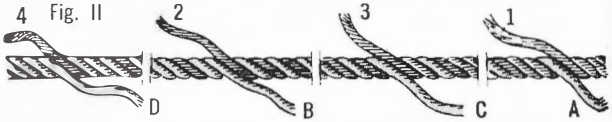
First, mark the rope to length, allowing 12 to 15 feet on each end. This will make a 20 to 26-foot splice. Unlay each end back to the markers, then twist the strands together, Fig. I. Cut marker "Y", unlay strand "1" five feet, lay strand "A" in its place; unlay strand "3"

Fig. I



two feet, lay strand "C" in its place; cut hearts just as they meet. Then, cut marker "M", unlay strand "D" five feet, lay strand 4 in its place; unlay strand "B" two feet, lay strand

Fig. II



2 in its place; cut off all strands about eighteen inches long for convenience in manipulation. The rope is now as in Fig II. As the strands are laid in, great care should be used to maintain the original twist in each. Each pair of strands is now successively subjected to the following operations:

Take strands "B" and 2, for example: unlay them each three turns, split and whip one end

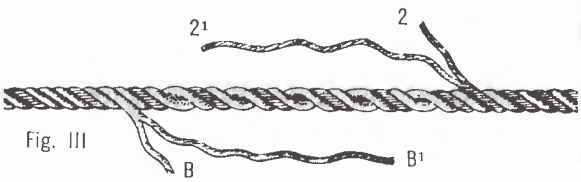


Fig. III

of each as "B" and 2¹ in Fig. III. Lay back the split strands "B¹" and 2¹ and tie in a simple

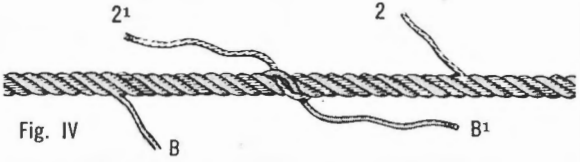


Fig. IV

knot. Fig. IV. With a fid or marlinspike raise "B¹" and tuck 2¹ around it until it reaches "B". Raise 2¹ and tuck "B¹" around it until it reaches 2.

Split "B" and pass 2¹ through it and through center of rope; split 2 and pass "B¹" through

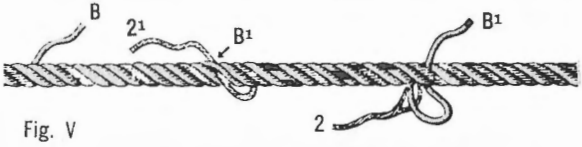


Fig. V

it and through center of rope. Do not put much twist into the part which is being tucked around; try to lay a smooth even course of

about the same angle as the original strands. These half strands should not pass around more than four times before being drawn through the rope. Fig. V shows "B^1" raised with 2^1 being tucked around it, and end "B^1" passed through 2 and through rope ready to be drawn tight.

This operation is called tucking, or locking the strands. If these tucks or locks are not made small and firm, they will wear more rapidly than the rest of the rope and the splice will fail. When the strand is split, preparatory to making this lock, it is common practice to make the parts used for tucking two or three yarns smaller. In this manner, the lock is made small and wear reduced.

Cut off ends of the strands, leaving one or two inches projecting, so that as the working tension is put upon the rope, the yarns may draw in somewhat without being loosened. Fig. VI shows completed section of splice.

Fig. VI

HOW TO SPLICE 8 STRAND PLI-MOOR® ROPE

YOU WILL NEED:

- A Splicing Fid
- A Roll of Plastic or Masking Tape
- A Sharp Knife
- A Supply of Light Strong String
- A Marking Pen or Colored Chalk

Plaited rope is made of 8 strands grouped in 4 pairs; 2 pairs turn to the left and 2 pairs turn to the right. In the illustrations, for the sake of simplification, we have the 2 pairs turning to the left in white and the 2 pairs turning to the right in a dark tone. From here on, we refer to them as the white and dark pairs. Note that the dark pairs are diametrically opposite one another but at a 90° angle to the white pairs and vice versa.

LONG SPLICE

1. As in Figure I, lay the two rope ends to be spliced side by side on a flat surface. Taking one rope at a time, carefully determine the two pairs of strands going to the right. If your rope is all white in color, use the marking pen or chalk to clearly mark these two pairs of strands from the end, back along the rope for a distance of 30 pics (Fig. I). From here on we will refer to these as the dark strands, the remaining two strands (which appear to move to the left) as white.

2. Now make certain that a pair of dark strands are running along the top of each rope. Starting from the ends, count back to the 9th crown (or 9 full pics). Mark this point clearly all around the rope. Repeat this for three counts of 6 each and clearly mark. This will be the ¾, ½, ¼ and center marks as shown in Figure I.

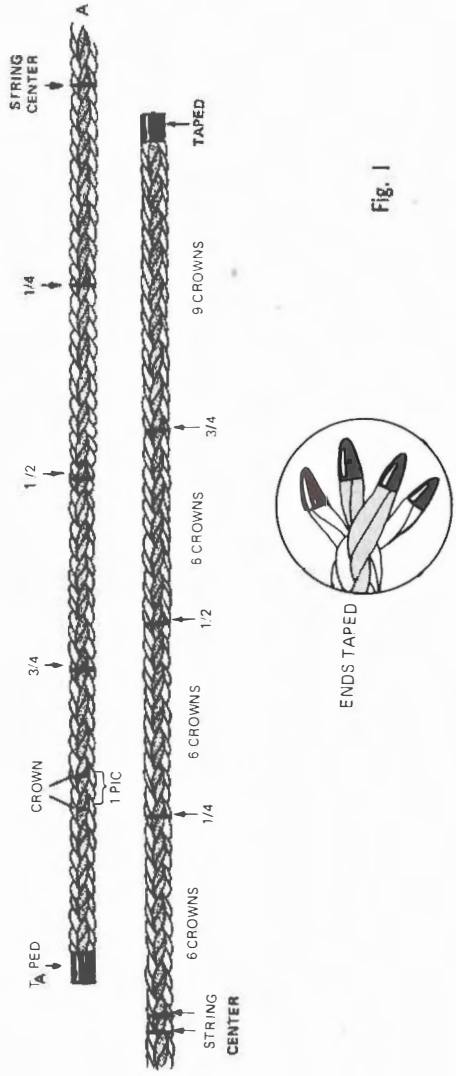


Fig. I

3. At the center mark of end "A" (Fig. I), *securely* tie the string around the rope, over the crown of the dark strands. With end "B", tie the string between the center mark dark strands and the next pair so that the string passes over the crown of the white strands.

4. Now carefully match your work with Fig. I.

5. Now taking one end at a time unlay the rope back a short distance. Taking each pair of strands, one at a time, tape them together at the end. Try to work this tape so that it is pointed or conical, (see insert Fig. I), this will help when the splice begins. Now that all 4 pairs of strands of each rope have been taped together, carefully unlay the ropes back to the strings. Position the strands as shown in Fig. II. You should now be ready to start your splice.

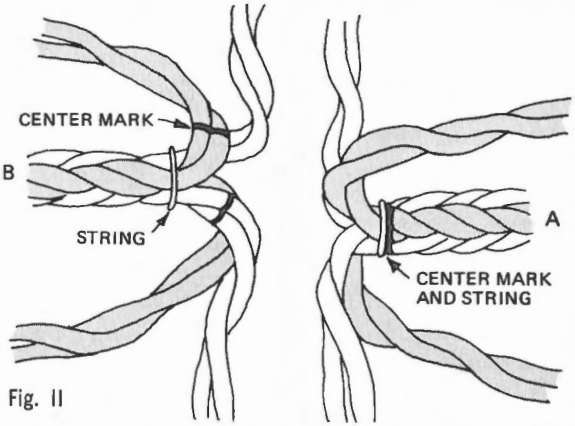


Fig. II

6. Marry the bottom dark pairs, by inserting the pair from the right between the two strands of the pair from the left at the center mark. *Do not pull tight.*

7. Now marry the white strands, on the side away from you, in exactly the same manner. The two white pairs, on the side towards you should be reversed in that the pair from the left should be inserted between the two strands of the pair from the right at the center mark.

8. To complete this initial step marry the top pair of dark strands by inserting the pair from the left through the pair from the right at the center mark.

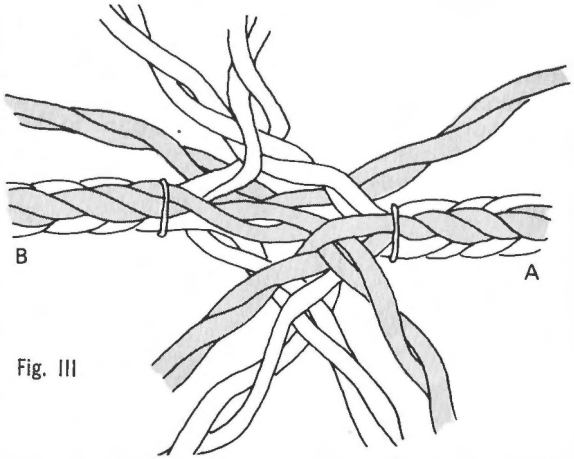


Fig. III

9. Now carefully check your work against Fig. III. If it does not conform, recheck the last 3 steps. Now cut and remove both strings. Taking 4 pairs of strands in each hand pull the marriages up tight so that all of the center marks are together.

10. Now tie off each of the four marriages individually as pictured in Fig. IV. This will take some care to keep them from loosening. The center marks must stay together for a successful splice.

