Webbing Savvy

A helpful guide to selecting the correct webbing for onboard use.

Story and photos by Jim Grant

Webbing is a length of woven fabric tape with selvedge edges i.e., it is woven in such a way that there are no yarn ends along the sides. It is generally highly flexible and strong and durable. Common uses are as slings and straps. Webbing is as flexible as rope, even more so along its flat axis (it can be rolled into a smaller bundle than rope of comparable strength). Because it is flat, it distributes stress across a broader area and causes very little abrasive damage and because it's flat, it is less prone to tangles and, although knots do not hold well, it can easily be sewn to increase its length or to create loops at its ends. Buckles and ratchet winches work well with it to make snug fits possible.

First, and probably perfectly obvious, there are limitless variations in the way webbing can be constructed. Not only can the weave be varied to create thicker or thinner cross sections (some flat, some tubular), the yarns used in the weave can be made larger or smaller and, finally, they can be made of different fibers. For marine use, we can limit our consideration to webbing with strength ratings of 7,000lb (3175kg) or less and to only those made of synthetic fibers.

Fiber Choices

Four synthetic fibers are used to make webbing for marine applications: polypropylene, nylon, polyester (Dacron) and ultra high molecular weight polyethylene (Spectra). Each of these yields a finished product with different characteristics that may or may not be helpful in a given application (refer to **Table 1**).

Polypropylene has a very low specific gravity (it floats) and it takes dye readily so it's available in a wide range of bright colors. It also has very good modulus ratings; that is, it stretches relatively little when loads are not extreme (relative to its breaking strength). On the other hand, polypropylene does not resist exposure to ultraviolet radiation well and it becomes brittle and eventually turns to powder. Even its initial strength is far inferior to other webbing fibers and constructions.

Nylon is the most ubiquitous fiber found in marine webbing. Because it stretches the most of all four fibers, loads are distributed evenly over its entire length, giving it an extremely high breaking strength. It can be dyed, though the colors are not as bright as they are for polypropylene. Many maintain that the darker dyes help increase its resistance to UV. There is no doubt that nylon has a much better resistance to solar rays than polypropylene, no matter the color, roughly two times the durability. Nylon shortens with exposure and gets more and more brittle but turns to powder very slowly. The strength of nylon decreases and its length increases (both only slightly) when it is water soaked. It returns to its original length and strength when dry.

Polyester stretches very little yet has roughly 70% of the strength of nylon (in similar constructions). It also holds up best in exposure to ultraviolet with roughly two to three times the durability of nylon. Downside? It costs quite a bit more than similar nylon and polypropylene webbings.

Ultra high molecular weight polyethylene (known as Spectra) stretches the least of all four fibers and has strength surpassing that of nylon. Its UV resistance is better than that of polyester. Unfortunately, this fiber is extremely expensive, about US$5.25 per foot (304mm) for webbing rated at 7,000lb (3175kg) breaking strength so its use is limited to only the most demanding applications, such as reinforcement straps at the corners of large sails. It has a low melting point and when sewn, keep sewing speeds slow so the needle heat doesn't weaken the webbing.

WEBBING USAGE

Nylon: Ideal for sail corners. The extra heavyweight nylon is perfect for safety straps, tethers, jacklines and wherever maximum safety is required.

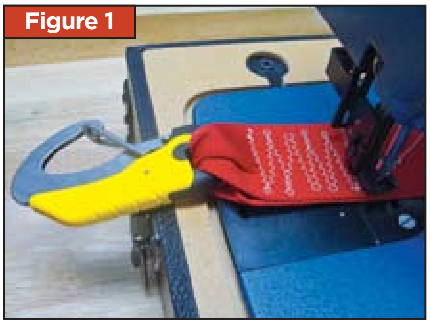
Polyester: Rugged and best to use outdoors. Use for sail corner reinforcements, tie downs, trampolines, etc.

Polypropylene: Thinner construction, the UV resistance is not as good as other webbing. Use for bags, sail ties, utility work, etc.

Spectra: Excellent in all ways but extremely expensive. Use sparingly.

Tubular (nylon and polyester): Thicker and bulkier than standard webbing, it's good for use as bag handles, hiking straps or any where you want more strength.

Figure 1



A sewn Wichard webbing loop. Note the cross pattern of stitches rather than the traditional boxed "X" stitch.

Figure 2

A #4 spur grommet securing a loop in 2" (50mm) webbing.

