

Strength Retention of Used Twin-Path® Extra Slings

Conference Program 2001

To provide some detailed analysis of the strength retention of used slings, and to give the dealers a background on the safety of used slings in the field, we have undertaken this study. The comfort level a dealer may feel after reading this report should not reduce or eliminate the dealer's efforts to have customers return slings for repair evaluation. When indicators (cover, Fiber Optic, Tell-tails) show the sling should be removed from service, the customer must be trained to take appropriate action.

In laboratory conditions, two distinctive test programs have shown that new K-Spec™ high performance fiber used in the construction of Twin-Path® Extra slings shows no deterioration from fiber on fiber abrasion or fatigue.

The first test program was conducted in 1997 at the laboratories of Tension Member Technology in Huntington Beach, CA. This test exposed both Kevlar® and K-Spec™ fiber to a cyclic-tension-testing program consisting of pulling each sling 50,000 times to a 50% overload and then performing a break test on the designated slings.

The Kevlar® sling failed at 86.5% of its new unused condition and the K-Spec™ sling achieved 105% of its new unused condition. Although the Kevlar® showed slight strength loss (13.5%), it proved to be many times better than a steel sling in the same test. Results of both wire rope and chain have shown a failure to achieve 25,000 cycles without complete disintegration. See exhibit A&B&C for the test reports. (Since 1996, Kevlar fiber has not been used in Twin-Path® Extra slings.) In 1993, a Kevlar® Twin-Path® sling, TPX 3,000 x 8', was removed from service after several years of use. When pulled to destruction the sling had retained 100% of its new strength, breaking at 155,000 lbs. This test is on video.

In 2001, a second set of test results was delivered to SLINGMAX® Headquarters by Shibamoto & Company Ltd. of Tokyo, Japan. These tests were also cyclic tension tests but differed because slings were connected and pulled in a basket hitch. The laboratory that performed the basket cycling test was Koukan Keisoku K.K. of Kanagawa, Japan.

There were two slings in this test program, one made with 100% Spectra® core yarn and identified as sample #1. The second sling was made from K-Spec™ fiber and identified as sample #2. Each sling was cycled 10,000 times to 20 tons in a basket hitch. This was the rated capacity for each of these slings at a 7-1 design factor.

They were measured before and after the test to determine the amount of creep that was induced into the slings. The Spectra® sling developed more creep than the K-Spec™ sling, see exhibit marked #2 and #3. (Creep is defined as non-recoverable stretch).

The next step was to connect the slings in a vertical hitch and pull them to destruction. The slings failed at an ultimate strength of 83.3 and 76.0 tons respectively. A 7-1 design factor would yield a minimum breaking strength of 70 tons on a 10-ton rated capacity sling.

The above tests were undertaken for the Toyota Motor Company to demonstrate the viability of using high performance synthetic slings in their factories.

Fittings that are too small or restrict the sling causing bunching will enable fiber on fiber abrasion to occur. This will lead to lower ultimate breaking strengths of used slings. The effect is to compress the core yarns tightly against each other causing abrasive wear as loads are lifted and released. Twin-Path® slings that have their core fibers constricted by wrapping or tight fittings should be tested and inspected on a regular basis. Fittings formerly used with wire rope slings can have sharp impressions, and should be carefully inspected to make sure they are smooth enough to use with synthetics.

Another test program was conducted at our SLINGMAX® Dealer, I&I Sling Inc. in their Kernersville, NC facility. This test compared the breaking strength of new K-Spec™ that had never been used in a sling, and K-Spec™ fiber that had been removed from a rejected sling.

The results showed that the used fiber had lost about 4% of its new strength when tested to destruction. The new material has an average breaking strength of 2,400 lbs. per strand and the old material failed at 2,300 lbs. per strand. To put this into the language of the sling industry, the old material had a design factor of 4.8 – 1 or 96% of new.