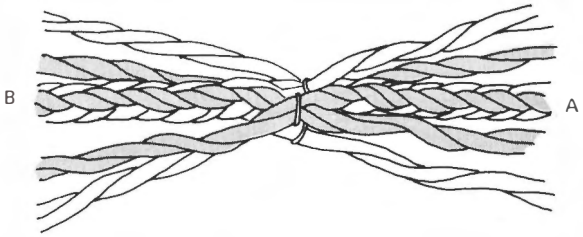


Fig. IV

11. Start splicing with the two top (dark) pairs of strands. First cut off the outside pair at the marriage (Fig. V). This should be the pair coming from the right. Now cut the string. Pull the cut ends back from under the white pair. Insert the uncut dark strands (that are coming from the left) in their place. *Make certain now,* and throughout the remainder of the splice, *that the inserted strands are layed in parallel and not twisted on one another.* (See Fig. VI). Continue removing the cut dark strands one pic at a time and inserting the dark pair from the left to the ¾ mark on the *strands being inserted.*

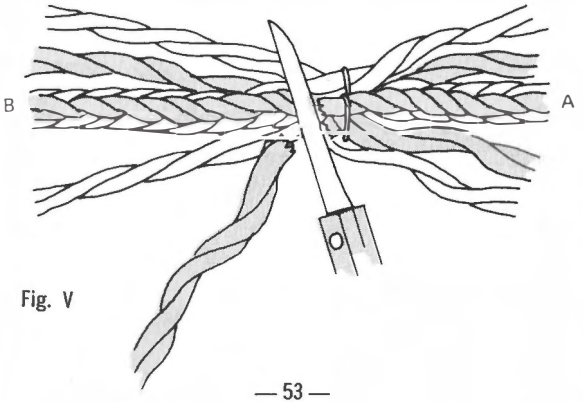


Fig. V

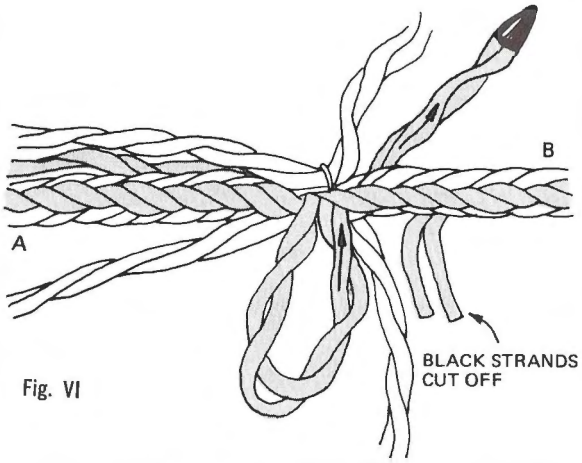


Fig. VI

12. Having reached the ¾ mark, cut the tape holding the two strands from the left. Split the pair into two separate strands. Choose one and its exact counterpart from the right. Remove the single strand from the *right* from under the white strands in the same manner as you previously did with the pair. Insert the single strand from the left in its place. Continue removing and inserting for a distance of 6 more pics. (Figure VII).

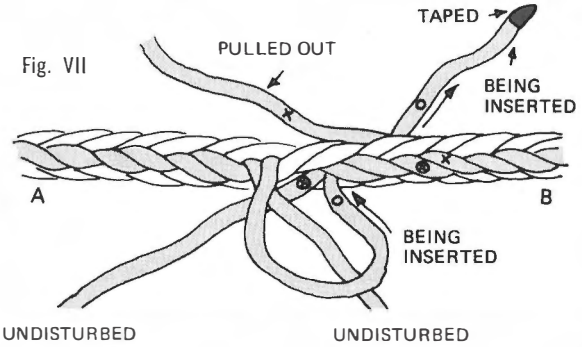


Fig. VII

13. Now return to the center marriage point. Choose the white strand marriage on the side away from you. This time cut off the two strands coming from the left. Cut the string. Then moving in the opposite direction duplicate your actions in Step #11 to the ¾ mark and Step #12 for 6 more pics.

14. From here on it is relatively simple. Return to the center marriage and repeat the above procedure with the remaining pairs of white strands working back in the original direction as in Step #11. *However,* this time go only to the ¼ mark with 2 strands and to the ½ mark with the single strand.

15. With the remaining pair of dark strands work to the left to the ¼ mark with two strands and to the ½ mark with a single strand. Your splice should now look like Figure VIII.

16. The ends now remaining should be cut off about 4 pics long. Then tape the ends in a conical manner as shown in Fig. I. Working in the direction that each has been spliced to this point, tuck each end, in turn, up the center axis off the rope for a distance of about three pics (see Fig. IX). Whatever short ends remain should now be cut off flush. Your finished splice should now look like Fig. X.

Fig. VIII

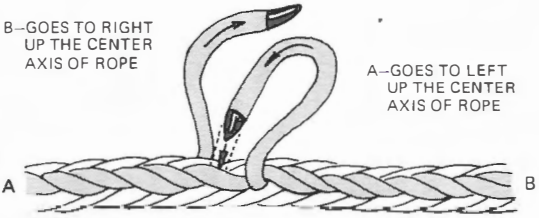


Fig. IX

Fig. X

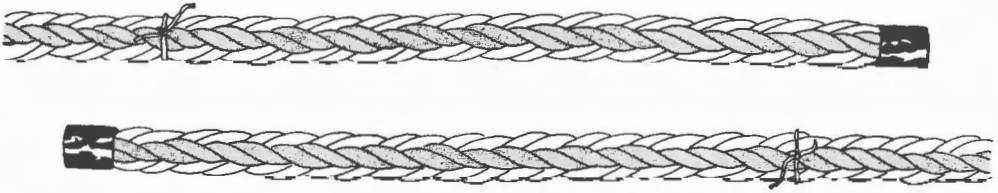


Fig. I

1. Lay the two rope ends that are to be spliced, side by side on a flat surface. Tape the ends as shown in Fig. I.

2. Determine which pairs of strands go to the right and which go to the left. If the rope which you are splicing is all one color, mark all the pairs which are going to the right with your marker, from the ends back along the rope for a distance of 11" to 12 pics (Fig. I). From here on we will refer to these pairs as dark (going to right) and light (going to left).

3. Count back from the ends of the rope 10 crowns (Fig. I). At this point mark around the entire rope and tie a string securely around the ropes at this point so that it passes directly over the pairs of dark strands on one rope and over the light strands of the second (Fig. I).

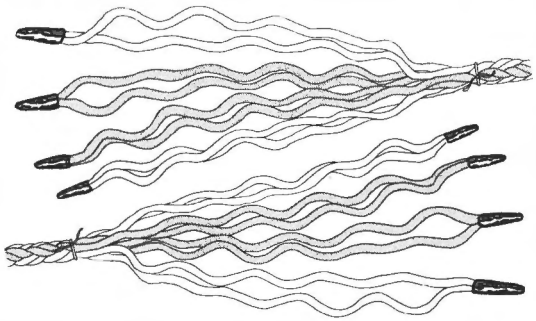


Fig. II

4. Unlay the four pairs of strands of both ropes back for a distance of 10 pics and tape the ends, in pairs, as shown in Fig. II. Now, complete the unlaying of the rope back to the strings. (Fig. II).

5. Your work should now appear as shown in Fig. II. The undisturbed portion of the ropes above the strings should be laying with the dark strands on top. Throughout the splice these pairs should run parallel and not be allowed to twist over one another.

6. Start to marry the two ropes at the strings in the following manner. (Fig. III).

a. Bend the two top (dark) pairs back along the rope.

b. Spread the white strands out at 45° angles to the axis of the rope.

c. Marry the bottom (dark) pairs by inserting the pair from the right between the pair from the left, at the strings.

d. Now marry the white pairs. The right pair between the two strands from the left on one side and the left hand pair between the strands from the right on the other.

e. Now marry the top dark strands. The pair from the left between the pair from the right. Your splice should now look like Fig. IV.

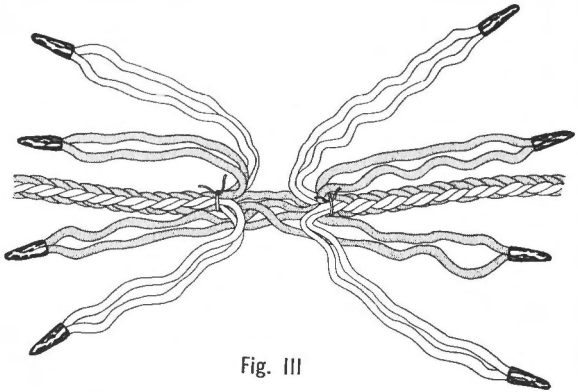


Fig. III

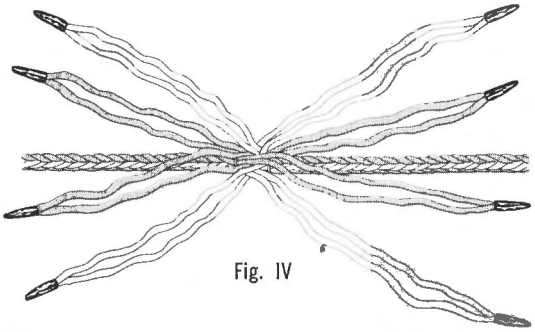


Fig. IV

7. Cut off both strings. Using both hands first grasp the four pairs on the right hand and then the four pairs on the left. Now pull the marriage up snug and tie a string securely around the entire marriage point as illustrated in Fig. V. Cut this string only when it is hopelessly in the way during the next step.

