How to Sew Webbing Loops

Item # X-HT-300336

Sewn loops on webbing are used in a variety of load bearing applications. Sailboat harness tethers use sewn loops so you can clip to your boat's jackline to keep you safely onboard. They're used in towing applications. They're found on safety harnesses and climbing gear, lifting harnesses for dinghies and outboard motors, and much more. If you want to sew your own webbing loops, it's important to understand the mechanics of proper loop construction and how to sew loops with the required minimum breaking strength (MBS) for your particular weight bearing application. Understanding the math and the calculations required to sew loops with adequate MBS will keep your sewn loops from breaking and causing potential harm or injury.

What Kind of Webbing, Thread, Needle & Sewing Machine Do I Need?

Determining what webbing you need depends entirely on what you're using it for. For example, if you're using webbing in a marine environment, choose a polyester webbing with a high UV resistance. If you need a soft hand and a decent amount of stretch for your webbing application, nylon webbing will suit your needs. Inexpensive polypropylene webbing is great for bags and crafts.

There are two kinds of webbing sold by Sailrite®: flat and tubular. While both appear flat, when you inspect the end of tubular webbing you can see that it's hollow. Tubular webbing is usually stronger and more flexible than flat webbing, so take that into consideration based on your needs. Tubular webbing is constructed in either a spiral structure or a chain structure. Spiral structure is much stronger than chain structure, so we recommend spiral structure webbing for the heaviest load bearing applications. In fact, spiral structure is the only tubular webbing we carry. Chain structure webbing has a seam that joins the webbing together; this seam makes it a weaker construction.

The most important factor in selecting webbing is knowing its minimum breaking strength and how much breaking strength you need for your load bearing application. Be aware that you can't sew a webbing loop with a higher breaking strength than your webbing's actual (not published) breaking strength. If you need a sewn loop with an MBS of 5,000 lbs., you can't use 3,000 lb. MBS webbing, because even if your stitching is at 100% strength, the webbing itself — not your sewn loop stitching — will break at the lower MBS. Therefore, if you're sewing a loop, you must select a webbing with a higher MBS than you need. If your webbing will be used outdoors, select a webbing with twice the MBS you need because sun exposure will rapidly reduce your webbing's initial strength.

Once you have your webbing selected, you need to know what thread type and size to use, along with what needle size to use. Bonded Nylon and Bonded Polyester are the recommended threads for sewn loops. They are very strong fibers with high tensile strength. Polyester thread has a high UV resistance and is the only thread we recommend for outdoor applications. Nylon is better suited for indoor use and beats polyester on tensile strength and elasticity. Do not use anything thinner than V-92 thread, and choose a thread that contrasts with your webbing so you can more easily check for chafed and popped stitches. Refer to the chart below for the tensile strength and recommended needle size for various weights of nylon or polyester thread.

Thread Size	Tensile Strength	Recommended Needle Size
V-69	11 lbs.	#16 or #18
V-92	15 lbs.	#18 or #20
V-138	22 lbs.	#20 or #22

Lastly, you need a sewing machine that can adequately handle these materials. Two layers of webbing might be thicker than some home sewing machines can handle. Likewise, if you're using a heavier weight thread and needle, you'll need an industrial or semi-industrial sewing machine that can sew V-92 or V-138 thread. You need a lockstitch sewing machine for sewing webbing, as lockstitch machines are the only sewing machines recommended in the manufacture of safety and load bearing equipment. If choosing to sew the parallel bar tacks stitch pattern, as mentioned in the next section, you'll need a sewing machine capable of zigzag stitching.

What Is the Strongest Stitch Pattern?

There's a lot of information online about the strength and efficiency of certain stitch patterns, and it can be difficult to know what the "right" stitch pattern is. We did our own testing to determine if there was one standout stitch pattern, and you'll find the results of our testing in later sections. While there may be some stitch patterns that are more efficient and more commonly used than others, the key factor in sewing webbing is knowing how many stitches you need to sew to achieve your desired MBS. Luckily, there is a formula you can use to determine this factor.

