

# Ropes, Lines & Knots

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Ropes, string,  
and cords  
all form a  
flexible means

of transmitting force in tension. Ropes have been used since the dawn of time when Tarzan's ancestors first swung on a vine.

Over time rope has slowly evolved, and today ropes are mostly manufactured from synthetic fibers and materials. When rope is used on a boat, it becomes a line and may further get a series of more specific names designating where and how it is used. On a sailboat, for example, lines take on additional names such as halyards and sheets which raise and control the movement of the sails. Lines may be called rodes when they are attached to an anchor or a painter when they are attached to the bow of a small boat, where their function is somewhat simpler but no less important. In our world of runabouts, we use our lines primarily for mooring or anchoring. And yes, lest we forget, the much-dreaded tow back to the dock after something has gone amiss.

Let's look at our choices for lines and see how they differ.



Fig. 1 – Three strand twisted Manilla Rope with a traditional tapered splice on one end.

*Manila* In the beginning of time, ropes were created by twisting fibers from the wild banana plant into a three-strand configuration which allowed them to be easily spliced. Unfortunately, Manila line is not friendly to handle when new. It is stiff and the raw fibers make it somewhat abrasive to the touch. Among the sailors the saying is that when manila lines become comfortable to handle, it is time to throw them out. Over time manila lines, being a natural fiber, lose their strength due to prolonged exposure to the sun's UV rays and the elements and soon must be replaced. Provided that they are properly sized for load capability manila lines provide reliable, albeit shortened service. They are relatively inexpensive, however when the short service life is factored in, they are probably equal in the cost of ownership when compared to nylon or polymer lines which have a much longer service life as well as a greater

strength per diameter. Manila lines Fig. 1 are still available today and, service life notwithstanding, offer a low-cost solution for managing various needs.

*Nylon* Once nylon lines became readily available back in the late 50's, manila lines began to be replaced by three strand nylon lines. The newer nylon lines offered more strength, better appearance, easier handling, plus they had some stretch. The stretch factor was somewhat of a double-edged sword. For the sailors who used the nylon lines as a halyard to raise their sails, it meant constantly having to retighten them as the line stretched and the sails started to slide back down the mast. However, when used as an anchor rode, the stretch offered a nice cushioning effect and reduced the peak loads encountered when anchoring in rough seas. The deciding advantage however was the extended service length since they did

not decay like manila. (On a personal note, I find it humorous that some of our most ardent preservationists with beautiful, period correct, restored craft choose polymer lines coupled with plastic inflatable fenders as opposed to the period correct manila lines and rope fenders). Today Nylon 3 strand rope is still available but much like manila it has been replaced by more advanced forms of rope. Depending on the application, the stretch factor of nylon can be a detriment or an advantage. Nylon is roughly twice as strong as a comparable manila line of the same size. Since nylon is much easier to handle and the texture can be chemically blended to be very soft or hard to the touch, it has found many applications.



Fig. 2 – Three strand twisted nylon rope with a melted end to prevent unravelling.

**Polyester** This family of synthetic fibers has taken over the market and offers a distinct difference over nylon in that it has the same strength but with very little stretch. This makes it very appealing for sailors. Depending on how it is manufactured, it can have a variety of textures as well as colors. Polyester rope is primarily available as a braided product.

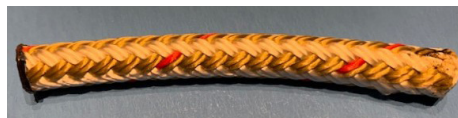


Fig. 3 – Double braided Polyester rope with a red accent or tracer strand. This rope works well for mooring since it is strong, flexible and soft to the touch.

**Aramid** This is the newest form of rope better known as Kevlar offers advanced strength and incremental stretch. Still quite expensive, it has nonetheless become a favorite of competitive sailors.

**Polypropylene** is another synthetic fiber which is relatively inexpensive, however it tends to deteriorate more rapidly than other members of the synthetic family. However, it offers a unique advantage in that it floats! This property makes it attractive for uses such as ski ropes, rescue rope, or any rope used in the water since it is less likely to sink and become entangled in the prop.

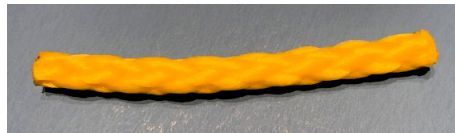


Fig. 4 – Loose braid Polypropylene Rope. This rope is most commonly used as a tow rope for water skiing since it floats, it is easily seen by the skier and it is less likely to become caught in the prop. It also makes a great rescue line since it floats and can more easily spotted and grabbed by someone in the water.



**Construction** Until the mid-sixties, three strand twisted manilla rope was all that was commercially available. Soon better manufacturing methods were developed and braided rope became available. Braided rope was soon followed by double braided rope. Double braided rope has become the popular rope we see today. It is available in a variety of colors and combination weaves. Braided type ropes are easy to handle and store. They coil nicely and are pliable and soft to the touch. This makes them especially advantageous when used against a varnished surface where they are less likely to inflict damage to the surface when compared to a polypropylene or manila rope.

**Usage** Now we know how a line works, let's look at some of the enhancements to turn it into something useful. Measure and decide how you want to arrange your typical mooring lines for what we might term a four point tie up at a boat show for example see Fig. 5. Begin

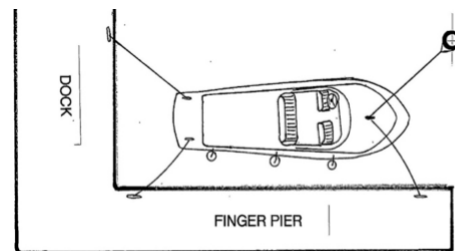


Fig. 5-A typical mooring situation where 4 lines are used to keep the boat from touching the dock. In order to get the boat closer to the dock for boarding, simply release the aft port-side line which will allow the boat to move forward and toward the finger pier.

by deciding how long you want the lines. For our typical usage on a 20-foot boat, two 20 ft. bow lines and a pair of stern lines of 15 ft. seem to take care of 90 % of our mooring requirements. For the odd dockage arrangement, always carry a spare.