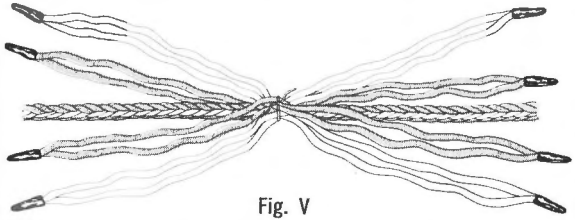


Fig. V

8. Using the fid to make space, start splicing by inserting the white pairs from the left under the dark pairs from the right. Next the white pairs from the right are inserted under the dark pairs from the left. Now complete this first tuck by following the same sequence, as above, with the four pairs of dark strands going under the white strands on the opposite side of the marriage. Your splice should look like Fig. VI.

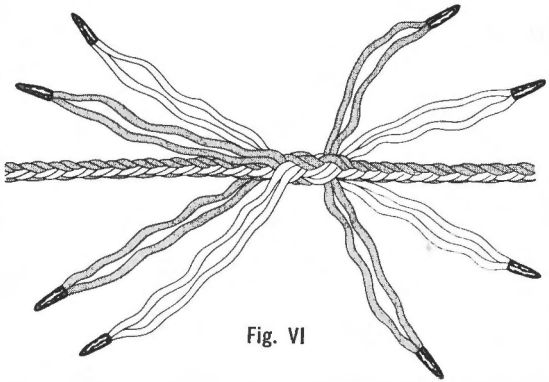


Fig. VI

9. Continue splicing pairs as in step 8 for two (2) additional complete tucks. Your work should now look like Fig. VII.

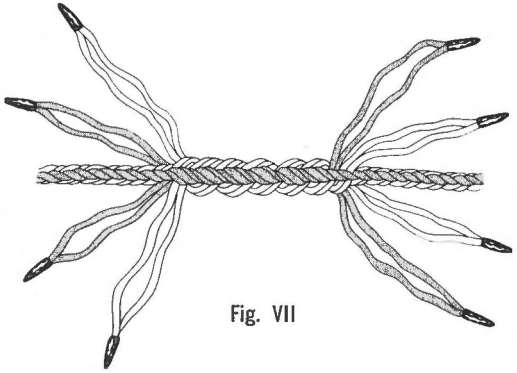


Fig. VII

10. Now split the pairs and using only one (1) strand of each pair, make two additional tucks, as illustrated in Fig. VIII.

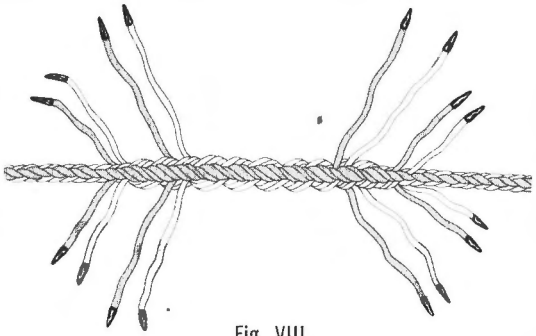


Fig. VIII

11. Tape and cut the ends off about 2 pics long. Now complete the taping as shown in Fig. IX.

Fig. IX

This is your finished splice. It should never be used when the spliced work must pass through a cleat or over a sheave. No matter how poor your first attempt may be, you will find that it has a high degree of efficiency in this splice. (90-95%).

AN EFFECTIVE, QUICK, TEMPORARY SHORT SPLICE FOR PLI-MOOR ROPE

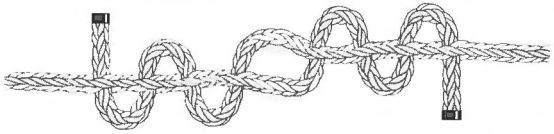


Fig. I

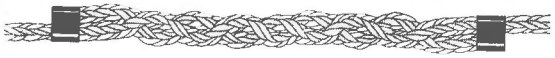


Fig. II

1. Lay the two ends of the ropes to be spliced side by side in opposite directions.

2. Starting at a point about 12 pics from the end of #1 rope and using a fid or other pointed tool, separate the strands so that there is an opening formed by one pair of right turning strands and one pair of left turning strands on either side of the opening. Tuck the end of the #2 rope thru this opening and pull thru about 12 pics.

3. Count down 3 pics and repeat tuck in opposite direction. Continue for a total of four tucks.

4. Now start with the end of the #1 rope and tuck this into standing part of the #2 rope for four tucks.

5. Pull these loops down until your splice appears as in Fig. II.

6. Cut off excess and tape the ends to the standing parts.

EYE SPLICE

Preparation: If the rope which you are about to splice is all of one color, it will be simpler if you mark those pairs which turn to the right so that they will conform with the dark pairs in the illustrations. Count back a distance of about 10 pics (See Fig. I) from the end, and tie a string *securely* around the rope so it passes directly over the center of both pairs of dark strands. Place the knot so that it is directly on top of one of these pairs. It is important that this be tied securely to prevent slipping. Now, unlay the pairs of strands back to the string. Making sure not to mix, or twist them, tape the ends of the pairs together as seen in Fig. I.

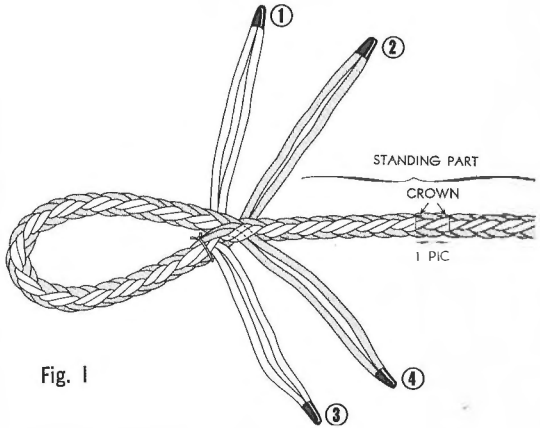


Fig. I

So far, so good — you are now ready to start the splice.

1. Hold or lay the rope so that the pairs of white strands are on top and bottom with a knot to the right as you look towards the end.

2. Bend the rope over to the desired eye in such a way as to keep the knot inside the loop as shown in Fig. I.

3. Using the fid to make clearance and starting with the dark pairs, tuck them under the diametrically opposite white pairs as shown in Fig. I. *Make sure that you do not disturb the lay of the pairs.* Do not twist them so that the individual strands cross over one another in the pair.

4. Now turn eye over, tuck the white pairs under the diametrically opposite dark pairs as shown in Fig. II. (Note that in Fig. II the splice is turned over from Fig. I). The white pairs to be tucked should follow the white pairs of the standing part and the black to be tucked should follow the black pairs of the standing part. The ends in the drawing have been numbered to help you follow their progress.

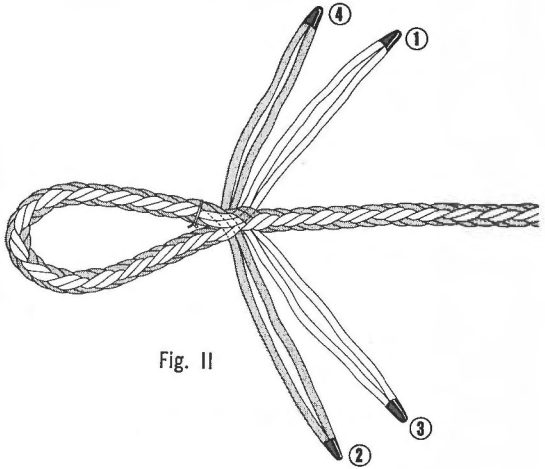


Fig. II

5. Now, you have your eye with the first full tuck complete; pull all 4 ends down firmly. Starting with the dark pairs, take another full tuck (a full tuck means inserting all 4 pairs. By starting with dark pairs, you avoid having to go under 2 pairs at once). Your splice should now look like Fig. III, which now lays on the same side as Fig. I. From here on, you should have no difficulty completing the splice.

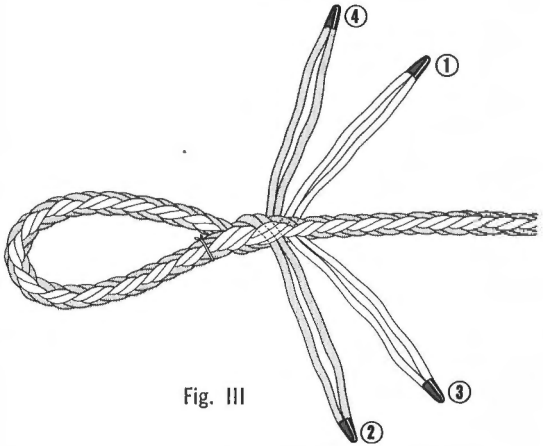


Fig. III

6. Now starting with the dark pairs, take at least one more full tuck. With a very soft rope, it may be necessary to take a 4th or 5th full tuck.

7. Having completed the 3rd full tuck (or 4th or 5th if necessary) select the strand closest to the eye in each pair. Tape this strand close to where it emerges from the tuck and then cut off as shown in Fig. IV.

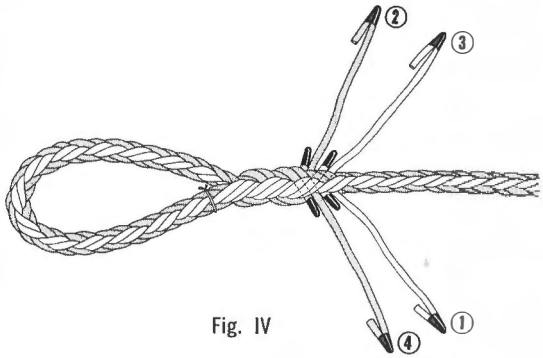


Fig. IV

8. Now, splice your remaining single strands just as before for another full tuck. Your splice should now appear as Fig. V, which you will note lays on the side opposite that shown in Fig. VI.