Formula:

SPI x thread x 1.5 = seam strength per inch

Let's explain this formula step by step. Take the number of stitches per inch times the strength of your thread times the ratio 1.5 (the average loop strength of thread on lockstitch sewing machines) to determine your seam strength in pounds per inch of sewing. We'll use one of our webbing test samples mentioned in the next section as an example. Test sample 319 (refer to the downloadable chart below) is the diamond pattern on 1-inch heavy weight nylon webbing. Stitches per inch is a personal choice, but eight to 12 SPI is what's generally recommended for sewing webbing. We chose eight stitches per inch with V-92 thread (tensile strength of 15 lbs.)

8 x 15 x 1.5 = 180

This means we have 180 lbs. of seam strength per inch of sewing. Next, take the MBS you need and divide by the seam strength. Let's show this in an example. For test sample 319, we want 4,050 lbs. of breaking strength. So, 4,050 ÷ 180 = 22.5, which means we need to sew 22-1/2 inches of total stitching to achieve an MBS of 4,050 lbs. You always have the option of sewing more than the required inches of stitching. Sometimes adding a safety factor is desirable, especially if your sewn loop will be used for safety equipment and will hold human weight. And as you'll see in a later section, this safety factor is necessary in some cases.

Now that we know how many inches of stitching we need, it's time to pick a stitch pattern. Our research indicates that there are two general stitch patterns that have the most efficient and strongest results for use in load bearing applications. These are the diamond and "W" stitch patterns. In these patterns, the stitches cross both the warp and weft threads in the webbing, and the stitch lines trend in the direction that the webbing will experience stress, another benefit. In our test results, we found bar tacks to perform well also, but due to the additional stitching, this was to be expected. We also did one test with the box X stitch pattern to see how it fared against the others. All the stitch pattern results are shown in the downloadable chart shown in the next section.

From left to right: bar tacks, diamond and W stitch patterns.

For test sample 319, we chose the diamond stitch pattern. This pattern has eight straight stitch lines that form two full diamond shapes and two half-diamond shapes (refer to the photo above). Each line is the same length and we sewed them 2-1/4 inches long. Remember, we need to sew a total of 22-1/2 inches. So 8 x 2.25 = 18. We still need to sew an additional 4-1/2 inches to reach our total of 22-1/2 inches, and we did so in our reinforcement stitches above and below the diamond stitch pattern. We sewed two rows of straight stitches (at the same 8 SPI as the diamond pattern) sewing back and forth three times to reach the final 4-1/2 inches. Our stitching is now at an expected stitching MBS of 4,050 lbs.

