

HOW STRONG IS A STITCHED SPlice IN NYLON WEBBING?

by Cal Magnussen

Tubular nylon webbing is one of the most versatile materials used in mountaineering. It is used for rappel anchors, rappel slings, chest slings, runners, hero loops, jam nut rigging, swami seats, and many other uses that the imaginative mind will conceive.

Joining the Ends

Probably the most common method for joining the ends to make a loop is with a knot. There are a number of different knots that can be used quite successfully, but all knots have certain disadvantages. The efficiency of knots varies from less than fifty percent to possibly seventy-five percent. Some knots require several inches of material, thus the sling or loop is heavier and bulkier than necessary. Some knots in slippery nylon materials tend to work loose unless they are pulled extremely tight or safetied by additional knots.

Sewing the ends of a piece of webbing together to form a loop of a sling, if done properly,

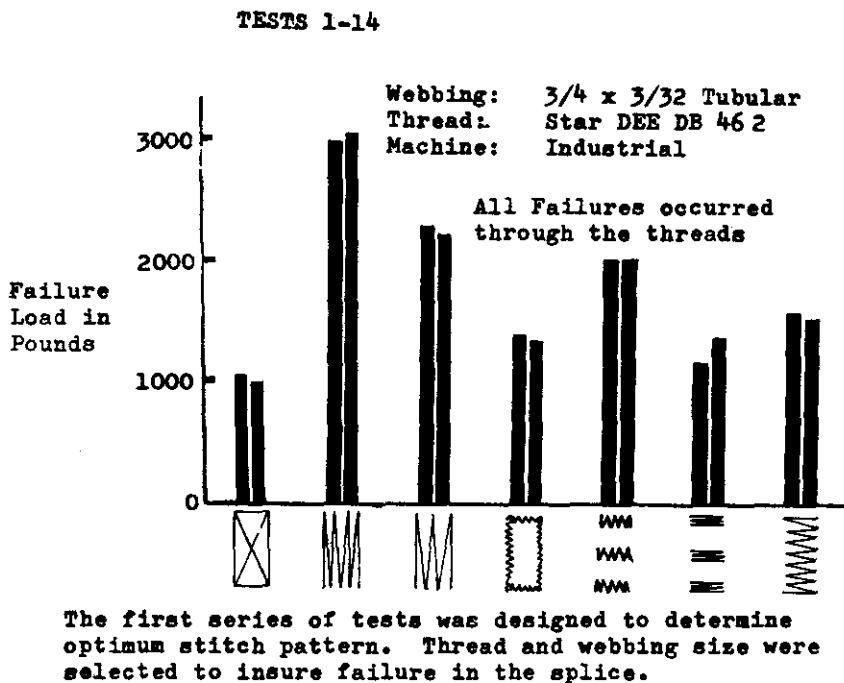
is much better than a knot. Some of the advantages of a sewed splice over a knot are higher strength, smooth surface, less material required, and more secure in use.

Testing For Optimum Splice

A series of tests were made using 3/4" x 3/32" tubular nylon webbing sewed with various stitch patterns to determine the most efficient splice. Tests 1 through 14 shows the stitch patterns and their respective test strengths. Several rows of parallel longitudinal stitches proved the best of all the patterns tested.

In the first series of tests

the thread broke in all of the specimens so another set of loops were made using heavier thread and the longitudinal stitch pattern. (See tests 15 through 21) Most of the second series failed at the one-half inch diameter bolt attaching the loop to the test machine, thus indicating that the optimum splice was achieved.