AVY

TABLE 1 WEBBING FIBER COMPARISONS

	Nylon	Poly-Pro	Spectra	Polyester
Cost	Average	Low	High	Average
Strength	Excellent	Very Good	Excellent	Good
Abrasion Resistance	Very Good	Good	Excellent	Excellent
UV Resistance	Very Good	Good	Excellent	Excellent
Mildew Resistance	Excellent	Excellent	Excellent	Fair
Acid Resistance	Poor	Excellent	Good	Good
Alklis Resistance	Good	Excellent	Excellent	Good
Oil & Gas Resistance	Good	Excellent	Excellent	Good
Melting Point	480F/249C	330F/165C	260F/127C	500F/260C

It's important to note that the initial strength of a length of webbing will not be even close to that of the same piece one year later. Exposure to sunlight easily halves the strength of webbing each year it's in use. Thus webbing with a 5,000lb (2,268kg) breaking strength may well have only 2,500lb (1,134kg) after a year and perhaps only 1,250lb (567kg) after the second year. Most webbing manufacturers refuse to even rate the strength of their products for this reason. Even when strength is given, assume a very much reduced working load depending upon the extent to which there will be UV exposure and, when strength is not indicated, err on the side of a much heftier webbing than would seem necessary.

Sewing Tips

When lengths of webbing are secured, either to themselves or to attachment hardware, some sewing is usually required. Use the largest thread possible for your machine (usually a V-92 or a V-138) or use a six to eight ply waxed twine for hand sewing. Use a straight stitch or a small zigzag of moderate length (1/8" or 3mm long). The reason for all this is that webbing joints, whether end-to-end or looped, can easily be exposed to peel stress where just a few stitches must bear the separating force. So it's a good idea to maximize the thread in any given local. Wichard tethers, for example, are locked to hardware at either end of the webbing, with loops closed by closely spaced back and forth rows of narrow zigzag stitches, 5 or so to the inch (25mm). Wichard calls this a "bar tack" stitch (**Figure 1**). The traditional boxed "X" stitch that was so common in military gear through WWII is really not so appropriate for modern synthetic webbing, which has more strength and a harder surface that doesn't cushion the thread by allowing it to sink into the weave.

Figure 3

Inserting a flag to show overload.

Loops of webbing can also be closed and lengths of webbing attached to each other by installing spur grommets to lock them in place (**Figure 2**). Even quite thin webbing has enough bulk to make such installations quite secure. So long as the grommet covers roughly one-half of the width of the webbing it gives strength similar to a proper sewing job. Such a grommet provides a secondary means by which webbing straps are secured.

Buckle sliders provide a reasonably (but not absolutely) secure way to attach webbing lengths. Be sure to match the buckle and webbing properly. If the webbing is too thin, slippage occurs. If it's too thick, the buckle is difficult to tighten properly. As a rule of thumb, the rectangular gap in the slider should be the same width as the webbing and just over twice as wide as the webbing is thick. The old double ring closure common on military belts is not very dependable with synthetic webbing because it's so hard and slippery.

Applications

So, how do we employ all this in the construction of boating gear? Jacklines are usually made of nylon with sewn loops for hardware (often carabiners or stainless-steel rings) at each end. Here strength with a minimum size (to reduce deck clutter) is the primary concern. Stretch is undesirable in jacklines and only nylon can provide the strength required by the latest Offshore Racing Council (ORC) rules; namely, 4,500lb (2,041kg) in 1" (25mm) wide webbing. The strongest polyester webbing readily available is automobile seat belt webbing, 2" (50mm) wide with a breaking strength of just 3,800lb (1,725kg). Nylon is the obvious choice even though it stretches about 10" (254mm) per 30' (9m) of length at maximum tension. The ORC rule does approve uncoated stainless steel wire of similar strength as an alternative but that is not desirable underfoot on deck.

Tethers need not meet the same strength standards. Indeed, the ORC rules do not set any standard at all except to require that a colored flag be embedded in the stitching to indicate an overload. The European Norm (EN1095) specifies that tethers not fail a drop test of 6.5' (2m) with a 220lb (100kg) load. The tubular construction enables the insertion of shock cord that reduces the tether length to roughly half its maximum length when not under tension. The colored flag need be nothing more than a 2' (50mm) or so doubling of the webbing over a tab of colored fabric, sewn in place with thread (**Figure 3**) that will break away at anywhere from 500lb to 2,000lb (226kg to 907kg) of loading.

About the author: Jim Grant is the founder of Sailrite (sailrite.com), a supplier of specialty marine fabrics, hardware and tools, sewing kits and sewing machines. All materials mentioned in this article are available from Sailrite.