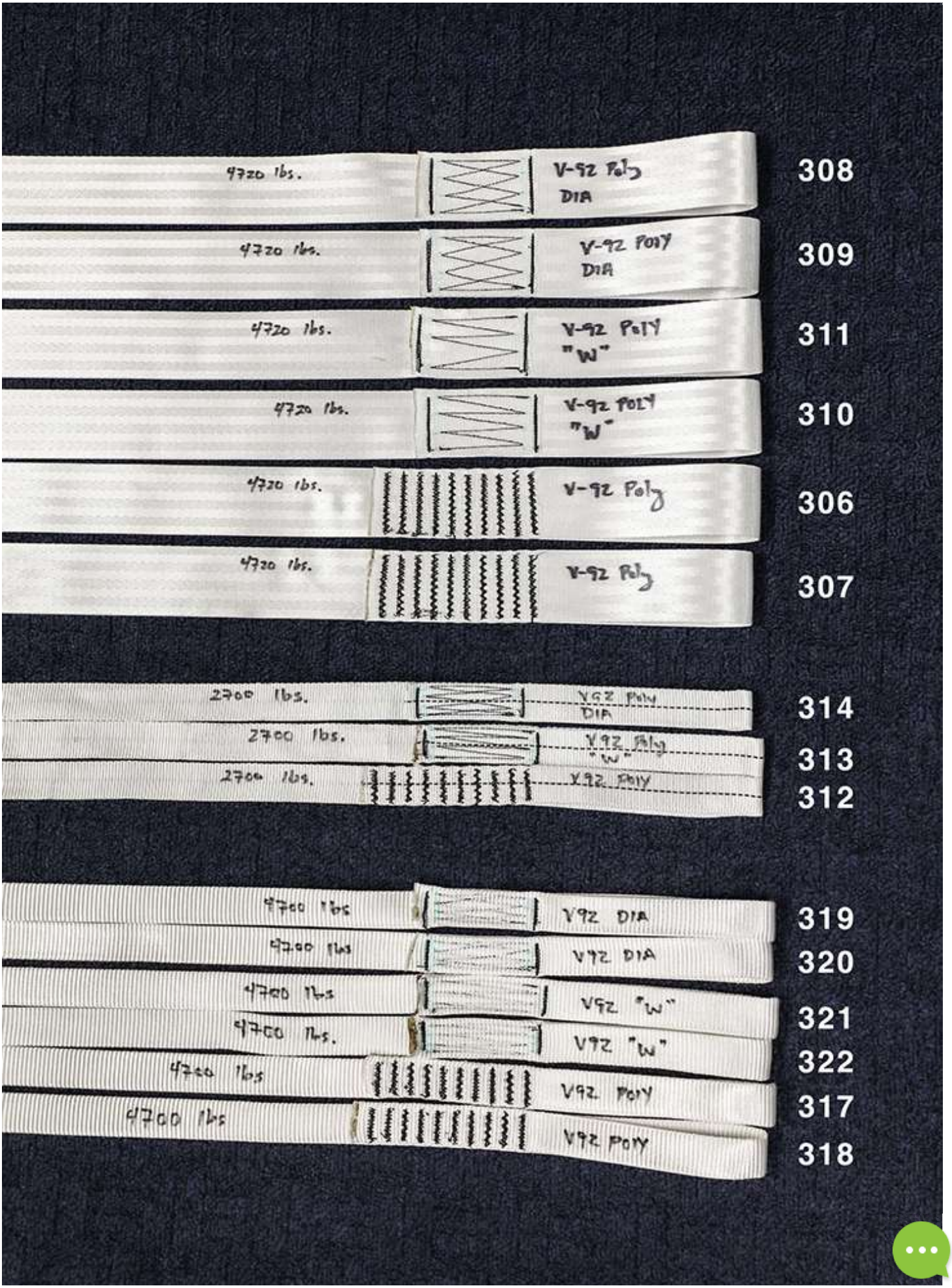
The W stitch pattern is sewn in a similar way, except in our samples the W has seven straight stitch lines instead of eight (sample 311 has only six straight stitch lines, and we evaluate the test results later). You'll perform the same calculations to determine how much total stitching in inches you'll need to achieve your expected stitching MBS. Remember to add the reinforcement stitches above and below the W pattern as done with the diamond. These reinforcement stitches can either be included in your total inches of stitching, or you can sew the W pattern to your total inches of stitching. The added reinforcement stitches then become an additional safety factor, increasing the total strength of your stitch pattern as well as your expected stitching MBS.

In the above photo, we sewed 10 bar tacks spaced 1/2 inch apart with both the zigzag width and stitch length set at 4mm. We sewed tw straight stitch passes first to lock the webbing together, then sewed three passes in zigzag stitch on top of the straight stitches. Our b tacks were well beyond the breaking strength of the webbing, but we wanted to see how bar tacks compared to our other straight stitc

patterns when we sent our samples off for testing.

The sewing area length (the webbing overlap) should generally be longer than the width of your webbing (for bar tacks, it will probably be much longer). For 1-inch webbing, we recommend a total sewing area length of three times the width of your webbing. If your stitch pattern is only 2-1/4 or 2-1/2 inches long (our samples were about 2-1/4 inches), the parallel reinforcement stitches at the top and bottom of your stitch pattern will help you reach 3 inches of total sewing area. We accounted for these reinforcement stitches in our testing samples. If you're using 2-inch or 3-inch webbing, try to sew a stitch area that's approximately twice or almost twice as long as the width of your webbing — even if that means sewing more than the stitch formula specifies. We also recommend basting your webbing overlap with basting tape to prevent the layers from sliding against each other; this will make the sewing process easier. To keep your stitch lines straight, trace guidelines onto the webbing to follow while sewing.

Testing Our Sewn Loops


4720 lbs.
V-92 Poly
DIA
308
4720 lbs.
V-92 Poly
DIA
309
4720 lbs.
V-92 Poly
"W"
311
4720 lbs.
V-92 Poly
"W"
310
4720 lbs.
V-92 Poly
306
4720 lbs.
V-92 Poly
307
2700 lbs.
V92 Poly
DIA
314
2700 lbs.
V92 Poly
"W"
313
2700 lbs.
V92 Poly
312
4700 lbs
V92 DIA
319
4700 lbs
V92 DIA
320
4700 lbs
V92 "W"
321
4700 lbs.
V92 "W"
322
4700 lbs
V92 Poly
317
4700 lbs
V92 Poly
318

Our webbing samples are sewn and ready for testing. Not pictured is the webbing loop sample with the box X stitch pattern.