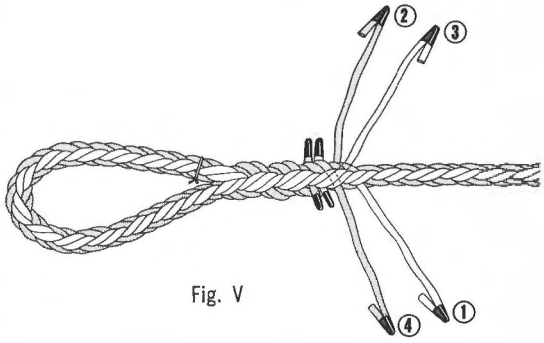


Fig. V

9. Tape first and then cut off the 4 single strands as shown in Fig. VI. The 8 ends may be heated and fused so they will not fray; however, take great *caution* to be certain that you fuse only the ends and do not damage the strands.

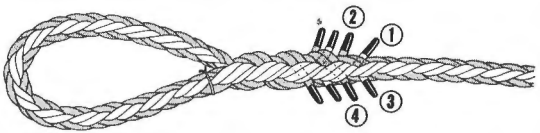


Fig. VI

A more professional appearance may be achieved by cutting the ends off flush and then taping or whipping the entire splice.

AN EFFECTIVE, QUICK, TEMPORARY EYE SPLICE

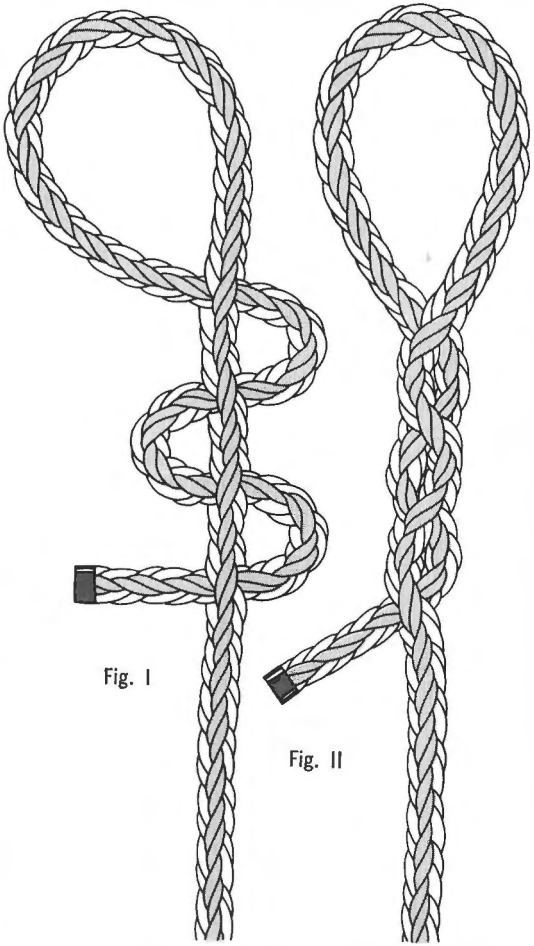


Fig. I

Fig. II

It is possible to make a quick splice which will be every bit as efficient as the regular eye splice as depicted on pages 64 thru 68. This splice is not designed for permanent use, although under certain circumstances, it would probably give long and lasting utility.

To construct this quick splice, perform the following steps:

1. Determine the size of the eye desired and form a loop as shown in Fig. I. Be sure to allow 10-12 in. of excess to be spliced.
2. Using a fid or other pointed tool, separate the strands so that there is an opening formed by one pair of right turning strands and one pair of left turning strands on either side of the opening. Tuck the excess rope to the point where you have formed the size of eye desired.
3. Counting down 3 pics for the top pair of strands, repeat the process in the opposite direction from number 2.
4. Repeat this 2 more times as shown in Fig. I.
5. Pull these loops down until your splice appears as Fig. II.
6. Cut off the excess to a distance no closer than 3 inches from the final tuck.

While we consider this type of splice to be temporary in nature, it will afford you a good splice; good enough to be used under most circumstances as a temporary measure.

Blocks and Tackle

DEFINITIONS:

Block — A frame of wood or metal within which are fitted sheaves or pulleys over which a rope runs. Blocks may be single, double, treble, etc. They are designated by the number of sheaves they contain. The lifting power is multiplied in ratio to the number of sheaves used.

Tackle — A combination of blocks, ropes and hooks for raising, lowering or moving heavy objects. A "tackle" increases lifting power but reduces lifting speed.

Fall Rope — That part of the tackle to which lifting power is applied.

Fall Block, Running Block — The block attached to the object to be moved.

Fled Block, Standing Block — is fixed to a permanent support.

Standing End — The end of the fall fixed to the tackle.

Running End — The end opposite the standing end.

Return — Each part of the fall between the two blocks or between either end and the block.

Lifting Force — Is in ratio with the number of times the rope passes to and from the fall block.

To Overhaul — Is to separate the blocks.

To Round In — Is to bring the blocks closer together.

Two Blocks — Means the blocks of the fall are in contact.

Shell or Frame — Part which holds sheave or wheel.

HINTS FOR SAFE LIFTING

Rule 1. For heavy work with a three or four sheave block, the fall should be rove with the hauling part leading from the middle sheaves of the blocks instead of the outer sheaves. This reduces the chances of slewing the blocks in their straps.

Rule 2. For heavy work do not make the standing part fast to a becket worked into the strap as may be done in light work. If the standing part is to be made fast to the block, it should be taken around and secured between block and hook. Better still plan to make it fast to the weight to be lifted along side the block.

Rule 3. The hauling part of a tackle should be kept as nearly parallel to the other parts as possible to prevent loss of power. Increase in speed and decrease in sheave diameter will increase the power loss.

Rule 4. Generally, the safe load for a well made block is in excess of the strength of the rope it will reeve. However, this is not always true of the hook. The hook is usually the weakest part of the block. Its strength invariably measures the strength of the block.

Rule 5. In lifting, the pull on the support of the fixed block is increased greater than the actual weight being lifted. This point is often overlooked. If it becomes necessary to determine the tension on a yard or support to which the fixed block is made fast, you must add the tension on the hauling part to the direct downward pull of the weight.

PARTS OF A BLOCK:

Shell or Frame — Part which holds sheave or wheel.

1. *Strap* — Iron or rope passing around the shell forming attachments for making fast the "hook" at one end and the "eye" at the other.

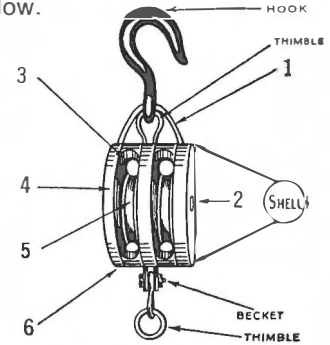
2. *Pin* — Axle upon which the sheave turns in shell.

3. *Swallows* — The space between the sheave and frame of the block through which the rope passes.

4. *Cheeks* — The side pieces of the frame of a block.

5. *Sheave* — Wheel or grooved pulley over which rope runs.

6. *Breech* — The end of the block opposite the swallow.



MAKE SURE YOUR TACKLE CAN TAKE IT!

In industry, the uses for rope and rope tackle are many and varied, and the importance of safety varies with the work to be done. Obviously, in hoisting, lowering and scaffolding work, nothing less than absolute safety for workers and materials should be considered.

While an ample margin of safety for the proper sizes of *new rope* is suggested in the tables on pages 75 and 76, a design factor higher than 5 to 1 should be used for rope that is old, that shows signs of abrasive wear, damage from exposure, or that has been used repeatedly under heavy strain. In such cases, depending on the condition of the rope, only ¾ or ½ or even ⅓ the working loads given in these tables should be handled by the rope. Rope that has been exposed to chemicals should be carefully examined for dark or brown spots and the affected sections cut out and the rope spliced. And in all cases where tackle is being used, rope that is cut or plainly damaged at any point should be properly spliced so that it will still pass through the block swallows easily. If this can't be done, it should be replaced.

Make sure your block is large enough for the size of rope (with a 5 to 1 design factor) required for the job. Proper sizes of blocks for given sizes of rope are listed in the tables on pages 75 and 76. Keep in mind that rope is stronger than the blocks. Due allowance is made for this in the tables. Using too small a block is false economy. The too-sharp bend over the smaller pulley is the main cause of rope wear. Also — because a block was designed for a certain size of rope, it may give way under a load that a larger rope is perfectly able to handle. So — don't overload either block or rope. Your tackle will "take it" if ***both*** the rope and blocks are of proper size.

