Pin Sizes for Twin-Path® Extra Slings

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Since the development of Twin-Path® Extra slings in 1988, we have worked with rigging companies to improve the products to meet the highest quality expectations. Thousands of tests have been conducted on the core yarn, covers, and complete slings, to assure their longevity and safety when used according to stated SLINGMAX® mechanical considerations. (See pages 18-19 in our current catalog and handbook)

During testing of wire rope, web, and round slings, it was determined that pin sizes do have an effect on sling breaking strength; larger pins result in higher breaking strength. The definition of a large pin is one with equal or larger diameter than the width of the sling. The geometrical shape of the fitting also affects sling strength with straight connections better than curved connections.

Initially, a 5-1 design factor was deemed sufficient for sling safety under all conditions, with the breaking strength realized on large straight pins. There were four good reasons to use large diameter straight pins for testing. First, those pins were the ones already in place on the testing equipment. Second, there was no knowledge, and no customer impetus to test on anything else. Third, it was considered adequate to test on large pins using the theory that a 5-1 Design Factor would accommodate normal use of the product and still provide an adequate margin of safety. Fourth, and most important, a large straight pin does not bend, break, or compromise the safety of those workers doing the testing.

Examples of these hazards were recently confirmed. When using a 12 ton shackle to test a Twin-Path® Extra 2,000 sling with 20,000 lb rated capacity, the shackle bent at 108,500 lbs and the pin could not be removed. We tested another Twin-Path® Extra 2,000 using a 1.5” pin with too wide a bearing area, and at 100,000 lbs the pin bent. An acetylene torch was required to remove the bent pin from the testing fixture.

For a round sling to develop a 5-1 design factor when pulled to break on a compatibly rated shackle bow, it would have to develop a higher design factor on straight pins. Uniquely, round slings are the only product that can be strengthened without materially changing their size and weight. A manufacturer can add more strands of load bearing core yarn or increase the strength of the individual strands, to meet higher design factors for different types of connections. With wire rope and web slings, the user must move to a larger diameter or width to meet more stringent requirements for design factors.

A Twin-Path® Extra 2,000 with a 20,000 lb rated capacity tested on a large straight pin could reach 140,000 lbs, or a 7-1 design factor. Tested on a 1.5” pin the strength may decline to 120,000 lbs (6-1 D/f) and on a 1-1/4” curved shackle bow, 105,000 lbs. (5.3-1 D/f)

Our testing has shown, when using polyester core yarn, there is a similar percentage of strength loss when comparing a large straight pin to a compatible shackle bow. However, these results may be different among the various manufacturers because the core yarn composition is not identical. A conservative mathematical computation would require a 25% deduction when estimating the decrease from a large straight pin to a curved shackle bow using any of the common fibers associated with round sling production.

SLINGMAX® Rigging Products can meet customer expectations of any design factor for various connections, by increasing the strength of our K-Spec™ core yarn or increasing the number of strands in a finished Twin-Path® Extra Sling product.

We state in our literature under the section identified as mechanical considerations:

"Slings used with fittings shall be compatible with the fittings used. The lifting capacity shall be rated at the lower of the fitting or sling. Fitting openings shall be of the proper shape and size to assure that the sling will seat properly." (7.6 page 18)

We have also stated under the capacity tables for Twin-Path® Extra slings the following:

"Ratings based on straight pin diameter, one-half the sling width."

Both of these statements provide the user with a secure connection between Twin-Path® Extra slings and the load. Fittings used with the slings at the lower of the rating for the sling or the fitting will provide a safe termination. Both the fitting manufacturer and the SLINGMAX® organization have provided testing to assure the adequacy of the lifting tools. However, we suggest a pin size one-half the sling width to protect end users from designing unsafe devices with pins that are inadequate for the job. The SLINGMAX® organization has no control over customer made attachments, including the steel type used or the bearing point width associated with the pins. When we cannot specify, we err on the side of safety, knowing well that the slings will develop a 5-1 design factor on smaller straight pins, but not whether the pins will bend or fail because of inadequacy of customer design.

In summary, a Twin-Path® Extra sling, connected to a compatibly rated shackle bow, provides a secure connection.

The safest, fastest, and most profitable rigging jobs are performed using Twin-Path® Extra slings.