### 50-100 ft mooring line

This line can be used in a number of applications ranging from a tow line to a Mooring line where the layout of cleats or posts is unique. I like to have a nylon line for this application since it may be used for a tow line where the stretch is really nice to prevent tearing out the cleats due to sudden shock loads. People are often tempted to rely on their anchor line as a backup for this use. I would highly recommend keeping your anchor line separate and only for use as an anchor line.

**Anchor** The anchor and its attached line or rode as it is properly called, should be carefully selected and available for immediate deployment. Think of the anchor as the nautical equivalent of an emergency brake. When things go wrong sometimes you need to stop the action and get your collective act together. As an example; if you were navigating on a river and approaching a dam or lock and suddenly lost power, it would be nice to be able to stop the impending doom while you regrouped and found the problem. In this example, if you had used the anchor line for another purpose,

it might make a bad situation worse. Usually when things go wrong, disaster compounds and bad things happen very quickly.

**End treatment** Loops are handy and allow us to quickly and neatly utilize a cleat or loop over a piling. Loops can be made by forming the loop and splicing the line. A three-strand line can be easily spliced and form a nice-looking properly sized loop. Fig. 1. Go on the internet and look up splicing, get some old rope and have some fun. If your line will be used for an anchor rode where it will have to accept a shackle use a metal eyelet to prevent wear at the junction. A nice tightly spliced loop will hold the eyelet in place and create a durable rode. Splicing braided line is a bit more difficult and requires a special tool to thread the end of the line down into the main portion of the line. Before you invest in the tools, look at what's available premade. Stores ranging from Walmart to West Marine have pre-made braided mooring lines in a variety of colors lengths and sizes with the loops already in place.



Fig.6 – Here we see the bitter end has been whipped with special wax coated string to prevent it from unravelling.

**Bitter end** This is the open end of a line. Typically, this end tends to fray and unravel. There are several ways to ensure this does not happen. Whipping is a process whereby the end of the line is wrapped or bound by a piece of specially treated string tightly wound around the end of the line to form a wide band at 90 degrees to the line and then secured to keep it from unravelling. Fig. 6 With polymer lines, a soldering gun with the proper attachment can be used to melt the polymer and fuse the fibers together so they don't unravel. (One note of

**CLOVE HITCH** Commonly used to tie a line to a piling. This is often a mistake. Although very adjustable, it tends to slip, especially with slippery nylon line. It is best to take an extra half hitch (or two half hitches) to make it secure. If you use the same line from the bow to a piling, and then to the stern, the clove hitch is ideal. Both ends are taut and you have the adjustable feature.

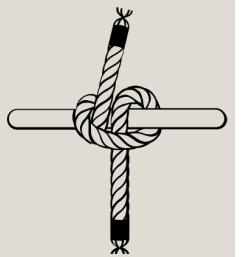
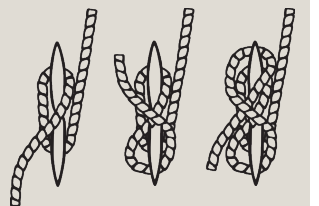


Fig. 7 – The Clove hitch is a simple but very effective knot for mooring. Tying up to a cleat can be simply done by taking one full turn around the cleat then looping the line over the cleat in a figure 8 pattern

### CLEAT HITCH – CLEATING

**A LINE** Start with a turn around the cleat, then go around the cleat so that the line passes under each horn once. Finish with a half hitch over one horn. More wrappings and hitches are not needed, and they only slow the process of casting-off.



**REEF KNOT OR SQUARE KNOT** If you are tying a bundle, this knot works; note that the two bitter ends are on the same side of the standing parts. If the line is under constant pressure, and if both ends are the same size, it can still be untied. If it is made with a strip of canvas or webbing, as when securing a furled sail, it is a useful knot and easily untied even when wet. If it is used to tie two lines together, to make a longer line, it is a mistake. Use the reef knot sparingly.



Fig. 8 – The Square knot again is a simple knot used to join two lines together to form one longer line

**BOWLINE** This is the most useful of all knots aboard a boat. Once learned (and practice is necessary) it is easy to make, never slips or jams, and can always be untied. Two bowlines, one on each line, are an excellent combination when you need to tie two lines together

Fig. 9 – The Bowline Knot (Pronounced Beau-lynn) is great know when you want to form a loop.



Drawings courtesy of Chapman Piloting & Seamanship.

caution here- Make sure the resulting glob of melted plastic at the end of the line does not have any sharp edges, otherwise it can cut like a knife when it passes through your hand). The final solution is to get some electrical shrink tubing of the proper size, place it over the bitter end, and simply apply heat to shrink the tube to the line. As a side note, some people put links of different colored shrink tubing on their anchor rode at specific intervals so they can quickly gage the length of their anchor rode in order to get the correct scope.

**Knots** Many people get flustered with

knots, and after trying several times, simply give up. Three simple knots will take you from looking like a cowboy at a calf roping contest and turn you into a nautical Maestro. A square knot, bowline knot, and clove hitch are all you really need. Master these three simple knots and you will be able to address virtually any nautical requirement you encounter. The pictures below are all that's required to start practicing. Add to this a proper cleat tie up and you will earn the respect of every dockmaster on the water.

**Happy Boating!**