SUITABLE WORKING LOADS FOR BLOCKS

For Manila Rope

FOR REGULAR MORTISE INSIDE IRON STRAPPED BLOCKS

Dimensions Inches		Suitable Working Loads					
		With Loose Side Hooks			With Shackles		
Length Shell Inches	For Diameter Rope	Double and Single Pounds	Two Doubles Pounds	Two Triples Pounds	Double and Single Pounds	Two Doubles Pounds	Two Triples Pounds
3	⅜	200	300	400	400	800	1,200
4	½	400	550	700	800	1,400	1,800
5	⅝	500	750	1,000	1,100	1,700	2,100
6	¾	1,000	1,500	2,000	1,600	2,400	3,000
7	⅞	1,500	2,000	2,500	2,000	3,000	3,700
8	1	1,700	2,450	3,200	2,400	3,600	4,400
10	1⅛	2,600	3,400	4,200	4,000	5,400	6,400
12	1¼	3,000	3,750	4,500	5,000	8,000	10,000

FOR HEAVY WIDE MORTISE BLOCKS

Dimensions Inches		With Loose Side Hooks			With Shackles		
Length Sheil Inches	For Diameter Rope	Double and Single Pounds	Two Doubles Pounds	Two Triples Pounds	Double and Single Pounds	Two Doubles Pounds	Two Triples Pounds
6	¾	1,500	2,000	2,500	1,600	3,000	4,000
7	1	1,700	2,450	3,200	2,000	3,800	4,800
8	1⅛	2,200	2,900	3,600	2,400	4,700	6,700
10	1¼	3,000	3,750	4,500	4,000	7,000	9,000
12	1½	3,600	4,800	6,000	5,000	9,000	12,000
14	1¾	4,400	5,700	7,000	6,500	11,000	15,000
16	2	6,000	7,500	9,000	8,000	14,000	18,000

NOTE: These tables are shown through the courtesy of the Boston & Lockport Block Company and indicate suitable loads for one series of their standard and heavy blocks. These should be used as a guide only in ordering without assuming any responsibility — since the loads will vary between blocks in the manufacturer's line, and between blocks in other manufacturers' lines. Remember, too, that these are suitable working loads for BLOCKS, not rope. Safe working loads for rope are higher than those for blocks.

HOW TO DETERMINE ROPE SIZE FOR A GIVEN LOAD

LIFTING POWER

Rope tackles are valuable not only as a means of multiplying power, but also as an aid in applying power smoothly. In lowering an object they permit it to be lowered easily and exactly, because what is gained in power is lost in speed.

From pages 79 and 80 you can see that a rule for lifting power of a tackle is: *the power at the movable block is to the power on the hauling part as the number of parts at the movable block is to one.*

$$\frac{\text{Power movable block}}{\text{Power hauling part}} = \frac{\text{No. parts movable block}}{1}$$

However, actually this is not an exact calculation, as a certain amount of power is lost at each sheave through friction. Experience shows that this loss is represented by a 10% increase in the load for each sheave of the tackle an ample safety factor will be had. To find the power required to lift a given weight: Add 10% for friction at each block and divide by the number of parts at the movable block.

Example: Power required to lift 100 pounds with two double blocks?

10% X 4 (number of sheaves) = 40%

40% X 100 lbs. (given wt.) = 40 lbs.

100 lbs. + 40 lbs. = 140 lbs.

140 ÷ 4 (pts. at mov. block) = 35 lbs., power required on hauling part to lift 100 lbs.

The above rule is for average working conditions and will vary at times due to changing friction at various speeds.

TYPES OF TACKLE:

Shown in Fig. I

A — *Single Whip* — A single fixed block and fall — no increase in power. Gain only in height of lift or change in direction of pull.

B — *Double Whip* — Two single blocks — one fixed, one moving. Double force gained.

C — *Gun Tackle* — Two single blocks. If lower block is movable, double force is gained. If upper block is movable, triple force is gained.

D — *Handy Billy* — A double block with a fall and a single block with a hook. Force gained, triple.

E — *Luff Tackle* — A double hook-block and a single hook-block. Force gained three if single block is movable, four if double block is movable.

F — *Double Tackle* — Two double sheave hook-blocks. Force gained four or five, depending upon application.

The force gained as given in all of these tackle combinations is theoretical only, as the friction of the blocks has been ignored. The method of calculating the actual force gained and compensating for this friction is shown on page 77.

A rope tackle is a handy bit of equipment to have when lifting must be done. No attempt is made in this short space to cover all applications of rope in use in tackle. Pages 71, 79 and 80 show basic information on the parts of a tackle as well as several of the more common types of tackle.

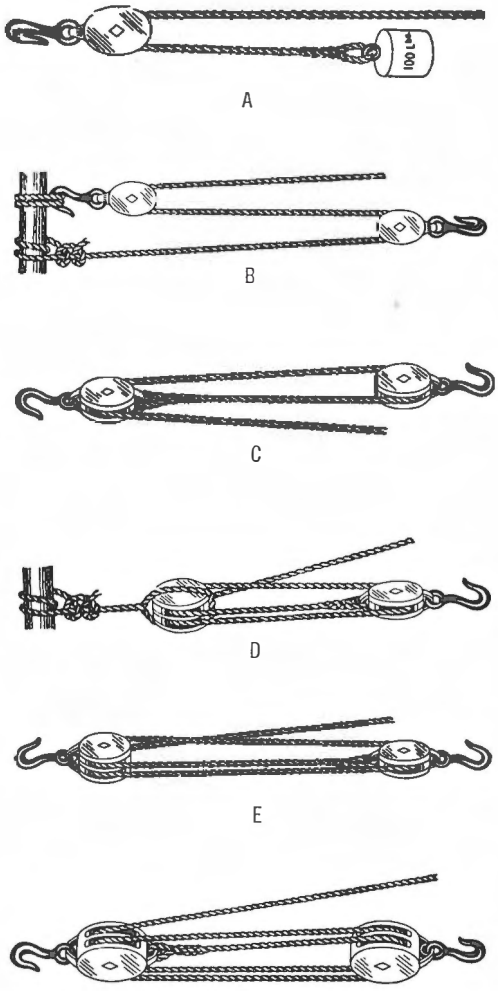


Fig. I

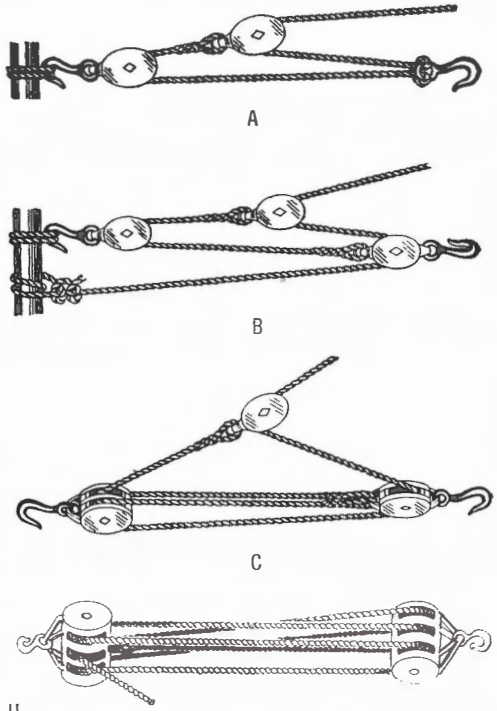


Fig. II

A — *Single Spanish Burton* — Two single sheave blocks and a hook. Force gained three times.

B — *Double Spanish Burton* — Three single blocks. Force gained five times. The disadvantage is that the whip block travels down and meets lower block coming up.

C — *Double Spanish Burton* — One double block, two single blocks. Force gained five times.

D — *Triple Tackle* — Two three sheave hook-blocks. Force gained six or seven times.

SHEAVES

When used for lifting, rope is constantly bent and straightened around pulleys or sheaves. As it is so bent the strands chafe each other at the center of the rope causing internal wear. The smaller the sheaves the worse is the chafing. To avoid serious wear on a hoisting rope, sheaves (not blocks) should always be at least eight times the diameter of the rope. The following table indicates the sizes of sheaves to be used with various diameters of rope:

Rope Diameter in Inches										
½	5/8	¾	13/16	⅞	1	1⅛	1¼	1⅜	1½	1⅝	2
Size of Sheaves by Diameter in Inches											
4	5	6	7	8	9	10	12	14	15	16	18

REEVING TACKLES

(Two Double Blocks)

Place the blocks on a bench or floor three feet apart, with cheeks down and swallows parallel to floor. Stand facing the becket block with the hook end nearest you. This is the block that is to take the hauling and standing part of the fall. With the end of the rope in your right hand pass it through the swallow of the upper sheave in the becket block from right to left. Next through the swallow of upper sheave of the second block from left to right.

Then pass the end through the swallow of the lower sheave of the becket block from right to left, and on through the lower sheave of the other block from left to right. Then eye splice the end around the thimble of the becket.

TO MAKE UP A TACKLE

(Two Blocks)

Place blocks about three feet apart, hooks pointing up. Coil the fall with the sun around the blocks and throw a clove hitch around the coil between the blocks. This is the accepted method for storing tackle not in use. It may be hung by the hook of the uppermost block.

When it is to be put in use, cast off the hitch, laying tackle down in same position as when reeving, lift the coil clear and capsize it. Fleet the tackle, that is, pull the blocks apart so they will be ready to use.

Rope Slings

Rules for the safe use of Rope Slings:

1. Before attempting to lift a load be sure the sling is in proper condition. This includes both a check of the rope and the hooks or other fittings to be sure they are properly spliced to the sling legs.

2. Estimate the weight of the load carefully and be sure the sling is of sufficient strength to lift the load.

3. Pads should be placed on all sharp corners between the load and rope to prevent any cutting of the fibers.

4. Do not use a sling to lift a load where there will be sharp bends of rope over an unyielding surface. These bends strain the outside fibers and seriously injure the rope.

5. If a sling shows evidence of cuts, excessive wear or other damage, it should be discarded, as continued use will result in serious personal injury or property damage.