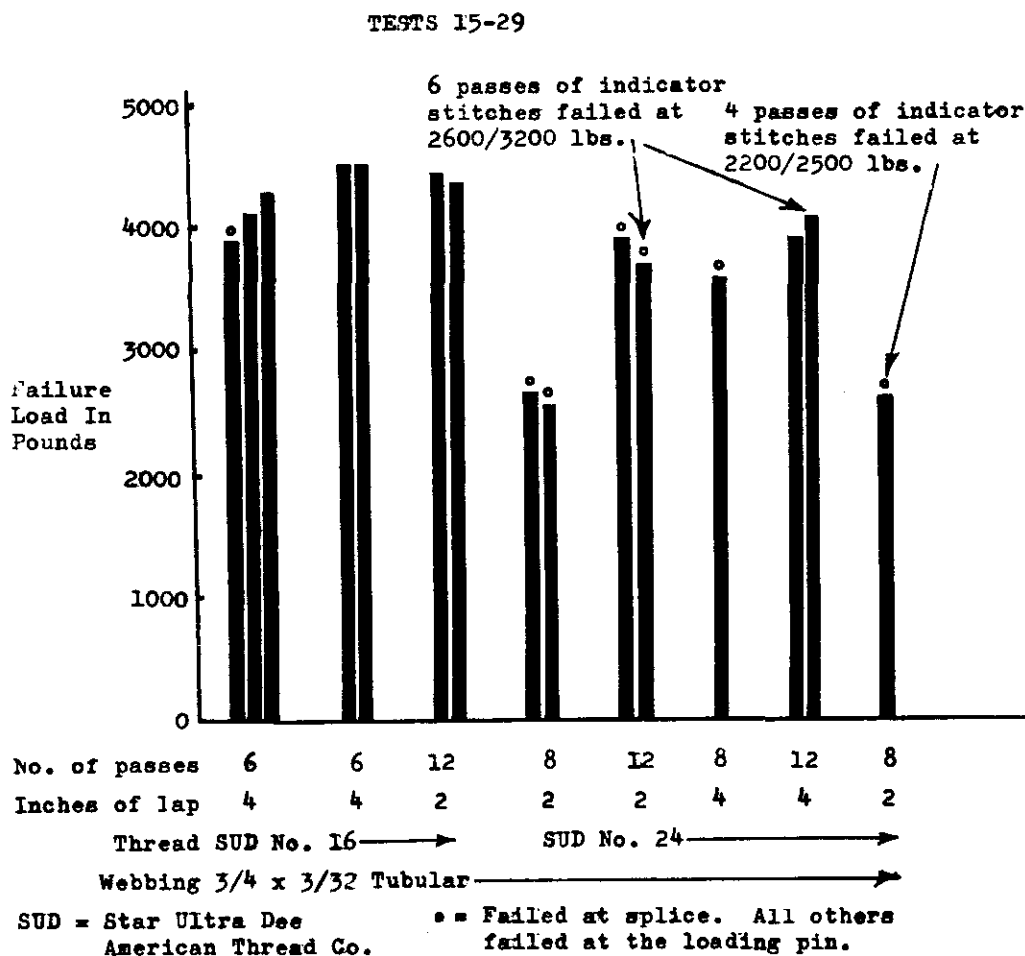
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On The Home Machine

The first two sets of loops were sewed with an industrial sewing machine using polyester thread. Since most climbers only have access to a home sewing machine and very few have industrial machines, a third series of tests were run with loops sewed on a Singer portable sewing machine using Number 24 Star Ultra Dee polyester thread and eight stitches per inch. See Tests 22 through 29.

How Much Is Enough

Once the seam strength per inch with a certain thread is determined, the optimum splice for any type webbing can be calculated. As shown in Figure Two, twelve passes on a four inch lap was stronger than the webbing around a one-half inch diameter bolt. A two inch lap was only slightly lower in strength than the webbing over the bolt so would undoubtedly be adeq-



The second series of tests explored thread size, lap over, and the number of passes.

of passes, length of splice and stitches per inch.

The loops with twelve passes both failed at the splice by webbing fracture rather than thread breakage indicating the optimum splice was achieved. Since the 9/16" webbing is thinner than 3/4" webbing, the stress due to bending around the one-half inch diameter bolt is

adequate for any normal use. One inch tubular webbing with a breaking strength of about two times that of the 3/4" x 3/32" webbing would require twenty-four passes using the same type thread to obtain the optimum splice. The 9/16" x 1/16" webbing would require about ten passes.