We needed to test our stitch formula to determine whether it actually achieved a minimum breaking strength that met our safety parameters. We sewed samples of the three stitch patterns mentioned in this blog — as well as one box X stitch pattern to test its holding power and compare it to the others — and sent them to a facility to be break tested. As stated, our diamond and W stitch patterns were sewn to 2-1/4 inches, and we added reinforcement stitches above and below the stitch pattern to achieve a 3-inch total stitch area. The bar tacks measured approximately 5 inches in total stitch area. The box X stitch was only sewn to 1-1/2 inches of sewing area (9 inches total stitching); we intentionally sewed this sample at a lower expected stitching MBS so that the stitching — not the webbing — would definitely break so we could see how well the stitching held.

The webbing loops for this test group were sewn by the same person, on the same machine (Ultrafeed® LSZ), with the same cone of thread and the same needle (size 20). Even though the same person sewed every sample, there will naturally be small fluctuations and differences in the stitching. A person can't perfectly replicate the same stitch pattern again and again. The stitch quality and stitch placement in the samples are representative of an average DIYer.

All the webbing break tests were performed at the same facility and by the same machine. The testing device is accurate to within 50 lbs. A dynamometer was used to record the breaking strength of the webbing and stitch patterns.

A Note About the Webbing Tested

This blog was written in 2019, and since then we have updated our webbing inventory. As of 2021, we now offer Heavy Duty Webbing with even higher MBS ratings than the webbings originally sent for testing for the purposes of this blog. Our new Heavy Duty Webbing will yield even better results than the break tests shown below. Search the old part numbers on Sailrite's website to see the new closest correlated webbing replacement.

Webbing Break Test Results

10 BAR TACKS					
	2" Seat Belt Webbing (#120264)		1" Tubular Poly (#82300)	1" Heavy Weight Nylon (#1271)	
	TEST 306	TEST 307	TEST 312	TEST 317	TEST 318
WEBBING PUBLISHED MBS	4,720 lbs.	4,720 lbs.	2,700 lbs.	4,700 lbs.	4,700 lbs.
TOTAL INCHES OF STITCHING	87.5"	87.5"	37.5"	37.5"	37.5"
THREAD / SPI (STITCHES PER INCH)	V-92 / 8 SPI	V-92 / 8 SPI	V-92 / 8 SPI	V-92 / 8 SPI	V-92 / 8 SPI
EXPECTED STITCHING MBS	15,750 lbs.	15,750 lbs.	6,750 lbs.	6,750 lbs.	6,750 lbs.
ACTUAL STITCHING MBS	Undetermined	Undetermined	2,950 lbs.	5,850 lbs.	5,900 lbs.
WHAT BROKE FIRST?	Webbing	Webbing	Stitching, Then Webbing	Bar Tacks Broke Diagonally	Bar Tacks Broke Diagonally
RESULTS MEET EXPECTATIONS?	Yes and No	Yes and No	Acceptable	Acceptable	Acceptable
DID WEBBING FAIL PUBLISHED MBS?	Yes - Webbing Broke at 4,150	Yes - Webbing broke at 4,550 lbs.	No	No	No
NOTES	Stitch pattern should be stronger than webbing, so as expected webbing broke first. Webbing broke around 600 lbs. lower than its published MBS.	Webbing broke just below the first bar tack. Webbing was closer to reaching webbing published MBS. Stitching remained intact.	It appears the stitching was ripped through half of the first bar tack. It's inconclusive whether webbing or stitching broke, or both. Either way, successful stitch pattern.	Stitching broke below expected stitching MBS but higher than webbing published MBS. Successful stitch pattern.	Stitching broke below expected stitching MBS but higher than webbing published MBS. Successful stitch pattern.