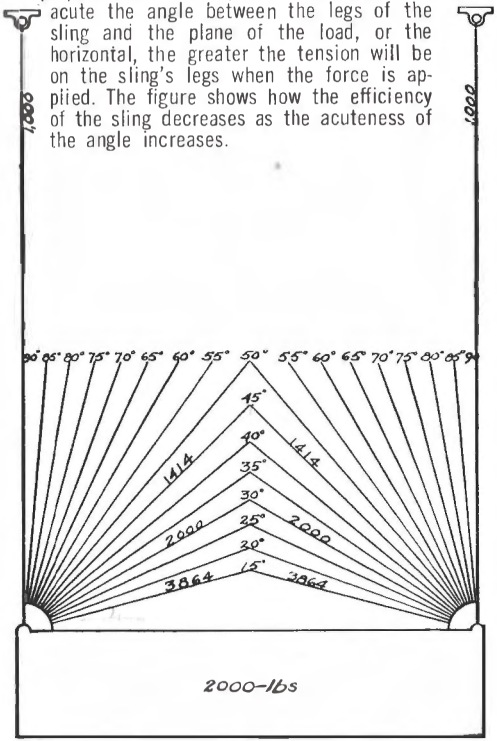
6. Do not use a rope sling for lifting molten metal or objects where the rope will be subject to unusually high temperatures.

7. All rules for the care of rope should also be applied to rope slings.

8. The safety of actual life and limb and the safety of the load handled are largely dependent upon the quality and the condition of the rope slings used.

ROPE SLING ANGLES

A greater load can be lifted when the legs of a sling are perpendicular to the plane of the load. The more acute the angle between the legs of the sling and the plane of the load, or the horizontal, the greater the tension will be on the sling's legs when the force is applied. The figure shows how the efficiency of the sling decreases as the acuteness of the angle increases.



Degrees	Strain	Degrees	Strain
15	3864 lbs.	50	1305 lbs.
20	2924 lbs.	55	1221 lbs.
25	2366 lbs.	60	1155 lbs.
30	2000 lbs.	65	1103 lbs.
35	1743 lbs.	70	1064 lbs.
40	1556 lbs.	75	1035 lbs.
45	1414 lbs.	80	1015 lbs.
		85	1004 lbs.

Table A

MANILA ROPE SLINGS

LOAD CAPACITY IN POUNDS — DESIGN FACTOR = 5

The figures below pertain only to new 3 Strand Manila Rope. In working with synthetic fiber rope one should use a safety factor of 9 for Nylon and Polyester, and a safety factor of 6 with Polypropylene.

Rope Dia. Nominal in Inches	Nominal Weight Per 100 Ft. in Pounds	Minimum Break Test in Pounds	Maximum Working Load in Pounds	EYE & EYE SLING					ENDLESS SLING				
						BASKET HITCH				BASKET HITCH			
						Angle of rope to horizontal				Angle of rope to horizontal			
				Vertical Hitch	Choker Hitch	90°	60°	45°	30°	Vertical Hitch*	Choker Hitch	90°	60°	45°	30°
						Angle of rope to vertical						Angle of rope to vertical			
						0°	30°	45°	60°			0°	30°	45°	60°
1/2	7.5	2,385	495	495	225	990	810	675	495	855	450	1,710	1,530	1,260	855
9/16	10.4	3,105	630	630	315	1,260	1,080	900	630	1,080	540	2,250	1,980	1,620	1,080
5/8	13.3	3,960	810	810	405	1,620	1,350	1,080	810	1,440	720	2,880	2,430	1,980	1,440
3/4	16.7	4,860	990	990	495	1,980	1,710	1,350	990	1,800	855	3,510	3,060	2,620	1,800
13/16	19.5	5,850	1,170	1,170	585	2,340	2,070	1,620	1,170	2,070	1,080	4,230	3,690	2,970	2,070
7/8	22.5	6,930	1,350	1,350	675	2,790	2,430	1,980	1,350	2,620	1,260	5,040	4,320	3,510	2,620
1"	27.0	8,100	1,620	1,620	810	3,240	2,790	2,340	1,620	2,880	1,440	5,850	5,040	4,140	2,880
1-1/16	31.3	9,450	1,890	1,890	990	3,780	3,240	2,700	1,890	3,420	1,710	6,840	5,940	4,860	3,420
1⅛	36.0	10,800	2,160	2,160	1,080	4,320	3,780	3,060	2,160	3,870	1,980	7,740	6,750	5,490	3,870
1¼	41.7	12,150	2,430	2,430	1,260	4,860	4,230	3,420	2,430	4,410	2,160	8,730	7,560	6,210	4,410
1-5/16	47.9	13,500	2,700	2,700	1,350	5,400	4,680	3,870	2,700	4,860	2,430	9,900	8,460	6,930	4,860
1½	59.9	16,650	3,330	3,330	1,665	6,960	5,760	4,680	3,300	6,030	2,970	12,150	10,350	8,460	6,030
1⅝	74.6	20,500	4,050	4,050	2,070	8,100	7,020	5,760	4,050	7,290	3,690	14,400	12,600	10,350	7,290
1¾	89.3	23,850	4,770	4,770	2,430	9,450	8,280	6,750	4,770	8,550	4,320	17,100	14,850	12,150	8,550
2"	107.5	27,900	5,580	5,580	2,790	11,250	9,450	7,920	5,580	9,900	5,040	20,250	17,550	14,400	9,900
2⅛	125.0	32,400	6,480	6,480	3,240	13,050	11,250	9,000	6,480	11,700	5,850	23,400	20,250	16,650	11,700
2¼	146.0	36,900	7,380	7,380	3,690	14,850	12,600	10,350	7,380	13,500	6,960	26,550	22,950	18,900	13,500
2⅜	166.7	41,850	8,370	8,370	4,230	16,650	14,400	11,700	8,370	14,850	7,560	30,150	26,100	21,150	14,850
2½	190.8	46,800	9,450	9,450	4,680	18,900	16,200	13,050	9,450	16,650	8,550	33,750	29,250	23,850	18,500

TABLE B

* For an Endless Sling with vertical hitch carrying a load of such size as to throw the legs more than 5° off vertical, use load capacity data for eye and eye sling, basket hitch and corresponding leg angles.

NYLON ROPE SLINGS

LOAD CAPACITY IN POUNDS

DESIGN FACTOR = .11

TABLE C

Rope Dia. Nominal in Inches	Nominal Weight Per 100 Ft. in Pounds	Minimum Break Test in Pounds	Maximum Working Load in Pounds	EYE & EYE SLING						ENDLESS SLING					
						BASKET HITCH						BASKET HITCH			
						Angle of rope to horizontal						Angle of rope to horizontal			
						90°	60°	45°	30°			90°	60°	45°	30°
				Vertical Hitch	Choker Hitch	Angle of rope to vertical				Vertical Hitch*	Choker Hitch	Angle of rope to vertical			
						0°	30°	45°	60°			0°	30°	45°	60°
1/2	6.5	6,080	635	700	350	1,400	1,200	950	700	1,200	600	2,400	2,100	1,700	1,200
9/16	8.3	7,600	790	850	400	1,700	1,500	1,200	850	1,500	750	3,000	2,600	2,200	1,500
5/8	10.5	9,880	1,030	1,100	550	2,200	1,900	1,600	1,100	2,000	1,000	4,000	3,400	2,800	2,000
3/4	14.5	13,490	1,410	1,500	750	3,000	2,600	2,100	1,500	2,700	1,400	5,400	4,700	3,800	2,700
13/16	17.0	16,150	1,680	1,800	900	3,600	3,100	2,600	1,800	3,200	1,600	6,400	5,600	4,600	3,200
7/8	20.0	19,000	1,980	2,100	1,100	4,200	3,700	3,000	2,100	3,800	1,900	7,600	6,600	5,400	3,800
1"	26.0	23,750	2,480	2,600	1,300	5,300	4,600	3,700	2,600	4,800	2,400	9,500	8,200	6,700	4,800
1-1/16	29.0	27,360	2,850	3,000	1,500	6,100	5,300	4,300	3,000	5,500	2,700	11,000	9,500	7,700	5,500
1⅛	34.0	31,350	3,270	3,500	1,700	7,000	6,000	5,000	3,500	6,300	3,100	12,500	11,000	8,900	6,300
1¼	40.0	35,625	3,710	4,000	2,000	7,900	6,900	5,600	4,000	7,100	3,600	14,500	12,500	10,000	7,100
1-5/16	45.0	40,850	4,260	4,500	2,300	9,100	7,900	6,400	4,500	8,200	4,100	16,500	14,000	12,000	8,200
1½	55.0	50,350	5,250	5,600	2,800	11,000	9,700	7,900	5,600	10,000	5,000	20,000	17,500	14,000	10,000
1⅝	68.0	61,750	6,440	6,900	3,400	13,500	12,000	9,700	6,900	12,500	6,200	24,500	21,500	17,500	12,500
1¾	83.0	74,100	7,720	8,200	4,100	16,500	14,500	11,500	8,200	15,000	7,400	29,500	25,500	21,000	15,000
2"	95.0	87,400	9,110	9,700	4,900	19,500	17,000	13,500	9,700	17,500	8,700	35,000	30,500	24,500	17,500
2⅛	109.0	100,700	10,500	11,000	5,600	22,500	19,500	16,000	11,000	20,000	10,000	40,500	35,000	28,500	20,000
2¼	129.0	118,750	12,400	13,000	6,600	26,500	23,000	18,500	13,000	24,000	12,000	47,500	41,000	33,500	24,000
2½	149.0	133,000	13,900	15,000	7,400	29,500	25,500	21,000	15,000	26,500	13,500	53,000	46,000	37,500	26,500
2⅝	168.0	153,900	16,000	17,100	8,600	34,000	29,500	24,000	17,000	31,000	15,500	61,500	53,500	43,500	31,000

See Figs. I & II for sling description.