A series of test samples were made up using 9/16" x 1/16" blue tubular nylon webbing. The splices with ten passes both broke at the thread so additional loops were made increasing the number

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less with the 9/16" webbing. This would account for the fact that more passes were required than the calculation indicated to obtain the optimum splice and that the failures occurred at the splice rather than at the bolts.

Overload Indicator

An indicator devised by Harmon Jones of Seattle, Washington was tried on several of the test loops See Test 25, 28, and 29. If a sling is subjected to a high load the nylon fibers take some permanent set as well as some reduction in strength. The indicator stitches will tell if the splice has been subjected to a certain predetermined load.

The splice is made in the normal manner except that an extra inch of material is used. Thus for a two inch splice, the ends are lapped over three inches. About half of the passes run the full three inches while the other half only run from one edge to the two inch mark.

As the loop is loaded up, the indicator stitches will fail first at a load somewhat lower than the breaking strength of the splice.

Nuts

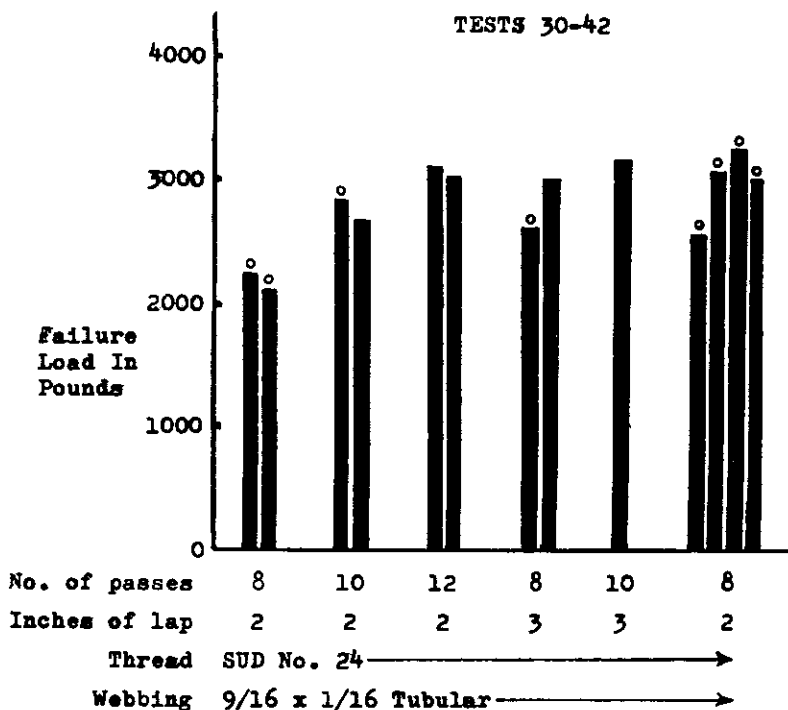
Several jam nuts were rigged with loops made from 9/16" x 1/16" blue tubular webbing. The webbing loop can be sewed together so that the splice is near the nut and the face of the webbing is parallel to the nut. This provides a fairly stiff convenient handle for easier insertion of the small size nuts into relatively deep cracks.

In all cases, the webbing loop on the jam nuts broke at the nut at about fifty-one to sixty-three percent of the strength of the optimum webbing loop. Nuts rigged in this manner would be satisfactory for protecting leads providing the climber does not advance too far above the nut without additional protection, or sufficient rope is cut between the belayer and the protecting nut to insure a dynamic belay in case of a fall.

Thread

The thread used to sew the webbing loops made for these tests was made by American Thread Company and was purchased at Sewing Machine Service Company in Renton, Washington.

Other thread manufacturers probably make similar thread that would be satisfactory for sewing nylon webbing. The thread size and seam strength information is available in litera-



The third series of tests continued the investigation on a smaller size webbing.