DIAMOND					
	2" Seat Belt Webbing (#120264)		1" Tubular Poly (#82300)	1" Heavy Weight Nylon (#1271)	
	TEST 308	TEST 309	TEST 314	TEST 319	TEST 320
WEBBING PUBLISHED MBS	4,720 lbs.	4,720 lbs.	2,700 lbs.	4,700 lbs.	4,700 lbs.
TOTAL INCHES OF STITCHING	28.5" including bar tacks	28.5" including bar tacks	22.5" including bar tacks	22.5" including bar tacks	22.5" including bar tacks
THREAD / SPI (STITCHES PER INCH)	V-92 / 8 SPI	V-92 / 8 SPI	V-92 / 8 SPI	V-92 / 8 SPI	V-92 / 8 SPI
EXPECTED STITCHING MBS	5,130 lbs.	5,130 lbs.	4,050 lbs.	4,050 lbs.	4,050 lbs.
ACTUAL STITCHING MBS	4,200 lbs.	4,700 lbs.	3,000 lbs.	4,750 lbs.	4,950 lbs.
WHAT BROKE FIRST?	All Stitching	Stitching, Then Webbing	Stitching, Then Webbing	All Stitching	All Stitching
RESULTS MEET EXPECTATIONS?	Slightly Below Desired	Acceptable	Acceptable	Exceed	Exceed
DID WEBBING FAIL PUBLISHED MBS?	No	Yes - webbing broke at	No	No	No

PUBLISHED MBS?		4,700 lbs.			
NOTES	Stitching was sewn at higher MBS than webbing. Webbing should have broken first.	Webbing broke after it ripped out the first bar tack and only a little of the diamond stitching. Rest of diamond pattern remained intact. Successful stitch pattern.	Webbing broke after it ripped through first bar tack. Entire diamond pattern remained intact. Successful stitch pattern.	Stitching broke higher than expected stitching MBS AND webbing published MBS. Very successful stitch pattern.	Stitching broke higher than expected stitching MBS AND webbing published MBS. Very successful stitch pattern.

W PATTERN					
	2" Seat Belt Webbing (#120264)		1" Tubular Poly (#82300)	1" Heavy Weight Nylon (#1271)	
	TEST 310	TEST 311	TEST 313	TEST 321	TEST 322
WEBBING PUBLISHED MBS	4,720 lbs.	4,720 lbs.	2,700 lbs.	4,700 lbs.	4,700 lbs.
TOTAL INCHES OF STITCHING	26.25" including bar tacks	24" including bar tacks	20.25" including bar tacks	20.25" including bar tacks	20.25" including bar tacks
THREAD / SPI (STITCHES PER INCH)	V-92 / 8 SPI	V-92 / 8 SPI	V-92 / 8 SPI	V-92 / 8 SPI	V-92 / 8 SPI
EXPECTED STITCHING MBS	4,725 lbs.	4,320 lbs.	3,645 lbs.	3,645 lbs.	3,645 lbs.
ACTUAL STITCHING MBS	4,300 lbs.	4,300 lbs.	2,900 lbs.	5,100 lbs.	4,650 lbs.
WHAT BROKE FIRST?	Stitching, Then Webbing	Stitching, Then Webbing	First Bar Tack	All Stitching	All Stitching
RESULTS MEET EXPECTATIONS?	Acceptable	Acceptable	Acceptable	Exceed	Exceed
DID WEBBING FAIL PUBLISHED MBS?	Yes - Webbing broke at 4,300 lbs.	Yes - Webbing broke at 4,300 lbs.	No	No	No
NOTES	Webbing broke after it ripped through first bar tack and some “W” stitching.	Webbing broke after it ripped through first bar tack and 1/3 of “W” stitching.	Webbing broke after it ripped through first bar tack. Rest of stitching remained intact. Successful stitch pattern.	Stitching broke higher than expected stitching MBS AND webbing published MBS. Very successful stitch pattern.	Stitching broke higher than expected stitching MBS. Successful stitch pattern.