* For an Endless Sling with vertical hitch carrying a load of such size as to throw the legs more than 5° off vertical, use load capacity data for eye and eye sling, basket hitch and corresponding leg angles.

POLYPROPYLENE ROPE SLINGS

LOAD CAPACITY IN POUNDS

DESIGN FACTOR = .17

TABLE D

Rope Dia. Nominal in Inches	Nominal Weight Per 100 Ft. in Pounds	Minimum Break Test in Pounds	Maximum Working Load in Pounds	EYE & EYE SLING						ENDLESS SLING					
						BASKET HITCH						BASKET HITCH			
						Angle of rope to horizontal						Angle of rope to horizontal			
						90°	60°	45°	30°			90°	60°	45°	30°
				Vertical Hitch	Choker Hitch	Angle of rope to vertical				Vertical Hitch*	Choker Hitch	Angle of rope to vertical			
						0°	30°	45°	60°			0°	30°	45°	60°
1/2	4.7	3,990	645	650	350	1,300	1,200	950	650	1,200	600	2,400	2,100	1,700	1,200
9/16	6.1	4,845	780	800	400	1,600	1,400	1,100	800	1,500	750	2,900	2,500	2,100	1,500
5/8	7.5	5,890	950	1,000	500	2,000	1,700	1,400	1,000	1,800	900	3,500	3,100	2,500	1,800
3/4	10.7	8,075	1,300	1,300	700	2,700	2,300	1,900	1,300	2,400	1,200	4,900	4,200	3,400	2,400
13/16	12.7	9,405	1,520	1,600	800	3,100	2,700	2,200	1,600	2,800	1,400	5,600	4,900	4,000	2,800
7/8	15.0	10,925	1,760	1,800	900	3,600	3,200	2,600	1,800	3,300	1,600	6,600	5,700	4,600	3,300
1"	18.0	13,300	2,140	2,200	1,100	4,400	3,800	3,100	2,200	4,000	2,000	8,000	6,900	5,600	4,000
1-1/16	20.4	15,200	2,450	2,500	1,300	5,100	4,400	3,600	2,500	4,600	2,300	9,100	7,900	6,500	4,600
1⅛	23.7	17,385	2,800	2,900	1,500	5,800	5,000	4,100	2,900	5,200	2,600	10,500	9,000	7,400	5,200
1¼	27.0	19,950	3,210	3,300	1,700	6,700	5,800	4,700	3,300	6,000	3,000	12,000	10,500	8,500	6,000
1-5/16	30.5	22,325	3,600	3,700	1,900	7,400	6,400	5,300	3,700	6,700	3,400	13,500	11,500	9,500	6,700
1½	38.5	28,215	4,540	4,700	2,400	9,400	8,100	6,700	4,700	8,500	4,200	17,000	14,500	12,000	8,500
1⅝	47.5	34,200	5,510	5,700	2,900	11,500	9,900	8,100	5,700	10,500	5,100	20,500	18,000	14,500	10,500
1¾	57.0	40,850	6,580	6,800	3,400	13,500	12,000	9,600	6,800	12,500	6,100	24,500	21,000	17,500	12,500
2"	69.0	49,400	7,960	8,200	4,100	16,500	14,500	11,500	8,200	15,000	7,400	29,500	25,500	21,000	15,000
2⅛	80.0	57,950	9,330	9,700	4,800	19,500	16,500	13,500	9,700	17,500	8,700	35,000	30,100	24,500	17,500
2¼	92.0	65,550	10,600	11,000	5,500	22,000	19,000	15,500	11,000	19,500	9,900	39,500	34,000	28,000	19,500
2½	107.0	76,000	12,200	12,500	6,300	25,500	22,000	18,000	12,500	23,000	11,500	45,500	39,500	32,500	23,000
2⅝	120.0	85,500	13,800	14,500	7,100	28,500	24,500	20,000	14,500	25,500	13,000	51,500	44,500	36,500	25,500

See Figs. I & II for sling description.

* For an Endless Sling with vertical hitch carrying a load of such size as to throw the legs more than 5° off vertical, use load capacity data for eye and eye sling, basket hitch and corresponding leg angles.

Slings

Tables A through D show that the angle formed by the plane of the load and the leg of the sling has a very important bearing on the load a sling will safely carry. This factor is often overlooked by the average man in using slings, or he may realize it makes a difference but how much he does not know. Referring to Tables B, C, or D you can readily determine with a great amount of accuracy the safe load for a rope sling of any size rope — at a definite angle. From Table B you can readily see that a rope that would have a strain on each leg of 1,000 pounds when lifting a 2,000 pound load at 90°, would have a 2,000 pound strain on each leg at 30°. This double strain at the more acute angle accounts for many sling accidents and making allowance for it cannot be stressed too emphatically.

For maximum safety of life and material It is good practice never to use a sling so that the legs form less than a 45° angle with the plane of the load; or greater than 90° angle at the hook or fastening.

Remember in making your sling that the type of splice employed also affects the sling efficiency. Refer to the table on page 37 and take this efficiency into account in calculating the lifting power of your sling.

In making a sling great care should be used in selecting the rope. Too often are slings made from the least damaged portion of discarded rope. Sling usage is among the most severe imposed upon rope.

15 WAYS TO MAKE ROPE LAST LONGER

REMOVE ROPE FROM COILS PROPERLY

Lay coil flat on floor, with inside end at the bottom. Reach down and pull inside end up through the coil. For regular right-laid rope, uncoil it in a counter-clockwise direction.

STORE ROPE PROPERLY

A dry, unheated room — with free air circulation — is the best place to store rope. Keep loose coils OFF the floor — preferably hung on a wooden peg.

DRY ROPE PROPERLY AFTER WETTING

Rope never should be stored wet. *Always* make sure it is thoroughly dry before storing. Moist rope, stored, is almost sure to mildew.

KEEP ROPES CLEAN

When rope becomes dirty, wash it with clean water and dry thoroughly before storing. Dirt on the surface and imbedded in rope acts as an abrasive on strands and fibers.

PROTECT ROPE FROM CHEMICALS

Acids and alkalies are very injurious to rope. Also many oils, such as linseed. Storage battery solutions, washing compounds or solutions, and paint, all injure rope. Same is true of animal excreta.

AVOID KINKS

When rope is repeatedly twisted in one direction, kinks are certain to develop — unless twist in the *opposite* direction is repeatedly thrown in, or out, of the rope. Kinks pulled through restricted space, such as a tackle block will seriously damage the rope.

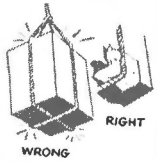
DON'T OVERLOAD ROPE

It's costly and dangerous. Follow the suggestions provided in the sections beginning on page 71 —especially the tables on pages 75, 76, 81, 85, 86, 87 — in figuring safe sizes of rope to use for various loads. In figuring the Safety Factor, due allowance should be made for a rope's age and condition.

SLACK OFF GUYS

When ropes are used as guy lines and other supports exposed to weather, they should be slacked off in wet weather. Otherwise, damage to the rope as well as to what it is supporting may result.

AVOID SHARP ANGLES OR BENDS



While fiber is somewhat elastic and, as a sling or lashing, will "hug" an object, sharp corners and angular bends put a heavy extra strain on the outer fibers of a rope. Avoid them, if possible.

AVOID UNNECESSARY WEAR AND ABRASION

The outer fibers of a rope, no less than the inner ones, contribute to its strength. When they are worn — by chafing, or dragging over rough, gritty or splintered surfaces — the rope is worn and weakened. Where rope *must* rub over cleats, winchheads, etc., make sure they are smooth.

REVERSE ROPE ENDS

Particularly in tackle use, reverse the rope, end-for-end, periodically — so that all sections of it will receive equal wear. Should it become badly worn on a short section, shorten the rope or cut out the section and splice. A good splice is safer than a damaged section.

DON'T TREAT YOUR ROPE

A good rope is properly lubricated by its manufacturer — for the useful life of the rope.

REEVE ROPES RIGHT

Remember that small sheaves, or pulleys, put a maximum of strain on rope and increase the friction load in the block. Never use a smaller sheave than is recommended for the size of rope you're using. (See pages 78-82.)

SPLICING CORRECTLY

When relatively small section of a rope has been worn or damaged, cut the section out and splice it together — either with a short or long splice, depending on the uses you give it. See pages 37-70 for full information on splicing.