Download a PDF of the sewn loop break test results chart:

Break Test Results (http://www.sailrite.com/PDF/Webbing-Break-Test-Results-Download.pdf)

BOX X	NO STITCHING		
1" Tubular Poly (#82300)	2" Seat Belt Webbing (#120264)	1" Tubular Poly (#82300)	1" Heavy Weight Nylon (#1271)
TEST 315	TEST 324	TEST 316	TEST 323
WEBBING PUBLISHED MBS 2,700 lbs.	4,720 lbs.	2,700 lbs.	4,700 lbs.
TOTAL INCHES OF STITCHING 9	—	—	—
THREAD / SPI (STITCHES PER INCH) V-92 / 8 SPI	—	—	—

Break Test Observations & Conclusions

As shown in the chart, there was no clear “winning” stitch pattern. The good news is that all of our stitching passed within reason, meaning that it’s not the stitch pattern that matters, it’s the amount of stitching. As long as you sew the minimum inches required according to the stitch formula, your sewn loop will be strong enough for load bearing applications. Some stitching did break lower than its expected stitching MBS, such as samples 310 and 311, so we suggest calculating your required stitching MBS, and then adding a few extra inches of stitching for an added safety factor. Sewing 10 bar tacks proved to be unnecessary. The expected stitching MBS was always higher than webbing’s published MBS — especially on the 2-inch webbing — proving that 10 bar tacks was an excessive amount. We feel confident eight bar tacks will be sufficiently strong enough.

What's interesting is that samples 310 and 311 both broke at exactly 4,300 lbs., even though 311 only had six rows of W stitching whereas sample 310 had seven rows of stitching. From this data we theorize that if you sew the diagonal, W or box X stitch patterns, you need to add independent reinforcement stitches above and below the stitch pattern. The results indicate that it is these reinforcements that hold the stitching to a reasonable breaking strength and without these, the diagonal, box X and W patterns would have failed at a much lower breaking point.

Here's a breakdown of some of the break tests. Notice how on certain patterns or certain types of webbing the stitching broke either at the first bar tack or throughout the stitch pattern.

EXPECTED STITCHING MBS	1,620 lbs.	1,620 lbs.	1,620 lbs.
ACTUAL STITCHING MBS	1,800 lbs.	1,800 lbs.	1,800 lbs.
WHAT BROKE FIRST?	All Stitching	Webbing	Webbing
Exceed	Exceed	Exceed	Exceed
No	No	No	No
Webbing broke at 5100 lbs.	Webbing broke at 3050 lbs.	Webbing broke at 5800 lbs.	

Sewn Webbing Break Test - From Sailrite

According to the test results, it can be deduced that stitching webbing lowers the webbing's actual MBS. In samples where the webbing itself was tested and there was no stitching, the webbing always broke at a higher MBS than the stitched samples. Interestingly, the unstitched webbing broke at a higher MBS than the webbing was, in fact, rated at, which attests to the quality and strength of Sailrite's webbing.

As previously stated, the most important factor is to sew enough inches of stitching to achieve the required MBS. Choose whichever stitch pattern you're most comfortable sewing. If you have a zigzag stitch machine, the bar tacks are probably the easiest pattern to sew, but any of them can be sewn by a DIYer as long as you draw guidelines on the webbing to keep your stitch lines neat and straight. And as our test results showed, reinforcement three-pass straight stitches are needed in addition to the stitch pattern on the diagonal, W and box X patterns.

When to Retire Your Webbing

Webbing is strong and can withstand abrasion very well, but it is not meant to last forever. Examine the webbing fibers in the weave and retire your webbing if 30% of the fibers are worn at any place along the webbing. Use a contrasting color thread so you can easily spot chafed and popped stitches on the webbing. Another trick is to hold your webbing up to your ear and flex it. If you hear crackling, then that is a sign that your webbing is becoming brittle and should be retired. You should keep your webbing clean and stored out of the sun to prolong its lifespan. If you take care of your webbing, it will take care of you.

References:

"On Rope" by Allen Padgett and Bruce Smith, National Speleological Society, 1987

"The Mountaineering Handbook" by Craig Connally, International Marine/Ragged Mountain Press, 2004

"A Study of Parachute Seam Design Criteria" WADC Technical Report Part II, 1956

www.superiorthreads.com

www.amefird.com

www.servicethread.com

www.cruisingclub.org

www.fireengineering.com

Special thanks to Ryan Jenks for break testing all of our webbing samples with his break test equipment. Ryan does his own webbing and other load bearing equipment testing for the slackline community. You can watch his break tests, as well as other related videos, on his How Not To Highline YouTube channel.

Disclaimer: The information in this article is the opinion of Sailrite Enterprises, Inc., and is not corroborated or verified by a safety authority. Sailrite shall not be held liable in the event of injury or death. Use at your own risk.

Footnote:

This blog was updated in December 2021 to mention Sailrite's updated webbing offerings.

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