AVOID SUDDEN JERKS OR STRAINS

A common piece of twine may be extremely difficult to break with a *pull* — yet can easily be broken with a *snap.* A similar principle applies to rope — especially when it has had considerable use. Sudden jerks on tackle, slings or lashings may result in breaks that would never have occurred with a steady, natural *pull.*

NOTES

Size (Inches)		Filament NYLON and GOLDLINE II®				Filament POLYESTER†				POLYPRO 6®				P/D 10®				P/D 100®				MANILA Regular Construction			
Dia.	Cir.	Pounds/ 100 feet	Feet/ Pound	New Rope Tensile Strength (Lb.)	Working Load (Lb.)*	Pounds/ 100 feet	Feet/ Pound	New Rope Tensile Strength (Lb.)	Working Load (Lb.)*	Pounds/ 100 feet	Feet/ Pound	New Rope Tensile Strength (Lb.)	Working Load (Lb.)*	Pounds/ 100 feet	Feet/ Pound	New Rope Tensile Strength (Lb.)	Working Load (Lb.)*	Pounds/ 100 feet	Feet/ Pound	New Rope Tensile Strength (Lb.)	Working Load (Lb.)*	Pounds/ 100 feet	Feet/ Pound	New Rope Tensile Strength (Lb.)	Working Load (Lb.)*
3/16"	5/8"	1.0	100.0	900	75	1.2	83.4	900	90	.70	143.0	720	72	.95	105.0	720	72	—	—	—	—	1.5	66.60	405	41
1/4"	3/4"	1.5	66.7	1,490	124	2.0	50.0	1,490	149	1.2	83.4	1,130	113	1.61	62.0	1,130	113	—	—	—	—	2.0	50.00	540	54
5/16"	1 "	2.5	40.0	2,300	192	3.1	32.2	2,300	230	1.8	55.6	1,710	171	2.48	40.3	1,710	171	—	—	—	—	2.9	34.50	900	90
3/8"	1 1/8"	3.5	28.5	3,350	278	4.5	22.2	3,350	334	2.8	35.7	2,430	244	3.61	27.7	2,430	244	4.0	25.0	2,390	239	4.1	24.40	1,215	122
7/16"	1 1/4"	5.0	20.0	4,500	410	6.2	16.1	4,500	500	3.8	26.3	3,150	352	5.00	20.0	3,150	352	5.5	18.1	3,020	336	5.3	19.00	1,575	176
1/2"	1 1/2"	6.5	15.4	5,750	525	8.0	12.5	5,750	640	4.7	21.3	3,780	420	6.48	15.5	3,960	440	6.5	15.3	3,780	420	7.5	13.33	2,385	264
9/16"	1 3/4"	8.3	12.3	7,200	720	10.2	9.8	7,200	900	6.1	16.4	4,590	575	8.0	12.5	4,860	610	9.5	10.5	5,490	686	10.4	9.61	3,105	388
5/8"	2 "	10.5	9.5	9,350	935	13.0	7.7	9,000	1,130	7.5	13.3	5,580	700	9.5	10.5	5,760	720	10.5	9.5	6,030	754	13.3	7.50	3,960	496
3/4"	2 1/4"	14.5	6.9	12,800	1,420	17.5	5.7	11,300	1,610	10.7	9.3	7,650	1,090	12.5	8.0	7,560	1,080	15.0	6.6	8,010	1,144	16.7	6.00	4,860	695
13/16"	2 1/2"	17.0	5.9	15,300	1,700	21.0	4.8	14,000	2,000	12.7	7.9	8,910	1,270	15.2	6.63	9,180	1,310	—	—	—	—	19.5	5.13	5,850	835
7/8"	2 3/4"	20.0	5.0	18,000	2,000	25.0	4.0	16,200	2,320	15.0	6.7	10,400	1,490	18.0	5.55	10,800	1,540	20.5	4.8	10,400	1,485	22.5	4.45	6,930	995
1 "	3 "	26.0	3.8	22,500	2,500	30.5	3.3	19,800	2,820	18.0	5.5	12,600	1,800	22.0	4.54	13,100	1,870	26.5	3.7	12,600	1,800	27.0	3.71	8,100	1,160
1 1/16"	3 1/4"	29.0	3.4	25,900	2,880	34.5	2.9	23,000	3,280	20.4	4.9	14,400	2,060	25.5	3.92	15,200	2,180	—	—	—	—	31.3	3.20	9,450	1,350
1 1/8"	3 1/2"	34.0	2.9	29,700	3,320	40.0	2.5	26,600	3,800	23.7	4.2	16,500	2,360	29.0	3.45	17,400	2,480	34.0	2.9	18,900	2,700	36.0	2.78	10,800	1,540
1 1/4"	3 3/4"	40.0	2.5	33,750	3,760	46.3	2.2	29,900	4,260	27.0	3.7	18,900	2,700	33.0	3.03	19,800	2,820	39.0	2.5	21,600	3,085	41.8	2.40	12,150	1,740
1 5/16"	4 "	45.0	2.2	38,750	4,320	52.5	1.9	33,800	4,820	30.5	3.3	21,200	3,020	35.5	2.82	21,200	3,020	44.0	2.2	24,300	3,470	48.0	2.09	13,500	1,930
1 1/2"	4 1/2"	55.0	1.8	47,700	5,320	66.8	1.5	42,100	6,050	38.5	2.6	26,700	3,820	45.0	2.22	26,700	3,820	55.0	1.8	30,600	4,370	60.0	1.67	16,650	2,380
1 5/8"	5 "	68.0	1.5	58,500	6,500	82.0	1.2	51,300	7,350	47.5	2.1	32,400	4,620	54.5	1.83	32,400	4,620	67.0	1.4	37,800	5,400	74.4	1.34	20,250	2,880
1 3/4"	5 1/2"	83.0	1.2	70,200	7,800	98.0	1.02	61,000	8,700	57.0	1.7	38,700	5,550	63.0	1.54	38,700	5,550	80.0	1.2	45,000	6,430	89.5	1.12	23,850	3,400
2 "	6 "	95.0	1.05	82,800	9,200	118.0	0.85	72,000	10,300	69.0	1.4	46,800	6,700	78.0	1.28	46,800	6,700	95.0	1.05	54,000	7,710	108.0	.93	27,900	4,000
2 1/8"	6 1/2"	109.0	0.92	95,400	10,600	135.0	0.74	82,800	11,900	80.0	1.2	54,900	7,850	92.0	1.09	54,900	7,850	112.0	.89	59,400	8,480	125.0	.79	32,400	4,620
2 1/4"	7 "	129.0	0.77	113,000	12,600	157.0	0.64	96,300	13,800	92.0	1.1	62,100	8,850	105.0	.95	62,100	8,850	127.0	.787	64,800	9,260	146.0	.685	36,900	5,300
2 1/2"	7 1/2"	149.0	0.67	126,000	14,000	181.0	0.55	110,000	15,700	107.0	0.93	72,000	10,300	122.0	.82	72,000	10,300	147.0	.68	74,700	10,700	167.0	.59	41,850	5,950
2 5/8"	8 "	168.0	0.59	146,000	16,200	205.0	0.49	123,000	17,600	120.0	0.83	81,000	11,600	138.0	.72	81,000	11,600	165.0	.606	85,100	12,200	191.0	.52	46,800	6,700
2 7/8"	8 1/2"	189.0	0.53	162,000	18,000	230.0	0.43	139,000	19,900	137.0	0.73	90,900	13,000	155.0	.65	91,000	13,000	—	—	—	—	215.0	.47	52,200	7,400
3 "	9 "	210.0	0.47	180,000	20,000	258.0	0.39	157,000	22,400	153.0	0.65	103,000	14,700	174.0	.57	103,000	14,700	208.0	.48	105,000	15,000	242.0	.42	57,600	8,200
3 1/4"	10 "	263.0	0.38	225,000	25,200	318.0	0.31	189,000	27,000	190.0	0.53	123,000	17,600	210.0	.48	123,000	17,600	253.0	.395	132,000	18,900	299.0	.33	69,300	9,950
3 1/2"	11 "	316.0	0.32	270,000	30,000	384.0	0.26	229,000	32,600	232.0	0.43	146,000	20,800	255.0	.39	146,000	20,800	—	—	—	—	367.0	.27	81,900	11,700
4 "	12 "	379.0	0.26	324,000	36,000	460.0	0.22	270,000	38,600	275.0	0.36	171,000	24,400	300.0	.33	171,000	24,400	—	—	—	—	436.0	.23	94,500	13,500

† Fibers such as Dacron (DuPont Registered Trademark) are polyester.

NOTE: Lb./100 ft. shown are average figures with maximum weight 5% above that shown.

New Rope Tensile Strengths are based on tests of new, 3-strand regular lay rope, tested according to Cordage Institute specifications — that is, a straight tensile test at slow speed using eye-spliced test pieces. Breaking Test results for 4-strand, 8-strand plaited (Plimoor®), and 3-strand rope in hard or soft lay construction will vary slightly from specifications shown here.

***CAUTION: Use of Working Loads** — Because of the wide range of rope use, rope condition, exposure to the several factors affecting rope behavior, and the degree of risk to life and property involved, it is impossible to make blanket recommendations as to working loads. However, to provide guidelines, working loads are tabulated for rope in good condition with appropriate splices in non-critical applications and under normal service conditions.

A higher working load may be selected only with expert knowledge of conditions and professional estimates of risk; if the rope has not been subjected to dynamic loading or other excessive use, has been inspected and found to be in good condition, and is to be used in the recommended manner, and the application does not involve elevated temperatures, extended periods under load, or obvious dynamic loading (see explanation on panel 5) such as sudden drops, snubs, or pick ups. For all such applications, for applications involving more severe exposure conditions, or for recommendations on special applications, consult the Technical Department of The Cordage Group. Many uses of rope involve serious risk of injury to personnel or damage to valuable property. This danger is often obvious, as when a heavy load is supported above one or more workmen. An equally dangerous situation occurs if personnel are in line with a rope under excessive tension. **Should the rope fail, it may recoil with considerable force — especially if the rope is nylon. Persons should be warned against standing in line with the rope. In all cases where any such risks are present, or there is any question about the loads involved or the conditions of use, the working load should be substantially reduced and the rope properly inspected.**

DIVISION OF
COLUMBIAN ROPE COMPANY
AUBURN, N.Y. 13021

U.S. SALES OFFICES:	TWX	TELEPHONE
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